GEORGIA GREENWAY MULTI-USE TRAILWAY AND BRIDGE CROSSING (Phase 1)

PRE-DESIGN MEMO (FINAL)

NANAIMO, BC

Prepared for:

411 Dunsmuir Street
Nanaimo, BC V9R 0E4
Attn: Kurtis Noble, AScT
Project Manager

Prepared by:

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Submittal Date:
May 9, 2018

H.E.L. Project No.: 0017-316

HEROLD ENGINEERING

May 11, 2018 0017-316/02

City of Nanaimo Engineering Department
411 Dunsmuir Street
Nanaimo BC
V9R 0E4

Attn: Kurtis Noble, AScT - Project Manager

Re: Georgia Greenway Multi-use Trailway and Bridge Crossing - Phase 1
Pre-Design Memo - Final

Dear Kurtis:

Herold Engineering Limited is pleased to submit this revised Pre-Design Memo relating to the above noted project.

We look forward to the successful completion of this project. If you have any questions or comments relating to this report, please contact the undersigned.

Yours truly,

HEROLD ENGINEERING LIMITED

Patrick Ryan, P.Eng.
Project Manager
Associate

Steve Scott, P.Eng.
Reviewer
Principal

Enclosure

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APPENDICES

1. INTRODUCTION AND SCOPE

Phase 1 of the Georgia Greenway is one of the Top 5 Key Capital Projects and Initiatives in the 2016-2019 Strategic Plan Update. The purpose of the Georgia Greenway is to provide a pedestrian and cycling friendly route through the Harewood neighbourhood. The Georgia Greenway will link a number of key destinations within the neighbourhood including schools, parks, sports fields, and commercial areas. It will create a comfortable experience for users of all ages, abilities, and confidence levels.

The 2013 Harewood Neighbourhood Plan identified the Georgia Greenway project with statements such as:

"Create a neighbourhood street bikeway on Georgia Avenue, including a multi-use pass across Harewood Centennial Park and a multi-modal bridge across the Chase River. This route will utilize rea lanes as well as sections of Georgia Avenue between Fourth Street and Eighth Street. Over time, the route could be developed into a full greenway street with traffic calming features to limit/slow vehicular traffic." Part F, 1.9 (3) Page 72

"As part of the Georgia Avenue bikeway, create a new 4.0 metre wide multi use pathway across Harewood Centennial Park, with a new multi-modal bridge over the Chase River." Part F, 8.1 (26) Page 127

The City of Nanaimo (City) has retained Herold Engineering Limited (HEL) for engineering consulting services related to Phase 1 of the project, which consists of the installation of a 410m long, 4.0m wide paved multi-use trailway along the Georgia Avenue alignment between Sixth and Seventh Streets. The project also includes a bridge crossing of the Chase River. The scope of work includes Civil Engineering services, Electrical Engineering Services, Geotechnical Engineering Services, Public Engagement Services, and Environmental Services.

This Pre-Design Memo consists of the work completed to date including:

1. Review of trailway and bridge alignment options
2. Review of bridge structure and foundation options
3. Sub-consultant reports for Archeological, Environmental, Geotechnical, Lighting, and Public Engagement components of the project
4. Stakeholder Consultation

The City's intent is to construct the project in 2018.

2. PUBLIC ENGAGEMENT

A detailed Public Engagement process was held for this project which was administered by Lanarc and City staff. The public engagement process included:

- A drop-in public event with an interactive kiosk as part of the Active for Life Expo on May13, 2017
- A public survey that was available online and in hard copy
- City Staff attendance at the Georgia Avenue Celebration Station for Bike to Work Week on May 29 and June 1, 2017

162 surveys were completed and returned from various parts of Nanaimo but primarily residents of the Harewood neighbourhood.

Some of the main themes of the survey results included the following:

1. Overall, participants were supportive of the project

2. The top three evaluation criteria most important to respondents were:
    a. Crime Prevention Through Environmental Design (CPTED)
    b. Pedestrian/Cyclist ease of use
    c. Separation from vehicle traffic

3. Concept Design Considerations included the use or implementation of:
    a. LED lighting
    b. Benches and rest points
    c. Fencing as a buffer between the trailway and fields (either black or wood)
    d. Trail markers to indicate location and access points
    e. Tree planting and careful management of invasive plants

The RCMP states that CPTED is 'an approach to building and property planning and development that reduces opportunities for crime'. CPTED reduction measures include:

- Territoriality - fostering residents' interaction, vigilance, and control over their neighbourhood.
- Surveillance - maximizing the ability to spot suspicious people and activities.
- Activity support - encouraging the intended use of public space by residents.
- Hierarchy of space - identifying ownership by delineating private space from public space through real or symbolic boundaries.
- Access control/target hardening - using physical barriers, security devices and tamper-resistant materials to restrict entrance.
- Environment - a design or location decision that takes into account the surrounding environment and minimizes the use of space by conflicting groups.
- Image/Maintenance - ensuring that a building or area is clean, well-maintained, and graffiti-free.
  Source: RCMP Website

Please refer to **Appendix C** for the full feedback summary report, which included the overall Georgia Greenway project as well as Phase 1 components.

3. TRAILWAY ALIGNMENT

The approximate alignment for the trailway was identified by the City prior to the RFP process but has been refined based on site constraints. The Phase 1 trailway alignment can be broken out into three distinct sections, from North to South:

1. Sixth Street to Chase River Crossing
2. Chase River Crossing
3. Chase River Crossing to Seventh Street

The base design guidelines for the trailway include

- City of Nanaimo - Bicycle Facility Design Guidelines (September 2008)
- Transportation Association of Canada (TAC) - Geometric Design Guide for Canadian Roads – Bicycle and Pedestrian Integrated Design

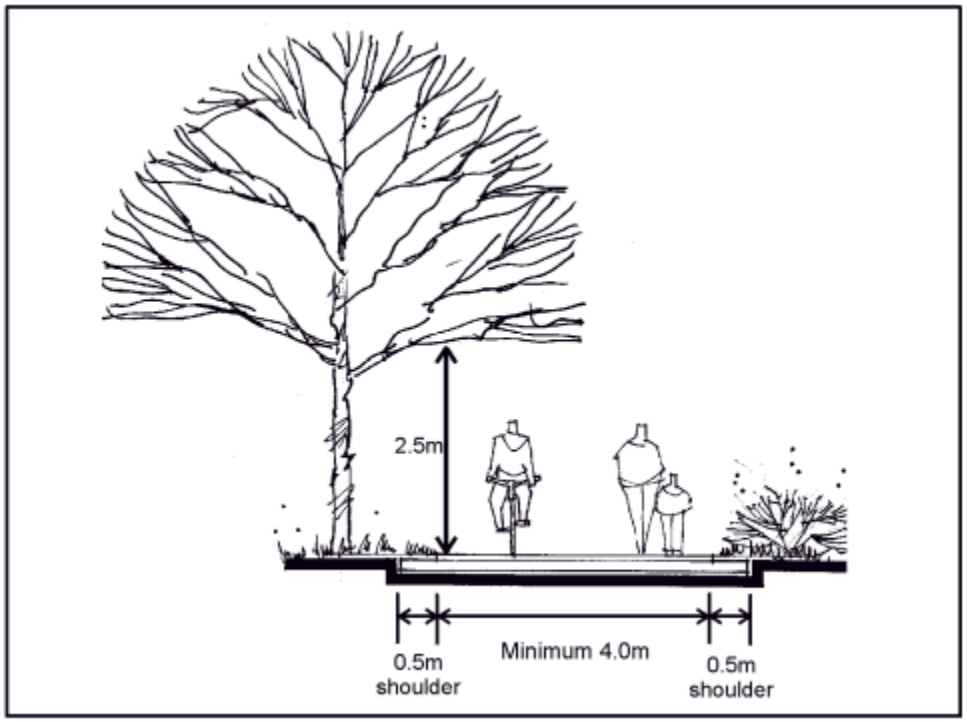


Figure 3.1 – Concept Drawing for Multi-use Pathway
Credit – City of Nanaimo Bicycle Facilty Design Guidelines

3.1. Sixth Street to Chase River Crossing

The alignment from Sixth Street to the Chase River crossing begins on the north side of Sixth Street with a curb extension and a yield controlled crosswalk. Currently, there is an existing east-west sidewalk along the north side of Sixth Street between Georgia Avenue and Howard Avenue, which will provide connection to Howard Avenue for trailway users. A new sidewalk has been proposed along the south side of Sixth Street between Georgia Avenue and Bruce Avenue to connect trailway users to Bruce Avenue.

The existing west access to 501 Sixth Street (Willow Grove Estates Apartment Complex) currently extends into the 10m ROW and will have a new sidewalk letdown driveway access to keep it separate from the trailway pedestrian crossing. Bollards will prevent vehicle traffic from using the trailway alignment unless for emergencies or by special permission. See drawing **C02** in **Appendix A**.

Figure 3.2 – Sixth Street/Georgia Avenue intersection looking south towards 10m wide road ROW

The alignment continues through a 10m wide undeveloped road right-of-way (ROW) that is approximately 90m long. Constraints to the trailway alignment in this section include the ROW width, established oak trees along the east side of the alignment, and a large retaining wall down into the parking lot of 501 Sixth Street.

In 2001 a 1050mm diameter storm sewer was installed along the west edge of the ROW along with catch basins for area drainage. The storm sewer terminates at Chase River with a large outlet headwall.

In addition, residents of 577 Sixth Street use the ROW for occasional parking and access to their yards. One resident has constructed a fence that encroaches 2.3m into the ROW, for a length of 19m, which is subject to an encroachment agreement between the owner and the City. This agreement has been in place for 20+ years and is renewed annually.

City Staff contacted residents who reside directly adjacent to this section of the alignment to discuss concerns over access to backyards, noise/light pollution, safety, and parking. Through much consultation, the City was able to mitigate several of the concerns with the exception of parking in the ROW which will no longer be permitted. As stated previously, removable locking bollards to prevent vehicle access into the undeveloped right of way, except for times when City crews need to access for maintenance, or when residents with backyards directly adjacent to the right of way need to access their properties. Access by the property owners is intended to be very occasional and details will be arranged between the City and the property owner.

The trailway and bridge crossing will have appropriate lighting that is respective of adjacent neighbours and the environment while providing safe levels for trailway users. Fencing will be placed to deter access from the north bridge abutment to adjacent properties.

Figure 3.3 – 10m wide road allowance looking south

Figure 3.4 – 10m wide road allowance looking north

3.2. Chase River Crossing

The Chase River crossing is located between the south end of the 10m ROW and the northeast corner of Harewood Centennial Park (HCP). The trailway will cross this section via a new bridge with a 4.0m wide bridge deck. Constraints to the bridge alignment include the:

- relatively narrow width of the 10m ROW, the crossing length, which is approximately 25m between the tops of banks,
- significant trees,
- existing storm sewer headwall, and
- location of the covered multi-purpose court at HCP which is currently under construction.

The three significant trees that have been identified are a big leaf maple at the top of the riverbank on the north side (70cm diameter) and two black cottonwoods within the floodplain of the river (120cm and 140cm respectively). Both Cottonwood trees are considered 'Landmark Trees' as per the City Tree Management Bylaw. There are also two other black cottonwood trees to the west of the larger cottonwoods which are 40cm & 50cm diameter.
The proposed river crossing was subject to an Archaeological Overview Assessment, and Environmental Assessment, a Geotechnical Investigation, as well as a Constructability Review; all of which are discussed further in **Sections 3 & 6-8** of this report. Sub-consultant reports are enclosed in **Appendix D**.

Figure 3.5 – Storm Sewer Headwall looking north

Figure 3.6 – Large Cottonwood trees in the Chase River floodplain

In light of these constraints, three bridge alignment options were considered and are discussed below. These options are discussed further from a structural and constructability standpoint in **Section 3**.

The proposed bridge is 30m long and will have a grade of 2-3%. As there is an elevation difference of 1.8m between the tops of banks, the southern abutment will be approximately 1-1.2m of fill above existing grade.

Option 1

Option 1 is a straight-through alignment from the east side of the 10m ROW directly south.

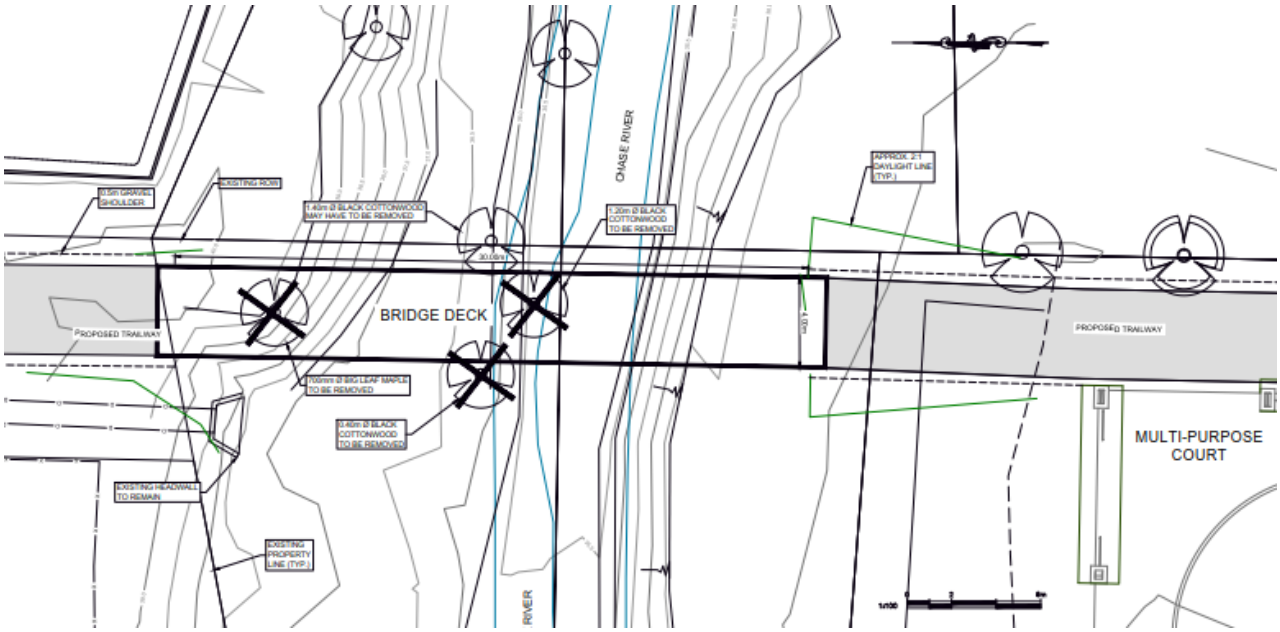


Figure 3.6 – Alignment Option 1

PROS	CONS
• Provides most straightforward alignment and optimal sightlines	• Requires removal of the Maple tree* and at least one Cottonwood tree
• Avoids conflict with existing storm sewer headwall (with spread footing construction – See **Section 3**)	• May require significant pruning of eastern Cottonwood tree (140cm)
• Shortest Bridge length (Approx. 5m shorter – lowest cost)	• Cottonwood branches left in place would overhang bridge
• Pile driving is away from existing headwall	*N/A*
• All precast elements limits time within riparian area	*N/A*
• Provides improved access to existing headwall	*N/A*

Note that a bridge constructability review suggested removal of the Maple tree to allow for pile driving, bridge girder launching and for general ease of construction staging – see **Section 4 for additional information. It is recommended that the Maple tree be removed in all of the three options.*

Option 2

Option 2 goes from the west side of the 10m ROW and angles slightly to the east to avoid the cottonwood trees. Option 2 will have the most complex abutment foundation as it needs to accommodate the existing storm sewer and would make any future maintenance access to the headwall more difficult as it would be underneath the bridge.

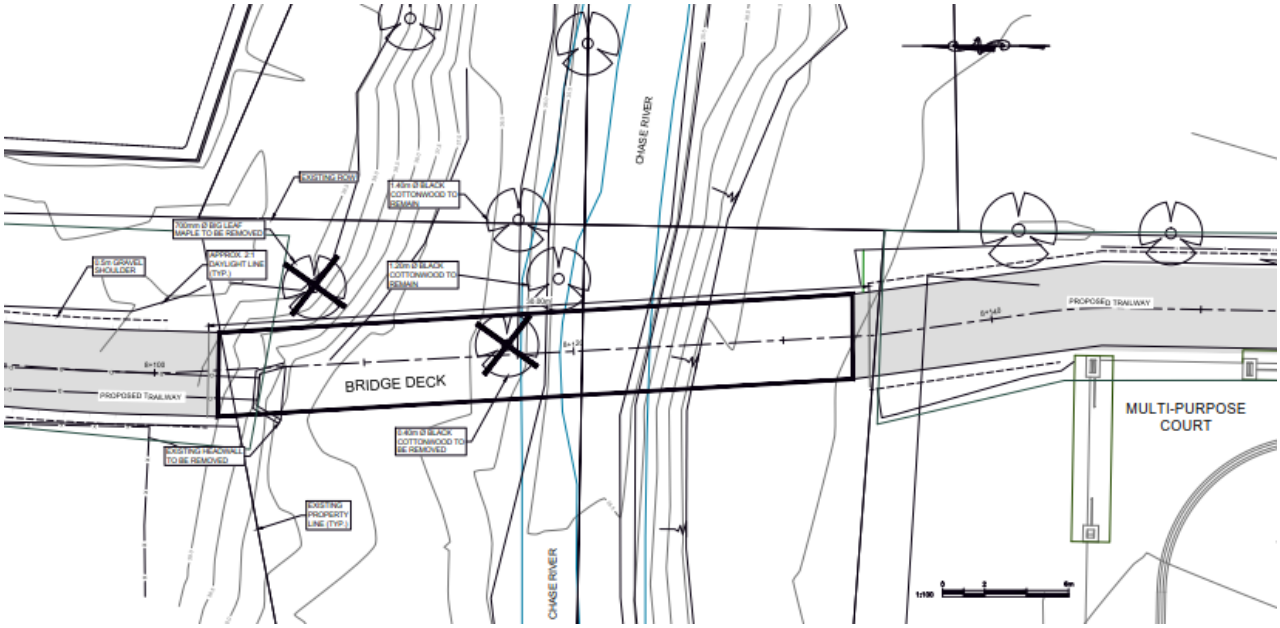


Figure 3.7 – Alignment Option 2

PROS	CONS
• Maintains Landmark Cottonwood trees	• North abutment overlaps with existing storm sewer and headwall, resulting in more complex foundation requirements and potentially impeding headwall maintenance abilities.
• Relatively straightforward alignment	• Highest risk of earthworks encroaching into private property
N/A	• Requires removal of Maple tree
N/A	• May require significant pruning of 120 cm Cottonwood tree
N/A	• Cottonwood branches left in place would overhang bridge
N/A	• Requires longer time within riparian area (complex foundation)

Option 3

Option 3 goes from the east side of the 10m ROW and angles west to avoid the cottonwood trees. This results in an alignment change at the southern bridge approach which could be difficult for cyclists to manage.

Although there is an abrupt alignment adjustment at the south abutment, the centerline radii are still within the TAC guidelines (Chapter 5 – Section 5.5) for a bicycle travelling at 20 km/h (10m radius).

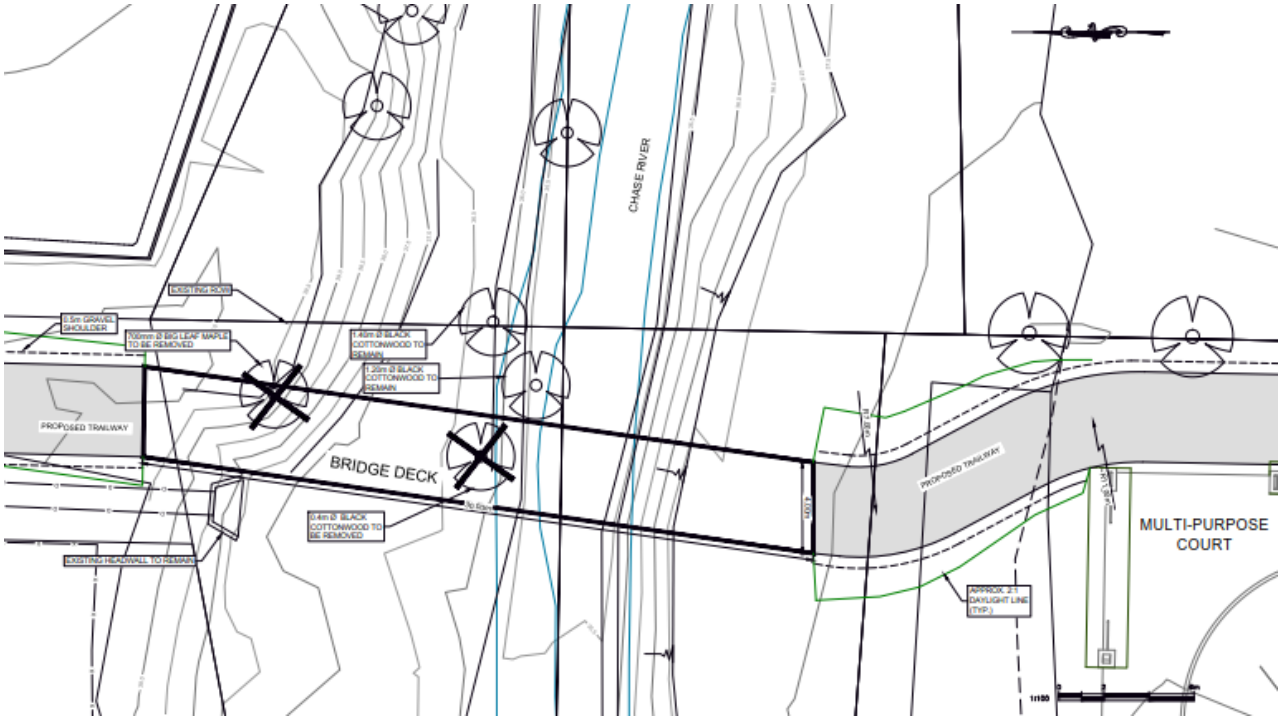


Figure 3.8 – Alignment Option 3

PROS	CONS
• Maintains Landmark Cottonwood trees	• Immediate curve required at south end of the bridge
• Avoids conflict with existing storm sewer headwall	• Poor sightlines
• Pile driving is away from existing headwall	• May require significant pruning of 120cm Cottonwood tree
• Provides improved access to existing headwall	• Cottonwood branches left in place would overhang bridge
N/A	• Requires removal of Maple tree

The recommended alignment, from a constructability and cost perspective, is Option 1. Please see **Sections 10 and 11** for costs and conclusions.

3.3. Chase River Crossing to Seventh Street

The final section of the alignment continues south within a 6m wide space between the covered multi-purpose court and the eastern property line between HCP and John Barsby Secondary School. The trailway alignment will veer east into the adjacent school property opposite the existing HCP washroom building to avoid a sloped bank and minimize earthworks. Discussions with School District 68 have indicated that this overlap is permissible – See **Section 9**.

Figure 3.9 – Alignment through park, looking north at existing washroom building

The trailway will veer to the west to align with the proposed yield controlled crosswalk across Seventh Street. Prior to crossing Seventh Street, the trailway intersects with the existing sidewalk on the north side of Seventh Street, and the intersection will have a curb extension for traffic calming and to reduce the length of the crosswalk.

The south side of Seventh Street will also have a curb extension and will direct trailway traffic up to the sidewalk and then either onto the roadway (for bicycle traffic) or to stay on the sidewalk (for pedestrian traffic *(refer to Figure 3.11)).*

Three trailway 'nodes', or rest and access/intersection points, are proposed in this section of alignment to take advantage of proximity to the covered multi-purpose court, walkways to the high school, and control access to the HCP fields. Each node is a location for bench seating, a refuse bin, can have informational and/or historical signage, and has the potential to act as an intersection with other trailways or walkways. The City has advised that the section south of the existing washroom building to Seventh Street should be contained to avoid trailway users entering the playfields at non-specific locations. Powder coated black chain link fencing or wooden split rail fencing is proposed for this boundary *(refer to Figure 3.10).*

Figure 3.10 – Alignment through park, looking south

Figure 3.11 – Looking north across Seventh Street at proposed crosswalk

4. BRIDGE CROSSING

The pre-design considerations for the Chase River Crossing in Harewood Centennial Park are generally as follows:

Based on the topographic survey that was conducted in April of 2017, a single span structure appears to be most suitable for this location. Single span structures minimize the in-stream work since they don't require piers in the river channel and allow for the best hydraulic opening below the structure (less likely for debris to get caught up in the flood channel). Q200 flood level is estimated at approximately 37.20 - 37.40m (depending on the final bridge width opening). For reference, the existing elevations for the north and south side top of bank are 39.70m & 37.90m respectively.

4.1. Structural Options

There are several options available for materials and structure-types for a single span crossing of this size. The conceptual designs that are presented include a pre-stressed box girder design, a weathering-steel girder design and an aluminum or steel truss design. Bridge drawings are provided in **Appendix B**.

The following photos show some of the available types of structures.

Figure 4.1 – Example of Concrete Box Girders and Galvanized Railing (Cat Stream Crossing near Park Avenue in Nanaimo)

Figure 4.2 – Example of Steel Girders and Timber Guardrails (Bings Creek Crossing near Duncan)

Figure 4.3 – Example of a Steel Truss Bridge with Integral Guardrails (Elk River Crossing near Sparwood)

4.1.1. Economy of Construction

The best economy for up-front construction costs would likely be achieved by using steel girders and timber deck. This option would however require ongoing maintenance of the timber deck. Ornate and decorative guardrails are possible if desired, but would carry additional cost to the project.

4.1.2. Material Durability and Maintenance Requirements

Generally speaking, concrete offers the best durability and lowest maintenance for this type of installation. Concrete structures require little to no maintenance for the first 10 years of their service life, but are subject to graffiti. Weathering steel structures also require little to no maintenance but can stain concrete at the abutments if left uncoated. Aluminum structures also require little maintenance but can be damaged by vandalism as aluminum is a relatively soft material. Aluminum is also subject to graffiti. Galvanized steel can be subject to visible rust if the application is not done in sufficient quantity.

4.1.3. Aesthetics

While appearance and aesthetics are somewhat subjective, general statements can be made for rating the different options being presented. Truss structures can be "Industrial" in appearance and may or may not fit into a park setting. Timber decks and guardrails are generally well accepted in a park environment, but can require additional maintenance over the other options. Concrete is generally viewed as clean and modern looking but can attract graffiti. Public response to weathering steel is varied. Some find the orange iron appearance to blend into a natural environment (particularly when combined with timber guardrails), others view weathering steel as industrial looking. Galvanized structures are generally viewed as industrial as well, but combined with concrete can provide a modern looking structure.

4.1.4. Travel Surface & User Comfort

Paved deck surfaces generally provide the best user comfort as they are smooth, blend well with approach pathways and normally provide good traction in wet conditions. Paved surfaces do have a tendency to crack at the interface of trail and bridge, however. Concrete is the most durable of deck surfaces and can be made to provide good traction in wet or icy conditions (using a tined surface or broom finish). Timber decks provide good user comfort for pedestrians, but cyclists and other wheeled users will notice the spaces between deck boards. Timber decks usually require additional surfacing to provide traction in wet or icy conditions (e.g. expanded metal mesh, roof shingles). Grating surfaces (either metallic or fibre-glass) are sometimes used on pedestrian structures to provide a light-weight design and open drainage. In order to provide traction on grating surfaces, serrations or other texturing is normally required. It should be noted that dogs generally prefer solid surfaces and some won't cross bridges that use grating surfaces.

4.2. Public Engagement Feedback

Some of the feedback that was received during the Public Engagement process (**Section 2**) in relation to the bridge crossing included:

1. Provide vandalism resistant materials (avoid use of timber components)
2. Restrict access to underneath the bridge
3. Provide direct line of sight from Sixth Street (straight alignment preferred by RCMP)

4.3. Existing Trees

As noted in **Section 3.2**, there are trees within the proposed bridge alignment. From a bridge construction perspective, these trees are a constraint for the following reasons:

1. Depending on the alignment option, they present a physical barrier
2. They present a barrier to construction/installation of the bridge in that the tree canopy prevents installing the bridge girders and precast deck panels by crane.
3. A risk to the constructed bridge, the removal of any tree in the immediate vicinity will further expose any remaining trees to wind movement and the possibility of falling branches which could significantly damage the railings, the bridge superstructure, or users of the bridge.

It should be noted that even if the two large cottonwoods were removed, the stumps and root system would be left in place for wildlife habitat and to reduce impact on the river channel itself.

4.4. Constructability

A constructability review was conducted on site on August 29th, 2017 with Mr. Glen Knappett, the former owner of a local contracting company. General comments were as follows:

1. Due to proximity of trees and the size of the tree canopy, launching of girders would likely be more feasible that lifting, bridge design should consider this. Steel girders are favoured over pre-stressed concrete boxes to allow for launching.
2. The existing Maple tree at the top of the bank on the north side of the river should be removed for launching of girders and for general construction staging.
3. Cast in place spread footings would likely be most economical versus piles. There doesn't appear to be an advantage to using pre-cast foundation components (i.e. not a remote site).
4. Pre-cast concrete deck panels are feasible and likely the most appropriate option, given the requirement for vandalism resistant materials and a paved deck surface.
5. Vibrations to existing structures during pile driving can be minimized by excavating around the structures to minimize vibration passing through the soil.

4.5. Effect of Trail Alignment on Bridge Structure

While alignment option 2, with the bridge structure over the existing outfall pipe, does provide the best option to avoid tree removal, it presents the following technical challenges:

1. The existing headwall structure would likely have to be removed in order to allow for construction of new foundations.
2. If spread footings are used for this option, they would have to be founded below the existing outfall pipe. This would require a large and deep excavation immediately adjacent to the property line.
3. Trail alignment over the existing outfall would not allow for direct line of sight from Sixth Street, as requested by the RCMP during the stakeholder engagement process.

4.6. Foundation and Abutments

Two styles of foundations were considered – piles and spread footings.

Piled foundations provide the best performance for scour resistance and minimize the amount of site excavation that needs to take place. Piled foundations also minimize the potential for settlement. Piled foundations require access for a pile driving rig to access the location, and do create substantial noise during driving, but this is generally a short-term activity in relation to the overall bridge installation.

Spread footings are generally less expensive to construct than piled foundations but do not offer the same level of scour resistance and normally represent a technical compromise in favour of economy. For pedestrian bridges not requiring emergency vehicle access, spread footings are common practice. The option we have presented in the appendix for a bridge on spread footings shows that footings would be a substantial distance away from the main river channel which would tend to mitigate scour.

From drawing **SK2** in **Appendix B**, it appears possible to place footings on native till and still be above the Thalweg elevation of the Chase River (meaning that excavation for the footings during the dry season is feasible). For this site, the geotechnical report indicates that materials above the native till are not suitable for founding spread footings upon. This means that a large excavation would be required to install spread footings. The cost differential between spread footings and piled foundations on this site is therefore nominal. In other words, the advantage usually given to spread footings in terms of construction cost does not appear to exist on this site.

The geotechnical report advises piled foundations for best performance in terms of earthquake and scour resistance. The geotechnical report recognizes that it is not the intent to meet the full requirements of CSA S6-14 for this project but nonetheless recommends piled foundations due to potential costs associated with excavating for spread footings.

Please see **Section 8** for a summary of the geotechnical report and **Appendix D** for the full geotechnical report.

4.7. Guardrails

Much of the aesthetic quality of a pedestrian bridge is determined by the guardrail type. Options for guardrails are numerous and can include timber, steel, aluminum, powder-coated, galvanized or other finishes. Guardrails for pedestrian bridges are generally designed to the Canadian Highway Bridge code, as modified to suit the specific requirements of the trail or roadway that the bridge is located on.

The Chase River crossing being studied will be part of a multi-use trailway accessed by pedestrians, wheelchairs, cyclists, parents with strollers, skateboarders, etc. For park settings, the usual approach is to mitigate risks of users falling off the structure while balancing the ability of users to enjoy the view. Off the bridge, guardrails will transition to fencing where appropriate to restrict access to underneath the bridge and direct users away from the top of the riverbank.

The guardrails may need to incorporate supports for bridge lighting and/or fit with bollard lighting and we can confirm that this is technically feasible (refer to **Section 5**).

Railings can be made simple and functional like the example given for a BC MoTI standard railing, or they can be ornate and architectural. The choice depends on cost and durability.

4.8. Recommendations

Based on the above criteria and the previous discussions, our recommendation for the optimal bridge structure at this site is as follows:

- Structural steel girders (allows for launching), using weathering finish (minimal paint for ease of maintenance)
- Driven steel pipe piles
- Pre-cast concrete pile caps
- Pre-cast concrete deck with paved travel surface (for durability and function)
- Aluminum guardrails with black powder coated pickets (allows for durability and aesthetic appeal)
- Alignment Option 1 (from **Section 3.2**) to provide the best sightlines and avoid interference with the existing outfall pipe and headwall.

5. LIGHTING

RB Engineering Limited completed a lighting review for the Phase 1 alignment, including the bridge crossing, as well as for Georgia Avenue between Fifth and Sixth Streets and the intersections of Georgia/Sixth and Georgia/Seventh.

Please refer to **Appendix D** for the full version the lighting reviews, including cut sheets for each proposed trailway lighting product.

5.1. Trailway Alignment

Feedback during the Public Engagement process (See **Section 2**) listed Crime Prevention Through Environmental Design (CPTED) as one of the top three evaluation criteria from the public. Lighting levels are one way to make areas safer and make it more difficult to carry out inappropriate or criminal activities and will be considered in the overall design of the project.

Three options of lighting styles were reviewed for the trailway alignment, listed as Options 1, 2 & 3 in the RB Engineering report.

- Option 1 – Cree Edge Series
- Option 2 – Cyclone Domia Pendant
- Option 3 – LED solar Powered Pathway Lighting

The design criteria for the trailway (per City standards for walkways) was identified as 4 lux and a uniformity ratio of 6:1. 19 Cree Edge fixtures would be suitable for the entire trailway alignment, or an approximate spacing of 20-25m. It should be noted that the spacing requirement did not take into account specialty lighting at the bridge crossing, or lighting from the adjacent covered multi-purpose court.

Order of magnitude costs for each option (including poles, bases, and wiring) are $47,000, $150,000 and $112,500, respectively.

The City advised that they like the 'Cree Edge Series' lighting which has been used in previous bikeway projects, due to its limited amount of fixtures and cost effectiveness. The luminaires would be mounted 3.3m above the trailway surface and would focus light along the path to avoid excessive light pollution to neighboring properties.

The Harewood Centennial Park covered multi-purpose court has its lighting controls located inside the existing washroom building and an extra power feed is being supplied to power the trailway lighting. An additional feed may be required for the section between Sixth Street and Chase River.

5.2. River Crossing

Trailway lighting, as discussed in **Section 4.1**, would provide a trailway scale lamp standard at each bridge abutment with the travelled section of the bridge being lit by bridge lighting options.

The lighting over the Chase River poses a unique challenge as the following considerations have to be made:

1. Light spillage over the watercourse
2. Incorporation into the bridge deck and/or guardrail system
3. Resistance to weather and vandalism

Bridge lighting is a balance of safety and environmental consideration. Best practices from an environmental perspective include the following:

- Limiting times lights are on
- Choosing appropriate fixtures
- Directing light only where it is needed (angled fixtures, fixture shields)
- Using vegetative screening
  Source: The Nature Conservancy

Lighting options that were considered include: fixtures embedded into the concrete bridge deck rail that shine in towards the travelled surface of the bridge, strip lighting that can be fixed to the guardrail or bridge decking, and bollard lighting that can be incorporated into the bridge railing that shines in towards the bridge surface.

The recommended approach is that bollards be installed, these allow for the greatest flexibility and are less susceptible to vandalism.

5.3. Intersection Crossings

The lighting review took place on April 18, 2017 and consisted of a visual inspection of the existing luminaires.

Based on the lighting review, the lighting levels for both Georgia Avenue and the intersections are about half what they should be in order to meet current City lighting standards. In order to achieve current lighting standards, the street lighting would need to be re-designed with 150W HPS or equivalent LED luminaires at appropriate spacing.

New roadway lamp standards will be installed at the Georgia/Sixth and Georgia/Seventh intersections to provide required lighting for the trailway crossings.

6. ENVRIONMENTAL ASSESSEMENT

Environmental Dynamics Inc. (EDI) completed an Environmental Assessment Summary for the bridge crossing site, up to and including the 15m setback from top of bank for the North and South sides of the Chase River. The assessment included both a desktop review and field review components, and offers the following information:

1. The field review was completed on April 17, 2017
2. Chase River is known to contain several fish species
3. The alignment contains potential nesting habitats
4. Construction of in-stream works are to take place between June 15 and September 15 and any work inside the wetted perimeter are to take place between August 15 and September 15.
5. EDI will prepare the required Section 11 Notification (Ministry of Environment), a Request for Review (Department of Fisheries and Oceans) may also be required
6. EDI will prepare an Environmental Protection Plan (EPP) to provide direction on environmental requirements during construction
7. Opportunities for riparian enhancement exist at the north and south abutments.
8. Three significant trees were identified, all with roots that provide structural stability functions to the edge of the channel and floodplain as well as habitat value:
    a. ISL 205 – 70cm dbh Big Leaf Maple at the top of the bank on the north side of the proposed crossing
    b. ISL 206 – 120cm dbh Black Cottonwood located near the centre of the alignment beside the natural boundary of the river.
    c. ISL ??? (broken tag) – 140cm dbh Black Cottonwood downstream of the centre of the alignment within the floodplain of the river.
9. Any trees removed should be replaced with the full ratio of tree compensation per the City bylaw.

Please refer to **Appendix D** for the full assessment summary.

7. ARCHAEOLOGICAL ASSESSMENT

Golder Associates completed an Archeological Overview Assessment (AOA) of the Chase River crossing. The assessment included a desktop review, and offers the following information:

1. Local Snuneymuxw First Nation was identified to have interest in the area and was notified of the AOA.
2. The project area is considered to have low archaeological potential for the presence of archeological sites.
3. There are no registered archaeological sites in the project area, and there is one within 1km (650m west).
4. Golder recommends the City retain an archeologist to prepare a project specific ‘chance find’ procedure to guide project construction personnel.
5. Golder recommends that a Section 14 Heritage Inspection Permit be obtained prior to ground disturbance within the bridge crossing area.

Please refer to **Appendix D** for the full assessment.

8. GEOTECHNICAL ASSESSMENT

Tetra Tech completed a Geotechnical Investigation of the Chase River crossing to identify subsurface conditions and provide recommendations for the bridge crossing foundations. The report specifically considered shallow foundations and piled foundations.

Two boreholes were completed on March 31, 2017, one each at the proposed north and south abutment locations:

Table 8.1 Borehole Summary

	17BH-01 (North)		17BH-02 (South)	
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
Fill	0 – 2.1	40.0 – 37.9	0 – 2.3	38.0 – 35.7
Native Sand	2.1 – 4.3	37.9 – 35.7	2.3 – 3.0	35.7 – 35.0
Sand Till	4.3 – 7.0	35.7 – 33.0	3.0 – 6.1	35.0 – 31.9
Refusal in Till or possible bedrock	7.0	33.0	6.1	31.9

Groundwater was located at depths of 3.0m and 2.4m for boreholes 17BH-01 and 17BH-02, respectively.

The investigation also offers the following information:

1. Tetra Tech's borehole results generally agree with a previous report completed by AMEC for the 2001 storm sewer installation.
2. The site classification for seismic response is given as Class C – 'very dense soil and soft rock'.
3. There is a high potential for liquefaction at the site due to the high groundwater table and the loose granular soils encountered. A detailed liquefaction assessment was beyond the scope of the report.
4. Shallow foundations were originally dismissed due to the Canadian Highway Bridge Design Code (CHBDC) requiring that foundations be situated below the river bed elevation for abutment scour protection. Further review of this pedestrian bridge not being subject to the full requirements of CHBDC led to a more detailed review of shallow foundations.
5. Tetra Tech considered shallow foundations (spread footings) and piled foundations and recommends piled foundations due to recommended deep excavations for spread footings.
6. Shallow foundations would require excavations to the undisturbed dense sand/silt till layer which doesn't have a large economic benefit over a piled foundation for the north side of the river.
7. One type of foundation is recommended for both abutments to minimize differential settlement.
8. Pile driving would extend into the glacial till layer at the north and south sides of the river.
9. Pile driving may result in significant vibration to adjacent structures.

10. Full time geotechnical review is recommended during pile driving.
11. Temporary excavation slopes of 1:1 may be possible above the groundwater table.
12. The bridge foundations should be appropriately set back from the crest of the river and suitable erosion protection against scouring should be designed.

Please refer to **Appendix D** for the full investigation.

9. STAKEHOLDER CONSIDERATIONS

The following stakeholders, in addition to the City of Nanaimo (and associated internal City groups), have been identified for this project. Stakeholder information is as follows:

Table 9.1 – Stakeholder Contact Information

Stakeholder		Reason for Involvement
1	Snuneymuxw First Nation	Chase River Crossing, Archeological Potential
2	BC Hydro	Street lighting connection, future planning
3	School District 68	Trailway alignment, High School adjacent to corridor
4	RCMP	Corridor Safety
5	Nanaimo Fire Department	Corridor Safety, Access
6	Sunny Brook Estates (577 Sixth Street)	Residents, User Group
7	Willow Grove Estates Apartments (501 Sixth Street)	Residents, User Group
8	Harewood Neighbourhood Association	Residents, User Group

The Snuneymuxw First Nation was advised of the project through the Archaeological Overview Assessment, and Stakeholders 3-8 were contacted by the City of Nanaimo. As the project moves forward, all relevant stakeholders certain property owners along the corridor will need to be consulted for the proposed works and any effects on their property.

Stakeholders with additional involvement at this point include:

9.1. School District 68

John Barsby Secondary School is adjacent to the trailway for the entire south side of the Chase River. At the existing washroom building (part of Harewood Centennial Park), the corridor alignment will likely have to deflect into the SD68 property to reduce earthworks and provide accessibility from both the park side and the school side.

Fencing was requested north of the existing washroom building to protect the community garden area.

A specific meeting was held with SD68 to discuss the project and they have indicated that they are supportive of the project and would welcome further discussion regarding proposed nodes that can connect school walkways to the corridor. Preliminary approval was given to proceed on this basis. At this time SD68 does not have plans to formalize any walkways between the school at the trailway.

Ongoing communication and coordination will be maintained with SD68 throughout the project to maximize user flexibility and safety.

9.2. Sunny Brook Estates (577 Sixth Street)

As noted in **Section 2.1**, the residents of 577 Sixth Street, and particularly the residents who have rear yards that back on to the 10m wide ROW, have been in close consultation with the City on the development of this project.

10. COST ESTIMATES

10.1. Bridge

This report recommends the steel girder, precast pipe cap, precast deck and driven steel pipe piles style of bridge. The prices below are for each alignment option presented in **Section 3**.

Item*	Cost
Alignment Option 1 (25m length)	$450,000
Alignment Option 2 (30m length)	$688,000
Alignment Option 3 (30m length)	$635,000
25% Contingency - Option 1	**$112,500**
Total (before GST) - Option 1	**$562,500**
*Costs include bridge foundations, abutments, girders, and superstructure (decking and railings)	

Costs for alignment Option 2 & 3 are very similar but Option 2 has increased costs related to the complexity of installing the bridge abutment over top of the existing outlet headwall.

10.2. Project (Excluding Bridge)

A complete Class D Cost Estimate is included in **Appendix E,** and includes the preferred bridge type and Option 1 alignment, which are the recommended option. A summary of anticipated costs before GST:

Table 10.1 – Cost Estimate Summary

Item	Cost
General Conditions	$17,800
General Requirements	$32,550
Storm Sewer System	$16,000
Curbs and Sidewalks	$42,300
Streets	$65,840

Item	Cost
Trailway Lighting	$94,500
Asphalt Concrete Paving	$76,170
Landscape	$8,500
Sub-Total	$353,660
Construction Monitoring	$64,500
Sub-Total	**$418,160**
25% Contingency	**$104,540**
Total (before GST)	**$522,700**

Combined project costs, including a 25% contingency, are **$562,500 + $522,700 = $1,085,200** before GST.

11. CONCLUSION, RECOMMENDATIONS

Based on the findings and constraints noted above, the following comments and recommendations are given:

1. For durability and cost effectiveness, the steel girder, precast pipe cap, precast deck and driven steel pipe pile is the recommended type of bridge structure.

2. Alignment Option 1 recommended from a perspective of:
    a. Constructability
    b. Alignment simplicity and usability
    c. Bridge length
    d. Safety
    e. Lowest Cost

3. Provide appropriate tree replacement per City bylaws.

4. Alignment Option 2 is the most challenging and has the most risk from a constructability perspective.

5. All alignment options are achievable but present different challenges for constructability.

6. Efforts to retain existing Landmark trees will still have pruning and limbing requirements which may be extensive, and may pose safety hazards to contractors during construction. Any large branches that remain over top of the bridge have risk potential for falling on the bridge.

7. Trees along the 10m wide SRW and river crossing, in conflict with the selected alignment, should be removed and/or pruned in the early stages of construction – up to March 1, 2018.

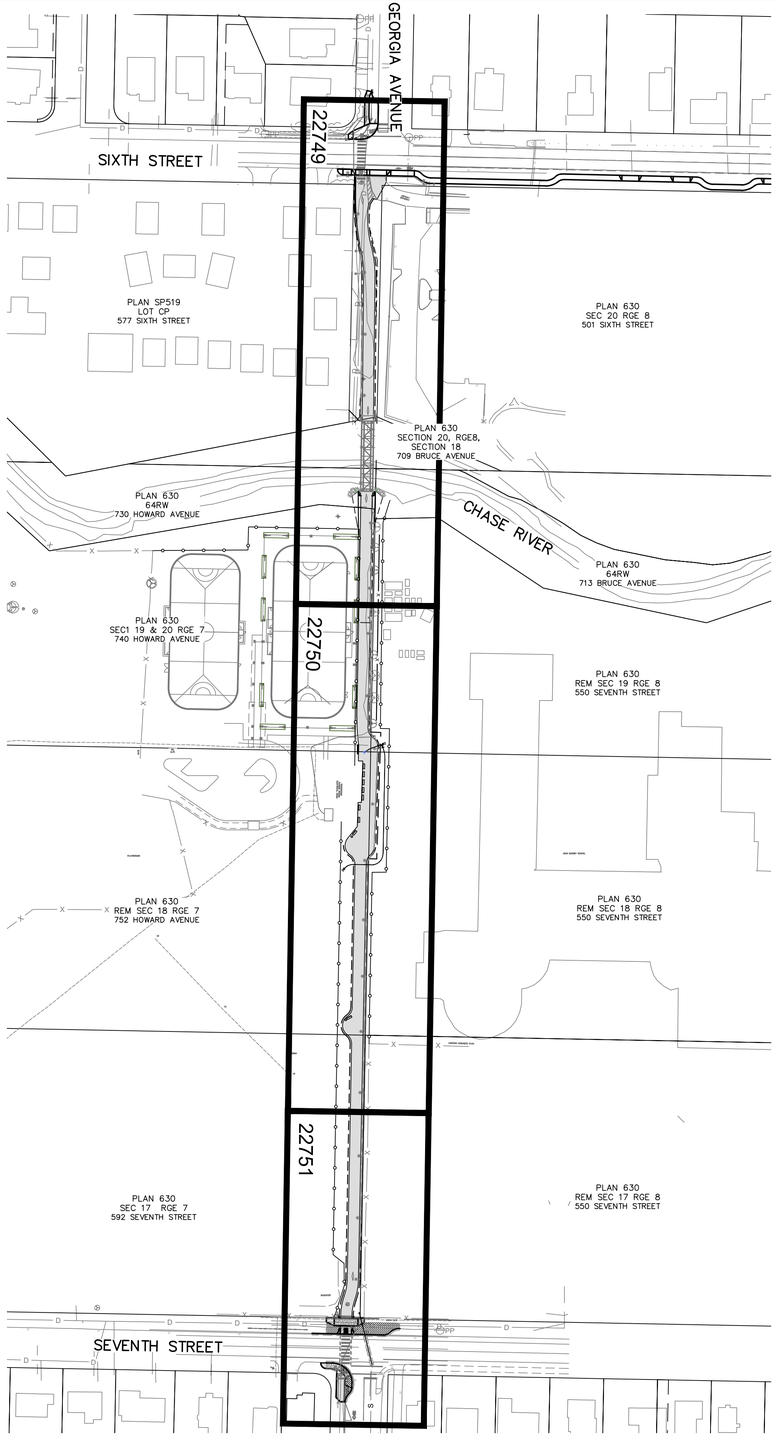
8. If the trees are to be removed after March 1, 2018, then a nesting survey should be completed prior to any tree removal.

Appendix A

PLAN VIEW DRAWINGS C01 TO C04

GEORGIA GREENWAY

PHASE 1: SIXTH TO SEVENTH



KEY PLAN
1:1000

1:1000 0 20 60m

GENERAL NOTES:

1. ALL WORK AND MATERIALS ARE TO BE AS DESCRIBED IN THE CITY OF NANAIMO ENGINEERING STANDARDS & SPECIFICATIONS LATEST EDITION OR AS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. CONNECTION TO, OR ALTERATION OF, EXISTING CITY-OWNED UTILITIES, REQUIRES AUTHORIZATION BY THE CITY ENGINEER.
3. A "PERMIT TO INSTALL WORKS WITHIN STREETS, LANES AND CITY PROPERTY AREAS" WILL BE REQUIRED WHERE CONSTRUCTION IS TO BE UNDERTAKEN IN CITY OF NANAIMO RIGHT-OF-WAYS AND/OR CITY OF NANAIMO-OWNED UTILITIES OR PROPERTIES.
4. UPON APPROVAL OF THE PERMIT, THE CITY OF NANAIMO'S CONSTRUCTION DIVISION SHALL BE NOTIFIED 48 HOURS PRIOR TO COMMENCEMENT OF WORK.
5. THE ENGINEER SHALL BE NOTIFIED 48 HOURS PRIOR TO COMMENCEMENT OF WORK.
6. CONTRACTOR TO COMPLY WITH ALL APPLICABLE MINISTRY OF ENVIRONMENT AND DEPARTMENT OF FISHERIES & OCEANS CANADA REQUIREMENTS AT ALL TIMES DURING CONSTRUCTION.
7. CONTRACTOR TO CONFIRM LOCATION OF EXISTING UTILITIES AT ALL CROSSINGS AND CONNECTIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO CONSTRUCTION.
8. CONTRACTOR TO CONFIRM THAT ELEVATION, LOCATION AND GRADIENT OF ASPHALT MATCH EXISTING PRIOR TO PLACEMENT OF ASPHALT OR CONCRETE.
9. ALL TREES NOT BEING REMOVED IN THE CONSTRUCTION AREA SHALL BE PROTECTED.
10. ALL SURFACES TO BE REINSTATED TO EXISTING CONDITIONS OR BETTER UPON COMPLETION OF INSTALLATION.
11. ALL PAINT MARKINGS AND SIGNAGE TO BE DONE BY OTHERS.
12. ALL LANDSCAPING TO BE DONE BY OTHERS.
13. ADJUST ALL MANHOLES, WATER VALVES, HYDRO VAULTS, ETC. TO MATCH NEW CONSTRUCTION.
14. ALL LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED BY USE OF A PIPE LOCATOR AND MANUAL DIGGING. ALL OR ANY STRUCTURES NOT NECESSARILY SHOWN.
15. ALL ELEVATIONS ARE TO GEODETIC DATUM.
16. DATA SOURCES:
    - TOPOGRAPHIC SURVEY COMPLETED BY 3D GEOMATICS INC. IN MARCH, 2017
    - ASBUILTS PROVIDED BY THE CITY OF NANAIMO.

STORM SEWER NOTES:

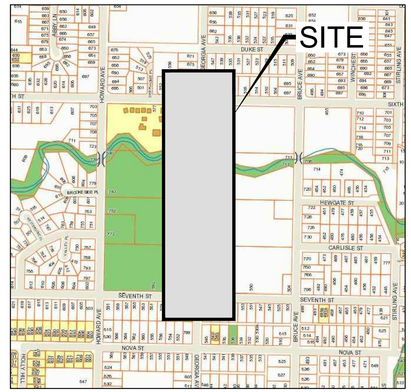
1. ALL CATCH BASINS TO BE C.O.N. TYPE SW-1 UNLESS OTHERWISE NOTED.
2. ALL CATCH BASIN LEADS TO BE 200ø PVC SDR35 UNLESS OTHERWISE NOTED.

WATER SERVICE NOTES:

1. ALL WATER SERVICES ARE TO BE 50ø CTS POLYETHYLENE TO AWWA C901, PRESSURE CLASS 200 TUBING CERTIFIED TO CSA B137.1 UNLESS OTHERWISE NOTED.
2. ALL WATER SERVICE FITTINGS ARE TO BE AS PER MASTER MUNICIPAL CONSTRUCTION DOCUMENTS (MMCD) PLATINUM - SECTIONS 33 11 01, 2.5 & 2.7.

SANITARY SEWER NOTES:

1. ALL SANITARY SERVICE BOXES SHALL BE IN ACCORDANCE WITH CITY OF NANAIMO STD S-5.
2. ALL PIPING AND RELATED APPURTENANCES TO BE INSPECTED PRIOR TO BACKFILLING OF THE TRENCH.



LOCATION PLAN
NTS

LIST OF DRAWINGS

DWG No.	DESCRIPTION
22748	KEY PLAN, DRAWING LIST, GENERAL NOTES, & LOCATION PLAN
22749	TRAILWAY - PLAN/PROFILE STA. 8+000 TO 8+170
22750	TRAILWAY - PLAN/PROFILE STA. 8+170 TO 8+350
22751	TRAILWAY - PLAN/PROFILE STA. 8+350 TO 8+440

LEGEND

EXISTING	PROPOSED	DESCRIPTION	EXISTING	PROPOSED	DESCRIPTION
		EDGE OF PAVEMENT			REDUCER
CURB		CURB AND GUTTER			FENCE
		EDGE OF GRAVEL			DITCH/SWALE
TB/BB		TOP/BOTTOM OF BANK	W	W	WATERMAIN (SIZE AND MATERIAL NOTED)
CB		CATCH BASIN	S	S	SANITARY SEWER (SIZE AND MATERIAL NOTED)
WV		WATER VALVE	D	D	STORM DRAIN (SIZE AND MATERIAL NOTED)
FH		FIRE HYDRANT	T	T	UNDERGROUND TELEPHONE
		CAPPED END	H	H	UNDERGROUND HYDRO
		UTILITY POLE AND STREET LIGHT (LABELED PP,TP,PP/LS ETC.)			MONUMENT
MH		MANHOLE			PROPERTY LINE
CO		CLEANOUT		5+100 5+110	CENTERLINE AND STATIONING
SSIC/SDIC	SSIC/SDIC	SANITARY/STORM INSPECTION CHAMBER (200ø RISER)			SANITARY SEWER SERVICE CONNECTION AT MAIN
JB		JUNCTION BOX	32.75	(43.170)+	ELEVATIONS
AR	AR	AIR VALVE			PAVEMENT REMOVAL
WM	WM	WATER METER			NEW ASPHALT

Reference data

MONUMENTS USED:

77H5242
ELEVATION: 40.700m

77H5270
ELEVATION: 40.881m

PRELIMINARY
NOT FOR CONSTRUCTION

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No.	Date	By	Revisions	Eng.
B	11.MAY.2018	PGR	PRE-DESIGN MEMO (REVISED)	
A	21.SEP.2017	PGR	PRE-DESIGN MEMO	

Design by PGR Date SEP 2017
Drawn by EGAP Date SEP 2017
Checked by
Approved by
Seal

CITY OF NANAIMO

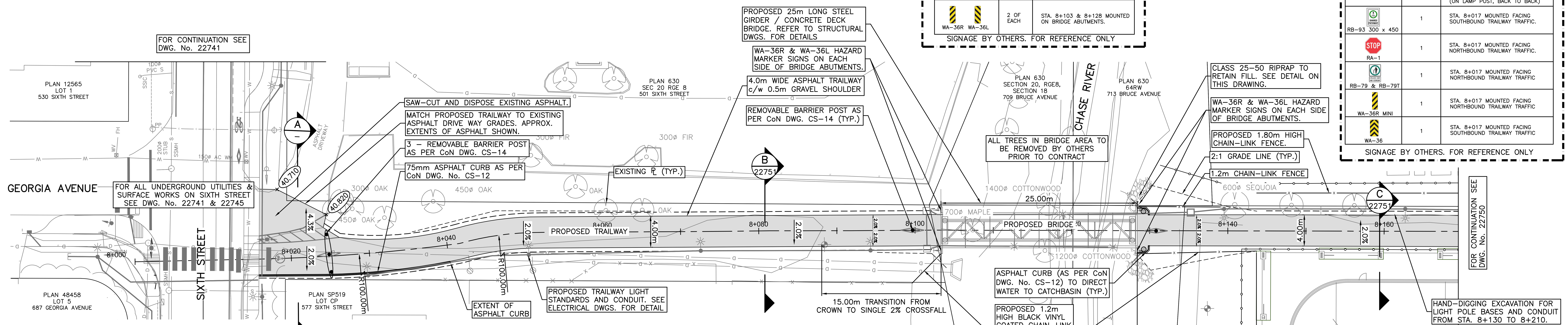
Scale
Horiz. 1:1000 Vert. N/A
Consult.Dwg C01 | Sheet 1 of 4
Eng File No.
Dwg No. C01

Project
HEL Project No. 0017-316
GEORGIA GREENWAY
PHASE 1: SIXTH TO SEVENTH

Title
KEY PLAN, DRAWING LIST,GENERAL NOTES & LOCATION PLAN
Rev. B

NOTES:

1. FOR GENERAL NOTES SEE DWG. No. 22748.
2. FOR TYPICAL SECTIONS SEE DWG. No. 22751.
3. ALL PAINT MARKINGS AND SIGNAGE DONE BY OTHERS.
4. TRAILWAY LANDSCAPING DONE BY OTHERS.



SIGNS SCHEDULE – THIS DRAWING

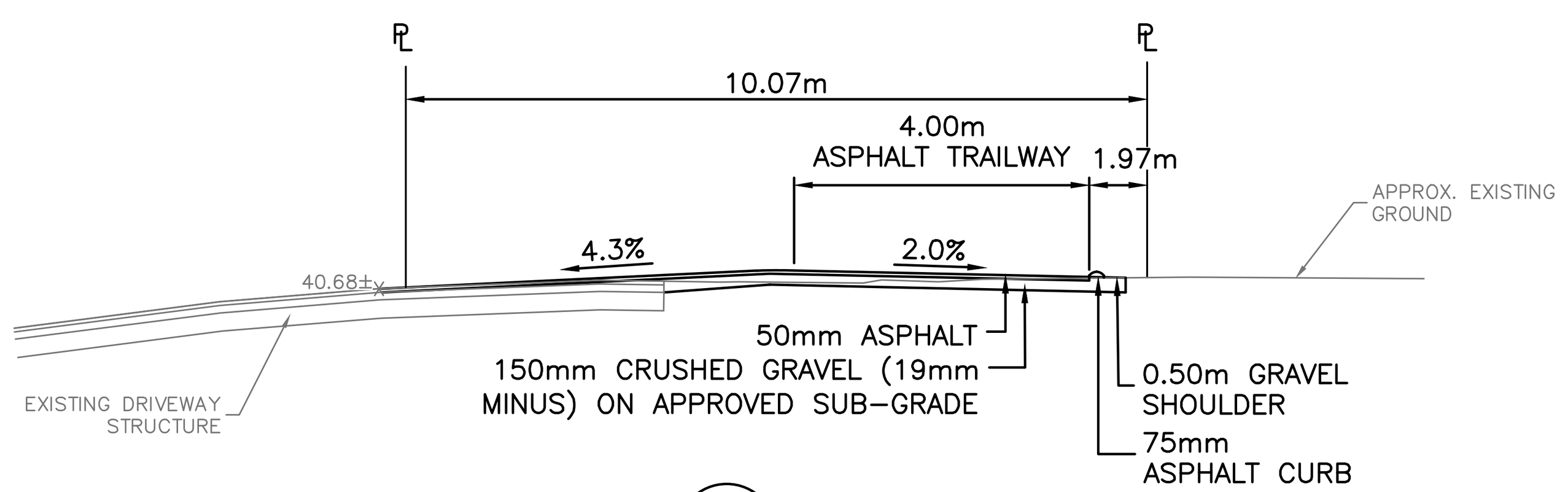
SIGN	QTY.	LOCATION
WA-36R WA-36L	2 OF EACH	STA. 8+103 & 8+128 MOUNTED ON BRIDGE ABUTMENTS.

SIGNAGE BY OTHERS. FOR REFERENCE ONLY

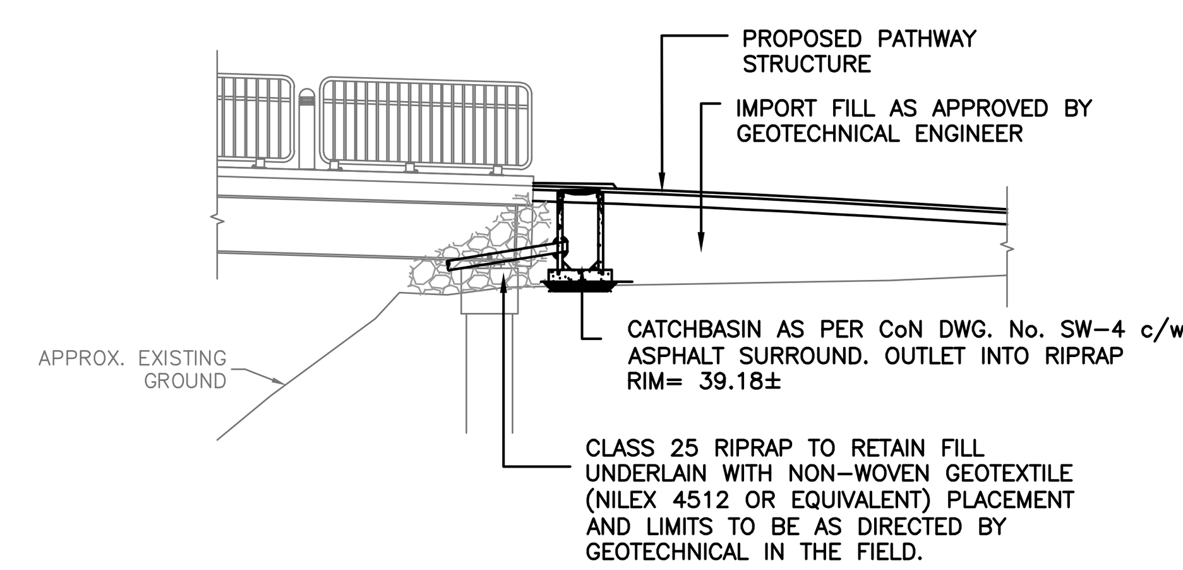
SIGNS SCHEDULE – THIS DRAWING

SIGN	QTY.	LOCATION
RA-4L RA-4R	2 OF EACH	STA. 8+005 WEST SIDE OF GEORGIA AVENUE (ON SAME POLE, BACK TO BACK) & STA. 8+017 WEST SIDE OF TRAILWAY ENTRANCE (ON LAMP POST, BACK TO BACK)
RB-93 300 x 450	1	STA. 8+017 MOUNTED FACING SOUTHBOUND TRAILWAY TRAFFIC.
RA-1	1	STA. 8+017 MOUNTED FACING NORTHBOUND TRAILWAY TRAFFIC.
RB-79 & RB-79T	1	STA. 8+017 MOUNTED FACING NORTHBOUND TRAILWAY TRAFFIC
WA-36R MINI	1	STA. 8+017 MOUNTED FACING NORTHBOUND TRAILWAY TRAFFIC
WA-36	1	STA. 8+017 MOUNTED FACING SOUTHBOUND TRAILWAY TRAFFIC

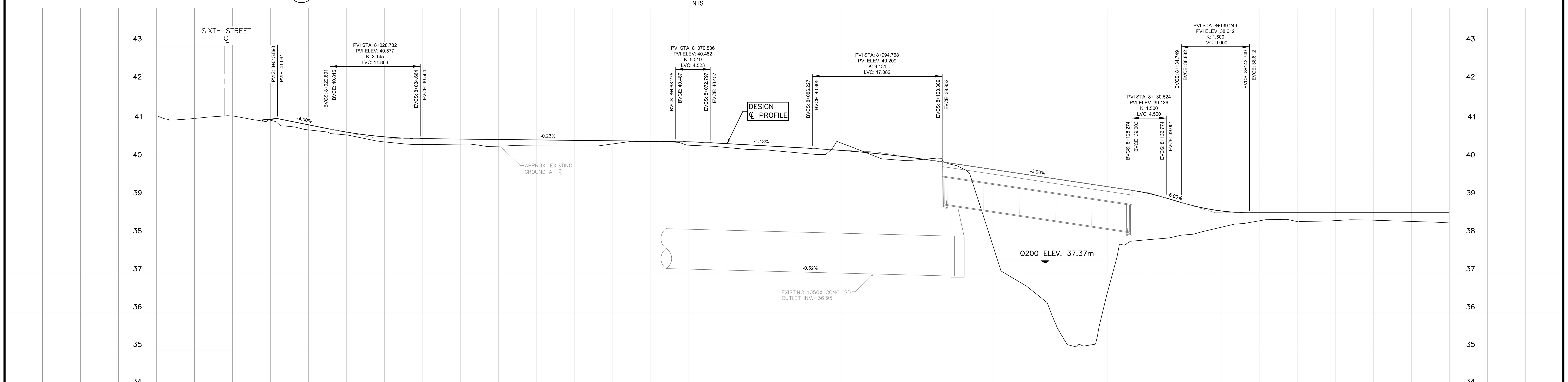
SIGNAGE BY OTHERS. FOR REFERENCE ONLY



A – SECTION
NTS



RIPRAP RETAINING WALL DETAIL
NTS



℄ CHAINAGE	DESIGN ℄ ELEVATIONS / EXISTING ℄ ELEVATIONS
8+000	41.17
	41.10
	41.16
	41.05
8+020	40.79 40.927
	40.66 40.734
	40.48 40.609
	40.41 40.563
8+040	40.42 40.552
	40.37 40.540
	40.37 40.529
	40.37 40.518
8+060	40.42 40.506
	40.48 40.495
	40.39 40.480
	40.33 40.432
8+080	40.27 40.375
	40.18 40.319
	40.45 40.255
	40.06 40.164
8+100	40.00 40.046
	39.86 39.902
	37.74 39.752
	36.59 39.602
8+120	35.13 39.452
	36.48 39.302
	37.90 39.142
	38.03 38.867
8+140	38.23 38.659
	38.40 38.612
	38.38 38.612
	38.41 38.612
8+160	38.42 38.612
	38.38 38.612
	38.35

Reference data

PRELIMINARY
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A	21.SEP.2017	PGR	PRE-DESIGN MEMO	

Design by PGR Date SEP 2017
Drawn by EGAP SEP 2017
Checked by
Approved by
Seal

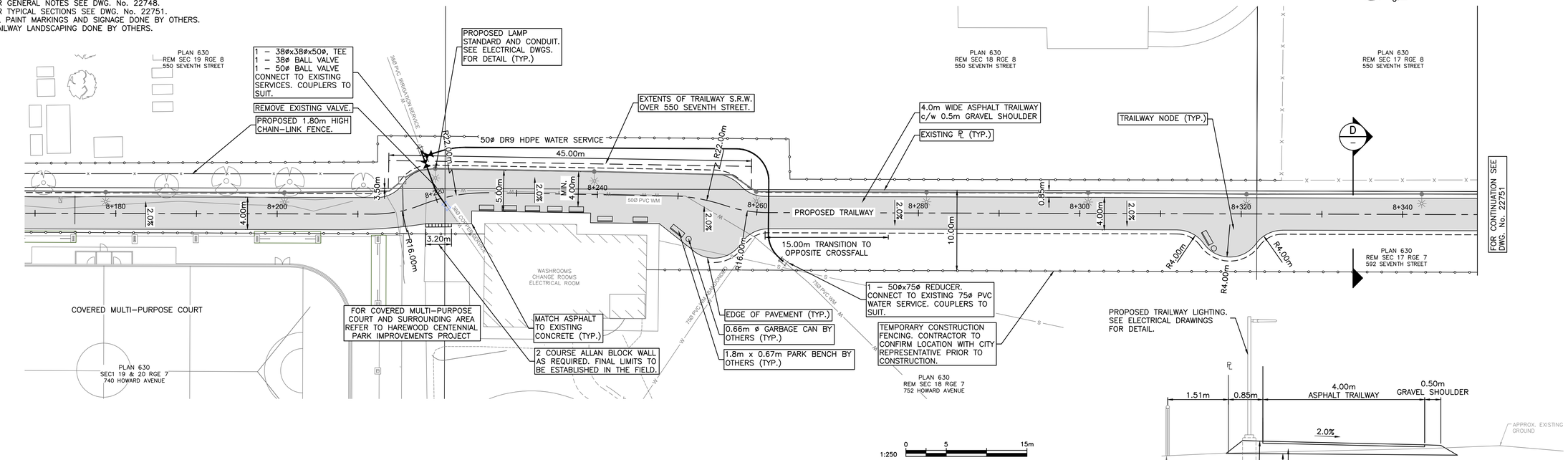
CITY OF NANAIMO

Scale Horiz. 1:250 Vert. 1:50
Consult.Dwg C01 Sheet 2 of 4
Eng File No.
Dwg No. C02

Project: GEORGIA GREENWAY PHASE 1: SIXTH TO SEVENTH
HEL Project No. 0017-316
Title: TRAILWAY PLAN/PROFILE STA. 8+000 TO 8+170
Rev. B

NOTES:

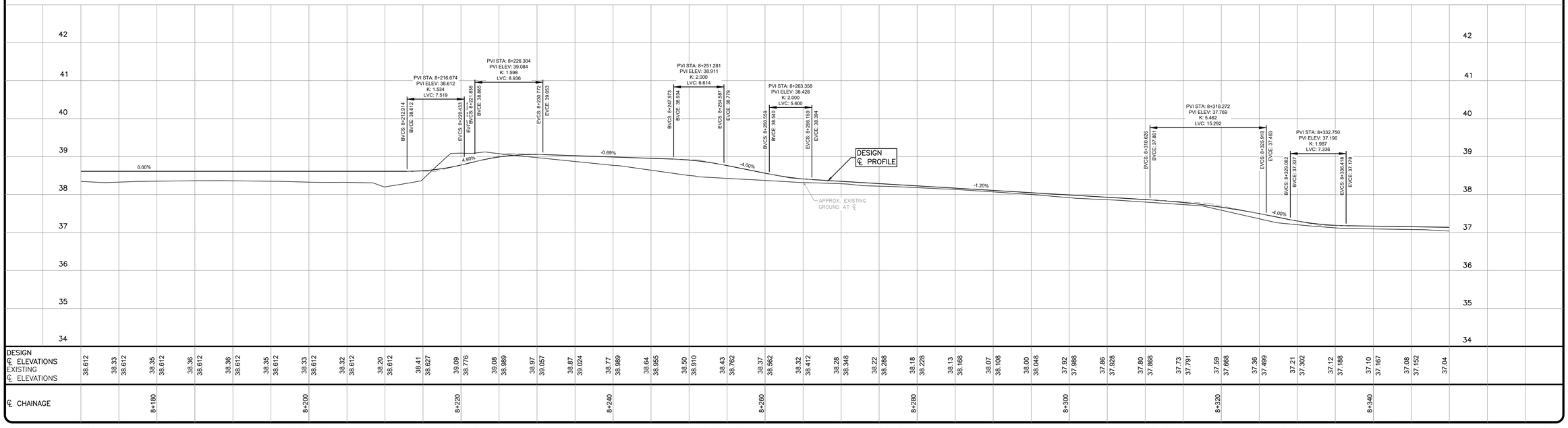
1. FOR GENERAL NOTES SEE DWG. No. 22748.
2. FOR TYPICAL SECTIONS SEE DWG. No. 22751.
3. ALL PAINT MARKINGS AND SIGNAGE DONE BY OTHERS.
4. TRAILWAY LANDSCAPING DONE BY OTHERS.



D – TYPICAL TRAILWAY DETAIL FROM STA. 8+260 TO 8+422

NTS

*TO BE READ IN CONJUNCTION WITH CoN DWG. No. CS–10A



Reference data

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Design by PGR SEP 2017
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Checked by
Approved by
Seal

CITY OF NANAIMO

Scale
Horiz. 1:250 Vert. 1:50
Consult.Dwg C03 Sheet 3 of 4
Eng File No.
Dwg No. C03

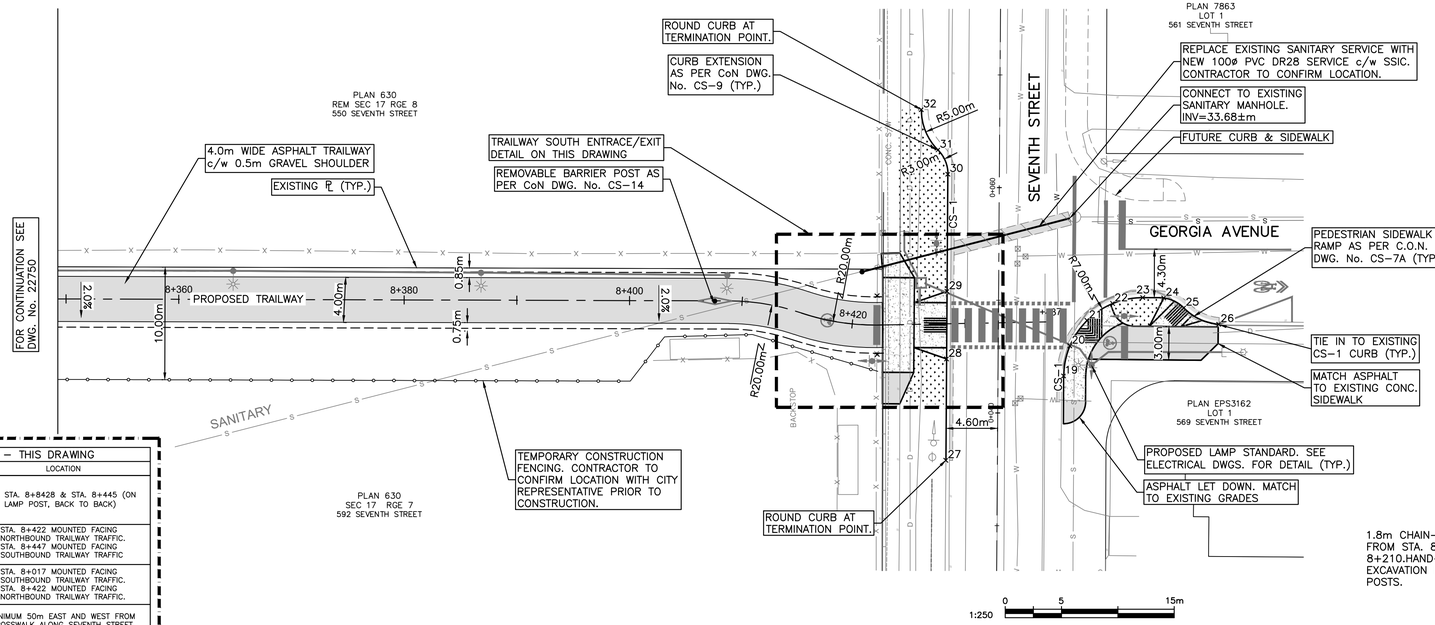
Project
HEL Project No. 0017-316
GEORGIA GREENWAY
PHASE 1: SIXTH TO SEVENTH
Title
TRAILWAY - PLAN/PROFILE
STA. 8+170 TO 8+350
Rev. B

NOTES:

1. FOR GENERAL NOTES SEE DWG. No. 22748.
2. FOR TYPICAL SECTIONS SEE DWG. No. 22751.
3. ALL PAINT MARKINGS AND SIGNAGE DONE BY OTHERS.
4. TRAILWAY LANDSCAPING DONE BY OTHERS.

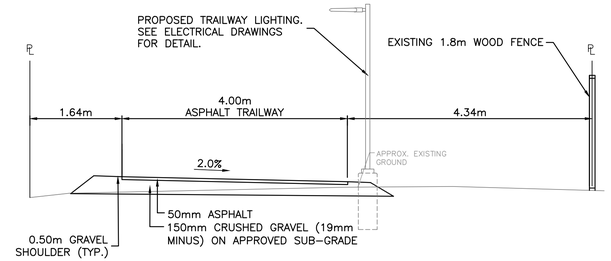
CURB RETURN ELEVATIONS

19	36.378
20	36.333
21	36.282
22	36.210
23	36.132
24	36.096
25	36.049
26	36.005
27	36.517
28	36.348
29	36.289
30	36.188
31	36.090
32	35.943



SIGNS SCHEDULE – THIS DRAWING		
SIGN	QTY.	LOCATION
R111–1L R111–1R	2 OF EACH	STA. 8+8428 & STA. 8+445 (ON LAMP POST, BACK TO BACK)
RB–93 300 x 450	2	STA. 8+422 MOUNTED FACING NORTHBOUND TRAILWAY TRAFFIC. STA. 8+447 MOUNTED FACING SOUTHBOUND TRAILWAY TRAFFIC
RA–1	2	STA. 8+017 MOUNTED FACING SOUTHBOUND TRAILWAY TRAFFIC. STA. 8+422 MOUNTED FACING NORTHBOUND TRAILWAY TRAFFIC.
WC–7 WC–7S	2 OF EACH	MINIMUM 50m EAST AND WEST FROM CROSSWALK ALONG SEVENTH STREET. FACING ONCOMING TRAFFIC

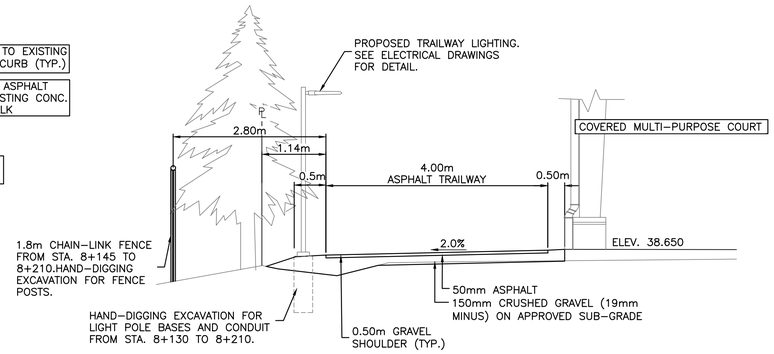
SIGNAGE BY OTHERS. FOR REFERENCE ONLY



B 22749 TYPICAL TRAILWAY DETAIL FROM STA. 8+026 TO 8+102

NTS

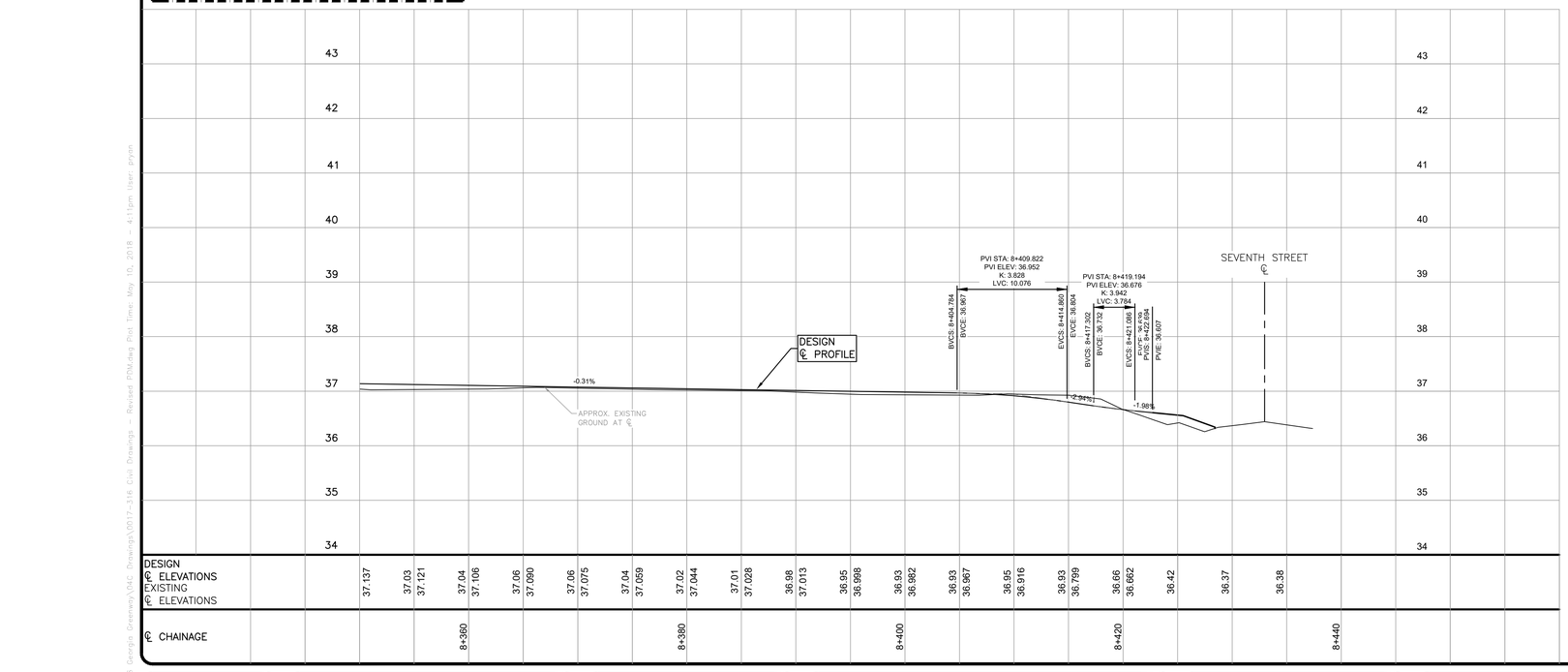
*TO BE READ IN CONJUNCTION WITH CoN DWG. No. CS–10A

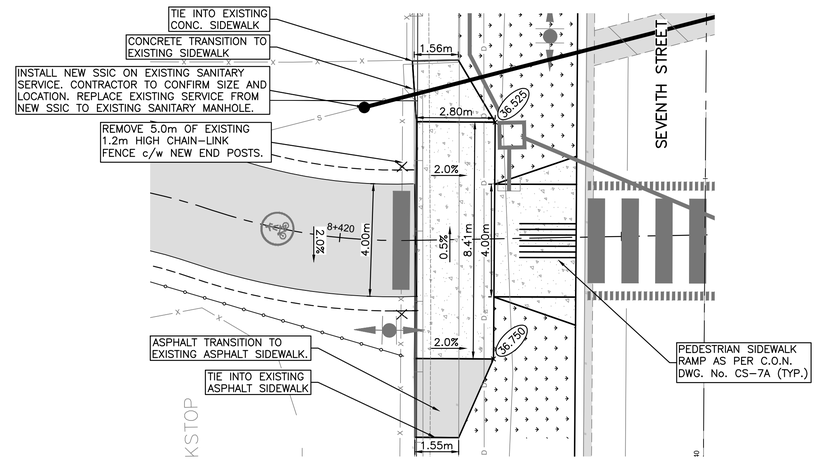


C 22749 TYPICAL TRAILWAY DETAIL FROM STA. 8+142 TO 8+213

NTS

*TO BE READ IN CONJUNCTION WITH CoN DWG. No. CS–10A





TRAILWAY SOUTH EXIT/ENTRANCE DETAIL

SCALE 1:100

Reference data

PRELIMINARY
NOT FOR CONSTRUCTION

HEROLD ENGINEERING
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Tel: 250–751–8558 Fax: 250–751–8559
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Design by PGR Date SEP 2017
Drawn by EGAP SEP 2017
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Seal

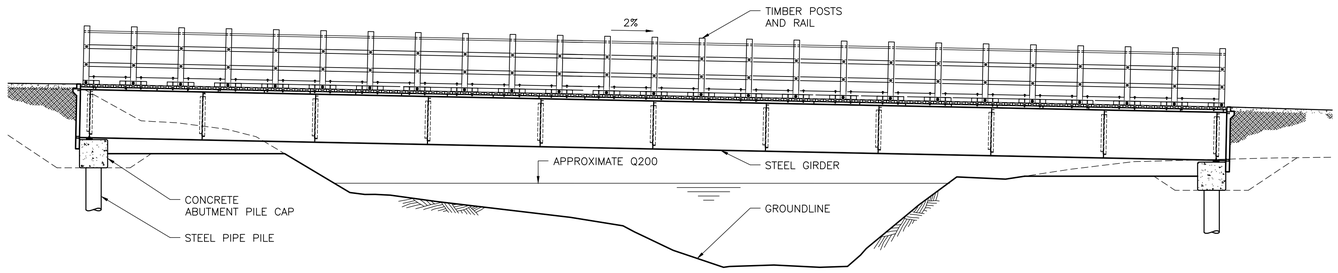
CITY OF NANAIMO

Scale Horiz. 1:250 Vert. 1:50
Consult.Dwg C04 Sheet 4 of 4
Eng File No.
Dwg No. C04

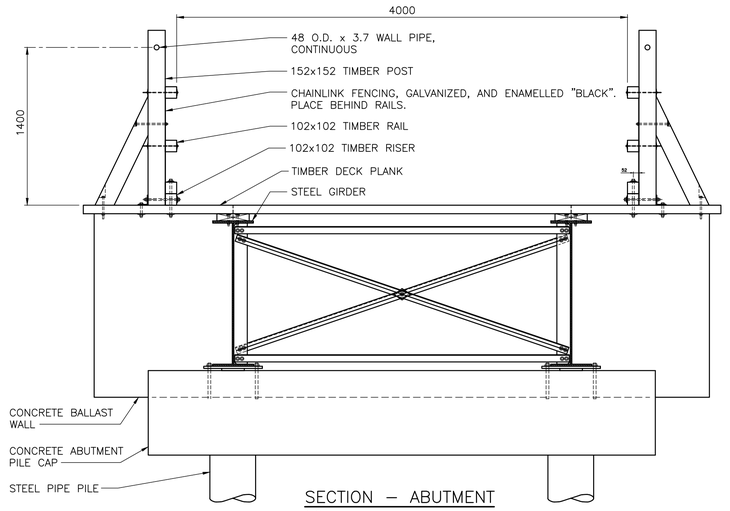
Project HEL Project No. 0017-316
GEORGIA GREENWAY
PHASE 1: SIXTH TO SEVENTH
Title
TRAILWAY - PLAN/PROILE
STA 8+350 TO 8+440
Rev. B

Appendix B

BRIDGE CONCEPT DRAWINGS



PROFILE ALONG CENTRELINE OF BRIDGE LOOKING EAST
1:75



SECTION – ABUTMENT
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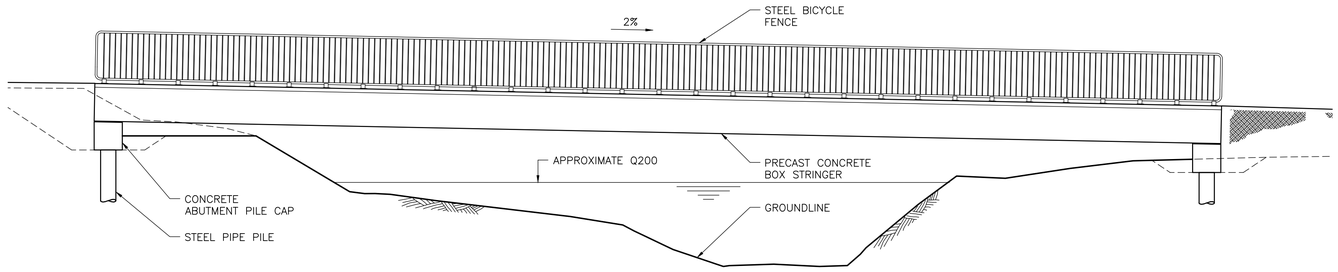
TIMBER DECK ON STEEL GIRDERS



PROFILE ALONG CENTRELINE OF BRIDGE LOOKING EAST
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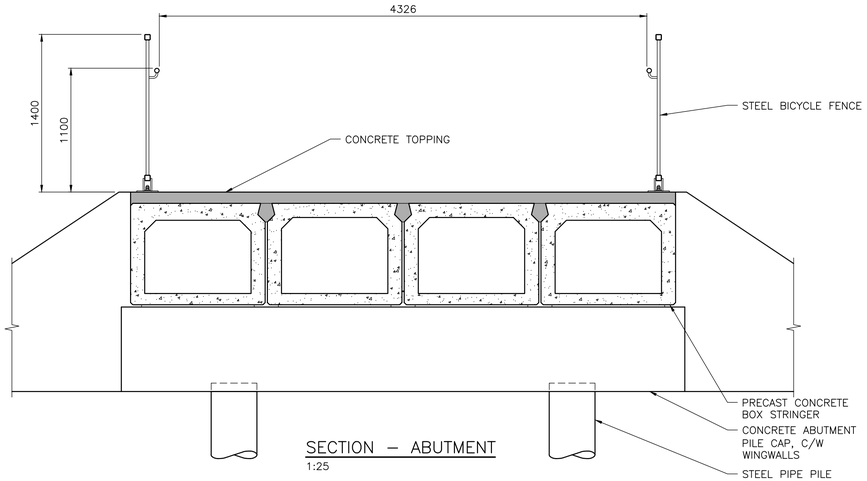

SECTION – ABUTMENT
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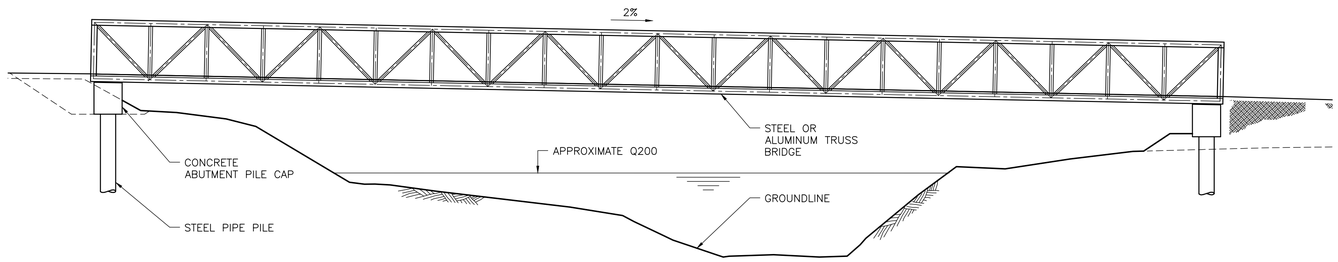
CONCRETE BOX STRINGERS



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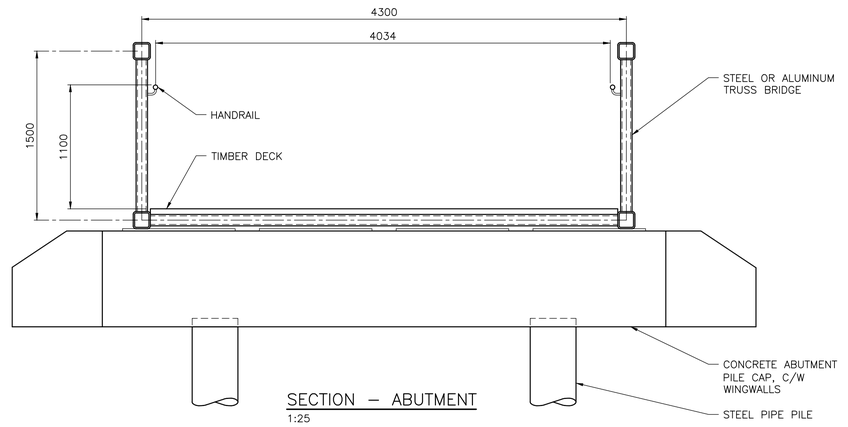

SECTION – ABUTMENT
1:25

STEEL OR ALUMINUM TRUSS

Reference data

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250-751-8558 Fax: 250-751-8559
Email: mail@heroldengineering.com

No.	Date	By	Revisions	Eng.
A.	2018.05.10	JJMC	ISSUED FOR PRE-DESIGN MEMO	

Design by SJS Date MAY 2018
Drawn by JJMC Date MAY 2018
Checked by
Approved by
Seal

CITY OF NANAIMO
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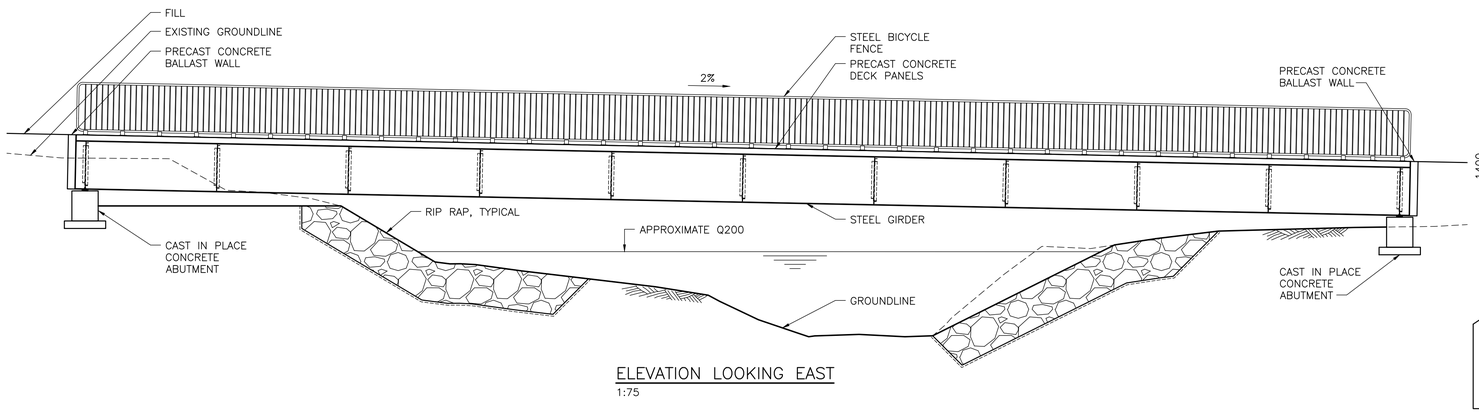
Scale AS SHOWN
Consult.Dwg Sheet 1 of 2
Eng File No.
SK1

Project
GEORGIA GREENWAY:
PHASE 1
HEL Project No. 0017-316

Title
BRIDGE - OPTIONS, SHEET 1
Rev. A



ELEVATION LOOKING EAST
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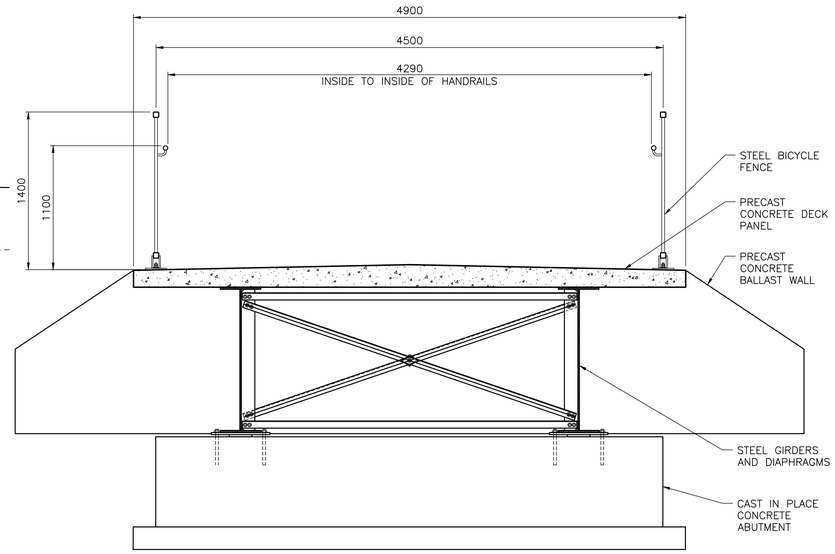

SECTION – ABUTMENT
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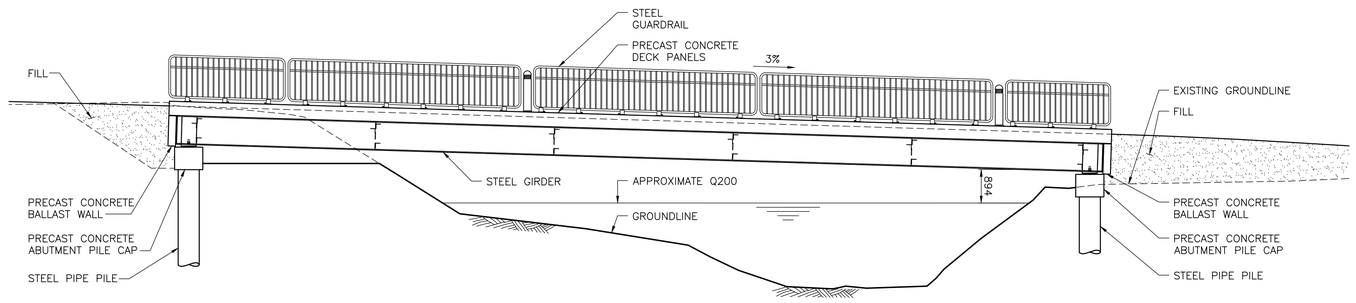
CONCRETE DECK AND STEEL GIRDERS ON CONCRETE ABUTMENTS



ELEVATION LOOKING EAST
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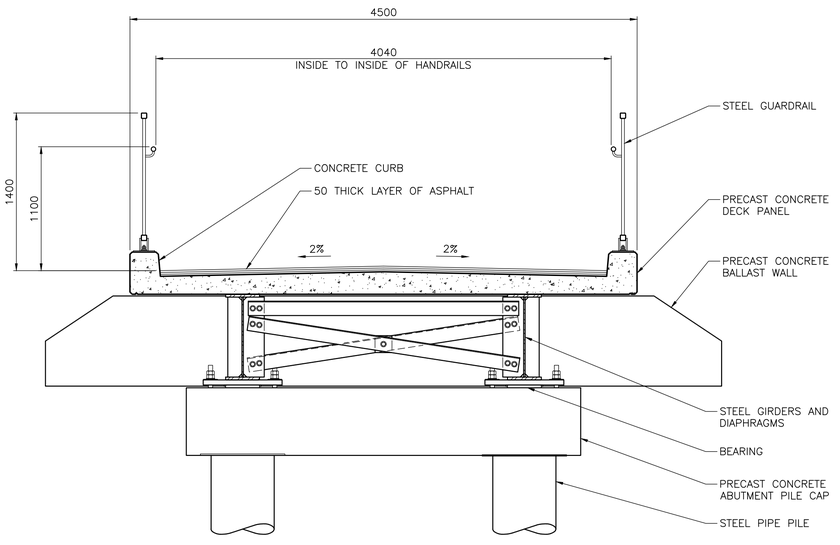


SECTION – ABUTMENT
1:25

CONCRETE DECK AND STEEL GIRDERS ON STEEL PIPE PILES

Reference data

HEROLD ENGINEERING
3701 Shenton Rd, Nanaimo, BC V9T 2H1
Tel: 250-751-8558 Fax: 250-751-8559
Email: mail@heroldengineering.com

No.	Date	By	Revisions	Eng.
A	2018.05.10	JJMC	ISSUED FOR PRE-DESIGN MEMO	

Design by SJS Date MAY 2018
Drawn by JJMC MAY 2018
Checked by
Approved by
Seal

CITY OF NANAIMO
THE HARBOUR CITY

Scale AS SHOWN
Consult.Dwg Sheet 2 of 2
Eng File No.
SK2

Project
GEORGIA GREENWAY:
PHASE 1
HEL Project No. 0017-316
Title
BRIDGE - OPTIONS, SHEET 2
Rev. A

Appendix C

PUBLIC ENGAGEMENT SUMMARY

GEORGIA GREENWAY

...FOR ALL AGES AND ABILITIES!

Summary of Public Feedback

Georgia Greenway Preliminary Design

CITY OF NANAIMO
THE HARBOUR CITY

FEEDBACK SUMMARY REPORT

Phase 1 – Concept Design Ideas

Georgia Greenway Project

1.0 Overview

The City of Nanaimo has proposed a pedestrian and cycling friendly route through the Harewood neighbourhood to link key destinations across the community including schools, parks, sports fields, and commercial areas. The proposed trail was first identified in the Harewood Neighbourhood Plan, and is also supported by the Nanaimo Transportation Master Plan, Harewood Centennial Park Master Plan, and the Official Community Plan.

Phase 1 of the of the Georgia Greenway project is a multi-use trail through Harewood Centennial Park connecting Sixth Street and Seventh Street, including a bridge crossing over the Chase River. The initiative is one of five key capital projects adopted by City Council as part of the 2016-2019 Strategic Plan Update.

Community feedback is a key component in the development of the Georgia Greenway. In May 2017, City staff engaged the public to provide feedback on the Phase 1 Concept (Sixth Street to Seventh Street), as well as evaluation criteria to assess potential route options for future phases. The results of the responses are summarized in the following report.

The Georgia Greenway will provide a safe, comfortable experience for all ages, abilities, and confidence levels to encourage more sustainable modes of transportation within the City.

Feedback was compiled from:

- A drop-in public event with an interactive kiosk as part of the Active for Life Expo on Saturday, May 13, 2017 from 10:00 am to 2:00 pm at Harewood Centennial Park (Sherry Field at John Barsby School).
- A public response form available online (using third-party vendor Simple Survey™ to collect data) or in hard copy open for submissions from Friday, May 12, 2017 through to Monday, June 5, 2017 (extended from May 29, 2017).
- City Staff attendance with project information at the Georgia Avenue Celebration Station for Bike to Work Week on Monday, May 29th, and Thursday, June 1st.

Outreach was made by:

- Project website
- Social media postings through City Twitter and Facebook Accounts
- Posters around Centennial Park and the Phase 1 study area

- Mailout letters to surrounding property owners
- Phone calls, emails, and meetings with Special Interest Stakeholder Groups (e.g. School District, Fire Department and Emergency Services, Barsby Community Garden, etc.)
- Business card-sized magnets handed out at Bike to Work Week celebration station at Georgia Avenue

2.0 Summary of Feedback

The following summarizes the overall feedback received. For a detailed summary, please see Section 3.0.

2.1 PARTICIPANTS

- A total of **162 participants** completed the Phase 1 Response Form.
- The largest number of participants (60%) live in the Harewood Neighbourhood (within the vicinity of the proposed Georgia Greenway), while 34% live in another neighbourhood in the City of Nanaimo.
- A total of 76% of respondents have household members that currently cycle, roll, walk, or run within the Harewood Neighbourhood.

2.2 KEY THEMES

GENERAL

- In general, participants support the implementation of the Phase 1 Georgia Greenway in the Harewood neighbourhood:
  - The majority of input supports the Project due to safety (as an improvement for pedestrian and cyclist safety from vehicles); added overall community benefits; encouragement of active transportation; and improved accessibility and connectivity for the neighbourhood.
  - Some oppose the Project due to safety concerns (related to theft, and other undesirable or criminal activity, as well as emergency response issues) and concerns about the Project cost and impact on taxpayers.

CONCEPT DESIGN CONSIDERATIONS (SIXTH STREET TO SEVENTH STREET)

- In general, participants support the six design considerations for Phase 1 with participants with strong support for:
  - LED lighting for the proposed bridge (as long as there is consideration to manage the impacts of light for the river wildlife)
  - Benches or rest points for trail access nodes
  - Fence as field buffer (either standard black or cedar character)
  - Pathway lighting (LED)
  - Trail markers to indicate location and access points to the greenway
  - Tree planting and careful management of invasive plants

OVERALL EVALUATION CRITERIA

- The top three evaluation criteria most important to respondents are:
  - Crime Prevention Through Environmental Design (CPTED);
  - Pedestrian/Cyclist East of Use; and
  - Separation from Vehicle Traffic.
- Other criteria suggested includes improvements for neighbourhood development, livability for community enhancement, accessibility, safety, environmental sustainability, and connectivity.

FUTURE PHASES

- For the design approach for the future phase of Fourth Street to Sixth Street, slightly more participants (51%) preferred a separation from vehicle traffic while 42% preferred a combination of separation from vehicles and on-street segments.
- For the design approach for the future phase of Seventh Street to Eighth Street, participants prefer separation from vehicle traffic (47%) or a combination of separation from vehicles and on-street segments (43%).

3.0 Detailed Summary of Input

3.1 Participant Demographics

Questionnaire respondents were asked to provide key background information so we could understand who participated in the public questionnaire.

Question 1: Postal Code

Participants were asked to provide their postal code. Compiled responses are mapped in the following Figure 1: Distribution Map of Postal Codes Provided by Participants in the Nanaimo, BC Area (markers indicate one or more responses per postal code).

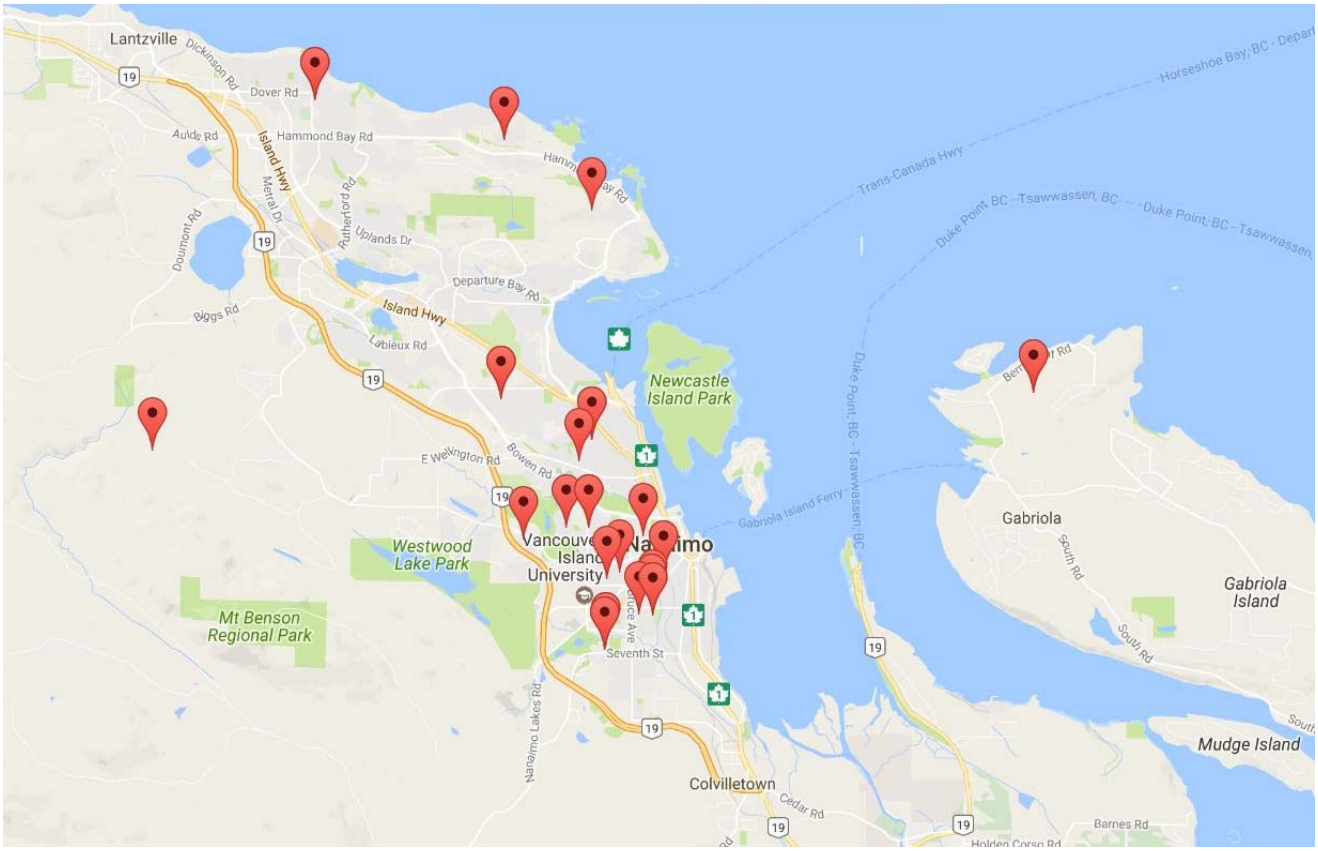
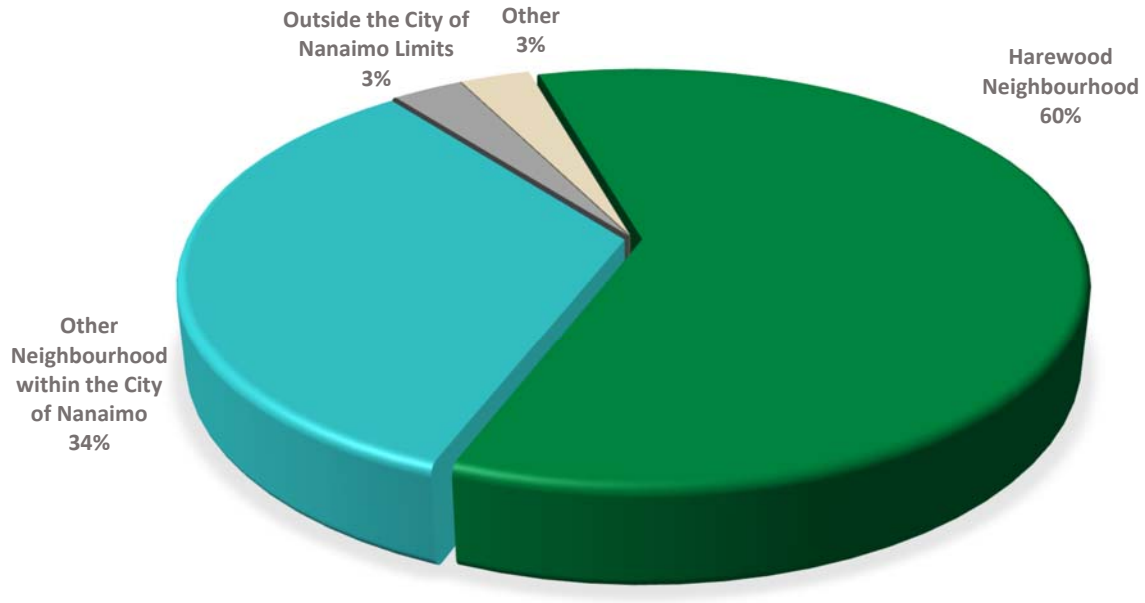


Figure 1: Distribution Map of Postal Codes Provided by Participants in the Nanaimo, BC Area (markers indicate one or more responses per postal code).

Question 1: Area of Residence

- The largest number of participants (60%) live in the Harewood Neighbourhood (within the vicinity of the proposed Georgia Greenway), while 34% live in another neighbourhood in the City of Nanaimo.
- A total of 6% live outside the City of Nanaimo limits or specified "Other".



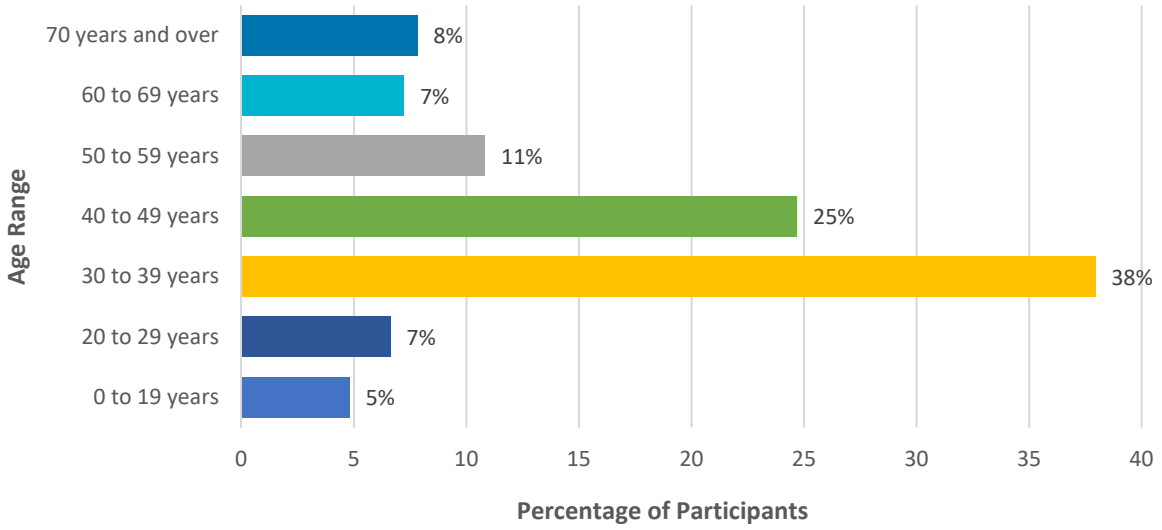
Other Neighbourhoods

Other neighbourhoods identified included:

- Old City
- Chase River
- Fairview
- Regional District of Nanaimo (RDN)
- Buttertubs Drive
- Protection Island
- South Nanaimo (near Milton)
- Near Vancouver Island University (VIU) including University Heights
- Brechin
- Uplands
- Work at John Barsby Community School

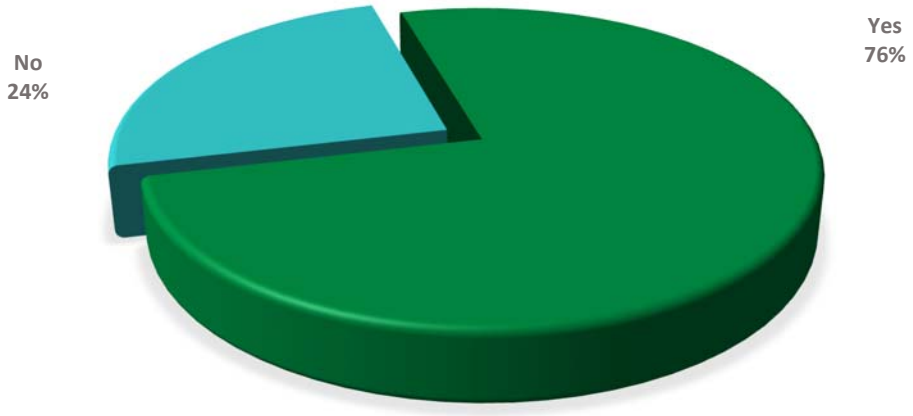
Question 3: Age Range of Participants

- The strong majority of respondents were between 30 and 49 years of age.



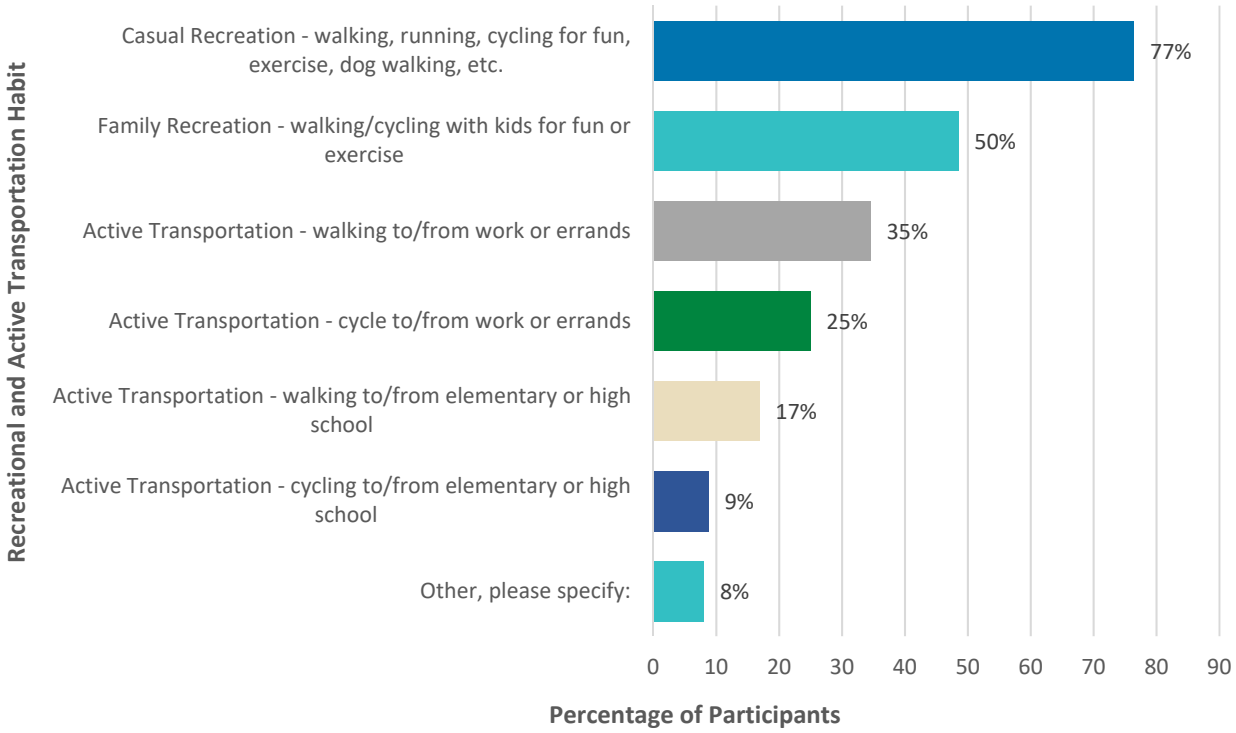
Question 4: Household Members Using Georgia Greenway Study Area

- The strong majority (76%) respondents have household members who currently cycle, roll, walk, or run within the Harewood Neighbourhood.



Question 5: Household Current Cycling/Walking Habits Within the Harewood Neighbourhood

- Most participants currently walk, run, cycle, or roll for recreation purposes as opposed to for active transportation purposes.



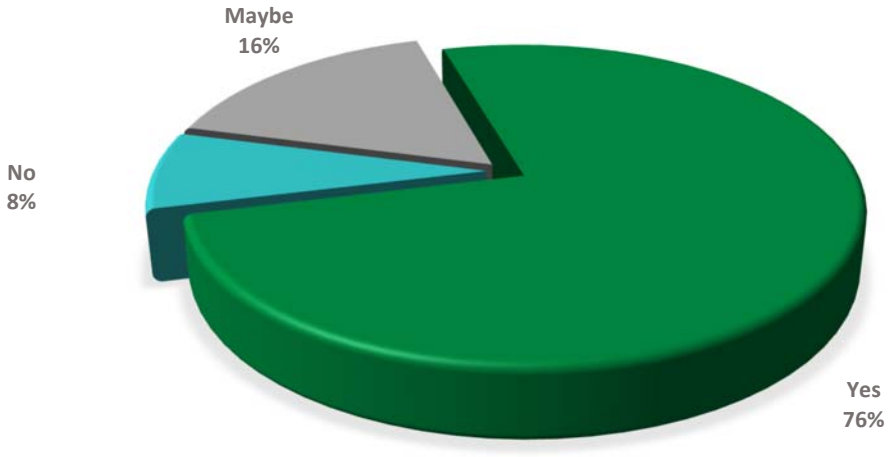
Other Walking or Cycling Habits within the Harewood Neighbourhood:

Participants were asked to provide other waking or cycling habits within the Harewood Neighbourhood. Responses included:

- Walking to/from Vancouver Island University or the bus stop at University Village.
- Walking to help keep neighbourhood safe/clean through use and to connect with neighbours/others out walking in the community.
- Walking to Centennial Park or to connect to the south end of the Parkway Trail for birdwatching and other nature appreciation activities (including Harewood Plains, Alley Way, and along the river).
- Scootering, skateboarding (future Harewood Skatepark), or biking for fun.
- Walking to access shopping areas or to visit friends.

Question 6: Participants that would use the Georgia Greenway if it provided an improved pedestrian and cyclist route and alternative to Howard Avenue and Bruce Avenue.

- The strong majority of participants (76%) would use the Georgia Greenway if an improved pedestrian or cyclist route and alternative to Howard Avenue and Bruce Avenue were developed.



3.2 Feedback on PHASE 1 CONCEPT: Sixth Street to Seventh Street

Participants were asked to review a series of series of six design components being considered for Phase 1 of the Georgia Greenway and indicate whether they "Support", are "Neutral", or "Don't Support" each design consideration. Participants were asked to provide any additional comments to clarify their response.

3.2.1 Concept Design Components

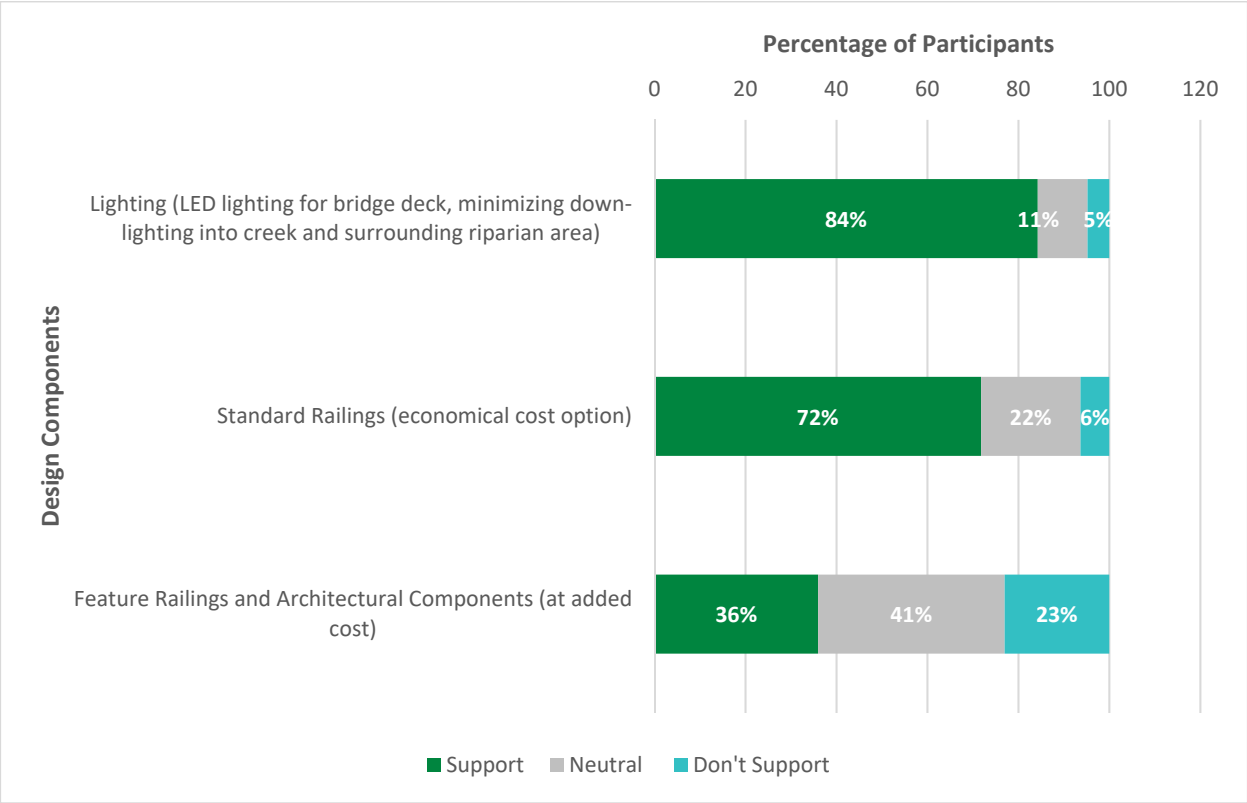
Design Components

• Bridge • Trail Access Nodes • Field Buffer

• Trail Lighting • Street Crossings • Riparian Area

Question 7: Proposed Bridge

- The strong majority of participants support bridge lighting (84%).
- The majority of participants preferred standard railings over feature railings and architectural components.



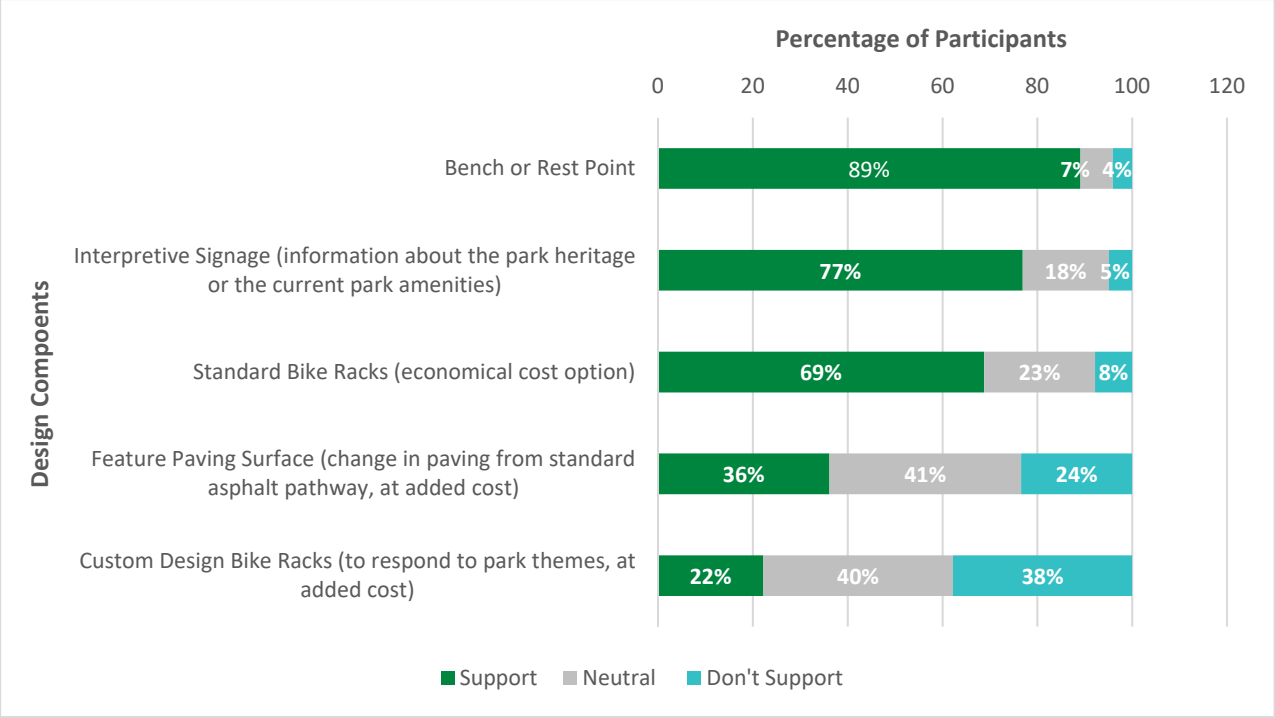
Sample Comments for the Bridge:

- Minimize vandalism using heavy materials and discourage homeless population from using bridge for homeless and/or transient occupation.
- Provide a space for graffiti artists to display their work (e.g. on railing walls). Edmonton has some good examples of promote graffiti art in permitted spaces.
- Support for additional lighting for safe walking and cycling during evening and nighttime through all seasons.
- Concerns relating to lighting included: ensuring that lighting is not too bright (e.g. LED), lighting could increase unwanted uses during nighttime and evening (e.g. theft, drug use, vandalism), lighting could have a negative impact on nearby residents (light pollution and related health percussions); and lighting could have a detrimental impact on local fauna.
- Suggestions for lighting included consideration for innovation and use of solar lighting, and managing the lighting program so that it comes on during peak commuting hours in the winter, but are not on for long hours.
- Support for cedar/timber structure and railings to retain a natural look and beauty of the river.
- Consideration for the sensitive riparian environment.

- Encourage safety features such as a security "911" button.
- Focus on design simplicity to manage expense for taxpayers and risk of vandalism.
- Use taxpayer funding wisely.
- Improve access for other transportation modes such as scooters.

Question 8: Trail Access Nodes

- The strong majority of participants support benches / resting points (89%) and interpretive signage (77%).
- Standard bike racks are also supported by the majority of respondents (69% support).
- Most participants did not support or were neutral for support of custom design bike racks.



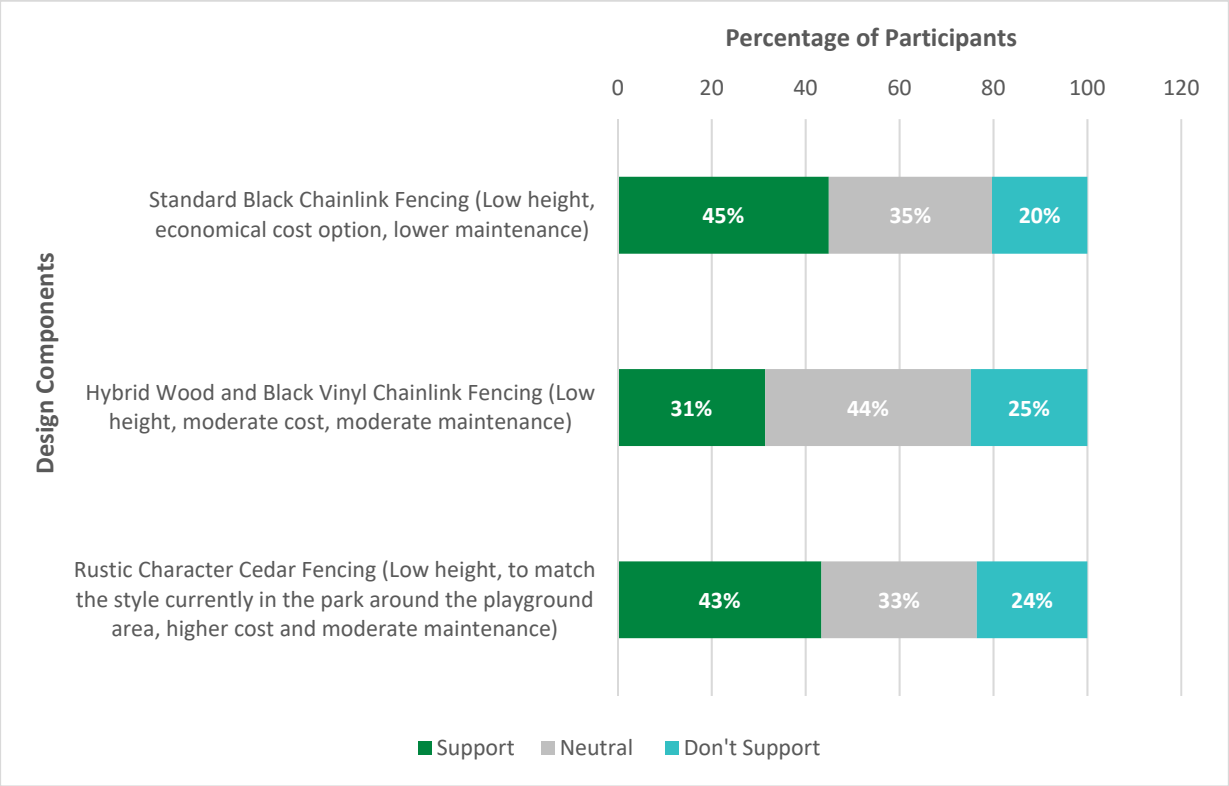
Sample Comments for Trail Access Nodes:

- Support for quality investment in public areas and the social use of these community areas including increased use by children and families.
- Support for clear, visible signage and wayfinding to access pathways including historical, local flora/fauna, or environmental stewardship interpretive signage for trail highlights.
- Bike rack security, space for different types of bikes, and amount of racks are all considerations for planning for bicycle travel.
- Some risk and concern with encouraging loitering and theft with bike racks.
- Bike repair stations could be a relevant feature here.
- Interest for other trail amenities such as upgraded washrooms, water fountains, garbage cans, and dog management.

- Benches or seating should be comfortable and wooden.
- Consideration for paving type for trail surface so that it is accessible and appropriate for skateboarding, seniors walking, etc.

Question 9: Field Buffer

- There is almost equal support for a standard black chain link fence (45%) or a Rustic Character Cedar Fence (44%).



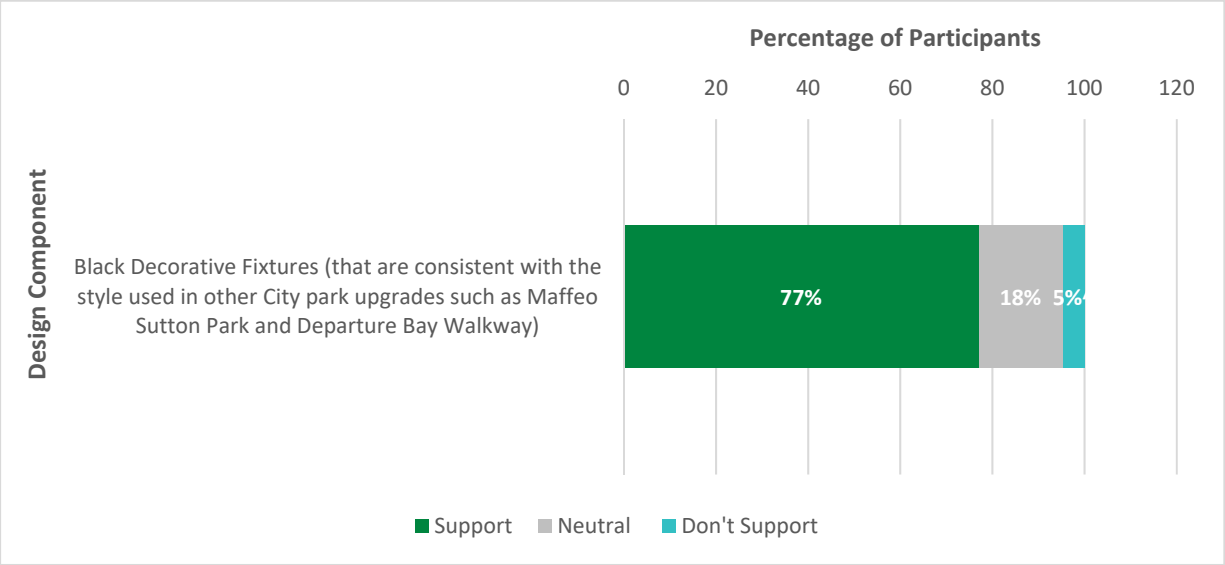
Sample Comments for Field Buffer:

- Ensure fencing is practical and cost efficient and that is it low cost to build and maintain.
- Consider design durability and design solutions that are less susceptible to vandalism and destruction.
- Strong support to ensure fence design is attractive, inviting, and provides an aesthetically-pleasing and useful place for people to socialize and increase community connections.
- Design style and upgrades here should demonstrate civic pride.
- Concerns that wood panels could block views and decrease the feeling of safety.
- Consideration for fencing to provide protection (e.g. to protect walkers from flying balls from the adjacent fields, to protection players from dogs, to minimize unwanted activity to the school and community gardens, and to reduce distractions for students on the other side of the fence).
- Some opinions that a chain link fence was too industrial or institutional with a "jail-like" character.

- Fencing to protect walkers from balls and flying soccer players, and protect players from dogs; try to disguise the chain link prison aspects but don't get all cutsey with 'character cedar'

Question 10: Trail Lighting

- The strong majority of participants (77%) support black decorative fixtures that are consistent with the style used in current City park upgrades for trail lighting.

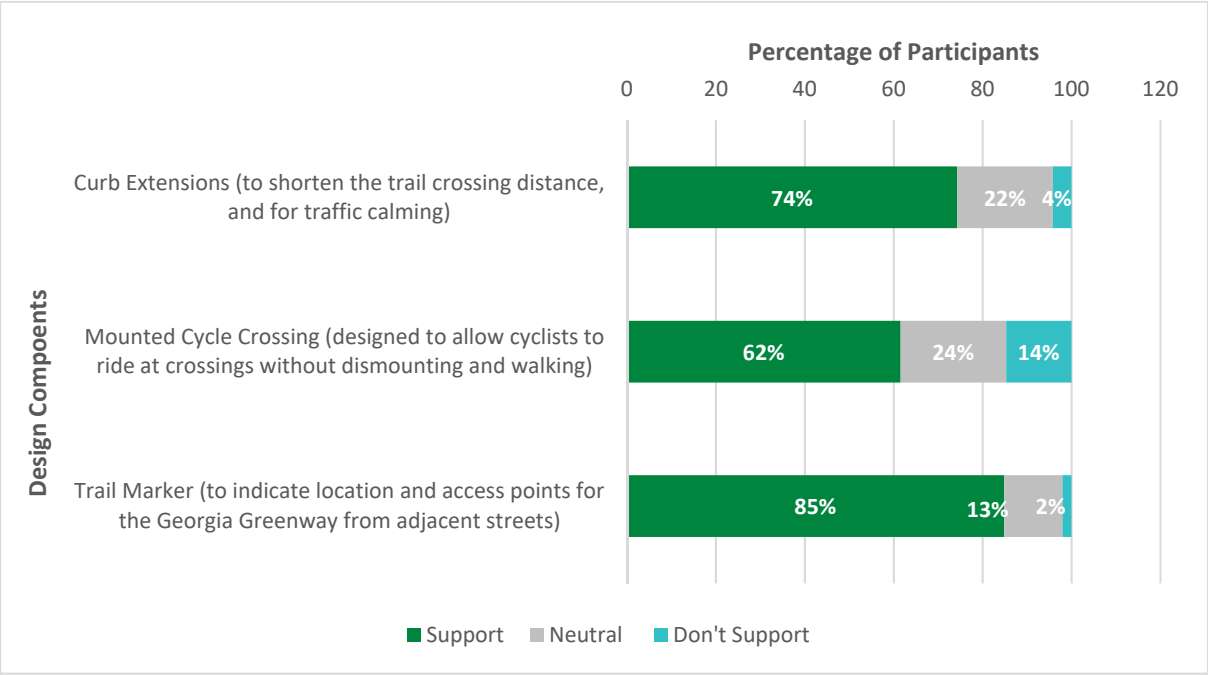


Sample Comments for Trail Lighting:

- Strong support for trail lighting in order to provide safety, deter crime, and discourage undesirable activities.
- Suggestions to consider solutions to save energy costs such as solar LED lighting.
- Mix of comments whether aesthetics or 'attractive' lighting was important or unnecessary.

Question 11: Street/Trail Crossings

- Participants strongly support curb extensions (74%) and trail markers (85%).

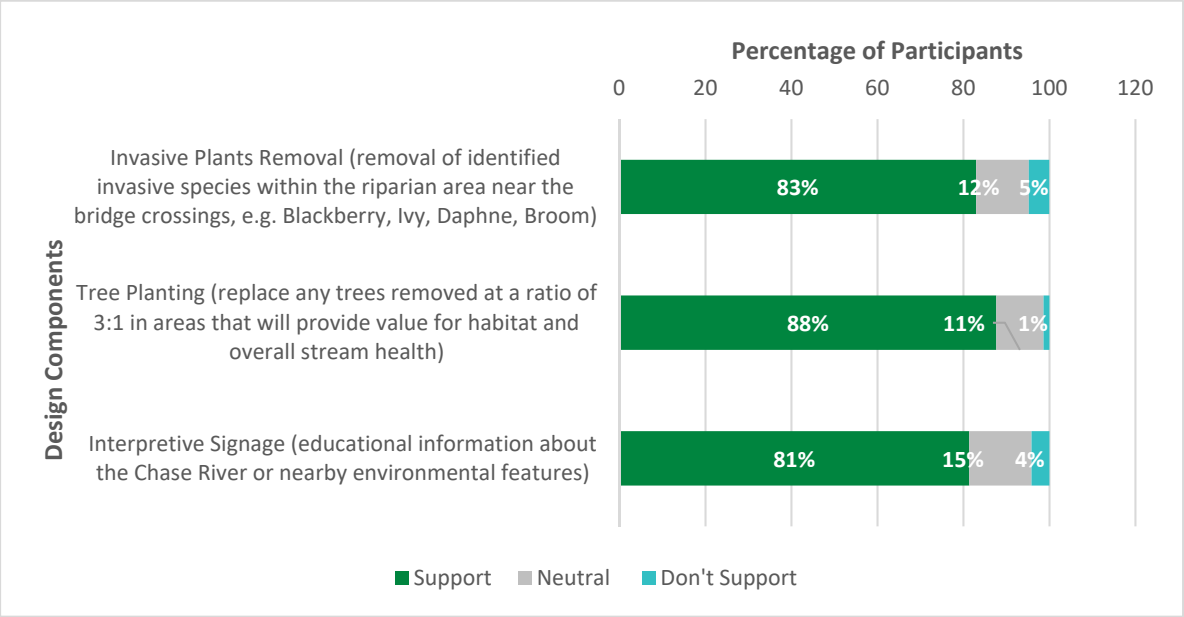


Sample Comments for Crossings:

- Support for traffic calming due to speeding traffic.
- Support for wheelchair and scooter accessibility on streets/trails crossings.
- Support for mounted cycle crossing as it tends to be left out due to budgetary constraints. Cyclists should not have to dismount when one of the purposes of the multi-use pathway is to encourage biking.
- Mixed comments for curb extensions:
    - Concern that they can be a hazard to drivers, and traffic is not so intense on Sixth or Seventh that calming is needed.
    - Others support the extensions for safety and comfort.

Question 12: Riparian Area Works

- The strong majority of respondents (82-88%) supported all three of the design components for consideration for the riparian area: Invasive plants removal, tree planting, and interpretive signage.



Sample Comments for Riparian Area Works:

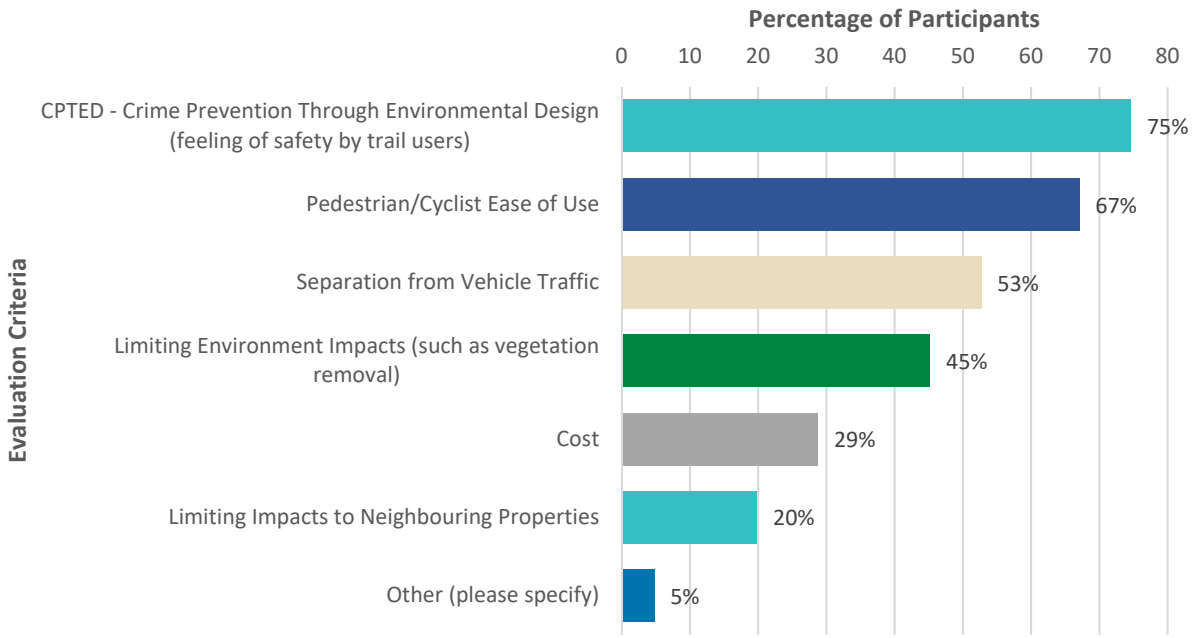
- Participants believe that riparian areas should be protected.
- Support for increasing urban canopy.
- Some concern that too much vegetation can make the area closed in and decrease the feeling of safety or increase undesirable activities.
- Support for planting provided it is done for the environment, is easily maintained, attractive, and adds shade.
- Some concern that invasive plant removal needs to be careful not to leave bare areas and decreased habitat within the riparian zone.
- Suggestion to set up volunteer funding for riparian area works, habitat restoration, and invasive species removal to minimize costs and use community members experience to maintain.
- Suggestion that interpretive signage could involve Snuneymuxw art work and information as well as include messaging related to geology, coal, water protection, or groundwater protection.

3.3 Overall Evaluation Criteria

To help assess the strengths and challenges of potential route options, participants were asked to consider the importance of potential evaluation criteria when designing and implementing the Georgia Greenway trail corridor.

Question 13: Top Three Criteria Most Important to Consider

1. Crime Prevention Through Environmental Design (CPTED)
2. Pedestrian/Cyclist East of Use
3. Separation from Vehicle Traffic



Other Evaluation Criteria Suggested:

Participants were asked to specify other evaluation criteria they felt was important to consider when designing and implementing the Georgia Greenway.

- **Neighbourhood Development** – Improve the design and functionality of the neighbourhood; consider overall growth and development of area.
- **Livability and Community Enhancement** – Provide the community with a place to meet, connect, and grow together; increase enjoyment of area so people want to spend time outdoors in.
- **Accessibility** - Improve universal accessibility; retain resident vehicle access to alley; ensure ease of use for pedestrians and cyclists.
- **Safety** - Increase safety for pedestrians; safety for students; clean up King Arthur Court; install video cameras; increase volunteer or police patrol to deter undesirable activity; increase lighting (especially in Third Street Park).
- **Environmental Sustainability** – Limit impacts to local flora and fauna; increase wildlife activity.
- **Connectivity** – Consider other plans for trail networks within the area.

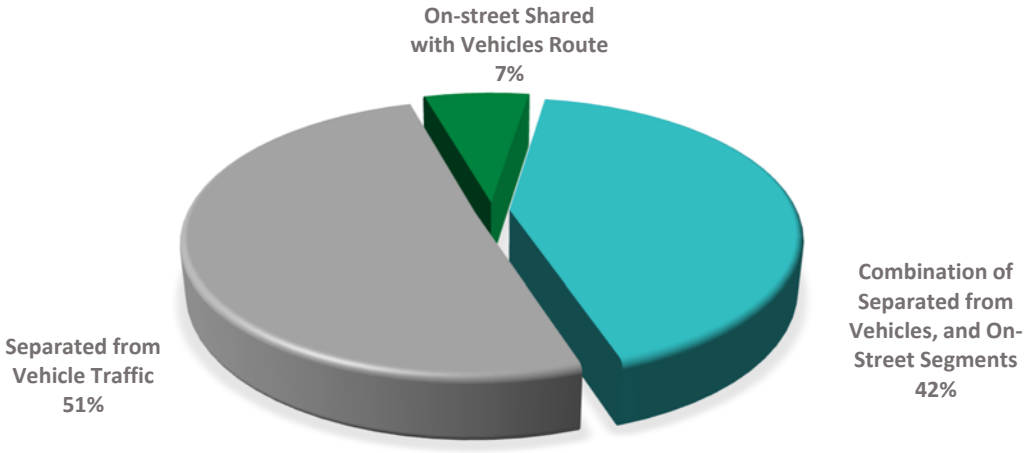
3.4 Future Phases

To understand community preferences for future phases on the Georgia Greenway, participants were asked to review conceptual options for:

- Fourth Street to Sixth Street
- Seventh Street to Eighth Street

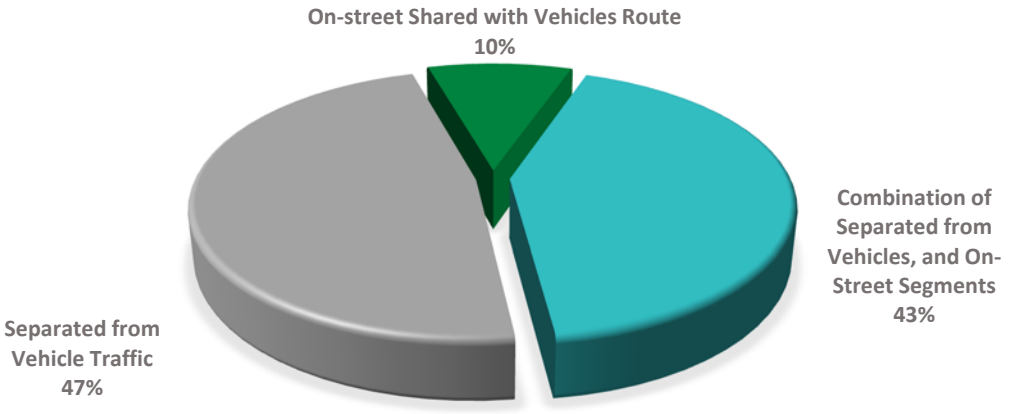
Question 14: Preferred Design Approach for Fourth Street to Sixth Street

- Slightly more participants (51%) preferred a separation from vehicle traffic while 42% preferred a combination of separation from vehicles and on-street segments.
- Only 7% prefer an on-street shared with vehicles route.



Question 15: Preferred Design Approach for Fourth Seventh Street to Eighth Street

- Similarly, participants prefer separation from vehicle traffic (47%) or a combination of separation from vehicles and on-street segments (43%).
- Only 10% prefer an on-street shared with vehicles route.



Question 16: Additional Comments or Ideas About Phase 1 (Current) or Future Phases of the Georgia Greenway

Participants were asked to provide any additional comments or ideas about Phase 1 (Current) or Future Phases of the Georgia Greenway. A summary of comments, organized by theme, are outlined below:

Project Support Themes and Comments:

The majority of participants are excited about the trail and future phases and welcome improvements due to benefits and opportunities for the following themes:

- General Safety (deter crime)
- Safety for Pedestrians and Cyclists
- Overall Community Benefit
- Active Transportation
- Accessibility & Connectivity
- Vegetation and Environment
- Development Strategies and Other Improvements

General Safety (deter crime):

- Improvements like lighting will improve safety for pedestrians and cyclists in the neighbourhood
- A through-route will bring community eyes to the area which will reduce crime and vandalism and discourage people from using it as a storage/dumping, sleeping, or drug trafficking area
- Improve safety in all times of day
- Provide fencing for the Community Garden to keep out all the people using the access. We need to protect the Community Garden from vandalism.

Increased Safety for Pedestrians and Cyclists:

- Design it to provide separation from vehicle traffic to differentiate the Greenway from existing cycling routes and increase user comfort with cycling in Harewood
- Provide an alternate to the speeding traffic and areas of no sidewalks along Bruce
- Bring comfort to allow children to walk to school
- Design it so that the trail is separated from busier roads where possible and then share the road with cars in low traffic areas
- Increase safety on Bruce due to traffic and unsafe crossings (e.g. suggest flashing lights on cross walks)
- Improve safety (vehicle traffic in the Bruce Avenue corridor has become dangerous)
- Provide a safe corridor for children to have freedom of movement and travel/cycle to school on their own
- Provide a safer way to get around
- Improve safety for families so that cycling increases
- Design it so there is a separate trail from vehicle traffic and actively discourage vehicles from using bicycle and multi-use pathway lanes as merging or parking points.

- Add more traffic calming measures throughout the Harewood neighbourhood
- Install traffic light at the street crossings
- Shared access as area is usable for a bike or a family or a scooter (motorized wheel chair) and traffic is rarely so heavy in this area that a little 'overlap' onto the roadway wouldn't be possible

Overall Community Benefit:

- Bring added benefit to the community
- Provide overall community enhancements
- Increase community pride for the Harewood neighbourhood
- Put people before profit
- Have the neighborhood be a model of sustainable design for future neighbourhoods and incorporate affordable housing, local business (please no big box stores) recreation and greenspace.
- Provide positive community investment
- Add a practical community asset
- Provide beautification to community
- Enhance modernity in Harewood neighbourhood
- Develop to help the underserved community
- Invest in a high-quality trail to make a "Class A" park
- Add more improvements to the South End (as opposed to the City prioritizing the North End)
- Carefully plan a high-quality trail (i.e. worthy investment for a safe and welcoming high-value community asset in a growing area that is supported by public)
- Be proactive in development of trail

Active Transportation:

- Ensure it is well-designed to encourage residents to use it frequently
- Encourage family-friendly activities
- Encourage more active transportation activities for the community
- Increase walking and pedestrian friendly routes and reduce car dependency, particularly as the area continues to grow
- Design trail appropriate for all ages and abilities
- Invest in secure bike and pedestrian transport corridor for community
- Promote a healthy lifestyle and invest in a healthy, active trail
- Encourage community to be active including families and children
- Implement trail to increase cycling
- Increase designated cycling areas in Harewood neighbourhood

- Add lighting to encourage more active transportation
- Enhance connectivity to multiple neighbourhoods by recreation trails
- Share access as it seems to be working on Bruce for bicycles and if there are problems, separation can be added

Accessibility & Connectivity

- Create access for all residents
- Ensure bridge is handicap accessible
- Consider possible lower physical strength of seniors and less-able-bodied walkers and provide benches and resting places, and multiple access points to the trail
- Link to Hammond Bay area to Departure Bay and Downtown
- Extend rail trail to connect Harewood to Downtown
- Extend to E & N Trail to do a large loop of City (Parkway Trail - Georgia Greenway – E & N Trail)
- Maintain fire access route
- Share use as there is plenty of room: install bollards at start of bridge (not at Sixth Street)
- Provide fencing for the Community Garden to keep out all the people using the access. We need to protect the Community Garden from vandalism.

Vegetation and Environment

- Increase trees and vegetation
- Provide some lovely flowering trees along the trails such as the ones along the Parkway Trail
- Enlist volunteer support for invasive plant removal and habitat restoration and invasive species removal
- Reduce damage to environment during the build of the Georgia Greenway
- Enhance vegetation and terrestrial habitats
- Ensure existing mature healthy trees remain
- Riparian area setback should be 50' minimum, optimally 100'. If more trees are going to be taken near the Chase, the trade-off should be trees planted to at least the distance along Centennial Park.

Development Strategies and Other Improvements

- Involve Harewood community so that locals help build and maintain with a vision so they will value and care for the trail (e.g. Single Track to Success in Carcross, Yukon (http://www.shiftthefilm.info/)
- Design the trail with the most durability possible at the lowest possible cost, so that funding can be used to make the trail longer or used in other ways
- Complete the project in entirety in the next 18-24 months maximum

- Undertake development of the initiative at one time (vs. smaller unconnected phases in the short-term)
- Quickly implement the project (prior to 2018)
- Provide adequate garbage cans for disposal
- Install more trash cans and recycling bins to reduce trash thrown to the side of the trail
- Design the trail infrastructure simple, clean, and effective
- Leave room for the skatepark at Harewood Centennial Park

Project Opposition Themes and Comments:

Some participants communicated a concern or lack of support for the project based on the following comments, grouped into three theme categories:

Safety Concerns

- Increase of drug use and related criminal activity
- Increase of theft ("getaway route")
- Decrease in community safety (and limited resources to patrol)
- Decreased safety for students and local school due to ease of public access to playing fields
- Concerns about trail requiring additional police patrol to minimize crime

Project Process and Costs

- Concerns about development of trail undertaken with little community involvement
- Concerns about trail improvements costing too much, potentially facing budget overruns, or being undertaken by expensive contractors
- Concerns about trail not being a priority for residents and therefore not a good use of taxpayers' money
- Other areas in Harewood are higher priority, such as support for the dams where currently many Harewood residents walk, cycle, and run

Access to Adjacent Private Properties

- Concern for potential loss of vehicle access to undeveloped Georgia Ave road right of way south of Sixth Street which is currently used as secondary access, parking, and RV storage by some adjacent residents in Sunny Brook Estates.

APPENDIX A:
VERBATIM RESPONSES FROM PUBLIC SURVEY & PUBLIC OPEN HOUSE

Verbatim Responses

PART 1: ABOUT YOU

QUESTION 2: Which area best describes where you live? If other, please specify.	
1	Old City
2	Chase River
3	Fairview
4	Regional District of Nanaimo (RDN).
5	Buttertubs Drive
6	Protection Island
7	South Nanaimo (near Milton).
8	Near Vancouver Island University (VIU).
9	Brechin
10	Uplands
11	Old City
12	University Heights
13	Work at John Barsby Community School.

QUESTION 5: How would you describe your household's current cycling/walking habits within the Harewood Neighbourhood? If other, please specify.	
1	Walking to/from Vancouver Island University.
2	None.
3	Walking to help keep neighbourhood safe/clean through use and connect with neighbours/others out walking in the community.
4	Walking to connect to the south end of the Parkway Trail for birding and enjoying wildflowers on Harewood Plains.
5	Skateboarding to the future Harewood Skatepark.
6	Safest, quietest route to Centennial Park :)
7	Walking to bus stop at University Village.
8	Limited walking, scooters.
9	Nil.
10	Shopping, visiting.

11	Cycle everywhere in the city.
12	Nature watching in alley way and along river - many birds.
13	Bird watching.
14	Drive.
15	Bike for fun.

PART 2: FEEDBACK ON PHASE 1 CONCEPTS

QUESTION 7: Proposed Bridge - Comments	
1	Anything that can be done to minimize the prospect of vandalism would be great (e.g. super heavy-duty materials or generally less cheaply made stuff). Also, knowing that in the summertime, this particular area is prone to "campers," anything that could be done to make it less comfortable or more difficult to hideout and "camp" would be great. On the topic of vandalism, I'm wondering if anything can be done to allow for space where graffiti artists can display their craft in certain areas?
2	Something that is made to feel safe while walking, including lights, would be good. No one likes to walk in the dark.
3	Timber deck and timber railings for most natural look.
4	Timber structure.
5	Do what is necessary for safety purposes but don't overdo the architectural components at added expense. This costs the taxpayer and repeatedly costs the taxpayer as it gets vandalized by non-taxpayers!
6	Great to see this trail taking advantage of natural features. It's a lovely river; just don't mess it up.
7	Lighting is 100% necessary, especially through the area for the proposed bridge as it may be dangerous or a safety concern for women and children in particular. As a frequent cyclist and pedestrian in the area, I do not feel comfortable or safe traveling in areas without appropriate lighting.
8	There are a lot of concerns with LED lighting that is too bright. I hope this is taken into consideration when choosing lighting.
9	Lighting will increase unwanted use during the night.
10	It is hard to assess an option "at added cost" without an idea of what "added" represents (e.g. 10%? 50%?).
11	Use our money wisely!
12	Lighting makes it easy for thieves to use for escapes.
13	Why not hold art space on the railing walls? Edmonton has had great success limiting graffiti by promoting the art in allowed spaces.
14	LED lighting is economical but would be detrimental to local fauna.

15	Lighting for safety is a valid consideration but not at the expense of light pollution, which has its own negative health repercussions for the surrounding dwellings. Perhaps the lighting could be timed to come on during peak commuting hours in the winter, but not throughout the night.
16	Interested in improved access to amenities regarding scooters.
17	In addition to lighting, a security "911" button would add safety to trail.
18	Cedar railings would be nice.
19	Anything with architectural involved adds mega-bucks.
20	Lots of lights.
21	Been waiting for this for years!
22	I like the third photo in examples of railings.
23	Lighting is important for public safety in vegetated areas and where environmental hazards exist (i.e. Chase River).
24	Lighting may reflect false negative as when I pressed "Tab" it shifted my "support" back to "neutral".
25	Too much light pollution already!
26	Something simple design-wise; well-lit for safety, yet sensitive to the riparian environment.
27	Lighting - as much as possible along the whole trail. Make it look great, not just basic. Pretend it was the North End.
28	I would suggest solar lighting. Let's show some innovation. It is the 21st century after all.
29	The area of the Chase River by Barsby often has (I quote the kids) “crackheads” and other sketchy characters. The proposed area is very close to the school and would be ideal for drug dealers.
30	I walk home a lot. It would be a big help and active trail to use on a daily basis.
31	There is nothing wrong with the Harewood areas. Building a trail/bridge in fire lane at the end of Georgia and Sixth Street is a waste of taxpayers’ dollars and will create more drug trafficking than there already is in our neighbourhood. I live on the corner of the fire lane at the end of Georgia with a six-year-old boy and don't need the drug trafficking on the side of my house.

QUESTION 8: Proposed Trail Access Nodes - Comments	
1	I support anything and everything to encourage pro-social use of our public areas. If any of these ideas will bring children and families and other users of services out, I support them.
2	Path signage is really poor in Nanaimo. Cyclists and walkers need clear, visible signs telling them where to access pathways.
3	The most important thing about the bike racks are security, ease of use (i.e. enough space for multiple bikes and different types of bikes, such as tandem, bike with a trailer, reclining tricycles), and of course, enough racks.

4	Are there only the three nodes in Harewood Park? I don't understand why three are needed. Just provide bike stands, signage, seating, and water fountain close to the washrooms (which I hope will be upgraded). Don't forget garbage cans and those doggy bags.
5	We need to invest in our community! I believe all of these options will be used and it is better to invest now in a quality option than later.
6	Make it smooth for skateboarding.
7	The bike repair stations that Saanich has been installing have shown to be effective and cost little.
8	It would be great to highlight and historical features with signs.
9	More vegetation and less pavement, please.
10	I don't see a need for bike racks. If I used it Harewood is not an area I would lock and leave a bike.
11	Bike racks are just another place for loitering (undesirable).
12	My preference would be to see the allocated funds stretched as far as possible, i.e. spend more to build and connect the trails and to improve safety and lighting, and keep the themes and frills to a minimum.
13	No bike racks. Yes, to signage about area history, local flora and fauna, and environmental stewardship.
14	A paving surface that is friendlier to aging knee joints is important for my age group.
15	Bike racks? Thieves tried to steal bikes from that area of the school, right beneath a classroom window. All racks were moved to the front.
16	Make it look dope, buddy.
17	The bench should either be wooden or something else comfortable, not a concrete, homeless-proof one. If there are too many concerns about vagrants using them, best to leave them out. This is a great way to celebrate and showcase the cycle-friendly and walkability of Harewood. Let's not skimp on amenities.
18	This a waste of money which should be put back into the schools for education for the children.

QUESTION 9: Proposed Field Buffer - Comments	
1	I support whatever you the experts think will be the most cost-efficient but also not look ghetto. Also, things that are less susceptible to vandalism/destruction are always great.
2	Hybrid wood fence looks great as pictured in the example. It would provide an attractive place for people to linger, talk, meet, drink a coffee, and increase community connections.
3	Let's be pragmatic: make the area useful, safe, low-cost for build and maintenance, and keep tendency to vandalism to a minimum (i.e. Chain link fencing is difficult to deface with spray cans!).
4	Fencing to protect walkers from flying balls from soccer players and protect players from dogs. Try to disguise the chain link prison aspects but don't get all cutesy with 'character cedar'.
5	Will be vandalised so it's best to use cheap and easily replaceable fencing.
6	This neighbourhood has traditionally been depressed and needs to be upgraded; therefore, I'm in favour of spending more to create more pleasing aesthetics/civic pride. Chain link fences have an institutional/jail-like character and I would suggest staying away from them whenever possible.

7	Want it to look nice and inviting, not industrial.
8	More vegetation and less chain.
9	Wood panels are more susceptible to vandalism and create a degree of privacy and therefore lessened safety.
10	Low cost, low maintenance.
11	High by the school. Minimizes access / vandalism to community gardens. Minimizes access for undesirables. Reduces distraction for students on that side of the school.
12	We want to take pride in our community so I think we should go all out.
13	If cost is not an obstacle, I would go for the cedar fencing and character.
14	If this trail goes through, I would like the City to put a fence up along my property line and the trail to keep people out of my yard as I don't feel that I would need to do this if the fire lane stayed as it should: a fire lane.

QUESTION 10: Proposed Trail Lighting - Comments	
1	I think that lighting is a must. It will likely serve to give some people a sense of safety while hopefully discouraging undesirable activities. All the better if the lighting style is consistent with other areas in town.
2	Lighting will be required for safety purposes.
3	Trail should be well lit to avoid people using it as a place to live or conduct unsavoury activities.
4	Sounds great!
5	LED lighting that is powered by solar to save energy costs.
6	All places should have the same. It doesn't matter where you come from. Everyone pays taxes.
7	What's wrong with dark?
8	Should include lighting but I think decorative is unnecessary.
9	Please include sufficient lighting to deter crime and drug use in the area.
10	Yes, absolutely! Make it look great!
11	Solar.
12	If it goes through, lots of lighting and possibly cameras.
13	This is not something we need in Harewood. There are roads that have worked just fine. Why waste tax payers' money when most of us are already low-income families.

QUESTION 11: Proposed Street/Trail Crossing - Comments	
1	I like the traffic calming idea. Slow down jerks! Also, signs and trail markers are great if only to let people know the trails are there.

2	Cyclists should have areas to cycle in at intersections that don't require them to dismount when using a multi-use pathway. Vancouver has installed these with great success.
3	Just don't make the bikers get off their bikes at every crossing. That does NOT encourage biking at all.
4	People will need to know the Greenway is there if we expect them to use it!
5	Those curb extensions are horrible. They do little to decrease the distance, can be a hazard to drivers, and traffic is not so intense on Sixth or Seventh that calming is needed. Pedestrians always -- no matter what precautions are provided -- need to watch for traffic.
6	Signage is very important in all parks and on all trails!
7	The cyclist dismount signs all over Nanaimo have become a "boy who cried wolf" issue. I've been told to dismount so many times that I never do it anymore. They should be restricted to the actual dangerous sites.
8	It should be wheelchair accessible.
9	Make it all wheelchair and scooter-friendly.
10	Mounted cycle crossing is key. Otherwise, I'd just ride the road if cycling to work.
11	More trees, please.
12	This (Mounted Cycle Crossing) is an important piece that is left out due to budgetary constraints at most/all of the City's projects. Make this happen.
13	The Harewood neighbourhood in general, but especially in the vicinity of the existing park and future trail, needs more traffic calming measures.
14	Don't really understand this question.
15	If cost effective, I would support all of these. If not too expensive, addition of curb extensions would be ideal.
16	Once again, I Do Not Support This Project as it will cause more issues in my neighbourhood that we have been trying to clean up i.e. drug trafficking down the side of my house.

QUESTION 12: Proposed Riparian Area Works - Comments	
1	Please protect the riparian area(s).
2	Trees are nice; flowers are nicer if can be planted somewhere. Too many trees make it more closed in and could possibly create a hidden space for predators if there were to be any, which would make certain individuals, including myself, not want to walk there alone.
3	Tree planting done in a manner that is best for: 1: Nature, 2: Ease of maintenance, 3: Adding shade from the west side of the bridge, 4: Attractiveness either visually or through scents. Not planting done to some arbitrary ratio.
4	Do what is necessary for both removal and planting but without extreme development for either!
5	We are every bit as invasive a species as ivy or broom; let it be. We live on the river and someone from the Georgia Strait Alliance told us that anything that stays in the river for more than a month becomes part of the environment. If we strenuously try to remove everything 'foreign' we could be doing a lot more harm to fish, crayfish, mussels and other living beings.

6	Set up some volunteer funding. My partner and I have 30 years combined experience in habitat restoration and invasive species removal. Keep project costs low with volunteer labour for this end of things.
7	I'm 100% in favour of expanding our urban canopy whenever the opportunity presents itself. Please make this trail as green as possible with the addition of trees and other plants.
8	Geology, coal, water protection, and groundwater protection to signage would be good for awareness as well.
9	Interpretive signage should be contracted to Sny-ney-meux artists.
10	We are nature lovers. This is extremely important!
11	Trees and other native plants to support a diverse habitat may be better than just trees. It would be nice to keep some of the wild fruit trees (now wild with the farms gone) in this area, considering how many have already been removed in Harewood due to new development.
12	Whether or not it goes through.
13	There are already trees there. Why take them down? Nothing wrong with them. I feel that the City is spending money for projects that DO NOT need to be done. Waste of my money as well as my neighbour's.

PART 3: OVERALL EVALUATION CRITERIA

QUESTION 13: Please select the top three criteria you believe are most important to consider when designing and implementing the Georgia Greenway trail corridor. (Please select up to three.) If other, please specify.	
1	Design, functionality, and overall enhancement of the neighbourhood.
2	Giving the community a place to meet, connect, and grow together.
3	You can best make the trail -- and the whole Harewood area -- feel safe by making it a livable community. Respect the residents, clean up King Arthur Court and other problem areas, and the trail will be a safe place.
4	Good educational signage to make it safe for pedestrians to use without being rundown/startled by faster moving cyclists.
5	Enjoyment. Harewood needs an area that people want to be outside in. Make something nice, spend a bit more if you need.
6	Limiting impact to local flora and fauna.
7	Make it safe for folks that have disabilities.
8	Safety top priority. Video cameras might be a good idea too.
9	There is going to have to be some police patrol or volunteers or something. The criminals are bad and so are the hookers hanging out at the new apartments in Harewood that are just getting remodelled. They don't live there; they just get sold there. Sad.
10	'Ease of use' a close fourth.
11	Non-human wildlife should also be encouraged to use this corridor.

12	Lighting is important, especially with Nanaimo's surge in crime and drug use. I find this to be an issue in Third Street Park (NAC to 2nd Street paved pathway). Super dark, tons of homeless camps in the trails, and often sketchy people.
13	Vehicle access for residents adjacent to alley must be retained!
14	Retaining resident access to alley.
15	Other plans for trail networks in the area.
16	Our neighborhood is changing rapidly due to increase in development and home prices are surging upwards. I love my community and am excited about this project, but am hoping that the overall growth of the neighborhood is being taken into considerations and that there is a community development plan in place that does not just involve beige house after beige house.
17	Safety of primary and secondary students.
18	This trail IS NOT wanted.

ADDITIONAL COMMENTS:

QUESTION 16: Do you have any additional comments or ideas about the Phase 1 (current) or future phases of the Georgia Greenway that you would like to share at this time?	
1	Thank you for improving our community.
2	I don't think that this is a priority area for cyclist.
3	In order to make cycling and trail use safe and accessible, it should be separated from vehicle traffic as much as possible, and vehicle traffic actively discouraged from using bicycle and multi-use pathway lanes as merging or parking points.
4	I understand that it all can't be done at once; however, small, unconnected phases aren't very useful in the short term. Better to do a phase a year.
5	I have concern that this "Greenway" may become a thoroughfare for thieves. We know that they are roaming the neighbourhoods and going into people's yards all night in this area. This pathway would be the perfect get-away. Police cars couldn't go on it. 24/7 patrolling by bike cops will obviously not be possible. I'm pretty sure the only time I'd feel safe to walk or bike on it would be in the busiest part of the day.
6	I look forward to the implementation of Phase 1 and future phases. We like in Harewood and want to have safe walking/bike paths to enjoy with our children.
7	I'd love to see a Greenway linking the Hammond Bay area to Departure Bay area then to Downtown.
8	Great project. Let's get 'er done before the election on October 20, 2018!
9	Full speed ahead and all the power to you, the City, for making this happen! I'm sure I would not be the only one interested in helping out with invasive plant removal or? Putting calls out to the community to have them/us come help.
10	If this is for the Harewood Neighborhood, then the people of the Harewood need to be invested in it. If they help build it, they will value it, care for it, and maintain it. This is a wonderful opportunity for a project like: 'Single Track to Success in Carcross, Yukon' (http://www.shiftthefilm.info/) HOWEVER, if this is just another 'big idea' for the City of Nanaimo - high costs, all work done by large contractors, end results far over budget, etc. and if this is just another area where police will

	need to patrol constantly in order to minimize crime, then it is a complete waste of time and money. This needs to be handled and built by 'locals with a vision,' not some city planning employees with a limited grasp of the realities of the area and the initial and ongoing costs of such a project.
11	Try shared access; it seems to be working on Bruce for bicycles. If there are problems, separation can be added. Without additional barriers, the area is usable for a bike or a family or a scooter (motorized wheel chair). Traffic is rarely so heavy in this area that a little 'overlap' onto the roadway would be impossible if a bike meets a scooter.
12	I think it's responsible to provide it safely for all ages and abilities, made with the most durability possible at the lowest possible cost, so that funding can be used to make the trail longer or used in other ways. No point in spending money for the sake of spending money.
13	The Georgia Greenway will provide an area with limited safety measures for pedestrians and cyclists (e.g. no sidewalk or minimal shoulder - paved or gravel) with transportation options. I am a big supporter of building a safe, well-lit, and beautiful addition to our community.
14	Leave room for the skatepark at Harewood Centennial Park.
15	If you're going to do this, do it right. It's worth spending more money (assuming appropriate Request for Proposals procedures are in place) if needed to implement a safe and welcoming project. It may be a tough sell with the public, so do your homework and take the time to properly consult with them, get the buy-in you need, and create a huge value-add for this very promising part of town.
16	It sounds like an exciting project that I am happy to have in my neighbourhood.
17	I'm excited for this addition to our growing community!
18	Would like to see some lovely flowering trees along the trails, such as the ones along the Parkway Trail.
19	Bravo Nanaimo, the proposed walkways that you are working on are a wonderful addition to our City and way of life. This makes me very happy.
20	I was serious about the volunteer labor for habitat restoration and invasive species removal. I'd love to talk about spearheading something with the City.
21	Great project. It'll be a great asset for this area.
22	I think this is a fantastic step forward to help Harewood become a modern neighborhood that creates access for all residents. Vehicle traffic in the Bride Avenue corridor has become dangerous for all. Having access to a safe corridor would allow my children to have freedom of movement and would allow them to…
23	The trail should be well designed to encourage residents to use it frequently and to discourage people from using it as a storage/dumping/living/drug-using area. Residents should feel completely safe while using the trail in all areas/at all times of day. If done right, the trail could be hugely beneficial to the Harewood area, perhaps deterring crime and drug use that has escalated in our neighbourhood as of late.
24	Go ahead and spend the money to make this trail as good as it can possibly be! This project is practical and provides beautification for an area that has been under-served in the past. Take my tax dollars!
25	Safety is my main concern. Is there a way to contact someone if being harassed? Is there a way for police to track suspicious person or suspect? Deterrents like cameras? But the overall idea of this trail is great, because right now, the traffic on Bruce is biggest safety concern. Safe crossing on Bruce is key too (flashing lights at cross-walks).

26	This is great for the community. I look forward to using it!
27	This looks like a great plan. I was also hoping for an extension of the rail trail to connect Harewood to Downtown.
28	I have lived in Harewood most of my life. I am saddened and appalled the way that the City of Nanaimo caters to the north and does very little for the south. I think they should put a red-light district by Country Club Mall and see how long it stays there...not very! Sad.
29	Lots of lights, surveillance cameras, security. Some of the path that already exists are used for thieves to get away.
30	I think investing in a secure bike and pedestrian transport corridor is a great investment for the whole community and promotes a healthy lifestyle.
31	Make it safe.
32	Extend to E & N Trail so we could do a large loop of the City (Parkway Trail - Georgia Greenway – E & N Trail).
33	Very excited as people should be walking and biking more. I am concerned that this become an area for crime, or will be vandalized frequently. Most of our neighbours lack a sense of community or pride in their neighbourhood.
34	Maybe the City should look at putting money into the dams where most of Harewood is willing to walk, cycle, run, etc. on any given day. The parking lots are full and there is a lot of people there. Stop wasting money in the north end, City parks that don't need it, and put some money into one of the South End's jewels, and as a long-term Harewood resident, it seems that the City would rather log burn and pave it.
35	Separation from vehicle traffic is essential to differentiate the Greenway from existing cycling routes and increase user comfort with cycling in Harewood.
36	People drive way too fast and there are portions with no sidewalks along Bruce. I think alternate separated pedestrian/bike paths would make me way more comfortable allowing my children to walk to school.
37	Make it a Class "A" park.
38	Busier areas should be separated from roads where possible, but low traffic areas could share roads with cars.
39	I am very pleased to see this trail being implemented. We cycle quite a bit as a family and work on proper etiquette and safety constantly, but traffic can be very dangerous for our children and the lack of designated cycling areas in our Harewood neighbourhood make us hesitant to allow them more freedom to cycle on their own. I like the idea of connecting multiple neighbourhoods by recreation trails. This helps us keep our kids active and allows them a safer way to get around.
40	The alley behind Sunny Brook Estates should remain as always and same as all of Harewood: accessible to residents to get to and from their properties. Plenty of room for shared use. Put bollards at start of bridge and not at Sixth Street.
41	The existing alley way portion access to homes #1,3,4, and 5 should not be taken away from residents, with at least one parking spot on the Greenway per house allowed. Existing mature healthy trees remain. Maintain fire access.
42	Have adequate garbage can for disposal so that people wont litter when using the Greenway.
43	As noted previously, I would like to see more traffic calming measures implemented throughout the Harewood neighbourhood generally, but certainly as part of this project. Improving the lighting in the area would likely also greatly increase the feeling of safety at night, and would encourage

	more active transportation. Design-wise, I would like to see the project infrastructure kept simple, clean, and effective.
44	Strongly support this project on behalf of myself and the tenants that occupy my property in the area. Improved walking and pedestrian friendly routes are badly need in Nanaimo to reduce our dependency on car travel. This need is only compounded by the growth in the area. This project should be completed in its entirety in the next 18-24 months max. The whole way to 4th. Good work City of Nanaimo for taking this on!
45	I would love our neighborhood to be a model of sustainable design that looks to the future of neighborhoods. Incorporating affordable housing, local business (please no big box stores), recreation, and greenspace. Let's raise the bar and put people before profit.
46	Planners to keep in mind the possible lower physical strength of seniors and less-able-bodied walkers. Provide benches and resting places, and multiple access points to the trail.
47	Safety concerns for all students. It will be extremely close to Barsby, and will cut student access to playing fields. Ease of public access to the back of the school is not necessarily a good thing.
48	Let's take pride in our community and make it a healthy, active trail.
49	I just hope for no more damage to be done to the environment during the build of the Georgia Greenway. I would want only the best for this planet. More trash cans and recycling bins will reduce trash thrown to the side of the trail. I would also want to see more plant life and better care for animals that live in the areas.
50	Traffic light on the street crossing.
51	Wishing you luck. Good to be proactive and encouraging us to be active.
52	Attention: Janes Park Bridge needs to be handicap accessible as I saw someone having difficulty there. Thanks.
53	Go for it! A great investment for our community!
54	This not wanted in the Georgia Ave./Sixth St. fire lane. I have already caught young teenagers selling and buying crack and crystal meth in the fire lane. If this trail is completed, the residents at Sunny Brook Estates that line with the fire lane may experience more criminal issues than we already have and I have a six-year-old that I have to watch out for. Future possibilities that residents get to look forward to: find dirty needles, drug shrapnel, etc. NO THANK YOU. KEEP IT OUT of my neighbourhood.

OTHER

OTHER	
1	▶ Provide fencing for the Community Garden to keep out all the people using the access. We need to protect the Community Garden from vandalism.
2	▶ In case of flood or earthquake, Barsby students evacuate to the only area above the water level: the corner of 5th and Howard on City property. Crossing the Greenway could be an obstacle.
3	▶ Too close to school: what will be the impact of trail so close to exit doors of school. Potential getaway route" for drug dealers.

Appendix D

SUB-CONSULTANT REPORTS

RB ENGINEERING LTD
ELECTRICAL CONSULTING ENGINEERS

September 8th 2017

Patrick Ryan, P.Eng.
Associate
Herold Engineering Limited
3701 Shenton Road
Nanaimo, BC V9T 2H1

Dear Patrick,

Re: Georgia Greenway – Pedestrian Trail Lighting Options – Rev. 1

RB Engineering Ltd. was retained by Herold Engineering Ltd. to review the proposed Georgia Greenway pedestrian trail lighting options.

Incorporating feedback that we received from City of Nanaimo through you, the City is interested in using 10 foot high lamp standards and in using a style of pedestrian light that has already been installed in the City to simplify their maintenance requirements.

In reviewing the currently available options for pedestrian level lighting, it became apparent that there are three main options available to the City for trail lighting applications: Economic LED (such as the Cree Edge Series), LED decorative (such as the Cyclone Domia), or LED solar powered (such as First Light Technologies IPL Series). Although there are many lighting products on the market, we believe that these options (and the specific luminaires) form a representative selection of light fixtures that would perform well for the City for this application. A couple of the products have even been incorporated into City projects.

In the following paragraphs, we have provided an overview of each of these options to help with the selection process.

Option 1: LED area/pathway light such as the Cree Edge Series that was specified for the City of Nanaimo Boxwood Bike Connection Project. This light fixture has a slim low profile design with minimal aesthetic options and is the most cost effective at approximately $2,500/pole (including pole, base and wiring). Refer to appendix A for cut sheet information.

Option 2: LED decorative pathway light such as the Cyclone Domia Pendant that was specified for the City of Nanaimo Departure Bay Seawall. For the purposes of this project, we would recommend going with the smaller scale Domia Mini Pendant (SY21P1) with dimensions of 21”x15.5” which was used for the Harewood Quality Foods pathway lighting. The Cyclone Domia Pendants that were used for the Departure Bay Seawall (CY55P1B) were mounted at 17 feet above grade and at 27.5”x19.5” they could look disproportionately large at 10 feet above grade, which is why we are suggesting the Domia Mini Pendant. Option 2 is more costly at approximately $5,000/pole (including pole, base and wiring). Refer to appendix A for cut sheet and Luminaire Scale Guide for the different Cyclone Domia options.

Option 3: LED solar powered pathway lighting. First Light Technologies out of Victoria BC specializes in solar powered LED lighting and they have a pathway lighting product called the IPL Series which is more aesthetically pleasing than many of its predecessors in that the solar panel has been minimized to fit on the light fixture itself. This option is approximately $3,750/pole and base and has the additional cost savings of no trench work, conduit, electrical wiring or electrical power service connection. Costs saved by the absence of power bills would be somewhat offset by the cost of battery replacement every 8-10 years. Refer to appendix A for cut sheet and details.

The potential pitfall of the solar powered technology over a standard utility powered installation is that the light output of the luminaire is dependent on how much sunlight is available during daylight hours. If the battery is not able to attain a full charge during the day, it will not output its full light rating at night.

Another consideration for the trail lighting is the number of light fixtures that will be required to light the trail to City of Nanaimo Walkway lighting level standards. A summary of the estimated number of light fixtures required to light the Georgia Greenway Trail to the City Walkway standard of 4 lux average and uniformity ratio of 6:1 is listed in the table below. This lighting calculation assumes a 4m wide trail with asphalt surface, light loss factor (LLF) of 0.79, mounting height of 10 feet and offset of 1m from the trail. Please note that the trail "nodes" have not been taken into account at this point for the purpose of allowing a simplified comparison.

Table 1: Summary Characteristics of Proposed Trail Lighting

Luminaire	LED Wattage	Average Light Level (lux)	Uniformity Level	Number of light fixtures required	$/pole	Total ROM Cost
Cree Edge Series	25	9.2	5.4	19	$2,500	$47,500
Cyclone Mini Domia	20	4.0	5.0	30	$5,000	$150,000
First Light Technologies IPL Series	unknown	6.41*	5.8*	30*	$3,750	$112,500

*Actual light output may be lower due to inability to attain full battery charge during low UV daylight hours.

Based on the lighting simulations completed by RB Engineering Ltd., the Cree Edge Series light fixture had the best performance characteristics of the three options listed above with regards to the number of light fixtures required and average lighting level achievable while maintaining the uniformity level.

The Cyclone Mini Domia and the First Light Technologies IPL are somewhat comparable with regards to the number of light fixtures required to achieve min. 4 lux average and maintain the uniformity ratio of 6:1, however; if a predictable lighting level is required, only the Cyclone Mini Domia will be able to achieve this out of these two fixtures.

All fixtures have optics that focus light along the path and thus avoid excessive light pollution into neighbouring properties. Further, at a mounting height of 10 feet, very little (if any) light will pass through to properties that have a solid fencing along the pathway.

RB ENGINEERING LTD
ELECTRICAL CONSULTING ENGINEERS

With regards to the lighting of the “node areas” along the Georgia Greenway Trail, we propose high-lighting these with bollards from the same product family as that of the trail lighting. This will visually denote the nodes as points of confluence where the pedestrian traffic will naturally converge to enter or exit the field areas.

The lighting of the pedestrian bridge over the Chase River poses a unique challenge as the City has requested that the light spillage over the water course be limited as much as possible. In order to properly address this concern, we would need quantitative light level limitations from a biologist for the detailed design. Decreased light spillage could potentially be accomplished by installing lower level lighting such as step lighting, strip lighting or handrail lighting on the bridge. The selected option would depend on exact light limitations and how the bridge is constructed. These options will be much more costly than using pole mounted luminaires, however; pole mounted luminaires will have the worst light spillage. If any of these lower level lighting options are of interest, we can investigate in detail as the design progresses.

This completes my observations and recommendations for the pathway lighting options for the Georgia Greenway Trail. Please give me a call if you have any questions.

Regards,

Laurie Voroney P.Eng.
RB Engineering Ltd.

RB ENGINEERING LTD
ELECTRICAL CONSULTING ENGINEERS

Appendix A: Lighting cut sheets

Cree Edge™ Series

LED Area/Flood Luminaire

Product Description

The Cree Edge™ Series has a slim, low profile design. Its rugged cast aluminum housing minimizes wind load requirements and features an integral, weathertight LED driver compartment and high performance aluminum heat sinks. Various mounting choices: Adjustable Arm, Direct Arm, Direct Arm Long, or Side Arm (details on page 2). Includes a leaf/debris guard.

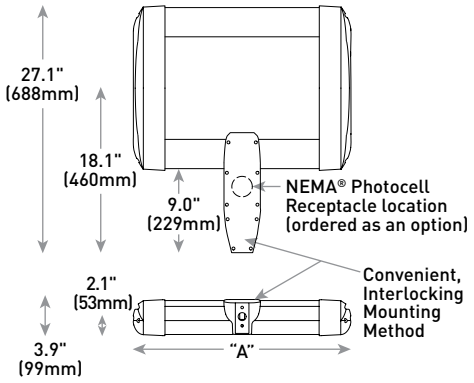
Applications: Parking lots, walkways, campuses, car dealerships, office complexes, and internal roadways

Performance Summary

- Patented NanoOptic® Product Technology
- Made in the U.S.A. of U.S. and imported parts
- **CRI:** Minimum 70 CRI
- **CCT:** 4000K (+/- 300K), 5700K (+/- 500K) standard
- **Limited Warranty†:** 10 years on luminaire/10 years on Colorfast DeltaGuard® finish

†See http://lighting.cree.com/warranty for warranty terms

DA Mount



LED Count (x10)	Dim. "A"	Weight
02	12.1" (306mm)	21 lbs. (10kg)
04	12.1" (306mm)	24 lbs. (11kg)
06	14.1" (357mm)	27 lbs. (12kg)
08	16.1" (408mm)	28 lbs. (13kg)
10	18.1" (459mm)	32 lbs. (15kg)
12	20.1" (510mm)	34 lbs. (15kg)
14	22.1" (560mm)	37 lbs. (17kg)
16	24.1" (611mm)	41 lbs. (19kg)

AA/DL/SA Mount - see page 22 for weight & dimensions

Accessories

Field-Installed	
Bird Spikes XA-BRDSPK **Hand-Held Remote** XA-SENSREM - For successful implementation of the programmable multi-level option, a minimum of one hand-held remote is required	**Backlight Control Shields** XA-20BLS-4 - Four-pack - Unpainted stainless steel

Ordering Information

Example: ARE-EDG-2M-AA-12-E-UL-SV-350

					E				
Product	**Optic**			**Mounting***	**LED Count (x10)**	**Series**	**Voltage**	**Color Options**	**Drive Current**	**Options**
ARE-EDG	**2M** Type II Medium **2MB** Type II Medium w/BLS **2MP** Type II Medium w/Partial BLS **3M** Type III Medium	**3MB** Type III Medium w/BLS **3MP** Type III Medium w/Partial BLS **4M** Type IV Medium **4MB** Type IV Medium w/BLS	**4MP** Type IV Medium w/Partial BLS **5M** Type V Medium **5S** Type V Short	**AA** Adjustable Arm **DA** Direct Arm **DL** Direct Long Arm	**02** **04** **06** **08** **10** **12** **14** **16**	**E**	**UL** Universal 120-277V **UH** Universal 347-480V	**BK** Black **BZ** Bronze **SV** Silver **WH** White	**350** 350mA **525** 525mA **700** 700mA - Available with 20-60 LEDs	**DIM 0-10V Dimming** - Control by others - Refer to Dimming spec sheet for details - Can't exceed specified drive current **F Fuse** - Refer to ML spec sheet for availability with ML options - Available with UL voltage only - Available for U.S. applications only - When code dictates fusing, use time delay fuse **HL Hi/Low (Dual Circuit Input)** - Refer to HL spec sheet for details - Sensor not included **ML Multi-Level** - Refer to ML spec sheet for details - Intended for downlight applications at 0° tilt **P Photocell** - Refer to ML spec sheet for availability with ML options - Available with UL voltage only **PML Programmable Multi-Level, 20-40' Mounting Height** - Refer to PML spec sheet for details - Intended for downlight applications at 0° tilt **PML2 Programmable Multi-Level, 10-30' Mounting Height** - Refer to PML spec sheet for details - Intended for downlight applications at 0° tilt **R NEMA® Photocell Receptacle** - Intended for downlight applications with maximum 45° tilt - Photocell by others - Refer to ML spec sheet for availability with ML options **40K 4000K Color Temperature** - Minimum 70 CRI - Color temperature per luminaire
FLD-EDG	**25** 25° Flood **40** 40° Flood	**70** 70° Flood **SN** Sign	**N6** NEMA® 6	**AA** Adjustable Arm **SA** Side Arm - Available with 20-60 LEDs						

* Reference EPA and pole configuration suitability data beginning on page 19

NOTE: Price adder may apply depending on configuration

Product Specifications

CONSTRUCTION & MATERIALS

- Slim, low profile, minimizing wind load requirements
- Luminaire sides are rugged die cast aluminum with integral, weathertight LED driver compartment and high performance heat sinks
- DA and DL mount utilizes convenient interlocking mounting method. Mounting is rugged die cast aluminum, mounts to 3-6" (76-152mm) square or round pole and secures to pole with 5/16-18 UNC bolts spaced on 2" (51mm) centers
- AA and SA mounts are rugged die cast aluminum and mount to 2" (51mm) IP, 2.375" (60mm) O.D. tenons
- Includes leaf/debris guard
- Exclusive Colorfast DeltaGuard® finish features an E-Coat epoxy primer with an ultra-durable powder topcoat, providing excellent resistance to corrosion, ultraviolet degradation and abrasion. Black, bronze, silver, and white are available
- **Weight:** See Dimensions and Weight Charts on pages 1 and 22

ELECTRICAL SYSTEM

- **Input Voltage:** 120-277V or 347-480V, 50/60Hz, Class 1 drivers
- **Power Factor:** > 0.9 at full load
- **Total Harmonic Distortion:** < 20% at full load
- DA and DL mounts designed with integral weathertight electrical box with terminal strips (12Ga–20Ga) for easy power hookup
- Integral 10kV surge suppression protection standard
- When code dictates fusing, a slow blow fuse or type C/D breaker should be used to address inrush current
- **Maximum 10V Source Current:** 20 LED (350mA): 10mA; 20 LED (525 & 700mA) and 40-80 LED: 0.15mA; 100-160 LED: 0.30mA

REGULATORY & VOLUNTARY QUALIFICATIONS

- cULus Listed
- Suitable for wet locations
- Enclosure rated IP66 per IEC 60529 when ordered without P or R options
- Consult factory for CE Certified products
- Certified to ANSI C136.31-2001, 3G bridge and overpass vibration standards when ordered with AA, DA and DL mounts
- 10kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2
- Meets FCC Part 15, Subpart B, Class A standards for conducted and radiated emissions
- Luminaire and finish endurance tested to withstand 5,000 hours of elevated ambient salt fog conditions as defined in ASTM Standard B 117
- DLC qualified. Exceptions apply when ordered with full backlight control or 3MP optic with 20 LEDs. Please refer to www.designlights.org/QPL for most current information
- Meets Buy American requirements within ARRA

Electrical Data*

LED Count (x10)	System Watts 120-480V	Total Current (A)					
		120V	208V	240V	277V	347V	480V
350mA							
02	25	0.21	0.13	0.11	0.10	0.08	0.07
04	46	0.36	0.23	0.21	0.20	0.15	0.12
06	66	0.52	0.31	0.28	0.26	0.20	0.15
08	90	0.75	0.44	0.38	0.34	0.26	0.20
10	110	0.92	0.53	0.47	0.41	0.32	0.24
12	130	1.10	0.63	0.55	0.48	0.38	0.28
14	158	1.32	0.77	0.68	0.62	0.47	0.35
16	179	1.49	0.87	0.77	0.68	0.53	0.39
525mA							
02	37	0.30	0.19	0.17	0.16	0.12	0.10
04	70	0.58	0.34	0.31	0.28	0.21	0.16
06	101	0.84	0.49	0.43	0.38	0.30	0.22
08	133	1.13	0.66	0.58	0.51	0.39	0.28
10	171	1.43	0.83	0.74	0.66	0.50	0.38
12	202	1.69	0.98	0.86	0.77	0.59	0.44
14	232	1.94	1.12	0.98	0.87	0.68	0.50
16	263	2.21	1.27	1.11	0.97	0.77	0.56
700mA							
02	50	0.41	0.25	0.22	0.20	0.15	0.12
04	93	0.78	0.46	0.40	0.36	0.27	0.20
06	134	1.14	0.65	0.57	0.50	0.39	0.29

* Electrical data at 25˚C (77˚F). Actual wattage may differ by +/- 10% when operating between 120-480V +/- 10%

Recommended Cree Edge™ Series Lumen Maintenance Factors (LMF)[1]

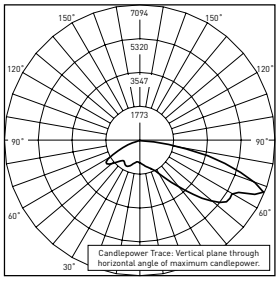
Ambient	Initial LMF	25K hr Projected[2] LMF	50K hr Projected[2] LMF	75K hr Calculated[3] LMF	100K hr Calculated[3] LMF
5˚C (41˚F)	1.04	1.01	0.99	0.98	0.96
10˚C (50˚F)	1.03	1.00	0.98	0.97	0.95
15˚C (59˚F)	1.02	0.99	0.97	0.96	0.94
20˚C (68˚F)	1.01	0.98	0.96	0.95	0.93
25˚C (77˚F)	1.00	0.97	0.95	0.94	0.92

[1] Lumen maintenance values at 25˚C are calculated per TM-21 based on LM-80 data and in-situ luminaire testing
[2] In accordance with IESNA TM-21-11, Projected Values represent interpolated value based on time durations that are within six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)
[3] In accordance with IESNA TM-21-11, Calculated Values represent time durations that exceed six times (6X) the IESNA LM-80-08 total test duration (in hours) for the device under testing ((DUT) i.e. the packaged LED chip)

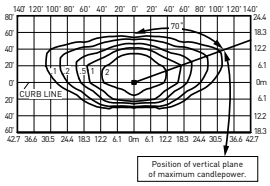
Photometry

All published luminaire photometric testing performed to IESNA LM-79-08 standards by a NVLAP accredited laboratory. To obtain an IES file specific to your project consult: http://lighting.cree.com/products/outdoor/area/cree-edge-series-1

2MP



CSA Test Report #: 6361
ARE-EDG-2MP-**-06-E-UL-700-40K
Initial Delivered Lumens: 9,912



ARE-EDG-2MP-**-10-E-UL-525-40K
Mounting Height: 25' (7.6m) A.F.G.
Initial Delivered Lumens: 15,458
Initial FC at grade

Type II Medium Distribution w/Partial BLS				
LED Count (x10)	4000K		5700K	
	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11	Initial Delivered Lumens*	BUG Ratings** Per TM-15-11
350mA				
02	2,209	B1 U0 G1	2,253	B1 U0 G1
04	4,418	B1 U0 G1	4,505	B1 U0 G1
06	6,551	B2 U0 G1	6,681	B2 U0 G1
08	8,735	B2 U0 G2	8,908	B2 U0 G2
10	10,892	B2 U0 G2	11,108	B2 U0 G2
12	13,071	B2 U0 G2	13,330	B2 U0 G2
14	15,153	B2 U0 G2	15,453	B2 U0 G3
16	17,317	B3 U0 G3	17,661	B3 U0 G3
525mA				
02	3,135	B1 U0 G1	3,200	B1 U0 G1
04	6,270	B1 U0 G1	6,401	B2 U0 G1
06	9,297	B2 U0 G2	9,492	B2 U0 G2
08	12,396	B2 U0 G2	12,656	B2 U0 G2
10	15,458	B2 U0 G3	15,782	B2 U0 G3
12	18,549	B3 U0 G3	18,938	B3 U0 G3
14	21,504	B3 U0 G3	21,954	B3 U0 G3
16	24,576	B3 U0 G3	25,091	B3 U0 G3
700mA				
02	3,700	B1 U0 G1	3,775	B1 U0 G1
04	7,400	B2 U0 G2	7,550	B2 U0 G2
06	10,973	B2 U0 G2	11,196	B2 U0 G2

* Initial delivered lumens at 25°C (77°F). Actual production yield may vary between -10 and +10% of initial delivered lumens
** For more information on the IES BUG (Backlight-Uplight-Glare) Rating visit: www.ies.org/PDF/Erratas/TM-15-11BugRatingsAddendum.pdf. Valid with no tilt

Domia
DETAILS

The Domia offers smooth curves and a timeless shape blends easily into any environment. With a flat lens design, the DOMIA family enhances any project while offering high performance and Dark-Sky compatibility.

CY55P1A

EPA: 1.295 FT²
Weight: 46 lbs - 21 kg

CONSTRUCTION
- Sturdy aluminum casting housing available with or without integrated driver compartment
- Certified IP67 optical system
- Silicone gaskets and stainless steel hardware
- Mounts onto Ø2" I.D. pendant tenon or onto side-mount 2 3/8"Ø O.D. tenon with optional self-leveling (ADV)

FINISH
- Super durable extremely resistant exterior polyester powder coating meets AAMA 2604 requirements (5 years South Florida exposure)
- Available in 10 standard colors / textured (TX) or smooth (SM) finish
- Optional RAL colors are also available
- For added protection a Marine Grade (MG) pre-finish is available to meet ASTM G7, B117,D1654 and D2247 requirements (salt spray, corrosion and humidity resistance)

LED, LENS & OPTICS
- High power LED available in 3000k & 4000K
- Type 2, 3, 3m (wide), 4 & 5 Roadway optics available
- Optional House-side shield available to cut back light
- Flat Clear Glass (FGC) - highest efficiency and performance
- Flat Clear Frost (FGF) - reduces glare with better unifomity
- All lens & optics are fully UV stable
- Dark Sky compliant

CY55T4

CY55P1B

FORMATS
- Available Pendant or Post Top (Yoke mount) or a Utility Fitter variation (top & bottom images) that features easy tool-free access

c UL us
SUITABLE FOR WET LOCATIONS

IP67

ELECTRICAL
- Dimmable 0-10 volt, high power factor (90%) driver
- 120, 208, 240, 277, 347 or 480 volts available
- 10 kA Surge protector supplied standard

OPTIONAL
- Programmable driver (PROG), Button-type photocell (PC)
- 7-Pin ANSI C136.41 receptacle (PTDR) available with shorting cap (PX), photocell (PT) or long-life photocell (PTL)
- Field adjustable 10% increment step-dimming switch (SD)

Contact factory for **WIRELESS CONTROLS** and further details

cyclone

Galaxy
LED ENGINE

The Galaxy Light engine unit is a custom designed, modular system that combines state-of-the-art optics, LEDs and thermal management and is rigorously tested to ensure high performance and long life.

ROBUST DESIGN

- Sealed IP67
- Modular aluminum LED board with acrylic optic
- Die cast aluminum alloy heat sink with thermal interface
- Heat sink designed and tested for optimal thermal management performance in all weather from
- 40C/-40F to 50C/ 122F
- High Power LEDs with thermal and electric protection for stability and protects it from electrical surge.

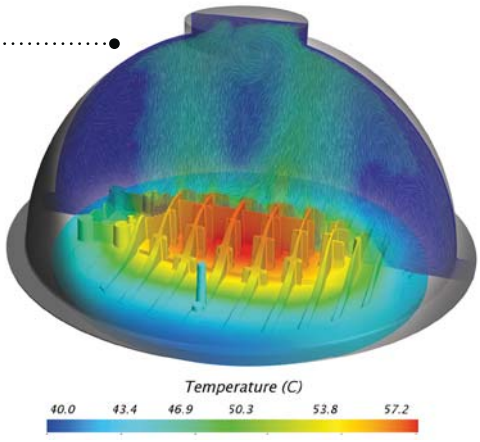
Computational Fluid Dynamics simulation

PERFORMANCE DRIVEN

- Modular design allows the GALAXY wattages ranging from 20 to 200W
- Equivalent to 50-400W HID with 60% energy saving

- GALAXY engines are tested & designed for a lifespan of over 100,000 hours

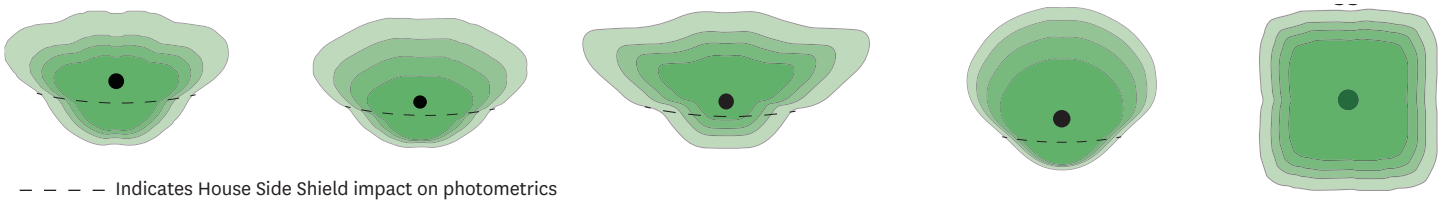
- Tested according to LM79 standard by recognize NVLAP independent laboratories



IES Distribution types

Cyclone Lighting offers optically engineered performance systems based on a series of acrylic injection molded lens of IES Roadway distribution types giving you the performance of a cobra head in a sleek decorative fixture.

Type 2 | Type 3 | Type 3M | Type 4 | Type 5



– – – – Indicates House Side Shield impact on photometrics

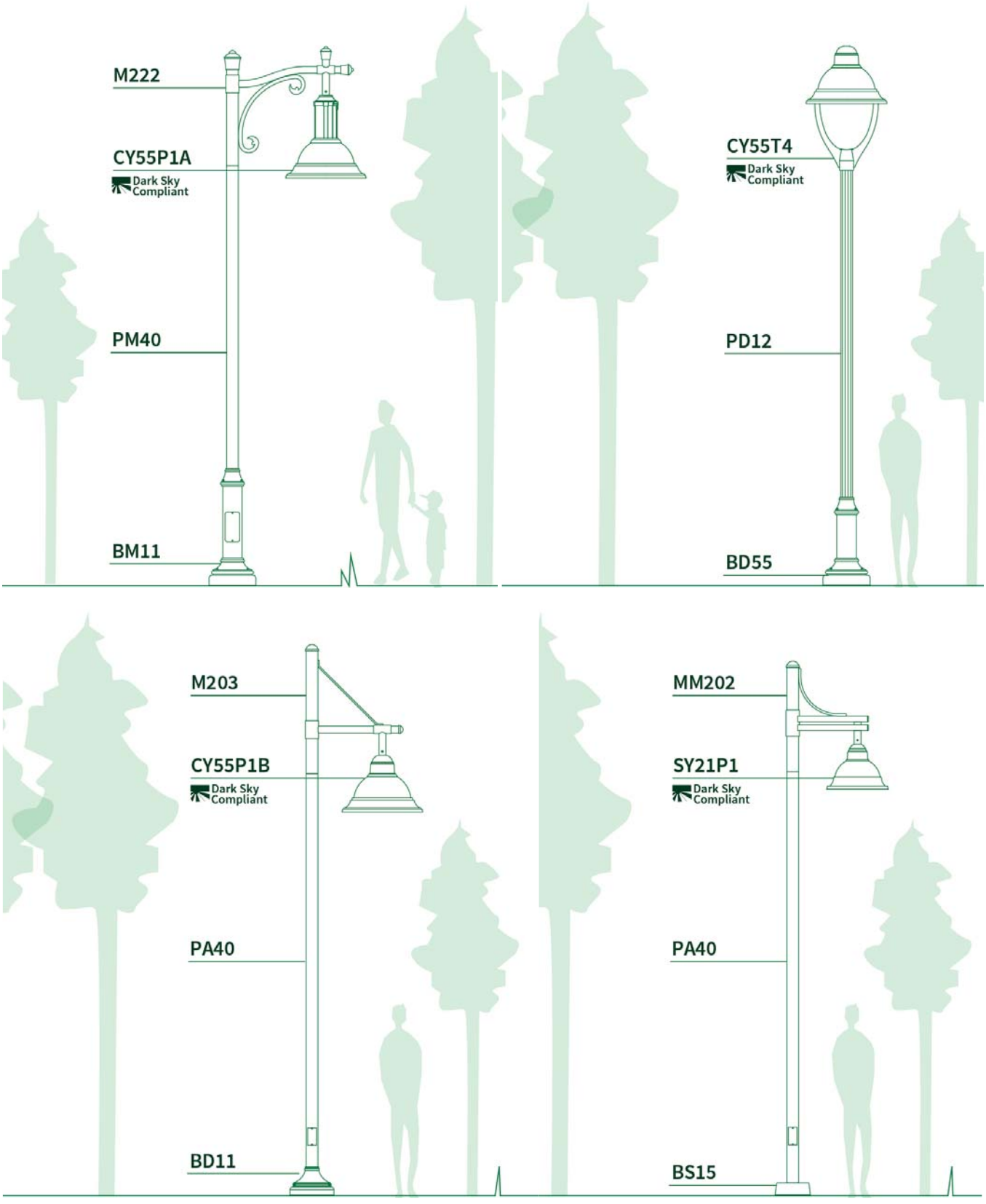
House Side Shield option

The HOUSE SIDE SHIELD (HS) give you a better back control for those LEED projects where light spill or light trespass are critical. This options can be added post installation.

Please consult website for latest IES files

cyclone

Luminaire
SCALE GUIDE



cyclone

Pendant

CY55P1A / CY55P1B

Ordering Template

MODEL	LENS	DIST.	WATT	CCT	VOLT	ADAPTOR	OPTIONS	COLOR	TEXTURE	OP.FIN.
CY55P1A	FGC	2	20W	3K	120	NONE	NONE	BK	TX	MG
CY55P1B	FGF	3	40W	4K	208	ADV	PC[2,3]	MT	SM[4]	
		3M	60W		240		PT[1, 3]	DG		
		4	80W		277		PTL[1, 3]	MA		
		5	100W		347		PTDR[1, 3]	SI[4]		
		2HS	120W		480		PX[1, 3]	BZ		
		3HS	140W[1]				PROG	BG		
		3MHS	160W[1]				SD	GM		
		4HS	200W[1]					PG		
								WH		

[1]FOR CY55P1A AND CY551PB WITH ADV ADAPTOR
[2]FOR CY55P1B ONLY
[3]ONLY ONE OF THESE OPTION CAN BE CHOSEN

ORDERING CODE

References

LENS

FGC	FLAT GLASS CLEAR
FGF	FLAT GLASS FROST

DISTRIBUTION

HS	INTERNAL HOUSE SHIELD

SEE PHOTOMETRIC PAGE FOR DETAILS

CCT

3K	3000K
4K	4000K

WATT

SEE PHOTOMETRIC PAGE FOR LUMEN OUTPUT

ADAPTOR

NONE	FITS INTO Ø2" I.D. X MIN 4" LONG TENON
ADV	SELF-LEVELING, SIDE MOUNT ADAPTOR FITS ONTO Ø2 3/8" O.D. x MIN 6" LONG TENON

OPTIONS

NONE	NONE
PC	BUTTON-TYPE PHOTOCELL
PT	PHOTOCELL W/7-PIN RECEPTACLE (ANSI C136.41)
PTL	LONG LIFE PHOTOCELL W/7-PIN RECEPTACLE (ANSI C136.41)
PTDR*	7-PIN RECEPTACLE (ANSI C136.41)
PX	SHORTING CAP W/7-PIN RECEPTACLE (ANSI C136.41)
PROG*	PROGAMMABLE DRIVER
SD*	FIELD ADJUSTABLE 10% INCREMENT STEP-DIMMING SWITCH

*CONTACT FACTORY FOR WIRELESS CONTROLS AND MORE INFORMATION REGARDING PROG AND SD OPTIONS

COLOR

BK	BLACK RAL9005
MT	METALLIC GRAPHITE TEXTURED ONLY (PROPRIETARY FORMULA)
DG	DARK GREEN RAL6012
MA	MARINE BLUE RAL5013
SI[4]	METALLIC SILVER RAL9006 (SMOOTH ONLY)
BZ	DARK BRONZE RAL8019
BG	BURGUNDY RAL3005
GM	MOSS GREEN RAL6005
PG	PALE GREY RAL7040
WH	WHITE RAL9003

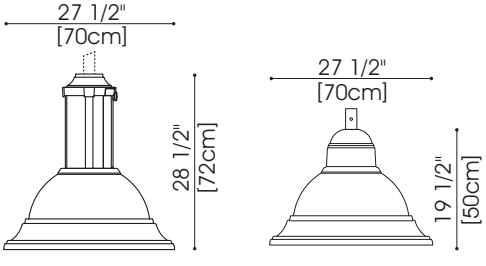
TEXTURE

TX	TEXTURED
SM[4]	SMOOTH (METALLIC SILVER RAL9006 ONLY)

OP.FIN. (OPTIONAL FINISH)

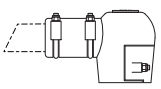
MG	MARINE GRADE PRE-FINISH

Luminaire



CY55P1A CY55P1B

Adaptors



ADV
(Self-Leveler)

cyclone

Pendant MINI

SY21P1

Ordering Template

MODEL	LENS	DIST.	WATT	CCT	VOLT	OPTIONS	COLOR	TEXTURE	OP.FIN.
SY21P1	FGC	2	20W	3K	120	NONE	BK	TX	MG
	FGF	3	40W	4K	208	PC	MT	SM	
		3M	60W		240	PROG	DG		
		4	80W		277	SD	MA		
		5	100W		347		SI		
		2HS			480		BZ		
		3HS					BG		
		3MHS					GM		
		4HS					PG		
							WH		

ORDERING CODE

SY21P1									

References

LENS

FGC	FLAT GLASS CLEAR
FGF	FLAT GLASS FROST

DISTRIBUTION

HS	INTERNAL HOUSE SHIELD

SEE PHOTOMETRIC PAGE FOR DETAILS

CCT

3K	3000K
4K	4000K

WATT

SEE PHOTOMETRIC PAGE FOR LUMEN OUTPUT

OPTIONS

NONE	NONE
PC	BUTTON-TYPE PHOTOCELL
PROG*	PROGAMMABLE DRIVER
SD*	FIELD ADJUSTABLE 10% INCREMENT STEP-DIMMING SWITCH

*CONTACT FACTORY FOR WIRELESS CONTROLS AND MORE INFORMATION REGARDING PROG AND SD OPTIONS

COLOR

BK	BLACK RAL9005
MT	METALLIC GRAPHITE TEXTURED ONLY (PROPRIETARY FORMULA)
DG	DARK GREEN RAL6012
MA	MARINE BLUE RAL5013
SI	METALLIC SILVER RAL9006 (SMOOTH ONLY)
BZ	DARK BRONZE RAL8019
BG	BURGUNDY RAL3005
GM	MOSS GREEN RAL6005
PG	PALE GREY RAL7040
WH	WHITE RAL9003

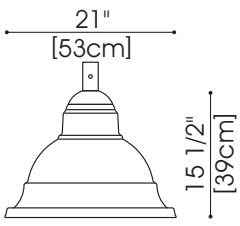
TEXTURE

TX	TEXTURED
SM	SMOOTH

OP.FIN. (OPTIONAL FINISH)

MG	MARINE GRADE PRE-FINISH

Luminaire



SY21P1

Photometry

CY55P1B / SY21P1

SOURCE: LED 4000K ± 150K, 70 CRI minimum[1]
WATERPROOF RATING: IP67 optical system
Dark Sky friendly optical system
Data base on luminaire using FGC (Flat glass clear)

LED code definition:

2 - 20W - 4K

- Color temperature
- LED Wattage
- Optical distribution

Type 2

LED CODE	LUMEN OUTPUT	EFFICACY (LM/W)	WATTAGE LED	WATTAGE SYSTEM[2]	LED CURRENT (mA)	BUG RATING	HID EQUIVALENCY[3]
2-20W-4K	2202	100	20	22	350	B1-U0-G1	50W
2-40W-4K	4015	89	40	45	700	B1-U0-G1	70W
2-60W-4K	6087	90	60	67	700	B1-U0-G1	100W
2-80W-4K	8030	89	80	90	700	B1-U0-G1	150W
2-100W-4K	10102	90	100	112	700	B2-U0-G2	200W
2-120W-4K	12304	91	120	135	700	B2-U0-G2	250W

Type 3

LED CODE	LUMEN OUTPUT	EFFICACY (LM/W)	WATTAGE LED	WATTAGE SYSTEM[2]	LED CURRENT (mA)	BUG RATING	HID EQUIVALENCY[3]
3-20W-4K	2168	98	20	22	350	B1-U0-G1	50W
3-40W-4K	3953	87	40	45	700	B1-U0-G1	70W
3-60W-4K	5993	89	60	67	700	B1-U0-G1	100W
3-80W-4K	7906	87	80	90	700	B1-U0-G2	150W
3-100W-4K	9946	88	100	112	700	B2-U0-G2	200W
3-120W-4K	12114	89	120	135	700	B2-U0-G2	250W

Type 3M

LED CODE	LUMEN OUTPUT	EFFICACY (LM/W)	WATTAGE LED	WATTAGE SYSTEM[2]	LED CURRENT (mA)	BUG RATING	HID EQUIVALENCY[3]
3M-20W-4K	1934	87	20	22	350	B0-U0-G1	50W
3M-40W-4K	3527	78	40	45	700	B1-U0-G1	70W
3M-60W-4K	5347	79	60	67	700	B1-U0-G2	100W
3M-80W-4K	7054	78	80	90	700	B1-U0-G2	150W
3M-100W-4K	8874	79	100	112	700	B1-U0-G3	200W
3M-120W-4K	10809	80	120	135	700	B2-U0-G3	250W

*For CY55P1B only
[1]**IES-TM-21** Calculated **L70** is over **363 000** hours.
IES-TM-21 Reported more than **54 000** hours.
[2]System wattage includes the LED and the Driver.
[3]Equivalency should always be verified by photometric layout.
*4000K used for testing, 3000K photometrics is available on website.

Note: Due to rapid and continuous advances in LED technology, LED luminaire data is subject to change without notice and at the discretion of Cyclone Lighting. Cyclone Lighting reserves the right to substitute materials or change the manufacturing process of its products without prior notification. See the latest results and updates on our website at www.cyclonelighting.com

cyclone


CY55P1B


CY55T4


SY21P1
cyclone


CY55P1B
www.cyclonelighting.com

FIRSTLIGHT TECHNOLOGIES

IPL Series

Solar LED Integrated Architectural Area Light

Project:

Type: Quantity:

The IPL series solar LED luminaire is an ideal choice for architectural, commercial, recreational bikeway/pathway and public space lighting applications. The self-contained, contemporary, curvilinear design smartly embraces modern solar power, adaptive control and LED technologies. With robust construction, and unequalled performance the IPL series is an excellent fit wherever high-quality, full cutoff lighting and minimal visual clutter is required.

Utilizing solar power and LEDs, the IPL is completely self-contained and offers significant benefits over grid-based pathway lights including:

- Low installed cost and minimal site impact with no trenching, cabling or wiring
- Minimal ongoing costs with no electrical bills or bulbs to change
- Not affected by power outages
- A sustainable choice without recurring carbon emissions

All of our solar powered lights are enabled by our innovative Solar Lighting Controller (SLC). The SLC in each light is "self-learning" and allows the lights to predictively adapt to their surroundings, providing a level of lighting performance and reliability unavailable in other solar lighting products.

TECHNICAL SPECIFICATIONS

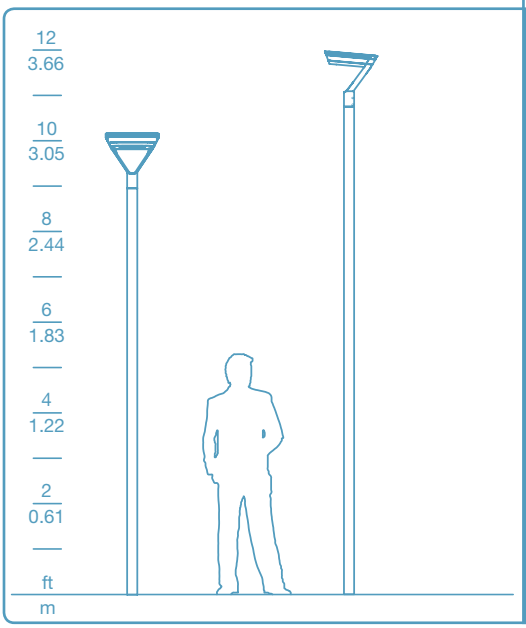
Solar Module:	▪ High-efficiency mono-crystalline cells ▪ Inconspicuously mounted on top of luminaire ▪ Used for day/night detection (no photocell required)
Solar Lighting Controller (SLC):	▪ High-efficiency, temperature compensated Maximum Power Point Tracking (MPPT) ▪ Micro-controller based technology ▪ Includes high-efficiency LED driver ▪ Integrated into luminaire housing ▪ Designed to automatically manage lighting performance based on environmental conditions and lighting requirements ▪ Patent Pending
Battery:	▪ High performance Lithium ($LiFePO_4$) ▪ Exceptional 8 – 10 year life cycle ▪ High temperature tolerance ▪ Contained within luminaire housing ▪ Designed for easy battery changes when required

LEDs and Optics:	▪ 100,000 hour L70 lifetime ▪ Warm (3000K) and neutral (4500K) white color temperatures available ▪ High efficiency Type 2, 3, 4 and 5, full cut-off optics ▪ Typical lumen output from 850 to 1200 lumens
Mechanical Construction:	▪ Cast, low copper aluminum top, housing, and arms ▪ Stainless fasteners with security fastener option ▪ Architectural grade, super durable, TGIC powder coat ▪ Four standard colors with custom colors available
Factory Set Lighting Profiles:	▪ On at dusk, off at dawn ▪ On at dusk, off after 6 hours ▪ On at dusk, dim to 30% after 6 hours till dawn ▪ On at dusk, off after 5 hours, on 1 hour before dawn ▪ On at dusk, dim to 30% after 5 hours, on 1 hour before dawn

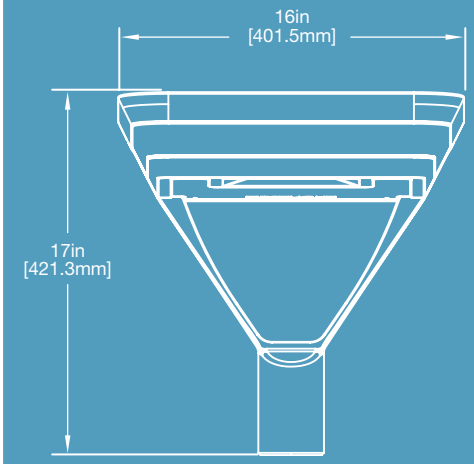
FIRSTLIGHT TECHNOLOGIES

IPL Series

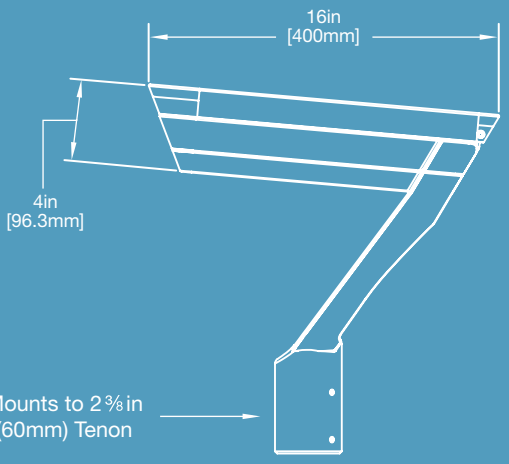
Solar LED Integrated Architectural Area Light



EPA: 0.65ft² (0.06m²) | Weight: 27 lbs (12.3 kg) including battery

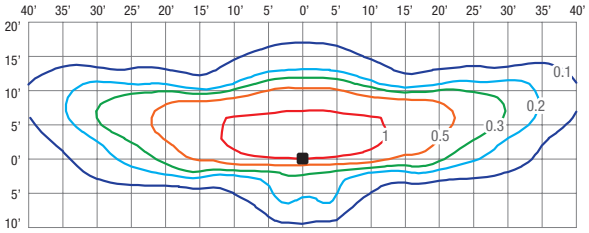


Front View

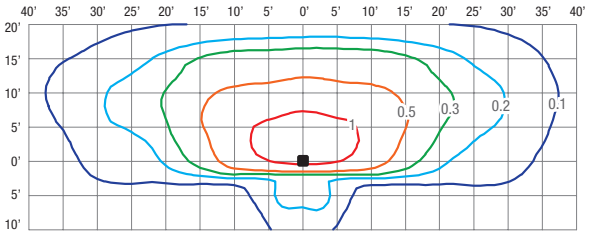


Side View

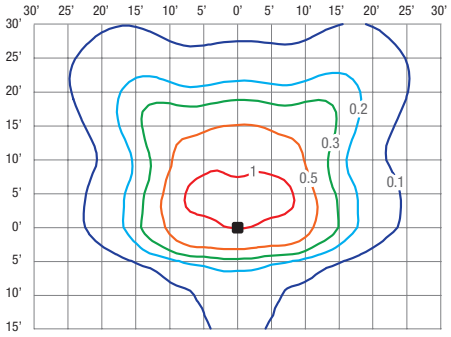
PHOTOMETRICS (IES files available on request)



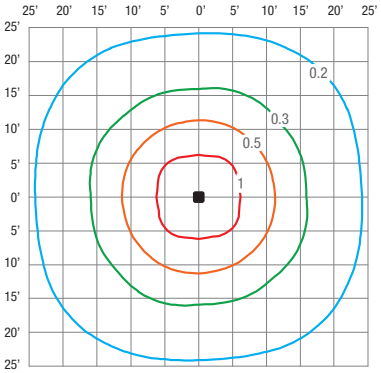
IPL - Type 2



IPL - Type 3



IPL - Type 4



IPL - Type 5

If you have any questions, please don't hesitate to call us toll free at 1-844-279-8754 (USA & Canada).

ORDER MATRIX

Series	Mounting	Finish	Distribution	LED Color	Lighting Profile	Options
IPL	**PTM** - Post Top Mount	**BK** - Black	**T2** - Type 2	**WW** - 3000K	**00** - Dusk till dawn	**SEC** - Security Fasteners
		BZ - Bronze	**T3** - Type 3	**NW** - 4500K	**01** - Dark +6 hours then off	
		SV - Silver	**T4** - Type 4		**02** - Dark +6 hours then 30%	
		WH - White	**T5** - Type 5		**03** - Dark +5 hours, off, Dawn -1 hour	
		CC - Custom			**04** - Dark +5 hours, 30%, Dawn -1 hour (DEFAULT)	

Notes:
- Photometrics based on 12 ft mounting height
- Specifications subject to change without notice
- All light levels in foot candles (fc) with 4500K color temperature and 850 lumen output
- To convert to lux multiply light level by 10.7

Illuminating Engineering Society | RoHS Compliant | LED lighting facts

First Light Technologies Ltd. | www.firstlighttechnologies.com | info@firstlighttechnologies.com | 1.844.279.8754

PHILIPS

GARDCO

Bollards

Dome/bevel top louver

BRM830/831/833
BRM834/835/837

Project:

Location:

Cat.No:

Type:

Qty:

Notes:

Philips Gardco dome and bevel top louver LED bollards provide uniform illumination, superior spacing and solid vandal resistance. Rugged extruded and cast construction with silicone seals and gasketing assure years of durability. Our advanced stack-louver LED technology and motion response provide maximized light output energy savings.

Ordering guide

Example: BRM830-42-CWL-NW-360-UNIV-BRP

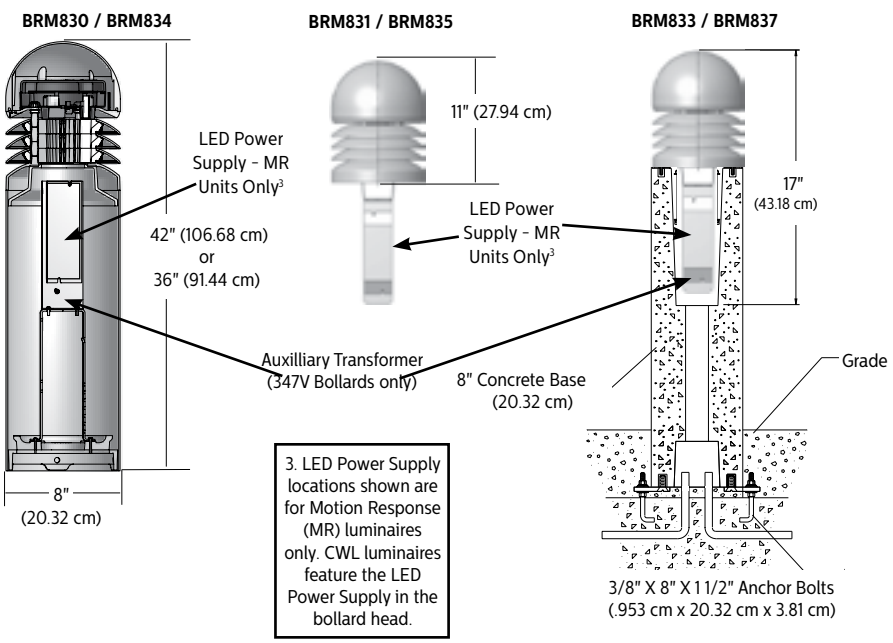
Prefix	Height	LED Control[4]	LED Selection	Lighted Coverage	Voltage	Finish
BRM830 Dome top with cast aluminum base **BRM31**[1] Dome top head only **BRM833** Dome top with natrual concrete base **BRM833B** Dome top with beige concrete base **BRM33G** Dome top with grey concrete base **BRM834** Bevel top with cast aluminum base **BRM835**[1] Bevel top head only **BRM837** Bevel top with natural concrete base **BRM837B** Bevel top with beige concrete base **BRM837G** Bevel top with grey concrete base	**42** 42" **36**[2] 36" **11**[3] 11"	**MR** Motion Response - LEDs stay on low level (8W) when no motion is present and increase to full light output (41W) when motion detected. **CWL** Constant Wattage Full Light Output - full light output only (41W). No motion sensor included. **Network System (SiteWise)** **SW** Integral module[7,8]	**CW** 6500K, 75 CRI **NW** 4500K, 75 CRI **WW** 3000K, 75 CRI **Solid Colors** **LA**[5] Amber	**360** 360° lighted louvers **180** 180° lighted louvers (provides reduced backside light)	**347**[6] **UNIV** (120-277V)	**BLP** Black Paint **WP** White Paint **BRP** Bronze Paint **NP** Natural Aluminum Paint **OC** Optional Color Specify optional color or RAL. ex: OC-LGP or OC-RAL7024. **SC** Special Color Specify. Must supply color chip. Requires factory quote.

1. Not available in 347V.
2. BRM830 and BRM834 only.
3. 11" height option to be selected only for "head only" units - BRM831 and BRM835.
4. A variation of LED wattage (+/- 8%) may occur due to LED manufacturer's forward volt specification and ambient temperature.)
5. Consult factory for lead times.
6. 347V bollards require and include a step-down transformer in bollard. Not available in BRM831 or BRM835.
7. SW option is not available with any other control options
8. Available in 120V or 277V only.

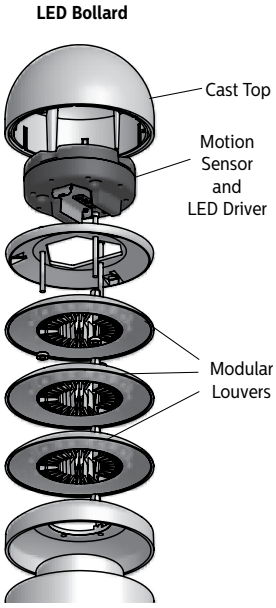
BRM830/831/833/834/835/837 LED bollard

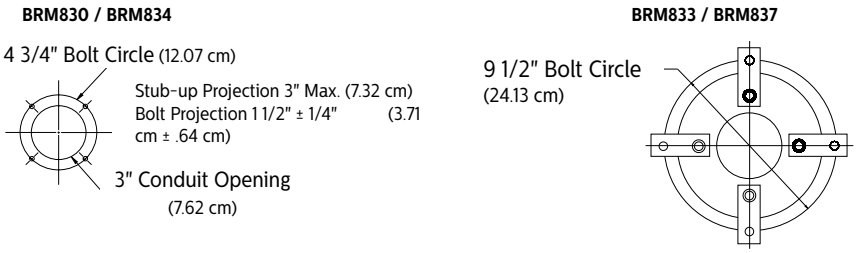
Dome or bevel top louver

Dimensions



3. LED Power Supply locations shown are for Motion Response (MR) luminaires only. CWL luminaires feature the LED Power Supply in the bollard head.





NOTE: Factory supplied template must be used when setting anchor bolts. Philips Gardco will not honor any claim for incorrect anchorage placement from failure to use factory supplied templates.

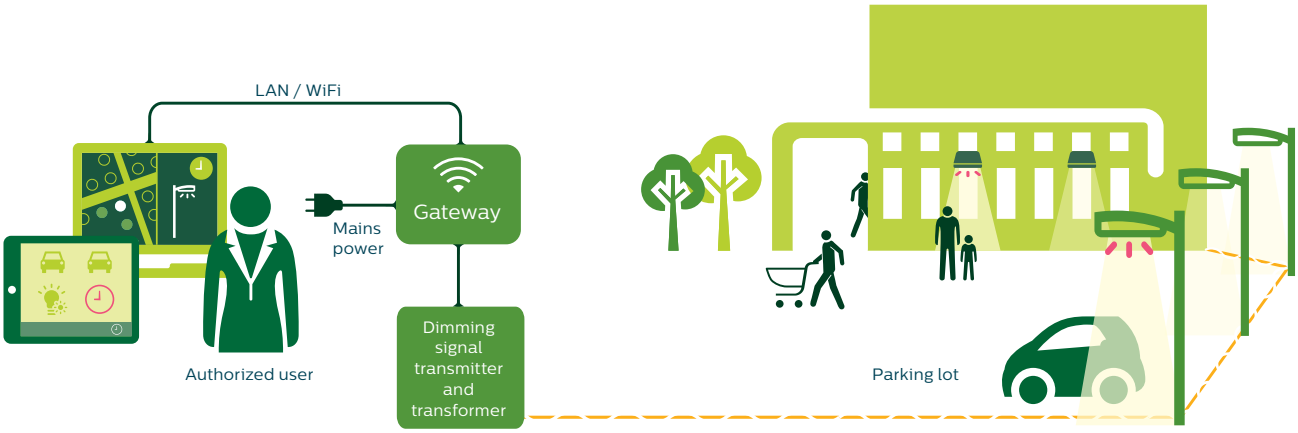
BRM830/831/833/834/835/837 LED bollard

Dome or bevel top louver

SiteWise system

SiteWise is a complete area lighting management system including a luminaire integrated controller, dimming signal transmitter cabinet, and locally accessible user interface. Installation and commissioning are simple. The cabinet communicates with the Philips luminaires using a patented central dimming technology. The control signal is embedded on the existing electrical line – no new cabling is required. An intuitive, locally accessible interface makes it easy for authorized users to set schedules in order to meet site specific lighting needs, local regulations, and energy codes.

SiteWise system diagram



SiteWise system interface

SiteWise has an intuitive user interface that makes it easy to plan, edit, and implement lighting schedules for your site. Authorized users can access the interface via a local app.

To ensure that only authorized users can access your lighting, SiteWise offers two user types, each with different permissions. An advanced user, or administrator, can set and edit schedules using the ten pre-set scenes, assign those schedules to calendar days, and check system status.

For everyday use, a basic user can manually override a schedule that is currently running but cannot create or edit schedules.

SiteWise system specifications

The SiteWise system includes both luminaires and controls. The controls used for SiteWise are circuit load dependent. Required for a complete installation are the following Philips SiteWise components: user interface, control kit, dimming signal transmitter cabinet, and dimming signal receiver located in the Philips luminaire (**SW** option). Optional luminaire-integrated or external motion sensors may also be specified as required. Within the electrical closet, the control kit and dimming signal transmitter cabinet are installed into the electrical system between the existing breaker panel and the site luminaires. New LED luminaires containing the dimming signal receiver are installed on the site. Once completed, use of the interface allows for scheduling and override capabilities. Wireless access point and tablet should be supplied by others. Complete information on the control system can be found on the SiteWise website at **philips.com/sitewise**

BRM830/831/833/834/835/837 LED bollard

Dome or bevel top louver

Specifications

Upper Housing

Diecast aluminum dome top secures to one-piece louvered casting with three (3) concealed tamper resistant screws.

Lower Housing

BRM830 / BRM834: Luminaire features a cylindrical .125" (.318 cm) wall 6063-T5 extruded aluminum base housing. Bottom section has a welded-in cast ring for attachment to base assembly with four (4) hex head set screws.

BRM831 / BRM835: Louver head assembly is affixed to ballast mounting bracket which is suitable for insertion into architectural elements (by others).

BRM 833 / BRM837: Luminaire includes a pre-cast concrete base constructed with steel molds and wire reinforcing. Base is acid-etched to provide a smooth textured aggregate finish.

LED Performance

PREDICTED LUMEN DEPRECIATION DATA[4]		
Ambient Temperature °C	Driver mA	L_{70} Hours[5]
15 °C	350	112,000
25 °C	350	90,000
40 °C	350	65,000

4. Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions.
5. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output.

Optical System

Philips Gardco LED Bollards feature the advanced Gardco stacked louver LED technology, assuring maxmimized light output. Each individual louver is replaceable if needed or desired.

Anchorage

BRM830 / BRM834: Base assembly consists of a cast aluminum platform and ballast mounting bracket. Assembly is secured and leveled to the mounting foundation with four (4) 3/8" X 8" x 1 1/2" (.953 cm x 20.32 cm x 3.81 cm) anchor bolts on a 4 3/4" (12.07 cm) bolt circle.

BRM 831 / BRM835: Mounting plate is cast aluminum with slots to accept anchor bolts (by others) at 90° on a 6 1/4" (15.88 cm) diameter bolt circle. A 4 1/2" (11.43 cm) diameter opening is required to house LED Power Supply for Motion Response (MR) units.

BRM833 / BRM837: Base assembly consists of four (4) galvanized steel base tabs fastened to pre-cast concrete base. Assembly is secured and leveled to the mounting foundation with four (4) 3/8" X 8" X 1 1/2" (.953 cm x 20.32 cm x 3.81 cm) anchor bolts on a 9 1/2" (24.13 cm) bolt circle. Base is designed for 5" (12.7 cm) direct burial.

Labels

All luminaires bear UL or CUL (where applicable) Wet Location labels

SiteWise Network System

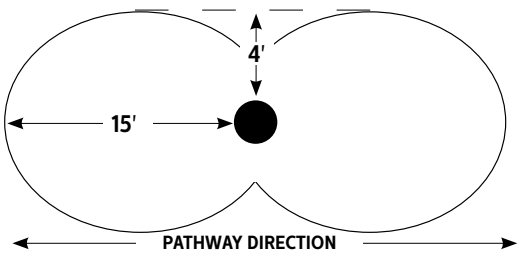
SiteWise system includes a controller fully integrated in the luminaire that enables the luminaires to communicate with a dimming signal transmitter cabinet located on site using Philips patented central dimming technology. A locally accessible mobile app allows users to access the system and set functionalities such as ON/OFF, dimming levels and scheduling. SiteWise is available with motion response options in order to bring the light back to 100% when motion is detected. Additional functionalities are available such as communication with indoor lighting and connection to BMS systems.

Electrical

For CWL bollards, the LED power supply is located within the bollard head. For Motion Response (MR) bollards the LED power supply is located within the bollard shaft. Bollards accept from 120 Volts through 277 Volts, 50hz to 60 hz, input. Bollards with 347V input require and include a step-down transformer (placed within the bollard shaft) to provide proper input voltage to the LED power supply. The LED driver is located in the upper dome. LED power supplies and LED drivers are replaceable. LEDs provided as specified.

Luminaires ordered with Motion Response include a microwave motion sensor. The motion sensor is completely and safely concealed within the LED Bollard head to avoid potential vandalism to the sensor. LEDs operate on Low Level (8 watts) when no motion is present. LEDs increase to full light output (41 watts) when motion is detected. Motion Response system permits adjustments for time on high level and motion sensitivity.

Approximate Motion Sensor Detection Pattern:



Bollard orientation is adjustable in 120° increments. Consult LED Bollard Motion Response installation instruction sheets for more detailed information concering bollard placement and sensor performance.

All product now include Surge Protection for 120V through 277V Input meeting ANSI C62.41.2 as a standard

Luminaire Finish

Each luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured textured powdercoat finish

Warranty

5 year limited warranty. See philips.com/luminaires for complete details and exclusions.

Philips Lighting North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Philips Lighting Canada Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

RB ENGINEERING LTD
ELECTRICAL CONSULTING ENGINEERS

September 8th 2017

Patrick Ryan, P.Eng.
Associate
Herold Engineering Limited
3701 Shenton Road
Nanaimo, BC V9T 2H1

Dear Patrick,

Re: Georgia Greenway – Review of Existing Lighting on Georgia Avenue between Fifth Street and Sixth Street – Rev. 1

RB Engineering Ltd. was retained by Herold Engineering Ltd. to review the existing lighting as noted above.

On Tuesday April 18th, I completed a visual inspection of the existing luminaires along Georgia Avenue between Fifth and Sixth Streets. I noted that the street lighting consisted solely of BC Hydro lease luminaires in an assortment of sag and flat lens. Please note that I could not confirm exact luminaire optic types since I do not have this as-built information for the project area and as such, I made assumptions based on industry standards. Please also note that the locations of the lease lights are approximate with regards to distance from the road since I do not have surveyed BC Hydro pole locations.

The roadway lighting on Georgia Avenue consists primarily of 100 watt high pressure sodium (HPS) luminaires. The intersection of Fifth Street and Georgia Avenue consists of 150 watt HPS lease lights in a combination of sag and flat lenses. The intersections of Georgia and Dundas Street and Georgia and Duke Street consist of 100 watt HPS luminaires. I was not able to determine the wattage of the lease light at Georgia and Sixth due to it not being labelled. For the purpose of the lighting simulation below, where the wattage was not labelled on the luminaire, I assumed 100 watt HPS as a worst case scenario.

A summary of the CoN roadway and intersection lighting requirements and the estimated lighting levels (via simulation) along Georgia Avenue (including intersections) is listed in the table on the following page.

RB ENGINEERING LTD
ELECTRICAL CONSULTING ENGINEERS

Road/Intersection	CoN Road/Intersection Classification & Lighting Standard	Average Lux Level	Uniformity Ratio (UR)
Georgia Avenue	Neighborhood collector (9 lux, 4:1 UR)	5.0	16.7:1
Intersection of Fifth and Georgia	Major collector & Neighborhood collector (21 lux, 3:1 UR)	10.3	4.9:1
Intersection of Duke St. and Georgia	Neighborhood collector & Local (13 lux, 4:1 UR)	7.5	5.4:1
Intersection of Dundas St. and Georgia	Neighborhood collector & Local (13 lux, 4:1 UR)	7.1	2.6:1
Intersection of Sixth and Georgia	Neighborhood collector & Neighborhood collector (18 lux, 4:1 UR)	6.8	11.4:1

Based on the lighting simulation completed by RB Engineering Ltd., the average lighting level along Georgia Avenue is about half of what it should be in order to meet the CoN lighting standards. Due to the uneven spacing of the BC Hydro poles along Georgia Avenue, the uniformity level of the lighting is approximately 4 times the CoN standard.

It can also be noted from the table above that the average lighting level of the intersections is roughly half of what it should be to meet City standards. The intersection uniformity levels ranged from meeting the standard at Dundas Street and Georgia to three times over the City standard at the intersection of Sixth Street and Georgia.

In order to meet the CoN lighting standards for roadways, the street lighting along Georgia Avenue (including intersections) would have to be re-designed with 150 watt HPS or CoN equivalent LED luminaires at an appropriate spacing to provide the required average lighting level of 9 lux and uniformity ratio of 4:1. Further to this, tighter pole spacing would be used at intersections to achieve the CoN standard lighting levels.

This completes my observations and recommendations for the street lighting along Georgia Avenue between Fifth and Sixth Streets. Please give me a call if you have any questions.

Regards,

Laurie Voroney P.Eng.
RB Engineering Ltd.

ENVIRONMENTAL DYNAMICS INC.

208A – 2520 Bowen Road
Nanaimo, BC V9T 3L3
P: (250) 751-9070

July 21, 2017

EDI Project No: 17N0124

Herold Engineering Limited
3701 Shenton Road
Nanaimo, BC V9T 2H1

Attention: Patrick Ryan, P.Eng.

RE: Environmental Assessment Summary for Georgia Greenway Project

EDI Environmental Dynamics Inc. (EDI) was retained by Herold Engineering Limited (HEL) to complete an environmental assessment to support the design and environmental permitting for the Georgia Greenway Project (the Project) within the City of Nanaimo. The environmental assessment consisted of an online review of known environmental features and sensitivities along and near the identified location of the multiuse trail alignment as well as one site visit made to review the alignment and assess the planned Chase River bridge crossing site.

Provided herein is a summary of the results of the environmental assessment. The purpose of this summary is primarily to inform the project team of environmental constraints, requirements and considerations for the design and environmental permitting phases of the Project.

RESULTS OF DESKTOP REVIEW

Several online databases were searched to identify known environmental values and sensitivities within the study area including: BC Conservation Data Centre (CDC), Wildlife Tree Stewardship Atlas, BC Wetlands Atlas, Sensitive Habitat Inventory Mapping (SHIM), Habitat Wizard and the City of Nanaimo's Habitat Atlas (*NanaimoMap*). Table 1 provides a summary of the desktop review.

Table 1. Summary of Background Information Review

Information Source	Type of Information	Results of Search
Conservation Data Centre	Known occurrences of provincially and federally listed species and ecosystems	No known species or ecosystems listed as threatened or rare are known to occur within or immediately adjacent to the study area. The nearest known occurrence is an observation of a rare (provincially blue-listed) plant near the corner of 8th St. and Howard Ave: slimleaf onion (ID 91556).
Habitat Wizard & Sensitive Habitat Inventory Mapping (SHIM)	Mapped streams, fish observations and stream reports for mapped watercourses	The only mapped watercourse is Chase River, which is known to contain chinook salmon, chum salmon, coastal cutthroat trout, coastrange sculpin, coho salmon, cutthroat trout, cutthroat trout (anadromous), lamprey (general), prickly sculpin, pumpkinseed, rainbow trout, sculpin (general), steelhead, steelhead (winter-run), stickleback (general) and

Information Source	Type of Information	Results of Search
		threespine stickleback.
Wildlife Tree Stewardship Atlas	Heron and raptor nest trees and other significant wildlife trees	No known nests or wildlife trees occur within or near the study area.
Wetlands Atlas	Mapped wetlands	No mapped wetlands within or near the study area.
City of Nanaimo's Habitat Atlas (*NanaimoMap*)	Large variety of aquatic and terrestrial habitat information.	The only environmental features noted within the study area are Chase River, its associated floodplain and its riparian area, which is identified as a Sensitive Ecosystem Inventory (SEI) polygon (ID N0145).

RESULTS OF FIELD REVIEW

The entire alignment was reviewed on April 19, 2017. As much of the alignment follows existing public roadways, most of the review was done by vehicle with the intent of confirming that there were no significant environmental features present. With the exception of the Chase River crossing, the entire alignment is previously developed and natural environmental features are largely absent. The only environmental feature observed along the alignment that is worth describing in detail is the Chase River crossing.

Chase River Crossing

The alignment crosses Chase River at an existing storm sewer outfall that was replaced in 2001. The storm sewer pipe follows a narrow lane that is part of Georgia Avenue, and discharges into the river at the north bank. There is a wide, low gradient, riprap armored, stormwater channel between the headwall and the natural boundary of the river. The channel discharges into the river at a large root wad of a deciduous tree (black cottonwood) that recently fell to the northwest.

At the approximate centerline of the crossing site the channel width is noticeably narrower than upstream and downstream (6.1 m) due to a constriction caused by the roots of a medium-sized, leaning tree (black cottonwood). Near the upstream extent of the alignment, the channel was 8.7 m wide and near the downstream extent the channel was 7.0 m wide. At the time of survey, water levels were moderately high and water depths ranged from 20 to 50 cm. At the approximate centre of the alignment, the channel morphology changes from riffle (upstream) to glide (downstream). The channel was relatively straight and fairly uniform throughout the general area in which the crossing is located. Riverbed substrates were dominated by cobbles and boulders in the riffle section and cobbles, boulders and gravels in the glide section. There were no deep pools at the crossing site; however, downstream of the root wad near the centre of the alignment, a small, relatively shallow pool has formed.

The storm sewer outfall, which is set back into the north bank, has disrupted the natural topography of the bank. There is a narrow floodplain area on the north side (between the natural boundary and the toe of the bank), which is likely to flood to varying extents on an approximately annual basis. There are several trees located within this floodplain and the storm sewer outfall channel overlaps with this narrow, flat, floodplain

bench. On the south side, the short but steep bank above the river extends uniformly to the natural boundary and there is no floodplain.

The riparian forest along either side of the river at the crossing is relatively narrow (approximately 10 to 15 m). There are several small to large deciduous trees throughout the area but the riparian area is significantly degraded due to the presence of the storm sewer outfall, invasive species, garbage and discarded yard wastes. There are three significant, large trees within the alignment of the crossing site. Identification of species with 100% certainty was not possible due to a lack of leaves at the time of survey; however, since the survey was conducted others have confirmed tree species. Each of these trees had been previously tagged:

- "ISL 205" was approximately 70 cm dbh (bigleaf maple) and was located at the top of bank adjacent to the storm sewer outfall.
- "ISL 206" was approximately 120 cm dbh (black cottonwood) and is located near the centre of the alignment, right beside the natural boundary of the river.
- An approximately 140 cm dbh (black cottonwood) with a broken, unreadable tag is located downstream of the centre of the alignment and is within the floodplain of the river.

The two larger trees (black cottonwood) should be considered to be Landmark Trees as per Schedule C of Nanaimo's tree protection bylaw (Bylaw No. 7126).

As Chase River is known to contain several fish species, including anadromous salmon and resident trout, it is considered to provide important and critical fish habitat and, due to the known importance, a thorough assessment of fish habitat at the site was not attempted. As flows were relatively high, it was not easy to determine whether any pockets of potentially suitable spawning habitats for salmonids were present at the site; however, this did not appear to be the case. Where substrates were readily visible, they generally appeared too coarse for most salmonids. It is expected that the area at and adjacent to the crossing site likely provides important habitat for rearing and migration but not for spawning (critical habitat is not likely present here).

As the storm sewer outfall channel has a low gradient and is readily accessible to fish in Chase River, it may be used by fish on a seasonal basis. While there suitable habitats and flows for periodic fish use, the habitat quality is low and it is considered to only provide marginal habitat. If or when water draining from the storm sewer outfall is of poor quality, it may limit or preclude fish presence in the outfall channel.

No raptor, heron or other stick nests were observed in any trees along the alignment, including the trees at the Chase River crossing site; however, potential nesting habitats for a variety of bird species occur in all vegetated areas of the alignment. The forested riparian area adjacent to Chase River can provide some good quality nesting habitat for a variety bird species. Some cavity nests were observed in rotting snags within and adjacent to the crossing site. These cavities may be used annually by cavity nesting species such as northern flicker.

Due to previous disturbances and the dominance of invasive species within the riparian area, the likelihood of rare plants is considered low. Follow up surveys later in the growing season are not warranted for any part of the planned alignment.

CONCLUSIONS AND RECOMMENDATIONS

The only substantial environmental features uncovered by the background and field reviews were Chase River and its associated floodplain and riparian areas; however, these were known sensitivities identified when the Project was tendered. The crossing location occurs at a location that has been significantly impacted by historic disturbances, which have degraded the ecological values of the site through the presence of the storm outfall, invasive species, garbage and discarded yard wastes. In addition, the riparian forest along either side of the river is narrow, with residential developments on the north side and institutional developments (school and playgrounds) on the south side. There are no significant concerns with a planned trail crossing at this location provided standard impact avoidance and mitigation measures are implemented. Environmental permits will be required for the planned river crossing as described below.

Environmental Permitting

The bridge crossing will require submission of a Section 11 Water Sustainability Act Notification or Change Approval application (depending on design details and the nature of the necessary works). The works may also require submission of a Request for Review to the Department of Fisheries and Oceans (DFO); however, for a clear span pedestrian bridge, this is unlikely to be necessary as there would be limited concerns that any of the works would cause 'serious harm' as defined by the Fisheries Act. Detailed designs shall be reviewed by EDI, who shall determine whether there is the potential for the project to result in serious harm to fish as defined by the Federal Fisheries Act and whether submission of a Request for Review is required or warranted.

To meet the conditions for a Section 11 Notification and thus avoid the more lengthy Change Approval application process, the following criteria must be achieved:

> *(i) the equipment used for site preparation, or for construction, maintenance or removal of the bridge is situated in a dry stream channel or operated from the top of the bank;*
>
> *(ii) the bridge and its approach roads do not produce a back water effect or increase the head of the stream;*
>
> *(iii) the hydraulic capacity of the bridge is equivalent to the hydraulic capacity of the stream channel, or is capable of passing the 1 in 200 year maximum daily flow;*
>
> *(iv) the height of the underside of the bridge is adequate to provide free passage of flood debris and ice flows;*
>
> *(v) the bridge is made of materials that meet the applicable standards of the Canadian Standards Association;*

One of the Project requirements is to prepare and submit a conceptual environmental protection plan (EPP) and recommendations that should be adhered to by the Contractor during construction. This EPP will be

prepared by EDI following detailed design and will be submitted along with environmental permit applications to ensure regulators are adequately informed of planned works, potential risks and required mitigation measures. The EPP shall describe any warranted/required environmental monitoring that will be conducted during construction of the trail and bridge.

In-stream Work Window

Unless a site-specific extension is granted by the province, all in-stream works should be completed during the appropriate reduced-risk timing window. Provided that no works in the wetted perimeter of the river are needed, the general window, rather than species-specific timing window would likely be appropriate (June 15 to September 15). Otherwise a more restrictive window should be used in consideration of the species likely to be present at this specific location of the river as identified by the Terms and Conditions for Changes in and about a Stream Specified by Ministry of Forests, Lands and Natural Resource Operations Habitat Officer, West Coast Region (Vancouver Island & Gulf Islands; Updated February, 2011)[1]. A more restrictive window that would likely be appropriate is August 15 to September 15. The rationale for the proposed timing window, based on required works and potential impacts to fish shall be provided by EDI in the EPP, which is to be submitted with agency approval applications.

Migratory Birds

As much as possible, removal of trees along the designed alignment should be completed outside of the typical breeding bird period (March 1st to August 31st of a given year). If any clearing of potential nesting vegetation (trees and shrubs) is undertaken along the alignment during the breeding period it should be immediately preceded by a bird nest survey of the area to be cleared. Active nest sites should be identified and flagged so that nest sites can be left undisturbed until the young birds have fledged and left the nest. If clearing cannot be completed within 3 to 5 days of the initial nest survey, an additional survey will be required to identify any new nests that may have been created. Any nest surveys should be completed by an appropriately qualified environmental professional, who shall provide site specific recommendations regarding items such as breeding bird timing, nest survey expiry periods and active nest buffer distances.

Significant Trees

The three large trees at the Chase River crossing are relatively important for a variety of reasons including but not limited to:

- The width of the forested riparian area is narrow so any mature trees present are important to maintain the current integrity and value of the riparian area of an important fish bearing river.
- The two cottonwood trees and single maple tree roots provide important structural stability functions to the edge of the channel and floodplain bank, respectively.
- Wildlife habitat value (nesting birds etc.).

[1] http://www.env.gov.bc.ca/wsd/regions/vir/wateract/VI_TermsandConditions_Feb11.pdf

- The two cottonwood trees are considered to be Landmark Trees as per Schedule C of Nanaimo's tree protection bylaw.
- An arborist has assessed the trees and determined that they are safe and healthy.

Removal of the trees are not necessarily prohibited any regulatory requirements and any planned removal could be mitigated or offset through a variety of means such as topping them to leave wildlife stumps, replanting, invasive species removal etc. Options for detailed design of the bridge crossing should be considered to determine the extent to which it is feasible, practical or safe to retain all or some of these trees. As the two large cottonwood trees are within the floodplain and provide structure to the edge of the channel, it would be more important to seek to avoid removing these trees in comparison to the maple tree.

Other trees at the crossing site are smaller and are less important to retain; however, the trees that are along the steep bank above the river on the south side appear to be important in terms of preventing bank erosion during high flow events. Removal of some of these trees will be necessary regardless of bridge design and orientation so bank stability should be a consideration of bridge design.

To avoid both bird nesting and in-stream timing window concerns, the ideal time to remove trees would be September 1 to 15 of the year before bridge construction is to occur; however, it is recognized that this timing may not be achievable due to funding, contractual and/or other logistical reasons.

Riparian Enhancement

The installation of a bridge at this location represents an opportunity to improve the adjacent riparian condition and function by removing invasive plant species and replacing them with species native to the area. Although it would not be a regulatory requirement a riparian enhancement plan could be developed and implemented to improve ecological and aesthetic conditions along either or both sides of the crossing. Enhancement plans would need to consider a variety of factors including proximity of future large trees to the new infrastructure, measures to discourage public from using the riparian area (fencing or hedging) and public safety (potential security concerns associated with poorly lit, concealed areas adjacent to the public trail). Interpretive signage could be used to inform public of the enhancement efforts and could be used as an educational tool regarding the importance of riparian, fish and aquatic habitats.

Please let me know if you have any questions or comments regarding this environmental assessment.

Yours truly,

EDI Environmental Dynamics Inc.

Adam Compton, R.P.Bio.
Senior Biologist/Project Manager

6 June 2017

ARCHAEOLOGICAL OVERVIEW ASSESSMENT

Proposed Georgia Greenway Project, Chase River Crossing, Nanaimo, BC

Submitted to:
Herold Engineering Limited
3701 Shenton Road
Nanaimo, BC, V9T 2H1

Attention: Mr. Patrick Ryan, PEng, Associate

REPORT

Report Number: 1772203-001-R-Rev0

Distribution:

2 Copies - Herold Engineering Limited
1 Copy - Snuneymuxw First Nation
1 Copy - Golder Associates Ltd.

Golder Associates

Executive Summary

At the request of Herold Engineering Associates Ltd., and on behalf of the City of Nanaimo, Golder Associates Ltd. conducted an archaeological overview assessment for the City of Nanaimo's proposed Georgia Greenway Project. The Project includes specifically a proposed pedestrian bridge to be constructed across the Chase River, near Bruce and Fifth Avenue, in the City of Nanaimo, British Columbia (the Project area).

The objectives of the archaeological overview assessment were as follows:

- Identify known archaeological sites within the Project area, to the degree possible, using existing records.
- Identify and evaluate the potential for undocumented archaeological sites to exist within the Project area.
- Determine the archaeological risks with proceeding with the development as currently planned.
- Assess the need for more detailed archaeological investigations (for example an archaeological impact assessment or archaeological monitoring), if warranted.

The background review summarizes readily available sources pertaining to the local physical and environmental setting, cultural and historical background, and previously conducted archaeological assessment, including the presence of any registered archaeological sites in the vicinity of the Project area. Based on this review, the Project area is considered to have low archaeological potential.

Golder recommends that Herold Engineering Associates Ltd. and the City of Nanaimo retain an archaeologist to prepare a Project-specific archaeological chance find management procedures to guide Project personnel and contractors in the event that archaeological resources are unexpectedly uncovered during construction. It is also recommended that construction personnel should be provided with an orientation to the chance find procedure prior to construction commencement.

Furthermore, Golder Associates Ltd. recommends that a Section 14 *Heritage Conservation Act* Heritage Inspection Permit be obtained prior to any ground disturbance within the Project area. This permit will allow for the immediate assessment and collection of archaeological resources should they be encountered as chance finds during any construction activities that may occur within the Project area.

For planning purposes, Herold Engineering Associates Ltd. should be aware that the current timeline for issuance of a *Heritage Conservation Act* permit is approximately 10 to 12 weeks from the time of the application submission.

Credits

Project Director	Ben Hjermstad, MA, RPA
Project Manager	Heather Pratt, MA, RPCA
Report Author	Matthew Ross, MSc
Senior Technical Review	Ben Hjermstad

Table of Contents

1.0 INTRODUCTION

At the request of Herold Engineering Ltd. (Herold) and on behalf of the City of Nanaimo, Golder Associates Ltd. (Golder) undertook an archaeological overview assessment (AOA) for the City of Nanaimo's proposed Georgia Greenway Project (the Project). The Project involves a series of proposed traffic calmed, bicycle and pedestrian trails within a greenway corridor aligned with Georgia Avenue within the community of Harewood on the southwest margin of the City of Nanaimo, on the east coast of Vancouver Island (the Project area). As per RFP No. 1862, the AOA is limited to the proposed Chase River pedestrian bridge crossing component of the Project (the Project area) (Figures 1 and 2).

2.0 PROJECT DESCRIPTION

The proposed Georgia Greenway Project extends approximately 1.5 km along Georgia Avenue between Fifth Street and Hannah Road. The Project area will be divided into three sections:

- Section 1, Georgia Avenue, from Fifth Street to Sixth Street
- Section 2, Centennial Park, from Sixth Street to Seventh Street
- Section 3, Georgia Avenue, from Seventh Street to Hannah Road

The proposed Chase River pedestrian bridge crossing is situated within Section 1. The approximately 50 m x 50 m Project area includes the north and south banks of the Chase River, as well as a 25 m buffer on either side of the proposed bridge crossing.

3.0 HERITAGE LEGISLATION

The Project area is located on provincial Crown land. All archaeological sites on provincial Crown or private land that predate AD 1846 are automatically protected under the 1996 amendments to the *Heritage Conservation Act* (HCA). Certain sites, including burials and rock art sites, that have historical or archaeological value are protected regardless of age.

Subsurface investigation of an archaeological site, or investigation with the intent to locate a site, requires a permit under Section 14 of the HCA. The Archaeology Branch is the provincial government agency responsible for administering the HCA, issuing permits, maintaining a database of recorded archaeological sites, and handling referrals from various development agencies.

Site protection under the HCA does not necessarily negate impact; in some cases, development proceeds following an impact assessment or other mitigative actions. With the exception of impacts occurring under a Section 14 permit, any alteration to a known archaeological site must be permitted under Section 12 of the HCA. A Section 12 permit is held by the individual responsible for the site alteration and morally includes data recovery and/or mitigation requirements such as monitoring or soil/artifact sampling.

All applications for Section 12 or Section14 HCA Permits are forwarded by the Archaeology Branch to appropriate First Nations for review. The Archaeology Branch determines which groups and organizations receive the application based on provincial records.

4.0 METHODS

The objective of this AOA is to determine the archaeological risks with proceeding with the proposed Project.

4.1 First Nation Communications

Based on a review of the Consultative Areas Database – Public (CAD) maintained by the Ministry of Aboriginal Relations and Reconciliation, First Nations groups with Aboriginal interests in the Project area were identified and notified of this AOA (DataBC 2017).

4.2 Background Review

Golder conducted an in-office background review of readily available information sources for the Project area pertaining to ethnographic background, historical background and previously recorded archaeological sites, as well as physical and environmental features, that may influence archaeological potential. Sources of information that were reviewed include the following:

- Provincial Heritage Register (PHR) maintained by the Archaeology Branch, Ministry of Forests, Lands and Natural Resource Operations (PHR 2017)
- Hul'qumi'num Treaty Group archaeological potential model available on the PHR (PHR 2017)
- Canadian Register of Historic Places (Parks Canada 2017a)
- Directory of Federal Heritage Designations (Parks Canada 2017b)
- Nanaimo Community Heritage Register (City of Nanaimo 2017)
- readily available and relevant archaeological and ethnographic reports and environmental data
- previously conducted geotechnical testing related to the Project

4.3 Analysis and Reporting

The results of the in-office background review were used to determine the potential for encountering archaeological sites in the Project area. The AOA considered standard archaeological variables such as proximity to registered archaeological site locations and topographic features that tend to correlate with archaeological site locations. Previous development activities will be reviewed to determine the extent of past land disturbance and the potential affects to archaeological sites from the proposed development will be summarized. The report will provide recommendations regarding the need for, and scope of, further archaeological work, if necessary

5.0 RESULTS

The results of First Nation communication, the in-office background review, and archaeological potential assessment for the Project area are provided as follows.

5.1 First Nations Communication

A CAD search indicates that the Snuneymuxw First Nation have interests that extend into the Project area (DataBC 2017). Chris Good, Lands and Resources Coordinator for the Snuneymuxw First Nation, was notified by email of the AOA and invited to provide any available heritage and/or traditional use data the Snuneymuxw First Nation were willing to share regarding the Project area. At the time of this report, no heritage and/or traditional use information for the Project area has been received from the Snuneymuxw First Nation.

5.2 Background Review

5.2.1 Physical and Environmental Setting

The Project area is located within the City of Nanaimo, on the east coast of Vancouver Island within the Nanaimo Lowlands Ecosection of the East Vancouver Island Ecoregion (Demarchi 2011). Topography within the Ecosection is characterized by a low relief with sharp crests, narrow valleys, and well developed estuaries associated with large rivers (Demarchi 2011).

The Project area is situated within the Coastal Douglas Fir (CDF) Biogeoclimatic Zone (Forest Analysis and Inventory Branch 2014). The CDF is present from the south tip of Vancouver Island along the east shore of Vancouver Island and within the Strait of Georgia to Hernando Island; the climate within the zone tends toward warm, dry summers and mild, wet winters due to its position within the rainshadow of the Vancouver Island and Olympic Mountains (Jones and Annas 1878). The most common tree species occurring within the CDF Subzone include Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), arbutus (*Arbutus menziesii*), and Garry oak (*Quercus garryana*). Nuszdorfer et al. (1991) provide a thorough description of the plant and animal species that are characteristic of the CDF Biogeoclimatic Zone.

The Project area is situated 1.9 km west and inland from the Nanaimo River estuary and a portion of the Chase River (the nearest fresh water source) flows through the Project area. Historic construction activities associated with urbanization has dramatically altered the original landscape. Terrain within the Project area has been harvested, stripped, levelled, excavated, and subject to fill placement, grading, paving, landscaping, and/or foundation installation associated with construction activities occurring on nearby residential parcels, or within Harewood Centennial Park.

Review of the local environment is important to understanding past use of the area. First Nation peoples and early Euro-Canadian settlers relied on the natural resources available to them including select animal, fish, and plant species. Many archaeological sites would have been the result of activities associated with the use of these natural resources or situated in locations that would maximize access to particular resources. Culturally modified trees (CMTs) are an example of an archaeological site type resulting directly from resource harvesting activity on the Northwest Coast.

5.2.2 Geotechnical Assessment

Lewkowich Engineering Associates Limited (2016) conducted a geotechnical assessment for the Project. Four test pits (TP16-01, TP16-05, TP16-10, and TP16-11) were drilled near the Project area. A review of the report results did not reveal cultural soils.

5.2.3 Cultural Background

As noted above, the Project area is located within the Snuneymuxw First Nation area of interest. The Snuneymuxw First Nation are part of the culture known as Central Coast Salish (Suttles 1990). Among other shared cultural traits, Central Coast Salish groups practiced a semi-sedentary lifestyle based on fishing, hunting, and gathering. Settlement and subsistence patterns were scheduled according to the season availability and distribution of resources. Detailed ethnographic information for Central Coast Salish groups is found in Barnett (1938, 1955), Boas (1886), Carlson (2001), Duff (1952), Harris (1994), Hill-Tout (1905), Lamb (1960), Maud (1978a, 1978b), Rozen (1979) and Suttles (1951, 1987, 1990). Typical activities associated with First Nations that may be reflected in the archaeological record within the Project area include: resource procurement (e.g., fishing, shellfish harvesting, hunting, plant/root gathering); habitation; transportation (e.g., use of trails); and spiritual activity.

5.2.4 Previous Archaeological Assessments

The PHR search reveals that the Project area has been subject to a previous archaeological assessment consisting of archaeological potential modelling conducted as part of the Hul'qumi'num Treaty Group (HTG) AOA (BC Archaeology Branch 2005). The HTG AOA results indicate that portions of the Project area overlap with areas of modelled high archaeological potential (BC Archaeology Branch 2005).

The Project area has not been subject to any previous archaeological impact assessments or archaeological inventory studies. For an introduction to archaeological assessments conducted in the general City of Nanaimo region over the past several decades refer to Arcas (1994) or Millennia (2007).

5.2.4.1 Archaeological Sites

A PHR search lists one registered archaeological site located within 1 km of the Project area (PHR 2017). Registered archaeological site DgRx-126 consists of a post-contact cemetery associated with a smallpox outbreak amongst an E&N Railway construction crew at the end of the 19th century (Archaeology Branch 2017), and is located 650 m west from the Project area. Based on the PHR report, the site has not been well recorded and little is known beyond an unknown source quoted as saying the cemetery existed in 1908 somewhere near the corner of Wakesiah and Harewood Road.

Expected precontact site types within the Project area based on the biogeoclimatic zone, associated natural resources, and specific environmental setting include CMTs, limited activity sites, low density lithic scatters, inland shell midden sites, fish traps, and/or trails. The Project area's location on the banks of the Chase River would suggest that past activities in the area would have focused on this river, and those resources most commonly found in a riparian environment, including fish (salmon and trout), birds, and plants located on the river banks.

5.2.5 Historical Review

A PHR search indicates that there are nine registered heritage sites located within 1 km of the Project area (PHR 2017). Each site is also present on the Nanaimo Community Heritage Register (City of Nanaimo 2015) and identified by address (Figure 1; Table 1). A search of the Canadian Register of Historic Places (Parks Canada 2017a) and Directory of Federal Heritage Designations databases (Parks Canada 2017b) indicates that no historic places formally recognized in either of these registers are located within 1 km of the Project area.

Table 1: List of Heritage Sites within 1 Km of the Project Area by Order of Borden Number

Borden Number	Distance From the Project	Street Address	Site Description
DgRx-112	927 m north	423 Fourth Street	Fourth Street Store Building
DgRx-116	834 m south east	467 Eighth Street	Eighth Street Residence
DgRx-120	636 m west	645 Wakesiah Avenue	Harewood Colliery Dam
DgRx-132	917 m east	764 Railway Avenue	Spence Residence
DgRx-148	899 m north east	18 Albion Street	Simpson Residence
DgRx-154	944 m north west	750 Fifth Street	Building #613 (Nanaimo Military Camp)
DgRx-157	635 m north east	620 Park Avenue	Robbins Park (Cricket Field)
DgRx-168	900 m north east	465 Park Avenue	Park Avenue Residence
DgRx-177	642 m north west	624 Wakesiah Avenue	Crewe Residence

5.3 Archaeological Potential Assessment

There are no registered archaeological sites in the Project area. The HTG AOA model indicates that there is potential in the Project area. The Project area is in the vicinity of a significant water course with relatively level terrain on either side. While there are only a limited number of registered archaeological sites in the local area, this may be a result of previous archaeological assessment and research in the region.

However, based on the AOA results, the Project area is considered to have low potential for the presence of archaeological sites. A review of the registered archaeological sites in the region indicates that expected site types would be limited to low density artifact scatters, trails, limited activity sites and/or CMTs. The absence of old growth forest cover, distance inland (almost 2 km) from the ocean shoreline, and the absence of nearby archaeological sites in similar terrain supports the low probability of finding low density archaeological sites and/or CMTs in the Project area.

In addition, the level of previous development (including the degree of grading) within the Project area would have significantly impacted any archaeological sites once present, including limited activity sites, trails, CMTs, and/or low density lithic scatters. While the level of previous development does not imply the absence of archaeological potential, it greatly reduces the probability that archaeological sites are situated in the Project area.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the in-office background review, the Project area is considered to have low archaeological potential due to the degree of historic disturbance and low density of potential archaeological resources. The Project area is not considered to have historic value.

Golder recommends that Herold and the City of Nanaimo consider retaining an archaeologist to prepare a project-specific chance find procedure to guide project personnel and contractors in the event that archaeological resources are unexpectedly uncovered during construction. It is also recommended that construction personnel should be provided with an orientation to the chance find procedure prior to construction commencement.

Furthermore, Golder Associates Ltd. recommends that a Section 14 *Heritage Conservation Act* Heritage Inspection Permit be obtained prior to any ground disturbance within the Project area. This permit will allow for the immediate assessment and collection of archaeological resources should they be encountered as chance finds during any occurring construction activities within the Project area.

No further recommendations are made for the project as described in this report provided that the proposed development is not extended beyond the area evaluated in the AOA. Should the development plans change, a further assessment may be required prior to development.

7.0 CLOSURE

We trust the information in this letter is sufficient for your current needs. Should you have any questions concerning this review letter, please do not hesitate to contact Heather Pratt at +1-250-754-5651 ext. 17112.

GOLDER ASSOCIATES LTD.

Matthew Ross, MSc
Archaeologist

Ben Hjermstad, MA, RPA
Associate, Senior Archaeologist

MAR/HP/BH/asd

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8.0 REFERENCES

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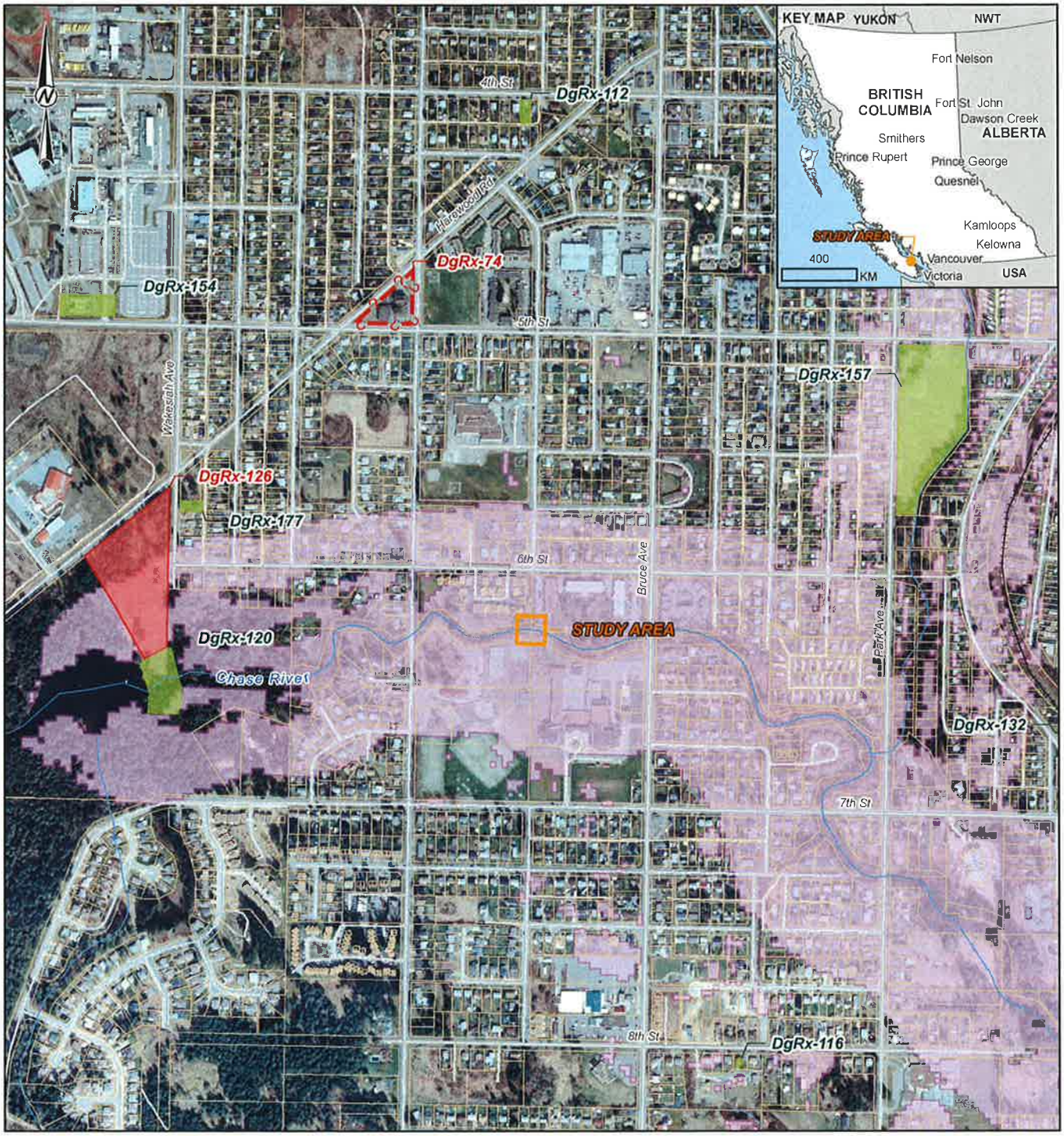

LEGEND

- STUDY AREA
- RECORDED ARCHAEOLOGCIAL SITE BOUNDARY (I.E. ***DgRx-126***)
- HISTORIC PLACE (I.E. ***DgRx-177***)
- LEGACY ARCHAEOLOGY SITE BOUNDARY (I.E. ***DgRx-74***)
- MODELLED HIGH ARCHAEOLOGICAL POTENTIAL (HTG)
- PARCEL
- MAJOR ROAD
- LOCAL ROAD
- RAILWAY
- WATERCOURSE

0 200 400

1:10,000 METRES

REFERENCES

1. ARCHAEOLOGICAL SITES OBTAINED FROM B.C. MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS ON 20170330.
2. MODELLED HIGH ARCHAEOLOGICAL POTENTIAL OBTAINED FROM HUL'QUMI'NUM TREATY GROUP AOA STUDY DATE: 2005.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
HEROLD ENGINEERING LIMITED

PROJECT
PROPOSED GEORGIA GREENWAY PROJECT, CHASE RIVER CROSSING, NANAIMO, BC

TITLE
MIDRANGE MAP

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-06-05
DESIGNED	MAR
PREPARED	RC
REVIEWED	MAR
APPROVED	BH

PROJECT NO.	PHASE	REV.	FIGURE
1772203	1000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

25mm

LEGEND

- STUDY AREA
- PARCEL
- MAJOR ROAD
- LOCAL ROAD
- WATERCOURSE

0 25 50

1:1,500 METRES

REFERENCES

1. IMAGERY PROVIDED BY HEROLD ENGINEERING.
2. WATERCOURSE, PARCEL, AND ROAD DATA CONTAINS INFORMATION LICENCED UNDER THE OPEN GOVERNMENT LICENCE - BRITISH COLUMBIA.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
HEROLD ENGINEERING LIMITED

PROJECT
PROPOSED GEORGIA GREENWAY PROJECT, CHASE RIVER CROSSING, NANAIMO, BC

TITLE
DETAILED RESULTS MAP

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-06-05
DESIGNED	MAR
PREPARED	RC
REVIEWED	MAR
APPROVED	BH

PROJECT NO.	PHASE	REV.	FIGURE
1772203	1000	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

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Golder Associates

Georgia Greenway Pedestrian Bridge
Geotechnical Services

PRESENTED TO

City of Nanaimo
***c/o* Herold Engineering**

OCTOBER 19, 2017
ISSUED FOR USE
FILE: VGEO03217-01

Tetra Tech Canada Inc.
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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Herold Engineering and the City of Nanaimo and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Herold Engineering and the City of Nanaimo, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech Canada Inc.'s Services Agreement. Tetra Tech's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Herold Engineering Ltd. (Herold) to provide geotechnical services for a pedestrian and cyclist bridge crossing over Chase River along the Georgia Greenway Project alignment. The general site location is shown on Figure 1, attached to this report.

The objective of the geotechnical services is to determine general subsurface conditions and to provide recommendations regarding the pedestrian bridge foundations.

2.0 SCOPE OF WORK

The scope of work for this project includes the following tasks:

- Information Review and Project Setup;
- Environmental Permitting;
- Geotechnical Exploration; and
- Geotechnical Recommendations and submission of this Report.

3.0 BACKGROUND REVIEW AND SITE DESCRIPTION

3.1 Site and Project Description

The project area includes the development of a pedestrian and cyclist friendly route through Harewood neighborhood. The pedestrian bridge will span the Chase River and connect the path between Georgia Avenue and Harewood Centennial Park.

3.2 Background Information

Tetra Tech reviewed the following reports as part of the background review.

3.2.1 Geotechnical Assessment Georgia Avenue Storm Sewer Upgrade - AMEC

AMEC Earth and Environmental Ltd. (AMEC) completed a geotechnical assessment of a storm sewer upgrade along Georgia Avenue, with an outfall into Chase River near the location of the proposed pedestrian bridge abutment (AMEC, 2000). The results of AMEC's report generally agree with Tetra Tech's borehole results for 17BH01 on the north side of the river, with Till-Like soils encountered at approximately 4 m below ground surface.

A soft clay deposit was encountered at depths ranging from 3.1 m to 3.4 m in boreholes and testpits located on the north side of the river, south of Sixth Street. The testpits excavated in this vicinity experienced significant sloughing due to the soft clay and loose gravel layers encountered.

Granular deposits in a loose to compact saturated condition were encountered north of the river by AMEC, and are expected to experience localized liquefaction.

3.2.2 Soil Assessment and Percolation Testing Data Report – EBA

EBA Engineering Consultants Ltd. (EBA), (now Tetra Tech), completed a soil assessment at Harewood Centennial Park to determine the feasibility of storm water infiltration for the proposed multi-phase redevelopment of the park. Ten testpits were excavated to maximum depths of 2 m, south of the river. Percolation tests were performed to assess the hydraulic conductivity of the various soils encountered at the site (EBA Engineering Consultants, 2013).

The majority of the soil encountered throughout the site consisted of free-draining granular soils. At most of the testpits, the inferred consistencies of the soils were observed to be compact to dense. EBA encountered Till-Like soils at depths ranging from 0.4 m to 1.5 m.

3.2.3 Harewood Centennial Park Geotechnical Report – Lewkowich

Lewkowich Engineering Associates Ltd. (LEA) carried out a geotechnical assessment for the Harewood Centennial Park Multi-Purpose Covered Court and Site Improvements, 740 Howard Avenue, Nanaimo, BC. A subsurface geotechnical investigation was completed, for which 13 testpits were excavated throughout the site. LEA concluded that Glacial Till was not encountered during their field investigation. Due to the proximity of the court to Chase River, it is possible that the testpits excavated by LEA were terminated prior to the till being encountered. Tetra Tech's borehole on the south side of Chase River (17BH02) did not encounter till until a depth of 3.0 m. No compressible or liquefiable soils were encountered during Lewkowich's testpitting investigation.

3.3 Geological Setting

The Ministry of Environment Soil Survey Report No. 44, Sheet 3 indicated that the surficial geology in the area consists of Arrowsmith Soils. Arrowsmith soils occur in very poorly drained depressional areas, have a year-round water table within 1 m of the soil surface and consist of shallow organic deposits ranging from 0.4 m to 1.6 m in depth and generally saturated with free water common at or near the soil surface for most of the year (British Columbia Ministry of Environment, 1985).

The Geological Survey of Canada Surficial Geology map 27-1963, of Nanaimo indicates the surficial geology consists of less than 1.5 m (5 feet) of Marine Deposits underlain by Ground Moraine Deposits, including till, with lenses of gravel, sand and silt (Geological Survey of Canada, 1963).

Bedrock in the area consists of sedimentary rocks of the Nanaimo Group, Upper Cretaceous (BC Ministry of Energy and Mines, 2017).

4.0 GEOTECHNICAL EXPLORATION

4.1 Drilling Program

A geotechnical drilling investigation was undertaken by Tetra Tech on March 31, 2017, under the conditions of a City of Nanaimo Working in City Streets Permit. Two boreholes were completed using a truck mounted auger rig owned and operated by Drillwell Enterprises Ltd. of Duncan, BC. The borehole locations are shown on Figure 2. The drilling program consisted of:

- Drilling borehole 17BH01 on the North side of the Chase River;
- Drilling Borehole 17BH02 on the South side of the Chase River;

- Completing Standard Penetration Tests (SPTs) at 1.5 m increments in one of the boreholes to determine the relative density / consistency of the soils encountered; and
- Obtaining samples for laboratory testing.

Upon completion of the boreholes, the location of the boreholes were measured using a handheld GPS. Both boreholes were backfilled with cuttings upon completion. Northings and Eastings for each borehole are shown on the borehole logs in Appendix B.

4.2 Subsurface Conditions

Detailed borehole logs have been included in Appendix B, and a general summary of the soils encountered during the investigation are provided below.

Table 1: Borehole Summary

Stratigraphy	17BH01		17BH02	
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
FILL	0 – 2.1	40.0 – 38.0	0 – 2.3	38.0 – 35.7
NATIVE SAND	2.1 – 4.3	38.0 – 35.7	2.3 – 3.0	35.7 – 35.0
SAND TILL	4.3 – 7.0	35.7 – 33.0	3.0 – 6.1	35.0 – 31.9
REFUSAL IN TILL OR POSSIBLE BEDROCK	7.0	33.0	6.1	31.9

4.3 Groundwater Conditions

Groundwater was observed during the drilling at a depth of 3.0 m in borehole 17BH01 and at 2.4 m in borehole 17BH02, correlating to elevations of EL 37.0 m and EL 35.6 m respectively. Groundwater levels are considered to be directly influenced by proximity to surficial runoff and creek water levels. During the field investigation no seepage was noted coming out of the embankment soils. The high water mark of the creek was measured, using a handheld clinometer, to be at an elevation of approximately 36 m, during the field investigation.

4.4 Laboratory Analysis

Moisture contents and laboratory visual classifications were carried out on all soil samples obtained during the drilling program. Moisture contents are shown on the attached borehole logs in Appendix B.

4.5 Seismic Data and Site Seismic Classification

Ground motions were obtained from Natural Resources Canada. The Peak Ground Accelerations (PGA) and selected spectral accelerations Sa(T) corresponding to the 1:475 and 1:2475-year seismic events are presented in Table 2.

Table 2: National Building Code Interpolated Seismic Hazard Values

Seismic Event Probability	Sa(0.05)	Sa(0.1)	Sa(0.2)	Sa(0.3)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA (g)	PGV (m/s)
1:475 year (10% / 50 years)	0.28	0.44	0.54	0.55	0.48	0.26	0.14	0.033	0.011	0.24	0.33
1:2475 year (2% / 50 years)	0.54	0.84	1.0	1.1	0.96	0.56	0.34	0.11	0.037	0.46	0.70

The site classifications for seismic site response have been assessed, in accordance with Table 4.1.8.4-A of the National Building Code of Canada (National Research Council Canada, 2015), to be Site Class C “very dense soil and soft rock”.

The values of F(PGA) and F(PGV) are both 1.0 for site class C.

4.6 Liquefaction Potential

As discussed in Section 4.3, groundwater was encountered at depths ranging from 2.4 m to 3.0 m below ground surface. The high groundwater table observed, combined with the loose granular soils encountered during the investigation indicates there is a high potential for liquefaction at the site. The AMEC report, as discussed in Section 3.2.1, also observed the potential for liquefaction based on their soil investigation.

Although a detailed liquefaction assessment is beyond the scope of this report, Tetra Tech can provide these services upon request.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

Tetra Tech understands that, although piled abutments were originally planned, the City of Nanaimo has requested that shallow footings be considered for foundations. Shallow foundations were originally not considered due to the potential for scour of the abutments from the Chase River and corresponding required depths from the Canadian Highway Bridge Design Code (CHBDC) (Canadian Standards Association, 2016). The ground conditions at the bridge abutments are expected to consist of variable fill, over loose to compact native sand, over glacial till.

It should be noted that, although not encountered during the drilling investigation, a very soft clay/silt layer was encountered by AMEC beneath the granular deposits and the underlying glacial till, north of the Chase River (Section 3.2.1). Depending on tolerance to differential settlement/movement, if this clay layer is encountered during construction, it may need to be overexcavated and replaced with Bridge End Fill (Section 5.6.2).

Tetra Tech has been informed that CHBDC standards do not apply to this pedestrian bridge and therefore, erosional scouring and related minimum footing depths do not need to be considered. However, even if CHBDC design standards are not used, it is our opinion that shallow spread footings would not be practical at the north end of this site. The fill material and underlying loose, saturated sands encountered at the north end would not make a suitable bearing surface for shallow foundations and, therefore, excavation down to the dense till layer would be required.

It is expected that significant sloughing / seepage would occur during any excavation down to till and an excavation plan would require dewatering and shoring. Dewatering could be complicated by the proximity to Chase River and well point testing should be carried out as part of developing an excavation plan.

5.2 Shallow Foundations

5.2.1 Spread Footings

If used, all footings should be constructed to bear on undisturbed, non-frozen, native, dense Sand / Silt Till or undisturbed, non-frozen, native, dense Sand and Gravel. Shallow footings should not be constructed on common fill or the loose sand encountered at the north end of the site.

Shallow foundations may be practical at the south side of the Chase River but they are not practical at the north side. However, to avoid differential settlements and stress concentrations caused by the different post-construction behaviour of differing foundation types, we recommend that this structure uses only one type of foundation.

Site preparation for shallow pad and strip footings should begin by stripping fill, organics, water softened, frozen and unsuitable soils from beneath the footprint of the foundations. If subexcavation is required below the elevation of the proposed footing, then the width of subexcavation should extend out from the edge of the proposed foundation to reach the bottom of the sub-excavation at a 2H:1V slope. The excavation should then be restored to design grades with engineered fill.

5.2.2 Bearing and Settlement

The bearing resistances are calculated assuming that the loads will be vertical and concentric and that the edge of the footing will be situated at least two foundation widths away from the edge of a slope. If the structural loads are to be inclined, or result in eccentric loading, then the bearing resistances may be lower than those presented in this section and should be checked by Tetra Tech using the actual design loads, eccentricities and inclinations.

The unfactored Ultimate Limit State (ULS) bearing resistance was estimated based on the approaches given in the CFEM 2006 as well as Tetra Tech's experience with past projects on similar soils. A resistance factor of 0.5 (per the NBCC 2015) should be applied to the unfactored ULS bearing resistance in order to obtain a factored ULS bearing resistance suitable for design.

Table 3: Shallow Foundation Design Parameters

Foundation Parameters	Foundation Stratum: Silt / Sand Till or Sand and Gravel (native, dense)
ULS Unfactored Bearing Resistance (kPa):	400
ULS Factored Bearing Resistance (factored) (kPa):	200
Static Serviceability Limit State (SLS) Bearing Pressure (kPa):	175

The long-term settlement of strip and pad footings when loaded is estimated to be approximately 25 mm.

5.3 Piled Foundation

Due to expected difficulties in excavating to competent subgrade, we recommend that piles are drilled or driven through the fill soils and native sand and gravels and into the glacial till at both the north and south ends of the site.

Based on drilling the piles through the fill and native sands, the skin friction and end bearing for piles embedded into the till soils are shown in Table 4.

Table 4: Skin Friction and End Bearing based on 17BH01

Depth (m)	Soil	SPT (N)	qs (kPa)	qt (kPa)
1 to 2.1	Sand and Gravel	NA	NA	NA
2.1 to 4.3	Sand	NA	NA	NA
4.3 to 5.8	SAND TILL	34	50	5000
5.8 to 7.0	SILT TILL	60	75	7500

(Canadian Geotechnical Society, 2006)

Where q_s is skin friction and q_t is end bearing for ultimate axial capacity. For factored geotechnical axial resistance of ultimate limit states, the 2006 Canadian Foundation Engineering Manual suggests that the ultimate axial capacity be multiplied by a geotechnical resistance factor of 0.3.

If ultimate axial loads are provided, Tetra Tech can provide recommended pile lengths for a range of pile diameters.

5.3.1 Lateral Loading on Piles

Lateral loads have not been provided and have therefore not been addressed in this report. If required Tetra Tech can undertake this analysis.

5.3.2 Pile Installation

- All piles shall be founded at a minimum depth of EL. 33.5 and embedded a minimum of 0.3 m into dense till soils.
- Steel Pipe Piles shall be concrete filled.

- If piles are driven, driving records should be kept for each pile. Information to be recorded should include, pile dimensions, hammer type, rated energy, ram weight, cap block weight and type, anvil weight, number of blows for each 0.3 m of penetration and final set.
- The elevation of the tops of driven piles should be measured immediately after driving. If uplift occurs in any piles during the driving of adjacent piles, the displaced piles should be re-driven to at least their previous final elevation and final set.
- Strict control of pile location and orientation should be exercised to obtain accurate pile installation.
- If piles are to be driven into the glacial till, special tips or preboring may be required.
- If piles are drilled they will most likely require casing to prevent sloughing of near surface granular soils.
- Pile driving may result in significant vibrations which may be unacceptable for adjacent structures. In areas where this is a concern, continuous monitoring of vibrations induced in adjacent structures by a seismograph is recommended in order to assess the potential for damage and the need for modification of procedures.

The bid documents should advise prospective piling contractors of the potentially difficult advancement of the piles into glacial till.

5.4 Construction Monitoring

It should be noted that pile design is an iterative process and is not complete until every pile has been driven and / or pile load testing is complete. Inspection is considered an integral part of the design of deep foundations. Therefore, full time inspection of the pile installation by Tetra Tech is required to confirm that the piles are satisfactorily embedded in the subsurface strata and to determine if adjustments to the embedment depth are required.

Construction review by the geotechnical engineer shall include monitoring installation of pile foundations, including clean-out of the inside of the piles and concrete filling.

5.5 Excavation and Temporary Slopes

All excavation slopes must comply with WorkSafeBC requirements.

The following recommendations are preliminary comments for temporary excavation slopes. A geotechnical engineer must make site specific recommendations at the time of construction:

- Where the depth of the excavation is less than the depth to the groundwater table, temporary excavation slopes of up to 1H:1V may be possible in the native granular soils; and
- Where the excavation depth is greater than the depth of the groundwater table, the native materials will be difficult to stabilize and pumping or special dewatering techniques will be required.

5.6 Abutments

5.6.1 Global Stability of Abutments

The location, dimensions, or conceptual design of abutments has not yet been provided to Tetra Tech for their review.

In general, the side slopes of Chase River appear to be statically stable with shallow till being observed along its banks.

An appropriate setback from the crest of the river bank for scouring should be established and/or appropriate erosion protection against scouring should be designed. Analysis of scouring is beyond the scope of this report. The proximity of the abutments to the river as well as the abutment design are required prior to providing global stability analysis.

5.6.2 Settlement of Approach Fill

Bridge End Fill (BEF) as defined in Section 202 of the *2016 Standard Specification For Highway Construction* consists of 'quality granular fill placed behind and below a bridge abutment to provide good drainage, a smooth transition from the bridge approaches to the bridge structure, and a suitable material through which to drive piles.'

General comments and recommendations concerning construction of BEF at this site are summarized as follows:

- Generally, fill material should be removed prior to placing Bridge End Fill. However, some areas of granular fill may be deemed suitable for approach fill bearing and, as such, a geotechnical engineer from Tetra Tech should inspect the excavations prior to placing bridge end fill to ensure that all unsuitable fill material has been removed.
- The BEF shall be constructed in successive horizontal layers not exceeding 150 mm in loose thickness and compacted to a minimum 100% of the Standard Proctor Maximum Dry Density (SPMDD).
- The fill material shall have the gradation outlined in Table 5, below:

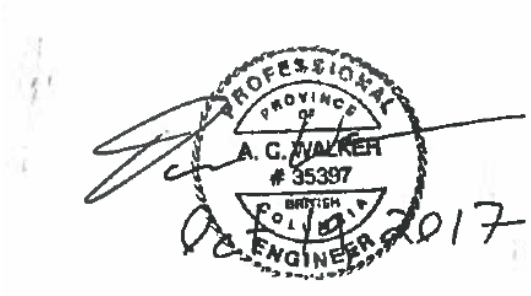
Table 5: Gradation of BEF Material (BCMoT Standard Specifications - Table 202-C)

Sieve Size (mm)	% Passing by Mass of Total Sample
75	100
50	30-100
19	20-100
4.75	10-60
1.18	6-32
0.300	4-15
0.075	0-5

6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



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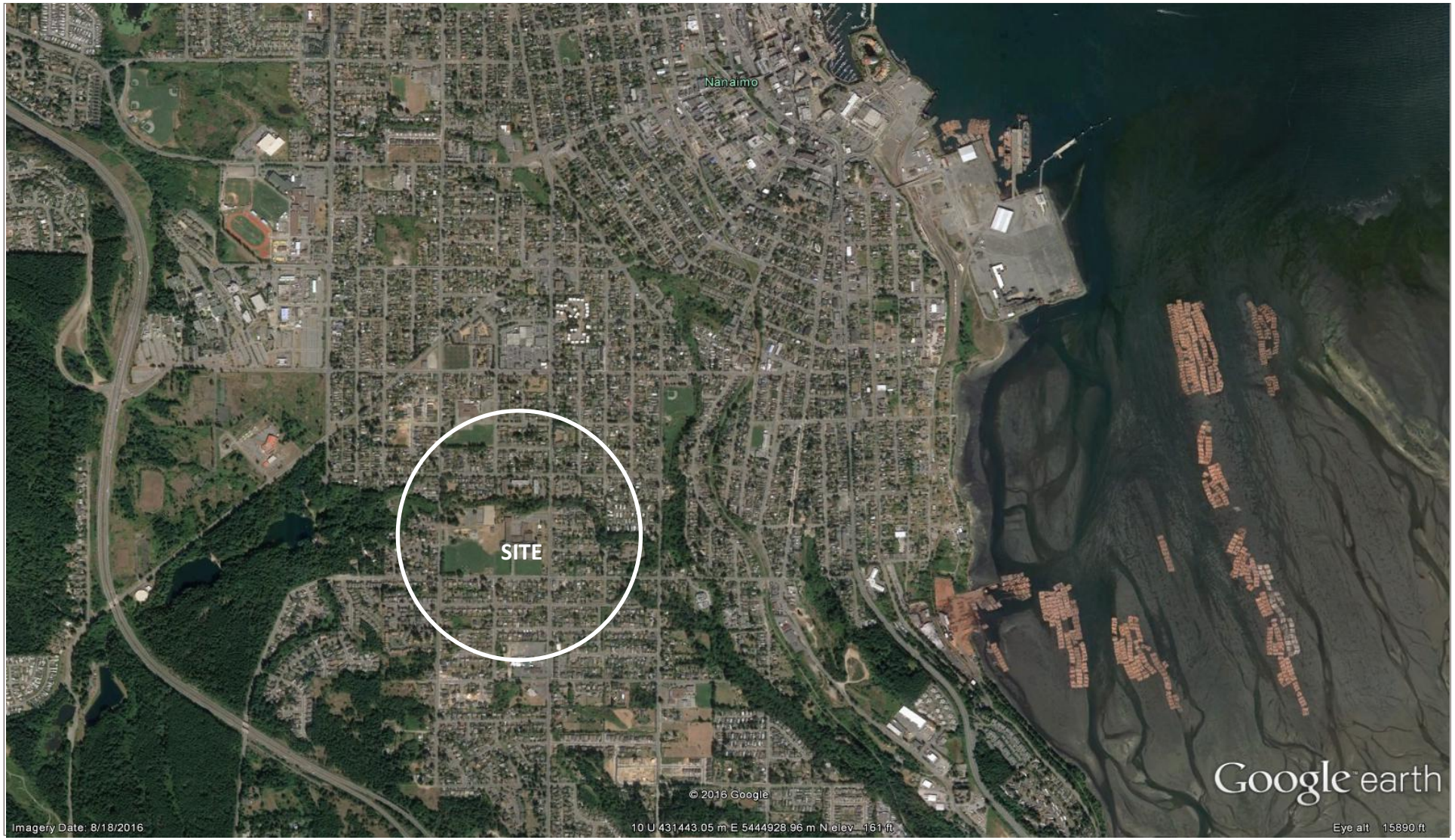
FIGURES



LEGEND

NOTES

STATUS
ISSUED FOR USE

CLIENT
City of Nanaimo

Georgia Greenway Pedestrian Bridge

Geotechnical Services

TETRA TECH

PROJECT NO.	DWN	CKD	APVD	REV
704-ENG.VGEO03217-01	SO	CC	AW	0

OFFICE	DATE
EBA-VANC	April 20, 2017

Figure 1

LEGEND

Tetra Tech 2017 Borehole Locations

NOTES

STATUS
ISSUED FOR USE

CLIENT
City of Nanaimo

Georgia Greenway Pedestrian Bridge

Geotechnical Services

TETRA TECH

PROJECT NO.	DWN	CKD	APVD	REV
704-ENG.VGEO03217-01	SO	CC	AW	0

OFFICE	DATE
EBA-VANC	April 20, 2017

Figure 2

APPENDIX A

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of TETRA TECH’s Client. TETRA TECH does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than TETRA TECH’s Client unless otherwise authorized in writing by TETRA TECH. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the report, if required, may be obtained upon request.

1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH’s instruments of professional service); only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. TETRA TECH’s instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.4 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.5 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.6 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.7 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.8 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.9 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.10 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.11 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.12 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.13 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.14 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

BOREHOLE LOGS

Borehole No: 17BH01

Project: Georgia Greenway	Project No: VGEO03217
Location: 730 Howard Avenue	Ground Elev: 40 m
Nanaimo, British Columbia	UTM: 430540 E; 5444640 N; Z 10

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80)	Elevation (m)
0										40
	Solid stem auger	SAND, silty, organics, roots, moist, loose, brown								
		SAND and GRAVEL (FILL), trace silt, moist, loose to compact, red brown; poorly graded sand			G1		11.7			
1										39
		- thin organic layer at 1.5 m			SPT2	6	12.6			
2										38
		SAND, trace silt, wet, loose to compact, yellow brown; poorly graded sand, medium to coarse grained								
		- changed to hollow stem auger, at 2.4 m, due to sloughing in hole - becomes some silt, grey with red and brown mottling, fine grained sand, moist and dense at 2.4 m			G3		21.9			
3										37
		SAND, trace silt, wet, very loose, grey; fine grained SPT pushed down with weight of hammer only, no blows			SPT4	0	22.6			
4										36
	Hollow stem auger	SAND (TILL), some gravel, some silt, damp, dense, grey; well graded sand; rounded to subrounded gravel - harder drilling at 4.3 m (inferred)			SPT5	34	9.2			
5										35
		SAND (TILL), silty, some gravel, moist, very dense, grey			SPT6	60	11			
6										34
		SILT (TILL), some sand, traced gravel, moist, hard, grey								
					SPT7	100	13.3			
7										33
		End of Borehole at 7.0 m - Refusal with SPT								
8										32

Contractor: Drillwell	Completion Depth: 7 m
Drilling Rig Type: Truck Mounted Auger	Start Date: 2017 March 31
Logged By: AW/CC	Completion Date: 2017 March 31
Reviewed By: AW	Page 1 of 1

Borehole No: **17BH02**

Project: Georgia Greenway	Project No: VGEO03217
Location: 730 Howard Avenue	Ground Elev: 38 m
Nanaimo, British Columbia	UTM: 430529 E; 5444586 N; Z 10

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80)	Elevation (m)
0	Hollow stem auger	SAND and GRAVEL (FILL), some cobbles, trace silt, moist, compact, red brown; well graded sand; angular gravel			SPT1	30	8.4			38
1		GRAVEL and SAND, some silt, some cobbles, moist, dense, brown very difficult drilling due to gravel and cobbles at 1.2 m			SPT2	16	5.7			37
2		- at 2.1 m could not advance with hollow stem auger, changed to solid stem								36
	Solid stem auger	SAND and GRAVEL, trace silt, moist, compact (inferred), grey; well graded sand; sub angular gravel								
3		SAND (TILL), some silt, some gravel, damp, grey			G5		10.6			35
4		SAND and SILT (TILL), some gravel, trace clay, moist, very dense (very hard drilling), grey			G6		9.1			34
5										33
6										32
		End of Borehole - Auger Refusal								
7										31
8										30

Contractor: Drillwell	Completion Depth: 6.1 m
Drilling Rig Type: Truck Mounted Auger	Start Date: 2017 March 31
Logged By: CC	Completion Date: 2017 March 31
Reviewed By: AW	Page 1 of 1

Appendix E

CLASS D COST ESTIMATE

City of Nanaimo
Engineering

Project Cost Estimate Summary

Project CPMS#:
Project Name Georgia Greenway: Phase 1

SAP Leg	Description	Pre-Design (Class D)	50% Design Class C	95% Design Class B	100% Design Class A
	Estimate completed by:	PGR/EGAP			
	Date:	09-May-18			
	Accuracy (for use in -99 Contingency)	25%	20%	15%	10%
-03	Land				
-05	Construction				
	Section 2 - General Conditions	17,800			
	Section 3 - General Requirements	32,550			
	Section 7 - Storm	16,000			
	Section 8 - Curbs & Sidewalks	42,300			
	Section 9 - Streets	65,838			
	Section 10 - Roadway and Trailway Lighting	94,500			
	Section 12 - Asphaltic Concrete Paving	76,170			
	Section 14 - Landscape and Irrigation	8,500			
	Section 18 - Bridge Works	450,000			
	Project Name	**$ 803,658**	**$ -**	**$ -**	**$ -**
-06	Private Utilities (Hydro, Telus, Terasen, Shaw)	$ -	$ -	$ -	$ -
-07	Environmental Monitor	$ 12,000			
-08	Archeological Monitor	$ 12,000			
-09	Field Engineering, Testing	$ 40,500			
-12	City-Supplied Materials				
-13	Other				
	Subtotal:	**$ 868,158**	**$ -**	**$ -**	**$ -**
-99	Contingency (Based on Class)	$ 217,040	$ -	$ -	$ -
	Total Estimated Costs	**$ 1,085,198**	**$ -**	**$ -**	**$ -**
	Budget:	**0**		**0**	**0** **0**

FUNDING ALLOCATION - individual utility value (Sections 5, 6, 7 and 8-12)				
Roads				
Storm				
Water				
Sanitary				
	$ -	**$ -**	**$ -**	**$ -**

FUNDING SUMMARY

DCC Roads				
Roads Capital				
DCC Storm				
Storm Capital				
DCC Water				
Water Capital				
DCC Sanitary				
Sanitary Capital				
Private Contributions				
Grants				
ICBC				
Other				
Total Budget:	**0**	**0**	**0**	**0**

-06 Private Utilities:				
BC Hydro				
Telus				
Shaw Cable				
Terasen				
E&N Railway				
Subtotal	*0*	*0*	*0*	*0*

Notes:

Cost Estimate Schedule of Quantities and Prices

Pre-Design - Sept. 2017

Project CPMS#:
Project Name **Georgia Greenway: Phase 1**

Item		Description	Est.Qty.	Units	Unit Price	Total
Section 2		**General Conditions**				
2.1		Location of Works - Project Layout (Article 7)	1	LS	$ 17,800.00	$ 17,800
		Total Section 2				**$ 17,800**
Section 3		**General Requirements**				
3.1		Clearing and Grubbing (Section 3.71)	0.2	ha	$ 18,000.00	$ 3,600
3.2		Control of Public Traffic (Section 3.73)	1	LS	$ 13,400.00	$ 13,400
3.3		Removal of Existing Structures (Section 3.75)				
	a)	Catch Basins	2	ea	$ 200.00	$ 400
	b)	Fences	5	m	$ 30.00	$ 150
3.4		Environmental Mitigation/Remediation Measures	1	LS	$ 15,000.00	$ 15,000
		Total Section 3				**$ 32,550**
Section 7		**Storm Sewer System**				
7.1		Piping (Section 7.70)				
	a)	1050mm dia. Concrete C76 (remove & replace)	10	m	$ 500.00	$ 5,000
7.2		Catchbasins (Section 7.74)				
	a)	200mm dia. SW-1	4	ea	$ 2,000.00	$ 8,000
7.3		Inlet and Outlet Structures (Section 7.85)				
	a)	Outlet for 1050mm Concrete Storm (Remove & Replace)	1	ea	$ 3,000.00	$ 3,000
		Total Section 7				**$ 16,000**
Section 8		**Curbs and Sidewalks**				
8.1		Curbs (Section 8.70)				
	a)	Non-Mountable Curb and Gutter, "CS-1"	105	m	$ 95.00	$ 9,975
8.2		Sidewalks, Miscellaneous Sidewalks and Crossings (Section 8.71)				
	a)	100mm Sidewalk	47	m2	$ 75.00	$ 3,525
	b)	150mm Sidewalk	16	m2	$ 90.00	$ 1,440
8.3		Cutting and Removal of existing Sidewalk (Section 8.72)				
	a)	Cutting	29	m	$ 20.00	$ 580
	b)	Removal	44	m2	$ 20.00	$ 880
8.4		Cutting and Removal of existing Curb & Gutter (Section 8.73)				
	a)	Allowance	35	m	$ 20.00	$ 700
8.5		Adjust Catchbasins and Manholes (Section 8.74)	1	ea	$ 300.00	$ 300
8.6		Handrails, Bollards and Barriers (Section 8.75)				
	a)	Bollards (Removable)	6	ea	$ 650.00	$ 3,900

Cost Estimate Schedule of Quantities and Prices			Pre-Design - Sept. 2017				
Project CPMS#:							
Project Name		**Georgia Greenway: Phase 1**					
Item		**Description**	**Est.Qty.**	**Units**	**Unit Price**		**Total**
8.7		Fencing					
	a)	1.2m Chain Link, Black Vinyl Coated	140	m	$ 150.00	$	21,000
		Total Section 8				**$**	**42,300**
Section 9		**Streets**					
9.1		Stripping and Common Excavation (Section 9.70)	620	m3	$ 20.00	$	12,400
9.2		Imported Granular Fill (Section 9.74)					
	a)	Trailway	745	Tonne	$ 16.00	$	11,920
	b)	Bridge Abutment	144	Tonne	$ 16.00	$	2,304
9.3		Sub-grade Preparation (Section 9.75)	2066	m2	$ 2.00	$	4,132
9.4		Base Course (Section 9.77)					
	a)	Trail	600	Tonne	$ 30.00	$	18,000
	b)	Shoulder	190	Tonne	$ 45.00	$	8,532
9.5		Traffic Signs (Section 9.80)					
	a)	Supply and Install new Sign	9	ea	$ 350.00	$	3,150
	b)	Relocate existing Sign	2	ea	$ 200.00	$	400
9.6		Line Painting					
	a)	Allowance	1	LS	$ 5,000.00	$	5,000
		Total Section 9				**$**	**65,838**
Section 10		**Trailway Lighting**					
10.1		Concrete Pole Base (Section 10.91)	2	ea	$ 1,500.00	$	3,000
10.2		Conduit & Wiring (Section 10.92)					
	a)	38 or 50mm RPVC	300	m	$ 40.00	$	12,000
10.3		Poles & Luminaires (Section 10.93)					
	a)	Trailway Lighting (incl. base)	19	ea	$ 2,500.00	$	47,500
	b)	Poles with Service Base (Section 10.94)	2	ea	$ 3,500.00	$	7,000
10.4		Allowance for Bridge Lighting	1	LS	$ 15,000.00	$	15,000
10.5		BC Hydro Drop Service	2	ea	$ 5,000.00	$	10,000
		Total Section 9				**$**	**94,500**
Section 12		**Asphalt Concrete Paving**					
12.1		Cutting of Existing Asphalt Pavement (Section 12.70)	100	m	$ 7.00	$	700
12.2		Removal of Existing Pavement (Section 12.71)					
	a)	Excavation	112	m2	$ 10.00	$	1,120
12.3		Adjustment of Services (Section 12.72)					
	a)	Allowance	1	ea	$ 350.00	$	350
12.4		Asphaltic Concrete (Section 12.74)					
	a)	50mm Thickness	1850	m2	$ 40.00	$	74,000
		Total Section 12				**$**	**76,170**

Cost Estimate Schedule of Quantities and Prices							Pre-Design - Sept. 2017
Project CPMS#:							
Project Name	**Georgia Greenway: Phase 1**						
Item	**Description**	**Est.Qty.**	**Units**	**Unit Price**			**Total**
Section 14	**Landscape**						
14.1	Seeding w/soil 100mm Depth (Section 14.72)	400	m2	$	10.00	$	4,000
14.2	Furniture Allowance						
a)	Garbage Can	3	ea	$	500.00	$	1,500
b)	Bench	3	ea	$	1,000.00	$	3,000
	Total Section 14					**$**	**8,500**
Section 18	**Bridge Works**						
18.1	Steel Girder Bridge (Alignment Option 1, Bridge Option D)	1	LS	$	450,000.00	$	450,000
	Total Section 18					**$**	**450,000**
Summary							
Section 2	General Conditions					$	17,800
Section 3	General Requirements					$	32,550
Section 7	Storm Sewer System					$	16,000
Section 8	Curbs and Sidewalks					$	42,300
Section 9	Streets					$	65,838
Section 10	Trailway Lighting					$	94,500
Section 12	Asphalt Concrete Paving					$	76,170
Section 14	Landscape					$	8,500
Section 18	Bridge Works					$	450,000
	TOTAL ALL SECTIONS					**$**	**803,658**