



To: Public Works and Transportation Committee
From: John Irving, P.Eng. MPA
 Director, Engineering
Re: **Flood Protection Programs Update**

Date: January 22, 2018
File: 10-6000-01/2018-Vol
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Staff Recommendation

That the process to update the 2008 – 2031 Richmond Flood Protection Management Strategy as identified in the report titled “Flood Protection Programs Update,” dated January 22, 2018, from the Director, Engineering, be endorsed .

John Irving, P.Eng. MPA
 Director, Engineering
 (604-276-4140)

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Roads & Construction Sewerage & Drainage	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: CJ	APPROVED BY CAO

Staff Report

Origin

Richmond City Council adopted the 2008 – 2031 Richmond Flood Protection Management Strategy in 2008. The 2008 – 2031 Richmond Flood Protection Management Strategy is the City's guiding framework for continual upgrades and improvement of the City's flood protection system. This report is an overview of current ongoing efforts under this strategy.

This report supports Council's 2014-2018 Term Goal #6 Quality Infrastructure Networks:

Continue diligence towards the development of infrastructure networks that are safe, sustainable, and address the challenges associated with aging systems, population growth, and environmental impact.

6.1. *Safe and sustainable infrastructure.*

Findings of Fact

Richmond's flat, low lying topography has inherent flood risk from inundation and rainfall. Understanding and managing this risk is critical to the City's success and a primary municipal responsibility. Richmond's diking and drainage systems provide a high level of flood protection for businesses and residents in Richmond, however, these systems require ongoing maintenance and upgrading to maintain this high level of service given ageing infrastructure challenges and forecasted climate change induced sea level rise.

The 2008 – 2031 Richmond Flood Protection Management Strategy is the overarching framework that guides Richmond's flood protection activities. Guided by this strategy and aging infrastructure planning, the City has developed dike master plans, ongoing maintenance programs and capital plans for infrastructure improvements. Funding for upgrades is largely provided through the City's Drainage and Diking Utility, which generates \$11.9 million annually. Additional financial support has been provided from senior levels of government through one off funding grants. The City has also been successful in partnering with development for the provision of localized infrastructure upgrades.

The following is a status report of current drainage and diking planning and construction activities for Council's information.

Flood Protection Management Strategy Update

The City received grant funding of \$500,000 through the National Disaster Mitigation Program to update the 2008 – 2031 Flood Protection Management Strategy. The 2018 – 2041 Flood Protection Management Strategy will update:

- hazard and consequence information including the latest climate change science;
- opportunities to improve flood risk management such as property acquisition requirements and Flood Construction Levels (FCLs); and
- partnership opportunities in achieving preferred options.

In developing the updated Flood Protection Management Strategy, staff will utilize expertise from:

- Technical consultants with international expertise;
- The Fraser Basin Council;
- The University of British Columbia; and
- British Columbia Ministry staff.

Staff has engaged a consultant and the consultant's draft work will be completed in the fourth quarter of 2018. The Fraser Basin Council, UBC and the Province will be invited to participate and provide comment and input. Staff will then develop a draft updated 2018 – 2041 Flood Protection Management Strategy, which will be utilized for public consultation and for Council's consideration in a subsequent report.

Recent Grants

The City has procured the following significant flood protection grants over the last two years. Richmond projects utilizing this grant funding and progress on those projects is detailed in the body of this report.

Steveston Island Flood Risk Investigation

Total Project Value: \$1,620,000

Federal: \$810,000; Provincial: \$405,000; City of Richmond: \$405,000

Flood Mitigation Strategy Update

Total Project Value: \$500,000

Federal: \$250,000; Provincial: \$250,000

Disaster Mitigation: Rebuild Pump Stations and Dike Upgrades: \$24,949,998

Provincial: \$16,633,332; City of Richmond: \$8,316,666

Dike Master Planning

The current phases of the Dike Master Plan are shown in Attachment 1. Phase 1 is complete and was endorsed by Council on April 22, 2013. Stakeholder consultation for the draft version of Phase 2 is complete and staff will report the results of that consultation to Council in March 2018. National Disaster Mitigation Program grant funding was secured for Phase 3 and work began in November 2017 as per the conditions of the grant. Work on Phase 4 of the dike master plan began in October 2017. Staff anticipate that both Phase 3 and Phase 4 will be completed in 2018. Staff recently secured a \$150,000 grant from the Union of BC Municipalities Community Preparedness Fund for Phase 5 of the Dike Master Plan and work will begin in 2018.

Steveston Island Dike Investigation

The Dike Master Plan Phase 1 identified Steveston Island as the preferred long term dike alignment for flood protection in Steveston Harbour. Staff obtained grant funding through the National Disaster Mitigation Program for Steveston Island Flood Mitigation Planning and began geotechnical investigation to determine the feasibility of this option in November 2017. The geotechnical investigative work will be completed in the first quarter of 2018.

Dike Raising and Pump Station Upgrades

As part of the City's Flood Protection Program, the following dike upgrades and pump station reconstruction projects are underway through the current approved capital program combined with \$16.6 million in grant funding secured from the Province of British Columbia:

- Horseshoe Slough Pump Station – detailed design has been completed, construction will begin in the first quarter of 2018 and be completed in the first quarter of 2019;
- No. 7 Road South Pump Station – design is underway, construction will begin in the second quarter of 2018 and be completed in the first quarter of 2019;
- Shell Road North Pump Station – design is underway, construction will begin in the second quarter of 2018 and be completed in the first quarter of 2019;
- No. 2 Road South Pump Station – conceptual architectural design is pending on Council approval, construction is scheduled to begin in the third quarter of 2018 and be completed in the first quarter of 2019;
- No. 2 Road North Pump Station – construction will be completed in early 2018
- South Dike from No. 3 Road to Gilbert Road – design to be completed in the first quarter of 2018. Construction is targeted for the third quarter of 2018 but will be dependent on receiving environmental approvals from the Province;
- North Dike Raising and Improvement from No. 2 Road to McCallan Road – design to be completed in the second quarter of 2018 and construction to be completed in the first quarter of 2019 but will be dependent on receiving environmental approvals from the Province;
- South Dike from No. 3 Road to 410 m east of the Woodward's Slough Drainage Pump Station (excluding Crown Packaging property) – design to be completed in the second quarter of 2018. Construction is targeted for the third quarter of 2018 but will be dependent on receiving environmental approvals from the Province;
- South Dike from No. 9 Road Pump Station to 680 m to the east, adjacent to Lafarge – design will begin in 2018 with completion scheduled for 2019; and
- North Dike from No. 8 Rd to approximately 500 m to the east – design will begin in 2018 with completion scheduled for 2019.

The City has existing agreements with Crown Packaging and Lafarge stating their responsibilities to raise and maintain the dike fronting their respective properties. Staff has initiated discussions with both Crown Packaging and Lafarge and are working to facilitate dike improvements at these locations.

Britannia Heritage Shipyard Flood Protection Improvements

This project will improve flood protection at the Britannia Heritage Shipyard site, which is outside the City dike. The scope includes repairing existing bulkheads, raising of concrete walls and installing new sheet pile flood barriers that will be cladded to preserve the heritage appearance. The project is scheduled to be completed in the second quarter of 2018.

Box Culvert Repair or Replacement

The City has 56 km of box culverts throughout the City that are the back bone of the City's drainage system. Some of the box culverts have deteriorated prematurely and have required remedial action or replacement. The following are box culvert capital projects competed in 2017 or scheduled for 2018.

- No. 2 Road between Westminster Highway and Granville Avenue – replaced 50 m of box culvert that had joint failure and was undermining No. 2 Road. Replacement was completed in February 2017 at a capital cost of \$1.5M ;
- No. 4 Road at Tuttle Avenue – replaced 25 m of deteriorated large diameter steel culvert with a 3.3 m x 1.5 m box culvert. Completed in February 2017 at capital cost of \$630k; and
- No. 2 Road south of Steveston Highway – inspection of this box culvert identified over 250 defects that require attention. The approved budget for required repair work is \$3.7M and work is scheduled to begin in the first quarter of 2018.

Maintenance

In 2017, dike maintenance staff re-armoured 6,000 square meters of dike face with 5,200 tonnes of rip rap and removed 5,500 square meters of trees and vegetation from the dikes. Staff will increase dike maintenance in 2018 with the additional funding approved by Council on November 14, 2017 as part of the 2018 Utility Budget rates.

Box culvert deterioration is an emerging issue in Richmond and the City implemented a box culvert inspection program in 2017. Staff performed comprehensive inspection of 7 km of box culverts in 2017 and will inspect another 8 km of box culverts in 2018.

New Technologies

Staff identified a unique technology to improve soil strength through utilization of microbes. This technology has potential to strengthen dikes that are susceptible to liquefaction during very long return period earthquakes. Staff has engaged a Dutch company to confirm the effectiveness of the microbes in Richmond's soil stratum and will employ this innovative technology in the City should it prove to be beneficial.

Financial Impact

None.

Conclusion

Richmond's flood protection system provides a high degree of security for the residents and businesses in the City of Richmond. The 2008 – 2031 Richmond Flood Protection Management Strategy is the City's guiding framework for continual upgrades and improvement of the City's flood protection system and the Drainage and Diking Utility provides a secure source of funding for these improvements. The City's Dike Master Plan identifies a long term program for increasing the height of the City's dikes over the next 25 to 75 years to stay ahead of climate change induced sea level rise and guides the City's Dike Improvement Program. The Dike Improvement Program has a number of projects that are currently in the implementation phase and additional projects are identified in the City's Capital Plan for implementation in the near future.

The City's 56 km of box culverts are the back bone of the City's drainage network. Richmond has a rigorous box culvert inspection program that has identified deterioration in some of the box culvert inventory. A number of projects have been completed or are under way to repair identified weaknesses in the box culverts.

Staff is continually identifying new technologies that may have application in Richmond and is working with a Dutch company to determine if a microbe based soil stabilization process will work in Richmond. This process has significant potential to improve the City's liquefiable soils and provide improved protection during seismic events.

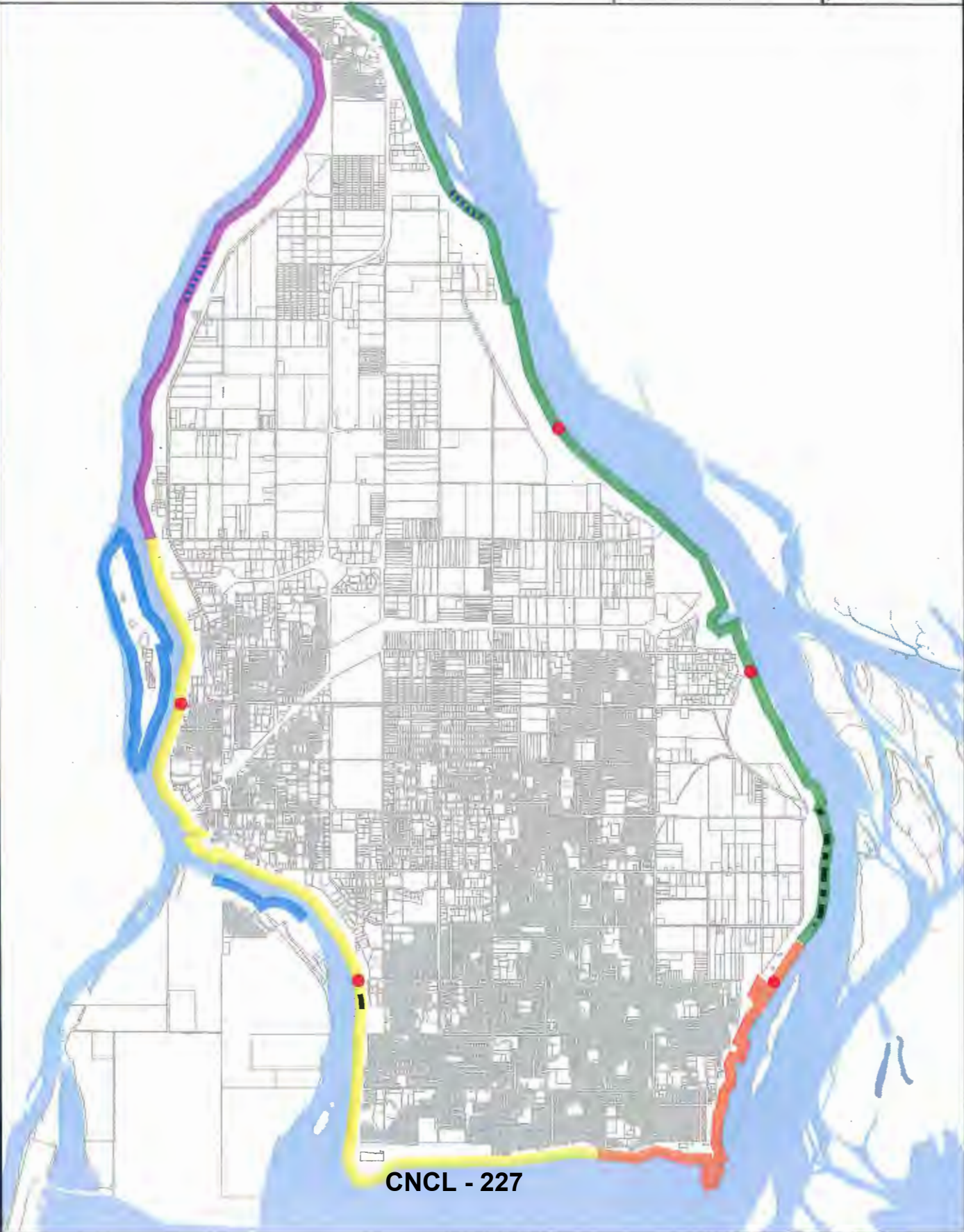


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Att. 1: Dike Master Plan Phasing Map

Dike Master Plan Phases Map



- Legend**
- Phase 1
 - Phase 2
 - Phase 3
 - Phase 4
 - Phase 5

- Pump Station Upgrades
- Current Dike Improvement Projects
- Projects in 2018 Capital Program

Notes:
 The information shown on this map is compiled from various sources and the City makes no warranty, expressed or implied, as to the accuracy or completeness of the information. Users are reminded that locations and legal descriptions have been obtained at the Land Title Office and are not guaranteed.
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