



City of Richmond

Report to Committee

To: General Purposes Committee **Date:** April 9, 2020
From: Milton Chan, P.Eng. **File:** 10-6060-01/2020-Vol
 Director, Engineering 01
Re: **2019 Winter Rainfall and 2020 Flood Protection Update**

Staff Recommendation



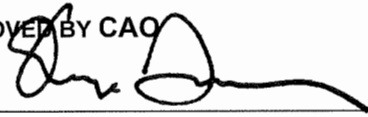
That the staff report titled, "2019 Winter Rainfall and 2020 Flood Protection Update", dated April 9, 2020 from the Director, Engineering, be received for information.

DocuSigned by:

 EE473F8C3481433...

Milton Chan, P.Eng.
 Director, Engineering
 (604-276-4377)

Att. 1

REPORT CONCURRENCE		
ROUTED TO: Sewerage and Drainage Roads and Construction	CONCURRENCE <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	CONCURRENCE OF GENERAL MANAGER DocuSigned by:  9352CB09CEDB448...
SENIOR STAFF REPORT REVIEW	INITIALS: 	APPROVED BY CAO 

April 9, 2020

- 2 -

Staff Report

Origin

As detailed in the Flood Protection Management Strategy 2019, the City of Richmond is situated approximately 1.0 m above sea level and flood protection is integral to protecting the health, safety, and economic viability of the City. Richmond is protected from flooding by infrastructure that includes 49 km of dikes, 585 km of drainage pipes, 61 km of culverts, 165 km of watercourses and 39 drainage pump stations.

Demands on the City's flood protection infrastructure are most significant during storm season in the winter and freshet season in the spring. This report provides Council with an update on 2019/2020 winter rainfall and ongoing works regarding the City's flood protection program.

This report supports Council's Strategic Plan 2018-2022 Strategy #1 A Safe and Resilient City:

Enhance and protect the safety and well-being of Richmond.

1.2 Future-proof and maintain city infrastructure to keep the community safe.

Analysis

2019 Winter Rainfall and Flood Protection System

Significant Rainfall Events

The City's drainage system is designed to accommodate a 10-year return period rainfall event. Rainfall amounts and water levels in the City's drainage system and the Fraser River are monitored using 5 rain gauges, 12 drainage level sensors and 9 river level sensors. Attachment 1 shows the total annual rainfall over the past 10 years and identifies lower than average total rainfall in 2019.

Between October 2019 and December 2019, there were four 2-year return period rainfall events. The drainage system performed well during these events.

In January 2020 and February 2020, there were two 2-year return period rainfall events and one 100-year return period rainfall event. January's rainfall was Richmond's fourth highest on record (since 1937) and staff saw a significant increase in drainage-related service requests over the 10-year average of 53. Staff responded to a total of 150 drainage-related service requests, 106 of which were a result of significant rainfall events. The main issues were caused by construction activity in the Hamilton Gilley area, which impeded the flow in the local drainage system, and have since been corrected.

In recent years, there has been an increase in the occurrences and intensities of significant storms, with the potential of multiple storms exceeding a 10-year return period intensity in a given year. This is consistent with predicted climate change impacts on local weather patterns and reinforces the need for the City's continued flood protection upgrade program.

April 9, 2020

- 3 -

Storm Surge

Seasonal high tides and king tides have not been significant this winter rainfall season.

Flood Protection Planning

Flood Protection Management Strategy Update

The City's flood protection efforts are guided by the recently updated Flood Protection Management Strategy. The strategy update was funded through the National Disaster Mitigation Program grant and provides a framework that outlines short- and long-term strategies for policy planning, infrastructure upgrades, and other areas related to flood risk mitigation.

Key elements of the Flood Protection Management Strategy include raising dikes, updating policies with current flood protection science, updating the City's dike operations and maintenance manual and establishing a world-class flood protection standard. These key elements will be advanced to improve the City's overall resilience to flooding. Staff will continue to engage key stakeholders and the public on climate change, flood protection, and area-specific considerations through the use of social media, open houses, presentations and other platforms.

At the January 27, 2020 Regular Council Meeting, Council introduced a referral for staff to review the City's Flood Protection Management Strategy 2019, as referenced in the staff memorandum titled "Non-Farm Use Soil Deposit Proposal for the Property Located at 21700 River Road" dated January 13, 2020, and provide comments with regard to the raising of land, specifically as it relates to agricultural land and agricultural viability. Staff will review and provide comments for Council's consideration in a separate report later this year.

Dike Master Plans

Current climate change science estimates that sea level will rise approximately 1.0 m by the year 2100 and 0.2 m of land subsidence is forecasted over the same time period. The City's Flood Protection Management Strategy is the guiding framework for continual upgrades and improvement to the City's flood protection system. A key action identified in the City's Flood Protection Management Strategy involves continuing to upgrade the City's perimeter dike to 4.7 m in the next 25 to 75 years to stay ahead of climate change induced sea level rise. The City's Dike Master Plans address this need by recommending dike upgrade options for each dike reach throughout the City.

Dike Master Plan Phases 1, 2, 3 and 5 have been adopted by Council. Dike Master Plan Phase 4, which includes the north dike of Lulu Island between No. 6 Road and Boundary Road, will be presented for Council consideration in a separate report this year.

Staff are continuing to implement the work plan endorsed by Council as part of Dike Master Plan Phase 1 for the Steveston Island dike concept. Per the Council endorsed work plan, staff are completing further assessments to negotiate land use and rights-of-way on Steveston Island, continue design work for concept preparation, work with key stakeholders to establish strategic partnerships that can be leveraged to reduce construction costs, and seek funding from senior government.

April 9, 2020

- 4 -

Infrastructure Improvements

Funded by the Drainage and Diking Utility and grants, the City's flood protection infrastructure is continuously upgraded and improved to address infrastructure age, growth and climate change.

Dike Upgrades

Construction is complete for the upgrade of the South Dike between Gilbert Road and No. 3 Road. Upgrades included raising and widening approximately 650 m of dikes, and constructing an improved multi-use path to enhance the safety and accessibility of pedestrians and cyclists.

Design is complete for dike upgrades along the South Dike between No. 3 Road and Finn Slough. A public information session was held in late spring 2019. Construction was scheduled to begin in 2020; however this may be delayed due to the impacts of the COVID-19 situation.

Design of the South Dike upgrades between No. 9 Road and west of McMillan Way is complete. Construction is expected to begin spring 2021.

In addition to dike upgrades completed as part of the capital program, 1.6 km of dikes were re-armoured with 11,400 tonnes of rip-rap as part of the City's Dike Maintenance Program in 2019.

Pump Station Upgrades

Significant progress has been made in upgrading the City's drainage pump stations to accommodate growth and climate change. Over the last 19 years, since the City introduced the Drainage and Diking Utility, the City has rebuilt 11 of its 39 drainage pump stations and has performed significant upgrades on four. Re-construction of the Horseshoe Slough Pump Station is nearing completion. Re-construction of the Shell Road North Pump Station and No. 7 Road South Pump Station is underway. Design is complete for the No. 2 Road South Pump Station. Design for the Steveston Highway and No. 3 Road Pump Station and the Steveston Highway and Gilbert Road Pump Station are underway.

During extreme events, a number of the older pump stations operate near full capacity. These stations have been identified to require upgrades through capacity analysis. Projects to upgrade or replace these stations are either included in current capital programs or will be brought forward for Council consideration as part of future capital programs.

Flood Protection Improvement Financing

Improvements to the City's flood protection system to address the needs of ageing infrastructure and climate change are funded through three basic funding sources.

Drainage and Diking Utility

The Drainage and Diking Utility was established by Council in 2000 and currently generates \$13.4 million annually to maintain and upgrade Richmond's flood protection infrastructure. Staff are continuously monitoring regional and global climate change science to inform the City's Flood Protection Program. In response to a referral from the November 12, 2019 Regular Council

April 9, 2020

- 5 -

Meeting, staff will present an accelerated flood protection implementation program for Council's consideration in a separate report this year.

Senior Government Grant Funding

The City's Flood Protection Management Strategy aims to acquire senior government funding for a wide range of flood prevention and protection research, monitoring, studies, planning and improvements. As a result of proactive flood protection planning efforts, the City has been successful in securing over \$30 million in senior government grants that will go towards implementing over \$60 million of dike and pump station improvements.

Development

The City has successfully partnered with developers to secure dike upgrades through development. In particular, the City is actively pursuing opportunities to construct superdikes, where land supporting development behind the dike is filled to the same elevation as the dike crest. This eliminates visual impacts of a raised dike structure on waterfront views while providing an enhanced flood protection structure for the City. Superdikes constructed through development include sections near the Richmond Olympic Oval and at the Imperial Landing and Kawaki developments in Steveston. Superdike construction at Parc Riviera and River Green developments was completed in 2018. Superdike construction at the Vancouver Airport Fuel Facility Corporation (VAFFC) Jet Fuel location and Western-Citimark development is expected to begin construction this year. Staff estimate that up to 20% of dike upgrades along Lulu Island's perimeter dikes will be completed through development.

Financial Impact

None.

Conclusion

The City received below average rainfall in 2019 and experienced one significant rainfall event that exceeded a 10-year return period in the 2019/2020 winter rainfall season. Through the capital improvements and investment in preventative maintenance programs, the City has developed the ability to proactively prepare and respond to flood related concerns. Significant progress continues to be made in advancing the City's dike planning efforts and implementing infrastructure improvements to the City's flood protection system.



Jason Ho, P.Eng.
Manager, Engineering Planning
(604-244-1281)



Corrine Haer, P.Eng.
Project Manager, Engineering Planning
(604-276-4026)

JH:ch

Att. 1: Annual Rainfall Data (2010-2019)

Annual Rainfall Data

