Bill Crothers Secondary School

CASE STUDY

Low Impact Development Series

Featured practice:

- Bioretention
- Grassed swales
- Rainwater harvesting
- LEED Silver rated building

Groups involved:

- York Region District School Board
- Schollen & Company Inc.
- Schaeffers Consulting Engineers

Budget:

$35.8 million

Construction:

Completed in 2008

Bill Crothers Secondary School in York Region promotes active and healthy living among its students. It is the second full sports academy in Canada and has programs relating to sports management, promotions, coaching and health sciences as well as an eco-school sustainability awareness curriculum.

In August 2008, the York Region District School Board (YRDSB) opened the doors of Bill Crothers Secondary School (BCSS) to its first students. The 220,000 ft^2 facility, located at 44 Main Street in Unionville, is a LEED® Silver certified Building. The site, previously an 18 hole golf course, drains to a tributary to the Rouge River and is located partially within its flood plain. Because the school is located on ecologically sensitive land, the site design includes several sustainable technologies, which are also part of the City's Markham Centre. The YRDSB and the City of Markham worked together to not only create an amazing space for students, but also for the community to enjoy. Within walking distance of the Unionville GO station and bicycle parking, the school also promotes green transportation choices.

The school covers approximately 130,000 m^2 and includes the school building and parking lot, three sports fields, a constructed wetland, and a two-cell stormwater management facility. The Low Impact Development (LID) practices implemented on site are bioretention areas, vegetated swales, and rainwater harvesting. There are no conventional catchbasins or storm sewers anywhere on the site; instead stormwater runoff drains to the LIDs for treatment and conveyance. Any stormwater in excess of that which can be infiltrated in the bioretention areas or reused in the rainwater harvesting system is conveyed to the aforementioned end of pipe stormwater management facilities on the site. The site ties into the larger sustainability initiatives in Markham while also enhancing and preserving a corridor of the Rouge River.

STUDY SITE

When the YRDSB purchased the golf course land they had not yet envisioned building a LEED® certified building or incorporating LID technologies. They were simply looking for a place to create a high school focused on athletics. The process of creating the program for the school that would meet their curriculum needs and the physical process of servicing the area were the first priorities. As the planning process progressed, the idea of applying LID practices on the site came about through discussions with the City of Markham and the Toronto and Region Conservation Authority. Normally the YRDSB purchases land that is part of a neighbourhood development but in this case the land was unserviced which meant that there was the opportunity to integrate sustainable initiatives and some funding leftover to help pay for them.

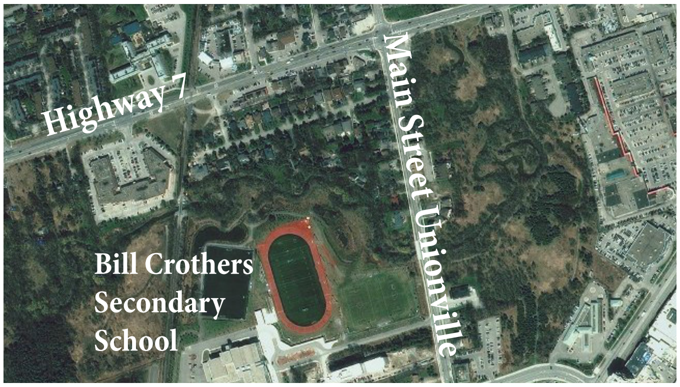

Figure 1. Study site location

Project Objectives

- Achieve pre- to post-development water balance.
- Provide capacity to treat runoff contribution from an off-site catchment area.
- Collect rainwater for irrigation of playing fields during summer months.
- Incorporate multiple LIDs in a treatment train approach.
- Enhance the Rouge River corridor through re-introduction of native species and improving the riparian area.
- Promote environmental stewardship by demonstrating to students and the community that a 'healthy' lifestyle is about more than just physical activity; it should also the protection and preservation of the natural environment.
- Promote pedestrian and cyclist infrastructure and sustainable transportation.
- Achieve LEED Silver Certification.

PLANNING AND REGULATION

While there were many suggestions as to which LID practices to use, the YRDSB had to consider which would make sense for them and would continue to work long term. At the time, LIDs were still an emerging concept, with different groups promoting different ideas. The YRDSB decided they needed time and the right people to guide them in determining which technologies would be most cost-effective. Schaeffers Consulting Engineers were retained by the YRDSB to prepare a Functional Servicing Plan in 2006. This plan was endorsed in principle by the City, based on the Site Plan application. Though the TRCA had some concerns over the proposed work in the floodplain, they agreed that the benefits to the urban environment from the addition of plantings and LIDs outweighed the potential risks.. The project was truly a collaborative effort, with all groups working together towards the end goal. Several measures were taken to enhance and preserve the Rouge River ecosystem, including the planting of a large number of native species. The landscape plan included the creation of a three-hectare constructed wetland and reforested riparian areas. Overall, any environmental impacts associated with the development of the site and the associated impervious surfaces were offset by the LIDs and specialized stormwater management areas (pond and wetland), which were also built with the capacity to service future developments that will drain to the property.

DESIGN

A core objective of the design team was to integrate LIDs in order to reflect the larger sustainable practices being promoted by the City. The school was also - constructed using sustainable design elements and practices that reduce water and energy consumption in accordance with LEED® Standards. Outside of the school building itself, the site features stormwater biofilters, vegetated swales, a rainwater harvesting system, and two stormwater management facilities that provide final treatment of stormwater runoff before it is discharged to the Rouge River. As the site is located partially in the Rouge River flood plain, the grading design allows for occasional flooding in certain areas, specifically two of the playing fields. The school building itself, parking lots and roads were all located above the floodplain. The stormwater management practices applied on this site provide numerous benefits, including runoff reduction, contaminant removal, reduced pollutant loads to watercourses, and groundwater recharge.

For information on the specific benefits of individual LID practices, please refer to the LID Stormwater Management Planning and Design Guide (TRCA and CVC, 2011).

Stormwater biofilter

Five stormwater biofilter systems were constructed at the site. Water enters through the curb inlets and is filtered by the filter fabric and infiltration gallery below grade. The surface is vegetated with turf, trees and shrubs which enhance the aesthetics of the stormwater biofilter, while the infiltration gallery is filled with granular media. A perforated storm sewer/exfiltration pipe is used to direct water exceeding the system's capacity to either the stormwater management pond or the constructed wetland, where it is treated before being discharged to the Rouge River on the North West side of the site.

Grassed swales

The design of the swales promotes sediment deposition, filtration of contaminants, and infiltration. One grassed swale directs stormwater along the entry road towards the Rouge River on the North East side of the site. A second is used to direct flows towards the constructed wetland when the cistern is partially drained for maintenance.

Figure 2. Grassed swale

Rainwater harvesting

The use of on-site alternative water sources is a key strategy for expanding potable water savings. At BCSS rainwater is captured from the school building roof (approximately 6300 m2) and from a portion of the road. The roof runoff is conveyed directly to the rainwater harvesting cistern while the road runoff is treated through bioretention first and then conveyed to the cistern, which is located beneath one of the artificial playing fields. The harvested stormwater is used for irrigation of the natural playing field and landscaped area from May to September, which saves approximately 9500 m^3 of potable water on an annual basis. The cistern holds 1,875 m3 of water at one time, making it one of the largest in North America. When the system reaches its storage capacity, excess water is directed to the constructed wetland for treatment before entering the Rouge River. Valves are are used to close the cistern off from incoming flows as needed, and to partially drain the cistern for maintenance purposes. When the valves are closed so that water cannot enter the cistern, the runoff is directed to the stormwater management facility, or through a grassed swale to the constructed wetland.

Figure 3. Cistern placement during construction (above); artificial field above cistern (Pictures courtesy of Schollen and Company Inc.)

Constructed wetland

A constructed wetland type stormwater management facility is located at the north east side of the property. It receives runoff from a 9.2 ha drainage area and has a pool storage volume of 1,060 m3, which is almost double the required amount.

Native vegetation

Vegetation already found along the Rouge River corridor was used throughout the landscape plan, including the 30,000-square-metre constructed wetland and reforested riparian areas.

LEED® Rating

The LEED® Silver-rated building uses 30% less energy than the Model National Energy Code. Sustainable features include occupancy sensors, demand controlled ventilation, high efficiency HVAC equipment, daylight harvesting, external solar shading devices and low VOC materials.

CONSTRUCTION AND COMMISSIONING

The TRCA conducted several site investigations over the course of construction from September 2006 to September 2008 and no major issues were noted. In general, LID areas should be well marked during the construction phase to ensure that they are not disturbed during construction. Erosion control devices should be installed to prevent sediment from accumulating in infiltration areas. Any accumulation of sediment must be removed to ensure the system is constructed as designed. Flow should not be directed to the LIDs until the area is stabilized.

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 Practice Inspection and Maintenance Guide (TRCA, 2016).

To date, the bioretention areas have not required any maintenance other than the normal trash and debris removal that is done for all landscaped areas. They continue to function effectively, with the plants flourishing and no signs of clogging or back up of water. Similarly, the constructed wetland and vegetated swale have not required any significant maintenance but are operating as intended.

The rainwater harvesting system is also functioning effectively, but has had to be pumped down for cleaning at least once since its construction. While the cistern capacity was reduced due to the buildup of silt, which triggered the need for the cleaning, the quality of the water leaving the system was not significantly compromised and the water remained suitable for reuse.

ACHEIVEMENTS

Aesthetic value. Biofilters and vegetated swales provide green space on site, increasing visual appeal and contributing to an improved visitor experience.

Functional design. The location and design promote sustainable modes of transportation, such as walking, cycling or public transportation. The school is walking distance from both the GO station and a Viva bus stop.

Joint partnership. All partners worked together to ensure the success of this project.

Multifunctionality. In addition to their stormwater benefits, theLIDs also improve the aesthetics of the site. . Some other sustainable features of the site, including the energy efficiency of the building, are integrated into the eco-school sustainability awareness curriculum.

Additional environmental and social benefits. Part of the Rouge River was enhanced through native plantings,and the trails and playing fields constructed can be used by all members of the community.

LESSONS LEARNED

• Protection of installations during construction is essential. Without protection from construction debris and sediment, the capacity of the LIDs to infiltrate water could besignificantly decreased, and installations could end up prematurely filled and/or clogged.

• Inadequate maintenance can impact function. Ignoring suggested maintenance can compromise the effectiveness of LIDs, resulting in decreased infiltration rates and reduced capacity in conveyance measures and rainwater cisterns.

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.

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

This communication has been prepared by the Toronto and Region Conservation Authority's 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. For more information about this project, please contact STEP@trca.on.ca.

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