



# RICHMOND

Investing in flood protection and sea level rise infrastructure

*By Leila Darwish*

*Source: Adobe Stock Photo*

## THE SCIENCE

The city of Richmond, British Columbia, is situated on a coastal floodplain at the mouth of the Fraser River and adjacent to the Pacific Ocean. Due to its location and the fact that the city sits at an average of one metre above sea level, Richmond is vulnerable to the risk of flooding by storm surge, high tides, rising sea levels, and overflow from the Fraser River from heavy rainfall and snowmelt. By the end of the century, sea levels along Richmond's coast are expected to rise by about 1.2 metres, increasing the risk of flooding for the growing city. Though Richmond is surrounded by existing dikes, not all of them are high enough to protect against projected sea level rise.

## THE TRIGGER

A main motivator in Richmond's flood protection efforts was the 1948 flood. Richmond was a farming and fishing community with a much smaller population and infrastructure. The major flood of 1948 galvanized funding to build the perimeter dike that exists today. Though there hasn't been any major flooding since then, increasing concerns about the impacts of climate change and sea level rise continue to push Richmond to increase its flood protection and drainage infrastructure.

## THE APPROACH

As a low-lying municipality, flood control and protection have long been a priority for Richmond. The City has substantially invested in flood management and protection infrastructure. Richmond has an extensive flood protection and drainage system, comprised of dikes, pump stations, box culverts, irrigation structures, and storm sewers. To deal with the ongoing challenge of securing funding for flood protection, Richmond established a drainage and diking utility, which allows for an ongoing source of capital funding for stabilizing and raising the existing dikes. Property owners in Richmond pay a utility charge of \$100 a year (generating about \$10 million annually), and the money is spent on dike upgrades, pump stations and improvements to the drainage system. Funding for flood protection infrastructure has also come from the Government of British Columbia.

## THE OUTCOME

Currently, Richmond is protected by 49 kilometres of dikes, 112 pumps at 39 pump stations, 320 kilometres of ditches and canals, and 600 kilometres of box culverts and storm sewers. Richmond has a plan in place to deal with sea level rise by upgrading and raising the height of its dikes in the coming decades. It is also building four new pump stations.

Richmond's drainage system is designed to accommodate a ten-year storm event. According to John Irving, Richmond's Director of Engineering and Public works, redundancy and the ability of the drainage system to disperse water quickly is key to Richmond's flood resilience. "The system is designed to handle the ten-year storm event, but it can handle even heavier rain events because we have such redundancy



**Figure 22:** Richmond has an extensive flood protection and drainage system, comprised of many elements including pump stations. (Source: City of Richmond)

and storage in a huge box culvert system running under the roads. They are interconnected with a canal system going into agricultural areas and ending at pump stations at the dike. The flow of water doesn't get concentrated, it gets dispersed. Even if a few pump stations go down, the water is just redirected to the next one. Water diverges instead of converges, so it's easy for us to get water off the island really quickly. We have a great system for dealing with urban rainfall risks so we don't see flooding when that happens."

Richmond's dikes were upgraded in the 1970s and 1980s to accommodate a 200-year event. Richmond's current dikes are constructed to a level two feet above the highest ever-recorded water level at this location on the Fraser Basin, which occurred in 1894. The municipality is hoping to raise its dikes further, to 4-5 metres above sea level, to prepare for projected sea level rise by 2100. It is also requiring new developments to be built up to that level. Besides raising the dikes, upgrades for the future flood proofing of Richmond include providing backup power for pump stations, increasing pump capacity, and elevating new developments.

## A WORD FROM RICHMOND

John Irving emphasized the importance of investing in flood protection infrastructure. “Existing infrastructure with regards to dikes and pump stations are built to handle existing risk and will likely be good for the next 50 years for sea level rise. After that we’d need to change, taking into account storm surge combined with sea level rise and king tide. We are going to build super dikes and build the city up over time. There are areas of Richmond, like the Port and other significant developments that have all been built up to the four to five-metre level. That is a super dike. You have raised the land behind the dike so there is no way the dike will fail, and there are multiple lines of defense. Addressing long term flood protection risk is also key to new approvals for projects for Richmond. Where new development is coming in or the redevelopment of an area, we are building up to the 100-year level, elevating up to four to five metres.”

As Richmond is situated in a seismically active zone, Irving highlighted the need to consider all hazards when investing in flood protection infrastructure. “One piece we are trying to get a better handle on and that is part of our new flood management strategy work is marrying the earthquake and flood risk together. Building code designs for a 1 in 2500-year risk for earthquake and is based on the science of how you save lives. But what about the dike? There is a different thought process for the dike and its performance in an earthquake and with flooding. We need to put earthquake risk, flood risk and flood protection infrastructure together.”

Mr. Irving highlighted the importance of scaling up for climate change and sharing information with other communities. “There are decisions we can make today that will help us be more successful in the long term. It’s a much bigger challenge to ramp up a flood protection program when you haven’t had one previously. It’s a new thing for communities who previously haven’t had that risk, while we’ve had it for a while. Communities come to us for information and to learn what we are doing and how we are doing it. We are happy to help them.”