Amendment to Purchase Order No. 6022814 for Engineering Services for the Rehabilitation of Wastewater Pumping Stations (Group 3)

Date: February 3, 2015

To: Public Works and Infrastructure Committee

From: General Manager, Toronto Water; Director, Purchasing & Materials Management

Wards: All

Reference Number: P:\2015\Cluster B\TW\PWI15003 (AFS20663)

SUMMARY

The purpose of this report is to request authority to amend an existing purchase order and to provide an update on the Wastewater Pumping Station Rehabilitation Program.

The purchase order is with Associated Engineering (Ont.) Ltd. for construction administration and site supervision services related to the oversight of a construction contract being completed by Torbear Contracting Inc. The construction contract, which has experienced a number of delays, is for the rehabilitation of ten (10) wastewater pumping stations. An amendment to the purchase order with Associated Engineering (Ont.) Ltd. is needed to pay for the additional services required to supervise the time extensions granted to the original construction schedule.

The total Purchase Order Amendment being requested is $138,922.00 net of all taxes ($141,367.03 net of HST recoveries), revising the contract value from $1,177,530.80 to $1,316,452.80 net of all taxes ($1,339,622.37 net of HST recoveries).

The Wastewater Pumping Station Rehabilitation Program is well underway with work completed at 43 of the City's 84 pumping stations.
RECOMMENDATIONS

The General Manager, Toronto Water and the Director of Purchasing & Materials Management recommend that:

1. The Public Works & Infrastructure Committee, in accordance with Section 71-11.1.C of the City of Toronto Municipal Code Chapter 71 (Financial Control Bylaw), grant authority to amend Purchase Order No. 6022814 with Associated Engineering (Ont.) Ltd. for engineering services for the rehabilitation of ten (10) wastewater pumping stations identified as Group 3, Request for Proposals 9117-06-7051, by an additional amount of $138,922.00 net of all taxes ($141,367.03 net of HST recoveries) revising the current contract value from $1,177,530.80 to $1,316,452.80 net of all taxes ($1,339,622.37 net of HST recoveries).

Financial Impact

Amendment of Purchase Order 6022814 for an additional $138,922.00 net of all taxes ($141,367.03 net of HST recoveries) will increase the current contract value from $1,177,530.80 to $1,316,452.80 net of taxes ($1,339,622.37 net of HST recoveries).

The delivery date for completion of the professional services covered by Purchase Order No. 6022814 is currently June 30, 2014. The amendment includes an extension, revising the completion date to December 31, 2015.

Funding of $141,367.03, which will be utilized in 2015, is available in the 2014 Approved Toronto Water Capital Budget and 2015-2023 Capital Plan in WBS Element CWW465 (YR06 District Sewer Operations).

The Deputy City Manager & Chief Financial Officer has reviewed this report and agree with the financial impact information.

DECISION HISTORY

At its meeting on August 23, 2006, Bid Committee granted authority to award an engineering consultant services agreement to Associated Engineering (Ont.) Ltd., as the highest overall scoring proponent meeting the requirements of RFP 9117-06-7051, to provide preliminary design, detailed design, preparation of tender documents, construction administration and site supervision for the rehabilitation and upgrade of ten (10) wastewater pumping stations identified as Group 3. Purchase Order No. 6022814 for $727,999.80 net of all taxes was issued accordingly. The following is the link to the Bid Committee approval:

http://www.toronto.ca/legdocs/2006/minutes/committees/bc/be060823.pdf
On February 20, 2008, Purchase Order No. 6022814 was amended, in accordance with the Financial Control By-law by $73,000.00 to $800,999.80 net of all taxes to accommodate additional scope for the design phase of the project.

At its meeting on May 5, 2010, Bid Committee granted authority to award Tender Call 003-2010, Contract TWDO-TW-TWOS-MCP-06-00005 for Wastewater Collection Pumping Station Upgrades and Rehabilitation – Group 3 to Torbear Contracting Inc. for $7,687,373.00 net of all taxes. The following is the link to the Bid Committee approval:


On July 17, 2012, Purchase Order No. 6022814 to Associated Engineering (Ont.) Ltd was amended, in accordance with the Financial Control By-law by $376,531.00 to $1,117,530.80 net of all taxes to accommodate additional construction administration and site supervision services resulting from approved change orders to Torbear Contracting Inc.

ISSUE BACKGROUND

Pumping stations in wastewater collection systems, also called *lift stations*, are normally designed to handle wastewater (i.e. sanitary, storm water or combined) that is fed from underground gravity pipelines (pipes that are sloped so that a liquid can flow in one direction under gravity). Wastewater is fed into and stored in an underground pit, commonly known as a *wet well*. The well is equipped with electrical instrumentation to detect the level of wastewater present. When the wastewater level rises to a predetermined point, a pump is started to lift the sewage upward through a pressurized pipe system called a *sewer force main* from where the sewage is discharged into a gravity manhole. From here the cycle starts all over again until the sewage reaches its point of destination, usually a treatment plant. By this method, pumping stations are used to move waste to higher elevations. In the case of high wastewater flows into the well (e.g. during peak flow periods and wet weather) additional pumps are used. If this is insufficient, or in the case of a system failure (i.e. power or mechanical), a backup in the sewer system can occur, leading to a sanitary sewer overflow (i.e. the discharge of raw sewage into the environment).

Wastewater pumping stations are designed so that one pump or one set of pumps will handle normal peak flow conditions. Redundancy is built into the system so that in the event that any one pump is out of service, the remaining pump or pumps will handle the designed flow. Generators are typically installed at each station to provide a backup power source in the event of a power system failure.

Electronic devices (i.e. programmable logic controllers (PLC) are used to control and supervise the pumping stations. PLCs are used for remote monitoring of each pumping station from a centralized control room with SCADA (Supervisory Control & Data Acquisition) systems. Leased data lines from local network communications service providers allow for the remote monitoring of the stations. This setup is helpful in
monitoring pump faults, levels or any other alarms and parameters making it more efficient.

Toronto Water is currently responsible for operating and maintaining 84 wastewater pumping stations and approximately 39 km of associated sewer force main. The pumping stations vary in age, capacity and complexity. Due to on-going projects associated with the Waterfront Renewal and the Basement Flooding Protection Program there will be several more wastewater pumping stations added to the system in the future.

In 2008, due to the highly specialized and technical nature of the wastewater pumping system, Toronto Water created the Complex Systems unit to oversee the operations and maintenance of the system. The unit's staff have specialized knowledge and experience in pumping systems, PLCs, SCADA, and network communications.

Since 2008, as part of Toronto Water's "state-of-good-repair" capital projects, staff have systematically reviewed the condition of each of the stations and organized them in groups that establish their priority for rehabilitation. In addition, the capacities of the pumping stations are being reviewed in order to address the population growth demands throughout the City.

Currently, the Wastewater Pumping Station Rehabilitation Program is well underway. Rehabilitation work has been completed at 43 of the pumping stations so far (10 of these were completed as part of the Group 3 contract). Rehabilitation work remains to be completed at 41 pumping stations and approximately 39 kms of sewer force main. Appendix A provides a map of the 84 pumping stations and shows which have been completed so far.

This report requests authority to amend a Purchase Order for engineering services for the rehabilitation of ten (10) wastewater pumping stations identified as Group 3 and to provide an update on the Wastewater Pumping Station Rehabilitation Program.

COMMENTS

1. Need for Amendment to Purchase Order No. 6022814 for Engineering Services

The City's original scope of work for engineering services included preliminary design, detailed design, preparation of tender documents, construction administration and site supervision for the rehabilitation and upgrade of ten (10) wastewater pumping stations, identified as Group 3, based on estimated construction duration of 52 weeks. The proposal from Associated Engineering (Ont.) Ltd. and subsequent agreement for engineering services was based on the estimated duration of 52 weeks.

Torbear Contracting Inc., the general contractor for the construction of the project, committed to completing the project in 64 weeks in their tender and subsequent agreement with the City. The Order to Commence was issued on June 14, 2010 and based on the 64 week duration the project was anticipated to be complete by September
4, 2011. The project experienced a number of delays at various pumping station sites requiring the general contractor to prepare a new construction completion forecast.

In December 2011, Torbear had forecast a revised construction completion date of April 20, 2012. The contractor was unable to meet that revised completion date and had to re-forecast the construction schedule several times during the project. Construction was finally completed in July 2014. The total contract duration was 214 weeks. Although the contract with Torbear Contracting Inc. was completed significantly behind schedule based on the original contract completion duration of 64 weeks, the project was completed within budget and the quality of work was performed in accordance with the City's construction standards and specifications.

In February 2012, when it became apparent that construction would not be completed by the revised completion date of April 2012, staff began discussion with Associated Engineering (Ont.) Ltd. to amend their original contract terms. The City's original agreement with Associated Engineering (Ont.) Ltd. provided for a weekly rate of $6,647.62 for construction administration and site supervision beyond 52 weeks. To mitigate future costs, staff requested that Associated Engineering (Ont.) Ltd. no longer provide full-time site services and make the most effective use of these services on a part-time basis as required for the remainder of construction.

As a result of these discussions and based on another revised construction schedule, the purchase order to Associated Engineering (Ont.) Ltd was amended on July 17, 2012, for additional construction administration and site supervision services of 44 weeks from 52 weeks to 96 weeks. At that time, staff believed this amendment would provide enough funds to pay for the additional construction supervision services. However, the construction work was not completed within the revised 96 weeks and a further amendment to the purchase order with Associated Engineering (Ont.) Ltd. is now required to ensure proper close out the construction project.

Had full-time construction administration and site supervision services been provided by Associated Engineering (Ont.) Ltd. during the final 118 weeks of construction, the cost to the City would have been an additional $784,419.16. However, since part-time services were provided, staff reviewed the request for $138,922.00 and considers it to be reasonable based on the work effort expended to date and that is still required for final inspections for contractor deficiencies prior to the expiry of warranties in March 2016.

Typically, a purchase order amendment report would proceed to Public Works and Infrastructure Committee prior to or immediately after staff are aware that additional funds are required to complete a project. In this situation, the construction completion date and the negotiation of final services required to complete the assignment was not determined until the third quarter of 2014. There were no further Committee meetings scheduled due to the municipal elections and this is the first opportunity to report.

Therefore, an amendment to the purchase order to Associated Engineering (Ont.) Ltd. for an additional $138,922.00 is now required for the part-time construction administration

Amendment to Purchase Order No. 6022814 for Engineering Services for the Rehabilitation of Wastewater Pumping Stations (Group 3)
and site supervision services associated with the final 118 weeks of construction. This amendment will bring the total amendment value including previous amendments to $588,453.00 net of all taxes which requires standing committee approval, in accordance with the City of Toronto Municipal Code, Chapter 71 – Financial Control By-Law.

During the construction phase there were a number of factors that contributed to delays in the completion of the project. Some of the delays overlapped in time or occurred at various pumping station sites and therefore are not to be considered cumulative. The main reasons for the delay to project completion and their duration are as follows:

(i) The general contractor was required to arrange with Toronto Hydro to provide new power service at several of the stations. The new services were not provided by Toronto Hydro in a timely manner and there were late changes in service requirements requested by Toronto Hydro to previously approved feeder installations that impacted 5 of the 10 sites. This resulted in re-work and a 35-week delay to project completion;

(ii) There was additional coordination required with Parks, Forestry & Recreation staff to sort through scheduling conflicts between the rehabilitation work at the Bluffers Park pumping station and a new electrical substation within the park. This conflict was not known at the beginning of construction and resulted in an 18-week delay to project completion;

(iii) Scope changes to the control logic programming that operates the pumping station equipment and remote monitoring system were introduced by operational staff and approved by project staff during the site acceptance phase. Although these changes will have long term benefits to the station operations, they were not foreseen at the beginning of the project and resulted in a 12-week delay to project completion;

(iv) In order to reduce the possibility of wastewater overflow during construction, the contractor was required to have a temporary bypass pumping system in place while work was being performed at each of the stations. Due to site specific issues such as unforeseen conflicts with underground utilities, coordination with Toronto Hydro and changes to the station control requirements, the temporary bypass pumping was required longer than the timelines outline under the contract at 5 of the 10 sites resulting in a 50-week delay to project completion; and

(v) Equipment supplied by the contractor failed shortly after the successful completion of site acceptance testing. Previously installed pumps and control equipment needed to be replaced at 2 of the stations which resulted in additional testing and a 52-week delay to project completion.

2. Update on the Wastewater Pumping Station Rehabilitation Program

Overall Status

Condition assessments completed since 2008 have highlighted a number of concerns regarding the state of the City's wastewater pumping stations and associated infrastructure. Due to the range in age of the facilities (i.e. 10 to 100 years) and the
various jurisdictions that operated them prior to the City's amalgamation, there was a wide variety of pumps, valves, instruments and PLCs and a lack of documented equipment standards to help guide replacement decisions. Much of the mechanical and electrical equipment had reached the end of its useful service life and there was inadequate emergency backup power at many of the facilities. The communication system in-place for monitoring the stations was outdated and unreliable.

Shortly after the initial condition assessments were completed, a strategic rehabilitation program was established that took into consideration both the state-of-good-repair of the aging facilities and the population growth demands throughout the City. Rehabilitation of the pumping stations include replacement of the mechanical (i.e. pumps, valves and piping) and electronic control equipment (i.e. motor control centres, pump variable frequency drives, programmable logic controllers and operator interface terminals) and associated control software. Upgrades also include the addition of emergency backup power generators and replacement of backup float systems at several of the facilities.

Currently, the Wastewater Pumping Station Rehabilitation Program is well underway. Rehabilitation work has been completed at 43 of the pumping stations so far. Stations identified as Groups 1, 2, 3 and 4 as well as Scott Street and Sunnyside pumping stations are substantially complete. Rehabilitation work remains to be completed at 41 pumping stations and approximately 39 kms of associated sewer force main.

Benefits

The benefits of the rehabilitation program have already been realized in many ways. Since the rehabilitation program started, substantial decreases in staff overtime costs have been realized each year. Reliability in the system has improved which requires much less emergency response due to system failures. Electric power costs have been reduced due to the higher efficiency of the modern pumps and equipment. Far fewer spills to the environment have occurred as a result of more reliable equipment, better remote monitoring capabilities and backup generators utilized during power outages.

During the recent ice storm of December 2013, over 300,000 Toronto Hydro customers were without power, which included approximately half of the wastewater pumping stations at the peak of the outage event. Due to the upgrades already completed, Toronto Water staff were able to more accurately monitor the power system failures and direct resources to ensure backup power was provided to all impacted stations which resulted in no wastewater spills to the environment. Had the ice storm event occurred before these upgrades were completed there likely would have been several reported spills across the City as well as damage to nearby properties.

Eliminating backups and spills greatly reduces the City's exposure to cleanup costs and litigation. Additional benefits include improved data collection and storage. This data is used in daily operational planning and as input to Key Performance Indicators, to expose potential future failures and investigate root causes of past failures. Establishing
standards for all stations across the City has greatly improved operational efficiency and will reduce future operating costs.

Budget/Financial Status

To date since the beginning of the program, Toronto Water has spent approximately $40 million towards rehabilitation work related to the wastewater pumping stations. The Division plans to spend an additional $59 million over the next five-year period and an additional $43 million over the following five-year period for a total of $142 million.

The table below shows the expenditures to-date and the projected cash flows for the various accounts related to wastewater pumping station rehabilitation and associated sewer forcemain replacement within Toronto Water's 2015 capital budget submission:

Table 1: Expenditures to-date and Projected Cash Flows

<table>
<thead>
<tr>
<th>Capital Account</th>
<th>Account Name</th>
<th>Expenditures Prior to 2015 ($,000) A</th>
<th>Cash Flow 2015-2019 ($,000) B</th>
<th>Cash Flow 2015-2019 ($,000) C</th>
<th>Total ($,000) A+B+C</th>
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<tbody>
<tr>
<td>CWW462-02</td>
<td>Group 1 SPS Upgrades</td>
<td>6,625</td>
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<td>7,025</td>
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<td>CWW465-02</td>
<td>Groups 2, 3, 4 SPS Upgrades</td>
<td>17,451</td>
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<td>18,239</td>
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<td>CWW465-05</td>
<td>SPS SCADA Upgrades - Engineering</td>
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<td>1,112</td>
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<td>3,203</td>
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<td>CWW465-07</td>
<td>SPS Standby Power</td>
<td>2,177</td>
<td>374</td>
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<td>2,551</td>
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<td>CWW465-08</td>
<td>Group 5 SPS Upgrades</td>
<td>296</td>
<td>21,549</td>
<td>1,056</td>
<td>22,901</td>
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<td>CWW472-07</td>
<td>Forcemain Replacement</td>
<td>430</td>
<td>2,172</td>
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<td>CWW472-B</td>
<td>Forcemain Replacement - Future</td>
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<td>10,000</td>
<td>16,500</td>
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<tr>
<td>CWW476-01</td>
<td>Scott Street PS</td>
<td>4,032</td>
<td>78</td>
<td>0</td>
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<td>CWW476-02</td>
<td>Brickworks PS</td>
<td>528</td>
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<td>CWW476-03</td>
<td>Sunnyside SPS</td>
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<td>CWW476-04</td>
<td>SPS SCADA Upgrades</td>
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<td>15,021</td>
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<td>CWW476-A</td>
<td>Groups 6 &amp; 7 SPS Upgrades</td>
<td>0</td>
<td>14,080</td>
<td>31,650</td>
<td>45,730</td>
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<tr>
<td><strong>Total - SPS &amp; Forcemains</strong></td>
<td></td>
<td><strong>39,867</strong></td>
<td><strong>59,339</strong></td>
<td><strong>42,706</strong></td>
<td><strong>141,912</strong></td>
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</table>

Major Challenges

Most of the stations are located within residential communities, therefore mobilizing construction equipment and completing the required work while minimizing the disruption to residents is a challenge. In order to avoid spills to the environment, work must be carried out with no service interruptions requiring temporary bypass pumping for
long periods of time. Temporary bypass pumping can be disruptive to residents and is a significant project cost.

Undocumented and/or abandoned underground structures, piping and equipment create challenges for the contractor and result in project delays. Performing rehabilitation work at several stations simultaneously increases the risk of service interruptions and strains the City's operational resources.

**Project Risk Mitigation**

Area residents and other project stakeholders are consulted prior to construction in order to explain the construction process and in order to mitigate concerns to the extent possible. Residents are advised that once the rehabilitation work is completed, the risk of localized flooding, noise and odour will be greatly reduced.

Detailed condition assessments are conducted prior to tender in order to define project scope as succinctly as possible and identify to the extent possible undocumented structures and equipment. Projects are broken up into relatively small groups in order to encourage the competitive bid process and to reduce risks of service interruptions.

**CONTACT**

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**SIGNATURE**

______________________________  ______________________________
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General Manager     Director
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**ATTACHMENTS**

Appendix A: Wastewater Pumping Station Rehabilitation Status