

PROJECT DESCRIPTION

BOWKER CREEK RESTORATION AT OAK BAY HIGH SCHOOL

INTRODUCTION

It took 100 years to put Bowker Creek in pipes and concrete channels. It will take another 100 years to daylight and bring life back to Bowker Creek: an innovative, sustainable adventure has begun. Bowker Creek watershed, home to 30,000 residents in the core of Greater Victoria, British Columbia, has been highly impacted by urbanization with >56% imperviousness throughout. Over two thirds of the 9.4 km creek length is underground and/or constricted within concrete channels. The Bowker Creek Initiative (BCI), a multi-stakeholder, inter-municipal and community partnership, has developed the *Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek watershed* (2010), a visionary plan which details watershed and reach-specific actions to rehabilitate the creek channel and improve the functioning of this developed watershed over the long term.

Currently, the reach of Bowker Creek, which runs along the border of Oak Bay High School (OBH) and the municipal facilities of Oak Bay Recreation Centre, is contained in an open concrete channel, sustaining no aquatic life or native riparian habitat. The *Bowker Creek Blueprint* identifies the restoration of this section of the creek as a key priority for implementation over the next three to five years.

There exists an upcoming opportunity to restore this section of the creek as the School District 61, in cooperation with the District of Oak Bay, is undergoing a redesign process for a new school, a Neighbourhood Learning Centre (including a theatre, learning and daycare facilities) and new sports fields. As required by the School District, the school and fields must be built to a minimum Leadership in Energy & Environmental Design (LEED) Gold certification; anticipated completion of construction is 2014 (contingent on construction and deconstruction of the school). As an extension to the redesign of the school facilities, the District of Oak Bay, a partner in the BCI, has identified this as a critical, opportunistic time to restore this reach of Bowker Creek to achieve a key short term implementation priority in the *Bowker Creek Blueprint*.

The District of Oak Bay and the BCI are keen to implement the *Bowker Creek Blueprint* and showcase themselves as leaders in innovative, integrated watershed management techniques. If external funding is obtained, restoring Bowker Creek through Oak Bay High School will be the first major creek restoration action undertaken as outlined in the 100-year plan. The creek restoration project will improve flow conveyance and reduce flooding, create habitat and improve water quality, provide a community-accessible greenspace and refurbish a greenway providing improvements to transportation networks, enabling walkability and bike transportation.

Since the creek runs through the community high school property, partnership opportunities exist to involve the students in all aspects of creek restoration, from channel design and planting to monitoring, and to the creation of curriculum where the naturalized creek becomes an outdoor classroom and a community amenity. The proposed project to restore Bowker Creek at its Oak Bay High School reach demonstrates collaboration, partnerships, long term visionary thinking and development of innovative green stormwater infrastructure. Collaboration, partnerships, timing and external funding are critical to take advantage of this innovative project.

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The proposed restoration of Bowker Creek where it runs through the Oak Bay High School site, which is the subject of this funding application, has four phases.

Phase 1 – Oak Bay High Student Engagement and Education

As the proposed restoration site is next to a school, municipal recreation centre and new Neighbourhood Learning Centre, the short and long term opportunities for integration of green infrastructure development and learning opportunities are enormous. The students and school have expressed a strong interest in having involvement and input into creation of a draft restoration design of the creek and using the creek as an outdoor classroom. Described below are components of this phase of the project.

a) Hydrometric Monitoring Program

A critical, high priority component of the Bowker Creek monitoring program will be flow monitoring. As soon as funding is secured, the students will engage in hydrometric monitoring of the creek to obtain pre-restoration baseline flow data. Two universal access hydrometric stations will be installed at either end of the restored section of creek (exact locations to be determined) for long term creek monitoring by students.

The students may be involved in determining the locations to install the hydrometric monitoring stations to obtain the appropriate and required data, may help with the cross sections and development of rating curves and will begin the pre-restoration monitoring of this section of the creek so that one or two years of baseline data can be obtained. After the physical works on the creek are completed, the students will continue the post-restoration hydrometric monitoring. A consultant will be engaged to analyze and interpret the pre- and post-hydrometric data collected by the students.

Over time, these hydrometric stations will provide water flow information to:

- Municipality of Oak Bay—with the intention of hooking the station into the municipal SCADA station so that Oak Bay can use the data for potential flooding alarms, thereby improving their capacity to plan for and adapt to changing climate conditions and reduce the risk of property flooding for downstream residents
- BCI and broader community—for the purpose of monitoring the effectiveness of widening the creek channel in some areas as a long term strategy to reduce downstream flooding and as a climate adaptation strategy to handle the expected increase in flows. Longer term data may also be used to monitor creek flows over time as low impact development and Blueprint implementation continues.
- Oak Bay High School students—providing them with an exciting and unique opportunity to understand urban creek flows through active monitoring and recording and to become ambassadors throughout the community for sustainable development in their neighbourhoods.

These innovative partnerships and education objectives also assist the Province of British Columbia to attain its water stewardship vision and plan that “*youth are the future of water stewardship*”, as outlined in **BC’s “Living Water Smart”**. The provincial plan recognizes that “*to become successful water stewards, young people need a basic*

understanding of stream health and riparian zones. Living Water Smart commits to all BC students completing a stream health assessment by 2012. Stream health assessments will give young people hands-on skills and knowledge about the processes and attributes of healthy creeks and streams....Teaching our youth about the characteristics of a proper functioning stream will help them learn the values of water, how to reduce human impacts on nature and ways to bring a stream back to health”.

b) Incorporation of Bowker Creek Monitoring into School Curriculum

The school has also expressed strong interest in long-term curriculum development to use the creek as outdoor classroom and to participate in the long term monitoring of Bowker Creek.

An education consultant would be retained to work with the Oak Bay high school teaching staff, the District of Oak Bay and the BCI to determine aspects of long term monitoring that could be incorporated into school science curriculum. Where possible, monitoring parameters that will assist the BCI and Oak Bay in obtaining future monitoring data for the watershed health index as defined in Section 7 of the *Bowker Creek Blueprint* will be encouraged. In addition to the hydrometric monitoring, an overall monitoring program may include parameters such as:

- water quality monitoring
- riparian vegetation monitoring
- benthic invertebrate monitoring
- plant health assessment

It is expected that some monitoring equipment will need to be purchased for the expansion of the monitoring program. While there will be considerable focus on incorporating the restored creek into the science curriculum at Oak Bay High, there is also interest in curriculum development in other areas such as film studies, photography, creative writing and arts. These opportunities will be discussed and incorporated where possible and as funding allows.

c) Bowker Creek Awareness Sessions

A series of interactive, multi disciplined awareness sessions about Bowker Creek will be developed and delivered in partnership with faculty and student at Oak Bay High. These awareness sessions will educate the students about the history of the creek, including the past decisions to culvert sections of the creek, watershed stewardship, stream assessment and stream health, typical urban creek flora and fauna, invasive species, impact of urbanization on functioning watersheds and potential restoration for the future. It is anticipated that these sessions could result in activities and projects such as:

- student discussions with community elders who remember what Bowker Creek was like during their childhood
- film documentation and archiving of sustainability, process of restoration of creek and site redevelopment so that the student can tell the story of their involvement with the creek
- history of the watershed and traditional views/techniques of stormwater management paradigm shift to Designing with Nature and green infrastructure
- student implementation projects from the *Bowker Creek Blueprint*

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The hope is to conduct these awareness sessions with students in Grade 8–10 during 2011 and to continue to engage these creek aware students in the other aspects the creek restoration project over the next three years. They would be reengaged in the “Creek and Career Planning” workshops and a design charette to provide input into the final design of the restored creek section, to conduct pre- and post-restoration hydrometric monitoring, planting and establishment of the riparian and creek habitat. Such an in depth practical and hands on program of watershed education will inculcate a strong sense of environmental responsibility and stewardship in these students and through them, their community.

Phase 2 – Detailed Design and Student Charette

Building on the conceptual design developed by Kerr Wood Liedel, a detailed engineered design for the creek restoration will be developed with participation and input of the students through two key mechanisms:

a) Creek and Career Planning Workshops

Short-term integration of the project into school curriculum is proposed through a series of workshops designed to introduce students to future career opportunities while providing input into the design process for the restoration of the creek. Various professionals, such as a municipal planner and engineer, landscape architect, hydrological engineer, plant ecologist, fisheries biologist, and a LEED auditor, would be invited to provide an overview of their chosen profession and then lead the students through a real world exercise of the role of that profession as it pertains to the restoration of Bowker Creek. For example, a landscape architect might discuss the skills required and the typical jobs for individuals in that profession. They could then teach the students about riparian plants and lead the students through a process to develop a landscape plan for the restored section of Bowker Creek. Through each workshop, the students will be directly exposed to a potential future career directions, obtain key learning’s about the proper functioning of creeks, and will be very engaged in planning the creek restoration.

b) Design Charette

Following a series of professional-led workshops, the students would then participate with the professionals in a facilitated design charette as an input to the final detailed design of the restored section of creek. An engineering consultant will be engaged to produce a final detailed design and will be responsible for facilitating the design charette for the students and other professionals.

Phase 3 – Creek Restoration and Greenway Construction

The proposed creek restoration project is located on Bowker Creek where it runs through the Oak Bay High School property. The project runs downstream from the existing arch culvert which passes under the Oak Bay Recreation Centre tennis courts (Tennis Bubble) to the upstream end of Bowker Creek Park. Along this reach, the creek generally runs from west to east, with the Oak Bay High School property and existing multiuse trail to the north and the running track to the south.

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From the outlet of the arch of the culvert at the upstream end of the project, the creek passes through a relatively short concrete channel section before passing through two short box culvert sections which form a foot bridge over the creek. Downstream of this foot bridge, the creek channel make a very sharp turn to the left before flowing into a 3.5 m to 4 m deep gully or ravine bounded on the right bank (south side) by a 3.5 m to 4.0 m high concrete retaining wall which runs adjacent to the running track. The north bank of the creek is formed by a steep slope covered with invasive yellow willow and Himalayan blackberry and a few young cottonwood. Some precast concrete blocks have been placed on the left bank by the District of Oak Bay to protect the slope from erosion that was occurring along that section. The creek channel is quite flat and runs in a straight alignment along the foot of the concrete retaining wall. Downstream of the study area, the creek flows into an open channel flume lined by grouted rock walls.

The primary objectives of the proposed restoration of the section of Bowker Creek through Oak Bay High School property are to:

- improve both stream and riparian habitats
- improve the existing trail along the creek to connect with a proposed Bowker Creek greenway system
- improve drainage by improving flood flow capacity
- provide stream health education opportunities for both the high school students and the public.

The major components of the proposed design concept (see draft conceptual drawings) include:

- a meandering, 2–2.5 m wide stream channel designed to carry low summer flows
- channel ravine with a 4 m bottom designed to handle larger flood flows
- erosion protection provided using bioengineering treatments, channel toe rock, and cobble rock bench areas
- low rock weirs providing energy dissipation, grade control and channel complexing
- left bank slope of 2:5:1 (H:V) with a 2 m wide terrace
- universal access path along the left bank slope to a 15 m x 6 m viewing/educational terrace
- stairs from a viewing educational area to the top of slope to provide circular traffic flow pattern
- an upper viewing area adjacent to the multi-use trail to provide viewing opportunity to the stream from the upper trail which would include a handrail fitted with public education boards focused on watershed health

The existing concrete retaining wall is required for the running track and cannot be removed. However, it is proposed to construct a planted floodplain benches along the toe of the wall to allow vegetation to grow. There is a concrete footing which extends approximately 2 m from the toe of the wall into the existing channel. This footing will have to remain in place to protect the structural integrity of the wall. It is proposed that the benches will cover this concrete to and allow for planting of riparian vegetation along both sides of the channel.

Planting along the creek banks and upslope area would consist of native riparian vegetation. The primary focus of the planting design will be to provide riparian habitat

and stream cover. However, in certain locations planting will be limited to low growing species to allow for viewing opportunities from the multi-use trail at the top of the bank. One of these viewing areas will coincide with the lower education/viewing terraces. This will also improve public safety and security of the viewing area by improving site lines into the ravine. OBH students would be engaged in planting the newly created riparian areas.

Phase 4 – Monitoring

Through the discussions for curriculum development as it pertains to the creek in Phase 1 of the project, a monitoring program will be developed for this section of the creek. Monitoring may include:

- flow monitoring
- water quality monitoring
- riparian vegetation monitoring
- benthic invertebrate monitoring
- plant health assessment

The BCI will work with Oak Bay High School and the District of Oak Bay to ensure successful implementation of a longer term monitoring program and partnership.

PROJECT BENEFITS

This project will achieve one of the top short-term actions identified in the *Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek watershed (2010)* (Appendix E) and a conceptual design plan produced by Kerr Wood Leidel (Appendix B).

We are confident that the restoration of Bowker Creek at Oak Bay High School will achieve numerous innovative sustainable goals and objectives by investing in the green future of our community, from creation of green infrastructure for stormwater management to educating high school students about proper functioning creeks, showcasing potential careers that contribute to a green community and enhancing lasting capacity-building.

More specifically, implementation of this Bowker Creek restoration through Oak Bay High School lands will achieve the following:

1. Create healthy in-stream and riparian habitats and improve water quality along this reach of the creek:
 - Improve channel complexity using a meandering channel alignment, a low flow channel with upper flood benches and in-stream complexing.
 - Remove invasive species in the riparian area and replant channel banks with native species.
 - Reduce the slope of the ravine banks to reduce potential of erosion and enhance creek access.
 - Increase the width of the riparian zone within the overall limits of the high school redevelopment plan (approximately 20 m wide).

2. Reduce greenhouse gas emissions through the creation of a community amenity that encourages walkability:
 - Improve existing trail along the creek to connect with the proposed Bowker Creek greenway system, i.e.,
 - Include a multi-use trail to align with plans for a regional greenway adjacent to the creek,
 - Include viewing opportunities to see the creek from the multi-use trail, and
 - Incorporate items which will reduce on-going maintenance requirements.
 - Feature the creek as a natural public amenity paralleling a refurbished greenway for a walkable community that links to a larger inter-municipal greenways plan (as identified in the Bowker Creek Blueprint), leading to the creation of meaningful ways for citizens to lower their greenhouse gas emissions.
 - Assist Oak Bay municipality in meeting their obligations as a signee of the Climate Action Charter.

3. Adapt to a changing climate and provide green infrastructure drainage by improving flood flow capacity:
 - Provide sufficient flood flow capacity for future flows in accordance with the Bowker Creek Master Drainage Plan (25-year return period, 15 minute peak instantaneous flow).
 - Provide appropriate erosion protection to protect existing utilities and infrastructure from erosion.
 - Create green infrastructure that will increase the storage capacity of the creek and slow downstream flow, resulting in decreased flooding of flood-prone residential and municipal property.
 - Extend the sustainable site design and LEED technologies to the restoration and naturalisation of a highly degraded creek as part of the redevelopment of the Oak Bay high school property.

4. Increase youth and community education and awareness by providing public opportunities for stream health education:
 - Identify the creek as an extension of the school, an “outdoor classroom” with integration into formal curriculum and create new opportunities for OBH students to get involved in actual environmental science projects, building their exposure to career opportunities through various professional lenses and allowing the school to develop both short- and long-term curriculum opportunities, while contributing to municipal monitoring needs.
 - Provide formal universal access within channel ravine for student and public access to the creek (not to be flooded during 25-year storm event).
 - Protect the enhanced riparian area from informal access.
 - Provide an opportunity for safe access creek channel during low flow periods.
 - Install public information boards and public art promoting stream health.

5. Create lasting impact by establishing long-term monitoring and evaluation:
 - Install in-stream hydrometric stations as a needed green infrastructure upgrade by municipality and utilized by high school students as an integrated component of core science curriculum.
 - Evaluation to be carried out by the three municipalities of the BCI and the CRD in terms of implementation of the *Bowker Creek Blueprint*.
 - Include in the five-year established monitoring program outlined in the *Bowker Creek Blueprint* tracking and evaluation of watershed wide monitoring variables, creek corridor monitoring variables, water and sediment quality variables, and five-year watershed snapshot map.

6. Build collaborative partnerships and community capacity

The proposed restoration of the reach of Bowker Creek that runs through the OBH grounds (School District 61) and borders the Oak Bay Recreation facilities

 - as the first major project identified in the *Bowker Creek Blueprint*, demonstrates the District of Oak Bay's leadership, and build capacity for co-operation in multi-jurisdictional initiatives such as the Bowker Creek Initiative
 - demonstrate the community benefits that can result from effective partnerships and integrated, sustainable site design
 - strengthen the ongoing partnership of BCI and OBH in creek stewardship
 - is a true collaborative project that benefits all parties involved in achieving their goals of sustainably both in the short and long term.

CONCLUSION

We are confident that the restoration of Bowker Creek at Oak Bay High School will achieve numerous innovative sustainable goals and objectives by investing in the green future of our community, from creation of green infrastructure for stormwater management to educating high school students about proper functioning creeks, showcasing potential careers that contribute to a green community and enhancing lasting capacity-building.

Restoration of Bowker Creek through the LEED-driven, redesigned Oak Bay High School property, will complement the new green sustainable infrastructure and facilities—high school, recreational fields, stormwater management, Neighbourhood Learning Centre with community theatre and daycare facilities. Only external funding would allow the creek to be included in the sustainability showcase site project. Moreover, creek restoration would strongly contribute to constructing Oak Bay's green infrastructure for stormwater management, reduce known downstream flooding, create a natural community amenity, create both aquatic and riparian habitat, increase both in-stream and marine receiving environment water quality, and refurbish Oak Bay's greenway, contributing to a more walkable community with linkages to regional trails.