

4 Project Description

4.1 Introduction

The contents of this chapter are divided into two primary sections:

- » **Design Criteria (Section 4.2):** The Design Criteria for Stage 2 ION define principles for design of a safe and operationally effective transit system. The Region's Roadway Classification system is summarized, along with the appropriate design parameters to be used for each classification of road. Finally, sub-sections break down, by category, the key Design Criteria used to develop the Stage 2 ION route and stations and discuss their derivation and overall application.
- » **Proposed Stage 2 ION LRT Route (Section 4.3):** A detailed summary of the key features and functional design elements for the Stage 2 ION route is described. The route is divided into five segments which are each described separately; each section includes an outline of the route alignment and associated cross-sections, the station locations and context specific impacts and opportunities along the corridor. Functional design plans are included in **Appendix A**.

4.2 Design Criteria

The design criteria for the project were established very early on in the study, in consultation with the Technical Advisory Committee (TAC). The design criteria outline standards governing the planning and designs of various elements of the roadway, LRT and active transportation components.

In developing the design criteria, the following considerations were key:

- » safety of passengers, workers and the public
- » cost effectiveness for design, construction, capital infrastructures and operations
- » public and community disruptions
- » system reliability and passenger comfort
- » opportunities for development and re-development

These design criteria address three principles:

- » Hierarchy of modes/users
- » Infrastructure requirements; and
- » Design parameters

These principles are outlined in more detail in **Table 4-1** below.

Table 4-1: Design Criteria Guiding Principles

Principle	Development	Guiding principles/ elements
Hierarchy of modes/users	To support sustainable development and to achieve the Region’s mode share targets, the Region’s approach to identifying transportation priorities was reviewed, particularly around future high density growth nodes and transit station areas.	In designing the rapid transit corridor, priority is given in the following order: <ul style="list-style-type: none"> • Walking; • Cycling; • Public transit; • Carpooling and other sustainable commute strategies; and • Single occupant vehicles.
Infrastructure requirements	The majority of the rights-of-way that were considered and those that were ultimately selected for the Stage 2 ION alignment have numerous infrastructure elements other than transportation that compete for the same space, these include: <ul style="list-style-type: none"> • Subsurface public utilities • Above ground public utilities • Subsurface private utilities • Above ground private utilities • Landscaping • Street furniture and public art • Bus stops • Snow storage • Signage and billboards The requirements for each of these elements was identified along with the desire to move, improve or bury infrastructure according to the guiding principles.	Guiding principles: <ul style="list-style-type: none"> • No subsurface utilities run parallel beneath LRT track beds and ION Stations have an exclusion zone which permits future access/ replacement/ rehabilitation of the infrastructure without disruption to LRT operations. • Landscaping and street furniture be provided wherever possible to transform and enhance the streetscape. • Multiple elements (e.g. utilities, overhead catenary system, lighting, signals) be co-located on poles to minimize pole clutter. • No overhead utility crossings of LRT alignment, utility crossings must be buried. • Allowances be provided for future utility crossings. • The various system elements (e.g. lighting, street furniture, poles, stops) have a unified aesthetic.
Design Parameters	To develop the design concepts within corridors, key design elements and associated parameters were identified early in the study and these were examined, added to and adjusted throughout the evolution of the project.	Design Elements: <ul style="list-style-type: none"> • Lanes • Medians • Pedestrian Facilities • Cycling Facilities • Parking • Platforms • Driveways • Curb Radii



Principle	Development	Guiding principles/ elements
		<ul style="list-style-type: none"> • Design Speeds • Design Vehicles • Grades • Vertical Clearances • Safety Elements








Design criteria were established based on Region roadway and active transportation design standards (as applicable), and Provincial and Federal standards and guidelines. In order to provide a design for Stage 2 ION which is consistent and compatible with Stage 1, the design criteria were also cross-referenced with the design standards established for Stage 1 ION. The following documents provide design references applicable to this Project:

- » Context Sensitive Regional Transportation Corridor Design Guidelines
- » TAC Geometric Design Guide for Canadian Roads
- » Region of Waterloo Transportation Engineering Practice “The Blue Book”,
- » Region of Waterloo 2018 Transportation Master Plan: Moving Forward
- » Region of Waterloo’s “General Conditions, Supplemental General Conditions, Standard Specifications, Standard Special Provisions and Drawings”
- » Ontario Traffic Manual (OTM) series of Books
- » Region Policy for Access onto Regional Roads, 1984
- » The American Railway Engineering and Maintenance-of-Way Association, (AREMA), 2015
- » Canadian Highway Bridge Design Code (CHBDC), 2007
- » Transport Canada’s “Standards Respecting Railway Clearance”, 1992







For the segments of Stage 2 ION that are located within or adjacent to a roadway corridor, the criteria parameters for Stage 2 ION derive from the Context Sensitive Regional Transportation Corridor Design Guidelines, which set different parameters based on roadway classification. The Regional Roadway Classifications applicable along the Stage 2 ION route are defined below and illustrated in **Figure 4-1**:

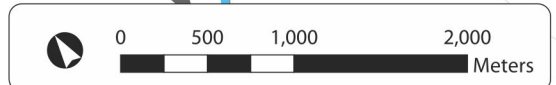
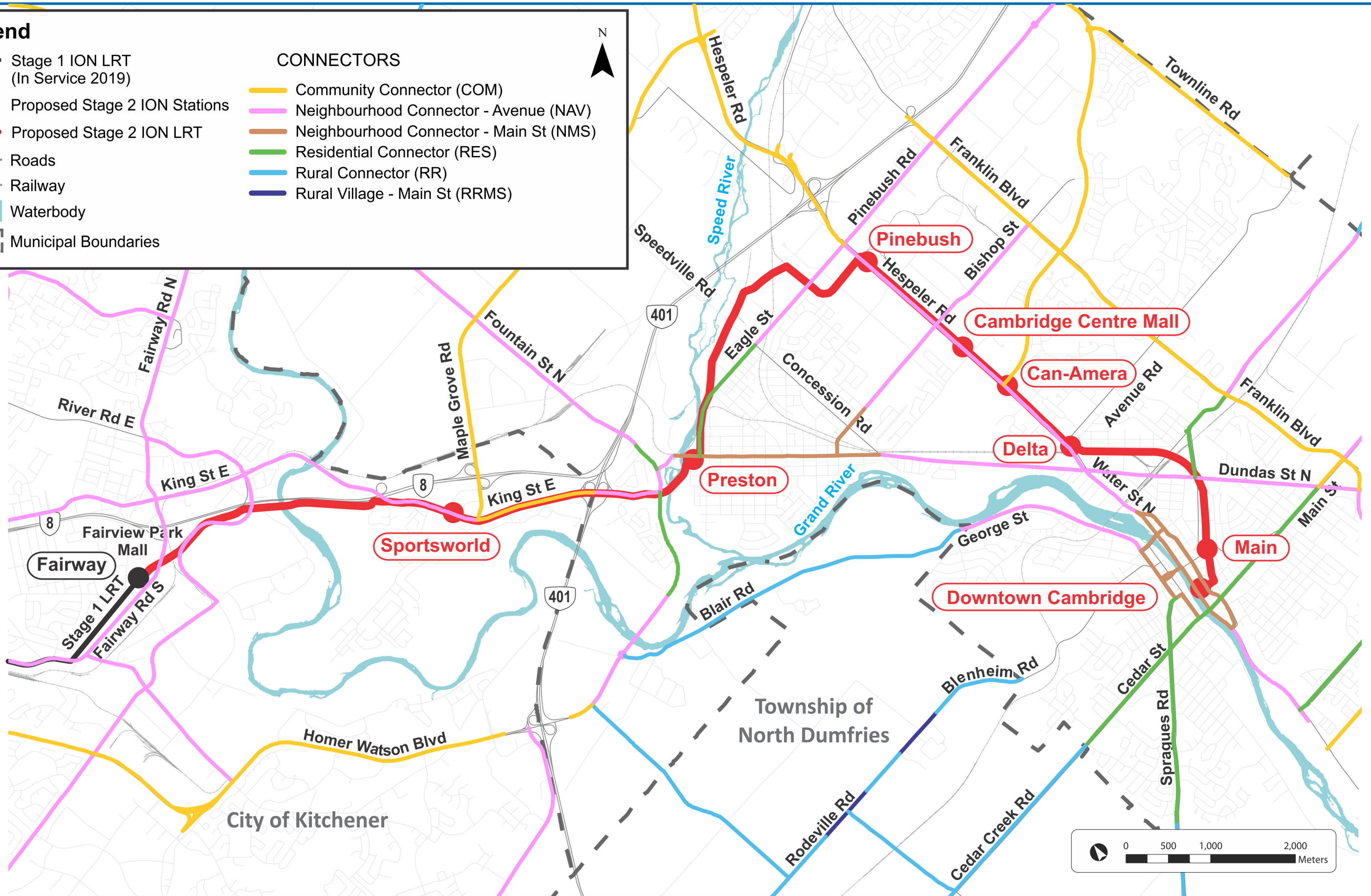
- » **Community Connector:** Connects to 400 series highways, Conestoga Parkway (expressway), other Community Connectors, Neighbourhood Connectors, and Rural Connectors. Community Connectors cross several communities within the Region and incorporate a high degree of access control. Community Connectors focus on moving vehicles and can be considered for higher order transit corridors. Facilities for active transportation (bicycles and pedestrians) are accommodated within the corridor however; consideration should be given to separating the facilities from the roadway. Community Connectors typically incorporate wide, landscaped centre medians.

Legend

-  Stage 1 ION LRT (In Service 2019)
-  Proposed Stage 2 ION Stations
-  Proposed Stage 2 ION LRT
-  Roads
-  Railway
-  Waterbody
-  Municipal Boundaries

CONNECTORS

-  Community Connector (COM)
-  Neighbourhood Connector - Avenue (NAV)
-  Neighbourhood Connector - Main St (NMS)
-  Residential Connector (RES)
-  Rural Connector (RR)
-  Rural Village - Main St (RRMS)



- » **Neighbourhood Connector (Avenue):** Located in existing built up areas with adjacent development facing the street but set back to incorporate large front yards and front yard parking, typical of medium to large format commercial, shopping malls, community facilities and low-rise neighbourhoods. Avenues also include roadways with back-lotted residential. Avenues have larger rights-of-way than Main Streets and include many opportunities for re-urbanization. The designs for Avenues typically incorporate wide, landscaped centre medians.
- » **Neighbourhood Connectors (Main Street):** Located in existing built up areas characterized by buildings that address the street with small or no setbacks. Buildings, lot sizes and right-of-way widths are typically smaller than those found within Avenues. Although intensification is encouraged on main streets, re-development should be required to respond to the scale and character of the area.
- » **Residential Connectors:** Short segments of roadway typically located in built up residential areas linking Neighbourhood Connectors and Rural Connectors. They are flanked primarily with residential uses of varying sizes and densities together with supporting neighbourhood uses such as schools, parks, and places of worship. Buildings are typically located close to and oriented towards the street with numerous driveways. Residential Connectors are supportive of active transportation (bicycles and pedestrians) and provide facilities (design and comfort) for pedestrians, cyclists and transit users.

The remaining subsections break down the key Design Criteria used to develop the design by category and discuss their derivation and overall application pertaining to the Stage 2 ION route.

The design criteria at this stage of the project is subject to refinements during future design phases, and will be further informed by lessons learned from the operation of Stage 1 ION. The final design criteria will be established and confirmed once the detailed engineering work of the corridor is undertaken.

4.2.1 LRT Design Criteria

Design criteria for the LRT runningway and associated roadway/runningway elements have been developed using reasonable operational parameters and informed by Stage 1 ION. For the purposes of planning, the project has been designed to accommodate two-car Light Rail Vehicle (LRV) trains; each car with dimensions 30m long and 2.65m wide. Based on this; other notable LRT criteria used in development of the preliminary design and their associated parameters are listed in **Table 4-2**. The design principle is to apply Preferred criteria wherever possible, and Minimum criteria where constraints are present.

Table 4-2: Preliminary Design Criteria for LRT Runningway

Criteria	Minimum (m)	Preferred (m)
Lanes: <ul style="list-style-type: none"> LRT runningway or carriageway between two non-mountable obstacles (i.e. between two curbs) 	4.8	5.5
Radii <ul style="list-style-type: none"> LRT centreline radius 	25.0	n.a.
Design Speed <ul style="list-style-type: none"> On-street Rapid Transit 	Posted	Posted
Grades <ul style="list-style-type: none"> Maximum Grade (%) Minimum Grade (%) 	6.0 0.5	6.0 0.5
Horizontal Tangent Lengths Between Curves	14.0	65.0

The maximum grade parameter set for the LRT is ultimately limited by traction power and braking capabilities of the system and vehicles, these parameters were determined with input from the vehicle manufacturer. The parameters outlined in **Table 4-2** also take into account external factors that may impact traction between the vehicle wheels and the LRT tracks, which could impact the vehicles reliability to climb and descend at steeper grades. These factors include but are not limited to: weather contributing factors (precipitation, temperature changes, etc.); disabled vehicles being pushed or towed; and potential lubricants present on tracks from other vehicles. A minimum grade of 0.5% is desired to allow for proper drainage.

4.2.2 LRT Stations

Stage 2 ION station platforms are generally 65 m in length and 3.5 m in width. These dimensions are consistent with the dimensions from the Stage 1 ION stations and provide enough space to accommodate station amenities. **Table 4-3** outlines the minimum and preferred design criteria for stations.

Table 4-3: Preliminary Design Criteria for LRT Stations

Criteria	Minimum (m)	Preferred (m)	
LRT Station Platforms	Platform Width (single direction)	2.5	3.5
	Platform Width (bidirectional)	4.5	6.0
	Platform Length	65.0	65.0
Horizontal Tangent Lengths	Beyond Edge of Platform	14.0	65.0

The typical features present at ION LRT Station platforms include:

- » Anchor walls; architecturally distinct to each neighbourhood;
- » Canopy and heated shelters;
- » Benches;
- » Garbage/recycling bins;
- » Bike racks;
- » Platform card readers for trip validation;
- » Fare collection/ticket vending machines;
- » Passenger information displays and audio speakers;
- » Security cameras and emergency call boxes;
- » System map/information;
- » Lighting; and
- » Safe access between platforms and adjacent public domain (i.e. sidewalks, parks, paths, businesses, etc.) including wayfinding signage.

The existing Fairway ION Station, which is currently the southern terminal station for Stage 1 ION and where Stage 2 ION will initiate, is equipped with an operator's facility including a driver rest area and washroom. The future Stage 2 ION station in Downtown Cambridge also includes an operator's facility.

All station elements will be developed further in a future design phase, and will comply with the standards of the *Accessibility for Ontarians with Disabilities Act (AODA)*.

There are three common layouts for LRT Stations:

- » **Adjacent Side-Loading Platforms:** In this configuration, the two station platforms are directly across from one another with LRT tracks located in between. This station layout requires the largest cross section of the options. Central Station on Stage 1 ION (see **Figure 4-2**) is an example of this configuration.
- » **Staggered Side-Loading Platforms:** This is also called a "split station" configuration with platforms located on opposite sides of an intersection. This station layout minimizes the overall cross section width required to accommodate an LRT station. **Figure 4-3** is a rendering of the vivaNext BRT in York Region showing a typical split station configuration on the far side of the interchange.
- » **Centre-Loading Island Platform:** This configuration has one wide platform located in the centre with LRT tracks on either side. The platform is required to be wider to accommodate passengers traveling in both directions. The Block Line Station on Stage 1 ION (see **Figure 4-4**) is an example of this configuration.



Figure 4-2: Adjacent Side-Loading Platform Configuration



Figure 4-3: Staggered (Far Side) Side-Loading Platform Configuration (example from York Region vivaNext BRT)



Figure 4-4: Centre-Loading Island Platform Configuration

4.2.3 Grand River Transit Stops

GRT bus stops are located in the boulevard with a concrete landing pad between the curb and sidewalk and, where width permits, a separate shelter pad behind the sidewalk. The following describes common elements and amenities which may be present at GRT bus stops (where space permits):

- » Shelter,
- » Lighting,
- » Passenger Information Displays (PIDs);
- » Pedestrian waiting area and benches;
- » Bicycle parking zone and rack;
- » Stop marker;
- » Snow clearing buffer; and
- » Garbage cans.

Stop locations were reviewed in consultation with Transit Development staff from Grand River Transit, and can be dependent on a number of location-specific factors.



Figure 4-5: Typical GRT Bus Stop

4.2.4 Inter-Regional Transit

Inter-regional transit providers with services into and out of the study area include:

- » GO Transit passenger bus service, which depart from Sportsworld Station in Kitchener and Cambridge Smart Centre (at Hespeler Road and Pinebush Road) in Cambridge;
- » Greyhound Bus Lines, which departs from Sportsworld Station and Cambridge Centre Station; and
- » Coach Canada/Megabus coach buses, which depart from the Ainslie Street Terminal.

In order to continue to accommodate these services traveling into and out of the region and provide convenient connections with LRT, their vehicle roadway, stop and lay over requirements were considered during the preliminary design.

4.2.5 Sidewalks and Active Transportation

The design criteria parameters used in the development of pedestrian and cycling elements differ based on the Region’s classification of each roadway corridor. These classifications, as defined by the Context Sensitive Regional Transportation Corridor Design Guidelines, are discussed above and illustrated for the project study area in **Figure 4-1**. The minimum and preferred cross-section dimensions for each element are shown in **Table 4-4** for roadway corridors classified as Community or Neighbourhood Connectors, which apply to the majority of the corridors along the Stage 2 ION route.

As the design guidelines for active transportation, especially cycling, have been evolving relatively fast, the design includes the latest concept of cycling facility design at intersections, midblock sections, and at transit stops and stations. Further review of active transport elements will be conducted in the next design phase to incorporate the latest guidance including design elements of sidewalks, multi-use trails and/or cycle lanes and intersection crossings.



The 2018 Regional Transportation Master Plan Update: *Moving Forward*, which incorporates and updates the 2014 Active Transportation Master Plan, identifies existing and future corridors for Active Transportation prioritization. In general, the Region is looking to implement All Ages and Abilities (AAA) cycling facilities wherever possible, and this is especially important at and around the ION corridor where the interconnection between active transportation facilities and the transit service will be integral to ION’s success. Where possible these have been integrated into the Stage 2 ION functional design. The design for Hespeler Road incorporates the Region’s Active Transportation recommendations for cycling facilities along the corridor. The need for upgraded trails and cycling facilities along Shantz Hill Road and Eagle Street North have been identified; these improvements are noted on the functional design plates in Appendix A and will be further addressed during a future design phase.

Table 4-4: Preliminary Design Criteria for Sidewalks and Active Transportation Facilities

Criteria	Community Connector		Neighbourhood - Avenue		Neighbourhood - Main Street	
	Minimum (m)	Preferred (m)	Minimum (m)	Preferred (m)	Minimum (m)	Preferred (m)
Sidewalk width with boulevard	1.5	1.8	1.5	2.1	1.5	2.5
Sidewalk width without boulevard (curb-face)	1.8	2.1	1.8	2.1	1.8	2.1
Crosswalk width	3.0	4.0	3.0	4.0	3.0	4.0
Median for pedestrian refuge	1.75	3.0	1.75	3.0	1.8	3.0
Pedestrian buffer zone width	0.5	0.8	0.5	0.5	0.5	0.5
Landscape zone width	1.0	3.0	1.0	4.0	1.0	3.0
Multi-Use Trail width	3.0	3.0	3.0	3.0	n.a.	n.a.
Bike lane width	1.5	1.8	1.5	1.8	1.5	1.8
Separated cycling facilities	1.8+0.5 boulevard	2.0+0.7 boulevard	1.8+0.5 boulevard	1.8+0.7 boulevard	n.a.	n.a.

To provide convenient connections for cyclists and support the Region’s goals for transit-supportive micromobility systems like bike share, bicycle parking will be provided and bike repair stands will be considered at all Stage 2 ION stations. To accommodate riders, ION also has a policy of allowing bicycles on trains.

4.2.6 General Traffic Lanes

The design criteria for general traffic lane widths differ based on the Region’s classification of each roadway corridor. These classifications, as defined by the Context



Sensitive Regional Transportation Corridor Design Guidelines, are discussed above and illustrated for the project study area in **Figure 4-1**.

Table 4-5 shows the parameters for lane widths, turning radii, design speed and design vehicles for general traffic lanes. The following exceptions override the values in **Table 4-5** where the specified conditions exist:

- » Undivided roads with one lane in each direction shall have a minimum lane width of 4.0 m;
- » Turning lane width shall be a minimum of 3.25 m where GRT or truck routes are designated;
- » Curb radii shall be based on design vehicle, percentage of trucks, posted speeds, bus routes and other factors; and
- » To reduce the turning speeds of cars while accommodating large vehicles at locations with cross rides, the installation of aprons may be required.

Table 4-5: Preliminary Design Criteria for Roadway and Traffic Lanes

Criteria	Community Connector		Neighbourhood - Avenue		Neighbourhood - Main Street	
	Minimum (m)	Preferred (m)	Minimum (m)	Preferred (m)	Minimum (m)	Preferred (m)
Left-turn Design Vehicle	WB-17	WB-20	WB-17	WB-20	SU	WB-19
Right-turn Design Vehicle	WB-17	WB-20	WB-17	WB-20	SU	WB-19
Design speed general traffic	Posted	Posted	Posted	Posted	Posted	Posted
Curb lane width without bike lane	3.35	3.65	3.35	3.65	3.05	3.65
Curb lane width with bike lane	3.35	3.35	3.35	3.35	3.35	3.35
Other travel lane width	3.25	3.35	3.25	3.35	3.25	3.25
Auxiliary turn lane width	3.0	3.25	3.0	3.25	3.0	3.25
Dual left turn lane width	3.5	3.5	3.5	3.5	3.5	3.5
Transit lane width	3.35	3.65	3.35	3.65	3.35	3.65
Curb width	0.21	0.5	0.21	0.5	0.21	0.5
Curb radius	7.5	9.0	context	9.0	context	9.0



Right and left turning movements for general traffic will be limited based on the alignment of the LRT within the roadway and the active transportation requirements. For example, centre-running LRT on a roadway limits any left turns between signalized intersections. For further detail see **Sections 4.2.7 Driveways and Access** and **4.2.8 Traffic Signals**.

4.2.7 Driveways and Access

The preliminary design criteria include parameters for driveways and access roads based on the Region's classification of each roadway corridor including:

- » Commercial two-way driveway width;
- » Commercial one-way driveway width;
- » High volume commercial driveway width; and
- » Non-commercial driveway width.

It is an objective of this project to maintain access to all businesses and residences along the corridor. Median-running LRT on a roadway limits left turning movements for general traffic. Where LRT runs in the centre of the road, all left turns between signalized intersections are eliminated and access to businesses and properties is right-in/right-out only. In order to maintain adequate access to properties, U-turns are accommodated from a shared left-turn/U-turn lane during a protected signal phase to allow for easy turn around.

The Region will continue to work with property owners seeking to develop lands along the Stage 2 ION route to provide access for vehicles and pedestrians.

4.2.8 Traffic Signals

In areas with a centre running LRT alignment (for example, on King Street and Hespeler Road) existing traffic movements are maintained at intersections. Implementation of the LRT corridor requires modifications to include additional signal heads for the LRT and potentially for cyclists where there are cross rides. Signal timing and phases also require adjustments to improve the flow of both LRT vehicles and general traffic across the corridor, and to minimize impacts for active transportation users.

As discussed in the previous section, it is a requirement of this study to maintain access to all businesses and residences along the corridor, and introducing median-running LRT on a roadway limits left turning movements for general traffic. Therefore, traffic signal improvements also involve the addition of appropriate turn signals and signage for U-turns on the dedicated left-turn phase at appropriate intersections. These additions are necessary at major intersections to allow general traffic access to properties and businesses on opposite side of the road to traffic flow which will have right-in-right-out only access between intersections.

4.2.9 Illumination

Streetlighting is generally located in the boulevard within the continuity strip between the curb and sidewalk. Existing lighting levels, where applicable, will be maintained or



upgraded as necessary to provide safe and adequate lighting levels for both pedestrian and vehicle traffic that meet the Region's Illumination Policy.

Consistent with Stage 1 ION, Stage 2 ION station platforms will include integrated lighting in shelters and adjacent bus stops, as well as light standards along the length of the platforms to provide a safe and comfortable pedestrian environment.

4.2.10 Utilities

(1) Municipal Utilities

The relocation of municipal utilities – watermains, sanitary sewers and storm sewers – may be required to either accommodate the alignment of the LRT corridor or to provide sufficient horizontal spacing between utilities to meet municipal servicing and regulatory requirements.

Municipal service relocations will comply with Region of Waterloo and applicable City of Kitchener or City of Cambridge regulatory standards and requirements. Watermains and sewers are located outside of the LRT runningway in accordance with the Region's exclusion zone. These services are commonly located under the roadway. Underground municipal service crossings under planned station locations should be considered for relocation given the challenges accessing these buried facilities after station construction. Where service crossings cannot be relocated away from the station areas, they should have a protective sleeve and additional isolation valves or maintenance hole structures.

(2) Private Utilities

The relocation of aerial and underground private utilities may be required to eliminate identified conflicts caused generally by the need to:

- » Accommodate the horizontal or vertical alignment of the LRT corridor, planned utilities or drainage infrastructure, or
- » Provide sufficient spacing between existing and/or proposed utilities to meet municipal servicing and regulatory requirements.

The known existing private utility providers with infrastructure in the project study area are noted in **Section 5.4.4**.

Relocations of telecommunications, power and gas services will comply with regulatory standards and requirements:

- » Aerial Hydro and Telecommunication lines in conflict with Light Rail OCS will require relocation. Hydro poles are preferably located behind the sidewalk if necessary.
- » Underground Hydro and Telecommunication services are ideally located under the boulevard continuity strip between the back of curb and sidewalk or under sidewalk; these services can often be combined into an underground joint utility trench with streetlighting and traffic signal cables.



- » Existing gas main under proposed station locations should be considered for relocation.

4.2.11 Railway Crossings

All locations where Stage 2 ION crosses CP Rail or CN Rail corridors will be fully grade separated. Crossings (e.g. horizontal and vertical clearance) will be designed in accordance with the AREMA (American Railway Engineering and Maintenance-of-way Association) Manual for Railway Engineering, CN Engineering Specifications for Industrial Tracks, and applicable design standards and specifications provided by CP Rail during the next design phase.

4.2.12 Structures

Elevated structures will be provided at key locations to carry Stage 2 ION over roadways or railways, or to traverse watercourses. All LRT structures support one track in each direction, along with walkways on each side of the tracks for maintenance and emergency passenger egress. The typical cross-section is just under 10 m wide.

All structures are designed in accordance with the Canadian Highway Bridge Design Code and other applicable standards.

4.2.13 Special Track Work

Generally, the LRT runningway will consist of either embedded track or ballasted track. Special trackwork includes cross-overs between adjacent track segments to facilitate moving Light Rail Vehicles (LRVs) between the track alignments. Cross-overs also serve as turn back or terminus points for LRVs during maintenance or construction.

Track work is designed according to American Railway Engineering and Maintenance-of-Way Association (AREMA) specifications.

4.2.14 Traction Power Substations

A Traction Power Substation (TPSS) is a building similar in size to a double car garage with a footprint of approximately 4.5 m by 14.5 m. A TPSS converts commercial alternating current (AC) electricity into the direct current (DC) power used by the light rail vehicles. TPSS are the main component of the overall traction electrification system for the Light Rail Transit system.

The determination of TPSS requirements is based on modelling and analysis, and takes into account the runningway operating speed, alignment and frequency. A preliminary assessment has identified the need for 12 TPSSs based on the anticipated operating criteria. More detailed modelling and analysis will be required in the next phase of design to confirm the final locations and electrical requirements for the TPSS. At that time, final locations and sizing of TPSS infrastructure will be confirmed. The physical features of the TPSS will be assessed for context sensitive design opportunities such as cladding or visual screening to integrate the substations into the surrounding environment.



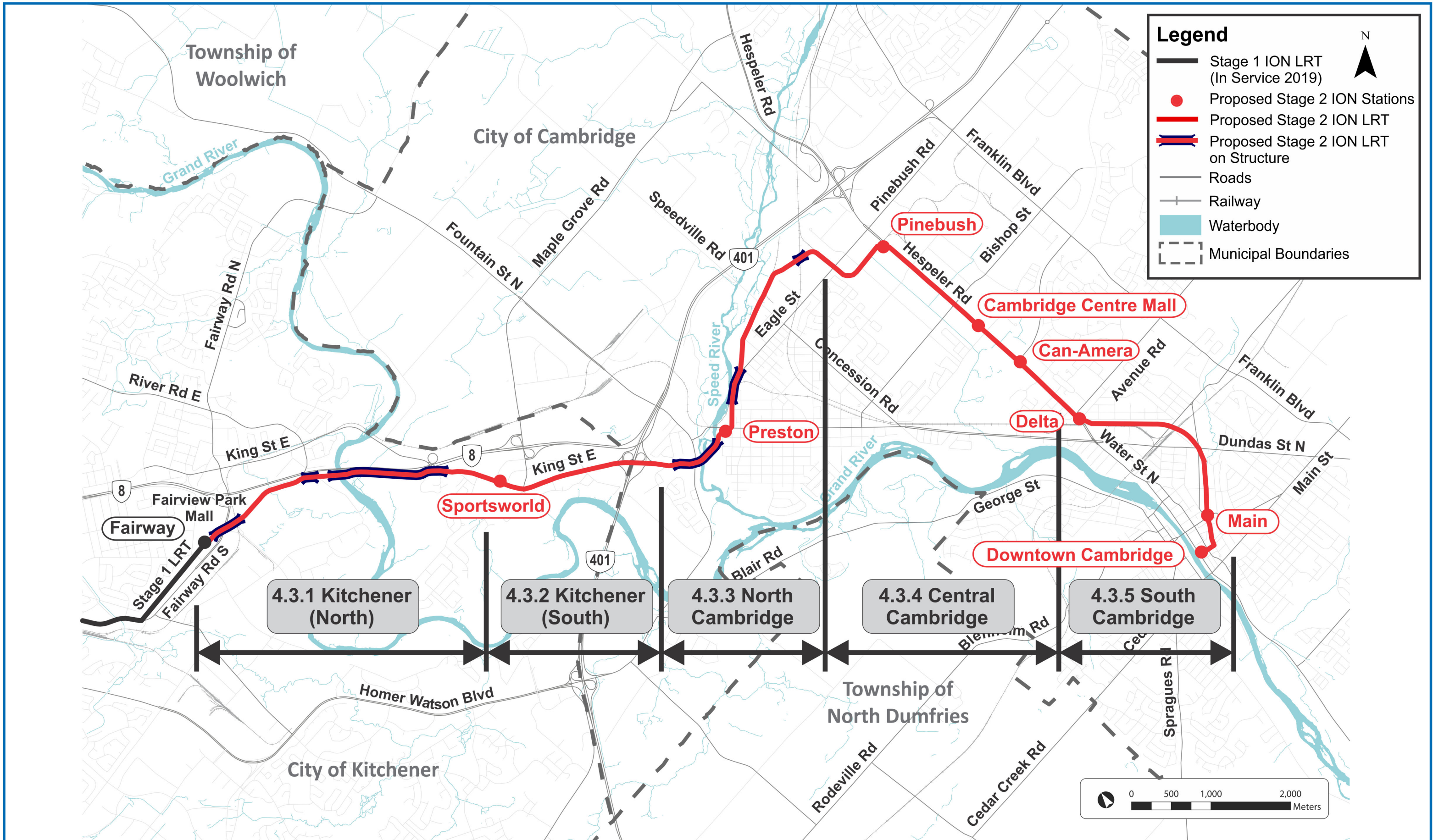
4.3 Proposed Route

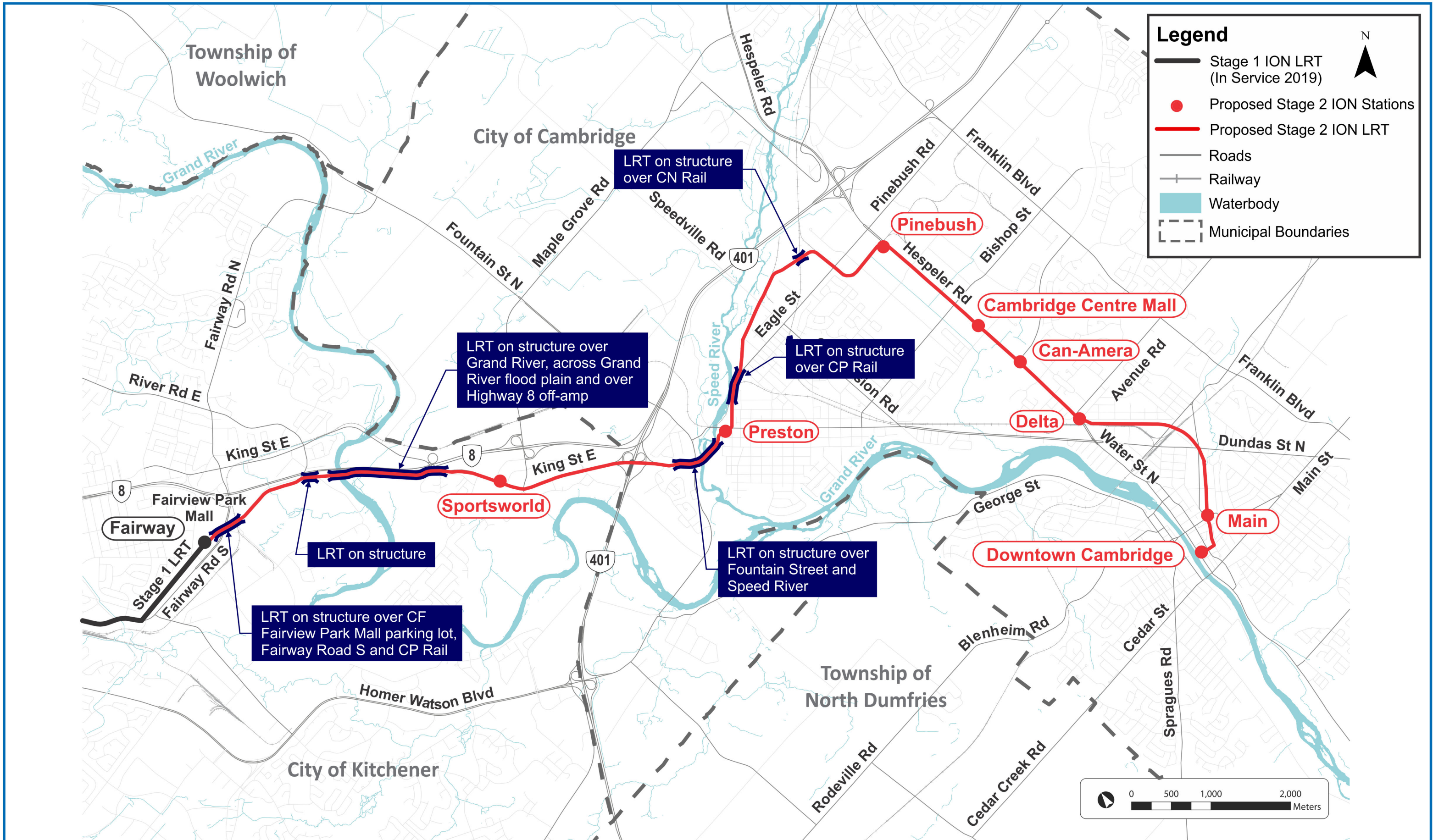
The following sections provide an in-depth review of the Stage 2 ION route. The focus in this analysis is on the route alignment and cross-sections, station locations and context specific associated impacts and opportunities along the corridor. Functional design plates are provided in **Appendix A**.

A Key Plan of the Stage 2 ION route is shown in **Figure 4-6** and structure locations are further highlighted in **Figure 4-7**. For the purposes of this presentation, the route has been divided into five geographical segments which are individually discussed in **Sections 4.3.1** through **4.3.5**:

- » Kitchener (North) – from the Fairway ION Station to King Street south of Highway 8 (Sportsworld)
- » Kitchener (South) – from Sportsworld to Highway 401
- » North Cambridge – from south of Highway 401 to CN Rail north of Eagle Street
- » Central Cambridge – from CN Rail Crossing to North of Avenue Road
- » South Cambridge – from Avenue Road to Bruce Street in Downtown Cambridge

It should be noted that station names are consistent with the preferred route and station location map as it was presented to and endorsed by Regional Council (Report TES-RTS-19-07) in June 2019.







4.3.1 Kitchener (North) – Fairway to King Street (Sportsworld)

This segment is shown in **Figure 4-8**. Functional design plates are provided in **Appendix A**.

(1) Route

The Stage 2 ION route starts at the existing Fairway ION Station at Fairview Park Mall, which is the existing southern terminal station for Stage 1 ION. Stage 2 ION then elevates across the mall's parking lot and crosses over the east end of the parking lot, Fairway Road and CP Rail on structure. Reconfiguration of a small portion of the mall's parking lot will be required to accommodate the new LRT structure and improve traffic circulation. An existing Hydro One substation and tower, located within a Hydro One easement within the Fairview Park Mall parking lot, will also require relocation and is discussed further below.

After crossing over the CP Rail corridor, the LRT runningway crosses over the westbound lane of the approved River Road Extension. The LRT runningway is then located at grade, in the centre median of the future road for approximately 800 m. River Road at this location will consist of one lane of traffic in each direction, with multi-use trails on each side. Given its proximity to the Hidden Valley Wetland and its sensitive natural heritage features, the grading footprint and right-of-way width established by the approved Municipal Class Environmental Assessment for the River Road Extension will be maintained.

From Hidden Valley Road to King Street, the alignment parallels Highway 8. North of the Grand River, Stage 2 ION requires a significant cut into the existing embankment and an extensive retaining structure to accommodate the LRT (see the typical cross-section in **Figure 4-8**). After crossing the Grand River on a structure downstream of the existing Highway 8 bridge, Stage 2 ION remains on structure adjacent to Highway 8 to King Street.

At the King Street interchange with Highway 8, Stage 2 ION crosses over the southbound exit ramp (Ramp N-S) and the southbound King Street lanes on structure, and then continues at grade in the median of King Street.

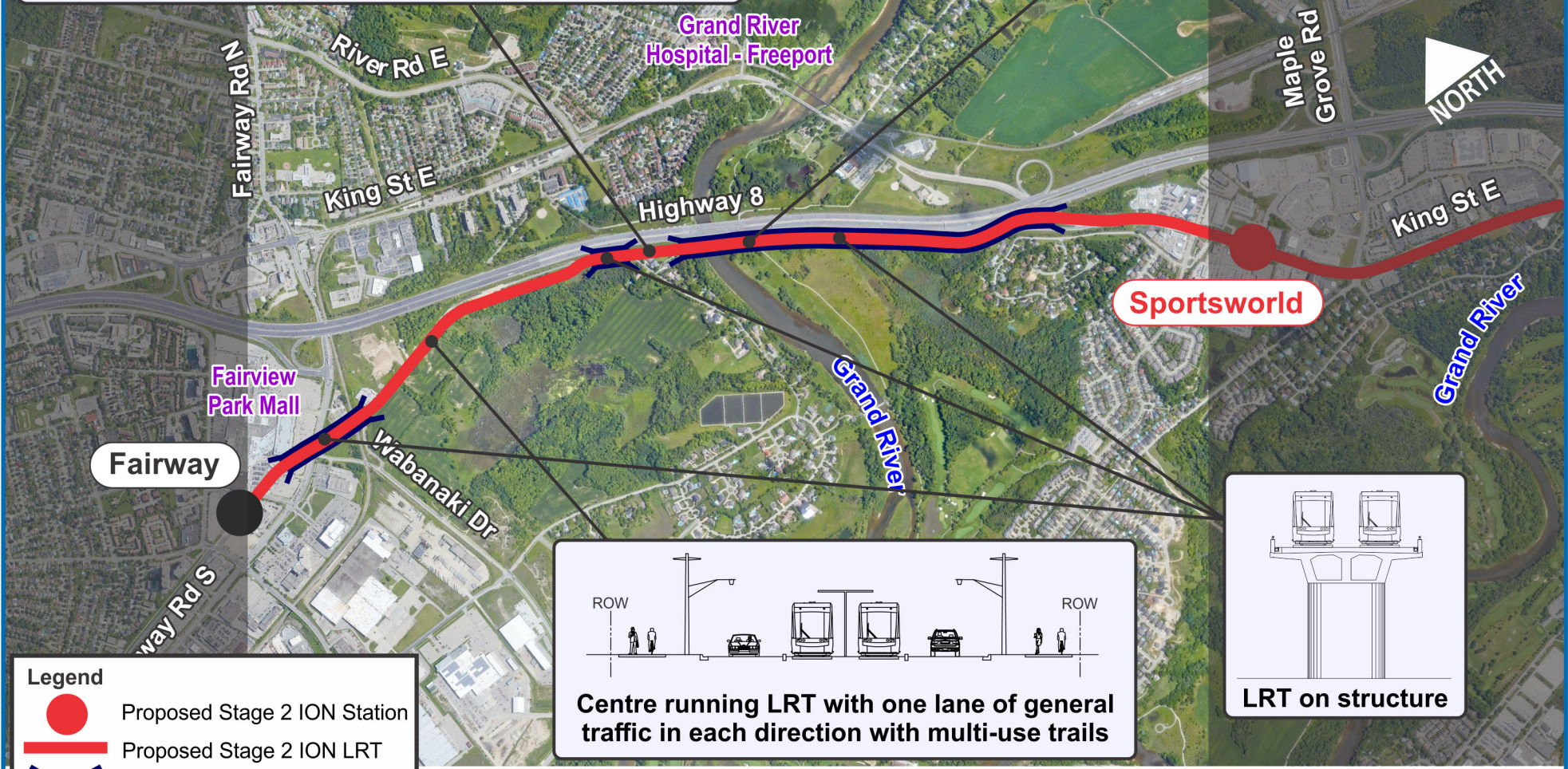
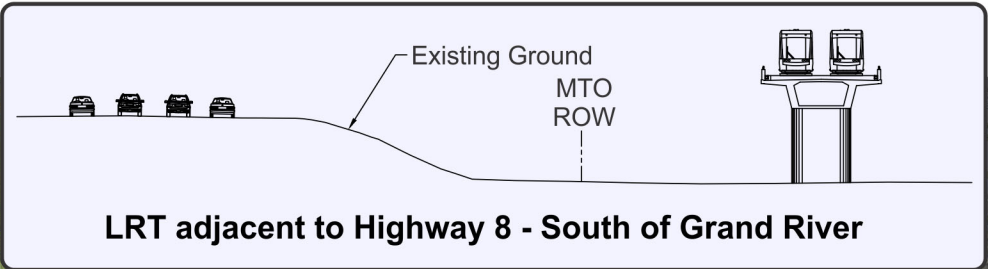
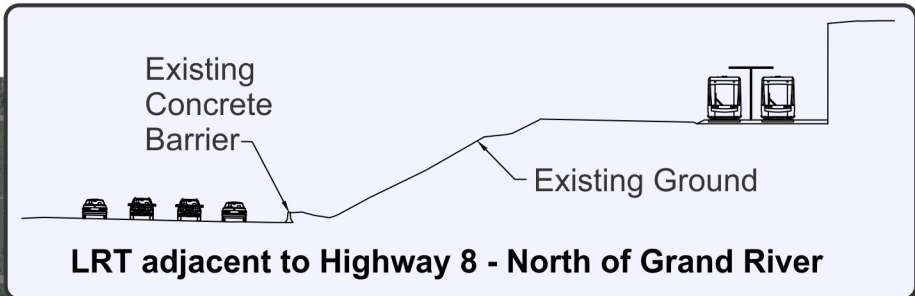
(2) Station

There are no stations within this segment.

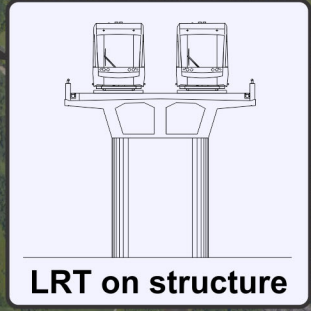
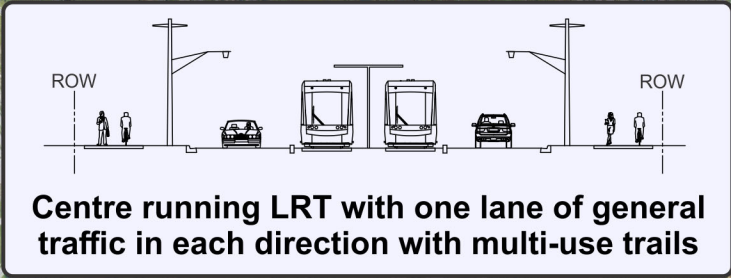
(3) Related Issues

Hydro One Substation

The alignment through the Fairview Park Mall lot is located within a Hydro One right-of-way.



- Legend**
- Proposed Stage 2 ION Station
 - ▬ Proposed Stage 2 ION LRT
 - ▬ Proposed Stage 2 ION LRT on Structure





As part of the Stage 1 ION project, the aerial Hydro One corridor west of the Fairway ION Station was relocated underground including a former tower which was located within the station footprint. A substation was constructed (as described in **Section 5.4.4**) to transition the buried hydro back to aerial beyond the station area. This substation and other towers are located within the Stage 2 ION corridor and thus will require relocation. Further consultation with Hydro One will be required to define the relocation plan and methodology in a future design phase.

Ministry of Transportation Requirements

The proximity of the Stage 2 ION route to Highway 8 necessitates authorization from the Ontario Ministry of Transportation (MTO), as the runningway is located within MTO's permit control area under the *Public Transportation and Highway Improvement Act*. MTO typically requires a setback of 14 metres from the designated highway right-of-way to any proposed permanent infrastructure to provide sufficient space for future highway expansion and ongoing maintenance activities.

Through discussion with MTO during the Pre-Planning Phase, the following was agreed:

- » Sufficient width to accommodate an ultimate Highway 8 cross-section of four lanes per direction plus 1 high occupancy vehicle (HOV) lane per direction will be protected for. This widening is not currently programmed.
- » North of the Grand River, given the presence of a significant embankment which introduces construction challenges, the Stage 2 ION alignment shall be as far from Highway 8 as practical.
- » Across and south of the Grand River, the Stage 2 ION alignment shall be at least 14 metres beyond the existing highway right-of-way.
- » The elevated crossing of the Highway 8 exit ramp to King Street (Ramp N-S) shall be designed with consideration of future modifications to the ramp alignment to accommodate future widening of Highway 8. Additional clearance from the bridge substructure was also provided to accommodate staging of construction.

A large retaining structure, approximately 200 m in length, will be required adjacent to the Stage 2 ION runningway between Hidden Valley Drive and the Grand River. For the purposes of this study, the functional design plates and impacts in this area were assessed based on this retaining structure. Alternative designs for this area, including reconstructing the embankment without a retaining wall, will be considered during a future design phase.

4.3.2 Kitchener (South) – King Street (Sportsworld) to Highway 401

This segment is shown in **Figure 4-9** and **Figure 4-10**. Functional design plates are provided in **Appendix A**.

(1) Route

Stage 2 ION is located in the centre median of King Street with two lanes of general traffic in each direction and sidewalks or multi-use trails on both sides of the road.



This section of King Street is programmed for reconstruction and improvements as part of the King Street Improvements Project, which extends from the bridge carrying King Street over the Grand River (the Freeport Bridge) to the north side of Highway 401. This reconstruction will include widening to accommodate LRT in the median, two through lanes in each direction, and intersection reconstruction with turning lanes. This work also includes utility relocations and upgrades, and improvements to the boulevards and pedestrian and cycling facilities. This design is being fully integrated with, but undertaken separately from, Stage 2 ION. Construction is expected to commence in 2021.

(2) Station (Sportsworld)

There is one station in this segment, located at the intersection of King Street and Sportsworld Crossing Road (see **Figure 4-10**). It is in the staggered side-loading station platform configuration (see **Section 4.2.2**), with the platforms located on the far side of the intersection in both directions. Pedestrian access to the station is provided at the signalized intersection of King Street and Sportsworld Crossing Road.

Major Transit Station Areas (MTSAs) will be identified as part of the Regional Official Plan (ROP) review process currently underway. Future development at Sportsworld Crossing is expected to redevelop to achieve a mix of residential, office (including major office), institutional (including major institutional) and commercial development (including retail commercial centres), which will be supported by Stage 2 ION service.

The Sportsworld ION Station is located approximately 450 m from the existing Sportsworld Park & Ride and Bus Terminal. GRT will also be undertaking a bus network planning study to examine route changes to service stops on King Street in close proximity to the Sportsworld ION Station.

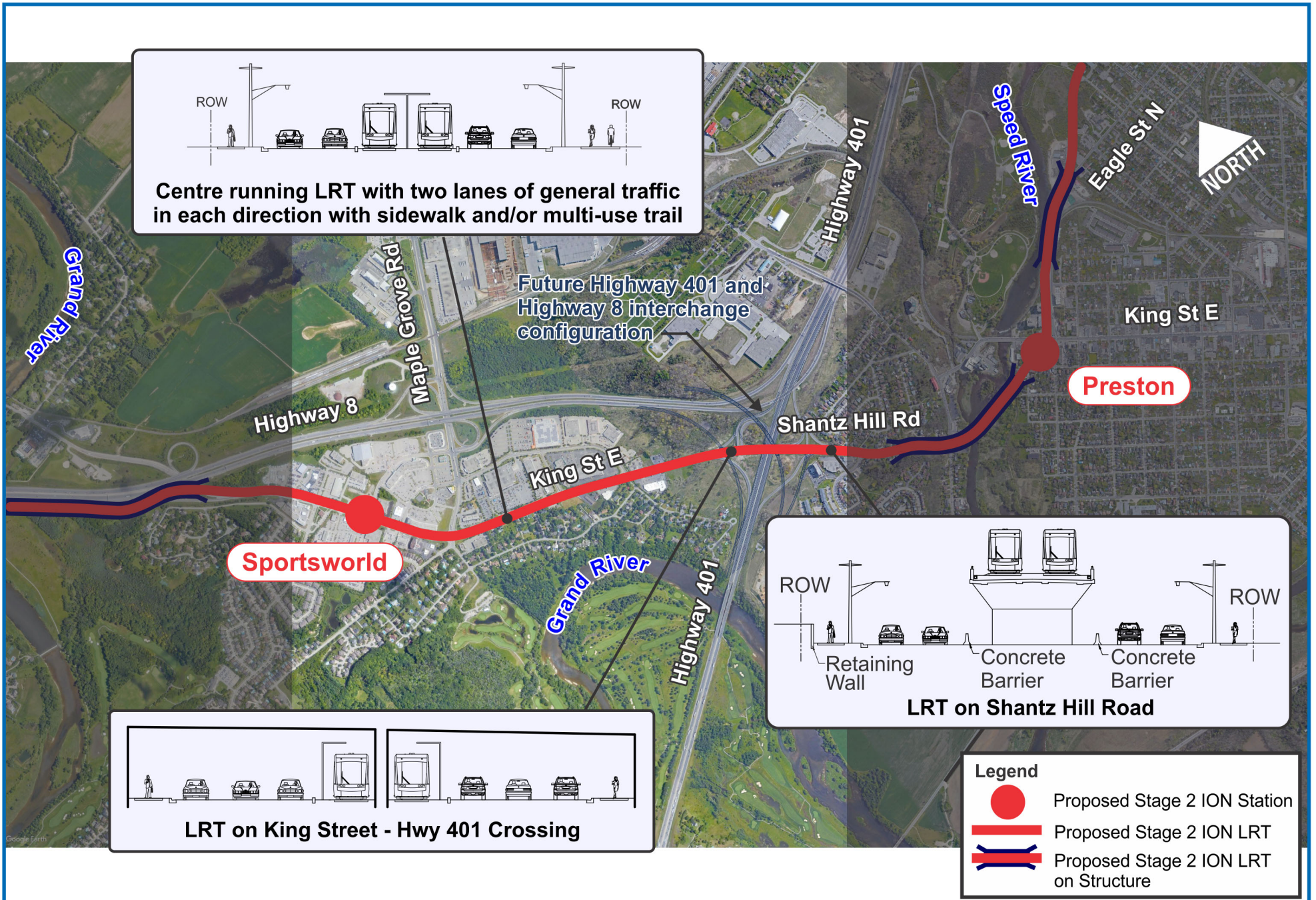
(3) Related Issues

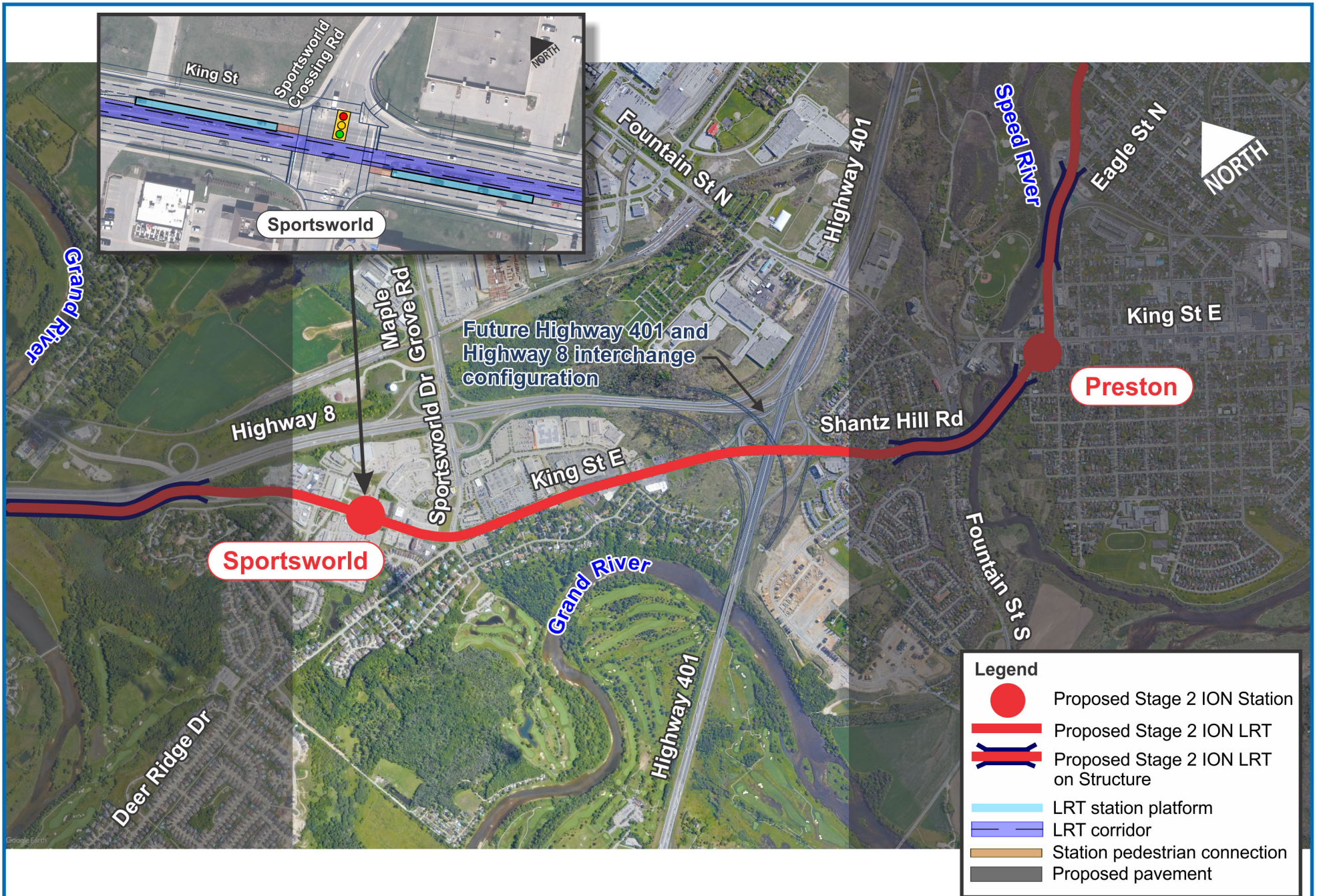
King Street Improvements Project

As discussed above, the Stage 2 ION Project is fully integrated with the Region's King Street Improvements Project, which is currently programmed for construction starting in 2021. Further road widening will not be required for Stage 2 ION, following completion of the King Street works.

Ministry of Transportation Requirements

The section of King Street through the Highway 401 interchange area is under the jurisdiction of MTO and thus must accommodate MTO design requirements including cross-section elements (lane and shoulder widths, auxiliary lanes and clearances) and interchange ramp configurations.

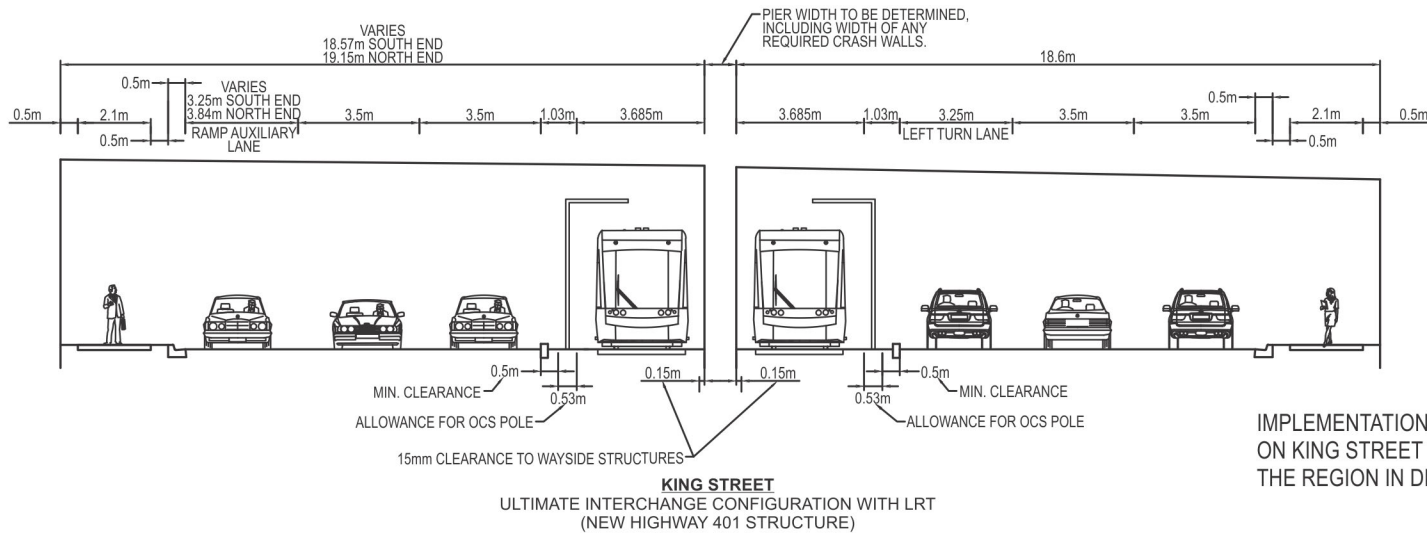
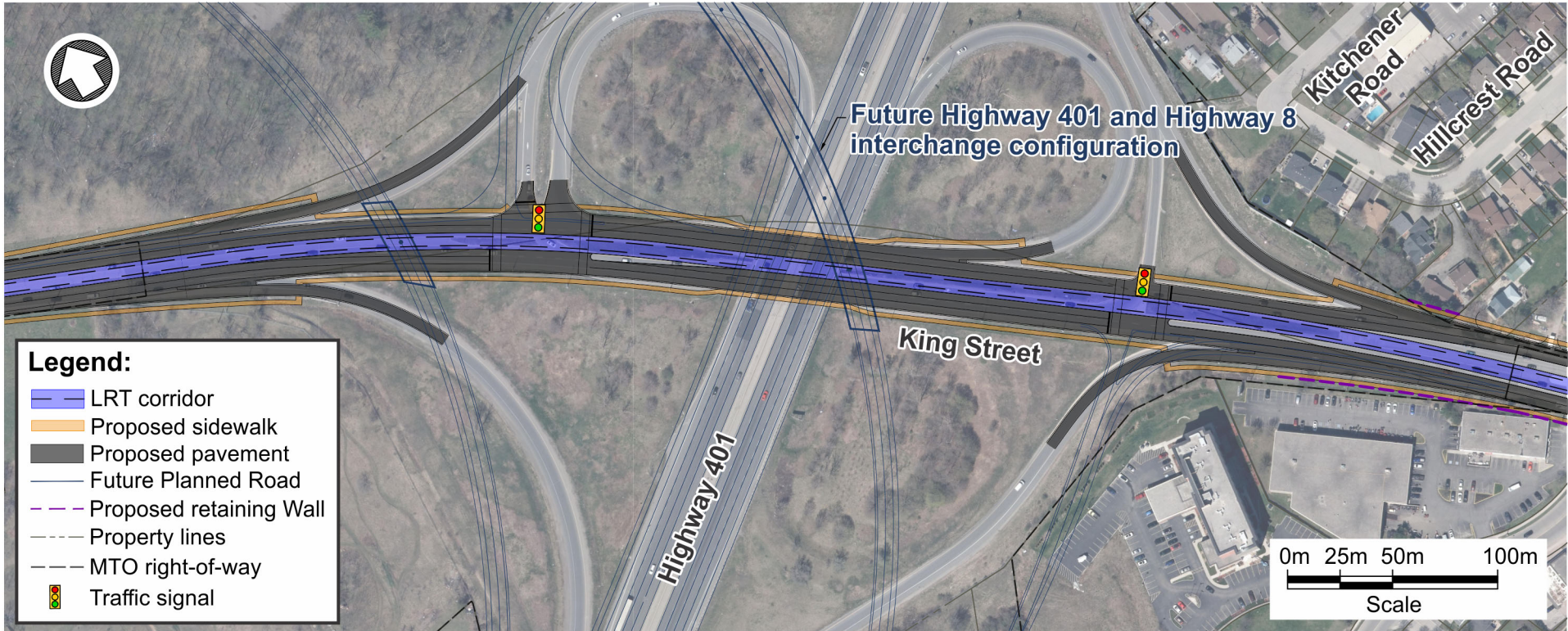






MTO is undertaking improvements to Highway 401 in this area in a phased program. MTO is currently widening Highway 401 in this area, including rehabilitation of the King Street overpass. For the purposes of this assessment, this current MTO project has been referred to as the interim plan. The ultimate plan includes construction of the west-oriented ramps at the Highway 401/Highway 8 interchange (W-N and N-W ramps), which will also require modifications to the Highway 401/King Street interchange (see **Figure 4-11**). The functional design for Stage 2 ION on King Street through the Highway 401 interchange area has been assessed to confirm its compatibility with MTO's interim and ultimate requirements and the following is noted:

- » Stage 2 ION can be accommodated on King Street with sufficient horizontal and vertical clearance under the planned interim improvements (bridge rehabilitation and outside widening by 1.1m on the south side and 1.6-1.9 m on the north side), which will be constructed in advance of Stage 2 ION. Modifications to the northbound auxiliary lane are proposed as part of the subsequent construction of Stage 2 ION, along with signalization of the north ramp terminal. All cross-section elements meet MTO geometric design criteria.
- » The ultimate improvements at the Highway 401/King Street interchange include replacement of the existing overpass, which will be at the end of its service life. MTO's design for the new bridge and the Region's design for Stage 2 ION can be closely coordinated to ensure that sufficient lane width, horizontal and vertical clearances and crash protection are provided (see **Figure 4-11**). The new overpass should be designed to accommodate OCS support (wall or ceiling mounted).
- » The ultimate improvements also include new bridges carrying the Highway 401/ Highway 8 interchange N-W and W-N ramps over King Street. Conceptual designs for these ramps include piers on the centreline of King Street. The designs for these ramps and Stage 2 ION will need to be closely coordinated to ensure proper alignment, clearance and crash protection.
- » If Stage 2 ION is completed prior to construction of the ultimate interchange, staging of the overpass replacement will have a significant impact on King Street and may require temporary suspension of LRT operations. An alternate operating strategy for ION will be required in this case.



IMPLEMENTATION OF MULTI-USE TRAILS ON KING STREET TO BE CONFIRMED BY THE REGION IN DETAIL DESIGN.

4.3.3 North Cambridge – South of Highway 401 to CN Rail North of Eagle Street

This segment is shown in **Figure 4-13** and **Figure 4-14**. Functional design plates are provided in **Appendix A**.




(1) Route

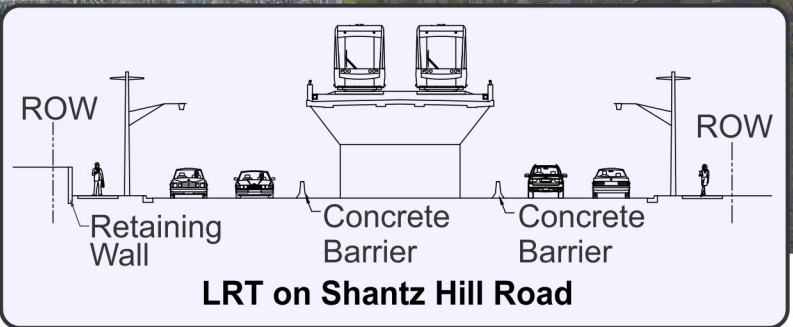
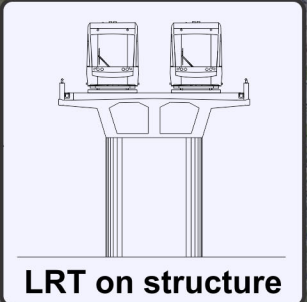
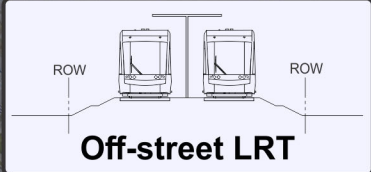
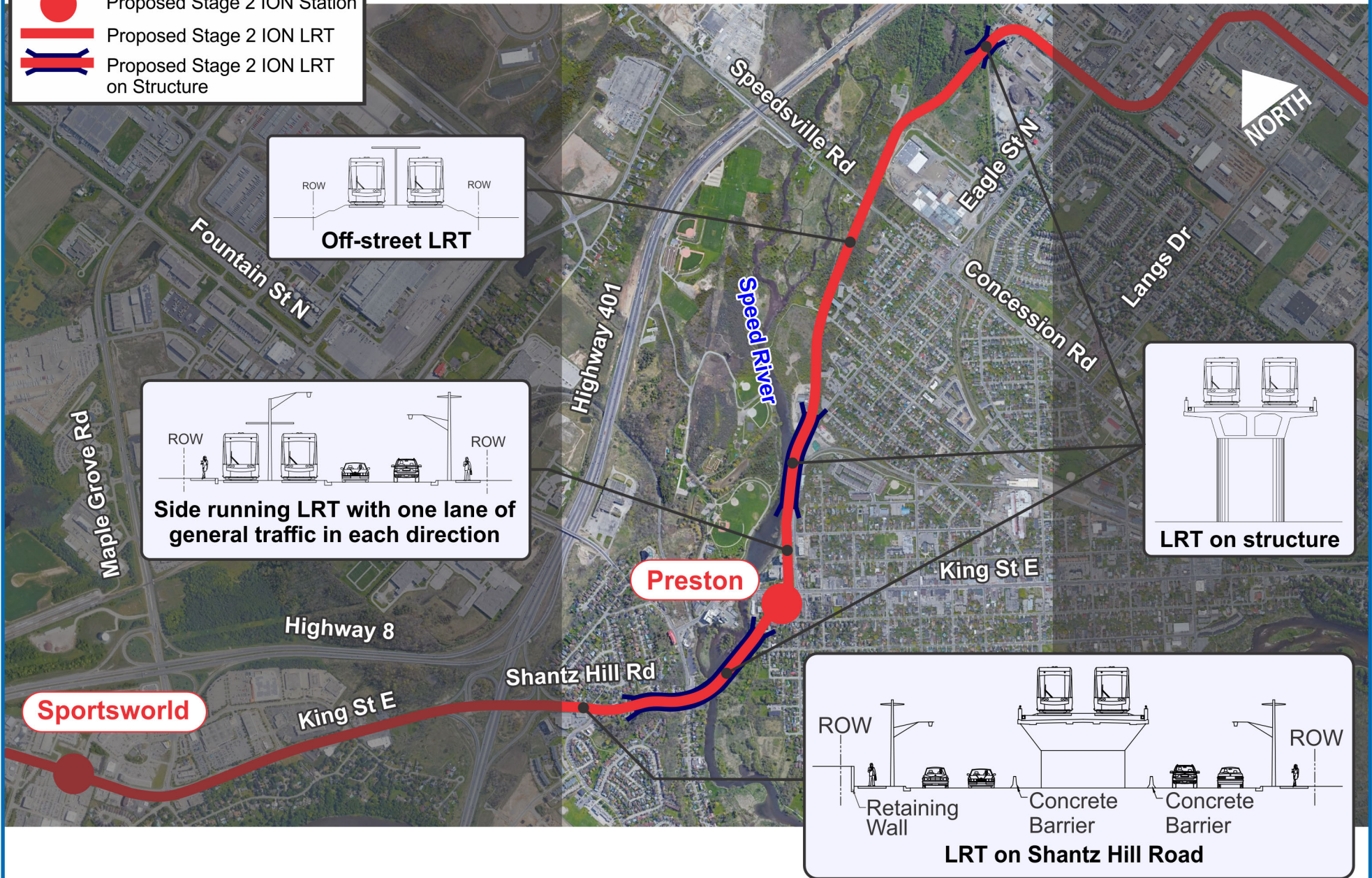
Stage 2 ION remains in the median of King Street/Shantz Hill Road from south of Highway 401 to south of Preston Parkway. Shantz Hill Road between Preston Parkway and Fountain Street is on a relatively steep, long grade, which constrains the operation of LRT for this distance. From south of Preston Parkway, Stage 2 ION gradually elevates on a structure running parallel to and above the median of Shantz Hill Road. At the Shantz Hill Road/Fountain Street intersection, Stage 2 ION has elevated sufficiently to be fully grade separated over the intersection, providing vertical clearance for traffic to pass below the bridge. **Figure 4-12** is a rendering illustrating this configuration, as viewed from Fountain Street looking towards the intersection and Shantz Hill Road.

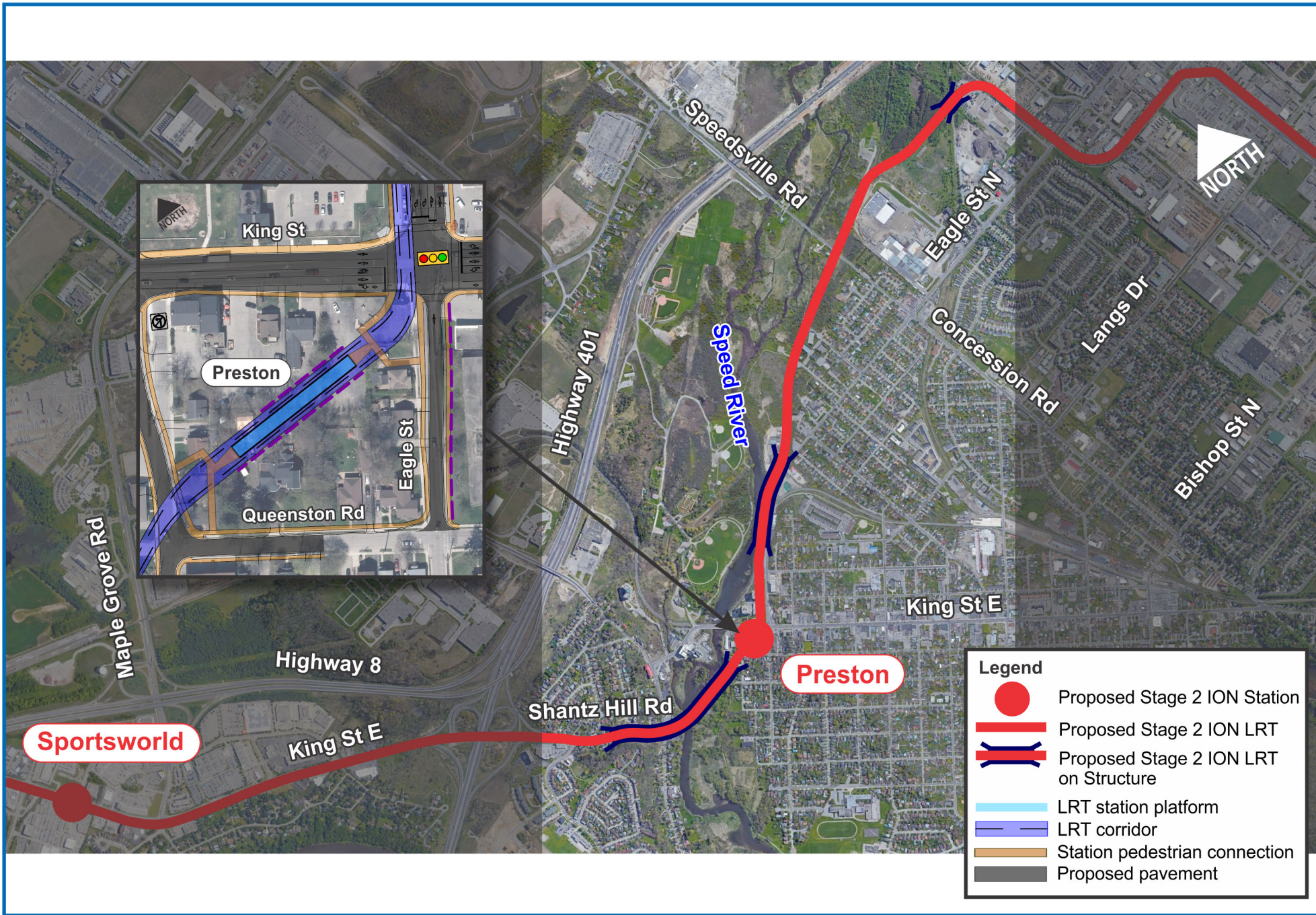


Figure 4-12: Rendering of Stage 2 ION at Shantz Hill Road and Fountain Street Intersection

Legend

-  Proposed Stage 2 ION Station
-  Proposed Stage 2 ION LRT
-  Proposed Stage 2 ION LRT on Structure







After crossing over the intersection of Shantz Hill Road and Fountain Street, Stage 2 ION remains on an elevated structure crossing the Speed River, and then parallels the river to the vicinity of Chopin Drive and Queenston Road. Stage 2 ION crosses Chopin Drive on a slight diagonal at-grade and enters the Preston ION Station, which lies diagonally across the block at the southwest corner of King Street and Eagle Street. The alignment then curves, crossing King Street at-grade on the northwest side of the intersection, and runs adjacent to the west side of Eagle Street.

Northeast of William Street, Stage 2 ION elevates to cross over the existing CP Rail corridor, and then follows the alignment of an unused CP Rail spur which runs generally parallel to the Speed River. Near Witmer Street, Stage 2 ION exits the unused railway spur and elevates to cross the CN Rail corridor on a structure.

(2) Station (Preston)

There is one station in this segment, located on the southwest corner of King Street and Eagle Street (see **Figure 4-14**). It is in the centre-loading island platform configuration (see **Section 4.2.2**). Pedestrian access to the station is provided from both ends of the platform, providing access from King Street, Eagle Street, Queenston Road and Chopin Drive.

Major Transit Station Areas (MTSAs) will be identified as part of the Regional Official Plan (ROP) review process currently underway. Preston Towne Centre is a Community Core Area in the City of Cambridge Official Plan, with a planned higher intensity and mix of land uses, promoting such elements as mixed-use buildings, intensification, heritage conservation, social facilities, the reuse of existing buildings and infrastructure renewal.

(3) Related Issues

Active Transportation

There are many walking and multi-use trails in Preston Towne Centre, both formal and informal, including the Bob McMullen Linear Trail along the Speed River. The Linear Trail, and its access points and parking areas, will not be impacted by Stage 2 ION. Temporary impacts to informal trails may occur, and this will be further examined in a future design phase as part of the construction staging strategy for the project.

An at-grade vehicular and pedestrian crossing of Stage 2 ION at the end of Russ Street will be provided to maintain access to the parking area and trail access at this location.

The City of Cambridge and the Cambridge Cycling and Trails Advisory Committee (CCTAC) have identified additional active transportation facilities within this segment that are not currently reflected on the functional design drawings for Stage 2 ION (see **Appendix A**). These will be assessed further in the next design phase for technical feasibility, in consultation with the City. These include:

- » Multi-use trail on Shantz Hill Road from Highway 401 to Fountain Street. This was recommended as part of the Regional Transportation Master Plan for the 2041 network.
- » Eagle Street, from King Street to the existing off-street multi-use trail along the CP Rail corridor. It is agreed that this would be a valuable connecting link in the



active transportation network. Eagle Street north of King Street is a very constrained corridor with buildings on both sides of, and very close to, the roadway, as well as a steep grade on one side. Based on the preliminary design it is not clear whether a multi-use trail is feasible. During the next phase of design, the Region will seek to include a multi-use trail, if it is feasible. As part of the current functional design, sidewalks have been included on both sides of Eagle Street.

Traffic and Access Changes

A preliminary traffic study has been conducted including the King Street and Eagle Street intersection in order to assess and maintain or improve upon traffic flow with the implementation of Stage 2 ION through the corridor (see **Section 6.4.1**). Adjustments to the surrounding roadway operations, traffic movements and accesses are necessary to accommodate LRT infrastructure and traffic:

- » Eagle Street South is reduced to a single lane with one-way southbound only traffic south of King Street.
- » Traffic signals at the intersection of Waterloo Street South and King Street have the potential to ease north to westbound left turn access from Waterloo Street onto King Street. Options will require further analysis in the next design phase.
- » A “queue jump” lane for buses is provided south-eastbound on King Street approaching the Eagle Street intersection to improve bus operations. The existing queue jump lane and transit signal priority at this intersection will be maintained.
- » Improvements to Eagle Street, Queenston Road and Chopin Drive have been incorporated to facilitate local bus stops and bus movements at the Preston ION Station.
- » The entrance to the Rivers Edge Apartment complex at 100 and 200 Eagle Street North has been relocated to King Street, aligned with the Chopin Drive intersection. The existing entrance at Eagle Street cannot be maintained with the Stage 2 ION alignment located immediately adjacent to Eagle Street. Access to the parking structure and surface parking will not be impacted. The existing entrance will be available for emergency services access only.

4.3.4 Central Cambridge – CN Rail Crossing to North of Avenue Road

This segment is shown in **Figure 4-15** and **Figure 4-16**. Functional design plates are provided in **Appendix A**.

(1) Route

Stage 2 ION follows an existing CN Rail industrial spur line from north of Eagle Street, crossing Eagle Street at grade, and through an existing industrial area to Hespeler Road. The LRT runningway is located adjacent to and fully independent of the CN Rail corridor, providing required horizontal separation to avoid operational conflict.

The runningway then crosses the southbound lanes of Hespeler Road at grade and is located in the median of Hespeler Road to Avenue Road. In addition to the northbound



and southbound LRT track, Hespeler Road includes two general traffic lanes in each direction and turning lanes at intersections. The final cross-section for Hespeler Road will be confirmed by the Region of Waterloo in consultation with the City of Cambridge, but will include separated cycle facilities and sidewalks on both sides. There are buildings along the corridor that will require a reduced boulevard width in selected locations. GRT bus stops are located in the boulevard with shelters behind the sidewalks in both directions along the full length of Hespeler Road.

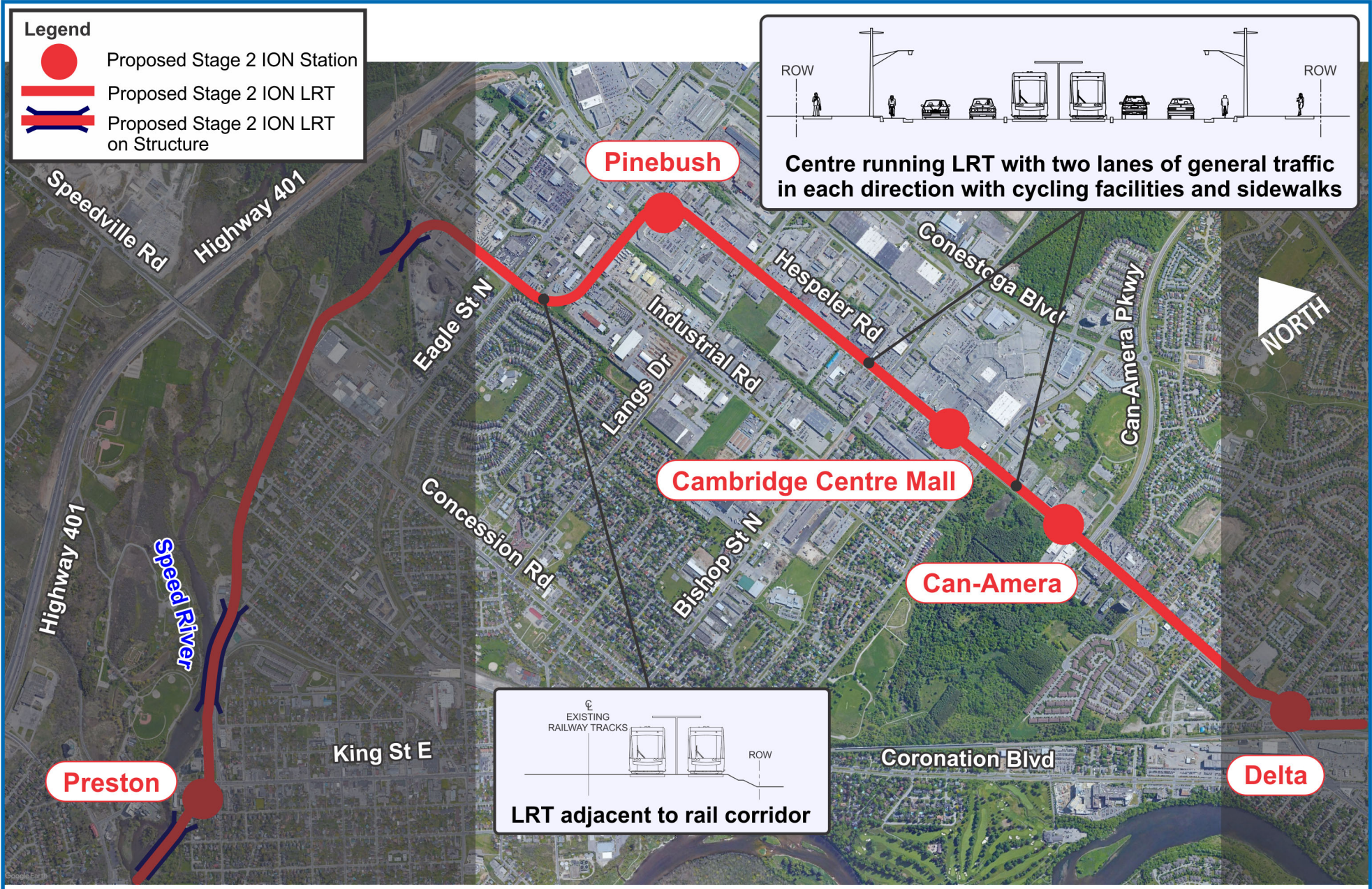
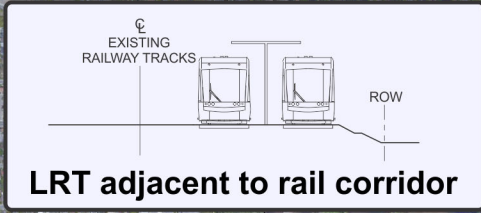
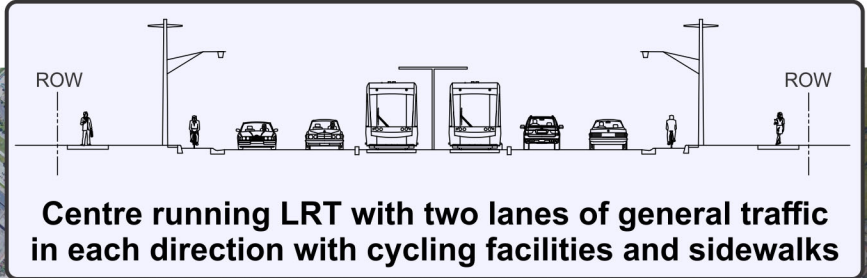
(2) Stations (Pinebush, Cambridge Centre and Can-Amera)

There are three stations on Hespeler Road within this segment (see **Figure 4-16**):

- » Pinebush ION Station is located on the west side of Hespeler Road, off street, approximately 320m south of the Hespeler Road and Eagle Street/Pinebush Road intersection. It is in the adjacent side-loading island platform configuration (see **Section 4.2.2**). Pedestrian access to the station is provided from both ends of the platform.
- » Cambridge Centre ION Station is located at the main entrance to the Cambridge Centre retail centre, which is mid way between Bishop Street and Dunbar Road. It is in the staggered side-loading station platform configuration (see **Section 4.2.2**), with the platforms located on the far side of the intersection in both directions. Pedestrian access to the station is provided at the signalized intersection between Hespeler Road and the Cambridge Centre entrance.
- » Can-Amera ION Station is located at the Hespeler Road/Can-Amera Parkway intersection. It is in the adjacent side-loading island platform configuration (see **Section 4.2.2**). Pedestrian access to the station is provided at the signalized intersection between Hespeler Road and Can-Amera Parkway.

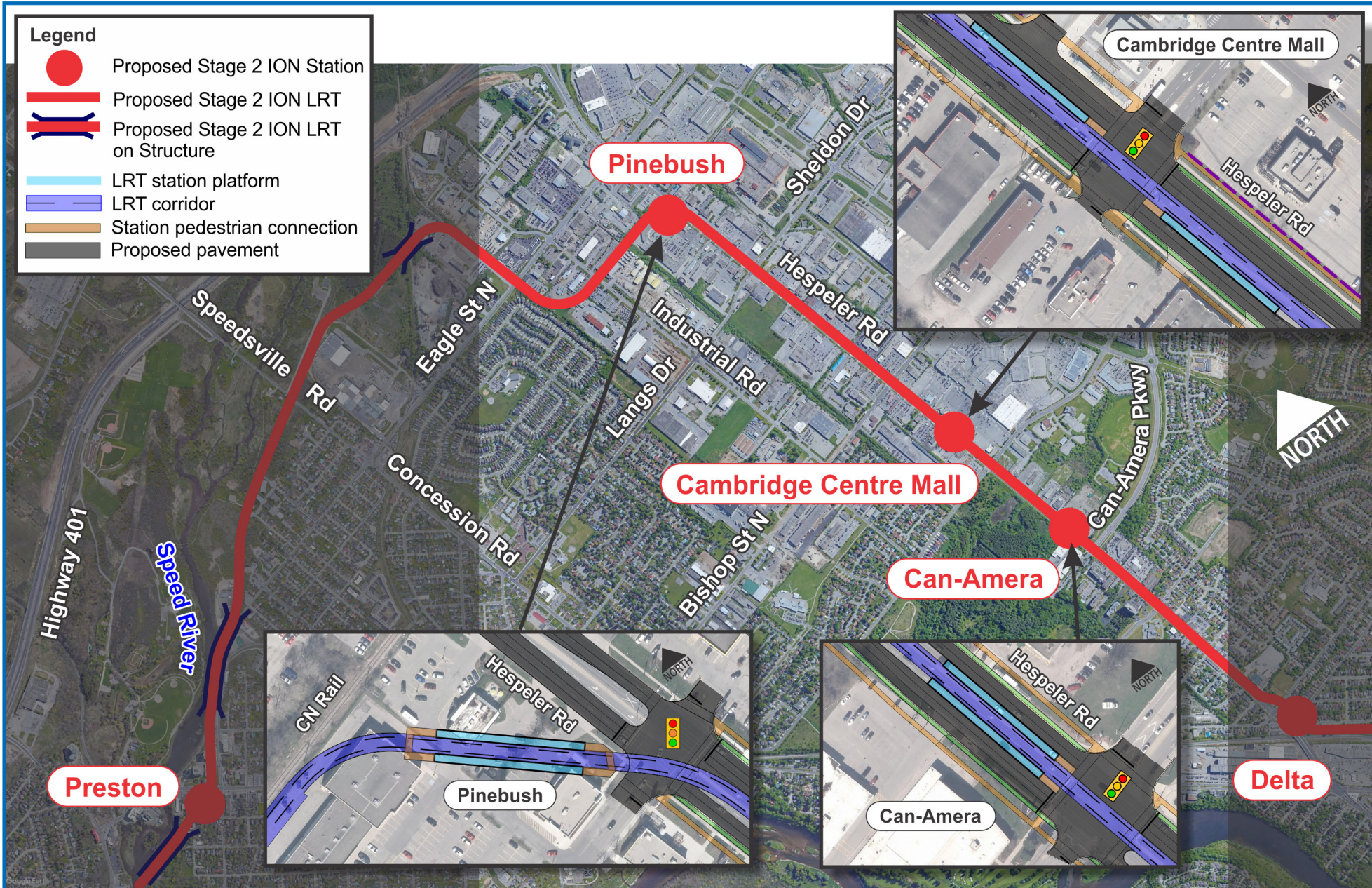
These station locations are being identified as Major Transit Station Areas through the Hespeler Road Corridor Secondary Plan.

- Legend**
- Proposed Stage 2 ION Station
 - ▬ Proposed Stage 2 ION LRT
 - ▬ Proposed Stage 2 ION LRT on Structure



Legend

- Proposed Stage 2 ION Station
- Proposed Stage 2 ION LRT
- Proposed Stage 2 ION LRT on Structure
- LRT station platform
- LRT corridor
- Station pedestrian connection
- Proposed pavement





Hespeler Road provides access to a mixed commercial corridor and includes a range of supporting designations including Community Node and Regeneration Area. The corridor has grown to become one of City of Cambridge's main commercial areas, offering full range of retail, services and commercial uses/destinations. Within the study area, the corridor connects Highway 401 (to the north) to Downtown Cambridge (to the south), with many east-west intersecting roads that provide access to surrounding neighbourhoods.

To support intensification, the City of Cambridge is in the process of preparing a Growth and Intensification Study which includes the preparation of a Secondary Plan for the Hespeler Road Corridor. Stage 2 ION and its stations will support this planned redevelopment.

(3) Context Specific Impacts and Opportunities

Cambridge Centre GRT Bus Station

The Cambridge Centre ION Station is located immediately adjacent to the Cambridge Centre GRT Bus Station. Transfers between Stage 2 ION and local bus services can be made at this location.

North of the Cambridge Centre GRT Bus Station, a dedicated bus turning lane is provided on Hespeler Road in the southbound direction. This turning lane provides bus-only access to the Cambridge Centre GRT Bus Station, for inbound buses only. This bus-only lane will also be provided with Stage 2 ION.

Dumfries Conservation Area

The addition of Stage 2 ION to the median of Hespeler Road will not require widening into the Dumfries Conservation Area.

Driveways and Accesses from Hespeler Road

The addition of Stage 2 ION in the median of Hespeler Road will preclude left turn access from Hespeler Road to adjacent properties, except at signalized intersections. U-turns will be accommodated at most signalized intersections.

At the functional design phase, existing driveways have been maintained at all locations as right-in/right-out entrances. As part of a future design phase, and in coordination with development plans, opportunities to consolidate the number of entrances to Hespeler Road may be considered.

4.3.5 South Cambridge – Avenue Road to Bruce Street

This segment is shown in **Figure 4-17** and **Figure 4-18**. Functional design plates are provided in **Appendix A**.

(1) Route

Stage 2 ION leaves the Hespeler Road corridor just north of Avenue Road, and follows adjacent to the CP Rail Waterloo Subdivision parallel to Norfolk Avenue. Stage 2 ION then follows the former Lake Erie and Northern Railway and Great Western Railway corridor (the railway is no longer present in the corridor), across Samuelson Street at grade and beneath the CP Rail Galt Subdivision at the Grantham Rail Bridge. Stage 2



ION continues to follow the former Great Western Railway corridor across Dundas Street, through the future Dundas Street and Beverly Street roundabout, and along the west side of Mill Creek, crossing Kerr Street at grade, to Main Street.

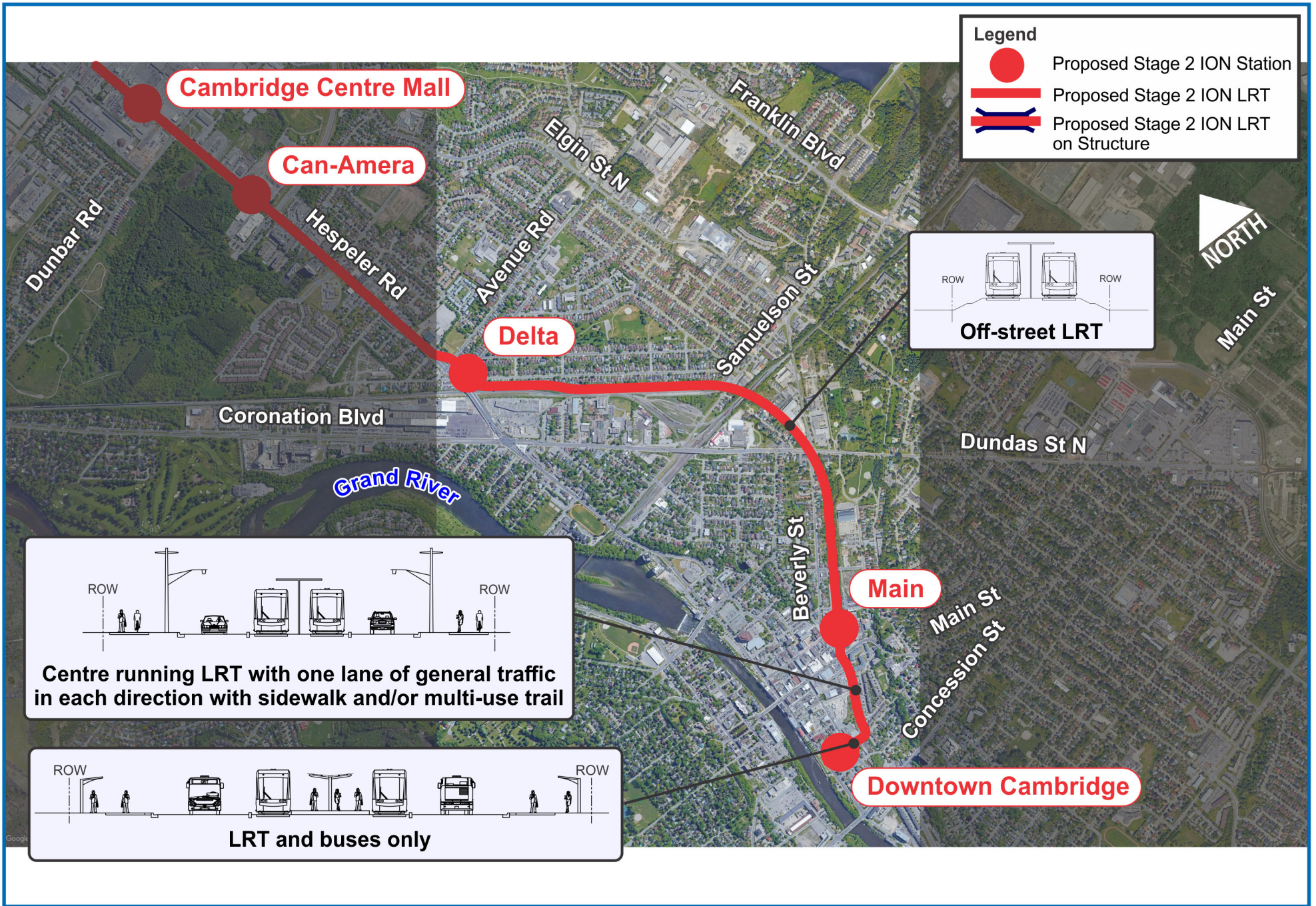
Stage 2 ION transitions to the median of Wellington Street at the Main Street intersection. The runningway remains in the centre of Wellington Street to Bruce Street, and on Bruce Street to Water Street. Bruce Street between Wellington Street and Ainslie Street is reconfigured with Stage 2 ION on the north side and a single one-way eastbound general traffic lane on the south side. Between Ainslie Street and Water Street, Bruce Street is restricted to LRT and bus operations only.

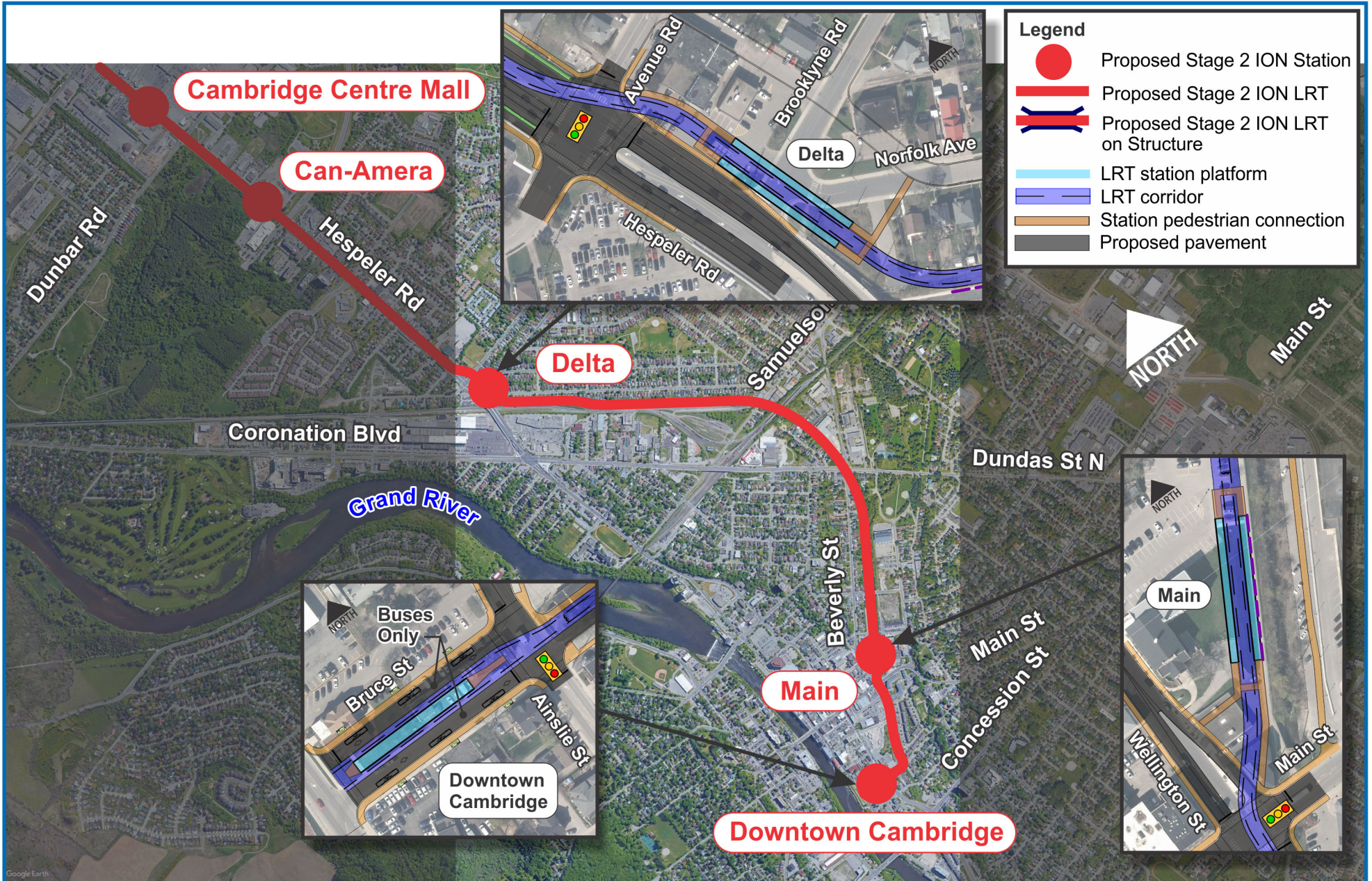
(2) Stations (Delta, Main Street and Downtown Cambridge)

There are three stations within this segment (see **Figure 4-18**):

- » Delta ION Station is located on the east side of Hespeler Road at Avenue Road. It is in the adjacent side-loading island platform configuration (see **Section 4.2.2**). Pedestrian access to the station is provided at both ends of the platform, providing access from Hespeler Road, Avenue Road and Norfolk Avenue.
- » Main Street ION Station is located north of the intersection of Main Street and Wellington Street. It is in the adjacent side-loading island platform configuration (see **Section 4.2.2**). Pedestrian access to the station is provided at both ends of the platform, providing access from Main Street, Wellington Street and a municipal parking lot on Beverly Street.
- » Downtown Cambridge ION Station is located on Bruce Street between Ainslie Street and Water Street. It is in the centre loading island platform configuration (see **Section 4.2.2**). This is the southern terminal station for Stage 2 ION, and is integrated with a proposed new on-street GRT bus station for convenient transfers between LRT and local bus services.

Major Transit Station Areas (MTSAs) will be identified as part of the Regional Official Plan (ROP) review process currently underway. The area surrounding the Main Street and Downtown Cambridge ION Stations are part of the Urban Growth Centre, Community Core Area and Regeneration Area in the City of Cambridge's Official Plan. These areas are being planned and designed as the focal area for investment in institutional and region-wide public services, as well as commercial, recreational, cultural and entertainment uses. Stage 2 ION will support and facilitate these growth plans.







(3) Context Specific Impacts and Opportunities

Interface with GRT Bus Network

As part of the implementation of Stage 2 ION, GRT proposes to replace the existing Ainslie Street bus terminal with an on-street bus facility integrated with the Downtown Cambridge ION Station on Bruce Street. This arrangement provides:

- » Pedestrian connectivity to more areas in the Downtown core, including the west side of the Grand River.
- » The opportunity to streamline bus routes, improve efficiency and reduce travel time.
- » Opportunities for redevelopment of the land at existing Ainslie Street Terminal location.

As shown on the functional design plates in **Appendix A**, the GRT bus facility includes six bus stops on Bruce Street (three on each side of the street) and additional layover space on Ainslie Street.

In order to prioritize bus and pedestrian movement, this section of Bruce Street will be restricted to buses, LRT vehicles and pedestrians.

Further refinement of the proposed layout and operations of this bus facility, along with development of network changes to support Stage 2 ION, will be undertaken in a future design phase.

Active Transportation

The existing multi-use trail along the west side of Mill Creek will be relocated to the east side of the watercourse to accommodate the Stage 2 ION runningway. This trail will be continuous from Dundas Street to Main Street. As noted on functional design plan in Appendix A, the proposed design linked the trail with Shade Street at the north limit, providing access to the existing trail connection at Dundas Street. At the south limit, the trail is proposed to connect to Main Street, with sidewalk connection to Wellington Street. The Cambridge Cycling and Trails Advisory Committee (CCTAC) has noted that Shade Street is a one-way street and thus cyclists would have significant out of way travel to reach Dundas Street. During the next design phase, further consideration will be given to design options for this trail connection.

There is an existing trail crossing of the CP Rail corridor at the end of Roxboro Road, which will also cross the Stage 2 ION runningway. The crossing will be formalized and equipped with an automatic crossing warning system (i.e. flashing lights, bells and gates).

Traffic and Access Changes

In most cases, there will be no changes to driveway access or traffic operations within this segment, except for modifications to certain intersection operations to accommodate Stage 2 ION. The areas where changes will be required are summarized as follows and shown in the functional design plates in **Appendix A**:



- » Norfolk Avenue and Brooklyne Road will be realigned to accommodate the Delta ION Station. The existing Brooklyne Road intersection at Hespeler Road will be closed. Vehicles from Brooklyne Road and Norfolk Avenue will use Avenue Road to access Hespeler Road.
- » Commonwealth Lane and Whitehall Lane will be right-in/right-out only at Wellington Street.
- » Lutz Street will be closed at Wellington Street. Access to Lutz Street from Main Street will not be impacted.
- » Bruce Street between Wellington Street and Ainslie Street will be converted to one-way operation, with traffic only being permitted eastbound (from Ainslie Street to Wellington Street). Access to properties on the south side of Bruce Street will be maintained.
- » Bruce Street between Ainslie Street and Water Street will be restricted to bus and pedestrian access, with general traffic prohibited. Driveway access via Bruce Street to 68-70 Ainslie Street South will be closed but the existing access via Ainslie Street to this property will remain.

Mill Creek Culvert

Mill Creek is an open watercourse flowing from Shade's Reservoir in Shade's Mills Conservation Area to Main Street in Downtown Cambridge. At Main Street, Mill Creek is enclosed within a reinforced concrete box culvert (inside dimensions 20 feet by 10 feet, 1.5 foot wall thickness) to the point where it outlets at the Grand River north of Bruce Street. A portion of this culvert is located beneath Wellington Street and thus will need to be considered in the next stage of design of Stage 2 ION, to ensure that both the culvert and the LRT related infrastructure can be accommodated.

More detailed inspections and a condition assessment of the Mill Creek culvert to determine its remaining life, and whether rehabilitation or improvement is required will be required during the next design phase. If required, coordinating this work with the Stage 2 ION construction would be beneficial to reduce impacts to traffic and transit operations.