CASE STUDY

Sustainable Technologies
EVALUATION PROGRAM

Low Impact Development Series

University of Ontario Institute of Technology, North Oshawa Campus

Image courtesy of Schollen and Company Inc.

Since it opened its doors in 2003, the University of Ontario Institute of Technology (UOIT) has prioritized environmental sustainability initiatives and been a leader among North American universities in sustainable design and technology. Located at 2000 Simcoe Street North in Oshawa, UOIT was the first new university established in Ontario in 35 years. Prior to designing the campus, Dr. Gary Polonsky, UOIT's first president, led a design team, consisting of an urban designer and a landscape architect, on tours of University and College campuses across North America to determine what makes a great campus. The result of that trip was the initial sketch of a master plan for the campus.

Two of the key findings from the trip were that it was important to (i) design beautiful landscapes and (ii) take advantage of the existing natural features and preserve them as much as possible. The campus is near Oshawa Creek, so creating a comprehensive stormwater management strategy was of the utmost importance to mitigate negative impacts on the adjacent ravine and watercourse. Low Impact Development (LID) technologies are used in key areas of interest throughout the campus, to both mitigate the impacts of the development and to green the campus. The processes are transparent to the campus community providing valuable visible lessons for students and faculty. The LID technologies used include bioretention, linear wetlands, green roofs and rainwater harvesting, all designed to reduce runoff volumes and pollutant loads to the adjacent ravine.

UOIT currently holds a GOLD Seal Rating from the Advancement of Sustainability in Higher Education's Sustainability Tracking, Assessment and Rating System program – a global reporting framework for post-secondary institutions.

Public lands

Featured practice:

- Bioretention
- Linear wetlands
- Green Roofs
- Rainwater harvesting
- Geothermal
- Grey water system
- Innovative Stormwater Management

Groups involved:

- UOIT
- Durham College
- Schollen & Company Inc.
- Diamond Schmitt Architects
- du Toit Allsopp Hillier (DTAH)
- Ellis Don Inc.

Construction:

Completed in 2003

STUDY SITE

UOIT is located adjacent to Durham College in north Oshawa, covering 42-acres of land with stunning views of the Oshawa Creek ravine. The design concept was of a technology-enriched academic village, where students and professors could easily interact, and which also enhanced the natural beauty of the area. At the centre of the campus is Polonsky Commons, a popular area for both social and recreational activities. Many of the buildings surrounding the Commons have green roofs and all have drainage systems that convey their roof runoff to the rainwater harvesting system. The terraced linear wetland runs along a walkway beside the Commons.

Another hallmark of the UOIT campus is energy efficiency. Buildings were constructed with high levels of insulation in their outer envelopes and with exposed concrete to store and moderate thermal energy. Energy efficiency is maximized through their geothermal heating and cooling system, which is one of North America's largest. The Borehole Thermal Energy Storage System (BTESS) provides 2000 tonnes of energy efficient and sustainable heating and cooling to the main academic buildings on the campus. Designers also strived for energy efficiency in building lighting by taking advantage of natural light on all floors though central atriums and by implementing a comprehensive building automation system. The campus was built to LEED Gold certification standards.

Figure 1. Study site location

Project Objectives

- The overriding goal of the campus' design was to make UOIT the 'greenest' campus in Canada by creating a sustainable campus that limits energy and resource consumption, while at the same time providing a supportive and inspiring environment for students.
- The storm water management strategy was primarily focused on improving the quality (80% TSS reduction) and reducing the quantity and discharge rate of storm water into the environmentally sensitive Oshawa creek watershed.

PLANNING AND REGULATIONS

All levels of partners and stakeholders were very supportive of the forward thinking campus design. The unique campus plan helps UOIT stand out in the sector and supports their mandate of being a future-driven institution.

The stormwater management plan for the campus was designed with the mindset that stormwater is a resource rather than a waste by-product of development. With this in mind, the systems were designed to treat runoff from different sources to maximize benefits and minimize contamination. Runoff from roads and parking areas, which are typically loaded with sediment and other contaminants, are treated in the stormwater management facilities prior to discharge to the Oshawa Creek and its tributaries, while water from foundation drains is clean enough to be discharged without treatment.

DESIGN

The stormwater management features on site contribute to campus aesthetics while achieving functional objectives related to flow moderation and water quality improvement.

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

Bioretention

The bioretention areas are located in parking lots and receive runoff from curb inlets that feed directly into an infiltration gallery. Locating the perforated underdrain at the top of the gallery allows for water stored below the drain to passively infiltrate into the ground. The soils are conducive to infiltration so the system was designed based on the assumption that water loss through the base and sides of the gallery would empty the gallery within 48 hours. At the City's request, the system was constructed with a redundant typical catchbasin and stormwater management system, however to date it has never seen flow. The system continues to function well, and there have been no complaints related to flooding of the parking lot.

Figure 2. Bioretention cell

Linear wetlands

The terraced linear wetlands are located in the centre of the campus and receive runoff from the rooftop areas of the library and science wing. The runoff is directed to the wetlands via a

system of trench drains, and water is contained in the wetland cells through weirs. When it is at capacity, runoff is directed out of the system through an overflow outlet in the form of an upturned corrugated steel pipe.

Figure 3. Linear wetland (Image courtesy of Schollen and Company Inc.)

Grassed swales

Grassed swales are used throughout the campus to convey runoff in any areas where grading and drainage considerations permit. They are constructed with a parabolic cross-section and have side slopes of 3:1 or less.

Figure 4. Grassed swale

Green roofs

Extensive green roofs located on the Campus Library, the Business and IT building, and the Science building cover a total area of approximately1600 m^2. Rainfall on the green roofs soaks into the soil and can be evaporated or transpired from the soil and plants back into the atmosphere. Water that is not retained passes through to the drainage layer and is conveyed through the roof drains to the rainwater harvesting system's underground cistern. In addition to helping manage stormwater runoff, the green roofs can help moderate building temperatures and improve local air quality.

Grey Water Collection & Management

The aquatic toxicology lab uses approximately 88,000 litres of fresh water per day. The municipal water is filtered for use within the lab, after which it is considered to be grey water and directed to the rainwater harvesting underground cistern. Water is drawn from this system for non-potable uses, thereby reducing the demand for potable municipal water. Without the rainwater harvesting system this waste water would be discharged directly to the sanitary sewer, but instead it is treated as a resource.

Figure 5. Forebay and inlet to linear wetland feature

Rainwater harvesting

Each building on campus has incorporated a second plumbing system that directs runoff to a 250,000 L underground cistern. In addition to runoff, the cistern receives grey water from the aquatic toxicology lab. The collected water is used for irrigation and toilet flushing within the buildings surrounding the quad. UOIT estimates that the campus saves 32 million liters of water per year by using this system in combination with sensor controls and low flow water features in the buildings.

CONSTRUCTION AND COMMISSIONING

Construction at the campus began in 2002, with the first two buildings open to students in the fall of 2003. As the LIDs are an integral part of the campus design, they were constructed at the time of the campus build. Since then the campus has expanded quickly, with the original eight buildings from the Campus Master Plan completed by 2011. Refer to the site layout in figure 6.

All of the LID practices have been functioning well since commissioning. Initially, the use of an unsuitable soil mix in the linear wetlands resulted in poor plant growth. Once the soil mix was replaced, the plants quickly established themselves.

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).

In general the LIDs on the UOIT campus have required little maintenance, though some design issues have come to light and will be considered in future installations. For instance, the Eastern Cottonwood trees in the bioretention area reproduce from seeds and shoots, which are a nuisance from a maintenance perspective. It has also been noted that the design of the bioretention area inlet requires cleanout by hand, which can be labour intensive.

Of all the LIDs on site, the green roofs are the most labour intensive and expensive to maintain, and as a result, UOIT is considering replacing them with reflective white roofs at the end of their lifespan. The grey water system also has a high operating cost, largely due to maintenance expenses for the filtration system, however it is effective in water use reduction.

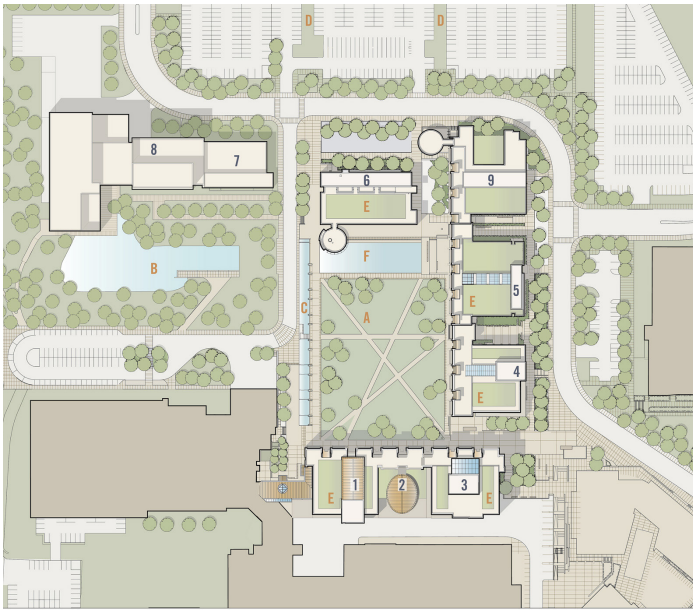

Figure 6. Site layout

ACHIEVEMENTS

Innovative project. From the suite of LID systems to the BTESS the campus promotes sustainability and showcases innovation in a variety of ways.

Stormwater management benefits. The LID practices implemented on campus help to improve the quality and reduce the volume of runoff discharging to the Oshawa Creek.

Aesthetic value. More natural and sustainable features on campus improve aesthetics and passively promote green initiatives over conventional options.

Joint partnership. A multidisciplinary design effort and coordination was needed throughout the planning and construction period.

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

LESSONS LEARNED

- The capital and maintenance costs of white reflective roofs are lower than those of green roofs, largely due to the need to structurally accommodate the additional weight of a green roof. While white roofs provide no stormwater retention benefit, they may provide similar building cooling benefits to green roofs.
- Future maintenance needs of plants should be considered when selecting species to be placed in vegetated LIDs.
- Certain bioretention area and inlet designs may require them to be cleaned out by hand, which was the case at UOIT. The design was revised for subsequent installations at other sites since maintenance could be carried out faster and more cost-effectively if they could be cleaned out with mechanical equipment.

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.

This communication has been prepared by Toronto and Region Conservation under the Sustainable Technologies Evaluation Program. Funding support for this study was provided by the City of Toronto, Region of Peel, York Region and the Great Lakes Sustainability Fund. The contents of this case study do not necessarily represent the policies of the supporting agencies and the funding does not indicate an endorsement of the contents.

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