

Application of concrete pipes for underground stormwater detention storage

In a recent commercial development located at the southeast corner of Highway #7 and Woodstream Boulevard in Vaughan (Woodbridge), Ontario, concrete pipe was used to help satisfy the stormwater management objectives for the development by providing underground (in-pipe) storage to attenuate post-development runoff rates to the City's standard target release rate of 180 L/s/ha for storm events ranging up to the 1:100 year return period.

The 1.4 hectare site, to be occupied by Shoppers Drug Mart and a Tim Hortons/Wendy's combination, falls significantly in a northeasterly direction and is constrained topographically on the north, south and west property limits, especially due to the access points to Highway 7 and Woodstream Boulevard. This condition does not easily lend itself to surface storage in a flat parking lot which is generally the preferred method of dealing with stormwater detention.

Several alternative designs were analyzed for functionality, aesthetics and, most importantly, cost. As the proposed buildings are to have flat roofs, rooftop storage was a common element of each alternative and, therefore, did

not factor into the decision-making process. In addition to rooftop storage, providing surface storage alone resulted in a generally unpleasant combination of steep slopes and retaining walls (ranging up to two metres in height). This scenario was poor from an aesthetic and marketing point of view for the users, who obviously want to maximize the exposure to the passing traffic on Highway #7. Also, the cost of the retaining walls was very high.

The final design employed a combination of rooftop storage (23%), parking lot surface storage (13%) and underground, or in-pipe, storage (64%). A conceptual design of the detention system is provided in the figure. The final design helped to reduce overall project costs by balancing the cost of retaining walls with that of increased pipe sizes. The final appearance of the site is more attractive as it blends in well with the surrounding topography and has mild parking lot slopes. Also, the buildings on the site will be set sufficiently high which results in good visibility for passing traffic.

The underground storage system was divided into two separate storage zones, based on topography. This en-

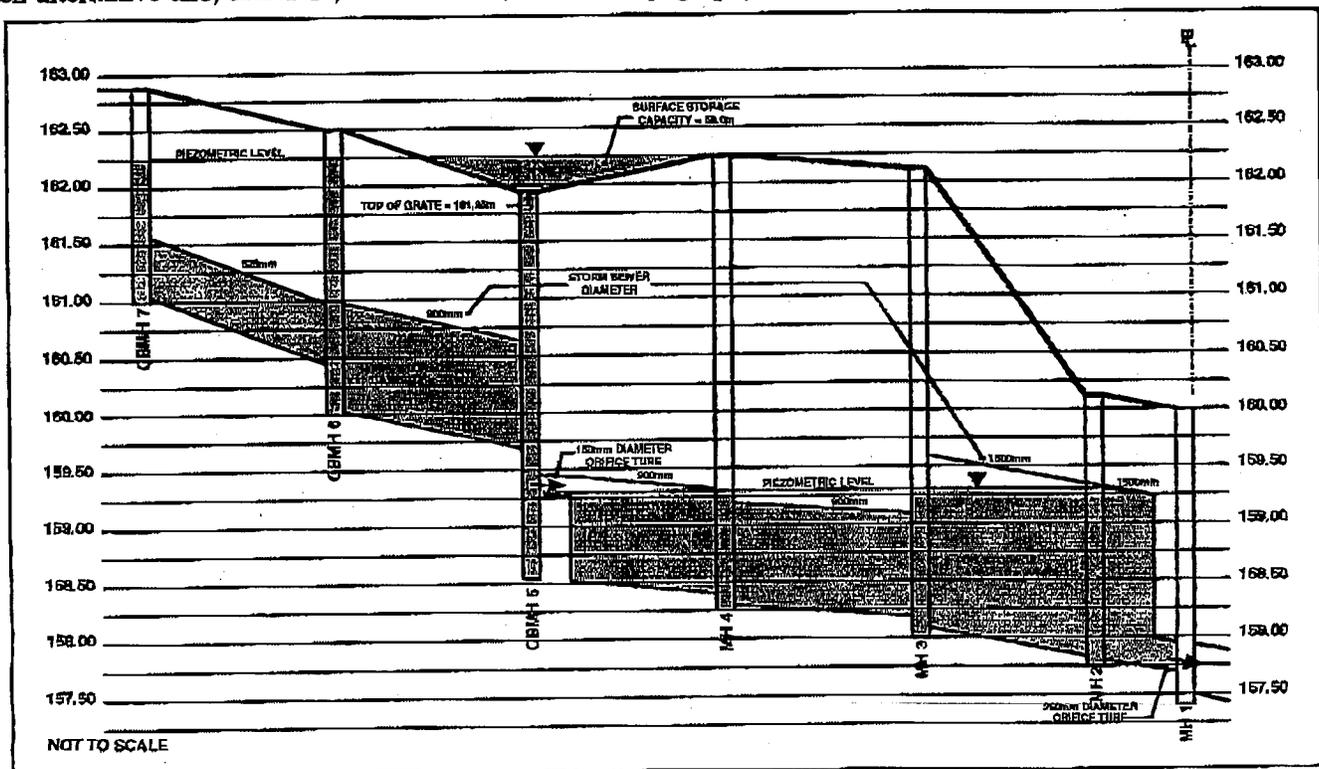
abled the upper lengths of the storm sewer system to be installed at shallower depths, thus reducing construction costs. The division of the zones was accomplished with a 150 mm diameter orifice tube in addition to the 250 mm diameter orifice tube at the downstream end of the site.

Normally, the City of Vaughan requires that only a single control in the storm sewer system be installed at the most downstream point in the system; however, City staff accepted the proposal, given the site-specific conditions and the technical merits of the design.

The site servicing contractor for this project was Torcon Construction of Woodbridge, who completed the installation of the underground storage tanks in three days.

The reinforced concrete pipe and maintenance holes were supplied by Centennial Concrete Pipe & Products. Material quantities for the construction of the stormwater holding tanks consisted of 55 m - 750 mm, 115 m - 900 mm and 90 m - 1,500 mm reinforced concrete pipe.

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Conceptual design and operation of stormwater detention storage system.