QUEENSVILLE-HOLLAND LANDING-SHARON (QHLS) WASTEWATER SERVICING PROJECT

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PROJECT SUMMARY

The Queensville-Holland Landing-Sharon (QHLS) Wastewater Servicing Project provides sanitary servicing for three communities in the Town of East Gwillimbury, one of the fastest-growing municipalities in Ontario. WSP led the design, construction and commissioning of the new system. The project demonstrated high level cooperation and integration of efforts to implement the major infrastructure improvements. Core components of the project included approximately 45 km of small to large diameter trunk sewer mains, forcemains and watermains and three new sewage pumping stations (SPS) situated at strategic locations.

INNOVATION

The QHLS project's core components include approximately 45 km of small to large diameter sewers and forcemains and three new sewage pumping stations located at strategic locations in East Gwillimbury. Road reconstruction, new bridges and new watermain installation along the sewer route were undertaken in conjunction with the core works, in order to realize both economies of scale and to minimize the overall disruption to residents associated with construction. Separating the QHLS project's core components into six construction contracts was a key element in the overall strategy for expediting these major works and keeping project costs down.

The project experienced a number of design and construction issues that required innovative solutions to ensure the work could be completed in a timely and cost effective manner.

COMPLEX PUMPING STATION DESIGN

All three sewage pumping stations have initial flow and forcemain configurations which primarily convey flow to the south, and flow will ultimately be reversed to convey sewage to the north to the proposed treatment plant. The pumps and forcemain systems have therefore been designed for two conditions and this has been accomplished using pumps equipped with variable frequency drive (VFD) motors that meet both the initial and ultimate head and flow requirements so that the pumps do not have to be changed for the ultimate flow requirements.

The forcemains from the 2nd Concession SPS to the Newmarket SPS have a high point along the forcemain route which posed a hydraulic and transient issue with negative pressure developing in the forcemain when pumps stop as well as the forcemains draining when the pumps stop. The design solution for this problem was to install throttling valves controlled by actuated valves at the end of the forcemains at the Newmarket SPS. The pumps and the actuated valves are interconnected through the Region's SCADA system and the valves open and close based on pump run or stop status. Final settings for the control system were based on field trials.

TUNNEL WITH PIPE ARRAY

Five forcemain pipes and a watermain were to be installed along 2nd Concession Road which involved installation through a small hill where the pipes would need to be buried at depth of 11m to accommodate future lowering of 2nd Concession Road. Installation by open trench would mean removal of the hill, creating issues with adjacent private property. The solution was to construct a 400m, 2.1m diameter liner pipe by micro-tunnelling through the hill and then install a pipe array of the five forcemain pipes within the liner pipe. The installation of the pipe array was very efficient, as an innovative rail system, to roll the pipe array into the liner was designed. Deeper sections of other pipes were also installed by micro-tunelling due to a high ground water table and environmental concerns.

DIRECTIONAL DRILLING

The installations of twin forcemains along Bradford Street in Holland Landing was by directional drilling. The contractor discovered, when excavating for the exit shaft, the abutments for an old bridge were never removed when the bridge was decommissioned. The old bridge deck was also dropped between the bridge abutments. Continuing would have required full road closures of a major arterial route. To mitigate the issue, the twin forcemain alignment was revised quickly and included a new air release valve chamber to handle the newly created high point.

PIPES ON NEW EAST HOLLAND RIVER BRIDGE

Once it was determined how many pipes needed to cross the East Holland River, the question was HOW? Open-cut was not a consideration and trenchless methods came with high risks with the potential of frac-outs in the river. The answer was to hang the pipes on the side of the bridge, but with many pipes the aesthetics would be of concern. The solution was to design the bridge to accommodate the pipes within the structure. A few of the insulated and heat traced pipes are only visible from underneath the bridge.

COMPLEXITY

The QHLS Project was a very complex project with six construction contracts and four contractors all working on adjacent sites over a 3 to 4 year period. Coordination was one of the major constraints with four contractors working adjacent to each other. In addition to the project works, extensive coordination was required with multiple agencies and groups while other construction projects occurred simultaneously adjacent to the 2nd Concession corridor. These included a new public school, a Paramedic Response station, and extensive subdivision construction.

Due to the high groundwater table, the design and construction methodology were selected to minimize dewatering requirements. This included installing the large (12-15 m) diameter and deep (25-30 m) wet wells for the sewage pumping stations by drilling caissons and installing a tremie plug at the bottom so that the permanent structure could be built in the dry with minimum dewatering. Similarly, the shafts for micro-tunnelling were installed using the sunken shaft method, which eliminated dewatering and allowed the shafts to be constructed expeditiously while minimizing environmental impacts. Trenchless methods were utilized not only to mitigate environmental impacts but also to minimize public inconvenience at road and railway crossings.

SOCIAL / ECONOMIC BENEFITS

Public consultation and liaison were critical issues for York Region in order to keep local municipalities, conservation authorities and the public informed of construction activities. An extensive consultation program was implemented during the construction period to keep all residents and stakeholders informed of construction activities and to address residents' concerns.

In conjunction with a community engagement program, it was imperative that the contractors adhered to the approved traffic management plans and that they did not cause significate delays to the travelling public. Detailed traffic management plans were developed along all major corridors impacted by construction including partial road closures and temporary traffic diversions to minimize impact to the general public. Further, all roads, boulevards and associated rights-of-way disturbed by construction were restored to their original pre-construction condition or better.

A new pedestrian bridge over Sharon Creek was constructed in Rogers Reservoir connecting two previously isolated trail networks. Connecting the two trails enhanced nature appreciation and wildlife viewing opportunities in Rogers Reservoir for East Gwillimbury residents. The connectivity also allowed residents to travel between Sharon, Holland Landing and Newmarket by foot or bike.

A testament to the goodwill developed and maintained during the course of the project was the 2nd Concession Re-Opening Street Festival organized by York Region and Town of East Gwillimbury in the summer of 2017. This event was attended by upwards of 1000 residents and corridor users and was a huge success. This event combined an official ribbon-cutting ceremony with a community barbeque, live entertainment, and guided walking and cycling tours of the boardwalk and trail connections.

ENVIRONMENTAL BENEFITS

In an effort to minimize potential adverse environmental effects, the construction of the linear works was undertaken using trenchless methods to cross permanently flowing watercourses and some of the unevaluated wetland features along the corridor. The use of trenchless methods at watercourse/ wetland crossings eliminated the need for in-water work or works in close proximity to these features and did not result in a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat.

Based on the high groundwater table, shafts for micro-tunnelling were installed using the sunken shaft method which eliminated dewatering and allowed the shafts to be constructed expeditiously while minimizing environmental impacts.

Pike Spawning Channels were created to enhance spawning opportunities for Northern Pike (a popular recreational species) which likes to spawn in side channels and vegetated floodplains. The area has also been utilized by Snapping Turtles (a special concern species at risk), Great Blue Herons, Mink and various other fish and wildlife species.

Two anuran (frog) breeding ponds with turtle basking logs and two turtle nesting mounds were created in Rogers Reservoir. Frog breeding and other wildlife use have been observed this year.

Butternut restoration plantings were made as compensation for Butternut trees impacted during construction of the Holland Landing twin forcemains and the Sharon Trunk Sewer. The plantings were done at higher ratios in accordance with the Endangered Species Act than those affected by the works in an effort to not just compensate for impacts, but rather increase the population of this endangered species in the local landscape.

Rogers Reservoir is a very important location in East Gwillimbury as it contains both significant natural and cultural heritage features for the community. The area attracts over 30,000 people a year and the reservoir is home to numerous plants and animals. The Sharon Trunk Sewer was designed by Micro-tunnelling to eliminate surface disruption and dewatering activities, and construction within the reservoir occurred in the winter when the ground was frozen as to not disrupt nesting species.

MEETING CLIENT'S NEEDS

The QHLS project demonstrated a high level of cooperation and integration of effort on the part the Region, the Municipalities, environmental agencies, as well as private sector interests to implement major infrastructure improvements in a coordinated manner, at a reduced overall cost and with minimum disruption to the public and the environment.

York Region was able to expedite major construction programs while keeping costs down. At the same time, the Region implemented a comprehensive strategy for ensuring quality in the constructed projects.

These strategies have resulted in the timely completion of a high quality sewer system and pumping stations that provide York Region with operational flexibility for existing operating scenario. Flow can be directed to the north with minimum modifications to the pumping stations once the new treatment plant is built.

The project participants' commitment to safety allowed six major construction contracts to be completed without any lost-time injuries.

Awareness of environmental considerations was demonstrated in many facets of the project, such as meeting the stringent Ministry of Environment conditions for protection of species at risk and environmental monitoring throughout the construction period with monthly reports with respect to dewatering; environmentally-conscious design of 14 watercourse crossings, including fish habitat enhancement at selected locations and significant compensation works.

The York Region and the local municipalities, together with WSP and the various construction teams, successfully met the many challenges inherent in a multi-contract, multi-player construction project of the scale and complexity of the QHLS Wastewater Servicing project.

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