>>> PREPARE OR REPAIR

How climate-proofing public infrastructure pays off

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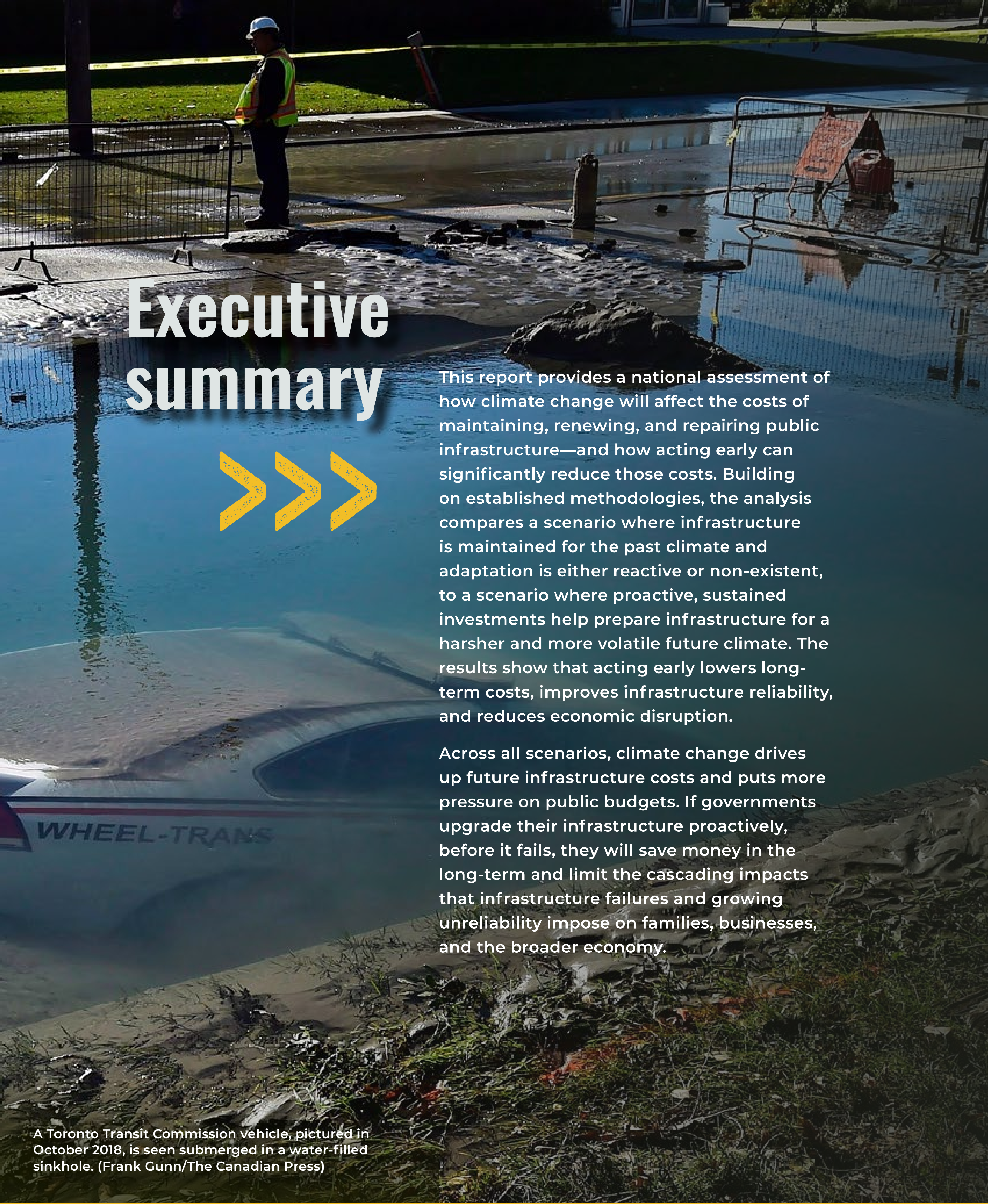


A Toronto Transit Commission vehicle, pictured in October 2018, is seen submerged in a water-filled sinkhole. (Frank Gunn/The Canadian Press)

Executive summary

This report provides a national assessment of how climate change will affect the costs of maintaining, renewing, and repairing public infrastructure—and how acting early can significantly reduce those costs. Building on established methodologies, the analysis compares a scenario where infrastructure is maintained for the past climate and adaptation is either reactive or non-existent, to a scenario where proactive, sustained investments help prepare infrastructure for a harsher and more volatile future climate. The results show that acting early lowers long-term costs, improves infrastructure reliability, and reduces economic disruption.

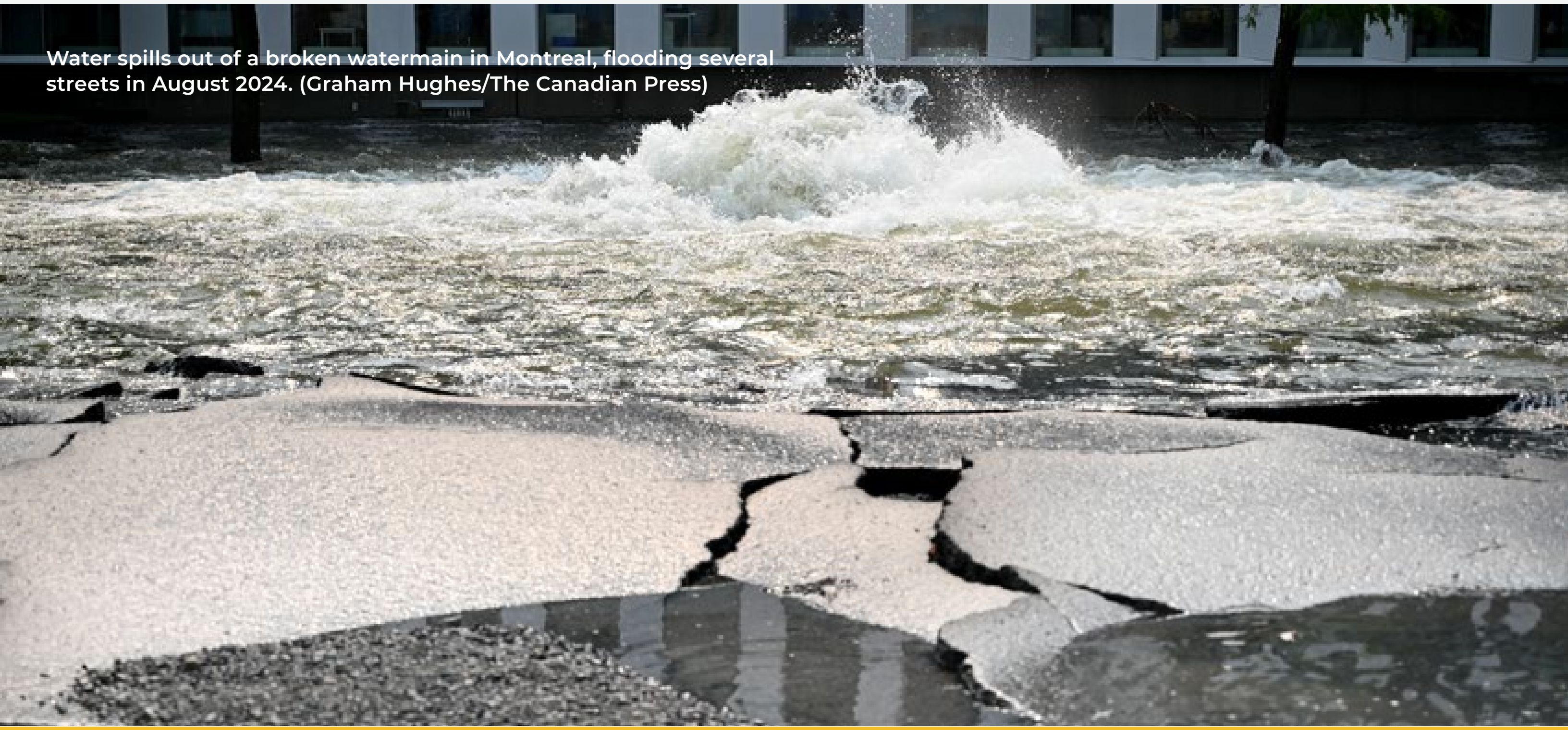
Across all scenarios, climate change drives up future infrastructure costs and puts more pressure on public budgets. If governments upgrade their infrastructure proactively, before it fails, they will save money in the long-term and limit the cascading impacts that infrastructure failures and growing unreliability impose on families, businesses, and the broader economy.

Canadian communities, businesses, and families rely on public infrastructure every day—the roads and transit systems that connect people to work, school, and services; the bridges and highways that allow goods to move across regions; and the water and sewer systems that provide safe drinking water and keep homes and streets from flooding. When these systems work well, daily life runs smoothly and businesses operate efficiently.

However, much of this infrastructure is already in poor or declining condition after decades of underinvestment. Climate change is compounding this challenge by accelerating wear and tear and increasing service disruptions. As primary owners of public infrastructure, governments—especially municipalities—must absorb rising maintenance and repair demands within already constrained budgets. When these costs rise faster than available funding, the pressure is felt by communities and taxpayers—showing up through higher taxes and utility rates, and more service outages, flooding, and travel disruptions.

Climate change will significantly increase infrastructure costs

The analysis projects that climate-driven hazards will accelerate damage and deterioration across public infrastructure. It focuses on a subset of impacts—extreme rainfall, heat stress, and select flooding effects—which capture only part of the pressures infrastructure owners will face. Even within this limited scope, infrastructure costs without adaptation reach $14 billion per year by the 2050s and $19 billion per year by 2085 in the most likely scenario—with higher or lower costs possible under different climate outcomes.



Water spills out of a broken watermain in Montreal, flooding several streets in August 2024. (Graham Hughes/The Canadian Press)

Proactive adaptation reduces long-term costs

Upgrading assets for climate resilience before they reach critical deterioration points avoids costly failures, emergency repairs, and service disruptions.

Median estimates indicate that proactive adaptation to extreme rainfall and rising heat:

- **Lowers total costs** by nearly **$10 billion per year** compared with no adaptation and more than **$5 billion per year** compared with reactive adaptation at time of replacement.
- **Generates net savings based on avoided direct infrastructure damage alone** even after conservatively discounting future benefits.
- **Increases the share of climate-resilient assets** from near zero today **to nearly 25 per cent by 2030 and over 70 per cent by 2050**.
- **Avoids sharp cost escalation later in the century**, reducing the risk of large, unplanned infrastructure expenditures and improving budget predictability.

Although proactive adaptation delivers significant cost savings compared to reactive or no-adaptation approaches, it does not stop infrastructure costs from rising. Proactive adaptation requires sustained investment averaging $3 billion per year, but even with that, some climate damage will be unavoidable, leading to added costs. Taken together, infrastructure owners face average annual costs of over $5 billion, including both adaptation investment and damage repairs—still substantially lower and far more predictable than reactive or no-adaptation approaches.

The analysis also shows that adapting existing infrastructure to heat and rainfall is only part of the response required: as climate risks intensify, governments will need to make major additional investments in new protective infrastructure—such as flood protection measures like dikes—to manage risks that cannot be addressed solely through upgrades to existing assets.

Indirect benefits strengthen the case for adaptation

When public infrastructure fails, the ensuing costs extend beyond infrastructure budgets, creating broad ripple effects. Governments face emergency response and disaster assistance costs, while households and businesses experience losses that do not appear on public balance sheets, including property damage, disrupted mobility, supply-chain interruptions, and reduced economic output.

Many of the economic impacts of infrastructure damage and disruption—such as insurance premium increases, business interruption, and supply-chain disruption—are outside the scope of the analysis. If these impacts could be fully quantified, the overall benefits and returns on investment from proactive adaptation would be substantially higher.

Recommendations

The report identifies six priority policy pathways for federal, provincial, and territorial governments to accelerate proactive, co-ordinated public infrastructure adaptation and reduce long-term costs:

1. **Mobilize financing and partnerships for adaptation.** Expand funding for infrastructure adaptation and modernize financial tools available to municipalities and other infrastructure owners—including Indigenous governments—to finance resilience upgrades.
2. **Mainstream adaptation in infrastructure asset management.** Plan, operate, maintain, and renew public infrastructure so it continues to function safely and reliably under future climate conditions.
3. **Strengthen hazard data foundations.** Expand and strengthen climate hazard data and mapping nationwide to support consistent, risk-informed infrastructure decision-making.
4. **Modernize codes and standards for a changing climate.** Accelerate updates to infrastructure codes and standards so that new and renewed infrastructure is built to withstand Canada's changing climate.
5. **Integrate climate resilience into public infrastructure funding.** Ensure all public infrastructure funding consistently accounts for climate risk and supports infrastructure owners in reducing long-term vulnerability.
6. **Identify and support vulnerable communities and critical assets.** Tailor programs to support the most vulnerable communities and critical infrastructure.

Taken together, the evidence shows that acting now costs far less than waiting. It also delivers strong economic returns and reduces long-term risks to public finances. Investing in resilient infrastructure is a smart use of public funds to manage climate risk, protect communities and taxpayers, and ensure Canada's infrastructure continues to support economic productivity and community well-being in a changing climate.

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FCM FEDERATION OF CANADIAN MUNICIPALITIES FÉDÉRATION CANADIENNE DES MUNICIPALITÉS

CLIMATE PROOF CANADA

IBC Insurance Bureau of Canada

Damage left by 2021 flooding in Abbotsford, B.C. is seen on Boundary Road, which separates Canada and the United States. (Darryl Dyck/The Canadian Press)

1

Introduction

Climate change is reshaping life in Canada. Floods hit harder, heat waves stretch communities past their limits, and wildfires burn longer than ever before. Across the country, the costs of extreme weather are mounting, displacing families, disrupting businesses, and straining public budgets. These impacts are no longer distant risks—they are changing the way Canadians live today.

One of the most striking consequences of climate change is the impact on the public infrastructure that was built for a climate that no longer exists. Roads buckle in the heat, storm sewers overflow during heavy rains, and water treatment systems struggle to maintain safe supplies during droughts and contamination events. When public infrastructure fails, the effects ripple through every part of the economy—cutting off transport, power, and emergency services, disrupting supply chains, closing schools and hospitals, halting manufacturing and trade, and stranding communities.

Whether these impacts intensify or are reduced depends on how effectively infrastructure is adapted to a changing climate. Because public infrastructure is owned and financed by individual governments across different orders, the burden of investing in adaptation is concentrated on those owners. But the benefits of resilient infrastructure reach far beyond government balance sheets, protecting households, businesses, and communities alike. This creates a shared public challenge: while proactive adaptation delivers strong returns to society as a whole, no single government can fully capture those benefits or finance the required investments alone. As a result, spending on proactive adaptation trails far behind the need, trapping governments in a deepening, costly cycle of infrastructure damage and repair.

This report examines the costs of inaction in the face of climate threats to publicly owned infrastructure—and the payoffs of adaptation. It puts clear economic evidence on the table to help governments make smarter, forward-looking investments that save money and lives over time. Building on earlier provincial studies, this analysis extends findings across all public infrastructure types at a national scale, bringing together insights on infrastructure risk, fiscal pressures, and adaptation needs into a unified assessment.

This analysis has three parts: First, it estimates how much climate change could cost for Canadian public infrastructure repair and replacement without adaptation. Second, it assesses the benefits of proactive adaptation—how much damage can be avoided, how much resilience can be gained, and what return investments deliver. Third, it compares these costs and benefits using clear and accessible economic metrics.

The message is clear: adapting public infrastructure proactively isn't just an expense—it's a smart investment. Acting now will save billions in future losses, while also protecting essential services and strengthening communities across the country. Waiting will only drive costs higher. Investing in infrastructure resilience today means a safer, more prosperous Canada tomorrow.

A sign along 48th street in Yellowknife warns of a bumpy road ahead. (Mikeinlondon/iStock.com)

Toronto's Gardiner Expressway, seen here in June 2014, underwent rehabilitation work after falling concrete became an issue. (Mikeinlondon/iStock)

2 Infrastructure pressures are intensifying under climate change

Canada's public infrastructure is increasingly strained by a changing climate. More frequent and intense rainfall, heat waves, freeze-thaw cycles, and coastal storms—among other hazards—are pushing systems beyond their design limits. Most of this infrastructure was built for past conditions and is already aging, leaving governments to manage growing costs and mounting repair backlogs. Without faster adaptation, these pressures will steadily erode service reliability and public budgets.

2.1 Canada's infrastructure is aging and already under strain

Canada begins infrastructure adaptation from a position of weakness. Long before climate pressures became evident, the country faced a deep and persistent infrastructure deficit. Since the mid-1970s, investment in building and maintaining public infrastructure has lagged behind population growth, inflation, and asset deterioration (BCG 2020; Mackenzie 2013). The result is a large stock of aging assets that are increasingly unreliable and costly to operate.

Across the country, decades of deferred maintenance have left about 14 per cent of core public infrastructure—roads, bridges, public buildings, and water and wastewater systems—in poor or very poor condition. Public infrastructure owners estimate a $294-billion investment is needed to restore Canada's infrastructure to good repair (Statistics Canada 2025b). Many systems are operating beyond their design life and are at risk of failure.

This deficit stems partly from fiscal policy. Budget restraint in the 1980s and 1990s cut infrastructure spending to balance public finances while responsibilities for maintenance and renewal were increasingly downloaded to municipalities without matching fiscal authority. Today, municipalities own more than

60 per cent of core public infrastructure but collect only about 10 per cent of government tax revenues (Statistics Canada 2023; Slack and Taylor 2024). This mismatch leaves local governments responsible for most infrastructure but with limited capacity to maintain or replace it. Deferring investment is not sustainable: postponed maintenance sharply increases future rehabilitation costs (Canadian Infrastructure Report Card 2019). The City of Calgary, for example, estimates that inadequate pavement maintenance can make future reconstruction five to seven times more expensive (Yang 2024).

>>> **Canada's infrastructure deficit is more than a fiscal problem—it is a climate-risk multiplier.**

Beyond funding, fragmented governance hampers long-term planning and co-ordination. Projects are often developed independently by multiple departments or orders of government, each with its own standards, criteria, and timelines. As a result, interdependent systems—such as roads, water networks, and flood-protection measures—are frequently planned and financed in isolation. This piecemeal approach leads to duplication, missed opportunities to co-ordinate upgrades, and investments misaligned with long-term resilience goals (BCG 2020; Canadian Infrastructure Council 2025). Unlike peer countries with independent infrastructure planning bodies, Canada lacks a national framework to guide investment, so spending often responds to immediate pressures—such as asset failure or one-time funding opportunities—rather than long-term risk and asset priorities (Siemiatycki 2019).

Canada's infrastructure deficit is more than a fiscal problem—it is a climate-risk multiplier. Aging systems are less efficient, more vulnerable to extreme weather, and more expensive to repair after failure. Each new flood, heat wave, or freeze-thaw cycle accelerates deterioration and adds to deferred costs. Yet this challenge also presents an opportunity: as governments renew and replace aging systems, they can embed climate resilience into every upgrade, reducing future repair costs, improving efficiency, and ensuring that public infrastructure continues to serve Canadians under increasingly extreme conditions.

2.2 Climate hazards are driving steep economic impacts

The financial toll of climate impacts on public infrastructure is already significant and projected to rise sharply. The Canadian Climate Institute's *Under Water* report showed that climate impacts on roads alone could reach $3.4 billion annually by the 2050s without adaptation (Ness et al. 2021). Proactive upgrades that help roads withstand increased heat and rainfall could avoid 90 to 98 per cent of these losses, saving nearly $7 billion annually by the end of the century.

In Ontario, the Financial Accountability Office (FAO) found that climate change could add an average of $4.1 billion per year in maintenance and replacement costs for public infrastructure—a 16 per cent increase from current levels (FAO 2023).

Without proactive adaptation, these pressures will grow steadily, compounding existing maintenance backlogs and straining local and provincial budgets.

Quebec's Union des municipalités du Québec (UMQ) and Ouranos found similar results: heavier rainfall, heat, and freeze-thaw cycles could add about $2 billion annually to municipal costs by 2055 (WSP 2022). These expenses are already eroding local budgets and forcing difficult trade-offs, particularly for smaller municipalities with limited fiscal capacity.

In Northern Canada, where infrastructure deficits are already severe, accelerating climate impacts pose even greater risks. Permafrost thaw, heat, and heavier precipitation are damaging roads, airport runways, water and wastewater systems, and community buildings (Clark et al. 2022). Lifespans for northern infrastructure could shorten by decades, doubling or tripling maintenance and rehabilitation costs by mid-century.

The fiscal implications of these rising costs are broad and long-lasting. Rising repair and replacement costs will also drive up borrowing needs, reduce available operating budgets, and crowd out investment in other priorities. For example, in Ontario, the FAO estimates that climate-related infrastructure costs could reach 5 to 7 per cent of current municipal spending over the century—on par with what municipalities now spend on social housing, emergency services, or general government administration (FAO 2023).

A section of the Dempster Highway, a vital link to the Northwest Territories, collapsed in August 2009 due to thawing permafrost. (Rick Bowmer/AP Photo)

The ripple effects extend well beyond repair bills. Infrastructure failures stall supply chains, disrupt essential services, and reduce productivity. When flooding in British Columbia in 2021 washed out key highways and rail corridors, the movement of goods in the province was effectively brought to a halt—resulting in an estimated $2.5 billion in trade losses and an additional $800 million to $1.4 billion in lost income and productivity (Hunter 2022; Lee and Parfitt 2022). The 2013 Calgary floods caused nearly $500 million in lost GDP due to widespread work disruptions (Government of Alberta 2013). After Hurricane Sandy, roughly US$16 billion of the total losses came from business interruptions and infrastructure outages, adding to between US$78 and $97 billion in direct economic losses (Kunz et al. 2013). Looking ahead, Canada faces rising systemic disruptions: by century's end, the indirect costs of climate-driven transport interruptions could nearly equal that of physical impacts to transport infrastructure, exceeding $2 billion annually if adaptation lags (Ness et al. 2021).

Nationally, climate-related damage and disruption are already slowing economic growth. The additional climate change experienced between 2015 and 2025 has reduced annual GDP in 2025 by at least $25 billion as resources were diverted from investment to repair (Sawyer et al. 2022). Without timely adaptation, these losses could compound—damaging productivity, shrinking tax bases, and locking governments into a costly cycle of damage and recovery.

2.3 Adaptation capacity is uneven across Canada

Canada's capacity to adapt infrastructure to climate change varies sharply across regions and communities. Rural, remote, northern and Indigenous communities often face higher exposure to hazards such as flooding, permafrost thaw, and wildfire, while managing older and more climate-vulnerable infrastructure (Canadian Infrastructure Council 2025). Smaller municipalities typically have less financial, technical, and institutional capacity to maintain and adapt infrastructure assets as climate risks grow (McClearn 2021; IISD 2023). In the North, high construction costs—up to three times higher than in southern Canada—and vast distances amplify these challenges (Clark et al. 2022).

Without careful planning, adaptation outcomes will be uneven. Well-resourced provinces and larger cities are better positioned to invest in resilience while smaller, remote, or marginalized communities risk falling further behind. These disparities are already evident in the North, where communities face rapidly deteriorating infrastructure with replacement costs that far exceed fiscal capacity (Clark et al. 2022). Unless these inequities are addressed, they will deepen existing infrastructure gaps and slow Canada's overall progress towards climate resilience.

A car is swallowed by a sinkhole following a July 2023 watermain break in Montreal. (Ryan Remiorz/ The Canadian Press)

3

Methodology

This analysis specifically estimates how changing climate conditions will affect the cost of maintaining and renewing public infrastructure across Canada. Our approach combines engineering-based asset deterioration modelling, regional climate projections, and fiscal analysis.

The approach applies environmental consulting firm WSP's infrastructure deterioration model—developed and applied by the Financial Accountability Office of Ontario (FAO 2021) and subsequently used by the Union des municipalités du Québec (WSP 2022)—to a comprehensive national dataset of infrastructure assets. It also integrates the Canadian Climate Institute's research on climate costs and data on insurance losses to add further insights into the costs of flood-related damages from infrastructure disrepair and failure. Together, the analysis allows for consistent estimates of how climate hazards affect infrastructure performance and cost under different adaptation scenarios while capturing differences in outcomes and infrastructure types in place across the country.

The steps of the analysis are:

1. Building a national public infrastructure asset inventory.
2. Projecting future changes to climate hazards.
3. Modelling asset deterioration and costs.
4. Comparing different adaptation scenarios to understand the benefits of early action.

3.1 Building a national asset inventory

A comprehensive picture of Canada's public infrastructure is the foundation for any assessment of climate impacts. The analysis begins with Statistics Canada's Core Public Infrastructure Survey (CPIS), which provides standardized, Canada-wide information on the replacement value, condition, age, and quantity of major public assets. These include roads, bridges and culverts, public buildings, and wastewater and stormwater systems, with data disaggregated by province and by level of government ownership.

The result is a harmonized, comprehensive database that captures the size, value, age, and condition of Canada's public infrastructure. This inventory forms the baseline for all subsequent analyses—linking infrastructure characteristics with exposure to climate hazards and allowing for consistent, comparable calculations of cost and risk across the country.

3.2 Identifying climate hazards and projecting future climate conditions

The analysis focuses on two major stressors—heat and heavy rainfall—two of the main physical channels through which climate drives the deterioration of Canadian public infrastructure. These hazards were modelled in detail because the asset-deterioration knowledge embedded in the WSP model is well suited to assessing how gradual increases in temperature and precipitation accelerate wear, shorten asset lifespans, and raise long-term maintenance and replacement costs. Other important climate stressors—such as wildfire, permafrost thaw, coastal erosion, and drought—also pose significant risks to infrastructure, but could not be quantitatively modelled within the scope of this study due to the limitations of deterioration-based modelling approaches and data required to project future changes in those hazards.

Flooding was also considered, but through a different analytical approach. Directly modelling flood damages to public infrastructure was beyond the scope of this analysis, as the sudden and highly variable nature of flooding is not well suited to climate-driven infrastructure deterioration models such as WSP's. Instead, the project developed a high-level assessment of the scale and benefits of flood-protection investments—such as dikes, seawalls, and the elevation of vulnerable structures—that will be required to protect communities as flood risks continue to rise with climate change (see Text Box 1). The aim was to illustrate that effective adaptation will require more than strengthening existing infrastructure—it will also demand significant new infrastructure investments in protective works.

To assess how these hazards will evolve, the project draws on the latest projections from the Intergovernmental Panel on Climate Change (IPCC), accessed through ClimateData.ca. These statistically downscaled datasets capture local temperature and precipitation patterns across three global emissions pathways—SSP1-2.6, SSP2-4.5, and SSP3-7.0—corresponding to approximately 1.8°C, 2.7°C, and 3.6°C of global warming by 2100.

The analysis focuses primarily on SSP2-4.5, the emissions pathway most closely aligned with current global policies and mitigation commitments. However, future warming remains uncertain due to both the pace and ambition of global emissions reductions and the climate system's response to rising greenhouse gas concentrations. As a result, lower- and higher-warming pathways (SSP1-2.6 and SSP3-7.0) remain plausible and provide useful bounds for understanding how infrastructure costs and adaptation needs change under different warming outcomes (see Section 4.6).

The analysis considered four time horizons for climate: a historical baseline (1991–2020), the near-term (2025–2040), mid-century (2041–2070), and end-of-century (2071–2100).

3.3 Modelling asset deterioration and costs

All infrastructure deteriorates as it ages, but climate change accelerates this process. To capture that effect, the analysis applies a deterioration model that estimates how asset condition declines over time under both normal and climate-stressed conditions.

The model tracks each asset's useful service life, or the number of years it can perform before major rehabilitation or replacement is needed. Climate stressors—such as more frequent extreme heat or intense rainfall—are built into the model through sensitivity coefficients that increase deterioration rates and shorten service life. As assets degrade, the model identifies when maintenance, rehabilitation, or full replacement are triggered, producing forecasts of the timing and frequency of interventions over coming decades.

To connect these physical effects to financial outcomes, the analysis uses coefficients that quantify how responsive different infrastructure costs are to changes in climate variables. For example, a 1°C increase in average temperature or a 10 per cent rise in annual precipitation translates into a corresponding percentage change in maintenance or replacement costs for a certain type of infrastructure. These coefficients, originally developed by WSP for Ontario, have been adapted for use across all provinces and territories, and for major asset types, including roads, bridges, buildings, and water systems (WSP 2023).

3.4 Comparing adaptation scenarios and the benefits of early action

Finally, the study compares how infrastructure costs and damages evolve under different adaptation pathways by modelling four scenarios.

1. The **baseline scenario** projects infrastructure deterioration and costs under historical climate conditions, providing a point of reference.
2. The **no-adaptation scenario** assumes assets continue to be replaced to today's standards, leaving them fully exposed to increasing climate stress.
3. The **reactive adaptation scenario** assumes assets are upgraded to be climate-resilient only at the time of replacement, resulting in a gradual increase in resilience over time.
4. The **proactive adaptation scenario** assumes that upgrades occur at the earliest opportunity—either during major rehabilitation or at the point of full replacement—accelerating the shift toward a more climate-resilient infrastructure network.

Each scenario changes both the timing and magnitude of maintenance and capital spending, as well as the level of damage and frequency of service disruption. Comparing results across these scenarios reveals how proactive adaptation can reduce long-term costs and avoid significant future losses. The outputs include national and regional estimates of adaptation investment needs, avoided damages, and overall fiscal impacts of climate change.

All future infrastructure maintenance and replacement costs are expressed in 2020 dollars. For the benefit-cost analysis of proactive adaptation across infrastructure asset types (see Section 4.4), we apply a range of discount rates representing both conventional public-sector cost-of-capital assumptions and the lower rates commonly used in climate-adaptation analyses. The latter reflect the long-lived, intergenerational nature of adaptation benefits and the high uncertainty surrounding future climate impacts.

3.5 Limitations and assumptions

As with any large-scale modelling exercise, the results carry inherent uncertainty. Data gaps remain in local asset inventories, condition assessments, and regional exposure mapping. Climate projections also vary by model and emissions scenario—especially for localized hazards such as extreme rainfall—introducing a wide range of potential outcomes for damage and adaptation cost estimates (see Section 4.6). Further, the analysis assumes current adaptation technologies and cost structures remain constant, which may understate future innovation or overstate certain costs.

The analysis includes only two climate stressors—heat and extreme rainfall—that can be modelled within the deterioration-based framework. Many other climate hazards that significantly affect infrastructure are not captured in the core model. As a result, the projected costs of maintaining and renewing infrastructure under climate change are conservative. In practice, the full range of climate impacts on public infrastructure will likely drive substantially higher long-term costs than those presented here.

The model is an upscaled version of one developed for Ontario, where climate shifts are relatively moderate; its performance may therefore be less precise in regions experiencing more extreme change, such as the territories or Atlantic Canada.

The "no-adaptation" scenario assumes infrastructure continues to be maintained and renewed at levels sufficient to keep assets in a state of good repair. In practice, however, many jurisdictions face persistent maintenance backlogs and chronic underinvestment in core infrastructure. If these gaps continue or widen, the actual costs of future replacement and adaptation could be substantially higher than the estimates presented here, as assets that are already degraded or beyond their intended service life are more vulnerable to climate impacts and more expensive to rehabilitate or replace.

The modelling assumes that stocks of infrastructure are held constant and only examines the effects of climate change and of adaptation on existing infrastructure. In reality, Canada's infrastructure stock will continue to grow as populations expand and service demands increase, meaning that the scale of future climate impacts—and the investments required to adapt—will likely be greater than the estimates presented here.

Critically, the model does not capture the broader economic benefits of increased resilience for households, businesses, communities, and regional and national economies. As a result, the climate change cost estimates in this document represent a lower bound, and the reported economic benefits of adaptation investments are highly conservative. Even so, the approach aligns with recognized best practices for infrastructure risk assessment and provides credible, policy-relevant estimates of the adaptation challenges and opportunities facing Canada's public infrastructure.

Traffic crosses the Île-aux-Tourtes bridge, a major artery to the Island of Montreal. The aging six-lane bridge, seen here in December 2023, is being rebuilt. (Peter McCabe/The Canadian Press)

4 Results

This section presents national and regional estimates of how climate change will affect the cost of maintaining, renewing, and adapting Canada's public infrastructure, and the savings achievable through proactive adaptation.[1]

4.1 Canada has a vast but aging infrastructure portfolio

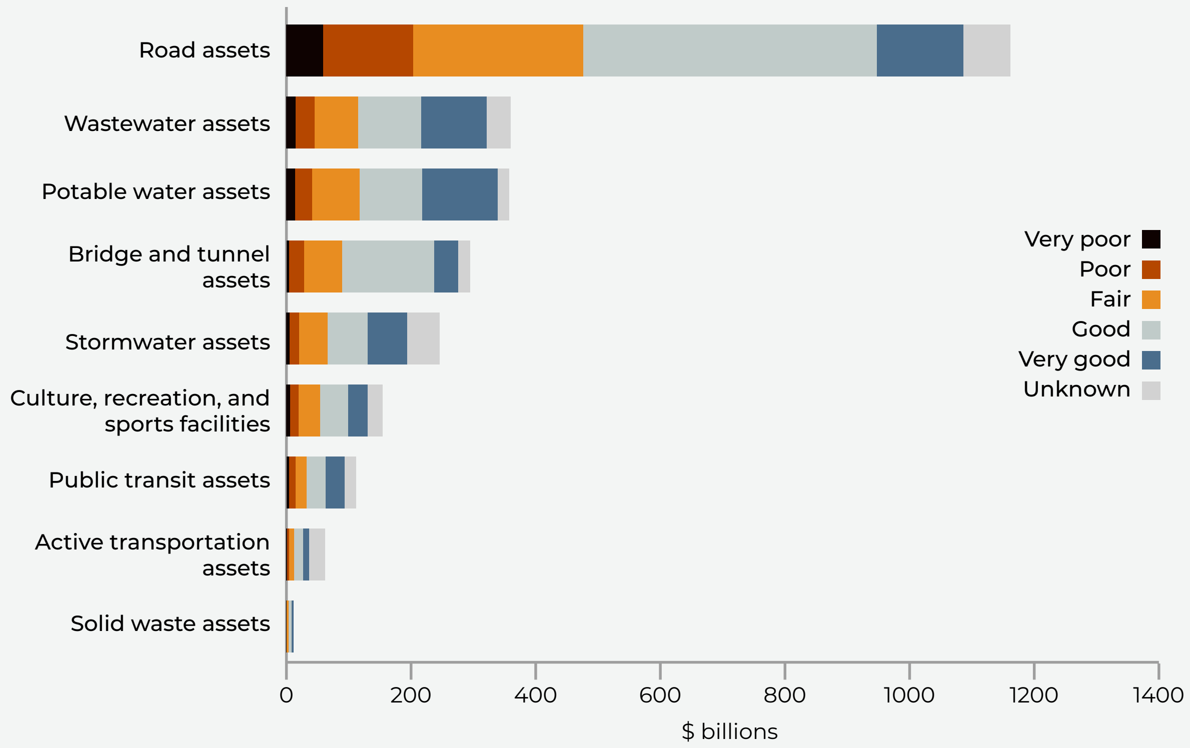
Canada's public infrastructure has a replacement value of approximately $2.7 trillion, according to Statistics Canada's Core Infrastructure Survey (2025). The total infrastructure backlog—the cost to return all of this infrastructure to a state of good repair—is about $294 billion, or approximately 11 per cent of total infrastructure asset value (Statistics Canada 2025b). Over 60 per cent of this infrastructure is owned by municipalities or regional governments, including most roads and virtually all drinking water, wastewater, and stormwater systems, public buildings, and public transit assets (Statistics Canada 2023). Provincial and territorial governments own most bridges and tunnels, and a substantial share of road infrastructure, while the federal government owns a relatively small number of bridges, tunnels, and some cultural facilities. The vast majority of infrastructure value is contained in transportation-related infrastructure, with a replacement value of $1.6 trillion, and water infrastructure, with a replacement value of $960 billion (Figure 1).

1 For clarity, results reflect the median outcome across climate models for the SSP2-4.5 emissions scenario, which corresponds with approximately 2.7°C of global warming by 2100. The implications of uncertainty and alternative emissions pathways are discussed in Section 4.6. Detailed results, including provincial and territorial breakdowns, can be found in the accompanying technical report (spring 2026 publication).

FIGURE 1.

Canada possesses a vast but vulnerable infrastructure portfolio

(Estimated replacement value by condition state and asset type)



Roughly 14 per cent of assets (by value) are in poor or very poor condition, with another 21 per cent in only fair condition. In practical terms, one in three public infrastructure assets is already at heightened risk of failure. Roads, bridges, and underground systems—especially stormwater and wastewater networks—are among the most deteriorated as well as most exposed to climate hazards like heat and excess rainfall.

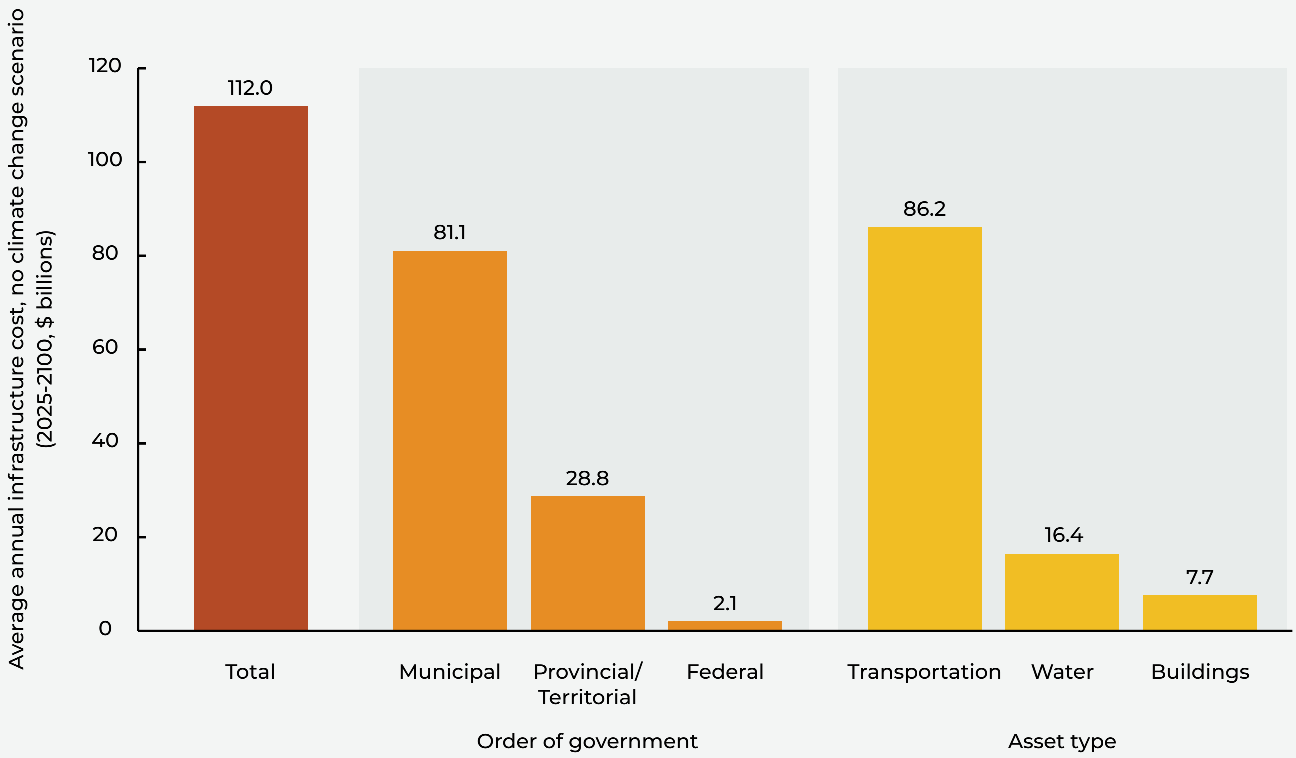
Finally, the portfolio is old and aging: about 85 per cent of assets were built before 2015—when climate change first began to enter design standards—and about 65 per cent were built before 1985.

4.2 Infrastructure costs are already high—even without climate change

Even if climate conditions remained stable, returning Canada's public infrastructure to a state of good repair and maintaining it in that condition will require significant investment. The infrastructure model used in this analysis estimates that, if climate conditions were to remain stable at 1991-to-2020 levels, the cost to renew and maintain Canada's infrastructure to a state of good repair would be $112 billion per year. Municipalities would account for about $81 billion of this spending, while provincial governments would account for approximately $29 billion and the federal government about $2 billion.

FIGURE 2.

Maintaining Canada's $2.7 trillion portfolio of public infrastructure will cost $112 billion per year to 2100, without considering climate impacts



Even without considering the additional impacts of climate change, maintaining Canada's public infrastructure at serviceable standards will require substantial and sustained investment. These baseline projections underscore the scale of the fiscal challenge against which the future costs of climate change must be measured.

4.3 Without adaptation, infrastructure costs rise substantially

The modelling shows that climate change will significantly increase the cost of maintaining and renewing Canada's public infrastructure, even when existing assets are managed responsibly. Rising temperatures and more frequent extreme rainfall will accelerate wear and shorten asset lifespans. Without adaptation, governments of all orders will face steeply rising maintenance and replacement bills, compounding existing infrastructure deficits and straining fiscal capacity.

Under the no-adaptation scenario, which assumes assets continue to be replaced to today's standards upon renewal, the combined effects of climate change have already added $8.8 billion per year in infrastructure costs in the present day. These additional costs rise to $14.3 billion per year by mid-century and $19.4 billion per year by the end of the century. On average over the 2025-2100 period, infrastructure costs increase by $15.1 billion per year, or 13 per cent, relative to the no-climate change baseline (Figure 3).

All provinces and territories experience rising costs, though the magnitude and timing vary depending on local climate hazards, asset age and condition, and historical investment patterns. National costs are largely driven by increases in the most populous provinces—Ontario, Quebec, British Columbia, and Alberta—while jurisdictions such as Saskatchewan and the territories see especially large increases in relative terms, reflecting the interaction between extensive or exposed infrastructure networks and more pronounced increases in heat and extreme rainfall hazards.

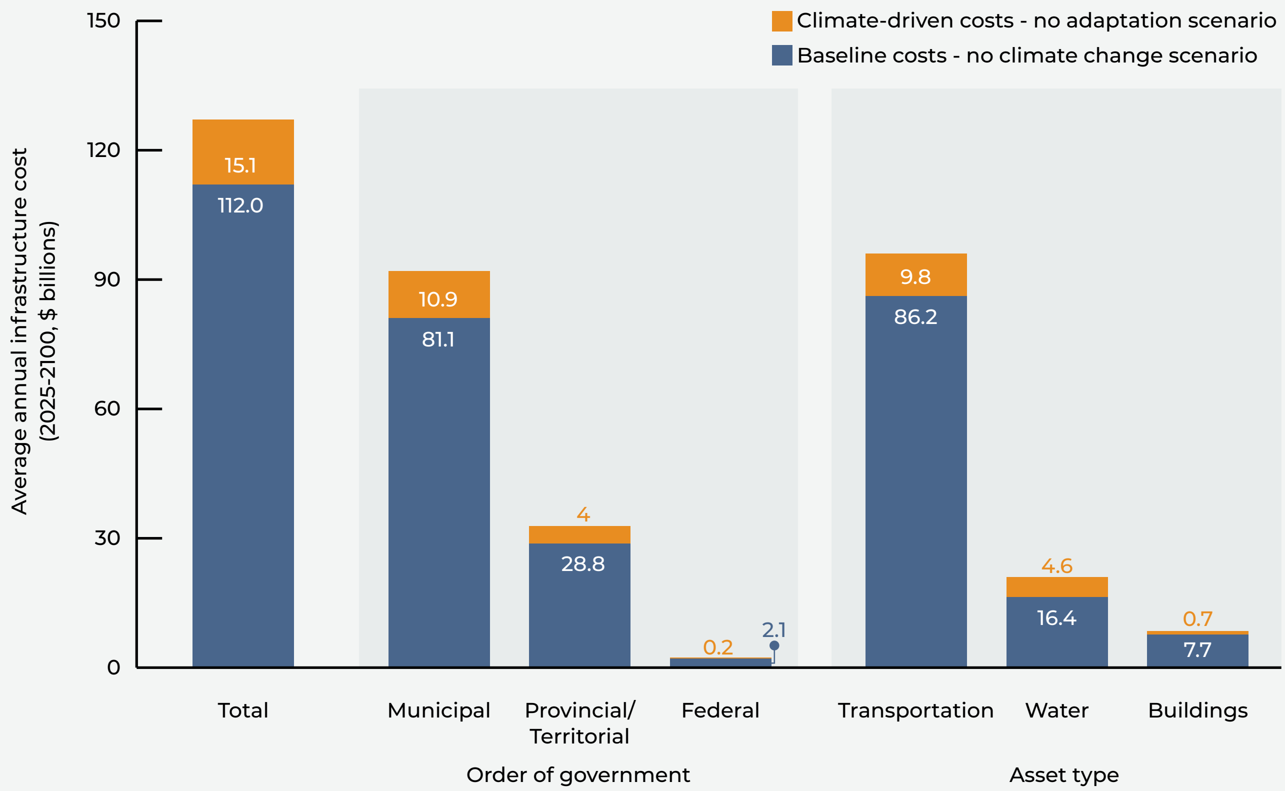
Key cost drivers include the combined effects of heat and extreme rainfall on roads, which accelerate material fatigue, shorten service life, and increase the frequency of maintenance and rehabilitation, particularly in jurisdictions with extensive road networks. Costs are also driven by extreme rainfall-related operating and damage pressures on stormwater and wastewater systems, including higher treatment demands, increased overflow risk, and flood-related repairs, especially in large urban systems.

Between 2025 and 2100, municipalities will bear 72 per cent of total climate-related infrastructure costs—about $10.9 billion per year—under a no-adaptation scenario (Figure 3), exceeding their already large share of asset ownership. This reflects the concentration of climate-driven costs in municipal assets, particularly water, wastewater, and public transit systems. Provincially and territorially owned infrastructure will account for approximately 26 per cent of climate-related costs, or about $4 billion per year, while federally owned infrastructure will account for roughly 2 per cent, or $200 million annually.

Transportation and water systems face the steepest increases in climate-related costs and damage risk (Figure 3). On average between 2025 and 2100, roads, bridges and tunnels, and public transit infrastructure account for about $9.8 billion per year, or roughly 65 per cent of total climate-related infrastructure costs, reflecting their large replacement value and direct exposure to temperature and precipitation extremes. Potable water, wastewater, and stormwater systems follow at about $4.6 billion annually, or around 30 per cent, with costs rising due to higher maintenance requirements and more frequent rainfall events that exceed system design capacity. Buildings account for approximately $700 million per year, or about 5 per cent, of total climate-related infrastructure costs.

FIGURE 3.

Climate change will increase the cost to maintain infrastructure, especially for municipalities

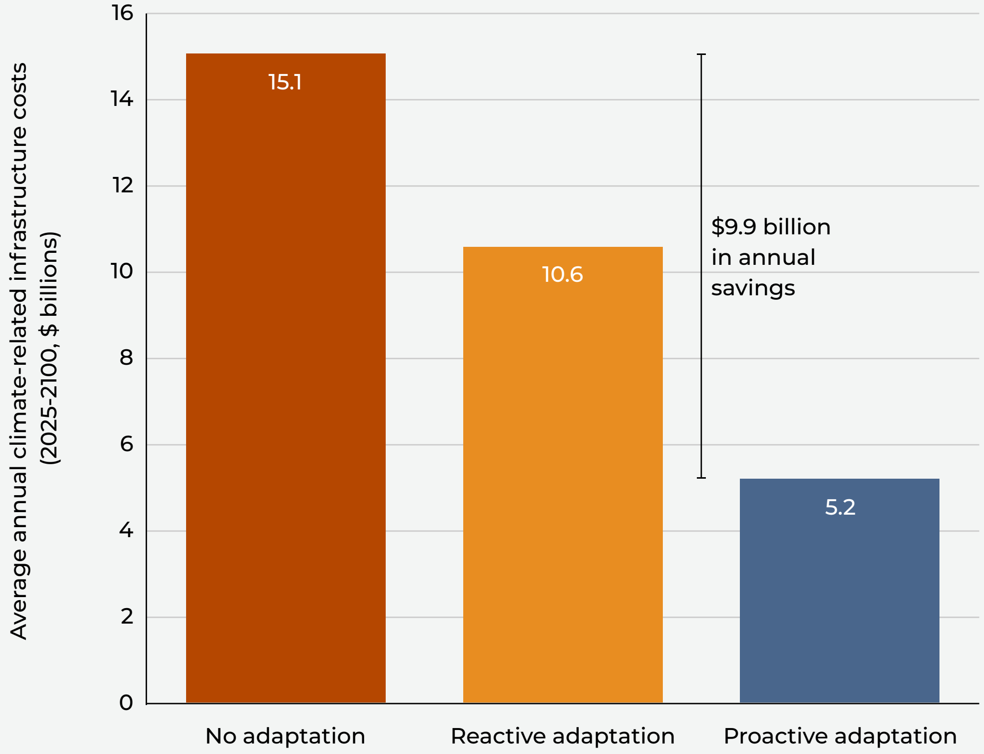


4.4 Adaptation reduces climate costs—but conventional analysis may understate the benefits

The analysis shows that proactive adaptation—upgrading infrastructure before it reaches the end of its useful life or major rehabilitation point—can deliver lower net costs than waiting for assets to fail and replacing them. Climate change drives up infrastructure management costs in every scenario, but a proactive approach delivers the lowest overall costs of infrastructure maintenance and replacement on an annual basis over the remainder of the century—$9.9 billion per year less than no adaptation and $5.4 billion less than a reactive adaptation approach.

FIGURE 4.

Proactive adaptation reduces climate-related infrastructure costs by nearly two-thirds



Acting early prevents assets from deteriorating into costly conditions, reduces the frequency of emergency repairs, and extends the longevity of critical infrastructure systems. These results underscore that proactive adaptation is not just a defensive strategy—it's a smart investment that reduces lifetime costs. But whether these long-term savings are visible in decision-making depends on how governments that own and operate infrastructure evaluate costs and benefits over time.

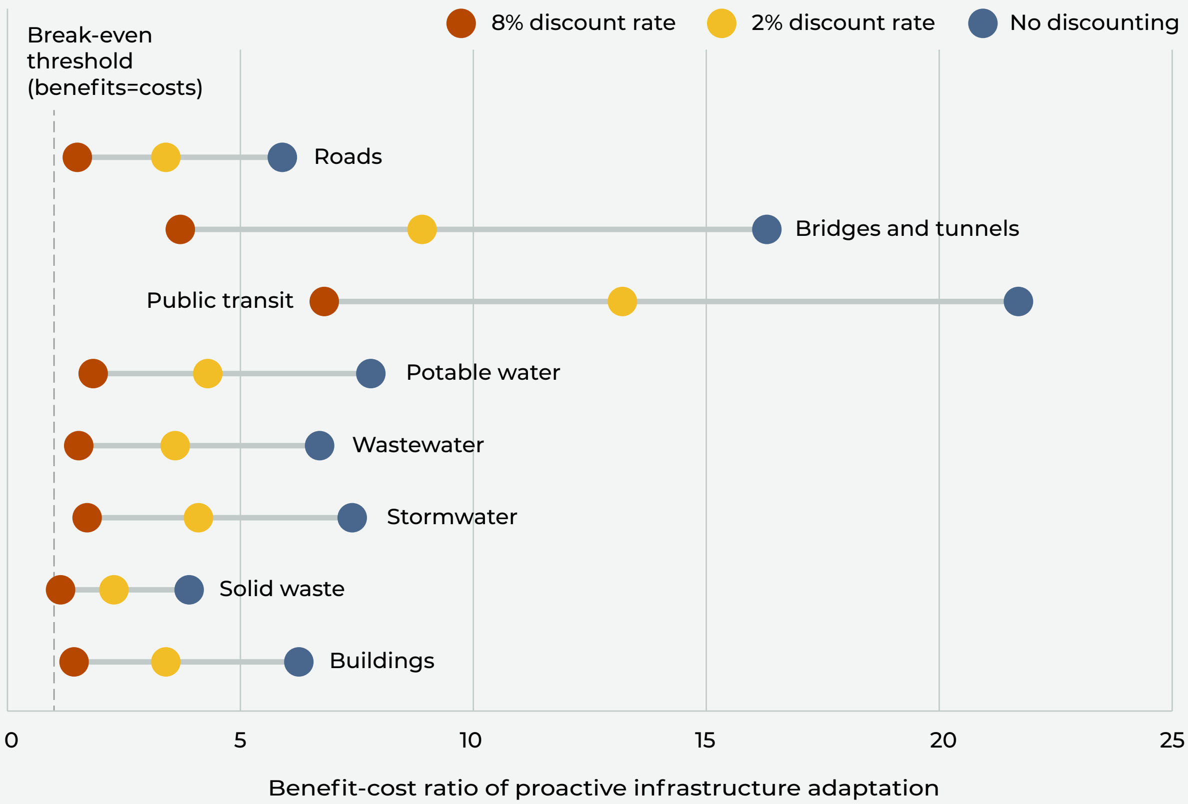
Evaluating infrastructure adaptation investments means comparing costs incurred beginning today with benefits that will materialize years or decades into the future. Figure 4 illustrates the total costs that governments will pay over the remainder of the century, giving equal weight to a dollar spent in 2100 and in 2025. In practice, governments do not make decisions this way. A dollar spent today toward long-term benefits has an opportunity cost—it could otherwise be used immediately to provide public services, reduce debt, or pursue other priorities. Long-term benefits also carry uncertainty: future economic conditions, technology, population needs, and climate risks may lead to outcomes very different from today's expectations. These factors are incorporated into decision-making through the use of discount rates.

Governments use discount rates to adjust future costs and benefits to reflect opportunity costs and risks. A higher discount rate places less value on benefits that occur far in the future, making long-term avoided damages appear smaller in today's terms. Governments typically use a higher discount rate—often around 8 per cent—to reflect the opportunity cost of public funds. Climate-adaptation analyses, however, often use much lower rates (around 2 per cent) to reflect intergenerational equity and the possibility of very large future damages that would be undervalued at higher rates. The choice of discount rate, therefore, influences both the timing of when adaptation appears to pay off—and, for some measures, whether it appears to pay off at all.

With this context, Figure 5 shows how the perceived fiscal benefits of proactive adaptation vary across asset types, depending on how they are accounted for—illustrating the payback in terms of benefit-cost ratio (BCR), or the number of dollars saved per dollar invested. When future costs and benefits are given equal weight (effectively a 0 per cent discount rate), proactive adaptation delivers far more benefit than cost across all asset classes. At a 2 per cent discount rate typical of adaptation analyses, proactive adaptation still consistently delivers BCRs greater than one. However, when using a conventional government decision-making discount rate of 8 per cent, proactive adaptation for assets requiring large near-term investments—such as public buildings, wastewater systems and solid waste facilities—can appear less cost-effective, with BCRs approaching one.

FIGURE 5.

Investing in resilient infrastructure pays off even if future cost savings aren't highly valued

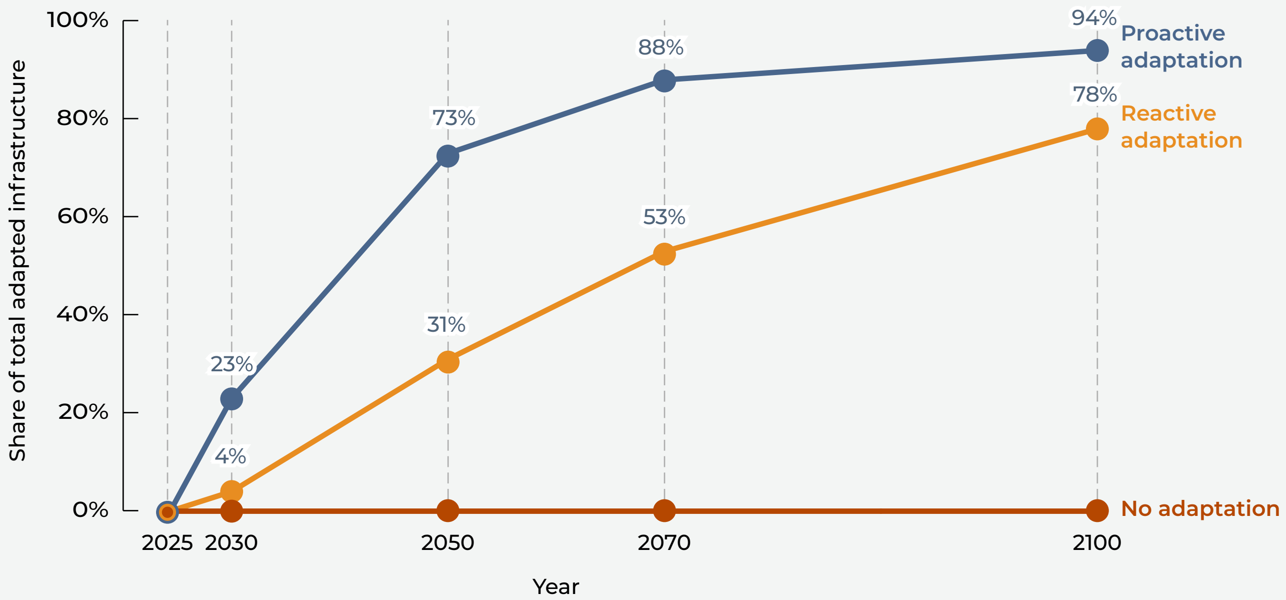


Traditional accounting frameworks thus risk undervaluing proactive adaptation—not only because they undervalue long-term benefits to future generations, but also because they overlook many of the financial and economic benefits of reliable infrastructure. These benefits extend beyond the governments that own and operate the assets to households, businesses, and other governments. Keeping infrastructure in good repair reduces maintenance and replacement costs, as well as the indirect economic and social losses that occur when infrastructure fails. Service disruptions impose indirect costs, including private property damage, business interruption, supply-chain delays, higher transportation costs, budgetary shocks, and increased emergency-response needs. Understanding how proactive adaptation reduces these failures and disruptions is essential to evaluating its full value.

By keeping infrastructure in good repair and reducing the likelihood of service disruptions, proactive adaptation steadily lowers the share of assets that remain vulnerable to escalating climate hazards (Figure 6). Under a proactive approach, over 70 per cent of public assets could be brought to climate-resilient standards by the 2050s, compared to about 30 per cent under a reactive strategy. By the 2080s, only a small share of assets would remain highly exposed to climate risks with a proactive approach, whereas reactive adaptation would leave nearly half still vulnerable to worsening impacts, high-consequence events, and sudden fiscal shocks to government infrastructure owners. Although these broader benefits are not fully captured in the modelling, they reinforce that acting early delivers stronger fiscal stability, fewer disruptions, and greater long-term resilience.

FIGURE 6.

Proactive adaptation quickly increases the share of resilient infrastructure assets



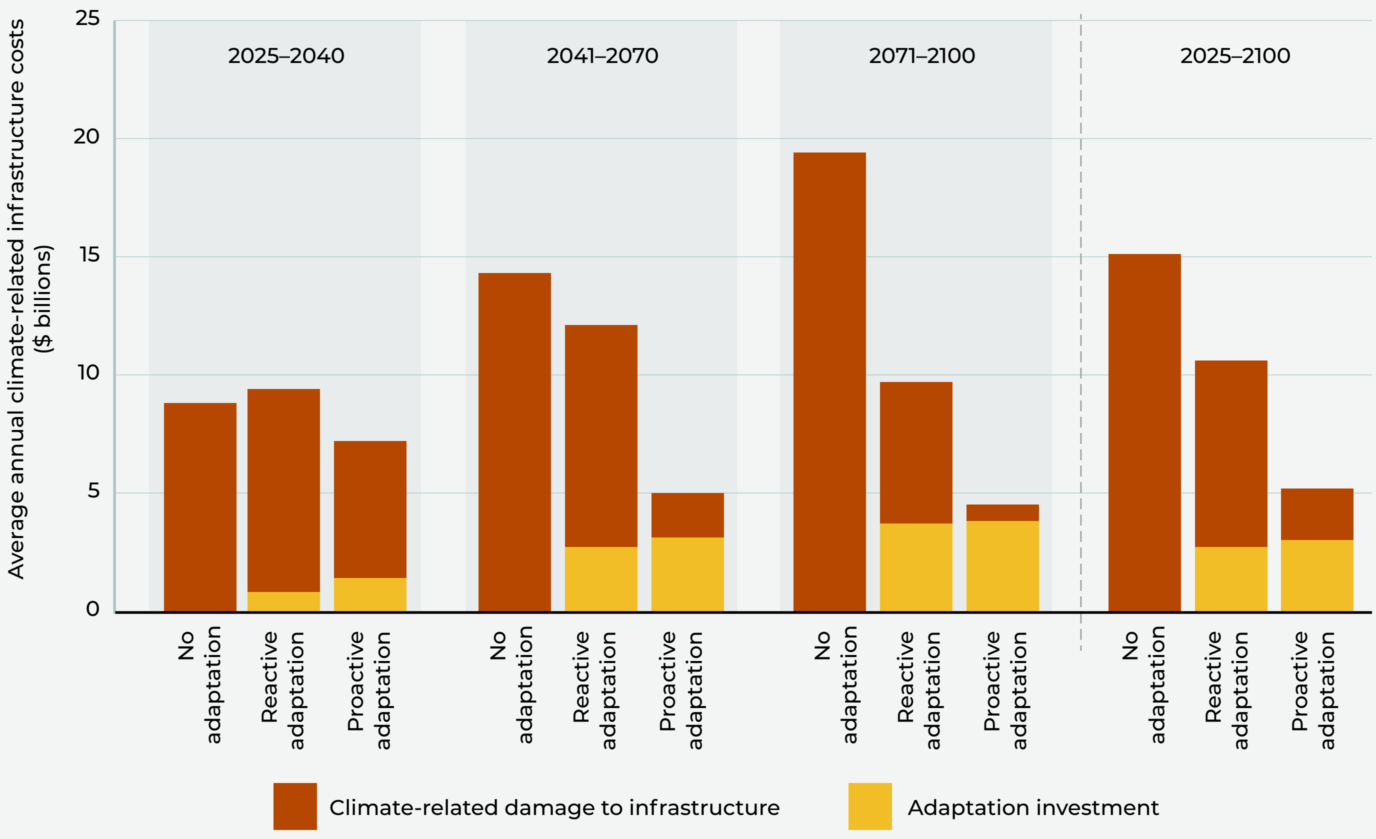
4.5 The costs of proactive adaptation are substantial—but so are the returns

Proactive adaptation lowers long-term infrastructure costs and reduces broader economic losses, but it requires governments to invest consistently in resilience by taking the earliest opportunities to upgrade infrastructure. The analysis shows that proactive adaptation to the climate threats considered in this study—increased heat and extreme rainfall—requires investment of approximately $1.4 billion annually beginning immediately, with an average annual investment of $3 billion over the remainder of the century.

In contrast, reactive adaptation and no-adaptation pathways defer spending into the future. Although less capital is required initially, these approaches almost immediately lead to much higher overall infrastructure costs as climate impacts intensify, deterioration accelerates, and repairs and replacement become more frequent and more expensive.

FIGURE 7.

Proactive adaptation investment reduces overall costs over time



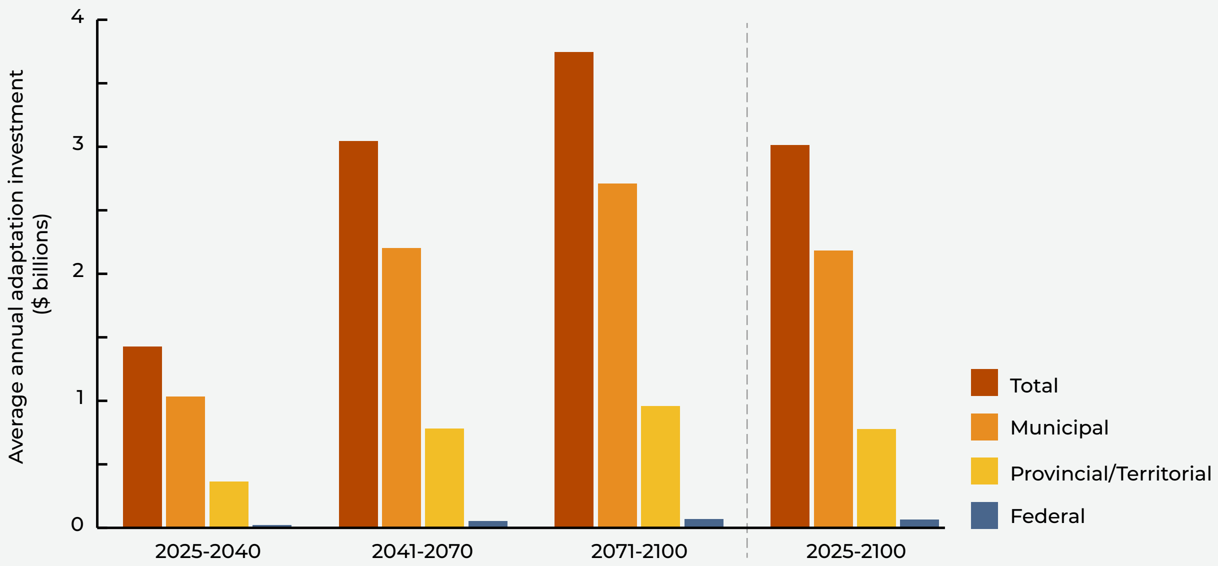
Even under a proactive approach, the cost of maintaining and renewing public infrastructure continues to rise over time. Climate pressures are intensifying, and many systems must be upgraded to meet modern design standards and safety expectations. Proactive adaptation does not eliminate the costs of climate change—but it reduces them significantly by capturing the benefits of early resilience upgrades while avoiding the major expenses associated with failures and emergency repairs—creating a more predictable long-term cost-profile for governments.

Under the proactive adaptation scenario, the combined costs of climate-driven infrastructure, repair, operation and maintenance, together with adaptation investments, average about $5.2 billion per year between 2025 and 2100—adding about 5 per cent to infrastructure spending compared to the no climate change baseline. As noted earlier, proactive adaptation reduces average annual infrastructure costs by $5.4 billion compared with the reactive approach and by $9.9 billion compared with the no-adaptation scenario.

Most proactive adaptation costs will fall to municipal governments, which own and operate the majority of Canada's public infrastructure (Figure 8). On average, municipalities would invest approximately $2.2 billion per year between 2025 and 2100 in adapting infrastructure to rising heat and extreme rainfall—representing roughly 72 per cent of all national proactive investment. Proactive adaptation of provincial and territorial infrastructure would account for about 25 per cent, while adaptation of federal assets would represent only 2 per cent. These results, however, only reflect the costs of adapting infrastructure assets to rising heat and extreme rainfall; other climate-driven threats such as more frequent and severe flooding will require additional investment (Text Box 1).

FIGURE 8.

Proactive adaptation will require major investments, with most falling to municipal governments



Repairs to the Sumas River dike are seen underway in Abbotsford, B.C., in November 2022. A major breach caused severe flooding after an atmospheric river brought heavy rainfall to the province. (Darryl Dyck/The Canadian Press)

TEXT BOX 1

Flooding will require major additional investments in adaptation

Flooding along Canada's coasts and rivers poses an escalating threat, not only to public infrastructure but also to homes, businesses, and essential community services. Protecting these assets from rising water levels will require governments to invest in more than simply strengthening existing infrastructure. Large-scale protective works such as dikes, seawalls, floodwalls, and elevation of vulnerable structures will be essential to reduce growing risks and prevent cascading economic losses.

To illustrate the potential scale of this additional type of adaptation investment, the analysis included a high-level estimate of the costs and benefits of structural flood protection measures across Canada. These measures were modelled wherever the value of avoided flood damages to public and private buildings exceeded their full life-cycle costs. The results show that, like other forms of proactive adaptation, investments in flood protection deliver substantial long-term savings and strong returns across all regions.

FIGURE 9.

Proactive adaptation dramatically reduces climate-driven flood losses and reduces overall costs

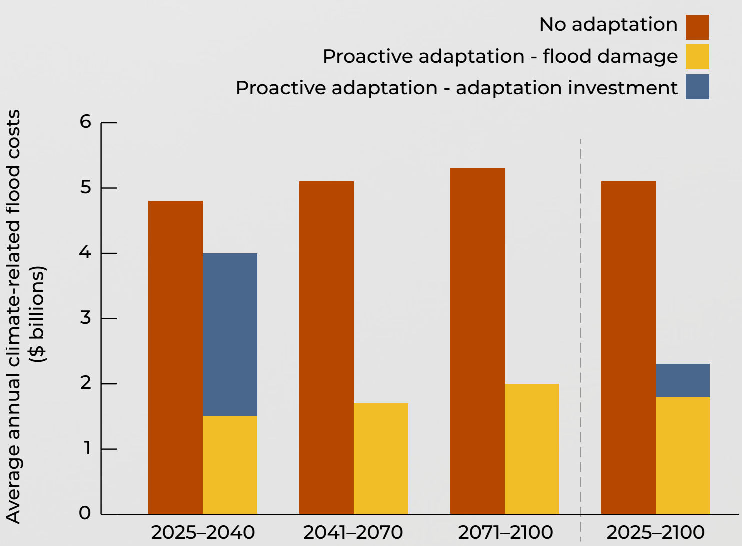


Figure 9 shows how proactive investments in flood protection could pay off. Across Canada, the analysis estimates that near-term adaptation investments of $2.5 billion per year between now and 2040 could reduce flood damages to public and private buildings by an average of $3.4 billion per year over the remainder of the century.

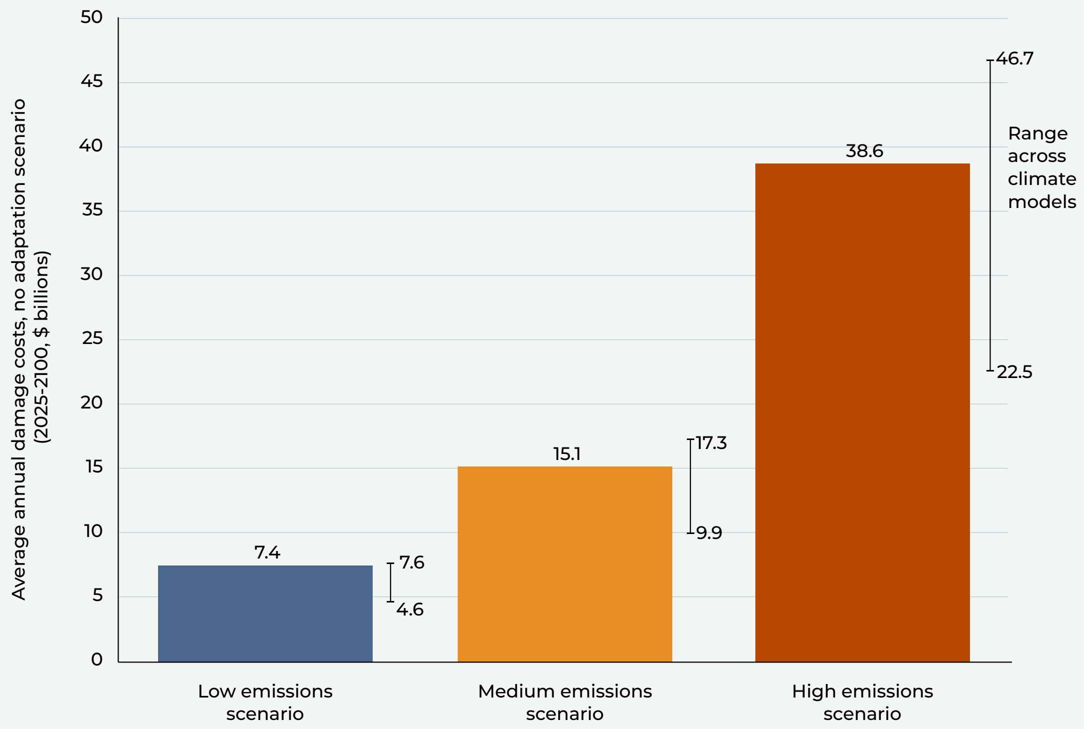
The scale of these potential savings underscores that adaptation must extend beyond upgrading existing infrastructure. To protect communities from flooding and other hazards, governments will need to help finance large-scale protective systems that reduce damage to both public and private assets. However, realizing these savings will require substantial upfront investment to ensure these measures are in place before the most severe impacts of climate change take hold.

4.6 Costs and adaptation needs vary significantly depending on climate change outcomes

The future costs of maintaining and adapting Canada's public infrastructure will depend strongly on how much the climate changes and how quickly. The results presented in this report focus on a medium-emissions scenario, where global emissions peak around mid-century and decline thereafter. The figures and tables presented in the preceding pages reflect the median outcome within that scenario. But even within this single pathway, there is a wide range of potential cost outcomes depending on which global climate model is used to generate projections of Canada's future climate (Figure 10). Differences in how each model projects temperature, precipitation, and extreme events translate directly into uncertainty in future climate-related infrastructure costs.

FIGURE 10.

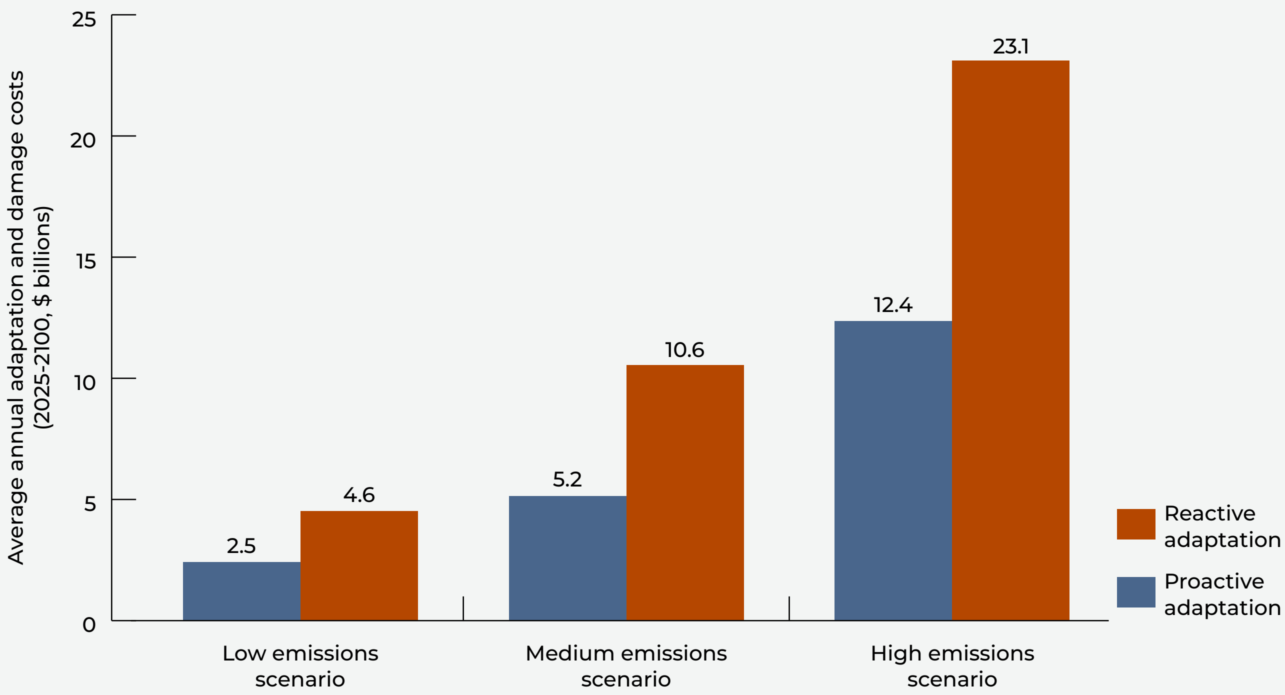
Higher global emissions increase infrastructure damage costs and heighten uncertainty



The modelling also included higher-emissions scenarios, which further expand the range of possible futures. In a higher-emissions world, infrastructure costs and corresponding adaptation needs could rise several times higher than the median estimates shown here, while a lower-emissions pathway would substantially limit those costs (Figure 11). These results underline that both climate change severity and model uncertainty drive large variations in future fiscal exposure and required adaptation investments. In addition, stronger global emissions reductions would significantly reduce the scale of adaptation needed to maintain Canada's infrastructure.

FIGURE 11.

Climate costs rise sharply with warming, making proactive adaptation more critical



This 23-metre deep sinkhole, seen at a busy intersection in Edmonton in October 2020, formed after an inspection of a sewer trunk line revealed an underground void. (Amber Bracken/The Canadian Press)

5

Implications for Canada

The costs of climate impacts on infrastructure and the benefits of proactive adaptation have interconnected implications for governments, households, businesses, and the economy.

5.1 Implications for municipalities

As owners of the majority of Canada's core public infrastructure, municipalities experience the largest share of direct infrastructure impacts and costs. Without adaptation, the analysis shows that climate change will drive steep increases in municipal capital and maintenance costs over the coming decades. Where municipal fiscal capacity is limited, these pressures could translate into higher local taxes, further deferred maintenance, service cuts, or delays to other spending priorities.

>>> **As owners of the majority of Canada's core public infrastructure, municipalities experience the largest share of direct infrastructure impacts and costs.**

Proactive adaptation can substantially reduce these pressures by extending asset life in the face of growing climate threats and lowering the frequency of maintenance shutdowns and costly emergency repairs.

However, achieving these savings requires upfront investment capacity that many municipalities currently lack. Given Canadian municipalities' limited ability to generate additional revenue, successful proactive adaptation may depend on cost-sharing with federal, provincial, and territorial governments or the creation of new revenue tools to recover some of the value of adaptation benefits to allow municipalities to invest early.

5.2 Implications for federal, provincial, and territorial governments

Federal, provincial, and territorial governments face growing fiscal exposure from climate-driven infrastructure costs, both directly through their own assets—particularly for provincial and territorial governments—and indirectly through transfers, disaster recovery assistance, and economic disruption as infrastructure systems owned by all orders of government deteriorate. As repair and replacement needs escalate, a larger share of federal and provincial budgets would be consumed by infrastructure maintenance and emergency support, leaving fewer resources for new projects and other essential services.

Proactive adaptation changes this trajectory. Early, sustained investment in resilient infrastructure reduces long-term liabilities, stabilizes public finances, and decreases the need for reactive spending. Predictable funding streams dedicated to adaptation across all levels of ownership would accelerate the strengthening of infrastructure systems, helping not only to reduce the long-term maintenance burden but to prevent future fiscal shocks and minimize the economic drag of repeated damage and disruption.

5.3 Implications for households

Households ultimately bear both the direct and indirect consequences of deteriorating public infrastructure. When critical systems such as roads, bridges, and water networks fail, service disruptions affect people's employment, mobility, health, and safety. The impacts also flow through higher taxes, user fees, and cuts to services, as governments recover the rising costs of damage and repair. Failures of public infrastructure can also trigger private property damage—for example, through flooded basements or extended power outages—creating financial strain and uncertainty for affected households and putting claim cost pressure on insurance premiums.

Proactive adaptation directly benefits households by improving reliability, safety, and affordability. Climate-resilient infrastructure reduces the frequency and duration of service interruptions, limits property damage from extreme events, and helps contain utility costs and insurance claims. By lowering both the direct and cascading costs of climate impacts, adaptation investments strengthen community resilience, reduce inequality in exposure and recovery capacity, and protect quality of life as risks intensify.

5.4 Implications for Indigenous People

Climate impacts on public infrastructure carry particularly serious consequences for First Nations, Inuit, and Métis communities, many of which face a combination of high climate hazard exposure, aging or inadequate infrastructure, geographic isolation, and longstanding infrastructure deficits (Clark et al. 2022). Because many of these communities often depend on a small number of transportation links and standalone drinking water, wastewater and energy systems, infrastructure failures can rapidly cascade into disruptions to health services, emergency response, and food security. The costs of repairing or replacing infrastructure are also significantly higher in remote and northern regions, amplifying the fiscal burden. Without adaptation, climate impacts risk deepening existing inequities in quality, safety, and access to essential infrastructure.

Proactive adaptation can deliver especially large benefits for Indigenous communities—but only if it aligns with Indigenous rights and self-determined priorities. Indigenous communities often lead some of the most innovative climate-resilience initiatives in Canada, but face persistent barriers including access to predictable, long-term funding, fragmented federal programs, and insufficient inclusion of community knowledge in infrastructure planning (Clark et al. 2022; Shute et al. 2024). Advancing proactive adaptation means the federal government must support Indigenous-led infrastructure and adaptation planning and provide stable, adequate investments in climate-resilient water, transportation, and other infrastructure in Indigenous communities.

5.5 Implications for businesses and the economy

Infrastructure failure under a no-adaptation pathway creates systemic risks for Canada's economy, including repeated supply chain disruptions, lost productivity, and reduced competitiveness. Conversely, maintaining reliable transportation, energy, and communications networks through proactive adaptation helps safeguard economic stability and investor confidence.

Proactive adaptation strengthens the foundations for sustainable growth by reducing systemic climate risk and ensuring that public infrastructure continues to underpin economic productivity. These economic benefits also feed back into public finances as stronger business continuity and productivity help sustain employment and preserve tax revenues, reducing fiscal strain on governments. In the longer term, the capital that would otherwise be diverted to repeatedly repairing climate-damaged infrastructure can instead be invested in more economically productive and socially beneficial activities—supporting business reliability, expansion, and higher-value growth across the economy.

5.6 The bottom line

The financial burden of inaction grows over time and across orders of government. Municipalities face near-term fiscal pressure as repair and maintenance costs mount, while federal, provincial, and territorial governments face escalating long-term liabilities through their own infrastructure bills, as well as stabilization spending and disaster recovery at the local level. Rising federal disaster assistance payments over the past decades illustrate this trend: reimbursements for disaster costs have grown from occasional, modest expenditures to billions of dollars annually in recent years (PBO 2024).

Unlike private infrastructure, public infrastructure lacks a market mechanism that rewards investments in resilience. The benefits of resilient infrastructure—fewer service disruptions, fewer insurance claims, stronger local economies, and saving public funds for other services and priorities—are widely shared across society. Upgrading stormwater systems to handle heavier rainfall can prevent basement flooding that damages homes, shuts down businesses, and strains local emergency services. Maintaining climate-ready roads helps avoid weather-related closures and vehicle damage, keeping goods moving, and supporting local economic activity during extreme events. And strengthening drinking water systems reduces the risk of boil-water advisories and emergency repairs, protecting public health while avoiding costly disruptions for households and businesses.

>>> **Proactive adaptation investments deliver strong value for money.**

Yet the upfront capital costs fall almost entirely on governments, especially municipalities that have limited revenue tools and borrowing capacity. This creates a structural mismatch: the level of investment that would make the most sense for society is typically greater than what the government that owns the infrastructure can justify on its own. As a result, governments struggle to adapt infrastructure proactively even when doing so would save money and reduce risk over time. Public infrastructure adaptation is therefore a public policy challenge: governments must find ways to co-ordinate across jurisdictions and mobilize capital to bridge the gap between their costs and the far broader benefits that resilience provides.

The analysis clearly shows that proactive adaptation investments deliver strong value for money even when only considering direct infrastructure costs borne by governments. Across every infrastructure asset type, the direct benefits of proactive adaptation far exceed the costs—even when future benefits are discounted at relatively high rates. Achieving these savings does not require a dramatic increase in spending: adapting infrastructure to rising heat and extreme rainfall would require sustained investment averaging about $3 billion per year—roughly 2.5 per cent above the spending currently required to keep public infrastructure in good repair.

While proactive investment yields substantial fiscal benefits for infrastructure owners, the full value of proactive adaptation extends far beyond government balance sheets. Upgrades that prevent infrastructure failure also reduce private property damage, avoid business interruptions, stabilize supply chains, and protect household well-being and economic stability. By reducing these wider indirect costs and reducing economic shocks, proactive adaptation ultimately strengthens public finances and preserves governments' capacity to invest in new infrastructure and other essential services.

In short, acting early pays dividends. Proactive adaptation investments today prevent escalating repair bills, stabilize public finances, and protect Canada's productivity and competitiveness. Because the benefits of resilient infrastructure extend beyond governments to households, businesses, and the entire economy—each dollar invested today safeguards multiple dollars in avoided losses tomorrow.

A roadworks sign is pictured in Montreal. (Graham Hughes/The Canadian Press)

Construction workers in New Westminster, B.C., work on the new Pattullo Bridge in July 2025. The aging original bridge spans the Fraser River, connecting New Westminster and Surrey. (Darryl Dyck/ The Canadian Press)

6

Policy pathways: How governments can act

Climate change poses a fundamental, long-term challenge for Canada's public infrastructure—one that demands co-ordinated and sustained policy action. Infrastructure decisions made today will shape the country's resilience for generations. The financial risks and the strong economic case for proactive adaptation outlined in this report point to the need for decisive steps to embed climate resilience into every stage of infrastructure planning, financing, and management across all orders of government.

Yet public infrastructure owners face structural barriers that hinder proactive adaptation. While the upfront costs of proactive adaptation fall largely on individual governments, the benefits accrue broadly across Canadian society. This disconnect between who benefits and who pays creates a collective under-investment problem: even when adaptation yields strong returns for society as a whole, many government infrastructure owners—acting individually rather than collectively—lack the incentive, or the fiscal room, to invest at the scale required.

Addressing the financing gap that this disconnect creates is critical for moving proactive adaptation forward. Even when investments demonstrate strong benefit-cost ratios, many government infrastructure owners—particularly municipalities—lack the revenue tools and borrowing capacity to act early. Property taxes and development charges—their primary sources of funding—were never designed to finance large-scale, long-lived infrastructure renewal. Indigenous governments also face challenges in accessing capital for infrastructure investments because of constraints imposed by the *Indian Act* and federal funding frameworks.

These fiscal and incentive barriers to proactive adaptation are compounded by information gaps, fragmented governance, outdated design standards, and uneven local capacity to plan, finance, and implement resilient infrastructure projects effectively. Overcoming these challenges requires a coherent national approach to proactive infrastructure adaptation that recognizes shared risks—and shared returns.

The following policy recommendations, drawn from the Canadian Climate Institute's research (Ness et al. 2021; Clark et al. 2022; Sawyer et al. 2022, Ewart et al. 2023) and reinforced by the findings of this analysis, outline how governments can overcome these barriers and act on the evidence in this report to advance proactive, co-ordinated public infrastructure adaptation.

6.1 Mobilize financing and partnerships for adaptation

Governments should expand and modernize the financial tools available to infrastructure owners, ensure that cost-sharing reflects the distribution of benefits, and create new pathways for public, private, and institutional capital to support resilience upgrades.

A co-ordinated financing framework can accelerate proactive adaptation by providing predictable funding, unlocking capital for long-lived assets, and enabling municipalities and other owners to invest early rather than react to failures. By broadening financing options and aligning them with shared risks and returns, governments can close the adaptation financing gap.

To achieve this, governments should:

- Expand senior government infrastructure programs with dedicated, predictable, and long-term support for local resilience upgrades.
- Establish multi-year adaptation funds with streamlined applications and clear, fair cost-sharing formulas aligned with the distribution of benefits.
- Support pooled and regional financing models to help smaller municipalities access capital and expertise.
- Attract private and institutional investment through credit enhancement and public–private financing vehicles.
- Develop new value-capture and financing tools—such as adaptation levies, resilience bonds, and property-assessed financing—to enable infrastructure owners to finance and repay adaptation investments over the life of assets.

6.2 Mainstream adaptation in infrastructure asset management

Integrating climate risks into asset management has proven to be one of the most effective tools for growing infrastructure resilience (Thouin et al. 2025; Federation of Canadian Municipalities [FCM] n.d.). Strong asset management identifies climate vulnerabilities early, prioritizes high-risk assets, and targets maintenance and renewal for maximum impact (FCM 2018).

Climate-informed asset management is firmly in the interest of infrastructure owners and the constituents they serve. Asset management that plans for resilience reduces long-term repair and replacement costs, extends asset life, and reduces the fiscal shocks of sudden failures. It also improves service reliability, protects public health and safety, and reduces wider social and economic losses when disruptions occur.

Still, climate-informed asset management in Canada remains the exception. In 2020, only about 30 to 65 per cent of municipalities had asset management plans, depending on infrastructure type. Even fewer municipalities reported factoring climate adaptation into infrastructure decisions—ranging from roughly 30 to 50 per cent, again varying by infrastructure type (Statistics Canada 2025a). This reflects the fact that standard tools rarely include climate-risk assessment, that many municipalities lack the capacity to interpret hazard projections, and that weak provincial/territorial requirements provide little incentive to go beyond basic compliance (Infrastructure Canada n.d.; Setoodeh 2022). As a result, most infrastructure maintenance and renewal decisions in Canada still do not account for how climate hazards accelerate wear and drive future costs.

Mainstreaming climate adaptation into asset management requires clear expectations, stable capacity supports, and consistent regulatory and funding frameworks across the country. To achieve this, governments should:

- Embed climate risk assessment in all asset management plans, including forward-looking projections for temperature, precipitation, flooding, wildfire, and permafrost thaw.
- Require climate-informed asset management as part of provincial/territorial infrastructure regulatory frameworks and for federal, provincial, and territorial funding eligibility criteria.
- Fund technical assistance, training, and local capacity-building to help municipalities and Indigenous governments interpret climate projections and integrate them into life-cycle planning.

6.3 Strengthen hazard data foundations

Effective, climate-informed asset management and adaptation planning requires accurate, accessible, and up-to-date hazard information. Canada still lacks comprehensive and consistent maps for floods, wildfires, permafrost thaw, and other hazards—especially in smaller, rural, northern, and Indigenous communities. Where public data exist, they are often fragmented or locked behind technical barriers. The cost of private data is beyond the reach of the public and many municipal governments.

Federal, provincial, and territorial governments should share the effort of expanding hazard mapping through a co-ordinated national effort that:

- Develops shared tools, templates, and data platforms that provide accessible, standardized climate hazard information for infrastructure owners.
- Establishes national mapping standards for consistency and comparability.
- Ensures hazard data is open, accessible, and usable for infrastructure managers.
- Supports local and Indigenous governments in integrating community-based knowledge in hazard mapping.

A national hazard data initiative will require significant but strategic investment—potentially hundreds of millions of dollars over the next decade—that will pay dividends across infrastructure, emergency management, and land-use planning.

6.4 Modernize codes and standards for a changing climate

Much of Canada's infrastructure is still being designed using historical climate data, locking in future vulnerability. Although some headway has been made through initiatives by the National Research Council, Housing, Infrastructure and Communities Canada, and the Standards Council of Canada, progress is moving too slowly to match the pace of climate change (Infrastructure Canada 2025).

Federal, provincial, and territorial governments should accelerate the modernization of infrastructure codes and standards under their jurisdiction to reflect forward-looking climate data. This means:

- Embedding future climate projections—such as rainfall intensity, heat loads, and freeze-thaw cycles—into design parameters.
- Co-ordinating bodies and professional associations to update design parameters consistently and on a shared timeline.
- Building professional capacity so that engineers, architects, and planners can apply new standards effectively.

Climate-informed codes and standards extend asset life, reduce long-term costs, and prevent billions in avoidable repair and recovery spending—making them among the most direct, high-impact measures governments can take.

6.5 Integrate climate resilience into public infrastructure funding

Governments spend billions each year on infrastructure, but without explicit resilience requirements, much of that funding risks locking in decades of climate vulnerability. Canada's *National Adaptation Strategy* committed to integrating climate resilience into all new federal infrastructure funding programs starting in 2024, but climate resilience is still not consistently required across federal programs (Government of Canada 2023).

To ensure public infrastructure dollars spent today reduce future climate risk, governments should:

- Make climate resilience a mandatory criterion for all infrastructure funding, expanding tools like the Climate Lens across all federal programs and aligning provincial and territorial programs with the same requirements.
- Prioritize funding for adaptation of high-risk and critical infrastructure, directing investments toward the most urgent vulnerabilities.
- Prevent new climate-vulnerable infrastructure, requiring applicants to demonstrate resilience under future climate conditions.
- Support municipalities—especially rural, northern, and lower-capacity communities—in meeting resilience requirements, including assistance with climate-risk assessments and application capacity.

A Montreal firefighter stands next to a geyser of water, which erupted from a broken watermain in August 2024, flooding streets and homes. (Graham Hughes/The Canadian Press)

6.6 Identify and support vulnerable communities and critical assets

The results underscore that not all regions and populations are affected equally. Some communities—particularly smaller, rural, northern, and Indigenous—face higher climate exposure and fewer fiscal and technical resources to adapt. When critical infrastructure is not adapted, these disparities deepen: communities may lose homes that cannot be rebuilt, essential services may remain disrupted for long periods, and residents—especially those without access to insurance or savings—bear disproportionate financial and social losses. Tailored programs are required to address these disparities.

To prevent climate impacts from deepening inequities, governments should:

- Identify infrastructure and community vulnerability hot spots.
- Design targeted adaptation funds for high-risk, low-capacity jurisdictions.
- Integrate equity and reconciliation objectives into infrastructure funding criteria.
- Support knowledge exchange and regional partnerships to build technical capacity and share best practices.

Critical assets that provide essential services—such as hospitals, water treatment facilities, and transportation links—should be prioritized for resilience upgrades, with contingency plans in place to maintain continuity during climate-related disruptions.

The path forward

Together, these policy pathways form an important part of the agenda for building climate resilience into Canada's public infrastructure. The benefits of proactive adaptation quantified in this report will only be realized if supported by good planning, modernized standards, reliable data, and wise and sustained investment. By embedding climate considerations into every stage of the infrastructure life-cycle, governments can transform adaptation from a reactive cost to a strategic investment—one that strengthens communities, safeguards public finances, and secures Canada's prosperity in a changing climate.

A backhoe was swallowed by a sinkhole that opened up in Montreal in August 2013. (Graham Hughes/The Canadian Press)

7 Conclusion: The case for investing now

The analysis leaves no doubt: investing now to adapt Canada's public infrastructure is essential to reduce long-term costs, maintain reliability, and protect communities. Every delay increases future expenses, amplifies fiscal pressures, and deepens the cycle of damage and repair. Proactive adaptation—guided by clear data, co-ordinated planning, and modernized design standards—offers governments and taxpayers the highest return on investment available.

While adaptation requires significant upfront spending, the benefits far outweigh the costs. Strengthened infrastructure reduces disaster recovery expenses, lowers life-cycle maintenance costs, and protects essential services that Canadians depend on daily. These investments deliver multiple dividends: safer communities, stable public finances, and resilient local economies capable of withstanding climate shocks.

People and communities across Canada stand to benefit directly from more resilient infrastructure. By investing in proactive adaptation, governments will not only reduce failures and service disruptions, but will also help protect homes, businesses, and essential services. These gains are only possible when governments work together and acknowledge that resilient infrastructure pays dividends far beyond infrastructure balance sheets—safeguarding livelihoods, supporting economies, and improving quality of life across Canada.

Governments now have a clear playbook for action. The evidence shows what works and where to start. The question is not whether Canada can afford to invest in adaptation—it is whether we can afford *not* to. Acting now will cost less, save more, and build a stronger, safer, and more prosperous Canada for generations to come.

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Cover image: A large pothole is pictured on a snowy Montreal street. (Marc Bruxelle/iStock.com)