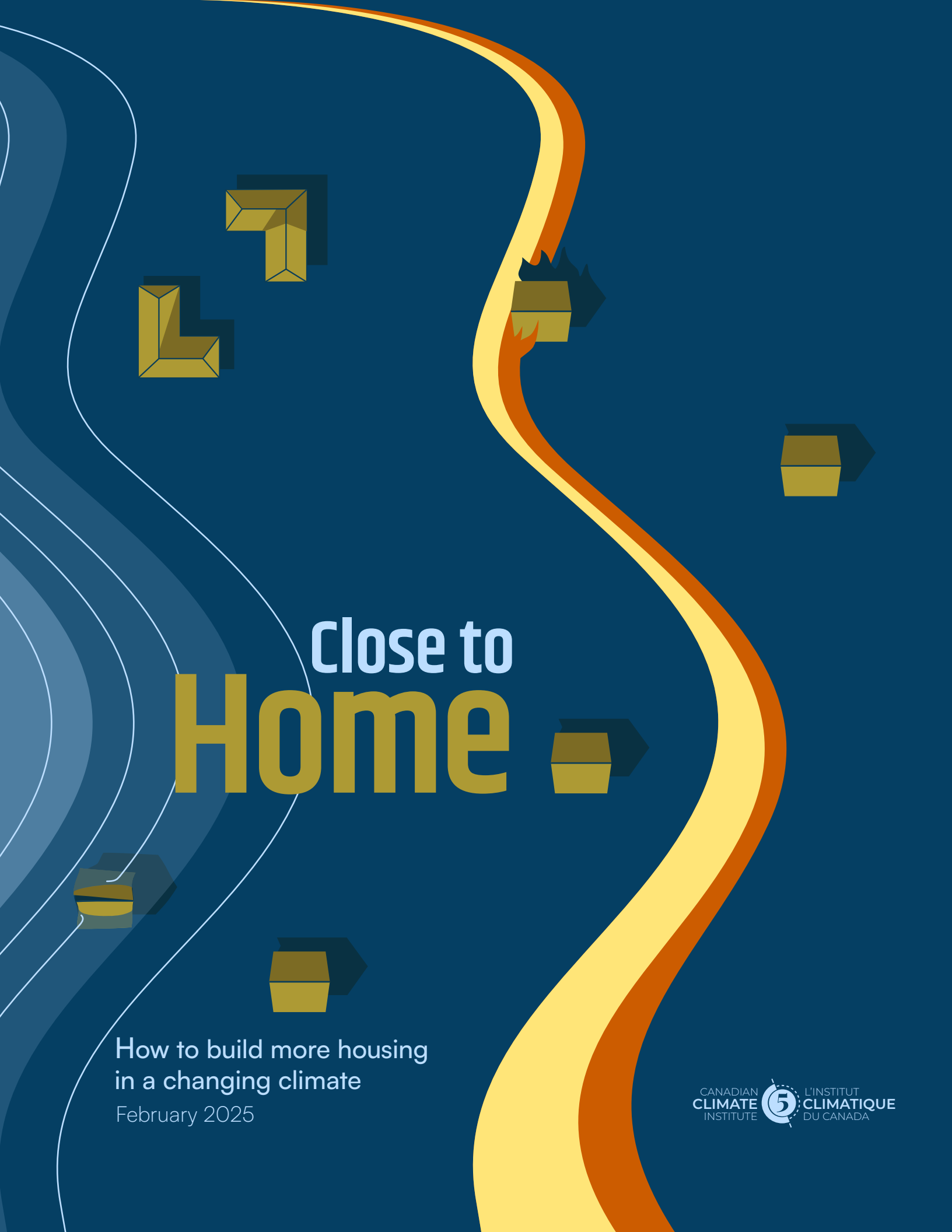

Close to Home

How to build more housing in a changing climate

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Executive Summary

In communities across Canada, the race is on to build millions of new homes as quickly as possible to improve housing affordability. While the speed of construction is important, it's also essential to consider where homes will be built. With climate change driving more frequent and severe extreme weather and weather-related hazards, building homes in safe locations is essential—because the most affordable home is one that doesn't have to be rebuilt after a disaster.

To meet housing affordability targets, the Canada Mortgage and Housing Corporation (CMHC) estimates that 5.8 million homes need to be built by 2030, representing a 35 per cent increase in housing stock. Governments aim to accelerate housing construction through funding programs, regulatory reforms, and incentives for municipalities to meet aggressive targets.

However, our analysis finds that, under existing policies, hundreds of thousands of these new homes could be built in areas that are highly exposed to climate-related hazards—particularly floods and wildfires. And unless governments and builders take proactive steps to address the threat of floods and wildfire when deciding where new homes are built, these homes will face costly and disruptive disasters, pushing the goal of affordable, safe housing further out of reach.

These risks are neither distant nor abstract. In the summer of 2024, damages from just three events—extreme flooding in the Greater Toronto Area and parts of Ontario and Quebec, combined with Jasper's catastrophic wildfire—totalled more than $4.3 billion in insured losses alone (IBC 2024a).

Meeting Canada's ambitious housing targets does not require greenlighting development in high-hazard zones. Instead, governments at all levels can act now to steer housing investment toward safer areas as they encourage accelerated housing construction. This report provides clear and actionable guidance on how Canadian governments, particularly at the provincial and territorial levels, can accelerate the development of new housing while dramatically reducing flooding and wildfire risks.

Our analysis evaluates the risks of flooding and wildfires for housing in Canada and identifies the gaps in policies that enable housing to continue to be built in harm's way. We used advanced flood and wildfire models to estimate risks to Canada's existing stock of approximately 16 million homes, and to project risks to the 5.8 million new homes needed by 2030 if they are built under current policies. In parallel, we surveyed provincial and territorial land use policies that

dictate how flooding and wildfire are considered when siting new housing, and assessed how other federal, provincial, and territorial policies—such as housing and infrastructure programs and disaster assistance rules—influence decisions about building in hazardous areas. We also commissioned a dedicated study on the unique challenges faced by Indigenous communities, particularly First Nation on-reserve communities, in building climate-resilient housing. Throughout, we engaged with officials across different orders of government, other stakeholders, and experts to inform our approach and our findings.

Our analysis indicates that, without policy changes, much new housing will be built in high-hazard flood and wildfire zones across the country, resulting in billions of dollars in additional damage every year. Most of this new risk is associated with a relatively small number of homes that will be built in the most hazardous places.

With strategic land use policy changes and better alignment in other housing-related policies, governments can steer the riskiest housing development toward safer ground, minimizing the creation of new risk without compromising the overall supply of new homes.

Conclusions

Conclusion 1

Damages to new housing from flooding and wildfire are on track to cost households and taxpayers billions

Without changes in policy, Canada could build more than 150,000 homes in areas of very high flood hazard and over 220,000 homes in municipalities exposed to high wildfire hazards by 2030. The financial implications are substantial: in a best-case scenario, annual flood losses could increase by $340 million by 2030, with a worst-case scenario of up to $2 billion annually. Wildfire-related damages could add another $1.1 billion annually, leading to total combined damages to new housing as high as $3 billion per year. Building homes in high-hazard areas will not just affect individual homeowners but will also impose broader costs on governments and society through higher insurance premiums and tax-funded disaster recovery efforts.

Conclusion 2

Permissive land use policies allow construction of risky housing

In most provinces and territories, gaps in land use policies allow housing to be built in high-hazard flood and wildfire zones. Municipalities, often under-resourced and pressured to prioritize immediate housing needs over long-term safety, may approve development in hazardous areas. Our analysis suggests a link between the strength of land use policies and the level of risk to current and future housing. Provinces with stronger land use policies, such as Ontario and Saskatchewan, have relatively lower risks to their housing stock, providing a model for others to follow.

Conclusion 3

Steering development away from high-hazard areas can dramatically reduce losses without limiting housing growth

Our analysis finds that a small number of homes concentrated in the highest-risk zones are responsible for the majority of potential future losses. Redirecting just 3 per cent of the homes targeted for construction by 2030—about 150,000 units—away from high-flood hazard areas and towards safer ground could reduce Canada's flood risk to new housing by nearly 80 per cent. In most communities, targeted policies can effectively reduce risk without limiting housing growth.

Conclusion 4

Other policy gaps also drive unsafe housing development when land use policies are permissive

Federal and provincial programs that aim to increase housing supply often overlook climate-related hazards, encouraging development in risky areas. Infrastructure funding programs that fail to consider the location of new developments also play a role in enabling housing construction in hazard zones. Disaster assistance programs further contribute to the problem by creating a moral hazard, allowing municipalities and homeowners to rely on post-disaster recovery rather than proactive risk avoidance.

Conclusion 5

A lack of information about climate risk hampers smarter housing decisions

Outdated and incomplete flood and wildfire hazard maps often leave developers, municipalities, and homeowners with insufficient information about climate risks. Further, without mandatory hazard disclosure in real estate transactions, buyers and renters are often unaware of the risks they may be taking on. As a result, many people continue to unwittingly build, buy, and rent in dangerous areas, increasing risk and future costs.

Recommendations

Recommendation 1

Federal, provincial, and territorial governments should steer housing and infrastructure investment to low-hazard areas and away from high-hazard zones

The federal government should expand its screening measures for housing programs—notably the Housing Accelerator Fund—and infrastructure funding programs so that these programs support housing development in low-hazard areas. Provincial and territorial governments should take similar measures by screening funding applications to ensure that public funds are used for new construction away from the most flood- and wildfire-prone areas. Governments should also provide municipalities with interim hazard screening maps and fund project-specific analyses to ensure development occurs in safer locations.

Recommendation 2

Provincial and territorial governments should strengthen land use policies to direct new housing away from high-hazard zones

Provincial and territorial governments should urgently enact or enhance land use regulations that explicitly direct development away from the most flood- and wildfire-prone areas. These regulations should include nationally consistent standards for high-hazard flood zones that prohibit development except in exceptional cases. For moderate-risk zones, regulations should only allow development with structural flood protection built to a consistent standard. Provincial and territorial governments should limit development in high-flood hazard zones reliant on structural protections, which may not be reliable with the increasing risks posed by climate change.

In provinces and territories with significant wildfire risks, provincial and territorial governments should strengthen land use regulations to require risk-mitigation measures such as FireSmart practices or community-level risk mitigation, and empower municipalities to require additional protections.

Recommendation 3

Federal, provincial, and territorial governments should reform disaster assistance programs to deter risky development

Federal, provincial, and territorial disaster assistance programs should be redesigned to discourage new construction in hazard zones. New homes built in designated high-hazard zones should be ineligible for publicly funded disaster compensation, signalling to homeowners and developers that these areas are unsuitable for safe housing. The forthcoming federal public flood insurance program should limit coverage to homes built before the program's implementation and introduce risk-based premiums over time to create incentives to live, buy, and rent housing in safe locations.

Recommendation 4

Federal, provincial, and territorial governments should urgently update hazard information and mandate its disclosure in real estate transactions

Federal, provincial, and territorial governments should accelerate the development of accurate, up-to-date—and regularly updated—flood and wildfire hazard maps, and ensure this information is freely accessible. In the interim, they should leverage data from private firms to guide housing decisions. Real estate regulators should mandate disclosure of flood and wildfire risks in sales and rental transactions, giving homebuyers and renters critical information to inform their choices. Insurance regulators should also require insurers to provide property-specific risk assessments to prospective buyers, ensuring transparency about potential risks.

Recommendation 5

The federal government should empower and support Indigenous communities to build climate-resilient homes in safe areas

The federal government should increase funding and co-develop tools in partnership with Indigenous communities to support the construction of climate-resilient homes in low-risk areas. Given the unique challenges faced by Indigenous communities—particularly on-reserve First Nations, where there are acute housing needs and limited access to safe land—the federal government should proactively support Indigenous governments and communities in land use planning that integrates traditional knowledge of climate hazards, and in building housing that can withstand future climate impacts. The federal government should also provide new funding and resources for flood and wildfire risk mitigation in Indigenous communities.

Without policy change, accelerating housing construction will cause many more risky homes to be built, making housing less safe and increasing costs for all Canadians. By strengthening land use policies and aligning housing, infrastructure, and disaster assistance policies to steer new homes away from the most hazardous areas, governments can achieve ambitious housing targets while protecting communities from the human and financial costs of flooding and wildfires.

Introduction

The most affordable home is the one you don't have to keep rebuilding

Across Canada, the race is on to build millions of homes as quickly as possible to make housing more affordable to more people. With climate change putting more and more Canadian homes and communities in harm's way, building these new homes in places where they are sheltered from extreme weather and climate-driven threats is critically important.

To meet affordability targets, the Canada Mortgage and Housing Corporation (CMHC) estimates that 5.8 million homes need to be built by 2030—a 35 per cent increase in housing stock (CMHC 2023). All orders of government are accelerating housing construction through funding programs, regulatory reforms, and incentives for municipalities to meet aggressive housing targets.

If making housing more affordable is the goal, however, location matters. Building new homes in locations vulnerable to worsening climate impacts will undermine affordability by placing new housing in harm's way, driving up costs for households and governments as climate-induced damage and destruction escalate. The Canadian Climate Institute has found that climate-related damages already cost the Canadian economy billions of dollars each year, with growing impacts on household affordability (Ness et al. 2021; Sawyer et al. 2022). Adding more homes in high-risk areas will only increase long-term costs, further pushing affordability goals out of reach.

This report examines the risks that climate-related hazards, specifically floods and wildfires, pose to existing and future housing in Canada, and explores how policies from each order of government can limit those risks. Our analysis shows that, without changes to current policies, new housing in high-hazard areas will increase future losses and lead to higher costs, pushing the goal of safe and affordable housing further out of reach. We conclude that strengthening land use policies can help avoid hazardous development and reduce future housing risks. Closing gaps in related policies—such as housing, infrastructure, disaster assistance, and hazard-mapping programs—will be critical to ensuring land use policies are effective.

Flooding and wildfire are the biggest climate risks to homes in Canada—and these risks are getting worse

The threat posed by climate hazards, particularly floods and wildfires, to Canada's existing housing stock underscores the need for caution when deciding where new homes are built. Currently, 1.5 million Canadian homes—10 per cent of all housing—are at high risk of flooding and lack flood insurance (IBC 2024b). Despite most of these homes being ineligible for flood coverage, private insurance payouts for flood events have still averaged almost $800 million per year over the last 10 years (IBC 2024c).

Similarly, an estimated 60 per cent of Canadian communities are at least partially situated in the wildland-urban interface, where wildfires can readily spread into residential areas (Johnston and Flannigan 2018). Wildfire damage is a growing national concern, with billions in losses over the past decade, including $880 million in insured losses alone from the 2024 Jasper fire and a record $3.6 billion in insured losses from the 2016 Fort McMurray wildfire (IBC 2024d; Statistics Canada 2017). Wildfires are also becoming a threat in areas that were previously less affected, such as Atlantic Canada, where the 2023 Tantallon wildfire in Nova Scotia caused more than $165 million in insured damage and displaced thousands of residents (IBC 2023).

As climate change drives more frequent and destructive floods and wildfires, risks to homes and communities will only continue to grow. Flood risks are escalating across the country, driven by a warming atmosphere that holds more moisture, leading to more rainfall and intense storms (Westra et al. 2014; Sandink 2015). Parts of southern British Columbia, Ontario, Quebec, and the Atlantic provinces are already seeing two to three additional days of heavy rainfall per year (Vincent et al. 2018; Zhang et al. 2019), and by the end of the century, an extreme rainfall event that currently occurs every 20 years could be happening every five years (Zhang et al. 2019).

Meanwhile, the severity and frequency of wildfires are also increasing due to warmer temperatures, drier conditions, and more erratic rainfall (Bush and Lemmen 2019). These worsening conditions, exacerbated by climate change, are making fires more destructive and harder to contain (Natural Resources Canada 2024a). Wildfire seasons are growing longer and harder to control, with "zombie fires" now smoldering through winter (Shingler 2024). In 2023, wildfire activity surged, burning nearly seven times the historical average and more than double the previous record (Jain et al. 2024; Canadian Interagency Forest Fire Centre 2024).

Continuing to build in harm's way is increasing Canada's housing risks

Despite the growing awareness of these threats, housing construction continues in high-hazard areas across the country, amplifying the threat of future damage, destruction, and loss of life. As Figure 1 illustrates, between 1985 and 2015, the total urban area at high risk of flooding increased by about 300 square kilometres—equivalent to roughly half the size of Toronto (Rentschler et al. 2023). Of this, 110 square kilometres are at very high risk, meaning most residents in these areas face substantial threats to life and property, along with severe and prolonged disruptions following floods. Moreover, the pace of new development in flood zones shows no signs of slowing. Between 2010 and 2015 alone, urban settlements in high and very high flood-risk areas expanded by 63 square kilometres across the country—an area more than half the size of Vancouver, added within just five years.

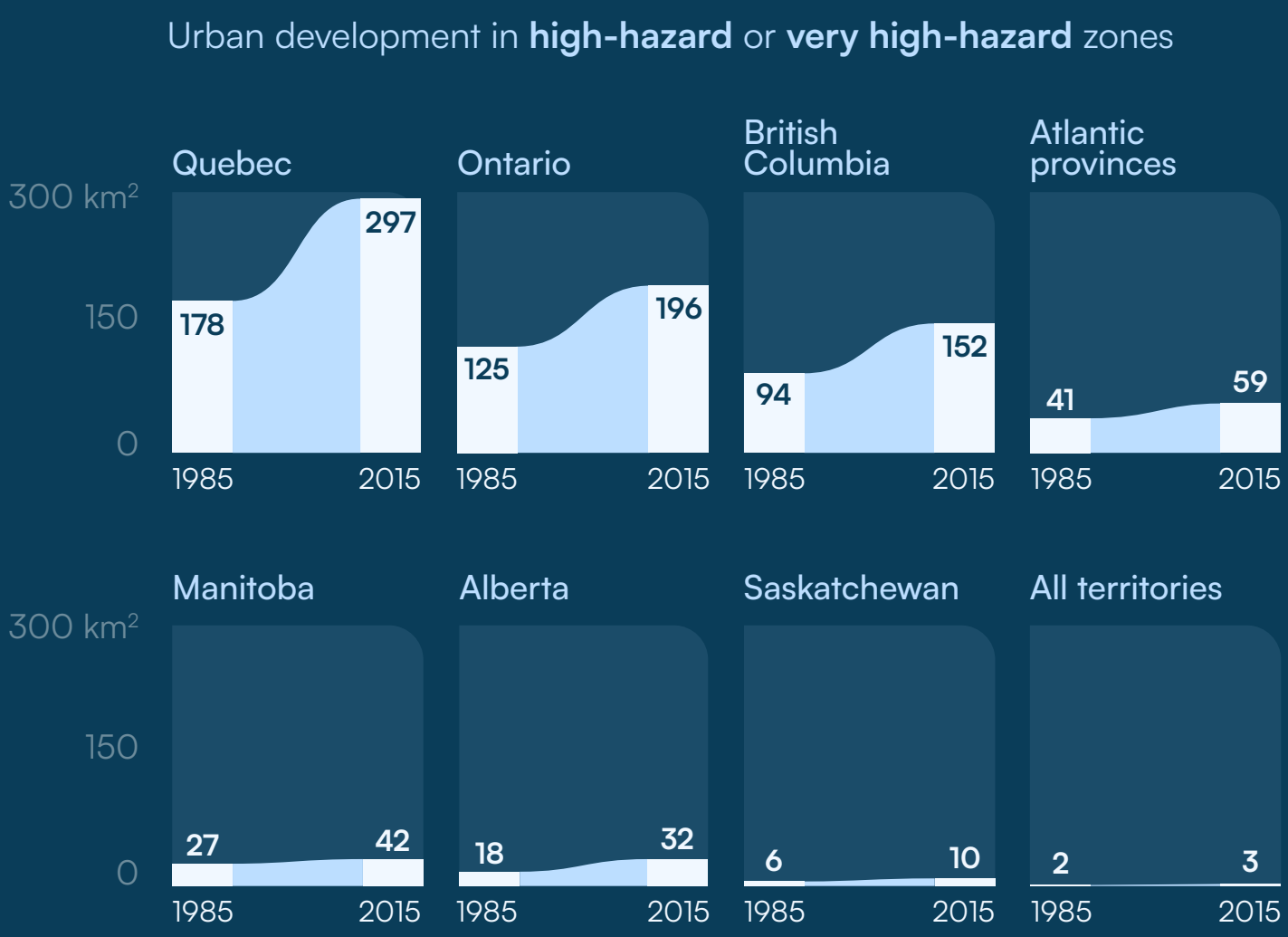
Development in wildfire hazard areas has also continued unabated. Research by the Canadian Forest Service shows that around 110,000 homes—including both houses and multi-unit dwellings—are now located in areas of high wildfire fire risk, with 10,000 in areas of very high risk. These buildings house approximately 280,000 and 30,000 people, respectively (Erni et al. 2024).

With millions of new homes planned in the coming years, Canada risks compounding an already serious problem by allowing further development in hazardous areas. Once housing is built in high-flood or -wildfire hazard areas, the risk is locked in for decades or centuries, as relocating homes and associated infrastructure is both exceedingly costly and politically fraught.

Figure 1

FLOOD

Across Canada, more homes are being built in flood-prone areas



High-risk development costs both individuals and society

Canadians living in high-risk housing face frequent extreme events and disasters, leading to significant financial stress. Out-of-pocket expenses for repairs—since insurance and disaster assistance programs rarely cover full losses—combined with higher insurance premiums or even loss of coverage, along with employment disruptions and lost earnings, all add to this burden. In addition to financial losses, those exposed to disasters also face mental and physical health impacts. People may have to cope with the loss of their home and belongings, widespread disruption and loss in their communities, concerns about the well-being of loved ones and neighbours, and uncertainty about the future. These impacts can be profound and long-lasting (Decent and Feltmate 2018).

Beyond the direct effects on individuals, high-risk development also imposes broader economic and societal costs. Continued building in hazardous areas increases government costs for rescue operations, emergency management, and public disaster relief, straining public resources and potentially leading to higher taxes, cuts to other services, or both. The economic impacts of disasters extend beyond local communities, affecting entire regions and the national economy. Business disruptions, supply chain breakdowns, reduced labour productivity, and lost jobs can ripple across sectors, compounding costs. Disasters can also erode investment confidence, reduce property values, and hinder long-term economic growth. These costs are not just short-term: they can create a drag on economic recovery and resilience as governments and businesses must divert resources from growth and innovation to recovery and rebuilding (Sawyer et al. 2022; Botzen et al. 2019).

The problem won't fix itself—public policy is essential to the solution

In an ideal world, governments, developers, real estate investors, and homebuyers would recognize the significant long-term and societal costs of building and owning high-risk housing, then act to minimize those costs. However, misaligned incentives, moral hazards, market failures, and lack of information prevent this from happening. Developers have little financial incentive to avoid building in high-hazard areas, since they face no long-term liability for disasters post sale. Insurance and disaster assistance programs can

create moral hazards as households and investors assume they'll have financial relief in the case of a disaster, diminishing their incentive to avoid risk. Municipal governments, under political and financial pressures, often prioritize immediate housing needs over long-term safety. Many key stakeholders—including governments, homebuyers, investors, and mortgage lenders—frequently lack adequate information about climate-related hazards to make informed decisions.

Government regulation of housing markets and urban planning has long been recognized as essential to address market failures and align private interests with the public good, including in the context of risks. Public policy plays an essential role in efficient land use, environmental protection, affordability, and equitable access to services and amenities, guiding development decisions in ways that housing markets alone cannot. Governments already play a central role in shaping where homes and infrastructure can be built safely and in the public interest, so ensuring that these efforts serve to minimize exposure to climate-related hazards is a logical and necessary step.

Land use policy is a powerful tool for preventing high-risk development, but this tool often goes unused

Land use policy is widely recognized as one of the most powerful policy tools for reducing risk from climate-fuelled hazards such as flooding and wildfires. It determines where and how development occurs by shaping decisions about zoning, infrastructure, and environmental protection. In the context of flood and wildfire risk, land use policy can play this role by designating areas as too hazardous for development, enforcing restrictions on certain types of buildings in hazardous areas, and building projections of future climate hazards into long-term planning. Effective land use policy prioritizes avoiding exposure to hazards from the start, minimizing future costs of risk mitigation and disaster response for communities and governments (OECD 2017; World Bank 2017; WMO 2016).

However, our analysis reveals significant gaps in land use policies in Canada. Provincial and territorial governments hold primary responsibility for land use decisions, but few directly regulate development in hazard zones. Those that do often set inadequate risk limits or rely on costly and limited protective infrastructure rather than preventing development in hazardous areas outright. Most provincial and territorial governments delegate final decisions about development in flood and wildfire hazard zones to municipal governments, which often lack the capacity and political leverage to prioritize long-term

risk prevention over immediate housing needs and local economic pressures. Persistent market failures and misaligned incentives, insufficient climate hazard information, and other policy shortcomings, including housing, infrastructure and disaster assistance policies that enable high-risk development, further exacerbate the problem. These gaps create an environment in Canada that allows risky housing to continue being built, leading to long-term costs that will far outweigh the benefits of that housing.

In order to address the threat posed by continued development in high-hazard areas, the remainder of this report delves deeper into the consequences of continuing Canada's current housing trajectory, explores the state of policy across the country influencing where housing is built, and identifies policy changes that could minimize the spread of flood and wildfire housing risk.

Section 2 describes our approach to quantifying the current and future risks of status quo housing development and assessing the limitations of land use and housing policy frameworks across Canada.

Section 3 describes the results of our spatial analysis, quantifying flood and wildfire risks to Canada's current and future housing stock, factoring in the worsening impacts of climate change.

Section 4 details gaps in the current policy environment for managing these risks, including how issues with current land use planning regimes allow misaligned incentives and how limitations in other policies continue to drive high-risk development.

Section 5 highlights practices from Canada and around the world that can be used to strengthen land use practices and other policies to address these gaps.

Section 6 summarizes key findings and recommends policy changes to minimize future exposure to floods and wildfires.

Approach

How big is the risk of unsafe housing, and what's causing it?

This section presents our methodology for assessing the exposure of Canada's housing stock to flood and wildfire risk as development continues and climate change worsens, and for identifying the policy drivers that are leading to more homes being built in harm's way.

This investigation has two main elements. First, through quantitative spatial analysis, we assess the current and future risks posed by floods and wildfires as new homes are constructed and as climate change intensifies. Second, our policy analysis examines the policies, policy gaps, and policy interactions that are leading to more homes being built in areas facing elevated and rising risk of flood or fire. This dual analysis of physical risk and the policies driving that risk underscores the threat that a business-as-usual approach to home construction represents, and points the way to policy solutions to ensure millions of new homes can be built across Canada without placing them in harm's way.

2.1 Spatial analysis
The risks of ongoing housing development in flood and wildfire hazard zones

To understand the threat to new and future housing in Canada, we began by modelling flood and wildfire damage to Canada's existing housing stock. Next, we estimated where future housing will be built over the next decade, using projections from the Canada Mortgage and Housing Corporation (CMHC) and an analysis of official community plans from hundreds of municipalities across the country. By applying our risk modelling for existing housing to this potential future housing stock, we gained a dynamic understanding of the flood and fire risks facing housing in Canada and the critical role that directing new development away from high-hazard zones can play in minimizing these risks.

Our approach includes **two main steps**:

1. **Understanding the baseline risk of floods and fires to existing homes:** Our analysis began by modelling flood and wildfire risk to Canada's existing housing stock. We modelled flood risk using hydrodynamic models from Fathom Global, and wildfire risk using models developed by the Co-operators (a Canadian financial services co-operative).
2. **Projecting flood and wildfire risk to future housing:** Next, we extended the analysis to future housing by projecting where the 5.8 million new homes CMHC estimates will need to built by 2030 are likely to be located under current planning practices. We then extrapolated our flood and wildfire damage models to estimate the risks facing this future housing stock, translating the Fathom and Co-operators modelling results for existing housing to projected future housing locations.

This analysis provides us with a comprehensive understanding of the risk landscape that Canada's housing stock faces from floods and wildfires, both now and in the future. By highlighting the intersection of housing development and climate risk, this analysis can help decision makers enable housing growth without putting people or homes in danger and inadvertently driving up the cost of living.

Let's look more closely at each of these steps.

We calculated the flood and wildfire risk to Canada's existing housing stock under changing climate conditions using advanced national-scale models

To estimate flood risk to Canada's future housing stock, we first established a comprehensive picture of coastal and inland flood risk to Canada's existing housing stock. This analysis built upon Public Safety Canada's work, which modelled flood risk to homes in Canada in its analysis for the Task Force on Flood Insurance and Relocation (See Box 3).

We contracted Fathom Global, a risk-intelligence firm that provides large-scale flood hazard mapping and risk modelling to governments, insurers, and financial institutions, to model the flood risk to Canada's existing housing stock. Fathom has developed hydrodynamic flood models that simulate the complex movement of water in oceans, rivers, and streams, as well as overland during flood events.

Fathom's models simulate the depth of coastal and inland flooding across Canada at a grid cell resolution of 30 metres by 30 metres for floods, with return periods of between five and 1,000 years. Their models also include climate change scenarios that allowed us to reflect changes in future flooding by the 2030s from sea level rise and from shifting storm surges and extreme rainfall.

Fathom used its models, Public Safety Canada's residential buildings dataset, and damage functions based on millions of observations of the damage different depths of flooding cause to buildings and their contents to produce estimates of flood damage for each of the approximately 16 million homes in the dataset. To characterize the financial risk posed by flooding, they calculated average annual loss (AAL), which represents the average monetary damage expected for each residential building in a given year (see Box 1). Fathom modelled flood damages under present (2020s) climate conditions for five-, 10-, 20-, 50-, 100-, 200-, 500-, and 1,000-year floods to produce estimates of AAL for each residential building.[1]

1 - See accompanying technical report by Fathom Global for more details.

Box 1

Understanding Average Annual Loss (AAL)

Average Annual Loss (AAL) is a metric originating in actuarial science and used by insurers, risk managers, and governments to quantify expected monetary losses due to hazards such as floods, wildfires, and earthquakes. These hazards are characterized by their unpredictability: they do not occur with regular frequency, and when they do, their impacts can range from minor to catastrophic. AAL provides a way to capture the average financial risk posed by such irregular hazards over a long period by accounting for the full spectrum of possible events—both common, lower-severity occurrences and rare, high-impact ones—providing an overall perspective on long-term risk.

Throughout this document, we primarily use AAL as it is readily generated by the flood and wildfire models employed in our analysis. While AAL gives valuable insight into the average long-term risk, it has limitations in representing the severe impacts of extreme events. For example, the 2013 Calgary flood resulted in $1.8 billion in insured losses and $5 billion in total damages—each substantially higher than typical AAL estimates. Similarly, in wildfire scenarios, years with probable maximum losses can result in damages far exceeding the average, particularly in regions with concentrated wildfire risk. Thus, while AAL offers an essential long-term overview of risk from these variable hazards, the actual financial and social toll in high-impact years can be significantly greater.

While we were able to use the Co-operators' wildfire model to estimate the potential for high-impact wildfire years (often called probable maximum loss, or PML, events), the Fathom flood model lacked the capability to produce comparable high-impact scenario insights. Consequently, we use AAL as our standard measure of financial risk from flooding and wildfires faced by housing in Canada, but it is important to remember that it masks the concentrated impacts of individual extreme events.

To undertake a similar analysis of wildfire risk, we partnered with Co-operators, which used its wildfire propagation and damage models to conduct a groundbreaking assessment of Canada-wide wildfire housing risk. Co-operators is pioneering the assessment of wildfire risk in the Canadian insurance sector and has developed a national risk model using detailed weather, fuel, and geographic data to model the ignition and spread of wildfires across the country. Co-operators' model simulates millions of scenarios of how wildfires might develop in different parts of Canada at a resolution of 200 metres by 200 metres and generates estimates of the probability and severity of wildfire damage to individual buildings.

Co-operators applied its model to the 16 million residential addresses in the Public Safety Canada dataset, producing estimates of expected wildfire damages for each one. To protect the confidentiality of proprietary information in its model, Co-operators aggregated the results as total modelled damages for each municipality across the country before providing them to us.

Box 2

Flood-defence assumptions for a national-scale flood-risk modelling exercise

Fathom's flood models include major flood defences, such as those in British Columbia's Lower Mainland and Manitoba's Red River region. However, they do not explicitly account for smaller dams, dikes, and other defences present in other parts of Canada. Instead, the models assume a general level of flood protection typical of industrialized countries. This often overestimates the actual level of protection in most regions of Canada, where flood protection infrastructure is limited.

To capture the range of possible outcomes, we used versions of Fathom's model with and without flood control infrastructure—referred to as "best-case" and "worst-case" scenarios.

In British Columbia and Manitoba, the best-case scenario assumes that flood protection infrastructure is properly built and maintained, and functioning as intended. The worst-case scenario reflects the potential consequences of infrastructure failure, such as the dike failure during the 2021 B.C. floods (Parfitt 2023), highlighting the significant reliance of these regions on protective infrastructure.

For other provinces and territories, where flood infrastructure is less consistent, the reality likely falls between the best-case and worst-case scenarios, but closer to the worst-case due to the general lack of comprehensive protection.

Using federal, provincial, and municipal data, we projected future housing growth and risk to new housing developments to 2030

To estimate how flood and wildfire risk and damage would impact an additional 5.8 million homes, we needed to project where this new housing would be located. Working with Sustainability Solutions Group, a firm specializing in climate change and land use planning, we estimated the allocation of new housing supply in municipalities across Canada under status quo land use policies and plans.

We used data on population trends and projections from Statistics Canada, CMHC's projections of the necessary quantity and distribution of new housing to provinces and territories, and provincial housing strategies and targets to estimate how these new homes would be distributed to cities and towns across the country. Through this process, we projected that 60 per cent of new housing units will be built in Ontario and British Columbia, and that these homes will be concentrated in high-demand regions such as the Greater Toronto Area, Metro Vancouver, and nearby small and medium-sized cities. The remaining 40 per cent of new housing is distributed across other provinces and municipalities with allocation patterns reflecting regional growth projections.

Sustainability Solutions Group then leveraged its extensive experience modelling future development in Canadian municipalities, drawing on community plans, input from municipal officials, and detailed information on land use, zoning, infrastructure, and protected areas to estimate the location of different types of new residential buildings in each city and town using an advanced GIS model. We estimated the potential flood damage to these new homes by translating the results from Fathom's flood modelling to their projected locations. Sustainability Solutions Group translated Fathom's flood damage estimates to these new locations with detailed, GIS-based regression analyses that match Fathom's results for existing homes to locations of future homes with similar characteristics.[2]

To reflect the effects of a continually changing climate, Fathom also modelled flooding damage to the existing housing stock in a projected 2030s climate. This allowed us to assess the risk and damage Canada's combined future housing stock will face once the 5.8 million new homes are built, providing insight into how climate change will affect housing exposure as flood-driving weather patterns shift. We also examined how flood risk is distributed in this projected new housing stock. In their analysis for the Task Force on Flood Insurance and Relocation, Public Safety Canada determined that most of the financial flood risk

2 - We used this interpolation technique instead of having Fathom model the tens of millions of permutations of future residential building types and potential locations we considered, which would have far exceeded the resources available for this project. See accompanying technical report by Sustainability Solutions Group for more details.

to Canada's existing housing stock is concentrated in a small number of homes, with 34 per cent of average annual loss associated with the riskiest 1 per cent of homes and 89 per cent with the riskiest 10 per cent. To assess whether this concentration of risk would continue in the projected new stock, we examined the financial risk associated with the highest risk areas projected for development in each province, based on our average annual loss estimates.

Using methods like those for flooding, we translated wildfire risk and damage estimates for existing homes to future homes. To extrapolate the Co-operators municipal-scale modelling results to our future housing projections, we obtained just-released Canadian Forest Service wildfire hazard mapping (Erni et al. 2024), which estimates the frequency and intensity of wildfire hazard on a 250 square metre grid across the country. Using this mapping, Sustainability Solutions Group established which parts of each fire-prone municipality are exposed to wildfire and scaled Co-operators' modelled damages based on the proportion of new to existing exposed homes.

Unlike our flood risk modelling, the results of our analysis of wildfire risk to projected new housing stock do not account for worsening climate impacts. Climate change is expected to significantly increase the prevalence and intensity of wildfires across Canada (Wotton et al. 2017; Zhang et al. 2019; Wang et al. 2020), as well as the frequency at which developed areas and housing are exposed to fire (Erni et al. 2021). However, in Canada, high-resolution wildfire damage modelling, including the Co-operators' model, does not yet incorporate climate change scenarios, as the necessary science is still in development (Coogan et al. 2020). Therefore, future damages to Canada's growing housing stock are almost certain to be significantly higher than our estimates, which are based on current climate conditions.

Box 3

The federal housing flood risk modelling that made this analysis possible

In 2021, Public Safety Canada conducted the first comprehensive flood risk analysis of residential buildings across Canada, which significantly advanced understanding of flood risk distribution. The analysis informed the national Task Force on Flood Insurance and Relocation's recommendations to the federal government for public flood insurance and proactive relocation programs (Canada's Task Force on Flood Insurance and Relocation 2022).

To conduct the assessment, PSC used third-party flood models commonly applied in the insurance industry, paired with building-level data from sources like Lightbox and Opta Information Intelligence (Lightbox 2024; Opta Information Intelligence 2024). This dataset includes address data and building characteristics such as construction features and replacement costs for nearly 16 million residential buildings, validated through extensive quality control.

The analysis estimated that total residential flood risk in Canada is $2.9 billion per year, with 89 per cent of average annual losses concentrated in the top 10 per cent of highest-risk homes and 34 per cent in the top 1 per cent. These findings led the Task Force to recommend that public flood insurance for the highest-risk households would require sustained public funding along with managed relocation for the highest-risk properties.

The Canadian Climate Institute is the first organization outside of the federal government to use the PSC residential buildings dataset for analysis of flood and wildfire risk. We extend our thanks to Public Safety Canada, Opta Information Intelligence, and Lightbox for facilitating access to the data.

2.2 Policy analysis
The drivers of development in hazard zones

To better understand how government policies shape decisions about housing development in flood and wildfire hazard zones, we conducted a comprehensive review of federal, provincial, and territorial government policies. This review went beyond land use policies to assess the broader policy environment that influences decisions about where homes are built, including housing, infrastructure, disaster financial assistance, and hazard mapping policies. Our goal was to assess how policies either account for, or overlook, flood and wildfire risks to new housing. By examining the interaction of these policies and their influence on local land use decisions, we sought to identify the drivers of housing exposure to flood and wildfire risks in Canada.

In addition to the policy review, we engaged directly with officials from various orders of government—federal, provincial, territorial, and municipal—as well as experts and stakeholders in land use planning, housing, real estate development, and climate adaptation. Between December 2023 and September 2024, we reached out to every provincial and territorial government to seek their input and succeeded in speaking with representatives from all except the Northwest Territories, who were unavailable at the time. At the municipal level, we focused our outreach on governments that have either experienced significant flood and wildfire impacts in recent years or are particularly vulnerable to these hazards. Our goal was to gather insights from across Canada, ensuring representation from diverse regions and contexts.

These discussions provided valuable, on-the-ground perspectives on how existing policies function in practice. They highlighted both the strengths and weaknesses of current approaches, revealing how policy gaps and inconsistencies can lead to unintended consequences, such as continued development in flood and wildfire hazard zones. This comprehensive approach allowed us to better understand the complex landscape of policies influencing where homes are built and the role these policies play in exacerbating or mitigating housing exposure to flood and wildfire hazards.

We identified limitations in Canadian land use policies that incentivize development in hazard zones

Provincial and territorial policies play a critical role in shaping land use decisions across Canada, as these higher-order government policies fundamentally influence the authority and capacity of municipal governments to plan and regulate housing development in flood and wildfire hazard zones. Understanding how these policies assess and respond to flood and wildfire risk is essential for evaluating the effectiveness of local government actions to mitigate such risks. While municipal governments are responsible for establishing community plans and bylaws that dictate what can be built and where, their decisions are fundamentally shaped by the frameworks set by provincial and territorial policies. For this reason, our assessment concentrated on these higher-order policies as they are crucial in determining the ability of local governments to channel further development away from flood and wildfire hazard zones.

To this end, we conducted a comprehensive review of provincial and territorial legislation, regulations, and policies governing land use planning and municipal authority. Our analysis focused on the regulatory flood and wildfire standards employed in land use planning, including risk-tolerance thresholds, and how these policies are applied within various jurisdictions. We also examined the processes established by provincial and territorial governments for municipal governments to follow, such as approval requirements and enforcement mechanisms.

Our review aimed to examine specific limitations in Canadian land use policies that may inadvertently encourage development in flood and wildfire hazard zones. We analyzed the rigour and scope of existing policies and regulations, focusing on flood and wildfire risk thresholds set by provinces and territories. Additionally, we assessed the level of reliance in provincial and territorial policies on structural protection measures like dikes and levees to address risk, which can potentially lead to more development in flood hazard zones.

We also investigated how responsibilities are distributed between provincial/territorial and municipal governments, particularly the capacity of local governments to enforce land use standards and the level of oversight provided by senior orders of government. Our goal was to understand where these policies may fall short in some parts of the country and how these gaps might allow greenlighting of housing developments in flood and wildfire hazard zones.

We uncovered other policy misalignments that drive housing development in hazard zones

Our review of federal, provincial, and territorial government policies and programs also considered ways in which policies and programs seek to accelerate the construction of housing and related infrastructure. We specifically analyzed whether these policies and programs account for flood and wildfire risks and how they influence local decisions to allow building in hazard zones. This included evaluating the eligibility criteria and whether mechanisms exist to screen out projects proposed for flood and wildfire hazard zones.

In addition, we assessed provincial and territorial disaster assistance policies and programs, aiming to understand the measures that are in place to discourage development in high-hazard areas. We identified the eligibility criteria and conditions that these programs set to inform and deter investment in housing development.

We identified promising policy levers for minimizing future development in hazardous areas

In our review of Canadian policies, we flagged policies from provinces and territories that appeared to effectively guide new housing development away from flood and wildfire hazard zones and towards safer areas. We also researched international approaches from Europe, the United States, and Australia that aim to minimize housing development in flood- and wildfire-prone areas. Our goal was to identify promising policies and practices that could be translated and scaled up for use across Canada to address the policy gaps we had identified. These include land use policies that create consistent standards for avoiding flood and wildfire risks, housing and infrastructure programs that are sensitive to climate hazards, disaster assistance and insurance programs that minimize moral hazard, and comprehensive flood and wildfire hazard information and mapping initiatives that support informed local land use decisions.

These good practices are discussed in Section 5, where we explore their potential to be adapted and scaled within the Canadian context to minimize future housing development in hazardous areas.

We commissioned a dedicated report to investigate unique barriers faced by Indigenous communities

Indigenous communities across Canada face unique and significant challenges in planning for and building climate-resilient housing. To better understand these challenges, we commissioned Shared Value Solutions, an environmental consulting firm with expertise in Indigenous land use planning and risk assessment, to explore the experiences and obstacles these communities encounter in building safe and sustainable housing. Shared Value Solutions conducted a comprehensive literature review and gathered insights through surveys and interviews with Indigenous governments, federal representatives, and Indigenous organizations. Its research focused particularly on policy challenges and opportunities for enhancing resilience on First Nations reserves. The detailed findings and specific recommendations are presented in Shared Value Solutions' report, Indigenous Housing and Climate Resilience, with notable themes highlighted in Box 11.

2.3 Limitations and assumptions

Our analysis uses the best available data and tools to assess the flood and wildfire risks facing Canada's housing stock. While these findings provide valuable insights into the risks of continuing to build homes in hazard-prone areas, any modelling exercise entails assumptions and limitations that must be acknowledged. These considerations are crucial for accurately interpreting our results.

Recognizing these assumptions and limitations can also guide future, more localized, and context-specific analyses. To better inform land use decisions and risk planning at local and regional levels, the type of analysis presented here will require further refinement to achieve a higher level of detail. Governments and planners will also need additional data and resources to conduct more granular studies, with the precision necessary for safe, informed land use planning at the community level.

Flood modelling

- Flood models like Fathom's, which necessarily operate at a relatively coarse spatial resolution, face inherent limitations in representing the complex hydrological and geographical variations across Canada's vast and diverse landscape. The simplifications necessary for large-scale modelling mean that flood risk may be over- or under-estimated in certain areas. Consequently, our results should be interpreted as best estimates rather than precise risk determinations.
- Public Safety Canada's dataset also lacks specific building characteristics like first-floor elevation and foundation type, which are crucial for accurately determining vulnerability to flooding. Fathom Global assumed a standard ground floor height of 0.2 metres, which could lead to either overestimation or underestimation of damage, depending on actual local variations in building design.
- There are other uncertainties in the Public Safety Canada buildings dataset that can affect flood risk estimates. Rural and northern regions' data are often incomplete or of lower quality, and the dataset may not fully account for recent housing developments, leading to underrepresentation of newer financial risks. A significant number of buildings have unknown uses, meaning that they may be residential but are not modelled as such, leading to further underestimates of financial risk.
- Available damage functions used in the analysis apply primarily to low-rise residential buildings. For multi-story apartment buildings (approximately 128,000 of which are in flood hazard zones across Canada, according to our analysis), the analysis only considers damage to contents on lower floors, excluding potential structural damage, which results in an underestimation of total damage costs.
- Fathom inland flood models include simulations of pluvial flooding (see Box 4) caused by overwhelmed storm drain systems. However, due to the lack of detailed data on stormwater infrastructure across Canada, Fathom relies on generalized assumptions about municipal storm drain capacities. These assumptions introduce uncertainties that are likely to balance out at provincial and national levels, but localized estimates of pluvial flood risk may be less reliable.

- Fathom's models incorporate flooding from small rivers and streams into its pluvial flood modelling, which is separate from its more complex modelling of riverine flooding in larger watercourses. Consequently, the pluvial model output captures both surface ponding caused by overwhelmed urban drainage systems and flooding from smaller watercourses. Due to this overlap, we do not distinguish between pluvial and riverine flooding in our results, instead reporting them collectively as "inland flooding". Climate change scenarios incorporated in Fathom's modelling use the latest internationally recognized climate models, but these still struggle to accurately project the future of localized and complex extreme events like intense thunderstorms and snowmelt. As a result, future flood risks may be underestimated in regions of Canada where these kinds of events are major drivers of flooding.
- Our analysis of future flood risk does not account for the impact of ongoing urban development on inland flood risk, particularly how the creation of new impervious surfaces in urban areas (rooftops, concrete and asphalt) can significantly increase the frequency and magnitude of downstream flooding.

Wildfire modelling

- The Co-operators wildfire model does not account for future climate impacts, such as increased frequency and intensity of wildfires driven by climate change. As a result, the estimated risks are based on current climate conditions and likely understate the future risks to housing.
- The Co-operators' model cannot fully account for how urban expansion alters the risk to housing previously on the margin of the wildfire-urban interface. Co-operators manually reduces the risk to that existing housing in its model, but this may underestimate risk if the new housing is not built to mitigate fire propagation.
- The model underestimates wildfire risk in the Atlantic provinces, as model development to date has focused on higher-risk areas in other parts of the country.
- The Canadian Forest Service's wildfire hazard maps are based on 2017 conditions, which may overestimate risk in areas where recent wildfires have reduced available fuel, as the data does not reflect more current forest conditions. The Service is developing an updated map with more current data.

Future housing scenarios

- Projections of future housing construction are based on current trends and available data, but they are limited by uncertainties in population growth, housing demand, and the accuracy of municipal planning data. In communities with limited or outdated planning information, assumptions had to be made about where new housing would be located and what kinds of residential buildings would be constructed, introducing potential inaccuracies in future risk estimates.
- The wildfire risk assessment for new housing developments does not consider landscape changes or common fire-mitigation efforts, such as those promoted by the FireSmart program, which are sometimes integrated into new construction practices in the wildland-urban interface. This gap was partially addressed by capping the wildfire risk for new development at the maximum level observed for existing housing in the same area.

Policy assessment

- We analyzed only the legislation and policies that were in force as of June 2024, excluding proposed legislation or draft policies still under development. Given the rapidly changing housing policy landscape, significant new policies may have been introduced after our analysis that are not covered here.
- Since provincial and territorial governments do not systematically collect data on the implementation, adherence to, and enforcement of land use policies, it remains unclear whether development in high-hazard areas continues due to policy design, enforcement, or other factors.

Results

A small share of new homes could result in billions in damages

Our analysis confirms that continuing to build new homes in flood and wildfire hazard zones as climate change worsens will substantially increase the already massive risks to Canada's housing stock. Addressing each of these risks in turn, we find that financial losses from flood damage to Canada's total housing stock could increase by up to 40 per cent through poor housing location choices and that wildfire damage could more than double.

3.1 Quantifying current and future flood risk to Canadian housing

Our analysis finds that homes in Canada face significant risk of flooding and flood damage. Damages vary widely across provinces and regions, and are concentrated in residential buildings in zones of greatest flood hazard. Continued development in these high-flood hazard areas across the country would expose more families to risk of flooding, while significantly raising the total cost of such events. These risks will continue to increase as the concentration of heat-trapping gases in the atmosphere continues to rise.

We find that continued development in flood hazard zones would increase flood damages by hundreds of millions of dollars per year, increasing housing damages by up to 40 per cent in 2030. Our findings also shed light on how those new housing damages will be concentrated in certain regions, cities, and neighbourhoods.

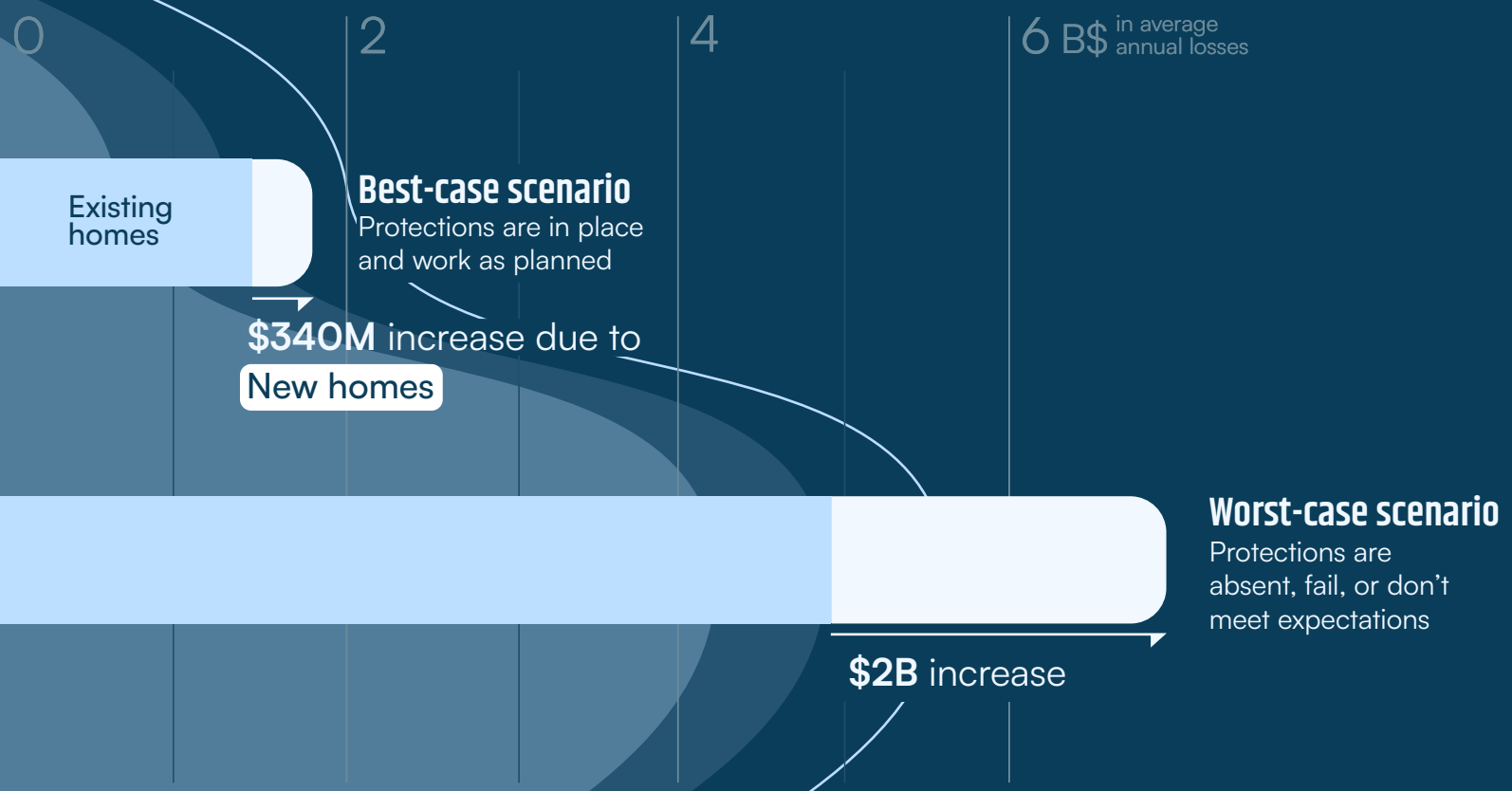
Poor decisions about new housing, combined with additional risk from climate change, could increase total housing flood damages by up to 40 per cent

Continued housing development under existing policies could significantly increase flood risk, placing at least 540,000 new homes in flood hazard zones across Canada, or nearly 10 per cent of the homes CMHC has called for. Our analysis estimates that continuing with status quo development would increase national average annual flood losses by between 22 per cent (best-case scenario) and 40 per cent (worst-case scenario) by 2030—or between $340 million and $2 billion per year (Figure 2).

Figure 2

FLOOD

Under status quo policies, annual residential flood **costs could grow significantly** by 2030



Flood damage increases will follow different patterns across Canada, shaped by growth, hazards, and infrastructure risks

The results of our flood damage modelling show significant regional disparities in projected increases in flood damage to new and existing housing across Canada. While every province and territory will see an increase in flood risk due to ongoing housing construction in hazard zones, the scale of that new risk and the associated financial losses will vary greatly.

As Figure 3 shows, we project the largest increases in total flood damage in Alberta, British Columbia, Ontario, and Quebec, where the most population growth will take place. Figure 4 provides more insights into what is behind these costs, showing how many new homes that we project will be built in each province and territory, and the amount of projected annual flood losses for each new unit built. Yukon, Manitoba, B.C., and Alberta will experience much larger damages per new household than Ontario, Saskatchewan, Nova Scotia, and Newfoundland and Labrador, indicating that new development in these provinces is more likely to be in areas of significant flood hazard.

While most of Canada's existing and potential future flood risk stems from inland flooding, coastal flooding also contributes significantly in British Columbia and the Atlantic provinces, as illustrated in Figure 5. A notable share of projected new flood damage in these regions is linked to homes that could be built in coastal flood-prone areas.

Comparing the best- and worst-case modelling results in Figure 3 and Figure 4 reveals a significant reliance on flood-protection infrastructure in British Columbia and Manitoba. In B.C., for example, the data indicates that roughly 65,000 homes are currently dependent on flood defences, with potential average annual losses of over $1,000 per home if these defences fail. This reliance is projected to grow in our future housing scenario, with flood defences needed to protect an additional 40,000 homes across 825 square kilometers of developed land. Similarly, Manitoba could see over 50 square kilometers of land developed for more than 16,000 new homes, relying on dikes, levees, and the Red River floodway. Any failure of this infrastructure, whether due to inadequate design or maintenance, could result in far more extensive flood damage than anticipated, posing a substantial risk to both current and future housing in these provinces.

Figure 3

FLOOD

Annual residential flood costs grow across every province and territory

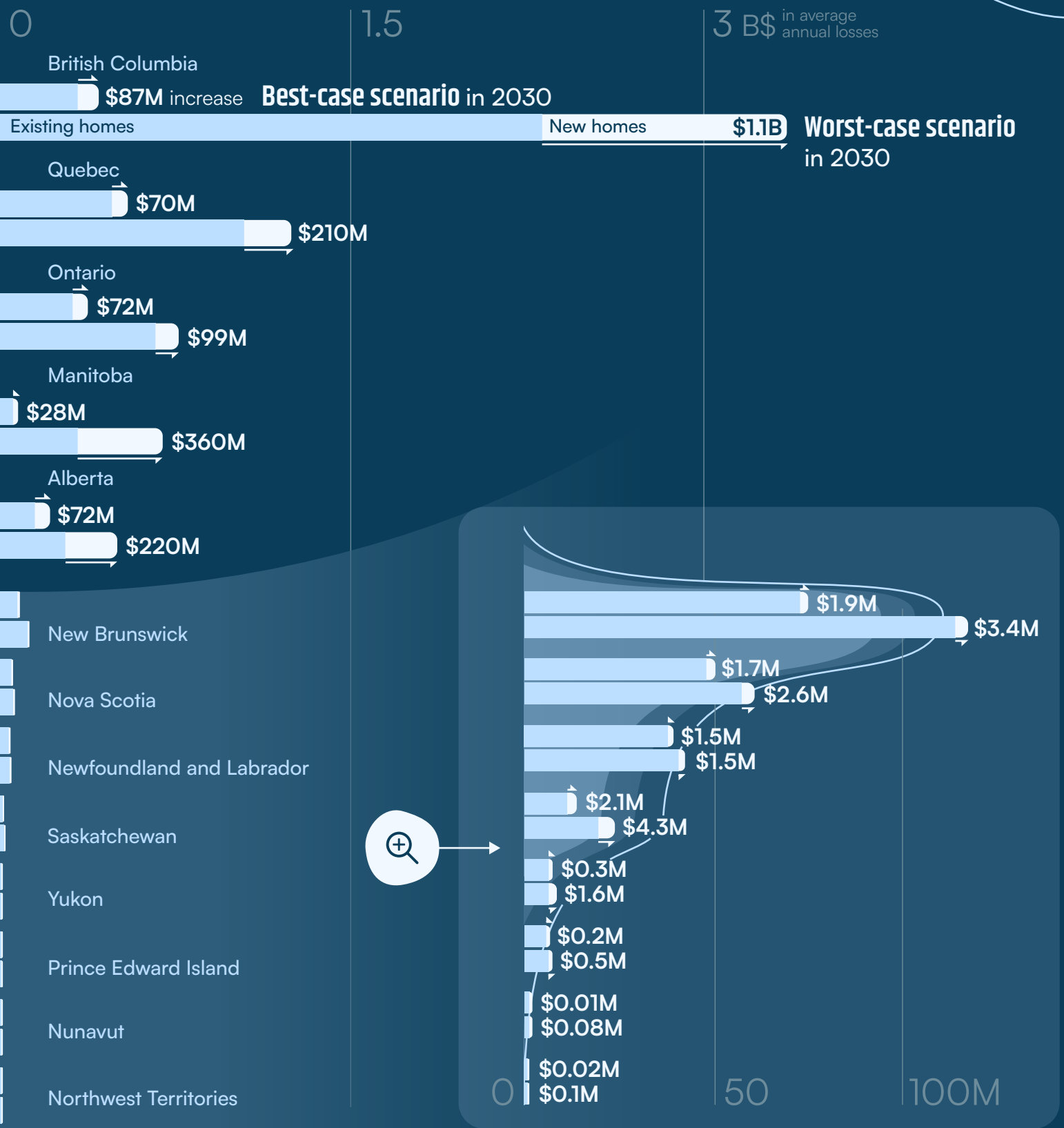
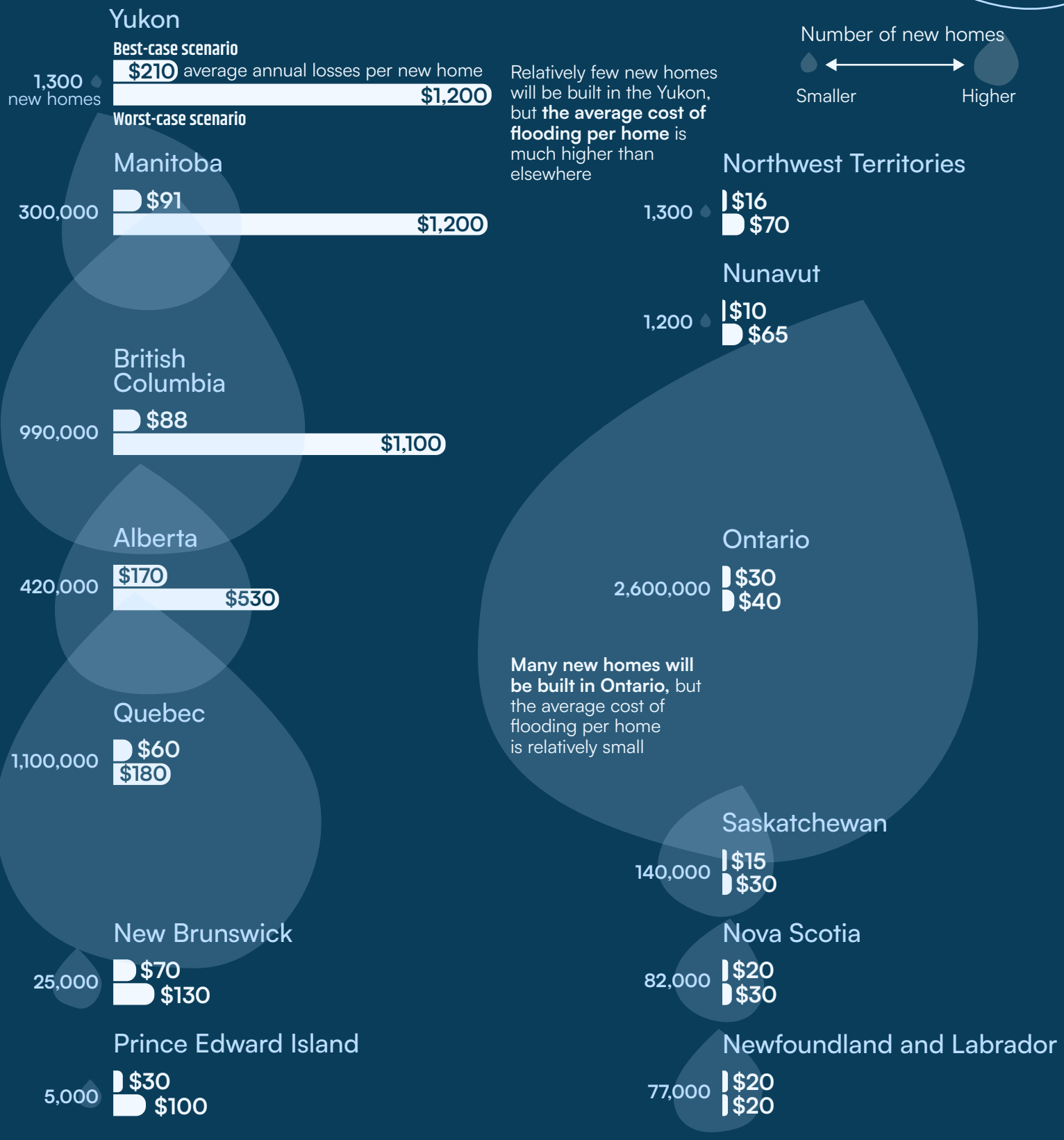


Figure 4

FLOOD

Flood costs to the average new home in 2030 vary significantly across the country



Box 4

The growing challenge of pluvial flooding in Canada

Pluvial flooding, caused by heavy rainfall overwhelming drainage systems and pooling on the surface, has become an increasing concern in Canada. Unlike riverine flooding, which results from overflowing rivers or streams, pluvial flooding occurs when intense rainfall exceeds the capacity of storm drains or cannot be absorbed by saturated or impervious surfaces, such as roads and sidewalks. This makes urban areas particularly vulnerable to its effects.

The impacts of pluvial flooding differ from those of riverine flooding. Pluvial floods typically cause damage to urban infrastructure—such as roads, sewers, and residential basements—much of which is often covered by insurance. In contrast, riverine flooding often leads to widespread, uninsured damage, including to large-scale public infrastructure like roads and bridges, as well as agricultural lands.

Pluvial flooding accounts for a significant portion of flood-related damage in Canada, and is one of the most significant causes of home insurance claims (Sandink 2015; Sandink and Robinson 2022). For instance, in the summer of 2024, torrential downpours in the Toronto area, Montreal, and southern Quebec, led to severe flash flooding. These largely pluvial events saw storm sewers overwhelmed by sudden, intense rainfall, resulting in water inundating streets, basements, and public infrastructure. Insurers estimate that the combined insured losses from these two events alone exceeded $3 billion (IBC 2024c).

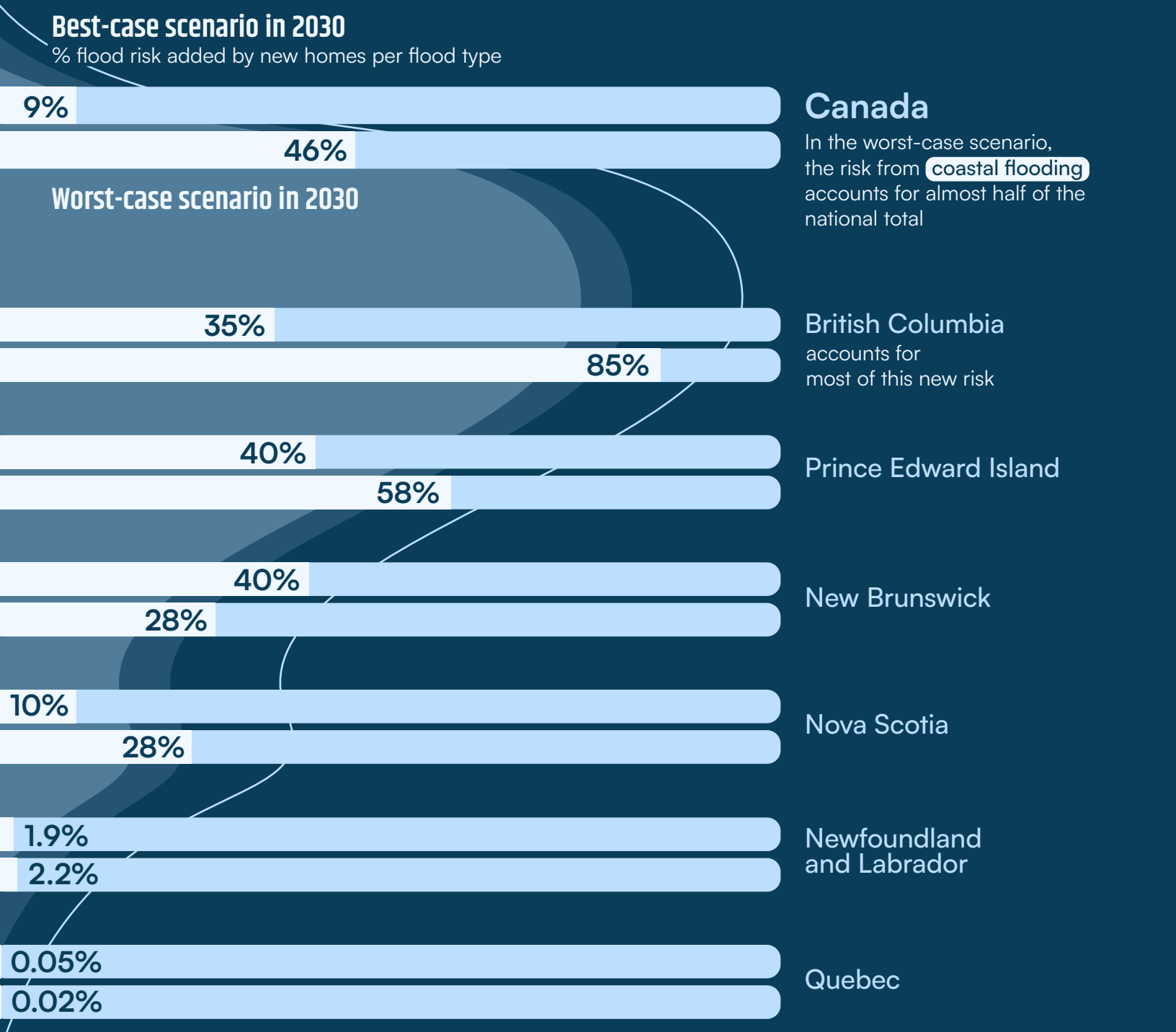
Our flood modelling suggests that the financial risks posed by pluvial flooding already approach or even exceed those from coastal and riverine flooding. As climate change drives more extreme rainfall events, pluvial flooding can be expected to increase across Canada (Burn and Whitfield 2023; Vincent et al. 2018). However, uncertainties remain. Large-scale models, such as the Fathom flood model used in this research, struggle to accurately simulate the local processes that drive pluvial flooding. Additionally, these models can only identify areas where surface ponding may occur and cannot capture the complex underground surcharging of storm sewers that often leads to costly basement flooding.

To better quantify and address pluvial flood risk, detailed local studies are essential. Federal, provincial, territorial, and municipal governments must invest in these studies to improve understanding of pluvial flood risk and to take the necessary actions to mitigate this growing threat.

Figure 5

FLOOD

While inland flooding is a major source of damage nationwide, building new homes in coastal flooding zones is also an acute risk



Building a small proportion of new homes on safer ground can reduce flood risk

Our analysis reveals that, although hundreds of thousands of new homes may be built in flood hazard zones across the country, most of the damage costs will be concentrated in relatively small areas of high hazard where flooding is most likely and most severe.

Public Safety Canada found that residential flood risk in Canada's existing housing stock is also concentrated in a relatively small number of high-risk homes. In its 2022 analysis, Public Safety Canada found that the 1 per cent of residential buildings with the highest risk accounted for 34 per cent of potential flood damage costs to existing housing, while 10 per cent of buildings represented 89 per cent of the total damage (Canada's Task Force on Flood Insurance and Relocation 2022).

Our findings for new housing developments reveal a similar pattern (Figure 6). We project that approximately 10 per cent of new homes will be flood-prone, and that the riskiest 3 per cent of new homes will account for up to 78% of the projected additional flood damage by 2030. This suggests that moving a small proportion of new homes to safer areas could dramatically reduce new flood damages.

Our analysis also shows that these high-hazard homes will be distributed unevenly across the country (Figure 7). For instance, while Ontario will see the most new homes overall, only about 1% would fall into the high-hazard category, representing $70 million in average annual losses in the worst-case scenario. In contrast, British Columbia and Manitoba will see 6% and 12% of new homes in high-hazard areas, respectively, accounting for $1.2 billion in new losses—the majority of the national total.

Examining the data further (see Figure 8), we see that flood damage at the community level will also concentrate in the zones of highest flood hazard. Of the 20 municipalities across Canada we project will experience the greatest losses from flooding of new homes, 18 will experience between 50 and 100 per cent of those losses from homes built in the highest-hazard zones. However, all of these municipalities have ample room to build new homes elsewhere, as the highest-hazard areas only make up between 0.3 and 34 per cent of their total land area.

Figure 6

FLOOD

Building a small proportion of homes on safer ground would **reduce new flood damages** by nearly 80%

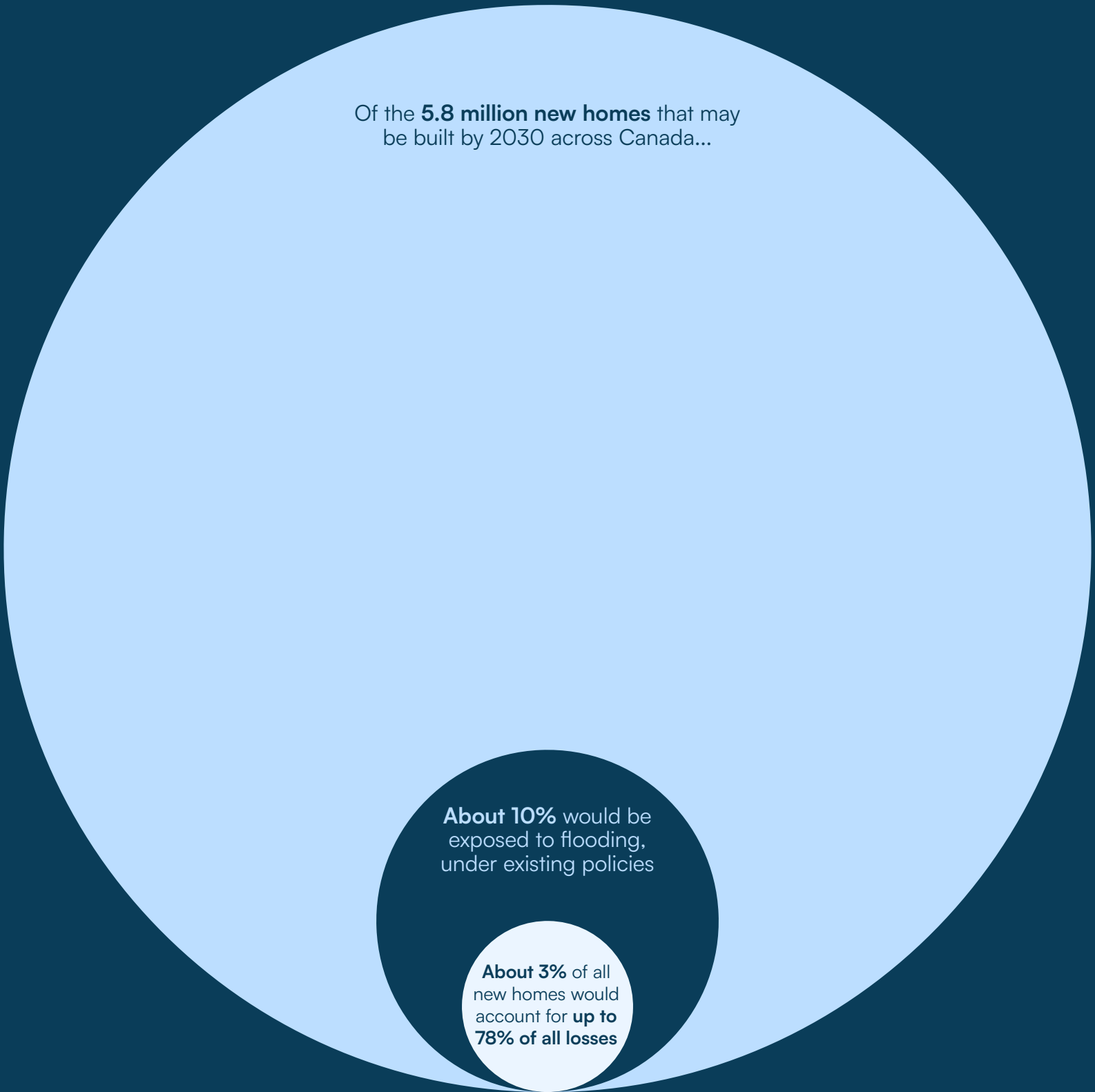
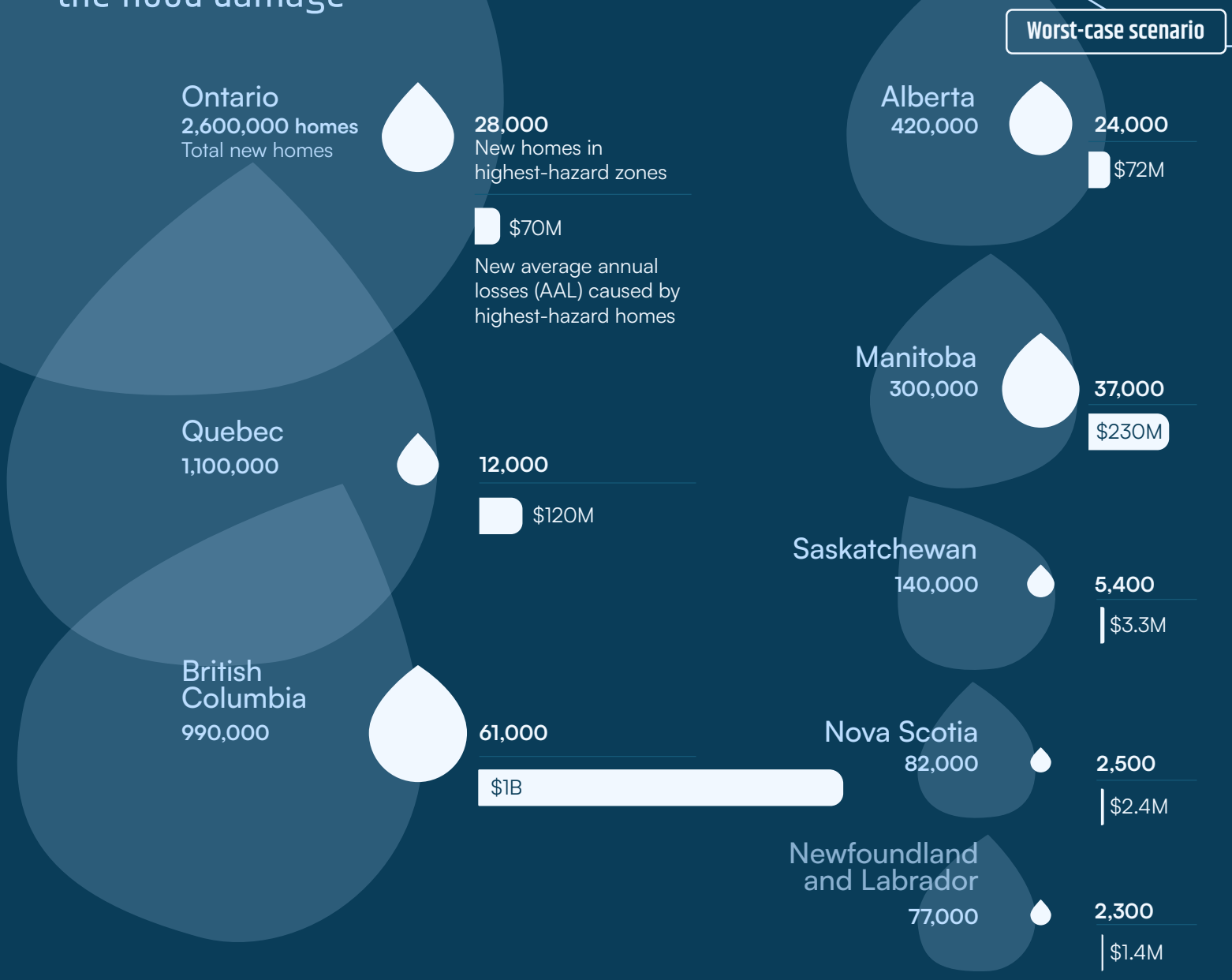


Figure 7

FLOOD

A relatively small share of new homes in the highest-hazard zones will incur most of the flood damage

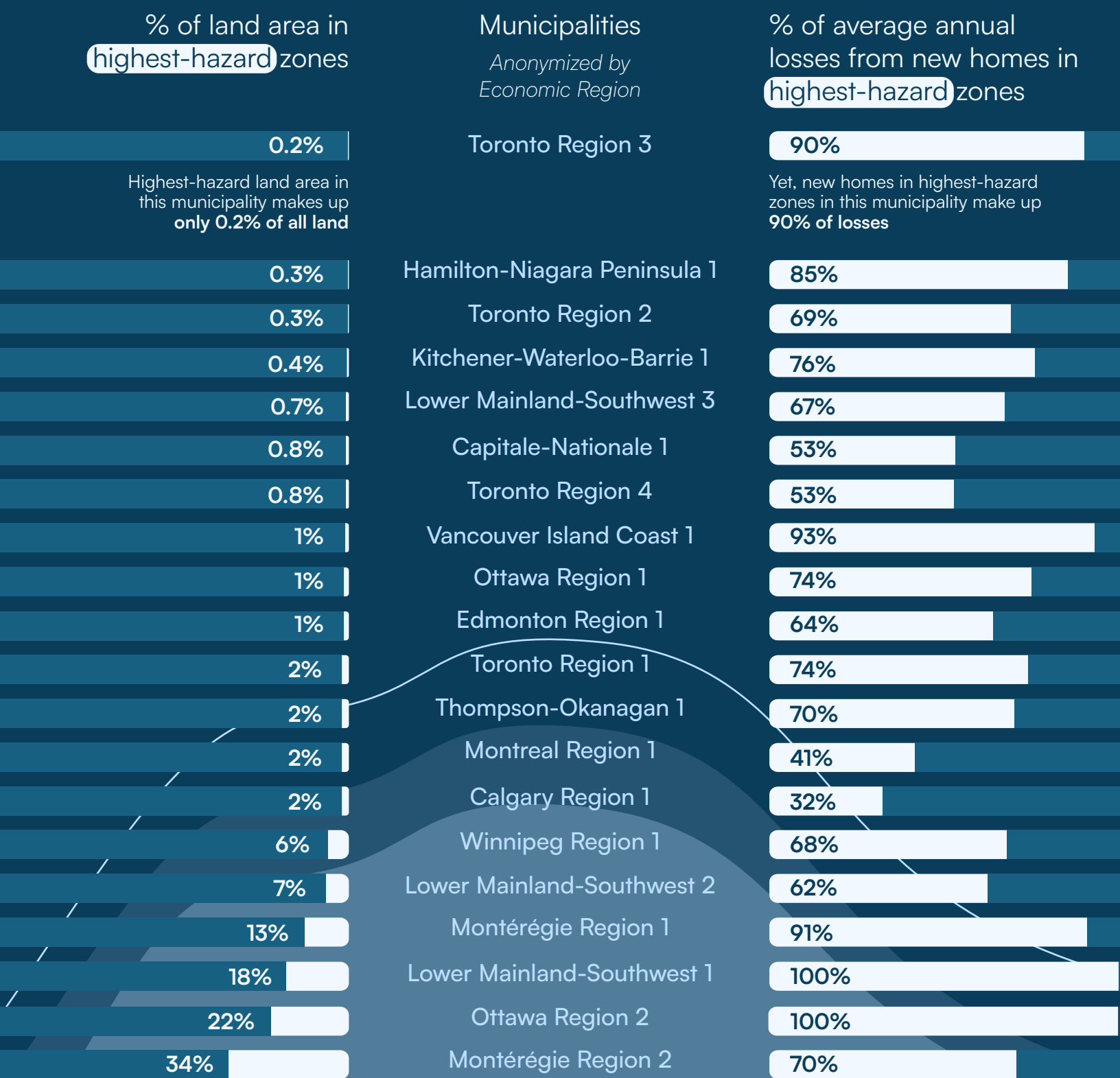


	New Brunswick	Prince Edward Island	Northwest Territories	Yukon	Nunavut
Total new homes	25,000	5,000	1,300	1,300	1,200
New homes in highest-hazard zones	960	160	35	34	31
New AAL caused by highest-hazard homes	$2.3M	$0.4M	$0.07M	$1.2M	$0.06M

Figure 8

FLOOD

Most flood losses in the riskiest communities will come from new homes in the highest-hazard zones—despite room to build elsewhere



3.2 Quantifying current and future wildfire risk to Canadian housing

Our analysis reveals that wildfire risk to housing in Canada is already critical, with potential losses that are nationally impactful and, in some regions, rival or even exceed the risks posed by flooding. Adding new homes in high-hazard zones could dramatically escalate the costs of wildfire damages. In some of the most-affected regions, the increase in wildfire risk could be exponential, significantly impacting people in those communities.

Wildfire is the dominant risk to Western Canada's existing housing, and a major national risk

Using the Co-operators model, our analysis estimates that Canada's existing housing is at risk of annual average losses of $730 million from wildfire (see Figure 9). The majority of these damages occur in British Columbia and Alberta, where settlement in and around wildfire-prone areas is highest. However, when looking at relative risk, the average home in the Yukon and Northwest territories faces substantially higher losses.

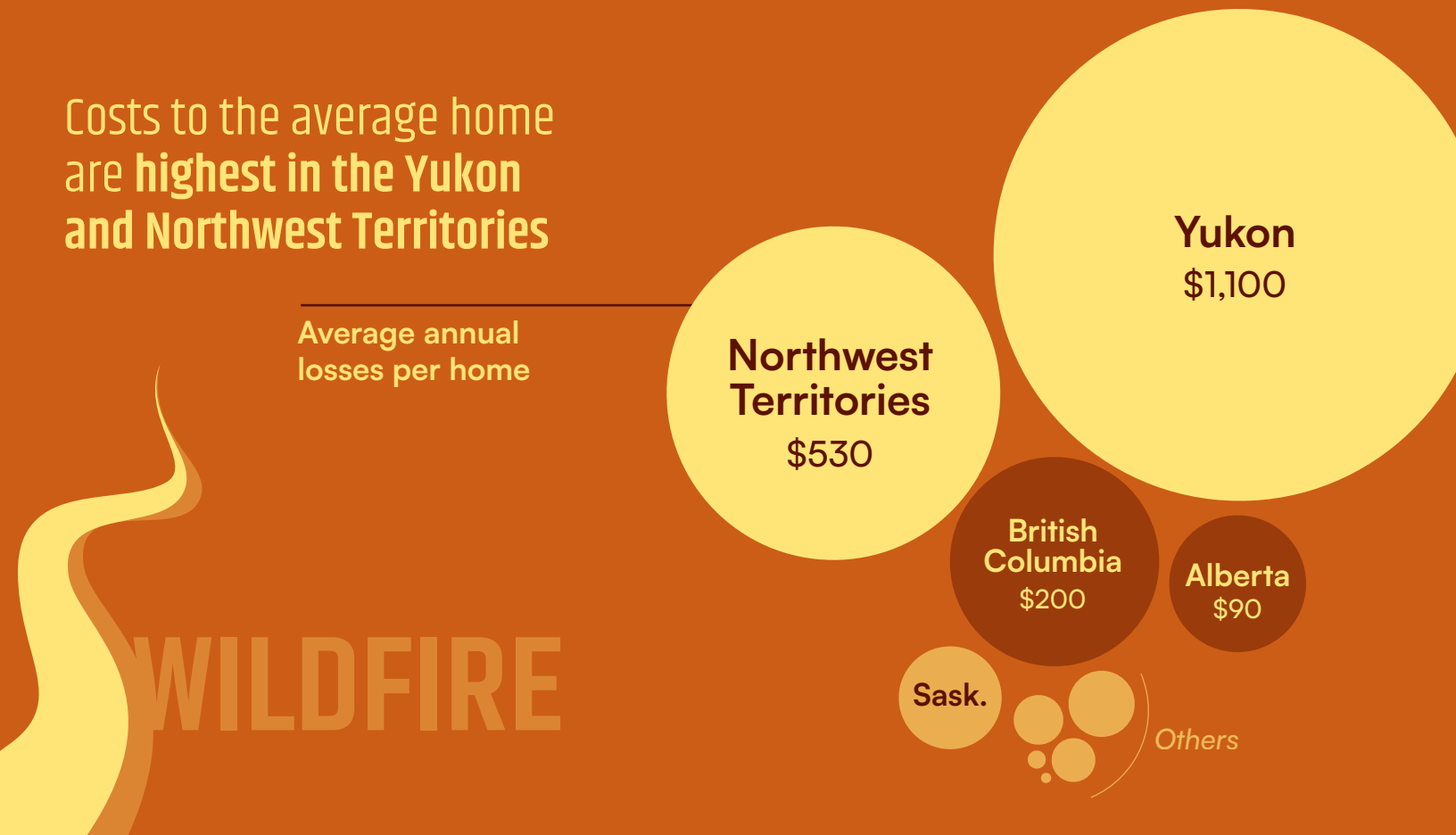
The Co-operators' model also highlights significant tail risk—the potential for catastrophic years where wildfire damage far exceeds the average annual loss (see Figure 10). For instance, fire-prone provinces such as British Columbia and Alberta have a 2 per cent chance in any given year of a billion-dollar fire season, with damages several times larger than expected average annual losses for those provinces. And while wildfire is less frequent close to cities and residential areas in Ontario and Quebec, reflected in their very low estimated average annual losses, those provinces each have a 1 per cent chance in any given year of a wildfire season that causes close to a billion dollars in damage.

Although we could not run future climate scenarios for the wildfire analysis, current scientific research suggests that rising temperatures and changing precipitation patterns due to climate change will significantly increase the likelihood of extreme fire weather conditions and the potential for larger and more destructive wildfires in Canada (Zhang et al. 2019; Tymstra et al. 2020). While further research on the impacts of these changes on homes and communities is still required, it is a virtual certainty that the already substantial risk posed by wildfires to existing housing in Canada will further intensify in the future, to a degree that is likely even greater than the climate change-driven increases in risk that we project for flooding.

Figure 9

Current residential wildfire risk is **highest in B.C. and Alberta**

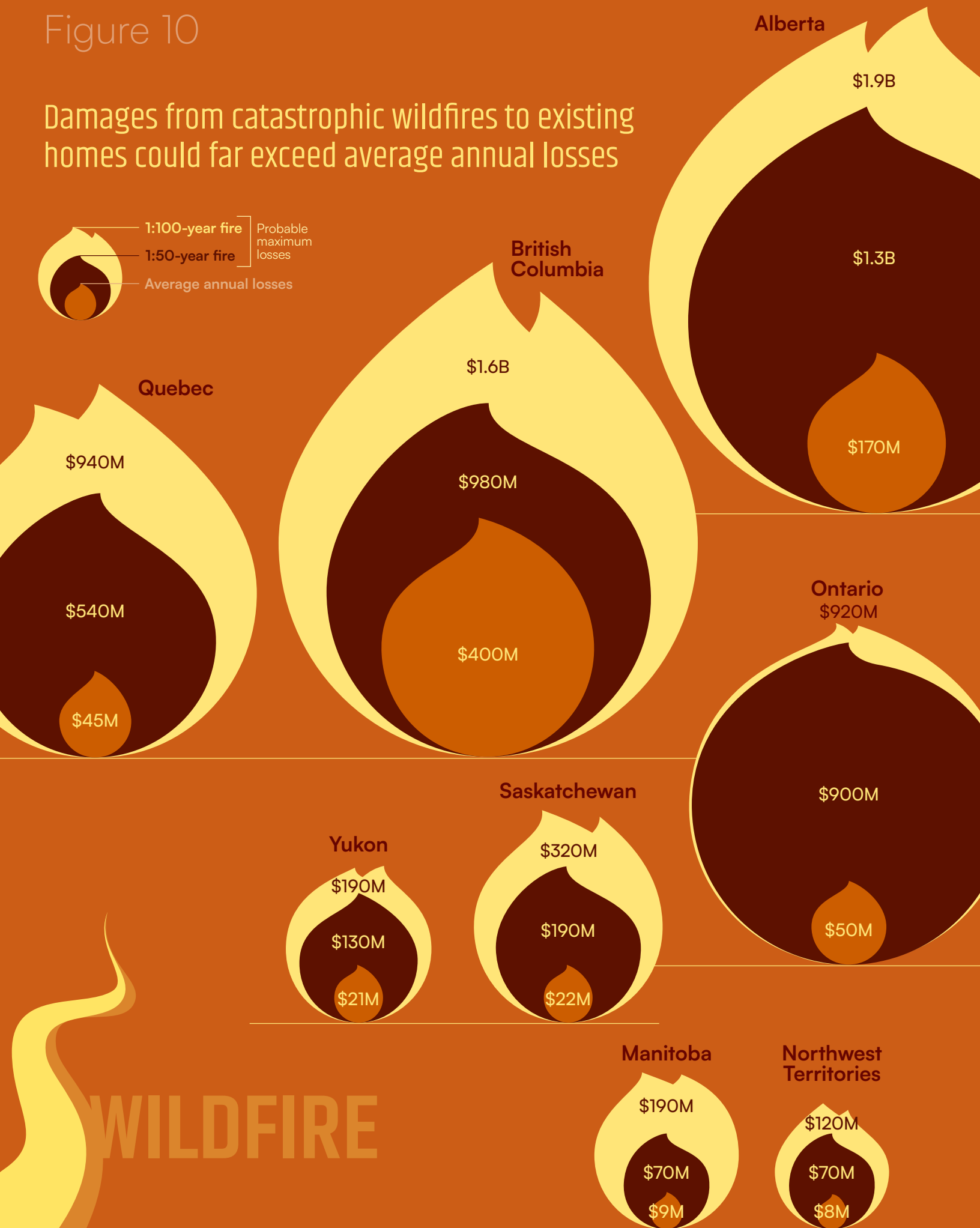
Costs to the average home are **highest in the Yukon and Northwest Territories**



WILDFIRE

Figure 10

Damages from catastrophic wildfires to existing homes could far exceed average annual losses



Continuing with status quo land use planning practices will increase wildfire risk to housing by 155 per cent, even before accounting for climate change

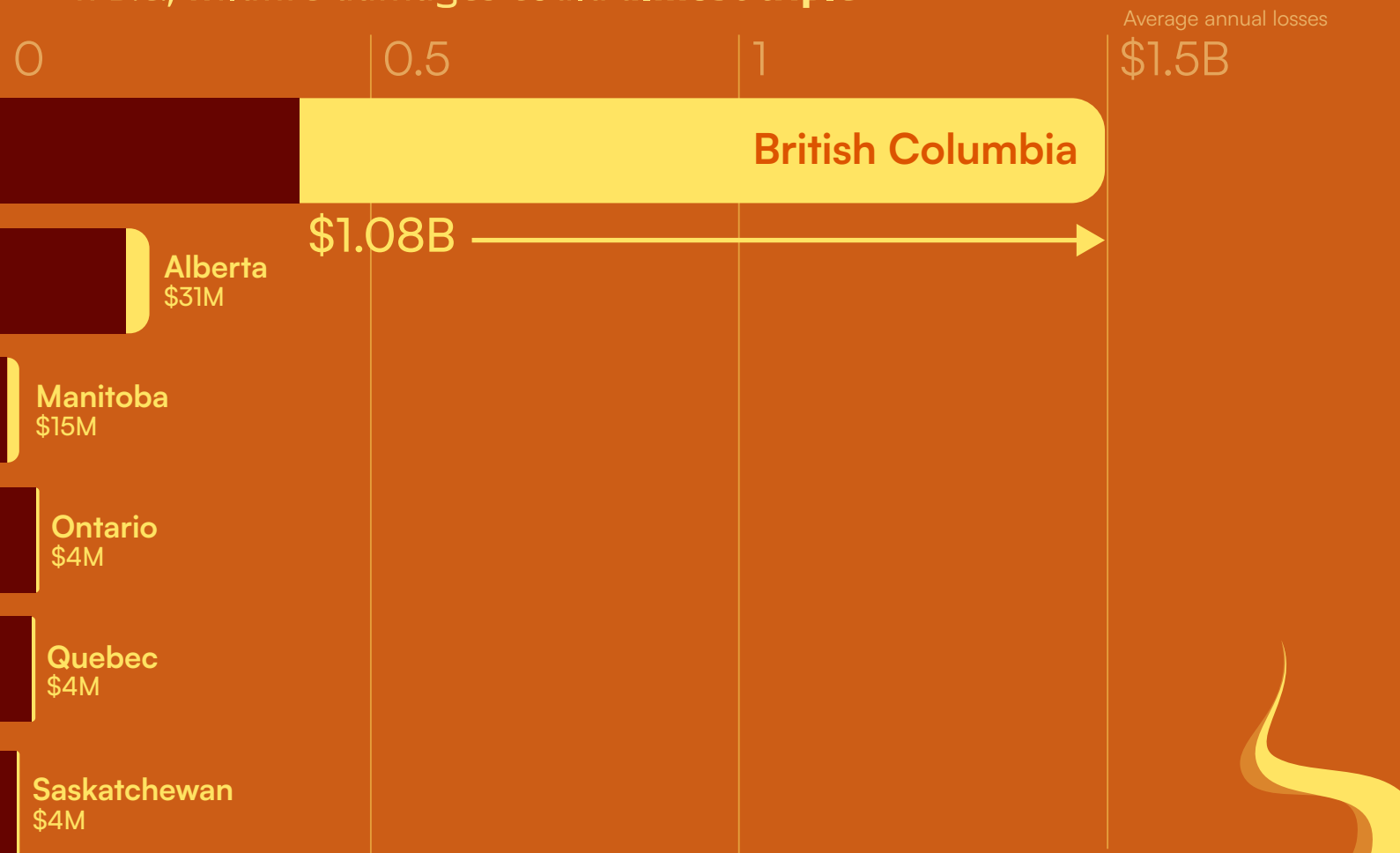
Our analysis shows that the siting of 5.8 million new homes by 2030, based on existing land use planning frameworks, could place many of these homes in wildfire hazard zones. Figure 11 summarizes the projected increases in wildfire losses, potentially raising wildfire damage by 155 per cent, equivalent to over $1.1 billion in additional average annual losses.

This increase in risk is especially prominent in British Columbia, where average annual damages are projected to increase by over 265 per cent, or an additional $1.08 billion annually. Alberta's projected increases are the next largest, but significantly less in total annual losses and in terms of percentage change, at $31 million and 18 per cent, respectively. Significant increases are also expected in other provinces, including Manitoba, Quebec, and Ontario (see Figure 11).

Figure 11

Without changes to current policies, wildfire damages in Canada could **more than double** in 2030

In B.C., wildfire damages could **almost triple**



WILDFIRE

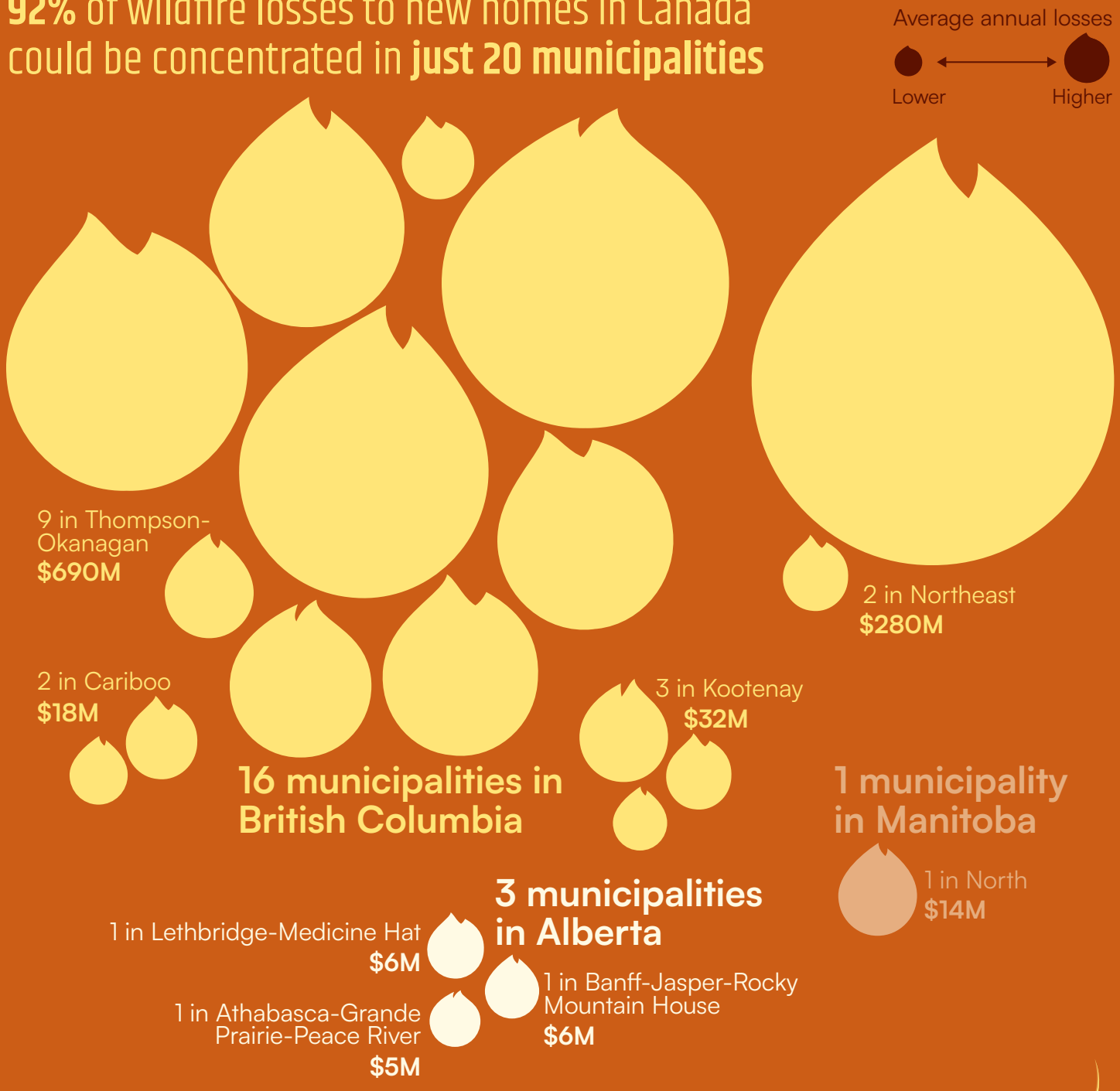
Wildfire risk to new housing will be highly concentrated in specific regions and municipalities

Our analysis shows that wildfire risk to new housing is highly concentrated in specific regions and municipalities—92 per cent of the total projected new average annual losses nationally is concentrated in just 20 municipalities (see Figure 12). And most of those municipalities are in just three regions of British Columbia: Thompson-Okanagan, Kootenay, and the Northeast.

Wildfire damage may not necessarily occur in the places where the risk is already high. Our analysis projects that several municipalities in B.C., Alberta, and Ontario with very high existing risk—among the top 20 municipalities nationally—will see very little new risk added because they will experience little housing growth or because that growth can occur in areas of low risk (see Figure 13). Other municipalities in the existing top 20 will see more substantial risk increases of between 40 and 150 per cent. Some see even more dramatic increases in the risk of wildfire damages, where average annual losses could grow by a factor of four, 10, or even 15—a scale that could catch local and provincial emergency responders unprepared and have devastating implications for people living in those communities.

Figure 12

92% of wildfire losses to new homes in Canada could be concentrated in **just 20 municipalities**



4,480 municipalities represent the remaining 8% of new home losses

All other municipalities

$88M

WILDFIRE

Figure 13

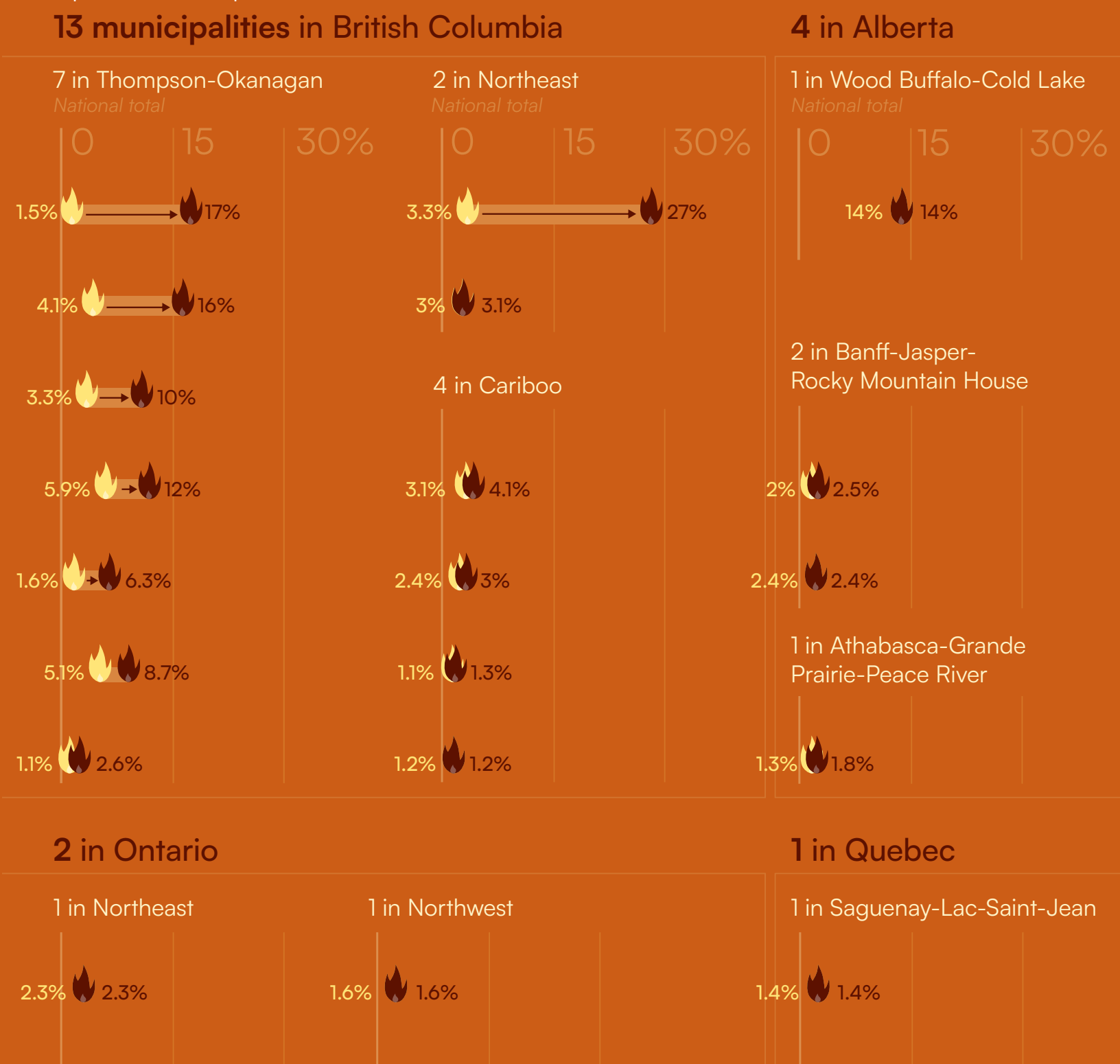
WILDFIRE

New communities may emerge as Canada's top wildfire risk hotspots

% of national average annual losses from

Existing homes | Existing **+ new** homes

Top 20 riskiest municipalities



3.3 The consequences of continuing with status quo development

Our analysis reveals an alarming trajectory for Canada's future housing if current planning practices remain unchanged. Building millions of new homes without stronger up-front consideration of flood and wildfire hazards—which will only worsen as climate change accelerates—will result in a growing number of homes being built in harm's way.

Poor siting decisions for new homes could increase flood damage to Canada's housing stock by up to 40 per cent by 2030. Financially, this translates to an additional $340 million in annual flood damages if flood defences hold, or up to $2 billion if they fail. In particular, large swaths of new homes in British Columbia and Manitoba will be built in areas reliant on engineered flood defences such as levees and dikes, introducing significant risks, should these systems falter. Encouragingly, Ontario shows far lower flood damage increases per new home compared to other provinces, despite being projected to accommodate more than half of the new housing development in Canada by 2030.

Wildfire risk is also set to rise sharply. Our analysis projects a 155 per cent increase in wildfire damage with new housing development by 2030, resulting in an additional $1.1 billion in average annual losses. British Columbia and Alberta are expected to experience the most substantial increases, with over 97 per cent of the new wildfire damage concentrated in these two provinces.

Building millions of new homes without stronger up-front consideration of flood and wildfire hazards—which will only worsen as climate change accelerates—will result in a growing number of homes being built in harm's way.

Flooding and wildfire risk to projected new housing is highly concentrated in specific provinces, regions, and municipalities. Our analysis shows that up to 78 per cent of new flood risk is concentrated in just 3 per cent of all new homes, which translates to a very small amount of land. Similarly, over 90 per cent of new wildfire risk is concentrated in just a handful of regions in B.C. and Alberta. Figure 14 shows that this distribution of flood and wildfire risk creates clear hotspots where decisions about new housing must be made very carefully. In the B.C. Interior, wildfire risk to new homes in rapidly growing communities could nearly double residential wildfire damages in Canada if current policies allowing construction in wildfire hazard zones remain unchanged. In B.C.'s Lower Mainland and the Calgary region in Alberta, continued development in flood risk zones could dramatically

increase residential flood losses in those provinces. In Winnipeg, flood risk to new homes could increase significantly, while fire risk in Manitoba's northern boreal forests could also escalate, leading to higher wildfire damages. In the Toronto and Montreal regions of Ontario and Quebec, even if only a small portion of the very large number of future homes is built in high flood hazard zones, the resulting damages and costs could be significant. However, no part of the country is immune. Even in areas where overall risk may appear lower, certain cities, towns, and neighborhoods still face high-risk development due to existing policies. Understanding the concentration of risk at multiple scales provides opportunities to build the homes needed to reduce housing prices without sacrificing safety from the impacts of accelerating climate change.

Figure 14

FLOOD

The highest costs from floods will be in major urban centers across Canada, while fire damages will be concentrated in the West

WILDFIRE

Challenges

Current policies drive new housing into hazard zones

A variety of policies across different orders of government shape where new housing is built in Canada, and whether climate-related hazards are considered. Most obviously, land use policies across the country direct where housing can be located. And although land use policy is recognized as the most effective approach to preventing development in high-hazard areas, these policies vary significantly across the country and often have critical limitations.

Where strong land use policies are lacking, risky housing development is exacerbated by misaligned financial incentives, gaps in related policies, and insufficient climate hazard information. In this section, we discuss the limitations of existing land use policies in Canada and explore three additional policy areas that drive development in hazard zones: housing and infrastructure programs, disaster assistance, and flood hazard information.

4.1 Gaps and limitations in land use policies across Canada

In Canada, land use policies vary widely across provinces and territories, leading to significant gaps in managing flood and wildfire risks for new housing. This section highlights four key gaps and limitations in Canada's land use policies that contribute to increased housing risk from flood and wildfire hazards. First, most provinces and territories do not fully exercise their authority to direct development away from high-risk flood and wildfire zones, allowing housing to be built in hazard areas without strong regulations or restrictions. Second, even where policies exist to restrict development in hazard zones, they often rely on inconsistent or inadequate risk thresholds, exposing new developments to significant residual risk. Third, provinces and territories frequently shift the responsibility for preventing hazardous development onto municipalities, which face considerable financial, technical, and political barriers in managing these risks. Finally, rather than focusing on avoiding new development in risky areas altogether, many jurisdictions permit housing in high-hazard areas if risk mitigation strategies, such as floodproofing or fireproofing, are implemented—even though these measures are costly and only partially effective.

Box 5

The importance of land use policy in minimizing high-risk development

Land use policy plays a critical role in preventing housing development in high-hazard areas, reducing exposure to climate-related hazards such as floods and wildfires (OECD 2017; World Bank 2017; WMO 2016). The vulnerability of housing is shaped by urbanization patterns and planning decisions, which makes land use policy a key tool for addressing the root causes of risk (UN-Habitat 2016; IPCC 2012; UNISDR 2015; World Bank 2019). Effective land use policy integrates flood and wildfire risk into planning processes and helps to minimize the exposure of new housing to these hazards (Natural Resources Canada 2022; OECD 2023; Bénichou et al. 2021).

While other policy tools like emergency planning, disaster financial assistance, and protective infrastructure can reduce risks, they do not eliminate them and are often ineffective or only partially effective in extreme flood and wildfire events, especially as climate change intensifies these hazards (OECD 2017; World Bank 2017). Furthermore, these measures are expensive and can encourage risky development because municipalities and home buyers tend to be too optimistic about the degree of protection such measures provide (World Bank 2017; Task Force on Flood Insurance and Relocation 2022).

For these reasons, land use policy is the most effective and cost-effective way to keep new housing safe from the most serious climate hazards (WMO 2016; UNISDR 2015). Studies consistently show that land use policies that direct development into safer areas provide significant benefits, including reduced damage and disaster recovery costs, and fewer long-term disruptions to communities (Hudson and Botzen 2019; Brown et al. 1997). While land use policies are most commonly used to manage flood risk, there is growing recognition—both internationally and domestically—of its importance for reducing housing risk from wildfires (OECD 2023; Bénichou et al. 2021). Robust land use policies set by national and state or provincial governments establish consistent risk standards and help local governments overcome the financial, technical, and political challenges of managing these risks independently (European Commission 2021; OECD 2017).

In a Canadian context, experts stress the urgent need for provincial and territorial governments to take decisive action to ensure that new housing is built in areas safe from flooding and wildfire hazards. They advocate for policy tools such as stricter land use regulations and risk-informed planning to direct development away from high-risk zones (Climate Proof Canada 2023; Task Force for Housing and Climate 2024).

Land use policy is also important for promoting equity. Studies show that economically vulnerable groups are more likely to live in high-risk housing (Bakkensen and Ma 2020; Ma et al. 2024; Lee and Jung 2014). In the U.S., affordable housing is often situated in floodplains, increasing risk for low-income households (Samoray et al. 2024; Ratnadiwakara et al. 2020). Similar patterns are emerging in Canada, where Indigenous people, older adults, low-income households, and people with disabilities are overrepresented in housing at high risk of flooding (Canada Task Force on Flood Insurance and Relocation 2022). Strong land use regulations can prevent the perpetuation of these inequitable patterns by limiting the creation of housing in hazardous areas.

Box 6

Managing hazards in housing development: Governmental responsibilities in Canada

In Canada, all orders of government shape and inform housing development decisions. Provincial and territorial governments have the primary authority over land use, establishing policies and regulations that guide local planning and development decisions. In some cases, these policies prohibit or limit development in areas prone to natural hazards such as flooding and wildfire. Provinces and territories also establish building codes and standards, which may include requirements to construct homes using practices and materials that will improve their resilience to climate risks.

Municipal governments implement and enforce provincial or territorial land use planning and housing approval policies within their communities. Through community plans, zoning bylaws, and planning approvals, they manage development proposals and ensure compliance with provincial and territorial requirements, including those related to flood and wildfire hazards, where they exist. In some provinces and territories, municipal governments have the authority to set their own hazard-related requirements.

The federal government does not directly regulate housing development, except on First Nations reserves and federal lands.[3] However, the federal government plays an indirect role by providing substantial funding for housing and municipal infrastructure, influencing local development choices by establishing conditions for that funding.

3 - Housing on First Nations reserves is a shared responsibility between First Nations governments and the federal government. While the federal government provides the majority of funding, First Nations governments have gradually regained greater authority over land use planning and building codes, shaping how, where, and when housing is developed on reserves. We have commissioned a standalone report that delves into the First Nations governance context and the challenges and opportunities in building resilience in Indigenous communities: Indigenous Housing and Climate Resilience.

Provinces and territories do not use their full authority to direct development away from flood and wildfire hazard zones

Despite having the constitutional authority to do so, most provincial and territorial governments do not exercise their full authority to direct development away from hazard zones. Only Quebec, Ontario, and Saskatchewan have regulations that limit development in certain riverine flood zones (Table 1). Manitoba has regulations, but these only require that new developments be floodproofed, and there are no zones where construction is prohibited. Nova Scotia has flood regulations, but they only apply to a small number of the province's floodplains. New Brunswick's regulation promotes development in safer areas but places no explicit restrictions or conditions on development in flood hazard zones. Nunavut approves local community plans that govern where new development is located across the territory, including with respect to watercourses, though it lacks regulations that set standards on development. Newfoundland and Labrador has a policy to limit development in riverine flood hazard zones, but it is less enforceable than a regulation. Alberta, British Columbia, the Northwest Territories, Prince Edward Island, and the Yukon do not regulate development in riverine flood hazard zones, and delegate the responsibility for limiting development in flood-prone areas to municipal governments.

Only Quebec has specific regulations that limit development in flood-prone coastal areas. New Brunswick's regulation promotes development away from all flood hazard areas, including coastal zones, but does not specifically prohibit or impose conditions on coastal development. Newfoundland and Labrador has policy to limit development in coastal flood zones, but it lacks the legal standing and enforceability of regulations. British Columbia offers non-binding guidance that encourages municipalities to account for coastal flooding, including sea level rise, through 2100. In December 2022, Prince Edward Island placed a moratorium on new development in coastal buffer zones until a coastal zone policy is developed, while Nova Scotia's 2019 Coastal Protection Act, which would restrict development in coastal flooding zones, has not been proclaimed by the provincial government (Government of Prince Edward Island 2023). No province or territory has land use policies or regulations addressing pluvial flood risk (see Box 4).

Furthermore, in some provinces and territories, such as Ontario and Nova Scotia, cabinet ministers can override regulations to allow development within flood hazard zones if they deem it a matter of provincial interest. While such flexibility may be necessary in certain situations, government watchdogs have raised concerns about the misuse of ministerial authority to bypass natural hazard avoidance policies and environmental policies under the pretext of promoting housing construction (Office of the Auditor General of Ontario 2022).

Box 7

Pluvial flooding is a different policy problem that needs different solutions

Pluvial flooding, caused by intense rainfall overwhelming drainage systems and pooling on impervious surfaces (see **Box 4**), presents a unique policy challenge and poses a different problem requiring different solutions than riverine and coastal flooding. Unlike riverine and coastal flooding, which involve overflowing waterbodies and fall under the jurisdiction of provincial and territorial authorities, pluvial flooding occurs across a much broader swath of urban and developed areas where governance and regulatory authority are more fragmented. Hazard zones for riverine and coastal flooding are much easier to identify and regulate than the much more widespread areas at risk of pluvial flooding.

Unlike coastal and riverine flooding, which often requires land use regulation to restrict development in the most hazard-prone areas, pluvial flood risk can sometimes be permanently mitigated by improvements to drainage and stormwater infrastructure. However, managing pluvial flood risk in Canada is complicated by the fact that municipalities bear most of the responsibility for urban drainage systems. They often lack the financial resources or technical capacity to address pluvial flooding, and there are no centralized provincial or territorial policy frameworks offering clear guidance. This policy gap leaves municipalities to tackle increasingly outdated and inadequate stormwater systems, which are already stretched by urban growth and further strained by more frequent and intense rainfall events as climate change intensifies. Even Canada's largest cities are struggling to find the resources to modernize their infrastructure to address pluvial flooding (Jeffords 2024).

Effectively managing pluvial flood risk to housing will require coordinated efforts across all orders of government. Federal, provincial, territorial, and municipal governments must work together to assess pluvial flood risks, invest in upgrading drainage systems, and develop policies to ensure risk is permanently mitigated before building.

Wildfire hazard regulations are even more limited than flood hazard regulations (Table 2). Most provinces and territories grant municipalities the authority to impose development restrictions or conditions in wildfire-prone areas, and some have regulations or policies that require municipalities to consider wildfire hazards in land use decisions. However, no provincial or territorial government has implemented binding requirements that restrict development in these areas. Consequently, development in high wildfire hazard zones can generally proceed without restriction or risk-mitigation measures unless required by specific municipal policies.

The extent of municipal authority to regulate development in wildfire hazard zones also varies significantly. In British Columbia, for example, local governments can designate wildfire-prone areas and deny development permits unless specific construction or landscaping criteria are met (Government of British Columbia 2024a). However, in Alberta, while municipalities can impose some restrictions—such as landscaping requirements—provincial law prevents them from exceeding provincial building codes, limiting their ability to mandate risk-reduction measures like the use of fire-resistant materials (Government of Alberta 2023a, 2024a).

Provincial and territorial governments generally provide minimal oversight of how municipal governments implement policies regarding development in flood and wildfire hazard zones. In many cases, provincial and territorial governments lack processes to ensure their regulations and policies are integrated into local community plans. In others, provincial or territorial authorities must approve community plans but lack processes to ensure those plans are ultimately carried through to zoning bylaws and local permitting decisions.

Policies to restrict development in hazard zones often leave significant residual risk

Provinces with regulations or policies that explicitly restrict development in certain flood zones vary widely in their flood-risk tolerance. For example, Quebec and Newfoundland and Labrador have regulations or policies for both riverine and coastal flooding; Nova Scotia, Ontario, and Saskatchewan have them for riverine flooding, and Ontario restricts most development within a 1:100-year riverine flood zone and sometimes within a zone associated with regional historic floods that are even larger than a 1:100-year event. Saskatchewan limits new development within the floodway zone of a 1:500-year flood.

Meanwhile, Quebec, Newfoundland and Labrador, and Nova Scotia only prohibit development within the 1:20-year flood zone and allow development in the 1:100-year zone with floodproofing mitigation measures.

Our flood damage modeling underscores the importance of setting appropriate flood risk thresholds. According to our estimates, homes within Canada's 1:20-year flood zone face average annual damages of $16,000 per home in the worst-case scenario. For homes in the 1:100-year flood zone but outside the 1:20-year zone, our modeling projects average annual damages of $1,100 per home. Similarly, homes in the 1:1000-year flood zone but outside the 1:100-year zone are estimated to incur average annual damages of just $200 per home. This demonstrates that relaxing flood risk standards significantly increases potential damages and economic losses.

Box 8

What does a "1:100-year flood zone" mean for land use planning in an era of climate change?

A "1:100-year flood" doesn't mean a flood that happens once every 100 years. Instead, it refers to a flood event with a 1 per cent chance of occurring in any given year. This probability remains the same each year, meaning that even after a 1:100-year flood, there's still a 1 per cent chance of a similar flood happening the following year. Likewise, a "1:20-year flood" has a 5 per cent chance of happening annually. Over time, the likelihood of such events increases: for instance, there is a 5 per cent chance of experiencing a 1:100-year flood within a 5-year period, and an almost 22 per cent chance over 20 years.

In land use planning, flood return periods help define flood hazard zones, such as "1:100-year flood zones" or "1:20-year flood zones." Homes in a 1:20-year flood zone are at significantly higher risk than those in a 1:100-year zone because the likelihood of flooding is five times greater. Over time, this leads to more frequent damage, higher recovery costs, and increased vulnerability for households.

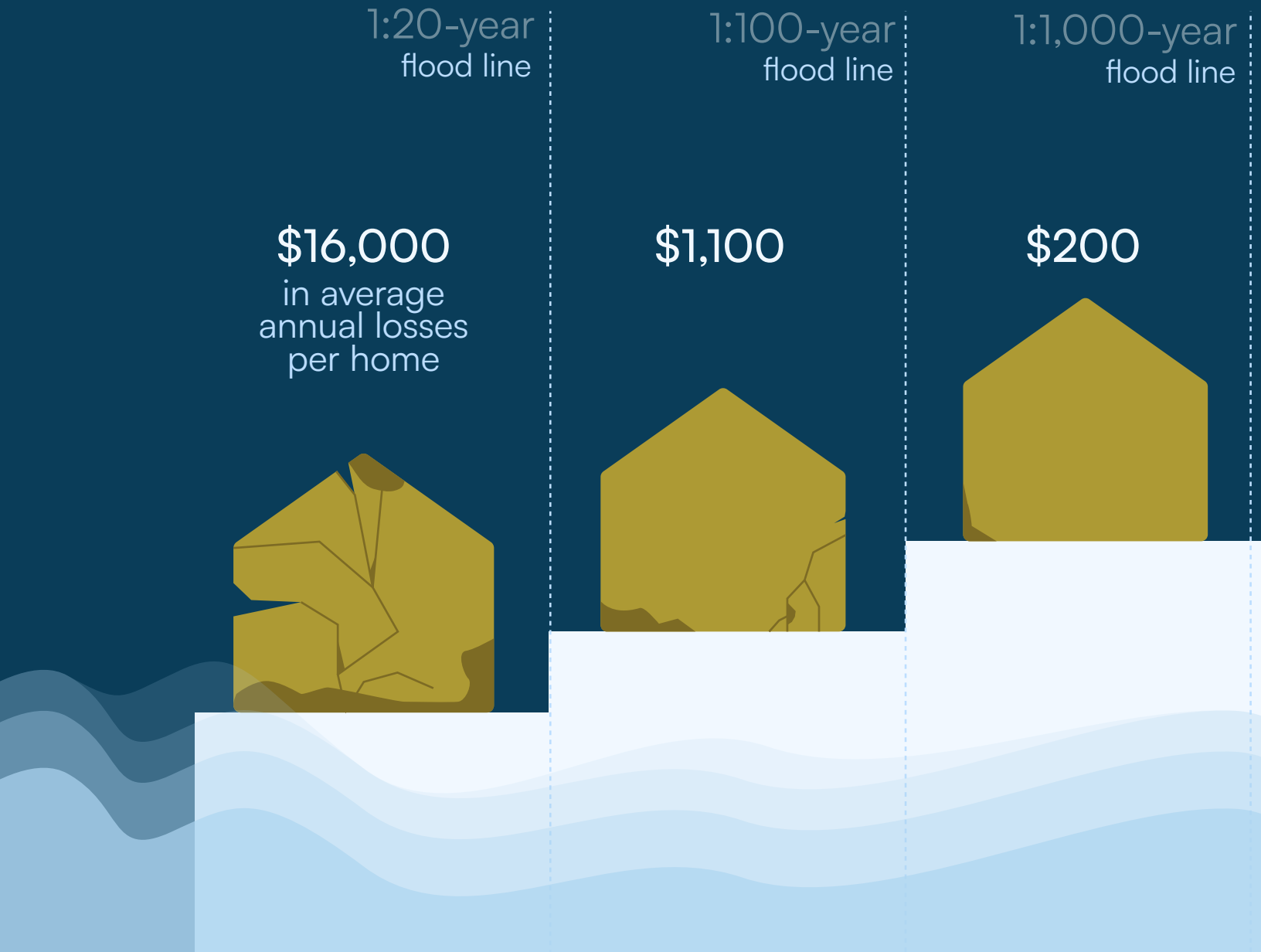
In Canada, flood hazard zones are mapped using historical flood and precipitation data, topographical analysis, and models that project flooding of different return periods. These zones are typically mapped by municipal, provincial, or territorial authorities, depending on how roles and responsibilities are assigned in each jurisdiction (see **Section 4.4**).

However, as climate change accelerates, warming temperatures and shifting weather patterns are making extreme rainfall and flooding events more frequent and severe in many regions. For example, some researchers project that historical 1:100-year floods are expected to become 10 times as likely to occur in a given year in some parts of Canada by the second half of this century (Gaur 2018). This shift challenges the long-standing assumption that flood hazards are static, potentially rendering many flood hazard maps and planning zones outdated.

Figure 15

FLOOD

Setting the right flood-risk thresholds in land use policy can significantly limit housing damages



In addition, most provinces and territories do not incorporate climate change projections into their flood-risk thresholds and related land use policies, leading to an underestimation of flood-risk. To date, only Newfoundland and Labrador incorporates climate change effects in their flood policies and calculation of flood hazard zones. Without factoring in the increased frequency and severity of flood events due to climate change, the use of flood-risk thresholds based on the historic climate is likely to leave new developments more exposed to future hazards than anticipated.

Table 1 Overview of provincial and territorial land use policy for flood hazard zones

	Riverine flooding hazard policy					Coastal flooding hazard policy
	Authority to regulate development in flood hazard zones	Binding flood hazard regulation or policy for land use	Non-binding guidance	Hazard zone where regulation or policy prohibits development	Hazard zone where regulation or policy requires development be floodproofed	Legally binding regulation or policy
Nova Scotia	Provincial + Municipal[4]	Yes	-	1:20-year flood in five designated floodplains	1:100-year flood in designated and other known floodplains	No
Ontario		Yes	-	1:100-year or Regional Storm flood[8,9]	Special Policy Areas, two-zone study areas	No[11]
Saskatchewan		Yes	-	1:500-year floodway	1:500-year flood	n/a
Manitoba		Yes	-	None[8]	1:100-year flood for Winnipeg and other designated zones	No
New Brunswick		Yes[6]	-	None	None	Yes, but no prohibition zone
Alberta		No	No	None[8]	None	n/a
Prince Edward Island		No	No	None[8]	None	No[12]
British Columbia	Municipal[5]	No	Yes	None	None	No
Nunavut		No	No	None[8]	None	No
Yukon		No	No	None	None	No
Northwest Territories		No	No	n/a[10]	n/a[10]	No[10]
Newfoundland and Labrador	Provincial	Yes	-	1:20-year flood	1:100-year flood in designated floodplains	Yes, same standard as riverine flooding
Quebec		Yes[7]	-	1:20-year flood	1:100-year flood	Yes, same standard as riverine flooding

Table 2 Overview of provincial and territorial land use policy for wildfire hazard zones

	Wildfire Hazard Policy				
	Authority to regulate development in wildfire hazard zones	Binding wildfire hazard policy for land use	Non-binding guidance	Hazard zone where regulation or policy prohibits development	Hazard zone where regulation or policy requires wildfire risk to development to be mitigated
British Columbia	Municipal[13]	Yes	-	None	None
Manitoba		Yes[14]	-	None	None
New Brunswick		Yes	-	None	None
Ontario		Yes	-	None	None
Saskatchewan		Yes	-	None	None
Alberta		No	No	None	None
Northwest Territories		No	No	None	None
Quebec		No	No	None	None
Yukon		No	No	None	None
Newfoundland and Labrador	None	No	No	None	None
Nova Scotia		No	No	None	None
Nunavut		No	No	None	None
Prince Edward Island		No	No	None	None

4 - Both provincial/territorial and local governments have formal authority to regulate development.

5 - These provinces and territories have legislative authority to regulate development in flood hazard zones but have not formalized this authority and leave the responsibility to municipalities.

6 - New Brunswick's regulation promotes safer development but does not explicitly restrict or impose conditions on building in flood-hazard zones.

7 - Following Quebec's 2017 and 2019 floods, the province introduced temporary restrictions on flood-prone development. A permanent policy, proposed in June 2024, is under consultation.

8 - Alberta, Manitoba, Nunavut, Ontario, and PEI require development setbacks from waterbodies for environmental or land tenure reasons, not primarily for flood risk.

9 - A Regional Storm refers to events like the 1954 Hurricane Hazel in southern Ontario, which now serves as the flood standard in that region.

10 - No information is published online, and government officials were not reachable for confirmation.

11 - Ontario does not regulate development in coastal flood zones on Hudson Bay, although it regulates flood hazard zones along the Great Lakes.

12 - In 2022, PEI placed a moratorium on new development in coastal buffer zones until a coastal zone policy is developed

13 - These provinces and territories have legislative authority to regulate development in wildfire hazard zones, but have not enacted this authority and leave the responsibility to municipalities.

14 - In Manitoba, municipalities are broadly required to consider hazards in land use planning, but wildfires are not explicitly mentioned

Provinces and territories often place the burden for preventing hazardous development on municipalities, which face substantial barriers

In Canada, municipal governments are tasked with managing land use development within their jurisdictions and implementing provincial policies related to development in flood and wildfire hazard zones, where such policies exist. When provincial or territorial governments regulate development directly, municipalities must integrate these regulations into their local planning processes, including official community plans, zoning bylaws, and permitting systems. However, in the absence of provincial or territorial regulations, municipalities may choose to develop and implement their own policies, although they face substantial barriers in doing so.

One of the key challenges municipalities face is a lack of financial and technical capacity. Many smaller municipalities lack the resources to effectively assess flood and wildfire risks or to develop and enforce the necessary regulations (Northwest Hydraulic Consultants 2021). While federal, provincial, and territorial governments sometimes provide financial support for these activities, such funding is limited and often awarded on a competitive basis, perpetuating disparities in municipal capacity and creating inconsistencies in how hazardous areas are managed, both within individual provinces and territories, and across the country (Steacy 2024).

Municipal governments also operate in constrained revenue environments. They rely heavily on property taxes—which make up approximately half of all municipal revenues and 90 per cent of municipal tax revenues—as well as development charges (FCM 2024; CMHC 2022). At the same time, municipalities face mounting financial pressures from maintaining critical social services and the major share of public infrastructure that they own and operate—the costs of which are increasing in response to population growth and the accelerating impacts of climate change (FCM and IBC 2021). These financial limitations often conflict with the need to restrict development in flood and wildfire zones, as avoiding development can mean forfeiting potential revenues, and developers may simply relocate projects to neighbouring jurisdictions with more permissive rules.

Local governments also contend with political barriers. Designating high-hazard flood zones often meets with opposition from residents concerned about declining property values (Logan 2024; Lyle et al. 2024). In addition, local politicians face pressure to address housing affordability by prioritizing immediate

housing supply over long-term risk management. This can make them reluctant to adopt and enforce stringent bylaws that restrict development or mandate more costly building practices, particularly when these measures are perceived as slowing new development and local economic growth.

Moreover, enforcement becomes more challenging when municipalities bear the brunt of public and industry backlash against restrictive policies, even when those policies originate from provincial or territorial governments. The situation is further exacerbated when higher orders of government fail to provide clear political support for local risk management policies and enforcement efforts.

Municipal governments also face challenges in managing development in wildfire hazard zones. While most provinces give municipalities the legislative authority to designate wildfire hazard areas and restrict development in these zones, few municipalities have exercised this authority. It is unclear why local governments are not making more use of land use policy tools to manage wildfire risk, but some municipalities have explicitly cited a lack of resources and enforcement capacity as key barriers (e.g., Regional District of Okanagan-Similkameen 2021; City of Kelowna 2022).

In some cases, the costs and timelines associated with implementing risk-management measures are prohibitive. For instance, after its devastating 2021 wildfire, the Village of Lytton, B.C. initially adopted bylaws requiring fireproofing measures but later rescinded them due to concerns over costs and delays in rebuilding (Village of Lytton 2022, 2023; Hunter 2024).

Box 9

Municipalities that go above and beyond

Despite significant challenges, some local governments are taking proactive steps to reduce flood and wildfire risks, often exceeding provincial requirements. Below are examples of municipalities that have implemented innovative approaches to protect their communities.

The flood risk bylaw in Saint John, N.B.

The City of Saint John has introduced stringent measures to prevent development in flood-prone areas. Although the New Brunswick provincial government does not impose restrictions on flood hazard areas, Saint John has proactively enacted a bylaw that applies to four high-risk zones. This bylaw prohibits development in the floodway and restricts activities that could reduce water storage capacity or disrupt the natural flow of water during flood events. To enforce the bylaw, the city requires developers to obtain a Flood Risk Area Development Permit (City of Saint John 2005).

Ottawa's floodproofing requirements

While the City of Ottawa enforces Ontario's regulations prohibiting development within the 1:100-year flood zone, it has taken extra

steps by applying stricter standards for new housing in the 1:350-year flood zone (City of Ottawa 2024). Ottawa's official plan mandates that new housing in this zone must include a riverine flood risk assessment and outline measures to mitigate or avoid these risks. In collaboration with local conservation authorities, Ottawa has updated its flood maps to ensure that these requirements are based on the most current data.

Lunenburg's coastal protection regulation

The Municipality of the District of Lunenburg in Nova Scotia has adopted forward-thinking coastal-protection regulations to address flooding and erosion hazards, taking climate change into account. Although provincial regulations do not limit coastal development, Lunenburg has prohibited new construction within 30 metres of coastal slopes and mandated that new residential structures be elevated approximately four metres above sea level. Additionally, no new development is permitted within 30 metres of coastal wetlands (Municipality of the District of Lunenburg 2024).

Canmore's Steep Creek Hazard Overlay District

The Town of Canmore, located in the Rocky Mountains in Alberta, has enacted a proactive land use bylaw to direct development away from areas of high flood hazard, even though the provincial government does not require municipalities to do so. Canmore's bylaw prohibits development in high-hazard areas and requires a risk assessment in moderate-hazard zones (Town of Canmore 2020). All development within this overlay must adhere to the town's engineering design and construction guidelines, which include specific provisions for steep creek hazard mitigation. Detailed hazard ratings for each lot are publicly available, improving transparency for residents.

North Vancouver's Wildfire Development Permit Area System

The District of North Vancouver has implemented comprehensive local standards for wildfire-prone areas. Since 2012, properties located within the wildfire-urban interface are subject to the district's Wildfire Hazard Development Permit Area system. Before building, applicants must obtain a development permit and submit a wildfire hazard assessment from a qualified professional. New homes must be positioned as far from wildfire-prone zones as possible and built using fire-resistant materials. In some cases, a 10-metre buffer around homes is required to reduce the risk of fuel accumulation (District of North Vancouver 2021).

Municipal requirements for fireproofed development approvals in B.C. and Ontario

Several municipalities in British Columbia and Ontario require developers to implement fireproofing practices as a condition for obtaining development permits. These actions include using fire-resistant building materials and managing vegetation around homes. Over 15 communities in British Columbia now have fireproofing regulations in their city bylaws (e.g., District of North Vancouver 2021; City of Prince George 2022). Other British Columbia municipalities provide incentives for voluntary action such as free fire risk assessments or vegetation removal (e.g., City of West Kelowna 2024; City of Kamloops 2024). In Ontario, municipalities like Huntsville are adopting similar practices (Town of Huntsville 2024).

Many provinces and territories allow housing in high-hazard areas with costly and only partially effective risk mitigation

Many provincial and territorial government policies allow housing development in high-hazard areas, provided risk-mitigation measures are in place. These measures aim to reduce risk rather than eliminate exposure to flood and wildfire hazards altogether. Common approaches include building infrastructure such as flood protection dikes and floodproofing individual homes in flood-prone areas, and implementing fireproofing practices like using fire-resistant building materials and managing landscaping in wildfire-prone areas.

For flood risk, some provinces and territories adopt a combined approach to regulation, restricting development in areas of greatest hazard and allowing development with mandatory mitigation measures in other hazard zones. Others do not establish prohibition zones but allow development throughout flood-hazard zones if floodproofing is provided (see Table 1). As noted previously, wildfire risk is often addressed more leniently, with provincial, territorial, and local governments rarely, if ever, prohibiting development in hazard zones, while promoting fireproofing as mostly voluntary measures.

Although flood mitigation measures can reduce risks, they are generally less effective and significantly more expensive than avoiding new development in risky areas altogether, particularly in high-hazard zones (World Bank 2017). Structural protection measures, such as dikes and seawalls, require high upfront investment and long-term operational costs. They can also create a moral hazard effect, where the perceived safety provided by these measures encourages further risky development (World Bank 2017; Task Force on Flood Insurance and Relocation 2022; Ebbwater Consulting 2023). The failure of such infrastructure can lead to catastrophic losses, especially when flood events exceed the protection levels (UNISDR 2015; OECD 2017). This risk was starkly illustrated during the 2021 British Columbia floods, when inadequate flood protection infrastructure failed, resulting in extensive damage (City of Merritt 2024; Parfitt 2023). Furthermore, much of this infrastructure does not account for the worsening impacts of climate change, making it even more unreliable in the long term (World Bank 2017).

Our analysis estimates that existing flood protection infrastructure currently shields homes in British Columbia from nearly $2 billion in average annual flood losses, and in Manitoba from $285 million. With new housing developments, this reliance is projected to increase by an additional $960 million in British Columbia and $330 million in Manitoba (see sections 3.1 and 3.2).

However, this protection is not guaranteed. If the infrastructure fails, as it did during the 2021 floods in British Columbia, the resulting losses could be catastrophic.

In Canada, unclear responsibilities and insufficient senior government support exacerbate the risk of infrastructure failure, leaving local governments—often under-resourced—responsible for managing protective infrastructure (KWL 2020; Authier 2019; Ebbwater Consulting 2021). Similarly, property-level floodproofing measures only reduce but do not eliminate flood risk. Households in high-hazard zones are still vulnerable to significant damage costs when flood events exceed the capacity of these mitigation measures.

Mitigating wildfire risk through fireproofing at the community and household levels presents fewer challenges than building and maintaining flood-protection infrastructure, but these practices also have limitations. While research suggests that in many contexts fireproofing is effective at reducing most risk, it does not eliminate it, and can still leave households more vulnerable than if development had avoided the most hazardous areas altogether (Czajkowski et al. 2020; Multi-Hazard Mitigation Council 2019).

4.2 Misaligned government housing and infrastructure initiatives

Federal, provincial, and territorial government housing policies and funding programs aim to increase housing supply through various regulatory frameworks, incentives, and penalties. To support housing development, these governments also fund the expansion of municipal infrastructure, such as water, wastewater, and transportation infrastructure. However, funding programs do not adequately account for their potential to enable development in high-hazard areas.

Addressing these gaps and integrating risk considerations into housing development and infrastructure expansion programs requires a time-scale shift to recognize that affordability considerations cannot be limited to upfront capital or purchase costs, but must also include ongoing costs, such as future insurance premiums or disaster risks. In other words, a home in a high-hazard area that

incurs damage and must be repaired or replaced, or is subject to increasing insurance premiums, will prove far less affordable than its purchase price or rental rate might convey. Similarly, infrastructure expansion that encourages further development in a hazardous area creates significant society-wide costs beyond the initial capital cost of the project.

Housing targets and incentives drive risky development

To improve housing affordability and accommodate population growth, the federal government and many provincial governments are accelerating housing supply additions through new funding programs, incentives and penalties for local governments, and policy changes that dictate local zoning and planning decisions. While aimed at quickly increasing housing stock, these policies can lead to rushed decisions to build large quantities of housing without fully accounting for climate risk. This short-term focus risks placing new housing in flood and wildfire hazard zones, ultimately undermining affordability goals by subjecting these households to significant future costs (see Section 1).

Recent federal initiatives aim to increase housing supply, with programs like the Housing Accelerator Fund incentivizing municipalities to rapidly approve more housing and build housing-supportive infrastructure. The Housing Accelerator Fund allocates significant federal funding directly to local governments to build housing and housing-supportive infrastructure. To be eligible, local governments must commit to housing supply growth targets of at least 10 per cent annually, and detail specific initiatives to meet these targets (CMHC n.d.). Despite having a stated aim of supporting climate-resilient communities, the Housing Accelerator Fund only encourages—rather than requires—that municipal applicants address flooding or climate change risk as part of their application (CMHC 2024). Because of its weak and optional resilience considerations, this program could worsen climate risk by adding extra pressure for municipalities to deliver on promised targets without being incentivized or required to assess and avoid climate hazards in the placement of new housing.

Some provincial governments, including B.C. and Ontario, have implemented policies to accelerate increases to housing supply, such as imposing housing start targets on municipalities, linking funding to pro-density reforms, fast-tracking permitting, and expanding provincial authority over local zoning (Government of British Columbia 2023; Government of Ontario 2022). These initiatives, however, lack safeguards to ensure that these new incentives and

requirements do not inadvertently drive development into hazard zones[15]. Without explicit consideration of flood and wildfire hazards in these housing strategies, senior government policies and programs may inadvertently drive development in high-hazard areas, as municipalities scramble to meet housing targets or implement zoning mandates—especially when combined with gaps in land use regulations.

15 - In British Columbia, local governments can exempt lands from new density requirements if they show that development would significantly raise risks or that the risks cannot be mitigated (Government of British Columbia 2023). However, this provision puts the onus on local governments to proactively identify hazards and demonstrate that an exemption is warranted.

Federal, provincial, and territorial infrastructure funding programs do not adequately consider climate risk

Federal, provincial, and territorial infrastructure programs sometimes incorporate screening processes to ensure funded projects are resilient to current and future climate hazards. However, these processes typically focus on the resilience of the infrastructure itself, without addressing whether the infrastructure will support new housing developments in an area exposed to climate hazards. This gap is consequential because infrastructure expansion precedes and enables housing development expansion, creating greater risk.

The federal government's Climate Lens is used to assess climate resilience for many federal infrastructure funding programs, requiring applicants to evaluate climate risk to proposed infrastructure and outline mitigation measures (Infrastructure Canada 2023). However, the Climate Lens is used for all federal infrastructure funding decisions and focuses on the climate resilience of the infrastructure itself, overlooking the potential for these projects to enable housing development in hazard-prone areas.[16] Thus, even with the Climate Lens, it is possible for municipalities to obtain federal infrastructure funding to build roads and sewers in flood hazard zones, potentially supporting future housing development in those areas.

Few provincial and territorial governments make resilience a condition for municipal infrastructure funding. Ontario requires municipal applicants to assess actions to make infrastructure climate resilient (Government of Ontario 2020), and B.C. and Alberta have non-binding guidelines to that effect (e.g., Government of British Columbia 2024b), but these measures, like the Climate Lens, focus on the resilience of the infrastructure itself, rather than its influence on the future location of housing.

16 - The resilience assessment under the Climate Lens applies to most projects funded by the Investing in Canada Infrastructure Program and all projects under the Disaster Mitigation and Adaptation Fund. However, it does not apply to the Canada Community-Building Fund or the Disaster Financial Assistance Arrangements program.

4.3 Moral hazard in disaster assistance programs

Federal, provincial, and territorial disaster assistance programs provide financial aid to households, businesses, and municipalities to repair damage to homes and infrastructure from disasters like floods and wildfires. However, the awareness that government aid will be available can, perversely, encourage development in high-hazard areas. Municipal governments may be more motivated to approve housing in risky locations, and individuals may be more willing to purchase homes there, knowing that disaster assistance will cover future losses. This moral hazard drives development in flood and wildfire hazard zones, increasing the future financial burden on government disaster assistance programs, which must repeatedly repair at-risk homes and infrastructure at public expense.

Disaster assistance programs enable development in high-hazard areas, despite efforts to reduce moral hazard

In Canada, disaster assistance programs administered by provincial and territorial governments fund disaster response and recovery efforts, including repairing and rebuilding homes and municipal infrastructure. The federal government reimburses a portion of these costs if specific criteria are met. Over recent decades, provincial, territorial, and federal disaster assistance programs have paid out billions of dollars in response to high-profile floods, wildfires, and other disasters. This consistent availability of government aid has likely reduced the incentive for homeowners and municipalities to avoid buying or developing in hazard-prone areas. Reliance on post-disaster financial support, rather than proactive risk mitigation, has allowed for continued development in areas vulnerable to floods and wildfires across Canada and beyond (Expert Advisory Panel on the Disaster Financial Assistance Arrangements 2022; First Street Foundation 2023; Lowrie 2024).

Many disaster assistance programs do not impose conditions on how and where funds can be used for rebuilding after disasters. Traditionally, these programs only cover expenses to rebuild homes to their pre-disaster condition. Most programs do not mandate or support relocating homes to safer areas when rebuilding, leading to continued reconstruction in high-hazard zones without additional safeguards against future disasters.

However, as private insurers retreat from high-hazard areas due to the escalating costs of covering flood and wildfire damage, the cost of disaster assistance programs have ballooned for governments in Canada (Task Force on Flood Insurance and Relocation 2022). The federal government and some provincial and territorial governments have recognized these issues and introduced measures to limit their financial liability. Several provinces have set compensation limits on individual homes, while others set lifetime limits to disaster assistance. Some programs go further by denying compensation for homes built in designated flood zones after the designation date. This policy is already in place in several provinces and territories, including Newfoundland and Labrador, Northwest Territories, Prince Edward Island, and Quebec (Government of Newfoundland and Labrador 2020; Government of Northwest Territories 2022; Government of Prince Edward Island 2022; Government of Quebec 2023a). Under federal disaster assistance rules, owners of new homes built in high-flood hazard areas may still be eligible for aid if the homes are protected to the 1:200-year flood elevation (Public Safety Canada 2024a).

Although these measures may deter repeated rebuilding in the same high-risk locations, they still do not necessarily prevent new development. Conditions on disaster assistance are not widely advertised and are difficult to access and understand. Furthermore, governments can create exemptions from these conditions, potentially setting a precedent that weakens deterrence of new development in hazard zones.

National public flood insurance may help those at risk but could exacerbate moral hazard

The federal government's forthcoming low-cost flood insurance program aims to provide affordable coverage for homeowners in high-hazard areas, where private insurance is unavailable or prohibitively expensive (Department of Finance Canada 2023). While this initiative is helpful to support homeowners already facing significant flood risk, it could inadvertently worsen moral hazard if not

carefully designed. To avoid this, the program must have stringent eligibility criteria and be part of a broader flood resilience strategy (Flórez Bossio and Ness 2024).

The federal government has indicated that coverage will be limited to homes built before the program's implementation and that risk-based premiums will be phased in over time—both necessary but potentially contentious measures that require strong implementation mechanisms. Moreover, the creation of a national flood insurance program could lead to the perception that it is a comprehensive solution to flood risk, fostering complacency across all levels of government and disincentivizing critical investments in flood risk reduction. This complacency may result in a lack of funding for protective infrastructure, such as dams and seawalls, or programs to relocate the highest-risk homes. Ensuring that these broader risk-reduction investments accompany the insurance initiative is essential for building long-term flood resilience rather than merely addressing immediate financial risk.

4.4 Incomplete, outdated, and unavailable flood and wildfire hazard information

Flood and wildfire mapping in Canada is inadequate, with flood hazard maps often outdated or entirely unavailable for large parts of the country, and wildfire hazard mapping lagging even further behind. This lack of comprehensive hazard information forces provincial and municipal governments to make critical housing development decisions based on incomplete and inaccurate data.

The gaps in mapping also hinder the implementation of provincial and territorial policies for avoiding or mitigating hazards, where they exist. Even when updated hazard information exists, it is frequently overlooked or inaccessible to governments, developers, homebuyers, and renters when making housing choices, leading to missed opportunities to avoid participating in risky development. This information gap is a major factor contributing to the ongoing construction of risky housing in Canada, and jeopardizes the safety and security of millions of households.

Municipal governments and the public contend with insufficient flood and wildfire risk information

Much of Canada's existing flood mapping was created under the now-defunct Flood Damage Reduction Program, a collaborative initiative between the federal and provincial governments that operated between 1975 and 1999. These outdated maps do not cover many populated areas and fail to account for recent changes in climate patterns, land use, and the projected future impacts of climate change. As a result, they potentially underestimate flood risks, contributing to poorly informed decisions about development in high-hazard areas.

Consequently, municipalities often face the difficult task of making development decisions using inaccurate maps or without any mapping at all. Efforts by municipalities to create their own maps are often hindered by a lack of technical expertise, insufficient funds for consultants, and complicated provincial or territorial government approval processes.

Moreover, many local governments may be politically hesitant to publish or update flood and wildfire hazard maps. Publicizing such risks can lead to decreased property values and slower development in high-hazard areas. Local officials, particularly those already under pressure to increase housing supply, may fear economic and political fallout. There are also concerns about liability: if a municipality approves development in an area later proven to be at high risk, it could face legal challenges. These factors can create a form of political paralysis that prevents municipalities from fully committing to the development or publication of hazard maps (Hino and Burke 2021).

The federal government has made some recent progress on addressing these gaps through the Flood Hazard Identification and Mapping Program, through which it partners with provincial and territorial governments to update flood hazard maps. However, the program currently lacks the necessary funding and scope to quickly and comprehensively expand flood mapping nationwide.

Private risk analytics companies, such as Fathom, have developed valuable flood hazard data, but the cost of these services often puts them out of reach for municipalities or private citizens. Insurers and institutional investors, who can afford these maps, use them to assess risk when deciding where to invest or who to insure. However, municipalities, homeowners, and homebuyers, as well as smaller-scale developers, typically lack access to this information, rendering them less equipped to make informed decisions.

The situation is even worse for wildfire hazard mapping. There is no standardized methodology in Canada for mapping wildfire hazards and assessing wildfire risk to housing and communities. Where modelling tools do exist, they vary widely, and wildfire hazard data remains incomplete, particularly in northern Canada (Johnston et al. 2020; Public Safety Canada 2024b). Most existing maps do not account for future climate projections, further limiting their utility for long-term planning (Johnston et al. 2020). Moreover, maps are not available in user-friendly formats, making it difficult for municipal governments and the public to use them effectively for risk-reduction efforts.

Box 10

Types of flood hazard mapping and their uses

Flood hazard maps vary in accuracy and scope depending on their purpose. Engineering-level flood mapping is highly detailed and often used for property-level decisions. It requires significant time, effort, and resources, involving hydraulic models, surveys, and site-specific data to assess flood risk at the individual property scale. Typically, local governments and developers commission this type of mapping to inform decisions about development, zoning, and flood defences. Once created, engineered maps generally become public and accessible to all.

In contrast, broad-scale flood maps produced by private risk analytic firms (such as Fathom), estimate flood hazard extents across entire regions or countries. These maps rely on large-scale hydrodynamic models that incorporate global datasets, such as topography, precipitation, and river flow, but with less granular accuracy. While these models provide useful insights into flood risk patterns, they are less accurate at the property level due to lower resolution and generalized assumptions. These maps are often used by governments, insurers, and researchers to understand flood risk trends and to assess broader flood risk exposure. Unlike engineering-level maps, broad-scale flood maps are typically proprietary and must be purchased, often at a substantial cost.

The key trade-off is between precision and scalability: engineering-level mapping is slow and expensive but highly accurate, whereas national-scale models are faster and cheaper but have limitations in their ability to pinpoint risk for individual properties. Engineering-level mapping is ideal for helping municipalities and individuals make final decisions about where to build and buy housing, but it is often not available in Canada. In such cases, broad-scale flood maps could give municipal planners and prospective purchasers insight into whether they should investigate flood risks further, but the high cost of accessing this information limits its availability.

Lack of public access to hazard information leaves other housing stakeholders—notably homebuyers—uninformed

Public awareness of flood and wildfire risk is a significant challenge across Canada: the vast majority of Canadians are unaware of the level of risk their property faces and believe that they live in a lower-risk area than is actually the case (Ziolecki et al. 2020; Ipsos 2021). The lack of available and publicly accessible hazard information contributes to this challenge, as does a lack of disclosure rules.

Even when flood and wildfire maps are publicly available, they are often difficult to access and interpret (Lyle et al. 2024). Governments may publish maps online, but these are frequently difficult to find and obscured in technical formats that require specialized knowledge to understand. As a result, individuals lack crucial insight into flood risk when purchasing homes. Inconsistencies between maps produced by different orders of government further complicate understanding and decision making (Golnaraghi et al. 2020).

Most provincial and territorial governments do not require sellers or developers to disclose whether homes and properties are in flood or wildfire hazard areas, or have been affected by such events. Most provincial governments that acknowledge the importance of disclosure rely on limited, often voluntary disclosure guidelines which typically only ask about past damage and not potential or future risks (Government of Manitoba n.d.; British Columbia Real Estate Association n.d.). In addition, Canadian sellers are generally required to disclose conditions that are relevant to a buyer's purchase decision, though this obligation is weaker than the requirements to disclose specific aspects of a property's risk and damage history that are seen in other jurisdictions (Henstra 2022). As a result of this lack of information and disclosure, these risks aren't priced into property prices, and consumers do not account for them, resulting in suboptimal decisions that put them at greater risk.

Opportunities

A good policy framework can shift new housing to safer ground

Policies governing land use, housing, and infrastructure can play a crucial role in ensuring that new housing development is safe from flooding and wildfires. This section highlights effective policies and practices for achieving this goal and for addressing the limitations of existing policies discussed in the previous section, both from Canada and from peer industrialized nations that face similar wildfire and flood hazards.

5.1 National and regional land use policies to reduce development in hazardous areas

Robust land use policies are an effective and cost-effective means to reduce climate risks facing new housing development, by eliminating or reducing exposure to hazards in the first place, rather than attempting to deal with the outcomes of housing being built in hazardous areas (see Box 5). Establishing land use policies at the provincial and territorial or national level can ensure consistency in flood and wildfire risk prevention, limit the financial, technical, and political burden on municipalities to chart their own policy course, and lay out clear rules for developers and real estate investors.

In the Canadian context, the robustness of land use policies addressing flood and wildfire risk vary significantly across provinces and territories, as discussed in Section 4. Some Canadian jurisdictions have developed policies that are proving effective in reducing risk. For instance, Saskatchewan has regulated flood hazard areas since 2012, prohibiting new construction in high-hazard zones and requiring municipalities to address climate change impacts in their planning. The provincial government enforces this requirement through the review and approval of official community plans, zoning by-laws, and amendments.

Newfoundland and Labrador similarly limits development in flood-prone areas. The province prohibits residential development in floodways and non-designated floodplains, and imposes strict conditions in lower-hazard areas. Post-flood reconstruction in flood hazard areas is tightly regulated and Crown land in flood hazard zones may not be released for development.

In Ontario, 36 regional Conservation Authorities regulate development with powers delegated by the province, typically restricting new construction. Local governments are required to align their official community plans with provincial policies, which prohibit development in flood hazard zones. Ontario's stringent regulations have reduced flood risk for decades, as evidenced by the province's much smaller flood damages compared to Michigan—which did not restrict development in floodplains—during a series of extreme rainfall events in 1986 that affected both jurisdictions (Brown et al. 1997).

Quebec's experience with severe flooding in 2017 and 2019 spurred the introduction of temporary province-wide regulations to restrict development in high-hazard zones and prohibit the reconstruction of severely damaged homes in high-hazard areas while permanent rules are being developed (Government of Quebec 2024).

Internationally, some countries have taken a strong and consistent approach to regulating development in high-hazard areas, at either the national or subnational level. For example, France has robust land use policies to mitigate flood risks, including national regulations for flood-prone areas that require local governments to prohibit construction in high-hazard flood zones. The national government also develops flood hazard maps and defines regulatory flood zones, and makes these public, including to potential homebuyers. Similarly, Spain amended its Water Act to regulate development in flood hazard areas, generally prohibiting new development within 1:100-year flood zones in undeveloped areas and imposing strict floodproofing conditions on development within 1:500-year flood zones, providing clear guidance for evaluating development proposals and legal certainty about where development can occur (Government of Spain 2016; European Commission 2021).

In response to growing wildfire risks, governments worldwide are increasingly adopting land use policies to reduce the exposure of new housing. Land use planning for wildfire is well-established in parts of the U.S. and Australia, where development in wildfire-prone areas is typically regulated, hazard maps are readily available, and development is subject to a range of requirements, including fireproofing and wildfire mitigation plans. Studies from the U.S. and Australia show that restrictions and conditions on development in wildfire-prone areas significantly reduce the likelihood of homes burning during wildfires, and also substantially reduce firefighting costs (Gude et al. 2013; Clark et al. 2016; Syphard et al. 2013; Alexandre et al. 2016; Browne et al. 2015; Holland et al. 2012; Paveglio et al. 2013).

France and Portugal have similarly strong policies to mitigate wildfire risks by prohibiting development in high-hazard areas.[17] In France, regional governments work with municipalities to map wildfire hazard zones, and require municipal

17 - France and Portugal have unitary forms of government that allow for the establishment of national-level land use policies.

governments to restrict development in areas of greatest wildfire hazard unless the risk can be adequately reduced via structural measures (Kocher et al. 2017; French Ministry of Ecological Transition 2024). Portugal's national government prohibits new home construction in high wildfire hazard zones, with very limited exceptions (Government of Portugal 2021; ICNF 2023).

Canada lacks strong policies for development in wildfire-prone areas, but there are signs of progress in British Columbia and Ontario, where provincial governments have introduced optional guidelines to assist municipalities. In British Columbia, over 15 communities have enacted bylaws to regulate new residential construction in high-hazard areas, though enforcement and effectiveness vary (Kovacs 2018). Ontario provides municipalities with technical guidelines for reducing wildfire risk through land use planning, including directing development to low-hazard areas and managing vegetation to mitigate risk. The guidelines also recommend that local authorities deny development applications where risks cannot be adequately mitigated (Government of Ontario 2017).

5.2 Integrating hazard awareness into housing and infrastructure programs

Failing to integrate hazard awareness into housing and infrastructure programs can lead to funding that supports development in high-hazard areas, resulting in unnecessary losses. Globally, public infrastructure planners and decision-makers are increasingly factoring climate risks into their choices to ensure housing and infrastructure are built in safer locations. This includes establishing criteria for funding programs that direct development away from areas vulnerable to flooding, wildfires, and other climate hazards (OECD 2024).

In Canada, Ontario requires funded projects to be compatible with the Provincial Policy Statement's (PPS) goals of avoiding development in flood-prone or other high-hazard areas (Government of Ontario 2020, 2024). Municipal infrastructure projects funded by the province must be aligned with PPS objectives to protect health and safety from natural hazards and support emergency management, and their potential vulnerabilities to climate hazards must be assessed (Government of Ontario 2015). In addition, Nova Scotia recently announced that municipalities will soon need to consider coastal flooding and erosion hazards to qualify for provincial infrastructure funding (Government of Nova Scotia 2024).

Internationally, New Zealand offers an example of how to consider climate hazards in infrastructure funding decisions. Its national adaptation plan commits to accounting for flood, wildfire, and other climate risks in infrastructure planning and investment decisions. Meanwhile, the national government is revising its funding programs for urban development to direct investments to safer areas and is creating a framework for public housing to ensure new dwellings are situated in safe areas (Government of New Zealand 2022).

5.3 Designing disaster assistance and insurance programs to minimize moral hazard

Globally, there is a growing consensus among researchers and policy makers that disaster assistance programs should discourage development in hazard-prone areas and promote a shift towards risk-based models such as insurance programs. Countries that adopt strategies that discourage risky development with conditional post-disaster aid are better equipped to ensure that new developments do not contribute to future disasters (OECD 2015).

In Canada, the challenge of moral hazard in disaster assistance programs remains (see Section 4.3). The perception that government assistance will be readily available incentivizes risky development and real-estate decisions, exacerbating long-term financial and safety risks. Encouragingly, some governments have begun implementing policies that help address this issue. The federal Disaster Financial Assistance Arrangements (DFAA) is introducing

conditions aimed at promoting flood risk avoidance and mitigation (Public Safety Canada 2024a). Under these new conditions, newly built homes in high-risk flood areas must be protected to at least a 1:200-year flood level through adequate flood infrastructure or other measures to qualify for disaster aid.

Quebec and Alberta have also implemented measures to restrict disaster assistance for new developments in hazard-prone areas, incentivizing development away from hazard areas and relocation rather than repeated rebuilding. Quebec now excludes homes built in 1:20-year flood zones from disaster aid eligibility, and caps disaster assistance at $162,500 per home or 50 per cent of the cost to build a new home, whichever is less (Government of Quebec 2023a). Alberta limits disaster assistance to a one-time payment per property, limits the payout to $500,000, and publicly lists homes that receive assistance as ineligible for future aid (Government of Alberta 2023b). In addition, under Alberta's Water Act, new municipal infrastructure built in provincially identified flood hazard areas may not qualify for disaster assistance programs (Government of Alberta 2024b). Newfoundland and Labrador, the Northwest Territories, and Prince Edward Island have recently updated their disaster assistance policies to discourage development in flood hazard areas by excluding homes built in designated flood zones after a certain date from receiving aid (Government of Newfoundland and Labrador 2020; Government of Northwest Territories 2022; Government of Prince Edward Island 2022).

Internationally, the UK's Flood Re program provides a model for flood disaster assistance through public flood insurance that minimizes moral hazard (Flood Re 2018). The program makes flood insurance affordable for homeowners in flood-prone areas but excludes homes built after 2009, actively discouraging new development in flood hazard zones. Additionally, the program is set to phase out national government subsidies by 2039, transitioning to risk-based premium pricing that will incentivize homeowners to relocate or invest in mitigation.

5.4 Improving access to hazard information and ensuring disclosure

Developing publicly accessible hazard information, especially when used in planning decisions and real estate transactions, is a crucial tool for informing prospective homebuyers and encouraging development in safer areas. Evidence shows that clear hazard information and disclosure of climate risks—such as flood risk scores on real-estate listings—can influence buyer behaviour, prompting a preference for lower-risk homes (Fairweather et al. 2023; Lyle et al. 2024).

In Canada, the federal government has committed to improving climate risk awareness through its National Adaptation Strategy, including funding new flood hazard mapping via the Flood Hazard Identification and Mapping Program (Environment and Climate Change Canada 2023; Natural Resources Canada 2024b). The government has also pledged to create a publicly accessible flood exposure online portal by 2026 (Department of Finance Canada 2023). However, while the program announcements are encouraging, progress on flood mapping has been slow and limited relative to the scale of the need nationwide, and there have been no updates on the online portal.

Some provinces have implemented programs to improve access to hazard information. Prince Edward Island offers a Climate Hazard and Risk Information System with an interactive map showing community and property exposure to inland and coastal flooding. P.E.I. also provides free Coastal Hazard Assessments showing property vulnerability to coastal flooding and erosion (Government of Prince Edward Island 2024). New Brunswick's Flooding Hazard Map Viewer allows users to see the history of flooding and future flood risk at a property level (Government of New Brunswick n.d.). In Saskatchewan, the Water Security Agency offers information about water levels and past flood events to development applicants free of charge, where that information is available (Saskatchewan Water Security Agency 2022, 2023).

While wildfire hazard mapping in Canada lags far behind flood mapping efforts, some municipalities, like the District of North Vancouver, B.C. have developed their own wildfire hazard maps to guide land use planning (District of North Vancouver 2024). Researchers at the Canadian Forest Service have also

developed national wildfire models (used in our analysis of wildfire risk) that may be refined in future to develop detailed hazard maps (Erni et al. 2024).

Other countries have made significantly more progress in flood, wildfire and other climate hazard mapping. In the U.S., California and Oregon have comprehensive wildfire hazard mapping programs that provide information to residents, municipalities, and state agencies (Office of the State Fire Marshal of California 2023; Oregon State University 2024). In Europe, the Netherlands has implemented the National Information System for Water and Floods, a unified flood risk mapping system that compiles data from local and national authorities and provides insight into risk for different scenarios, including the failure of flood protection infrastructure (Government of the Netherlands n.d., European Commission 2021).

Although most Canadian provinces do not require developers or sellers to disclose flood or wildfire risk, Quebec is a notable exception, legally mandating sellers to disclose flood risk by indicating whether a property is in a flood zone and if it has previously sustained water damage (OACIQ 2022). The province also requires a location certificate provided by a surveyor indicating whether a property is in a flood zone, and details of any applicable municipal restrictions (Government of Quebec 2023b). The federal government announced it would create a Climate Adaptation Home Rating Program in 2021 aimed at helping homeowners assess and improve the climate resilience of their properties and create resilience ratings to inform real estate transactions (Office of the Prime Minister of Canada 2021). This program is still under development, with no recent updates. The Canadian Council of Insurance Regulators has recommended that insurers provide property-specific hazard information during the sale and renewal of home insurance policies as a key opportunity to enhance Canadians' understanding of risk to their home or property—including at the point of sale—but provincial insurance regulators have not yet implemented such a requirement (CCIR 2024).

Climate risk disclosure for real estate is more comprehensive in many other nations. In the U.S., states like Florida, New Jersey, Oregon, and South Carolina, as well as European countries such as France and the U.K., have more robust systems for disclosing flood and wildfire risk (Government of Florida 2024; Government of France 2024a, 2024b; Government of New Jersey 2023; South Carolina Department of Labor, Licensing and Regulation 2023; Government of New York 2023a; Texas Real Estate Commission 2023; Louisiana Real Estate Commission 2023; Mississippi Real Estate Commission 2023; Government of Oklahoma 2023; The Law Society 2020; California Department of Forestry and Fire Protection 2019; Government of Oregon 2021; Government of California 2019). Disclosure requirements vary but often include a property's history of

damages, insurance claims, disaster compensation, resilience retrofits, and whether it is located in a known hazard zone.

While hazard mapping and disclosure are essential tools for increasing public awareness and reducing exposure to risks, they can have unintended consequences for equity-deserving groups. Many such populations may face barriers accessing or utilizing hazard maps, leaving them more likely to purchase or rent high-risk homes (Lyle et al. 2024). Experts recommend that governments ensure hazard maps are accessible and presented in plain language, and that risk disclosure be extended to rental transactions, as equity-deserving populations are more likely to be renters (Lyle et al. 2024; Dundon and Camp 2021). In the U.S., New York and New Jersey now require landlords to disclose flood risks to renters (Government of New York 2023b; Government of New Jersey 2023), and France has introduced similar requirements for wildfire risk (Government of France 2024c).

Box 11

Climate-resilient housing in Indigenous communities: Barriers and opportunities

Indigenous communities face unique challenges and barriers in developing climate-resilient housing. We commissioned a standalone report, Indigenous Housing and Climate Resilience, by Shared Value Solutions, which highlights the severe housing shortage in Indigenous communities and the unique challenges in building housing in communities that is safe, affordable, and climate-resilient. Some themes from this report are highlighted here.

Homes in Indigenous communities, particularly on First Nations reserves, are disproportionately exposed to climate hazards, including floods and wildfires. These homes are expensive to build and maintain, especially in remote areas, and there is limited access to developable land that is safe from climate hazards. Since neither First Nations bands, nor their individual members, hold title to reserve land, accessing conventional mortgages is difficult, further constraining the housing supply. This crisis is rooted in colonial policies, including forced relocations to substandard lands and the creation of small reserves, which have severely constrained the choices of Indigenous communities about where and how to build homes.

Historically, the federal government exerted significant control over land use and housing decisions on reserves, but First Nations have gradually regained greater authority to oversee the development, allocation, and maintenance of reserve housing. However, Shared Value Solutions' report identifies significant funding and capacity challenges that First Nations communities face in planning and constructing resilient housing. Available funding is often unpredictable, difficult to obtain, and frequently aligned with the priorities of funders rather than the needs of the communities.

Given the pressing demand for new housing and infrastructure, many communities face tough decisions between the quantity and quality of housing. The lack of accessible, accurate information and data necessary for effective land use planning—already a challenge for many local governments—is particularly acute for Indigenous communities. These issues collectively hinder the ability of Indigenous communities to engage in land use planning that effectively reduces housing exposure to climate hazards.

Despite these challenges, the report highlights numerous examples of Indigenous communities successfully navigating such barriers. Many have leveraged Indigenous knowledge in land use planning, engaged in cultural burning practices to mitigate wildfire risk, and co-created effective training and capacity-building programs. Shared Value Solutions offers several recommendations based on their research, aimed primarily at federal, provincial, and territorial governments. These include improving coordination among different orders of government, enhancing the availability and use of hazard information, building local capacity, and reforming infrastructure funding models.

Moving Forward

Better policy can make new housing safer and more affordable

Our analysis shows that Canadian federal, provincial, and territorial governments can accelerate housing development to help restore affordability while ensuring that nearly all new homes are built in safe areas. By improving land use policies and addressing related policy gaps, governments can boost housing supply without increasing exposure to floods and wildfires. In this section, we present key conclusions from our modelling and policy review, offering recommendations for how governments can increase housing supply while minimizing the flooding and wildfire risk.

6.1 Conclusions

Our results confirm that accelerating housing construction under existing land use policies and development plans will cause many more risky homes to be built, making housing less safe and more costly in the long run, and leaving households, governments, and ultimately all Canadians on the hook for ballooning costs to repair damaged homes and communities. However, our analysis also suggests that policy change can shift development away from the highest-hazard areas without adversely affecting the supply of new housing.

Conclusion 1

Damages to new housing from flooding and wildfire are on track to cost households and governments billions

Our analysis reveals a disturbing trend: under current local and regional housing and urban development plans, Canada is likely to build hundreds of thousands of new homes in areas at high risk of flooding and wildfires. Our modelling projects that, out of the 5.8 million homes targeted for construction by 2030, about 3 per cent (over 150,000 homes) could be situated in zones of very high flood hazard, while nearly 4 per cent (over 220,000 homes) could be built in municipalities with significant wildfire risk.

The economic implications of these development patterns are severe. Our results suggest that continued construction of high-

risk housing could lead to an increase in average annual flood-related losses of $340 million by 2030, or nearly $2 billion in a worst-case, undefended scenario. Wildfire-related housing damages could escalate by $1.1 billion annually. In British Columbia alone, the financial risk from new housing in flood and wildfire hazard zones could surpass $2 billion per year, with several municipalities facing losses in the hundreds of millions annually. Such large and unpredictable disaster costs would put enormous strain on municipal budgets, likely requiring funds to be diverted from other essential public services or leading to unsustainable reliance on provincial and federal assistance.

These findings underscore the urgent need for action to prevent further risky housing development. If the status quo continues, the development of millions of new homes across Canada will expose more people and communities to the devastating impacts of climate-related disasters. Instead of improving affordability, this high-risk housing boom will actually increase the cost of living for homeowners and renters facing frequent damage and costly repairs. And all Canadians will pay for these risky housing decisions through ever-rising insurance premiums and tax-funded disaster response and assistance programs.

Conclusion 2

Permissive land use policies allow construction of risky housing

Canada's provincial and territorial government land use policies have gaps that allow housing to be built in hazardous areas, leaving households needlessly vulnerable to climate threats. Most provinces and territories do not directly limit development in flood and wildfire zones, leaving the responsibility to municipalities. However, municipalities often lack the capacity, resources, and authority to effectively minimize risky development. Moreover, political and financial pressures frequently push municipal governments to approve development, even when long-term safety and financial stability are at risk.

Our findings indicate that strong land use policies correlate with lower risk to current and future housing. Provinces like Ontario and Saskatchewan, which have adopted stricter land use regimes that prohibit development in high-flood hazard areas and set conservative risk thresholds, show lower flood losses. Our modelling estimates that existing housing in these

provinces incurs smaller losses per home compared to most other provinces. And without policy changes, the damages per new home built in provinces with more permissive policies, like Alberta, British Columbia, and Quebec, are projected to be significantly higher than in Ontario and Saskatchewan.

Even in provinces and territories that have adopted more direct roles in land use planning, their policies often fall short in effectiveness. Some provincial governments set risk thresholds that allow housing in areas where significant hazards still exist, such as places beyond riverbanks that are still subject to fast, damaging river flows during severe floods. Additionally, many provincial governments permit development in high-hazard zones that relies on structural protections like large dikes around communities or floodwalls for individual homes—measures that can fail during extreme events or if maintenance is insufficient. Furthermore, most provincial and territorial governments do not have adequate systems in place to track or enforce whether municipalities are adhering to these land use policies, which can lead to inconsistent implementation.

Conclusion 3

Steering development away from high-hazard areas can dramatically reduce losses without limiting housing growth

Our analysis projects that future flood and wildfire risk in Canada will be concentrated in a relatively small number of homes built in the most hazardous areas. For flooding, the riskiest 3 per cent of new developments located in flood hazard zones represents up to 78 per cent of the potential flood-related financial losses associated with new housing construction. Similarly, our wildfire analysis projects that 92 per cent of potential wildfire-related financial losses will be concentrated in just 20 municipalities.

This concentration of risk in a small number of homes underscores the importance of targeted land use policy that shifts development from the most hazardous areas to lower-hazard locations wherever possible. By steering the development of a relatively small number of homes away from the most hazardous areas, governments can significantly reduce flood and wildfire risk without impacting the overall supply of new housing. For example, redirecting the 3% of homes projected to be built in the highest flood-hazard zones to ample safer land could reduce the overall flood risk to new housing

by nearly 80%. While our wildfire modelling does not support similar precise estimates, the projected concentration of wildfire damage in a small number of communities suggests a similar opportunity to avoid creating new housing risks.

While limiting development in hazard zones may not significantly impact national or provincial housing supply, it could affect communities where a large portion of the land is in high-hazard areas. In such cases, provincial, territorial, and municipal governments must manage housing growth responsibly by directing development to safer areas, either by intensifying housing in existing low-hazard zones in the community or by shifting development to other, lower-risk regions.

Conclusion 4

Other policy gaps also drive unsafe housing development when land use policies are permissive

In the presence of permissive land use policies, gaps and misalignments in other policy areas exacerbate risk. Federal, provincial, and territorial housing initiatives often focus on increasing housing supply rapidly, without adequately accounting for the risks posed by flooding and wildfires. Programs like the Housing Accelerator Fund, which sets aggressive housing growth targets for municipalities, may push local governments to prioritize quantity over safety, leading to rushed decisions that place new housing in high-hazard areas. Though some housing programs encourage climate-resilient development, they lack enforceable mechanisms to ensure that municipalities avoid flood and wildfire hazard zones, inadvertently increasing future risks for households, and communities.

Infrastructure funding programs are similarly misaligned. These programs, which fund critical infrastructure like roads, sewers, and water systems, often fail to consider how the placement of infrastructure may enable development in hazard zones. While tools like the federal Climate Lens assess the resilience of infrastructure itself, they do not adequately address whether the infrastructure will facilitate housing in climate-exposed locations.

Many disaster assistance programs create a moral hazard, leading to a reliance on post-disaster recovery, rather than proactive risk avoidance, and weakening the incentive for

municipalities and homebuyers to avoid hazardous areas. Though the federal government and some provinces have introduced compensation limits or denied support for some homes built in designated flood zones or without appropriate fire insurance, new homes built in areas of known hazard are still eligible for disaster aid in many parts of the country. Even where disaster assistance criteria make new homes ineligible, the rules are often not widely enforced or communicated, reducing their effectiveness as a deterrent.

Conclusion 5

A lack of information about climate risk hampers smarter housing decisions

Inadequate, outdated, and inaccessible flood and wildfire hazard maps prevent informed housing and development decisions in Canada. Many existing flood maps, created decades ago, no longer reflect current climate conditions or future risks. Wildfire mapping is even more limited, with no standardized approach and significant gaps in identifying high-hazard areas. Even when hazard maps are available, they are often difficult to access or interpret, and expensive, private-sector data remains out of reach for many. These deficiencies leave municipalities, developers, and homebuyers without critical information, leading to decisions that put new homes in harm's way.

Furthermore, most provincial and territorial governments do not require mandatory hazard disclosure in real estate transactions. Without this, and in the frequent absence of publicly accessible mapping, homebuyers and renters are left in the dark regarding flood or wildfire risks when purchasing or leasing homes, and so may unknowingly find themselves living in high-hazard areas.

6.2 Recommendations

The costs of building new homes in the wrong places can be avoided if governments implement policies that align incentives for municipalities, developers, and homebuyers. We recommend five policy changes for federal, provincial, and territorial governments to address gaps in existing policies, enabling new housing construction while steering development out of harm's way. In addition, Shared Value Solutions' report, Indigenous Housing and Climate Resilience, offers recommendations to address challenges associated with building climate-safe housing in Indigenous communities.

There will be some costs associated with these measures—administrative and enforcement expenses, as well as the opportunity costs of limiting development on certain lands. However, these costs are miniscule compared to the prospect of governments and households accruing billions of dollars in losses, year after year, from continuing with status quo development. Evidence from other countries shows that policies guiding development away from hazardous areas are far more cost-effective than waiting for disasters to strike and then paying for the damage. While definitive evidence for Canada is still emerging, the enormous costs of recent floods and wildfires that have devastated homes and communities strongly suggest that such policies will prove as cost-effective in Canada as they've been shown to be elsewhere.

To keep new housing safe from flooding and wildfire hazards, governments should take a coordinated approach that strengthens land use policies while addressing other policy gaps to better align financial incentives, reduce moral hazard, and enable informed housing decisions. This approach is crucial because the main task of strengthening land use policies may take time, leaving a critical period where other policy gaps may still enable risky development—especially given the current political emphasis on rapidly increasing housing supply to improve affordability. Moreover, land use policies will continually face opposition from those focussed on short-term gains rather than long-term safety and affordability. Enforcement of these policies is already a challenge. By strengthening other housing-related policies outlined here to identify, address, and communicate climate risks, governments can further relieve the pressure to build homes in hazard zones, even as land use regulations are improved.

Our recommendations are as follows:

Recommendation 7

Federal, provincial, and territorial governments should steer housing and infrastructure investment to low-hazard areas and away from high-hazard zones

The federal government and provincial and territorial governments can increase housing supply to meet affordability goals by encouraging construction in safer areas and discouraging development in risky places. To do so, the federal government should broaden screening measures for the Housing Accelerator Fund and for federal infrastructure funding programs, ensuring that funds are awarded to projects that develop housing or enable development away from high-hazard areas. Provincial and territorial governments should similarly implement screening processes for their housing and infrastructure programs to ensure public funds are used for construction away from flood- and wildfire-prone areas.

Recognizing that most municipalities lack the necessary resources to fully assess climate hazards and that many regions of Canada do not have accessible, up-to-date flood and wildfire hazard data, the federal government, in coordination with provinces and territories, should immediately develop and provide interim hazard screening maps. These maps should serve as an initial tool until more detailed information becomes available. Where more granular, project-specific risk assessments are required for funding decisions, governments should provide applicants with the funding and resources needed to conduct these analyses.

Provincial and territorial governments should also revise policies that incentivize or mandate municipalities to increase housing supply to ensure they prioritize development in low-hazard areas, such as funding that is conditional on meeting targets for housing starts. They should also introduce tailored targets or exceptions for municipalities with limited low-hazard land available for development. At a broader scale, provincial and territorial governments should integrate flood and wildfire hazards into their decisions about where to allocate population and housing growth, concentrating on areas with lower hazard exposure wherever possible.

Recommendation 2

Provincial and territorial governments should strengthen land use policies to direct new housing away from high-hazard zones

Provincial and territorial governments should urgently establish or strengthen policies that shift development away from high-hazard flood and wildfire zones with explicit criteria that restrict housing development in the most hazardous areas. This is particularly critical in provinces with high hazard exposure, population growth, and permissive policies that could drive large-scale construction in risky areas. Strong provincial and territorial land use policies will create a consistent approach across municipalities, reducing the burden on local governments to make independent decisions about housing risk. It also alleviates local political and financial pressures that might prioritize short-term economic gains over long-term safety and affordability.

Effective land use policy also supports equity by preventing the creation of new high-risk housing that is likely to become devalued, potentially leading to risk-based segregation and concentration of economically marginalized populations in hazardous areas.

Federal, provincial, and territorial governments should work together to establish stringent, nationally consistent flood risk standards for riverine and coastal areas. These standards should define high and moderate flood hazard zones, which may vary regionally but could include thresholds frequently used in many areas, such as 1:100-year flood zones for high-hazard areas and 1:500-year flood zones for moderate-hazard areas. In high-hazard areas, development should generally be prohibited, whereas in moderate-hazard areas, development may only proceed if supported by structural flood protection. Provincial and territorial governments, which already have the legislative authority, should use these standards as a baseline and strengthen regulations to prohibit development in high-hazard areas while requiring protective measures in moderate hazard zones. Municipalities should also have the authority to implement stricter bylaws as needed.

Provincial and territorial governments should strengthen regulations to limit new housing developments in high-flood hazard areas that rely solely on structural flood protection, as these measures cannot be fully relied upon—particularly with the increasing risks posed by climate change.

In provinces and territories with significant wildfire risks, governments should strengthen land use regulations to mandate community and household risk mitigation measures, such as FireSmart practices, in high- and moderate-hazard zones. Municipalities should also be empowered to adopt additional requirements beyond provincial or territorial standards. Moreover, provinces and territories should define extreme wildfire hazard zones where typical risk-mitigation measures like FireSmart practices cannot sufficiently protect communities and amend land use regulations to limit development in those areas or require community-level wildfire risk-reduction measures such as permanent firebreaks and landscape-scale vegetation management.

Finally, provincial and territorial governments should review community plans to ensure compliance with land use regulations, including at the zoning and building approval stages. These reviews can occur without causing development delays, as most provincial and territorial governments already have oversight systems in place for community planning.

Recommendation 3

Federal, provincial, and territorial governments should reform disaster assistance programs to deter risky development

Federal, provincial, and territorial governments must update disaster assistance program rules to deter moral hazard and discourage risky development. Disaster assistance should generally not be available for new housing built in designated high-hazard areas. This would send a clear message to municipalities, prospective homeowners, and real estate investors that these areas are unsuitable for development, and that government support will not repeatedly cover losses from risky housing decisions.

In exceptional cases where provincial, territorial, or municipal governments must approve new housing in high-hazard zones, the federal government, along with provincial and territorial counterparts, should set strict standards in disaster assistance programs for risk mitigation and protection. Eligibility for disaster assistance in these cases should depend on meeting these high standards, with verification both initially and on an ongoing basis to ensure compliance.

To avoid repetitive cycles of destruction and rebuilding for existing homes, disaster assistance programs should also limit the total aid available per property over time. Federal, provincial, and territorial governments should provide incentives and support for homeowners to relocate to safer areas, as well as to invest in floodproofing and wildfire risk-reduction measures for homes in moderate-risk areas where feasible.

The federal government should apply similar principles in the forthcoming federal public flood insurance program to discourage new construction in flood-prone areas. Insurance coverage should be limited to homes built before the program's implementation, capping the pool of insured properties, and clearly signalling that new development in high-hazard zones will not be covered. The program should also gradually introduce risk-based premiums that reflect the true cost of living in high-hazard areas, raising awareness among homeowners and prospective buyers about the financial risks and encouraging homeowners to adopt mitigation measures or eventually relocate (Florez Bossio and Ness 2024).

Federal, provincial, and territorial governments should also improve communication about the criteria and conditions for public disaster assistance and insurance programs, which have historically been unclear and difficult to access. Clear and transparent guidelines are essential for ensuring that homebuyers, municipalities and developers understand the limitations of both disaster assistance and the associated financial liability, helping them make informed decisions about building, purchasing, or mitigating properties in hazard zones.

Recommendation 4

Federal, provincial, and territorial governments should urgently update hazard information and mandate its disclosure in real estate transactions

The federal government and provincial and territorial governments should collaborate to more rapidly develop and disseminate accurate, up-to-date flood and wildfire hazard maps to inform the building wave of housing development. The ongoing Flood Hazard Information and Mapping Program demonstrates the potential of such collaboration, but needs to be dramatically accelerated, while a similar effort for wildfire hazard mapping needs to be initiated (Natural Resources Canada 2024b). Governments must also ensure that any new hazard mapping reflects the projected impacts of climate change, given its significant influence on future flood and wildfire risks. These maps should be updated regularly to account for the latest climate models and other advances in climate science. And while detailed hazard maps are being developed, federal, provincial, and territorial governments should jointly acquire large-scale flood and wildfire hazard mapping from private risk analytics firms and make it broadly available to inform housing policies and decisions in the interim.

Federal, provincial, and territorial governments should make all flood and wildfire hazard information freely and easily accessible to municipalities and the public. Provincial and territorial governments should follow the lead of provinces like Prince Edward Island and New Brunswick, which have created regional portals, while the federal government should expedite the development of the online flood hazard information portal announced in the 2023 Budget, for which no progress has been reported at time of writing. Governments should design information portals and similar tools to ensure equity-deserving populations have the equal access to hazard information they are often denied when making housing decisions.

Provincial and territorial real estate regulators should mandate disclosure of flood and wildfire hazard and risk at key transaction points, for both real estate sales and rentals. To make informed decisions, developers, investors, purchasers, and renters need access to comprehensive information, including historical damage data, insurance and disaster assistance claims, and hazard zone designations. Additionally, provincial insurance regulators should require property insurers to disclose their assessments of property-specific flood and wildfire risk at the point of sale, providing prospective homebuyers with critical insight into potential hazards before finalizing a purchase.

Recommendation 5

The federal government should empower and support Indigenous communities to build climate-resilient homes in safe areas

The federal government should provide increased funding and co-create tools with Indigenous communities to enable them to make informed land use and housing decisions that minimize climate risks to new homes. The report by Shared Value Solutions, Indigenous Housing and Climate Resilience, offers specific recommendations for addressing the unique challenges faced by Indigenous communities, particularly those on First Nations reserves, in building climate-resilient housing. These challenges include finding safe locations for new homes, which is difficult given often-limited access to safe land, and ensuring that the homes are built to withstand climate impacts.

As the report highlights, since provincial and territorial governments do not have jurisdiction over First Nations reserves, the federal government should co-develop flood and wildfire hazard information and improved housing tools with First Nations. This will empower First Nations governments to make informed land use decisions, build local capacity, and reform infrastructure funding models to better meet the unique needs of their communities.

The report also emphasizes that the federal government and provincial and territorial governments should engage collaboratively and across jurisdictions to empower First Nations to proactively plan housing and communities. This includes reforming the often-disconnected federal, provincial, and territorial housing, infrastructure, and land use policies that limit Indigenous governments' options and autonomy. Additionally, the federal government and provincial and territorial governments should prioritize Indigenous knowledge and ensure that it is not only integrated into land use planning for Indigenous communities but is also incorporated into broader planning processes.

Given the severe housing shortage and the limited access to safe land for development on many First Nations reserves and in other Indigenous communities, the federal government should expand funding and provide new resources for flood and wildfire risk mitigation. This includes long-term support for flood- and wildfire-protection infrastructure, and active wildfire fuel management to safeguard new homes that may have no alternative but to build in hazard zones.

Appendix

Land Use Acts, Regulations, and Policies Reviewed by Province or Territory

Alberta

Municipal Government Act (2000)

Flood Recovery and Reconstruction Act (2013)

Safety Codes Act (2000)

Respecting Our Rivers Alberta's Approach to Flood Mitigation (2014)

Stepping Back from Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region (2012)

British Columbia

Local Government Act (2015)

Provincial Policy Manual & Site Standards (2023)

Environmental Management Act (2003)

Flood Hazard Area Land Use Management Guidelines (2018)

Climate Preparedness and Adaptation Strategy: Actions for 2022-2025 (2022)

Manitoba

The Planning Act (2005)

Provincial Planning Regulation (2011)

Water Resources Administration Act (1987)

Designated Flood Area Regulation (2011)

Designated Floodway Fringe Area Regulation (2002)

The Wildfires Act (1997)

New Brunswick

The Community Planning Act (2017)

Statement of Public Interest Regulation (2023) and User Guide (n.d.)

Clean Water Act (1989)

Watercourse and Wetland Alteration Regulations (1990)

Coastal Areas Protection Policy (2019)

Forest Fires Act (2014)

Flood Risk Reduction Strategy (2014)

Our Pathway Towards Decarbonization and Climate Resilience: New Brunswick's Climate Action Plan 2022-2027 (2022)

Newfoundland and Labrador

Urban and Rural Planning Act (2000)

Water Resources Act (2002)

Provincial Policy for Flood Plain Management (1996)

Provincial Land Use Policy (n.d.)

Flood Management Strategy (2022)

Climate Change Action Plan (2019-2024)

Northwest Territories

Community Planning and Development Act (2011)

Northwest Territories Lands Act (2014)

Forest Act (2023)

Community Wildland Fire Protection Plans (multiple dates)

Forest Fire Management Policy (2023)

2030 NWT Climate Change Strategic Framework (n.d.)

2030 NWT Climate Change Strategic Framework, 2019-2023 Action Plan (n.d.)

Nova Scotia

Municipal Government Act (1998)

Statements of Provincial Interest on Flood Risk Areas (2001)

Minimum Planning Requirements Regulations (2019)

Coastal Protection Act (2019)

The Future of Nova Scotia's Coastline (2024)

Environmental Goals and Climate Change Reduction Act (2021)

Our Climate, Our Future: Nova Scotia's Climate Change Plan for Clean Growth (2022)

Nunavut

Planning Act (1988)

Nunavut Land Claims Agreement (1993)

Climate Change Impacts and Adaptation in Nunavut (2011)

Municipal Land Administration Policy (2023)

Ontario

Planning Act (1990)

Provincial Policy Statement (2020 and 2024)

Conservation Authorities Act (1990)

Reg. 41/24: Prohibited Activities, Exemptions, and Permits (2024)

Ontario Flood Strategy (2020)

Fire Protection and Prevention Act (1997)

Emergency Management and Civil Protection Act (1990)

Wildland Fire Risk Assessment and Mitigation Reference Manual in support of Provincial Policy Statement (2014)

Wildland Fire Management Strategy (n.d.)

Prince Edward Island

Planning Act (1988)

Subdivision and Development Regulations (2000)

Province-Wide Minimum Development Standards Regulation (1995)

Environmental Protection Act (1998)

Watercourse and Wetland Protection Regulations (2021)

Building Resilience: Climate Adaptation Plan (2022)

Environmental Protection Order - Shoreline Development (2023)

Quebec

Act Respecting Land Use Planning and Development (1979)

Environment Quality Act (1972)

An Act to Establish a New Development Regime for the Flood Zones of Lakes and Watercourses, to Temporarily Grant Municipalities Powers Enabling Them to Respond to Certain Needs and to Amend Various Provisions (2021)

Regulation Respecting Activities in Wetlands, Bodies of Water and Sensitive Areas (2021)

Regulation Respecting the Temporary Implementation of the Amendments made by Chapter 7 of the Statutes of 2021 in connection with the Management of Flood Risks (2022)

Plan to Protect the Territory Against Flooding: Sustainable Solutions to Better Protect Our Living Environments (2020)

2013-2020 Government Strategy for Climate Change Adaptation (2012)

Saskatchewan

The Planning & Development Act (2007)

Statements of Provincial Interest Regulations and Handbook (2012)

The Water Security Agency Act (2005) The Water Security Agency Act (2005)

The Wildfire Act (2014)

Prairie Resilience: A Made-in-Saskatchewan Climate Change Strategy (2017-2018)

Yukon

Municipal Act (2002)

Area Development Act (2002)

Our Clean Future: A Yukon Strategy for Climate Change, Energy and a Green Economy (2020)

Glossary

AVERAGE ANNUAL LOSS	A measure used to quantify the average expected monetary losses due to hazards, calculated over a range of possible events of varying severities and frequencies. It accounts for both frequent, minor events and rare, catastrophic ones, providing a single value that represents the average cost of damages over time. This metric is particularly useful for insurers, governments, and planners to evaluate long-term financial risk and inform decision-making.
CLIMATE CHANGE	Changes in the climate of the Earth, predominantly caused by the burning of fossil fuels, which add heat-trapping gases to Earth's atmosphere. It manifests as overall global warming but also in sea level rise, melting of previously permanent snow and ice fields, and more extreme weather, among other changes.
CLIMATE HAZARD EXPOSURE	The degree to which housing, infrastructure, or communities are susceptible to damage from climate-related hazards like floods, wildfires, or extreme storms. It reflects the potential risk posed by environmental factors based on the location and characteristics of the area or structure.
CLIMATE-RELATED HAZARD	A natural event influenced by changing climate conditions that poses risks to people, property, or the environment, such as floods, wildfires, droughts, and extreme storms. These hazards are increasingly driven by the impacts of climate change, which can make them more frequent or severe over time.
CLIMATE RESILIENCE	The ability of communities, infrastructure, and ecosystems to withstand, adapt to, and recover from climate-related hazards. Climate resilience can be fostered by planning, preparing, and implementing measures that reduce vulnerability to climate impacts.
CLIMATE RISK DISCLOSURE	The practice of disclosing the risks faced from the physical impacts of climate change and the transition to a low-carbon economy, to encourage preparation for those risks and to help investors make more informed investment decisions.

COASTAL FLOODING	Flooding of normally dry, low-lying land from an adjacent body of water, which is typically the result of high water levels from tides and storm surges or from a combination of high water levels and stormy conditions in which waves and wind drive water onshore. Sea level rise, caused by climate change, will increase coastal flooding in the future.
DISASTER	Severe disruption of the normal functioning of a community or society due to hazardous physical events interacting with conditions of social vulnerability, leading to widespread negative human, material, economic, or environmental effects that require an immediate emergency response and may require external support for recovery.
EXPOSURE	In the context of climate, exposure refers to the presence of something of value—like housing, infrastructure, or communities—in areas where they are susceptible to damage from climate-related hazards like flooding and wildfires. It reflects the degree to which these elements are potentially at risk due to their likelihood of experiencing hazards.
FLOOD RETURN PERIOD	The estimated likelihood of a flood of a given size occurring in a specific location, expressed as a probability (e.g., a 1:100-year flood has a 1 per cent chance of occurring in any given year, while a 1:20-year flood has a 5 per cent chance). It does not guarantee that a flood will happen at regular intervals but instead conveys statistical risk. Flood return periods help guide land use planning and infrastructure design, though their reliability is affected by changing climate conditions.
FIRESMART	A Canadian program that provides guidelines and best practices to reduce the risk of wildfire damage to communities and properties. It emphasizes proactive measures such as vegetation management, fire-resistant building materials, and community planning to improve wildfire resilience.

FLOOD MAPS	Maps that identify areas that are expected to experience periodic coastal or inland flooding. Flood maps or floodplain maps typically show ground elevation contours, the location of buildings and roads, and the horizontal extent of the high-water mark for one or more flood events, such as a 1-in-100-year flood. In Canada, flood maps are typically developed by provincial or municipal governments.
FLOODPLAIN	The low-lying area of land adjacent to a river, stream, or other water body that is prone to flooding during periods of high water flow. Floodplains are formed by the natural processes of sediment deposition and serve important ecological roles, but they can also pose significant risks to communities and infrastructure built within them.
FLOODWAY	The portion of the floodplain including the channel of a river or other watercourse and the adjacent land areas where the most frequent flooding occurs. It typically experiences deeper and faster-moving water compared to other parts of the floodplain. Floodways are often defined using a flood-year standard such as the 1-in-20-year flood zone for regulatory purposes.
HIGH-HAZARD AREA	Areas with a high likelihood of experiencing severe climate-related hazards such as flooding and wildfires. These areas pose significant threats to life, property, and infrastructure, often requiring stringent risk-mitigation measures or development restrictions to minimize potential impacts.
HIGH-RISK DEVELOPMENT	The construction of housing or infrastructure in areas highly exposed to climate-related hazards. If not adequately protected from or resilient to these hazards, these developments face a greater likelihood of adverse impacts, leading to increased risks for residents and potentially greater damage and costs.
INLAND FLOODING	Occurs when precipitation over land accumulates locally or runs off and elevates the water level in rivers, streams, and other inland water bodies. It can manifest as either riverine flooding or pluvial flooding.

MORAL HAZARD	A situation when an individual or organization becomes more inclined to take risks because they do not bear the costs, such as when insurers or governments cover the costs of climate-related disasters.
PLUVIAL FLOODING	Caused when heavy rainfall creates a flood event independent of an overflowing water body. It occurs when intense rain overwhelms urban drainage systems, causing water to flow out into streets and nearby structures, or when intense rain falls on surfaces that are unable to drain or absorb it, causing runoff to pool in low-lying areas.
RELOCATION PROGRAMS	Government-supported initiatives that assist residents in high-hazard areas to move to safer locations. These programs are designed to reduce the long-term risk of damage from natural disasters by moving people out of vulnerable zones.
RISK	In the context of climate, risk refers to the potential for adverse consequences where something of value—such as housing, infrastructure, or community well-being—is at stake and where the outcome is uncertain. It is commonly represented as the probability of climate-related hazards occurring, combined with the severity of their potential impacts. Risk arises from the interaction of climate hazards, vulnerability, exposure, and hazard. In this report, the term risk is used primarily to refer to the risks of impacts related to climate change.
RIVERINE FLOODING	Occurs when the water level in a river or stream rises and overflows onto the surrounding banks, shores, and adjacent land. The severity of a flood is influenced by the amount of rainfall in the catchment area of the river as well as in-stream flow conditions such as ice jams or the operation of human-made dams.
STRUCTURAL FLOOD PROTECTION	Infrastructure such as dikes, levees, or floodwalls that are constructed to protect areas from flooding, or property-level measures like elevating homes or installing flood barriers around individual lots. These measures aim to reduce flood risks by controlling or redirecting floodwaters away from vulnerable areas.

VULNERABILITY	In the context of climate, vulnerability refers to the degree to which something of value—like housing, infrastructure, or a community—is susceptible to, or unable to cope with, the adverse effects of climate-related hazards.
WILDFIRE	Any ignition that burns in wildland areas and consumes natural fuels (trees, brush, grass, etc.). While forest fires are naturally occurring disturbances that contribute to the health and renewal of many forest ecosystems, fires are burning hotter and wilder as the climate warms, causing much greater destruction.
WILDFIRE HAZARD MAPS	Maps that identify areas expected to experience periodic wildfires. These maps are based on factors such as vegetation type, fuel load, topography, and climate conditions, and typically display zones of varying fire risk, fire behaviour potential, and proximity to infrastructure like buildings and roads. In Canada, only a few provinces have developed province-wide wildfire hazard maps, while some local governments have also created maps specific to their communities.
WILDLAND-URBAN INTERFACE (WUI)	The zone where human development meets or intermingles with natural vegetation, making it particularly vulnerable to wildfire. The WUI is a key focus for wildfire risk mitigation due to the potential for fires to spread from wildland to residential areas.

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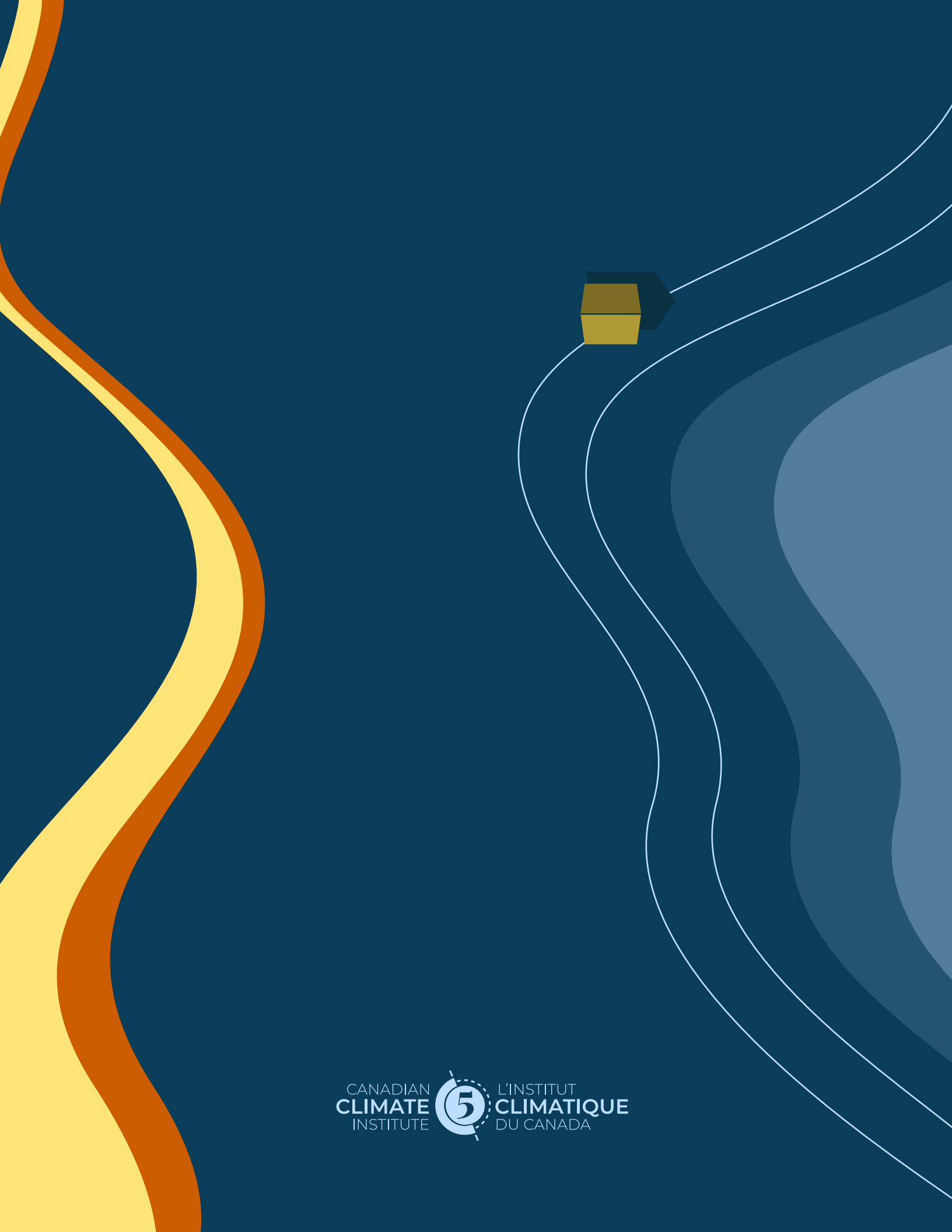

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