



**INFRASTRUCTURE DEPARTMENT
MEMORANDUM**

TO: **MAYOR J. LEHMAN AND MEMBERS OF COUNCIL**

FROM: **S. DIEMERT, MANAGER OF VERTICAL INFRASTRUCTURE PROJECTS**

NOTED: **B. ARANIYASUNDARAN, P. ENG., PMP, DIRECTOR OF INFRASTRUCTURE**

A. MILLER, RPP, GENERAL MANAGER OF INFRASTRUCTURE, AND GROWTH MANAGEMENT

M. PROWSE, CHIEF ADMINISTRATIVE OFFICER

RE: **BARRIE WASTEWATER TREATMENT FACILITY – PROGRAM DELIVERY APPROACH**

DATE: **MAY 25, 2020**

The purpose of this Memorandum is to provide an update to members of Council on the implementation approach for the program of approved projects in the 2020 Capital Plan related to the upgrade of the Wastewater Treatment Facility (WwTF). Staff have selected a delivery approach that is unique for wastewater projects. Given the complexity of the program, the site constraints, and the need to replace existing processes with newer processes will result in significant and long-term construction. Following an evaluation process, the project team selected Integrated Project Delivery (IPD) as the preferred approach based on its collaborative approach to managing and controlling risk, program schedule, program costs and scope.

Program Overview

There are many projects required at the WwTF with the goal of meeting the provincial requirements for phosphorus reduction, to accommodate population growth, and to upgrade treatment systems that are at the end of their useful life. Staff are currently working on an asset management plan for the WwTF and this identifies capital maintenance projects which could also be incorporated within this program.

The following projects in the 2020 Capital Plan are included in the program. These projects were identified in the 2019 Wastewater Treatment Master Plan:

- Upgrade/replace electrical substation infrastructure to service future needs,
- Conversion of the high purity oxygen biological system to a conventional fine bubble aeration system,
- Implementation of Membrane Bio Reactor (MBR) treatment to meet the stringent phosphorus requirements to service population growth to 2041,
- New flow attenuation facilities to address the peak flows at the plant,
- Construction of a fourth digester to increase solids handling capacity,
- Class Environmental Assessment and associated technical studies to increase plant capacity to 96 MLD.

The above program of projects is anticipated to be completed over a 13-year period.

Key Program Drivers

Implementation of this program is critical for the City to comply with provincial legislation and regulations, to support the City's growth plan and optimize renewal of the City's assets.



**INFRASTRUCTURE DEPARTMENT
MEMORANDUM**

Phosphorous levels are a key water quality concern in Lake Simcoe. The Ontario government approved the Lake Simcoe Phosphorus Reduction Strategy in 2010 which established reductions in phosphorous loadings to restore Lake Simcoe's water quality and ecological health. The new limit requires the Barrie WwTF to maintain existing loadings of total phosphorous as flows to the Barrie WwTF increase with future development in the Secondary Plan areas and intensification of the built boundary.

Prior to 2015, the WwTF regulatory requirements included an effluent limit of 0.15 mg/l for total phosphorous. This was achieved by a tertiary sand filter system, which was the best technology in common use prior to this time. Due to the Lake Simcoe Phosphorus Reduction Strategy, the Certificate of Approval required that by 2015 the effluent limit was to be reduced to 0.1 mg/l for total phosphorous. As such, there was a need to upgrade the filtration technology in order to meet the stringent effluent quality.

The current WwTF is operating at 50 MLD and servicing a population of 150,000. The new upgraded plant will have a capacity of 96 MLD to service a residential population of 253,000. Implementation of the program as described above is required to service this growth and additional growth beyond 2041.

All wastewater treatment plants on Lake Simcoe will be required to be upgraded to meet these new requirements.

Integrated Project Delivery (IPD)

Integrated Project Delivery (IPD) is the preferred approach. The technical team considered many delivery approaches including: Design Build, Design Bid Build, Public Private Partnership, Construction Management and IPD. Rationale for selecting IPD is discussed below.

Traditionally, major construction projects in the water and wastewater industry are delivered through a Design-Bid-Build delivery approach. This approach has been prone to schedule delays and cost overruns in addition to creating adversarial relationships and competing interests between the contracting parties. IPD removes the traditional contractual boundaries between project stakeholders, placing instead a single contractual boundary around the entire design and construction project. This removal of internal contractual boundaries incentivizes the team to focus on optimizing the whole project results, and look beyond the individual pieces or interests of each party.

Another key driver for a new approach is the need to maintain treatment performance and regulatory compliance throughout construction. This means special precautionary measures will be required to enable unit treatment processes to be isolated and taken offline, for the upgrade work to proceed in sequence. Construction phasing will be complex. The sequencing of the work will require careful planning by the team of contractors and consultants. The program will need to have multiple projects occurring at the same time and within the same space. It also requires flexibility in phasing the projects to deal with the complexities of the wastewater treatment plant. The IPD approach will facilitate this better than the traditional design-bid-build approach.

Some benefits of IPD over other methods are summarized below:

- IPD offers the best use of integrated expert resources and time up front with opportunity to provide high level of detail and scrutiny on design and construction process to provide cost certainty and avoid costly change orders later in the process and reduce potential for delays that result in cost escalation.
- Having the contractor for the construction team secured through a public competitive bid process (mechanical, electrical, structural etc.), ensures reduced risk and cost certainty in the early stages of the project.

- Multi party agreement with incentives for all parties to find efficiencies that result in shared benefits for owners, designers and the construction team. This ensures that all IPD team members are working collaboratively and actively seeking ways to discover efficiencies through all stages of the project.
- Multiple quotes and market comparators are used to ensure all costs (labour, materials, costs per square foot) are within industry standards and consistent with our experience with similar facilities.
- IPD has a shared risk and reward model based on project outcomes that further the creation of a “best for project” environment. It is in everyone’s best interest that the project be successful for every party, not just individual parties. This encourages team members to collaborate rather than compete, actively seeking opportunities to support one another and, ultimately, the program.
- IPD establishes a platform where cost and schedule are much more certain in addition to the attainment of much broader metrics of success that the team establishes as a set of common values, goals and objectives.
- All project stakeholders are brought on board early in the process, where the ability to leverage experience and expertise yields high returns in terms of positive impact to the project while the costs are low.

Next Steps

Next steps for the program team will be to work on the Procurement Plan to retain the IPD team and expertise required. The first step in the procurement process will be to retain a Design Consultant and then a General Contractor. Assistance from an IPD experts and staff members within the Facilities Department will be leveraged for the support needed.

Once the integrated program team is in place, the first step will be validation phase.

Validation phase is the process that establishes certainty for the IPD team and for the owner: it proves or disproves whether the IPD team can meet the full range of the owner’s Conditions of Satisfaction within the owner’s allowable-cost and schedule constraints. The purpose of validation is certainty. If the specifics of the outcomes are acceptable to the owner, it allows the owner and the team to proceed with confidence that the entire program is viable.

During the validation phase the IPD team will meet regularly to distill designs that meet the goals and requirements of all the key stakeholders. A multi-stakeholder team studies the program of work over an established timeline. High level budgets are established with increase in detail as the design matures, allowing the team to design to a detailed estimate instead of estimating a detailed design. Risks are identified in a detailed risk register and are assigned both a numeric scope and likelihood value. This information is taken into account in arriving at the Target cost. Target cost is committed to at the end of validation collectively by the team (including the owner).

Once the validation phase is complete, then the procurement of materials and construction services can begin.

Staff will report back to Council with details related to schedule, cost and risk allocation at the end of the validation period.



**INFRASTRUCTURE DEPARTMENT
MEMORANDUM**

Summary

The IPD approach will minimize cost escalation and schedule delays similar to what has been experienced in the past with projects using traditional approaches. This is an opportunity for development and growth of City staff to employ a new program delivery approach to large complex projects. Most experiences with the IPD approach have been in greenfield applications and has not typically been used for wastewater projects in Ontario. Barrie would be innovative being the first in Ontario.

With the implementation of such a large and complex program to address population growth and Lake Simcoe phosphorus requirements, and the installation of the best available technology, the Barrie WwTF will be a flag ship featuring the most advanced treatment systems in Canada for a plant of this size. IPD will be an innovative and collaborative approach for wastewater treatment, building on the City's experience with IPD project delivery.