
Subject: Niagara Falls Wastewater Treatment Plant Upgrade

Report to: Public Works Committee

Report date: Tuesday, September 25, 2018

Recommendations

1. That Report PW 45-2018 **BE RECEIVED** for information.

Key Facts

- Special Reference
 - Given Section 275 of the *Municipal Act, 2001*, and Regional Council's delegated authority to the Chief Administrative Officer via report GM 8-2018, that the Chief Administrative Officer consider and authorize:
 - That this report will incur expenditures or liability which exceeds \$50,000; and
 - That staff proceed with the single source award to Environmental Infrastructure Services Inc. (EIS) in the amount of \$820,785 (excluding contingency and HST) in accordance with Purchasing Bylaw 2016-02 Section 18(a)(iv) as urgency exists due to an MECP Provincial Official Order issued on July 26, 2018 for the assessment and enhanced conceptual design of the upgrades to: (1) the secondary treatment (replacement aeration) system, and (2) the anaerobic digestion system at the existing Niagara Falls Wastewater Treatment Plant (WWTP).
 - Should the Chief Administrative Officer incur an expenditure or liability greater than \$50,000, then the CAO will report to the new Council all taken pursuant to this decision.
- The purpose of this report is to provide an update on the status of the Niagara Falls WWTP secondary treatment and digestion systems and to seek approval for the single source to Environmental Infrastructure Services Inc. (EIS) for the assessment and enhanced conceptual design in order to expedite detailed design and construction to meet the conditions set by the Ministry of Environment, Conservation and Parks (MECP).
- In the recent years, there has been a number of Environmental Compliance Approval (ECA) non-compliances related to CBOD, TSS, TP, and E. coli in the Niagara Falls WWTP effluent discharge (compliance and objective limit exceedances).
- MECP issued a Provincial Official Order dated July 26, 2018 with a number of requirements including a requirement for the submission of an ECA Amendment for

the secondary treatment system to the MECF by January 2, 2020. This will require a minimum of 90% complete detailed design.

- Before initiating full detailed design of the new aeration system as well as the anaerobic digestion system, preliminary steps including condition assessments, process review, mass balances, design basis, and enhanced predesign will need to be completed immediately on a priority basis.
- The anticipated schedule for the future stages of design is: 2018 (predesign), 2019 (detailed design), and 2020 (construction).

Financial Considerations

Project 10SW1517 (Niagara Falls WWTP Upgrade) has a previously approved capital budget of \$2,100,000. To date a total of \$76,877 of funds have been spent or committed, leaving an uncommitted amount of \$2,023,123 available. Therefore sufficient budget is available to accommodate this award.

Construction funds will be requested through future the capital budget process in future years.

Analysis

The Niagara Falls WWTP is owned and operated by Niagara Region. The Plant was originally constructed in 1963 and has been upgraded periodically since then with the main upgrades occurring in 1982 (plant expansion), and 1986 (conversion to secondary treatment). It is located at the intersection of Stanley Avenue and Swayze Drive in the City of Niagara Falls. The existing sewer infrastructure consists of storm, sanitary, and combined sewers, and 20 sewage pumping stations (SPS). The sanitary and combined sewers discharge to the Niagara Falls WWTP. The service area covers approximately 60 square kilometres.

The existing service population consists of approximately 80,000 year-round residents; however, Niagara Falls experiences seasonal changes in population due to visiting tourists. It is estimated that Niagara Falls hosts approximately 14 million tourists per year, primarily between the months of May and September.

Under normal operating conditions, the Niagara Falls WWTP provides treatment via screening, grit removal, primary clarification, rotating biological contactors (RBC): total of 35 (5 trains of 7) contactor units for biological treatment, secondary clarifiers, and disinfection via chlorination/dechlorination. Ferric chloride is added for chemical phosphorus removal. A polymer feed system is available to provide chemically enhanced primary treatment (CEPT).

Figure 1 in Appendix 2 presents a process flow diagram (PFD) of the Niagara Falls WWTP liquid treatment and solids management trains, and Figure 2 presents an aerial image of the Niagara Falls WWTP site.

The rated average day flow (ADF) capacity of the Niagara Falls WWTP is 68,300 m³/d. The Plant is also rated for a peak dry weather flow rate of 136,400 m³/d and a peak wet weather flow rate of 205,000 m³/d.

Waste sludge is stabilized by two-stage anaerobic digestion, and the resulting biosolids are dewatered on-site. Waste sludge from the Queenston WWTP is also hauled to the Niagara Falls WWTP for stabilization and dewatering. The dewatered cake is disposed off-site.

Treated effluent is discharged to the Queenston Power Canal.

The existing facility is old and has experienced operational difficulties, including failures of the RBC shafts, bearings, gearboxes, and turnbuckles. In addition, significant sulfide loading to the RBC system has resulted in growth of hydrogen sulfide oxidizing bacteria on the RBC media and mechanical equipment failures. The RBCs have historically operated within typical organic loading values, however, increases in influent flow and loadings could result in decreased BOD removal and development of anaerobic conditions in the first stage RBCs, which would favour the growth of nuisance organisms.

To date, there have been a number of ECA non-compliances related to CBOD, TSS, TP, and E. coli in the effluent (compliance and objective limit exceedances).

Previous studies were completed in 2014 and 2017 by XCG Consultants (now Cole Engineering Group) to review options for the secondary treatment system. Upon further review, additional information related to asset condition, process optimization and design scoping is required to progress the secondary treatment and digestion systems into detailed design and ultimately construction. Additionally, the 2016 MSP identified a new WWTP in south Niagara Falls that will impact the flows to the existing WWTP, which requires further review and confirmation of existing and future flows for process optimization and design.

In addition to the secondary biological system (new aeration system to replace RBCs) and aging infrastructure related deficiencies described above, the plant has experienced anaerobic digester failures in the recent years (2014 and 2017).

MECP issued a Provincial Official Order dated July 26, 2018 with a number of requirements including a requirement for the submission of an ECA Amendment for the secondary treatment system to the MECP by January 2, 2020. The Order creates urgency in completing this complex design for the secondary treatment.

Given the magnitude and intricacies associated with the scope of work, staff recommend a phased approach to design – Phase 1) Assessment and Enhanced Conceptual Design Phase 2) Detailed Design. Fully understanding the condition and operation of the WWTP will facilitate a seamless transition into Phase 2 (detailed design) and aims to eliminate ambiguity and increase accuracy in scope, costing and understanding of risks. This phased-design approach is utilized by other municipalities in Southern Ontario on large scale facility upgrades. The Region will also be implementing this on the Anger Avenue Wastewater Treatment Plant upgrade project (20000695) using a competitive procurement model, via a Request for Proposals call from prequalified consultants (using 2017-RFPQ-03).

Liquid (i.e., secondary treatment) and solids (digestion) treatment trains are included in Phase 1 of the scope of the work as it allows for a holistic view of the interconnected WWTP operations. Also, in addition to the issued Order, MECP is monitoring and aware of the digester issues that NFWWTP has experienced. Phase 2 scope can be developed and detailed design for the liquid and solids treatment trains can then be separated, if necessary. Controls will be put into place to ensure that one portion of the project is not holding up another, especially for secondary treatment.

The Project team has worked collaboratively to develop the following comprehensive scope required to successfully complete Phase 1:

Conduct condition assessments and reporting for the following:

- Existing secondary clarifiers and gallery
- Existing primary clarifiers (1, 2, and 3) and chlorine contact tank
- Existing secondary digester (Digester 4) and gallery
- Existing main power substation and standby power

Conduct individual studies and develop tech memos as follows:

- Design basis and mass balance
- New aeration system
- Secondary clarifier and RAS/WAS pumping
- Chlorination and dechlorination tank
- Upgrades of aeration system for existing aerated grit system and primary effluent channels
- Hydraulic profile
- Feasibility to relocate existing ferric system and provide flexibility for alternative chemicals
- Feasibility of sludge thickening to optimize sludge digestion system
- New primary digestion system
- Upgrading requirements to the existing secondary digester and biogas system
- Upgrading requirements to the main power substation and standby power

Conduct a topographic survey of the project site.

Generate Project Scoping Report (PSR)

- Compliance with all applicable acts, regulations, codes and standards
- Compliance with design standards
- Project constraints / opportunities
- Site layout
- Field investigation analysis and results summary (with reports appended)
- Confirmation and/or modification of the plant conceptual design basis and criteria
- Conceptual design and scope for wastewater treatment (liquid train)
- Conceptual design and scope for wastewater treatment (solids train)
- Conceptual design and scope for power supply and distribution
- Conceptual design and scope for Control and SCADA system
- Conceptual design and scope for site plan upgrades
- Identification of potential construction constraints
- Identification of plant operation constraints during construction
- Preliminary project schedule
- Cost estimate to +/- 20% (Class 'C' cost estimate)
- Pending significant issues to be addressed/resolved during design stage
- Conceptual design drawings
- Registers / Plans

Detailed design (Phase 2) will follow immediately after the completion of Phase 1.

Alternatives Reviewed

The anticipated schedule for the secondary treatment and digestion system upgrades is 2018 (predesign), 2019 (detailed design), and 2020 (construction). Based on projects completed of similar scope and size, phase 1 could take up to 1 year and phase 2 could take 1.5 years to 2 years to complete. To meet the requirements of the MECP Order of an ECA Amendment submission by January 2, 2020, this work will have to be significantly expedited. The following are alternatives that have been reviewed by staff:

- 1) Do nothing – not a viable option considering the July 26, 2018 MECP Order and the recent ECA non-compliances reported for the Niagara Falls WWTP effluent discharge. Niagara Region can be fined by MECP if this condition is not met.
- 2) Single source (Phase 1) and single source (Phase 2) – viable option but not recommended at this point. Assuming award following October 4, 2018, this option provides the maximum duration for detailed design (phase 2) to approximately one year, however, is not being recommended at this point as it does not promote formal competitive procurement at any design phase.
- 3) Formal RFP procurement (Phase 1) and formal RFP procurement (Phase 2) – not a viable option as this only allows for 5 months to complete the detailed design (phase 2). Based on similar projects, this is inadequate time to complete the works.

- 4) Single source (Phase 1) and formal RFP procurement (Phase 2) – viable and recommended option. Assuming award following October 4, 2018 Council meeting, this option allows for approximately 5 months for phase 1 and approximately 8 months for phase 2. It also promotes formal competitive procurement in phase 2.

Staff recommend that Environmental Infrastructure Services Inc. (EIS) be awarded phase 1 in accordance with Purchasing Bylaw 2016-02 Section 18(a)(iv) as urgency exists and there is limited time to obtain services by means of an open or roster request for proposals. EIS has provided an aggressive timeline for delivery of the Project Scoping Report, which is five (5) months from award. Presuming phase 2 is awarded through formal procurement, the schedule for detailed design is anticipated to be Spring 2019 to January 2020 (approximately 8 months), which is very aggressive but necessary to satisfy the MECP's Provincial Official Order.

EIS was selected for phase 1 due to their involvement at NFWWTP during the digester failures, their extensive knowledge and staff expertise in wastewater treatment in the Region and other municipalities across Ontario, intimate knowledge of Region's design manual, and for their commitment to the Region and understanding of the significance of the current compliance issues. EIS will assign dedicated staff to this assignment for the duration to ensure consistency, quality, and timely delivery. The Region has had great success with EIS in terms of coordination, delivery, quality, and risk management. Region staff are familiar with the proposed EIS Project team having worked closely on other recent Regional projects.

EIS letter proposal, including scope, team, cost and schedule is attached for reference (Appendix 1). The total amount being recommended for single source assignment is \$820,785.00 (excluding HST and contingency).

Other Pertinent Reports

N/A

Prepared by:

Shahab Shafai, M.Sc., P.Eng.
Associate Director of Wastewater
Public Works Department

Recommended by:

Ron Tripp, P.Eng.
Commissioner
Public Works Department

Submitted by:

Carmelo D'Angelo, BSc, MPA
Chief Administrative Officer

This report was prepared in consultation with Lisa Vespi, P.Eng. Senior Project Manager, W-WW Engineering and Michael Leckey, Program Financial Specialist W-WW and reviewed by Joe Tonellato, Director W-WW Services.

Appendices

Appendix 1

EIS Letter Proposal

Appendix 2

Process Flow Diagram Niagara Falls Wastewater Treatment Plant