Planning Advisory Committee Meeting

May 6, 2021

4:00 p.m.

Virtual – Via Zoom/Teams

Agenda

Call to Order

1. **Approval of Agenda**

2. **Approval of Minutes**
   a. Planning Advisory Committee Meeting, April 8, 2021

3. **Public Input / Question Period**

   PLEASE NOTE:
   - Public Participation is limited to 30 minutes
   - Each Person is limited to 3 minutes and may return to speak once, for 1 minute, if time permits within the total 30-minute period
   - Questions or comments are to be directed to the Chair
   - Comments and questions that relate to personnel, current or potential litigation issues, or planning issues for which a public hearing has already occurred, but no decision has been made by Council, will not be answered.

4. **New Business:**
   a. Mobility Project Update and discussion
      i. BNS Report
      ii. NACTO AAA Guidance

iii. ICIP application (presented to Council April 20, 2021)

b. Climate Action Planning Update
    i. Lindsay Slade introduction

c. Development and Permitting Update

5. Old Business:

a. Waterloo Student Projects Debrief
    i. Final Reports can be found here.

b. Continued Housing Discussion
    i. Alan Howell's presentation from last meeting is here.

6. Round Table

7. Next Meeting

a. June 10, 2021 – 4:00 p.m.

8. Adjournment

STAGE I

NETWORK PLANNING

Wolfville

Blue Route Hub Study

BLUE ROUTE

Prepared by:

BICYCLE NOVA SCOTIA

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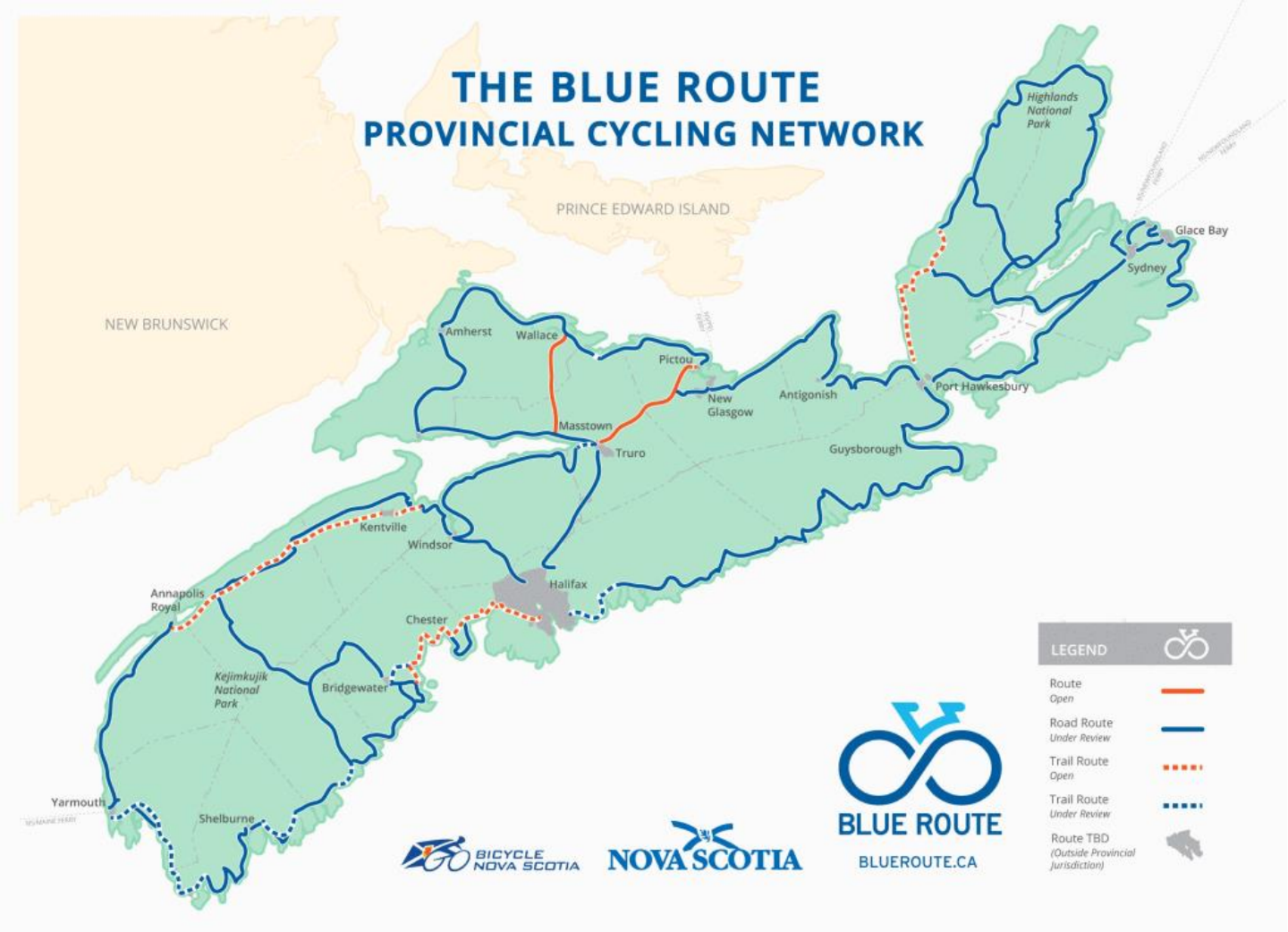


THE HUB STUDY

The Blue Route Hub Bikeway Study is a Bicycle Nova Scotia (BNS) initiative to assist municipalities and towns throughout Nova Scotia to advance bicycle culture in their region. Locations selected for this study are situated at junctions, referred to as "Hubs," along the proposed province-wide bikeway network known as the Blue Route. The purpose of this study is to develop community-based plans that identify a minimum grid of priority routes where the implementation of bicycle specific infrastructure could have the greatest impact on increasing bicycle use in the area.

Goals of the Hubs Study:

- Develop a proposed priority network of safe and connected bicycle routes in Wolfville to facilitate cycling as a viable, healthy, sustainable, and environmentally friendly mode of transportation for users of all ages and abilities.
- Engage residents of the region to help guide the planning process to ensure that the network will add value to the community.
- Establish routes that will provide cycling tourists traveling along the provincial Blue Route with easy and direct access to local attractions (parks, historic sites, etc.) and amenities in Wolfville.

Objective of the Report

The focus of Stage I has been to establish three primary routes, within the boundary limits of Wolfville, that have the potential to form a bikeway network that will allow the residents of Wolfville to move throughout the town by bicycle. The primary focus of this stage was to consult with the public to better understand their needs, and to determine which routes provide the most valuable solutions.

UNDERSTANDING THE TOWN

In order to develop a network plan, Bicycle Nova Scotia looked at the local context of the area; including the current travel behaviour and perceptions of transportation in Wolfville, origin and destination data, as well as physical characteristics of the Town.

Information was gathered on the ground in Wolfville, through public consultation, existing plans and analysis completed for the Town and using online resources such as National Census data.

EXISTING BICYCLE INFRASTRUCTURE

Figure 1 shows the existing bicycle infrastructure in Wolfville, including the Harvest Moon Trail (HMT) which is part of the Blue Route, and the painted on-street bike lanes along Main Street. The trail experiences a significant amount of recreational use by residents of Wolfville and surrounding communities. The HMT is also one of three 'destination trails' in Nova Scotia, attracting cycle tourists from around the globe. Maple Avenue and Main Street (Trunk 1) have been identified as potential on-road segments of the Blue Route by the Department of Transportation and Active Transit.

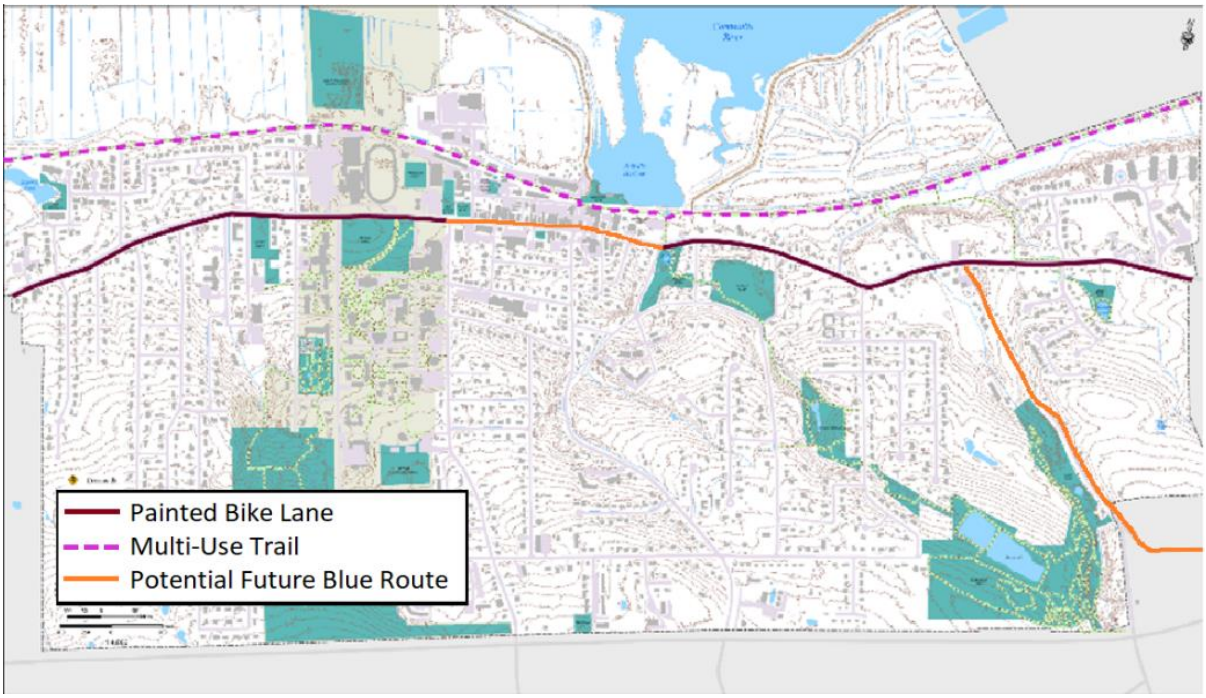


Figure 1 *- Existing and proposed bicycle infrastructure*

ACTIVE TRANSPORTATION PLANS & STRATEGIES

In 2015, an Active Transportation Plan was created for Wolfville by WSP consulting firm (Figure 2). The network proposed in the report was very similar to one suggested in an Active Living Master Plan created in 2011. The Municipality of the County of Kings will also soon be releasing an Active Transportation Plan for the region. Information gathered during their rounds of community engagement was also made available to BNS, and has been taken into consideration for the proposed network plan.

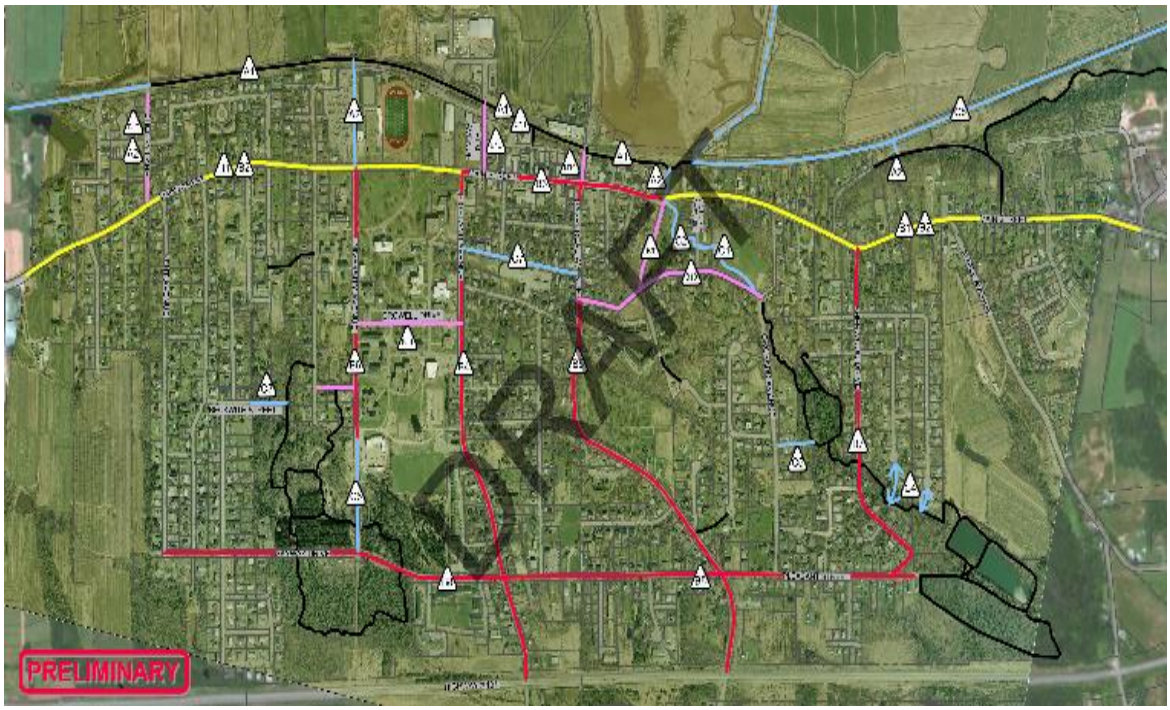


Figure 2 *- Recommended Active Transportation Plan, WSP (2015)*

CONSULTATION

BNS staff carried out consultation with both members of the public and specific local stakeholder groups in Wolfville to determine how the network could best support their needs. The Town of Wolfville's Mobility Survey was conducted online in Fall 2020 and had 403 individuals respondents.

BNS staff met with local stakeholder groups to better understand their needs in relation to a potential bikeway network. Engagement with these groups was carried out via virtual consultation sessions and an online questionnaire. Stakeholder groups that took part in the consultation included:

- The Town of Wolfville's Accessibility Advisory Committee (AAC),
- The Town of Wolfville's Planning Advisory Committee (PAC),
- Eastern Kings Community Health Board (CHB),
- Acadia University's Student Union (ASU),
- Wolfville Memorial Library,
- Wolfville Business Development Corporation (WBDC), and
- Residents of Woodman's Grove.

Additionally, a modified version of the stakeholder questionnaire was sent to participants of the original Mobility Survey who indicated an interest in participating in future consultation opportunities; 44 people responded to the questionnaire.

Travel Behaviour

Acadia University enrolls approximately 3,700 full-time students and employs nearly 260 faculty and other staff members. Although the campus is compact, many of the students and staff members live off-campus and must commute to campus on a regular basis. Travel to and from Acadia University is an important consideration for developing a high-quality network for Wolfville.

According to the 2016 Census, motor vehicles are the primary mode of transportation in Wolfville for commuting to and from work (73%), walking accounts for approximately 22%, and cycling for 1.6%. Compared to 2011 Census data, the proportion of residents for whom cycling is the primary form of transportation has declined from 4.6% to 1.6%. Forty-five percent (45%) of Census participants in 2016 answered that they both lived and worked within the Town's boundaries, meaning that, due to the size of Wolfville, there is an excellent market for walking and cycling(see Figure 3).

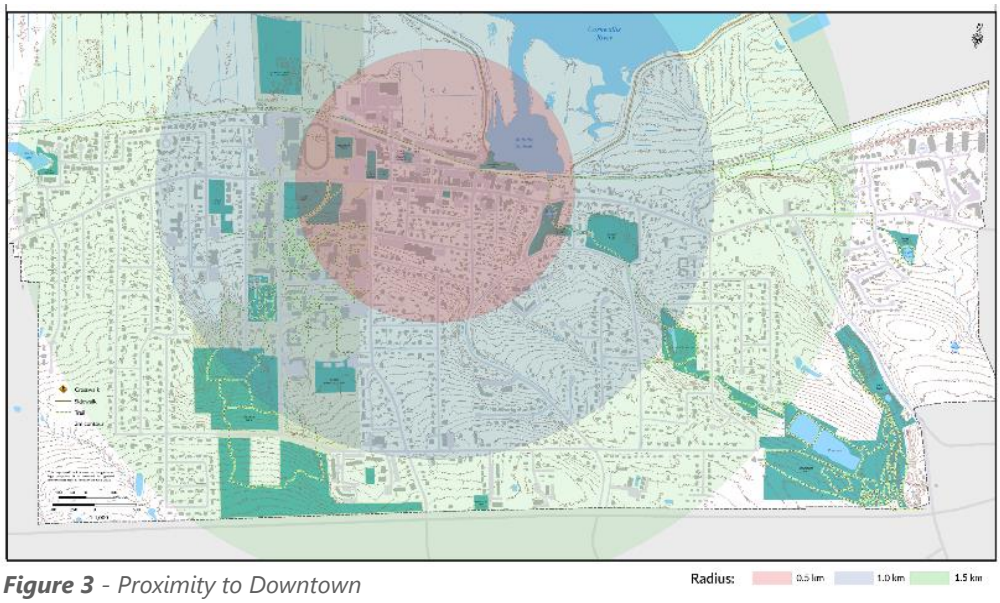


Figure 3 *- Proximity to Downtown*

CYCLING IN WOLFVILLE

Results from the Wolfville Mobility Survey, presented in Figure 4, suggests that a significant proportion (43%) of Wolfville residents consider themselves strong or at least confident cyclists. However, 74% of survey respondents indicated that they rarely or never travel by bicycle for trips in Town.

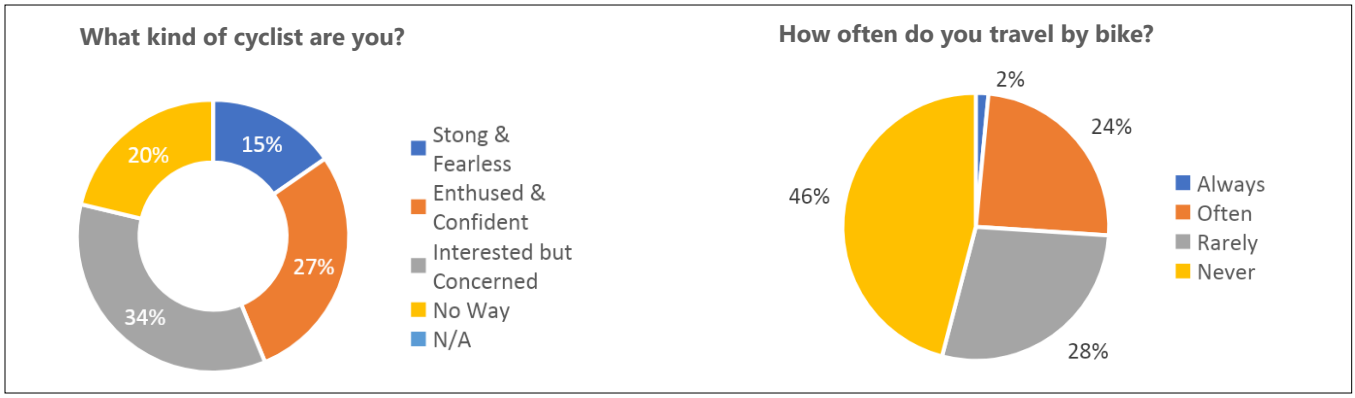


Figure 4*- Cyclists in Wolfville*

Physical activity was the most common motivation for existing cyclists in Wolfville (90%), suggesting that an effective approach to encourage more cycling in Wolfville would be to pair new infrastructure with efforts to promote the health benefits associated with cycling.

The **number one deterrent** to cycling for the survey population is **not owning a bicycle** (35%). Concerns about safety, the hill, level of confidence, poor infrastructure, and lack of infrastructure were also significant deterrents (between 24% and 29% response). Figure 6 illustrates the percentage of survey respondents who reported being impacted by each deterrent. Last year Wolfville introduced e-bike rentals at the public library, and this may be an indication that more promotion of that bike share program is needed. Considering that the hill is a significant barrier to cycling (28%), making e-bikes available for residents at the top of the hill could also help reduce barriers to cycling in Wolfville.

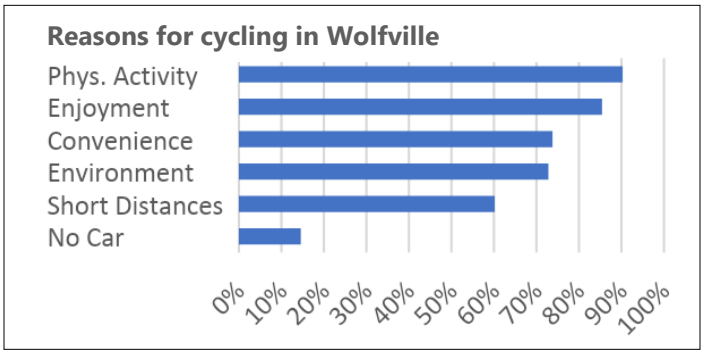


Figure 5 *– Motivations for cycling, identified from Mobility Survey*

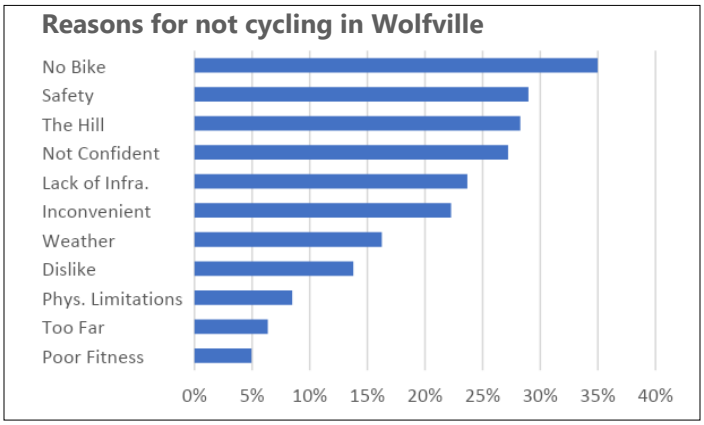


Figure 6 *– Barriers to cycling, identified from Mobility Survey*

Origins & Destinations

According to latest Census data [1], in 2016 the town of Wolfville had a population of 4,195 residents, and a population density of approximately 650 people per square kilometer (km^2). Figure 7, presented in the town's Municipal Planning Strategy (MPS) [2], shows the distribution of population densities throughout the town. Medium and high-density areas are concentrated on the west end of Main Street, and in the centre of Town, between Highland Avenue and Gaspereau Avenue. Connecting the network to these denser areas will improve access to the greatest number of people.

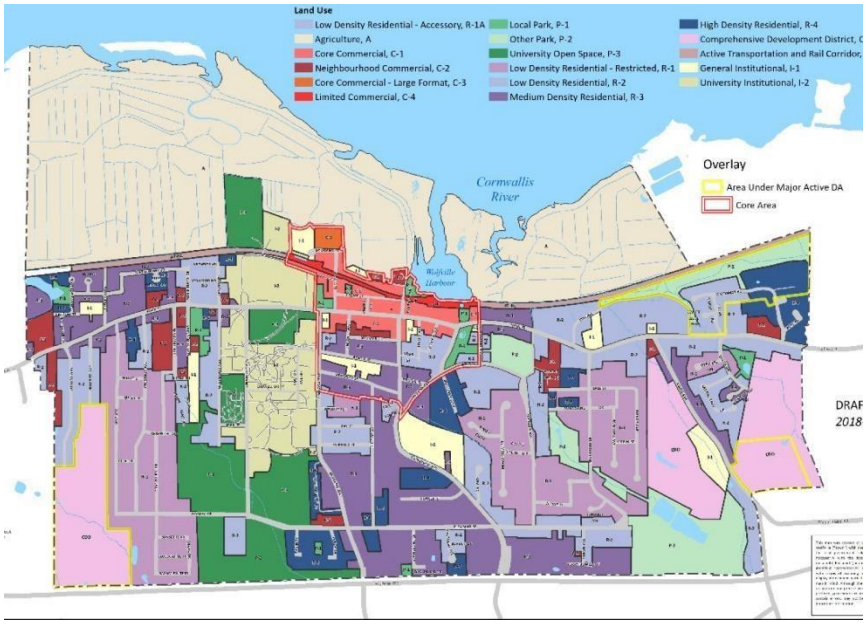


Figure 7 *- Population Density in Wolfville*

Key destinations in Wolfville, as determined through consultation with the public and stakeholder groups , are shown in Table 1, and mapped in Figure 8. According to numerous comments received during public engagement, in addition to easier movement throughout the town, the people of Wolfville also desire AT connections to nearby communities in the region. Access to Horton High School was also mentioned as a priority during public engagement.

Table 1 *- Destinations in Wolfville, from public engagement*

- Downtown core
- Acadia University
- Wolfville School
- Harvest Moon Trail
- Reservoir Park
- Residential neighbourhoods
- Surrounding communities - Kentville, New Minas, Port Williams, Avonport, etc.

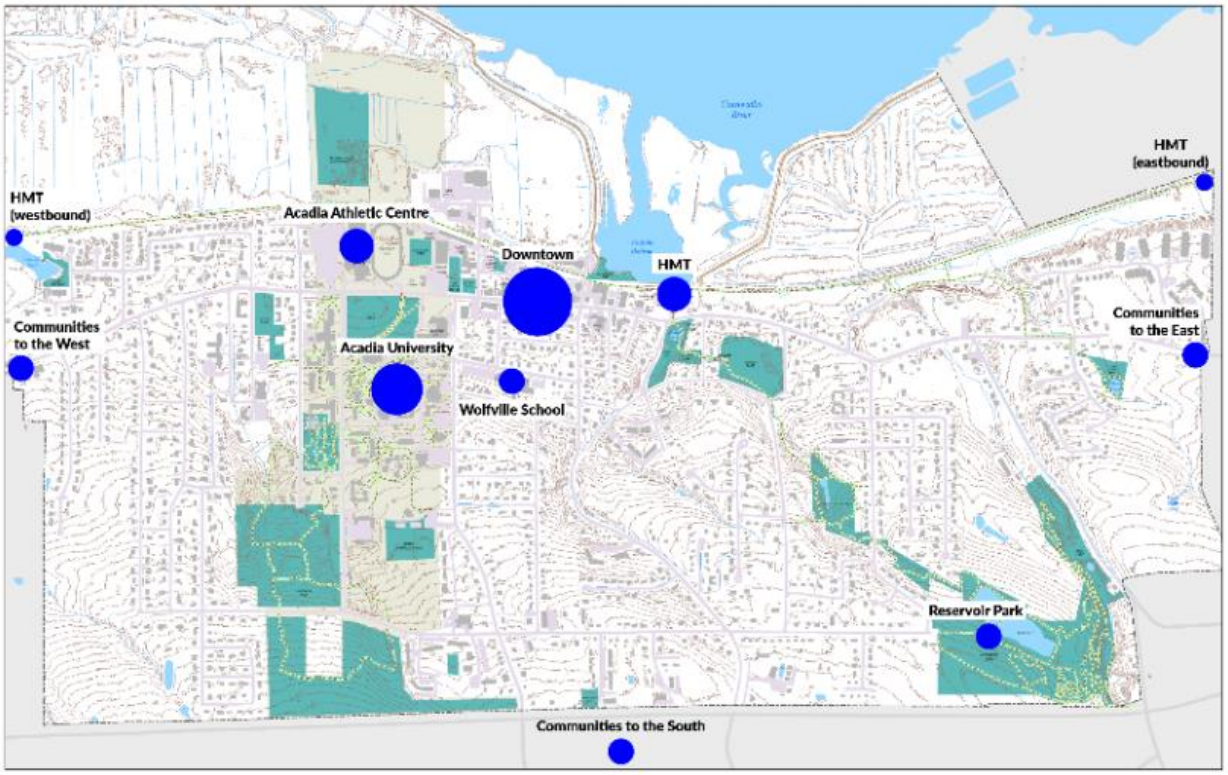


Figure 8 *– Map of destinations in Wolfville, identified through stakeholder engagement*

When stakeholders were asked what they considered the key routes or connectors in Wolfville to be through the online questionnaire, Main Street was the most common answer. The top 5 responses can be found in Table 2. While the Harvest Moon Trail was identified as a key route, there were several comments for improving the trail, such as improving surface condition, widening the trail through Town, and improving signage and wayfinding.

Table 2 *- What are the key routes or connectors in Wolfville*

Street	**# of people** *(n=71)*
Main Street	64
Gaspereau Ave.	27
HMT	25
Highland Av.	22
Skyway / Pleasant	22

NETWORK ANALYSIS: MAPPING ROUTES

To create a final plan for the network, used the five main requirements of cycle-friendly infrastructure to identify and compare potential routes: Safety, Comfort, Directness, Cohesion, and Attractiveness [3] [4] [5] [6]. For this analysis, directness and cohesion have been combined and analysed by looking at the origins and destinations, the 'comfort' of routes via their slope, and comparing the safety of routes by looking at sightlines. Attractiveness has not been considered, as that relates more to the design of the infrastructure rather than the route.

Directness and Cohesion

The first step to designing a bicycle network in Wolfville was to map out the key origins and destinations and connect them using straight lines, i.e. the most direct link (seen in Figure 9). This is a standard method for developing network plans in several transportation design guides [4] [5] [6]. These lines were used to determine which of the nearby roads and paths have the greatest potential to provide the most direct and intuitive route between points.

To service the origins and destinations that have been identified through this process, Main Street is a key connector. Due to comments related to the existing high vehicle and pedestrian traffic on Main Street, an additional east-west for connection would be appropriate. Skyway Drive/Pleasant Street provides connection to Reservoir Park, which was a popular destination. A north-south route that connects Main Street to Skyway Drive/Pleasant Street in the middle of the Town would seem beneficial as there is certainly a concentration of destinations downtown.

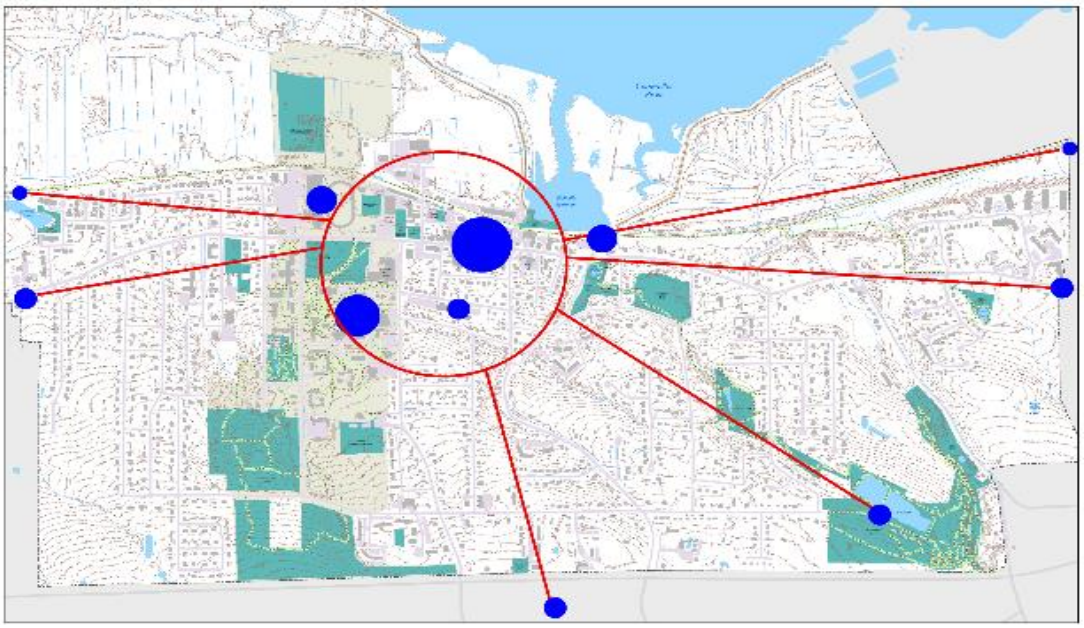


Figure 9 *- Connections between major origins/destinations*

Comfort

For the route to be accessible to people of all ages and abilities, the maximum grade of a slope should be below 4%. While all potential east-west routes in the town are well below this threshold, all potential north-south routes exceed it, except for Maple Avenue. Maple Avenue currently lacks connections to the rest of Town. A future connection through Reservoir Park could be considered to connect Maple to Pleasant Street particularly if higher density housing is built on Maple Avenue, though the hills in Reservoir Park are quite steep and without creative design could be a greater deterrent than existing hills. This also suggests that protected infrastructure would be desirable on the final north-south route, particularly going uphill where speed differences can be higher.

Table 3 *- Slope of potential bicycle routes*

	Avg. Slope	Greatest Slope
East-West Collectors		
Pleasant St.	0.1%	4.5%
Skyway Dr.	0.1%	3.0%
Main St.	0.4%	0.5%
North-South Collectors		
Maple Ave.	2.6%	3.0%
Gaspereau Ave.	4.2%	8.0%
Highland Ave.	4.6%	9.5%
Chestnut Ave.	5.3%	6.5%
Kent Ave.	5.6%	6.0%
University Ave.	5.7%	11.0%
Sherwood Dr.	6.2%	11.0%
Orchard Ave.	6.4%	10.0%

Safety

Real and perceived safety are both important factors in the creation of a bicycle network. While safety can be improved during the design phase by slowing down traffic, improving sightlines, and physically separating bicycles from motor vehicles using bollards or curbs. Traffic volume and existing sightlines were reviewed to determine the current level of safety for cyclists. Road widths and right-of-way was looked at to determine whether there is space for physical separation where necessary.

TRAFFIC VOLUMES

Traffic volume data was used where available. No additional traffic volume data was gathered as part of this study as irregular travel activity and patterns during the COVID-19 pandemic are unlikely to persist post-pandemic, limiting the utility of the data. Traffic speed and volume (TSV) data gathered on Main Street in 2015 (Table 4), shows a high volume of vehicles and would require protected bicycle lanes. Table 4 also shows the difference in traffic volume on Highland Avenue and Gaspereau Avenue, with Highland having fewer cars per hour.

Table 4 *- Speed volumes in Wolfville*

	Main Street - (west of University Av)	**Main Street -** (east of Gaspereau Av)	**Highland Avenue**	**Gaspereau Avenue**
Vehicles per Hour	~600vph	~360vph	145vph	214vph

While traffic speeds and volumes are not available for the remaining streets, it is assumed that many of the streets in Wolfville would have a low speed and volume of traffic. Where physically separated bicycle infrastructure is not being looked at, lower speed limits in Wolfville could be considered to ensure streets are safe all road users.

VISIBILITY AND SIGHTLINES

During public and stakeholder engagement, concerns were raised regarding sightlines and visibility at crosswalks along Main Street. The Town knows of this issue and, concurrent to the drafting of this report, is in the process of identifying and prioritizing problem areas.

For Gaspereau Avenue and Highland Avenue, both streets have similar widths and right-of-way allowance to incorporate separated cycling infrastructure. Highland Avenue has fewer bends along its length, which improves sightlines. Gaspereau Avenue was recently repaved and further changes or upgrades to it would have to be performed as part of a standalone project. Alternatively, at the beginning of BNS' engagement with the Town of Wolfville, the Town was in the process of planning for the reconstruction of Highland Avenue, which presents an opportunity to include safe bicycle infrastructure into an existing project, at a potentially lower cost.

PROPOSED NETWORK

BNS has proposed the following network as a priority minimum grid in Wolfville. This network includes Main Street, Highland Avenue, and Sky. These four routes will establish connections between residential areas, Wolfville's downtown amenities, and connect Wolfville to regional and provincial cycling networks.

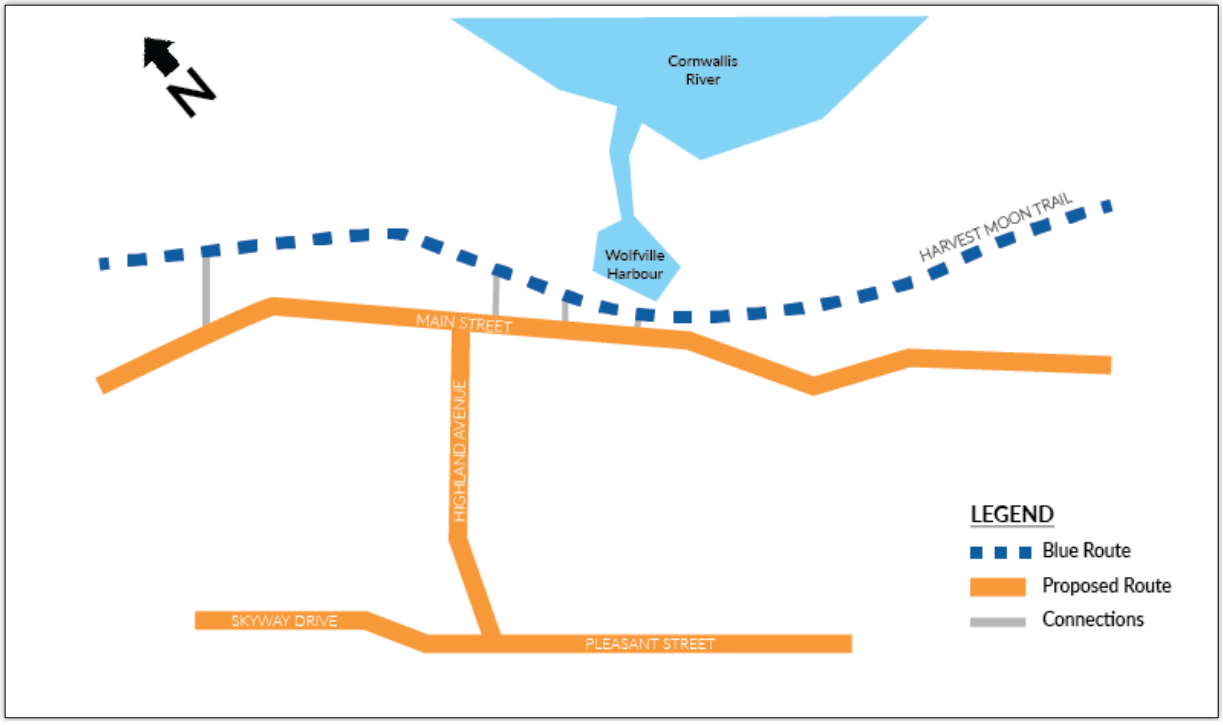


Figure 10 *- Proposed bicycle network for Wolfville*

Main Street: Downtown Wolfville, and destinations in downtown Wolfville, were unsurprisingly the most desirable destinations according to the public and stakeholders. There are existing bike lanes along the entire length of Main Street outside of the downtown core; connecting this route through downtown is extremely important for local and regional connectivity. Comments from the public indicate that space and movement are already constrained in this area, and suggestions were made to divert bike lanes to Front Street or even to the Harvest Moon Trail through downtown. These options would reduce the directness of the route.

This route also has spur connections to the Harvest Moon Trail. These are important to connect residents of Wolfville to regional destinations, but also important to connect visiting tourists travelling along the HMT to downtown businesses. Widening the trail between these spurs should be considered to accommodate increased use.

Highland Avenue: This route is a key central connector for the Town of Wolfville. While Gaspereau and Highland score similarly for connectedness, Highland has lower traffic and better sight lines for cyclists. Additionally, considering the condition of both roads and plans for construction, it will be significantly cheaper to add bicycle facilities to Highland Avenue in the near term. Like all the other

north-south connection options, the slope is above the AAA recommended grade of 4% and special consideration will need to be taken in the final design to provide as safe and comfortable a route as possible.

Skyway Drive/Pleasant Street: This route was identified as a key connector for residents as the only east-west route through Town other than Main Street, for the access it provides to Reservoir Park, and because it connects many of the current and future high density residential areas in Town. Most of the corridor has significant right of way to create separated bicycle infrastructure. Traffic calming could be implemented in the near-term to create a calmed street which would be safe for people on bicycles to use.

A Complete Connected Network

The ability of a bicycle network to encourage ridership is heavily dependent on its connectedness. While four routes have been deemed "priorities" for near-term implementation to form a minimum grid, the proposed layout does not provide a fully connected network. BNS suggests that the additional routes identified in Figure 11 should also receive consideration for active transportation infrastructure or traffic calming treatments in future, as funding and road maintenance opportunities arise, to complete and strengthen the connectivity of the network.

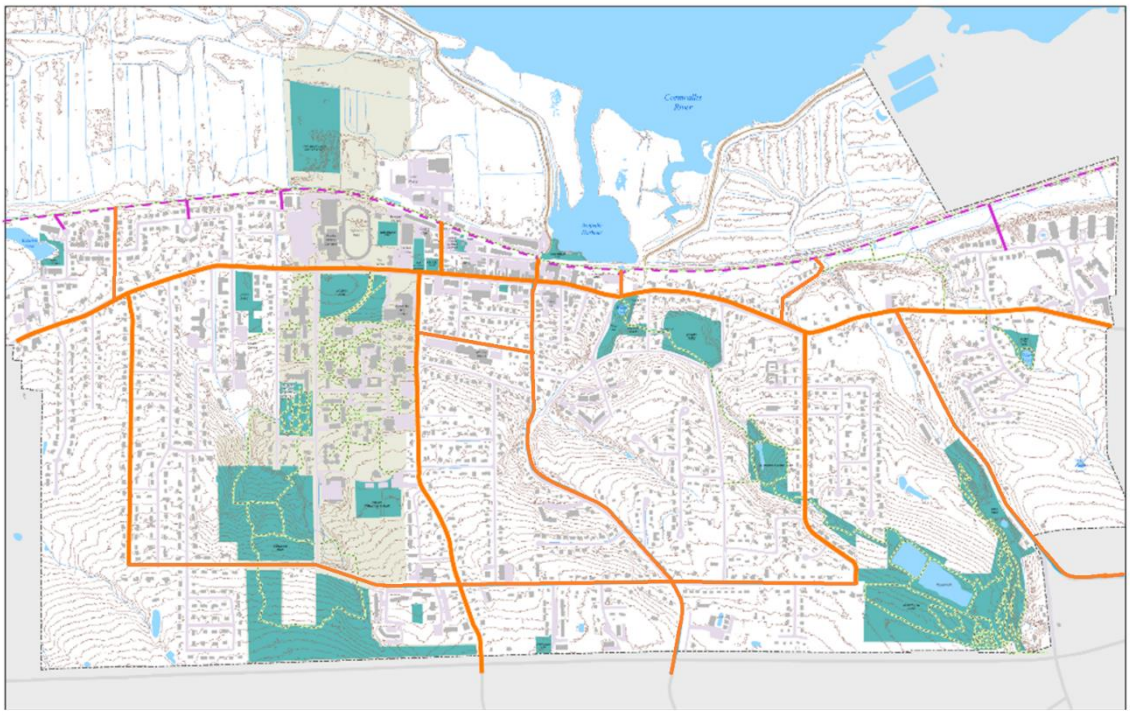


Figure 11 *– Recommendation for a complete bicycle network for Wolfville*

RECOMMENDATIONS

The creation of a safe and connected bicycle network has the potential to increase cycling rates in town for everyday journeys as well as connect Wolfville to the provincial network, attracting business from cycle tourists. After reviewing existing conditions and land-use patterns, and engaging with the community, Bicycle Nova Scotia recommends that the Town develop a three-route network, on Main Street, Highland Avenue and Pleasant Street/ Skyway Drive. The next stage in the Hubs Study design process will be to present the proposed network to the public and determine the most appropriate route for Bicycle Nova Scotia to focus on in Phase 3 of the Study.

A safe, well-maintained network of inclusive bicycle facilities will help residents feel confident and comfortable while cycling in Town. BNS suggests that the first step in the process should be to construct bicycle facilities along Main Street, Highland Avenue, while trialing temporary infrastructure on Pleasant Street/ Skyway Drive. The town should also investigate lower the speed limit of Pleasant Street/Skyway Drive to ensure the conditions are appropriate for a Bicycle Boulevard. Long-term, a network of fully connected routes should be developed to provide access to all corners of the town for those traveling by bicycle.

REFERENCES

[1] Statistics Canada, "2016 Census Profile - Wolfville, town [Census subdivision]," 2016.

[2] Town of Wolfville, "Municipal Planning Strategy," Wolfville, 2018.

[3] CROW, "Design Manual for Bicycle Traffic," CROW fietsberaad, Utrecht, 2007.

[4] DfT, "Cycle Infrastructure Design," The Stationary Office, Norwich, 2020.

[5] Province of British Columbia, "British Columbia Active Transportation Design Guide," Province of British Columbia, 2019.

[6] FHWA, "Bikeway Selection Guide," Federal Highway Administration, Washington DC, 2019.

Designing for All Ages & Abilities

Contextual Guidance for High-Comfort Bicycle Facilities

NACTO
National Association of City Transportation Officials

December 2017

Streets that are safe and comfortable for All Ages & Abilities bicycling are critical for urban mobility.

NACTO cities are leading the way in designing streets that are truly safe and inviting for bicyclists of All Ages & Abilities and attract wide ridership. This guidance—developed by practitioners from cities across North America—builds on NACTO's *Urban Bikeway Design Guide* and sets an **All Ages & Abilities** criteria for selecting and implementing bike facilities. Building bicycle infrastructure that meets this criteria is an essential strategy for cities seeking to improve traffic safety,[1] reduce congestion,[2] improve air quality and public health,[3] provide better and more equitable access to jobs and opportunities,[4] and bolster local economies.[5]

This All Ages & Abilities facility selection guidance is designed to be used in a wide variety of urban street types. It considers contextual factors such as vehicular speeds and volumes, operational uses, and observed sources of bicycling stress. In doing so, it allows planners and engineers to determine when, where, and how to best combine traffic calming tools, like speed reduction and volume management, with roadway design changes, like full lane separation, to reduce traffic fatalities and increase cycling rates and rider comfort.

The All Ages & Abilities criteria is a national and international best practice that should be adopted for all bicycle facility design and network implementation; lesser accommodation should require additional justification. Along with a problem-solving approach to street design, the All Ages & Abilities benchmark should be applied across a city's entire bicycle network to grow bicycling as a safe, equitable mode for the majority of people.

All Ages & Abilities Bike Facilities are ...

Safe

More people will bicycle when they have safe places to ride, and more riders mean safer streets. Among seven NACTO cities that grew the lane mileage of their bikeway networks 50% between 2007–2014, ridership more than doubled while risk of death and serious injury to people biking was halved.[6] Better bicycle facilities are directly correlated with increased safety for people walking and driving as well. Data from New York City showed that adding protected bike lanes to streets reduced injury crashes for all road users by 40% over four years.[7]

Comfortable

Bikeways that provide comfortable, low-stress bicycling conditions can achieve widespread growth in mode share. Among adults in the US, only 6–10% of people generally feel comfortable riding in mixed traffic or painted bike lanes.[8] However, nearly two-thirds of the adult population may be interested in riding more often, given better places to ride, and as many as 81% of those would ride in protected bike lanes.[9] Bikeways that eliminate stress will attract traditionally under-represented bicyclists, including women, children, and seniors.

Equitable

High-quality bikeways expand opportunities to ride and encourage safe riding. Poor or inadequate infrastructure—which has disproportionately impacted low-income communities and communities of color—forces people bicycling to choose between feeling safe and following the rules of the road, and induces wrong-way and sidewalk riding. Where street design provides safe places to ride and manages motor vehicle driver behavior, unsafe bicycling decisions disappear,[11] making ordinary riding safe and legal and reaching more riders.

SE Mill Street, PORTLAND
(photo credit: Portland Bureau of Transportation)

Who is the "All Ages & Abilities" User?

To achieve growth in bicycling, bikeway design needs to meet the needs of a broader set of potential bicyclists. Many existing bicycle facility designs exclude most people who might otherwise ride, traditionally favoring very confident riders, who tend to be adult men. When selecting a bikeway design strategy, identify potential design users in keeping with both network goals and the potential to broaden the bicycling user base of a specific street.

Children

School-age children are an essential cycling demographic but face unique risks because they are smaller and thus less visible from the driver's seat than adults, and often have less ability to detect risks or negotiate conflicts.

Seniors

People aged 65 and over are the fastest growing population group in the US, and the only group with a growing number of car-free households.[12] Seniors can make more trips and have increased mobility if safe riding networks are available. Bikeways need to serve people with lower visual acuity and slower riding speeds.

Women

Women are consistently under-represented as a share of total bicyclists, but the share of women riding increases in correlation to better riding facilities.[13] Concerns about personal safety including and beyond traffic stress are often relevant. Safety in numbers has additional significance for female bicyclists.

People Riding Bike Share

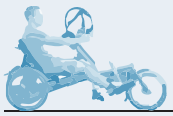
Bike share systems have greatly expanded the number and diversity of urban bicycle trips, with over 28 million US trips in 2016.[14] Riders often use bike share to link to other transit, or make spontaneous or one-way trips, placing a premium on comfortable and easily understandable bike infrastructure. Bike share users range widely in stress tolerance, but overwhelmingly prefer to ride in high-quality bikeways. All Ages & Abilities networks are essential to bike share system viability.

People of Color

While Black and Latinx bicyclists make up a rapidly growing segment of the riding population, a recent study found that fewer than 20% of adult Black and Latinx bicyclists and non-bicyclists feel comfortable in conventional bicycle lanes; fear of exposure to theft or assault or being a target for enforcement were cited as barriers to bicycling.[15] Long-standing dis-investment in street infrastructure means that these riders are disproportionately likely to be killed by a car than their white counterparts.[16]

Low-Income Riders

Low-income bicyclists make up half of all Census-reported commuter bicyclists, relying extensively on bicycles for basic transportation needs like getting to work.[17] In addition, basic infrastructure is often deficient in low-income neighborhoods, exacerbating safety concerns. An All Ages & Abilities bikeway is often needed to bring safe conditions to the major streets these bicyclists already use on a daily basis.



People with Disabilities

People with disabilities may use adaptive bicycles including tricycles and recumbent handcycles, which often operate at lower speeds, are lower to the ground, or have a wider envelope than other bicycles. High-comfort bicycling conditions provide mobility, health, and independence, often with a higher standard for bike infrastructure needed.

People Moving Goods or Cargo

Bicycles and tricycles outfitted to carry multiple passengers or cargo, or bicycles pulling trailers, increase the types of trips that can be made by bike, and are not well accommodated by bicycle facilities designed to minimal standards.

Confident Cyclists

The small percentage of the bicycling population who are very experienced and comfortable riding in mixed motor vehicle traffic conditions are also accommodated by, and often prefer, All Ages & Abilities facilities, though they may still choose to ride in mixed traffic.

Choosing an All Ages & Abilities Bicycle Facility

This chart provides guidance in choosing a bikeway design that can create an All Ages & Abilities bicycling environment, based on a street's basic design and motor vehicle traffic conditions such as vehicle speed and volume. This chart should be applied as part of a flexible, results-oriented design process on each street, alongside robust analysis of local bicycling conditions as discussed in the remainder of this document.

Users of this guidance should recognize that, in some cases, a bicycle facility may fall short of the All Ages & Abilities criteria but still substantively reduce traffic stress. Jurisdictions should not use an inability to meet the All Ages & Abilities criteria as reason to avoid implementing a bikeway, and should not prohibit the construction of facilities that do not meet the criteria.

Contextual Guidance for Selecting All Ages & Abilities Bikeways

Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**

* While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[18]

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

The All Ages & Abilities Design Toolbox

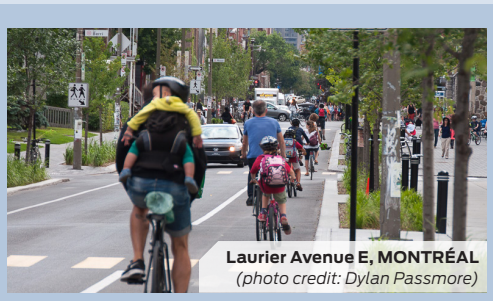
Five major types of bikeway provide for most bike network needs, based on the contextual guidance on page 4. This list is organized from more to less shared operation with automobiles. Each facility type is appropriate as an All Ages & Abilities bikeway in relevant street contexts. The NACTO *Urban Bikeway Design Guide* provides detailed guidance on bikeway facilities.

Argyle Street, CHICAGO
(photo credit: Chicago DOT)

Low-Speed Shared Streets allow bicyclists to comfortably operate across the entire roadway. Shared streets target very low operating speeds for all users, typically no greater than 10 mph. The volume of people walking and bicycling should be much greater than vehicle volume to maintain comfort. Issues for bicycling in shared environments arise from conflicts with people walking, who may be expected at any point across the street's width. Materials and street edges must be appropriate for bicycling; materials are often varied to delineate road space, but any seams or low mountable curbs must be designed to avoid creating fall hazards for bicyclists.

SE Taylor Street, PORTLAND
(photo credit: Greg Raisman)

Bicycle Boulevards (or neighborhood greenways) provide continuous comfortable bicycle routes through the local street network. Bike Boulevards are characterized by slow motor vehicle speeds and low volumes. Sometimes these are present by the very nature of the street and its function (e.g. narrow streets with no major destinations), but sometimes design work is needed, such as adding traffic calming elements, filtering most motor vehicle traffic off, and/or prioritizing bicycles at major and minor street intersections. In this way, bicycling is made comfortable across the entire roadway. Directional markings and wayfinding signage provide riders with intuitive, coherent routing.



Laurier Avenue E, MONTRÉAL
(photo credit: Dylan Passmore)

Buffered & Conventional Bicycle Lanes provide organized space for bicycling, and are often part of street reconfiguration projects that improve safety and comfort for all users. Bicycle lanes are an important tool to improve comfort and safety on streets where the number of passing events is too high for comfortable mixed-traffic bicycling, but where curbside activity, heavy vehicles, and lane invasion are not significant sources of conflict. Buffered bike lanes are almost always higher comfort than conventional bike lanes. In many cases, cross-sections with room for buffered bicycle lanes also have room for protected bicycle lanes.

Dunsmuir Street, VANCOUVER
(photo credit: Paul Kreuger via Flickr)

Protected Bicycle Lanes (also known as Separated Bike Lanes or Cycle Tracks) use a combination of horizontal separation (buffer distance) and vertical separation (e.g. flex posts, parked cars, or curbs) to protect people bicycling from motor vehicle traffic. The combination of lateral buffer distance and vertical separation elements (such as flexible delineators, curbs or height differences, or vehicle parking) can ameliorate most of the stressors of on-street bicycling. The robustness of bikeway separation often scales relative to adjacent traffic stress.

Cultural Trail, INDIANAPOLIS
(photo credit: Green Lanes Project)

Shared-Use & Bicycle Paths have in many cities served as the early spines of an All Ages & Abilities network. Paths can provide a continuous corridor, but usually do not take riders to their destinations. High pedestrian volumes, driveways, obtrusive bollards, sharp geometry, and crossings all degrade bicycling comfort, but often require long project timelines to eliminate. To become useful for transportation, paths work best when connected to an on-street network that meets the same high benchmark of rider comfort, and design provides bicycle-friendly geometry. Ideally, bicycles should be separated from pedestrians where significant volume of either mode is present, but where space limitations exist, multi-use paths are still valuable.

Motor Vehicle Speed & Volume Increase Stress

Whether or not people will bicycle is heavily influenced by the stresses they encounter on their trip. These stressors impact their actual physical safety and their perceived comfort level.

For all roadways and bike facilities, two of the biggest causes of stress are vehicular traffic speed and volume. These factors are inversely related to comfort and safety; even small increases in either factor can quickly increase stress and potentially increase injury risk.[19] The stresses created by speed are compounded by vehicular volume, and vice versa.

Slower or less confident bicyclists experience "near misses"—or non-injury incidents that cause stress—much more frequently per trip than faster riders, which can contribute to discouraging people from riding who would otherwise do so.[20]

SPEED

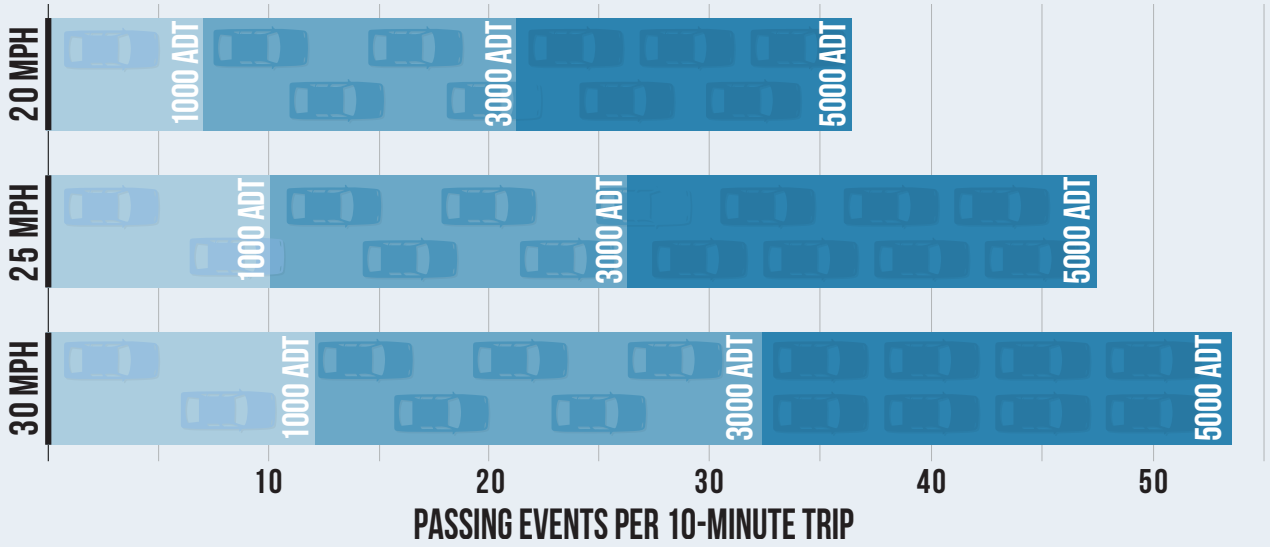
High motor vehicle speeds and speeding introduce significant risk to all road users, narrowing driver sight cones, increasing stopping distance, and increasing injury severity and likelihood of fatality when crashes occur.[21] Most people are not comfortable riding a bicycle immediately next to motor vehicles driving at speeds over 25 mph. Conventional bike lanes are almost always (with rare exceptions) inadequate to provide an All Ages & Abilities facility in such conditions.

VOLUME

When vehicular volumes and speeds are low, most people feel most comfortable bicycling in the shared roadway as they are able to maintain steady paths and riding speeds with limited pressure to move over for passing motor vehicles. However, as motor vehicle volume increases past 1,000 – 2,000 vehicles per day (or roughly 50 vehicles in the peak direction per peak hour), most people biking will only feel comfortable if vehicle speeds are kept below 20 mph.

Conflicts Increase with Speed & Volume

This chart illustrates the number of passing events (at increasing motor vehicle average speed and volume) experienced over a 10-minute period by a bicyclist riding 10 mph. As motor vehicle speed and volume increase, they magnify the frequency of stressful events for people bicycling.



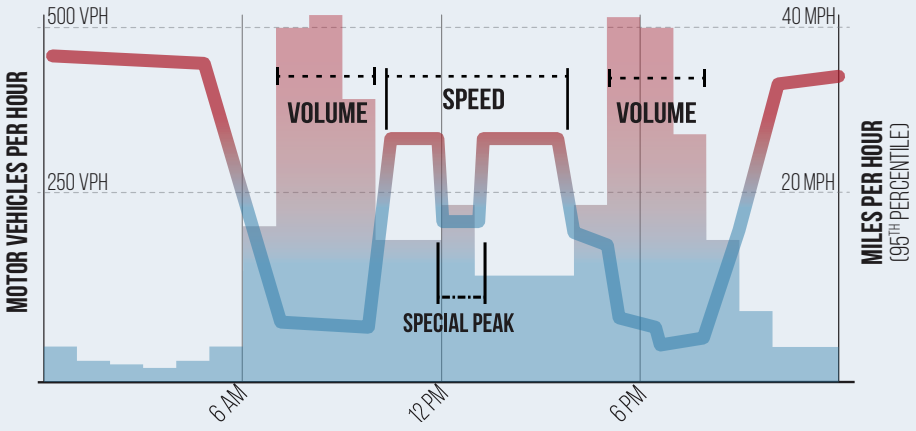
Motor Vehicle Speed and Volume Amplify One Another as They Increase

The frequency at which a person bicycling is passed by motor vehicles is one of the most useful indicators of the level of stress of a roadway or bike facility. Passing events increase with speed and volume, decreasing rider comfort and safety. Where car traffic is routinely above 20 mph, or where traffic volume is higher than 50 vehicles per direction per hour, pressure on bicyclists from motor vehicles attempting to pass degrades comfort for bicycling and increases risk.

- **At speeds of 20 mph,** streets where daily motor vehicle volume exceeds 1,000 – 2,000 vehicles, frequent passing events make shared roadway riding more stressful and will deter many users.
- **Between 20 and 25 mph,** comfort breaks down more quickly, especially when motor vehicle volume exceeds 1,000 – 1,500 ADT. When motor vehicle speeds routinely exceed 25 mph, shared lane markings and signage are not sufficient to create comfortable bicycling conditions.
- **Motor vehicle speeds 30 mph or greater** reduce safety for all street users and are generally not appropriate in places with human activity.
- **Where motor vehicle speeds exceed 35 mph,** it is usually impossible to provide safe or comfortable bicycle conditions without full bikeway separation.

Sources of Stress Change Throughout the Day

Large fluctuations in motor vehicle traffic volume between morning, mid-day, afternoon, and nighttime result in radically different bicycling conditions on the same street throughout the day. The example at right shows a street with roughly 500 vehicles per direction per hour during the peak. While queuing stress occurs at peak times, low off-peak volume results in dangerously high motor vehicle speeds.



Peak vs. Off-Peak

The variation in speed and volume conditions between peak and off-peak hours can manifest as two distinct issues that decrease comfort and safety.

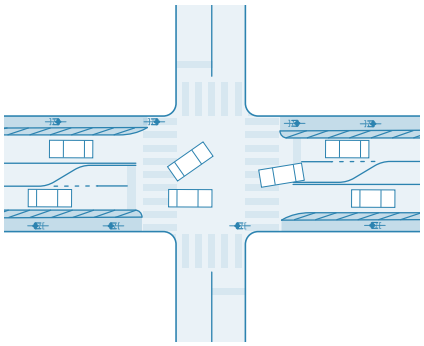
- **During high-volume peak periods,** motor vehicle queuing prevents comfortable mixed-traffic operation and increases the likelihood of bicycle lane incursions, unless physical separation is present.
- **During off-peak periods,** speeds can rise quickly, especially on wide and multi-lane streets, unless the street's design and operations specifically discourage speeding. Streets with very low off-peak volumes that also see little speeding, including many small neighborhood streets, may indicate All Ages & Abilities conditions if peak volumes are managed effectively.
- **Special Peaks** occur on streets that experience intensive peak activity periods. Schools have multiple short windows of time where pedestrian and motor vehicle activity are intense at exactly the time and place where the appeal of All Ages & Abilities bicycling is most sensitive. Downtown cores and retail streets experience intensive commercial freight activity throughout the day including at off-peak times, adding importance to the creation of protected bike lanes.

Changing the Street: Design, Operation, Networks

Not every solution that helps to create safe and comfortable bicycling conditions will be a geometric design. Creating a network of high-comfort bicycle facilities that meet the All Ages & Abilities criteria requires leveraging the full suite of design, operational, and network strategies to transform streets. Strategies can be implemented incrementally to address sources of stress and conflict, change demand for access and movement, and ultimately transform streets for all users by continuously increasing comfort and creating more opportunities to make more trips by bicycle.

Change Design

Design strategies change the cross-section of a street in order to provide bike lanes, buffered bike lanes, protected bike lanes, or other dedicated bicycle infrastructure. Creating dedicated space for bicycling— either by reducing the number of motor vehicle lanes or their width—usually does not involve substantial changes to motor vehicle volume or the types of vehicles that can use a street, and has substantial benefits for the safety of all street users. 4-to-3 and 4-to-2-lane (with left turn pocket) conversions are widely used, and many other street redesigns apply the same basic principle of organizing movements and modes into dedicated space to improve the efficiency of each space.



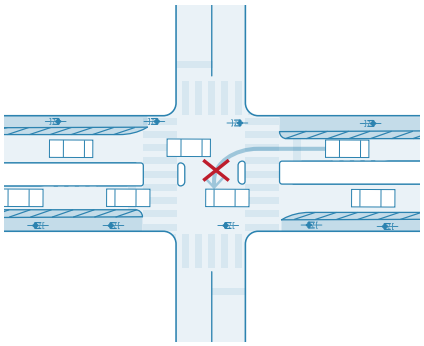
Examples:

- **Repurpose Motor Vehicle Lane**
- **Convert from Buffered to Protected Bike Lane**

Change Operation

Operational changes—such as speed reduction, signalization and other conflict management, and proactive curbside management—improve bicycling conditions by reducing the level of traffic stress on a street. Operational strategies make streets more predictable, efficient, and safe without necessarily changing the street's cross-section or the types of vehicles allowed.

On all facility types, reducing motor vehicle speeds to 20 – 25 mph is a core operational strategy for improving bicycle comfort and meeting the All Ages & Abilities criteria. In addition, reducing speeds can also make it easier to enact other safety changes, such as changes to intersection geometry, signalization, turn lanes, and turn restrictions. Since operational changes do not impact what types of vehicles can use the street, they usually do not require significant planning beyond the street itself, and are often the easiest type of change to implement.



Examples:

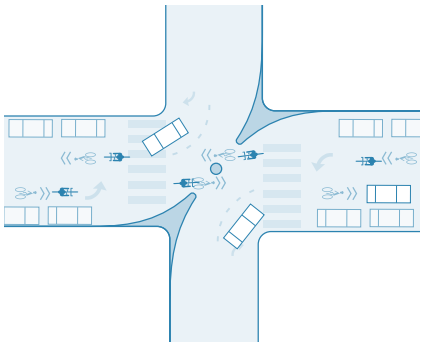
- **Signal Separation of Conflicting Movements**
- **Low-Speed Signal Progression**

Change the Network

Diverting motor vehicle traffic from a street, changing travel direction, (dis)allowing specific types of curbside access, and making other changes to the role of a street in the motor vehicle network are powerful ways to create All Ages & Abilities bicycling conditions. Such network changes allow the street to be transformed into a comfortable bicycling environment without requiring dedicated space.

Bicycle boulevards and shared streets, in particular, often rely on network changes to create the low-speed, very low-volume conditions necessary for cyclists to feel safe and comfortable. Prohibiting through-traffic (requiring all motor vehicles to turn off the street at each intersection), either through physical diverters or signage, is an effective strategy for reducing speed and volume.

Changes to the motor vehicle network can open up opportunities for better bikeway designs. For example, converting a high volume or high speed street from two-way to one-way or removing all curbside parking can provide space for a protected bike lane.



Examples:

- **Bicycle Boulevard**
- **Time-of-Day Regulations**

Ames Street, CAMBRIDGE
(photo credit: People for Bikes)

Low-Speed, Low-Volume Roadways Can Be Shared

See the Urban Bikeway Design Guide *for detailed guidance on Bicycle Boulevards, Conventional Bike Lanes, Buffered Bike Lanes, and Left Side Bike Lanes.*

Bicycle Boulevards & Shared Streets

Bicycle boulevards and shared streets place bicycle and motor vehicle traffic in the same space at the same time. These facilities meet the All Ages & Abilities criteria when motor vehicle volumes and speeds are so low that most people bicycling have few, if any, interactions with passing motor vehicles.

What to do:

- **Use both peak-hour volume and off-peak speed** to determine whether a shared roadway can serve as an All Ages & Abilities bike facility. High peak period volumes or high off-peak speeds create a high-stress bicycling environment. These sources of stress can be addressed through speed management or volume management, or may indicate the need for a separated bicycle facility.
- **Set a 20 – 25 mph target speed (10 mph on shared streets)** for motor vehicles in the majority of urban street contexts. Use the 95th percentile motor vehicle speed, along with the overall speed profile of motor vehicle traffic, to determine whether high outlying speeds exist, since even small numbers of motor vehicles traveling at high speeds can degrade the comfort of people bicycling on shared roadways.
- **Manage motor vehicle speeds** through operational and network tools such as speed humps, pinchpoints, and neighborhood traffic circles.
- **Reduce motor vehicle volume** by constructing diverters, prohibiting through traffic, or removing parking. The All Ages & Abilities condition is likely to be reached below approximately 1,000 – 1,500 vehicles per day or approximately 50 vehicles per hour per direction.
- **Use time-of-day analyses** to match regulations or access restrictions to demand. Commercial setting can also work with bike boulevards if stressors are managed. Prioritize delivery and freight access off-peak, or allow only transit and bikes at peak periods.

SE Ankeny Street Bike Boulevard, PORTLAND
(photo credit: NACTO)

Brookline Street, CAMBRIDGE
(photo credit: City of Cambridge)

Conventional & Buffered Bicycle Lanes

Conventional and buffered bike lanes on urban streets delineate space for bicyclists but provide no physical separation between people bicycling and driving. With on-street parking, they also place the bicycle between parked vehicles and moving motor vehicles. Since bicyclists must enter the motor vehicle lane to avoid conflict with turning vehicles, parking maneuvers, double parking or curbside loading, or open doors, it is important for passing events to be minimized.

What to do:

- **Set target speeds at or below 25 mph.** Speeds of 20 – 25 mph improve comfort and allow drivers to more easily react when bicyclists need to move into the motor vehicle lane. Use strategies such as lower progression speed and shorter signal cycle lengths to reduce the incentive for drivers to speed, and reduce top-end speeding incidents.
- **Discourage motor vehicle through-movement to reduce volumes.** Lower motor vehicle volumes reduce the number of passing events. Depending upon the presence and intensity of other operational stressors, an All Ages & Abilities condition may be reached below approximately 3,000 – 6,000 vehicles per day, or approximately 300 to 400 vehicles per hour.
- **Reduce curbside conflicts**, especially freight, loading, and bus pull-outs (see page 15). Carefully manage loading activity and parking demand. On one-way streets with transit activity, move the bike lane or buffered bike lane to the left side of the street to alleviate intersection and curbside conflicts. On streets with heavy curbside use but low motor vehicle volume, consider moving truck traffic or curbside loading to other streets.
- **Address intersection conflicts** through motor vehicle turn prohibitions, access management, and signal phasing strategies. Due to the likelihood of both left- and right-turning conflicts from bi-directional motor vehicle traffic, use the same motor vehicle volume threshold on two-way streets as on one-way streets.
- **Increase buffer distance** where traffic characteristics adjacent to the bike lane decrease comfort, including large vehicles or curbside parking. Where adjacent sources of stress are present, a buffered bike lane can improve comfort by increasing shy distance between bikes and motor vehicles. Where multiple motor vehicle lanes, moderate truck and large vehicle volumes, or frequent transit indicate that most bicyclists will need more separation to be comfortable.

Separate Bicyclists When Speed & Volume are High

Protected Bicycle Lanes

Protected bike lanes (including raised bikeways) create All Ages & Abilities conditions by using physical separation to create a consistently exclusive, designated bicycling space. The physical protection offered by protected bike lanes means that they can often meet the All Ages & Abilities criteria even in higher speed, high volume, or unpredictable conditions. Protected bike lanes improve the overall organization of the street, and increase safety for people walking, bicycling, and in motor vehicles.

What to do:

- **Build protected bike lanes where motor vehicle speed consistently exceeds 25 mph,** where daily motor vehicle volume is higher than approximately 6,000 vehicles per day, where curbside conflicts are expected, or wherever there is more than one motor vehicle lane per direction.
- **Manage intersection and curbside conflicts** with transit boarding islands, protected (bend-out or offset) intersection designs, signal phasing, and other turn management strategies.
- **Reduce speeds through operational strategies,** such as signal time, lower signal progression, and shorter signal cycles.
- On streets with parking, **reverse the position of the parking and the bike lane to create physical separation** between the bike lane and moving motor vehicle traffic.
- On streets without parking, **add vertical separation elements** (e.g. delineators, barriers, raised curbs) in an existing buffer, or raise existing curbside bike lanes.
- On streets with multiple motor vehicle lanes in each travel direction, **convert one travel lane to a protected bike lane,** better organizing the street and improving safety for people biking, walking and driving.[22]
- **Convert conventional or buffered lanes to protected lanes** if motor vehicle speeds and volumes cannot be otherwise reduced and where there is high curbside activity or peaks of intensive demand such as retail-heavy streets, or around schools, large employers, institutions, and entertainment districts.

Second Avenue, SEATTLE
(photo credit: Adam Coppola for Green Lanes Project)

Strategies to Reduce Other Sources of Stress

In addition to motor vehicle speed and volume, All Ages & Abilities bikeway facility selection should respond to street conditions that increase bicycling stress and often degrade comfort and safety for all people using the street. These sources of stress can be addressed through design, operations, and network solutions that either remove the source of stress or separate it from bicycle traffic.

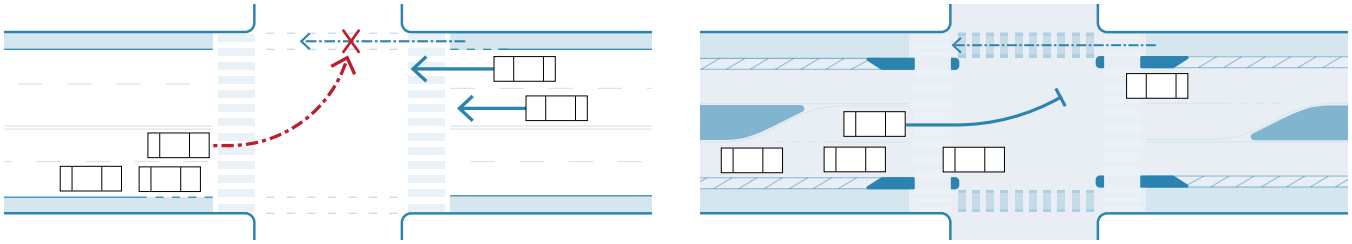
Multiple Motor Vehicle Lanes

Source of Stress

Motor vehicle traffic on multi-lane streets, whether two-way or one-way, is less predictable than on streets with a single lane per direction of travel. Lane changes, acceleration and passing, and multiple-threat visibility issues degrade both comfort and safety. Corridors with a major through-traffic function and multiple motor vehicle lanes are inherently unpredictable biking environments.

Design Strategy

Reduce the cross-section to one motor vehicle travel lane per direction, where possible. On streets where multiple through lanes in one direction are used to allocate very high motor vehicle traffic capacity, provide physical protection and manage turns across the bikeway. 4-to-3 or 5-to-3 lane conversions paired with protected bikeways are transformative for both bicycling and walking safety and comfort.[23]



A common "multiple threat" conflict, where reduced visibility for motor vehicles turning across multiple travel lanes increase bicyclists' risk at crossings. The 4-to-3 lane conversion is a common technique for managing motor vehicle traffic flow while reducing the multiple threat conflict, though two-way left turn lanes introduce turn conflicts at mid-block locations (e.g. driveways).

Motor Vehicle Queuing

Source of Stress

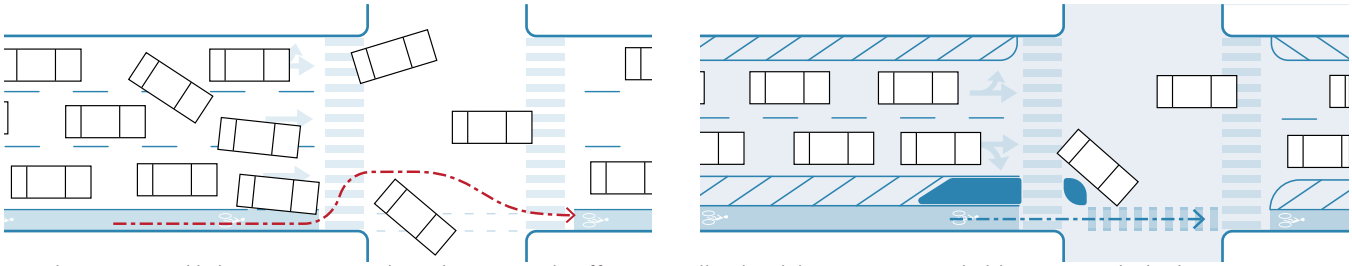
Motor vehicle congestion presents safety and comfort issues for people bicycling. Queued traffic moves at unpredictable speeds and will often invade conventional or buffered bike lanes.

Queuing encourages both motorists and bicyclists to engage in unpredictable movements. Bicyclists may weave through queued cars when bicycle facilities are obstructed, where motorists are also prone to move unexpectedly.

Design Strategy

Protected bike lanes should be implemented where motor vehicle invasion of the bike lane is likely to occur otherwise. Visual and physical barriers can prevent encroachment on the bikeway.

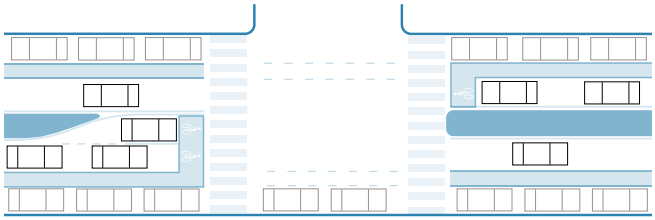
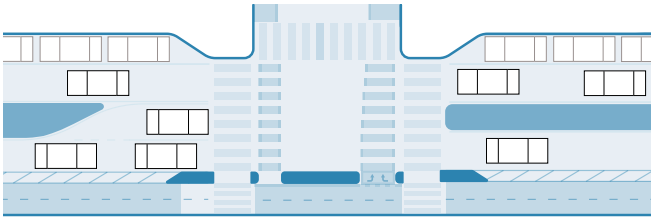
Bicycle facilities should be designed with capacity for growing ridership, including passing of slow-moving cargo bicycles.



Bicyclists are more likely to try to weave through congested traffic, especially when bikeways are impeded, but motor vehicles become unpredictable. Separation and protection prevent queued vehicles from permeating bicycle space and maintain bikeway integrity throughout the day.

Strategies to Reduce Other Sources of Stress

Intersections

Source of Stress	Design Strategy
Motor vehicles turning across the bikeway typically require people bicycling to negotiate with motor vehicles, a significant stressor at all but the very lowest speed conditions. Bicycle design treatments that require people biking to cross or mix with motor vehicle traffic are stressful at all but low volumes.	Provide separation in space and time between bicycles and vehicles to the extent possible, or reduce speed and maximize visibility between drivers and bicyclists. Tighter effective corner radii, raised crossings, and protected intersection designs are effective in slowing motor vehicle turning speed and placing bicyclists in a priority position.
Bicycle left turns, especially on busy streets, can be very stressful or even dangerous for bicyclists, especially if bikes are expected to merge with fast-moving traffic or turn across multiple lanes.[25]	Provide appropriate intersection treatments to accommodate desired turning movements, including bike boxes, two-stage queue boxes, phase separation, or protected intersections (also known as "offset" or "bend-out" crossings) that organize and give priority to people bicycling.
	
Sharp grade or direction changes, such as sharp lateral transitions approaching the intersection, require people biking to slow down and may increase fall risks. Frequent starts and stops also create instability at intersections.	Reduce or mitigate situations that increase risk of falling and instability. Design intersection approaches and transitions with bicycle-friendly geometry; place bicycle movements first in the signal phase; time signal progressions to bike-friendly speeds; and rotate stop signs to face cross streets.

Trucks & Large Vehicles

Source of Stress	Design Strategy
High volumes of truck traffic degrade adjacent bicycling safety and comfort. This is often the case on major streets, or in commercial or industrial places.	Provide protected bicycle facilities—or, at minimum, buffered bike lanes—on observed or designated trucking routes, regardless of general motor vehicle speed and volume.
Large vehicles have large blind spots, increasing risk of side-swipe and right-hook crashes.	Use buffers to increase the distance between truck and bicycle travel paths. Consider protected intersection geometry (also known as "offset" or "bend-out").
Large vehicle noise and exhaust increase bicycling stress and present public health issues.	Provide wide lateral separation—such as with wide buffers, planters or planting strips, or parking-protected facilities—to dissipate pollutants entering the bikeway.[26]

Curbside Activity

Source of Stress	Design Strategy
Frequent freight and passenger loading either happens in the bikeway or adjacent in the curbside lane. Loading activities increase conflicts crossing the bike lane, or even blockages by double-parked vehicles that imperil bicyclists and rapidly decrease assurances of safety.	Provide designated truck loading zones and provide space for other curbside uses to prevent blockages of the bicycle lane. Consider restricting freight loading to off-peak periods. If frequent freight or passenger loading is observed, provide protected bicycle facilities regardless of speed and volume, or move passenger and freight loading uses to a cross-street.
High parking turnover results in frequent weaving and door zone conflicts.	Where parking turnover is high, provide protected bikeways regardless of speed to avoid sudden conflicts and reduce injury risk, or remove parking. Cities should establish local guidance on acceptable levels of parking maneuvers across bicycle lanes.
Freight loading is present throughout the day, but motor vehicle speed and volume are consistently low.	Implement a robust bike boulevard or shared street treatment with traffic calming strategies to provide comfort and safety across the entire roadway.
Car doors open into the bicycle travel path during vehicle exit and entry, but parking turnover is low to moderate.	Provide a wide marked buffer adjacent to the vehicle door zone to guide bicyclists clear of dooring conflicts for both buffered and protected bike lanes.

Frequent Transit

Source of Stress	Design Strategy
Buses merge across conventional bike lanes to access curbside stops. At all but the lowest bus frequencies, conventional "pull-out" transit stops degrade comfort and increase transit delay.	Provide spot protection using transit boarding islands, which are compatible with protected, buffered, and conventional bicycle lanes. Boarding islands create in-lane transit stops, which improve bus reliability and travel time.
Bikes and transit travel at similar average speeds but different moving speeds, as buses stop and accelerate frequently. Overtaking buses and bicycle leapfrogging decrease riding comfort in mixed conditions.	Provide dedicated bicycle facilities. On one-way streets, left-side bicycle facilities can be used to separate bikes and transit vehicles.
Core transit routes and trunklines often operate on streets with dense destinations and demand for bicycle access. In some cases, right-of-way width may constrain design decisions and facility types that can be implemented.	On trunkline transit streets, it is even more important to accommodate users in dedicated lanes, since the major streets are where people need to get to their destinations. If the primary demand for the corridor is through travel, it may be possible to consider providing high-quality bike infrastructure on parallel, nearby, and continuous routes, while allowing local bicycle access on the transit street. To improve All Ages & Abilities bicycling conditions, use low-speed signal progressions and other calming measures consistent with transit effectiveness. As on all transit routes, pedestrian safety is the foremost design need.

The NACTO *Transit Street Design Guide* provides detailed guidance for streets with frequent bus transit routes.

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2 Study of 1st, 8th, and Columbus Avenues in New York found that after installation of protected bike lanes on each, average motor vehicle travel times throughout the day were either unchanged or fell as much as 35% at parts of the day.

Protected Bicycle Lanes in NYC. New York City Department of Transportation, 2014. nyc.gov/html/dot/downloads/pdf/2014-09-03-bicycle-path-data-analysis.pdf

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4 Lower-income workers spend proportionally more of their income on transportation, are significantly more likely to commute during evening and weekend hours where transit service is less frequent, and most likely to commute by bicycle.

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Wolfville Comprehensive Active Transportation Network

Investing in Canada Infrastructure Program (ICIP) Climate Change Mitigation Sub-Stream

Council Overview

April 20, 2021

The Project

The development of a minimum-grid-style, town-wide AT (active transportation) network, comprised of AAA (all-ages-and-abilities) walking and cycling facilities. The network would provide residents and visitors with safe, comfortable, and convenient access, by AT modes, to key destinations in town and the regional AT network.

*The opportunity to have this project funded at **73.3%** is time sensitive and requires a Council decision.*

- *Provincial Government **33.33%,***
- *Federal Government **40%***
- *The Town **26.66%.***

This package outlines the opportunity so Council can make an informed decision.

Background

Nova Scotia is taking an ambitious path to reduce GHG emissions with legislative targets for 2050 and 2030.

Wolfville Council has recently adopted its own GHG emission reduction targets.

In the summer of 2020, Staff submitted an expression of interest to the Province (Department of Energy and Mines) to fund a comprehensive 'All Ages Accessible' Active Transportation network in the Town through the Investing in Canada Infrastructure Program's (ICIP) Climate Mitigation stream.

The Province is focused on a transition to a greener future. Projects that will create opportunities for everyone and stimulate economic growth, create jobs, spark innovation, increase social equity, reduce poverty and enhance community connectedness are the focus.

The Province is looking to advance our project for Federal review and investment. They are supportive of our project because it showcases:

- An All Ages Accessible network – using best practice in Active Transportation facilities that work for all users;
- A comprehensive network that connects important destinations in the Town and wider Region; and
- Acts as a Demonstration/Leadership on how investments can both reduce GHG emissions and have other co-benefits (e.g. adaptation/flood control, economic development, health and wellness, social equity, etc).

How did we get here?

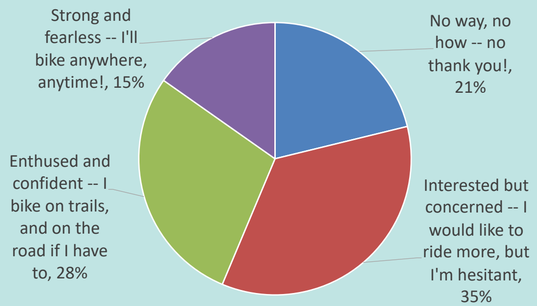
Staff have worked with Bicycle Nova Scotia and consulted the public through surveys and in-person meetings with committees and interest groups (over past 6 months) to inform the development of the minimum AAA grid being presented.

There is a clear desire for improved active transportation in the Town.

1. ***Wolfville: Access by Design (2019)***. The Town adopted an Accessibility plan to ensure equitable access to community life and participation in society for all people regardless of their abilities. The plan has 5 areas of focus: the built environment, information on and communication on, transportation on, goods and services, employment.
2. ***Municipal Planning Strategy (2020).*** After a substantial process, Council's Municipal Planning Strategy clearly articulates directions related to Active Transportation in part 5 (Mobility) of the plan.
3. ***Council Strategic Plan (2021-2024).*** Council's recently adopted strategic plan outlines priorities and initiatives which include:
   - Clear plan to address, in a timely manner, the revitalization and maintenance of road, sidewalk, crosswalk infrastructure and traffic management including addressing the issue of the 4-way stop
   - Climate management related initiatives to reduce carbon emissions, support local transportation, local food security and environmental protection.

Excerpt from 2020 Mobility Survey

How would you characterize yourself as a cyclist?



Example Policies from part 5 of the MPS

IT SHALL BE THE POLICY OF COUNCIL:

1. To build cost-effective infrastructure that increases participation in active transportation and discourages reliance on fossil fuel vehicles in the Town of Wolfville.

2. To support sustainable transportation, reduce our reliance on fossil fuels, and promote health by striving to prioritize infrastructure development, in the following order of infrastructure;
   - 2.1. active transportation (walking, biking)
   - 2.2. public transportation options
   - 2.3. other shared mobility options
   - 2.4. private electric vehicles
   - 2.5. private fossil-fuel vehicles

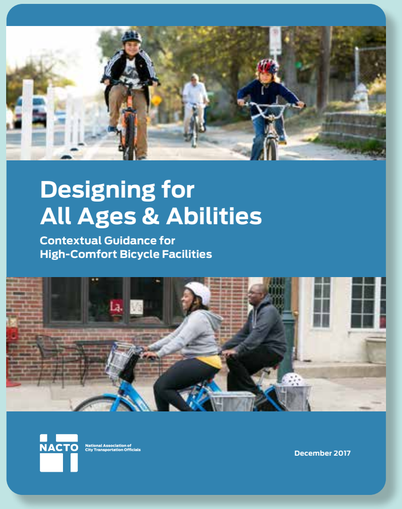
Council's Strategic Priorities

Core Concepts

1. *All Ages and Abilities (AAA)*

Streets that are safe and comfortable for All Ages & Abilities bicycling are critical for mobility. The NACTO Guide for achieving AAA has informed our approach.

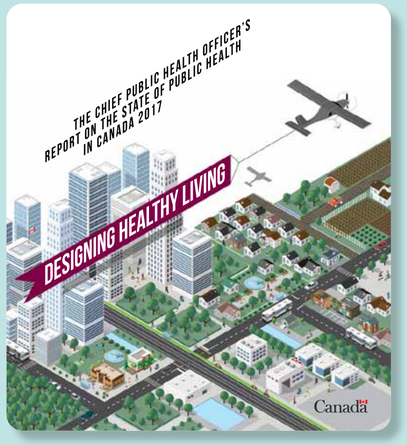
For more information on this report click here



2. *Healthy Communities*

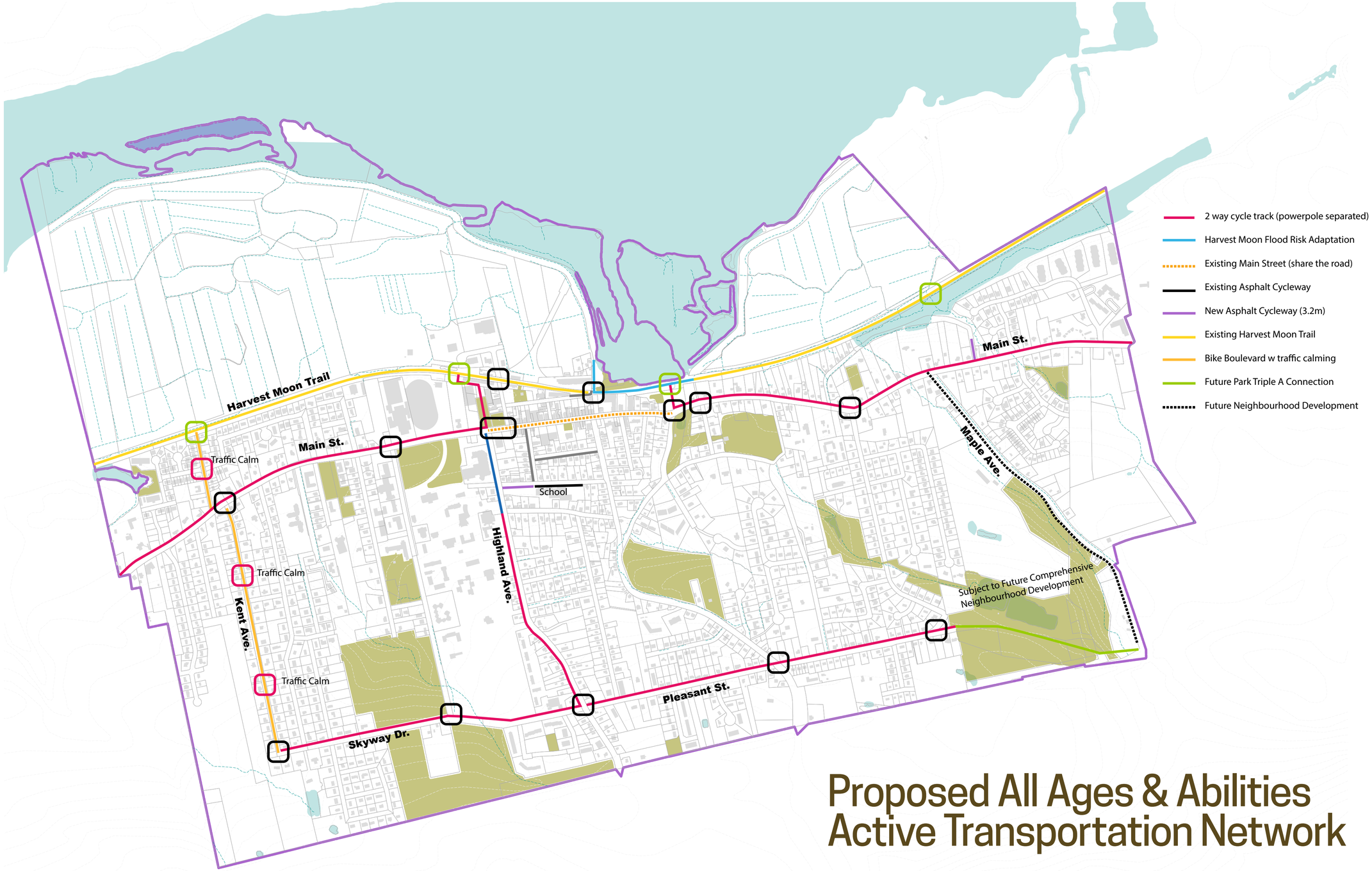
The design of our communities influence how physically active we are, how we travel through our communities, how socially connected we are, the kinds of foods we have access to, how exposed to the natural environment we are, and ultimately, how we experience health and wellness.

For more information on healthy communities click here



Proposed Comprehensive Active Transportation Network

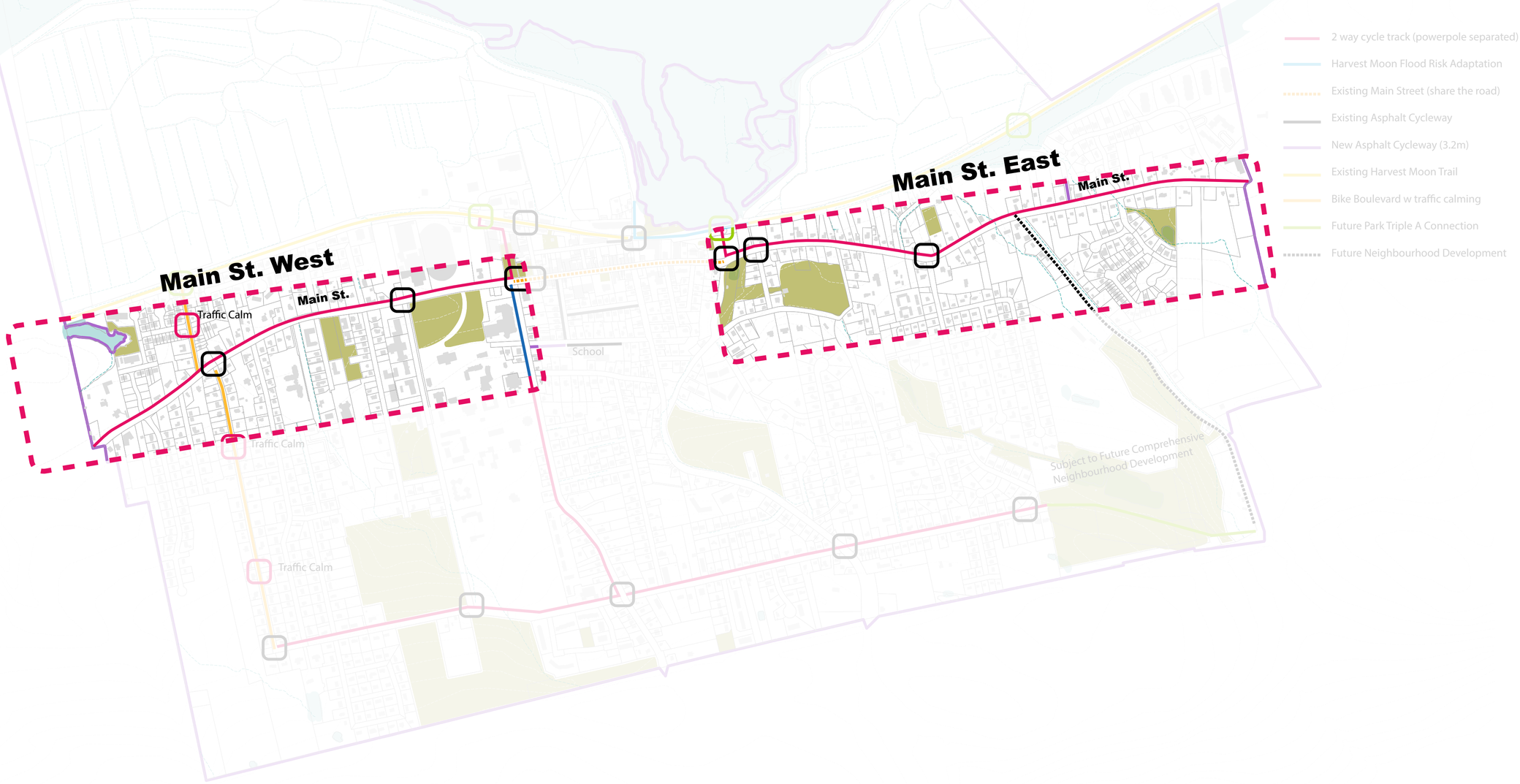
wolfville



Proposed All Ages & Abilities Active Transportation Network

Main Street

2-Way All Ages and Abilities Corridor

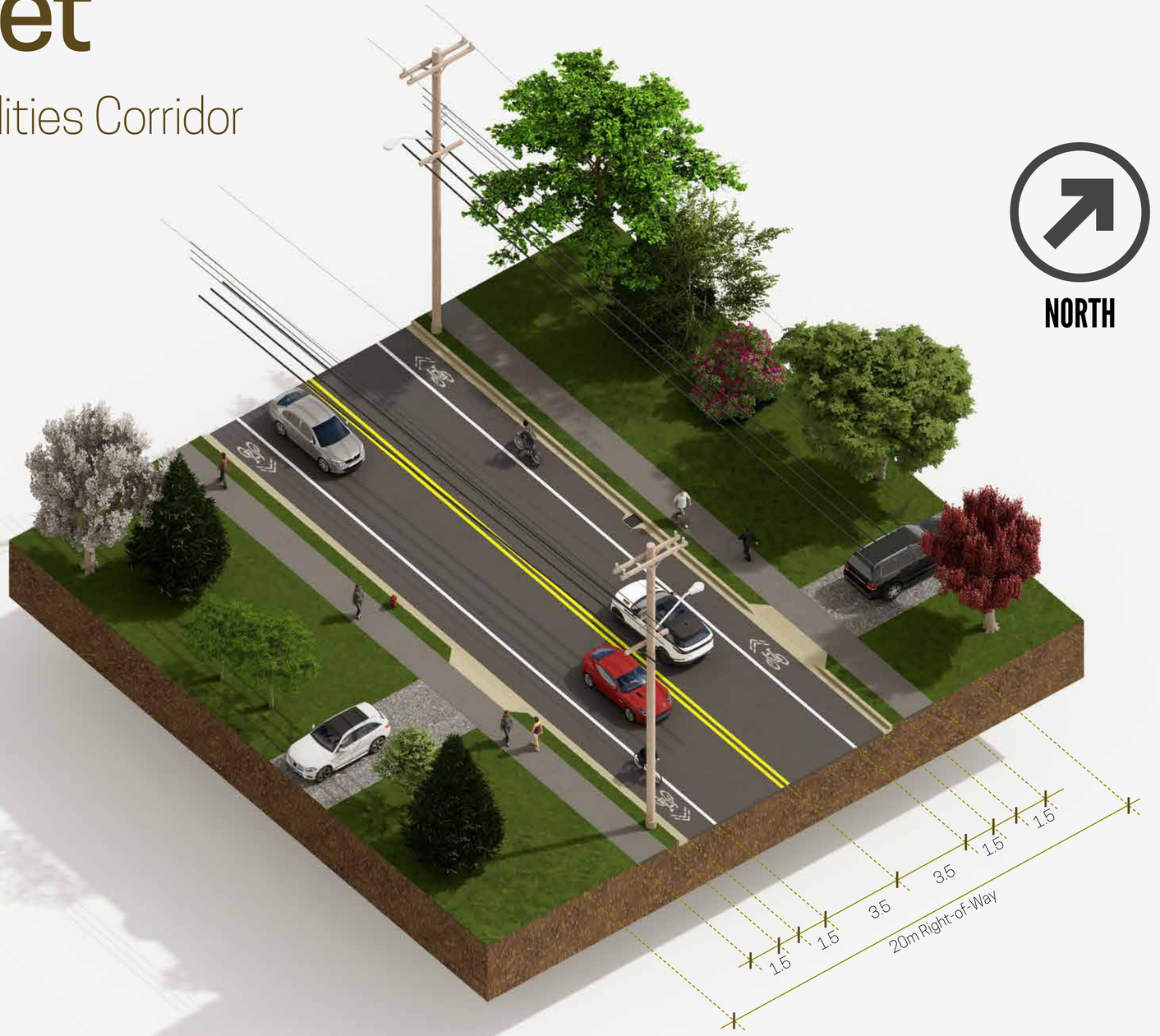


Main Street

2-Way All Ages and Abilities Corridor

Existing Conditions

- 1.5m on-street lanes @ east end
- 3.5m travel lanes
- Asphalt sidewalk both sides
- power-lines both sides

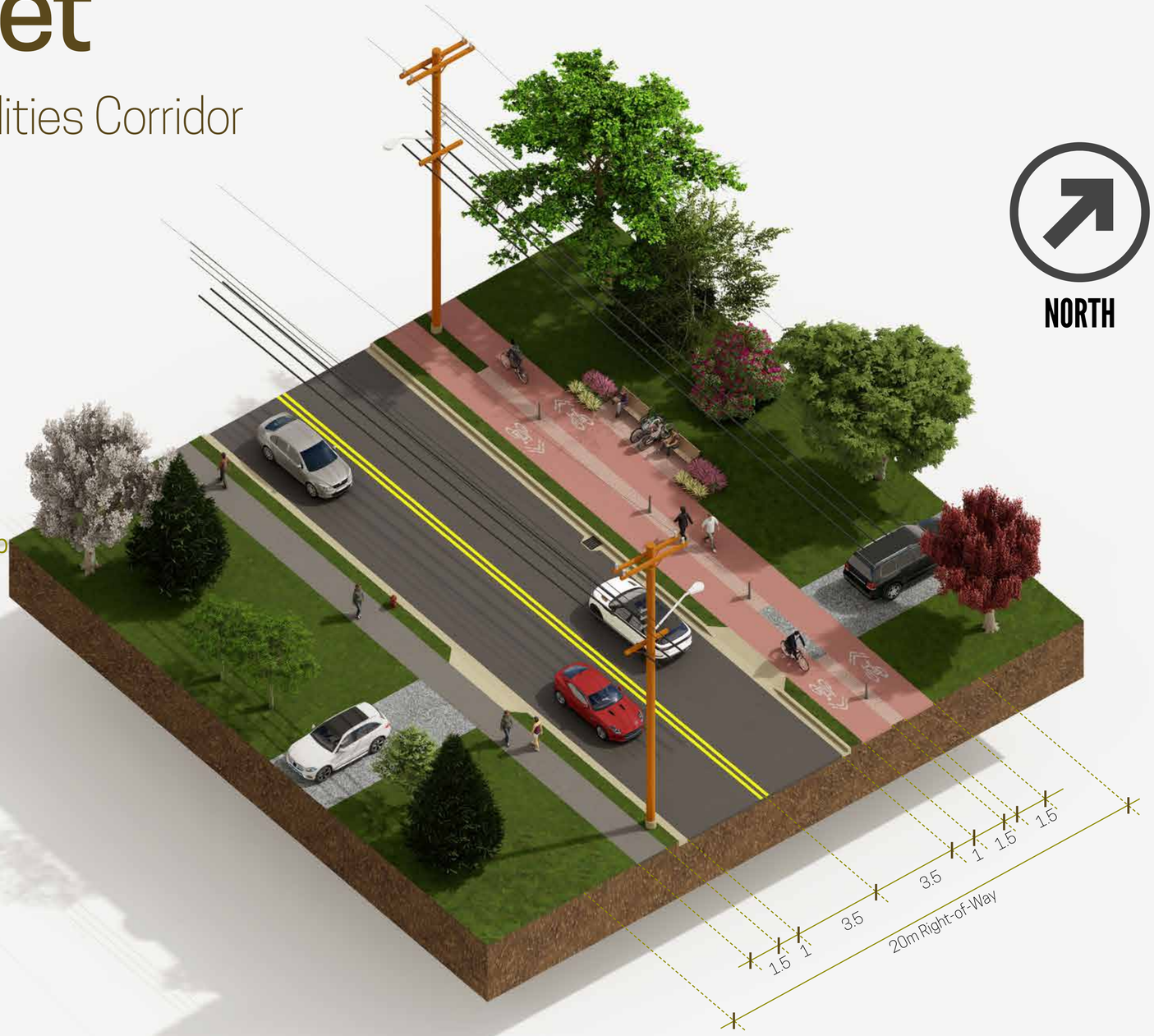


Main Street

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

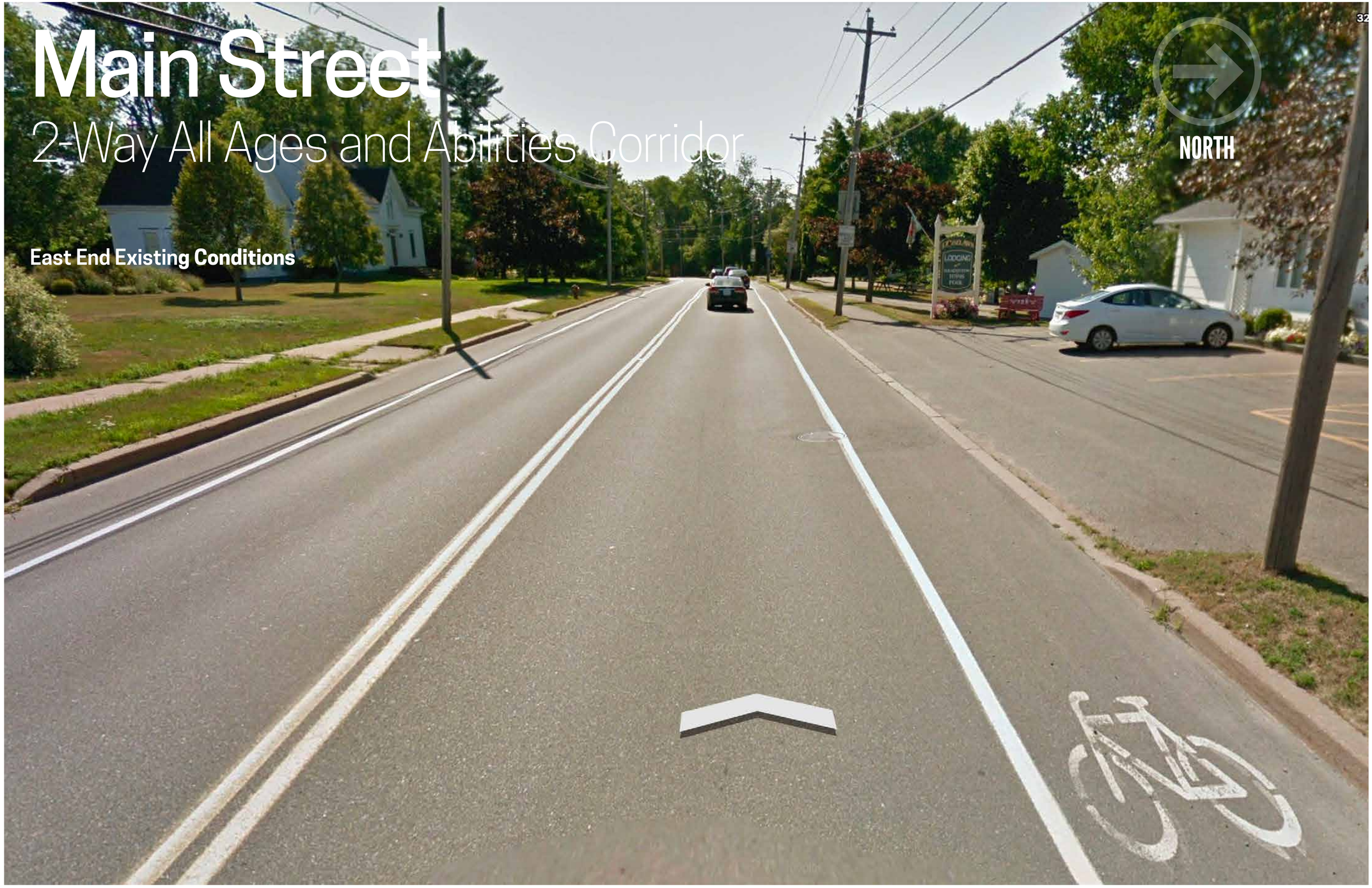
- onstreet lanes removed
- 3.5m travel lanes
- North curb-gutter moved south
- 2-separated 1.5m shared-use lanes
- Powerpoles unchanged
- CB & MH's on north side move w/ curb
- New street furnishings



Main Street

2-Way All Ages and Abilities Corridor

East End Existing Conditions



Main Street

2-Way All Ages and Abilities Corridor

East and West Existing Conditions

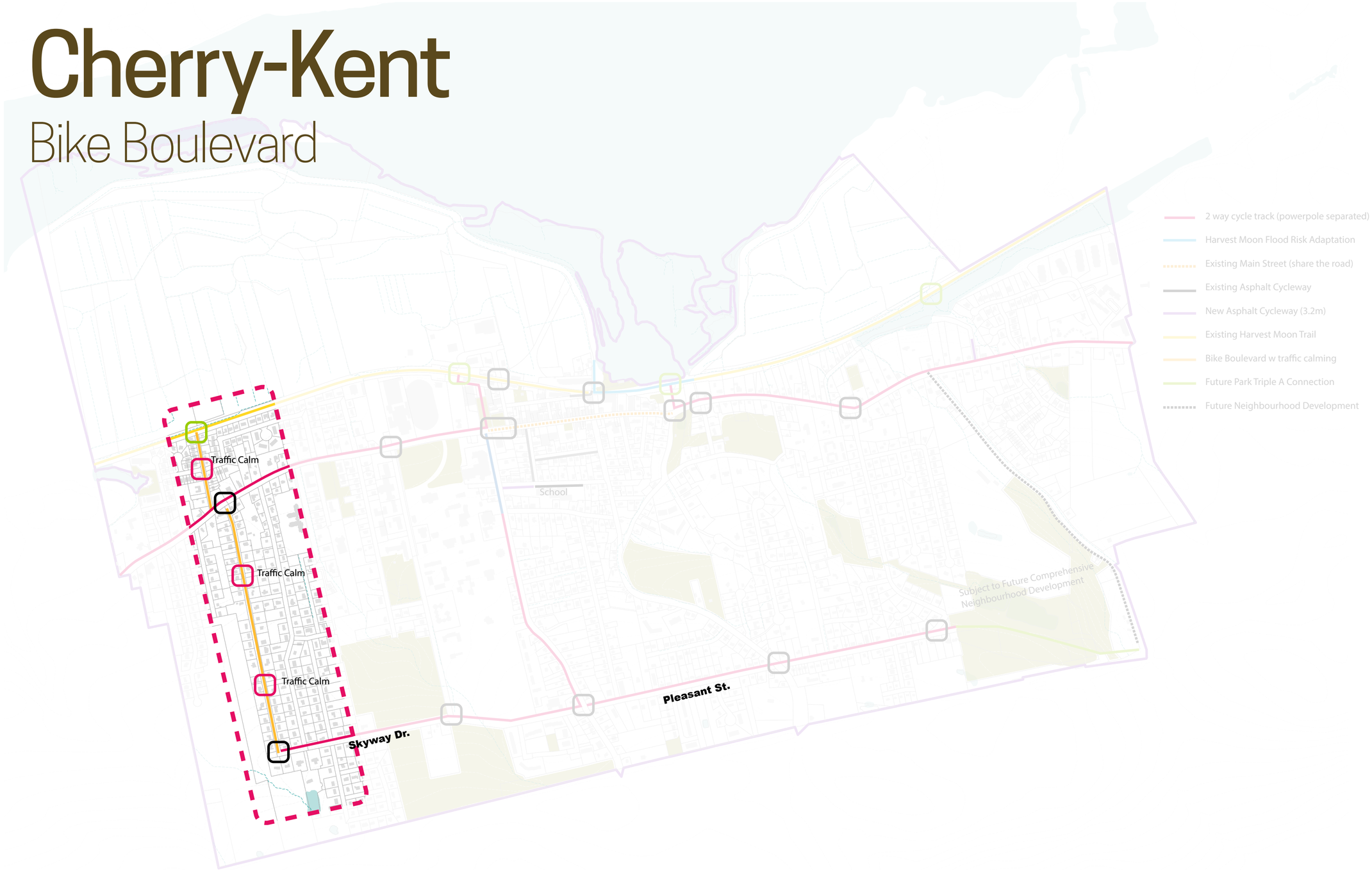
Main Street

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

Cherry-Kent

Bike Boulevard



wolfville

Kent Avenue

Bike Boulevard

Existing Conditions

Cherry Lane

Bike Boulevard

Existing Conditions

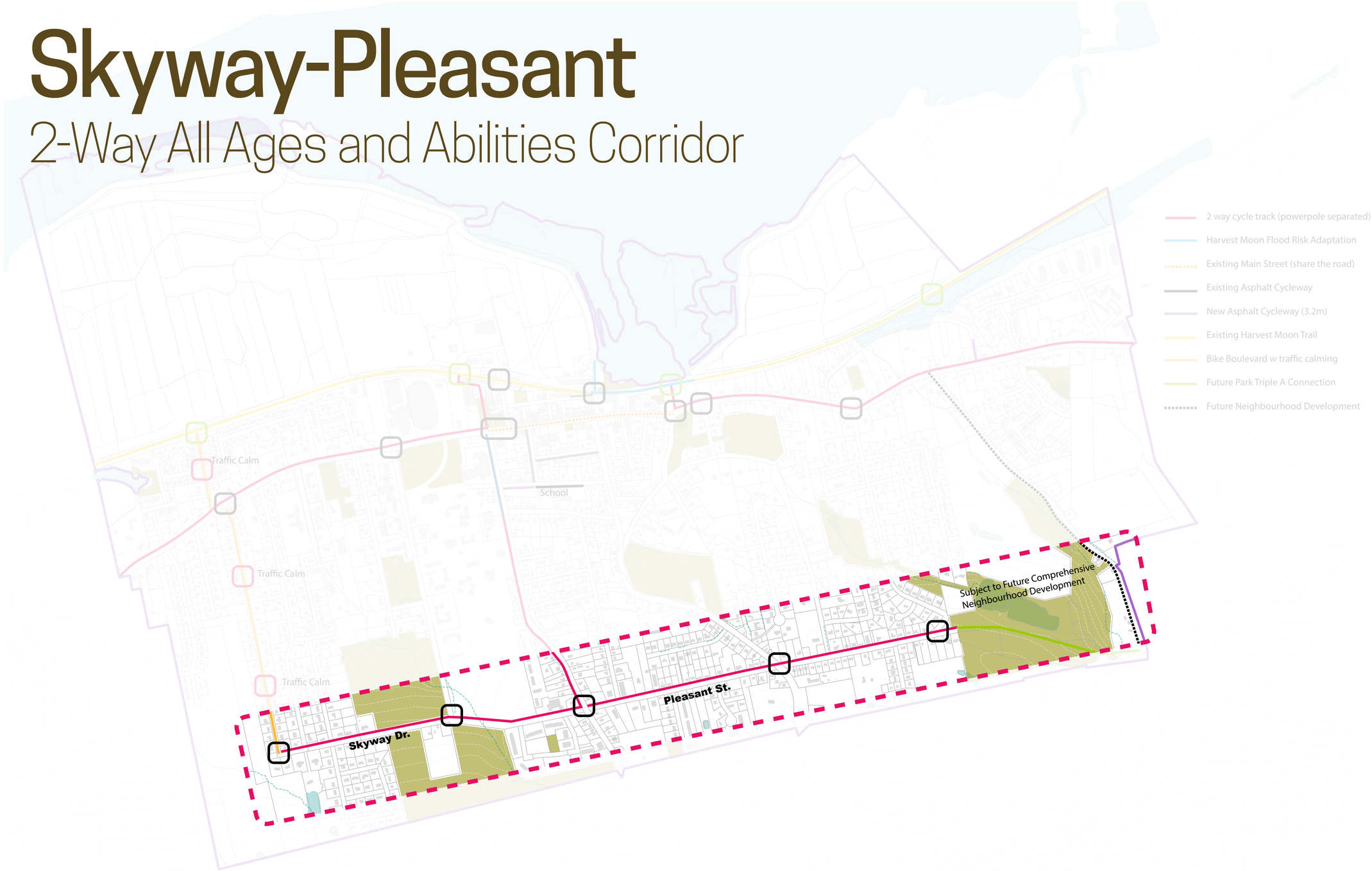
Cherry Lane

Bike Boulevard

Proposed Conditions

Skyway-Pleasant

2-Way All Ages and Abilities Corridor



Skyway-Pleasant

2-Way All Ages and Abilities Corridor

Existing Conditions

- No AT infrastructure
- 3.5m travel lanes
- Asphalt sidewalk and curb/gutter on north side
- Power-lines on north side of Skyway
- Power-lines on south side of Pleasant

Skyway-Pleasant

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

- No change to 3.5m travel lanes or curb/ gutter
- 1.5m sidewalk on north side replaced with 3.2m 2-way ashpalt shared use cycleway
- Powerpoles unchanged
- CB & MH's unchanged

Skyway-Pleasant

2-Way All Ages and Abilities Corridor

Skyway-Pleasant

2-Way All Ages and Abilities Corridor

Existing Conditions

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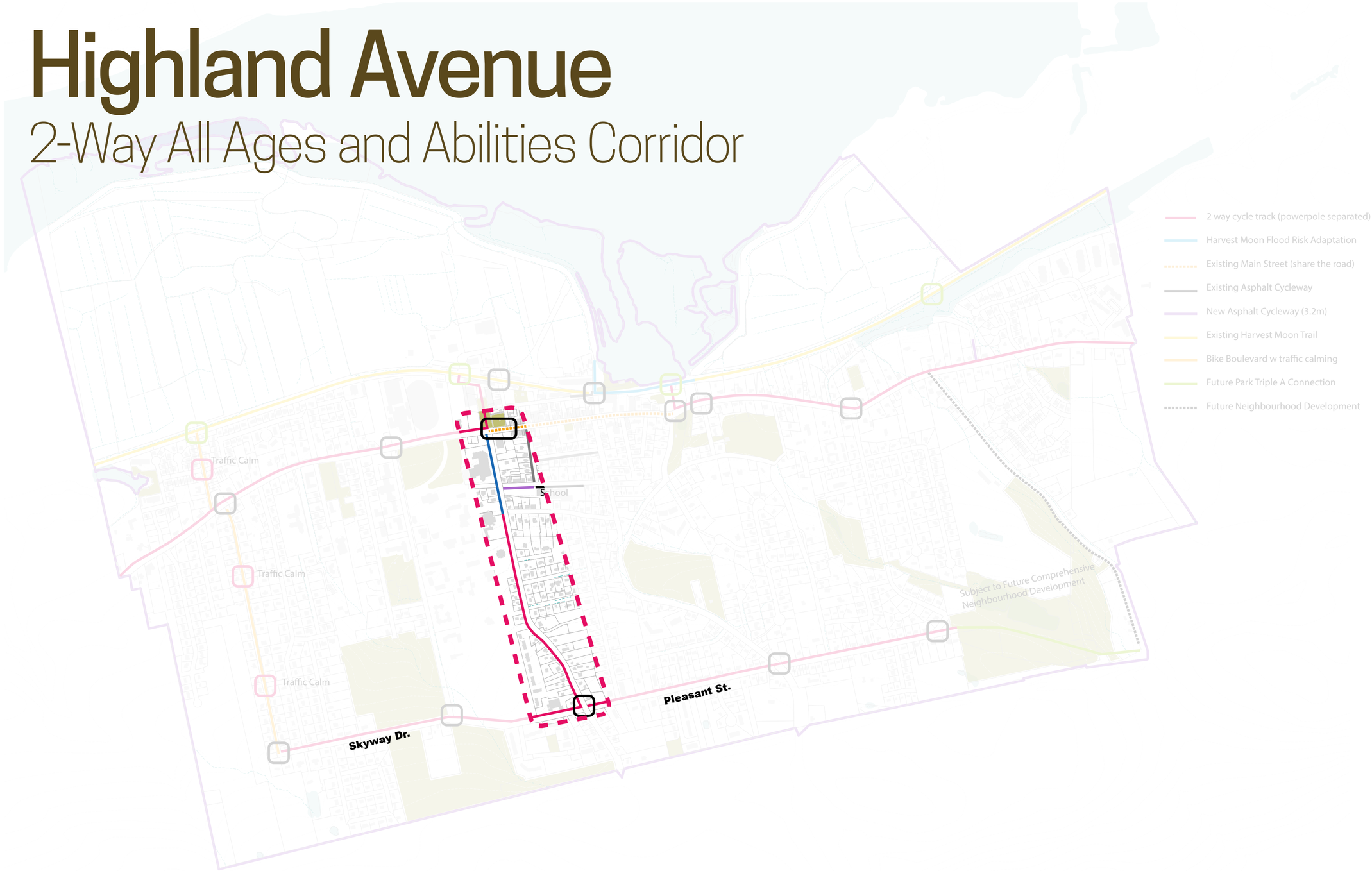
Skyway-Pleasant

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

Highland Avenue

2-Way All Ages and Abilities Corridor



Highland Avenue

2-Way All Ages and Abilities Corridor

Existing Conditions

- No AT infrastructure
- 3.5m travel lanes
- Asphalt sidewalk and curb on both sides
- Power-lines on west side of Highland

Highland Avenue

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

- No change to 3.5m travel lanes or curb/ gutter
- 1.5m sidewalk on west side replaced with 3.2m 2-way ashpalt shared use cycleway
- Powerpoles unchanged
- CB & MH's unchanged

wolfville

Highland Avenue

2-Way All Ages and Abilities Corridor

Highland Avenue

2-Way All Ages and Abilities Corridor

Existing Conditions

wolfville

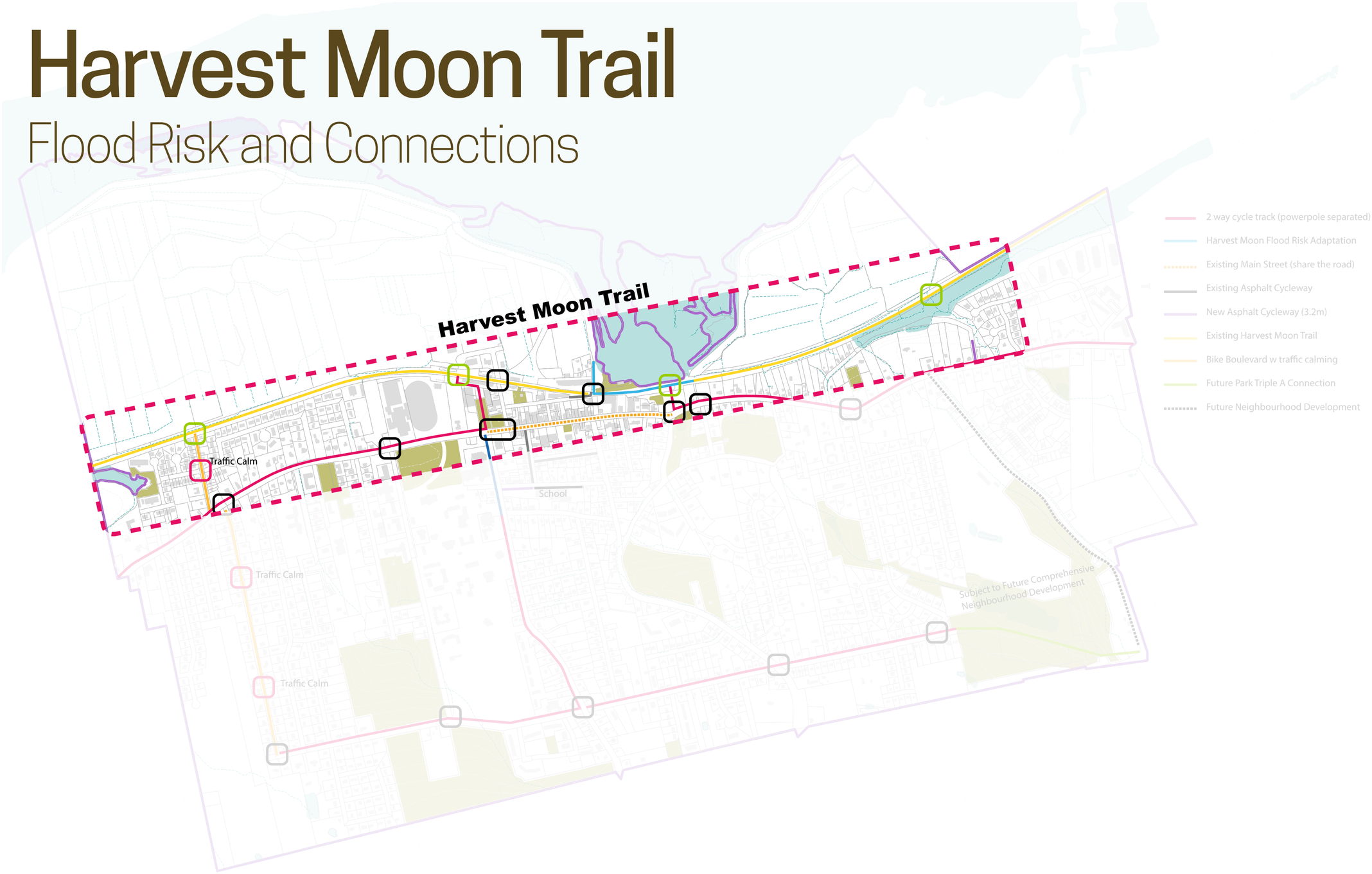
Highland Avenue

2-Way All Ages and Abilities Corridor

Proposed "AAA" Conversion

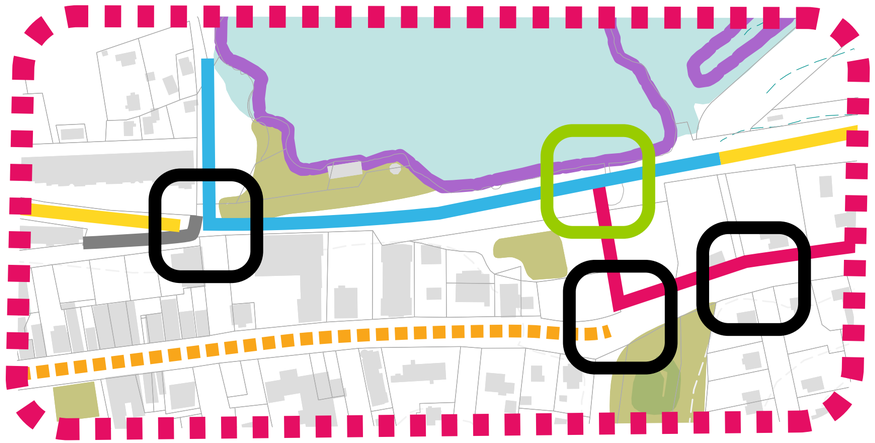
Harvest Moon Trail

Flood Risk and Connections



Harvest Moon Trail

Flood Risk



- Climate Change Adaptation measures are required along the waterfront portion of the Harvest Moon Trail (as identified in the 2021 Flood Risk Study, excerpts to the right).
- The plan is to raise the existing trail to elevation 8.5m CGVD2013, 500mm on average, in the next 3 to 5 years (the blue line shown in the map above).

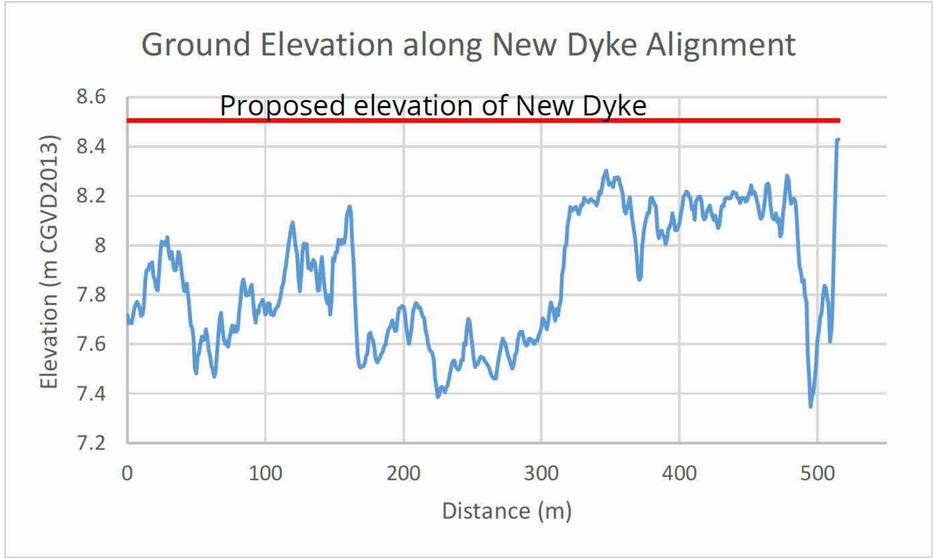
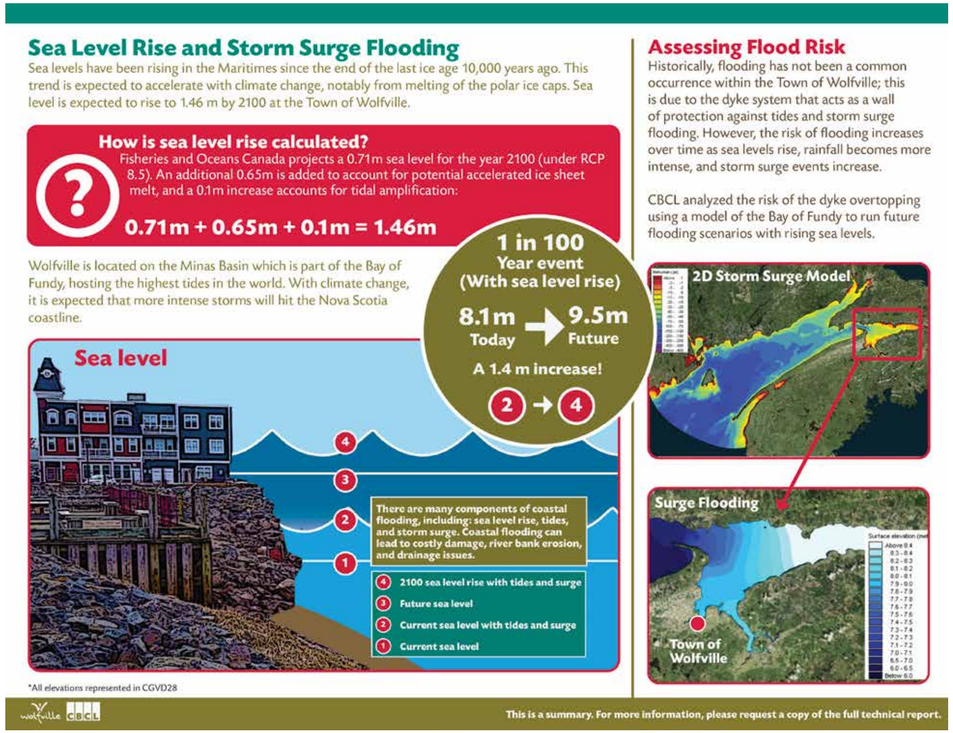
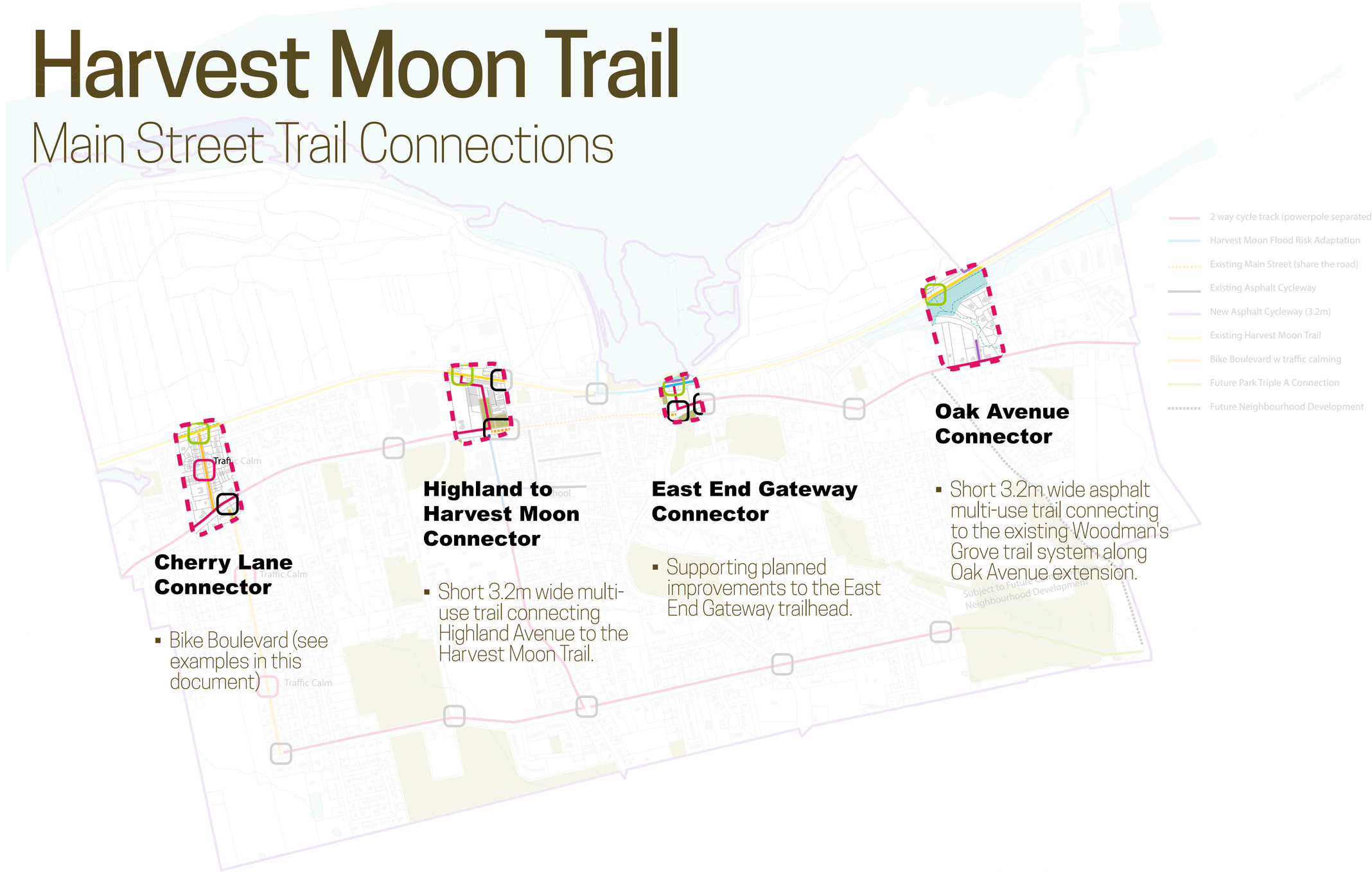


Figure 4.10: Ground Elevation along Potential New Dyke Alignment



Harvest Moon Trail

Main Street Trail Connections



Cherry Lane Connector

- Bike Boulevard (see examples in this document)

Highland to Harvest Moon Connector

- Short 3.2m wide multi-use trail connecting Highland Avenue to the Harvest Moon Trail.

East End Gateway Connector

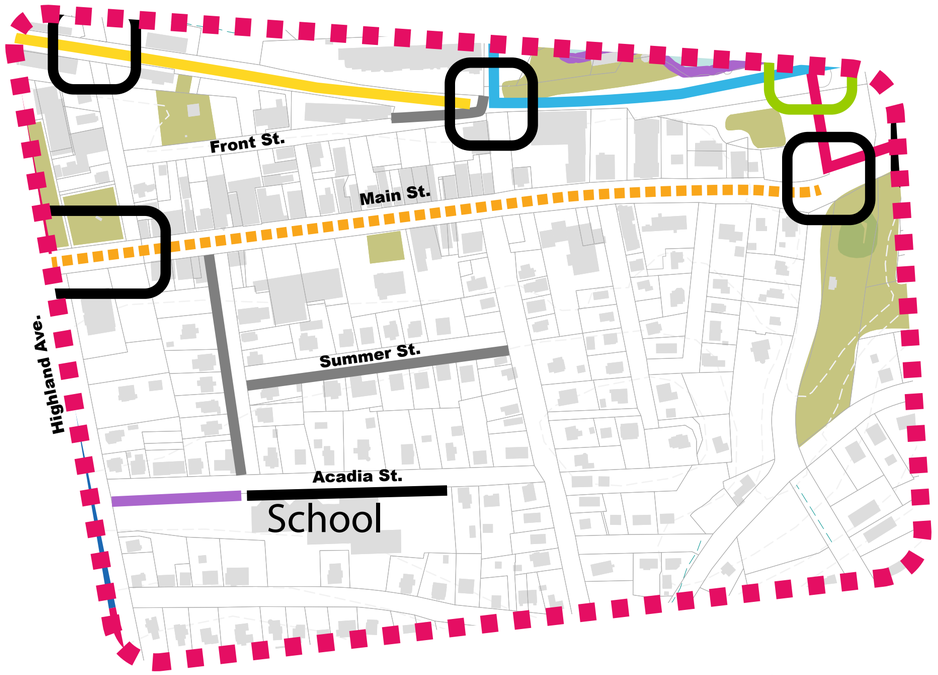
- Supporting planned improvements to the East End Gateway trailhead.

Oak Avenue Connector

- Short 3.2m wide asphalt multi-use trail connecting to the existing Woodman's Grove trail system along Oak Avenue extension.

Downtown Improvements

Main Street & C-2 Area



- 2 way cycle track (powerpole separated)
- Harvest Moon Flood Risk Adaptation
- Existing Main Street (share the road)
- Existing Asphalt Cycleway
- New Asphalt Cycleway (3.2m)
- Existing Harvest Moon Trail

Downtown Improvements

- Supporting C-2 zoning changes with sidewalks
- Connecting the elementary school to Highland Avenue.
- Harvest Moon intersections at Elm & Harbourside.
- Main St seasonal traffic calming through sidewalk cafes and other means.

Project Costing

Town of Wolfville Comprehensive AT Network

Estimate of Probable Cost

DRAFT - April 16

Main Street Corridor - East End - including Gateway Connection				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Trees / Shrubs	1	L.S.	$5,000	$5,000.00
Regrading	151	m	$20	$3,020.00
New Shoulder Asp (sign to Post Rd)	90	m2	$80	$7,200.00
Asphalt / Curb Removal	1510	m	$5	$7,550.00
New Curb/Gutter	1510	m	$140	$211,400.00
Asphalt Cycleway (3.2m) + Surfacing	1510	m2	$192	$289,920.00
Powerpole Relocation	2	Each	$10,000	$20,000.00
Powerpole Guy Relocation	17	Each	$2,000	$34,000.00
Catch Basin Relocation/Drain Cover	18	Each	$2,000	$36,000.00
Manhole Relocation	2	Each	$2,500	$5,000.00
Oak Avenue Culvert	1	LS	$5,000	$5,000.00
Driveway Repairs Asphalt	625	Each	$60	$37,500.00
Retaining Wall	90	m2	$600	$54,000.00
Misc. Property Front Repairs / Adjustments	5	Each	$5,000	$25,000.00
Soft Landscape Reinstatement (1m width)	1510	m2	$15	$22,650.00
Signage	8	L.S.	$400	$3,200.00
Sub-Total				**$766,440.00**

Main Street Corridor - West End				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Trees / Shrubs	1	L.S.	$5,000	$5,000.00
Regrading	138	m	$20	$2,760.00
Asphalt / Curb Removal	1380	m	$6	$8,280.00
New Curb/Gutter	1380	m	$140	$193,200.00
Asphalt Cycleway (3.2m) + Surfacing	1480	m2	$192	$284,160.00
Powerpole Relocation	2	Each	$10,000	$20,000.00
Powerpole Guy Relocation	12	Each	$2,000	$24,000.00
Catch Basin Relocation/Drain Cover	7	Each	$2,000	$14,000.00
Driveway Repairs Asphalt	255	Each	$60	$15,300.00
Retaining Wall	150	m2	$1,000	$150,000.00
Misc. Property Front Repairs / Adjustments	5	Each	$5,000	$25,000.00
Soft Landscape Reinstatement (1m width)	1380	m2	$15	$20,700.00
Signage	7	L.S.	$400	$2,800.00
Sub-Total				**$765,200.00**

Downtown AT				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
New 1.5m Concrete Sidewalk (Linden/Summer/Front)	460	m	$120	$55,200.00
3.2m asphalt cycleway by School (Acadia St)	120	m	$192	$23,040.00
Harvest Moon Intersections	2	ea	$5,000	$10,000.00
Signage	10	ea	$400	$4,000.00
Sub-Total				**$92,240.00**

Total Cost = $2,600,000

+ HST, + Design, + Contingency

Harvest Moon Trail Connections				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Cherry Lane On Street Bike Boulevard	280	m	$100	$28,000.00
Oak Avenue Gateway Trail (3.2m asphalt)	80	m	$192	$15,360.00
Old Burying Ground Trail (3.2m asphalt)	110	m	$192	$21,120.00
East End gateway Connection (3.2m asphalt)	90	m	$192	$17,280.00
Signage	8	ea	$400	$3,200.00
Sub-Total				**$81,760.00**

Harvest Moon Trail Flood Risk Improvements				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Fill Import (assume 0.75m raise)	430	m	$20	$8,600.00
Crusher Dust Trail (150mm deep)	430	m	$14	$6,192.00
Misc Storm Drainage Pipe (Backflow prevention)	6	ea	$2,500	$15,000.00
Meadow Mix (1.5m both sides) Hydroseed	430	m	$12	$5,160.00
Sub-Total				**$34,952.00**

Kent Avenue				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Sharow Paint	30	m	$100	$3,000.00
Traffic Calming at intersections (raised bumps)	4	ea	$6,000	$24,000.00
Signage	7	each	$500	$3,500.00
Sub-Total				**$30,500.00**

Skyway & Pleasant Corridor				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Trees / Shrubs	1	L.S.	$5,000	$5,000.00
Regrading	237	m	$20	$4,740.00
Asphalt Cycleway (3.2m) + Surfacing	2370	m	$192	$455,040.00
Powerpole Relocation	3	Each	$10,000	$30,000.00
Powerpole Guy Relocation	5	Each	$2,000	$10,000.00
Driveway Repairs Asphalt	495	Each	$60	$29,700.00
Retaining Wall	50	m2	$1,000	$50,000.00
Soft Landscape Reinstatement (1m wide)	2370	m	$15	$35,550.00
Signage	20	Each	$500	$10,000.00
Sub-Total				**$630,030.00**

Highland Corridor (incremental improvements for Triple A)				
Item	**QTY**	**Units**	**Unit Cost**	**Sub-Total**
Trees / Shrubs	NA			$0.00
Tree Removal	NA			$0.00
Regrading	NA			$0.00
New Curb/Gutter and Asphalt Removal	NA			$0.00
Asphalt Cycleway (3.2m) + Surfacing	1030	m	$192	$197,760.00
Powerpole Relocation	NA			$0.00
Powerpole Guy Relocation	NA			$0.00
Catch Basin Relocation/Drain Cover	NA			$0.00
Manhole Relocation	NA			$0.00
Driveway Repairs Asphalt	NA			$0.00
Retaining Wall	NA			$0.00
Soft Landscape Reinstatement (1m wide)	NA			$0.00
Signage	5		$400	$2,000.00
Sub-Total				**$199,760.00**