Bedford Highway Functional Plan

Final Report

Prepared for:

Halifax Regional Municipality

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May 31, 2019
Project No. 18310

Crandall Project No.:	18310
Project Name:	**Bedford Highway Functional Plan**
Client:	**Halifax Regional Municipality**
Issue Status:	**FINAL**
Revision No.:	1.0
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FUNDING PARTNERS:

NOVA SCOTIA

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The preparation of this Study was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them."

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1.0 Introduction

1.1 Project Background

Bedford Highway is an arterial road that runs between Windsor Street in the south and Highway 102 in the north. Its primary function is to move people and goods as smoothly as possible. The roadway is a key commuter route and connects with many other key routes, including Dartmouth Road, Hammonds Plains Road, Larry Uteck Boulevard, and Kearney Lake Road. It also provides access to many neighbourhoods, commercial areas, and Mount Saint Vincent University (MSVU).

The areas adjacent to the corridor have seen significant development in recent years, so much so that Bedford and Mainland North were among the fastest growing areas of the region between 2011 and 2016. The Fairview-Clayton Park and Bedford area are expected to continue growing rapidly by as many as 89,000 people by 2031. Just recently, Halifax Regional Council approved the mixed-use Seton Ridge project with up to approximately 3,000 residential units and 70,000 square feet of commercial space with a collector road running between Bedford Highway and Lacewood Drive.

Historically a rural road, land uses and development dynamics along Bedford Highway have long eclipsed the functionality of this important connector. Even as a single mode road, the current design of Bedford Highway today does not match the character and intensity of urbanization along the Bedford-Halifax corridor. Bedford Highway has an inconsistent cross section that varies considerably in width, and ranges from two lanes to up to five lanes. Sidewalks and bicycle infrastructure are disconnected and limit the potential attractiveness for active transportation. Rush hour traffic congestion and the lack of prioritization for transit forces buses to sit in traffic, increasing delays and impacting service reliability. There are also areas where turning on and off the roadway is chaotic or difficult. Despite its significance in the regional transportation network, there is currently no clear vision for how Bedford Highway should look, feel, and function.

Rather than simply widening Bedford Highway to four lanes as previously planned, the Halifax Regional Municipality (HRM) is taking a fresh look at a new multi-modal vision for the corridor that aims to move people, rather than just cars, and strengthen the communities through which it passes. A purposeful plan is needed to guide investment in this crucial roadway, accommodate future land development, and build a transportation system that shapes communities in the area in a desirable way.

1.2 Project Objectives and Scope

The Functional Plan for Bedford Highway provides a corridor-wide vision that examines how the right-of-way is used currently and informs how space can be reallocated to serve all modes of travel, including people who walk; people who bicycle; people who take transit; people who share vehicles, and people who drive alone. In studying the corridor configuration and identifying the ways to best move people through it, the Plan also outlines implications for land use planning, so that the future development pattern supports local and regional transportation mobility.

The Integrated Mobility Plan (IMP), adopted by HRM in 2017, provides a new paradigm for the future of Bedford Highway. The IMP sets a new approach for how people move throughout the region,

aimed at improving travel choices and creating Complete Streets and Complete Communities. It sets targets to increase the number of trips made by walking, bicycling or transit, and recognizes the inter-relationship of transportation and land use. The IMP provides the direction to develop long range plans for particular roadways in the region identified as Strategic Corridors; Bedford Highway is the first strategic corridor to undergo this planning process. The IMP also encourages pursuing Transit Oriented Development in strategic corridor planning.

Specific objectives of the Bedford Highway Functional Plan include:

- Describe existing conditions and constraints.
- Identify options to improve consistency and quality of infrastructure for all users.
- Identify land use planning considerations to guide future secondary planning decisions that align with the corridor options.
- Demonstrate how different modes of travel can be accommodated, as well as trade-offs, implementation requirements, and costs associated with various options.
- Lay out a course for phased improvements to the roadway.

1.3 Study Area

The Study Area shown in **Figure 1-1** illustrates the project limits, beginning at Windsor Street (Station 0+000) and ending just south of Highway 102 (Station 12+000). The corridor contains 19 signalized intersections and many other unsignalized intersections. Several core collector routes feed into Bedford Highway including Kearney Lake Road, Larry Uteck Boulevard, Hammonds Plains Road, and Dartmouth Road. The corridor is bordered by the CN rail line and Bedford Basin to the east and large residential developments to the west constructed on a steep upward slope to Highway 102.

For the purposes of the Functional Plan, the Bedford Highway corridor has been divided into six segments that share common characteristics. Each segment has unique transportation and land use features, as described in **Figure 1-2**. These segments have been carried through the concept and functional design stages.

Figure 1-1: Study Area

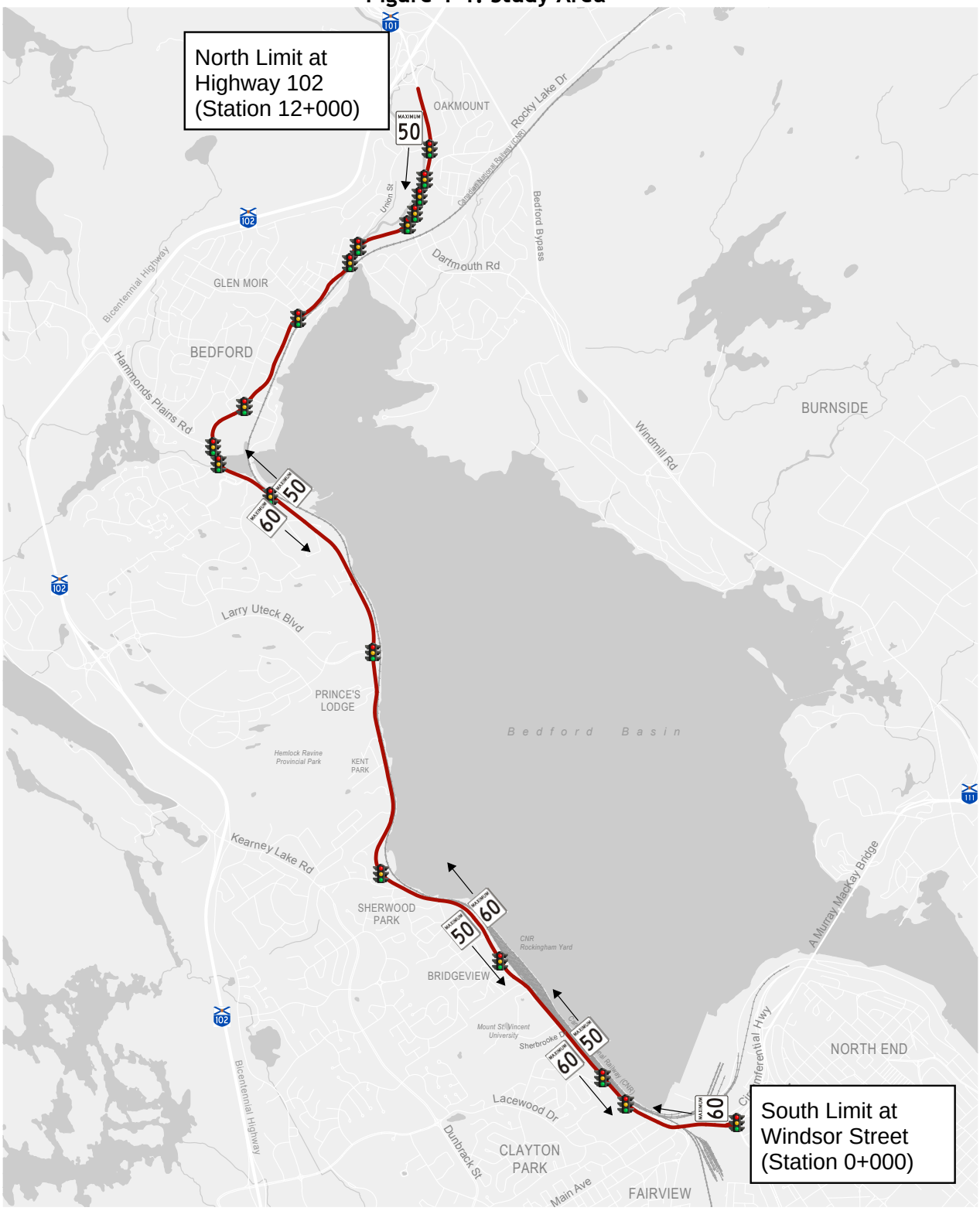
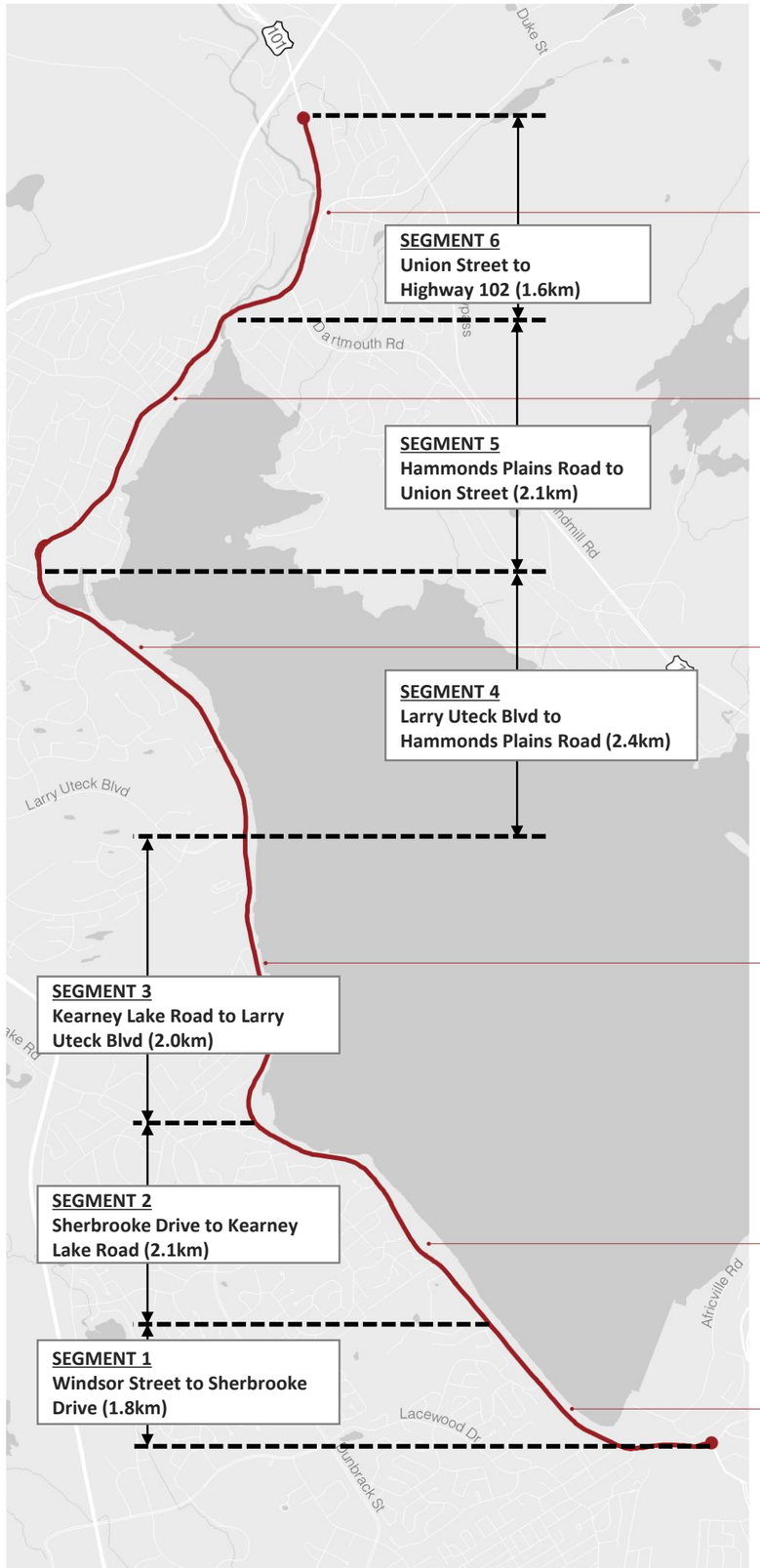
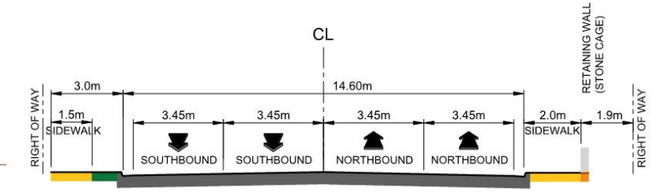


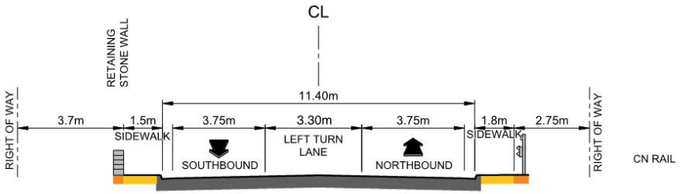
Figure 1-2: Bedford Highway Study Segment Features





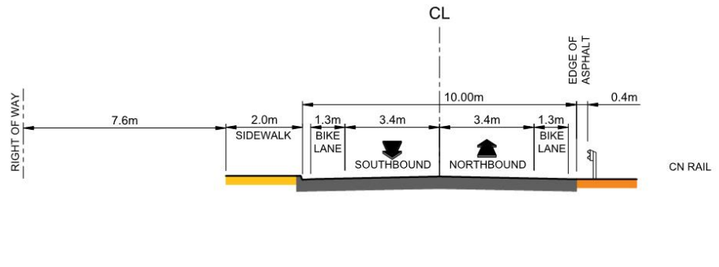
- Average of 16,400 vehicles per day
- 4 Traffic lanes
- Sidewalk on both sides
- No bike lanes





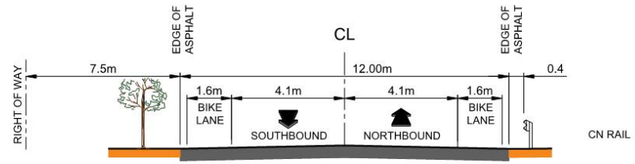
- Average of 21,500 vehicles per day
- 3 Traffic lanes
- Sidewalk on both sides
- No bike lanes





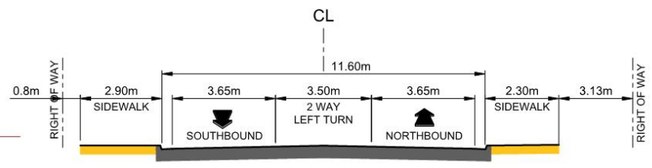
- Average of 19,500 vehicles per day
- 2 Traffic lanes
- Sidewalk on the west side
- Bike lane in each direction





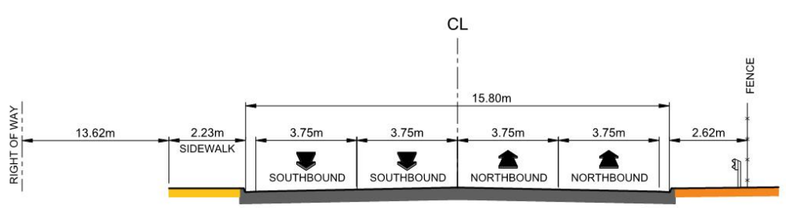
- Average of 19,500 vehicles per day
- 2 Traffic lanes
- No sidewalk
- Bike lane in each direction





- Average of 23,500 vehicles per day
- 3 Traffic lanes
- Sidewalk on both sides
- No bike lanes





- Average of 48,300 vehicles per day
- 4 Traffic lanes
- Sidewalk on the west side
- No bike lanes



2.0 Information Gathering

2.1 Mapping and Topo Survey

GIS and lidar data were provided by HRM and were used to generate Study Area mapping and a topographic surface. A basic topographic survey of the roadway was also completed, picking up the curb lines for the length of the Bedford Highway corridor as well as utility poles, retaining walls, and other notable constraints.

2.2 Traffic and Transit Data

HRM provided peak hour traffic volume data for all signalized intersections within the Study Area as well as automatic traffic recorder counts at various segment locations which were used to derive daily traffic volumes. Collision data were also provided for a 6-year period and reviewed for patterns and problematic locations (Refer to **Chapter 3.0**).

Halifax Transit provided data on existing and planned routes as well as schedule adherence and boarding and alighting data for a one-week period from September 24 to 28, 2018. An analysis of this data is presented in **Section 3.5** and **Section 5.2**.

2.3 Previous Plans and Studies

A number of corridor studies and improvements have been considered along Bedford Highway that relate to this Functional Plan. Previous municipal plans - most recently the 2014 Regional Municipal Planning Strategy (Regional Plan) - identified the future potential of widening Bedford Highway to 4 lanes in some sections of the corridor. Reversing lanes have also been considered to alleviate inbound and outbound traffic during peak rush hours. Additionally, a traffic study examined several options for reconfiguring the Windsor Street Exchange to reduce delays and improve traffic flow through the area.

The most relevant studies and background information are documented in this section.

Fairview Interchange Capacity Assessment

A capacity assessment was performed by Exp Services Inc. in 2016 on what is known as the "Windsor Street Exchange", the intersection of Windsor Street/Lady Hammond Road/Barrington Street/Bedford Highway. This intersection is known to bottleneck rush hour traffic and cause significant delays for travelers. The Fairview Overpass is the direct ramp connector to/from Bedford Highway to Joseph Howe Dr. before reaching the Windsor Street Exchange. The purpose of the assessment was to identify potential infrastructure improvements to alleviate capacity issues and delays at these locations.

The assessment proposes seven options to consider. Option 6 has 5 additional scenarios to consider. Of these options, three were short listed as they were considered the most feasible. The options are described as follows:

- **Concept 3**: Reroute eastbound traffic on Bedford Highway away from the signalized "Windsor Street Exchange" by installing a direct flyover to Lady Hammond Rd. This single improvement is expected to reduce peak hour travel time by approximately 7% and is the most expensive concept of the three proposed.

- **Concept 5**: Install a northbound left turn crossover to allow the northbound left turn movement and the southbound movement to occur concurrently at the Windsor Street traffic signal. This then allows more green time to the heavily congested eastbound movement on Bedford Highway. This concept is expected to reduce peak hour travel times by approximately 20% and is the least expensive concept of the short list.
- **Concept 6A**: Remove the westbound outbound movement at the Windsor Street Exchange signal and divert the eastbound movement from Bedford Highway through the overpass onto Barrington Street. All vehicles wanting to enter Bedford Highway from Lady Hammond Road or Windsor Street will enter Bedford Highway through Mackintosh Street and Bayne Street, resulting in increased travel time for those movements, but still providing travel time savings overall. This concept is expected to provide an overall reduction of travel time by 29% and is slightly costlier than the lowest costing concept.

The Windsor Street Exchange is a significant bottleneck for the corridor and modifications there will be necessary to realize the benefits of corridor improvements on Bedford Highway itself. Based on the findings of the Fairview Interchange Capacity Assessment Study, Option 6A was found to provide the best return on investment for overall travel time improvements. Therefore, this option was carried forward in the Bedford Highway Functional Plan, while recognizing that the details of the concept design have not been fully vetted and are beyond the scope of this project. The concept plan for Option 6A is shown in the functional design drawings.

Bedford Highway Reversing Lanes Study

In 2015, HRM Staff prepared a report to council on the potential for reversing lanes on Bedford Highway. The analysis examined the use of a center reversing lane during the peak travel times, including the use of a high occupancy vehicle (HOV) lane if feasible. The study covered a 3.6 km stretch of Bedford Highway from the Fairview Overpass to Kearney Lake Rd.

The report suggests that reversing lanes are not appropriate in this context due to the following reasons:

- Left Turns: Design guidance recommends against reversing lanes on corridors with high turning demand, which is the case for the outbound direction on Bedford Highway. Reducing the outbound direction to one lane during the AM peak would likely result in significant outbound delays due to left turning vehicles.
- Windsor Street Exchange Capacity Constraint: Reversing lanes would primarily benefit inbound AM peak period traffic, and modeling was shown to reduce delay significantly on this section. However, given the downstream capacity constraint at Windsor Street exchange, there is little overall benefit.
- Directional Distribution: Guidelines for the use of reversing lane typically suggest a minimum directional imbalance of 2:1 to 3:1. Bedford Highway data were shown to not meet these thresholds.

Commuter Rail Feasibility Study

In 2015, the Commuter Rail Feasibility Study was completed to evaluate the feasibility of a commuter rail system in the Halifax-Bedford corridor.

The Feasibility Study concluded that, although commuter rail is found to be operationally feasible, economically the immediate benefits would be insufficient to justify a rail service. The IMP recommends that commuter rail continue to be explored for its potential to help shape settlement patterns and support downtown regeneration. Accordingly, the conversation around the potential for commuter rail through Bedford continues today and there is public interest in this travel option. It is recognized that some form of higher order transit service will be required in order to reach the Regional Plan's aggressive modal split targets. Therefore, the implications of a Commuter Rail service have been considered in the future functional plan options.

Bedford-Halifax Mainland North Corridor Transportation Study

The Mainland North Corridor Transportation Study, completed in 2013, analyzed the functionality of the transportation infrastructure within West Bedford and how it can be made more effective to accommodate the opening of five new developments. These developments include Paper Mill Lake, Birch Cove, Mill Cove, Rockingham South, and Seton Ridge, which are all located between Bedford Highway and Highway 102. The study used HRM's Visum model to evaluate low population and high population growth scenarios under three transportation improvement scenarios including:

- Low Transit Service with minimal transit improvements, but a basic bus network and all existing transit services still offered.
- Medium Transit Service with an effort to improve the expected delays with Major Bus Routes (using portions of Dunbrack Street and Bedford Highway), dedicated transit lanes, transit priority measures and additional traffic alleviation during peak travel times (e.g. reversible lanes on Bedford Highway);
- High Transit Service with a similar version of Medium Transit but including a high-level transit system such as commuter rail or express ferry.

Findings of interest from the study evaluation are as follows:

- The Medium Transit scenario could increase transit mode share between the Peninsula and Bedford by 3-5%, while the High Transit scenario could increase transit mode share by 5-10%.
- The Medium and High Transit scenarios would reduce the total delay in the network under both low and high population scenarios. The implementation of transit improvements would also benefit auto users, reducing the average auto delay by 3.9%.

These results give some indication what modal shift might be expected by providing higher quality transit facilities and transit priority measures along Bedford Highway.

2.4 Stakeholder Consultation

Internal HRM Stakeholder Meeting - Transportation

An Internal Stakeholder meeting was held on November 19, 2018 at HRM offices with representatives from HRM Strategic Transportation Planning, Traffic, Transit, Active Transportation, Design, and Right-of-Way. The purpose of the meeting was to discuss existing conditions and stakeholder concerns in detail. Below are the topics discussed:

- A future plan for the Windsor Street Exchange has not been determined and the results of the 2016 Exp Services study have not been advanced. It was discussed that Concept 6A is a viable option for the intersection, though further review is required by HRM to confirm that Concept 6A should be used as a basis in the Functional Plan. Additionally, the Functional Plan should look at how transit and Active Transportation (AT) movements will be made through the Exchange, since prior efforts were focused only on automobile traffic.
- Design criteria to be applied to Bedford Highway were discussed, based on a draft memo submitted by Crandall. The minimum widths of lane, sidewalks, and cycling facilities were reviewed. It was agreed that narrower lane widths should be pursued and set in the context of the speed limit. A 50 kph posted speed throughout the corridor would allow for lower minimum widths and would influence driver speed. City of Toronto, NACTO, and TAC design guidelines should be referenced when determining minimum design standards.
- Pedestrian crossing designs should follow the Traffic Control Guide. Strategic planning should determine crosswalk locations at future bus stops and appropriate signage for pedestrians crossing roadways. Rectangular Rapid Flashing Beacons (RRFBs) are acceptable for crosswalks.
- Bedford Highway's right-of-way is constrained by CN Rail, topography and mature development. Right-of-way acquisition may be acceptable if reasonable strategic design calls for the expansion of Bedford Highway, but cost needs to be considered.
- HRM is in the process of updating its traffic signal controllers along the Bedford Highway corridor and all traffic signal communications will be through the I-net system. Transit signal priority (TSP) is not operational on this corridor at this time. Signals are equipped with GTT/Opticom pre-emption equipment, but these cannot currently communicate with the GPS systems on board the buses. To enable active TSP, additional GPS control units would be required to be installed on each bus in the fleet.
- Transportation mode usage, including transit ridership, is important to HRM staff for the corridor analysis. The quantity of people moving through the corridor should be noted and projected.
- Updates have been made to the transit service network which affects Bedford Highway. New transit routes were put into effect in August of 2018.
- Pedestrian and cyclist facility improvements are essential on this corridor. Separated facilities are desirable as well as safe access and transitions. "Bend-out" driveway applications should be considered where pedestrian paths and driveways intersect, especially in commercial areas.

- A separated bi-directional cycle track is desired for any portion of Bedford Highway where the cycle track is feasible.

Internal HRM Stakeholder Meeting - Planning

A second Internal Stakeholder meeting was held on November 19, 2018 with representatives from HRM Regional Planning. A summary of comments from the stakeholders is as follows:

- MSVU and the proposed Seton Ridge, Birch Cove, and Mill Cove developments are important anchors for mixed-use destination locations along Bedford Highway. Office developments are occurring in the suburbs and should be focused at strategic locations along Bedford Highway to create more destination locations in key nodes identified for future intensification. Developers are interested and looking to redevelop properties along Bedford Highway but are awaiting the results of this Functional Plan.
- There are a number of sites that have potential to be the new central growth centres and there are intersections that can provide better connectivity to these locations. However, the focus may need to be the walkability, transit access, and connectivity of existing areas, prior to proposing new significant developments.
- Commuter rail would need transit-oriented developments (TOD) which have been criticized for squeezing out affordable housing. This should be avoided by connecting TOD to affordable housing requirements and incentives. E.g. Older multi-unit building stock should be retained and improved where possible, and if redeveloped, a portion of the new units should be required to be affordable.
- The IMP recommends train stations along Bedford Highway. Additional input and station locations should be considered. If sections of Bedford Highway are not suitable for higher order transit, perhaps alternative routes with more generous ROWs should be suggested.
- The Sunnyside Growth Centre has less developable land than previously thought because of sea level rise and flood risks.
- There has been interest in redeveloping key properties along Bedford Highway. HRM Regional Council has directed that most of the major sites for intensification should be informed by completion of the IMP. This Functional Plan will help inform the redevelopment of these sites and future secondary planning. The Municipality has told developers to wait for completion of the Functional Plan.
- Burnside Expressway (Highway 107) is a planned provincial project that is expected to alleviate pressure on Bedford Highway.

External Stakeholder Meeting

An external stakeholder meeting with community advocacy groups was held on November 20, 2018. Participating groups included the Halifax Cycling Coalition, Walk n' Roll Halifax, Dept of Energy, Bicycle NS, and Ecology Action Centre. Comments from participants included:

- The Functional Plan should look at 10min cycling trip radius to bus stops and consider bike park-and-ride locations with emphasis on mode-transfer points. Safe bike parking is needed.
- The Functional Plan should consider AT access to Bedford Highway (facilities along feeder routes).

- Make cycling a more competitive option to vehicles. Consider lighting. Consider Bedford Highway in the context of a regional cycling network.
- Even some avid cyclists no longer cycle on Bedford Highway because it is very uncomfortable.
- There was a strong preference for separated cycling facilities, but with some division as to whether they should be one-way or two-way.
- There were concerns with any sections that would have painted bike lanes as these are seen as an unacceptable compromise on any portion of the corridor. Consider parallel routes where separated bike facilities cannot fit (along Waterfront Drive and Shore Drive).
- The Functional Plan needs to consider recreational riders, but separate cyclists from pedestrians.
- Public education/mapping on pinch points and route options would be helpful particularly for newcomers.
- Crosswalks should be considered at every bus stop along the east side of the road. Sidewalks are generally disconnected and lacking on the east side. The connection to Chain of Lakes trail is poor. Sidewalk plowing is poor.
- Bus lanes could be used for HOV lanes also.
- The equity piece is important – affordable housing and connections to transit.
- Does modal shift help to defer road deterioration and maintenance?
- HRM needs a new vision for this corridor, including place making, rethinking speeds, and narrowing lanes.
- The Functional Plan is an important and timely project given all the development happening. Bedford Highway is not a Highway – it is a street.

Open House

Two Public Open Houses were held on November 19 and 20, 2019. Approximately 120 participants attended. A high-level summary of the discussions had at the meeting, commentary from the public, and the overall outcome of the open house is presented in the "What We Heard Report" which is provided as **Appendix A**.

Utilities

The Project Team attended a Halifax Utilities Coordinating Committee (HUCC) Meeting on December 13, 2018 to introduce the Bedford Highway Functional Plan project to committee members. A general project overview was provided. Following the meeting various utilities provided information on their facilities along the corridor.

3.0 Existing Corridor Characteristics

3.1 General Roadway Elements

The physical characteristics of Bedford Highway change throughout the corridor, ranging from two to five vehicle lanes with or without sidewalks and bike lanes. These characteristics are described for each of the 6 corridor segments in **Figure 1-2** while intersection lane configurations are shown in **Figure 3-1**. The speed limit ranges from 50 to 60 km/h, with 60 km/h being posted from Windsor Street to Sherbrooke Drive and from Tremont Drive to Southgate Drive.

3.2 Traffic Volumes

The AM and PM peak hour and daily traffic volumes along Bedford Highway are shown on the maps in **Figure 3-2** to **Figure 3-3**. The AM and PM peak hour traffic volumes are also shown graphically in **Figure 3-5** and a temporal volume profile at MSVU is shown in **Figure 3-6**. Turning movement volumes are provided in **Appendix B**.

Traffic flows can be characterized as follows:

- North of MSVU, daily traffic volumes range from 16,400 to 23,500 vehicles per day. South of MSVU, the daily volume increases dramatically to 36,000 vehicles per day due to traffic associated with the university, Bayview Road, and other feeder points. Volumes increase further at the Fairview Overpass to 48,300 vehicles per day.

- During the AM peak hour, the predominant flow of traffic is southbound due to a heavy commuter flow toward the Peninsula. Southbound hourly volumes reach 1,500 to 2,000 vehicles per hour in the southern end of the corridor. There is also a relatively high northbound traffic volume in the morning up to MSVU. North of Larry Uteck Boulevard, directional volumes are well balanced and in the range of 500-1,000 vehicles per hour per direction.

- During the PM peak hour, the predominant flow is northbound from Joseph Howe Drive to Larry Uteck Boulevard. Northbound traffic flow exceeds 2,000 vehicles per hour in the south end, but the volume gradually decreases moving northward. North of Larry Uteck Boulevard, the directional flows are quite balanced and are close to 1,000 vehicles per hour per direction. The moderately heavy flows in the northern end of the corridor can be attributed to commuter traffic mixing with commercial/retail related local traffic.

- The volume profile by time of day near MSVU shows that southbound traffic volumes increase sharply between 6am and 7am and remain relatively high throughout the day. Northbound traffic is low in the morning and gradually builds throughout the day, peaking from 3pm to 7pm.

Figure 3-1: Bedford Highway Intersection Lane Configurations

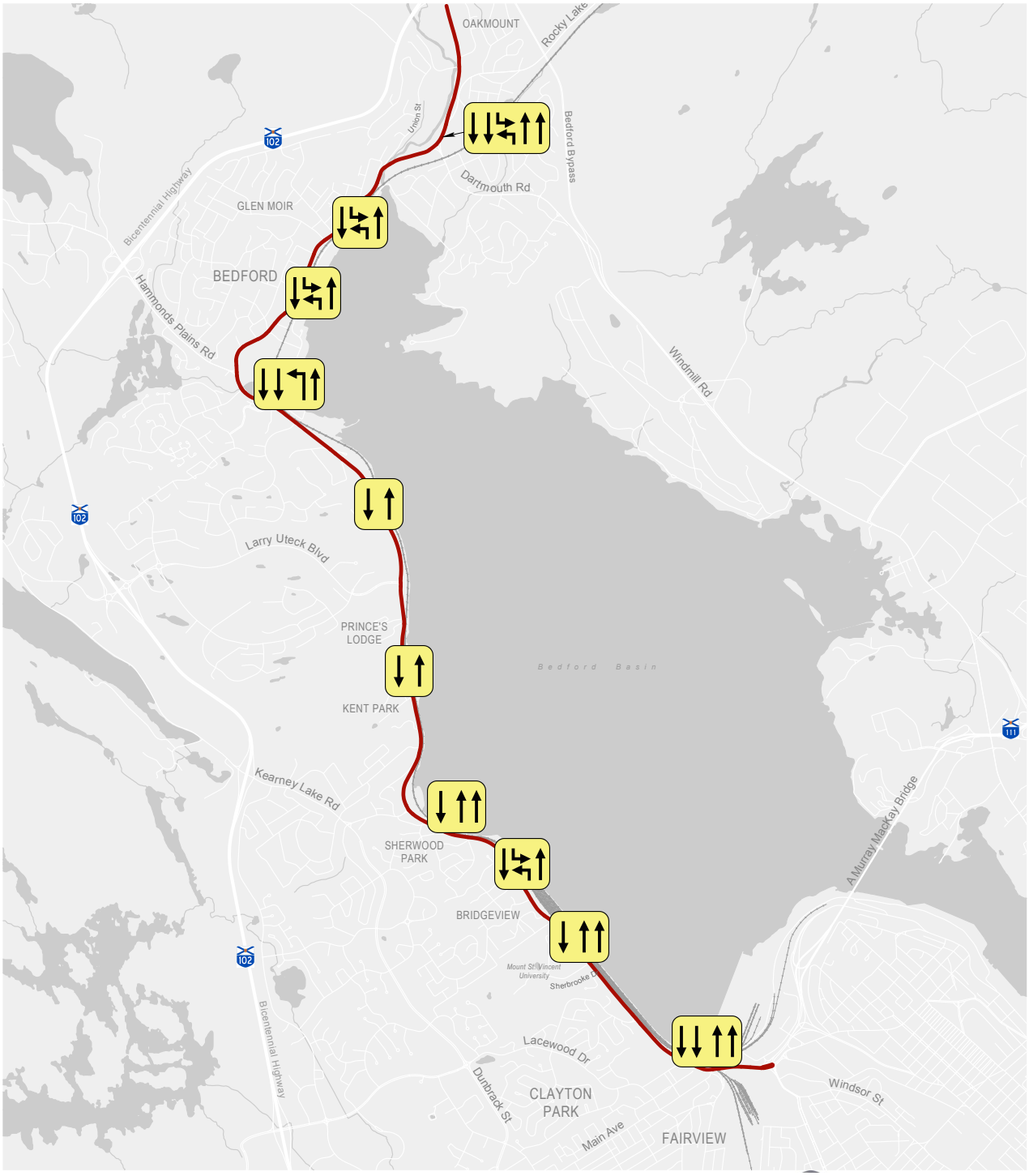


Figure 3-2: Bedford Highway Existing Traffic Volumes - AM Peak

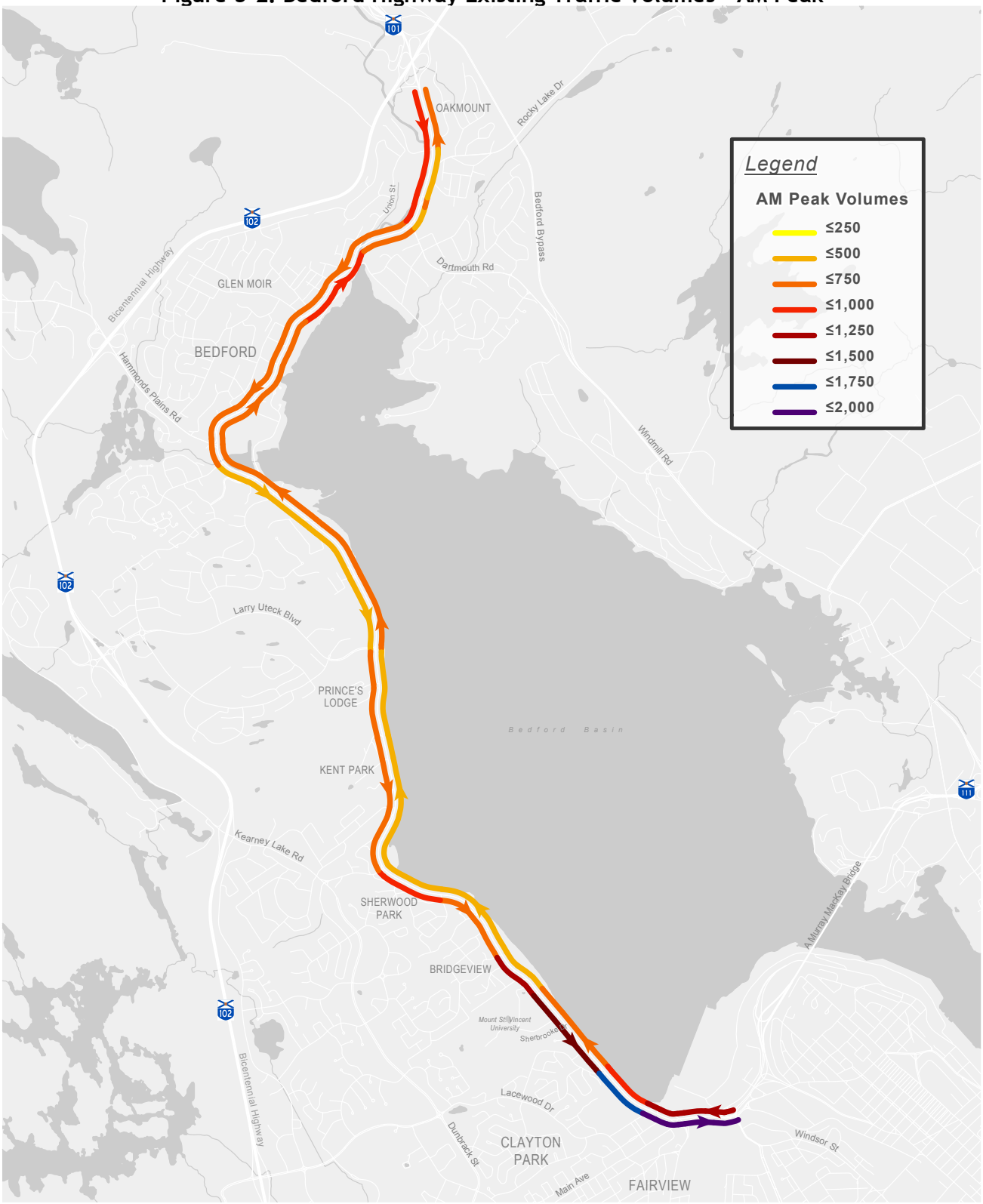


Figure 3-3: Bedford Highway Existing Traffic Volumes - PM Peak

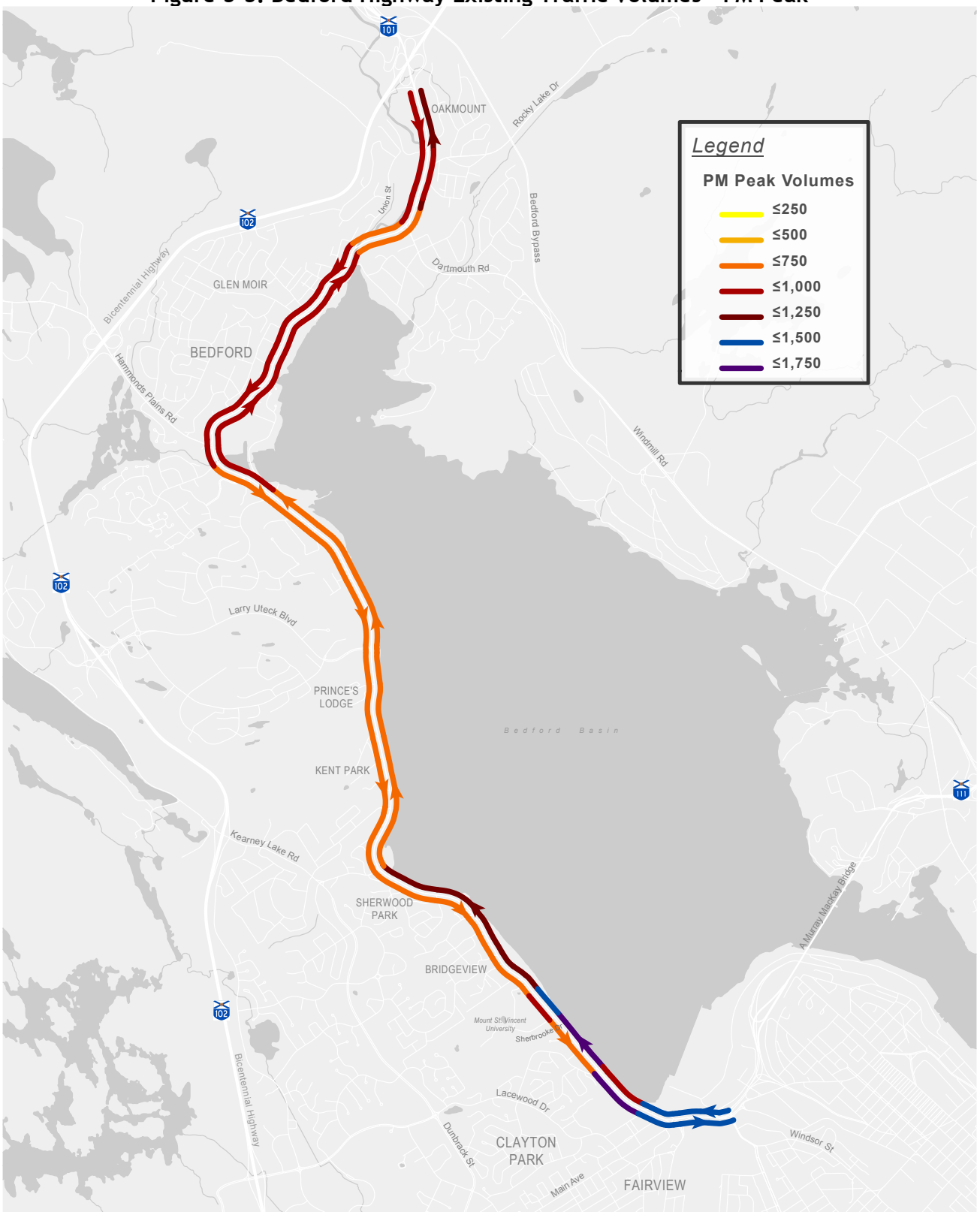


Figure 3-4: Bedford Highway Existing AADT

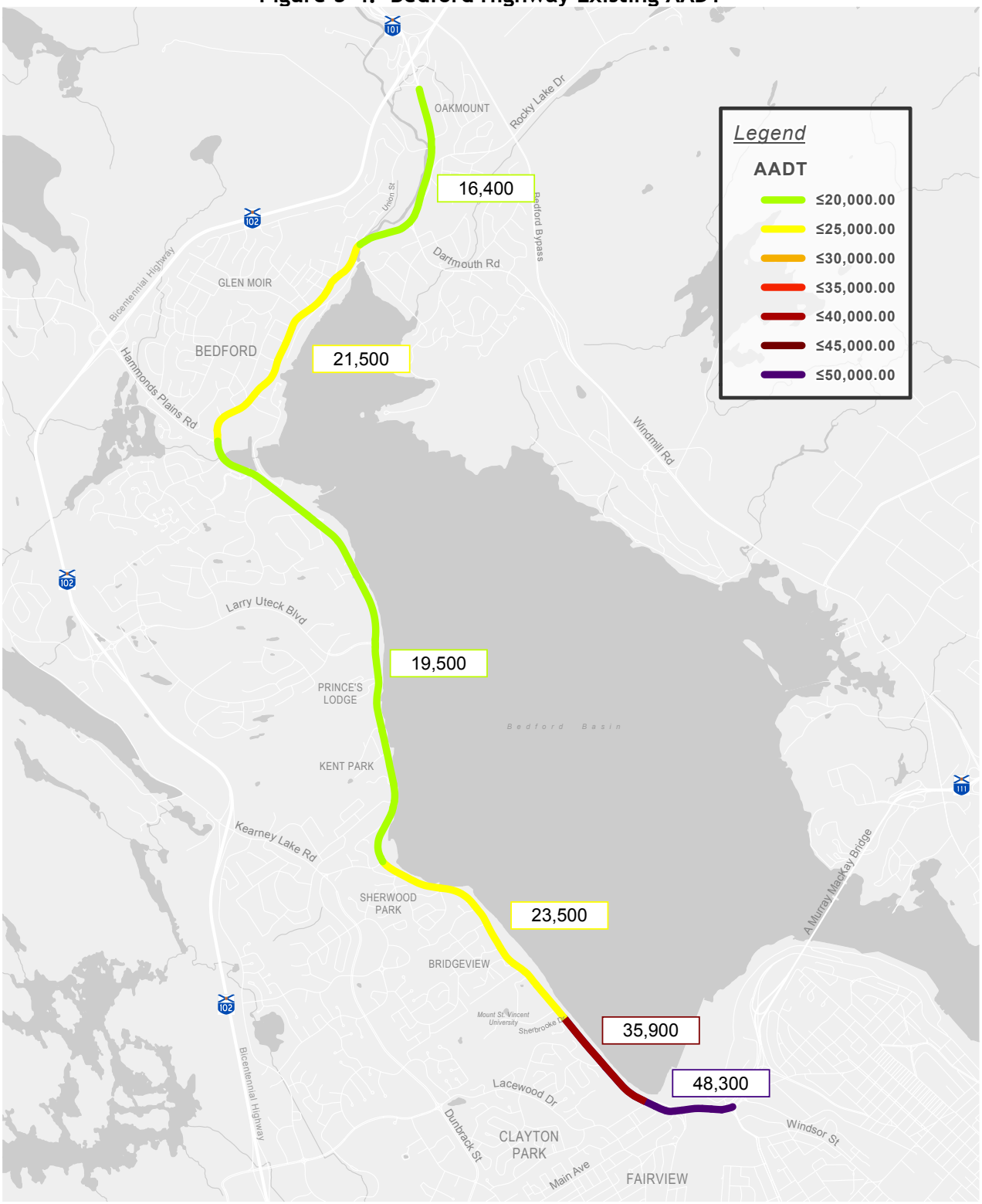
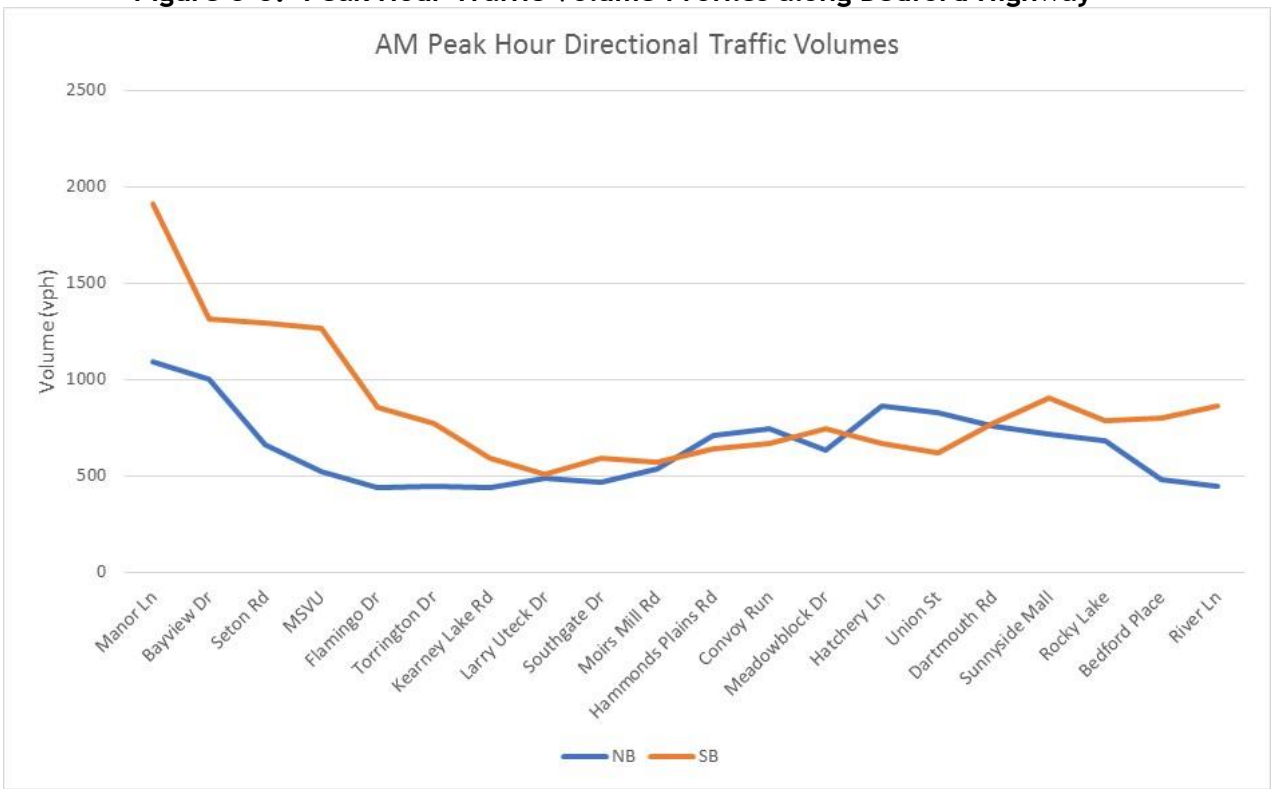


Figure 3-5: Peak Hour Traffic Volume Profiles along Bedford Highway



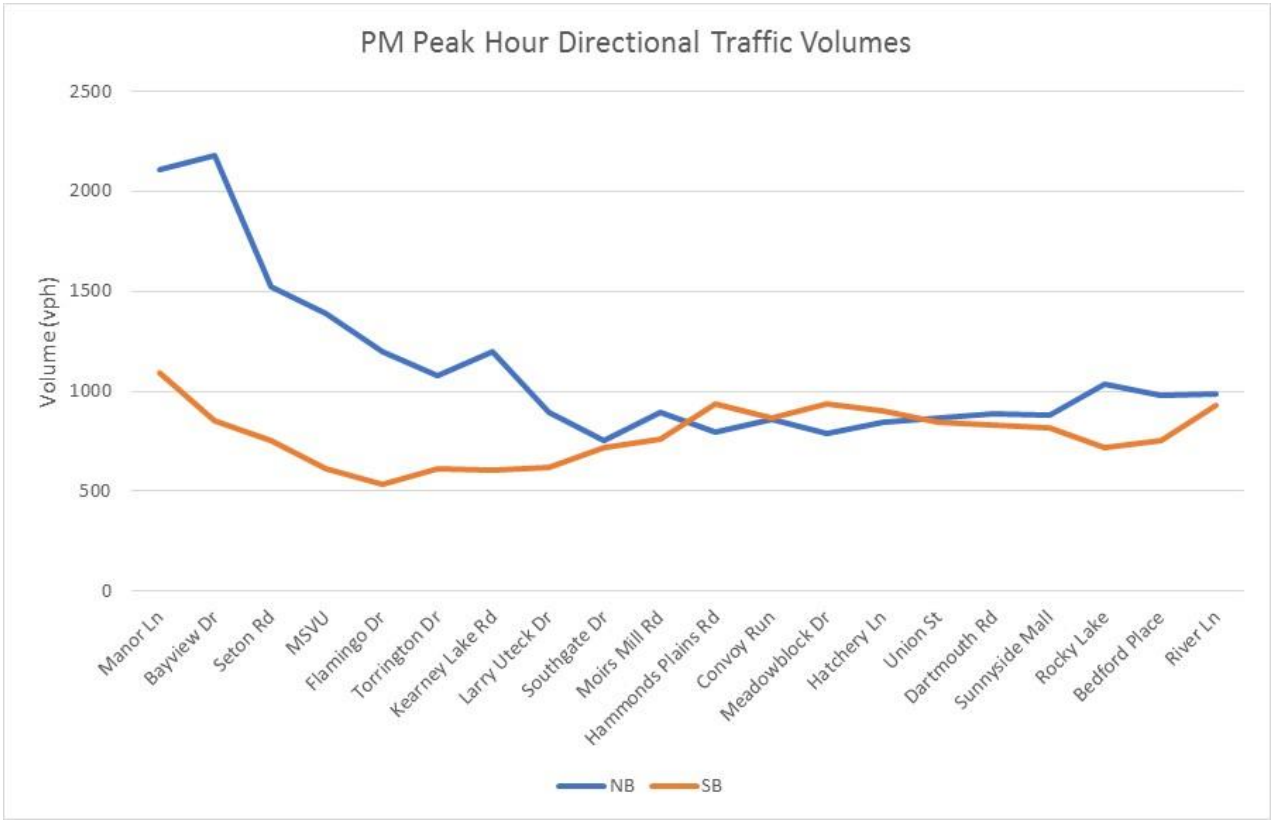
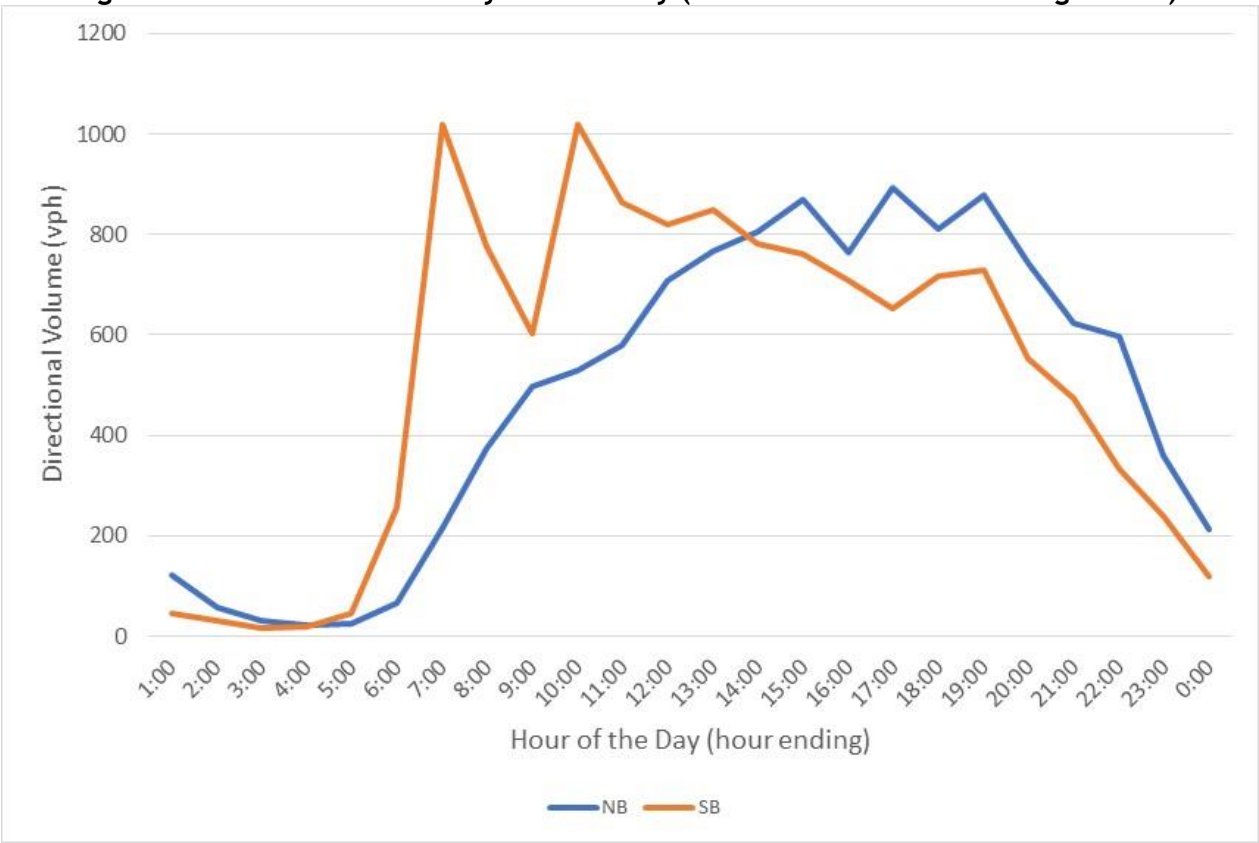


Figure 3-6: Traffic Volumes by Time of Day (between MVSU and Flamingo Drive)



3.3 Collision Analysis

HRM provided its complete collision database containing details on reported collisions occurring between 2007 to 2011, and 2015 along the Bedford Highway corridor. Details included collision date, location, severity, and vehicle type, among other characteristics. A total of 1,329 vehicle incidents were recorded during the 6-year analysis period. A summary of collision characteristics is presented below.

Year

Figure 3-7 shows the number of collisions that have been recorded each year from 2007 through 2011, and 2015. On average, there have been 221 collisions per year along Bedford Highway during the analysis. Although 2015 recorded the highest frequency of collisions, there is inadequate data to suggest there is an upward trend.

Severity

Figure 3-8 shows the breakdown of collisions by severity. Over the 6 years, 77% of collisions resulted in property damage only while 23% resulted in injury. There were no recorded fatal collisions along Bedford Highway during the data collection period.

The data from 2007 through 2011 gave further detail on the severity of the injuries. During these years, only two incidents resulted in serious injury. Both occurred in normal driving conditions during

the day. In one of the incidents the driver had a prior medical condition and lost consciousness while driving.

Vehicle Types

The collision database included details on the types of vehicles involved in each collision. Of particular interest were the number of pedestrians and bicyclists involved in collisions. A review of the data revealed the following:

- 16 collisions (1.2%) involved a bicycle. One bicycle collision occurred after dark.
- 33 collisions (2.5%) involved a pedestrian. Of these, 1 resulted in moderate injuries. 8 of the 33 pedestrian collisions occurred after dark.

Although the percentage of collisions involving pedestrians or cyclists is low, it is concerning that there are more than 5 pedestrian collisions along Bedford Highway each year on average. The collision records do not indicate there are any locations with an overrepresentation of pedestrian collisions; therefore, general safety improvements throughout the corridor should be considered for pedestrians.

Figure 3-7: Collisions by Year along Bedford Highway

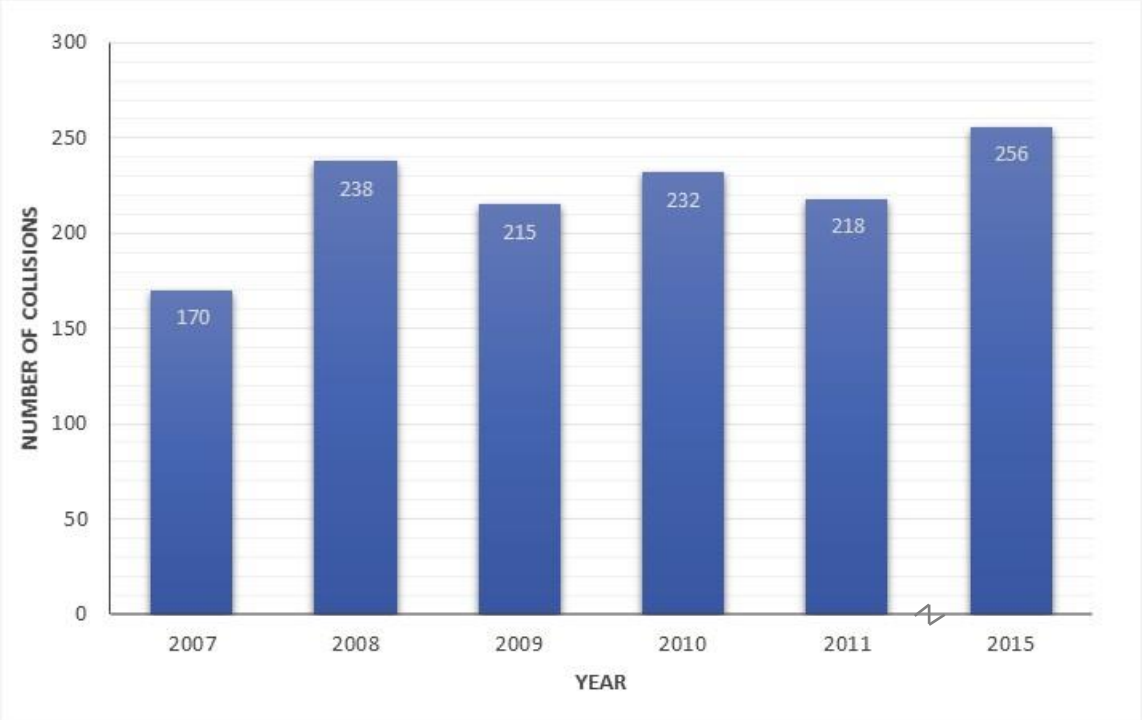
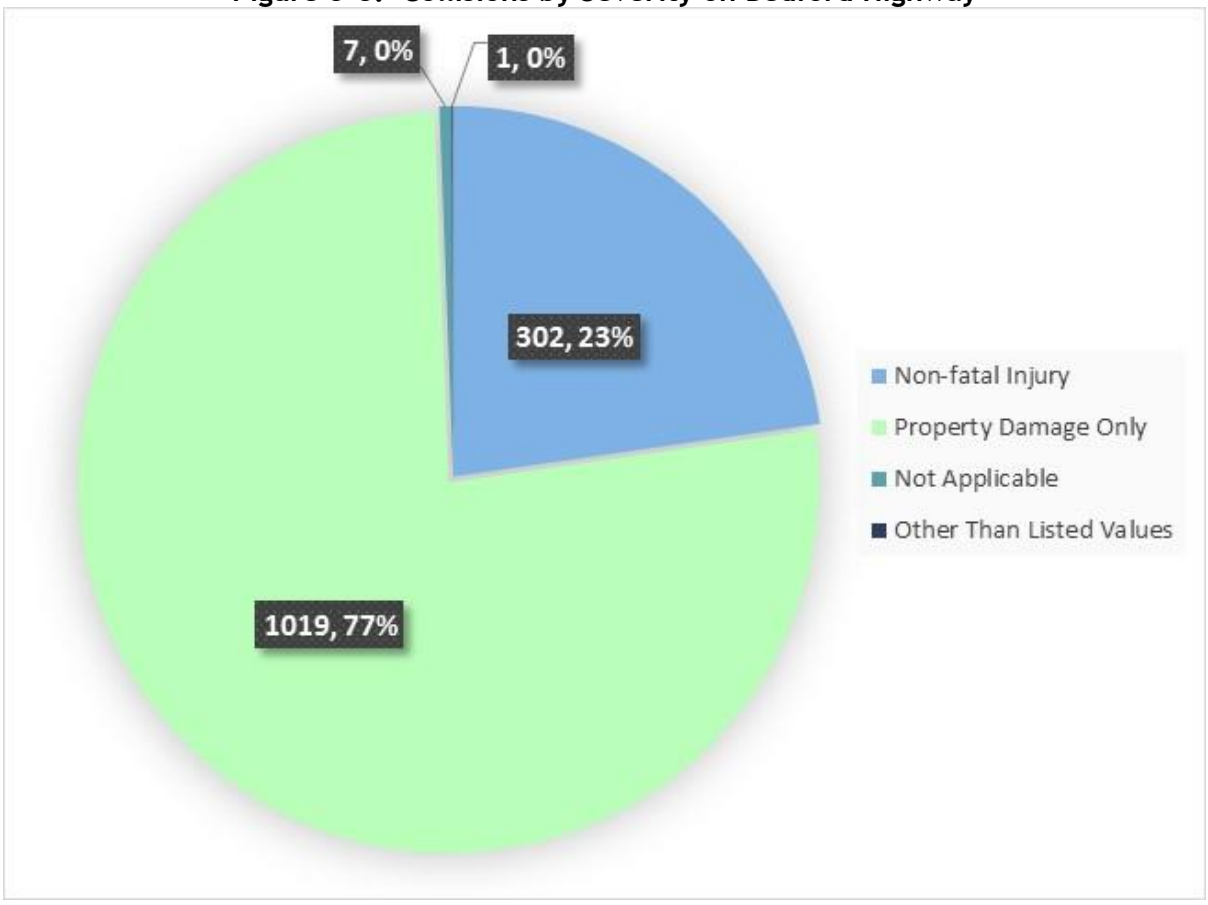


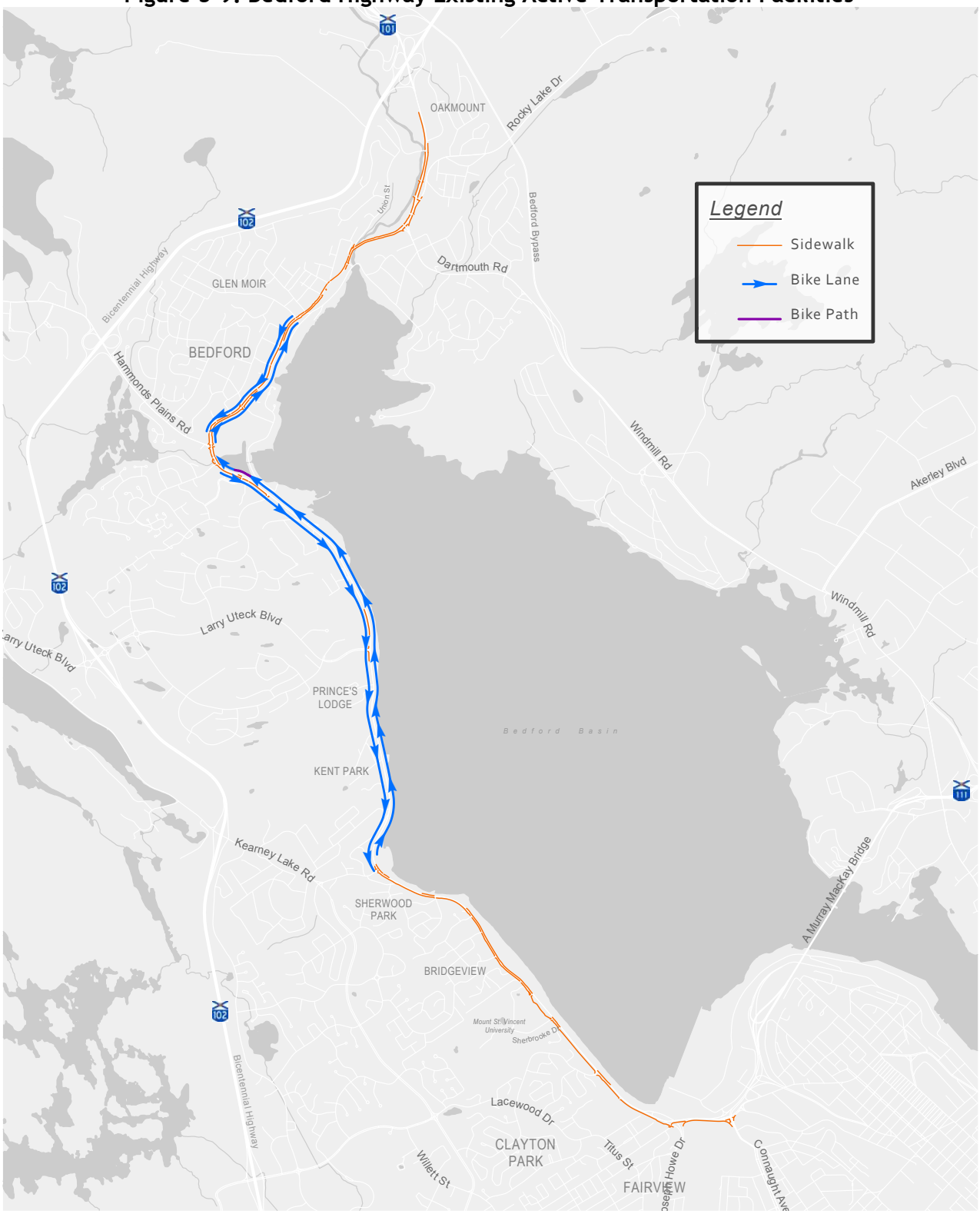
Figure 3-8: Collisions by Severity on Bedford Highway



3.4 Active Transportation

Pedestrian and cycling facilities on Bedford Highway consist of intermittent sidewalks and bike lanes. Bike lanes exist from Kearney Lake Road to Meadowbrook Drive, but mostly consist of a paved shoulder and are not buffered from traffic. Sidewalk is present on the west side of the roadway for the majority (73%) of the corridor but is absent from Kearney Lake Road to Southgate Drive (3.6km), where pedestrians must share the paved shoulder with cyclists. The lack of continuous facilities makes for an uncomfortable experience and likely deters active transportation users. **Figure 3-9** shows the existing active transportation facilities on Bedford Highway.

Figure 3-9: Bedford Highway Existing Active Transportation Facilities



3.5 Transit Service and Ridership

Existing Transit Routes

Bedford Highway is currently serviced by nine (9) transit routes:

- Route 39: Flamingo;
- Route 66: Penhorn;
- Route 80: Sackville;
- Route 81: Hemlock Ravine;
- Route 82: Millwood;
- Route 86: Basinview Express;
- Route 89: Bedford;
- Route 90: Larry Uteck; and
- Route 135: Flamingo Express.

A map of these routes is provided in **Figure 3-10**. A brief description of each transit route and the portion of Bedford Highway on which it travels is provided below. Note that "Inbound" refers to buses travelling southbound along Bedford Highway towards the downtown core, while "outbound" refers to buses travelling in the northbound direction.

- **Route 39: Flamingo** - Route 39 travels along Bedford Highway from Flamingo Drive to the south end of the corridor. During the weekdays, the service headway is 30 minutes in each direction of travel from the start of service to approximately 6:30 PM. From 6:30 PM to end of service, the service headway is 60 minutes, in each direction. Saturday services provide headways of 30 minutes in each direction throughout the day. For Sundays and Holidays, the route operates on 60-minute headways in both directions for the entire day.
- **Route 66: Penhorn** - Route 66 travels along Bedford Highway from the Cobequid Terminal to Dartmouth Road, continuing on to Dartmouth, during the Weekdays. Weekday services operate on a 30-minute headway throughout the day. During the evening, the headway is 60 minutes. For weekends and Holidays, service is provided every 60 minutes in each direction only within Dartmouth, from Highfield Terminal to Gaston Road.
- **Route 80: Sackville** - Route 80 travels along Bedford Highway from the Cobequid Terminal to Joseph Howe Drive. During weekdays and Saturday, service is provided at 30-minute headways through the majority of the day. Late in the evening, service is provided every 60 minutes. Peak service frequency is approximately 15 minutes inbound during the AM peak hour and outbound during the PM peak hour.

  Sunday and Holiday services are provided all day. During these periods, the route operates at a service headway of 30 minutes in both directions for the majority of the day from 7:00 AM to approximately 10:00 PM. After 10:00 PM, the service transitions to a 60-minute headway inbound (towards downtown Halifax), and maintains the 30-minute headway outbound (away from downtown Halifax).
- **Route 81: Hemlock Ravine** - Route 81 travels along Bedford Highway from Larry Uteck Boulevard to Joseph Howe Drive from Monday to Friday only. Service is provided from 6:00 AM to approximately 8:30 PM at 30-minute headways in each direction.

- **Route 82: Millwood** - Route 82 provides services along Bedford Highway from the Cobequid Terminal to Windsor Street in the inbound direction during the AM peak and the outbound direction during the PM peak period from Monday to Friday only. Headways from the start of service to approximately 5:30 PM is 30 minutes and transitions to 60 minutes afterwards. During the weekends and Holidays, headways are between 60 minutes to 120 minutes in both directions.
- **Route 86: Basinview Express** - Route 86 travels along Bedford Highway between Rocky Lake Drive and Meadowbrook Drive in peak directions (AM peak inbound and PM peak outbound), and from Windsor Street to Kearney Lake Road in the outbound direction during the PM peak from Monday to Friday only. In both directions, the headway is 30 minutes.
- **Route 89: Bedford** - Route 89 travels along Bedford Highway from the Cobequid Terminal to Hammond Plains Road and from there to Lacewood Terminal, from Monday to Friday only. For the majority of the day, the route operates on a 30-minute headway in both directions.
- **Route 90: Larry Uteck** - Route 90 travels along Bedford Highway from Larry Uteck Boulevard to Windsor Street, South End Halifax and the Halifax Ferry Terminal from Monday to Sunday. For the majority of the weekday and Saturday service, buses operate on a 30-minute headway in both directions. However, from approximately 6:00 PM onward, service frequency is decreased to one bus every hour. For Sunday service, buses operate on 60-minute headways.
- **Route 135: Flamingo Express** - Route 135 is an express route that travels inbound from MSVU (via Flamingo Drive) to Robie Street/University Avenue in the AM peak and back to MSVU during the PM peak. This route operates on Bedford Highway only from Flamingo Drive to MSVU. Service frequency is 15 minutes in the AM peak and 30 minutes in the PM peak.

There are several other transit routes that enter and exit Bedford Highway at Joseph Howe Drive, including Routes 2, 3, 4, 136, 137, 138, & 194, but these have been excluded from the discussion given their short duration on the corridor. **Table 2** summarizes the existing transit coverage and service frequencies on Bedford Highway.

The timing points along Bedford Highway were provided by HRM staff and summarized below:

- Bedford Highway at MSVU (Stop number 6216, and 6219); and
- Bedford Highway at Dartmouth Road (Sunnyside) (inbound stop # 6236 and 6270 and outbound stop # 6238).

Planned Transit Route Changes

Halifax Transit implemented several route changes in August 2018 that are reflected in the above "Existing Routes" and has plans to implement several more route changes over the next year or two as part of the "Moving Forward Together Plan". These additional changes are noted in the following list and presented in **Figure 3-11**:

- Route 8 replaces Route 80;
- Route 39 and 135 will remain as existing;
- Route 87 replaces Route 66;
- Route 89 will no longer operate along Bedford Highway;
- Route 90 will remain as existing;

- Route 91 replaces Routes 81 and will operate seven days a week;
- Route 93 will replace Route 82;
- Route 186 replaces Route 86; and
- Route 182 – First Lake Express is a new route that will travel along Bedford Highway.

Table 3-1: Existing Transit Service for Bedford Highway

Route	Extent of Travel on Bedford Highway	Direction[1]	Number of Buses per Hour		Frequency (Every X mins)		*Comments*
			AM Peak	PM Peak	AM Peak	PM Peak	
39	Flamingo Drive to Windsor Street	SB	2	2	30	30	
	Windsor Street to Flamingo Drive	NB	2	2	30	30	
66	Cobequid Terminal To Dartmouth Road	SB	2	2	30	30	
	Dartmouth Road to Cobequid Terminal	NB	2	2	30	30	
80	Cobequid Terminal to Joseph Howe Drive	SB	4	2	15	30	
	Joseph Howe Drive to Cobequid Terminal	NB	2	4	30	15	
81	Larry Uteck Blvd to Joseph Howe Drive	SB	2	2	30	30	
	Joseph Howe Drive to Larry Uteck Blvd	NB	2	2	30	30	
82	Cobequid Terminal to Windsor Street	SB	2		30		*Peak Service Only*
	Windsor Street to Cobequid Terminal	NB		2		30	
86	Rocky Lake Drive to Meadowbrook Drive	SB	2		25		*Express Service*
	Windsor Street to Kearney Lake Road	NB		2		30	
	Meadow Brook Drive to Rocky Lake Drive	NB					
89	Cobequid Terminal to Hammonds Plains Rd	SB	2	2	30	30	
	Hammonds Plains Rd to Cobequid Terminal	NB	2	2	30	30	
90	Larry Uteck Blvd to Windsor Street	SB	2	2	30	30	
	Windsor Street to Larry Uteck Blvd	NB	2	2	30	30	
135	Flamingo Drive to Mount St. Vincent Univ.	SB		2		30	*Express Service*
	Mount St. Vincent Univ. to Flamingo Drive	NB	4		15		
		Total Southbound Buses	18	14			
		Total Northbound Buses	16	18			
		Total Buses	**34**	**32**			

[1] Southbound is Inbound, Northbound is Outbound

Transit Stops

Table 3-2 and **Table 3-3** list all the transit stops and timing points along the Bedford Highway corridor for the inbound and outbound directions, respectively. These are also shown in **Figure 3-12.** As shown in the tables, transit stops are shared between the majority of the transit routes between Larry Uteck Boulevard and Bayview Road.

Bus laybys are provided at many of the stops. HRM is in agreement that these laybys could be eliminated as part of the functional plan options if the space can be more effectively used, with the exception of the timing point locations mentioned in the above sections. At these locations, the laybys will be maintained.

Existing Transit Signal Priority

It was identified through discussions with HRM staff that there is currently no Transit Signal Priority (TSP) deployed along the Bedford Highway corridor; however, the emergency vehicle pre-emption is enabled (GTT/Opticom). HRM is currently in the process of upgrading their signal controllers and communications systems. It is envisioned that the implementation of active TSP can leverage off of the existing pre-emption equipment at each intersection, but the new signal system will not be able to communicate with the current transit vehicle GPS-AVL system. Therefore, additional on-board equipment will be required to implement active TSP.

Transit Ridership

Table 3-4 illustrates weekday ridership data recorded during the week of September 24-28, 2018 for routes along Bedford Highway. All riders boarding, riding, and alighting through the corridor were recorded for both the inbound and outbound directions, respectively, and a summary of total ridership per segment per direction is provided. The volume of transit riders is highest at the southern end of the corridor and equates to approximately 10-15% of vehicle traffic. Note that this ridership information should be treated with caution and is for interest only given that Halifax Transit has found inaccuracies in the data when calculated in this manner.

Figure 3-10: Bedford Highway Existing Transit Routes

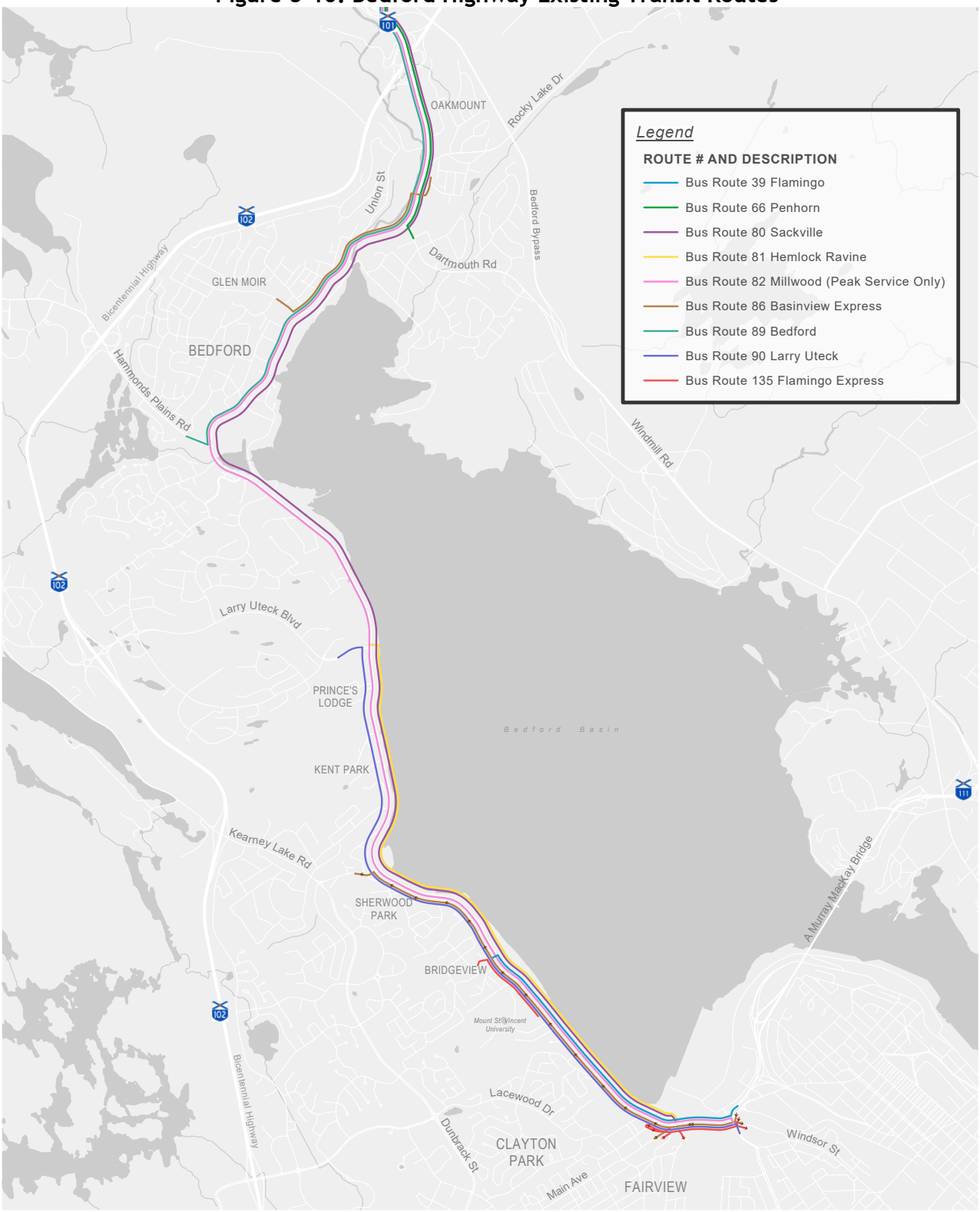


Figure 3-11: Bedford Highway Future Transit Routes

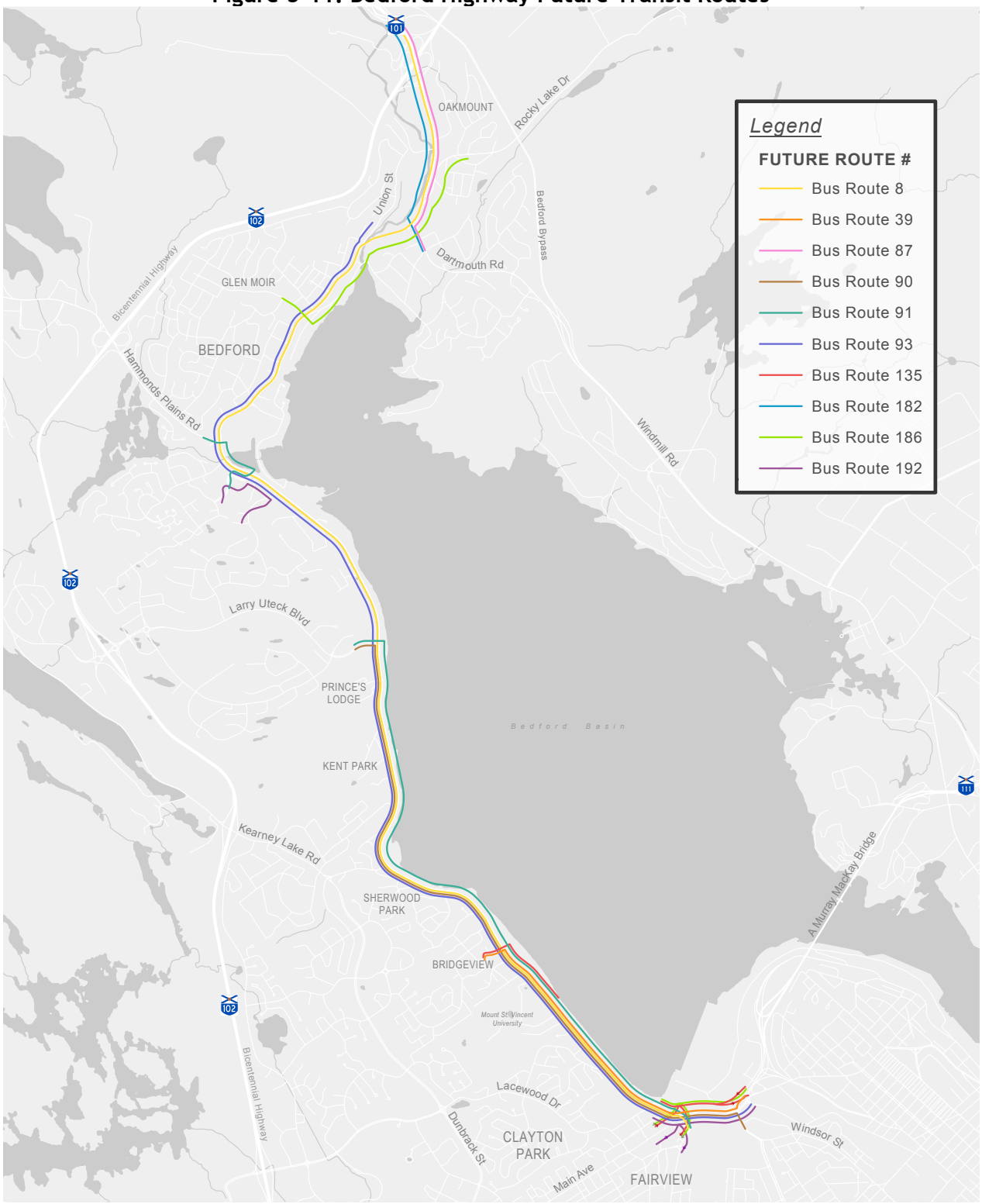


Figure 3-12: Location of Transit Stops and Timing Points

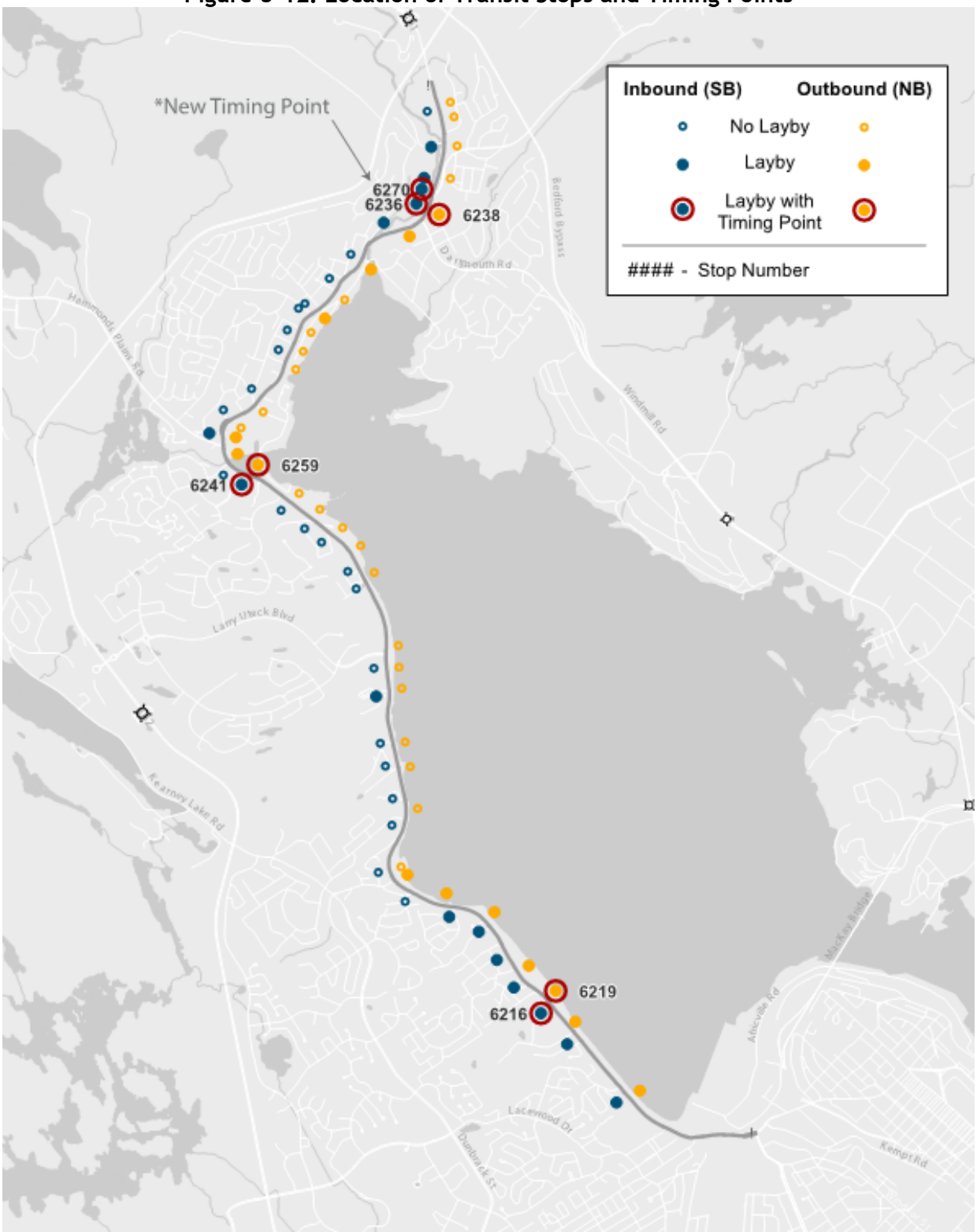


Table 3-2: Inbound Transit Stops

	Route								
Bus Stop	**39**	**66**	**80**	**81**	**82**	**86**	**89**	**90**	**135**
Before Oakmount Dr (6266)		●	●		●		●		
After River Ln (6245)		●	●		●		●		
Before Rocky Lake Dr (6226)		●	●		●		●		
Before Dartmouth Rd (6270) (Timing Point)		●							
Before Dartmouth Rd (6236) (Timing Point)		●	●		●	●	●		
Before Union St (6228)			●		●	●	●		
After Hatchery Ln (6285)			●		●	●	●		
Before Spring St (6249)			●		●	●	●		
Before Meadowbrook Dr (6261)						●			
After Meadowbrook Dr (6257)			●		●		●		
Before Sullivans Hill (6278)			●		●		●		
Before Lindsay Hill (6277)			●		●		●		
Before Holland Ave (6240)			●		●		●		
Before Valley Rd (6280)			●		●		●		
Before Hammonds Plains Rd (6255)			●		●		●		
After Moirs Mill Rd (6253)			●		●				
Before Nelsons Landing Blvd (6241)			●		●				
After Southgate Dr (6230)			●		●				
Before Glenmont Ave (6274)			●		●				
At Millview Ave (6258)			●		●				
Before Welch Ln (6224)			●		●				
At Fern Ave (6273)			●		●				
After Larry Uteck Blvd (6272)			●	●	●			●	
After Shaunslieve Dr (6234)			●	●	●			●	
At Lodge Dr (6233)			●	●	●			●	
At Kent Ave (6276)			●	●	●			●	
At Tall Trees Ln (6242)			●	●	●			●	
At Dakin Dr (6248)			●	●	●			●	
Before Kearney Lake Rd (6275)			●	●	●			●	
After Kearney Lake Rd (6246)			●	●	●			●	
After Torrington Dr (6279)			●	●	●			●	
Before Watervista Ln (6264)			●	●	●			●	
After Forest Hill Dr (6252)			●	●	●			●	
After Flamingo Dr (6251)	●		●	●	●			●	●
At MSVU (6216) (Timing Point)	●		●	●	●			●	●
After Seton Rd (6217)	●		●	●	●			●	
After Bayview Rd (6269)	●		●	●	●			●	

Table 3-3: Outbound Transit Stops

	Route								
Bus Stop	**39**	**66**	**80**	**81**	**82**	**86**	**89**	**90**	**135**
Before Bayview Rd (6289)	●		●	●	●			●	
Before Seton Rd (6286)	●		●	●	●			●	
Opposite MSVU (6219) (Timing Point)	●		●	●	●	●		●	●
Before Flamingo Dr (6250)			●	●	●	●		●	
After Watervista Ln (6288)			●	●	●	●		●	
After Torrington Dr (6262)			●	●	●	●		●	
Before Kearney Lake Rd (6268)			●	●	●			●	
After Kearney Lake Rd (6256)			●	●	●			●	
After Cresthaven Dr (6247)			●	●	●			●	
Opposite Kent Ave (6222)			●	●	●			●	
Opposite Lodge Dr (6223)			●	●	●			●	
After Charlotte Ln (6287)			●	●	●			●	
Before Larry Uteck Blvd (6239)			●	●	●			●	
After Larry Uteck Blvd (6220)			●	●	●				
Opposite Fern Ave (6221)			●		●				
After Civic 741 (6271)			●		●				
Before Millview Ave (6232)			●		●				
Opposite Glenmont Ave (6284)			●		●				
Before Southgate Dr (6290)			●		●				
After Nelsons Landing Blvd (6259)			●		●				
Opposite Moirs Mill Rd (9023)			●		●				
After Hammonds Plains Rd (6254)			●		●		●		
After Valley Rd (6265)			●		●		●		
After Convoy Run (6235)			●		●		●		
Before Lindsay Hill (6229)			●		●		●		
Before Sullivans Hill (6244)			●		●		●		
Opposite Fourth St (6283)			●		●		●		
After Meadowbrook Dr (9024)			●		●		●		
Opposite Spring St (6227)			●		●	●	●		
Before Hatchery Ln (6282)			●		●	●	●		
Before Dartmouth Rd (6237)			●		●	●	●		
After Dartmouth Rd (6238) (Timing Point)		●	●		●	●	●		
After Rocky Lake Rd (6281)		●	●		●		●		
Before River Ln (6263)		●	●		●		●		
After Oakmount Dr (6260)		●	●		●		●		
At Civic 1743 (6243)		●	●		●		●		

Table 3-4: Transit Ridership on Bedford Highway

Segment	Bus Routes	AM Passengers per Route		PM Passengers per Route		AM Peak Ridership		PM Peak Ridership	
		SB Passengers in the peak hour	NB Passengers in the peak hour	SB Passengers in the peak hour	NB passengers in the peak hour	Total SB Passengers	Total NB Passengers	Total SB Passengers	Total NB Passengers
6	80	36	15	47	32	84	18	57	63
	82	22			19				
	89	4	8	1	10				
	86	6			10				
	66	16	-5	9	-8				
5	80	54	46	63	36	105	59	64	82
	82	27			24				
	89	11	13	1	12				
	86	13			10				
4	80	68	61	70	46	107	61	70	77
	82	39			31				
3	80	73	67	71	56	181	86	87	142
	82	48			19				
	81	14	5	-3	20				
	90	46	14	19	47				
2	80	60	53	76	61	193	90	131	264
	82	48			54				
	86				45				
	81	17	8	7	21				
	90	41	15	30	48				
	135	2			2				
	39	25	14	18	33				
1	80	60	74	75	65	260	139	125	329
	82	48			56				
	86				45				
	81	18	7	6	23				
	90	41	24	24	56				
	135	64			57				
	39	29	34	20	27				

*Note: Negative numbers reflect results that did not capture all riders correctly and therefore, riders did not balance out. No adjustments were made to correct these.

3.6 Major Physical Constraints

Rail

A CN Rail corridor runs along the east side of Bedford Highway between the roadway and Bedford Basin. This rail corridor is part of the Bedford Subdivision, which connects the Halifax Ocean Terminals (and Via Rail Station) to Truro and then to Moncton and Montreal as part of the Eastern Mainline. The rail corridor serves freight and long-distance passenger rail. Within the Bedford Highway Study Area, there are two major rail facilities – the Fairview Cove Container Terminal and Rockingham Marshalling Yard.

The opportunity to operate commuter rail service along the CN Bedford Subdivision has been studied and HRM is currently in discussions with CN on this opportunity. Four commuter stations along Bedford Highway have been envisioned – Rockingham, Larry Uteck, Mill Cove, and Sunnyside. The Bedford Highway Functional Plan has considered a Commuter Rail scenario, but specifically focused on land use implications and coordination of roadway and transit infrastructure.

Utilities

Overhead and underground utilities are located on one or both sides of the roadway throughout the corridor. They pose a challenge for roadway modifications due to the cost for relocations and proximity to abutting developments. Utility poles have been located in the topographic survey and underground services are shown in the Municipality's GIS. The utilities have been mapped on the concept and functional designs to demonstrate impacts resulting from the proposed modifications.

Right-of-Way

The right-of-way width varies widely throughout the Bedford Highway corridor and can be as narrow as 20m in built up areas. Additionally, there are many areas where Bedford Highway is located within CN Rail right-of-way. This issue will need to be resolved to avoid complications with implementing the proposed improvements.

Topography

Bedford Highway is flanked by steep slopes on its west side and the Bedford Basin on its east side. These constraints make widening the roadway very costly or impractical in many areas. The Functional Plan options have been developed considering the topographic constraints. Some minor retaining walls are required to achieve the proposed geometry, but major excavations have been avoided.

4.0 Existing Land Use Characteristics

4.1 Key Definitions

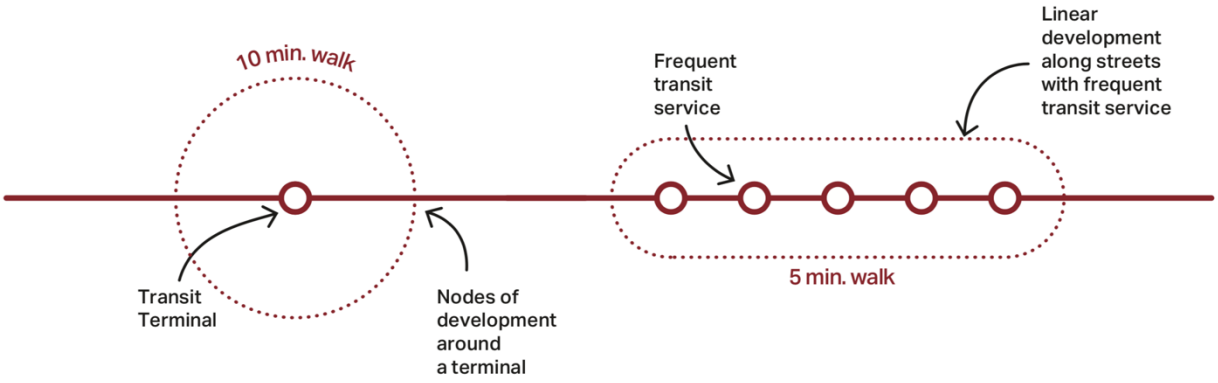
The following definitions describe key concepts of integrated transportation and land use planning and are used throughout this report:

Strategic Corridors are transportation corridors that are important based on their role in traffic operations, transit, goods movement and active transportation.

Complete Communities are places where it is possible to work, shop, learn and play within an attractive walking distance of where people live.



Transit Oriented Development is an approach to development that integrates land-use planning and transit and focuses a Complete Community around a transit terminal or along a transit corridor.



4.2 Settlement History

Canada's Indigenous peoples first arrived in Bedford around 12,000 years ago. Evidence of human settlement is inconsistent until 6,000 years ago when the glaciers retreated and the presence of Mi'kmaq settlements grew as inhabitants travelled along the Sackville River system and Bedford Basin. Mi'kmaq petroglyphs over 500 years old were found in the community, including a symbol for unity etched into a rock surface.

As Ingalls and Ingalls (2010) describe, France founded Port Royal in 1604, establishing trade connections with the Mi'kmaq inhabitants. In 1713, France lost mainland Nova Scotia to the British, and in 1745 Louisbourg was also taken. The French hoped to retake Acadia with the help of the Mi'kmaq people, who in 1746 awaited a large French fleet to arrive with arms and supplies for the fight. The fleet, led by Duc d'Anville, arrived late and sailors were plagued with sickness—including their leader who died shortly after arrival in Halifax. The Mi'kmaq took in sailors at their camps along the Bedford Basin both in Fairview and Birch Cove, but the men continued to die at alarming rates and passed on these highly contagious diseases to their hosts. By the time the fleet returned to France, over a third of the Mi'kmaq population had been wiped out by disease, buried on the grounds of these camp sites along with French sailors, and despite their efforts surviving inhabitants were eventually displaced from their homes by British settlers. In 1929 a monument was erected on the highway lands in honour of the French sailors who lost their lives, today sitting in Centennial Park.

This event soon led British settlers to the deep and expansive harbour where they founded Halifax in 1749. Led by Cornwallis, settlers arrived to the harbour in 1749 and began construction of a road to the Bay of Fundy, and Fort Sackville military base (where Scott Manor House stands today). At this time, the Mi'kmaq communities had been so decimated by disease, and likely reluctant to return home to the scene of this horrific event, that the area was largely uninhabited and the fight against British colonialists was not enough to protect against this imperialism. Some Mi'kmaq communities still inhabited Bedford's Birch Cove, where they remained until the 1920s, and where evidence of Acadian settlements has also been found. Withrow (1999) explains that a Birch Cove gravesite discovered in 1890 and originally believed to be remnants of the losses endured during Duc d'Anville's stay, but proven in fact to be the graves of Acadian settlements. The traces of these various settlements illustrate Nova Scotia's long history of cultural expulsion and violence.

Cornwallis hired Acadian workers to build what is now known as Bedford Highway, as it followed a road used by these communities to move livestock from the Annapolis Valley to the Basin for transport to Louisbourg. The road was intended to strengthen defences by transporting troops and easing communication between the new town and older communities, and in 1755 following the expulsion of the Acadians that built the road, New England troops marched along the stretch. Following the construction of the road that is now Bedford Highway, European communities began to appear along this road that connected them to the greater region. Bedford has had many names, including Fort Sackville, Ten Mile House (after the Inn of the same name and the distance to Halifax), Sunnyside, and Bedford Basin. In the late 1700s, Bedford and surrounding neighbourhoods was used largely as a throughway. Ordered by legislature, a tollgate was installed along Bedford Highway in an attempt to fund road maintenance with the increasing traffic, but the gate was repeatedly torn

down. Black Loyalists who had been forcibly relocated from America to Nova Scotia's South Shore would travel through Bedford to reach Halifax, a route also travelled by many others.

In 1789, John Wentworth, surveyor general, purchased 200 acres overlooking the Bedford Basin, soon to be known as the Prince's Lodge—home to Prince Edward and Madame de St. Laurent. Wentworth loaned the lodge to Prince Edward, Duke of Kent (and father of Queen Victoria) during a five year stay in Halifax with his mistress. The estate was built in 1795, surrounded by a carefully manicured pleasure garden including a heart shaped pond in what is now Hemlock Ravine Park. The site attracted many royal visitors throughout the 1800s including Prince Albert, Prince of Wales and King Edward VII, forming a poignant landmark.

Protestant immigrants began to arrive in Nova Scotia in the 1750s, recruited by the British Board of Trade as most British settlers were attracted to more southern colonies. These immigrants began settling in areas adjacent to Bedford including Fairview (to the South of Halifax City limits) and Rockingham (South of Birch Cove). In Rockingham, these settlers started farms and inns where travellers would stay before taking their livestock to Halifax markets. Going into the early 1800s, industry expanded as Bedford participated in the Golden Age of Sail, constructing ships in the Basin and soon forming other industries like The Acadia Paper Mill. Bedford became the traditional stopping place as celebrated in its slogan, as travelers would stop into the Bedford / Sackville area between Windsor and Truro, with a stage coach service to Truro beginning in 1816. Ten Mile House was a landmark for travelers to stop, and city residents would also come to the inn for special events. The town officially adopted the name Bedford in 1850 (after the 4th Duke of Bedford), and rail was introduced in 1855, with two trains daily from Richmond to Sackville. By the late 1800s Bedford was a true resort community, one of the first in Nova Scotia. A local population of only 450, city-dwellers would come in summer months to swim and fish, shoot target practice, play tennis or golf, and stroll along Main Street. A seasonal train is advertised in an 1870 paper, offering to transport business men and their families between Halifax homes and Bedford cottage country.



Cyclist and pedestrians use the early Bedford "Highway", undated.



Bedford train station, sometime soon after 1845.

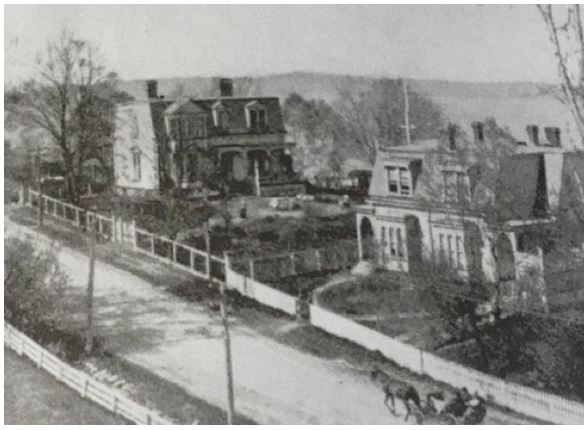


African Nova Scotian travellers heading to market in Halifax with a cartload of goods to sell. Robert Petley, Bedford Basin Near Halifax, 1835.



Escaping the city to Bedford for picnicking and other leisure pursuits were popular in the mid to late 1800s.

Also in the 19th century, Rockingham expanded with the rail, and the first stop was constructed outside the Four Mile House Inn in 1855. The community was referred to as Four Mile House after this institution, named for its distance to Halifax. The railway accommodated tourists and summer homes as in the neighbouring Bedford area. Though this brought wealth to the area, it also cut off farmers from the coastline, signalling a shift in the local economy. In the 1870s The Sisters of Charity established the Motherhouse convent and Mount Saint Vincent Women's Finishing School up from Rockingham Station, two facilities that proved to be very influential for the greater Bedford/Halifax areas.





Fernbank, built in the 1890s on Park Avenue.



Chipman House, built 1850s.



Clayton House, built in 1904 as a summer home on the Basin's western shore.

In the 1880s and 90s, Rockingham shifted from a small community of innkeepers, farmers and shop owners to form a suburban escape, accommodating an influx of professionals looking to escape the now crowded city in search of clean air and open spaces. Some converted summer homes to permanent dwellings, or built Victorian houses on land along the coast. Simon McDonald was an influential developer who in 1891 converted the old Evans Farm into a subdivision called *Park Avenue*, of which four houses remain surrounding what is now Trident Avenue. Homes of this era included Fernbank, Chipman House, and Clayton House, originally built as a summer home. Similar to Rockingham, a German settlement built up around the Fairview rail junction in what was called Westerwald (Western Forest) or Dutch Village, employing middle class rail workers and their families for the greater part of the 19th and 20th centuries. Birch Cove also began to develop in this era, owned in part by the Donaldson family who, arriving from Scotland in 1790 and starting a local confectionary business, held land in the area for four generations. Though the family suffered many deaths and financial turmoil, Minnie Donaldson built the Donaldson House in 1901, which remained the family homestead until 1957. Once overlooking the head of Birch Cove the house now sits on Silverwood Terrace, surrounded by suburban development.

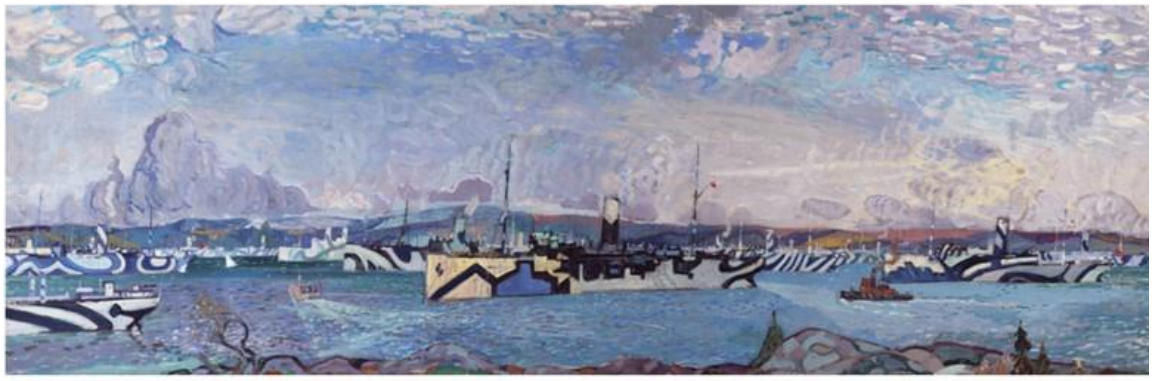
As growth continued in these areas, the Moirs family industry opened a mill factory and soon expanded to include a chocolatier and power plant in the early 1900s, the Moirs Mill Power House (1931) stands today as a provincially and municipally registered heritage property. By 1904 cars started to come to the province, and industry continued to diversify. Local business included diners, recreation (such as the Eaglewood Golf Course), The Bedford Theatre, hotels (such as the Bedford Motel and Traveller's Motel), cabins, a Canada Dry bottling plant, Dominion Fish Hatchery, and a wool mill.

In 1921, The Bedford Ratepayers Association was formed, reflecting a growing base of permanent residents. Bedford Highway was widened in 1939 as a means to encourage investment, razing buildings. The population grew to around 4,000 residents in the mid 1900s, and transportation networks expanded to include diesel electric trains (making frequent stops for Bedford commuters, as a bus would), special occasion ferries and Acadian Lines bus service along the highway (until Metro Transit took over in the 1970s). Though settlement patterns were shifting, the military history of this community continued to have an influence throughout both world wars, with shipbuilding and supplies being assembled along the basin, and navy ships docking here. This time was characterized by tragedies as well, with the 1917 Halifax Explosion, the 1945 explosion of Magazine Hill, and the 1956 Sackville River flood. Vince Coleman, a Halifax train dispatcher managed to save passengers when he lost his life signalling for the train to stop at Rockingham Station seconds before the Halifax Explosion.



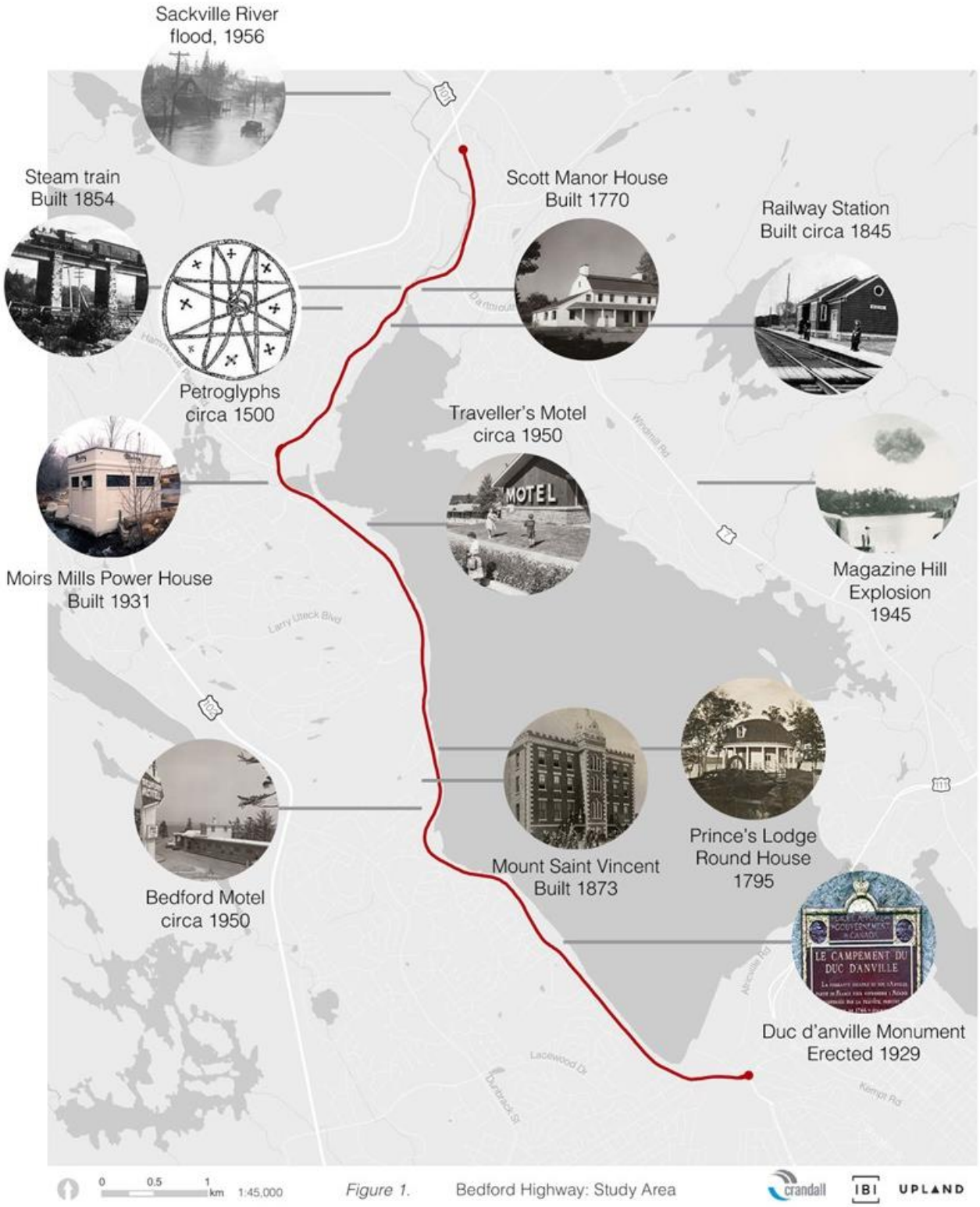
The motor car, and traffic congestion, were introduced to the Bedford Highway in the 1920s.


Commercial development of Bedford in the 1980s.


Arthur Lismer, Convoy in Bedford Basin, 1919.

Post-war Bedford transitioned from a resort town into a bedroom community, well positioned by its location on the CNR commuter rail from Windsor Junction, and the newly paved Bedford Highway to Halifax. Rockingham began to subdivide around this time, attractive for its lower tax rates, and officially adopting the name Rockingham in 1961. Mount Saint Vincent became a fully-fledged university at this time, and major development built up around it. By the 1960s Fairview had also taken up its current name, and the Bayers Road Shopping Centre was open by the end of this decade. Housing development in all three communities densified until a shift came in the 1970s-1990s, when demand grew for larger family homes. Fairview in particular began to gentrify, as Halifax professionals took over middle class worker housing looking for an easy commute to town. Clayton Park development began in 1962, accommodating many of these upper middle-class commuters. **Figure 4-1** locates some key events and locations in Bedford's history.

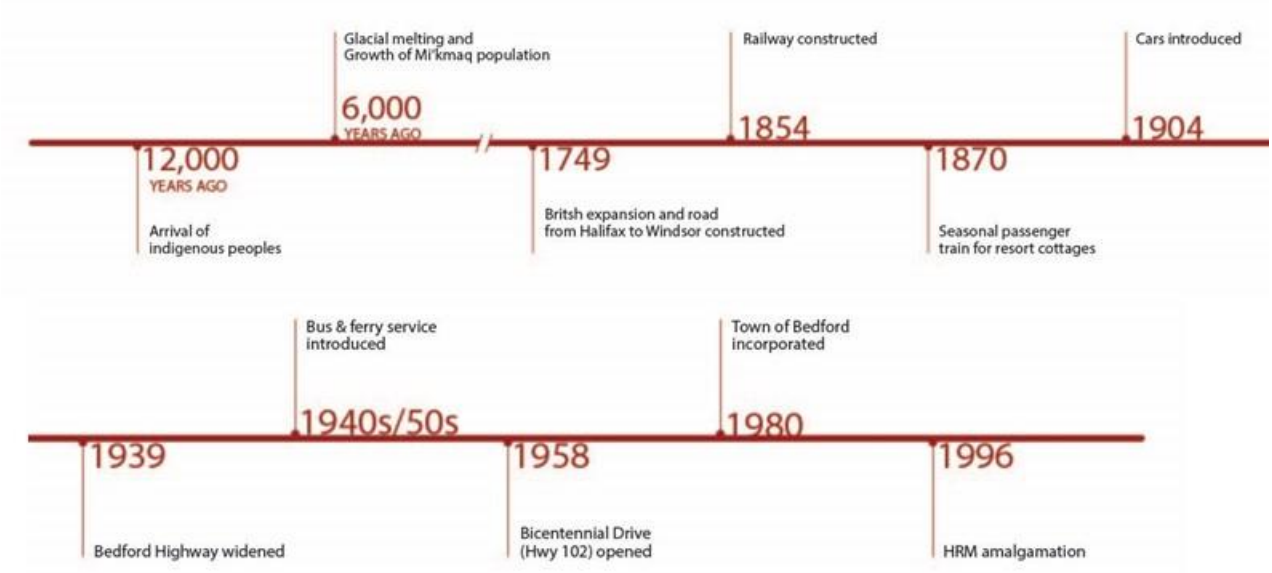
Figure 4-1: Select Historic Events



In 1980 Bedford incorporated as a town, the beginning of another major population boost that continues today. At the same time, the Bedford Waterfront Development Corporation was created with a goal of rejuvenating the Basin and Highway lands and providing public waterfront access. A large area of Mill Cove was infilled as an approved location for disposing of pyritic slate from construction projects elsewhere, creating new land for development. By 1990 upgrades to Bedford Highway were complete, and with the discontinuation of regional passenger train service, commuter rail service had already disappeared years earlier. In 1996, Bedford became part of the Halifax Regional Municipality, but the waterfront project continued under new governance. The shape of the waterline has changed significantly with rising sea levels, infill projects, and commercial development, and it has become a public amenity connecting many parks, trails and open spaces. The infill beyond the railway at Mill Cove already supports mid-to-high-density development and includes a large vacant area with potential for Transit Oriented Development.

Figure 4-2 shows the evolution of transportation along Bedford Highway.

Figure 4-2: Evolution of Transportation



4.3 Growth 1960s-Present

The following series of maps depict the evolution of development along Bedford Highway.[1] A suburban pattern was emerging during the 1960s and 70s, primarily in Bedford and to the south of the study area, closer to Halifax. This pattern continued to expand through the 1980s and 1990s. In the past 15 years, development has extended throughout the middle of the study area. Today, most of the remaining undeveloped land is park space. **Figure 4-3** to **Figure 4-9** show how these development patterns shaped the history of Bedford from 1964 to present day.

[1] These maps were created by overlaying historic aerial photography and adapting building footprint layers in ArcGIS.

Figure 4-3: Development 1964

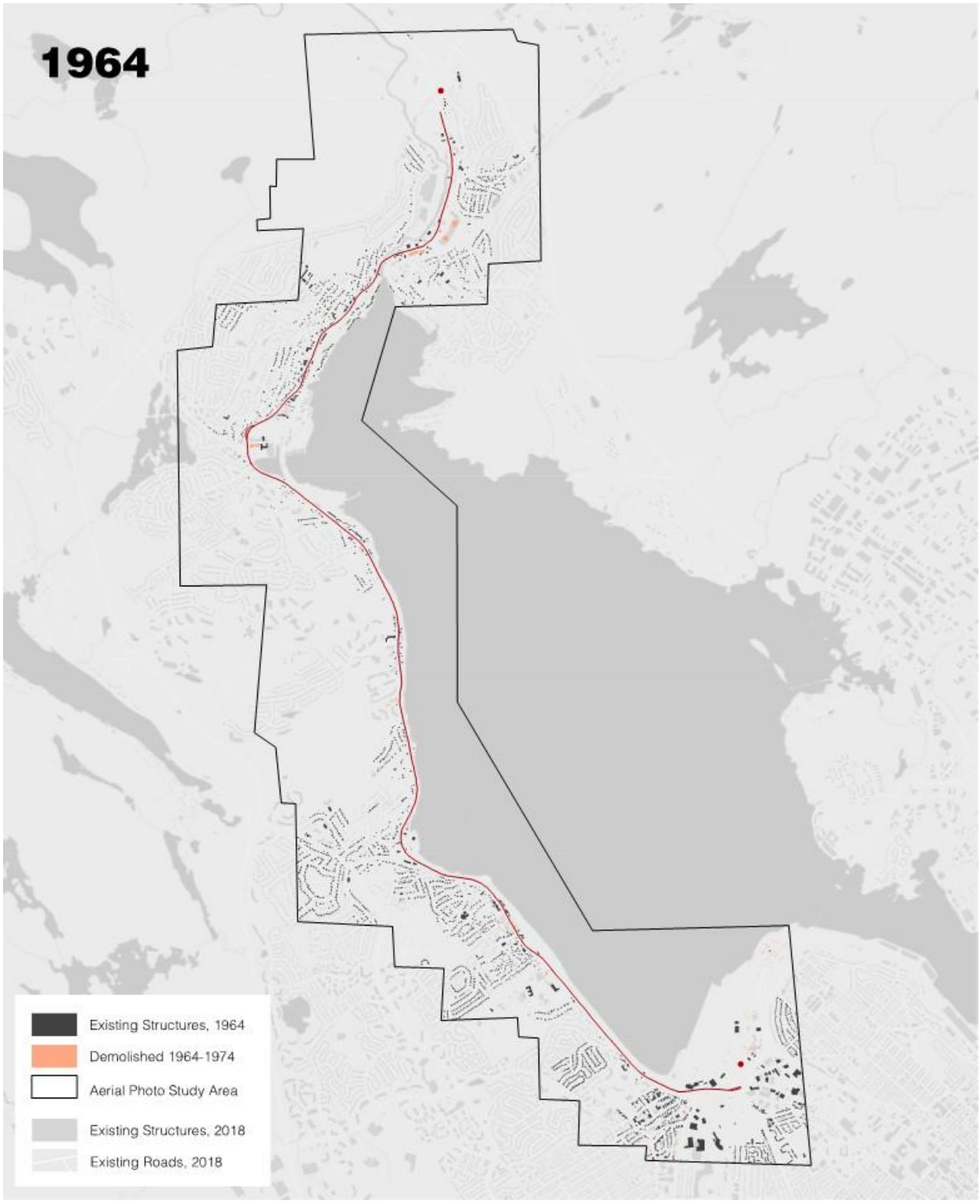


Figure 4-4: Development 1974

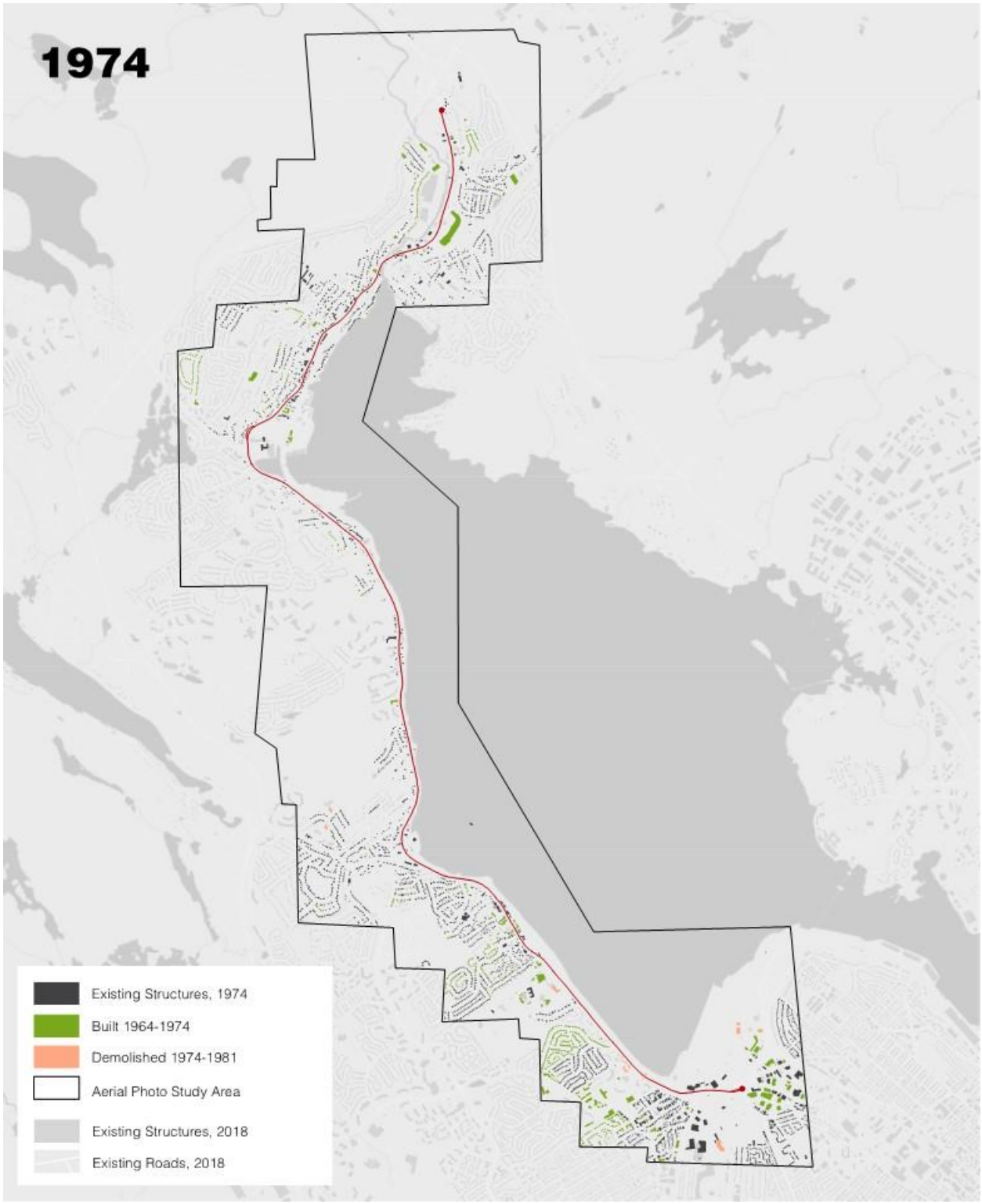


Figure 4-5: Development 1981

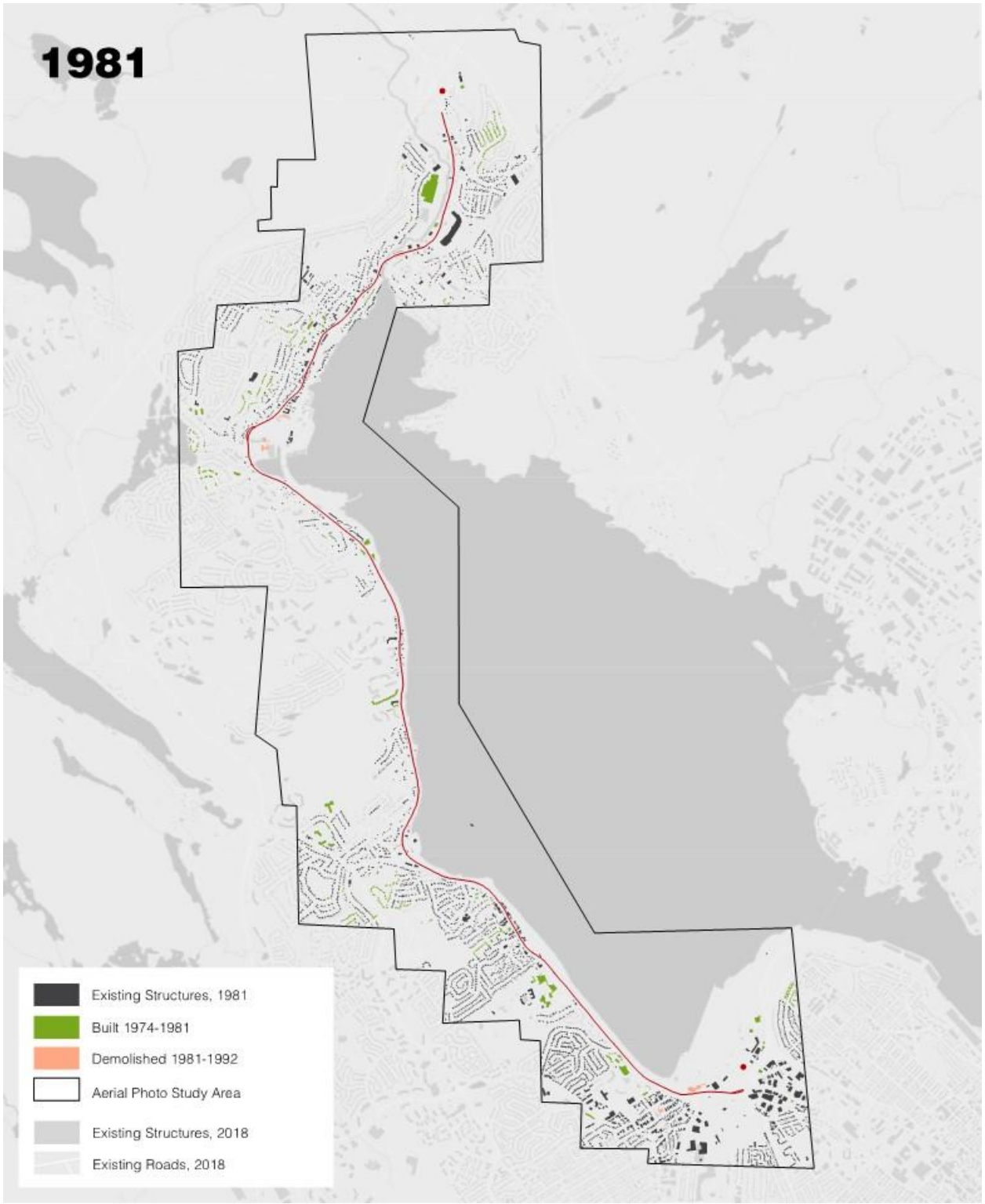


Figure 4-6: Development 1992

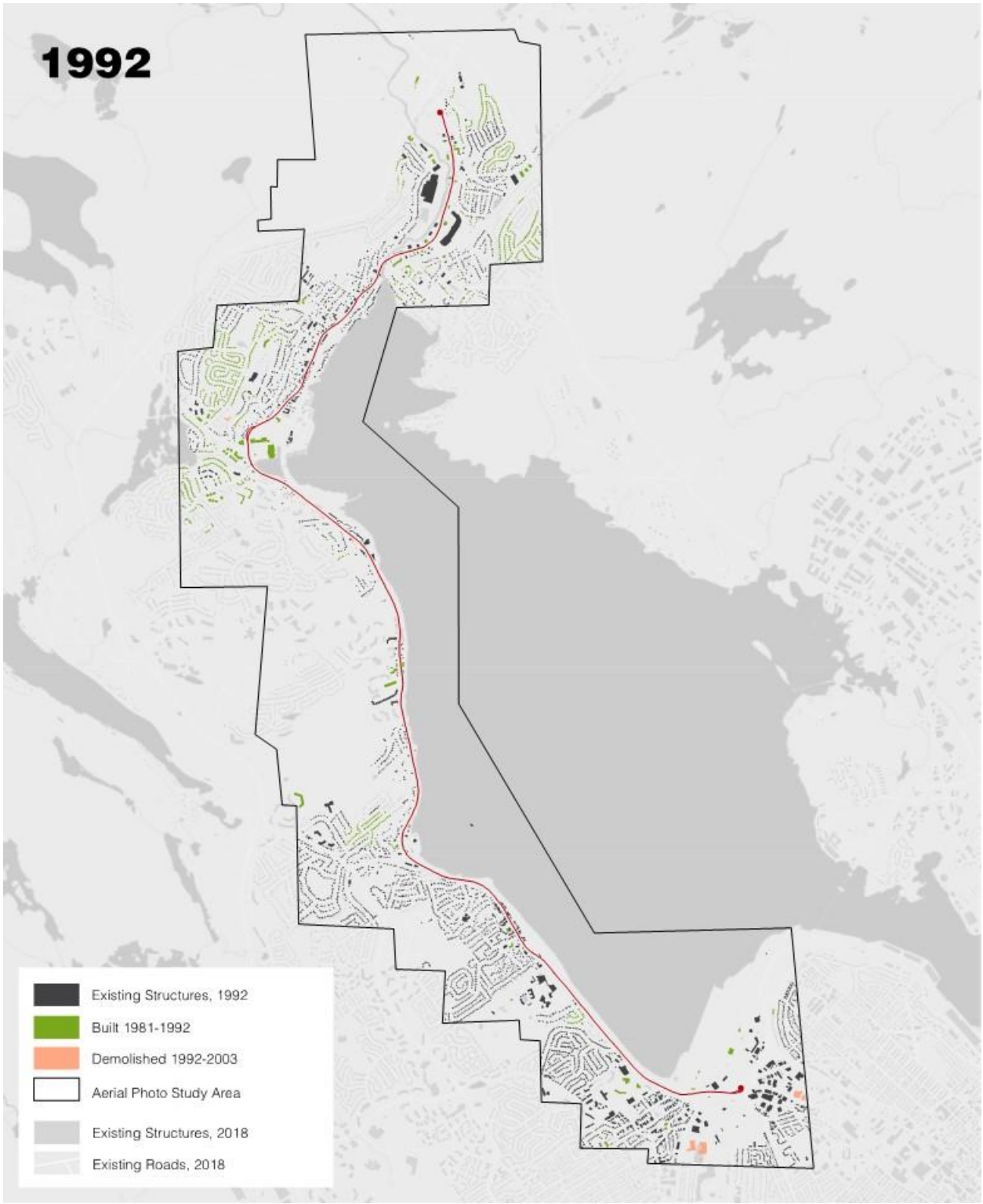


Figure 4-7: Development 2003

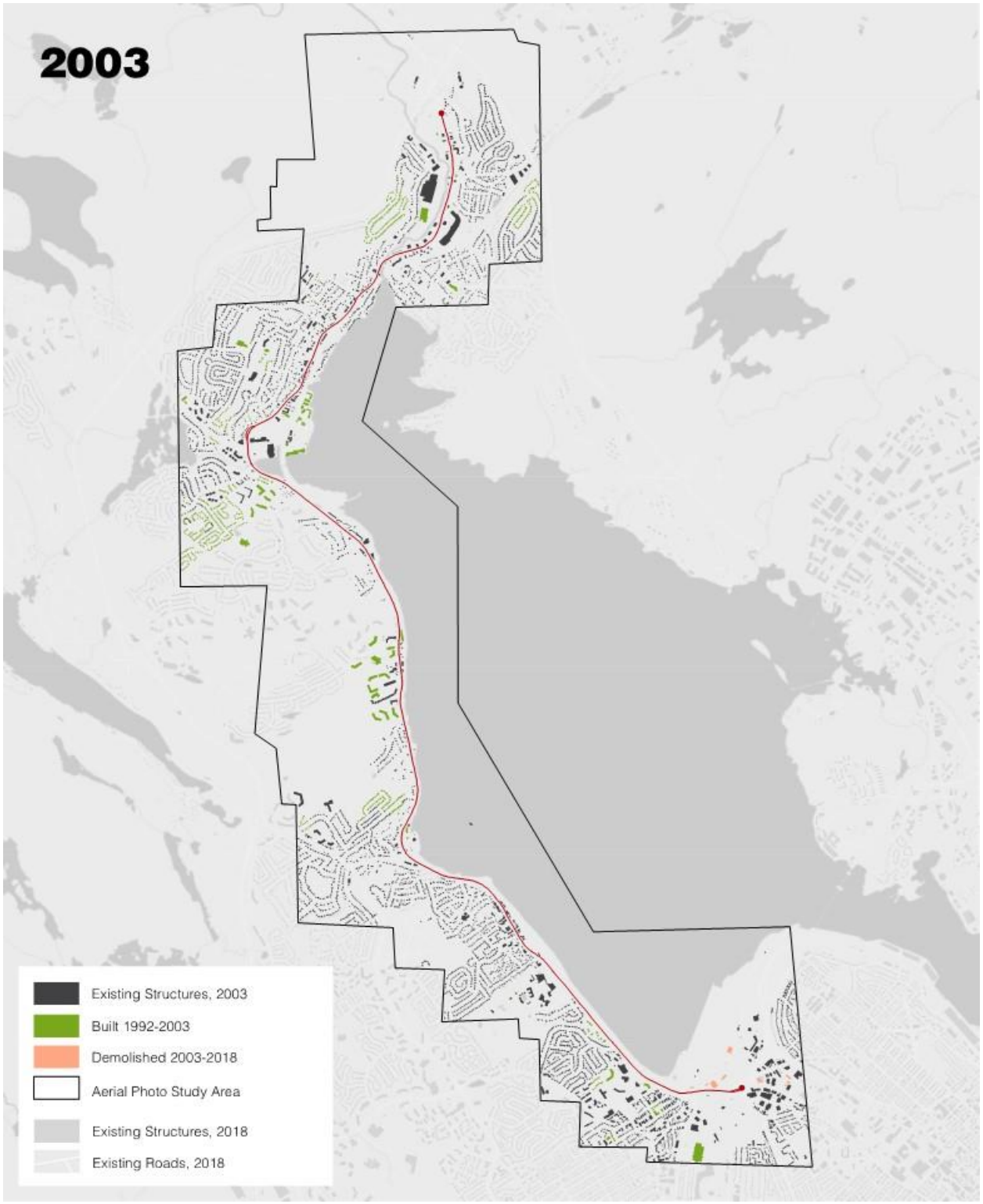


Figure 4-8: Development 2018

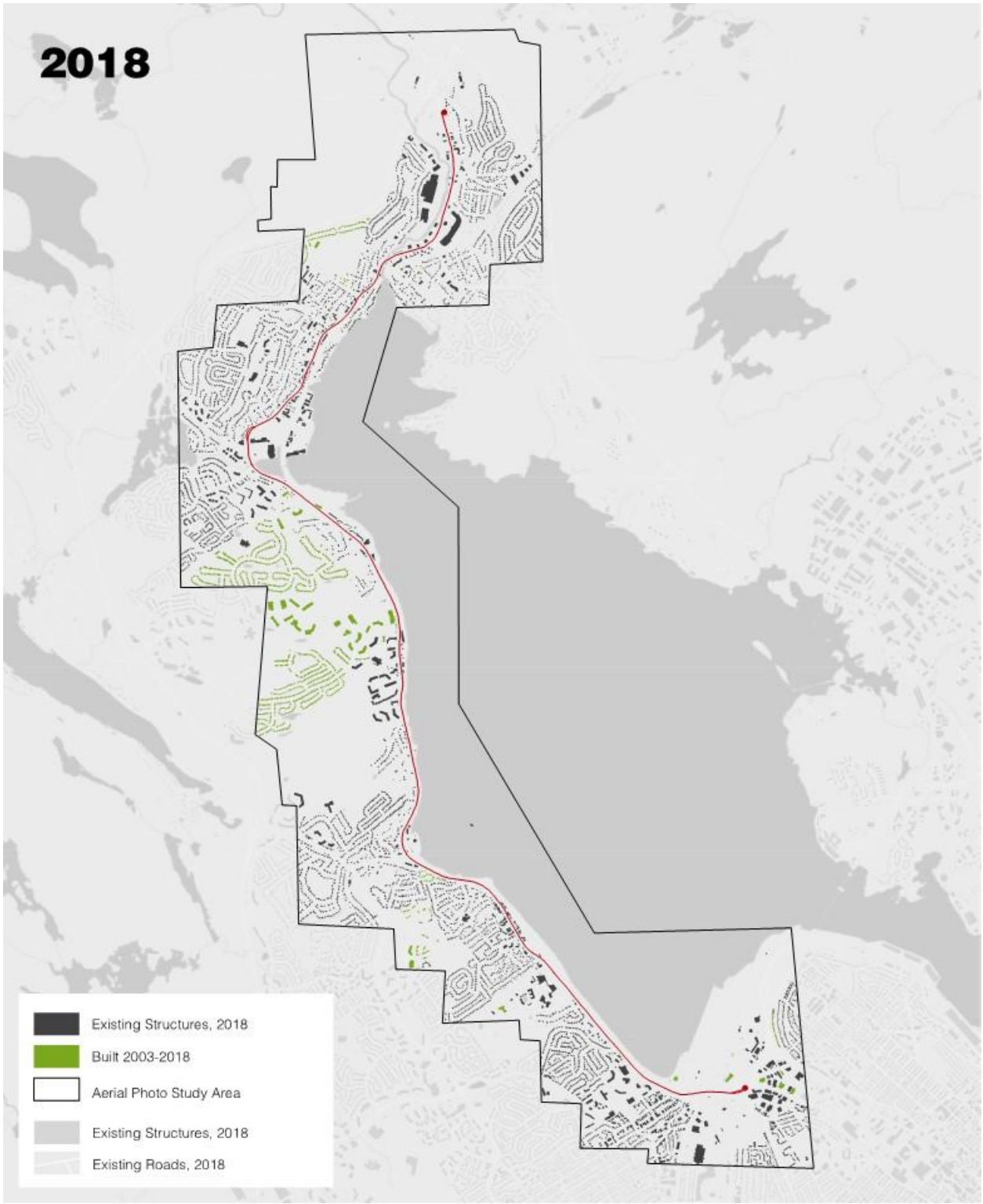
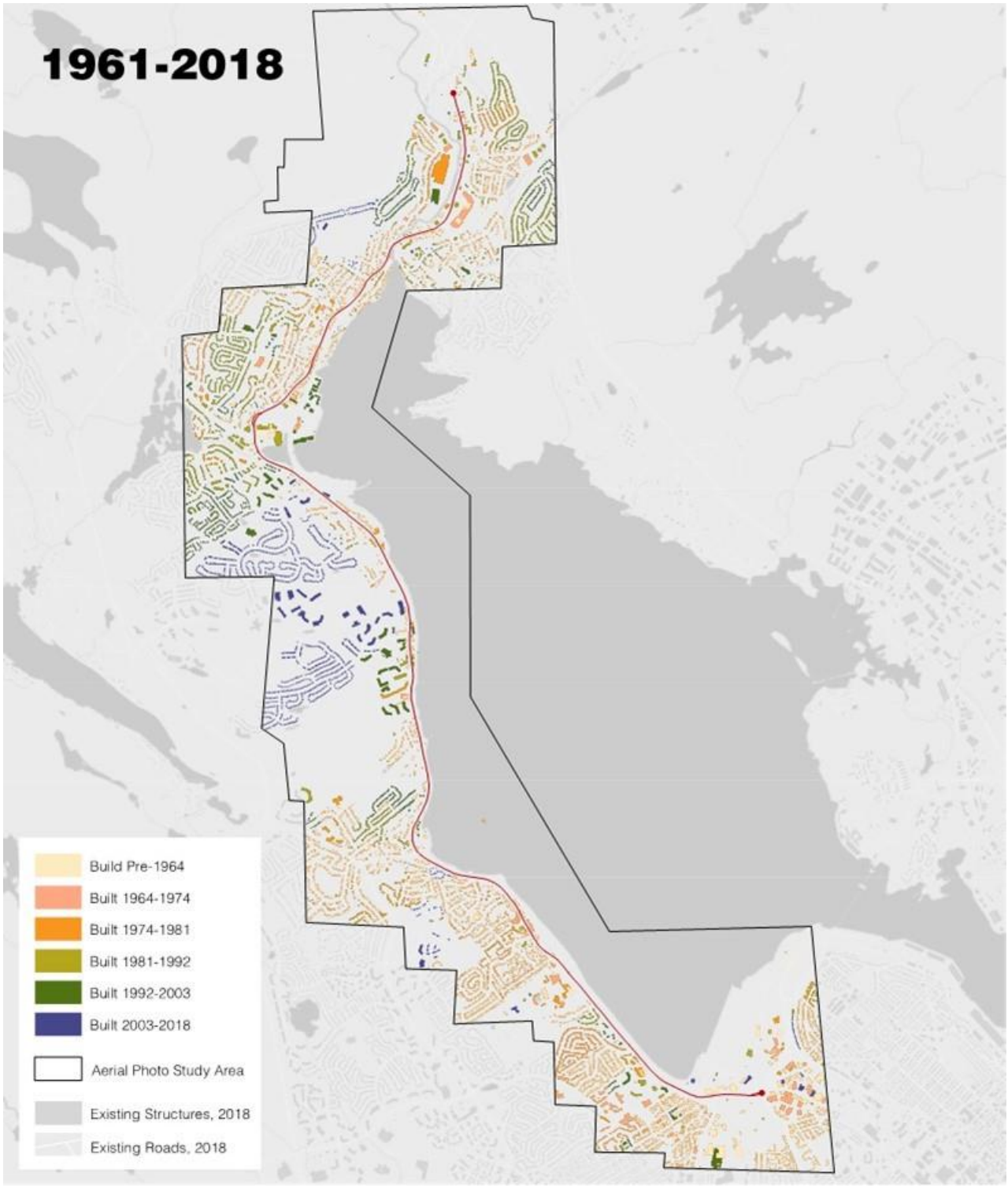


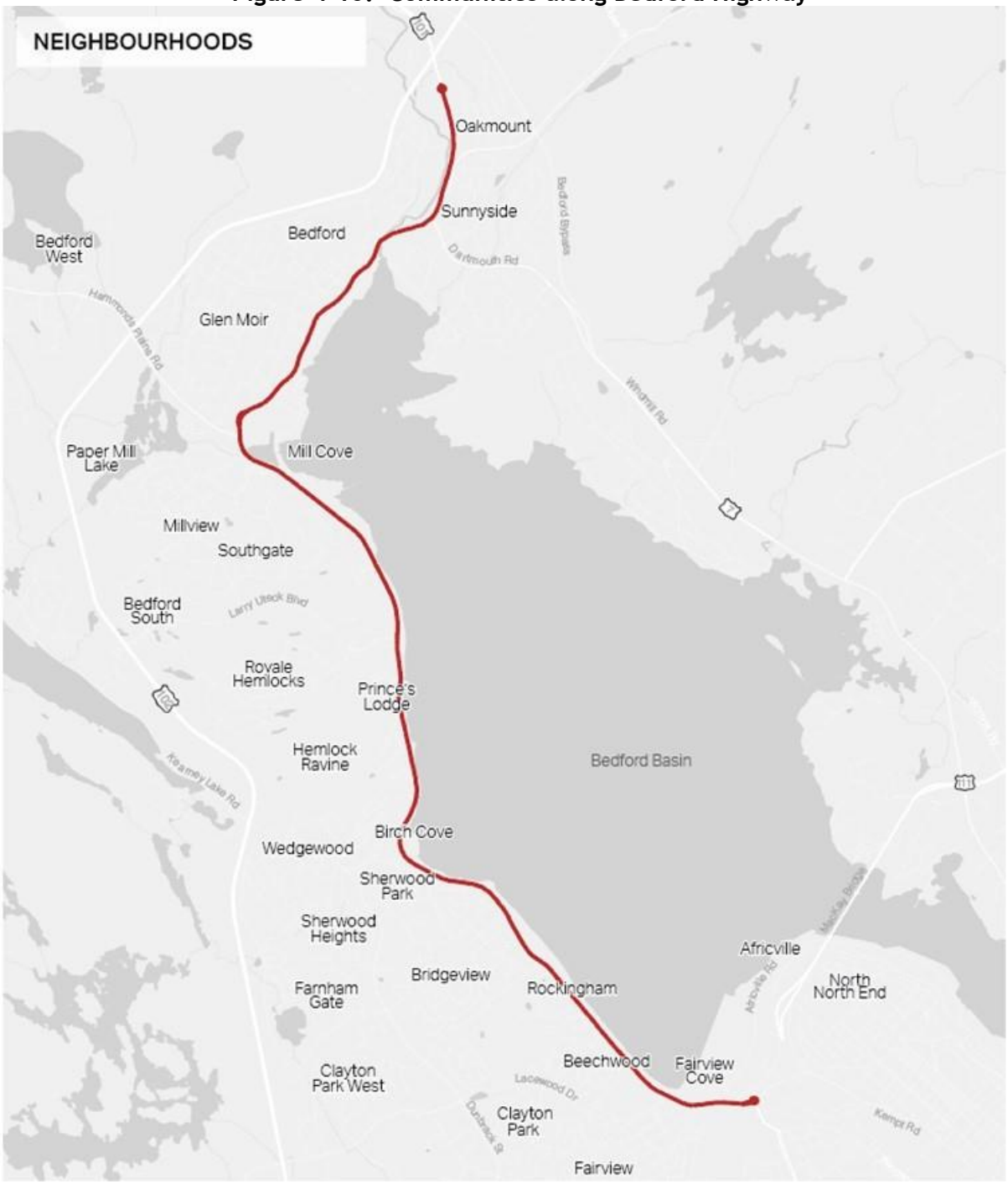
Figure 4-9: Development Activity Summary 1961-Present



4.4 Corridor Communities

Local place names have always held importance for Bedford Highway suburban communities and neighbourhoods. Some of these names are historic, while others are freshly adopted identifiers that give a sense of identity to new developments. **Figure 4-10** depicts communities on along Bedford Highway.

Figure 4-10: Communities along Bedford Highway



4.5 Municipal Planning

Regional Plan

The Regional Plan includes several aims which are relevant to land use and transportation in the Bedford Highway corridor and supports an integrated approach between these two aspects which shape the future of the region. The Plan sets 2031 targets for at least 30% of trips to be made by walking, bicycling or transit, and no more than 70% to be made by private vehicle. Among other aims, the plan seeks to:

- Implement a sustainable transportation strategy by providing a choice of integrated and connected travel options emphasizing public and community-based transit, active transportation, carpooling and other viable alternatives to the single occupant vehicle;
- Promote land settlement patterns and urban design approaches that support fiscally and environmentally sustainable transportation modes;
- Forecast the municipality's need for mobility and provide service and infrastructure to meet this demand while influencing choice towards transportation sustainability; and
- Design complete streets for all ages, abilities and travel options.

The inland side of the Bedford Highway corridor is within the Urban Settlement Designation, which supports a wide range of development on piped services. The portion of the Bedford Highway corridor between the roadway and the shoreline is in the Regional Plan's Halifax Harbour designation, the intent of which is to protect port related industries as well as mitigate possible land use conflicts that can arise with increased residential development.

The Bedford Highway corridor also includes four Regional Plan Urban Growth Centres: Birch Cove (Local); Bedford South (District); Bedford Mill Cove (Local); and Sunnyside Mall (District). The Growth Centres are intended to guide future secondary planning policy. Urban Local Growth Centres envisage a mix of low, medium and high density residential, small office, small institutional and convenience commercial uses. Such Centres should encourage infill or redevelopment of large parking lots into traditional blocks with streetwalls, step-backs and pedestrian oriented facades. Urban District Growth Centres have similar criteria to those of Local Centres, but allow for large offices and institutions as well as a wide range of commercial uses. The Integrated Mobility Plan calls for the next Regional Plan review to rationalize the location and size of the Growth Centres and align them with existing and proposed transit service.

Regional Plan Policy S-9 calls for HRM to prepare secondary planning strategies for the centres, giving consideration to specific boundaries, population targets and detailed design policies related to the layout of each centre, the range of permitted uses, criteria for conversion of uses, allowable development densities and mechanisms for implementation. However, as updated secondary planning strategies based on this policy have not yet been developed, land use along the corridor continues to be regulated by the Bedford Municipal Planning Strategy and Halifax Municipal Planning Strategy and their associated Land Use By-laws.

Secondary Planning Strategies

Bedford Municipal Planning Strategy

Dating from 1996, the Bedford MPS aims to "encourage the development of a small town identity fostered by the creation of a main street commercial core along Bedford Highway where increased volumes of traffic would be discouraged, and by the creation of geographically dispersed neighbourhood cores which would provide commercial, recreational and educational facilities for the immediately surrounding areas."

The plan aims to strike a balance between efficient movement of traffic and discouraging high volumes of through traffic along arterials. A study in the early 1980's identified a preference to limit the capacity of Bedford Highway by restricting improvements to it to three lanes, one lane in each direction with a central turning lane. Policy T-9 of the Bedford MPS specifically calls for narrowing the section between Dartmouth Road and Highway 102 to three lanes:

> Policy T-9: It shall be the intention of Town Council, in conjunction with the Department of Transportation and Communications, to redesign Bedford Highway between City of Halifax limits and the Dartmouth Road intersection to a three-lane configuration with a maximum of 48 feet of travelled right of way at signalized intersections. Between the Dartmouth Road intersection and Sackville/Highway 102 interchange redesign shall be considered in order to reduce traffic speed and increase safety, thereby improving access to abutting properties.

To reduce traffic congestion on Bedford Highway, Policy T-13 calls for a transportation study to identify and evaluate alternative north-south routes between the Sunnyside and the Mill Cove areas of Town and to identify methods of directing traffic to the Bicentennial Highway.

In terms of land use, the Plan supports a choice of housing types, affordable housing, preservation of the character of existing neighbourhoods, and development designed to suit the natural terrain and minimize negative impacts to the natural environment. The plan envisages a pedestrian oriented commercial core which relates to local heritage and identity, and development of an active year-round mixed-use urban waterfront area containing public spaces and activities with residential, commercial, cultural and institutional uses that emphasize the area's location, heritage and environment.

Within the main street commercial core, the Bedford Land Use By-Law regulates the type and size of commercial uses, signage, landscaping and architectural design to foster a pedestrian oriented streetscape. In the words of Policy T-10:

> It shall be the intention of Town Council to consider Bedford Highway between the Sackville River and the Halifax City boundary as the "main street" of the Town and work towards creating a "main street character" through the development of sidewalks, the encouragement of pedestrian traffic, and the discouragement of large volumes of through traffic consistent with Policies C-19 to C-29B.

The intention is to create a pleasant pedestrian-oriented streetscape which reflects local heritage. Permitted uses are limited to local small commercial uses oriented to pedestrian traffic. Designated

heritage buildings within the area are to be combined with new developments subject to signage, landscaping, parking, setback, and architectural controls. Policy C-19 provides more specific guidance, calling for development of a viable and pleasant pedestrian-oriented small town commercial core along the south side of Bedford Highway between the Sackville River and the Waterfront Development area, and along the north side of Bedford Highway between the Sackville River and the vicinity of Locke Street. A Mainstreet Commercial designation applies to this area, and no rezonings or development agreements for uses other than those in the Mainstreet Commercial Zone may be considered.

To help revitalize the main street commercial core, the Land Use By-Law has included controls to limit residential units to a maximum of 50% of the gross floor area, and require commercial uses at street level within the first floor of buildings within the Mainstreet Commercial zone. These controls are most effective for relatively small lots with a local commercial use on the main floor fronting Bedford Highway and where one or two residential units are provided on the second floor.

The Bedford MPS supports transit-dependent, mixed-use medium density development with minimal impact on existing residential development, for example at the corner of Moirs Mill Road and Bedford Highway. Multiple unit dwellings can also be considered by development agreement in the core of Bedford.

Policy WF-14 aims to protect views of the Bedford Basin from points on Bedford Highway and a residential site behind the portion of the Highway between the Travellers Motel and Moirs Pond, by means of at least three view corridors at least thirty (30) feet wide.

Halifax Municipal Planning Strategy and Bedford Highway Secondary Planning Strategy

To the south of the former Town boundary, the Bedford Highway Secondary Planning Strategy dates from 1985, and forms part of the Halifax Municipal Planning Strategy. This Secondary Plan applies to the lands adjoining the Highway, except a small segment in the Sherbrooke-Kelvin area (designated Residential under the general Halifax MPS) just south of the Mount Saint Vincent University campus.

The Plan encourages retention of structurally viable existing buildings and emphasizes protection of established neighbourhoods. Policies establish minor commercial centres and support highway commercial uses. The Minor Commercial (C-2A) Zone allows commercial uses serving several neighbourhoods along with limited institutional uses and residential uses that range from single unit dwellings to multiple unit residential dwellings. The zone limits height to a maximum of 35 feet.

When the Bedford Highway Secondary Plan was adopted, central sanitary, sewer and water services did not extend fully along Bedford Highway, and it was anticipated that there would be little multiple unit dwelling development. R-3 (General Residential and Low-Rise Apartment) zoning typically limits apartment buildings to 35 feet in height, but allows 50 feet with angle controls where a commercial use occupies the full ground floor.

Following the recommendations of the *Land Use Planning Study of the Western Shore Bedford Basin* (see description below), in 2011 a policy was introduced to support two mixed-use nodes, one at the foot of Larry Uteck Boulevard and the other near the Halifax Plan Area boundary (between Welsh

Lane and Millview Avenue). This policy established "Schedule R" within the Halifax Mainland Land Use By-Law on those properties where multi-unit residential buildings would be appropriate. Such developments may proceed by development agreement, and permit developments to include only local commercial uses on the first or second floors of buildings. Commercial facades must be transparent and interactive, front yard parking should be minimized, and pedestrian access should be facilitated.

Bedford South – Wentworth Secondary Planning Strategy

The Bedford South-Wentworth Secondary Plan Area encompasses approximately 625 acres bounded by Crestview on the Basin Subdivision to the north, Royale Hemlocks Estates Subdivision to the south, the Bicentennial Highway to the west, and Bedford Highway to the east, excluding the Fernleigh and Millview Subdivisions. Development within the southern portion of the Master Plan area is governed by the Halifax Municipal Planning Strategy and the northern portions governed by the Bedford Municipal Planning Strategy. Accordingly, special provisions were incorporated into each of these Municipal Planning Strategies in 2009. When complete, up to 10,000 residents are anticipated in this area.

Recent Planning Studies

Community Visioning (2007)

To guide future secondary planning processes envisaged by the 2006 Regional Plan, Council chose the Bedford Waterfront as one of three areas as a pilot project for a new Community Visioning program. In 2007, Council endorsed the resulting **Bedford Waterfront Vision and Strategic Action Plan,** which was prepared by a citizen-led visioning committee. The vision states ten objectives:

1. Promote and develop the Bedford Waterfront as the focal point for Bedford throughout all seasons of the year.
2. Improve the level of public access to the waterfront both from land and sea.
3. Provide an "iconic" multi-use facility for the arts, recreation and leisure activities.
4. Promote aesthetically pleasing and quality design that respects public view corridors.
5. Provide safe, secure, full-serviced, publicly accessible facilities to pedestrians, boaters and cyclists.
6. Promote and expand recreational, cultural, residential and business activity at the Bedford Waterfront which is accessible to all members of the community
7. Provide a range of housing types to meet the changing needs of residents through all life stages.
8. Promote the Bedford Waterfront as a contributor toward the economic vitality of HRM by enhancing the vibrancy and quality of business activity at the Bedford Waterfront through diversification of businesses and expansion of events and attractions.
9. Provide viable road and water transportation links.
10. Anticipate and provide for future parking needs.

Land Use Planning Study – Western Shore of Bedford Basin (2008)

Also following up from the 2006 Regional Plan, Council commissioned a Land Use Planning Study for the western shore of Bedford Basin, with a study area extending from the Traveller's Motel southward to Hogan's Point. In 2008, the Municipality received a report by consultants O'Halloran Campbell, which recommended high-density development for "bookends" of Bedford Highway

(Bedford Waterfront and the Chinatown area), where higher density development above a height of 35 feet could be considered by development agreement. The study also proposed that two smaller "nodes" could accommodate some mixed-use development but recommended that areas outside of the nodes should remain low density. The study warned against allowing unbroken highway commercial development, and recognized the value of "breaks" characterized by low density development and green space:

> [i]t is important that continuous strip commercial developments not be permitted to take place all through the study area. The existing wooded and residential areas should continue to exist to maintain the special character of this length of Bedford Highway.

On February 19, 2008, Regional Council approved-in-principle the findings and recommendations of this land use study, leading to amendments to the Halifax MPS and Bedford Highway Secondary Plan in early 2011. The "node" concept envisioned in the study was implemented by adding the Schedule "R" provisions to the Bedford Highway Secondary Planning Strategy, as already described above.

Bedford Waterfront Design Study (2010)

The Bedford Waterfront Design Study (Ekistics and Associates, June 2010) was prepared for the Municipality and Halifax Waterfront Development Corporation Ltd. (HWDCL – now known as Develop Nova Scotia) in response to a recommendation of the Bedford Waterfront Vision and Strategic Action Plan.

The study provided design guidance for the future development of lands around Mill Cove, including water lots infilled by HWDCL, the Esquire and Travellers Hotel properties on Bedford Highway, the Sobeys Mall and a former boat yard at the south end of Shore Drive. Approximately 3,600 housing units and 634,500 square feet of commercial and institutional space were proposed.

A study steering committee, comprising property owners and community representatives, and the North West Community Planning Advisory Committee, recommended that Council initiate amendments to the Bedford MPS to implement the study recommendations with minor amendments. Both committees also recommended that studies be done to ensure that transportation infrastructure and services could accommodate further development.

Birch Cove Waterfront Plan (2010)

Concurrent with the initiation of the Bedford Waterfront Study, the Municipality and HWDCL retained Ekistics and Associates to prepare a Birch Cove Waterfront Plan (March 2010) to provide design guidelines for the future redevelopment of lands adjacent to Birch Cove, in the vicinity of Kearney Lake Road and Bedford Highway.

The consultants proposed 440 new dwelling units and 106,000 square feet of commercial space. A steering committee recommended that the consultant's recommendations be approved with certain design amendments and that a community plan amendment process to be initiated, but the project has been put on hold and has drawn local opposition.

Mainland Halifax North – Bedford Corridor Transportation and Wastewater Servicing Strategy
On February 28, 2012 Regional Council directed that a servicing strategy be initiated for the Bedford - Mainland Halifax North Corridor to estimate transportation and wastewater services upgrades needed to service future growth with associated costs and suggested means of finance. Council also moved to defer public consultation on development proposals for Mill Cove, Bedford Waterfront, Birch Cove Waterfront, Kearney Lake Road/Bedford Highway Area; Paper Mill Lake, the Sister of Charity "Motherhouse Property, and the former radio Transmitter Lands on Dunbrack Street.

The servicing strategy was undertaken through a wastewater study by Halifax Water, and a transportation study by consultants MRC. Each is discussed in turn below.

Halifax Water Integrated Resource Plan (2012)
As directed by the N.S. Utility & Review Board, the Integrated Resource Plan (October 2012, Genivar, Halcrow & XCG Consultants Ltd.) was completed by Halifax Water to define its overall program and resource needs for the next thirty years (2013 - 2043). The IRP, utilizing the output of Halifax Water's recently completed Regional Wastewater Functional Plan, responded to the combined requirements of regional growth, present and expected regulatory compliance and asset renewal. HRM's planning department provided a range of growth projections for use by the IRP project team.

The IRP outlined required upgrades to regional infrastructure to facilitate the HRM growth projections. In conjunction with the infrastructure plan, Halifax Water is developing an implementation plan that includes an appropriate funding mechanism and reasonable timeline to provide the infrastructure.

Under an ideal timeline, Halifax Water would complete the regional infrastructure upgrade implementation plan prior to any major development. However, modeling of the existing system determined that the wastewater system has dry weather capacity for proposed developments at the time, though wet weather flows would be exacerbated. The long-term vision of the IRP assumes that federal regulation of wet weather flows will become more stringent.

Bedford-Halifax Mainland North Corridor Traffic Study (2013)
On November 14, 2013, the Community Planning & Economic Development Standing Committee received the Bedford-Halifax Mainland North Corridor Traffic Study (MRC, October 2013) and a staff report. The study was undertaken in response to the major development proposals noted above. The Committee recommended to Regional Council that they accept the study for consideration in planning future transportation improvements, initiate a plan amendment process for the Motherhouse lands, and defer consultation processes and deliberations for the other development proposals until completion of the Regional Plan 5-year review (RP+5), the 5 year Transit Review (Moving Forward Together Plan, or MFTP), the Commuter Rail Study and a decision on development charges for transit and transportation. Regional Council accepted these recommendations, except that it allowed for approvals to be sought without deferral on the transmitter lands (Rockingham South).

Commuter Rail Feasibility Study (2015)

On October 20, 2015, Regional Council received the report of the Commuter Rail Feasibility Study (CPCS), which confirmed the technical feasibility of a service in the Halifax-Bedford corridor. Within the Bedford Highway corridor, the study envisaged stations at Sunnyside Mall, Mill Cove and Rockingham. The study concluded that the cost would not be justified, but did not factor in potential synergies between commuter rail, transit oriented development and downtown employment.

Accordingly, Council directed staff to develop a strategic plan (later named the Integrated Mobility Plan, or IMP) specifically aimed at increasing the modal split of sustainable forms of transportation as per the Regional Plan, integrating land use and transportation planning, and with comparative costing analysis of road and right of way infrastructure upgrades and widening as compared to other forms of transportation. Council also directed staff to continue consultation with CN in terms of receiving information on cost implications of commuter rail.

Integrated Mobility Plan

The *Integrated Mobility Plan* (IMP), endorsed by Halifax Regional Council in December 2017, is a transportation priorities plan that outlines the Municipality's approach to improving transportation sustainability, primarily through promoting a shift to non-auto travel modes. A key recommendation of the IMP is to develop 'Strategic Corridor' plans for regionally significant corridors such as the Bedford Highway. Strategic corridor planning undertaken as recommended by the IMP should explicitly consider the Plan's overarching objectives, which support investment in infrastructure and programs aimed at improving transportation sustainability and creating complete communities. The functional plan for the Bedford Highway represents the first strategic corridor plan directed by the IMP. As such, the plan should include a focus on assessing the feasibility of reconfiguring the corridor to include improved transit and active transportation facilities, as well as considering the potential for enhancement from a 'Complete Streets' perspective.

4.6 Existing Land Use Pattern

Traveling north from the Halifax Peninsula from **Fairview Cove**, Bedford Highway abuts the CN Rockingham Yard which fronts on the Bedford Basin. On the inland side, a steep uphill slope features multi-unit residential towers and some walk-up apartment buildings, while a car dealership is located between the highway itself and the residential buildings. Development permits for over 300 new residential units have been issued in this area since 2005 (**Figure 4-11**), and construction permits have been issued for 155 units since that year. A recently built residential tower has necessitated the provision of traffic signals on Bedford Highway. **Bayview Drive** winds uphill through low-density residential neighbourhoods in **Clayton Park.** Between Bayview Drive and Seton Road, large houses overlook the highway and Basin above a high concrete retaining wall.

Just before the **Mount Saint Vincent University** campus, **Seton Road** is planned for upgrading to accommodate car and bus traffic anticipated from the recently approved **Seton Ridge** development on the former Motherhouse lands. Seton Ridge is expected to accommodate approximately 2,400 new housing units, of which about 175 will comprise single-family houses or townhouses. The remaining 2,225 units will be in multi-unit buildings, some of which will also include lower-level commercial space. The development will generate traffic on both Bedford Highway and Lacewood

Drive and will be served by a bus route passing through a pedestrian-oriented town centre, following Bedford Highway onto the Halifax Peninsula.

North of the campus, Bedford Highway passes through the low-rise **Rockingham** neighbourhood commercial area which also includes some older walk-up apartment buildings. There is some concern that development pressure could eradicate these relatively affordable apartments, and any large residential redevelopment would also raise safety and nuisance issues associated with the railway yard, especially on the east side of the highway.

North of the commercial area near the intersection with Tremont Drive, the Rockingham rail yard becomes a double-track railway and abuts Bedford Highway on the east side. The west side of the road is characterized by wooded, low-density residential neighbourhoods. Birch Cove Marine Park is located at Hogans Point but is isolated from Bedford Highway by the railway line.

Although it is designated as in the Regional Plan as an Urban Local Growth Centre, the area around **Birch Cove** is primarily low-density, though there has been some duplex development. The highway itself is bordered by a motel, highway commercial uses and a church, and there may be some potential for redevelopment. A low, narrow underpass leads to the former site of the Chinatown Restaurant on the shore side of the railway line.

At Birch Cove, **Kearney Lake Road** links Bedford Highway with Dunbrack Street and Highway 102. Between Kearney Lake Road and Dunbrack Street, former radio transmitter lands are being redeveloped into a mixed-use, high-density community known as **Rockingham South**. A development agreement has been approved to develop 55 acres on the east side of Dunbrack Street, across from the Farnham Gate Rd. intersection. The proposal includes nearly 1000 dwelling units, including multi-unit buildings and commercial uses with frontage on Dunbrack Street. Almost 700 of the residential units have been permitted to date, and construction is well underway. Although most of the site lies within an 800 metre radius of Bedford Highway, pedestrian access routes are circuitous due to the existing local street pattern.

North of the Kearney Lake Road intersection, a low-rise commercial building has recently been developed between the east side of Bedford Highway and the railway, offering a produce market, office space and various services.

The highway then reverts to a wooded, low-density setting uphill on the west side, while continuing alongside the railway to the east. **Princes Lodge**, a domed rotunda and heritage landmark built for the Duke of Kent, can be reached across the railway via a narrow driveway and unprotected rail crossing. On the inland side and uphill from the residential neighbourhoods, **Hemlock Ravine Park** offers natural trails and preserves a stand of old-growth forest. A famous heart-shaped pond commemorates Prince Edward, Duke of Kent and Julie St-Laurent. The only frontage for this major natural park on Bedford Highway itself is a narrow strip just south of Shaunslieve.

Residential density alongside the highway begins to intensify as one continues northward to enter the **Bedford South Regional Plan Urban District Growth Centre**, beginning with low-rise multi-unit dwellings at **Princes Lodge Estates** and comparable but older development at **Shaunslieve Drive**. The highway then passes through a short highway commercial area, including the Fishermen's

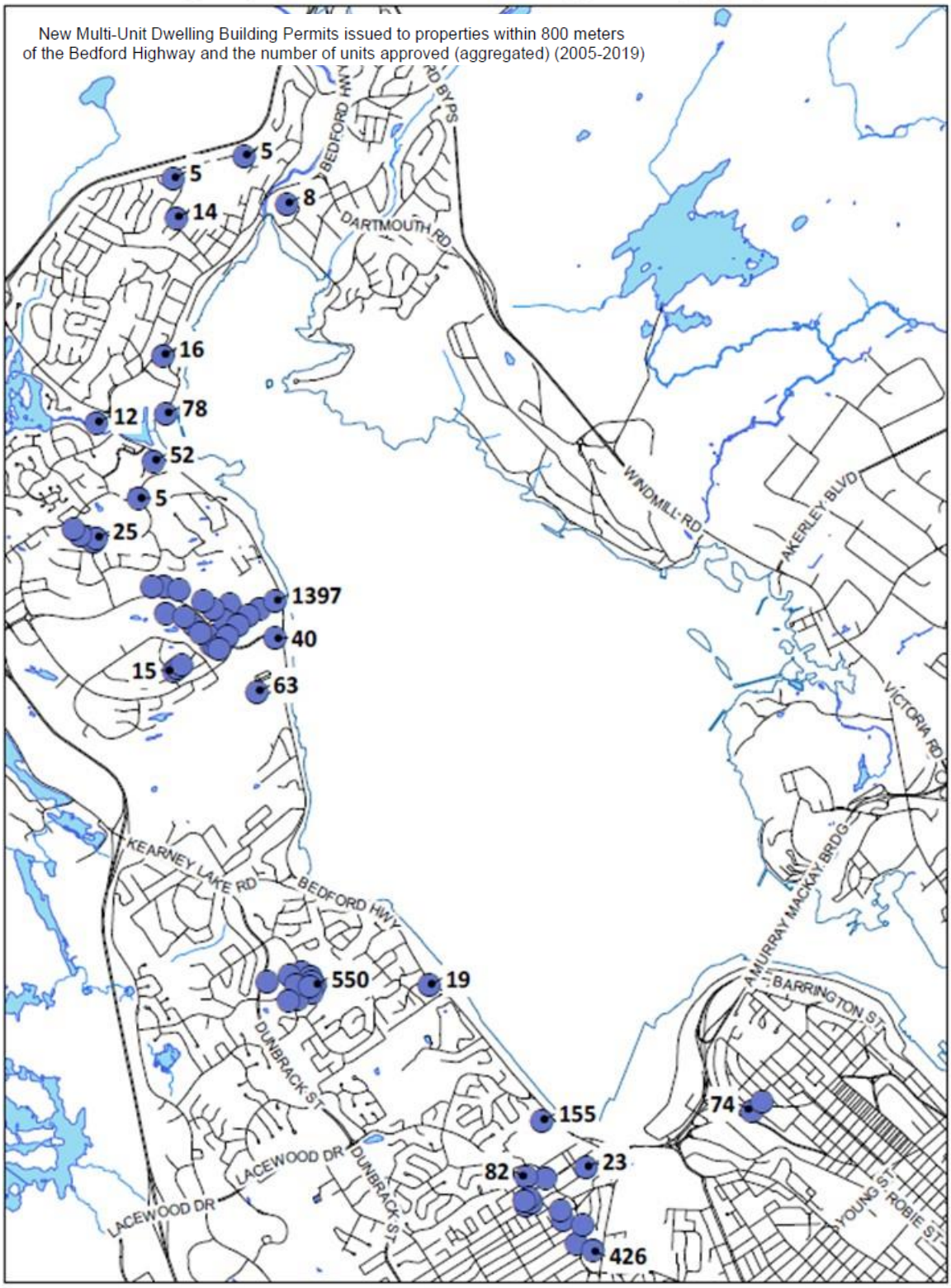
Market between the highway and the railway, before reaching the intersection of **Larry Uteck Drive**. Several multi-unit buildings have been approved on Bedford Highway in this area under the Schedule "R" policies of the Halifax MPS. District-level retail for this Growth Centre are not located on Bedford Highway; rather, they are found at the interchange with Highway 102 at the top of the hill.

The **Bedford South-Wentworth Secondary Plan Area** encompasses approximately 625 acres bounded by Crestview on the Basin Subdivision to the north, Royale Hemlocks Estates Subdivision to the south, the Bicentennial Highway to the west, and Bedford Highway to the east, excluding the Fernleigh and Millview Subdivisions. When complete, up to 10,000 residents are anticipated in this area. Significant multi-unit residential development has occurred: Together with Shaunslieve, in this general area construction permits have been issued for 1500 units within 800 metres of Bedford Highway since 2005 (**Figure 4-11)**.

North of the Larry Uteck Drive area, the long-established, low-density **Fernleigh** and **Millview** residential neighbourhoods are located uphill from Bedford HighwayAt the southern end of the Millview neighbourhood near the **former Halifax-Bedford boundary**, a commercial area has developed on both sides of the highway, extending further along the east (Basin) side and featuring low-rise offices, the Clearwater Seafood distribution and office complex, retail, services and motels. There is potential for redevelopment on the many surface parking lots, and there is interest in redeveloping the motels. Behind these a concept plan has been proposed by Develop Nova Scotia (formerly the Waterfront Development Corporation) for the Mill Cove lands, but further planning and development must await transportation improvements.

A short distance to the north, **Southgate Drive** joins Bedford Highway as part of the Wentworth - Bedford South Secondary Planning Areas and is characterized by townhouses and low-rise apartment buildings. The Secondary Plan policy recognizes the potential for mixed-use development fronting on the highway itself.

Figure 4-11: New Units from Multi-Unit Building Permits (2005-2019)



At the **Bedford Mill Cove Regional Plan Urban Local Growth Centre**, the rail line follows a causeway and defines the western edge of the Basin infill lands, which form two lobes joined by a road that shares the same causeway. The northern lobe is largely developed with low-to-midrise apartments, offices and townhouses. Convoy Run provides the only road access, which crosses the railway on an overpass. Near the intersection with Hammonds Plains Road, the Mill Cove Plaza shopping centre has large surface parking lots fronting on Bedford Highway.

In 2013, Regional Council accepted the *Bedford-Halifax Mainland North Corridor Transportation Study Report* (MMM, October 2013) for consideration in planning future transportation improvements, and deferred consultation processes and deliberations for several development proposals including the **Bedford Waterfront**, as well as Birch Cove and Paper Mill Lake, until the completion of the 2014 Regional Plan, a 5-Year Transit Review, and a commuter rail study, and until a decision is made on development charges for charges for transit and transportation. Following an update in 2015, Council accepted a recommendation to continue to defer public consultations pending a review of various transportation studies.

On the inland side of the highway between **Southgate Drive** and **Hammonds Plains Road**, low-to-midrise apartment buildings and townhouses step uphill. Commercial uses with surface parking flank the intersection of this road and the west side of Bedford Highway. Tucked almost out of sight between **Moirs Mill Road** and this commercial area is the Moirs Ltd. Power House, an old industrial building which is a Registered Heritage Property. The property includes the long, narrow **Moirs Mill Park** which follows a former mill run up to a dam on **Paper Mill Lake**.

Continuing north past Hammonds Plains Road, the highway curves past older, low-density residential neighbourhoods on the west side and wooded vacant land on the east side. The intersection with **Convoy Run** is defined by a fire station which will potentially become available for adaptive re-use or redevelopment. North of Convoy Run, the area is characterized by low-density residential neighbourhoods on the west side of the highway, and low-rise apartments, seniors' accommodation and local retail and services on the east side backing onto the railway.

North of **Lindsay Hill**, the highway takes on a small-town "main street" character, with small businesses on either side as well as churches and other community uses. On the east side, opposite **Rutledge Street**, a narrow roadway leads to **Shore Drive** across the only public grade crossing on the railway south of Cobequid Road. This route, which connects to the boardwalk and shoreline trail around the infilled lands at Mill Cove, offers an attractive alternative bicycle route between the cove and **Sackville River**.

Where the highway crosses the Sackville River, **Union Street** diverges inland to provide access to residential neighbourhoods on the west side of the river. A multi-use trail begins about 350 metres along this street, following the riverbanks and providing the only legal cycling and pedestrian connection to Lower Sackville. On the east side of Bedford Highway, **Fish Hatchery Park** includes a trail and greenspace, providing a foreground for the nearby railway trestle. The trail passes underneath, enabling cyclists and pedestrians to follow local residential streets on the far side of the railway as far as **Dartmouth Road**.

After crossing the Sackville River, the character of the route changes again, resembling a well landscaped suburban highway commercial strip as one enters the **Sunnyside Mall Regional Plan Urban District Growth Centre**. The area also has a few low-to-midrise office buildings. There has been some recent interest in redeveloping office building properties for high-density residential or mixed-use purposes. In 2018, Regional Council initiated a process to consider updated floodplain protection policies based on **the Sackville River Floodplain** Study, various redevelopment scenarios, additional flood modeling, and flood mitigation measures for the **Sunnyside Urban District Growth Centre** as a whole. Council also directed staff to refuse to accept any new site-specific municipal planning strategy amendment applications for proposals received after June 18, 2018 for lands located within the 1 in 20 year and 1 in 100 year floodlines identified in the Sackville River study, while this MPS and LUB amendment exercise to update floodplain protection policies, regulations and mapping is in process.

Immediately south of **Sunnyside Mall**, Dartmouth Road diverges to provide access to Burnside Business Park and central Dartmouth via Trunk 7 (Magazine Hill). **Bedford Place Mall** is located on the western side of Bedford Highway and Sackville River. With its large surface parking areas, the mall been suggested as a high-density, mixed-use redevelopment opportunity, but this potential is now in being reviewed after the Sackville River Study recently identified a much larger floodplain than had previously been recognized.

On the east side of the highway, Sunnyside Mall features a combination of underground, surface and rooftop parking. Together with Bedford Place Mall, this shopping venue has felt retail competition from the recently developed large-format retail tract known as **Bedford Common** at Rocky Lake. Sunnyside Mall itself is located outside the floodplain, so may have potential for redevelopment, though its surface and underground parking are vulnerable to floods.

North of Sunnyside Mall, the highway diverges from the railway, and **Rocky Lake Road** follows the railway to Duke Street and the large-format stores and offices at Bedford Common. This is near the proposed endpoint of the **Burnside Expressway** which when completed may divert some traffic from the Bedford Bypass and even Bedford Highway itself.

North of Rocky Lake Road, Bedford Highway becomes a wide thoroughfare flanked by low-density development, characterized by large parking lots, highway commercial uses, vacant lands, playing fields and a large church. **River Lane** branches off the highway on the west side, crossing the Sackville River to reach Bedford Place Mall and several low-rise apartment buildings alongside the river. Bedford Highway ends at the interchange with Highway 102 to the airport and Highway 101 to the Annapolis Valley. Local ramps provide motor vehicle access to Lower Sackville.

4.7 Population Density and Concentration

Figure 4-12 and **Figure 4-13** demonstrate the density and concentration of population along Bedford Highway. Census Blocks are used in this analysis, as this is the most detailed data available. For confidentiality reasons, other census information is available only at a dissemination area scale.

The population density in Bedford is widely dispersed between Highway 102 and Bedford Highway. Most of the high-density development along Bedford Highway is located closer to the peninsula, as

well as in some pockets along Larry Uteck Boulevard where there are between 20 and 50 dwellings per acre. The largest dissemination block of high density over 50 units per acre is to the west of Belcher's Park, where a few apartments house residents off the Centennial Highway.

Moving further north, the Wedgewood community has quite low densities under 10 units per acre. Paper Mill Lake and the area north of Hemlock Ravine have a wide range of densities, with most in the mid-range of 10 to 20 units per acre.

Glen Moir subdivisions have low to medium densities, typically between 5 and 20 units per acre. At the tip of the Basin, density is low under 10 units per acre, with a few small blocks of medium density.

Along the Basin side of Bedford Highway there is some mixed-use development, but the density remains low along this full stretch, with 0 to 5 units per acre.

4.8 Population Change

Figure 4-14 shows the population change between 2006 and 2016, using dissemination areas. Most neighbourhoods in the study area are relatively stable in population, with only a small decrease or increase over the last census period. However, the area to the north of Larry Uteck Boulevard has seen a substantial population increase with the construction of numerous multi-unit buildings since the 2006 census. The areas with the greatest percentage decline in population are typically older, more established neighbourhoods where average household size, rather than development, plays a large role in the neighbourhood population.

Figure 4-12: 2016 Population Density by Census Dissemination Block

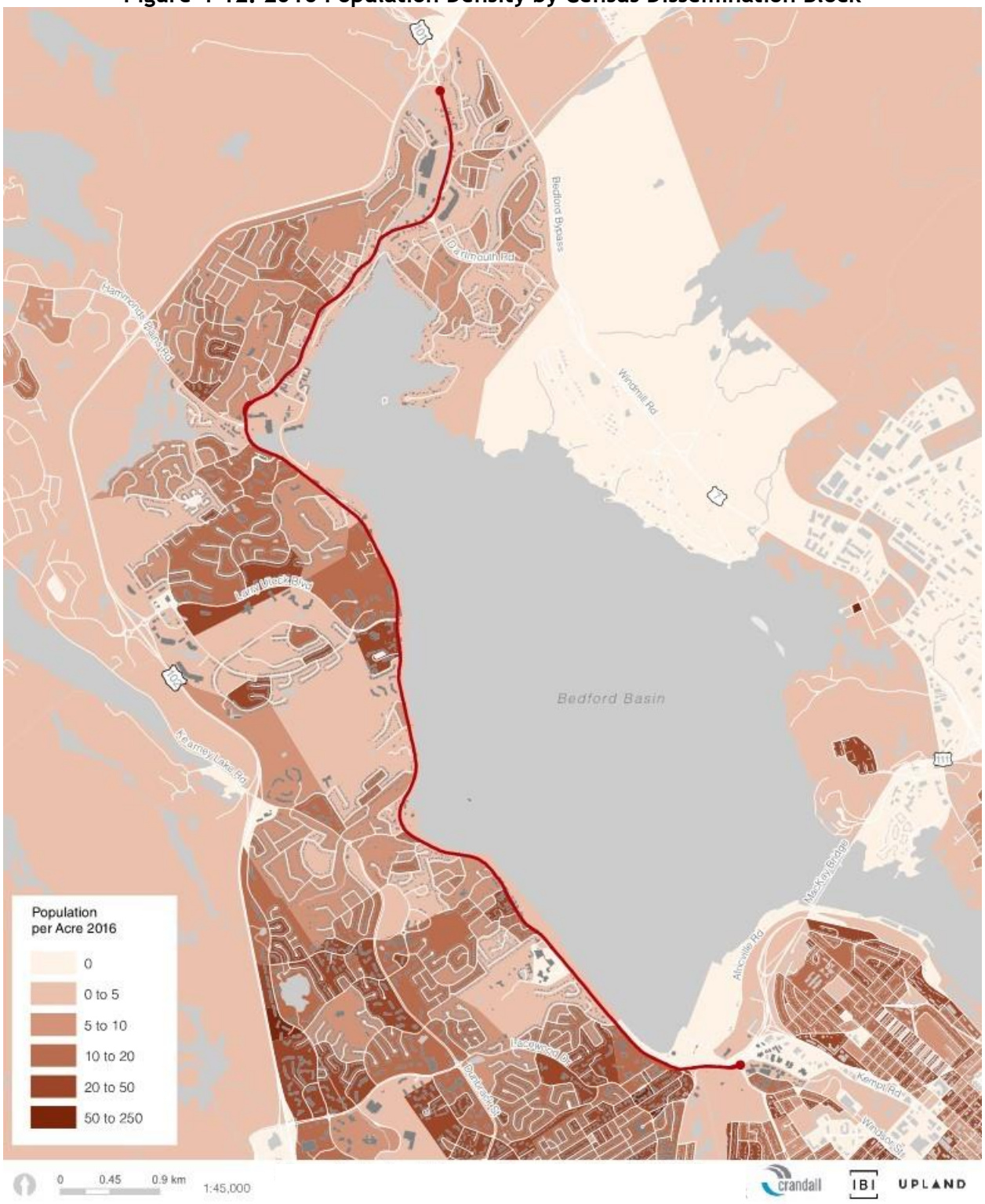


Figure 4-13: Population Civic Concentration by Address and Number of Units

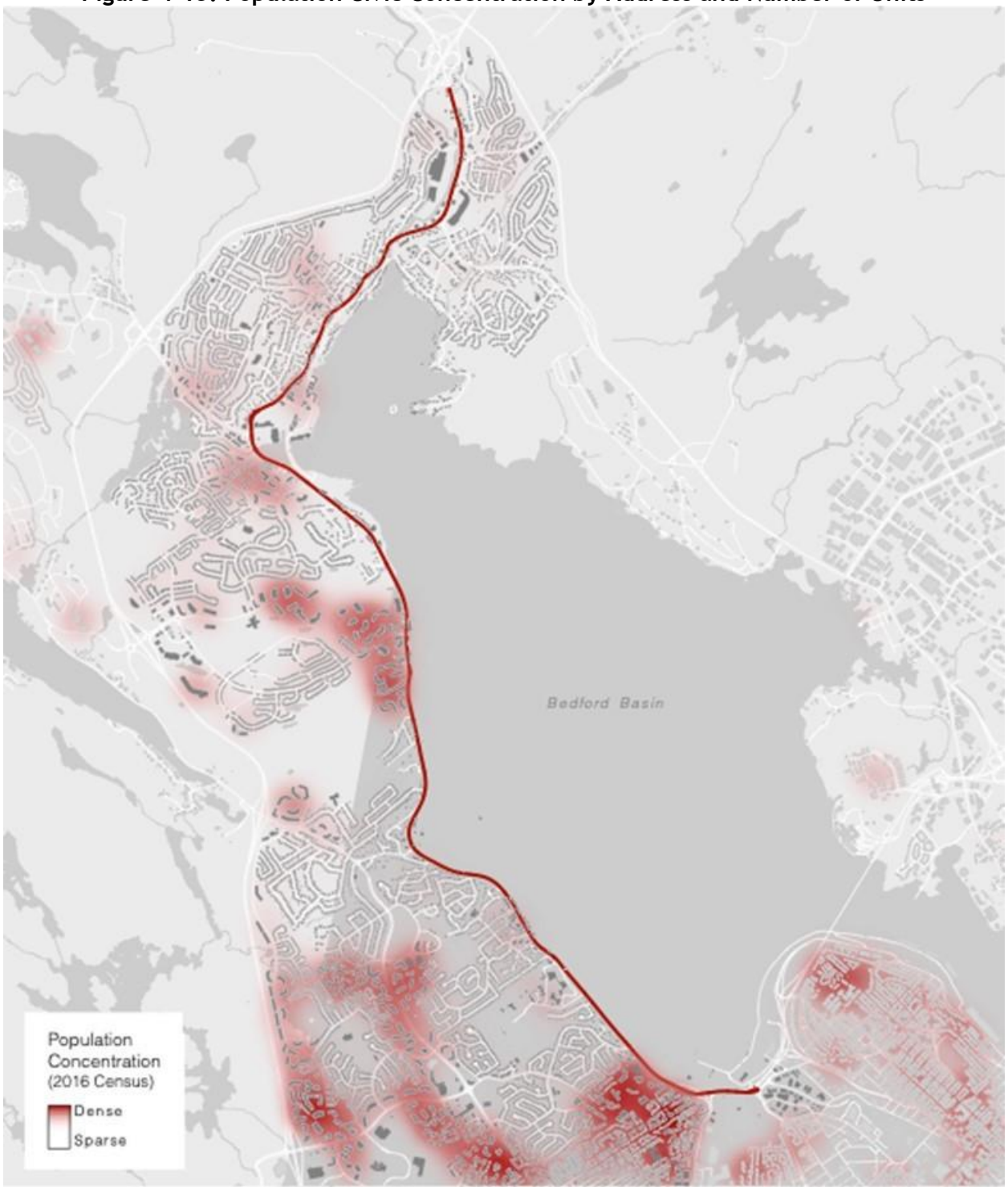
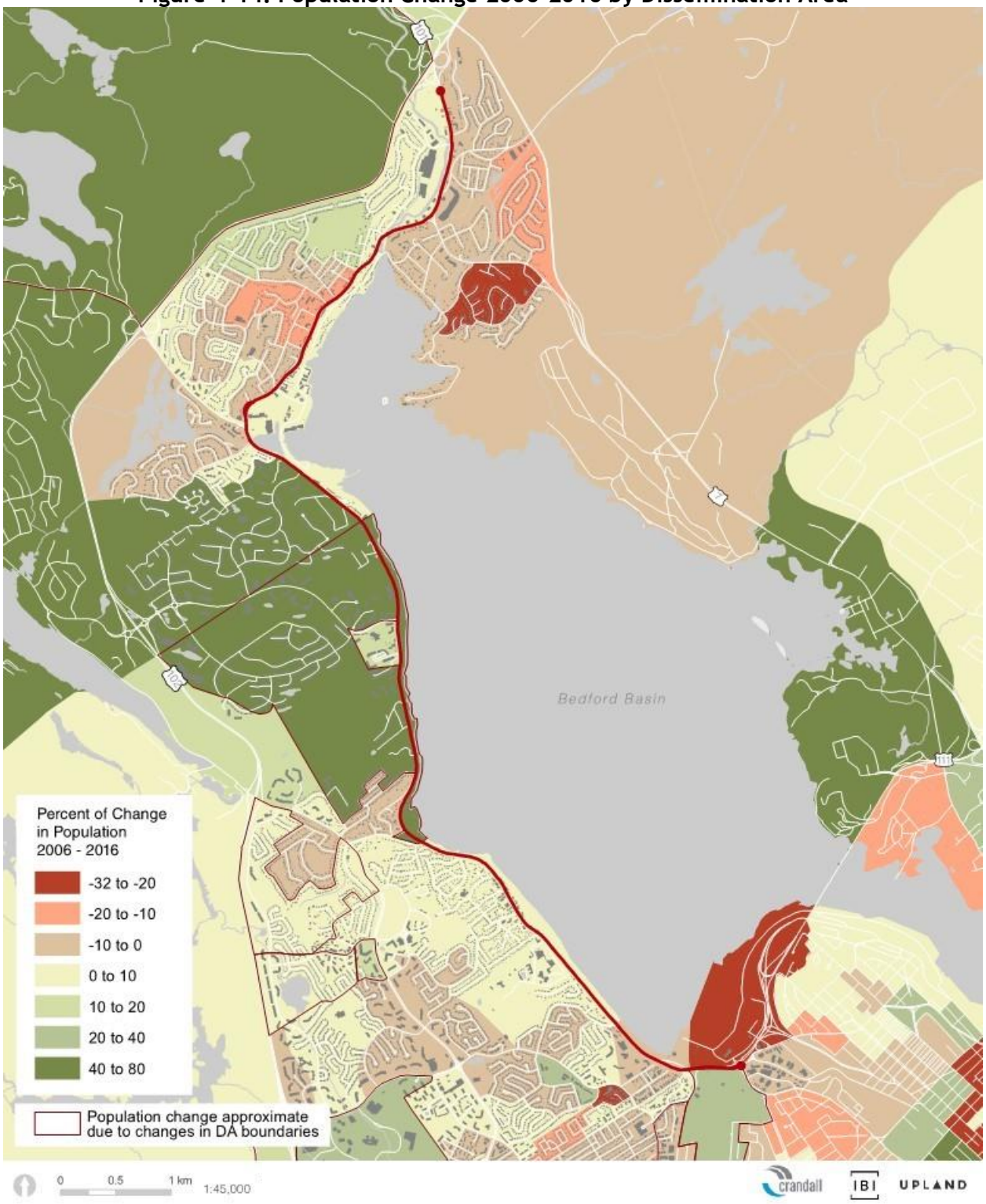


Figure 4-14: Population Change 2006-2016 by Dissemination Area



4.9 Future Development

The Bedford Highway communities are growing quickly. The Future Developments map includes development concepts that have been proposed. The development concepts for Mill Cove and Birch Cove including retail, public parks and trails access, and housing, will be informed by the Integrated Mobility Plan, CN commuter rail feasibility analysis and this Bedford Highway Functional Plan. Based on current interest in development for these and other nearby areas as summarized below, there is potential to build up to 2,500 new residential units over the next 10-20 years.

Examples of future developments are shown in **Figure 4-15**:

Mill Cove
In 2010, HRM and the Waterfront Development Corporation Ltd. (HWDCL, now "Develop Nova Scotia") commissioned the Bedford Waterfront Design Study. The study provided design guidance for the future development of lands around Mill Cove including water lots that were in the process of being infilled by HWDCL. Approximately 3,600 housing units and 600,000 square feet of commercial and institutional space were proposed. After pushback from the community, HWDCL embarked on a second round of public engagement in 2014, proposing to not further infill the Bedford Basin and instead creating a mixed-use community for about 1,200 residential units on the already infilled 20 acres.

Papermill Lake
Going back to an application letter requesting MPS/LUB amendments for the Paper Mill Lake CCDD lands in 2009, United Gulf Developments Limited has been in negotiations with HRM to request site specific policies for the CCDD lands encompassing 23 acres of land at the corner of Hammonds Plains Road and Highway 102. United Gulf plans to develop the area as a mixed-use community of multi-unit residential buildings stacked above ground floor retail. In 2010, United Gulf requested a density of 87 people per acre resulting in 1,952 people. While staff did not support this density, it recommended that Council approve amendments to the Bedford MPS/LUB to enable a commercial/residential mixed-use development not exceeding 70 people per acre. At Council's approved density, Papermill Lake would be comprised of about 700 residential units.

Bedford Highway and Glenmont Avenue
WSP has requested amendments to an existing Development Agreement which would allow a five storey, 73-unit apartment building, as well as 30 three storey townhouses and one single unit dwelling (a total of 104 units).

Traveller's and Esquire Motels
United Gulf has proposed Development Agreement amendments for these motel lands to expand their commercial space. The existing agreement allows commercial use as well as the retainment of motel uses, but the applicant indicates commercial interest in this site has heightened. No residential units will be generated by this proposal.

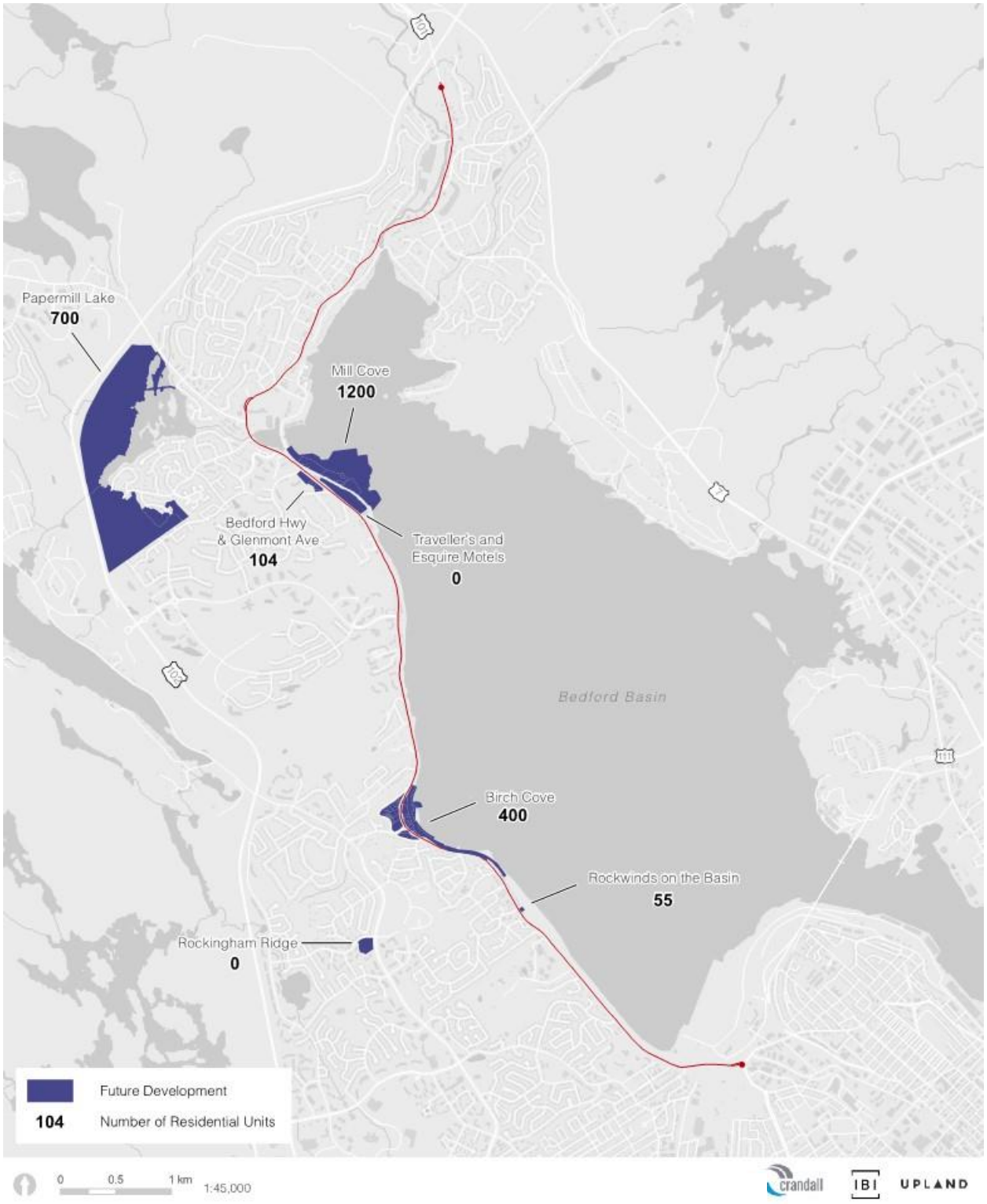
Birch Cove
Identified as an Urban Local Centre by the Regional Plan, Birch Cove was the location for another concept plan which has been put on hold pending further studies. It has been proposed that this

project could contain 400 residential units mixed in with parkland and commercial spaces. Public access to the waterfront is emphasized throughout this concept.

Rockingham Ridge
FS Industries has requested amendments to a development agreement in order to expand commercial space within an existing commercial site on Farnham Gate Road. This project includes the construction of a new two-storey building where parking currently exists, increasing retail and office space on the site from approximately 4,500 to 6,000 square metres.

Rockwinds on the Basin (205 Bedford Highway)
KWR Approvals has requested an amendment to the Halifax MPS to enable a proposed 8-storey mixed-use building would be constructed where a 13-unit apartment building currently sits. The proposed building would house 55 new units, 40 of which would be affordable by CMHC standards and five of which would be barrier-free design.

Figure 4-15: Future Developments



5.0 Existing Operational Conditions

5.1 Automobile Level of Service

Traffic Modelling

Traffic conditions were modelled using Synchro 10, which is a traffic analysis software that uses the Highway Capacity Manual and Intersection Capacity Utilization procedures.

The intersection performance was evaluated mainly in terms of the motor vehicle level of service (LOS), which is a common performance measurement of an intersection. The LOS is determined based on vehicle delay and is expressed on a scale of A through F, where LOS A represents very short delay (<10 seconds per vehicle) and LOS F represents very long delay (>50 seconds per vehicle at a stop controlled intersection and >80 seconds per vehicle at a signalized intersection). A LOS D is often considered acceptable in urban locations; however, some communities will accept a LOS E. The LOS criteria for both signalized and stop control intersections are shown in **Table 5-1**.

Table 5-1: Intersection Level of Service Criteria

LOS	LOS Description	Control Delay (seconds per vehicle)	
		Signalized Intersections	Stop Controlled Intersections
A	Very low delay; most vehicles do not stop (**Excellent**)	less than 10.0	less than 10.0
B	Higher delay; more vehicles stop (**Very Good**)	between 10.0 and 20.0	between 10.0 and 15.0
C	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping **(Good**)	between 20.0 and 35.0	between 15.0 and 25.0
D	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop (**Satisfactory**)	between 35.0 and 55.0	between 25.0 and 35.0
E	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of **acceptable** delay	between 55.0 and 80.0	between 35.0 and 50.0
F	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection (**Unacceptable**)	greater than 80.0	greater than 50.0

In addition to the LOS criteria described above, the motor vehicle volume to capacity (V/C) ratio was reported for each turning movement. The model reflects traffic signal timings and coordination parameters provided by HRM.

The resulting intersection LOS for the 2018 existing conditions are shown in **Table 5-2. Figure 5-1** and **Figure 5-2** identify the intersection LOS for the AM and PM peak hour, respectively. The results indicate that all intersections operate at an overall satisfactory LOS D or better with the exception of two intersections – Bedford Highway/Windsor Street and Bedford Highway/Bayview Road. **Table 5-2** shows the turning movements for the failing intersections that are the cause of the delay. The LOS results are discussed below and Synchro reports can be found in **Appendix C**.

Bedford Highway/Windsor Street

- AM Peak Hour
    - This intersection operates at an overall LOS F in the AM peak hour with 142.5 seconds of delay per vehicle.
    - The southbound left and through movements from Bedford Highway are the heaviest movements and operate at LOS F with delays of 204 and 172 seconds per vehicle, respectively. V/C ratios exceed 1.30 and modelled 95th percentile queue lengths exceed 300m.
- PM Peak Hour
    - This intersection operates at an overall LOS D in the PM peak hour with 47 seconds of delay per vehicle.
    - The southbound approach from Bedford Highway continues to serve the heaviest demand, but the left and through movements operate at LOS D and C and are below capacity.

Bedford Highway/Bayview Road

- AM Peak Hour
    - This intersection operates at an overall LOS F in the AM peak hour with 87 seconds of delay per vehicle.
    - The eastbound right turn movement from Bayview Road is the source of the highest delays, operating at LOS F with 320 seconds of delay/vehicle and a V/C ratio of 1.64. 95th percentile queue lengths are 270m.
- PM Peak Hour
    - This intersection operates at an overall LOS F in the PM peak hour with 230 seconds of delay per vehicle.
    - The northbound approach from Bedford Highway is the heaviest movement and operates at LOS F with 349 seconds of delay/vehicle and a V/C ratio of 1.73. 95th percentile queue lengths are nearly 500m.

Other primary sources of delay within the Study Area include the westbound left turn from Dartmouth Road at the Bedford Highway/Dartmouth Road intersection, which operates at LOS E and near capacity in both peak periods.

Table 5-2: Motor Vehicle LOS Results for Existing (2018) Conditions

Segment	Signalized Intersection	AM Peak Hour		PM Peak Hour	
		Intersection LOS (avg delay)	Highest V/C	Intersection LOS (avg delay)	Highest V/C
1	Windsor Street	F 142.5 sec/veh	1.37	D 46.7 sec/veh	0.88
	Eastbound Left Windsor St.	E 57.5 sec/veh	0.48	E 63.3 sec/veh	0.81
	Eastbound Through Windsor St.	E 57.8 sec/veh	0.88	D 41.2	0.60
	Westbound Through Barrington Street	D 45.4 sec/veh	0.59	E 57.7 sec/veh	0.78
	Southbound Left Bedford Highway	F 204.2 sec/veh	1.37	D 46.4 sec/veh	0.88
	Southbound Through Bedford Highway	F 171.6 sec/veh	1.30	C 32.5 sec/veh	0.53
	Manor Lane	A 3.9 sec/veh	0.65	C 29.4 sec/veh	0.73
	Bayview Road	F 86.9 sec/veh	1.64	F 230.5 sec/veh	1.73
	Eastbound Left/Right	F 319.6 sec/veh	1.64	D 46.7 sec/veh	0.96
	Northbound Through/Left	A 9.5 sec/veh	1.92	F 348.6 sec/veh	2.00
2	Flamingo Drive	A 6.8 sec/veh	0.68	A 9.9 sec/veh	0.63
3	Kearney Lake Road	A 9.3 sec/veh	0.55	B 16.9 sec/veh	0.78
4	Larry Uteck Boulevard	B 14.2 sec/veh	0.69	B 13.7 sec/veh	0.74
	Southgate Drive	A 9.2 sec/veh	0.54	B 13.6 sec/veh	0.71
	Moirs Mill Road	B 12.0 sec/veh	0.70	A 8.4 sec/veh	0.65
5	Hammonds Plains Road	B 19.5 sec/veh	0.70	C 33.7 sec/veh	0.90
	Holland Avenue/Convoy Run	A 7.3 sec/veh	0.51	B 13.6 sec/veh	0.72
	Meadowbrook Drive	B 15.6 sec/veh	0.73	B 13.7 sec/veh	0.76
	Hatchery Lane	A 9.2 sec/veh	0.67	B 10.5 sec/veh	0.67
6	Union Street	A 6.3 sec/veh	0.56	A 7.2 sec/veh	0.64
	Dartmouth Road	C 25.6 sec/veh	0.96	C 28.3 sec/veh	0.90
	Sunnyside Mall	A 7.1 sec/veh	0.32	B 12.2 sec/veh	0.60
	Rocky Lake	C 25.0 sec/veh	0.58	D 36.8 sec/veh	0.69
	Bedford Place	A 2.5 sec/veh	0.27	A 5.9 sec/veh	0.46
	River Lane	A 5.4 sec/veh	0.42	A 9.3 sec/veh	0.68

Figure 5-1: Intersection Level of Service in the AM Peak hour

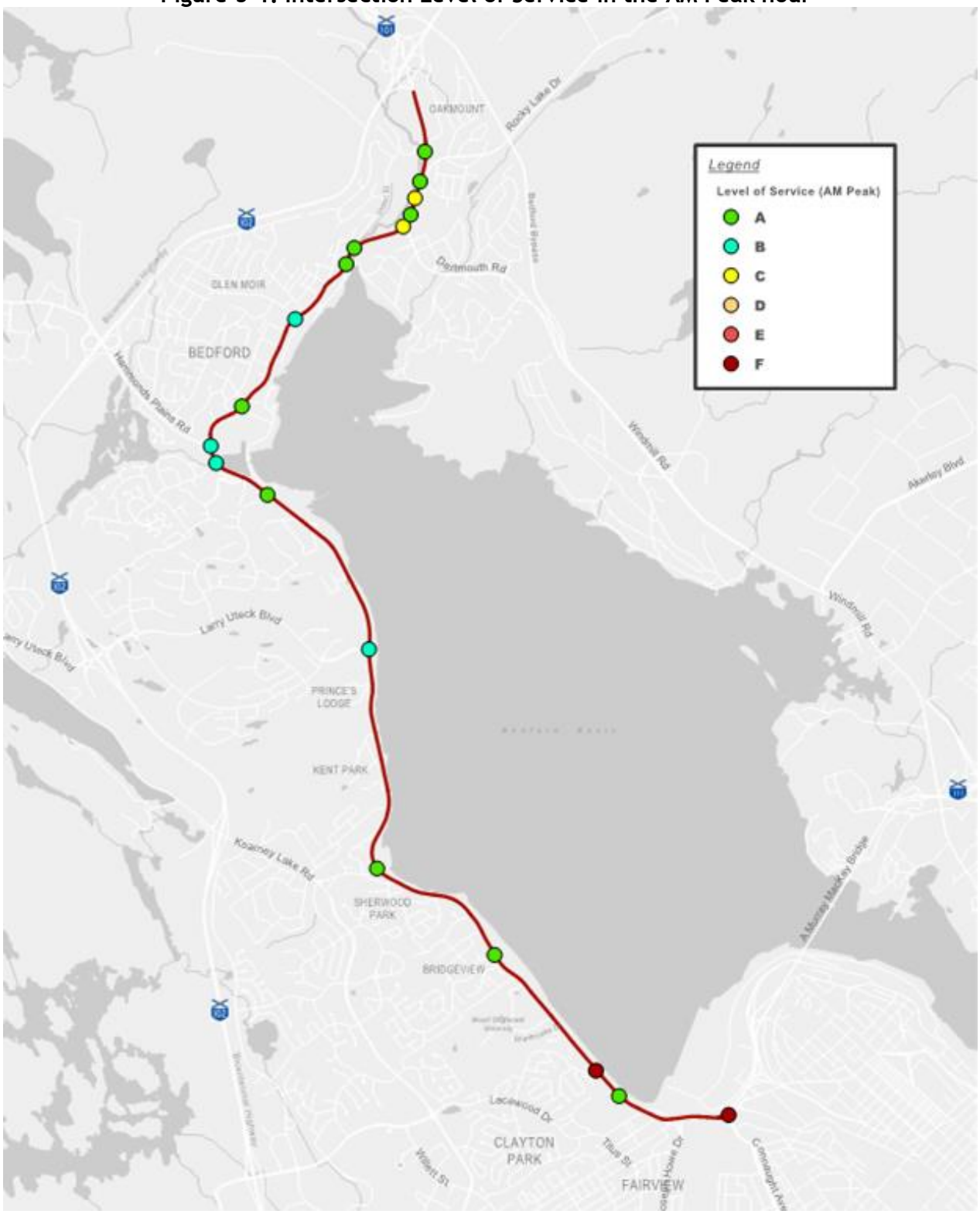
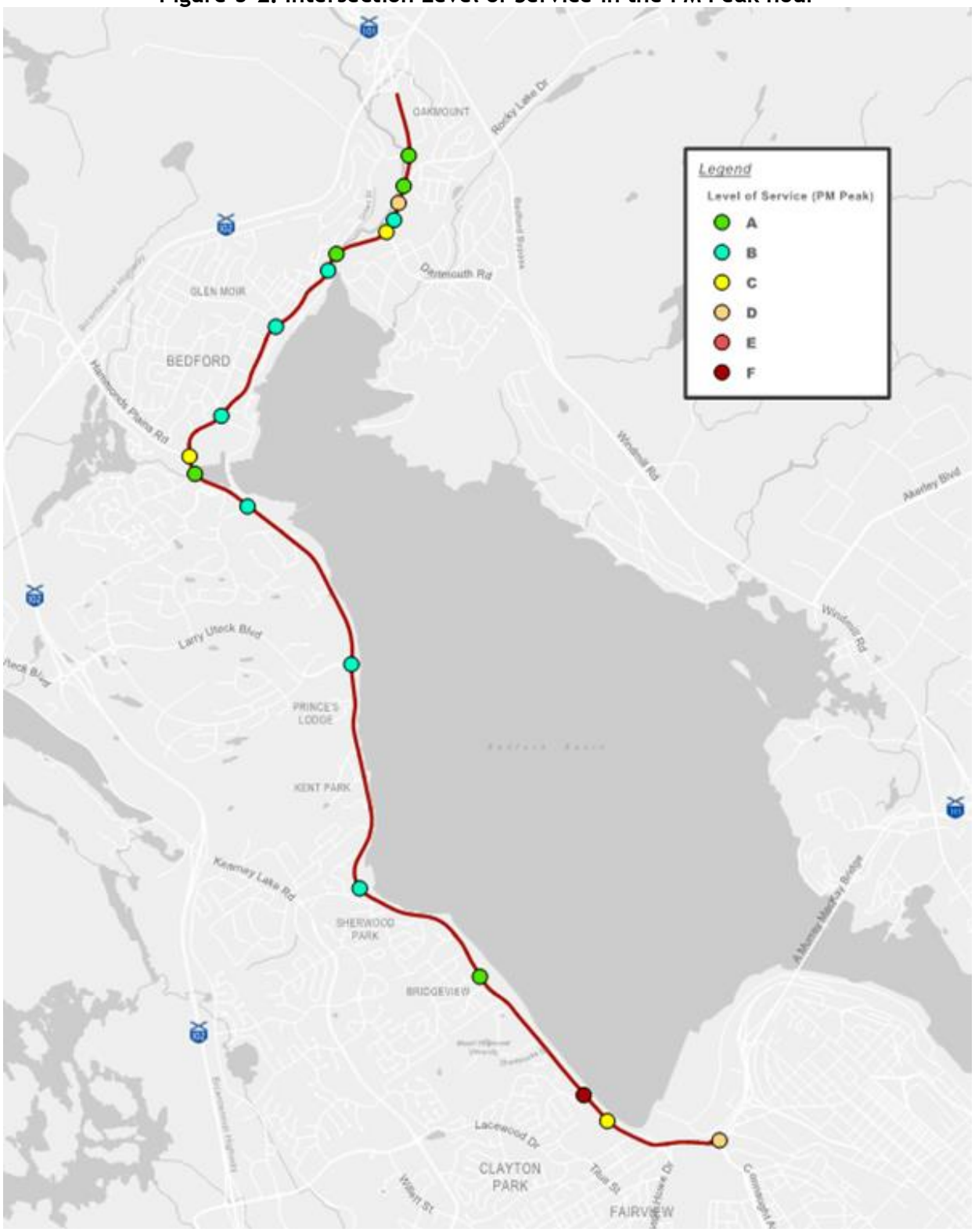


Figure 5-2: Intersection Level of Service in the PM Peak hour



Comparison of Modelled Results to Field Observations

Based on field observations, the following general comments can be made about the traffic operations along Bedford Highway:

AM Peak Hour

- Recurrent southbound traffic congestion is very high in the southern portion of the corridor during the AM peak period. Queues begin at Windsor Street and commonly back-up to Kearney Lake Road (4km) and sometimes to Larry Uteck Boulevard. It appears that this congestion is not entirely due to intersection delays but general friction along the corridor caused by vehicles forcing their way into the traffic stream from side streets and driveways. This is most notable at the Bayview Road and Joseph Howe Drive entries where volumes of 650 and 1,500 vehicles per hour enter the heavy mainline flows. Mainline vehicles braking to allow these vehicles to enter cause turbulence that propagates far up the corridor, causing a very slow rolling queue for kilometres.
- Delays on Bayview Road are very high, with queues extending far back from the traffic signal.
- Congestion in the northern end of the corridor is not significant, however it was noted that signal coordination in the Sunnyside area is not working as intended, likely due to drifting of independent signal time clocks.

PM Peak Hour

- Recurrent northbound congestion is high in the southern portion of the corridor between Windsor Street and Bayview Road. This is largely due to congestion at Bayview Road caused by a heavy left turn movement of 750 veh/hr which effectively reduces the through capacity to one lane. Long queues propagate back through the Windsor Street Exchange.
- Northbound congestion is also experienced in the northern portion of the corridor from Union Street up past Sunnyside Mall. Much of the delay is due to intersection delays and capacity restrictions due to a single through lane. As noted above, signal coordination may also be off. Heavy volumes are caused by outbound commuters mixing with evening commercial area traffic.

The field observations listed above are not fully reflected in the Synchro model. In particular, the heavy southbound queuing in the AM Peak is not reflected given that the model does not include all side streets and does not account for entering traffic forcing its way into the traffic stream. Additionally, traffic signal coordination programmed from timing sheets does not appear to be operating in the field as intended due to drifting of offsets. This makes the modelled conditions better than what is being experienced in the field.

Because of the above model limitations, the existing and future vehicle LOS analyses and comparisons need to be treated with caution.

5.2 Transit Performance

Halifax Transit provided on-time performance information for the nine transit routes that travel along Bedford Highway for either a portion, or the full extent, of the Study Area (defined in **Section 1.3**). However, the transit performance excludes Routes 86 and 135, as both are express routes, and travel on only short portions of Bedford Highway.

Performance information was provided from Monday, September 24, 2018 to Friday, September 28, 2018. For the purpose of this analysis, the primary focus is the AM, midday, and PM periods, as it was assumed that the greatest delays would occur during these times. More specifically, the peak periods analyzed are defined as follows:

- AM from 7:00 AM to 9:00 AM;
- PM from 4:00 PM to 6:00 PM; and
- Midday from 9:00 AM to 4:00 PM

The analysis primarily investigated buses that are late, which is defined as buses arriving at a stop more than three (3) minutes behind schedule, consistent with Halifax Transit's on-time performance standard. Also, only the portion of the bus route that is travelling along Bedford Highway was investigated. However, where a significant part of the route travels on other roadways, additional stops were also included to identify potential causes of delay that cascade onto Bedford Highway. Typically, the additional stops consisted of one stop before, and one stop after the bus enters/ leaves the subject corridor.

The detailed findings from the analysis of the on-time performance for each transit route are provided in **Appendix D**. Based on the above findings, the following conclusions can be made:

Inbound (summarized in **Figure 5-3**):

- During the AM period, operations are generally good along the corridor between Cobequid Terminal and Lodge Drive. Buses begin to fall behind schedule around Lodge Drive, with a significant amount of delay being incurred at each successive stop;
- During the AM period, a higher percentage of buses are experiencing delays in the south end of the corridor (i.e. south of Kearney Lake Road). The delay experienced in this section of the corridor is also higher with a significant variation in how late the buses are. This may be attributed to the buses operating in mixed traffic, and the higher traffic volumes along this section;
- During the PM period, buses begin to experience schedule delays around Union Street, with a spike in the number of late buses at Moirs Mill Road. Operations improve after Glenmont Avenue;
- There is a sharp increase in the percentage of buses arriving late at the following bus stops:
    - MSVU during all periods, which could potentially be because this is a timing point, and the scheduling is purposely tight to reduce layover time;
    - Moirs Mill Road during the PM period.
- Factors that may have a significant impact on schedule adherence include:

- Signal delay experienced by buses making the eastbound right-turn movement from Flamingo Drive onto Bedford Highway;
- Signal delay experienced by buses making the southbound left-turn movement from Bedford Highway onto Dartmouth Road;
- Buses leaving Cobequid Terminal behind schedule; and
- Buses operating in mixed traffic, especially in the south end of the corridor where vehicle volumes are high.

Outbound (summarized in **Figure 5-4**):

- Transit operations are consistently poor during all analysis periods, along the entire Bedford Highway corridor with up to 100% of buses more than three minutes behind schedule in the PM period;
- Transit operations are better in the north end of the corridor during all analysis periods;
- During the AM period, a high percentage of buses are behind schedule when they turn onto Bedford Highway and are found to generally be able to make up some time as they travel along Bedford Highway. Although the information shows some improvements to the transit travel times, buses remain behind schedule along Bedford Highway;
- There is a significant amount of variation in how late buses are, with some buses arriving less than five minutes behind schedule, but with others arriving more than 45 minutes late. The variation is more prominent north of Moirs Mills Road, and in particular between Dartmouth Road and Oakmount Drive;
- There is an increase in the percentage of late buses at the MSVU bus stop during all analysis periods;
- Factors that may have a significant impact on schedule adherence include:
  - Delay incurred on Bayers Road and at Joseph Howe Drive before Dutch Village Road;
  - Vehicles using the dual-lane channelized right-turn to merge onto Bedford Highway from Dartmouth Road may be having difficulty finding gap opportunities in the northbound traffic along Bedford Highway, delaying buses; and
  - Buses operating in mixed traffic, especially in the south end of the corridor where vehicle volumes are high.

Figure 5-3: Transit Performance Summary - Inbound

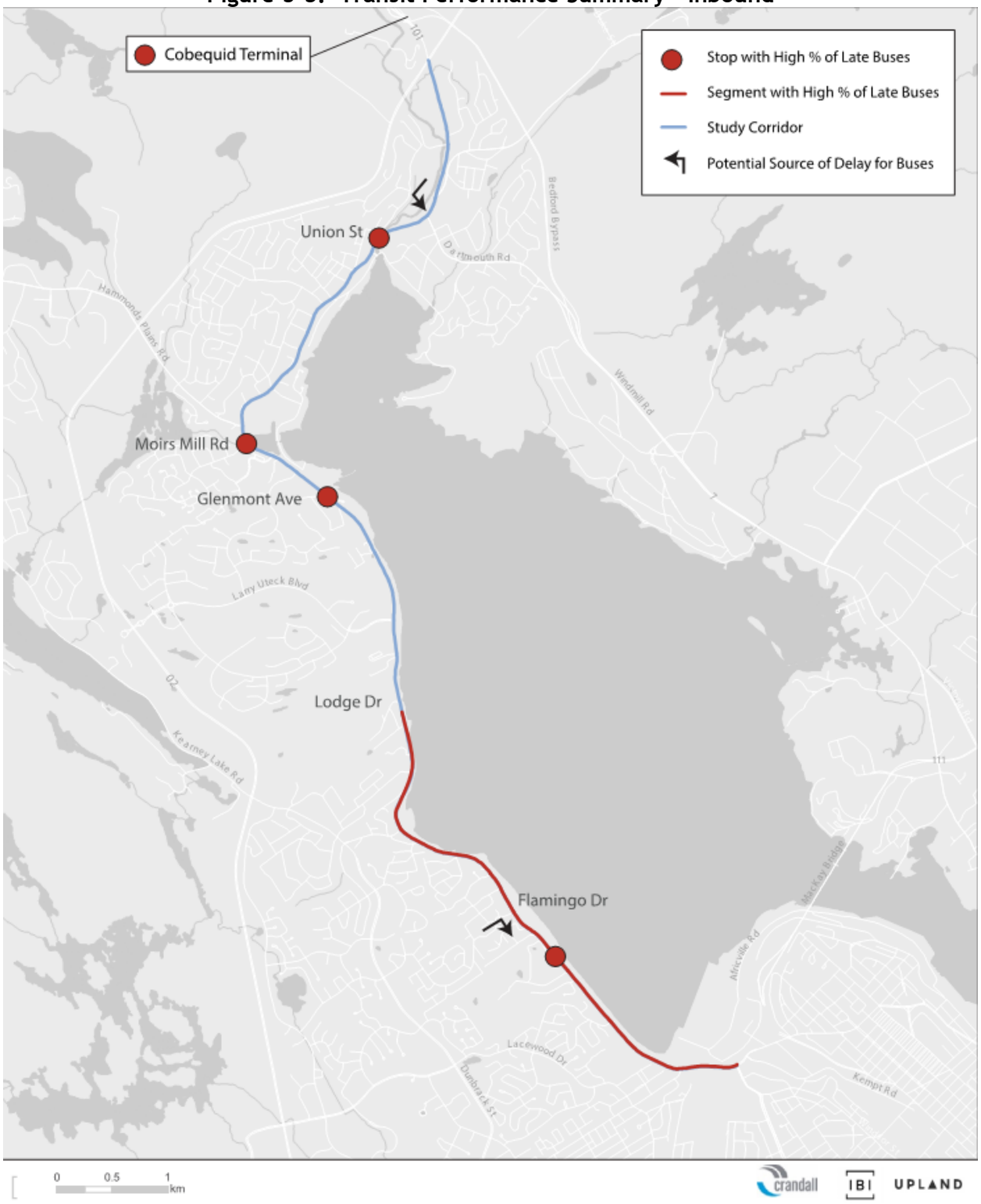
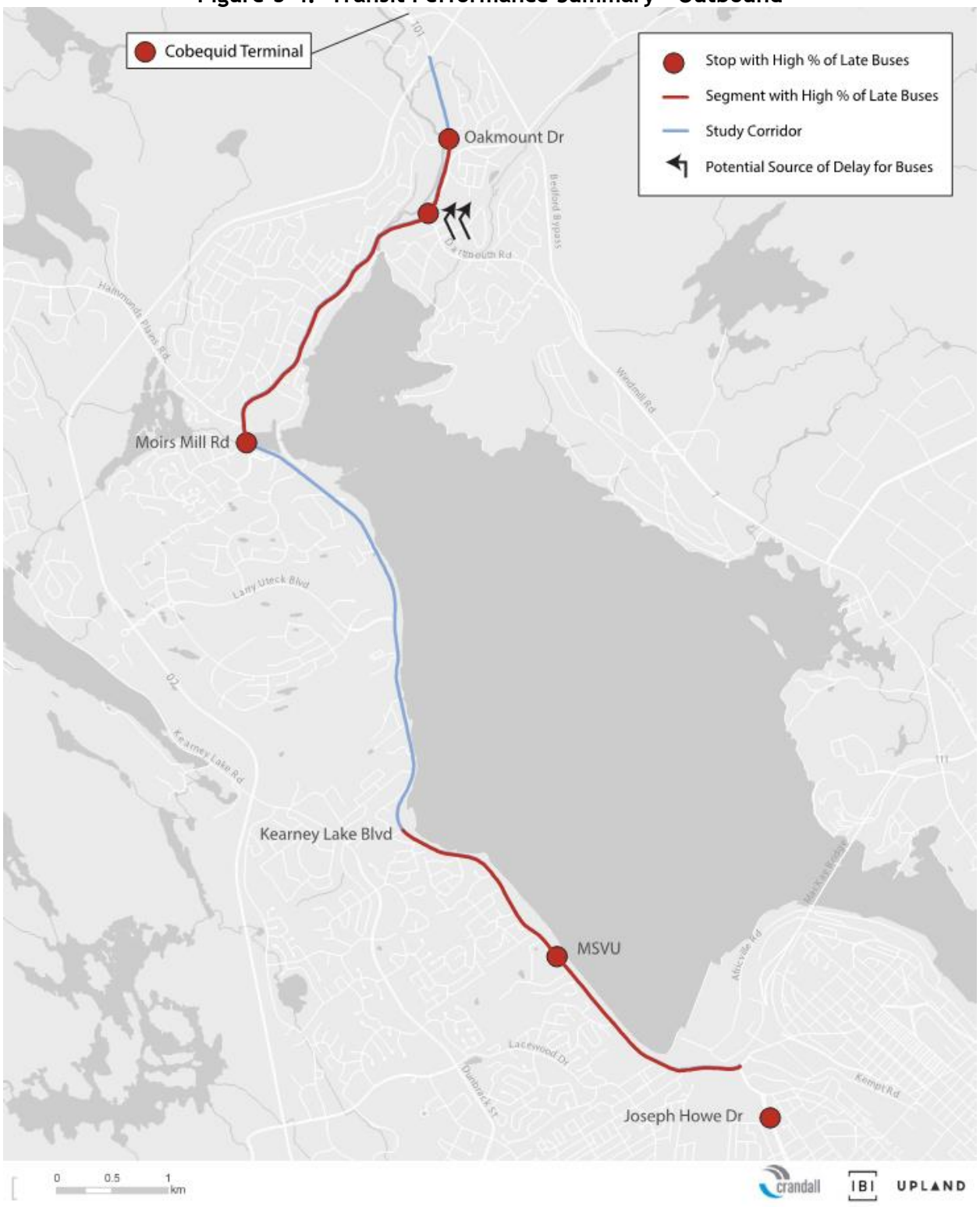


Figure 5-4: Transit Performance Summary - Outbound



5.3 Existing Multi-Modal Level of Service

As part of the Strategic Corridor Plan process, multi-modal level of service (MMLOS) is an important tool identified to help assess existing conditions and evaluate potential future improvements along Bedford Highway. Multi-modal level of service is an evaluation tool that allows for the comparison of modes. It is defined as:

> *A set of discrete quantitative measures used to describe the convenience and comfort experienced by all roadway users over a particular roadway segment or at a particular intersection.*

MMLOS simplifies the evaluation and comparison of different design alternatives by assessing a set of critical parameters that determine the relative attractiveness and comfort for a particular mode along a corridor. These factors vary by mode – an overview is presented in **Table 5-3**.

Table 5-3: LOS Ranges by Mode

MODE	ELEMENT	LEVEL OF SERVICE A					LEVEL OF SERVICE F
Pedestrians (PLOS)	Segments	*High level of comfort*					*Low level of comfort*
	Intersections	*Short delay, high level of comfort, low risk*					*Long delay, low level of comfort, high risk*
Bicycles (BLOS)	Segments	*High level of comfort*					*Low level of comfort*
	Intersections	*Low level of risk / stress*					*High level of risk / stress*
Trucks (TkLOS)	Segments	*Unimpeded movement*					*Impeded movement*
	Intersections	*Unimpeded movement / short delay*					*Impeded movement / long delay*
Transit (TLOS)	Segments	*High level of reliability*					*Low level of reliability*
	Intersections	*Short delay*					*Long delay*
Vehicles (LOS)	Intersections	*Low lane utilization*					*High lane utilization*

Source: City of Ottawa / IBI Group

For the purposes of evaluating the Bedford Highway corridor, a multi-modal level of service evaluation tool originally developed for the City of Ottawa was applied to assess existing conditions. The methodology uses a look-up table approach to evaluate the following characteristics for each mode at the segment (refer to **Table 5-4**) and intersection level (refer to **Table 5-5**).

Table 5-4: Criteria for Segment MMLOS

MODE	SEGMENT EVALUATION CRITERIA
Pedestrian Level of Service	» Vehicular operating speed » Sidewalk width » Boulevard width » Motor vehicle volume » Presence of on-street parking
Cycling Level of Service	**Evaluation criteria depends on type of cycling facility:** **Mixed Traffic (No cycling facility)** » Street width (number of lanes) » Vehicular operating speed **Bike Lanes / Paved Shoulders** » Street width (number of lanes) » Bike lane width » Parking lane width (where bike lane is adjacent to parking lane) » Vehicular operating speed » Qualitative assessment of commercial deliveries for commercial areas **Physically Separated Bikeway (includes cycle tracks, protected bike lanes and multi-use paths)** » No additional criteria considered **Unsignalized Crossings along the corridor (where applicable)** » Presence of median refuge island » Width of street being crossed (number of lanes in both directions) » Speed limit of street being crossed
Transit Level of Service	» Level/exposure to congestion delay, friction, and incidents (qualitative assessment) » Average transit travel speed (where available) » Posted speed limit » Number of driveways along corridor and approximate crossing volume
Truck Level of Service	» Street width (number of lanes) » Curb lane width (m)

Table 5-5: Criteria for Intersection MMLOS

MODE	SIGNALIZED INTERSECTIONS
Pedestrian Level of Service	**Exposure to Traffic** » Street width to be crossed and presence of refuge island » Right & left turn conflicts based on signal phasing and pedestrian-only phases » Right turn on Red (RTOR) restrictions » Corner radius and type » Crosswalk treatments **Delay** » Cycle length » Pedestrian green time (walk time)
Cycling Level of Service	**Evaluation criteria depends on type of cycling facility at the intersection:** **Pocket bike lanes** » Right turn lane characteristics (number of right turn lanes, length of lanes, speed) » Vehicular operating speed » Left turn accommodation (presence of bike box, number of left turn lanes, number of lanes crossed) **Mixed Traffic (No cycling facility)** » Right turn lane characteristics (number of right turn lanes, length of lanes, speed) » Vehicular operating speed » Left turn accommodation (presence of bike box, number of left turn lanes, number of lanes crossed)
Transit Level of Service	» Average Signal Delay
Truck Level of Service	» Effective radius » Number of receiving lanes on departing leg

Following an initial presentation of the methodology to HRM staff, several modifications to the methodology were applied to better reflect the local context, as the transportation facilities and user thresholds differ within Halifax.

Key modifications to the original methodology are summarized below:

- **Pedestrian Level of Service (PLOS)** - Modifications to the thresholds for the PLOS segment evaluation were applied to reflect the local context, reflecting feedback that the initial thresholds were too stringent. In addition to changes to the segment-level evaluation, the intersection evaluation was slightly modified to account for two common conditions along Bedford Highway. Since there are some locations where no crosswalks are painted for pedestrians, a new category was added to the 'Crosswalk Type' evaluation table. There are also many right turn channelized islands along the corridor. In these locations, the crossing of the right turn channel was included as part of the total number of lanes crossed, and the channelized island was assigned points as if it were a median refuge island, since it does

provide a midpoint waiting area for the pedestrian crossing. Traditionally, the distance to cross right turn channels is not included in the pedestrian clearance time (i.e., the flashing don't walk). Therefore the crossing of the right turn channel was not included as part of the total crossing distance, which influences the calculated intersection pedestrian delay.

- **Transit Level of Service (TLOS)** – For the segment evaluation, the methodology identifies numerical measures that can be applied to estimate the driveway / friction factors (range of ratio of average transit travel speed to posted speed limit associated with different classes of friction). However, for this evaluation, this analysis was completed using a qualitative assessment due to the lack of data on transit speeds. For intersections, transit level of service was evaluated at any side-street where transit service is provided. To summarize the overall intersection level of service for transit, results were weighted based on the number of transit buses on each leg.

No modifications were made to the cycling or truck level of service evaluations. Copies of the final look-up tables applied for each mode are provided in **Appendix E**.

It is important to note that multi-modal level of service is most useful as a tool for evaluating and comparing trade-offs. Traditionally, there has been an emphasis on the performance of vehicular traffic in evaluating the level of service (LOS) on streets. *Since no comparable LOS measures were institutionalized for other modes of travel, the tradeoffs between vehicle delay and its impacts on the quality of travel by other modes were often overlooked. MMLOS attempts to overcome this challenge by defining similar results for multiple modes.* However, MMLOS is not an all-encompassing evaluation tool. It focuses on a core set of criteria and cannot cover all of the possible factors that influence the overall safety and attractiveness of each mode. It is important that MMLOS be supplemented by an evaluation of land use, network connectivity, as well as operational and safety considerations when identifying future improvements. All of these components are also being considered through the Bedford Highway Functional Plan.

The following sections provide a summary of the MMLOS evaluation results by mode. The detailed evaluation summary tables for segments and intersections are provided in **Appendix F**. Note that the delay used in the evaluation is taken from Synchro models of the PM peak period, unless otherwise noted. The PM peak typically experiences more congestion than the AM peak. Therefore, the results presented are representative of the worst-case scenario.

Pedestrian Level of Service

The pedestrian level of service varies significantly along the corridor, which is intuitive given the significant change facility or lack of facilities. Although some sections of the corridor do have sidewalks, they are often narrower sidewalks without wide boulevards, which is still uncomfortable along major arterial roadways with heavy vehicular volumes.

Intersections are often typified by multi-lane crossings, right turn channels and lower order crosswalk treatments.

The results of the pedestrian level of service evaluation are presented in **Figure 5-5**.

Cycling Level of Service

Similar to pedestrians, the cycling level of service varies substantially along the corridor. As noted in **Section 3.4**, there are intermittent cycling facilities along the corridor, ranging from bike lanes to paved shoulders to shared facilities. The variability of these conditions and resulting cycling level of service results along the corridor, are presented in **Figure 5-6**.

Transit Level of Service

Transit operates in mixed traffic (level of service D or lower) along the corridor. At intersections, results vary according to intersection delay. It is important to consider that many other factors, including comfort at transit stops, route frequency and operational factors (refer to **Section 5.2**) are not captured in TLOS but will also influence the attractiveness of transit. TLOS scores are shown in **Figure 5-7**.

Truck Level of Service

Based on the results of the MMLOS evaluation, Bedford Highway accommodates truck traffic well along segments, with variability in intersection level of service depending on corner radii, and the width of the receiving lanes. The truck level of service along the corridor is presented in **Figure 5-8**.

A specific consideration for trucks is that Bedford Highway is frequently used at night for moving oversized loads between Halifax docks and Highway 102 via Kearney Lake Road. This is because Bedford Highway has relatively few overhead constraints. Any future plans for the southern portion of Bedford Highway must bear in mind the need for generous overhead clearance and adequate horizontal clearances.

Figure 5-5: Pedestrian Level of Service

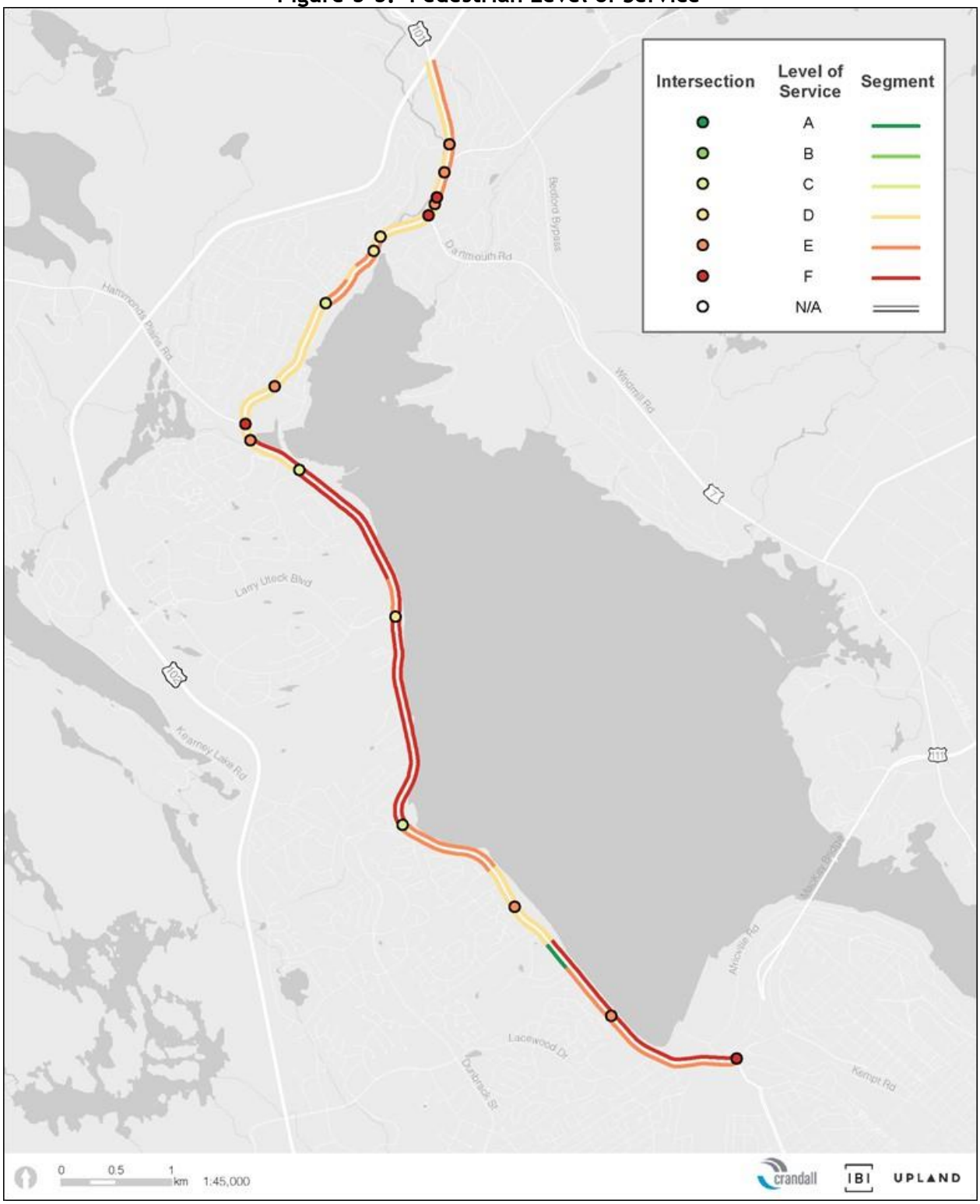


Figure 5-6: Cycling Level of Service

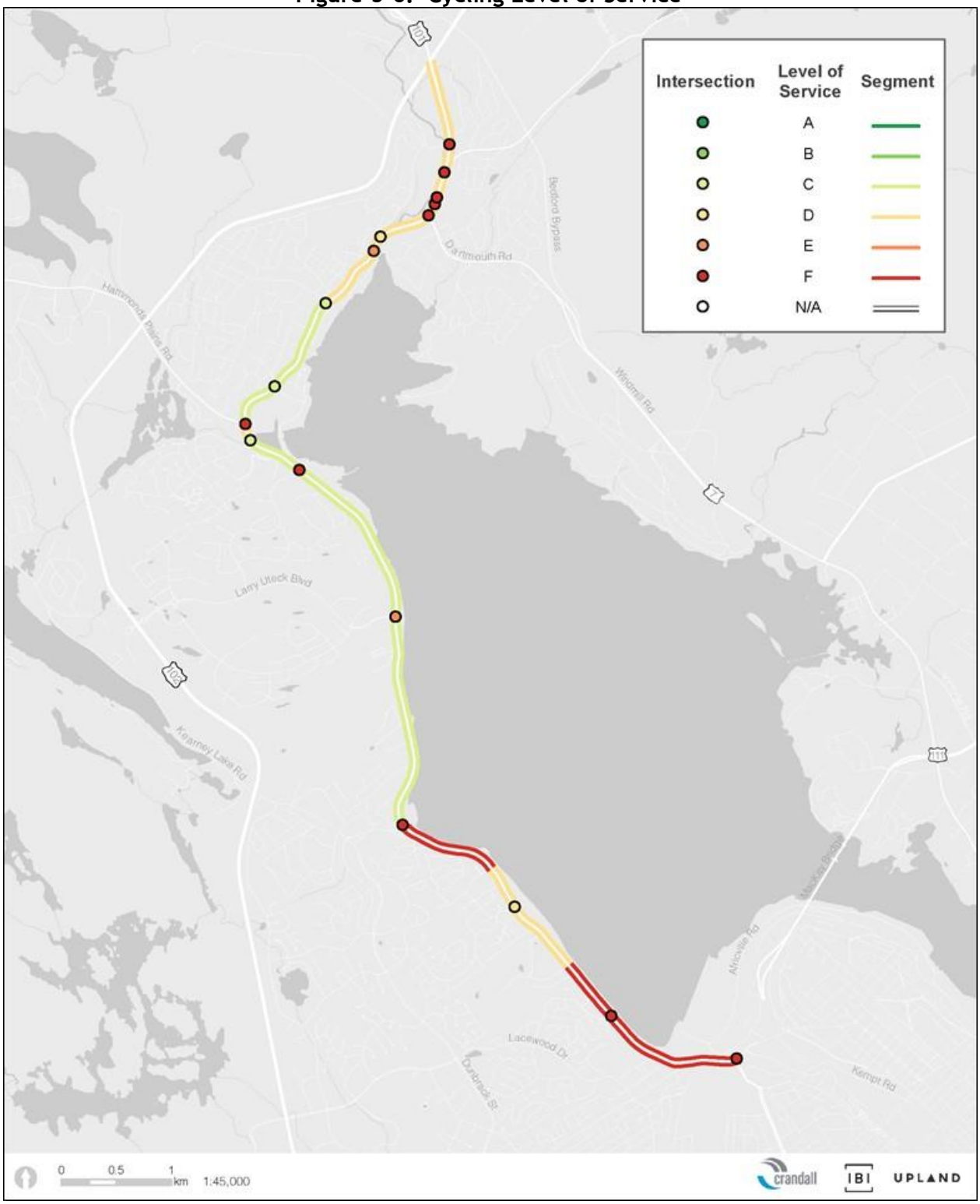


Figure 5-7: Transit Level of Service

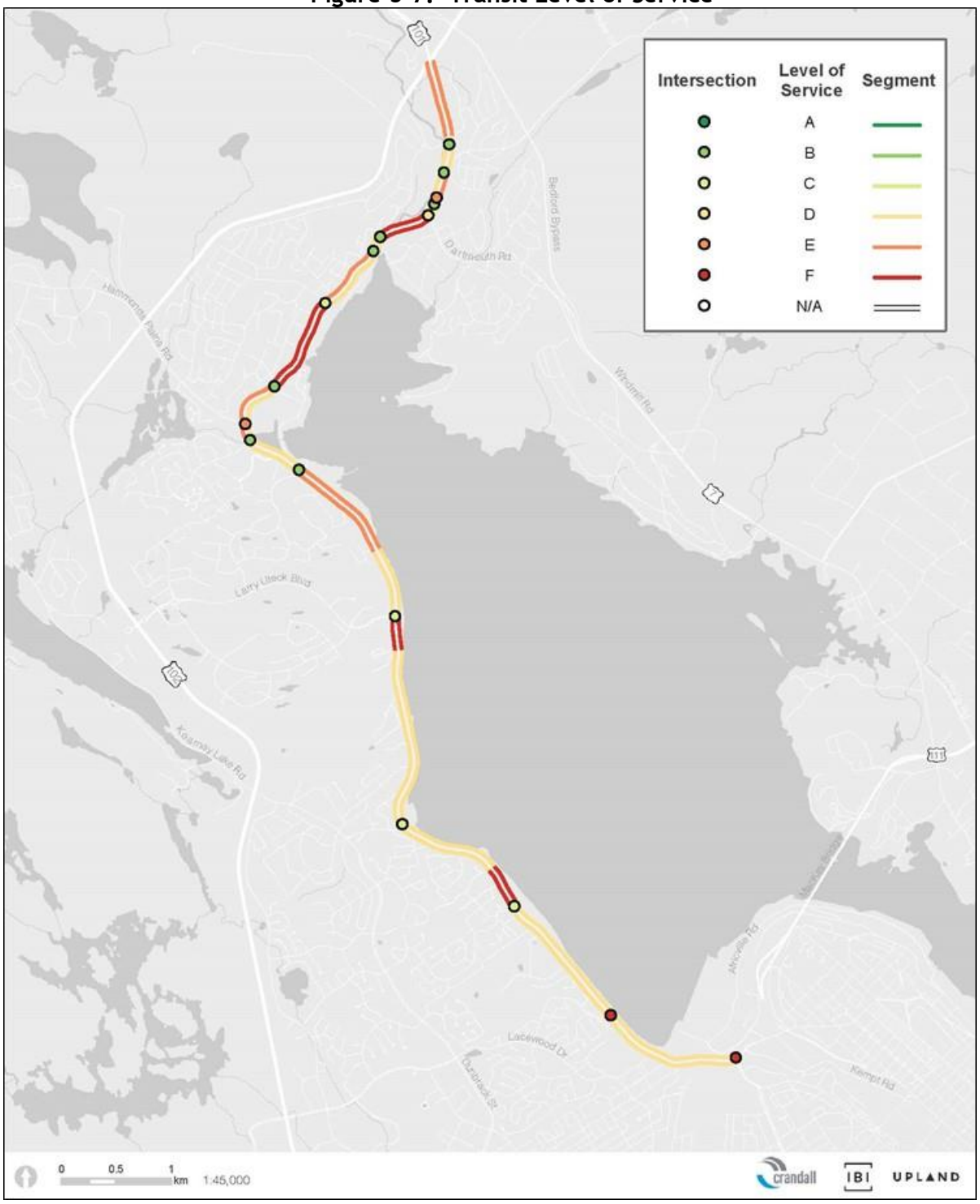
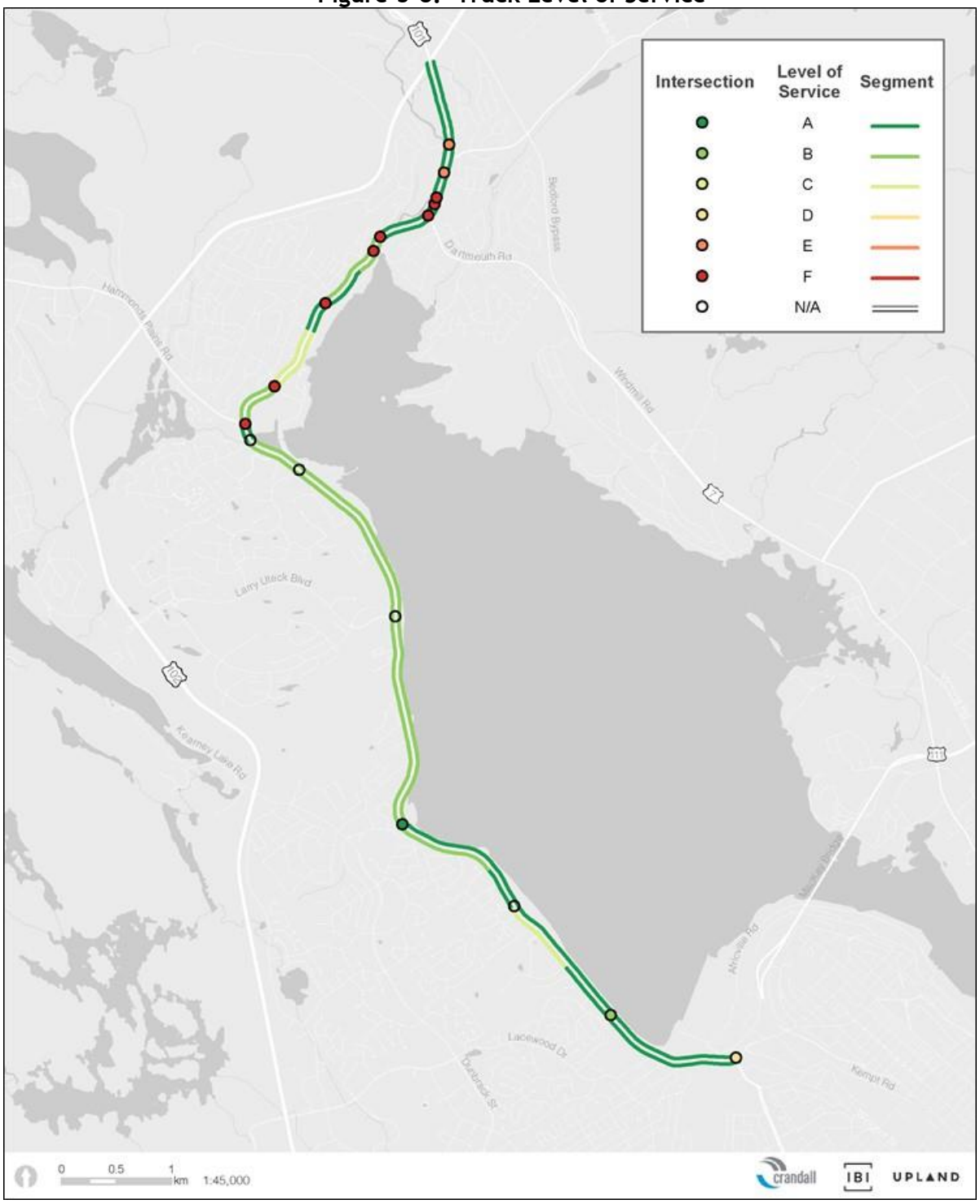


Figure 5-8: Truck Level of Service



5.4 MMLOS Summary

The results of the MMLOS analysis are summarized for all modes by segment in **Table 5-6** and by intersection in **Table 5-7**. The following observations can be made from the results:

Pedestrians

- 48% of directional segments and 65% of intersections are at a LOS E or F.
- The pedestrian LOS is poorest south of Moirs Mill Road, where many segments are at LOS F. However, it could be argued that in some of these segments there is little demand or need for a sidewalk on the east (northbound) side due to the absence of adjacent development.
- Only one segment is at LOS C or better (the section at MSVU where the sidewalk is located well off the roadway (on MSVU property).
- Generally, the results indicate the pedestrian experience along Bedford Highway is moderate to poor.

Cyclists

- 10% of directional segments and 71% of intersections are at LOS E or F. No segments are better than LOS C and no intersections are better than LOS B.
- The worst segments are south of Seton Road and from Tremont Drive to Flamingo Drive. These poor levels of service are due to high traffic volumes, 60 km/h speed limit, and lack of separated bike facilities.
- Generally, the results indicate the cyclists' experience along Bedford Highway is moderate north of Kearney Lake Road, but moderate to poor through the southern portion of the corridor.

Transit

- 38% of directional segments and 24% of intersections are at LOS E or F. No segments are better than LOS D but multiple intersections are at LOS B or C.
- The worst segments are from Holland Avenue to Meadowbrook Drive due to friction from frequent driveways.
- Generally, the results indicate that the transit experience along Bedford Highway is moderate to poor, which is consistent with the findings that many buses are running slowly and behind schedule.

Trucks

- All directional segments are at LOS C or better, but 59% of intersections are at LOS E or F.
- The poor intersection levels of service are mainly due to tight radii.
- Generally, the results indicate that the truck experience along Bedford Highway is very good due to multiple and wide vehicle lanes, although turns at some intersections may be somewhat restrictive.

Table 5-6: MMLOS Summary by Road Segments

Road Segment		Pedestrians		Cyclists		Transit		Trucks	
From	**To**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**	**NB**	**SB**
Windsor St	Bayview Rd	F	E	F	F	D	D	A	A
Bayview Rd	Seton Rd	F	E	F	F	D	D	A	A
Seton Rd	MSVU	F	A	D	D	D	D	A	C
MSVU	Flamingo Dr	D	D	D	D	D	D	A	C
Flamingo Dr	Tremont Dr	D	D	D	D	F	F	A	A
Tremont Dr	Kearney Lake Rd	E	E	F	F	D	D	A	B
Kearney Lake Rd	Charlotte Ln	F	F	C	C	D	D	B	B
Charlotte Ln	Larry Uteck Blvd	F	F	C	C	D	D	B	B
Larry Uteck Blvd	Condo Access	F	E	C	C	D	D	B	B
Condo Access	Fern Ave	F	F	C	C	D	D	B	B
Fern Ave	Southgate Dr	F	F	C	C	E	E	B	B
Southgate Dr	Moirs Mill Rd	F	D	C	C	D	D	B	B
Moirs Mill Rd	Hammonds Plains Rd	D	D	D	D	D	E	A	A
Hammonds Plains Rd	Holland Ave	D	D	C	C	D	E	B	B
Holland Ave	Locke St	D	D	C	C	F	F	C	C
Locke St	Lindsay Hill	D	D	C	C	F	F	C	C
Lindsay Hill	Sullivans Hill	D	D	C	C	F	F	C	C
Sullivans Hill	Meadowbrook Dr	D	D	C	C	F	F	A	A
Meadowbrook Dr	Spring St	E	E	D	D	D	E	A	B
Spring St	First Ave	E	D	D	D	D	E	A	B
First Ave	Hatchery Ln	E	E	D	D	D	E	B	B
Hatchery Ln	Union St	E	D	D	D	D	D	B	B
Union St	Dartmouth Rd	D	D	D	D	F	F	A	A
Dartmouth Rd	Sunnyside Mall	D	D	D	D	D	D	A	A
Sunnyside Mall	Rocky Lake Dr	D	D	D	D	D	D	A	A
Rocky Lake Dr	Bedford Pl	E	D	D	D	E	D	A	A
Bedford Pl	River Ln	E	D	D	D	D	D	A	A
River Ln	Oakmount Dr	E	D	D	D	D	D	A	A
Oakmount Dr	Highway 102	E	D	D	D	E	E	A	A
# of Segments at E or F		28		6		22		0	
% of Segments at E or F		*48%*		*10%*		*38%*		*0%*	

Table 5-7: MMLOS Summary by Intersection

Intersection	Pedestrians	Cyclists	Transit	Trucks	Auto
Windsor Street	F	F	F	D	F
Bayview Road	E	F	F	C	F
Flamingo Drive	E	D	C		A
Kearney Lake Road	C	F	C		B
Larry Uteck Boulevard	D	E	C		B
Southgate Drive	C	F	B		B
Moirs Mills Road	E	C	B		B
Hammonds Plans Road	F	F	E	F	C
Convoy Run/Holland Avenue	E	C	B	F	B
Meadowbrook Drive	D	C	C	F	B
Hatchery Lane	D	E	B	F	B
Union Street	D	D	B	F	A
Dartmouth Road	F	F	D	F	C
Sunnyside Mall	E	F	B	F	B
Rocky Lake Drive	F	F	E	F	D
Bedford Place	E	F	B	E	A
River Lane	E	F	B	E	A
# of Intersections at E or F	**11**	**12**	**4**	**10**	**2**
% of Intersections at E or F	*65%*	*71%*	*24%*	*59%*	*12%*

6.0 Future Travel Conditions

6.1 Traffic Volume Forecasts

Traffic volume forecasts were prepared for a future horizon year of 2031 which coincides with the horizon year applied in the IMP. Forecasts were estimated based on the three components described below:

1. **Background Growth** - A background linear growth rate of 1% per year was applied to all turning movements along the corridor to account for general traffic growth that is not related to a specific development. This would capture regional growth as well as local growth from small developments. This results in a background growth rate of 13% from year 2018 to 2031.

2. **Major Network Changes** – The most significant planned change in the transportation network that would impact Bedford Highway by 2031 is the Highway 107 Extension (Burnside Expressway). The new Expressway is expected to draw some traffic away from Bedford Highway that is currently moving between Lower Sackville and Dartmouth Road. A traffic study by Griffin has estimated the following impacts at the Bedford Highway/Dartmouth Road intersection:
    a. AM Peak Hour: 150 vehicles per hour would be removed from the left turn on Bedford Highway to Dartmouth Road; and
    b. PM Peak Hour: 150 vehicles per hour would be removed from the right turn on Dartmouth Road to Bedford Highway.

3. **Major Developments** – The most significant development advanced in its planning stage is the proposed mixed-used Seton Ridge development. This 24.4 ha (60.2 ac) development is proposed on Seton Road, west of Bedford Highway and will consist of single-family and multi-family housing, retail space, and a community centre. A traffic impact study was completed for the development in 2017 (Ekistics Planning and Design) and evaluated two scenarios – an 1,800-unit scenario and a 2,500- unit scenario. The traffic generation and assignment estimated for the 2,500-unit scenario was applied in our traffic forecasts and would add 540 vehicle trips to Bedford Highway in the AM peak hour and 700 trips in the PM peak hour. Note that the traffic impact study recommended the following infrastructure improvements to accommodate this increase in traffic:
    a. A traffic signal at Seton Road and Bedford Highway;
    b. A northbound left turn lane on Bedford Highway;
    c. Widen Bedford Highway to provide an additional southbound traffic lane from Sherbrooke Drive through the Seton Road intersection; and
    d. A new bus route directly through the Seton Ridge Development and the expectation that HRM will implement strategic transit improvements through the IMP and regional transportation plans.

The future traffic volumes resulting from the above methodology are summarized in **Table 6-1** at six representative locations along the corridor and are compared to existing volumes at the same location.

The largest changes in demand occur in Segment 1 and 2 due to the impacts of the proposed Seton Ridge development. Note that other large developments along or near to Bedford Highway could begin within the next 10-15 years, including Mill Cove and Birch Cove, but details on these developments are not well advanced at this time.

Table 6-1: Existing and Future (2031) Peak Hour Volumes along Bedford Highway

Location	Direction	2018		2031	
		SB	NB	SB	NB
Segment 1 North of Bayview Road	AM Peak	1,420	735	1,619	799
	PM Peak	813	1,456	1,143	1,909
Segment 2 South of Flamingo Drive	AM Peak	1,353	493	1,585	666
	PM Peak	604	1,037	796	1,269
Segment 3 South of Larry Uteck Boulevard	AM Peak	549	510	654	657
	PM Peak	586	892	744	1,074
Segment 4 South of Hammonds Plains Road	AM Peak	555	681	650	832
	PM Peak	810	656	977	787
Segment 5 North of Meadowbrook Drive	AM Peak	754	907	866	1,066
	PM Peak	920	843	1,081	978
Segment 6 North of Dartmouth Road	AM Peak	677	705	830	818
	PM Peak	820	957	949	948

Note that under a "Do-Nothing" scenario, no significant increases in transit and AT trips along the corridor are expected.

6.2 Future Traffic Analysis (Do-Nothing Scenario)

The resulting intersection LOS for the future 2031 conditions with no infrastructure changes are shown in **Table 6-2**, which lists the overall LOS and highest V/C at each intersection. The results indicate that all intersections experience higher delays due to traffic growth, but most continue to operate at an overall satisfactory LOS D or better with the exception of two intersections – Bedford Highway/Windsor Street, Bedford Highway/Bayview Road, and Bedford Highway/Seton Road (signalized upon development of Seton Ridge). The LOS results are discussed further below and Synchro reports can be found in **Appendix C**.

Bedford Highway/Windsor Street

- AM Peak Hour
    - This intersection would continue to worsen in the future, operating at LOS F with 224 seconds of delay per vehicle.
    - The southbound approach from Bedford Highway would operate at LOS F with more than 300 seconds of delay per vehicle and a V/C = 1.55. The Windsor Street approach would also be very congested at LOS E with 79.7 seconds of delay/vehicle.
- PM Peak Hour

- This intersection would operate at an overall LOS E in the PM peak hour with 66 seconds of delay per vehicle.

Bedford Highway/Bayview Road

- AM Peak Hour
  - This intersection would operate at an overall LOS F in the AM peak hour with 136.2 seconds of delay per vehicle.
  - The most congested movements would be the eastbound movement from Bayview Road and southbound movement on Bedford Highway. The eastbound movement would operate at LOS F with 448.2 seconds of delay/vehicle, a V/C ratio of 1.93 and 95th percentile queue length of 330m. The southbound movement would operate at LOS E with 76.6 seconds of delay/vehicle, a V/C ratio of 1.04, and 95th percentile queue length of 280m.
- PM Peak Hour
  - This intersection would operate at an overall LOS F in the PM peak hour with 423.2 seconds of delay per vehicle.
  - The most congested movements would be the eastbound movement from Bayview Road and northbound movement on Bedford Highway. The eastbound movement would operate at LOS F with 108.5 seconds of delay/vehicle, a V/C ratio of 1.93 and 95th percentile queue length of 330m. The northbound movement would operate at LOS F with 651.2 seconds of delay/vehicle, a V/C ratio of 3.69, and 95th percentile queue length of 660m.

Bedford Highway/Seton Road

This intersection was modelled with a traffic signal and second southbound traffic lane per the recommendations from the traffic impact study.

- AM Peak Hour
  - This intersection would operate at an overall LOS C in the AM peak hour with 32.3 seconds of delay per vehicle.
- PM Peak Hour
  - This intersection would operate at an overall LOS F in the PM peak hour with 153 seconds of delay per vehicle. Delays can be attributed to heavy northbound through volumes combined with a heavy left turn demand onto Seton Road. The lack of a separated northbound left turn lane would result in capacity constraints. This is a similar situation to Bayview Road.

Table 6-2: Auto LOS Results -2031 (Do Nothing) vs. 2018 Conditions

Segment	Signalized Intersection	Intersection LOS Average Delay (sec/veh)			
		2018 Existing		2031 Do-Nothing	
		AM Peak	PM Peak	AM Peak	PM Peak
1	Windsor Street	F 142.5	D 46.7	F 223.8	E 66.1
	Manor Lane	A 3.9	C 29.4	A 7.5	B 12.2
	Bayview Road	F 86.9	F 230.5	F 136.2	F 423.2
2	Seton Road	---	---	C 32.3	F 152.8
	Flamingo Drive	A 6.8	A 9.9	C 26.2	B 12.5
3	Kearney Lake Road	A 9.3	B 16.9	B 11.6	C 27.6
4	Larry Uteck Boulevard	B 14.2	B 13.7	B 16.3	B 17.5
	Southgate Drive	A 9.2	B 13.6	B 11.4	C 20.6
	Moirs Mill Road	B 12.0	A 8.4	B 12.5	A 9.0
5	Hammonds Plains Road	B 19.5	C 33.7	C 23.1	D 44.4
	Holland Avenue/Convoy Run	A 7.3h	B 13.6	A 8.3	B 19.1
	Meadowbrook Drive	B 15.6	B 13.7	B 18.9	C 20.2
	Hatchery Lane	A 9.2	B 10.5	B 13.2	B 13.7
6	Union Street	A 6.3h	A 7.2	A 7.3	A 9.8
	Dartmouth Road	C 25.6	C 28.3	D 41.4	D 51.8
	Sunnyside Mall	A 7.1h	B 12.2	A 7.0	B 12.5
	Rocky Lake	C 25.0	D 36.8	C 27.5	D 41.1
	Bedford Place	A 2.5	A 5.9	A 2.9	A 5.8
	River Lane	A 5.4	A 9.3	A 5.7	B 10.6

7.0 Concept Development

7.1 Traffic Improvement Opportunities

Traffic Signal Coordination

Several segments along Bedford Highway with closely spaced traffic signals could benefit from traffic signal coordination. Although some existing controllers are programmed with coordination, it appears that offsets have drifted, or the coordination is not operating properly. HRM's plans to roll-out a replacement of its traffic controllers and move to a central system offers an opportunity to implement updated coordination plans and technology. Segments where coordination would be most beneficial include:

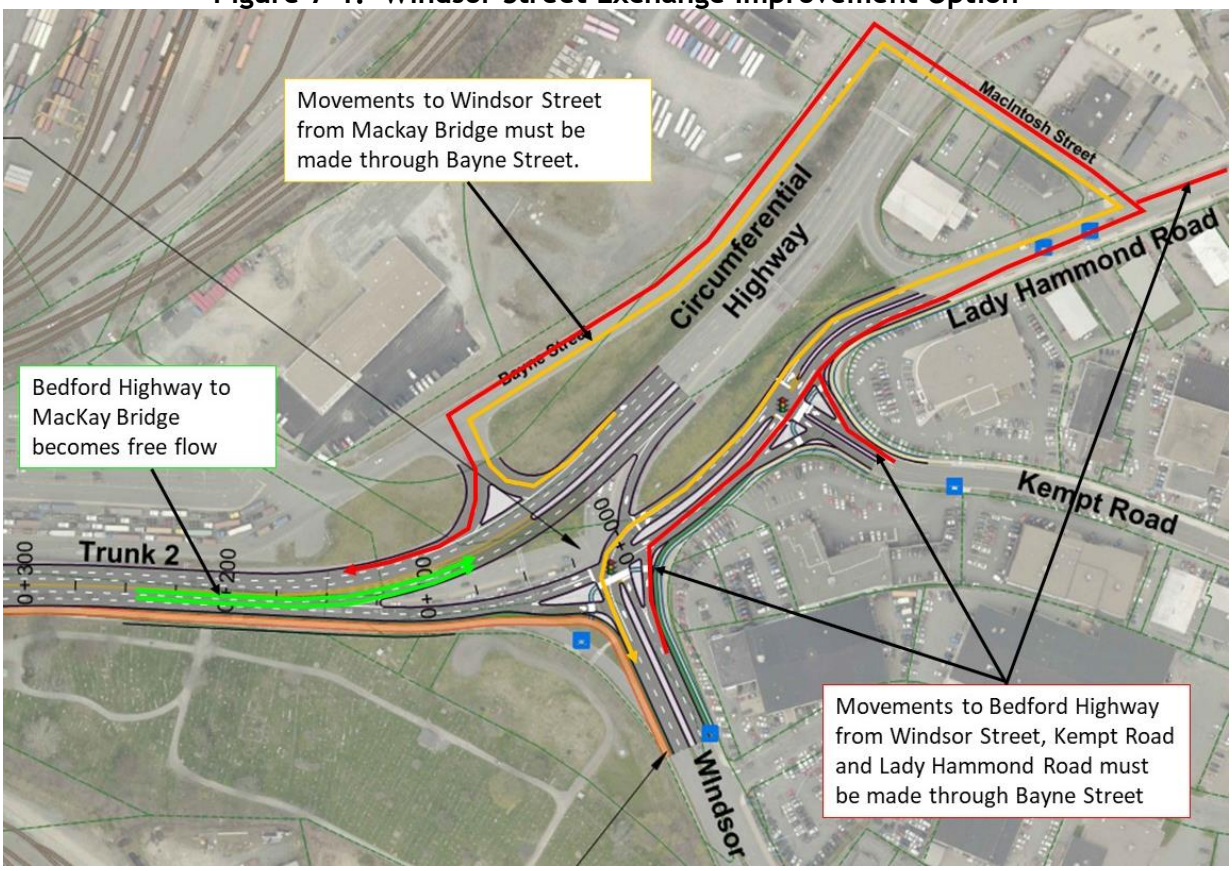
1. **Manor Lane to Flamingo Drive:**
    a. # of traffic signals = 4 (assuming Seton Road is signalized);
    b. Average signal spacing = 530m
2. **Southgate Drive to Convoy Run:**
    a. # of traffic signals = 4
    b. Average signal spacing = 390m
3. **Union Street to River Lane:**
    a. # of traffic signals = 7
    b. Average signal spacing = 220m

Windsor Street Exchange Improvements

The Windsor Street Exchange is a significant bottleneck at the southern terminus of Bedford Highway due to the confluence of many competing traffic movements with high traffic demands. The *Fairview Interchange Capacity Assessment* (exp Services Inc, 2016) evaluated multiple options for increasing capacity through the Windsor Street Exchange and determined that their "Option 6A" would provide the overall best return on investment and an estimated 29% reduction in overall peak hour travel time. Exp's Option 6A has been carried forward in the Bedford Highway Functional Plan and is shown below in **Figure 7-1**. Key features, benefits, and disbenefits of this configuration are discussed below. Note that further work is required to fully assess this option and its costs/benefits, but this is beyond the scope of the Functional Plan.

- The most significant benefit is that movements from Bedford Highway to the MacKay Bridge would become free flow resulting in a significant reduction in southbound queuing and delays on Bedford Highway, particularly in the AM peak. The 2016 Study estimated that travel time for this movement would be reduced by nearly 70% during peak periods.
- The trade-off to the above is that, movements to Bedford Highway from Windsor Street, Kempt Road, and Lady Hammond Road can no longer be made through the Windsor Street traffic signal and would need to be made via MacKintosh Street, Bayne Street, and the Bayne Street entry to Bedford Highway. Similarly, movements from MacKay Bridge to Windsor Street would need to take the Bayne Street exit and route through MacKintosh Street and Lady Hammond Road. These impacts result in an increase in trip distance and travel time for these movements, but the net travel time benefit for the network is still positive.

Figure 7-1: Windsor Street Exchange Improvement Option



Bayview Road Intersection Upgrade

The Bedford Highway/Bayview Road intersection is one of the most congested intersections on the corridor. The intersection operates at LOS F and is over capacity under existing conditions and operations will worsen by 2031. This intersection is a bottleneck to northbound traffic in the PM peak due to the heavy northbound left turn demand onto Bayview Road and no dedicated left turn lane. The inside northbound left turn acts as a "de-facto" left turn lane, which restricts northbound through capacity to one lane.

One option to mitigate the traffic delays at this intersection is to widen Bedford Highway to provide a dedicated northbound turning lane while maintaining two northbound through lanes. This option may require some widening beyond the existing CN rail fence and relocation of retaining walls. Further details on this option and its impacts are discussed under Functional Design Alternatives in **Section 8.6**.

Dartmouth Road Intersection Upgrade

This intersection operates at LOS C under existing conditions and is projected to operate at LOS D by 2031. The key issues are the left turn demand from Bedford Highway onto Dartmouth Road and the left turn demand from Dartmouth Road onto Bedford Highway. Several options were considered for this intersection:

1. Modify the Dartmouth Road-to-Bedford Highway left turn to be a double left turn with two southbound receiving lanes on Bedford Highway. This left turn would operate on a protected

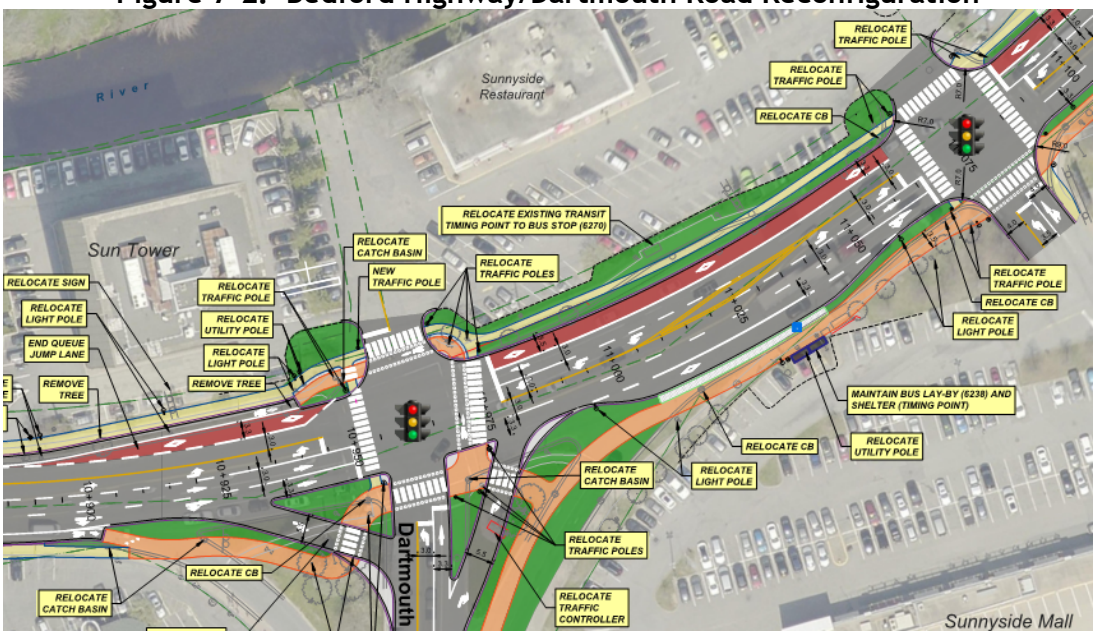
effectiveness of this option is limited by the short length of double receiving lanes on Bedford Highway. Given that left turn vehicles would need to merge into one lane quickly, it would likely lead to imbalanced lane utilization and the full advantage of the double left would not be achieved. A split phase would also increase the cycle length which is less desirable for pedestrians.

2. Implement a Multi-lane Roundabout, which would provide significant reductions in delay at this location and better handle the conflicting left turn demands than the signalized options. A single lane roundabout could provide acceptable levels of service, but a multi-lane roundabout provides better lane continuity on Bedford Highway between Dartmouth Road and the Sunnyside Mall entrance; however multi-lane approaches can be less desirable for pedestrians. A roundabout could fit at this location with only minor right-of-way impacts. Further details on this option and its impacts are discussed under Functional Design Alternatives in **Section 8.6**.

3. Maintain existing lane capacity but modify intersection channels to be more pedestrian friendly and implement transit priority measures, which could include:
    a. Southbound queue bypass lane on Bedford Highway. Transit vehicles exiting the SB timing point (relocated to stop 6270) could enter the transit lane directly.
    b. A transit signal could be installed for transit vehicles turning left on Dartmouth Road so that they can use this bus layby as a timing point and make a left turn directly from the bay layby. The proposed geometry can accommodate both standard and articulated left turning buses. This measure would need to be discussed further with Halifax Transit.

This option, shown below, maintains status quo capacity for vehicles, but performance can be improved through traffic signal coordination. This option has been carried forward in the Functional Design Drawings given its smaller footprint, benefits to pedestrians, and benefits to transit.

Figure 7-2: Bedford Highway/Dartmouth Road Reconfiguration

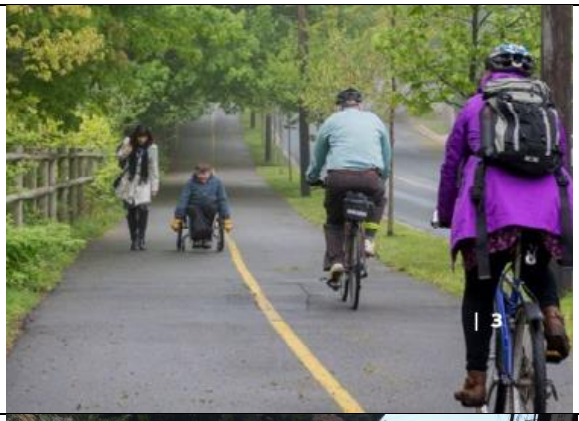


7.2 AT Improvement Opportunities

Cycling Facility Types

The primary types of cycling facilities applicable for consideration along Bedford Highway are cycle tracks (protected bike lanes), multi-use trails, and bike lanes (buffered/unbuffered). A description of each type of facility is provided in **Figure 7-3**.

Figure 7-3: Cycling Facility Types

Cycle Tracks (Protected Bike Lanes) Cycle tracks (also referred to as protected bike lanes or separated bike lanes) are enhanced cycling facilities that provide some form of physical protection between cyclists and moving cars i.e. bollards, curbs, or parked cars, as examples. Cycle tracks can be one-way or two-way and are most appropriate on arterial roads, depending on the speed and volume of traffic.	
Multi-Use Trail Multi-use trails are located off-road, either in the boulevard of a roadway or through green space/parkland. Both pedestrians and cyclists can use these facilities, and pavement markings and signage can help to clarify how users should share the path.	
Bike Lanes Bike lanes are lanes dedicated exclusively for use by cyclists through a combination of pavement markings and signage. Buffered bike lanes are similar to conventional bike lanes but incorporate a painted buffer area to provide additional clearance and comfort between cyclists and vehicles.	

Cycling Facility Selection Tool

One of the key goals of the project as noted through the multi-modal level of service review and target-setting exercise is to improve the comfort and safety of the corridor for cyclists. To inform the concept design, a cycling facility selection analysis was completed to identify whether a shared, dedicated or separated facility is warranted along the various sections of the corridor.

The review was based on the Ontario Traffic Manual (OTM) Book 18 cycling facility selection process. A number of criteria (including road class, volume and speed) were reviewed along the corridor to identify an appropriate facility class. Based on the facility selection review, a **separated cycling facility** (e.g. cycle track or multi-use trail) is deemed appropriate along most of the corridor. In some sections of the corridor, a dedicated facility (e.g. buffer bike lanes) may also be considered. Results are summarized in the following tables and detailed analysis sheets are included in **Appendix G**.

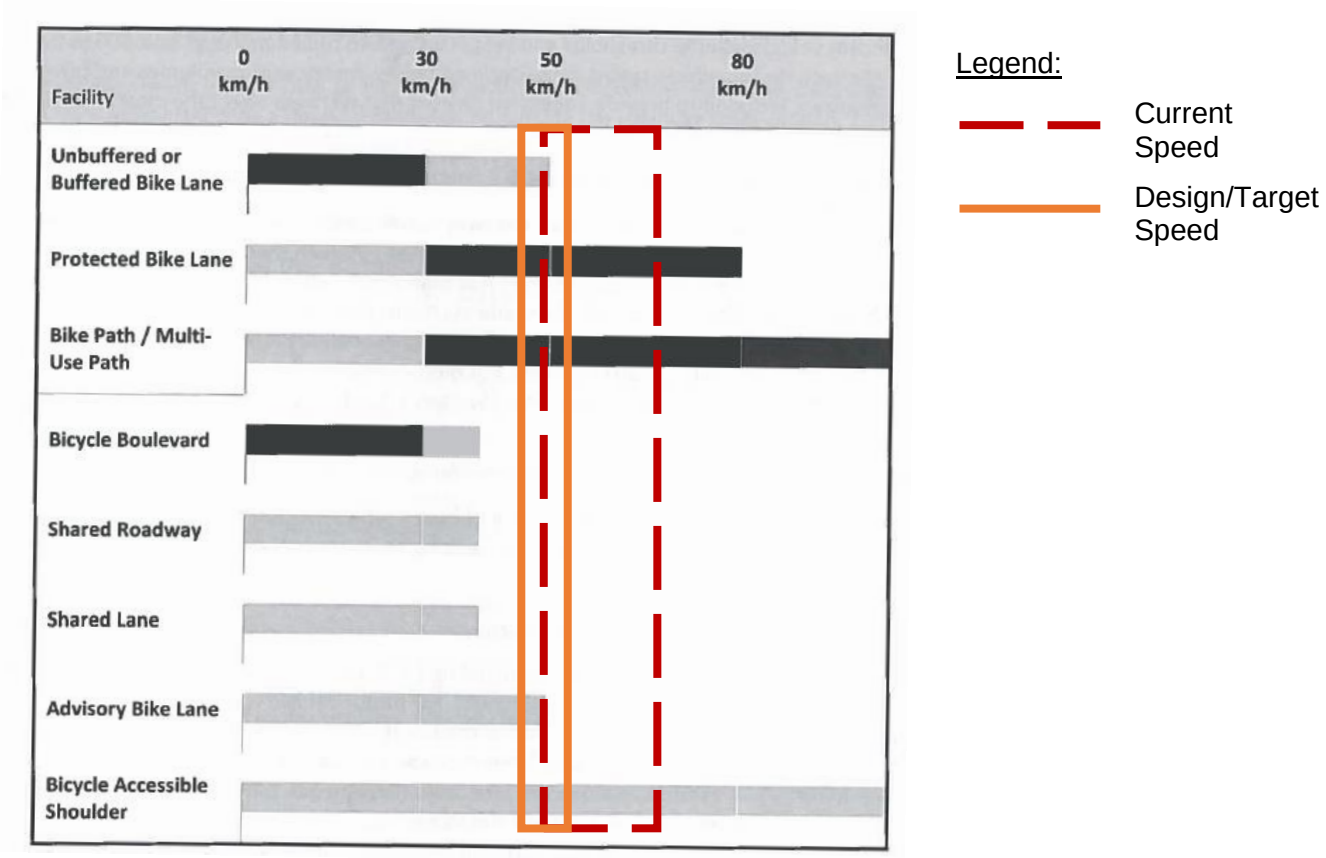
Table 7-1: Recommended Cycling Facility Types

Segment	Limits	AADT	Lanes	Preferred Facility
I	Windsor to Sherbrooke	48,300	4	Separated
II	Sherbrooke to Kearney Lake	23,500	2	Separated
III	Kearney Lake to Larry Uteck	19,500	2	Separated
IV	Larry Uteck to Hammonds Plains	19,500	2	Separated
V	Hammonds Plains to Union Street	21,500	2	Separated
VI	Union Street to Highway 102	16,400	4	Separated*

*The traffic volume suggests a dedicated facility may also be applicable, but the existing five-lane cross-section could lead to higher vehicle speeds, even if the speed limit is posted at 50 km/h.

As a supplement to the OTM analysis (which provides a high level of detail regarding factors for cycling facility selection), the 2017 TAC Geometric Design Guide was also reviewed. The TAC guidelines suggest that for speeds greater than 50km/h, **cyclists should generally be separated from motor vehicle traffic** by a physical barrier or be outside the roadway cross-section except along rural sections where paved shoulders may be considered. Through the planning work to date, a modification to a uniform 50 km/h design / target / posted speed along Bedford Highway has been proposed. With this change, the facility selection tool has more flexibility, including the potential to consider buffered/conventional bike lanes.

Figure 7-4: TAC Bicycle Facility Selection by Roadway Speed



Source: TAC Geometric Design Guidelines; Chapter 5 - Bicycle Integrated Design (2017), Figure 5.4.1

Cycling Connections

Integrating the planned facilities along Bedford Highway with existing and planned facilities on intersecting streets will increase the connectivity of the bike network and overall attractiveness of the route. Existing and planned cycling facilities on streets that intersect Bedford Highway are outlined in **Table 7-2** below.

Table 7-2: Intersecting Cycling Routes

Intersecting Roadway / Trail Name	Status	Facility Type	Source
Kearney Lake Rd	Desired	Desirable Connection (Type TBD)	HRM AT Plan
Larry Uteck Blvd	Proposed	Bike Lane / Paved Shoulder	HRM AT Plan
Hammonds Plains Rd	Desired	Desirable Connection (Type TBD)	HRM AT Plan
Meadowbrook Rd	Proposed	Local Street Bikeway	HRM AT Plan
Union St / Bedford Sackville Connector Greenway Trail	Existing	Active Transportation Greenway	HRM AT Plan
Rocky Lake Dr	Desired	Desirable Connection (Type TBD)	HRM AT Plan

At the intersecting routes where the side street facility type is known, special consideration should be given to treatments that improve access for cyclists i.e. advanced bike boxes, two-stage left turn queue boxes and/or jughandles.

Sidewalk Extensions

An objective of the functional design was to provide sidewalks on both sides of Bedford Highway (or a sidewalk on one side and a multi-use trail on the other) through all developed areas to improve access to transit stops as well as general pedestrian connectivity through communities. This results in opportunities for new sidewalk (or multi-use trail) facilities where none currently exist, totaling 7,800m and as summarized in **Table 7-3**. Note that these figures do not include sections of existing sidewalk that would be replaced by a multi-use trail.

Table 7-3: Opportunities for New Sidewalk/Trail Facilities

Sidewalk Section	Length
Manor Lane to MSVU (east side)	1,150m
Tremont Drive to Kearney Lake Road (east side)	900m
Kearney Lake Road to Charlotte Lane (one side)*	1,600m
Charlotte Lane to Larry Uteck Boulevard (both sides)	300m x 2
Larry Uteck Boulevard to Clearwater Seafoods (one side)*	750m
Clearwater Seafoods to Southgate Drive (both sides)	800m x 2
Southgate Drive to Moirs Mill Road (east side)	500m
North of Convoy Run to North of Sullivans Hill (east side)	400m
Spring Street to South of Hatchery Lane (east side)	300m
Total	7,800m

*These sections contain undeveloped areas where a sidewalk/trail is required only on one side and the other side would remain as a paved shoulder.

Pedestrian Crossings

There are currently 25 pedestrian crossing locations along Bedford Highway, including 17 crossings at traffic signals, 7 RA-5 crossings and 1 signed and marked crossing. Based on discussions with HRM Traffic and Transit staff, two potential new crossing locations were identified – one at Torrington Drive and one at the new development north of Larry Uteck Boulevard. Based on roadway, speed, and traffic volume characteristics, these two new crossings could be controlled by RRFBs per the TAC Pedestrian Crossing Control Manual. Additionally, it is recommended that the signed and marked crosswalk at Sullivan's Lane be upgraded to an RRFB.

Table 7-4 lists all existing and proposed pedestrian crossings on Bedford Highway, including the existing or proposed type of crossing control and the distance between crossings. Generally, the distance between crossings is between 200 and 500m. The longest distance between crossings is from north of Larry Uteck Boulevard (station 6+280) to Southgate Drive, a distance of 1,320m. Another new crosswalk might be considered in this area, perhaps in the vicinity of Millview Avenue to reduce the distance between crossings.

Table 7-4: Existing and Proposed Pedestrian Crossing Locations

Pedestrian Crossing Location	Station	Status	Type	Distance from Previous Crossing
Manor Lane	1+000	Existing	Traffic Signal	---
Bayview Road	1+300	Existing	Traffic Signal	300m
Seton Road	1+900	Existing	RA-5[1]	600m
MSVU	2+200	Existing	RA-5	300m
Flamingo Drive	2+650	Existing	Traffic Signal	450m
Tremont Drive	3+050	Existing	RA-5	400m
Torrington Drive	3+430	NEW	RRFB	380m
Kearney Lake Road	3+980	Existing	Traffic Signal	550m
Kent Avenue	4+970	NEW	RRFB	990m
Charlotte Lane	5+630	Existing	RA-5	660m
Larry Uteck Boulevard	5+930	Existing	Traffic Signal	300m
North of Larry Uteck Boulevard	6+280	NEW	RRFB	350m
North of Fern Avenue	6+780	NEW	RRFB	500m
Southgate Drive	7+600	Existing	Traffic Signal	820m
Nelsons Landing Boulevard	7+880	Existing	RA-5	280m
Moirs Mill Road	8+130	Existing	Traffic Signal	250m
Hammonds Plains Road	8+300	Existing	Traffic Signal	170m
Convey Run/Holland Avenue	8+780	Existing	Traffic Signal	480m
Sullivans Hill	9+400	Existing	RRFB[2]	620m
Meadowbrook Drive	9+680	Existing	Traffic Signal	280m
Spring Street	9+980	Existing	RA-5	300m
Hatchery Lane	10+340	Existing	Traffic Signal	360m
Union Street	10+480	Existing	Traffic Signal	140m
Civic 1496 (Bedford Tower)	10+720	Existing	RA-5	240m
Dartmouth Road	10+960	Existing	Traffic Signal	240m
Sunnyside Mall 1	11+080	Existing	Traffic Signal	120m
Sunnyside Mall 2	11+230	Existing	Traffic Signal	150m
Bedford Place Mall	11+380	Existing	Traffic Signal	150m
River Lane	11+640	Existing	Traffic Signal	260m

[1] A traffic signal may be installed at this crossing should the Seton Ridge development proceed.
[2] The crossing at Sullivan's Hill is signed and marked currently, but should be upgraded to an RRFB based on existing traffic volumes and street width.

To improve pedestrian safety at RA-5, RRFB, and signed and marked crossings, it is recommended that pedestrian safety islands be installed, subject to suitable site conditions. Safety islands provide the benefit of two-stage crossings, traffic speed reduction, and blocking centre left turning lanes from being used as overtaking lanes. They may also be used to enhance streetscaping. Further details on proposed pedestrian safety islands are discussed in **Section 8.0**.

7.3 Transit Improvement Opportunities

Candidate Transit Priority Measures

Based on the existing conditions analysis, bus arrival time is highly variable at transit stops along the Bedford Highway corridor. In addition, there are also several transit routes that enter Bedford Highway behind schedule. Transit Priority Measures (TPMs) are, in general, designed to improve transit services by reducing travel time and travel time variability to improve on-time performance. This assessment of potential TPM takes into account the following factors:

- Existing transit operations;
- Future traffic projections discussed in **Section 6.0**; and
- Future transit routes.

To improve transit operations, there is a suite of TPM that can be considered for implementation. In general, these measures can be grouped into three broader categories, as follows. It is important to note that TPM techniques from various TPM categories can be combined to develop a "layered" TPM solution.

Regulatory Measures

Regulatory measures are transit priority measures that can be applied through existing legislation/regulations, typically through signage and/or pavement markings. Alternatively, new legislation/regulations may be proposed at federal, provincial, and/or municipal levels, if existing legislation does not exist to support the proposed measure. The time required for new legislation to be passed will vary. Furthermore, the implementation of regulatory measures may not be as effective as other measures presented below, as full compliance to the regulatory changes may be a challenge.

Regulatory measures include, but are not limited to, vehicular lane use restrictions, time-of-day or part-time reserved transit lanes and on-street parking restrictions, and turn restrictions by time-of-day or period (e.g. Monday to Friday, etc.). Provincial legislation already requires motorists to yield to buses when they indicate their intention to pull into a traffic lane.

Transit Signal Priority

Transit Signal Priority (TSP) refers to the adjustment of the existing phase timings and/or phase sequence to provide preferential treatment to transit vehicles at a signalized intersection. These techniques range from passive approaches that prioritize transit movements by adjusting standard timing plans to suite transit operations, or active TSP where traffic control algorithms are dynamically invoked in response to real-time positioning data provided by transit vehicles. Examples of active TSP include, but are not limited to, green extension, red truncation/early green, phase insert, phase rotation.

In general, the implementation of TSP has a small impact on general traffic, and recovery usually occurs within one signal cycle. However, it is good practice to consider the effects of providing preferential treatment to transit when implementing TSP at a specific location. In addition to providing priority to transit vehicles, the use of TSP may also provide benefits for general traffic.

For example, general traffic travelling through an intersection concurrently with transit can benefit from longer green time as a result of TSP (either passive or active).

Additional benefits in implementing TSP may include, but are not limited to, the following:

- Reduction in delay at the intersection;
- Conditional TSP can discern whether a route is behind schedule. As a result, TSP measures would only be provided when it is required by the bus;
- Reduces travel time variability, while increasing reliability;
- Facilitates complex transit movements (e.g. turning left from the curb lane); and
- Improves overall safety of the intersection.

The location of the station/stop may have an impact on transit reliability, performance, and how effective TSP operations will be. Optimizing the location of the transit station/stop can minimize exposure to vehicular conflicts, and/or improve TSP efficiency.

The variability in passenger service time (dwell time) can make it difficult to accommodate TSP effectively at locations with near-side stops. However, at stops with low passenger service time variability and a high level of priority granted, TSP can be very effective in reducing the amount and variability of delay. At stops with low passenger service time variability, passengers can often be served during the red display (unlike at far-side stops). Near-side stops facilitate transit vehicle insertion into traffic, as the transit vehicles can use the width of the cross street to merge into the traffic lane.

Generally, far-side stops can accommodate TSP more easily than near-side stops due to the variability of time taken for passengers to board and exit a bus. As a result, the transit vehicle's estimated time of arrival at the intersection is easier to predict. Far-side stops also simplify the TSP parameters.

Implementation of active transit signal priority will require additional on-board equipment. The implementation plan and cost estimates presented in **Section 8.7** have taken this into consideration.

Physical Measures

Physical improvements may be applied to create an exclusive transit runningway or to change the geometric design of a street segment to improve the operation of transit vehicles. Physical improvements to create an exclusive transit runningway, as defined in the "Guidelines for the Application and Display of Transit Signals" by TAC, may be "dedicated" (the transit lane is continuous from signalized intersection to signalized intersection), or "localized" (a transit lane is provided on the signalized intersection approach). Examples include busways, transit malls, reserved lanes, and queue jump lanes. Physical improvements to the street, such as geometric improvements at intersections, bus bulbs, and bay laybys, are designed to improve transit service when operating in general traffic.

The implementation of physical TPM is intended to minimize interactions between transit vehicles and other vehicles and increase the efficiency of the transit system. Some disadvantages of implementing physical measures may include:

- Capacity constraints to general traffic;
- More complex traffic operations at signalized intersections; and
- Increase capital costs if road widening is required to accommodate the additional lane.

Transit Priority Assessment and Selection

The Transportation Association of Canada (TAC) publication, "Guidelines for Planning and Implementation of Transit Priority Measures" (2012), identifies a variety of TPM and provides guidance for practitioners in selecting the appropriate measures to implement. The selection process involves six steps; however, the primary focus was Step 1 to Step 4, as Steps 5 and 6 are TPM Implementation and Post Evaluation, respectively. Steps 1 to 4 are presented below:

- **Step 1: Trigger** – This identifies what actions/events initiated the need to implement TPM;
- **Step 2: Preliminary Assessment** – Identifies the problem and assesses if issues are localized or corridor-wide;
- **Step 3: Identify Potential TPM**; and
- **Step 4: Assess Impacts to Guiding Principles** established in the TAC manual. The Guiding Principles are Safety, Delay, Disruption to other Road Users, Consistency/Conspicuity, and Pragmatism.

Using the above steps as a basis for evaluation, the selection of the potential TPM along Bedford Highway is presented below. Note that the following sections summarizes the findings from each of the steps. Refer to **Appendix H** for the template tables containing the detailed information for the selection of the proposed TPM.

Step 1: Trigger

As highlighted in the IMP, Bedford Highway was identified as a proposed transit priority corridor where TPMs are desired. Furthermore, one of the objectives of this functional plan is to improve transit operations along the corridor.

Step 2: Preliminary Assessment

Based on the analysis of existing transit performance, outbound transit vehicles were found to be arriving at the Bedford Highway corridor late. Upon entering the corridor, there were no significant increases in transit delays, except for certain segments. Inbound transit vehicles are delayed within the Bedford Highway corridor itself, though the source of that delay is at the entry point to the Halifax peninsula.

Given that the significant variability in arrival times is not localized to a single intersection, the selection of appropriate TPMs is a corridor wide concern; however, with the changes in the cross-section throughout the corridor and the trends in transit operations identified in the existing assessment, the corridor was further subdivided such that the selection of TPM would be better suited to accommodate transit operations for each section. For the purpose of TPM assessment, these road sections are:

- Bedford Highway from Joseph Howe Drive to Kearney Lake Road;
- Bedford Highway from Kearney Lake Road to Southgate Drive;

- Bedford Highway from South Gate Drive to Hatchery Lane; and
- Bedford Highway from Hatchery Lane to Oakmount Drive.

Within these road sections, localized measures have also been proposed to aid transit operations for routes that are turning on and off the Bedford Highway corridor. These locations include:

- Bedford Highway at Flamingo Drive;
- Bedford Highway at Larry Uteck Boulevard; and
- Bedford Highway at Dartmouth Road.

From the results of the future (Do-Nothing) traffic analysis, the general trends in traffic operations remain similar to the existing conditions. Overall, traffic operations would still be good along the northern sections of Bedford Highway, but become progressively more congested as traffic approaches the Windsor Street Exchange. The main exception is friction with local traffic within Bedford itself during the PM peak.

The findings of the TPM assessment and proposed measures, based on Steps 3 and 4 of the selection process, are summarized in **Table 7-5** for corridor level measures and **Table 7-6** for intersection level measures.

Table 7-5: TPM Assessment for Corridor Sections

Road Section	Key characteristics	Proposed TPM
Joseph Howe Drive to Kearney Lake Road	• Significant variability in bus arrival times in the southbound direction during the AM peak; • Traffic operations are generally poor in the southbound direction; • Traffic signals are generally far apart; • Driveways/accesses are frequent through this section.	**Dedicated southbound bus lane**. There are approximately 20 inbound buses that would use the dedicated lane on headways of approximately 4 minutes. As a result, general traffic perception of the implementation of the dedicated transit lane should be positive.
Kearney Lake Road to Southgate Drive	• Only 3 signalized intersections in this segment; • 3-lane cross-section along the majority of the section; • Driveways/accesses are infrequent along section; • Intersection spacing is at least one kilometre; • Transit delays generally increase after Larry Uteck Boulevard in the southbound direction during the AM peak, and northbound during the PM peak; • Coordination between signalized intersections may not benefit transit as there is ~1 km between signalized intersections.	**Active TSP at signalized intersections**. Although overall travel time savings may be minimal, there may be some local benefits. Active TSP will require additional on-board bus equipment.
Southgate Drive to Hatchery Lane	• 2-lane cross-section along the majority of the section; • Overall traffic operations are good along this section; • Based on the information provided, the number of inbound buses being late increases at the intersection of Bedford Highway/Moirs Mills Road.	**Passive TSP, Active TSP, and a curbside bus lane**. Active TSP will require additional on-board bus equipment. A short curbside bus lane is proposed from Moirs Mill Road to Hammonds Plains Road in the southbound direction.
Hatchery Lane to Oakmount Drive	• No significant increases in transit delay are experienced along this stretch; • General traffic operations are good, but the closely spaced traffic signals result in frequent stops. • The majority of transit vehicles travel along Bedford Highway versus entering from side streets. • Traffic signals are at most 400 metres apart; and • Road widening not proposed.	**Passive and Active TSP**. As there are no significant transit issues experienced and general traffic operations are good, it is proposed that the signalized intersections be coordinated in the northbound and southbound directions. If transit vehicles are behind schedule, TSP is proposed in the form of green extensions or early green actuation (red truncation). Opticom GPS equipment will be required to be installed on each bus.

Table 7-6: TPM Assessment for Selected Intersections

Road Section	Key characteristics	Proposed TPM
Bedford Highway at Flamingo Drive	• Eastbound right turn transit delays are attributable to the southbound queues spilling back to this intersection during the AM peak; • There were minimal delays associated with the northbound left turning vehicles at this intersection. Transit delays that were observed were primarily due to vehicles entering the corridor already behind schedule	**Active Transit Signal Priority** for the eastbound right turn movement that would benefit both transit and automobile traffic waiting to turn right onto Bedford Highway. This measure would be more beneficial following an improvement to Windsor Street Exchange that would reduce southbound queuing on Bedford Highway.
Bedford Highway at Larry Uteck Boulevard	• Transit vehicles were observed to be behind schedule at this intersection. The associated movements for entering and exiting buses are the eastbound right turn (inbound) and northbound left turn (outhbound); • Analysis indicates that northbound left turn and eastbound right turn operations are generally good under the existing conditions and future conditions; • Eastbound right turning movement is currently channelized.	**Passive Transit Signal Priority**. Retiming the intersection may help to reduce the amount of delay experienced by transit vehicles. The proposed measures upstream and downstream of the intersection may also help reduce the amount of delay experienced by Route 90.
Bedford Highway at Dartmouth Road	• The southbound left turn movement from Bedford Highway on Dartmouth Road was indicated to be a source of delay for transit vehicles; • The westbound right turn movement from Dartmouth Road onto Bedford Highway is a source of delay for transit. Currently, this movement is channelized. Delays associated with this movement may be attributed to the traffic conditions at the downstream intersection (Sunnyside Mall entrance).	**Actuated Transit Signal Priority** and **Queue Jump Lane** for left turning traffic. Southbound left turning transit vehicles from the proposed queue jump lane would require a dedicated transit phase for buses to turn onto Dartmouth Road. Transit vehicles travelling straight through the intersection can use the queue jump lane or general traffic lanes, so that they can proceed through the intersection on Bedford Highway through green phase.

7.4 Cross-Section Design Criteria

Design criteria were established for roadway, transit, and active transportation cross-section elements in consultation with the HRM internal stakeholders. The TAC 2017 Geometric Design Guide, HRM Red Book, City of Toronto Lane Width Guidelines, and NACTO Bikeway Urban Design Guide were used as reference standards. The agreed-upon design criteria are presented in **Appendix I**.

A fundamental design element to this functional plan is the narrowing of traffic lanes to 3.3m for curb lanes (measured to face of curb) and 3.0m for interior lanes. The narrower lanes allocate space for other modes which is critical to achieving MMLOS objectives. The lane width criteria follow the City of Toronto guidelines for urban street lane widths and are appropriate if the posted speed limit is reduced to 50 km/h throughout the corridor.

7.5 Cross-Section Assessment

Applying the design criteria, the Study Team prepared fifteen potential cross-sections that could be applicable to various segments of the corridor. These cross-sections are shown in **Appendix J** and demonstrate the widths required to accommodate a range of AT facility types in combination with varying numbers of transit and traffic lanes. AT facilities include two-way cycle tracks, one-way cycle tracks, multi-use paths, bike lanes and sidewalks. Two, three, and four lane cross-sections are shown.

Each of the six corridor segments was then reviewed to determine typical widths available, respecting major constraints such as retaining walls, steep slopes, rail infrastructure, and developed properties. The candidate cross-sections were vetted to determine which cross-sections could realistically fit along each segment while also considering minimum functional requirements (e.g. minimum # of traffic lanes to be maintained and minimum sidewalk requirements).

The cross-section fit analysis is mapped in **Table J.1** of **Appendix J**. Generally, this assessment determined that one-way cycle tracks are not feasible throughout, as available widths do not allow for a continuous facility. A two-way cycle track is possible but becomes difficult in some areas where an adjacent sidewalk is required and where transit stops need to be accommodated. A multi-use path is the preferred AT facility because it avoids the need for separate cycling and walking facilities and therefore fits within most segments. Although some functionality may be lost by mixing AT users, this trade-off is considered acceptable to achieve a continuous separated AT facility. The fit-analysis also informed where additional sidewalks, transit or traffic lanes would be possible.

7.6 MMLOS Targets

MMLOS targets were established for each road segment in consultation with HRM stakeholders. These targets are provided in **Table 7-7** and have been used to evaluate how well corridor options satisfy level of service objectives for each mode.

Table 7-7: MMLOS Targets

Segment	Pedestrian LOS		Bicycle LOS	Bus Transit LOS	Truck LOS	Auto LOS	Corresponding Facilities to Achieve Target
	West	East					
1: Windsor to Sherbrooke	C	C/F	A	B	C	E	• **Pedestrian**: 2.0m sidewalks with narrow (0-0.5m) boulevards assuming >50 km/h operating speed • **Bicycle:** Separated cycling facility • **Bus Transit:** Bus lane with limited parking/driveway friction • **Truck:** Curb lane width ≥ 3.3m
2: Sherbrooke to Kearney Lake	C	C/F	A	B	C	E	• **Pedestrian:** 2.0m sidewalks with narrow (0-0.5m) boulevards assuming ≤50 km/h operating speed. • **Bicycle:** Separated cycling facility • **Bus Transit:** Bus lane with limited parking/driveway friction • **Truck:** Curb lane width ≥ 3.5m
3: Kearney Lake to Larry Uteck	C/F	C/F	A	C	C	E	• **Pedestrian:** 2.0m sidewalks with narrow (0-0.5m) boulevards assuming >50 km/h operating speed. Sidewalk on one side only in undeveloped areas. • **Bicycle:** Separated cycling facility or buffered bike lanes • **Bus Transit:** Bus lane with frequent parking/driveway friction • **Truck:** Curb lane width ≥ 3.5m
4: Larry Uteck to Hammonds Plains	C/F	C/F	A	C	C	E	• **Pedestrian:** 2.0m sidewalks with narrow (0-0.5m) boulevards assuming >50 km/h operating speed. Sidewalk on one side only in undeveloped areas. • **Bicycle:** Separated cycling facility or buffered bike lanes • **Bus Transit:** Bus lane with frequent parking/driveway friction • **Truck:** Curb lane width ≥ 3.5m
5: Hammonds Plains to Union	B	B	B	C	D	E	• **Pedestrian:** 2.0m sidewalks with 0.5-2.0m boulevards • **Bicycle:** Bike lanes (1.5-1.8m wide, not adjacent on-street parking) • **Bus Transit:** Bus lane with frequent parking/driveway friction • **Truck:** Curb lane width ≥ 3.3m
6A: Union to Rocky Lake	B	B	B	C	C	E	• **Pedestrian:** 2.0m sidewalks with 0.5-2.0m boulevards • **Bicycle:** Bike lanes (1.5-1.8m wide, not adjacent on-street parking) • **Bus Transit**: Bus lane with frequent parking/driveway friction • **Truck:** Curb lane width ≥ 3.3m
6B: Rocky Lake to Highway 102	C	C	C	C	C	E	• **Pedestrian:** 2.0m sidewalks with narrow (0-0.5m) boulevards assuming >50 km/h operating speed • **Bicycle:** Bike lanes (1.5-1.8m wide, not adjacent on-street parking) • **Bus Transit:** Bus lane with frequent parking/driveway friction • **Truck:** Curb lane width ≥ 3.3m

7.7 Corridor Concept Options

A concept design workshop was held with HRM Internal Stakeholders on December 11, 2018. The candidate cross-sections were presented along with a constraint assessment of the corridor, demonstrating which sections fit and which do not. Direction was provided by the stakeholders as to which sections and facility options were preferred considering the constraints. The meeting also provided an opportunity to review stakeholder priorities, opinions on trade-offs and establish MMLOS targets. This information was used as inputs in developing corridor options.

Using all the inputs above, three corridor concepts were developed at a schematic level to demonstrate different ways to utilize the corridor space, continuity of facilities, MMLOS results, and ability to achieve MMLOS targets. The three corridor concepts are described briefly as follows:

- **Corridor Option 1 – Balanced:** Option 1 provides a continuous AT facility comprising a multi-use path with limited sections of bike lanes, sidewalk extensions, and targeted transit improvements including transit lanes, queue jumps, and transit signal priority.

- **Corridor Option 2 – Transit Focused:** Option 2 focuses the improvements primarily on transit improvements, such as strategically located transit lanes to a larger extent than Option 1. AT improvements are limited to sidewalk extensions, widening of existing bike lanes and adding limited sections of new bike lanes.

- **Corridor Option 3 – AT Focused:** Option 3 focuses the improvements primarily on a continuous AT facility, comprising a multi-use path for the length of the corridor along with sidewalk extensions. No transit lanes are included in this option, although TSP would be considered.

More detailed descriptions of each option are provided in **Appendix K**, along with accompanying schematic diagrams showing existing and proposed roadway elements along the corridor. Note that cross-sections being shown within each option could be interchanged to reach a preferred corridor concept, as long as desirable continuity of facilities is maintained.

Common to all options is a proposed 50 km/h speed limit for the entire corridor. The reduced speed limit improves safety and MMLOS for AT users and permits the narrowing of traffic lanes to the widths being proposed.

As a means of evaluation, the MMLOS for each cross-section throughout the corridor was determined for each Corridor Option. These are shown in **Appendix K** along with the existing MMLOS for comparison. MMLOS results that meet or exceed the targets are shown in green, while results that do not meet targets are shown in red. Comments on the ability of each Corridor Option to meet MMLOS targets are as follows:

- **Option 1** meets targets for pedestrians and cyclists in most road segments but does not meet the transit target of MMLOS B & C, except for the segment from Kearney Lake Road to Bayview Road. Option 1 has limited impacts to traffic capacity given that the southbound

transit lane ends at Sherbrooke Drive, where the second southbound traffic lane (existing) begins. Bayview Road operates at LOS F and over capacity during both peak periods (similar to existing), but all other intersections operate below capacity with good levels of service.

- **Option 2** meets most transit targets south of Kearney Lake Road and selected locations in the north part of the corridor and meets most pedestrian targets, but fails to meet targets for cyclists except for limited sections where bike lanes are added or improved. Option 2 also results in significantly higher delays and longer queuing for general automobile traffic than Option 1 and 3. Approaches at Manor Lane, Bayview Road, and Seton Road operate at LOS F and over capacity, with 95th percentile queues that exceed 700m in the southbound direction in the AM peak.

- **Option 3** provides slight improvements in pedestrian and cyclist MMLOS but does not meet transit MMLOS targets on any segment in the corridor. Traffic operations are similar to Option 1.

Based on the above assessment, it was determined that Option 1 (Balanced) was an attractive option that should be advanced to functional design given its ability to achieve many of the modal objectives while limiting adverse impacts. Option 2 was also selected to be advanced to functional design given its contrasting ability to meet transit targets, albeit with impacts to cyclists and motor vehicles; however, the final version of Option 2 only has transit lanes south of Kearney Lake Road, since that is where transit priority is most beneficial. Option 3 was dropped from further consideration since it lacks transit priority and is otherwise quite similar to Option A. Further details on the Balanced and Transit Options are provided in **Chapter 8.0 – Functional Design**.

8.0 Functional Design

8.1 Selected Corridor Options

Following the evaluation of concept options, two corridor design options were selected to advance to functional design in consultation with the HRM internal stakeholders. These options are described as follows and are summarized in **Table 8-1**.

Option 1: Balanced Modes Option - This option provides a continuous AT facility and targeted transit priority improvements while minimizing impacts to existing traffic capacity. The continuous AT facility comprises a multi-use path along the basin side of the corridor, but with a 2.2 km section of bike lanes from Convoy Run to Dartmouth Road. Sidewalks are extended to provide connectivity within developed areas and improved access to transit stops. A dedicated bus lane is provided in the southbound direction from Kearney Lake Road to Sherbrooke Drive to assist buses in bypassing morning peak hour traffic queues. Other targeted transit improvements include transit signal priority and queue bypass lanes at strategic locations. A speed limit of 50 km/hour is proposed for the entire corridor to improve safety and permit narrowing of traffic lanes that will enable improvements for other modes. No traffic lanes are removed except for the left turn lane from Rutledge Street to Hatchery Lane.

Option 2: Transit Priority Option - This option focuses more heavily on transit improvements, specifically between Joseph Howe Drive and Kearney Lake Road where a dedicated bus lane is provided in each direction. The bus lanes will enable buses to bypass the most congested areas, improving transit travel times and reliability during peak hour, which will increase transit attractiveness and ridership and support HRM's mode share goals. To accommodate the two bus lanes, one southbound traffic lane is removed between Joseph Howe Drive and Sherbrooke Drive and no dedicated cycling facility can be installed between Manor Lane and Kearney Lake Road. Cyclists would be permitted to use the bus lanes. Further discussion on shared bus-bike lanes is provided in **Section 8.2**. North of Kearney Lake Road, this corridor option is the same as Option 1 - Balanced Modes.

Detailed functional design drawings were prepared for each corridor option and are provided separately from this report. The following sections provide discussions of:

- General design features found in each corridor option;
- Detailed description of the options by road segment;
- Operational performance of options, including MMLOS analysis;
- Key trade-offs;
- Design alternatives and considerations;
- Costing and implementation plan; and
- Commuter Rail considerations.

Segment level drawings for each option are provided in **Appendix L**.

Table 8-1: Highlights of Functional Design Options

Mode	Key Features Option 1 - Balanced	Option 2 - Transit Priority
	• SB Transit Lane from Kearney Lake Road to Sherbrooke Drive • Transit Queue Bypass Lanes at strategic locations • Transit Signal Priority • Removal of most bay laybys • Enhanced bus stops	• NB & SB Transit Lanes from Kearney Lake Rd to Joseph Howe Dr • Transit Queue Bypass Lanes at strategic locations • Transit Signal Priority • Removal of most bay laybys • Enhanced bus stops
	• 9.5 km of new Multi-Use Trail • 2.2 km of 2m wide Bike Lanes • Sidewalk extensions • 2 new Crosswalks to improve transit access • 6 pedestrian safety islands at crosswalks	• 6.5 km of new Multi-Use Trail • 2.2 km of 2m wide Bike Lanes • 3.0 km of Shared bus-bike lanes • Sidewalk extensions • 2 new Crosswalks to improve transit access • 6 pedestrian safety islands at crosswalks
	• Windsor Street Exchange Reconfiguration • Traffic signal coordination • Improvements to Bedford Highway/ Dartmouth Road intersection	• Windsor Street Exchange Reconfiguration • Traffic signal coordination • Improvements to Bedford Highway/ Dartmouth Road intersection

8.2 General Design Features

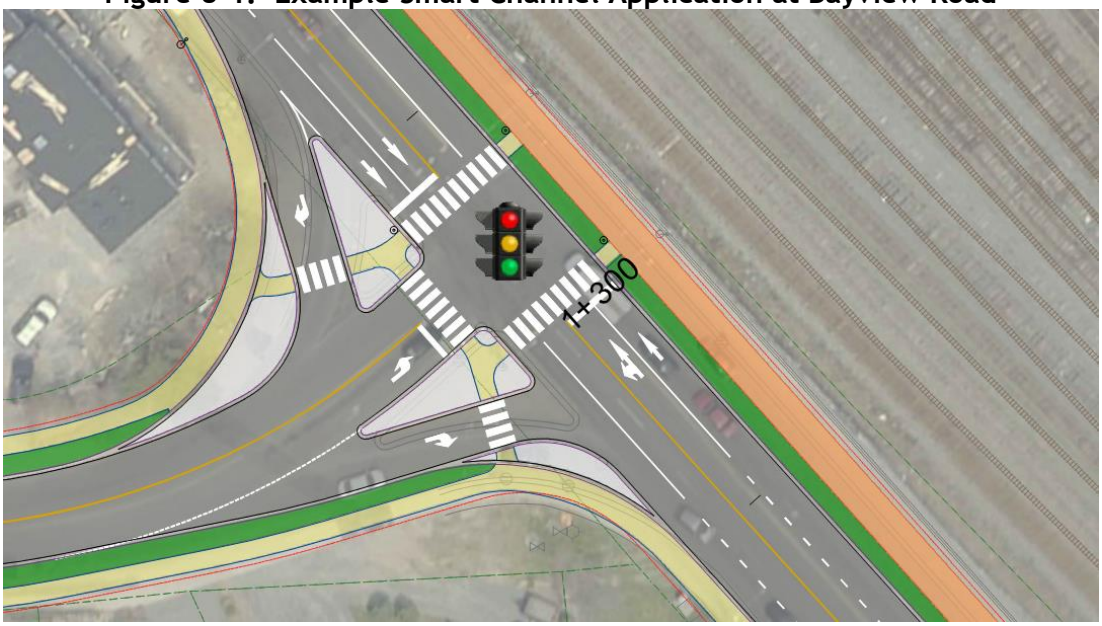
Intersection Smart Channels

Smart Channels are an emerging design approach for channelized right turn slip lanes at urban intersections. Traditional channelized designs tend to have large radii and wide lanes which result in higher turning speeds, indirect sight lines to pedestrians, and sharp entry angles onto the intersecting street. Smart Channels address these issues by increasing the road entry angle, which achieves the following:

- Reduces driver workload by relaxing the angle of shoulder check and entry;
- Improves visibility of pedestrians by reducing viewing angle; and
- Reduces turning speed to be more consistent with yield conditions that may require a full stop.

Smart Channels can still accommodate the turning movements of large vehicles by including a mountable truck apron which is custom designed for each intersection based on the design vehicle. An example of the application at Bedford Highway/Bayview Road is shown in **Figure 8-1**.

Figure 8-1: Example Smart Channel Application at Bayview Road



Smart Channels are recommended for all channelized intersections along Bedford Highway; however, it is preferable to remove channels altogether where practical, considering factors such as truck turning requirements, resulting crosswalk length, and placement of traffic signal poles and utility poles.

Pedestrian Safety Islands

A pedestrian safety island is a curbed island installed in the centre of a roadway at a pedestrian crossing location that reduces the exposure time experienced by a pedestrian. NACTO provides the following application guidelines for pedestrian safety islands.

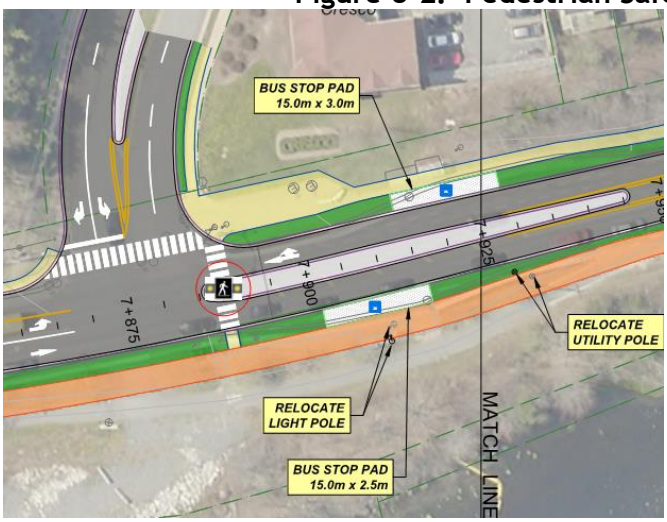
- While safety islands may be used on both wide and narrow streets, they are generally applied at locations where speeds and volumes make crossings prohibitive, or where three or more lanes of traffic make pedestrians feel exposed or unsafe.
- Pedestrian safety islands should be at least 1.8m wide but have a preferred width of 2.4-3.0m. The minimum protected width is 1.8m, based on the length of a bicycle or a person pushing a stroller. The island should be a minimum of 12m long.
- It is preferable to have the crosswalk "cut-through" the median. The cut-through or ramp width should equal the width of the crosswalk.
- All medians at intersections should have a "nose" which extends past the crosswalk. The nose protects people waiting on the median and slows turning drivers.

Additionally, the placement and design of pedestrian safety islands needs to consider:

- The roadway lane configuration and turning lane requirements;
- Any nearby driveways that may be impacted by the median;
- Vehicle turning paths where the island is located near an intersection; and
- Requirements for oversized load corridors. This applies to Bedford Highway south of Kearney Lake Road, where a minimum curb-to-curb width of 4.8m needs to be maintained.

Pedestrian safety islands are recommended at six crosswalk locations on Bedford Highway. These locations have 3-4 lane cross-sections with RA-5 or RRFB crossing control. An excerpt from the functional design drawings showing a pedestrian safety island at Nelsons Landing Boulevard is shown in **Figure 8-2** along with an example of an installed island (source: NACTO).

Figure 8-2: Pedestrian Safety Island Examples





Accessibility Upgrades

General accessibility upgrades are not shown in the functional designs but should be considered upon detailed design. These include the application of Tactile Walking Surface Indicators (TWSI's) at all crosswalk ramps, which is consistent with HRM's practice, and consideration of Accessible Pedestrian Signals at signalized intersections.

AT Design Treatments at Conflict Areas

The addition of high-quality active transportation facilities has been identified as a critical component of the functional design. The proposed options have much of the corridor including a multi-use path on the east (basin) side of the corridor, on-road bike lanes, sidewalks extensions and upgrades to transit stops. Several typical active transportation treatments have been developed for critical conflict areas and transition points to inform the subsequent stages of design. These typical treatments build upon the design criteria prepared for the corridor with an additional level of detail, including recommendations for pavement markings and signage. The memo attached in **Appendix M** illustrates typical treatments for the following:

- **Transit Stops**
  - Minimum requirements for transit stops;
  - Transit stop integration with Multi-use path (wide boulevard);
  - Transit stop integration with Multi-use path (narrow boulevard);
  - Transit stop integration with Multi-use path (rural cross-section).
- **Driveways**
  - with Multi-use path (constrained);
  - with Multi-use path (preferred).

- **Facility Transitions**
  - Multi-use path to on-road bike lanes at signalized intersection;
  - Multi-use path on one side of the street to the multi-use path on the far side.

Bus Stop Locations and Design

All bus stop locations were reviewed with respect to stop locations and the spacing between stops. Following discussions with HRM, it was agreed that the stops identified in **Table 8-2** could be eliminated or consolidated given the close spacing. All other bus stops are accommodated in the functional design. Slight location adjustments have been made to achieve the desired bus stop pad size and placement. Bus stop pad and shelter dimensions and placement were generally in accordance with HRM Standard Detail 56 and the multi-use trail treatments identified previously.

Table 8-2: Proposed Bus Stop Modifications

Bus Stop Location	Recommended Action
Inbound Stops	
Bedford Hwy Before Dartmouth Rd (6270)	Consolidate Timing Point with 6236 given the proposed queue bypass lane for thru and left turning buses.
After Meadowbrook Dr (6257)	Consolidate with 6261 north of Meadowbrook
Before Sullivan's Hill (6278)	Remove due to close spacing
Before Valley Rd (6280)	Remove due to close spacing
Between Hammonds Plains and Moirs Mill	New Stop
At Millview Ave (6258)	Consolidate stops with 6274
New stop between Larry Uteck and Fern	New Stop
Outbound Stops	
After Larry Uteck Blvd (6220)	Keep but adjust location
Opposite Glenmont Ave (6284)	Consolidate stops with 6232
After Valley Rd (6265)	Remove due to close spacing
Before Sullivans Hill (6244)	Remove due to close spacing
Opposite Fourth St (6283)	Remove due to close spacing
At Civic 1743 (6243)	Remove due to close spacing

Bay Laybys

Through discussions with HRM Traffic and Halifax Transit staff, it was agreed to remove all bay laybys along Bedford Highway with the exception of the pair of timing points at MSVU and Dartmouth Road. Removal of bay laybys allows that corridor space to be allocated to other modes while minimizing property acquisition. Removing bus laybys will benefit transit operations given that buses will not need to merge into general traffic; however, some additional traffic delays will be caused since buses will need to stop in the general-purpose lanes.

The two bay laybys that are being maintained are the timing points located at MSVU and Dartmouth Road. These bay laybys have been designed with 25m long bays plus tapers. The southbound bay layby at MSVU is proposed to be relocated given that there is insufficient space to accommodate it in its current location. The new location is just south of the MSVU main access and will require land acquisition from the University.

Enhanced Bus Stops

Enhanced bus stops are typically found at major destinations and/or a transfer location for a large volume of passengers. This classification represents a new level of investment in bus stops for Halifax Transit, meant to facilitate the transfers required to complete a trip in the transit network. A bus stop is a candidate to become an enhanced bus stop if there are more than 250 boardings per day, and the stop is serviced by at least two routes and/or is located at a regional destination or intermodal transportation hub. Bus stops will be upgraded to enhanced bus stops based on these criteria and availability.

The amenities at each enhanced bus stop will vary based on site conditions, but in addition to a shelter, they may be equipped with additional seating, lighting, passenger information (route maps or schedule information), waste receptacles, or additional/larger shelters. **Figure 8-3** shows examples of potential amenities provided at enhanced bus stops. Candidate bus stops for enhancement on Bedford Highway are as follows, based on current boardings and/or proximity to strategic development locations:

- MSVU – Daily Boardings = 194 Inbound / 151 Outbound
- Shaunslieve Drive/Charlotte Lane – Daily Boardings = 122 Inbound / 48 Outbound
- Hammonds Plains Road – Daily Boardings = 112 Inbound / 47 Outbound
- Sunnyside Mall – Daily Boardings = 112 Inbound / 36 Outbound

Figure 8-3: Examples of Enhanced Transit Stops





Shared Bus-Bike Lanes

In Option 2 – Transit Priority, the space allocated to the dedicated bus lanes south of Kearney Lake Road directly impacts the space available to provide dedicated cycling facilities. In some instances, this may require considering shared bus and bike lanes. According to NACTO:

> *"The shared bus-bike lane is not a high-comfort bike facility, nor is it appropriate at very high bus volumes. However, buses and bicycles often compete for the same space near the curb. On streets without dedicated bicycle infrastructure, curbside bus lanes frequently attract bicycle traffic, prompting some cities to permit bicycles in bus lanes. Shared bus-bike lanes can accommodate both modes at low speeds and moderate bus headways, where buses are discouraged from passing, and bicyclists pass buses only at stops. In appropriate*

conditions, bus-bike lanes are an option on streets where dedicated bus and separate high-comfort bicycle facilities cannot be provided." (Transit Street Design Guide).

These facilities are not preferred by cyclists or transit operators but reflect a compromised facility that is sometimes required along highly constrained corridors such as Bedford Highway. Examples of these facilities in other cities are shown in **Figure 8-4**.

Bus-bike lanes should only be considered where the following conditions are met:

- Transit headways are 4 minutes or longer with operating speeds below 30 km/hr. Where speeds or frequency of buses exceeds these thresholds, significantly more passing events (bus overtaking cyclists) will occur, which decreases the overall comfort and safety of the corridor. Currently, south of Kearney Lake Road, 14 buses operate on Bedford Highway in the peak hour direction. This equates to an average headway of 4.3 minutes. Bus operating speeds should be controlled to be within the 30 km/h limit. This limits the travel time advantage of the bus lane, but still allows the bus to move past queued automobile traffic.
- Shared lanes should be implemented as the curb lane (or adjacent to a parking lane) i.e. not as a centre-running / median lane.

In addition, the following design elements should be considered where bus-bike lanes are provided:

- The width of a full-time bus-bike lane should be 3.35 to 3.65m for curbside lanes.
- Lane widths can be wider than a conventional bus lane to permit passing within the lane (if feasible). For example, lane widths of 4.5m allow buses to pass cyclists in the same lane. However, lane widths of 4.0m to 4.5m should be avoided to limit unsafe passing movements.
- Appropriate signage and pavement markings must be provided to indicate buses and bikes share the lane.
- Attention must be paid to interactions between the shared bus-bike lane and right turning traffic from general purpose lanes at intersections. Right-turning traffic across the shared lane can severely impact the performance of the lane for buses and bicyclists, for example where right turns are allowed from the shared lane in areas where heavy pedestrian traffic delays right turns (Center for Urban Transportation Research, 2012). There is also a risk that right-turning vehicles may not notice or anticipate through cyclists within the bus-bike lane.

Figure 8-4: Examples of Shared Bus-Bike Lanes



Shared Bus, Bike and Taxi Lane
Viau Street, Montreal



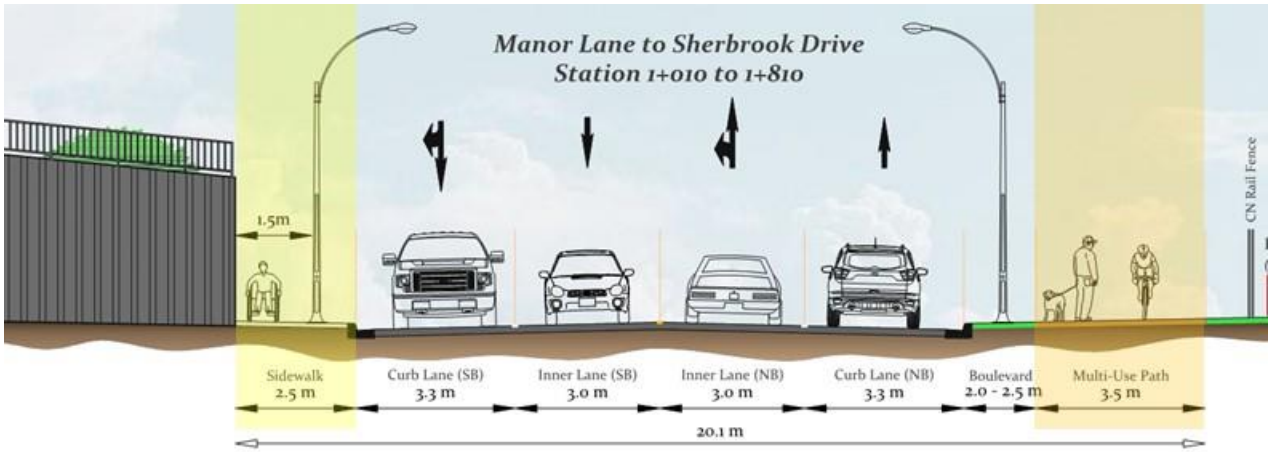
Shared Bus-Bike Lane
Douglas Street, Victoria BC

8.3 Functional Design Option 1 Description

Key features of **Option 1 - Balanced Modes** are presented below by mode for each corridor segment. Representative cross-sections are also shown for illustration purposes.

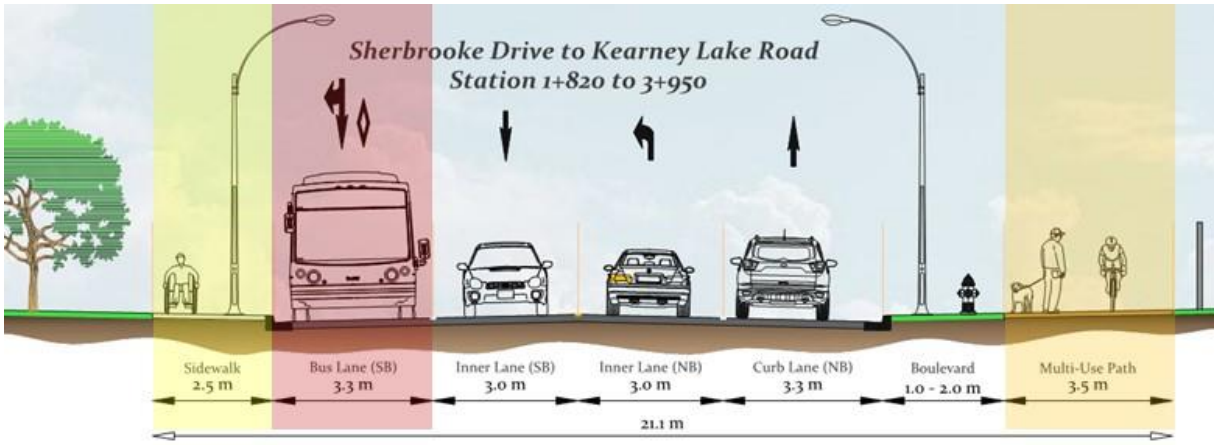
Segment 1 – Windsor Street to Sherbrooke Drive

Mode	Key Features
	• No physical TPM are proposed for this segment. • TSP may be considered at the Bayview Road and Manor Lane intersections. • The Windsor Street Exchange reconfiguration is expected to improve inbound bus travel times.
	• A multi-use trail is extended up the southwest side of Bedford Highway, from Windsor Street to Manor Lane. This provides connections to potential future AT extensions along Windsor Street and Joseph Howe Drive which possibly could connect with the Chain of Lakes Trail. • The multi-use trail switches to the east (basin) side of Bedford Highway at Manor Lane and continues north. Cyclists would use a proposed cross-ride at the Manor Lane traffic signal to cross Bedford Highway.
	• 2.5m wide sidewalk (including 0.5-1.0m reserved for utility poles) is provided adjacent to the curb on the west side of Bedford Highway from Manor Lane to Sherbrooke Drive and northward. • Pedestrians will benefit from the multi-use trail for general connectivity and transit stop access.
	• Windsor Street Exchange is reconfigured as described in **Section 7.1.** • Traffic signal coordination is implemented from Manor Lane to Flamingo Drive. • There is no impact to traffic lanes in this segment as the existing 4-lane cross-section is maintained, with two lanes in each direction.



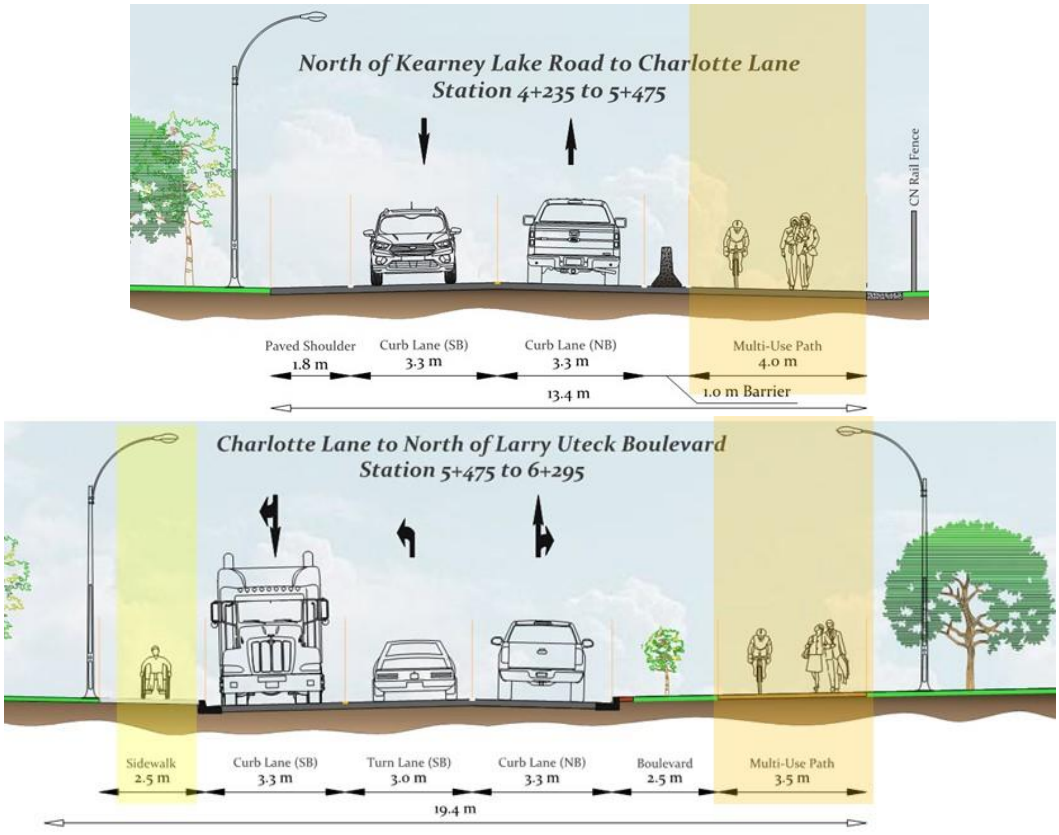
Segment 2 – Sherbrooke Drive to Kearney Lake Road

Mode	Key Features
	• A dedicated southbound transit lane would be implemented from Sherbrooke Drive to Kearney Lake Road. This would be a new lane, forming a 4-lane cross-section on Bedford Highway. The lane begins just north of Kearney Lake Road so buses can advance to the stop bar at the traffic signal. It is envisioned that this would be a permanent bus-only lane during all periods of the day, but general traffic would be permitted to turn right from the lane. • Bay laybys and associated timing points would be maintained at MSVU and upgraded to Enhanced Bus Stops. The southbound bay layby would be moved south of the MSVU main access. This would require property acquisition from the university. • TSP is implemented at the Flamingo Drive intersection to improve access onto Bedford Highway for inbound buses. • TSP may be considered at Kearney Lake Road subject to future transit performance.
	• The multi-use trail continues up the east side of Bedford Highway beyond Kearney Lake Road. MSVU is a major AT destination in this segment. • Cross-rides would be provided at the MSVU, Tremont Drive and Torrington Drive crosswalks.
	• A continuous 2.5m wide sidewalk (including a 0.5-1.0m buffer reserved for utility poles) would be provided adjacent to the curb on the west side of Bedford Highway from Sherbrooke Drive to Kearney Lake Road. • The existing crosswalk at Seton Road would be replaced with a traffic signal once the Seton Road development proceeds. • A pedestrian safety island is recommended at the existing crosswalks at the MSVU access and at Tremont Drive. RA-5 crossing control can remain or be replaced with an RRFB. • A new RRFB crosswalk is recommended at Torrington Drive including a pedestrian safety island. • Pedestrians will benefit from the multi-use trail for general connectivity along the east side and for transit stop access.
	• Traffic signal coordination is implemented from Manor Lane to Flamingo Drive. • Generally, the existing 3-lane cross-section is maintained with one thru lane in each direction and a centre turning lane, mostly used for northbound left turns, but will continue to serve two-way left turns in the Flamingo commercial area.



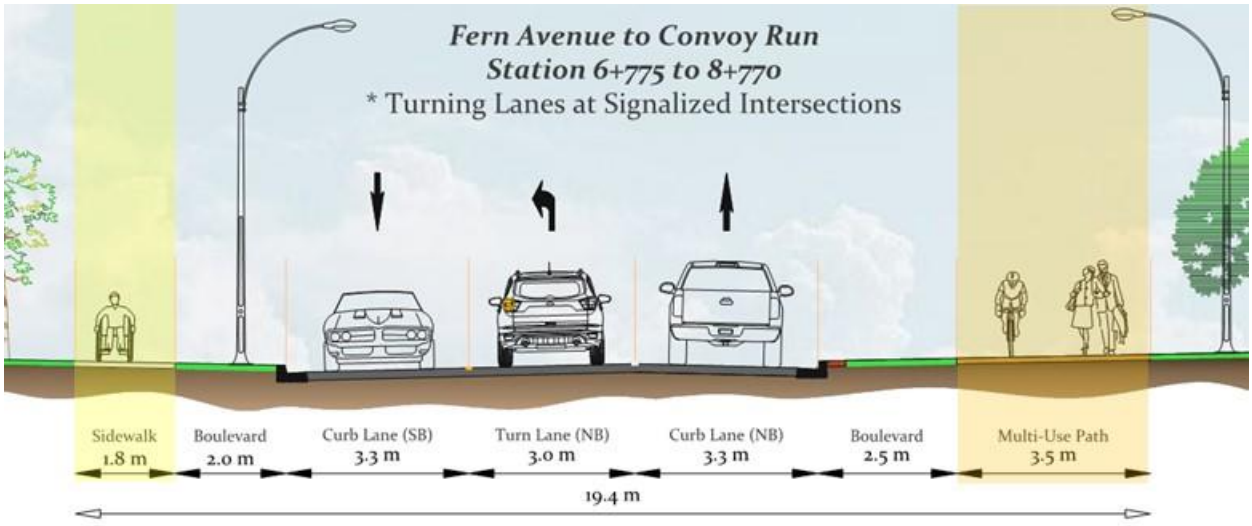
Segment 3 – Kearney Lake Road to Larry Uteck Boulevard

Mode	Key Features
	• No physical TPM are proposed for this segment. • Passive TSP may be achieved at the Larry Uteck Boulevard intersection by signal timing optimization to improve access to and from Bedford Highway.
	• The multi-use trail continues up the east side of Bedford Highway from Kearney Lake Road to Larry Uteck Boulevard and northward. • From north of Kearney Lake Road to Charlotte Lane, the multi-use trail would be barrier separated from the two-lane roadway. Where existing side streets enter the west side of Bedford Highway, breaks in the barrier should be provided to facilitate trail access.
	• Due to the limited development between Kearney Lake Road and Charlotte Lane, no sidewalk is provided, but a 1.8m wide asphalt shoulder will remain. • The Charlotte Lane crosswalk is upgraded with a pedestrian safety island. • From Charlotte Lane to Larry Uteck Boulevard, 2.5m wide sidewalk (including a 0.5-1.0m buffer reserved for utility poles) is provided adjacent to the curb on the west side of Bedford Highway.
	• Generally, the existing lane configuration remains, with one thru lane in each direction and a left turning lane at selected intersections. • The southbound acceleration lane at Larry Uteck Boulevard is removed as it is not required for traffic capacity and eliminating it allocates space for other uses. • New curbing (and storm system) is introduced on both sides of the road from Charlotte Lane to Larry Uteck Boulevard and development accesses are formalized.



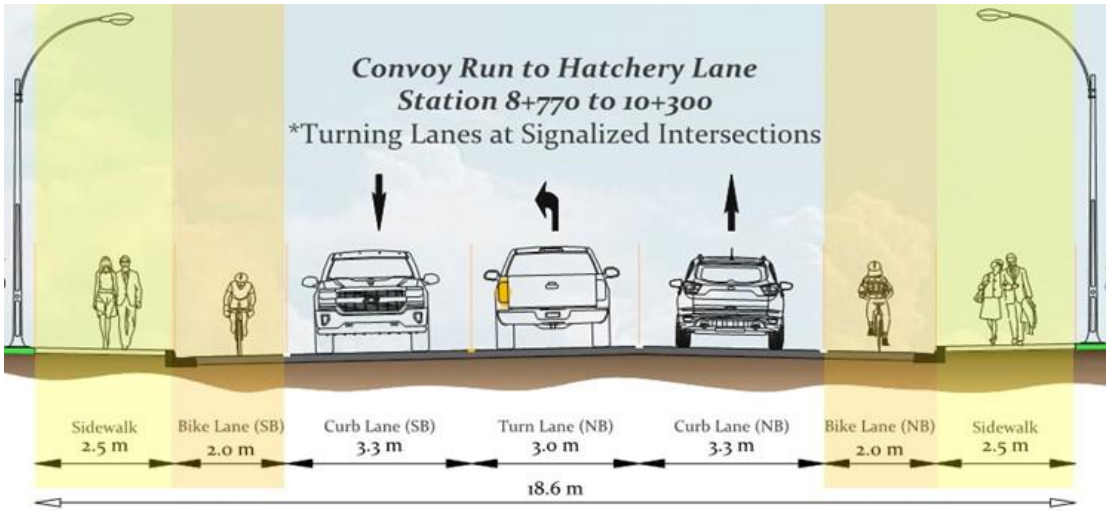
Segment 4 - Larry Uteck Boulevard to Hammonds Plains Road

Mode	Key Features
	• A short southbound queue bypass lane is recommended from Hammonds Plains Road through Moirs Mill Road. This is implemented with limited roadway impacts given excess existing southbound vehicle lane capacity. • Active TSP is recommended at Southgate Drive, Moirs Mill Road, and Hammonds Plains Road.
	• The multi-use trail continues up the east side of Bedford Highway from Larry Uteck Boulevard to Hammonds Plains Road and northward. The trail would connect with future AT facilities planned along Larry Uteck Boulevard and Hammonds Plains Road. • From north of Larry Uteck Boulevard to Fern Avenue (300m) the multi-use trail is barrier separated from the two-lane roadway.
	• Sidewalk continues up the west side of Bedford Highway from Larry Uteck Boulevard to the new condo development, as already exists. There, it ends and access to the east side trail is provided via a new RRFB crosswalk with pedestrian safety island. • A paved shoulder continues on the west side of Bedford Highway for 500m, at which point the west sidewalk begins again. The wide right-of-way allows for a boulevard between the curb and sidewalk up to Millview Avenue. • Sidewalk continues up the west side of Bedford Highway to Hammonds Plains Road and beyond. • A pedestrian safety island is installed at the existing Nelsons Landing crosswalk.
	• Generally, the existing lane configuration remains, with one thru lane in each direction and a left turning lane at selected intersections. • New curbing is introduced on both sides of the roadway from north of Fern Avenue to Southgate Drive. Development access points are formalized. • The existing northbound right turn slip lane into the Mill Cove Plaza remains for truck access due to the small radius in the southeast corner of the Hammonds Plains Road intersection. • Traffic signal coordination should be considered from Southgate Drive to Convoy Run.



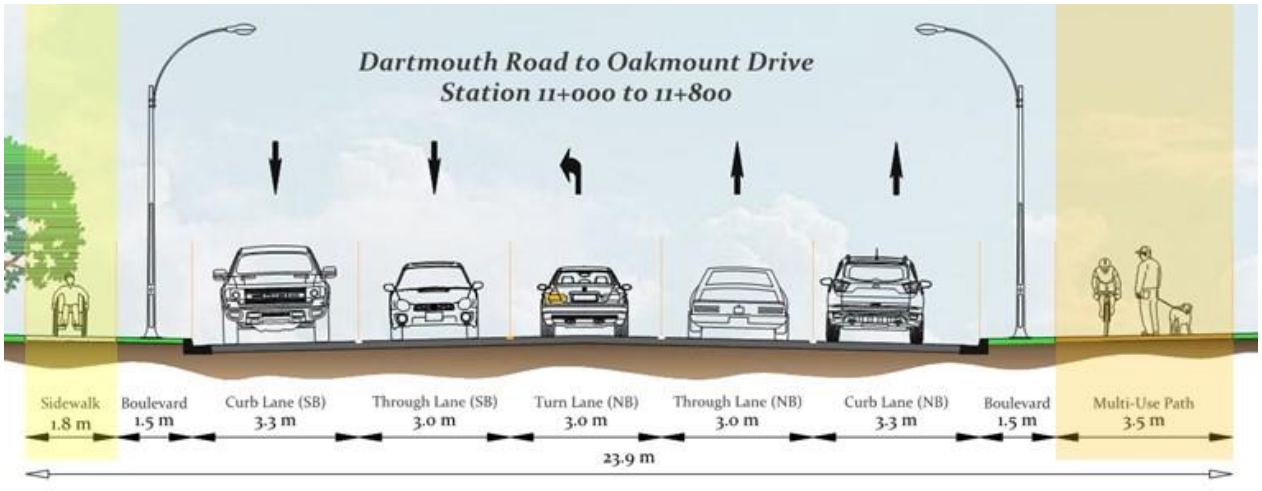
Segment 5 – Hammonds Plains Road to Union Street

Mode	Key Features
	• No physical TPM are proposed for this segment due to the constrained right-of-way widths. • Active TSP may be considered at signalized intersections within this segment subject to future transit performance.
	• The multi-use trail continues up to Convoy Run, at which point it terminates and bike lanes begin. (An alternative route to Dartmouth Road is available via the Bedford waterfront, Shore Drive and Stone Terrace for cyclists who wish to avoid Bedford Highway) • 2.0m wide bike lanes continue north of Convoy Run to Union Street and beyond to Dartmouth Road. The width is such that these bike lanes could be buffered or partially raised as one-way cycle tracks. Refer to **Section 8.6** for further discussion. • Transitions from the trail to bike lanes need to be carefully considered in the design. Refer to functional design drawings for proposed transition.
	• Sidewalk continues up the west side of Bedford Highway from Hammonds Plains Road to Convoy Run, as already exists. • From Convoy Run to Union Street, 2.0-2.5m wide sidewalk continues up both sides of Bedford Highway. This represents new sidewalk in some areas on the east side of Bedford Highway. • The Sullivans Hill crosswalk is upgraded to RRFB control and the Spring Street crosswalk may remain as an RA-5 or be converted to an RRFB. Pedestrian safety islands are not installed at this crosswalk due to lack of width.
	• The northbound left turn lane is removed from Rutledge Street to First Avenue due to limited width and corridor constraints including a retaining wall adjacent to the CN rail line. Traffic volumes were not available for the impacted intersections, but it is expected the left turn lane removal will impact vehicle operations, particularly at Rutledge Street during the PM peak hour. Peak hour turn restrictions might be considered. • Traffic signal coordination should be considered from Southgate Drive to Convoy Run.



Segment 6 – Union Street to Oakmount Drive

Mode	Key Features
	• A southbound queue bypass lane is provided at the Dartmouth Road intersection. This bypass lane begins at a bus layby which serves as a timing point. Buses will be able to exit the layby directly into the bypass lane. • A transit signal is added at the Dartmouth Road traffic signal to allow southbound buses to turn left onto Dartmouth Road from the bypass lane. • Active TSP is implemented at all traffic signals from Hatchery Lane to River Lane.
	• 2.0m wide bike lanes continue from Union Street to Dartmouth Road, at which point they terminate and transition to a multi-use trail on the northeast side of Bedford Highway. • The multi-use trail continues northward along the northeast side of Bedford Highway to Oakmount Drive where it terminates. • Transitions from the trail to bike lanes need to be carefully considered in the design. Refer to functional design drawings for proposed transition. • The Bedford-Sackville Connector Greenway Trail is located just across the river from Bedford Highway, and bicycle crossings should be considered opposite Bedford Place Mall or at River Lane, to enable users to access each trail from the other. • The multi-use trail provides a connection to a future AT facility on Rocky Lake Drive and potentially a future AT connection up Dartmouth Road.
	• Sidewalk continues up both sides of Bedford Highway from Union Street to Dartmouth Road, as existing. • North of Dartmouth Road, sidewalk continues on the southwest side of Bedford Highway, as existing. • The RA-5 crosswalk at Civic 1496 is maintained but without a pedestrian safety island due to impacts to existing driveways.
	• The existing lane configuration through this segment generally remains the same as existing. • Traffic signal coordination is recommended from Hatchery Lane to River Lane to address queuing and frequent stops throughout this segment.



8.4 Functional Design Option 2 Description

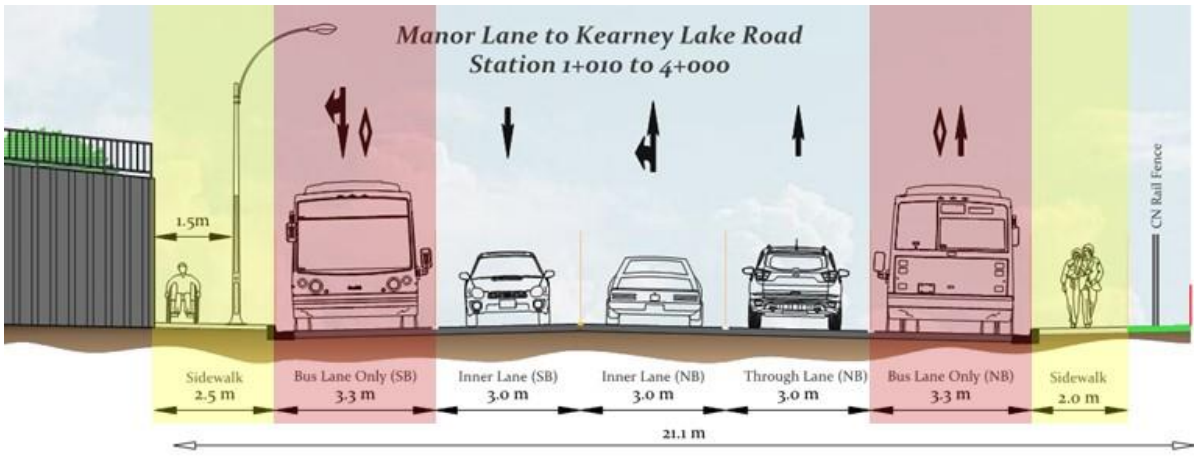
Key features of Option 2 – Transit Priority are presented below by mode for Segment 1 and 2. For Segments 3 to 6, the features are identical to Option 1. Representative cross-sections are also shown for illustration purposes.

Segment 1 - Windsor Street to Sherbrooke Drive

Mode	Key Features
	• Dedicated transit lanes are provided in both directions from Joseph Howe Drive to Kearney Lake Road. This would form a 5-lane cross-section along Bedford Highway throughout this segment. It is envisioned that these bus lanes would be permanent bus-only lanes during all periods of the day, but general traffic would be permitted to turn right from the bus lanes. Shared bus-bike lanes may be considered given the lack of cycling facilities as noted below. • The Windsor Street Exchange reconfiguration is also expected to improve inbound bus travel times.
	• A multi-use trail is extended up the south and west side of Bedford Highway, from Windsor Street to Manor Lane. This provides connections to potential future AT extensions along Windsor Street and Joseph Howe Drive which possibly could connect with the Chain of Lakes Trail. • The multi-use trail terminates at Manor Lane and no cycling facilities are provided northward in this segment due to the lack of remaining width with the transit lanes in place. Transitions between the trail and bus-bike lanes will need to be considered carefully. • Cyclists would be permitted to share the bus lanes. This is not a comfortable facility for cyclists, but conditions are within the realm of what is considered acceptable for bus-bike lanes given the 4-5 minute headways and lower operating speeds.
	• 2.5m wide sidewalk (including a 0.5-1.0m butter reserved for utility poles) is provided on both sides of Bedford Highway from Manor Lane to Sherbrooke Drive and northward to MSVU.
	• Windsor Street Exchange is assumed to be reconfigured as described in **Section 7.1**. • Traffic signal coordination is recommended from Manor Lane to Flamingo Drive. • The roadway cross-section is reduced to 3-lanes from Joseph Howe Drive to Sherbrooke Drive with two lanes in the northbound direction and one lane in the southbound direction. This represents a loss of one existing southbound traffic lane which is removed to accommodate the two transit lanes.

Segment 2 - Sherbrooke Drive to Kearney Lake Road

Mode	Key Features
	• Dedicated transit lanes continue in each direction from Sherbrooke Drive to Kearney Lake Road. This would form a 5-lane cross-section along Bedford Highway throughout this segment. It is envisioned that these bus lanes would be permanent bus-only lanes during all periods of the day, but general traffic would be permitted to turn right from the bus lanes. Shared bus-bike lanes may be considered given the lack of cycling facilities as noted below. • Bay laybys and associated timing points would be maintained at MSVU and upgraded to Enhanced Bus Stops. The southbound bus layby would be moved south of the MSVU main access. This would require property acquisition from the University. • TSP is implemented at the Flamingo Drive intersection to improve access onto Bedford Highway for inbound buses. • TSP may be considered at Kearney Lake Road subject to future transit performance.
	• No dedicated cycling facilities are provided in this segment due to the width required for the transit lanes. • Cyclists would be permitted to share the bus lanes. This is not a comfortable facility for cyclists, but conditions are within the realm of what is considered acceptable for bus-bike lanes given the 4-5 minute headways and lower operating speeds.
	• A continuous 2.5m wide sidewalk (including a 0.5-1.0m buffer reserved for utility poles) is provided on both sides of Bedford Highway from Sherbrooke Drive to Kearney Lake Road. • The existing RA-5 crosswalk at Seton Road will be replaced with a traffic signal once the Seton Road development proceeds. • A pedestrian safety island is installed at the existing crosswalks at the MSVU access and at Tremont Drive. RA-5 crossing control can remain or be replaced with an RRFB. • A new RRFB crosswalk is installed at Torrington Drive including a pedestrian safety island.
	• Traffic signal coordination is implemented from Manor Lane to Flamingo Drive. • Generally, the existing 3-lane cross-section is maintained with one thru lane in each direction and a centre turning lane, mostly used for northbound left turns, but continuing to serve two-way left turns in the Flamingo commercial area.



8.5 Operational Analysis of Options

Vehicle Level of Service

The 2031 Synchro model was updated to reflect infrastructure changes in Option 1 and Option 2. This allowed a comparison of operational performance between the two options and with the 2031 Do-Nothing conditions. Note that future background growth in these models was reduced by 5% (from 13% to 8%) to account for modal shift arising from improved AT and transit service. Ideally, a larger modal shift would be achieved from these improvements in coordination with larger regional efforts in travel demand management. The LOS results are summarized in **Table 8-3** and **Table 8-4** and Synchro reports can be found in **Appendix C**. Observations from the results are as follows:

Option 1

- Option 1 shows significant improvements at the Bedford Highway/Windsor Street intersection due to the reconfiguration of the Windsor Street Exchange.
- Generally, Option 1 shows a 10-15% reduction in intersection delays north of Kearney Lake Road, which can be attributed to traffic signal optimization and coordination and the 5% reduction in traffic for modal shift.
- The operations of the Manor Lane and Bayview Road intersections under Option 1 are similar to the 2031 Do-Nothing conditions in the AM. In the PM, Bayview Road shows a reduction in delay due to traffic signal optimization and coordination, while Manor Road shows an increase in delay, most likely due to the introduction of a pedestrian phase crossing Bedford Highway.
- Delays at the Seton Road intersection increase in Option 1, given that the southbound lane that was added on Bedford Highway to satisfy the Seton Ridge TIS recommendations has been converted to the transit lane. This loss of southbound capacity causes increased delay at Seton Road to increase in both peak hours.

Option 2

- Operations are similar to Option 1 except at the Manor Lane and Bayview Road intersections given that one southbound traffic lane has been converted to a transit lane.
- The Manor Lane intersection operates at an overall LOS F both peak hours with 180 to 200 seconds of delay per vehicle. The southbound through movement experiences the highest delays, at nearly 300 seconds per vehicle and a V/C = 1.59 in both peak hours.
- Similarly, the Bayview Road intersection operates at an overall LOS F in both peak periods with the AM peak exhibiting average intersection delays of 331.8 seconds per vehicle. The southbound through movement operates at LOS F in both peak periods with a V/C up to 1.62. The 95th percentile queue for the southbound approach on Bedford Highway is over 700m in the AM peak.

Table 8-3: Auto LOS Results - 2031 (Do-Nothing) vs. 2031 Option 1

Segment	Signalized Intersection	Intersection LOS Average Delay (sec/veh)			
		2031 Do-Nothing		2031 Option 1	
		AM Peak	PM Peak	AM Peak	PM Peak
1	Windsor Street	F 223.8	E 66.1	F 99.0	D 46.4
	Manor Lane	A 7.5	B 12.2	A 6.4	D 38.5
	Bayview Road	F 136.2	F 423.2	F 144.8	F 119.3
2	Seton Road	C 32.3	F 152.8	D 50.9	E 57.9
	Flamingo Drive	C 26.2	B 12.5	C 25.1	A 9.1
3	Kearney Lake Road	B 11.6	C 27.6	B 12.9	C 24.1
4	Larry Uteck Boulevard	B 16.3	B 17.5	B 15.7	B 16.5
	Southgate Drive	B 11.4	C 20.6	B 10.0	B 18.1
	Moirs Mill Road	B 12.5	A 9.0	B 12.3	A 8.7
5	Hammonds Plains Road	C 23.1	D 44.4	C 21.8	D 39.8
	Holland Avenue/Convoy Run	A 8.3	B 19.1	A 7.9	B 17.0
	Meadowbrook Drive	B 18.9	C 20.2	B 17.6	B 17.6
	Hatchery Lane	B 13.2	B 13.7	B 13.3	B 14.3
6	Union Street	A 7.3	A 9.8	A 4.3	A 5.4
	Dartmouth Road	D 41.4	D 51.8	C 27.0	D 39.4
	Sunnyside Mall	A 7.0	B 12.5	A 4.4	A 9.0
	Rocky Lake	C 27.5	D 41.1	C 20.9	C 26.5
	Bedford Place	A 2.9	A 5.8	A 2.2	A 3.6
	River Lane	A 5.7	B 10.6	A 6.2	B 10.2

Table 8-4: Auto LOS Results - 2031 (Do-Nothing) vs. 2031 Option 2

Segment	Signalized Intersection	Intersection LOS Average Delay (sec/veh)			
		2031 Do-Nothing		2031 Option 2	
		AM Peak	PM Peak	AM Peak	PM Peak
1	Windsor Street	F 223.8	E 66.1	F 97.6	D 46.4
	Manor Lane	A 7.5	B 12.2	F 177.7	F 200.8
	Bayview Road	F 136.2	F 423.2	F 331.8	F 188.8
2	Seton Road	C 32.3	F 152.8	D 50.8	E 58.8
	Flamingo Drive	C 26.2	B 12.5	C 25.1	A 8.5
3	Kearney Lake Road	B 11.6	C 27.6	B 12.9	C 24.1
4	Larry Uteck Boulevard	B 16.3	B 17.5	B 15.7	B 16.5
	Southgate Drive	B 11.4	C 20.6	B 10.0	B 18.1
	Moirs Mill Road	B 12.5	A 9.0	B 12.3	A 8.7
5	Hammonds Plains Road	C 23.1	D 44.4	C 21.8	D 39.8
	Holland Avenue/Convoy Run	A 8.3	B 19.1	A 7.9	B 17.0
	Meadowbrook Drive	B 18.9	C 20.2	B 17.6	B 17.6
	Hatchery Lane	B 13.2	B 13.7	B 13.3	B 14.3
6	Union Street	A 7.3	A 9.8	A 4.3	A 5.4
	Dartmouth Road	D 41.4	D 51.8	C 27.0	D 39.4
	Sunnyside Mall	A 7.0	B 12.5	A 4.4	A 9.0
	Rocky Lake	C 27.5	D 41.1	C 20.9	C 26.5
	Bedford Place	A 2.9	A 5.8	A 2.2	A 3.6
	River Lane	A 5.7	B 10.6	A 6.2	B 10.2

Travel Time Assessment

Recognizing the Synchro model's limitations in modelling the full extent of congestion along the southern portion of the Bedford Highway corridor, a Vissim microsimulation analysis was also completed to better replicate driver behaviour and queuing activity and to assess a comparison of travel times for the existing conditions versus future Option 1 and Option 2 conditions. The Vissim base model was created for the 4 km road section from Windsor Street to Kearney Lake Road and calibrated for 2018 AM and PM peak hour conditions. The model was then adjusted to reflect 2031 traffic conditions and the proposed infrastructure modifications under Option 1 and Option 2. The results of the modelled travel times are summarized in **Table 8-5**.

Table 8-5: Comparison of Modelled Travel Times (Windsor St to Kearney Lake Rd)

	AM Peak		PM Peak	
Scenario	**NB**	**SB**	**NB**	**SB**
Existing (2018)	4 min 7 s	20 min 56 s	4 min 31 s	4 min 38 s
Option 1 (2031)	4 min 23 s	6 min 58 s	6 min 29 s	6 min 24 s
Option 2 (2031)	4 min 6 s	8 min 21 s	5 min 14 s	7 min 31 s

The following observations can be made from the travel time results.

Existing

- The AM southbound trip under modelled existing conditions takes 21 minutes on average (average travel speed of 11 km/h). This appears representative of existing field conditions based on observations.
- The existing AM northbound and PM trips have much lower delays, with average travel speeds around 50-60 km/h.

Option 1

- The AM southbound travel time under Option 1 improves dramatically due to the Windsor Street Exchange reconfiguration and other corridor improvements such as traffic signal optimization and coordination. The resulting southbound travel time is approximately 7 min with an average travel speed of 34 km/h. There would still be some signal delay expected, but not the severe queuing experienced currently.
- The proposed bus lane would still offer inbound buses the advantage of circumventing local signal delay at Kearney Lake Road, Flamingo Drive, and Seton Road and bypassing more severe congestion resulting from incidents or short term spikes in queuing.
- Travel times in the PM peak increase from existing due to increased traffic volumes and congestion at the new Seton Road traffic signal. There is no change in general traffic lane capacity in Option 1.

Option 2

- The AM southbound travel time under Option 2 is 20% higher than Option 1 due to the loss of one southbound traffic lane from Sherbrooke Drive to Joseph Howe Drive. The average AM southbound travel speed is 29 km/h. Despite the loss of the southbound lane, the southbound travel time is still significantly better than under existing conditions, due to the reconfiguration of the Windsor Street Exchange.

- Similarly, the PM southbound travel time increases due to the loss of southbound capacity for general traffic. However, the PM northbound traffic time decreases compared to Option 1, which could be explained by the removal of buses from the northbound traffic stream.

MMLOS Evaluation

The overall operational performance of Option 1 and Option 2 was evaluated by repeating the MMLOS analysis for all road segments and signalized intersections. This allowed a comparison between Option 1 and 2 as well as a comparison against existing conditions and MMLOS targets.

The ability of Option 1 and 2 to meet MMLOS targets is summarized in **Table 8-6** which shows the percentage of segments or intersections where targets have been met. Complete MMLOS results for road segments and intersections are summarized in **Table 8-7** and **Table 8-8**, respectively. Results are also mapped on **Figure 8-5** to **Figure 8-14**. Detailed MMLOS worksheets are provided in **Appendix F.**

The MMLOS results indicate that Option 1 provides a significant improvement over existing for non-auto modes, particularly pedestrians and cyclists, with limited impacts to autos or trucks. Nearly all segments in Option 1 meet targets for pedestrians and cyclists. Option 1 only provides small improvements to transit, with 9% of segments meeting target compared to 0% existing.

Option 2 raises the number of segments meeting transit targets to 22%, but this is at the expense of cyclists LOS which sees the % of segments meeting target drop from 100% to 79%. Option 2 also sees a slight reduction in the number of segments meeting truck and auto LOS compared to Option 1.

Table 8-6: Percentage of Segments/Intersections meeting MMLOS Target

Mode	% of Segments/Intersections meeting MMLOS Target		
	Existing	Option 1 – Balanced	Option 2 – Transit
Segments			
Peds	2%	90%	90%
Cyclists	0%	100%	79%
Transit	0%	9%	22%
Trucks	100%	83%	79%
Autos	93%	95%	91%
Intersections			
Peds	35%	58%	53%
Cyclists	18%	89%	68%
Transit	71%	63%	79%
Trucks	12%	5%	5%
Autos	94%	89%	84%

Table 8-7: Segment MMLOS Summary for Existing, Option 1 and Option 2

		Existing									Option 1									Option 2								
Road Segment		Pedestrians		Cyclists	Transit		Trucks		Autos		Pedestrians		Cyclists	Transit		Trucks		Autos		Pedestrians		Cyclists	Transit		Trucks		Autos	
From	To	West	East		SB	NB	SB	NB	NB	SB	West	East		SB	NB	SB	NB	NB	SB	West	East		SB	NB	SB	NB	NB	SB
	SEGMENT 1 TARGETS	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*
Windsor St	Manor Lane	E	F	F	D	D	A	A	B	F*	B	F**	A	D	D	C	C	E	E*	B	F**	A	B	D	C	C	F	E*
Manor Lane	Bayview Rd	E	F	F	D	D	A	A	F	A	C	A	A	D	D	C	C	F	A	C	C	D	B	B	C	C	F	F*
Bayview Rd	Seton Rd	E	F	F	D	D	A	A	F	E*	C	A	A	D	D	C	C	C	F	C	C	D	B	B	C	C	D	F
	SEGMENT 2 TARGETS	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*B*	*B*	*C*	*C*	*E*	*E*
Seton Rd	MSVU	A	F	D	D	D	C	A	A	A	C	B	A	B	D	C	C	A	F	C	C	D	B	B	C	C	A	F
MSVU	Flamingo Dr	D	D	D	D	D	C	A	B	A	C	B	A	B	D	C	C	A	A	C	C	D	B	B	C	C	A	A
Flamingo Dr	Tremont Dr	D	D	D	F	F	A	A	A	B*	C	B	A	C	F	C	C	A	C*	C	C	D	C	C	C	C	A	C*
Tremont Dr	Kearney Lake Rd	E	E	F	D	D	B	A	B	A	C	B	A	B	D	C	C	C	A	E**	B	D	B	B	D	D	C	A
	SEGMENT 3 TARGETS	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*
Kearney Lake Rd	Charlotte Ln	F	F**	C	D	D	B	B	B	C	E**	B	A	D	D	D	D	B	C	C	B	A	D	D	D	D	B	C
Charlotte Ln	Larry Uteck Blvd	F	F**	C	D	D	B	B	A	C	C	B	A	F	F	D	D	B	C	B	C	A	F	F	D	D	B	C
	SEGMENT 4 TARGETS	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*A*	*C*	*C*	*C*	*C*	*E*	*E*
Larry Uteck Blvd	Condo Access	E	F**	C	D	D	B	B	A	C	B	B	A	D	D	D	D	B	C	B	B	A	D	D	D	D	B	C
Condo Access	Fern Ave	F	F**	C	D	D	B	B	A	C	E**	B	A	D	D	D	D	B	C	E**	B	A	D	D	D	D	B	C
Fern Ave	Southgate Dr	F	F**	C	E	E	B	B	B	C	C	B	A	E	E	B	B	B	C	C	B	A	E	E	B	B	B	C
Southgate Dr	Moirs Mill Rd	D	F**	C	D	D	B	B	A	B	C	B	A	D	D	D	D	A	B	C	B	A	D	D	D	D	A	B
Moirs Mill Rd	Hammonds Plains Rd	D	D	D	E	D	A	A	C	A	D	B	A	A	D	C	C	D	A	D	B	A	A	D	C	C	D	A
	SEGMENT 5 TARGETS	*B*	*B*	*B*	*C*	*C*	*D*	*D*	*E*	*E*	*B*	*B*	*B*	*C*	*C*	*D*	*D*	*E*	*E*	*B*	*B*	*B*	*C*	*C*	*D*	*D*	*E*	*E*
Hammonds Plains Rd	Holland Ave	D	D	C	E	D	B	B	B	C	B	B	A	E	D	D	D	B	C	B	B	A	E	D	D	D	B	C
Holland Ave	Locke St	D	D	C	F	F	C	C	B	B	B	B	B	F	F	D	D	B	B	B	B	B	F	F	D	D	B	B
Locke St	Lindsay Hill	D	D	C	F	F	C	C	B	B	B	B	B	F	F	D	D	B	B	B	B	B	F	F	D	D	B	B
Lindsay Hill	Sullivans Hill	D	D	C	F	F	C	C	B	B	B	B	B	F	F	D	D	B	B	B	B	B	F	F	D	D	B	B
Sullivans Hill	Meadowbrook Dr	D	D	C	F	F	A	A	A	B	B	B	B	F	F	C	C	B	B	B	B	B	F	F	C	C	B	B
Meadowbrook Dr	Spring St	E	E	D	E	D	B	A	A	B	B	B	B	E	D	D	D	B	B	B	B	B	E	D	D	D	B	B
Spring St	First Ave	D	E	D	E	D	B	A	A	B	B	B	B	E	D	D	D	B	B	B	B	B	E	D	D	D	B	B
First Ave	Hatchery Ln	E	E	D	E	D	B	B	A	B	B	B	B	E	D	D	D	B	B	B	B	B	E	D	D	D	B	B
Hatchery Ln	Union St	D	E	D	D	D	B	B	A	A	B	B	B	D	D	D	D	A	B	B	B	B	D	D	D	D	A	B
	SEGMENT 6A TARGETS	*B*	*B*	*B*	*C*	*C*	*C*	*C*	*E*	*E*	*B*	*B*	*B*	*C*	*C*	*C*	*C*	*E*	*E*	*B*	*B*	*B*	*C*	*C*	*C*	*C*	*E*	*E*
Union St	Dartmouth Rd	D	D	D	F	F	A	A	C	A	B	B	B	F	F	C	C	D	A	B	B	B	F	F	C	C	D	A
Dartmouth Rd	Sunnyside Mall	D	D	D	D	D	A	A	A	D	C	B	A	B	D	C	C	A	D	C	B	A	B	D	C	C	A	D
Sunnyside Mall	Rocky Lake Dr	D	D	D	D	D	A	A	D	A	C	B	A	D	D	C	C	C	A	C	B	A	D	D	C	C	C	A
	SEGMENT 6B TARGETS	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*E*	*E*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*E*	*E*
Rocky Lake Dr	Bedford Pl	D	E	D	D	E	A	A	A	D	C	B	A	D	E	C	C	A	B	C	B	A	D	E	C	C	A	B
Bedford Pl	River Ln	D	E	D	D	D	A	A	A	A	C	B	A	D	D	C	C	A	A	C	B	A	D	D	C	C	A	A
River Ln	Oakmount Dr	D	E	D	D	D	A	A	A	A	C	B	A	D	D	C	C	A	A	C	B	A	D	D	C	C	A	A
# of Segments Meeting Target		1		0	0		58		54		52		29	5		48		55		52		23	13		46		53	
% of Segments Meeting Target		*2%*		*0%*	*0%*		*100%*		*93%*		*90%*		*100%*	*9%*		*83%*		*95%*		*90%*		*79%*	*22%*		*79%*		*91%*	

LEGEND

E	DOES NOT MEET TARGET
A	MEETS OR EXCEEDS TARGET

*LOS from AM Peak operations. All other Auto LOS are from PM Peak.
**Poor LOS due to lack of facility is acceptable as it is not needed.

Table 8-8: Intersection MMLOS Summary for Existing, Option 1 and Option 2

	Existing					OPTION 1					OPTION 2				
Intersection	**Pedestrians**	**Cyclists**	**Transit**	**Trucks**	**Auto**	**Pedestrians**	**Cyclists**	**Transit**	**Trucks**	**Auto**	**Pedestrians**	**Cyclists**	**Transit**	**Trucks**	**Auto**
MMLOS Targets	***D***	***C***	***C***	***D***	***E***	***D***	***C***	***C***	***D***	***E***	***D***	***C***	***C***	***D***	***E***
Windsor Street	F	F	F	D	F	C	F	E	B	F*	C	F	E	B	F*
Manor Lane					B	E	A	F		D	E	C	B		F
Bayview Road	E	F	F	C	F	E	A	F	E	F	E	D	B	E	F
Seton Road					F	E	A	F		E	E	D	B		E
Flamingo Drive	E	D	C		A	E	A	C		C*	E	D	C		C*
Kearney Lake Road	C	F	C		B	D	A	C	E	C	E	D	C	E	C
Larry Uteck Boulevard	D	E	C		B	D	A	C		B	D	A	C		B
Southgate Drive	C	F	B		B	C	A	C		B	C	A	C		B
Moirs Mills Road	E	C	B		B	D	A	B		A	D	A	B		A
Hammonds Plans Road	F	F	E	F	C	E	A	E	F	D	E	A	E	F	D
Convoy Run/Holland Avenue	E	C	B	F	B	C	B	C	F	B	C	B	C	F	B
Meadowbrook Drive	D	C	C	F	B	D	C	C	F	B	D	C	C	F	B
Hatchery Lane	D	E	B	F	B	D	C	C	F	B	D	C	C	F	B
Union Street	D	D	B	F	A	D	C	B	F	A	D	C	B	F	A
Dartmouth Road	F	F	D	F	C	E	F	E	F	D	E	F	E	F	D
Sunnyside Mall	E	F	B	F	B	E	A	B	F	A	E	A	B	F	A
Rocky Lake Drive	F	F	E	F	D	E	A	D	E	C	E	A	D	E	C
Bedford Place	E	F	B	E	A	D	A	B	E	A	D	A	B	E	A
River Lane	E	F	B	E	A	D	A	B	F	B	D	A	B	F	B
# of Intersections Meeting Target	**6**	**3**	**12**	**2**	**16**	**11**	**17**	**12**	**1**	**17**	**10**	**13**	**15**	**1**	**16**
% of Intersections Meeting Target	*35%*	*18%*	*71%*	*12%*	*94%*	*58%*	*89%*	*63%*	*5%*	*89%*	*53%*	*68%*	*79%*	*5%*	*84%*

LEGEND

E	DOES NOT MEET TARGET
A	MEETS OR EXCEEDS TARGET

*LOS from AM Peak operations. All other Auto LOS are from PM Peak.

Figure 8-5: Option 1 Pedestrian Level of Service

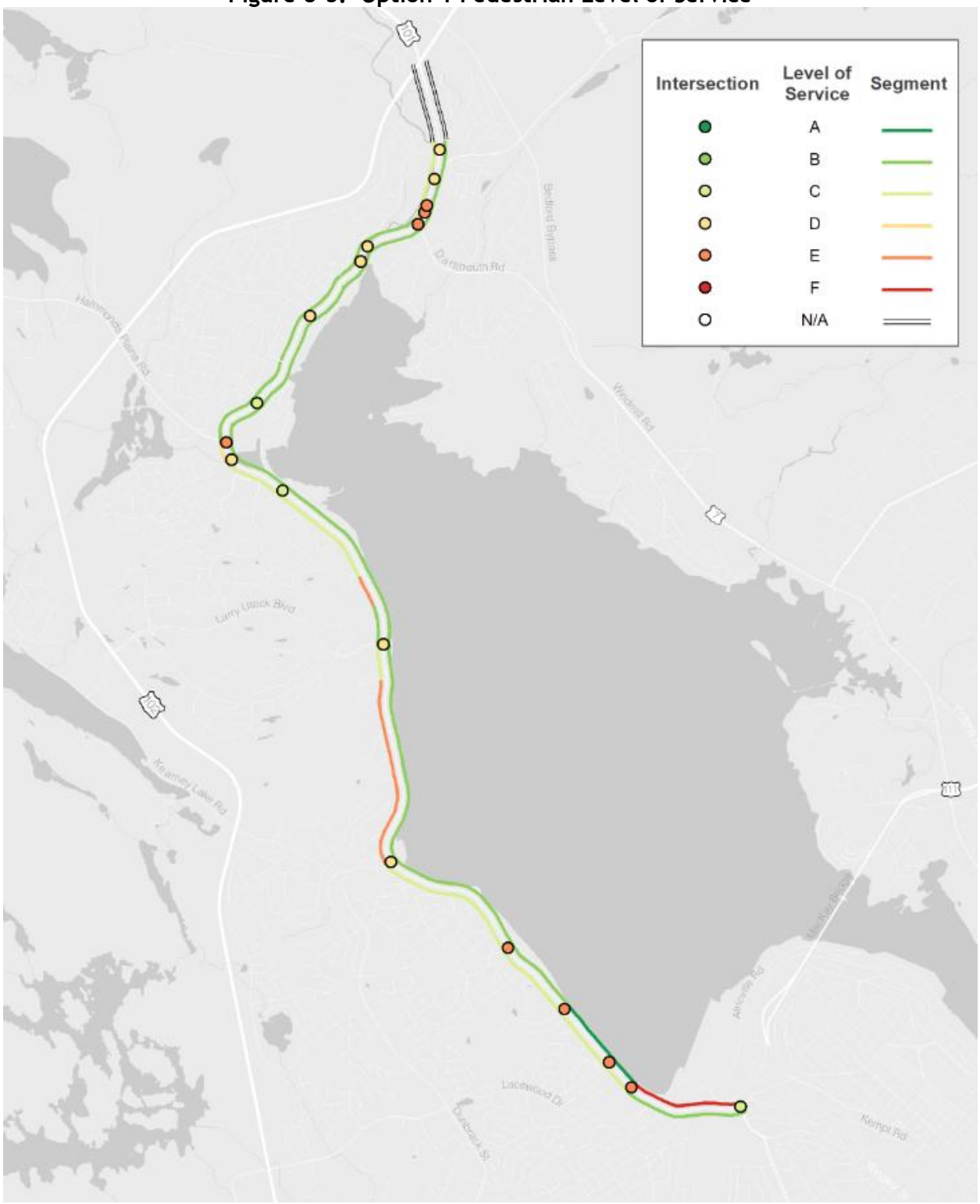


Figure 8-6: Option 1 Cyclist Level of Service

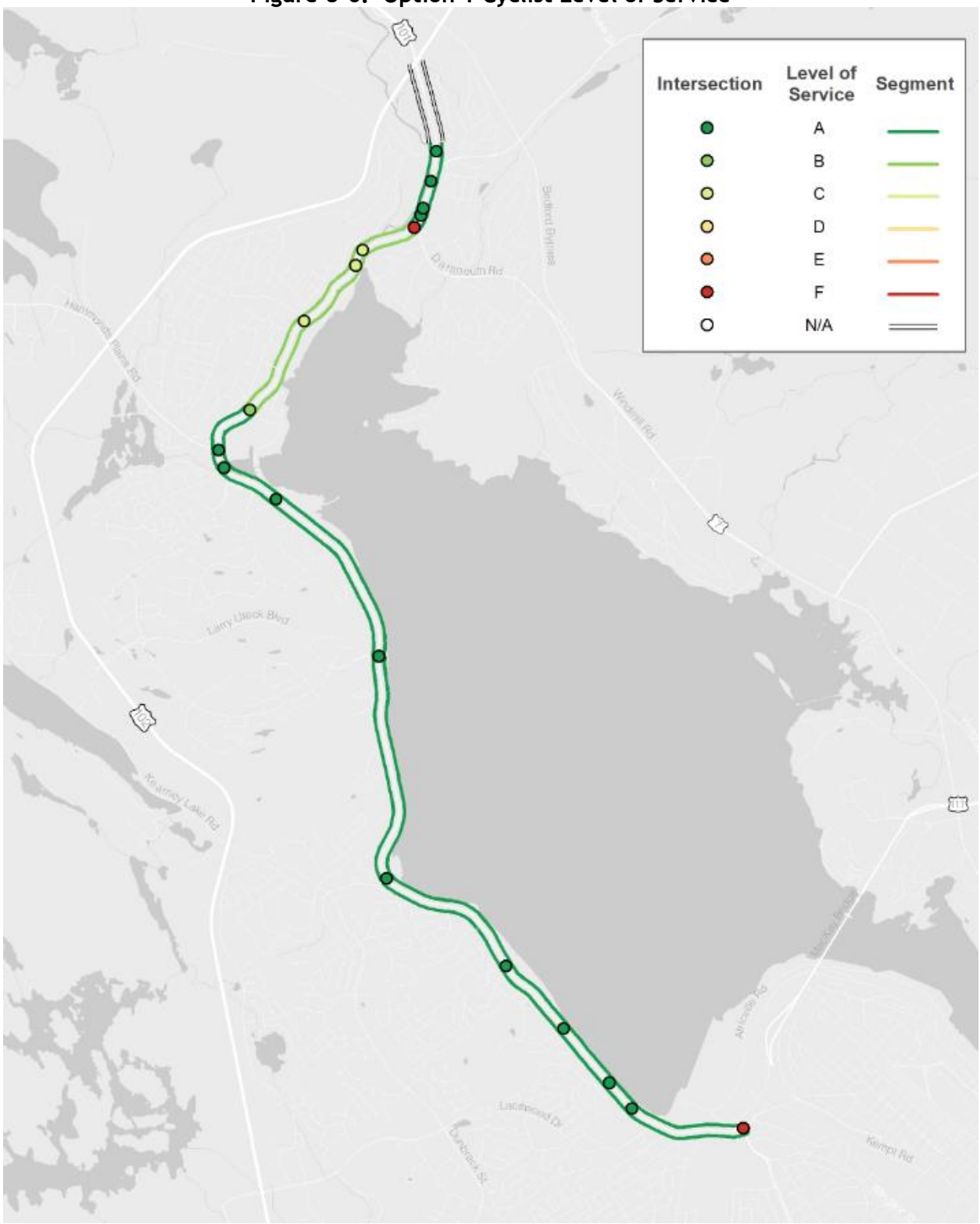


Figure 8-7: Option 1 Transit Level of Service

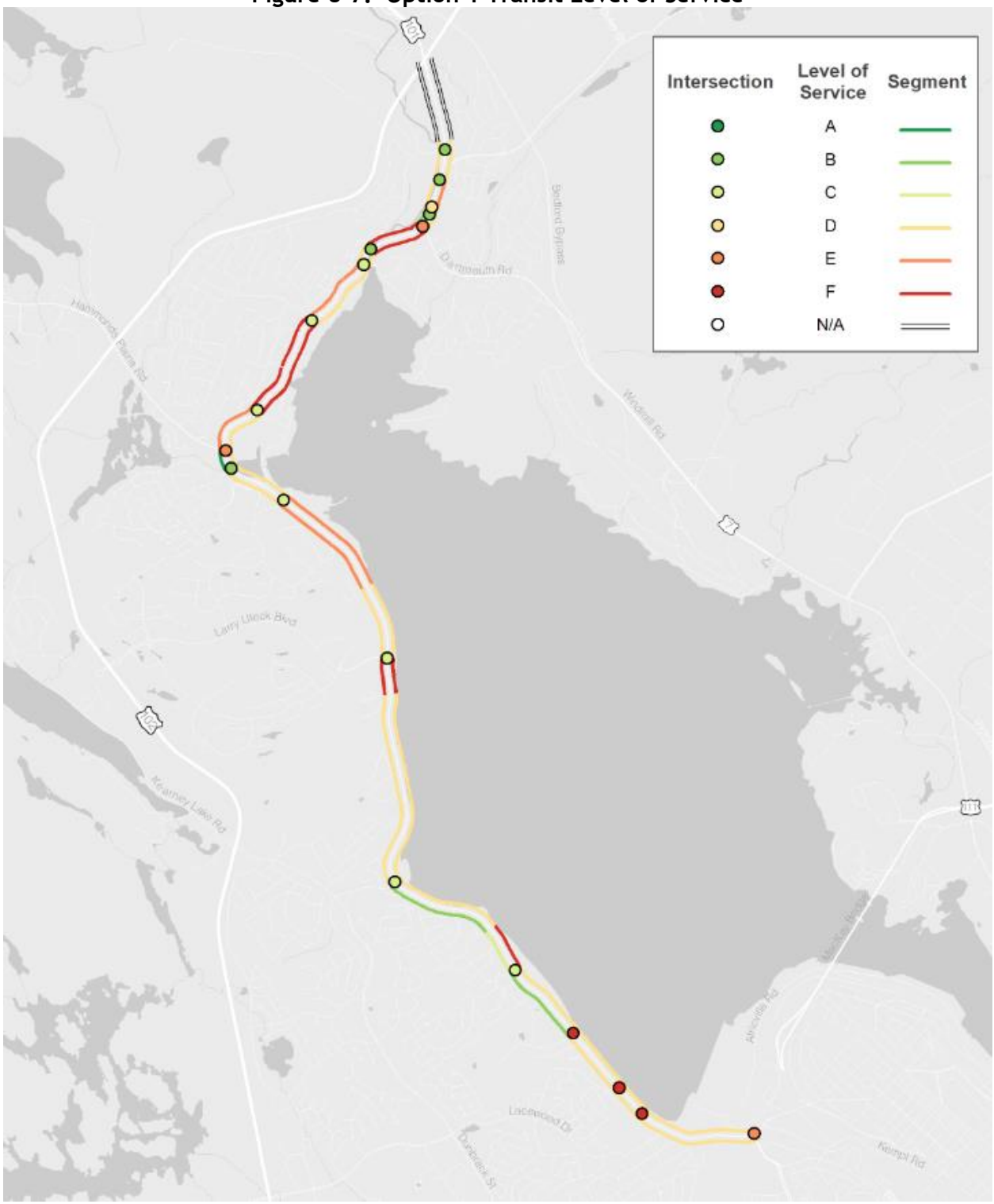


Figure 8-8: Option 1 Truck Level of Service

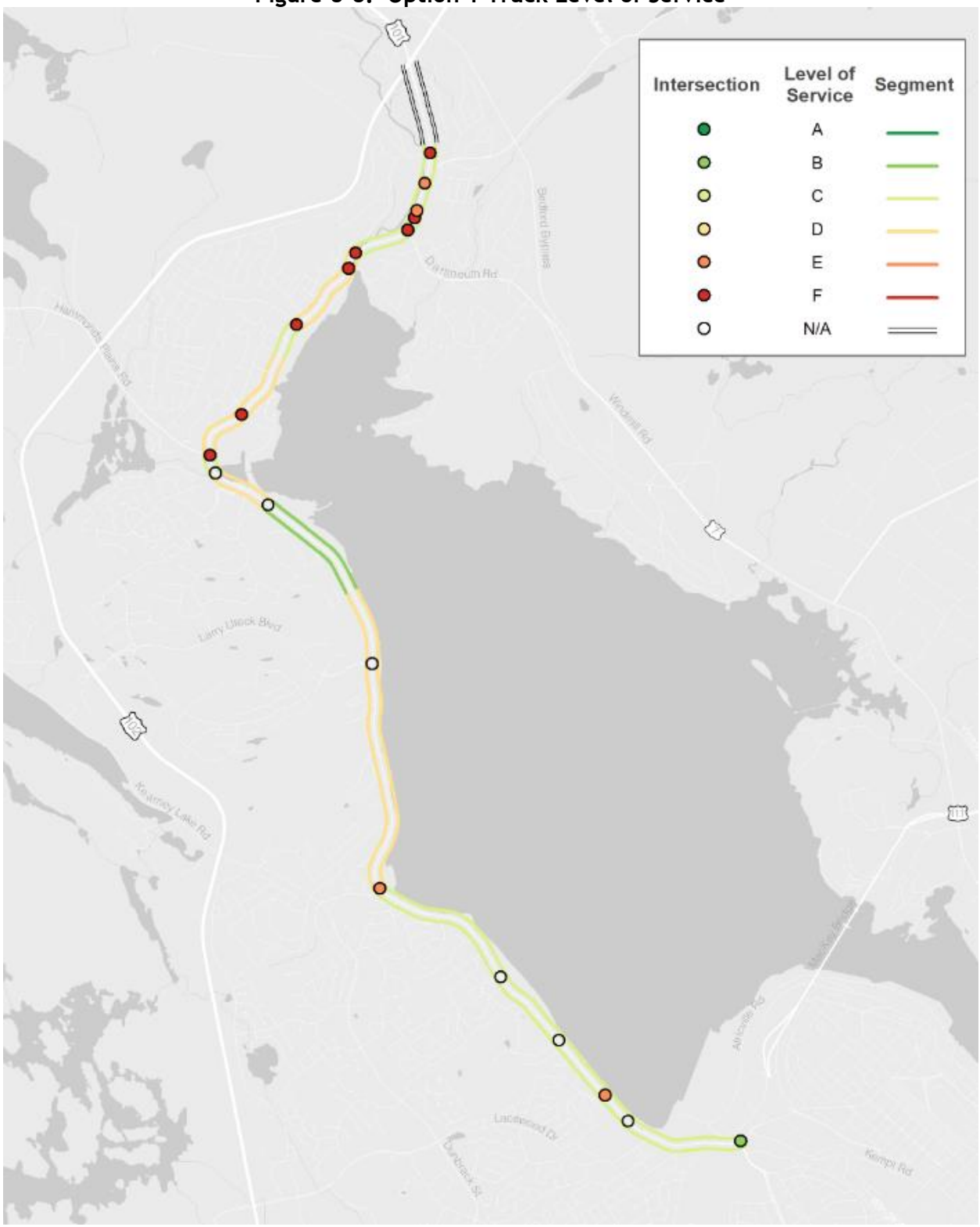


Figure 8-9: Option 1 Auto Level of Service

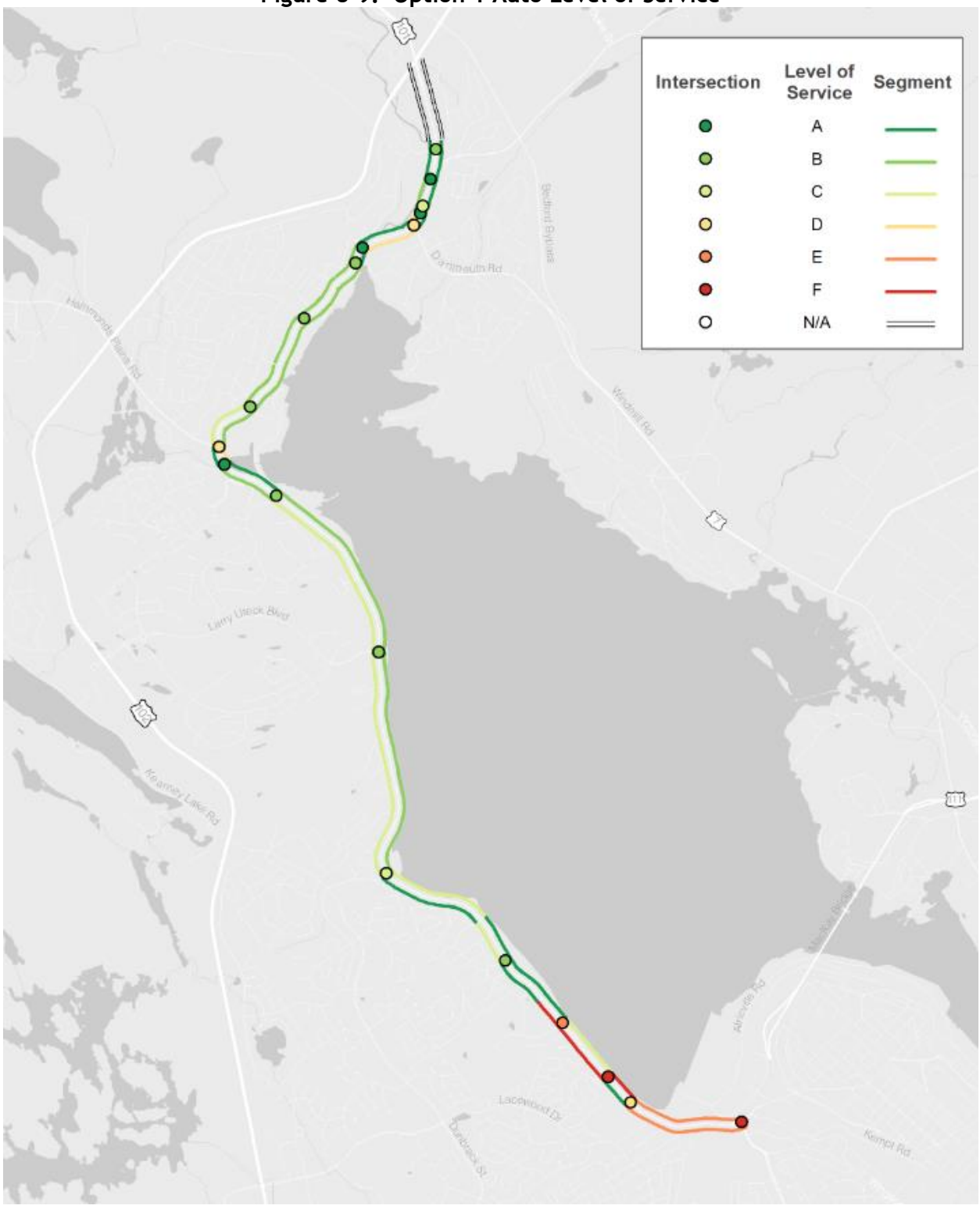


Figure 8-10: Option 2 Pedestrian Level of Service

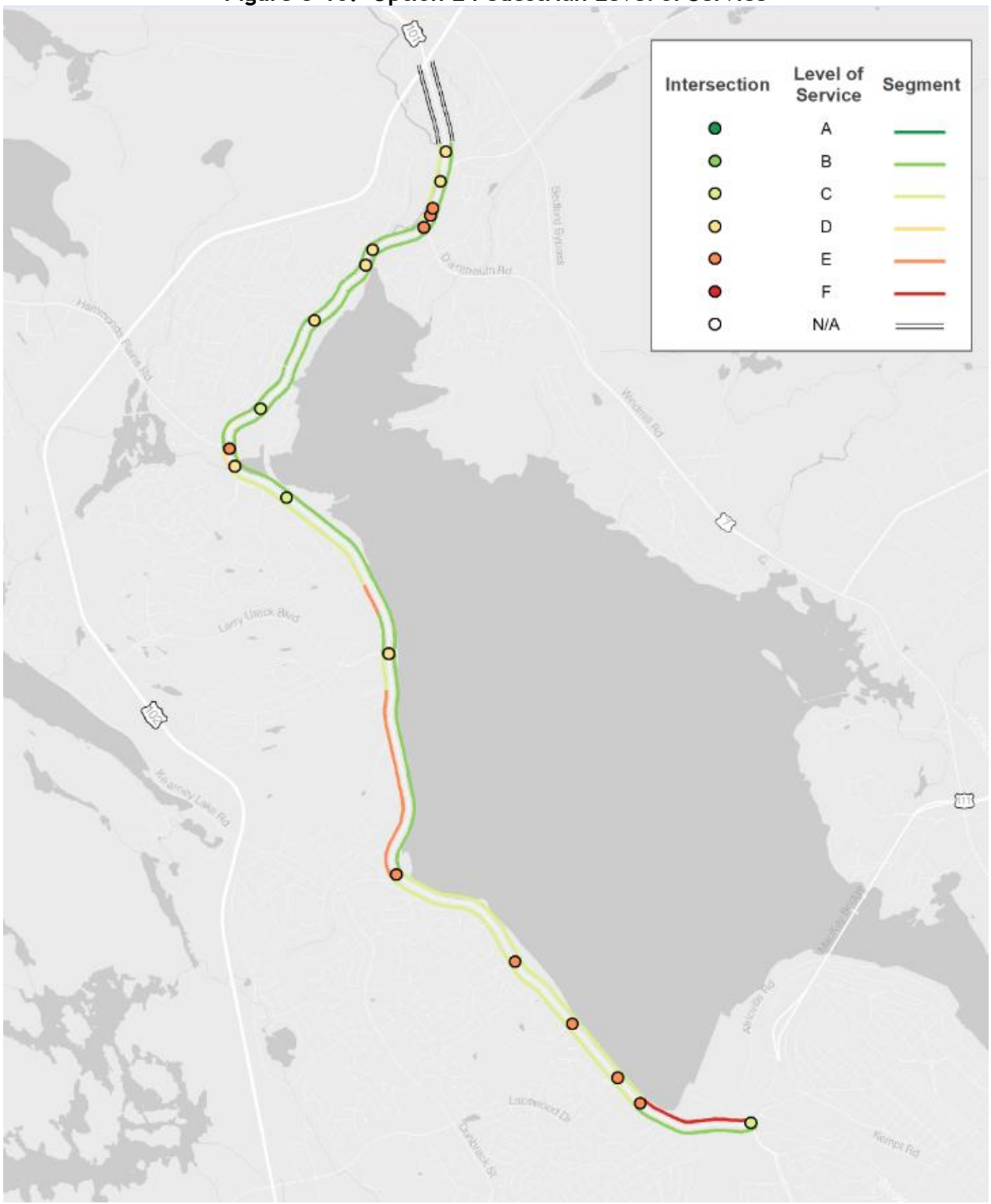


Figure 8-11: Option 2 Cyclist Level of Service

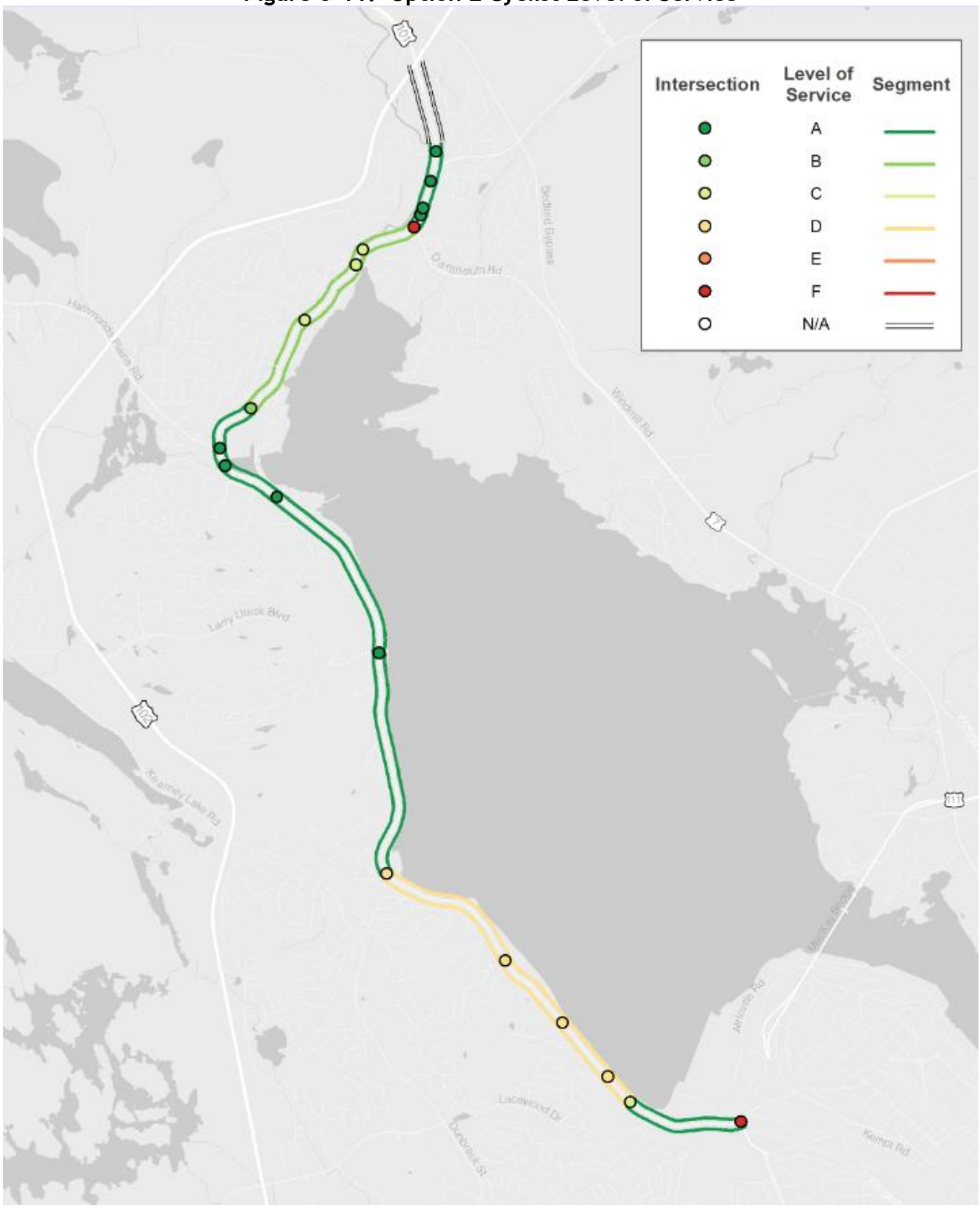


Figure 8-12: Option 2 Transit Level of Service

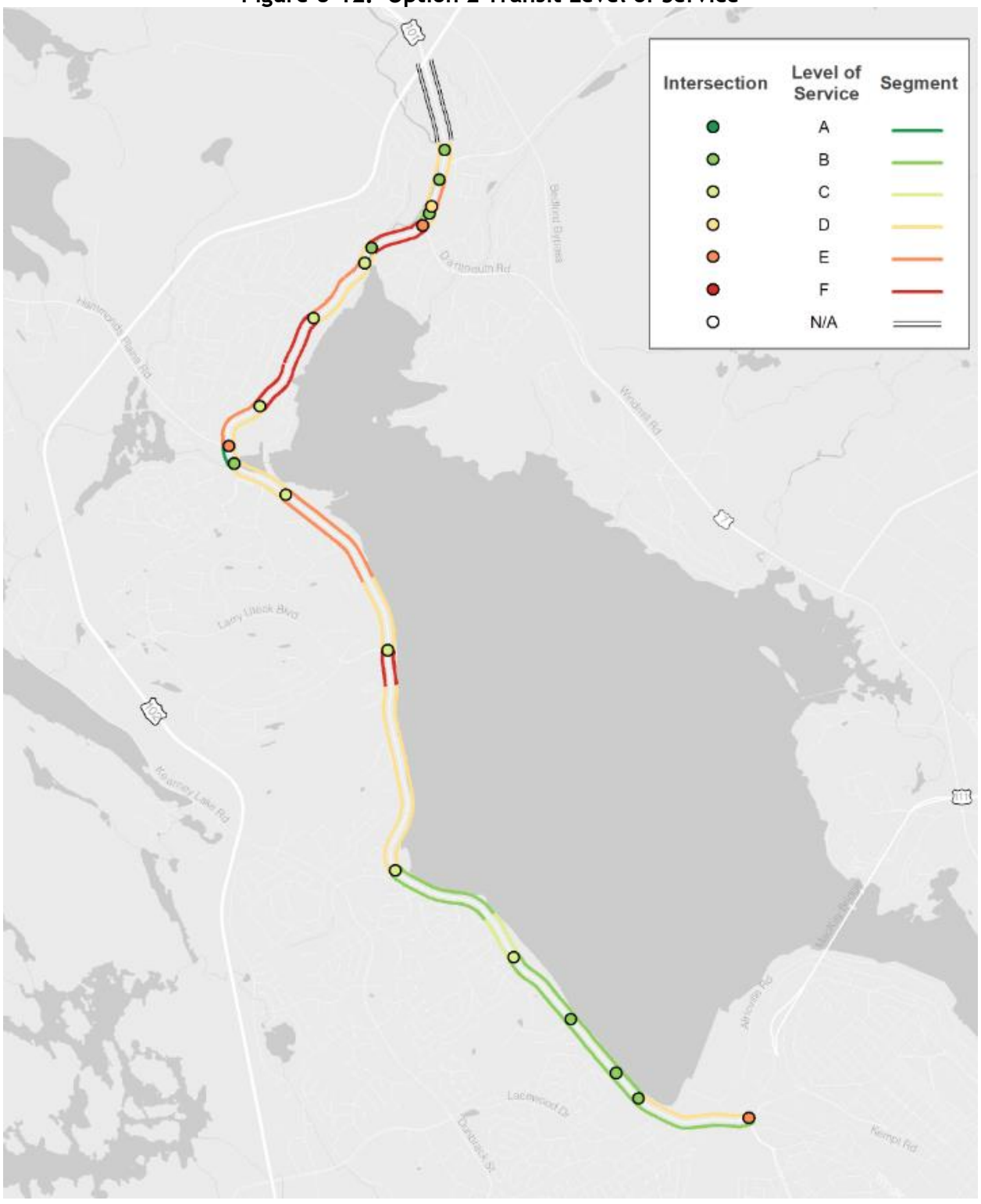


Figure 8-13: Option 2 Truck Level of Service

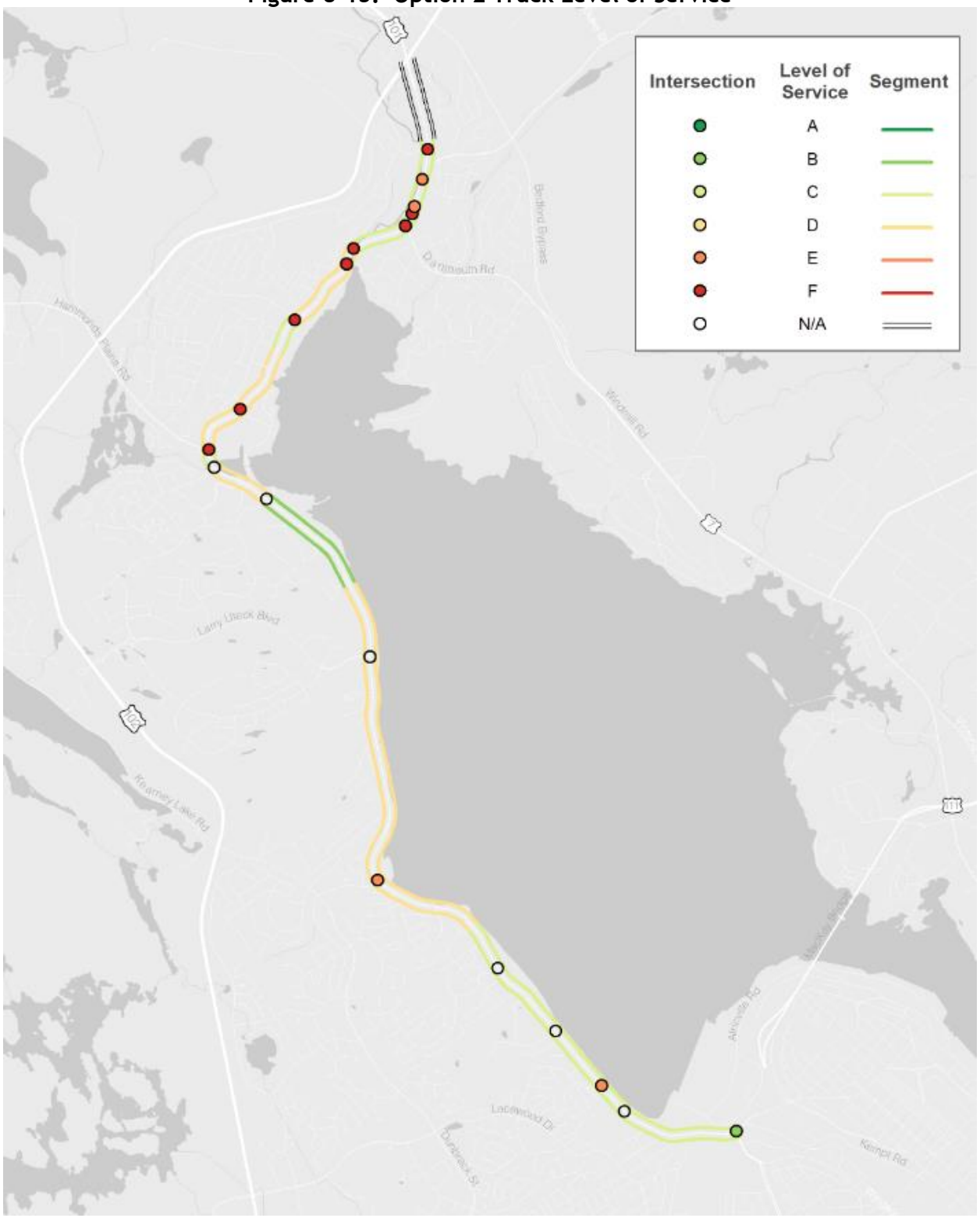
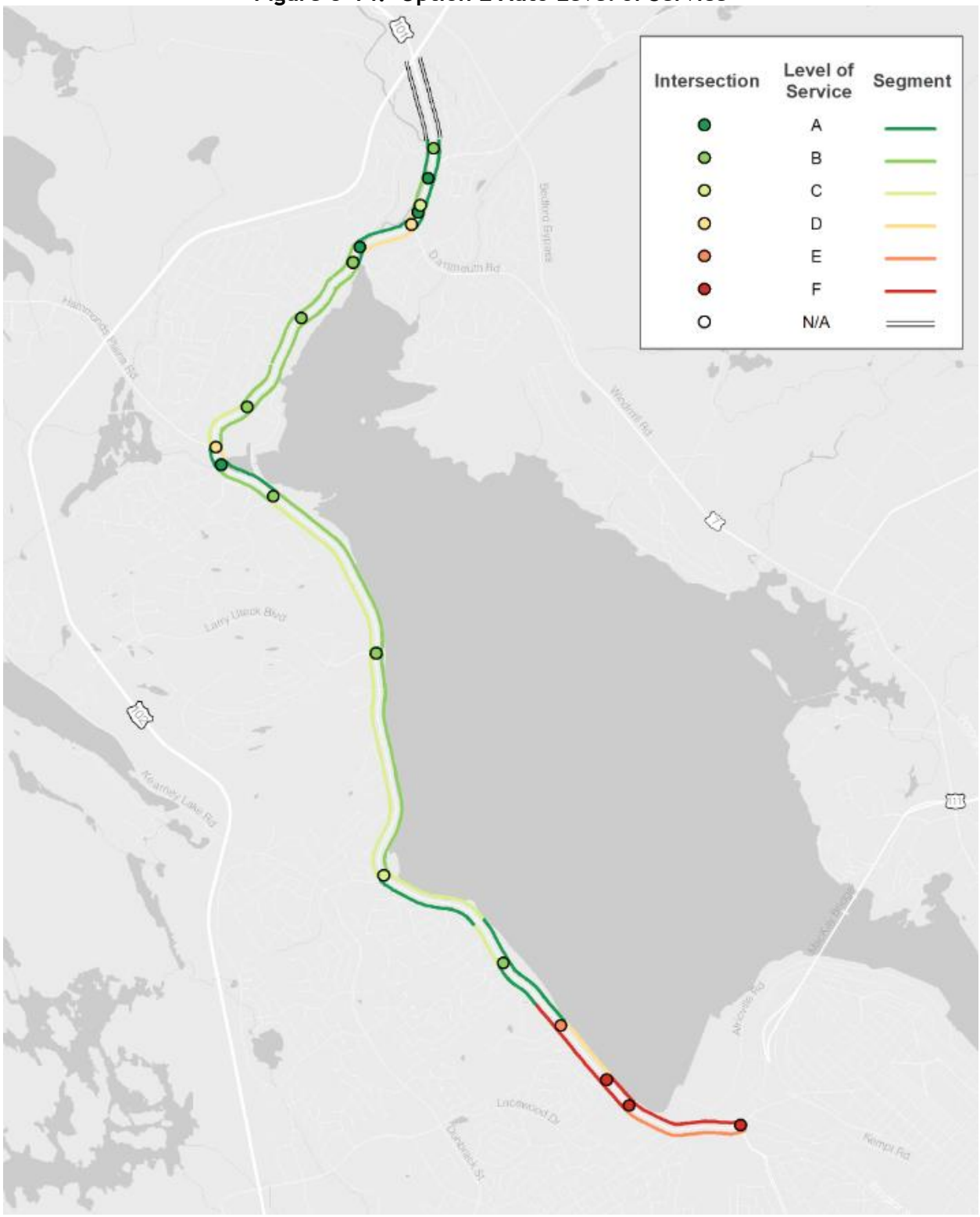


Figure 8-14: Option 2 Auto Level of Service



Summary of Trade-Offs

A summary of the key trade-offs for each mode resulting from functional design of Option 1 – Balanced and Option 2 – Transit Priority is provided in **Table 8-9** below.

Table 8-9: Summary of Key Trade-offs associated with Option 1 and 2

Mode	Option 1 – Balanced	Option 2 – Transit Priority
	• Dedicated bus lanes are limited to minimize reduction in traffic capacity and enable space for a multi-use trail • Transit priority measures are limited north of Kearney Lake Road to accommodate space for sidewalks and cycling infrastructure. Targeted transit priority measures are provided only where the greatest benefits can be realized.	• Transit priority measures north of Kearney Lake Road are limited in order to accommodate sidewalks and cycling infrastructure. Targeted transit priority measures are provided only where the greatest benefits can be realized.
	• Generally, grass boulevards are not provided between the street and sidewalk in order to gain space for other modes. • On-road bike lanes, versus a separated cycling facility, are provided from Convoy Run to Dartmouth Road in order to maintain desired lane widths and sidewalks on both sides. Narrow cycle tracks may be alternative as discussed in Section 8.6.	• No dedicated cycling facilities from Manor Lane to Kearney Lake Road, requiring cyclists to share the bus lanes. This is an improvement for cyclists over existing conditions, but less desirable than a separated cycling facility. • Generally, grass boulevards are not provided between the street and sidewalk to gain space for other modes.
	• Loss of the left turn lane from Rutledge Street to Hatchery Lane to accommodate bike lanes and continuous sidewalks on both sides of the roadway. • Narrowed traffic lanes and reduced speed limit to 50 km/h throughout.	• Loss of a southbound traffic lane from Sherbrooke Drive to Joseph Howe Drive resulting in increased motor vehicle traffic congestion. However, over time, improved transit service can prompt modal shift to minimize this increase. • Loss of the left turn lane from Rutledge Street to Hatchery Lane to accommodate bike lanes and continuous sidewalks on both sides of the roadway. • Narrowed traffic lanes and reduced speed limit to 50 km/h throughout.

8.6 Design Alternatives

Detailed Design Considerations

The functional design was prepared based on a basic topographic survey, aerial photography, GIS property fabric, and GIS utility locations. The geometric details will need to be refined during detailed design once more detailed topographic survey and other field information are acquired. Specific considerations during detailed design include:

- Opportunity to increase general curb lane widths – The proposed curb lane widths are 3.3m throughout most of the corridor, but this is a minimum. Curb lane widths of 3.5m would be desirable where feasible.

- Placement of utility poles in sidewalk/boulevards - Sidewalk width and placement in the functional design assumes utility poles would be placed approximately 0.7m from the curb face and a clear walking space of at least 1.5m would be provided behind the poles. This is typical practice for HRM but would traditionally be combined with wider curb lanes. With the narrowed curb lanes, there will need to be careful consideration of an appropriate offset of utility poles to satisfy an appropriate clear distance from passing vehicles.

- Opportunity to separate cyclists from pedestrians on the multi-use trail – The functional design proposes a continuous 3.5m wide multi-use trail for combined use by pedestrians and cyclists. Where space permits, it would be beneficial to explore separation of users, perhaps with a 3.0m wide cycling trail and adjacent 1.5m walking track, delineated by different surface treatments.

Bayview Road Intersection

An alternative design for the Bedford Highway/Bayview Road intersection was prepared for Option 1 that would see Bedford Highway widened to accommodate two northbound through lanes and a separate northbound left turning lane, while maintaining a narrowed trail (2.7m wide) on the east side. A concept design is shown in **Figure 8-15**.

This improvement may require relocation of the rail fence and retaining wall, but offers the following improvement opportunities:

1. If the two northbound lanes remain as general-purpose lanes, the separate left turn lane would provide significant capacity improvements to serve the heavy northbound left turn demand into Bayview Road during the PM Peak. This would have the following operational impacts during the 2031 PM peak period:
    a. Intersection LOS would improve from LOS F to LOS C.
    b. The northbound approach would improve from LOS F to LOS B.
    c. 95th percentile queue for the northbound through would reduce from 500m to 120m.

2. Alternatively, the general purposes lane configuration could remain the same as existing and the widened area could be dedicated to a transit queue bypass lane to reduce transit delays

in this highly congested area. In this case, operations would remain similar for general purpose traffic, but outbound transit vehicles would see a reduction in delay of perhaps 1-2 minutes on average.

It is recommended that this option be explored further upon obtaining a more detailed topographic survey and also considering the placement of relocated traffic signal poles.

Dartmouth Road Intersection

An alternative design for the Bedford Highway/Dartmouth Road intersection was prepared (for Option 1 or 2) that would see the signalized intersection replaced with a multi-lane roundabout. A concept design is shown in **Figure 8-16**. Some right-of-way acquisition would be associated with this concept, but the roundabout location may be optimized during detailed design to limit these impacts. Design features, operations, and pros and cons of the roundabout are as follows:

- The concept shows an Inscribed Circle Diameter of 47m with multi-lane entries on Bedford Highway and single lane entries on Dartmouth Road and the commercial driveway.
- Based on an Arcady analysis, the proposed configuration operates at LOS A for both existing and future growth conditions.
- A single lane roundabout with a right turn bypass lane on Dartmouth Road would also operate at LOS A, but the lane continuity with the adjacent signalized intersection is not as desirable and a weaving movement may be introduced. This could be explored further in design.
- Pros of the roundabout:
    - Delays at the roundabout would be considerably lower than the signalized option.
    - The roundabout concept does not include transit priority features, but with the smooth traffic flow, transit vehicles would have little delay.
    - A roundabout would allow for smoother transitions from the bike lanes to the multi-use trails.
    - The roundabout provides an opportunity for a gateway treatment.
- Cons of the roundabout:
    - Roundabout pedestrian crossings are not as desirable for vulnerable or visually impaired pedestrians, particularly crossings on multi-lane entries/exits.
    - The roundabout would disrupt the proposed traffic signal coordination along Bedford Highway; and
    - The construction cost of the roundabout would be higher than the signalized option.

END NEW PEDESTRIAN BARRIER

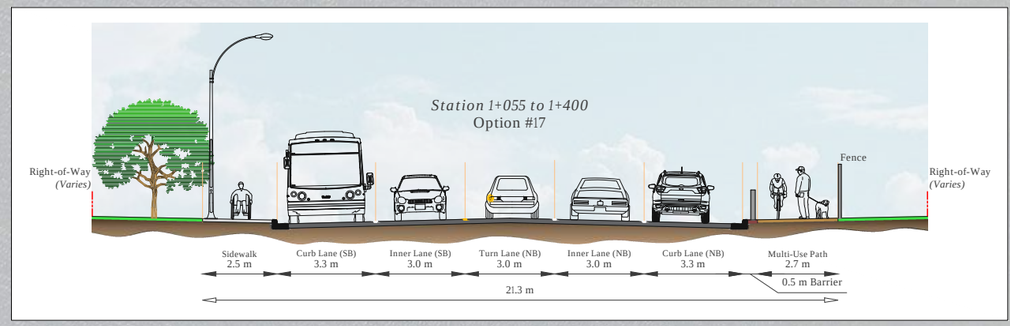
CN Rail
Rockingham Yard

WIDEN MULTI-USE PATH FROM 2.7m BACK TO 3.7m

RELOCATE UTILITY POLES TO BACK SIDE OF SIDEWALK WHERE REQUIRED

REPLACE EXISTING TRAFFIC ISLANDS WITH SMART CHANNELS

REMOVE EXISTING GUIDERAIL TO END OF NEW PEDESTRIAN BARRIER AT STN. 1+490 (FENCE TO REMAIN)



Fairview Cove

Bayview Road

CN Rail

INSTALL PEDESTRIAN BARRIER ON 0.5m WIDE BOULEVARD (STN. 1+055 TO STN. 1+490)

NARROW MULTI-USE PATH FROM 3.5m TO 2.7m

Bedford Highway

Laurentide Drive

BEECHWOOD PARK

Laurentide Drive

ConBay

Manor Lane

0 10 20 30 40 50 75 m

1 : 750

Figure 8-15: Alternative Design for Bedford Highway/Bayview Road

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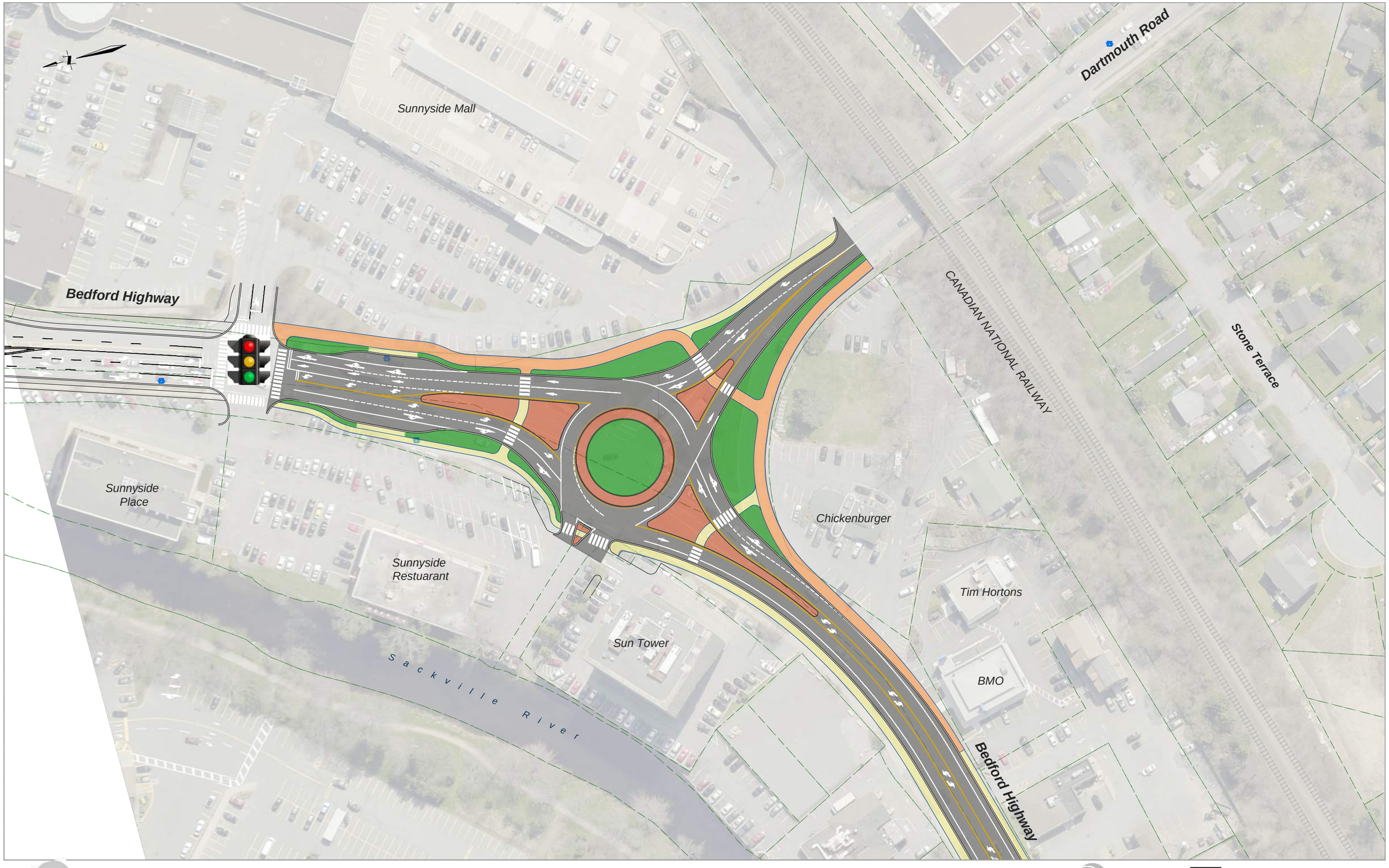


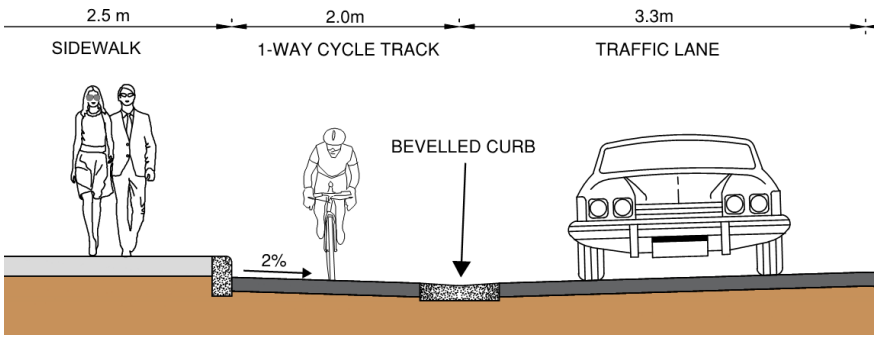
Figure 8-16: Roundabout Concept for Bedford Highway/Dartmouth Road

Cycling Facility from Convoy Run to Dartmouth Road

The functional designs for Option 1 and Option 2 show 2.0m wide bike lanes from Convoy Run to Dartmouth Road (2.2km distance). This road segment passes through a tightly constrained area of mature commercial development. The area has a "downtown" feel, traffic speeds are generally low, and driveways are frequent. On-road buffered bike lanes have a number of benefits in this context, including improved visibility of cyclists through driveways and maintaining the cycling facilities at a consistent grade. However, it was noted from stakeholders that separated facilities would be preferred along the full length of the corridor for a consistent high-comfort cycling facility.

One potential alternative treatment to the on-road buffered bike lanes is a raised cycle track with a bevelled curb that can be carried continuously through the numerous driveways. In addition to allowing the cycling facility to remain at a consistent grade, the bevelled curb type is preferred as there is insufficient lateral clearance to a barrier curb (which can be a hazard for cyclists along narrow cycling facilities). Examples are shown in **Figure 8-17**.

Figure 8-17: Example Partially Raised Cycle Track



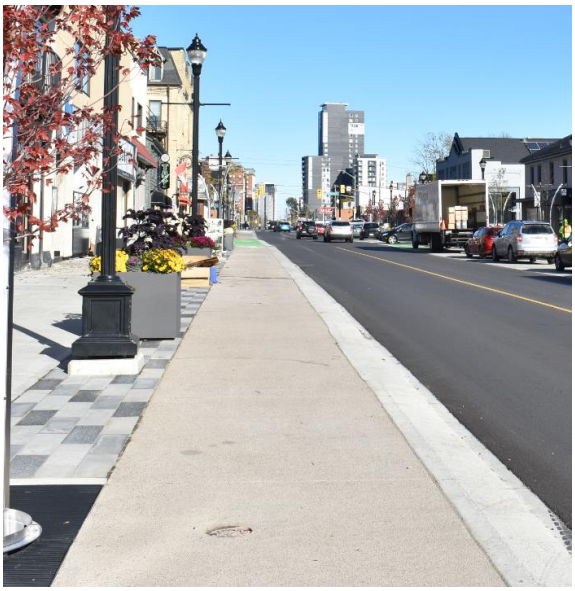


Photo Source: IBI Group

8.7 Costing and Implementation Plan

Cost Estimates

Class D Cost estimates were prepared for each of the two functional design options based on the functional design drawings, expected impacts to utilities and underground services, and historical unit pricing in HRM.

Table 8-10 summarizes the estimated construction cost by segment for each option. The cost estimates include all road reconstruction items, allowances for utility impacts, and 25% contingency. **The estimates do not include underground service renewals (unless impacted by construction), right-of-way acquisitions, or engineering**. The cost estimates also exclude the cost of the Windsor Street Exchange Reconfiguration, given the uncertainty regarding the scope of that work. Detailed breakdowns of estimates are provided in **Appendix N**.

The Utility Relocation component of the cost estimate is approximately $2.5 million for each option.

The cost estimates show very little difference in cost between Option 1 and 2 given that the right-of-way is being maximized and similar quantities of material are being used.

Table 8-10: Class D Construction Cost Estimates

Road Segment	Construction Cost ($millions)	
	Option 1	Option 2
1: Windsor to Sherbrooke Km 0.000 to 1.9000	$8.085	$7.497
2: Sherbrooke to Kearney Lake Km 1.900 to 4.000	$10.665	$10.548
3: Kearney Lake to Larry Uteck Km 4.000 to 6.000	$4.899	$4.899
4: Larry Uteck to Hammonds Plains Km 6.000 to 8.300	$5.870	$5.870
5: Hammonds Plains to Union KM 8.300 to 10.500	$5.363	$5.363
6: Union to Oakmount Km 10.500 to 11.700	$5.730	$5.730
Transit Signal Priority Budget	$0.200	$0.200
Total (including utility relocations and 25% Contingency)	**$40.812 million**	**$39.907 million**

Utility Impacts

The Bedford Highway corridor contains several major utilities including overhead power and communications, underground communications, and gas. Relocations to above-ground infrastructure have been shown on the functional designs and are summarized in **Table 8-11** by station (applicable to both options). It is expected that nearly 180 utility poles will need to be

relocated as well as 52 light poles and 19 fire hydrants. Relocation of traffic signal poles at most signalized intersections is also expected.

Generally, no major impacts to underground communications are anticipated. An assessment of this infrastructure and any potential impacts is summarized in **Table 8-12**.

Finally, a review of the Heritage Gas line indicates that it should not be impacted by the proposed reconstruction works.

Table 8-11: Impacts to Above-Ground Utilities

Station		Side of Roadway Corridor	No. of Utility/ GUY Pole Relocations	No. of Fire Hydrant Relocations	No. of Light Pole Relocations
From	To				
0+000	1+215	Southbound	3	0	0
		Northbound	0	0	0
1+215	1+905	Southbound	0	0	9
		Northbound	3	0	0
1+905	2+605	Southbound	23	4	0
		Northbound	10	1	0
2+605	3+310	Southbound	21	3	0
		Northbound	14	0	0
3+310	4+230	Southbound	23	3	0
		Northbound	13	0	0
4+230	5+525	Southbound	0	0	0
		Northbound	0	0	0
5+525	6+220	Southbound	6	0	1
		Northbound	9	1	0
6+220	7+225	Southbound	3	0	0
		Northbound	2	0	0
7+225	7+925	Southbound	15	3	0
		Northbound	2	0	1
7+925	8+460	Southbound	0	0	2
		Northbound	3	0	5
8+460	9+070	Southbound	0	0	0
		Northbound	3	0	1
9+070	10+065	Southbound	3	1	5
		Northbound	12	0	5
10+065	11+100	Southbound	2	1	13
		Northbound	5	1	10
11+100	11+700	Southbound	1	0	0
		Northbound	1	1	0
		Total	**177**	**19**	**52**

Table 8-12: Assessment of Impacts to Underground Communications

Station		Side of Roadway Corridor	Existing Surface Condition at Facility Location	Proposed Surface Condition at Facility Location	Impact
0+000	0+550	SB Side	Outside of curb, no sidewalk	Remains outside of roadway, below proposed AT Trail	Adjusted AT Trail structure to accommodate the existing structure. Consider constructability, increase monitoring to ensure no damage to existing infrastructure. Vertical adjustment to existing MH structures.
0+550	7+860	N/A	N/A	N/A	There is no bell underground infrastructure in this area.
7+860	8+850	SB Side	Outside of curb, below sidewalk in some places	Remains outside of roadway, below proposed concrete sidewalk	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
8+850	8+850	Crosses roadway	Within roadway	No change to surface.	There should not be any impact to the existing u/g infrastructure, this area is to be milled and paved.
8+850	9+690	NB Side	Outside of curb, below sidewalk in some places	Remains outside of roadway and below proposed concrete sidewalk.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
9+690	9+725	NB Side	Existing bus stop pad.	New bus stop pad.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk.
9+725	10+270	NB Side	Outside of curb, below sidewalk in some places	Remains outside of roadway and below proposed concrete sidewalk.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
10+270	10+300	NB Side	Existing bus stop pad.	New bus stop pad.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk.
10+300	10+525	NB Side	Outside of curb, below sidewalk in some places	Remains outside of roadway and below proposed concrete sidewalk.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
10+525	10+950	NB and SB Sides	Outside of curb, below sidewalk in some places	Remains outside of roadway and below proposed concrete sidewalk.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
10+725	10+730	Crosses roadway	Within roadway	No change to surface.	There should not be any impact to the existing u/g infrastructure, this area is to be milled and paved.
10+950	11+150	NB Side	Outside of curb, below sidewalk in some places	Remains outside of roadway and below proposed concrete sidewalk.	Consider constructability, increase monitoring to ensure no damage to existing infrastructure while installing new concrete sidewalk. Vertical adjustment to existing MH structures.
11+150	11+825	N/A	N/A	N/A	There is no bell underground infrastructure in this area.

Right-of-Way Impacts

Right-of-way impacts associated with Option 1 and Option 2 have been detailed on a separate set of plans. The impacts are summarized in **Table 8-13** by Property Identification number (PID) and the area of property required. These right-of-way requirements are based on impacts of widened infrastructure as well an attempt to establish a new, consistent right-of-way boundary along Bedford Highway, based on the following:

- From Joseph Howe Drive to Moirs Mill Road – A "standard" ROW was created that varies from 19m to 25m in width with the average being 22-23m. New boundaries are at least 0.5m behind the proposed sidewalk or trail, or in the absence of sidewalk, 3.5m from either the face of curb or the edge of asphalt. This gives a fairly consistent right-of-way width but does not take into account toes or tops of slopes.

- North of Moirs Mill Road - The existing ROW is only widened where necessary to accommodate infrastructure widening, with the same offsets described above.

In total, 143 PIDs are impacted and an estimated 23,630 m^2 of property is required (2.4 hectares). This applies to both options.

Table 8-13: Summary of Right-of-Way Impacts

Parcel PID	Property Required (m^2)	Parcel PID	Property Required (m^2)	Parcel PID	Property Required (m^2)	Parcel PID	Property Required (m^2)
137828	65.3	291575	21.9	456533	47.1	41043621	6.1
137828	94.2	291591	1.4	40018244	36.8	41043837	34.0
177733	30.1	292508	71.3	40041212	120.7	41072778	156.1
177741	17.0	293084	6.2	40068892	37.8	41119496	146.0
177758	17.9	294173	74.1	40106825	25.4	41200700	148.3
177766	16.2	294975	35.6	40106825	3.8	41252701	26.6
177774	17.4	294983	62.5	40106874	584.2	41256223	26.3
212647	8.0	296665	68.1	40106908	39.5	41260860	13.3
277178	34.9	319947	18.0	40106916	226.5	41263096	13.7
286930	45.4	325233	79.6	40107161	595.4	41340688	350.8
286948	140.8	325290	1.1	40107195	5.6	41340696	2108.6
286971	8.3	360560	72.3	40116337	263.4	41340704	4096.6
289496	66.6	428466	166.0	40116360	124.5	41340704	108.9
289546	118.1	428581	55.2	40180424	632.6	41340704	683.1
289553	40.2	428615	39.0	40180432	5.9	41340704	42.9
289561	107.3	428755	127.5	40180440	1341.9	41340704	76.4
289611	146.5	428813	37.8	40311540	68.7	41340704	1295.1
289629	143.8	428920	9.7	40355927	50.3	41340712	3.3
289637	15.3	428938	24.2	40368037	31.6	41340720	1533.0
290148	78.0	429142	8.6	40368037	31.9	41347493	43.0
290155	69.2	429159	94.4	40459018	26.7	41347501	45.4
290163	66.2	429183	1.6	40592297	167.8	41350539	57.8
290171	65.4	429209	225.5	40592297	81.0	41399759	14.2
290189	4.4	429209	399.5	40719833	1.7		
291070	43.1	429209	3.5	40723835	39.8		
291096	0.0	429217	71.6	40724734	6.7		
291161	1.8	429233	103.5	40741480	1.1		
291187	90.9	429977	12.4	40741480	14.7		
291195	0.4	429993	7.0	40813388	91.1		
291310	159.6	430017	13.7	40813396	33.4		
291328	50.8	430025	12.1	40813404	32.0		
291336	60.9	430249	3.4	40866949	82.2		
291344	29.9	430306	0.8	40877383	52.6		
291377	12.3	430363	6.9	40917254	3.9		
291427	86.2	431528	5.6	40917288	296.3		
291443	89.3	434712	56.7	40917346	2893.5		
291450	9.4	434720	20.2	41019480	23.8		
291534	5.7	434985	7.8	41020256	213.2		
291559	0.2	435073	87.2	41043605	30.2		
291567	3.5	435131	1.6	41043613	59.3		
						TOTAL	**23,630 m^2**

Implementation Plan

A complete upgrade of the Bedford Highway corridor is a major undertaking that will take several years to complete. Therefore, an implementation plan is required to advise the sequencing of work that takes into consideration the priority needs of the corridor, HRM plans for street recapitalization, coordination with other construction projects and traffic disruptions, utility impacts, property acquisition, and budgetary constraints. The following outlines guidance for implementing the function design of either option.

Phase 1 – Windsor Street to Kearney Lake Road

The southern end of the corridor experiences the largest delays and is the most significant bottleneck for traffic and transit. It is also the most uncomfortable environment for cyclists. Therefore, it is suggested that it receive priority for investment. A project from Windsor Street to Kearney Lake Road would capture many key elements of this plan including dedicated transit lanes, 4 km of separated cycling facility through the highest volume section of the corridor, several pedestrian crossing improvements, and improved multi-modal access to MSVU. The total cost of this project would be approximately $18 million and may be tendered as several contracts over 3-5 years. Considerations for this Phase 1 work, including some complications, are as follows:

- HRM has identified the area south of MSVU for immediate recapitalization due to deteriorating roadway condition. It would be critical to reconstruct the roadway geometry to align with the preferred functional design option.
- A multi-use path up to Kearney Lake Road would provide a connective function for the local area even if the trail was not immediately extended northward. In other words, this 4km trail in itself would provide a strong feature in the AT network.
- Transit would receive its most significant benefits of the plan early in the implementation period.
- The work would be coordinated with the possible advancement of the Seton Ridge development, providing good transit and AT connections early in the life of the development.
- Complications of advancing this phase immediately include:
    - A preferred option would need to be selected very soon so that detailed design can proceed in coordination with recapitalization efforts.
    - This segment has the highest concentrations of utility pole relocations, requiring lead time for planning and executing the relocation work.
    - ROW acquisition will be required from multiple properties, including MSVU, which poses a risk to construction schedule.
    - The Windsor Street Exchange would be treated as its own, standalone project. Given the potential magnitude of this project, its timing is uncertain. Until this reconfiguration is complete, severe queuing on Bedford Highway will persist, so upstream improvements will not realize their full potential benefits. Nevertheless, it is advised to proceed with Phase 1 given the urgency regarding recapitalization.

Phase 2 – Traffic Signal Coordination and TSP

Traffic signal coordination and TSP are relatively low-cost technological improvements that can be implemented more nimbly and can provide immediate benefits. The implementation would need

to be coordinated with the timing of HRM's rollout of its new traffic controllers. There is also onboard technology required for buses that would need to be budgeted for and procured. This Phase could begin sooner than Phase 1 and proceed independently. Given the possibility of implementation in a very short term, a more detailed phasing plan for traffic signal coordination and TSP is provided further below.

Phase 3-6 – Kearney Lake Road to Oakmount Drive
The remaining phases of the corridor construction could proceed northward, segment by segment. The construction cost of each of the remaining four segments ranges from $4-6 million. Therefore, each may be considered as its own contract. Completing the segments in order is not compulsory, but considerations should be made for interim transitions of AT facilities where continuity of facilities is not achieved between phases. Flexibility in the sequencing is required so that work can be coordinated with recapitalization and service renewal programs and other construction works and traffic disruptions in the local area (e.g. major works on Bedford Highway should be avoided if parallel routes are also under construction).

Implementation Plan for Phase 2 – Traffic Signal Coordination and TSP

Several steps are required to transition from Functional Design to implementation of traffic signal coordination and TSP. The implementation plan for this work has been divided into three stages, as follows:

- Stage 2A: Traffic Operational Improvements for Transit;
- Stage 2B: Transit Signal Priority and Roadside Equipment;
- Stage 2C: Opticom Central Management System (Future Option).

Note there will be some overlap with the end of one stage and the commencement of the other.

Stage 2A: Traffic Operational Improvements for Transit

Description
Stage 2A involves the development of coordination plans at the selected segments of Bedford Highway and requires the least investment from an equipment procurement and staffing standpoint. As such, this can be completed during the early stages of implementation. The work required for developing these coordination plans include:

- Developing existing conditions models for the AM, PM, and Off Peak plans;
- Developing the proposed timing plans for the AM, PM, and Off Peak plans; and
- Monitoring bus performance post implementation.

The candidate segments for coordination are proposed to be:
- From River Lane to Hatchery Lane;
- From Holland Avenue/Convoy Run to Southgate Drive; and
- From Flamingo Drive to Manor Lane.

Prior to the reconfiguration of the Windsor Street Exchange, the benefits of implementing new coordination plans during the AM peak in the southbound direction may not be as effective as it would be for the opposing direction or for the segment from River Lane to Hatchery Lane. Although the full benefits of coordination may not be fully realized until resolving the traffic conditions at the Windsor Street Exchange, development of coordination plans is still recommended as primary step for developing a solution to benefit traffic and transit operations along Bedford Highway.

Following the implementation of the coordinated plans, "after" travel time studies should be completed to verify that traffic and transit progression along the corridor has improved.

Duration

Based on the proposed functional design, 15 intersections are proposed for coordination. Given this scope, the duration of this activity is anticipated to be no more than six months. Post implementation, it is recommended for HRM staff to monitor the progression along Bedford Highway. As previously indicated, this can be completed by conducting travel time analysis before and after implementation.

Costs

The anticipated cost to conduct the Coordination Studies is $50,000.

Stage 2B: Transit Signal Priority Implementation

Description

The subject signalized intersections along Bedford Highway are already equipped with Opticom GPS receivers for emergency vehicles. As a result, to enable TSP operations along Bedford Highway during this stage, buses will need to be able to communicate the TSP request to the intersection. There are several options for HRM to consider. Each option will have its own specific requirements, and are described as follows:

- Option A: Hardware Integration. Under this option, the Opticom GPS equipment is installed on the bus. Through discussions with HRM staff, the current Trapeze system does not require any software upgrades to perform the desired operations. This preliminary cost estimate only accounts for the installation of the on-board Opticom GPS equipment; and

- Option B: Software Integration. Under this option, in addition to the on-board GPS equipment, a central management system (CMS) would be required. For this option, the CMS would allow users to monitor the health of the overall priority system. This option requires the procurement of the CMS software (approximately $300,000), and software for each transit vehicle (approximately $1,800 per vehicle). Note that the values presented here serves as an initial budgetary estimate only. The exact costs associated with the procurement of the system will need to be discussed in further detail if this option is elected.

To observe the benefits in the provision of TSP along the entire Bedford Highway corridor, Option A is proposed, and buses used for Route 80 and Route 82 should have the on-board equipment installed first under Stage 2B.

Duration

Establishing the functional requirements can occur concurrently with Stage 2A. The procurement and installation of Option A occurs following Stage 2A and is anticipated to be one year to equip the buses for Route 80 and 82 and also to program the on-street equipment to permit transit signal priority operations along the entire corridor.

For the remaining routes, the schedule for implementation will coincide with annual budgets and considering implementation schedule of the road construction.

Cost

The cost associated for Stage 2B is $4,000 per bus plus an estimated $35,000 for signal system integration, system development and in-field programming. In developing the costs associated under this stage, the following assumptions were made:

- The proposed Opticom GPS bus equipment can be installed without upgrading the existing Trapeze system;
- The TSP system was developed for the entire corridor; and
- Option A for GTT Installation was selected.

Stage 2C: GTT Central Management System (CMS) (Future Option)

As discussed under Stage 2B, GTT also offers a central management system (CMS), which will help HRM monitor the health of the overall transit priority system in real time. The preliminary estimate to procure such a system represents significant capital cost to the HRM. As a result, if HRM elects to purchase a CMS, it is proposed to be completed as more transit vehicles are equipped with the GPS equipment for other routes.

8.8 Commuter Rail Scenario

One of the objectives of the Bedford Highway Functional Plan was to determine how transportation options for Bedford Highway could support or complement a potential future Commuter Rail service along the CN Rail Corridor, considering the infrastructure needed to provide multi-modal access to rail stations.

The 2015 Commuter Rail Feasibility Study identified three potential station locations, including Sunnyside, Mill Cove, and Rockingham. It is now contemplated that a station might also be located at the base of Larry Uteck Boulevard (refer to locations in **Figure 9-3)**. There is limited space to accommodate Park & Ride traffic at these locations, so it is expected most patrons would access these stations via active transportation and transit. Park & Ride rail ridership would primarily occur at stations north of Bedford Highway.

Commuter sheds for walking and cycling modes for each of the four stations were determined based on a 800m trip distance for pedestrians and a 1,500m trip distance for cyclists. The commuter shed mapping shown in **Figure 9-3** indicates there are 9,000 current residents within the 500m walking distance of one of the four proposed rail stations and 20,000 current residents within the 1,500m cycling distance of a proposed rail station.

For bus transit riders, the potential for transfer to rail decreases closer to the Peninsula given that the cost of time for the transfer is less likely to be made up on a short rail trip. Therefore, bus transit transfers would be most likely to occur at the Mill Cove and Sunnyside Stations. Additional bus pull-offs may be required to allow time for transferring passengers.

Providing strong AT connections to the station locations will be critical to supporting a rail service along with TPM measures and efficient transit connections to enable buses to remain on schedule. In some locations, steep slopes between Bedford Highway and the rail line may facilitate grade-separated AT crossings over the railway, which could also serve for station access and extend the multi-use trail system. These crossings must be accessible for persons with disabilities.

The functional designs for Bedford Highway support and complement the above needs by:

- Providing a continuous cycling facility along Bedford Highway that can connect to other future feeder routes.
- Improving the connectivity, comfort and safety of pedestrian infrastructure and crosswalks and strategic locations
- Providing TSP throughout the corridor, particularly through the Sunnyside Area and Mill Cove areas where bus transfers may be most likely.

Should commuter rail proceed, further refinement of the proposed AT and transit connections can be made, subject to final station locations. Either Functional Design Option can accommodate commuter rail, but the Balanced Option offers the most promising fit because the long multi-use path would feed potential stations, and the train service would provide another mode of transit priority between communities. Additionally, the presence of a commuter rail service does not serve all travel needs and does not reduce the need for corridor wide AT and bus transit improvements along Bedford Highway. Therefore, the functional design can and should be implemented independently of a decision on commuter rail.

9.0 Land Use Vision

9.1 Future Role of the Corridor

The two functional design options presented in this report strive for a better balance between travel modes along the corridor and improve the overall safety, comfort, travel flow and visual quality of the roadway. **Option 1 - Balanced Modes Option** provides a continuous active transportation facility and targeted transit priority improvements while minimizing impacts to existing traffic capacity. **Option 2 - Transit Priority Option** focuses heavily on transit improvements, specifically between Joseph Howe Drive and Kearney Lake Road, where a dedicated bus lane is provided in each direction. While commuter rail remains a possibility, it can be integrated into either functional design option in the future.

With a decision about considerable investments into an improved Bedford Highway on the horizon, it is imperative to configure land development along the corridor and its vicinity in a way that maximizes linkages and access to improved transit and active transportation. The integrated mobility plan envisions that higher density walkable community forms in strategic locations will improve the viability of higher order transit and contribute to achieving the Regional Plan's 2031 target for at least 30% of trips to be made by walking, bicycling or transit.

9.2 Commuter Catchment Alignment

A "catchment area" is the geographic area from which a transit or active transportation facility attracts users. It primarily depends on the availability and connectivity of transportation routes. The distance used for catchment areas is determined by research into the willingness of users to travel a given distance using an identified form of transportation. For the purpose of this study the following distances were used:



The geographic extent of the land use study contained in this report aligns with the commuter catchment areas of the non-auto mode improvements of the functional design options. By making changes to the Land Use Structure within the following commuter catchment areas, land uses and employment and residential densities can contribute to increased usage of transit and active transportation infrastructure.

Enhanced Transit

In addition to regular bus stops, enhanced bus stops at major destinations could accommodate (and attract) larger numbers of users. As land uses around those nodes intensify, more people live and work within comfortable walking distance from these enhanced bus stops. **Figure 9-1** shows the geographic extent of an enhanced transit catchment area (500m for walking and 1.5 km for cycling).

The enhanced transit infrastructure would serve the following number of potential pedestrians and cyclists residing in already existing developments:



Multi-Use Path

The introduction of a separated multi-use path along the entire length of the corridor has potential to attract recreational and commuter cyclists from a large catchment area with the promise of traveling along the Bedford Basin on a scenic, safe, continuous, family-friendly path. **Figure 9-2** shows the geographic extent of the multi-use trail catchment area (1.5 km for cycling). Such a path would offer equal cycling conditions to both north and southbound commuters and would serve the following number of potential cyclists residing in already existing developments:



Commuter Rail

If rail-based transit was added to the Bedford Highway corridor, it could potentially improve transit use and catalyze transit-oriented development around stations (**Figure 9-3**). There is limited space to accommodate Park & Ride traffic at most locations along the corridor, so most patrons would access stations via active transportation (800 m walking distance and 1.5 km cycling distance) and buses. Park & ride rail ridership would primarily occur at stations north of Bedford Highway. There is also potential for temporary park-and-ride pending redevelopment of vacant land as Transit Oriented Development.

By itself, without bus transit or a multi-use path, commuter rail alone would be within a convenient walk or bike ride of slightly fewer people than bus transit alone. This is because rail would have fewer stops, despite drawing walk-on users from a wider radius. To understand whether rail would contribute to the total transit catchment of the Bedford Highway Corridor, and to recognize that rail would supplement, rather than replace bus service, two further aspects should be considered, which are beyond the scope of this study:

- Rail and bus walking catchments should be overlaid and compared.
- Several bus routes extend up the hill to the west of Bedford Highway itself. As a result, actual bus walking catchments extend inland beyond the areas shaded in purple on the bus catchment map, and those same uphill bus routes could also feed future rail stations.

With these considerations in mind, the catchments shown on the map and the numbers shown below provide only a starting point for more complex analysis which should be done if commuter rail is considered for future implementation.



Figure 9-1: Bus Stop Commuter Catchment Areas

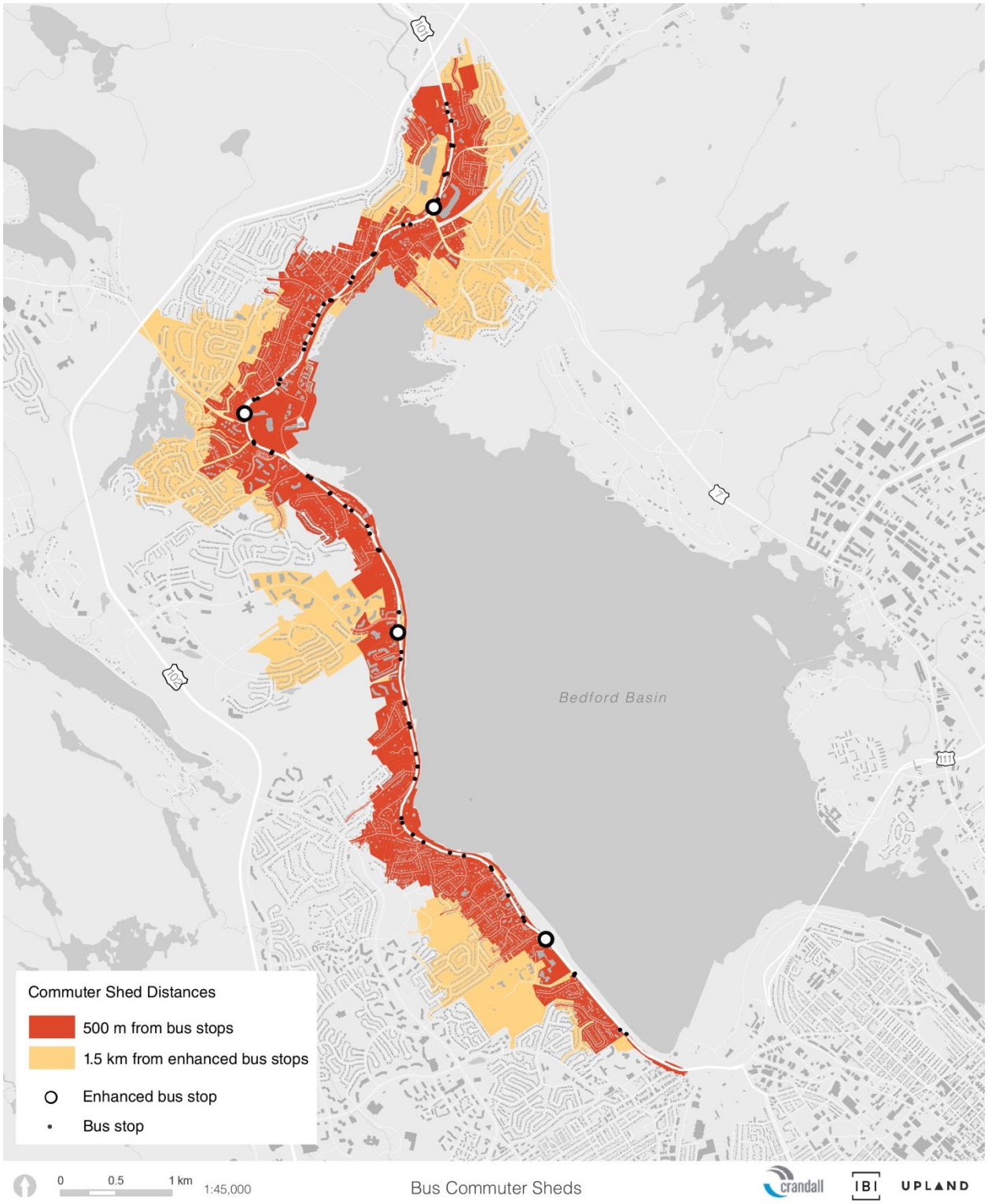


Figure 9-2: Multi-Use Trail Catchment Areas

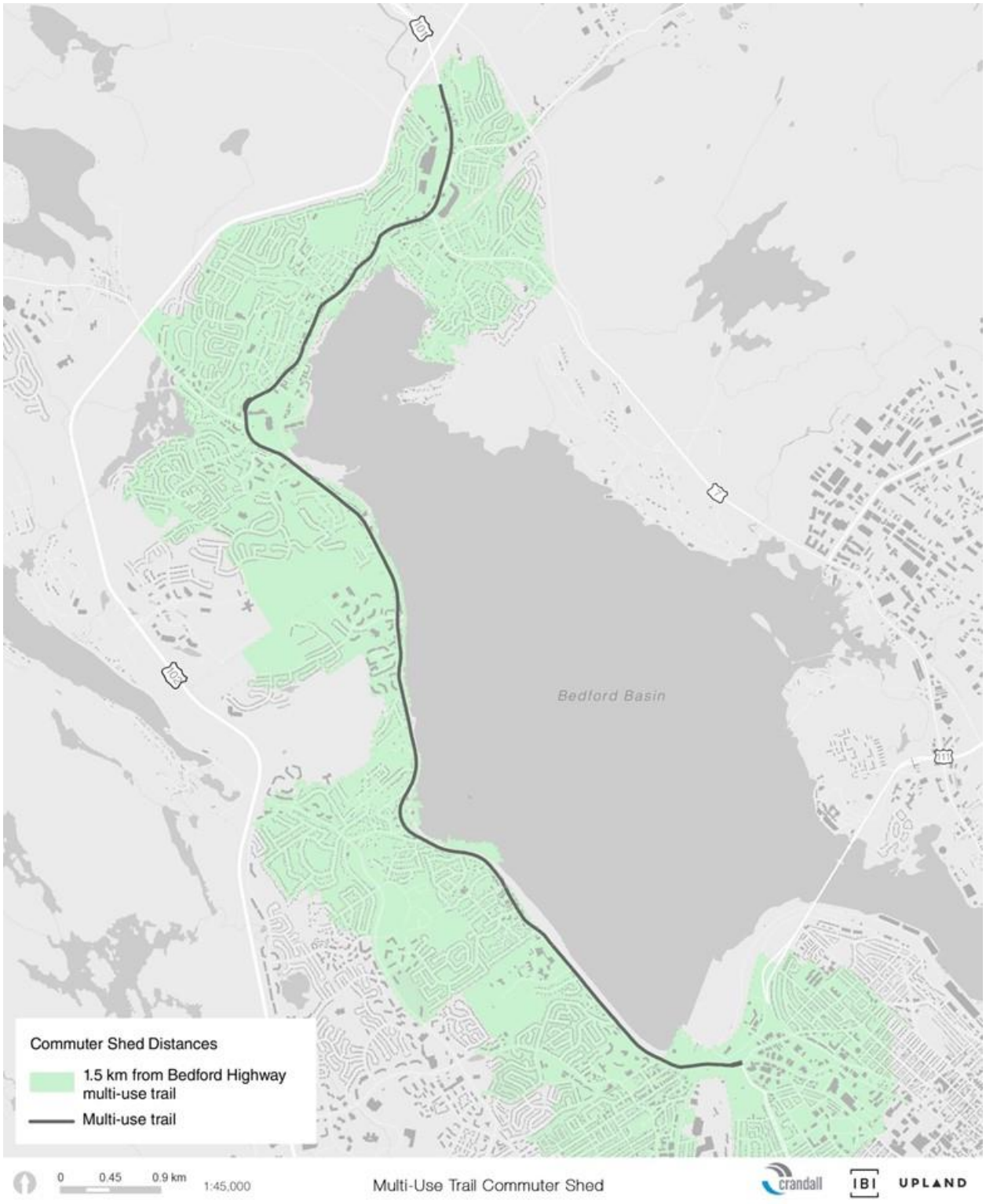
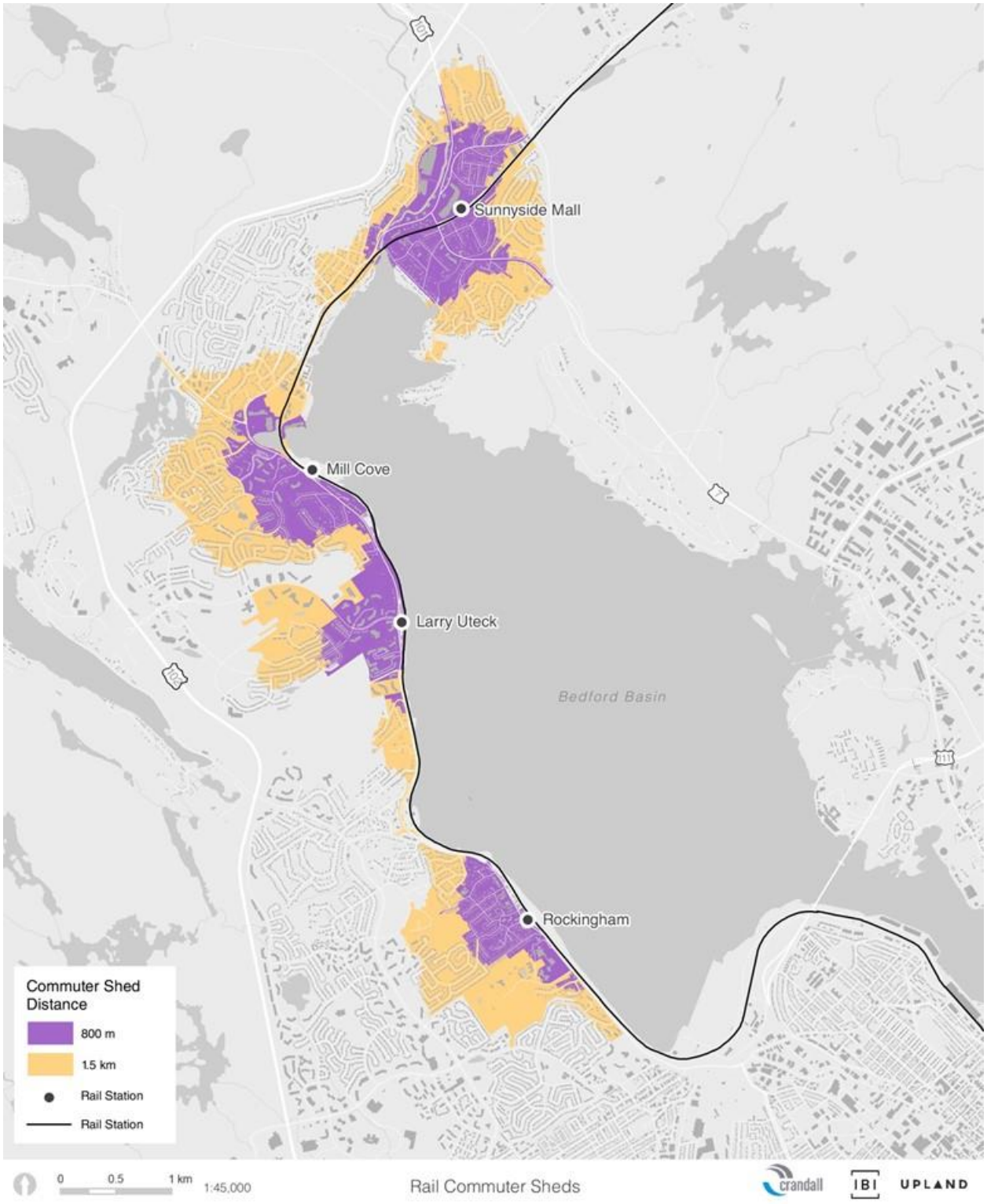


Figure 9-3: Rail Station Commuter Catchment Areas



9.3 Corridor Land Use Limitations

The evolution of the Bedford Highway corridor, its geographic location and the significant development that has occurred in its vicinity over the last two decades, means that land use intensification should be carefully considered, and integrated with transit improvements. This section makes recommendations that should be incorporated in secondary planning processes for the corridor.

Railway Proximity Guidelines

Guidelines for New Development in Proximity to Railway Operations developed through the collaboration of the Railway Association of Canada and the Federation of Canadian Municipalities in 2013 strongly recommend that municipalities should take a proactive approach to identifying and planning for potential conflicts between rail operations and new developments in proximity to railway corridors. The guidelines are based on a comprehensive literature/best practices review from national and international sources as well as a consultation process involving planners, architects, developers, and other professionals from across Canada, the USA, and Australia, as well as members of RAC and FCM.

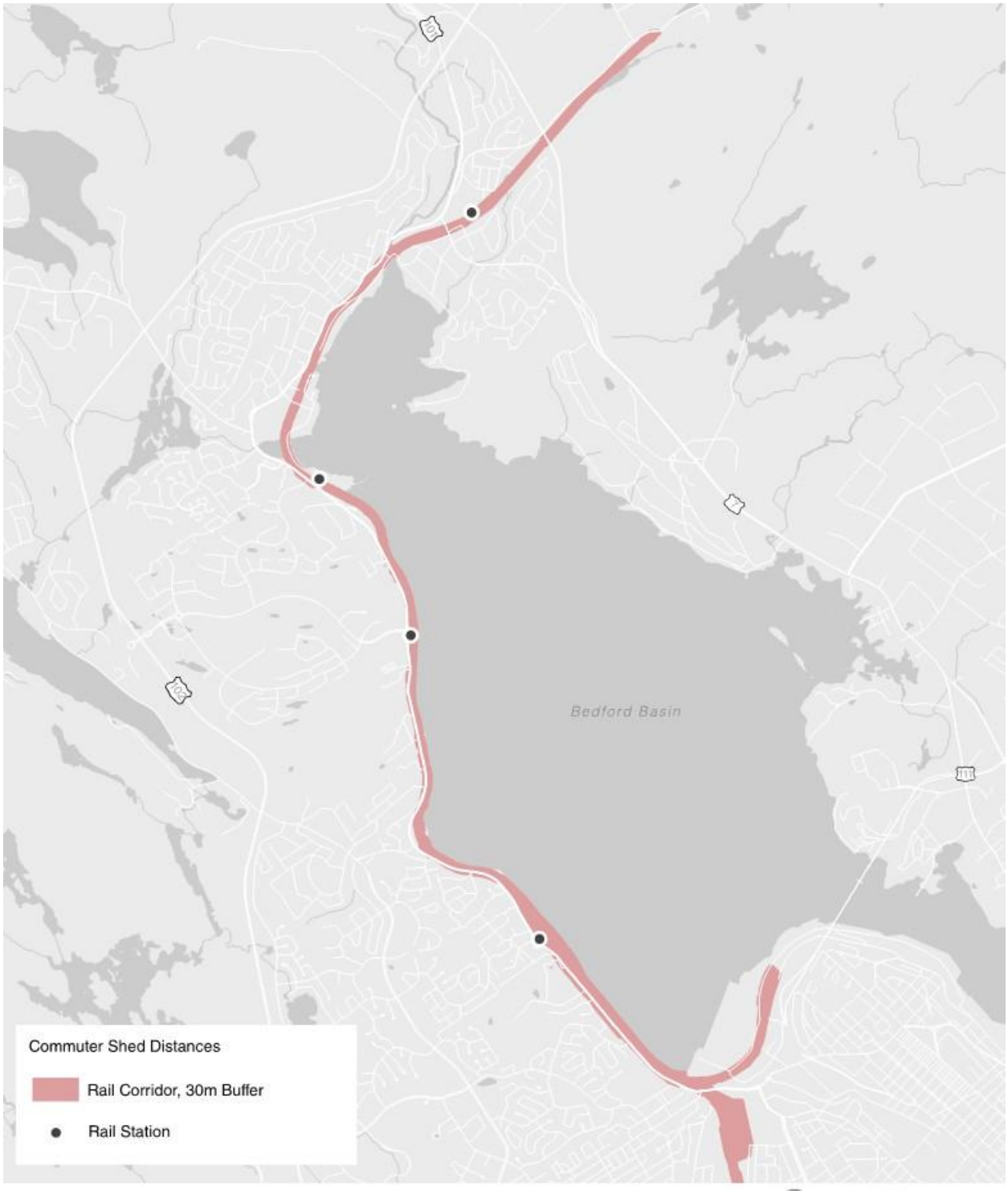
The standard recommended building setbacks for new residential development in proximity to railway operations (measured from the mutual property line to the building face) are as follows:

- Freight Rail Yard: 300 metres
- Principle Main Line: 30 metres
- Secondary Main Line: 30 metres
- Principle Branch Line: 15 metres
- Secondary Branch Line: 15 metres
- Spur Line: 15 metres

If applied along Bedford Highway, these setbacks present significant restrictions for residential development on narrow properties between the rail line and the roadway. Moreover, a 300m setback from railyards would render residential redevelopment within 300 metres of the Fairview railyard impossible. The impact of a 30 metre setback for residential development from the rail line along the Bedford Basin is mapped on **Figure 9-4**.

Recommendation: Conduct further study to ensure a consistent approach across HRM towards implementing minimum setback requirements for new residential development, infill and conversions in proximity to railway corridors, as part of the next Regional Plan review.

Figure 9-4: Impact of 30 Metre Residential Development Setback from Rail Line



Access Control

As the traffic analysis of the study has shown, vehicles merging their way into the traffic stream from driveways causes significant traffic delays along Bedford Highway. The large number of driveways and curb cuts also contribute to a cluttered visual perception of the roadway and take away space that could otherwise be used for landscaped edges visually framing the road. Access control, shared parking, shared driveways and generally reducing the number of cars that use these driveways could contribute to better traffic flow and enhanced urban design.

Recommendation: In order to minimize friction and delays of traffic caused by driveways along Bedford Highway, require shared parking and shared driveways for new development, infill and conversions.

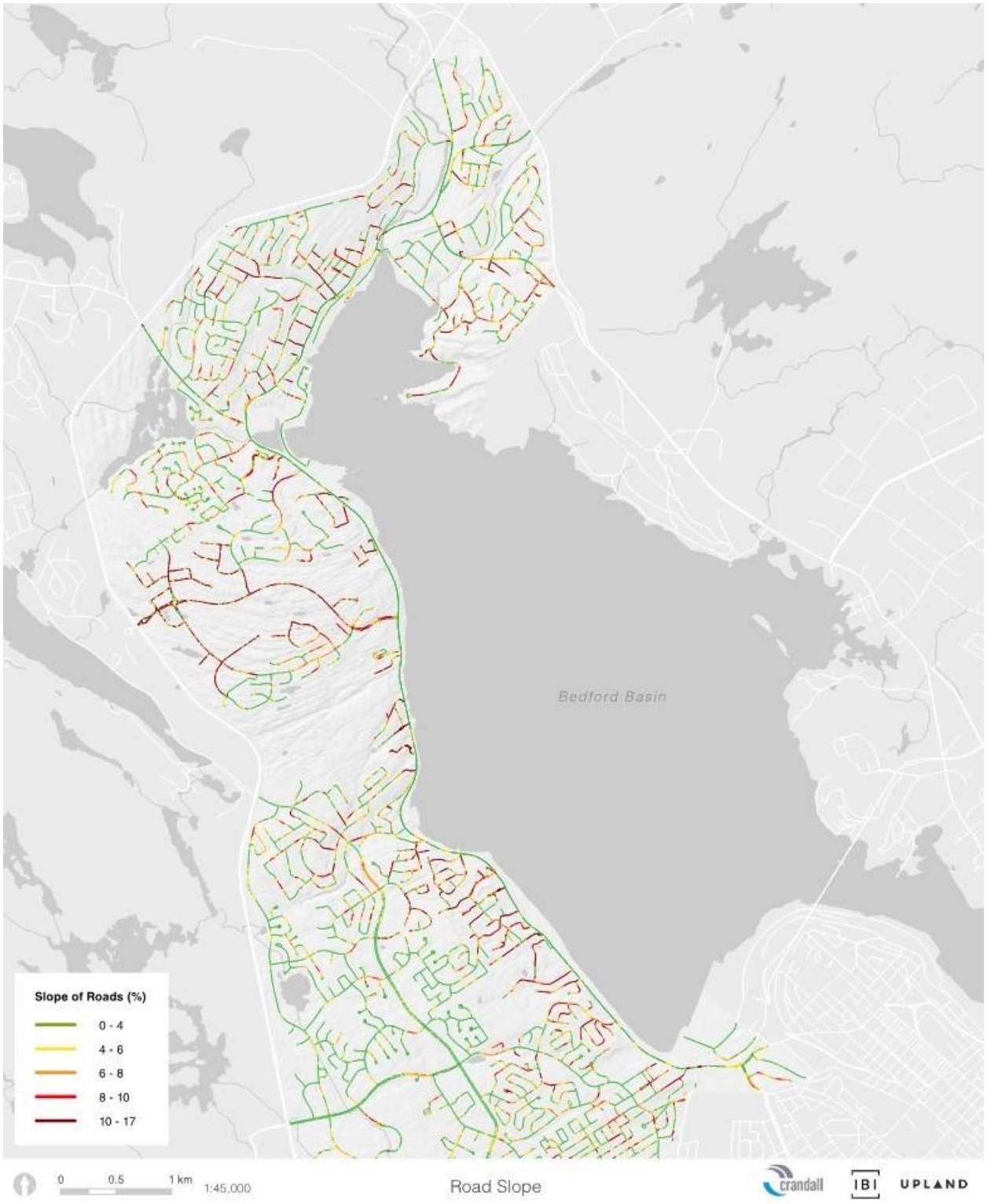
Recommendation: In order to minimize driveway usage along Bedford Highway and to facilitate higher transit mode share, remove the minimum parking space requirements for new development, infill and conversions.

Topography and Commuter Sheds

As the land rises from the shore of the Bedford Basin, many streets connected to Bedford Highway, have considerable slopes as they ascend into residential neighbourhoods (**Figure 9-5**). Grades above 8% (shown as red and dark red on the map) are typically not considered suitable for cycling. Roads classified as green and yellow on this map have slopes below 5% grade and are most suitable for active transportation infrastructure. Slope can also be a particularly important factor to anyone with accessibility concerns, and residents using mobility devices cannot navigate routes with steep slopes. Generally, the topography along Bedford Highway impacts the willingness and ability of residents living within transit and active transportation commuter sheds to walk or cycle to facilities.

Recommendation: Focus new development around active transportation facilities on roads connecting to Bedford Highway that have suitable slopes for walking and cycling.

Figure 9-5: Slopes and Active Transportation Suitability of Existing Road Network



Sea Level Rise

The most robust local projections HRM currently uses for sea-level rise predictions come from BIO's Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT)[2]. The CAN-EWLAT application takes into account the 40-year average storm surge, but doesn't represent more acute extreme surge events such as Hurricane Juan. The two local sites that are featured in the application are the Halifax Harbour tide gauge and the Eastern Passage Small Craft Harbour. According to the authors at BIO, the two sites are effectively representative of HRM's entire coastline. However, how these projections would apply to the Bedford Basin given its depth profile, surface area, coastal morphology, etc. remains unclear.

The most recent flooding scenarios from sea level rise and storm events combined for the Halifax Harbour are included in a 2014 report prepared for the Nova Scotia Department of Environment.[3] The sea-level rise and flooding scenarios presented in this report reflect the projections of sea-level rise from the 2014 IPCC Fifth Assessment Report (AR5) as well as the application of the regional impacts of vertical land movement, land glacier and ice sheet meltwater redistribution, dynamic oceanographic effects and Bay of Fundy tidal range expected increases. The report recommends that the following Mean values of the Total Sea Level estimates for the selected return period and year be used as a tool for sea-level rise adaptation planning.

The flooding scenarios in the **Figure 9-6** are presented in the form of Total Sea Levels (sum of HHWLT[4], regional sea-level rise and respective storm surge components). This scenario represents the worst-case scenario where a storm surge occurs at the highest spring tide. The storm surge component is demonstrated in the columns, where a 100-year flood has a 1 in 100 (or 1%) chance of happening during any given year, though a 1- and 100-year flood could happen in direct succession. HHWLT shows the highest of high waters, for comparison. The rows in this table demonstrate the sea level rise component, ranging over 90 years, with surge residual displaying the storm surge value for each flood type.

[2] http://www.bio.gc.ca/science/data-donnees/can-ewlat/selected-location-en.php?type=TG&prov=NS&loc=Halifax&station=20

[3] RJ Daigle Enviro: Sea-Level Rise and Coastal Flooding Estimates for Chignecto Isthmus and Halifax Harbour, 2014

[4] HHWLT is the average of the highest high waters, one from each of 19 years of predictions.

Figure 9-6: Halifax Harbour total Sea Levels

Halifax Harbour Total Sea Levels – Mean (metres above CGVD28)

Total Sea Levels	HHWLT	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Surge Residual		0.47	0.54	0.64	0.71	0.81	0.88	0.95
2010	1.36	1.83	1.90	2.00	2.07	2.17	2.24	2.31
2020	1.42	1.89	1.96	2.06	2.13	2.23	2.30	2.37
2030	1.49	1.96	2.03	2.13	2.20	2.30	2.37	2.44
2040	1.56	2.03	2.10	2.20	2.27	2.37	2.44	2.51
2050	1.65	2.12	2.19	2.29	2.36	2.46	2.53	2.60
2060	1.74	2.21	2.28	2.38	2.45	2.55	2.62	2.69
2070	1.84	2.31	2.38	2.48	2.55	2.65	2.72	2.79
2080	1.95	2.42	2.49	2.59	2.66	2.76	2.83	2.90
2090	2.08	2.55	2.62	2.72	2.79	2.89	2.96	3.03
2100	2.21	2.68	2.75	2.85	2.92	3.02	3.09	3.16

Source: RJ Daigle Enviro: Sea-Level Rise and Coastal Flooding Estimates for Chignecto Isthmus and Halifax Harbour, 2014, page18. [5]

Inland Flooding

In 2008, the Sackville Drive Business Association wrote the North West Community Council requesting that the watercourse setback of the Little Sackville River be reduced to remain consistent with the Regional Plan, and the floodplain plan be updated. Regional council began directing staff to update relevant plans in 2012, before receiving a report outlining the need for new floodplain studies for both the Little Sackville River and the Sackville River (as well as respective watersheds).

This study commissioned by HRM included two phases, one (completed in 2015) used historical data analysis, high-level hydraulic modeling and survey data collection. Phase 2, completed in 2017, used data analysis, hydrology and hydraulic floodplain modeling, flood scenario modeling, climate change impact assessment, floodline delineation and flood mitigation recommendations[6]. In order to ensure that known risks to public safety are not being ignored, HRM proposed to select the most conservative model results of this study. The 1 in 20 year and 1 in 100-year flood lines in worst case climate conditions are shown in **Figure 9-7**. Outlined in The National Disaster Mitigation's Flood Risk Assessment Study, flooding along the Sackville River system's large natural watershed is often most critical during winter storm events which, while characterized by lower precipitation levels, create

[5] CGVD28 refers to Canadian Geodetic Vertical Datum of 1928

[6] Halifax. Sackville Rivers Floodplain and Case 20361 Staff Report, August 14, 2018

dangerous flood conditions in combination with impervious surfaces caused by both urbanization and frozen ground.

Unlike the Sackville River Floodplain, Bedford Highway has flood conditions relating to the design of storm water management systems. The features involved in storm water drainage include catch basins, storm drains and culverts which must cooperate with streets, detention ponds and watercourse crossings. On this corridor, the local drainage system is directly adjacent to the Bedford Basin, so the hydraulic capacity of sewers is easily impacted by tidal influences and storm surges. This Flood Risk Assessment Study identifies Bedford Highway from Union Street to the Highway 102 as the number one flood risk priority, based on risks related to safety, displacement, infrastructure and property damage, among others. Number 7 on this list is Bedford Highway where it meets Mount Saint Vincent University, and Bedford Highway at Shaunslieve Drive also makes the list at number 29 in priority.

Recommendation: Future policies, plan amendments and land use planning should consider climate change, sea level rise and flood risk mitigation, particularly along the shore of the Bedford Basin.

Figure 9-7: Sackville River Flood Impact



9.4 Nodal vs. Linear Intensification

The land use limitations along Bedford Highway are not favourable to continuous linear intensification along the corridor given the lack of available land and potential rail proximity restrictions. Rather, some nodal intensification in keeping with the Regional Plan's Growth Centre approach is a land use pattern that will retain and enhance the character of the corridor and support the transportation mode configurations of both functional design options of this study. Primarily, nodal intensification will enable the creation of transit-oriented developments in strategic locations around higher-order transit stops and possibly commuter rail stations.

This document suggests adjustments to the 2014 Regional Plan, Growth Centres along the Bedford Highway corridor should be created, reclassified or removed to integrate their local and district land use functions with the two roadway functional design options for Bedford Highway.

Two types of Growth Centres from the Regional Plan classification are suitable for the corridor; Urban District Growth Centre and Urban Local Growth Centre. Both types of Growth Centres envision a mix of low, medium and high density residential, commercial, institutional and recreation uses with transit connections to other Centres and the Regional Centre. Urban District Growth Centres are typically larger in scale than Local Growth Centres, with (re)developable land available that is conducive to building complete communities.

Mount Saint Vincent /Seton Ridge

With the approval of the Seton Ridge development on the former Motherhouse lands this area above Bedford Highway will have approximately 2,400 new housing units added, 2,225 of which will be in multi-unit buildings. Seton Ridge will be served by a bus route passing through its pedestrian-oriented town centre and connecting to Bedford Highway. Immediately next to Seton Ridge, Mount Saint Vincent University with over 2,000 students, 300 full and part-time faculty and 230 staff is a major institution generating significant non-auto trips. Implementing enhanced transit and possibly a rail stop can further shape this node into an area with complete community characteristics.

Recommendation: Classify Mount Saint Vincent /Seton Ridge as Urban District Growth Centre as part of the next Regional Plan review.

Birch Cove

Designated as a Regional Plan Urban Local Growth Centre in the 2014 Regional Plan, the area around Birch Cove is primarily low-density. Bedford Highway is bordered by a motel, highway commercial and church related uses, some of which have potential for redevelopment. A low, narrow underpass leads to the Chinatown Restaurant on the shore side of the railway line. There have been proposals to redevelop this site for multi-unit residential buildings, but restricted access and local opposition have thwarted this to date. Even though the land mass available for redevelopment or new development is limited, further study regarding access, location of the rail line and infill of water lots is needed to study the full potential of this area.

Recommendation: Undertake detailed land use study to understand the relationship between development, Bedford Highway Access, the rail line, transit modes, and climate change/sea level rise and consider removing the Urban Local Growth Centre classification for Birch Cove area as part of the next Regional Plan review.

Larry Uteck Boulevard

The area where Larry Uteck Boulevard intersects with Bedford Highway has seen major residential multi-unit developments in recent years. However, the district-level retail for this Urban District Growth Centre is not located on Bedford Highway, but rather, at the interchange with Highway 102 at the top of the hill. Only a short highway commercial area, including the Fishermen's Market, exists at the foot of Larry Uteck Boulevard. Despite the challenging slopes of Larry Uteck, the high residential densities within walking distance from Bedford Highway, the redevelopment potential of underutilized commercial properties as well as the two bus routes connecting Larry Uteck to Bedford Highway offer an opportunity for higher order transit and a rail stop that could capture a significant number of residents. Any redevelopment close to these transit stops should include retail that lets users integrate daily errands into their non-auto commute.

Recommendation: Classify Larry Uteck Boulevard as Urban Local Growth Centre as part of the next Regional Plan review.

Mill Cove and Bedford Waterfront

The Mill Cove and Bedford Waterfront area has the greatest potential for redevelopment. In addition to existing multi-unit buildings, the area features single-use commercial sites with redevelopment potential as well as Develop Nova Scotia's Bedford Waterfront Phase II site. At the last round of engagement sessions in 2014, Develop Nova Scotia proposed a mixed used community with about 1,200 residential units on 20 acres of already-infilled Bedford Basin land. Of all the proposed nodes along Bedford Highway, this is also the only one with land availability to accommodate potential Park & Ride facilities for higher order transit and a potential rail station. Further study regarding access, location of the rail line and climate change is needed to understand the potential of this area.

Recommendation: Retain Urban Local Growth Centre as part of the next Regional Plan review and undertake a Master Planning/detailed land use study to understand the relationship between development, Bedford Highway access, the rail line, transit modes, and climate change/sea level rise.

Sunnyside Mall

Designated as an Urban District Growth Centre in the 2014 Regional Plan, the significant intensification of this area is not supported by the findings of the Sackville Rivers Floodplain Study. While the Sunnyside Mall itself is not within the 1-in-20 year or 1-in-100 year flood lines, much of the commercial development along the Sackville River is at risk of flooding. However, this node will continue to function as a Centre; albeit with a more local focus. Sunnyside Mall and the intersection of Bedford Highway with Dartmouth Road will remain a local retail anchor. Integrating higher order

transit and potentially a rail stop would put these enhanced travel options within reach of a significant population. Removing the growth centre designation reflects that new development will be constrained by the presence of the floodplain, even though the area will continue to be an important commercial anchor for the community.

Recommendation: Remove Urban District Growth Centre from Sunnyside Mall as part of the next Regional Plan review.

Figure 9-8: Existing Growth Centre Classification

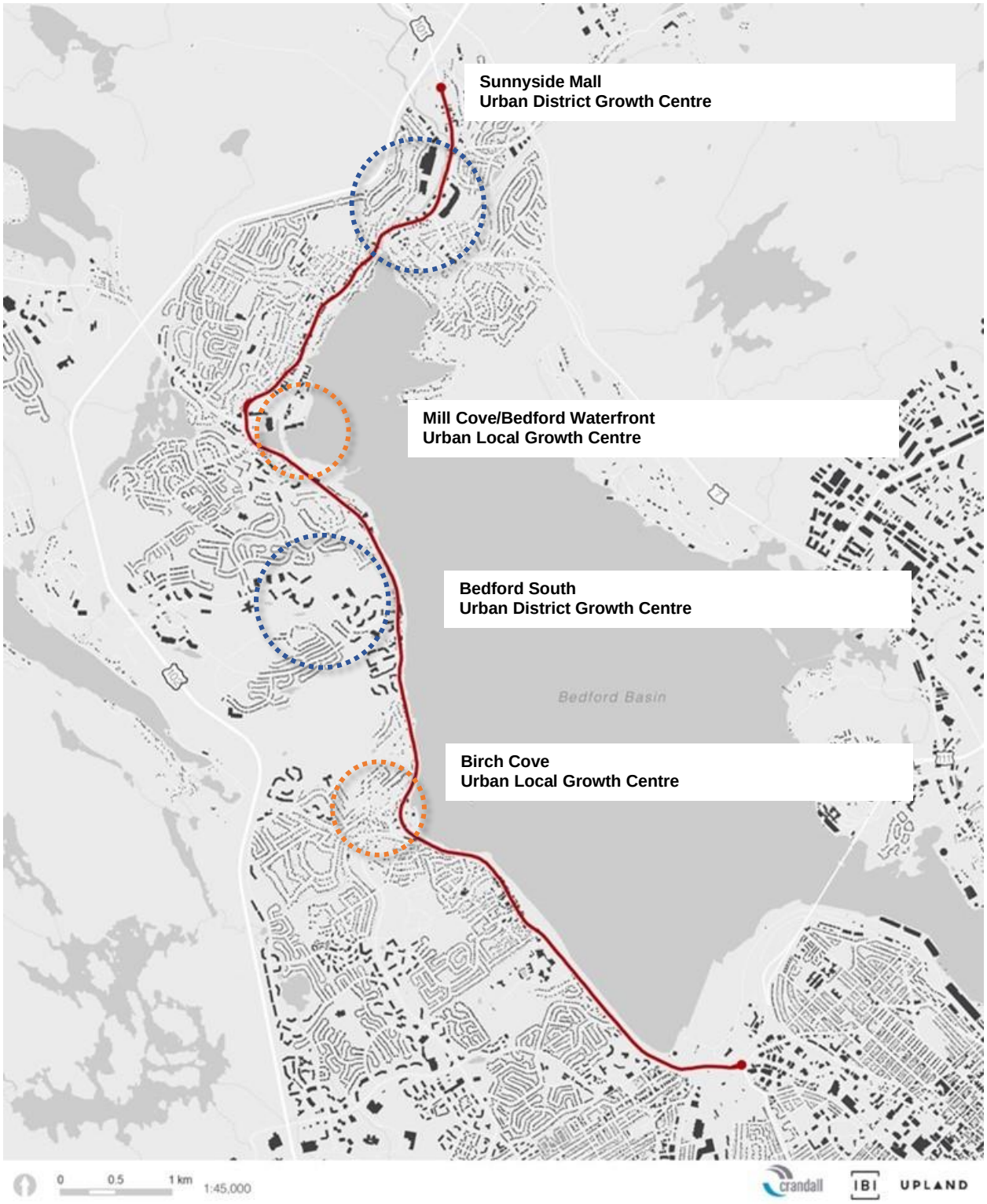
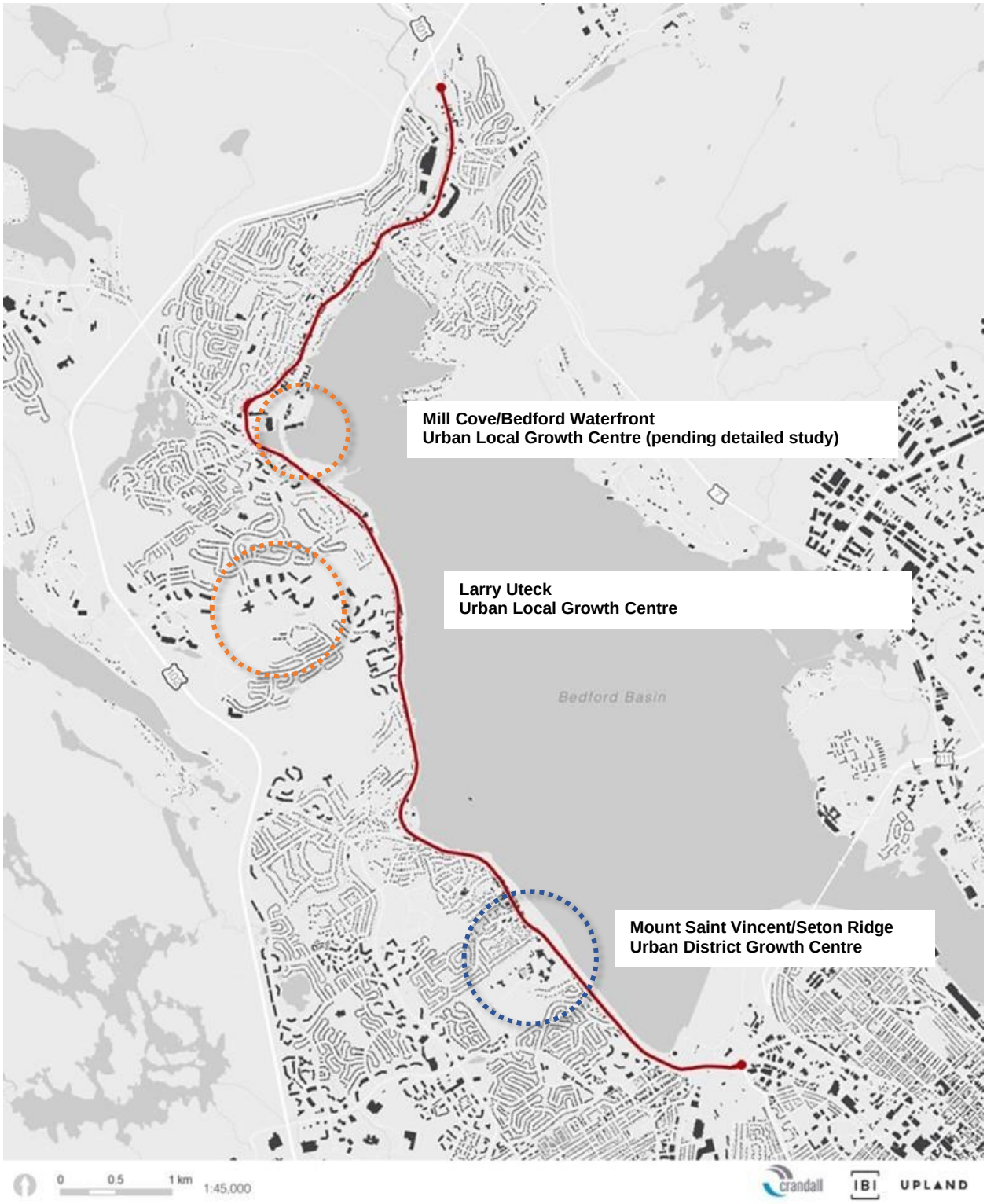


Figure 9-9: Proposed Growth Centre Classification



10.0 Closing Summary

Bedford Highway was the first Strategic Corridor in the Halifax Regional Municipality to undergo this joint transportation and land use planning process stipulated by the 2017 Integrated Mobility Plan (IMP). This Functional Plan enables municipal staff, residents, stakeholders and Regional Council to develop a more detailed understanding of the opportunities and limitations for improving travel choices and for developing land in support of a modal shift along Bedford Highway. The following summarizes key findings and recommendations derived from the Functional Plan.

- The Bedford Highway corridor has varying right-of-way widths and is flanked in many areas by the CN rail line to the east and steep topography to the west. Additional constraints exist where established residential neighbourhoods or recent developments line the corridor with properties fronting the road right-of-way. Available widths for road reconstruction are as little as 14m in some areas.
- These physical constraints limit the potential for Bedford Highway to be widened to accommodate all travel modes and are prohibitive to achieving a vision of a bus rapid transit corridor or even applying continuous bus lanes throughout. Additionally, only limited excess vehicle capacity exists along the corridor that could be reallocated to other modes.
- Significant residential intensification has already occurred in the Bedford South and Seton Ridge areas along the Bedford Highway corridor. Further opportunities for corridor-wide residential intensification are limited given the corridor is single-loaded and there is lack of available land on the Bedford Basin side. Redevelopment may be further constrained by the presence of the rail line and sea level rise constraints.
- For these reasons, the corridor does not have capacity to accommodate travel for additional intensification given the lack of excess traffic capacity, lack of available land and limited physical opportunity to develop higher order bus transit that would drive a meaningful modal shift.
- Mill Cove and Bedford Waterfront is the only existing Regional Plan growth centre with potential to create a true transit-oriented development. It is possible that intensification of this site may be limited by the presence of the rail line and sea level rise. A study assessing this should be undertaken prior to proceeding with redevelopment of this area, to ensure any intensification does not exacerbate traffic constraints in the corridor, and some form of higher-order transit can be established to support redevelopment.
- Along a few short sections of the corridor, mid-rise redevelopments are appropriate and can be supported by a strong AT facility and improved bus transit service. These are generally already enabled in current policy and will be further refined through future secondary planning. By removing minimum parking requirements for residential buildings near transit, developers could be enticed to build units that attract tenants that are inclined to use transit. Where redevelopment sites are impacted by potential rail proximity setbacks for residential uses, mid-rise office buildings could provide workplaces and services for nearby residents.

The findings of this Functional Plan have identified the limitations and opportunities along Bedford Highway which have informed the following guiding vision for the corridor:

- Limit additional vehicle demand. The corridor is operating at capacity in many locations. Any increases in vehicle lane capacity along the corridor should also be limited and improvements focused on other modes.
- Provide a high-comfort, continuous AT facility that serves commuters, connects neighbourhoods, and completes a recreational link that takes advantage of the natural features of the Bedford Basin;
- Provide strategic transit priority measures and improve transit rider experience with enhanced transit stops and safe and convenient sidewalk and trail connections;
- Recognize that the character of Bedford Highway may be better suited as an Urban Collector than a Regional Arterial given its limited capacity, proposed reduced speed limit, proposed multi-use trail and greater emphasis on pedestrians. A starting point for recognizing this change would be to rename the Bedford "Highway" to a name that better describes the scenic qualities and mixed character of the corridor.
- A Regional Arterial is still needed in the area to support the modal shifts established in the IMP, to support the residential intensification envisioned in the Regional Plan expected to be required to support continued population growth. The municipality should seek to establish higher order bus transit service on adjacent corridors that are better suited for bus rapid transit with wider rights-of-way, fewer intersections and driveways, and higher densities on both sides of the corridor (e.g. Dunbrack Street);

While the future of Bedford Highway might not be as transformative as envisioned by the IMP, the redesigns of the roadway laid out in Option 1 and Option 2 of this Functional Plan provide significant potential improvements. In particular, pedestrians, bus passengers and cyclists could benefit from a transition from a partially hostile through-fare environment to a safe and inviting street with reduced vehicle speeds and quality places. Existing residents, new multi-unit dwellers and businesses can be connected to quality transit and active transportation options. Last but not least, this scenic coastal route can be experienced by all travelers as a shared cherished asset of the community.