

REPORT

Engineering Services

To: Mayor Cote and Members of Council **Date:** March 28, 2022

From: Lisa Leblanc **File:** 09.1750.01
Director of Engineering Services (Doc#2030424v1)

Item #: 2022-214

Subject: 2022 Spring Freshet and Snow Pack Level

RECOMMENDATION

THAT Council receive this report for information.

PURPOSE

This report is to inform Council of the current snowpack conditions as of March 1, 2022 in the Fraser River Basin and related preparation for the annual freshet for 2022.

SUMMARY

The March 1st, 2022 snow basin indices throughout British Columbia is slightly above normal. The average of all snow basin indices across B.C. decreased to 105% in the past month due to drier conditions (February 1st: 109%). The snow basin index for the Fraser River at Hope is above normal at 119%. By early March, nearly 80% of the annual B.C. snow pack has typically accumulated. With about a month left for snow accumulation, the snow pack as well as the flood risk can still change. Staff will continue with ongoing preparations and inventory review of flood protection equipment & materials, as well as monitoring of the river basin conditions. Following the April 1st snowpack measurement, staff in consultation with the Emergency Management Office will make a determination on the freshet flood risk and execute the High Water Response Plan accordingly. At that time, additional financial resources may be required to implement flood mitigation measures depending on further development of freshet conditions.

BACKGROUND

The waterfront portions of the New Westminster mainland as well as all of Queensborough are located within the floodplain of the Fraser River. Only Queensborough has an existing permanent dyke system for protection against flooding from the Fraser River. The Engineering Department has a High Water Response Plan which is invoked annually to ensure that risk of flooding in vulnerable areas in the floodplain is managed by a series of temporary mitigation measures in the event of a significant freshet.

EXISTING POLICY AND PRACTICE

The City has a Freshet Preparation Work Plan that is regularly updated. Key components in the preparation stage include:

1. Review historical information and update the Freshet Preparation Work Plan and High Water Response Plan. *Status: The City has an up to date High Water Response plan and Freshet Preparation Workplan;*
2. Monitor snowpack information to assess risk. *Status: The City’s Engineering Department is actively in contact with the Emergency Management Office and closely monitoring the developing risk;*
3. Complete a dike inspection and crest survey to identify potential areas where either permanent or temporary works may be necessary. *Status: Scheduled for early April, 2022;*
4. Start the process to update contact lists of local suppliers and contractors and potential emergency measures. *Status: The City has over 40,000 burlap sandbags with another 12,000 on standby order. The City will also be placing orders for various sizes of sandbags based on the River Forecast Centre modelling forecasts;*
5. Coordinate with adjacent municipalities to develop joint work plans where inter-boundary concerns exist *Status: Ongoing;*
6. Evaluate new flood protection techniques developed since 2020 that could be used for permanent or temporary mitigation measures. *Status: Completed;*
7. Inspect condition of existing City fast-deployment water dams (Aqua-dams) and have supplier complete a refresher training for staff. *Status: Completed on April 27th, 2021.*

The City’s freshet monitoring and associated tasks have historically been referenced to the water level at the Mission gauge which is not influenced by tidal effects. Certain tasks of the 2022 Freshet Preparation Plan are activated when the gauge readings reach the levels indicated in the following table:

Tasks / Historical References	Mission Gauge Water Level
CNW Starts Weekly Dyke Patrols	6.0 m

CNW Starts Daily Dyke Patrols	6.5 m
CNW Starts 24hr Continuous Patrol and installs temporary protection measures in certain locations	7.0 m
1948 Flood levels (June 8th)	7.56 m
1894 Flood Levels	7.92 m
Top of Dykes at Mission Gauge	8.53 m

The Work Plan includes additional tasks to be completed later in the spring.

ANALYSIS

The Climate Prediction Center (CPC) shows that El Niño Southern Oscillation (ENSO) demonstrated La Niña conditions during the fall of 2021. This is the second La Niña in a row, with La Niña present during the fall-winter of 2020-21. La Niña occurs when oceanic temperature anomalies along the equatorial Pacific Ocean region are below normal for an extended period. Historically, La Niña conditions create cooler temperatures for British Columbia and wetter weather in the South Coast and Vancouver Island during the winter months.

Forecasts from the CPC indicate a likelihood (77% chance) of continued La Niña conditions (March-May 2022), with a potential transition to neutral conditions (56% likelihood) into summer (May-July 2022). Historically, the April 1st snow pack is often above normal when winter La Niña conditions exist in British Columbia, particularly for the South Coast and Southern Interior. La Niña conditions that persist into the spring can lead to late-season snow accumulation and delayed snowmelt, which increases the risk for freshet flooding.

The Fraser River Snow Basin Index for March 1, 2022 is slightly above normal at 107%, where the Fraser River at Hope Snow Basin Index is at 119%. By early March, nearly 80% of the annual B.C. snow pack has typically accumulated. With a month left for snow accumulation, seasonal snow packs and the flood risk can still change.

Extreme Weather Events

In general, flooding usually occurs due to extreme weather. In 2021, there were two extreme weather events that resulted in catastrophe: the heat dome in late-June and atmospheric rivers in November. Alpine temperatures during the heat dome reached up to 38°C, triggering extraordinary snow melt at high elevation. If such an extreme heat event occurred earlier in the freshet season when there is more snow to melt (May or early-June), it could lead to significant flooding at a provincial scale. Atmospheric rivers tend to affect the province primarily between September and January. However, strong storms can occur as early as August for the North Coast and there are numerous

examples of atmospheric rivers occurring on the South Coast into February and March. It is less likely that these events will occur in May or June, but not impossible.

The most likely cause for major flooding would be a period of persistent cool temperatures and wet weather into the late spring, followed by a sudden heat wave of at least five or more days. There is evidence that 1948 and 1894 floods on the Fraser River were caused by this scenario. Based on current snow stations that had measurements in 1948, the snow conditions for March 1st were considered average, showing the potential impact of spring weather on flooding risk. A secondary risky scenario is a widespread heavy rainfall event that occurs during the high flows from snowmelt.

In general, snowpack factor produces about 20-40% of the flood risk, while weather factors produce about 60-80%. For further context:

- 5-6 days of hot weather (greater than 25 degrees Celsius) during the snowmelt peak period (mid-June) will produce very high flows (but not flood flows), whereas greater than 8 days of hot weather during the snowmelt peak period may produce flows that approach those of the 1948 flood;
- Rainfall of 70+ mm over 48 hours occurring widespread near the time of snowmelt peak can produce very high flows (but not flood flows) in the Fraser River.

The River Forecast Centre continues to monitor snow pack conditions and will provide an updated seasonal flood risk forecast in the April 1, 2022 bulletin, which is scheduled for release on April 9, 2022. Subsequently, Staff will provide the next update on snow pack conditions to Council in mid to late April.

SUSTAINABILITY IMPLICATIONS

Staff continues to consult with the provincial River Forecast Centre in order to understand the impacts of Climate Change such as the recent atmospheric river and heatwave in 2021, and how this translates to the seasonal freshet flood risk now and in the future. Engineering staff is also in the process of updating the City's Floodplain Management Strategy, which will recommend future dike protection measures to adapt to sea level rise and other effects of climate change.

FINANCIAL IMPLICATIONS

There is no expenditure at this time except the allocation of regular staff time to monitor the river basin conditions, assess the developing risk, initiate preparations and inventory review, and to complete the annual dike inspection. There is sufficient budget allocated at this time to respond to the current level of risk. Following the April 1st snowpack measurement, additional financial resources may be required to implement flood mitigation measures depending on the further development of freshet conditions.

INTERDEPARTMENTAL LIAISON

Interdepartmental liaison to date has been limited to coordination between Engineering Operations, the Emergency Management Office and Infrastructure Planning. More interaction with other departments such as Police, Electrical and Finance will be incorporated if the City & the Province activate their respective Emergency Operations Centers.

OPTIONS

The following options are presented for Council's consideration:

1. That Council receive this report for information; or
2. That Council provide alternative direction to staff.

Staff recommends Option 1.

CONCLUSION

The snow basin index for the Fraser River at Hope is above normal at 119%. By early March, nearly 80% of the annual B.C. snow pack has typically accumulated. Snow pack throughout the province ranges from 83% to 129% of normal. With about a month left for snow accumulation, the snow pack as well as the flood risk can still change. The Engineering Department annually executes its High Water Response Plan to ensure that vulnerable areas in the floodplain will be protected by a series of temporary mitigation measures in the event of a significant freshet. Staff will continue ongoing preparations and inventory review of flood protection equipment & materials, as well as monitoring of the river basin conditions.

Following the April 1st snowpack measurement, staff in consultation with the Emergency Management Office will make a determination on the freshet flood risk and execute the High Water Response Plan accordingly. At that time, additional financial resources may be required to implement flood mitigation measures depending on further development of freshet conditions.

ATTACHMENTS

Attachment 1 - Snow Survey & Water Supply Bulletin - March 1, 2022

APPROVALS

This report was prepared by:
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This report was reviewed by:

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