ACADIA MARSH GREENWAY FEASIBILITY STUDY

PHASE 2 REPORT: FEASIBILITY ANALYSIS HIGHWAY 107 (SOUTH SIDE) OPTION

SHORE ACTIVE TRANSPORTATION ASSOCIATION

FINAL REPORT **DECEMBER 2015**

WSP
1 Spectacle Lake Drive
Dartmouth, NS B3B 1X7

Phone 902-835-9955
Fax 902-835-1645
www.wspgroup.com

Table of Contents

1.0 Introduction

1.1 Background

WSP is currently preparing a feasibility study for the Shore Active Transportation Association (SATA) that investigates the potential for an active transportation (AT) facility connecting the missing Trans Canada Trail Gap between the Blueberry Run and the proposed 'Gaetz Brook Connector' (formerly referred to as the 'Chezzetcook-Musquodoboit Trail') on HRM's Eastern Shore.

The work plan established for the study has broken it down into two phases. Phase 1, completed in August 2015 and documented in *Phase 1 Report: Evaluation of Candidate Options,* included an evaluation of several potential routes for an AT connection through the Porters Lake area. The results of Phase 2, which includes further analysis of the preferred option – Highway 107 (south side) – are presented in this report.

1.2 Phase 2 Objectives

The primary objective of Phase 2 of the Study is to complete preliminary planning and conceptual design for the selected option that enables SATA and other stakeholders to determine the feasibility and sustainability of the facility and adequately inform next steps in the process of implementation. Specifically, this includes:

- Establish appropriate design standard and facility alignment;
- Identify lands that may be required for trail construction based on conceptual alignment (acquisition costs will not be included as it is considered beyond the scope of this level of review);
- Review of connection options;
- Identify options for watercourse crossings (i.e. utilize existing structures vs. build new)
- Identify and explain the environmental constraints that may be present, and provide guidance on what level of environmental assessment and / or mitigative measures may be required.
- Provide guidance on what is expected to be required in subsequent phases to implement the project, including:
    - Order of magnitude cost estimates for detailed design and construction of the facility;
    - Consideration of potential opportunities and constraints associated with the construction process (i.e. construction access, proximity to existing roadways, etc.).

1.3 Highway 107 (South Side) Option

The preferred option runs along the south side of Highway 107 between Exit 21 (East Chezzetcook Road) and Highway 207. The alignment, approximately 4km in length, would fill in a significant gap in connectivity along the abandoned rail corridor, presenting opportunities for integration with the regional trails network and the Trans Canada Trail.

The area's Active Transportation Plan[1] recommended this alignment for consideration as a "destination greenway", citing its key advantages for connectivity, directness (between Trans

[1] *Active Transportation Plan: Porters Lake and Surrounding Communities* (WSP, 2014)

Canada Trail sections), and the natural beauty afforded by the Chezzetcook Inlet to the south. The greenway was envisioned as a "Signature AT Facility" for Porters Lake and the Surrounding Communities, attracting visitors from near and far to experience the trail. Further, its length is considered well suited for walkers and cyclists to make a return trip comfortably from one end to the other, which when combined with its physical surroundings could make it an excellent destination trail for recreational pursuits.

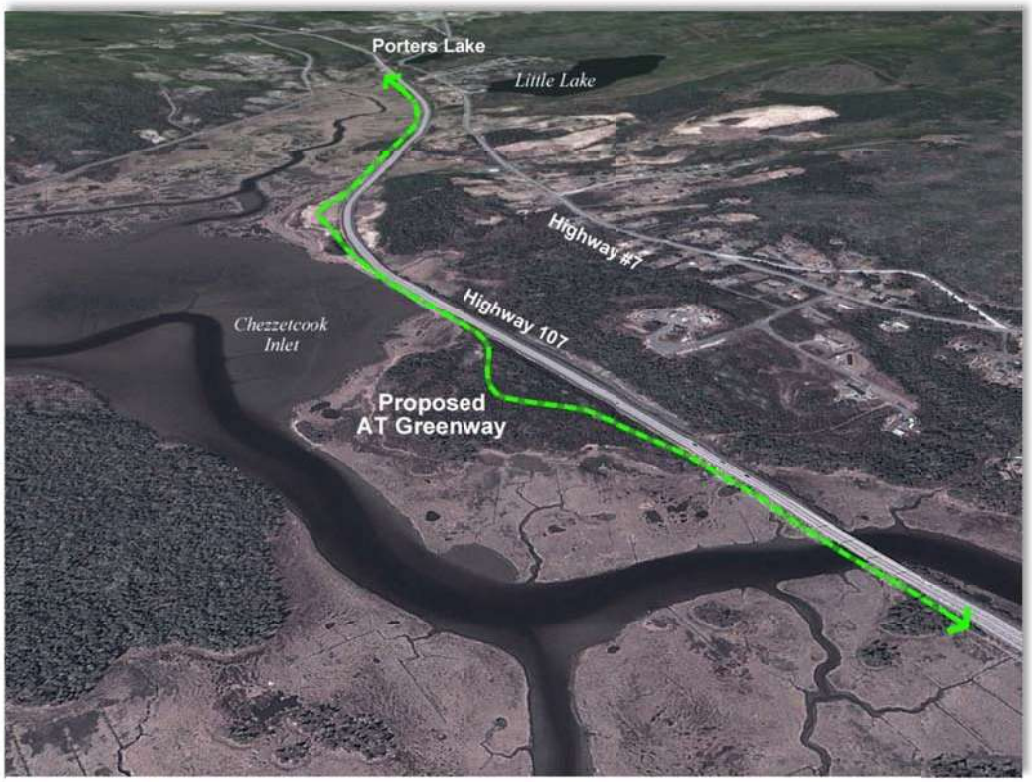

Figure 1-1: Proposed Highway 107 (South Side) Alignment
[Source: *Active Transportation Plan: Porters Lake and Surrounding Communities* (WSP, 2014)

2.0 Background Review

2.1 Data & Information

Digital mapping including property boundary information, Lidar topographical data, GIS layers, and aerial photography were obtained from HRM Business Intelligence & Data Services. Digital mapping was compiled to establish base drawings of the Study Area.

2.2 Site Investigations

WSP completed initial site investigations for options under consideration on Wednesday, May 6, 2015, along with representatives from SATA, Nova Scotia Departments of Transportation and Infrastructure Renewal (NSTIR) and Natural Resources (DNR), HRM Regional Trails, and Nova Scotia Trails. Candidate locations were explored on foot to review potential alignment options and observe the relevant opportunities and constraints expected to dictate the potential for each as an AT facility.

WSP completed subsequent site visits in October 2015 to explore potential alignments along the south side of Highway 107 in more detail to aid in the conceptual design process.

3.0 Facility Design Standard

3.1 User Types

The proposed facility will be an active transportation (AT) greenway, and will accommodate any non-motorized users. The primary users of the facility are expected to be walkers / runners, cyclists, and persons using wheelchairs. There is also potential that during winter months the trail could be attractive for cross country skiing and snowshoeing if winter access is not prohibited (for safety reasons due to snow clearing on Highway 107).

An important policy requirement that should be considered is that the facility must prohibit motorized vehicles due to its location within the ROW. This is particularly relevant in the Porters Lake area due to the prevalence of off highway vehicles (OHVs) and given that the adjacent Blueberry Run does permit OHVs.

3.2 Key Design Criteria

The following describe key design criteria and how they relate to the proposed AT greenway.

3.2.1 *Physical Separation*

Physical separation between the greenway and Highway 107 is very important consideration. Highway 107 is a 100-series highway that carries traffic at very high speeds, including large trucks. During winter, snowplows clear large amounts of snow and ice to the side of the traveled way. To the extent possible, separation between the greenway and Highway 107 should be included in order to create a more safe and comfortable environment for users.

Horizontal and vertical separation from the highway provides the most cost effective means of physically separating the greenway from the highway. There are several locations along the proposed alignment where this is possible; however, for a significant portion of the greenway, limited available space between the highway and wetlands will require that it be constructed in close proximity to the highway.

In locations where separation width is constrained, physical barriers may be considered as an option to improve user comfort and safety. Though there are guide rails along much of the highway alignment, they do not provide effective sound attenuation or visual obstruction. Another option that has been used in similar applications is concrete jersey barriers. Jersey barriers are excellent sound attenuators and also have the added benefit of providing a stronger physical barrier for vehicles running off the road.

3.2.2 *Cross Section*

AT greenways typically have a minimum recommended width of 3.0m, with a preferred width of 4.0m. The lower range is more appropriate in a rural context, where the volume of users is typically less than that of an urban greenway. Trails with cross sectional widths less than 3.0m are common in recreational applications such as woodland trails.

Due to the limited available space between Highway 107 and the Chezzetcook Inlet at many locations along the proposed alignment, it may be advisable to reduce the cross section width below the 3.0m recommended minimum in order to reduce construction costs and allow for increased separation from the highway ROW and/or limit encroachment on wetlands.

Typical cross sections for the greenway are described further below and are categorized based on the amount of space available to separate the greenway from the highway.

A. **Typical Section A – Large Separation from Highway:** The standard HRM Red Book active transportation trail shows a 4.0m wide paved surface with 0.5m sod or gravel shoulders on either side, however a 3.0m wide crusher dust trail is more cost effective and suitable in rural areas with less traffic. Paving the greenway would provide a more stable surface with chance of wash-out but would add a significant expense to the overall project cost.

   Figure 3-1 shows the proposed typical greenway cross section at locations where the space between the highway and marshlands is not constrained. A minimum 4.0m width should be cleared to provide additional space on each side of the greenway as a buffer from vegetation and to provide visibility around corners. Minor earthwork will be required to provide a level sub-base with compacted gravels and crusher dust placed on the level surface to form the greenway. In isolated areas small swales and culverts may be required adjacent to the greenway to help reduce erosion caused by stormwater flowing over the gravels.

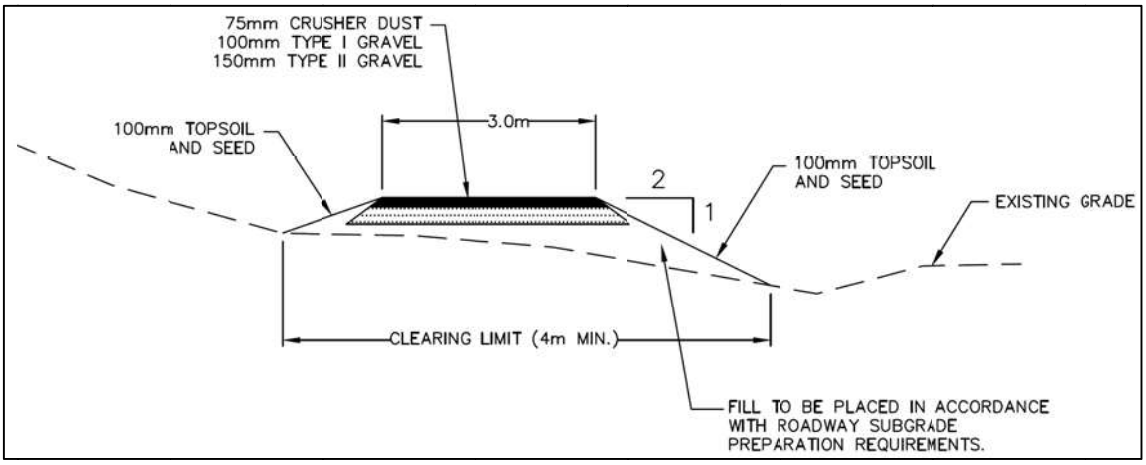

Figure 3-1: Typical Greenway Cross Section with Large Separation from Highway

B. **Typical Section B – Moderate Separation from Highway:** Figure 3-2 shows the proposed typical greenway cross section at locations where the space between the highway and marshlands is partially restricted. In these locations, a 3-4m buffer can be provided between the highway shoulder and the edge of the greenway and a guide rail or jersey barrier can be installed to provide protection from highway traffic. An existing highway ditch is roughly defined and culverts would be required where the greenway transitions from cross section B to cross section C (described below).

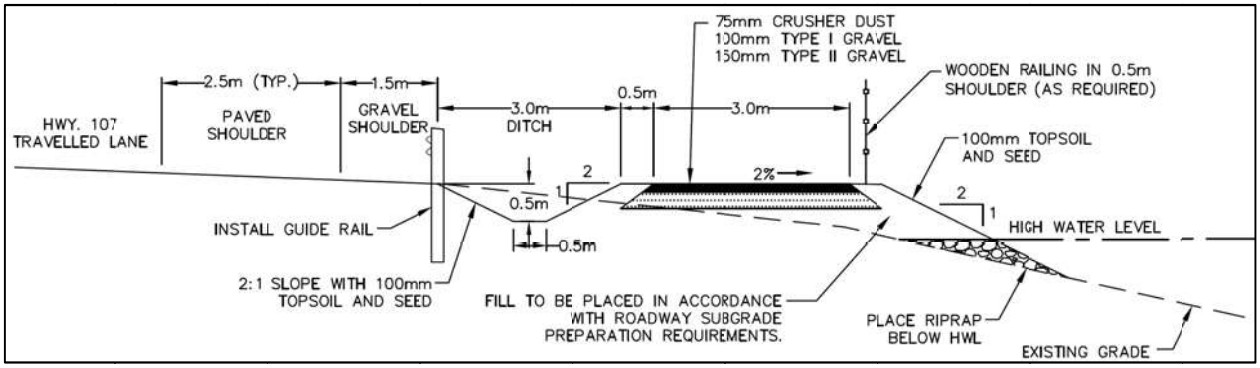

Figure 3-2: Typical Greenway Cross Section with Moderate Separation from Highway

C. **Typical Section C – Restricted Separation from Highway:** Figure 3-3 shows the proposed typical greenway cross section at locations where there is very limited space between the highway and marshlands. For these segments, we recommend reducing the greenway width to 2.5m or less to minimize impact on the wetland and reduce the amount of earthwork and fill required to create a level area for the trail.

Due to the significant space limitations, the cross section shows a minimum of a 1.5m buffer between the existing guide rail and the edge of the greenway; the guide rail may be replaced with a jersey barrier to provide improved protection from highway traffic. A wooden railing is recommended in areas where the adjacent drop is 1.5m or greater. Slope stabilization measures should be added to sections of the greenway that are prone to flooding during storm surges and high tides.

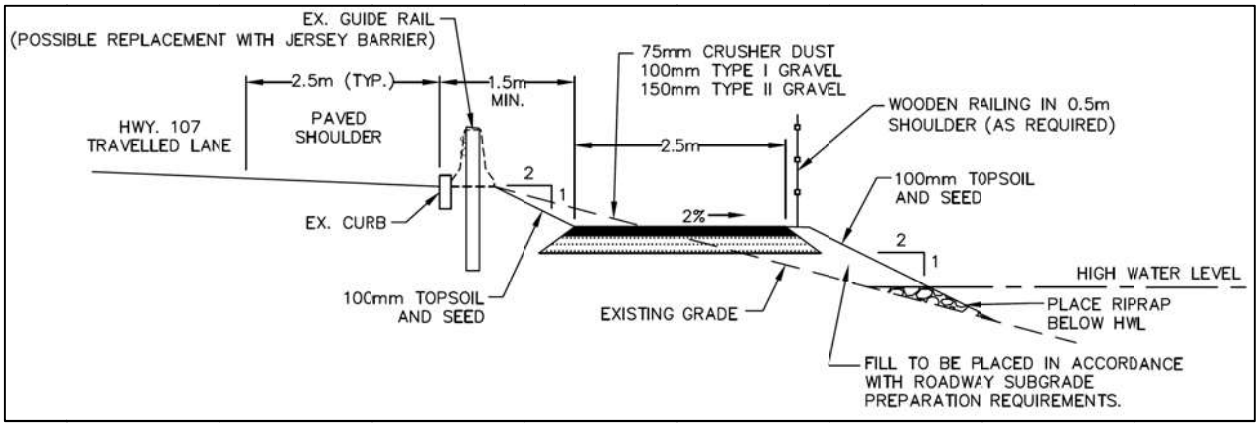

Figure 3-3: Typical Greenway Cross Section with Restricted Separation from Highway

3.2.3 *Alignment and Grades*

Horizontal and vertical alignments are important to consider in greenway design. Horizontal alignment should aim to provide a direct route with adequate sightlines, introducing some curvature where necessary to efficiently integrate with topography and provide a less monotonous experience for users. Vertical alignments should be designed to limit grades as much as possible; a maximum of 5% (up to 8% over short sections) is preferred in order to improve user comfort, particularly for wheelchair users.

3.2.4 *Surface*

Greenway surface has a considerable impact on user experience, maintenance, and cost. Though the majority of trails in HRM have a crusher dust surface, the installation of asphalt pavement surfaces is growing in popularity due to its notable improvements related to maintenance (snow removal, reduced ongoing surface repair) and user experience (primarily for cycling and other wheel-based activities). There are downsides, however, such as significantly increased installation costs, reduction in comfort for some users (particularly for runners), and a less natural feeling.

A crusher dust greenway surface is expected to be most appropriate for the proposed Acadia Marsh Greenway. Given the length of the proposed Acadia Marsh Greenway, costs to pave the facility would be extensive. Also, the rural context and scenic nature of the area appear to be more conducive to the crusher dust option.

4.0 Existing Conditions in the Study Area

4.1 Topography

Topographically, the alignment – which runs along a former railway corridor – is well suited to greenway development in terms of grades. There do not appear to be any locations at which grades are in excess of the preferred 5% maximum.

Chezzetcook Inlet

Through the Study Area, Highway 107 was constructed using the former rail corridor as part of its base. Material used for the base of the highway varies along its length, ranging from grassy soil to large boulders. Without the benefit of a geotechnical investigation, surface conditions and their impact on greenway construction have been assessed based on visual inspection.

A typical cross section of Highway 107 is shown in Photo 4-1. The right-of-way width varies long the highway, with minimum widths of approximately 29-30m, including 7.5m curb-to-curb asphalt. The greenway option under consideration is on the south side of the highway, which directly abuts the Chezzetcook Inlet. Fore slopes (fills) along the highway are typically in the range of 1:1 to 2:1, and separation between the bottom the top of slope and wetlands typically varies between 5m and 10m. The south side of the highway has curb and gutter along the majority of areas that run close to the wetlands; other sections where there is increased buffer between the highway and wetlands include a gravel shoulder and ditch. Typical NSTIR guide rail run along the outside of the traveled way for the majority of the alignment.

Photo 4-1: Typical Highway 107 Cross Section

Available space varies considerably along the proposed alignment, which dictates the potential flexibility in layout of the horizontal geometry. Sections that directly abut the highway and/or the salt marsh will require a fixed alignment as close as possible to the highway.

Based on information from property boundary plans obtained from Nova Scotia Property Online, it appears that the highway ROW is typically a minimum of 60m wide, centered on the highway. This suggests that the majority of the proposed alignment will be located within the Highway 107 ROW with a few possible exceptions. In order to introduce separation from the highway and expose users to the natural environment provided by the marshlands, it may be necessary to encroach on private lands south of the highway in a few areas. As a result, though the greenway can likely be built entirely within NSTIR ROW, the extent to which it can meander away from the highway would be dependent on the ability to negotiate with landowners.

It should be noted that the review of property ownership along the proposed greenway was limited by the lack of detailed and accurate land ownership information. Mapping from 'Nova Scotia Property Online' was used, which may not be completely accurate and up-to-date to reflect current property boundaries. In general, it is assumed that mapping information is relatively accurate and provides a level of detail sufficient for this level of investigation. More detailed review of land ownership would be expected to be required during the detailed design stage for areas where there is uncertainty.

4.1.1 *Highway 107 ROW*

There are several issues that must be considered when attempting to place a trail within a highway ROW. Examples include user safety, road / trail maintenance, and impacts to drainage.

Development within the ROW of a 100-Series provincial highway is not generally permitted, and the presence of AT facilities adjacent to freeways is very rare. However, given that the existing Highway 107 alignment was built directly on top of the former railway corridor in this location – which severed its continuity – it may be reasonable to expect that an exception is a possibility. NSTIR has indicated its support of the objective to improve non-motorized connectivity in the area[2], and has agreed to participate in the feasibility review process.

Use of NSTIR right-of-way for trail uses is subject to the Department's *Trail Policy*[3]. Any trail development within NSTIR right-of-way requires a 'Work Within Highway Right-of-Way Permit', which is a type of agreement between NSTIR and a trail proponent (i.e. municipality, trails organization) that establishes the framework for trail operation including assignment of responsibility for key items such as maintenance, insurance, and liability. Trails developed within NSTIR right-of-way are not granted any ownership of the land (e.g. easement, lease) but rather are issued a permit or license to use the space. Also, as mentioned in Section 3.1, the facility must prohibit motorized vehicles due to its location within the ROW.

4.2 Environmental Constraints

The Chezzetcook Inlet's unique natural environment provides many advantages for trail development, but also subjects the area to special environmental constraints that are important to consider as part of this Study. The proposed alignment crosses several watercourses and

[2] *Proposed Non-Motorized Trail South of Highway 107*, Correspondence from Darcey MacBain, P.Eng. (NSTIR Area Manager, Halifax East), May 30, 2014.
[3] NSTIR Policy PO1033: *Trail Policy*

possibly wetlands including salt marshes (wetlands of special significance) and bogs. Environmental approvals that may be required if this route is selected include:

- Watercourse alterations
- Wetland alterations
- Coastal permits

It is important to consider that it is the mandate of the Provincial Government is to achieve zero loss of wetlands of special significance (WSS). Though under some circumstances it will permit development within a WSS, it is stipulated that the development must facilitate maintenance, restoration, or enhancement of the WSS, and that it must provide a necessary public function. Evaluation of the extent to which a given project meets these criteria is at the discretion of government officials. Nova Scotia Environment (DOE) Officials have completed preliminary evaluation of the Highway 107 options and have indicated that the department is willing to consider the possibility of such a facility, subject to more detailed analysis[4]. Contact with DOE Officials also indicated that any development should endeavour to limit impacts on the salt marsh to the extent possible.

4.2.1 *HRM 2014 Land Use By-Law for Planning Districts 8 & 9:*

Halifax Regional Municipality (HRM) planning by-laws provide a riparian buffer of 20 metres, in which development cannot take place, for watercourses and wetlands that are contiguous with a watercourse. However, there are exceptions for development within the riparian buffer, including boardwalks, walkways and trails not exceeding 3 metres in width (Section 4.18, pg. 19). Therefore, if the proposed greenway is 3 metres wide or less, it could potentially be developed within 20 m of a watercourse/ wetland contiguous with a watercourse, as long as the applicable approvals are granted for crossing the watercourses and/or wetlands.

4.2.2 *Nova Scotia Wetland Conservation Policy (September 2011)*

Wetlands in the Study Area are protected from alteration (including infilling) under the *Nova Scotia Wetland Policy*. When a wetland alteration cannot reasonably be avoided, an application to proceed with the alteration must be submitted though the Wetland Alteration Approval process. Alterations may be exempt from this process if the wetland is less than 0.01 hectares in total area or if a wetland is created by humans on upland habitat. If the proposed development will impact the wetlands, a wetland field delineation and functional assessment must be conducted in the field along with an alteration application, which must be approved by NSE.

It is important to keep in mind that all salt marshes and wetlands known to support at-risk species under the federal Species at Risk Act or the Nova Scotia Endangered Species Act are wetlands of special significance (WSS). Government does not support or approve alterations of a WSS, unless the alterations are required to maintain, restore or enhance the WSS and are deemed to provide a necessary public function. Alterations that will impact two or more hectares of wetland require assessment under the Environmental Assessment Act.

Another important consideration is wetland compensation requirements. DOE requires that any project altering a wetland must subsequently restore, create, or enhance another wetland as a means of balancing the overall impact on wetlands. It is difficult to estimate the costs to

[4] Email Correspondence with Rachel Bower, Inspector Specialist III, Nova Scotia Environment, June 29, 2015

complete wetland compensation requirements due to a wide variation in of project types; however, DOE has indicated that recent restoration projects have cost between $3 and $10 per square metre of restored wetland ($30,000 to $100,000 per hectare)[5]. A summary of the Nova Scotia Wetland Conservation Policy has been included in Appendix A.

4.2.3 *Nova Scotia Environment Act*

Under the Nova Scotia Environment Act any alteration to a watercourse, including the construction of a road crossing, requires approval by the Department of Environment prior to construction. Approval can be obtained from NSE through the submission of an application for approval. Field assessment is required prior to completing the approval application.

4.2.4 *Nova Scotia Department of Natural Resources Coastal Permit*

Prior to building a structure below the ordinary high water mark (OHWM) of any coastal waters, a permit must be obtained from the Department of Natural Resources. This includes infilling and bank protection, which would have to be approved by NSDNR, and is also subject to review by the Department of Fisheries and Oceans (DFO). Infilling is generally not permitted, however it may be considered if the project is likely to result in a public benefit. In most cases, if infilling is approved by NSDNR, the proponent is required to purchase the infilled land. If bank protection takes place below the OHWM, including operation of machinery and placement of material, a permit must be obtained from NSDNR, and may be reviewed by DFO.

4.2.5 *High Water Level*

Based on correspondence with the Canadian Hydrographic Service, the highest recorded water level at Chezzetcook Inlet is 3.92m above Chart Datum. Future water levels could exceed this elevation if a storm surge corresponds to the highest tide with additional impact from wind waves. It is recommended that the greenway be installed at an elevation above 4.5m where possible to minimize risk of wash-out during extreme weather events. Elevations shown on the functional plan profiles are approximate only and based on provincial mapping contours. Topographic survey will be required at the beginning of detailed design to provide accurate greenway elevations with respect to the high water level.

[5] *Wetland Compensation: What's Required and What Are My Options* (Nova Scotia Environment - https://www.novascotia.ca/nse/wetland/docs/Wetland_Compensation.pdf)

5.0 Conceptual Design

Conceptual design drawings have been prepared for the section of the proposed Acadia Marsh Greenway running between Anne Marie Drive and the Highway 107 off-ramp at Exit 21 (See Appendix B). This section provides an overview of connectivity issues at either end of proposed facility as well as description of the design constraints and rationale for each section of the alignment.

5.1 Connectivity

The primary connectivity objectives for the Study include a high level review of options for connecting the greenway to adjacent sections of the Trans Canada Trail at either end of the Study Area as well as potential options for parking and/or a trailhead.

5.1.1 *Anne Marie Drive / Route 207*

The western terminus of the proposed greenway is located at Anne Marie Drive, a gravelled cul-de-sac approximately 250m in length that extends north from Shore Road. Though the greenway could potentially extend west along Highway 107 to the Exit 20 (William Porter Connector) interchange, for the purposes of this Study, alternate connection options between Anne Marie Drive and the existing Blueberry Run Trail are being considered.

Looking south toward Anne Marie Drive from Highway 107

- **Connection to Blueberry Run:** The proposed connection between the Acadia Marsh Greenway and the Blueberry Run will run along Shore Road (800m), Route 207 (700m), and Les Collins Avenue (1.3km). It is expected that the installation of wayfinding signage will be sufficient in connecting the two facilities, and installation of formal AT infrastructure would not be necessary in the short term. Long term enhancements may be considered in the future to improve this section of road to better accommodate pedestrians and cyclists.

- **Potential Parking and/or Trailhead:** Though Anne Marie Drive itself provides an ideal location for a parking area / trailhead, the cul-de-sac appears to be fully built out with residential properties. Chezzetcook Inlet wetlands constrain the ability to expand to the east. Consideration should be given to exploring the potential for a parking / trailhead area on a parcel owned by NSTIR located west of Anne Marie Drive and north of Shore Road as shown in Figure 5-1. Connections to the parking area could be made from the end of the Anne Marie Dr. cul-de-sac, however there is no direct connection to Shore Road except through privately owned property.

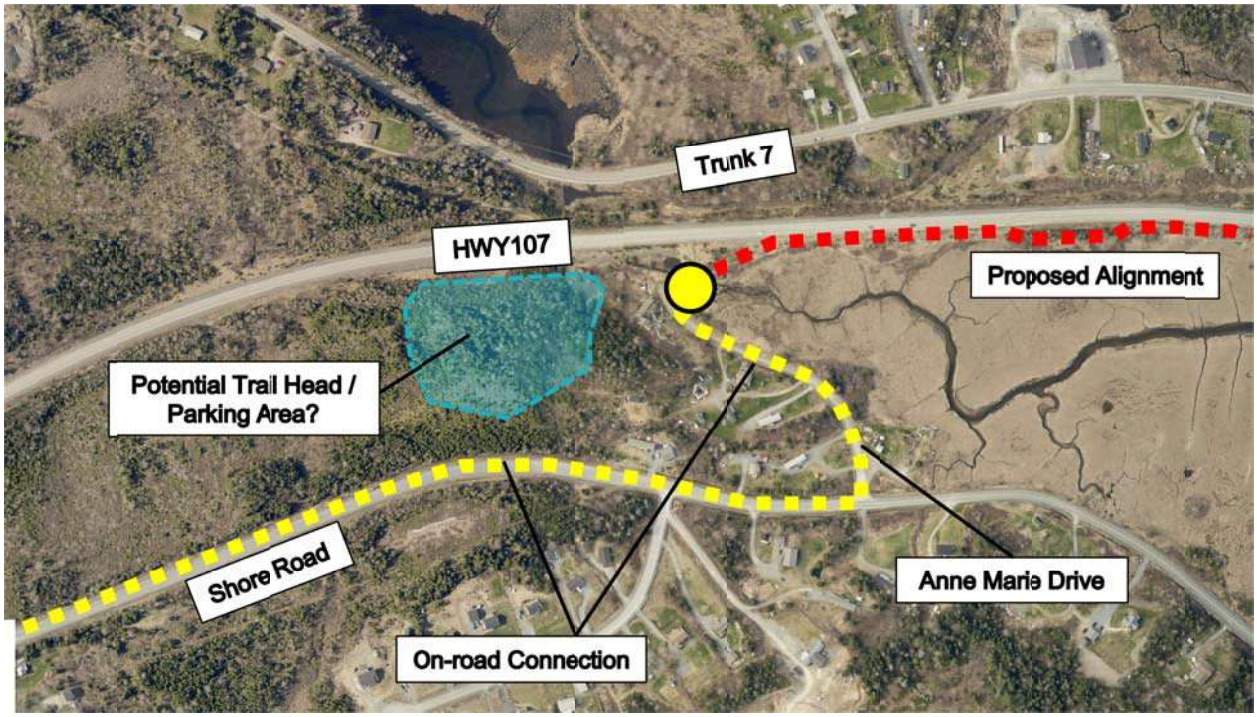

Figure 5-1: Anne-Marie Drive Connection

5.1.2 *Exit 21 (East Chezzetcook Road)*

The eastern terminus of the proposed greenway is at Exit 21 (East Chezzetcook Road). The primary connectivity objectives at this location are linking to the proposed 'Gaetz Brook Connector' (approximately 525m north of the Exit 21 off-ramp) and determination of a potential location for parking and/or a trailhead.

- **East Chezzetcook Road Trail Crossing:** It is expected that the proposed greenway will terminate at the intersection of East Chezzetcook Road and the Exit 21 eastbound off-ramp on the south side of the ramp. Consideration may be given to installation of a crossing treatment at this location to aid users in crossing East Chezzetcook Road.

  Installation of trail crossings on non-controlled access provincial highways must be done in accordance with the *Trail Construction / Maintenance and Trail Crossings* Policy[6], which includes guidance on trail crossing location and configuration along with stipulation of responsibilities of the Province and the trail developer. As part of this policy, NSTIR will prepare a trail crossing signage plan for the identified crossing location. Typical signage and layout is provided in Appendix A.

WC-46: Multi-use Trail Crossing Sign

[6] NSTIR Policy PR5092: *Trail Construction / Maintenance and Trail Crossings*

- **Connection to Gaetz Brook Connector:** The following options were considered to connect to the Gaetz Brook Connector via East Chezzetcook Road.
    - Sidewalk Connection: Extend the existing sidewalk on the east side of the Highway 107 overpass bridge south to the off-ramp and north to the Gaetz Brook Connector. This would provide pedestrians with a dedicated facility; however, would not accommodate cyclists, who would remain on-street.
    - AT Greenway: A more extensive option would include construction of an AT greenway on the east side of East Chezzetcook Road that would accommodate both pedestrians and cyclists. This would likely involve the construction of a new pedestrian bridge to cross over Highway 107 adjacent to the existing overpass.
    - Signage Only: An interim approach could include installation of wayfinding signage without any formal infrastructure upgrades to connect the two facilities. This would require pedestrians to walk along the shoulder and cyclists to remain on-street.

- **Potential Parking and/or Trailhead:** Unfortunately, the terrain in the southwest quadrant of the Exit 21 interchange is not conducive to development of a directly accessible area for parking and/or a trailhead, and there appear to be limited options available for this purpose. Some potential locations include:
    - Inletview Road or Dunphy Lane. Though property ownership could be a challenge, these options would provide relatively good proximity to the end of the greenway, although users would be required to cross East Chezzetcook Road to access the facility. A formalized crossing of East Chezzetcook Road would be required for this option.
    - At or near Grady Road (approximately 300m to the south). This would require an AT connection along the west side of Chezzetcook Road between the Exit 21 off-ramp and the facility. There appears to be limited available ROW on East Chezzetcook Road to complete this connection and all land appears to be privately owned. In addition, the area west of East Chezzetcook Road slopes steeply away which implies higher construction costs will be needed to fill the slope to create a flat parking area.

Based on the above considerations, the Inletview Road and Dunphy Lane areas appear to be better options for the parking and/or trailhead locations. For all of these potential options, it is expected that any upgrades to AT facilities may require that the height of existing bridge railings be increased to a higher standard height of at least 1.40m (4.5 ft.) above the bikeway surface. It should be noted that as per NSTIR policy[7], the Province does not construct or maintain sidewalks. Consequently, it is expected that HRM would need to assume these responsibilities.

Looking south (left) and north (right) on East Chezzetcook Road from the Exit 21 Off-Ramp

[7]NSTIR Policy PO1001: *Sidewalk Construction and Maintenance*

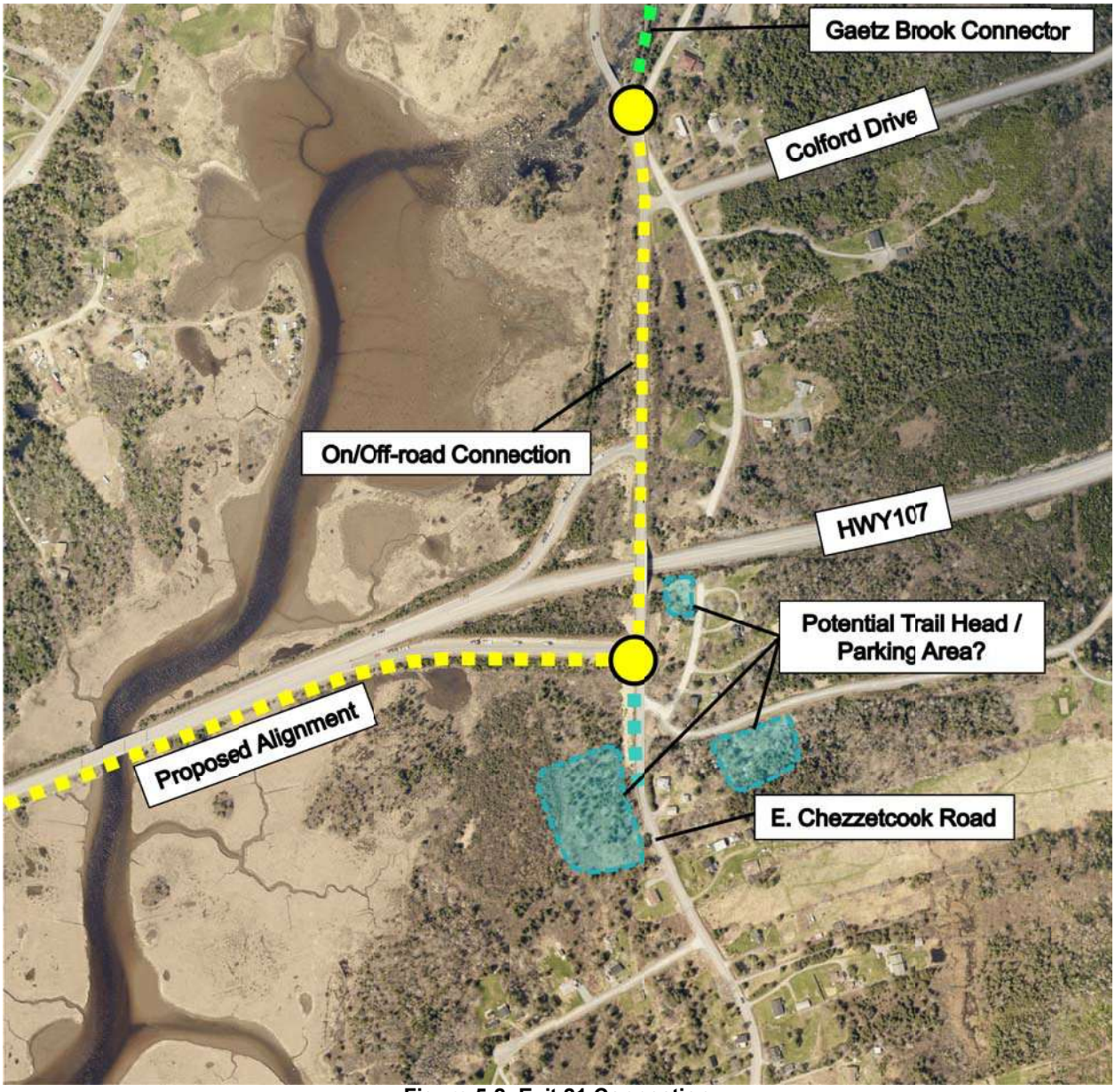

Figure 5-2: Exit 21 Connection

5.2 Greenway Segments

For the purposes of commentary on the various design considerations, the 2.7km alignment has been divided into 11 distinct segments, running from east to west, as illustrated in Figure 5-3. The following sections describe key design considerations for each Study Segment.

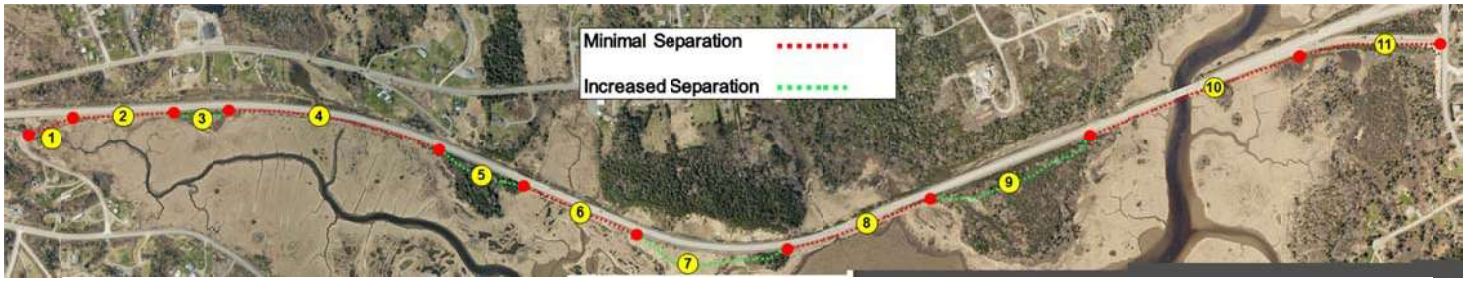

Figure 5-3: Greenway Segments

5.2.1 *Segment 1 (Station 0+00 to Station 0+100)*

Connection between Anne-Marie Drive and Highway 107 has been envisioned along a ridge above the wetlands. It appears that this connection can be implemented relatively easily, as the existing terrain is firm, moderately sloped and seemingly above the typical high water line given the distinct difference in vegetation relative to the more marshy terrain directly adjacent at the bottom of the ridge. Delineation of wetlands in this area will be necessary to ensure that the proposed alignment is suitable.

Potential Connection between Anne-Marie Drive and Highway 107

5.2.2 *Segment 2 (Station 0+100 to Station 0+300)*

This segment runs approximately 200m along Highway 107. With minimal available space between the traveled way on Highway 107 and the wetlands, the greenway will need to be located close to the highway. The highway's fore slope is relatively flat immediately adjacent to the highway, becoming moderately steep approximately 4-5m from the guide rail.

Photo 5-1 depicts a 5m distance extending from the guide rail. Given the width constraints along this segment, the proposed alignment has remained tight to the Highway 107 ROW, with as little as 1.0 to 1.5m of separation. A narrowed cross section of less than 3.0m has also been considered as a means of reducing the amount of required fill and minimizing the potential impact to the adjacent wetlands.

Photo 5-1: Looking and east on Highway 107

5.2.3 *Segment 3 (Station 0+300 to Station 0+375)*

This short segment, approximately 75m in length, includes a wooded area that provides opportunity to introduce a moderate separation from the highway. The proposed alignment provides 3-4m buffer south from the highway, though this may be increased further depending on the limits of the nearby wetland. An existing highway ditch separates the highway from the proposed alignment and a culvert would likely be required where the greenway crosses over the ditch on the east end of this segment.

Given the amount of available space, the greenway's cross section width through this segment can be increased. The proposed cross section for this segment is 3.0m wide. This segment appears to be contained entirely within the existing highway ROW.

Photo 5-2: Looking east on Highway 107

5.2.4 *Segment 4 (Station 0+375 to Station 0+800)*

Segment 4 is one of the longest and most challenging along the proposed alignment, with minimal available space between the highway and the Chezzetcook Inlet and a highway fore

slope comprising large boulders. The greenway alignment has been located as close as possible to the Highway 107 traveled way in order to limit encroachment on wetlands and minimize construction costs. The proposed cross section has also been reduced below 3.0m.

Although there is an existing guard rail along this segment, consideration should be given to the installation of a more substantial physical barrier between the greenway and Highway 107 to improve the level of comfort and safety for users.

Photo 5-3: Looking west on Highway 107

5.2.5 *Segment 5 (Station 0+800 to Station 0+900)*

Segment 5, running approximately 100m, is a wooded area that provides additional space for separation from the highway. The proposed alignment veers 15 to 20m south from the highway, though this could be increased further by increasing the segment length. An existing highway ditch separates the highway from the prosed alignment and a culvert would likely be required where the greenway crosses over the ditch on the west end of this segment.

Given the amount of available space, the greenway's cross section through this segment can be increased. The proposed cross section for this segment is 3.0m wide. This segment appears to be partly within the existing ROW, and partly on a separate property owned by NSTIR.

Photo 5-4: Looking east on Highway 107

5.2.6 Segment 6 (Station 0+900 to Station 1+150)

Segment 6 has minimal available space between the highway and the Chezzetcook Inlet and a steep highway fore slope. As with similar locations, the greenway alignment has been located as close as possible to the Highway 107 traveled way in order to mitigate encroachment on wetlands and limit construction costs to the extent possible. A large corrugated metal culvert crosses the highway along this segment. It is expected that there is sufficient room between the highway and the culvert for the greenway without the need to alter or extend the culvert.

Photo 5-5: Looking west on Highway 107

The proposed cross section has also been reduced below 3.0m and, similar to Segment 4, consideration should be given to the replacement of the guide rail with a more substantial physical barrier between the greenway and Highway 107 to improve the level of comfort and safety for users.

5.2.7 Segment 7 (Station 1+150 to Station 1+450)

Segment 7 runs through a large hilly area extending up from Highway 107. Offering impressive vistas of the Chezzetcook Inlet, this is expected to be the greenway's signature area. There is

ample space to divert the greenway away from the highway to provide separation from traffic and allow users to experience the natural surroundings. The majority of lands in this section are owned by NSTIR, though there is a privately held parcel on the southern tip near to the crest of the hill.


Photo 5-6 and Photo 5-7: Looking east (left) and west (right) on Highway 107

The proposed alignment veers away from Highway 107 by up to 25m, introducing some curvature in order to maintain acceptable grades. A 3.0m wide greenway is proposed and there is some flexibility on the alignment and cross section given the amount of available space, however, this may be restricted by the private property located to the south. An existing highway ditch separates the highway from the prosed alignment and culverts would likely be required where the greenway crosses over the ditch on each end of this segment.

Given its location at the halfway point of the proposed greenway and the natural advantages that it affords, it is expected that this segment would serve as an ideal opportunity for a rest area. Installation of amenities such as benches, look-off areas, and interpretive signage should be considered.

It is noted that the promotion of this area as an attraction may result in undesirable visits from motorists on Highway 107. Consideration may need to be given to the installation of measures discouraging drivers from stopping and parking along the highway in order to access the look-off areas. These may include signage and/or physical interventions such as the reduction in shoulder width.

Photo 5-8: Looking west from a high point between the Chezzetcook Inlet and Highway 107

5.2.8 Segment 8 (Station 1+450 to Station 1+750)

Segment 8 is a challenging section approximately 300m in length that includes minimal available space and a watercourse crossing. Highway fore slopes are steep, requiring extensive fill in order to establish a sub-grade for the greenway.

As with similar locations, the greenway alignment has been located as close as possible to the Highway 107 traveled way in order to limit encroachment on wetlands and construction costs to the extent possible. The proposed cross section has also been reduced below 3.0m. Consideration should be given to the replacement of the guide rail with a more substantial physical barrier between the greenway and Highway 107 to improve the level of comfort and safety for users.

Photo 5-9 Looking west on Highway 107

A key challenge along this segment is an approximately 15m watercourse crossing where Highway 107 crosses via a bridge structure. Options for crossing the watercourse that were considered include the following:

- **Existing Highway 107 Bridge:** The highway bridge has a cross sectional width of 12.5m between curbs, including two 3.85m travel lanes and 2.4m paved shoulders. With reconfiguration of the existing bridge cross section, there may be adequate width to accommodate users from the AT greenway on the south side of the bridge.
    - Advantages: Use of the existing bridge would avoid the need to construct a dedicated AT bridge parallel to the Highway 107 bridge, resulting in significant construction cost savings.
    - Disadvantages: This option presents safety and comfort challenges, as there would be very minimal separation between greenway users and high speed Highway 107 traffic. This is particularly concerning given that greenway traffic will be 2-way. Addition of physical separation elements such as jersey barrier could provide effective separation between highway traffic and greenway users, however, would likely present an unacceptable hazard to highway traffic and a significant reduction in lane and shoulder widths.

- **New Dedicated AT Greenway Bridge:** Construction of a dedicated AT bridge running parallel to the existing Highway 107 bridge. The AT bridge must span approximately 15-

20m and would be 2-3m wide to be consistent with the greenway width. A pre-fabricated steel truss bridge would be appropriate for this application with cast-in-place abutments and a concrete deck installed between the trusses to form the walking surface. The AT bridge would be separated from the vehicle bridge by 2-3m – far enough to provide enough space for construction without undermining the existing abutments but close enough to minimize impact on the Chezzetcook Inlet.

- Advantages: A dedicated AT bridge would provide separation from Highway 107 traffic and maintain continuity of the alignment south of the highway. Given the relatively short span, it is expected that a bridge structure would not require an intermediate pier, which is advantageous from an environmental perspective as the watercourse remains undisturbed.
- Disadvantages: This option would increase the construction cost of the greenway considerably and involve environmental approvals and additional engineering.

Photo 5-10: Looking east on Highway 107

5.2.9 *Segment 9 (Station 1+750 to Station 2+100)*

Segment 6, approximately 350m in length, is a wooded area that provides additional space to achieve significant separation from the highway. The proposed alignment veers as much as 50m south from the highway, though this could be increased further by increasing the segment length and adjusting the alignment. The existing alignment was chosen to maintain moderate slopes by avoiding the crest of the steep hill. These lands are owned by NSTIR.

Photo 5-11: Looking east on Highway 107

5.2.10 *Segment 10 (Station 2+100 to Station 2+400)*

Segment 10 is challenging section approximately 300m in length that includes minimal available space and a watercourse crossing. Highway fore slopes are generally steep, requiring extensive fill in order to establish a sub-grade for the greenway.

As with similar locations, the greenway alignment has been located as close as possible to the Highway 107 traveled way in order to limit encroachment on wetlands and construction costs to the extent possible. The proposed cross section has also been reduced below 3.0m.

Consideration should be given to the replacement of the guide rail with a more substantial physical barrier between the greenway and Highway 107 to improve the level of comfort and safety for users.

Photo 5-12: Looking west on Highway 107

The primary challenge along this segment is a major watercourse crossing approximately 50m in length. Highway 107 crosses the watercourse via a bridge structure that has 2 intermediate piers. Options for crossing the watercourse that were considered include the following:

- **Existing Highway 107 Bridge:** The highway bridge has a cross sectional width of 12.5m between curbs, including two 3.85m travel lanes and 2.4m paved shoulders. With reconfiguration of the existing bridge cross section, there may be adequate width to accommodate users from the AT greenway on the south side of the bridge.
    - Advantages: Use of the existing bridge would avoid the need to construct a dedicated AT bridge parallel to the Highway 107 bridge, resulting in significant construction cost savings.
    - Disadvantages: This option presents safety and comfort challenges, as there would be very minimal separation between greenway users and high speed Highway 107 traffic. This is particularly concerning given that greenway traffic will be 2-way. Addition of physical separation elements such as jersey barrier could provide effective separation between highway traffic and greenway users, however, would likely present an unacceptable hazard to highway traffic and a significant reduction in lane and shoulder widths.

- **New Dedicated AT Greenway Bridge:** Construction of a dedicated AT bridge running parallel to the existing Highway 107 bridge. With a span of approximately 50-60m the bridge would have a width of 2-3 to be consistent with the greenway. A pre-fabricated steel truss bridge would be appropriate for this application with cast-in-place abutments and a concrete deck installed between the trusses to form the walking surface. The AT bridge would be separated from the vehicle bridge by 2-3m – far enough to provide enough space for construction without undermining the existing abutments but close enough to minimize impact on the Chezzetcook Inlet.

    - Advantages: A dedicated AT bridge would provide separation from Highway 107 traffic and maintain continuity of the alignment south of the highway.

- Disadvantages: This option would increase the construction cost of the greenway considerably and involve environmental approvals and additional engineering, particularly if an intermediate pier is required.

Photo 5-13: Looking east on Highway 107

5.2.11 *Segment 11 (Station 2+400 to Station 2+750)*

Segment 11 is the final section at the eastern end of the proposed facility, running approximately 350m along the Exit 21 off-ramp. The terrain adjacent to the ramp is very steep and drops off quickly to a gully in the southwest quadrant of the Exit 21 interchange. As a result, it is proposed that the greenway utilize some of the existing ramp area through shifting of the guide rails to the north and installing the AT facility between the guide rail and edge of slope.

Though removal and reinstatement of approximately 350m of existing guide rail is not ideal and relatively costly, it is expected that the costs would be considerably less than that required to widen the existing off-ramp sufficiently to add the greenway. It is expected that the existing ramp slope is 7 to 8% which is in the upper limit of what is acceptable for long greenway sections.

Photo 5-14: Looking east toward the Exit 21 Off-Ramp

6.0 Implementation Process

This section highlights some of the key requirements that will need to be fulfilled to implement the Acadia Marsh Greenway, from regulatory approvals to design and construction.

6.1 Regulatory Approvals and Policies

6.1.1 *Nova Scotia Transportation & Infrastructure Renewal*

Nova Scotia Transportation & Infrastructure Renewal (NSTIR) is arguably the most important regulator to be considered in the approval process. Since much of the facility would be developed on lands owned by NSTIR – the majority of which within Highway 107 ROW – they will need to approve the concept, endorse the trail configuration, and grant permission for construction.

- Approval of Trail Concept / Configuration: The proposed greenway will be unique in that it will be located in close proximity to a 100-series highway. It will be necessary to obtain approval of the proposed trail concept / configuration, including the proposed cross section and its location relative to the existing highway. Consideration will need to be given to highway operational issues such as winter maintenance and how they may impact the operation of the greenway.

- Obtain "*Work Within Highway Right of Way Permit*": NSTIR does not construct or maintain trails, but does permit others to do so through a "*Work Within Highway Right of Way Permit*". As per the *Trail Policy* (NSTIR Policy #PO1033), trail organizations such as SATA can assume the responsibility for construction and maintenance of trail facilities. As noted in the *Trail Policy*, a recognized trail organization must have a current Certification of Incorporation as provided for in the Societies Act R.S.N.S., c. 435.

6.1.2 *Environmental Approvals*

The proximity of the alignment to the Chezzetcook Inlet presents a number of challenges for development of the greenway, most notably the potential for encroachment on sensitive wetlands and watercourses.

The following approvals, which were discussed in greater detail in Section 4.2, would be required prior to development of the proposed greenway:

- Wetland Alteration Approvals: The proposed greenway is expected to impact wetlands, which will require that the project be considered under the Nova Scotia Wetland Conservation Policy. The following are expected to be required:
    - Field investigations to delineate and assess function of existing wetlands in the areas potentially impacted by the proposed greenway.
    - A Wetland Alteration Application will need to be submitted for approval by DOE.
    - The Nova Scotia Wetland Conservation Policy mandates that any impact on wetlands should be offset by restoration, creation, or enhancement of another wetland as a means of balancing the overall impact on wetlands. The extent to which this may apply to the proposed greenway is challenging to quantify without a detailed knowledge of the total wetland impacts. The project would provide a valuable public benefit, enabling safe and convenient access to the Chezzetcook Inlet as well as an opportunity to educate patrons on the unique aspects of area and on the importance of wetlands in general. As a result, there is potential that

these public benefits be recognized by DOE in its determination of any required offsetting costs.

- Watercourse Alteration Approvals: Alteration to a watercourse requires approval by DOE under the Nova Scotia Environment Act. Approval can be obtained from NSE through the submission of an application for approval. Field assessment of flora and fauna (e.g. wetlands, fish habitat, rare plants etc.) as well as a screening level archaeological study, is typically required prior to completing the approval application.

- Coastal Permits: A coastal permit is required for any structure that will be built below the ordinary high water mark of coastal waters. Though it is expected that the majority of the greenway will be located above the ordinary high water mark, there is potential that bridge abutments will be constructed below the mark. Intermediate piers are not expected to be required for either of the required bridges, but if they are required, would require consideration under these policies.

  Coastal permits are obtained from the Department of Natural Resources (DNR). Infilling and bank protection are generally not permitted, however, may be considered in cases such as this that result in a public benefit. In most cases, if infilling is approved by DNR, purchase of the infilled land by the proponent is required. If bank protection takes place below the ordinary highway water mark (including operation of machinery and placement of material) a permit must be obtained from DNR, and may be reviewed by the Department of Fisheries and Oceans (DFO).

6.2 Detailed Design Process

Detailed design will convert the concept ideas into construction-ready plans. A request for proposals (RFP) can be issued to qualified consultant(s) to coordinate data collection and design activities, including those summarized in Table 6-1.