

Water Environment Association of Ontario

Young Professionals Committee and Student Design Competition Sub-Committee

and the

Ontario Ministry of Environment, Conservation, and Parks

in Collaboration with

City of London

WEAO STUDENT DESIGN COMPETITION 2027

PROBLEM STATEMENT

Treatment Train Restoration and Intensification, Section 1 at Greenway
Wastewater Treatment Plant

September 2026

WEAO Student Design Competition 2027

Treatment Train Restoration and Intensification, Section 1 at Greenway Wastewater Treatment Plant

1.0 INTRODUCTION

The topic of the 2026-27 Water Environment Association of Ontario (WEAO) Student Design Competition is wastewater infrastructure expansion and process intensification at the Greenway Wastewater Treatment Plant (WWTP) in London, Ontario.

Greenway WWTP treats municipal wastewater from residential, commercial, and industrial sources. It consists of three treatment trains, termed Section 1, 2 and 3. Greenway WWTP has a current ECA rated capacity of 170,000 m³/d. Sections 1, 2 and 3 have current rated capacities of 30,000 m³/d, 40,000 m³/d and 100,000 m³/d, respectively. A high-level study, completed in 2019, looked at future expansion options at Greenway WWTP driven by growth expectations and projected asset life. Since then, Section 1 has been removed from service and will not be re-started in its current form.

The City would like to begin construction of a new Section 1 as early as 2027/2028. Due to budgetary constraints, it is envisioned that the construction of the replacement for Section 1 will be completed in phases, allowing the City to regain current Section 1 ECA rated capacity in the short term with the first phase, and the second phase will offset Section 2 capacity when the decision to decommission Section 2 is made in 10-15 years.

2.0 BACKGROUND – CITY OF LONDON AND GREENWAY WASTEWATER TREATMENT CENTRE

The Greenway WWTP is owned and operated by the City of London in accordance with the terms and conditions of the Environmental Compliance Approval (ECA) 8252-CZMH6E, issued April 3, 2024. See appendices for more details.

Greenway WWTP is located near the center of London, at 109 Greenside Avenue. It receives and treats about 60% of all wastewater generated in the City and discharges treated effluent to the main branch of the Thames River. It is a regulated Class IV wastewater treatment facility.

The major processes that are used to treat wastewater at Greenway WWTP include:

- Influent Screens (6 mm mechanically raked bar screens)
- Grit Removal (vortex)
- Primary Clarification (rectangular chain and flight)
- Aeration/Bioreactors (conventional fine-bubble diffusers)

- Final (Secondary) Clarification (combination of circular and rectangular chain and flight)
- Waste Activated Sludge Thickening (rotary drum thickeners)
- Seasonal UV disinfection

The Greenway facility treats their own wastewater biosolids on-site. They also receive and treat biosolids for final disposal from the City's four other satellite plants. Biosolids treatment at Greenway includes the following processes:

- Waste Activated Sludge Thickening (Greenway WAS only)
- Thickened WAS Storage (above-grade glass-fused steel tanks)
- Sludge Dewatering (centrifuge)
- Incineration (fluidized bed incinerator)
- Incinerator Ash Slurry Dewatering (Geotube)
- Bioset Lime Stabilization (fertilizer production) - only during periods of incinerator shut-down

2.1 BACKGROUND – TREATMENT SECTION 1

Section 1 treatment processes include the following, designed originally to treat 30 million litres daily (MLD) average flow:

- Two (2) Rectangular Primary Clarifiers @ 33.5 x 9.1 x 3 m deep
- Four (4) Aeration Tanks of varying sizes as follows:
 - 28.8 x 18.6 x 3 m deep
 - 32.3 x 15.2 x 3 m deep
 - 27.9 x 18.8 x 3 m deep
 - 36.6 x 29.9 x 3 m deep
- Two (2) Circular Final Clarifiers @ 30.5 and 29 m diameter, both 3.35 m deep.
- Screening, grit removal (upstream), and UV disinfection (downstream) are all common elements sized for the entire plant flow

The 2019 study noted that the age of concrete in Section 1 for primary clarification, aeration and final clarification all pre-date 1950; therefore, all tankage is considered to be either at end-of-life or nearing end-of-life. Section 2 at Greenway is also anticipated to reach the end of its life by 2040. This investigation concluded that, with the use of more intensive process technologies, the area currently occupied by Section 1 tankage could support as much as 80,000 to 100,000 m³/d of treatment capacity, but the potential for ECA amendments and effluent criteria modifications associated with a plant capacity expansion must also be considered.

Section 1 was taken offline in 2022 as a result of a mechanical failure and is currently being used for wet weather storage to attenuate peak flows at the facility. As such, the

plant has a current functional secondary treatment capacity of 140,000 m³/d total and is rapidly approaching this capacity.

In addition, Section 2 at Greenway is approaching the end of its expected service life, so plans must be made for its restoration or decommissioning. One proposed strategy is to intensify Section 1 to offset both the 30,000 m³/d (30 MLD) of capacity in Section 1 plus the 40,000 m³/d (40 MLD) capacity in Section 2. Growth would then need to be accommodated through separate or combined upgrades in Sections 1 and 3.

The primary goal of this project is to restore the lost Section 1 treatment capacity as soon as possible.

2.2 BACKGROUND – CHALLENGES

The Greenway site contains multiple abandoned infrastructure features that are noted on the drawing package included in the appendices. These should be reviewed and considered when designing Section 1 features.

The expectation of the Section 1 restoration is that most, if not all, existing concrete tankage in the available area is to be removed. The Section 1 area will be excavated to an elevation below the existing grade, meaning greenfield design of new infrastructure is possible. Cost estimation for demolition and removals for many aspects of Section 1 is challenging to quantify, as it includes all existing tankage (some of which abut structures that will need to be maintained and have been noted in the appendices), buried and otherwise hidden infrastructure, and research facility piping infrastructure that either needs to be maintained or re-routed as part of construction.

The need to sequence construction and tie into existing flow paths without interrupting plant operation also remains a challenge typical of any construction project at an operating wastewater treatment plant.

3.0 OBJECTIVES

The City is seeking solutions that fully address the following issues:

Phase 1:

- Immediately restore 30 MLD of secondary treatment capacity within the footprint of the abandoned Section 1.
- Ensure that permanent infrastructure constructed in Section 1 also allows for future expansion/intensification to a minimum of 70 MLD in a future phase.

Phase 2:

- Develop conceptual designs to demonstrate the feasibility of potential future Section 1 expansions to 70 MLD processing capacity.

4.0 DESIGN CRITERIA

Section 1 Capacity:

As described previously, the current rated capacity of Section 1 is 30 MLD. In order to avoid the need for additional assimilative capacity studies or an Class Environmental Assessment in the short term, this represents the target capacity rating of the restored Section 1 as well.

Section 1 Effluent Water Quality:

The current ECA Effluent Objectives and Limits for Greenway are included in the table below:

Parameter	Effluent Objective	Effluent Limit
cBOD ₅	7.5 mg/L	9.0 mg/L
Total Suspended Solids	7.5 mg/L	9.0 mg/L
Total Phosphorus	0.4 mg/L	0.58 mg/L
Unionized Ammonia	0.08 mg/L	0.1 mg/L
Dissolved Oxygen	5.0 mg/L ¹ 6.0 mg/L ²	4.0 mg/L ¹ 5.0 mg/L ²
<i>E. coli</i>	150 Organisms/100 mL ³	200 Organisms/100 mL ³
pH	6.5 to 9.0	6.0 to 9.5

Notes:

1. Apr 1 to Nov 30
2. Dec 1 to Mar 31
3. Apr 1 to Sep 30

Section 1 Site Plan:

Proposed designs must take into consideration the limitations of the footprint for the existing Section 1 at the Greenway facility.

5.0 SCOPE OF WORK

Design teams should prepare the following elements for this assignment:

Phase 1:

- Immediately restore 30 MLD of secondary treatment capacity within the footprint of the abandoned Section 1.
- The design shall assume that the existing primary clarifiers are suitable for re-use. Possible limitations of the primary clarifier process given the current design guidelines should be identified or preliminarily assessed in the design.

- The existing aeration tanks and final (secondary) clarifiers must be removed and replaced. The design will include a new Section 1 secondary treatment train that efficiently and effectively provides 30 MLD capacity. This restoration of Section 1 will also provide flexibility to accommodate future technological innovations and process intensifications recommended in Phase 2 to maximize treatment capacity.
- The City has an available budget of \$80M for Phase 1, including engineering design costs. Due to cost limitations, a phased approach is proposed whereby the restoration of Section 1 should be considered, to the highest degree practicable, 'future proofing' any permanent infrastructure installed in Phase 1 to allow for future intensification recommended in Phase 2.
- The proposal should include
 - A statement of the general goals of the project and what students were able to achieve
 - Detailed evaluation of the current footprint area and process stream connections to optimize layout and demonstrate feasibility
 - Sizing assessment for aeration and clarification steps
 - Outline of proposed construction sequence and projected schedule
 - Preliminary capital cost estimate

Phase 2:

- Develop conceptual designs of at least two possible future-state treatment trains demonstrating the proposed implementation plan and effective utilization of the permanent infrastructure constructed in Phase 1.
- The target for capacity expansion in the Section 1 will increase from the existing 30 MLD provided in the Phase 1 restoration to a minimum treatment capacity of 70 MLD. The treatment capacity increase is equivalent to current capacity in Section 2 (40 MLD), which will allow Section 2 to go completely offline for restoration work in the future and still accommodate the total capacity at Greenway (170 MLD).
- There are no cost constraints for Phase 2 designs, and there is a benefit to achieving even higher treatment capacities than 70 MLD in Phase 2, since this can provide growth servicing

The proposal should include an analysis of historical data of secondary treatment performance and the recommended method for improving treatment capacity in Section 1. The engineering feasibility of implementing the selected method to intensify capacity in the treatment train should also be considered.

Designers are expected to refer to the following documents to ensure compliant designs:

- Environmental Compliance Approval for Greenway WWTP
- Sewage Works Design Guidelines (Ontario Ministry of the Environment, Conservation and Parks)

6.0 DESIGN REPORT REQUIREMENTS

Please refer to the WEAO SDC Guidelines for the acceptable report format.

The design report should address the following points:

Background

- Description of the site
- Identification of challenges of the existing Section 1 design with regard to secondary treatment capacity and performance
- Identification of anticipated future population growth and wastewater demands in terms of flow, concentrations, and treatment capacity

Phase 1

- Section 1 restored process flow diagram drawing
- Hydraulic profile of the proposed Section 1
- Sizing of major treatment processes, including existing processes to be re-used
- Sizing of major process equipment, including projected power consumption
- A series of drawings laying out the proposed construction sequence, including access/haul routes and the maintenance access of all plant operation (including the City's sludge haulers and chemical deliveries)
- Drawing of proposed tankage, including details all pipe and duct routing
- Preliminary capital cost estimate
- Construction schedule and phasing outline, including preliminary schedule, removals drawings, and proposed site plan drawings
- Summary of anticipated impact on operations costs, specifically chemical and electricity consumption

Phase 2

- Conceptual design of the process or processes for intensifying treatment capacity in the restored Section 1 train, including site plan drawings
- Hydraulic profile of Phase 2
- Expected intensification in secondary treatment performance for lower total phosphorus, considering that the Thames River is currently classified as a Policy

2 receiver for phosphorus. The potential for de-nitrification in future phases should also be considered, noting that it is not currently a requirement of Greenway's ECA.

- Viability of process intensification method for capacity expansion in Section 1
- Constructability analysis of Phase 2 intensification, focusing on maintaining more than half of treatment capacity available at all times and identifying design features of Phase 1 that contribute to this goal

There is no limit to the number of appendices attached to the design report. However, the appendices must contain, as a minimum, the following:

- Calculations showing treatment efficacy, hydraulic profile through the entire section, unit process capacity and limitation identification. Include all calculation spreadsheets
- Manufacturer data sheets and catalogues of all major equipment used for wastewater treatment, if applicable
- Design drawings (see Section 7.0 for details)

Design teams may use modelling software. If used, an appendix must be attached to the design report containing the model input data and output, as well as the rationale for selection of the chosen model(s).

7.0 DESIGN DRAWING REQUIREMENTS

Design drawings must be provided that clearly show the layout of:

- Section 1 removals of existing infrastructure (Phase 1)
- Multiple site plans showing phases of construction (Phase 1) – general level of detail sufficient to show sequencing and access/haulage routes for each (consolidation of multiple site plans is possible if the level of detail warrants)
- Restored Section 1 site plan (Phase 1), including all pipe and duct routings
- Conceptual plan for intensification of Section 1 treatment train (Phase 2)

The drawings must be printed on 11" x 17" landscape sheets, submitted as a PDF document and as an appendix in the design report.

8.0 SUPPLEMENTAL INFORMATION

The following documents are provided to aid in the preparation of the design report:

- Environmental Compliance Approval for Greenway WWTP
- Historical Greenway WWTP influent and effluent data (2023-2025)
- As-built drawings of Section 1, adjacent yard piping, and shared process areas
- 2019 Process Evaluations (AECOM)