Improving Industry Loss Data:

Refining Personal and Commercial Kind of Loss Codes for Water Damage, Flood, Fire, Wind and Hail

December, 2014

Dan Sandink, ICLR
Clinton D’Souza, CGI
Harvey Ledra, CGI

Table of contents

Executive Summary

In the past few years, Canadian property and casualty (P&C) insurers have experienced a significant increase in losses associated with natural disasters and water damage. Yearly losses associated with disaster events exceeding $1 billion have become almost commonplace, and at $3.4 billion, 2013 saw the greatest total losses associated with natural disasters in the history of the Canadian P&C insurance industry. Water damage losses associated with extreme rainfall and flood events, as well as a myriad of plumbing and building failures, have also recently driven a substantial portion of property losses. It is clear that insurers are operating in a more complex risk environment and that there are greater demands on insurers from their clients to manage these risks.

Historical loss data are widely used by numerous stakeholders within the insurance industry to help understand and assess risk. Databases maintained by CGI's Insurance Information Services (IIS) for example, including the Habitational Information Tracking Systems (HITS) and Commercial Tracking System (CTS), are used to access personal and commercial property and liability claims information, including claims histories for specific properties.

Current loss codes, however, used by insurers to populate the CGI IIS HITS and CTS databases have limited ability to reflect the nuances of many types of personal and commercial property losses. Loss codes are highly aggregated, group many types of relatively distinct perils, and limit the ability of insurers to fully understand property level exposure to natural disaster risk based on historical claims. Aggregated loss codes also limit the ability of the insurance industry to participate in key public policy discussions surrounding mitigation of natural disaster risk and climate change adaptation.

This paper provides the background and context for a discussion on refining loss codes used to populate the CTS and HITS databases. Recommended refinements presented here are aimed at increasing the granularity of the codes for pertinent insured perils, including water damage, commercial flood, fire, wind and hail.

With respect to loss codes used to populate the HITS database and the information products based on it, this paper specifically recommends increasing the granularity of loss codes to collect more detailed claims information about the following perils:

- Plumbing failures resulting in water damage, including failures related to appliances, sprinkler systems and pipe freeze;
- Water damage associated with ice damming;
- Water damage associated with sump pump failure;
- Sewer backup, including differentiation between isolated and regional sewer backup events;
- Seepage and groundwater related water damage;
- Overland water influx;

- Structural/urban fire and wildland fire, and;
- Wind and hail.

To refine loss codes used to populate the CTS database and the products based on it, this paper recommends increasing the granularity of loss codes to allow for collection of claims data for the following perils:

- Plumbing failures causing water damage, including failures related to appliances, sprinkler systems and pipe freeze;
- Water damage associated with ice damming;
- Water damage associated with sump pump failure;
- Sewer backup, including differentiation between isolated and regional sewer backup events;
- Losses associated with seepage or groundwater flooding;
- River and/or stormwater related overland flooding;
- Coastal flooding, and;
- Structural/urban fire and wildland fire.

Proposed codes are based on evidence of extreme historical loss, evidence of current and future risk as reflected in the scientific literature, potential benefits to insurers, and potential benefits related to disaster mitigation and climate change adaptation public policy. Input from HITS and CTS subscribers further informed the development of the proposed loss codes. The practicality of recording losses was a major consideration in the development of the proposed codes, as were technical constraints related to recording and reporting losses to the CGI IIS databases.

This paper recommends a phased-in approach to the introduction of new loss codes. This approach may include the following components:

- Preservation of existing codes to allow companies to continue to report losses while new codes are introduced;
- Gradual adoption of new codes by contributing companies;
- Retention of existing formatting of HITS and CTS records, and;
- Introduction of new codes as subsets of existing codes.

In the near term, a working group involving a number of HITS and CTS subscriber companies will be formed by CGI to finalize recommended loss code revisions and to develop a detailed implementation strategy.

1. Introduction

In the past few years, Canadian property and casualty (P&C) insurers have experienced an alarming increase in losses associated with natural disasters and water damage. Total losses associated with disaster events exceeding $1 billion have become almost commonplace, and at $3.4 billion, 2013 saw the greatest total losses associated with natural disasters in the history of the Canadian P&C insurance industry. Water damage losses associated with extreme rainfall and flood events, as well as a myriad of plumbing and building failures, have also recently driven a substantial portion of property losses. It is clear that insurers are operating in a more complex risk environment and that there are greater demands on insurers from their clients to manage these risks.

Historical loss data are widely used by numerous stakeholders within the insurance industry to help understand and assess risk. Databases maintained by CGI's Insurance Information Services (IIS), for example, including the Habitational Information Tracking System (HITS) and Commercial Tracking System (CTS), are used widely in the industry and contain personal and commercial property and liability claims information, including claims histories for specific properties.

Despite the widespread use of HITS and CTS historical claims products, loss codes used to populate the databases do not have the ability to reflect the nuances of many types of personal and commercial property losses. Current loss codes are highly aggregated, grouping many types of relatively distinct perils, and therefore limit the ability of insurers to appropriately understand peril level risk based on historical claims. Aggregated loss codes also limit the ability of the insurance industry to participate in key public policy discussions surrounding mitigation of natural disaster risk, including participation in federal and provincial construction code revision processes.

This paper provides background for a review and refinement of property and casualty insurance industry Kind of Loss (KOL) codes used to record insurance industry claims data in CGI IIS HITS and CTS databases. The need for a review of loss codes is motivated by several drivers, including the significant increase in disaster related damages experienced by P&C insurers over the past decade, the already significant and rising costs associated with water damage (see Friedland et al. 2014), and a need to better understand non-natural hazard related water damage losses. The primary premise of this report is that improved insurance industry data, based on more refined, granulated loss coding, will serve to improve the management of risk associated with a variety of perils not currently represented in KOL codes and will increase the capacity of the insurance industry to participate in public policy discussions related to climate change adaptation and disaster mitigation.

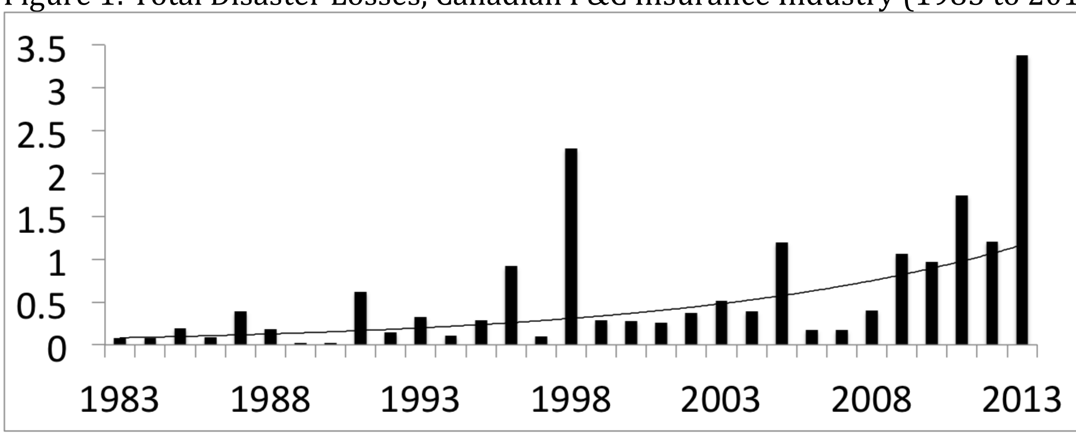
This paper concentrates on loss codes related to natural hazards, including those associated with water damage, commercial flooding, fire, wind and hail, with an emphasis on loss coding for water and flood related losses. The paper also provides discussion and recommendations for improving water damage loss codes for non-natural water damages, such as those related to plumbing and appliance failure. This first section of this report reviews trends in natural disaster losses in Canada. A brief overview of the CGI HITS and CTS databases is then provided, followed by a review of existing codes used to record personal and commercial property losses in these databases. Next, the paper discusses the need for improved water damage, commercial flood, fire, wind and hail loss codes. Proposed loss codes are provided in Section 4, and insurance industry and public benefits that could result from improved loss codes are discussed in Section 5. Finally, implementation strategies for refined loss codes are provided in Section 6.

2. The Changing Context: Rising Natural Disaster and Water Related Losses

Over the past few years, the frequency and cost of large loss events associated with natural disasters has increased significantly for the Canadian P&C insurance industry. Overall yearly losses associated with extreme events exceeding $1 billion have become almost commonplace. Indeed, the Canadian P&C insurance industry experienced natural disaster losses that approached or exceeded $1 billion in 1998, 2005, 2009, 2010, 2011, 2012 and 2013 (Figure 1) (IBC 2014a). Significant events in these years included:

- The Ontario/Quebec/New Brunswick Ice Storm in 1998 ($2.1 billion);
- The 2005 Greater Toronto Area (GTA) extreme rainfall/urban flood event ($718 million);
- A wind/thunderstorm event in Alberta in 2009 ($404 million);
- A hail/wind/thunderstorm event in southern Alberta in 2010 ($559 million);
- The 2011 Slave Lake, Alberta wildland fire disaster ($760 million);
- Numerous wind and thunderstorm events in 2012 including a $567 million event in the Calgary region, and;
- 2013 flood events in southern Alberta ($1.8 billion) and the GTA ($1 billion)[1] (IBC 2014a).

Figure 1: Total Disaster Losses, Canadian P&C Insurance Industry (1983 to 2013)*

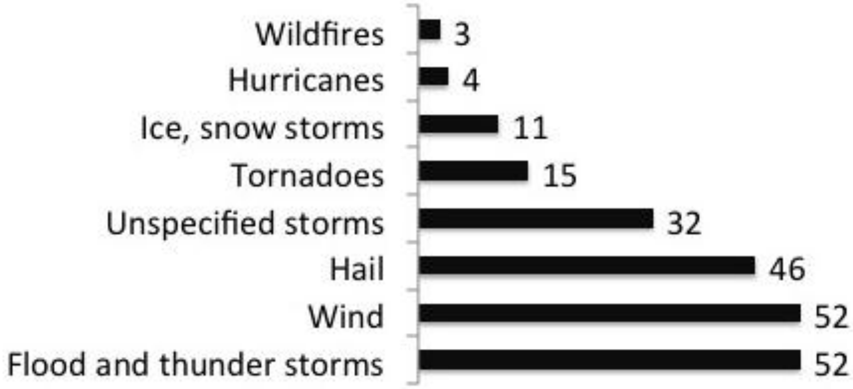


*in billions CAD, adjusted to 2013 and including adjustment expenses. Source: IBC 2014a

At $3.4 billion, 2013 saw the highest recorded insured disaster losses in Canadian history (IBC 2014a,b). Data collected on large P&C insurance industry loss events between 1983 and 2013 have revealed that flooding and thunder storms, along with wind, were the most frequent cause of large loss events (Figure 2).

[1] Losses include insured payouts and adjustment expenses, adjusted to 2013 (IBC 2014a).

Figure 2: Hazards associated with large loss events for the Canadian property and casualty insurance industry (1983-2013).



The count includes hazard types associated with 156 large loss events that occurred between 1983 and 2013. Minimum loss for an individual event included in the analysis (adjusted for 2013 CAD) was $750,000. Sources: IBC 2014a; PCS Canada 2014.

2.1. Water Damage Risk in Canada

Water damage, sewer backup and other losses associated with urban flooding have emerged over the past decade as the largest damage claims cost for P&C insurance companies in Canada (Friedland et al. 2014). In 2012, the Insurance Bureau of Canada estimated that total home insurance water damage payouts averaged $1.7 billion per year (IBC 2012), much of which could be attributed to the flooding of basements from sewer backup during extreme rainfall events. In 2014, Aviva Canada reported that 51 percent of homeowner insurance claims paid in 2013 were associated with water damage. Aviva also noted an increasing trend in the cost of an average home water damage claim, which increased from $8,994 in 2003 to $20,537 in 2013. The increasing cost of claims was attributed to a trend toward finished basements in ground-related homes (Aviva Canada 2014).

The 2013 southern Alberta and GTA flood events have served to intensify focus of the Canadian P&C insurance industry on the issues of water damage and sewer backup. As discussed above, total insured damages associated with the southern Alberta flood were estimated at $1.8 billion, making it the most expensive single insured loss event in Canadian history. While many of the losses experienced during this event were associated with commercial flood claims, homeowner insurance claims associated with sewer backup comprised a significant portion of insured payouts (PCS Canada 2014). The July 8, 2013 GTA extreme rainfall flood resulted in approximately $1.0 billion in insured losses, making it the third most expensive insured loss event in Canadian history (IBC 2014). Most of the claims experienced during this event were associated with homeowner sewer backup losses (PCS Canada 2014).

The insurance industry has also experienced severe losses from recent urban flood events in Thunder Bay and Montreal in 2012 ($260 million), the Greater Toronto Area in 2005 ($625 million), Edmonton in 2004 ($166 million), Peterborough in 2004 ($87 million), amongst several other events across the country (IBC 2014a). Sewer backup damages often comprise a considerable portion of damages experienced during these events. For example, just under half of the claims associated with the 2005 GTA flood events were attributed to sewer backup.[2] It was also estimated that $144 million of the $166 million in insured damages that occurred during the 2004 Edmonton storm were associated with sewer backup (Sandink 2007).

Various environmental and infrastructure-related factors may result in increasing urban flood risk in Canada over the next few decades. These factors include increasing urban development, resulting in numerous impacts including increased peak stormwater flows during rainfall events (Booth & Jackson 1997; Burby 2006; Nirupama & Simonovic 2006). Infrastructure deficits, identified as a key public policy issue by the Federation of Canadian Municipalities (see Mirza 2007), are a further risk factor affecting the likelihood of severe urban flood events in the future. Many cities are dealing with infrastructure issues that lead to widespread, or regional, basement flood events, notably inflow and infiltration in sanitary sewer systems (for example, City of Hamilton 2013), and legacies of historical stormwater management practices that did not adequately account for extreme events and stormwater quantity management issues (Watt et al. 2003).

It is further expected that climate change will have significant implications for stormwater management in Canadian urban municipalities (Cheng et al. 2011; Mailhot et al. 2012; Mailhot et al. 2010; Mailhot & Duchesne 2010; Mladjic et al. 2011; Nguyen et al. 2007; Peck et al. 2012; Peck & Simonovic 2009; Prodanovic & Simonovic 2007), increasing risk associated with water damage in the future. There are several property-level factors that also affect water damage risk. For example, Friedland et al. (2014) noted several "lifestyle" factors that may be linked to increasing water damage losses for the P&C industry, including increasing numbers of people living in condominiums (increasing exposure to plumbing-related water damage losses), an increase in the number of finished basements in ground-related homes, extended periods of time away from home, "busy lives," and attitudes toward loss prevention. Specific design and construction factors at the property level, including existing of physical urban flood mitigation measures, also have significant impacts on property-level risk (Sandink 2013; 2011a; 2009).

2.2. Loss Data and Understanding Risk

Rising losses associated with natural disasters bring many risk management and policy issues for insurers and governments across the country. For example, there is an increasing need to better account for environmental factors that affect risk of properties experiencing water damage loss (Friedland et al. 2014), and insurers must increasingly manage significant losses associated with extreme rainfall events and sewer backup.

[2] The initial estimate for damages from the August 2005 GTA extreme rainfall and urban flooding event was $500 million. Of this total, approximately $247 million was attributed to sewer backup (Sandink 2007).

Similarly, there is a need to accommodate increasing disaster risk in public policies that relate to population density, urban planning, infrastructure planning, design, maintenance and operations, management of urban and coastal flood risks, among a plethora of other measures required to address increasing disaster risk.

As discussed below, KOL codes used by the insurance industry to record and aggregate claims information were developed approximately two decades ago. These codes were not developed in the context of natural disaster risk that is apparent today. For example, it was not until 1998 that the Canadian insurance industry experienced its first event exceeding $1 billion in total losses. Since that time, large loss events have become far more frequent and water related damages have become the primary driver for property claims for Canadian P&C insurers.

3. The HITS and CTS Databases

The HITS and CTS databases are a formalized method of collecting and storing P&C insurance industry personal and commercial property and liability claims data for use, in turn, by the industry to understand risk. The majority of private insurers, brokers and agents across Canada access HITS and CTS products for information on historical insurance claims. Users generally include underwriting, claims and actuarial professionals.

HITS and CTS were developed to reflect a need for better collaborative risk management and improved accuracy for pricing of commercial and personal property and liability policies. HITS was created in 1992 and went live in 1993, and development of the CTS followed in 1995. The HITS database currently stores approximately 9.5 million records, while CTS stores 2.5 million records. Access to the databases by ICLR has been attained through appropriate agreements between individual contributing insurance companies and ICLR. The purpose of ICLR's access to the databases is for research and participation in public policy discussions surrounding disaster mitigation and climate change adaptation.

3.1. Current Kind of Loss (KOL) Codes

KOL codes used by insurers when reporting claims data were adopted from the IBC Personal Lines Statistical Plan and Commercial Lines Property Statistical Plan, respectively, at the time of inception of the databases in the early 1990s. Tables 1 and 2 provide the current list of loss codes that are used to record fire, wind, hail, water damage and flood losses. Appendix A provides the full list of KOL codes for personal and commercial claims.

There are several key characteristics of existing codes that limit the ability to understand the type of loss associated with several hazards. For residential property claims these characteristics include a failure to differentiate between urban/structural fire risks and wildland fire risks, aggregation of wind and hail losses, and limited ability to differentiate between various sources of water losses, including plumbing failures and losses associated with sewer backup.

Table 1: Current Loss Codes for Personal Property/Residential Fire, Windstorm, Hail and Water Damage

Category	Sub-Category	Code
Fire	Buildings	10
	Contents	11
Windstorm/Hail	Standard, buildings	20
	Standard, contents	21
	Special, T.V. aerials, etc.	29
Water Damage	Standard, buildings	30
	Standard, contents	31
	Special, sewer backing, flood etc.	39

KOL codes are also used by insurers to record commercial claims, but are somewhat more refined than those used for residential property. For example, codes reported to the CTS database differentiate between wind and hail losses. Additional codes for flood are also provided to account for availability of flood coverage for many commercial insureds (Table 2). However, similar to KOL codes used for residential property claims, the commercial KOL codes do not allow for differentiation between structural/urban fire and wildland fire losses, and they provide limited ability to differentiate several key water damage and flood risks. As discussed in Section 4.1, commercial KOL codes do not allow for differentiation between damages associated with plumbing failures, damages associated with sewer backup, and damages associated with a variety of different flood types that may be experienced in Canada.

Table 2: Loss Codes for Commercial Property

Category	Sub-Category	Code
Fire[1]	Buildings	10
	Contents	11
	Business interruption	14
Wind	Buildings	20
	Contents	21
	Business interruption	24
Hail	Buildings	25
	Contents	26
	Business interruption	27
Water[2]	Buildings	30
	Contents	31
	Business interruption	34
Flood	In transit	32
	Other	33

[1]Including smoke, lightning and explosions of all kinds
[2]Other than flood, and including leakage of protective equipment and sprinklers

4. Proposed Loss Codes

Both the insurance industry and the general public have the potential to benefit from improved KOL codes. Perhaps the most compelling reason to improve loss codes, however, is the fact that aggregated codes have resulted in the loss of pertinent data related to the cause and consequence of many types of perils. Given the increasing trend of many types of loss, notably water damage, and the potential for increasing losses as a result of climate change, changing building and maintenance practices, changing homeowner behaviour, growing populations and increasing investment in homes, it is important that relevant risk information be properly collected to ensure that a sufficient base of data is available to be analyzed in the future.

This section outlines the need for more refined KOL codes for water, commercial flood, fire, wind and hail, and proposes several additional codes to improve P&C insurance industry property loss data. Each peril category (water/flood, wind/hail and fire) is discussed separately, followed by identification of proposed loss codes. This section also outlines major findings from industry consultation meetings held in February, May and June 2014 to discuss refinement of KOL codes.

4.1. Water Damage and Flood Loss Codes

This section reviews nuances of property-level water damage losses that should be better reflected in KOL codes, for both personal and commercial property claims. Proposed codes for property and commercial claims are discussed in Section 4.1.3.

4.1.1. Nuances of Property Level Water and Flood Losses: Multiple Causes of Loss

One of the most significant issues associated with existing loss codes is that they do not reflect the nuances of property-level losses. The problem of using highly aggregated codes is exemplified in this section, which describes multiple potential causes of water damage loss at the property level.

Despite that fact that most insurers do not offer coverage for homeowners for losses associated with "flooding" (typically defined as flooding associated with natural surface water bodies – including rivers, lakes and oceans) (see Sandink et al. 2010), there are many types of water damage losses that occur in combination with extreme natural events, aside from sewer backup. For example, homeowner insurance coverage for losses associated with seepage (the infiltration of water into homes and/or basements through cracks in foundation walls and basement floors) and sudden entrance of overland water, possibly associated with extreme rainfall stormwater flows,[3] is widely available in Quebec, though frequently excluded in other parts of Canada (Sandink et al. 2010). Further, coverage is typically available for damage caused by water entering homes

[3] For more detail on sewer backup, infiltration and overland flood risk at the property level, see Sandink (2009).

through "…an opening which has been created suddenly and accidentally…" by an insured peril, such as wind (IBC 2003). However, all of these types of losses are likely to be coded as "39 – Special" water damages losses in the HITS database, despite the vastly different risk factors and mechanisms of damages associated with each of these perils.

Table 3 provides a summary of common types of water damage that may occur in residential structures. Causes of water damage can be categorized as plumbing failures (including a variety of types, such as failed appliances and sprinkler system failures), sump system failure, sewer backup, seepage or infiltration flooding, stormwater related flooding, river and coastal flooding, and other causes. Each of the causes of water damage provided in Table 3 are distinct, and have specific risk factors for individual buildings. However, current residential KOL codes allow for the coding of only three types of water damage – buildings, contents and special – and do not account for the myriad of potential causes of water damage in residential or commercial structures.

Table 3: Example Types and Causes of Water Damage Losses: Residential

Category	Type	Description	Insurance coverage typically available for homes?
Plumbing failures	Burst pipes, failure of fittings, etc.	Failure of water supply pipes under normal conditions (e.g., burst water supply pipes for washing machines as a result of aging of materials)	Yes
	Frozen (burst) pipes	Freezing of water supply pipes	Yes
	Appliance failure	Water damage associated with use of fridges, dishwashers, humidifiers, etc. and plumbing serving these appliances	Yes
	Sprinkler system failures	Failure of residential sprinkler systems	Yes
	Water heater/tank failure	Failure of water heater tank	Yes
Sump failure	Failure of pump	Failure of sump pump associated with mechanical failure of pump or power outage	Yes
	Inadequate system capacity	Inadequacy of sump pump and/or sump pit to handle foundation drainage water	Yes
Sewer backup	Regional sewer backup associated with extreme rainfall	Regional sewer backup associated with excess water entering and surcharging of public storm, sanitary and/or combined sewer systems. Typically multiple homes will experience sewer backup at the same time.	Yes -- this type of flooding may be misclassified as seepage if it enters the home via foundation drainage through foundation wall and basement floors.
	Regional sewer backup associated with public infrastructure failure	Sewer backup associated with infrastructure failures on the public side (e.g., blockages in public sanitary sewers).	Yes
	Isolated sewer backup	Sewer backup isolated to specific properties, not associated with public infrastructure failure or extreme natural events. Typically caused by failure of individual sewer laterals. Failures may be associated with shifting/grading of pipes, blockages with debris or tree roots and possible total pipe failure (e.g., collapse).	Yes
	Sewer backup associated with uninsured overland flooding (e.g., river flooding)	Sewer backup (isolated or regional) associated with flows of uninsured flood perils.	Variable, typically excluded

Table 3, continued

Category	Type	Description	Insurance coverage typically available for homes?
Seepage, infiltration	Infiltration flooding, seepage, groundwater influx	Entrance of water into home through foundation walls, basement floors. May include groundwater or surface water that has percolated through pervious backfill zones.	Variable – widely available in Quebec
Stormwater/overland flow/overland flow influx	Overland flow associated with stormwater	Flooding associated with overland flow associated with extreme rainfall or snowmelt events.	Variable – widely available in Quebec
	Overland flows associated with infrastructure failure	Overland flows associated with breakage of municipal watermains, other infrastructure failures	Variable
Flooding	Riverine, coastal flooding	Flooding associated with overflowing natural or manmade surface watercourses and coastal flooding. Includes flooding from tsunami, storm surge, etc.	No
Other types of water damage	Failure of building envelope, roof	Failure of cladding, roofing, etc. allowing rainwater to enter or seep into home. Could be associated with other perils, including wind damage, ice damming, freezing, etc.	Variable (E.g., yes, if envelope or roof failure was caused by an insured peril)
	Ice damming	Formation of ice dams on roofs during winter months, associated with poor roof insulation and venting, melting snow when then freezes on unheated roof overhangs. Water from melted snow that pools behind ice dams can leak into buildings through roofing materials and trim.	Yes

Sources: Fisette 2011; IBC 2003; 2009a,b; 2014c; Sandink 2009; 2011a,b; 2013; Sandink et al. 2010. Consultations with CTS and HITS subscribers also informed the development of this table.

Regional vs. Isolated Sewer Backup

While widespread or regional sewer backup events associated with the flooding of hundreds or possibly thousands of homes during extreme rainfall events garner a great deal of attention from the industry and government (e.g., as experienced following the 2013 GTA and Alberta flood events), losses associated with isolated sewer backup also represent a significant problem in many cities across the country. For example, several municipalities have identified isolated home sewer connection failures as a key cause of sewer backup (see for example, City of Edmonton n.d.; City of Hamilton 2002; City of Niagara Falls n.d.; City of Ottawa 2014; City of Vancouver 2014; City of Winnipeg 2013) and the City of Brantford has reported that "the most common cause of backed up drains or basement flooding [in Brantford homes] is a blockage in the sewer pipe connecting [homes] to the sanitary sewer on the street" (City of Brantford 2014). Thus, isolated sewer backups may be a considerable, but as yet poorly understood driver for home insurance sewer backup payouts. However, sewer backup losses are frequently coded using the "39 – Special" water damage code, which does not allow differentiation between different causes of sewer backup.

Many insurers are incentivizing lot-level plumbing measures to reduce the risk of regional sewer backup events associated with extreme rainfall events. For example, several companies have provided options to increase sub-limits, decrease deductibles and/or reduce rates when high-risk policy holders undertake specific plumbing related measures, including installing backwater valves or sump pump systems (Applied Systems 2013; Sandink 2014). It is important to note that measures designed to reduce property-level risk from regional sewer backup events do not address many risks associated with isolated sewer backup risk (see Table 4), signifying a further important driver to reflect the nuances of sewer backup losses in water damage loss codes.

Table 4: Regional vs. Isolated Sewer Backup

Type	Description	Example lot-level mitigation measures
Regional	• Frequently associated with extreme natural events, including extreme rainfall and snowmelt events or with failures of municipal infrastructure (e.g., blockages of underground sewer systems) • Typically results in flooding of several homes/buildings over a short duration of time • Primary mechanism of damages: Water and/or sewage from municipal sewer systems backing up into buildings through main sewer connections (e.g., storm and/or sanitary sewer laterals)	• Backwater valves • Foundation drain disconnection • Downspout disconnection
Isolated	• Associated with failure of plumbing systems at the lot-level • Typically associated with failure of main sewer connections caused by blockages from tree roots, various blockages from debris or build up of fats oils and grease, or shifting or sagging of sewer laterals, breakage or collapse of sewer laterals • Primary mechanism of damage: Inability of household sanitary waste to exit the home, resulting of backing up of sewage through low-elevation plumbing fixtures in building (e.g., basement floor drains)	• Repair, replacement of sewer laterals • Auguring, pipe relining

4.1.2. Commercial Property and Flood Codes

Reflecting availability of overland flood coverage for many commercial properties (Sandink et al. 2010; Sandink 2011b), there currently exists commercial property KOL codes specifically designed to capture "flood" losses (Table 2). However, similar to criticisms of the ability of existing residential water damage loss codes to reflect the nuances of property-level water damage losses, existing flood KOL codes (see Section 3.1) are highly aggregated and provide little latitude to record crucial details of commercial flood losses.

Table 5 outlines three categories of flooding that may result from extreme natural events. Each of these categories of flooding may have several different causes. Despite the variety of types and causes of natural-hazard related flooding that buildings may experience, each with very distinct risk factors, there are currently only two commercial property KOL codes for flood, including "32 – In transit" and "33 – Other."

Table 5: Natural-Hazard Related Flooding – Common Causes and Mechanisms in Canada

Flood category	**Subcategories and causes**
Overland	Riverine flooding associated with: • Snowmelt runoff/freshet flooding • Storm rainfall • Ice jams • Flooding associated with the formation and failure of natural dams (e.g., glacial outburst flooding, flooding associated with landslides, moraines and glaciers that block river flows • Failure of engineered flood control structures
	Coastal flooding (ocean and lake coastal areas), associated with: • High wind and wave action • Combination of high estuarine flows and tides • Storm surge, hurricanes • Seiches • Wind setup causing high lake levels • Tsunamis
	Urban stormwater, associated with: • Extreme rainfall overwhelming the capacity of urban stormwater management infrastructure • Rapid snowmelt • Failure of urban stormwater management infrastructure (e.g., blockages in catch basins and underground stormwater systems)
Seepage or infiltration flooding	Water seeping into lower levels/basements/foundations of buildings, associated with: • High groundwater conditions • Infiltration of overland water through pervious backfill areas beside foundation walls during snowmelt or rainfall events • Backing up of municipal storm and/or sanitary underground sewer systems into foundation drainage, forcing water into buildings through foundation walls, basement floors
Underground sewer systems	Storm, sanitary and/or combined sewer backup associated with: • Overwhelming of underground stormwater management systems with extreme rainfall flows • Excessive inflow/infiltration in sanitary systems during extreme rainfall events • Overwhelming of combined sewer systems during extreme rainfall events

Sources: Environment Canada 2013; Hausmann 1998; Sandink 2009; Shrubsole et al. 2003; Shrubsole et al. 1993

4.1.3. Proposed Water Damage and Flood Codes

Detailed proposed codes for water damage and flood are listed in Appendices B and C, and are summarized here. As discussed in Section 4.3, consultations with insurers revealed a need to balance both the granularity/specificity of proposed codes with the time constraints of claims staff and their ability to accurately record losses using the provided codes. Thus, the emphasis of the proposed refined codes was to provide a small but essential level of increased detail, including differentiating key causes of water damage (e.g., plumbing failures vs. sewer backup losses). Further reporting of the nuances of individual loss codes may be accommodated through application of the claims notes questionnaires, discussed in Section 4.1.4.

Currently, three loss codes are available for recording water damages losses. These include:

- 30: Standard, buildings;
- 31: Standard, contents, and;
- 39: Special.

Commercial codes for water related losses reflect the availability of flood coverage for commercial insureds. Commercial codes for water include:

- 30: Buildings;
- 31: Contents, and;
- 34: Business interruption.

Commercial codes for flood include:
- 32: In transit, and;
- 33: Other.

Proposed loss codes for personal property water damages are summarized in Table 6. Proposed loss codes for commercial property water damage and flood are summarized in Tables 7 and 8. For more detail on the proposed codes, see Appendices B and C.

Table 6: Proposed Loss Codes, Personal Property Water Damage[4]

Codes to be added to standard, building (30) and standard, contents (31)*:

- Plumbing failure
  - Appliance failure
  - Sprinkler system failure
  - Pipe freeze
- Water damage associated with ice damming
- Sump failure
- Sewer backup, seepage, overland influx
  - Sewer backup
    - Regional event
    - Isolated event
  - Seepage, groundwater
  - Overland influx

*Denotes an already existing code

Table 7: Proposed Loss Codes, Commercial Property Water Damage[5]

Codes to be added to standard, building (30) and standard, contents (31)*:

- Plumbing failure
  - Appliance failure
  - Sprinkler system failure
  - Pipe freeze
- Water damage associated with ice damming
- Sump failure
- Sewer backup
  - Regional event
  - Isolated event

*Denotes an already existing code

Table 8: Proposed Loss Codes, Commercial Property Damage, Flood[6]

Codes to be added to flood, other (33):

- Buildings
  - Seepage, groundwater
  - Overland flooding
    - River related flooding
    - Stormwater related flooding
  - Coastal flooding
- Contents
  - Seepage, groundwater
  - Overland flooding
    - River related flooding
    - Stormwater related flooding
  - Coastal flooding

*Denotes an already existing code

---

[4] For a more detailed breakdown of proposed codes, see Appendices B and C.

[5] Ibid.

[6] Ibid.

4.1.4. Claims Notes Questionnaires – Water and Flood

As discussed above, the granularity of proposed loss codes has to be balanced against time constraints associated with the coding of losses during the claims process. For this reason, the proposed loss codes, though providing a substantial increase in the granularity of water and flood losses codes, are still relatively aggregated in comparison to the complexity and variety of causes of loss at the property level. To augment the proposed loss codes, lists of questions that could be considered as part of the claims notes process for residential and commercial water and flood losses was developed for this report. The proposed claims notes questionnaires are provided in Appendices D and E. Both claims notes questionnaires are aimed at water losses associated with extreme natural events.

4.2. Fire and Wind/Hail Codes

Existing claims codes are unable to account for relatively high-level but important differentiation of fire, wind and hail risks. For example, current personal and commercial KOL codes do not allow for distinction between structural fire losses and wildland fire losses. Further, while treated as distinct perils in commercial property KOL codes, wind and hail losses are aggregated in the personal property/residential KOL codes. The importance of treating urban/structural fire, wildland fire, hail and wind as distinct perils and proposed codes for these perils are discussed in the following sections.

4.2.1. Fire Codes: Separation of Structural/Urban Fire and Wildland Fire

The risk of damage associated with wildland fire disasters is considerable. Indeed, P&C insurers paid nearly $1 billion[7] for damages in the two major wildland fire disasters that affected Kelowna, BC in 2003 and Slave Lake, Alberta in 2011 (IBC 2014a). There is also considerable evidence that losses associated with wildland fire will increase – perhaps significantly – in the coming years. For example, climate change impacts are expected to result in increasing frequency and severity of wildfires in Canada (Wotton et al. 2010) and it has been argued that wildfire suppression, increasing human occupancy of wildland-urban interface areas for recreational, habitational and commercial purposes will also increase wildland fire risk across North America (Braun et al. 2010; McCaffrey 2004; Radeloff et al. 2005; Wotton et al. 2010). Total area burned in Canada has already been increasing since the 1960s, and it has been argued that human-induced climate change has already had a detectable influence on area burned by wildfire (Gillett et al. 2004).

Despite the risks associated with wildland fire losses, current loss codes for both personal and commercial property do not allow for distinction between wildland fire and structural/urban fire. Currently, residential fire codes include:

- 10: Buildings, and;

[7] Both figures are in 2013 CAD and include adjustment expenses.

- 11: Contents.

For commercial losses, an additional code is used for business interruption associated with fire losses, and losses are coded as follows:
- 10: Buildings;
- 11: Contents, and;
- 14: Business interruption.

The ability to differentiate wildland fire and structural/urban fire losses can be addressed by adding two codes: One for wildland fire for buildings losses and an additional for wildland fire for contents losses. The proposed codes are provided below. For more detail on the proposed codes, see Appendices B and C.

For residential losses, proposed codes include:
- Buildings
    - Structural, urban fire
    - Wildland fire
- Contents
    - Structural, urban fire
    - Wildland fire

For commercial losses, proposed codes include:
- Buildings
    - Structural, urban fire
    - Wildland fire
- Contents
    - Structural, urban fire
    - Wildland fire
- Business interruption
    - Structural, urban fire
    - Wildland fire

4.2.2. Windstorm/Hail Codes: Separation of Wind and Hail

Wind and hail are both major drivers for insurance industry loss events. As discussed in Section 2, industry-wide data on large loss events collected since 1983 have revealed that wind has caused as many large-loss events for the P&C insurance industry as flooding/thunderstorms, and hail was the third most frequent cause of large loss events. Individual hail loss events can lead to significant damages. Indeed, the 2010 southern Alberta storm that resulted in $560 million in insured losses,[8] making it one of the most expensive insured loss events in Canadian history (IBC 2014a).

[8] Losses are in 2013 CAD and include adjustment expenses.

Hail and wind perils are distinct both in terms of damages and mitigation measures. For example, 67% of all large loss events associated with hail recorded by IBC and PCS Canada between 1983 and 2013 occurred in the Prairie regions (Etkin & Brun 2001; IBC 2014a; PCS 2014), suggesting an important geographical component to this risk. Hail is also associated "exclusively" with severe thunderstorms (LeDochy & Paul 1986). Thus, this peril typically occurs in combination with additional hazards, including wind and extreme rainfall.

Hail losses for residential buildings are largely related to roofing material damage. During very severe hail events, other components of a home, including siding, vents, soffits, windows and doors can also be severely damaged (McGillivray 2013). In comparison to hail damage risk reduction measures, which typically focus on impact resistance of roofing materials, wind risk reduction measures for residential structures are typically oriented toward structural components of buildings and fastening of key building components to the structure, including, for example, fastening of sheathing, and fastening roofs to the building structure (see Section 5.2.1).

Recognizing the distinct nature wind and hail perils, several P&C insurers have begun to segregate these losses and treat them as unique perils. For example, in a 2014 interview, Ken McCrea, president and CEO of Wawanesa stated that

> the industry will move, and is moving, to decouple the property product — separate out wind and hail, separate out sewer backup coverages more than ever, have separate premiums on them, separate deductibles, separate coverage limits…the perils are not the same. You'll have to offer those things separately and price them according to the costs (*Thompson's World Insurance News* 2014).

It is also notable that KOL codes for commercial claims already provide unique codes for wind and hail losses (see Appendix A).

Similar to the separation of wildland fire from structural/urban fire losses, this paper proposes a relatively simple separation of windstorm and hail damages for KOL codes. Proposed additional codes are provided here. These recommendations apply only to KOL codes used for personal property losses and the HITS database.

For residential losses, proposed codes include:

- Buildings
  - Windstorm
  - Hail
- Contents
  - Windstorm
  - Hail
- Special
  - Windstorm
  - Hail

4.3. Industry Consultation

On February 3, 2014, CGI hosted an event for CTS database subscribers. At the event, a presentation was given by ICLR that outlined the need to refine loss coding used by insurers. The presentation highlighted various causes of water damage and the inability of current loss coding to reflect the intricacies and nuances of water damage losses for both residential and commercial property. Meeting participants, who included underwriting staff from Northbridge Insurance, Aviva Canada, The Co-operators, Unica Insurance, Intact Insurance, RSA Canada and Wawanesa Insurance, were invited to discuss the prospect of refining industry loss codes. It was agreed at the meeting that there was a need to pursue refinement of loss codes and that improved loss coding could provide benefits to insurers. It was further discussed that the public could potentially benefit from improved loss coding as well, provided that application of refined codes lead to better public policy decisions related to disaster mitigation.

From May to June, 2014, CGI and ICLR staff consulted with 17 underwriting, claims and IT staff from Aviva Canada, The Co-operators, Portage Mutual Insurance Company, Gore Mutual Insurance Company and Northbridge Insurance. At the consultations, insurer staff were asked to provide their opinions on the feasibility and need to refine KOL codes and their appetite for refining codes. Meeting attendees were provided background detail on each of the requested code changes and on the proposed claims notes questionnaires, with an emphasis on refinement of data collected associated with water-related perils. Findings from industry consultations are discussed below.

4.3.1. General Observations

Two primary observations were made as a result of the consultations. First, the majority of insurer staff, notably underwriting staff, agreed that loss coding should be improved and strongly supported CGI/ICLR efforts to pursue loss code refinements. This was especially the case for water related losses, which were cited as major drivers for both residential and commercial property losses (Table 9). Second, claims and IT staff noted several potential challenges associated with increasing the granularity of existing loss codes. Specific challenges associated with implementing new loss codes are discussed in Section 4.3.2.

A key finding of the consultations was the desire to include a range of water damage loss codes for non-natural water damage perils, including detailed plumbing failure related codes (see Table 9). The greatest emphasis was for additional codes that allowed for distinct coding of losses associated with appliances and sprinkler systems. Further codes that were recommended during consultations included codes that allowed for identification of properties that experienced water damage despite having mitigation measures in place, water damage associated with failure of building envelopes and water intrusion in above-ground spaces, flooding related to failure of municipal watermains, water damage related to ice damming and specific codes for water damage related to frozen pipes. It was notable that several companies reported that they were already using more refined loss codes and had, for example, already been recording water losses associated with freezing and sewer backup with distinct codes within their organizations.

Table 9: Industry Consultation, General Comments on Proposed, Refined Loss Codes

Category	Finding
Support for loss code changes	Consultations revealed a general need and support to develop codes that reflect the various types of insurance water damage losses, including different types of flooding (e.g., seepage vs. sewer backup)
	Reinsurers are asking for separation of wind and hail losses (for residential)
	Refined loss codes would help improve underwriting
Additional codes	Initial loss codes presented to industry stakeholders focused on natural hazard related perils only. However, consultations revealed a desire to include many additional codes beyond those that reflected natural hazard losses. Additional codes recommended by consultation participants included: • Water damage associated with appliances (e.g., espresso machines, washers and dryers on the second floor, etc.) • Water damage associated with sprinkler systems • Codes for classification of natural and non-natural related water losses • Losses in buildings that have been equipped with mitigation measures (e.g., backwater valves) • Water damage resulting in infiltration of water in upper levels of buildings, not associated with flooding (e.g., water intrusion through building envelope during storms) • Flooding related to failure of municipal watermains/infrastructure failure • Water damage related to ice damming • Water damage related to frozen pipes
	Several companies reported that they are already using codes with a greater degree of granularity (e.g., codes related to freezing, sewer backup, separation of wind and hail losses for residential claims, etc.) than those used to record losses for the HITS and CTS databases.
	Some existing codes (e.g., code 29 – Special, T.V. Aerials, etc.) may be obsolete and could be replaced with more pertinent loss codes.
Concurrent causation	Multiple causes of flooding are difficult to differentiate. This creates problems especially in cases where water damage result from insured (e.g., sewer backup) and uninsured (e.g., overland flood) water damage perils. There is a need to build capacity to differentiate different sources of flooding.
Ongoing work	There is a need to review and assess loss codes on a continuing basis, for example, every five or ten years – however, there will have to be a defined group within the industry that will manage continuing review and updating of loss codes.
Additional comments	It would be beneficial to consult with reinsurers and product testing agencies, such as the Canadian Standards Association, to assist in the development of improved loss coding.

The need to better distinguish insured and non-insured water damage losses that occur concurrently was also cited as a driver to refine loss codes. For example, insurers reported difficulties in separating out losses for specific claim events that were associated with uninsured overland flooding and insured sewer backup for homeowners. Consultations further revealed a need to continually refine loss codes to reflect changes in risk that may be associated with climate change, and changes in building design and construction practices, which may increase risk of plumbing- and cladding-failure related water damages in the future. It was argued that industry loss codes should likely be reviewed every five or ten years, and that a specific agency or organization would have to adopt this task. Finally, the need for ongoing consultation with reinsurers and organizations concerned with product standards and testing, including the Canadian Standards Association, was identified as a strategy to ensure that proposed loss codes are as relevant and effective as possible.

4.3.2. Implementation Challenges and Strategies

While there was strong support and general recognition of the need for refined loss codes, several challenges for implementation of new codes were noted during the consultations (Table 10). These challenges included limited ability of existing claims recording computer systems to handle additional loss codes and time constraints for claims staff to accurately record losses. For example, consultations with claims staff revealed a need for insurers to quickly "get the cheque out" for a claim, providing staff with limited time to review, examine and verify losses to ensure that they were properly coded. The capacity of staff to appropriately code losses based on technical criteria was also highlighted as a concern.

Table 10: Implementation and Technical Issues related to Refined Loss Codes

Implementation issues	Losses may be very quickly coded after a claims file has been opened to facilitate prompt payment for losses. This process may not allow a claims staff person appropriate time to carefully consider the cause of the loss and appropriate code the loss. However, there may be limited latitude within an insurance company to re-code claims after a claims file has been opened.
	It will be difficult to defined what is meant by "extreme event" for the purposes of coding regional vs. isolated sewer backup losses
	Claims staff have limited time to verify accuracy of loss coding
	It is possible that, if improperly implemented, more refined coding could result in increasing frequency of reporting claims as "other" (e.g., 99 code) claims
Technical issues	Avoid using more than two characters for new loss codes. Consider using alpha characters to increase the range of available codes.
	Some claims recording systems may allow use of three digit loss codes

It was also noted that there might be limited latitude to change loss codes following the opening of a claims file, even if it has been found that the initial code was inaccurate. It was further stated that, if claims staff are not adequately educated about how to code claims using more granular coding systems, there may be an increase in the reporting of claims using the "99 – All other losses" claims code, effectively reducing data quality rather than increasing it. Technical issues were also identified during consultations, including possible limitations on the number of characters that can be used for new loss codes. However, several staff who suggested that implementing new codes would be difficult also noted that they would be willing to work on improved loss coding, given the potential benefits of improved insurance industry claims data.

Several implementation strategies were also identified during industry consultation meetings (Table 11). For example, several of the companies involved in consultations were in the process of implementing new computer software for recording and analyzing claims data. The implementation of new claims management systems was identified as a key window of opportunity for implementing new claims codes.

It was also suggested that a "phased-in" approach be used for implementing new loss codes. As discussed in later sections of this paper, all proposed claims codes are subsets of existing claims codes. Introducing additional claims codes as optional codes for an initial period of time, allowing companies to use new codes if their internal processes allow reporting at the required level of granularity. It was argued that, as additional members of the industry refine codes over the next few years, the uptake of new codes would increase.

Limiting the ability of insurers to report claims using the "99 – All other losses" code was also identified as a means of increasing uptake of more granular codes. It was suggested that many losses are recorded using this code because the nature of some losses are not reflected in existing KOL codes. If this code were removed as an option, it may force insurers to report using available codes. However, appropriate application of this approach would require increased claims staff and adjuster capacity to understand and appropriately code losses. Thus, education of key staff would further be required to ensure successful implementation of new codes.

Table 11: Implementation Strategies

Implementation strategies	Some companies involved in the consultations were in the process of updating their claims recording computer systems. The updating process was identified as a potential window of opportunity to implement additional loss codes.
	A phased-in approach may assist in implementation. For example, the proposed codes may be initially provided as option as sub-codes to existing loss codes when submitting claims data to CGI IIS databases.
	Avoiding use of the existing "99 – All other losses" code may encourage increased use of more granular codes and provision of more refined codes may help insurers avoid use of the existing "99" code.
	Education for claims staff and adjusters will be necessary to ensure accurate coding of claims.

As discussed above, industry consultations highlighted a need to balance the granularity of loss codes with the ability of claims staff to appropriately code losses. For example, though there are potentially dozens of codes that could be applied to reflect the nuances of specific water damage losses (see Section 4.1.1), it was recognized that it would be unlikely that a large number of highly specific codes could be effectively used. Thus, the number of new codes presented in this paper are limited to those that would assist in understanding some of the most crucial aspects of property level losses, for example, whether a water damage claim is associated with a plumbing failure or sewer backup. However, this paper also presents claims notes questionnaires designed to assist insurers in the collection of detailed information about water damage losses, without necessitating recording of highly detailed information using KOL codes (see Section 4.1.4).

5. Benefits of Improved Loss Codes

5.1. Benefit to Insurers

Referring to loss coding, Friedland et al. (2014) stated that

> …good practice for property pricing requires that actuaries have the ability to link claims data with detailed exposure data. Thus, actuaries require accurate cause-of-loss coding for all property claims (pg. 20).

Indeed, improved loss data can feed back into underwriting processes to improve risk management for property insurance companies. Improved data will become more important as various factors increase society's vulnerability to natural extremes and as losses from natural disasters continue to rise in the future.

Further, as populations continue to grow and urbanization increases, vulnerability to many types of hazards will increase, especially hazards related to urban, river and coastal flood risks. There are many important sub-components to urban flooding, notably flooding associated with stormwater flows and sewer backup, which are not accounted for in existing loss codes. Improved data on these specific hazard types will have growing importance as water damages increase over time and as insurers seek methods to reduce risk and exposure to these losses.

Generation of data that can be applied to more appropriately incentivize lot level measures to reduce disaster risk is a further benefit of improved loss codes. For example, as discussed in Section 4.1, an important gap in the current data is the lack of separation of regional sewer backup losses and isolated sewer backup losses. Many insurers have been incentivizing the installation of property-level measures that are designed only to reduce the risk of regional sewer backup – notably backwater valves and sump pumps (Sandink 2014). While these measures do little to nothing to address risks associated with lateral failure and blockages that result in isolated sewer backup, there are options that can be applied at the lot-level to reduce risk associated with isolated sewer backup occurrence, including maintenance and repair of sewer laterals and good landscaping practices (e.g., not planting trees directly above sewer laterals). However, the opportunities to apply measures, including deductibles, premiums and sub-limits, to encourage these measures and reduce isolated sewer backup risk is lost if insurers do not have available claims data to help them understand this risk.

The above argument applies to hail and wind losses, which are currently aggregated through existing personal property KOL codes. These perils are highly distinct, each with their own specific risk factors and mitigation measures. Similarly, structural and wildland fire are distinct hazards affecting different portions of the population and requiring vastly different approaches for risk reduction, both at the lot and community level. Refined loss codes will also improve the general quality of data available to the industry through the HITS and CTS systems, increasing the applicability of this data to address a number of insurer concerns, including accurate pricing and fraud.

To summarize, some of the key benefits to insurers may include:

- Improved data to assess the risk of loss for specific insureds;
- Improved ability to incentivize risk reduction measures;
- Improved accuracy in pricing of policies;
- Prevention of fraud during claims investigation process, and;
- General improvements in transparency and accuracy of data.

5.2. Public Benefits

One of the primary benefits of improved insurance loss data will be improved research capacity for academics, government and the insurance industry. A few pertinent questions that could be pursued with improved loss data using the proposed coding may include assessing the accuracy of government riverine flood hazard maps, assessing the impact of climate change on exposure to a variety of hazards, including wind, hail, wildland fire, riverine and coastal flooding, stormwater flooding and sewer backup, providing necessary background information to improve model construction codes, provincial building and plumbing codes and local building by-laws across the country, among numerous additional benefits.

Improved loss codes can further provide the basis for increased participation of the Canadian P&C insurance industry in public policy discussions related to disaster mitigation and climate change adaptation. Potential benefits may include: Improved, safer housing stock, as a result of improved building code submissions based on reliable insurance loss data; Improved hazards and risk management, including, for example, improved understanding of river and coastal flood risks through evaluation of the accuracy of river flood hazard maps, and; identification of areas prone to isolated and regional sewer backup, stormwater and seepage flooding at the municipal government level. Further, improved risk assessment for insurers will increase their ability to appropriately price coverage, thus increasing the sustainability of insurance coverage for the public.

As identified above, a potential application of improved insurance industry data related to water damage is improved risk assessment for sewer backup and stormwater flood risk in urban municipalities. Currently, municipalities frequently rely on homeowner complaints to identify areas vulnerable to urban flood losses. However, ICLR research has found that far more homeowners who are affected by urban flooding, specifically sewer backup, are likely to report their damages to their insurance provider, rather than their municipal government (see Sandink 2007). Thus, there may be a considerable data gap in the reporting of basement flood events to municipalities, limiting their ability to appropriately apply infrastructure investments to reduce urban flood risk. Thus, if shared with municipal governments through the research community, loss data that is appropriately coded may help improve infrastructure investment. The application of this information would be further augmented by differentiating between regional and isolated sewer backup events, infiltration and overland flood water influx, as would be accommodated through application of more granular loss codes.

A further specific example of the need for improved data that will lead to safer construction is exemplified in the next section. Through ICLR, the Canadian P&C insurance industry has begun to make specific requests to the model construction code communities to improve building standards to increase disaster resiliency of housing stock in Canada. This is a key area that would benefit from improved insurance industry data, and has the potential to benefit insurers through reduced disaster payouts and the public by increasing the quality and safety of housing stock.

5.2.1. Application of Improved Loss Coding: Model Construction Code Change Requests

Currently, model construction codes developed by the National Research Council are adopted in whole or with relatively modest adaptations by provinces across the country (NRC 2012). Codes are then adopted and enforced at the local level (Simonovic 2011). In terms of safety, buildings codes in both Canada and the United States are oriented toward protecting the "life safety" of occupants, with limited consideration of the resilience or ability of housing stock to withstand extreme natural events (Mileti 1999). Thus, model building, fire and plumbing codes incorporate measures to reduce the risk of injury from falls, structural fire, and sewer gases, but have limited consideration of measures to reduce the costs associated with building failure during extreme natural events.

Through ICLR, the Canadian P&C insurance industry is currently working to change specific components of national and provincial building and plumbing codes to increase the resilience of housing stock to extreme natural events, including wind and extreme rainfall. Specific changes that have been proposed to provincial and national building code committees are presented in Table 12.

Each of the above code changes require relatively specific data in order to be advanced at the national and provincial levels. Improved loss data and claims reporting could serve to strengthen the evidence for code changes aimed at improving the resilience of housing stock, including those provided in Table 12.

Over the coming years, the insurance industry, through ICLR, will be continuing their involvement in building code review and improvement processes, including submission of additional code change requests to national and provincial construction code development communities. For example, additional code change requests that would increase the resilience of new home construction to water damage risk include:

- Requiring backup systems for sump pumps in new residential construction;
- Requiring protection from backflow for both storm and sanitary connections;
- Clarifying lot grading/site drainage requirements for new lots and subdivisions;
- Requiring extension of eavestrough downspouts, and;
- Requirements for construction and building practices to improve durability of building sewer connections.

These requests would experience a greater likelihood of success if there were supported by improved insurance loss data, as would be facilitated through application of more granular KOL codes.

Table 12: Insurance Industry Code Change Requests, National Building and Plumbing Codes

Code change request	Description
Clarify wording for backwater valve requirements	• National Plumbing Code wording currently requires backwater valves to reduce the risk of sanitary or storm sewer backup in specific circumstances. However, evidence from large, regional urban flood events suggests that
Clarify wording for connection of foundation drainage to sanitary sewers	• National Building and Plumbing Code wordings currently allow connection of residential foundation drainage systems to sanitary sewer systems, increasing the risk of sewer surcharge causing sewer backup. This code change request asked for national model construction codes to clarify that this type of connection should be prohibited unless no other option is available.
Align roof and wall sheathing fastening requirements	• Aligning the requirements for roof sheathing fastening so that they match current requirements for wall sheathing. Improving roof sheathing fastening strength would reduce risk of roof failure during high wind events.
Bracing to resist lateral wind loads	• Connecting roof rafters, joists, and/or trusses to wall framing to increase the resistance to uplift forces during high wind events to reduce the risk of structural damage to homes.
Clarification of requirements for anchoring columns and posts	• By clarifying requirements for the connection of columns for porch roofs and raised decks, resistance to failure (e.g., lifting of posts off of supports) can be increased, reducing the risk of structural damage during wind events.

6. Implementation of Proposed Codes

As discussed in Section 4.3.2, specific obstacles to implementation of new codes identified during insurer consultations included limited claims staff time to record and verify losses after a claim is made and limited ability to recode claims after claim files have been opened. Consultations also suggested that it would be difficult to implement new KOL codes that require more than two characters. Strategies for implementation of additional KOL codes identified during consultations included adopting codes during the internal implementation of new claims management software and application of a "phased-in" approach to introduce additional codes.

While issues related to staff time and resources to record losses using the proposed codes and opportunities related to implementation of new claims management software will largely have to be addressed by individual companies, a general approach to incorporating new loss codes into reporting practices is described here. This approach may be described as a phased-in approach, as recommended during industry consultations.

A phased-in approach would have several key characteristics, including:

- Preservation of existing codes to allow companies to continue to report losses while new codes are introduced;
- Gradual adoption of new codes by contributing companies;
- Retention of existing formatting of HITS and CTS records, which include use of no more than two characters for loss codes, and;
- Introduction of new codes as subsets of existing codes.

As discussed in Section 4.3, it is likely that many companies are already internally recording losses using more refined codes. Thus, the introduction of codes using a phased-in approach would allow insurers to sync existing claims coding approaches with those relevant to the HITS and CTS databases. This approach would also allow for uninterrupted data collection using historical codes while companies begin the process of submitting loss information using new codes.

As modification of database record layouts and lengths would require substantial resources both on the part of CGI and contributing companies, retaining the formatting of existing loss records will be an important component of the introduction of new codes. This approach will include retaining existing formats for two-character KOL codes, and ensuring that any changes to claims records that result from new codes do not do not exceed the 256 character limit currently in place for claims records.

Introduction of new codes as a subset of existing codes will also be an important part of the implementation process. Codes presented in Appendices B and C have been designed in a way that would allow more detailed loss records to be aggregated into existing loss codes. For example, losses recorded in the HITS database using the proposed sewer backup, seepage and overland influx codes (codes 32, 33 and 34, respectively) could be aggregated into the existing "39 – Special" water damage code to allow for comparison with previous HITS records. Similarly, proposed water damage codes for plumbing failure, pipe freeze, and so on could be aggregated into existing water damage codes "30 – Water damage, buildings" and "31 – Water damage, contents." Several companies consulted for the preparation of this report further indicated that sewer backup losses are typically coded as "water damage" losses in the case of commercial claims. Thus, refined sewer backup loss codes are proposed as subsets of water damage codes for CTS claims reporting (see Appendix C).

Consultations with insurance companies revealed that claims staff might have difficulty applying the proposed codes without appropriate background knowledge on how to apply the proposed codes. This was identified as a particular concern for relatively technical codes, including codes differentiating regional and isolated sewer backup events. Thus, education materials to support the implementation of new codes should also be developed and distributed to claims staff. These materials should be developed with the assistance of HITS and CTS subscribers.

In the near term, a working group involving a number of CGI HITS and CTS subscribers will be formed. This working group will be tasked with finalizing a set of revised loss codes and developing a detailed implementation strategy for HITS and CTS subscribers. Table 13 outlines a timeline for the development and implementation of refined loss codes.

Table 13: Implementation Timeline

Implementation item	Date
First meeting of CTS users to discuss KOL codes	February 2014
Drafting first list of refined KOL codes for HITS, CTS	March-April 2014
Consultation with industry partners	May-June 2014
Drafting white paper	June-September 2014
Second meeting of CTS and HITS users	September 2014
Final white paper	**November** 2014
Form working group	January 2015
Publish final codes	June 2016*
Develop implementation strategy	June 2016*
Implementation of codes	Late 2016*

*Depending on working group outcomes and recommendations

7. Conclusion

In the past two decades, the landscape of insured losses in Canada has changed considerably. Large loss events associated with natural extremes have increased in frequency and severity, and the P&C insurance industry has experienced an alarming increase in the occurrence of water-related property damage losses. A number of risk factors, including changing development patterns, increasing populations and population densities, deteriorating infrastructure and climate change will continue to drive increases in natural disaster related losses.

Existing KOL codes are highly aggregated and do not allow for recording of a substantial amount of information relevant to understanding loss risk at the individual property level. For example, existing codes do not allow insurers to distinguish between plumbing failures and sewer backup losses, residential wind and hail losses, and losses associated with wildland and urban fire claims.

This paper represents a first step toward improving insurance industry loss data through provision of more refined KOL codes used for property claims data. There are many potential benefits that could be experienced by both insurers and the public as a result of improved loss data, including improved information to support public policy related to disaster mitigation and climate change adaptation, and increased sustainability of insurance products. Given the size and complexity of the Canadian P&C industry, implementation of new codes may require a gradual approach, however it appears that many insurance industry stakeholders are highly supportive of improving industry claims information.

Appendix A: Current KOL Codes

KOL Codes: Personal Property/Residential

Category	Sub-Category	Code
Fire	Buildings	10
	Contents	11
Windstorm/Hail	Standard, buildings	20
	Standard, contents	21
	Special, T.V. aerials, etc.	29
Water Damage	Standard, buildings	30
	Standard, contents	31
	Special, sewer backing, flood etc.	39
Burglary/Theft	On premises loss	40
	Off premises loss	41
	Special, mysterious disappearance, etc.	49
Personal Liability	Personal, bodily injury or death, employer’s liability, voluntary compensation, medical payments	50
	Property damage	51
Glass Breakage	$50 deductible or more	60
	$25 deductible	70
	$10 deductible	71
	No deductible	72
Collapse of building		61
Collision, upset or overturn of carrying vehicle		62
Earthquake damage		63
Smoke damage—faulty operation of heating device		64
Vandalism or malicious acts		65
Mass evacuation		80
All other losses		99

KOL Codes: Commercial Property

Category	Sub-Category	Code
Fire[1]	Buildings	10
	Contents	11
	Business interruption	14
Wind	Buildings	20
	Contents	21
	Business interruption	24
Hail	Buildings	25
	Contents	26
	Business interruption	27
Water[2]	Buildings	30
	Contents	31
	Business interruption	34
Flood	In transit	32
	Other	33
Crime[3]	On premises loss	40
	Off premises, including transit	41
Farm losses		50
Glass breakage		60
Collapse		61
Vehicle impact, collision, upset or overturn	Contents of carrying vehicle	62
	Other[4]	66
Earthquake		63
Vandalism, malicious acts and riots		65
All other business interruptions[5]		94
All other losses		99

[1]Including smoke, lightning and explosions of all kinds
[2]Other than flood, but including leakage of protective equipment and sprinklers
[3]Including mysterious disappearance, burglary and damage to buildings caused by theft
[4]Including damage to building and its contents by vehicle impact
[5]Including flood

KOL Codes: Commercial Liability

Category	Sub-Category	Code
Premises/operations	Bodily injury	11
	Property damage	12
	Personal injury	13
Products/completed operations	Bodily injury	21
	Property damage	22
	Personal injury	23
Professional[1]	Bodily injury	31
	Property damage	32
	Personal injury	33
	Financial loss	34
Tenants' legal liability	Property damage	42
Pollution liability	Bodily injury	61
	Property damage	62
	Other	69
Automobile liability	All losses	70[2]

[1]Malpractice, errors and omissions, officers and directors

[2]Kind of Loss code 70 applies to Ontario policies only where a commercial liability policy includes automobile liability coverage, i.e. coverage codes 42, 43 44.

Appendix B: Proposed Residential/Personal Property Loss Codes (HITS)

Category	Sub-category	2nd order sub-category	3rd order sub-category	4th order sub-category	Code
Fire	Buildings	-	-	-	10
		Buildings, structural/urban fire	-	-	12*
		Buildings, wildland fire	-	-	13*
	Contents	-	-	-	11
		Contents, structural/urban fire	-	-	14*
		Contents, wildland fire	-	-	15*
Windstorm/Hail	Standard, buildings	-	-	-	20
		Windstorm	-	-	22*
		Hail	-	-	23*
	Standard, contents	-	-	-	21
		Windstorm	-	-	24*
		Hail	-	-	25*
	Special, T.V. aerials, etc.	-	-	-	29
		Windstorm	-	-	26*
		Hail	-	-	27*
Water damage	Standard, buildings	-	-	-	30
		Plumbing failure[1]	-	-	73*
			Appliance failure	-	74*
			Sprinkler system failure	-	75*
			Pipe freeze	-	76*
		Water damage associated with ice damming	-	-	78*

Continued

Water damage (continued)	Standard, contents	-	-	-	31
		Plumbing failure[1]	-	-	79*
			Appliance failure	-	81*
			Sprinkler system failure	-	82*
			Pipe freeze	-	84*
		Water damage associated with ice damming	-	-	85*
	Special	-	-	-	39
		Sump failure (buildings)	-	-	86*
		Sump failure (contents)	-	-	87*
		Sewer backup, seepage, overland influx (buildings)	-	-	88*
			Sewer backup	-	32*
				Regional event[2]	90*
				Isolated event[3]	91*
			Seepage, groundwater[4]	-	33*
			Overland influx	-	34*
		Sewer backup, seepage, overland influx (contents)	-	-	92*
			Sewer backup	-	35*
				Regional event[2]	93*
				Isolated event[3]	95*
			Seepage, groundwater[4]	-	36*
			Overland influx	-	37*

*Proposed code

[1]Includes failure of water heater, etc.

[2]This code applies when there is evidence that multiple homes (e.g., two or more) were affected at the same time in the same neighbourhood or region, by the same event. Regional events may have been caused by extreme rainfall, failure of municipal infrastructure (e.g., watermain failure, sewer blockage), etc.

[3]Isolated event – only one home affected on a particular date and time.

[4]Including basement flooding from infiltration through foundation walls, basement floors, groundwater influx

Appendix C: Proposed Commercial Loss Codes (CTS)

Category	Sub-category	2nd order sub-category	3rd order sub-category	4th order sub-category	Code
Fire	Buildings	-	-	-	10
		Buildings, structural/urban fire	-	-	12*
		Buildings, wildland fire	-	-	13*
	Contents	-	-	-	11
		Contents, structural/urban fire	-	-	15*
		Contents, wildland fire	-	-	16*
	Business interruption		-	-	14
		Business interruption, structural/urban fire	-	-	17*
		Business interruption, wildland fire	-	-	18*

Continued

Water damage	**Standard, buildings**	-	-	-	30
		Plumbing failure[1]	-	-	42*
			Appliance failure	-	43*
			Sprinkler system failure	-	44*
			Pipe freeze	-	45*
		Sump failure	-	-	47*
		Sewer backup	-	-	48*
			Regional event[2]	-	49*
			Isolated event[3]	-	51*
		Water damage associated with ice damming	-	-	52*
	Standard, contents	-	-	-	31
		Plumbing failure[1]	-	-	54*
			Appliance failure	-	55*
			Sprinkler system failure	-	56*
			Pipe freeze	-	57*
		Sump failure	-	-	59*
		Sewer backup	-	-	73*
			Regional event[2]	-	74*
			Isolated event[3]	-	75*
		Water damage associated with ice damming	-	-	76*
	Business interruption	-	-	-	34

Continued

Flood	In transit	-	-	-	32
	Other	-	-	-	33
		Buildings	-	-	81*
			Seepage, groundwater[4]	-	82*
			Overland flooding	-	83*
				River related flooding	84*
				Stormwater related flooding	85*
			Coastal flooding	-	87*
		Contents	-	-	89*
			Seepage, groundwater[4]	-	90*
			Overland flooding	-	91*
				River related flooding	92*
				Stormwater related flooding	93*
			Coastal flooding[5]	-	96*

*Proposed code
**Proposed revised wording of existing code
[1]Includes burst pipes, failure of water heaters, etc.
[2]This code applies when there is evidence that multiple structures (e.g., two or more) were affected at the same time in the same neighbourhood or region, by the same event. Regional events may have been caused by extreme rainfall, failure of municipal infrastructure (e.g., watermain failure, sewer blockage), or by other mechanism that affect buildings on a regional scale.
[3]Isolated event – only one structure affected on a particular date and time.
[4]Including flooding from infiltration through foundation walls, basement floors, groundwater influx
[5]Includes ocean and lake related flooding, tsunami, storm surge, etc.

Appendix D: Proposed Claims Notes Questions for Water Damage (Residential)

Water damage loss category	1st order question	2nd order questions
Questions to consider for all types of "special water damage"(code 39) losses	Approximate age of the home	Approximate age of the home's sewer connection (same age as hoe if never replaced
	Did the loss occur during or shortly after an intense rainfall event?	-
	How did the water enter the home?	-
	How did the water leave the home?	-
	How long did the home remain flooded?	-
	Was there evidence that other homes in the neighbourhood were affected by flooding at the same time?	-
	Were any mitigation measures installed in the home? If yes, see 2nd order questions.	Mainline backwater valve installed on sanitary
		Mainline backwater valve installed on storm
		Inline backwater valve(s) installed on sanitary
		Foundation drain disconnection
		Sump system
		Downspout disconnection
		Other (describe)
	Has the homeowner conducted a camera investigation of the sanitary sewer lateral?	If yes, were any issues identified (describe)
	Was the flood damage limited to the basement?	-
	Specific characteristics of the home, including:	Finished basement (if yes, what proportion of the basement is finished in %)
		Does the home have a reverse slope driveway?
		Does the home have sunken/below-grade basement doorways?
		Does the home have sunken/below-grade basement windows?
		Additional important features of the home (e.g., might include lot-specific features or community-scale features)
Sewer backup losses	Was the floodwater contaminated with raw sewage (yes, no, unsure)?	-
	Were there multiple/concurrent causes of flooding (e.g., sewer backup as well as overland and/or seepage flooding)? If yes, see 2nd order questions	Did floodwater also enter the home through windows, doors or other above-ground openings?
		Did floodwater also enter the home through below-ground openings (e.g., below-grade doors, windows, reverse slope driveways)?
		Did water enter the home through cracks in the foundation wall or basement floor?
		Describe any additional sources of flooding if applicable.

Continued

Water damage loss category	**1st order question**	**2nd order questions**
Overland/influx water damage	Describe the source of the flooding (see 2nd order questions):	Did the flooding originate on the insured's property?
		Did flood originate from municipal property?
		Was the flooding associated with stormwater flows (e.g., overland flows directly attributable to extreme rainfall)?
		Was the flooding associated with overflowing of natural surface water bodies (e.g., lakes, streams, rivers)?
		Was the flooding associated with the failure of a municipal watermain?
	Was the structure located inside of the **government defined** flood hazard area? If yes see 2nd order questions:	Was the structure located in the **government defined** floodway?
		Was the structure located in the **government defined** flood fringe?
Seepage/infiltration flooding	Was there evidence of extreme hydrostatic pressure (e.g., as would be evidenced by heaving of concrete floors, damage to foundation, etc.)	-

Appendix E: Proposed Claims Notes Questions for Water Damage and Flood (Commercial)

Water damage loss category	1st order question	2nd order questions	3nd order questions
Questions for all code 33 (flood – other) losses	Approximate age of the structure	Estimated age of the structure's sewer connection(s)	-
	Did the loss occur during or shortly after an intense rainfall event?	-	-
	How did the water enter the structure?	-	-
	How did the water leave the structure?	-	-
	How long did the structure remain flooded?	-	-
	Was there evidence that other structures in the neighbourhood were flooded at the same time?	-	-
	Where any flood mitigation measures installed in the structure?	Describe the measures.	-
	Was the damage limited to the basement and/or below-grade area of the structure?	-	-
For sewer backup losses*	Was the floodwater contaminated with raw sewage (yes, no, unsure)?	-	-
	Were there multiple causes of flooding, aside from sewer backup? If yes, see 2nd order questions	Did floodwater also enter the structure through windows, doors or other above-ground openings?	-
		Did floodwater also enter the structure through below-ground openings (e.g., below-grade basement doors, below-grade basement windows, reverse slope driveways)?	-
		Did water enter the structure through cracks in the foundation wall or basement floor?	-
		List any additional sources of floodwater.	-

Continued

For overland flooding	Identify the source of the flooding (see 2nd order questions).	Did flooding originate on the insured's property?	-
		Did flooding originate from municipal/public property?	-
		Was the flooding associated with stormwater flows (i.e., flows directly attributable to extreme precipitation)?	-
		Was the flooding associated with the failure of a municipal watermain?	-
		Was the flooding associated with overflowing of natural surface water bodies (e.g., lakes, streams, rivers)?	-
		Was the structure located inside of the **government defined** flood hazard area? If yes see 2nd order questions:	Was the structure located in the **government defined** floodway?
			Was the structure located in the **government defined** flood fringe?
For seepage/infiltration flooding	Was there evidence of extreme hydrostatic pressures (for example, below-ground concrete floor heaving, damage to foundation, etc.)?	-	-

*Sewer backup may be coded as water damage loss (KOL codes 30, 31) for commercial property

References

Applied Systems. 2013. *Sewer Backup Definitions*. Windsor: Applied Systems.

Aviva Canada. 2014. *Over 50% of all home insurance claims caused by water damage in 2013, Aviva Canada data shows*. http://www.avivacanada.com/article/media-release-march-25-2014 (accessed May 2014).

Booth, D., and R. Jackson. 1997. Urbanization of aquatic systems: Degradation thresholds, stormwater detection and the limits of mitigation. *Journal of the American Water Resources Association* 33(5): 1077-1090.

Braun, J., Jones, B., Lee, J., Woolford, D. and Wotton, M. 2010. Forest fire risk assessment in Muskoka, Ontario. *Journal of Probability and Statistics* 2010: 1-26.

Burby, R. 2006. Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas. *The ANNALS of the American Academy of Political and Social Science* 604(1): 171-191.

Cheng, C.S., Li, G., Li, Q., & Auld, H. 2011. A synoptic weather-typing approach to project future daily rainfall and extremes at local scale in Ontario, Canada. *Journal of Climate* 24: 3667-3685.

City of Brantford. 2014. Sewer Lateral Blockages. Accessed July 2014 from http://www.brantford.ca/residents/health/sewers/sanitarysewers/Pages/SewerLateralBlockages.aspx

City of Edmonton. n.d. Repairs and Damage. Accessed July 2014 from http://www.edmonton.ca/for_residents/flooding_sewers/repairs-damage.aspx

City of Hamilton. 2013. *Binbrook Sanitary and Stormwater Systems Performance. Report to the Planning and Economic Development Department Growth Management Division*. Hamilton: City of Hamilton, 70 pp.

City of Hamilton. 2002. Harmonization of Sewer Lateral Tree Root Policies. Council Report. Hamilton: City of Hamilton.

City of Niagara Falls. n.d. Sewer backup problems? Niagara Falls: City of Niagara Falls.

City of Ottawa. 2014. Backups and Flooding. Accessed July 2014 from http://ottawa.ca/en/residents/water-and-environment/sewers-and-septic-systems/backups-and-flooding

City of Vancouver. 2014. Renewing and upgrading your sewer connection. Accessed July 2014 from http://vancouver.ca/home-property-development/renewing-and-upgrading-your-sewer-connection.aspx

City of Winnipeg. 2013. Sewers and Tree Roots. Accessed July 2014 from http://winnipeg.ca/waterandwaste/sewage/treeRoots.stm

Environment Canada. 2013. Flood events in Canada. Accessed August 2014 from https://www.ec.gc.ca/eau-water/default.asp?lang=En&n=D44BCC98-1

Etkin, D. and S. Brun. 2001. Canada's Hail Climatology: 1977-1993. Toronto: Institute for Catastrophic Loss Reduction.

Fisette, P. 2011. Preventing Ice Dams. Amherst: University of Massachusetts.

Friedland, J., H. Cheng, and A. Peleshok. 2014. *Water Damage Risk and Canadian Property Insurance Pricing*. Ottawa: Canadian Institute of Actuaries.

Gillett, N.P., Weaver, A.J., Zwiers, F.W. and Flannigan, M.D. 2004. Detecting the effect of climate change on Canadian forest fires. *Geophysical Research Letters* 31(18) DOI: 10.1029/2004GL020876.

Hausmann, P. 1998. Floods – An Insurable Risk? Zurich: Swiss Re.

Harris, C. 2013. Diving into big data. *Canadian Underwriter,* February.

IBC (Insurance Bureau of Canada). 2014a. Facts of the Property and Casualty Insurance Industry in Canada – 2014. Toronto: Insurance Bureau of Canada.

IBC (Insurance Bureau of Canada). 2014b. Canada inundated by severe weather in 2013: Insurance companies pay out record-breaking $3.2 billion to policyholder. Accessed July 2014 from http://www.ibc.ca/en/Media_Centre/News_Releases/2014/January/Canada_inundated_by_severe_weather_in_2013.asp

IBC (Insurance Bureau of Canada). 2013. Canadian Severe Weather—Events and Insured Damage. Toronto: Insurance Bureau of Canada.

IBC (Insurance Bureau of Canada). 2012. *IBC Reminder to Torontonians about protecting homes from water damage*. http://www.ibc.ca/en/Media_Centre/News_Releases/2012/05-31-2012-2.asp (accessed May 2014).

IBC (Insurance Bureau of Canada). 2014c. Limited Sewer Backup Endorsement. IBC 1142-06.214. Toronto: Insurance Bureau of Canada.

IBC (Insurance Bureau of Canada). 2009a. Water Damage Endorsement: Above Ground Water. IBC 1562Q-2009. Montreal: Insurance Bureau of Canada.

IBC (Insurance Bureau of Canada). 2009b. Water Damage Endorsement: Ground Water and Sewers. IBC 1561Q-2009. Montreal: Insurance Bureau of Canada.

IBC (Insurance Bureau of Canada). 2003. Homeowners Comprehensive Form: A Guide to Your Policy. IBC 1155 04.2003. Toronto: Insurance Bureau of Canada.

LaDochy, S. and Paul, A. 1986. A climatology of hail for the southeastern prairies. 20th Annual Congress of the Canadian Meteorological and Oceanographic Society, Regina, Saskatchewan, June 5.

Mailhot, A., and S. Duchesne. 2010. Design criteria of urban drainage infrastructures under climate change. *Journal of Water Resources Planning and Management* March/April: 201-208.

Mailhot, A., I. Beauregard, G. Talbot, D. Caya., and S. Biner. 2012. Future changes in intense precipitation over Canada assessed from mulit-model NARCCAP ensemble simulations. *International Journal of Climatology* 32: 1151-1163.

Mailhot, A., A. Kingumbi, G. Talbot, and A. Poulin. 2010. Future changes in intensity and seasonal pattern of occurrence of daily and multi-day annual maximum precipitation over Canada. *Journal of Hydrology* 388(3-4): 173-185.

McCaffrey, S. 2004a. Thinking of Wildfire as a Natural Hazard. *Society and Natural Resources* 17: 509-516.

McGillivray, G. 2013. Taking action to reduce hail losses. *Cat Tales* 7(1): 6-10.

Mirza, S. 2007. *Danger Ahead: The Coming Collapse of Canada's Municipal Infrastructure*. Ottawa: Federation of Canadian Municipalities.

Mladjic, B., L. Sushama, M. Khaliq, R. Laprise, D. Caya, and R. Roy. 2011. Canadian RCM projected changes to extreme precipitation characteristics over Canada. *Journal of Climate* 24: 2565-2584.

Nguyn, V., T. Nguyen, and A. Chung. 2007. A statistical approach to downscaling of sub-daily extreme rainfall processes for climate-related impact studies in urban areas. *Water Science & Technology* 7(2): 183-192.

Nirupama, N., and S. Simonovic. 2006. Increase of flood risk due to urbanization: A Canadian example. *Natural Hazards* 40: 25-41.

NRC (National Research Council). 2012. Model code adoption across Canada. Accessed Otober 2012 from http://www.nationalcodes.nrc.gc.ca/eng/code_adoption.shtml

PCS Canada. 2014. *Catastrophe Bulletins*. New Jersey: PCS Canada. Restricted access website (accessed May 2014).

Peck, A., P. Prodanovic, and S. Simonovic. 2012. Rainfall intensity duration frequency curves under climate change: City of London, Ontario, Canada. *Canadian Water Resources Journal* 37(3): 177-189.

Peck A., & Simonovic, S. 2009. Updated rainfall intensity duration frequency curves for the City of London under changing climate. London: FIDS, University of Western Ontario.

Prodanovic, P., and S. Simonovic. 2007. Development of rainfall intensity duration frequency curves for the City of London under the changing climate. London: The University of Western Ontario Department of Civil and Environmental Engineering.

PSC (Public Safety Canada). 2014a. Canadian Disaster Database. Ottawa: Public Safety Canada.

Radeloff, V., Hammer, R., Stewart, I., Fried, J., Holcomb, S., & McKeefry, J. 2005. The wildland-urban interface in the United States. *Ecological Applications* 15: 799-805.

Sandink, D. 2014. Urban flooding and ground-related homes in Canada: An overview. 6th International Conference on Flood Management, Sao Paulo, Brazil. September 2014.

Sandink, D. 2013. Urban Flooding in Canada: Lot-Side Risk Reduction through Voluntary Retrofit Programs, Code Interpretation and By-Laws. Toronto: Institute for Catastrophic Loss Reduction.

Sandink, D. 2011a. Involving Homeowners in Urban Flood Risk Reduction: A Case Study of the Sherwood Forest Neighbourhood, London, Ontario. Toronto: Institute for Catastrophic Loss Reduction.

Sandink, D. 2011b. Insurance Issues in Atlantic Canada. Halifax: Atlantic Climate Adaptation Solutions Association.

Sandink, D. 2009. Handbook for reducing basement flooding. Toronto: Institute for Catastrophic Loss Reduction.

Sandink, D. 2007. *Sewer backup: Homeowner Perception and Mitigative Behaviour in Edmonton and Toronto*. Toronto: Institute for Catastrophic Loss Reduction.

Sandink, D., P. Kovacs, G. Oulahen, and G. McGillivray. 2010. *Making Flood Insurable for Canadian Homeowners: A Discussion Paper.* Zurich: Swiss Re.

Shrubsole, D., Brooks, G., Halliday, R., Haque, E., Kumar, A., Lacroix, A., Rasid, H., Rousselle, J., & Simonovic, S. (2003). An Assessment of Flood Risk Management in Canada. Toronto: Institute for Catastrophic Loss Reduction.

Shrubsole, D., Kreutzwiser, R., Mitchell, B., Dickinson, T. & Joy, D. 1993. The history of flood damages in Ontario. *Canadian Water Resources Journal* 18: 133–143.

Simonovic, S. 2011. *Systems Approach to Management of Disasters: Methods and Applications*. Hoboken, NJ: Wiley & Sons Inc.

Thompson's World Insurance News. May 12 2014. Regulators may look into unbundling. Accessed July 2014 from http://www.Thompson'snews.com/story.asp?story=1811

Watt, W.E., D. Waters, and R. McLean. 2003. *Climate Change and Urban Stormwater Infrastructure in Canada*. Toronto-Niagara Region Study Report and Working Paper Series, Report 2003-1. Waterloo: Meteorological Service of Canada.

Wotton, B.M., Nock, C.A. and Flannigan, M.D. 2010. Forest fire occurrence and climate change in Canada. *International Journal of Wildland Fire* 19: 253-271.