ATTACHMENT 1

MUNICIPALITY OF NORTH cowichan

PHASE 2 SUMMARY REPORT

NORTH COWICHAN CLIMATE VULNERABILITY & RISK ASSESSMENT

December 22, 2023

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APPENDICES

1.0 PROJECT INTRODUCTION

The Municipality of North Cowichan ("MNC," "North Cowichan," or "the Municipality") is in the process of conducting a climate risk and vulnerability assessment and developing a climate adaptation strategy. The scope of work has three phases as shown in Figure 1.

Figure 1: Project Phases

These phases aim to achieve the following objectives:

- Understand local context and climate hazards of concern for residents of the Municipality, First Nations, and other local stakeholders, businesses, and non-profits.
- Determine the Municipality's vulnerabilities to climate hazards and identify strengths and gaps that exist in municipal services and opportunities for regional collaboration.
- Identify and evaluate risks to support the prioritization of time and resources for adaptation.
- Create an adaptation strategy that outlines actions to treat and manage high-priority risks.

This summary report provides an overview of the findings of **Phase 2 – Conduct a Vulnerability and Risk Assessment.** The primary purpose of Phase 2 is to evaluate key areas of concern and determine priority risks to focus on in the development of the Climate Change Adaptation Strategy through **Phase 3**. To accomplish this, a vulnerability assessment was conducted for each service area by climate hazard. The findings from the vulnerability assessment informed the creation of a risk register that captures the primary risks posed by climate change to MNC's municipal services. MNC staff and Urban Systems evaluated the risks through a collaborative process, identifying overall themes and priorities from the results.

2.0 PROCESS AND METHODOLOGY

2.1 VULNERABILITY ASSESSMENT

The purpose of the vulnerability assessment is to identify and assess the exposure and sensitivity of MNC's service areas to the climate hazards of greatest concern. All MNC's key service areas were considered in this assessment:

1. Community Development & Planning
2. Drinking Water Treatment & Distribution
3. Environmental Stewardship
4. Forest Management
5. Government Services
6. Interment
7. Public Safety
8. Recreation
9. Stormwater Management & Flood Protection
10. Support for the Economy
11. Transportation
12. Waste Collection
13. Wastewater Collection, Treatment, and Disposal

The climate hazards included in the assessment were determined based on review of the most relevant hazards from the 2019 BC Preliminary Strategic Climate Risk Assessment and Cowichan Valley Regional District's (CVRD) 2020 Climate Change Adaptation and Risk Management Strategy. Extreme cold emerged as an additional theme through vulnerability assessment discussions and was added to the list.

1. Coastal Storm Surge & Sea Level Rise
2. Flooding
3. Extreme Cold
4. Extreme Wind
5. Heatwaves
6. Water Shortages
7. Severe Wildfire
8. Landslides
9. Invasive Species

Several meetings were convened with Steering Committee members to gather staff knowledge on the vulnerability of each service area to the climate hazards considered in the assessment process. Each service area's interaction with a climate hazard was classified as major, minor, or insignificant according to the following four definitions:

Major: potential for substantial or complete disruption to the delivery of the service from climate hazard impacts.

Major/Minor: vulnerability of the service is significantly dependent on the magnitude of the climate hazard experienced.

Minor: partial or brief disruption to the delivery of the service from climate hazard impacts.

Insignificant: little to no disruption expected from climate hazard impacts.

In addition to this classification, specific risks of concern were extensively discussed through the initial vulnerability assessment process. This information formed the basis for the subsequent generation of risk statements and the risk assessment.

2.2 RISK ASSESSMENT

The primary objective of the risk assessment process is to identify and evaluate risks to the services MNC provides in order to support the development and prioritization of climate change adaptation actions. The risk assessment process builds from the information gathered during the service area vulnerability assessment (above) and the engagement process completed in Phase 1 of the project.

The risk assessment process is grounded in risk fundamentals. Risk is a function of the likelihood (i.e., probability) of an event happening and the consequence (i.e., impact) of that event happening. It is important to understand these two drivers and their contribution to overall risk, as different climate adaptation options may or may not be applied depending on these factors, in addition to other contextual considerations deemed appropriate.

To assess the risks of climate hazards, risk statements were generated using data gathered throughout the vulnerability assessment process and Phase 1 of the project. A risk statement describes the impact that could result from a climate hazard's occurrence (see example in Box 1). The risk statements were captured in an Excel based risk register, categorized by service area and climate hazard. The generation and review of risk statements was a collaborative process, with a high level of engagement from the Steering Committee.

Box 1: Risk Statement Example

"Extreme heat events exceed the cooling capacity of municipal buildings."

Once the risk statements were finalized, Urban Systems and MNC staff collaborated to rate the likelihood and consequence of the risks on 5-point scales that considered local contextual knowledge, specific service area expertise, and local climate projections from the CVRD. The results of the risk assessment were reviewed with the Steering Committee on December 4th, 2023. The risk rating process followed a Risk Rating Guide developed for the assessment (Appendix A). The likelihood and consequence scores were multiplied together to determine the final risk score and qualitative risk rating (Special[1], Low, Medium, High, Very High), as shown in Figure 2.

[1] Special risk scores are categorized as those that were scored a five for consequence and a one for likelihood or vice versa. This would typically result in a 'medium' risk rating; however, it is often prudent to consider these risks closely. For example, the risk of invasive species is considered high likelihood, but relatively low consequence as invasive species management is part of regular parks maintenance and operations.

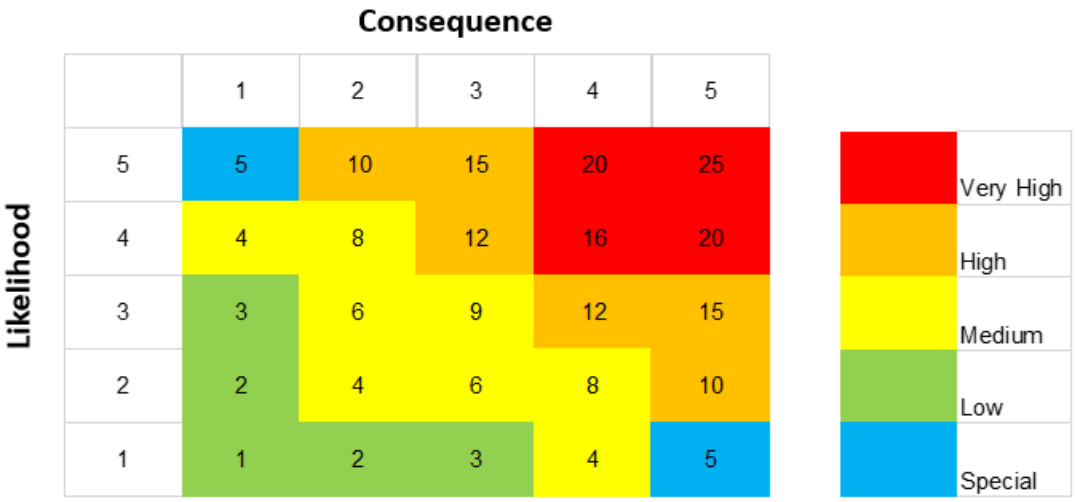

Figure 2: Risk Rating Table

3.0 RESULTS

3.1 VULNERABILITY ASSESSMENT RESULTS

Key observations on the results of the vulnerability assessment included:

- Generally high service vulnerability to Flooding and Severe Wildfire; all service areas have a major/minor vulnerability to at least one of these two climate hazards.
- Environmental Stewardship, Recreation, and Support for the Economy service areas have the highest distribution of major vulnerabilities to climate hazards.
- Landslides and Extreme Cold have the lowest amount of major vulnerability interactions with service areas.

3.2 KEY RISK ASSESSMENT RESULTS

A total of 80 risk statements were generated. The number of risk statements by risk rating is shown below in Table 1.

Table 1: Number of Risk Statements by Rating

Risk Rating	Number of Risk Statements
Very High	5
High	16
Medium	36
Low	22
Special	1

The risk assessment results by climate hazard are shown in Figure 3. Key risk themes for each climate hazard are outlined in detail in the following sections.

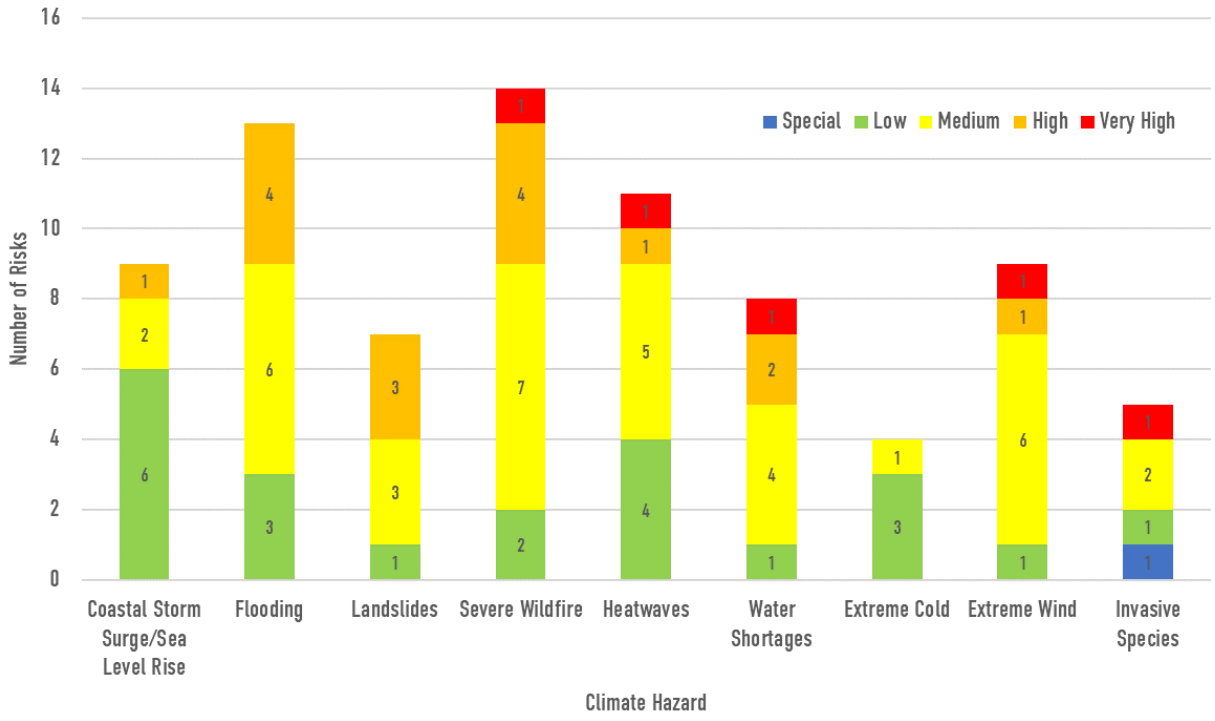

Figure 3: Risk Assessment Results by Climate Hazard

Some key observations emerged from Figure 3:

- The climate hazards with the highest number of risk statements were Severe Wildfire (14), Flooding (13), and Heatwaves (11).
- The climate hazards with the highest number of risks rated Very High or High were Severe Wildfire (5) and Flooding (4).

To situate these results in the context of existing climate risk assessments, the key risk themes are presented along with the results of the B.C. Preliminary Strategic Climate Risk Assessment[2] and the CVRD Climate Change Risk Assessment[3] as well as insights into MNC's historic experience with each climate hazard and existing risk management practices.

[2] B.C. Ministry of Environment and Climate Change Strategy. (2021). Preliminary Strategic Climate Risk Assessment for British Columbia. Note: The Likelihood and Consequence rating scales used in the B.C. assessment differ from those used in this assessment.
[3] Cowichan Valley Regional District. (2021). Climate Change Adaptation and Risk Management Strategy.

COASTAL STORM SURGE & SEA LEVEL RISE

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** assesses coastal storm surge as Medium Risk, with greatest consequences on social functioning and economic vitality and Major consequences related to health, natural resources, and provincial government costs. While severe coastal storm surges are presently Almost certain not to happen, their likelihood is projected to increase by 2050 due to an increased depth and frequency of coastal flood events caused by projected sea level rise. The **CVRD Climate Change Risk Assessment** identified storm surges as a concern with respect to damage to infrastructure and energy transmission systems. Parts of **MNC** are coastal and exposed to this hazard, although steep terrain has limited the potential impacts.

Key Risk Themes

High Risks

- Displacement and/or damage to established natural marine habitats (ex. estuaries, salt marsh).

Medium Risks

- Damage and/or service interruptions to coastal transportation infrastructure (roads, wharves) in areas at or near sea-level.
- Long-term sea-level rise and storm surge events impact the operations of major employers located along the coastal area, potentially impacting the local economy.

Connection to Phase 1

Phase 1 Component		Connections
CVRD		• CVRD assessment identified sea level rise as impacting grey and green infrastructure
Indigenous Engagement		• Sea level rise is a focus for the Lyackson Nation
Interested Party Engagement		• Western Forest Products identified sea level rise impacting its Cowichan Bay site as a priority concern
Supporting Information		• CVRD Coastal Sea Level Rise Risk Assessment • Biodiversity Assessment Report

FLOODING

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** assessed flooding as Medium Risk. Climate change is projected to result in increased precipitation, more frequent heavy rain events, and greater snowmelt due to increased temperatures. Although there is annual variability in the location and severity of flooding, these climatic changes are expected to increase the frequency of moderate and major flood events and could include repeat flooding in specific locations or more flood events occurring in multiple communities over the same flood season. Because of this, the likelihood rating of flooding is projected to increase from Unlikely to Possible by 2050. The B.C. Assessment determined the greatest consequences to be the loss of infrastructure services and loss of social cohesion. The **CVRD Climate Change Risk Assessment** also identified these as consequences of flooding. **MNC** experiences regular flooding in the community, and areas of highest risk have been historically identified. Because of this, significant investments have already been made in adapting to flooding in the community.

Key Risk Themes

High Risks

- Damage and/or service interruptions to built assets (road network, drinking water system, flood protection/drainage systems) and natural assets (terrestrial and riparian habitats).

Medium Risks

- Service interruptions to recreation, wastewater collection and treatment, waste collection, and financial impacts of flood response and recovery.

Connection to Phase 1

Phase 1 Component		Connections
Public Engagement		• Flooding was highlighted as one of the most commonly observed impacts to municipal services from climate change
CVRD		• Flooding is the CVRD's hazard of greatest concern
Indigenous Engagement		• The Halalt Nation is significantly impacted by flooding • Erosion is causing loss of the Halalt Nation's reserve land
Interested Party Engagement		• Western Forest Products identified flooding on Tzouhalem Road as a priority concern
Supporting Information		• Official Community Plan Floodplain Maps • Lower Chemainus Flood Mapping and Management Plan • Sediment Transport Study, Chemainus River • Lower Cowichan-Koksilah River Flooding Study • Regional Dam Safety Reviews and Risk Assessments • Risk Assessment of Floodplains

LANDSLIDES

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** assessed the risk of landslides resulting from extreme precipitation, which it identified as Medium Risk. Though precipitation-driven landslides are currently Unlikely, they are expected to become more frequent by 2050 due to heavy precipitation, warming temperatures, and rain-on-snow events projected to occur with climate change. The highest consequences of landslides relate to loss of economic productivity and infrastructure services. The **CVRD Climate Change Risk Assessment** (CVRD Assessment) noted that mountainous regions of the CVRD are at high risk of landslides, heightened by the elevated likelihood of heavy precipitation that may trigger these landslides. The CVRD Assessment also projected that landslide events will become more frequent and severe due to climate change, which has impacts on its emergency management and regional planning. **MNC** has known areas of steep slopes as identified in the Official Community Plan Bylaw, and recent slope sluffing in geohazard prone areas has required road closures to mitigate risk to the public.

Key Risk Themes

High Risks

- Considerations for landslide risks to existing and planned developments and transportation routes
- Damage to terrestrial and aquatic habitats.

Medium Risks

- Damage to infrastructure and/or disruption in service for drinking water system and stormwater system.

Connection to Phase 1

Phase 1 Component		Connections
CVRD		• The CVRD strategy identified no high level impacts from landslides, but further emergency response actions are included in actions
Supporting Information		• CVRD Climate Adaptation Strategy • Official Community Plan Hazard Maps

SEVERE WILDFIRE

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** (B.C. Assessment) assessed severe wildfire seasons as High Risk. At present, severe wildfire seasons are Possible and expected to increase to Likely by 2050 due to increasing temperature and dry fuel load and decreasing summer precipitation. The consequences of severe wildfire seasons are Major to Catastrophic across all assessed categories. The **CVRD Climate Change Risk Assessment** (CVRD Assessment) supports the B.C. Assessment of severe wildfire risk, noting the infrastructure damage and service interruption caused by wildfires. Additionally, the CVRD Assessment outlined specific vulnerabilities to severe wildfires in communities that are rural

and rely on their own water and sewer infrastructure. The vulnerability of **MNC** communities to wildfires is due to the decentralised ownership and control of land, as well as their being surrounded by the Municipal Forest Reserve. The Community Wildfire Protection Plan and vehicle gate closures during periods of high wildfire risk are in place to help reduce the risk of both natural and human-caused wildfires.

Key Risk Themes

Very High/High Risks

- Developable areas are limited due to increased wildfire protection requirements, capital costs, and insurance premiums.
- Impacts to the Municipal Forest Reserve, a major natural asset and recreational amenity, and biodiversity loss.
- Damage and/or service interruptions to the drinking water system and business continuity of government services.

Medium Risks

- Damage to infrastructure and/or disruption in service for wastewater (e.g., sanitary mains, sewage spills), stormwater (e.g., deadfall, sediment build up) and transportation (e.g., bridges, culverts).

Connection to Phase 1

Phase 1 Component		Connections
CVRD		• The CVRD strategy identified no high level impacts from wildfire except for smoke inhalation, but mitigation efforts are included in actions
Interested Party Engagement		• Island Health identified severe wildfire as one of the priority concerns (health impacts from air quality)
Supporting Information		• CVRD Emergency Preparedness Website, including FireSmart • Community Wildfire Protection Plan

HEATWAVES

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** (B.C. Assessment) assessed heatwaves as High Risk due to their Likely occurrence and widespread and significant consequences for the province's health, social functioning, natural resources, economic vitality, and government costs. Most notable are the Catastrophic consequences of heatwaves such as loss of life and morbidity; injury, disease, or hospitalization; and psychological impacts. By 2050, it is expected that extreme heat days will become more common due to an increase in both average and extreme temperatures caused by climate change. Aligned with this assessment, the **CVRD Climate Change Risk Assessment** notes that heatwaves necessitate improvements of infrastructure resilience. **MNC** has recently experienced heatwaves that have impacted municipal operations and community health.

Key Risk Themes

Very High/High Risks

- Impacts to lake water quality affecting ecosystem health and human health (e.g., toxic blue-green algae, reduced dissolved oxygen).
- Reduced outdoor work activity decreases the level of service for operational and recreational assets (e.g., Park maintenance, construction/repair projects).

Medium Risks

- Increased demand for recreational facilities as cooling centers.
- Reduced effectiveness of natural stormwater management features.
- Impacts on tree growth in young plantations in the Municipal Forest Reserve.

Connection to Phase 1

Phase 1 Component		Connections
Public Engagement		• Through online engagement, extreme heat was identified as the most common climate hazard that has been experienced by the public
CVRD		• The CVRD strategy identified heatwaves as impacting human health
Interested Party Engagement		• Social Planning Cowichan highlighted the outsized impacts of climate change on most vulnerable population and identified unhoused population as particularly impacted by extreme heat • Western Forest Products identified heatwaves impacting business operations as a priority concern
Supporting Information		• Parks and Trails Master Plan • CVRD HRVA

WATER SHORTAGES

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** assessed both long-term and seasonal water shortage, both of which were assessed as High Risk. Presently, seasonal water shortage is Likely and is expected to increase to Almost certain by 2050 due to increasing temperatures and changes in precipitation form, timing, and intensity. There is a large degree of uncertainty regarding how changing climatic conditions will affect the likelihood of long-term water shortages. The B.C. Assessment identified seasonal water shortage consequences across all categories, with the greatest relating to loss of economic productivity. The consequences of long-term water shortages are rated slightly higher overall. In addition to these consequences, the **CVRD Climate Change Risk Assessment** identified additional consequences on forestry industry in the long-term due to increased water costs as well as on emergency response operations, which will require additional planning to ensure community health and resilience when facing long-term water shortages. **MNC**'s primary drinking water supply is groundwater aquifers,

and these have been extensively studied and are not assessed to be at risk of depletion due to water shortages. There has been no observed relationship to date between surface water shortages and groundwater shortages. Surface water sources, however, have been significantly depleted during water shortages.

Key Risk Themes

Very High/High Risks

- Impacts on aquatic habitats and other sensitive ecosystems.
- High water demands combined with water restrictions impact the level of service for the water system.
- Low flows in Cowichan River impact dilution levels of treated effluent from the Joint Utilities Sewage Lagoons Treatment Plant. (Process is underway to move effluent disposal out of the river).

Medium Risks

- Increased tree mortality in the Municipal Forest Reserve.
- Challenges for businesses and industry impacted by municipal bylaws and provincial restrictions.
- Potential risks to community growth when additional water sources and licensing from the province are required.
- Impacts to recreational assets (e.g., maintenance timing for aquatic facilities).

Connection to Phase 1

Phase 1 Component		Connections
Public Engagement		• Water restrictions are one of the most commonly observed impacts to municipal services
CVRD		• Water shortages impact green growth and sustainable development, ecosystems, and bioregional carrying capacity
Indigenous Engagement		• Droughts are affecting water resources and cultural practices of Halalt Nation
Interested Party Engagement		• Stakeholders (Island Health and Paper Excellence) highlighted droughts as a priority concern
Supporting Information		• CVRD Climate Adaptation Strategy • CVRD Climate Projections • Water Supply and Treatment Technical Memo • State of the District's Water Supplies Technical Memo • MNC Waterworks Bylaw • Cowichan Lake Water Use Plan • Cowichan Basin Water Management Plan

EXTREME COLD

Climate Hazard Context

Neither the **B.C. Preliminary Strategic Climate Risk Assessment** nor the **CVRD Climate Change Risk Assessment** assessed the risk of Extreme Cold. In **MNC**, recent extreme cold events have impacted municipal service provision.

Key Risk Themes

Medium Risk

- Damage and/or service interruptions to drinking water distribution (e.g., water mains, pumps).

Connection to Phase 1

Phase 1 Component		Connections
Stakeholder Engagement		• Social Planning Cowichan highlighted the outsized impacts of climate change on most vulnerable populations and identified the unhoused population as particularly impacted by extreme cold

EXTREME WIND

Climate Hazard Context

Neither the **B.C. Preliminary Strategic Climate Risk Assessment** nor the **CVRD Climate Change Risk Assessment** assessed the risk of Extreme Wind. **MNC** contains a large amount of forested area. This affords residents with many opportunities for outdoor recreation, and extreme wind events have historically increased blowdown in forested areas, posing risks to outdoor recreationalists and occasionally interrupting other municipal services due to blocked roads or power outages.

Key Risk Themes

Very High/High Risks

- Tree blowdown in forested areas is a safety risk.
- Tree blowdown management and cleanup can be resource intensive.
- Tree blowdown within the community is a public safety and environmental risk.

Medium Risks

- Power outages impact service to recreation facilities, flood protection pump stations, wastewater system, government services (e.g., business administration functions, communications).
- Debris results in temporary road closures and exceeds the capacity of cleanup and disposal services.

Connection to Phase 1

Phase 1 Component		Connections
CVRD		• The CVRD strategy identified a risk of storm events affecting hydro and communications systems

INVASIVE SPECIES

Climate Hazard Context

The **B.C. Preliminary Strategic Climate Risk Assessment** assessed the risk of an increase in the invasive species, knotweed, which it deemed Medium Risk. This hazard is currently Likely and is expected to increase to Almost certain by 2050, due to increasing temperatures, precipitation, and growing degree days that encourage the spread of knotweed. While the greatest consequence is related to its impacts on species (particularly the health and abundance of native species) and ecosystems, an expansion of its range could also have consequences for infrastructure integrity. Although these potential consequences can be managed, controlling the spread of knotweed through treatment and disposal is costly for the province. As noted in the **CVRD Climate Change Risk Assessment**, Vancouver Island is one of the geographic areas most suitable for knotweed habitat. As a result, the CVRD Assessment notes the high likelihood of impacts on forestry and agricultural activities and on terrestrial and aquatic ecosystems. **MNC** staff regularly manage invasive species presence, and significantly increased presence of invasives has been observed in terrestrial and aquatic habitats in recent years.

Key Risk Themes

Very High Risk

- Impacts all habitats and ecosystems, creating a risk to environmental stewardship.

Medium Risks

- Impacts on tree planting survival and create costs and liability for developers.

Special Risk

- High likelihood of invasive species impacting various recreational activities and services, but relatively low consequence as invasive species management has become part of normal staff operations.

Connection to Phase 1

Phase 1 Component		Connections
CVRD		• The CVRD strategy identified invasive species as a threat to ecosystems and bioregional carrying capacity
Interested Party Engagement		• Island Health highlighted the importance of maintaining a healthy natural environment and ecosystem to mitigate climate impacts and positively influence human health

Supporting Information		• CVRD Climate Adaptation Strategy • Biodiversity Assessment Report • MNC Invasive Species Website • MNC Nuisance Abatement and Cost Recovery Bylaw

4.0 NEXT STEPS

The final Phase (Phase 3) of the project is the development of a Climate Change Adaptation Strategy. Throughout the previous phases of the project, the following key questions have been explored to inform where MNC should prioritize resources to generate the highest impact in advancing climate adaptation:

- Where are climate hazard impacts already happening?
- What climate hazards are of greatest concern to the community, today and in the future?
- Where does resilience already exist?

With this information, Urban Systems and the Steering Committee will work together to develop adaptation strategies for high-priority risks. The strategy will be developed in parallel with other community planning processes in mind to support its implementation, such as asset management planning. The final strategy will serve as a practical guide to implementing climate change adaptation actions to enhance existing resilience and address identified gaps.

Appendix A

Risk Rating Guide

Date:	November 7, 2023
Subject:	MNC Climate Change Vulnerability & Risk Assessment

Introduction – The purpose of a risk assessment is to prioritize action by identifying and ranking risks. The assessment will support North Cowichan in prioritizing actions and allocating resources to address the most pressing climate-related threats. In Steering Committee meeting #3 we tested a framework for evaluating risk. The Steering Committee indicated that staff are the most equipped to complete the initial risk rankings.

An excel risk register tool has been developed to support staff in completing the risk rankings.

Objectives of the Tool – The tool is designed to leverage staff knowledge for input on the following:

- Risk statement phrasing
- Specific contextual notes about the risk
- Likelihood ranking and rationale
- Consequence ranking and rationale

Important Note: *There can be a tendency to overthink likelihood and consequence ratings. For a high-level risk assessment, the intent is for the rating to be qualitative and subjective. It is common to get stuck thinking 'it depends.' If this happens, make a conservative assumption (i.e., leaning towards worst-case scenario) and document this in the notes/assumptions columns.*

Step-by-step Guide:

Please open the excel file and reference the following steps. Please make edits to all columns highlighted green. Columns highlighted blue are not meant to be edited.

1. Sort the file by Lead Department (column B) using the drop-down arrow in row 1 and selecting A to Z. Scroll to your department and complete the following steps for each row assigned to your department.
2. Review the phrasing of the risk statement (column E). Does it capture the essence of the risk? Please add any suggested edits to the Risk Statement Notes (column G).
    a. *Note the risk statement is meant to be simple and capture the risk at a high-level. More detailed contextual information can be added to the risk statement notes (column G)*
3. Review and add to the risk statement notes (column G). Note specific locations, infrastructure, services and/or staff roles associated with the risk statement.
    a. *Note that some risk statements have notes that were captured from previous project activities, whereas some do not.*
4. Choose a likelihood rating between 1 and 5 (column I) using the criteria table and guiding questions below. Select rationale options that supported your rating using the drop-down menus in column J and column K. Add additional notes and assumptions (column L).
5. Choose a consequence rating between 1 and 5 (column M) using the criteria table below. Select a primary and secondary rationale using the drop-down menus in column N and column O. Add additional notes and assumptions (column P).
6. Optional – One final opportunity to add any additional notes on the risk and/or ratings (column R).

Thank you for your time, effort and knowledge in support of the climate change risk assessment. If you have questions while working through the excel tool, please contact Aaron Coelho at Urban Systems:

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