

Low Impact Development Series

The Bentway, Toronto

The Bentway is an ambitious project that aims to transform 10 acres of vacant or underutilized public land beneath a segment of the Gardiner Expressway in Toronto into a series of vibrant spaces. More and more in dense urban areas, civic infrastructure is playing host to green and open space that can accommodate passive and active recreational activities. The Bentway joins UnderPass Park, Mitosis Courtyard and other local public and private enhancements on the underside of the expressway. There are many examples of reclaiming underutilized for recreational space. For example, the New York City High Line was a 2.3 km railroad trestle which was out of use for 25 years before being transformed into a public green space in 2009. Now it attracts on average 8 million visitors a year.

11 km of the 18-km long Gardiner Expressway are elevated. This elevated portion stretches across the south of Toronto running right past prime attractions such as the CN Tower, Rogers Centre and Lake Ontario. The land underneath is mostly vacant public right-of-way, covered in gravel, dark and inhospitable and largely avoided by residents and tourists, despite the Expressway's prime downtown location. However at the Fort York heritage site that runs east of Strachan Avenue, the expressway's elevation soars 14 m overhead creating cathedral like space ready to be incorporated into the city's extensive green space network. Thanks to the Judy and Wilmot Matthews Foundation, that is now happening. The foundation recognized the need for new public spaces downtown and the potential of the unused space to fill that need. Eighteen months after the original announcement of the foundation's \$25 million donation the first phase of 'The Bentway' was opened in January 2018.

As the area was the original shoreline of Lake Ontario before the City expanded into the Lake, it was important to the design team to involve the idea of the movement of water. In order to realize this vision, the team set out to manage not only rainfall incidents on the site, but also some runoff from the Gardiner Expressway above.

Featured practice:

- Bioretention
- Infiltration facilities
- Enhanced grass swales

Groups involved:

- Judy and Wilmot Matthews Foundation
- The Bentway Conservancy
- City of Toronto
- Waterfront Toronto
- Ken Greenberg Consultants
- PUBLIC WORK office for urban design and landscape architecture
- WSP Canada Group Limited

Construction:

March 2017 - January 2018

STUDY SITE

Located underneath a portion of the elevated Gardiner Expressway between Strachan Avenue and Spadina Avenue, the Bentway will link seven Toronto neighbourhoods and provide improved access to several downtown destinations. While some of the lands were vacant or occupied by a parking lot, the area is bordered by the historic Fort York to the north and condominiums to the south. Fort York houses Toronto's oldest buildings, including barracks from the War of 1812. Once fully completed the Bentway will consist of a series of rooms framed by the Gardiner columns that will support various activities. Low Impact Development (LID) technologies are used throughout the site to manage surface runoff and runoff from the Gardiner Expressway which can cover much of the site. Technologies chosen include bioretention, enhanced grass swales and underground infiltration trenches.



Figure 1. Study site location

Project Objectives

- Create a unique landmark cultural attraction in a federally designated heritage area
- Create new green and open space for 77,000 local residents, including 2,500 children under the age of 10
- Manage the site runoff
- Improve the management of the Gardiner Expressway runoff
- Re-use excavated material on site

PLANNING AND REGULATIONS

This project would not have been possible without the \$25-million donation from the Judy and Wilmot Matthews Foundation to the City of Toronto, as well as the City's contribution to the project. The Matthews recognized the need for more public spaces in Toronto to accommodate the City's growing population. In April 2015 Judy contacted Ken Greenberg, of Greenberg Consultants, about creating a legacy project based around a new public space. Ken had already been wondering about further enhancing the lands surrounding Fort York National Heritage Site, which includes an architecturally stunning 2,508 m² visitor's centre. When he brought the Matthews to the site, they immediately realized the potential for it to be part of a bold public realm. PUBLIC WORK office for urban design & landscape architecture was brought in to further develop the idea and in July of that year they brought the concept to the City of Toronto. Local councillors and Mayor John Tory supported the project and directed City staff to help expedite the process.

In accordance with the City of Toronto's donation policy, a report went to the City's Executive Committee on December 1, 2015, and then to Council at the December 9-10 Council meeting, to seek authority to accept this donation. Waterfront Toronto was engaged to execute the project given the site's location within the Designated Waterfront Area and the agency's track record of managing complex projects. The agency worked in close conjunction with a dedicated City staff team led by the Waterfront Secretariat and the Toronto Office of Partnerships. WSP Canada Group Limited was brought on as the civil engineer to design the stormwater management system which would not only manage the site's runoff but was expanded to include improvements to the existing management of runoff from the Gardiner Expressway and from Fort York. Generally projects of this scale take many years to reach completion, but in this case stakeholder and project team motivation to expedite this design and construction meant that the first phase of the project was able to be completed in only two years. This first phase – the Bentway Skate Trail – opened in January 2018.

DESIGN

Based on the Toronto Wet Weather Flow Management Guidelines, the site required the provision of almost 58 m³ of stormwater retention, but given the project objective of improving the management of runoff from other areas (i.e. parts of the Gardiner and Fort York), additional storage was incorporated in to the design. In total, the site provides 328 m³ of onsite retention through enhanced grass swales, bioretention, infiltration galleries and open-bottomed sub-surface storage units. All runoff from impervious surfaces is treated by the treatment train approach. The site's drainage is essentially split in half by the twin culverts that dissect the site, so that east and west drainage are managed separately.

For specific information on individual LID practices please refer to the LID Stormwater Management Planning and Design Guide (TRCA and CVC, 2010).

Bioretention and infiltration trenches

Most of the bioretention areas on the site are designed with infiltration trench systems below. Within the systems, water can flow to the infiltration trenches through two routes: via infiltration or by conveyance of surface ponded water into the trenches via catchbasins. Should the capacity of the system be reached the catchbasins also have outlets to the conventional stormsewers.

Native plantings

While the majority of the site is under the Gardiner and requires shade tolerant plants, the west side receives a surprising amount of natural light, of which the design team wanted to take advantage of. There is comparatively less development south of the site on the west side which allows for more

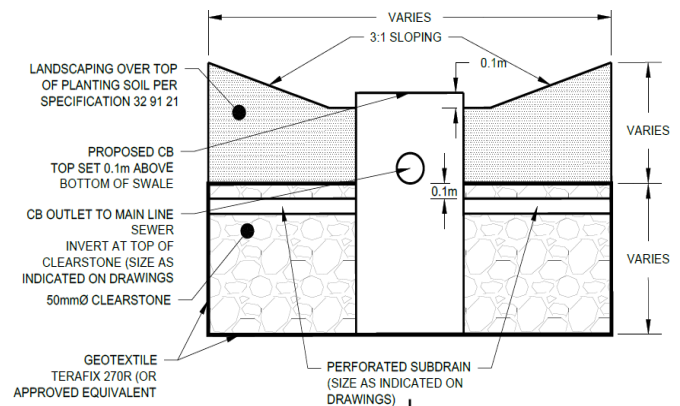
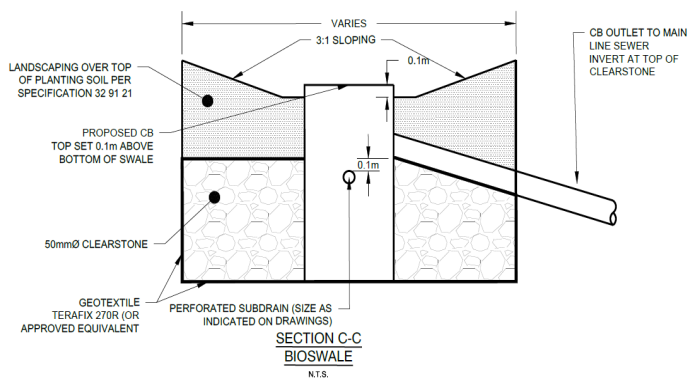


Figure 2. Profile views of the bioretention and infiltration trench designs (image courtesy of WSP Consultancy Services)

planting options such as flowering mixes which will encourage habitats for bees. Whenever possible new planted areas were constructed at the downspouts from the Gardiner, which meant additional considerations were involved in the selection of appropriate plants. Due to the high contaminant and sodium (road salt) loads in the Gardiner's runoff, a mix of salt tolerant grasses were selected and seeded in the spring of 2018. Salt tolerant grasses were seeded in Spring 2018 and the site will be monitored to see how plants thrive with additional plantings to be added as needed.

Enhanced grass swales

Prior to the Bentway project, runoff from the Fort York Visitors Centre, which had just been freshly constructed in the fall of 2014, would rush down the sloped areas and create muddy areas below the Gardiner. Enhanced grass swales were constructed along the north edge of the site in key places. The 10.4 m swale on the west side of the site directs the runoff to one of the Brentwood sub-surface storage units through a perforated underdrain pipe that connects to a catchbasin in the centre of the swale.



Figure 3. Surface swale with below grade infiltration takes run-off from Garrison Common above (image courtesy of PUBLIC WORK)

Infiltration facilities

Two open-bottomed subsurface storage units provide a combined 140 m³ of stormwater detention for the site. The system on the west side of the site receives runoff from the Fort York site to the north and the Gardiner Expressway, while the eastern system receives only runoff from the Gardiner Expressway. Prior to entering the systems the water from the Gardiner is directed through Oil Grit Separators (OGS) to reduce the suspended solids entering the systems, which will ultimately extend their life span and reduce the potential for clogging. The outlet from each of the storage units is set above the required infiltration volume of the lower clear stone base. Each of the outlets has an orifice to control discharge to the municipal storm system should they reach their capacity.



Figure 4. Construction of an infiltration facility (image courtesy of PUBLIC WORK)

CONSTRUCTION AND COMMISSIONING

Temporary erosion and sediment control measures were implemented during construction activities in accordance with the Erosion and Sediment Control Guidelines for Urban Construction (Greater Golden Horseshoe Area Conservation Authorities, 2006).

It was important to the design team to re-use excavated soil on site. Consequently during construction much of the excavated material was used to create a series of landforms. These not only maximize the green space, they enhance the natural

undulating topography of the heritage site. Different landscape design treatments were applied to the site, including typical sodded lawns and some wild seed and pollinator mixes.

OPERATION AND MAINTENANCE

Proper maintenance of LID practices is crucial for optimizing performance, cost effectiveness, and aesthetics, especially during the initial establishment of vegetation. It may be necessary to follow-up with the contractor to ensure that the activities specified within the maintenance agreement are taking place. For specific information on individual LID practices please refer to the LID Stormwater Management Practice Inspection and Maintenance Guide (TRCA, 2016).

From the outset, the Bentway has proven a unique public-private partnership. Conceived as a landmark open space with year-round programming, it requires a high degree of oversight and maintenance that is not typical of most public open space sites. Following completion of a governance study and endorsement from City Council, the Bentway Conservancy was created as a not-for-profit conservancy to manage the site following construction. It is now embarking upon completing the second phase of the Bentway. City staff secured the necessary Council endorsements and agreements to enable both the newly formed Conservancy and the Fort York National Historic Site to deepen their place on Toronto's rich cultural and heritage map.

ACHIEVEMENTS

Stormwater management benefits. Incorporation of LID principles results in more sustainable stormwater management.

Functional design. Dual functioning of a public recreational area and stormwater management.

Multifunctionality. The LID features provide aesthetic benefits beautifying the areas where they are installed while also effectively managing stormwater.

Green Infrastructure. Stormwater is diverted from the sewer system into areas where it can be infiltrated, reused or evapotranspired.

LESSONS LEARNED

- Catchbasins in the bioretentions which direct water to the infiltration trenches were elevated to allow for more ponding on the bioretention to increase surface infiltration.
- Runoff from the Gardiner Expressway downspouts is greater than expected in some areas, and as such dissipation measures may be required to better contain flows and may require a dissipation material to contain it better

REFERENCES

Credit Valley Conservation and Toronto and Region Conservation (CVC & TRCA) (2010). Low Impact Development Stormwater Management Planning and Design Guide (Version 1.0). Toronto, Ontario.

Toronto and Region Conservation (TRCA) (2016). Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide. Toronto, Ontario.

Greater Golden Horseshoe Area Conservation Authorities (2006). Erosion and Sediment Control Guideline for Urban Construction.



Figure 6. . Downspout from the Gardiner with a splash pad to dissipate flow.

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Visit us at www.sustainabletechnologies.ca for more information about STEP and our studies related to urban runoff and low impact development.

About STEP

The water component of the Sustainable Technologies Evaluation Program (STEP) is a partnership between Toronto and Region Conservation Authority, Credit Valley Conservation, and Lake Simcoe Region Conservation Authority. Contact us at STEP@trca.on.ca.