



BEST PRACTICES

A comprehensive local plan

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In 2019, the Council of Canadian Academies published Canada's Top Climate Change Risks, in which an expert panel of climate scientists identified the top 12 climate change risks where adaptation is urgently needed in Canada. Risks to physical infrastructure was identified at the top of this list. This includes addressing the threat of direct damage to homes, buildings, and critical infrastructure from heavy precipitation, high winds, and flooding.

Moreover, the expert panel also reported physical infrastructure as the climate risk with the greatest adaptation potential. That is to say, there is a greater consensus in the expert community about the actions proven to reduce the risk of loss and damage to physical infrastructure than for Canada's other top climate risks. For example, there is agreement about what actions are needed to reduce and perhaps prevent most damage to municipal infrastructure.

In addition, studies by the Institute for Catastrophic Loss Reduction and others find that the additional cost to enhance the resilience of municipal infrastructure is fully offset by reduced risk of future damage. The benefits of investing in climate resilience typically exceeds the cost by 5- to 10-fold.

Canadians know what to do, and the economics of action is favourable; however, communities continue to experience significant damage and destruction of municipal infrastructure as a result of extreme climate hazards.

The 2016 World Risk Report, jointly published by the Bündnis Entwicklung Hilft (Alliance Development Works) and the United Nations University, highlights the idea that when a hazard strikes, infrastructure performance can be a deciding factor in whether or not the situation becomes a disaster. Roads can, for instance, allow communities to evacuate and provide fast access to relief aid to affected communities; but if roads are destroyed, entire regions can become isolated and cut off from support.

The vast majority of Canada's public buildings and infrastructure has been designed and built with the use of older building codes and construction standards that were based on historical climate data and can no longer withstand the extreme weather events we are increasingly witnessing. The case studies presented in this book demonstrate that a wide variety of infrastructure is at risk, including buildings, bridges, and water and wastewater systems, and that comprehensive actions need to be implemented in order to mitigate current and future risks of failure. Importantly, we celebrate the 20 cases here of municipal leadership to address this risk. Climate change will increase the frequency and severity of many extreme climate hazards, but we can prevent extreme events from becoming disasters by investing in climate-resilient public infrastructure and buildings.

Cities across the country have large infrastructure portfolios to look after. The value of these infrastructure is anchored in the services they provide. Comprehensive

management of public infrastructure by local government will result in fewer risks faced by the community and its residents. The Institute for Catastrophic Loss Reduction has identified four critical elements that should be included in a comprehensive strategy to maintain, rehabilitate, and design climate-resilient infrastructure:

- Understanding infrastructure vulnerabilities to climate risks;
- Creating asset management plans;
- Leveraging cross-sectoral collaborations;
- Growing local capacity for climate-resilient planning;

UNDERSTANDING INFRASTRUCTURE VULNERABILITIES TO CLIMATE RISKS

Policies, design, and construction practices for public infrastructure should be anchored in a strong understanding of climate risks faced by the specific asset and its broader infrastructure system when applicable. When evaluating the risk faced by an infrastructure, various elements need to be considered, such as current and future climate conditions, exposure, infrastructure vulnerability, capacity, maintenance needs, etc. The knowledge coming out of vulnerability assessments is instrumental in planning lasting design and rehabilitation needs and can assist municipalities in their long-term planning effort.

The Institute finds that communities should manage municipal infrastructure with a focus on performance over the lifetime of the asset. Assets should be designed and managed based on the climate expected in the future, not the weather experienced in the past. Climate models can provide specific climate forecasts for each community.

Various strategies can be used by municipalities to further their understanding of public infrastructure vulnerability. The PIEVC protocol was used by several Canadian municipalities, including eight case studies presented in this report, to review historical and future climate conditions and establish the adaptive capacity of a wide range of infrastructure assets. Indeed, more than 150 PIEVC assessments have been completed for a broad range of public infrastructure projects. To do so, the protocol promotes cross-sectoral collaborations to evaluate the infrastructure design, operation and maintenance to identify which components are at higher risk of specific climate threats.

The comprehensive assessment used under the PIEVC protocol allows communities to make informed decisions around budget planning, intervention prioritization, and long-term rehabilitation planning. The City of Laval used the PIEVC protocol to understand the vulnerabilities faced by a major overflow structure on the City's territory. The vulnerability risk assessment allowed the municipality to have important knowledge available and a clear path forward when funding became available to

implement risk reduction actions that would reduce the demand faced by the infrastructure. Similarly, the City of Vernon used the PIEVC assessment to confirm previously suspected risks and, as a stepping stone, to conduct a broader analysis through the Climate Lens program of Infrastructure Canada.

The knowledge gathered through infrastructure vulnerability assessments is instrumental to support prevention and mitigation actions and to allow communities to plan their asset maintenance and rehabilitation in a sustainable way.

CREATING ASSET MANAGEMENT PLANS

Municipalities benefit from getting the most value of their public infrastructure with low maintenance and rehabilitation expenses. Asset management planning allows communities to establish long-term management plans that can inform decision-makers on priority investments.

Understanding the vulnerabilities of public infrastructure allows municipalities to establish long-term asset management plans over the lifecycles of a large asset portfolio. These management plans allow decision-makers to make informed decisions on priority investments and allocate resources wisely. Municipalities presented in this report have taken different approaches to asset management planning. The City of Ottawa used the PIEVC protocol alongside other risk analysis methods to gain a deeper understanding of infrastructure risk around the community and prioritize risk mitigation initiatives. The PIEVC process used by Ottawa also allows municipal staff to include new information that may emerge around climate risks and infrastructure components, ensuring that the asset management strategy evolves over time as new information emerges.

The City of Calgary's strategy was guided by a systems approach and operational plan that allows for flexibility and adaptability when considering ways to improve climate resilience of infrastructure. The Glenmore Dam rehabilitation was part of a comprehensive analysis that allowed the municipality to develop a holistic plan around flood mitigation and resilience. While this type of approach typically requires more time and resources during the analysis period, it ensures various components of key infrastructure are not overlooked and that the infrastructure system is considered as a whole.

Asset management plans allow communities to prepare for capital investment planning so that particular projects are given priority. Saddle Lake Cree Nation represents a great example of this approach. The community partnered with a consulting company to first establish which interventions were worth pursuing to increase climate resiliency of infrastructure assets given the needs of the community. Following this initial analysis, Saddle Lake has been reviewing annually which infrastructure investments will be prioritized.

LEVERAGING CROSS-SECTORAL COLLABORATIONS

As cities work to understand their infrastructure vulnerabilities and plan for their maintenance and rehabilitation, it is crucial to leverage the expertise and resources that come with cross-sectoral collaborations. Case studies presented in this report have highlighted the need to leverage cross-sectoral partnerships as a way to obtain a comprehensive analysis of risks faced by an infrastructure asset or system, but also to secure funding for infrastructure repair, construction, and maintenance.

When evaluating asset vulnerabilities, the PIEVC protocol favours multi-disciplinary and multi-stakeholder teams to provide thorough assessments. The project team can be customized to the specific needs of the community, but often includes engineers, climate scientists, representatives from the infrastructure owner (e.g., operators, risk managers, public works, etc.), as well as other stakeholders (e.g., emergency managers, planners, policymakers, etc.). Through participatory workshops, the various stakeholders get to exchange and engage in two-way dialogues to share their perspective and collective experience with the infrastructure being assessed. Those facilitated sessions allow for the exchange of both quantitative and qualitative data, enabling the project team to prepare a comprehensive analysis of vulnerabilities and options to repair, redesign, and maintain in the future. Cross-sectoral collaboration during infrastructure vulnerability analysis also allows for identification of any missing information, from local historic climate data to maintenance records and to clearly identify where an infrastructure is within its lifecycle. Early and ongoing stakeholder engagement enables for a clear project definition as well as a shared understanding around expectations and execution.

Public infrastructure is costly to build and maintain. Many communities presented in this report have benefited from external sources of funding from the federal and provincial governments through programs such as the Disaster Mitigation and Adaptation Fund (DMAF) from Infrastructure Canada, the Climate Change in the North Program of Crown and Indigenous Relations and Northern Affairs, the Alberta Community Resilience Program and the Indigenous Services Canada's Emergency Management Assistance Non-Structural Mitigation program. Some communities have also benefited from non-governmental funding through programs like the Municipalities for Climate Innovation program (MCIP) from the Federation of Canadian Municipalities.

GROWING LOCAL CAPACITY FOR CLIMATE-RESILIENT PLANNING

Increasing local capacity to perform climate-resilient infrastructure planning and maintenance is key to ensuring the performance and longevity of public infrastructure across Canada. In this context, building local capacity refers to financial, human, and political resources.

From a financial standpoint, planning and securing resources for infrastructure maintenance and upgrades is key, particularly in the context of increased extreme weather events that can put a significant amount of stress on aging infrastructure. Local governments presented in this report have been successful at leveraging public spending to attract additional funding resources while ensuring that the infrastructure investment was consistent with a climate- resilient economy.

There is considerable value in educating and engaging municipal staff in climate-focused infrastructure planning. This was particularly well demonstrated in Welland where the engagement of asset managers proved to be effective in factoring in logistical and operational issues crucial to climate-resilient infrastructure management. Beyond the engagement of municipal staff, outreach and engagement of local communities is beneficial to achieve successful outcomes. This was demonstrated in Windsor, where frequent public engagement sessions, public meetings, and newsletters were used to encourage community ownership and responsibility for the project.

Human resources are not limited to staff and consultants involved in climate resilience planning, but also require the presence of strong political leadership. This report features several local champions who have successfully influenced and secured resources to ensure that infrastructure investments were done in a way that would be sustainable environmentally, socially, and economically for their communities. They have been leaders through a transformational change that involved rethinking how public infrastructure should be designed, given changing climate conditions.

Finally, it is important to note that all case studies presented in this report are strongly aligned with the Sendai Framework priorities for action. Communities have showcased their commitment to understanding their infrastructure risk through comprehensive vulnerability assessments, demonstrated strong disaster governance by making climate-resilient planning a local priority, secured significant resources to invest in disaster risk reduction, and committed to rebuilding infrastructure in ways that would optimize their performance under future climate conditions.

This report celebrates communities across Canada who are actively working to adapt their public buildings, sewer systems, water treatment facilities, bridges, roads, and other public infrastructure. Climate change is increasing the risk that more frequent and severe extreme weather events result in direct damage and failure in the performance of municipal infrastructure. Nevertheless, we find communities across Canada investing in climate resilience. Proven and affordable adaptation, like the examples reported here, demonstrate how communities can reduce and prevent the risk of loss and damage in a changing climate. More action is urgently needed, yet it is important to celebrate the leaders taking action now.