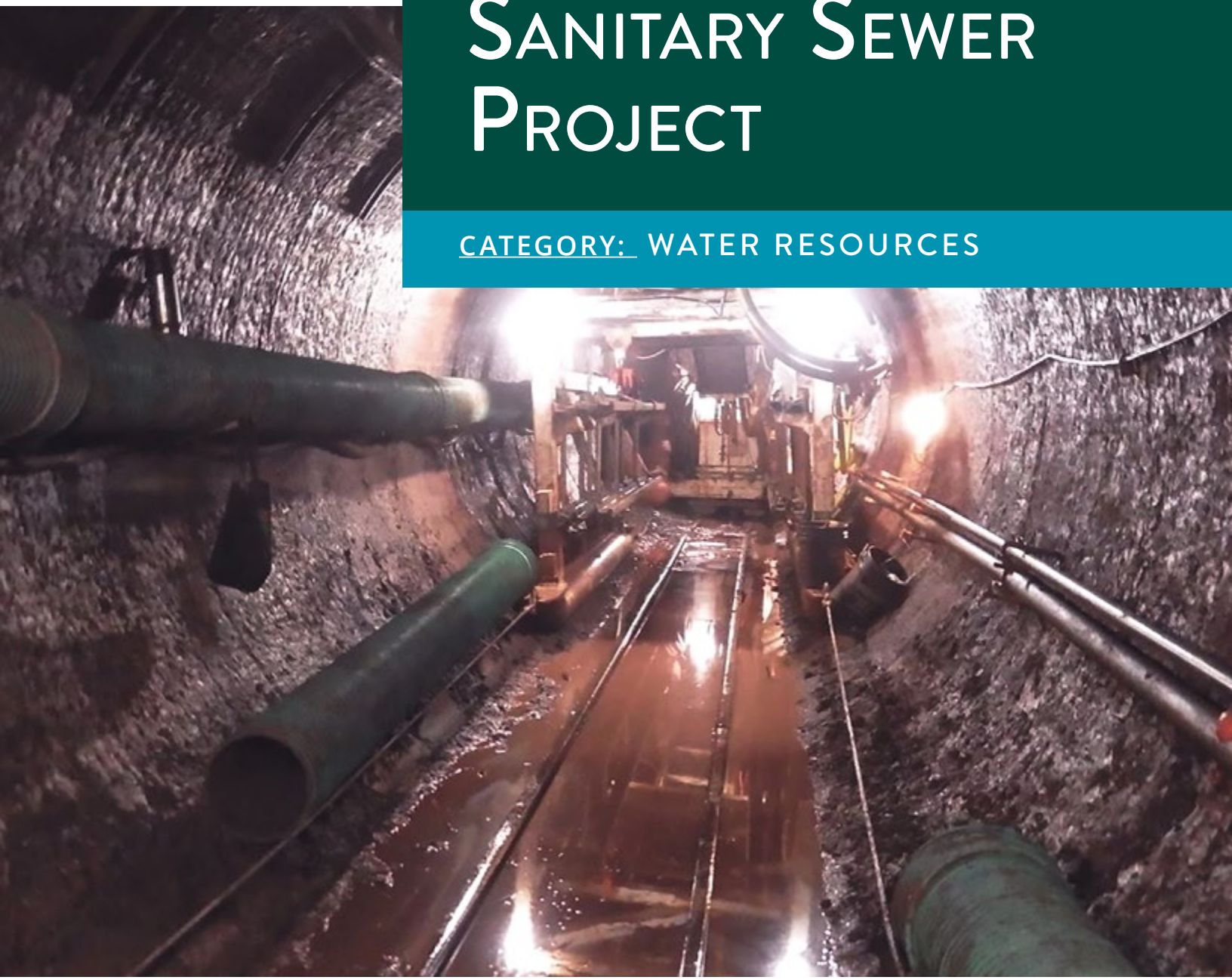
DILLON CONSULTING

Boyne Trunk Sanitary Sewer Project

CATEGORY: WATER RESOURCES



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CANADIAN CONSULTING ENGINEERING AWARDS | 2018

PROJECT INFORMATION

Project Name: **Boyne Trunk Sanitary Sewer Project**

Location: **Region of Halton, ON**

Completed: **July 2017**

Firms: **Dillon Consulting Limited**

Contacts:

- Bill Allison, P.Eng.,
- Mark Hunter

Other Firms Involved:

- RV Anderson Limited
- Dibco Underground Ltd.
- Varcon Construction

PROJECT SUMMARY

With Ontario's Places to Grow legislation, the northern portion of Halton Region has seen phenomenal growth which is expected to continue for many years. Development has been rapid albeit constrained by the limited capacity of the existing trunk sewers that convery sewage to treatment plants. The Boyne Trunk Sanitary Sewer was identified in the Region's Wastewater Master Plan and commissioning of this new major trunk sewer was critical to the overall economic well-being of Halton.

PROJECT HIGHLIGHTS

- Total length – 8.35 km
- Start – 3rd line and Dundas Street in Oakville
- End – Regional Road 25 and Britannia Road in Milton
- Maximum Internal Diameter 2.4m
- Construction Duration - 28 months with up to 5 contractors working simultaneously
- Overall Duration (environmental assessment to commissioning) - 8 years
- Average Tunnel Advancement per 24 hour day – 8m
- Maximum Depth to Bottom of Pipe – 26.2 m
- Number of Individual Pipes – 1,235
- Maximum Weight per Pipe length– 24.5 tonnes
- Sewage Conveyance Capacity (2031) -5.275 m^3/s or about 90 million; 5 litre toilet flushes per day
- Cost - $90 Million
- The southern contract (S2584C-12) was capable of conveying sewage in early February 2016, with substantial completion on June 30th, 2016. The sewer was not needed in service until the upstream contract was completed so additional time was provided to the Contractor to clean up minor deficiencies.
- The northern portion (R2186B-14) had a tender completion date for the sanitary sewer of December 8, 2015. Other than the connection to the Boyne Sewage Pumping Station, the sewer was completed on December 23, 2015 ahead of the required January 29, 2016 commitment.

INNOVATION

Based on the Region of Halton's Sustainable Master Plan, a significant up-front infrastructure funding requirement of approximately $1.7 billion was identified to address the growth demands in the Region. The Boyne Trunk Sanitary Sewer was one of these significant infrastructure projects with an estimated cost of approximately $90 million. Sewer construction was divided into two main contracts, north and south of Lower Baseline Road to coincide with required road improvements. Three months prior to tendering, a section of approximately 1250m of 1500mm diameter sewer was added to the project to be tendered.

The project team designed the project to maximize the use of trenchless technologies to reduce the project's overall impact to the environment and community, minimize cost and shorten the schedule. Trenchless technology is a type of subsurface construction method that minimizes impacts to the surface and can make construction projects a lot less intrusive. It is a rapidly growing sector of the infrastructure industry.

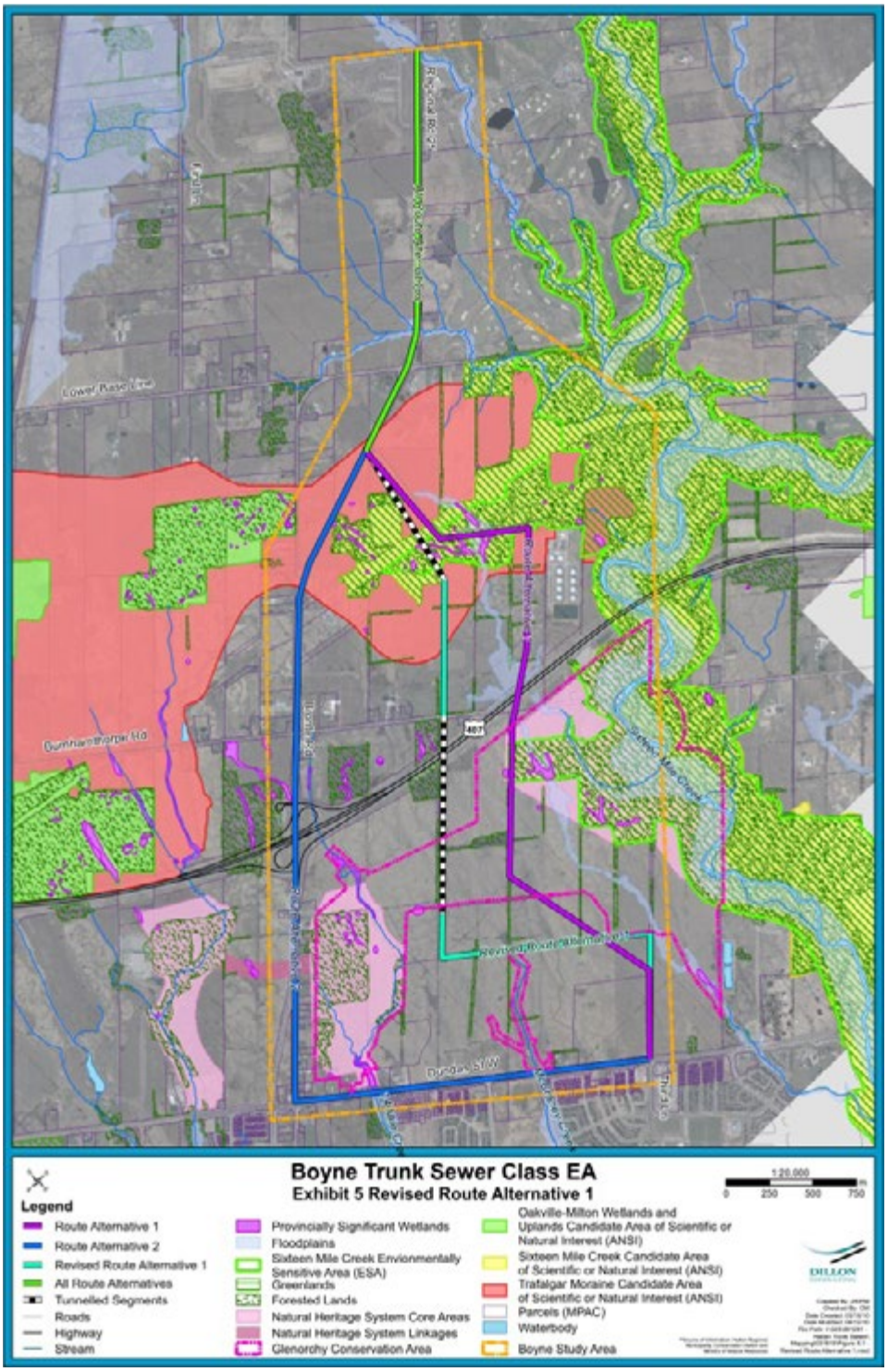
The Region employed a "teamwork" approach with the Contractors to deliver the project in the best way possible. It is this combination of approaches that facilitated the delivery with reduced impacts to the environment and the greatest possible overall benefit to the residents of Halton.

The significant elevation difference between the upstream and downstream connection points were addressed as part of the hydraulic

design. The large diameter of the pipe meant that the grade of the pipe had to remain fairly flat to avoid excessive flow velocities. Drops of a maximum of 600mm were incorporated along the entire alignment to address the elevation difference eliminating the need to construct large, very expensive custom drop structures within the chamber.

Oversized risers were used at strategic locations to accommodate video equipment required to monitor a sewer of this size and chamber were designed so that future maintenance access would be obtained by removing the flat cap located just below ground surface eliminating the need for future modification.

To reduce the potential for infiltration and exfiltration and to maximize the life of the sewer, watermain quality concrete pressure pipe was stipulated for the project. A microbial inhibitor was specified within the concrete of the pipe and all concrete on the project potentially coming in contact with sewer gases. The inhibitor reduces the potential for hydrogen sulphide corrosion of the concrete which plagued the existing pumping station and gravity sewer which are being replaced with this new sewer.



Site map of project area

COMPLEXITY

Many of the challenges were due to the number of public and private concerns with this major infrastructure improvement.

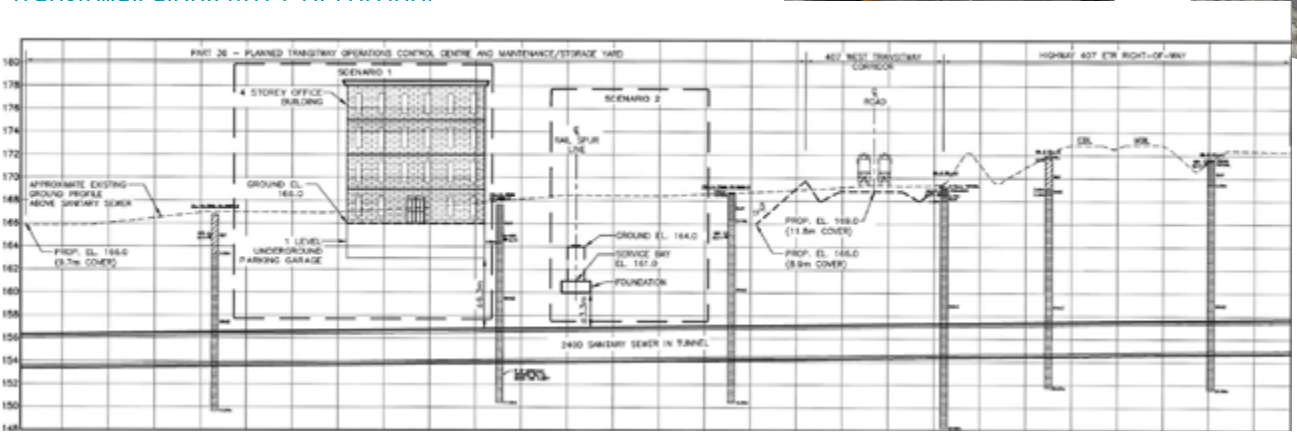
- The Glenorchy Conservation Area Environmental group were concerned about crossing the newly designated Conservation Area
- Local residents were concerned over the long term impact on their wells
- MTO has future plans for a rail based transitway adjacent to Highway 407 ETR
- The Town of Oakville required the sewer to be designed away from a future park

Construction was impacted by the very harsh and prolonged winter of 2015 that required additional crews in the spring, working up to 24 hours per day to recoup the schedule. The shale through which the tunnel was excavated contained high in-situ lateral stresses which required the tunnel to remain open for a minimum of 100 days before grouting could begin. More firmly than anticipated bedded shale made excavation more difficult and required blasting of the southerly open cut section within the Town of Oakville.

The future transitway along Highway 407 ETR was a key concern for MTO. As there were no set plans for the development of the site, a hypothetical plan for development was agreed to with MTO. The plan included three levels of underground parking and subsurface locomotive maintenance. The tunnel and the pipe beneath the future development was modelled using Finite Element Analysis (FEA) method to assess the potential effect of the structures on the sewer. Over-strength concrete pipe were required to mitigate the impacts of this future loading condition.

Varcon installing first pipe. Bulkhead installed on pipe was removed once Dibcos final stretch of tunnel/pipe was ready for connection.

hypothetical loading situation for potential future transitway along 407 ETR corridor



SOCIAL AND/OR ECONOMIC BENEFITS

Halton's approach to financing growth-related infrastructure differs significantly from the surrounding Regions of Peel, York and Durham that received provincial funding in the 1970s and early 1980s to finance similar infrastructure projects. In Halton, the development community provides early payment of future development charges (DCs) over and above the current allocation DC payments. This partnership has been extremely successful for over 20 years as it has allowed vital infrastructure to be built and financed without undue burden on the tax payer or the need for major provincial or federal funding.

The key benefit of this project is to the local economy and allows a major constraint to the potential growth of Milton to be overcome. Construction of new homes in Milton can continue as well as all of the spin-off benefits attributable to new home construction such as home decorating, landscaping and furniture purchases. The consulting and contracting teams worked closely together with the Region to overcome many hurdles. The result is a successful project that will greatly support the strength and growth of our economy.

This project had significant public consultation, both through the environmental assessment and the detailed designs. Prior to construction, nearby residents were made aware of the upcoming works with primary impacts to traffic and groundwater. The concerns of residents were heard and alterations to the project were made to ensure that the project was delivered meeting both the Regions and the residents best interests.

Installing first pipe.

ENVIRONMENTAL BENEFITS

The project was designed to reduce its overall impact to the environment during construction and long term operation. Analysis determined that this project is carbon negative in that the carbon emissions created during construction will be quickly balanced by the reduction of carbon emissions associated with the discontinued use of the pumping station. This is a very good news story that although there was a large carbon footprint associated with construction and material supply, the gravity sewer will reduce carbon emissions over the long-term, which are a leading cause of climate change.

Any potentially contaminated material was collected, tested and hauled to appropriate receivers as determined by the results of the tests. The results of the surface water discharged helped the Contractor, in consultation with the Region's team, to further refine their treatment methods to minimize the potential contaminants released into the environment.

Groundwater levels and surface water levels in both creeks and wetlands adjacent to the project were intensively monitored. Due to the significant dewatering required to complete this work, impacts to the groundwater levels were expected and tracked accordingly. If any impacts had been identified to the wetlands, mitigation measures would have been implemented. However, there were no impacts detected within the wetlands attributable to the construction.

Nest searches and land clearing occurred early in the project to avoid disturbing any potential nesting sites. A temporary crossing over a regulated watercourse was installed in late winter to provide access to portions of the site isolated by the watercourse.

MEETING THE CLIENT'S NEEDS

The commissioning of a new major trunk sewer to replace the existing system and to convey the future flows from the northern reaches of the Region was of critical importance to the overall economic well-being of Halton. Failure to appropriately address the sewer capacity constraint could have resulted in a development "freeze" in Halton with curtailed construction and sale of new homes and the loss of the associated economic spin off benefits.

Safety was an integral component of the project's construction. Weekly safety meetings took place for all staff present on site with specific training provided by the tunnelling contractors for their staff, and any members of the owner's project team, who could have required the need to enter the excavations. Safety discussions occurred at each project meeting. There were only 2 lost time days due to injuries for the entire project. The estimated lost time injuries per 1000 hours worked was less than 0.01 days.

As a result of the close relationship between the development community and the Region, it was agreed that the Region would be able to issue occupancy permits for new developments in Milton in January 2016.

Inside the tunnel from Shaft 9 to 10 where the contractor was nearing tunnel completion. From this picture you can see the pipes for ventilation, water and electricity.