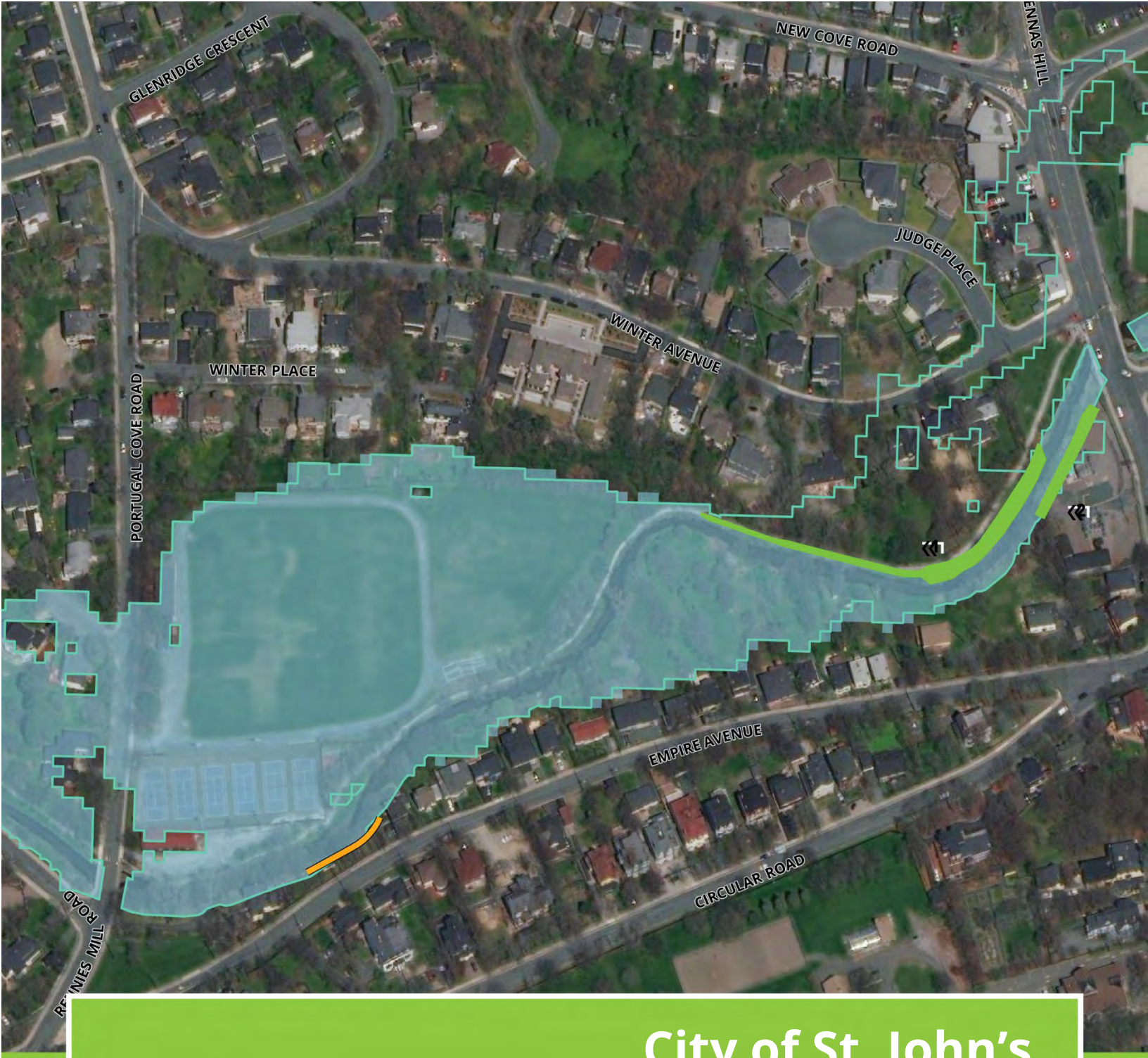

City of St. John's

Rennies River Flood Mitigation

Portugal Cove Road to Kings Bridge Road

Environmental Preview Report

CBCL

ST. JOHN'S

Project No. 213032 • September 2022

	Final	L. Hardwick	September 2022	C. Walker V. Fernandez A. Coldham M. Rutherford
	Draft	L. Hardwick G. Sheppard	June 2022	C. Walker V. Fernandez A. Coldham M. Rutherford
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

Report: 213032.00

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September 19, 2022

Joanne Sweeney
Dept. of Municipal Affairs and Environment
PO Box 8700
St. John's, NL A1B 4J6

Dear Ms. Sweeney:

RE: City of St. John's – Rennies River Flood Mitigation
Portugal Cove Road to King's Bridge Road
Environmental Preview Report (EPR) Document
Registration No. 2115
CBCL Project # 213032.00

Enclosed is our application and associated materials required for your review of the Environmental Preview Report for the above noted project. If you have any questions or require clarification, please contact me.

Yours very truly,

CBCL Limited

Prepared by:
Melissa Rutherford
Environmental Scientist
Direct: 902-421-7241 Ext. 2574
E-Mail: mrutherford@cbcl.ca

Project No: 213032.00

Contents

Tables

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Table of Concordance

Submission Check List

Please see the report sections indicated in the table below to locate the required information for the Environmental Preview Report, as outlined in the Newfoundland and Labrador Department of Environment and Climate Change (NLECC) Guidelines for Environmental Preview Report for the Rennies River Flood Mitigation Portugal Cove Road to King's Bridge Road (2021).

Item	Required Information		Section
1	**Name of Undertaking**		Chapter 1
2	**Proponent**		Chapter 2
	(i)	Contact information of Proponent and Corporate Body	
	(ii)	Chief Executive Officer and contact information	
	(iii)	Principal Contact Persons for purposes of environmental assessment and contact information	
3	**The Undertaking**		Chapter 3
	(i)	Nature of the Project	Section 3.1
	(ii)	Purpose/Rationale/Need for the Project	Section 3.2
	(iii)	Changes from the Original Project Description	Section 3.3
4	**Description of the Undertaking**		Chapter 4
4.1	**Geographical Location/ Physical Components / Existing Environment**		Section 4.1
	(i)	Provide description of the proposed berms and erosion control measures along Rennies River, including GPS location coordinates. Attach an original base map (1:25,000 scale) and/or recent air photos/aerial imagery.	Section 4.1.1
	(ii)	Provide information regarding ownership and/or zoning of the land upon which the project is to be located and any restrictions imposed by that ownership or zoning.	Section 4.1.2
	(iii)	Clearly describe the current ground water levels in the area around the proposed berms and erosion control measures.	Section 4.1.3
4.2	**Construction**		Section 4.2
	(i)	State the time period in which proposed construction will proceed and proposed date of first physical activity.	Section 4.2.1
	(ii)	Provide the details, materials, methods, schedule, and location of all planned construction activities.	Section 4.2.2
	(iii)	Describe the potential sources of pollutants during the construction including soil erosion, and sedimentation.	Section 4.2.3
	(iv)	Identify potential causes of resource conflicts during construction including temporary disruption of the use of Rennies River Trail and disruption of fish habitat.	Section 4.2.4
	(v)	Describe any potential impacts of the construction on the area, such as to trees established along the river.	Section 4.2.4

Item	Required Information	Section
4.3	**Operation and Maintenance**	Section 4.3
	(i) Aspects of the operation and maintenance of the proposed berms and erosion control measures.	Section 4.3.1
	(ii) Identify how the project will avoid interference with the rights of other legitimate landowners/users.	Section 4.3.2.1
	(iii) Describe the potential effects of waterlogging inside the earthen berm structure and a drainage plan for post construction water logging.	Section 4.3.2.2
	(iv) Describe measures that will be implemented to address localized surface water draining to Rennies River that will be inhibited by the berm structure.	Section 4.3.2.3
5	**Alternatives**	Chapter 5
	(i) Identify and describe alternative means and locations of carrying out the project that are technically and economically feasible.	Section 5.1
	a. Identify alternative means and locations to carry out the project.	Section 5.1.2
	b. Identify the environmental effects of each alternative means and location, including the approximate river changes for each of the flood mitigation measures along the river channel for each of the different scenarios.	Section 5.1.3
	c. Explain why the installation of the berms near King's Bridge Road and the erosion control measure for Portugal Cove Road were identified to be completed before flood control measures further upstream.	Section 5.1.4
	d. Provide reasons for the rejection of alternative sites.	Table 5.4
	e. Identify why the proposed berms does not contain any drainage mechanisms to prevent localized pooling of water.	Section 5.1.2
	(ii) Include information from previous project related studies describing alternate locations that were considered, including the expansion of existing sites, reasons for rejection, and reasons supporting the proposed site as the preferred location, if applicable.	Section 5.1 Appendix B
	(iii) Alternative locations should be clearly outlined on maps of a suitable scale (i.e., 1:50,000, 1:25,000) and aerial imagery.	Figure 5.1
6	**Potential Environmental Effects and Mitigation**	Chapter 6
	(i) Provide detailed information regarding the potential effects of the project on the environment and the proposed mitigation to be used to avoid adverse environmental effects.	Section 6.1

Item	Required Information	Section
	(ii) Describe the expanded floodplain (including mapping) upstream as a result of the proposed berm and erosion control measures. This must include the effect of the expanded flooding on private and public property, and the measures that will be undertaken to mitigate the effects of the expanded floodplain.	Section 6.1.1
	(iii) Describe the environmental impact of the impermeability of the berm and erosion control measures on the ability of localized runoff to drain into the river.	Section 6.1.2
	(iv) Describe the change in the river morphology and flow velocity at the berm section, upstream and downstream of the berm and riverbank stabilization.	Section 6.2
	(v) Describe the effect of the berms and the erosion control measures may have on groundwater levels, and the measures that will be undertaken to mitigate the effects.	Section 6.3
	(vi) Describe measures that will be undertaken to ensure a quick and effective response to a potential spill event associated with petroleum products.	Section 6.4
7	**Project Related Documents**	
	(i) Bibliography of all project-related documents.	Section 9.1 Section 9.2
8	**Public Information Meeting**	Chapter 7
	a. Information concerning the undertaking to the people whose environment may be affected by the undertaking.	Section 7.3 Appendix E
	b. Information gathered to fulfill the requirements of Section 5 of these guidelines.	Section 7.3 Appendix E
	c. Record and respond to the concerns of the local community.	Section 7.3 Appendix E
	d. Present the public concerns and measures that will be implemented to address those concerns.	Section 7.3 Table 7.3
9	**Approval of the Undertaking**	Chapter 8
	(i) Main permits, licences, approvals and authorizations required for the undertaking, including issuing authorities.	Chapter 8
	Additional Information	
	Summary consultations undertaken prior to EPR	Section 7.2
	Copies of reports of Project Specific Studies	Appendix A Appendix B Appendix C

1 Name of the Undertaking

The name of the undertaking is Rennies River Flood Mitigation - Portugal Cove Road to Kings Bridge Road.

2 Proponent

2.1 Project and Proponent Information

The contact information for the proponent is provided in Table 2.1 and contact information for the consultant of this Environmental Preview Report (EPR) is provide in Table 2.2.

Table 2.1 Proponent Contact Information

Role	Name / Title	Address/Contact Info
Proponent	City of St. John's	10 New Gower Street St. John's, NL A1C 5M2
Principal Contact Representative	Scott Winsor, P. Eng. Director of Engineering	10 New Gower Street, St. John's, NL A1C 5M2 Telephone No: 709-576-8258 Fax: 709-576-8474 Email: swinsor@stjohns.ca
Mayor	Danny Breen Mayor	10 New Gower Street, St. John's, NL A1C 5M2 Telephone No: 709-576-8477 E-mail: mayor@stjohns.ca

Table 2.2 Project Consultant Contact Information

Role	Name / Title	Address/Contact Info
CBCL Limited Project Lead	Jennifer Bursey Civil Engineer	187 Kenmount Rd, St. John's, NL A1B 3P9 Telephone No: 709-364-8623 Email: jenniferb@cbcl.ca
CBCL Limited Regulatory and Environmental Lead	Melissa Rutherford Environmental Scientist	1505 Barrington Street, Suite 901 Box 606 Halifax, NS B3J 2R7 Telephone No: 902-421-7241 x 2574 Email: mrutherford@cbcl.ca

3 The Undertaking

3.1 Nature of Project

The City of St. John's (the City) is proposing to construct flood mitigation berms (the Project or Undertaking) as part of the overall stormwater management approach along Rennies River in St. John's, Newfoundland and Labrador (NL). The primary objective of the Project is to provide protection from flooding that occurs as a result of extreme precipitation events and thereby reduce potential damage to infrastructure and properties along the Rennies River between Portugal Cove Road to Kings Bridge Road.

The Undertaking consists of two earth berms and bank stabilization/erosion control measures along Rennies River between Portugal Cove Road and Kings Bridge Road (Section 4.1).

3.2 Purpose/Rationale/Need for the Undertaking

Increasing urbanization in the Rennies River watershed and anticipated increase in precipitation frequency and intensity due to climate change are expected to result in an increase in potential risk of flood damage along Rennies River (CBCL, 2014). As part of this Undertaking, the City is proposing to construct flood mitigation infrastructure in strategic locations along Rennies River from Portugal Cove Road to Kings Bridge Road. The purpose of the Project is to reduce flood risk and take action to safeguard residential areas and community infrastructure against potential economic loss immediately and into the future.

The Rennies River is part of the greater 32 km^2 Rennies River watershed. The Rennies River spans approximately 3 km through the City, connecting Long Pond to Quidi Vidi Lake, and ultimately discharges to the Atlantic Ocean. The Rennies River watershed has been subject to major flood events caused by river flooding in the past. One of the earlier major flood events recorded was in 1986, when 110 mm of rainfall caused flooding along Leary's Brook and Rennies River (CBCL, 2014).

In April 2014, on behalf of the City, CBCL completed the Rennies River Catchment Stormwater Management Plan (RRCSMP). The RRCSMP indicated that during significant rainfall events, flooding occurs at locations along Rennies River, as well as Ken Brook and Leary's Brook, at times resulting in major public and private property damage (CBCL, 2014). The RRCSMP developed an estimation on flooding effects, based on field surveys, and

hydrologic and hydraulic models corresponding to the 1:20 and 1:100 annual exceedance probability (AEP) precipitation events, including the effects of climate change (CC). These events represent the probability of a precipitation or flow event of a specified magnitude occurring in any one year. For example, a 1:100 AEP event has a 1% probability of occurring in any given year, and a 1:20 AEP has a 5% probability of occurring in any given year.

The RRCSMP provided recommendations prioritizing flood protection infrastructure improvements to be implemented, including a flow control structure at the outlet of Long Pond, flood protection berms around the Health Sciences Centre (construction concluded in 2021), and flood protection berms downstream of Long Pond along the Rennies River.

The City intends to implement the measures as identified in the RRCSMP in phases. However, the sequencing of the measures is dependent on the construction of other flood mitigation measures, such as a flow control structure at the outlet of Long Pond, as well as available funding and overall priorities.

At the outlet of Long Pond, the City has proposed a passive flow control structure on the downstream side of Long Pond and accompanying mitigative flood protection berms. The flow control structure at the outlet of Long Pond was initially stated as priority number 1 in the RRCSMP, while the flood protection berms downstream of Long Pond were identified as priority number 2 to protect properties bordering Rennies River. Supplemental hydrodynamic analyses conducted from 2019 through to 2021 identified that the proposed Undertaking could be constructed along Rennies River capable of protecting residential properties on Winter Avenue, in advance of the implementation of other items identified in the RRCSMP, such as the flow control structure at the outlet of Long Pond.

3.3 Modifications to Project

Following further design refinement, minor aspects of the Project have been updated since the submission of the Environmental Assessment Registration Document (EARD) on February 2, 2021 to the Newfoundland and Labrador Environment and Climate Change (NLECCC).

Design refinements include modification to berm types, locations, lengths, and heights to reduce berm footprints and potential encroachment on adjacent properties. Potential laydown areas have been identified to refine the work areas. As a mitigative approach, the Project will include stormwater collection on the north side of the north berm (Berm 1). Further information of these changes is described in Section 4.1 of the EPR.

4 Description of the Undertaking

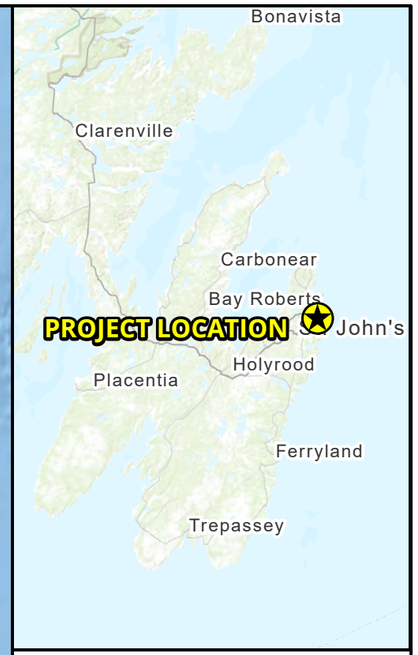
The Undertaking consists of two earth berms upstream of Kings Bridge Road, armour stone erosion control measures between Portugal Cove Road and Kings Bridge Road, and drainage system located on the north side of the north berm (Berm 1). The berm locations were selected based on the results of hydraulic modelling, which is further described in Section 4.1.3.1.

4.1 Geographical Location / Physical Components / Existing Environment

4.1.1 Geographic Location

The Project is located along Rennies River in St. John's, NL (Figure 4.1). The Project area (Figure 4.2) extends along the north and south banks of Rennies River from the east side of Portugal Cove Road to the west side of Kings Bridge Road, approximately 600 m. The area is classified as medium density residential, with vegetation areas primarily within the riparian zone of the river (CBCL, 2014).

Between Portugal Cove Road and Kings Bridge Road, the Rennies River Trail runs adjacent to the north bank of the river and is maintained by the Grand Concourse Authority, a local non-profit charitable organization. On the east side of Portugal Cove Road, on the north side of the river, there are two parks: Feildian Grounds and the Riverdale Tennis Club (Figure 4.2). The Rennies River Trail is positioned on the north side of the river. East of the parks and the south side of the river are several residential homes with vegetated riparian areas separating their property from the river.



CBCL

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 4.1: Project Location

Drawn: SF	**Date: 2022-05-31**
Checked: MR	**Project #: 213032**
Approved: LH	**Scale @ 11"x17"** 1:2,200,000
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Notes:

0 20,000 40,000 80,000 m

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

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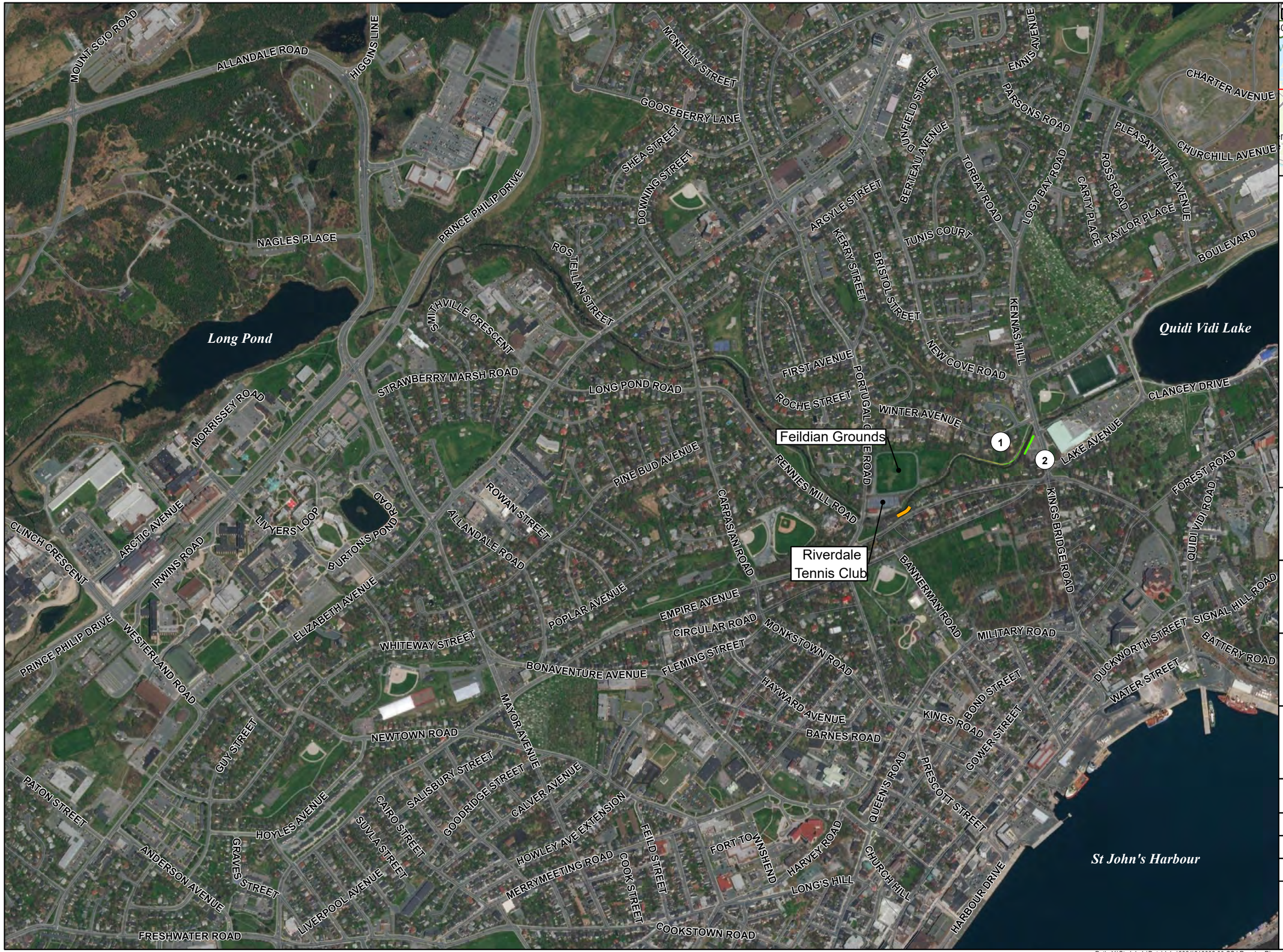

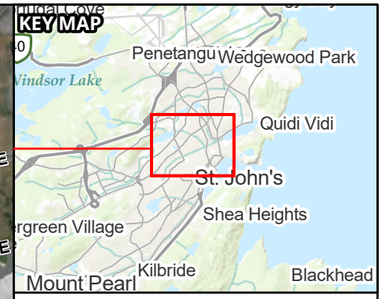

LEGEND

- Erosion Control Improvements
- Earth Berm Flood Mitigation Structure
- Concrete Block Retaining Wall Flood Mitigation Structure
- (#) Berm ID

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 4.2: Project Area

CBCL

Notes:

Drawn: SF	Date: 2022-05-31
Checked: MR	Project #: 213032
Approved: LH	Scale @ 11"x17" : 1:10,000

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 55 110 220 330 440 m

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The two flood mitigation berms are designed to accommodate a 1:100 AEP CC precipitation event. The geographical coordinates of the two berms are provided in Table 4.1, and footprints may be refined further during detailed design. The design of the berms reflects the natural curvature of the riverbanks, on which the berms are to be placed (Figure 4.2 and Figure 4.3). Berm 1 will be located on the west side of Kings Bridge Road and will extend approximately 300 m upstream at the rear of properties on Winter Avenue, along the north bank of Rennies River. The Rennies River Trail overlaps with the location of Berm 1. Berm 1 will be designed such that it is contained within the existing trail alignment, as much as possible. Berm 2 will be located in the south riverbank, beginning at Kings Bridge Road and extending approximately 60 m upstream.

Table 4.1 Berm Coordinates

Berm ID	Berm Type	Easting Coordinates NAD 1983 MTM 1	Northing Coordinates NAD 1983 MTM 1
1	Earth	371861	5270590
		371866	5270582
		371808	5270531
		371810	5270522
	Block Wall	371805	5270528
		371736	5270543
		371805	5270526
		371703	5270553
2	Earth	371887	5270609
		371892	5270606
		371865	5270553
		371860	5270556

LEGEND

- Erosion Control Improvements
- Earth Berm Flood Mitigation Structure
- Concrete Block Retaining Wall Flood Mitigation Structure
- Berm Footprint
- 0.2m-0.3m — Height (m)
- (#) Berm ID

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 4.3: Project Layout

CBCL

Notes:

Drawn: SF	Date: 2022-05-31
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Approved: LH	Scale @ 11"x17" : 1:1,500

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

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Two types of berms are proposed to preserve the natural waterline, accommodate available space, and optimize effectiveness and aesthetics. Earthen berms are most preferred to blend into existing conditions, while not compromising structural integrity. The dimensions of each individual berm will vary laterally and vertically due to differences in the natural topography of the riparian zone; a summary of the lengths and sizes are provided in Table 4.2. The modular block wall was selected for the west side of the Berm 1 due to space limitations and to reduce impact to the adjacent waterbody and encroachment on adjacent properties.

Table 4.2 Conceptual Berm Specifications

Berm ID	Structure / Berm Type	Proposed Materials	Approximate Length (m)	Approximate Height of Structure (m)
1	Block Wall	Concrete block	110 m	0.5 m – 2.2 m
	Earth	Granular Fill	90 m	0.1 m – 0.5 m
2	Earth	Granular Fill	60 m	0.2 m – 0.3 m

The berms are designed to reduce the potential for erosion and the release of materials that may harm fish and fish habitat. These designs will include an engineered slope, landscaping, and rock stabilization techniques. As required, additional stabilization techniques, such as armour stone, may be used along the berms adjacent to the watercourse.

Earth berms will generally be constructed of a typical sand and gravel mixture containing approximately 10 to 15% fines content, when the berm is greater than 15 m away from the watercourse. Where work adjacent to a watercourse is required (within 15 m) earth berms will be constructed with clean rockfill. The size of the material will be determined in future stages of design. The berms will be constructed with an approximately 2:1 side slope. However, depending on the final design, slopes may vary. Following construction of the berm, the side slopes of the earth berms will be covered using topsoil and a mix of hydroseed and/or sod.

The concrete block wall will be approximately 1.5 m wide, and heights of the structure will vary ranging from 0.5 m to 2.2 m. The concrete block wall structure will be placed within an excavated foundation along the existing trail. The design of the raised trail will accommodate safety/accessibility requirements of trail users. Following the construction of the block wall the berm will include the installation of handrails.

To support water drainage along the north side of Berm 1, a stormwater collection system will be designed to assist local drainage. The collection system will be oriented north of Berm 1, flowing parallel to the Rennies River, and discharging to the Rennies River through an outfall. The stormwater collection system will include catch basins and piping to the outfall to be located downstream of Kings Bridge Road. The outfall will be reinforced with

shoreline protection, such as armour stone or gabion wall. The outfall will be equipped with a backflow prevention device, which will prevent water from the Rennies River from entering the outfall and piping. During large storm events, as the water level rises above the stormwater outlet (downstream of Kings Bridge Road), the backflow prevention device valves close and prevents water from flowing from the Rennies River side into the stormwater collection system. Flow from the outfall will resumes when the river recedes below the stormwater outfall pipe. The location of catch basins and stormwater piping is to be determined in detailed design.

During the 2014 RRCSMP study, erosion areas were identified along the length of the river. The Project will include the stabilization of the riverbank in one of the locations identified in the RRCSMP. The erosion control improvements will complement the flood mitigation that is offered by the construction of berms. The site is located approximately 350 m upstream of Berm 2. The riverbank will be stabilized by means of armour stone. The armour stone will be approximately 45 m in length; the height of the armour stone structure will be determined during further design.

Table 4.3 Erosion Control Measures Coordinates are listed from West (End 1) to East (End 2)

Structure Type	Coordinates NAD 1983 MTM 1 (End 1)	Coordinates NAD 1983 MTM 1(End 2)
Armour stone	371507.67 m E 5270382.31 m N	371542.81 m E 5270408.62 m N

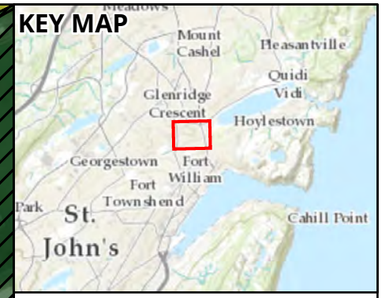
4.1.2 Ownership and Zoning

From Portugal Cove Road to Kings Bridge Road, land use zoning includes Open Space, Residential Special, and Residential Special 1 (Figure 4.4 , City of St. John's, 2022). Approximate locations of lot lines have been provided by the City for review and interpretation for the purpose of this assessment. The lots depicted on Figure 4.4 have not been legally surveyed. As part of detailed design, legal surveys may be required for design and construction. Agreements may be required with private landowners as part of future stages of the Project, if Project activities are to encroach on private properties.

Rennies River and Rennies River Trail from Portugal Cove Road to Kings Bridge Road are located in an unclassified zone. Berm 1 is located within the unclassified zone. West of Berm 1, the Feildian Grounds are classified as Open Space Reserved zone (OR) and municipally owned. North of Berm 1 the proposed project abuts residential properties designated as Residential Special (RA). There are eight residential properties within the RA zone that back onto the trail and would be directly behind Berm 1. The berm may be visible from the backyards of the eight residential properties. At the east end of the berm, the zoning transitions back to OR under ownership of the Municipality.

GLENRIDGE CRESCENT
NEW COVE ROAD
PORTUGAL COVE ROAD
JUDGE PLACE
WINTER AVENUE
WINTER PLACE
KINGS BRIDGE ROAD
EMPIRE AVENUE
CIRCULAR ROAD
1
2

KEY MAP



LEGEND

Land Use Zoning

- Apartment 2 Zone
- Cemetary Zone
- Commercial Neighbourhood Zone
- Commercial Regional Zone
- Institutional Zone
- Open Space Zone
- Residential 1 Zone
- Residential 2 Zone
- Residential Special Zone
- Residential Special 1 Zone

Property Ownership

- Municipal / Public Ownership
- Private Ownership

- Erosion Control Improvements
- Proposed Flood Mitigation Structure Footprint

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 4.4: Surrounding Land Use Zoning & Property Ownership

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NOTES:
- Property Boundaries depicted on this map are geographic representations only. They do not reflect Legally Surveyed Boundaries

Drawn: SF	**Date: 2022-05-31**
Checked: MR	**Project #: 213032**
Approved: LH	**Scale @ 11"x17" : 1:1,920**

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 10 20 40 60 80 m

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On the south side of the Rennies River, there is an unclassified zone adjacent to the river; south of this space the lands are zoned as Residential Special 1 (RA1, Figure 4.4). Berm 2 intersects this unclassified zone and a property zoned as Residential Special 1 Zone, used as Public Utility location operated by Newfoundland Power. The proposed erosion control measures (armour stone) overlaps with the unclassified zone and is located adjacent to the two properties zoned as Residential Special 1 (RA1).

According to the Envision St. John's Development Regulations (City of St. John's, 2022), a minimum buffer of 15 m is required from the 100-year high water mark; however, the City may permit development within the buffer for flood control infrastructure, protection of areas of geological instability, public works and infrastructure, as well as for residential accessory structures (i.e., decks, fences, and accessory buildings).

4.1.3 Existing Environment

The Rennies River watershed is one of the largest drainage basins in St. John's. It joins many tributaries including Ken Brook, Yellow Marsh Stream, Leary's Brook, Cartys Stream, Nagels Brook, and other unnamed streams (NAACAP, 2015). Rennies River is the most downstream river in the watershed, and joins Long Pond, a 4,000 m^2 waterbody, at its upstream end, to Quidi Vidi Lake downstream, and ultimately discharges to the Atlantic Ocean.

To support the EPR, additional information as been provided to describe the existing floodplain and groundwater conditions, outlined in the following sections.

4.1.3.1 Hydraulics of Rennies River

The 1:100 AEP CC floodplain for the existing condition of the river (i.e., without mitigative measures in place) was prepared during the RRCSMP and updated during the 2020/2021 (CBCL 2020/2021a) assessments to include recent developments, such as the flood control constructed along Leary's Brook at the Health Science Centre (Appendix B). The floodplain demonstrates predicted flooding impacts to adjacent lands considering anticipated climate change.

Hydraulic modelling of Rennies River was performed using the stormwater modelling software, XP Solution's Storm Water Management Model (XPSWMM). The hydraulic model was used to determine the floodplain, estimate water levels in the river channel, through structures (i.e., culverts and bridges) along the river reach, and in the overbanks. Inputs consisted of river channel invert elevations, channel and floodplain roughness coefficients, Light Detection and Ranging (LiDAR) information, hydraulic structure dimensions, and inflow hydrographs. The model structure is a one-dimension (1D) network representing the hydraulic structures (and the channel for the 2020/2021a assessment) nested within a two-dimension (2D) domain (grid) representing the floodplain. Hurricane Igor (September 2010) was used as the calibration event for the hydraulic model.

The model shows that, without the flood mitigation measures in place, the Project area is susceptible to localized flooding during 1:100 AEP CC events (as illustrated in Figure 4.5). Downstream of Carpasian Road to upstream of Portugal Cove Road bridge, the floodplain is mainly contained to the river channel and riparian areas of the river and trail. Upstream of Portugal Cove Road bridge, flooding occurs over the residential properties at Pringle Place and over several roads including Pringle Place, Portugal Cove Road, and Rennies Mill Road. Downstream of Portugal Cove Road, flooding is anticipated over Feildian Grounds and the Riverdale Tennis Club properties, yards of residential properties along the south side of Winter Place, and Winter Avenue towards Kings Bridge Road. Additionally, the flood boundary extends into the yards of the residential properties along Empire Avenue and the electrical substation located at Kings Bridge Road. The floodplain also extends to portions of Winter Avenue, Judge Place, Kings Bridge Road, the Boulevard and onto the King George V soccer field and park.

KEY MAP

LEGEND

1:100 AEP Climate Change Boundaries (Existing Conditions)

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 4.5: 1:100 AEP Climate Change Boundaries

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Notes:

Drawn: SF	Date: 2022-05-31
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Approved: LH	Scale @ 11"x17" : 1:3,000

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 15 30 60 90 120 m

Path: Y:\St. John's\Data\Jobs\2021\213032.00 CSJ Rennies River, Phase 2 EPR\44 CAD\07 ENVIRO\PRO\213032_RenniesRiverP2_EPR.aprx

4.1.3.2 Groundwater

Provincial government mapping indicates that there are no potable groundwater wells in the Project area (Government of Newfoundland and Labrador, 2022). The Project area is serviced by municipal water and sewer.

A conceptual model of shallow groundwater flow systems was developed to interpret how the Project could interact with groundwater. Rennies River is likely to act as a local groundwater discharge zone, receiving groundwater baseflow that maintains flow in the river. Figure 4.6 shows the location of conceptual cross-section C-C', which traverses Rennie's River from south to north, near Kings Bridge Road.

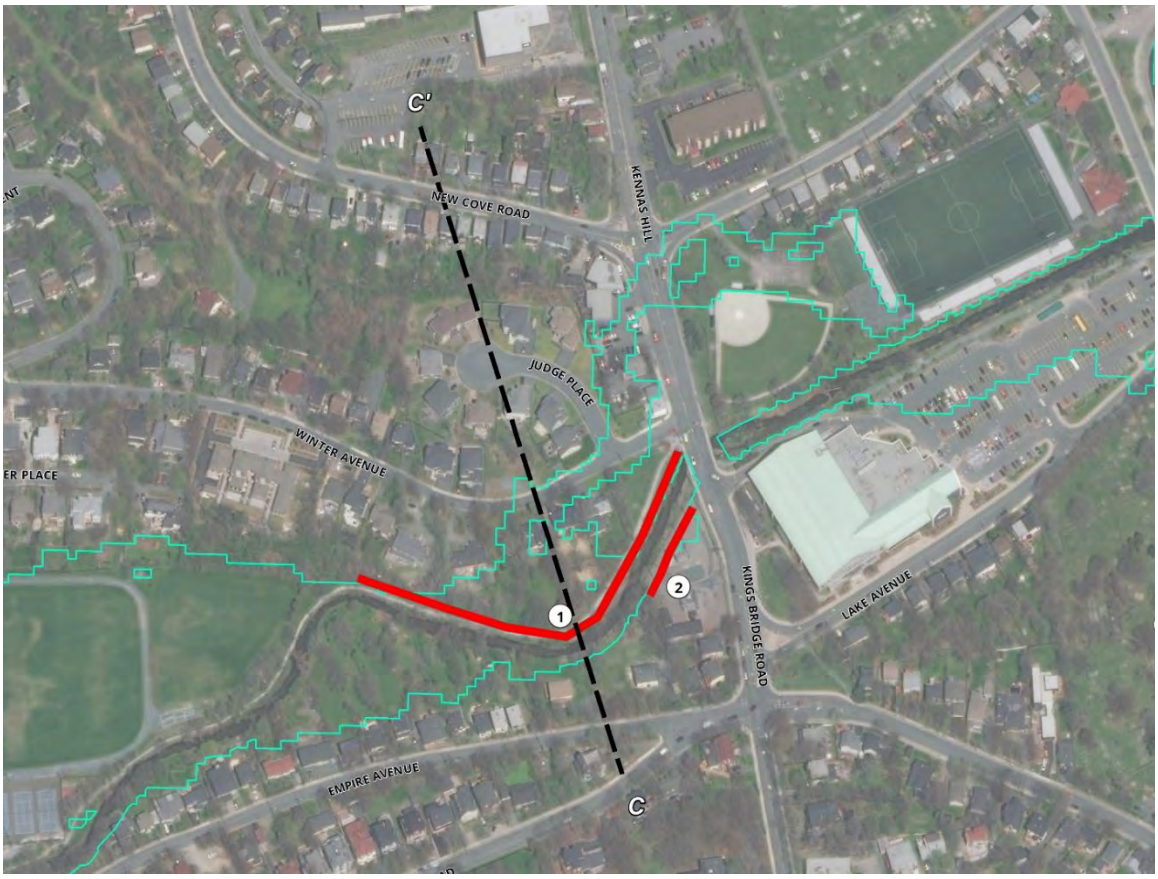


Figure 4.6 Location of Conceptual Cross-Section through Rennies River

Figures 4.7 and 4.8 show a conceptual profile of Rennies River: Figure 4.7 without flooding and Figure 4.8 with temporary flooding. Shallow groundwater in the Project area is assumed to flow through low permeability till or alluvium associated with the river valley (the lighter coloured unit). The underlying bedrock is marine siltstone and sandstone of the Fermeuse Formation, which is typically associated with low to moderate permeabilities (darker coloured unit).

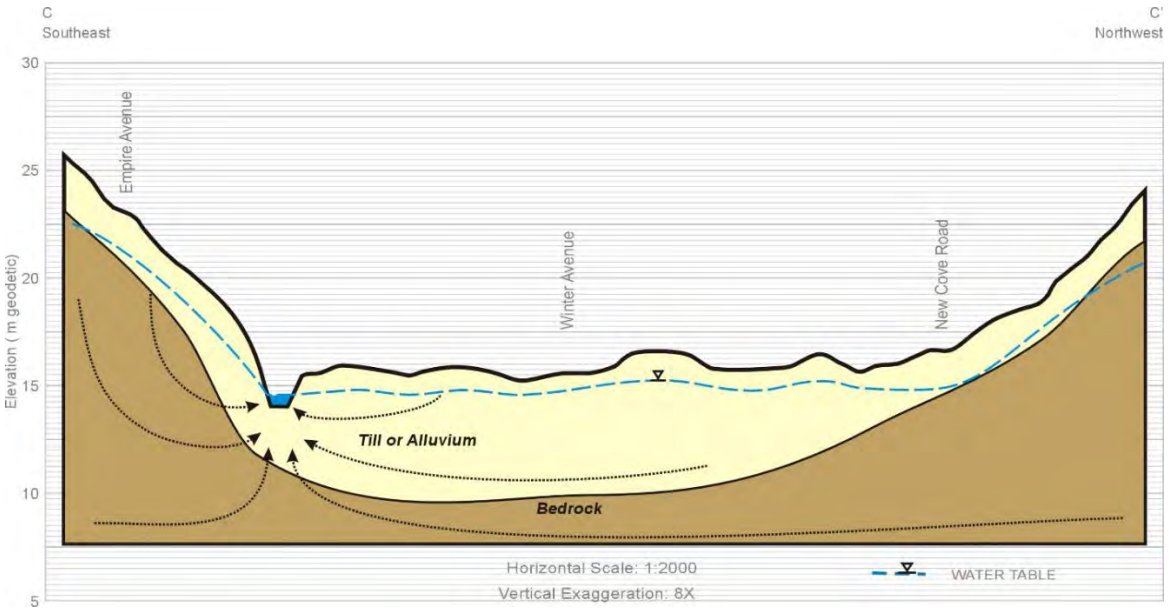


Figure 4.7 Conceptual sketch of shallow flow systems that discharge to Rennies River: Existing Conditions, No Flooding

The flow arrows on Figure 4.7 show typical pathways of groundwater flow. With average rates of precipitation, groundwater would typically infiltrate in upland areas and discharge to the banks of the river or to the lower-lying floodplain shown in the centre of Figure 4.7. Deeper groundwater flow paths may contribute to the river, which may originate further away in regional topographic high areas (Figure 4.7).

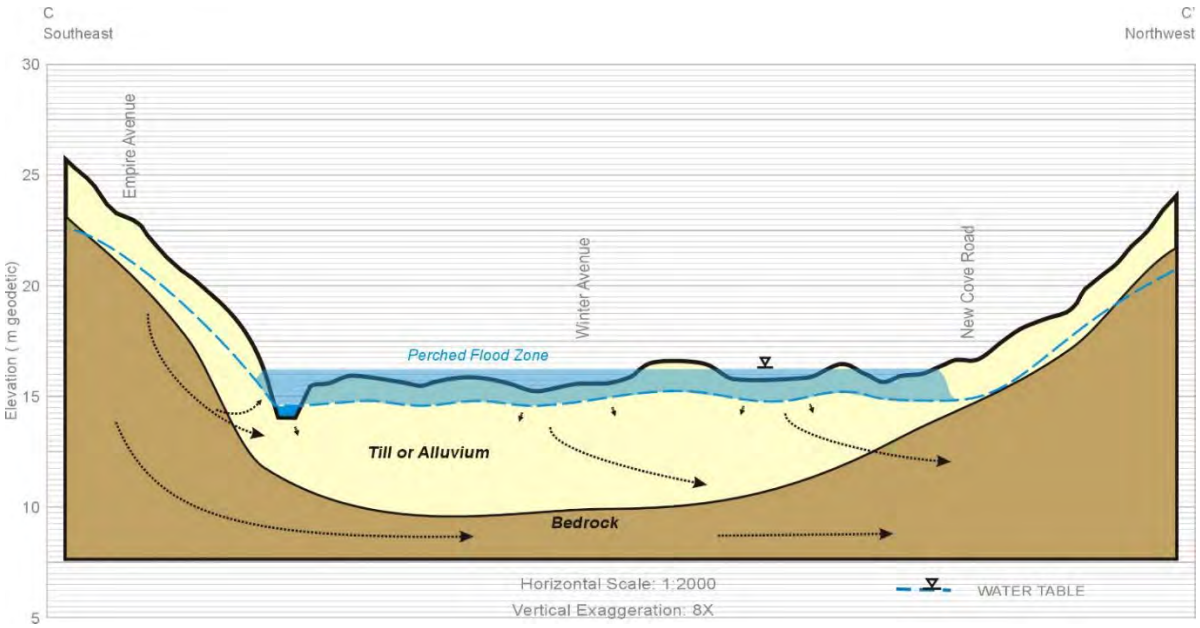


Figure 4.8 Conceptual sketch of shallow flow systems that discharge to Rennies River: Temporary Flooding

Rapid precipitation and flooding will tend to form ponded areas perched above the regional water table, forming a focused recharge zone (Figure 4.8). The elevation of ponded

water shown on Figure 4.8 is based roughly on hydrodynamic model scenarios used to develop the design of the proposed berms. Some ponded flood water will infiltrate through the unsaturated zone, and higher water levels on the floodplain will affect shallow groundwater flow paths. Deeper systems may be redirected, discharging to a more regional water body. Depending on the duration of event and associated flooding, the position of the water table will be relatively unchanged over the time frame of a typical flooding event due to the low permeability of the soil and rock, and the rapid saturation of surface soils. Baseflow to the river could be temporarily reduced or diverted by flooding.

4.2 Construction

The construction of the Project will require detailed design, and communication with landowners. The flood mitigation infrastructure will be designed in accordance with applicable engineering standards and will be constructed by a qualified contractor. The preliminary design activities such as land surveys, topographic surveys, and geotechnical assessments are scheduled to take place in 2022 and detailed design will continue through the spring/summer of 2022. The construction process of this project is described in the following sections:

- Project phasing and Project schedule
- Construction methodology
- Potential sources of pollutants during the construction
- Potential causes of resource conflicts during the construction phases

4.2.1 Project Phasing and Schedule

The Project will include two construction phases:

- Site preparation
- Infrastructure construction

Upon receipt of required approvals and authorizations, the construction is expected to occur over a six-month period including site preparation and construction. The construction of the berms is likely to take place over a three-month period including mobilization to demobilization.

Site preparation will include clearing of vegetation and grubbing of organic materials to prepare a base for construction. If possible, vegetation clearing would occur outside the general nesting period for breeding birds (mid-April to mid-August, ECCC, 2018).

Following site preparation, the berms will be constructed. The staging of construction will be dependant on the contractor; however, the flood retention berms will be in place prior to periods of typical flooding events. In-water works will occur during the summer low flow period (June 1 to September 30) to avoid sensitive life stages of aquatic life (from October 1 to May 31). If all in-water works cannot be completed during the period of the June 1 to

September 30, the project could be completed in phases and some phases rescheduled to the following year.

Construction will occur only between the hours of 07:00 and 18:00 from Monday to Friday, and from 08:00 to 17:00 on Saturdays, Sundays, and statutory holidays (if required). This aligns with the requirements of the St. John's Noise By-law, which states that construction equipment must cease between 11:00pm and 7:00am (City of St. John's. 1998). Approval will be required from the City to work outside of regular hours/days for construction of the Project. Request for approval must be issued to the City at least 72 hours in advance if work is scheduled outside of the above noted times and must follow the City by-laws.

4.2.2 Construction Activities

The Project includes construction of the berms and the stabilization of the riverbank. Equipment to be used during construction may include heavy equipment such as excavators, bulldozers, and equipment to compact the soils, as well as hand tools, such as chainsaws (as required). An Environmental Protection Plan (EPP), including erosion and sediment control plan, will be implemented during construction. The selected contractor will determine the final types and number of equipment to be used. Anticipated activities associated with construction include the following:

Berm Construction

Site Preparation

- Vegetation clearing
- Grubbing
- Environmental protection, and sediment and erosion control measures, as required

Earth Berm Construction

- Excavation for foundation of the berm, as required
- Placement of new materials (rock fill, granular material, and armour stone)
- Grading and shaping of berm
- Stabilization of berm slopes
- Placement of topsoil
- Revegetation of the constructed berm
- Environmental protection, and sediment and erosion control measures

Segmental Concrete Block Wall Construction

- Excavation for the wall foundation
- Compaction of fill material for wall
- Installation of modular block wall
- Placement of new materials (i.e., rock fill, granular material, armour stone and geotextile liner)
- Placement of new handrails
- Environmental protection, and sediment and erosion control measures

Stormwater Collection infrastructure (dependant on final design):

- Excavation for new catch basins and piping system on the north side of the Berm 1
- Installation of catch basins on the north side of the Berm 1
- Installation of outfall downstream of Kings Bridge Road, including backflow prevention device, and shoreline protection, such as armour stone or gabion wall
- Backfilling and grading for new stormwater systems.
- Re-establishment of roadbed
- Paving of road

Bank Stabilization and Erosion Protection

Site Preparation

- Vegetation clearing
- Installation of temporary environmental protection, and sediment and erosion control measures, as required

Bank Stabilization Construction

- Placement of new materials (armour stone and additional granular material), as required to stabilize the bank

The construction activities are anticipated to be located within the unclassified area adjacent to the Rennies River and on private properties with owners' consent, as identified on Figure 4.5. For any proposed work that is not on municipal land, access agreements may be required from the property owners. Additionally, further discussion with adjacent landowners may be required as design progresses, in areas where construction activities could encroach toward adjacent properties, such as design of the stormwater collection system.

Access to the work sites will vary depending on the location of the structure. Berm 1 will be accessed from the trail entrances either from Feildian Grounds or Kings Bridge Road. Berm 2 will be accessed from Kings Bridge Road or via the adjacent property with owner's consent. The proposed bank stabilization maybe be accessed from the opposite bank of the river or via the adjacent property with owner's consent. For example, similar bank stabilization exercises had been completed in this this area previously. In this instance, the area was accessed via an excavator with a long boom, which was operated from the parking lot at the tennis club.

The laydown areas have not been confirmed. However, it is anticipated that nearby City properties could be used for laydown areas or site trailers (Figure 4.9).

Figure 4.9 Potential Staging Area Examples

4.2.3 Potential Sources of Pollutants

Potential sources of pollutants can be generated by construction activities and use of construction equipment, including dust, noise and air emissions, and accidental spills and releases. Potential impacts from sources of pollutants include those as identified in Table 4.4. Construction methods and mitigation measures will be implemented to reduce the potential effects from the release of pollutants. Mitigation measures to address potential impacts of pollutants are described in Section 6.4.

Table 4.4 Potential Source of Pollutants and Associated Activities from Construction

Potential Source of Pollutants	Project Activities
Silt and sediment runoff	Soil erosion could be caused by construction and use of equipment. Runoff from exposed unconsolidated soils following precipitation could result in surface water runoff to be contaminated with silt and sediment and may flow toward adjacent watercourses.
Refuse	Generation of construction debris.
Dust	Use of heavy equipment during construction over disturbed ground and soils. Release of airborne dust within area of exposed soils or stockpiles.

Potential Source of Pollutants	Project Activities
Airborne emissions	Emissions of particulate matter, carbon monoxide (CO), or nitrous oxide (NO_X) from use of heavy equipment during construction.
Noise pollution	Noise emissions from use of heavy equipment during construction activities.
Accidental release or spill	Risk of release of fuel, lubricant, and hydraulic fluid from equipment during construction activities.

4.2.4 Potential Causes of Resource Conflict During Construction

As the Project is located in St. John's and adjacent to the Rennies River, construction of the Project could conflict with existing uses of resources within the Project area, such as environmental features, residential areas, and recreational trails. The following section identify the potential causes of resource conflict during construction and associated potential effects. To mitigate the effects, mitigation measures and best management procedures are identified in Section 6.4. Resources or resource uses that the Project could conflict with include the following:

- Land / soil
- Groundwater
- Surface water
- Fish and fish habitat
- Wildlife
- Vegetation
- Air quality
- Land use
- Human uses

4.2.4.1 Land or Soil

During site preparation and construction activities, such as vegetation clearing, excavation activities or removal of existing soil materials, there is a potential to affect adjacent lands and soils, such as through soil erosion, soil compaction, and soil contamination. These effects may result from construction activities within the Project area and surrounding lands, and accidental release of fuels and other contaminants from equipment.

The Project will require earth works and changing of grades and slopes within the Project area. Change of the slopes could result in erosion soil if slopes are not stabilized and maintained. The berms will be constructed with an approximately 2:1 side slope, to minimize erosion of the berm banks. The final designs of the berms could be installed with additional stabilization techniques, such as armour stone mitigating the potential for erosion along the watercourse. Construction equipment will not be permitted to operate outside the construction zone to prevent damaging adjacent areas. Following construction, disturbed areas will be restored and stabilized.

The use of heavy equipment and berm construction could also result in soil compaction within the Project area. Soil compaction will likely be necessary for berm foundation, which will be contained within direct work areas. Construction equipment will not be permitted to operate outside the construction zone to prevent compaction of soils outside of the work area.

Where possible, surface soil will be reused. Material that cannot be reused on site will be disposed of offsite following applicable regulations and guidelines. In the event an accidental spill occurs to land, spills will be cleaned up and reported to NLECC. Standard safety and environmental practices will be enforced to reduce and prevent potential conflicts caused by construction equipment and the activities, such as those identified in Section 6.4.

4.2.4.2 Groundwater

During construction, there is a potential that activities may intersect with groundwater within the work areas. These effects are expected to be short-term, and include excavation activities or removal of existing soil materials within the berm footprints. Whenever possible, construction, particularly work in wet areas, will be completed during dry or low-flow periods. Dewatering plans and associated measures will be implemented to control the inflow of groundwater into the excavations. Discharge of water from the site will be conducted in accordance with applicable environmental guidelines.

An additional potential for resource conflict includes the handling of soils affected by accidental spills and releases. The improper disposal and treatment of potentially contaminated soils during construction could also lead to contaminated groundwater.

Description of interactions of the Project during the operations of the berms are further described in Sections 4.3.2.2 and 6.3.

4.2.4.3 Surface Water and Surface Water Management

The construction of berms and bank stabilization occur within 30 m of the Rennies River. The following potential effects may occur because of construction:

- Dewatering and release of water from the dewatered area.
- Modification of surface water drainage in the location of the flood mitigation structures.

Excavation will be confined to the berm footprint areas, and areas of modification will be minimized as much as possible outside of this area including adjacent to the watercourse. During excavations, there are a potential for surface water to collect within the berm footprints. Dewatering plans and associated measures will be implemented to control the inflow of surface water into the excavations. Discharge of water from the site will be conducted in accordance with applicable environmental guidelines.

There is also the potential that construction of the flood mitigation infrastructure will result in localized changes to surface water drainage, particularly in areas behind the proposed structures. Areas where drainage may be altered will be assessed during detailed design and a stormwater collection system will be installed on the north side of Berm 1. The berm design will consider alternatives to minimize stormwater build up behind the berms.

Overall, the selection of the Project minimized the amount of work required adjacent to the Rennies River. Alterations of the watercourse as part of construction will be restored. Earthen berms will be covered with sod and/or hydroseed and/or native vegetation to enhance stabilization. Prior to construction, NLECC and Fisheries and Oceans Canada (DFO) will be consulted, and applicable regulatory permits and authorizations will be obtained.

The construction of the Project is proposed to be short in duration (i.e., months). In-water works will occur during the summer low flow period (May 1 to September 30) to reduce effects and to avoid sensitive life stages of aquatic life (from October 1 to May 31).

4.2.4.4 Fish and Fish Habitat

Due to the proximity of the Project to Rennies River, the following potential effects may occur as a result of construction:

- Bank erosion and sediment loading
- Release of deleterious substances associated with accidental spills/leaks, improper disposal of waste materials, or the use of chemical-based dust suppressants

As described in Sections 4.2.4.1 and 4.2.4.3, the Project will be designed, and construction activities executed, to minimize impacts to Rennies River, thereby minimizing the effects on fish or fish habitat areas. Prior to construction in the river, NLECC and DFO will be consulted, and applicable regulatory permits and authorizations will be obtained. Existing watercourses will not be disturbed other than the areas indicated, and only clean rock fill materials will be used directly adjacent to the watercourse.

The construction of the Project is proposed to be short in duration (i.e., months). In-water works will occur during the summer low flow period (May 1 to September 30) to reduced effects and to avoid sensitive life stages of aquatic life (from October 1 to May 31). Alterations of the watercourse as part of construction will be restored.

Construction of the Project could also result in the release of deleterious substances associated with soil, sediment, accidental spills/leaks, improper disposal of waste materials, or the use of chemical-based dust suppressants. During construction, erosion and sediment control techniques, and spill prevention and spill response measures will be used to mitigate the release of deleterious substances (Section 6.4). The berm design and stabilization approaches will also be used to mitigate these releases post construction (i.e., berm slopes, and vegetation stabilization).

4.2.4.5 Vegetation

The Project area is located within a trail alignment and the riparian zone in which several native and non-native plant species exist. Clearing and grubbing, as part of site preparation, will result in the direct loss or alteration of vegetation, mature trees or mature tree branches within the berm footprints and for access of equipment. The berms have been designed to overlap with the existing location of the trail; however, footprints outside of the trail will be required for the earth berm slopes or bank stabilization. Where necessary, concrete block walls may be used to minimize the area of alteration outside of the trail alignment.

Another source of potential resource conflict is the introduction of invasive species. The use of heavy machinery during construction may inadvertently introduce, or spread, invasive or exotic species to the existing environment. Construction equipment will be cleaned prior to mobilization to site to minimize transfer of species from external areas to the Project area.

Following construction, berms will be covered with topsoil, hydroseed and/or sod as well as revegetated with native vegetation wherever possible. Non-native species that are non-invasive may be planted in specific instances to enhance reinforcement or structural durability that would otherwise not be provided by native species. Additionally, if native species cannot be sourced, non-native, non-invasive species may be planted as a replacement. A mixture of hydroseed may be applied in areas that are the closest to the river, and sod may be used where there is reasonable distance between the berm and the watercourse.

4.2.4.6 Wildlife

Potential effects to wildlife are expected during the construction period. Effects include:

- Habitat loss or alteration
- Deposition of harmful substances into areas utilized by wildlife
- Disturbance as a result of
    - Noise associated with machinery
    - Human presence as a deterrent
    - Construction lighting
- Improper disposal of refuse

Loss or alteration of habitat may affect wildlife that use the riparian area for cover, foraging, breeding, and nesting. Clearing activities are proposed to occur prior to sensitive timing windows such as the nesting period.

As described in Section 4.2.4.4, the deposition of harmful substances into waterbodies or areas utilized by wildlife could potentially occur due to accidental spills or leaks. Mitigation measures as identified in Section 6.4 will be used to mitigate the likelihood of accidental spills.

Operation of machinery, equipment, human presence, and noise may result in temporary avoidance behaviours by animals in the vicinity of the berm construction areas. Clearing activities are proposed to occur prior to sensitive timing windows such as the nesting period. Construction lighting also has the potential to disturb wildlife, increasing the likelihood of affecting wildlife behaviour and potential for subsequent wildlife injury. Any lighting for construction will follow Best management practices (BMPs) to reduce the potential effects to wildlife.

Domestic refuse from construction crews may act as an attractant for wildlife. BMPs will be implemented for the handling of domestic refuse generated during construction. Implementation of BMPs will reduce potential for wildlife to opportunistically forage on these materials.

4.2.4.7 Air Quality

During construction, the use of heavy equipment, and associated noise and dust emissions from Project activities, could result in disturbance to wildlife and adjacent properties. Mitigation measures as identified in Section 6.4 will be implemented to prevent the potential release of dust and particulate matter into the air. Equipment and construction activities on site will occur during approved working hours in conjunction with other mitigations, such as maintaining equipment in good working order and implementing a no idling policy will further reduce the potential for conflict. Mitigation measures will be in place as identified in Section 6.4, and following construction the potential effect will subside.

4.2.4.8 Land Use

The intent of the Project is to provide positive benefits of flood mitigation; however, there could be potential resource conflicts within the location of the proposed berms and stormwater features if encroachment occurs on private properties. The Project is located within a residential community. The Project activities are primarily to take place on municipal land in the location of the Rennies River trail and riparian area to the Rennies River. Depending on the final design, the structure could also occur on private properties, where owners' consent has been obtained. The berms will be designed in accordance with applicable engineering standards to mitigate for a 1:100 AEP CC event and will be constructed by a qualified contractor. The berms will be constructed with an approximately 2:1 side slope. However, depending on the final design, slopes may vary and could be installed with additional stabilization techniques. The widths required for the berms will vary based on the required heights of the berms.

The proposed Project activities for berm construction and stormwater system could interact with properties on Kings Bridge Road and Winter Avenue. The bank stabilization could interact with two properties on Empire Avenue. The City will require owners' consent and access agreements for works that occur outside of municipally-owned land. The City

will communicate with the adjacent landowners, as required, during the design and installation of the structure and will work with adjacent landowners to minimize potential resource conflicts. Measures could include fencing, alternative access, procuring portions of land for the construction of the structures, or establishments of agreements for easements, if required.

4.2.4.9 Human Uses

The intent of the Project is to provide positive benefits through flood protection, while maintaining the trail; however, construction will overlap with the Rennies Rivers Trail, which is used for recreation, and access to the Rennies River. As well, construction activities will result in the temporary disruption of traffic. Mitigation measures and BMPs will be established and monitored to minimize potential resource conflicts (Section 6.4). The following subsections outline potential causes of resource conflict for human use activities, including the following:

- Recreation
- Fishing
- Traffic

Recreation

Due to limited space between the riverbanks and the trail, the trail will be raised in some places to accommodate the berms underneath. Impacts to human activities will involve temporary blockage of the Rennies Rivers Trail, as in many places the berms will border or be built into the trail. The trail will not be accessible during construction, and access limitations is a health and safety requirement in the public interest. Temporary exclusion fences will be installed to isolate the construction area and to restrict the entry of unauthorized persons in the Project areas. The potential resource conflict will be in place for the duration of construction and following construction regular use will resume.

Fishing

Fishing has been noted to occur in Long Pond, Quidi Vidi Lake, and some spots along the Rennies River (such as approximately 120 m upstream of Kings Bridge Road). The Salmonid Association of Eastern Newfoundland (SAEN) confirmed that fishing was primarily for brown trout and that fish may be consumed; however, the quantity of fish caught and consumed is not known (R. Bishop, *pers comm.* 2021). Access within the work area will be limited during construction periods.

The project as proposed has been designed to minimize work adjacent to the Rennies River. Mitigation measures have been identified to avoid or reduce the potential effects to fish and fish habitat, which will also mitigate potential effects on fishing. Other mitigations such as restricting fueling and maintenance of equipment within 30 m of a waterbody will also be used to reduce potential effects from accidents or malfunctions.

Traffic

Impacts to human activities during construction may include temporary restriction of traffic along Kings Bridge Road during mobilization and demobilization of equipment, and construction. Traffic controls will be implemented following the City's requirements; however, effects are expected to be infrequent and short in duration.

4.3 Operation and Maintenance

Following construction, the berms, stormwater system, and bank stabilization infrastructure will remain in place for the foreseeable future. The following sections include key considerations during the Operations and Maintenance phase including:

- Operation and maintenance activities for the flood mitigation berms, stormwater system, and bank stabilization measures
- Approaches to avoid interference with the rights of other legitimate landowners/users
- Mitigation of potential effects of water-logging inside the earthen berm structure
- Measures implemented to address localized surface water draining to Rennies River through the berm

4.3.1 Operations and Maintenance Activities

The berms will require periodic maintenance activities following construction, including:

- Annual inspection of berm conditions (planting and structural)
- Berm repairs including regrading and planting
- Geotechnical inspection every five years
- Annual inspection of stormwater piping and outfall
- Cleaning, repair, and replacement of stormwater piping, following the findings of the inspection

The berms are to remain in-situ indefinitely or until they require decommissioning or rehabilitation. When the need to decommission or rehabilitate one or both berms arise, the berms will be revised or incorporated into additional flood water control structures along the river, removed and replanted with vegetation, or left in place and integrated into plans for more extensive water management of Rennies River watershed.

4.3.2 Potential Causes of Resource Conflict During Operations and Mitigations

4.3.2.1 Water Management – Interference with the Rights of Owners/Users

The berms are designed to accommodate a 1:100 AEP CC flow event and minimize overall flood risk. However, use of the berms as part of the flood mitigation network could result in a potential resource conflict or interference with the rights of owners/users. These conflicts could include changes to the floodplain which could affect adjacent properties and erosion. This section includes approaches the Project used to avoid interference with the rights of other legitimate landowners/users. Further assessment of the effects to the floodplain (including mapping) resulting from the long-term operations of the flood protection infrastructure is found in Section 6.1.1.

Flood protection measures have been evaluated within the Rennies River Watershed, and there is not a simple, direct solution to minimize the effects from flooding within the watershed without interacting with rights of owners and users of the area. If no action is taken to resolve effects from flooding, areas will continue to be affected from the flooding events and climate change. Under existing conditions, flooding events could damage road infrastructure, power utilities, and personal property; result in a short-term disruption of roads and power; and could result in restriction of access to areas during these events, including emergency response access.

The intent is to continue with the development the first priority items as identified in the RRCSMP; however, the construction of the flow control structure downstream of Long Pond alone does not eliminate flooding downstream (CBCL, 2021b, Appendix B). By restricting the flow released from Long Pond, the peak volume is decreased during an event resulting in a reduction of water levels and overall floodplain downstream. The proposed berms would still be necessary to reduce flooding effects to some properties on the north side including Winter Avenue, roadway infrastructure Kings Bridge Road, and Judge Place; as well as a property on the south side of the river at Kings Bridge Road, which houses power infrastructure.

A series of projects have been assessed to help mitigate the extent of flooding from a storm event within the Portugal Cove Road to Kings Bridge Road area, and alternatives assessed are further described in Chapter 5.0. The two-berm alternative combination (Berm 1 and 2) uses the existing topography, such as shown on Figure 4.8, to contain water within the existing floodplain to the south / southeast. This option minimizes the amount of road infrastructure, power utilities, and buildings on private properties that will be flooded while reducing the need for multiple berms and reducing associated conflict with landowners and land users. In turn, this also minimizes the extent of required alteration

along to Rennies River and disruption of existing facilities while still reducing the effects of flooding.

The berm designs include the use of concrete block walls, and earth berms to reduce the required space for the berm or to blend into the surrounding conditions. The concrete block walls are to be used to avoid interaction with adjacent properties and reduce encroachment to the river.

To minimize the potential for conflict for the berms themselves, once constructed, a care and maintenance program will be implemented to assess berm conditions annually, at a minimum. Following the yearly assessment, the berms will be rehabilitated, as required, to maintain the berms' aesthetics and function. Items will be repaired and cleaned as required to maintain the function of the infrastructure.

4.3.2.2 Water Management – Waterlogging within Berm

The flood protection berms are proposed to temporarily contain water within the floodplain during storm events such as a 1:100 AEP CC event. The water level is projected to increase up to 0.4 m during the 1:100 AEP CC event. The water will only remain in the area for a short period of time before receding to pre-storm conditions. If water was to enter the berms and not able to drain, waterlogging within the berm could result in instability of the berm, berm surfaces, or berm cover.

When the berms are in place during normal flow conditions or small storm events, the berms are not anticipated to be inundated with water. During a major storm event such as a 1:100 AEP CC event, the water level rises within the floodplain. As the water level increases, the water gradually rises along the face/ slope of the berm, containing the water temporarily within the floodplain. As the storm event subsides and water flows from the area, the water level will recede exposing the berm faces.

The berm will be constructed using industry standard practices for construction to reduce the potential effect of waterlogging. Some of these practices include installation of geotextile liners within the block walls, and grading and shaping of earth berms. The berms will be constructed with an approximately 2:1 side slope to support slope stability. Earth berms will generally be constructed of a typical sand and gravel mixture containing approximately 10 to 15% fines content, when the berm is greater than 15 m away from the watercourse. Where work adjacent to a watercourse is required (within 15 m) earth berms will be constructed with clean rockfill. The size of the material will be determined in future stages of design considering flood protection and drainage from the structure. To mitigate the potential for waterlogging, from the collection of surface water on the north side of Berm 1, a drainage system will be installed to assist with drainage of surface water which could potentially affect the stability of the berms.

As there is no long-term retention of water along the berms anticipated, and the berms will only be in use temporarily during storm events, waterlogging is not anticipated within the

berms. The addition of a drainage system on the north side is further described in the Section 4.3.2.3.

4.3.2.3 Water Management – Within Localized Area

Within the Project Area, a stormwater collection system will be designed to assist local drainage of surface water to Rennies River. The stormwater collection system will help improve drainage where flow may be altered or inhibited by the berm structure and where existing drainage issues could occur, such as existing properties set at a lower elevation then the existing trail. The system, including piping and catch basins, will be installed along the north side of Berm 1. The installed system will collect water along to the north side of the Rennies River discharging stormwater downstream of Kings Bridge Road.

The location of catch basins and stormwater piping is to be determined in detailed design. During the design phase, additional grading could be considered on the north side of the berms to improve drainage, if landowners are interested.

5 Alternatives

The City has undertaken various assessments of flood mitigation options within the Rennies River watershed. Structural methods of managing flooding, including upgrading existing infrastructure and construction of new flood mitigation measures, were assessed as alternatives to the Project. The potential alternatives were investigated within the Elizabeth Avenue to Kings Bridge Road portion of the Rennies River watershed. The options derived from hydrologic and hydraulic models included (Figure 5.1):

- Berms or levees
- Diversion
- Raising of vulnerable infrastructure

An alternative was considered as a suitable solution if it met the following criteria:

- Reduced the overall floodplain downstream of Elizabeth Avenue
- Reduced potential damage to the natural environment and minimized work within Rennies River
- Low capital cost and maintenance requirements

5.1 Alternatives

The alternatives assessment identified the following potential flood protection measures (Figure 5.1):

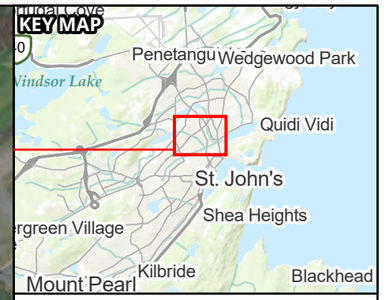
- 0 -Null
- 1 -Earth berms and concrete walls along portion of the Rennies River
- 2 -Channel realignment through Feildian Grounds
- 3 -Raising of vulnerable structures

5.1.1 Null

If no improvements are made to mitigate the risk of flooding, the area is predicted to be susceptible to localized flooding during 1:100 AEP CC events (Figure 4.5). Modelled flooding scenarios were evaluated for the 1:100 AEP CC event (Appendix B), including conditions with and without a flow control structure at the outlet of Long Pond (Table 5.1).

INSET MAP

KEY MAP



LEGEND

Alternative 1 - 8 Berms Along Watercourse

- Berm Location
- (#) Berm ID

Alternative 2 - Channel Realignment With Berms

- Berm Location
- Channel Realignment

Alternative 3 - Raising of Vulnerable Structure Within the 1:100 Year Floodplain Boundary

- 1:100 AEP Climate Change Boundaries (Existing Conditions)

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 5.1: Alternatives

CBCL

Notes:

Drawn: SF	Date: 2022-05-31
Checked: MR	Project #: 213032
Approved: LH	Scale @ 11"x17" : 1:6,250

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 35 70 140 210 280 m

Path: Y:\St. John's\Data\Jobs\2021\213032.00 CSJ Rennies River, Phase 2 EPR\44 CAD\07 ENVIRO\PRO\213032_RenniesRiverP2_EPR.aprx

Table 5.1 Summary of Flooding Scenarios Modelled for the Null Alternative (Status Quo, 1:100 AEP CC Event)

Alternative Berm Configuration	Scenario within CBCL, 2020 or 2021a	Health Science Center Berms Included	Long Pond Flow Control Structure Included	Results
None	Scenario 1 Appendix B - CBCL, 2020 - Figure 5	✓		Floodplain extent is the largest of the scenarios. Floodplain is as described in Section 4.1.3.1.
	Scenario 5 Appendix B - CBCL, 2020 - Figure 9	✓	✓	Flow control structure does not reduce flow enough to prevent downstream flooding. Flooding will still occur upstream of Portugal Cove Road toward Pringle Place, onto Feildian Grounds and Riverdale Tennis Club property, and toward east end of Winter Avenue.

The assessment determined that the construction of a flow control structure downstream of Long Pond alone does not eliminate flooding. However, by restricting the flow released from Long Pond, it results in reduction of the peak volume during an event.

If no action is taken to resolve this issue, areas will continue to be affected from the flooding events resulting in potential damage to road infrastructure, power utilities and personal property. It would also result in a short-term disruption of roads and could result in restriction of access to areas during these events, including emergency response.

5.1.2 Alternative 1 – Flood Mitigation Berms

As part of Alternative 1, eight berms between Elizabeth Avenue and Quidi Vidi Lake were considered (Figure 5.1). As identified in the RRCSMP, the berms included earth berms, segmental concrete block wall, and cast-in-place concrete wall structures of various lengths (Table 5.3). The height of the berms was variable depending on the combination of berms evaluated.

Table 5.2 Alternative 1 – Conceptual Berm Specifications

Berm ID	General Location	Structure / Berm Type	Conceptual Materials	Approximate Concept Length (m)
1	Upstream of Kings Bridge Road, north side of river	Earth and Segmental concrete block wall	Granular Fill	260
2	Upstream of Kings Bridge Road, south side of river	Earth	Granular Fill	60
3	Downstream of Portugal Cove Road, south side of river	Earth	Granular Fill	240
4	Downstream of Portugal Cove Road, north side of river	Earth Berm and Segmental Concrete block Wall	Segmented Concrete blocks Granular Fill Geotextile Liner	320
5	Upstream of Portugal Cove Road, south side of river	Cast-in-place Concrete Wall	Concrete Granular Fill Geotextile Liner	135
6	Upstream of Portugal Cove Road, north side of river	Segmental Concrete block Wall	Segmented Concrete blocks Granular Fill Geotextile Liner	240
7	Upstream of Carpasian Road, north side of river	Earth	Granular Fill	170
8	West side of Prince Phillip Drive, north side of river	Earth	Granular Fill	40

Four combinations of berms were assessed, including conditions with and without a flow control structure at the outlet of Long Pond. In total, seven modelled flooding scenarios were evaluated for the 1:100 AEP CC event (Appendix B). Combinations evaluated downstream of Long Pond included the following, and a summary of the flooding extent results is provided in Table 5.3.

- **Eight Berms:** Berms 1-2 upstream of Kings Bridge Road, Berms 3-4 downstream of Portugal Cove Road, Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive.
- **Four Berms:** Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive.

- **Six Berms**: Berms 1-2 upstream of Kings Bridge Road, Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive
- **Two Berms:** Berms 1-2 (Project as proposed in the EPR).

Table 5.3 Summary of Flooding Scenarios Modelled for Alternative 1 (1:100 AEP CC Event)

Alternative Berm Configuration	Scenario within CBCL, 2020 or 2021a	Health Science Center Berms Included	Long Pond Flow Control Structure Included	Results
Eight Berms: • Berms 1-8	Scenario 2 Appendix B - CBCL, 2020 - Figure 6	✓		Water level upstream of Portugal Cove Rd will exceed the height of the proposed improvements. Portions of the improvements downstream of Portugal Cove Road would also be overtopped.
	Scenario 6 Appendix B - CBCL, 2020 - Figure 10	✓	✓	Floodplain remains within riparian zone. Residential and non-residential lands protected.
Four Berms: • Berms 5-8	Scenario 3 Appendix B - CBCL, 2020 - Figure 7	✓		Feildian Grounds and Riverdale Tennis Club flooded. Floodplain extends north toward Winter Avenue, over Kings Bridge Road and onto the King George V Soccer field.
	Scenario 7 Appendix B - CBCL, 2020 - Figure 11	✓	✓	Feildian Grounds and Riverdale Tennis Club flooding, as well as flooding toward Winter Avenue.
Six Berms: • Berms 1-2 , and Berms 5-8	Scenario 4 Appendix B - CBCL, 2020 - Figure 8	✓		Feildian Grounds and Riverdale Tennis Club flood. Residential properties protected along Vaughan Place, Pringle Place, Winter Avenue, and Judge Place.
	Scenario 8 Appendix B - CBCL, 2020 -Figure 12	✓	✓	Feildian Grounds and Riverdale Tennis Club flood. Residential properties protected along Vaughan Place, Pringle Place, Winter Avenue, and Judge Place.
Two Berms: • Berms 1-2 (in this EPR)	Scenario 9 Appendix B - CBCL, 2021a - Figure 1	✓		Feildian Grounds and Riverdale Tennis Club flood. Residential properties protected along Winter Avenue, and Judge Place.

The assessment of the combinations of potential berms determined that the construction of a flow control structure downstream of Long Pond alone does not eliminate flooding. However, by restricting the flow released from Long Pond, it results in reduction of the peak volume during an event.

The combinations of berms were evaluated on the potential effects to the natural environment, and capital cost and maintenance requirements. The combination of the berms which result in the longest extent of berms, required higher berms along the corridor from upstream of Portugal Cove Road to Kings Bridge Road to contain the water within the Rennies River channel. Increasing the height of berms could result in increased footprints, therefore, greater changes to the environment. The greater number of berms also increase overall costs and maintenance requirements.

The two-berm combination (Berm 1-2) was selected as it reduced flooding and minimized the extent of required alteration along the Rennies River, and disruption of existing facilities while still reducing the effects of the flood. In selecting this two-berm configuration, several of the flood protection berms identified in the Alternative 1 were not immediately selected to be part of the Project. Following the approval and construction of the other mitigation measures, such as the flow control structure downstream of Long Pond, additional flood protection berms can be constructed downstream with the following advantages:

- Reduction in required berm heights and areas (i.e., footprint) for future additional berms.
- Reduce the potential of fish habitat alteration or loss.
- Reduce potential of removal of mature trees along the riverbanks.
- Reduce encroachment of berms on tennis courts.
- Eliminated the need to acquire portions of properties (rear yards) along Empire Avenue.

Berm 8 was also noted to reduce flooding of Prince Phillip Drive and minimized the extent of required alteration along Rennies River. As it did not result in flooding improvements between Portugal Cove Road and Kings Bridge Road it was not included within this Project. The berm along Prince Phillip Drive was identified as a mitigation for a separate undertaking not included within this EPR.

In selection of the two-berm alternative combination, mitigative approaches added into design included:

- Drainage mechanisms
- Bank Erosion

As identified in Section 4.1.1, a stormwater collection system will be included as part of the installation of Berm 1 on the north side of Rennies River to address the potential of localized pooling water. The drainage system will be designed to collect water on the north side of the berm and convey it back into the Rennies River downstream of Kings Bridge Road. The system will be developed as the Project undergoes further design refinement.

With selection of the two-berm combinations, areas that are currently demonstrating erosion and could be susceptible to stability issues will be stabilized. Without stabilization, there is a risk of erosion within the watercourse. To mitigate this effect without the installation of a berm, a portion of the watercourse located south of the Portugal Cove Road was identified for shoreline stabilization, which would include the reinforcement of approximately 45 m of the channel bank with armour stone.

5.1.3 Alternative 2 – Channel Realignment

Alternative 2 includes the realignment of the Rennies River to flow through Feildian Grounds through a new bridge at Portugal Cove Road. The new channel would be approximately 420 m long, with berms adjacent to the two new watercourse banks.

The construction may require the removal of trees and vegetation located along the riverbanks, at the connections back to the main watercourse. This option is anticipated to conflict with private property, including the removal of one property and may also require potential considerations for relocating the sports field.

5.1.4 Alternative 3 – Raising of Vulnerable Structures

The third alternative would include building up or raising vulnerable structures within the 1:100 AEP CC floodplain between Portugal Cove Road and Kings Bridge Drive. For example, the parking lot at Feildian Grounds could be raised, reducing the effects of flooding. Areas outside of the areas to be raised would still experience flooding such as upstream of Portugal Cove Road, Feildian Grounds, and properties along Winter Avenue to the north. The advantage of this option is that berms would not need to be constructed along Rennies River.

5.2 Assessment of Alternatives

Table 5.4 identifies potential environmental effects of each alternative and rational for selection or dismissal.

The proposed Project was ultimately selected as it provided the largest overall reduction in floodplain area and reduced flooding to properties along Winter Avenue to the north, as well as the electrical substation adjacent to Kings Bridge Road. These benefits can be achieved with or without the construction of the other flood mitigation projects, such as a flow control structure at the outlet of Long Pond.

Upon evaluation of the other alternatives, the other options were considered impractical due to a combination of factors such as flood reduction, land ownership, and potential damage to the natural environment.

Table 5.4 Alternatives Assessment

Alternatives	Effects / Cost Considerations	Rationale for Selection
Null: The null alternative, i.e., no changes for flood protection or river stabilization.	▸ Continued risk of flooding within modelled floodplain extent ▸ Risk of erosion within the watercourse south of Portugal Cove Road ▸ Risk of infrastructure damage from flooding north of Winter Avenue, and power station	This alternative was determined to not be a viable, suitable alternative as it does not reduce effects of flooding or improve resiliency to the change of flooding from climate change.
Alternative 1 – Flood Mitigation Berms	▸ Following the implementation of the two berms the floodplain for a 1:100 AEP CC event decreases by approximately 15,000 m^2 versus the floodplain with no mitigation measures. ▸ Expansion of the floodplain by 1000 m^2, approximately 5 m from the existing extent. ▸ Alteration within infrastructure footprint, including: o Loss of vegetation and habitat from clearing or installation of berms o Potential habitat loss for wildlife ▸ Release of sediment during construction could negatively affect water quality ▸ Effects to localized surface water drainage ability ▸ Effects to localized surface water ponding on either side of the berms ▸ Temporary restriction of trail use during construction ▸ Potential conflicts with land users or landowners ▸ Potential risk of soil contamination from accidental releases and spills	The proposed Project was ultimately selected as it provides the largest overall reduction in floodplain area and reduces flooding to properties along Winter Avenue to the north, as well as the electrical substation adjacent to Kings Bridge Road.
Alternative 2 – Channel Realignment	▸ Construction of an approximately 420 m channel resulting in an increased footprint, including: o Effects to vegetation and habitat from clearing o Potential habitat loss for wildlife ▸ Relocation of existing Rennies River resulting in removal of approximately 400 m of existing watercourse o Temporary/ permanent loss of fish habitat o Alteration of existing fish habitat ▸ Release of sediment during construction negatively affecting water quality ▸ Reduction of area available for other land uses, such as recreation ▸ Temporary restriction of trail use during construction ▸ Conflicts with land users or landowners ▸ Traffic disruption during bridge relocation ▸ Additional noise disruption from relocation ▸ Effects to localized surface water ponding on either side of the berms. ▸ Effects to localized surface water drainage ability ▸ Potential risk of soil contamination from accidental releases and spills	This option was not selected as it requires the largest construction footprint of the other alternatives, results in the most alteration to the environment including relocation of the watercourse, requires displacement of properties and current land uses, and it is most cost prohibitive.
Alternative 3 – Raising of Vulnerable Structures	▸ No substantial changes to the floodplain ▸ Alteration within infrastructure footprint, including: o Loss of vegetation and habitat from clearing or installation of berms o Potential habitat loss for wildlife ▸ Release of sediment during construction negatively affecting water quality ▸ Effects to localized surface water drainage ability ▸ Traffic disruption during infrastructure construction ▸ Additional noise disruption from construction ▸ Conflicts with land users and private landowners ▸ Potential risk of soil contamination from accidental releases and spills ▸ Risk of erosion within the watercourse south of the Portugal Cove Road	This option was not selected as it did not reduce the floodplain, it is cost prohibitive, and would require the largest construction footprint of the other alternatives and conflicts with land users and landowners.

6 Potential Environmental Effects and Mitigation

During the initial stages of the Project, potential effects and mitigation measures were identified. Potential environmental effects are identified in Table 6.1, along with the relevant Project phase. Mitigation measures to address potential adverse environmental effects are described in Section 6.4.

Table 6.1 Summary of Potential Environmental Effects identified in the EARD

Potential Environmental Effect	Project Phase	
	Site Preparation and Construction	Operation and Maintenance
Additional flooding as a result of the berms		✓
Alteration of Terrestrial Habitat, including: • Removal of vegetation and some mature tree branches • Disruption of wildlife, including birds and fish	✓	
Effect to Surface Water • Surface water drainage • Silt and sediment runoff • Risk of release of fuel, lubricant, and hydraulic fluid from construction vehicles	✓	✓
Effect to Aquatic Environment • Effects to fish habitat i.e., river stabilization • Silt and sediment runoff • Risk of release of fuel, lubricant, and hydraulic fluid from construction vehicles	✓	
Affects to Air Quality • Dust generation • Airborne emissions from construction equipment • Noise pollution from construction activities	✓	
Effects to Land Use: • Generation of construction debris • Disruption to adjacent property owners • Temporary disruption of traffic or trail use	✓	

In response to the EPR Guidelines, further information is provided for the following potential effects of the Project on the environment and the proposed mitigation to be used to avoid adverse environmental effects:

- Effects associated with the expanded floodplain (including mapping) upstream as a result of the proposed berm and erosion control measures.
- Effects to the river morphology and flow velocity at the berm section, upstream and downstream of the berm and riverbank stabilization.
- Effects associated with the impermeability of the berm and erosion control measures on the localized water ability to drain into the river canal.
- Effect of the berms and the erosion control measures may have on groundwater levels, and the measures that will be undertaken to mitigate the effects.
- Measures that will be undertaken for the quick and effective response to a potential spill event associated with petroleum products, i.e., heavy equipment leak.

6.1 Effects to Surface Water

Potential environmental effects to surface water have been identified and are further described in the following subsections:

- Effects from expanded floodplain
- Effects from change in surface water drainage
- Effects to surface water quality from spills

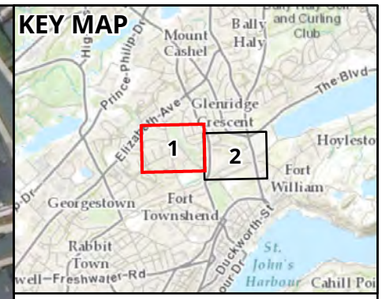
6.1.1 Expansion of Floodplain

The berms are designed to accommodate a 1:100 AEP CC event (Figure 6.1) and use the existing topography within the floodplain to contain the flood water. Under a 1:100 AEP CC event, the Project will prevent flooding in an area covering 15,000 m^2; however, there will be areas that will be flooded that are not under existing conditions. These additional flooded areas combined are approximately 1,000 m^2.

When compared to the existing 1:100 AEP CC floodplain, as described in 4.1.3.1, downstream of Portugal Cove Road, the Feildian Grounds and the Riverdale Tennis Club are still expected to experience similar flooding. Under a 1:100 AEP CC event, the Project will prevent flooding in an area covering 15,000 m^2. This includes buildings on Winter Avenue, Kings Bridge Road, and the Boulevard; portions of roads including Winter Avenue, Judge Place, Kings Bridge Road, and the Boulevard; and the Wyatt Park on the east side of Kings Bridge Road are no longer flooded with the construction of Berm 1. Berm 2 provides localized benefit to the electrical substation.

Post construction, the 1:100 AEP CC floodplain extends approximately 1,000 m^2 than under existing conditions, which includes extension of approximately 5 m further along the properties at Winter Place. On the south side of the river, the floodplain extends on average approximately 5 m, up to 10 m in some places, and is confined to the vegetated areas and backyards along Empire Avenue. A summary of the changes following the implementation of the berms is provided in Table 6.2.

KEY MAP



LEGEND

- 1:100 AEP Climate Change Boundaries (Existing Conditions)
- 1:100 AEP Climate Change Boundaries (Post Berm Conditions)

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 6.1:
1:100 AEP Climate Change Boundaries and Post Berm Construction

CBCL

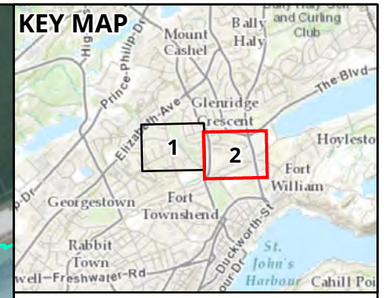
Drawn: SF	Date: 2022-05-31
Checked: MR	Project #: 213032
Approved: LH	Scale @ 11"x17" : 1:2,000

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 10 20 40 60 80 m

Path: Y:\St. John's\Data\Jobs\2021\213032.00 CSJ Rennies River, Phase 2 EPR\44 CAD\07 ENVIRO\PRO\213032_RenniesRiverP2_EPR.aprx

KEY MAP



LEGEND

- 1:100 AEP Climate Change Boundaries (Existing Conditions)
- 1:100 AEP Climate Change Boundaries (Post Berm Conditions)
- Erosion Control Improvements
- Proposed Flood Mitigation Structure Footprint

Rennies River Flood Mitigation Project - Portugal Cove Road to Kings Bridge Road

Figure 6.1:
1:100 AEP Climate Change Boundaries and Post Berm Construction

CBCL

Drawn: SF	Date: 2022-05-31
Checked: MR	Project #: 213032
Approved: LH	Scale @ 11"x17" : 1:2,000

Coordinate System: NAD 1983 UTM Zone 22N
Units: Meter

0 10 20 40 60 80 m

Path: Y:\St. John's\Data\Jobs\2021\213032.00 CSJ Rennies River, Phase 2 EPR\44 CAD\07 ENVIRO\PRO\213032_RenniesRiverP2_EPR.aprx

Table 6.2 Summary of the Hydrologic and Hydraulic Conditions for Flood Protection Berms and the pre and post Construction 1:100 AEP CC

Summary of Changes between Existing Conditions and Post- Construction	
Flooding Area Reduction (m^2)	Approximately 15,000 (m^2)
Additional Area Flooded (m^2)	Approximately 1000 (m^2)
Maximum Change in Water Level along the berms (m)	0.4 m
Average width of additional flooding (m)	5 m
Infrastructure removed from Floodplain	9 Buildings 4 Roads 1 Power utility
Additional Infrastructure Flooded	None

The proposed Project will not result in more frequent storm events; however, it is modelled to result in a water level increase of approximately 0.4 m during a 1:100 AEP CC event, which is projected to result in additional fields and yards being flooded. This option minimizes the amount of road infrastructure, power utilities, and buildings on properties that will be flooded while reducing the need for multiple berms, and associated conflict with landowners and land users.

The Project is a mitigation measure that reduces the area of potential flooding. The 1,000 m^2 of additional flooding is small compared to the 15,000 m^2 that is removed from the active floodplain. Although the Project may extend flooding to fields and yards on public and private properties, it also protects buildings, roads, and power utility infrastructure that may be susceptible to flooding without protection versus. The main mitigation measure is to continue with the construction of the priority 1 items as identified in the RRCSMP, such as the flow control structure at the outlet of Long Pond. When completed in conjunction with these other measures, the change of the floodplain extent is further minimized. As the projects are designed and developed, the City will work with property owners to minimize potential resource conflicts.

6.1.2 Surface Water Management

Within the Project Area, local surface water drainage could be affected if the berm alters or inhibits drainage. This could result in water pooling on the exterior side or create berm stability issues. To mitigate potential effects, a stormwater collection system, including piping and catch basins, will be installed along the north side of Berm 1. The installed system will collect water along to the north side of the Rennies River discharging stormwater downstream of Kings Bridge Road.

The location of catch basins and stormwater piping is to be determined in detailed design. During the design phase, additional grading could be considered on the north side of the berms to improve drainage, if landowners are interested.

6.1.3 Effects to Surface Water Quality from Spills

During site preparation and construction activities, with the use of heavy equipment and vehicles there is a potential for accidental spills or release of fuels and other contaminants. If such an accidental release occurs in proximity to a watercourse, it could adversely affect surface water quality. Pollutants may also be transferred to surface water via runoff or erosion should spills occur on land during either site preparation or construction.

An EPP including an Emergency Spill Response Plan will be developed for the Project. The contractor will prepare this document which will include approaches for proper handling, storage and disposal of hazardous and other waste materials. In the event of an accidental spill, spills will be cleaned up and reported to NLECC. The following mitigation measures are recommended for the prevention of accidental spills or leaks:

- Spills will be contained as quickly as possible.
- Spill kits, including spill socks, must be kept onsite during site preparation and construction.
- Avoid bulk storage of fuel products on site.
- Store hazardous materials, such as fuel, at least 30 m from the watercourse.
- Fuel or service vehicles and machinery at a minimum of 30 m of the watercourse and on a hardened, impermeable, and level surface.
- Maintain vehicles and machinery in good working order.
- Prevent equipment leaks by using drip pans or other appropriate means.

An Erosion and Sediment Control Plan will be implemented prior to construction and will describe measures to:

- Prevent loss of soil during construction by stormwater runoff or wind erosion, including protecting topsoil by stockpiling for reuse.
- Prevent sedimentation of storm sewers or receiving streams.
- Prevent pollution of the air with dust and particulate matter.

Standard practices, including the use of temporary erosion and pollution control devices such as silt fences will be used to mitigate the possible sources of pollutants and protect Rennies River from potential effects. Following these requirements, minimal conflicts are expected.

6.2 Effects to River Morphology

Reductions of the cross-section of a river floodplain could result in increased average velocities along the main channel, increased erosion vulnerability along the riverbanks, and increased fish habitat vulnerability. This section presents an assessment of the impact of

the proposed berms on the velocity distribution along the river and on the vulnerability of the river to sudden changes in morphology (as result of high velocities and riverbank erosion).

In a river, the interaction of sediment and streamflow is in a constantly changing state, described as dynamic equilibrium. Changes to the flow regime or the sediment supply in a river can lead to erosion or deposition of sediments and with that, to changes in the river morphology. In highly intervened and urbanized streams this dynamic is characterized by low sediment supply and highly stabilized slope to mitigate erosion vulnerability. The current geomorphological conditions of Rennies River are consistent with those typical of urban streams. The Rennies River flows through an urbanized area and features channelized riverbanks as the river flows towards Quidi Vidi Lake (CBCL, 2022, Appendix C). From Portugal Cove Road to Kings Bridge Road, the river channel features channelized banks and multiple stabilization works including gabion walls, riprap, and retention walls. These areas could be less vulnerable to relatively small increases in velocity.

Given the relatively high degree of stabilization measures already in place along the river and close to the Project location, a high-level assessment was conducted to evaluate the potential impacts of the Project on velocities and erosion risks (Appendix C presents additional details of the analysis). The assessment compares existing and post development average channel velocities for the following design events:

- 1:2 AEP event
- 1:100 AEP event

During a 1:2 AEP event, the calculated average cross-sectional velocity in the river ranges from 1.96 m/s to 2.61 m/s prior to the construction of the berms (Figure 6.2). Following the construction of the berms, the calculated average cross-sectional velocity remains consistent with those calculated for pre-construction conditions. These results indicate that, under small events, velocities along the channel are unlikely to show significant changes after construction (Figure 6.2).

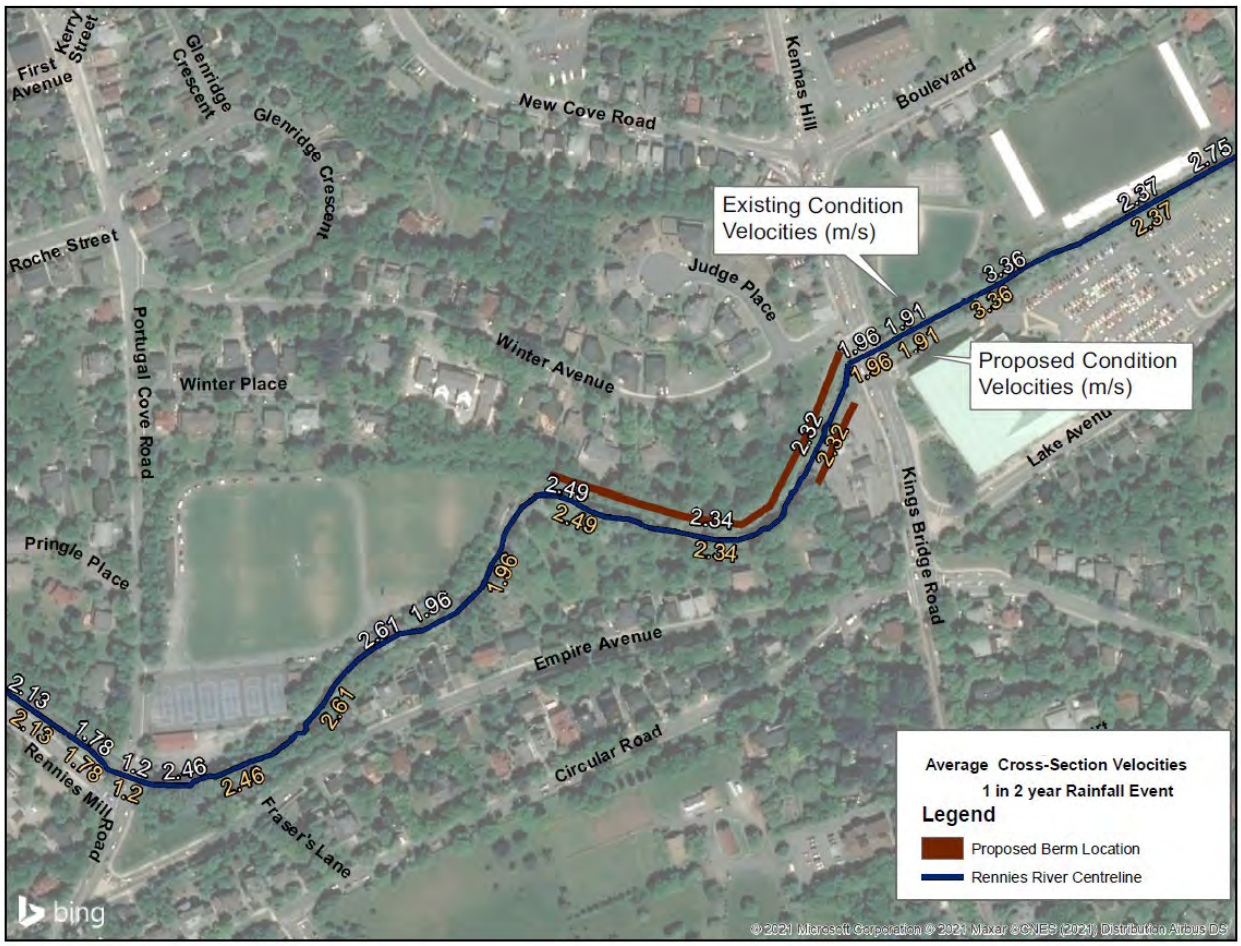


Figure 6.2 Average Cross-Sectional Velocities Pre and Post Construction Conditions from Portugal Cove Road to Kings Bridge Road during 1:2 AEP Event

During a 1:100 AEP event, the calculated velocities range from 2.0 m/s to 3.45 m/s within the Rennies River prior to the construction of the berms (Figure 6.3). Under post construction conditions, the velocities calculated along the general location of the berms and in the downstream area show an increase from those calculated for existing conditions. The largest change in velocity was calculated along Berm 1 approaching the river bend. However, there is already a retention wall along the south side of the channel following the river bend across from Berm 1. Calculations do not show a change in velocities upstream of the proposed berm structures.

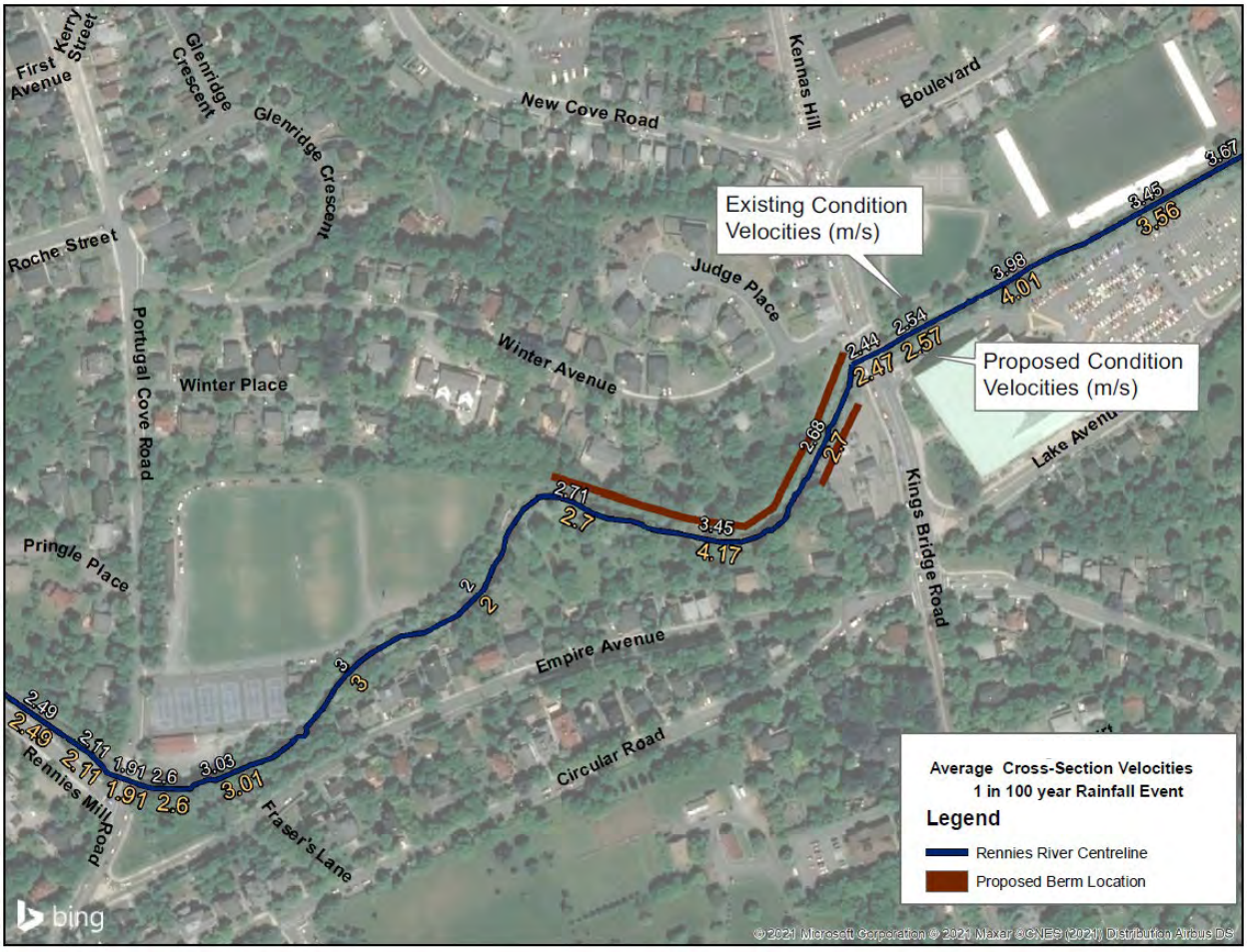


Figure 6.3 Average Cross-Sectional Velocities Pre and Post Construction Conditions from Portugal Cove Road to Kings Bridge Road during 1:100 AEP Event

The assessment indicates that, during high flow events, such as the 1:100 AEP, the construction of the berms could result in increased velocities. Because the berm construction would not affect the main river channel cross-section, smaller events, such as the 1:2 AEP event did not show increases in velocity.

To mitigate risks of erosion and vulnerability to sudden changes to the river morphology during high flow events, erosion mitigation measures may be required along the face of the new berm and along downstream sections of the river that are not currently stabilized. These options could include riprap, turf reinforcement mats (TRMs), or reinforced vegetation or erosion control blankets.

6.3 Effects to Groundwater

Figure 6.4 shows a scenario for flooding after containment berms are built. Containment berms would limit the effects of flooding to a zone directly below the river. The temporary

increase in the river level could influence groundwater flow patterns. Possible effects include reduced baseflow to the river, temporary pooling of water on the floodplain, or redirection of groundwater to a more regional flow system. This scenario assumes that the regional water table will not rise rapidly during a storm event.

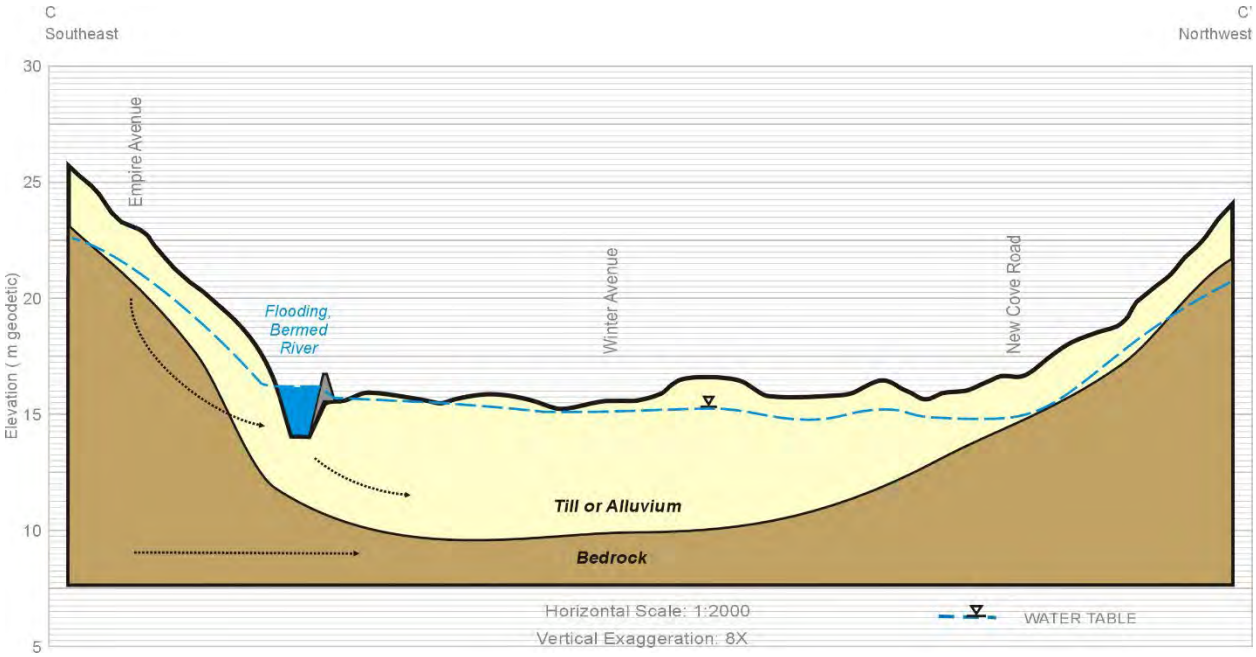


Figure 6.4 Conceptual sketch of shallow flow systems that discharge to Rennies River: Berm Conditions Channel

In conditions with more permeable soils, prolonged rainfall, or spring conditions, a higher water table could develop (Figure 6.5). A higher water table could generate localized flow paths that discharge to the areas immediately outside of the berms. This could lead to a temporary and localized accumulation of surface water, depending on the soil permeability and rate of rainfall. Potential effects of the Project on groundwater flow systems are localized and short-term, relevant for the duration of flooding events and the brief period of recession that follows. There are no expected long-term or regional effects on groundwater flow systems.

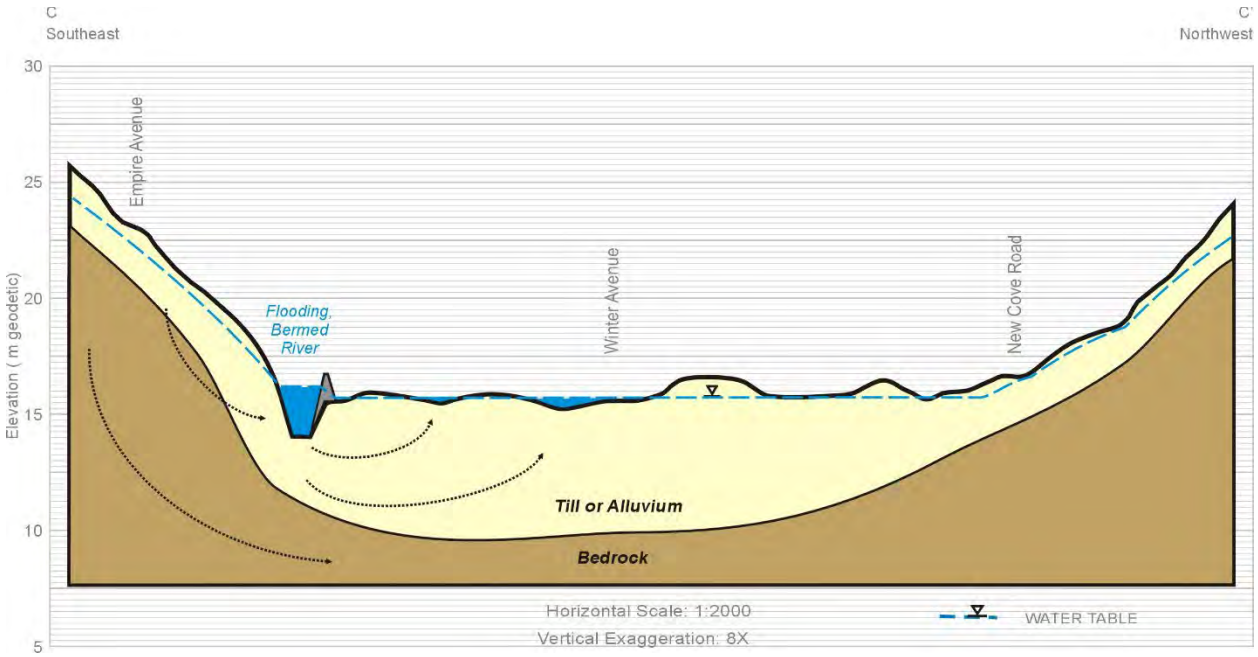


Figure 6.5 Conceptual sketch of shallow flow systems that discharge to Rennies River: Berm Conditions, High Water Table

6.4 Mitigation Measures

During construction (and where upgrades or repairs are scheduled throughout infrastructure lifespan), the City and their contractors will comply with all relevant federal, provincial and municipal acts and regulations such as the *Environmental Protection Act* (SNL 2002: Chapter E-14.2), *Wild Life Act*, *Occupational Health and Safety Act*, *Fisheries Act*, *Migratory Birds Convention Act*, *Species at Risk Act*, and their respective regulations. Most mitigation measures to be implemented during construction will be outlined in a series of project-specific plans that will serve as guidelines to promote due diligence. Other mitigation measures that will be abided by include BMPs and the following:

General

- The berms will be constructed as part of the mitigation measures for surface water management and land users. The berms will be constructed to the design criteria for a 1:100 AEP CC event.
- City will require owners' consent and access agreements for works that occur outside of municipally-owned land.
- The City will communicate with the adjacent landowners, as required, during the design and installation of the structure and will work with adjacent landowners to minimize potential resource conflicts. Measures could include fencing, alternative access, procuring portions of land for the construction of the structures, or establishments of agreements for easements, if required.
- A site-specific EPP will be prepared and followed. The EPP will include requirements and responsibilities for training and mitigation measures to reduce effects to terrestrial,

aquatic, and human health such as accidental spills/leaks and release of fuel and mechanical fluids, hazardous materials, dust, and deleterious substances. At a minimum, the following topics will be included:

  - Emergency Response Plan
  - Emergency Spill Response Plan including locations of spill response equipment
  - Erosion and Sediment Control Plan
  - Handling and storage of fuel, gasoline and associated products
  - Waste management strategy
  - Invasive Species Mitigation Plan
  - Operation and maintenance of machinery

- The Erosion and Sediment Control Plan will be implemented prior to construction and will describe the measures implemented to prevent loss of soil during construction. The plan will include protecting topsoil by stockpiling for reuse; preventing sedimentation of storm sewer or receiving streams; and preventing air pollution by dust and particulate matter. Temporary erosion and pollution control devices such as silt fences will be used to mitigate possible sources of pollutants. The plan at a minimum will address the following:
  - Site dewatering
  - Protecting topsoil by stockpiling for reuse
  - Preventing sedimentation to receiving streams
  - Preventing air pollution by dust and particulate matter
  - Temporary erosion and pollution control devices such as silt fences will be used to mitigate possible sources of pollutants and their removal at completion of the Project
- Any quarried materials required for the proposed Project shall be purchased from a supplier permitted under the *Quarry Materials Act* (1998).
- All debris and waste materials will be disposed of in accordance with the provisions of the *Environmental Protection Act* and latest regulations, guidelines, and policies. Non-hazardous construction and demolition debris will be either recycled or salvaged. Items may include cardboard, metal, concrete, plastic, clean wood, and glass. The disposal of waste materials not reused, resold, or recycled will be at an approved waste disposal site.
- Only new or reused, clean materials will be used for the purposes of the berm construction, backfill, and grading.

Spill Prevention

- Avoid bulk storage of fuel products on site.
- Store hazardous materials, such as fuel, at least 30 m from the watercourse.
- Fueling and storage of gasoline and associated products (e.g., oils, greases, diesel, hydraulic and transmission fluids), should occur in a designated refueling/storage area at least 30 m from any waterbody and on flat, paved terrain.
- Maintain vehicles and machinery in good working order.

- All maintenance of equipment should occur at least 30 m from any waterbody on flat, paved terrain.
- Prevent equipment leaks by using drip pans or other appropriate means.

Spill Response

- In the event of a spill or leak, the operator must immediately notify NLECC and the Environmental Emergencies 24 Hour Report Line (1-800-563-9089), abate the discharge and restore the affected area to the satisfaction of the NLECC.
- All soils and water impacted via spills and releases will be disposed of off-site in accordance with applicable environmental legislation.
- Spills will be contained as quickly as possible.
- Spill kits must be kept onsite during site preparation and construction.

Air / Noise Emission

- All heavy machinery should be in good working order and operated in a manner to maximize fuel efficiency, thereby reducing greenhouse gas emissions and effects to air quality, such as emission and noise.
- All construction activities will occur during working hours as defined in the permit, and in compliance with local by-laws.
- Minimize equipment idling during construction.

Fish and Fish habitat

- Heavy machinery will not be permitted to enter existing watercourses (i.e., Rennies River).
- In-water works will be completed within periods of low flow to further reduce the risk to fish and fish habitat. Further information regarding the schedule is provided in Section 4.2.1.
- Adjacent to watercourses, only clean rock fill materials (minimal fines) will be used to reduce the potential of release of sediments, or any other materials considered deleterious, to fish and fish habitat.
- Erosion and sediment control measures shall be implemented to reduce effects to fish and fish habitat. Such measures may include isolation measures (e.g., silt fences, and sandbags); minimizing the removal of vegetation and natural debris (e.g., rocks, logs, sand); and shoreline stabilization with appropriate materials (e.g., native vegetation, riprap or armour stone).
- Fish passage and flow should be maintained at all times.
- All guidance and mitigation measures issued from DFO will be followed.

Vegetation

- The Project will be designed to minimize disruption to existing natural areas. Removal and disposal of trees, brush, stumps, surface litter, boulders and grubbing will follow applicable legislation, permits and BMPs. Vegetation, such as trees, and shrubs, should be retained when possible.

- All equipment must be devoid of soils, seeds, and residual debris prior to use on-site. Undercarriages, wheels, tracks and blades/buckets should be cleaned (i.e., pressure washed) prior to use on the site.
- The berms will be covered with topsoil, hydroseed and/or sod as well as revegetated with preference to native vegetation, trees and shrubs. A hydroseed mixture will be used in areas directly adjacent to watercourses. Sod will not be placed in locations directly adjacent to watercourse.

Wildlife

- Whenever possible, vegetation clearing will occur outside the general nesting period for breeding birds (mid-April to mid-August). If this is not avoidable, and without implementation of mitigation measures, there could be a risk of impacting breeding birds and their nests. If vegetation clearing outside the breeding bird nesting period (mid-April to mid-August) is unavoidable, breeding bird /nest surveys will be completed prior to removal of vegetation or disturbance of potential habitat. A trained biologist should complete surveys to confirm the present of breeding birds and their nests. Nests and neighbouring vegetation will be left undisturbed until nesting is complete. If nests containing eggs, or young, or migratory birds are discovered during construction, disruptive activities in the nesting area should cease until nesting is completed. A buffer zone should be established at an appropriate set-back distance surrounding the nest. Appropriate set-back distances should be based on setbacks identified in the literature or in consultation with a provincial or federal wildlife biologist.
- The contractor shall develop a management plan encompassing measures to mitigate effects to migratory birds and incorporate this plan into the EPP. These measures shall include ways to avoid disturbing birds' nests or eggs.
- Mitigation measures to deter migratory birds from nesting in stockpiles during the breeding season shall also be implemented.
- Contractors should implement management practices to reduce the effects to migratory birds as a result of artificial light, such as reducing the number of site illuminating lights in the project area, where possible, and low intensity lights at after sundown.
- Best management practices for wildlife protection during construction will be incorporated into the EPP, such as proper waste management to deter wildlife from entering the Project area.

Traffic

- Traffic control, where required, will be provided by certified traffic control personnel in accordance with the Traffic Control Manual issued by the NL Transportation and Infrastructure.

Construction Closure / Demobilization

- On completion of the Project, construction equipment, surplus materials and temporary works will be removed from the site.

- On completion of the Project, any disturbed areas will be restored to the original conditions or better.

On-going Maintenance

- Berm repairs will be completed, including regrading and planting, to maintain berm conditions and aesthetic.
- Geotechnical inspection will be completed every five years including review of annual inspections.

7 Public Consultation

The City provided opportunities for public engagement and involvement throughout the process from the prior to the EARD through the EPR process including:

- A Project-specific webpage on the 'Engage St. John's' website
- Two virtual public engagement sessions, during to stages of the Environmental Assessment Process
    - Pre- EARD Submission Public Information Meeting
    - EPR Public Information Meeting

The following is a summary of the consultation efforts completed by the City.

7.1 Project Webpage

The Project-specific webpage on the 'Engage St. John's' website provides a Project description, available information for the Project, and question submission form. The Project description on the Engage St. John's' website included the identification of five potential berms located from Elizabeth Avenue to Kings Bridge Road. The public was encouraged to ask questions throughout the engagement process. Questions submitted were posted and responses were provided from the City of St. John's on the Webpage. A summary of the questions from the EARD stage is provided in Appendix D and a summary of questions from the EPR stage is provided in Appendix E.

7.2 Previous Consultation Efforts

The City held an initial virtual public engagement session on November 17, 2020, to provide information on the proposed Project to the people whose environment may be affected, and to respond to questions and seek feedback from the local community. A "What We Heard" document outlining a summary of the engagement activities was developed and is included in Appendix D.

As a result of the engagement activities and public feedback, the City Council on December 14, 2020, decided to proceed with a reduced selection of two flood protection berms: one earth berm located adjacent to Winter Avenue, one earth berm located adjacent to the power substation berm, and erosion protection along Rennies River downstream from

Portugal Cove Road. The other structures discussed in the Virtual Engagement Session may be designed and developed as part of future flood mitigation efforts; however, are not included as part of the Undertaking for the EPR.

A summary of key questions and concern themes are outlined in Table 7.1. Questions asked about other undertakings are not included within this EPR.

Table 7.1 Summary of Questions and Concerns from Pre EARD-Public Information Meetings

Theme	Topic	Response Summary
Project	How were the heights of the berm determined?	The berm heights were determine based on the 1:100 AEP CC with allowing for approximately 30 cm of freeboard.
	Will the berms be designed to be impermeable?	The Project design in underway, this will be consider as required, and as not to affect surface water drainage.
	Does the Project consider other infrastructure such as bridges?	Yes, the size and capacity of bridges has been considered in the development of the Project.
Flooding Concerns	Has the Project considered Hydraulic flows?	Hydraulic modelling has been completed for various conditions (Appendix A).
	Does the Project include run-offs from other areas in the watershed, such as upstream of Kelsey Drive?	Yes, the watershed has been included in this assessment.
	How will the other projects affect the Project, such as the Health Science Centre Berms and Long Pond Weir?	The modelling has been completed for various conditions (Appendix A). The proposed project can be completed prior to the construction of the Long Pond Weir.
	Does the Project result in additional flooding?	Following the implementation of the berms during a 1:100 AEP CC event, the floodplain decreases approximately 14,910 m^2 compared to the floodplain without mitigation measures. The Project will result in the extension of the floodplain by approximately 1000 m^2 along the backyard of properties at Winter Place (up to 5 m width), vegetated area adjacent to north side of the Rennies River, and the vegetated

Theme	Topic	Response Summary
		area along the south side of the river and to some backyards along Empire Avenue (average 5 m, up to 10 m)
Other Environmental Concerns	How will this Project affect the riparian areas and the river?	As much as possible, the berms will be constructed within the existing trail alignment. The types of berms were selected to preserve the natural waterline, accommodate available space, and optimize effectiveness and aesthetics. Earthen berms are most preferred to blend into existing conditions, while not compromising structural integrity, when space allows.
	Will the Project change groundwater level?	The Project is proposed as a mitigation measure for surface water from acute flooding events.
Approvals	Pippy Park Approvals	The Project is not located within the Pippy Park managed areas and is not anticipated to require a Pippy Park Approval.

7.3 Public Information Meeting

The City held an Open House Public Information Session virtually using a web-based meeting platform (Zoom) on March 22, 2022 from 7:00 pm to 8:30 pm. The purpose of the meeting was to present information about the Project to the people whose environment may be affected by the undertaking, provide information on the alternatives to the Project, document and respond to concerns regarding potential effects of the Project, and in accordance with the *Environmental Protection Act*, *Environmental Assessment Regulations*, and EPR Guidelines. A summary of the advertisements and announcements for the Open House Public Information Session are provided in Section 7.3.1, and summary of public concerns themes and approaches to address those concerns are documented in Section 7.3.2.

7.3.1 Public Meeting Announcements

Under the requirements of the *Environmental Assessment Regulations* and the EPR Guidelines, the City provided postings about the Public Meeting. The public meeting was advertised following the EPR Guidelines. A copy of the notice was posted in The Telegram Newspaper as outlined in Table 7.2 (Appendix E). The ad size was approximately two column widths measuring 4.68 inches wide by 7 inches high. Communication about the meeting included newspaper public releases and social media (Table 7.2). NLECC was notified of the Public Information Meeting on March 15, 2022.

Table 7.2 Dates of Announcements and Notice Postings for the Public Information Session

Location of Announcement / Notice Posting	Days of Posting
The Telegram	March 12, 2022 March 18, 2022 March 19, 2022 March 21, 2022
'Engage St. John's' website	Starting March 8, 2022,
Media Release	March 8, 2022
Social Media - Twitter	March 8, 2022
Social Media - Facebook	March 8, 2022

7.3.2 Summary of Public Information Meeting

The EPR Public Information Meeting was held on March 22, 2022. Approximately 66 people attended the virtual public engagement session. The session provided project details on two proposed structures. Presented materials included:

- Code of Conduct for Engagement Session
- Background
- The Project
  - Location
  - Project Design
  - Project Activities
  - Project Schedule
- Surface Water Management
  - Flooding
  - Temporary Ponding
  - Groundwater
- Alternatives
- Permits and Authorizations
  - Environmental Assessment Process
  - Other Permit Requirements

During the meeting there was expression of concern, including a mix of opposition and support for aspects of the Project. Key theme areas included project design, schedule, potential alternatives, resource conflict, flooding concerns, groundwater, watercourse and riparian area effects, and engagement process and further consultation. A summary of key questions and concern themes from the Public Meeting are outlined in Table 7.3. A summary of the questions from the meeting, the St. John's Engage Page and other communications are provided in Appendix E.

References to and questions asked about other undertakings or approaches outside of Elizabeth Avenue to Kings Bridge Road area are not included within this Summary. Observations on the current state of other infrastructure within the area, such as bridges

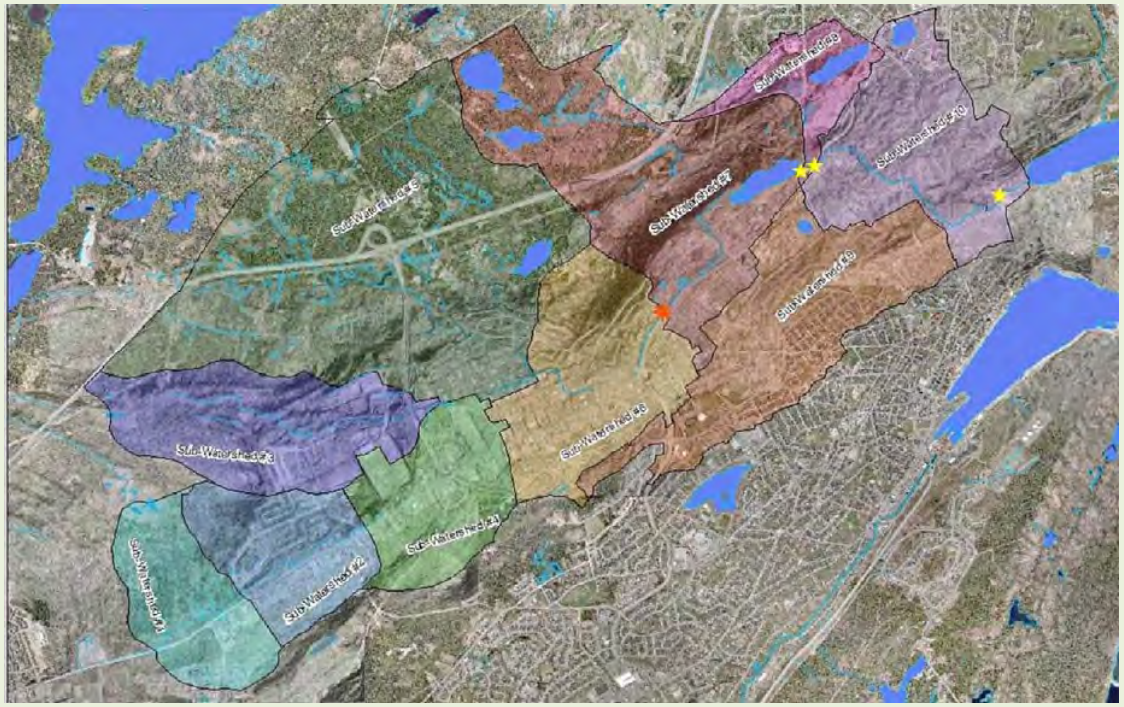
and deterioration of stormwater infrastructure, was noted by the City, however, is not further addressed within the EPR. Comments and questions were acknowledged and responded to during the Public meeting. Document of Questions are provided in Appendix E.

Table 7.3 Summary of Questions and Concerns from Public Information Meeting

Theme	Topic	Response Summary
Project	What are the berm sizes?	The height of the structure is bases on the required elevation to meet the 1:100 AEP CC event. Berm 1 on the north side of the river ranges from 0.1 m to 2.2 m. Where heights of greater than 0.5 m are required, a block wall will be used to minimize the require footprint. Berm will range in height of 0.2 m to 0.5 m.
	Where the structures are high, what safety features will be used?	Where required, safety features will be installed, such as new handrails along the proposed block wall
	What happens to the walking trail? Where will the trail be in relation to the berms?	The berms construction will be focused within the existing trail alignment. Once complete, the trail would be oriented on top of the berm
	Will environmental features be removed for the berm construction?	The primary location of the berms will be within the existing trail right-of-way. Some vegetation will be removed for the location of the berm footprint and to allow access of equipment. The configuration attempts to reduce the number of mature trees which would require removal.
	Can more information be provided on the drainage solution being proposed, such as would drainage be installed on all properties, will this include fixing existing structures and how will covers remain affixed?	The proposed drainage system is still under development and is anticipated to be oriented parallel to the river. The system will collect water and discharge downstream of the bridge across Kings Bridge Rd.
	Would this ensure properties would be free from water in the future?	The project has been designed to mitigate flooding effects from a 1:100 AEP CC event. Additional mitigations such as stormwater collection on the north side of the have been identified to further mitigate water which could collect on the north side of the berm. The proposed project is part of series measures to reduce flowing risk within the floodplain. Assurance or guarantee of water retention or that properties are water free is not possible.
	Would it not be better to backfill the back yards there instead of having maintenance of sewers for years and years?	The initial approach to the project was to minimize works on not City owned or managed lands. The City will work with people in design phase to address look of berms such as slope, etc. Grading could be included if the parties are interested.

Theme	Topic	Response Summary
Schedule	What is driving the schedule of this Project? Is the delivery of the Project aligned with funding applications with specific timelines?	The Project is not aligned with funding applications with specific timelines.
	Can this Project go ahead without other flood mitigation projects, such as works upstream?	The two-berm alternative combination (Berm 1 -2) was selected as it reduced flooding and minimized the extent of required alteration along to Rennies River. As other flood mitigation Project are still being evaluated by the NLECC, a hydraulic assessment was undertaken to assess if this Project could be constructed before other mitigation measures such as the flow control structure downstream of Long Pond. The hydraulic assessment determined that the construction of a flow control structure, such as downstream of Long Pond, alone does not eliminate flooding. The assessment identified that the Project could occur in advance as it would result in the reduction of the floodplain with marginal increases to the overall floodplain.
	If the construction is not completed by Sept 30th, will you stop construction until the following year?	In-water works will occur during the summer low flow period (June 1 to September 30) to avoid sensitive life stages of aquatic life (from October 1 to May 31). Work outside of the watercourse, could occur outside of the June 1 to September 30 period with mitigation measures. If all in-water works cannot be completed during the period of the June 1 to September 30, the project could be completed in phases and portions rescheduled to the following year.
Alternatives	While climate change may exacerbate flooding, there is a water management issue from the upstream sources. This has created a burden on the City and taxpayers to mitigate that downstream flooding, such as with these berms, retaining walls and weirs. What alternatives can be used to address this?	Upstream development contributes to higher flow, but climate change is also a major issue. The RRCSMP included an assessment of potential approaches, this Project is part of the approaches as identified. Based on the RRCSMP and the predictive modeling, the capacity of water retention alone does not eliminate flooding, such as downstream of Long Pond. The project was identified as it has the potential to reduce the larges area of potential flooding downstream of Portugal Cove Road. However, an alternative to the Project assessed include to do nothing within the present area, which does not provide any mitigation to flooding within the area.
	Why has this project been selected, could approaches be implemented from upstream to downstream?	An assessment was undertaken as part of the RRCSMP. Approaches for retention were evaluated in undeveloped areas, such as Kelsey Drive /Kenmount Terrace. An area in southwest development area upstream, could work but would not have significant impact because of its location in the head waters. Another significant recommendation was related to flow control structure at Long Pond. The assessment of the combinations of potential berms determined that the construction of the flow control structure downstream of Long Pond alone does not eliminate flooding. However, by

Theme	Topic	Response Summary
		restricting the flow released from Long Pond, it results in reduction of the peak volume during an event. This Project could be implemented without the other measures, and berm heights could be modified if the other undertaking is approved or completed concurrently.
	Given key problem areas are residents on east side of Pringle Place and Feildian Grounds has there been any analysis of options that would eliminate or minimize flood risk to those locations (other than Long Pond Flow control)?	Five combinations of berms were assessed, including of conditions with and without a flow control structure at the outlet of Long Pond. Combinations evaluated downstream of Long Pond included the following: • No flood mitigation along Rennies River. • Eight Berms: Berms 1-2 upstream of Kings Bridge Road, Berms 3-4 downstream of Portugal Cove Road, Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive. • Four Berms: Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive. • Six Berms: Berms 1-2 upstream of Kings Bridge Road, Berms 5-6 upstream of Portugal Cove Road, Berm 7 upstream of Carpasian Road, and Berm 8 at the west side of Prince Phillip Drive • Two Berms: Berms 1-2 (proposed Project as Proposed in the EPR). Of the berm assesses as alternatives several of the flood protection berms were not immediately selected to be part of the Project. Following the approval and construction of the other mitigation measures such as the flow control structure downstream of Long Pond, additional flood protection berms can be constructed downstream with the following advantages: • Reduction in required berm heights and areas (i.e., footprint) for future additional berms. • Reduce the potential of fish habitat alteration or loss. • Reduce potential of removal of mature trees along the riverbanks. • Reduce encroachment of berms on tennis courts.
	Has the City considered the installation stormwater retention features from the headwaters all the way downstream as an alternative?	Throughout St. John's, there is an extensive network of storm sewers and catch basis which discharge at various locations along the watercourses. However, this alternative would not prevent flooding within the subject area. The stormwater collection system was identified as a mitigation to a potential problem regarding the change of drainage conditions where Berm 1 is located.

Theme	Topic	Response Summary
	Could providing stormwater retention on upstream portions of Kelly's Brook be a useful possibility?	This was evaluated as part of the RRCSMP. The Kelly's Brook Catchment Area is only a portion of the overall Rennies River (Orange below) and represents 336.99 ha of the total 3184.22. ha in the catchment area. The area did not provide enough retention to reduce flooding within the area. 
Flooding Concerns	Kelly's Brook flows into the Rennies River downstream of Portugal Cove Road and upstream of the tennis courts. This could result in additional water within the system. Is this considered in the assessment of the Floodplain?	The flows from the Kelly's Brook are accounted for within the floodplain predictions.
	Could debris within the river be creating the flooding issue?	The modelling identified the risk of flooding during a 1:100 AEP CC event. To minimize disruption from debris within the watercourse, the City tries to keep ahead of debris issues through part of operations and maintenance.

Theme	Topic	Response Summary
	The existing observations flooding conditions and the mapping do not seem to match.	The modeling projections of the floodplain at 1:100 consider climate change and taking higher flows into account. These projected conditions may not represent events presently observed. Along Empire Avenue, Winter Place and Winter Avenue properties do flood, and some homes along Winter Avenue. There are properties on Winter Avenue that have experienced basement flooding from the river. The Project proposed to reduce flooding risks to homes, and other infrastructure such as roads. The Project does not protect back yards from flooding.
	The modelling suggests that elevation of water could increase from what is presently observed. What will be the potential impact on homes along winter avenue?	As part of the modelling a predicted water elevation is established along the river for a flooding event. Along Empire Avenue, the back yards generally drop off at a steep elevation. The buildings are located at a higher elevation; therefore, the water does not reach the properties. The flood line extends into the backyards and does not reach the homes. It some cases there could be a slight increase of approximately 5 m from the existing flood condition. The basic principle is to attempt to protect buildings and infrastructure.
	Does this Project result in further flooding upstream?	There is a slight change in the floodplain from Portugal Cove Road to Kings Bridge Road; however, no changes upstream of Portugal Cove Road.
	Will the Project, with considering other projects Upstream, result in greater flood risk?	The Project as been designed to work with other proposed projects and independently to mitigate flooding effects of 1:100 AEP CC events.
Groundwater	Infiltration of groundwater into subgrades of properties (basements and crawl spaces) are a concern within this area. Will the berms prevent property flooding due to groundwater?	The berms are focused on retaining surface water during the storm events and could affect groundwater flow systems directly adjacent to the river. The containment of flood waters by the berms is not expected to have a direct influence on groundwater seepage into building foundations. A stormwater collection system along the north side of Berm 1 is proposed help collect localize surface water which occur from precipitation events. The stormwater collection system could improve drainage, particularly within low lying areas, which may help reduce effects from water infiltration into homes.
	Has an assessment been completed to determine if additional groundwater concerns could result for the residential properties following the construction of the project?	The conceptual model of groundwater flow suggests that construction of the berms will not create additional groundwater concerns for properties adjacent to the river. Potential changes to groundwater flow systems are expected to be localized and limited to the duration of each flood and flood recession.

Theme	Topic	Response Summary
	Quidi Vidi Lake has changed the elevation through modification of the stop log configuration. Is there a correlation between the elevation of Quidi Vidi (QV) Lake and flooding with the Portugal Cove Road and Kings Bridge Road Area?	The assessment considered local flow systems only within Portugal Cover Road to Kings Bridge Road.
Watercourse and Riparian Area Effects	Could the project result in the development of new channel?	The assessment indicates that changes to morphology may occur as a result of the berms during larger flooding events, such as a1:100 AEP events. Smaller events, such as the 1:2 AEP event did not show increases in velocity along the berms. To mitigate the effect of changes to the river morphology, erosion mitigation measures may be required along the face of the new berm and along downstream sections of the river that are not currently stabilized. These options could include riprap, turf reinforcement mats (TRMs), or reinforced vegetation or erosion control blankets.
	The Rennies River provides spawning habitat for fish species. How will the project minimize effects to the watercourse and potentially sensitive areas of species, such as Brown Trout	Berms will be designed to minimize encroachment on the river. If in-water works are required, they will occur during the summer low flow period (June 1 to September 30) to avoid sensitive life stages of aquatic life (from October 1 to May 31). Specific to Brown Trout, work within the watercourse from October 1 to November 30 (DFO, 2019) will be avoided. If in-water works cannot be completed during the summer low flow period, the project could be completed in phases and portions rescheduled to the following year. Other mitigation measures that will be used include: • Adjacent to watercourses only clean rock fill materials (minimal fines) will be used to reduce the potential of release of sediments, or any other materials considered deleterious, to fish and fish habitat. • Erosion and sediment control measures shall be implemented to reduce effects to fish and fish habitat such as silt fences and sandbags • Removal of vegetation along the watercourse will be minimized.
	How will the Project minimize effects to the Riparian area, such as removal of Vegetation adjacent to the river?	The primary location of the berms will be located within the existing trail right-of-way. Some vegetation will be removed for the location of the berm footprint and to allow access of equipment. The two berm configuration attempts to reduce the vegetation clearing requirements and number of mature trees which would require removal.

Theme	Topic	Response Summary
	Will the Project result in waterlogged soil and impact on trees within the Riparian Area	Under existing 1:100 AEP CC conditions, riparian areas adjacent to the Rennies River presently experience flooding during a 1:100 event. This is denoted on Figure 6.1. The Project will not result in more frequent flooding. However, it will result in the diversion of water from the low lying areas, and containing it with the existing topography. The water level is projected to increase up to 0.4 m during the 1:100 AEP CC event. The water will only remain in the area for a short period of time before receding to pre-storm conditions.
Resource Conflict	As per the EPR Guidelines, how will the City avoid interference with the rights of other legitimate landowners/users?	The City will engage with the adjacent landowners during the design of the structures to minimize potential resources conflicts. Agreements may be required with landowners as part of future stages of the Project, if Project activities are to encroach on private properties. The two-berm alternative combination (Berm 1 -2) utilizes the existing topography, such as shown on Figure 4.8, to contain water within the existing floodplain to the south / southeast. This option minimizes the amount of road infrastructure, power utilities, and building on private properties that will be flooded while reducing the need for multiple berms, and associated conflict with landowners and land users. In turn this also minimizes the extent of required alteration along to Rennies River, and disruption of existing facilities while still reducing the effects of the flood. Further information is provided in Section 4.3.2.1.
	Does the Project include the removal of the Existing Trail?	The berms construction will be focused within the existing trail alignment. Once complete, the trail would be oriented on top of the berm.
Engagement Process and Further Consultation	Seems like people living near the proposed berms should be consulted before the Province approves the plan?	The engagement is a key part of the EPR process. As per the EPR Guidelines, one of the items identified is to hear the feedback from the community and how document how concern will the addressed.
	Can in-person meetings be scheduled onsite with individual property owners who are adjacent to these proposed berms?	The Project is still at the conceptual stage and is still ongoing design refinement at this stage. The City is open to those conversations with property owners adjacent to the proposed berms and affected areas.
	How else can someone provide feedback on the Project?	As part of EPR, one of the items identified is to hear the feedback from the community and provide response to how will the concern be addressed. The engagement is a key part of the process. The Project is still in design refinement at this stage, and the City is open to those conversations.

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8 Approval of Undertaking

After completion of the environmental assessment process, the Project is anticipated to require federal and provincial environmental permits, approvals, and authorizations. Table 8.1 provides a list of the anticipated permits, approvals, authorizations, or reviews that may be required, the enabling legislation, and the regulatory agency responsible for administration. Respective approvals, permits, authorizations or reviews will be in place prior to the commencement of construction activities, such as Permit to Alter a Body of Water and Request for Review, prior to in water works.

Table 8.1 Permits, Approvals, Authorizations or Reviews Anticipated for the Project

Permit, Approval, Authorization or Review	Applicable Legislation	Issuing Body
Approval for the Undertaking	*Environmental Protection Act* / *Environmental Assessment Regulation*	Minister of Environment Climate Change and Municipalities
Permit to Alter a Body of Water Schedule F – Stream Modification Schedule J - Miscellaneous Works in a Freshwater Body i.e. Other works not specific to above schedules	*Water Resources Act,* SNL 2002	NSECC Water Resources Management Division
Request for Review *	*Fisheries Act*	Fisheries and Oceans Canada (DFO)
Development, Building, and Occupancy Permits	*City of St. John's Act*, RSNL 1990	St. John's City Council

* If DFO determines that the project results in harmful alteration, disruption, or destruction (HADD)of fish habitat, a DFO Authorization and offsetting plan may be required.

9 Project Related Documents

The following section includes a summary of the documents used to generate this EPR.

9.1 Project Specific Studies

The following documents have been completed to identify the need for the Project, identified potential alternatives, and provide further information to this EPR. The locations of the studies are provided below:

Available Online: CBCL. 2014. Rennies River Catchment Stormwater Management Plan (RRCSMP): Final Report. File No. 123097.00. Report prepared for City of St. John's by CBCL, St. John's, NL. Dated April 15, 2014. Available Online: http://www.stjohns.ca/sites/default/files/files/publication/Rennies%20River%20Catchment%20Stormwater%20Management%20Plan_0.pdf

Appendix A – Design Sketches
Conceptual Plan View
Conceptual Cross Sections

Appendix B – Flood Mitigation Studies

CBCL. 2020. Rennies River Flood Mitigation – Phase 2A – Additional Analysis. Draft Final Report. File No. 193030.00. Report prepared for City of St. John's by CBCL, St. John's NL. Dated March 2, 2020.

CBCL. 2021a. Rennies River Flood Mitigation - Winter Avenue. Report prepared for City of St. John's by CBCL, St. John's NL. Dated January 19, 2021.

CBCL. 2021b. Long Pond Flow Control Structure Environmental Assessment. Report prepared for Department of Environment, Climate Change and Municipalities by CBCL, St. John's NL. Dated July 16, 2021.

Appendix C – River Morphology Assessment

CBCL. 2022. Rennies River Flood Mitigation – Portugal Cove Road to Kings Bridge Road – River Morphology Assessment. Letter prepared for Newfoundland and Labrador Environment, and Climate Change by CBCL, St. John's NL. Dated March 15, 2022.

Appendix D – Pre-EPR Public Consultation Documents

Appendix E – EPR Public Consultation Documents

9.2 Reference Documents

The following references were used in support of this EPR:

Bishop, Robert (Bob). President of Salmonid Association of Eastern Newfoundland (SAEN), St. John's, Newfoundland and Labrador. February 22, 2021.

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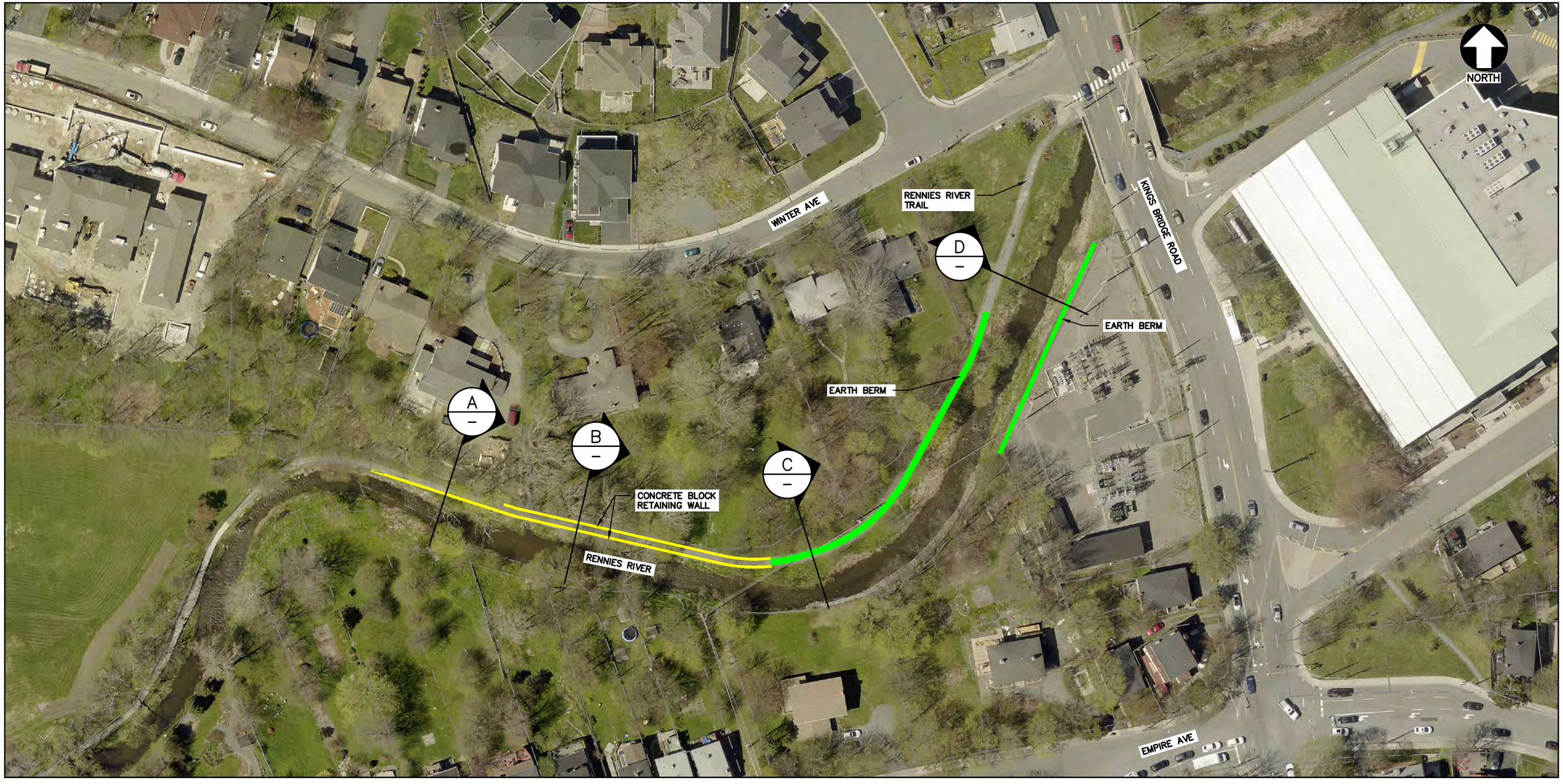
Appendix A

Design Sketches



PLAN

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1:1000

No.	Description

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
MAR 17 2022	AS SHOWN	-	JRB	JSB	GES	213032.00	-

CBCL

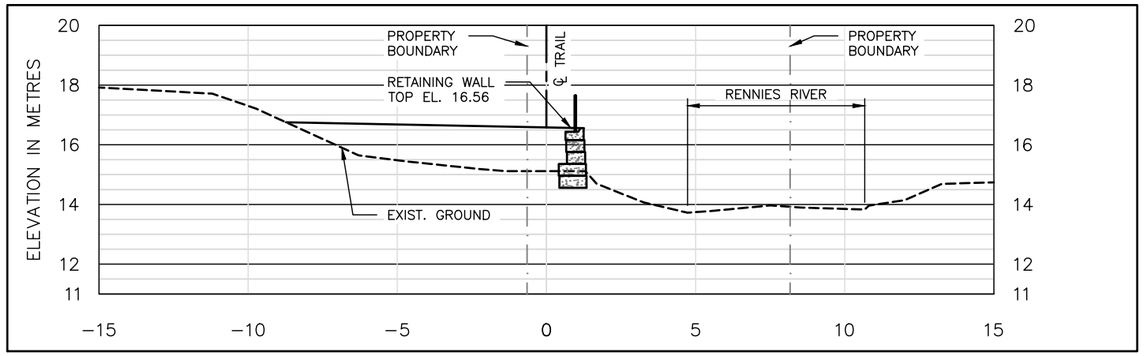
CITY OF ST. JOHN'S
RENNIES RIVER PHASE 2 EPR

WINTER AVENUE BERMS AND RETAINING WALL PLAN

Drawing

A-1

DRAWING NAME: \\CBCLLAN\CBCLST. JOHN'S\DATA\JOBS\2021\213032.00 CSJ RENNIES RIVER, PHASE 2 EPR\44 CAD\01 CIVIL\04 SKETCHES\213032.00-FIGURES.DWG LAYOUT NAME: PLAN PLOT DATE: March-17-22 3:21:00 PM CAD OPERATOR: JLARACY



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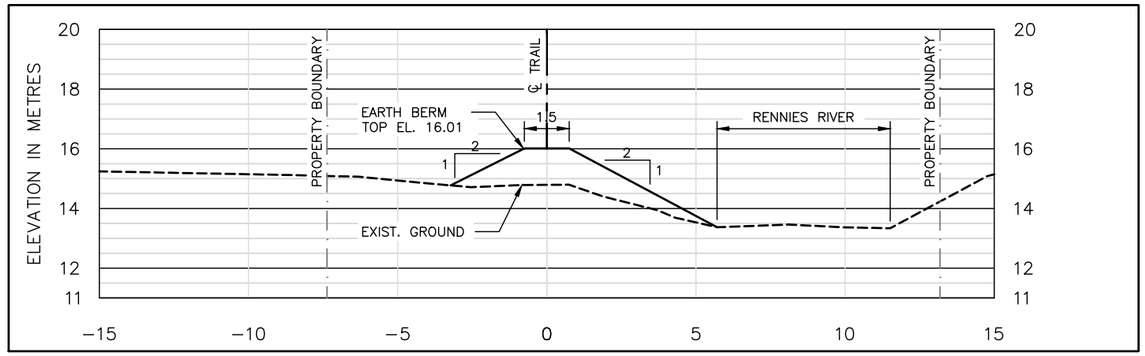

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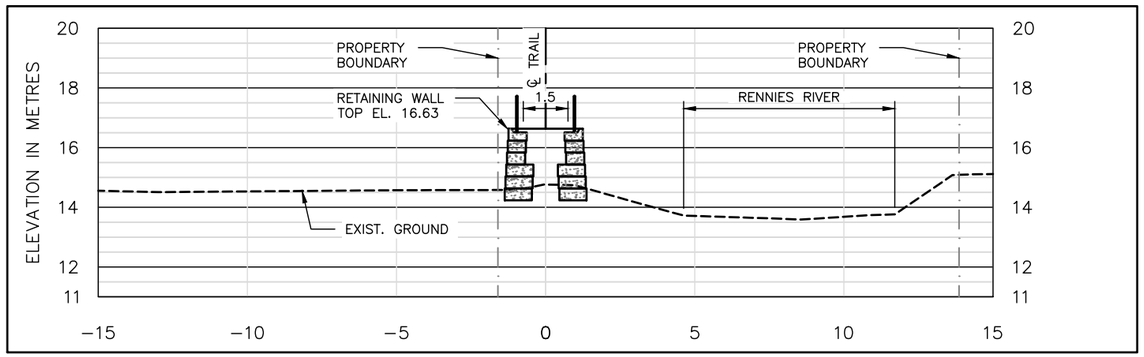

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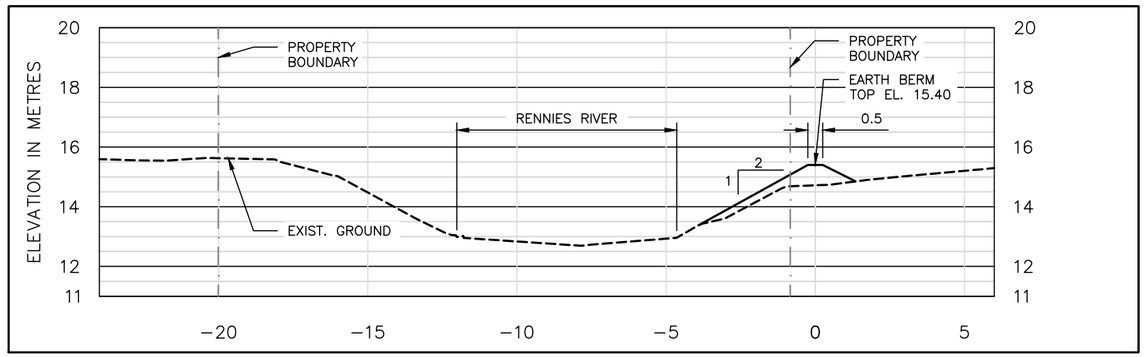

D – SECTION
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1:200

No.	Description

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
MAR 17 2022	AS SHOWN	-	JRB	JSB	GES	213032.00	-

CBCL

CITY OF ST. JOHN'S
RENNIES RIVER PHASE 2 EPR

WINTER AVENUE BERMS AND RETAINING WALL SECTIONS

Drawing
A-2