

# STRATEGIC SUMMARY FOR POLICY MAKERS

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CO-CREATING NEW KNOWLEDGE FOR UNDERSTANDING RISK AND RESILIENCE IN BC

# STRATEGIC SUMMARY FOR POLICY MAKERS

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# THE CONTEXT

### URGENT NEED FOR ACTION

In 2015, countries around the globe came together to endorse several major global agreements: the Sustainable Development Goals (SDG2030), the Paris Agreement for climate change, and the Sendai Framework for Disaster Risk Reduction (2015-2030).<sup>1</sup> These agreements specifically recognize resilience as the unique opportunity to enhance coherence across policies, plans, institutions, goals, indicators, and monitoring systems to move towards a unified objective of ending poverty, protecting the environment, and ensuring that all people enjoy peace and prosperity.

The 2021 heat dome, wildfires, and damaging floods in BC have had devastating impacts and are serious warning signals of the negative impacts of climate change. These events further underscore the reality that there will be more events in the future that exceed historical events with greater magnitude, increased frequency, new locations, different timing, and new complexity. The experience of COVID-19 pandemic impacts and responses has taught us firsthand how disasters are complex events with intertwined and cascading impacts across systems in our society. In the Sixth Assessment Report of Working Group I, the Intergovernmental Panel on Climate Change (IPCC) established that global warming will reach or exceed 1.5°C by the early 2030s—much earlier

than previously projected. This makes accelerating action to address climate risks even more urgent.

We must manage risks from natural, biological, and technological hazards, and from climate change, in a comprehensive and collaborative manner across all sectors and at all levels to mitigate disaster risk. Success in this endeavor requires the whole of society to first understand the risks, including the drivers and interdependencies across society, and know their role in collaboratively managing these risks.

### THE VALUE OF THE RESILIENCE PATHWAYS REPORT

In 2018, the Province of British Columbia was the first province in Canada to adopt the Sendai Framework. The Province, under the leadership of Emergency Management BC (EMBC), is in the process of modernizing the *Emergency Program Act* (EPA). This process is paying strong attention to the key components and guiding principles<sup>2</sup> of the Sendai Framework, especially as they relate to the shift to disaster risk reduction (DRR) as a holistic approach to manage risk with the goal of preventing new and reducing existing disaster risk and increasing preparedness for response and recovery. In early 2021, BC Ministry of Environment (MoE) released the draft Climate Preparedness and Adaptation *Strategy* and released the Actions for 2022-2025 in June 2022. The **Resilience Pathways Report provides** findings and recommendations

# BOX A: REQUIREMENTS FOR DISASTER (AND CLIMATE) RISK MANAGEMENT BASED ON SENDAI FRAMEWORK GUIDANCE

The Sendai Framework is a very comprehensive document that was developed based on decades of lessons learned from successful and failed policies and projects in disaster risk management across the globe. Below are the key enablers for success in disaster (and climate) risk reduction outlined in the Sendai Framework (Figure 1).

- Legislative or regulatory frameworks that are used to mainstream and integrate disaster risk reduction within and across all sectors.
- Governance mechanisms that are transparent and inclusive for effective and efficient management of disaster risk
- Policy coherence and compliance, notably with the Sustainable Development Goals (SDGs) and the Paris Agreement, between national and local levels.
- Public and private sectors guided with defined roles and responsibilities for the whole of society.
- Clear time frames, targets, and indicators.
- Comprehensive assessment of disaster risk from all hazards.
- Evaluation of technical, financial, and administrative disaster risk management capacity at the local and national levels, used to inform DRR measures.
- Explicit objectives and measures aimed at preventing the creation of risk, reducing existing risk, and strengthening economic, social, health, and environmental resilience.
- Sufficient and stable financial resources dedicated to DRR.
- Mechanisms that build technical and institutional capacities of the actors to be able to implement measures.
- Strengthened mechanisms to follow up with and periodically assess and publicly report on progress.



Figure 1: Sendai Framework's Seven Global Targets (Graphic: UNDRR).



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that have the potential to influence the policies and programs that will be designed in the near future to implement the Modernized EPA and *Climate Preparedness and Adaptation Strategy.* 

The long-term vision for the Resilience Pathways process is to biannually reassess climate-related issues and opportunities and to serve as a strategic resource for decision makers. In addition, this process and ensuing reports offer a mechanism with which to monitor and evaluate progress on implementation of the Sendai Framework, the Modernized EPA, and the *Climate Preparedness and Adaptation Strategy*.

## AN OVERVIEW OF HAZARD THREATS AND GROWING RISKS IN BC

BC is exposed to a range of hazards including wildfires, earthquakes, floods, landslides, avalanches, droughts, extreme weather, volcanoes, biological threats, industrial or chemical spills, and cyber-attacks. The population is rapidly growing along with the physical assets that support the lives and economy of BC residents. Disaster risk will transform over time in relation to population growth, land-use change, new construction, building code improvements, and changing social vulnerabilities. Overall risk may increase or decrease, some types of losses may become more prominent, and the location of risk

"hot spots" may shift. Development strategies (e.g., compact or sprawled development) used to accommodate the growth can affect how hazard impacts manifest. It is critical to employ long-term measurable targets for risk mitigation efforts and integrate risk management into development strategies, thereby ensuring that disaster and climate risk created from development is not outpacing our capacity to reduce risk and respond to residual risk. In defining the resilience path forward, it is a fundamental necessity to understand the drivers of threat from all hazards, learn the lessons from past inappropriate development, integrate Indigenous Knowledge, and define tolerable levels of risk in regional planning.

### PEOPLE

BC, with 9,950 km<sup>2</sup> of land, encompasses ~8% of the total developed area of Canada and is home to more than 5.1 million people, or approximately 13% of the national population. There are ~269,000 Indigenous people living in BC of First Nations, Métis, and Inuit origin. There are 198 distinct First Nations in BC. each with their own unique traditions and history. Most Indigenous people (60%) live in cities, towns, and villages throughout the province, with the remaining living on designated First Nations reserve lands.<sup>3</sup> BC's densely settled metropolitan regions are home to 88% of the province's total population and cover about 48% of BC's land area; 11% lives in rural and remote settings (Figure 2a).

Disasters can have many social

impacts, including displacement, disrupted social cohesion, decreased mental health, domestic violence, and disrupted child and youth education and socialization. The social and cultural impacts of disasters are generally not tracked well, poorly understood, and not effectively managed.

It is critical to employ long-term measurable targets for risk mitigation efforts and integrate risk management into development strategies, thereby ensuring that disaster and climate risk created from development is not outpacing our capacity to reduce risk and respond to residual risk.

The most vulnerable people are disproportionately affected by disasters and climate change impacts, and certain social groups are particularly vulnerable to crises: female-headed households, children, persons with disabilities, displaced persons, sexual and gender minorities, those in poverty, those experiencing racial or social inequality or who are impacted by colonialism and systemic racism, and older people are often affected more strongly by the impacts of events.



The existing social inequities in BC are exacerbated by the impacts of disaster and climate change. The root causes of social vulnerability lie in a combination of geographical location, income level, cultural and social status, gender, access to services, personal agency, and justice.<sup>4</sup> As of 2018, one in nine people<sup>5</sup> in Canada live in poverty. Low-income populations often live in low-cost, vulnerable buildings, and in both urban and rural regions they have fewer resources to allow them to adjust to changing climatic conditions or cope with extreme events.

### **BUILT ENVIRONMENT**

There are ~1.2 million buildings in BC, with an estimated replacement cost of \$1.42 trillion.<sup>i</sup> Nearly three quarters of all buildings (74%) are single-family urban and rural residential homes where ~45% of the population lives (2.1 million people). The rest live in multi-storey buildings in higherdensity multi-family residential and mixed-use neighbourhoods. Nonresidential buildings account for ~41% of the total capital asset value (\$587 billion), followed by multi-family buildings (30%; \$426 billion) and single-family homes (28%; \$404 billion).

Today, the BC Building Code, which is based on the National Building Code of Canada, has provisions for earthquakes but is largely silent on flood and wildfire resistance and resilience measures. Moreover, when it comes to seismic resilience, an

<sup>i</sup> All values in Canadian dollars.



overwhelming majority of structures in the existing building stock were designed and constructed using building codes with low levels of seismic provision. For example, in Vancouver, over half of the 90,000 buildings were built prior to 1974 and have no or little seismic resistance, leaving residents and workers vulnerable to disruption, displacement, injury, or loss of life.

People and businesses rely on critical infrastructure (CI) assets and services, such as transportation networks, clean water, sanitation, power, recreation facilities, a vast array of local and provincial services, and far more. There are ten CI sectors as defined by the Government of Canada: energy and utilities, finance, food, transportation, government, information and communication technology, health, water, safety, and manufacturing.<sup>6</sup> Infrastructure demand has outpaced investments for several decades and population growth in the near future will put significant pressure on all CI systems, especially the transportation and trade corridors.<sup>7</sup> Many CI systems are aging and vulnerable to various hazards, especially with the changes in intensities and frequencies of climate hazards. Damage and disruption to CI can have significant health, economic, and social impacts on society.

## HOT SPOTS

Areas of considerable, high, and extreme multi-hazard threats across the province (where assets are exposed to damaging hazard events)

are presented in Figure 2b. Hotspot areas with a potential for significant levels of damage and socioeconomic disruption are concentrated in the Lower Mainland and Vancouver Island regions and collectively affect more than 90% of the total population (~3.6 million people). Profiles of hazard threat are influenced primarily by potentially catastrophic earthquake and related tsunami events along the active plate margin of western North America, and by the combined effects of flood, landslide, and wildfire events that occur on a more regular basis along river valleys and major transportation corridors throughout BC.

### PAST DISASTER TRENDS IN CANADA AND BC

Disasters, especially hydrometeorological events, have been increasing in frequency and cost across Canada and in BC (Figure 3). Since 1970, the Government of Canada has paid out an estimated \$8.5 billion dollars in post-disaster assistance through the federal **Disaster Financial Assistance** Arrangements (DFAA) to assist provinces and territories with response and recovery costs. Of these costs, 97% occurred in the past 25 years, and more than one-third occurred in the past six years alone, which indicates that disasters are increasing in both frequency and cost.

This is mostly due to the growth of population. Canada's population has grown by 80% since 1970 and many of the assets are built on floodplains.



Figure 2: (2.a) Patterns of human settlement; (2.b) regional profiles of physical exposure in BC (Graphic: Murray Journeay).



Figure 3: Natural hazard frequency by decade and hazard subgroup in Canada, 1900-2030 (Graphic: Matt Godsoe et al.).8



The increase can also be attributed to climate change to some extent. Floods now account for nearly 75% of DFAA events and two-thirds of all DFAA payments. A significant portion of disaster events and losses occur in BC; based on the Canada Disaster Database records of events from 1900 to 2016, 15.8% of the disasters occurred in BC, with 18.7% of fatalities.

An assessment conducted by Natural Resources Canada<sup>9</sup> analysed past trends of population growth and corresponding growth of the exposure to various hazards in BC.<sup>11</sup> The study looked at population growth in areas that are likely to experience damaging hazard events. The results (Figure 4) show that profiles of flood and tsunami hazard threat in BC have increased at rates of 71% and 73%

<sup>ii</sup> The study is not a risk assessment; it does not incorporate vulnerabilities nor the probability of hazards. The study geospatially overlays the population or building assets data on hazard intensity information. respectively over a forty-year period and are comparable but lower than overall trends in population growth (76%). Wildfire and landslide hazards have increased at much lower rates (42%–61%, respectively), although approximately 45% of the dwellings in BC are located within 2 km of potentially flammable wildland fuel (this is similar to estimates in Washington and Oregon). Exposure of assets associated with catastrophic earthquake hazards have increased by more than 90% over this same period.

Lower rates of growth for wildfire and landslide hazard threats may be related to the higher growth rates in metropolitan areas. More rapid rates of growth for earthquake threats are attributed to a corresponding increase in the numbers of people moving into densely populated urban centres that are situated in areas exposed to more severe ground shaking hazards. It is anticipated that these trends will likely continue but at slower rates of growth over the next forty years.

### FUTURE DISASTER TRENDS IN BC

Climate modelling indicates that climate change will bring extreme temperatures, severe storms, rising sea levels, heavy precipitation, landslides, floods, droughts, wildfires, and other climate-related challenges. The Province completed a *Preliminary Strategic Climate Risk Assessment for British Columbia* in 2019, which evaluated the likelihood of 15 climate risk events that could occur in BC along with their health, social, economic, and environmental consequences. The key findings include:

- The greatest risks to BC are a severe wildfire season, seasonal water shortage, heat waves, ocean acidification, glacier loss, and long-term water shortage.
- Severe riverine floods and severe coastal storm surge risk events

Epoch	1975	1990	2000	2015	40-year Growth Rate
Total Population	2,660,621	3,368,910	3,865,314	4,687,192	76%
Earthquake	1,775,932	2,324,388	2,715,764	3,380,124	90%
Tsunami	172,401	217,032	247,168	298,855	73%
Flood	179,464	225,559	256,877	306,406	71%
Wildfire	144,279	170,302	184,108	204,480	42%
Landslide	310,982	382,690	429,410	499,340	61%
🗢 Total Population 🔶 Earthquake 🔶 Tsunami 🐟 Flood 🔶 Wildfire 🔶 Landslide					

Figure 4: Correlations between past growth and development over a forty-year period (1975–2015) and corresponding profiles of natural hazard threat in BC (Graphic: Murray Journeay).





Figure 5: Climate projections and impacts in BC for 2050 (Graphic: BC Ministry of Environment).<sup>10</sup>



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would have among the highest overall consequences, but their relatively low likelihood reduces their overall risk relative to other events.

- Nearly every risk event scenario would have major province-wide consequences in at least one category.
- The majority of risk events would have "catastrophic" economic consequences.

Figure 5 above outlines climate projections and impacts in BC produced as part of BC's draft *Climate Preparedness and Adaptation Strategy*, which builds on the 2019 climate risk assessment.

BC's population is expected to increase from a total of 5.1 million in 2020 to 6.5 million in 2041 at an average growth rate of 1.4% per year.<sup>11</sup> Past population growth trends (1975-2015) show that the population has nearly doubled in metropolitan regions while growth in rural and remote settlements has increased by a factor of only ~1.3 over this same period of time.<sup>12</sup> As it turns out, many of these larger metropolitan regions are situated in areas that are exposed to significant levels of natural hazard threat along the river basins and coastal zone.

The profile of the population is also changing. As BC's population continues to age, the relative proportion of senior population (age 65 and older) will increase from 19% in 2020 to 25% in 2041. New immigrants are also part of the population growth.

The result of climate change impacts combined with the growth of population and physical assets (buildings and infrastructure) is a substantial increase in disaster and climate risk, unless forward-looking measures are applied—especially related to land-use decisions for where the new assets will be placed.

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# POLICY RECOMMENDATIONS

The evaluative approach used in the Resilience Pathways Report is using resilience as the ultimate goal of all actors' efforts. Resilience is defined in the Sendai Framework terminology as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management."<sup>13</sup>

The findings and recommendations that have emerged from the articles of the Resilience Pathways Report 2022 are presented here. The key findings and recommendations are grouped under the four priorities for action of the Sendai Framework for DRR. There are also five overarching themes identified that are applicable to all four priorities for action of the Sendai Framework. To write this section, the authors have drawn on additional research and sources, including conversations with several thought leaders in the field of disaster and climate risk management in BC and Canada. It is important to recognize the significant amount of effort and investment in disaster and climate resilience by all levels of government and non-governmental actors in recent years. The recommendations here are meant to build on the existing mechanisms and use lessons, experiences, and expertise to enhance and scale disaster and climate risk management in BC.

## OVERARCHING THEMES: RE-IMAGINE DISASTER AND CLIMATE RISK MANAGEMENT

These five themes are a call to reimagine the institutional mechanisms,



approaches, and processes for protecting what we value for a prosperous life for all people in BC.

#### THEME 1: Develop strategies that outline the imagined future and are accompanied by action plans with measurable targets, timelines, and accountability.

An important common recommendation, outlined in many of the articles, is the need for developing strategies. In particular, strategies would be useful for: managing different risks at the provincial level; supporting resilience at the local level by embedding it in local development plans and mainstreaming resilience across local government departments; and the many other components of risk management that require a multihazard approach, such as community resilience, risk data management, multi-hazard early warning systems, critical infrastructure resilience, etc. Strategies need to provide a clear picture of the goal with mid- to long-term targets that are measurable and supported by mechanisms for tracking. They should be accompanied by action plans that layout timelines, budgets requirements (approved and unmet needs), and accountability for implementation.

It is critical to define measurable targets for risk reduction and resilience based on what we value and our risk tolerance for protecting them. Without targets

# BOX B: EXAMPLES OF INDICATORS FOR MEASURING PROGRESS ON ADAPTATION AND CLIMATE RESILIENCE<sup>14</sup>

#### Protecting and Improving Human Health and Wellbeing

- Percentage of Canadians living on low incomes in climate hazard areas
- Number of culturally appropriate public awareness and education campaigns to promote personal protection from climate change health effects

#### Supporting Particularly Vulnerable Regions

• Percentage of people in northern, remote, and coastal communities whose access to the land, including country foods and traditional ways of life, is impacted by slow-onset events

#### **Reducing Climate-Related Hazards and Disaster Risks**

Percentage or number of culturally and locally relevant emergency response warning systems focusing on high-risk vulnerable populations

#### **Building Climate Resilience through Infrastructure**

- Number of codes and standards reviewed, updated, and developed across the full breadth of climate hazard types and
  asset types at risk, including Indigenous-specific building programs
- Percentage of total government infrastructure spending directed to building resilience towards locally identified highpriority climate risks (as identified by community climate vulnerability assessments)
- Number of infrastructure owners and operators that have integrated climate resilience into their planning, infrastructure investments, operations, and strategy

#### Translating Scientific Information and Indigenous Knowledge into Action

- Number of community-based climate-related monitoring and adaptation programs that include Indigenous, local, and scientific knowledge
- Extent of each province and territory covered by adaptation plans incorporating climate risk assessments, designed to be updated every five years



and indicators to monitor progress in implementation, the strategies will remain as conceptual documents. See Box B for few examples of indicators recommended to the government of Canada in 2018 by an expert panel for measuring progress in climate change adaptation and resilience.<sup>15</sup> More work is needed to develop risk-based indicators and use risk models and data for progress in risk reduction.

# THEME 2: Shift from reactive to proactive governance and financing.

The current governance mechanism and budgeting for disaster risk management in all hazards is built on emergency response and recovery approaches of the past. As a result, the design of policies, funding, and programs are mostly reactive-including to the most recent disaster events in BC. A more strategic and proactive approach would apply our understanding of hazards and risks alongside climate change impacts, sources and drivers of vulnerabilities, priority objectives, and long-term goals for safety and prosperity. The current and ongoing process of the EPA Modernization, the National Adaptation Strategy,<sup>16</sup> and BC's Climate Preparedness and Adaptation Strategy, along with the political and social momentum for managing the climate crisis, triggered by catastrophes in BC in 2021, provide excellent opportunities to shift from reactive to anticipatory governance and financing for reducing disaster and climate risk.

#### THEME 3: Embrace Indigenous Knowledge and practices because they contain the true principles of sustainability and resilience for everyone.

The decisions of the past have shaped today's realities and the decisions of today are shaping the future. To effectively manage disaster risk exacerbated by climate change, we need to shift from the current approach of seeing the land and natural assets as a resource for extraction and instead choose a path that builds a sustainable relationship with the natural world and resilience of future generations. Indigenous Peoples have been adapting to changing climates and conditions for countless generations, and Indigenous Knowledge is typically founded on direct observation and interaction with the natural world over a long period of time. It is connected to land, water, air, and all life, language, spirituality, values, and sovereignty.

Understanding and embracing Indigenous Knowledge for living in harmony with nature is critical not only for the work that is needed in building the resilience of Indigenous communities but also for the shift that we need to protect BC's people and prosperity for future generations.

THEME 4: Redesign governance mechanisms to merge disaster risk reduction and climate change adaptation, recognizing commonalities particularly between risk mitigation and climate adaptation.

Building the resilience of people, economies, and natural resources to the impacts of slow-onset and extreme weather and climate events is the common ground between climate change adaptation and disaster risk reduction efforts (Figure 6). As we are already experiencing the impacts of climate change, the blurry line between the two fields has now almost disappeared. Weather- and climate-related hazards and their health, social, economic, and environmental impacts are risks common to both efforts. Geological, biological, and technological hazards contribute to disaster risk,<sup>17</sup> though climate change can cause novel biological hazards and extreme climate events, which can lead to cascading technological incidents.

The separation between the two fields is rooted in the origins of where they started and how they advanced. The different origins, with one stemming from national security and civil defence and the other from advocacy by environmental scientists, means that there are two completely separate institutional mechanisms, with separate financing streams, that are leading, coordinating, and implementing DRR and climate change adaptation (CCA) in every country around the world—including Canada. For DRR, Public Safety Canada is the federal lead and Emergency Management BC is the provincial lead. For CCA, Environment and Climate Change Canada is the federal lead and BC Ministry of Environment is the provincial lead.

But CCA and DRR, especially the



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Figure 6: Common and uncommon hazards that are the focus of CCA and DRR (Graphic: UNDRR).<sup>18</sup>

risk mitigation component, face very similar common challenges, require similar approaches in governance, financing, information and data analysis, capacity development, and monitoring. The recommendation is to take steps to merge the common components of DRR and CCA by uncoupling risk mitigation from preparedness, response, and recovery and merge disaster risk mitigation with climate change adaptation.

A committee approach, with strong leadership from senior levels, would allow for shared responsibility for building resilience across departments—engineering, land-use planning, emergency management, climate change adaptation, climate change mitigation, social planning, asset management, and long-range financial planning. The committee approach can be applied at all levels of government.

#### THEME 5: Design disaster and climate risk management measures that deal with systemic inequalities.

Disasters almost always disproportionately impact the most vulnerable people. The most vulnerable people in Canada are seniors, Indigenous people, lowincome residents, those with low literacy levels, transient populations, people with disabilities, medically dependent persons, children and youth, women, new immigrants, and cultural minorities.<sup>19</sup> Our society is only as strong as our most vulnerable. It is critical to ensure disaster and climate risk measures address systemic inequalities within the sphere of their impact.

Existing social inequities in BC are exacerbated by climate change and impacts of disasters. People who experience poverty, racial or social inequality, and who are impacted by colonialism and systemic racism are often more strongly affected by the impacts of a crisis, including the changing climate. Low-income and racialized populations in both urban and rural regions are less likely to be adequately insured and have fewer resources to adjust to changing climatic conditions or respond to extreme events. For example, they may not be able to invest in an air conditioner during a heat wave or repair their home after a flood. They may also have higher rates of

adverse health conditions. Indigenous communities are disproportionately impacted by climate change, as they are witnessing the immediate impacts on their territories, traditional foods, medicines, and ways of living.<sup>20</sup>

### RECOMMENDATIONS

The following recommendations are organized in alignment with Sendai Framework priorities.

#### SENDAI FRAMEWORK PRIORITY 1: Understanding Disaster Risk

We need strategies, investments, and methodologies to support all actors with reliable and accessible hazard and risk information that empowers a systemic approach to climate and disaster risk management.

#### Sendai Framework Priority 1

"Policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be leveraged for the purpose of pre-disaster risk assessment, for prevention and mitigation and for the development and *implementation of appropriate* preparedness and effective response to disasters."<sup>21</sup>

#### 1.1 Develop provincial strategies, supported by guidelines, to produce harmonized hazard and risk information with insights on interdependencies and drivers of risk.

Effective policies and actions for reducing the impacts of hazard events require information on the drivers of risk to target the root causes. Hazard and risk assessments should provide insight into how past decisions and actions have led to the current condition and shed light on the future trends of risk due to climate change, population growth, and physical asset development under the current setting. Such information can support planners for designing strategic and game-changing measures.

Though there has been significant progress in advancing methods and investing in hazard and risk assessments, the level of progress varies significantly across the hazards, and the following challenges are prevalent:

- The coverage is patchy across the province. For example, only a few municipalities with enough capacity have managed to embark on coastal flood risk assessments.
- The outputs are not comparable across municipal boundaries due to variations in methodologies. This is the case with riverine flood risk assessments.
- Risk assessments are conducted in silo and approach the problem without identifying interdependencies. This approach

produces results that cannot be used for integrated planning.

- The processes do not always include proper consultations and engagements with the communities, nor do they include Indigenous Knowledge and practices. Many quantitative assessments are only focusing on hazard modelling without insights on exposed assets and potential damage and losses, such as the case of wildfire quantitative assessments.
- The current practice is most often only focused on physical assets and takes a static view of the likelihood and intensity of impacts at the present time.
- Risk assessments are not accompanied by clear communication of the results with actors. Typically, there is no budget allocated for communication of the final results in an engaging and effective way.
- The final datasets are not always accessible to others to use for future projects or for further research.

A provincial strategy for enhancing and harmonizing the quality, format, and availability of information on all key hazards and risks is needed to design the path forward for addressing the gaps and challenges. The strategy would be supported by plans and guidelines to harmonize methodologies and outputs allowing comparison across a region and collaboration and exchange of information within and across sectors and jurisdictions. This would allow risk assessments to be done in small scale but be comparable and complementary to other efforts in a region.

It is important to acknowledge that there are existing professional practice guidelines and standards for some of the hazards, including riverine and coastal flooding and landslides. But not all guidelines cover the endto-end process that includes required consultations with communities and users, integration of Indigenous Knowledge, insights on the drivers of risk, format of results, data sharing protocols, and final communications.

#### 1.2 Develop a provincial strategy for risk data management and establish a data platform to share the datasets.

Risk data<sup>iii</sup> and information are the valuable outputs of data collection projects and hazard and risk assessments and can be quite a costly endeavor. A common finding and recommendation among many articles of this report is the challenge that practitioners and researchers in both the public and private sector face in accessing data and information from publicly funded hazard and risk assessment projects.

It is important to note the existing and ongoing efforts on open data management in BC. Province of BC introduced its Open Information and Open Data Policy in July 2011, becoming the first province in Canada to publish its data under an open licence.<sup>22</sup> The Province produces and maintains over 1,000 datasets about natural resources, the economy, justice, education, and social programs, which are accessible on BC Data Catalogue free for anyone to use or repurpose under the Open Government Licence - British Columbia.

A provincial strategy for enhancing and harmonizing the quality, format, and availability of information on all key hazards and risks is needed to design the path forward for addressing the gaps and challenges.

GeoBC creates and manages geospatial information and products to help better manage natural resources in BC. Among GeoBC services is BC's Emergency Management Common Operating Picture portal (BC EM COP) which, since 2018, has been serving the province as the one-stop-shop for emergency GIS information and the primary mechanism to display realtime emergency response data for stakeholders at agencies like EMBC.<sup>23</sup> At the time of writing, BC EM COP is not open to the public and login information is shared with emergency managers, mostly for use during response.

The recommendations for enhancing accessibility of risk data are:

 Develop a strategy for risk data management with a lead provincial entity to manage implementation.

The recommended risk data management strategy for BC can define the governance mechanism and provide a common approach for sharing and managing risk data. Good governance of risk data would mean effective and efficient production, sharing, and use of risk data in policy and planning for disaster and climate risk management. It would provide regulatory and accountability frameworks, collaboration mechanisms, capacities, and incentives for production and sharing of risk data. Some of the specific areas of focus include:<sup>24</sup>

- Establishing legislation that requires a risk data management strategy at the provincial level and data sharing among ministries.
- Building capacity for data management and data sharing approaches and technologies.
- Creating standards for data collection, formatting, and sharing.
- Identifying and promoting incentives for industry actors to participate in open data, such as



<sup>&</sup>lt;sup>iii</sup> We use "risk data" as a general term inclusive of all types of data involved in the inputs and outputs of hazard and risk assessments.

#### BOX C: CHANGE VIA GUIDELINES AND FUNDING PROGRAMS

Guidelines and funding programs can bring the changes that are needed in how risk assessments are conducted. Critical upgrades that we need in the current practice of risk assessments are:

Assessments should include insights on the drivers of risk (diagnostic approach to understanding risk): Designing effective policies and actions for reducing the impacts of natural hazard events requires a holistic and integrated approach to hazard and risk assessments to provide insights on how past decisions and current conditions are the drivers of hazards, the exposure and vulnerability of assets, and the cascading impacts. Such insights, combined with an understanding of how the current trends and projections on climate change, population growth, and development will influence the risk levels in the future, can equip planners for reducing existing disaster and climate risk and mitigating it for future generations. Although it is important to note that current practice in hazard and risk assessment has a static view of the likelihood and intensity of impacts at the present time.

The outputs should match the needs of the target users: Each category of actors may require a different type of risk information depending on the asset and impact type that they are concerned about and the action they need to take. For the same risk type—for example, riverine floods—the land use planner would need a geospatial map of the floodplain with water depth and likelihoods, including the potential variations in time horizon due to climate change. The dike engineer would need to know the water flow values of the 200-year return period flood with climate change consideration. The actor concerned with community emergency planning would need to know the location of shelters in the context of the floodplain and an understanding of the socioeconomic characteristics of the exposed communities, such as knowing who will need evacuation support and where they live or work.

Inclusive consultations with stakeholders and First Nations should start in the early stages of risk assessments: Engagement with various stakeholders and First Nations is critical in a risk assessment not only for gathering relevant information on vulnerabilities, capabilities, needs, existing knowledge, and practices for risk management but also for gaining the trust of users on the quality of the results. It is important to ensure that consultations are inclusive of all stakeholders and First Nations and are designed and facilitated with awareness of the background and culture of each specific group. For example, technical terminology can be very different between emergency managers and planners. Also, scientific risk terminology is foreign to many groups, such as Indigenous communities, community-based institutions, and the general public.

for business development and adding value).

- Creating sustainable funding mechanisms.
- Working with stakeholders,
  First Nations, and end-users to understand their data needs and help them understand why and how to use risk data and information; this establishes the demand.
- Establishing a governance structure that includes an entity in the leadership position, with established authority and mandate, and a set of protocols for data sharing and collaborations.
- Open dialogues on perceptions versus facts of sensitive data, on data security, and on the value of open data policies.
- Establish a dedicated risk data
  management platform for hosting

the publicly funded risk data produced at provincial, regional, and local levels.

It is important to design such a platform based on the needs of the users in disaster and climate risk management. For example, one of the desired features is to allow the user to browse the data by location. There are many good examples internationally, such as Australian Flood Risk Information Portal.<sup>25</sup>



#### 1.3 Establish a "Disaster and Climate Risk Management Hub" at the provincial level.

Governance of risk information tends to lack the necessary connections across hazard types and between actors. Such fragmentation increases the price tag of each new risk assessment, keeps risk assessments within the scientific community and isolated from policy processes, and impedes the use of risk information in policy design, capability development, and for shaping investments. Alongside recommendations 1.1 and 1.2, a Disaster and Climate Risk Management Hub at the provincial level with a goal of facilitating connection and collaboration between science and policy actors can play a critical role in supporting actors, especially local governments and First Nations. The role of the Hub would include: 1) responding to priority demands of practitioners and policy designers for risk data management and production of relevant risk information, and 2) enabling its use in the design of policies and investments that build resilience in BC communities.

The Hub would tackle the following challenges:

- Making risk data accessible
- Establishing data sharing modalities
- Understanding and using risk information in DRR and CCA
- Coordination and collaboration

across projects, hazards, and sectors

 Identifying priorities and common needs for effective disaster and climate risk management across hazards and sectors

A concept note has been developed that outlines the proposed design for an institution that would facilitate connection and collaboration between science and policy actors for the common goal of disaster and climate risk reduction in BC.<sup>26</sup>

# 1.4 Collect data on what we value and develop methods to analyze.

While there is an obvious need to measure the potential physical impacts of natural hazards, it is also important to understand who is in harm's way, cultural perceptions of risk, socioeconomic vulnerabilities, and potential issues of social inequity that may be associated with the spatial distribution of hazard threats within a given community or region. Addressing systemic risk requires applying metrics that reflect economic as well as environmental and societal wellbeing. When the mechanisms are not collecting the right data, key assets are undervalued in decision making and opportunities are missed for a systemic approach to risk management.

We need to invest in data collection and research and development of analysis methodologies that support the design of DRR programs with an equity focus to address the root causes of vulnerability—not just response solutions for individual characteristics. We also need to invest in collecting comprehensive and harmonized data on environmental assets, cultural assets, and sites of interest to Indigenous communities.

#### 1.5 Invest in advancing science and methods to incorporate climate change into hazard and risk assessments and to interpret the results while managing the uncertainty.

The need for incorporating climate change into hazard and risk assessments and in resulting policies is outlined in this report's articles on wildfires, coastal and riverine floods, avalanches, and landslides as well as few other articles on risk management practice and enablers. For example, the Preliminary Strategic Climate Risk Assessment for British Columbia rated severe wildfires as having the highest expected consequences across all climate risk events by 2050. Projections include severe wildfire seasons increasing in frequency with a return period decreasing from one fire in 50 years to one in 10 years. Nevertheless, climate change is not included in current provincial-scale wildfire threat assessments.

The uncertainties in climate-related hazard and risk assessments, which mostly stems from the uncertainty in the climate projection models, pose challenges for decision making in terms of defining the course of action, especially when decisions need to be made on major capital investments with longer life spans. There is a need for guidance and tools to support making decisions in the face of climate uncertainty.



1.6 Conduct a collaborative exercise using a major catastrophic event scenario to help risk owners and actors understand the interdependencies, current capabilities, gaps, and the way forward.

An approach that has proven more effective in facilitating the understanding of potential impacts and gaps in capabilities is to define a disaster scenario with inputs from a wide range of sectors and experts. Such an approach allows use of empirical knowledge in addition to scientific and quantitative models for identifying the complex interdependencies within and among physical, social, and environment systems.

Canada's National Risk Profile, led by Public Safety Canada, is a great example of this approach using scientific evidence, presented as disaster scenarios across the country, and stakeholder and First Nations input to create a forward-looking picture of Canada's disaster risks and capabilities. In the first stage of the National Risk Profile (2021-22), twelve whole-of-society risk assessment sessions were held to better understand national risks and challenges with respect to floods, wildfires and earthquakes. Participants included experts from across all levels of government, academia, Indigenous organizations, and the private sector in order to produce a whole-of-society picture of risks facing Canada.<sup>27</sup> Participants provided perspectives

on the level of risk in the five All Hazards Risk Assessment (AHRA) impact categories (people, economy, environment, government, and social function) as well as on critical infrastructure, on Gender-based Analysis Plus considerations, on the risk of a similar event in 2050, and on the risk during a pandemic. Traditional Knowledge and perspectives were also discussed with respect to risks facing Indigenous communities.

Collaborative analysis using a disaster scenario is especially helpful for understanding critical infrastructure interdependencies and vulnerabilities. Scenario development with multisectoral participation can be an effective approach in defining and understanding the interdependencies and impacts across CI systems and the vulnerability drivers, and for developing risk management scenarios. An example of such an effort is the HayWired scenario,<sup>28</sup> which anticipates the impacts of a hypothetical magnitude 7.0 earthquake on the Hayward Fault in Northern California. The fault runs along the east side of California's San Francisco Bay and is among the most active and dangerous in the United States because it runs through a densely urbanized and interconnected region. The USGS and its partners in the HayWired Coalition and the HayWired Campaign are working to energize residents and businesses to engage in ongoing and new efforts to prepare the region for such a future earthquake.

#### SENDAI FRAMEWORK PRIORITY 2: Strengthening Disaster Risk Governance

We need to enhance risk governance mechanisms to provide more clarity on roles and responsibilities of all actors and lead entities, while empowering and incentivizing collaborations for integrated planning.

#### Sendai Framework Priority 2

"Disaster risk governance at the national, regional and global levels is of great importance for an effective and efficient management of disaster risk. Clear vision, plans, competence, quidance and coordination within and across sectors, as well as participation of relevant stakeholders, are needed. Strengthening disaster risk governance for prevention, mitigation, preparedness, response, recovery and rehabilitation is therefore necessary and fosters collaboration and partnership across mechanisms and institutions for the implementation of instruments relevant to disaster risk reduction and sustainable development." 29



#### 2.1 At the provincial level, identify and empower a lead entity for each risk to coordinate and empower collaborations among all actors.

Many public entities are actively working on understanding and managing various risk types across BC. While we do have a culture of collaboration and sharing, new forms of collaborations are needed to deal with the complex and growing risks. This includes formal institutional setup as well as the connections and relationships among the individuals who play a role in risk management.

The systemic nature of disaster and climate risk requires many different players to manage each type of risk. But due to a lack of clarity on mandates and commonly agreed methods and approaches, at times there are overlapping activities with outputs that are not comparable or compatible in the same jurisdiction or neighboring jurisdictions. For example, wildfire risk occurs on Crown, Indigenous and private land. It has economic, sociopolitical and ecological dimensions as well as interaction and feedback with other challenges and hazards, including Indigenous land governance, floods and landslides, extreme heat events, and resource industry instability. While no single stakeholder or risk manager can influence all aspects of a hazard, exposure, and vulnerability, collaboration and integration among stakeholders and First Nations is a major challenge; communities and other stakeholders have different incentives, capacities, and barriers to engaging in proactive risk mitigation. Similarly, decision making and resource allocation for landslide risk management is currently spread among many entities, including provincial government agencies, local governments, private companies, and individual professionals. This dispersion has led to inconsistency, duplication of effort, data sharing challenges, and suboptimal resource allocation.

Different organizations need the flexibility to adopt plans, policies, and risk reduction strategies that are suitable to their context and based on resources available. However, issues related to inconsistency, lack of coordination, and disparity in available resources arise due to the absence of leadership.

#### 2.2 Redesign the required professional profiles and human resource planning for disaster risk reduction and climate change adaptation.

We have unrealistic expectations for emergency managers to plan for longterm resilience while concurrently meeting their responsibilities for response and recovery, and this is holding back progress. The approach and understanding of how disasters affect society and how disaster risk should be managed has evolved in recent years; the Sendai Framework marked this transition by clearly calling for a widening of the approach to managing disaster risks (managing the potential impacts before they happen, including planning for dealing with the residual risk), instead of only focusing on managing disasters (managing the impacts once they

happen). But this expansion of scope, which requires dramatically different skill sets, has fallen on emergency managers. Currently, emergency managers have to be adaptive and opportunistic in their pursuit of long-term risk reduction while being overworked and fully immersed in response and recovery during the months after disasters.

The systemic nature of disaster and climate risk requires many different players to manage each type of risk. But due to a lack of clarity on mandates and commonly agreed methods and approaches, at times there are overlapping activities with outputs that are not comparable or compatible in the same jurisdiction or neighboring jurisdictions.

To address this, we need stronger leadership, resource commitment, and strategic planning across several different sectors in each level of government. Leadership and resources for climate and disaster resilience should be present in many units, such as asset management, land-use planning, engineering, social development, and environmental preservation units at the local and



regional governments. The model of having a resilience officer position that can align and coordinate these efforts is recommended. This model would also enable integrated planning, which has been identified by many of this report's articles as an essential shift for more effective climate and disaster risk management. Another possibility is to implement resilience committees, with clearly defined mandates and leadership from the senior level. Such a committee can be chaired by the resilience officer.

#### 2.3 Share insights and lessons learned through increased guidance, enhanced capacities, and a dedicated mechanism.

Contributors to this report have identified the need for developing further guidance and increasing capacities in a wide range of issues across different levels of government, Indigenous government, stakeholders, and the general public to empower them in playing their role in building resilience.

Common themes of what is needed have emerged from the articles in this report:

- Develop methods for managing climate uncertainties in decision making for long-term asset investments.
- Conduct trainings to build capacities for design and manage engagements and consultations with Indigenous and non-Indigenous governments and

communities; capacities are needed in government and the private sector.

- Develop various policies and plans, including integrated disaster and climate resilience plans, alert and evacuation plans, recovery plans, and more.
- Provide media training for reporting during and after disasters, and investigate and report the progress of policy implementation and investments in risk reduction.
- Develop a cross-disciplinary and cross-issue accessible body of knowledge for use by professionals (engineers, planners, architects, others) in understanding and managing various aspects of climate and disaster risk.
- Integrate climate and DRR skills into professional practice areas and provide every professional with ongoing continuing professional development and beyond-introductory climate adaptation and DRR knowledge.
- Explore nature-based solutions for climate change adaptation, disaster risk management, and resilience.
- Incorporate disaster and climate risk management into rezoning and development-related applications.
- Provide open-source access to all disaster and climate risk management projects, research,

and strategic planning initiatives that are paid for from public funds.

 Provide policy support for innovative practices that have proven effective in other jurisdictions.

#### 2.4 Upgrade building codes for new and existing buildings to integrate climate change mitigation and adaptation criteria with post-disaster functionality criteria.

Codes and standards have a significant impact on all phases of building and infrastructure life cycles. We must therefore ensure that building codes and standards are updated to reflect expected future climate conditions, the most recent understanding of geohazards, and the expected performance of both new and existing structures. This can be an effective way to increase the resilience of the built environment.

The National Building Code (NBC) is the model building code issued by the National Research Council of Canada. A model building code is one that is developed by a standards organization independent of the jurisdiction responsible for applying and enforcing it. As a model code, the NBC has no legal status until it is adopted by a jurisdiction that regulates construction, which is a provincial responsibility. The City of Vancouver is an exception; it governs the design and construction of buildings through its own Vancouver Building Bylaw. This means the NBC is voluntary and provinces and territories ultimately decide which components of the code to integrate



Strategic Summary for Policy Makers

in their jurisdictions.

Building codes in Canada have evolved since the first NBC was released in 1941. Currently, it has provisions for wind, snow, rain, and earthquakes but not for floods.

The earthquake provisions are periodically updated to reflect new scientific knowledge. Earthquake risk tolerance levels have also evolved over time, reflecting a lower tolerance for risk of collapse in modern editions of the NBC. High-importance buildings, such as schools and hospitals, are designed for higher loads and more stringent requirements. The BC Building Code, however, does not set minimum requirements beyond life safety for new buildings, nor contain specific requirements for the earthquake assessment of existing buildings, while an overwhelming majority of structures in the existing building stock were designed and constructed using building codes with low levels of earthquake provisions. Two articles in this report focus on managing earthquake risk and include recommendations for building codes and standards for new and existing buildings.

The recommendations are:

 Upgrade building codes to shift from minimum requirements to protect life safety to desired functionality and recovery performance post-disaster (the requirement that the building will take only five days to achieve functional recovery after a major earthquake).

 Investigate means to incorporate new standards for existing buildings and enforce compliance.

Studies from the United States show above-code design could save \$4 per each \$1 spent, and private-sector building retrofits could save \$4 per \$1 spent.<sup>30</sup>

The current national and provincial codes do not integrate any climate change projections. NRC is in the process of using updated climate design values with future climatic changes to incorporate climate resilience in the relevant national codes and standards. This includes provisions for flood-resilient building design. Building codes in BC need to follow suit.

#### 2.5 Support risk mitigation actions by the public by making hazard and risk information available.

For the whole of society to engage with and democratically influence decisions, and to play a role in managing disaster and climate risk, hazard and risk information should be publicly available in understandable and accessible formats.

The Access to Information Act of Canada gives people the legal right to obtain information, in any form, that is under the control of a government institution.<sup>31</sup> The general purpose of this act is to make government more open and transparent and to allow citizens to more fully participate in the democratic process of public policy. Hazards, vulnerabilities, and risks can directly affect people's safety and open access to such information can be transformative—increasing the resilience of assets and people—if delivered in a usable format (i.e., without the complex scientific jargon) along with instructions on actions people can take to reduce their own risk.

#### 2.6 Monitor and report on the progress and impacts of risk reduction policies to promote accountability, create incentives, and guide course correction.

The Sendai Framework and accompanying implementation guidelines and tools emphasize the importance of establishing monitoring mechanisms as a key component of accountability in good governance and continuing to enhance policies and programs. Sendai also calls for monitoring trends and patterns in disaster risk, loss, and impacts. A reporting mechanism has been established by UNDRR, in which every country, including Canada, has agreed to report on disaster losses on a yearly basis. Public Safety Canada, which is the national lead for Sendai Framework implementation and reporting, prepared a Readiness Report in 2017 on how prepared Canada is to report on all indicators of the Sendai Framework. Based on the Sendai monitoring platform,<sup>32</sup> Canada has "report in progress" status for 2017, 2018 and 2021. Establishing a provincial program for monitoring disaster risk reduction under the leadership of Public Safety Canada can provide major insights on damage



and loss trends, drivers, and impacts of risk reduction measures.

The Canadian Disaster Database (CDD) is the significant source of data on disaster frequency, fatalities, injuries, and evacuations. The CDD includes an interactive geospatial map and database, which contains detailed disaster information on more than 1,000 natural, technological, and conflict events since 1900.<sup>33</sup> But it only covers events that are major on a national scale. To be officially tracked through the CDD, disaster events must meet the following criteria: 10 or more people killed; 100 or more people affected/injured/infected/ evacuated/homeless; an appeal for national/international assistance; historical significance; and/or significant damage/interruption of normal processes such that the community affected cannot recover on its own.<sup>34</sup> This means that many events that can be catastrophic for a community or a region do not get included in CDD. Tracking disaster impacts at provincial level could provide very meaningful insights on trends and drivers, but such work would require criteria for local- or regional-scale events and a dedicated team and process.

Another recommendation is to have programs conducting forensic analysis post-disaster to understand how past decisions resulting in human-made and natural alterations of physical, social, and environmental assets relate to disaster impacts and the resilience of the assets. This can provide immense value in designing post-disaster recovery and

# BOX D: EVALUATION AND MONITORING OF NATIONAL DISASTER MANAGEMENT PROGRAM

This report contains an article by Public Safety Canada summarizing an evaluation of the National Disaster Management Program (NDMP) at the regional level in BC. This work was complementary to an NDMP evaluation conducted in 2019 at the national level. From 2015 to 2022, the NDMP funded 460 projects across Canada, including 132 in BC, and contributed to an increase of communities that undertook mitigation investments to reduce their vulnerability to floods through four streams of the program: 1. Risk Assessments, 2. Flood Mapping, 3. Mitigation Planning, and 4. Investments in Non-structural and Small-Scale Structural Mitigation Projects.

The evaluation of the NDMP sheds light on successful elements as well as the challenges and recommendations for enhancing the program. A few key findings are presented here:

- The information products, as the outputs of the project, have led to a better understanding of local and regional flood risk, have highlighted major gaps in flood risk management, and have enabled changes in policies and program design.
- No direct quantitative data was collected to determine how the recipient projects have reduced the impacts of disasters in the area or how the value of disaster-related financial liabilities for municipal, provincial, or federal governments (the objective of the NDMP) have been reduced. However, the recipients overwhelmingly stated that their projects contributed to risk reduction and reducing financial liabilities, as these projects triggered policy work and decision making at the municipal level that is effecting changes to future developments and spin-off projects.
- Regional partners spoke to the value of the NDMP in enabling regional cooperation in the development of context-driven tools within local areas and facilitating greater relationship building between municipalities and communities.
- The importance of Indigenous participation and input into the plans was highlighted by many contributors to the evaluation.
- A challenge to procuring the projects in a timely manner was the limited number of consulting firms available to undertake risk mitigation work, which contributed to sometimes lengthy delays, as there can be more projects than technical consultants available.
- The fact that the NMDP is only focused on floods leads to some missed opportunities for designing and investing in mitigation measures that can address multiple types of risk. Public Safety Canada states that this point has been raised in the NDMP's 2019 Evaluation at the national level and the new mitigation programming will consider interplays between hazards to increase resilience in Canadian communities and reduce the overall disaster risk to individuals and their homes.



transferring the knowledge for risk reduction to other communities. Such programs would look into Indigenous Knowledge, historic and existing landuse plans, agricultural and residential development trends, and past risk reduction measures.

#### 2.7 Develop a longterm strategy for critical infrastructure resilience with stronger coordination, harmonized approaches, and accountability.

Infrastructure is critical to the economic capacity and livability of our communities and the viability of our businesses within them. CI is defined as the "processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic wellbeing of Canadians and the effective functioning of government."35 Disruptions of CI could result in catastrophic loss of life and injuries, adverse economic effects, and significant harm to public confidence. The Sendai Framework has dedicated Target D to CI resilience. The challenge of securing and maintaining critical infrastructure assets and systems in a complex and fast-changing risk landscape require coordinated approaches between the public sector, private sector, and citizens, which in turn will foster ingenuity, promote adaptability, and ensure collaboration.<sup>36</sup>

Generally, across Canada, municipalities manage nearly 60% and provinces 38% of public infrastructure.<sup>37</sup> In BC, some infrastructure is owned, operated,



and maintained by both the public and private sectors. For example, the Canada Line rapid transit system connecting YVR airport, Richmond, and Downtown Vancouver is a publicprivate partnership built and operated by a private entity. In BC, most electricity is generated and distributed by BC Hydro, which is a provincial Crown corporation, but there are now numerous smaller-scale private power providers selling into the electrical grid. Telecommunications, cable providers, and railways are squarely in the realm of the private sector, although regulated by the public sector, which plays a significant role in the resilience of CI systems and society.

Local governments are essential to identifying and implementing projects that respond to local needs while contributing to regional, provincial, and federal prosperity. However, local governments often lack the resources and expertise to deliver productive and sustainable infrastructure in a cost-effective and timely fashion. Local budgeting processes currently fail to require accounting for future demands for infrastructure upgrades and replacement.

In recent years, all orders of government in Canada have increased their investments in infrastructure.<sup>38</sup> Through the Investing in Canada Plan, launched in 2016, the Government of Canada committed over \$180 billion over 12 years for infrastructure, with three objectives: 1) create long-term economic growth to build a stronger middle class; 2) support the resilience of communities and transition to a clean growth economy; and 3) build social inclusion and socioeconomic outcomes for all Canadians. Yet, barriers remain for achieving these objectives. Many communities are struggling with competing financial pressures and aging, failing infrastructure. Government support at all levels is required to renew our infrastructure as well as assist with paying for new and increased regulations and standards.<sup>39</sup>

The main recommendation from the BC Chamber of Commerce is for the provincial government to develop a long-term infrastructure strategy (a strategic investment planning document) for BC, which is coordinated with the long-term strategic planning processes of the province's regional districts. To improve effectiveness in planning, a long-term provincial plan would allow for regional and municipal governments to anticipate the plans in upcoming provincial infrastructure investments and align their budgeting processes and work to federal, provincial, and regional goals.<sup>40</sup>

At the national level, Public Safety Canada has led the development of the *National Strategy for Critical Infrastructure* (2009), addressing three strategic objectives: 1) to build partnerships among federal, provincial and territorial governments and CI sectors, 2) to implement an allhazards risk management approach, and 3) to advance the timely sharing and protection of information among partners.<sup>41</sup> The strategy will go through a renewal process that will take place over the next three years (2021–2023)<sup>42</sup> and is an opportunity to shed light on what is working well, what needs to be improved, and what our vision for the future should be as Canada faces an evolving list of risks and threats.

Key points and recommendations from two articles in this report, submitted by Public Safety Canada and BC Hydro on this topic, are:

- The interdependence of CI sectors presents significant risks that can only be better understood and managed through collaboration among governments and CI sectors. A reconfiguration of CI sector networks into networks grouped by function could help to identify interdependencies and related risks as well as facilitate cross-sector information sharing.
- Harmonizing approaches to strengthen the resilience of CI at all levels will enable efforts to facilitate timely and effective prevention, mitigation, preparedness, response, and recovery measures to deal effectively with disruptions.
- The roles and responsibilities are not clearly understood across CI partners, stakeholders, and First Nations. Although different delivery models across regions might be needed to address the specific situation, the cluttered organizational landscape makes it difficult to advance common CI priorities and resilience goals and

RESILIENCE PATHWAYS creates conflicting advice for CI owners and operators.

- Building stronger and more formalized partnerships with academia and think tanks that study issues related to CI security and resilience, infrastructure protection, and digital technology could provide valuable advice to Canada's CI leadership.
- A clear framework that supports results and accountability could help ensure that a focused direction exists, objectives are achieved for public and private sector investments, and efforts to enhance the security and resilience of CI are measurable. Canada currently does not have a national results-based framework in place that effectively measures the collaborative, non-regulatory efforts to achieve CI objectives, as set out in the *National Strategy* for Critical Infrastructure and supporting action plans.
- With climate change impacts, the current practice of using historical data is no longer valid. There is a need for developing event scenarios with future climate data to acknowledge the range of uncertainty from the new realities of climate change, evolving demands on infrastructure, and technology advancement.
- CI systems provide an opportunity to act as the unifying link between levels of government and government entities, the end user, the community, and emergency

responders. Strong leadership at CI sectors can enable this role.

 Provincially funded infrastructure has similar requirements as that funded by the federal government—requiring a climatefocused assessment to align investments with acceptable risk.

#### 2.8 Empower stakeholders and First Nations to play their crucial role with expertise, information, and inclusive collaborations.

Non-governmental stakeholders play a crucial role in risk management. They need expert knowledge, data and information, and mechanisms in order to be included in the relevant processes for disaster and climate risk management. This report includes three articles dedicated to the roles of stakeholder groups.

#### Professional Associations

The influence of professional associations is far reaching, allowing them to play a complementary role to government as a distinct part of civil society. Professional associations govern professional interactions with the social, natural, and built environment, positioning them as leaders and key advisors in disaster and climate risk management.

Professional associations can influence and guide disaster and climate risk management practice through:

#### SENDAI FRAMEWORK: ROLE OF STAKEHOLDERS

"While States have the overall responsibility for reducing disaster risk, it is a shared responsibility between Governments and relevant stakeholders. In particular, non-State stakeholders play an important role as enablers in providing support to States, in accordance with national policies, laws and regulations, in the implementation of the present Framework at local, national, regional and global levels. Their commitment, goodwill, knowledge, experience and resources will be required."43

The stakeholder groups outlined in the Sendai Framework are:

- Business, professional associations and private sector financial institutions
- Media
- Civil society, volunteers, and community-based organizations
- Academia, scientific and research entities
- Professional practice guidelines
- Practice resources
- Continuing education and training
- Collaboration and volunteerism
- Strategic frameworks and knowledge management
- Hazard and risk information

A few key recommendations identified for enhancing the role of professional associations are:

- Develop a collaborative community of practice among professional associations, and between professional associations and Indigenous Peoples.
- Create a shared vocabulary for communicating risk broadly, for cross-disciplinary communication, and for developing a business case for adaptation action; create a

RESILIENCE PATHWAYS

process to support development of a shared vocabulary.

- Integrate climate and DRR skills into professional practice areas.
- Provide every professional with ongoing continuing professional development and beyondintroductory climate adaptation and DRR knowledge.

#### Media

The Canadian media plays an integral role in the resilience of British Columbians. The Government of Canada recognizes that "people need free media to provide them with accurate information and informed analysis to hold governments to account."<sup>44</sup> This has been more vital than ever in recent years following the COVID-19 pandemic and the backto-back weather disasters of 2021 in BC. Media empowers individuals with clear information for collective action. Canadian media is far reaching, with the ability to connect with most of the population either directly or indirectly through broadcasting, publications, word of mouth, and social media. This holds enormous weight in getting a message of resilience to the public. Media can be a powerful tool for invoking change, including influencing power for more responsive and inclusive governance systems.

The media landscape and the way the public consumes news is constantly changing, so journalists and media platforms must stay agile. Journalists have a responsibility to stay informed about emergency procedures as well as the latest risks to communities, and to navigate the best way to get information to the public. The media also needs an open line of communication to all those involved in risk reduction and resilience, especially as messaging and information changes. However, with the advent of social media and the proliferation of disinformation and misinformation, the core mission of providing facts to the public is even more important.

There is no overarching protocol for the media on how to respond to disaster, at any stage. The media has journalistic guidelines—at both federal and agency levels—but there is no specific protocol to be followed by all agencies. However, individual newsrooms have extensive emergency response protocols, which rely heavily on a list of existing contacts. These include readily available and predetermined experts and officials who can be contacted during breaking news. Developing these relationships ahead of time is key. Often these protocols are created following an event.

#### Community-based Organizations as Part of Social Infrastructure

In the wake of disasters, survivors emphasize the importance of community-based support systems, including neighbours,

grassroots groups, organizations, and businesses that mobilize and deliver aid in response to the failure of basic services. These community-based assets make up networks of social infrastructure (SI) and may include programs and services, physical facilities and spaces, informal networks, deep relationships, knowledge and resourcefulness that support and enable social interaction and hold social purposes. Disasters expose and exacerbate our deepest pre-existing inequities, as impacts are not equally distributed among populations and communities. Networks of SI play a fundamental role in strengthening community resilience by improving equity, reducing disaster risk and vulnerability, and facilitating collective action and essential services through crises, emergency response, and recovery. The sheer number and variety of SI organizations is

staggering, and their decentralized locations offer unique opportunities for place-based planning. In BC, there are over 29,000 non-profit organizations that employ 86,000 people and contribute \$6.7 billion to the provincial economy.<sup>45</sup>

This report's article on social infrastructure outlines a few key points and recommendations to empower these organizations in playing their crucial role. These are:

- EPA modernization is a great opportunity to acknowledge the role of place-based and embedded SI organizations and their facilities within disaster risk management more prominently.
- SI organizations should be engaged to integrate their capabilities and needs into hazard, risk, and vulnerability assessment (HRVA)

# BOX E: TWO STRATEGIES OF CITY OF VANCOUVER LINKING RESILIENCE AND SOCIAL INFRASTRUCTURE

The City of Vancouver has two strategies that directly link resilience and SI. In 2019, the City of Vancouver approved the Resilient Vancouver Strategy, which includes framing as well as several objectives and actions specifically designed to reframe and transform the role of SI in disaster risk and resilience. These objectives include:

- Cultivating community connections, stewardship, and pride through actions like participatory budgeting processes.
- Empowering communities to support each other during crises and recover from disasters through actions like scaling the Resilient Neighbourhoods Program and training community centre staff to support disaster preparedness.
- Strengthening social and cultural assets and services through actions like evaluating the resilience of food assets and meal programs.

City council approved Spaces to Thrive: Vancouver SI Strategy Policy Framework in December 2021. Spaces to Thrive takes a human rights-based approach that emphasizes addressing needs of those most disproportionately impacted by shocks and stresses. Directions within the strategy range from partnerships and capacity building, addressing persistent facility deficits (quality, quantity, and location), prioritizing reconciliation, equity, and resilience in supply, and optimization of the SI ecosystem to improve resilience and adapt to pressures from climate change and disasters.



processes and comprehensive recovery plans. Under the existing *Emergency Program Act* there is no direction to develop HRVA using participatory approaches that engage diverse stakeholders, which is resulting in inconsistent standards, quality, and approaches to assessing risks.

- SI needs funding mechanisms that are comprehensive, recognizing the importance of operational costs, staff, and facilities and physical assets that make the services, programs, and social connections possible and flexible at the time of disasters, as most SIs cannot afford contingency funds.
- SI organizations need to be a part of communication, coordination, and collaboration mechanisms

in emergencies. For a lasting and supportive relationship between local authorities and SI, it is necessary for local authorities to ensure clear and effective support for SI across all departments during emergencies (for example, getting permits for temporary facilities in a timely manner).

#### SENDAI FRAMEWORK PRIORITY 3: Investing in Disaster Risk Reduction for Resilience

Provincial and federal funds drive the design of policies, projects, and actions at the local level. We need funding mechanisms that are strategic while empowering the implementation of priority actions designed at the local level and facilitating collaborations at the regional level.

#### **Sendai Framework Priority 3**

"Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. These can be drivers of innovation, growth and job creation. Such measures are cost-effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation." 46

#### BOX F: BC BUDGET 2021

In BC's 2021 budget, the allocation for managing disaster and climate risk is significantly higher than in past years, although the increase is mostly driven by preparation for response and recovery from 2021 events. The budget allocates \$1.5 billion in funding to rebuild from last year's floods and wildfires. More than \$600 million in operating and capital funding is targeted for continuing the response to climate-related disasters, for local government and First Nations disaster and recovery projects, and to begin to implement the Climate Preparedness and Adaptation Strategy, which will do the following:

- Expand climate monitoring networks.
- Lead climate resilience initiatives with local and Indigenous governments.
- Develop an extreme heat response framework.
- Expand the River Forecast Centre and provincial floodplain mapping program.
- Build data collection and expertise to better understand how to mitigate climate risks.

There is also \$210 million to help local governments and First Nations plan for and reduce disaster risk, including through the FireSmart program, the Community Emergency Preparedness Fund, and Indigenous-led emergency management priorities.



#### BOX G: DISASTER FINANCIAL ASSISTANCE ARRANGEMENTS (DFAA)

In the event of a large-scale natural disaster, the Government of Canada provides financial assistance to provincial and territorial governments through the Disaster Financial Assistance Arrangements (DFAA), administered by Public Safety Canada. Since 1970, the Government of Canada has paid out an estimated \$8.5 billion dollars in post-disaster assistance with the costs of response and in returning infrastructure and personal property to pre-disaster condition. Of these costs, 97% occurred in the past 25 years, and more than one-third occurred in the past six years alone.48

When response and recovery costs exceed what individual provinces or territories could reasonably be expected to bear on their own, assistance is paid through the DFAA to the province or territory—not directly to affected individuals, small businesses or communities. DFAA funds are disbursed based on a cost-sharing setup with the provinces and territories. As of January 2022, the threshold for BC is at \$17,743,766 (disaster costs higher than this value are eligible for cost sharing through DFAA).

Under DFAA, repairs that are eligible for reimbursement through insurance are not eligible for cost sharing. At the provincial level, BC Disaster Financial Assistance also doesn't cover insurable losses, which includes damages caused by wildfires, earthquakes, snow loads, and wind storms.49 This is despite the fact that insurance is unaffordable to some.

# 3.1 Prioritize investing in risk reduction to reduce the cost of future disasters.

The increases in federal and provincial budgets for disaster and climate risk management in recent years is good news but they are still heavily focused on disaster preparedness and response instead of mitigating the risk. In the past few decades there has been an increase in federal and provincial budgets to fund emergency response and recovery as well as climate and disaster risk management, though it is noteworthy that decisions for most funding programs have been in response to major events and are still very much focused on preparedness, response, and recovery instead of reducing existing risk.

Existing analyses suggest that the costs of preparedness and mitigation are several times lower than the savings these measures create. For example, flood mitigation spending is a particularly sound investment: one Canadian analysis reported that every \$1 spent on reducing residential basement flood risks led to \$11 in savings and found that the implementation of the tools and guidelines, established by Canada's Climate-Resilient Buildings and Core Public Infrastructure initiative, could yield annual benefits of \$4.7 billion. A recent study in the United States estimated that investment in mitigation has a 13:1 average benefitto-cost ratio.<sup>47</sup>

#### 3.2 Design funding programs based on risk information and the intention to shape a harmonized and strategic risk management approach across the province.

Local governments have a political mandate to protect citizens, yet they often lack the financial resources to undertake disaster and climate mitigation projects. The lack of operating budget (staff salaries) and base funding for planning, combined with the reality of response and recovery processes, leaves little time for an emergency management team to work on proactive and strategic risk management. Response and recovery activities may require many days where staff work at the activated Emergency Operations Centre; on average, the EOC in the Kootenay region is activated 100 days per year.

With minimal base funding at local governments, the grants from federal and provincial governments are the main funding source for risk mitigation, especially for the large engineering design and construction projects and to pay the required long-term operation and maintenance costs. In the current ecosystem of disaster and climate risk management in BC, local governments are opportunistic rather than strategic as they end up designing their risk mitigation efforts based on the available provincial and federal



funding programs versus their own risk-informed and objective-based risk management plans.

Local governments have a political mandate to protect citizens, yet they often lack the financial resources to undertake disaster and climate mitigation projects. ... [They] end up designing their risk mitigation efforts based on the available provincial and federal funding programs versus their own risk-informed and objective-based risk management plans.

Local governments compete for funding of capital costs from a variety of provincial and federal grants, but the grants can take years to secure and are without a guarantee of success. They often have a maximum value that is insufficient and unrelated to the cost of reducing risk to a tolerable level. The biggest challenge is the lack fund continuity to support long-term planning.

With this context, this report recommends enhancing the design of funding programs, employing the following considerations:

- Design funding programs based on organized consultations on vulnerabilities, risks, capabilities, and needs at the local level. While there are some committees and working groups created through various programs that allow communication with local-level representatives, at the moment there is no organized and systematic mechanism for inputs from local and Indigenous governments on priority needs for funding.
- Have wider and more flexible scope to empower local authorities with the strategic and priority actions that they have identified based on their risks and capabilities.
- Accommodate regional projects, as many local governments don't have the resources to apply and implement risk mitigation projects, and also because some risks are cross-boundary and can be managed more effectively at the regional level.
- Encourage multi-hazard approaches, as many actions such as inspection, monitoring, warning, evacuation and response plans, social resilience building, and even structural upgrades can be costeffective ways of reducing risk for several types of hazard scenarios.
- Provide longer-term operational grants for social infrastructure organizations and technical institutions to maintain their core programs and services and

conduct long-term planning.

 Support long-term plans and continuity of different phases of risk management. The short-term schedules don't allow adequate research and engagement of the stakeholders and the uncertainty for continuation of funds for capital projects lowers the incentives for proactive risk management.

#### 3.3 Organize the information about the funding programs for disaster and climate risk management.

Every one of the funding programs at the federal or provincial level has its own webpage, which gets updated as needed with new information on the details of the program. Many regional and local practitioners have a hard time staying up to date on the new funding programs or updates to existing programs, as it would require checking various sites or be on numerous mailing lists, if they exist. Developing a simple platform to host links to all available federal and provincial funding programs with one newsletter for updates would facilitate information sharing with local practitioners immensely. A great example of such a platform that has recently been developed is www.indigenousclimatehub.ca/ funding, which has a page dedicated to available funding sources.



SENDAI FRAMEWORK PRIORITY 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction

Emergency response and recovery processes need enhancement with effective early warning systems, and collaboration mechanisms, response and recovery plans that are developed pre-disaster.

#### Sendai Framework Priority 4

"The steady growth of disaster risk, including the increase of people and assets exposure, combined with the lessons learned from past disasters, indicates the need to further strengthen disaster preparedness for response, take action in anticipation of events, integrate disaster risk reduction in response preparedness and ensure that capacities are in place for effective response and recovery at all levels. Empowering women and persons with disabilities to publicly lead and promote gender equitable and universally accessible response, recovery, rehabilitation and reconstruction approaches is key. Disasters have demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of a disaster, is a critical opportunity

to "Build Back Better", including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters." <sup>50</sup>

#### 4.1 Establish a task force for enhancing and managing multi-hazard impact-based forecasting and early warning systems.

Forecasting and early warning and alerting systems are vital tools for saving lives in disasters. As the economic and social impacts of disasters are increasing, further refinements to accuracy and accessibility are needed.

There is currently no comprehensive strategy or plan for early multi-hazard forecasting, warning systems, and alerting in BC that would provide clarity on roles and responsibilities of various entities and collaborations among them in the design and implementation of each component for various hazards and the connections between each of the four components (Box H).

#### 1. Disaster risk knowledge

Enhancing the quality and availability of hazard and risk information across the province, as mentioned in earlier sections of this document, would directly support the early warning system.

2. Detection, monitoring, analysis, and forecasting of the hazards and possible consequences There has been progress with numerous recent initiatives in monitoring systems of various hazards. Examples are the federal government investment of \$4.9 million over five years (2019-2024) for Environment and Climate Change Canada to improve Canada's ability to predict coastal floods and to develop early warning systems (not yet operational).

There is currently no comprehensive strategy or plan for early multihazard forecasting, warning systems, and alerting in BC that would provide clarity on roles and responsibilities of various entities and collaborations among them in the design and implementation of each component for various hazards and the connections between each of the four components.

NRCan is developing a national Earthquake Early Warning System (EEW) with federal, provincial, Indigenous, and other partners and in collaboration with the United States Geological Survey. The national EEW network is focused on the west coast of BC and in the densely populated regions



of eastern Ontario and southern Quebec; this national EEW system is slated to be operational in 2024.

Lack of long-term financial support for maintaining operation and improving technology is the main challenge for many of the existing monitoring and forecasting systems, such as the BC Storm Surge Forecasting System (a joint program between the BC Ministry of Environment and Fisheries and Oceans Canada), and avalanche warning services (mostly run by Avalanche Canada, which is a non-governmental and non-profit organization, and Parks Canada). The monitoring system for volcanoes is far less advanced than other hazards. There is a need for enhancing predictive services to integrate climate projections into forecasting landslides, debris flows, droughts, water scarcity, and wildfires.

# 3. Communication and dissemination of warnings

Canada has a National Public Alerting System (NPAS) that provides emergency management organizations across the country with the capability to rapidly warn the public of imminent or unfolding hazards to life. The NPAS is a collaborative initiative between federal, provincial, and territorial (FPT) governments and complements existing public alerting systems and tools in a number of FPT jurisdictions.

The BC government is expanding the use of push notifications to cellular phones during emergencies to also include floods and wildfires. The Alert Ready system was previously used only for tsunami warnings, Amber Alerts, and very rare police

# BOX H: FOUR COMPONENTS OF IMPACT-BASED FORECASTING AND EARLY WARNING SYSTEMS

Early warning systems consists of four components. All of these components are critical and the design and implementation of each requires a wide range of technical, legislative, governance, accountability, operational and capacity development, organizational partnership (including with the private sector and volunteer organizations), community engagement, and public communications.

#### 1. Disaster risk knowledge

Having an understanding of the possible impacts of events provides the basis for forecasting impacts and can significantly improve the quality and effectiveness of response and evacuation planning in an early warning system as it can shape the evacuation and response plans as well as the content of public messages.

#### 2. Detection, monitoring, analysis, and forecasting of the hazards and possible consequences

The detection, monitoring, analysis, and forecasting of hazards and possible consequences is essential to generating accurate warnings in a timely fashion that allow sufficient time for the affected communities and authorities to enact their disaster management plans, including evacuations. Early warning systems must have scientifically sound and reliable technology that allows for the monitoring and detection of hazards in real time or near real time, and a forecasting and warning system that is operational 24 hours a day, 365 days a year. The system must be staffed and monitored by qualified people and have a multi-hazard focus.

#### 3. Communication and dissemination of warnings

It is critical that early warning systems provide timely, clear, and concise warning messages containing simple, useful, and actionable information on risk and impact. This is key to enabling the necessary preparedness and response measures that will help safeguard lives and livelihoods by individuals, communities, and organizations.

#### 4. Preparedness and response capabilities

For an early warning system to ultimately be effective, the general public (and particularly vulnerable populations) should be aware of the risks they face, understand what different warnings mean, and be clear on what actions they should take to protect themselves and their property.



incidents, but the alert system was not used in November 2021 during the atmospheric river and following floods. All other hazards (avalanche, volcano, landslides) should also get connected to NPAS. Until May 2022, the Alert Ready system was not accessible to local governments, yet the duty to warn residents of hazards and risks has been the responsibility of the local authority for many years, as stated in provincial legislation: Local Authority Emergency Management Regulation describes the duty to "establish procedures by which those persons who may be harmed or who may suffer loss are notified of an emergency or impending disaster."<sup>51</sup> In order to meet this legislated requirement, local governments procured private notification services, all of which require some form of user subscription, which results in woefully inadequate subscription rates (less than 10% in most jurisdictions). Due to Canadian Radio-television and Telecommunications Commission (CRTC) regulations, local authorities do not have access to push notification technology and so were reliant on national and provincial governments for that service. The recent move to allow local authorities the ability to request push notifications via Alert Ready is welcome.

# 4. Preparedness and response capabilities

There are challenges observed in evacuations mostly because



evacuation plans are not in place or the population is not well educated in how to respond to an evacuation notice. Emergency preparedness education and outreach campaigns are key components in ensuring that residents are ready to effectively act on risk information, warnings, and instructions. Residents need to know the answer to "What now?" when they receive a notification through the Public Alerting System.

# 4.2 Develop standardization and guidelines in recovery processes.

It is important to note that this edition of the Resilience Pathways Report does not include dedicated articles on emergency response nor recovery planning. A few key points have been raised through interviews, which are presented here. EMBC has published the fourth edition of *Recovery Guide for Local Authorities and First Nations* in February 2022. Some of the following points may already be reflected in the updated guide.

#### Physical Recovery

The accurate and efficient assessment of the damage caused to buildings and critical infrastructure in an area hit by a disaster (earthquake, tsunami, fire, flood, etc.) is essential for prioritizing recovery resources and actions. Rapid damage assessment guidelines, training, and tools have been developed by BC Housing for residential buildings. Further work is needed for infrastructure damage assessment protocols and prioritization tools. Greater

government and private sector cooperation and communication is required before, during, and after the disaster. This was evident in October 2018 when an explosion and fire in a natural gas pipeline northeast of Prince George led to natural gas shortages throughout BC. A working group was established, facilitated by Integrated Partnership for Regional Emergency Management (IPREM), to ensure clarity in roles and responsibilities in recovery and improve communication between Fortis and local governments. This collaborative work would best be facilitated before an emergency and applies across all CI sectors.

Delays in development planning and building permit processes during disaster recovery are exacerbated by reduced staff capacity and applicants under financial and emotional stress. Local government planning departments could consider disaster scenarios and create tools and resources to expedite the implementation of official community plans (OCPs) as part of proactive recovery planning. Hazards and risks should be considered early in the process of developing OCPs. Most importantly, the community impacted by the disaster must be consulted in a meaningful way throughout the recovery process. This consultation should be facilitated by both engagement and planning professionals and should be an eligible cost under Disaster Financial Assistance.

#### Social Recovery

Social recovery planning committees are one forum available to work collaboratively before a disaster with SI organizations, BC Housing, Ministry of Social Development and Poverty Reduction, and Ministry of Health. These same agencies can then come together during disaster recovery as an "Unmet Needs Committee" to assist residents to fill the gaps of recovery assistance for longer term.

#### Economic Recovery

While Disaster Financial Assistance is important, it does not go far enough nor is it accessible quickly enough to meet the initial recovery needs of a community post-disaster. Some local governments can access reserve or emergency funds to implement immediate, high-priority actions.

Insurance provides the best financial resilience. Yet, vulnerable populations tend not to be adequately insured because insurance is expensive. In rural areas compared to urban areas in BC, there are more property owners that do not have mortgages and are therefore not required to have insurance.

When more people buy insurance, society tends to be more resilient, prompting it to bounce back faster after a catastrophic loss than in places where fewer people purchase coverage. Only 60% of homeowners in the BC Lower Mainland have earthquake insurance, leaving a large protection gap. Linear assets (sewer, water lines) tend to not be insurable.

# GAPS IN THE FIRST EDITION OF RESILIENCE PATHWAYS REPORT

While this first edition of the Resilience Pathways Report covers a wide range of topics and issues in its articles, there are some important issues that were not covered sufficiently, and future editions can bring experts together to analyse and share insights on these topics:

- Emergency response and recovery planning is fundamental work for managing impacts of residual risk and requires riskinformed planning pre-disaster. Guidance and support in the form of resources and capacity development is needed in developing response plans and recovery plans. While many emergency managers were engaged at early stages and interested to contribute to this report, none of them could afford the time as they were all fully occupied with the various disaster events of 2021.
- The role of the private sector in disaster and climate risk management needs to be recognized and better understood as the backbone of the economy and provider of many services to society. The private sector also has deep expertise and resources in areas that are required for disaster and climate risk management.

Issues of critical importance to be explored include:

- The status, gaps, and needs in enterprise risk management and business continuity for small and medium businesses.
- Understanding and managing disaster and climate financial risks in pension funds.
- Leveraging public-private partnerships in establishing forecasting and alerting systems.
- Land-use planning is one of the most effective tools in avoiding the creation of new risk and building long-term resilience. Urban and land-use planning practices are still allowing extensive development in hazard-prone areas. While it might not be possible to completely avoid building in hazard zones, we need updates in land-use planning legislations and enforcement mechanisms to prioritize resilience of the society over financial benefits or the cost of change in status quo approaches.
- Nature-based solutions are an effective approach to manage disaster and climate risk that also protect, sustainably manage, and restore natural ecosystems. While its value has been recognized, there are limited expertise, guidance, and resources available to local governments for designing and implementing nature-based solutions.



- Specific hazards such as tsunami, urban floods, drought, extreme windstorms, extreme weather (cold and heat waves, snowstorms, and frosts), chemical and industrial accidents, biological hazards and cyber-attacks.
- Insurance and other financial risk management mechanisms are critical in managing the financial impacts of residual risk and there are many recent efforts to enhance insurance availability and protection for Canadians (for example, Public Safety Canada-led task force on flood insurance and relocation).
- Understanding the risk and resilience in telecommunication, water and sanitation, and transportation critical infrastructure.

## CONCLUDING REMARKS

With the growing trends of disaster and climate risk due to population growth, climate change, and aging infrastructure, "business as usual" in risk management can have devastating social, environmental, and economic costs. There is great need for innovative, informed, and collaborative planning at all levels to support climate and disaster risk management that is integrated in a wide range of policies and actions, including development planning, across different sectors. The authors and collaborators who prepared the articles of the Resilience Pathways Report 2022 have provided insights on challenges and recommendations for the paths forward based on scientific evidence and experiences on the ground. Each article is accessible independently and provides detailed information on the challenges and recommendations related to its respective topic. The common trends from all articles were identified and synthesized for developing this Strategic Summary for Policy Makers.

The Resilience Pathways Report provides a mechanism and platform for a wide range of stakeholders to collaborate and share their valuable insights on gaps and priority actions for building our resilience. Sustainability and success of this initiative requires funding, a dedicated editorial team, and leadership support from a provincial or federal government entity. This initiative, as a bi-annual endeavour, provides an up-to-date strategic resource on the current issues that need attention from risk management actors and decision makers. It will be an effective mechanism to monitor and evaluate progress over time in implementation of the Sendai Framework, Modernized EPA, and BC Climate Preparedness and Adaptation Strategy.

The continuation and sustainability of this initiative requires funding, a dedicated editorial team, and leadership support from a provincial or federal governmental or strong non-governmental entity. The editorial team welcomes expressions of interest from any governmental or non-governmental entities interested in hosting the next edition.



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