

# MOBILIZING PRIVATE CAPITAL FOR CLIMATE ADAPTATION INFRASTRUCTURE

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## INTRODUCTION: The role of private finance in climate adaptation infrastructure

Infrastructure is essential to Canadians' well-being and to the country's economic activity, but increasingly acute climate impacts pose serious threats. Floods, wildfires, heat waves, and other extreme weather events are already taking a toll on infrastructure, and these damages are set to accelerate (Sawyer et al. 2022, IPCC 2021; ECCC 2019). Canada has experienced a number of costly extreme weather events during the last decade, including the estimated \$4 billion impacts of Hurricane Fiona in the Maritimes in 2022 (Sullivan 2022), the \$9 billion floods in British Columbia in 2021 (Hunter 2022), and the \$9 billion wildfire in Fort McMurray in 2016 (Snowdon 2017). These events reinforce the urgency of adapting Canada's infrastructure to climate change.<sup>1</sup>

Of particular importance in limiting the damage from worsening climate change is the need to scale up systems-focused adaptation investments, which are investments "explicitly intended to deliver climate resilience benefits to the broader system" (CBI 2019: 18).<sup>2</sup> These investments, which we refer to as "climate adaptation infrastructure," will be the focus of this paper.

The challenge of scaling up this needed investment cannot be met through public funding alone. The scale of investment required is simply too large, especially as governments are operating in a relatively constrained spending

This scoping paper is part of a series that explores specific challenges and opportunities in the development and implementation of adaptation policy in Canada.

<sup>1</sup>A major driver of the costs of these and other extreme weather events are infrastructure repair and business interruption associated with infrastructure failure, in addition to other impacts.

<sup>2</sup>Examples of systems-focused adaptation investments include new or upgraded infrastructure to reduce community flood risk and landscape-level interventions to protect communities from wildfires. By contrast, asset-focused climate resilience investments "enhance the resilience of an asset or activity to climate change" (CBI 2019: 18).

environment and their ability to borrow and spend is not infinite.<sup>3</sup> This challenge is particularly acute for municipalities, which own and operate 60 per cent of Canada’s public infrastructure: they face limited capacity and revenue sources to address climate impacts and are facing a large price tag for infrastructure adaptation—an estimated \$5 billion annually (IBC and FCM 2021).

Climate adaptation is chronically underfunded, not only in Canada but around the world. Adaptation accounted for only 7 per cent of climate finance flows in 2021 (while so-called “dual-use” low-carbon resilience projects accounted for an additional 2 per cent), leaving the remaining 90+ per cent focused on climate mitigation (Buchner et al. 2021). In Canada only 3 per cent of climate bonds issued in 2018 were used for climate adaptation projects (Zerbe 2019). And while the recent National Adaptation Strategy is a major step forward for more effective national adaptation action, the investment that the federal government has so far committed to implementing the strategy falls far short of what is required (Government of Canada 2022a, Ness and Miller 2022).

Closing the funding gap and investing more ambitiously in proactive adaptation is critical—not only to protect communities and livelihoods but also to limit the toll that climate change takes on Canada’s economy as a whole. The economic case for proactive adaptation is extremely strong: recent studies estimate that without proactive adaptation, climate impacts could cost the Canadian economy \$78 billion annually by mid-century, even under a low-emissions scenario. Proactive adaptation can cut those costs in half (Sawyer et al. 2022).

But despite a strong economic case for resilience, Canada must address considerable challenges to unlock private finance. Most significantly, the benefits of climate adaptation infrastructure cannot always be easily quantified, aggregated, and monetized in a way that creates the cash flows required for the private sector to invest. This paper explores these challenges and identifies potential solutions to align the financial case for adaptation investment with the myriad benefits it provides. Beyond this primary challenge, other barriers have hampered progress in adaptation infrastructure broadly—and mobilizing private finance for adaptation infrastructure specifically—that must be addressed. These include a lack of climate risk awareness at the individual and organizational level, institutional inertia, and capacity challenges, particularly at the municipal level. We discuss these challenges and put forward potential tools to begin to address them, for further discussion and policy analysis.



<sup>3</sup>Among other factors, the Russian invasion of Ukraine changed the geopolitical and macroeconomic context, and the conflict continues to drive uncertainty for supply chains and global markets. Inflation and rising interest rates have altered the investment environment that had been stimulated by public spending in response to the COVID-19 pandemic. The effect is rising cost of capital and increased discount rates, which in turn depress the value of future cash flows—rendering long-term investments such as infrastructure more challenging than they otherwise would be, at least in the near term.



# ADDITIONAL BENEFITS TO HARNESSING THE PRIVATE SECTOR

In addition to providing the capital needed to close the adaptation infrastructure funding gap, the private sector can deliver benefits in how infrastructure projects are delivered. These are not new: governments already have experience realizing these benefits from partnerships with the private sector in designing, building, financing, maintaining, and operating other categories of public infrastructure, including for climate mitigation.

**SPEED AND SCALE:** Canadians and their assets are already at risk. The longer it takes to build the climate adaptation infrastructure required to reduce risk, the more loss and disruption is likely to occur. If public dollars can be used to crowd in private investment, this increased capital will increase the speed and scale at which Canada is able to build adaptation infrastructure. In addition, the private sector is motivated to move quickly to complete projects, which may accelerate timelines and keep costs contained, and the additional capacity can generate swifter progress than may otherwise be the case.

**SHARING OF RISK:** Engaging the private sector in building, financing, operating, or maintaining infrastructure transfers some of the inherent risks in those activities from the public to the private sector. This limits the potential liability facing the public if the risks are greater than anticipated or work does not go to plan.

**SOPHISTICATION:** In some instances, there is a benefit of increased creativity, efficiency, and/or flexibility from engaging the private sector in building adaptation infrastructure. A collaborative approach involving the private sector can bring additional resources and expertise to municipalities of all sizes. For example, the City of Edmonton's flood mitigation plan was initially priced by City staff at between \$2.4 billion and \$4.7 billion, with a completion timeline of "up to a century" using traditional approaches (Stolte 2017). Upon engaging the expertise and capacity of its City-owned utility, EPCOR, the approach was revisited to use more nature-based solutions and to manage risk more strategically, and the price reduced to \$1.6 billion over 20 years, "requir[ing] less capital investment and deliver[ing] faster results than traditional engineering approaches" (EPCOR 2023). EPCOR finances the infrastructure with debt secured by modest utility rate increases phased in over the period.



# ADAPTATION HAS MANY BENEFITS— THE CHALLENGE IS MONETIZING THEM

It's clear that adaptation infrastructure provides economic value to society, and this value is likely to increase over time given our changing climate. Multiple studies have computed the economic value of resilience, including adaptation infrastructure specifically, and have found that an ounce of prevention is worth a pound of cure. Even conservative estimates of benefits-to-costs ratios range from 4:1 to 6:1 (GCA 2019; PSC 2022a; FCM 2023a). Others have estimated the ratio at up to 15:1, when indirect macroeconomic benefits are included as well as direct avoided costs (Sawyer et al. 2022). Assuming a piece of infrastructure has a 50-year lifespan, this would amount to an annual return on investment of 30 per cent.<sup>4</sup> As such, investing in adaptation infrastructure presents a significant opportunity for investors and beneficiaries, with the ability to drive positive societal outcomes by reducing overall climate change risk.

Nevertheless, making adaptation investments “bankable” for private investment remains challenging. Most significantly, despite the strong economic case for resilience, there is a “difference between an economic perspective, which considers all costs and benefits to society, and a financial perspective, which considers private costs and benefits from the perspective of an organization, group or individual” (U.K. CCC 2023: 51). The elephant in the room is the absence of readily available cash flows typically required to incentivize private investment (Tall et al. 2021). The fundamental question is whether enough of the benefits resulting from climate adaptation infrastructure can be quantified, aggregated, harvested, and/or monetized in such a way that enables crowding in private capital.

The U.K. Climate Change Committee rated the lack of revenue as among the most important barriers to adaptation infrastructure interventions, concluding that “A lack of revenues from undertaking adaptation actions is preventing investable adaptation projects from securing financing” (U.K. CCC 2023: 11). Canada faces a similar challenge, the dimensions of which include the following factors (adapted from Alvarado and Welch 2022: 7):

- ▶ **Concentration:** The benefits of resiliency infrastructure, including social value and avoided losses, accrue to a wide range of individuals and organizations, rather than primarily to the investors in that infrastructure (Miller and Swann 2019: 37). The highly diffuse nature of these benefits makes

<sup>4</sup> Assuming a 50-year infrastructure lifespan, a benefit-to-cost ratio of 15:1 would generate a return on investment of 30% (1,500% divided by 50 years).

quantification and harvesting complex and costly.

- ▶ **Quantification potential:** Some benefits are easily quantified (e.g., changes in insurance premiums, property values, and corresponding taxes). Some are contingent, like avoided losses. Others are difficult to quantify or may elude quantification altogether (e.g., peace of mind, livability, mental health from green space). In addition, there are particularly thorny challenges with quantifying the benefits of avoided costs from avoided disasters with a high enough degree of confidence to form the basis of investment decisions. Quantifying the absence of a phenomenon may require modelling future scenarios (sometimes distant) on which there may not be a high degree of understanding or high degree of agreement among decision-makers.
- ▶ **Cash-ability:** Even if benefits are quantifiable, some can be difficult to monetize as cash flows—much less to aggregate and harvest to repay investors.

And yet, as noted above, there is a strong economic case for investing in resilience. To bring the economics to fruition, new financial models are required to quantify, aggregate, harvest, and monetize sufficient benefits to attract private investment. The following section describes potential solutions for addressing the challenges outlined above and identifies potential tools in the policy toolkit for governments to create a more favourable investment environment. These ideas are presented to initiate further discussion and policy analysis to move the dial on private finance for adaptation.

## MONETIZING THE BENEFITS OF RESILIENCE

Although cash flows may not always be readily available, they can be realized with creativity and flexibility. To use a nature-based analogy, this may take more of a watershed approach, where tributaries of benefits flow in a variety of ways to investors, instead of through one aggregated channel. Different situations may call for different approaches, as shown in Table 1 (Alvarado and Welch 2022).

Table 1:

### How cash flows arise from climate adaptation infrastructure

Cash flow genesis	Explanation	Examples
<b>Direct cash flows</b> from resiliency infrastructure	Flow directly to infrastructure owners or the beneficiaries of the infrastructure as a result of its existence	User fees, insurance premium reductions, other revenues (e.g., sale of electricity from a turbine in a dam system that mitigates flood risk)
<b>Indirect cash flows</b> from the infrastructure but dependent on it	The existence of the infrastructure may enable a public entity to enact a cash-generation mechanism that can flow to investors	Avoided mop-up costs, enhanced infrastructure reliability, development cost charges, local improvement charges, tax-increment financing
<b>Cash flows that are independent</b> from the infrastructure	A public entity may generate cash (that flows through to investors by agreement) by means completely independent of the resiliency infrastructure	Taxes, general operating revenues, transfer from other orders of government

Source: Alvarado and Welch (2022)

The remainder of this section offers illustrations to bring to life several examples.

## Direct cash flows

Two simple illustrations of direct cash flows for investors are user fees and changes in insurance premiums.

### 1. User fees

Municipal governments frequently charge user fees to “recover the cost of specific services delivered to properties” (Zerbe 2019: 29), from potable water to waste collection. Widely applied in the United States and increasingly in Canada, stormwater user fees are the most prominent example related to climate adaptation. These fees provide relatively stable revenues and can strengthen incentives to enhance resilience (especially when complemented by rebate programs). Multiple models exist for managing stormwater, which may involve municipal departments, independent utilities, Crown corporations, or utility structures within a municipality. And multiple methods are available to calculate the fees, trading off effort and accuracy (O’Neil and Cairns 2016).<sup>5</sup>



## CASE STUDY 1: Stormwater user fees in Victoria, B.C.

Prior to 2016, stormwater fees in Victoria were assessed based on property values, leaving homeowners with no financial incentives to reduce stormwater flows that stress the city’s infrastructure. Starting in 2016 the City shifted the bulk of stormwater fees from property taxes to utility bills, charged based on each property’s:

- ▶ Impervious surface area, such as roofs, driveways and parking areas;
- ▶ Street cleaning, as determined by frontage length and street type;
- ▶ Property type, which impacts stormwater intensity; and
- ▶ Stormwater cleaning practices (in the case of larger properties).

(City of Victoria, 2023a)

To strengthen the incentive for property owners to adopt practices that reduce peak stormwater flow, the city introduced a rewards program, including rebates and credits for certain activities, such as the use of rain barrels, cisterns, infiltration chambers, permeable paving, rain gardens, bioswales, and green roofs (City of Victoria 2023b).

<sup>5</sup> For example, assessing a flat fee requires little effort but does not distinguish between properties, whereas measuring impervious area on properties provides high accuracy but requires effort.

## 2. Insurance premiums

When climate-resilient infrastructure is installed that reduces risk in a community, property insurance payouts should decrease. In a competitive insurance market this means that insurance premiums will be lower than they would otherwise be, as less money needs to be collected by insurers to cover claims payouts (since premiums reflect the risk being underwritten). This change in insurance premiums is a source of cash flow that, in theory, could be used to pay back investors for having built the climate adaptation infrastructure. The challenge with this option would not be in quantifying or monetizing the benefits but rather in aggregating them, since the adaptation project would protect homeowners and businesses served by numerous insurers, each with their own actuarial and distribution models. Some mechanisms have been conceptualized that employ this phenomenon, such as resilience bonds (Vajjhala and Rhodes 2015) and community-based flood insurance (CDI 2022), but implementation is lacking. Capturing changes in insurance premiums could in theory work at different scales, from the sovereign level for the country, to the watershed scale provincially, to a bundle of contiguous or non-contiguous communities with like risks willing to invest in adaptation infrastructure.





## CASE STUDY 2: Ste-Marthe-sur-le-Lac's upgraded dike

Ste-Marthe-sur-le-Lac is a suburb of Montreal, located at the convergence of the Ottawa and St. Lawrence rivers. It was built on wetlands and, in the 1970s, a natural dike was built from clay and grass to protect the city from flooding. On April 27, 2019, floodwaters breached the dike. According to the Government of Quebec, the water level is estimated to have reached the 1-in-200-year flood level.<sup>6</sup> Approximately 2,500 of the community's 6,000 private dwellings were flooded, and approximately 7,700 of the community's 18,000+ people were evacuated (Olson 2019).

The insured losses from the floods in and around Ste-Marthe-sur-le-Lac totalled over \$127 million (IBC 2019). Given the insurance protection gap, the total economic losses were likely significantly higher.

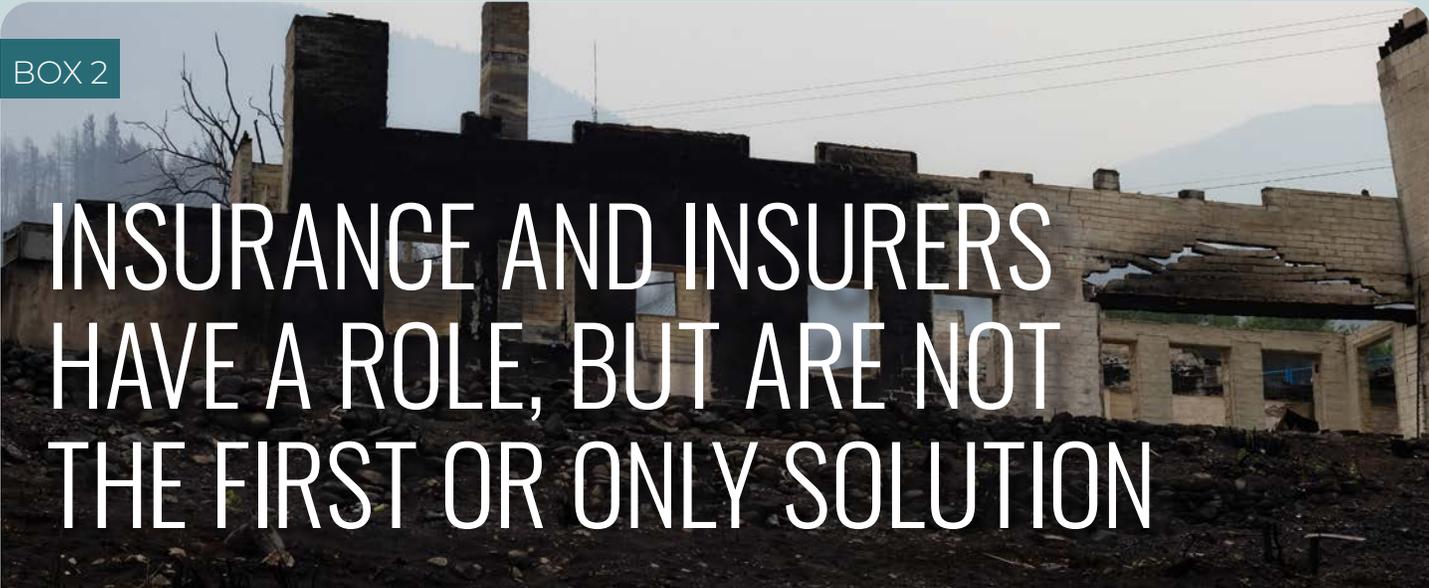
Within four months of the flood, the community had begun to rebuild the dike and added 1.5 metres to the previous dike's height. These enhancements were designed to protect the town against a bigger flood.

The investment totalled \$49 million, equivalent to approximately \$8,100 per household (Infrastructure Canada 2019). The costs were shared by the city and the provincial and federal governments.

### The economic case for investing in flood resiliency

According to one Canadian insurer's models, if all residents of Ste-Marthe-sur-le-Lac were insured against flooding to the full value of their homes, the premiums associated with the water damage coverage would have decreased by an average of 64 per cent after the dike enhancement. These savings equate to a 15.4-year payback on the municipality's investment in the flood defence, at 20 per cent of the cost. This payback period is shorter than the expected lifetime of the dike but would have been insufficient to single-handedly pay up-front for the total cost of the infrastructure if there had been no provincial or federal grants. Despite this, this example shows that changes in insurance-related cash flow arise from adaptation. Moreover, if a wider range of the future avoided costs were factored in beyond premium reductions for homeowners' water damage insurance—including, for example, uninsured losses, clean-up costs, business interruption, emergency response, and mental health impacts—the payback would become much more compelling.

<sup>6</sup> [https://www.cehq.gouv.qc.ca/depot/historique\\_donnees\\_som\\_mensuels/043108\\_NL\\_MAX.txt](https://www.cehq.gouv.qc.ca/depot/historique_donnees_som_mensuels/043108_NL_MAX.txt)



# INSURANCE AND INSURERS HAVE A ROLE, BUT ARE NOT THE FIRST OR ONLY SOLUTION

Two myths are worth dispelling. First, that insurance alone can address climate impacts to infrastructure. Second, that insurers are financially self-interested in climate adaptation.

## MYTH #1:

### Insurance alone is the solution

Insurance is but one tool in society's climate action toolkit—and far from the most important. That is because climate change is a risk reduction problem, not a risk transfer problem. A few comments are noteworthy about risk transfer versus risk reduction.

First, insurance is designed to protect against rare and unpredictable events. While it's impossible to know precisely which neighbourhoods will flood this year, it is possible to predict with increasing confidence which neighbourhoods will experience a flood in the coming decades. Armed with this knowledge, the goal of governments, communities, and individuals should be to reduce and manage the risk before an event occurs instead of relying on insurance to provide protection in the aftermath.

Second, while the societal value of risk transfer and indemnification cannot be overstated, the ideal societal outcome is to avoid the loss in the first place.

Third, on a practical level, the cost of insurance must reflect the risk it is covering (or else the insurer's financial stability and, in turn, the security of their policyholders, will be in jeopardy). Climate risk is increasing, and therefore so must the cost of insuring against that risk, making it unaffordable for some people in some locations. Instead, they must adapt to the risk and increase their resilience.

Without a doubt, there will be a critical role for insurance to protect against extreme events that are difficult to predict and therefore avoid, such as the so-called 1-in-1,000-year storms. A wetland can only absorb so much water, and a community can only afford to build a seawall or river dike to a certain height without taking away money from other social priorities. Inevitably, there will be residual physical climate risk once adaptation infrastructure has been put in place, and this is where insurance should come into play—whether in the form of a catastrophe bond at the community level, a performance guarantee for the adaptation infrastructure itself, or a flood endorsement in a homeowner’s insurance policy at the individual level.

## MYTH #2:

### Insurers are self-interested investors in climate adaptation

It is true that insurers have a direct interest in adapting to climate change. After all, they are already in the resilience business, focusing on recovery (UNDRR 2015) by providing financial relief after a loss. If Canada does not increase resilience, over time more and more Canadians will become insufficiently protected, leading to a widening protection gap.

However, when it comes to reaping the financial benefits of adaptation and resilience, the situation is more nuanced. Premiums are typically adjusted annually to reflect the nature of the risk being underwritten. While lower risk means lower claims costs, it also means reduced insurance premiums. In a properly functioning market, insurers should not realize improved underwriting profitability as a result of its clients having built resilience, because they should be collecting less revenue in client premiums than they would be if the adaptation infrastructure did not exist (UCISL 2016).



### 3. Other revenues

It is possible that other revenues may arise directly from climate adaptation infrastructure that are not related to its role in climate adaptation. For example, imagine a small dam designed to protect a community from flooding; a small turbine could be incorporated into the dam's design, generating electricity that could be sold to unlock the financing required for the project. Alternatively, an effort to manage wildfire risk by clearing the timber that is uneconomic to the forestry industry could lead to revenue generation through other uses, such as for wood pellets and biochar. Another example is natural infrastructure such as dry ponds, which may be tied to recreation spaces and can generate co-benefits through rental fees.

## Indirect cash flows

Different stakeholders—each order of government, First Nations, businesses, and individuals—pay for climate-driven loss and damage and stand to benefit from adaptation infrastructure. Therefore, many indirect sources of cash flows exist for the wider, more diffuse benefits of resilience projects. This sub-section provides examples of the various beneficiaries of adaptation infrastructure and draws inspiration from Simon Fraser University's Adaptation to Climate Change Team's study "Paying for Urban Infrastructure Adaptation in Canada" (Zerbe 2019).

### 1. Avoided mop-up costs

While it is not known precisely what proportion of clean-up costs are paid by different stakeholders, we know that less than half of the total economic cost from Canadian catastrophes is covered by insurance (42 per cent in 2022) (DiSabatino 2023), with governments, households, and businesses paying the balance. Government disaster relief programs are both often oversubscribed and do not fully indemnify people affected by disasters (Office of the PBO 2016). Directing even small proportions of the budgets for existing disaster assistance programs could provide a potential source of public capital to crowd in private investment to climate adaptation infrastructure—ultimately decreasing the growing budgetary pressure on reactionary post-disaster relief programs.





## CASE STUDY 3: Federal High-Risk Flood Insurance Program

In early 2023, the federal government was reviewing the recommendations of the Task Force on Flood Insurance and Relocation to develop a new national flood insurance program to protect homeowners facing high flood risk. Careful design of such a program will be critical to providing incentives for building climate-resilient infrastructure before further flooding occurs and the federal government's insurance backstop kicks in.

The federal government should design the flood program in such a way that creates strong incentives to invest in adaptation infrastructure. Given the significant cost savings from proactive adaptation compared to cleaning up and rectifying flood damage after the fact, the federal government should offer a significant portion of the approximately \$25 billion liability it would assume through a national flood insurance program to enable the development of climate-resilient infrastructure (PSC 2022b). To create accountability, these payments could be linked to the performance of the infrastructure, meaning that the government only pays if the infrastructure materially defends and de-risks insured properties over its lifecycle.

If done right, this program could unlock massive investment at scale in flood protection. Canadians would realize significant savings both as policy holders and taxpayers through federal aggregation of incentives for private investors to design, deliver, and potentially maintain climate-adjusted flood adaptation infrastructure.

On the other hand, a poorly designed program could disincentivize the building of effective defences by subsidizing poor risk management—simply distributing rising unmanaged risk without reducing it would be financially unsustainable and maladaptive.

## **2. Enhanced reliability of critical infrastructure**

A future of compounding climate disruptions is likely to undermine the reliability of critical infrastructure, from electricity to transportation, and disrupt critical services in the times when they are most needed. The beneficiaries of critical infrastructure may be willing to pay for performance guarantees related to climate resilience—a possible source of cash flows.

## **3. Additional development cost charges**

Climate change explains only part of the increase in loss and damage from catastrophic events in Canada over the last few decades; socio-economic factors also play a role, including building on flood plains, outdated building codes, and lack of investment in risk-mitigating infrastructure. Eventually, as climate risk awareness passes a critical threshold and incentives to reduce risk become aligned, these issues should begin to resolve. Adaptation infrastructure can give rise to incremental development cost charges—either through recovering the value of property increasingly at risk, or by unlocking new development. Rising risk transparency and market awareness may negatively impact some property values, which may only be recovered if appropriate adaptation infrastructure is put in place. Similarly, the development of previously flood-prone land thanks to an adaptation infrastructure intervention may give rise to incremental development cost charges—one-time fees paid by developers to municipalities—which can be used as a cash flow to crowd in private finance. A caution is warranted: Canada has a poor track record of supplanting natural infrastructure, which may provide the most cost-effective form of flood mitigation, to say nothing of its other co-benefits (Moudrak et al 2018). Therefore, care must be taken to ensure that natural infrastructure is not further supplanted in pursuit of revenue from development cost charges.

## **4. Local improvement charges**

Also known as levies, these fees are added “on title” to property tax bills to help pay for improvements that benefit specific properties. These charges are typically set for a payback period of 10–20 years and “run with the land,” so if a property changes hands, the new owners contribute during the period of their tenancy. Already used in Canada (largely for climate mitigation), local improvement charges “are likely a more politically acceptable funding tool for smaller neighborhood infrastructure projects ... and can be a useful tool for rural municipalities, where service levels vary significantly between communities and residents” (Zerbe 2019: 28).

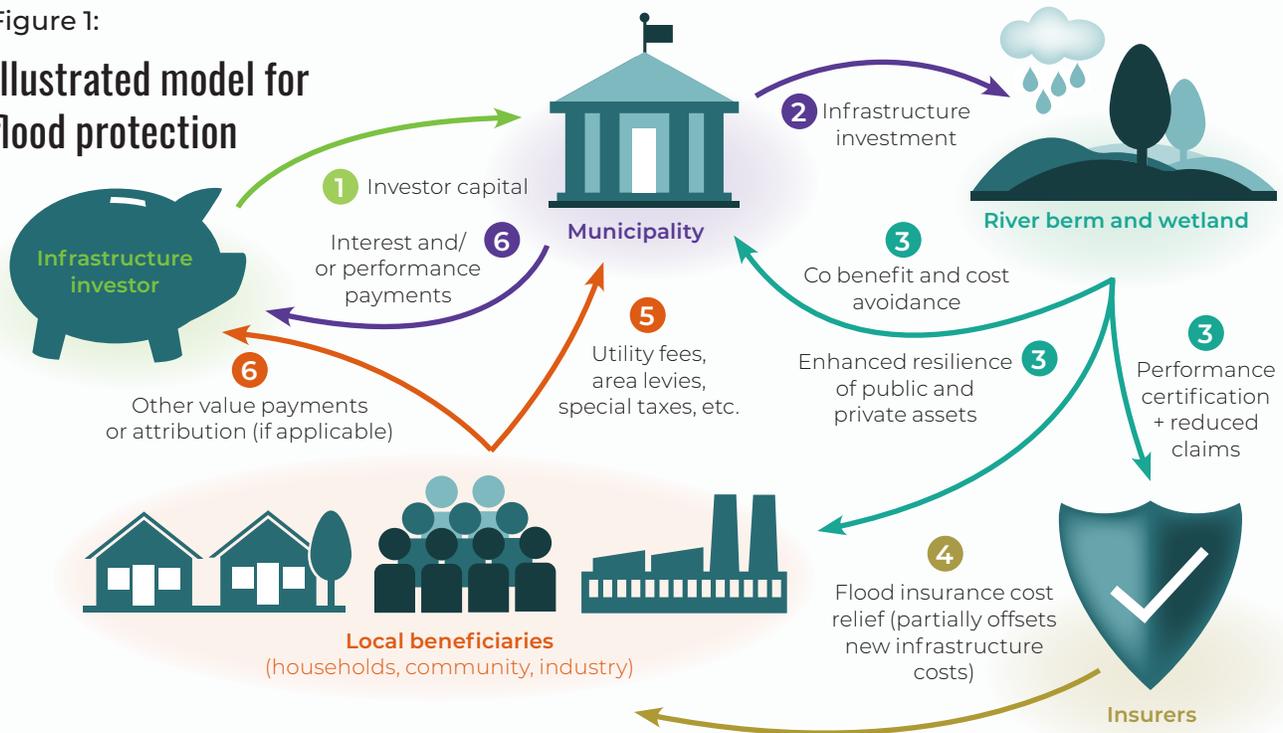
## **5. Tax-increment financing**

Tax-increment financing,<sup>7</sup> which enables a municipality to collect up front a future increase in property tax resulting from an improvement, could enable a cash flow derived both from rising property values in a catchment area and from an incremental new tax base arising from development that’s enabled by the presence of adaptation infrastructure. The cash flow could be split between the municipality and a private investor in an infrastructure intervention paid for by the private investor. While tax-increment financing in Canada has included components related to adaptation (e.g., flood-proofing), it has not been used to fund adaptation infrastructure (Zerbe 2019). However, these mechanisms could generate cash flows linked to the performance of adaptation infrastructure that restores investor confidence in a benefitting area, reflected in stronger property values. This could drive incremental new tax revenue that can in turn pay back private investors for having financed the adaptation infrastructure.

<sup>7</sup> Known in Alberta as “community revitalization levies.”

Figure 1:

## Illustrated model for flood protection



## CASE STUDY 4: California's Climate Resilience Districts

Building resilience is often “most effective and most economical” (CDI 2021: 40) through actions at the regional level. In August 2022, California state legislature authorized the creation of Climate Resilience Districts (Senate Bill 852), modelled after its Geologic Hazard Abatement Districts. The districts were intended as innovation sandboxes where pilot projects blending community- and landscape-level risk reduction and risk transfer could be pursued. The Districts can raise cash flows from one or more jurisdictions to fund resilience projects through tax-increment financing, property benefit assessments or fees (local improvement charges), or dedicated property tax increases.

Provinces and territories in Canada should consider enacting legislation similar to California's SB 852, to enable action at the regional level and equip designated districts with more ways to raise funds to build adaptation infrastructure.

## Independent cash flows

The third category of cash flow sources to pay back investors in adaptation infrastructure are those independent of the infrastructure. In other words, the government relies on taxation, general operating revenues, or other means of raising funds to pay investors, based on avoided costs or modelled savings that are otherwise difficult to gather. While tax-supported cash flows can be efficiently administered, securing them may depend on an appropriate political environment (e.g., high level of trust in elected officials, high climate risk awareness and desire for action, well-communicated benefits of adaptation infrastructure). The investor may be agnostic on how governments generate revenues so long as there is a robust agreement in place to secure cash flows.



### CASE STUDY 5: Edmonton and “utility-izing” flood mitigation

It is rare for municipalities to have a wholly owned Crown-style utility that can support flood mitigation efforts. Edmonton has this resource in the form of EPCOR Utilities Inc., the city’s provider of electricity, water, wastewater treatment, and sanitary and storm drainage services. EPCOR also deploys its expertise and scale in communities throughout North America, from operating the wastewater plant in Regina to being the largest private water provider in both Arizona and New Mexico.

With respect to Edmonton’s overland flooding challenge, EPCOR’s approach reduced costs significantly through efficiencies in planning action across five themes: slowing water from entering drainage networks, moving it away from areas at risk, securing properties, predicting water movement, and responding to rising water. By contrast, traditional approaches focus on the “move, predict, and respond” themes, neglecting the significant cost savings that can come from needing smaller infrastructure due to slowing water.

EPCOR also consolidated an all-important mechanism to amass the required equity and debt on the strength of its balance sheet and stable, predictable utility rate revenue. EPCOR finances flood mitigation infrastructure by raising debt capital secured through city-wide utility rate increases, effectively collecting stormwater charges distributed on all utility bills based on lot size. The rate increases are tied not to the benefits provided by the infrastructure but rather to the cost of installing it. In this sense, the cash flow is independent of each incremental flood-mitigation infrastructure project.

In aggregate, the aim of the Stormwater Integrated Resource Plan (a cornerstone of the City’s Climate Resilience plan) is to systematically reduce the city’s risk from overland flooding by prioritizing works according to risk reduction potential. A 20-year effort piggybacks on the

existing asset management capacity and funding, with a modest 3 per cent per year increase over that time to fund climate resilience measures. Using a utility model, which can also be a segmented department, allows for dedicated cash flows and long-term planning and helps separate the utility's infrastructure program from competition with transit, roads, housing, parks, hockey rinks, and other local projects.

## ALLOCATING CAPITAL

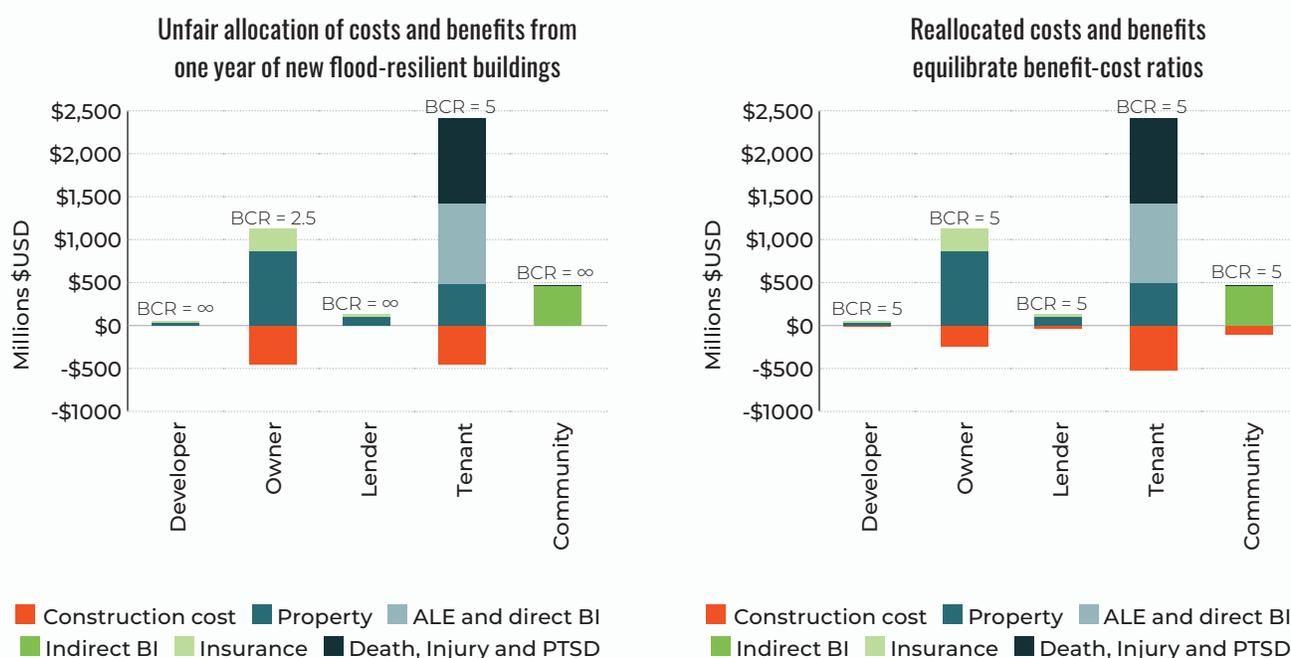
An innovative study conducted by the Multi-Hazard Mitigation Council (2020) for the U.S. National Institute of Building Sciences, which examined how to incentivize investment in resilient buildings, suggests a logic for how governments might decide on which levers to focus to generate cash flows.

The study calculated the benefit-to-cost ratios of resilient buildings experienced by different stakeholders, including developers, owners, lenders, tenants, and the community. It found that while building owners and tenants bear all the cost to make the building resilient, they are not the sole beneficiaries of the resilience—and they do not share the same benefit-to-cost ratio (Figure 2). Building on past research that found a 5-to-1 benefit-to-cost ratio for investing in above-code flood design in buildings, the study recommended that all stakeholders contribute to the cost for resilience in proportion to ensure they all receive the same benefit-to-cost ratio. Consequently, less cost would be borne by the ultimate decision-maker (the building owner), thus incentivizing resilience.

Figure 2:

### Allocations of Costs and Benefits from Flood Resilient Building (from MMC, 2020)

BCR = benefit-to-cost ratio



A similar approach could be taken with system-level adaptation infrastructure—focusing on the potential sources of cash flows described above proportionate to the benefits and with the objective of influencing the decision makers. For example, in B.C.'s Lower Mainland, where significant flood risk exists, modelling could predict the Disaster Financial Assistance Program liabilities and/or the National Flood Insurance program payments that would be avoided by upgrading adaptation infrastructure, and these sums could then be redirected to fund the upgrades. This could be paired with tax increment financing charges and/or stormwater utility fees collected at the property level through a California-style Resilience District to fund a systems-level upgrade to flood prevention in Canada's third largest metropolitan area.

## AGGREGATING CASH FLOWS AND PROJECTS

Building resiliency into assets and systems often requires several—and often small—interventions (U.K. CCC 2023). This is especially critical in systems-based resiliency, where cascading interventions build upon one another to provide a strong fabric of resiliency that is more beneficial in aggregate. Once cash flows supporting an infrastructure project have been quantified, monetized, and harvested, the cash flows need to be aggregated—coalescing sufficient cash flows and other benefits to justify undertaking the project. It is beyond the scope of this paper to analyze how in detail cash flows might be aggregated—a clear opportunity for innovation.

Beyond cash flows, aggregation should also occur with the infrastructure projects themselves. Governments, and in particular municipalities, have several strong reasons to finance multiple adaptation infrastructure projects in aggregate rather than as one-offs. First, many institutional investors have minimum investment sizes, given the significant legal, financial, and administrative due diligence required for each deal. For larger institutional investors, the threshold may be in the hundreds of millions of dollars—significantly more than the average adaptation infrastructure project. Aggregating projects creates the “critical mass necessary to attract large, sophisticated financiers, builders, designers and operators to compete for the opportunity” (Rana 2017: 6). Second, for risk management reasons, investors often prefer a diversified portfolio, which has projects in different geographies that protect against different climate perils. A diversified project portfolio may enable more favourable credit terms. Third, there may be economies of scale for the public sector in tackling multiple projects simultaneously (e.g., in procurement, in contracting, or through uniformity in project documentation over time) (Rana 2017).

Bundling also opens up more access to grant funding from provincial and federal governments, as one of the challenges with many nature-based or flood-proofing initiatives is that, as individual projects, they tend to not hit the minimum thresholds required to apply for the grants available. Thinking societally, there is another critical reason for aggregating projects: it may allow more projects to be undertaken using private finance, as those that are not bankable alone could be bundled with those with bankability. This bundling of bankable and non-bankable projects has important social equity implications, as it can help ensure that more vulnerable communities are able to see the benefits of adaptation infrastructure.



# PUBLIC FINANCE POLICY OPTIONS

The federal government should identify, study, and then operationalize its most effective means for de-risking private investment in adaptation infrastructure.

The U.K.'s Climate Change Committee has recommended that “UK Public financial institutions... should create adaptation finance strategies, setting out they will independently and collectively ensure that no viable UK climate adaptation project fails for lack of finance” (U.K. CCC, 2023: 100). We believe that Canada should do the same.

The federal government should identify, study, and then operationalize its most effective means for de-risking private investment in adaptation infrastructure. Two potential means include concessionary capital and guarantees.

## CONCESSIONARY CAPITAL

According to the U.K.'s Climate Change Committee, “public funding represents the most significant investment source for many key areas of adaptation today” (U.K. CCC 2023: 90). Whether in the form of grants or capital seeking below-market rates of return, concessionary capital can help de-risk projects, making it easier to attract private capital. In Canada, concessionary capital for adaptation infrastructure presently comes from various sources.

The Government of Canada Adaptation Action Plan (Government of Canada 2022a: 45–50) describes existing federal government actions in support of resilient infrastructure systems. Most notably, the flagship \$2 billion, 10-year Disaster Mitigation and Adaptation Fund (DMAF) launched in 2018 invests in built and natural infrastructure to help communities remain resilient in the face of extreme events. In 2021, an additional \$1.375 billion was committed over 12 years, topped up again in 2022 with a further \$489 million over 10 years. Even with the top-ups, this program remains woefully underfunded and must be scaled up.

Also at a national level, the Canada Infrastructure Bank—the country’s publicly owned \$35 billion impact investor—includes “green infrastructure” among its priority sectors. This could be broadened to enable investing in any adaptation infrastructure, unlocking further concessionary capital to layer into the capital stack, thus de-risking private investment. The U.K. Infrastructure Bank committed in 2023 to “incorporate resilience to climate change as an additional pillar” (U.K. CCC 2023: 88) in its strategic plan.

Some provinces also have funding programs to support adapting infrastructure to climate change (i.e., Alberta's Community Resilience Program and B.C.'s Community Emergency Preparedness Fund), which could act as concessionary capital to de-risk supplementary private investment. At the municipal level, in late 2022, the federal government announced an expansion to the mandate and budget of the Federation of Canadian Municipalities' Green Municipal Fund in support of community-based adaptation initiatives—a commitment of \$530 million by 2031.

Public funding could act as concessionary capital to leverage private capital, “allow[ing] projects to be deployed at greater scale and ambition” (U.K. CCC 2023: 73). Its allocation should be informed by rigorous analyses of where capital flows are most likely to leverage further private funding.

## GUARANTEES

Risk-averse private-sector investors, especially lenders, often request government guarantees to protect them from risks that may impact a project's cash flow, in particular, risks beyond private partners' control. A government guarantee is also referred to as a “sovereign guarantee” or “wrap” that provides a protective layer around the original agreement. When used strategically, such a guarantee proves an effective way to make use of private finance and leverage multiples of private capital to close infrastructure gaps.<sup>8</sup>

A guarantee could also serve as a form of differential pricing that benefits an adaptation or resilient infrastructure project. Differential pricing is a sophisticated strategy that sets a price based on a customer's characteristics. So, while a resilient infrastructure project's risk might be higher than a traditional infrastructure project, with a guarantee it could be priced lower than the traditional one, persuading private investors to help fund it. However, because of worsening climate impacts, there are some challenges with government guarantees. In many cases, governments must agree to provide a counter-guarantee, which they may be unwilling to do. A crisis may trigger a simultaneous payout of guarantees for multiple projects, and ready funding may not be available in current budgets. Furthermore, the number of projects that are seeking guarantees or meet development banks' requirements may be insufficient.

It also proves difficult to withdraw a guarantee relating to a specific risk unless the risk is eliminated. One way to address this is for the asset owner to update a physical risk assessment before doing a refinancing without a guarantee. This assumes the physical risk assessment shows the asset is less vulnerable to specific climate risks because climate resilience options have been implemented. Physical risk assessments should be repeated at significant points during an asset's life cycle, such as the financing close, the end of construction, a change in ownership, a refinancing, or a major expansion.

Similarly, performance guarantees could be offered to help de-risk projects from both the municipal and investor perspectives. Ultimately, insurance companies may wish to occupy this space in the market, but until the market matures, this could be a role for governments through existing disaster relief funding or other budgets.

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<sup>8</sup> For a thorough primer on government guarantees that relate to private infrastructure investment, see the World Bank's paper on this topic (Lu et al., 2019).



# ADDITIONAL HURDLES THAT MUST BE OVERCOME

Stakeholder support will be critical in determining whether Canada can build the adaptation infrastructure required to withstand the impacts of climate change.

While monetizing resilience benefits is the central issue, there are additional hurdles that must be addressed to create a better enabling environment to mobilize private capital.<sup>9</sup> Of particular note to Canada are the lack of awareness of climate risk, inertia and status quo bias, challenges with intergovernmental coordination, and limited government capacity, particularly at the municipal level.

## PHYSICAL CLIMATE RISKS REMAIN ABSTRACT TO CANADIANS

Regardless of the approach taken, public and stakeholder support will be critical in determining whether Canada can build the adaptation infrastructure required to withstand the impacts of climate change. One prerequisite for support is awareness and buy-in.

At the household level, Canadians do not see themselves as personally at risk from climate impacts. A University of Waterloo survey conducted in 2020 found that only 6 per cent of 2,700 respondents living in high-risk flood areas considered themselves to be at risk—a result unchanged from when the study was initially conducted in 2016 (Ziolecki et al. 2020). This result may not be surprising given that many flood maps are outdated nationwide. However, even with better information and increasingly severe weather events, the motivation to act on prevention may not arise until after a catastrophic event has directly impacted someone. Even then, longitudinal evidence shows that collective memory about floods fades relatively quickly (Fanta et al. 2019). This is a challenge, as the ability to mobilize capital for adaptation is dependent on the climate risk awareness of Canadians, their elected officials, and those who are part of the infrastructure delivery ecosystem, including financiers.

Potential homebuyers would benefit from a rating system that transparently communicates a property's physical climate risk, especially risk of flooding. In fact, one realtor introduced such a system in early 2023, an example that could be replicated (Warren 2023). Filling this information gap should shift market and political demand for investment in climate resilience. The realtor and home inspection industries could support this change, and some may carve out a competitive advantage by becoming certified in climate resilience. Lenders and CMHC could also begin to use rankings to provide incentives for customers to

<sup>9</sup> For a more in-depth discussion of these additional challenges, see, for example, Miller and Swann (2019), Tall et al. (2021), and U.K. CCC (2023).

mitigate their property's physical climate risk, although this is not without issues in terms of access to capital. Support should be provided to lower-income property owners, who may not have been aware of the risk at time of purchase and may be negatively affected by such a rating.

At the organizational level, while there is growing knowledge of physical climate risk throughout Canada, it is not evenly distributed across public entities, sectors, or organizations. There has been much discussion about this challenge and the need to address it; indeed, it is reflected in the Foundational Objectives section of Canada's National Adaptation Strategy (Government of Canada 2022b). There have been some important steps forward, including the federal Flood Hazard Identification and Mapping Program, but more is needed. Better data sharing, including downscaled physical climate risk modelling, would help. Financial support is needed to educate and train "climate translators" able to bridge the gap between science and the operational needs of governments and organizations (Fiedler et al. 2021). More cross-sector collaboration would accelerate progress on this systemic challenge, and insurers, with their sophisticated climate risk-modelling capabilities, would be ideal partners.

The Office of the Superintendent for Financial Institutions' decision in March 2023 to require federally regulated financial institutions to assess and disclose physical and transition-related climate risks, including their financial and operational resilience to climate-related disasters, is an important step forward (OSFI 2023). Building on this requirement for financial institutions, there should be wider adoption of consistent and comparable climate-related financial risk disclosures across the economy, including among municipalities.<sup>10</sup> Better understanding risk will drive demand for action on resilience. Furthermore, Canada should build a more complete picture of how climate change will affect public finances in the future, including integrating climate impacts into baseline economic forecasts. This will enable a more accurate analysis of the costs and benefits of investments in climate adaptation and is consistent with recent moves in other countries, notably the United Kingdom and Australia.<sup>11</sup> In addition, Canada needs a more rigorous inventory quantification of the geographic areas and specific public infrastructure at risk from different climate hazards, along with an estimate of the total capital required to protect it.

## INSTITUTIONAL INERTIA PERSISTS IN INDUSTRY AND GOVERNMENTS

There is a widely held assumption that financing adaptation infrastructure is solely the role of governments. For example, in a recent report, the U.K.'s Climate Change Committee provides an in-depth discussion on ways to crowd in private capital, only to then call for public funding "particularly for adaptation actions that provide distributed (public) benefits" (U.K. CCC 2023: 12). The reason for this assumption is that, as noted above, adaptation infrastructure does not create a cash flow for investors despite providing clear economic benefits to society. Another dimension of this inertia is the widely held belief "that Government will pay for adaptation or the costs of recovery from climate impacts" (U.K. CCC 2023: 11). These assumptions limit creativity and the potential solutions required to rapidly adapt Canada's infrastructure at scale.

Another example of institutional inertia is that public procurement processes, especially at the municipal level, are often bound by trade agreements and other regulatory measures, and governments tend to be risk-averse and often emphasize cost as the ultimate arbiter. In fact, many municipalities are legally

<sup>10</sup> These disclosures should be aligned with the recommendations of the Task Force on Climate-related Financial Disclosures.

<sup>11</sup> The U.K.'s Climate Change Committee recently made a similar recommendation that the U.K. Office for Budget Responsibility build upon initial steps to "undertake a full review of how the impacts of climate change in the UK will affect the UK's macroeconomic performance and public finances ... to enable a full-cost benefit analysis for public investment in adaptation" (U.K. CCC 2023: 98).



Canada's municipalities are on the front lines of dealing with the impacts of climate change on infrastructure, but capacity gaps limit their ability to prepare and respond.

required to select the lowest-priced bid in a procurement process. Concepts like best value over life cycle, or total cost of ownership, are becoming more prevalent due to improved asset management practices and to efficiency measures that seek to reduce tangible energy use and its associated carbon price. But the dominant culture of public procurement is still driven by immediate cost rather than by the climate risks that will manifest over the life of assets that are being built or rehabilitated today.

To address the challenges of inertia, policy makers should send unambiguous and repeated signals to the market that they want private capital to play a role in climate adaptation infrastructure. Policy certainty is critical for the private sector and is particularly important in this instance, given the innovation and collaboration necessary as new financial and investment models are developed.

In addition, Canada should consider heeding a recommendation made by the U.K. Climate Change Committee in its 2023 report *Investment for a Well-adapted UK*: "Government and its implementing agencies should ensure that a growing fraction of their funding helps to support pioneering projects that seek to provide proof of concept for successful funding and delivery of adaptation actions through public-private partnership funding and financing" (U.K. CCC 2023: 99).

When it comes to public procurement, municipalities in particular should be encouraged to think systemically about their asset upgrades and build climate resilience into their infrastructure procurement, rather than procuring on a piecemeal basis focused on lowest bid cost. One approach gaining traction is the so-called "progressive public-private partnership," where a holistic plan is co-developed up front but with available off-ramps in case any party wishes to cease participation without being penalized. This ensures the needs of all parties are met without taking on undue risk.

Acknowledging the sensitivities of public-private partnerships, it is worth noting that many private entities have mandates that are aligned squarely with the public interest, such as public pension plans, municipally owned utilities, and co-operative insurance companies. Such entities are obvious potential participants in projects in certain political environments.

## GOVERNMENTS—ESPECIALLY MUNICIPAL—LACK CAPACITY

Canada’s municipalities are on the front lines of dealing with the impacts of climate change on infrastructure, but capacity gaps limit their ability to prepare and respond. Municipalities own and operate 60 per cent of Canada’s public infrastructure but collect just 10 per cent of tax revenues, are unable to run deficits, and possess few revenue tools beyond property taxes (FCM 2023b). The majority of Canada’s municipalities are small, and many lack the staffing and internal capacity required to tackle complex, dynamic, and interconnected challenges such as adaptation (ICLEI Canada 2022a). Furthermore, not all municipalities have sophisticated, city-owned utilities that lend capacity and expertise. Oftentimes municipalities have not met the requirements of private capital providers when it comes to “project preparation and credit proposal” (Rana 2017: 3), a clear barrier to municipalities accessing private capital.

The Federation of Canadian Municipalities (FCM), among others, successfully advocated that the federal government address this issue in Canada’s National Adaptation Strategy, which takes aim at the issue with the objective that “local, regional, and institutional capacity for adaptation contributes to self-sufficiency and participation in adaptation actions” (Government of Canada 2022b: 30). ICLEI’s “Building Adaptive and Resilient Communities” program has provided tools and resources to support over 100 municipalities of all sizes in adaptation planning, but much work remains (ICLEI 2022a; ICLEI 2022b).<sup>12</sup>

To address challenges of capacity, Canadian municipalities need more support. The \$530 million federal top-up for FCM’s Green Municipal Fund in late 2022 is a step in the right direction and should support municipal project development. ICLEI Canada’s climate adaptation programs have a strong track record and could be scaled up with financial support from the federal and provincial governments. Sustainable funding for the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol—originally developed by Engineers Canada—should be provided to continuously improve the tool and integrate it into public decision-making processes.



<sup>12</sup>ICLEI was formerly known as the International Council for Local Environmental Initiatives. It is now known as ICLEI - Local Governments for Sustainability.



# CONCLUSION

In addition to providing capital to make the necessary investments, the private sector could help build adaptation infrastructure with greater speed and scale, and in some instances more sophistication, while sharing some of the risk.

System challenges like climate change adaptation cannot be solved by any one actor—even the federal government—and instead “require whole-of-society action” (Government of Canada 2022b: 34). Harnessing the resources and capacity of the private sector will be critical for governments at all levels to meet this challenge. In addition to providing capital to make the necessary investments, the private sector could help build adaptation infrastructure with greater speed and scale, and in some instances possibly more sophistication, while sharing some of the risk. As the World Bank bluntly put it: “Private sector investment is critical to closing the adaptation finance gap” (Tall et al. 2021: v).

However, there are many challenges that must be overcome to unlock the significant stores of private capital available for adaptation infrastructure, and success will require patient and transparent dialogue, innovative thinking, and dedicated collaboration across sectors and orders of government. Chief among these challenges is developing new financial models that account for the many economic benefits resulting from building adaptation infrastructure. This paper outlined some potential solutions, presented in the spirit of further development and discussion. In addition, while outside the scope of this paper, it is important to note that there is a risk that the cash flows required to unlock private capital arise most readily in those cities with the greatest population and neighbourhoods with the highest property values (often located in hazardous areas like alongside water). It is therefore essential that a social equity lens be applied to project prioritization, in addition to considering the degree of climate hazard faced and other criteria. Failing to do so risks exacerbating the growing socioeconomic divide between groups of people and communities across Canada.

Canada possesses many of the ingredients necessary to lead on meeting the challenge of building resilience to climate change: a national infrastructure bank and a forward-thinking federation of municipalities, globally leading life insurance companies that seek long-term assets to match their long-term liabilities, globally leading pension funds that have an interest in protecting their beneficiaries and their other investments in Canada, a thriving co-operative financial sector committed to sustainability and prepared to drive social innovation, and a National Adaptation Strategy that calls for “whole-of-society” action. Let’s get to work!

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