Courtright Wastewater Treatment Plant Expansion Schedule C Class Environmental Assessment

Revision No: Final Report for 30-Day Review

Township of St. Clair

Courtright WWTP Expansion Schedule C Class EA
February 7, 2025

Courtright Wastewater Treatment Plant Expansion Schedule C Class Environmental Assessment

Client Name:	Township of St. Clair
Project Name:	Courtright WWTP Expansion Schedule C Class EA
Document Number:	Final for 30 Day Review
Project Number:	CE852700
Project Manager:	Janice Rimmer, Jacobs
Prepared by:	Jasmine Biasi, Jacobs
Revision Number:	Final Report for 30-Day Review
Date:	February 7, 2025
File Name:	CE852700_Courtright WWTP Expansion Schedule C Class EA_ESR_Final for 30-Day Review_2025-02-03

Document History and Status

Revision	Date	Description	Author	Checked	Reviewed	Approved
0	Sept 19, 2024	Draft 1	J. Biasi	J. Rimmer	J. Schmitter	J. Rimmer
Final	February 7, 2025	Final Report for 30-Day Public Review	J.Biasi	J. Rimmer	J. Schmitter	J. Rimmer

Distribution of Copies

Revision	Issue Approved	Date Issued	Issued to	Comments

Jacobs Consultancy Canada Inc.
165 King Street West
Suite 201
Kitchener, ON N2G 1A7
Canada
T +1.519.579.3500
www.jacobs.com

Executive Summary

Background

The Courtright Wastewater Treatment Plant (WWTP) is located at 1464 St. Clair Parkway in the County of Lambton and has a rated capacity of 6,000 cubic metres per day as listed in Amended Environmental Compliance Approval (ECA) No. 4042-BEUW6N dated August 9, 2019. The plant receives influent flow from the sanitary system and pre-treated industrial wastewater. A septage receiving facility is in place, however not in use at the time of this report. The WWTP is classified as a secondary treatment plant (Class II), with a preliminary treatment system consisting of screenings and grit removal and a secondary treatment system consisting of a fine bubble diffused extended aeration system and secondary clarification. Supplementary treatment systems include phosphorus removal via chemical addition and ultraviolet (UV) disinfection. The sludge management system includes a primary digester and a biosolids storage tank for seasonal storage of biosolids to be hauled off-site for land application. The effluent from the WWTP discharges through a 600-millimetre diameter sewer to the St. Clair River.

Jacobs was retained by the Township of St. Clair (Township) to complete a MEA Schedule 'C' Class Environmental Assessment (EA) for capacity expansion of the Courtright WWTP. The Township identified the need for capacity expansion at the Courtright WWTP to accommodate future industrial sanitary loads that are anticipated to be generated in the next three years in addition to future flows and loads from forecasted population growth over the planning horizon (to 2042).

The objective of this Environmental Study Report (ESR) is to provide the Township with updated recommendations to guiding the implementation of infrastructure upgrades and improvements over the next

The objective of this Environmental Study Report is to provide the Township with updated recommendations to guiding the implementation of infrastructure upgrades and improvements at the Courtright WWTP over the next 20-year planning horizon (to 2042) using a transparent decision-making process. The Courtright WWTP Class EA is intended to provide timely, fiscally responsible, and achievable solutions to better manage the wastewater and biosolids infrastructure required to service growth while managing risks using sound environmental planning principles.

Existing Conditions

The purpose of this section is to describe the existing conditions at the Courtright WWTP.

Existing Liquids Treatment Conditions

Historical wastewater flow data from 2013 to 2021 were analyzed. Table ES 1 summarizes the historical average day flow (ADF), per capita flows, maximum day flow, and peak factor for each year.

The ADF was relatively constant for 2013 to 2015 at an average of 2,825 cubic metres per day but increased by about 20 percent in 2016 and has since remained at this elevated level at an average of 3,570 cubic metres per day. The overall ADF throughout this time period was approximately 55 percent of the rated capacity for the WWTP at 3,323 cubic metres per day.

The peaking factors observed between the maximum daily flow and the ADF varied from approximately 2.1 to 5.5, with an average of 3.3.

Table ES 1. Historical Flows to the Courtright WWTP (2013 to 2021)

Year	ADF (m^3/day)	Maximum Day Flow (m^3/day)	Peak Factor (Max Day Flow/ADF)
2013	2,927	10,794	3.69
2014	2,766	5,802	2.10
2015	2,781	7,521	2.70
2016	3,388	13,856	4.09
2017	3,451	9,963	2.89
2018	4,369	18,137	4.15
2019	3,644	11,723	3.22
2020	3,282	12,848	3.91
2021	3,291	8,678	2.64
Average (2013 to 2021)	3,323	11,036	3.27
Current Design Basis	6,000	15,000	2.50

Influent Quality

Historical influent raw sewage concentrations were analyzed to establish current plant loadings. Monthly sampling results were available for biochemical oxygen demand (BOD_5), total suspended solids (TSS), total phosphorus (TP), and total Kjeldahl nitrogen (TKN). Table ES 2 summarizes the raw wastewater characteristics including contaminant concentrations, in milligrams per litre (mg/L), average and maximum month loads, in kilograms per day (kg/d), and per capita load rates in grams per capita per day (g/cap/d). Typical per capita load rates as reported by Metcalf & Eddy are also summarized in Table ES 2. The per capita load rates for BOD_5, TSS, TP, and TKN all fall within the typical ranges reported by Metcalf & Eddy (Metcalf & Eddy, 2013).

Table ES 2. Historical Courtright WWTP Concentrations and Loads (2013 to 2021)

Influent Parameter	Average Concentration (mg/L)	Average Load (kg/d)	Maximum Month Load (kg/d)	Maximum Month Peak Factor (Max Month Load/ Average Load)	Estimated Per Capita Contribution (g/cap/d)	Typical Range Per Capita Contribution (g/cap/d) [a]
BOD_5	156	514	1,023	1.93	61	50 – 120
TSS	181	600	1,424	2.25	71	60 – 150
TKN	32	104	164	1.57	1.8	1.5 – 4.5
TP	4.67	15	29	1.87	12	9 – 18

a) Adapted from: (Metcalf & Eddy, 2013)

Effluent Quality

The operation of the Courtright WWTP is governed by ECA No. 4042-BEUQ6N (dated August 9, 2019). Table ES 3 summarizes the plant's effluent concentration objectives and limits per the current ECA for carbonaceous biochemical oxygen demand ($cBOD_5$), TSS, TP, total ammonia nitrogen (TAN), *Escherichia coli (E. coli)*, and pH.

Table ES 3. Courtright WWTP Existing Effluent Criteria

Effluent Parameter	Averaging Calculator	Concentration Limit	Concentration Objective
$cBOD_5$	Monthly Average	25.0 mg/L	15.0 mg/L
TSS	Monthly Average	25.0 mg/L	15.0 mg/L
TP	Monthly Average	0.94 mg/L	0.50 mg/L
TAN	Monthly Average	8.0 mg/L May 1 to October 31 10.0 mg/L November 1 to April 30	3.0 mg/L May 1 to October 31 5.0 mg/L November 1 to April 30
E. coli	Monthly Geometric Mean Density	200 colony forming units (CFU)/100 millilitres (mL)	150 CFU/100 mL
pH	Single Sample Result	6.0 to 9.5	6.5 to 8.5

Generally, the Courtright WWTP has achieved ECA limits and objectives for most effluent parameters throughout the 2013 to 2021 time period, with the following exceptions:

- Effluent TP concentrations generally do not meet the ECA objective of 0.50 mg/L, with samples higher than this value 64 percent of the time from 2013 to 2018. From 2019 to 2021, the ECA objective was met more frequently, only exceeding the objective 25 percent of the time; however, there were two compliance limit exceedances for TP in this time.
- There were two compliance limit exceedances for TSS from 2013 to 2021, and two additional samples with concentrations higher than the objective.
- From 2013 to 2014, ammonia nitrogen (NH_3-N) concentrations exceeded the objective twice during the winter period (i.e., 5.0 mg/L objective).
- Generally, pH fell within the objective range of 6.5 to 8.5. The ECA objectives and limits are based on single pH sample results, however daily pH data was only available from 2019 to 2021.
- From 2013 to 2019, there were four months where monthly average pH fell below the ECA objective however there were no compliance limit exceedances. From 2019 to 2021, 26 daily pH measurements fell below the ECA objective (approximately 4 percent of data from 2019 to 2021), four of which also fell below the ECA limit (approximately 0.6 percent of data from 2019 to 2021).

Existing Solids and Biosolids Conditions

Waste activated sludge from the secondary clarifiers is aerobically digested and stored prior to land application. Table ES 4 presents the historical biosolids haulage volumes, loadings and per capita generation rates. Annual haulage volume data were available from the Township. Average annual total solids (TS) concentrations were calculated based on sampling data. Digested biosolids are sampled seasonally (four to six times per year) from the storage tank and analyzed for various quality parameters. The annual biosolids loading rate and per capita generation rate were calculated based on the haulage volumes, TS data, and historical population data. The biosolids loadings and per capita rates were relatively consistent from 2013 to 2022 except for 2021 which was significantly lower. Excluding the 2021 data, the overall average biosolids loading rate was 133 dry tonnes per year and the average per capita rate was 15.7 kilograms per capita per year (kg/cap/year).

Table ES 5 presents a summary of other digested biosolids quality parameters from 2012 to 2022 including $cBOD_5$, TKN, TAN, and TP. Data for $cBOD_5$ was only available for 2022.

Table ES 4. Historical Biosolids Quantity Data (2013 to 2022)

Year	Annual Biosolids Haulage Volume (m^3/year)	Average TS (mg/L)	Annual Biosolids Loading Rate (dry tonnes/year)	Per Capita Biosolids Generation Rate (kg/cap/year)
2013	6,548	15,855	103.8	12.33
2014	2,546	58,420	148.7	17.77
2015	3,139	32,675	102.6	12.33
2016	3,360	39,533	132.8	16.07
2017	3,443	38,350	132.0	15.59
2018	3,324	42,525	141.4	16.82
2019	3,822	40,867	156.2	18.44
2020	4,268	33,680	143.7	16.84
2021	3,638	16,130	58.7	6.82
2022	4,243	31,200	132.4	15.34
Average [a]	3,855	37,012	133	15.7

a. Data from 2021 is excluded from the overall average as an outlier.

Table ES 5. Digested biosolids quality data (2012 to 2022)

Parameter	Average Concentration (mg/L)
$cBOD_5$ [a]	1,100
TKN, as Nitrogen [b]	1,531
TAN, as Nitrogen [b]	350

Parameter	Average Concentration (mg/L)
TP [b]	1,429

a. Data for $cBOD_5$ was only available for 2022.
b. Data from 2021 is excluded as an outlier.

Future Conditions

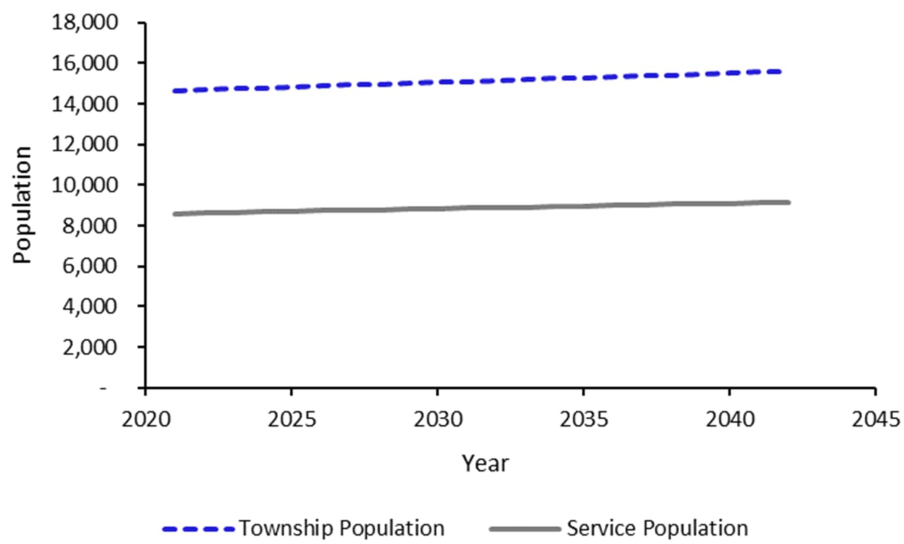
Population and Demographics

Projections for the St. Clair Township population and Courtright WWTP service populations to 2042 are presented in Table ES 6 and Figure ES 1. Township population projections were developed based on the 2021 census data from Statistics Canada which reported a population of 14,659 (Statistics Canada, 2021). An annual growth rate of 0.3 percent was assumed. This growth rate is consistent with the 2007 ESR which included population projections to 2027 (TSH, 2007). The current service population was estimated based on the number of service connections and the average household size of 2.4 reported in the latest census data (Statistics Canada, 2021). The service population is approximately 59 percent of the Township population, which is consistent with the previous ESR where service population was estimated at approximately 56 percent of the total population.

Table ES 6. Population Projections

Year	St. Clair Township Population	Courtright WWTP Service Population
2021	14,659	8,604
2022	14,703	8,630
2023	14,747	8,656
2024	14,791	8,682
2025	14,836	8,708
2027	14,925	8,760
2030	15,060	8,839
2033	15,196	8,919
2036	15,333	8,999
2039	15,471	9,081
2042	15,611	9,163

Figure ES 1. Population Projections



Liquids Treatment

A capacity assessment was completed for the various liquid treatment processes at the Courtright WWTP including the influent pumping at the Corunna and Courtright Pump Stations, the headworks facility, secondary treatment, including aeration, secondary clarification, phosphorous removal and disinfection. Table ES 7 presents a summary of the deficiencies identified in the capacity assessment.

Table ES 7. Wastewater Treatment Process Capacity Assessment Summary

Process	2042 Design Basis Deficiencies
Corunna Pump Station	No deficiency identified. New ICI users to be directly connected to the Courtright WWTP.
Courtright Pump Station	Additional peak flow capacity is required prior to bringing contingency flows online. New ICI users to be directly connected to the Courtright WWTP.
Headworks	Additional peak flow capacity is required prior to bringing new ICI users online.
Secondary Treatment	Aeration tanks HRT, organic loading, and SRT, and secondary clarifiers SOR and SLR greatly vary from the recommended ranges. Significant additional capacity required prior to bringing new ICI users online. Additional aeration blower capacity required for peak flow. Additional firm RAS pumping capacity is required.
Phosphorus Removal	No deficiency identified.
Disinfection	Additional peak flow capacity required prior to bringing new ICI users online.

Solids and Biosolids

Biosolids projections for the planning period (to 2042) are presented in Table ES 8 and Figure ES 2.

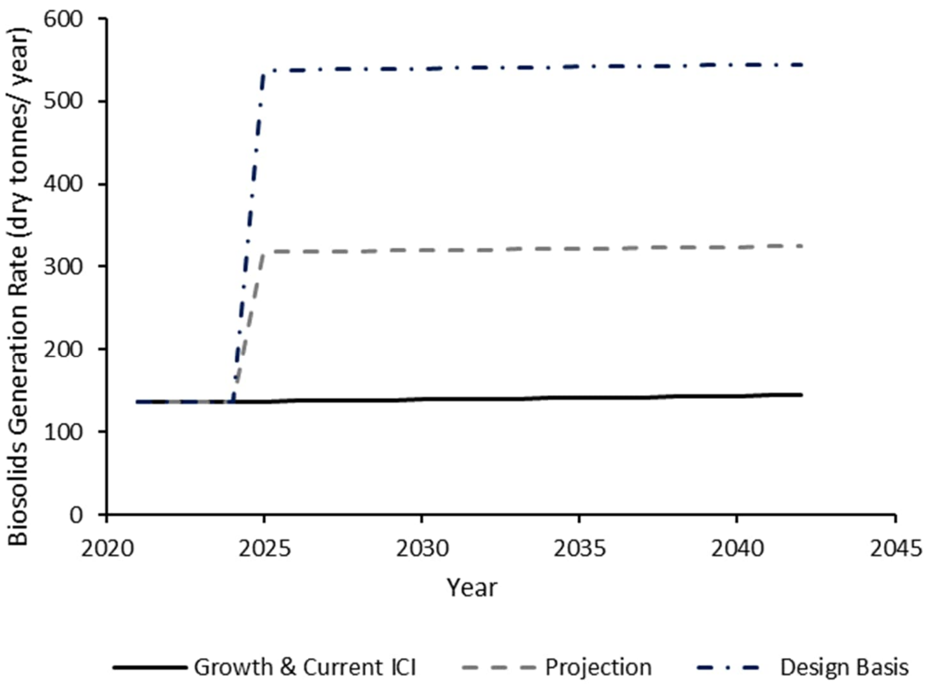
By 2042, the biosolids generation is projected to be approximately 325 dry tonnes per year, compared to 140 dry tonnes per year for projected residential growth and current ICI use. The design basis, which includes contingency flows, resulted in an increased biosolids generation rate of 540 dry tonnes per year by 2042. Assuming an average TS of 37,000 mg/L, the design basis corresponds to a biosolids volume of 14,700 cubic metres per year.

In addition to significantly increasing the biosolids generation rate, the future new ICI users will impact the biosolids characteristics as the new ICI users are expected to have a significant impact on the raw sewage quality, with higher BOD_5, TKN, and TP loadings. These increased influent loadings will impact the BOD_5, TKN, and TP concentrations in the biosolids.

Table ES 8. Biosolids Projections

Year	Growth & Current ICI Biosolids Generation (dry tonnes/year)	Projected Biosolids Generation (dry tonnes/year)	Design Basis Biosolids Generation (dry tonnes/year)
2021	135.3	135.3	135.3
2022	135.7	135.7	135.7
2023	136.1	136.1	136.1
2024	136.5	136.5	136.5
2025	136.9	317.8	537.3
2027	137.8	318.6	538.1
2030	139.0	319.8	539.4
2033	140.3	321.1	540.6
2036	141.5	322.4	541.9
2039	142.8	323.6	543.2
2042	144.1	324.9	544.5

Figure ES 2. Biosolids Generation Projections



Aerobic Digestion

A capacity assessment was conducted for the aerobic digestion process, which consists of a single aerobic primary digester divided into two cells for Stage 1 and Stage 2. The results of the capacity assessment are presented in Table ES 9. The aerobic digester provides sufficient capacity for the current design basis. For the future design basis, both the Stage 1 VS loading rate and SRT significantly vary from the guidelines, with Stage 1 VS loading greatly exceeding 1.6 kilograms per cubic metre per day, and SRT significantly below 45 days. A significant increase in capacity would be required for the future design basis.

Table ES 9. Aerobic Digestion Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)
Number of Primary Digesters	1	1	N/A	N/A
Stage 1/ Stage 2 Digester Volume Split	2:1	2:1	N/A	2:1
Total Digester Volume, m^3	1,021	1,021	N/A	N/A
Design ADF, m^3/d	6,000	15,000	N/A	N/A
Stage 1 VS Loading Rate, $kg/m^3/d$	1.35	3.36	N/A	1.6
Solids Retention Time (SRT), d	58.7	24.7	60	45

Solids Storage

Digested biosolids are stored in a single biosolids storage tank with a capacity of 3,400 cubic metres. The storage tank is equipped with two mixing pumps (one duty, one standby), each rated at 189 L/s at 12.2 metres TDH, an ultrasonic level sensor, and float switch high level alarm.

The original design basis was to provide 8-months (240-days) of storage for aerobically digested solids (TSH, 2007). As shown in Table ES 10, the existing storage capacity falls short of the 8-month storage target for the current and future design bases. To meet the current design basis, an additional 25 percent of storage volume is needed to provide 240-days of storage. For the 2042 design basis, an additional 180 percent storage capacity would be needed to provide 240-days of storage.

Table ES 10. Solids Storage Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)
Existing Storage Capacity, m^3	3,400	3,400	N/A
Storage Available with Existing Capacity, d	192	84	240
Storage Capacity Required for 240-day Storage, m^3	4,255	9,673	N/A

Problem and Opportunity Statement

The Township of St. Clair owns and operates the Courtright WWTP with a rated capacity of 6,000 cubic metres per day and provides treatment capacity to service approximately 8,600 people in the Township. Approximately 3,855 wet tonnes (133 dry tonnes) of aerobically digested biosolids are generated, stored, and land applied annually.

Future industrial sanitary loads are scheduled to be generated in the next 3 years within the Courtright collection area which has triggered the need to expand the Courtright WWTP. In addition to the expected industrial flows, additional flows and loadings from projected growth in the sewershed over the planning horizon (to 2042) will also impact the required treatment capacity. Influent BOD_5, TSS, TKN, and TP loads are expected to significantly increase with the new industrial flows by up to 510 percent. Additional treatment capacity will be required to address the increased loads in order to continue to meet effluent limits and objectives. The increased influent loadings will be a significant consideration in alternatives development.

Effluent quality has historically complied with the current ECA limits. A review of the St. Clair River assimilative capacity confirmed the existing ECA limits and objectives for $cBOD_5$, TSS, TP, *E. coli*, and pH will be acceptable for the proposed expansion to the Courtright WWTP. For TAN, an annual objective and limit were proposed rather than seasonal, consistent with the current summer objective and limit which the WWTP effluent has historically met year-round. The ECA objective for effluent TP has historically not been met. There is an opportunity to review options for optimizing phosphorus removal through this EA.

There is a need now to start planning for the Courtright WWTP expansion to identify projects required in the short-term to manage the expected industrial flows within three years and provide the necessary treatment capacity to manage projected growth in the sewershed throughout the planning horizon (to 2042).

Environmental Assessment Process

Overview of Study Approach

This study was completed as Schedule C Municipal Class EA, following Phases 1 through 4 of the Class EA process.

The activities completed in Phases 1 through 4 include:

- **Phase 1 - Existing Conditions and Future Needs:** This phase included development of capacity and performance requirements, assessing the existing unit processes at the Courtright WWTP for wastewater treatment and biosolids management, identifying gaps in meeting future needs, and development of a Problem and Opportunities Statement.
- **Phase 2 -Identification and Evaluation of Alternative Solutions:** This phase included identification of alternative wastewater treatment and biosolid management solutions to meet future requirements or provide benefit with respect to future opportunities. Alternative solutions were subject to comparative evaluation to identify preferred solutions.
- **Phase 3 - Development of Design Concepts and Implementation Plan:** In this phase, design concepts and implementation triggers as well as a schedule for the recommended solutions was documented, and capital costs were forecasted for the planning period. Potential impacts and mitigation measures were documented.
- **Phase 4 - Environmental Study Report:** The methodology and project recommendations are documented in this Environmental Study Report.

Decision Making Process

A fundamental goal of this study is to document the transparent, defensible, and reproducible decision-making process such that the selected preferred solutions for wastewater liquid and solids treatment over the planning horizon are technically sound and understood by the community. The evaluation will be completed per the following steps:

1. **Short-list.** Develop a short-list of wastewater liquid and solids treatment alternatives to meet future needs. The liquid and solids treatment alternatives will be combined into a short-list of alternative integrated plant-wide solutions for the Courtright WWTP.
2. **Detailed Evaluation.** The short-list of integrated plant-wide alternative solutions will be evaluated using criteria in accordance with the MEA Class EA process. Criteria are identified in the broader categories of Natural Environment, Society & Culture, Technical, and Economic. Criteria are identified within each category with a defined scoring framework. The framework provides a performance measure defining the score for how each alternative solution performs for each criterion.

Alternatives Identification and Evaluation

Expansion of the WWTP using the same technologies/treatment processes as those currently in use was selected as the preferred alternative to upgrade the Average Day Flow (ADF) capacity from 6,000 m^3/d to 15,000 m^3/d. This alternative was selected because the technology is familiar to plant staff and the approach offers more flexibility for future upgrades (e.g., retrofitting the new trains in the future to a process intensification option).

Additional upgrades were determined to be required for headworks, disinfection, and solids treatment. it was assumed the existing technologies would be maintained and expanded as needed to meet the future capacity constraints.

The preferred alternative consists of the following upgrades:

- Headworks
  - Convert both existing mechanical screening channels to duty, each with a hydraulic capacity of 26,500 m3/d (coarse screen with bar spacing of 10 mm) and construct one new screening conveyor/compactor.
  - One new vortex grit removal system with a hydraulic capacity of 26,500 m^3/d.
- Secondary Treatment
  - Construct two new aeration basins (36.6 x 14.3 metres with 5.92 metres SWD) and secondary clarifiers (14.3 x 14.3 metres with 4.6 metres SWD) for a total of four secondary treatment trains.
  - Construct one new multi-stage centrifugal blower with 4,000 Nm3/d capacity.
  - Construct two new RAS/WAS pumps, each with 70 L/s capacity.
- Disinfection
  - Construct one new UV channel with 22,500 m3/d peak capacity, for a total of two UV channels with 37,500 m3/d peak capacity.
- Solids Treatment
  - Construct one new aerobic digester with the same dimensions as the existing digester (14.3 x 14.3 metres with 5.1 metres SWD) for a total of two digesters.
- Solids Storage
  - Construct two new biosolids storage tanks, each with 3,400 m3 capacity, for a total of three tanks and total storage volume of 10,200 m3.

Table ES 11 presents a summary of the preferred solution and associated costs (+100/-50 percent accuracy). The preferred solution will need to be implemented when the new ICI users begin discharging to the Courtright WWTP.

Table ES 11. Preferred Solution for Courtright WWTP

Preferred Solution	Year Required	Driver	Capital Cost, $ million	20-year O&M NPV Cost, $ million[1]	20-year Lifecycle Cost, $ million[1]
WWTP Expansion	2025 When the new ICI users begin discharging	Capacity	$46.4 (Range $23.2 to $92.7)	$29.8 (Range $14.9 to $59.7	$76.2 (Range $38.1 to $152.4)

3. Based on 3% inflation and 5% discount rate.

Engagement

Engagement Plan and Approach

Effective public engagement programs build and maintain community trust and credibility to improve decision making and identify community issues far enough in advance that they can be effectively addressed before final decisions are made.

The Township is committed to undertaking public consultation that provides a variety of opportunities for learning and sharing. As such, the Township has committed to a program that exceeds requirements of the Schedule C Class EA. Through the public consultation program, the proponent will conduct a consultation process that meets the following requirements:

- Is meaningful to those involved
- Facilitates open and transparent dialogue resulting in defensible and traceable decision making
- Provides opportunities for early public and stakeholder involvement
- Helps promote public learning regarding wastewater treatment and the environment

The objective of the public consultation component was to provide information in support of the Courtright Wastewater Treatment Plant Expansion EA and to provide the public and agencies (stakeholders) the opportunity to be involved in the study in a meaningful way.

Engagement Activities

Engagement is a key component of the Municipal Class EA Process. The following provides a summary of the engagement activities completed for this Class EA:

- Project Notices
    - Notice of Commencement
    - Notices of Public Information Centres
    - Notice of Study Completion
- Public and Stakeholder Engagement Activities
    - Public Information Centre 1 (PIC 1) was held on March 29, 2023, from 6:00 to 8:00 PM at the Township's Council Chambers during phase 1 of the Municipal Class EA process. The objective of this PIC was to introduce the study to the public, provide background information on existing conditions at the Courtright WWTP, future needs, and to provide the opportunity for the community to provide feedback. Attendees had the opportunity to ask questions during the session and voice potential concerns through a project survey available at the PIC. A total of 6 participants attended the PIC.
    - Public Information Centre 2 was held on July 17, 2024, from 6:00 to 8:00 PM at the Township's Council Chambers during phase 2 of the Municipal Class EA process. The objective of this PIC was to present the initial alternatives, supporting technical documentation highlighting the decision-making process, the plan to implement the preferred alternative solution, and next steps. The PIC provided another opportunity for interested members of the public to provide comments on the project. Attendees had the opportunity to ask questions during the session and voice potential concerns through a project survey available at the PIC. A total of 10 participants attended the PIC.

How the Preferred Solutions Incorporates Engagement Feedback

The engagement conducted throughout the study resulted in the team receiving valuable feedback at key stages in the study. In summary, the team identified common themes in the feedback received across the engagement activities:

1. **Protecting the St. Clair River.** The St. Clair River is an important natural feature of the Township, supporting aquatic and natural habitats.

2. **Protecting Natural Environmental Features:** Protecting and/or restoring natural environmental features surrounding the plant from street view and local residents is an important aspect of the study.

The feedback received through the engagement process impacted the decision-making on this study can be summarized as follows:

1. **Evaluation Framework:** Feedback received early in the project related to the community's values were incorporated into the detailed evaluation framework. In addition, the feedback received through the engagement activities provided important context for the project team during the scoring and evaluation of alternatives project phase.

2. **Confirmation of the short-listed alternatives and preferred solutions:** Engagement activities prioritized, presented, and sought feedback on the decision-making process throughout the study. The feedback received during these activities confirmed the decision-making process reflected the community's priorities and values. The study team received feedback supporting the identified preferred solutions and indicated that the community priorities identified through earlier engagement activities were reflected in the recommendations.

3. **Assimilative Capacity of the St. Clair River:** Feedback through engagement activities indicated that protection of the St. Clair River was a priority. An assimilative capacity study of the St. Clair river was completed in order to incorporate the findings directly in this study. The results of the Assimilative Capacity study indicated that the proposed limits and objectives are consistent with the current ECA for the Courtright WWTP (No. 4042-BEUQ6N) as no significant increase in background parameter concentrations to the river resulting from plant discharge at the expanded capacity is expected. Treatment technologies identified considered the findings of the assimilative capacity by continuing to exceed the effluent objectives identified through the assimilative capacity study.

Implementation Plan

This section presents a summary of the implementation plan developed for this study.

Table ES 12 presents the required timing of the upgrades identified. Providing capacity for the new ICI users is the primary driver for the implementation plan. All unit processes are expected to have sufficient capacity until the new ICI users begin discharging to the Courtright WWTP.

Table ES 12. Implementation Timing for Capital Works at Courtright WWTP

Unit Process	Project	Year Required
Headworks (Screening & Grit Removal)	Screening & Grit Removal Expansion consisting of one new screenings conveyor/compactor and one new vortex grit removal system.	When the new ICI users begin discharging
Secondary Treatment	Secondary Treatment Expansion consisting of two new secondary treatment trains (extended aeration basin and secondary clarifier), one new aeration blower for peak capacity, and two new RAS/WAS pumps.	When the new ICI users begin discharging
Disinfection	UV Disinfection Expansion consisting of one new UV Channel with 22,500 m^3/d peak capacity.	When the new ICI users begin discharging
Solids Treatment	Aerobic Digestion Expansion consisting of one new aerobic digester.	When the new ICI users begin discharging

Unit Process	Project	Year Required
Solids Storage	Solids Storage Expansion consisting of two new solids storage tanks.	When the new ICI users begin discharging

The cost breakdown required for these projects is presented in Table ES 13 and the timeline for implementation is summarized in Table ES 14. These projects are required to be completed by the time the ICI users begin discharging. Implementation of either projected ICI user will exceed the existing uncommitted reserve capacity of the Courtright WWTP. Based on MECP guidance received on recent similar projects, the Township should not accept these applications for ICI flows nor issue any Planning Act or Condominium Act approvals for proposals that would exceed the uncommitted reserve capacity, and should consider these developments to be premature until such time as a suitable Class EA process is completed, the requisite tenders are let, and the contracts for the required municipal sanitary sewage works expansion/upgrades are awarded (MECP, Master Plan Guidance, 2023). Therefore, the earliest the ICI users could be approved would be Q1 2026 when the construction tender is expected to be awarded. The ICI flows could not be connected to the plant until the upgrades are constructed and commissioned, which is projected for Q2 2027.

In the proposed implementation schedule, conceptual design would be initiated in Q1 2025 at which time the estimated design and engineering fees and design development contingency total of $13.0M would be incurred. Tender of the construction would occur in Q1 2026 at which time the remaining estimated cost of $34.6M would be incurred.

The proposed schedule is based on the traditional project delivery method of Design-Bid-Build. Alternative delivery methods could be explored to accelerate the project schedule, such as a phased approach, design-build or integrated project delivery.

Table ES 13. Capital Costs for Courtright WWTP Expansion

Item	Cost (in million $)[a]
Headworks	$1.8
Secondary Treatment (including Extended Aeration Basins, Aeration Blower, Secondary Clarifiers, and RAS/WAS Pumping)	$14.6
Disinfection	$1.2
Solids Treatment	$2.8
Solids Storage	$5.5
Subtotal	**$25.9**
Mobilization/demobilization, bonds, insurance, and contract profit (15%)	$3.9
Contractor overhead (10%)	$2.6
Construction Contingency (5%)	$1.3
Design development contingency (30%)	$7.8
Design and Engineering Fees (20%)	$5.2
Location Adjustment Factor (4%)	$1.0
Total	**$47.6**

Notes:

a. Costs are reported with +100/-50 percent accuracy.

Table ES 14. Summary of Project Milestones for Courtright WWTP Expansion

Milestone	Costs Incurred	Timeline
Schedule C EA Notice of Completion	N/A	Q1 2025
Procurement for Conceptual Design, Detail Design, Services During Construction	$13.0M	Q4 2024 to Q2 2027
Conceptual Design	N/A	Q1 2025 to Q2 2025
Detail Design	N/A	Q2 2025 to Q1 2026
Construction Tender & Award	$34.6M	Q4 2025 to Q1 2026
Construction & Commissioning	N/A	Q1 2026 to Q2 2027
Warranty Period	N/A	Q3 2027 to Q3 2029

Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

Acronym	Definition
ECA	Environmental Compliance Approval
WWTP	Wastewater Treatment Plant
UV	ultraviolet
ESR	Environmental Study Report
TSH	Totten Sims Hubicki Associates
EA	Environmental Assessment
Km	kilometres
Mm	millimetre
Township	Township of St. Clair
MEA	Municipal Engineers Association
MECP	Ministry of the Environment, Conservation and Parks
ESR	Environmental Study Report
L/s	Litres per second
TDH	total dynamic head
alum	aluminum sulfate
m^3/d	cubic metres per day
L/h	litres per hour
kPa	kilopascals
SCADA	Supervisory Control and Data Acquisition
ASR	activated sludge recycle
PS	Pump Station
kW	kilowatt
V	volt
ATS	Automatic Transfer Switch
LED	light emitting diode
MCEA	Municipal Class Environmental Assessment
ADF	average day flow

Acronym	Definition
PIF	peak instantaneous factor
ICI	institutional, commercial, and industrial
L/cap/day	litres per capita per day
PDF	peak day flow
TP	total phosphorus
TKN	total Kjeldahl nitrogen
BOD_5	biochemical oxygen demand
TSS	total suspended solids
Mg/L	milligrams per litre
g/cap/d	grams per capita per day
Kg/d	kilograms per day
$cBOD_5$	carbonaceous biochemical oxygen demand
TAN	total ammonia nitrogen
E. coli	*Escherichia coli*
ACS	Assimilative Capacity Study
CFU	Colony-forming unit
TS	total solids
kg/cap/year	kilograms per capita per year
PE	population equivalent
RoW	right-of-way
SCRCA	St. Clair Region Conservation Authority
NHF	Natural Heritage Feature
LIO	Land Information Ontario
MNDMNRFF	Ministry of Northern Development, Mines, Natural Resources and Forestry mapping
ANSI	Areas of Natural and Scientific Interest
OBBA	Ontario Breeding Bird Atlas
SAR	Species at Risk
NHIC	Natural Heritage Information Centre
ESA	*Endangered Species Act*

Acronym	Definition
DFO	Department of Fisheries and Oceans Canada
LAWSS	Lambton Area Water Supply System
PWQO	Provincial Water Quality Objectives
U.S. EPA	United States Environmental Protection Agency
DO	dissolved oxygen
CN Rail	Canadian National Rail
ARA	Archaeological Research Associates
RAS	return activated sludge
WAS	waste activated sludge
SRT	Solids Retention Time
MLSS	mixed liquor suspended solids
HRT	hydraulic retention time
kg O_2	kilograms of Oxygen
SOTE	Standard oxygen transfer efficiency
psi-g	pounds per square inch gauge
O&M	Operation and Maintenance
SOR	Surface Overflow Rate
SLR	Solids Loading Rate
$m^3/m^2/d$	meter per square meter per day
$kg/m^2/d$	kilograms per square meter per day
F/M	food to microorganism
SVI	Sludge Volume Index
mL/g	millilitres per gram
Al:P	aluminum-to-phosphorus
VS	volatile solids
$kg/m^3/d$	kilograms per cubic metre per day
d	day
MODA	Multiple Objective Decision Analysis
MLD	Million Litres per day

Acronym	Definition
kWh	kilowatt-hour
IFAS	Integrated fixed-film activated sludge
MBBR	Moving Bed Biofilm Reactor
MABR	Membrane Aerated Biofilm Reactor
RBC	rotating biological contactors
SWD	Side Wall Depth
RDT	Rotary Drum Thickener
GBT	Gravity Belt Thickener
NPV	Net Present Value
FTE	Full Time Equivalent
EIS	Environmental Impact Study
SAC	Ontario Spills Action Centre
MBCA	Migratory Birds Convention Act
SUE	subsurface utility engineering
APU	assessment of past uses

2. Introduction and Background

2.1 Background

The Courtright Wastewater Treatment Plant (WWTP) is located at 1464 St. Clair Parkway in the County of Lambton and has a rated capacity of 6,000 cubic metres per day as listed in Amended Environmental Compliance Approval (ECA) No. 4042-BEUW6N dated August 9, 2019. The plant receives influent flow from the sanitary system and pre-treated industrial wastewater. A septage receiving facility is in place, however not in use at the time of this report. The WWTP is classified as a secondary treatment plant (Class II), with a preliminary treatment system consisting of screenings and grit removal and a secondary treatment system consisting of a fine bubble diffused extended aeration system and secondary clarification. Supplementary treatment systems include phosphorus removal via chemical addition and ultraviolet (UV) disinfection. The sludge management system includes a primary digester and a biosolids storage tank for seasonal storage of biosolids to be hauled off-site for land application. The effluent from the WWTP discharges through a 600-millimetre diameter sewer to the St. Clair River.

An Environmental Study Report (ESR) was prepared in November 2007 by Totten Sims Hubicki Associates (TSH) for the Corunna and Courtright WWTPs. The report documented the findings of Phases 1 to 4 of the Municipal Engineers Association (MEA) Municipal Class Environmental Assessment Process. The ESR was undertaken to address the projected shortfall in treatment capacity to meet the anticipated growth in the communities of Corunna, Mooretown, and Courtright. During the 2007 study, the 2027 population was projected to be 15,675 for serviced and unserviced areas, with a serviced population of 8,700 (TSH, 2007). Several alternatives were developed and evaluated to determine the preferred planning solution, with public and agency input. The preferred planning alternative was to expand the Courtright WWTP at the existing site which led to its current rated capacity of 6,000 cubic metres per day. At the time of the 2007 ESR, the rated capacity included an additional 15 percent to allow for potential growth.

The preferred alternative provided a combined service area with conveyance of wastewater from the Corunna service area through a new 140 litres per second (L/s) pumping station and 6 kilometres (km) of 300-millimetre (mm) diameter forcemain. The Courtright WWTP was expanded on the existing site to meet the combined flows. Several treatment alternatives were evaluated, and the extended aeration activated sludge process was selected.

In 2015, CH2M HILL (now Jacobs) was retained by the Township to assist with investigation into odour concerns at the Courtright WWTP. Implementation of liquid phase odour control was recommended as a first step for reducing odour generation at the plant. Subsequently, odour concerns persisted which resulted in the construction of a biofilter to treat odorous air from the facility's headworks building, which was completed in 2019. Odour control measures will remain a focus during future expansion planning given the proximity of the WWTP to residential areas.

2.2 Study Purpose and Approach

Jacobs was retained by the Township of St. Clair (Township) to complete a MEA Schedule 'C' Class Environmental Assessment (EA) for capacity expansion of the Courtright WWTP. The Township identified the need for capacity expansion at the Courtright WWTP to accommodate future industrial sanitary loads that are anticipated to be generated in the next three years in addition to future flows and loads from forecasted population growth over the planning horizon (to 2042).

The objective of this Environmental Study Report (ESR) is to provide the Township with updated recommendations to guiding the implementation of infrastructure upgrades and improvements over the next

The objective of this Environmental Study Report is to provide the Township with updated recommendations to guiding the implementation of infrastructure upgrades and improvements at the

Courtright WWTP over the next 20-year planning horizon (to 2042) using a transparent decision-making process. The Courtright WWTP Class EA is intended to provide timely, fiscally responsible, and achievable solutions to better manage the wastewater and biosolids infrastructure required to service growth while managing risks using sound environmental planning principles.

2.3 Report Structure

This Environmental Study Report is structured as follows:

Section 2: Introduction and Background provides an overview of the Class Environmental Assessment process.

Section 3: Ontario Environmental Assessment Process describes how the environmental assessment process has informed the development of this Class EA.

Section 4: Project Context describes the project purpose, background information related to existing conditions and operation of the Courtright WWTP and presents the regulations and policies that inform and shape the Class EA.

Section 5: Methods and Approach details the overall study approach, and approach to community engagement.

Section 6: Study Area Existing Conditions details the existing conditions establishing foundation for understanding the existing and future wastewater treatment and biosolids management needs at the Courtright WWTP.

Section 7: Study Area Future Conditions details the outcomes of the capacity assessment completed for the unit processes at the Courtright WWTP, and projects the anticipated future needs within the planning horizon, forming the basis for the Class EA problem and opportunity statement.

Section 8: Problem and Opportunity Statement defines the problems and opportunities identified through the documentation of the existing conditions and future needs in accordance with the Class EA process.

Section 9: Decision Making Process describes the approach to the decision-making process to identify the preferred recommended alternative.

Section 10: Wastewater Treatment Alternatives Development and Evaluation Methodology identifies the wastewater treatment alternatives to address the current and future needs identified in Sections 5 and 6, the results from the detailed evaluation approach, and the preferred solutions.

Section 11: Public, Agency, and First Nations Consultation and Engagement details the engagement activities conducted throughout the Class EA and how the feedback received through engagement activities informed the recommendations of the project.

Section 12: Implementation Plan presents the recommended upgrades, the implementation schedule, triggers, and capital cost forecast for implementing the Class EA recommended capital work. This section also details the potential effects, benefits, and mitigation measures necessary to reduce the likelihood of impacts from implementation of recommendations.

2.4 Project Contact

Primary contacts for the project are as follows:

St. Clair Township

Brian Black
Director of Public Works
Township of St. Clair

1155 Emily Street
Mooretown, ON N0N 1M0
(519) 867-2125 ext. 2252

Jacobs Consultancy Canada

Janice Rimmer, Project Manager
165 King Street West, Suite 201
Kitchener, ON N2G1A7
(705) 229-7140
janice.rimmer@jacobs.com

Project engagement is intended to address all comments received during the consultation period and resolve any outstanding concerns with the project team. In the event there are outstanding concerns that relate to the potential adverse impacts to constitutionally protected Indigenous and treaty rights, a Section 16 Order request on those matters (only) should be addressed in writing to:

Minister Andrea Khanjin
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Avenue, 1st Floor
Toronto, ON M4V 1P5
ClassEAnotices@ontario.ca

If other concerns with the Environmental Study Report and/or EA process are made known to the minister, or determined following a review of the document, the Minister reserves the right to issue an order on his or her own initiative within a specified time period.

3. Ontario Environmental Assessment Process

3.1 Environmental Assessment Act

The objective of the Ontario Environmental Assessment Act R.S.O. 1990, c. E. 18 is to consider the possible effects of projects early in the planning process, when concerns may be most easily resolved, and to select a preferred alternative with the fewest identified impacts.

The EA Act requires the study, documentation, and examination of the environmental effects that could result from projects or activities.

The EA Act defines "environment" very broadly as follows:

1. Air, land, or water
2. Plant and animal life, including human life
3. Social, economic, and cultural conditions that influence the life of humans or a community
4. Any building, structure machine, or other device or thing made by humans
5. Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities
6. Any part or combination of the foregoing, and the interrelationships between any two or more of them, in or of Ontario

In applying the requirements of the EA Act to projects, two types of EA planning and approval processes are identified:

- Individual EAs (Part II of the EA Act): Projects have terms of reference and individual EAs, which are carried out and submitted to the Ministry of the Environment, Conservation and Parks (MECP) for review and approval.
- Class EAs: Projects are approved subject to compliance with an approved Class EA process; provided that the appropriate Class EA approval process is followed, a proponent will comply with the requirements of the EA Act.

3.2 Class Environmental Assessment Process

The Class EA process is a decision-making framework that effectively meets the requirements of the *EA Act* and is comprised of the following five phases. These phases are illustrated in Figure 3-1.

1. Identify the problem or opportunity
2. Identify alternative solutions and establish a preferred solution
3. Examine alternative methods of implementing the preferred solution that will minimize negative effects and maximize positive effects
4. Prepare the project file
5. Implement the preferred solution

This study was completed as a Schedule C Class EA, including Phases 1 through 4 of the Municipal Engineer's Class EA process, as shown on Figure 3-1 (Municipal Class Environmental Assessment (MCEA), 2015). These include:

- Schedule A projects are minor operational and upgrade activities and may go ahead without further assessment once Phase 1 of the Class EA process is complete (that is, the problem is reviewed, and a solution is confirmed).

- Schedule "A+" projects are pre-approved but still require public notification prior to implementation of the project. Projects categorized as Schedule A+ include activities such as municipal infrastructure plans previously approved by a municipal council (Phase 1).

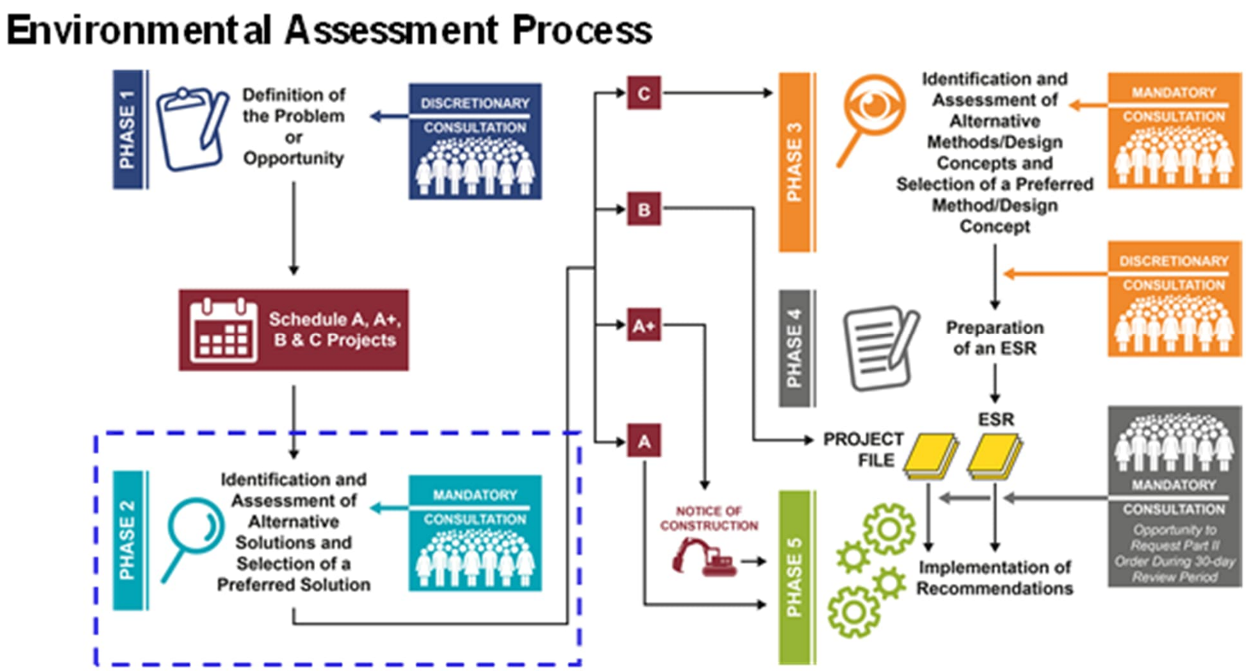
- Schedule B projects must proceed through the first two phases of the process. Proponents must identify and assess alternative solutions to the problem, inventory impacts, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided that no significant impacts are identified and no requests are received to elevate the project to Schedule C or undertake the project as an Individual EA (Section 16 Order), the project may proceed to the next phase.

- Schedule C projects require more detailed study, public consultation, and documentation, as they may have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of an assessment. An ESR must be completed and available for a 30-day public review period prior to proceeding to implementation.

A Section 16 Order is the legal mechanism in which the status of an undertaking can be elevated before the project can progress. The study's planning and design process allows for concerns to be identified and resolved throughout the course of the project; however, a Part 16 Order request can be submitted to MECP on the grounds that the order may prevent, mitigate or remedy adverse impacts on the existing Aboriginal and treaty rights of the Aboriginal peoples of Canada as recognized and affirmed in section 35 of the Constitution Act, 1982.

The EA Act as amended through the COVID-19 Economic Recovery Act, 2020, also provides the Minister with the authority to make two types of orders with respect to an undertaking proceeding in accordance with a Class EA. The Minister may, on their own initiative, within a time limited period, require a proponent to undertake an individual EA, referred to as a section 16(1) order, in which case the proponent cannot proceed with the project without first seeking and obtaining approval under Part II of the Act (conduct an individual EA). The Minister may also impose conditions on an undertaking, referred to as a section 16(3) order, where the proponent must meet the conditions outlined in the order.

Figure 3-1. MEA Process



4. Project Context

4.1 Study Area

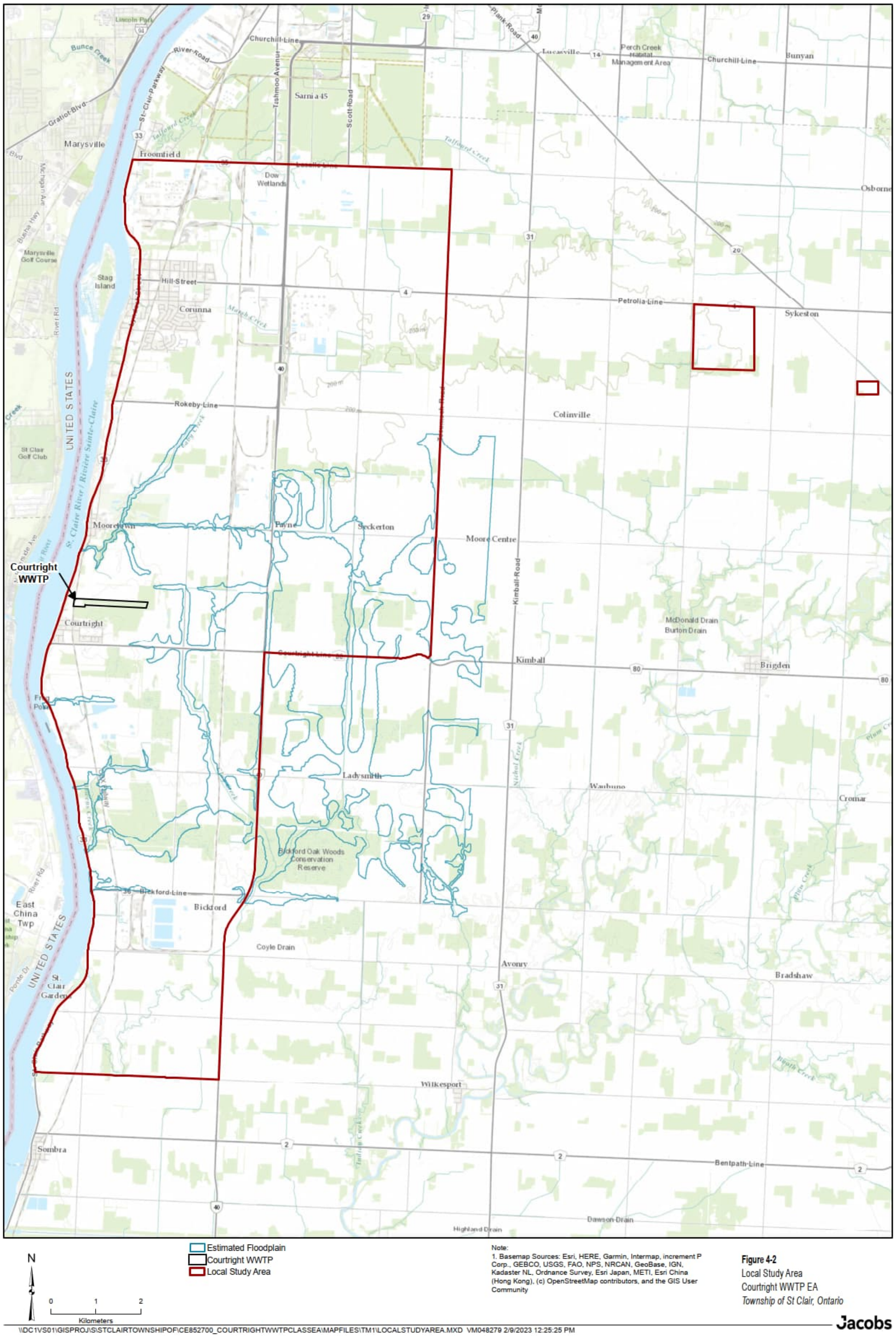
The Township of St. Clair is located in southwestern Ontario, just south of the City of Sarnia. It is bounded by LaSalle Line to the north, the St. Clair River to the west, Mandaumin Road to the east and Kent Line to the south.

The study area for the Courtright WWTP Expansion EA consists of the Courtright WWTP site, as shown in Figure 4-1. This study area represents the site which may be directly disturbed by implementation of the preferred alternative.

A larger local study area shown in was also considered in this EA to evaluate impacts to the surrounding community. The local study area extends beyond the project footprint to include outlying residential, industrial, commercial, and institutional development within the communities of Corunna, Moortown, and Courtright. The local study area is bounded by LaSalle Line to the north, St. Clair Parkway to the west, Wilkesport Line to the south, and 40 Highway and Tecumseh Road to the east. The majority of current and future industrial growth identified in the Township Official Plan, last amended in 2013, is located within these bounds, as well as two smaller areas located near Petrolia Line and Plank Road (Lambton County Planning & Development Department, 2005, amended 2013).

Figure 4-1. Study Area for the Courtright WWTP EA.

Figure 4-2. Local Study Area for the Courtright WWTP EA



4.2 Courtright Wastewater Treatment Plant

4.2.1 Overview

The Courtright WWTP is located at 1464 St. Clair Parkway in the County of Lambton and has a rated capacity of 6,000 cubic metres per day as per ECA No. 4042-BEUQ6N (dated August 9, 2019). The plant consists of a septage receiving facility (not in use at the time of this report), preliminary treatment (screening and grit removal), extended aeration secondary treatment, supplementary phosphorus removal, UV disinfection, and a sludge management system.

The plant receives influent flow from the sanitary system and pre-treated industrial wastewater. A septage receiving facility is in place, however not in use at the time of this report.

Influent flows are conveyed to Headworks for preliminary treatment. The purpose of preliminary treatment is to remove debris from the raw sewage to protect equipment and downstream processes. The Headworks consists of a mechanical screening and vortex grit removal facility, each with a capacity of 26,500 cubic metres per day (m^3/d). Influent flow is sampled and measured via magnetic flow measurement devices located at the Corunna and Courtright Pump stations. An automatic composite sampler is installed at the Headworks Building.

Following the preliminary treatment, flow is split between two extended aeration secondary treatment plants for biological treatment and secondary sedimentation. The purpose of secondary treatment is to remove dissolved and suspended organic matter. Two extended aeration basins are equipped with fine bubble diffused aeration systems and dissolved oxygen analyzers. Aeration is achieved by a turbo blower with a capacity of 2,500 normal metres cubed per hour and a centrifugal blower with a capacity of 2,000 normal metres cubed per hour. Secondary sedimentation occurs in two square secondary clarifiers equipped with rotary sludge and scum collector mechanisms. The three return activated sludge pumps (two duty and one standby) are rated at 70 L/s at total dynamic head (TDH) of 13.2 metres and two scum pumps (one duty and one standby) are rated at 20 L/s at TDH of 8 metres. There are four activated sludge magnetic flow metres. A portion of the return activated sludge flow is returned to the inlet end of the aeration basins, while the remaining portion is conveyed to the headworks and mixed with incoming raw sewage flows from the Corunna and Courtright pump stations for liquid-phase odour control.

Phosphorus removal is achieved through aluminum sulfate (alum) addition at the aeration tank outlet. The phosphorus removal system consists of two 15,000 litre capacity alum storage tanks, and three (two duty and one standby) positive displacement metering pumps, each with a maximum capacity of 90 litres per hour (L/h).

Disinfection is completed as a final treatment step to remove pathogens from the treated water prior to discharging into the St. Clair River. Disinfection is achieved via one UV disinfection system with a total peak flow rate of 15,000 cubic metres per day. Effluent flow rate is measured via two Parshall flumes, each equipped with an ultrasonic level sensor, from the effluent chamber of each secondary clarifier. An automatic composite sampler is installed at the outlet of the disinfection channel. One 600-millimetre diameter outfall sewer conveys effluent from the UV/filter building to the outfall chamber. The outfall runs west from the WWTP and discharges directly to the St. Clair River.

Waste activated sludge is collected from the secondary clarifiers and further treated to reduce the sludge volume and stabilize the organic materials present in the sludge prior to land application. The sludge management system consists of aerobic digestion, biosolids storage, and a truck loading facility. The aerobic digestion process consists of a single aerobic primary digester divided into two cells for Stage 1 and Stage 2. The Stage 1 cell is sized for twice the volume of Stage 2. One jet aeration system is provided for each stage. Two submersible recirculation pumps are provided: one rated at 95 L/s at TDH of 6.1 metres for Stage 1 and one rated at 47 L/s at TDH of 6.1 metres for Stage 2. There are two air blowers, each rated at a capacity of 310 normal cubic metres per hour at 50 kilopascals (kPa), and three positive displacement, digester sludge/supernatant transfer pumps, each with a capacity of 8.7 L/s. Digested biosolids are stored in a single biosolids storage tank with a capacity of 3,400 cubic metres. The storage tank is equipped with two mixing pumps (one duty, one standby), each rated at 189 L/s at 12.2 metres TDH, an ultrasonic level sensor, and float switch high level alarm. The biosolids truck loading station consists of two (one duty one standby) positive displacement biosolids transfer pumps, each rated at 30 L/s, access stairs and platform, a discharge pipe with swivel joint, and one magnetic flow meter on the biosolids loading line. Biosolids are typically hauled off-site for land application under the Nutrient Management Act. Seasonal storage is provided by the biosolids storage tank.

4.2.2 Wastewater Treatment Plant Layout and Processes

A site layout and simplified process flow diagram for the Courtright WWTP are provided in Figure 4-3 and Figure 4-4, respectively. Influent flow from the sanitary system and pre-treated industrial wastewater are first processed through preliminary treatment consisting of screening and grit removal. These processes are housed in the preliminary treatment and operations building. Flows are then conveyed to the two secondary treatment plants for further processing through extended aeration and secondary clarification. Alum is dosed following the aeration tanks for phosphorus removal. A portion of the return activated sludge is recycled from the secondary clarifiers to the aeration tanks, with the balance returned to the headworks and mixed with the raw sewage prior to screening for odour control. Waste activated sludge is removed from the secondary clarifiers and stabilized through aerobic digestion. Digested biosolids are stored on-site prior to disposal via land application. Two biofilters were added for odour control during the odour control project (initiated in 2015 and constructed in 2019), with space for a future third unit. Effluent water is disinfected through a UV disinfection system prior to discharge directly to the St. Clair River.

In response to odour complaints, the Township retained CH2M HILL (now Jacobs) in 2015 to assist with investigation into odour concerns at the Courtright WWTP. Implementation of liquid phase odour control was recommended as a first step for reducing odour generation at the plant. A permanent chemical dosage system was installed and commissioned in 2016 at the Corunna Pumping Station to reduce the hydrogen sulphide generation in the Preliminary Treatment Building. Vapour phase odour control was addressed in a subsequent project including a biofilter odour control system, activated sludge recycling to the headworks, and an effluent water re-use system, which were installed and commissioned in 2019. The odour control system consisted of a pre-humidifier, foul air fan, and two biofilter cells, with space for a future third cell. Each biofilter cell was designed to treat continuously exhausted odorous air at a rate of 2,300 normal cubic metres per hour.

Figure 4-3. Courtright WWTP Site Layout

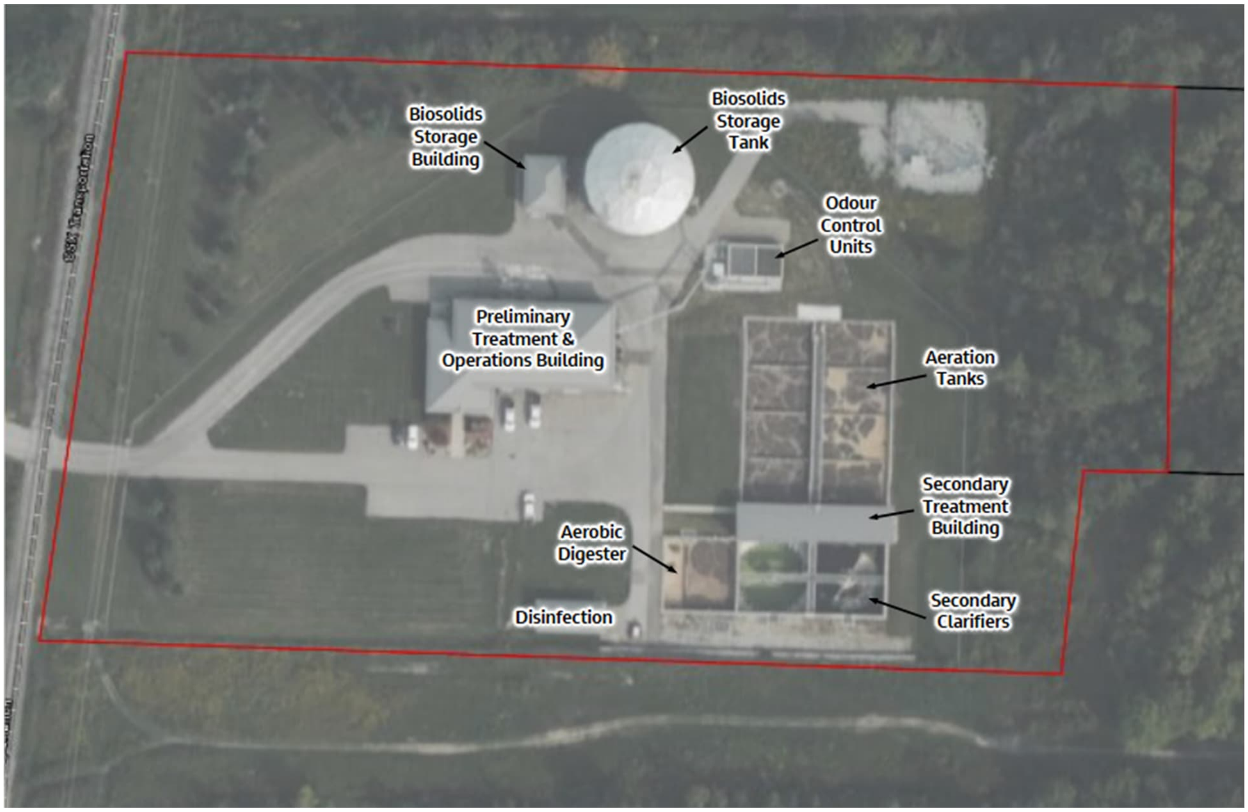
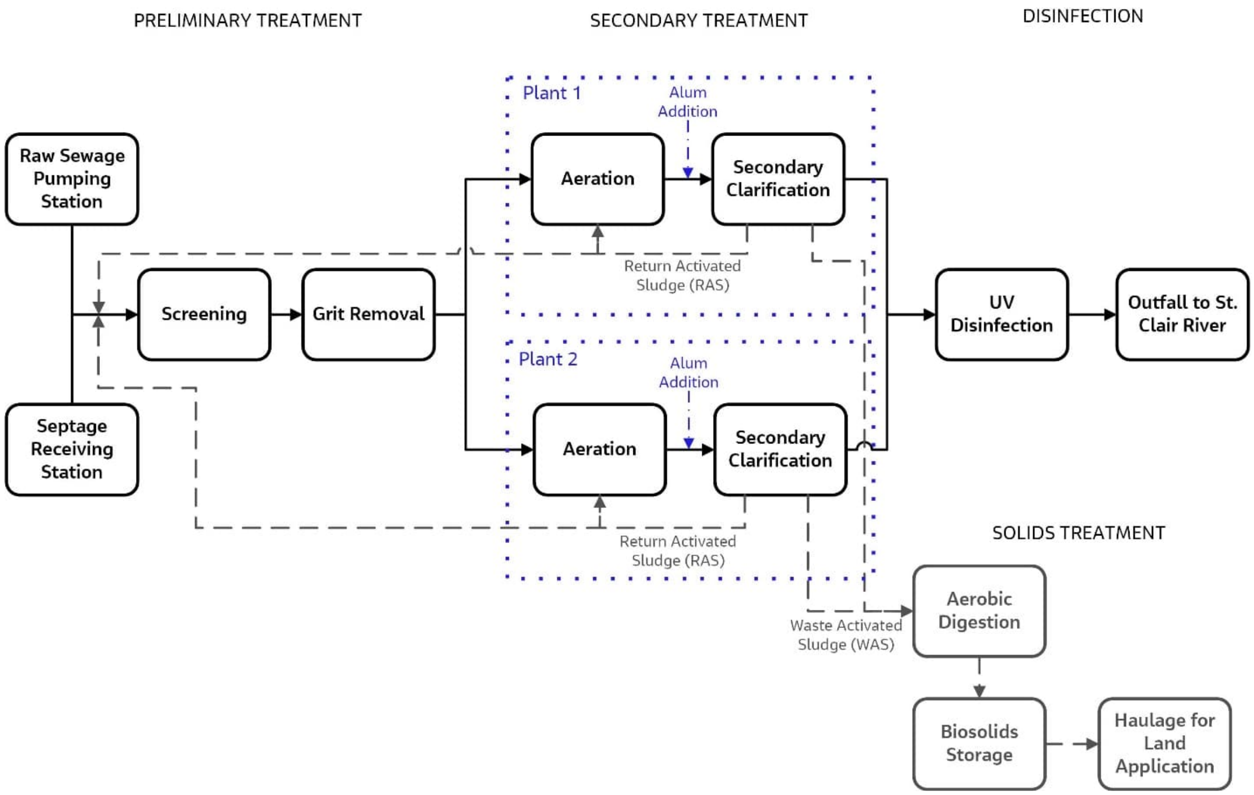


Figure 4-4. Simplified Process Flow Diagram for Courtright WWTP.



4.2.3 Current Conditions

In 2020, CH2M HILL (now Jacobs) was retained by the Township to complete a ten-year wastewater capital plan to prioritize future sanitary service projects. The scope of the ten-year plan was township wide however several projects were identified specifically for the Courtright WWTP as follows:

- Odour Treatment Upgrades:
  - Additional odour assessments were recommended following the construction of the biofilter odour control system in 2019.
  - Aerobic Digester Cover System to allow for biofilter treatment of foul air. May be needed to address additional odour concerns following the 2019 upgrades.
  - Aeration Basin Cover System to allow for biofilter treatment of foul air. May be needed to address additional odour concerns following the 2019 upgrades.
- Secondary Effluent Flow Measurement Improvements including addition of a second level measurement point and re-calibration of the flow metres at the existing Parshall flumes to correct for submergence.
- Secondary Effluent Launder Covers to minimize algae growth and simplify maintenance.

- Complete review of Supervisory Control and Data Acquisition (SCADA) system to confirm existing functionality and identify gaps and upgrades needed with the goal of operating primarily in automatic mode.
- Control wiring for modulating the activated sludge recycle (ASR) valve positioning from the SCADA system to improve operational flexibility and allow return activated sludge flow to be split between headworks and the aeration tanks.
- Replacement of interior lighting fixtures.
- UV Building Drain Sump to prevent discharge of UV cleaning solution and debris into the final effluent channel.
- Addition of a ground level connection for truck loading from the biosolids tank.

In addition, a feasibility study was recommended to investigate the potential for importing sewage from Brigden to the Courtright WWTP for treatment rather than continuing to treat at the Brigden lagoon. Depending on the outcome of this study, the future flows and loadings to the Courtright WWTP may be impacted (CH2M HILL Canada Limited, 2020). The Township plans to complete a study to import the Brigden flows to the Courtright WWTP within the next 10 years, with an anticipated future flow of 300 cubic metres per day.

The approximate timeline for the completion of these projects as identified in the ten-year plan is summarized in Table ES 15.

Table ES 15. Schedule for Capital Upgrades (CH2M HILL Canada Limited, 2020)

Project Name	Year
PS Pump Replacements	2025, 2027, 2029
PS Panel Upgrades	2026, 2028, 2030
Port Lambton Sewage Lagoon Alum Station Upgrades	2024
Sombra Main PS Replace 60 kW 600 V Generator	2024
Power Sewers Lambton Line – Replace 4 Units	2024
Corunna PS Lighting Upgrade to light emitting diode (LED)	2024
Brander Park PS Replace 600 V 15 kW Generator	2025
Brander Park PS Replace Service Entrance Switch	2025
Brander Park PS Replace 600 V Main Electrical Panel	2025
Port Lambton Storm Station Replace Service Entrance Disconnect	2026
Port Lambton Storm Replace 600 V Generator	2026
Port Lambton Storm Lighting Panel	2026
Courtright WWTP Secondary Effluent Flow Measurement Improvements	2026

Project Name	Year
Courtright WWTP SCADA Review and Programming Updates	2027
Courtright WWTP Secondary Effluent Launder Covers	2027
Forcemain Video Inspection	2028
Sewage from Brigden to Courtright Study	2028
Courtright WWTP Control wiring for the intermediate position of ASR valves from the SCADA system	2028
Courtright WWTP Lighting Upgrade to LED	2029
Courtright WWTP UV Building Drain Sump	2029
Spare Pump for Courtright PS	2030
Courtright WWTP Ground Level Connection to Truck Loading	2030

4.3 Legislative Framework

4.3.1 Wastewater Treatment

Wastewater treatment processes must meet the requirements of the following environmental protection legislation and regulations:

- Ontario *Water Resources Act*, as amended by the Safeguarding and Sustaining Ontario's Water Act, 2007, is the legal foundation of Ontario's water policy and an important law governing water quality and quantity in Ontario. This Act prohibits the discharge of polluting material in or near water, prohibits or regulates the discharge of sewage, facilitate orders requiring measures to prevent, reduce or alleviate impairment of water quality, enables the designation and protection of sources of public water supply, and regulates water taking more than 50,000 litres a day.

- Ontario *Safe Drinking Water Act, S.O*. 2002, c. 32: is intended to protect human health through the control and regulation of drinking water systems and drinking water testing. Wastewater systems need to be located, designed, constructed, maintained, and operated in accordance with applicable standards so that drinking water is protected, safe, clean and reliable.

- Ontario *Clean Water Act* requires that communities, through local Source Protection Committees, protect municipal drinking water supplies (and non-municipal supplies if added by the municipality of Minister) from overuse and contamination, now and into the future. This Act aims to prevent contaminants from entering sources of drinking water, including lakes, rivers and aquifers.

- Thames-Syndenham and Region Source Protection Plan (2015, Updated 2023): includes plans and policies that apply to activities that are identified as drinking water source threats. The following policies are relevant to the St. Clair WWTP:

  - Policy 2.10 Existing Sewage Discharge - Management - is applicable to new or existing (including expansions, modifications, or replacements) sewage treatment plants subject to an Environmental Compliance Approval in accordance with the Ontario Water Resources Act and where these activities are, or would be, significant drinking water threats, the Ministry of the Environment shall review and, where necessary, amend Environmental Compliance Approvals to incorporate terms and conditions. These terms and conditions, when implemented, shall manage these activities so that they cease to be, or never become, significant drinking water threats.
  - Policy 2.11 Future Sewage Discharge - Prohibition - is applicable to any existing sewage treatment plant effluent discharges, storage of sewage, industrial effluent discharge, sewage treatment plant by-pass discharges, or combined sewer discharge where these activities are significant drinking water threats, the Ministry of the Environment shall review and, where necessary, amend Environmental Compliance Approvals to incorporate terms and conditions These terms and conditions, when implemented, shall manage these activities so that they cease to be significant drinking water threats.
  - Policy 2.12 Existing Sewage Storage – Management - To reduce the risk to municipal drinking water sources from existing sewage storage in vulnerable areas where it is a significant drinking water threat, the Province (MECP) shall review and, where necessary, amend Environmental Compliance Approvals (ECA) to incorporate terms and conditions. These terms and conditions, when implemented, shall manage this activity so that it ceases to be a significant drinking water threat.
- O. Reg. 129/04: Water Works and Sewage Works applies to wastewater collection and treatment facilities, licensing of facility operators and operating standards.
- Canada *Fisheries Act:* manages and protects Canada's fisheries resources prohibiting the deposit of all deleterious substances that may degrade or alter water quality in a manner that directly or indirectly harms fish, fish habitat or the use of fish by humans. The Wastewater Systems Effluent Regulations (include mandatory minimum effluent quality standards) apply in respect of a wastewater system that deposits effluent as part of a wastewater system. Effluent containing deleterious substances will follow the requirements and standards outlined in this regulation.

4.3.2 Biosolids Management

Transport and infrastructure planning for biosolids management must meet the requirements of the following environmental protection legislation and regulations:

- Ontario *Environmental Protection Act,* R.S.O. 1990, c. E. 19 is the main pollution control legislation in Ontario, prohibiting discharge of any contaminants into the environment that cause or are likely to cause adverse effects while approved contaminants must not exceed limits prescribed by the regulations. Biosolids and products incorporating biosolids used for non-agricultural purposes can be managed within the restrictions of the Environmental Protection Act. Applicable regulations under this Act include:
  - O. Reg. 347: General Waste Management: Biosolids and incineration ash are defined as a non-hazardous organic waste under this Regulation. Compost that meets the requirements for Category A is exempt from O. Reg. 347.
  - O. Reg. 419/05: Air Pollution – Local Air Quality: Guideline A-7: Air Pollution Control, Design and Operation guidelines for Municipal Waste Thermal Treatment Facilities

  - Ontario *Water Resources Act,* R.S.O. 1990, c. O.40 Management of biosolids on agricultural land in Ontario is governed by the Ontario Water Resources Act.
  - Ontario *Safe Drinking Water Act*, S.O. 2002, c. 32 is described in subsection 4.3.1.
  - Ontario *Clean Water Act,* S.O. 2006, c. 22 is described in subsection 4.3.1.
  - Ontario *Nutrient Management Act*, 2002, S.O. 2002, c. 4 governs the transport and land application of biosolids. Dewatered residuals need to be stabilized to reduce pathogen levels in order to fall into Non-agricultural Source Material Category 3, specifically as 'sewage biosolids from large treatment works' (Section 98.0.2 (1)) (Ontario Government, 2002) which can only be applied to land if the concentration of regulated metals and Escherichia coli (E. coli) bacteria do not exceed the threshold levels specified. In general, this Act requires generators (i.e., County of Lambton) are responsible for sampling and analysis of the biosolids, haulers of biosolids must have a Waste Systems ECA from MECP, and, agricultural land application of biosolids must be applied by a business licensed by OMAFRA. The MECP is responsible for the compliance and enforcement of the provisions set out under the Nutrient Management Act. OMAFRA is responsible for all required approvals of the plans, certifications, and licenses under the Nutrient Management Act and O. Reg. 267/03.

- Ontario Compost Quality Standards (MECP, Ontario compost Quality Standards, 2021): governs biosolids composting which applies to aerobic composting of non-hazardous organic materials (including biosolids) for the purpose of producing a humus-like material intended for use as a soil conditioner. This Standard is regulated by the MECP through issuance of ECAs.
- Environmental Compliance Approval (ECA) for individual landfills sites: can restrict the quantity of certain materials from being disposed at the site, including biosolids.

4.3.3 Provincial Policy Statement

The Provincial Policy Statement (PPS) came into effect May 1, 2020 under section 3 of the Planning Act. The purpose of the PPS is to provide direction on matters of provincial interest related to land use planning and development and to set the foundation for policy regarding the regulation of development and use of land (Province of Ontario, 2020). The PPS supports a comprehensive, integrated, and long-term approach to planning, and recognizes linkages among policy areas. Municipal official plans (described in the subsection that follows) are considered the most important "vehicle" for implementation of the PPS. Policies applicable to the Project are described.

Section 1.1.1: Healthy, livable, and safe communities are sustained by promoting development and land use patterns that conserve biodiversity and prepare for regional and local impacts of climate change.

Section 1.2.1: A coordinated, integrated, and comprehensive approach should be used when dealing with planning matters within municipalities, including managing natural heritage, water, agricultural, mineral, cultural heritage, and archaeological resources.

Section 1.2.2: Planning authorities shall engage with Indigenous communities and coordinate on land use planning matters.

Section 1.6.6.1: Planning for sewage and water services shall:

- accommodate forecasted growth in a manner that promotes the efficient use and optimization of existing municipal sewage services;

- ensure that these systems can be sustained by water resources and prepare for the impacts of climate change; and,
- promote water conservation and water use efficiency.

Section 1.6.6.2: Municipal sewage services and municipal water services are the preferred form of servicing for settlement areas to support protection of the environment and minimize potential risks to human health and safety. Within settlement areas with existing municipal sewage services and municipal water services, intensification and redevelopment shall be promoted wherever feasible to optimize the use of the services.

Section 1.6.6.7: Planning for stormwater management will: be integrated with planning for sewage and water services; minimize or prevent increases in contaminant loads; minimize erosion or changes in water balance; prepare for climate change impacts; mitigate risks to human health, safety, property and the environment and, promote stormwater management best practices.

4.3.4 County of Lambton Official Plan

The County of Lambton Official Plan (County of Lambton, 2020) provides several policies to guide wastewater treatment and management and to protect drinking water sources and watersheds.

The County's goal is to encourage expansions and improvements to distribution, collection, and treatment systems when required to accommodate new growth or to alleviate environmental concerns, to protect and manage the natural water system in connection with human drinking water sources to provide for water quality and human health, and to implement and reiterate applicable policies of the local Source Protection Plans. Policies from the Official Plan (County of Lambton, 2020) that are applicable to the Project include:

- Full municipal water and sewage services, including communal sewage treatment systems, is the preferred method for servicing.
- Establish municipally owned and operated stormwater quality treatment facilities where feasible and practical, based on the findings of watershed and subwatershed studies, will be encouraged.
- Local municipalities are encouraged to work together, where appropriate, in the provision of sanitary sewer and municipal water services to development.
- Local municipalities shall comply with recommended buffer separation guidelines as presented in MOECC's D-2 Guideline, or successor document, for compatibility between sewage treatment works and sensitive land uses and are encouraged to identify in their official plans and/or zoning by-laws the locations of municipal and communal sewage treatment works in Lambton County or adjoining Counties within 400 metres of sensitive land uses.
- As required by the Clean Water Act, municipal decisions made under the Planning Act and Condominium Act shall conform to the significant drinking water threat policies and have regard for low and moderate threat policies within the applicable Ausable Bayfield and Maitland Valley Source Protection Plan or Thames-Sydenham and Region Source Protection Plan.
- Any use or activity that is, or would be, a significant drinking water threat in the location it would occur is required to conform to applicable Source Protection Plan policies, which may prohibit, regulate, or otherwise restrict the use or activity.
- The County of Lambton will encourage Municipal initiatives in support of the protection of water resources.

- Foster infrastructure, services, built form, and communities that are adaptive and capable of functioning within or quickly recovering from climatic and weather conditions that fall outside of historic norms.

4.3.5 County of Lambton Strategic Plan

The County of Lambton Strategic Plan (County of Lambton, 2024) serves to set current priorities, and confirm the principles that guide actions and decision-making for the County. The County's priority for corporate sustainability focuses on implementing financial plans, policies, and practices that bolster and safeguard municipal services and infrastructure, adopting and promoting environmentally sustainable practices in the face of climate change, and undertaking environmental initiatives that protect and enhance woodlots and the County's natural heritage features, and target waste reduction, energy conservation, lower fuel consumption, and the use of sustainable technologies and processes.

4.3.6 St. Clair Township Official Plan

The St. Clair Township Official Plan (St. Clair Township, 2011) provides several requirements for sanitary sewage collection, treatment, and disposal systems.

- All development within the sewer service area will be serviced by sewer facilities. When development is proposed in the sewer service area and the necessary lines are not yet installed, the developer will be responsible for the provision of necessary extensions. The Township of St. Clair will pass a By-law pursuant to the Municipal Act defining areas where sewer system connections are mandatory.
- Industrial Areas within the sewer service area may, at the discretion of the Township of St. Clair in consultation with the Province, be permitted to develop on individual services where specialized treatment related to industrial processes is required. Council will pass a By-law outlining such services.
- The Township of St. Clair may reallocate sewage capacity when the Township of St. Clair deems that allocated sewage capacity is not being utilized by existing approved draft plans of subdivision subject to the time period outlined in the draft approval. Reallocation will occur only when the specified time limit has expired, and no appeal has been filed.
- The Township of St. Clair will make no commitment or approve any development that would cause the capacity of a sewage treatment plant to be exceeded. In certain cases improvements to the sanitary sewer system may be required before development may proceed. Such improvements may include the provision of a new pumping station and/or sewer line extensions.

4.3.7 St. Clair Township Strategic Plan

The Strategic Plan for St. Clair Township (St. Clair Township, 2023) outlines priorities that reflect the community's vision for a sustainable and vibrant community. Specifically, the plan outlines specific priorities and action plans to invest in infrastructure and improve services. These priorities and actions included planning for a sewage treatment plant expansion and lobbying for additional federal and provincial funds for key projects, including to support this expansion.

4.4 Climate Change Strategy and Energy Initiatives

The County of Lambton's Integrated Community Sustainability Plan (ICSP) was approved in 2013 and is intended to accelerate the shift in local planning and decision making toward a more long-term, coherent and participatory approach. With an ICSP in place, municipalities can leverage funding (grants and below-market loans) under the Green Municipal Fund for plan development, feasibility studies/field tests and projects in five sectors of municipal activity: brownfields, energy, transportation, waste and water. The ICSP is intended to complement existing initiatives, plans and projects that include the objective of creating a sustainable community. These include Official Plans, Strategic Plans, as well as initiatives from other sector such as economic and environmental partnerships or associations.

Local municipalities within the County will be encouraged to implement the ICSP for those areas for which they have delegated responsibilities, including those for wastewater collection and treatment. Complementary programs will be integral to the new Integrated Community Sustainability Plan and its initiatives and will continue to be incorporated into the evolving community sustainability plan with future projects subjected to a Quadruple Bottom Line and SWOT analysis to ensure that the sustainability principles are being met and implemented across the County. Since application of bio-solids on agricultural land is increasingly restricted the treatment of bio-solids (sewage sludge) and its disposal could be an area of future research where the sustainability criteria would apply.

4.5 Related Studies

4.5.1 2007 Environmental Study Report

In 2007, Totten Sims Hubicki Associated completed an Environmental Assessment, documenting Phases 1 through 4 of the MCEA process for the Corunna and Courtright WWTPs. The EA was undertaken to address the projected shortfall in treatment capacity to meet the anticipated growth in the communities of Corunna, Mooretown, and Courtright. As part of the study, several alternatives were developed and evaluated to determine a preferred planning solution with public and agency input. The preferred planning alternative was to expand the Courtright WWTP at the existing site which led to its current rated capacity of 6,000 cubic metres per day, with a peak flow of 15,000 cubic metres per day. At the time of the 2007 ESR, the rated capacity included an additional 15 percent to allow for potential growth.

4.5.2 2015 Odour Study

The Township of St. Clair retained CH2M Hill Canada Limited in 2015 to investigate the potential sources of odours at or from the Courtright Wastewater Treatment Plant as a result of several historical odour complaints from nearby residents. The study included several deliverables to assist the Township in implementing a corrective plan to mitigate odour problems at the treatment plant, including, but not limited to a desktop assessment of Hydrogen Sulphide generation and emissions, a desktop evaluation of existing odour control system(s), air-dispersion and liquid-phase modelling to evaluate existing conditions and effectiveness of recommended odour mitigation and an evaluation of potential control strategies. The following recommendations were made as part of the study, and subsequently implemented at the WWTP:

- Implementation of a liquid-phase chemical treatment system at the Corunna Pump Station, designed for handling ferric chloride chemical, which allows for switching to Bioxide™ chemical in the future if desired
- Implementation of adding an additional channel draw-off points for the existing BioAir™ odour control unit at the Courtright WWTP to improve the performance of the unit.
- Following implementation of the liquid phase treatment system at the Corunna Pump Station, the existing air relief valves on the Corunna forcemain be opened and carbon canisters be added on the discharge.
- Future monitoring of the implemented odour control measures to determine effectiveness in service

4.5.3 Sewer Use By-Law

The Township of St. Clair Sewer-Use Bylaw was adopted in 2017 by b-law 24 of 2017, which sets the standards for allowable discharges to the sewer. The by-law was amended by-law 20 of 2023 to adjust the permitted pH levels of sanitary sewage entering the Township sewer system. Prohibited discharge, characteristics, components, and concentrations are outlined. The amended by-law now includes updates to discharger information. Currently only Industrial and Commercial sanitary sewer customers are required to complete the "Discharger Information Report". Dischargers may also enter into an Extra Strength Surcharge Agreement with the municipality to permit the discharger the discharge of sewage into a sanitary sewer that would otherwise be prohibited, to the extent permitted in Schedule D of the by-law.

5. Methods and Approach

5.1 Overview of Study Approach

This study was completed as Schedule C Municipal Class EA, following Phases 1 through 4 of the Class EA process. Community Engagement is an important component of the Class EA process. The approach to community engagement is presented in Section 5.2.

The activities completed in Phases 1 through 4 include:

- **Phase 1 - Existing Conditions and Future Needs:** This phase included development of capacity and performance requirements, assessing the existing unit processes at the Courtright WWTP for wastewater treatment and biosolids management, identifying gaps in meeting future needs, and development of a Problem and Opportunities Statement.
- **Phase 2 -Identification and Evaluation of Alternative Solutions:** This phase included identification of alternative wastewater treatment and biosolid management solutions to meet future requirements or provide benefit with respect to future opportunities. Alternative solutions were subject to comparative evaluation to identify preferred solutions.
- **Phase 3 - Development of Design Concepts and Implementation Plan:** In this phase, design concepts and implementation triggers as well as a schedule for the recommended solutions was documented, and capital costs were forecasted for the planning period. Potential impacts and mitigation measures were documented.
- **Phase 4 - Environmental Study Report:** The methodology and project recommendations are documented in this Environmental Study Report.

The following sections provide additional details on the approach to each phase.

5.2 Engagement Plan and Approach

Effective public engagement programs build and maintain community trust and credibility to improve decision making and identify community issues far enough in advance that they can be effectively addressed before final decisions are made.

The Township is committed to undertaking public consultation that provides a variety of opportunities for learning and sharing. As such, the Township has committed to a program that exceeds requirements of the Schedule C Class EA. Through the public consultation program, the proponent will conduct a consultation process that meets the following requirements:

- Is meaningful to those involved
- Facilitates open and transparent dialogue resulting in defensible and traceable decision making
- Provides opportunities for early public and stakeholder involvement
- Helps promote public learning regarding wastewater treatment and the environment

The objective of the public consultation component was to provide information in support of the Courtright Wastewater Treatment Plant Expansion EA and to provide the public and agencies (stakeholders) the opportunity to be involved in the study in a meaningful way.

5.2.1 Communication and Consultation Plan

Upon study initiation, a Communication and Consultation Plan was developed. The Communication and Consultation Plan establishes a strategy for the Township to provide meaningful information about the project to the identified audiences, as well as provide engagement opportunities over the course of the EA.

The Communication and Consultation Plan has the following objectives:

- Inform interested and potentially affected parties
- Solicit input
- Consider input in the selection and development of the preferred recommended solutions
- Consider input in the development of environmental mitigation strategies
- Earn support for the Project

Project communications and engagement with members of the public, review agencies, and other stakeholders (i.e., organizations, businesses) is an important part of the Municipal Class Environmental Assessment (MCEA) process. The objective of the Communication and Consultation Plan is to present the activities and methods that will be used throughout the EA.

Specifically, the Communication and Consultation Plan presented the following information:

- The MCEA study project team
- The principles guiding the Communications Plan for this project
- Consultation and communication opportunities, methods, roles, and responsibilities
- An approach to responding to comments and feedback
- An approach to documenting communications and engagement activities, which will be included in the Environmental Study Report.

The goal for communications and engagement was to effectively inform the public, agencies, and other stakeholders about the Class Environmental Assessment process, as well as the study background and goals, and provide sufficient opportunities for two-way communication opportunities. Specific goals of the Communication and Consultation Plan included:

- Providing accessible methods and opportunities for consultation and engagement
- Addressing comments, questions, and concerns so they can be considered within the study process
- Garnering support from members of the public, agencies, and other stakeholders that the process is fair, transparent, and honest

To achieve these goals, the following specific objectives were defined for the communications and consultation program:

- Provide adequate notice at the start of the study to actively encourage inclusive and equitable participation.
- Clearly and effectively communicate information on each alternative solution the project considers, including:

  - Benefits, negative effects, and costs of each alternative
  - Rationale for the recommendations
  - Opportunities for sustainable
  - Recommendations to minimize adverse effects and maximize benefits
- Foster public trust and confidence by:
  - Demonstrating the Township is following a comprehensive process, with a team of specialists who have the experience and qualifications to complete a fair, transparent, and educated evaluation of alternatives
  - Providing consistent messaging to all interested members of the public and stakeholders and other potential influencers, such as elected officials and other opinion leaders
  - Engage stakeholders and the public in consultation that provides balanced information and elicits meaningful input.

Managing and incorporating input from the community was used to appropriately influence the decision-making process and support in the identification and development of informed wastewater treatment and biosolids management solutions.

Engagement activities conducted throughout the project are described in Section 11. The full Communication and Consultation Plan is provided in Appendix B.

6. Study Area Existing Conditions

6.1 Introduction

The purpose of this section is to describe the existing technical, natural and social environment within the spatial boundaries defined for the Study (refer to Section 4.1), through information available from existing literature, government databases and online resources, and feedback collected during community engagement. This information supports the identification of the detailed evaluation framework and the selection of alternatives.

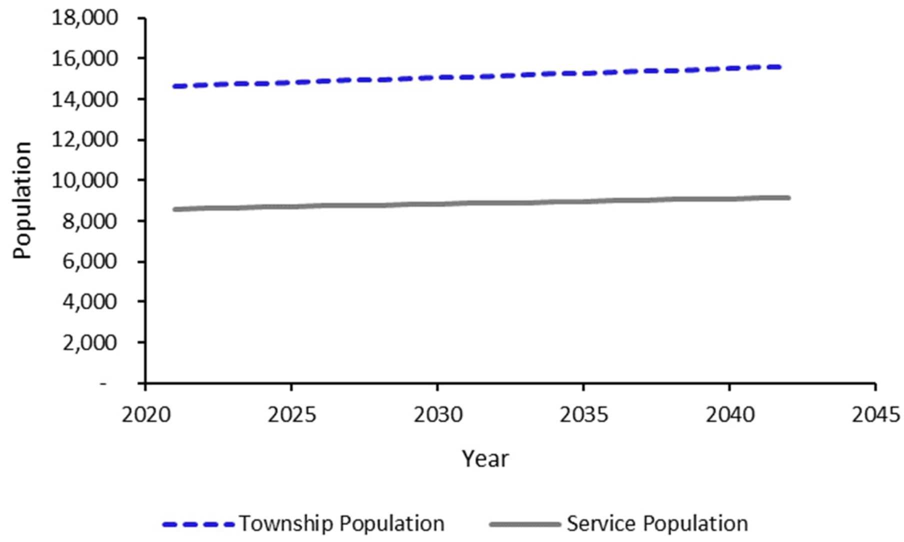
6.2 Population and Demographics

Projections for the St. Clair Township population and Courtright WWTP service populations to 2042 are presented in Table ES 16 and Figure 6-1. Township population projections were developed based on the 2021 census data from Statistics Canada which reported a population of 14,659 (Statistics Canada, 2021). An annual growth rate of 0.3 percent was assumed. This growth rate is consistent with the 2007 ESR which included population projections to 2027 (TSH, 2007). The current service population was estimated based on the number of service connections and the average household size of 2.4 reported in the latest census data (Statistics Canada, 2021). The service population is approximately 59 percent of the Township population, which is consistent with the previous ESR where service population was estimated as approximately 56 percent of the total population.

Table ES 16. Population Projections

Year	St. Clair Township Population	Courtright WWTP Service Population
2021	14,659	8,604
2022	14,703	8,630
2023	14,747	8,656
2024	14,791	8,682
2025	14,836	8,708
2027	14,925	8,760
2030	15,060	8,839
2033	15,196	8,919
2036	15,333	8,999
2039	15,471	9,081
2042	15,611	9,163

Figure 6-1. Population Projections



6.3 Technical Environment

6.3.1 Current Flows

Historical wastewater flow data from 2013 to 2021 were analyzed. Table ES 17 summarizes the historical average day flow (ADF), per capita flows, maximum day flow, and peak factor for each year.

The ADF was relatively constant for 2013 to 2015 at an average of 2,825 cubic metres per day but increased by about 20 percent in 2016 and has since remained at this elevated level at an average of 3,570 cubic metres per day. The overall ADF throughout this time period was approximately 55 percent of the rated capacity for the WWTP at 3,323 cubic metres per day.

The peaking factors observed between the maximum daily flow and the ADF varied from approximately 2.1 to 5.5, with an average of 3.3. Section 6.3.2 presents a more detailed analysis of peak day flows.

Table ES 17: Historical Flows to the Courtright WWTP (2013 to 2021)

Year	ADF (m^3/day)	Maximum Day Flow (m^3/day)	Peak Factor (Max Day Flow/ADF)
2013	2,927	10,794	3.69
2014	2,766	5,802	2.10
2015	2,781	7,521	2.70
2016	3,388	13,856	4.09
2017	3,451	9,963	2.89
2018	4,369	18,137	4.15
2019	3,644	11,723	3.22

Year	ADF (m^3/day)	Maximum Day Flow (m^3/day)	Peak Factor (Max Day Flow/ADF)
2020	3,282	12,848	3.91
2021	3,291	8,678	2.64
Average (2013 to 2021)	3,323	11,036	3.27
Current Design Basis	6,000	15,000	2.50

6.3.2 Peak Flow Analysis

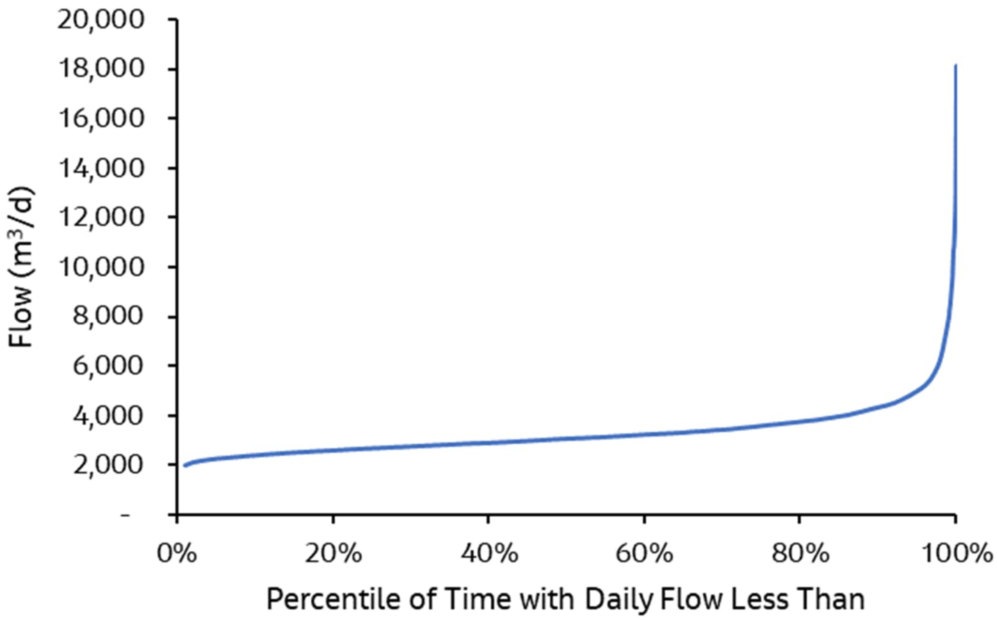
A statistical analysis of the daily flow data was completed to identify the frequency distribution of peak flows, with results summarized in Table ES 18. Figure 6-2 illustrates a frequency analysis of historical daily flows. Daily flows were below the average flow of 3,323 cubic metres per day approximately 65 percent of the time. The current design basis for the Courtright WWTP uses a maximum daily flow of 15,000 cubic metres per day corresponding to a peak factor of 2.50. Plant flows were below this peak factor, corresponding to a flow rate of 8,306 cubic metres per day, approximately 99.1 percent of the time, with flow exceeding this value for approximately 3 days per year. Therefore, a peak factor of 2.50 is reasonable based on the historical data.

Instantaneous or hourly flow data were not available. The original design basis had a peak instantaneous factor (PIF) of 4.42 (TSH, 2007). A PIF of 4.42 was carried forward as the design PIF.

Table ES 18. Percentile Ranking of Daily Flows to the Courtright WWTP (2013 to 2021).

Daily Flow Equal to or Less Than, cubic metres per day (m^3/day)	Peak Factor	Frequency of Occurrence (Percentile)
2,786	0.84	30
3,346	1.01	65
4,362	1.31	90
5,022	1.51	95
7,953	2.39	99
8,306	2.50	99.1
9,714	2.92	99.5
12,919	3.89	99.9
18,137	5.46	100

Figure 6-2. Historical Daily Flow Frequency Analysis (2013 to 2021).



6.3.3 Per Capita Flows

Per capita flows are summarized in Table ES 19. Per capita flows were calculated using the flow data in Section 6.3.1 and census population data.

The historical flow data represents the total influent flow from all residential, as well as institutional, commercial, and industrial (ICI) sources. The current maximum daily volume for the largest industrial users is 1,135 cubic metres per day. To estimate per capita flows, the industrial volume was subtracted from the ADF reported in Section 6.3.1.

Census data were available for 2011, 2016 and 2021 and were linearly interpolated to calculate total population for the intermediate years. Service population was assumed to be 59 percent of the total population as described in Section 6.2.

Per capita flows were relatively consistent from 2013 to 2015, with an average of 202 litres per capita per day (L/cap/day) and increased by about 20 percent in 2016 to an average of 288 L/cap/day. The overall average of 259 L/cap/day was used as a basis for the flow projections in Section 6.3.4.

Table ES 19. Per Capita Flows to the Courtright WWTP (2013 to 2021)

Year	ADF Per Capita Flow (L/cap/day)
2013	213
2014	195
2015	198
2016	273
2017	273

Year	ADF Per Capita Flow (L/cap/day)
2018	385
2019	296
2020	252
2021	251
Average (2013 to 2021)	259

6.3.4 Flow Projections

Flow projections were calculated as the sum of projected residential and ICI flows according to the following:

- Residential flows were developed using the average per capita flow in Section 6.3.3 and population projections in Section 6.2.
- ICI flows were estimated using user data available from the Township. The current ICI maximum day use of 1,135 cubic metres per day was used for projections up to 2025. By 2025, there are two future industrial users expected to discharge 2,000 and 5,000 cubic metres per day, respectively. An additional 300 cubic metres per day is expected to be imported from Brigden within the planning horizon. It is therefore anticipated that maximum ICI total daily volume will increase to 8,435 cubic metres per day. Flows from new ICI users were assumed to be online by 2025.

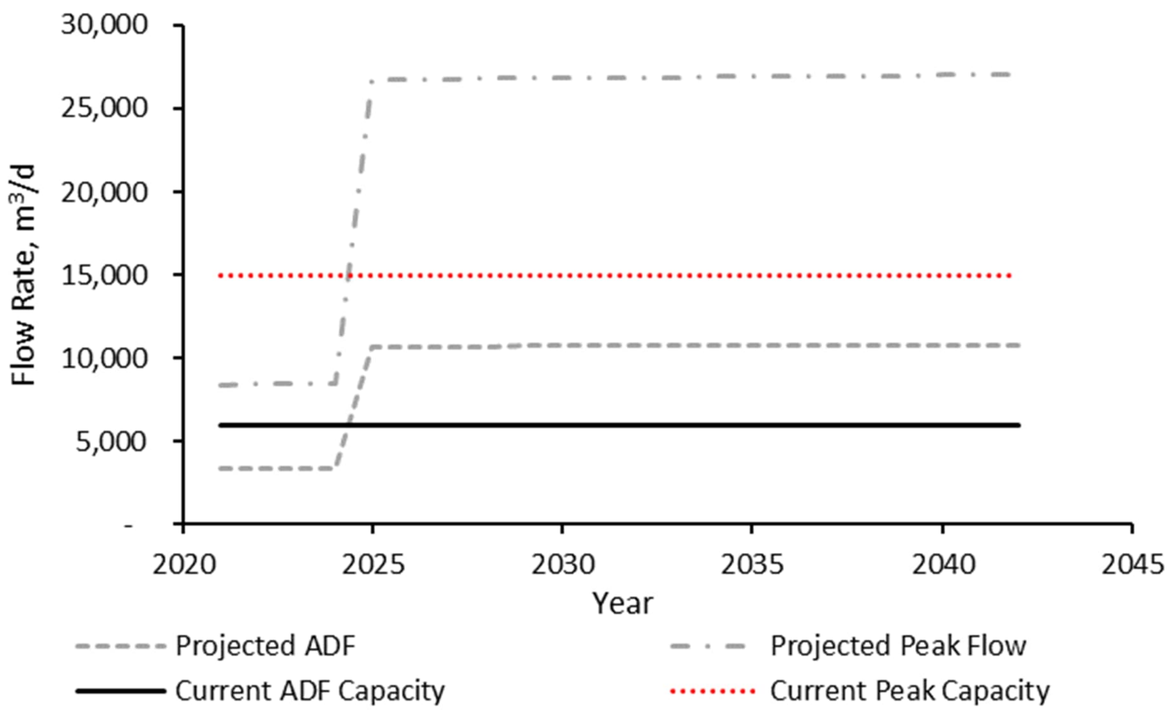
The ADF and peak day flow (PDF) projections are summarized in Table ES 20 for the planning horizon (to 2042) and shown in Figure 6-3. The plant's current capacity of 6,000 cubic metres per day with a peaking capacity of 15,000 cubic metres per day would be exceeded by 2025, or as soon as the new ICI users begin discharging.

Table ES 20. Influent Flow Projections for the Courtright WWTP

Year	Projected ADF (m^3/day)	Projected PDF (m^3/day)
2021	3,367	8,417
2022	3,374	8,434
2023	3,380	8,451
2024	3,387	8,468
2025	10,694	26,735
2027	10,707	26,769
2030	10,728	26,820
2033	10,749	26,872

Year	Projected ADF (m^3/day)	Projected PDF (m^3/day)
2036	10,770	26,924
2039	10,791	26,977
2042	10,812	27,030

Figure 6-3. Flow Projections



6.3.5 Influent Quality

6.3.5.1 Historical Influent Quality

Historical influent raw sewage concentrations were analyzed to establish current plant loadings. Monthly sampling results were available for biochemical oxygen demand (BOD_5), total suspended solids (TSS), total phosphorus (TP), and total Kjeldahl nitrogen (TKN). Table ES 21 summarizes the raw wastewater characteristics including contaminant concentrations, in milligrams per litre (mg/L), average and maximum month loads, in kilograms per day (kg/d), and per capita load rates in grams per capita per day (g/cap/d). Typical per capita load rates as reported by Metcalf & Eddy are also summarized in Table ES 21. The per capita load rates for BOD_5, TSS, TP, and TKN all fall within the typical ranges reported by Metcalf & Eddy (Metcalf & Eddy, 2013).

Table ES 21: Historical Courtright WWTP Concentrations and Loads (2013 to 2021)

Influent Parameter	Average Concentration (mg/L)	Average Load (kg/d)	Maximum Month Load (kg/d)	Maximum Month Peak Factor (Max Month Load/ Average Load)	Estimated Per Capita Contribution (g/cap/d)	Typical Range Per Capita Contribution (g/cap/d) [a]
BOD_5	156	514	1,023	1.93	61	50 – 120
TSS	181	600	1,424	2.25	71	60 – 150
TKN	32	104	164	1.57	1.8	1.5 – 4.5
TP	4.67	15	29	1.87	12	9 – 18

b) Adapted from: (Metcalf & Eddy, 2013)

6.3.5.2 Future Influent Quality

Influent quality parameters for the future influent sources are presented in Table ES 22. These parameters were selected based on available data from future ICI users, historical concentrations listed in Table ES 21, the original plant design basis (TSH, 2007), and the current sanitary sewer discharge limits from Township By-law No. 24 of 2017 which regulates the discharge of sewage and storm water (Township of St. Clair, 2017). Relevant sanitary sewer discharge limits from the sewer use by-law were assumed to represent the influent quality for the imported flows from Bridgen and where parameters were unknown. The Township amended the sewer use by-law in 2023 to align the pH limit with the ECA limit of 6.0 to 9.5 (Township of St. Clair, 2023).

Table ES 22. Influent Characteristics for Future Flows

Parameter	ICI User 1 (2,000 m^3/d ADF)[a]	ICI User 2 (5,000 m^3/d ADF)[a]	Brigden Imported Flows (300 m^3/d ADF)[b]	All Other Flows[d]
BOD_5 (mg/L)	800	1.10	300	191[e]
TKN (mg/L)	100[b]	12.58[c]	100	181
TP (mg/L)	10[b]	0.021	10	32
TSS (mg/L)	400	1.0	350	4.67
pH	5.0 to 11.0	7.1	6.0 to 9.5	6.0 to 9.5[b]
Temperature (°C)	60[b]	60[b]	60	60[b]

Note:

a. Influent characteristics based on available data from ICI User unless otherwise indicated.

b. Influent characteristics based on sewer use bylaw limits from Township By-law No. 24 of 2017 Limits for Sanitary Sewer Discharge, amended in 2023 (Township of St. Clair, 2017) (Township of St. Clair, 2023).

c. Total nitrogen reported, not TKN.

d. Influent characteristics based on historical concentrations unless otherwise indicated.

e. Design basis for BOD_5 adjusted to be consistent with the original plant design basis (TSH, 2007) which is more conservative than the historically observed average concentration of 156 mg/L.

The projected impacts of these new influent flows on the overall raw sewage characteristics are summarized in Table ES 23. Future residential growth and current ICI use is not expected to impact the raw sewage concentrations. The projected influent flows include the two future ICI users and imported flows from Brigden, for a total of 7,300 cubic metres per day in addition to flows due to residential growth and existing ICI use. The design basis for 2042 includes an additional 4,188 cubic metres per day of contingency flows, or approximately 30 percent contingency, with influent concentrations consistent with the residential growth and current ICI flows.

The design basis represents an increase in influent BOD_5 loadings by 470 percent, TSS loadings by 360 percent, TKN loadings by 510 percent, and TP loadings by 360 percent compared to residential growth and current ICI use alone. These loadings are all significant changes to the current influent loadings and concentrations. The capacity of the current treatment processes to manage these increased loads will need to be verified to continue to meet the effluent requirements.

The design basis presented in Table ES 23 will be carried forward for capacity assessment and developing design concepts. The design basis is highly specific to the wastewater quality identified in Table ES 22. There is a significant stream from ICI User 2 of 5,000 cubic metres per day of very dilute wastewater. The capacity assessment and design concepts developed will need to be re-evaluated should the composition of any of these future streams change.

Table ES 23. Projected Future (2042) Influent Characteristics

Parameter	Growth & Current ICI	Projected Influent (2042)	Design Basis (2042)
ADF, m^3/day	3,512	10,812	15,000
BOD_5 Concentration, mg/L	191	219	211
TSS Concentration, mg/L	181	143	154
TKN Concentration, mg/L	32	40	38
TP Concentration, mg/L	4.67	3.66	3.94
BOD_5 Loading, kg/d	671	2,369	3,169
TSS Loading, kg/d	634	1,547	2,303
TKN Loading, kg/d	112	436	570
TP Loading, kg/d	16	40	59

6.3.6 Effluent Quality

The operation of the Courtright WWTP is governed by ECA No. 4042-BEUQ6N (dated August 9, 2019). Table ES 24 summarizes the plant's effluent concentration objectives and limits per the current ECA for carbonaceous biochemical oxygen demand ($cBOD_5$), TSS, TP, total ammonia nitrogen (TAN), *Escherichia coli (E. coli)*, and pH.

Table ES 24. Courtright WWTP Existing Effluent Criteria

Effluent Parameter	Averaging Calculator	Concentration Limit	Concentration Objective
$cBOD_5$	Monthly Average	25.0 mg/L	15.0 mg/L
TSS	Monthly Average	25.0 mg/L	15.0 mg/L
TP	Monthly Average	0.94 mg/L	0.50 mg/L
TAN	Monthly Average	8.0 mg/L May 1 to October 31 10.0 mg/L November 1 to April 30	3.0 mg/L May 1 to October 31 5.0 mg/L November 1 to April 30
E. coli	Monthly Geometric Mean Density	200 colony forming units (CFU)/100 millilitres (mL)	150 CFU/100 mL
pH	Single Sample Result	6.0 to 9.5	6.5 to 8.5

Figure 6-4 to Figure 6-9 present historical monthly average effluent quality data relative to ECA objectives and limits for $cBOD_5$, TSS, TP, TAN, *E. coli*, and pH. Generally, the Courtright WWTP has achieved ECA limits and objectives for most effluent parameters throughout the 2013 to 2021 time period, with the following exceptions:

- Effluent TP concentrations generally do not meet the ECA objective of 0.50 mg/L, with samples higher than this value 64 percent of the time from 2013 to 2018. From 2019 to 2021, the ECA objective was met more frequently, only exceeding the objective 25 percent of the time; however, there were two compliance limit exceedances for TP in this time.
- There were two compliance limit exceedances for TSS from 2013 to 2021, and two additional samples with concentrations higher than the objective.
- From 2013 to 2014, ammonia nitrogen (NH_3-N) concentrations exceeded the objective twice during the winter period (i.e., 5.0 mg/L objective).
- Generally, pH fell within the objective range of 6.5 to 8.5. The ECA objectives and limits are based on single pH sample results, however daily pH data was only available from 2019 to 2021.
- Figure 6-9 includes monthly average data from 2013 to 2019 and daily data from 2019 to 2021. From 2013 to 2019, there were four months where monthly average pH fell below the ECA objective however there were no compliance limit exceedances. From 2019 to 2021, 26 daily pH measurements fell below the ECA objective (approximately 4 percent of data from 2019 to 2021), four of which also fell below the ECA limit (approximately 0.6 percent of data from 2019 to 2021).

As mentioned in Section 6.3.5, the potential future ICI influent flows are expected to impact the raw sewage concentrations requiring treatment. Enhanced treatment alternatives will need to be considered in order to continue to meet the ECA effluent limits and objectives.

Figure 6-4. Courtright WWTP Effluent BOD_5 Concentrations (Monthly Averages) and ECA Limits

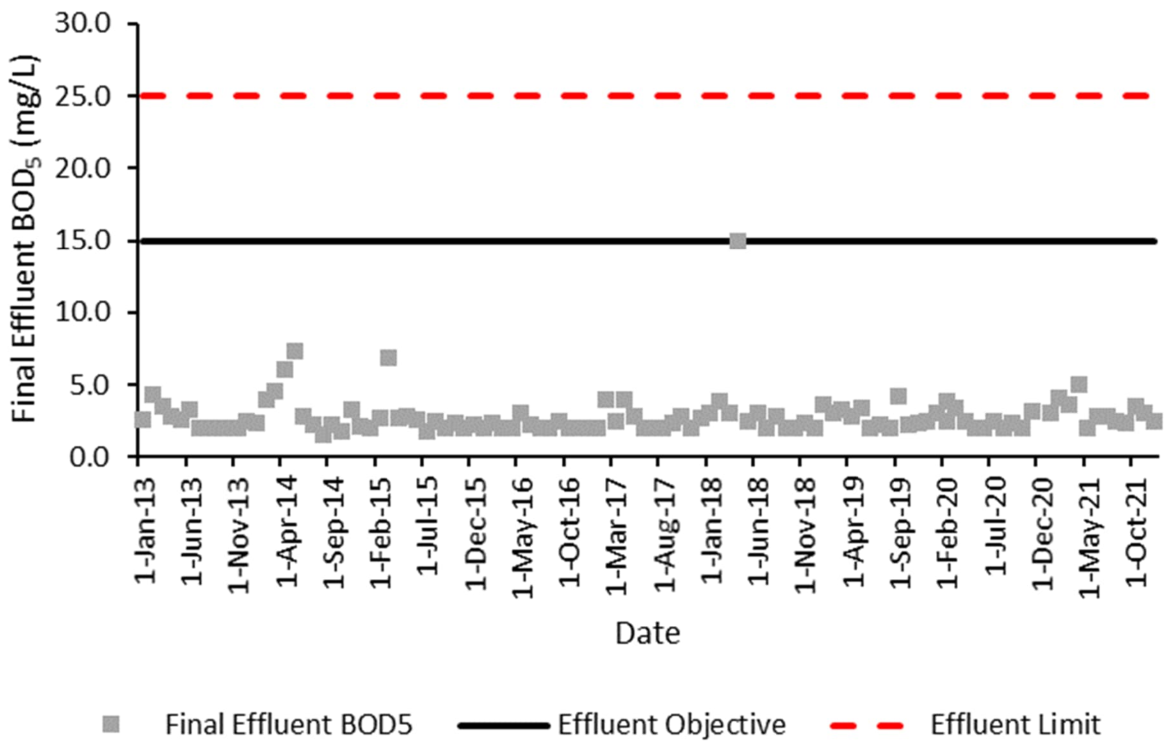


Figure 6-5. Courtright WWTP Effluent TSS Concentrations (Monthly Averages) and ECA Limits

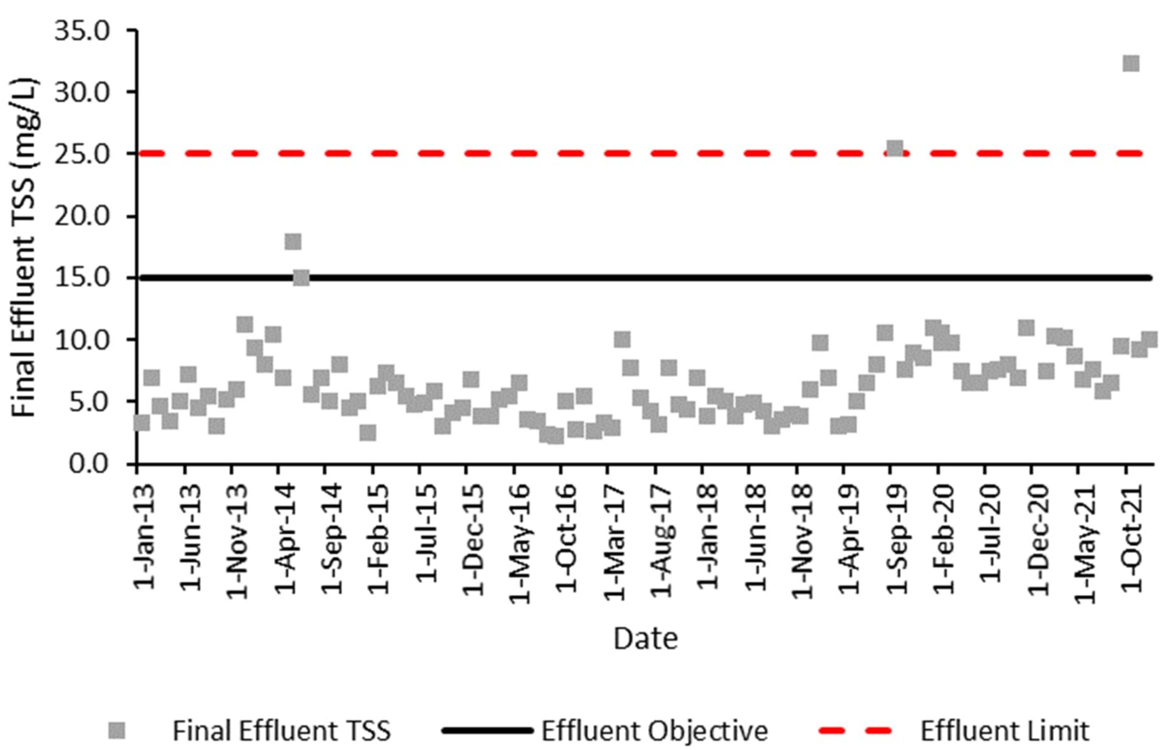


Figure 6-6. Courtright WWTP Effluent TP Concentrations (Monthly Averages) and ECA Limits

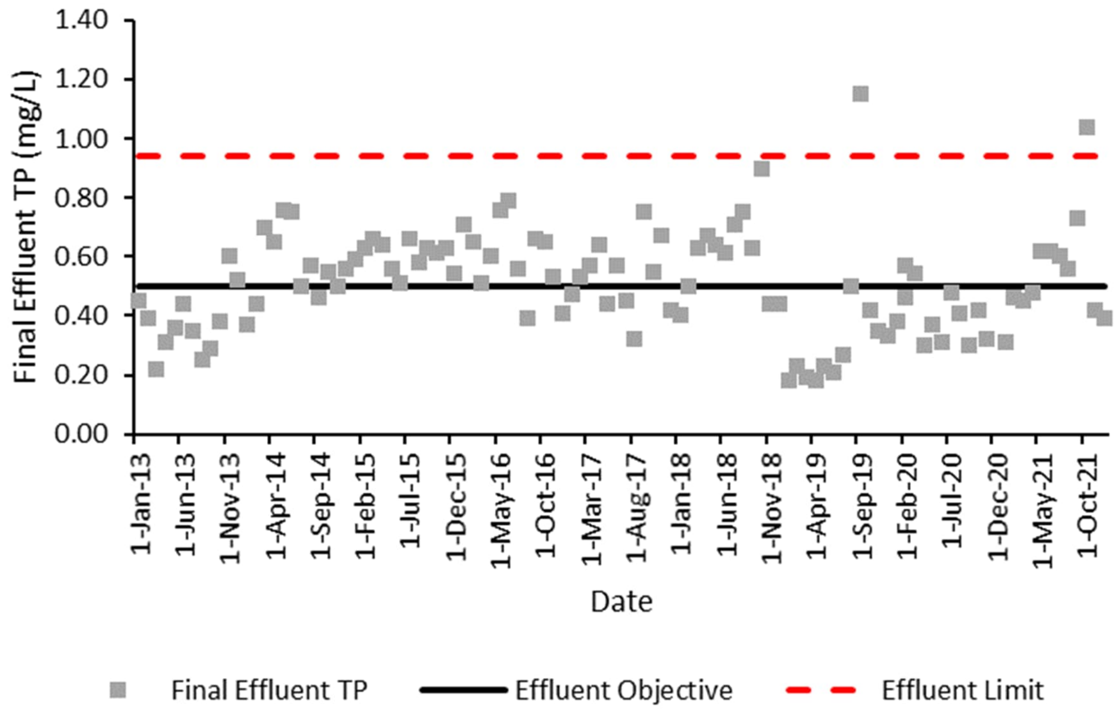


Figure 6-7. Courtright WWTP Effluent Ammonia Nitrogen (NH3-N) Concentrations (Monthly Averages) and ECA Limits

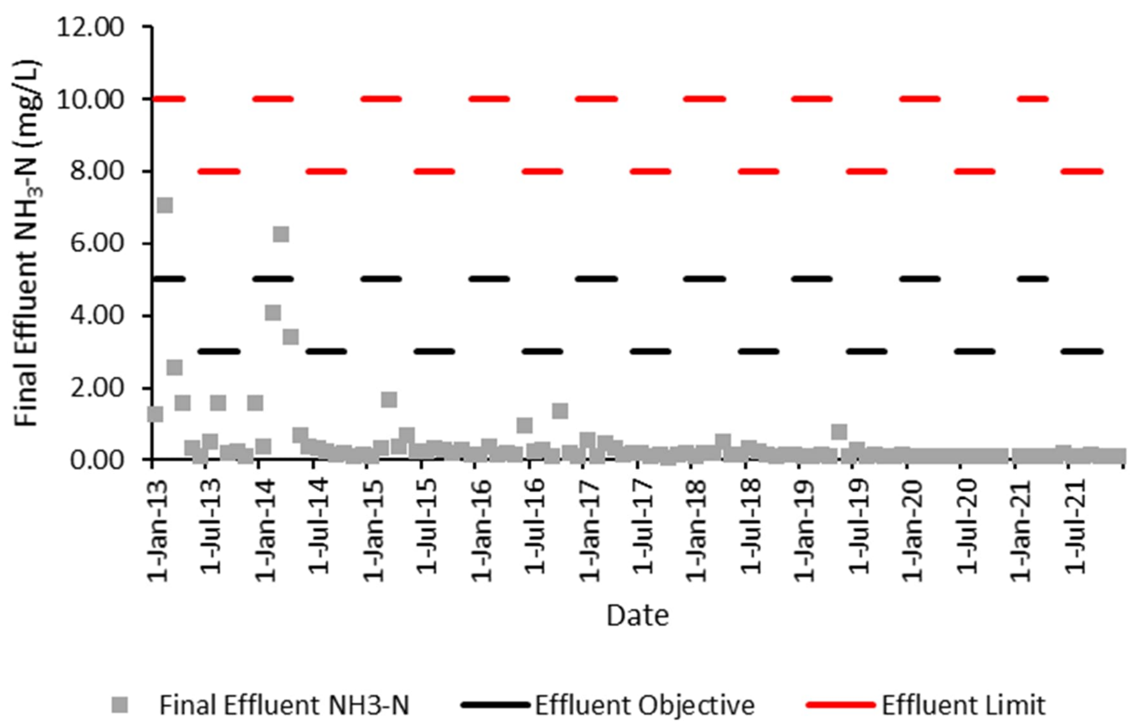


Figure 6-8. Courtright WWTP Effluent *E. coli* Concentrations (Monthly Geometric Mean) and ECA Limits

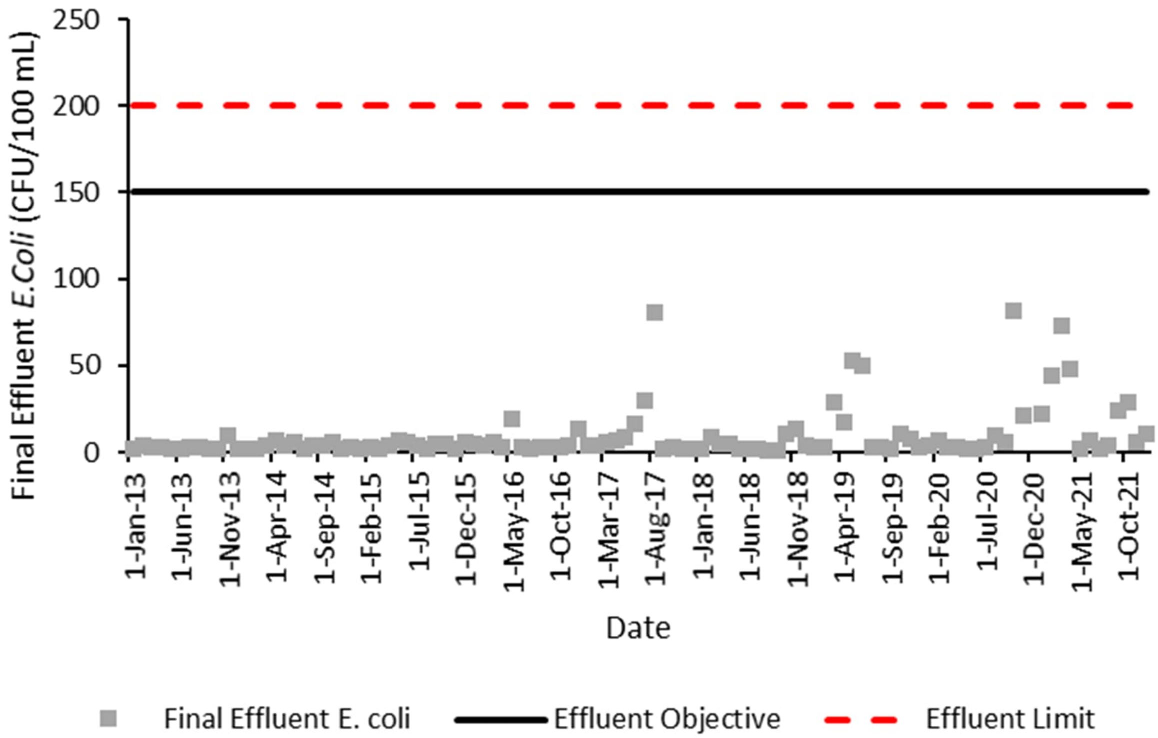
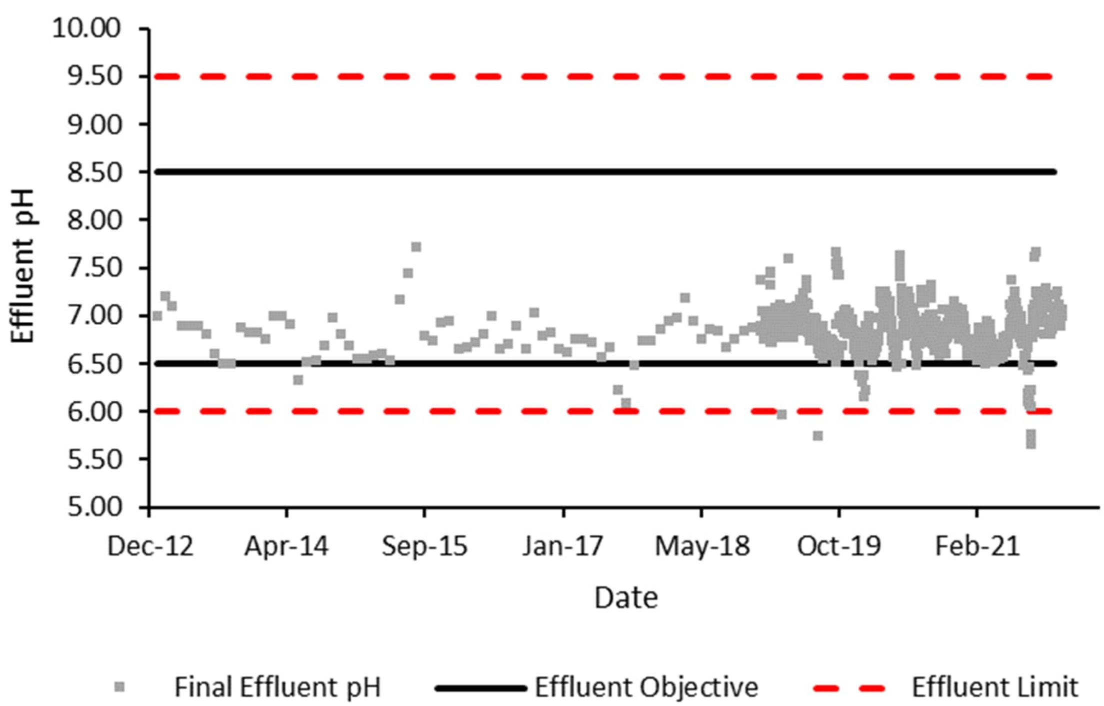


Figure 6-9. Courtright WWTP Effluent pH (Monthly Averages 2013 to 2019; Daily Measurements 2019 to 2021) and ECA Limits



6.3.7 Effluent Performance Criteria

The Courtright WWTP discharges directly to the St. Clair River through a 600-millimetre diameter outfall sewer. To meet future growth and industrial service needs, the plant capacity will need to increase from 6,000 to 15,000 cubic metres per day, which is a significant increase that may impact effluent loadings to the river. An Assimilative Capacity Study (ACS) was completed by AECOM in 2008 to establish effluent limits for a design capacity of 6,000 cubic metres per day (AECOM, 2008). Jacobs prepared an updated assimilative capacity assessment to establish effluent discharge limits for the expanded Courtright WWTP at the existing site. This section presents a summary of findings from the updated ACS. The full report is provided in Appendix A-5.

The proposed effluent limits and objectives for the plant expansion to 15,000 cubic metres per day are summarized in Table ES 25 and Table ES 26, respectively. The proposed limits and objectives are consistent with the current ECA for the Courtright WWTP (No. 4042-BEUQ6N), as Jacobs' analysis did not indicate a significant increase in background parameter concentrations to the river resulting from plant discharge at the expanded capacity.

Based on correspondence with the Ministry of the Environment, Conservation and Parks, the proposed effluent objectives and limits are reasonable and acceptable, resulting in the overall water quality after discharge not exceeding the guidelines under the Provincial Water Quality Objectives. However, since the concentration of TP measured in the receiver at the downstream monitoring station 740016 reported a maximum value of 0.030 mg/L, TP is considered a limiting effluent for the plant's discharge. Any additional volume of WWTP discharge to the St Clair River would require further assessment and approval from the MECP, mainly with respect to TP loading. A copy of the correspondence with the MECP can be found in Appendix B.

One key parameter in determining the secondary treatment capacity needed is the organic loading rate to the aeration basins. The organic loading rate refers to the mass of organics, measured in biochemical oxygen demand (BOD_5), that is fed to the aeration basins. Design guidelines from the MECP indicate best practice is to operate between an organic loading of 0.17 to 0.24 kilograms per cubic metre per day ($kg/m^3/d$) (MECP, 2019), and Metcalf & Eddy recommend an operating range of 0.1 to 0.3 $kg/m^3/d$ for extended aeration (Metcalf & Eddy, 2014). If the organic loading rate is too high, one solution could be to construct additional aeration basins to spread the organic load over a larger volume.

Table ES 25. Proposed Effluent Limits

Parameter	Current Effluent Limits	Proposed Future Effluent Limits
Effluent $cBOD_5$ Limit	25 mg/L	25 mg/L
Effluent TSS Limit	25 mg/L	25 mg/L
Effluent TAN Limit	Summer (May 1 to October 31): 8 mg/L Winter (November 1 to April 30): 10 mg/L	Annual: 8 mg/L
Effluent TP Limit	0.94 mg/L	0.94 mg/L
Effluent *E. coli* Limit	200 Colony-forming unit (CFU)/100 mL	200 CFU/100 mL
Effluent pH Limit	6.0 to 9.5	6.0 to 9.5

Table ES 26. Proposed Effluent Objectives

Parameter	Current Effluent Objective	Proposed Future Effluent Objective
Effluent $cBOD_5$ Objective	15 mg/L	15 mg/L
Effluent TSS Objective	15 mg/L	15 mg/L
Effluent TAN Objective	Summer (May 1 to October 31): 3 mg/L Winter (November 1 to April 30): 5 mg/L	Annual: 3 mg/L
Effluent TP Objective	0.5 mg/L	0.5 mg/L
Effluent *E. coli* Objective	150 CFU/100 mL	150 CFU/100 mL
Effluent pH Objective	6.5 to 8.5	6.5 to 8.5

The proposed effluent performance criteria for future expansion being revised from the current seasonal effluent objective to a year-round effluent objective for Nitrogen (TAN) is reflective of observed climate trends and milder winters. The current summer effluent target is proposed to be used as an annual future effluent objective, therefore reducing year-round nutrient discharges from the plant up to 15MLD. Stricter annual effluent limits reflect climate change adaptation to mitigate a changing climate while also addressing resiliency concerns.

6.3.8 Existing Solids and Biosolids Conditions

Waste activated sludge from the secondary clarifiers is aerobically digested and stored prior to land application. Table ES 27 presents the historical biosolids haulage volumes, loadings and per capita generation rates. Annual haulage volume data were available from the Township. Average annual total solids (TS) concentrations were calculated based on sampling data. Digested biosolids are sampled seasonally (four to six times per year) from the storage tank and analyzed for various quality parameters. The annual biosolids loading rate and per capita generation rate were calculated based on the haulage volumes, TS data, and historical population data. The biosolids loadings and per capita rates were relatively consistent from 2013 to 2022 except for 2021 which was significantly lower. Excluding the 2021 data, the overall average biosolids loading rate was 133 dry tonnes per year and the average per capita rate was 15.7 kilograms per capita per year (kg/cap/year).

Table ES 28 presents a summary of other digested biosolids quality parameters from 2012 to 2022 including $cBOD_5$, TKN, TAN, and TP. Data for $cBOD_5$ was only available for 2022.

Table ES 27. Historical Biosolids Quantity Data (2013 to 2022)

Year	Annual Biosolids Haulage Volume (m^3/year)	Average TS (mg/L)	Annual Biosolids Loading Rate (dry tonnes/year)	Per Capita Biosolids Generation Rate (kg/cap/year)
2013	6,548	15,855	103.8	12.33

Year	Annual Biosolids Haulage Volume (m^3/year)	Average TS (mg/L)	Annual Biosolids Loading Rate (dry tonnes/year)	Per Capita Biosolids Generation Rate (kg/cap/year)
2014	2,546	58,420	148.7	17.77
2015	3,139	32,675	102.6	12.33
2016	3,360	39,533	132.8	16.07
2017	3,443	38,350	132.0	15.59
2018	3,324	42,525	141.4	16.82
2019	3,822	40,867	156.2	18.44
2020	4,268	33,680	143.7	16.84
2021	3,638	16,130	58.7	6.82
2022	4,243	31,200	132.4	15.34
Average [a]	3,855	37,012	133	15.7

b. Data from 2021 is excluded from the overall average as an outlier.

Table ES 28. Digested biosolids quality data (2012 to 2022)

Parameter	Average Concentration (mg/L)
$cBOD_5$ [a]	1,100
TKN, as Nitrogen [b]	1,531
TAN, as Nitrogen [b]	350
TP [b]	1,429

c. Data for $cBOD_5$ was only available for 2022.

d. Data from 2021 is excluded as an outlier.

6.4 Natural Environment

The Study Area occurs entirely within the active Courtright WWTP property. In review of imagery, the Study Area is a disturbed feature, with minor tree plantings noted at the front of the property and a right-of-way (RoW) access route to the south occurs at the property boundary. However, directly adjacent to the Study Area and plant property to the east, a large intact woodland occurs. Woodland habitat also occurs south of the Study Area but is separated by the RoW access route. A natural tree row along the northern limits of the Study Area is also noted. Other adjacent areas include agricultural fields, rural roads, and residential zones. The Study Area does not occur within the St. Clair Region Conservation Authority (SCRCA) Regulated Area (SCRCA, 2022). However, the Study Area and associated plant property is considered Natural Heritage Adjacent Lands, due to the proximity of the woodland area to the east which is zoned as a

Natural Heritage Feature (NHF) (SCRCA, 2022). Appendix A-6 contains the Natural Environment Desktop Study completed for the Courtright WWTP EA.

6.4.1 Terrestrial Habitat

Based on the desktop natural environment review, the Study Area consists of an anthropogenically disturbed industrial site, due to the active WWTP. The plant property also includes open fields which appear to be dominated by manicured grasses and/or a cultural meadow. A cultural tree plantation is noted to occur at the front on the property. No natural terrestrial features occur within the Study Area.

6.4.2 Aquatic Habitat and Fisheries

According to Land Information Ontario (LIO) and the Ministry of Northern Development, Mines, Natural Resources and Forestry mapping (MNDMNRFF) (MNDMNRFF, 2022), aquatic and fish habitat do not occur within the Study Area or within the 120 metres adjacent lands. The St. Clair River occurs approximately 320 metres west of the Study Area. The Courtright WWTP effluent is discharged directly to the St. Clair River.

6.4.3 Wetlands

According to LIO and the MNDMNRF mapping (MNDMNRFF, 2022), the Study Area and the 120 m adjacent lands do not contain wetland habitat.

6.4.4 Areas of Natural and Scientific Interest (ANSI)

There are no ANSIs located within Study Area or within the 120 metre adjacent lands (MNDMNRFF, 2022).

6.4.5 Wildlife and Wildlife Habitat

The Study Area is generally comprised of open and disturbed cultural and industrial areas; however, these features can still provide habitat for wildlife, particularly avifauna.

Background data obtained for wildlife included a review of the Ontario Breeding Bird Atlas (OBBA), which provides information on avifauna occurrences based on a 10 square-kilometres area. The second Atlas of the OBBA includes data collected from 2001 to 2005 (Bird Studies Canada, 2009). The Study Area and adjacent lands occur within OBBA Square Summary 17LH74 and 17LH84, Region Number 3: Lambton.

LIO and MNDMNRF Species at Risk (SAR) mapping was also accessed (MNDMNRFF, 2022). To note, only a fraction of the 1 square-kilometre Natural Heritage Information Centre (NHIC) (MNDMNRF, 2022) is available for the Study Area, and data is missing for the majority of the Study Area and to the east. The NHIC was contacted for the missing data; however, data simply does not exist for those parts of the Study Area. The SAR screening results have been sent to the MECP SAR Branch as per the *Endangered Species Act (ESA)* on November 16, 2022, and replied on January 25, 2023. MECP additions have been added to Section 6.4.6.

6.4.6 Species at Risk

According to the NHIC 1 square-kilometre area partial mapping (MNDMNRFF, 2022), the Department of Fisheries and Oceans Canada (DFO) (Government of Canada DFO, 2022), OBBA 10 square-kilometres, iNaturalist (California Academy of Sciences and the National Geographic Society, 2022), SAR may occur within the vicinity of the Study Area as listed in Table ES 29. The presence of SAR or SAR habitat within the Study Area has not been field verified to date.

Table ES 29. Potential SAR within or proximal to the Study Area

Type	Common Name	Scientific Name	S Rank [a]	SARO [b]	COSEWIC [c]	SARA [d]
Bird	Northern Bobwhite	*Colinus virginianus*	S1?B	END	END	END
Bird	Least Bittern	*Botaurus lentiginosus*	S5B	-	-	-
Bird	Common Nighthawk	*Chordeiles minor*	S4B	SC	SC	THR
Bird	Eastern Whip-poor-will	*Antrostomus vociferus*	S4B	THR	THR	THR
Bird	Chimney Swift	*Chaetura pelagica*	S3B	THR	THR	THR
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*	S3	END	END	THR
Bird	Eastern Wood-Pewee	*Contopus virens*	S4B	SC	SC	SC
Bird	Acadian Flycatcher	*Empidonax virescens*	S1B	END	END	END
Bird	Bank Swallow	*Riparia riparia*	S4	THR	THR	THR
Bird	Barn Swallow	*Hirundo rustica*	S4B	THR	THR	THR
Bird	Wood Thrush	*Hylocichla mustelina*	S4B	SC	THR	THR
Bird	Golden-winged Warbler	*Vermivora chrysoptera*	S3B	SC	THR	THR
Bird	Cerulean Warbler	*Setophaga cerulea*	S2B	THR	END	END
Bird	Prothonotary Warbler	*Protonotaria citrea*	S1B	END	END	END
Bird	Louisiana Waterthrush	*Parkesia motacilla*	S2B	THR	THR	THR
Bird	Yellow-breasted Chat	*Icteria virens*	S1B	END	END	-
Bird	Grasshopper Sparrow	*Ammodramus savannarum*	S4B	SC	SC	-
Bird	Bobolink	*Dolichonyx oryzivorus*	S4B	THR	THR	THR
Bird	Eastern Meadowlark	*Sturnella magna*	S4B, S3N	THR	THR	THR
Bird	Harlequin Duck	*Histrionicus histrionicus*	S2N	-	-	-
Bird	Canvasback	*Aythya valisineria*	S1B,S3N,S4M	-	-	-
Bird	Redhead	*Aythya americana*	S2B,S4N	-	-	-
Fish	Northern Madtom	*Noturus stigmosus*	S1	END	END	END
Fish	Channel Darter	*Percina copelandi*	S3	SC	-	-
Mammal	Eastern Small-footed Myotis [e]	Myotis leibii	S2S3	END	-	-
Mammal	Little Brown Myotis [e]	Myotis lucifugus	S3	END	END	END

Type	Common Name	Scientific Name	S Rank [a]	SARO [b]	COSEWIC [c]	SARA [d]
Mammal	Northern Myotis [e]	Myotis septentrionalis	S3	END	END	END
Mammal	Tricolored Bat [e]	Perimyotis subflavus	S3?	END	END	END
Plant	Butternut [e]	Juglans cinerea	S2?	END	END	END

[a] NHIC Subnational Rank

? = more data required

S1 = Critically Imperiled (often 5 or fewer occurrences)

S2 = Imperiled (often 20 or fewer occurrences)

S3 = Vulnerable (restricted range with relatively few populations – often 80 or fewer

S4 = Uncommon but not rare; some cause for long-term concern due to declines or other factors

S5 = Secure species, common, widespread, and abundant

S#S# = Range given due to uncertainty

B = Status qualifier; breeding

N = Status qualifier; non-breeding

M = Status qualifier; migrant species

H = Status qualifier; possibly extirpated

[b] Species at Risk Ontario (SARO)

- = Not at Risk

SC = Special Concern

THR = Threatened

END = Endangered

[c] Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

[d] Species at Risk Act (SARA)

[e] MECP SAR Addition

To note, the Northern Madtom occurrence is within the St. Clair River, and at this time the work is limited to the WWTP Study Area. As such, no impacts to this species or habitat are predicted. Many of the SAR avifauna as outlined within Table ES 29 would prefer the adjacent woodlands and agricultural zones for nesting and forage habitat, however, some of the species could opportunistically utilize the WWTP property.

While some of the species from Table ES 29 have the potential to occur within the Study Area or adjacent lands, field verification and SAR specific surveys were recommended to confirm presence or absence of SAR and associated habitat.

6.4.7 Natural Environment Permitting

DFO review was not required under the scope of this EA as the potential works are limited to the WWTP site and are setback approximately 320 metres from fish habitat, for example the St. Clair River. A permit from SCRCA may not be required as the WWTP does not occur within the Regulated Area. However, based on the SAR background review and adjacent natural features such as the woodlands, consideration for SAR and SAR habitat is required under the *ESA* as administered by the MECP. The EA shall be further screened for SAR by contacting the MECP's SAR Branch and the NHIC for the missing 1 square-kilometre data.

6.4.8 Geology

The bedrock geology within the study area is a formation of the Mississippian and Devonian eras overlain by thick deposits of unconsolidated clay, sand, and glacial till to depths of 30 metres. Beneath the soil are two distinct rock formations:

1. Port Lambton Formation – composed of fissile shale and dolomite and bordering the St. Clair River north from Walpole Island to Stag Island
2. The Kettle Point Formation – composed of dark bituminous shales which underlay most of the County of Lambton (L.J. Chapman and D.F. Putnam, 1984)

6.4.9 Physiography

The Township is predominantly flat because of its location on the St. Clair Sand Plain. The St. Clair Sand Plain covers most of the County of Lambton and is a till plain that is smoothed by shallow deposits of clay under Glacial Lake Whittlesey (L.J. Chapman and D.F. Putnam, 1984). The predominant soil types in the Township study area include:

- Corunna
    - *Caistor* – clay, which is in the Great Group of Grey Brown Podzolic and composed of shaley medium lime clay fill resulting in imperfect drainage.
    - *Perth* – clay, which is in the Great Group of Grey Brown Podzolic and composed of shaley medium lime clay fill resulting in imperfect drainage.
- Courtright
    - *Caistor* – clay, which is in the Great Group of Grey Brown Podzolic and composed of shaley medium lime clay fill resulting in imperfect drainage.

6.4.10 Surface Water Resource

The St. Clair River is the western boundary of the study area with Talford Creek (north of the study area), Baby Creek (Central), and its main tributaries Baby Creek Tributary and Marsh Creek, and Bowens Creek (southern portion of the study area) feeding into the river. The creeks are classified as Natural using the DFO Classification Scheme and each creek contains unclassified drains. The Courtright WWTP property is located outside of the floodplain, as shown in

Figure 4-2.

There are no intake protection zones located within the study area. An intake protection zone is an area around a municipal water intake in which a spill or leak may threaten the municipal drinking water supply too quickly to respond. The Lambton Area Water Supply System (LAWSS) draws water north of the study area, from the mouth of the St. Clair River where Lake Huron narrows. The LAWSS intake protection zone includes the portion of the St. Clair River upstream of the intake, extending into Lake Huron and the surrounding shore and tributaries (Thames - Sydenham & Region Drinking Water Source Protection, 2011).

Ministry Procedure B-1-5, "Deriving Receiving Water Based on Point Source Effluent Requirements for Ontario Waters," stipulates that the water quality status for a receiving water body be determined based on a review of the 75th percentile water quality parameters and assigned according to the following:

- Policy 1: The receiving stream has water quality better than the Provincial Water Quality Objectives (PWQO),

- Policy 2: The receiving stream does not meet the water quality requirements listed in the PWQO. A single incident of exceedance may constitute a Policy 2 designation.

The St. Clair River quality data that were reviewed as part of the updated ACS described in Section 6.3.7 were also used to verify the policy status of the river. Water quality in the St. Clair River is monitored by the United States Environmental Protection Agency (U.S. EPA). Monitoring Station 740376 is located upstream of the Courtright WWTP discharge at the mouth of Lake Huron. Monitoring Station 740016 is located downstream of the plant at the mouth of Lake St. Clair.

The PWQO level for ammonia is 0.020 mg/L. Although the maximum value of ammonia at both the upstream and downstream sampling locations exceeds the PWQO level, the 75th percentile at both locations meets the PWQO requirement, with 0.012 mg/L upstream and 0.015 mg/L downstream. Therefore, the St. Clair River is a Policy 1 receiver with respect to ammonia.

The maximum total phosphorus concentration was 0.015 mg/L at the upstream sampling location and 0.030 mg/L at the downstream sampling location. These values are within the PWQO limit of 0.030 mg/L. Therefore, the St. Clair River is a Policy 1 with respect to total phosphorus.

The minimum value of dissolved oxygen (DO) was 7.5 mg/L at the upstream sampling location and 7.4 mg/L at the downstream sampling location. These values meet the minimum PWQO DO requirement of 5 mg/L.

The policy status for the St. Clair River was re-confirmed with river quality data available from 1998 to 2018. The St. Clair River is a Policy 1 receiver with respect to total ammonia, total phosphorus, and dissolved oxygen. A Policy 1 receiver is defined by the MECP as a receiving stream with water quality better than the PWQO. The St. Clair River meets this requirement in accordance with Ministry Procedure B-1-5.

Based on the analysis of historical water data collected at monitoring stations 740376 and 740016 from 1998 to 2018, the following policy status can be developed:

- Total Ammonia – Policy 1
- Total Phosphorus – Policy 1
- Dissolved Oxygen – Policy 1

Based on the assimilative capacity update described in Section 6.3.7, the effluent discharge resulting from the proposed expansion to the Courtright WWTP is not expected to significantly impact contaminant concentrations in the St. Clair River or affect PWQO compliance. The assimilative capacity update is provided in Appendix A-5.

6.4.11 Groundwater Resources

As of the previous ESR (2007), the majority of the residents of Lambton County (88 percent) obtained their domestic water supplies from municipal water systems. The total water usage supplied by groundwater was less than 0.15 percent in the Township (TSH, 2007).

There are currently no wellhead protection areas in the study area. No municipal systems in the St. Clair Region are serviced by groundwater wells. Wellhead protection areas are vulnerable areas around a municipal wellhead in which contaminants are reasonably likely to move toward or reach the well (Thames - Sydenham & Region Drinking Water Source Protection, 2010).

6.5 Social and Cultural Environment

Table ES 30 summarizes the social/economic information obtained from Statistics Canada for the 2021 Community Profile for St. Clair (Statistics Canada, 2021).

Table ES 30. Profile for the Township of St. Clair

Parameter	Township of St. Clair	Province of Ontario
Average Total Income – all persons reporting earnings	$60,150	$56.350
Unemployment Rate	8.7%	12.2%
Labour Participation Rate – General	57.9%	62.8%
Labour Participation Rate – Agriculture and Natural Resources	6.4%	2.0%
Labour Participation Rate – Manufacturing, Trades, Construction	33.1%	20.9%
Labour Participation Rate – Business, Finance, Administration, Legislation	12.2%	28.5%
Labour Participation Rate – Service, Health, Education, Sciences, Recreation, and Other	48.3%	45.7%
Occupied Private Dwellings – Owned	86.3%	68.4%
Occupied Private Dwellings – Rented	13.7%	31.4%
Population – 0 to 14 years	17.0%	15.8%
Population – 15 to 64 years	60.5%	65.6%
Population – 65 years and over	22.6%	18.5%

Note: Social and economic information was obtained from Statistics Canada for the 2021 Community Profile for St. Clair (Statistics Canada, 2021).

6.5.1 Land Use

The Township of St. Clair is located along the bank of the St. Clair River, south of the City of Sarnia. It is approximately 620 square-kilometres in size, encompassing the communities of Brigden, Corunna, Courtright, Mooretown, Port Lambton, Sombra, and Wilkesport, in the Region of Sarnia-Lambton.

The predominant land uses in the local study area are agricultural, residential neighbourhoods, industrial development, green spaces and smaller commercial areas. Surrounding the local study area are predominantly agricultural land and greenspaces. Industrial use is classified as Type 1, 2 or 3 in the Township Official Plan (Lambton County Planning & Development Department, 2005, amended 2013). Type 1 industrial use is typically smaller in scale, with minimal potential environmental impacts, and minimal or no separation required from residential uses. Types 2 and 3 are increasingly larger in scale, with more significant environmental impacts, and more stringent separation requirements. The main industrial areas include:

- Industrial Type 3 east of St. Clair Parkway, south of LaSalle Line, west of Ladysmith Road and north of Petrolia Line

- Industrial Types 2 and 3 east of Greenfield Road, south of Petrolia Line, west of Ladysmith Road and north of Courtright Line
- Industrial Types 2 and 3 east of St. Clair Parkway, south of Courtright Line, west of the 40 Highway, and north of Wilkesport Line

The main residential and commercial areas are located within the communities of Corunna, Mooretown, and Courtright. Most suburban residential development is located along the St. Clair Parkway and St. Clair River. Additional information on land use is provided in the Township Official Plan (Lambton County Planning & Development Department, 2005, amended 2013). The Courtright WWTP is located within the residential development in Courtright.

6.5.2 Utilities

In the Township of St. Clair, Hydro One Networks Inc. provides distribution and related electrical services. Enbridge Inc. owns and operates the natural gas storage, transmission and distribution systems in Lambton County.

6.5.3 Recreation

Given the Township's considerable natural resources and attractions, a variety of recreational opportunities are available to local residents, including swimming, boating, sailing, and fishing on the waters of the St. Clair River. There is also a 34-kilometre hiking and biking trail along the watercourse.

6.5.4 Economic Environment

The Township is 16 kilometres from Provincial Highway 402 by way of Provincial Highway 40.

Rail service in Sarnia-Lambton is provided by both CN Rail (Canadian National Railway) and CSX Transportation. The CSX rail line runs adjacent to the Courtright WWTP, on the west side of the plant. Deep port facilities accommodating domestic and international shipping are available at the Port of Sarnia, which has direct access to the St. Lawrence Seaway. Within the Township of St. Clair, industrially zoned riverfront lands have the capability to house significant docking infrastructure. Directly adjacent to Highway 402, is the Sarnia Chris Hadfield Airport.

The Township of St. Clair accommodates a mix of commerce, industrial development and agriculture. Within its broadly diversified industrial base, the major sectors are petrochemicals, plastics, refining, automotive parts and building products.

There are two natural gas power plants in operation, located to the south of the community of Courtright and to the east of the community of Corunna.

6.5.5 Agricultural

The Canada Land Inventory Soil Capability for Agriculture mapping system has classified the soils of the province according to their ability to support agricultural production with ratings from 1 to 7. Class 1 farmland is able to support continuous production of field crops with little to no restrictions, while lesser classifications have varying degrees of restrictions as a result of low fertility, poor drainage, stoniness and other factors which limit production. Class 6 land are those considered totally unsuitable for farming. At the Regional level, soils vary from a Class 2 to 3.

The majority of rural areas in the Township of St. Clair are designated as agricultural lands in the Official Plan (Lambton County Planning & Development Department, 2005, amended 2013).

6.5.6 Cultural Heritage Resources

Heritage resources include artifacts, buildings or structures (e.g., bridges, monuments), landscapes (e.g., parks, trails), and archaeological sites. There are no known buildings, structures, cultural landscapes within the study area. The Courtright WWTP property has a low potential for built heritage or cultural heritage landscape (Ministry of Tourism, Culture and Sport, 2016). The completed cultural heritage screening checklist available from the Ministry of Tourism, Culture and Sport is included in Appendix A-4.

6.5.7 Archaeological Heritage Resources

6.5.7.1 Stage 1 Archaeological Assessment

Archaeological Research Associates Ltd. (ARA) was retained to complete a Stage 1 Archaeological Assessment for the Courtright WWTP EA. A Stage 1 assessment of lands with the potential to be impacted by the proposed Courtright Wastewater Treatment Plant expansion conducted in January 2022.

The investigation encompassed the entire study area. At the time of assessment, the study area comprised structures associated with the current WWTP, roadways and grassed, overgrown and treed areas. A property inspection did not occur; accordingly, no permissions were required for property access.

The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. It was recommended that the identified areas of archaeological potential be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 Standards and Guidelines for Consultant Archaeologists. The identified areas of no archaeological potential did not require any additional assessment. A copy of the Stage 1 Archaeological Assessment is included in Appendix A-4.

6.5.7.2 Stage 2 Archaeological Assessment

A Stage 2 archaeological assessment of lands with the potential to be impacted by the proposed Courtright Wastewater Treatment Plant expansion was conducted in December 2023. The investigation encompassed the entire study area. Legal permission to enter and conduct all necessary fieldwork activities within the assessed lands was granted by the property owner. At the time of assessment, the study area comprised structures associated with the current WWTP, roadways and grassed, overgrown and treed areas.

The Stage 2 assessment of the project limits did not result in the identification of any archaeological materials. It was recommended that no further assessment be required within the project limits. The areas of archaeological potential outside of the study area will not be impacted and do not require further work at this time. These areas may require Stage 2 assessment if development is contemplated in the future.

If impacts become necessary outside of the study area, these lands must be assessed using the test pit survey method. A survey interval of 5 m is warranted due to the proximity of the lands to the identified features of archaeological potential. Each test pit must be excavated into at least the first 5 cm of subsoil, and the resultant pits must be examined for stratigraphy, cultural features and/or evidence of fill. The soils from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If archaeological materials are encountered, all positive test pits must be documented, and intensification may be required. A copy of the Stage 2 Archaeological Assessment is included in Appendix A-4.

7. Future Conditions

7.1 Liquids Treatment

7.1.1 Influent Pumping

Wastewater is conveyed to the Courtright WWTP through the Corunna Pump Station, located at 362 Beresford Street, and the Courtright Pump Station located on the WWTP site.

7.1.1.1 Corunna Pump Station

The total and firm capacities of the Corunna Pump Station are listed in Table ES 31. The firm capacity was calculated with one unit out of service for maintenance or repair. The Corunna Pump Station currently conveys approximately 80 percent of the existing influent flows to the Courtright WWTP. Future ICI flows of 7,300 cubic metres per day are expected to be directly connected to the Courtright WWTP and therefore would not be conveyed through either the Corunna or Courtright Pump Stations. Flows due to residential growth and current ICI as well as future contingency flows were assumed to be conveyed through both the Corunna and Courtright Pump Stations with the same 80:20 division of influent flows.

The Corunna Pump Station capacity is sufficient for the current design flows as well as future flows.

Table ES 31. Corunna Pump Station Capacity Assessment

Parameter	Current	2042 Design Basis
Number of Pumps	3	3
Pump Capacity (each), m^3/d	9,072	9,072
Firm Capacity, m^3/d	18,144	18,144
Total Capacity, m^3/d	27,216	27,216
Design ADF Capacity Required, m^3/d	4,800	6,160
Design Peak Capacity Required, m^3/d	12,000	15,400
Percent of Existing Equipment Firm Capacity Required at Peak Flow, %	66%	85%

7.1.1.2 Courtright Pump Station

The total and firm capacities of the Courtright Pump Station are presented in Table ES 32. The firm capacity was calculated with one unit out of service for maintenance or repair. The Courtright Pump Station currently conveys approximately 20 percent of the existing influent flows to the Courtright WWTP. Future ICI flows of 7,300 cubic metres per day are expected to be directly connected to the Courtright WWTP and therefore would not be conveyed through either the Corunna or Courtright Pump Stations. Flows due to residential growth and current ICI as well as future contingency flows were assumed to be conveyed through both the Corunna and Courtright Pump Stations with the same 80/20 division of influent flows.

The Courtright Pump Station capacity is sufficient for the current design flow but not for the future peak capacity as shown in Table ES 32. The Courtright Pump Station capacity would be exceeded by about 10 percent, or 300 cubic metres per day for the 2042 design basis for peak flow.

Table ES 32. Courtright Pump Station Capacity Assessment

Parameter	Current	2042 Design Basis
Number of Pumps	2	2
Pump Capacity (each), m^3/d	3,542	3,542
Firm Capacity, m^3/d	3,542	3,542
Total Capacity, m^3/d	7,085	7,085
Design ADF Capacity Required, m^3/d	1,200	1,540
Design Peak Capacity Required, m^3/d	3,000	3,850
Percent of Existing Equipment Firm Capacity Required at Peak Flow, %	85%	109%

7.1.2 Headworks

Influent flows are conveyed to the Headworks building for preliminary treatment. The Headworks consists of a mechanical screening and vortex grit removal facility, each with a peak instantaneous capacity of 26,500 cubic metres per day. The screening facility consists of two mechanical screen units and one screening conveyor/compactor. Each mechanical screen unit has a peak instantaneous capacity of 26,500 cubic metres per day for a combined total capacity of 53,000 cubic metres per day. The vortex grit removal facility consists of one vortex grit tank, two air compressors, each rated at 31.2 cubic metres per hour at 861.8 kPa, an air operated diaphragm grit pump with a capacity of 6.5 L/s, and one grit dewatering screw for grit classification and dewatering.

The screening and grit removal capacities are presented in Table ES 33 for the current and future design bases. The existing mechanical screening capacity is sufficient; however, the screening conveyor/compactor and vortex grit removal unit capacity will not meet future peak flow demands. Given the anticipated ICI discharger flow information, the peak factor for the Courtright WWTP has been reduced relative to what was used in the original facility design based on the assumption that there will be little-to-no variability in the instantaneous flow coming from the ICI Users. As additional information is made known to the Township from the ICI Users, and discharge Agreements are established, this assumption may need to be revisited and impacts to the preferred recommended alternative might follow during preliminary design.

Table ES 33. Screening and Grit Tank Capacity Assessment

Parameter	Current	2042 Design Basis
Peak Screening Hydraulic Capacity, m^3/d	53,000	37,500
Peak Grit Tank Capacity, m^3/d	26,500	37,500
Peak Day Flow at Design Capacity, m^3/d	26,500	37,500
Percent of Existing Screening Equipment Capacity Required, %	50%	75%
Percent of Existing Grit Removal Equipment Capacity Required, %	100%	142%

7.1.3 Secondary Treatment

Following preliminary treatment, flow is split between two extended aeration secondary treatment plants, each consisting of an extended aeration basin and a square secondary clarifier. A large population of microorganisms (biomass) consumes the influent organic material in the aeration tanks. The concentrated solution in the aeration tanks (mixed liquor) flows to the secondary clarifiers for final settling where biomass is separated from the clear effluent.

The two extended aeration basins are equipped with fine bubble diffused aeration systems and dissolved oxygen analyzers. Aeration is achieved by one Turbo blower with a capacity of 2,500 normal cubic metres per hour and one centrifugal blower, with a capacity of 2,000 normal cubic metres per hour.

The secondary clarifiers are each equipped with rotary sludge and scum collector mechanisms. A portion of the settled sludge in the clarifier underflow is recycled to maintain a functional biomass concentration (return activated sludge [RAS]), while the remainder is wasted to solids treatment (waste activated sludge [WAS]).

The three RAS pumps (two duty and one standby) are rated at 70 L/s at TDH of 13.2 metres and two scum pumps (one duty and one standby) are rated at 20 L/s at TDH of 8 metres. A portion of the RAS flow is returned to the inlet end of the aeration basins, while the remaining portion is conveyed to the headworks and mixed with influent raw sewage flows for liquid-phase odour control.

Capacity assessment for secondary treatment was based on the MECP Design Guidelines (MECP, 2019), original design basis for the Courtright WWTP (TSH, 2008), and recent operations data. Operations data were available from January 2022 to April 2023, however annual averages were only calculated for 2022 to capture a full year of seasonal variations. The following information was used in the capacity assessment:

- Solids Retention Time (SRT) target of at least 15 days for extended aeration with nitrification, based on the MECP Design Guidelines (MECP, 2019)
- Average flow mixed liquor suspended solids (MLSS) concentration of 4,410 mg/L, and peak flow MLSS concentration of 2,980 mg/L, based on the 2022 operations data (St. Clair Township, April 2023). The MECP recommends a MLSS concentration of 3,000 to 5,000 mg/L for extended aeration with nitrification (MECP, 2019). The volatile suspended solids concentration is assumed to be 78 percent based on the original design basis for undigested sludge (TSH, 2007).
- Aeration hydraulic retention time (HRT) target of at least 15 hours for extended aeration with nitrification, based on the MECP Design Guidelines (MECP, 2019)
- Oxygen demand for aeration (in kilograms of Oxygen, kg O_2) calculated according to the MECP Design Guidelines (MECP, 2019), using the estimated BOD_5 and TKN removal in the following equation:

$$Oxygen\ Demand = 1.5 \frac{kg\ O_2}{kg\ BOD_5} + 4.6 \frac{kg\ O_2}{kg\ TKN}$$

- Standard oxygen transfer efficiency (SOTE) of 31 percent and operating pressure of 10 pounds per square inch gauge (psi-g) based on the equipment information in the Courtright WWTP Operation and Maintenance (O&M) Manual (AECOM, 2012).
- Secondary clarifier capacity based on the MECP Design Guidelines for extended aeration with nitrification:
    - Peak Surface Overflow Rate (SOR) of 40 cubic meter per square meter per day ($m^3/m^2/d$), based on peak hour flow
    - Peak Solids Loading Rate (SLR) of 170 kilograms per square meter per day ($kg/m^2/d$), based on peak hour flow

  Peak day flows were used in lieu of peak hour flow data (MECP, 2019).
- RAS rate equal to 155 percent of the influent flow based on the 2022 operations data (St. Clair Township, April 2023).
- WAS rate equal to 3 percent of the influent flow based on the 2022 operations data (St. Clair Township, April 2023)

- WAS/RAS solids concentration of 6,600 mg/L based on the 2022 operations data (St. Clair Township, April 2023)

7.1.3.1 Aeration

The results of the capacity assessment are presented in Table ES 34 for the aeration tanks and Table ES 35 for the aeration blowers along with the corresponding original design parameters, MECP design guidelines, and additional design guidelines where applicable. For the current design basis of 6,000 cubic metres per day, design parameters for the aeration tanks were generally in acceptable ranges, however the organic loading rate and food to microorganism (F/M) ratios for the aeration tanks were slightly lower than the recommended guidelines, suggesting that the WWTP is receiving relatively dilute sewage. The aeration blowers were able to provide sufficient ADF and peak capacity at the current design basis.

For the future design basis, several design parameters fell outside the acceptable range. The aeration tanks did not meet the design guidelines for HRT, organic loading, and SRT. The F/M ratio was elevated but within an acceptable range. The aeration blowers were able to provide sufficient ADF capacity, however firm capacity was exceeded by approximately 21 percent under peak flow conditions. A significant increase in secondary treatment capacity as well as additional blower capacity for peak flow would be needed for the future design basis.

Table ES 34. Aeration Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)	Design Guideline (Metcalf & Eddy, 2014)
No. Aeration Basins	2	2	N/A	N/A	N/A
Aeration Tank Volume (per basin), m^3	3,098	3,098	N/A	N/A	N/A
Total Aeration Tank Volume, m^3	6,197	6,197	N/A	N/A	N/A
Design ADF, m^3/d	6,000	15,000	N/A	N/A	N/A
Hydraulic Retention Time (HRT), h	24.8	9.9	24.1	>15	20 to 30
Organic Loading, $kg/m^3/d$	0.185	0.511	0.19	0.17 to 0.24	0.1 to 0.3
Food to Microorganism (F/M) Ratio, d^{-1}	0.054	0.149	0.068	0.05 to 0.15	0.04 to 0.1
Solids Retention Time (SRT), d	22.5	9.0	25	>15	20 to 40

Table ES 35. Aeration Blower Capacity Assessment

Parameter	Current	2042 Design Basis
Oxygen Demand, kgO_2/d	2,559	7,276
Air Flow Required at ADF, Normal cubic metres per hour (Nm^3/h)	1,147	3,260
Air Flow Required at ADF, Actual cubic metres per hour (Am^3/h)	681	1,937
Percent of Firm Capacity Required at ADF, %	17%	48%
Air Flow Required at Peak, Am^3/h	1,704	4,844
Percent of Firm Capacity Required at Peak, %	43%	121%

7.1.3.2 Secondary Clarification

7.1.3.2.1 Capacity Assessment

The results of the capacity assessment are presented in Table ES 36 for the secondary clarifiers, along with the corresponding original design parameters, MECP design guidelines, and additional design guidelines where applicable.

For the current design basis of 6,000 cubic metres per day, design parameters for the secondary clarifiers were generally in acceptable ranges.

For the future design basis, several design parameters fell outside the acceptable range. The secondary clarifiers greatly exceeded the MECP design guidelines for SOR and SLR. A significant increase in secondary clarification capacity would be needed for the future design basis.

The RAS pumps currently have sufficient firm capacity, however by 2042, the RAS flow is expected to exceed the RAS pump firm capacity by 192 percent. Additional RAS pumping capacity would be needed for the future design basis.

Table ES 36. Secondary Clarification Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)
Number of Clarifiers	2	2	N/A	N/A
Clarifier Surface Area (each), m^2	205	205	N/A	N/A
Total Clarifier Surface Area, m^2	410	410	N/A	N/A
Side Wall Depth (SWD), m	4.6	4.6	N/A	N/A
Peak Flow at Design Capacity, m^3/d	15,000	37,500	N/A	N/A
Surface Overflow Rate (SOR) at Design Peak Flow, $m^3/m^2/d$	36.6	91.5	37	40
Solids Loading Rate (SLR) at Design Peak Flow, $kg/m^2/d$	177	442	150	170
No. RAS Pumps	2	2	N/A	N/A
RAS Flow at 155% of ADF, m^3/d	9,300	23,300	N/A	N/A
RAS Pump Percent of Firm Capacity, %	77%	192%	N/A	N/A

7.1.3.2.2 State Point Analysis

A mathematical model that predicts secondary clarifier performance using operating data known as a state point analysis, was conducted around the secondary clarifiers to determine if solids washout would be a risk in the future.

Sludge Volume Index (SVI) and MLSS concentration data were analyzed from 2020 to 2023, as summarized in Table ES 37. In general, the SVI is relatively low which suggests fast settling sludge. The MECP Guidelines suggest a maximum Peak SLR of 170 kilograms per square meter per day ($kg/m^2/d$), based on peak hour flow at an SVI of 150 millilitres per gram (mL/g) (MECP, 2019). However, the maximum SVI observed in the historical data was around 80 mL/g.

The state point analysis was conducted based on the maximum observed SVI of 80 mL/g. A revised maximum SLR of 254 $kg/m^2/d$ was calculated at an SVI of 80 mL/g and average MLSS concentration of 3,872 mg/L.

Theoretically, the secondary clarifiers could be operated at an elevated SLR of 254 kg/m^2/d rather than the MECP recommended SLR of 170 kg/m^2/d. Table ES 38 shows the impact of adding additional clarifiers on SLR. The existing two clarifiers do not provide sufficient capacity and would lead to solids washout. Five clarifiers in total would be needed to meet the MECP recommendation, whereas only four clarifiers would be needed to meet the revised maximum SLR of 254 kg/m^2/d, based on current plant performance.

The revised maximum SLR of 254 kg/m^2/d was carried forward for developing the design concepts. We recommend process modelling at the onset of design to confirm if operating at an elevated SLR is viable. Further, the impact of the new ICI flows on sludge properties such as SVI is unknown and could impact the observed clarifier performance. An additional clarifier may need to be added to the design if it is later determined that the MECP recommendation of 170 kg/m^2/d SLR is more appropriate.

Table ES 37. Data Summary for State Point Analysis

Data Summary, 2020 to 2023	Average	Maximum	Minimum
Sludge Volume Index (SVI), mL/g	59.0	80.4	38.0
MLSS Concentration, mg/L	3,872	6,080	1,860

Table ES 38. Peak Solids Loading Rate (SLR) Clarifier Analysis

No. of Clarifiers	Total Surface Area, m^2	Peak Solids Loading Rate (SLR), kg/m^2/d
2	410	442
3	615	294
4	820	221
5	1,025	177

7.1.4 Phosphorous Removal

Phosphorus removal is currently achieved through aluminum sulfate (alum) addition at the aeration tank outlet. The phosphorus removal system consists of two 15,000 litre alum storage tanks, each with a useful capacity of 13,438 litres, and three (two duty and one standby) positive displacement metering pumps, each with a maximum capacity of 350 L/h.

The influent TP concentration for the future design basis is presented in Table ES 49. The target effluent TP concentration was assumed to be equal to the ECA objective of 0.50 mg/L. Generally, alum is dosed at a molar ratio of aluminum-to-phosphorus (Al:P) between 1.4 to 2.5 to verify that adequate chemical is dosed to achieve the desired level of TP removal despite any side reactions that occur (Metcalf & Eddy, 2014). An Al:P of 2.0 was selected, assuming liquid alum solution strength of 49 percent. It was assumed that no TP removal is achieved in the extended aeration process via biological uptake, therefore only the chemical phosphorus removal system provides the target TP removal.

In the original design, the phosphorus removal system was designed to provide 30-days of storage (TSH, 2007). The MECP Design Guidelines recommend a minimum of 10-days storage (MECP, 2019).

As shown in Table ES 39, the current alum storage capacity is sufficient for the current design basis regardless of either a 10-day or 30-day minimum storage design basis. For the future design basis, the current storage capacity will meet the 10-day recommendation from the MECP Design Guideline but falls short of the 30-day target in the original design basis for the Courtright WWTP.

The existing chemical metering pumps can meet capacity needs throughout the planning horizon with a total capacity of 1,050 litres of alum per hour and firm capacity of 700 litres of alum per hour with one pump offline.

Table ES 39. Phosphorus Removal Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)
No. Alum Storage Tanks	2	2	N/A	N/A
Storage Tank Volume (each), m^3	13,438	13,438	N/A	N/A
Total Storage Capacity, m^3	26,876	26,876	N/A	N/A
Design ADF, m^3/d	6,000	15,000	N/A	N/A
Alum Dose, mg/L of raw sewage	165	136	162	110 to 225
Storage Available with Existing Capacity, d	37	18	30	10
Meter Pump Capacity Required, L alum/h	30.6	63.0	N/A	N/A
Percent of Existing Metering Pump Firm Capacity Required, %	4	9	N/A	N/A

7.1.5 Disinfection

Disinfection is achieved via one UV disinfection system with a total peak flow rate of 15,000 cubic metres per day. As shown in Table ES 40, this capacity is sufficient for the current design basis but cannot meet the increased peak capacity requirements under the future design basis. An additional 22,500 cubic metres per day in peak capacity would be required.

Table ES 40. Disinfection Capacity Assessment

Parameter	Current	2042 Design Basis
UV Disinfection Peak Flow Rate, m^3/d	15,000	15,000
Peak Flow at Design Capacity, m^3/d	15,000	37,500
Percent of Existing Equipment Capacity Required, %	100%	250%

7.2 Solids Treatment

Waste activated sludge is collected from the secondary clarifiers and further treated to reduce the sludge volume and stabilize the organic materials present in the sludge prior to land application. The sludge management system consists of aerobic digestion, biosolids storage, and a truck loading facility.

7.2.1 Solids and Biosolids Projections

Biosolids projections for the planning period (to 2042) are presented in Table ES 41 and Figure 7-1. Projections were calculated according to the following:

- Residential and current ICI loadings were estimated using the average historical per capita rate of 15.7 kilograms per capita per day (kg/cap/day) and the population projections from Section 6.2.
- Future ICI loadings were developed for each user as follows:
    - ICI User 1 and Brigden Flows: A population equivalent (PE) was estimated based on the projected flow divided by 300 litres per day based on industry experience. To estimate future loadings, the PE was multiplied by the average historical per capita rate and added to other projected loadings. The future ICI biosolids generation was further increased by a 50 percent correction factor due to the significant influence of the high concentration flows.

- o ICI User 2: Assumed to have no impact on biosolids generation. The influent water quality data available for ICI User 2 indicates this will be a dilute stream and is assumed to have negligible impact on biosolids generation compared to other future flows.

For the design basis, an additional 4,188 cubic metres per day of contingency flows were included. Biosolids generation due to this additional flow was calculated according to the following:

- Contingency flows were also estimated using a PE defined as the projected flow divided by 300 litres per day based on industry experience. To estimate future loadings, the PE was multiplied by the average historical per capita rate and added to other projected loadings.

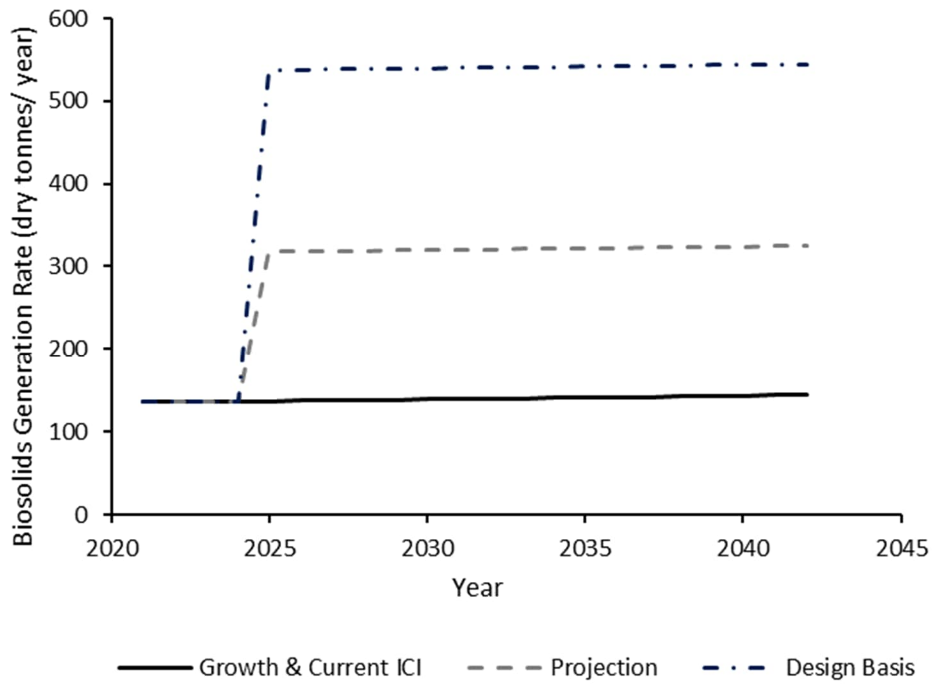
By 2042, the biosolids generation is projected to be approximately 325 dry tonnes per year, compared to 140 dry tonnes per year for projected residential growth and current ICI use. The design basis, which includes contingency flows, resulted in an increased the biosolids generation rate of 540 dry tonnes per year by 2042. Assuming an average TS of 37,000 mg/L, the design basis corresponds to a biosolids volume of 14,700 cubic metres per year.

In addition to significantly increasing the biosolids generation rate, the future new ICI users will impact the biosolids characteristics. As mentioned in Section 6.3.5, the new ICI users are expected to have a significant impact on the raw sewage quality, with higher BOD_5, TKN, and TP loadings. These increased influent loadings will impact the BOD_5, TKN, and TP concentrations in the biosolids.

Table ES 41. Biosolids Projections

Year	Growth & Current ICI Biosolids Generation (dry tonnes/year)	Projected Biosolids Generation (dry tonnes/year)	Design Basis Biosolids Generation (dry tonnes/year)
2021	135.3	135.3	135.3
2022	135.7	135.7	135.7
2023	136.1	136.1	136.1
2024	136.5	136.5	136.5
2025	136.9	317.8	537.3
2027	137.8	318.6	538.1
2030	139.0	319.8	539.4
2033	140.3	321.1	540.6
2036	141.5	322.4	541.9
2039	142.8	323.6	543.2
2042	144.1	324.9	544.5

Figure 7-1. Biosolids Generation Projections



7.2.2 Aerobic Digestion

The aerobic digestion process consists of a single aerobic primary digester divided into two cells for Stage 1 and Stage 2. The Stage 1 cell is sized for twice the volume of Stage 2. One jet aeration system is provided for each stage. Two submersible recirculation pumps are provided: one rated at 94.3 L/s at TDH of 6.1 metres for Stage 1 and one rated at 52.7 L/s at TDH of 6.1 metres for Stage 2. There are three air blowers, each rated at a capacity of 310 normal cubic metres per hour at 50 kPa, and three positive displacement, digester sludge/supernatant transfer pumps, each with a capacity of 8.7 L/s.

The aerobic digester was original designed to provide a 60-day SRT (TSH, 2007). The MECP Design Guidelines recommend a 45-day SRT for aerobic digestion, including both the aerobic digester and activated sludge treatment, and a volatile solids (VS) loading rate of 1.6 kilograms per cubic metre per day ($kg/m^3/d$) to the first stage of the digester (MECP, 2019).

The results of the capacity assessment are presented in Table ES 42. The aerobic digester provides sufficient capacity for the current design basis. For the future design basis, both the Stage 1 VS loading rate and SRT significantly vary from the guidelines, with Stage 1 VS loading greatly exceeding 1.6 kilograms per cubic metre per day, and SRT significantly below 45 days. A significant increase in capacity would be required for the future design basis.

Table ES 42. Aerobic Digestion Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)
Number of Primary Digesters	1	1	N/A	N/A

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)	Design Guideline (MECP, 2019)
Stage 1/ Stage 2 Digester Volume Split	2:1	2:1	N/A	2:1
Total Digester Volume, m^3	1,021	1,021	N/A	N/A
Design ADF, m^3/d	6,000	15,000	N/A	N/A
Stage 1 VS Loading Rate, $kg/m^3/d$	1.35	3.36	N/A	1.6
Solids Retention Time (SRT), d	58.7	24.7	60	45

7.2.3 Solids Storage

Digested biosolids are stored in a single biosolids storage tank with a capacity of 3,400 cubic metres. The storage tank is equipped with two mixing pumps (one duty, one standby), each rated at 189 L/s at 12.2 metres TDH, an ultrasonic level sensor, and float switch high level alarm.

The original design basis was to provide 8-months (240-days) of storage for aerobically digested solids (TSH, 2007). As shown in Table ES 43, the existing storage capacity falls short of the 8-month storage target for the current and future design bases. To meet the current design basis, an additional 25 percent of storage volume is needed to provide 240-days of storage. For the 2042 design basis, an additional 180 percent storage capacity would be needed to provide 240-days of storage.

Table ES 43. Solids Storage Capacity Assessment

Parameter	Current	2042 Design Basis	Original Design (TSH, 2008)
Existing Storage Capacity, m^3	3,400	3,400	N/A
Storage Available with Existing Capacity, d	192	84	240
Storage Capacity Required for 240-day Storage, m^3	4,255	9,673	N/A

7.3 Summary of Challenges and Opportunities

Table ES 44 presents a summary of the deficiencies identified in the capacity assessment.

Table ES 44. Wastewater Treatment Process Capacity Assessment Summary

Process	2042 Design Basis Deficiencies
Corunna Pump Station	No deficiency identified. New ICI users to be directly connected to the Courtright WWTP.
Courtright Pump Station	Additional peak flow capacity is required prior to bringing contingency flows online. New ICI users to be directly connected to the Courtright WWTP.
Headworks	Additional peak flow capacity is required prior to bringing new ICI users online.
Secondary Treatment	Aeration tanks HRT, organic loading, and SRT, and secondary clarifiers SOR and SLR greatly vary from the recommended ranges. Significant additional capacity required prior to bringing new ICI users online. Additional aeration blower capacity required for peak flow. Additional firm RAS pumping capacity is required.
Phosphorus Removal	No deficiency identified.

Process	2042 Design Basis Deficiencies
Disinfection	Additional peak flow capacity required prior to bringing new ICI users online.

8. Problem and Opportunity Statement

The Township of St. Clair owns and operates the Courtright WWTP with a rated capacity of 6,000 cubic metres per day and provides treatment capacity to service approximately 8,600 people in the Township. Approximately 3,855 wet tonnes (133 dry tonnes) of aerobically digested biosolids are generated, stored, and land applied annually.

Future industrial sanitary loads are scheduled to be generated in the next 3 years within the Courtright collection area which has triggered the need to expand the Courtright WWTP. In addition to the expected industrial flows, additional flows and loadings from projected growth in the sewershed over the planning horizon (to 2042) will also impact the required treatment capacity. Influent BOD_5, TSS, TKN, and TP loads are expected to significantly increase with the new industrial flows by up to 510 percent. Additional treatment capacity will be required to address the increased loads in order to continue to meet effluent limits and objectives. The increased influent loadings will be a significant consideration in alternatives development.

Effluent quality has historically complied with the current ECA limits. A review of the St. Clair River assimilative capacity confirmed the existing ECA limits and objectives for $cBOD_{5,}$ TSS, TP, *E. coli*, and pH will be acceptable for the proposed expansion to the Courtright WWTP. For TAN, an annual objective and limit were proposed rather than seasonal, consistent with the current summer objective and limit which the WWTP effluent has historically met year-round. The ECA objective for effluent TP has historically not been met. There is an opportunity to review options for optimizing phosphorus removal through this EA.

There is a need now to start planning for the Courtright WWTP expansion to identify projects required in the short-term to manage the expected industrial flows within three years and provide the necessary treatment capacity to manage projected growth in the sewershed throughout the planning horizon (to 2042).

9. Decision Making Process

9.1 Overview of Decision-Making Methodology

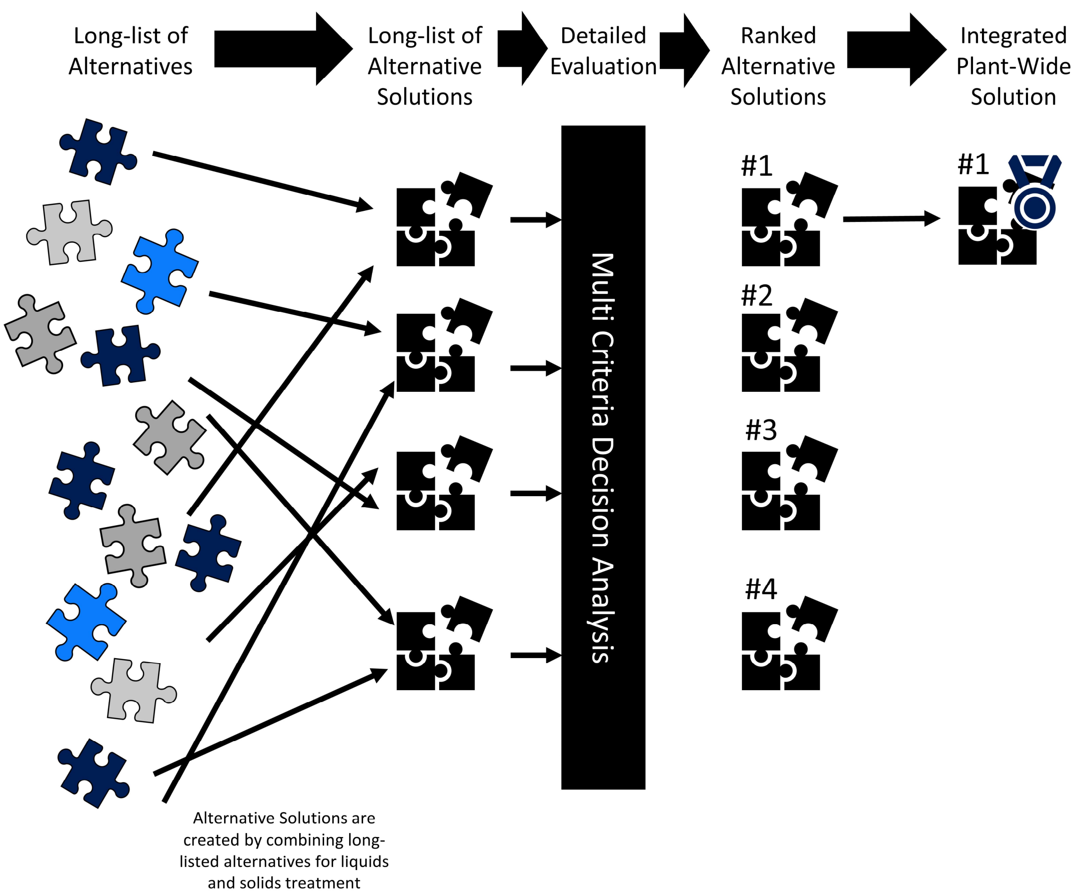
This section describes the evaluation approach that was used to identify the preferred alternatives for wastewater liquid and solids treatment over the planning horizon. The methodology is intended to be a sound, transparent, and defensible decision-making process. The evaluation will be completed per the following steps:

1. **Short-list.** Develop a short-list of wastewater liquid and solids treatment alternatives to meet future needs. The liquid and solids treatment alternatives will be combined into a short-list of alternative integrated plant-wide solutions for the Courtright WWTP.

2. **Detailed Evaluation.** The short-list of integrated plant-wide alternative solutions will be evaluated using criteria in accordance with the MEA Class EA process. Criteria are identified in the broader categories of Natural Environment, Society & Culture, Technical, and Economic. Criteria are identified within each category with a defined scoring framework. The framework provides a performance measure defining the score for how each alternative solution performs for each criterion.

The process is illustrated in Figure 9-1.

Figure 9-1. Decision Making Process.



9.2 Detailed Evaluation Framework

9.2.1 Decision Making Model

The project team used Jacobs' proprietary Multiple Objective Decision Analysis (MODA) tool. This tool was customized for the project to incorporate the detailed evaluation criteria, performance measures, project team scores, and score summary methodology. This tool incorporated criteria category weightings, including different weighting scenarios, and scoring sensitivity analysis.

9.2.2 Multi-Criteria Evaluation

The project team scored the short-list of alternative solutions in a workshop setting. The MODA tool was used in the workshop to aid with visualizing the impacts of changes in scores and category weightings.

9.2.3 Development of Evaluation Criteria, Category and Weights for Non-Economic Criteria

Table ES 45 to Table ES 48 outline the draft detailed evaluation framework that was applied to the short-list of integrated solutions.

To establish a defensible preferred solution, four evaluation methodologies were used to evaluate the scoring sensitivity, as follows:

1. All evaluation criteria are given an equal weighting.
2. All evaluation categories (natural environment, social/cultural environment, technical environment, economic) are given an equal weighting.
3. A benefit to cost ratio is developed using a benefit score based on the natural, social/cultural and technical environment criteria, and the 20-year lifecycle cost developed for each alternative. The benefit score is calculated using an equal weighting for each non-economic category. Rather than developing a score for the economic section, the actual cost is used.
4. The nine prioritized criteria were assigned a weight of 8.33 percent, while the remaining criteria were assigned a weight of 1.67 percent. Prioritized criteria include the following:
    - Community Health and Safety
    - Occupational Health and Safety
    - Noise
    - Odour
    - Ease of Implementation (Constructability)
    - Operational Compatibility
    - Capital Costs
    - O&M Costs
    - Lifecycle Costs

Table ES 45. Natural Environment Criteria Draft Detailed Evaluation Framework

Criterion	Definition	Scoring Regime
Ground Water Quality and Quantity	The potential to impact sensitive groundwater resources in the St. Clair Township and protect overall groundwater quality and quantity.	10 – The alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity. 5 – The alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. May require careful monitoring over the long-term to maintain protection. Contingency measures may be required. 1 – The alternative poses unacceptable risks to the protection-sensitive groundwater resources and to the overall quality and quantity of groundwater.
Terrestrial Habitats and Corridors	The potential impacts to terrestrial habitats and corridors.	10 – The alternative will avoid terrestrial habitats and corridors. 5 – The alternative may require special measures to protect terrestrial habitats and corridors. 1 – The alternative will result in an unacceptable loss of terrestrial habitats and corridors.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries.	10 – The alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements. 5 – The alternative may require special measures to protect aquatic habitats and fisheries. 1 – The alternative will result in an unacceptable loss of aquatic habitats and fisheries.
Floodplain	The potential impacts to existing flood plain and reduction of flood volume capacity in the St. Clair River.	10 – The alternative will maintain the existing floodplain and flood volume capacity. 5 – The alternative will require special measures to maintain the existing floodplain and flood volume capacity. 1 – The alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity.
Surface Water Quality	The potential impact to contaminant loadings in the St. Clair River.	10 – The alternative will provide a high degree of protection to the water quality of the St. Clair River all year and treated effluent can be readily assimilated. 5 – The alternative will provide a high degree of protection to the water quality of the St. Clair River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. 1 – The alternative may present a threat to the water quality of the St. Clair River during low flow periods, and there may be significant restrictions to treated effluent discharge conditions.
Soil Quality	The potential impact to soil as a result of biosolids end-use.	10 – The alternative has the potential to improve the quality and/or productivity of the soil 5 – The alternative provides for similar quality or productivity of the soil 1 – The alternative has the potential to reduce the quality and/or productivity of the soil

Criterion	Definition	Scoring Regime
Air Quality	The potential impact to the quality of the air.	10 – The alternative has the potential to improve the air quality 5 – The alternative provides for similar air quality 1 – The alternative has the potential to reduce the air quality
Wetlands	The potential for the alternative to protect and maintain wetlands	10 – The alternative will avoid wetlands. 5 – The alternative may require special measures to maintain wetland protection. 1 – The alternative will result in an unacceptable threat to wetlands.

Table ES 46. Social/Cultural Environment Criteria Draft Detailed Evaluation Framework

Criterion	Definition	Scoring Regime
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	10 – There are no risks to community health and safety. 5 – There are minor risks to community health and safety that can be properly managed. 1 – There are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels.
Occupational Health and Safety	The potential for the alternative to minimize risks to occupational health and safety (operations, maintenance and during construction)	10 – There are no risks to occupational health and safety. 5 – There are minor risks to occupation health and safety that can be properly managed. 1 – There are significant risks to occupation health and safety which require significant training and risk management plans to minimize risks to acceptable levels.
Noise	The potential for the occurrence of noise events.	10 – The alternative has little or no potential to produce noise. 5 – The alternative has moderate potential to produce noise; noise control measures may be needed to prevent migration off site. 1 – The alternative has a high potential to produce noise; significant mitigation would be needed to control migration off site.
Odour	The potential of the occurrence of odour events.	10 – The alternative has little or no potential to produce odour. 5 – The alternative has moderate potential to produce odour; odour control measures may be needed to prevent migration off site. 1 – The alternative has a high potential to produce odour; significant mitigation would be needed to control migration off site.
Archaeological Resources	Impacts to archaeological sites and/ or areas of archaeological potential	10 – The alternative will not impact archaeological sites and/or areas of archaeological potential. 1 – The alternative will impact archaeological sites and/or areas of archaeological potential.

Criterion	Definition	Scoring Regime
Built Heritage Resources and Cultural Heritage Landscapes (BHR/CHLs)	Impacts to known (previously recognized) or potential BHR/CHLs	10 – The alternative will not impact known and/or potential BHR/CHLs. 1 – The alternative will impact known and/or potential BHR/CHLs.
Transportation	The potential for the alternative to avoid increased demands on the transportation systems (patterns, volumes, and infrastructure requirements)	10 – The alternative will reduce demands on the transportation system. 5 – The alternative will place similar demands on the transportation system. 1 – The alternative will increase demands on the transportation system.

Table ES 47. Technical Environment Criteria Draft Detailed Evaluation Framework

Criterion	Definition	Scoring Regime
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality and/or biosolids quality.	10 – The alternative includes proven technology with a high degree of reliable performance. 5 – The alternative includes newer technology with a growing record of demonstrated performance reliability. 1 – The alternative includes innovative technology with a limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility.
Ease of Implementation (Constructability)	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations during implementation; minimal need to require system modifications.	10 – The alternative can be implemented with no disruption to existing service. 5 – The implementation of the alternative may result in minor disruptions to existing service. 1 – The implementation of the alternative may require significant or periodic disruptions to existing service.
Energy Requirements	The energy required from all sources (electricity, natural gas, fuel)	10 – The alternative requires less energy than the existing system. 5 – The alternative has a similar energy requirement to the existing system. 1 – The alternative uses more energy than the existing system
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions.	10 – The alternative can be readily approved. 5 – The alternative can be approved with minimal conditions. 1 – The alternative can be approved with significant or onerous conditions.

Criterion	Definition	Scoring Regime
Operational Compatibility	The alternative's compatibility with current existing process operations and its ability to integrate within the existing site.	10 – The alternative is very compatible and compliments current processing units. It can be integrated into current plant operations with minimal impact. 5 – The alternative is somewhat compatible and complimentary to current processing units; it can be integrated; but will have some impact. 1 – The alternative is not compatible or complimentary to current processing units and integration may be difficult.
Chemical Consumption	The degree to which the alternative requires chemical usage.	10 – The alternative uses less chemicals than the existing system, by more than 20 percent. 5 – The alternative uses the same amount of chemicals as the existing system, within 20 percent. 1 – The alternative uses more chemicals than the existing system, by more than 20 percent.

Table ES 48. Economic Environment Criteria Draft Detailed Evaluation Framework

Criterion	Definition	Scoring Regime
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives	10 – The alternative has the lowest capital costs relative to other alternatives. 5 – The alternative is in the mid-range of capital costs relative to other alternatives. 1 – The alternative has the highest capital costs relative to other alternatives.
O&M Costs	The relative Operations and Maintenance (O&M) when compared to other alternatives	10 – The alternative has the lowest lifecycle costs relative to other alternatives. 5 – The alternative is in the mid-range of lifecycle costs relative to other alternatives. 1 – The alternative has the highest lifecycle costs relative to other alternatives.
Life Cycle Cost	The relative lifecycle costs (including O&M and Depreciation/Replacement) when compared to other alternatives	10 – The alternative has the lowest lifecycle costs relative to other alternatives. 5 – The alternative is in the mid-range of lifecycle costs relative to other alternatives. 1 – The alternative has the highest lifecycle costs relative to other alternatives.

9.2.4 Scoring Rationale

The Project Team documented the rationale for the scores assigned for each short-listed alternative solution by criterion. The written rationale of the detailed evaluation exercise is an important component of documenting and demonstrating a transparent and defensible decision-making process to the public, stakeholders, and Indigenous communities.

9.3 Design and Evaluation Basis

9.3.1 Design Criteria

A summary of the future design criteria is presented in Table ES 49. The design basis in this EA is anticipated to mostly consist of new ICI contributions, which are not expected to behave the same way as residential flows in terms of short-term peaking events caused by wet weather. The design peak factor for the Courtright WWTP would be more directly impacted if the size of the sewer catchment area were to change as a result of significant residential development, not from new ICI flows. Maintaining the same PIF from the original design basis is assumed to be unrealistically high given the significant contribution from ICI in the future. Further, Jacobs understands that incoming flows to the Courtright WWTP will all be pumped via pump stations, which will provide a degree of control over peak instantaneous flows.

Future influent and effluent concentrations are presented in Table ES 50. Effluent concentrations are assumed to be consistent with current operations.

Table ES 49. Future Design Criteria

Criteria	2042 Design Basis
Service Population (2042)	9,163
Per Capita Flow Rate (L/cap/day)	259
Peak Day Factor	2.5
Future Flows due to Residential Growth and Current ICI Use (m^3/day)	3,512
Maximum ICI Flow from New Users (m^3/day)	7,300
Contingency Flows (m^3/day)	4,188
Design ADF (2042) (m^3/day)	15,000
Peak Day Flow (2042) (m^3/day)	37,500
Design Digested Biosolids Generation Rate (2042) (kg/day)	544.5

Table ES 50. Future Influent and Effluent Concentrations

Concentration (mg/L)	Current	2042 Design Basis
Influent BOD_5	191	211
Influent TSS	181	154
Influent TKN	32	38
Influent TP	4.67	3.94
Effluent $cBOD_5$	2.83	2.83
Effluent TSS	6.74	6.74
Effluent TKN	0.49	0.49

Concentration (mg/L)	Current	2042 Design Basis
Effluent TP	0.51	0.51

9.3.2 Capital Cost Basis

Capital cost estimates were developed for the short-listed alternatives based on the future projected average daily flow of 15 million litres per day (MLD). Capital cost estimates were developed based on vendor quotations for specific equipment and/or technologies, and by using reference projects of similar scope to obtain high-level estimates. The generated cost estimates include allowances to reflect the risks and contingency factors associated with predicting future costs. The following mark-ups and adjustment factors were included, unless otherwise specified:

- 10 percent contractor overhead
- 15 percent contractor profit, mobilization, demobilization, insurance, and bonding
- 30 percent contingency
- 20 percent design and engineering fees
- 4 percent location adjustment factor for reference unit costs based outside of Ontario

9.3.3 O&M Cost Basis

The basis of various components of the annual O&M cost estimate is presented in Table ES 51. The O&M requirements (and associated costs) were developed based on the design annual average day load and sludge generation rates for the planning period (to 2042).

Table ES 51. O&M Cost Basis for Evaluation of Short-listed Alternative Solutions

Item	Unit Cost	Source
Electricity	$0.15/kilowatt-hour (kWh)	Jacobs previous project experience, escalated to 2023 dollars
Labour	$50/hour	Typical for local labour market
Alum	$3.75/litre	Typical market rate
Thickening Polymer	$5.19/kg	Jacobs previous project experience, escalated to 2023 dollars
Truck Haulage	$48/wet tonne	Jacobs previous project experience, escalated to 2023 dollars
Maintenance	2 to 5 percent of equipment costs	Typical range of allowances for annual equipment maintenance, unless otherwise specified.

9.3.4 Lifecycle Cost Basis

Life-cycle cost estimates include capital costs and annual O&M costs, if not specified otherwise. The life-cycle costs were developed using the design annual flow, loading and sludge generation projections between year 2023 and 2042. Table ES 52 summarizes the basis for life-cycle cost estimate for this study.

Buildings and process equipment have different useful life spans (e.g., typically over 50 years for buildings and 15 to 25 years for equipment depending on technology and operating model). Equipment or material replacement costs were included in the life-cycle O&M cost depending on the short-listed technologies. If major equipment replacement such as diffusers, membranes, or media replacement are expected within the planning period, those costs will be included.

Table ES 52. Life-Cycle Cost Basis

Item	Value	Source
Life-Cycle Duration	20 years	The planning horizon for the EA is 20 years
Discount Rate	5 percent (range 3 to 7 percent)	Similar Jacobs projects in Ontario; the range was used for a sensitivity analysis
Inflation Rate	2 percent	Similar Jacobs projects in Ontario; general inflation rate to be applied on annual O&M costs for utilities, chemicals, labour, and maintenance

10. Wastewater Treatment Alternatives Development and Evaluation Methodology

10.1 Development of Alternatives for the Courtright Wastewater Treatment Plant

10.1.1 Do Nothing

The Do Nothing alternative consists of maintaining the existing treatment plant capacity of 6 MLD with a peak capacity of 15 MLD. In this case, the headworks, secondary treatment, disinfection, aerobic digestion and solids storage processes would all be operating at over 100 percent capacity when the new ICI users come online. The existing capacity is sufficient to treat future flows from residential growth but would not be able to reliably accommodate the future expected ICI use.

10.1.2 Process Intensification

The first alternative is Process Intensification which consists of retrofitting the existing Courtright WWTP to provide an ADF capacity of 15 MLD and peak capacity of 37.5 MLD. The existing unit processes would be maintained, with equipment upgrades, operational changes, and other methods of process intensification to increase the capacity where possible.

This alternative includes the following upgrades for each unit process:

- Liquids Treatment
  - Retrofit the two existing extended aeration treatment trains to an alternative secondary treatment approach that can operate at higher solids and organics loading rates.
  - Maintain the two existing secondary clarifiers and construct two additional secondary clarifiers for a total of four clarifiers.
  - Construct one additional aeration blower for peak capacity.
  - Maintain the three existing RAS pumps and construct two additional pumps.
- Solids Treatment
  - Maintain the existing aerobic digester and construct one additional digester.
  - Construct a solids thickening process for the aerobically digested solids to reduce the volume required for storage.
  - Maintain the existing biosolids storage tank and construct one additional tank.
- Other Processes
  - Headworks: Maintain the existing screening and grit removal equipment. Construct one additional screening conveyor/compactor and grit removal process.
  - Disinfection: Maintain the two existing UV disinfection channels and construct one additional UV channel.

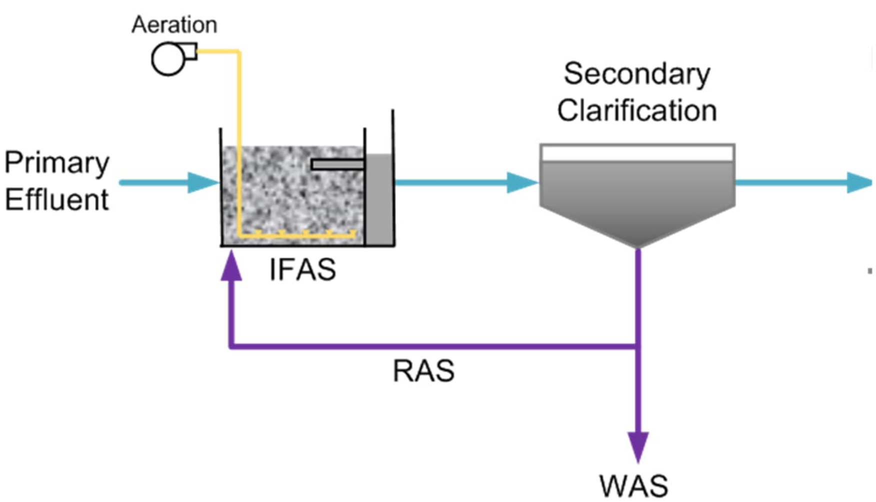
10.1.2.1 Liquids Treatment

Secondary treatment is currently provided by two extended aeration treatment trains. As discussed in Section 7, future flows are expected to push the HRT, organic loading, and SRT in the aeration tanks and the SOR and SLR in the secondary clarifiers beyond the design guidelines. Some alternative secondary treatment technologies can accommodate higher organics loading rates. The existing extended aeration tanks could be retrofitted to an alternative secondary treatment approach to provide additional capacity without requiring additional tankage or footprint.

In this alternative, the two existing extended aeration treatment plants would be retrofitted to a fixed-film secondary treatment approach. There are two common fixed-film configurations: 1) Integrated fixed-film activated sludge (IFAS), and 2) Moving Bed Biofilm Reactor (MBBR).

IFAS is similar to the conventional activated sludge process, however it incorporates fixed-film or free-floating media in the biological reactor. The process flow schematic of an IFAS secondary treatment process is presented in Figure 10-1.

Figure 10-1. IFAS Process Flow Schematic



In an IFAS system, the nitrifiers will tend to grow on the biofilm carriers (media), decoupling nitrifier growth from the activated sludge SRT, allowing nitrification to occur at lower SRTs. A common application of IFAS technology is to retrofit existing bioreactors that are originally sized for carbon removal only with media to achieve full nitrification, therefore avoiding the need to invest in new tanks.

Figure 10-2 presents examples of the plastic biofilm carriers offered by different vendors. Media retention screens are required to prevent media escape from the aeration tanks (Figure 10-3). The screens also introduce headloss. Most IFAS systems use stainless-steel coarse bubble aeration diffusers to improve mixing and minimize the need for maintenance in the tanks; however, this reduces the oxygen transfer efficiency compared to fine bubble diffusers.

Figure 10-2. Examples of Plastic Biofilm Carrier (Media) Supplied by Various Vendors

Veolia Inc., AnoxKaldnes™ (4 to 22 mm)

Headworks BIO, ActiveCell™ (15 to 22 mm)

Siemens Water Technologies Corp, Biosphere CM-10D™ (9 to 13 mm)

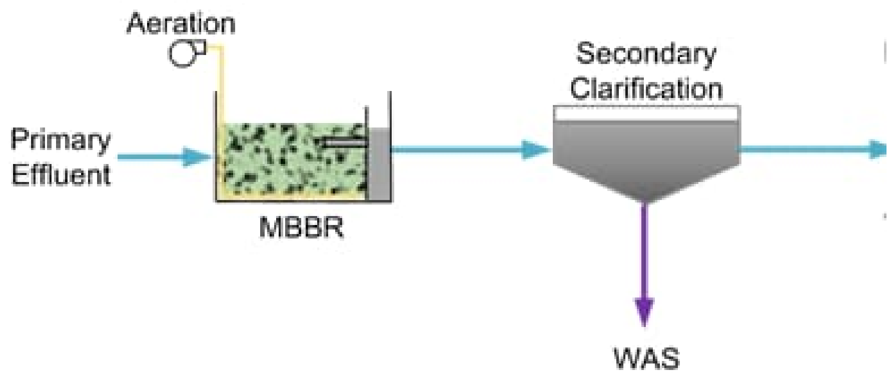
Biowater Technologies BWT Series

Figure 10-3. Photo of Media Retention Screens

The IFAS process is a well-established technology with proven performance within the industry and many vendors. Examples of large installations in North America include the South End Water Pollution Control Centre (peak capacity of 420 MLD, Winnipeg, MB), Field's Point WWTP (291 MLD, Providence, RI), James River WWTP (76 MLD, Hampton Roads, VA), and Twin Falls WWTP Phase 2 Expansion (70 MLD, Twin Falls, ID).

Like IFAS, MBBRs incorporate fixed-film floating media into the aeration tanks; the difference between the two processes is that the MBBR process does not have a RAS stream, as shown in Figure 10-4. It is essentially a continuous-flow biofilm reactor, with the biofilm located on free-moving plastic carriers (similar to those used for IFAS). Like IFAS, media retention screens are used in MBBRs to prevent the media from escaping the process, which introduce additional headloss. The MBBR process relies on good preliminary treatment to prevent screenings/plastics from getting into the MBBR tanks; for example, fine screening with less than 6 mm openings is usually recommended. Because of the continuous-flow nature, the suspended solids in the MBBR effluent are very low (100 to 200 mg/L, compared to 2,000 to 4,000 mg/L in a system with a RAS stream) and relatively difficult to settle with a significant fraction of fine particles. In some cases, coagulant (such as ferric or alum) and/or flocculant (polymer) may be added to the secondary clarifier influent to improve the effluent quality.

Figure 10-4. Process Flow Schematic for MBBR Process



The MBBR process is a well-established technology with proven performance within the industry and has many suppliers/vendors. There are more than 800 installations in over 50 countries, with half of them for municipal wastewater applications. The Niagara Falls WWTP, historically using rotating biological contactors (RBCs), is being upgraded with MBBR. There are a limited number of other installations in North America.

The advantages of fixed-film secondary treatment processes include the following:

- Smaller footprint for secondary treatment
- Ease of expansion for future capacity (e.g., by adding more media)
- MBBR has simpler operation and less maintenance than IFAS because it does not require RAS pumping

Potential disadvantages of fixed-film secondary treatment processes are as follows:

- Media must be removed to service aeration diffusers, although the stainless-steel diffuser design reduces maintenance frequency
- More headloss due to the presence of floating media and retention screens
- There is a risk of media escaping the aeration tank to be transferred to downstream processes in an extreme hydraulic event, although this risk generally is mitigated through proper design of media retention screens.

Other potential retrofit options include:

- Improving solids settleability to enable the bioreactor to provide a greater SRT or handle greater loads without affecting clarifier performance. One example is the inDENSE® hydrocyclone wasting process from World Water Works which has been recommended for the Gold Bar WWTP in Edmonton, AB.
- Ballast processes, which involve the addition of an artificial agent (organic or inorganic) to the basin to substantially improve settleability. Examples include Nuvoda's Mobile Organic Biofilm™ technology, Evoqua's Biomag® system, and S:Select® with MIMICS® by ETA Inc. Ballasted treatment (Nuvoda) has been recommended for the Saskatoon WWTP.

- Addition of primary clarification to reduce the load to secondary treatment. With a reduced load to secondary treatment, the existing system could handle higher SRTs or greater influent loads.
- Converting to a Membrane Aerated Biofilm Reactor (MABR). The MABR process is based on passing air or pure oxygen through bundles of gas permeable hollow fibre membranes. Aerobic biomass, typically nitrifying bacteria, grow directly on the outside of the membranes, allowing for extremely efficient use of oxygen, with heterotrophic denitrification typically taking place in the outer layer of the biofilm. The system can be run at a reduced MLSS concentration and still achieve nitrification. With the reduced MLSS concentration, the load to secondary treatment can be increased while still maintaining reasonable secondary clarifier loads.

Fixed-film secondary treatment was selected for the Process Intensification alternative as it would be a simple retrofit requiring minimal changes to the existing infrastructure relative to the other options considered. The existing aeration basin and secondary clarifier footprint would remain unchanged. The aeration basins would be retrofitted with a fixed-film process (i.e., IFAS or MBBR). It is recommended to undertake a more detailed analysis in the design phase to confirm design details and treatment performance.

Additionally, the aeration blower capacity was identified to be deficient at peak flow conditions. The simplest solution would be to install one additional blower to provide peak capacity.

In summary, the secondary treatment design basis for this alternative includes the following:

- One (1) additional aeration blower with 4,000 Normal cubic metres per hour capacity and operating pressure of 10 psi-g.
- Two (2) fixed-film bioreactors retrofitted from the existing aeration basins, 36.6 metres in length, 14.3 metres in width, and 5.92 metres SWD, for a total volume of 6,197 cubic metres.
- Four (4) square secondary clarifiers. Two (2) of which would be existing clarifiers, 14.3 metres in length/ width, and 4.6 metres SWD, for a total clarification surface area of 410 square metres. Two (2) additional clarifiers would be newly constructed with the same dimensions as the existing clarifiers.
- Five (5) RAS pumps, consisting of three (3) existing and two (2) new pumps with four (4) duty and one (1) standby pump.

10.1.2.2 Solids Treatment

The existing aerobic digestion process fell significantly outside of the recommended MECP Design Guidelines for Stage 1 VS loading rate and SRT. Addressing the SRT deficiency in secondary treatment can help to improve the total SRT; however, the Stage 1 VS loading exceeded the recommended value by approximately 110 percent. Therefore, the aerobic digestion capacity should be expanded. In this alternative, one additional aerobic digester would be constructed with the same dimensions and capacity as the existing digester.

Solids storage capacity was also identified as a key deficiency in the capacity assessment. In this alternative, a solids thickening process would be constructed following aerobic digestion to increase the solids concentration in the storage tank and reduce the total storage requirement.

Several potential thickening technologies could be considered including the following:

- **Rotary Drum Thickener (RDT):** The RDT process consists of a conditioning drum, where the solids are mixed with polymer, and rotating cylindrical screen drums separate the flocculated solids from the water. With aerobically digested solids as feed, RDTs can typically achieve a solids concentration of 4 to 6 percent (Metcalf & Eddy, 2014). RDTs are currently used for WAS thickening at the Guelph WWTP.

- **Gravity Belt Thickener (GBT):** Solids are concentrated as free water drains by gravity through a porous horizontal belt in GBTs, which are typically designed for a maximum of 5 to 7 percent thickened solids. There is no shearing action on the flocs in GBTs, therefore the capture efficiency is usually very high (90 to 98 percent) (Metcalf & Eddy, 2014). GBTs are used at the City of Hamilton's Woodward Avenue WWTP for separate WAS and primary sludge thickening processes.
- **Centrifuge**: Solids are separated using centrifugal force. Centrifuges can be used for thickening or dewatering. When used for WAS thickening, centrifuges can typically achieve solids concentrations of 4 to 6 percent with polymer addition (Metcalf & Eddy, 2014). Centrifuge WAS thickening has been used in many WWTPs in southern Ontario, such as two of the City of Toronto's three largest facilities (Highland Creek Treatment Plant and Humber Treatment Plant), and Peel Region's G.E. Booth WWTP.

RDTs have been selected as the design basis for this alternative as this technology is typically used in small- to medium-sized plants and is more cost effective than other technologies. It is recommended to undertake a more detailed analysis in the design phase to confirm design details and thickener performance.

The existing storage tank would be maintained, and a second solids storage tank would be constructed with a minimum capacity of 3,355 cubic metres to provide 240-days of storage.

In summary, the solids treatment design basis for this alternative includes the following:

- Two (2) square aerobic digesters, 14.3 metres in length/ width, and 5.1 metres in depth, for a total digestion volume of 1,021 cubic metres
- One (1) RDT solids thickening facility to process aerobically digested biosolids
- Two (2) biosolids storage tanks, 21.3 metres in diameter and 9.76 metres SWD, for a total storage volume of 6,800 cubic metres

10.1.2.3 Other Processes

Additional deficiencies were identified for Influent Pumping, Headworks and Disinfection processes.

Although the Corunna Pump Station capacity is sufficient, the Courtright Pump Station capacity would be exceeded if the current division of flows with 80 percent to Corunna and 20 percent to Courtright Pump Station is maintained. Diverting the additional 300 cubic metres per day in peak flow to the Corunna Pump Station would allow both facilities to be operated below capacity. Alternatively, one additional pump could be provided at the Courtright Pump Station to provide the additional firm capacity. Another option would be to directly connect some or all contingency flows to the Courtright WWTP, bypassing the Courtright Pump Station. These solutions are relatively minor and are therefore excluded from alternatives development.

For Headworks, both the screening conveyor/compactor and grit removal processes would be expanded. The existing equipment would be maintained. One additional screening conveyor/compactor and one additional grit removal process would be constructed with the same capacity as the existing processes (i.e., each unit with a peak capacity of 26,500 cubic metres per day). The two existing mechanical screening channels would remain to provide a total combined capacity of 53,000 cubic metres per day.

For Disinfection, one additional UV disinfection channel would be constructed to provide an additional 9,000 cubic metres per day ADF capacity and 22,500 cubic metres per day peak capacity.

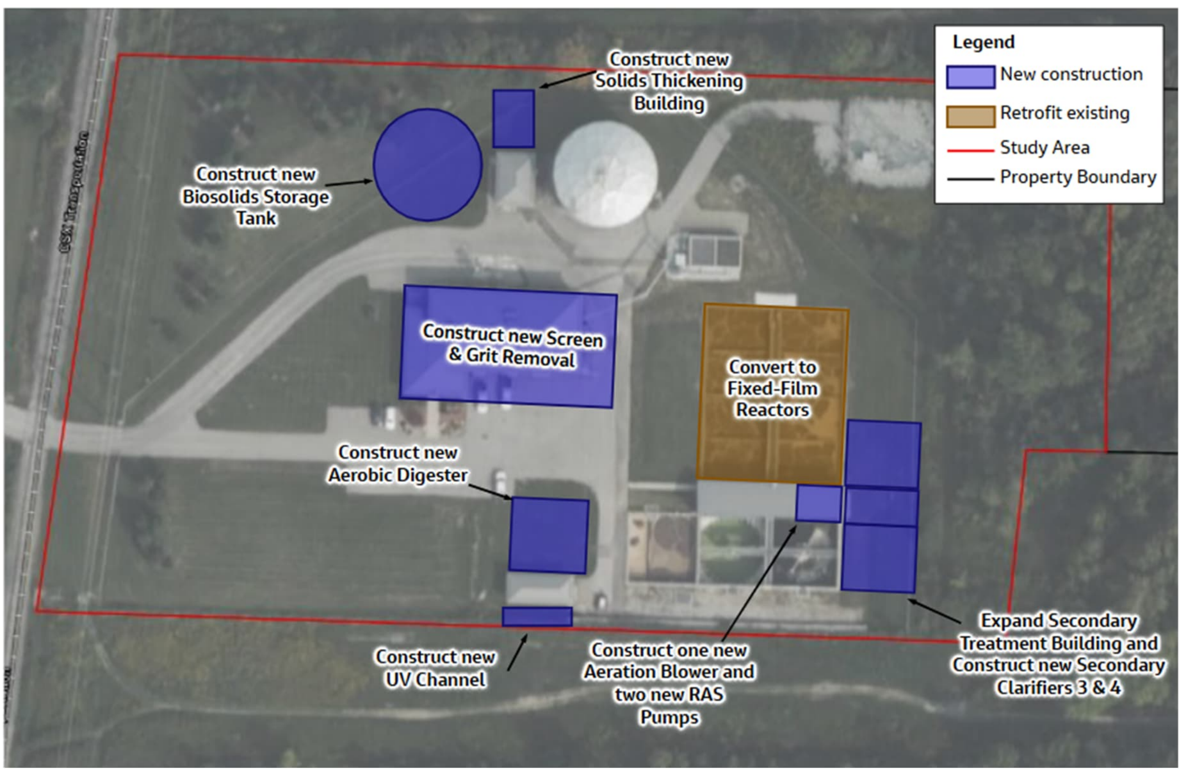
10.1.2.4 Site Layout

The preliminary site layout for this alternative is presented in Figure 10-5. The following modifications at the Courtright WWTP would be included:

- Construct a new screening conveyor/compactor and grit removal process in the Preliminary Treatment & Operations Building
- Retrofit the existing extended aeration basins to fixed-film reactors
- Construct two new secondary clarifiers
- Construct one new aeration blower and two new RAS pumps in the secondary treatment building. We assume there is sufficient space for the new blower without expanding the existing building.
- Construct a new aerobic digester
- Construct a new solids thickening building to house the RDT process for aerobically digested biosolids
- Construct a new biosolids storage tank
- Construct a new UV channel

Note that the footprint shown is approximate and would need to be confirmed in the design phase.

Figure 10-5. Process Intensification Alternative Preliminary Site Layout



10.1.3 Wastewater Treatment Plant Expansion

The second alternative is WWTP Expansion which consists of expanding the existing Courtright WWTP to address deficiencies and provide an ADF capacity of 15 MLD and peak capacity of 37.5 MLD. The existing equipment would be maintained, and new equipment or unit processes would be constructed to provide additional capacity.

This alternative includes the following upgrades:

- Liquids Treatment
  - Maintain the two existing extended aeration treatment trains.
  - Construct two additional aeration basins and two secondary clarifiers to provide additional capacity.
  - Construct one additional aeration blower for peak capacity.
  - Maintain the three existing RAS pumps and construct two additional pumps.
- Solids Treatment
  - Maintain the existing aerobic digester and construct one additional digester.
  - Maintain the existing biosolids storage tank and construct additional tanks to provide additional capacity.
- Other Processes
  - Headworks: Maintain the existing screening and grit removal equipment. Construct one additional screening conveyor/compactor and grit removal process.
  - Disinfection: Maintain the two existing UV disinfection channels and construct one additional UV channel.

10.1.3.1 Liquids Treatment

In this alternative, the two existing secondary treatment trains would be maintained, and two additional aeration basins and two secondary clarifiers would be constructed with the same dimensions and capacity as the two existing trains.

Additionally, the aeration blower capacity was identified to be deficient at peak flow conditions. The simplest solution would be to install one additional blower to provide peak capacity.

The secondary treatment design basis for this alternative includes the following:

- One (1) additional aeration blower with 4,000 Normal cubic metres per hour capacity and operating pressure of 10 psi-g.
- Four (4) aeration basins, 36.6 metres in length, 14.3 metres in width, and 5.92 metres SWD, for a total aeration volume of 12,394 cubic metres
- Four (4) square secondary clarifiers, 14.3 metres in length/ width, and 4.6 metres SWD, for a total clarification surface area of 820 square metres.
- Five (5) RAS pumps, consisting of three (3) existing and two (2) new pumps with four (4) duty and one (1) standby pump.

10.1.3.2 Solids Treatment

The existing aerobic digestion process fell significantly outside of the recommended MECP Design Guidelines for Stage 1 VS loading rate and SRT. Addressing the SRT deficiency in secondary treatment can help to improve the total SRT; however, the Stage 1 VS loading exceeded the recommended value by approximately 110 percent. Therefore, the aerobic digestion capacity should be expanded. In this alternative, one additional aerobic digester would be constructed with the same dimensions and capacity as the existing digester.

Solids storage capacity was also identified as a key deficiency in the capacity assessment. The existing storage tank would be maintained, and additional solids storage tanks would be constructed with a minimum total capacity of 9,673 cubic metres to provide 240-days of storage.

The solids treatment design basis therefore includes the following:

- One (1) square aerobic digester, 14.3 metres in length/ width, and 5.1 metres in depth, for a total digestion volume of 1,021 cubic metres
- One (1) existing biosolids storage tank, 21.3 metres in diameter and 9.76 metres SWD, and at least one (1) new tank with a minimum capacity of 6,273 cubic metres, for a total storage volume of 9,851 cubic metres. For example, two (2) additional tanks with the same dimensions as the existing tank would be needed to provide the additional capacity.

10.1.3.3 Other Processes

Additional deficiencies were identified for Influent Pumping, Headworks, and Disinfection.

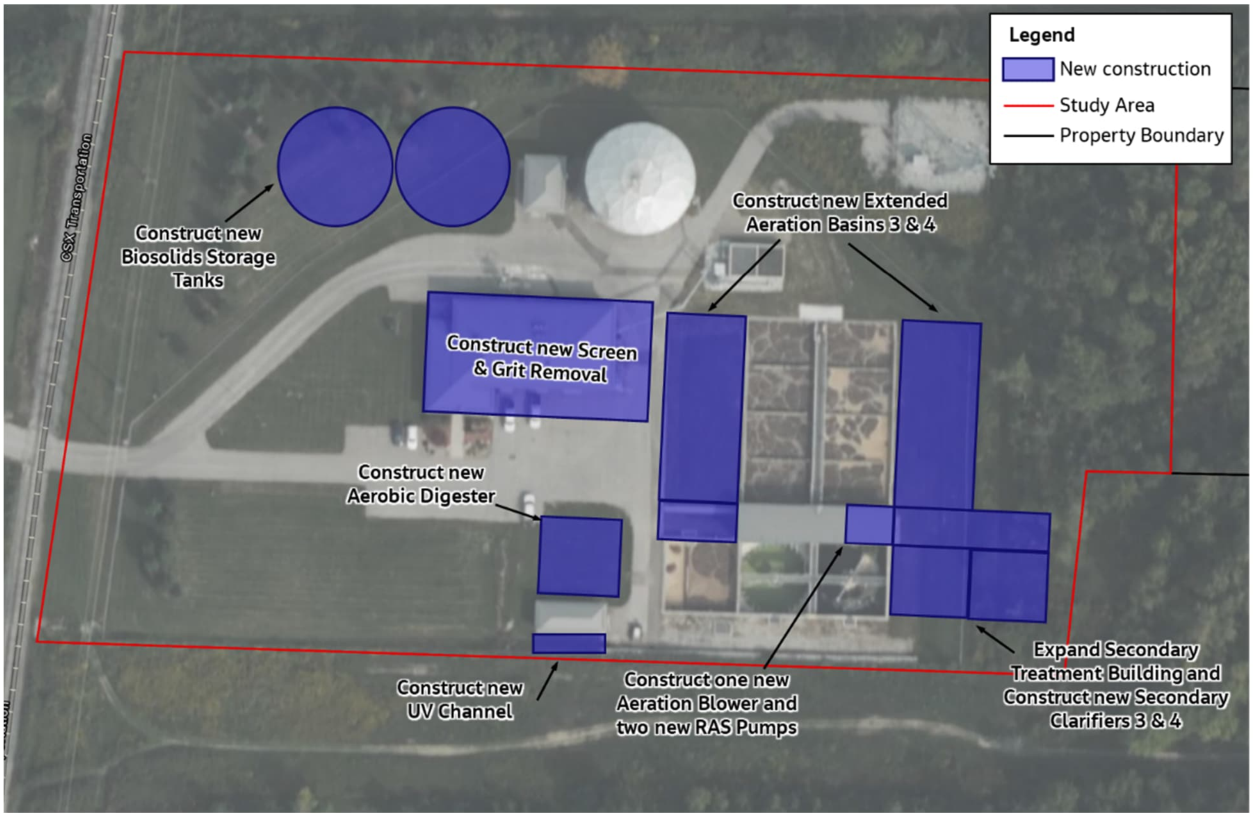
10.1.3.4 Site Layout

The preliminary site layout for this alternative is presented in Figure 10-6. The following modifications at the Courtright WWTP would be included:

- Construct a new screening conveyor/compactor and grit removal process in the Preliminary Treatment & Operations Building
- Construct two new aeration tanks and two new secondary clarifiers
- Construct one new aeration blower and two new RAS pumps in the secondary treatment building. We assume there is sufficient space for the new blower without expanding the existing building.
- Construct a new aerobic digester
- Construct two new biosolids storage tanks
- Construct a new UV channel

Note that the footprint shown is approximate and would need to be confirmed in the design phase.

Figure 10-6. WWTP Expansion Alternative Preliminary Site Layout



10.2 Detailed Evaluation

This section defines the detailed evaluation of alternatives based on natural environment, social/cultural, technical, and economic considerations. The detailed evaluation scores the alternatives against multiple criteria, and the consolidated scores were used to identify the preliminary preferred solution.

10.2.1 Do Nothing

The Do Nothing alternative is described in Section 10.1.1. Briefly, this alternative would maintain the existing treatment plant capacity of 6 MLD with a peak capacity of 15 MLD. Headworks, secondary treatment, disinfection, aerobic digestion and solids storage would not have sufficient capacity when the new ICI users come online. Capital, O&M, and lifecycle costs were not developed for this alternative as no construction would be required.

10.2.2 Process Intensification

10.2.2.1 Design Concept

The design concept for the Process Intensification alternative is presented in Section 10.1.2.

Table ES 53 presents a summary of the new equipment and capacities that formed the basis of the capital, O&M, and lifecycle cost estimates.

The preliminary design concept for the fixed-film reactors is based on the Hybas™ IFAS system by AnoxKaldnes®, a subsidiary of Veolia Water Technologies. The retrofit would involve dividing each of the existing aeration basins into three separate zones: an aerobic zone, followed by the IFAS reactor, and a second aerobic zone. Additional design details and the full quotation are provided in Appendix D.

Table ES 53. Design Information for Process Intensification Alternative

Parameter	Value
Headworks	N/A
Number of Duty Screens	2 (2 existing)
Type and Screen Opening	Coarse Screen, 10 mm opening
Screen Peak Capacity (each), m^3/d	26,500
Number of Duty Screen Conveyor/Compactors	2 (1 existing, 1 new)
Screen Conveyor/Compactor Peak Capacity (each), m^3/d	26,500
Number of Vortex Grit Removal Systems	2 (1 existing, 1 new)
Vortex Grit Removal Peak Capacity (each), m^3/d	26,500
Secondary Treatment	N/A
Number of Fixed-Film Hybas™ Reactors	2 (retrofitted from existing extended aeration basins)
Reactor Zone 1 – Aerobic Volume (each), m^3	1,900
Reactor Zone 2 – IFAS Volume (each), m^3	700
Reactor Zone 3 – Aerobic Volume (each), m^3	500
Hybas™ Media Type	K5
Aeration System – Aerobic Zones 1 and 2	Fine bubble
Aeration System - IFAS	Medium bubble
Number of Aeration Blowers	3 (2 existing, 1 new)
Aeration Blower Capacity (each), Nm^3/h	4,000
Number of Secondary Clarifiers	4 (2 existing, 2 new)
Secondary Clarifier Dimensions (each), m	14.3 x 14.3 x 4.6 (length x width x SWD)
Secondary Clarifier Surface Area (each), m^2	205
Number of RAS/WAS Pumps	5 (3 existing, 2 new)
RAS/WAS Pump Capacity (each), m^3/d	6,048
Disinfection	N/A
Number of UV Channels	2 (1 existing, 1 new)
Existing UV Channel Peak Capacity, m^3/d	15,000
New UV Channel Peak Capacity, m^3/d	22,500
Solids Management	N/A
Number of Aerobic Digesters	2 (1 existing, 1 new)
Aerobic Digester Volume (each), m^3	1,021
Aerobic Digester Stage 1 Dimensions (each)	14.3 x 9.5 x 5.1 (length x width x SWD)
Aerobic Digester Stage 2 Dimensions (each)	14.3 x 4.5 x 5.1 (length x width x SWD)
Number of RDTs for Solids Thickening	2
RDT Operating Schedule, hours/day	12

Parameter	Value
RDT Hydraulic Loading Rate at ADF, m^3/h	6.2
RDT Solids Loading Rate, kg/h	124.3
Number of Biosolids Storage Tanks	2 (1 existing, 1 new)
Storage Tank Capacity (each), m^3	3,400

10.2.2.2 Capital Cost

The capital cost estimate (+100/-50 percent range) for the Process Intensification alternative is presented in Table ES 54. Details of the capital cost estimate are provided in Appendix D.

Table ES 54. Capital Costs for Process Intensification Alternative

Item	Cost (in million $)
Headworks	$1.8
Aeration Basins Retrofit to IFAS	$4.1
Aeration Blowers	$0.7
Secondary Clarifiers	$2.9
RAS/WAS Pumping	$1.2
UV Channel	$1.2
Aerobic Digestion	$2.8
Solids Thickening	$3.6
Solids Storage	$3.3
Subtotal	$21.7
Mobilization/demobilization, bonds, insurance, and contract profit (15%)	$3.3
Contractor overhead (10%)	$2.2
Design development contingency (30%)	$6.5
Design and Engineering Fees (20%)	$4.3
Location Adjustment Factor (4% for reference projects outside of Ontario)	$0.8
Total	$38.8

10.2.2.3 O&M Requirements and Costs

Table ES 55 summarizes the O&M requirements and costs for the Process Intensification alternative. Details are presented in Appendix D.

Table ES 55. O&M Requirements and Costs for Process Intensification Alternative

Item	Value	Unit	Annual Cost
Electricity Usage	616,100	kWh/year	$95,200
Labour [1]	2,080	hours/year	$104,000
Alum Usage	552,200	Litres/year	$2,068,800
Thickening Polymer Usage	5,400	kg/year	$28,000
Digested Sludge Haulage	10,300	Wet tonnes/year	$491,900
Annual Equipment Maintenance [2]	N/A	N/A	$194,400

Item	Value	Unit	Annual Cost
Total Annual O&M Cost	N/A	N/A	$2,982,300

Notes:

1. Based on 1 Full Time Equivalent (FTE) at $50/hour
2. Based on 2 percent of new equipment costs

10.2.2.4 Lifecycle Cost Analysis

Table ES 56 presents the 20-year lifecycle costs for the Process Intensification alternative, including a sensitivity analysis on varying discount rates. Details are presented in Appendix D.

Table ES 56. Lifecycle Costs for Process Intensification Alternative

Cost (in million $)	3% Discount Rate	5% Discount Rate	7% Discount Rate
Total 20-y O&M Net Present Value (NPV) Cost [1]	$35.8	$29.7	$25.1
Capital Cost	$38.8	$38.8	$38.8
20-y Total LCC [2]	$74.6	$68.5	$63.8

Notes:

1. Based on 3% inflation rate
2. Capital costs are added in year 1 for comparison purposes

10.2.3 WWTP Expansion

10.2.3.1 Design Concept

The design concept for the WWTP Expansion alternative is presented in Section 10.1.3.

Table ES 57 presents a summary of the new equipment and capacities that formed the basis of the capital, O&M, and lifecycle cost estimates.

Table ES 57. Design Information for WWTP Expansion Alternative

Parameter	Value
Headworks	N/A
Number of Duty Screens	2 (2 existing)
Type and Screen Opening	Coarse Screen, 10 mm opening
Screen Peak Capacity (each), m^3/d	26,500
Number of Duty Screen Conveyor/Compactors	2 (1 existing, 1 new)
Screen Conveyor/Compactor Peak Capacity (each), m^3/d	26,500
Number of Vortex Grit Removal Systems	2 (1 existing, 1 new)
Vortex Grit Removal Peak Capacity (each), m^3/d	26,500
Secondary Treatment	N/A
Number of Extended Aeration Basins	4 (2 existing, 2 new)
Extended Aeration Basin Dimensions (each), m	36.6 x 14.3 x 5.92 (length x width x SWD)
Extended Aeration Basin Volume (each), m^3	3,098
Number of Aeration Blowers	3 (2 existing, 1 new)

Parameter	Value
Aeration Blower Capacity (each), Nm^3/h	4,000
Number of Secondary Clarifiers	4 (2 existing, 2 new)
Secondary Clarifier Dimensions (each), m	14.3 x 14.3 x 4.6 (length x width x SWD)
Secondary Clarifier Surface Area (each), m^2	205
Number of RAS/WAS Pumps	5 (3 existing, 2 new)
RAS/WAS Pump Capacity (each), m^3/d	6,048
Disinfection	N/A
Number of UV Channels	2 (1 existing, 1 new)
Existing UV Channel Peak Capacity, m^3/d	15,000
New UV Channel Peak Capacity, m^3/d	22,500
Solids Management	N/A
Number of Biosolids Storage Tanks	3 (1 existing, 2 new)
Storage Tank Capacity (each), m^3	3,400

10.2.3.2 Capital Cost

The capital cost estimate (+100/-50 percent range) for the WWTP Expansion alternative is presented in Table ES 58. Details of the capital cost estimate are provided in Appendix D.

Table ES 58. Capital Costs for WWTP Expansion Alternative

Item	Cost (in million $)
Headworks	$1.8
Extended Aeration Basins	$9.8
Aeration Blowers	$0.7
Secondary Clarifiers	$2.9
RAS/WAS Pumping	$1.2
UV Channel	$1.2
Aerobic Digestion	$2.8
Solids Storage	$5.5
Subtotal	$25.9
Mobilization/demobilization, bonds, insurance, and contract profit (15%)	$3.9
Contractor overhead (10%)	$2.6
Design development contingency (30%)	$7.8
Design and Engineering Fees (20%)	$5.2
Location Adjustment Factor (4%)	$1.0
Total	$46.4

10.2.3.3 O&M Requirements and Costs

Table ES 59 summarizes the O&M requirements and costs for the WWTP Expansion alternative. Details are presented in Appendix D.

Table ES 59. O&M Requirements and Costs for WWTP Expansion Alternative

Item	Value	Unit	Annual Cost
Electricity Usage	491,171	kWh/year	$75,900
Labour [1]	2,080	hours/year	$104,000
Alum Usage	552,200	Litres/year	$2,068,800
Digested Sludge Haulage	14,800	Wet tonnes/year	$706,900
Annual Equipment Maintenance [2]	N/A	N/A	$139,900
Total Annual O&M Cost	N/A	N/A	$3,095,500

Notes:

1. Based on 1 FTE at $50/hour
2. Based on 2 percent of new equipment costs

10.2.3.4 Lifecycle Cost Analysis

Table ES 60 presents the 20-year lifecycle costs for the WWTP Expansion alternative, including a sensitivity analysis on varying discount rates. Details are presented in Appendix D.

Table ES 60. Lifecycle Costs for WWTP Expansion Alternative

Item	3% Discount Rate	5% Discount Rate	7% Discount Rate
Total 20-y O&M NPV Cost [1]	$35.9	$29.8	$25.1
Capital Cost	$46.4	$46.4	$46.4
20-y Total LCC [2]	$82.3	$76.2	$71.5

Notes:

1. Based on 3% inflation rate
2. Capital costs are added in year 1 for comparison purposes

10.2.4 Multi-Criteria Evaluation

Table ES 61 to Table ES 64 presents the multi-criteria evaluation results for the alternatives using the four methods for criteria weighting outlined in Section 9.2. Scoring and rationale details are provided in Appendix C.

For the Social/Cultural Environment criteria, the Do Nothing alternative consistently scored higher than other alternatives. The Do Nothing alternative would not require any construction and would maintain the current operating strategy, therefore no additional impacts due to noise, odour, traffic, or health and safety are expected. Both the Process Intensification and WWTP Expansion alternatives would involve higher flows and loadings, therefore increasing the odour potential and demands on the transportation system for additional sludge haulage. The WWTP Expansion alternative scored slightly higher than Process Intensification in this category. The potential impacts to Occupational Health & Safety are expected to be lower as the technology is familiar to O&M staff and would require less training. Further, a lower potential for noise impacts is anticipated as the aeration requirements are expected to be lower than IFAS in the Process Intensification alternative. Aeration is the main process contributor to noise. For these reasons, Do Nothing, followed by WWTP Expansion then Process Intensification, scored higher in the Social/Cultural Environment.

For the Natural Environment criteria, the Do Nothing alternative also consistently scored higher than the other alternatives, followed closely by the WWTP Expansion alternative. Both the Process Intensification and WWTP Expansion alternatives may require construction in the undisturbed wooded area adjacent to the developed area of the plant which could impact terrestrial habitats and corridors. The increased effluent flows in both of these alternatives have potential impacts on aquatic habitats and fisheries and surface water quality in the St. Clair River. An impacts inventory will be required to assess potential impacts and mitigation measures due to construction and operation. Any trees removed would need to be replaced at a ratio of 2:1. The Process Intensification alternative involves a new secondary treatment technology. The potential impacts of this new technology on surface water quality are less well known than if the current technology is maintained in the WWTP Expansion alternative. Additionally, solids thickening would be implemented in the Process Intensification alternative to minimize storage requirements. Land application of thickened solids could be more challenging and potentially result in a need for landfilling solids or uncertainty in where the biosolids could be accepted for land application. For these reasons, Do Nothing, followed by WWTP Expansion then Process Intensification, scored higher in the Natural Environment.

For the Technical Environment criteria, the WWTP Expansion alternative consistently scored higher than the other alternatives. Process Intensification generally scored higher than Do Nothing except in the Method 4 weightings. The Do Nothing alternative was generally less favourable in the Technical Environment as this approach would not provide sufficient capacity to manage future ICI flows and loadings. There is potential for future regulatory issues with approving new ICI discharges at the current rated treatment process capacity. Both the WWTP Expansion alternative and Process Intensification alternatives provide additional capacity to accommodate the anticipated future ICI flows as well as provide contingency to manage additional future flows. The Process Intensification alternative introduces additional risk and challenges with operating a new secondary treatment technology as well as solids thickening. Retrofitting the existing aeration basins would be more complex in terms of construction staging and commissioning as the impacts to other treatment processes are unknown. Energy and chemical usage are expected to be higher for the Process Intensification alternative as well. Overall energy requirements are expected to increase from the Do Nothing alternative for both the Process Intensification and WWTP Expansion alternatives due to higher flows and loadings, however the WWTP Expansion will likely have lower overall energy requirements compared to the IFAS Retrofit for Process Intensification. For these reasons, the WWTP Expansion alternative, followed by Process Intensification then Do Nothing, scored higher in the Technical Environment.

For the Economic criteria, the Process Intensification alternative consistently scored higher than WWTP Expansion. Retrofitting the two existing aeration basins is expected to have lower capital costs compared to adding two new secondary treatment trains. Process Intensification had slightly lower O&M and lifecycle costs largely due to the reduced haulage costs for the thickened solids. Overall, the benefit to cost ratio was more favourable for the WWTP Expansion alternative. The Do Nothing alternative was excluded from the economic evaluation as capital, O&M, and lifecycle costing were not developed for this alternative. Therefore, a benefit to cost ratio was not calculated for the Do Nothing alternative.

The WWTP Expansion alternative is the preferred alternative using all four methodologies for criteria weighting.

Table ES 61. Multi-Criteria Evaluation for Alternatives using Method 1 Weightings

Category	Category Weight	Do Nothing	Process Intensification	WWTP Expansion
Social/Cultural Environment	29.17	19.91	9.72	12.04
Natural Environment	33.33	25.46	19.44	23.15
Technical Environment	25.00	7.87	11.11	17.13
Economic	12.50	0.00	12.50	11.10
Total Score	N/A	53.24	52.78	63.42

Table ES 62. Multi-Criteria Evaluation for Alternatives using Method 2 Weightings

Category	Category Weight	Do Nothing	Process Intensification	WWTP Expansion
Social/Cultural Environment	25.00	17.05	8.33	10.31
Natural Environment	25.00	19.27	14.72	17.52
Technical Environment	25.00	7.84	11.07	17.06
Economic	25.00	0.00	24.90	22.11
Total Score	N/A	44.16	59.00	67.00

Table ES 63. Multi-Criteria Evaluation for Alternatives using Method 3 Weightings

Category	Category Weight	Do Nothing	Process Intensification	WWTP Expansion
Social/Cultural Environment	33.33	22.80	11.14	13.79
Natural Environment	33.33	25.43	19.42	23.12
Technical Environment	33.33	10.48	14.80	22.81
Subtotal Non-Economic Criteria	N/A	58.72	45.36	59.72
Total 20-y Lifecycle Cost, $ million (3% inflation, 5% discount rate)	N/A	N/A	$68.5	$76.2
Benefit to Cost Ratio	N/A	N/A	0.66	0.78

Table ES 64. Multi-Criteria Evaluation for Alternatives using Method 4 Weightings

Category	Category Weight	Do Nothing	Process Intensification	WWTP Expansion
Social/Cultural Environment	38.33	23.52	11.30	17.41
Natural Environment	13.33	10.19	7.78	9.26
Technical Environment	23.33	9.81	7.41	16.48
Economic	25.00	0.00	25.00	22.21
Total Score	N/A	43.52	51.48	65.35

10.2.5 Risks and Opportunities

The multi-criteria evaluation results were based on assumptions and preliminary influent water quality data available at the time of writing this report. There are several potential risks or opportunities that could be identified in the future that may impact the design basis. Potential anticipated risks and opportunities include the following:

- Process modelling is recommended at the outset of the design phase to confirm the design basis. The assumptions for the design basis are dependent on and highly specific to the preliminary influent water quality and flow data provided for future ICI User 1 and 2. Any changes to the assumed wastewater characterization from the future ICI users should be evaluated through process modelling.
- There is an opportunity to manage additional ICI flows in the future with the contingency built into the design basis. Influent flows and water quality data should be obtained from any potential ICI users and impacts to the WWTP treatment processes should be assessed through process modelling.

- The secondary clarification design basis was based on a maximum SLR of 254 kg/m^2/d at an SVI of 80 mL/d. Process modelling is recommended at the onset of design to confirm if operating at an elevated SLR is viable. Further, the impact of the new ICI flows on sludge properties such as SVI is unknown and could impact the observed clarifier performance. An additional clarifier may need to be added to the design if it is determined that the MECP recommendation of 170 kg/m^2/d SLR is more appropriate.
- Potential impacts due to expansion into the adjacent forested area and due to increased effluent flows to the St. Clair River. An impacts inventory will be required to identify mitigation measures during construction and normal operation. Any trees removed would need to be replaced at a ratio of 2:1.
- Long-term regulation changes that may affect the ability to land apply biosolids, such as allowable metal concentrations. The impact of new ICI flows on biosolids composition is unknown.

10.2.6 Summary of Preferred Solution for the Courtright WWTP

Expansion of the WWTP using the same technologies/treatment processes as those currently in use was selected as the preferred alternative to upgrade the ADF capacity from 6,000 m^3/d to 15,000 m^3/d. This alternative was selected because the technology is familiar to plant staff and the approach offers more flexibility for future upgrades (e.g., retrofitting the new trains in the future to a process intensification option).

Additional upgrades were determined to be required for headworks, disinfection, and solids treatment. it was assumed the existing technologies would be maintained and expanded as needed to meet the future capacity constraints.

The preferred alternative consists of the following upgrades:

- Headworks
  - Convert both existing mechanical screening channels to duty, each with a hydraulic capacity of 26,500 m3/d (coarse screen with bar spacing of 10 mm) and construct one new screening conveyor/compactor.
  - One new vortex grit removal system with a hydraulic capacity of 26,500 m^3/d.
- Secondary Treatment
  - Construct two new aeration basins (36.6 x 14.3 metres with 5.92 metres SWD) and secondary clarifiers (14.3 x 14.3 metres with 4.6 metres SWD) for a total of four secondary treatment trains.
  - Construct one new multi-stage centrifugal blower with 4,000 Nm3/d capacity.
  - Construct two new RAS/WAS pumps, each with 70 L/s capacity.
- Disinfection
  - Construct one new UV channel with 22,500 m3/d peak capacity, for a total of two UV channels with 37,500 m3/d peak capacity.
- Solids Treatment
  - Construct one new aerobic digester with the same dimensions as the existing digester (14.3 x 14.3 metres with 5.1 metres SWD) for a total of two digesters.
- Solids Storage
  - Construct two new biosolids storage tanks, each with 3,400 m3 capacity, for a total of three tanks and total storage volume of 10,200 m3.

Table ES 65 presents a summary of the preferred solution and associated costs (+100/-50 percent accuracy). The preferred solution will need to be implemented when the new ICI users begin discharging to the Courtright WWTP.

Table ES 65. Preferred Solution for Courtright WWTP

Preferred Solution	Year Required	Driver	Capital Cost, $ million	20-year O&M NPV Cost, $ million[1]	20-year Lifecycle Cost, $ million[1]
WWTP Expansion	2025 When the new ICI users begin discharging	Capacity	$46.4 (Range $23.2 to $92.7)	$29.8 (Range $14.9 to $59.7	$76.2 (Range $38.1 to $152.4)

1. Based on 3% inflation and 5% discount rate.

11. Public, Agency, and First Nations Consultation and Engagement

11.1 Overview

As an integral part of the MCEA process, active and ongoing consultation, and engagement with the public and stakeholders including First Nations and Indigenous communities, community members and government entities is maintained. A project mailing list was established where interested members of the public could sign up to receive updates on the progress of the projects and be notified of key communication points and sessions open to the public. This essential procedure fosters a transparent and responsible planning process.

Key opportunities for the public to receive information about the project and express their input were communicated through project notices distributed to the project mailing list, posted on the Township's website (https://www.stclairtownship.ca/government/departments-2/water-sewer/), Facebook page (fb.com/stclairtwppw) and printed in the local newspaper. A dedicated project email box (CourtrightClassEA@jacobs.com) was set up to allow for interested members of the community to ask questions and provide feedback at any phase of the project A copy of the project contact list is provided in Appendix B.

11.2 Engagement with Indigenous Communities and First nations

Meaningful engagement with Indigenous communities, including First Nations, Métis, and Inuit peoples to understand traditional knowledge of the lands throughout the past, in the present, and into the future was an important component of this study.

The MECP establishes guidelines for engagement with Indigenous communities throughout the environmental assessment process. Communities were encouraged to identify interests in the Courtright Wastewater Treatment Plant Expansion project to support the planning process, including, but not limited to: interest in archaeological or natural environment surveys, and to understand how the potential adverse effects of a proposed alternative can be prevented or mitigated.

Using the Aboriginal and Treaty Rights Information System as a preliminary step in identifying communities that were anticipated to have a potential interest in this study, the following list of communities was identified. This list was confirmed through a letter from the MECP dated December 30, 2022.

- Aamjiwnaag First Nation
- Chippewas of Kettle and Stoney Point
- Walpole Island First Nation (Bkejwanong Territory)
- Chippewas of the Thames First Nation
- Caldwell First Nation
- Oneida Nation of the Thames

As discussed in section 11.3.2, Indigenous communities were notified via email and/or other specific methods requested by individual communities of the project commencement, and opportunities to provide input and feedback. A copy of all Indigenous community correspondence is provided in Appendix B.

11.3 Public Engagement Activities

11.3.1 Project Mailing List

A project contact list was developed at the onset of the project which includes stakeholders from relevant government agencies, First Nations community representatives and interested members of the public who signed up to the project mailing list. The contact list was maintained and updated throughout the Master Planning process.

All relevant agencies, stakeholders and interested parties will be included in the Study Mailing List. The starting point of the proposed list is based on the proposal and the project team's previous experience and knowledge of the study area. The list includes the followings areas of stakeholder engagement:

- Community members - including residents, businesses, and organizations in the community
- Indigenous peoples – First Nations, Indigenous, and Métis
- Municipal staff and elected officials (The Township)
- Review agencies, including federal and provincial agencies
- Utility companies

Throughout the Class EA process, the list was revised and updated, as appropriate, to reflect the inclusion of agencies or parties who wish to be involved in the study as well as those who wish to be excluded from the mailing list.

11.3.2 Project Notices

Project notices were used to raise awareness of the project and inform the community of an opportunity to provide input. Notices were posted on the project's engagement webpage, emailed to the project mailing list and agency contact list, mailed to those on the mailing list without email addresses, and published in two consecutive publications of the local newspaper.

Notices for this study are provided in Appendix B. Notices were distributed and published for the following points throughout the project:

- Notice of Commencement
- Notices of Open Houses (Public Information Centres)
- Notice of Study Completion

Notices provided a clear overview of the project rationale and objectives, description of the process, advise the community where to find project updates, an invitation to participate, and provide contact information for the study project team.

Table ES 66. Study Notices

Communication Method	Study Commencement	PIC 1	PIC 2	Study Completion
Township Webpage	December 12, 2022	March 15, 2023	July 2, 2024	TBD
Project Mailing List	December 12, 2022	March 15, 2023	July 2, 2024	TBD
Traditional Media (Newspaper)	Various	Various	Various	TBD

11.3.3 Public Information Centres

The purpose of hosting public information centres (PICs) was to provide an opportunity for the public to receive an update on the study progress and provide feedback to the project team. The feedback received through the PICs helped to inform the project teams understanding of the community priorities related to wastewater treatment and biosolids management, thereby helping to inform how the Township will treat wastewater and manage biosolids in the future.

Two (2) Public Information Centres were held in-person at a venue located within close proximity to the study area and confirmed by the Township. The format of the PICs followed an "Open House" format with display boards presenting the study information. PIC material, including display boards, sign-in sheets and survey responses are included in Appendix B.

11.3.3.1 Public Information Centre 1

Public Information Centre 1 (PIC 1) was conducted during phase 1 of the Municipal Class EA process. The objective of this PIC was to introduce the study to the public, provide background information on existing conditions at the Courtright WWTP, future needs, and to provide the opportunity for the community to provide feedback. Attendees had the opportunity to ask questions during the session and voice potential concerns through a project survey available at the PIC. A total of 6 participants attended the PIC. All questions and comments received during the PIC have been documented as part of this EA and can be found in Appendix B.

Logistics for PIC 1:

- **Where:** Township Council Chamber, 1155 Emily Street, Mooretown Ontario, N0N 1M0
- **When:** March 29, 2023, 6:00 to 8:00 PM

11.3.3.2 Public Information Centre 2

Public Information Centre 2 was held during Phase 2 of the Municipal Class EA process. The objective of this PIC was to present the initial alternatives, supporting technical documentation highlighting the decision-making process, the plan to implement the preferred alternative solution, and next steps. The PIC provided another opportunity for interested members of the public to provide comments on the project. Attendees had the opportunity to ask questions during the session and voice potential concerns through a project survey available at the PIC. A total of 10 participants attended the PIC. All questions and comments received during the PIC, including both survey responses and subsequent emails, as well as their responses have been documented as part of this EA and can be found in Appendix B.

Logistics for PIC 2:

- **Where:** Township Council Chamber, 1155 Emily Street, Mooretown Ontario, N0N 1M0
- **When:** July 17, 2024, 6:00 to 8:00 PM

11.3.4 Project Email Box

A dedicated project email box was set up to allow for interested members of the community to ask questions and provide feedback at any phase of the project via email. A copy of relevant email correspondence in provided in Appendix B.

11.3.5 Traditional Media

The notices of commencement and each open house were published in two consecutive publications of The Beacon of St. Clair Township, a multi-page newsletter that is mailed monthly to every municipal residence as well as posted on the Township's webpage.

11.4 How the Preferred Solution Incorporates Engagement Feedback

The engagement conducted throughout the study resulted in the team receiving valuable feedback at key stages in the study. In summary, the team identified common themes in the feedback received across the engagement activities:

4. **Protecting the St. Clair River.** The St. Clair River is an important natural feature of the Township, supporting aquatic and natural habitats.
5. **Protecting Natural Environmental Features:** Protecting and/or restoring natural environmental features surrounding the plant from street view and local residents is an important aspect of the study.

The feedback received through the engagement process impacted the decision-making on this study can be summarized as follows:

6. **Evaluation Framework:** Feedback received early in the project related to the community's values were incorporated into the detailed evaluation framework documented in Section 9.2 of this ESR. In addition, the feedback received through the engagement activities provided important context for the project team during the scoring and evaluation of alternatives project phase.
7. **Confirmation of the short-listed alternatives and preferred solutions:** Engagement activities prioritized, presented, and sought feedback on the decision-making process throughout the study. The feedback received during these activities confirmed the decision-making process reflected the community's priorities and values. The study team received feedback supporting the identified preferred solutions and indicated that the community priorities identified through earlier engagement activities were reflected in the recommendations.
8. **Assimilative Capacity of the St. Clair River:** Feedback through engagement activities indicated that protection of the St. Clair River was a priority. An assimilative capacity study of the St. Clair river was completed in order to incorporate the findings directly in this study. The results of the Assimilative Capacity study indicated that the proposed limits and objectives are consistent with the current ECA for the Courtright WWTP (No. 4042-BEUQ6N) as no significant increase in background parameter concentrations to the river resulting from plant discharge at the expanded capacity is expected. Treatment technologies identified considered the findings of the assimilative capacity by continuing to exceed the effluent objectives identified through the assimilative capacity study.

12. Implementation Plan and Mitigation Measures

12.1 Recommended Implementation Plan

Table ES 67 presents the required timing of the upgrades identified. Providing capacity for the new ICI users is the primary driver for the implementation plan. All unit processes are expected to have sufficient capacity until the new ICI users begin discharging to the Courtright WWTP.

Table ES 67. Implementation Timing for Capital Works at Courtright WWTP

Unit Process	Project	Year Required
Headworks (Screening & Grit Removal)	Screening & Grit Removal Expansion consisting of one new screenings conveyor/compactor and one new vortex grit removal system.	When the new ICI users begin discharging
Secondary Treatment	Secondary Treatment Expansion consisting of two new secondary treatment trains (extended aeration basin and secondary clarifier), one new aeration blower for peak capacity, and two new RAS/WAS pumps.	When the new ICI users begin discharging
Disinfection	UV Disinfection Expansion consisting of one new UV Channel with 22,500 m^3/d peak capacity.	When the new ICI users begin discharging
Solids Treatment	Aerobic Digestion Expansion consisting of one new aerobic digester.	When the new ICI users begin discharging
Solids Storage	Solids Storage Expansion consisting of two new solids storage tanks.	When the new ICI users begin discharging

The cost breakdown required for these projects is presented in Table ES 68 and the timeline for implementation is summarized in Table ES 69. These projects are required to be completed by the time the ICI users begin discharging. Implementation of either projected ICI user will exceed the existing uncommitted reserve capacity of the Courtright WWTP. Based on MECP guidance received on recent similar projects, the Township should not accept these applications for ICI flows nor issue any Planning Act or Condominium Act approvals for proposals that would exceed the uncommitted reserve capacity, and should consider these developments to be premature until such time as a suitable Class EA process is completed, the requisite tenders are let, and the contracts for the required municipal sanitary sewage works expansion/upgrades are awarded (MECP, Master Plan Guidance, 2023). Therefore, the earliest the ICI users could be approved would be Q1 2026 when the construction tender is expected to be awarded. The ICI flows could not be connected to the plant until the upgrades are constructed and commissioned, which is projected for Q2 2027.

In the proposed implementation schedule, conceptual design would be initiated in Q1 2025 at which time the estimated design and engineering fees and design development contingency total of $13.0M would be incurred. Tender of the construction would occur in Q1 2026 at which time the remaining estimated cost of $34.6M would be incurred.

The proposed schedule is based on the traditional project delivery method of Design-Bid-Build. Alternative delivery methods could be explored to accelerate the project schedule, such as a phased approach, design-build or integrated project delivery.

Table ES 68. Capital Costs for Courtright WWTP Expansion

Item	Cost (in million $)[a]
Headworks	$1.8
Secondary Treatment (including Extended Aeration Basins, Aeration Blower, Secondary Clarifiers, and RAS/WAS Pumping)	$14.6
Disinfection	$1.2
Solids Treatment	$2.8
Solids Storage	$5.5
Subtotal	**$25.9**
Mobilization/demobilization, bonds, insurance, and contract profit (15%)	$3.9
Contractor overhead (10%)	$2.6
Construction Contingency (5%)	$1.3
Design development contingency (30%)	$7.8
Design and Engineering Fees (20%)	$5.2
Location Adjustment Factor (4%)	$1.0
Total	**$47.6**

Notes:

a. Costs are reported with +100/-50 percent accuracy.

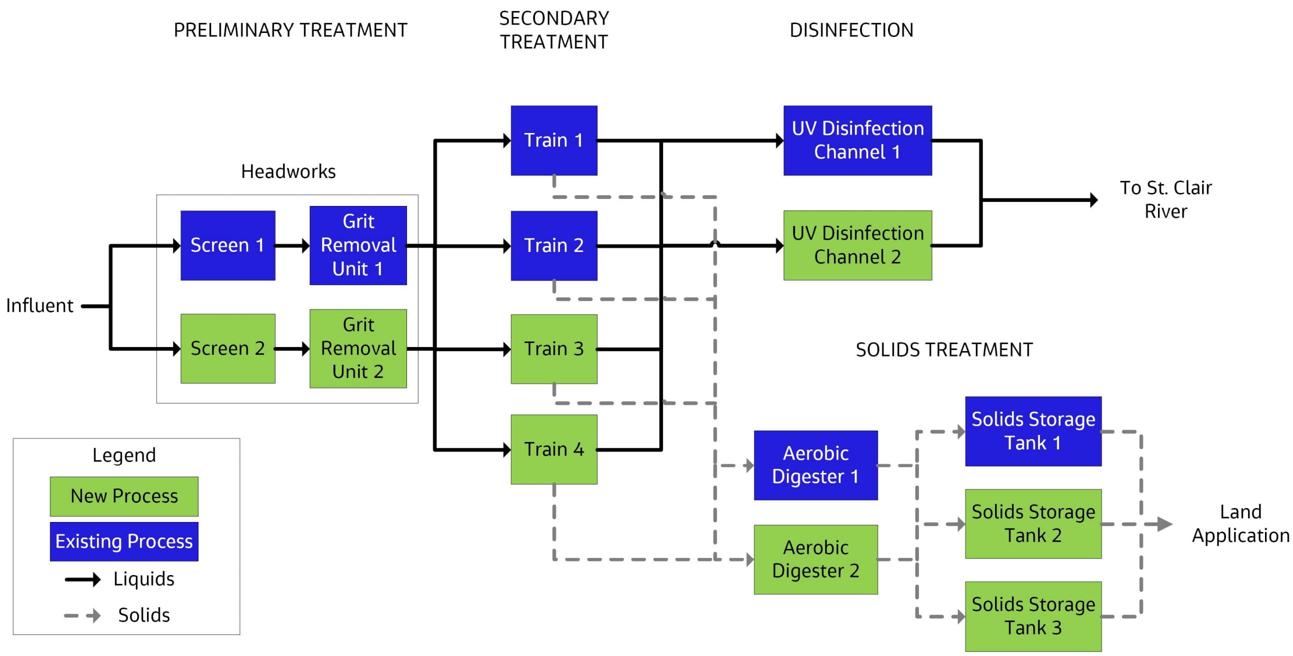
Table ES 69. Summary of Project Milestones for Courtright WWTP Expansion

Milestone	Costs Incurred	Timeline
Schedule C EA Notice of Completion	N/A	Q1 2025
Procurement for Conceptual Design, Detail Design, Services During Construction	$13.0M	Q4 2024 to Q2 2027
Conceptual Design	N/A	Q1 2025 to Q2 2025
Detail Design	N/A	Q2 2025 to Q1 2026
Construction Tender & Award	$34.6M	Q4 2025 to Q1 2026
Construction & Commissioning	N/A	Q1 2026 to Q2 2027
Warranty Period	N/A	Q3 2027 to Q3 2029

12.2 Process Flow Diagram

Figure 12-1 presents the Courtright WWTP process flow diagram after implementation of the proposed upgrades.

Figure 12-1. Future Process Flow Diagram for Wastewater Treatment and Solids Management

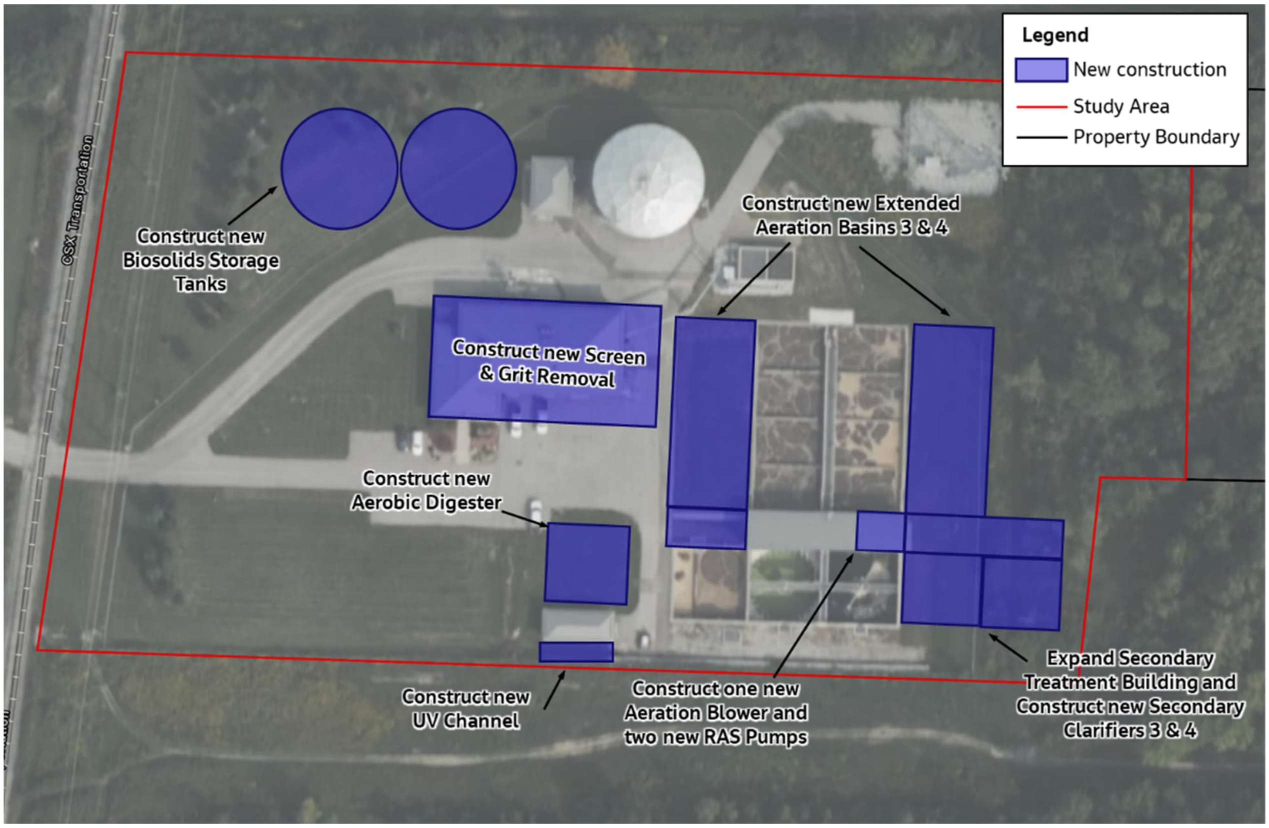


12.3 Site Plan

The site plan for the preferred alternative is presented in **Figure 12-2**.

.

Figure 12-2. Future Site Plan



12.4 Design Concept & Performance

The design basis presented in Section 9.3 was based on assumptions that are dependent and highly specific to the preliminary influent water quality and flow data provided by the Township for future ICI User 1 and 2. The influent characteristics are summarized in Table ES 70. Jacobs highly recommends confirming this design basis with the ICI users and confirming plant performance using modelling software at the outset of the design phase.

Table ES 70. Influent Characteristics for Future ICI Flows

Parameter	ICI User 1 (2,000 m^3/d ADF)[a]	ICI User 2 (5,000 m^3/d ADF)[a]	Brigden Imported Flows (300 m^3/d ADF)[b]	All Other Flows[d]
BOD_5 (mg/L)	800	1.10	300	191[e]
TKN (mg/L)	100[b]	12.58[c]	100	32
TP (mg/L)	10[b]	0.021	10	4.67
TSS (mg/L)	400	1.0	350	181
pH	5.0 to 11.0	7.1	6.0 to 9.5	6.0 to 9.5[b]
Temperature (°C)	60[b]	60[b]	60	60[b]

Note:

a. Influent characteristics based on available data from ICI user unless otherwise indicated.

b. Influent characteristics based on sewer use bylaw limits from Township By-law No. 24 of 2017 Limits for Sanitary Sewer Discharge, amended in 2023 (Township of St. Clair, 2017) (Township of St. Clair, 2023).

c. Total nitrogen reported, not TKN.

d. Influent characteristics based on historical concentrations unless otherwise indicated.

e. Design basis for BOD_5 adjusted to be consistent with the original plant design basis (TSH, 2007) which is more conservative than the historically observed average concentration of 156 mg/L.

Table ES 71 presents a summary of the new equipment and capacities that form the design concept for the preferred solution.

Table ES 71. Design Information for Preferred Solution

Parameter	Value
Headworks	N/A
Number of Duty Screens	2 (2 existing)
Type and Screen Opening	Coarse Screen, 10 mm opening
Screen Peak Capacity (each), m^3/d	26,500
Number of Duty Screen Conveyor/Compactors	2 (1 existing, 1 new)
Screen Conveyor/Compactor Peak Capacity (each), m^3/d	26,500
Number of Vortex Grit Removal Systems	2 (1 existing, 1 new)
Vortex Grit Removal Peak Capacity (each), m^3/d	26,500
Secondary Treatment	N/A
Number of Extended Aeration Basins	4 (2 existing, 2 new)
Extended Aeration Basin Dimensions (each), m	36.6 x 14.3 x 5.92 (length x width x SWD)
Extended Aeration Basin Volume (each), m^3	3,098
Number of Aeration Blowers	3 (2 existing, 1 new)
Aeration Blower Capacity (each), Nm^3/h	4,000
Number of Secondary Clarifiers	4 (2 existing, 2 new)
Secondary Clarifier Dimensions (each), m	14.3 x 14.3 x 4.6 (length x width x SWD)
Secondary Clarifier Surface Area (each), m^2	205
Number of RAS/WAS Pumps	5 (3 existing, 2 new)
RAS/WAS Pump Capacity (each), m^3/d	6,048
Disinfection	N/A
Number of UV Channels	2 (1 existing, 1 new)
Existing UV Channel Peak Capacity, m^3/d	15,000
New UV Channel Peak Capacity, m^3/d	22,500
Solids Management	N/A
Number of Biosolids Storage Tanks	3 (1 existing, 2 new)
Storage Tank Capacity (each), m^3	3,400

Implementing these capital upgrades would provide the Courtright WWTP with an ADF capacity of 15,000 m^3/d and peak day capacity of 37,500 m^3/d based on the influent characteristics presented in Section 6.3.5. The anticipated secondary treatment performance is summarized in Table ES 72 compared to design guidelines from the MECP and from Metcalf & Eddy (MECP, 2019) (Metcalf & Eddy, 2014). All parameters roughly fall within the recommended guidelines after implementing the four proposed secondary treatment trains; however, the following should be noted:

- Aeration Tanks Organic Loading Rate exceeds the MECP Design Guidelines but is within the design range proposed by Metcalf & Eddy. Additional considerations for this parameter are presented in Section 2.5.
- Secondary Clarifiers SLR exceeds the MECP Design Guidelines. The state point analysis determined that the maximum SLR was 254 kilograms per square meter per day ($kg/m^2/d$) at the historical average SVI of 80 millilitres per gram (mL/g). The proposed SLR is below the calculated maximum from Section 7.1.3.2.2. Process modelling is recommended to confirm if operating at an elevated SLR is viable. Further, the impact of the new ICI flows on sludge properties such as SVI is unknown and could impact the outcome of the state point analysis and observed clarifier performance.

Table ES 72. Future Anticipated Secondary Treatment Performance

Parameter	Value	MECP Design Guidelines (MECP, 2019)	Metcalf & Eddy Design Guidelines (Metcalf & Eddy, 2014)
Aeration Tanks Hydraulic Retention Time (HRT, h)	19.8	>15	20 to 30
Aeration Tanks Organic Loading ($kg/m^3/d$)	0.256	0.17 to 0.24	0.1 to 0.3
Aeration Tanks Food to Mass Ratio (F/M, d^{-1})	0.074	0.05 to 0.15	0.04 to 0.1
Aeration Tanks Solids Retention Time (SRT, d)	18.0	>15	20 to 40
Secondary Clarifiers Surface Overflow Rate at Peak Flow (SOR, $m^3/m^2/d$)	45.7	40	N/A
Secondary Clarifiers Solids Loading Rate at Peak Flow (SLR, $kg/m^2/d$)	221	170	N/A

12.5 Considerations for Implementation

One key parameter in determining the secondary treatment capacity needed is the organic loading rate to the aeration basins. The organic loading rate refers to the mass of organics, measured in BOD_5, that is fed to the aeration basins. Design guidelines from the MECP indicate best practice is to operate between an organic loading of 0.17 to 0.24 kg/m^3/d (MECP, 2019), and Metcalf & Eddy recommend an operating range of 0.1 to 0.3 kg/m^3/d for extended aeration (Metcalf & Eddy, 2014). If the organic loading rate is too high, one solution could be to construct additional aeration basins to spread the organic load over a larger volume. This approach is consistent with the preferred alternative of WWTP Expansion.

Figure 12-3 demonstrates the impact of the influent BOD_5 loading on the organic loading rate for two to six aeration basins. Four aeration basins are sufficient for the future design basis to operate within the design guidelines per the design basis. If the influent BOD_5 loading were to increase, it could trigger the need for a fifth or even a sixth aeration basin.

Scenarios that may result in increased influent BOD_5 loading include:

- Accepting new residential flows beyond 3,512 cubic meter per day would result in a higher concentration of BOD5 loading compared to the future design basis concentrations that includes the dilute ICI flows.
- If the composition of the planned ICI flows changes significantly. In particular, any changes to the 5,000 m^3/d dilute flow from ICI User 2 could have a significant impact on the influent loading rate.
- If new ICI users are considered in addition to or instead of the two planned future ICI users.

In general, any changes to the influent streams should be evaluated through process modelling to determine if the future design basis of four secondary treatment trains is still appropriate. As shown in Table ES 73, the projected influent quality is on the low strength end of the typical municipal wastewater influent quality range. This projected influent quality is a weighted average of the influent streams documented in Table ES 70. The projected wastewater is considered low strength largely due to the influence of the dilute flows from ICI User 2. Additional residential or other ICI flows could have a significant impact on the overall influent quality and subsequently the treatment capacity required. These additional flows would impact the ability of the plant to meet its effluent targets and objectives in the ECA. If the influent stream (waste characterization) composition changes are significant, it may trigger the need for a larger treatment capacity expansion and evaluation of other alternatives. The documentation of this process would require an amendment to this EA should this be required within the next 10 years. If significant changes occur more than 10 years after the completion of this EA, a new Schedule C Class EA will be required.

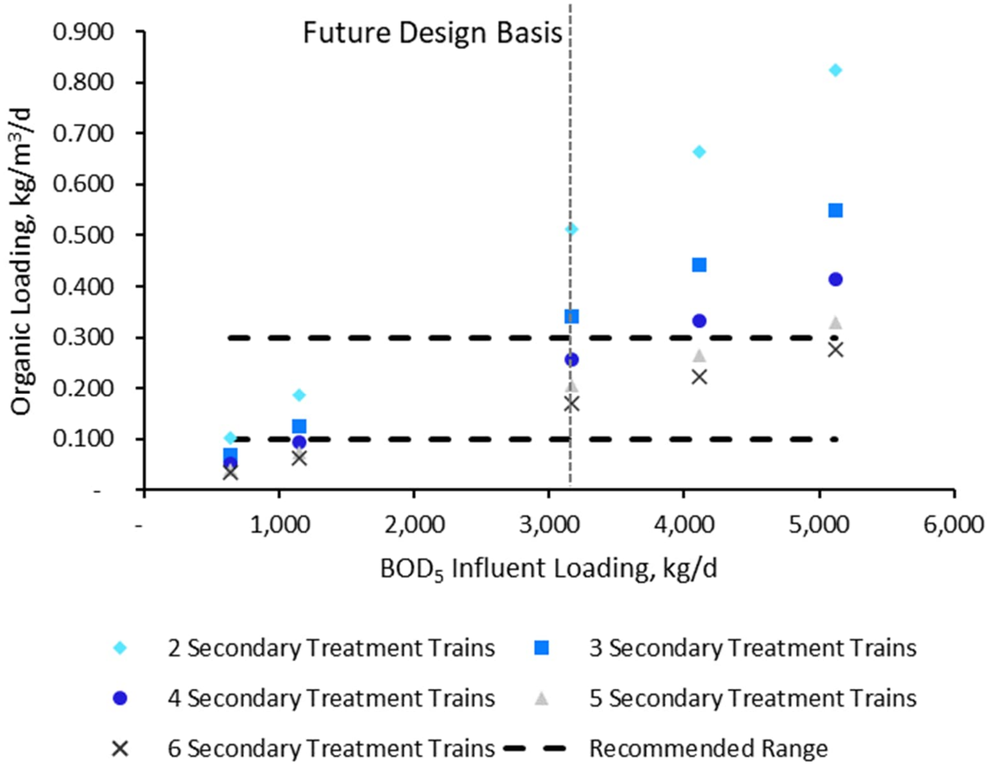


Figure 12-3. Organic Loading to Aeration Basins depending on BOD_5 Influent Loading and Number of Secondary Treatment Trains

Table ES 73. Overall Influent Wastewater Quality

Parameter	Projected Influent Quality	Typical Municipal Wastewater Influent Quality (Metcalf & Eddy, 2014)
BOD_5 (mg/L)	211.3	110 to 350
TSS (mg/L)	153.5	120 to 400
TKN (mg/L)	38.0	20 to 70
TP (mg/L)	3.94	4 to 12

12.6 Impacts and Mitigation

12.6.1 Natural Environment

Construction and operation of the preferred solution are not anticipated to interact with the physical environment. A negligible increase in air emissions is expected from construction vehicles and equipment which will be short-term in duration (i.e., the construction schedule). An increase in air emissions during ongoing operation of the Courtright WWTP is not anticipated.

Potential effects from construction and operation of the preferred solution on water quality, terrestrial habitat and wetlands may occur. To protect the natural environment during construction and long-term operation, the following future studies are recommended:

- An Environmental Impact Study (EIS), species at risk assessment, and arborist surveys (if required) will be completed in the detailed design stage, and measures will be identified and implemented to protect species at risk and associated habitat during construction activities.

- A site-specific Erosion and Sediment Control Plan will be developed by a qualified person and updated as required.

The following mitigation measures will be adopted:

- The project will be screened by the MECP for species at risk occurrences to determine setback or restricted activity periods.
- Vegetation removal, grading, and heavy equipment use will only occur within the project footprint where these areas have been previously demarcated and construction works is approved. Silt fencing will be erected, where appropriate.
- A minimum buffer of 30 metres will be provided around water, including creeks, rivers, lakes and wetlands to prevent erosion, runoff, and contamination. If this cannot be avoided and construction or disturbance areas are within 30 metres of water, reptile exclusion fencing, and tree protection fencing will be used if applicable to prevent damage to the tree and root compaction.
- Construction activities are not expected to occur in the waterways. Any potential work in the waterways will occur only during the in-water working windows stipulated by the St. Clair Region Conservation Authority and must be approved by DFO.
- Stockpiled material will be covered to prevent erosion and potential sedimentation into natural features. Staging access areas are planned to be located primarily within existing open and disturbed areas.
- Access and movement of vehicles and equipment will be controlled to limit the introduction and spread of invasive species. Vehicles and equipment will be inspected prior to entering and leaving the construction site to verify the equipment is clean and free of invasive species. Equipment will be inspected and used only if in good working order by the contractor.
- A designated and lined refuelling area with appropriate spill containment will be established a minimum of 30 m from any watercourse. A spill response team member (from the contractor's team) will be appointed as a point of contact in the case of an accident or spill to verify the proper and timely implementation of site response controls as required.
- Absorbent materials and equipment required to control and clean up spills of deleterious substances will be available onsite. Spills and leaks of deleterious substances will be immediately contained and cleaned up in accordance with regulatory requirements and reported immediately to the Ontario Spills Action Centre (SAC) at 1.800.268.6060, as well as the necessary site contacts (i.e., Township project manager).
- If possible, tree and shrub removal, and vegetation clearing will be avoided from early April to late August, conforming to the general nesting period at the site, corresponding to the Migratory Birds Convention Act (MBCA) (Government of Canada, 2023).
- Any trees removed will be replaced at a ratio of 2:1. The replacement of trees will mitigate impacts to carbon sinks from project implementation.

A desktop Assimilative Capacity study was conducted by Jacobs and reviewed by the MECP in January 2023 to identify effluent limits and objectives for the new effluent flows and loadings. It was determined that the St. Clair River had sufficient assimilative capacity to accept effluent loadings at 15,000 m^3/d capacity at the effluent limits and objectives in Table ES 74. Therefore, no long-term impacts to the St. Clair River water quality are anticipated as a result of the proposed upgrades in this EA. Any expansion beyond 15,000 m^3/d would require another Assimilative Capacity Assessment to confirm and update the effluent targets and objectives.

Table ES 74. Effluent Limits and Objectives

Effluent Parameter	Averaging Calculator	Future Limit	Future Objective
$cBOD_5$	Monthly Average	25.0 mg/L	15.0 mg/L
TSS	Monthly Average	25.0 mg/L	15.0 mg/L
TP	Monthly Average	0.94 mg/L	0.50 mg/L
TAN	Monthly Average	8.0 mg/L	3.0 mg/L
E. coli	Monthly Geometric Mean Density	200 colony forming units (CFU)/100 millilitres (mL)	150 CFU/100 mL
pH	Single Sample Result	6.0 to 9.5	6.5 to 8.5

12.6.2 Social, Cultural, and Economic Environment

Potential effects from construction and operation of the preferred solution on the social, cultural, and economic environment are generally expected to be negligible and short-term in duration.

The MECP provides guidelines on buffer zones between sensitive land uses and sewage plant to avoid impacts due to noise and odour. For a facility the size of Courtright WWTP, a minimum separation distance of 100 metres and recommended distance of 150 metres is specified (MECP, 2021). The MECP recommends that this buffer zone be owned by the municipality. The Courtright WWTP is surrounding by forest to the south and east, and agricultural lands to the north. Residential properties are located along the St. Clair River to the west of the plant. These properties meet the minimum separation distance of 100-m but are within 150-m of the Courtright WWTP.

A Stage 1 Archaeological Assessment was conducted by ARA in January 2022. The Stage 1 assessment findings are as follows:

- The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. It is recommended that the identified areas of archaeological potential be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 Standards and Guidelines for Consultant Archaeologists (S&Gs).
- The Grassed, overgrown and treed areas must be assessed using the test pit survey method. A survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that some of the areas along the laneway and the existing structures were previously impacted, a combination of visual inspection and test pit survey should be utilized to confirm the extent of disturbance in accordance with Section 2.1.8 of the 2011 S&Cs. This will allow for the empirical evaluation of the integrity of the soils and the depth of any impacts.
- Each test pit must be excavated into at least the first 5 cm of subsoil, and the resultant pits must be examined for stratigraphy, potential features and/or evidence of fill. The soil from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If archaeological materials are encountered, all positive test pits must be documented, and intensification may be required.
- The identified areas of no archaeological potential do not require any additional assessment. Given that there are still outstanding archaeological concerns within the study area, no ground alterations or development may occur until the required investigation is complete, a recommendation that the lands require no further archaeological assessment is made and the associated report is entered into the Ontario Public Register of Archaeological Reports.

A Stage 2 Archaeological Assessment was conducted by ARA in December 2023 with an expanded scope to include the undeveloped woodlands adjacent to the developed site. The woodlands are located within the Township owned property. The scope was expanded to account for additional footprint for the new secondary treatment trains. The Stage 2 assessment involved a property inspection where a test pit survey was conducted at intervals of 5 metres. The findings of the Stage 2 assessment are summarized as follows:

- The Stage 2 assessment of the project limits did not result in the identification of any archaeological materials. It is recommended that no further assessment be required within the project limits. The areas of archaeological potential outside of the study area will not be impacted and do not require further work at this time. These areas may require Stage 2 assessment if development is contemplated in the future.
- If impacts become necessary outside of the study area, these lands must be assessed using the test pit survey method. A survey interval of 5 m is warranted due to the proximity of the lands to the identified features of archaeological potential. Each test pit must be excavated into at least the first 5 cm of subsoil, and the resultant pits must be examined for stratigraphy, cultural features and/or evidence of fill. The soils from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If archaeological materials are encountered, all positive test pits must be documented, and intensification may be required.

ARA provided the following information regarding Section 7.5.9 of the 2011 S&Gs for the benefit of the proponent and approval authority in the land use planning and development process:

- The report is submitted to the Minister of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MCM, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the Ontario Heritage Act.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act.
- The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar at the Ministry of Public and Business Service Delivery.

The following measures will be taken to mitigate potential impacts to the community due to the recommendations, both during and following construction at both sites:

- **Community Health and Safety:** Development and construction activities may increase the type and volume of traffic on surrounding roadways (e.g., construction vehicles and equipment) or introduce additional hazards to the environment (e.g., material spill). Vehicles and equipment used during construction will follow traffic laws and multi-passenger vehicles will be used, when possible, to reduce traffic associated with construction activities.
- **Noise:** Construction noise will be temporary and short-term in nature. Construction activities will generally be carried out during the day where traffic and human activity are occurring. A negligible increase in noise at the existing Courtright WWTP due to operations is expected. The technologies that were selected are consistent with the existing Courtright WWTP and are not expected to result in off-site noise impacts on the surrounding community. Increased aeration demand for the future loadings is anticipated however the new aeration blower will be designed with appropriate noise mitigation measures to prevent impacts off the plant site.
- **Odour:** Odour is not expected to increase substantially during construction. Existing odour control and treatment facilities will continue to operate following construction. New odour sources for the proposed expansion include additional screening/grit removal, two new secondary treatment trains, additional biosolids storage tank vents, and additional biosolids volume requiring truck haulage. The inlet channel in the screen room is currently a major odour source. Increased flows and loadings to the plant may increase the odour potential. There is also more significant odour potential due to increased truck loading and haulage, as well as from the storage tank vents as a larger volume of biosolids will be stored on site. The aeration tanks are a minor odour source. Additional odour mitigation measures may be required and should be evaluated at the detailed design stage (e.g., expanding the existing biofilter process, additional tank covers, or liquid odour control).
- **Infrastructure and Services:**
  - Traffic: During construction, a small increase in traffic to and from the project site is anticipated to transport crews and equipment. No impact on traffic is expected during operations.
  - Utilities: Additional utilities may be needed to support the operation of the preferred solution. In the event existing utilities are disrupted during construction activities, it is expected that this will be short-term in duration. Utility locates, consisting of subsurface utility engineering (SUE) during design and Ontario One-Call locates prior to construction, will be done to reduce the potential for service disruptions.
  - Services: All waste materials from operation of the plant will be disposed of off-site in accordance with applicable legislation and guidelines. Construction and operation of the preferred solution is not anticipated to increase demand on local or regional services (e.g., emergency or health care services).
- **Viewshed:** Permanent infrastructure changes may present a negligible change to the existing viewshed considering these changes will be made within the Courtright WWTP site.
- **Cultural Heritage:** The following general recommendations and mitigations measures are identified to protect cultural heritage resources:
  - Should previously undocumented archaeological resources be discovered, they are subject to Section 48(1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the Ontario Heritage Act.

  - o The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11 the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the Ontario Heritage Act.

- **Climate Change:** The following general recommendations and mitigations measures are identified for energy efficiency and chemical consumption during the design and construction phases of the project:
  - o All upgrades to consider the most energy efficient blowers and chemical dosing and usage
  - o Efficient construction practices, including opportunities for using both recycled and carbon efficient materials will be considered during the design phase
  - o Ensure stricter year-round effluent water quality limits are maintained to reflect climate change adaptation and address resiliency concerns

Before a development project can proceed, an archaeological assessment of all lands that are part of the project is required where land has a known archaeological site or the potential to have archaeological sites (Ministry of Heritage, Sport, Tourism and Culture Industries, 2022).

Construction within a previously disturbed site reduces the potential to uncover archaeological resources during construction. However, ground disturbance (e.g., soil handling, grading) may uncover previously unidentified artifacts. Disturbing these resources in a controlled, scientific excavation is considered an acceptable, and in some cases, the only method to collect in situ information to add t the historic record. The removal of these resources is offset by the recovery of knowledge about the site when catalogued and preserved in compliance with provincial guidelines. In the event an artifact is encountered during construction, work should be suspended, and the Ministry of Citizenship and Multiculturalism should be contacted. Construction and City personnel are not permitted to collect or disturb artifacts in accordance with the Ontario Heritage Act R.S.O. 1990 c 0.18.

12.6.3 Investigative Studies

The following investigative studies will be required prior to construction to provide information regarding the impacts and mitigation measures discussed in the previous sections:

- Geotechnical: to investigate soil and geologic conditions and identify potential impacts and mitigation measures.
- Hydrogeology: to identify mitigation measures to protect groundwater resources during excavation and trenching operations.
- Subsurface Utility Engineering: to confirm underground utilities on selected areas where excavation is anticipated for new structures or pipes.
- Topographical Survey: to locate aboveground features of the property (e.g., catch basins, manholes, light poles, gas valves, fire hydrants, trees, curbs, ditches, sidewalks, culverts, buildings, landscape features, etc.) and confirm site elevations.

- Excess Soils Management: to develop a plan for re-use or disposal of excess and excavated soil according to Ontario Regulation 406/19 On-site and Excess Soil Management. In general, the following is required by O. Reg. 406/19: filing of a notice in the Excess Soil Registry for the project; retention of a qualified person to complete an assessment of past uses (APU), develop a sampling and analysis plan, complete a soil characterization report (if necessary), and complete an excess soil destination assessment report; and implementation of a tracking system (MECP, 2024).

12.6.4 Climate Change Considerations

Climate change is an increasingly salient issue, the effects of which warrant special consideration in the design of upgrades at the Courtright WWTP. Climate change considerations were incorporated in the evaluation of alternatives and will be further considered during implementation of the project by evaluating energy efficiency and chemical consumption for blowers and other infrastructure, assessing various efficient construction practices and opportunities to use recyclable and/or carbon-efficient materials, as well as the new proposed effluent objectives and target for the WWTP expansion that will help to reduce nutrient discharges from the plant and help to address climate resiliency concerns.

13. References

AECOM. (2008). *Courtright Water Pollution Control Plant Expansion Assimilative Capacity Study.* TSH doing business as AECOM.

AECOM. (2012). *The Township of St. Clair Operations Manual.*

AECOM, Matrix Solutions Inc., Gauley Associates. (2021). *Final Draft Water Supply Master Plan Update.* City of Guelph.

AMEC Environment & Infrastructure. (2012). *City of Guelph Stormwater Management Master Plan.*

AquaTech. (2009). *Reclaimed Wastewater Reuse in the City of Guelph: A Feasibility and Implementation Study.*

Bird Studies Canada. (2009). *Ontario Breeding Bird Atlas*. Retrieved from https://www.birdsontario.org/atlas/index.jsp

Bird Studies Canada. (2009). *Ontario Breeding Bird Atlas*. Retrieved from https://naturecounts.ca/nc/onatlas/findsquare.jsp

Black and Veatch. (2020). *Guelph Water Reclamation Feasibility Study Report.*

C3 Water. (2019). *Water Reuse and Demand Substitution Technologies.*

California Academy of Sciences and the National Geographic Society. (2022). *iNaturalist*. Retrieved from https://www.inaturalist.org/

CH2M HILL Canada Limited. (2020). *Township of St. Clair Ten Year Wastewater Capital Plan.* Township of St. Clair: CH2M HILL Canada Limited.

City of Guelph. (2018). *Community Energy Initiative*. Retrieved from https://guelph.ca/plans-and-strategies/community-energy-initiative/

City of Guelph. (2019). *City's Strategic Plan.* Guelph, Ontario: City of Guelph. Retrieved from https://guelph.ca/wp-content/uploads/StrategicPlan_2019.pdf

City of Guelph. (2020). *Guiding Principles for Community Engagement.* Retrieved February 2022, from https://guelph.ca/city-hall/communicate/community-engagement/

City of Guelph. (2021). *Envision Guelph, The City of Guelph Master Plan.* Guelph, Ontario: Planning Services, City of Guelph. Retrieved from https://guelph.ca/wp-content/uploads/Official-Plan-Consolidation-June-2021.pdf

City of Guelph. (2021, October). *Guelph's Water Supply*. Retrieved from City of Guelph: https://guelph.ca/living/environment/water/groundwater/

City of Guelph. (2021). *Sewer Use Bylaw Update*. Retrieved from https://guelph.ca/city-hall/by-laws-and-policies-2/draft-by-laws/sewer-use-bylaw-update/

City of Guelph. (2022, March 1). *Guelph's Growth Management Strategy*. Retrieved from City of Guelph: https://guelph.ca/plans-and-strategies/guelphs-growth-management-strategy/

City of Guelph. (2022). *Zoning Bylaw Map*. Retrieved from City of Guelph: https://www.arcgis.com/apps/webappviewer/index.html?id=ae5e0f8e8209463eb5766e09640493ec

DenHoed, J., & Robertson, T. (2003). *City of Guelph Wastewater Treatment Historical Perspective.* City of Guelph: City of Guelph.

Environment and Climate Change Canada. (2021). *Canadian Climate Normals 1981-2010 Station Data*. Retrieved from Waterloo Wellington A, Ontario.: https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=ON&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=4832&dispBack=0

Fisheries and Oceans Canada. (2022, March). *Aquatic Species at Risk Map*. Retrieved from Fisheries and Oceans Canada: http://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

GENIVAR. (2011). *York Trunk Sewer and Paisley-Clyde Feedermain Municipal Class EA.*

GM BluePlan. (2019). *Wastewater Facilities Inventory and Condition Assessment.*

GM BluePlan. (2019). *Wastewater Facilities Inventory and Condition Assessment Technical Memorandum #1 - Condition Assessment, Capital Program Development and Framework.*

Government of Canada. (2018, October). *General Nesting Periods of migratory Birds*. Retrieved March 2022, from https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html#_01_2

Government of Canada. (2023, May 30). *Overview of Nesting Periods*. Retrieved from Government of Canada: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/overview.html

Government of Canada DFO. (2022). *Aquatic species at risk map*. Retrieved from https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Grand River Conservation Authority. (2003). *Wetlands Policy.*

Grand River Conservation Authority. (2022, March). *Fishing Rivers and Streams*. Retrieved from Grand River Conservation Authority: https://www.grandriver.ca/en/outdoor-recreation/Fishing-rivers-and-streams.aspx

Grand River Conservation Authority. (2022, March). *Flooding*. Retrieved from Grand River Conservation Authority: https://www.grandriver.ca/en/our-watershed/Flooding.aspx

GRCA. (2022). *GRCA Web Map.* Retrieved from Map Your Property.: https://www.grandriver.ca/en/Planning-Development/Map-Your-Property.aspx

GRCA. (2022, March 16). *Map Your Property*. Retrieved from Grand River Conservation Authority: https://www.grandriver.ca/en/Planning-Development/Map-Your-Property.aspx

Hook Line and Sinker. (2022, March). *The Spped and Eramosa Rivers*. Retrieved from Hook Line and Sinker Fishing Tackle: http://hooklineandsinker.ca/the-speed-eramosa-rivers/

Housing, M. o. (2020). *A Place to Grow: Growth Plan for the Greater Golden Horseshoe.* Queen's Printer for Ontario.

Hutchinson Environmental Sciences Ltd. (2022). *Assimilative Capacity Study for the Speed River Downstream of the Guelph WWTP.*

iNaturalist. (2022). *Ontario, CA*. Retrieved from iNaturalist: https://www.inaturalist.org/places/ontario-ca

L.J. Chapman and D.F. Putnam. (1984). *Physiography of Southern Ontario.*

Lake Erie Source Protection Region Technical Team. (2008). *Grand River Watershed Characterization Report.* Government of Ontario.

Lambton County Planning & Development Department. (2005, amended 2013). *Township of St. Clair Official Plan.*

MECP. (2014). *ECA No. 8835-9QJKSD.*

MECP. (2019). *Design Guidelines for Sewage Works.* Retrieved from Government of Ontario: https://www.ontario.ca/document/design-guidelines-sewage-works-0

MECP. (2021). *D-2 Compatibility between Sewage Treatment and Sensitive Land Use.* Ontario Water Resources Act, Sections 10(1d) and 53.

MECP. (2021, July 15). *Ontario compost Quality Standards*. Retrieved from https://www.ontario.ca/page/ontario-compost-quality-standards

MECP. (2023, December). Master Plan Guidance. (Jacobs, Interviewer) (Private Communication).

MECP. (2024, May 6). *Excess soil management and reuse requirements for project areas*. Retrieved from Government of Onario: https://www.ontario.ca/document/excess-soil-fact-sheets/excess-soil-management-and-reuse-requirements-project-areas

Metcalf & Eddy. (2013). *Wastewater Engineering: Treatment and Resource Recovery.* McGraw-Hill Education.

Metcalf & Eddy. (2014). *Wastewater Engineering - Treatement and Resource Recovery.*

Metcalf & Eddy. (2014). *Wastewater Engineering Treatment and Reuse, 5th Edition.* McGraw Hill.

Ministry of Environment, Conservation and Parks. (2022). Source Protection Information Atlas Interactive Map. Retrieved from https://www.lioapplications.lrc.gov.on.ca/SourceWaterProtection/index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-CA

Ministry of Heritage, Sport, Tourism and Culture Industries. (2022, March). *Archaeological assessments*. Retrieved from Government of Ontario: https://www.ontario.ca/page/archaeological-assessments

Ministry of Heritage, Sport, Tourism and Culture Industries. (2022, March 07). *Archaeological Assessments*. Retrieved from Government of Ontario: https://www.ontario.ca/page/archaeological-assessments

Ministry of Municipal Affairs and Housing. (2017). *Greenbelt Plan.* Ottawa: Queen's Printer for Ontario. Retrieved from https://files.ontario.ca/greenbelt-plan-2017-en.pdf

Ministry of Municipal Affairs and Housing. (2020). *A Place to Grow: Growth Plan for the Greater Golden Horseshoe.* Ottawa: Queen's Printer for Ontario. Retrieved from https://files.ontario.ca/mmah-place-to-grow-office-consolidation-en-2020-08-28.pdf

Ministry of Natural Resources. (2009). *The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions.* Inventory, Monitoring and Assessment.

Ministry of Natural Resources and Forestry. (2022, March). *Make a Map: Natural Heritage Areas*. Retrieved from Ministry of Natural Resources and Forestry: http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

Ministry of Tourism and Culture. (2022). Criteria for Evaluating Archaeological Potential. Toronto, Ontario: Programs and Services Branch.

Ministry of Tourism, Culture and Sport. (2016). *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes.*

Ministry of Tourism, Culture and Sport. (2022). Criteria for Evaluating Marine Archaeological Potential. *A Checklist for Non-Marine Archaeologists*. toronto, Ontario: Programs and Services Branch.

MNDMNRFF. (2022). *Make a Map: Natural Heritage Areas*. Retrieved from Ministry of Natural Resources and Forestry: https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA

Municipal Class Environmental Assessment (MCEA). (2015). Retrieved from https://municipalclassea.ca/manual/page1.html

Municipal Engineers Association. (2000). *Municipal Class Environmental Assessment.* Mississauga: MEA.

NWWBI. (2013). *National Water and Wastewater Benchmarking Initiative.*

Ontario Government. (2002). *Nutrient Management Act - O. Reg 267/03.*

Province of Ontario. (2020). *Provincial Policy Statement, 2020.*

SCRCA. (2022). *SCRCA Regulated Areas*. Retrieved from https://maps2.camaps.ca/GVH/index.html?viewer=SCRCA_Public.SCRCA

St. Clair Township. (April 2023). *Courtright WWTP Capacity Assessment Info.*

(2022). *Stage 1 Archaeological Assessment Guelph WRRC.* Archaeological Research Associates Ltd.

Statistics Canada. (2021). *Census Profile, 2021 Census of Population*. Retrieved from Statistics Canada: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?LANG=E&GENDERlist=1&STATISTIClist=1,4&DGUIDlist=2021A00053538003,2021A000235&HEADERlist=0&SearchText=ontario

Statistics Canada. (2022, February). *Census of Population.* Retrieved from Census Profile, 2021.: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

Thames - Sydenham & Region Drinking Water Source Protection. (2010). *St. Clair Region Assessment Report.* St. Clair Conservation; Upper Thames River Conservation Authority; Lower Thames Conservation.

Thames - Sydenham & Region Drinking Water Source Protection. (2011). *Municipal Drinking Water System Summary - Lambton Area Water Supply System.* St. Clair Conservation; Upper Thames River Conservation Authority; Lower Thames Conservation.

Township of St. Clair. (2017). *By-Law No. 24 of 2017. A By-law to regulate the discharge of sewage and storm water in St. Clair Township.* Township of St. Clair.

Township of St. Clair. (2023). *By-Law No. 20 of 2023. A By-Law to Amend By-Law No. 24 of 2017 to adjust the permitted pH Levels of sanitary sewage entering the Township sewer system.* Township of St. Clair.

TSH. (2007). *Corunna and Courtright Wastewater Treatment Plants Class Environmental Assessment - Environmental Study Report.* Township of St. Clair.

TSH. (2008). *St. Clair Township Wastewater System Preliminary Design Report.*

Water Environment Federation. (2012). Aerobic Digestion. In *Solids Process Design and Management* (pp. 413-417). McGraw Hill.

Zammit, A. a. (2019, September). Spatial Relationship Between Key Natural Heritage and Hydrological Features within the Grand River Watershed. Ontario: Grand River Conservation Authority.

Appendix A
Technical Information

Appendix A-1
Technical Memorandum 1

Appendix A-2
Technical Memorandum 2

Appendix A-3
Technical Memorandum 3

Appendix A-4
Cultural Heritage & Archaeology

Appendix A-5
Assimilative Capacity Study

Appendix A-6
Natural Environment Study

Appendix B
Community and First Nations Engagement

Appendix C
Detailed Evaluation Framework and Scoring

Appendix D
Cost Breakdown