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Public relief and insurance for residential flood losses in Canada: Current status and commentary

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Abstract

Flood-affected households in Canada rely on a complex arrangement of public disaster assistance and partial private insurance coverage for flood recovery. Recently, calls have been made for a review of the role of private insurance in residential flood losses; however, there are many challenges associated with the introduction of private flood insurance. Some ways to increase the viability of flood insurance include providing flood coverage for a variety of flood types, limiting coverage for very high-risk households and implementing risk-based coverage. To be effective, flood insurance will further require households, insurers and governments to participate in the reduction of flood risk. Governments and insurers should work toward a national, consistent approach to flood hazard assessment that includes assessment of a variety of flood types that affect households and supports both non-structural flood risk reduction and

of very high-risk households and improve the quality and accessibility of flood loss data. Furthermore, households will have to become better informed of the specifics of insurance coverage and bear a portion of flood losses through risk-based insurance pricing and conditions.

Les ménages affectés par des inondations au Canada doivent compter sur le support d'un réseau d'assistance complexe, complémenté par une couverture d'assurance partielle, afin de recevoir de l'assistance suite à une inondation. Récemment, une demande s'est fait sentir pour une évaluation du rôle que pourraient avoir les assureurs privés en ce qui a trait aux pertes dues aux inondations résidentielles. De nombreux défis sont cependant associés aux couvertures d'assurances contre les pertes dues aux inondations. Une des façons d'accroître la viabilité de l'assurance contre les inondations est d'inclure des couvertures d'assurance couvrant une variété de types d'inondation, de limiter la couverture pour les ménages à très haut risque et de mettre en œuvre une couverture basée sur les niveaux de risques. Afin d'être efficaces, les couvertures d'assurance contre les inondations devront exiger que les ménages, les assureurs et les gouvernements participent à la réduction des risques d'inondations. Les gouvernements devraient également travailler en partenariat avec les assureurs afin de développer une approche nationale cohérente évaluant les risques d'inondation à l'échelle du pays. Cette évaluation devrait considérer la variété de types d'inondations qui affectent les ménages canadiens, supportant à la fois une approche non structurale de la réduction des risques d'inondation et la tarification de l'assurance. Les gouvernements et assureurs devraient également s'efforcer de réduire le nombre de ménages à très hauts risques, tout en améliorant la qualité et l'accessibilité des données relatives aux pertes suite à des inondations. De plus, les ménages devront devenir mieux informés des spécificités relatives aux différents types de couvertures et devront assurer une portion des coûts associés aux pertes suite aux inondations en fonction de la tarification et des conditions d'assurance fondées sur les risques.

Introduction

Private insurance and public disaster relief are important components of flood disaster recovery processes, and have the potential to influence prevention and mitigation

coverage is available for most natural hazards that present a risk to homeowners in Canada, such as wind, earthquake, tornado, structural and wildland fire, winter storms, hail and lightning. Further, commercial and automobile insurance policies frequently cover damages associated with overland flooding; however, private insurance for damages associated with coastal and riverine flooding is presently excluded from virtually all homeowner insurance policies (Sandink et al. 2010; Lamond and Penning-Rowsell 2014). By providing financial assistance for losses from uninsurable perils, disaster relief programs provided by provincial and territorial governments are an important component in flood recovery and rebuilding processes across Canada. Further, Shrubsole (2000, 17) stated that "in providing flood relief, we support flood victims…this generosity is often a measure of a caring society."

Flood insurance is available in most developed countries, including the United States, the United Kingdom, Germany and France. Flood products have been offered in these countries despite considerable technical barriers to flood insurance, including lack of randomness and mutuality of flood losses, resulting in adverse selection and low economic viability of coverage (Paklina 2003; Mehlhorn and Hausmann 2012; Lamond and Penning-Rowsell 2014). Despite the challenges associated with insuring flood, Canada's federal government (Government of Canada 2014), the Government of Alberta (Government of Alberta 2014) and the National Round Table on Environment and Economy (NRTEE 2011) along with non-government commentators (for example, Alberta WaterSMART Solutions Ltd. 2013) have indicated that a need exists to review the role of private insurance in flood recovery. Specifically, the 2014 federal budget (Government of Canada 2014, 232) stated:

> Canada is the only G-8 [Group of Eight] country without residential flood insurance coverage, leaving many Canadian homeowners with inadequate protection against losses from overland flood events. The Government will consult with the insurance industry, provinces and territories, and other stakeholders to explore options for a national approach to residential flood insurance in Canada and insurance issues arising from natural disasters more generally.

The provision of overland flood insurance coverage in Canada has also been explored by key insurance industry players, including insurance brokers' associations and provincial governments in Manitoba and Quebec following severe flood damages in

Feltmate 2013; Feltmate and Thistlethwaite 2014; Lamond and Penning-Rowsell 2014). The Insurance Bureau of Canada (IBC) noted that Canadian insurers are also facing significant damages associated with covered flood perils – specifically sewer backup flooding in residential basements in most of Canada (IBC 2014a, 2014b). Homeowner losses from groundwater flooding and some types of overland flooding are also frequently insured in Quebec (IBC 2009a, 2009b). Thus, the private insurance industry is already a key player in financing recovery following some types of residential flood events in Canada.

There are benefits and drawbacks for both insurance and government relief approaches to financing recovery following a flood. Disaster relief assistance is helpful for those who do not have the resources to recover from disaster events, and spending of financial aid within an affected community can assist in triggering community-wide economic recovery (Tobin and Montz 1997); however, public relief programs have been criticized for shifting individual losses associated with disasters to the wider tax-paying population and limiting incentives for property-level mitigation (Handmer 1990; Barnett 1999; Anderson 2000; Paudel 2012). Moreover, government disaster relief programs are designed to provide relief and do not seek, like insurance, to restore homeowners to a condition similar to that before a flood event. Public misperceptions about the comprehensiveness and adequacy of public disaster relief may deter individuals from adopting mitigation measures (Mileti 1999). Further, the inconsistency of disaster relief coverage throughout the country and the relative complexity in determining the thresholds that trigger relief programs create additional uncertainty for those affected by disaster events.

Private insurance has also been criticized for creating “moral hazard,” which exists when the expectation of insurance coverage limits the likelihood that a policyholder will engage in appropriate risk-reduction behaviour (McLeman and Smit 2006; Jongejan and Barrieu 2008; Lamond and Proverbs 2008). Others have viewed insurance as a sustainable disaster mitigation tool that can provide education to policyholders, increase risk-reduction behaviour by offering financial incentives, and limit the availability of coverage for very high-risk individuals (Mileti 1999; Crichton 2008).

This paper provides review and commentary on current flood disaster relief and risk-transfer regimes in Canada. First, the cost of flooding for government and the insurance industry is briefly reviewed. Next, the current state of water damage insurance

programs. The paper concludes with a discussion of challenges and opportunities associated with current approaches to flood disaster assistance and water damage insurance, and challenges and opportunities associated with increasing the role of private insurance in flood recovery. The focus of this paper is on public relief and private insurance for residential flood losses.

Flood disasters and losses

From 1983 to 2013, the Canadian Disaster Database recorded a total of 450 meteorological and hydrological disasters. Flooding was by far the most frequent cause of disasters during this period, resulting in a total of 169 disaster events (Table 1). Flood disasters result in significant losses in Canada. Numerous severe flooding events have exceeded CAD $40 million in damages since 1996 (Table 2). In 2015, Public Safety Canada (PSC) reported that Disaster Financial Assistance Arrangements (DFAA) payments to provinces totaled approximately CAD $3.4 billion since program inception in 1970, and that 190 of the 210 events that resulted in DFAA payouts were caused by flood (PSC 2015c, 2015d).

Table 1. Top five causes of hydrological and meteorological disaster events and proportion of total number of meteorological and hydrological disasters recorded in the Canadian Disaster Database, 1983–2013.

Download CSV Display Table

Table 2. Selection of flood disaster events exceeding CAD $40 million in damages, 1996 to present.

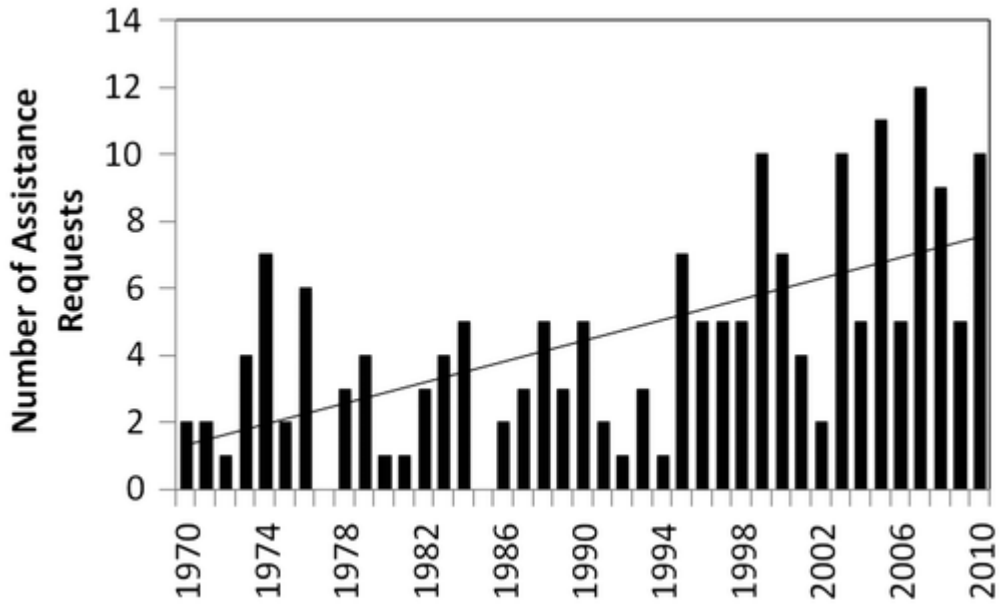
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Data available on assistance requests made to the federal DFAA program illustrate the growing cost and frequency of large disaster events more generally in Canada. As displayed in Figure 1, the number of requests made for assistance through the DFAA program increased during the period 1970 to 2010. Further, in 2015, PSC revealed that "from 1970 to 1995, DFAA payments averaged [CAD] $10 million per year; from 1996

to 2011, the average annual payment grew to $118 million, and increased to $280 million in 2012–2013” (PSC 2015d).

Figure 1. Number of requests for Disaster Financial Assistance Arrangements (DFAA) assistance from 1970 to 2010.

Source: Public Safety Canada (PSC 2011, 8).



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Due to the proprietary nature of property and casualty (P&C) insurance industry loss data, specific figures on insurance industry losses for insured homeowner water damages are unavailable; however, several industry sources have identified losses associated with sewer backup and water damage more generally as major drivers for homeowner insurance payouts in Canada. For example, a 2014 IBC (2014b, 21) report stated:

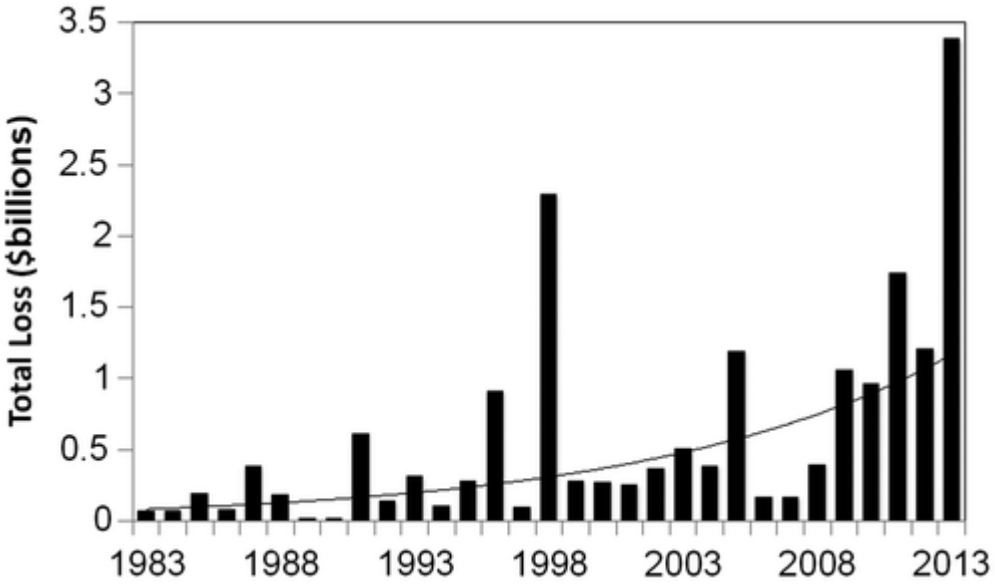
> while residential flood coverage is not available, Canadian P&C insurers already cover water-related damage, including sewer backup, through both residential and commercial policies, and overland flooding, through automobile and commercial property policies. As a result…water claims [are] the number 1 cause of home insurance losses across the country.

Other insurance industry commentators have noted the importance of sewer backup as a driver for homeowner insurance losses (Jardine et al. 2012; Friedland et al. 2014; Harris 2014) and Aviva Canada – Canada’s second largest P&C insurer by market share

water damage (Aviva Canada 2015b). IBC (2014a) also noted a significant increase in natural catastrophe-related payouts in the past decade, much of which has been associated with flooding and extreme rainfall events in large, urban municipalities (Figure 2).

Figure 2. The Insurance Bureau of Canada (IBC) notes a steady increase in the costs of natural catastrophes for the Canadian insurance industry. Overall catastrophic losses recorded by the industry approached or exceeded CAD $1 billion* in 1998, 2005, 2009, 2010, 2011, 2012 and 2013, though IBC (2014a) notes a change in data collection methods starting in 2009. At over $3 billion in losses, 2013 saw the greatest amount of natural catastrophe-related damages since the industry began recording figures in 1983. Much of the damage experienced in 2013 was associated with riverine and extreme rainfall related flooding in southern Alberta and southern Ontario.

Source: IBC (2014a).



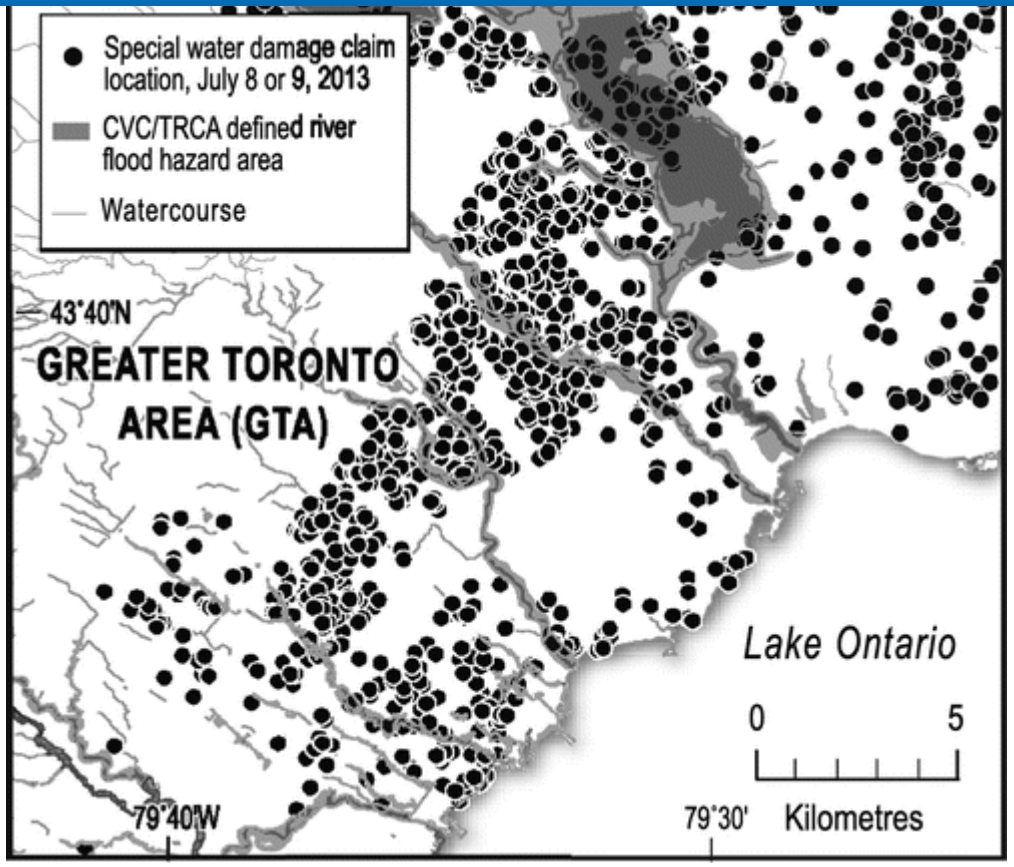
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Two significant flood events in 2013 intensified the focus of the Canadian P&C insurance industry on the issue of water damage and sewer backup. The first was the substantial losses associated with the June 2013 southern Alberta flood. Insurance losses for this event were estimated at CAD $1.8 billion, making it the single most expensive disaster event for the P&C insurance industry in Canadian history (IBC 2014a). While many of the losses experienced during this event were commercial flood claims, homeowner insurance claims associated with sewer backup comprised a significant portion of payouts (Friedland et al. 2014).

The second significant flood event occurred as a result of extreme rainfall in the Greater Toronto Area (GTA) on 8 July 2013. This event resulted in CAD $999.5 million in insured losses, making it the third most expensive insured loss event in Canadian history (IBC 2014a). The insurance industry has also experienced severe losses from recent extreme rainfall events in Thunder Bay and Montreal in 2012 (CAD $262 million), the GTA in 2005 ($717.8 million), Edmonton in 2004 ($194 million) and Peterborough in 2004 ($102.4 million), amongst several other events across the country (IBC 2014a). Since sewer backup coverage is widely available and overland and groundwater flood losses are uninsured for most Canadian homeowners, a significant portion of the property losses experienced during these events can be attributed to sewer backup. Further, the initial estimate for insured damages associated with the 19 August 2005 GTA extreme rainfall and flood event was CAD $500 million (IBC 2006). Of this total, approximately $247 million was associated with sewer backup damages (Sandink 2007). Subsequent surveys of insurance providers revealed that total damages were estimated $625 million (2005 CAD) (IBC 2014a).

Another important feature of recent large-scale flood loss events has been the geography of damages. A sample of homeowner insurance claim data from the 8 July 2013 extreme rainfall flood in the western GTA indicate that most of the losses that occurred during this event were outside of formally defined riverine flood hazard areas (Figure 3). While the historical emphasis of public flood-prevention programs has been on riverine flooding, the distribution of losses associated with the GTA flood suggest the need for similar prevention programs by public and private agencies to better address sewer backup.

Figure 3. A sample of water damage insurance claims in the western Greater Toronto Area filed on 8 or 9 July 2013. “Special” water damage claims typically include sewer backup losses but exclude other types of insured water damages, including plumbing and appliance failure. The claim sample is from a selection of property and casualty (P&C) insurers representing 17.5% of the Ontario personal property market. River flood hazard area delineations provided courtesy of Credit Valley Conservation and Toronto Region Conservation Authority.



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Homeowner insurance coverage for flood: current status

The current homeowner insurance regime for water and flood is complex. With more than 300 federally and provincially regulated home insurers in Canada (Canadian Council of Insurance Regulators [CCIR] 2013; Office of the Superintendent of Financial Institutions [OSFI] 2014), competition in the industry is fierce. Moreover, there is often variation among companies in specific insurance policy coverage, terms and conditions (see Applied Systems 2013). Nevertheless, several generalizations about home water damage coverage can be made.

There are rare instances where private households may have the option of purchasing flood coverage (e.g. Beynon 2014), and one major insurer has announced its intention to offer an overland water endorsement across Canada, providing limited homeowner and tenant overland flood coverage in 2015 (see Aviva Canada 2015a).[1] Nevertheless, the vast majority of Canadian homeowners continue to be uninsured for flood damage associated with “waves, tides, tidal waves or the rising of, the breaking out or the overflow of, any body of water, whether natural or man-made” (IBC 2003, 6).

be offered commercial flood insurance that covers damage to building structures and other common elements; however, flood coverage for contents and unit upgrades is typically not offered to apartment tenants or individual condominium unit owners.

There are a number of different flood types that affect residents, notably those who occupy ground-related homes (homes with below-ground foundations and basements). Floodwaters may enter homes via the surface of the ground (overland flooding) through foundation walls and basement floors (seepage or infiltration flooding) or through underground wastewater or stormwater management systems (sewer backup) (Sandink 2014). As described in Table 3, the specifics of available coverage depend on region and flood type.

Table 3. Insured and uninsured flood types in Canada. This table is based on a summary of model wordings for homeowner insurance policies and endorsements produced by the Insurance Bureau of Canada (IBC). While the model wordings are largely optional outside of Quebec, they provide an indicator of the types of water damages that are currently insured by property and casualty (P&C) insurers in Canada.

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Flooding associated with plumbing failures (including burst pipes, water main failure, failed water heaters, appliance failures and sprinkler system failure), basement sump pump failures, and other “non-natural” sources of flooding are widely insured in Canada (Sandink et al. 2010). Further, coverage is typically available for damage caused by water entering homes through “an opening which has been created suddenly and accidentally” by an insured peril, such as wind (IBC 2003, 9). Coverage for sewer backup, frequently attributed to excess water entering municipal wastewater systems during extreme rainfall events (City of Hamilton 2013; Pawlowski et al. 2014), is typically available in Canada as an optional endorsement or add-on to standard homeowner insurance policies (Sandink et al. 2010); however, some providers may deny payouts for residential sewer backup events if uninsured overland flooding is found to be the underlying cause of the sewer backup event (IBC 2014c).

Further adding to the complicated nature of water damage insurance coverage, the details of specific home insurance policies are affected by the risk of loss for individual policyholders, resulting in different premiums, deductibles and coverage conditions for

claims history and location of the household. In some circumstances, homeowners may not be offered optional sewer backup endorsements if they are considered to be at high risk of loss – a determination likely made based on the claims history of the policyholder and the frequency of sewer backup claims in a policyholder's neighbourhood (typically defined by forward sortation area or postal code) or municipality (Applied Systems 2013; Friedland et al. 2014), although the high-level of competition in the industry means that high-risk households denied sewer backup coverage by one insurance provider may be able to find coverage from another provider.

The insurance regime for flood and water damage is complicated when contrasted with the availability of coverage for a wide variety of other perils, including wind damage, structural and wildland fire, hail and lightning. Comprehensive automotive coverage typically covers losses associated with overland flooding. Commercial entities in Canada are frequently offered overland flood coverage, and homeowner flood insurance is available in most other developed countries, including Austria, Australia, Belgium, Spain, Switzerland, the United States, the United Kingdom, France and Germany, among many other countries (Sandink et al. 2010; Lamond and Penning-Rowsell 2014), potentially leading to the assumption by the general public that flooding is insured. Indeed, national surveys have revealed that anywhere from 21% to 70% of homeowners believe that they are insured for overland flooding (ICLR 2004 cited in Sandink et al. 2010; J.D. Power 2014) and a 2014 IBC survey of Quebec homeowners revealed that 50% believed that they were insured for flood (Canadian Underwriter 2014b).

Limited public understanding of the complexity of water damage coverage was reflected in media reports following recent flooding events in Canada. For example, the June 2013 flooding in southern Alberta generated reports citing the frustration of homeowners facing what they considered confusing water damage insurance coverage terms and conditions (see, for example, Canadian Press 2013; CBC News 2013a, 2013b; CTV News 2013; Franklin 2013; Insurance Business 2013; Lasalle 2013; Nelson 2013).

The insurability of flooding

Mehlhorn and Hausmann (2012) argued that the conditions of mutuality, assessability, randomness, economic viability and similarity of threat are key conditions required for a

can be easily met, as water is the primary driver of damages during flood events (Hausmann 1998; Sandink et al. 2010); however, the conditions of assessability, mutuality, randomness and economic viability are difficult to meet (Hausmann 1998; Mehlhorn and Hausmann 2012). A 2013 survey of Canadian insurance leaders found that the primary reason insurance companies do not presently provide residential flood insurance is because of the difficulty of assessing the risk of damage (Thistlethwaite and Feltmate 2013).

Table 4. Five conditions that must typically be met for a peril to become insured. With respect to flood insurance, the conditions of mutuality, assessability, randomness and economic viability make the provision of flood insurance difficult.

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Mutuality has been cited as a particularly difficult condition to meet for flood insurance, as only a relatively small number of households occupy formally defined flood hazard areas (Mehlhorn and Hausmann 2012). Mutuality relates to the economic viability of insurance. If only a small number of households are exposed to flood risk, the community of insured households would be too small to cover losses from a large flood event. Economic viability is also threatened when large loss events affect an area concentrated with a large number of policyholders, over a very short time period. Limited mutuality results in the need to charge very high insurance premiums for flood coverage in order to attain economic viability, reducing the likelihood that individuals will choose to purchase coverage (Hausmann 1998).

Adverse selection is related to mutuality, randomness and economic viability, and acts as a significant deterrent to the provision of flood insurance. Adverse selection occurs when flood coverage is made available as an option. Optional coverage may lead insurers to “select against” flood-vulnerable households by making coverage available only in areas classified as low risk. Conversely, adverse selection against insurers occurs when only high-risk households choose to purchase coverage (Crichton 2008; Mehlhorn and Hausmann 2012; Hudson et al. 2014). The result is that optional flood insurance is expensive and has a low market penetration (Mehlhorn and Hausmann 2012).

An alternative approach to optional flood insurance coverage is to bundle flood

Japan, Portugal, Spain, Switzerland and the United Kingdom (Sandink et al. 2010; Paklina 2003). Bundling contributes to economic viability, as it allows insurers to spread losses across time, across a number of different perils and across areas exposed to differing levels of risk (Penning-Rowsell and Pardoe 2012). Bundled coverage also allows for the creation of a large insurance community, overcoming the problem of limited mutuality, and addresses the problem of adverse selection (Crichton 2008; Sandink et al. 2010).

International approaches to flood insurance

To highlight several of the challenges and opportunities associated with insuring flood in Canada, international examples of flood insurance programs are briefly reviewed here. The provided examples are classified as private, bundled flood insurance coverage (United Kingdom), public, optional flood coverage (United States), public, compulsory/bundled coverage (France) and private, optional coverage (Germany) (Sandink et al. 2010; Mehlhorn and Hausmann 2012; Lamond and Penning-Rowsell 2014). These examples illustrate that no single flood insurance arrangement is viewed as ideal.

Private and bundled: the United Kingdom

In the UK, flood insurance is bundled into standard home insurance policies offered by private insurers. An informal “Gentlemen’s Agreement” was established in 1961 between insurers and the government to make flood insurance nearly universally available. Insurers agreed that they would insure flood loss in all but the highest risk areas if the government provided adequate flood infrastructure, hazard mapping and land-use management. The bundled approach in the UK resulted in a flood insurance penetration rate of between 75 and 90% (Huber 2004), and premiums are risk-based (Priest et al. 2005; Mehlhorn and Hausmann 2012). British insurers purchase reinsurance on the international market for extreme losses (Paudel 2012).

While the UK approach has been successful at overcoming the lack of mutuality by bundling flood coverage, the program remains imperfect. As a result of significant flood losses and criticism that the government was not upholding its responsibilities under the Gentlemen’s Agreement, in 2002 the industry no longer guaranteed coverage for high-risk households, considered to be those exposed to 1-in-75-year flood hazards (Crichton 2002, 2005; Huber 2004). It has also been argued that premiums often do not

with older contracts; however, newer contracts may exclude coverage for high-risk insureds (Mehlhorn and Hausmann 2012; Penning-Rowsell and Pardoe 2012). Insurers and the government are currently working toward introducing a risk-sharing pool that subsidizes flood coverage for high-risk properties, called Flood Re. Flood Re will cover an estimated 350,000 homes that are currently facing prohibitively expensive premiums (Association of British Insurers 2014).

Public and optional: United States National Flood Insurance Program

In the United States, federal, state and local governments deliver the National Flood Insurance Program (NFIP) in cooperation with private insurers (Burby 2001). The federal government provides a financial backstop for the program, sets premium rates and identifies flood hazard areas. Local and state governments regulate land use and development in flood hazard areas. Insurers sell policies to homeowners in eligible communities on behalf of the government but do not bear any of the risk (Burby 2001; Lamond and Penning-Rowsell 2014).

Since only those living in high-risk, 1-in-100-year Special Flood Hazard Areas (SFHAs) are either required or have an incentive to buy flood insurance, adverse selection is promoted by the NFIP. Further, though purchase of coverage through the NFIP for households in SFHAs is mandatory for those securing a mortgage from a federally regulated lender (Government Accountability Office 2014), Dixon et al. (2006) identified an NFIP policy penetration rate of 49% in these areas, and many policyholders allow NFIP policies to lapse (Michel-Kerjan and Kunreuther 2011). Penetration rates have been estimated to be as low as 1% in non-SFHAs (Dixon et al. 2006; Government Accountability Office 2014), despite the fact that approximately 50% of flood damages occur outside of these areas (Lamond and Penning-Rowsell 2014).

Adverse selection in the NFIP resulted in very high actuarial-based premium rates, resulting in government subsidies for the cost of insurance for many high-risk households (Government Accountability Office 2014). The problems inherent in public subsidization of flood insurance premiums have been noted elsewhere (for example, Anderson 1974; Kunreuther and White 1994; Platt 1999; Burby 2001; Carolan 2007; Michel-Kerjan 2010). As a result of the inherent adverse selection of the program, the NFIP has proven financially unsustainable. Indeed, as of September 2013, the program was USD $24 billion in debt to the US Treasury following recent significant loss events,

including Hurricane Katrina (2005) and Superstorm Sandy (2012) (Kousky 2011; Government Accountability Office 2014).

Public and compulsory: France

In France, coverage against flood and other natural hazards is included in standard home insurance policies sold by private insurers. Home insurance is mandatory, making flood insurance penetration nearly universal (Michel-Kerjan 2010; Lamond and Penning-Rowsell 2014). Coverage is provided by private insurers, who are offered the option of purchasing reinsurance through a state-owned reinsurer (the Caisse Centrale de Reassurance or CCR), which is in turn supported by a government backstop (IBC 2014b). The government prescribes a single rate, independent of risk, for insurers to charge customers to cover the catastrophe portion of the policy (Michel-Kerjan 2001). While the program has provided flood coverage to a large section of the public, prescription of a single rate limits incentives to mitigate risk by policyholders (Lamond and Penning-Rowsell 2014).

Private and optional: Germany

In Germany, natural hazards insurance, which includes flood coverage, is offered by private insurers as an optional supplement to home insurance policies. While home insurance penetration is nearly 90%, penetration rates for flood coverage have been estimated at 5% for buildings and 10% for contents (Thieken et al. 2006; Paudel 2012). Hudson et al. (2014) identified a strong potential for adverse selection in Germany's flood insurance approach, and optional coverage has failed to insure a large proportion of German households.

Public disaster assistance

While the details of provincial disaster relief programs differ, they typically follow the example provided by the DFAA and are aimed at providing partial assistance toward returning affected individuals and communities to "pre-disaster" conditions, while excluding losses that are reasonably or affordably insurable and losses that are recoverable through legal action. Programs typically focus on providing partial assistance for recovery of essential items and primary residences (Government of the

Alberta 2012; Government of British Columbia 2012; Government of New Brunswick 2012; Government of Ontario 2013; Government of Saskatchewan 2014; Government of Newfoundland and Labrador 2015; PSC 2015c).

Despite their similarities, several characteristics of disaster assistance programs add to the complexity of residential flood recovery. These characteristics include differences in total funds that are made available to individual claimants, and determination of conditions for triggering of relief payouts to individuals and communities affected by disaster events.

Public disaster programs have historically focused on returning affected households to pre-disaster conditions, garnering criticism that these programs serve to maintain disaster vulnerabilities over time (Park and Miller 1982; Tobin and Montz 1997; Barnett 1999). Thus, an important development in the implementation of public disaster assistance programs in Canada is the inclusion of post-disaster mitigation as part of post-disaster disbursements.

Federal disaster financial assistance arrangements

Federal disaster assistance is provided to provinces through the DFAA (Shrubsole 2013). A formula is applied to calculate the federal share of disaster losses (see Table 5). Aside from providing assistance to provinces for costs associated with emergency response and repairing infrastructure, the DFAA provides assistance to provinces for costs paid out for “replacing or repairing basic, essential personal property of individuals, small businesses and farmsteads” (PSC 2015c). For individual households or families, the DFAA covers only losses associated with “essential” items (including personal clothing, furnishings and appliances), and costs associated with the replacement and repair of primary residences (PSC 2015c).

Table 5. The Disaster Financial Assistance Arrangements (DFAA) financial assistance formula. The formula will be indexed to inflation beginning January 2016.

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Provincial and territorial disaster assistance programs

Provincial and territorial (P/T) programs typically provide partial assistance for essential items and primary residences that were damaged by uninsurable perils, such as riverine and coastal flooding. Differences exist with respect to total payout caps, deductibles and the proportion of eligible losses that will be covered by P/T programs (Table 6).

Table 6. Summary of key financial characteristics of provincial/territorial disaster financial assistance programs, individual and family components.

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Available funds

Several provincial programs place limits on total payouts that may be made to individuals and families. These limits vary considerably across the country. For example, total payout amounts range from a high of CAD $300,000 in British Columbia to $80,000 in most of the Atlantic Provinces, while other programs, including programs in Alberta and Ontario, do not specify maximum coverage amounts (Table 3). While the Quebec program provides a maximum payout amount for structural damages to homes, coverage is provided for essential items based on an itemized list of pre-set payout amounts (such as CAD $1000 for refrigerators, $450 for televisions, $1650 for living room furniture and so on). A similar itemized list of coverage limits for essential items is provided for Alberta's disaster assistance program (Government of Alberta 2012).

While the Ontario Disaster Relief Assistance Program does not provide a specific payout cap, it differs from other P/T programs in that local communities affected by a disaster are required to raise disaster recovery funds through a Disaster Relief Committee (DRC). The DRC is established immediately after a disaster event, is composed of local representatives and is charged with raising funds and settling claims. After claims have been submitted and funds have been raised by the DRC, the province provides CAD $2 for every $1 raised by the DRC, to a maximum of 90% of the eligible claim estimate (Government of Ontario 2009, 2013).

Several programs also apply a specific deductible that must be covered by individuals applying for disaster relief. For example, CAD $1000 deductibles are in place in British

of “severe hardship,” individual applicants in New Brunswick may apply to have the $1000 deductible waived (Government of New Brunswick n.d., 1). Some programs further specify a proportion of eligible losses that will be covered by the programs. Eligible payout proportions range from 80% in British Columbia, Manitoba and the Northwest Territories, to 95% in Saskatchewan (Table 3).

Triggering of disaster relief programs

Triggering thresholds for P/T disaster relief programs differ across the country. For example, Saskatchewan’s program allows local authorities to request assistance if an eligible disaster caused “one eligible claimant” to sustain uninsurable losses exceeding CAD $5000 (Government of Saskatchewan 2014, 2), while most other programs trigger as a result of widespread damage (Government of Ontario 2009; Government of Prince Edward Island 2011; Government of British Columbia 2012; Government of Newfoundland and Labrador 2015). For example, the New Brunswick program would apply when the disaster event “caused significant loss to a wide sector of the community as a whole” (Government of New Brunswick 2012, 1). Triggering of Newfoundland and Labrador’s program occurs on a “case by case basis…in response to abnormal events…in a defined geographical area” resulting in “widespread damage…” (Government of Newfoundland and Labrador 2015, 3). Alberta’s program guidelines state that an event must have caused widespread damage and must be “extraordinary” in nature to trigger disaster assistance programs. Rather than relying on loose definitions of “significant losses,” the Alberta guidelines provide thresholds based on event probabilities that must be met for events to be considered extraordinary, and state:

> an event is considered extraordinary if it meets or exceeds the equivalent of a 1 in 25 year precipitation level in an urban area; a 1 in 50 year precipitation level in a rural area; or a 1 in 100 year stream flow for watercourses. (Government of Alberta 2012, 3)

The lack of clear definition of triggering thresholds for disaster relief programs has led to criticisms that these programs are often affected by political motivations (Anderson 2000; Downton and Pielke 2001; Garrett and Sobel 2002). For example, it has been found that political motivations affected both the declaration of disasters and subsequent triggering of federal disaster assistance programs, and the amount of

and Pielke 2001; Garrett and Sobel 2002). While the political economy of disaster assistance programs in Canada remains unstudied, relatively loose triggering thresholds identified in the majority of P/T assistance programs add a further level of uncertainty for individuals who have been affected by flood disaster events.

Government assistance and post-disaster mitigation

The post-disaster/recovery phase is one of the most effective times to implement mitigation measures and reduce vulnerability to future events (Berke et al. 1993). At the same time, it has been argued that disaster relief assistance programs may lead to perpetual states of damage and repair, as these programs are typically aimed at returning affected individuals to “pre-disaster” condition (Park and Miller 1982; Tobin and Montz 1997; Barnett 1999). It has further been argued that the expectation of government disaster relief creates moral hazard, serving to limit the willingness of individuals to engage in risk-reducing behaviour and increasing the likelihood that they will occupy hazard-prone areas (Shughart II 2011). To counter these arguments, a positive trend in both federal and P/T disaster assistance programs is the incorporation of mitigation clauses, incentives and requirements.

Since 2008, the DFAA may provide an additional disbursement to mitigate disaster risk, on top of disaster relief payouts. The program guidelines state that “mitigation enhancements undertaken within specific repair/rebuilding projects to reduce vulnerability to future emergencies will be considered on a case-by-case basis” and “the value of enhancements eligible for cost sharing is limited to 15% of the estimated cost of repair to pre-disaster condition” (PSC 2007, 15). The DFAA also allows for “innovative recovery solutions” that reduce vulnerability to future disaster events. Innovative solutions are those that can be implemented at a cost that does not exceed the eligible DFAA payout, plus the additional 15% mitigation disbursement (PSC 2007, 16). Measures may include relocation to less disaster-prone areas, buy-out of exposed properties and measures applied to individual properties (for example, elevating structures and installing foundation drainage systems; PSC 2007 2015a). The DFAA also excludes coverage for buildings that were constructed in 1-in-100-year flood hazard areas if these buildings were built after the lands were designated as vulnerable to flooding, unless flood mitigation measures had been incorporated into properties (PSC 2007).

Several provinces have also incorporated post-disaster mitigation assistance into disaster relief programs. For example, additional disbursements of 15% of disaster payouts for mitigation measures are applied in Nova Scotia, and Newfoundland and Labrador (Government of Nova Scotia 2013; Government of Newfoundland and Labrador 2015). Incorporation of mitigation into disaster assistance was also applied in Alberta following the June 2013 flooding, where eligible homeowners could receive 15% in additional funding up to CAD $10,000 (if not more) to incorporate basic flood mitigation measures into properties, including moving electrical panels out of basements and incorporating sewer backflow prevention measures into homes (Government of Alberta 2013a, 2013b). Mitigation of future loss is also incorporated in the British Columbia program for claimants who have experienced repeated losses (Government of British Columbia 2012), and flood-affected individuals in the Northwest Territories are “expected to restore their property” to “reasonably protect it against future damage” after receiving a disaster relief payout (Government of the Northwest Territories 2011, 5).

A 2011 evaluation of the DFAA program identified some provincial level criticism of the 15% mitigation disbursement. Specifically, the disbursement limited the range of choice for mitigation options as it only applied to damaged infrastructure and provided for only a small portion of the total cost of mitigation projects (PSC 2011). Nevertheless, the evaluation highlighted the need to consider long-term mitigation/prevention considerations along with the short-term recovery goals of the program (PSC 2011), and the incorporation of mitigation into disaster relief programs provides a positive step toward sustainable disaster mitigation in Canada.

Flood recovery and insurance in Canada: challenges and opportunities

The current system: disaster relief and limited insurance coverage for flood losses

The complexity of the current system is a challenge to increasing the level of understanding of it. Flood-affected households must rely on a mix of private insurance for sewer backup (across the country), groundwater and limited types of overland flood coverage (in Quebec), and public relief for uninsurable losses. As discussed above,

confusion amongst the public. Unclear home insurance policy wordings have also resulted in public confusion, including situations where insurers have provided payouts for uninsured overland flood damages (Friedland et al. 2014). Public relief also provides inconsistent payout limits and triggering conditions across the country.

The potential for significant amounts of losses that are not covered either by public relief or private insurance is a further challenge associated with the existing system. For example, private insurance will not provide assistance for river or coastal flooding, or any type of overland or groundwater flooding in Canada, except for Quebec. Further, public relief programs typically exclude coverage for insurable losses, whether or not affected households chose to purchase coverage.

There has been increasing consideration of risk reduction in both public relief programs and private insurance coverage for sewer backup – a positive trend toward sustainable disaster mitigation (Mileti 1999). Notably, insurers have increasingly applied ex-ante and ex-post incentives for mitigation of sewer backup. Ex-post disaster mitigation incentives provided by public relief programs also represent a positive trend, although a system that relies heavily on ex-post disaster payouts and facilitates mitigation only after disasters occur is far from ideal. Transferring substantial costs associated with flooding to Canadian taxpayers represents a further challenge associated with the current system.

Moving forward with private flood insurance

Challenges

There are many challenges associated with the introduction of private flood insurance. Challenges include the inherent difficulty of insuring flood, inadequate flood loss and exposure information, difficulties in pricing water damage coverage and in insuring high-risk households, the potential for crowding out of insurance by public relief programs, and limited willingness of individuals to engage in risk-reducing behaviour.

While flood coverage has been made available in many countries around the world, it is clear that riverine and coastal flood damages are inherently difficult to insure (Kousky and Cooke 2012; Lamond and Penning-Rowsell 2014). Reviews of international flood insurance models suggest that there is no ideal approach that can be directly applied to Canada. The UK model, which has achieved high penetration rates through bundling of

of flood coverage (Sandink et al. 2010; Mehlhorn and Hausmann 2012); however, this program has experienced difficulties as a result of a lack of government investment in flood management. It has also been argued that bundling flood coverage into standard home insurance policies may reduce home insurance affordability and may limit the capability of insurance to communicate risk and incentivize risk reduction through price signaling (Thistlethwaite and Feltmate 2013). Optional flood coverage, perhaps bundled with other insured water damage, including sewer backup, provides a potential alternative (Thistlethwaite and Feltmate 2013), but opens up the possibility of adverse selection.

The quality of loss information further challenges the introduction of flood insurance. Insurance loss data are largely proprietary in Canada, limiting their availability to researchers, as well as to policy and decision makers. Insurers may also find that existing loss data, which aggregate various types of flooding along with non-flood related water damages, provide limited utility in the assessment of flood risk at the household level (Friedland et al. 2014; Sandink et al. 2014). Loss figures provided by government authorities are also highly aggregated and do not break out flood losses by flood type (for example, see PSC 2014). Further, there are likely significant losses that have been covered by neither private insurers nor public relief programs. Thus, there may be significant, unaccounted-for residential flood losses in Canada, limiting the ability of insurers to fully understand flood risk.

The potential for the introduction of flood insurance is limited by inadequate exposure information, in the form of hazard assessments for a variety of flood types that affect Canadian households. In particular, insurance companies seek access to current, high-quality flood risk maps, information about flood defense infrastructure and property-specific data on flood risk factors. This information is considered either unavailable or unreasonably difficult to attain by insurance industry stakeholders, limiting their ability to assess risk and appropriately price flood coverage (Sandink et al. 2010; Thistlethwaite and Feltmate 2013). Indeed, a 2014 assessment of riverine flood hazard map coverage in Canada revealed that not all residences located in riverine flood prone areas had flood map coverage, maps for 53% of the total of 28,000 km of mapped rivers and streams were between 18 and 40 years old, and the vast majority of existing maps did not account for the impact of climate change on flood hazards (MMM Group 2014). Further, the ability to provide a consistent, national flood product is limited by the application of different flood mapping standards across the country, in the form of

Flooding outside of formally defined riverine flood hazard areas may account for a significant portion of flood losses, as illustrated in Figure 3. It has also been reported that urban developments constructed before the 1970s were not typically serviced by major stormwater systems (typically designed to handle up to 1-in-100-year flow events) (Hulley et al. 2008), resulting in vulnerability for many Canadian households to stormwater flood hazards. Despite these vulnerabilities, a variety of flood types that are affecting Canadian households, including overland stormwater, storm and sanitary sewer surcharge and groundwater flooding, are largely not addressed in current flood hazard assessments (Sandink et al. 2010; Alberta WaterSMART Solutions Ltd. 2013, 2014; City of Calgary 2014), limiting the ability of governments, insurers and residents to understand flood risk.

Aside from regional-scale exposure information in the form of flood hazard maps, there is also a need to better understand risk reduction at the property or household scale. A variety of flood risk reduction measures are available for riverine flooding (for example, Construction Industry Research and Information Association 2005; American Society of Civil Engineers 2006; Federal Emergency Management Agency 2012) as well as urban flooding (Sandink 2009, 2013; Federal Emergency Management Agency 2012), which should be taken into account when assessing risk and implementing risk-based insurance coverage. The difficulty in accessing information on property-level mitigation is reflected in the current situation with respect to water damage pricing experienced by Canadian insurers (Friedland et al. 2014).

Insurers have expressed difficulty in appropriately understanding water damage risks that are currently insured, notably sewer backup. In the current regime, insurers lack information on both municipal-level factors (including infrastructure, land use and various regional factors) as well as property-level factors that affect risk of sewer backup. This situation has limited the ability of insurers to apply risk-based rates for water damage and sewer backup (Friedland et al. 2014).

Sustainably insuring very high-risk homeowners without subsidies or cross-subsidization from lower-risk households is difficult. Due to the highly concentrated nature of flood losses, limiting exposure by excluding coverage for very high-risk households may be a necessary component of a flood insurance model for Canada (Sandink et al. 2010; Thistlethwaite and Feltmate 2013).

The existence of public relief for flood losses may inhibit the purchase of or willingness to pay for flood insurance (Lamond and Penning-Rowsell 2014). Previous research indicates that there is a complicated relationship between the provision of public relief funds and the crowding out of insurance (Browne and Hoyt 2000; Raschky et al. 2010; Kousky et al. 2014). For private flood insurance to be viable in Canada, government relief programs should not discourage the purchase of insurance (Sandink et al. 2010; IBC 2014b).

Evidence suggests that there is often limited willingness of property owners to engage in risk-reducing behaviour (Kunreuther 2006; Siegrist and Gutscher 2006) and that property owners may not be fully aware of the specific nature of their insurance coverage (Sandink 2007, 2011; Hudson et al. 2014; Lamond and Penning-Rowsell 2014; Oulahen 2015). For insurance incentives to be effective, policyholders must be made aware of policy terms and conditions, and how regional and property-scale risk factors affect flood insurance pricing and coverage conditions, and must be appropriately motivated to undertake actions to mitigate risk.

Aside from the challenges noted above, insurers may experience regulatory and reputational risk if risk-based rates become prohibitively expensive. Also, increased exposure of insurers to flood and climate change-related risks through a flood insurance product challenge the introduction of flood insurance (Thistlethwaite and Feltmate 2013; Lamond and Penning-Rowsell 2014). Nevertheless, as discussed in the following section, there are several opportunities associated with the introduction of flood insurance.

Opportunities

In February 2015, Aviva Canada announced its intention to offer a product that would provide homeowner and tenant coverage for “losses that result from the accumulation or run off of surface waters, including torrential rainfall when water enters the property” (Aviva Canada 2015a). While details about the nature of the coverage (for example, limits and pricing) were not accessible at the time of writing, a newspaper article indicated that the product would focus on freshwater flooding, and would exclude very high-risk households (Nelson 2015). This announcement from Aviva highlights the fact that the above-mentioned challenges do not necessarily preclude the introduction of limited flood insurance products across Canada. As discussed here, extending coverage

opportunities for the introduction of flood insurance. Flood insurance also presents a business opportunity for insurers and creates an opportunity for improved disaster mitigation incentives.

Given the variety of flood hazards that present a risk to Canadian households and the fact that many of these hazards (including stormwater flooding, storm and sanitary sewer backup, infiltration flooding and groundwater) occur outside of formally defined river and coastal flood hazard areas, it is likely that the condition of mutuality can be met if flood coverage is extended for a variety of flood types. This factor also supports the prospect of bundling flood coverage with standard homeowner insurance policies.

While representing a challenge to comprehensive flood coverage, excluding coverage for households in very high-risk areas increases the likelihood that a sustainable flood insurance product can be offered in Canada. A product that covers flood types that occur outside of high-risk areas could still provide coverage for a large number of Canadian households, increasing the viability of bundled coverage, and would act as a disincentive for the development of high-risk areas. This approach could help ensure that flood coverage remains affordable for a large segment of the population while limiting cross-subsidization, and increases the potential for application of risk-based rates for insured households. Bundling would also help reduce risk exposure to private insurers by increasing diversification and sustainability of coverage (Aseervatham et al. 2014; Lamond and Penning-Rowsell 2014).

The offering of flood coverage provides a business opportunity for private insurers. Canadian insurers have been faced with reputational risk associated with unclear water damage policy wordings, and with failing to cover overland flood damages. Losses concurrently caused by insured and uninsured flood perils (for example, overland stormwater and sewer backup flooding) also present a challenge to Canadian insurers (Sandink et al. 2010; IBC 2014b). Providing coverage for all types of flooding would help insurers meet a consumer need, provide an opportunity for the generation of new revenues, and may also help offset increasing losses associated with sewer backup (Sandink et al. 2010; Thistlethwaite and Feltmate 2013; Friedland et al. 2014). Voluntary provision of coverage may also preempt an imposition of flood insurance by governments (Thistlethwaite and Feltmate 2013).

Finally, risk-based insurance conditions and pricing have the potential to incentivize

et al. 2009; Friedland et al. 2014; IBC 2014b; Paudel 2014; Poussin et al. 2014), helping to offset the limited willingness of property owners to voluntarily participate in risk reduction. While insurers have already engaged in incentivizing measures for sewer backup, the introduction of flood coverage represents an opportunity to incentivize measures for other flood types; however, effective incentives will require policyholders to become aware of the specifics of their insurance coverage, including deductibles, coverage exclusions and sub-limits (Thieken et al. 2006; Hudson et al. 2014; Sandink 2014).

Conclusion and recommendations

Flood-affected residents in Canada rely on a mix of partial insurance and public relief assistance for flood losses. This system provides limited assistance for flood damages and reduces incentives for mitigating flood risk at the household level. The introduction of private flood insurance has been proposed to improve the current residential flood recovery regime.

Challenges to increasing the role of private insurance in flood recovery include technical barriers to insuring flood, including lack of mutuality and adverse selection, inadequate loss and exposure information for a variety of flood types, difficulties in providing sustainable coverage for high-risk households, the potential that public relief will crowd out private insurance for flood, and limited willingness of homeowners to participate in risk-reducing behaviour. Nevertheless, expanding the definition of flood to include all flood types that affect Canadian households, exclusion of coverage for very high-risk households, provision of risk-based pricing and recognition of flood coverage as a business opportunity for private insurers present opportunities for flood insurance in Canada.

For flood to become sustainably insurable, insurers, governments and residents should participate in mitigation of flood risk. Governments and insurers should work together to develop a national, consistent approach to assessing flood hazards and define high-risk households and residences that may not be insurable. Flood hazard assessments must provide multiple functions, including supporting wise land-use management decisions that will reduce flood risk over time and support the assessment of flood risk for the purposes of setting risk-based flood insurance pricing. Hazard assessments

impact on households, including riverine, coastal, storm and sanitary sewer backup, stormwater and groundwater flooding.

Improved hazard assessment should support and renew national efforts aimed at mitigating flood risk. If sustainable flood insurance is to be introduced, mitigating risk and reducing the number of households that are in high-risk areas will assist in increasing the number of residents who will be eligible for flood coverage. Improvement of the quality and accessibility of flood loss data by insurers and governments would help increase understanding of flood risk and exposure, and would further support the introduction of flood insurance.

To further support flood insurance, property owners and tenants will have to become better informed of their risk of experiencing damage from a variety of flood types, and will have to participate in both mitigation of risk and in a portion of flood losses (through deductibles and risk-based premiums). Currently, private insurers are applying a combination of risk-based rates, sub-limits, deductibles and availability conditions to promote mitigation for sewer backup. An examination of these approaches would help improve understanding of the role of insurance incentives for promoting risk reduction at the household level.

The introduction of viable flood insurance for households will require continued dialogue between the insurance industry and key federal and provincial agencies involved in flood management. Because of the considerable damages resulting from storm- and wastewater-related flooding, municipalities should also be involved in the discussion. As the key agency representing the insurance industry, the Insurance Bureau of Canada should work directly with governments to explore the viability of flood insurance in Canada.

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Notes

1. Aviva Canada's "Overland Water Protection" product was launched on June 2, 2015 and The Co-operator's launched a "Comprehensive Water" product on May 25, 2015. The products include coverage for fresh-water related overland flooding (for example, flooding associated with stormwater and overflow of lakes and rivers). Offering of the overland flood products depends on whether the insureds have sewer backup coverage in place. Both insurers plan to offer the products across Canada After initial offerings in specific provinces. The Co-operators' product will be offered to high and low-risk policyholders, and will include variable deductibles and coverage limits (Aviva Canada 2015c; The Co-operators General Insurance Company 2015).

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