University of Toronto Scarborough Campus

CASE STUDY

Low Impact Development Series

Featured practice:
- Bioretention
- Dry pond

Groups involved:
- University of Toronto Scarborough Campus
- ARUP
- DTAH
- XCG Consultants Ltd.
- LEA Consultants

Budget:
- $4,000,000

Completion data:
- 2012

Launched in 2007, UTSC's Sustainability Office helps the campus meet its present needs in a sustainable manner. Through events on and off campus they aim to facilitate, coordinate and promote sustainable initiatives in all aspects of campus life.

The University of Toronto Scarborough campus (UTSC) is located at 1265 Military Trail in Toronto. Sustainability is seen as a central operating principle similar to accessibility and equity with initiatives promoted throughout the campus, such asSmart Commute Scarborough, Bike Share, and an on campus vegetable and herb garden. The buildings on campus also include designs and features focused on environmental sustainability. Featuring a green roof and over 2000 m^2 of solar panels, the LEED® Silver certified Instructional Center building became the first renewable energy source at UTSC. Another campus building, the Pan Am Sports Centre, has over 1800 solar panels and is the first new building to achieve LEED® Gold certification at the University of Toronto. The newest building on campus, the Environmental Science and Chemistry building, includes a geothermal energy system and is also aiming to achieve LEED® Gold certification.

Campus growth has resulted in nearly 60,000 m^2 of new buildings from 2011 to 2015. As the campus continues to grow, minimizing the impact on the environment and managing stromwater runoff are important considerations. The latest of these efforts is related to the East Arrival Court (EAC) retrofit, which created a new entrance that improves access to the campus and includes a surface parking facility, passenger pick-up/drop-off area and a bus loop. Before the retrofit, stormwater was captured incatchbasins and conveyed through the sewer system into Highland Creek, or directed along the surface to wooded parkland. Now the stormwater is captured in the bioretention area and dry pond, which provide temporary storage, and greater opportunities for infiltration and evapotranspiration. Water that is not infiltrated or evaporated is conveyed from the bioretention area via a pipe network that includes perforated drains.

STUDY SITE

The retrofit of the EAC is one of the many initiatives that the university has undertaken to green their campus and make sustainability a priority. The campus is home to four LEED certified buildings: the Student Centre (Silver), the Instructional Centre (Silver), the Pan Am Sports Centre (Gold) and the Environmental Science and Chemistry building (ESCB, certified Gold). The buildings contain a variety of green energy features, from solar panels to geothermal systems to earth tubes, as well as sustainable water technologies for reduced consumption and improved runoff management. The Low Impact Development (LID) practices that have been incorporated into buildings on campus include two rainwater harvesting systems, four green roofs and an infiltration gallery that receives excess stormwater from the ESCB and the Instructional Centre. Also on the campus at the west entrance is a large, well-established bioretention area which was constructed in 2004.

Figure 1. Original bioretention at the west campus entrance traffic loop

Prior to the East Arrival Court retrofit, which increased the impervious area by 1.5%, the area was comprised on four parking lots. The existing conventional stormwater infrastructure was retrofitted to accommodate the Low Impact Development (LID) designs. The water balance objective - retention of a 5 mm rainfall event on site - is met through the use of the LIDs. Soil testing for the site indicated that the soils located below the parking surfaces were appropriate for infiltration measures. As well, groundwater drilling indicated rather low groundwater levels that would allow for proper operation of the bioretentions.

parking area, passenger pick-up/drop-off area and dedicated bus terminal

Figure 2. Original bioretention at the West campus entrance traffic loop

Project Objectives

- Reduce stormwater runoff in the traffic loops.
- Redevelopment of campus as part of UTSC mandate to improve student, staff, and visitor access through a new entrance, increased

PLANNING AND REGULATION

UTSC retained Arup Canada Inc. to design the new East Arrival Court, together with sub-consultants DTAH and XCG Consultants. In August 2011 Arup Canada Inc. completed the design package for the retrofit with a stormwater management brief that was submitted to the City of Toronto for review. By October 2011, the City had completed its review and issued approval contingent on consultation with the Toronto and Region Conservation Authority (TRCA) and demonstration of the effectiveness of the proposed stormwater measures. At this time SPL Consultants Limited provided a Geotechnical Study Report on Soils Information, based on soils characteristics and groundwater observations. This report showed that the subject site meets the requirements for the implementation of an infiltration system such as a bioswale. In December 2011, TRCA deferred review of the stormwater management plan to the City of Toronto as the proposed works are not located within a TRCA regulated area. XCG Consultants provided a Stormwater Management (SWM) Plan for the UTSC Parking Lot Alterations to Arup in April 2012, which describes SWM measures proposed for the site. The measures proposed are intended to minimize the risk of downstream flooding, stream bank erosion, and overflows of infrastructure.

Designed in accordance with the City of Toronto's Wet Weather Flow Management Guidelines (November 2006), and their Green

Design Standards Tier 1 (December 2010), the SWM plan meets all associated water balance, water quantity, and water quality performance requirements. The LID features provide naturalized storage areas for captured stormwater runoff. The features promote stormwater infiltration and evapotranspiration, provide peak flow attenuation and improve water quality through sediment deposition, filtration, and pollutant uptake.

The end design transformed the area's existing parking facilities into a beautiful new entrance to campus that includes a larger parking area, passenger pick-up/drop-off area, dedicated bus loop, and wide pedestrian walkways to access the rest of the campus. The SWM facilities are integrated into the surrounding area through landscape planting, which enhances the aesthetics of the site while meeting applicable SWM regulatory performance requirements. The large bermed dry pond in the centre of the bus loop is the key landscape feature.

DESIGN

The retrofit was designed to capture stormwater and convey it to the bioretention areas and dry pond. These practices have been implemented to improve the quality and reduce the quantity of runoff discharged into Highland Creek. The innovative design is in accordance with the City of Toronto's Green Design Standards Tier 1 and Wet Weather Flow Management Guidelines, and meets three key targets from the Guidelines:

- Water Balance (or annual runoff volume) – for erosion control, groundwater recharge and downstream habitat protection
- Water Quality – for protection of downstream water resources
- Water Quantity – peak flow control for flood management, and both peak flow and runoff volume controls to mitigate erosion impacts

Dry pond

A dry pond was constructed the centre of the bus loop to receive all flows from the curb inlets around the bus loop, as well as overflows from two of the bioretention areas. The pond has a storage area of 1200 m2 and provides a storage volume of 1,120 m3, which exceeds the site stormwater management requirements. It provides stormwater runoff attenuation and infiltration and improves water quality by providing an opportunity for sediment deposition, filtration and pollutant uptake by plants. When the dry pond reaches its storage capacity, excess water is directed to depression storage in a wooded area through the storm sewer.

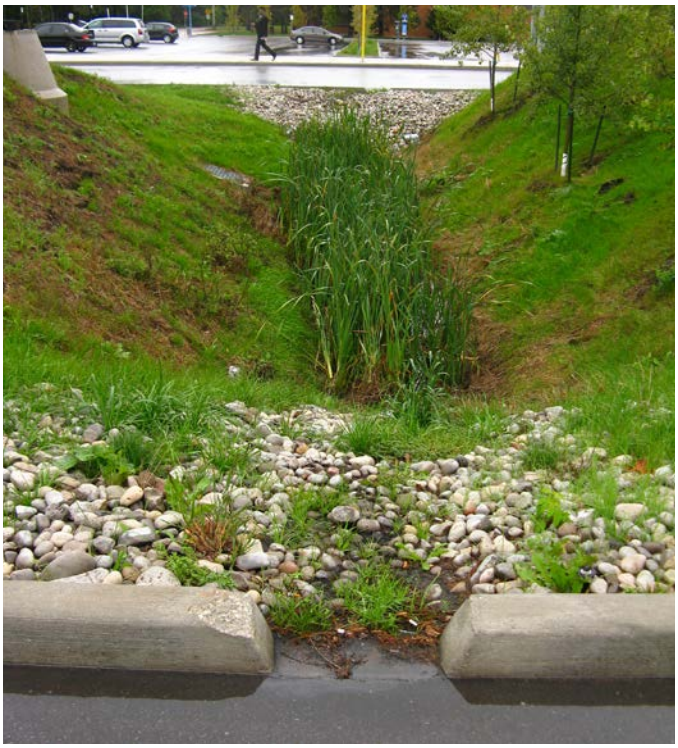

Figure 3. Dry pond in the centre of the EAC bus loop

Bioretention

A total of four bioretention areas are located within the East arrival court, providing a total of 470 m3 of stormwater storage. Along the perimeter of the parking lots on the east and south sides, two bioretention areas discharge overflows to the sewer system which in turn discharges to Highland Creek. The remaining two bioretentions located within traffic islands in the visitor parking lot and curb inlets around the bus loop convey excess flows into a dry pond.

Figure 4. Bioretention inlets in parking lot traffic islands

CONSTRUCTION AND COMMISSIONING

Standard erosion and sediment control (ESC) measures were installed prior to the start of construction and maintained until the site was stabilized and restored along the site boundary at the downstream end of overland flow. Sediment fencing was installed where site grading allowed for stormwater to leave the site as sheet flow and there was inlet protection at catchbasins, culverts and ditches. Flows from any external drainage areas were re-directed during construction. Construction was staged to ensure that the site would be developed in a way that prevented impacts to any constructed and existing features.

OPERATION AND MAINTENANCE

Proper maintenance of LID practices is crucial for optimizing performance, cost effectiveness, and aesthetics over the full life cycle. Maintenance is especially important during the initial establishment of vegetative practices. Contractors responsible for maintenance of the LID practices on site should have a maintenance agreement in place detailing maintenance tasks and schedules. For specific information maintenance of individual LID practices please refer to the LID Stormwater Practice Inspection and Maintenance Guide (TRCA, 2016).

To date, the bioretention areas on the campus have not required any major maintenance interventions and continue to function effectively. Maintenance activities for all the bioretention areas have included weeding, pruning, and removal of trash and debris. For the bioretention area at the west entrance to the campus, which was built in 2004, removal of invasive weeds like dog-strangling vine has been necessary to preserve the health of the other plants and maintain the function and environmental benefits of the bioswale.

Figure 5. Leaf litter potentially clogging bioretention inlet

ACHEIVEMENTS

Stormwater management benefits. The LID practice implemented onsite helps to improve the quality and reduce the volume of runoff discharging to the Rouge River.

Aesthetic value. More natural and sustainable features on campus to help beautify and passively promote green initiatives over conventional options.

Joint partnership. Multidisciplinary design effort and on-going design support and coordination throughout the construction period.

LESSONS LEARNED

- Researching appropriate tree and vegetation species is an important part of LID design to ensure that plants can thrive in the various environmental conditions
- Meeting the challenges involved with achieving storage volume requirement, providing erosion control, and vegetation inspection requires on-going design support and coordination throughout the process
- It is possible to incorporate functional SWM facilities as key site landscaping features that enhance the aesthetics of the site

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.
City of Toronto 2006. City of Toronto Wet Weather Flow Management Guidelines. 2006.

For more information on STEP's other Low Impact Development initiative visit us online at www.sustainabletechnologies.ca

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