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TECHNICAL SUPPORT SERVICES FOR TUNNEL BORING MACHINES DURING CONSTRUCTION OF THE SOUTHEAST COLLECTOR TRUNK SEWER

The Environmental Services Committee recommends the adoption of the recommendation contained in the following report dated January 3, 2011, from the Commissioner of Environmental Services.

1. RECOMMENDATION

It is recommended that:

1. The two existing purchase orders with Lovat Inc. for manufacture, supply and delivery of four tunnel boring machines be increased by \$4,257,100 to a new combined total of \$41,508,900 to incorporate additional technical support services required for the commissioning, operation, maintenance and disassembly of the machines during construction of the Southeast Collector Trunk Sewer.

2. PURPOSE

The purpose of this report is to secure authorization to increase Lovat Inc.'s two existing purchase orders to include all technical services and assistance required for the tunnel boring machines' commissioning, operation, maintenance and disassembly commencing in 2011 and continuing for the duration of construction of the Southeast Collector Trunk Sewer to 2014.

3. BACKGROUND

York Region ordered tunnel boring machines in 2009

The approved Individual Environmental Assessment is based upon the new Southeast Collector Trunk Sewer being constructed using Earth Pressure Balance tunnel boring machines to ensure minimal impact to private wells, groundwater and surface water systems, and the natural environment.

Since manufacturing of tunnel boring machines takes approximately one year, advanced procurement of this equipment was necessary to enable commencement of tunnelling activity immediately upon receipt of all required approvals. On April 23, 2009, Regional Council authorized staff to enter into an agreement with Lovat Inc. for manufacture, supply and delivery of four earth pressure balance tunnel boring machines. To protect the Region's opportunity to tender the Southeast Collector tunnel contract as two separate tenders, the Region issued two separate purchase orders (two tunnel boring machines

each) to Lovat Inc. The tunnel boring machines are now manufactured and awaiting delivery to the Region. Council's proactive decision has prevented a year of lost productivity that would have otherwise been incurred if procurement had been left to the successful contractor.

Scope and contingency allowances were activated to complete tunnel boring machines

At the time of ordering, purchase orders were issued to Lovat Inc. on the assumption that one or possibly two tunnel contractors would be retained and assume the contract with Lovat Inc. to become responsible for final completion of the tunnel boring machines. By enabling the contractor to complete the machines, they would have opportunity to select specific components to suit their preferences and by extension become responsible for the performance of components selected. Payment for works from final completion to placement into service were planned to be made to the tunnel contractor under the tunnel contract and therefore not included in the original purchase orders to Lovat Inc.

Subsequently, project delays were incurred to address unanticipated Ministry of the Environment approval conditions and the Region was unable to tender the tunnel contract and novate (assign) the Lovat Inc. contract to a successful tunnel contractor prior to completion of the tunnel boring machines. As a result, it became necessary to increase the original purchase orders with Lovat Inc. to fund final completion of the machines. The purchase order increases were administered per the initial prices negotiated with Lovat Inc. in 2009 and in accordance with the contingency and scope allowances provided in the Region's purchasing by-law. Items added to enable completion of the tunnel boring machines include installation of an electronic guidance system, segment cars, gas detection systems, data cables and a set of disc cutters. The remaining permissible scope change allowance is insufficient to address technical services needed during construction and consequently, Council approval of an increase is required.

York Region to retain ownership of tunnel boring machines to oversee and influence maintenance for risk mitigation

Since the Region was not able to novate the Lovat Inc. contract for tunnel boring machine supply to a successful contractor prior to completion of the tunnel boring machines, Regional staff reviewed the merits of transferring ownership of the now completed tunnel boring machines to the contractor versus retaining ownership for the duration of construction.

The principle benefit of novation was to have a contractor take responsibility for completing the tunnel boring machines to select the operation systems and equipment. Since the Region was required to complete the machines on account of delays to respond to Ministry approval conditions, the benefits of novation were lost.

To effect a decision on whether to novate or keep the machines, staff evaluated experience gained during recent tunnelling projects and determined that improved tunnel boring machine maintenance combined with more instrumentation data access could have prevented or mitigated problems and resultant delays.

Under past contracts, the contractor owned and maintained the tunnel boring machines, the contractor had sole control over maintenance decisions. In addition, access to the tunnel boring machine's instrumentation data was in complete control of the tunnelling contractor. Neither the Region or its consultant team could readily assess conditions in real time to influence corrective action. Data and changing conditions were more often reported after the fact. This practice required the Region and consultant team to make reactive decisions and reduced opportunity to make proactive recommendations on the contractor's operational practices or maintenance decisions.

After much analysis, the Region elected to retain ownership of the tunnel boring machines for the Southeast Collector project. As owners, the Region will retain rights to oversee and influence the contractor's maintenance activities, maintenance schedule, as well as have real time access and first rights to all instrumentation data from the tunnel boring machines. The contractor will remain responsible for operating tunnel boring machines and performing required maintenance as directed by the owner and in accordance with all Ontario Health and Safety Act requirements.

It is noteworthy that this practice of retaining ownership of owner procured machines has also been adopted on the recently awarded \$279,078,688 Toronto Transit Commission subway contract to extend the Spadina subway north to the Vaughan Corporate Centre.

Complexity of constructing sewer tunnel will require skilled technical support service to reduce undue construction delays

Due to the specialized nature of tunnel boring machines and the instrumentation selected for use on this project, the Region must retain skilled technical support services to ensure collection of significant data in the event of any mechanical issues, changing ground conditions and mitigate against the potential for legal claims. Technical support technicians will continuously monitor mechanical, hydraulic and electrical operations to ensure performance of required maintenance. Technicians will also monitor a continuous stream of telemetry data and report directly to the Region. Using this operating model, the Region will be better positioned to resolve complications and reduce undue construction delays.

A potential benefit of retaining technical support services to oversee and ensure appropriate maintenance is that the tunnel boring machines are expected to complete the project in better condition and with higher resale value or potentially be available for re-use on future Region projects if appropriate.

4. ANALYSIS AND OPTIONS

Risks are reduced by Lovat Inc.'s direct support services to York Region

To ensure appropriate maintenance of the tunnel boring machines and their instrumentation by the contractor, it is recommended that Lovat Inc. provide technical support services to oversee contractor operation and maintenance practices for the duration of tunnel boring construction. Lovat Inc. is the original equipment manufacturer for the Canadian made tunnel boring machines and is a recognized global leader of this highly specialized technology located here in the Great Toronto Area. As designer and manufacturer, Lovat Inc. is best positioned to deliver the required services effectively and with assurance of capability.

Expert analysis of tunnel boring machine data will provide York Region assurance that equipment is being maintained and operated effectively

Historically, past tunnelling contracts have relied upon the contractor to source, own, operate and maintain tunnel boring machines and instrumentation. In this circumstance, typically the contractor provides its own maintenance staff and only outsources specific maintenance issues to the tunnel boring machine manufacturer. In this scenario, the manufacturer reports to the general contractor and responds according to the contractor's preferences, which may increase risk to the Region. Also under this scenario where the contractor procures the machines, important machine condition and instrumentation data is reported to the contractor first and the Region second. In some cases only limited data on machine condition is provided to the Region.

By directly retaining Lovat Inc., the Region is assured direct and timely access to all tunnel boring machines condition reports, instrumentation equipment and data. Lovat Inc. will report directly to the Region and there will be no delay or filtering of information on all issues. This will ensure the Region has the best available information in the event of any mechanical issues, changing ground conditions or legal claims arising from the work. The Region will be better positioned to resolve complications in a timely manner and reduce undue delays.

5. FINANCIAL IMPLICATIONS

The technical support services required during the commissioning, operation, maintenance and dismantling of the tunnel boring machines and the corresponding hourly rates for these services by Lovat Inc. specialists were included in the original contract negotiations in 2009; however, the costs for these services are not part of the current contract price as the current purchase order was issued to only include manufacture and supply of the tunnel boring machines. Service during the construction phase as recommended for approval will be based upon the previously negotiated rates.

As there are four machines in concurrent operation, the cost estimate for the recommended purchase order increase has been premised upon full time services until completion of the tunnelling operations. Technical support costs are summarized in Table 1.

Table 1
2011 – 2013 Technical Support Cost Summary

Project Year	Description of Technical Services	Total Annual Cost
2011	Storage, Technical Support during Commissioning, Tunnel Boring Operation and TBM maintenance	\$472,500
2012	Storage, Technical Support during Commissioning, Tunnel Boring Operation, TBM maintenance and disassembly	\$2,535,500
2013	Technical Support during Tunnel Boring Operation, TBM maintenance, and disassembly	\$1,249,100
Total		\$4,257,100

The estimated cost of the technical support services for the duration of tunnelling operations (2011-2013) is \$4,257,100 excluding all taxes. These services will increase the combined value of the two existing Purchase Orders from \$37,251,800 to \$41,508,900. These same costs would be incurred if procured through the tunnel construction contract and would have been subject to a further contractor mark up premium. This increase is approximately 1% of the estimated \$400,000,000 construction cost and is fully within the current project budget. The 2010 Capital Budget outlines a total budget for this project of \$546,087,000 with \$158,346,000 approved for 2011.

6. LOCAL MUNICIPAL IMPACT

The Southeast Collector Trunk Sewer is a critical infrastructure component to ensure adequate wastewater capacity for growth across the Region. Construction of the Southeast Collector Trunk Sewer 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 Trunk Sewer is required to carry projected flows to accommodate growth in the Region to 2036 and beyond.

7. CONCLUSION

It is recommended that the Region increase the existing Purchase Orders to Lovat Inc. to include their technical assistance and support services required for tunnel boring machines commissioning, operation, maintenance and disassembly needed for the construction of the Southeast Collector Trunk Sewer.

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.