

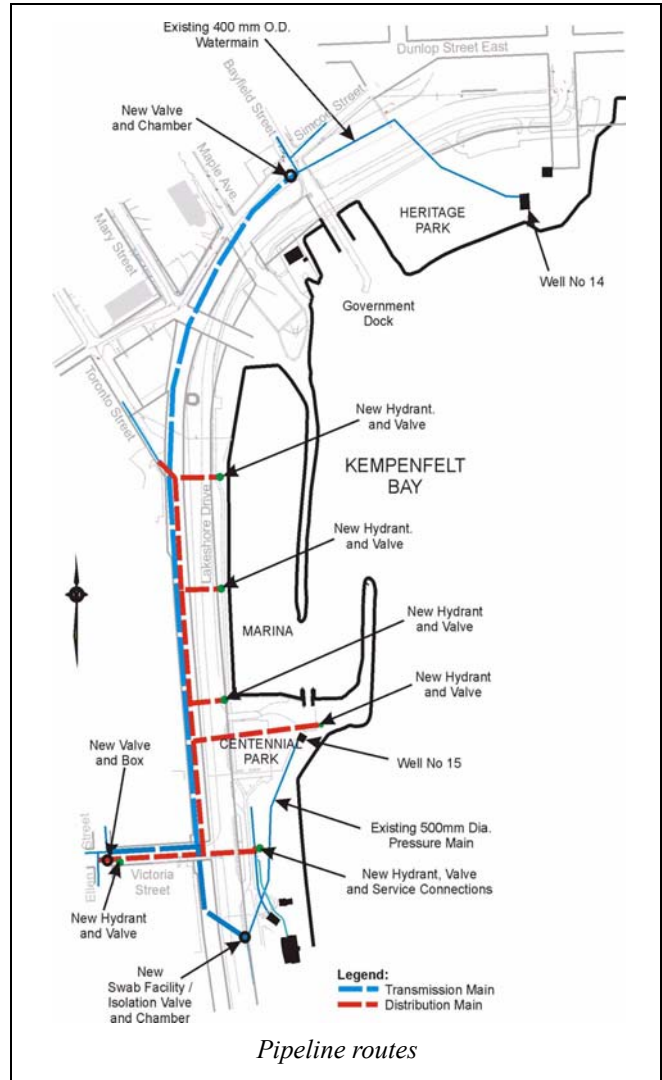
## Barrie's First Horizontal Directional Drilling (HDD) Project

In early 2002, the City of Barrie (Ontario) in co-operation with the Ontario Ministry of the Environment (MOE), determined that, under certain conditions, the water output (106 Lps) from Heritage Well No. 14 had insufficient chlorine contact time. To rectify the problem, the City concluded that a new 1040-metre transmission main to provide the required chlorine contact time was required, along with a 622-metre distribution watermain, complete with 6 new fire hydrants. The MOE required that the new transmission main be in service by December 31, 2002.



*Abandoned railroad right-of-way adjacent to Lakeshore Drive.*

The project site is in the heart of Barrie along the shore of Kempenfelt Bay. The alignment was to be within the abandoned railroad right-of-way in the vicinity of Lakeshore Drive. An existing 1200 mm diameter sanitary sewer, buried fibre-optic cables and various other utilities are buried beneath Lakeshore Drive, parallel to the proposed watermains. The project presented considerable challenges since the alignment is immediately adjacent to a marina and waterfront beach/park and also required three creek crossings. Part of an old corduroy road was discovered beneath the abandoned railroad right-of-way. This road is suspected to be a remnant of an important link in the supply route from York (now Toronto) to the former British naval base at Penetanguishene. The naval base helped protect Canada from invading American forces during the war of 1812.



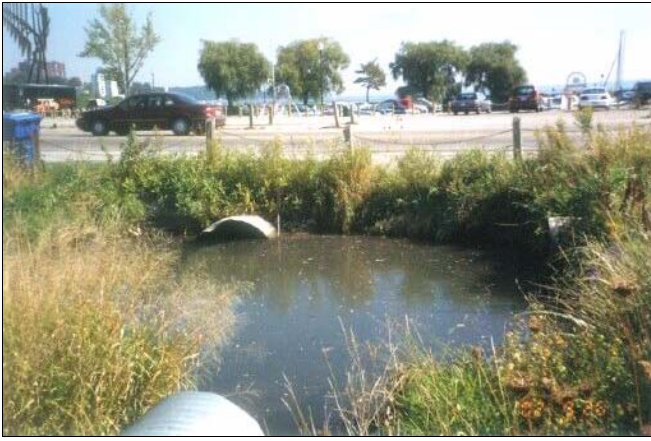
*Waterfront Park at Lakeshore Drive.*

A geotechnical investigation, undertaken by Peto-MacCallum Limited of Barrie, revealed a significantly high-water table along the proposed route. Groundwater or wet cave was noted in the boreholes at depths of 0.3 to 2.4 metres. The soils comprise sand fill over discontinuous but extensive layers of peat /organics over a major basal sand component. Organic deposits of peat or marl were encountered along the majority of the proposed alignment - ranging in thickness from less than 1 metre to 4.5 metres and extending down to depths of 4 to 10 metres. The completed geotechnical report predicted long-term settlement of up to 500 mm if conventional trenching and backfill methods were used. To support the watermain and provide the greatest assurance against settlement of the pipe, the report suggested that a piled foundation system and continuous grade beam would be necessary.

Following the geotechnical investigation, the Ainley Group was retained to analyze the cost-effectiveness of conventional design, the requirements for dewatering, optimum trench support and watermain structural support (pile and grade beam). Consideration was also to be given to a submarine crossing beneath Kempenfelt Bay - but *only on a conceptual basis*.

Approximately 70% of the transmission main and almost 100% of the distribution main and fire hydrant locations lay within an area of deep organic deposits. The Ainley Group determined that these site conditions indicated horizontal directional drilling (HDD) with HPDE pipe was a construction method worth considering; however, this construction method was unfamiliar to the City of Barrie. Furthermore, HDPE pipe was not on the City's approved material list. Nevertheless, the draft pre-design report addressed four construction alternatives:

Option	Location	Considerations		Cost Estimate
		Advantages	Limitations	
Conventional Open Cut	Railroad Right-of-Way	<ul style="list-style-type: none"> <li>Several pipe materials available</li> <li>Many contractors can bid work</li> </ul>	<ul style="list-style-type: none"> <li>Corduoy road would be destroyed</li> <li>Poor soils - require piles, grade beams &amp; concrete bedding</li> <li>Wide trench or trench box required</li> <li>High water table - required well points along entire project</li> <li>Disruption to public access to park and marina</li> <li>Difficult creek crossings.</li> </ul>	<b>\$1,900,000 (Tendered)</b>
Conventional Open Cut (shallow trench)	Railroad Right-of-Way	<ul style="list-style-type: none"> <li>Can shallow bury in RR with insulation and berming</li> <li>Several pipe materials available</li> <li>Many contractors can bid work</li> <li>Much of corduroy can remain undisturbed.</li> </ul>	<ul style="list-style-type: none"> <li>Poor soils - consider soil stabilizing geo-fabric c/w filter cloth wrapped clear stone bedding and backfill</li> <li>Depth must be greater than 1.2 metres because of live-wheel loading from traffic/parking</li> <li>High water table - required well points along entire project</li> <li><b>Geotechnical report indicated that geotextile re-enforced soils will have no effect on peat settlement</b></li> <li>Disruption to public access to park and marina</li> <li>Difficult creek crossings.</li> </ul>	<b>\$1,700,000</b>
Directional Drill	Railroad Right-of-Way	<ul style="list-style-type: none"> <li>No requirement for piles, grade beams or concrete bedding</li> <li>Limited excavation</li> <li>Only local dewatering required</li> <li>Limited disruption to public access to park and marina.</li> </ul>	<ul style="list-style-type: none"> <li>Only HDPE pipe material available</li> <li>Specialist contractors required for directional drilling.</li> </ul>	<b>\$1,400,000 (Tendered)</b>
Submarine	Transmission main on top of lake bed	<b>Transmission Main</b> <ul style="list-style-type: none"> <li>No disruption to public</li> <li>Only local dewatering at shore connection points.</li> </ul>		<b>\$1,600,000</b>
		<ul style="list-style-type: none"> <li>Extremely deep portion of lake</li> <li>Unknown soil conditions. Required additional geotechnical investigation</li> <li>Only HDPE pipe material available</li> <li>Specialist contractor required (diver)</li> <li>Required Coast Guard and Department of Fisheries and Oceans approvals.</li> </ul>		
	Open cut distribution main in RR ROW	<ul style="list-style-type: none"> <li>Several pipe materials available</li> <li>Many contractors can bid work.</li> </ul>	<ul style="list-style-type: none"> <li>Poor soils - required piles, grade beams &amp; concrete bedding</li> <li>Wide trench or trench box required</li> <li>High water table - required well points along entire project</li> <li>Disruption to public access to park and marina</li> <li>Part of corduroy road would be destroyed</li> <li>Difficult creek crossings.</li> </ul>	



*One of the three creeks along the route of the project.*

The Ainley Group assisted City staff in learning more about the HDD process in general and the use of HDPE pipe by way of:

- arranging an HDPE pipe fusing demonstration in the City works yard for City design, inspection and maintenance staff
- organizing site visits to ongoing HDD projects
- attendance at an HDD seminar (hosted by the Centre for the Advancement of Trenchless Technology)
- addressing numerous questions and concerns expressed by City staff.

The above helped to familiarize City staff with the benefits (and limitations) of HDD. The project was tendered in September 2002 with HDD as the primary construction method and conventional open-cut as an acceptable alternative in certain identified areas of suitable soils.



*Hydrant lead beneath Lakeshore Drive.*

The specified pipe, 450-mm DR 9 HDPE for the transmission main and 300-mm DR 11 for the local distribution main, provides capacity for the required chlorine contact time and the required fire flow of 1114 Lps respectively. The choice of DR 9 pipe for the transmission main was dictated by the discharge pressure from Heritage Well No 14.

The project was awarded to Rexco Limited of Gadshill, Ontario, in mid-September 2002, at a tendered price of \$1,400,000. Construction was uneventful (problem-free) and was completed on time and on budget with little disruption to the public. Archeological investigations will be undertaken within the near future to determine the origin of the corduroy road.



*Drilling beneath Bayfield Street.*



*Insertion pit at Toronto Street.*