CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	September 21, 2020
SUBJECT/REPORT NO:	Hamilton Harbour Waterfront Trail - Shoreline Protection (PW19095(a)) (Ward 1 and 2)
WARD(S) AFFECTED:	Ward 1 and 2
PREPARED BY:	Wes Kindree (905) 546-2424 Ext. 2347
SUBMITTED BY: **SIGNATURE:**	Craig Murdoch Director, Environmental Services Public Works Department 

RECOMMENDATION

That Option 3 - Stepped Revetment, found within SNC-Lavalin Design Brief - Hamilton Harbour Waterfront Trail Shoreline Protection, be selected as the preferred option for detailed design and construction of the 2 kilometre easterly facing section of the Hamilton Harbour Waterfront Trail.

EXECUTIVE SUMMARY

On May 8, 2019, Council approved Report FCS 19038 allocating the City of Hamilton (City) portion of funding for Infrastructure Canada's Federal Disaster Mitigation and Adaptation Fund (DMAF) project for Shoreline Protection Measures. This project has a total value of $30.67million. The Hamilton Harbour Waterfront Trail (HHWT) is one of 31 shoreline assets identified within the DMAF project bundle.

The HHWT is a 3.2-kilometre long, 6-metre wide, asphalt multi-use trail situated at the westerly end of Hamilton Harbour. The HHWT is the most travelled trail within the City limits with an average of 2,350 pedestrian trips daily in 2019. The 2-kilometre section of trail that runs between the Desjardins Canal floating bridge and the Bayfront Park parking lot is the focus of this report, as shown in-Appendix "B" attached to Report PW19095(a) - Hamilton Harbour Waterfront Trail Mapping. This 2-kilometre section of

the east facing trail is often exposed to severe wave action generated within the harbour by northern and easterly winds. With the unprecedented high-water levels of the Great Lakes in recent years, combined with repetitive significant weather events experienced at this location, the trail and its shoreline continue to be negatively impacted and at risk of damage and closure, as seen in 2017, 2018 and 2019.

The purpose of Report PW19095(a) is to seek approval for staff to proceed with the detailed design, tendering and construction of the HHWT based on the design concept Option 3 - Stepped Revetment, as shown in Appendix "A") attached to Report W19095a. While Council approval is not required for staff to proceed, staff are seeking direction due to the significant variation in solutions and their subsequent costs.

Alternatives for Consideration – See Page 5

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The estimated design and construction budget for the recommended option is $17 million. This includes a consulting assignment to be awarded to a consultant from the Shoreline Protection Consulting Assignments roster, created through Report FCS19076-PW19087.

The funding source for this project is the $31.7 million Disaster Mitigation and Adaptation Funding (DMAF) program associated with the approved 2019 Capital Budget Project ID 4401956930 City Wide Shoreline Protection Measures ($30.67 million), and Project ID 5181967500 - DMAF CSO Backflow Preventers ($1.05 million) outlined within (FCS19038).

The $30.67 is for the remediation of 31 sites that were identified in the original DMAF application of which the HHWT represents just one of those locations. The work at the HHWT is fully covered by the DMAF funding. The program anticipates that detailed design has not been completed for all of the sites yet and will be refined over time as they are completed.

Staffing: No impact.

Legal: The DMAF agreement has been signed by the City and Federal government. There are no other legal implications to complete the work.

HISTORICAL BACKGROUND

Through 2017- 2019, the Great Lakes experienced record setting high water levels and have remained high through 2020. During this same time period, there has been an increase to the frequency of significant weather events occurring within the Hamilton

area. The combination of these environmental impacts has caused City shoreline assets to experience flooding and significant damage. The HHWT is one of the shoreline assets that was negatively impacted by these climate conditions, resulting in its extended closure in 2017, followed by periodic closures in 2018 and 2019. Temporary measures have been put in place along those sections impacted the greatest, but these measures will not be able to withstand the climate conditions that presented themselves in 2017 and 2018.
For an in-depth review of events to date, studies undertaken and staff progress, please refer to Report PW19095.

In response to the extreme storms and high-water levels causing damage to City shorelines, staff applied for and were successful in obtaining DMAF funding that covers 40% of the capital project costs. Subsequently staff engaged municipal and coastal engineers SNC Lavalin to complete an in-depth review of the HHWT and its shoreline. The consultant was asked to provide engineered recommendations on improving both the trail and shoreline's resiliency to future climate impacts and ensure that this important recreational asset is protected.

The 2.1-kilometre section of HHWT from Bayfront Park to the mouth of the Desjardins Canal was an asset identified as being of high priority as part of the DMAF program. The 760m section of trail that spans between the Desjardins Canal and Longwood Rd North (Cootes Paradise) is not part of this study or the DMAF project. This section of trail does not typically experience coastal impacts or wind events due to its south facing shoreline and shallow basin. In 2019 - 2020, staff raised a section of this trail to help alleviate flooding during high-water levels and therefore this section of trail was not included in the HHWT proposal.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

This project is part of Infrastructure Canada's Disaster Mitigation and Adaptation Funding program that the City of Hamilton has entered into as outlined in Report PW18097 and FCS19038.

Permitting and consultation with Fisheries and Oceans Canada (DFO), the Ministry of Natural Resources and Forestry (MNRF) and the Hamilton Conservation Authority (HCA) will be required during detailed design.

RELEVANT CONSULTATION

Consultation with the Hamilton Conservation Authority (HCA) has been ongoing with the HCA staff indicating support for the improved shoreline protection measures elevation.

Public Works Department, Environmental Services Division, Parks and Cemeteries Section is a key stakeholder in the in development of this recommendation and will continue to be a stakeholder and contributor during in the detailed design process.

The Mississaugas of the Credit First Nation were consulted, and further consultation and monitoring may be required. Furthermore, consultation with Indigenous Communities is a requirement of the DMAF project.

The Ward 1 Councillor was consulted on the four options contained in the SNC Lavalin report. At the request of the Ward 1 Councillor, staff will inquire with local conservation authorities to see if examples of submerged habitat reefs have been utilized in similar applications as seen in Options 2 and 4 of the SNC Lavalin report.

The Ward 2 Councillor was circulated the SNC report with an outline of staff's recommendation. The Ward 2 office is in support of staff's recommendation of Option No. 3, and the recommendation of the coastal engineers.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

SNC-Lavalin was tasked with reviewing the HHWT shoreline and trail's current condition, and to provide engineered solutions to redeveloping the trail and shoreline.

Upon review of the existing conditions and collection of general historic wind, wave and water level data, the consultant prepared 4 concepts for consideration, as shown in Appendix "C" attached to Report PW19095(a):

Option 1 – Conventional Revetment, page 16 of Appendix "C" attached to Report PW19095(a);
Option 2 – Habitat Reef, page 18 of Appendix "C" attached to Report PW19095(a);
Option 3 – Stepped Revetment, page 153 of Appendix "C" attached to Report PW19095(a); and,
Option 4 – Hybrid Solution of Option 1, 2 and 3, page 22 of Appendix "C" attached to Report PW19095(a).

These four concepts were developed using the same high-level modelling data, such as designated high-water level, wind speed/direction and subsequent wave sizing. The consultant reviewed the volume of overtopping the trail would experience based on an Annual Exceedance Probability (AEP) of 1:100 (1% probability within a one-year period) weather event and based on the principal of keeping overall water overtopping onto the trail at a manageable, non-destructive level. Based on the historical data and reasonable forecasting, it is anticipated that these four concepts will provide a life cycle expectancy of greater than 50 years when looking at the shoreline protective measures specifically. It is the opinion of the consultant that all four of these options will work to

protect the trail, so staff have evaluated the options for sustainability, environmental impact, health and safety, maintenance, and overall cost, and are recommending option 3 for the final solution to implement.

This option provides the best balance of cost efficiency with protection of the trail and shoreline.

The recommended option is described as a stepped revetment concept and is made up of a large armour stone shoreline structure that includes strategically placed steps that create a rough surface to help in absorbing the energy of oncoming wave action. The steps within the design will allow for the public to have a closer experience with the water for general recreational use during periods of typical water levels.

The proposed concept increases the elevation of the asphalt trail by approximately 0.6 - 0.9 metres, depending on the section of trail we are looking at. These increased heights would be further refined during detail design. While the current concept illustrates a trail elevation of 77.00 metres and revetment crest elevation of 77.90 metres, the relationship between these two elevations will be reviewed in more detail during wave modelling exercises.

A concrete curb is required at the property line with CN Rail, and the concrete curb would be flush with the trail while its overall height will fluctuate based on the trail's final elevation in relation to the CN property.

While no shoreline solution will completely remove the risk of future damage by extreme storms, the recommended solution in Report PW19095(a) strikes an important balance between protection, cost and maintenance, and preserves DMAF funding for the rest of the properties in the project bundle.

ALTERNATIVES FOR CONSIDERATION

The alternatives shown in Appendix "C" attached to Report PW18063a - Design Brief, Hamilton Harbour Waterfront Trail Shoreline Protection by SNC-Lavalin illustrates three alternative engineered concepts for the trail and shoreline protection. These three alternatives were developed using the same modelling and figures as noted in Option 3 of Report PW19095(a). The alternative options provide similar protection while looking at reducing the volume of overtopping based on an AEP 1:100 weather event. However, the overall design of these 3 concepts offer an alternative approach and have different capital costs, physical appearances and varying maintenance requirements.

Alternative Option 1 (called Option 1 in Appendix "C" attached to Report PW19095(a)) This alternative utilizes a typical stone revetment with a berm to absorb wave action prior to reaching the crest. This approach requires the path elevation to be raised 1 - 2

metres higher depending on its location along the shoreline. This option would result in a significant concrete wall at the CN property line, and would require a substantial amount of fill, therefore increasing the costs.

Overall costs for the first alternative are estimated at approximately $25 million. For this reason, staff do not recommend this alternative.

Financial: The estimated design and construction budget for alternative option 1 are estimated at $25 million which is $8 million more than the recommended option.

Staffing: No Impact

Legal: The DMAF agreement has been signed by the City and Federal government. There are no other legal requirements to complete the work.

Alternative Option 2 (called Option 2 in Appendix "C" attached to Report PW19095(a))
The second alternative option recommends the use of a submerged habitat reef located offshore in lieu of a conventional armoured shoreline. This approach reduces the volume and size of the stone needed at the shoreline. The submerged habitat reef is a rock structure located within the bay, but offshore and away from the trail. This submerged structure would absorb and disrupt the wave energy prior to reaching the shoreline. This approach requires a greater volume of lake infill and would require further environmental studies to review the impacts this may have on water quality such as blue/green algae conditions within the harbour.

By reducing the need for a large armoured shoreline and the ability to reduce its crest, the elevation of the trail would only need minor changes. Maintenance of the shoreline structure and path would be similar to that of the other 3 options, but any maintenance specific to the submerged habitat reef would pose logistical concerns for staff and likely increased monitoring of the habitat.

Since this alternative has some significant maintenance challenges and unknowns with respect to the environmental impacts, staff do not recommend this alternative.

Financial: Overall costs for this alternative is currently estimated at approximately $12 million, excluding the additional environmental studies to review its feasibility and final design. This option is $5 million less than the recommended option.

Staffing: No impact

Legal: The DMAF agreement has been signed by the City and Federal government. There are no other legal requirements to complete the work.

Alternative Option 3 (called Option 4 in Appendix "C" attached to Report PW19095(a))

The third alternative presents a hybrid approach that uses features of SNC Lavalin's options 1, 2 and 3.

This design proposes the use of both an armoured stone revetment and submerged habitat reef alternating at different points along the 2-kilometre shoreline, depending on the conditions. Advantages of this option is that the design would visually break up the armoured look, while providing recreational opportunity in certain areas. The spacing of the different shoreline structures would be determined during detailed design.

Further environmental studies would be required to determine the impacts of the submerged reef on water quality and movement amongst the reefs, similarly to the second alternative - SNC Lavalin option 2.

Due to the combination of both an armoured shoreline and submerged habitat reef, overall maintenance may pose some logistical concerns as a portion of the works are submerged off shore.

Because of the high construction estimate, unknowns related to environmental study and approvals, and concerns about the maintenance of offshore reef habitats, staff do not recommend this alternative.

Financial: Overall costs for this alternative is estimated at $23 million and excludes additional costs for environmental studies. This option is $6 million more than the recommended option.

Staffing: No impact

Legal: The DMAF agreement has been signed by the City and Federal government. There are no other legal requirements to complete the work.

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Healthy and Safe Communities
Hamilton is a safe and supportive City where people are active, healthy, and have a high quality of life.

Clean and Green
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure
Hamilton is supported by state-of-the-art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” attached to Report PW19095(a) – Recommended Option No. 3 – Stepped Revetment Concept

Appendix “B” attached to Report PW19095(a) – Hamilton Harbour Waterfront Trail Mapping

Appendix “C” attached to Report PW19095(a) – Design Brief, Hamilton Harbour Waterfront Trail Shoreline Protection by SNC-Lavalin.