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INTRODUCTION

The 2011 assessment and recommendations were originally prepared in October 2008 - November 2009 by the Bowker Creek Initiative Coordinator (Tanis Gower, RPBio), to support the Bowker Creek Blueprint that was prepared by the Bowker Creek Initiative Steering Committee and supporting consultants. This 2022 update seeks to record any changes in the watercourse including evidence of increased erosion, small and large-scale restoration projects (Oak Bay High School) and the very important ongoing volunteer restoration such as removal of invasive species, planting of native vegetation and addition of salmon spawning gravels. The same reach breaks are used as defined by the Bowker Creek Watershed Proper Functioning Condition Assessment (Barraclough et al., 2007), with the addition of sub-reach breaks (A, B, C, etc.) and more detail is provided regarding current and potential vegetation conditions and restoration opportunities. This assessment focusses on addressing those sections of Bowker Creek that are currently open, but includes the assessment and recommendations of enclosed (culverted) sections as contained in the Bowker Creek Daylighting Feasibility Study (ISL, 2020).

Assessment methods for 2022 updates consisted of a desktop review of available resources (2011 Bowker Creek Blueprint, online aerial photos and stormdrain mapping, invasive species priority lists, and additional reports on a reach-by-reach basis) and discussions with municipal staff (through CRD) and volunteer groups working within the creek corridor (see Resources & Further Reading at the end of this section). On-site meetings with representatives from creek volunteer groups were conducted in tandem with field work. Field work was conducted on September 1, 9, 12, October 6, 2022 and February 7, 2023. Field work was preferentially conducted from within the creek channel where accessible, and observations were conducted from the banks when clear sightlines to the creek were possible. Field work included: photographs of each sub-reach to document existing conditions, recording observations, including riparian and upland vegetation (native and invasive species), channel and bank width, height, substrate and armouring, erosion locations, and where work has been completed by municipalities, owners, and volunteers. Additionally, the recommendations of the ISL Engineering and Land Services (2020) Daylighting Feasibility Study – Bowker Creek have been added into each of the reaches, including enclosed reaches, with the text designated in grey. The focus of the Appendix C is on restoration potential and opportunities and all recommendations may not be aligned with all of the current management planning documents.

The Resources & Further Reading section provides the background reports and reviews for the 2011 and 2022 assessments and additional materials to support restoration of the Bowker Creek watershed.

BOWKER CREEK ASSESSMENT SUMMARY

In general, the open sections of Bowker Creek are deeply incised with two to four metres elevation difference between top of bank and creek bottom. The incised (historically excavated) channel corridor typically measures between 5 to 13 metres from top of bank to top of bank, with the narrower sections supported by retaining walls. The average wetted channel width under low to moderate flow conditions is two to five metres. The natural floodplain has been removed or significantly altered in all but the uppermost sections of the creek located on the UVic campus (portions of Reaches 15B & 15C) and in a small section of Cedar Hill Park (portion of Reach 17B). In most locations without retaining walls or concrete sandbags/gabions, the banks are steeply sloping (ranging from an engineered 1:1 grade to vertical) and consist mainly of a clay substrate. The steep clay banks are unsuitable for the establishment of a diverse community of native vegetation (Reid Crowther, 2000), and where riparian vegetation exists it is often dominated by invasive species, particularly Himalayan blackberry, English ivy and golden willow. In-

stream habitat is extremely poor. A taxonomic plant list is located in Appendix C-2. The habitat type is mostly shallow runs, with very little pool habitat, and short and infrequent riffle habitats. Substrates vary and where the creek bottom is not hardened with cement or asphalt, small gravels, sand, silt or and cobble overlay clay or bedrock substrates. In some areas the creek bottom consists of exposed clay. In many areas, root mats from the invasive golden willow are seen on the channel bottom.

Bowker Creek is protected by the provincial Riparian Areas Protection Regulation (RAPR) and the Streamside Protection and Enhancement Area (SPEA) setbacks for Bowker Creek range from 10 to approximately 15 metres from the High Water Mark on both side of the creek, and 15-30m for wetland and pond areas. While existing areas of human disturbance can continue in their current form, new or re-development is restricted by the RAPR requirements. The RAPR is implemented through the Streamside Development Permit Area (District of Saanich) and the Riparian Development Permit Area (District of Oak Bay). The City of Victoria is currently exempt as there are no open Bowker Creek channels in the municipality. The RAPR applies to residential, commercial and industrial development. The RAPR does not apply to municipal or institutional (ie schools, hospitals) lands; however, most municipalities have made the commitment to follow the intent of the RAPR and implement the appropriate SPEAs in their own projects. The above SPEA setbacks are general estimates. Because the RAPR requirements are more complex than can be conveyed in this Introduction, any development within 30m of the creek requires contact with the municipality and the review of a Qualified Environmental Professional.

WATERSHED-WIDE RECOMMENDATIONS

While this Appendix C focuses on specific channel restorations and needs, there are a number of crucial recommendations that are applicable on a watershed-wide scale:

- Include climate change adaptation into all of the restoration approaches, including designing for changes in precipitation, prolonged drought, and providing a diverse range vegetation species to adapt to changing site conditions.
- Riparian and channel restoration projects should focus on improving the ecological integrity of the creek and adjacent riparian area, including channel morphology, floodplain access, vegetation communities and aquatic organisms.
- Improve the stormwater management in the watershed by increasing on-site infiltration of rainwater whenever new or re-development occurs, thereby reducing the energy loads placed on the creek and improving water quality.
- Community engagement – Any significant changes to the creek and riparian area should be accompanied by interpretive signage and at controlled points of visual access to the creek. Physical access along the banks of the creek is not recommended, but controlled points of access are beneficial to fostering community awareness and connection that, in turn, promote stewardship.
- Landowner engagement – Provide copies of the Bowker Creek Blueprint (paper or digital) and engage them in education regarding the creek health, restoration opportunities (including planting native trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. A significant number of residents encountered during the 2022 survey had never heard of the Blueprint or the restoration objectives.
- Install more stand-alone temperature sensors to assess the impacts on water temperature for aquatic life and habitat, particularly for salmonids:
    - where shading from riparian vegetation is absent (resulting in increased water temperatures, potentially to a degree lethal for salmonids), and
    - where shading from riparian vegetation is present and/or where the creek exits underground sections (resulting in decreased water temperatures, potentially providing essential cooling of water during heat domes that can be expected to increase with climate change).
- Install more hydrometric stations to assess changes in flows from climate change, infiltration improvements and flood plain/capacity restoration on downstream reaches.

GENERAL RESTORATION RECOMMENDATIONS

General restoration prescriptions that can be adopted in any open channel area, on an opportunistic basis as land use changes or as property owners decide to get involved are (see also Appendix C-1):

- Increase floodplain area by creating more gently sloping banks and/or removing fill to create a wide bench and lower the top of bank. Where benches are created, they should be one metre or less above the creek bed, as possible, to maximize floodplain area and to provide areas to plant floodplain vegetation, while also maintaining a narrow low flow channel for minimum summer water depths.
- Remove invasive species, especially those that are new or have the potential to migrate downstream and be reintroduced to areas under restoration and/or the care of volunteer eradication efforts (see notes for golden willow).
- Cessation of mowing grass/lawn areas needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas. In some reaches where the 2011 plan recommended mowing cessation next to the creek, dense fields of invasives species (thistle, etc) have taken over (ie Reach 15C UVic).
- Plant native species and maintain them during their establishment period, see Appendix C-1 for suggested species, soil amendments and maintenance schedules.
- Increase channel diversity by installing engineered rock weirs and groins. This is particularly important for those downstream reaches with potential salmonid habitat and areas requiring increased channel complexity.
- Paths or trails should be set back (preferably outside of the SPEA, if possible) from the creek channel to allow space for increasing sinuosity, floodplain access and the width of the riparian corridors, and to protect banks from trampling.

With respect to removing invasive species such as golden willow (*Salix alba* ssp. *vitellina*), it is not possible to remove dense areas of mature trees without major channel reconstruction that includes excavating the root mats. For this reason, most golden willow could remain intact when short-term restoration actions are taken. As a longer-term strategy, it is recommended to transition the vegetation community from golden willows to native species in stages, by the addition of the appropriate native tree species (such as native willows, trembling aspen, cottonwood, and red-osier dogwood) in conjunction with thinning the golden willow. Doing this in stages allows a new canopy to establish before moving to the next section in order to maintain wildlife habitat, shade and water temperatures during the transition. The Golden Willow Management Strategies by Dave Polster (2010) provide detailed prescriptions for this process, both in techniques and timing. It is important to note that care must be taken upstream to minimize golden willow cuttings from travelling downstream and spreading into additional areas. Strategies such as booms or barriers in the channel should be implemented when working with golden willows to minimize downstream migration.

For larger properties that may come available, the creek channel could be further restored by creating a new channel configuration with meanders of appropriate amplitude. The bankfull width, depth, channel and bank slope can be designed based on existing flows and desired flow conveyance (e.g. Keir Wood Leidal, 2007) as well as on the site conditions and the principles of natural channel configurations as found in Newbury and Gaboury (1994). Depending on design considerations and the site in question, the original channel could be maintained as an overflow channel for peak flows. In areas where the ability to expand the floodplain is limited, retaining walls or bioengineering, such as willow wattles, when feasible, can be used on one or both sides of the creek, to enable the creation of a lower riparian bench alongside the creek. In addition to enabling the development of healthy riparian vegetation and a limited floodplain, this option will allow for increased flood conveyance. This option is less desirable than the development of a more natural floodplain, but represents a good compromise in areas where a significantly wider creek corridor will never be logistically feasible due to existing infrastructure.

Detailed restoration plans including the channel design, instream habitat structures, floodplain areas, slope reconfiguration and number and type of riparian plants should be prepared as restoration opportunities present themselves. A list of native plants that can be used as a starting point for detailed restoration planning is found in Appendix C-1.

Appendix C was compiled in 2011 by Tanis Gower, RPBio, and updated in 2022 by Lehna Malmkvist, RPBio, (Swell Environmental Consulting Ltd.), Sara Stallard, AScT, Envr. Tech. (Fish-Kissing Weasels Environmental), Cori Barraclough, RPBio, and Patrick Lucey (Aqua-Tex Scientific Consulting Ltd.), and Steve Voller, RPBio (Seamount Consulting).

Bowker Creek Watershed

Bowker Creek Reaches and Sub-reaches

CRD
Making a difference...together

Metres
0 100 200 400 600 800 1,000

Projection: NAD 1983 UTM Zone 10N
This map is for general information only and may contain inaccuracies.

N W E S

Lambrick Park
Feltham Rd
Blair Park
Carnegie Cres
Blair Ave
Larchwood Dr
Fairburn Dr
Fairburn Park
Laval Ave
Montague Park
Lexington Ave
Edgelow St
Dawnview Cres
Gordon Head Rd
Finnerty Rd
Greenwood Dr
Braefoot Park
Braefoot Rd
Blenkinsop Rd
Wende Rd
Athlone Dr
Merriman Dr
Ascot Dr
Reynolds Park
Teakwood Rd
McKenzie Ave
14
Cedar Hill Middle School
Garnet Rd
Howroyd Ave
Onyx Park
Ansell Rd
Mortimer St
Campus View Elementary School
15C
15B
15
SW
Fraser Building
McGill Rd
15A
University Club
UVIC
West Campus Gate
SAANICH
Midgard Ave
Kisber Ave
Horner Park
13
Cedar Hill Cross Rd
Kings Pond Park
Jennifer Park
Doncaster Dr
Cedar Hill Rd
Pear St
Doncaster Elementary School
Derby Rd
Mount Tolmie Park
Frederick Norris Rd
Redwood Rd
Cadboro Bay Rd
Avondale Rd
Henderson Park
Maplewood Rd
Cedar Hill Park
17
Camrose Park
Oakmount Rd
17C
Oak Crest Dr
Browning Park
Knight Ave
Kendal Ave
Plymouth Rd
Woods
University
Cedar Hill Recreation Centre
17D
17B
17A
Wetherby Park
Keats St
12B
McRae Ave
12
12A
Peacock Hill Park
16
11
North Dairy Rd
Kingsley St
Aldridge St
Carman St
Service St
Fletcher St
Henderson Rd
Woodburn Ave
OAK BAY
Cloverdale Rd
Lang St
Burton Ave
Oakland Ave
Summit Park
Oswald Street Playground
Hillside Mall
Lansdowne Rd
Uplands Rd
Richmond Ave
Landsdowne Middle School North Campus
10
Taylor St
Mid-Downe Rd
Oakdowne Park
Nottingham Park
Dewdney Ave
Hillside Ave
Myrtle Ave
Mt. Stephen Ryan Park
Ryan St
David Spencer Park
Roseberry Ave
Scott St
Oaklands Park
VICTORIA
9
Landsdowne Middle School South Campus
Allenby Park
Townley St
Carnarvon Park
Eastdowne Rd
Pacific Ave
Estevan Ave
Dufferin Ave
Thompson Ave
Dunlevy St
Heron St
Lincoln Rd
Cook St
Stephen Ave
8
King's Road Community Nature Green Space
7B
Haultain St
7
Carrick St
Adanac St
7A
Royal Jubilee Hospital
St Patrick's Elementary School
6
Oak Bay High School
5
5B
5A
4
3
3B
3A
Oak Bay Recreation Centre
Redfern Park
Bowker Creek Walkway
2
1C
1B
1A
1
Firefighter's Park
Glenlyon Norfolk School
Monteith Street Community Garden
Willows Park
Haynes Park
Harris Green
Pandora Ave
Cavendish Ave
Bowker Ave
Beach Dr
Cranmore Rd
Monterey Ave
Hampshire Rd
Amphion St
Stadacona Park

Bowker Creek Daylighting Options

Current Alignment
- Open Channel
- Underground

Proposed Alignment*
- Open Channel
- Underground
- SW Proposed Storm Water Management Facility

Reach Label
- (8) Reach Marker
- 1A Sub-Reach Marker

Reach Marker
- Reach End Marker
- Sub-Reach End Marker

Existing Greenway
- Multi-Use Trail
- Walking Trails

Other Features
- Green Space
- School
- Municipal Boundaries
- Watershed Boundary
- Park
- Building Footprint

* More detail about the proposed daylighting routing is available in the Daylighting Feasibility Study.

TABLE 1. SUMMARY OF CONDITIONS & OPPORTUNITIES (by REACH). For full detailed descriptions of conditions and opportunities, see maps, tables and photos at each Reach in the following pages.

REACH	CONDITION	OPPORTUNITIES
Reach 1A	- Banks and channel bottom are hardened - Very little native riparian vegetation	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. - Work with landowners to improve fish habitat and access through rock/gravel weirs, repair erosion areas with bioengineering, if possible, and remove invasive species. - Long-term removal of armouring, restoration of channel, and re-sloping of banks possible with single-family lot owners and re-development of 1725 Beach Drive multifamily lot.
Reach 1B	- Banks and channel bottom are hardened in many area - Erosion is occurring in over-steepened banks with soil sections, many of which are from fill used to extend yards. - Mix of invasive species and native trees with some native understory shrubs.	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. - Improve instream fish habitat through enhancing stone lines into weirs and adding spawning gravel for natural redistribution - Repair erosion areas, with bioengineering, if possible. - Remove invasive species - Long-term removal of armouring, restoration of channel, and re-sloping of banks possible with property owners.
Reach 1C	- Banks are stable (except the concrete sandbag area) and channel has floodplain access - Community gardens encroach into the riparian area and limit restoration opportunities - Friends of Bowker Creek have done extensive invasive removal and plantings, water quality monitoring, and installed a chum salmon egg incubator and spawning area. - Mix of invasive species and native trees with some native understory shrubs.	- Provide community gardeners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, invasive species, garden waste management, and restoration opportunities. - Improve instream fish habitat through enhancing stone lines into weirs and adding spawning gravel for natural redistribution - Repair erosion areas with bioengineering, if possible. - Continue invasive species removal.
Reach 2	Enclosed	- Daylighting when firehall and park are redeveloped (funding has been designated for redevelopment) as recommended in Daylighting Feasibility Study (2020). - Re-contouring to direct overland flood waters away from vulnerable properties (if not daylighted).
Reach 3A	- Channel is contained within concrete banks and bottom - Friends of Bowker Creek have done extensive invasive removal and plantings within the floodplain area, as well as water quality monitoring - Riparian area is disconnected from the stream with concrete walls, and consists primarily of trees, lawn and some groupings of native and ornamental vegetation.	- Provide adjacent property owners with the Bowker Creek Blueprint, and engage them in education regarding the creek health and restoration opportunities, including planting trees to shade the creek. - Improve channel habitat by adding complexity (boulders), deepening pools and allowing planted vegetation to fill in and define a low flow channel between the concrete walls. - Work with Friends of Bowker Creek to continue to remove invasive species, plant native riparian species and widen the riparian zone. - Install a water temperature sensor downstream of the school and park to observe the effects of the reduced riparian cover. - Long-term removal of armouring, channel restoration, re-sloping of banks and planting native riparian vegetation. - Chum salmon habitat could be further improved in areas where the channel is narrowed and results in higher velocities by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park. For now, riparian restoration to provide shading to moderate summer stream temperatures would be most beneficial. In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally.
Reach 3B	- Channel and north bank were reconstructed and planted with native vegetation in 2015-2017; south bank is a vertical concrete wall with constructed willow planting benches at the base.	- Work with District of Oak Bay to stop the frequent discharges of turbid water from the Public Works Yard. - Provide Oak Bay High School with the Bowker Creek Blueprint, and engage them in education regarding the creek health and restoration opportunities.

	- Friends of Bowker Creek and Oak Bay High School conduct ongoing invasive species maintenance, vegetation monitoring and plantings - ~600 chum salmon fry were released in winter 2021-2022	- Work with Friends of Bowker Creek and Oak Bay High School to continue to remove invasive species, plant native riparian species and widen the riparian zone. - Plant trees and shrubs at the top of the vertical wall along the running track to provide critical shade to the creek from the south. - Install a water temperature sensor downstream of the tennis bubble to observe the effects of possible cooling from upstream piped reaches. - Chum salmon habitat could be further improved in areas where the channel is constricted and results in higher velocities, by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park. In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally. - Long-term redevelopment of the running track could allow restoration of the south bank.
Reach 4	Enclosed	Daylighting when Tennis Bubble and/or Oak Bay Recreation Centre are redeveloped as recommended in Daylighting Feasibility Study (2020).
Reach 5A	- Channel is entrenched with Himalayan blackberry at the upstream end and a mix of native and non-native vegetation in the south section. - On both sides of the creek, the riparian zone is constrained by land uses (parking, soccer field). - Recent erosion events on the south bank have been treated with riprap slope amouring.	- Provide Oak Bay High School, Oak Bay staff and nearby commercial business owners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, spread of invasive species, restoration opportunities (including planting trees to shade the creek) and the RAPR. - Remove invasive vegetation, particularly European black nightshade that is establishing in topsoil at top of bank of the new erosion protection: removal now could prevent it from spreading downstream. - Encourage the ongoing maintenance of the flow meter at the bottom of the reach for monitoring of water temperatures and flooding. - Work with District of Oak Bay and Oak Bay Recreation Centre to reconfigure the parking lot to allow reconstruction of the channel, re-sloping the banks, planting native riparian vegetation, installing a raingarden to treat parking lot runoff, and constructing a pedestrian connection to Oak Bay High School and the Bowker Creek Walkway Park as recommended in Daylighting Feasibility Study (2020). - More extensive creek restoration would be possible in tandem with future reconstruction of the tennis bubble when it reaches the end of its functional life.
Reach 5B	- Concrete and mortared rock channel, highly constrained by adjacent land uses.	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities, spread of invasive species and the RAPR. - Increase trees and shrubby vegetation at top of bank for shading. - Install baffles/boulders for in-channel complexity, to create a low flow channel and to allow more vegetation to establish between the concrete walls. - Check for aquatic invasive species to prevent downstream spread. - A low priority for treatments without redevelopment and land use changes, with possible improvements if upstream section daylighted as recommended in Daylighting Feasibility Study (2020).
Reach 6	Enclosed	Daylighting when redevelopment or opportunities arise as recommended in Daylighting Feasibility Study (2020).
Reach 7A	- Restoration demonstration site (lower 45m, downstream of footbridge) is well established - Remaining reach upstream of the footbridge is entrenched and dominated by golden willow, Himalayan blackberry, and English ivy - On both sides of the creek the riparian zone is constrained by land uses (parking, playground, mowed grass, etc.).	- Provide property owners along the creek (and School District 61) with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. - Short term – Engage with landowners to partner for restoration, bioengineering for erosion protection and invasive species removal. - Short term – Stop mowing riparian area along parking lot. Cessation of mowing needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas. - Long term – A range of options are available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school. - Long term – Realign and restore channel and riparian area as recommended in Daylighting Feasibility Study (2020).
Reach 7B	- Channel is entrenched, with steep banks, and some eroding sections. - Vegetation is dominated by invasive species, including new invasives (white poplar and European black	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.

	nightshade) not seen in very many other locations in the watershed.	- Short term – Invasive species removal (particularly climbing vines and new species), erosion protection with bioengineering, relocation of trail away from the stream and protect banks from trampling (e.g. fencing), and planning for long-term restoration with the District of Saanich. - Long term – Realign and restore channel and riparian area as recommended in the Daylighting Feasibility Study (2020), including the construction of a Stormwater Management Facility.
Reach 8	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 9	- Straight, entrenched channel with steep banks (~ 3m high) and no floodplain access, fenced with adjacent mowed lawn areas and a parking lot. - Channel and banks are dominated by golden willow, Himalayan blackberry, and English ivy - The existing riparian zone is constrained by land uses (large mowed areas, parking, playground, multi-family dwellings).	- Provide property owners along the creek (including School District 61) with the Bowker Creek Blueprint and engage them in education regarding the creek health, restoration opportunities, yard and garden waste storage, spread of invasive species and the RAPR. - Engage with landowners (including School District 61) to partner for restoration, bioengineering for erosion protection, invasive species removal, fence re-location and reduced mowing of the riparian area on both sides of the creek. Cessation of mowing needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas. - Depending on the feasibility and schedule for the long-term restoration activities, the removal of invasive species and widening of the riparian area could be initiated; however, if the channel will be relocated and/or channel banks re-sloped, the invasive removal and planting should be done at that time. <u>Long term</u> – - A range of options are available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school, School District 61, and with residents. - Realign and restore channel and riparian area as recommended in the Daylighting Feasibility Study (2020), including the construction of a Stormwater Management Facility. - The optimal restoration will use the area of land to the west of the existing channel, with space for a meandering channel and a significant pond/wetland. - The distance that the creek corridor can be moved eastward is constrained by the designated right of way above the north east trunk sewer line. The School Board (School District 61) has signed an agreement to maintain this right of way. Design options should use this corridor for greenway development. Access for sewer maintenance needs to be maintained. - In areas where widening the riparian corridor is not feasible, improvements could be made and the channel could be reconstructed, similarly to the lower section of Reach 7A. Keeping within a similar footprint with a rock toe at the base, would create a low flow channel and floodplain terrace, and provide a small riparian area up to the top of the slope to be planted with native vegetation, using bioengineering to stabilize slopes, if needed. <u>NOTE</u>: Currently (2022) a land sale is proposed for the southwest triangle of land on the school district property, if this sale proceeds and the land redeveloped, it will limit the ability to achieve the long-term goals for this reach.
Reach 10	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 11	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 12A	- Banks and channel bottom are armoured in many areas - Erosion in over-steepened soil sections and undercutting/erosion of armouring, in particular concrete sandbag areas - Vegetation varies from lot to lot, including lawns, cedar hedging, ornamental gardens, invasive species, and some native riparian vegetation	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. - Opportunities exist for increasing the width and vegetation composition of the riparian area with landowner participation. With private landowner involvement the creek corridor could be significantly improved via re-sloping the banks, widening the riparian buffer and planting more native trees and shrubs. - Erosion areas should be addressed with bioengineering, if possible. - Vegetate the west bank riparian zone along the Wordsworth Street right of way accessed from McRae Avenue. Re-slope the bank to the degree possible while leaving room for a greenway path. - Add rain gardens within the road right-of-ways to treat runoff prior to discharge to the creek.

		- In the long term, the best outcome would be removal of the bank and channel bottom armouring, re-sloping of banks and planting with native vegetation, and installation of channel complexity. The final location and design will be determined by the amount of space made available. If possible, 10-15 metres of riparian corridor on each side of the channel would provide the most benefit to the creek.
Reach 12B	- Banks and channel bottom are hardened in many areas - Pockets of erosion in oversteep soil sections - Mix of invasive species and native trees with some native understory shrubs. - Friends of Browning Park are removing invasives, planting native species and fencing the riparian area.	- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR. - Repair erosion areas with bioengineering, if possible. - Work with Friends of Browning Park and District of Saanich to remove invasives and plant native riparian species - Close off informal trails and revegetate. - Install a rain garden at the drain from McCrae Avenue to treat runoff from the road and install a rain garden to address house drainage coming through the west side of the park - Create an upstream oil capture device and/or determine the source of hydrocarbons to this reach. - In the long term, the best outcome would be removal of the concrete/rock bank and channel bottom armouring, re-sloping the creek banks and planting with native vegetation, and installation of channel complexity. The final location and design will be determined by the amount of space made available. If possible, a minimum of 15m of riparian corridor on each side of the channel would provide the most benefit to the creek.
Reach 13	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 14	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 15A	- Manmade, concrete-lined channel and pond, with an aerating pump - Riparian vegetation is a mix of native, ornamental and invasive species.	- Check outlet weir and maintain stop logs, if required. - Remove invasive species and plant native riparian species. - Habitat complexity could be increased in the pond through the additional of large wood and rock. - Long term - Construct a larger wetland and riparian area if the building is removed.
Reach 15B	- Wide wetland floodplain with low flow channel, with some incised sections and tributaries. - Riparian vegetation mix of native and invasive species.	- Priority is invasive species management –English ivy, Himalayan blackberry, etc., and removing new invasive hanging sedge before it spreads. - Expand riparian areas to extent possible (e.g. remove lawn edge around Parking Lot 9), reduce or remove lawn areas in the north and southwest and replant with native vegetation. - Cessation of mowing needs to be accompanied by control of invasive species and diverse native riparian planting, to prevent weed growth in un-mowed areas. - Install more interpretive signage for Bowker Creek and stormwater management. - Improve stormwater management by creating ponding areas in the vegetation where curb cuts have been installed in Parking Lot 8. - Rehabilitate the incised portion of the mainstem along Gordon Head Road by re-grading and widening the banks, increasing the floodplain, and re-creating channel complexity and sinuosity. - The Gordon Head Road tributary ditch with which it forms a confluence and the tributary ditch downstream from Reach 15C could be regraded and shaped to function as small streams or rain garden areas. - Plant additional native trees to replace the mature trees that have died, and as the overstory tree layer senesces. - Ensure that as UVic continues to develop the upper watershed channel, wetland and riparian areas are protected.
Reach 15C	- Moderate wetland floodplain with low flow channel. - Riparian vegetation mix of native and invasive species.	- Invasive species management – Himalayan blackberry, creeping buttercup, Canada thistle, etc. The thistles especially should be removed to prevent further spread. - Widen riparian buffer by cessation of mowing. Cessation of mowing needs to be accompanied by control of invasive species and diverse native riparian planting, to prevent weed growth in un-mowed areas. - If possible, a minimum of 10m of riparian corridor on each side of the channel would provide the most benefit to the creek and would meet the SPEA as defined by the RAPR. - Convert tributary ditch at the downstream end of reach 15C from Parking Lot 9 into a rain garden to treat parking lot runoff. - Habitat complexity could be increased by adding large wood into the channel and riparian area. - Install Stormwater Management Facility in open field in the northwest corner (Gordon Head Road/McKenzie Avenue). This location is considered to be the highest priority for stormwater storage.

		- Ensure that as UVic continues to develop the upper watershed channel, wetland and riparian areas are protected.
Reach 16	Enclosed	Daylighting as described in the Daylighting Feasibility Study (2020).
Reach 17A	- Incised channel with no floodplain access - Riparian vegetation is mostly native with some invasive species, particularly in the upper channel.	- Short term restoration should focus on invasive species removal and replanting in the riparian area. Above the riparian area, consider Garry oak and associated meadow species for very dry and sunny areas. - Long term restoration could include re-sloping the banks and increasing the riparian width to provide floodplain access and channel complexity, including LWD. - In areas that are more constrained, terraces could be created using bioengineering techniques to reduce the footprint.
Reach 17B	- Wetland area in lower reach and channelized stream in upper reach adjacent to recreational facilities and golf course greens. - Wetland consists of invasive golden willow and upper area is a mix of native (black cottonwood and cattails) and non-native vegetation (reed canary grass and Himalayan blackberry).	- Short-term focus on invasive species removal and riparian planting, especially moisture-tolerant trees adjacent to wetland areas as a start to long-term strategies. - Long-term opportunities in the upper section, include widening the stream channel or creating a larger wetland area and planting with riparian species to create channel complexity (large wood) and sinuosity for improved instream habitat and flood capacity. - Long-term opportunities in the lower section include transitioning from the golden willows to native species by removing sections of golden willow and replanting with native willows, trembling aspen and other wetland vegetation – doing this in phases will allow the wetland to continue to function as water storage and habitat during the transition. - The spring and foreign fill area to the east of the upper section has been identified in the Cedar Hill Park Management Plan as an opportunity to create additional wetland habitat and flood response. - Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.
Reach 17C	- Lower section – culverted - Gully section – natural channel with extensive Himalayan blackberry and other invasive species. - Upper section – channelized with very little riparian area	- Short term focus on invasive species control - Long-term channel daylighting and restoration, invasive species and native riparian plantings. - Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.
Reach 17D	- Mostly culverted (130m) - Large pond, recirculating pump and narrow riparian vegetation around the perimeter - Small vegetated wetland between two culverted sections.	- Short term focus on invasive species control and increasing riparian planting width. - Long-term channel daylighting and restoration, invasive species and native riparian plantings. - Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.

RESOURCES & FURTHER READING

Most documents are available on the CRD Bowker Creek Initiative website:
https://www.crd.bc.ca/bowker-creek-initiative/resource-library/reports-studies

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ISL Engineering and Land Services. 2020. Memorandum: Potential Stormwater Management Facilities on Bowker Creek - https://www.crd.bc.ca/docs/default-source/initiatives-pdf/bci-pdf/200331_bowker_creek_potential_swmfs_final_32297.pdf?sfvrsn=297b1bcd_0

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Kings Community Greenspace Vision - https://www.saanichlegacy.ca/project/kings-community-greenspace-vision

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Newbury, B. and M. Gaboury. 1994. Creek analysis and fish habitat design. A field manual.

Oak Bay Highschool Bowker Creek Restoration CRD webpage: - https://www.crd.bc.ca/bowker-creek-initiative/projects-outreach/projects/creek-restoration-projects

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University of Victoria Student Reports (Others may be available from UVic Departments):

https://www.uvic.ca/socialsciences/environmental/assets/docs/courses/BowkerCreekRestoration.pdf

https://www.uvic.ca/socialsciences/environmental/assets/docs/course341/bowker_creek_headwaters_Fall%202008.pdf

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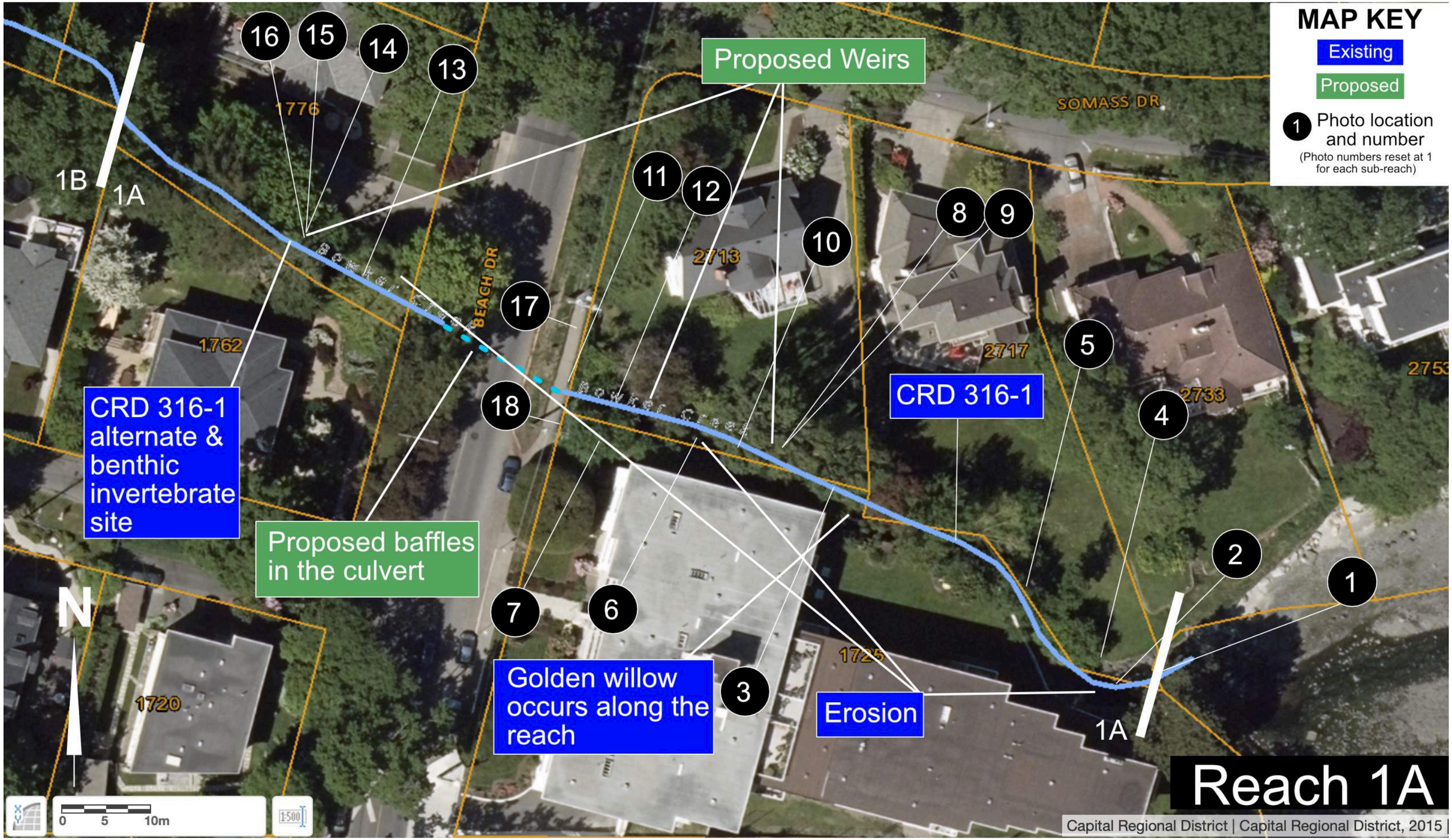

MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Proposed Weirs
CRD 316-1 alternate & benthic invertebrate site
Proposed baffles in the culvert
Golden willow occurs along the reach
Erosion
CRD 316-1
1B
1A
BEACH DR
SOMASS DR
1776
1762
2713
2717
2733
1725
1720
N
0 5 10m
Reach 1A
Capital Regional District | Capital Regional District, 2015 |

REACH 1A

Reach # 1A – Creek mouth into Oak Bay to upstream (west) end of 1776 Beach Drive) (140m)
2733, 2717, and 2713 Somass Drive; 1725, 1762, and 1776 Beach Drive (privately owned)

Channel Description
Channel banks are primarily concrete, mortared rock and concrete sandbags (Photos 1-6,8-10,12-15). The channel bottom is a mix of bedrock, heavily silted substrate of sand, gravel, cobble, and boulders, and extensive concrete and asphalt armouring (Photos 3,8,9,12,13,16). Thick algal mats and root mats from golden willow are present. Vertical armoured banks 1-2m tall, channel width 3.0m – 5.5m, wetted width 0.4m-3.5m (summer). The creek is channelized and straightened with a gradient range from 1.5-4% with a narrow strip of riparian vegetation (Photos 17 & 18). There is a 22m long pool downstream of the culvert which is suitable as a holding location for juvenile fish prior to entering the marine environment, and also for adults entering the stream to hold while awaiting higher flows and while maturing. Tidal influence occurs downstream of Beach Drive. Concrete box culvert at Beach Drive (3.0m wide x 2.2m tall x 15m long). Small areas of steep, but unarmoured, eroding soil banks: north bank just upstream of the culvert (portion of 1776 Beach Drive); south bank just downstream of the culvert (1725 Beach Drive). This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
North bank: Single family properties with lawn and in some places a narrow strip of landscaped plantings (~1 tree/shrub wide) to the edge of generally vertical hardened banks (except as above) (Photos 2,3,5,6,8-10;13-15). Strip of trees/shrubs above retaining wall on north bank is 0-2m wide and a mix of ornamental/invasive, with a few native species, and yard waste disposal along the creek edge (Photo 4). Potential riparian width could be 5-10m wide, with landowner involvement and could also include removal of concrete wall.
South bank: 1725 Beach Drive is an apartment building that is very close (<5m) to the top of channel bank with a lawn to the top of the vertical concrete wall, and occasional ornamental trees, shrubs and ivy. Just downstream of the culvert, the bank is a steep soil bank and eroding at the upstream end of the concrete wall (Photos 2, 3, 5, 6, 8). 1762 Beach Drive has a 2+m vertical concrete wall along the length of the property with ivy and trees at the top (Photos 12-15).
Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium
- North bank upstream of Beach Drive culvert (Photo 13)
- South bank at the base of the concrete wall near outlet into the bay (Photo 2)
- South steep bank (up to 3m high and ~7m long) just downstream of Beach Drive (Photo 6)

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Narrow strip of trees, shrubs, ornamentals and lawn along the creek corridor.
Dominant species: Downstream of Beach Drive - golden willow, Himalayan blackberry, laurel hedge, English ivy, traveler's joy (clematis), and many properties with lawn close to the top of bank. Golden willow has colonized a short segment of deposited fine soil/sand in the channel and concrete walls. English ivy and Himalayan blackberry cover parts of the concrete walls.
Upstream of Beach Drive - weeping willow, black cottonwood, bigleaf maple, Douglas-fir with traveler's joy, English ivy and Himalayan blackberry.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Garry oak, weeping willow, black cottonwood, bigleaf maple, Douglas-fir, ornamental trees (e.g. cherry, golden chain tree), cedar hedge, spurge-laurel, morning glory, snowberry.

Percent coverage of invasive vs. native species
Approximately 20% invasive, 80% non-native in total.
Invasive species observed**:** English ivy, golden willow, Himalayan blackberry, laurel hedge, golden chain tree, English hawthorn, English holly, spurge-laurel, traveler's joy, morning glory, Canada thistle, ornamentals, lawn.
NOTE: Japanese knotweed and policeman's helmet were observed in 2011 and not observed in September 2022. The knotweed may have been removed by hand or erosion, and Policeman's helmet may not be visible at this time of year. Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short term riparian restoration potential and techniques
Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
Invasive species removal, work with private landowners (2713 and 2717 Somass Drive; 1725, 1762 and 1776 Beach Drive):
- Watch for recurrence of Japanese knotweed on the south bank, downstream of the culvert
- Watch for Policeman's helmet
- Control traveller's joy vines growing on trees along the creek (1725 Beach Drive and 1776 Beach Drive)
- Remove English ivy from concrete walls and trees (1725, 1762 and 1776 Beach Drive)

Plant native species, work with private landowners (2713 and 2717 Somass Drive; 1725, 1762 and 1776 Beach Drive):
- Increase native riparian plantings along the creek and increase the width of the riparian zone
- 1776 Beach Drive has a bank with some soil banks and less hardening, if invasives were removed, there is a good opportunity for native riparian plantings on much of the bank.

Address erosion in areas along the bank to prevent sedimentation and potential bank failure:
- North bank, 1776 Beach Drive, possible bioengineering location upstream of the culvert (Photo 13).
- South bank, 1725 Beach Drive, possible bioengineering location downstream of the culvert (Photo 6) and repair retaining wall upstream of the mouth of the channel (Photo 2).

Short term channel restoration potential and techniques
Improve fish passage and habitat:
- Downstream end of the 22-metre pool is controlled by 2 small boulders (30-40 cm diameter) that appear to have been purposefully placed. A few more spanning the channel with a gap in the middle for low flows would increase the depth of the pool (need hydrologist to ensure no increase in flood or bank erosion). Could also place spawning gravel on leading edge of these boulders. Access by wheelbarrow from apartment on right bank on Beach Drive (Photos 8 and 9).
  - Location: UTM 10U 0477276 5364072.

Fish passage is limited during low flow because of water depth in culvert and a hydraulic jump at the downstream end of the culvert. Fish passage and channel complexity could be improved by installing:

- Two rock/gravel weirs downstream of the culvert (32m and 10m downstream of the culvert) (Photos 8, 9, 12)
- Concrete baffles/chevrons (~40 cm high) drilled into the culvert would improve upstream adult salmon migration in low and high flow. The upstream-most baffle would also provide a hydraulic control for the tail-out of an existing pool immediately upstream of the culvert and would increase its depth to allow fish to rest after passing through the culvert, (Photos 10 and 11)
- Rock/gravel weir in the channel along 1776 and 1762 Beach Drive (20m upstream of the culvert)
- 29 metres upstream of the culvert, the above-mentioned pool ends and a 3-m patch of boulders creates a small riffle (Photos 14, 15). Boulders could be rearranged to enhance riffle and increase depth of another pool immediately upstream. Spawning gravel could be placed on the upstream face of the boulders for spawning.
    - Location: UTM 10U 0477176 5364127

The channel substrate would also be improved by the removal of garbage and loose debris, such as concrete and asphalt chunks, old water heater, broken pipes, etc.

Long term channel and riparian restoration potential

A range of options are available in the long term, depending on future redevelopment and/or landowner involvement:

The best outcome would be removal of the concrete/rock walls, replacement of channel bottom armouring with fish-appropriate substrate (gravel/cobbles), addition of channel complexity (large woody debris, boulders), and the slope reduction of creek banks followed by increased slope planting with native vegetation. The final locations and designs would be determined by the riparian width made available. If possible, 15m of riparian corridor on each side of the channel would provide the most benefit to the creek and meet the SPEA goals as defined by the RAPR.

Channel restoration should be focused on improving fish passage and habitat complexity of the channel substrate, along with installing channel weirs and culvert baffles as described in the section above. Due to the lack of natural inputs of gravel for spawning substrate, gravel could be added at a few key locations over time to allow natural distribution throughout the stream.

If future redevelopment constraints require the creek corridor to remain relatively narrow, other options to improve the creek include:

- Bioengineering to replace concrete retaining walls while maintaining a narrow footprint.
- Moving retaining walls back from the channel to allow floodplain and plantings adjacent to the channel (such as on the south bank at Oak Bay High).

North Bank (2713 and 2717 Somass Drive; 1776 Beach Drive)
Work with property owners to remove concrete walls, re-slope the creek banks, remove invasive species and plant native species.

South Bank (1725 and 1762 Beach Drive)
When the apartment complex at 1725 Beach Drive is redeveloped, the building footprint could be moved back from the channel, providing opportunities to remove the concrete retaining walls, re-slope the creek banks, remove invasive species and plant native species. At 1762 Beach Drive, work with property owner to remove concrete walls, re-slope the creek banks, remove invasive species and plant native species.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 1 of 13) for proposed alignment], provides the following information (in grey):

Oak Bay [mouth] to Beach Drive

- Creek is on private property, primarily on back of lots on Somass Drive.
- BCI has identified 3 lots along Somass Drive for partial acquisition to improve the creek and/or for greenway; no changes required.

Additional Observations/Notes

2022 – The barriers to fish passage, and characteristics of the channel and riparian areas (armouring and vegetation) are similar to those observed in 2011, with some small changes to erosion locations and invasive species.

Yearly CRD water quality sampling is done just above the limit of tidal influence below Beach Drive (**CRD site 316-1**). More extensive '5/30' CRD water quality sampling is done on a 5-year rotation, including sampling for Benthic Macroinvertebrates, immediately upstream of Beach Drive.

Friends of Bowker Creek conduct water quality monitoring in this reach.

2011 – The stream bed under and adjacent to Beach Drive is asphalt and concrete, which presents the first fish barrier in Bowker Creek, due to high velocities in higher flows, and shallow depths during low flow because of water depth in culvert and jump at downstream end. Tidal influence extends up into this reach.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Banks and channel bottom are hardened
- Very little native riparian vegetation

Opportunities:

- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Work with landowners to improve fish habitat and access through rock/gravel weirs, repair erosion areas with bioengineering, if possible, and remove invasive species.
- Long-term removal of armouring, restoration of channel, and re-sloping of banks possible with single-family lot owners and re-development of 1725 Beach Drive multifamily lot.

Photo 1A-1. Bowker Creek mouth, flowing into Oak Bay.

Photo 1A-2. Channel with concrete walls, non-native species in the riparian zone, erosion under the concrete wall at 1725 Beach Drive, near mouth of the creek (view upstream).

Photo 1A-3. Concrete wall at 1725 Beach Drive, and golden willow mats at 2713 Somass Drive (view upstream).

Photo 1A-4. Concrete wall, lawn, ornamental vegetation, and yard waste at 2717 Somass Drive (view downstream).

Photo 1A-5. Himalayan blackberry and golden chain tree at 1725 Beach Drive and 2717 Somass Drive (view upstream).

Photo 1A-6. 1725 Beach Drive, erosion downstream of Beach Drive culvert, at upstream end of retaining wall (south bank).

Photo 1A-7. Traveler's joy (clematis) in trees/shrubs downstream of the Beach Drive culvert at 1725 Beach Drive

Photo 1A-8. Downstream end of Beach Drive culvert, weir proposed to improve fish passage (view downstream).

Photo 1A-9. Proposed weir location downstream of Beach Drive.

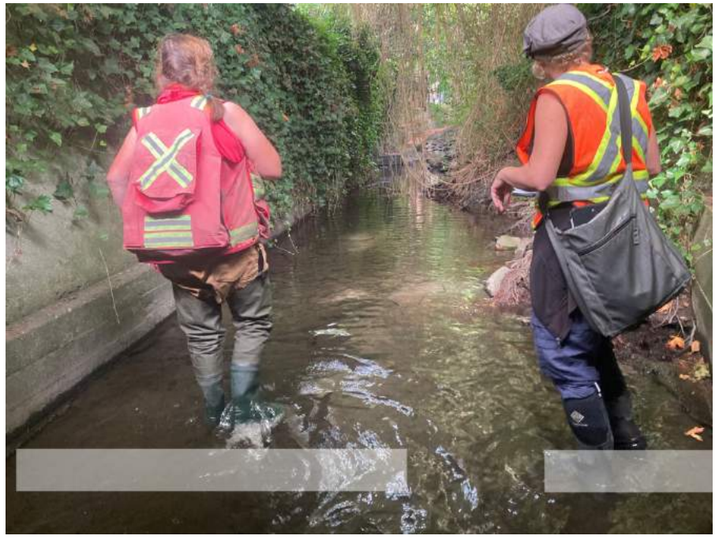


Photo 1A-10. Proposed baffle location downstream of Beach Drive.

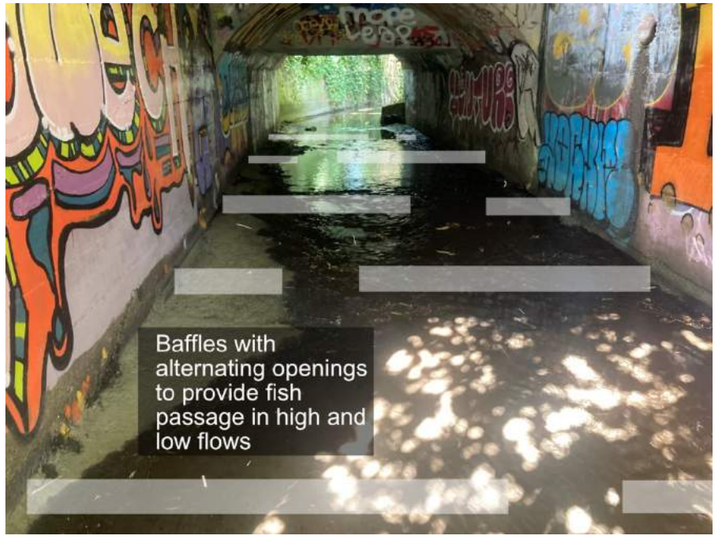


Photo 1A-11. Culvert under Beach Drive, with baffles proposed to assist low flow fish passage (view upstream).

Photo 1A-12. Downstream end of Beach Drive culvert, weir proposed to improve fish passage.

Photo 1A-13. View upstream from Beach Dr culvert: ivy on the concrete wall at 1762 Beach Dr and eroding bank and ivy at 1776 Beach Dr.

Photo 1A-14. Proposed improvements for fish passage at 1776 Beach Drive, near upstream end of the reach (view upstream).

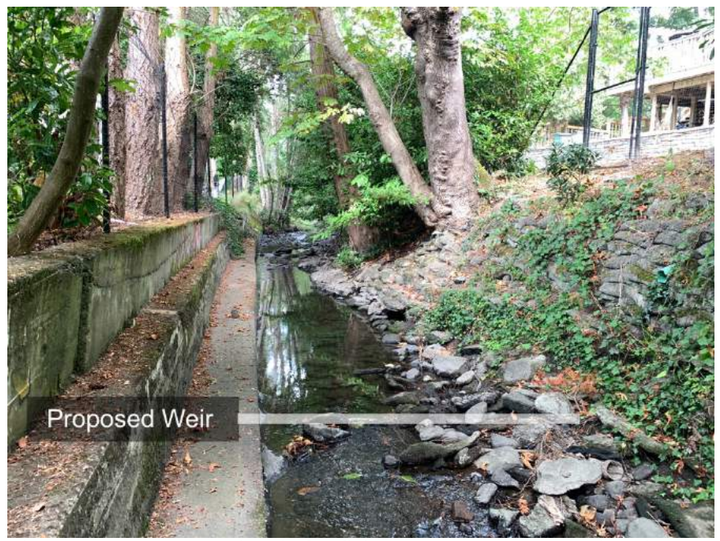
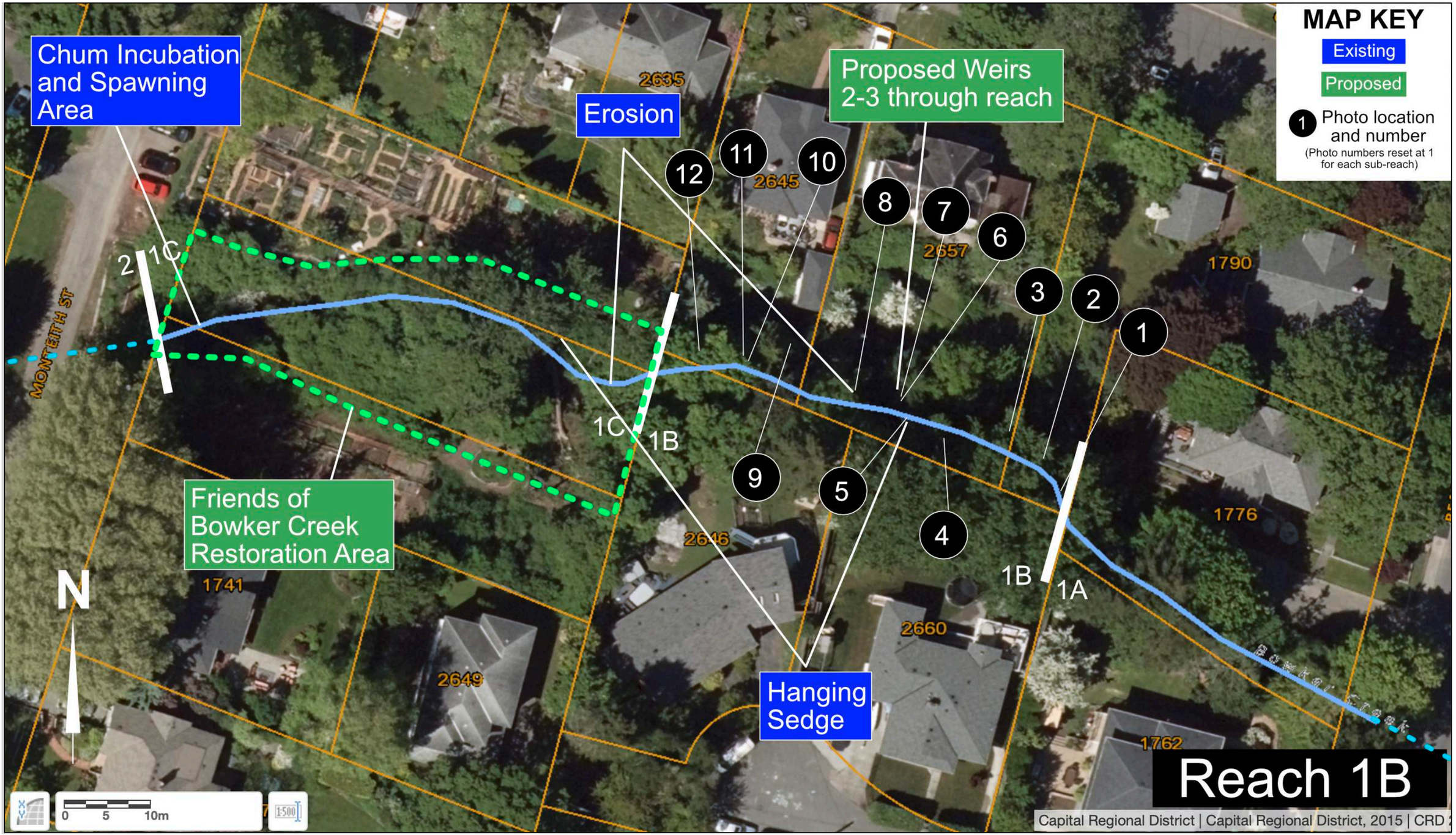


Photo 1A-15. Proposed weir for fish passage at 1776 Beach Drive, near upstream end of the reach (view upstream).

Photo 1A-16. Heavily silted cobble substrate upstream of Beach Drive.

Photo 1A-17. The vegetated riparian area in this reach is very narrow, with lawns extending almost to the edge of the creek (view of north bank downstream from Beach Drive).

Photo 1A-18. The vegetated riparian area in this reach is very narrow, with development extending almost to the edge of the creek. Warning tape flags off a recent tree blowdown (view of south bank downstream from Beach Drive).


Chum Incubation and Spawning Area
Erosion
Proposed Weirs 2-3 through reach
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Friends of Bowker Creek Restoration Area
Hanging Sedge
Reach 1B
N
MONTEITH ST
2635
2645
2657
1790
1741
2649
2646
2660
1776
1762
2
1C
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0 5 10m
Capital Regional District | Capital Regional District, 2015 | CRD

REACH 1B

Reach # 1B - Upstream (west) end of 1776 Beach Drive to eastern end of Monteith Community Gardens (55m)
1790 Beach Drive; 2645 and 2657 Cranmore Road; 2646 and 2660 Shady Lane (privately owned)

Channel Description
Channel banks are possibly fill, with a mix of mortared rock, concrete sandbags, and mostly steepened soil banks (vertical to 2:1 slope), approximately 2m tall (Photos 1,3,4,6-8,11-12). The channel is generally 3.5m – 5.5m wide, with a braided section of >10m wide over bedrock outcrops, and a wetted width of 0.8m-2.5m (summer). In this reach the channel has more sinuosity as compared to the straightened channel downstream. The channel bottom is bedrock and heavily silted boulder/cobbles with some armoured sections, and approximately 1% slope (Photos 1,2,6-8,11). This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Both sides of this reach are single family home lots with houses setback 8m or more (some accessory buildings may be closer). There is 2-5m strip of existing trees and shrubby vegetation along each bank and opportunities for increasing the width and vegetation composition of the riparian area. Yard and garden waste are close to, and over, the banks of the creek.

With private landowner participation the creek corridor could be significantly improved via re-sloping the banks, widening the riparian buffer and planting more native trees and shrubs. The current building footprints appear to leave enough room for this to occur. Additionally, erosion areas and activities such as yard waste disposal could be addressed.

North bank: (1790 Beach Drive, 2645 and 2657 Cranmore Road) – Steep banks (mix of soil and concrete sandbags) and extensive Himalayan blackberry, with some erosion points. With landowner involvement and possible removal of armouring, potential width of the riparian area could be 5-10m (Photos 1,3,4,6-9,11-12).

South bank: (2646 and 2660 Shady Lane) – 2660 Shady Lane has a mortared rock wall and trees at the top of bank with English ivy. 2646 Shady Lane has lower (2:1) soil slopes, with trees and a mix of native and non-native vegetation. With landowner involvement and possible removal of the concrete wall, potential width of the riparian area could be 5-10m (Photos 1,4,6,7,10).

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium – North bank eroding at vertical sections (Photos 1,3,8,11). As in many (if not most) places along the creek, streamside properties are built up with fill. The erosion problems at 1776 Beach Drive are a result of a corner of the filled lot extending into the creek channel and causing a narrowing and a slight bend in the creek.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Narrow strip of trees, shrubs, ornamentals along the creek corridor.
Dominant species: black cottonwood, bigleaf maple, red alder, Himalayan blackberry, English ivy, laurel hedge.
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
grand fir, Douglas-fir, June plum, bracken fern, oceanspray, snowberry, mock orange, Nootka rose, red-osier dogwood, vine maple, bracken fern, Pacific water-parsley and invasives: English holly, orchard grass, hanging sedge, morning glory, creeping buttercup, spurge-laurel

Percent coverage of invasive vs. native species
60% invasive species, with some fairly natural areas and others completely dominated by blackberry and morning glory
Invasive species observed**:** Himalayan blackberry, English ivy, laurel hedge, English holly, orchard grass, hanging sedge, morning glory, creeping buttercup, spurge-laurel
NOTE: hanging sedge (*Carex pendula*) is a newly observed invasive species with one plant observed in this reach (Photo 1B-5). Additionally, there is a high likelihood of lesser celandine and shiny geranium in this reach, however they were not visible during the September 2022 site visit.

Short term riparian restoration potential and techniques
Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.

- **HIGH PRIORITY**: remove new invasive hanging sedge before it spreads further
- North Bank: (1790 Beach Drive, 2645 and 2657 Cranmore Road) – Short-term action not recommended on the Himalayan blackberry, laurel hedge, and morning glory covered north bank.
- South Bank: (2646 and 2660 Shady Lane) – Work with property owners to remove invasive species and replant with native species.

Short term channel restoration potential and techniques
At the cluster of large cottonwoods adjacent to 2657 Cranmore Road and 2660 Shady Lane the substrate is featureless cobble. Fish passage and channel complexity could be improved by enhancing existing stone lines into rock weirs and placing gravel on the upstream edge of the weirs to provide spawning platforms in 2-3 locations along this area (Photos 1,2,7).

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on future redevelopment and/or landowner involvement. The best outcome would be removal of the concrete/rock walls, replacement of channel bottom armouring with fish-appropriate substrate (gravel/cobbles), addition of channel complexity (large woody debris, boulders), and the slope reduction of creek banks followed by increased slope planting with native vegetation. The final locations and designs would be determined by the riparian width made available. If possible, 10-15m of riparian corridor on each side of the channel would provide the most benefit to the creek and meet the SPEA goals as defined by the RAPR.

Channel restoration should be focused on improving fish passage and habitat complexity by removing channel bottom armouring and improving the bottom substrate. This can be accomplished by the

enhancement of stone lines and placement of gravel as described above in Short-term channel restoration and by the periodic placement of gravel at strategic locations to allow the stream to distribute it naturally.

If landowner constraints require the creek corridor to remain relatively narrow, other options to improve the creek include:

- Bioengineering to replace concrete retaining walls, while maintaining a narrow footprint
- Moving retaining walls back from the channel to allow floodplain and plantings adjacent to the channel (such as on the south bank at Oak Bay High, Photos 3B-5 & 3B-6 in Reach 3B).

North Bank (1790 Beach Drive, 2657 and 2645 Cranmore Road) – Work with property owners to remove fences and armouring (concrete sandbags, mortared rock walls), repair erosion areas, re-slope the creek banks, remove invasive species and plant native species. This work should be done in conjunction with any work on 1776 Beach Drive in Reach 1A.

South Bank (2660 Shady Lane and 2646 Shady Lane) – Work with property owner at 2660 Shady Lane to remove mortared rock wall, and with both owners (2660 and 2646 Shady Lane) to remove fences, re-slope the creek banks, remove invasive species and plant native species.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 1 of 13) for proposed alignment], provides the following information (in grey):

Beach Drive to Monteith Street

- Three lots on Monteith are currently municipal parkland with gardens each side of creek; no trail through site due to private property to the east.
- BCI has identified 7 lots along Cranmore Road, Beach Drive and Shady Lane for partial acquisition to improve the creek and/or for greenway; no changes required.

Summary

Condition:

- Banks and channel bottom are hardened in many area
- Erosion is occurring in over-steepened banks with soil sections, many of which are from fill used to extend yards.
- Mix of invasive species and native trees with some native understory shrubs.

Opportunities:

- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Improve instream fish habitat through enhancing stone lines into weirs and adding spawning gravel for natural redistribution
- Repair erosion areas, with bioengineering, if possible.
- Remove invasive species
- Long-term removal of armouring, restoration of channel, and re-sloping of banks possible with property owners.

Additional Observations/Notes

2022 – The fish barriers, channel and riparian areas are similar to those observed in 2011, with some small changes to erosion locations and invasive species.

2011 – Many places along the creek are built up with fill and overly steep, resulting and armouring and/or erosion. Any action taken would be best accomplished in cooperation with several properties.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

Photo 1B-1. Downstream end of Reach 1B, mortared wall on south side (1762 Beach Dr/2660 Shady Ln) and eroding soil bank on north side (1776/1790 Beach Dr). Bedrock and cobble creek bottom, creating natural weir with pool above (view upstream).

Photo 1B-2. Cobble and occasional boulder creek bottom, with possible areas for stone weirs and gravel spawning beds.

Photo 1B-3. Himalayan blackberry on North Bank (1790 Beach Dr and 2657 Cranmore Rd)(view upstream).

Photo 1B-4. Trees and less steep soil bank on south bank (2660 Shady Lane)(view downstream).

Photo 1B-5. Hanging sedge, new invasive species south bank (2660 Shady Lane).

Photo 1B-6. Himalayan blackberry on north bank (2657 Cranmore Rd), and cobble and boulder channel bottom. Fish habitat improvements: enhance existing stone lines into weirs and add spawning gravel on upstream side (view downstream).

Photo 1B-7. Cobble/boulder channel bottom with fish habitat improvements: enhance existing stone lines into weirs and add spawning gravel on upstream side (view upstream).

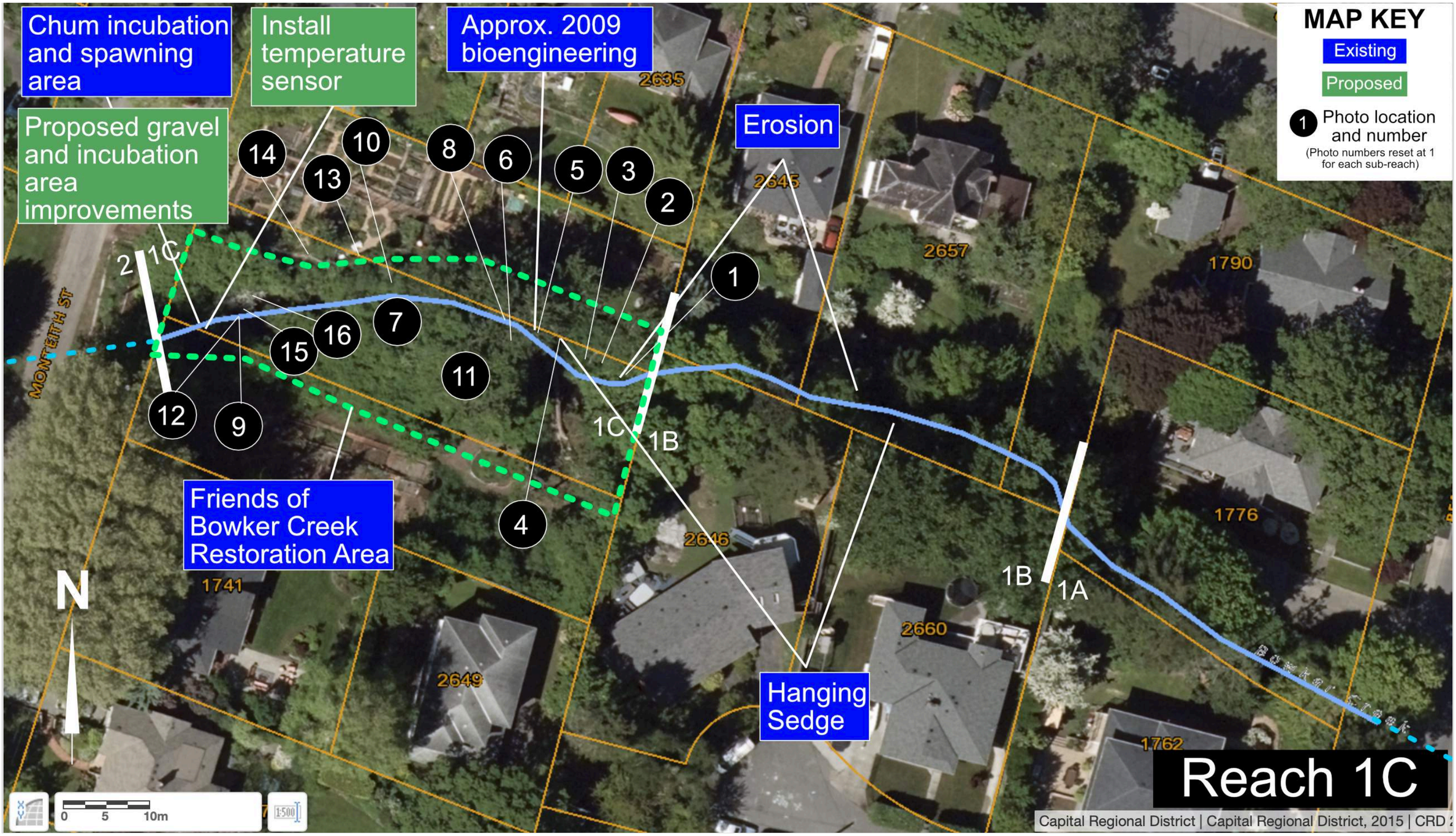

Photo 1B-8. Overhanging and eroding bank at 2645/2647 Cranmore Road (view downstream).


Photo 1B-9. English holly and traveler's joy clematis on north bank.


Photo 1B-10. Steep banks, English ivy, traveler's joy, English holly (2645 Cranmore Road)(view upstream).


Photo 1B-11. English ivy and concrete sandbags on the north bank at upstream end of Reach 1B (2645/2647 Cranmore Road) (view upstream).


Photo 1B-12. Large diameter English ivy strangling trees (north bank).


Chum incubation and spawning area
Install temperature sensor
Approx. 2009 bioengineering
Proposed gravel and incubation area improvements
Erosion
Friends of Bowker Creek Restoration Area
Hanging Sedge
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
2635
2645
2657
1790
1776
2646
2660
1762
1741
2649
MONTEITH ST
BOWKER CREEK
1C
1B
1A
2
N
0 5 10m
1:500
Reach 1C
Capital Regional District | Capital Regional District, 2015 | CRD

REACH 1C

Reach # 1C - Eastern end of Monteith Community Gardens to Monteith Road (municipal park) (65m) (Community Gardens owned by District of Oak Bay)

Channel Description
Downstream of the culvert under Monteith Road, the stream flows into a pool and then in a meandering channel (2-3%) through the community gardens, where both banks are un-hardened and vegetated (Photos 2,3,5,6,9,12, 15, 16). The exception is the 20m downstream section adjacent to reach 1B, where the south side is armoured with concrete filled sandbags, but eroding (Photo 1). The channel has gravel bars and some floodplain access. The Monteith Road culvert (which runs through Firefighter's Park) is undersized and the resultant high flow velocities have caused erosion and widening at the top of the reach (forming a pool). Within the pool, Friends of Bowker Creek have created a location for Chum egg incubation boxes and installed spawning gravel (Photos 9,12, 13, 14). This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The properties on both sides of the channel are owned by the District of Oak Bay and utilized for community garden plots and the creek corridor. With changes to the land use in some areas, invasive species removal and riparian plantings, the riparian area could be 15-25m wide on each side.

North bank: The north side the riparian area is constrained by the close proximity of the garden plots, limiting the area available for riparian restoration. Part of this strip is a bioengineering area (willow wattle fencing and terraces) that was installed in 2007. While there is a row of willows along the bank, many of the wattles did not establish. The current riparian vegetation strip is 1-2m in the eastern half of the reach, adjacent to the plots, and 5-10m wide in the western section (Photos 2,3,6).

South bank: This area has seen extensive restoration (invasive species removal and native riparian plantings) by Friends of Bowker Creek (Photos 7-9, 11). The community gardens on the south side are approximately 5-10m from the channel.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium – South bank erosion under the concrete sandbag wall at the downstream end of the reach.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs, with community gardens adjacent.
Dominant species: black cottonwood, native willow (Scouler's and Sitka), red-osier dogwood, snowberry
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names) bigleaf maple, Nootka rose, June plum, thimbleberry, sword fern, lady fern, cow parsnip, Pacific water-parsley, skunk cabbage, and invasives: Himalayan blackberry, traveller's joy, English ivy, hanging sedge, thistle, spurge-laurel, reed canary grass, European bittersweet, morning glory, creeping buttercup,

Percent coverage of invasive vs. native species
Approx. 10% invasives immediately adjacent to the channel; however community gardens are encroaching into the riparian area, in particular in the northeast end of the reach.

Invasive species observed**:** English Ivy, Himalayan blackberry, hanging sedge, thistle, spurge-laurel, reed canary grass, traveller's joy, European bittersweet, morning glory, creeping buttercup.
NOTE: Hanging sedge (*Carex pendula*) is a newly observed invasive species with a few plants observed in this reach. Policeman's helmet was noted in the reach in 2011 and lesser celandine has been observed by volunteers and CRD staff. These were not observed during the September 2022 site visit, but along with shiny geranium they may not be visible at this time of year.

Short term riparian restoration potential and techniques
Provide community gardeners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities, yard and garden waste storage, spread of invasive species and the RAPR.
Invasive species removal, work with District of Oak Bay, Friends of Bowker Creek, and Community Gardeners):

- **HIGH PRIORITY:** Remove hanging sedge to prevent further spreading
- Watch for Policeman's helmet, lesser celandine
- Control travellers' joy vines growing on trees along the creek
- Continue removing English ivy, Himalayan blackberry and other invasives.

Control access to the riparian area through paths, fencing and signage which will prevent trampling of riparian vegetation and native plants installed by volunteers.

Short term channel restoration potential and techniques
Address erosion under the concrete sandbags by removing the armouring and installing bioengineering, or re-sloping the bank and replanting with native species.

Friends of Bowker Creek are rebuilding spawning area gravels in Fall 2022. Further improve chum salmon incubation and spawning gravels by the addition of natural gravels instead of sorted gravels. Place gravel in faster flowing water.

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on the future land use in the park. The main constraint in this area is the close proximity of the community gardens on the north side of the channel, as well as ensuring the ones on the south side do not encroach any farther towards the creek. Relocating the gardens closest to the creek will allow space to reshape the channel banks and plant native riparian species through the riparian zone. The final location and design will be determined by the amount of space made available. A riparian corridor of +15m on each side of the channel would provide the most benefit to the creek and 15m would meet the SPEA as defined by the RAPR.

If less space is available in the long-term, the restoration work could be done incrementally starting with the short-term recommendations described previously and restoring banks and expanding the riparian area as space becomes available.

Long term channel restoration in this reach should focus on installing additional spawning gravels. Cutthroat may be possible if water temperatures and quality are suitable. Natural gravel placement (as opposed to mechanically sorted gravel sizes) will have a range of sizes that will be sorted by stream velocities into sizes suitable for both chum salmon and cutthroat trout. Re-establishing stone lines will help to trap gravel and create spawning riffles.

REACH 1C

NOTE: culvert through Firefighter's Park is undersized, and if daylighted, this would reduce the scouring flows in the upstream area of the reach, and improve the chances of success of the spawning area.
The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 1 of 13) for proposed alignment], provides the following information (in grey):
Beach Drive to Monteith Street

- Three lots on Monteith are currently municipal parkland with gardens each side of creek; no trail through site due to private property to the east.
- BCI has identified 7 lots along Cranmore Road, Beach Drive and Shady Lane for partial acquisition to improve the creek and/or for greenway; no changes required.

Additional Observations/Notes

2022 – Changes to this reach since 2011 are:

- Establishment of community gardens 5-10m from the channel on the south side of the creek
- Invasive species removals (in particular English ivy noted in 2011) and plantings by Friends of Bowker Creek on the south side
- Installation of the chum salmon incubator and spawning area
- Winter 2021/2022 chum fry were released upstream and an incubator was installed with 30,000 eggs in this reach.
- Friends of Bowker Creek conducts water quality monitoring in this reach.
- The wattles of the bioengineering area (willow wattle fencing and terraces) that were installed on the north bank in 2007 did not fully establish, although some willows remain.

2011 – This reach (along with UVic) has a significant floodplain. Invasive species are less predominant here than in many reaches, though ivy is prominent on the south bank.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

Friends of Bowker Creek. Chum Salmon Recovery Project. https://bowkercreek.org/chum-salmon-recovery/

D.R. Clough Consulting. 2021. Bowker Creek Restoration Assessment

Summary

Condition:

- Banks are stable (except the concrete sandbag area) and channel has floodplain access
- Community gardens encroach into the riparian area and limit restoration opportunities
- Friends of Bowker Creek have done extensive invasive removal and plantings, water quality monitoring, and installed a chum salmon egg incubator and spawning area.
- Mix of invasive species and native trees with some native understory shrubs.

Opportunities:

- Provide community gardeners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, invasive species, garden waste management, and restoration opportunities.
- Improve instream fish habitat through enhancing stone lines into weirs and adding spawning gravel for natural redistribution
- Repair erosion areas with bioengineering, if possible.
- Continue invasive species removal.
- Work with Friends of Bowker Creek to continue to plant native riparian species and widen the riparian zone.
- Long-term removal of armouring, channel restoration, and re-sloping of banks possible with relocation of some community gardens.

Photo 1C-1. Downstream end of Reach 1C, south bank, eroding concrete sandbags (view upstream).

Photo 1C-2. Traveler's joy over native shrubs on the north bank (view upstream).

Photo 1C-3. Native vegetation and tree over the channel, some invasive species (traveler's joy, hanging sedge)(view downstream).

Photo 1C-4. Hanging sedge (new invasive species) on north bank, near downstream end of Reach 1C (near fallen tree over the channel).

Photo 1C-5. Bedrock in the channel, with gravel/sand bar, with red-osier dogwood and willow on the bank (view upstream). Willows are remnants of bioengineering that was installed (approx. 2009).

Photo 1C-6. Bedrock in the channel, with gravel/sand bar, with red-osier dogwood and willow on the bank (view downstream).

Photo 1C-7. Invasive species removal area (Friends of Bowker Creek) with understory plantings.

Photo 1C-8. Lady fern and skunk cabbage in the riparian area.

Photo 1C-9. Pool at upstream end of Reach 1C, location of chum incubation area and spawning gravels (view upstream).

Photo 1C-10. Traveler's joy over native shrubs.

Photo 1C-11. Native planting restoration area (Friends of Bowker Creek) on the south side of the creek.

Photo 1C-12. Sand and gravels at chum incubation area.

Photo 1C-13. The community gardens at Monteith extend right to the north bank of the creek with <1m to top of bank. A wider riparian buffer here of native vegetation would benefit water quality and reduce potential spread of garden escapees (view downstream).

Photo 1C-14. The community gardens at Monteith extend to the edge of the creek. Much of the garden area closest to the creek is used for storage of tools and materials (view downstream).

Photo 1C-15. The area of chum egg placement is subject to periodic oil spills (oil booms in upper right). Winter flows have large impacts, especially at the lowest reaches (view upstream from community gardens)

Photo 1C-16. The area of chum egg placement is subject to periodic oil spills (oil booms at right). Winter flows have large impacts, especially at the lowest reaches (view upstream from community gardens)


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Daylighting and Channel Restoration Opportunity
Enclosed channel
1
2
1C
2
3A
2
ST ANN ST
MONTEREY AVE
MONTEITH ST
LUJE ST
Bowker
1744
1736
1724
1709
1718
1703
1712
1704
1749
1745
1733
1717
1734
1746
1755
1745
1756
1741
1733
1718
1712
1704
1725
1715
1705
1707
1703
1647
2272
2276
2278
1650
1660
N
0
15
30m
1:500
Reach 2
Capital Regional District | Capital Regional District, 2015 | CRD 2018

REACH 2

Reach # 2 - Enclosed – Culvert from Monteith Road, through Firefighter's Park to the upstream side of Monterey Ave (310m)

Channel Description
310m culvert. This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
There have been multiple occasions that overland flooding has occurred through this reach. With the constraint of the culvert under Monteith, the creek spills over the road, through the firehall parking lot and through the park into the garage of 1741 Monteith.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
Potentially some short-term contouring around the ball fields could better direct the overland flow from flood events to minimize impact to the property at 1741 Monteith.

Additionally, Oak Bay has recently designated funds to replace the firehall, therefore there is an upcoming short-term opportunity for daylighting as part of the fire hall reconstruction.

Long term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 1 of 13) and Exhibit 7.1) for proposed alignment], which includes Firefighter's Park (in grey):

Monteith Street to Monterey Avenue/St. Anne Street – [Firefighter's] Park

- To maintain the functionality of both ball diamonds, it will be necessary to shift the east diamond slightly. Rotating this diamond by about 10 degrees clockwise would provide a narrow corridor for daylighting on the north side of the diamond. This would impact the right field corner which could be rectified by acquiring a small portion of the adjacent lot on Monteith Street.
- Daylighting the creek at the west end of Firefighter's Park may not be practical as the land is currently used for parking. The District of Oak Bay will need to prepare master plan for the park prior to, or in conjunction with, daylighting design.
- The fire hall building from 1938 will remain as a heritage building. Oak Bay may be looking at constructing a new fire hall within the site in future years**.** The defined route will be important for selecting the location of the new hall.
- The recommended alignment for daylighting is along the north edge of the park as it is avoiding the existing fire hall, police station and one of the two ball diamonds, with minimal impact on the second ball diamond. There is unused park space immediately west of Monteith north of the ball diamond as well as immediately south of Lulie Street.
  - • There is a minimum of 15m of available corridor width immediately west of Monteith Street between the ball diamond at the edge of the park. This will allow a natural cross section to be used for approximately 40 m.
  - • There is only about 5m between the ball diamond and the existing lot at 1745 Lulie Street. It is proposed to shift the ball diamond slightly (about 5-10 degrees clockwise) to create another 5m+ of space to accommodate a greenway trail and the creek. The creek would need to be retained for about 30m adjacent to the ball diamond.
  - • South of Lulie Street, between the northeast ball diamond and the parking lot, there is 10 m to 20 m of available park space that can be used for daylighting and a trail. It may be necessary to move the playground to optimize the amount of natural cross-section in this area.
  - • Daylighting can be extended west to St. Anne Street along the north edge of the existing parking lot, subject to finding alternate parking spaces for the park. This section of the creek would likely be a fully retained cross-section due to the impact on parking.
- It is understood that the District of Oak Bay will be reviewing the condition of the municipal buildings at Fireman's Park in the medium term and that the western edge of the park may be re-designed in the future. The parking spacing and potential for daylighting should be reviewed at that time.
  - • Due to the orientation of Monterey/St. Anne relative to the existing creek/storm trunk, the piped section under the creek would be relatively long. It could be shortened by refining the existing daylighted section west of Monterey Avenue.
  - • It may be possible to keep the existing storm trunk in service for moderate to high flow conditions and divert low to moderate flows to the daylighted channel. The open creek drops approximately 1m as it enters the storm trunk at Monterey Avenue. This would require a new weir structure and a new storm pipe under Monterey/St. Anne Street. The advantage of this is that the daylighted creek could be a metre shallower in the western park of Fireman's Park, making it easier to utilize a natural cross-section.
  - • There is severe erosion in the existing creek immediately east (downstream) of the storm trunk under Monteith Street. It may be beneficial to deepen the daylighted creek west of Monteith and construct a new (small diameter) culvert under Monteith to help address this erosion issue.
  - • To rotate the eastern ball diamond by 5 to 10 degrees and keep the current field size, it will be necessary to obtain a small portion in the northeast corner of 1718 Monteith Avenue (about 5 m x 10 m triangle).

NOTE: An additional consideration is a restoration option that considers only one ball diamond.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

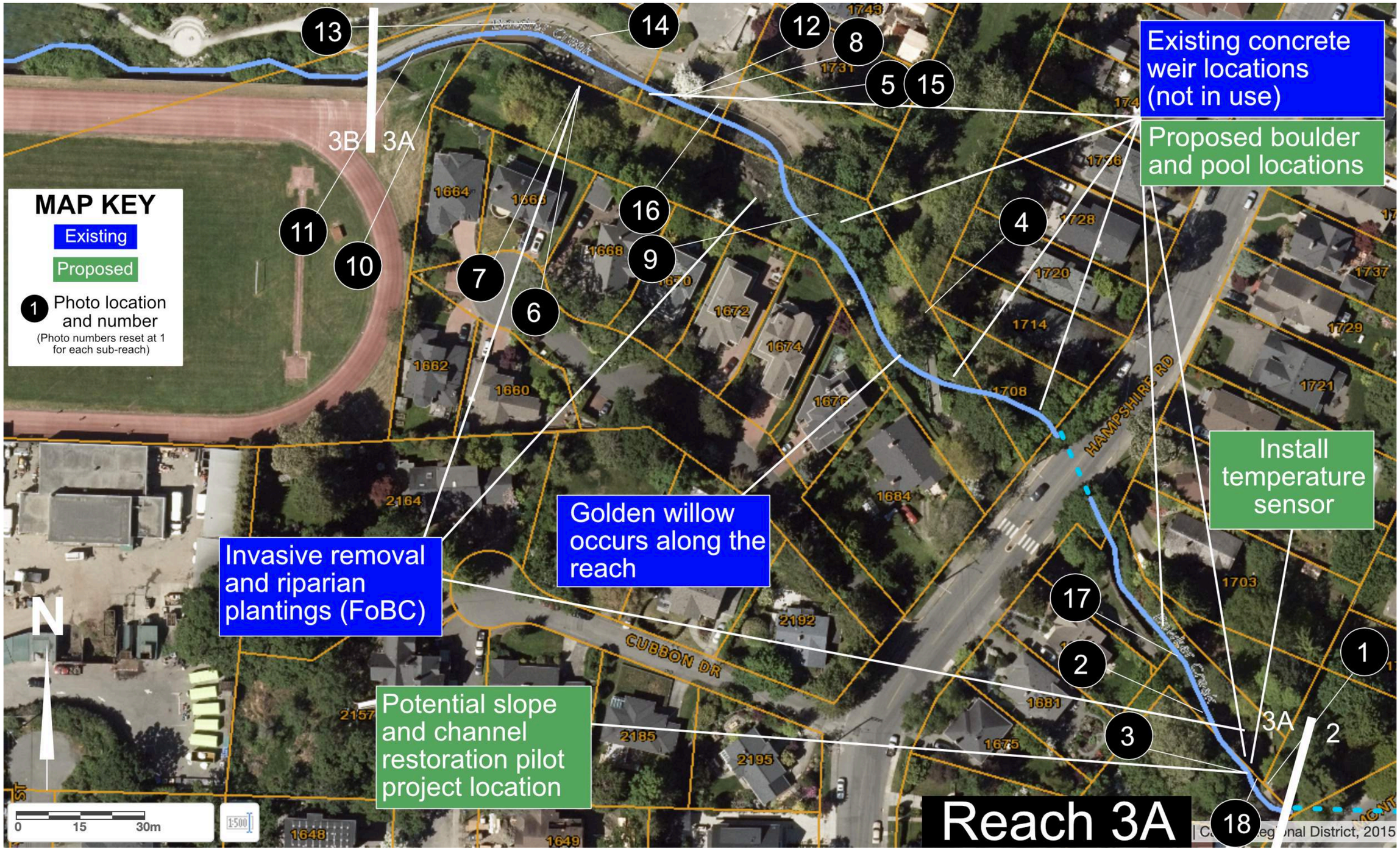
REACH 2

Summary
Condition:
- Culverted

Opportunities:
- Daylighting when firehall and park are redeveloped (funding has been designated for redevelopment) as recommended in Daylighting Feasibility Study (2020).
- Re-contouring to direct overland flood waters away from vulnerable properties (if not daylighted).

Photo 2-1. Firefighter's Park from the top of Reach 1C at Monteith Street (view west/upstream).

Photo 2-2. Firefighter's Park from the bottom of Reach 3A at St Ann Street (view east/downstream).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Existing concrete weir locations (not in use)
Proposed boulder and pool locations
Invasive removal and riparian plantings (FoBC)
Golden willow occurs along the reach
Potential slope and channel restoration pilot project location
Install temperature sensor
3B
3A
2
1
Reach 3A
N
0
15
30m
CUBBON DR
HAMPSHIRE RD

REACH 3A

Reach # 3A - Monterey Street to Oak Bay High School (Bowker Creek Walkway Park owned by District of Oak Bay) (305m)

Channel Description
Concrete and mortared rock channel with vertical concrete walls, surrounded by lawn with isolated pockets of landscaped native and non-native trees and shrubs. There are several wider pond areas and locations where removable barriers within the concrete weirs can be installed (not installed for several years). It enters into a large culvert under Hampshire Road and there are several footbridges over the creek (Photos 1-18).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Vertical walls separate the top of bank from the channel, disconnecting the riparian corridor. Removal of the concrete weirs has resulted in the growth of riparian vegetation (native and non-native) within the wider ponding areas, creating some riparian habitat between the concrete walls (Photos 1,2,5-7).

Width of the park ranges from 13-37m wide and is the currently available area of public land that could be used for an expanded riparian corridor. This could give approximately 5 to 15m of riparian area on each side of the channel and could be increased with property acquisition. Removal of the concrete walls and channel bottom, and re-sloping and replanting the banks would reconnect the channel with the riparian area.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No – Channel and banks are concrete.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees with lawn and pockets of landscaped native and non-native trees and shrubs.
Dominant species: Black cottonwood, western redcedar, red alder, big leaf maple, golden willow, ornamental trees, ornamental shrubs, lawn, red-osier dogwood.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names): Dull Oregon-grape, snowberry, oceanspray. In the channel/floodplain area between the concrete walls are: reed canary grass, tule, cattails, planted native willows (see below), watercress, Pacific water-parsley.

NOTE: Friends of Bowker Creek have planted native species at the top of the wall along the creek at the upstream end of the reach (willows (Sitka, Pacific, and/or Hooker's), hardhack, cattail, soft-stemmed bulrush, small-flowered bulrush, and Pacific water-parsley), and are removing invasive species (golden willow, English ivy, reed canary grass, Himalayan blackberry, European bittersweet, lesser celandine, yellow flag iris, curly dock).

Percent coverage of invasive vs. native species
80% lawn, 10% invasive, and 10% native species
Invasive species observed: golden willow, English ivy, reed canary grass, Himalayan blackberry, European bittersweet, lesser celandine, yellow flag iris, curly dock

NOTE: Japanese knotweed was observed in 2011 and identified as a priority for removal. It was not observed in September 2022, but monitoring for its presence should continue. Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short-term riparian restoration potential and techniques
Provide park-adjacent property owners with the Bowker Creek Blueprint and engage both property owners and Oak Bay Parks staff in education regarding restoration opportunities

Invasive species removal - work with District of Oak Bay and Friends of Bowker Creek
- Watch for Japanese knotweed re-establishment and lesser celandine
- Continue to control reed canary grass in the channel
- Continue removing invasives as described previously

Plant native riparian vegetation
- Replace some grassed areas adjacent to the creek with overhanging vegetation to provide shading to moderate summer stream temperatures.
- Continue to establish native vegetation in the floodplain areas between the concrete channel walls.
- Pilot project for concrete wall removal suggested by Friends of Bowker Creek upstream of Hampshire Road (Photo 3)

Short-term channel restoration potential and techniques
Create channel complexity and potential low flow fish access by:
- Adding rock weirs and large boulders within the channel
- Create ponding areas by digging down into the channel upstream of the former weir areas
- Allow the floodplain vegetation to continue to establish, narrowing and deepening the low-flow channel
- Install a water temperature sensor downstream of the school and park to observe the effects of the reduced riparian cover.

Long-term channel and riparian restoration potential
A range of options are available in the long term, depending on the future land use in the park. The main constraint in this area, is the concrete banks and bottom constraining the channel and disconnecting it from the riparian zone.
The final location and design of bank sloping will be determined by the amount of space made available. A riparian corridor of 5-15m riparian on each side of the channel could be established within the existing park area and would provide the most benefit to the creek. 15m would meet the SPEA as defined by the RAPR. Potential future property acquisition adjacent to the park could allow for additional width.

The long-term restoration goal is to:
- Remove the concrete lined bottom and sides.
- Grade the banks back and/or use terraces to create planting areas of native vegetation along the banks.
- In locations where space is limited, bioengineering or setback retaining walls could be used to create planting benches with a smaller footprint.
- Re-create a natural-bottomed meandering stream bed. As per the PFC assessment (Barraclough *et al.* 2007), the general alignment and footprint of the channel and ponds can remain.

A potential pilot project for this concept is the west bank at south end of reach, an area that isn't heavily used by the public, and could be used as demonstration areas of bank and riparian area restoration (Photos 1-3).

Chum salmon habitat could be further improved in areas where the channel is narrowed and results in higher velocities by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park (Photo 12). In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 2 of 13) for proposed alignment], provides the following information (in grey):

Monterey Avenue to Oak Bay High

- This section is largely daylighted with trails and park system
- Alignment on west side of Monterey may need to be refined, depending on daylighting east of Monterey as noted [in Reach 2].
- Consider acquiring lot immediately north of creek on west side of Monterey (prone to flooding) if necessary.

Additional Observations/Notes

2022 – The channel alignment and concrete lining of the bottom and banks remains unchanged. Changes to this reach since 2011 are:

- Japanese knotweed was no longer observed (but monitoring for it should continue).
- As recommended in 2011, Friends of Bowker Creek have done extensive invasive species removal and planting in the floodplain areas between the concrete walls.
- Friends of Bowker Creek conducts water quality monitoring in this reach.

2011 – Japanese knotweed was observed in the channel.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

Friends of Bowker Creek. Chum Salmon Recovery Project. https://bowkercreek.org/chum-salmon-recovery/

FoBC and 5th Garry Oak Cubs. 2020. Bowker Creek Habitat Restoration Project Proposal (Reach 3)

Summary

Condition:

- Channel is contained within concrete banks and bottom
- Friends of Bowker Creek have done extensive invasive removal and plantings within the floodplain area, as well as water quality monitoring
- Riparian area is disconnected from the stream with concrete walls, and consists primarily of trees, lawn and some groupings of native and ornamental vegetation.

Opportunities:

- Provide adjacent property owners with the Bowker Creek Blueprint, and engage them in education regarding the creek health and restoration opportunities, including planting trees to shade the creek.
- Improve channel habitat by adding complexity (boulders), deepening pools and allowing planted vegetation to fill in and define a low flow channel between the concrete walls.
- Work with Friends of Bowker Creek to continue to remove invasive species, plant native riparian species and widen the riparian zone.
- Install a water temperature sensor downstream of the school and park to observe the effects of the reduced riparian cover.
- Long-term removal of armouring, channel restoration, re-sloping of banks and planting native riparian vegetation.
- Chum salmon habitat could be further improved in areas where the channel is narrowed and results in higher velocities by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park. For now, riparian restoration to provide shading to moderate summer stream temperatures would be most beneficial. In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally.

Photo 3A-1. Downstream end of Reach 3A, where it enters the culvert under Monterey St (view upstream) (see Photos 3A-17 & 18 for winter conditions).

Photo 3A-2. Downstream former pond area with reed canary grass establishing. FoBC removing invasives and planting native species since weirs were removed (view across/upstream) (see Photos 3A-17 & 18 for winter conditions).

Photo 3A-3. Potential pilot project location for concrete wall removal and restoration of channel and slope upstream from Hampshire Road.

Photo 3A-4. Example of where formal paths are bypassed and creek side vegetation is trampled (view downstream).

Photo 3A-5. Example of where formal paths are bypassed and creek side vegetation is trampled (view upstream) (see Photo 3A-15 for new plantings here).

Photo 3A-6. Upstream ponding area with reed canary grass establishing. FoBC removing invasives and planting native species since weirs were removed. (view downstream).

Photo 3A-7. Upstream ponding area with reed canary grass establishing. FoBC removing invasives and planting native species since weirs were removed. (view upstream).

Photo 3A-8. Concrete channel and footbridge at upstream end of reach (view upstream).

Photo 3A-9. Concrete weir structures with cement aprons, cobble upstream (view upstream).

Photo 3A-10. Concrete channel and new riparian plantings by District of Oak Bay and FoBC (view upstream).

Photo 3A-11. Turbidity in creek, discharged in Reach 3B from Oak Bay Public Works Yard. Note golden willow growing out of mortared wall (view upstream).

Photo 3A-12. Suggested fish habitat improvements at the end of Armstrong Avenue (view upstream).

Photo 3A-13. Uppermost ponding area in winter conditions (view downstream) (see Photos 3A-6 & 7 for summer conditions).

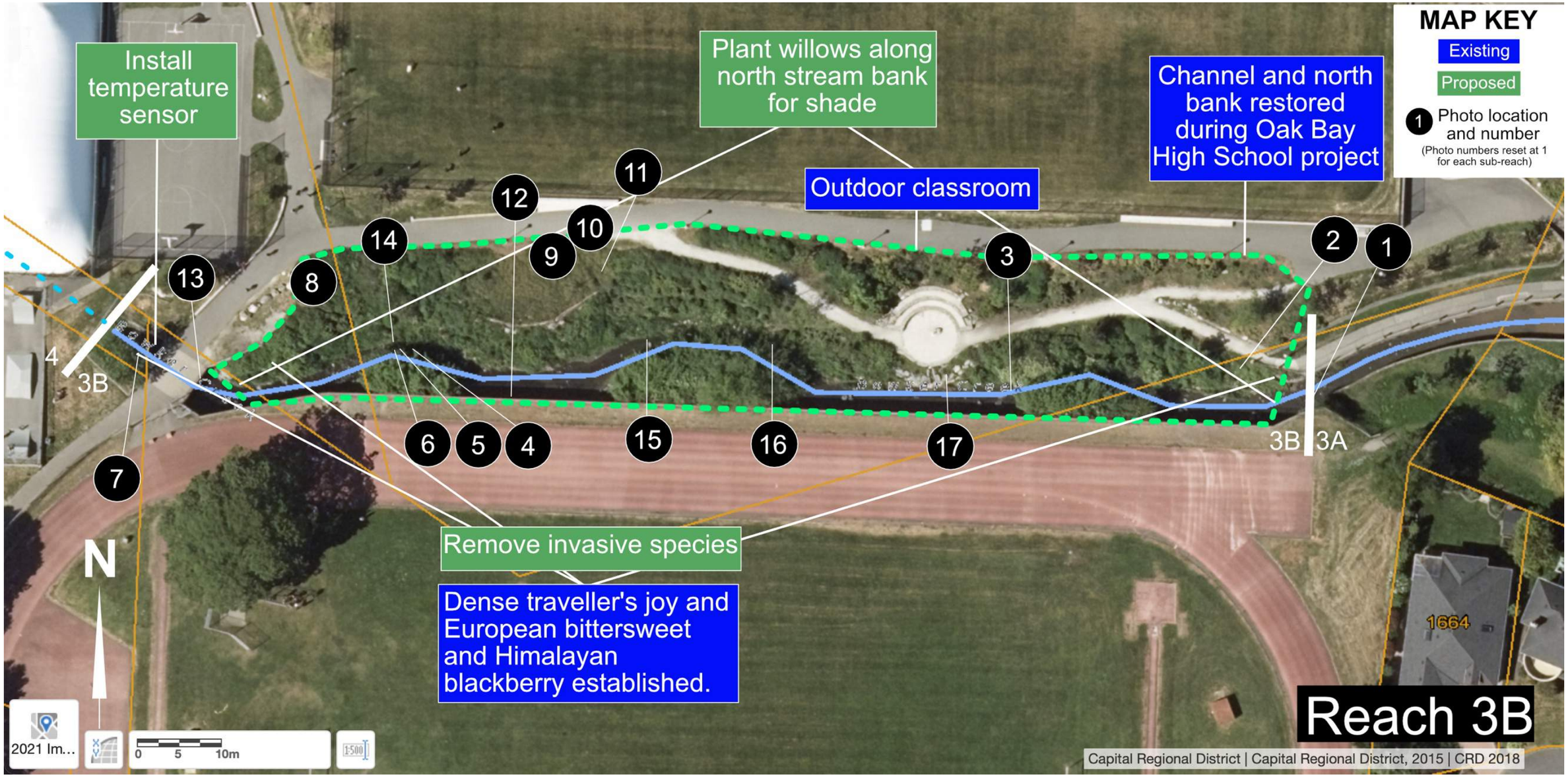
Photo 3A-14. Uppermost ponding area in winter conditions with ducks using instream boulders and vegetation for refuge (view across stream) (see Photos 3A-6 & 7 for summer conditions).

Photo 3A-15. A former area of bare earth with recent plantings and mulch. Fencing around the mulched area would provide protection from inadvertent trampling as the many small shrubs are not protected by posts and are hard to see (see Photo 3A-5 for Before).

Photo 3A-16. The downstream ponding area between the two footbridges in the upper reach provide expanded areas for high flows and refuge for wildlife (view downstream, adjacent to new plantings).

Photo 3A-17. Waterfalls over the weir locations in the lower end of the reach (view downstream to Monteray) (see Photos 3A-1 & 2 for summer conditions).

Photo 3A-18. Waterfalls over the weir locations in the lower end of the reach (view upstream) (see Photos 3A-1 & 2 for summer conditions).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Install temperature sensor
Plant willows along north stream bank for shade
Channel and north bank restored during Oak Bay High School project
Outdoor classroom
Remove invasive species
Dense traveller's joy and European bittersweet and Himalayan blackberry established.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
3B
3A
1664
N
2021 Im...
0 5 10m
1:500
Reach 3B
Capital Regional District | Capital Regional District, 2015 | CRD 2018

REACH 3B

Reach # 3B - Oak Bay High School to Tennis Bubble (150m) (Oak Bay High School Property)

Channel Description
The north bank and channel were reconstructed in 2015-2016 to introduce sinuosity and a gentler sloped bank, which was planted with native riparian vegetation in 2017. The south bank is a vertical concrete wall adjacent to the running track (Photos 1-17).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The riparian area on the north side has been re-sloped and restored (2015-2017) and is approximately 10-15m from the channel to the path at the top of the slope (Photos 2,3,5,6,8-11). The riparian area includes paths and an outdoor classroom to facilitate ecological education at the high school.

The south bank is a vertical concrete wall adjacent to the running track. Three pockets of riparian vegetation (3-7m wide x 13-20m long) have been planted at the base of the wall to create sinuosity and habitat on the south bank (Photos 3-6,8). Unless the running track is redeveloped, the riparian area is at the maximum width.

NOTE: Friends of Bowker Creek and Oak Bay High School conduct ongoing maintenance for invasive species throughout the reach, as well as planting native species, and implementing pedestrian control fencing.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs.
Dominant species: Hooker's willow, snowberry, Nootka rose, common rush, reed canary grass,
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names) Garry oak, red alder, big leaf maple, Douglas-fir, June plum, tall Oregon-grape, thimbleberry, baldhip rose, California wax-myrtle, common rush, Himalayan blackberry, European bittersweet, traveler's joy, Queen Anne's lace, morning glory

Percent coverage of invasive vs. native species
10% invasive, and 90% native species
Invasive species observed: reed canary grass, Himalayan blackberry, European bittersweet, traveler's joy, Queen Anne's lace, morning glory
Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short term riparian restoration potential and techniques
- Provide Oak Bay High School with the Bowker Creek Blueprint, and engage them in education regarding the creek health and restoration opportunities.
- Continue invasive species removal, work with Oak Bay High School, Friends of Bowker Creek, and Community Gardeners.
- Increase shading of the channel to help control water temperatures for downstream fish habitat by installing willow and red-osier dogwood cuttings at the bottom of the north bank (underway by Friends of Bowker Creek).
- Plant trees and shrubs at the top of the vertical wall along the running track to provide critical shade to the creek from the south.

Short term channel restoration potential and techniques
- Work with District of Oak Bay to stop the frequent discharges of turbid water from the Public Works Yard.
- Install a water temperature sensor where the creek daylights downstream of the tennis bubble to observe possible cooling effects of piped flow.
- Restoration was conducted in 2015-2017, no further short term restoration is recommended in the channel.

Long term channel and riparian restoration potential
Restoration of the north bank and channel were conducted in 2015-2017. The long-term potential restoration is to remove the vertical wall along the south bank, when the running track is redeveloped. At that time, the bank could be re-sloped and revegetated with native riparian vegetation.

Chum salmon habitat could be further improved in areas where the channel is constricted and results in higher velocities, by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park. In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 2 of 13) for proposed alignment], provides the following information (in grey):
Oak Bay High to East of the Tennis Bubble
- This section is largely daylighted with trails and park system
- The section adjacent to the Oak Bay High School was recently daylighted by the BCI and is a great example of daylighting. It consists of a paved upper trail connecting the Oak Bay Recreation Centre to Bowker Park. There is also a granular trail down towards the daylighted creek.

Additional Observations/Notes
2022 – The channel and north bank underwent a major restoration effort in 2015-2016, as recommended in 2011. The project showcases a hybrid restoration model where the limitation of the significant south retaining wall was addressed through bioengineered willow planting islands at the base of the wall, allowing for the creation of a sinuous low flow channel despite the retaining wall remaining in place. This model serves as a template that can be exported to other problematic reaches where retaining walls are integral to the structural support of the adjacent land uses.
Friends of Bowker Creek, working with school groups, released ~600 chum salmon fry into this reach in the winter of 2021-2022.
Friends of Bowker Creek conducts water quality monitoring in this reach.
2011 – The school facility will be completely rebuilt due to the need for seismic upgrades and other issues. The School District is willing to work with the BCI to allow for restoration on their property.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Oak Bay High School Bowker Creek Restoration CRD webpage: https://www.crd.bc.ca/bowker-creek-initiative/projects-outreach/projects/creek-restoration-projects

Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Channel and north bank were reconstructed and planted with native vegetation in 2015-2017; south bank is a vertical concrete wall with constructed willow planting benches at the base.
- Friends of Bowker Creek and Oak Bay High School conduct ongoing invasive species maintenance, vegetation monitoring and plantings
- ~600 chum salmon fry were released in winter 2021-2022

Opportunities:

- Work with District of Oak Bay to stop the frequent discharges of turbid water from the Public Works Yard.
- Provide Oak Bay High School with the Bowker Creek Blueprint, and engage them in education regarding the creek health and restoration opportunities.
- Work with Friends of Bowker Creek and Oak Bay High School to continue to remove invasive species, plant native riparian species and widen the riparian zone.
- Plant trees and shrubs at the top of the vertical wall along the running track to provide critical shade to the creek from the south.
- Install a water temperature sensor downstream of the tennis bubble to observe the effects of possible cooling from upstream piped reaches.
- Chum salmon habitat could be further improved in areas where the channel is constricted and results in higher velocities, by the placement of rock weirs and gravel to create some spawning areas for chum. Such use would be dependent upon plans to daylight the creek downstream of this reach in Firefighter's Park. In the event of decent adult returns from the egg incubation project, adults could be transported by truck with oxygenated tank up into this reach to spawn naturally.
- Long-term redevelopment of the running track could allow restoration of the south bank.

Photo 3B-1. Downstream end of Reach 3B, Himalayan blackberry, traveler's joy, and European bittersweet (view downstream).

Photo 3B-2. Restored channel and north bank adjacent to the outdoor classroom at Oak Bay High (wall is for the running track to the south), primarily native vegetation with some reed canary grass along the channel (view upstream).

Photo 3B-3. Restored channel and north bank at Oak Bay High, primarily native vegetation with some reed canary grass along the channel. Constructed willow bench (upper right) against south wall adjacent to running track (view downstream).

Photo 3B-4. Cobbles and gravels adjacent to constructed willow bench (view upstream).

Photo 3B-5. Constructed willow bench (left) on the south bank, adjacent to the running track wall (view upstream).

Photo 3B-6. Constructed willow bench (right) on the south bank, adjacent to the running track wall (view downstream).

Photo 3B-7. Traveler's joy covering a tree at the upstream end of the reach (view upstream).

Photo 3B-8. Native riparian plantings along the north side of the creek and tall willows on constructed benches (view downstream).

Photo 3B-9. Garry oak / grass area on north side of the creek (view upstream).

Photo 3B-10. Path through riparian plantings on north side of the creek (view downstream).

Photo 3B-11. Roped path area to control pedestrians and prevent trampling of riparian vegetation.

Photo 3B-12. Turbidity in creek, discharged into Reach 3B from Oak Bay Public Works Yard.

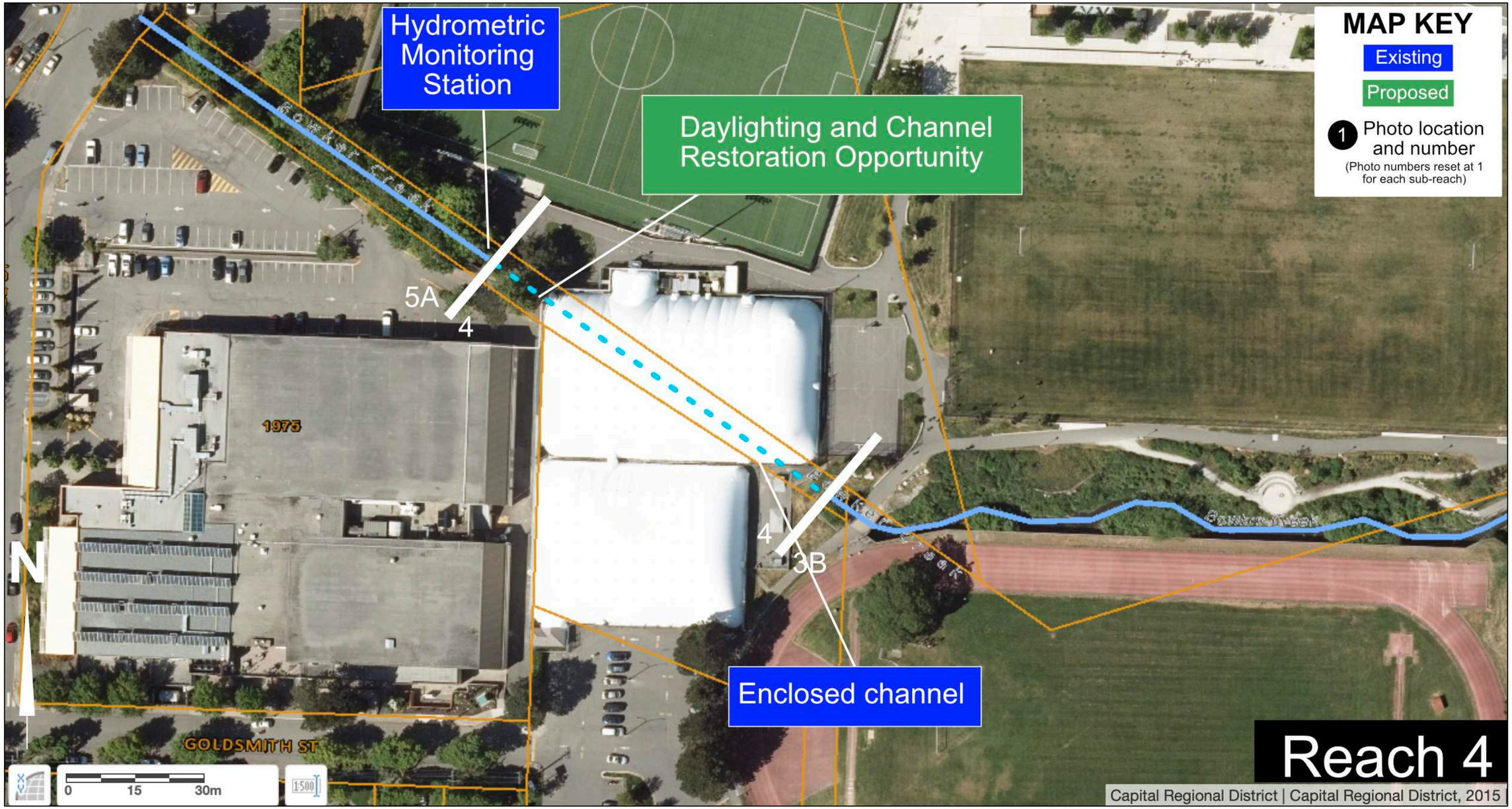
Photo 3B-13. View downstream from pedestrian crossing of upper reach during winter flows.

Photo 3B-14. View downstream during winter flows with dis-lodged oil boom (blue, centre right) from recent oil inputs. Constructed willow bench on south wall (right).

Photo 3B-15. Ducks taking advantage of instream vegetation for refuge from high flows. Ropes and posts define access points to reduce damage to vegetation from foot traffic (view downstream, mid-reach). Constructed willow bench on south wall (upper right).

Photo 3B-16. Oil booms deployed for recent oil inputs (view south).

Photo 3B-17. View of stormwater pipe under the outdoor classroom area during winter flows (view upstream).


Hydrometric Monitoring Station
Daylighting and Channel Restoration Opportunity
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
5A
4
4
3B
Enclosed channel
1975
GOLDSMITH ST
N
0
15
30m
1:500
Reach 4
Capital Regional District | Capital Regional District, 2015

REACH 4

Reach # 4 - Enclosed – Culvert under the Tennis Bubble, from Oak Bay High School to Oak Bay Recreation Centre. (100m)

Channel Description
90m culvert. This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short term riparian restoration potential and techniques
N/A

Short term channel restoration potential and techniques
N/A

Long term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 2 of 13) for proposed alignment] (in grey):

- There is a 100 m section of the creek that runs under the tennis bubble at the back of the Oak Bay Recreation Centre.
- The tennis bubble is heavily used and would need to be relocated and not removed. The tennis bubble is an inflatable structure has a more limited life span than conventional buildings, so it would be preferable to daylight the creek when the existing tennis bubble has reached the end of the functional life.
- Pedestrian and bicycle connectivity from Bee Street/Oak Bay Recreation Centre to Oak Bay High School daylighted section is available on the north side of the tennis bubble and through the rec centre parking lot.
- It may be easier to obtain stakeholder approval for daylighting if both the existing storm trunk and the tennis bubble were both reaching the end of their functional life.
- Shift channel to northeast to allow tennis bubble to be redeveloped close to its current location.
- The recommended alignment for daylighting would likely be along the north and east edges of the existing tennis bubble (and outdoor basketball court) adjacent to the existing pathway between the rec centre and the high school. This would maximize the available space for the tennis bubble and basketball court to be redeveloped.
- Alternate alignments could be considered if Oak Bay was to undertake a complete redevelopment of the Oak Bay Recreation Centre site. It would incorporate redevelopment of the open creek within Reach 5. This is likely a long term (50+ years) away, but it could become a great recreational amenity as part of a much more urbanized rec centre site.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

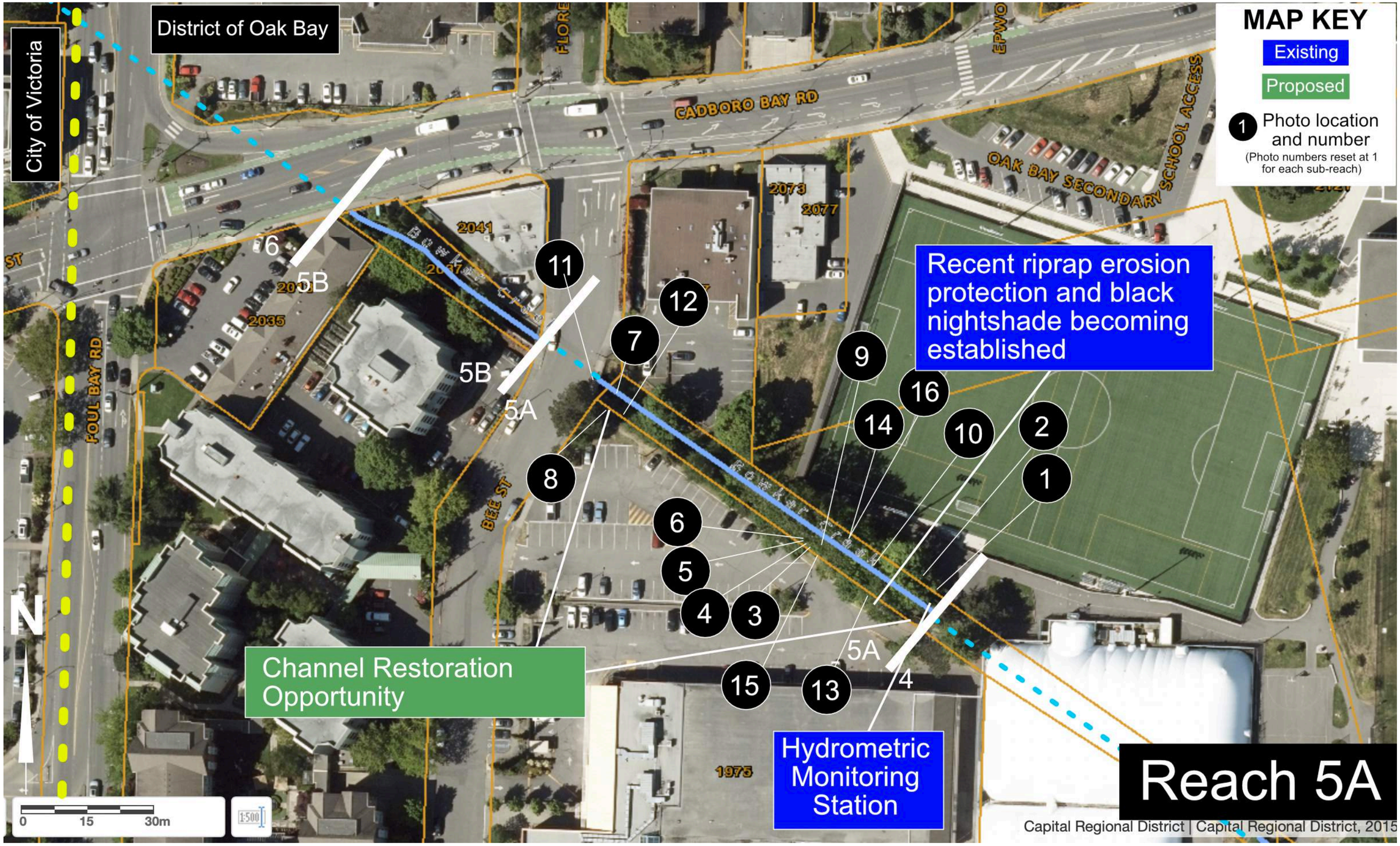
Summary

Condition:

- Culverted

Opportunities:

- Daylighting when Tennis Bubble and/or Oak Bay Recreation Centre are redeveloped as recommended in Daylighting Feasibility Study (2020).


District of Oak Bay
City of Victoria
CADBORO BAY RD
OAK BAY SECONDARY SCHOOL ACCESS
FOUL BAY RD
BEE ST
2073
2077
2041
2035
1975
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Recent riprap erosion protection and black nightshade becoming established
Channel Restoration Opportunity
Hydrometric Monitoring Station
Reach 5A
6
5B
11
12
7
5B
5A
9
16
14
10
2
1
8
6
5
4
3
5A
15
13
4
N
0
15
30m
1:500
Capital Regional District | Capital Regional District, 2015

REACH 5A

Reach # 5A - Tennis Bubble to Bee Street (95m) (District of Oak Bay property)

Channel Description
Straight, entrenched channel, with steep banks and development close to the top of bank (Photos 1-16). The south bank has sections of near vertical mortared wall and new (2022) riprap erosion protection adjacent to the Oak Bay Recreation Centre parking lot. There is a section of concrete retaining wall along the upper slope of the north bank adjacent to the soccer pitch. This area has a history of flooding.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Riparian corridor, including the creek channel and both banks, is approximately 8m wide, with parking at the top of bank on the south side, and soccer field and parking on the north side.

South Bank: Currently the area at the top of bank is parking and a well-used informal path. Potential channel and riparian restoration is possible with District of Oak Bay and Oak Bay Recreation Centre (1975 Bee Street) by removing and reconfiguring some of the parking area. (A new parking lot was installed in 2015 on the other side of the building, so there may be the ability to reduce parking in this area.) There is parking 25m to 50m from the top of bank of the channel, so it may be possible to provide at least 15m of re-sloped banks and native riparian areas, which would meet the RAPR intent.

North Bank: The north bank is on 2067 Cadboro Bay Road and Oak Bay High School where there may be the ability to expand the riparian area with cooperation of these landowners (e.g. reconfiguring the parking at 2067 Cadboro Bay Rd and re-orienting the soccer field, where possible).

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Low – Small unvegetated patch on downstream north side of reach. On the downstream end of the south bank, erosion protection was installed in 2022 where the bank collapsed at an area that historically had been built up to create the adjacent parking lot.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs in the downstream half of the reach and Himalayan blackberry in the upper half of the reach (Photos 2-4,6-8).
Dominant species: Black cottonwood, bigleaf maple, Himalayan blackberry, snowberry.
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Douglas-fir, red alder, golden willow, golden chain tree, English hawthorn, red-osier dogwood, Nootka rose, Scotch broom, Pacific water-parsley, English ivy, European bittersweet, European black nightshade, spurge-laurel, morning glory, grasses

Percent coverage of invasive vs. native species
60% invasive, and 40% native species

Invasive species observed: Himalayan blackberry, golden willow, golden chain tree, English hawthorn, Scotch broom, English ivy, European bittersweet, European black nightshade, spurge-laurel, morning glory, grasses

NOTE: Invasive European black nightshade establishing on topsoil at top of bank of the new erosion protection, removal now could prevent it from spreading downstream (Photos4-5). Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short term riparian restoration potential and techniques
Provide Oak Bay High School, Oak Bay staff and nearby commercial business owners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, spread of invasive species, restoration opportunities and the RAPR.

- **HIGH PRIORITY:** Remove invasive European black nightshade that establishing in topsoil at top of bank of the new erosion protection, removal now could prevent it from spreading downstream.
- Removal of other invasive species and replanting with native species could be undertaken, but would be a low priority if larger scale project could be undertaken with Oak Bay Rec Centre.

Short term channel restoration potential and techniques

- No short-term channel restoration is suggested

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on the ability to reconfigure parking and adjacent land uses.
South Bank: There is an opportunity to work with the Oak Bay Rec Centre to reconstruct the channel, re-slope, and widen the riparian area if site was to be redeveloped. If approximately 20 parking stalls and a driving lane were reduced or removed, it would be possible to have a 15m wide riparian area on the south side. This would provide more space to incorporate a raingarden to treat the parking lot runoff and trail connection to Oak Bay High School and the Bowker Creek Walkway Park. 15m of riparian zone would meet the SPEA as defined by the RAPR.

North Bank: Investigate opportunities to work with the property owner at 2067 Cadboro Bay Road and Oak Bay High School to explore opportunities to expand the riparian corridor, while working with the existing land uses, or when these sites are redeveloped, incorporate reconstruction and restoration of the channel and riparian area.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 3 of 13) for proposed alignment] (in grey).

- As noted [in Reach 4], in the long term the Oak Bay Recreation Centre may be redeveloped. It would incorporate redevelopment of the open creek within Reach 5. This is likely a long term (50+ years) away, but it could become a great recreational amenity as part of a much more urbanized rec centre site. This would allow the open creek to be re-designed and incorporated as an amenity for the rec centre. This could include a wider section with natural elements (e.g. boulders, logs) to be incorporated into the creek bed.

Additional Observations/Notes
2022 – The channel and riparian area are in a similar condition as in 2011, with the exception of the erosion protection recently installed at the southwest (downstream) end of the reach (Photos 3-6,9).

Friends of Bowker Creek are very interested in working with the BCI and District of Oak Bay to restore the creek and riparian area, and create a pedestrian connection to Oak Bay High School and the Bowker Creek Walkway Park.

A hydrometric monitoring station is located at the downstream end of the reach, immediately before the underground Reach 4. This station has been inactive since December 2020. The CRD and Oak Bay are in discussions regarding the ongoing maintenance of this station.

2011 – The District of Oak Bay is interested in treating this reach for bank stability but is waiting to see integrated recommendations from the BCI.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Channel is entrenched with Himalayan blackberry at the upstream end and a mix of native and non-native vegetation in the south section.
- On both sides of the creek, the riparian zone is constrained by land uses (parking, soccer field).
- Recent erosion events on the south bank have been treated with riprap slope amouring.

Opportunities:

- Provide Oak Bay High School, Oak Bay staff and nearby commercial business owners with the Bowker Creek Blueprint, and engage them in education regarding the creek health, spread of invasive species, restoration opportunities (including planting trees to shade the creek) and the RAPR.
- Remove invasive vegetation, particularly European black nightshade that is establishing in topsoil at top of bank of the new erosion protection: removal now could prevent it from spreading downstream.
- Encourage the ongoing maintenance of the flow meter at the bottom of the reach for monitoring of water temperatures and flooding.
- Work with District of Oak Bay and Oak Bay Recreation Centre to reconfigure the parking lot to allow reconstruction of the channel, re-sloping the banks, planting native riparian vegetation, installing a raingarden to treat parking lot runoff, and constructing a pedestrian connection to Oak Bay High School and the Bowker Creek Walkway Park as recommended in Daylighting Feasibility Study (2020).
- More extensive creek restoration would be possible in tandem with future reconstruction of the tennis bubble when it reaches the end of its functional life.

Photo 5A-1. Downstream end of Reach 5A culvert that flows under the Tennis Bubble (view downstream).

Photo 5A-2. Looking upstream from the culvert at the downstream end.

Photo 5A-3. Recent riprap erosion protection along the south bank and the Oak Bay Recreation Centre parking lot is immediately adjacent to the creek (view upstream).

Photo 5A-4. Recent riprap erosion protection along the south bank and the Oak Bay Recreation Centre parking lot is immediately adjacent to the creek (view downstream).

Photo 5A-5. Invasive European black nightshade establishing in topsoil at top of bank of the new erosion protection.

Photo 5A-6. Centre of the reach, steep banks, vegetated on both sides with a mix of native and non-native species (view upstream).

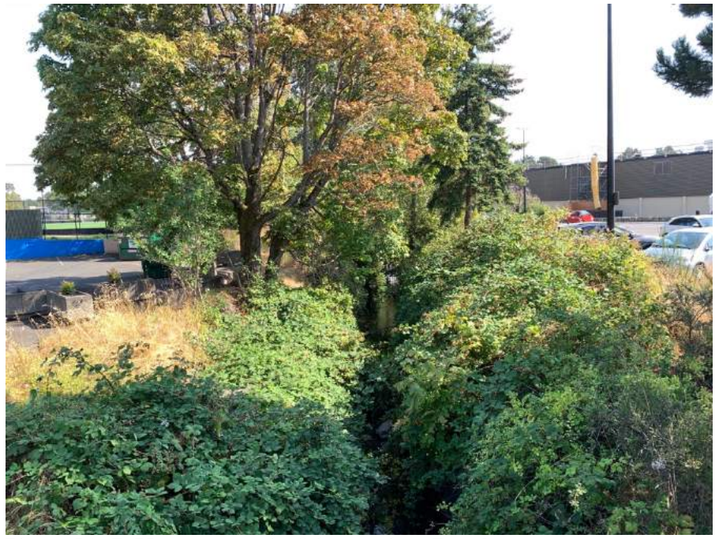


Photo 5A-7. Upstream end of the reach at Bee Street, vegetation dominated by Himalayan blackberry (view downstream).

Photo 5A-8. Parking area at the Oak Bay Recreation Centre, a potential area for channel and riparian restoration, and pedestrian connection to Oak Bay High School and the Bowker Creek Walkway Park (view downstream).

Photo 5A-9. Catchbasins adjacent to the creek in the new riprap erosion protection along the south bank: connection to oil/water separator infrastructure unknown.

Photo 5A-10. The creek substrate is a mix of rounded cobble and large riprap and is highly silted (view slightly upstream).

Photo 5A-11. Upstream end of the reach at Bee Street, vegetation dominated by Himalayan blackberry in winter flows (view downstream).

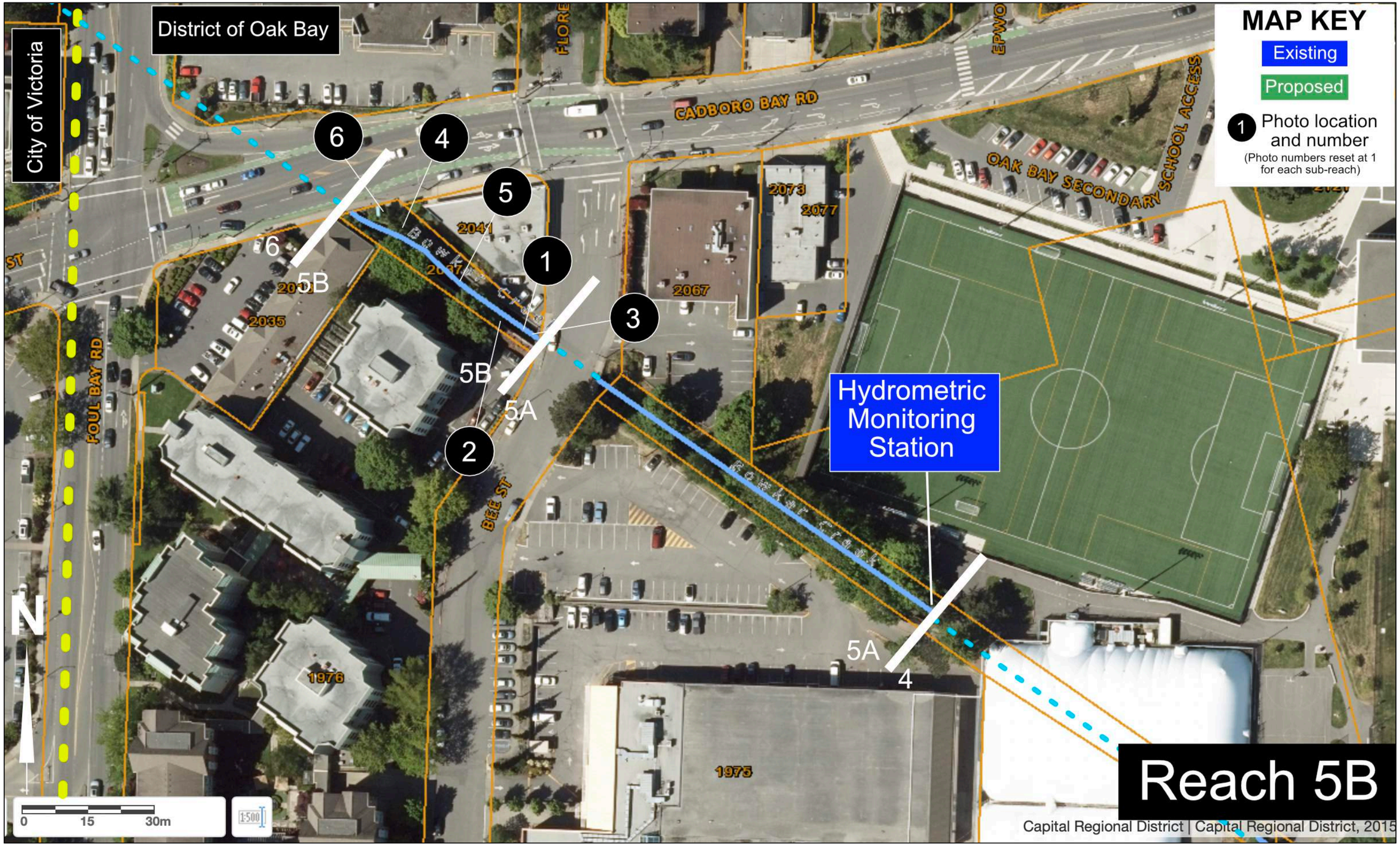
Photo 5A-12. South bank at Bee Street is a mortared rock wall overgrown with blackberry and Scotch broom (view south/downstream in winter flows). A stormdrain outlet from the parking lot is visible at the waterline.

Photo 5A-13. Recent riprap erosion protection along the south bank and the Oak Bay Recreation Centre parking lot is immediately adjacent to the creek. The bowed tree trunk at centre left has had time to straighten its growth upward, indicating the slow ongoing slumping of this bank (view upstream in winter flows).

Photo 5A-14. In winter, the concrete retaining wall along the upper slope of the north bank is visible (see below).

Photo 5A-15. Recent riprap erosion protection along the south bank and the Oak Bay Recreation Centre parking lot is immediately adjacent to the creek (view downstream in winter flows).

Photo 5A-16. In winter, the concrete retaining wall along the upper slope of the north bank is visible.


District of Oak Bay
City of Victoria
CADBORO BAY RD
OAK BAY SECONDARY SCHOOL ACCESS
FOUL BAY RD
BEE ST
2073
2077
2067
2041
2035
1976
1975
6
4
5
1
3
2
5B
5A
Hydrometric Monitoring Station
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
N
0 15 30m
1:500
Reach 5B
Capital Regional District | Capital Regional District, 2015

REACH 5B

Reach # 5B - Bee Street to Foul Bay Road (50m) (District of Oak Bay property)

Channel Description
Concrete and mortared rock channel with adjacent path, ornamental landscaping, buildings and parking Photos 1-6).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Vertical walls separate the top of bank from the channel, disconnecting the riparian corridor. The top of bank is heavily developed, with parking, a walkway, buildings, and ornamental landscaping. There is very little riparian area (Photos 1-6).

With existing land uses there is little potential to expand the riparian area.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No – Vertical concrete channel walls and bottom

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Aquatic emergent in the channel and ornamental trees and shrubs at the top of the concrete walls.
Dominant species: English ivy, Pacific water-parsley, ornamental plants.
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names). Bigleaf maple, ornamental maple, poplar, and ash, tall Oregon-grape, Himalayan blackberry, wisteria, red flowering currant, sword fern, ornamental, likely creeping Taiwan bramble

Percent coverage of invasive vs. native species
Mostly ornamental and invasive species (90%) and few native species (10%).
Invasive species observed: English ivy, Himalayan blackberry, likely creeping Taiwan bramble, wisteria
NOTE: Yellow flag iris was not observed, but has been reported in this reach previously. Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short term riparian restoration potential and techniques
Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities, spread of invasive species and the RAPR.
Increase trees and shrubby vegetation at top of bank for shading.
Very few opportunities in this reach.

Short term channel restoration potential and techniques
Install baffles/boulders for in-channel complexity, to create a low flow channel and to allow more vegetation to establish between the concrete walls.

Long term channel and riparian restoration potential
Review for restoration potential if major redevelopment occurs.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 3 of 13) for proposed alignment], provides the following information (in grey):
Bee Street to Cadboro Bay Road
- This section is currently daylighted but has limited recreational or ecological benefit due to its vertical walls and limited access to public.
- As noted [in Reach 5A], in the long term the Oak Bay Recreation Centre may be redeveloped. This would allow the open creek to be re-designed and incorporated as an amenity for the rec centre. This could include a wider section with natural elements (e.g. boulders, logs) to be incorporated into the creek bed.
- Consideration should be given to acquiring the parcel bound by Cadboro Bay Road, Bee Street and creek (2041 Cadboro Bay Road) to allow for a wider, natural creek between Cadboro Bay Road and Bee Street. This would also facilitate the Florence Street alignment option north of Cadboro Bay Road (refer to Map 3, see below).

Additional Observations/Notes
2022 As stated in **2011** this short reach is a low priority for treatments without redevelopment and land use changes.

Resources & Further Reading
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org

Summary
Condition:
- Concrete and mortared rock channel, highly constrained by adjacent land uses.

Opportunities:
- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities, spread of invasive species and the RAPR.
- Increase trees and shrubby vegetation at top of bank for shading.
- Install baffles/boulders for in-channel complexity, to create a low flow channel and to allow more vegetation to establish between the concrete walls.
- Check for aquatic invasive species to prevent downstream spread.
- A low priority for treatments without redevelopment and land use changes, with possible improvements if upstream section daylighted as recommended in Daylighting Feasibility Study (2020).

Photo 5B-1. Concrete-lined channel and bottom, looking downstream to Bee Street culvert, with ornamental landscaping and northside walkway.

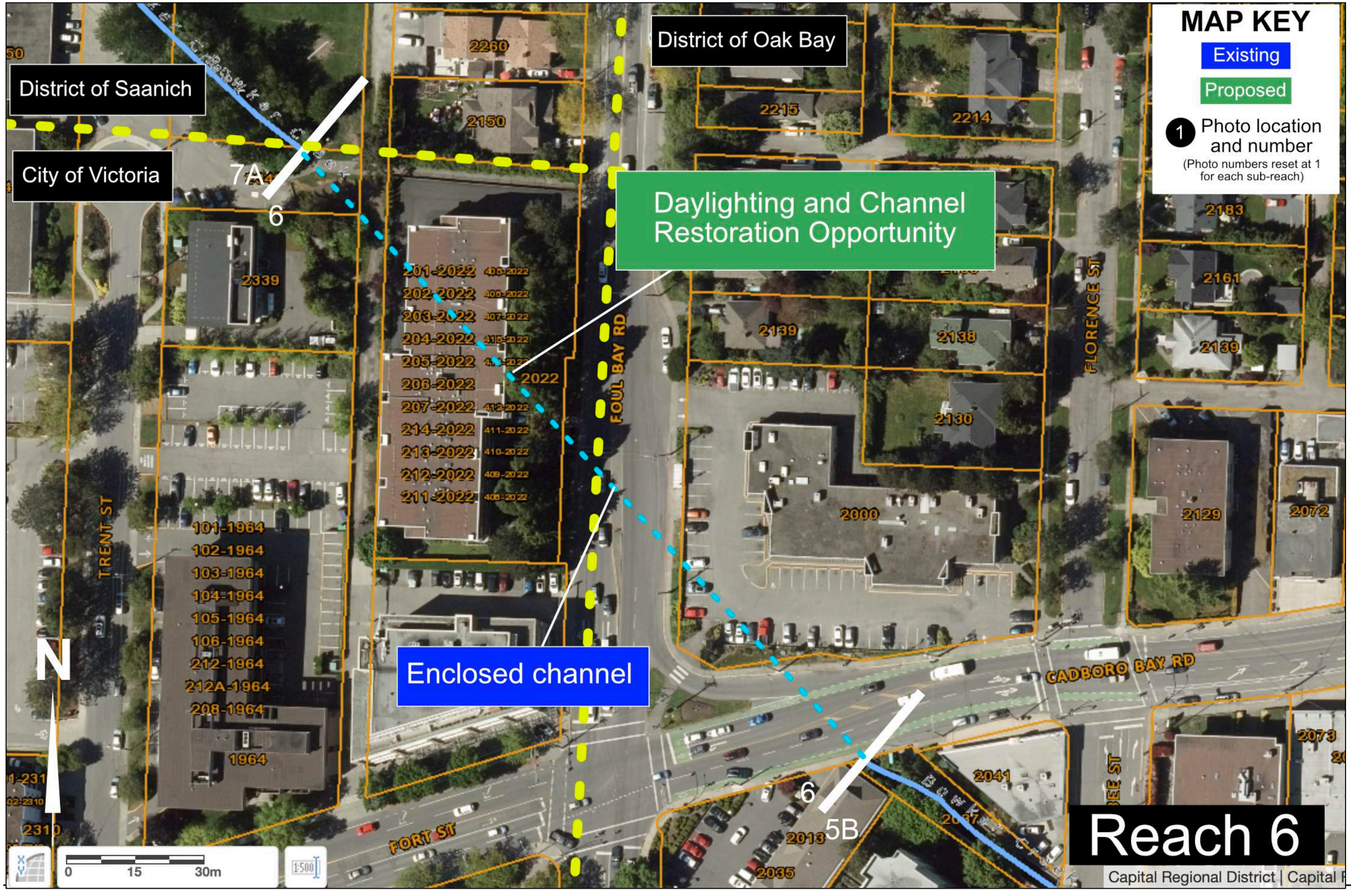
Photo 5B-2. Multi-family housing, lawn and mostly ornamental landscaping along vertical masonry walls (view upstream from Bee Street).

Photo 5B-3. Vertical masonry walls and mixed cobble on hardened channel bottom. Weir structure visible midreach (view upstream from Bee Street).

Photo 5B-4. Walkway between Bee Street and Cadboro Bay /Fort/Foul Bay intersection. Mostly ornamental landscaping along south bank and limited planting area on north side (and only at upstream end of reach) (view downstream).

Photo 5B-5. Vertical masonry walls and small incomplete weir with limited substrate complexity, and sword fern growing from wall cracks (view downstream).

Photo 5B-6. View downstream from Cadboro Bay Road at English ivy, Himalayan blackberry, creeping Taiwan bramble, wisteria and other mostly ornamental species. While invasive, the vegetation likely provides some greater complexity and cooling of the walls in comparison with bare walls.


District of Saanich
City of Victoria
District of Oak Bay
7A
6
Daylighting and Channel Restoration Opportunity
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Enclosed channel
FOUL BAY RD
FLORENCE ST
TRENT ST
CADBORO BAY RD
FORT ST
6
5B
N
0 15 30m
Reach 6
Capital Regional District | Capital

REACH 6

Reach # 6 - Enclosed – Foul Bay to St. Patrick's Elementary School (180m)

Channel Description
90m culvert

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long-term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in the Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 3 of 13) for proposed alignment] (in grey):

Cadboro Bay Road to east of Trent Street

- This section is the most urbanized and likely one of the most challenging section to daylight. Two corridor options are proposed for further study, one using Foul Bay Road (current alignment), and one using Florence Street. The Foul Bay alignment is more direct, but it may not be optimal in terms of greenway connectivity due to the traffic volumes at the Cadboro Bay Road/Foul Bay Road intersection. The Florence Street alignment is recommended as it integrates with the proposed greenway.
- The Cadboro Bay Road/Foul Bay Road intersection is very busy, and Florence Street is a more suitable alignment for active transportation. Thus, daylighting along Bee Street and Florence Street should be considered.
- The proposed greenway would have signaled pedestrian crossings on Foul Bay Road (100 m north of Cadboro Bay) and at Cadboro Bay Road and Florence Street.
- The existing Bowker Trunk alignment between Foul Bay Road and Trent Street has been identified as a potential active transportation route. Additional right-of-way is needed to integrate a multi-use path with daylighting

Recommended Alignment – Florence Street

- Acquire all or part of residential lot on west side of Foul Bay Road; existing walkway is only 3-4 m wide. The additional width needed for daylighting could be subdivided from the rest of the lot and the remnant lot sold. While it would be preferable to use the entire lot for a natural channel, there may only be support for acquiring a portion of the lot.
- Acquire part or all of the two lots between Foul Bay Road and Florence Street adjacent to existing lane (sanitary sewer is within existing lane). These could be either north or south of the existing lane, but south would be preferable to minimize costs and provide a more direct connection across Foul Bay Road. Again, either a portion or the entire lot could be acquired.
- Construct daylighted creek on east side of Florence Street (homes on west side of street only have front driveways) including part of boulevard. There is about 5m from the sanitary sewer in the middle of the street to the property line on the east side, thus the creek would need to have vertical walls and railings. The vertical daylighted creek could extend in front of three single-family homes and the multi-family building on Cadboro Bay Road.
- This alignment requires a connection to Bee Street south of Cadboro Bay Road, preferably within the commercial lot bounded by Cadboro Bay Road and Bee Street.
- Traffic calming is being considered along Florence Street to restrict short cutting. This would make Florence Street a preferred greenway.
- The recommended alignment could shift if the lots west of Florence Street were to redevelop in the medium to long term.

Alternate Alignment – Foul Bay Road

- Acquire all or part of residential lot on west side of Foul Bay Road; existing walkway is only 3-4m wide. The additional width needed for daylighting could be subdivided from the rest of the lot and the remnant lot sold. While it would be preferable to use the entire lot for a natural channel, there may only be support for acquiring a portion of the lot.
- When commercial property northeast of Foul Bay Road and Cadboro Bay Road redevelops, work with the owner to exchange additional height for a portion of land where the current trunk runs. Within a future, more urban context, it may be possible to integrate streetscaping on this commercial site with the daylighted creek, presumably with primarily vertical retained walls.
- Use the wide boulevard area between the property line and the Foul Bay roadway to daylight the creek. There is about 10 m from the property line to the edge of the cycling lane in front of these houses. The street parking along the east side of Foul Bay Road would need to be removed. Two of the three houses have front driveways which would limit the amount of daylighting. There is potential for redevelopment of these lots in the longer term which would preferable as it would consolidate the driveways and allow for more daylighting width through dedication.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary

Condition:

- Culverted

Opportunities:

- Daylighting when redevelopment or opportunities arise as recommended in Daylighting Feasibility Study (2020).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
24
7B
7A
22
12
11
Gabions
Extensive invasive climbing vines
23
18
Potential channel relocation area
10
21
20
9
19
8
7
Golden willow occurs extensively along the reach
17
6
5
16
Restoration demonstration site from 2004
4
3
2
15
14
13
1
District of Saanich
City of Victoria
Trent Street Rain Gardens
N
0
15
30m
Reach 7A
7A
Capital Regional District | Capital Regional District, 2

REACH 7A

Reach # 7A – Trent Street to Haultain Street (330m)
St. Patrick's Elementary School – School District 61; Adanac Street right-of-way – District of Saanich; 1880 Adanac Street –Bishop of Victoria; 1855 and 1871 Haultain St – ownership unknown

Channel Description
Straight, entrenched channel (3-4m wide), with steep banks (2-3m high; 1:1 to vertical slope), no floodplain access, and adjacent mowed lawn areas, parking area, and playground (Photos 2, 3, 4, 7, 8, 9, 11). West bank has riprap above the bridge at the school and gabions on the west bank at the upstream end. Golden willow trees grow in the channel at the base of the banks on both sides of the creek. The channel gradient is <2% slope. The channel substrate is gravel, sand, cobble with a layer of fines (Photo 4). This area has a history of flooding and the upper reach has numerous examples of new and old flood barriers including sandbags and clay berms around vulnerable properties (Photos 23 & 24).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The existing riparian area is approximately 3m wide on each side of the channel and is constrained by fencing along the channel and informal pathways at top of bank. There is parking and a play area at the school, and mowed grass along most of the reach., including to top of bank in some areas (Photos 1, 7, 10). Trees and shrubs are extensively pollarded/trimmed in the reach adjacent to the hospital heliport (Photo 18).

In the lower section where there has been armouring of the base of the slope, the riparian vegetation stops approximately halfway down the slope. In areas with no armouring, vegetation comes down to the low flow water level and golden willows growing in the channel bottom have created mats in the bottom which creates some pools and narrows the channel.

The lower section (45m) below the footbridge was the site of a demonstration restoration area in 2004. Rock was installed at the base of the slope to create a low flow channel with a floodplain terrace, mid-slope bioengineering (willow wattles), and riparian plantings.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium to High

- Lower end armoured at toe and near bridge
- Some bioengineering has not established
- Low bank scoured and shaded with some patches of erosion

2011 Comments
Yes, Medium. There are short sections of eroding bank on the west bank across from the heliport and at the Bishop of Victoria or Adanac ROW property.

Bioengineering done by Saanich above the footbridge has variable survival. On the east bank, little has survived. On the west bank, survival is moderately good, with the middle section having poor survival. The key section below the corner of the school gym is thriving.

Immediately above the footbridge on the west bank, there is a rock retaining wall. This wall appears to be leaning and there is some erosion behind it.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs in a narrow strip (3-4m wide on each side of the channel, with mowed grass at the top of the slope (Photos 1, 5, 10).

Lower section (demonstration restoration site - 45m below the footbridge): Black cottonwood, Pacific, Sitka and Hooker's willows, patch of Himalayan blackberry with snowberry, Nootka rose, red-osier dogwood (Photos 1-4)
Upper section (upstream of the footbridge to Haultain Street): Golden willow, black cottonwood, English ivy, Himalayan blackberry, reed canary grass (Photos 5-12)

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Lower section (demonstration restoration site - 45m below the footbridge): bigleaf maple, western redcedar, occasional golden willow, hardhack, oceanspray, June plum, Pacific ninebark, vine maple, black hawthorn, Pacific crabapple, Pacific water-parsley, horsetail, reed canary grass.
Upper section (upstream of the footbridge to Haultain Street): golden willow, Himalayan blackberry, Canada thistle, morning glory, Scotch broom, English hawthorn, black hawthorn, snowberry, creeping buttercup, laurel hedge, English holly, traveller's joy, woodbine, spurge-laurel, poison hemlock.
NOTE: in the field at the VIHA, Adanac St right-of-way, and 1880 Adanac St there are isolated patches of plantings set back from the top of bank (e.g. Pacific crabapples, ocean spray, snowberry) and mowed all the way around allowing for an informal pathway created by foot traffic at the top of bank (Photo 10).

Percent coverage of invasive vs. native species
Lower section (demonstration restoration site - 45m below the footbridge):

- 70% native / 30% invasive (Himalayan blackberry, golden willow)

Upper section (upstream of the footbridge to Haultain Street):

- 90% invasive / 10% native

Invasive species observed: golden willow, Himalayan blackberry, English hawthorn, Scotch broom, English ivy, European bittersweet, spurge-laurel, morning glory, grasses, Canada thistle, creeping buttercup, laurel hedge, English holly, traveller's joy, woodbine, poison hemlock.
Additionally, there is a high likelihood of lesser celandine in this reach, but along with shiny geranium it is not visible at this time of year.

Short-term riparian restoration potential and techniques
The short-term recommendations are:

- Provide property owners along the creek (including School District 61) with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Remove vegetation that has been cut and placed in the riparian area along the school parking lot (smothering the riparian vegetation).
- Remove invasive species from the lower section (downstream of the footbridge) including: Himalayan blackberry patch, one remaining mature golden willow, reed canary grass.
- Stop mowing the riparian area along the St. Patrick's school parking lot and, if vegetation must be trimmed, do not place the cuttings behind the fence into the riparian area. Cessation of mowing

needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas.
- Stabilize eroding areas as needed to prevent sedimentation/bank failure, using bioengineering, if possible.
- Remove climbing invasive species, which are smothering other vegetation (*e.g.* English ivy, traveller's joy, woodbine, and European bittersweet).
- Remove poison hemlock from west bank adjacent to heliport.

Depending on the feasibility and schedule for the long-term restoration activities, invasive species removal and widening the riparian area could be initiated; however, if the channel will be relocated and/or channel banks re-sloped, the invasive removal and planting should be done at that time.

Short-term channel restoration potential and techniques

The following could be done in the short term or combined with longer term/larger scale actions:
Widen the creek corridor (to approx. 15m), on properties 1855 and 1871 Haultain Street where there is an informal path and gabions on the west side. Gabions could be removed to create a terraced stream bank with native vegetation. This may require a retaining wall on the west bank and at the corner of the lot at 1875 Haultain – a detailed design would be required.

Flooding on the west bank in the upper reach immediately south of Haultain Street is evidenced by a number of old and new berms of soil, sandbags and clay (Photos 23 & 24). The newest berm (fall 2022) in unvegetated clay. Planted MSE bags or vegetated berms would be longer-lasting and have less sedimentation potential, especially in high flows.

Long-term term channel and riparian restoration potential

A range of options are available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school.

If the school is eventually relocated and land acquisition accomplished, an optimal restoration can be achieved; however, if this is not in the near-future plans, the restoration can be done in phases, and the upper part of the reach could be realigned and restored first.

In areas where widening the riparian corridor is not feasible, improvements could still be made. The channel could be reconstructed (similarly to downstream of the footbridge), keeping within a similar footprint, with a rock toe at the base to create a low flow channel and floodplain terrace, providing a small riparian area up to the top of the slope to be planted with native vegetation, using bioengineering to stabilize slopes, if needed.

The upper part of the reach is constrained between lots. A long-term term option is to purchase the lot at 1860 Adanac and/or 1875 Haultain Street to allow more room for the creek.

Golden willow is dominant above the footbridge and spreads to downstream areas. Transitioning from golden willow to native willows could be possible, while maintaining bank stability and habitat, but it is recommended to shift the vegetation community in stages by removing sections (rather than all) and replanting with native willows. This allows a new canopy to establish before moving to the next section in order to maintain habitat, shade and water quality.

The ISL Engineering Daylighting Feasibility Study (2020) examined this location and provided the following analysis [see Map 6.1 and Map 7.1 (alignment 3 of 13) for proposed alignment] (in grey):

Trent Street to Haultain Street
- This section of Bowker Creek is currently open as a straight, narrow channel. It runs adjacent to St. Patrick's School and Royal Jubilee Hospital and has a very narrow right-of-way.
- There are open parcels of land north and south of Adanac Street that could be incorporated into park space, provide a corridor for multi-use pathways, and re-route the creek to a more natural, meandering alignment.

This section is currently daylighted and partially within public lands. The following items are noted for this reach:
- Acquire lots adjacent to the creek to provide for greenway, wider (more natural) cross-section, storage, and to create alternate alignments.
- There is currently no formal pedestrian or cycling trails adjacent to the creek, but there are dirt paths:
  - southwest of the creek between Haultain Street and Royal Jubilee Hospital; and
  - northeast of the creek west of Trent Street that connects the St. Patrick's School playground with Haultain Street.
- Optimal creek realignment with greenways is shown on the map.
- Lands below ~14.5 m are subject to flooding.
- The lands between Haultain Street and Trent Street are optimal for storage; consider lowering the green space east of Adanac Street for passive storage. The available volume is generally too small to make a significant reduction in the expected flooding at Trent Street.
- Consider relocating St. Patrick's School to consolidate storage/minimize flooding risk.
- As homes on Trent Street near the creek redevelop, they should be constructed at a higher elevation to minimize their flooding risk.

NOTE: Paths or trails should be set back from the creek channel to allow space for increasing sinuosity, floodplain access and the width of the riparian corridors, and to protect banks from trampling.

Additional Observations/Notes

2022 – The demonstration restoration site (lower 45m section below the footbridge) described in 2011 is now well-established and requires maintenance as described in the short-term restoration section. This section is much improved with respect to riparian conditions, bank stability, and appropriate stream width, but still lacks instream complexity and a significant floodplain. If the area is ever redeveloped this section could be improved further by creating a reshaped, more complex channel in a wider floodplain, as described above. Fish were observed in 2022, likely sticklebacks.

Rain gardens have been installed at Trent Street to treat runoff prior to discharge to the creek.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Restoration demonstration site (lower 45m, downstream of footbridge) is well established
- Remaining reach upstream of the footbridge is entrenched and dominated by golden willow, Himalayan blackberry, and English ivy
- On both sides of the creek the riparian zone is constrained by land uses (parking, playground, mowed grass, etc.).

Opportunities:

- Provide property owners along the creek (and School District 61) with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Short term – Engage with landowners to partner for restoration, bioengineering for erosion protection and invasive species removal.
- Short term – Stop mowing riparian area along parking lot. Cessation of mowing needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas. If vegetation needs to be trimmed along the fence line, remove cut material, do not dump into the riparian area.
- Long term – A range of options are available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school.
- Long term – Realign and restore channel and riparian area as recommended in Daylighting Feasibility Study (2020).

Photo 7A-1. Lower end of reach (45m section downstream of footbridge), restoration demonstration area, fencing and mown grass to the top of bank (see Photo 7A-13 for winter view).

Photo 7A-2. Lower end of reach (45m section downstream of footbridge), restoration demonstration area.

Photo 7A-3. Lower end of reach (45m section downstream of footbridge), restoration demonstration area. Himalayan blackberry patch should be removed.

Photo 7A-4. Cobble and gravel channel bottom in lower end of reach (45m section downstream of footbridge), restoration demonstration area.

Photo 7A-5. Golden willow, black cottonwood and Himalayan blackberry above the footbridge, fencing and mown grass to the top of bank.

Photo 7A-6. Golden willow and Himalayan blackberry above the footbridge.

Photo 7A-7. Golden willow, English hawthorn, and English ivy, with snowberry above the footbridge.

Photo 7A-8. Golden willow in the channel upstream of the footbridge, with mostly bare lower banks.

Photo 7A-9. Golden willow in the channel and Himalayan blackberry, upstream of the footbridge

Photo 7A-10. Upper end of reach, golden willow, and fencing and mown grass to the top of bank with isolated pockets of native plantings (see Photo 7A-18 for extensive later pollarding (trimming) of this section).

Photo 7A-11. Downstream of Haultain Street: gabions, European bittersweet, and English ivy on the west bank, and golden willow at the base of the east bank (see Photo 7A-24 for winter conditions).

Photo 7A-12. Traveller's joy on fence, adjacent to the creek, growing throughout the golden willow canopy (downstream of Haultain Street).

Photo 7A-13. The 45m section of restoration downstream of the footbridge is an example of where the transition to a mature native tree canopy allows for the removal of the only mature golden willow remaining in this section while maintaining wildlife values. The inset demonstrates the opportunity for riparian widening of vegetation.

Photo 7A-14. Black cottonwood nurse log sprouting large trees on southwest bank along 45m restoration area.

Photo 7A-15. The 45m restoration area looking downstream from the footbridge in winter. Himalayan blackberry beginning to encroach.

Photo 7A-16. Vertical banks bare of vegetation contribute to the sediment load in the creek and are vulnerable to erosion during high flows (upstream of footbridge view southwest/downstream).

Photo 7A-17. Leaning sections of fencing at top of bank adjacent to the playground are destabilised by foot traffic and erosion of vertical banks here (inset Photo 7A-16). The golden willows at the upper right show previous pollarding, likely as maintenance for the hospital heliport (see Photos 7A-10 & 18).

Photo 7A-18. All the higher vegetation (including native trees/shrubs & golden willow) along the section of creek adjacent to the hospital heliport have been extensively pollarded (view southwest) (see Photo 7A-10 for condition before cutting). Inset: Additionally, much of the northeast bank is devoid of shrubs and trees (view upstream).

Photo 7A-19. Poison hemlock and English ivy on the west bank adjacent to the hospital heliport and otherwise bare vertical banks common to many reaches.

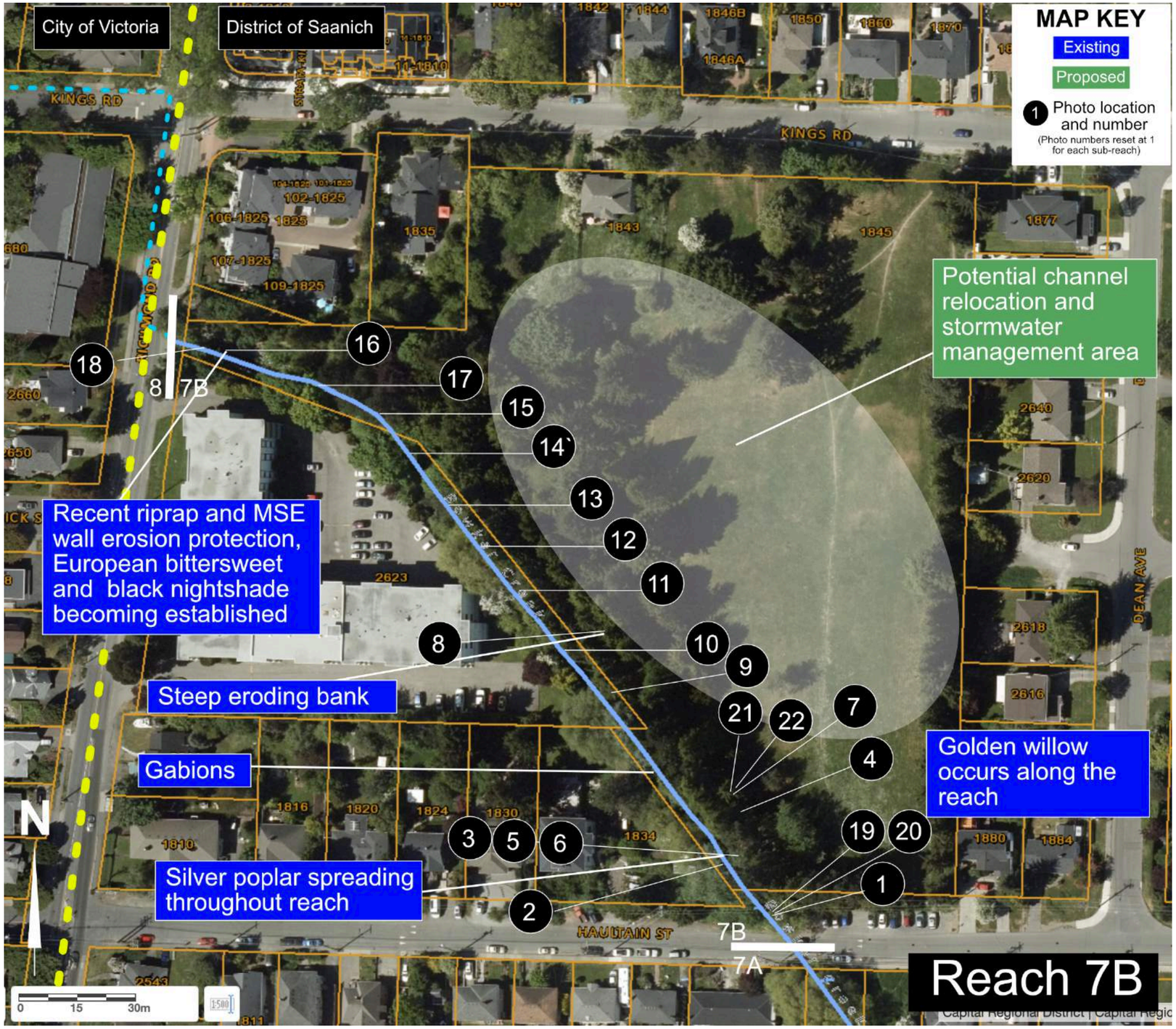
Photo 7A-20. Winter conditions in rainfall with many golden willows that grow at the base of banks submerged (view downstream).

Photo 7A-21. Informal gathering spots at the side of the creek create bare patches in vegetation (albeit invasive) and accumulate trash, contributing to sedimentation and pollution of the creek (view downstream).

Photo 7A-22. Instream golden willows and debris jams create waterfalls during storm events (view downstream immediately south of Haultain Street).

Photo 7A-23. New and old (inset) flood control measures have been installed in the upper reach immediately south of Haultain Street, in some cases leading to sediment-laden runoff (view north on west bank). Planted MSE bags or vegetated berms would be longer-lasting and have less sedimentation potential, especially in high flows.

Photo 7A-24. View downstream from Haultain Street bridge of instream golden willows and gabions. An old berm of disintegrated sandbags lines the property fence immediately adjacent to the footpath above the west bank, indicating previous flood events.


City of Victoria
District of Saanich
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
KINGS RD
Potential channel relocation and stormwater management area
Recent riprap and MSE wall erosion protection, European bittersweet and black nightshade becoming established
Steep eroding bank
Gabions
Silver poplar spreading throughout reach
Golden willow occurs along the reach
HAULTAIN ST
DEAN AVE
8
7B
7A
N
0
15
30m
Reach 7B

REACH 7B

Reach # 7B – King's Road Community Nature Green Space (2661 Richmond Road) – Haultain Street to Richmond Road (District of Saanich) (225m)

Channel Description
Straight, entrenched channel (3-4m wide), with steep banks (2-3m high; 1:1 to vertical slope) and no floodplain access (Photos 1-22). There are some small riffle habitats in this section, and the channel substrate is gravel and cobble with sand and silt. West bank has gabions at the downstream end. Downstream of the culvert under Richmond Road, recent erosion protection riprap and MSE grassed walls have been installed (Photos 16-18). Some native plantings have been added to the east bank.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The existing riparian area has vegetation growing along the channel on the steep banks for 3-5m on each side; however, the banks are steep and in many areas there is bare soil (Photos 2,7,8,11,15).

At the top of bank on the east side is a foot path and row of ornamental conifers (Photos 3,4,15). On the west side at the top of bank the riparian area is constrained by fencing and a residential lot and an apartment complex (building and parking).

District of Saanich has purchased the property on the east bank and is currently conducting public consultation for the park. With restoration the creek corridor could be widened as much as necessary to create a meandering channel with appropriately sloped banks, ponds and stormwater management.

Streamside Protection and Enhancement Area (SPEA)

Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, High. There are several sections of steep unvegetated and eroding banks, and recent erosion protection works have been installed at the upper end of the reach.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs in a narrow strip (3-4m wide on each side of the channel).

Dominant species: Golden willow, white poplar, bigleaf maple, red alder, Himalayan blackberry, European bittersweet, European black nightshade, English ivy, grasses.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Mixed conifers (planted along the path), snowberry, Nootka rose, salmonberry, dull Oregon-grape, saskatoon, sword fern, Pacific water-parsley, English holly, English hawthorn, spurge-laurel, thistle, morning glory, golden chain tree, laurel hedge, orchard grass, reed canary grass.

Percent coverage of invasive vs. native species
95% invasive, non-native or unvegetated
Invasive species observed: Golden willow, white poplar, Himalayan blackberry, European bittersweet, European black nightshade, English ivy English holly, English hawthorn, spurge-laurel, periwinkle, thistle, morning glory, golden chain tree, laurel hedge, orchard grass, reed canary grass.
NOTE: White poplar (Photo 5) and European black nightshade (Photo 18) are a newer invasive species becoming established at the upper end of the reach. White poplar was in the lower part of the reach and nightshade was at the upstream end.

Lesser celandine was not visible during the 2022 site visit, but Friends of Bowker Creek reported that it is present in this reach. It was likely too late in the season to be visible.

Short-term riparian restoration potential and techniques
- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Initiate planning with District of Saanich for this new park area to achieve Bowker Creek long-term goals.
- **HIGH PRIORITY:** In the short term, the recommended focus is to remove invasive species, particularly climbing vines (which can smother understory vegetation and trees), and newer invasives, to prevent them from spreading downstream, such as: white poplar, European black nightshade, European bittersweet, English ivy (especially on trees in the short term).

Short-term channel restoration potential and techniques
- Short-term channel and bank recommendations are to continue bank stabilization measures as needed, including bioengineering (e.g. willow wattle).
- Relocate the trail away from the stream and protect the banks from trampling (e.g. fencing)

Long-term term channel and riparian restoration potential
A range of options are available in the long term, depending on the ability to reconfigure land uses of the property. Now that the property is owned by the District of Saanich for a community green space, there is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to constructing a well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities for the neighbourhood. Moving the channel would result in the loss of some of the double row of ornamental conifers along the path. Consideration should be given to minimize this impact because they provide significant habitat for birds in the area.

Park planning activities including community consultation are starting in November 2022.

The ISL Engineering Daylighting Feasibility Study (2020) examined this location and provided the following analysis [see Map 6.1 and Map 7.1 (alignment 4 of 13) for proposed alignment] (in grey):

The 2661 Richmond Road site was recently acquired by the District of Saanich from BC Hydro. The District does not have official plans for the site but may select to develop part or all of the site into a park. There is strong public support for designated park use, including a community group (Kings Road Community Nature Green Space).

The site generally falls from the north to south and drops about 3 to 4 m over 200 m length. Bowker Creek is an open channel running along the southwest edge of the parcel flowing in a southeasterly direction. The creek is straight and runs parallel and close to the private property boundary to the southwest. The creek has steep banks that are susceptible to erosion.

The site is bordered by Kings Road to the north and Haultain Street to the south; both are dedicated as City of Victoria People Priority Greenways (west of Richmond Street). It is understood that improvements to the Haultain Street bicycle facilities are being coordinated between the City of Victoria and the District of Saanich.

REACH 7B

The proposed concept for constructing a Stormwater Management Facility (SWMF) as part of a future park development is summarized below:

- The existing parcel would be divided into thirds:
  - the bottom (southern) third would be a low lying naturalized area along the creek that would be inundated during frequent storm events (~2 year);
  - the middle third would be turf grass for casual park use but would be inundated during infrequent storm events (~25 year); and
  - the northern third would be park space that is not part of the SWMF.
- The creek would be re-aligned at the south to provide a more natural setting; naturalize the south end with boulders and woody debris; riparian plants in lower area would be suitable for frequent inundation.
- A granular trail would be developed along the creek to connect Haultain Street to the south (connecting to the informal path to Royal Jubilee Hospital) with Richmond Road to the west (with connection to Spirit Garden via existing sidewalks).
- A MUP could be constructed to improve active transportation connectivity between Haultain Street to the south and Kings Street to the north.
- Pedestrian bridges and/ or open bottom culverts may be considered to integrate the existing and proposed pathways.
- To maximize the available storage volume, it will be necessary to construct a south berm approximately 1m above the existing ground elevation. It is anticipated that some of the material excavated to create the SWMF could be reused for the berm.
  - A concept of the 2661 Richmond Road SWMF is shown in Figure 5.4 (of the Daylighting Feasibility Study). The stage-storage relationship from this configuration was inserted to the model, with the downstream trunk hydraulics used to control the flows. (Note: this SWMF was modeled as a widened creek cross-section in the MDP).

  Further details are provided in the ISL Engineering Memorandum: Potential Stormwater Management Facilities on Bowker Creek (March 2020)

NOTE: Paths or trails should be set back from the creek channel to allow space for increasing sinuosity, floodplain access and the width of the riparian corridors, and to protect banks from trampling.

Additional Observations/Notes

2022 –The creek is in a similar condition as was observed in 2011, with the change in land ownership to District of Saanich, there is greatly increased potential for significant improvements to the channel, riparian area, and stormwater management. This section continues to have a healthy population of crayfish.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

ISL Engineering and Land Services. 2020. Memorandum: Potential Stormwater Management Facilities on Bowker Creek

Save Kings Community Nature Space - https://www.facebook.com/SaveKingsCommunityNatureSpace/

Kings Community Greenspace Vision - https://www.saanichlegacy.ca/project/kings-community-greenspace-vision

Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Channel is entrenched, with steep banks, and some eroding sections.
- Vegetation is dominated by invasive species, including new invasives (white poplar and European black nightshade) not seen in very many other locations in the watershed.

Opportunities:

- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Short term – Invasive species removal (particularly climbing vines and new species), erosion protection with bioengineering, relocation of trail away from the stream and protect banks from trampling (e.g. fencing), and planning for long-term restoration with the District of Saanich.
- Long term – Realign and restore channel and riparian area as recommended in the Daylighting Feasibility Study (2020), including the construction of a Stormwater Management Facility.

Photo 7B-1. Culvert at Haultain Street at downstream start of reach (view downstream) (see Photos 7B-19 & 20 for high flows here).

Photo 7B-2. Gabions on the west bank, large white poplar tree (invasive) on the bank, and sedimentation from stormdrain very likely from the nearby open pit construction site (view upstream).

Photo 7B-3. Steep banks with grass and golden willow (invasive), path with double row of non-native conifers at top of bank (view upstream).

Photo 7B-4. Path with double row of non-native conifers at top of east bank (view upstream).

Photo 7B-5. Invasive white poplar spreading along the bank and into the field.

Photo 7B-6. Large white poplar (invasive) on the bank, adjacent to golden willow (invasive) (view downstream to Haultain St).

Photo 7B-7. Invasive golden willow, bare soil on banks, and debris jam in the channel (see Photos 7B-21 & 22 for high flows here).

Photo 7B-8. Himalayan blackberry (west bank) and steep bare soil bank on east side (view upstream).

Photo 7B-9. Steep bank with Himalayan blackberry, English ivy, agricultural grasses and golden willow in the background (view downstream).

Photo 7B-10. Almost vertical bank with English ivy and morning glory (view upstream).

Photo 7B-11. Bare, steep bank, with invasive species, and cobble/gravel substrate.

Photo 7B-12. Barred owl in golden willow.

Photo 7B-13. Golden willow, English ivy, English holly (all invasive).

Photo 7B-14. Invasive periwinkle on the steep slope (view upstream).

Photo 7B-15. Eroding bare bank (east side of channel) (view upstream).

Photo 7B-16. Riprap and MSE bags (with grass) as recent erosion protection (west bank) immediately downstream of Richmond Road, and golden willow (view upstream).

Photo 7B-17. Riprap and MSE bags (with grass) erosion protection (west bank) (view upstream).

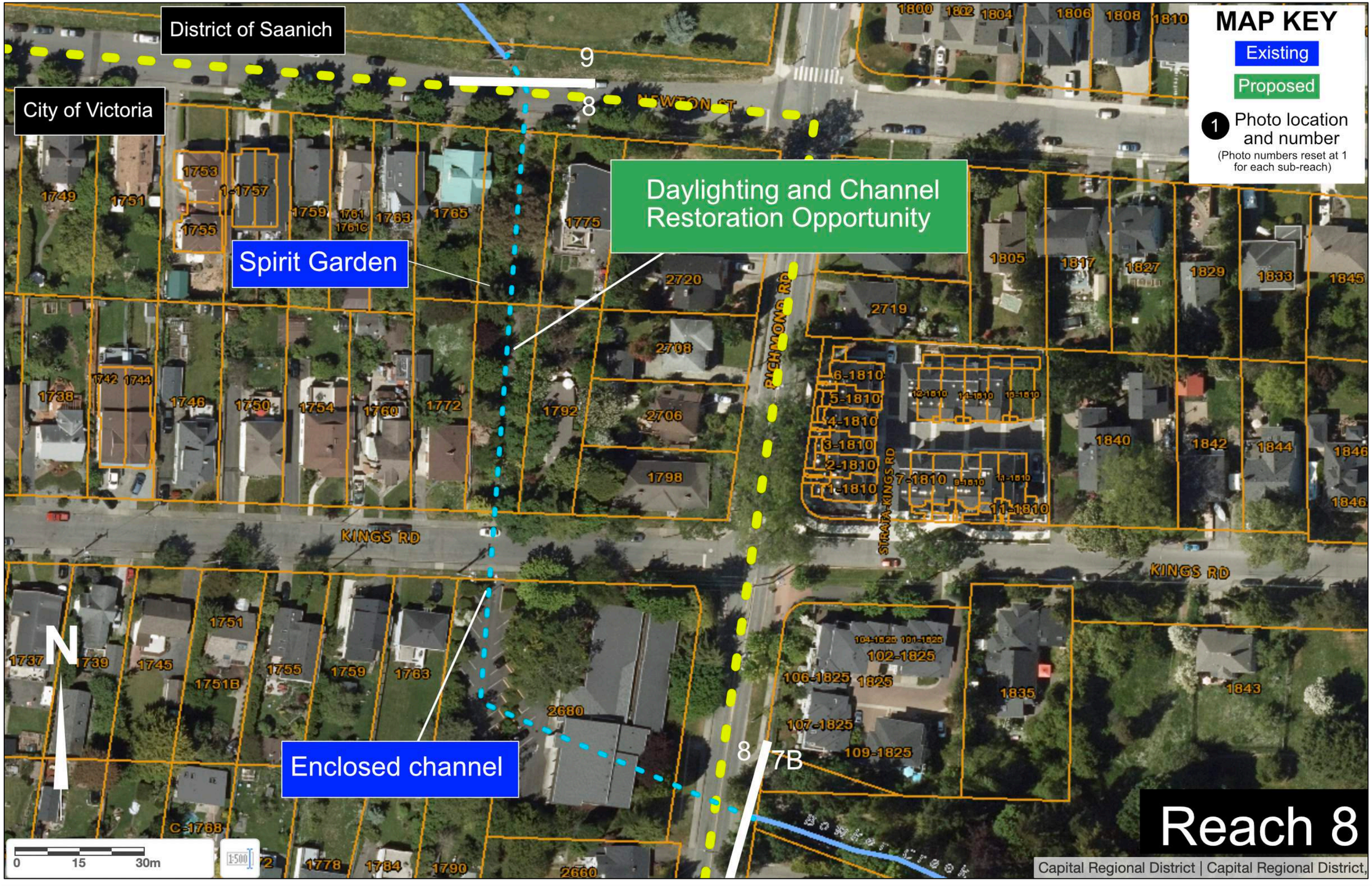
Photo 7B-18. Invasive European black nightshade and European bittersweet on erosion protection at upstream end of the reach, culvert under Richmond Road in the background (view upstream).

Photo 7B-19. Haultain Street bridge during rainfall (view downstream).

Photo 7B-20. Haultain Street bridge and high water during rainfall (view downstream).

Photo 7B-21. Lower end of reach looking upstream at debris jam pictured in Photo 7B-7 (~30m upstream of Haultain Street).

Photo 7B-22. Lower end of reach looking upstream at debris jam pictured in Photo 7B-7 with a vertical drop in height of approximately 0.5-0.75 m (~30m upstream of Haultain Street).


District of Saanich
City of Victoria
9
8
Daylighting and Channel Restoration Opportunity
Spirit Garden
Enclosed channel
8
7B
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
KINGS RD
N
0
15
30m
Reach 8
Capital Regional District | Capital Regional District,

Reach 8 - ENCLOSED

Reach # 8 - Enclosed – Culvert from Richmond Road to Newton Street (215m)

Channel Description
215m culvert (Photo 1)

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long-term term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignment 4 of 13) for proposed alignments], which includes (in grey):

Richmond Road to Kings Road

- The trunk runs diagonally under an existing commercial property (currently Victoria Arthritis Centre). While this building is relatively new, it is only a single storey and it is in an area that is densifying with several 3-storey structures constructed recently. Thus, there is a good likelihood of the site redeveloping over the medium term.
- Redeveloping the site to 3-4-storey mixed use or commercial use could benefit from the daylighted creek, especially if the alignment was shifted to the back of the lot (south and west) as shown on Map 4. Developments such as cafes, medical/healing, etc. could be very compatible with a daylighted creek.
- The trunk is approximately 2.5 m deep and thus a natural creek with partial retaining walls would be possible, depending on the amount of land that the developer would be willing to give up.
- The greenway could run parallel to the creek but that could detract from the land use described above. Given the size of the parcel and the relatively short distance between Spirit Garden and the "BC Hydro" park site, it would be reasonable to use Kings Road and Richmond Road for the pedestrian/cycling connectivity.

Newton Street to Kings Road – "Spirit Garden"

- The existing trunk alignment is within Spirit Garden, a narrow section of City parkland that has granular pathways and benches. The park ranges from approximately 12 m to 18 m wide. The garden is currently maintained by a local community group.
- The existing trunk is 2.4 m by 2.4 m and is just below grade (~3 m to invert or bottom of pipe) and is located about the middle of the lots. A sanitary trunk runs parallel to the storm trunk on the east side and about 6 m below grade. A daylighted creek can have water ponding above the sanitary sewer as the risk of infiltration into the sewer is negligible as the sewer is in a casing pipe.
- Based on the depth of the storm trunk and the available width of the lot, it is possible to daylight with some retained sides. This would leave enough room for a path on the east side but little room for gardens.
- In order to have a natural creek and have space for paths and gardens, the [City of Victoria] should consider acquiring the lots immediately west of Spirit Gardens (1772 Kings Road & 1765 Newton Street). The BCI has identified lots to east for possible acquisition.
- If it is not practical to obtain additional lots, consideration should be given to landscaping the daylighting and walkway using boardwalks and partial retaining walls.
- Refer to Exhibit 7.2.
- To keep the quiet ambiance of the current Spirit Garden, it is suggested that cycling trails be routed around the garden. A cycling trail could be incorporated into a wider park site if the lots to the west were acquired.

Resources & Further Reading

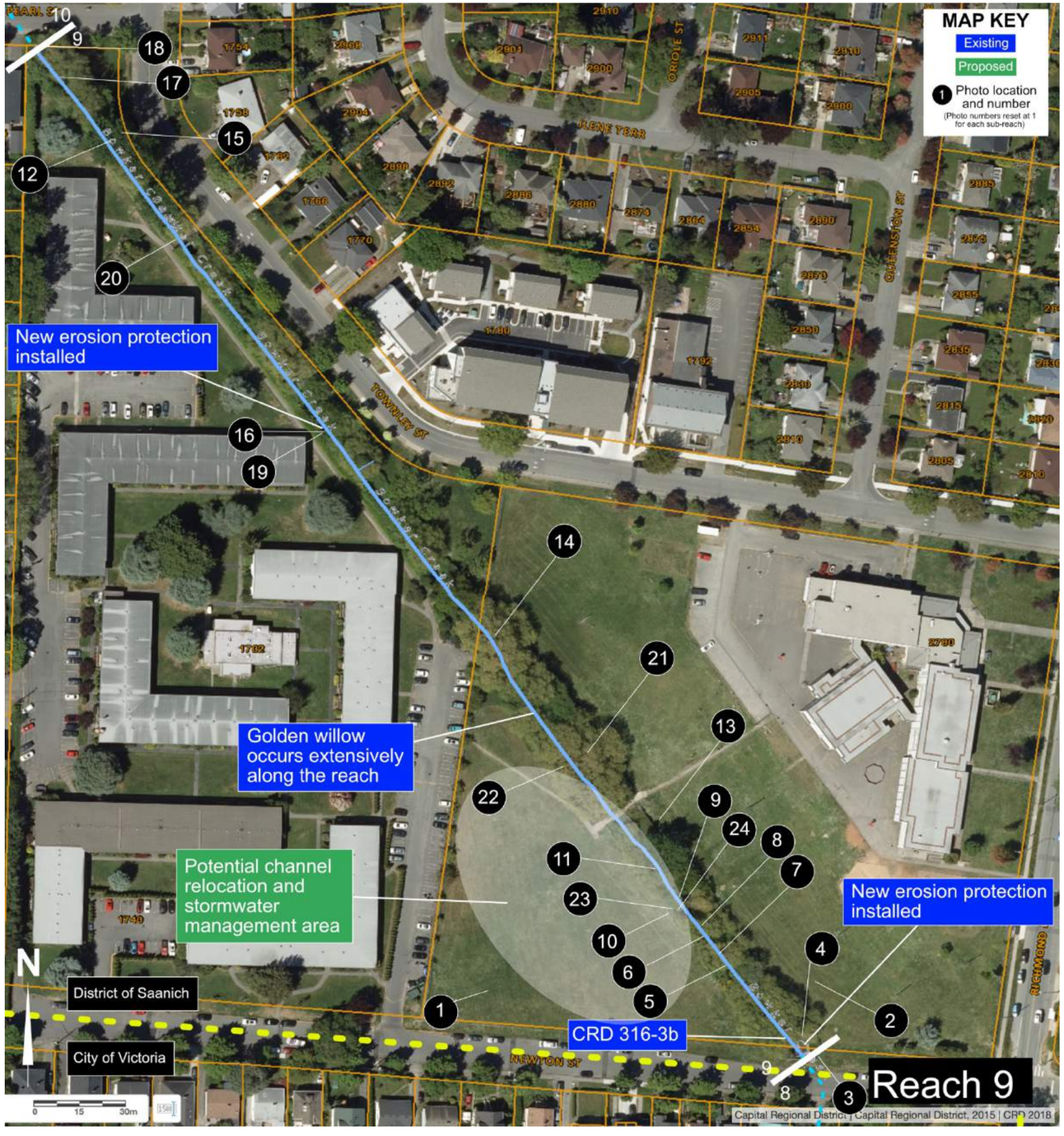
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary

Condition:
- Culverted

Opportunities:
- Daylighting as described in the Daylighting Feasibility Study (2020).

Photo 8-1. View into culvert from Reach 7B at Richmond Road (view upstream).


MAP KEY
Existing
Proposed
Photo location and number
(Photo numbers reset at 1 for each sub-reach)
New erosion protection installed
Golden willow occurs extensively along the reach
Potential channel relocation and stormwater management area
New erosion protection installed
CRD 316-3b
District of Saanich
City of Victoria
Reach 9
N
Pearl St
Oriole St
Queenston St
Townley St
Newton St
Burnham Rd
Capital Regional District | Capital Regional District, 2015 | CRD 2018

REACH 9

Reach # 9 – Newton Street to Pearl Street (420m)
Lansdowne Middle School South Campus – School District 61 (formerly Richmond Elementary School) (2780 Richmond Rd)
Apartment complex (1740 and 1702 Newton St)

Channel Description
Straight, entrenched channel (3-4m wide), with steep banks (approx. 3m high) and no floodplain access, fenced with adjacent mowed lawn areas and a parking lot (Photos 1-24). East bank has new riprap erosion protection above the downstream culvert, and the west bank has new erosion protection being installed in the upstream portion, adjacent to the apartment building. Older gabion sections were observed at the upstream and downstream west bank, with portions of cement retaining walls on the upper west bank in some places upstream and downstream of the school footbridge. A row of concrete lockblocks form the base of east bank immediately upstream from the footbridge. The channel gradient is <2% slope. The channel substrate is gravel, sand, cobble with a layer of fines and a couple of deeper pools (~1m depth), invasive golden willow roots form mats that create narrower channel sections and plunge pools.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The existing riparian area is 3-4m wide on each side of the channel and is constrained by fencing along the top of bank on both sides, mowed grass along most of the reach, as well as a parking area and apartment building on the west side. The riparian vegetation area extends only to the top of bank (Photos 1-3,13-18).

With school board involvement, the creek could be restored (re-sloped banks, reconstructed channel morphology, including sinuosity, and complexity), and riparian areas could be widened to a minimum of 15m on each side, which would meet the RAPR intent, as well as provide space for needed stormwater management.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium moving towards High (IE if the upper banks start to collapse into the channel)

- Erosion is occurring on both banks and a variety of historic and current erosion protection measures have been installed throughout the reach, including lockblocks, gabions, concrete retaining walls, and riprap. Large cement footings for the upper reach footbridge show significant movement resulting in the recent removal of the bridge deck.
- East bank has new riprap erosion protection above the downstream culvert, and the west bank has new erosion protection being installed in the upstream portion, adjacent to the apartment building.
- Some sections of the chainlink fence at the top of bank (mainly on west side) are falling over due to erosion at these vertical banks with cracks visible on the top of bank, including an area on the west bank upstream of the school footbridge that has double chainlink fencing where the older section has become highly unstable. While the banks are very steep, and there is evidence of some slope movement on the upper banks, extensive downcutting or lateral movement was not observed

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs in a narrow strip (3-4m wide) on each side of the channel, with mowed grass at the top of the slope.
Dominant species: Golden willow, Himalayan blackberry, black hawthorn, English ivy, and morning glory
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Black cottonwood, field maple, red-osier dogwood, snowberry, Scotch broom, English hawthorn, English holly, European bittersweet, laurel hedge

Percent coverage of invasive vs. native species
90% invasive / 10% native
Invasive species observed: Golden willow, field maple, Himalayan blackberry, English ivy, morning glory, Scotch broom, English hawthorn, ornamental hazelnut, English holly, traveller's joy, European bittersweet, laurel hedge

Short-term riparian restoration potential and techniques
The short-term recommendations are:

- Provide property owners along the creek (including School District 61) with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Stabilize eroding areas as needed to prevent sedimentation/bank failure, using bioengineering, if possible.
- Fencing that is falling over could be replaced farther away from the top of bank. The existing fence location and mowing are preventing the outward spread of invasive species. Cessation of mowing needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas.

Depending on the feasibility and schedule for the long-term restoration activities, the removal of invasive species and widening of the riparian area could be initiated; however, if the channel will be relocated and/or channel banks re-sloped, the invasive removal and planting should be done at that time.

Short-term channel restoration potential and techniques
No short-term channel restoration is proposed.

Long-term term channel and riparian restoration potential
A range of options is available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity, and complexity, create a well-developed floodplain and ponds, and extend a minimum 15m planted riparian zone on each side (which would meet the RAPR intent), as well as opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school, School District 61, and with residents in this well-used area.

The distance that the creek corridor can be moved eastward is constrained by the designated right of way above the north east trunk sewer line. The School Board (School District 61) has signed an agreement to maintain this right of way. Design options should use this corridor for greenway development. Access for sewer maintenance needs to be maintained.

REACH 9

Currently a land sale is proposed for the southwest triangle of land on the School District 61 property, if this sale proceeds and the land redeveloped, it will limit the ability to achieve the long-term goals for this reach.

The optimal restoration will use the area of land to the west of the existing channel, with space for a meandering channel and a significant pond/wetland.

In areas where widening the riparian corridor is not feasible, improvements could be made and the channel could be reconstructed, similarly to the lower section of Reach 7A. Keeping within a similar footprint with a rock toe at the base, would create a low flow channel and floodplain terrace, and provide a small riparian area up to the top of the slope to be planted with native vegetation, using bioengineering to stabilize slopes, if needed.

At the top of the reach, options become more limited due to the apartment buildings on the west bank and the narrow right of way beside Townley Street. In this area with the reduced width, the sidewalk and greenway trail could be combined to reduce the footprint and allow for maximizing the riparian area. The sewer line runs mainly below the street, but there is a Saanich water line in the road right of way.

The ISL Engineering Daylighting Feasibility Study (2020) examined this location and provided the following analysis [see Map 6.1 and Map 7.1 (alignment 5 of 13) for proposed alignments] (in grey) (Note that Richmond School is now called Lansdowne Middle School South Campus):

This reach is daylighted and follows the narrow strip of land west of Townley as well as the Newton School site. Ways that this reach can be enhanced include:

- Acquire edge of apartment site along existing creek to enhance creek and integrate greenway trails (current creek too straight).
- Acquire triangle southwest of existing creek at the school site for potential storage and alternate creek alignment (identified by BCI).
- Consider acquiring school site for storage (school currently used for students when other schools are renovated).

Richmond School has not been used as a full-time community school for several years; currently, it is used as a temporary school while other nearby schools are undergoing renovations. The SD61 has not committed to a long-term use for the school, but it is expected to remain in use based on current enrollment.

The site is currently divided by Bowker Creek (open channel), which runs northwest to southeast. The creek is fenced off from the school for safety reasons. The triangular parcel southwest of the existing creek was suggested as a SWMF in the MDP but was considered too small to be effective in mitigating downstream flood risks (area is a 100 m x 100 m triangle). At the south boundary of the property, the creek enters a storm sewer at Spirit Garden, a City of Victoria owned property that has a high potential for daylighting and active transportation connectivity.

The southwest section of the site is generally flat, the northeast is approximately 1-2 m higher (includes school buildings) than the southwest part. Both the southwest and northeast sections each have a soccer field and baseball backstop. The two sections are connected by an existing pedestrian bridge.

A sanitary trunk sewer runs parallel to the creek (northwest to southeast direction) which will have to be considered in the design.

The proposed concept for developing a Stormwater Management Facility (SWMF) within the existing school site is summarized below:

- The creek would be re-aligned to the southwest to increase the green space available for school playing fields.
- The creek would be naturalized with a slight meander, boulders, woody debris, and native plant species. Flow velocities would be reduced to limit erosion potential.
- The lower portion of the SWMF would be low lying along the creek and would be inundated during frequent storm events (~2 year). This area would be fenced from the school and naturalized with suitable riparian plants.
- The green space between the re-aligned creek and the school buildings would be developed as a dual-use dry pond; it would have a net increase in green space available for playing fields; the playing fields would flood during infrequent storm events (~25 year).
- The existing bridge crossing could be maintained via a new pedestrian bridge or open bottom culvert.
- A granular walking path and multi-use path (MUP) could be constructed alongside the creek; to maintain or improve active transportation connectivity between Townley Street and Newton Street.

A concept of the Richmond School SWMF is shown in Figure 5.3 of the Daylighting Feasibility Study. The stage-storage relationship from this configuration was inserted to the model, with the downstream trunk hydraulics used to control the flows. (Note: this SWMF was modeled as a widened creek cross-section in the MDP).

Further details are provided in the ISL Engineering Memorandum: Potential Stormwater Management Facilities on Bowker Creek (March 2020).

Additional Observations/Notes

2022 – The creek appears to be in a similar condition as observed in the 2011, with a new trash rack installed on the Newton Street culvert and some small areas of erosion protection installed.
Fish were observed in 2011 and 2022, likely sticklebacks. Bridge decking requires repair.

NOTE: Currently a land sale is proposed for the southwest triangle of land on the school district property, if this sale proceeds and the land redeveloped, it will limit the ability to achieve the long-term goals for this reach.

CRD site 316-3b, immediately upstream of Newton Street, is the location of extensive '5/30' CRD water quality sampling in conjunction with other sites on Bowker Creek and is conducted on a 5-year rotation.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
ISL Engineering and Land Services. 2020. Memorandum: Potential Stormwater Management Facilities on Bowker Creek
Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Straight, entrenched channel with steep banks (~ 3m high) and no floodplain access, fenced with adjacent mowed lawn areas and a parking lot.
- Channel and banks are dominated by golden willow, Himalayan blackberry, and English ivy
- The existing riparian zone is constrained by land uses (large mowed areas, parking, playground, multi-family dwellings).

Opportunities:

Short term –

- Provide property owners along the creek (including School District 61) with the Bowker Creek Blueprint and engage them in education regarding the creek health, restoration opportunities, yard and garden waste storage, spread of invasive species and the RAPR.
- Engage with landowners (including School District 61) to partner for restoration, bioengineering for erosion protection, invasive species removal, fence re-location and reduced mowing of the riparian area on both sides of the creek. Cessation of mowing needs to be accompanied by control of invasive species and/or riparian planting, to prevent weed growth in un-mowed areas.
- Depending on the feasibility and schedule for the long-term restoration activities, the removal of invasive species and widening of the riparian area could be initiated; however, if the channel will be relocated and/or channel banks re-sloped, the invasive removal and planting should be done at that time.

Long term –

- A range of options are available in the long term, depending on the ability to reconfigure adjacent land uses. There is the potential to realign the creek, restore appropriate channel morphology, sinuosity and complexity, in addition to well-developed floodplain and ponds. With a minimum of a 15m planted riparian zone on each side (which would meet the RAPR intent) there are opportunities to detain and treat surface runoff at this site. Restoration works should include interpretive signage and education opportunities with the school, School District 61, and with residents.
- Realign and restore channel and riparian area as recommended in the Daylighting Feasibility Study (2020), including the construction of a Stormwater Management Facility.
- The optimal restoration will use the area of land to the west of the existing channel, with space for a meandering channel and a significant pond/wetland.
- The distance that the creek corridor can be moved eastward is constrained by the designated right of way above the north east trunk sewer line. The School Board (School District 61) has signed an agreement to maintain this right of way. Design options should use this corridor for greenway development. Access for sewer maintenance needs to be maintained.
- In areas where widening the riparian corridor is not feasible, improvements could be made and the channel could be reconstructed, similarly to the lower section of Reach 7A. Keeping within a similar footprint with a rock toe at the base, would create a low flow channel and floodplain terrace, and provide a small riparian area up to the top of the slope to be planted with native vegetation, using bioengineering to stabilize slopes, if needed.

Photo 9-1. Richmond School property on west side of the creek: Extensive mowed field up to the narrow and fenced riparian strip at the top of bank (view east toward creek).

Photo 9-2. Richmond School property on east side of the creek: Extensive mowed field up to the narrow and fenced riparian strip at the top of bank (view northwest/upstream). School buildings are on right.

Photo 9-3. View upstream into Reach 7B, Richmond School property, from Newton Street at the end of the underground Reach 8. A narrow vegetated riparian zone is immediately adjacent to the mowed fields (view upstream).

Photo 9-4. Newton Street culvert and recent riprap erosion protection along the east bank with Spirit Park (culverted Reach 8) in the background (view downstream/south).

Photo 9-5. Older gabions on the west bank, near the Newton Street culvert.

Photo 9-6. Golden willow and root mats forming pool areas in the channel. Invasive species on the bank (Himalayan blackberry, English ivy) (view upstream).

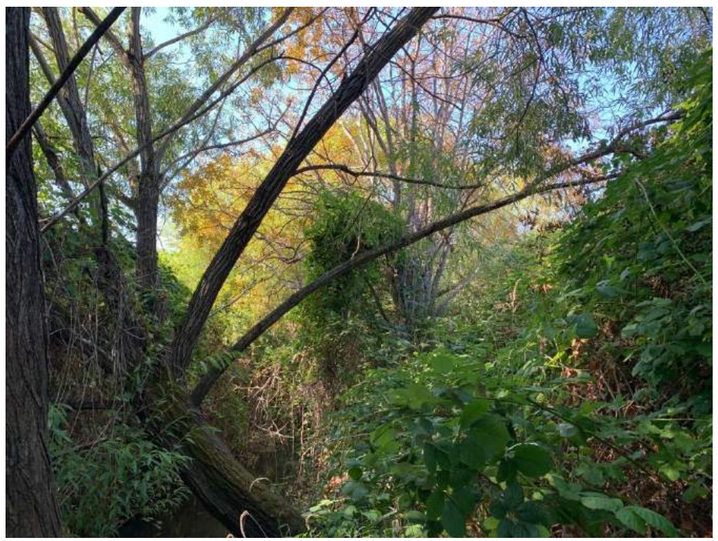


Photo 9-7. Invasive golden willow Himalayan blackberry, English ivy, morning glory, European bittersweet.

Photo 9-8. Invasive golden willow covered in morning glory.

Photo 9-9. This reach provides good habitat for Signal crayfish.

Photo 9-10. Cracks at top of bank, where slope is migrating on the west bank between Newton Street and the school footbridge at mid-reach (see Photos 9-23 & 9-24).

Photo 9-11. Overhead canopy in this reach (while mostly invasive willow) is close to 100%, providing shade for reduced water temperatures.

Photo 9-12. Older gabions on the west bank, near the apartment complex (upper end of reach)

Photo 9-13. Black cottonwood, with invasive golden willow and Himalayan blackberry, and mowed lawn to top of bank (view downstream along east bank).

Photo 9-14. The east side of the creek is fenced immediately adjacent to the top of bank, with some fences up to 8 ft tall and embedded with invasive species (view downstream along east bank).

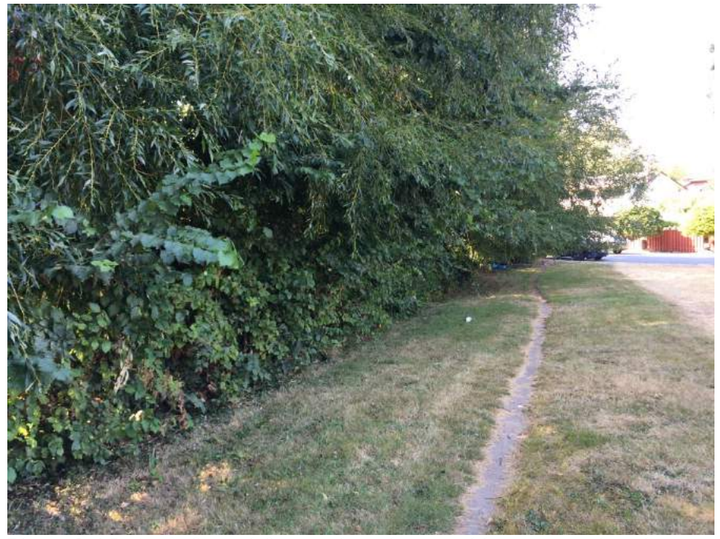


Photo 9-15. An informal foot path and mowed lawn extend to the top of bank along the upper reach to Pearl Street. Along this section there is an older dis-used footbridge that was blocked off and has since been removed (see Photo 9-20) (view upstream along east bank).

Photo 9-16. New erosion protection being installed at the apartment complex (mid/upper end of reach) (see Photo 9-19 for completion).

Photo 9-17. Riprap on west bank at Pearl Street culvert (upper end of reach).

Photo 9-18. Riparian vegetation is dense, but limited in width by fences. Multiple opportunities for public education exist along this high foot-traffic area: Bowker Creek signage is simple and has become defaced (view downstream from Pearl Street).

Photo 9-19. New erosion protection completed at the apartment complex (mid/upper end of reach, view downstream) (see Photo 9-16).

Photo 9-20. Former upstream footbridge has been removed. Footings show significant movement from erosion (view west).

Photo 9-21. Lockblocks at the base of the east bank, upstream of the school footbridge (view northeast, upstream).

Photo 9-22. Double chainlink fences on the west bank above the school footbridge demonstrate the ongoing erosion and slope failure at vertical banks (view downstream).

Photo 9-23. Leaning chainlink fence and slope cracking along 20 m of the west bank below the school footbridge demonstrate the ongoing erosion at vertical banks (view upstream) (see Photos 9-10 & 9-24).

Photo 9-24. Vertical bare slopes at leaning chainlink fence and slope cracking along west bank below the school footbridge demonstrate the ongoing erosion (view west) (see Photos 9-10 & 9-23).


District of Saanich
City of Victoria
Daylighting and Channel Restoration Opportunity
Enclosed channel
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17a
16
16
11
11
12a
10
10
9
N
0
50
100m
1:500
Reach 10, 11, and16

Reach 10 - ENCLOSED

Reach # 10 - Enclosed – Culvert from Pearl Street to Clawthorpe Avenue (1020m)

Channel Description
1020m culvert

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long-term term channel and riparian restoration potential
The long-term term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignments 5-7 & 13 of 13) for proposed alignment], which includes (in grey):

WEST OF TOWNLEY STREET TO DONCASTER DRIVE ALONG PEARL STREET

- The recommended alignment for daylighting the creek from west of Townley to Shakespeare Street is along the north side of Pearl Street. This roadway is relatively wide and has no utilities running on the north half of the right- of-way. The existing storm trunk is located approximately in the middle of the roadway. There appears to be up to 10m of available space.
- This section of roadway has very low traffic volumes and thus could be converted to a one way. It would make an excellent cycling corridor along a daylighted creek.
- Unfortunately, there are 7 driveways on the north side of the roadway for the 7 lots, which will severely limit the amount of continuous daylighted creek that can be created. Of these 7 lots, only 2 have Pearl Street as its only point of access, thus there is potential to limit the number of driveways in the future.
- The short section on Pearl Street between Shakespeare and Doncaster Drive is much narrower and there is little potential for daylighting without land acquisition. All or part of the lots would need to be acquired to facilitate daylighting.
- Overall, the potential for daylighting the creek at the depth of the existing trunk without land acquisition and/or redevelopment is considered to be fair to poor.
- It may be feasible to acquire the lots on the north side of Pearl Street, remove the driveways and garages, and reselling them as a way to improve the daylighting potential. It may also be possible to acquire multiple parcels and subdivide them so that they have access to one of the side streets (Shelbourne, Scott or Shakespeare).
- The optimal solution, which is likely be available only in the long term, is for developers to acquire the lots on the north side of Pearl and redevelop with high density. This would address the driveway issues but would also provide an opportunity to obtain additional space on the north side of Pearl Street. This should be addressed through future OCP updates.
- Refer to Exhibit 7.5.

PEARL STREET TO MYRTLE AVENUE ON DONCASTER DRIVE

- This reach will be very difficult, if not impossible, to daylight without land acquisition. The existing 2.4 m by 2.4 m trunk is approximately 5 m deep and is generally under the east side boulevard and sidewalk. The lots all have front driveways as there are no lanes.
- The recommended daylighting option is to wait for redevelopment in the area (which is expected to be long term only) and acquire space on the east side of Doncaster Drive. The lots on the east side of Doncaster Drive between Myrtle Avenue and Pearl Street are about 42 m deep (140 ft.) and thus can dedicate space along the front and still be developable.
- The City of Victoria may need to revise its redevelopment plans in this area to promote higher densities in order achieve this redevelopment.
- Without redevelopment, it may be necessary to leave this section on Doncaster as a piped section.

MYRTLE AVENUE TO HILLSIDE AVENUE– DONCASTER GREEN

- This section is unique in that it is on City owned land but is located between two 3-storey buildings, an apartment and a professional building. The lot is approximately 70 m long and 20 m wide and has a pedestrian walkway. The storm trunk is about 5 m deep and is adjacent to a ~7 m deep sanitary trunk.
- As a result of the limited available width and the depth of the trunk, at least part of the creek would need to have retained side slopes. The aesthetic value can be enhanced by constructing boardwalks and/or paths down closer to the creek. If space permits a wider creek bottom width, it can be naturalized with logs, boulders, etc.
- Refer to Exhibit 7.3.

HILLSIDE AVENUE TO CLAWTHORPE AVENUE ON DONCASTER DRIVE

Two alternate corridors are proposed, the current trunk alignment along Doncaster Drive, and a potential alignment through a redeveloped Hillside Mall. Both alignments would take extensive redevelopment to fully daylight the creek. These may require updates to the City of Victoria OCP.

• Alternate Alignment – Through West Side of Hillside Mall

- The mall was recently renovated and thus this is a long-term idea. The mall is spread over a large area as suburban malls were in the 1950s and 1960s. As demand for residential housing increases density in the area, it is possible that the mall will redevelop with residential towers as part of a mixed use redevelopment. If this was to happen, the value of a daylighted creek as an amenity may result in a business case for re- routing the creek through the west edge of the mall. The amenity may be a selling feature for adjacent high rise development and be part of the setback between the high density mixed use and the adjacent single family neighbourhood.
- The west edge of the mall along Shakespeare Street is about 2m higher than at the existing trunk on Doncaster Drive. As a result, the depth to the creek base would be 2m greater. This can be offset using a retaining wall between Shakespeare Street and the mall redevelopment. It is anticipated that the daylighted creek would be partially retained but would be naturalized as much as possible to provide aesthetic value to the redevelopment.

- This is a very long term strategy that may never materialize but should be considered over time in long term planning exercises. For this reason, this alignment is shown on the maps as an alternate alignment.

• Recommended Alignment – East side of Doncaster Drive

- This alignment follows the existing storm trunk and connects to Reach 16 (branch to Cedar Hill Golf Course).
- The existing trunk is beneath the east sidewalk on Doncaster Drive and/or the east parking lane. Doncaster Drive currently has a single lane plus bike lane in each direction plus parking on either the east or west side. The boulevard, sidewalk and parking lane are about 7 m wide. It narrows to about 4 m where there is no parking lane.
- The 2.4 m by 2.4 m trunk is approximately 3 m deep. Thus, the creek would need to be fully retained in order be daylighted. The sidewalk and parking lane would need to be removed.
- The quality of the daylighting could be greatly enhanced if it was possible to acquire 5 m or more off the adjacent single family lots east of Doncaster Drive. The lots abutting Doncaster Drive are only 15 m wide and thus losing 5 m would result in a very narrow lot. These lots are expected to remain as single family in the short to medium term but with greater demand for density, they could be re-zoned to a 3-storey townhouse in the long term.
- The proposed strategy would be to acquire an additional 5m on the east side of Doncaster Drive over the long term and use the additional space to daylight the creek with partially retained walls.
- A part of this section is adjacent to the Hillside Mall and due to traffic constraints, it is expected that most or all of the space for daylighting would need to come from mall property. The mall was recently renovated so this should be considered a long term strategy.
- Refer to Exhibit 7.5.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary

Condition:

- Culverted

Opportunities:

- Daylighting as described in the Daylighting Feasibility Study (2020).


District of Saanich
City of Victoria
Daylighting and Channel Restoration Opportunity
Enclosed channel
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17a
16
16
11
12a
11
10
10
9
N
0 50 100m
1:500
Reach 10, 11, and16

Reach 11 - ENCLOSED

Reach # 11 - Enclosed – Culvert from Clawthorpe Avenue to Shelley Street (290m)

Channel Description
215m culvert

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long-term term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignments 7&13 of 13) for proposed alignment] (in grey):

- The recommended alignment for this reach is along the lane between Clawthorpe and Burton Avenues, which extends through the south edge of Clawthorpe Park and crossing North Dairy near the existing creek at Shelley Street. The existing trunk alignment on Clawthorpe has limited space (without redevelopment), driveways on both sides and utility conflicts. It also runs through a private condo site on the north side of North Dairy Road which would be difficult to daylight.
- The existing trunk could be used to accept flows from Reach 16 or the daylighting along Doncaster Drive could extend upstream to future daylighting of Reach 16.
- The recommended alignment would require acquisition of the back of the lots on the south side of Clawthorpe. It would also facilitate natural daylighting along the south edge of Clawthorpe Park. All or part of the lot east of the park (1655 North Dairy Road) would need to be acquired to maximize the daylighting and adjacent greenway connection to the daylighted creek and greenway on the north side of North Dairy Road.
- The daylighted section through Clawthorpe Park could look similar to the illustrated cross-section at Firefighter's Park, refer to Exhibit 7.1.
- This alignment is along a proposed greenway connecting the Doncaster Drive greenway with Bowker Creek greenway north of North Dairy Road.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary
Condition:

- Culverted

Opportunities:

- Daylighting as described in the Daylighting Feasibility Study (2020).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
MCRAE AVE
KEATS ST
SHELLEY ST
WORDS
BROWNING PARK
12B
12A
Dead willow wattles
Erosion
Erosion
Golden willow occurs along the reach
District of Saanich
City of Victoria
NORTH DAIRY RD
Reach 12A
N
0 15 30m
1:500
Capital Regional District | Capital Regi

REACH 12A

Reach # 12A - 12A North Dairy Road to McRae (380m)
1564 North Dairy Road, 3211 Shelley Road, 3204, 3211, 3225, 3235, Keats Street, 3226, 3228, 3230 Wordsworth Street, 1589, 1599, 1601, 1607 McRae Ave, and Shelley Street, Wordsworth Street, and Keats Street rights-of-way (District of Saanich)

Channel Description
The channel flows through the private properties and municipal road rights-of-way, and varies from 3-4m wide to narrower sections (1-2m wide) with wider terrace above (Photos 1-30). The banks range from 2-4m tall, and are a mix of steep soil, concrete sandbags, riprap, gabions and lock blocks. The channel is entrenched with no floodplain access. The channel bottom is a mix of concrete, asphalt, bedrock and boulder/cobbles with some pools, and approximately 1% slope.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The riparian vegetation area in this reach is highly variable and is a mix of vegetation types, primarily landscaped or invasives. It is steep (1:1 to vertical) and narrow (0-3m wide on each side), and armoured (concrete sandbags, riprap and lock blocks) in many locations (Photos 1-30). Yard waste dumping along the creek is smothering vegetation and introducing invasive species.

Both sides of this reach are single family home lots with houses setback 7m or more (some accessory buildings may be closer) and opportunities exist for increasing the width and vegetation composition of the riparian area with landowner participation.

With private landowner involvement the creek corridor could be significantly improved via re-sloping the banks, widening the riparian buffer and planting more native trees and shrubs. The current building footprints appear to leave enough room for this to occur. Additionally, erosion areas and activities such as yard waste disposal could be addressed.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Medium. There are a few spots of significant erosion including: near Shelley Street on the south east bank (concrete sandbags), near the private footbridge between 3204 Keats St and 3211 Shelley St (concrete sandbags), and upstream of Keats St (north east bank) (concrete sandbags) (Photos 1, 7, 20, 24, 26).

A significant portion of the reach, particularly below Keats Street, has armouring, such as concrete sandbags, gabions, or rock walls (Photos 1, 4, 5, 6, 7, 8, 9, 10, 14, 15, 22, 23, 24, 25, 26, 27).

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees, shrubs, ornamental landscaping and invasives.
The creek winds through residential properties and the vegetation varies from lot to lot, including lawns, cedar hedging, ornamental gardens, invasive species, and some native riparian vegetation (Photos 1-30).

Dominant species: black cottonwood, golden willow, Himalayan blackberry, English ivy (trees and ground), laurel hedge, snowberry

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
bigleaf maple, red alder, cedar hedge, native willows (bioengineering at McRae Ave), chestnut, golden chain tree, English hawthorn, English holly, Scotch broom, Nootka rose, June plum, privet, European bittersweet, morning glory, herb-Robert, St. John's wort, thistle, yellow archangel, silver dollar plant, ornamental vegetation.

Percent coverage of invasive vs. native species
95% invasive, ornamental, or unvegetated.
Invasive species observed: golden willow, Himalayan blackberry, English ivy (trees and ground), laurel hedge, chestnut, golden chain tree, English hawthorn, English holly, Scotch broom, privet, European bittersweet, morning glory, herb-Robert, St. John's wort, thistle, yellow archangel, ornamental vegetation.

Short-term riparian restoration potential and techniques
- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, yard & garden waste, control of invasive species and restoration opportunities.
    - 1564 North Dairy Road, 3211 Shelley Road, 3204, 3211, 3225, 3235, Keats Street, 3226, 3228, 3230 Wordsworth Street, 1589, 1599, 1601, 1607 McRae Ave, and Shelley Street, Wordsworth Street, and Keats Street rights-of-way (District of Saanich)
- Work with private landowners to remove invasive species, re-slope creek banks, and plant native vegetation, widening the riparian area where possible.
- Vegetate the west bank riparian zone along the Wordsworth Street right of way accessed from McRae Avenue. Re-slope the bank to the degree possible while leaving room for a greenway path.
- Add rain gardens within the road rights-of-way to treat runoff prior to discharge to the creek (Photo 12).

Short-term channel restoration potential and techniques
- Stabilize erosion areas, using bioengineering, where possible.

Long-term term channel and riparian restoration potential
A range of options are available in the long term, depending on future redevelopment and/or landowner involvement:
The best outcome would be removal of the concrete/rock bank and channel bottom armouring, re-sloping the creek banks and planting with native vegetation, and installation of channel complexity. The final location and design will be determined by the amount of space made available. If possible, 10-15 metres of riparian corridor on each side of the channel would provide the most benefit to the creek. 15m would meet the SPEA as defined by the RAPR.

The current creek and riparian corridor width is approximately 8 metres or less, with a very narrow to no riparian vegetation. The creek winds between residential properties, and acquisition, redevelopment, and/or landowner cooperation will be required for significant restoration to occur. The Wordsworth Street right-of-way also offers opportunity.

If landowner constraints require the creek corridor to remain relatively narrow, other options to improve the creek include:

- Bioengineering to replace concrete retaining walls, but maintain a narrow footprint
- Moving retaining walls back from the channel to allow floodplain and plantings adjacent to the channel

The ISL Engineering Daylighting Feasibility Study (2020) examined this location and provided the following analysis [see Map 6.1 and Map 7.1 (alignment 7 of 13)] (in grey):

- Creek is daylighted from Browning Park to Shelley Street/North Dairy Road. Property acquisitions previously identified by BCI for channel improvements and/or walkways will be important.
- Trail markings would be beneficial highlighting connecting trails (Bowker signage at Shelley shows the creek but not how to connect with the trail network).

Work with the owners to remove armouring, remove invasive species, re-slope banks, and plant native vegetation.

- 1564 North Dairy to remove the eroding concrete wall and restore the riparian area on the north east side of the creek, this part of the lot appears unused (Photos 1-4).
- 3204 Keats Street, remove armouring and repair erosion, re-slope banks, and plant native vegetation (Photo 6-7).
- 3211 Shelley Street and District of Saanich (Keats Street right-of-way) remove extensive Himalayan blackberry, remove gabions and armouring, re-slope banks and plant native vegetation (Photos 5, 8-10).
- 3211 Keats Street, property to the north (no address) and District of Saanich (Keats Street right-of-way) remove eroding concrete sandbags, remove extensive Himalayan blackberry, re-slope banks and plant native vegetation (Photos 13-17).
- 3225, 3235 Keats Street, 3221, 3226, 3228, 3230 Wordworth Street, and District of Saanich (Wordsworth Street right-of-way) remove invasive species, remove armouring, and re-slope banks, plant native vegetation (Photos 18-28).
- 1589 and 1599 McRae Avenue to address bank erosion on the bend in the creek by re-grading the bank and planting with native species. These properties are quite large and extend to the top of bank of Bowker creek, so there may be opportunities for significant widening of the riparian area (Photos 24, 25).
- 1601 and1607 McRae Avenue, vegetate the grassed terrace below their upper rock wall, and to re-slope the bank as necessary. Part of the lower terrace is also armoured and part is a bare clay bank (Photos 29, 30).

Additional Observations/Notes

2022 – Channel and riparian area are in a similar condition as observed in 2011. Bioengineering near McCrae Avenue does not appear to have become well established (some cuttings are growing, but most have died).

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
District of Saanich. 2017. Shelbourne Valley Action Plan
Friends of Bowker Creek – www. bowkercreek.org

Summary

Condition:

- Banks and channel bottom are armoured in many areas
- Erosion in over-steepened soil sections and undercutting/erosion of armouring, in particular concrete sandbag areas
- Vegetation varies from lot to lot, including lawns, cedar hedging, ornamental gardens, invasive species, and some native riparian vegetation

Opportunities:

- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Opportunities exist for increasing the width and vegetation composition of the riparian area with landowner participation. With private landowner involvement the creek corridor could be significantly improved via re-sloping the banks, widening the riparian buffer and planting more native trees and shrubs.
- Erosion areas should be addressed with bioengineering, if possible.
- Vegetate the west bank riparian zone along the Wordsworth Street right of way accessed from McRae Avenue. Re-slope the bank to the degree possible while leaving room for a greenway path.
- Add rain gardens within the road rights-of-way to treat runoff prior to discharge to the creek.
- In the long term, the best outcome would be removal of the bank and channel bottom armouring, re-sloping of banks and planting with native vegetation, and installation of channel complexity. The final location and design will be determined by the amount of space made available. If possible, 10-15 metres of riparian corridor on each side of the channel would provide the most benefit to the creek.

Photo 12A-1. 1564 North Dairy Road and culvert at downstream end of the reach. Concrete bottom Invasive species and erosion under the concrete sandbags.

Photo 12A-2. 1564 North Dairy Road and culvert at downstream end of the reach. Invasive species and erosion under the concrete sandbags.

Photo 12A-3. 1564 North Dairy Road unused lawn area where riparian area could be re-sloped and native vegetation planted.

Photo 12A-4. 1564 North Dairy Road concrete sandbags.

Photo 12A-5. 1564 North Dairy Road and 3211 Shelley Street lock blocks and English ivy at 1564 North Dairy Road and 3204 Keats Street.

Photo 12A-6. 3204 Keats Street concrete sandbag retaining wall.

Photo 12A-7. 3204 Keats Street concrete sandbag retaining wall with erosion at the base.

Photo 12A-8. 3204 Keats Street with narrow channel and small terrace on the south (right side); 3211 Shelley Street with lawn and concrete sandbags.

Photo 12A-9. 3211 Shelley Street with gabions, lawn and Himalayan blackberry (left), joins with Himalayan blackberry in the Keats Street right-of-way (right) (view upstream).

Photo 12A-10. 3211 Shelley Street with gabions, lawn and Himalayan blackberry, joins with Himalayan blackberry in the Keats Street right-of-way.

Photo 12A-11. Looking downstream from the Keats Street footbridge, Himalayan blackberry in the Keats Street right-of-way.

Photo 12A-12. Ditch in the Keats Street right-of-way that could be converted to a rain garden to treat road run off.

Photo 12A-13. Looking upstream from the Keats Street footbridge (3211 Keats Street and property to the north) with golden willow, Himalayan blackberry, English ivy and morning glory.

Photo 12A-14. 3211 Keats Street and property to the north (no address), with concrete sandbags and a mix of invasive and native vegetation.

Photo 12A-15. Property to the north of 3211 Keats Street (no address), with concrete sandbags and a mix of invasive and native vegetation.

Photo 12A-16. Property to the north of 3211 Keats Street (no address), with Himalayan blackberry and English ivy.

Photo 12A-17. Property to the north of 3211 Keats Street (no address), with morning glory.

Photo 12A-18. 3225 Keats Street and 3226 Wordsworth Street with steep soil banks and mix of native and invasive vegetation.

Photo 12A-19. 3225 Keats Street and 3226 Wordsworth Street with steep soil banks and mix of native and invasive vegetation.

Photo 12A-20. Erosion at 3225 Keats Street across from 3226 Wordsworth Street with steep soil banks and mix of native and invasive vegetation.

Photo 12A-21. 3225 Keats Street and 3226 Wordsworth Street with steep soil banks and mix of native and invasive vegetation.
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Photo 12A-22. 3225 Keats Street with overhanging mostly native shrub vegetation and 3228 Wordsworth Street with riprap banks and lawn.

Photo 12A-23. 3235 Keats Street with overhanging mostly native shrub vegetation and 3228 Wordsworth Street with riprap banks and lawn.

Photo 12A-24. 3245 Keats Street, 1589 McRae Avenue and 3230 Wordsworth Street with eroding bank and gabions with Himalayan blackberry and English ivy.

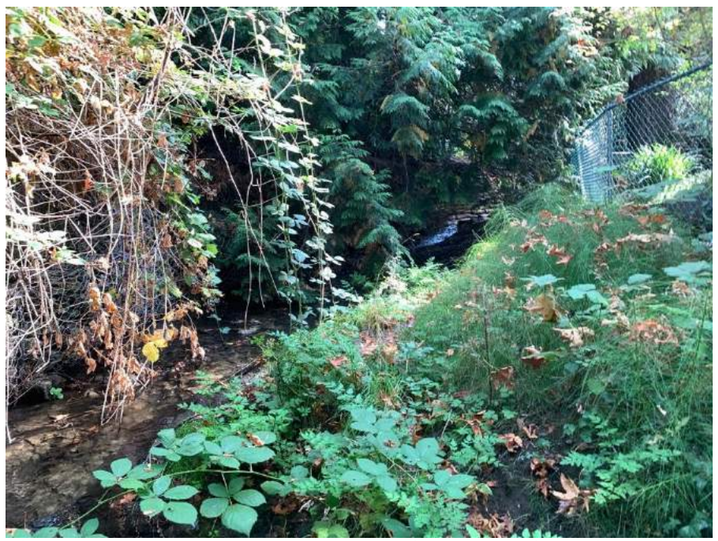


Photo 12A-25. 1589 McRae Avenue and 3230 Wordsworth Street with eroding bank and gabions with Himalayan blackberry, English ivy, horsetail, and Pacific water-parsley.

Photo 12A-26. 1599 McRae Avenue and 3230 Wordsworth Street with eroding bank and MSE geo bag wall and bare understory.

Photo 12A-27. Wordsworth Street right-of-way and 1601 McCrae Avenue, soil banks with a mx of native and invasive species.

Photo 12A-28. 1599 McRae Avenue and 3230 Wordsworth Street with eroding bank and MSE geo bag wall and bare understory.

Photo 12A-29. 3230 Wordsworth Street with some floodplain on the inside corner of the channel.

Photo 12A-30. 1607 McCrae Avenue, soil banks with bioengineering willow wattles that have died.


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Hydrocarbon odour at the upstream culvert
Hydrometric Monitoring Station
Friends of Browning Park - invasive removal, replanting, and split rail fencing
Friends of Browning Park restoration activities to continue along reach
CRD 316-4b
Golden willow occurs along the reach
Planted area with new invasives becoming established
Potential rain garden location
13
12B
17
14
16
12
9
11
8
15
10
7
5
6
4
3
2
1
18
12B
12A
BROWNING PARK TRAIL
BROWNING ST
SHELBOURNE ST
MCRAE AVE
Bowker Creek
N
0
15
30m
Reach 12B

REACH 12B

Reach # 12B - McRae Avenue to Knight Street – Browning Park (District of Saanich); 1631 and 1637 Knight Ave (private property) (250m)

Channel Description
Downstream section (below the footbridge) – 2-3m wide channel, with steep east riprap bank approx. 2m tall and gently sloping east bank. Lower bank armoured on both sides with mortared rock.
Upstream section (above the footbridge) – 3-4 wide channel, with steep east riprap bank, and more gently sloping west bank with little armouring.
Channel bottom is a mix of bedrock, armoured channel (including asphalt) and cobble areas.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
A treed corridor runs along the creek approximately 10-20m wide on each side, the understory varies throughout the park and creek corridor.

Downstream section: west bank, lower slope and grass extends to the creek bank in many places; in other areas the riparian vegetation consists of trees with a shrub understory (0-10m). The bank on the west side is low (~ 1m). On the east bank the vegetated buffer is wider (0 to 10m) and the height of bank increases moving north. The east bank slopes back at approximately 1:1. (Photos 1-8,18).

Upstream riparian area is narrow (<5m wide) with upland vegetation along the top of bank because of the steeper slopes. The east bank is 3-4m high and near vertical riprap. The west bank is low and transitions to high and steep at the upper end of the reach. At the upper end, the stream is very incised, with tops of bank four or more metres above the stream. The north end of the east bank is adjacent to residential property and is near vertical, armoured with riprap, and covered with English ivy (Photos 10, 14-17).

Under the Saanich Pulling Together program, the Friends of Browning Park have done extensive invasive species removal and plantings, and fencing of the riparian area in the north west section of the creek to restore the riparian area of Bowker Creek (Photos 9,11-13). Restoration plans are being proposed by the Friends of Browning Park to restore additional riparian areas. For the uppermost 40m of this reach where the channel is deeply incised, invasive species removal and plantings are possible, but it may be difficult to reconfigure the channel. Downstream of this narrow area there is more space and opportunity for removing armouring, re-sloping banks to widen the riparian area, removing invasive species and planting native plants.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Low – There are some small areas of erosion (e.g. on the east bank above the footbridge), where the banks are not armoured and where bare soil is present, partially due to trampling to access the creek (Photos 5,8,10).

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees with shrubs, grass and invasive ground cover.
Dominant species: Black cottonwood, golden willow red alder, bigleaf maple, common snowberry, English ivy, Himalayan blackberry

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Arbutus, Hooker's willow, chestnut, field maple, ornamental trees, English hawthorn, laurel hedge, tall Oregon-grape, English holly, black ash, Nootka rose, red-osier dogwood, June plum, Pacific ninebark, horsetail, Pacific water-parsley, English ivy, red-osier dogwood, creeping buttercup, American brooklime.

Percent coverage of invasive vs. native species
Approximately 30% invasive, decreasing through work by Friends of Browning Park
Invasive species observed: Golden willow, English ivy, Himalayan blackberry, chestnut, field maple, English hawthorn, laurel hedge, English holly, black ash, creeping buttercup
NOTE**:** The area planted by Saanich Parks (next to the trail) with logs added on the west bank, is a location for dumping yard waste by the neighbours and has additional invasive species: thistle, Himalayan blackberry, morning glory, and other ornamentals.
In addition to the usual invasives, field maple and black ash are non-native species which are spreading throughout the riparian corridor

Short-term riparian restoration potential and techniques
- Provide property owners along the creek and around the park with the Bowker Creek Blueprint, and engage them in education regarding the creek health, management of yard and garden waste, spread of invasive species, and restoration opportunities.
- Remove invasive species and replant with native vegetation along the creek corridor, as is being done by Friends of Browning Park and District of Saanich Parks
- Remove grass areas near the creek and replant with native vegetation: maintenance to control invasive species will be critical to their success.
- Widen the riparian vegetation area along the east bank:
  - In the southern part of the reach where housing formerly stood (if longer term action not planned as per below)
  - In the area just south of the footbridge, by moving the footpath further east
- On the east bank above the footbridge, stabilize the bank at the corner of the property line at 1637 Knight Avenue (as per park plans)
- Remove invasive species in all possible locations
- Increase species and age class diversity with native plantings
- Remove golden willow in stages and transition to native willows
- Close off informal trails and revegetate

Short-term channel restoration potential and techniques
- Add channel complexity with rock weirs throughout the channel
- Remove the concrete walls and asphalt bottom from the lower reach and reconfigure the banks at a stable slope.
- Install a rain garden at the drain from McCrae Avenue to treat runoff from the road
- Install a rain garden to address house drainage coming through the west side of the park
- Create an upstream oil capture device and/or determine the source of hydrocarbons to this reach.

Long-term term channel and riparian restoration potential
A range of options are available in the long term, depending on future redevelopment and/or landowner involvement:
The best outcome would be removal of the concrete/rock bank and channel bottom armouring, re-sloping the creek banks and planting with native vegetation, and installation of channel complexity. The final

location and design will be determined by the amount of space made available. If possible, a minimum of 15m of riparian corridor on each side of the channel would provide the most benefit to the creek. 15m would meet the SPEA as defined by the RAPR.

The ISL Engineering Daylighting Feasibility Study (2020) examined this location and provided the following analysis [see Map 6.1 and Map 7.1 (alignments 7-8 of 13) for proposed alignments] (in grey):

Creek is daylighted from Browning Park to Shelley Street/North Dairy Road. Property acquisitions have been previously identified by BCI for channel improvements and/or walkways.
The alignment within the report remains as is.

Within the park some of the potential long-term works include:

- South of 1621 Knight Avenue (38 metres from top of reach), depending on how many trees would be lost, there is the opportunity to regrade the west bank back to a gentler angle (1:1 at minimum), and move the path further west. Remove invasive species and plant native the bank with native trees and shrubs.
- The east bank is high (likely fill), steep and armoured along much of the reach, where possible, and balancing tree removals, remove the armouring and invasive species, and re-slope the banks, and replan with native vegetation
- Remove channel armouring and install habitat complexity (large wood, rock weirs to create pools)
- Transition from golden willow to native willows along the channel
- Additional restoration is also feasible in the upland area (e.g. the pollinator meadow restoration proposed by the Friends of Browning Park).

Summary

Condition:

- Banks and channel bottom are hardened in many areas
- Pockets of erosion in oversteep soil sections
- Mix of invasive species and native trees with some native understory shrubs.
- Friends of Browning Park are removing invasives, planting native species and fencing the riparian area.

Opportunities:

- Provide property owners along the creek with the Bowker Creek Blueprint, and engage them in education regarding the creek health, restoration opportunities (including planting trees to shade the creek), yard and garden waste storage, spread of invasive species and the RAPR.
- Repair erosion areas with bioengineering, if possible.
- Work with Friends of Browning Park and District of Saanich to remove invasives and plant native riparian species
- Close off informal trails and revegetate.
- Install a rain garden at the drain from McCrae Avenue to treat runoff from the road and install a rain garden to address house drainage coming through the west side of the park
- Create an upstream oil capture device and/or determine the source of hydrocarbons to this reach.
- In the long term, the best outcome would be removal of the concrete/rock bank and channel bottom armouring, re-sloping the creek banks and planting with native vegetation, and installation of channel complexity. The final location and design will be determined by the amount of space made available. If possible, a minimum of 15m of riparian corridor on each side of the channel would provide the most benefit to the creek.

Additional Observations/Notes

2022 – This channel remains similar 2011 observations. Friends of Browning Park have done extensive invasive species removal and replanting, as well as fencing the northeastern riparian area, with additional restoration plans. New invasive species include field maple and black ash, spreading through the riparian area. The District of Saanich creek-side restoration (the logs on the ground by the creek) has additional invasive species becoming established (e.g. thistle, morning glory, Himalayan blackberry) and residents deposit yard waste in this area.

CRD site 316-4b, at the footbridge to the Shelbourne playground, is the location of extensive '5/30' CRD water quality sampling in conjunction with other sites on Bowker Creek and is conducted on a 5-year rotation. The **CRD Hydrometric Station** measures water depth and temperature and is located at the upstream end of the reach, immediately below the Knight Street ROW where the creek daylights. Flow discharge is calculated from the water depth and field measured rating curves.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Ronna Woudstra & Glenn Bartley. 2022. Pulling Together Browning Park Site Plan Proposal. Friends of Browning Park
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
District of Saanich. 2017. Shelbourne Valley Action Plan
Friends of Bowker Creek – www. bowkercreek.org

Photo 12B-1. Culvert under McRae Avenue, downstream end of Reach 12B (view downstream).

Photo 12B-2. Armouring on banks and channel bottom, downstream end.

Photo 12B-3. Armouring on banks and channel bottom, downstream end.

Photo 12B-4. Yard waste deposited in the creek.

Photo 12B-5. West bank, low slope riparian area, mix of native and invasive species, and example of informal, rogue trail and trampling (view downstream).

Photo 12B-6. Recent District of Saanich Riparian restoration on the east bank, needs maintenance to remove invasives becoming established (view downstream).

Photo 12B-7. Steeper east bank with mix of native and invasive vegetation (ivy on trees) and armouring at the base of the slope (view downstream).

Photo 12B-8. Golden willow and ivy, downstream of the footbridge, with informal, rogue trail and trampling. CRD 316-4b water quality sampling site (view upstream).

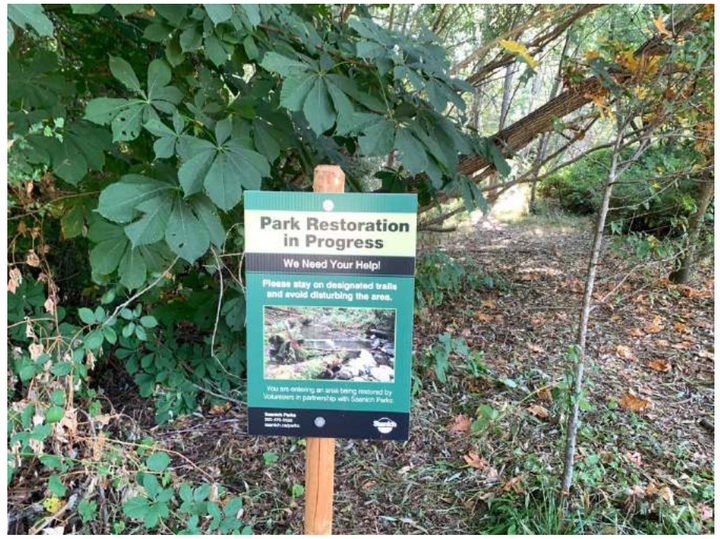


Photo 12B-9. Saanich Pulling Together restoration information sign draws attention to ongoing Friends of Browning Park volunteer efforts, in addition to encouraging neighbour participation and hopefully discouraging trampling.

Photo 12B-10. Armouring and old foundation materials with perimeter drain from residences to the east (rain garden potential in the upland area, prior to discharge) (view upstream).

Photo 12B-11. West bank interpretive signage and community-building hub, with split rail fencing (upper right) to protect volunteer restoration riparian area by Friends of Browning Park (view upstream/north).

Photo 12B-12. West bank split rail fencing to protect volunteer restoration riparian area (invasive species removal and native species planting) by Friends of Browning Park (view downstream/south).

Photo 12B-13. West bank restoration riparian area by Friends of Browning Park, with invasive species removal and replanting native species in upper reach (view upstream).

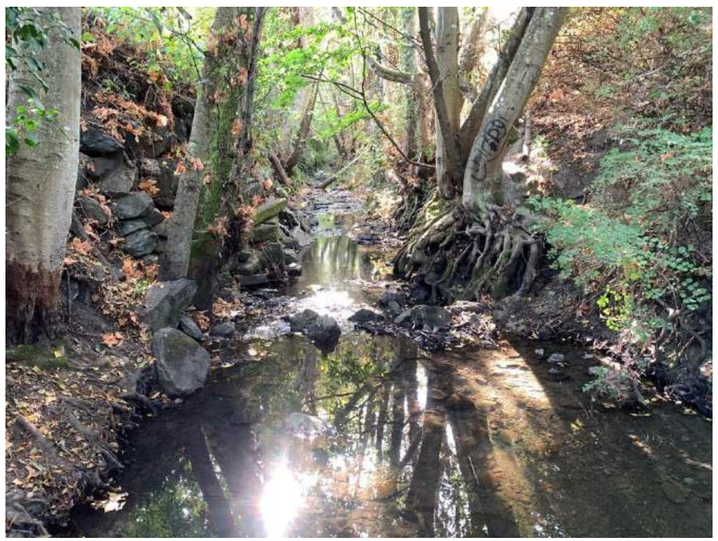


Photo 12B-14. Upstream end of the reach at the Knight Street (right-of-way) culvert: steep banks on both sides and armoured east bank (view downstream).

Photo 12B-15. Grassed area on the west side of the park is a potential area to re-grade and widen the riparian area, creek is on the left (view downstream).

Photo 12B-16. Armoured east bank at the upstream end, covered in English ivy (view downstream).

Photo 12B-17. Oil absorbent boom at the Knight Street (right-of-way) culvert outlet at upstream end: odour of hydrocarbons in the area. CRD flow meter is immediately downstream (view downstream).

Photo 12B-18. Possible rain garden location to treat runoff from McRae Avenue at downstream end of the reach (view downstream).


Reach 13 and 14
Capital Regional District | Capital Regional
District of Oak Bay
District of Saanich
Daylighting and Channel Restoration Opportunities
Enclosed channel
Bowker Creek
15b
14
13
12
MAP KEY
Existing
Proposed
Photo location and number
(Photo numbers reset at 1 for each sub-reach)
N
0 50 100m

Reach 13 - ENCLOSED

Reach # 13 - Enclosed – Culvert from Knight Avenue to Garnet Road (1700m)

Channel Description
1700m culvert –flowing down the Shelbourne Street corridor, discharging into Browning Park

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long-term term channel and riparian restoration potential
The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignments 8-10 of 13) for proposed alignment], which includes (in grey):

Knight Avenue to Derby Road
- The existing trunk alignment is through the back of the existing lots on the west side of Shelbourne Street. As the ground rises fairly quickly to the east and west, it will be necessary for the daylighted creek to follow the trunk alignment.
- The Shelbourne Valley Action Plan proposes up to 4 storey redevelopments on the lots facing Shelbourne and 2-3-storey townhouses on the lots backing on to them to the west on Browning Street.
- The recommended alignment is along the back of these lots with about a 5 m dedication on each side of the property line to provide a 10m corridor for daylighting. The width of dedication should be reviewed to confirm that the remnant lots are sufficiently wide to accommodate a 4 storey structure with the required setbacks from Shelbourne Street.
- A 10 m easement would provide enough space for a retained creek plus a paved trail. It would also accommodate a more natural creek (partially retained) if the pedestrian and cycling used Browning Street as a greenway as currently proposed.
- Refer to Exhibit 7.8.

Derby Road to Cedar Avenue
- This section is similar to the section south of Derby Road, except that the trunk shifts closer to Shelbourne Street at the north end. It is currently a church site.
- The site is shown as institutional in the Shelbourne Valley Action Plan.
- The back of the church lot rises to the north near Cedar Avenue and is more than a metre higher than
- Shelbourne.
- The recommended alignment is to shift to the east within the church site, and daylight between the church building and Shelbourne Street. This would require one row of church parking to be removed. Some of this parking could be replaced by expanding the parking on the north side of the building.
- The creek would need to be fully retained at this location as there is only about 7 m available between the church building and the existing sidewalk. Development of the Shelbourne Street will affect the available space as well.
- It is noted that this section of the trunk is relatively deep at about 5m below grade at Derby Avenue.

Cedar Avenue to Donnelly Avenue
- This short section consists of two single family lots abutting Shelbourne, with the existing trunk located within the Shelbourne Street right-of-way behind the existing sidewalk.
- There is a current redevelopment proposal for this location and the District of Saanich did note in its response to the developer that the Shelbourne Valley Action Plan's policy to integrate the Bowker Creek Blueprint as part of redevelopment proposals. However, due to the depth of the trunk, the District did not believe that it would be advisable to daylight the creek in this location. Instead, staff recommend an increased boulevard for enhanced stormwater management, which would serve as a storm water channel. The proposed cross section incorporates a minimum 3.5 m wide swale with 4:1 slopes, thus the swale would be a maximum of 0.5 m deep.
- This current example illustrates the challenges of relying on narrow dedication during redevelopment to achieve full daylighting of the creek. To achieve full daylighting (even with retained walls), it would have likely been necessary for the municipality to purchase some additional right-of-way, especially in areas where the existing trunk is relatively deep.
- It is recommended that the alignment shift to the east side of Shelbourne Street for this section.

Donnelly Avenue to Pear Street
- The trunk shifts to the east side of Shelbourne for this section and runs along the back of 3 commercial properties. These properties appear to have been developed in the past 20-30 years and include a gas station and 1 to 2-storey commercial buildings.
- The trunk alignment is slightly lower than Shelbourne Street and thus the back of lots would be the recommended alignment for daylighting.
- Based on the approximate age and height of the buildings, it is probable that these sites will redevelop in the medium term (20 to 50 years). The Shelbourne Valley Action Plan allows for up to 4- storey commercial development at this location.
- Daylighting should be incorporated into future redevelopment, although the municipality may need to acquire part of the daylighting width. The current lot depths are about 35 m.

Pear Street to Cedar Hill Cross Road – Shelbourne Plaza
- The trunk runs north south through the existing Shelbourne Plaza shopping centre, from about 20 m east of Shelbourne Street at the south end to adjacent to the street at the north end.
- The existing mall is one storey with surface parking along Shelbourne Street. The Shelbourne Valley Action Plan allows for redevelopment of up to six storeys of commercial or mixed-use development. Most of the existing mall appears to be 50 years old and thus redevelopment may take place sooner than other areas along Shelbourne Street, which have developed more recently. There are newer single storey commercial developments immediately south of Cedar Hill Cross Road and east of Shelbourne Street.
- This location is an excellent opportunity to integrate a daylighted Bowker Creek into a commercial/mixed-use development as an amenity. There is sufficient space to a wider daylighted creek with nominal retaining walls as the trunk is generally less than 2m deep.
- Refer to Exhibit 7.4.

Cedar Hill Cross Road to Broadmead Avenue/Kisber Avenue

- This section is very similar to the section south of Cedar Hill Cross Road (Shelbourne Plaza) with the trunk being close to Shelbourne Street and about 2m deep. The existing commercial development is single storey and is also planned for up to 6 storeys in the Shelbourne Valley Action Plan. The primary difference is that this site has been recently redeveloped and thus further redevelopment would likely be in the medium to long term.
- Daylighting should be incorporated into future (medium to long term) redevelopment, near or along the existing Bowker Trunk. Due to the proximity to Shelbourne Street, a retained creek section will be necessary.

Broadmead Avenue/Kisber Avenue To Christmas Avenue

- The trunk switches to the west side of Shelbourne Street for this section and runs in front of a commercial lot (Maude Hunter's Pub) and a two storey multifamily development. This site is planned for up to a 4 storey commercial or mixed use development according to the Shelbourne Valley Action Plan.
- It is proposed to daylight the creek along the existing trunk as these lots redevelop, likely over the medium term.
- The existing trunk is about 3m deep so the daylighted creek will need to be at least partially retained.

Christmas Avenue to Mortimer Street

- The trunk currently runs along the back driveway and parking area of three multi-family buildings ranging from 2 to 3 storeys. The trunk is about 3m deep and could be daylighted on its current alignment with the driveway/parking lots. Approximately 40 parking stalls would need to be removed to facilitate daylighting.
- At the south end, the alignment could be shifted slightly to the west to the green space adjacent to Ophir Street (1544 Christmas Avenue). It is understood that the District of Saanich recently approved a development on this lot, so this is no longer a viable option. As a result, daylighting would need to be immediately east of this lot at the back of the apartment site.
- The central portion (south of Earlston Avenue) would require either a row of parking stalls from the apartment complex or acquiring part of a residential lot to the west (1537 Earlston Avenue).
- At the north end this section is through the middle of a large parking area which appears to be a part of the apartment building to the south. Shifting the daylighting to the west may be challenging based on the size of the parking lot. It may be possible to negotiate with the apartment owners for an easement in exchange for a relaxation of the parking requirements. It may also be possible to do a land swap for any nearby municipally owned land.
- The central and north sections would likely be retained cross-sections in order to minimize the land acquisition needed.
- It should be noted that a greenway is proposed for just west of the proposed daylighting alignment (about 2 lots west). Consideration was given to shifting the daylighting west, but the ground rises to the west and the creek would need to be about 2 m deeper than the current alignment. Thus, it is recommended that the greenway be shifted east if possible, to align with the proposed daylighting.

Mortimer Street to Shelbourne Street & Stockton Avenue

- The trunk runs behind (west of) a 3 story condo and then under another 3-storey condo before crossing Shelbourne Street near Stockton Avenue. The portion behind the existing condo is largely within a gated parking area. The Shelbourne Valley Action Plan proposes up to 4 storeys of residential development adjacent to Shelbourne Street, but this site is unlikely to redevelop in the short or medium term given the relatively new 3-storey condos that currently existing.
- Shifting the daylighting alignment to the west is not practical as the ground rises quickly in that direction. The lots east of Stockton are currently single family and are also proposed for up to 4-storey residential but are not deep enough to accommodate 4 storeys plus a dedicated easement for daylighting.
- The recommended alignment is to follow Mortimer Street to Shelbourne Drive and then the east side of Shelbourne Drive.
- The short section on Mortimer Street would need to be retained and may have to be piped as Mortimer Street is currently has bike lanes and is proposed to be a greenway.
- On the east side of Shelbourne there are 5 single family lots that appear to be 50+ years old that can be redeveloped at up to 4 storeys according to the Shelbourne Valley Action Plan. There is a very good chance that these lots will redevelop in the short term and acquiring an alignment for daylighting as part of the redevelopment is important.

Shelbourne Street and Stockton Avenue to Garnet Road East of Shelbourne

- The trunk runs under a condo building and behind another condo building in this section. These condo buildings are relatively new and are 3 storeys tall, thus are unlikely to redevelop in the short or medium term.
- The recommended alignment is along the back of the condo lots. If this is not feasible, the alternate alignment is along the front of the lots on the east side of Shelbourne Street and Garnet Road. This would require a minimum of 3-5 m land fronting Shelbourne Street and Garnet Road to be acquired. The condos are currently set back about 7 m from the sidewalk on Garnet and 9m on Shelbourne. This may require removing street parking along Garnet Road.
- The recommended alignment for daylighting is on the north side of North Dairy Road from Cedar Hill Road. There are 3 single family lots north of North Dairy that would have to be acquired, along with a multi-family building. About 5-10 m would need to be acquired to facilitate daylighting, either via an easement or by acquiring, subdividing and selling the remnant lot.
- Some local water mains and sanitary sewers may need to be relocated to facilitate daylighting, depending on the width of right-of-way obtained.
- The sub-trunk draining the golf course is about 3-4 m deep and the creek would need to be retained in order to minimize the land acquisition requirements.
- The lots on the east side of Doncaster Drive at Clawthorpe Avenue would also need to be acquired to facilitate daylighting.

Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary

Condition:

- Culverted

Opportunities:

- Daylighting as described in the Daylighting Feasibility Study (2020).


Reach 13 and 14
District of Oak Bay
District of Saanich
Daylighting and Channel Restoration Opportunities
Enclosed channel
15b
14
13
12
MAP KEY
Existing
Proposed
Photo location and number
(Photo numbers reset at 1 for each sub-reach)
0 50 100m
N

Reach 14 - ENCLOSED

Reach # 14 - Enclosed –Garnet Road to Gordon Head Road (840m)

Channel Description
1700m culvert

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
N/A

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
N/A

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
N/A

Percent coverage of invasive vs. native species
N/A

Short-term riparian restoration potential and techniques
N/A

Short-term channel restoration potential and techniques
N/A

Long term channel and riparian restoration potential
The long term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignments 11-12 of 13) for proposed alignment], which includes (in grey):

EAST OF SHELBOURNE STREET TO ANSELL ROAD

- The trunk crosses Garnet Road about 100 m east of Shelbourne Street and then runs east between McKenzie Avenue and Garnet Road. The alignment is generally along the back of the single family lots on Garnet or the back of the apartment or condo properties on McKenzie. Further east, the trunk crosses between single family lots on Emerald Place and on Ansell Road.
- The Shelbourne Valley Action Plan allows for 4 and 6 storey mixed use and commercial along McKenzie near Shelbourne, and 4-storey residential along McKenzie east towards Emerald Place. The Action Plan proposes 2-3-storey townhouses on the back of these lots to transition to the single family lots on Garnet Road to the south. No changes are proposed for the single family lots on Garnet.
- The existing apartment and condo developments along McKenzie are fairly recent (less than 30 years old) and are close to the allowable heights in the Action Plan. The only exception is the east end towards Emerald where the existing condos are 2-storey for the entire depth of the lot. As a result, the multi-family buildings along McKenzie have a low likelihood of redeveloping in the short to medium term.
- The single family homes on Emerald Place and Ansell Road may redevelop over time if higher densities are allowed.
- The best opportunity for daylighting will likely be for the District of Saanich to acquire a 5-10 m easement along the back of the residential lots on Garnet. These lots are about 42m (140 ft.) deep and 21 m (70 ft.) wide, so there would still be a reasonably large lot remaining even with a 10m easement taken off the back. This can be done over time by having the District or the BCI acquire the lot, subdivide or register an easement, and re-sell the lot. This strategy will minimize the land acquisition costs significantly.
- The District of Saanich should consider updating its OCP to allow redevelopment of the lots north of Garnet Road as a way to facilitate Bowker Creek daylighting.
- Refer to Exhibit 7.6.
- A similar strategy is proposed for the lots on Emerald Place and on Ansell Road, except that the land acquisition would be the sides of the lots. Unfortunately, taking a few metres off the side of these lots would require the existing homes to be removed. These lots are slightly smaller but could be redeveloped as two storey single family lots. This may require changes to the zoning rules to allow for large single family homes within a narrow lot.
- Refer to Exhibit 7.7.
- The existing trunk is 3-4 m depth in this area and the daylighted creek would have to be retained or partially retained even if a 10 m wide right-of-way was available. A 10 m wide right-of-way would allow for a pedestrian/cycling trail adjacent to the creek. The benefit of a trail adjacent to the daylighted creek needs to be considered. It would be a valuable amenity, but the quality of the amenity is reduced when the total right- of-way is narrow (10 m or less) and the creek is 3-4 m deep and fully retained.

ANSELL ROAD TO GORDON HEAD ROAD

- The section between Ansell Road and Gordon Head Drive is essentially the same as that described above from Emerald Place to Ansell Road, with newer low rise condos along McKenzie Avenue and single family homes adjacent to the trunk at Ansell, Jade Place and Gordon Head Road.

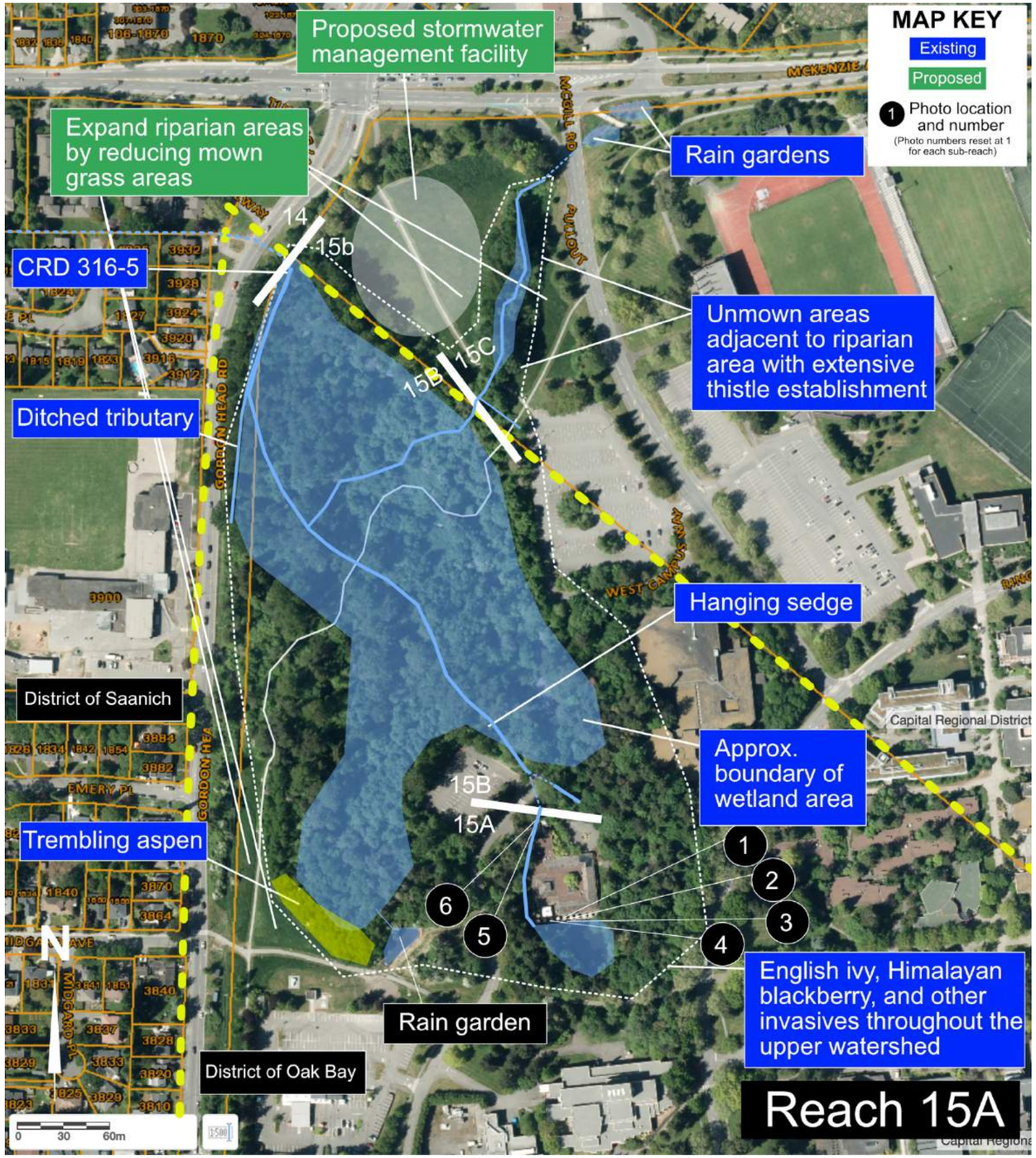
Resources & Further Reading

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek

Summary

Condition:
- Culverted

Opportunities:
- Daylighting as described in the Daylighting Feasibility Study (2020).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Proposed stormwater management facility
Expand riparian areas by reducing mown grass areas
Rain gardens
CRD 316-5
Unmown areas adjacent to riparian area with extensive thistle establishment
Ditched tributary
Hanging sedge
District of Saanich
Approx. boundary of wetland area
Trembling aspen
English ivy, Himalayan blackberry, and other invasives throughout the upper watershed
Rain garden
District of Oak Bay
Reach 15A
14
15b
15C
15B
15A
McGILL RD
GORDON HEAD RD
WEST CAMPUS WAY
EMERY PL
MCKENZIE
Capital Regional District
N
0 30 60m

REACH 15A

Reach # 15A – University of Victoria - University Club to West Campus Way (130m)

Channel Description
UVic University Club concrete pond with an aeration pump and short outlet channel (approx. 2 m wide) with boulder edges flows into a culvert under West Campus Way. Considered the headwaters of Bowker Creek.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The existing riparian area varies in width around the pond on most sides (14 – 50m) and narrows to om width adjacent to patio and University Club building on north side. Narrow buffer width around outlet channel (2m on east side, 5-10m on west side). The riparian areas are gentle slopes up from the pond and channel (Photos 1-6).

The size of the riparian area of this reach is unlikely to change, until such time as the building is demolished or redesigned, however invasive and ornamental species could be replaced with native species.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is:
- pond/wetland areas: 15m on the north, east, and west sides, and 30m on the south side.
- stream sections (<3.3m wide): 10 metres from the High Water Mark on both sides of the creek.

While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees and shrubs, with aquatic emergent vegetation in the pond.
Dominant species: Douglas-fir, red alder, bigleaf maple, black cottonwood, western redcedar with red-osier dogwood, Himalayan blackberry, ornamental rhododendrons, and salal

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Riparian Vegetation: Garry oak, arbutus, ornamental birch, common snowberry, oceanspray, June plum, lady fern, sword fern, tall Oregon-grape, skunk cabbage, common rush, equisetum, English ivy, and creeping buttercup.

Aquatic Vegetation: duckweed, cattails (native), pond-lily (no flowers, so species not confirmed), yellow flag iris, Pacific water-parsley

Percent coverage of invasive vs. native species
80 % native in the riparian area
Invasive species observed: Himalayan blackberry, yellow flag iris, English ivy, creeping buttercup, English holly, spurge-laurel, English hawthorn.
NOTE: While not observed during the site visit, the landscaping around the pond maybe be the source of a new invasive Hanging sedge (*Carex pendula*), observed downstream of the site.

Short term riparian restoration potential and techniques
Riparian area around the pond and outlet channel:
- Remove invasive and ornamental species, especially yellow flag iris, hanging sedge (if present)
- Plant native species around pond edge and outlet channel.

Short term channel restoration potential and techniques
- The Proper Functioning Condition Assessment (2004) noted that the wooden stop logs in the weir needed to be replaced. The weir is currently functioning and this location should be monitored periodically as failure would result in draining the pond.
- Habitat complexity could be increased in the pond through the additional of large wood and rock.

Long term channel and riparian restoration potential
Long term changes to the pond and outlet channel will likely not occur unless the University Club building is removed. If that were to occur, a larger wetland and riparian area could be constructed.

Additional Observations/Notes
2022 – Possible source of new invasive downstream: Hanging sedge

Resources
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
University of Victoria. 2004. UVic Integrated Stormwater Management Plan: https://www.uvic.ca/campusplanning/assets/docs/2004.Integrated.Stormwater.Management.Plan..pdf
University of Victoria. 2016. Campus Plan - https://www.uvic.ca/campusplanning/assets/docs/CampusPlan2016.pdf
Student Reports:
https://www.uvic.ca/socialsciences/environmental/assets/docs/courses/BowkerCreekRestoration.pdf
https://www.uvic.ca/socialsciences/environmental/assets/docs/course341/bowker_creek_headwaters_Fall%202008.pdf
Others may be available from UVic Departments

Summary
Condition:
- Manmade, concrete-lined channel and pond, with an aerating pump
- Riparian vegetation is a mix of native, ornamental and invasive species.

Opportunities:
- Check outlet weir and maintain stop logs, if required.
- Remove invasive species and plant native riparian species.
- Habitat complexity could be increased in the pond through the additional of large wood and rock.
- Long term - Construct a larger wetland and riparian area if the building is removed.

Photo 15A-1. UVic University Club pond with aerating pump. Diverse riparian structure and mostly native vegetation on east, south, and west sides and patio along north side (view south).

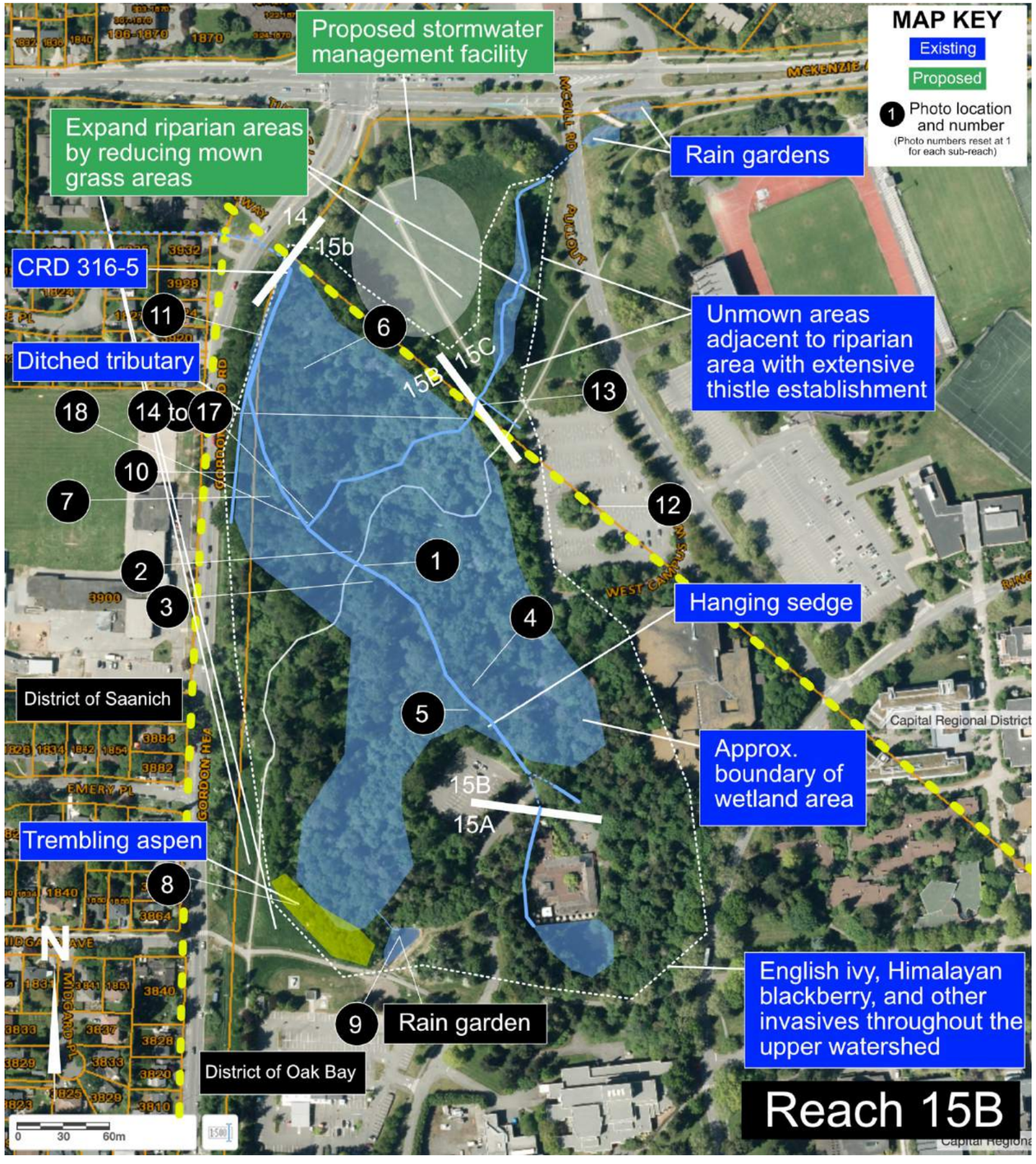
Photo 15A-2. Riparian area of pond is diverse on three sides with mostly native vegetation (view southeast).

Photo 15A-3. Outlet channel with duckweed and pond lilies, ornamental plantings, and patio along all of north side (view downstream/west).

Photo 15A-4. Yellow flag iris – problematic invasive species in the upper reaches of the watershed should be targeted for removal to prevent downstream spread (view east).

Photo 15A-5. Outlet channel from pond (view upstream).

Photo 15A-6. Weir at the downstream end of the outlet channel from pond before piped crossing under West Campus Way (view downstream/northwest).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Proposed stormwater management facility
Expand riparian areas by reducing mown grass areas
Rain gardens
CRD 316-5
Ditched tributary
Unmown areas adjacent to riparian area with extensive thistle establishment
Hanging sedge
Approx. boundary of wetland area
Trembling aspen
English ivy, Himalayan blackberry, and other invasives throughout the upper watershed
Rain garden
District of Saanich
District of Oak Bay
Capital Regional District
14
15b
15B
15C
15A
1
2
3
4
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6
7
8
9
10
11
12
13
14 to 17
18
N
0
30
60m
Reach 15B

REACH 15B

Reach # 15B – University of Victoria:

- From two culverts under West Campus Way (adjacent to Parking Lot 9) to Gordon Head Road (400m), emanating from Reach 15A University Club pond (south pipe) and from both piped and open flows north of the University Club driveway (north pipe)
- Tributary from the north (portion of tributary downstream from Reach 15C) (180m)
- Ditched tributary discharging from Saanich stormwater pipe along Gordon Head Road from the south (100m)

Channel Description

Wide wetland floodplain area with a generally low gradient channel, 1-2m widths varying to 3-4m, with some areas widening to undefined sections. The creek becomes an incised (1m deep x 1m wide) channel at confluence with the similarly incised stormwater ditch adjacent to Gordon Head Road, and flows north into the outlet culvert under Gordon Head Road (Photos 1-12). The tributary downstream from Reach 15C is also incised, but then the channel immediately widens into multiple overland flows and undefined sections before joining the mainstem from the south (Photos 13-18). See map for tributaries included in this reach.

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)

The existing riparian area is extensive (>50 m), with width constrained only at West Campus Way and Parking Lot 9, and parallel to Gordon Head Road (Photos 10-11).

This is the only section of the creek with abundant existing floodplain.

Streamside Protection and Enhancement Area (SPEA)

Under the RAPR, the SPEA for Bowker Creek is:

- pond/wetland areas: 15m on the north, east, and west sides, and 30m on the south side.
- stream sections (<3.3m wide): 10 metres from the High Water Mark on both sides of the creek.

While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)

No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species

Widely spaced deciduous and coniferous trees with a shrub understory, sometimes replaced by dense ivy coverage.

Dominant species: Black cottonwood, bigleaf maple, with Himalayan blackberry, common snowberry, Nootka rose, red-osier dogwood, salmonberry, skunk cabbage, slough sedge, and some areas of very dense coverage of English ivy (on ground and in trees) (Photos 4,6,7).

Some areas of mature trees have died, possibly due to hydrological changes from development in the upper watershed.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)

In addition to the above: trembling aspen, western redcedar, grand fir, Douglas-fir, Garry oak, red alder, Pacific crabapple, Pacific willow, Scouler's willow, Hooker's willow, June plum, ocean spray, black hawthorn, hardhack, Saskatoon berry, Pacific ninebark, cascara, baldhip rose, English holly, Scotch broom, bracken fern, creeping buttercup, sword fern, piggy-back plant, trailing blackberry, reed canary grass, English hawthorn, Pacific water-parsley, lady fern, American brooklime, curly dock, willowherb, Cooley's hedge nettle, European bittersweet, watercress, morning glory, thistle, hanging sedge.

Percent coverage of invasive vs. native species

60% native / 40% invasive

Invasive species observed: English ivy, Himalayan blackberry, English holly, English hawthorn, Scotch broom, creeping buttercup, reed canary grass, curly dock, creeping buttercup, European bittersweet, watercress, morning glory, thistle, hanging sedge.

NOTE: Hanging sedge (*Carex pendula*) is a new invasive (1 large plant) adjacent to Parking Lot 9 (Photo 5).

Short term riparian restoration potential and techniques

Invasive species management is the priority for this area.

- **HIGH PRIORITY:** Remove new invasive, Hanging sedge, before it spreads.
- Remove ivy, starting with ivy covered trees and clearing dense areas in the understory.
- Remove the large blackberry patches.
- Install more interpretive signage for Bowker Creek and stormwater management.
- Expand riparian areas to extent possible (e.g. remove lawn edge around Parking Lot 9), reduce or remove lawn areas in the north and southwest and replant with native vegetation.
- Improve stormwater management by creating ponding areas in the vegetation where curb cuts have been installed in Parking Lot 8 (Photo 12).

Short term channel restoration potential and techniques

No channel restoration is required in the majority of the main stem. The incised portion of the mainstem along Gordon Head Road before it discharges into the 600 mm pipe could be improved by re-grading and widening the banks, increasing the floodplain, and re-creating channel complexity and sinuosity. The Gordon Head Road tributary ditch with which it forms a confluence could be regraded and shaped to function as small stream or rain garden area.

Long term channel and riparian restoration potential

- Manage invasive species
- Plant additional native trees to replace the mature trees that have died, and as the overstory tree layer senesces.
- Ensure that as UVic continues to develop the upper watershed channel, wetland and riparian area is protected

Additional Observations/Notes

2022 – Creek and riparian area is in a similar condition to those observed in 2011, a new rain garden has been installed at the south edge.

Resources

UVic Facilities Management

Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment

Friends of Bowker Creek – www. bowkercreek.org

University of Victoria. 2004. UVic Integrated Stormwater Management Plan: https://www.uvic.ca/campusplanning/assets/docs/2004.Integrated.Stormwater.Management.Plan..pdf

University of Victoria. 2016. Campus Plan - https://www.uvic.ca/campusplanning/assets/docs/CampusPlan2016.pdf

Student Reports: https://www.uvic.ca/socialsciences/environmental/assets/docs/courses/BowkerCreekRestoration.pdf

REACH 15B

https://www.uvic.ca/socialsciences/environmental/assets/docs/course341/bowker_creek_headwaters_Fall%202008.pdf
Others may be available from UVic Departments

Summary

Condition:

- Wide wetland floodplain with low flow channel, with some incised sections and tributaries.
- Riparian vegetation mix of native and invasive species.

Opportunities:

- Priority is invasive species management –English ivy, Himalayan blackberry, etc., and removing new invasive hanging sedge before it spreads.
- Expand riparian areas to extent possible (e.g. remove lawn edge around Parking Lot 9), reduce or remove lawn areas in the north and southwest and replant with native vegetation.
- Cessation of mowing needs to be accompanied by control of invasive species and diverse native riparian planting, to prevent weed growth in un-mowed areas.
- Install more interpretive signage for Bowker Creek and stormwater management.
- Improve stormwater management by creating ponding areas in the vegetation where curb cuts have been installed in Parking Lot 8.
- Rehabilitate the incised portion of the mainstem along Gordon Head Road by re-grading and widening the banks, increasing the floodplain, and re-creating channel complexity and sinuosity.
- The Gordon Head Road tributary ditch with which it forms a confluence and the tributary ditch downstream from Reach 15C could be regraded and shaped to function as small streams or rain garden areas.
- Plant additional native trees to replace the mature trees that have died, and as the overstory tree layer senesces.
- Ensure that as UVic continues to develop the upper watershed channel, wetland and riparian areas are protected.

Photo 15B-1. Footbridge over Bowker Creek in broad wetland area.


Photo 15B-2. Red osier dogwood and skunk cabbage.


Photo 15B-3. Red osier dogwood along channel edge in wetlands.


Photo 15B-4. English ivy along the creek edge smothers other vegetation.


Photo 15B-5. Hanging sedge (*Carex pendula*) in creek adjacent to Parking Lot 9.


Photo 15B-6. Extensive English ivy in the understory of this large wetland.

Photo 15B-7. Slough sedge and skunk cabbage, with English ivy on the ground and on trees.

Photo 15B-8. Trembling aspen near Gordon Head Road and Parking Lot 10 (view north).

Photo 15B-9. New rain garden near Parking Lot 10, with very tall tule (view north).

Photo 15B-10. Ditched tributary along Gordon Head Road, dry in summer.

Photo 15B-11. Bowker Creek channel, just upstream of culvert under Gordon Head Road.

Photo 15B-12. Curb cuts in Parking Lot 8: some lawn/runoff areas need to be slightly deepened to create a ponding area for runoff.

Photo 15B-13. Channelized tributary from 15C as it transitions into 15B dispersed area of wide unconfined flows.

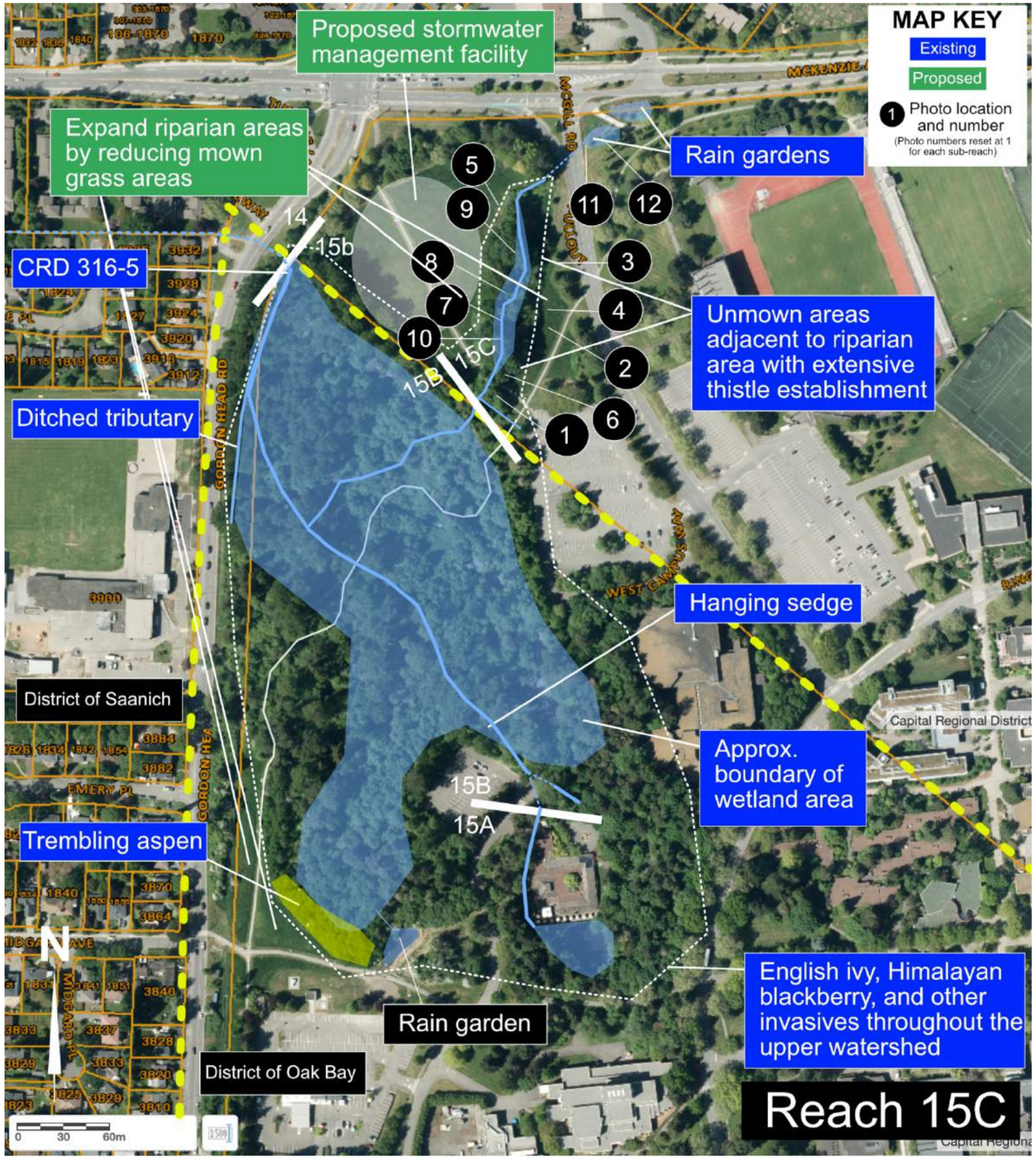
Photo 15B-14. Tributary from 15C disperses in wide unconfined flows in saturated ground in 15B.

Photo 15B-15. Tributary from 15C disperses in wide unconfined flows in this woody wetland in 15B.

Photo 15B-16. Tributary from 15C transitions into some areas of dense vegetation in 15B.

Photo 15B-17. Tributary from 15C disperses in wide unconfined flows in this woody wetland with high English ivy coverage in 15B.

Photo 15B-18. Tributary from 15C disperses in wide unconfined flows before entering confluence with mainstem flow from the south.


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
Proposed stormwater management facility
Expand riparian areas by reducing mown grass areas
Rain gardens
CRD 316-5
Ditched tributary
Unmown areas adjacent to riparian area with extensive thistle establishment
Hanging sedge
Approx. boundary of wetland area
Trembling aspen
English ivy, Himalayan blackberry, and other invasives throughout the upper watershed
Rain garden
Reach 15C
District of Saanich
District of Oak Bay
Capital Regional District
14
15b
15C
15B
15A
1
2
3
4
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6
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8
9
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11
12
N
0
30
60m

REACH 15C

Reach # 15C – Upper portion of the tributary from Mackenzie/Stadium - the lower portion of this tributary is described in 15B.

Channel Description
Wide wetland floodplain, with a low flow channel 1-2m wide and gently sloping banks (Photos1-12).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
The width of the riparian vegetation is from 3 to 15m wide, with gently sloping banks, up to mown grass areas. The riparian width could be expanded by reducing the mown grass areas and establishing riparian vegetation. Where mowing has ceased along the riparian area (possibly to allow the riparian area to expand), non-native Canada thistle and Himalayan blackberry is becoming established. The thistles especially should be removed to prevent further spread. Expanding the riparian area will require invasive species management and re-planting with native species (Photos 3-4).

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is:

- pond/wetland areas: 15m on the north, east, and west sides, and 30m on the south side.
- stream sections (<3.3m wide): 10 metres from the High Water Mark on both sides of the creek.

While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Deciduous trees and shrubs, with mown grass on the upper slopes.
Dominant species: Black cottonwood with salmonberry, native willow (Pacific and Sitka) and Himalayan blackberry, some patches are dominated by Pacific water-parsley, and some with creeping buttercup, Canada thistle in unmown grass areas, and mown grass along the edges up the slope.

Rain gardens are dominated by cattail, tule, soft stemmed bulrush, rushes.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names) Red alder, lodgepole pine, common snowberry, red-osier dogwood, reed canary grass, sword fern, trailing blackberry, spurge-laurel, English ivy, European bittersweet, morning glory, agricultural grasses.

Percent coverage of invasive vs. native species
Approximately 70% native if grassed area is not included. Creeping buttercup, Canada thistle, and Himalayan blackberry are responsible for the greatest extent of invasive plant cover.

Invasive species observed: Creeping buttercup, Canada thistle, Himalayan blackberry, reed canary grass, spurge-laurel, English ivy, European bittersweet, morning glory, agricultural grasses.

Short term riparian restoration potential and techniques

- Remove the invasive Canada thistle and large Himalayan blackberry thicket (north end).
- Widen riparian buffer by cessation of mowing. Cessation of mowing needs to be accompanied by control of invasive species and diverse native riparian planting, to prevent weed growth in un-mowed areas.
- Convert tributary ditch at the downstream end of reach 15C from Parking Lot 9 into a rain garden to treat parking lot runoff.

Short term channel restoration potential and techniques
Habitat complexity could be increased by adding large wood into the channel and riparian area.

Long term channel and riparian restoration potential
Continue with invasive species removal and management. If possible, a minimum of 10m of riparian corridor on each side of the channel would provide the most benefit to the creek and would meet the SPEA as defined by the RAPR.

The Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services proposes a Potential Stormwater Management Facility (Figures 2.1 & 5.1) (in grey):

- Open space in the northwest corner of the University of Victoria. The proposed SWMF at the University of Victoria is at an ideal location, especially given the excessive hydraulic grade lines (HGL) from the Master Drainage Plan (shown in Figure 2.1). This location is considered to be the highest priority for stormwater storage. Refer to Figure 5.1. for proposed location.

Additional Observations/Notes
2022 – Rain gardens have been added near the stadium to manage runoff, sedimentation noted in 2007 was not evident in 2011 or 2022, so is likely not a concern in the reach.
2011 – Potential for sedimentation issue from roads was noted in 2007 Proper Functioning Condition assessment.

Resources
UVic Facilities Management
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org
ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
ISL Engineering and Land Services. 2020. Memorandum: Potential Stormwater Management Facilities on Bowker Creek - https://www.crd.bc.ca/docs/default-source/initiatives-pdf/bci-pdf/200331_bowker_creek_potential_swmfs_final_32297.pdf?sfvrsn=297b1bcd_0
University of Victoria. 2004. UVic Integrated Stormwater Management Plan: https://www.uvic.ca/campusplanning/assets/docs/2004.Integrated.Stormwater.Management.Plan..pdf
University of Victoria. 2016. Campus Plan - https://www.uvic.ca/campusplanning/assets/docs/CampusPlan2016.pdf
Student Reports:
https://www.uvic.ca/socialsciences/environmental/assets/docs/courses/BowkerCreekRestoration.pdf
https://www.uvic.ca/socialsciences/environmental/assets/docs/course341/bowker_creek_headwaters_Fall%202008.pdf
Others may be available from UVic Departments

Summary
Condition:

- Moderate wetland floodplain with low flow channel.
- Riparian vegetation mix of native and invasive species.

(cont'd next page)

REACH 15C

Opportunities:

- Invasive species management – Himalayan blackberry, creeping buttercup, Canada thistle, etc. The thistles especially should be removed to prevent further spread.
- Widen riparian buffer by cessation of mowing. Cessation of mowing needs to be accompanied by control of invasive species and diverse native riparian planting, to prevent weed growth in un-mowed areas.
- If possible, a minimum of 10m of riparian corridor on each side of the channel would provide the most benefit to the creek and would meet the SPEA as defined by the RAPR.
- Convert tributary ditch at the downstream end of reach 15C from Parking Lot 9 into a rain garden to treat parking lot runoff.
- Habitat complexity could be increased by adding large wood into the channel and riparian area.
- Install Stormwater Management Facility in open field in the northwest corner (Gordon Head Road/McKenzie Avenue). This location is considered to be the highest priority for stormwater storage.
- Ensure that as UVic continues to develop the upper watershed channel, wetland and riparian areas are protected.

Photo 15C-1. Tributary ditch (top left to right) from Parking Lot 9 at the downstream end of 15C (lower right).

Photo 15C-2. Black cottonwoods, shrubby understory, and mown grass, east side of channel.

Photo 15C-3. Himalayan blackberry patch at the north end of the channel, near McKenzie Ave, east side of channel.

Photo 15C-4. Thistle establishing where grass is left unmown, east side of channel.

Photo 15C-5. Black cottonwood and willow, with mown grass, west side of the channel

Photo 15C-6. ~1m wide channel in wide wetland floodplain.

Photo 15C-7. Channel with creeping buttercup and reed canary grass.

Photo 15C-8. Pacific water-parsley in the wetland floodplain.

Photo 15C-9. English ivy and morning glory on trees adjacent to the channel.

Photo 15C-10. Typical riparian area for this reach.

Photo 15C-11. Rain gardens at McKenzie Ave and McGill Rd.

Photo 15C-12. Rain gardens at McKenzie Ave and McGill Rd


District of Saanich
City of Victoria
Daylighting and Channel Restoration Opportunity
Enclosed channel
MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17a
16
16
11
12a
11
10
10
9
N
0
50
100m
1:500
Reach 10, 11, and16

Reach 16 – ENCLOSED

Reach # 16 - Enclosed – Culvert from Clawthorpe Avenue to Cedar Hill Road (270m)
Channel Description 215m culvert – tributary flowing from Reach 17a at the Cedar Hill Golf Course
Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment) N/A
Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern) N/A
Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species N/A
Percent coverage of invasive vs. native species N/A
Short term riparian restoration potential and techniques N/A
Short term channel restoration potential and techniques N/A
Long term channel and riparian restoration potential The long-term restoration potential is to daylight the culvert and construct a restored, open channel, as described in Daylighting Feasibility Study – Bowker Creek by ISL Engineering and Land Services [see Map 6.1 and Map 7.1 (alignments 7&13 of 13) for proposed alignments] (in grey): - The recommended alignment for daylighting is on the north side of North Dairy Road from Cedar Hill Road. There are 3 single family lots north of North Dairy that would have to be acquired, along with a multi-family building. About 5-10 m would need to be acquired to facilitate daylighting, either via an easement or by acquiring, subdividing and selling the remnant lot. - Some local water mains and sanitary sewers may need to be relocated to facilitate daylighting, depending on the width of right-of-way obtained. - The sub-trunk draining the golf course is about 3-4 m deep and the creek would need to be retained in order to minimize the land acquisition requirements. - The lots on the east side of Doncaster Drive at Clawthorpe Avenue would also need to be acquired to facilitate daylighting.

Resources & Further Reading Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment Friends of Bowker Creek – www. bowkercreek.org ISL Engineering and Land Services. 2020. Daylighting Feasibility Study – Bowker Creek
Summary Condition: - Culverted Opportunities: - Daylighting as described in the Daylighting Feasibility Study (2020).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17C
17D
17C
17B
17D
17B
17A
Spring and potential expanded wetland area
Tributary Swale
Extensive golden willow population
Bowker Creek
CAMROSE CRES
HOLLOWAY ST
OCEAN VIEW RD
MAPLEWOOD RD
CEDAR HILL GOLF COURSE TRAIL
TOLMIE AVE
SLATER PL
MERRITT PL
FINLAYSON ST
CEDAR HILL RD
DONCASTER DR
N
0 30 60m
Reach 17A
Capital Regional District | Capital Regional D

REACH 17A *Return in winter when leaves are off to see slopes/erosion

Reach # 17A – Tributary from Cedar Hill Golf course, adjacent to Cedar Hill Recreation Centre (160m long) (District of Saanich property)
Lower = Cedar Hill Rd to 1st footbridge; Upper = (Between 1st & 2nd footbridges)

Channel Description
Incised excavated channel with steep banks, straight channel and no floodplain access in the reach (Photos 1-10). The channel is approx. 1-2m width and no armouring was observed in the reach.
Lower section: bank heights of 3-4 metres on each side. Slopes 1:1 – 1:2.
Upper section: Very high banks ~5 m high on SW side; slopes 2:1 – 1:1; Banks decrease on NE bank travelling upstream from 1.5 -3 m; slope 1:3.
A tributary swale flows south along Cedar Hill Road and forms a confluence with the creek just as the creek flows into the culvert at the base of the reach (Cedar Hill/Finlayson/North Dairy intersection).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Lower Section: riparian vegetation is approximate 5-8 m wide on each side, with a path, lawn, parking lots and rec centre beyond. Upper Section: The width of SW riparian vegetation is up to 12 m, and the NE bank vegetation is ~5 m wide.

The potential width of riparian area varies from about 8m adjacent to the building and parking lot up to +30m. Pathways closely parallel stream on alternating sides and the vegetated corridor includes mown grass areas that could transition to riparian vegetation. This reach is on public (District of Saanich) golf course property and there is potential to reshape the banks and create a wider riparian buffer.

The tributary swale is densely covered with native shrubby vegetation at the north end, which transitions into more invasive species before it joins the mainstem to the south.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Trees with shrub understory and areas of mown grass along the creek corridor.
Dominant species:
Lower Section: young western redcedar and Douglas-fir in a very dense overstory and sparse understory, dense areas of Himalayan blackberry, red-osier dogwood, Nootka rose
Upper Section: Black cottonwood, red-osier dogwood, Sitka willow, snowberry, Himalayan blackberry
Tributary Swale: Red-osier dogwood, hardhack, Nootka rose, snowberry, reed canary grass, Himalayan blackberry
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Horsetail, June plum, young western redcedar, red alder, thimbleberry, sword fern, skunk cabbage, Pacific water-parsley, morning glory, thistle, cherry cultivar, curly dock, creeping buttercup, golden chain tree, agricultural grasses

Percent coverage of invasive vs. native species
20% invasive:80% native

Invasive species observed: Himalayan blackberry, English ivy, morning glory, reed canary grass, golden chain tree, English hawthorn, English holly, thistle, curly dock, creeping buttercup, agricultural grasses

Short term riparian restoration potential and techniques
Friends of Cedar Hill Park have been conducting invasive species removal and native planting along this reach. The short-term recommendations are to work with them to continue this work to control invasive species, plant native species and expand the area of riparian restoration along the entire reach. Native riparian vegetation suggestions: red-osier dogwood, native willows, hardhack, salmonberry, thimbleberry, etc. Above the riparian area, consider Garry oak and associated meadow species for very dry and sunny areas.

Short term channel restoration potential and techniques
No channel reconfiguration is proposed in the short term, however coarse woody debris could be added to provide more instream complexity and habitat.

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on land use at the Cedar Hill Recreation Centre. The recently completed Cedar Hill Park Management Plan contains a variety of strategies in more detail.
The best ecological outcome would be to create floodplain areas, through re-sloping and terracing the banks, and creating channel complexity (large wood) and sinuosity for improved instream habitat. If possible, at least 15 metres of riparian corridor on each side of the channel would provide the most benefit to the creek and meet the SPEA as defined by the RAPR.

In areas that are more constrained, terraces could be created using bioengineering techniques to reduce the footprint.

Additional Observations/Notes
2022 – The Friends of Cedar Hill Park have been working on invasive species removal and plantings along this reach of the creek with Saanich Parks under the Saanich Pulling Together program. Significant progress has been made in the balance between invasives and native vegetation in this reach, with over 7300 volunteer hours between 2016 and 2021 (average >1200 hrs/yr). The swale along Cedar Hill Road, observed in 2011, continues to provide filtration of road and parking lot runoff prior to discharge into the creek. While the upper section is mainly native shrubs, a dense area of Himalayan blackberry at the downstream end could be replace with native vegetation.

Poison hemlock was observed in 2011 and reported to Saanich Parks and none was observed in 2022. Purple salsify was not observed, but might not have been visible at this time of year.

2011 – There is a long and deep vegetated ditch between Cedar Hill Rd and the Recreation Centre parking lot that discharges into the lower end of Reach 17A just before the creek flows underground at Cedar Hill Rd. Quadra Cedar Hill Neighbourhood Association has hosted invasive species removal parties in this reach in 2007 and 2008.

Resources & Further Reading
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Friends of Bowker Creek – www. bowkercreek.org

REACH 17A

Saanich Parks, Recreation, and Community Services Department. 2020. Cedar Hill Park Management Plan 2020 to 2040 Quadra Cedar Hill Neighbourhood Association Friends of Cedar Hill Park
Summary Condition: - Incised channel with no floodplain access - Riparian vegetation is mostly native with some invasive species, particularly in the upper channel. Opportunities: - Short term restoration should focus on invasive species removal and replanting in the riparian area. Above the riparian area, consider Garry oak and associated meadow species for very dry and sunny areas. - Long term restoration could include re-sloping the banks and increasing the riparian width to provide floodplain access and channel complexity, including LWD. - In areas that are more constrained, terraces could be created using bioengineering techniques to reduce the footprint.

Photo 17A-1. Tributary swale along Cedar Hill Road (view downstream toward confluence).

Photo 17A-2. Dense young conifers along lower section of the reach. Much of vegetation ends at the top of bank and transitions to lawn.

Photo 17A-3. Sparse understory under young conifer trees in lower section of the reach (view downstream).

Photo 17A-4. Path and building close to the creek, young conifers and grass in the riparian area in the upper section of the reach (view upstream).

Photo 17A-5. English ivy in the understory along the creek channel in the lower section of the reach.

Photo 17A-6. Young western redcedar with horsetail and English ivy, downstream of the first footbridge, in the lower section of the reach.

Photo 17A-7. Red osier dogwood and reed canary grass in the upper section of the reach.

Photo 17A-8. View from upper footbridge (at the top of the reach) into area of concerted volunteer efforts in invasive species removal and native plantings (view downstream/south).

Photo 17A-9. Looking downstream from the second footbridge at the upper section of the reach, reed canary grass in the channel.

Photo 17A- 10. Historic fill area increases steepness of the south slope of this reach. This riparian area could be re-sloped and expanded into the undeveloped parking area. This area has seen concerted volunteer efforts in invasive species removal and native plantings (view upstream/north).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17C
17D
17C
17B
17D
17B
17A
Spring and potential expanded wetland area
Tributary Swale
Extensive golden willow population
Reach 17B
CAMROSE CRES
HOLLOWAY ST
OCEAN VIEW RD
CEDAR HILL GOLF COURSE TRAIL
MAPLEWOOD RD
TOLMIE AMIE AVE
SLATER PL
MERRITT PL
FINLAYSON ST
CEDAR HILL RD
DONCASTER DR
0 30 60m
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REACH 17B

Reach # 17B– Tributary from Cedar Hill Golf course, from 2nd footbridge to culvert outlet at upstream end of the ball diamond (180m) (District of Saanich property)

Channel Description
Lower: wide, unconfined wetland area, ~2500 m^2 and up to 60 m across (Photos 1-6,12).
Upper: creek consists of a linear ditch ~1 m wide and 0.5 m deep in a low-gradient field, creek source discharges into a shallow, ~3-5 m wide pool from 600 mm concrete pipe emerging from steep hill (Photos 7-10).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Lower: Existing vegetated riparian area around the wetland varies greatly from 2-5 m wide (NE bank) to up to 10 m (SW bank).

Upper: Existing W bank is manicured golf course (Fairway 7) to within <1 m of channel, E bank is infrequently/roughly mowed to 1 m the channel (Photos 7-9).

Potential riparian area could be up to 30+m, depending on the future configuration of the park, ball diamond and golf course (Photos 4-6,8).

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is:

- pond/wetland areas: 15m on the north, east, and west sides, and 30m on the south side.
- stream sections (<3.3m wide): 10 metres from the High Water Mark on both sides of the creek.

While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
Yes, Low – small area of erosion at culvert outlet at upstream end.

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Most of the reach is dominated by trees in the overstory, with a fringe of shrubs.
Dominant species:
Lower: Mature golden willow, wetland has areas of cattails and reed canary grass.
Upper: Mature black cottonwood tapering off to with open sections of cattails and reed canary grass.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Douglas-fir, red alder, western redcedar, red-osier dogwood, black hawthorn, Scouler's willow, Himalayan blackberry, hardhack, thimbleberry, Nootka rose, horsetail, cleavers/bedstraw, skunk cabbage, Pacific water parsley, cattail, morning glory, thistle, English holly, English hawthorn, English ivy, curly dock, creeping buttercup, Scotch broom, American brooklime, European bittersweet, common rush, water-plantain.

Percent coverage of invasive vs. native species
Lower (wetland): 95% invasive (golden willow)
Upper (channel): 70% native and 30% invasive (mainly reed canary grass)
NOTE: Willow reported in 2011 as possible Pacific willow was a transcription error and should have been golden willow, resulting in 5% native vs. 95% non-native.
Invasive species observed: Golden willow, reed canary grass, Himalayan blackberry, English holly, English hawthorn, English ivy, Scotch broom, thistle, European bittersweet, morning glory, creeping buttercup, curly dock, watercress, agricultural grasses.

Short term riparian restoration potential and techniques
The focus of short-term restoration should be removal of invasive species, especially at the upstream end (reed canary grass, Himalayan blackberry, European bittersweet, creeping buttercup, mint). Depending on the plans for channel restoration, native riparian plantings could be conducted in the upper section of the reach. The addition of tree species such as trembling aspen and native willows adjacent to the invasive golden willow wetland would eventually allow for the thinning of the invasive trees with reduced impact to water temperatures and wildlife habitat (Photo 12)(also part of long-term plan). Currently the Friends of Cedar Hill Park volunteer work is limited by the scope of the Pulling Together program from working in this section of the park. An expansion of the areas for volunteer efforts is suggested.

Short-term channel restoration potential and techniques
No short-term channel restoration is proposed. Examine erosion at culvert out and armour bank with bioengineering such as willow wattles or native-planted coir logs.

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on land use at the Cedar Hill Recreation Centre and Golf Course. The newly completed Cedar Hill Park Management Plan discusses the potential for the golf course to achieve certification in the Audubon Cooperative Sanctuary Program for Golf. The Plan also identifies the spring area of reed canary grass and historical fill immediately east of the source culvert for the reach as an opportunity to create additional wetland habitat and flood response (Photo11).

The best ecological outcome for the lower section would be to transition the golden willows to native species by removing sections of golden willow and replanting with native willows, trembling aspen and other wetland vegetation – doing this in phases will allow the wetland to continue to function as water storage and habitat during the transition.

In the upper section, widening the stream channel or creating a larger wetland area and planting with riparian species would create channel complexity (large wood) and sinuosity for improved instream habitat and flood capacity.

If possible, expanding the riparian area to a corridor of at least 10 metres on each side of the channel, and 15m (north, east and west) and 30m (south side) on the wetland would provide the most benefit to the creek and meet the SPEA as defined by the RAPR.

Additional Observations/Notes
2022 – There is little change from 2011.
2011 – Creek substrate is fine silty mud along all sections of the reach, including other substrate (e.g. gravel and cobble) could provide some habitat complexity. Tributary flows from spring and golf course pipes are other potential areas for riparian plantings.

Resources & Further Reading
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Saanich Parks, Recreation, and Community Services Department. 2020. Cedar Hill Park Management Plan 2020 to 2040
Friends of Bowker Creek – www. bowkercreek.org
Quadra Cedar Hill Neighbourhood Association
Friends of Cedar Hill Park

REACH 17B

Summary

Condition:

- Wetland area in lower reach and channelized stream in upper reach adjacent to recreational facilities and golf course greens.
- Wetland consists of invasive golden willow and upper area is a mix of native (black cottonwood and cattails) and non-native vegetation (reed canary grass and Himalayan blackberry).

Opportunities:

- Short-term focus on invasive species removal and riparian planting, especially moisture-tolerant trees adjacent to wetland areas as a start to long-term strategies.
- Long-term opportunities in the upper section, include widening the stream channel or creating a larger wetland area and planting with riparian species to create channel complexity (large wood) and sinuosity for improved instream habitat and flood capacity.
- Long-term opportunities in the lower section include transitioning from the golden willows to native species by removing sections of golden willow and replanting with native willows, trembling aspen and other wetland vegetation – doing this in phases will allow the wetland to continue to function as water storage and habitat during the transition.
- The spring and foreign fill area to the east of the upper section has been identified in the Cedar Hill Park Management Plan as an opportunity to create additional wetland habitat and flood response.
- Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.

Photo 17B-1. Golden willow wetland at lower section of reach (view upstream).

Photo 17B-2. Golden willow wetland at lower section of reach (view upstream).

Photo 17B-3. Additional un-mapped water source from under golf course Fairway 7 where it enters the west edge of the golden willow wetland (right) (view west).

Photo 17B-4. Ball diamond adjacent to golden willow wetland at lower section of reach (right) (view downstream/south).

Photo 17B-5. Ball diamond adjacent to golden willow wetland at lower section of reach (view upstream).

Photo 17B-6. Ball diamond adjacent to upper section of reach with black cottonwood trees and mowing close to edge of the creek (view upstream).

Photo 17B-7. Upper section of reach near confluence with reach 17D, demonstrating mowed creek edge adjacent to golf course Fairway 7 (view upstream/northwest).

Photo 17B-8. Upstream end of reach where culvert is under the golf course, discharging into the cattails and reed canary grass in low flow conditions (view downstream of Reach 17B and 17D confluence from west/right)(see Photo 9 for comparison).

Photo17B-9. Widespread flooding during the atmospheric river event in November 2021 overwhelmed the piped flows from Reach 17D (right) (view downstream of Reach 17B and 17D confluence) (Photo Peter Haddon).

Photo 17B-10. Upstream end of reach where creek emerges from underground portion within the golf course, discharging into the cattail area (view upstream).

Photo 17B-11. This area of reed canary grass and historical fill immediately east of the source culvert for the reach is a spring from the hill and identified as an opportunity to create additional wetland habitat in the Cedar Hill Park Management Plan 2020 to 2040 (Figure 5.3) (view north/upstream).

Photo 17B-12. A young forest has been recently planted on the south slope above the wetland, which will improve wildlife connectivity to the riparian area. The addition of tree species such as trembling aspen adjacent to the invasive golden willow wetland would eventually allow for the thinning of the invasive trees with reduced impact to water temperatures and wildlife habitat (view north).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17C
17D
17B
17A
12
11
10
9
8
6
7
5
3
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2
1
Spring and potential expanded wetland area
Tributary Swale
Extensive golden willow population
Reach 17C
CAMROSE CRES
HOLLOWAY ST
OCEAN VIEW RD
TOLMIE AMIE AVE
SLATER PL
MERRITT PL
FINLAYSON ST
CEDAR HILL GOLF COURSE TRAIL
MAPLEWOOD RD
COOK ST
CEDAR HILL RD
DONCASTER DR
OCEAN VIEW PL
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Capital Regional District | Capital Regional D

REACH 17C

Reach # 17C – Culvert under golf course (120m) and open creek channel (260m) up to 1299 Camrose Crescent. Creek is on the golf course (District of Saanich property).

Channel Description
Culverted sections, including long section (120m) at downstream end flowing into Reach 17B.
Stream is approximately 1-2m wide, in natural bedrock gully (2-4 m high banks) in the middle of the reach and approximately 0.5m wide at the top of the reach where it is channelized through the golf course (Photos 1-12).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Gully section: 8m on the east side and 25m on the west side
Upper section: <1m wide through the golf course.

The potential riparian area depends on how much area at the golf course can be dedicated to riparian vegetation. If possible, 10m on each side of the channel would provide a good buffer and habitat corridor and meet the RAPR.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is approximately 15m from the High Water Mark on both sides of the creek. While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Gully: trees and shrubs
Golf course: mown grass with patches of shrubs and ground cover.
Dominant species:
Gully: Garry oak, Himalayan blackberry (especially on the east bank), English ivy, snowberry, tall Oregon-grape
Golf course: lawn, Himalayan blackberry, weeping willow, creeping buttercup, common rush.

Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Gully: Scouler's willow, ocean spray, Nootka rose, black hawthorn

Percent coverage of invasive vs. native species
80% invasive (including the golf course lawn) / 20% native
Invasive species observed: Himalayan blackberry, Scotch broom, weeping willow, European bittersweet, black ash, spurge-laurel, creeping buttercup, watercress, morning glory, periwinkle, dock, thistle, burdock, grass.
NOTE: In the gully area, golf course staff has removed Himalayan blackberry and Scotch broom, however it is starting to re-establish and needs to be maintained.

Short term riparian restoration potential and techniques
- Continuing to remove invasive species from the gully section of the reach
- Invasive species removal along the channel

Short term channel restoration potential and techniques
No short-term channel restoration recommendations.

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on the space available at the golf course. The newly completed Cedar Hill Park Management Plan discusses the potential for the golf course to achieve certification in the Audubon Cooperative Sanctuary Program for Golf.
- Lower section – remove the culvert and construct a stream channel from the gully section to Reach 17B
- Gully section – remove invasive species and increase riparian plantings to 10m on each side of the channel
- Upper section – through the golf course reconfigure the channel to create a natural sinuous creek channel with riparian plantings to 10m on each side of the channel

10 metres of riparian corridor on each side of the channel would provide the most benefit to the creek and meet the SPEA as defined by the RAPR.

Additional Observations/Notes
2022 – Golf course staff have removed Himalayan blackberry and Scotch broom on the west side of the gully section
2011 – Was not assessed

Resources & Further Reading
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Saanich Parks, Recreation, and Community Services Department. 2020. Cedar Hill Park Management Plan 2020 to 2040
Friends of Bowker Creek – www. bowkercreek.org
Quadra Cedar Hill Neighbourhood Association
Friends of Cedar Hill Park

Summary
Condition:
- Lower section – culverted
- Gully section – natural channel with extensive Himalayan blackberry and other invasive species.
- Upper section – channelized with very little riparian area

Opportunities:
- Short term focus on invasive species control
- Long-term channel daylighting and restoration, invasive species and native riparian plantings.
- Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.

Photo 17C-1. Culverted section above Reach 17B under Fairway 7 hole (view upstream/northwest).

Photo 17C-2. Downstream end of gully section (view upstream).

Photo 17C-3. Gully section with Himalayan blackberry and English ivy (view across stream/east).

Photo 17C-4. Upland area of gully section where golf course staff have removed Scotch broom and Himalayan blackberry, but it is re-establishing (view downstream/southeast).

Photo 17C-5. Garry oak over channel in the gully section.

Photo 17C-6. Gully section with Himalayan blackberry on the east side of the channel and Garry oak with snowberry and tall Oregon-grape on the west side.

Photo 17C-7 Upland area of gully section where golf course staff have removed Scotch broom and Himalayan blackberry, but it is re-establishing.

Photo 17C-8. Upper section above the gully, Himalayan blackberry section (view upstream).

Photo 17C-9. Upper section through the golf course (view downstream).

Photo 17C-10. Upper section through the golf course (view downstream).

Photo 17C-11. Widespread flooding during the atmospheric river event in November 2021 overwhelmed both piped flows and channel banks in the upper section through the golf course (view downstream) (Photo Peter Haddon).

Photo 17C-12. Upper section discharging from culvert at 1299 Camrose Crescent (view upstream).


MAP KEY
Existing
Proposed
1 Photo location and number
(Photo numbers reset at 1 for each sub-reach)
17C
17D
17C
17B
17D
17B
17A
1
2
3
4
5
6
Spring and potential expanded wetland area
Stormwater management facility
Tributary Swale
Extensive golden willow population
Bowker Creek
CAMROSE CRES
HOLLOWAY ST
OCEAN VIEW RD
MAPLEWOOD RD
CEDAR HILL GOLF COURSE TRAIL
SLATER PL
MERRITT PL
FINLAYSON ST
COOK ST
CEDAR HILL RD
DONCASTER DR
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0 30 60m
Reach 17D
Capital Regional District | Capital Regional D

REACH 17D

Reach #17D –Tributary from the stormwater management at 1290 Tolmie Place joining Reach 17B, across from the ball diamond and just below 17B source pipe.

Channel Description
Originates in the stormwater management rain garden at 1290 Tolmie Place, which flows into the golf course pond at the west side of the golf course (Photos 1-4).
The pond has a recirculating pump and 2m falls from the upper pond to the lower pond. It is connected through to Reach 17B via two culverted sections that are intersected midway by a small wetland (130m) (Photos 5-6).

Riparian Area – Existing and Potential Area (with private landowner involvement/redevelopment)
Large pond – 1-3 m of limited riparian vegetation on west side, surrounded by golf course mown grass on three sides.
Small wetland – mown grass to the edge.

The potential riparian area depends on how much area at the golf course can be dedicated to riparian vegetation. If possible, 15m (north, east and west) and 30m (south side) on the ponds would provide a good buffer and habitat corridor and meet the RAPR. A riparian buffer around the small wetland would also improve its ecological condition. Daylighting the culverts through the golf course would provide the optimal riparian restoration and a habitat connection to the water bodies.

Streamside Protection and Enhancement Area (SPEA)
Under the RAPR, the SPEA for Bowker Creek is:
- pond/wetland areas: 15m on the north, east, and west sides, and 30m on the south side.
- stream sections (<3.3m wide): 10 metres from the High Water Mark on both sides of the creek.

While existing areas of human disturbance can continue in their current form, new development is restricted by the RAPR requirements, see Introduction for additional information.

Streambank erosion issues (Yes/No and High, Medium, Low Extent/Concern)
No

Dominant vegetation structure (trees, shrubs or ground cover) and dominant and co-dominant plant species
Mown grass, with a fringe of ornamental and native riparian vegetation.
Golf course: mown grass with patches of shrubs and ground cover.
Dominant species:
Large pond: Ornamental birch, red alder, sedge, cattail, fragrant pond-lily (pink), rushes, soft-stemmed bulrush, Himalayan blackberry
Small wetland: Himalayan blackberry, reed canary grass, black cottonwood (seedlings),
Additional species covering >5% of the area within vegetated streamside zone (see Table 1 for scientific names)
Large pond: reed canary grass, morning glory, yellow flag iris, Queen Anne's lace.
Small wetland: cattail, bracken fern, common rush, Pacific water-parsley

Percent coverage of invasive vs. native species
95% invasive (including the golf course lawn) / 5% native
Invasive species observed: Himalayan blackberry, reed canary grass, morning glory, yellow flag iris, queen Anne's lace. fragrant pond-lily (pink).

Short term riparian restoration potential and techniques
- Remove invasive species, in particular yellow flag iris and reed canary grass to prevent migration downstream
- Expand the riparian zone around the pond and wetland with native riparian plantings.

Short term channel restoration potential and techniques
No short-term channel restoration recommendations.

Long term channel and riparian restoration potential
A range of options are available in the long term, depending on the space available at the golf course. The newly completed Cedar Hill Park Management Plan discusses the potential for the golf course to achieve certification in the Audubon Cooperative Sanctuary Program for Golf.
- Remove the culverts and construct a stream channel from the large pond through to the small wetland to Reach 17B

If space is limited, restoration could include:
- Add habitat complexity to the pond by adding large wood and rock
- Invasive species removal around the pond and wetland
- Increasing the width of the riparian vegetation as much as is possible with the constraints on space.

If possible, 15m (north, east and west) and 30m (south side) on the ponds would provide the most benefit to the creek and meet the SPEA as defined by the RAPR.

Additional Observations/Notes
2022 – This reach experience major flooding during the atmospheric river event of November 2021 (see Photo 17B-9 in Reach 17B section).
2011 – was not assessed

Resources & Further Reading
Aqua-Tex Scientific Consulting Ltd. 2007. Bowker Creek Watershed Bowker Creek Watershed Proper Functioning Condition Assessment
Saanich Parks, Recreation, and Community Services Department. 2020. Cedar Hill Park Management Plan 2020 to 2040
Friends of Bowker Creek – www. bowkercreek.org
Quadra Cedar Hill Neighbourhood Association
Friends of Cedar Hill Park

Summary
Condition:
- Mostly culverted (130m)
- Large pond, recirculating pump and narrow riparian vegetation around the perimeter
- Small vegetated wetland between two culverted sections.

Opportunities:
- Short term focus on invasive species control and increasing riparian planting width.
- Long-term channel daylighting and restoration, invasive species and native riparian plantings.
- Continue plans toward achieving certification in the Audubon Cooperative Sanctuary Program for Golf.

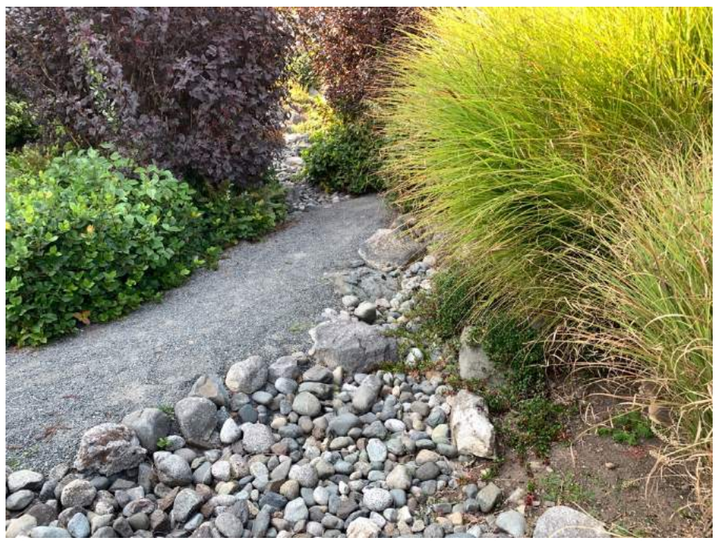

Photo 17D-1. Stormwater management rain garden at 1290 Tolmie Place.

Photo 17D-2. Upper pond, connected to the stormwater management rain garden at 1290 Tolmie Place.

Photo 17D-3. Waterfall between upper and lower ponds adds aeration.

Photo 17D-4. Large pond with some shrubby riparian vegetation on western edge and lawn surrounding most other edges including the long piped section downstream to Reach 17B (view upstream/northeast).

Photo 17D-5. Small wetland between the two long culverted sections under Fairways 5 and 7, mix of native and non-native vegetation (view downstream toward Reach 17B tree line).

Photo 17D-6. Culvert from the small wetland to Reach 17B across Fairway 7 (view downstream/southeast).

APPENDIX C-1: RECOMMENDED PLANT SPECIES FOR RIPARIAN RESTORATION PROJECTS ON BOWKER CREEK

Detailed restoration prescriptions including the exact number and type of riparian plants will be prepared as restoration opportunities present themselves. Plants should be spaced two to four metres apart (trees should be four metres apart). A list of native plants that can be used as a starting point for detailed restoration planning is as follows:

TREES	
bigleaf maple	*Acer macrophyllum*
red alder	*Alnus rubra*
black hawthorn	*Crataegus douglasii*
Garry oak	*Quercus garryana*
Pacific crab apple	*Malus fusca (Pyrus fusca)*
black cottonwood	*Populus trichocarpa*
bitter cherry	*Prunus emerginata*
Douglas-fir	*Pseudotsuga menziesii*
western redcedar	*Thuja plicata*
western hemlock	*Tsuga heterophylla*
SHRUBS	
Upper Slope	
vine maple	*Acer circinatum*
Douglas maple	*Acer glabrum*
saskatoon	*Amelanchier alnifolia*
salal	*Gaultheria shallon*
oceanspray	*Holodiscus discolor*
black twinberry	*Lonicera involucrata*
dull Oregon grape	*Mahonia nervosa*
June plum	*Oemleria cerasiformis*
mock orange (Coastal)	*Philadelphus lewisii 'Gordianus'*
Pacific ninebark	*Physocarpus capitus*
cascara	*Rhamnus purshiana*
red flowering currant	*Ribes sanguineum*
nootka rose	*Rosa nutkana*
clustered wild rose	*Rosa pisocarpa*
common snowberry	*Symphoricarpos albus*
Evergreen huckleberry	*Vaccinium membranaceum*
Lower Slope	
red-osier dogwood	*Cornus stolonifera*
Pacific ninebark	*Physocarpus capitus*
cascara	*Rhamnus purshiana*
thimbleberry	*Rubus parviflourus*
salmonberry	*Rubus spectablis*
Hooker's willow	*Salix hookeriana*
Scouler's willow	*Salix scouleriana*
Sitka willow	*Salix sitchensis*
red elderberry	*Sambucus racemosa*
hardhack	*Spirea douglasii*

PERENNIALS, SEDGES, RUSHES, FERNS, GROUNDCOVER	
Upper Slope	
vanilla leaf	*Achlys triphylla*
Hooker's onion	*Allium acuminatum*
nodding onion	*Allium cernuum*
pearly everlasting	*Anaphalis margaritacea*
cut-leaved anemone	*Anemone multifida*
small-leaved pussytoes	*Antenaria microphylla*
red columbine	*Aquilegia formosa*
kinnickinick	*Arctostphylos uva-ursi*
wild ginger	*Asarum caudatum*
Douglas' aster	*Aster douglasii (subspicatus)*
great northern aster	*Aster modestus*
lady fern	*Athyrium felix-femina*
deer fern	*Blechnum spicant*
fool's onion	*Brodiaea hyacinthina*
great camas	*Camassia leichtlinii*
common camas	*Camassia quamash*
common red paintbrush	*Castilleja miniata*
dwarf dogwood, bunchberry	*Cornus canadensis*
Menzies larkspur	*Delphinium menziesii*
bleeding heart	*Dicentra formosa*
coastal strawberry	*Fragaria chiloensis*
twinflower	*Linnaea borealis*
false lily-of-the-valley	*Maianthemum dilatatum*
sword fern	*Polystichum munitum*
sword fern	*Polystichum munitum*
bracken fern	*Pteridium aquilinum*
false Solomon's seal	*Smilacina racemosa*
star-flowered false Solomon's seal	*Smilacina stellata*
Cooley's hedge-nettle	*Stachys chamissonis var. cooleyae*
fringecup	*Tellima grandiflora*
broad-leaved starflower	*Trientalis latifolia*
western trillium	*Trillium ovatum*
Lower Slope	
Merten's sedge	*Carex mertensii*
slough sedge	*Carex obnupta*
beaked Sedge	*Carex rostrata*
Sitka Sedge	*Carex sitchensis*
sawbeak Sedge	*Carex stipata*
common Rush	*Juncus effusus*
dagger-leaf Rush	*Juncus ensifolius*
sword fern	*Polystichum munitum*
Soft-stemmed bulrush	*Schoenoplectus tabernaemontani*
Small-flowered bulrush	*Scirpus microcarpus*

Recommendations:

Planting will be most successful if installed in the fall, when rainfall starts. Ideally, the plants should be irrigated for a minimum of two growing seasons. If this is not possible, deep mulching should be applied to the planted areas, and emergency watering provided in very dry periods as needed. Providing sufficient water to establish plantings is especially crucial with our changing climate and prolonged droughts that have been observed in recent years (e.g. 2021 and 2022). Extra care with plantings during their establishment period (2-3 years) is important for their survival and the success of restoration efforts.

Sustained control of invasive species is required to allow native plants to establish (minimum of 2-3 years). For aggressive invasive species (e.g. Himalayan blackberry, knotweeds, English ivy) control will be required on an ongoing basis until they are eliminated from the site. Recommended removal techniques are provided in the documents list at the end of this section.

The banks of Bowker creek often consist of clay. As the channel and riparian slopes are modified based on restoration prescriptions, it may be necessary amend the soils with compost, mulch or topsoil to support native plant growth.

District of Saanich. 2017. Controlling invasive plants on your property. 5th Edition.
- https://www.saanich.ca/assets/Community/Documents/Environment/Invasive%20Plants%20Booklet%202015%20web.pdf

Invasive Species Council of BC Publications - https://bcinvasives.ca/resources/publications/

APPENDIX C-2: COMMON AND LATIN NAMES FOR COMMONLY OCCURRING BOWKER CREEK RIPARIAN VEGETATION

A star (*) indicates non-native vegetation and two stars (**) indicates invasive non-native vegetation.

NOTE: hanging sedge, traveller's joy (clematis), European black nightshade, black ash, field maple, and white poplar are newly observed invasive species with small populations (in 2022) and if control measures are implemented immediately could be removed from the riparian area.

Trees

alder, red alder (*Alnus rubra*)
arbutus (*Arbutus menziesii*)
big-leafed maple (*Acer macrophyllum*)
birch (*Betula* spp.) *
black ash (*Fraxinus nigra*) **
black cottonwood (*Populus balsamifera* ssp. *tricocarpa*)
black hawthorn (*Crataegus douglasii*)
cherry (*Prunus* spp.) *
chestnut (*Castanea* spp.) *
Douglas-fir (*Pseudotsuga menziesii*)
field maple (*Acer campestre*) **
Garry oak (*Quercus garryana*)
golden willow (*Salix alba L. ssp. vitellina*) **
grand fir (*Abies grandis*)
hemlock (*Tsuga heterophylla*)
Hooker's willow (*Salix hookeriana*)
June plum (*Oemleria cerasiformis*)
lodgepole pine (*Pinus contorta*)
Pacific crabapple (*Malus fusca*)
Pacific willow (*Salix lucida* ssp. *lasiandra*)
poplar (*Populus balsamifera*)
Scouler's willow (*Salix scouleriana*)
shore pine (*Pinus contorta*)
Sitka willow (*Salix sitchensis*)
trembling aspen (*Populus tremuloides*)
weeping willow (*Salix bablylonica*) *
western redcedar (*Thuja plicata*)
white poplar (*Populus alba*) **

Shrubs

baldhip rose (*Rosa gymnocarpa*)
California/Pacific wax-myrtle, (*Morella californica*)
cascara (*Frangula purshiana*)
dull Oregon-grape (*Mahonia nervosa*)
tall Oregon-grape (*Mahonia aquifolium*)
English hawthorn (*Crataegus laevigata*) **
English holly (*Ilex aquifolium*) **
golden chain tree, common laburnum (*Laburnum anagyriodes*) ** All parts are extremely poisonous
hardhack (*Spirea douglasii*)
Himalayan blackberry (*Rubus discolour*) **
Japanese knotweed (*Polygonum cuspidatum*) **
laurel hedge, Portuguese or common/cherry (*Prunus* spp.) **
mock-orange (*Philadelphus lewisii*)
Nootka rose (*Rosa nutkana*)
oceanspray (*Holodiscus discolour*)
Pacific ninebark (*Physocarpus capitatus*)
privet (*Ligustrum* spp.) **
salal (*Gaultheria shallon*)
Saskatoon berry (*Amelanchier alnifolia*)
Scotch broom (*Cytisus scoparius*) **
snowberry (*Symphoricarpos albus*)
spurge-laurel, laurel-leaved daphne (*Daphnea laureola*) ** All parts are poisonous
red-osier dogwood (*Cornus stolonifera*)
rhododendron (*Rhododendron* spp.) *
thimbleberry (*Rubus parviflorus*)
vine maple (*Acer circinatum*)

Climbing Vines

English ivy (*Hedera helix*) **
European bittersweet (*Solanum dulcamara*) **
European black nightshade (*Solanum nigrum*) **
traveler's joy, old man's beard (*Clematis vitalba*) **
wisteria (*Wisteria* sp.)*
woodbine, Devil's darning needles (*Clematis virginiana*) **

Herbs & Groundcover

American brooklime (*Veronica beccabunga* var. *americana*)
bracken fern (*Pteridium aquilinum*)
Canada thistle, creeping thistle (*Cirsium arvense*) **
cattail (*Typha latifolia*)
cleavers/bedstraw (*Galium* spp.)
common rush (*Juncus effusus*)
Cooley's hedge nettle (*Stachys chamissonis* var. *cooleyae*)
cow parsnip (*Heracleum maximum*)
curly dock (*Rumex crispus*) **
creeping buttercup (*Ranunculus repens*) **
duckweed (*Lemna* spp.) (native, non-native, unknown)
hanging sedge (*Carex pendula*) **
horsetail (*Equisetum* spp.)
herb-Robert (*Geranium robertianum*) **
lady fern (*Athyrium filix-femina*)
lesser celandine, pilewort (*Ficaria verna,* formerly *Ranunculus ficaria*) **
morning-glory (*Ipomoea* spp.) **
orchard grass (*Dactylis glomerata*) **
Pacific water-parsley (*Oenanthe sarmentosa*)
periwinkle spp. (*Vinca major or V.minor*) **
piggy-back plant, youth-on-age (*Tolmiea menziesii*)
policeman's helmet (*Impatiens glandulifera*) **
poison hemlock (*Conium maculatum*) ** All parts are poisonous
pond-lily (yellow), cow-lily (*Nuphar polysepalum*)
pond-lily (pink), fragrant water-lily (*Nuphar odorata*) *
purple salsify, oyster plant (*Tragopogon porrifolius*) **
Queen Anne's lace, wild carrot (*Daucus carota*) **
reed canary grass (*Phalaris arundinacea*) **
St. John's wort (*Hypericum perforatum*) **
silver dollar plant, money plant, honesty (*Lunaria annua*) **
skunk cabbage (*Lysichiton americanum*)
slough sedge (*Carex obnupta*)
small-flowered bulrush (*Scirpus microcarpus*)
soft-stemmed bulrush (*Schoenoplectus tabernaemontani*)
sword fern (*Polystichum munitum*)
trailing blackberry (*Rubus ursinus*)
tule, hard-stemmed bulrush (*Schoenoplectus acutus*)
trailing blackberry (*Rubus ursinus*)
watercress (*Nasturtium microphyllum*) **
water-plantain (*Alisma plantago-aquatica*)
willowherb (*Epilobium* spp.)
yellow archangel, lamium (*Lamiastrum galeobolon*) **
yellow flag iris (*Iris pseudacorus*)

TABLE C.2. SUMMARY of INVASIVE SPECIES (by REACH)

Reach	Trees	Shrubs	Other	*Notes
Reach 1A	golden willow, golden chain tree, English hawthorn	Approximately 20% invasive, 80% non-native in total. Himalayan blackberry, laurel hedge, English holly, spurge-laurel,	English ivy, traveler's joy, morning glory, Canada thistle, *Japanese knotweed, *policeman's helmet, *lesser celandine, *shiny geranium, ornamentals, lawn	- Japanese knotweed and policeman's helmet were observed in 2011 and not observed in September 2022 - The knotweed may have been removed by hand or erosion - Policeman's helmet, lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 1B		Himalayan blackberry, laurel hedge, English holly, spurge-laurel	English ivy, orchard grass, *hanging sedge, morning glory, creeping buttercup, *lesser celandine, *shiny geranium	- Remove new invasive hanging sedge before it spreads further - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 1C		English Ivy, Himalayan blackberry, spurge-laurel,	reed canary grass, traveller's joy, European bittersweet, morning glory, creeping buttercup, *hanging sedge, thistle, *lesser celandine, *shiny geranium	- Remove new invasive hanging sedge before it spreads further - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 3A	golden willow	Himalayan blackberry	English ivy, reed canary grass, European bittersweet, yellow flag iris, curly dock, *Japanese knotweed, *lesser celandine, *shiny geranium	- Japanese knotweed and policeman's helmet were observed in 2011 and not observed in September 2022 - The knotweed may have been removed by hand or erosion - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 3B		Himalayan blackberry	European bittersweet, reed canary grass traveler's joy, Queen Anne's lace, morning glory, *lesser celandine, *shiny geranium	- Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 5A	golden willow, golden chain tree, English hawthorn,	Scotch broom, Himalayan blackberry	English ivy, European bittersweet, *European black nightshade, spurge-laurel, morning glory, grasses, *lesser celandine, *shiny geranium	- Remove invasive European black nightshade that establishing in topsoil at top of bank of the new erosion protection, removal now could prevent it from spreading downstream - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 5B		Himalayan blackberry	English ivy, creeping Taiwan bramble, wisteria, *yellow flag iris, *lesser celandine, *shiny geranium	- Yellow flag iris was not observed, but has been reported in this reach previously - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 7A	golden willow, English hawthorn	Himalayan blackberry, Scotch broom, spurge-laurel, laurel hedge, English holly	English ivy, European bittersweet, morning glory, grasses, Canada thistle, creeping buttercup, traveller's joy, woodbine, *lesser celandine, *shiny geranium	- Large golden willow population in the upper part of this reach - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 7B	golden willow, *white poplar, English hawthorn, golden chain tree	Himalayan blackberry, English holly, spurge-laurel, laurel hedge	European bittersweet, *European black nightshade, English ivy, periwinkle, thistle, morning glory, orchard grass, reed canary grass.	- White poplar and European black nightshade are newer invasive species that are becoming established in the reach, controlling them now may prevent spreading downstream - Lesser celandine, shiny geranium, are likely present but were not visible during the late summer site visit
Reach 9	golden willow, field maple, English hawthorn, ornamental hazelnut,	Himalayan blackberry, laurel hedge, Scotch broom, English holly,	English ivy, morning glory, traveller's joy, European bittersweet	- Large golden willow population in this reach - Field maple is a newer invasive species that are becoming established in the reach, controlling them now may prevent spreading downstream
Reach 12A	golden willow, chestnut, golden chain tree, English hawthorn	Himalayan blackberry, English ivy (trees and ground), laurel hedge, English holly, Scotch broom, privet,	European bittersweet, morning glory, herb-Robert, St. John's wort, thistle, yellow archangel, ornamental vegetation.	

Reach	Trees	Shrubs	Other	*Notes
Reach 12B	*golden willow, chestnut, field maple, English hawthorn,	Himalayan blackberry, laurel hedge, English holly, black ash,	English ivy, creeping buttercup, thistle, morning glory, ornamentals	- Area planted by Saanich Parks (next to the trail) with logs added on the west bank, is a location for dumping yard waste by the neighbours and has additional invasive species: thistle, Himalayan blackberry, morning glory, and other ornamentals. - Field maple and black ash are newer invasive species that are becoming established in the reach, controlling them now may prevent spreading downstream - Managing golden willow should start in the upstream populations such as Reaches 12b and 17b to prevent re-introduction into downstream reaches after the willows are removed.
Reach 15A	English hawthorn	Himalayan blackberry, English holly, spurge-laurel	yellow flag iris, English ivy, creeping buttercup, *hanging sedge (possibly)	- while not observed during the site visit, the landscaping around the pond maybe be the source of a new invasive hanging sedge (*Carex pendula*), observed downstream of the site
Reach 15B		Himalayan blackberry, English holly, English hawthorn, Scotch broom,	English ivy, creeping buttercup, reed canary grass, curly dock, creeping buttercup, European bittersweet, watercress, morning glory, thistle, *hanging sedge	- hanging sedge is a new invasive (1 large plant) adjacent to Parking Lot 9 (Photo 5), removal now may prevent spread downstream
Reach 15C		Himalayan blackberry, spurge-laurel	Creeping buttercup, *Canada thistle, reed canary grass, spurge-laurel, English ivy, European bittersweet, morning glory, agricultural grasses.	- where mowing has ceased along the riparian area (presumably to allow the riparian area to expand), Canada thistle is becoming established and should be removed to prevent further spread
Reach 17A	golden chain tree, English hawthorn	Himalayan blackberry, English holly	English ivy, morning glory, reed canary grass, thistle, curly dock, creeping buttercup, agricultural grasses	
Reach 17B	*golden willow, English hawthorn	Himalayan blackberry, English holly, Scotch broom	reed canary grass, English ivy, thistle, European bittersweet, morning glory, creeping buttercup, curly dock, watercress, agricultural grasses.	- Managing golden willow should start in the upstream populations such as Reaches 12b and 17b to prevent re-introduction into downstream reaches after the willows are removed.
Reach 17B		*Himalayan blackberry, *Scotch broom, black ash, spurge-laurel,	European bittersweet, creeping buttercup, watercress, morning glory, periwinkle, dock, thistle, burdock, grass.	- In the gully area, golf course staff has removed Himalayan blackberry and Scotch broom, however it is starting to re-establish and needs to be maintained
Reach 17C		Himalayan blackberry	reed canary grass, morning glory, yellow flag iris, queen Anne's lace. fragrant pond-lily (pink).	- reed canary grass and yellow flag iris control will help prevent spread in downstream reaches