TORONTO

REPORT FOR ACTION

Update on Flood Mitigation and Damage Repair for Toronto's Waterfront and Toronto Island Park

Date: October 2, 2019
To: Infrastructure and Environment Committee
From: General Manager, Parks, Forestry and Recreation
Wards: Wards 10, 3, 4, 14, 19 and 20

SUMMARY

This report responds to City Council direction to report to the Infrastructure and Environment Committee in fall 2019 on the Toronto Islands Flood Characterization and Risk Assessment Project (the "Project"). This Project will assist the City of Toronto and the Toronto Region Conservation Authority (TRCA) in planning for future flooding through flood characterization, flood risk assessment, and flood mapping for Toronto Island Park. It provides options for long-term flood mitigation and adaptation.

This report also provides an update on repairs and mitigation efforts from the 2017 and 2018 weather events, and a preliminary assessment of the 2019 high lake effect along the waterfront and Toronto Island Park.

RECOMMENDATIONS

The General Manager, Parks, Forestry and Recreation recommends that:

1. The Infrastructure and Environment Committee receive this report for information.

FINANCIAL IMPACT

The 10-Year Capital Plan for Parks, Forestry and Recreation (PFR) includes the High Lake Effect and Windstorm Impacts capital project with Council approved project cost and cash flow funding totalling $28.267 million, funded by debt, to address the high priority rehabilitation and repair work to waterfront parks, including permanent pumping facilities at Toronto Island Park, as summarized in Table 1 below.

Table 1: Capital Funding for High Lake Effect and Windstorm Impacts ($000s)

Sub-Project and Description	WBS Element	2018 Approved	2019 Budget	2020 Plan	2021 Plan	2022 Plan	Total Project Costs
High Lake Effect Impacts							
Waterfront High Lake Effect Flooding Rehab	CPR126-48-02	$2,000					$2,000
CAMP (SGR) Special Facilities Buildings & Structures FY2018-2019 (Bluffer's Park Shoreline Infrastructure)	CPR126-48-01	$576					$576
Various Parks - Parks Rehab FY2018 (Humber River bank erosion, Centre Island Park Washroom, Balmy Beach Park)	CPR117-48-03, CPR117-48-05, CPR117-48-04	$685					$685
2017 High Lake Effect Flooding Damage	CPR126-49-01		$3,580	$2,889	$3,479	$2,958	$12,906
Subtotal High Lake Effect Impacts		**$3,261**	**$3,580**	**$2,889**	**$3,479**	**$2,958**	**$16,167**
Windstorm Impacts							
Parks Plan (Bluffer's Park headland)	CPR117-48-10	$300					$300

Sub-Project and Description	WBS Element	2018 Approved	2019 Budget	2020 Plan	2021 Plan	2022 Plan	Total Project Costs
2018 Windstorm wave damage	CPR126-49-02		$4,550	$3,600	$2,000	$1,650	$11,800
Subtotal Windstorm Impacts		**$300**	**$4,550**	**$3,600**	**$2,000**	**$1,650**	**$12,100**
Total High Lake Effects & Windstorm Impacts		**$3,561**	**$8,130**	**$6,489**	**$5,479**	**$4,608**	**$28,267**

In August 2019, the City was advised of the successful application for the Federal Disaster Mitigation and Adaptation Fund (DMAF) in the amount of $11.989 million, with $10.412 million for High Lake Effect and Windstorm project costs and $1.577 million to enhance the resiliency of the tree canopy.

As part of the requested 2020 operating and capital budget, PFR will include the Federal DMAF funding to replace the existing debt funding source for the High Lake Effect and Windstorm project in its 2020-2029 Capital Budget and Plan submission and to enhance the resiliency of the urban forest and tree canopy through tree maintenance and planting, fully funded by the DMAF fund and the Tree Canopy Reserve Fund in the operating budget.

Preliminary cost estimates to fully implement the Toronto Islands Flood Characterization and Risk Assessment Project (Project) varies between $13.9 million to $15.9 million depending on the flood protection options selected. This estimate is based on the 2017 flood event and does not account for the 2019 flood event or any study, planning, and design-related costs. Together with TRCA, staff are in the process of initiating a third party estimate that will factor in the 2019 flood event and additional study, planning and design-related costs. This review may result in a higher cost estimate from the one identified through the Project. As the financial implications for these initiatives are unknown at this time, they will be reported out to Council and if approved included in future budget submissions once determined.

The Chief Financial Officer and Treasurer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

City Council, at its meeting of July 4, 5, 6 and 7, 2017, directed the General Manager, Parks, Forestry and Recreation to report to the Executive Committee in the third quarter of 2018 with a comprehensive inventory of all capital costs associated with the Spring flooding of 2017, including repair of existing infrastructure and mitigation strategies.

At its meeting of January 31 and February 1, 2018, City Council directed the General Manager, Parks, Forestry and Recreation to submit outstanding short term Capital repair and mitigation projects and longer term capital projects, arising from high lake levels, for priority consideration in the 2019 Capital Budget process.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.EX30.7

City Council, at its meeting of February 12, 2018, adopted the 2018 Capital Budget for Parks, Forestry and Recreation through item EX31.2 (20 a.i.) and a total project cost and 2018 cash flow of $2.000 million for the Waterfront High Lake Effect Flooding Rehab sub-project.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.EX31.2

Executive Committee, at its meeting of July 17, 2018, received the report Capital Repair and Remediation Cost of 2017 Flooding of Waterfront Parks.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2018.EX36.22

At its meeting of March 7, 2019, City Council adopted Parks, Forestry and Recreation's 2019 Capital Budget through item EX2.5 (199.a.i.), including $24.706 million for the 2018 Windstorm Damage and 2017 High Lake Effect Flooding sub-projects.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX2.5

City Council, at its meeting of June 18 and 19, 2019, directed the General Manager, Parks, Forestry and Recreation to report to the Infrastructure and Environment Committee in September 2019 through Member Motion MM8.9 with respect to protecting Toronto Island Park, long-term flooding mitigation and Adaptation.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.MM8.9

At its meeting of June 18 and 19, 2019, City Council authorized the City Manager to apply for federal funding under the Disaster Mitigation and Adaptation Fund for approved City Council capital projects that meet the funding eligibility criteria; granted approval to receive the funds; and for the Mayor to enter into and execute any agreements with the Government of Canada as required.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2019.EX6.4

COMMENTS

2017 High Lake Level and 2018 Windstorm Events Update

In the spring of 2017, Lake Ontario saw an unprecedented rise in water level, as snowmelt and an exceptionally rainy spring season increased water supply to the basin. On May 27, 2017, lake levels reached their peak height of 75.93 metres above sea level, the highest water level ever recorded in over 100 years of tracking levels of Lake Ontario. The effect of this flooding event was felt along the entire length of Toronto's waterfront, especially Toronto Island Park, resulting in flooding and erosion damage.

With the lake still above average spring levels, the City of Toronto was impacted by the ice and windstorm of April 14-15, 2018 which further exacerbated the shoreline

damage. The damage was most pronounced along the perimeter of waterfront parks, such as Bluffer's Park, Ashbridges Bay Park and Humber Bay Park East and West. City of Toronto and TRCA staff collaborated to mitigate, inspect and assess this damage.

Since these major flood events, City of Toronto and TRCA staff have been implementing emergency works and prioritizing and planning all other identified immediate and short-term projects across the entire waterfront. The following projects were immediate emergency repairs or mitigation efforts that were either completed in 2018 or in progress in 2019.

Category of Repair	Locations
Erosion Control	Bluffer's Park Southwest Bluffer's Park South Scarlett Woods Golf course Cherry Beach temporary measures Colonel Sam Smith Park
Trails, Pathways and Boardwalks	Balmy Beach Park
Asset Infrastructure	Eastern Beaches (Leuty Boathouse) Toronto Island Park Sumps and Pumps Centre Island Park Washroom Humber Bay Park West Boat Launch
Shoreline Infrastructure	Humber Bay Shores Ward's Island Palace Pier Court
Flood Study	Toronto Islands Flood Characterization and Risk Assessment Project

2019 High Lake Level Event

In the spring of 2019, Lake Ontario once again saw unprecedented water levels, breaking the 2017 record with a peak height of 76.03 metres above sea level on May 29, 2019. Lessons learned in 2017 along with proactive measures implemented in 2018 allowed for effective mitigation measures to reduce the impact of flooding in 2019 despite the higher water levels; however, a long-term solution is still required.

Similar to the 2017 event, the City of Toronto and TRCA have been responding to and monitoring the 2019 high lake level event along waterfront parks and Toronto Island Park. In 2019, TRCA used an innovative map to track and share all reported flooding incidents with site-specific details and photos across a web-based platform. This has increased emergency response and collaborative reporting efficiencies. This mapping is also being shared with the Great Lakes Adaptive Management Committee allowing

them and Lake Ontario regulators to understand the risks along Lake Ontario's shorelines.

Due to high lake water levels, there has not yet been a comprehensive evaluation of the incidents in 2019 as the water levels are still too high to evaluate the full extent of hazards and damages. Once water levels have receded, PFR staff and TRCA Erosion Hazard Monitoring staff will undertake an on-the-ground assessment of all reported shoreline incidents, which will include a boat survey to visually inspect the entire shoreline, and an analysis of shoreline drone photography taken between July 2019 and September 2019. PFR and TRCA staff will also inventory all capital costs associated with the 2019 high lake level event.

These new assessments of 2019 flooding are expected to result in the need for additional rehabilitation and repair work across the waterfront, and will impact planned capital project estimates from the 2017 events, as the 2019 event further exacerbated erosion and damage to the shoreline.

Impact of High Lake Level Events on Toronto Island Park 2017

While the impact of the 2017 high lake level event was felt along the entire length of Toronto's waterfront, flooding severely affected Toronto Island Park, which has approximately 800 residents, many seasonal businesses, and two schools. Staff from both the City of Toronto and TRCA worked diligently for several weeks to prevent damage and the loss of property and assets through emergency flood mitigation efforts.

In response to the 2017 flood conditions the City of Toronto and TRCA deployed over 45,000 sandbags, 1000 meter bags, and over a dozen industrial pumps to mitigate the effects of the rising water. These mitigation assets were positioned throughout Toronto Island Park with the help of GIS maps created from Light Detection and Ranging (LiDAR) imagery. This technology identified the most vulnerable areas and infrastructure in the Park and identified the most strategic locations for deployment. Despite these efforts to reduce the impact of flooding, access to Toronto Island Park was restricted between May 4 and July 30, 2017.

The suspension of PFR ferry service to Toronto Island Park impacted tourism and permitted recreational activity, which are important revenue sources for the City and local businesses. The Park also experienced significant shoreline erosion, damage, and debris accumulation over the spring and summer of 2017. The flooding resulted in the activation of the City of Toronto Emergency Operations Centre and in direct and indirect damages related to the closing of the Park.

Impact of High Level Events on Toronto Island Park 2018

In 2018, the City of Toronto worked with TRCA to repair damaged areas and install naturalized berms and sumps to protect strategic areas from anticipated future flooding. The large meter bags deployed in 2017 were removed but the sand was left in place, forming berms that were planted with native grasses along Algonquin and Ward's

Islands. A total of twelve sump pits, including six on Ward's Island, were installed in strategic locations to collect surface flooding and drain low lying and saturated areas with a series of weeping tiles. An armourstone break wall was installed to protect building infrastructure during high water events. TRCA flood mapping provided insight on the best location for these mitigation efforts. The City also made significant upgrades to the ferry docks, allowing for safe passenger use when lake levels rise and flooding occurs on Toronto Island Park.

In 2018, TRCA in collaboration with the City of Toronto, successfully secured $0.150 million in grant funding from the federal National Disaster Mitigation Program (NDMP), with the City matching $0.150 million for a total of $0.300 million to undertake the Toronto Islands Flood Characterization and Risk Assessment Project (the “Project”). As part of this Project, W.F. Baird & Associates Coastal Engineers Ltd. (Baird) was retained to provide coastal engineering services to complete a study that would assist the City and TRCA in responding to and planning for future flood conditions. The study consisted of the following four major components: i) Flood Characterization Report, ii) Flood Risk Assessment Report, iii) Flood Mapping, and iv) Flood Mitigation Alternatives Report.

Impact of High Lake Level Events on Toronto Island Park 2019

In the spring of 2019, Lake Ontario once again experienced unprecedented water levels, surpassing the previous 2017 record by ten centimeters. Despite higher water levels, proactive mitigation measures implemented in 2018 were effective in reducing the impact of flooding in 2019.

The utility of the Project, which was undertaken following the 2017 flood event, has already been demonstrated during the 2019 high water levels. Flood mapping developed as part of the project, which identifies areas of flooding under varying water levels, allowed for the effective deployment of resources in response to rising water levels. In addition, the Flood Characterization Report provided background information that informed the ideal placement of short-term mitigation measures to address the flood levels, including the ideal placement of sandbags and other efforts.

TRCA and PFR staff were deployed on Toronto Island Park from the end of April to mid-June 2019, including a two-week period of round-the-clock (24 hour) staffing in order to lead and manage these efforts. During this time, a total of 22,000 sandbags were placed, 14 Aqua Dams were installed, and 14 previously installed pumps were operated and/or maintained. Efforts were largely focused on Algonquin and Ward's Islands to protect property, as well as various locations across Centre Island, including Billy Bishop Airport, Gibraltor Point, and Manitou Beach. The strategic deployment of proactive short-term mitigation efforts, in combination with the preventative measures implemented in 2018, greatly reduced the scale and impact of the 2019 event on the Island community compared to 2017 despite the record breaking water levels.

Toronto Islands Flood Characterization and Risk Assessment Project – Flood Mitigation Alternatives Report

The final component of the Toronto Islands Flood Characterization and Risk Assessment Project is the Flood Mitigation Alternatives Report. This report identifies flood mitigation alternatives for the areas most affected by the 2017 flood and will be updated to provide consideration of the 2019 event as needed. The flood mitigation concepts within the report focus on community-scale flood protection measures and build upon recommendations made by Toronto Island Park residents, including protecting low-lying residential areas with a berm or dike structure, elevating low-lying roads, increasing the crest elevation of shore protection structures, and directing surface drainage to the sumps that were installed in 2018. The report presents the conceptual designs, estimated quantities, and budgetary cost estimates for flood mitigation alternatives with a focus on six key areas: Ward's Island Promenade, Algonquin Island Berm and Flood Wall, Centreville Flood Protection, Cibola Avenue Berm, Island Water Treatment Plant, and the Elevation of Arterial Roads.

Preliminary cost estimates to fully implement the Toronto Islands Flood Characterization and Risk Assessment Project varies between $13.9 million to $15.9 million depending on the flood protection options. This estimate is based on the 2017 flood event and does not account for the 2019 flood event or any study, planning, and design-related costs. A Conservation Authority Class Environmental Assessment for Remedial Flood and Erosion Control (Class EA) is also required to proceed with the development and eventual implementation of flood mitigation alternatives and will be led by TRCA. No funding sources have been confirmed for this work as yet as TRCA and PFR staff are in the process of initiating a third party estimate that will factor in the 2019 flood event and additional study, planning and design-related costs. This may result in a higher cost estimate. The financial implications for these initiatives will be reported to Council and if approved included in future budget submissions once determined.

PFR has also initiated a Toronto Island Park Master Plan and the Toronto Islands Flood Characterization and Risk Assessment Project will be a key resource for this plan. Staff expect that there will be many opportunities to integrate the flood protection capital works into overall park improvements that benefit the public realm, in keeping with the City of Toronto’s First Resilience Strategy and the goal of integrating risk reduction with community enhancement.

Conclusion

The Toronto Islands Flood Characterization and Risk Assessment Project provides TRCA and PFR with an improved understanding of flood scenarios and community and infrastructure vulnerabilities and risks. It also provides direction on future flood mitigation investments, where TRCA’s experience in implementing shoreline and flood protection measures throughout the Toronto waterfront could be leveraged in the delivery of these flood protection measures. While strategically placed short-term mitigation measures helped to reduce the impact of the 2019 high lake level event, a long-term solution is needed to provide adequate and sustainable flood protection.

The impacts of severe storms are no longer infrequent events occurring only once or twice a decade. Modeling shows that the storms and impacts related to climate change and urbanization will only continue to accelerate both in frequency and severity. Long-term planning and coordination is required to ensure Toronto's shoreline and waterfront parks are stewarded for future generations. PFR staff will continue to work with the TRCA and the City's Flood working group and resilience staff to determine long-term repair and resiliency work in preparation for anticipated high water levels and severe weather events.

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