



2013 Canadian Consulting Engineering Awards

# Victoria Park Lake Improvements

Category: Water Resources

Submitted by: Stantec Consulting Ltd.





## Victoria Park Lake Improvements

CATEGORY: WATER RESOURCES

PROJECT DESCRIPTION 1

### Project Description

Victoria Park, surrounded by historical houses and buildings, located in the heart of downtown Kitchener, has been a civic landmark and an integral part of the City's recreational system since its construction in 1895.

Victoria Park Lake, the focal point of the park, has long suffered from ongoing water quality issues, most notably sedimentation, which has impacted aesthetics and recreational enjoyment within the park. This challenge has resulted in a need for dredging every 12-15 years.

The Victoria Park Lake Improvements project was initiated to improve both current conditions and the sustainable long-term management of the lake. The project was guided by years of planning, study, extensive public consultation, and design, all focused on its primary objective of improving the environmental, habitat, recreational, aesthetic, and social conditions of Victoria Park and lake.

The improvements consisted of:

- Removal of 45,000 tonnes of sediment
- Reconstruction of over 2,000 m of shoreline
- Rehabilitation of an existing heritage bridge structure
- Realignment of the trail system to improve connectivity and circulation and allow for incorporation of a new pedestrian bridge
- Improvements to lake bathymetry and aquatic habitat conditions
- Tree/vegetation management and protection
- Decommissioning and removal of existing infrastructure
- Construction of measures to assist future maintenance activities

The heritage characteristics of the park and surrounding Victoria Park Area Heritage Conservation District were preserved and enhanced during an aggressive winter construction schedule that was completed in time for the City Centennial celebrations in June 2012.



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PROJECT DESCRIPTION 2

### Project Objectives, Solutions and Achievements

In 2011, the City of Kitchener retained the Stantec Consulting Ltd. team to complete the detailed design, contract administration, inspection and post construction monitoring of the Victoria Park Lake Improvements project. The purpose of the assignment was to refine and execute the lake-based recommendations of the previous Class Environmental Assessment work (also completed by the Stantec team), and additionally to implement some elements of the Victoria Park Strategic Plan, particularly where those elements required in-water work (such as the lakeshore reconstruction and bridge rehabilitation). The construction work was required to be completed over the 2011-2012 winter period in order to minimize the impact on park users and programming.

The requirement for winter construction set the stage for an aggressive schedule for completion of both the design and construction work. In order to achieve this schedule, Stantec took the approach of expediting the design and approval process to allow for as much flexibility in the construction schedule as possible. Initial consultations with all agencies were undertaken immediately following project award in April 2011 to get input early in the process and minimize future review and approval time. The design timeline was very compressed, with only 6 months to complete detailed drawings and obtain all approvals.

While the design work was ongoing, a pre-qualification process was initiated in August to identify contractors willing and able to bid on the project. Following completion of the design and the receipt of approvals, the project tender was released in October, and construction started in November, 2011. Fish removal and lake drawdown activities were completed in October, prior to the contractor selection to further maximize the construction window.

The construction window was also compressed – with little more than 6 months before Kitchener's centennial celebration – and shorter days and winter weather could lead to potential delays. To further complicate matters, because the site is considered fish habitat, all in-water work must be completed by the end of March. Ultimately, after a short extension to the fish window, work was substantially complete by mid-May, and the ribbon-cutting ceremony was held as part of the City centennial celebrations in June 2012.





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PROJECT DESCRIPTION 3



One of the goals of the project was to improve the existing shoreline conditions around the lake by removing the deteriorating gabion baskets and replacing them with more aesthetically pleasing armour stone. The design team worked with the City staff to identify a quarry with appropriate stone size, colour and availability and designed a structure that varied around the lake depending on water depth and shore elevations. In order to minimize the number of armour stone blocks required, the sub-structure below the water line was comprised of large concrete blocks instead of armour stone.

Sediment removal was one of the key elements of this project. The Stantec team devised and implemented a plan to undertake a trial program to manage sediment in such a way as to not require landfill disposal. A partnership was negotiated with the City of Kitchener and Region of Waterloo to stockpile the sediment at the Cambridge Landfill site for ongoing study and analysis to determine if the material could be used as a topsoil product. If successful, this approach would mean that a variety of materials including future lake dredgeate, sediment from stormwater management basins and some brownfield sites could be diverted from landfill sites and given a beneficial re-use. Not only is this a more environmentally friendly solution, it is also less expensive as tipping fees would be significantly reduced.





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### Technical Excellence and Innovation

The multi-disciplinary nature of the Victoria Park Lake Improvements project required the technical assessment of various lake components and an innovative approach to satisfy the project objectives and timelines.

The sediment management efforts required for this project are a prime example of both technical excellence and innovative thinking. The Stantec team used its knowledge of environmental remediation measures, landfill requirements and local site conditions to develop a strategy that diverted thousands of tonnes of material from a landfill site, saving millions of dollars in tipping fees and envisioning opportunities for beneficial re-use of the material. The environment, the municipality and future projects all stand to benefit from this approach to re-using material from a variety of sites such as lake dredgeate, stormwater management pond sediment and brownfield material.

Rehabilitation of the footings of one of the existing bridges over the lake known as the "Heritage Bridge" was required as part of the project. The original structures consisted of stone, but they, along with portions of the steel towers were subsequently encased with a concrete facing. The deterioration of the concrete facing required rehabilitation, and the best time to undertake that work is while the lake is drained for sediment removal. The Stantec team's structural experts reviewed conditions, discussed a variety of approaches with City staff and ultimately recommended that the deteriorating concrete encasement be removed and replaced. This approach would minimize the risk entailed with the full replacement of the structures, achieve the design life requirements and minimize construction costs.

Considerable efforts were made during the design and construction process to minimize tree removal around the lake. Existing (deteriorating) shoreline gabions were retained in places to protect root zones of existing trees as the new shoreline was constructed. In other locations, the lake edge was moved slightly to allow for the retention of vegetation. This approach saved dozens of trees and helped maintain the unique Romantic Landscape characteristics within Victoria Park.

Future lake maintenance requirements were also considered in the design. Because the lake is an on-line feature with streamflow continuously entering the lake, sediment deposition will always occur and periodic sediment removal will continue to be required. The design includes a forebay area where Schneider Creek enters the lake to collect most of the sediment deposition in a smaller area. This area is physically separated from the remainder of the lake by a weir and is equipped with elements that facilitate future cleanout activities including maintenance access to the bottom of the forebay, permanent piping to allow flows to be routed around the forebay while cleanout is occurring, etc. These features will allow future cleanouts to be conducted efficiently, with the work primarily limited to the forebay area itself, minimizing disturbance to the rest of the lake and park, and minimizing costs.



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PROJECT DESCRIPTION 5

### Level of Complexity and Project Challenges

The Victoria Park Lake Improvements project required the coordination of a wide variety of disciplines to achieve the multiple project objectives of improving lake conditions, maintaining the park character, etc. Various City departments and regulatory agencies were involved in the project and the public was keenly interested in everything related to the lake improvements. The public was involved throughout the design and construction process through participation on a Public Advisory Committee, attendance at several Public Information Centres, and observing work during the construction stage. Interactions with the public were a daily part of the construction process on this site since the park remained open and members of the public could watch the work proceeding.

The complex nature of the project, and the aggressive design and construction schedule required Stantec to draw on resources from five offices across Ontario. The technical disciplines engaged in this project included hydrology, hydraulics, terrestrial and aquatic ecology, structural engineering, hydrogeology, geotechnical engineering, archaeology, heritage, landscape architecture, civil engineering, and environmental remediation of the existing sediments and soils.

The project took place in and around an existing lake environment, which required significant effort to manage both water flows and fish. Victoria Park Lake is an on-line feature, meaning that flows are conveyed to and through the lake on a continuous basis from the 1400 ha upstream watershed. It was imperative that flows be maintained downstream of the lake, so the water management plan included a continuous pump to by-pass up to 200 L/s around the site, and the work was staged to allow most construction to occur "in the dry". Prior to the start of construction over 5,000 fish were removed from the 3 ha lake area. This effort was so successful that little effort was required to further manage fish during construction.







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PROJECT DESCRIPTION **6**

Contributing to the complexity were the scheduling and space limitations required by virtue of the site location. In order to minimize the potential impact to park users and programming, the construction was required to be completed during the winter months, and the park outside of the work area remained open to the public. Existing infrastructure in the lower lake (2500mm diameter storm sewer and 1200mm diameter sanitary sewer) required careful excavation and construction crossings, and a 450mm diameter watermain had to be daylighted to confirm its location before construction could proceed in the upper part of the lake. Additionally, with existing development surrounding the park, construction working areas were generally limited to the lake footprint, a few selected access locations, and a restricted construction window that required the in-water work be completed by the end of March.

The physical process of handling the sediment and subsoil material was also challenging. The material was roughly the consistency of thick motor oil, and had to be piled in windrows, mixed with wood chips to pass the required slump test before loading onto trucks for shipping to the storage area. 45,000 tonnes of sediment and an additional 40,000 tonnes of subsoil were mixed with about 8,000 tonnes of wood chips (about a 5:1 ratio) during a three month period. Sediment and soil testing was completed throughout this process to ensure the material quality was satisfactory.

The heritage characteristics of the park and surrounding designated Victoria Park Area Heritage Conservation District were preserved during an aggressive winter construction schedule that started in November and was completed in May 2012 and ready for the City of Kitchener Centennial celebrations in June.





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PROJECT DESCRIPTION 7

### Contribution to Economic, Social and Environmental Quality of Life

In an era where clients expect efficient use of funds that accomplish multiple objectives with any project, this assignment was easily able to achieve that objective. The completion of the Victoria Park Lake Improvement project offered numerous, diverse benefits.

#### Environmental Benefits:

- **Water Quality Improvements:** The removal of the accumulated sediment results in better water quality both in the lake and in Schneider Creek and the Grand River downstream of the site. The deeper lake areas will also reduce the warming that tends to occur in large water bodies.
- **Aquatic Habitat Improvements:** The habitat conditions within the lake were improved by changing the previous bathymetry to provide greater water depths and variety of habitats, and by the installation of specific fish habitat structures. Aquatic plants were also added to the lake to provide food and shelter to aquatic fauna. The intent was to improve habitat for native fish species so that they would have a competitive advantage over invasive species that may enter the lake.
- **Terrestrial Habitat Improvements:** The project retained key habitat areas on existing islands, and in fact the lake design was altered to retain as many of the existing trees around the lake as possible.
- **Sediment Re-use:** The sediment and subsoil removed from Victoria Park Lake were not added to dwindling landfill space, but a trial program is investigating the potential for a beneficial re-use of the material as a topsoil product. This trial has significant environmental implications for the sediment to be removed from stormwater management facilities and material from some brownfield sites as this material could be diverted from landfills and re-used for other purposes.



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PROJECT DESCRIPTION 8

### Economic Benefits:

- **Sediment Management:** The process of evaluating the potential sediment re-use eliminated the need for disposal at a hazardous waste facility, saving the client (and taxpayers) a significant sum that could be re-invested in other project elements.
- **Future Maintenance:** The design of the forebay at the upper end of the lake is intended to facilitate future cleanouts by providing infrastructure for stream by-pass operations, containing the sediment in the forebay to reduce the extent of future dredging operations.
- **Property Values:** Residents surrounding the lake have frequently complained of odour and aesthetic issues from sediment accumulation in the lake, so the elimination of those problems may be beneficial to property values around Victoria Park.

### Social Benefits:

- **Aesthetics:** The improvement of lake conditions offers an evident benefit to all users of Victoria Park since they will be afforded a more enjoyable experience regardless of whether they are passing through on a trail, sitting in quiet contemplation beside the lake, enjoying the boathouse patio, attending an event at the pavilion or playing on the swings and/or play structures.
- **Trails:** Improvements to the trails will offer better connectivity to other City trails once linkages outside the park are completed. The rehabilitation of the "Heritage Bridge" and the introduction of a new pedestrian bridge at the upstream end of the lake offer improved circulation in the park and around the lake.
- **Municipal Image:** Victoria Park Lake is a renowned feature in downtown Kitchener, and its improved condition offers a general benefit to the image of the community.







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PROJECT DESCRIPTION 9



Overall Site Plan