

Future by design: standards for a climate resilient Canada

Final Report of the 2016-2021
Standards to Support Resilience
in Infrastructure Program

Standards
Council
of Canada

Open a world of possibilities.

Canada 

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Message from the CEO

One of the most clear and present dangers to Canada's health, well-being, and economic prosperity today is the dramatic change to our climate and its impact on our communities. Devastating floods that leave destruction in their wake, heat waves that put our most vulnerable at risk, enormous snow loads that threaten our infrastructure and weigh not only on our homes but on our minds; these are just some of the extreme weather threats that we must now mitigate. As these threats increase exponentially, so does our resolve within the Standards Council of Canada to provide tangible resources and solutions.

Since 2016, SCC's Standards to Support Resilience in Infrastructure Program (SSRIP) has led the development of standards and related guidance to safeguard infrastructure and communities from these susceptibilities. In Phase 1 (2016–2021) of this program, SCC successfully helmed the advancement of over 40 standards and guidance initiatives to protect Canadians and their communities. These standards-based solutions can help inform the design, maintenance, and operation of various types of infrastructure, from tower antennas to low rise residential buildings and stormwater systems.

Many of these standardization solutions have been focused on Canada's North, a highly vulnerable region facing ongoing threats from climate change. The impacts are most distinctly felt in this area and strategies to deal with it are most needed. The standards and other solutions being developed address northern-specific issues, such as roadway management, treatment of permafrost zones and regionally unique asset management requirements. We are incredibly proud to be a resource and partner for northern communities. Outside of the North, we are working to ensure climate change is considered at early infrastructure planning stages, with tools to flood-proof new and existing communities, and to protect against high winds and tornado events. Throughout the program, SCC has continued to collaborate directly with communities, standards development organizations, and experts from across Canada to ensure that the guidance provided is developed by and accessible to those who need it.

We could not have accomplished this without our partners, likeminded organizations that want to provide real tools to face climate challenges head on. As co-funders, delivery partners, and advisors, their research and input, as well as their connections to broader stakeholder network, is invaluable. The Standards Council of Canada thanks these organizations for their contributions to the success of the program.

However, our work is far from over. Unfortunately, the need for solutions against the impact of climate change continues and SCC has begun SSRIP's phase 2 to build on its momentum. As experts anticipate increased frequency and intensity of extreme weather events due to changing climate, new initiatives addressing elements of catastrophic events are needed more than ever. SCC and SSRIP will strive to continue to be an invaluable resource and partner for all Canadians to safeguard our future.

Chantal Guay, ing. P.Eng. FCAE, ICDD
CEO, Standards Council of Canada

Executive summary

Our buildings and infrastructure are designed with weather in mind. We expect our homes to protect us from heavy snow, our stormwater systems to whisk away heavy downpours, and our electrical grid to be reliable so that we can stay cool in the hottest summers. Climate change means that the intensity and frequency of extreme weather events are changing, and the climate that we considered when setting requirements is not likely to be the same climate that our buildings and infrastructure will experience 10, or 30, or 50 years from now.



Since 2016, the Standards Council of Canada's **Standards to Support Resilience in Infrastructure Program** has advanced standardization strategies to address these rising risks. By updating existing standards and guidance, and developing new standards where there are gaps, we can reduce or avoid many of the risks from climate change. This report provides a detailed overview of our work from 2016 to 2021.

The Program has led the development of **41 standards and related guidance** to safeguard communities and infrastructure. These include:

- Three guidance documents that will help people writing standards – who may be experts in their fields, but not in climate change – consider how to incorporate **weather and climate change information** into their work;
- Thirteen standards and foundational documents that will help communities across Canada reduce the risks of **flooding**;
- Eight projects considering other hazards to buildings and infrastructure, ranging from **extreme heat to wildfire to severe winds**;
- Six new standards, four updated standards, and an updated technical guide that directly help Northern communities deal with **thawing permafrost and extreme weather**, while considering the North's unique geographic and climatic factors;
- A series of four new standards that will increase infrastructure practitioners' **access to highly localized weather and climate data**, by standardizing how hydrometeorological data in Canada is collected, shared, described, and assessed; and,
- New guidance document to support Indigenous communities seeking to **monitor weather and climate variables**.

We've made significant progress, but there is still much more to do to ensure infrastructure is built to **higher design standards** and with climate change in mind. Fortunately, the Standards to Support Resilience in Infrastructure Program has been renewed for a further five years, until 2026. SCC is eager to continue leading the update and development of climate-ready standards that make a substantive difference to Canadian communities, households, and business.

We look forward to continuing our collaborations with researchers, engineers, climate and weather scientists, all levels of government, and other interested parties to advance resilience for Canadian infrastructure and buildings. We encourage you to [get in touch](#) and get involved in standardization for a sustainable future.

Introduction

Canada's climate experts have been clear: "Canada's climate has warmed and will warm further in the future"¹. The effects of this warming are already being felt in communities and by people across the country. The changes that are occurring, from increased flooding to greater wildfires to thawing permafrost² in the North, are having real economic and social impacts on both personal and community levels.

1 Bush, E., and D. Lemmen. 2019. Canada's Changing Climate Report. Ottawa: Environment and Climate Change Canada.

2 Permafrost is rock or soil that remains below 0°C for at least two consecutive years (Source: Northwest Territories Environment and Natural Resources).

Between 2010 and 2019 in
Canada, weather-related,
insured catastrophic
losses totalled over

**\$18
billion**



As we've seen over the past several years, Canada's infrastructure is not immune to the changing climate. Extreme weather and long-term climatic changes put Canada's infrastructure at risk, shortening intended lifespans and increasing the risk of catastrophic failure. In fact, weather-related insured catastrophic losses in Canada have totalled over \$18 billion between 2010 and 2019³. Without action, future costs from flooding events alone could be as high as \$13.6 billion annually by the end of the century⁴. And the costs aren't only financial. Natural disasters, like flooding, can cause high levels of worry and stress with mental health impacts that can last years after an event.⁵

Many of these risks can be reduced or avoided by making sure infrastructure is built to **higher design standards** and with climate change in mind. This is where the Standards Council of Canada's (SCC) **Standards to Support Resilience in Infrastructure program** (or **Infrastructure Program** for short) can help.

Since 2016, SCC's Infrastructure Program has led the development of **41 standards guidance documents and related tools** to safeguard communities and infrastructure. Responding directly to community needs, the Infrastructure Program has championed standards that tackle everything from designing thermally comfortable playgrounds, to protecting communities against flooding, to finding ways to protect Northern buildings against permafrost thaw. This report provides an overview of our work to date.

SCC is continuing to lead development of practical guidance that will make a concrete difference to communities. Under a renewed program, SCC will be expanding our collaboration with standards development organizations, professional associations, local governments, civil society and other interested parties to ensure that Canadians across the country have the tools they need to remain resilient to the impacts of climate change.

3 Canadian Institute for Climate Choices. 2020. Tip of the Iceberg: Navigating the known and unknown costs of climate change for Canada. Available at: <https://climateinstitute.ca/reports/tip-of-the-iceberg/>

4 Canadian Institute for Climate Choices. 2021. Under Water: The costs of climate change for Canada's infrastructure. Available at: <https://climateinstitute.ca/reports/under-water/>

5 Decent, D., and B. Feltmate. 2018. After the flood: The impact of climate change on mental health and lost time from work. Waterloo: Intact Centre on Climate Adaptation.

“

Standards mainstream, advance, and professionalize the field of climate change adaptation by codifying key principles and best practices. Because they are built by consensus, with a balance of stakeholders, they reflect a variety of voices and perspectives, ensuring broad applicability and usefulness.”

Chantal Guay
CEO, SCC

Climate change and Canada’s infrastructure

HOW STANDARDS CAN HELP ADAPT INFRASTRUCTURE

Standards are documents that outline best practice guidance. Following a standard ensures consistency in process, such as in manufacturing, construction or service delivery. A standard can be **mandatory** (if referenced in a regulation, for instance) or **voluntary**. Because the climate is changing, organizations around the world – including SCC and Canadian standards development organizations – are now working to update existing standards or write new ones so that engineers, construction workers, and many others have the tools they need to tackle extreme weather and changing climate conditions.

If used correctly, and checked by a third party, a standard can help make sure that best practices are followed, that people have the proper skills to do their job, or that a piece of built infrastructure will last for a perform and last. On the ground level, having climate-resilient standards implemented will help reduce the impacts of natural disasters, keep homes safe, and save Canadians money over the long term (see Box A).



Box A: Adapting our practices can save money over the long term

An ounce of prevention is worth a pound of cure. This is especially true when it comes to ensuring that infrastructure is safe – having resilient infrastructure will be much cheaper over time than having to repair damages to homes and community infrastructure following an extreme event.

For instance, in its 2019 report, the Global Commission on Adaptation found that investing in adaptation (such as through strengthening early warning systems, making new infrastructure resilient, and other measures) can have significant returns, with “benefit-cost ratios ranging from 2:1 to 10:1”, mostly due to avoided damages⁶. Implementing standards and guidelines have similar benefits.

In 2020, SCC funded an economic assessment that found that if new communities implemented [CSA W204:19 Flood resilient design of new residential communities](#), Canada’s gross domestic product could be boosted by up to \$234 million between 2020 to 2035. The standard, funded under the Infrastructure Program, calls for increasing the stormwater capacity of communities (e.g., through larger stormwater pipes or bigger stormwater ponds) which would result in minimal implementation costs but high returns.

Similarly, a 2019 economic assessment⁷ funded by the National Research Council found that if communities implemented a few new flooding and wildfire guidelines and standards, Canada could save an estimated \$4.7 billion a year, at an estimated added construction cost of \$400 million per year—savings of almost \$12 per \$1 invested.

6 Global Commission on Adaptation. 2019. Adapt now: A global call for leadership on climate resilience. Rotterdam: Global Commission on Adaptation

7 Porter, K; Scawthorn, C. (2020) Estimating the benefits of Climate Resilient Buildings and Core Public Infrastructure (CRBCPI). Prepared for Institute for Catastrophic Loss Reduction, Toronto, 35 pp. Available at: <https://www.iclr.org/wp-content/uploads/2020/03/SPA-Climate-resiliency-book.pdf>

Standards to Support Resilience in Infrastructure Program

By working with researchers, engineers, climate and weather scientists, all levels of government, and other stakeholders, the Infrastructure Program has taken concrete steps to boost infrastructure resilience across the country, to ensure stronger, safer, and more prosperous communities for Canadians in the future.

As of March 31, 2021, the Program exceeded its original goals, and launched **41 projects** directly related to climate change and climate resilience (see Appendix A: Overview of standardization strategies). These projects range from publishing foundational reports that identify priorities and best practices, to supporting national and international standards committees, to funding the development of new standards and updating existing ones.

Box B: Four main themes of work



Designing infrastructure that can stand up to extreme weather

As Canada faces floods, wildfires, coastal erosion, heatwaves, high winds and other weather-related events, SCC is investing in standards that will help build and adapt current infrastructure to extreme weather.



Helping Northern communities adapt to climate change

Recognizing the unique climatic and geographic conditions of the north, SCC has been a leader in advancing Northern-specific standards that help Northerners build in permafrost, deal with extreme weather, and design community systems (like wastewater lagoons).



Arming standards writers with tools to fight climate change

SCC is funding key research to help standards writers make better assumptions—ones that reflect the risks of a changing climate, both today and in the future. This knowledge will allow subject matter experts to update and develop standards that boost the resilience of infrastructure.



Helping get the most out of weather and climate data

To address climate change, we need to understand current conditions, and have the data to forecast for the future. That's why SCC has been supporting new standards and guides to increase the availability and quality of weather and climate data to support better planning and design decisions.



By using standards to tackle climate change, we can strengthen and improve the performance of our infrastructure while demonstrating leadership both at home and globally to build a safer future. Collectively, the work we have done is ensuring that all those involved in the development of infrastructure – from the design of standards, through the maintenance of buildings – are given the tools they need to enact change. For instance, under four main themes of work (see Box B) we have now supported:

- Three guidance documents that will help people writing standards – who may be experts in their fields, but not in climate change – consider how to incorporate weather and climate change information into their work;
- Thirteen standards and foundational documents that will help communities across Canada reduce the risks of flooding;
- Eight projects considering other hazards to buildings and infrastructure, ranging from extreme heat to wildfire to severe winds;
- Six new standards, four updated standards, and an updated technical guide that directly help Northern communities deal with thawing permafrost and extreme weather, while considering the North's unique geographic and climatic factors;
- A series of four new standards that will increase infrastructure practitioners' access to highly localized weather and climate data, by standardizing how hydrometeorological data in Canada is collected, shared, described, and assessed; and,
- A new guidance document to support Indigenous communities seeking to monitor weather and climate variables.

We are working with key stakeholders to find the most important gaps and to address them through standardization (see Figure 1). This includes making standards more accessible to members of the public, promoting and building capacity through training and outreach, and finding ways to help implement and document standards use cases. For instance, to support Northern practitioners, SCC has provided in-person and online training, and has developed [NISI 101 guides](#) on six Northern standards. These illustrated guides are available in English, French, and Inuktitut; two are also available in Inuinnaqtun.

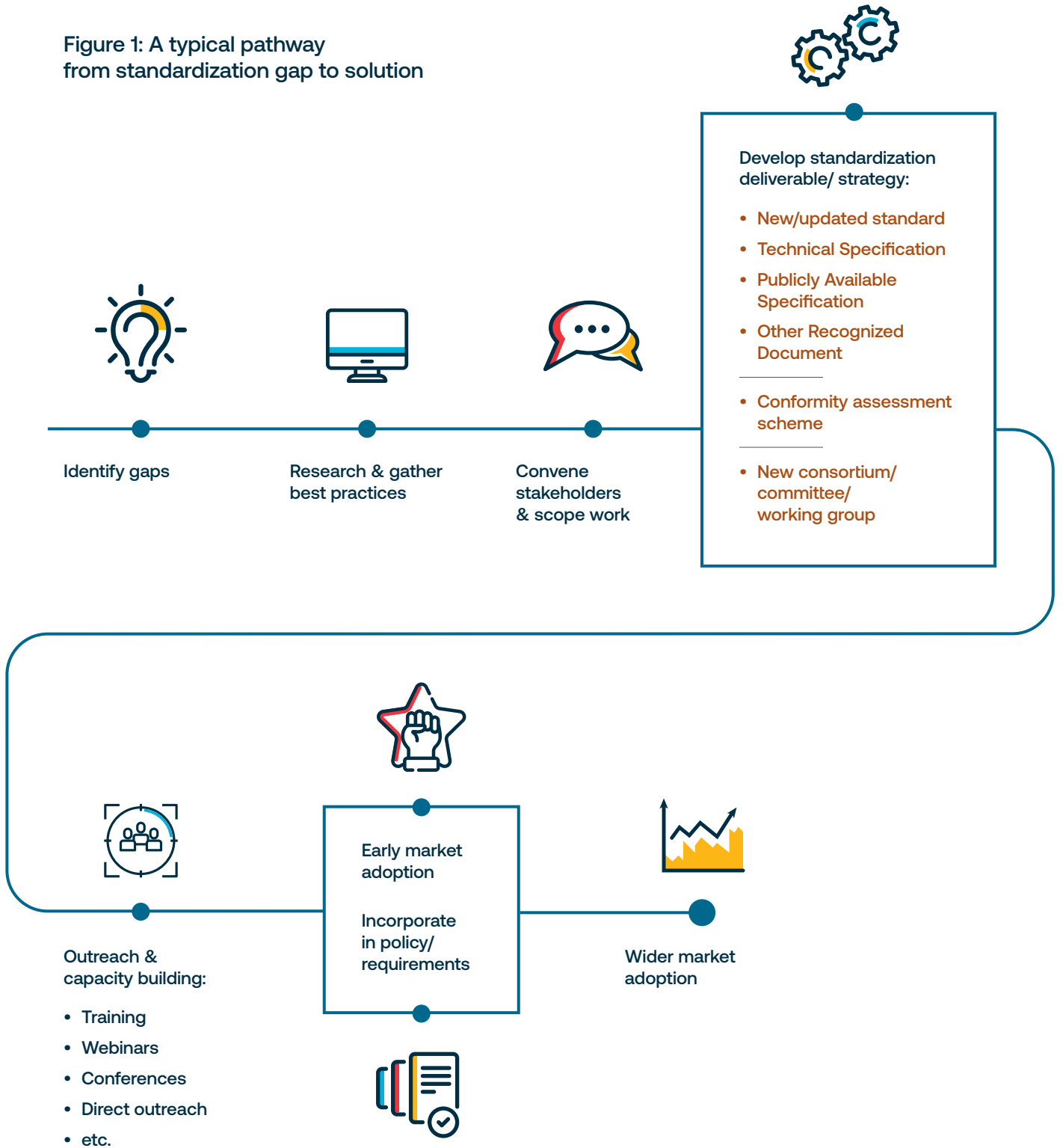
To help Canadians navigate the plethora of new resources on flooding, SCC also funded the development of a new report, [Under One Umbrella: Practical Approaches for Reducing Flood Risks in Canada](#), summarizing the practical actions that stakeholders in Canada can undertake to materially improve flood resilience in their homes, businesses and communities.

To measure our impacts, SCC is collecting data and monitoring the uptake and implementation of new guidance and standards. We are already seeing the incorporation of these documents into new regulations, requirements, and policies across Canada.

For example, CSA W204:19: Flood resilient design of new residential communities have been implemented in several regions in the Alberta, including both Calgary and Edmonton.

We've also seen many northern communities benefit from the adoption of standards, like CSA 5503 Community drainage system planning, design and maintenance in northern communities (2020-11).

Figure 1: A typical pathway from standardization gap to solution



Program achievements



Designing infrastructure to withstand extreme weather

Canada is a large country with a range of weather and climate conditions. From coast to coast to coast, we inhabit Arctic communities, temperate coastal towns, high mountains, and prairie grasslands. Given our range of landscapes, it's not surprising that we also face a range of climate impacts, including floods, wildfires, coastal erosion, heatwaves, high winds, and other weather-related events (see Figure 2).

Given these challenges, it would be impossible to have one document describing how to adapt Canadian infrastructure to all hazards. Rather, we need targeted solutions that address different challenges so that different regions and infrastructure types have the solutions they need.

For that reason, SCC has supported the delivery of several standards that will help build and adapt current infrastructure to different extreme weather and long-term climate change. Below are a few examples.

Figure 2: Climate change hazards and impacts in Canada





New flooding and
wildfire standards could
save Canada, yearly,
an estimated

**\$4.7
billion**

HELPING CANADIANS ADAPT TO FLOODING

Flooding is the costliest extreme weather disaster affecting Canadians, leading to increases in disaster-assistance payouts by all levels of government, and in insurable and uninsurable losses. Beyond financial costs, Canadians who have experienced flood-related losses have also experienced significant mental health impacts. For these reasons, practical guidelines and standards are being designed to strengthen our individual and collective resilience to floods, ranging from simple home maintenance and renovations to more sophisticated community-planning approaches and regulations. SCC has been advancing this effort by supporting the development of research reports, workshops, and new National Standards of Canada that help reduce the risks of residential flooding.

For example, [CSA W204:19 Flood resilient design of new residential communities](#) is a new national standard that provides on-the-ground solutions to reduce residential flooding. Beyond providing peace of mind, an economic analysis has found, that if the standard were implemented in all new communities moving forward, Canada could see a GDP boost of up to \$234M between 2020 and 2035 due to reductions in long-term repair and replacement costs.

SCC also is working to address flooding risks at a system-wide level. For instance, in 2020 the Infrastructure Program hosted a [Federal Flood Mapping Guidelines Series standardization workshop](#) with Natural Resources Canada and Public Safety Canada, which resulted in a roadmap to support the transitioning of certain Federal Flood Mapping Guidelines into National Standards of Canada (NSCs). SCC will be pursuing this work under our renewed Infrastructure Program.



MAKING PLAYGROUNDS SAFER FOR CHILDREN

Playgrounds are essential community infrastructure that introduce children to outdoor fun and encourage active, creative play. Unfortunately, as summers get hotter, those playgrounds are becoming blisteringly hot and uninviting, but, they don't need to be. SCC partnered with the National Program for Playground Safety at the University of Northern Iowa to develop [Thermally Comfortable Playgrounds: A review of literature and survey of experts](#), a report that lays out best practices for keeping kids cool while they play. By considering factors such as natural and artificial shade features, different materials and colours for equipment and surfaces, and where playground equipment is placed, designers can create safe and comfortable playgrounds for all seasons of play.

PROTECTING HOMES AGAINST TORNADOES AND HIGH WINDS

High winds have contributed in part to many natural catastrophes. The September 2018 tornadoes in the National Capital Region, for instance, caused close to \$295 million in insured losses.⁸ Recognizing this, SCC teamed up with the Institute for Catastrophic Loss Reduction to develop a best practice guide, [Increasing High Wind Safety for Canadian Homes: A Foundational Document for Low-Rise and Residential and Small Buildings](#), that proposes measures for roofs, walls, upper and lower storey connections, and anchoring building foundations. These measures, which will protect the structural integrity of residences, are now being considered as part of an SCC-funded NSC that will be published in 2022 (entitled CSA S520 High wind safety for low-rise residential and small buildings).



In September 2018, tornadoes in the National Capital Region caused insured losses close to

\$295 million

8 IBC. 2019. *Severe Weather Causes \$1.9 Billion in Insured Damage in 2018*. January 16. Accessed April 20, 2021. <http://www.ibc.ca/on/resources/media-centre/media-releases/severe-weather-causes-190-million-in-insured-damage-in-2018>



We are currently tackling drainage planning in multiple communities across Nunavut. Drainage planning is of utmost importance for community climate change adaptation in the North because it protects buildings and infrastructure by improving the stability of underground permafrost, thereby reducing the risk of soil sinking, and by reducing the costly impacts of intense floods during the annual spring melt and during summer storms. Having this standard means we can be certain that projects carried out by different suppliers at different sites – often separated by great distances – will all meet a similar standard. That gives us greater peace of mind that we are doing everything we can to keep our communities as safe as we can from the threat of climate change.”

William Patch

Manager, Community Planning,
Government of Nunavut

Helping Northern communities adapt to climate change

Canada’s North is on the front lines of climate change, with temperatures warming at about three times the global rate.⁹ As temperatures increase, the area is seeing more severe storms, precipitation, melting sea ice, and coastal erosion. However, one of the greatest challenges comes from buildings being impacted by changing permafrost (or frozen ground) conditions. Northern communities have tailored their engineering around frozen grounds for decades, on the expectation that the grounds would remain frozen. With climate change disrupting this assumption, older facilities which did not consider climate change or changing permafrost conditions are more vulnerable to sinking and cracking.

Given the high costs and challenges of building in remote regions of the North, it is important that buildings are made to be resilient - this is where standards can make a real difference.

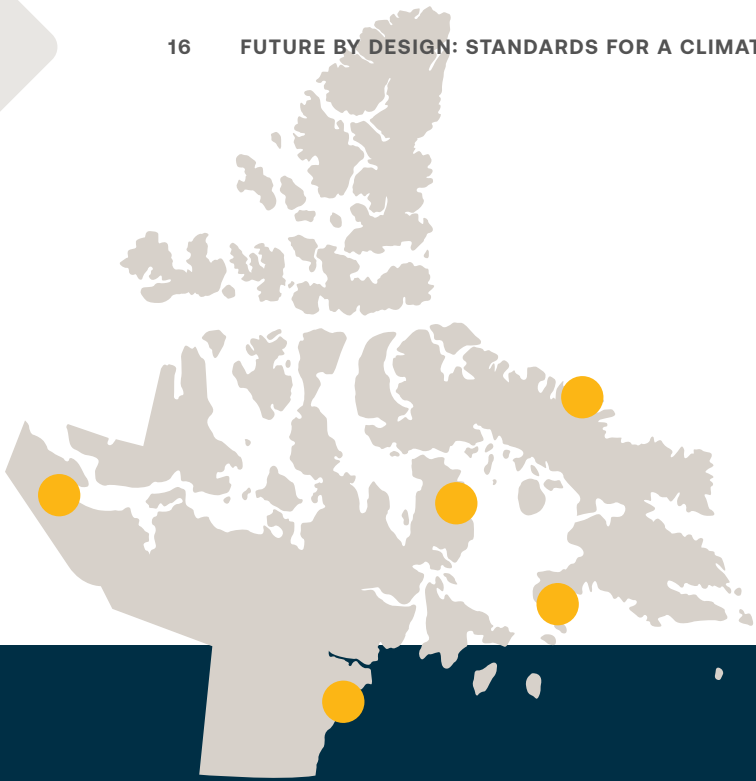
Since 2011, SCC has been leading the [Northern Infrastructure Standardization Initiative \(NISI\)](#) to help building owners and operators, as well as those responsible for public and community infrastructure, construct and maintain infrastructure in a changing climate.

Our work strives to be by-the-North and for-the-North. That’s why all standards developed under NISI have been chosen and shaped by our Northern Advisory Committee, which is made up of representatives from Nunavut, the Northwest Territories, Yukon and Nunavik. Further, every time a new standard is being written, we work with standards development organizations to make sure that it’s written by experts with Northern experience and/or by those living in the North. This way, we help to guarantee that once produced, the standards truly meet the needs of Northerners.

To date, nearly a dozen standards have been developed to help communities build in permafrost, address extreme weather (like high winds and heavy snow), plan community systems (like wastewater sites), and take a long-term view of designing with climate change risks in mind.

More information on our various activities in northern communities can be found here: <https://www.scc.ca/en/nisi/nisi-101>

9 Bush, E., and D. Lemmen. 2019. Canada’s Changing Climate Report. Ottawa: Environment and Climate Change Canada.



Since CSA S503:20 was first published in 2015 (and updated in 2020), it has been implemented in numerous communities across Nunavut including Clyde River, Kugluktuk, Cape Dorset, Hall Beach, and Rankin Inlet.

FIGHTING FLOODING IN CANADA'S NORTH

Flooding is a huge challenge across Canada, and that is no different in the North, where flooding, brought on by climate-fueled extreme weather, can impose extreme costs on small communities. Community leaders and their insurers are looking for ways to avoid disaster and make their communities safer and more resilient in the face of battering storms.

Supporting efforts to create safer, more resilient communities is at the heart of [CSA S503:20 Community drainage system planning, design, and maintenance in northern communities](#). This SCC-supported standard lays out the essentials for ensuring a community's drainage systems are up to the task. Drainage planning is widely recognized as a primary means of community change adaptation because flooding can cause damage to roads and buildings, deteriorate the stability of the permafrost, increase the need for costly maintenance, and compromise the safety of a community. By following this standard, communities can improve their ability to manage their existing drainage challenges, address existing deficiencies, and prepare for future weather events.



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The guideline helps practitioners and decision-makers reach a common understanding of the risks associated with a potential development. For the practitioner, there is initial guidance on climate change projections. For the decision-maker, there is descriptive background information. These facets lead to a framework to develop a sound approach to properly assessing and controlling those risks.”

Ed Hoeve
Senior Geotechnical Engineer

GUIDING INFRASTRUCTURE DECISIONS IN PERMAFROST ZONES

Positive change is more likely if you can get useful knowledge into the hands of decision-makers. We may have the technical know-how to tackle the challenge of permafrost degradation, but if our decision-makers are unaware of what's possible, they may not know where to invest their valuable resources to make their communities as durable and resilient as they can be.

[CSA PLUS 4011:19 Technical Guide: Infrastructure in permafrost: A guideline for climate change adaptation](#) provides such a guide for building infrastructure in permafrost. It includes important guidance on climate change adaptation that is designed to help those with a role in planning, purchasing, developing, or operating community infrastructure. This technical guide will help them better understand the role of climate change in infrastructure planning, what things should be considered when building on permafrost, and what types of foundations work best for different circumstances. In short, it helps decision-makers make the best infrastructure decisions for the future of their communities.






Supporting standards writers considering climate change

Over time, it is expected that many standards in Canada will need to be updated to reflect the impacts of climate change. However, to do so we need to make sure that the people writing standards and related guidance have the tools they need to include climate change considerations in their work, and that the standardization system is well prepared to tackle climate change. That's why in 2017 we established the Standards Development Organizations for Climate Resilient Infrastructure Working Group (SDO CRI WG), which has been instrumental in building the capacity of standards writers. With the participation of representatives from SCC-accredited standards development organizations, this group provides input and advice to SCC's Infrastructure Program and has been integral in delivering projects that aim to integrate climate change adaptation into the standards development process.

With the SDO CRI WG's support, we are now funding research to help standards writers make better assumptions—ones that reflect the risks of a changing climate, today and in the future. In doing so, we are raising the bar and changing the way standards are developed. The knowledge we are helping to build will allow subject matter experts to update and develop standards that boost the resilience of infrastructure.

ADDRESSING CLIMATE CHANGE, NO MATTER THE TOPIC

Standards writers are experts in their topic areas, but climate change adaptation is an emerging area of expertise on its own. That's why it is important that standards writers have tools at their disposal that help them consider the climate. To support this, the Infrastructure Program supported the development of the [Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards](#). This guide provides standards writers with an overview of key considerations for integrating climate change adaptation into standards, guiding questions to help people understand when and how climate change should be considered in a standard, and resources to help find and access relevant climate and data sources. A technical companion to this guidance document with information on collecting and using climate data will be published in 2022.



The SCC is leading the development of standards to increase the quality and quantity of weather data.

Getting the most out of weather and climate data

Canadians love talking about the weather - and for good reason. Canada has a huge range of temperatures with some regions ranging from -30 to plus 30 degrees Celsius over the course of a year. It is integral to our planning that we have reliable, consistent weather data to help us prepare for day-to-day activities. Similarly, engineers and designers also need quality weather and climate data, under both current and future scenarios, to ensure that the buildings they design can withstand changing temperatures, high precipitation, and other extreme weather events.

While Environment and Climate Change Canada has an extensive network of weather stations across the country that keeps us all updated on the conditions outside, there are hundreds and potentially thousands of weather stations that are owned privately or by other orders of government that exist outside this network. That is why we are leading the development of standards that help increase both the quality and quantity of weather data so that underserved areas, like remote and Northern regions, have the local information they need.

EXPANDING THE AVAILABILITY OF QUALITY WEATHER DATA

To help fill weather data gaps, SCC spoke with weather station owners and weather data users to understand what data are missing, what data are most useful for design professionals, and where those data could be found. The result: CSA Group, a standards development organization accredited by SCC, is now being funded by SCC to develop four interlinked National Standards of Canada that will provide guidance for Canadian weather stations on metadata reporting, design and operations, data quality ratings, and protocols for sharing data. Collectively, these standards will go a long way toward improving access to local and regional weather and climate data for infrastructure designers, planners, owners and operators. Having common standards for data collection will also increase the pool of quality data that users can draw from, so they will have the information they need to ensure infrastructure is resilient to the impacts of climate change.

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Indigenous Peoples are disproportionately affected by climate change, particularly in the North and Arctic. Indigenous Peoples are seeing and experiencing the impacts of climate change first-hand. And they are also leaders in climate action, including climate monitoring and research. Indigenous-led climate monitoring and Indigenous Knowledge provide essential and unique information about the changing environment. The Government of Canada is supporting the development of tools that help enable Indigenous communities in monitoring and adapting to the rapidly changing climate as well as plan for future climate action.”

The Honourable Daniel Vandal, P.C., M.P.
Minister of Northern Affairs

SUPPORTING INDIGENOUS COMMUNITIES ACROSS CANADA

Indigenous Peoples in Canada have been observing the local environment for millennia, even if the term “monitoring” has not been applied historically. Increasingly, Indigenous Knowledge Systems and western science are being considered equally for climate change adaptation planning and land-use planning, especially when operating in remote and northern regions.

To support this, SCC partnered with Crown Indigenous Relations and Northern Affairs Canada to develop a new guidance document that will aid Indigenous communities that wish to take part in community-based climate monitoring.

This voluntary guidance document is one step toward supporting Indigenous partners in undertaking self-determined climate monitoring while considering the co-application of Indigenous Knowledge Systems and western science to help monitor and adapt to a changing climate.

Once completed, the document will provide voluntary guidance on how to collect, record, and validate data related to key physical climate variables (e.g., temperature, precipitation, sea ice thickness) and outline best practices for the recording, storage, and sharing of Indigenous climate knowledge while respecting Indigenous principles for data collection, analysis and management, ownership, control and sharing.



Looking forward



The Standards in Action campaign

Over the spring and summer of 2020, SCC held the *Standards in Action: Building a Climate-Resilient Future Campaign* to find out what else is needed to help Canadians adapt to climate change. This virtual, cross-country consultation included online surveys that resulted in a total of 371 survey responses, and key informant interviews with over 40 government, not-for-profit, and private sector stakeholders from across the country. The input we received underscores the importance of the work SCC has advanced to date in close partnership with standards development organizations (SDOs) and other key partners. The findings also highlight the risks of not taking further action to adapt to climate change.

Detailed findings are available in SCC's [final report](#) on the consultation.

SCC received a large volume of input over the course of the campaign, with thought-provoking insights on a wide range of topics. From this input, the following key themes emerged:



Standards are needed to respond to all hazards, but the urgency of these hazards varies by region and sector in Canada.



Responses to climate change in Canada are emerging and maturing, but additional standards and supporting tools are needed.



Mobilizing standards will require more efforts on awareness, guidance, and capacity building.



Standardization could boost the cost-effectiveness of responding to over 35 additional adaptation, mitigation, and sustainability-related challenges.



Over 100 National Standards urgently need updating for climate change.



Canada's standardization system has room to be faster, more ambitious, and more inclusive of diverse perspectives.



Between 2020 and 2035,
new flooding and wildfire
standards could boost
Canada's GDP up to

**\$234
million**

What's next?

Building on accomplishments to date, and the needs identified in the Standards in Action Campaign, SCC is pleased to have renewed funding to continue the Standards to Support Resilience in Program for a further five years. These funds were announced in the [2021 Federal Budget](#) and National Adaptation Strategy. As part of this renewal, SCC has established a formal relationship with Infrastructure Canada and the National Research Council Canada, to maximize our impact and contribution to climate change adaptation for infrastructure.

As Canada's National Standards Body, we look forward to leading the update and development of climate-ready standards that make a concrete difference to Canadian communities, households, and businesses. This work will also require the continuation and expansion of collaboration with partner organizations including standards development organizations, professional associations, and jurisdictions with authority.

Investing in climate-resilient standards and related technical guidance will safeguard and reduce long term maintenance and repair costs of critical infrastructure and protect the health and safety of Canadians.

Appendix A:

Overview of standardization strategies



This annex provides a short description of each of the standardization strategies developed under the Infrastructure Program, including the type of document, the developer, and the hazards addressed. For published documents, click the title to access the report. Most are available to download or view at no cost; exceptions to this are noted in the description of the document. A few documents are pending publication, and for these items the expected publication date is included in the description.

For questions about access to any of these documents, please contact info@scc.ca.

Arming standards writers with the tools to fight climate change

ISO Guide 84:2020 Guidelines for addressing climate change in standards

Type: Guidance Document Developer: ISO Hazards addressed: General

This document provides guidance to standards developers on how to take account of climate change in the planning, drafting, revision and updating of ISO standards and other deliverables. It outlines a framework and general principles that standards developers can use to develop their own approach to addressing climate change on a subject-specific basis. Indisponible en français

Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards

Type: Guidance Document Developer: Manifest Climate Hazards addressed: General

The long-term impacts of climate change are expected to intensify in the future. With Canada's average temperature warming at twice the global rate, recognizing impacts like the increasing occurrence of extreme weather conditions is vital in the development and revision of national standards. A new step-by-step guide, supported by the Standards Council of Canada and prepared by Manifest Climate, will help standards writers address potential climate risks and impacts across the life cycle of products, services, infrastructure, and tests.

Using Climate Information in Standards Development: Technical Companion to the Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards

Type: Guidance Document Developer: WSP Canada and ICLEI Canada Hazards addressed: General

Using Climate Information in Standards Development: Technical Companion to the Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards Technical Companion to the Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards

This Guide is a technical companion to the Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards. It was created to help users understand fundamental concepts in climate change and to determine potential climate impacts and risks to the scope of the standard. It is meant to be applied in cases where climate change has been determined relevant to the standard.

Getting the most out of weather and climate data

Standardization guidance for weather data, climate information and climate change projections

Type: Foundational document

Developer: Ouranos

Hazards addressed: General

This research report examines the state of climate information in our country and highlights how it can be integrated into infrastructure design decisions to make us more climate resilient and better able to adapt to a changing climate.

The research is a comprehensive overview of the state of weather data, climate information and climate change projections in Canada. The report provides recommendations for where standardized guidance could address current gaps and strengthen the integration of this information into infrastructure design. This report supported subsequent roundtable discussions with key stakeholders (below).

Development and implementation of an engagement strategy with weather monitoring stations owners and operators

Type: Foundational document

Developer: SCC

Hazards addressed: General

In 2018, SCC convened a stakeholder roundtable including owners, operators and users of Canadian weather networks to discuss how data collected outside of Environment and Climate Change Canada's meteorological network could be used in planning infrastructure design, and how the collection of that data could be standardized. Findings from this roundtable informed the development of a series of four national standards on weather stations (CSA R100, CSA R101, CSA R102, and CSA R103), described on the next page. The document is an internal SCC report, but is available on request, in English.

CSA R100:20 Canadian metadata standard for hydrometeorological monitoring stations

Type: Standard

Developer: CSA Group

Hazards addressed:
General / Data collection and use

This is one of four national standards focusing on data collected by hydrometeorological monitoring stations and descriptive data about the stations. This standard promotes best practices for collecting metadata for hydrometeorological stations and for publishing those metadata publicly at a central repository. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA R101 Siting, operations and maintenance of Canadian automated hydrometeorological monitoring stations

Type: Standard

Developer: CSA Group

Hazards addressed:
General / Data collection and use

This standard will provide information on the siting, design, and operations of automated hydrometeorological stations. This is one in a four-part series of standards on data collected by hydrometeorological monitoring stations and descriptive data about the stations. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA R102 Data quality of Canadian hydrometeorological stations

Type: Standard

Developer: CSA Group

Hazards addressed:
General / Data collection and use

This is one in a four-part series of standards on data collected by hydrometeorological monitoring stations and descriptive data about the stations. This Standard provides a framework to assess, tabulate, and quantify factors contributing to the quality of hydrometeorological data. It includes a description of the data quality rating system, a description of organization-wide factors linked to management systems, training and certification of operators, as well as data storage and archiving policies, and a description of instrument-specific factors. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA R103 Data sharing for Canadian automated hydrometeorological monitoring stations

Type: Standard

Developer: CSA Group

Hazards addressed:
General / Data collection and use

This is one in a four-part series of standards on data collected by hydrometeorological monitoring stations and descriptive data about the stations. This Standard provides requirements and recommendations for the sharing of data collected at hydrometeorological monitoring stations, and considers the use of equipment and software for doing so. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

Risk assessment of the effects of climate change on the Rideau Canal Skateway

Type: Foundational document

Developer: WSP Canada

Hazards addressed: General

The NCC and the Standards Council of Canada (SCC) commissioned a climate change risk assessment to define the climate change impacts on the Rideau Canal Skateway (RCS), analyse the severity of consequences and likelihood of these impacts, and propose recommendations to mitigate the greatest climate risks and increase the resilience of the RCS. The findings have been used to inform further research and activities by National Capital Commission, including a four-year partnership with Carleton University. The findings have also informed SCC's understanding of the application of the ISO 31000 and ISO 14091 standards to unique Canadian infrastructure.

CSA PLUS 4013:19 Technical guide: Development, interpretation and use of rainfall intensity-duration-frequency (IDF) information: Guideline for Canadian water resources practitioners

Type: Updated guidance document

Developer: CSA Group

Hazards addressed:
Extreme precipitation / flooding

This Guideline has been designed for professionals with a role in the planning, design, management, inspection, and regulation of stormwater, drainage, wastewater, and flood management systems. It is not a design text book, but rather a resource for understanding the derivation, and application in water system planning and design, of rainfall intensity-duration-frequency (IDF) information.

Indigenous community-based physical climate monitoring best practices guide

Type: Guidance document

Developer: Scout Engineering

Hazards addressed: General / Data collection and use

This voluntary guidance document is one step toward supporting Indigenous partners in undertaking self-determined climate monitoring while considering the co-application of Indigenous Knowledge Systems and western science to help monitor and adapt to a changing climate. Once completed, the document will provide voluntary guidance on how to collect, record, and validate data related to key physical climate variables (e.g., temperature, precipitation, sea ice thickness) and outline best practices for the recording, storage, and sharing of Indigenous climate knowledge while respecting Indigenous principles for data collection, analysis and management, ownership, control and sharing. SCC partnered with Crown Indigenous Relations and Northern Affairs Canada to lead this project.

Helping Northern communities adapt to a rapidly changing climate**CSA-S500:21 Thermosyphon foundations for buildings in permafrost regions**

Type: Updated standard

Developer: CSA Group

Hazards addressed: Permafrost thaw

This standard provides requirements for all life cycle phases of thermosyphon foundations for new buildings on permafrost, including site characterization, design, installation, and commissioning phases as well as for monitoring and maintenance phases. This Standard is meant to ensure the long-term performance of thermosyphon-supported foundation systems under changing environmental conditions. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA-S501:21 Moderating the effects of permafrost degradation on existing building foundations

Type: Updated standard

Developer: CSA Group

Hazards addressed: Permafrost thaw

This standard covers the following strategies to maintain permafrost or mitigate permafrost degradation related to existing buildings or structures:

- a. site techniques that consist of i) site grading and drainage; ii) snow management; and iii) shading or albedo change.
- b. foundation techniques that consist of i) ventilation; ii) ground insulation; iii) foundation adjustment and levelling; iv) mechanized refrigeration and thermosyphons; and v) foundation replacement.

The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA-S502:21 Managing changing snow load risks for buildings in Canada's North

Type: Updated standard

Developer: CSA Group

Hazards addressed: Extreme precipitation (snow)

The objective of this standard is to inform communities on measures for safe roof snow removal from existing buildings and for protection of building occupants and assets from overloading risks due to increasing accumulations and weights. Procedures that can reduce risks for roof and building collapses are outlined, including procedures for monitoring heavy snow and ice accumulations, safe removal of snow on roofs when needed, and for maintenance and snow removal planning. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA-S503:20 Community drainage system planning, design, and maintenance in northern communities

Type: Updated standard

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This standard specifies the minimum planning, design, and maintenance requirements for community drainage systems in Canada's northern communities. The purpose of this Standard is to increase the capacity of communities and individuals to prepare and implement effective community drainage plans. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA W203:19 Planning, design, operation, and maintenance of wastewater treatment in northern communities using lagoon and wetland systems

Type: Standard

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This standard specifically addresses the planning, design, operation, and maintenance of intermittent/seasonal discharge lagoon and wetland systems that are most appropriate for use in Northern regions, where effluent discharge is either difficult or not possible in colder months. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

BNQ 9701-500 Risk-Based Approach for Community Planning in Northern Regions

Type: Standard

Developer: Bureau de normalisation
du QuébecHazards addressed:
Permafrost thaw

When determining the best places to build new community infrastructure, it is important to identify the hazards and vulnerabilities of potential construction areas, as well as the potential future climate risks. This standard will help communities understand the pros and cons of developing infrastructure in different areas. The standard is available for purchase from the Bureau de normalisation du Québec and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA W205:19 Erosion and sedimentation management for northern community infrastructure

Type: Standard

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This standard applies to the management of erosion and sedimentation risks, including the evaluation, planning, design, implementation, monitoring, and maintenance of erosion and sedimentation risk management strategies and mitigation measures for new and existing infrastructure in northern communities. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA S504:19 Fire resilient planning for northern communities

Type: Standard

Developer: CSA Group

Hazards addressed: Wildfire

This standard specifies requirements for fire resilient community planning, building design, materials for new developments, and also for re-locatable industrial, commercial, or residential structures in northern regions. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA PLUS 4011:19 Technical Guide: Infrastructure in permafrost: A guideline for climate change adaptation

Type: Updated guidance document

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This guidance document supports decision makers – who may not be experts in permafrost – who have a role in planning, purchasing, developing, or operating community infrastructure in permafrost regions. This guide is intended to equip decision makers with the ability to ensure that the impacts of climate change on permafrost are considered for new community infrastructure. The standard can be purchased from the CSA Store and is also available for no-fee download to visitors with a Canadian IP address.

CSA PLUS 4011.1:19 Technical Guide: Design and construction considerations for foundations in permafrost regions

Type: Guidance document

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This guideline is intended to assist developers, designers, the general public, and other stakeholders understand the permafrost terrain of Canada, as well as the general selection process and choices for permafrost foundations and their limitations. This Guideline is a companion document to CSA PLUS 4011. It is intended to provide more detailed technical information on the attributes of the various foundation systems, selection criteria, ground conditions, and related issues. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA R111:21 Solid waste sites in northern communities: From planning to post-closure

Type: Standard

Developer: CSA Group

Hazards addressed:
Permafrost thaw

This standard draws on industry expertise and best practices in Canada and internationally to address the requirements for solid waste management in the North, including the entire lifecycle of solid waste sites beginning with siting, to design, construction, operations, and management, and, finally, closure and decommissioning, and post-closure of municipal solid waste facilities. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA S505:20 Techniques for considering high winds and snow drifting as it pertains to northern infrastructure

Type: Standard

Developer: CSA Group

Hazards addressed: High winds

This standard provides guidance to northern infrastructure designers, builders, operators, and owners to address the increased risk of damage to the built environment, including the potential effects of climate change (specifically, risks from higher and more frequent wind loads and from associated snow drifting). The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

Designing infrastructure that can stand up to extreme weather events**CAN/CSA S37-18 Antennas, towers, and antenna-supporting structures**

Type: Updated standard

Developer: CSA Group

Hazards addressed: General

This Standard applies to structural antennas, towers, antenna-supporting structures, and roof- and wall- mounted structures, including their components, such as guys and foundations. It covers the structural design, fabrication, and erection of new structures and the modification of existing structures. SCC supported the review and update of this standard to consider climate change adaptation.

CSA Z240.10:19 Site preparation, foundation, and installation of buildings

Type: Updated standard

Developer: CSA Group

Hazards addressed: General

This is the fifth edition of CSA Z240.10:1, Site preparation, foundation, and installation of buildings. Significant changes to this edition address climate change adaptation with revisions and new provisions. This standard is intended to be referenced by regulatory authorities, land-lease community owners, and building designers and installers so that proper on-site installation of buildings can be achieved. SCC supported the review and update of this standard to consider climate change adaptation.

Increasing High Wind Safety for Canadian Homes: A Foundational Document for Low-Rise Residential and Small Buildings

Type: Foundational document

Developer: ICLR

Hazards addressed:
High winds

This report provides the basis for the development of a set of commonly acceptable, straightforward, wind risk reduction measures that can be incorporated into new single-family home construction and significant renovations to reduce risk to life, health, and property. Measures presented in this document are intended to reduce risk from high winds associated with tornadoes, hurricanes, and other types of extreme weather events. This report was used as a seed document for the development of CSA S520 (described below).

CSA S520 High wind safety for low-rise residential and small buildings

Type: Standard

Developer: CSA Group

Hazards addressed: High winds

This Standard contains best practice guidance for the design and construction of low-rise, wood-frame buildings to withstand high winds corresponding to EF-2 tornado-level wind speeds.

Developing a method for conducting wildland/urban interface fire case study research: A foundational document

Type: Foundational document

Developer: ICLR

Hazards addressed: Wildfire

This report serves as a foundation and is a first step toward creating best practices for wildland/urban interface (WUI) fire exposure and impact case studies in Canada. The report also explores what a comprehensive methodology might look like. It addresses scientific, operational, and administrative aspects of implementing WUI fire case study research.

Thermally comfortable playgrounds: A review of literature and survey of experts

Type: Foundational document

Developer: National Program for
Playground Safety, University of
Northern Iowa

Hazards addressed: Extreme heat

Thermally Comfortable Playgrounds collects the latest research and practical knowledge into one document. It draws upon a literature review and a survey of experts while summarizing design practices and site features that create safe and comfortable playgrounds for all seasons of play. The report considers factors such as natural and artificial shade features, material and colour selection for equipment and surfaces, and playground equipment placement before presenting a set of evidence-based recommendations that can be included in equipment and design standards. Recommendations from this report were included as informative guidance in the CSA Z614:20 Children's playground equipment and surfacing standard.

Mobilizing the recommendations in *Thermally Comfortable Playgrounds*: Engagement summary report

Type: Foundational document

Developer: Kennedy Consulting

Hazards addressed: Extreme heat

This report summarizes the results of an engagement process to discuss ideas to mobilize the recommendations found in a recently published report by the Standards Council of Canada (SCC), in collaboration with the National Program for Playground Safety (NPPS), called *Thermally Comfortable Playgrounds*. It provides a vision for playgrounds in 2050 and recommendations for short-, medium-, and long-term actions.

Developing a Stormwater Quality Management Standard (QMS) in Light of a Changing Climate

Type: Foundational document

Developer: Credit Valley
Conservation, Zizzo Strategy
(now Manifest Climate), and
Engineers CanadaHazards addressed: Extreme
precipitation / Flooding

This project seeks to understand the role and scope of a risk and quality management standard that could be developed to assist municipalities, engineers and other professional practitioners in designing, operating, maintaining and continuously improving stormwater management systems—both today and in light of a changing climate. This report was used as a seed document for the development of CSA W211:21 (described below).

CSA Z240.10.1:19 – Site preparation, foundation, and installation of buildings

Type: Foundational document

Developer: Credit Valley Conservation, Zizzo Strategy (now Manifest Climate), and Engineers Canada

Hazards addressed: Extreme precipitation / Flooding

This is the fifth edition of CSA Z240.10.1, Site preparation, foundation, and installation of buildings. Significant changes to this edition address climate change adaptation with revisions and new provisions. This Standard is intended to be referenced by regulatory authorities, land-lease community owners, and building designers and installers so that proper on-site installation of buildings can be achieved. This report was used as a seed document for the development of CSA W211:21 (described below).

CSA W211:21 Management standard for stormwater systems

Type: Standard

Developer: CSA Group

Hazards addressed: Extreme precipitation / Flooding

The purpose of this Standard is to provide requirements and recommendations for management of stormwater systems. It defines a risk-based process for decision makers responsible for the operation, maintenance, and management of stormwater systems. It provides a standardized guidance process to manage a stormwater system to meet regulatory requirements, reflect sound policy decision-making, and demonstrate a high standard of care to minimize legal, environmental, social, and economic risks, especially given a changing climate and hydrologic conditions. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

Weathering the Storm: Developing a Canadian Standard for Flood-Resilient Existing Communities

Type: Foundational document

Developer: Intact Centre on Climate Adaptation

Hazards addressed: Extreme precipitation / Flooding

This standard outlines voluntary guidance associated with a flood hazard and vulnerability screening framework. The purpose of the screening framework is to aid in the process of prioritizing flood risk-reduction work within existing communities. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

CSA W210:21 Prioritization of flood risk in existing communities

Type: Standard

Developer: CSA Group

Hazards addressed: Extreme precipitation / Flooding

This standard supports the integration of flood risk management in the municipal infrastructure planning process, serving as a tool to inform decisions about flood-related resource allocation. It presents a three-tiered risk assessment methodology that overlays various flood hazards and proxy risk factors to score and determine areas within a community at highest risk of flooding. The standard is available for purchase from the CSA Store and is also available for no-fee View Access to visitors with a Canadian IP address.

Preventing Disaster Before It Strikes: Developing a Canadian Standard for Flood-Resilient Residential Communities

Type: Foundational document

Developer: Intact Centre on Climate Adaptation

Hazards addressed: Extreme precipitation / Flooding

This report identifies 20 best practices to design and build new residential communities that are more flood resilient. This report was funded by SCC and Intact Financial Corporation and served as a seed document to develop CSA W204:19 (described below).

CSA W204:19 Flood resilient design of new residential communities

Type: Standard

Developer: CSA Group

Hazards addressed: Extreme precipitation / Flooding

This standard gathers together requirements and recommendations for designing and building flood resilient communities and provides guidance on how to manage with increased urban development and aging infrastructure. The standard captures a holistic view of planning and development, from the watershed level to the operation and maintenance of stormwater infrastructure, and clearly lays out what needs to be done from the earliest stages to ensure that communities can recover quickly from severe flooding events.

Under One Umbrella: Practical Approaches for Reducing Flood Risks in Canada

Type: Capacity building

Developer: Intact Centre on Climate Adaptation

Hazards addressed: Extreme precipitation / Flooding

This report is a compilation of national standards and guidelines for increasing Canada's resilience to flooding. Presented as a "one-stop-shop" for practical and cost-effective ways to alleviate the risk of future floods, the report's key message is that Canadians already have the tools they need to protect lives and property from flooding. What has been lacking – until now – is a summary of practical actions that stakeholders in Canada can undertake to materially improve flood resilience in their homes, businesses, and communities. This report was funded by SCC and Intact Financial Corporation.

Federal Flood Mapping Guidelines Series Standardization Workshop Summary Report

Type: Foundational document

Developer: Kennedy Consulting

Hazards addressed: Extreme precipitation / Flooding

The Federal Flood Mapping Guidelines Series Standardization Workshop was co-hosted by Natural Resources Canada, Public Safety Canada, and the Standards Council of Canada. The workshop was held to initiate a long-term project to strengthen flood mapping practices, contributing to safer and more resilient communities across Canada.

Reducing the Risk of Inflow and Infiltration in New Sewer Construction

Type: Foundational document

Developer: ICLR, Norton Engineering Inc., and Engineers Canada

Hazards addressed: Extreme precipitation / Flooding

The report compiles methods that can be applied when sewers are first constructed to limit the risk of leakage. Every year across Canada, billions of litres of clean rain and groundwater leaks or flows into sanitary sewers and on to sewage treatment plants. This entry of excess water into sewers – referred to as Inflow/Infiltration (I/I) – shortens the lifespan of pipes, takes up capacity in the sewage network, and drives up costs for governments and taxpayers. Recent research in Ontario suggests that excessive I/I occurs even in new sewer systems which, if built properly, should be essentially leak-free. This report served as a seed document for the development of BNQ 3682-320 (described below).

BNQ 3682-320 Mitigation of risks of inflow and infiltration in new sewer networks

Type: Standard

Developer: Bureau de normalisation du Québec

Hazards addressed: Extreme precipitation / Flooding

This new Canadian standard establishes the requirements associated with the design of the new sanitary sewer systems to ensure that they are more efficient and more resistant to weather phenomena related to climate change. This new National Standard of Canada is a reference for infrastructure professionals and decision makers involved in the management of local and regional infrastructure, residential construction as well as the creation and implementation of climate resilience programs. The standard is available for purchase from the Bureau de normalisation du Québec and is also available for no-fee View Access to visitors with a Canadian IP address.

Developing an Efficient and Cost-Effective Inflow and Infiltration (I/I) Reduction Program

Type: Foundational document

Developer: ICLR and Norton Engineering Inc.

Hazards addressed: Extreme precipitation / Flooding

This report discusses methods that can be applied for efficient, effective programs designed to address I/I in existing sewer systems. The report was supported by an expert stakeholder committee and a national consultation process that engaged municipal, building, development, insurance and engineering experts from across the country.

Rising Seas and Shifting Sands: Combining Natural and Grey Infrastructure to Protect Canada's Eastern and Western Coastal Communities

Type: Foundational document

Developer: Intact Centre on Climate Adaptation

Hazards addressed: Extreme precipitation / Flooding

Rising seas, swollen atmospheric rivers and post-tropical storms are a threat to community infrastructure, housing and the safety of those living along Canada's east and west coasts. This new guidance, supported by the Standards Council of Canada, the National Research Council of Canada, and Infrastructure Canada, catalogues approaches falling under two types of coastal protection: Traditional Grey Infrastructure: Hard, engineered coastal protection measures, such as seawalls, dikes, and barriers; and Nature-Based Solutions: Measures that depend on, or mimic, natural systems to manage flood and erosion risk, such as saltmarsh restoration or replenishing beach and dune systems with sand.

Appendix B:

Partner organizations



The following organizations participated in the delivery of the Standards to Support Resilience in Infrastructure Program, as co-funders, delivery partners, and advisors. The Standards Council of Canada thanks these organizations for their contributions to the success of the Program.

Bureau de normalisation du Québec (BNQ)

Canadian Forest Service

Credit Valley Conservation

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)

CSA Group

Engineers Canada

ForestWise Environmental Consulting

Health Canada

ICLEI Canada

Infrastructure Canada

Institute for Catastrophic Loss Reduction (ICLR)

Intact Centre on Climate Adaptation

Intact Financial Corporation

International Organization for Standardization (ISO)

Kennedy Consulting

Manifest Climate (formerly Zizzo Strategy)

National Program for Playground Safety

National Research Council Canada

Natural Resources Canada

Norton Engineering Inc.

Ouranos

Public Safety Canada

Scout Engineering Inc.

University of Waterloo

Western University

WSP Canada Inc.



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