Riverine Flood

Occurs when water levels overflow from river channels onto land that is normally dry. This includes lakes and stream environments.

EXTENTS	CONSEQUENCE
LOCAL-REGIONAL	MODERATE-HIGH

TYPE	DURATION	SEASONALITY	WARNING TIME	LIKELIHOOD
SHOCK	HOURS-DAYS	ALL YEAR	DAYS	VERY LIKELY

About the Hazard

River flooding can damage a range of assets that are located in the floodplain, and hazard levels increase with flood depth and velocity. Riverine flooding is primarily **driven** by local hydroclimate processes (intense/prolonged rainfall, rapid snowmelt due to warm air temperatures), with atmospheric rivers being a key mechanism for extreme precipitation. The general conditions for these drivers are influenced by large-scale climate patterns and atmospheric pressure systems. The flood's characteristics are **modulated** by watershed physical characteristics (catchment size, shape, slope, soil type, channel/floodplain geometry), land use and changes (affecting runoff and sediment), and infrastructure and extractive modifications (dams, dikes, channelization).

What We Assessed

Riverine flood hazard mapping was conducted by others and was available for the main stems of the two largest rivers in the LSA, the **Nanaimo River** and **Millstone River**. We mapped the work of others that shows flood hazard extents on these two rivers for an event with an **annual exceedance probability of 0.5%** (a flood with an indicative return period of 200 years). The **flood extents were mapped for current (2018)** and **far future (2100)** conditions under climate change, which included consideration for peak flow increases and 1 m of sea level rise. Our maps include the stream network to provide a sense of potential riverine flood hazard areas.

Recent Past | **Current** | Future | **Far Future**

Challenges

- Floods that occur on tributaries and smaller rivers and creeks (e.g. the Chase River) could also cause impacts.
- Available information is limited to just a few severity scenarios and does not represent the potential for smaller and more frequent, or larger and less likely flood events.
- Studies have been conducted to map and understand dam breaches on the three main rivers; however, dam breach hazard was not considered a priority for this project and was not studied in detail.

Mapping Results

Approximately 99 ha of the Millstone River is prone to flooding, especially in the area of East Wellington and Buttertubs Marsh parks (see inset A on the map).

The Nanaimo River estuary is notably prone to flooding, which includes **49% of the surface area of SFN Reserves 2, 3, and 4** (see inset C on the map).

Climate Change Trends (2100)

- Projected increases in winter rainfall are the main cause for higher riverine flows causing flooding.
- In the Millstone and Nanaimo River watersheds, flood extents are projected to increase by 7.1% and 5.4%, respectively, from current to far future conditions.
- A substantial portion of additional flooded area (i.e. pink colours on the map) is projected to occur in Trumpeter Park (see inset B on the map) in the far future.
- Sea level rise plays a role in estuarine areas of riverine flooding.

In the next 5-10 years, the above trends are likely to apply, meaning that this hazard is trending toward getting worse.

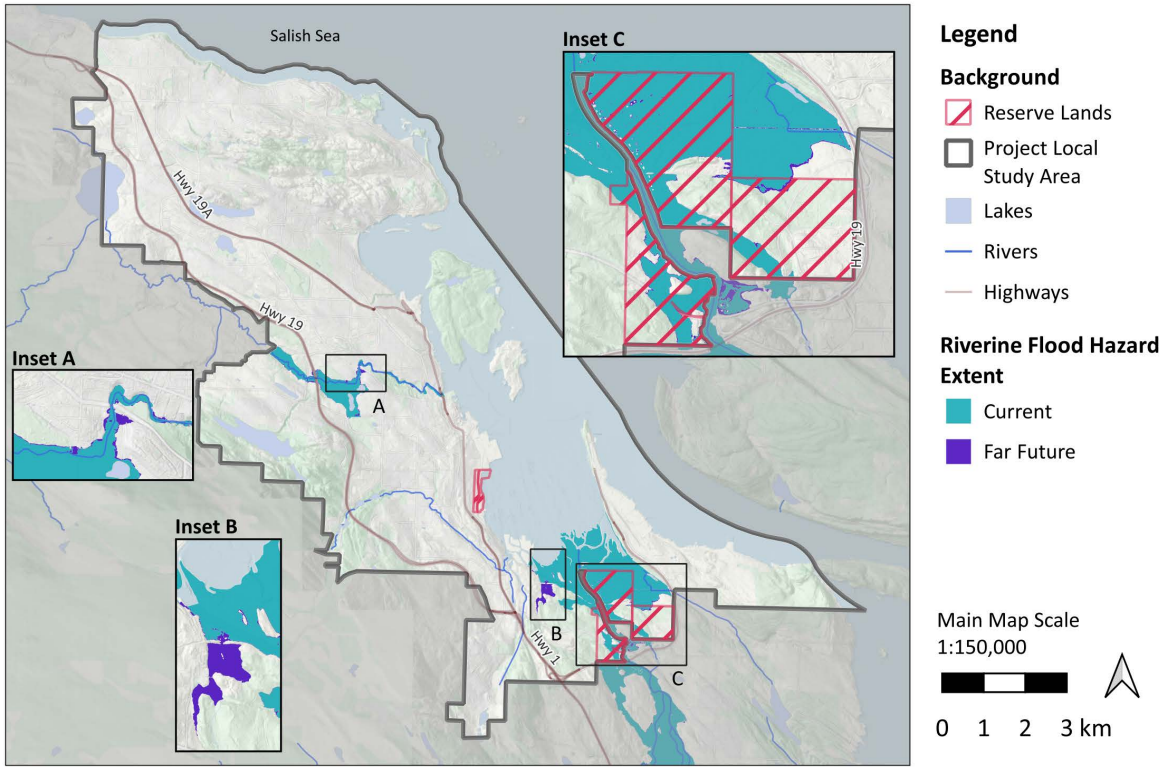
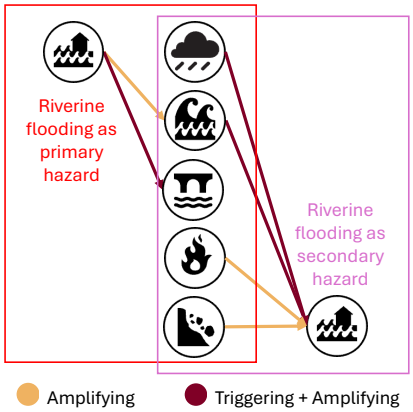


Figure 14-1: Riverine flood hazard within the local study area.

Interactions with Other Hazards

Riverine flooding amplifies and coincides with coastal flooding and triggers, amplifies, and coincides with localized stormwater flooding. It frequently coincides with extreme precipitation and concurrent windstorms. Riverine flooding can be succeeded by periods of extreme heat or the re-emergence/persistence of drought if rainfall is insufficient regionally. Riverine flooding is primarily triggered, amplified, and coincided by extreme precipitation and coastal flooding, which causes backwatering especially in estuaries. Post-wildfire conditions amplify riverine flooding, and mass movement geohazards can amplify and coincide by damming rivers or adding sediment to channels.



Emergency Management Considerations

- Due to its strong linkages with precipitation, riverine flood hazard could potentially increase during La Niña events, whose forecasting can be used to track upcoming hazard potential (see Provincial resource discussed in Section 9 Recommendations)[25].
- Precipitation forecasts should be more closely linked with flow gauging stations, and the existing flood mapping, to improve warning times and preparedness.
- The existing flood maps can be used to identify actions for specific areas in the lead-up to a forecasted flood.
- Flood hazard mapping should be completed on more watercourses.
- Monitor City operated water level gauging stations and Provincial gauging stations on Millstone River at Nanaimo[26] and Nanaimo River at Cassidy[27].

25 The ENSO index is based on long-term average conditions, and it does not mean that an extreme precipitation event cannot occur during an El Niño phase.

26 Weblink: https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=08HB032. Accessed 4 August 2025.

27 Weblink: https://wateroffice.ec.gc.ca/report/real_time_e.html?stn=08HB034. Accessed 4 July 2025.