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### **ADDITIONAL SCOPE FOR SOUTHEAST COLLECTOR ENGINEERING AND CONTRACT ADMINISTRATION SERVICES**

**The Environmental Services Committee recommends the adoption of the recommendation contained in the following report dated June 2, 2011, from the Commissioner of Environmental Services.**

#### **1. RECOMMENDATION**

It is recommended that:

1. Contingent upon award of Tender T-09-61 for the construction of the Southeast Collector Sanitary Trunk Sewer construction contract, Blanket Purchase Order B0001185 issued to AECOM and Hatch Mott McDonald be increased from \$52,839,513 to \$71,362,832 excluding taxes, for additional required scope through to 2018, including additional contract administration and site inspection services, comprehensive construction and post construction monitoring programs for surface and ground water, noise and vibration, as well as settlement surveying and materials testing during the construction phase.

#### **2. PURPOSE**

This report seeks Council authority for an engineering fee increase for additional scope of work required during the construction and post construction phases of the Southeast Collector Sanitary Trunk Sewer to 2018 in accordance with the Purchasing By-law

#### **3. BACKGROUND**

##### **Individual environmental assessment was approved in March 2010**

York Region commenced the individual environmental assessment for this project in 2007 with the assistance of consulting services provided by AECOM. On March 31, 2010 the individual environmental assessment for this project was approved. The approval resulted in 72 stringent conditions, including new monitoring procedures during construction that were not originally envisioned in the overall scope of the project. Since that time, York Region has been successful in submitting all requirements to meet Ministry of the Environment conditions, enabling the project to proceed to tender.

### **Detailed design was completed in January 2011**

Completion of the detailed design and preparation of the tender documents were undertaken by AECOM and Hatch Mott Macdonald (collectively referred to as Southeast Collector Team). The Southeast Collector Team was also retained to provide construction administration, site inspection and project management services for the duration of the construction phase. Based upon the scope of the final tendered construction contract, it is now envisioned the Southeast Collector Team will lead the monitoring of surface and ground water, noise and vibration, as well as settlement surveying and materials testing during the construction phase.

### **Contract was tendered with several innovative approaches to proactively manage project risks**

To ensure contractor interest and competitive bids for this critical project, many innovative approaches were adopted by the project team and reflected in the contract specifications. Application of these innovative approaches resulted in moving some activities into owner control instead of assigning them to the contractor as is common procurement practice. This assignment of work activities was based on a detailed consideration of which party (i.e. owner or contractor) was in the best position to manage risk associated with carrying out some project activities. By retaining control of selected activities, the Region is better positioned to ensure execution according to regulatory permits and the stringent reporting conditions imposed on the project.

The Region avoids risk and cost premiums by removing secondary construction activities such as ground and surface water monitoring, noise and vibration monitoring, and settlement surveying from the construction contractor's scope of work. These types of activities are not usually part of a contractor's primary constructor role and are typically subcontracted.

Innovative approaches utilized in this project include:

- Provision of owner controlled insurance program
- Enabling a Dispute Resolution Board to review claims
- Advance identification of available disposal sites for excavated soils
- Owner responsibility for environmental monitoring, surface and ground water monitoring, noise and vibration monitoring, and settlement monitoring
- Maintenance and funding of spare parts for tunnel boring machines by Owner
- Direct owner responsibility for commissioning the odour control equipment and associated facilities

### **Southeast Collector Team provided key support to Region in completing advanced procurement to optimize construction duration**

To mitigate the impact of timelines associated with procurement of specialized equipment and materials the Region completed advance procurement of time sensitive

equipment, materials and infrastructure improvements prior to tendering the main contract. Examples of work already underway or completed include:

- Procurement of tunnel boring machines
- Procurement of precast concrete segmental tunnel liners
- Pre-purchase of inorganic biofilter equipment for the odour control facility
- Upgrade of haul roads to be used by the contractor in York and Durham Regions
- Archeological investigations and pre-clearance of shaft sites
- Relocation of utilities and installation of power supply to all mining sites

Proactively commencing and completing these procurement activities with the support of the Southeast Collector Team has reduced the schedule risk during construction by ensuring principle equipment and materials are ready for shipping to project sites as soon as required by the contractor. This advance procurement work has resulted in a project expenditure of approximately \$70,000,000 to date.

## **4. ANALYSIS AND OPTIONS**

### **Additional scope is required for project consulting team during construction and post-construction stages to 2018**

Throughout the detailed design phase the consultant team has been responsive by undertaking significant design revisions required to incorporate stakeholder input to the project. These revisions have increased both the scope and complexity of construction activities from that originally foreseen when the Engineering Services agreement was negotiated in 2008.

As a result of the changes, several factors now necessitate a change in scope for the consultant team during the construction and post construction phases of the work. These factors include:

- An increase in project complexity warranting additional supervision and inspection expertise on the consultant team to provide support, supervise and administer the contract including both tunnel and shaft construction
- New odour control and air handling facilities, as well as an upgrade to existing odour control facilities on the existing Southeast Collector, located on Townline Road, south of Steeles Avenue, none of which were specified in the original assignment.

- The need for comprehensive construction and post construction monitoring services and additional specialized project management support, including a project construction scheduler and a field accountant
- Salary escalation for services during construction attributable to two-year delay in the planned start of construction
- Inclusion of York-Durham Line reconstruction from Steeles Avenue to Fourth Concession in the construction contract

Costs for undertaking this additional scope do not change the forecasted cost to complete this critical infrastructure project. Changes to project scope outlined above do not impact forecasted construction costs and approved Total Project Budget Authority of \$546,087,000. Estimated total project costs have not changed since June 2009.

### **Increased project complexity impacts original Engineering Services Agreement allowances for tunnel construction and project management**

While the original 2008 Engineering Services Agreement included some staff resource requirements for contract administration and project management services, the final project scope has changed significantly since 2008. The current complexity and size of the project requires additional resources and level of effort beyond that contemplated in the 2008 agreement. Significant additional coordination, not only during construction but through commissioning is required. Additional staff are also needed for both on-site and specialized engineering support for the duration of tunnel construction, as well as through the post construction period to 2018.

It is typical of tunnel construction projects for contractors to devise alternative means and methods to complete the work. Alternatives are often borne out of desire or need to improve the schedule or to address developing issues that arise due to changing ground conditions. Accordingly it is necessary that the work scope and associated budget allocation be increased to provide additional project engineering support to review contractor proposals and the implications associated with their implementation. This additional level of effort will ensure issues that arise are addressed promptly to prevent schedule delay and to manage risk.

The original agreement provided for a part-time construction manager and given the current project complexity it is necessary that this be increased to a full-time resource. Person-hour increases are also required for resident engineers for tunnel construction, on-site support as well as project controls in the project management office. Budget for all on-site resources are time based and staffing will be reduced as the project approaches completion and needs diminish. Similarly, project management support is provided on an as needed basis and will be invoiced for actual hours worked.

### **Scope increase required to provide comprehensive and expanded air and odour management construction services on both new and existing Southeast Collectors**

The most fundamental issues arising from the individual environmental assessment for the Southeast Collector were air and odour management. Feedback received during the environmental assessment made it clear that successful odour management was paramount to the new project's success. The importance of addressing this issue is reflected in the stringent conditions associated with air and odour management included in the Minister's approval of the project.

While some odour management services were provided for in the original project consulting team's scope of work, it is now necessary to address both the existing odour control facility on the existing Southeast Collector and implement a very sophisticated odour control facility and air management plan for the new Southeast Collector. This comprehensive integrated approach will ensure untreated air is moved in the sewer to the new treatment facility to be constructed in York Region. Additional work scope resulting from these requirements makes it necessary to significantly expand the scope and level of effort provided in the consultant's construction and post construction services to include odour management works for the new Southeast Collector that were not previously included in the project scope.

Similarly, the existing odour control facility on the existing Southeast Collector sewer will be upgraded to new biofilter technology. The construction contract for upgrading the existing facility will be tendered later this year, but the consultant construction services are covered under the purchase order for the new Southeast Collector project. The existing odour control facility and these associated consulting team services were not previously provided for in the original project scope.

Along with new detail design and air flow modeling, the scope of additional services now includes inspection and administration of the odour control facilities and air handling fan facilities.

### **Significant additional multi-year construction and monitoring activities transferred from contractor to consultant**

Owing to the significant additional approval conditions and reporting obligations imposed by the Ministry of the Environment, the project team elected to retain direct control over reporting requirements that were originally planned to be included in the tendered construction contract. Project costs transferred from the contractor's control to the consultant's scope of services includes noise and vibration monitoring and settlement surveying. By retaining direct control through the consultant's team and services, the Region is better positioned to obtain thorough and timely information needed to fulfill the reporting obligations included in the project's conditions of approval.

Commissioning and start-up of the odour control facility and associated air handling facilities is typically tendered as a contractor activity, whereby the contractor performs process control trials and adjustments until the facilities are functioning as intended and then turned over to the owner for operation. Due to the critical importance of these facilities to the project's success, the Region has elected to retain control of this activity to ensure direct access and control of equipment and programming throughout the commissioning and start up process.

### **Consultant agreement includes provision for time escalation**

The existing agreement with the consultant contains provision for salary escalation due to time. The time escalation due to the delay of construction start from 2009 to 2011 is primarily due to the delay in receiving the individual environmental assessment approval and resultant changes to the odour control facilities.

### **Additional scope of work to address York Durham Line reconstruction**

The Class Environmental Assessment for the reconstruction and widening of York Durham Line was completed in 2006. The road construction was planned to commence upon completion of the Southeast Collector project; however, locating the odour control facility on York Durham Line necessitated that the roadway be realigned to accommodate the new facility as part of the Southeast Collector project. Consequently the consultant scope must now incorporate construction inspection and administration of the York Durham Line road widening and reconstruction. This work will be completed in two phases to coordinate with construction of the new odour control facility.

## **5. FINANCIAL IMPLICATIONS**

### **Southeast Collector Project forecasted cost to complete within existing total project budget authority**

The 2011 Council approved Total Project Budget Authority for the Southeast Collector Sanitary Trunk Sewer Project is \$546,087,000. On the basis of the low bid received and additional required work scope for the project consulting team, the total project costs are forecasted to complete within this total amount. Award of the contract and changes to the engineering fees during construction and post construction phases will proceed upon resolution of Provincial Allowable Repayment Limit financial requirements.

### **Engineering fees associated with a significant increase in construction services now reflect the additional project scope and complexity since 2008 agreement**

The current Purchase Order Value is \$52,839,513. Of this amount, \$23,318,672 was designated for construction period services. Construction period services were comprised of \$17,504,571 for contract administration and inspection plus \$5,814,100 for environmental monitoring. Fees associated with environmental monitoring are over and above what is typically required on construction projects and are not considered as part of engineering fee valuations.

The net increase for additional construction and post-construction consulting services to 2018 is \$18,523,319 (see Table 1). This increase is due to both expanded scope and to new work scope assigned within owner control summarized as follows:

- Expansion of current services during construction in the amount of \$11,385,505
- Transferred work scope which results in a fee increase of \$7,137,814 on previously unscoped items

**Table 1**  
**Additional Construction and Post Construction Scope and Associated Fee Increase Breakdown**

| <b>Description</b>                                                                                                                                                                | <b>2008 (\$)</b> | <b>2011 (\$)</b> | <b>Increase</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|-----------------|
| <b>*Scope Items Increased</b>                                                                                                                                                     |                  |                  |                 |
| Additional Tunnel and Shaft Construction to 2014                                                                                                                                  | 13,266,620       | 18,630,348       | 5,363,728       |
| <ul style="list-style-type: none"> <li>• Increased Resident Engineering Resources</li> <li>• Additional Construction Manager</li> <li>• Increased Inspection Personnel</li> </ul> |                  |                  |                 |
| Odour Control Facilities                                                                                                                                                          | 0                | 2,266,447        | 2,266,447       |
| <ul style="list-style-type: none"> <li>• Additional Resident Engineer</li> <li>• Increased Engineering Support</li> <li>• Additional Inspection Personnel</li> </ul>              |                  |                  |                 |
| Post Construction Services                                                                                                                                                        | 636,710          | 2,636,740        | 2,000,030       |
| <ul style="list-style-type: none"> <li>• Continued monitoring of surface and ground water, warranty period administration from 2014 to 2018</li> </ul>                            |                  |                  |                 |

|                                                                                                                                                                                                                                                                                      |           |           |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-------------------|
| Project Management                                                                                                                                                                                                                                                                   | 2,236,490 | 3,765,620 | 1,529,130         |
| <ul style="list-style-type: none"> <li>• Senior Project Controller</li> <li>• Contract Administrator</li> <li>• Field Accountant</li> <li>• Scheduler</li> <li>• Document Control and Admin support</li> </ul>                                                                       |           |           |                   |
| York Durham Line                                                                                                                                                                                                                                                                     | 0         | 226,170   | 226,170           |
| <ul style="list-style-type: none"> <li>• Additional Inspection Personnel</li> </ul>                                                                                                                                                                                                  |           |           |                   |
| <b>Sub-total Construction Services Scope Increase</b>                                                                                                                                                                                                                                |           |           | <b>11,385,505</b> |
| <b>Work scope transferred from contractor to consultant</b>                                                                                                                                                                                                                          |           |           |                   |
| <ul style="list-style-type: none"> <li>• OCF Commissioning and start up</li> <li>• Settlement Survey Monitoring</li> <li>• Noise and Vibration Monitoring</li> <li>• Process Control Programming</li> <li>• Provision of Site Offices</li> <li>• eBuild document platform</li> </ul> | 0         | 240,000   | 240,000           |
|                                                                                                                                                                                                                                                                                      | 0         | 1,081,500 | 1,081,500         |
|                                                                                                                                                                                                                                                                                      | 0         | 3,178,731 | 3,178,731         |
|                                                                                                                                                                                                                                                                                      | 0         | 187,583   | 187,583           |
|                                                                                                                                                                                                                                                                                      | 0         | 1,200,000 | 1,200,000         |
|                                                                                                                                                                                                                                                                                      | 0         | 250,000   | 250,000           |
| Disbursements contingency                                                                                                                                                                                                                                                            | 0         | 1,000,000 | 1,000,000         |
| <b>Sub-total Transferred Scope</b>                                                                                                                                                                                                                                                   |           |           | <b>7,137,814</b>  |
| <b>Total Fees for additional/expanded scope</b>                                                                                                                                                                                                                                      |           |           | <b>18,523,319</b> |

\*All costs include salary escalation allowance provided for in current agreement

**The Southeast Collector Team is well positioned to effectively carry out the specified tasks given their extensive work on this project to date and their world class experience on other tunnel projects throughout North America**

On the basis of the low bid received and advance procured materials, the estimated total cumulative value of the works to be constructed and installed under consultant supervision is \$361,000,000. This results in a valuation of consultant services for construction administration, inspection, project monitoring during construction and post-construction phases as well as associated project management of approximately 11.6% of construction value. This includes all environmental monitoring and transferred scope components that are not usually considered part of the engineering services valuation. Of this amount, monitoring requirements and other transferred activities comprise approximately 3.9% of construction value and comprehensive services during construction comprise approximately 7.7% of construction value.

Construction of this project will commence on multiple work sites in the Town of Markham and the City of Pickering. At peak productivity, four separate tunnelling operations will be conducted concurrently from three mining compounds, as well as shaft

construction at ten additional locations. Facilities associated with odour control will be under construction at three separate locations.

For each tunnel operation a full time in-tunnel inspector is required to monitor all subterranean activity associated with the tunnel boring machines and placement of the precast concrete segments. There will also be a full time surface inspector to monitor operations on the surface, activities which include the handling and transportation of muck mined from the tunnels as well as time of day sensitive issues such as noise and dust control. The contract permits construction up to 20 hours per day requiring two shifts of supervisory staff during peak productivity. This effort on mining operations is in addition to administering construction activities at over a dozen shaft and odour control/air handling facility locations. Full-time inspection and monitoring are required to ensure contractor activities are carried out in full accordance with all detailed permit requirements and obligations.

Resident engineers and engineering support roles will address technical issues as they arise. Engineering review will also be required on contractor proposals for changes in construction methodology or to address issues arising from actual site conditions. On-site resident engineers ensure prompt response, mitigate schedule delays and reduce the possibility for costly delay claims from contractors as a result of technical issues.

Project management personnel are responsible for continually maintaining the project schedule, identifying time constraints or delays, reviewing and approving contractor invoices for progress draws, as well as coordinating the receipt and review of all shop drawings and submittals that the contractor must provide for review by resident engineers and engineering support personnel. These staff will work from an on-site office which will be the project construction control centre.

Owing to the significant approval conditions imposed upon this project, post construction engineering services have been increased to cover not only warranty issues that are typical of post construction warranty periods, but also to undertake monthly and annual reporting of surface and groundwater monitoring to 2018 or as may be otherwise directed by regulatory agencies.

The level of effort and fees have been reviewed by staff and compared with other complex multi-disciplinary projects. Staff are of the opinion that the level of effort and fees are appropriate given the magnitude of this major tunnelling project. Fees throughout this phase of the project are time based and consultant staffing will be closely monitored and reduced as the project nears completion and needs diminish. By undertaking the project in this manner, the Region is in a better position to manage risks associated with construction and the critical monitoring activities.

Since 2002, approximately 960 purchase orders with a total value of approximately \$1.8 billion have been issued to secure engineering, consulting and construction services on water and wastewater projects. Of these, approximately 97 or 10% of the purchase orders have required increases beyond the increases allowed in the Regional Purchasing By-law.

The total value of such increases is approximately \$85 million or 4.8% of the total original value of the purchase orders.

### **Project remains within total budget authority despite significant changes**

The Southeast Collector project has been subjected to numerous and significant scope changes since commencement and has stayed within total project budget authority in large part due to strong engineering controls. Responsive revisions have been made to incorporate community input and regulatory requirements. Many of these changes have required substantial effort.

Recognizing that schedule is a significant factor, staff resorted to innovative practices to mitigate delays including the advanced procurement of time sensitive components as well as adopting several innovative approaches to ensure a successful tendering process. Success thus far is evidenced by the approval of the independent environmental assessment and the receipt of competitive bids from all of the prequalified bidders. Achieving these successes has required significant resources to ensure the schedule was not impeded further. Similarly a continued effort is required to ensure successful completion of the construction phase.

Notwithstanding the effort to date and forecasted costs to completion, the total project budget authority has remained constant since 2009. Barring significant events or issues arising, the project is forecasted to be completed within the current total project budget authority.

## **6. LOCAL MUNICIPAL IMPACT**

The Southeast Collector Sanitary Trunk Sewer Project is a critical infrastructure component to ensure adequate wastewater capacity for growth across the Region. Construction of the Southeast Collector is required to support forecasted growth within the Region, as established by *Places to Grow* and reflected in the Region's Official Plan (June 2009). The plan establishes forecasts for each local municipality for the plan period. Further, as envisioned in the Province of Ontario's *Growth Plan for Greater Golden Horseshoe (2006)*, there will be a requirement to service 1.5 million people and an employment population of 800,000 people by year 2031. To achieve this, a new Southeast Collector Sanitary Trunk Sewer is required to be in service by 2014 to provide adequate sanitary servicing capacity for the continued growth in York Region to 2036 as identified in the Region's Official Plan.

## **7. CONCLUSION**

It is recommended that pending award of the Southeast Collector Sanitary Trunk Sewer Project, Purchase Order B000118 issued to the Southeast Collector Team be adjusted to

reflect the increased and additional scope of engineering services during construction required to meet the current project scope and comprehensive Ministry of the Environment Conditions of Approval and Permit requirements.

For more information on this report, please contact Daniel Kostopoulos, Director, Capital Planning and Delivery, Environmental Services at (905) 830-4444 Ext. 5070.

The Senior Management Group has reviewed this report.