# Appendix B: Summary of the Climate-Informed Hazard, Risk, and Vulnerability Assessment Report

## New Westminster Climate Change Adaptation and Resilience Plan

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Risk assessments are a foundational step in developing climate change adaptation and resilience plans. They are required under the BC Emergency and Disaster Management Act (EDMA)[1] which stipulates that local governments consider vulnerability and the influence of climate change within risk assessments. Associated regulations are anticipated in 2027.

This report summarizes the climate-informed Hazard, Risk, and Vulnerability Assessment (HRVA) completed for the City of New Westminster in December 2025 as part of developing a Climate Change Adaptation and Resilience Plan (CCARP). The climate-informed HRVA follows the same methodology applied in the development of the existing City all-hazard HRVA, completed in 2023. The stated purpose of an HRVA, as per BC government guidance, is "*to help a community make risk-based choices to address vulnerabilities, mitigate hazards, and prepare for, respond to, and recover from hazard events.*"[2] This climate-informed HRVA assessed the following hazards:

- river (riverine) flooding, pluvial (rainfall) flooding;
- extreme heat (including heat dome and compound heat/power outage scenarios);
- extreme cold;
- drought;
- wildfire smoke;
- storm events; and
- slope failure.

[1] Government of B.C. 2023. Emergency and Disaster Management Act.
[2] Government of B.C. 2020. Hazard, Risk and Vulnerability Analysis (HRVA) For Local Authorities and First Nations; Companion Guide for the HRVA Tool.



Slow-onset climate changes such as ecosystem degradation are addressed in broader project methods. Hazard-specific scenarios applied in this climate-informed HRVA are attached as Appendix B-1.

Risk is a function of the likelihood that a hazard scenario will occur and the severity of its consequences *(Risk = Consequence x Likelihood)*. The assessment included identifying potential hazard impacts, discussing associated vulnerabilities and scoring the likelihood and consequences using the BC HRVA tool. Climate change was incorporated by adjusting likelihood estimates for mid-century (2050s) and end-of-century (2080s) conditions under both a medium emissions climate change scenario (SSP2-4.5) and a high emissions climate change scenario (SSP5-8.5). More information about the climate projections can be found in the Summary of Preliminary Research to Inform the CCARP[3].

Consequences were rated across seven categories: health and safety, property and displacement, environment, public infrastructure and services, economy, cultural impacts, and reputation. Ratings were developed through participatory workshops with City staff in the Internal Working Group and partners with the project's External Advisory Group. HRVA methods have inherent limitations including the uncertainty associated with estimating future likelihood with climate change and the subjectivity of qualitative scoring of a limited set of perspectives. Availability bias, which is the tendency to overestimate the likelihood of events when they readily come to mind, leads participants to focus on recent or memorable events rather than the objective scenario presented.

In addition, we acknowledge that not accounting for the compounding and cumulative risks is a limitation to how risk is understood and prioritized. For example, environmental degradation is impacted by multiple hazards and their compounding and cumulative impacts. Environmental degradation both influence and is influenced by climate change, and the complexity is not accurately accounted for in this Report. HRVA scoring does not adequately capture the importance and the intrinsic value of ecosystems and environmental systems.

As well, because this Report is solely looking at climate change impacts. Other parallel influences that are not strictly because of climate change (such as certain types of habitat loss) can impact climate risks and hazards, resulting in complexity that is not considered in this Report.

However, HRVA methods still provide valuable insights. When these are integrated with public engagement findings and current risk reduction efforts, they help pinpoint priority areas for future action planning.

Representatives from the Tsleil-Waututh (səlilwətaɬ) and Kwikwetlem (kʷikʷəƛəm) First Nations participated in the External Advisory Group workshop that provided input to the risk assessment. Moving forward, it will be important to review any risk assessments completed by First Nations in the area to identify similarities and differences and opportunities for collaboration.

[3] New Westminster City Council, July 14, 2025, Climate Change Adaptation and Resilience Plan Project – Phase One: Attachment 1: https://pub-newwestcity.escribemeetings.com/filestream.ashx?DocumentId=22756

Extensive public engagement was completed during phase two of the project from September 8 to October 30, 2025, as laid out in the accompanying What We Heard Report. Themes from engagement have been integrated with the HRVA results to guide prioritization for action planning, which will be undertaken from February to May 2026.

## Key Findings

Table 1 below shows current risk with low risk in light blue, moderate risk in yellow and high risk in red, using the BC HRVA framework. The vertical axis shows the likelihood of the events increasing from rare (A) to frequent (E) events and the horizontal access shows severity of consequences increasing from left to right.

Extreme heat was represented by three hazard scenarios in this climate-informed HRVA, a scenario similar to the 2021 heat dome event, a scenario representative of an extreme heat emergency as detailed in the BC Heat Alert and Response System (BC HARS), and a compound event which is an extreme heat emergency level temperature event with a concurrent power outage.

*Table 1. Risk Matrix Table - Current Time Period Risk Matrix Table (BC HRVA framework)*

Likelihood

| | | | | | |
|---|---|---|---|---|---|
| E | | | | | |
| D | | Extreme Heat | | | |
| C | | Drought<br>Extreme Cold<br>Wildfire Smoke | Heavy Rainfall<br>Storm Event | | |
| B | | | River Flood | | |
| A | | | Heat Dome<br>Compound Event<br>Slope Failure | | |

Consequence

Table 1 illustrates that most climate-related hazards currently pose a moderate risk, with heavy rainfall events, storms and river flood hazard being the greatest concerns. Heat Dome type events, the compound event (high temperature and power outage), and slope failure remain in the low-risk category at present due to their low likelihood or frequency. The average likelihood and consequence of the climate hazards within this matrix considers the work the City has done or is currently doing to help adapt to or mitigate these risks. However, this changes over time as climate change increases the frequency and intensity of these events, and as the City's work plan priorities may shift or adjust over time.





Table 1 also assumes that the City, as a whole, has similar exposure to storms, extreme temperatures, drought, and wildfire smoke; however, factors such as wind direction, microclimates, and shading can create localized variations in exposure.

### Risk

Table 2 and Table 3 below show the current and future risk levels for climate-related hazards, incorporating the influence of climate change. The future risk profile for the 2080s is based on the high emissions climate scenario, representing conditions during the last 30 years of the century.

*Table 2. Summary of risk findings by hazard*

| Hazard | Current Risk Profile | Risk Profile 2080s (high emissions climate scenario) |
|---|---|---|
| **Heavy Rainfall and Storm events** | Moderate risk. These hazards pose significant threats to public infrastructure and services, including roads, pump stations, and electrical systems. Consequences include flooding of transportation routes, mobility challenges, and power outages. | Move into high-risk category, with greater frequency and severity, stressing aging infrastructure and increasing the risk of service disruptions. |
| **River Flooding** | Moderate risk combining low likelihood but high consequences. A major Fraser River flood could cause widespread property damage, displacement, and cultural and environmental loss, particularly in Queensborough and Downtown. | Remains a moderate risk, amplified by sea level rise and higher freshet (higher water levels due to rainfall or snow melt) flows. Dike performance and floodplain management will be critical. Coordinating efforts on floodplain management with other jurisdictions will also be critical. |
| **Extreme Heat and combined heat event with power outage** | Heat emergencies (as defined by the BC Heat Alert and Response System)[4] occur frequently with moderate consequences (moderate risk), primarily health impacts and electrical system strain. More intense heat dome-type events and compound heat/power outages are rare (low risk), with risks of mortality, mental health stress, and infrastructure failure. Extreme heat also impacts and stresses native species to the area, such as Western redcedar. | Heat emergencies remain moderate risk, with heat dome-type events and compound heat/power outages shifting into the high-risk category. Health and safety impacts intensify, and infrastructure strain increases. Extreme heat strain will continue to stress native ecosystems. |
| **Wildfire Smoke** | Moderate risk today, with health and mental health impacts, social isolation, and disruption of outdoor activities. | Continues to be moderate risk with unknown long-term risks to health. |
| **Drought** | Moderate risk, affecting ecosystems, urban forests, and food security. Cultural impacts include threats to species such as western red cedar and salmon | Remain moderate risk with cascading impacts on health, ecosystems, and culturally significant species. |
| **Slope Failure** | Rare, low risk event but potentially damaging to utilities, transportation corridors, and cultural sites in localized areas. | Increases to moderate risk as these events could become more frequent due to rainfall intensifying and becoming more frequent. |
| **Extreme Cold** | Moderate risk, primarily affecting unhoused and poorly housed individuals, with risks of hypothermia and property damage from frozen pipes | As the climate warms, extreme cold events will become rare, moving these events to low risk. |

[4] BC Provincial Heat Alert and Response System (BC HARS): 2025





Under a high-emissions scenario by the 2080s, heat dome events, heavy rainfall, slope failure and the compound event all shift into the high-risk category. River flooding continues to be a major concern, driven not only by freshet-related flows but also by ocean storms coinciding with high tides and the added element of sea level rise.

*Table 3. Risk Matrix Table - Projected future risk 2080s (2071-2100) under high emissions scenario*

| Likelihood | | | | | | |
|---|---|---|---|---|---|---|
| E | | Extreme Heat<br>Wildfire Smoke | Heat Dome Event | | | |
| D | | Drought | Heavy Rainfall Storm Event<br>Compound Event | | | |
| C | | | Slope Failure<br>River Flood (1:100, 2025) | | | |
| B | | | | | River Flood (1:100, 2100) | |
| A | | Extreme Cold | | | | |

Consequence

Because future changes to the City of New Westminster – such as land use and risk mitigation measures – are uncertain, the HRVA does not estimate future consequences. Instead, it adjusts likelihood to reflect climate change.

Subjective, high-level risk ratings, such as this assessment, are useful for comparing hazards and setting broad priorities, but they lack the precision needed for resource allocation or major investment decisions. While these ratings can inform adaptation and disaster risk reduction planning, more detailed risk assessments are typically required to support large-scale investments, such as flood or landslide mitigation infrastructure.

### Vulnerability

Social vulnerability statistics and descriptions for New Westminster were detailed in Phase 1 project reporting and can be found in the July 14, 2025 Council Report[5]. Each hazard reviewed in the HRVA affects specific vulnerable people, places, animals, and assets, as detailed in the appendices of the detailed HRVA report. Across all hazards, common vulnerabilities that amplify impacts include aging infrastructure, housing type and tenure, social isolation, and inequities in access to cooling and clean air. Groups most at risk across hazards include seniors, renters, newcomers, unhoused individuals, and people with chronic health conditions.

### Consequences

As part of the HRVA exercise, the Internal Working Group and External Advisory Group developed and reviewed impact statements. These are brief statements that identify the consequence of a hazard event and what/who is affected. For example: the risk of sewer backups in residential areas with combined sewers during heavy rainfall or high river levels. The following is a summary of impact themes across climate-related hazards:

- **Public infrastructure and services** is the dominant impact category across hazards, reflecting recurring exposure of roads, electrical systems, pump stations, and stormwater/sewer networks to multiple hazards.
    - Critical infrastructure stress and damage emerged as a recurring theme. Extreme heat drives electrical system strain and potential failure, while floods threaten transportation networks and cause impacts to pump stations and sewer outfalls.
    - Slope failure is more localized but can disrupt utilities and transportation corridors.
- **Health and safety** impacts are also prominent, particularly for extreme temperature and wildfire smoke events.
    - Physical and mental health are most directly impacted by extreme temperature and wildfire smoke, but risks also arise from traumatic climate events and post-flood mold exposure.
    - Prolonged heat and smoke events tend to drive mental health burdens and reduce community activity, increasing social isolation.
    - Acute events such as rainstorms, windstorms, and floods have the potential to disconnect community members from essential services, programs, and resources.
- **Property damage and displacement** are heavily represented for flood hazards (both riverine and heavy rainfall).
- **Environmental assets** are consistently at risk across hazards.
    - Environmental degradation and cultural loss often occur in parallel, particularly for Indigenous communities with close relational connections to nature. Low river flows and elevated stream temperatures threaten salmon, while western red cedar and other culturally significant species are affected by drought and a generally warming climate.
    - Examples of loss include that intertidal and foreshore habitats are at risk of damage and loss from flooding, and all climate hazards threaten the urban forest, which is critical for moderating temperatures and supporting well-being and biodiversity.
    - Intrinsic value of environmental assets is not accurately captured, and the environmental losses could not be accurately captured in the scope of this assessment.
- **Cultural assets** and practices are consistently at risk across hazards.
    - Environmental degradation and cultural loss often occur in parallel, particularly for Indigenous communities with close relational connections to nature.
    - Outdoor recreational and sports activity can get cancelled due to poor air quality or extreme weather, such as rainfall or heat, which can impact social connection, physical health, and mental health.
- **Economic** impacts were noted less frequently, which may reflect limited available data or the perception that localized disruptions do not significantly affect the regional economy. Impacts to outdoor workers from extreme weather events and impacts to the broader regional and provincial supply chains were discussed.
- **Reputational** risk emerges when residents perceive inadequate preparedness or response.

It is important to remember that while some of these hazard events have moderate or high consequences or likelihoods for one or several of the consequence categories, their placement on the matrix in Table 1 reflects the average consequences across the seven consequence categories. The average consequences also consider the work the City has done or is doing to help adapt to or mitigate these risks.

It is also important to note the HRVA scoring and consequence table does not fully capture the importance and the intrinsic value of ecosystems and environmental systems. These systems are foundational, regulating risk across all other categories, while also having intrinsic value in their own right. The scope of this Report compliments other City plans that have a greater focus on biodiversity, ecosystems, and environmental systems, such as the City's Biodiversity and Natural Areas Plan and the City's Urban Forest Management Strategy.

### Public Engagement

The highest concerns from the first round of community engagement in fall 2025—extreme heat, flooding, and wildfire smoke—align closely with HRVA findings. Understanding public concerns and specific vulnerabilities discussed during round one community engagement helps ensure future actions address the drivers of vulnerability and are tailored towards disproportionately impacted members of the community. Embedding equity considerations and reaching individuals who do not traditionally participate in civic engagement are the priority for project engagement, providing a valuable complement to the risk assessment. High level messages related to hazards from the first round of public engagement are presented in Table 4.

[5]New Westminster City Council, July 14, 2025, Climate Change Adaptation and Resilience Plan Project – Phase One: https://pub-newwestcity.escribemeetings.com/filestream.ashx?DocumentId=22755

Table 4. High level messages related to hazards from round one project engagement

| Hazard | Key Concerns | Key Impacts | Vulnerable Groups |
|---|---|---|---|
| Heat | • Apartments overheating<br>• Lack of cooling options<br>• Landlord restrictions<br>• Rising energy costs<br>• Stress to terrestrial and aquatic ecosystems<br>• Loss of life | • Heat-related illness, hospitalizations, mental health stress<br>• Unsafe coping strategies<br>• Slowing down and missing work when hot | • Indigenous Peoples<br>• Seniors<br>• Renters<br>• Unhoused or precariously housed individuals<br>• Newcomers<br>• People with chronic health conditions<br>• Pets are vulnerable to extreme heat |
| Flooding | • Property damage from atmospheric rivers<br>• Lack of preparedness<br>• Communication gaps<br>• Evacuation challenges<br>• Fear of displacement | • Basement and parkade flooding<br>• Long-term displacement<br>• Disruption of building services (e.g., elevators)<br>• Economic impacts for renters without insurance<br>• Heat waves can dry out soil and vegetation, making them more vulnerable to flooding when it rains | • Indigenous Peoples<br>• Renters<br>• Seniors<br>• Newcomers<br>• People with disabilities<br>• Pet owners, as pets must be evacuated |
| Wildfire Smoke | • Poor outdoor and indoor air quality<br>• Health risks<br>• Cancelled events<br>• Lack of filtration options | • Respiratory health challenges<br>• Cardiovascular impacts<br>• Mental health stress during smoke + heat<br>• Social isolation | • Indigenous Peoples<br>• Seniors<br>• Children<br>• People with respiratory and chronic health conditions<br>• Unhoused individuals<br>• Pets are vulnerable to poor air quality |

### Next Steps

The climate-informed HRVA provides a high-level comparison of risks to help guide priority-setting. It will inform both an update to the City's all hazard HRVA (last updated in 2023) and the action development phase of the Climate Change Adaptation and Resilience Plan. Immediate next steps include reviewing top risks and public concerns against current risk reduction measures underway at the City of New Westminster. This analysis will identify key areas of focus for the action development phase scheduled in phase three of the project during February to May 2026.

# Appendix B-1 – Hazard Scenarios

**Hazard scenarios** are used to describe how a specific hazard could realistically impact a community. They help local governments and First Nations visualize the potential consequences of a hazard and guide the assessment of likelihood and impact. Below are the scenarios used for each hazard in this climate-informed HRVA.

### Wildfire Smoke (poor air quality)

Scenario: Wildfires burning south of the border and in the interior carpet the Lower Mainland with wildfire smoke for three consecutive weeks during the summer. The $PM_{2.5}$ concentrations are above 25µg/$m^3$ for much of the three weeks and the Air Quality Health Index is at high or very high in the City of New Westminster.

- The last time the AQHI (air quality health index) reached high or very high levels was during May, June and July of 2023 – the levels were due to ground level ozone and wildfire smoke. In total five air quality advisories were issued covering 10 days.
- $PM_{2.5}$ is fine particulate matter and typically consists of a mix of things such as soot and smoke in the air. It poses a risk to health because it can travel deeply into the lungs when inhaled.

### Extreme Heat[6]

Heat Dome Scenario: The last day of June is beautiful with sunny weather and highs of 30°C in New Westminster. On Canada day, temperatures climb to 35°C during the day and the minimum temperature at night is 23°C. Temperatures on July 2nd are 37°C during the day and 20°C at night and on July 3rd they are 38.5°C during the day with a minimum nighttime temperature of 24°C. July 4th daytime temperatures lower to 32°C but nighttime temperatures stay at 24°C. Finally on the sixth day of above normal temperatures, daytime temperatures are at 25°C with a nighttime low of 18°C. Temperatures return to more seasonal levels after that.

Heat Emergency Scenario: It is the beginning of August in New Westminster, and the temperature is 30°C. The next few days are projected to be about the same temperature before cooler weather prevails. Nighttime temperatures are around 17°C.

### Compound Event (Extreme Heat + Power Failure)

Scenario: It has been around 30°C in the Metro Vancouver Region for several days and a heat warning has been issued. The forecast may push the warning to an extreme heat emergency in the next few days. A transformer malfunction causes a power outage in New Westminster. The power has been out for 12 daytime hours and is forecast to be out overnight at minimum.

[6] Extreme Heat is divided into two different scenarios. As per BC Heat Alert and Response System, an Extreme Heat Emergency is when daytime maximum temperatures are expected to reach or exceed regional temperature thresholds for three or more consecutive days. A Heat Dome scenario is an extreme heat scenario caused by hot air trapped or slow-moving due to the atmosphere, so it is a prolonged heat emergency scenario.



### Extreme Cold

Scenario: It is a Tuesday in early February, and the temperature has plummeted to -8°C in New Westminster over the last few days with further days below zero forecast through the rest of the week. Nighttime temperatures are reaching -12°C.

### River Flood

Freshet Scenario: The winter had a higher-than-average snowpack around the province. The whole province is hit by several days of unseasonably warm weather in mid-May which triggers rapid snow melt over a large portion of the Fraser River watershed. The warming is followed by several days of heavy rainfall. Water levels in New Westminster along the Fraser River coincide with a 1:100-year flood (1% Annual Exceedance Probability (AEP)). The AEP is the chance, expressed as a percentage that a flood or extreme weather event of a specific size or greater will occur in any single year.

### Heavy Rainfall Event

Scenario: It is November and a series of pacific low-pressure frontal systems sit over the Lower Mainland for several days. The soil in New Westminster is saturated ahead of receiving 119mm of rain over a 24-hour period.

- This is the volume of rain for a 24 hour 1:50 year return period storm historically.

### Storm Event

Scenario: It is December and the temperatures are moderate at 4°C. High winds of 70km/hr are measured with strong gusts up to 80km/hr. Trees and power lines come down. The power is out for 12 hours affecting most of New Westminster.

### Slope Failure

Scenario: Following days of heavy rainfall, a slope failure occurs in the Glenbrook Ravine. It impacts the culverts at the bottom of the ravine and the walking trail and creek, as debris falls from the top of the slope. Thankfully no one is harmed but there is settlement of structures built on the fills at the crest of the slope.

### Drought

Scenario: It is late August and there has been very little precipitation in the City of New Westminster all summer. Average rainfall in June was 30mm; about half of normal. July had just 15mm of rain and it has rained less than 20mm in August so far. The Lower Mainland has been designated to be in drought level 5[7] since late June.

[7] Drought levels range from 0 to 5, where 0 is normal or wetter than normal weather, and 5 is a severe drought. Information can be found at: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/drought-information