UNIVERSITY OF BRITISH COLUMBIA

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CANADA

Risk & Vulnerability Summary Report 2024

BARC Framework Milestone 2 Output Report

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EXECUTIVE SUMMARY

Climate change is a reality that our community is currently facing. Already we are experiencing impacts to our local infrastructure, environment, economy, and well-being. The University of British Columbia (UBC) has taken a proactive approach by guiding a Climate Change Adaptation Vulnerability and Risk Assessment (UBC VRA) to identify and prioritize the impacts of a changing climate and extreme weather on the community's built social, natural, and economic systems.

The work undertaken as part of this project, along with subsequent adaptation action planning work, will enable UBC Vancouver to minimize the negative impacts of climate change by addressing locally identified risks while seizing any local opportunities to increase resilience.

The VRA process followed Milestone One and Two of ICLEI Canada's Building Adaptive and Resilient Communities (BARC) process. BARC is a national program focused on resilience and adaptation. The VRA included the following steps:

- Analyzing localized climate science projections.
- Identifying impacts to the community.
- Refining and prioritizing impacts using both a vulnerability assessment and a risk assessment.

UBC's VRA was designed to be cross-institutional and involve broad community participation to fully consider a system understanding of the climate change impacts to the UBC Vancouver community. A network of community members, organizations, UBC staff and stakeholders were assembled to participate in the process as workshop participants. Key milestones in the work to complete the VRA are listed below:

- UBC Climate Science Report
    - Report summarizes localized climate change projections.
- Workshop 1 (Sept 2023)
    - Workshop participants identified potential impacts to UBC Vancouver based on the localized climate projections.
- Vulnerability Survey (online, Nov 2023)
    - Workshop participants evaluated UBC's current sensitivity and adaptive capacity to the impacts.
- Workshop 2 (December 2023)
    - Workshop participants assessed the risk of the impacts.

This assessment has led to a refined list of 26 high-priority impacts, which can be brought to further climate adaptation planning processes. The higher risk impacts include:

- Wildfire damage to natural systems resulting in ecosystem changes.
- Flooding damage to buildings and infrastructure
- Higher temperatures and extreme heat events resulting in negative health impacts including increased mortality for vulnerable populations.
- Drought resulting in limited available water to establish and maintain plants.
- Higher temperatures and extreme weather causing damage to trees and natural features, resulting in a loss of biodiversity and ecosystem goods and services.

ICLEI Canada recommends that UBC continue their adaptation planning work with 'Milestone 3: Plan' of the BARC Framework. This milestone is focused on planning for the final list of priority impacts, identifying an overarching vision of the plan as well as more concrete goals, objectives and adaptive actions UBC can undertake to address these impacts. Milestone 3 would also include identifying implementation considerations and a process for monitoring and evaluation of the Plan.

INTRODUCTION

The University of British Columbia (UBC) Vancouver campus, recognizing the urgent need for climate change adaptation, has taken a proactive approach by guiding a Climate Change Adaptation Vulnerability and Risk Assessment (UBC VRA) to identify and prioritize the impacts of a changing climate and extreme weather on the community's built, social, natural, and economic systems.

The work undertaken as part of this project, along with subsequent adaptation action planning work, will enable UBC Vancouver to minimize the negative impacts of climate change by addressing locally identified risks while seizing any local opportunities to increase resilience.

This report summarizes the UBC VRA approach, including the project framework, localized climate change projections, and vulnerability and risk assessment methodology. Results from each step of the UBC VRA process are summarized in the sections below.

This report serves as a valuable output to share with the broader community and decision-makers as the University of British Columbia (UBC) continues the process of developing a climate adaptation response for the Vancouver campus.

PROJECT BACKGROUND

BARC Methodology

UBC's climate adaptation work is guided by ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Framework. The BARC Framework guides municipalities and communities through a comprehensive planning methodology that includes research and climate impact assessment, plan development, action-setting, implementation planning, and monitoring and review strategies. ICLEI Canada's BARC Framework is a proven methodology that has been implemented by hundreds across the country. A model of BARC's Milestone process is shown in Figure 1 below.

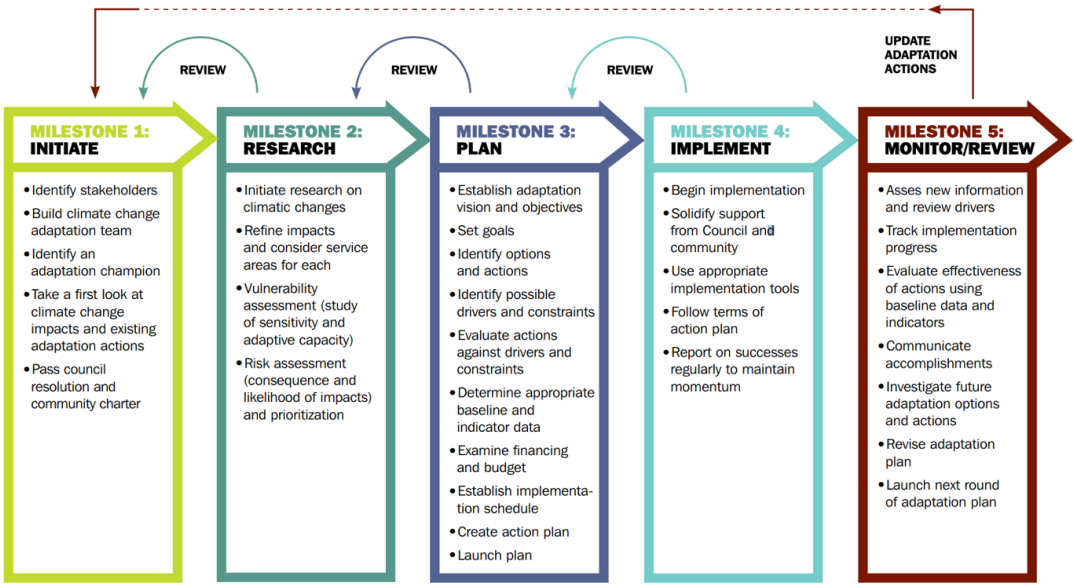


Figure 1: BARC 5-Milestone Framework

This project fulfills Milestones One, and Two, of the BARC Framework. Following the Vulnerability and Risk Assessments, UBC has the opportunity to begin the planning stage (Milestone 3). A Cost of Doing Nothing Report (CODN) will commence following this VRA report.

Community Adaptation Planning Workshops

To date, UBC has participated in two in-person workshops as well as an online Vulnerability Assessment survey. With ICLEI, the Core UBC Project Team led and facilitated workshops with the UBC Vancouver community. Climate change adaptation planning with the community ensures that those most affected by the impacts of climate change are involved in how risks are identified, assessed, and responded to. The UBC VRA engagement sessions are summarized below.

Workshop 1: Impact Statement Identification (September 21st, 2023)
The goal of Workshop 1 was to identify impacts of climate change to the UBC Vancouver campus and community based on localized climate change projections.

Vulnerability Survey (online):
The goal of the Vulnerability Survey was to gather feedback on UBC Vancouver's current sensitivity to and adaptive capacity to the identified impacts.

Workshop 2: Risk Assessment (December 4th, 2023)
The goal of Workshop 2 was to prioritize impacts of climate change to the UBC Vancouver campus and community.

Workshop Participants

Workshop participants included members of UBC's academic community, UBC staff, University Neighbourhoods Association staff, UBC Properties Trust staff, as well as other subject matter experts. Participants were brought together to speak to their experiences and understanding with respect to

adapting to climate change and mitigating vulnerability and risk. Their participation provided valuable direction and input to the UBC VRA process. A list of the workshop participants can be found in **Appendix A**.

Local Climate Context

UBC is already experiencing the impacts of climate change. More broadly, the province and region have already experienced instances of extreme flooding, wildfire and heat events. For example, the BC Coroners Service confirmed that there were 619 heat-related deaths during the heat dome, which took place from June 25 to July 1, 2021.[1] The heat dome and poor air quality directly impacted the UBC population. That same year also included a devastating fire season, which destroyed the village of Lytton, and saw provincial firefighting costs hit $718.8 million.[2] This was then followed by severe flooding in the fall. The atmospheric river in mid-November led to floods and landslides that killed five people and cut off all road and rail routes between Metro Vancouver and the rest of Canada—the costliest natural disaster in the province's history.[3]

These recent, close-to-home events have highlighted the need to be prepared for ongoing challenges, especially as the climate will continue to change over the next century.

To gain an understanding of the changes to come and to help with adaptation planning and decision-making, ICLEI Canada worked with UBC to develop a localized climate science report. This report examines climate trends and projections on a global, national, and local scale. Projections in this report are focused on temperature, precipitation, growing season, extreme weather events (e.g. wildfires), and sea level rise. This report informed the development of the climate change impacts for the Vulnerability and Risk Assessment process. A summary of these projections is outlined below:

- **Temperature:** In a high emissions scenario, minimum seasonal temperatures are projected to increase substantially. UBC can expect to experience more and longer heat wave events per year. The number of hot and humid days for UBC Vancouver Campus will increase. Ice Days are expected to decrease, increasing the risk of survival and spread of ticks and Lyme disease.
- **Precipitation:** At the UBC Vancouver Campus, on a seasonal basis, spring, winter and autumn precipitation accumulations are projected to increase marginally by the end of the century for UBC Vancouver campus, while summer precipitation will decrease.
- **Growing Season:** The growing season is expected to start earlier and end later by the end of the century. The growing season is also projected to increase.
- **Extreme Weather Events:** Due to the projected hotter summer temperatures with less summer precipitation, an increase in the risk and intensity of wildfires is anticipated. The intensity and duration of rainfall, especially during infrequent, extreme storms, is projected to increase.

[1] Government of Canada. https://science.gc.ca/site/science/en/blogs/science-health/surviving-he -impacts-2021-western-heat-dome-canada. Published 2022-06-26

[2] Government of British Columbia. https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

[3] Zwiers, Francis. "2021 BC floods and climate change." *University of Victoria*, 15 February 2022, https://www.uvic.ca/news/topics/2022+bc-floods-and-climate hange+news. Accessed 14 September 2023.

Storms that occur less frequently (e.g. 100-year storms) are projected to see a greater increase in intensity.
- **Sea Level Rise:** Sea levels are predicted to rise.

These changes will significantly affect the UBC Vancouver campus, impacting its social, natural, built, and economic systems. A more complete graphic breakdown of these results is included within the Climate Science Infographics in **Appendix B**.

VULNERABILITY AND RISK METHODOLOGY

Analyzing risk based on climate change projections for the region is a key step in adapting to climate change and planning for the future. The UBC VRA process led university and community stakeholders through a vulnerability and risk assessment framework to create a prioritized list of impacts from which actions for each impact, or impact area, can be planned.

The assessment of vulnerability and risk was supplemented by expert knowledge and reviewed against existing risk assessments across the region to ensure alignment in our understanding of climate risks across the community. The outcomes from the risk assessment reflect our current understanding of present climate conditions and considered anticipated climate projections for the community. The risk assessment can be revisited at regular future intervals as climate science and our capacity to respond changes over time.

The UBC VRA included three key steps in order to develop a prioritized set of impacts for UBC Vancouver:
1. Identifying impacts to the community
2. Completing a vulnerability assessment on the impacts
3. Completing a risk assessment on the impacts

The approach to these steps is summarized in the sections below.

Impact Statements

Impact statements are the foundation of the risk and vulnerability process and must be tailored to each locations' context. They are intended to be concise sentences that outline what climatic changes are going to be occurring and how that is going to affect the municipality. More specifically, they are intended to answer:

- IF - A climatic threat/ change (i.e. increase in freezing rain events)
- THEN - The outcome of the climatic change (i.e. damage to trees and electrical infrastructure)
- SO - The consequences associated with this outcome (i.e. power outages)

Table 1: Example Impact Statements

Climatic Threat (IF)	Impact statement (outcome (THEN) and consequence (SO)
Increase in summer temperatures	Making indoor spaces hot causing increased energy use to cool UBC facilities.
Increase in heavy rainfall events	Overburdening of storm sewers causing basement flooding.
Increase in wind events	Damage to tree canopy increasing the number of hazardous trees and branches.

The impact statements cover a range of affected areas including infrastructure, natural environment, public health and safety, essential services, and more. The statements have been further organized by climate event to help UBC better understand the focus and scope of each impact. Climate event categories included:

- Changes in temperature
- Changes in precipitation
- Extreme weather events

Vulnerability Assessment

Vulnerability refers to the susceptibility of a given asset or service or group to harm arising from climate change impacts. Vulnerability is a function of two criteria – the **sensitivity** of the community to a given climate change impact, and its **adaptive capacity** (ability to respond, recover and/or cope).

A vulnerability assessment necessitates an understanding of both biophysical and socioeconomic factors, as the focus is on understanding the processes involved with climate change impacts and the factors that influence sensitivity and adaptive capacity. This understanding can help assist with the development of suitable adaptive actions later in the 'Milestone 3: Plan' stage if UBC decides to proceed through the BARC process. These statements will also be used during the Cost of Doing Nothing (CoDN) process which will begin to back these impacts up with facts and economic figures.

To determine sensitivity, how the functionality of the community would be affected should the impact occur today is considered. This includes examining how the impact would affect the community's ability to deliver and access services, continue regular functionality, etc. In contrast, adaptive capacity refers to the ability of systems, institutions, individuals, and other assets to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. To determine adaptive capacity, we consider the time and resources required to restore the community or asset to its previous functionality should the impact occur today, as well as consider any plans, policies, and actions already in place to address this issue.

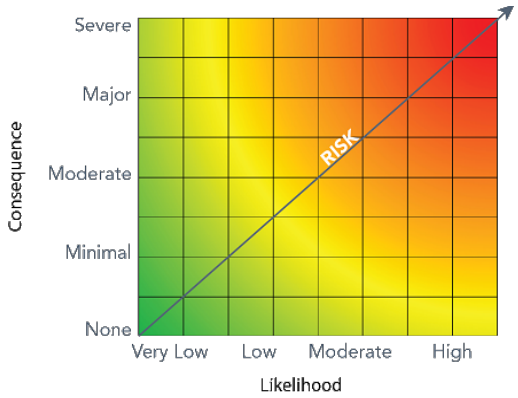
The following scale was used to assign the vulnerability rankings:

- Low Vulnerability = The community is not very/not at all vulnerable to harm arising from the impact.
- Medium Vulnerability = The community is somewhat vulnerable to harm arising from the impact.
- High Vulnerability = The community is very vulnerable to harm arising from the impact.

Risk Assessment

The risk assessment process is used to further prioritize which impacts are most pertinent to plan for. Risk is generally considered to be a function. of likelihood and consequence (see **Error! Reference source not found.**). The output of this type of risk assessment is a prioritized list of future climate impacts.

Figure 2: Risk Matrix



Likelihood:
Likelihood scores were assigned using the following scale:

Table 2: Likelihood Scores

Likelihood Rating	Recurrent Impact	Single Event
Almost Certain (5)	At least once per year (Annual chance: 100%)	Almost certain - 95% or greater chance of occurrence in next 50 years
Likely (4)	Once in 1 to 5 years (Annual chance: 20% - 100%)	Likely - 65% to 90% chance of occurrence in next 50 years
Possible (3)	Once in 5 to 10 years (Annual chance: 10% to 20%)	Possible - 35% - 65% chance of occurrence in next 50 years
Unlikely (2)	Once in 10 to 50 years (Annual chance: 2% to 10%)	Unlikely - 5% to 35% chance of occurrence in next 50 years
Very Unlikely (1)	Once in 50 years or more (Annual chance: <2%)	Very unlikely - less than 5% chance of occurrence in next 50 years

Consequence: For the risk assessment activity, the consequences of each climate impact statement were assessed across three sectors using a five-point scale as outlined below. At a high level, this scale reads:

1) Negligible
2) Minor

3) Moderate
4) Major
5) Catastrophic

A full consequence scale and methodology can be reviewed in **Appendix C**.

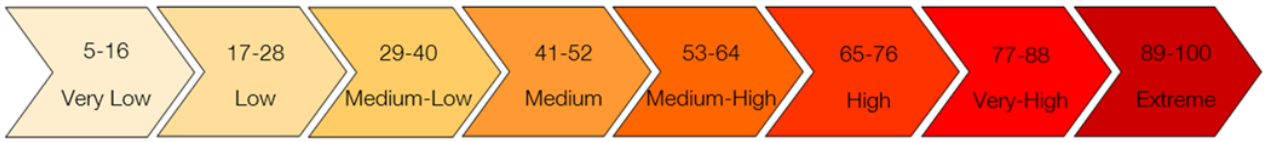
Table 3 outlines the three systems (social, economic, and environmental) developed for the consequence assessment.

Table 3: Consequence Categories

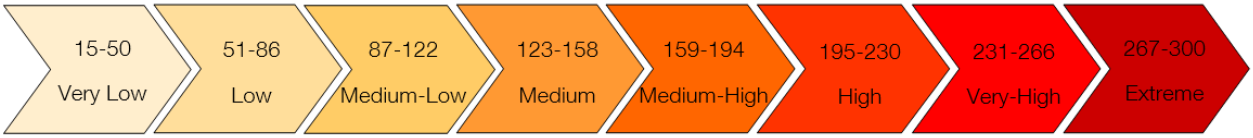
Social Factors	Economic Factors	Environmental Factors
• Public Health and Safety • Displacement • Cultural practices • Loss of Livelihoods	• Property Damage • Local Economy & Growth • Community Liveability • Public Administration	• Water quality and quantity • Air quality • Soil & Vegetation • Ecosystem Function

Risk Spectrums: The evaluation of likelihood and consequence generates risk scores for each consequence category (e.g. social, built, and natural) as well an overall risk score.

The level of risk per consequence category was calculated using the spectrum below:



The total risk score (the sum of each risk category score multiplied by likelihood of the impact occurring) was obtained using the spectrum below:



The purpose of providing one overall risk score, as well as three category-specific risk scores, is to try and capture certain impacts that may score high in certain categories, but low in other categories. This is intended to ensure the impacts that may pose a high risk in only certain categories will still be captured, despite maybe having a lower overall risk score.

Limitations of the Risk Assessment

It is important to note that the risk assessment process is not an exact science; it is a subjective exercise that evaluates participants' opinions, based on either their professional expertise or their lived

experiences, of the risks that the impacts pose to UBC's infrastructure, services, environment or the wider community. The outputs of the exercises are dependent on those that participated in the assessment. While great effort was made to engage key stakeholders in the UBC community, the exercise does not necessarily capture every possible perspective. It is also important to acknowledge that the impact statements themselves are also subjective, however, great effort was made to ensure the lists were both inclusive and exhaustive and captured how climate change could impact UBC and the surrounding context.

UBC VRA RESULTS

The results of the UBC VRA for each step of the process are summarized in the sections below.

Impact Statement Development

The first UBC VRA workshop presented climate change projections for the Campus. A group brainstorm of climate change impacts, how climate change could affect social, built, economic, and natural systems in the community was also facilitated. Workshop Participants were divided into groups based on their area of expertise (built, environmental, and socio-economic systems). A long list of 122 impact statements were initially identified. 48 opportunities were also developed.

This list was reviewed, edited, and revised by the UBC Core Project Team to closely and concisely reflect the level of impact, available mitigation and priority of the changes that are expected to affect the community. Ultimately, 63 impact statements moved forward to the Vulnerability Assessment.

Vulnerability Assessment Results

The UBC Vulnerability Assessment was carried out using an online survey completed by the workshop participants. Analysis of these scores and the summative draft score was then prepared. The mode was used to determine the summative score in most cases. If an impact statement had multiple rankings (low, medium, high) with the most scores then the median was used. In some cases, the final score was adjusted based on justifications provided.

As previously noted, a total of 63 impact statements were put through the vulnerability assessment, the results of which are indicated below.

Vulnerability Ranking	Number of Impacts
High (Red)	17
Medium – High (Orange)	4
Medium (Yellow)	30
Medium – Low (Blue)	1
Low (Green)	11

Figure 2: Vulnerability Assessment Ranking Distribution

The vulnerability assessment results provide a first look at prioritization of impacts before doing a more in-depth consideration of future risk. Vulnerability rankings that are "high" indicate the impacts to which the Vancouver campus is *sensitive* or have low *adaptive capacit*y (ability to cope/recover).

High-ranking impacts in the vulnerability assessment were related to increased extreme heat days, wildfires, low precipitation, overall temperatures, sea level rise, and extreme weather events. Areas of concern were mainly spread across three categories, threats to social and economic systems (i.e. public health and safety, increased costs, loss of land-based knowledge, food insecurity) including impacts to the built environment and assets (i.e. loss of essential services, etc.), and to our natural environment and ecosystem function (i.e. loss of the ability to maintain landscapes, habitat degradation and loss, loss of culture, etc.). A total of 14 impacts with low vulnerability were removed from the next phase of the VRA process.

Risk Assessment Results

Likelihood ratings were assigned to each of the identified impacts by the Project Team and then reviewed by the stakeholders. Likelihood ratings were adjusted in response to any refinements that were made to the impact statements based on expert input.

The distribution of the Likelihood Assessment results is displayed in the figure below.

Likelihood Ranking	Number of Impacts
Almost Certain (5)	19
Likely (4)	12
Possible (3)	10
Unlikely (2)	7
Very Unlikely (1)	1

Figure 3: Risk Assessment Ranking Distribution

For the risk assessment activity, workshop participants assessed the consequences of each climate impact statement across the range of consequence categories using the five-point scale as outlined above.

Following the workshop, the Core UBC Project Team conducted expert interviews and completed a complimentary desktop risk assessment to ensure that risks were scaled accurately and evaluated consistently. This process also provided the scoring for impact statements that the community stakeholders deemed they were inadequately informed to provide scoring for.

A final review of the results of the risk assessment compared the type and magnitude of risks identified with previous studies conducted at the University, in neighbouring municipalities, and at the provincial scale. Subsequent working sessions and meetings were held to further refine the number of impact statements to be included in this final Vulnerability and Risk Assessment report. The purpose of reducing the number of statements is to ensure that a manageable and focused number of actions can be built from these statements by the UBC project team. The 49 impacts assessed in the risk assessment workshop were refined down to 26. The methodology for refining the list included revisiting statements with low consequence and/or likelihood, as well as combining some similar items. Additional consideration was given to highlight impacts that had any consequence categories with a 'major' or 'catastrophic' score, even if the overall risk was on the lower end.

A full list of all 49 impact statements with the risk assessment scoring can be found in **Appendix D**.

The distribution of the Risk Assessment results for the refined list of 26 impacts is displayed in Figure 4 below.

Risk Ranking	Number of Impacts
Very High	1
Medium-High	5
Medium	6
Medium-Low	13
Low	1

Figure 4: Risk Assessment Ranking Distribution

UBC PRIORITIZED CLIMATE IMPACTS

UBC Vancouver's final prioritized climate impacts are listed in Table 4 below.

Table 4: A Community Perspective on Prioritized Climatic Impacts for UBC

Climate Impact Statement	Risk Score
Natural 8: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires, resulting in damage/destroyed natural environments and ecosystem changes and connectivity, specifically at Pacific Spirit Park.	Very High
Built 9: Increased frequency and intensity of precipitation events causing flooding, resulting in damage to buildings, residential properties, utility facilities, subterranean labs and/or animal care facilities, and electrical/mechanical rooms.	Medium-High
Built 13: Increase in average temperatures, frequency and intensity of extreme weather, and changes in precipitation patterns globally causing need for	Medium-High

Climate Impact Statement	Risk Score
design/building standard changes, and supply chain and labour disruptions, resulting in delayed or more costly infrastructure repairs and new capital projects.	
Socio-Econ 1: Increased average temperatures and hot days over 30 degrees Celsius causing poor air quality and prolonged heat, resulting in discomfort, negative health impacts including increased mortality for vulnerable populations, decreased productivity, and social strain on occupants in buildings with insufficient cooling.	Medium-High
Natural 3: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing drought conditions and water restrictions, resulting in limited available water to establish and maintain plants, especially manicured landscapes.	Medium-High
Natural 14: Increase in average temperatures, extreme weather, and changes in precipitation patterns causing damage to trees and natural features, resulting in a loss of biodiversity and ecosystem goods and services, including cooling and shading.	Medium-High
Built 2: Increase in average summer temperatures and hot days causing an increased demand for indoor space cooling, resulting in electrical overloads, and increased maintenance, water consumption, and decreased life of cooling equipment.	Medium
Socio-Econ 3: Increase in hot days over 30 degrees Celsius and extreme weather events causing unsafe conditions, increased discomfort and health concerns, resulting in decreased productivity of outdoor workers and work/service disruptions for outdoor activities.	Medium
Socio-Econ 4: Increase in wildfire conducive conditions within the region and beyond causing an increase in wildfires, resulting in an increase in respiratory health impacts.	Medium
Socio-Econ 7: Increase in extreme weather events, including extreme heat, causing inhospitable outdoor conditions, resulting in increased safety and health risks for vulnerable populations.	Medium
Socio-Econ 19: Increase in average temperatures, frequency and intensity of extreme weather, and changes in precipitation patterns causing frequent physical and mental health impacts on UBC community members such as heightened health risks due to increase presence of diseases (e.g. Lyme disease in tick bites), poor weather conditions causing physical injuries (e.g. snow clearing causing back injury), aggravation of existing conditions (e.g. smoke effects on asthma).	Medium
Natural 12: Increase in average temperatures causing shifts in eco-regions and increased survival and spread of invasive species and pests, resulting in biodiversity loss, the decrease of native flora and fauna survival, and ecosystem stress.	Medium
Built 1: Increase in extreme weather events, such as wind and rain storms causing power outages, resulting in a loss of essential building services (heating, cooling, hot water) without backup power.	Medium-Low
Socio-Econ 2: Increased average temperatures and hot days over 30 degrees Celsius causing an increased need for cooling equipment, retrofits, and power, resulting in increased building ownership and rental costs.	Medium-Low
Built 4: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires, resulting in damaged/destroyed buildings and infrastructure assets.	Medium-Low
Built 8: Increased frequency and intensity of precipitation and other extreme weather events causing flooding over roads, pathways and bridges, resulting in disruptions to	Medium-Low

Climate Impact Statement	Risk Score
transportation networks, including inaccessibility, accidents, threats to public safety and delays.	
Built 10: Increase in the intensity and frequency of extreme weather events, specifically with high winds and heavy snow/ice loads, causing unsecured objects to blow around and trees to be damaged, resulting in damage to buildings and safety concerns.	Medium-Low
Socio-Econ 8: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires at Pacific Spirit Park, resulting in mobility/transportation challenges to facilitate evacuation and increased demand for emergency services.	Medium-Low
Socio-Econ 14: Increase frequency and intensity of extreme weather events causing a negative impact on human health, resulting in a greater demand on emergency services before (e.g. education and preparedness), during (e.g. temporary shelters), and after (e.g. recovery).	Medium-Low
Socio-Econ 15: Increased average temperatures and hot days over 30 degrees Celsius, reduced air quality from wildfire events, and/or extreme weather events causing unsafe conditions outdoors causing rescheduling or cancelling of outdoor events (e.g. performances, sporting, cultural).	Medium-Low
Socio-Econ 17: Increase in frequency and intensity of extreme weather events causing academic disruptions resulting in mental health impacts on students and faculty (e.g. class and exam rescheduling, research delays)	Medium-Low
Socio-Econ 18: Increase in frequency and intensity of extreme weather events causing increasing the difficulty of commuting to campus, resulting in a shortage of on-site staff.	Medium-Low
Natural 2: Increased average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation and increased frequency and intensity of precipitation events causing crusted/hydrophobic soils resulting in increased instances of flooding, and cliff erosion, and damaged/dead vegetation.	Medium-Low
Natural 5: Increased sea levels causing coastal erosion, resulting in damage/destruction of coastal infrastructure, recreational space and habitat.	Medium-Low
Natural 6: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing low flow in ephemeral creeks, resulting in changes to the boundaries of waterbodies and species composition.	Medium-Low
Natural 13: Increase in the frequency and intensity of extreme weather such as rain and wind causing damage to green and grey infrastructure, resulting in temporary or permanent closures of parks, trails, green spaces etc.	Low

From Risks to Action – Recommendations & Next Steps

The UBC Vulnerability and Risk Assessment prioritized the climate impacts that are the most significant to UBC's Vancouver campus. Now that these impacts have been refined and prioritized, planning for the most significant impacts by developing adaptation actions is the next step in the process. ICLEI Canada recommends that UBC continue their work with 'Milestone 3: Plan' of the BARC Framework. This is focused on planning for the final list of priority impacts, identifying an overarching vision of the plan as well as more concrete goals, objectives, and adaptive actions UBC can undertake to address these impacts. Milestone 3 would also include identifying implementation considerations and a process for monitoring and evaluation of the Plan.

Climate Adaptation Planning Approach

Resources for adaptation planning should be directed towards the higher-ranking risk impacts first but designed to address as many impacts as possible whenever feasible. Climate impact statements evaluated as a low risk should be monitored for any changes in their likelihood and consequence and should be considered in future iterations of the Plan once re-evaluated. The Core UBC Project Team identified health and wellbeing as a critical focus for future adaptation planning.

Based on the list of prioritized climate impacts, below is a list of recommended actions/action areas that are recommended be brought into the planning phase:

Infrastructure Resilience and Adaptation

Some recommendations include:

- Incorporate low impact development (LID) features and green infrastructure in development and redevelopment projects to promote groundwater recharge and stormwater management.
- Update the campus's stormwater management master plan to include updated floodplain maps and climate-adjusted intensity-duration-frequency curves.
- Investigate the resilience of energy systems on campus, identify critical areas susceptible to disruption, and ensure backup power generation for key infrastructure.
- Strengthen the campus's power infrastructure with more robust backup power solutions, such as additional generators and battery storage systems, to maintain essential services during power outages caused by extreme weather.
- Update engineering and building standards to enhance resilience against climate-induced extremes and require climate-resilient features in new developments and redevelopments through municipal by-laws and development guidelines.
- Implement the PIEVC protocol for infrastructure vulnerability where high risks are identified.
- Increase the capacity and efficiency of cooling systems in buildings to handle increased temperatures and reduce overloads and maintenance issues.
- Use building materials and designs that are resistant to wildfires for new constructions and renovations.
- Develop and implement comprehensive wildfire management and response strategies, including creating firebreaks and managing fuel loads in and around Pacific Spirit Park.

Environmental and Ecosystem Enhancement and Protection

Some recommendations include:

- Protect natural environments and biodiversity by promoting fire-resilient landscapes and controlling invasive species through a consolidated strategy.
- Increase education for campus grounds staff and the community on invasive species and pests.
- Map canopy cover and identify tree deficit and greenspace deficit areas and determine trees vulnerable to wind damage, changing temperature patterns, and other climate impacts.
- Strengthen tree protection through species diversification and enhancement of tree canopy including setting coverage target.
- Develop restoration strategies to manage erosion of cliffs.

- Focus on habitat restoration and protection efforts to mitigate the effects of increased temperatures and changes in precipitation on local biodiversity and ecosystems.
- Implement permeability Pilot projects to test and communicate the opportunities for detention and/or infiltration.
- Implement water-saving technologies and drought-resistant landscaping to address the challenges of low summer precipitation and water restrictions.

Public Health and Safety

Some recommendations include:

- Conduct detailed heat, cold and flood maps to identify high-risk areas for blackouts or brownouts, particularly areas with vulnerable populations.
- Develop support networks for vulnerable campus users, including seniors, youth, and those experiencing homelessness.
- Increase the capacity of emergency services to handle higher demands during extreme weather events, including wildfires and heatwaves.
- Develop and implement heatwave response plans that include opening cooling centers and increasing public awareness about heat-related health risks.
- Establish more designated and accessible areas of refuge (e.g. community centres, libraries, places of worship, etc.) from extreme weather events.
- Consider promoting an emergency preparedness week and 72 hour emergency kits.
- Enhance shading and cooling options in new facilities and parks, including green roofs.
- Enhance health surveillance systems to monitor and respond to increased health risks associated with hotter temperatures and wildfire smoke.
- Conduct training on social vulnerabilities and resilience for emergency response staff, volunteers, and health practitioners
- Develop policy to use Personal Protective Equipment (PPE) that reduces the impact of temperature on outdoor workers.
- Improved maintenance of sidewalks/trails, during inclement weather.
- Prioritize public health by improving conditions for supporting better air quality through tree planting and evaluating, installing upgrades for better indoor air quality like air filters, and providing more indoor recreation options during periods of poor air quality.

Economic Resilience

Some recommendations include:

- Build socio-economic resilience through support for outdoor workers with health and safety training.
- Ensure continuity of services during extreme events by developing robust disaster recovery planning.
- Develop guidelines for adapting workplaces to higher temperatures, including provisions for sufficient cooling and air quality management.
- Implement strategies for rescheduling or canceling outdoor events during extreme weather conditions to ensure public safety.

- Work with Translink to enhance the resilience of transportation networks to cope with increased precipitation and extreme weather events that cause flooding and disrupt transportation.
- Plan for redundancy of critical routes for emergency response and flow of goods and services.

Resilient Governance and Planning

Some recommendations include:

- Adopt forward-thinking and flexible management strategies that incorporate regular risk assessments and community engagement in resilience initiatives.
- Consider the development of a Telework (Work-from-Home) policy for inclement weather.
- Create flexible academic scheduling and infrastructure to accommodate disruptions caused by extreme weather, ensuring continuity of education.
- Identify and integrate extreme weather events and impacts into all corporate emergency response testing and plans.
- Integrate changing climate extremes into coordinated emergency management programs including preparedness, prevention, response and recovery.
- Ensure all Risk Assessments within the Corporation are updated to include climate change considerations

Cost of Doing Nothing

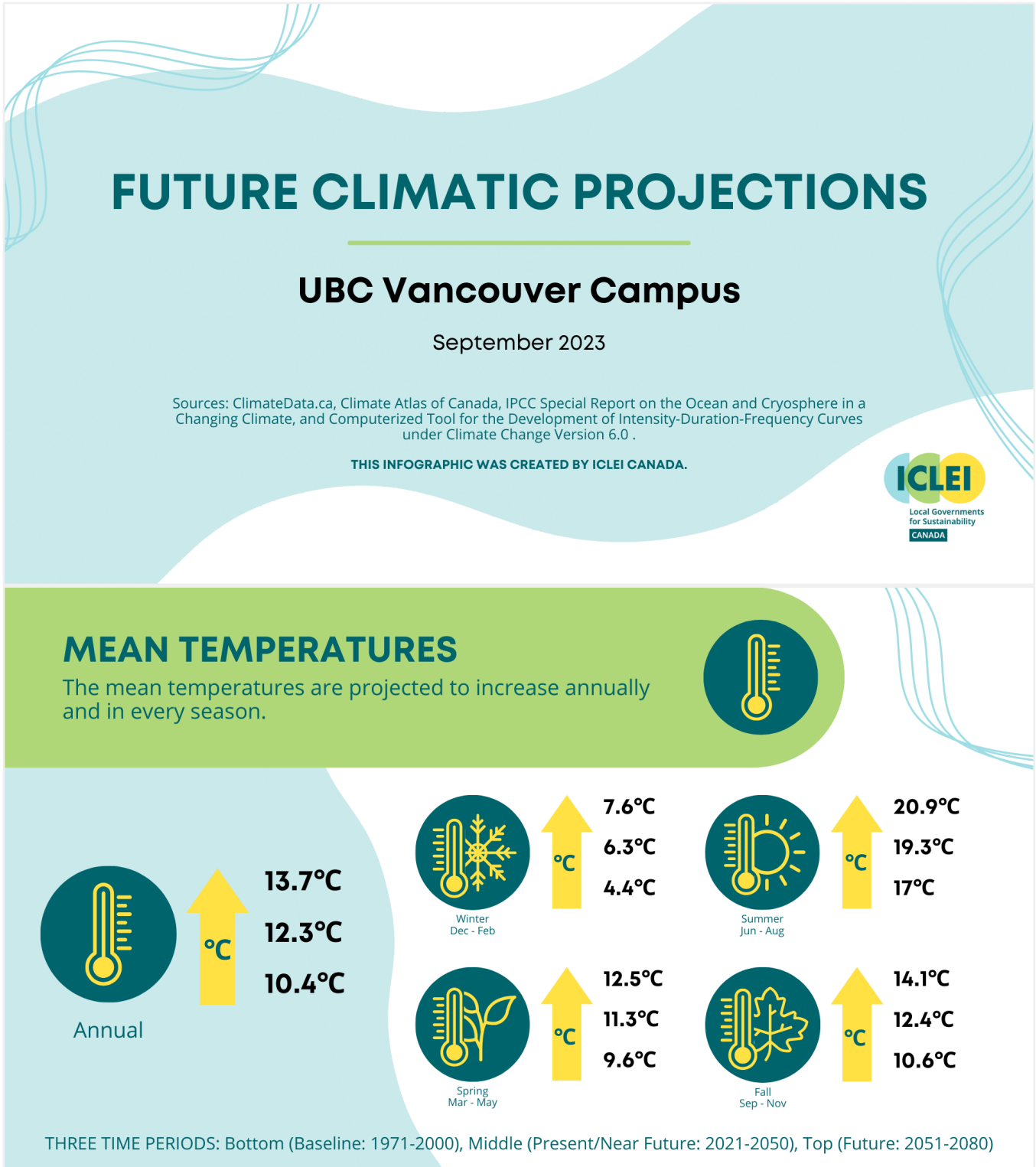
Following the Vulnerability and Risk Assessment Report, UBC and ICLEI Canada will work in collaboration to conduct a Cost of Doing Nothing (CoDN) assessment based on the prioritized list of impacts identified in this report. The CoDN provides a stepping stone to assess the costs of inaction within their own local context to support their own climate adaptation planning process. It also provides decision makers with locally-relevant data, and weighing the costs of action versus inaction. ICLEI Canada has developed a CoDN toolbox that includes key documents, case studies, and appendices that together can be used to support UBC in building a local business case for adaptation and provide incentive to advance the community toward Milestone 3 of the BARC framework.

Appendix A - Workshop Participants

Role	Department/ Organization	Member	Workshop Participation
Climate Change Program Manager	ICLEI Canada	Rena Viehbeck	Workshop 1 & 2
Climate Change Program Lead	ICLEI Canada	Adrián Tóth	N/A
Core Team	UBC – Campus + Community Planning (C+CP)	Kerry Shaw	Workshop 1 & 2
Core Team	UBC – C+CP	Ralph Wells	Workshop 1 & 2
Core Team	UBC – Safety & Risk Services (SRS)	Hailey Maxwell	Workshop 1 & 2
Core Team	UBC – SRS	Cassandra Torres	Workshop 1 & 2
Core Team	UBC – C+CP	Brittany Jang	Workshop 2
Note Takers	UBC – SRS	Alicia Head	Workshop 1 & 2
Note Takers	UBC – C+CP	Saya Kawabe	Workshop 1 & 2
Note Takers	UBC – C+CP	Zainab Sayedain	Workshop 1 & 2
Note Takers	UBC – SRS	Mariyam Syed	Workshop 1
Note Takers	UBC – C+CP	Kyle Vinson	Workshop 1 & 2
Note Takers	UBC – C+CP	Madeleine Zammar	Workshop 1 & 2
Note Takers	UBC – SRS	Lynda Cuddy	Workshop 2
Note Takers	UBC – C+CP	Simmi Puri	Workshop 2
Workshop Attendee	UBC – C+CP	Adam Hyslop	Workshop 2
Workshop Attendee	UBC – Enterprise Risk and Assurance	Alison Birdsall	Workshop 1 & 2
Workshop Attendee	UBC – Sustainability Hub	Angelique Pilon	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Bud Fraser	Workshop 1 & 2
Workshop Attendee	UBC – Sustainability Hub	Cait Murphy	Workshop 1 & 2
Workshop Attendee	UBC – SRS	Cathy Myles	Workshop 2
Workshop Attendee	UBC – C+CP	Chris Fay	Workshop 1 & 2
Workshop Attendee	UBC – Faculty of Land & Food Systems, UBC Farm	Clare Cullen	Workshop 1
Workshop Attendee	UBC – Facilities, Energy & Water Services (EWS)	Colin Mingus	Workshop 2
Workshop Attendee	Vancouver Coastal Health	Craig Dedels	Workshop 2
Workshop Attendee	UBC – Facilities and Building Services	David Kiloh	Workshop 1
Workshop Attendee	UBC – Facilities, Infrastructure Development	Denise Brown	Workshop 2
Workshop Attendee	UBC – Facilities, Building Operations	Denise Pearce	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Emma Luker	Workshop 1 & 2
Workshop Attendee	UBC Properties Trust (UBCPT)	George Poliusuk	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Georgia Stanley	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Gerry McGeough	Workshop 1

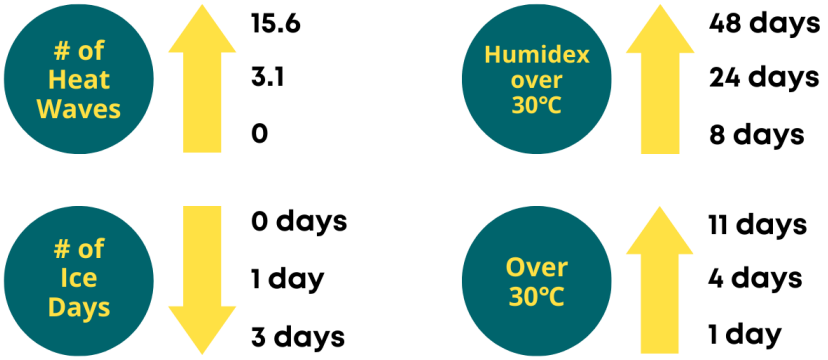
Role	Department/ Organization	Member	Workshop Participation
Workshop Attendee	UBC – SRS	Jamiann Questa	Workshop 1
Workshop Attendee	UBC – Facilities, Infrastructure Development	Jay Hiscox	Workshop 1 & 2
Workshop Attendee	UBC – Facilities, EWS	Jeannie Lee	Workshop 2
Workshop Attendee	UBC – Facilities, Building Operations	Jenniffer Sheel	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Joanne Proft	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	John Madden	Workshop 1 & 2
Workshop Attendee	UBC - Facilities	John Metras	Workshop 2
Workshop Attendee	UBC – C+CP	Juan Luis Rivera Espinosa	Workshop 1 & 2
Workshop Attendee	UBC – Child Care Services	Karen Vaughn	Workshop 1
Workshop Attendee	UBC – C+CP	Krista Falkner	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Lia Gudaitis	Workshop 2
Workshop Attendee	UBC – SRS	Ligia Gheorghita	Workshop 2
Workshop Attendee	UBC – C+CP	Maximillian Kniewasser	Workshop 1 & 2
Workshop Attendee	UBC – Climate Hub	Meghan Wise	Workshop 2
Workshop Attendee	UBC – Climate Hub	Michelle Xie	Workshop 1
Workshop Attendee	UBC – Facilities, Infrastructure Development	Noel McNally	Workshop 1
Workshop Attendee	UBCPT	Paul Young	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Penny Martyn	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Renée Lussier	Workshop 1 & 2
Workshop Attendee	UBC – Facilities, EWS	Richard Hugli	Workshop 2
Workshop Attendee	UBC – Facilities and Building Services	Ricky Biring	Workshop 1 & 2
Workshop Attendee	University Neighbourhoods Association (UNA)	Robyn Chan	Workshop 1
Workshop Attendee	UBC - School of Community and Regional Planning, AND Institute for Resources, Environment and Sustainability	Stephanie Chang	Workshop 1
Workshop Attendee	UBC Botanical Garden	Tara Moreau	Workshop 1 & 2
Workshop Attendee	UBC – C+CP	Taryn Alessandra Cigagna	Workshop 1
Workshop Attendee	UNA	Wegland Sit	Workshop 1
Additional Stakeholder	UBC – C+CP	Jake Li	Targeted sessions
Additional Stakeholder	Corix	Jeff Giffin	Targeted session
Additional Stakeholder	Corix	Paul Holt	Targeted session

Appendix B - Climate Science Report Infographics



TEMPERATURES EXTREMES

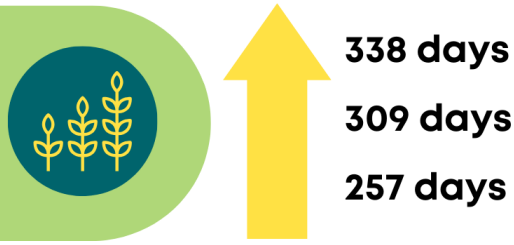
Extreme heat is projected to increase annually and Ice Days, days that do not exceed 0°C, are expected to decrease.



THREE TIME PERIODS: Bottom (Baseline: 1971-2000), Middle (Present/Near Future: 2021-2050), Top (Future: 2051-2080)

GROWING SEASONS

First frost dates will be later, and last frost days will be earlier, extending the annual growing season.



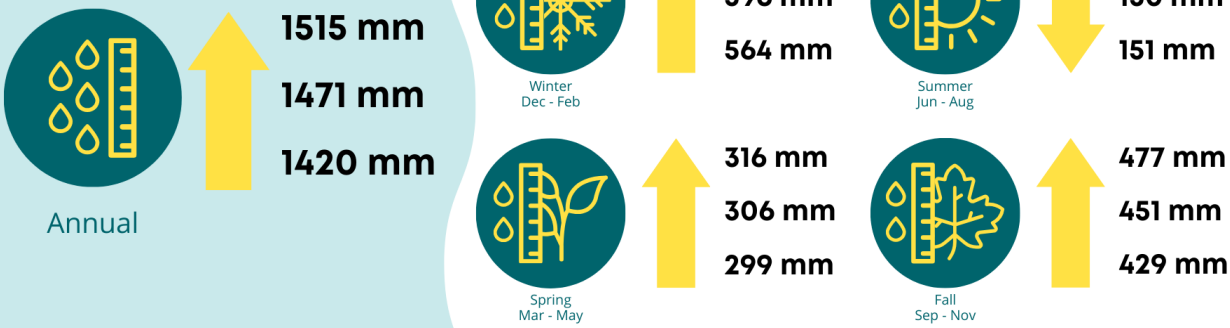
WILDFIRES

Extreme wildfire risk in western Canada continues to increase due to warmer temperatures and unchanged summer rainfall resulting in drought conditions. Warmer weather is also causing earlier snow melt and later fall frosts, all of which are expanding the fire season.

THREE TIME PERIODS: Bottom (Baseline: 1971-2000), Middle (Present/Near Future: 2021-2050), Top (Future: 2051-2080)

MEAN PRECIPITATION

Annual precipitation is expected to increase. Winter and Spring are projected to get significantly wetter, with a slight decline in the Summer.



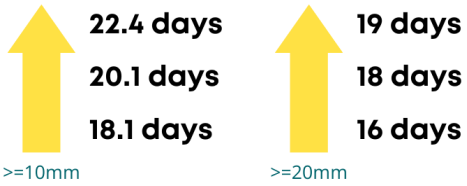
THREE TIME PERIODS: Bottom (Baseline: 1971-2000), Middle (Present/Near Future: 2021-2050), Top (Future: 2051-2080)

PRECIPITATION EVENTS

Precipitation events in general are projected to become more intense and extreme, with more rain falling over a shorter period of time.

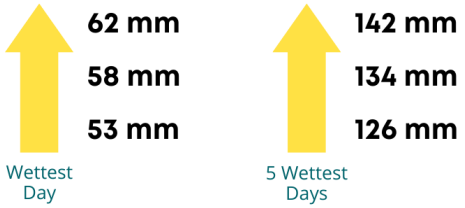
HEAVY OR EXTREME PRECIPITATION

Days with precipitation over 10mm and 20mm are considered Heavy Rainfall days, and are projected to increase.



WETTEST DAYS

The amount of precipitation falling on the wettest single day and the wettest 5 days of the year are expected to increase.



THREE TIME PERIODS: Bottom (Baseline: 1971-2000), Middle (Present/Near Future: 2021-2050), Top (Future: 2051-2080)


SEA LEVEL RISE
The relative sea level rise is estimated to be 38cm by 2080. The BC province provided guidance to communities to plan for a minimum of 50 cm of sea rise by 2050, given variability of locations and temporal, atmospheric and oceanographic factors.
38 cm
18 cm
2 cm
THREE TIME PERIODS: Bottom (Baseline: 2006), Middle (Present/Near Future: 2050), Top (2080)

Appendix C – Risk Assessment Materials

CONSEQUENCE TABLES

Social Factors

CONSEQUENCE RATING	SOCIAL FACTORS			
	Public Health & Safety	Displacement	Loss of Livelihood	Cultural Aspects
Catastrophic	Large number of fatalities or serious injuries, or permanent illness	Large number of permanently displaced people on a widespread scale	Large disturbances leading to permanent changes in people's normal routines and way of life	Unprecedented loss of cultural identity (i.e. traditions and customary practices) across the wider community (i.e. cancellation of flagship annual event)
	5	5	5	5
Major	Isolated instances of fatalities or serious injuries, or long-term illness	Isolated instances of permanently displaced people on a widespread scale	Large disturbances leading to prolonged changes in people's normal routines and way of life	Significant loss of cultural identity (i.e. traditions and customary practices) for multiple social groups
	4	4	4	4
Moderate	Small number of injuries or cases of illness	Isolated instances of temporary displaced people on a widespread scale	Moderate disturbances leading to short-term changes in people's normal routines and way of life	Moderate impact on cultural identity (i.e. traditions and customary practices) for multiple social groups
	3	3	3	3
Minor	Near misses or minor injuries	Isolated instances of temporary displaced people in localized areas	Minor and short-term changes to people's normal routines and way of life	Minor impact on cultural identity (i.e. traditions and customary practices) for a small number of social groups
	2	2	2	2
Negligible	Appearance of a threat but no actual harm	Appearance of a threat but no actual displacement	No changes to people's normal routine and way of life	Appearance of a threat but no actual impact on cultural identity (i.e. traditions and customary practices)
	1	1	1	1

Economic Factors

CONSEQUENCE RATING	ECONOMIC FACTORS			
	Property Damage	Local Economy & Growth	Community Livability	Public Administration
Catastrophic	Catastrophic damage and costs incurred by the owner ($$$$$)	City-scale decline leading to widespread business failure, loss of employment and hardship	Permanent decline in services, causing the city to be seen as very unattractive, moribund, and unable to support the community	Public administration would fall into decay and cease to be effective
	5	5	5	5
Major	Major damage and costs incurred by the owner ($$$$)	City-scale stagnation such that businesses are unable to thrive	Widespread and severe decline in services and quality of life within the community	Pubic administration would struggle to remain effective and would be in danger of failing
	4	4	4	4
Moderate	Moderate damage and costs incurred by the owner ($$$)	Isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Public administration would be under severe pressure on several fronts
	3	3	3	3
Minor	Minor damage and costs incurred by the owner ($$)	Inconveniences that cause minor shortfall relative to current forecasts	There would be minor areas in which the community is unable to maintain its current services	There would be minor instances of public administration being under more than usual stress
	2	2	2	2
Negligible	No damage and costs incurred by the owner ($)	No real impact to the local economy and growth	No real pressure on current services	No real stress on public administration
	1	1	1	1

Environmental Factors

CONSEQUENCE RATING	ENVIRONMENTAL FACTORS			
	Air	Water	Soil & Vegetation	Ecosystem Function
Catastrophic	Very frequent periods of reduced air quality.	Irreversible, widespread reduction in water quality/quantity	Irreversible, widespread impacts to soil or vegetation	Major and widespread loss of ecological functions and irrecoverable damage
	5	5	5	5
Major	Considerable increase in periods of reduced air quality in the medium term	Major, widespread reduction in water quality/quantity in the medium/long-term	Major, widespread impacts on soil or vegetation in the medium/long-term	Severe and widespread loss of ecological functions and damage that could be reversed with intensive efforts
	4	4	4	4
Moderate	Moderate increase in periods of reduced air quality in the short/medium term	Moderate, widespread reduction in water quality/quantity in the short/medium-term	Moderate, widespread impacts on soil or vegetation in the short/medium-term	Isolated but moderate instances of damage to the ecosystem that could be reversed with intensive efforts
	3	3	3	3
Minor	Minor increase in periods of reduced air quality in the short term	Minor, localized reduction in water quality/quantity in the short-term	Minor, localized impacts on soil or vegetation in the short-term	Isolated but minor instances of damage to the ecosystem that could be reversed
	2	2	2	2
Negligible	Appearance of a threat but no real impact to air quality	Appearance of threat but no real reduction in water quality/quantity	Appearance of threat but no real impacts on soil or vegetation	Appearance of a threat but no real damage to the ecosystem and its functions
	1	1	1	1

Appendix D - Detailed Vulnerability and Risk Assessment Results

(starts on the next page)

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Built 1: Increase in extreme weather events, such as wind and rain storms causing power outages, resulting in a loss of essential building services (heating, cooling, hot water) without backup power.	4	9	36	Medium-Low	11	44	Medium	5	20	Low	25	100	Medium-Low
Built 2: Increase in average summer temperatures and hot days causing an increased demand for indoor space cooling, resulting in electrical overloads, and increased maintenance, water consumption, and decreased life of cooling equipment.	4	13	52	Medium	9	36	Medium-Low	10	40	Medium-Low	32	128	Medium
Built 3: Increase in average summer temperatures and hot days causing an increased demand for indoor space cooling, resulting in increase in power shortages or outages.	2	12	24	Low	8	16	Very Low	9	18	Low	29	58	Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Built 4: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires, resulting in damaged/destroyed buildings and infrastructure assets.	3	12	36	Medium-Low	13	39	Medium-Low	13	39	Medium-Low	38	114	Medium-Low
Built 5: Increase in wildfire conducive conditions causing wildfires within the region, and an increase in extreme weather events, causing damaged power infrastructure, resulting in increased frequency and duration of electrical power disruptions.	2	11	22	Low	12	24	Low	7	14	Very Low	30	60	Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Built 6: Sea level rise causing increased tidal height and erosion resulting in damage to sewer line.	1	5	5	Very Low	10	10	Very Low	11	11	Very Low	26	26	Very Low
Built 7: Increased average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing crusted/hydrophobic soils, and increased frequency and intensity of precipitation events causing flooding, resulting in cliff erosion, and damage/loss of buildings, infrastructure, property and lands located near cliffs.	2	14	28	Low	13	26	Low	11	22	Low	38	76	Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Built 8: Increased frequency and intensity of precipitation and other extreme weather events causing flooding over roads, pathways and bridges, resulting in disruptions to transportation networks, including inaccessibility, accidents, threats to public safety and delays.	4	8	32	Medium-Low	9	36	Medium-Low	7	28	Low	24	96	Medium-Low
Built 9: Increased frequency and intensity of precipitation events causing flooding, resulting in damage to buildings, residential properties, utility facilities, subterranean labs and/or animal care facilities, and electrical/mechanical rooms.	5	11	55	Medium-High	13	65	Medium-High	10	50	Medium	34	170	Medium-High
Built 10: Increase in the intensity and frequency of extreme weather events, specifically with high winds and heavy snow/ice loads, causing unsecured objects to blow around and trees to be	4	10	40	Medium-Low	9	36	Medium-Low	9	36	Medium-Low	28	112	Medium-Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
damaged, resulting in damage to buildings and safety concerns.													
Built 11: Increase in intensity and frequency of precipitation events causing increased impacts on and overflow of stormwater systems, resulting in increased operations and maintenance.	3	7	21	Low	10	30	Medium-Low	10	30	Medium-Low	27	81	Low
Built 12: Increase in storm and precipitation intensity causing damage to buildings, infrastructure, and utilities, resulting in increased repair and maintenance	2	8	16	Very Low	9	18	Low	6	12	Very Low	23	46	Very Low
Built 13: Increase in average temperatures, frequency and intensity of extreme weather, and changes in precipitation patterns globally causing need for design/building standard changes, and supply chain and labour	5	10	50	Medium	17	85	Very High	7	35	Medium-Low	34	170	Medium-High

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
disruptions, resulting in delayed or more costly infrastructure repairs and new capital projects.													
Built 14: Increase in hot days causing an increased demand for indoor space cooling, resulting in increased noise from cooling systems.	3	7	21	Low	7	21	Low	4	12	Very Low	18	54	Low
Socio-Econ 1: Increased average temperatures and hot days over 30 degrees Celsius causing poor air quality and prolonged heat, resulting in discomfort, negative health impacts including increased mortality for vulnerable populations, decreased productivity, and social strain on occupants in buildings with insufficient cooling.	5	13	65	Medium-High	12	60	Medium-High	11	55	Medium-High	36	180	Medium-High

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 2: Increased average temperatures and hot days over 30 degrees Celsius causing an increased need for cooling equipment, retrofits, and power, resulting in increased building ownership and rental costs.	5	8	40	Medium-Low	9	45	Medium	4	20	Low	21	105	Medium-Low
Socio-Econ 3: Increase in hot days over 30 degrees Celsius and extreme weather events causing unsafe conditions, increased discomfort and health concerns, resulting in decreased productivity of outdoor workers and work/service disruptions for outdoor activities.	5	9	45	Medium	10	50	Medium	9	45	Medium	28	140	Medium
Socio-Econ 4: Increase in wildfire conducive conditions within the region and beyond causing an increase in wildfires, resulting in an increase in respiratory health impacts.	5	11	55	Medium-High	8	40	Medium-Low	8	40	Medium-Low	27	135	Medium

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 5: Increase in average temperatures combined with increased winter precipitation amount and intensity and decrease in summer precipitation causing crop damage, resulting in a reduction in food/crop yields and food shortages/insecurity.	3	7	21	Low	6	18	Low	4	12	Very Low	17	51	Low
Socio-Econ 6: Increase in average temperatures, extreme weather, and changes in precipitation patterns causing a decrease or loss of native habitat and species (eg. cedar), resulting in a loss of land-based knowledge, culture and language.	5	9	45	Medium	6	30	Medium-Low	4	20	Low	19	95	Medium-Low
Socio-Econ 7: Increase in extreme weather events, including extreme heat, causing inhospitable outdoor conditions, resulting in increased safety and health risks for vulnerable populations.	5	13	65	Medium-High	9	45	Medium	4	20	Low	26	130	Medium

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 8: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires at Pacific Spirit Park, resulting in mobility/transportation challenges to facilitate evacuation and increased demand for emergency services.	2	16	32	Medium-Low	16	32	Medium-Low	16	32	Medium-Low	48	96	Medium-Low
Socio-Econ 9: Increase in frequency and intensity of extreme weather events and wildfire smoke causing an impact on the learning and health of children in daycare, resulting in changes to outdoor programming and operations .	5	7	35	Medium-Low	6	30	Medium-Low	4	20	Low	17	85	Low
Socio-Econ 10: Increase in sea level rise and storm surge causing damage or loss of cultural sites, resulting in exacerbating existing social inequities and increasing burden on mental health/well-being.	4	6	24	Low	7	28	Low	4	16	Very Low	17	68	Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 11: Increase in frequency and intensity of extreme weather events causing an increase in unintended use of space (e.g. vulnerable populations seeking refuge), resulting in an increase in campus response resources.	5	10	50	Medium	10	50	Medium	4	20	Low	24	120	Medium-Low
Socio-Econ 12: Increased average temperatures and hot days over 30 degrees Celsius causing an increased demand for indoor, air-conditioned recreation space, resulting in limited access.	5	9	45	Medium	8	40	Medium-Low	5	25	Low	22	110	Medium-Low
Socio-Econ 13: Increase in extreme weather events, such as wind and rain, causing a demand in operational (clearing/maintaining property) resources resulting in a shortage of resources for non-critical facilities, travel routes and outdoor spaces.	4	7	28	Low	8	32	Medium-Low	4	16	Very Low	19	76	Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 14: Increase frequency and intensity of extreme weather events causing a negative impact on human health, resulting in a greater demand on emergency services before (e.g. education and preparedness), during (e.g. temporary shelters), and after (e.g. recovery).	4	11	44	Medium	8	32	Medium-Low	4	16	Very Low	23	92	Medium-Low
Socio-Econ 15: Increased average temperatures and hot days over 30 degrees Celsius, reduced air quality from wildfire events, and/or extreme weather events causing unsafe conditions outdoors causing rescheduling or cancelling of outdoor events (e.g. performances, sporting, cultural).	5	8	40	Medium-Low	10	50	Medium	4	20	Low	22	110	Medium-Low
Socio-Econ 16: Increased extreme weather events creating challenges and/or unsafe conditions for public transit and/or active transportation,	5	6	30	Medium-Low	7	35	Medium-Low	10	50	Medium	23	115	Medium-Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
resulting in an increased reliance on personal vehicles for transportation and their associated GHGs.													
Socio-Econ 17: Increase in frequency and intensity of extreme weather events causing academic disruptions resulting in mental health impacts on students and faculty (e.g. class and exam rescheduling, research delays)	5	10	50	Medium	7	35	Medium-Low	4	20	Low	21	105	Medium-Low
Socio-Econ 18: Increase in frequency and intensity of extreme weather events causing increasing the difficulty of commuting to campus, resulting in a shortage of on-site staff.	4	10	40	Medium-Low	8	32	Medium-Low	6	24	Low	24	96	Medium-Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Socio-Econ 19: Increase in average temperatures, frequency and intensity of extreme weather, and changes in precipitation patterns causing frequent physical and mental health impacts on UBC community members such as heightened health risks due to increase presence of diseases (e.g. lyme disease in tick bites), poor weather conditions causing physical injuries (e.g. snow clearing causing back injury), aggravation of existing conditions (e.g. smoke effects on asthma).	5	12	60	Medium-High	9	45	Medium	4	20	Low	25	125	Medium
Socio-Econ 20: Increase in frequency and intensity of extreme weather events causing more frequent property damage (e.g. building, vehicles), resulting in increased legal, financial and insurance implications.	3	4	12	Very Low	8	24	Low	4	12	Very Low	16	48	Very Low

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Socio-Econ 21: Increase in climate change impacts globally causing students, staff and visitors from away to be unable to return home, resulting in increased demand on UBC resources and supports.	2	8	16	Very Low	8	16	Very Low	4	8	Very Low	20	40	Very Low
Natural 1: Increase in intensity of king tides and storm surges, all causing soil erosion, and reducing plant survival, resulting in land and habitat loss, and cliff collapse.	3	9	27	Low	11	33	Medium-Low	14	42	Medium	34	102	Medium-Low
Natural 2: Increased average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation and increased frequency and intensity of precipitation events causing crusted/hydrophobic soils resulting in increased instances of flooding, and cliff erosion, and damaged/dead vegetation.	3	10	30	Medium-Low	9	27	Low	13	39	Medium-Low	32	96	Medium-Low

Impact	Likelihood (/5)	Social score (/20)	Social (/100)	Social Risk Ranking (across spectrum)	Economic Score (/20)	Economic (/100)	Economic Risk Ranking (across spectrum)	Environmental Score (/20)	Environmental (/100)	Environmental Risk Ranking (across spectrum)	Consequence Total (/60)	Total Risk Score (/300)	Total Risk Ranking (across spectrum)
Natural 3: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing drought conditions and water restrictions, resulting in limited available water to establish and maintain plants, especially manicured landscapes.	5	8	40	Medium-Low	10	50	Medium	16	80	Very High	34	170	Medium-High
Natural 4: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing a reduced supply of local seeds and native flora and fauna, resulting in a loss of culture.	3	6	18	Low	6	18	Low	6	18	Low	18	54	Low
Natural 5: Increased sea levels causing coastal erosion, resulting in damage/destruction of coastal infrastructure, recreational space and habitat.	3	11	33	Medium-Low	7	21	Low	12	36	Medium-Low	30	90	Medium-Low

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Natural 6: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing low flow in ephemeral creeks, resulting in changes to the boundaries of waterbodies and species composition.	5	4	20	Low	5	25	Low	15	75	High	24	120	Medium-Low
Natural 7: Increase in hot days over 30 degrees Celsius resulting in increased exposure of marine life during low tide, resulting in the loss of marine life and biodiversity.	4	5	20	Low	4	16	Very Low	6	24	Low	15	60	Low
Natural 8: Increase in average and extreme temperatures paired with a decrease in summer precipitation creating conditions conducive to wildfires, causing wildfires, resulting in damage/destroyed natural environments and ecosystem changes and connectivity, specifically at Pacific Spirit Park.	5	16	80	Very High	16	80	Very High	16	80	Very High	48	240	Very High

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Natural 9: Increased frequency and intensity of precipitation events causing increased sediment load and contaminant/pollutant runoff, resulting in a decrease in water quality.	4	6	24	Low	4	16	Very Low	7	28	Low	17	68	Low
Natural 10: Increase in average temperatures and hot days over 30 degrees Celsius combined with low summer precipitation causing a decrease in available fresh water and degredation of soil quality, resulting in increased species mortality and extripation.	4	6	24	Low	7	28	Low	9	36	Medium-Low	22	88	Medium-Low
Natural 11: Increase in average temperatures and changes to seasons causing changes to migration patterns and mis-alignment of the phenology of plants and their pollinators, as well as in intensity of precipitation events causing flooding and soil depletion and nutrient	3	7	21	Low	10	30	Medium-Low	9	27	Low	26	78	Low

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loss, resulting in a reduction in food crops.													
Natural 12: Increase in average temperatures causing shifts in eco-regions and increased survival and spread of invasive species and pests, resulting in biodiversity loss, the decrease of native flora and fauna survival, and ecosystem stress.	4	12	48	Medium	10	40	Medium-Low	16	64	Medium-High	38	152	Medium
Natural 13: Increase in the frequency and intensity of extreme weather such as rain and wind causing damage to green and grey infrastructure, resulting in temporary or permanent closures of parks, trails, green spaces etc.	2	10	20	Low	12	24	Low	7	14	Very Low	29	58	Low
Natural 14: Increase in average temperatures, extreme weather, and changes in precipitation patterns causing damage to trees and natural features,	5	10	50	Medium	11	55	Medium-High	13	65	Medium-High	34	170	Medium-High

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resulting in a loss of biodiversity and ecosystem goods and services, including cooling and shading.													