Associated
STRATEGIC ADVISORY SERVICES

# TECHNICAL MEMORANDUM

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| **To:** | Jenn Wilson, P.Eng. | **Previous Issue Date:** | August 22, 2025 |
| **From:** | Jeff Zukiwsky, RPP | | |
| **Client:** | City of Salmon Arm | | |
| **Project Name:** | Climate Resiliency Plan | | |
| **Subject:** | Salmon Arm Community Risk Assessment Results | | |

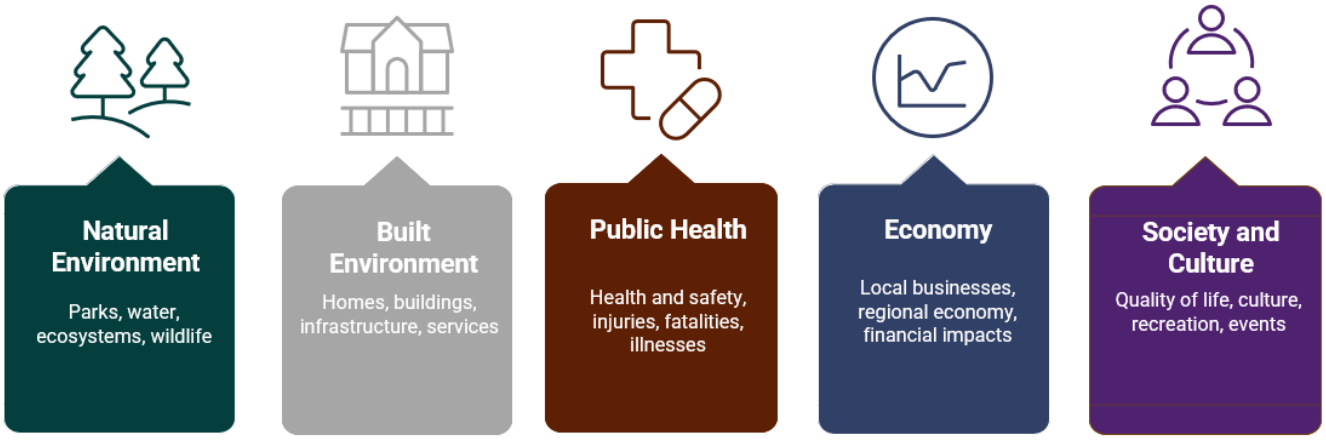
## 1 OVERVIEW

This memo provides the draft results of a climate risk assessment for the City of Salmon Arm. This Memo is intended to be a Section (or Chapter) within the Climate Resiliency Plan. Information about the overall project approach, engagement, climate projections, vulnerability, and other details are not included.

The following information is provided:

- **Section 2** provides an overview of the climate risk assessment process.
- **Section 3** summarizes results of the climate risk assessment, highlighting the highest rated impacts to each community system – Natural Environment, Built Environment, Public Health, Economy, Society and Culture (**Figure 1-1**).
- **Appendix A** provides an overview of all hazards assessed and the details of the methodological approach for assessing likelihood for each hazard.

**Figure 1-1 Community Systems**



# 2 CLIMATE RISK ASSESSMENT PROCESS

**Risk** is the combination of the likelihood of an event occurring, and the consequences of that event should it occur. The objective of the climate risk assessment process is to prioritize risks facing the City, considering the effects of climate change. The result of the risk assessment process is the determination of risk levels ranging from "very low" to "very high". A risk matrix is used to combine likelihood and consequence scores to determine risk levels, as shown in **Figure 2-1**. Climate events that rank "high" or "very high" may pose an unacceptable threat to the community and would be the focus of climate resilience planning. Likelihood and consequence scales are used to define what a low or high risk is for Salmon Arm and are described in **Section 2.2** and **Section 2.3**, respectively.

## 2.1 Climate Hazards and Impacts

At the climate impacts workshop (April 16, 2025) participants identified climate hazards relevant to the City and the way these hazards may affect different community systems. Using the information gathered from the workshop, along with research and expertise from the consulting team, a full list of potential local impacts on Salmon Arm was developed. The likelihood of climate hazards was assessed by the consulting team, as outlined in **Section 2.2**. The consequences of climate hazards and potential local impacts was completed at the climate risk assessment workshop (May 28, 2025), with subsequent updates from the consulting team and City project team. The consequence assessment process is outlined in **Section 2.3** below. The risk assessment process also considers:

- **climate impacts to the community as a whole**, including risks to the community, local businesses and organizations, as well as City assets, services and operations.
- **the duration of the hazards,** which includes both slow-onset (chronic) stresses and sudden-onset and discrete (acute) events. The latter tend to be short duration events that may last minutes, hours, days, or weeks. These events will generally occur regardless of climate change—though their frequency, intensity, or distribution will shift because of climate change. Examples include windstorms, heavy snowfall events, freezing rain events, wildfire, and temperature extremes. Slow-onset stresses, in contrast, are caused entirely by climate change, with impacts unfolding gradually, building up over longer time frames—decades or more. Examples of slow-onset impacts include warming trends in air and surface water temperatures and ecosystem shifts.
- **"compounding" hazards**, which include more than one hazard, hazards occurring simultaneously or in sequence, or from one hazard driving an increase in the frequency or magnitude of other hazards. For example, an increase in lightning strikes may lead to increased risk of wildfires.
- **"cascading" or downstream impacts,** such as damage to roads, which have social and economic consequences. The assessment includes both the direct impacts of the hazard as well as any downstream impacts that may occur. This approach facilitates action planning to address the impacts of the hazard, at the most practical point of intervention.

Figure 2-1 Risk Assessment Matrix

| CONSEQUENCE | | | | | | |
|---|---|---|---|---|---|---|
| | Catastrophic (5) | HIGH | HIGH | HIGH | VERY HIGH | VERY HIGH |
| | Major (4) | MEDIUM | HIGH | HIGH | HIGH | VERY HIGH |
| | Moderate (3) | LOW | MEDIUM | MEDIUM | HIGH | HIGH |
| | Minor (2) | VERY LOW | LOW | LOW | MEDIUM | MEDIUM |
| | Insignificant (1) | VERY LOW | VERY LOW | LOW | LOW | LOW |
| | | Rare (1) | Unlikely (2) | Possible (3) | Likely (4) | Almost Certain (5) |
| | LIKELIHOOD | | | | | |

## 2.2 Likelihood Assessment

The goal of the likelihood assessment is to determine the probability of each climate hazard occurring, both historically and in the future. The likelihood assessment is based on defined climate indicators or thresholds. The consulting team has assigned likelihood scores to each of the climate hazards identified, using existing data and climate projections.

*What kind of information or data is used?*

- *Intensity-Duration-Frequency (IDF) Change in Return Periods Tool*
- *ClimateData.ca*
- *Canada's Changing Climate Report*
- *Government of Canada Open Data Portal*
- *Academic literature*
- *Pacific Climate Impacts Consortium - Design Value Explorer*

The Likelihood Scale is shown in **Table 2-1**. The scale includes options for both a probability-focused assessment, and a baseline method assessment. The probability method is preferred and is used in cases where data is available to estimate an annual probability of the climate hazard occurring in the 2060s (2051-2080). When data is not readily available, a 'baseline' assessment approach is used, as described in the Public Infrastructure Engineering Vulnerability Committee (PIEVC) High Level Screening Guide. Under the PIEVC approach, all hazards have a historic likelihood score of '3' (Possible), and are adjusted either up or down, higher or lower likelihood, based on future climate projections. However, in some cases, such as a catastrophic wildfire event, it is logical that the historic likelihood be lower than a '3'. In these cases, a "Modified Baseline" approach is used, and proportional adjustments are made in the assessment to reflect this lower likelihood. The likelihood scores for each hazard, as well as the methodological approach are presented in **Appendix A**.

Table 2-1 Likelihood Scale

| Likelihood Score | Descriptor | Baseline Method | Probability Method |
|---|---|---|---|
| 1 | Rare | | Every 100 years or less (Annual chance <= 1% in the 2060's) |
| 2 | Unlikely | >50% reduction in frequency<br>10-50% reduction in frequency | 51-100 year (1% < annual chance < 2% in the 2050's) |
| 3 | Possible | Establish current climate baseline | 11-50 years (2% ≤ annual chance < 10% in the 2050's) |
| 4 | Likely | 10-50% increase in frequency<br>>50% increase in frequency | 3-10 years (10% ≤ annual chance < 50% in the 2050's) |
| 5 | Almost Certain | | Every two years or more frequently (Annual chance ≥ 50% in the 2050's) |

## 2.3 Consequence Assessment

**Consequence** describes the severity of local impacts if the event does occur and is ranked on a scale from Insignificant (1) to Catastrophic (5), as shown in the Consequence Scale at **Table 2-2**. The scale was customized for Salmon Arm based on what we learned from the climate impacts workshop. At the climate risk assessment workshop (May 28, 2025) participants assessed the severity of potential local impacts in today's context, assigning each impact a consequence score from one to five.[1] Following the climate risk assessment workshop, the consulting team and City project team worked collaboratively to evaluate and update the results ensuring that climate risks, when viewed collectively, accurately portrayed risks to city assets, services and operations, and to the community more broadly.

[1] Note: the descriptions for 2 (Minor) and 4 (Major) have been intentionally excluded for ease of readability.

Table 2-2 Consequence Scoring Scale

| Consequence Score | Insignificant - 1 | Moderate - 3 | Catastrophic - 5 |
|---|---|---|---|
| **Natural Environment** | • Minimal or no environmental disruption or damage to land, water, animals, trees and other natural features | • Isolated but eventually reversible damage to wildlife, habitat, and ecosystems, or short-term disruption to environmental features<br>• Full restoration of function possible but could take months or 1-2 years | • Widespread and irreversible damage to wildlife, habitat and ecosystems, or long-term damage, disruption to environmental features<br>• Full restoration of function is not possible or could take decades |
| **Built Environment** | • Not likely to result in damage to property<br>• Minimal or no impact on operations and delivery of services | • Localized moderate damage to homes, buildings, or property (e.g., a few buildings requiring moderate repairs)<br>• Temporary (12-24 hours) localized interruption and/or moderate additional costs to provide a municipal service | • Widespread and severe damage to homes, buildings, or property (e.g., many buildings require significant repairs or renewal)<br>• Long-term (> 72 hours) and widespread interruption and /or additional costs to provide a municipal service |
| **Public Health** | • Minimal health effects | • Some injuries, illnesses or mental health effects<br>• Potential absenteeism / reductions in workforce productivity | • Many serious injuries, illnesses, fatalities and/or mental health effects<br>• Significant absenteeism / reductions in workforce productivity |
| **Economy** | • Very minimal impact on local businesses or the economy<br>• Minimal disruption of economic activities<br>• Minor, insignificant decrease in revenue | • Temporary impact on income and employment for a few businesses, or modest costs and disruption to a few businesses<br>• Disruption of economic activities for days or weeks<br>• Moderate decrease in revenue | • Long-term impact on businesses and economic sectors, major economic costs or disruption<br>• Disruption of economic activities for months or years<br>• Significant decrease in revenue |
| **Society and Culture** | • Minimal impact or disruption to quality of life for most residents and vulnerable populations<br>• Minimal or no psychosocial impacts<br>• Minimal or no disruption of social or cultural events or activities | • Modest impact or temporary disruption to quality of life for most residents and vulnerable populations<br>• Some psychosocial impacts and potential erosion of community cohesion<br>• Disruption of social or cultural events or activities for days or weeks | • Long-term impact or widespread disruption to quality of life for most residents and vulnerable populations<br>• Widespread psychological effects and erosion of community cohesion<br>• Disruption of social or cultural events or activities for months or years |

## 3 CLIMATE RISK ASSESSMENT RESULTS

A total of 167 potential local climate impacts we analyzed through the climate risk assessment. An overview of the results is provided in Table 3-1.

**Table 3-1 Summary of Climate Risk Assessment Results**

| Community System | Very High | High | Medium | Low | Very Low |
|---|---|---|---|---|---|
| Natural | 3 | 5 | 15 | 6 | 2 |
| Built | 2 | 10 | 14 | 14 | 2 |
| Public Health | 5 | 11 | 8 | 0 | 0 |
| Economy | 2 | 9 | 19 | 12 | 0 |
| Society & Culture | 0 | 8 | 11 | 9 | 0 |
| **Total** | **12** | **43** | **67** | **41** | **4** |

The following sections present the detailed risk assessment results for each of the five community systems assessed. Each table contains the following information:

- The **climate hazard.**
- Potential local impact **(or consequences)** for the community.
- Future **likelihood** of the hazard occurring, generally in the 2051-2080 (2060s) time period, using the scale at **Table 2-1**, and with further details provided in Appendix A.
- The severity of **consequence** of each impact using the scale at **Table 2-2.**
- **Risk Level** which combines the future likelihood and consequence level within the risk matrix (**Figure 2-1**).

### 3.1 Natural Environment

The natural environment includes terrestrial and aquatic ecosystems and the biodiversity that provide intrinsic and extrinsic value to the City. A total of 31 impacts to the natural environment were assessed with eight (8) impacts being rated as a Very High (3) or High (5) risk for the community. **Table 3-2** provides details of the risk assessment in order from Very High risks to Very Low risks for the natural environment.

Table 3-2 Risk Assessment Results – Natural Environment

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Compounding Hazards | Increased occurrence of pests and invasive species from compounding hazards including wildfire, heat, cold and flooding, threaten ecosystems and biodiversity. | Likely | Catastrophic | Very High |
| Compounding Hazards | Increased stress and negative health effects on terrestrial and aquatic ecosystems in summer from heat, smoke, drought and other climate events. | Likely | Catastrophic | Very High |
| Long-Term Temperature Increase | Increased occurrence of pests, animal diseases, and invasive species, affecting local flora and fauna. | Almost Certain | Major | Very High |
| Compounding Hazards | Damage to trees / tree branches, impacting urban forests, wildlife habitat, and wildlife food sources. | Likely | Major | High |
| Drought | Stress on aquatic systems (e.g. fish movement and spawning) from dry conditions, low water levels and increased concentrations of contaminants. Loss of habitat, loss of species, or poor survival in lakeshore or riparian environments. | Likely | Major | High |
| Drought | Increased tree mortality and stress on terrestrial systems (directly, or due to increased pest activity), impacting the urban tree canopy. | Likely | Moderate | High |
| Long-Term Temperature Increase | Increased temperatures in natural water bodies negatively impacting aquatic ecosystems, including growth of cyanobacteria (blue-green algae) blooms. | Almost Certain | Moderate | High |
| Wildfire | Negative impacts to wildlife including injuries or fatalities, loss of habitat, and/or food sources. | Possible | Major | High |
| ↑ PRIORITY CLIMATE RISKS FOR RESILIENCY PLANNING ↑ | | | | |
| Air Quality | Deteriorated water quality and soil health from particulate matter. | Almost Certain | Minor | Medium |
| Air Quality | Adverse health affects on wildlife, leading to behavior changes and ecosystem impacts, affecting hunting and food security. | Almost Certain | Minor | Medium |
| Compounding Hazards | Damage to trees / tree branches, impacting natural forest, wildlife habitat, and wildlife food sources. | Likely | Minor | Medium |
| Compounding Hazards | Increased human/wildlife interactions due to multiple stress factors. | Likely | Minor | Medium |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Creek Flooding | Increased nutrient/pollutant runoff from agricultural and urban areas into lake, wetlands, and watercourses, resulting in habitat damage and poor water quality. | Possible | Moderate | Medium |
| Drought | Decreased soil health and soil stability leading to greater potential for flash flooding, erosion, and habitat loss. | Likely | Minor | Medium |
| Drought | Wildlife stress (e.g. decreased food or water availability) leading to behavior changes, adverse health effects, and ecosystem damage. | Likely | Minor | Medium |
| Extreme Heat | Stress on ecosystems and wildlife, behavioral changes, and adverse health effects. | Likely | Minor | Medium |
| Freezing Rain | Damage to trees / tree branches, impacting urban forest, wildlife habitat, and wildlife food sources. | Possible | Moderate | Medium |
| High Winds | Damage to trees / tree branches, impacting urban forest, wildlife habitat, and wildlife food sources. | Possible | Moderate | Medium |
| Lake and River Flooding | Increased nutrient/pollutant runoff from agricultural and urban areas into lake, wetlands, and watercourses, resulting in habitat damage and poor water quality. | Possible | Moderate | Medium |
| Lake and River Flooding | Direct damage to environmentally sensitive lakeshore ecosystems and endangered species habitats along Salmon River and lakeshore. | Possible | Moderate | Medium |
| Long-Term Temperature Increase | Shifts in wildlife species distribution (migratory patterns), vegetation or biodiversity (e.g. declining cedar forests), and biology due to changing ecological regimes affecting overall ecosystem health and natural assets. | Almost Certain | Minor | Medium |
| Wildfire | Damage to trees and loss of tree cover, contributing to heat island effect and loss of beauty/appeal. | Possible | Moderate | Medium |
| Wildfire | Decreased water quality due to increased runoff and erosion after wildfires. | Possible | Moderate | Medium |
| Freezing Rain | Damage to trees / tree branches, impacting natural forest, wildlife habitat, and wildlife food sources. | Possible | Insignificant | Low |
| Creek Flooding | Erosion of slopes, especially over wetlands, ponds and creeks, causing habitat loss or damage. | Possible | Insignificant | Low |
| High Winds | Damage to trees / tree branches, impacting natural forest, wildlife habitat, and wildlife food sources. | Possible | Insignificant | Low |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Hail | Damage to trees / tree branches, impacting urban forest, wildlife habitat, and wildlife food sources. | Likely | Insignificant | Low |
| Lightning | Damage to trees and forest habitat. | Likely | Insignificant | Low |
| Snowstorms and Blizzards | Damage to trees and urban forest from heavy snow loads. | Likely | Insignificant | Low |
| Extreme Cold | Stress on wildlife, behavioral changes, and adverse health effects | Rare | Minor | Very Low |
| Extreme Cold | Ecosystem damage due to plant die-off during cold snaps. | Rare | Minor | Very Low |

### 3.2 Built Environment

The Built Environment includes impacts to homes, buildings, infrastructure, and other assets, including interruption of critical services (e.g., power, heat, water, wastewater, stormwater management, roads, etc.) and/or additional costs to provide services. A total of 42 impacts to the built environment were assessed with 12 impacts being rated as a Very High (2) or High (10) risk for the community. **Table 3-3** provides details of the risk assessment in order from Very High risks to Very Low risks for the built environment.

**Table 3-3 Risk Assessment Results – Built Environment**

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Compounding Hazards | Increased demand on indoor recreational facilities in the summer, due to smoke and heat events. | Likely | Catastrophic | Very High |
| Long-Term Temperature Increase | Decreased snowpack reducing groundwater and watercourse water recharge affecting long-term water supply for those relying on groundwater. | Almost Certain | Catastrophic | Very High |
| Compounding Hazards | Increased development/construction costs to better protect homes, buildings and City infrastructure against climate-related risks (may be required by insurance companies). | Likely | Moderate | High |
| Compounding Hazards | Increased taxes and user fees due to reactionary maintenance, replacements of assets damaged by various impacts and/or demand for new services/assets to mitigate impacts. | Likely | Moderate | High |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Drought | Increased demand for City supplied water to agricultural areas (and rural-area residential using wells) to mitigate decreasing ground and surface water availability. | Likely | Major | High |
| Drought | Decreased groundwater availability in private wells and for agriculture due to limited recharge and lower groundwater levels. | Likely | Major | High |
| Extreme Heat | Increased space cooling requirements in homes and buildings to improve occupant comfort. | Likely | Moderate | High |
| Lake and River Flooding | Flooding of public infrastructure, particularly electrical infrastructure, as well as water and wastewater treatment plants, leading to loss of critical services. | Possible | Major | High |
| Long-Term Temperature Increase | Increased space cooling requirements in homes and buildings, increased maintenance costs and upgrade requirements. | Almost Certain | Moderate | High |
| Long-Term Temperature Increase | Increased demand on City services such as pools, splash parks, and indoor recreation facilities for cooling. | Almost Certain | Moderate | High |
| Stormwater Flooding | Damage to homes or public facilities due to undersized stormwater mains and retention structures, and costs of cleanup and relocation. | Possible | Major | High |
| Wildfire | Damage to homes, buildings and critical infrastructure, particularly those bordering the wildland urban interface, and interruptions to critical services (water, power). | Possible | Catastrophic | High |
| ↑ PRIORITY CLIMATE RISKS FOR RESILIENCY PLANNING ↑ | | | | |
| Air Quality | Increased air filtration requirements in homes and buildings, increased maintenance (filter replacement, cleaning assets) and effort. | Almost Certain | Minor | Medium |
| Compounding Hazards | Widespread power outages and disruption to critical City services from damage to transmission and distribution lines or due to stress on the electrical grid. | Likely | Minor | Medium |
| Creek Flooding | Damage to or washouts of transportation infrastructure. | Possible | Moderate | Medium |
| Drought | Increased wear and tear and cost of operating municipal water treatment or raw water supply due to low water levels. | Likely | Minor | Medium |
| Hail | Damage to homes and buildings, including building envelopes and roof-mounted structures and equipment. | Likely | Minor | Medium |
| Hail | Damage to vehicles and equipment, including City fleet, bus shelters and transportation assets. | Likely | Minor | Medium |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| High Winds | Damage to homes and buildings, including building envelopes and roof-mounted structures and equipment. | Possible | Moderate | Medium |
| Lake and River Flooding | Erosion and flood damage to local roads, trails, parking lots and other transportation infrastructure. | Possible | Moderate | Medium |
| Lake and River Flooding | Increased demand for Marina dredging due to sedimentation resulting in reduced useability. | Possible | Moderate | Medium |
| Lake and River Flooding | Flooding of homes along floodplain—particularly in the Adams Lake Band reserve and in the southwest—leading to structural losses, cleanup cost and mold growth. | Possible | Moderate | Medium |
| Lightning | Facility or community-level power outages and disruption to critical services. | Likely | Minor | Medium |
| Long-Term Temperature Increase | Premature degradation of structures and materials from hotter temperatures and ultraviolet (UV) radiation exposure. | Almost Certain | Minor | Medium |
| Snowstorms and Blizzards | Damage to structures (i.e. homes, cabins) from snow loads beyond design capacity. | Likely | Minor | Medium |
| Snowstorms and Blizzards | Operational costs and effort for snow clearing. | Likely | Minor | Medium |
| Creek Flooding | Damage to homes or public facilities and costs of cleanup and relocation. | Possible | Minor | Low |
| Extreme Cold | Damage to water mains from frozen and bursting pipes. | Rare | Moderate | Low |
| Freeze-Thaw Cycles | Damage to and decreased service life of sidewalks, roads (e.g. Highway 1, local roads), and underground infrastructure, affects mobility due to poor road/sidewalk condition. | Unlikely | Minor | Low |
| Freeze-Thaw Cycles | Degradation of buildings and other assets. | Unlikely | Minor | Low |
| Freezing Rain | Damaged trees / tree branches falling on buildings, cars, sidewalks, etc. in turn leading to increased maintenance and cleanup. | Possible | Minor | Low |
| Freezing Rain | Increased salt use and sanding leading to greater operational costs, faster asset deterioration, and/or environmental damage. | Possible | Minor | Low |
| High Winds | Damaged trees / tree branches falling on buildings, cars, sidewalks, etc., leading to transportation disruptions and increased maintenance and cleanup. | Possible | Minor | Low |
| Lake and River Flooding | Damage to lakeshore infrastructure (e.g. marinas, park infrastructure, buildings). | Possible | Minor | Low |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Lake and River Flooding | Increased cost of operation of municipal water treatment or raw water supply from sedimentation (increased filter maintenance, chlorine use). | Possible | Minor | Low |
| Long-Term Temperature Increase | Decreased snowpack reducing lake water availability, affecting long-term water supply for those relying on lake water. | Almost Certain | Insignificant | Low |
| Stormwater Flooding | Damage to City's drainage infrastructure (e.g. culverts, drainage ditches), requiring more frequent replacement/maintenance and increased costs. | Possible | Minor | Low |
| Stormwater Flooding | Damage to local roads and/or parking lots due to flooding. | Possible | Minor | Low |
| Wildfire | Stress on City's water system from fire fighting, impacting other water users and increasing wear on infrastructure. | Possible | Minor | Low |
| Wildfire | Damage to dispersed structures in surrounding forest (e.g. recreational infrastructure, hunting cabins). | Possible | Minor | Low |
| Extreme Cold | Damage to water services lines from frozen and bursting pipes, causing damage to homes and buildings. | Rare | Minor | Very Low |
| Extreme Cold | Increased wear-and-tear and decreased reliability of mechanical/electrical systems (e.g. car batteries failing, heat pumps providing insufficient heating capacity). | Rare | Insignificant | Very Low |

### 3.3 Public Health

A total of 24 impacts to public health and safety were assessed with 16 impacts being rated as Very High (5) or High (11) risk for the community. **Table 3-4** provides details of the risk assessment in order from Very High risks to Medium risks for public health.

**Table 3-4 Risk Assessment Results – Public Health**

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Air Quality | Health impacts (respiratory) resulting in increased mortality, injuries, and mental illness, especially for vulnerable populations such as those with pre-existing health conditions or in homes and buildings with poor ventilation. | Almost Certain | Catastrophic | Very High |
| Compounding Hazards | Widespread power outages during extreme heat or cold events, affecting the health and wellness of vulnerable populations. | Likely | Catastrophic | Very High |
| Extreme Heat | Health impacts or fatalities to due hot weather exposure, particularly for vulnerable populations | Likely | Catastrophic | Very High |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| | such as those experiencing homelessness, with pre-existing health conditions or in homes and buildings without mechanical cooling. | | | |
| Long-Term Temperature Increase | Long-term health impacts (decreased exercise, mental illness, substance use, cardiovascular diseases), especially for vulnerable populations. | Almost Certain | Major | Very High |
| Snowstorms and Blizzards | Injuries or fatalities from traffic accidents due to poor road conditions, or heavy snow shovelling. | Likely | Catastrophic | Very High |
| Compounding Hazards | Negative mental and physical health effects, stress, and anxiety, loneliness, and isolation, due to the threat or realization of multiple hazards, reduced access to nature, recreation, and community, or economic uncertainty. | Likely | Major | High |
| Compounding Hazards | Increased strain on healthcare system as hospital visits increase and the capacity of local doctors and hospitals is stressed. | Likely | Major | High |
| Compounding Hazards | Mental health impacts to outdoor City workers (bylaw, parks, emergency services) dealing with vulnerable populations affected by climate impacts, reducing productivity or increasing burn-out. | Likely | Moderate | High |
| Creek Flooding | Injuries or fatalities as a direct result of steep creek flooding and debris flows, especially if recreating outside. | Possible | Major | High |
| Drought | Health effects from low water levels in recreational water bodies, and increased concentrations of contaminants. | Likely | Moderate | High |
| Freezing Rain | Injuries or fatalities from traffic accidents due to poor road conditions. | Possible | Catastrophic | High |
| Freezing Rain | Injuries from slips and falls on ice sidewalks, especially for senior populations. | Possible | Major | High |
| Long-Term Temperature Increase | Increased occurrence of vector-borne diseases from ticks, mosquitos, birds, and new disease regimes leading to greater strain on the healthcare system. | Almost Certain | Moderate | High |
| Snowstorms and Blizzards | Injuries or increased hospital visits from slips and falls on snowy sidewalks, as well as from snow-clearing activities, especially for senior or vulnerable populations such as those experiencing homelessness. | Likely | Major | High |
| Wildfire | Injuries, fatalities, or illnesses from wildfire event. | Possible | Major | High |
| Wildfire | Mental health impacts (stress) related to evacuation, displacement, and property loss. | Possible | Major | High |

↑ PRIORITY CLIMATE RISKS FOR RESILIENCY PLANNING ↑

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Air Quality | Negative mental and physical health effects due to smoky conditions and reduced access to nature, recreation, and community. | Almost Certain | Minor | Medium |
| Compounding Hazards | Increased human-wildlife conflicts and potential injuries from stress on wildlife in summer from heat, smoke, drought and other events. | Likely | Minor | Medium |
| Extreme Cold | Health impacts or fatalities due to cold weather exposure, especially for vulnerable populations such as those experiencing homelessness, or in older and poor-quality homes and buildings. | Rare | Major | Medium |
| Extreme Heat | Negative mental and physical health effects due to extreme heat and reduced access to nature, recreation, and community. | Likely | Minor | Medium |
| Hail | Injuries resulting directly from hail. | Likely | Minor | Medium |
| High Winds | Injuries and potential fatalities resulting directly from extreme wind event. | Possible | Moderate | Medium |
| Lake and River Flooding | Health effects from contamination of the land, food production, recreational swimming areas, and wells by pollution or septic systems. | Possible | Moderate | Medium |
| Lake and River Flooding | Injuries as a direct result of flooding. | Possible | Moderate | Medium |

### 3.4 Economy

A total of 42 impacts to the local and regional economy were assessed with 11 impacts being rated as High risk for the community. **Table 3-5** provides details of the risk assessment in order from High risks to Low risks to the economy.

**Table 3-5 Risk Assessment Results – Economy**

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Compounding Hazards | Ongoing damage to forestry sector resulting from compounding climate hazards, impacting tax base. | Likely | Catastrophic | Very High |
| Compounding Hazards | Ongoing damage to Agricultural sector resulting from compounding climate hazards. | Likely | Catastrophic | Very High |
| Air Quality | Reduced attractiveness of the City as an outdoor recreation destination. | Almost Certain | Moderate | High |
| Compounding Hazards | Increasing insurance premiums and/or lack of insurance coverage for homeowners and businesses from heavy rainfall, flooding, wildfires and storms. | Likely | Major | High |
| Compounding Hazards | Lost revenue (particularly for retail and tourism sectors) as climate events make the City less | Likely | Major | High |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| | attractive as an outdoor recreation tourism destination or lead to the cancellation of community and cultural events. | | | |
| Compounding Hazards | Increased capital investments and operation and maintenance budgets due to increased exposure to various extreme weather events. | Likely | Moderate | High |
| Compounding Hazards | Increased financial costs to residents to pay for climate change impacts, for example home repairs, leading to increased numbers of vulnerable populations. | Likely | Moderate | High |
| Compounding Hazards | Widespread power outages and disruption to local business operations. | Likely | Moderate | High |
| Drought | Increased irrigation demand during periods of drought, resulting in increased operational costs for agricultural producers. | Likely | Major | High |
| Long-Term Temperature Increase | Increased pesticide use and agricultural costs, and decreased production due to pest and invasive species or an unsuitable climate for typical crops. | Almost Certain | Moderate | High |
| Wildfire | Widespread economic impacts including employee shortages and lost revenue for forestry, agriculture and tourism sectors. | Possible | Major | High |
| ↑ PRIORITY CLIMATE RISKS FOR RESILIENCY PLANNING ↑ | | | | |
| Air Quality | Reduced revenue and labour productivity for employees, and sectors with a high proportion of outdoor workers (construction, agricultural, forestry, tourism). | Almost Certain | Minor | Medium |
| Air Quality | Reduced City services due to restrictions on outdoor work. | Almost Certain | Minor | Medium |
| Air Quality | Reduced crop growth and quality, and lost revenue for agricultural producers. | Almost Certain | Minor | Medium |
| Drought | Increased operational costs for irrigation and dust control (parks, sports fields, roads, construction sites, etc.) | Likely | Minor | Medium |
| Drought | Damage to timber supply, decreasing forestry revenue and shortening the employment season. | Likely | Minor | Medium |
| Drought | Decreased agricultural revenue due to crop damage or reduced growth. | Likely | Minor | Medium |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Extreme Heat | Reduction in summer tourism during extreme heat events | Likely | Minor | Medium |
| Extreme Heat | Reduced revenue and labour productivity for employees, and sectors with a high proportion of outdoor workers (construction, agricultural, forestry, tourism). | Likely | Minor | Medium |
| Extreme Heat | Decreased agricultural revenue due to loss of crops. | Likely | Minor | Medium |
| Extreme Heat | Increased operational costs for agricultural sector from increased watering requirements and cooling to protect animals from extreme heat. | Likely | Minor | Medium |
| Extreme Heat | Reduced City services due to restrictions on outdoor work. | Likely | Minor | Medium |
| Hail | Decreased agricultural revenue due to loss of crops. | Likely | Minor | Medium |
| Lake and River Flooding | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Possible | Moderate | Medium |
| Lake and River Flooding | Flood damage to agricultural lands, decreased revenue. | Possible | Moderate | Medium |
| Long-Term Temperature Increase | Decreased winter tourism and recreation opportunities. | Almost Certain | Minor | Medium |
| Long-Term Temperature Increase | Increased plant diseases affecting timber supply, decreasing revenue and shortening the employment season. | Almost Certain | Minor | Medium |
| Snowstorms and Blizzards | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Likely | Minor | Medium |
| Stormwater Flooding | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Possible | Moderate | Medium |
| Wildfire | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Possible | Moderate | Medium |
| Creek Flooding | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Possible | Minor | Low |
| Creek Flooding | Damage to agricultural lands and lost revenue for agricultural sector. | Possible | Insignificant | Low |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Extreme Cold | Decreased agricultural revenue due to loss of crops. | Rare | Moderate | Low |
| Extreme Heat | Increased demand on City services such as pools, splash parks, and indoor recreation facilities for cooling. | Likely | Insignificant | Low |
| Freeze-Thaw Cycles | Impacts on agricultural producers, for example from plants and fruits freezing after a thaw period. | Unlikely | Minor | Low |
| Freezing Rain | Local or regional transportation disruption impacting supply chain, food availability and emergency and other City services. | Possible | Minor | Low |
| Freezing Rain | Decreased agricultural revenue due to crop damage. | Possible | Minor | Low |
| High Winds | Decreased agricultural revenue due to loss of crops, and damage to orchards and vineyards. | Possible | Minor | Low |
| Lake and River Flooding | Lost revenue for retail and tourism sectors as flooding events disrupt access and damage assets. | Possible | Minor | Low |
| Long-Term Temperature Increase | Increased operational costs for agricultural sector from increased irrigation and cooling to protect animals from extreme heat. | Almost Certain | Insignificant | Low |
| Wildfire | Damage to timber supply, decreasing forestry revenue and shortening the employment season. | Possible | Minor | Low |
| Wildfire | Reduced timber harvesting season as logging is halted when fire hazard is high. | Possible | Minor | Low |

### 3.5 Society & Culture

A total of 28 impacts to society and culture were assessed with eight (8) impacts being rated as High risk for the community. **Table 3-6** provides details of the risk assessment in order from High risks to Low risks to local society and culture.

**Table 3-6 Risk Assessment Results – Society & Culture**

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Air Quality | Cancellation or postponement of outdoor community sporting and cultural events. | Almost Certain | Moderate | High |
| Air Quality | Negative impact on quality of life from individuals being confined indoors due to poor air quality, limiting daily activities. | Almost Certain | Moderate | High |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Compounding Hazards | Damage to cultural assets such as public art installations, cemeteries, and cultural sites from compounding climate hazards (extreme wind, snow, foundation issues from frost heave, etc.). | Likely | Moderate | High |
| Compounding Hazards | Climate-related disruptions eroding community cohesion and causing long-term decline of social and cultural events resulting in increased social isolation and interruptions to daily life, including a decline in volunteer engagement and participation. | Likely | Moderate | High |
| Drought | Insufficient water volume for private water sources leading to water use restrictions affecting quality of life, including increased costs to purchase drinking water. | Likely | Moderate | High |
| Extreme Heat | Cancellation or postponement of outdoor community sporting and cultural events. | Likely | Moderate | High |
| Long-Term Temperature Increase | Impacts to traditional food sources, especially related to traditional medicines, cultural practices, and critical food sources for Secwepemc people, including hunting and fishing. | Almost Certain | Moderate | High |
| Wildfire | Disruption of critical community services (i.e. schooling, seniors services, etc.). | Possible | Catastrophic | High |
| ↑ PRIORITY CLIMATE RISKS FOR RESILIENCY PLANNING ↑ | | | | |
| Compounding Hazards | Reduced mobility and increased dependency on cars as active transportation and mobility becomes restricted during extreme cold, extreme heat, freezing rain, or other extreme weather events. | Likely | Minor | Medium |
| Drought | Impacts and damage to community gardens and food growing affecting food security. | Likely | Minor | Medium |
| Drought | Reduced availability of and opportunity to harvest traditional food sources, especially related to traditional medicines, cultural practices, and critical food sources for Secwepemc people. | Likely | Minor | Medium |
| Hail | Damage to plants, trees, and gardens affecting local food security. | Likely | Minor | Medium |
| Lake and River Flooding | Negative impact on quality of life related to evacuation, displacement, and property loss. | Possible | Moderate | Medium |
| Lake and River Flooding | Loss of cultural artifacts due to flooding and erosion. | Possible | Moderate | Medium |
| Long-Term Temperature Increase | Cyanobacteria (blue-green algae) blooms in natural water bodies limit water-based recreational opportunities (swimming, boating). | Almost Certain | Minor | Medium |

| Hazard | Potential Local Impact | Likelihood | Consequence | Risk Level |
|---|---|---|---|---|
| Long-Term Temperature Increase | Long-term impact or loss of community, cultural or sporting events, which can no longer be held in summer months. | Almost Certain | Minor | Medium |
| Wildfire | Cancellation or postponement of most cultural events and general breakdown of societal norms due to wildfire evacuations/alerts. | Possible | Moderate | Medium |
| Wildfire | Damage to cultural assets such as public art installations, cemeteries, and cultural sites. | Possible | Moderate | Medium |
| Wildfire | Reduced availability of and opportunity to harvest traditional food sources due to wildfire safety risks or evacuation orders (e.g. berry-picking, hunting), especially related to traditional medicines, cultural practices, and critical food sources for Secwepemc people. | Possible | Moderate | Medium |
| Creek Flooding | Cancellation of community and cultural events due to flooding. | Possible | Insignificant | Low |
| Extreme Cold | Damage to plants and gardens, as well as disrupted hunting, affecting local food security. | Rare | Moderate | Low |
| Freezing Rain | Damage to plants and gardens affecting local food security. | Possible | Minor | Low |
| High Winds | Damage to plants, trees, and gardens affecting local food security. | Possible | Minor | Low |
| Lake and River Flooding | Increased sedimentation in the Shuswap Lake, including the downtown marina and boat launch, affecting boat access and navigation. | Possible | Minor | Low |
| Lake and River Flooding | Cancellation of community and cultural events due to flooding. | Possible | Insignificant | Low |
| Lake and River Flooding | Lake-based recreational impacts as high-water levels inundate beaches. | Possible | Insignificant | Low |
| Snowstorms and Blizzards | Negative impact on mental health and quality of life from individuals being confined indoors due to snow-covered transportation routes, limiting daily activities. | Likely | Insignificant | Low |
| Stormwater Flooding | Cancellation of community and cultural events due to flooding. | Possible | Insignificant | Low |

### 3.6 Climate Change Benefits and Opportunities

The Hazard, Risk and Vulnerability Assessment (HRVA) focuses primarily on the negative impacts and consequences associated with climate hazards. However, climate change may provide potential benefits for the community. The following potential benefits of opportunities have been identified:

- Increased opportunity to grow a wider variety of foods/crop diversification and a longer growing season for cultivated or wild vegetation, resulting in decreased food costs, greater agricultural revenue, and greater access to food sources.

- Earlier spring break-up period over land, allowing forest-based activities such as logging and recreation to start sooner.
- Reduced negative health effects of cold exposure in winter.
- Increased construction and outdoor work season through the fall, winter and spring.
- Increased opportunities for summer recreation and tourism activities in the spring and fall, with potential benefits for the economy, human resourcing and capital works planning.
- Reduced snow-clearing requirements and salting in the spring and fall seasons, due to decreased snow and ice on sidewalks and roads. This may increase mobility, reduce slips and falls and vehicle accidents, reduce the cost and effort of winter road maintenance, and decrease asset damage from salt exposure.
- Reduced space heating costs for homes and buildings.
- Increase in climate migrants seeking to escape from harsher conditions elsewhere (heat waves, droughts, smoke, etc.) and opportunity to attract amenity and entrepreneurial migrants to boost real estate development and business growth and increase the tax base.

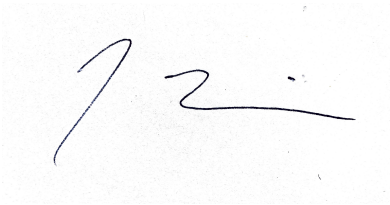
## 4 SUMMARY AND CONCLUSION

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this memo were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering (B.C.) Ltd.

Prepared by:



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Review by:

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[JZ/ml]

# APPENDIX A: CLIMATE HAZARDS & LIKELIHOOD ASSESSMENT DETAILS

The tables in this section summarize the methodological approach for assessing likelihood for each climate hazard. For each climate hazard, the following information is provided in the tables below:

- The **climate hazard** and description.
- An **indicator (or threshold)**, which defines the climate event and is used to define the likelihood of the hazard occurring, and the associated magnitude of the impacts, in the risk assessment process.
- **Historic likelihood** of the hazard occurring, generally in the baseline climate period of 1981-2010, as well as the baseline indicator value and a likelihood score using the scale at **Table 2-1**.
- **Future likelihood** of the hazard occurring, generally in the 2051-2080 (2060s) time period, as well as the future indicator value and projected change, and a likelihood score using the scale at **Table 2-1**. Wherever possible, future likelihood is based on a high greenhouse gas emissions scenario, called "SSP5-8.5."

The table below outlines the methodological approach for assessing likelihood for each hazard. The time period for each hazard is 1981-2010 for the historic baseline and 2051-2080 (2060s) for the future period, unless otherwise specified due to data limitations.

### A.1 Air Quality (Smoke)

| | | |
|---|---|---|
| **Description** | Solids, liquids, or gases which, if discharged into the air, may result in air pollution. (wildfire smoke). A very smoky summer with many days of high risk (7-10+) on the Air Quality Health Index. | |
| **Indicator** | Average annual area burned in the Montane Cordillera region. | |
| **Historic Likelihood** | **3** *[Average Annual Area Burned = 190,000 ha]* | **Possible** |
| **Future Likelihood** | **5** *[Average Annual Area Burned = 1,435,000 ha (+655% increase)]* | **Almost Certain** |
| **Assessment Method** | **Baseline Method**. Change in average annual area burned for the region was derived from: Wang, Xianli, Tom Swystun, and Mike D. Flannigan. "Future wildfire extent and frequency determined by the longest fire-conducive weather spell." *Science of the total environment* 830 (2022): 154752. | |

### A.2 Wildfire

| | | |
|---|---|---|
| **Description** | An unplanned fire occurring on forest or range lands, burning forest vegetation, grass, brush, or scrub, and spreading into the wildland urban interface, causing evacuations and some structural loss. An event similar to the 1998 wildfire. | |
| **Indicator** | May to September mean Fire Weather Index | |
| **Historic Likelihood** | **2** *[Fire Weather Index = 12]* | **Unlikely** |
| **Future Likelihood** | **3** *[Fire Weather Index = 14 (+17% increase)]* | **Possible** |
| **Assessment Method** | **Modified Baseline Method**. May to September mean fire weather index values taken from ClimateData.ca. Likelihood score of 2 reflects the lower likelihood of this event. | |

### A.3 Drought

| | | |
|---|---|---|
| **Description** | A recurrent feature of climate involving a deficiency of precipitation over an extended period, resulting in a water shortage for activities, communities, or aquatic ecosystems. | |
| **Indicator** | Probability of a moderate or greater drought on a given year (Standardized Precipitation-Evapotranspiration Index value of -1 or less) | |
| **Historic Likelihood** | **4** *[Probability of* a moderate or greater drought on a given year = *16%]* | **Likely** |
| **Future Likelihood** | **4** *[Probability of* a moderate or greater drought on a given year = *24% (+8% increase)]* | **Likely** |
| **Assessment Method** | **Probability Method**: Informed by change in projected mean of Standardized Precipitation Transpiration Index (SPEI) using a threshold SPEI value of -1 representing a moderate or greater drought. Projected means sourced from ClimateData.ca. | |

### A.4 Extreme Heat

| | | |
|---|---|---|
| **Description** | Temperatures significantly above the mean for an extended period, or by a combination of high temperatures with high humidity and a lack of air motion. | |
| **Indicator** | Extreme heat event, based on Environment and Climate Change Canada's criteria for issuing public weather alerts of 2 consecutive days of with high temps above 35°C, and low temps above 18°C. | |
| **Historic Likelihood** | **1** *[Probability of experiencing an extreme heat event on a given year = <1%]* | **Rare** |
| **Future Likelihood** | **4** *[Probability of experiencing an extreme heat event on a given year = 48%]* | **Likely** |
| **Assessment Method** | **Probability Method**: Annual likelihood of seeing 1 or more extreme heat events on a given year. Annual number of heat events meeting criteria sourced from ClimateData.ca. | |

### A.5 Extreme Cold

| | | |
|---|---|---|
| **Description** | A period of abnormally cold weather. | |
| **Indicator** | Extreme cold event, based on Environment and Climate Change Canada's criteria for issuing public weather alerts due to cold where temperature or wind chill is expected to reach minus 35°C for at least two hours. | |
| **Historic Likelihood** | **1** *[Days with minimum temperature of -35 °C or less = 0]* | **Rare** |
| **Future Likelihood** | **1** *[Days with minimum temperature of -35 °C or less =0 (+0% increase)]* | **Rare** |
| **Assessment Method** | **Probability Method.** Annual likelihood of seeing 1 or more extreme cold events on a given year. Annual number of cold events meeting criteria sourced from ClimateData.ca. | |

### A.6 Freezing Rain

| | | |
|---|---|---|
| **Description** | Rain that freezes on impact to form a coating of clear ice (glaze) on the ground and on exposed objects. | |
| **Indicator** | Median annual number of hours of freezing rain. | |
| **Historic Likelihood** | **2** *[Hours of freezing rain = 16]* | **Unlikely** |
| **Future Likelihood** | **3** *[Hours of freezing rain = 20 (+22% increase)]* | **Possible** |
| **Assessment Method** | **Modified Baseline:** Change in median number of hours of freezing rain sourced from: McCray, C. D., Paquin, D., Thériault, J. M., & Bresson, É. (2022). A multi-algorithm analysis of projected changes to freezing rain over North America in an ensemble of regional climate model simulations. *Journal of Geophysical Research: Atmospheres*, *127*(14), e2022JD036935. Likelihood score of 2 reflects the lower likelihood of this event. | |

### A.7 Hail

| | | |
|---|---|---|
| **Description** | Precipitation in the form of lumps of ice mainly associated with thunderstorms. Hail ranges in size from that of a small pea to the size of cherries but has been observed as large as grapefruit. | |
| **Indicator** | Number of hail days with hail >4cm | |
| **Historic Likelihood** | **3** *[Number of hail days = 3 days]* | **Possible** |
| **Future Likelihood** | **4** *[Number of hail days = 4 days (+25% increase)]* | **Likely** |
| **Assessment Method** | **Baseline Method:** Change in number of hail days for the region nearest to Salmon Arm sourced from Brimelow, J. C., Burrows, W. R., & Hanesiak, J. M. (2017). The changing hail threat over North America in response to anthropogenic climate change. *Nature Climate Change*, *7*(7), 516-522. | |

### A.8 High Winds

| | | |
|---|---|---|
| **Description** | High wind events, exceeding National Building Code design guidelines (1:50 year wind gust event). | |
| **Indicator** | 1-in-50-year hourly wind gust event | |
| **Historic Likelihood** | **2** *[Current day return period = 1:50 years (2% chance per year)]* | **Unlikely** |
| **Future Likelihood** | **3** *[Future return period for present-day = 1:35 years (3% chance per year)]* | **Possible** |
| **Assessment Method** | **Probability Method:** Present-equivalent return period for 1:50 year hourly wind gust events calculated from percentage change in wind pressure data for the Salmon Arm location derived from: ECCC's Climate-Resilient Buildings and Core Public Infrastructure - An Assessment of the Impact of Climate Change on Climatic Design Data In Canada - Annex 1.2. | |

### A.9 Lightning

| | | |
|---|---|---|
| **Description** | Any and all of the various forms of visible electrical discharge that are produced by thunderstorms; often seen as a bright flash of light in the sky. | |
| **Indicator** | Convective storms, using Convective Available Potential Energy (CAPE) as an indicator. | |
| **Historic Likelihood** | **3** *[Present-day CAPE]* | **Possible** |
| **Future Likelihood** | **4** *[Moderate Projected Increase in CAPE]* | **Likely** |
| **Assessment Method** | **Baseline Method:** Change in CAPE for the Pacific Coast region derived from Dominique Paquin, Ramón de Elía & Anne Frigon (2014) Change in North American Atmospheric Conditions Associated with Deep Convection and Severe Weather using CRCM4 Climate Projections, Atmosphere-Ocean, 52:3, 175-190, DOI: 10.1080/07055900.2013.877868. Source data was unavailable, so exact values for CAPE could not be included. | |

### A.10 Snowstorms and Blizzards

| | | |
|---|---|---|
| **Description** | Meteorological disturbance giving rise to a heavy fall of snow, often accompanied by strong winds. | |
| **Indicator** | Heavy snowfall days (>20mm of precipitation in winter months) | |
| **Historic Likelihood** | **4** *[Days of heavy snowfall per year= 0.2 (20% chance per year)]* | **Likely** |
| **Future Likelihood** | **4** *[Days of heavy snowfall per year = 0.3 (30% chance per year)]]* | **Likely** |
| **Assessment Method** | **Probability Method:** Annual probability seeing 1 or more high precipitation events in winter months on a given year. Annual number of high precipitation events meeting criteria from ClimateData.ca (>20mm). Note: Some high precipitation days during winter months may be high rainfall rather than high snowfall days. There are not currently robust projections for precipitation which falls as snow-only. | |

### A.11 Lake and River Flooding

| | | |
|---|---|---|
| **Description** | Flooding of the Salmon River and/or Shuswap Lake. Flooding is the overflow of natural drainage channels or shorelines, leading to partial or complete inundation from the overflow of waters and/or the accumulation or runoff of surface waters from any source. | |
| **Indicator** | 1:100-year 24-hour heavy rainfall event | |
| **Historic Likelihood** | **1** [*Current day return period = 1:100 years (1% chance per year)* | **Rare** |
| **Future Likelihood** | **3** [*Future return period for present-day = 1:25 years (4% chance per year)]* | **Possible** |
| **Assessment Method** | **Probability Method:** Present-equivalent return periods calculated from change in precipitation intensity using future-projected IDF curves from ClimateData.ca. | |

### A.12 Stormwater Flooding

| | | |
|---|---|---|
| **Description** | Flooding associated with heavy or excessive rainfall in a short period of time that produces immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall. | |
| **Indicator** | 1:100 year 1-hour heavy rainfall event | |
| **Historic Likelihood** | **1** [*Current day return period = 1:100 years (1% chance per year)* | **Rare** |
| **Future Likelihood** | **3** [*Future return period for present-day = 1:17.5-year event (6% chance per year)]* | **Possible** |
| **Assessment Method** | **Probability Method:** Present-equivalent return periods calculated from change in precipitation intensity using future-projected IDF curves from ClimateData.ca. | |

### A.13 Creek Flooding

| | | |
|---|---|---|
| **Description** | Creek flooding, including steep creeks and debris flows caused by heavy or excessive rainfall in a short period of time. Generally occurring on small to moderate sized creeks, including steep creeks and including debris avalanches which are rapid flows of mud, rock, brush, trees, and other debris propelled by torrential rains. | |
| **Indicator** | 1:100 year 1-hour heavy rainfall event | |
| **Historic Likelihood** | **1** [*Current day return period = 1:100 years (1% chance per year)* | **Rare** |
| **Future Likelihood** | **3** [*Future return period for present-day = 1:17.5-year event (6% chance per year)]* | **Possible** |
| **Assessment Method** | **Probability Method:** Present-equivalent return periods calculated from change in precipitation intensity using future-projected IDF curves from ClimateData.ca. | |

### A.14 Long-Term Temperature Increase

| | | |
|---|---|---|
| **Description** | Gradual, long-term increase in average seasonal and annual temperatures. | |
| **Indicator** | Growing Season Length | |
| **Historic Likelihood** | **3** *[Growing Season Length = 150 days]* | **Possible** |
| **Future Likelihood** | **5** *[Growing Season Length = 224 days (+50% (74 days) increase)]* | **Almost Certain** |
| **Assessment Method** | Change in growing season length calculated from average first fall frost day minus last spring frost day taken from ClimateData.ca. | |

### A.15 Freeze-Thaw Cycles

| | | |
|---|---|---|
| **Description** | Freeze-thaw cycles occur when water repeatedly freezes and thaws, expanding and contracting, which can cause damage to roads and pathways, buried infrastructure and building foundations. | |
| **Indicator** | Annual number of freeze-thaw cycles | |
| **Historic Likelihood** | **3** *[87 freeze-thaw cycles]* | **Possible** |
| **Future Likelihood** | **2** *[45 freeze-thaw cycles (48% decrease)]* | **Unlikely** |
| **Assessment Method** | Number of freeze-thaw cycles sourced from ClimateData.ca. | |

### A.16 Compounding Hazards

| | | |
|---|---|---|
| **Description** | Multiple climate-related hazards occurring either at the same time or in sequence, or local impacts that could be caused by multiple hazards. | |
| **Indicator** | Multiple hazards | |
| **Historic Likelihood** | **3** | **Possible** |
| **Future Likelihood** | **4** *[Increased likelihood across multiple hazards]* | **Likely** |
| **Assessment Method** | Qualitative estimate based on changes (increased likelihood) across other hazards. | |