HOME FLOOD PROTECTION PROGRAM™

DISASTER RISK REDUCTION APPLIED TO CANADIAN RESIDENTIAL HOUSING:

INTERIM REPORT ON THE *HOME FLOOD PROTECTION PROGRAM*

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The Intact Centre on Climate Adaptation (Intact Centre) is an applied research centre at the University of Waterloo. The Intact Centre was founded in 2015 with a gift from Intact Financial Corporation, Canada's largest property and casualty insurer. The Intact Centre helps homeowners, communities and businesses to identify and reduce risks associated with climate change and extreme weather events. For additional information, visit: www.intactcentreclimateadaptation.ca.

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The Ministry of the Environment and Climate Change protects and improves the quality of the environment and leads Ontario's actions on climate change leading to healthier communities, ecological protection and economic prosperity for present and future generations.

ABOUT CITY OF BURLINGTON

Burlington, Ontario is a city in the Regional Municipality of Halton at the northwestern end of Lake Ontario. It has a population of 183,314 (2016 Census). Burlington was chosen as the ideal location for the Home Flood Protection Program pilot due to a highly localized catastrophic flooding event in August of 2014 that flooded roughly 3,500 homes in very specific neighbourhoods and left others virtually unscathed. As a result, the program has the ability to compare program uptake and effectiveness in areas directly impacted by flooding and those that were not.

ABOUT HALTON REGION

The Regional Municipality of Halton, or Halton Region, is a regional municipality of Ontario, Canada, located in Southern Ontario in the southwest part of the Greater Toronto Area ("GTA"), although it is the only region in the GTA that is not situated directly adjacent to the City of Toronto proper. It comprises the city of Burlington and the towns of Oakville, Milton, and Halton Hills. Halton Region has some of the most comprehensive residential flood protection subsidies in the country.

ABOUT AET GROUP

AET Group is an employee-owned multi-disciplinary environmental consulting, auditing and scientific services company that has been serving Canadians since 1998. With over 1,000 projects completed in Ontario and across Canada, AET offers extensive experience, capabilities and a proven track record that, among other benefits, assures that our clients receive value-added services, credible results and effective solutions. AET Group has been contracted by the University of Waterloo to provide delivery of the Home Flood Protection Program assessments in Burlington, Ontario.

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EXECUTIVE SUMMARY

Residential basement flooding is on the rise across Canada, due in large part to more frequent and extreme rainfall events. In response, the Intact Centre on Climate Adaptation, University of Waterloo developed the Home Flood Protection Program (HFPP) to help Canadians protect their homes from flooding.

The two primary goals of the HFPP are: (1) to limit pathways for water to enter a home (e.g., plastic covers over window wells), and (2) to minimize damage if flooding occurs (e.g., elevate electronics from basement floor).

This interim report profiles the fundamental components of the HFPP, and key findings to date regarding the most effective means to roll out flood protection to homeowners. Findings are based on the ongoing deployment of the HFPP as a pilot in the City of Burlington, Ontario, a community where over 3,000 homes were impacted by residential flooding in 2014. A full HFPP report will be released in 2018, upon completion of the Burlington pilot.

The need for basement flood protection is evident in:

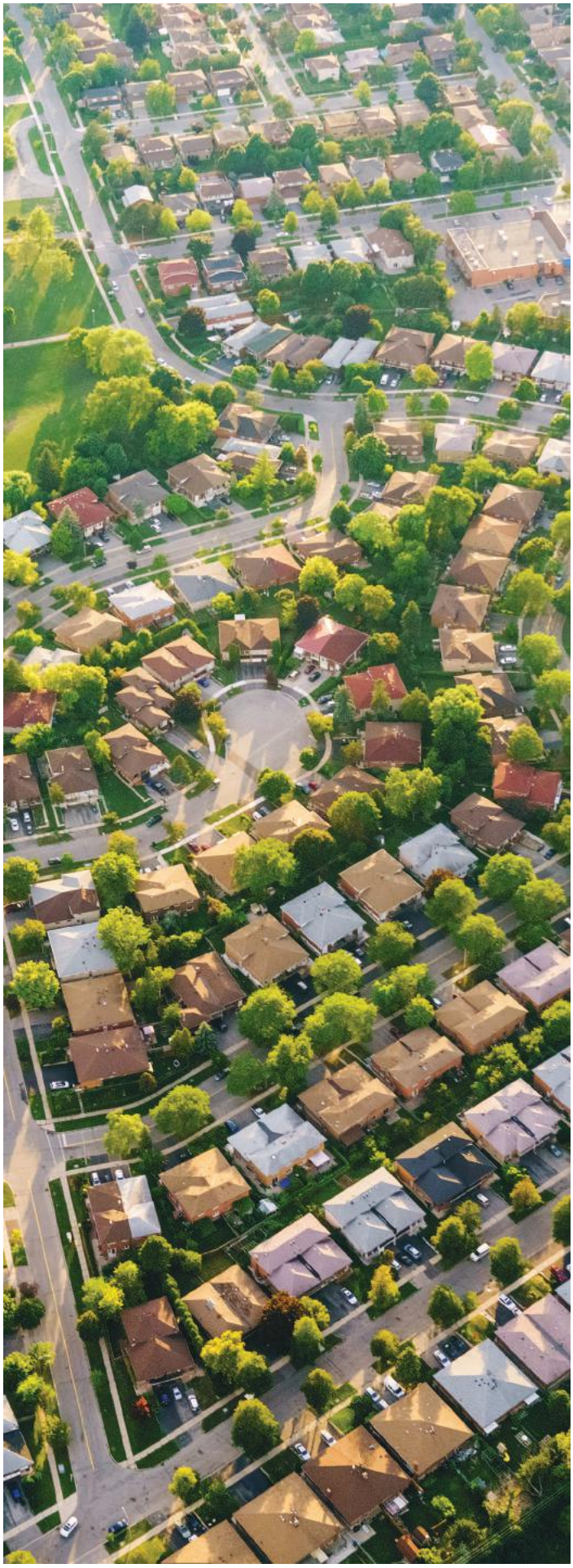
- substantial increases in home flood insurance premiums
- growth in the number of homes in Canada deemed uninsurable due to flood risk
- greater demand by provinces for Federal flood assistance (under Disaster Financial Assistance Arrangements), and
- greater focus by banks to track flood-induced residential mortgage defaults

Overview: Home Flood Protection Program

The HFPP offers homeowners a customized flood-risk assessment that addresses over 50 potential ways that water might enter into their home and cause flood damage *(see Figure 1 on page 7)*. Based on the in-person assessment – which generally requires 1.5 hours – actions that homeowners can take to reduce flood risk are prioritized in a user-friendly report. This report also provides a list of standard questions that home owners should discuss with their insurance broker regarding flood coverage. Homeowners may opt in to receive seasonal maintenance reminders to help reduce flood risk around the house on an ongoing basis.

The Return on Investment (ROI) for the HFPP is impressive – for an average home, $1 invested in the program will return $13 in avoided flood damage costs over a period of 10 years (based on the average basement flood cost of $40,000 in Canada). Also, **every dollar invested into HFPP supports local jobs** (e.g., flood protection assessors, program trainers and a variety of contractors and suppliers involved in flood risk reduction work).

By focusing on avoiding the disaster before it strikes, the HFPP aligns well with the directives for climate adaptation under federal *Pan-Canadian Framework on Clean Growth and Climate Change*, as well as disaster preparedness priorities under the Sendai Framework, of which Canada is a signatory.



On-the-Ground Application of the Home Flood Protection Program

The Intact Centre launched the pilot of the HFPP in August 2017 in Burlington, Ontario. Program funding to support the development and execution of the program was secured from Intact Financial Corporation, the Ontario Ministry of the Environment and Climate Change, the City of Burlington, and from homeowners themselves.

As part of the pilot, homeowners who live in Burlington and select surrounding areas qualify to participate in the *Home Flood Protection Assessment* for a subsidized fee of $125.00. AET Group, an Ontario-based engineering technical services company, delivers these Home Flood Protection Assessments. To date, hundreds of homeowners have registered for the Home Flood Protection Assessment.

Of those who have registered for an assessment, 86% have committed to participating in a Home Flood Protection Study, which documents the most common actions taken by homeowners to reduce flood risks identified during the assessments. The study identifies barriers that homeowners face to take action to reduce flood risk, and the means to address those barriers.

Below are key findings from the initial phase of the HFPP pilot in Burlington:

- **History of flooding and program uptake:** The HFPP program uptake was the highest in neighbourhoods with a history of flooding (68% of participants). In neighbourhoods not impacted by flooding, uptake of the program was lower (32%). This highlights the fact that **it is a much bigger challenge to engage people who have never been impacted by flooding to take preventative action to reduce flood risk.** There is a need for broader homeowner awareness that any home in Canada is potentially at risk of flooding (as localized microbursts can impact any neighbourhood).

- **Most common flood risk challenges:** Based on completed assessments in Burlington, the most common flood risk challenges include:
  - improperly installed or inadequate window wells (issue documented for 50% of assessed properties);
  - presence of unsecured hazardous materials - paints, aerosols and corrosive substances - stored on basement floors (issue documented for 47% of assessed properties);
  - presence of furniture and electronics susceptible to water damage in the basement (issue documented for 35% of assessed properties);
  - poor grading of garden beds located outside homes (issue documented for 35% of assessed properties);
  - high levels of moisture on basement floors (issue documented for 25% of assessed properties); and
  - downspouts depositing water less than 1m from the foundation (issue documented for 25% of assessed properties).

- **Importance of trust, confidentiality and third party-delivery is critical for the program uptake:** 48% of homeowners who registered for the Home Flood Protection Assessment indicated that they acted on information about the program received from City of Burlington or Halton Region (primarily through city councilor newsletters). Traditional media coverage that featured HFPP launch event at Burlington City Hall accounted for 33% of registrations. Social media posts that garnered registrations (14%) also featured trusted political and community leaders, as well as city logos in their posts. Finally, homeowners conveyed the importance of confidentiality of Home Flood Protection Assessments (including the fact that information gathered during the assessments would not be shared with the city and home insurance providers) and appreciated a third-party program delivery model.

The HFPP pilot in Burlington will be completed in the Fall of 2018. **Interim lessons learned from the pilot are currently informing the development of a National Standard of Canada (CSA Group - Z800-18 - Basement Flood Protection Guideline), which is scheduled for completion in mid-2018.**

Promoting the Home Flood Protection Program with Key Stakeholders

Next steps will address building promotional support for the HFPP with key stakeholders, including:

- **Engaging real estate brokers/agents** to encourage them to purchase the HFPP as a value-add service for house buyers and sellers; and
- **Working with select insurance brokers,** who can encourage homeowners to participate in the HFPP to lower flood insurance premiums.

The most important financial investment most Canadians will ever make is their home – the Home Flood Protection Program offers a simple means to protect that investment.

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Figure 1: Key Aspects of the Home Flood Protection Program (HFPP)

The scope of the HFPP pertains to existing low-rise residential developments, including:

- detached homes
- semi-detached homes
- row houses (including stacked and back-to-back townhomes)

Types of flood hazards addressed through the HFPP include:

- overland flooding
- storm and sanitary sewer surcharge (sewer backup)
- infiltration flooding (groundwater seepage)

Types of flood hazards not addressed by the HFPP Assessment include:

- municipal stormwater drainage system failures
- coastal flood hazards
- unique flood hazards (e.g., dam failures)

Each Home Flood Protection Assessment consists of an initial homeowner questionnaire that confirms previous flood history of the assessed property, the year of construction and actions taken to reduce flood risk.

Following the initial questionnaire, flood risks inside and outside the property are assessed through a combination of visual inspections and series of standardized questions directed to the homeowner. Key features assessed are noted below, with maintenance questions that accompany each feature.

Exterior Features Assessed

Lot grading and Drainage:

- Water drains away from the house and into nearby storm drains; does not pool around the house.
- Lot grading achieves a minimum 5% slope for landscaped surfaces and 1-2% for hard surfaces in relation to the house. Lot surface does not easily soak up water.
- Storm water drainage is not directed into the sanitary sewer to avoid sanitary sewer surcharge during extreme rain events.

Landscaping:

- Trees are in good condition (e.g., branches do not extend over the house, driveway and hydro lines).
- Trees are located away from the foundation, storm and sanitary sewer laterals (to reduce potential risk of damage caused by tree roots, which can lead to water infiltration).
- Garden beds are located away from the foundation, at a 5% slope (to reduce potential risk of water infiltration).

Walkways and Driveways:

- Walkways direct water away from the foundation and are free of cracks.
- Impermeable driveways direct water away from the foundation and are free of cracks and gaps.
- Permeable driveways direct water away from the foundation and all water drains from the driveways within 24 hours.

Eaves Troughs, Downspouts and Sump Pump Discharge:

- Eaves troughs wrap around the entire house, are in good repair and are free of debris.
- Minimum downspout placement is every 30-40'.
- Eaves trough of 5" is present for asphalt shingles or 6" for metal roof.
- Downspouts extend at least 10' away from the foundation or to a drainage swale. Water is not directed onto adjacent private property.
- Sump pump drain pipe is present and drains at least 15' from the foundation or to drainage swale. Water is not directed onto adjacent private property.

Window Wells:

- Window wells are present at each basement window, are located at least 3-6" above grade and are sealed at foundation.
- Lot grading adjacent to window wells slopes away from the house at a minimum of 2-3%. Window wells are free of debris and drain freely within 1 hour.

Rain Barrels and Water Hoses:

- Rain barrels have diverters and overflow discharge pipes that divert water at least 10' from the foundation or to drainage swales.
- Water hose bibs are free of leaks and are drained in winter.

Snow Piles (where applicable):

- Snow piles are kept 3' away from foundation, window openings and vents.

Exterior Condition of Foundation Walls, Doors and Windows:

- Foundation appears to be in good condition, is dry, free of cracks and finishing gaps.
- Exterior condition of doors, window frames and weather stripping are in good condition.

Interior Assessed Features

Plumbing:
- Basement sanitary sewer lateral cleanout is easily accessible.
- If backwater valves are used on storm or sanitary sewers, the valves are checked and cleaned according to manufacturer's instructions once per season.
- Floor drain is present, the drain is in a good condition (e.g., free of debris). The standing water is present in the trap and water flows towards the drain.
- Toilets, taps and water heaters are in good condition.

Sump Pits and Sump Pumps:
- Sump pit has a sealed cap, is in good condition (free of cracks and holes) and is free of debris.
- Sump pump is present and is functioning.
- Back-up sump pump is present and is functioning.
- Sump pump back-up battery or generator is present and functioning. The back-up battery or generator can generate electricity for a minimum of 12 hours.

Internal Condition of Walls, Floors and Windows:
- Foundation walls are free of cracks and mineral deposits, no evidence of water entry.
- Floors are free of cracks and mineral deposits, no evidence of water entry.
- Earth floors are covered with a minimum 6 millimetre moisture barrier, with all seams and edges sealed.
- Window frames, glass and seals are in good condition.
- Moisture levels are low in the basement. Moisture levels of walls and window frames are low (as measured by the moisture meter).

Furniture and Electronics:
- Furniture items located in the basement have non-absorbent surfaces up to 12" off the basement floor.
- Electronic items are stored at least 12" off the floor.

Storage of Valuables:
- Valuables are stored in sealed, non-absorbent containers at least 12" off the basement floor and at least 6" away from basement walls OR no valuables are stored in the basement.

Hazardous Materials:

No hazardous materials are stored in the basement (e.g., paints, aerosols and corrosive substances).

DEFINITIONS

Backwater valve: a device that mitigates against storm or sanitary sewage in an overloaded main sewer line from backing up into a basement. The valve automatically closes, if the flow from storm or sanitary sewage attempts to back up into a basement from the main sewer.

Combined Sewer: sewer that carries both wastewater and stormwater.

Flood Mitigation: a sustained action taken to reduce or eliminate long-term risk to people and property from flood hazards and their effects. Mitigation distinguishes actions that have a long-term impact from those that are more closely associated with preparedness for, immediate response to, and short-term recovery from specific events.

Floodproofing: any combination of structural or non-structural measures that reduce or prevent flood damage to the structure and/or its contents.

Flood Protection: any combination of structural and non-structural additions, changes, or adjustments to structures, which reduce or eliminate risk of flood damage to real estate or improved real property, water and sanitation facilities, or structures with their contents.

Flood Risk: flood risk is a combination of the likelihood of occurrence of a flood event (flood frequency) and the social or economic consequences of that event when it occurs (through exposure to the flood hazard).

Groundwater Seepage: groundwater that enters through cracks, pores or gaps in foundation walls, cracked pipes or other openings.

Infiltration (Sewer): the water entering a sewer system, including building sewers, from the ground through defective pipes, pipe joints, connections or manhole walls.

Lateral: any pipe from a building connected to the main sewer.

Overland Flooding: flooding that occurs when runoff water flows from the streets onto properties causing flood damages. It can happen anywhere in the community, independent of an overflowing water body.

Riverine Flooding: excess of stream flow in a watercourse, such that land outside the normal banks is submerged or inundated. Can be caused by extreme rainfall or snowmelt, or physical conditions (such as ice jams and undersized watercourse crossings) associated with a watercourse.

Roof leader: a drainpipe that conveys storm water from the roof of a structure to a sewer for disposal onto the ground and removal from the property.

Sanitary sewer: part of the public sewage works for the transmission of sanitary sewage (includes human and industrial waste, and septic waste, but not stormwater).

Stormwater: rain, melting snow and ice that washes off driveways, parking lots, roads, yards, rooftops, and other surfaces.

Storm sewer: a sewer, the purpose of which is to carry stormwater (including surface and rainwater, melted snow and ice) and water in underground pipes and foundation drains.

CHAPTER 1. INTRODUCTION

Residential basement flooding is on the rise across Canada, due in large part to more frequent and extreme rainfall events. In response, the Intact Centre on Climate Adaptation, University of Waterloo, developed the **Home Flood Protection Program (HFPP)** to help Canadians protect their homes from flooding.

The two primary goals of the HFPP are to (1) limit pathways for water to enter a home (e.g., plastic covers over window wells), and (2) minimize potential damage if water was to enter a basement (e.g., elevate electronics from basement floor).

The purpose of this report is threefold:

1. To outline the imperative for flood risk reduction in Canada;
2. To profile the Home Flood Protection Program (HFPP); and
3. To share key findings to date from the HFPP pilot in Burlington.

Chapter 1 has three sections. It describes the rising economic costs associated with flooding in Canada; profiles emerging mortgage default risk for areas of the country where repeated flooding has occurred and insurance has become limited; and, it outlines the rise in lawsuits associated with flooding in Canada.

Chapter 2 describes the method employed to develop the HFPP, supporting tools and outreach materials.

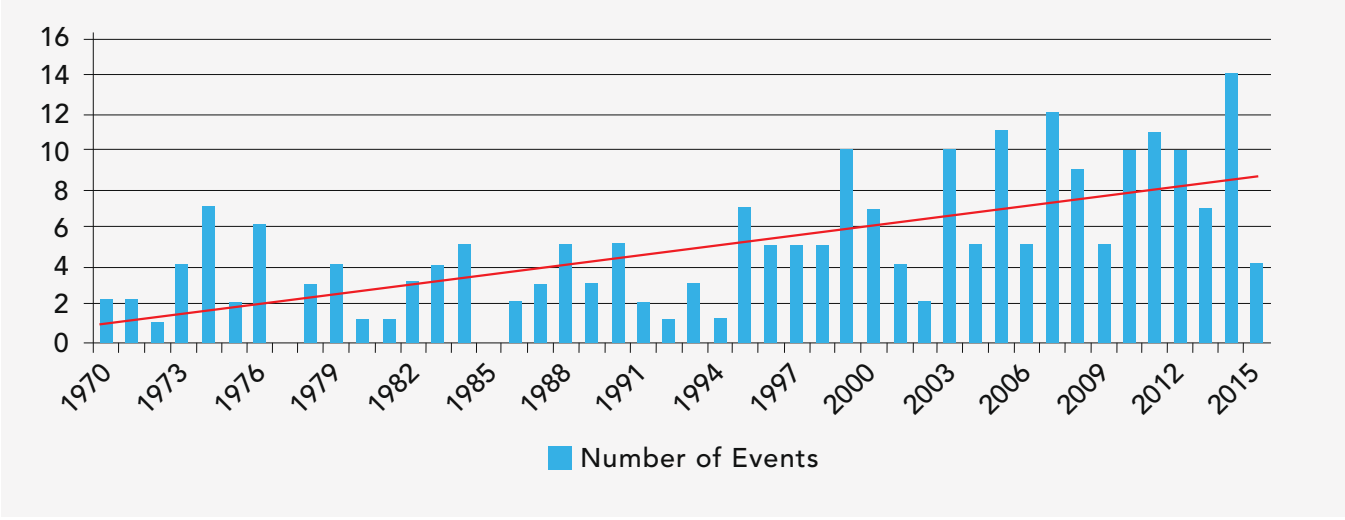
Chapter 3 describes key findings to date from the HFPP pilot in Burlington, Ontario.

Chapter 4 profiles next steps to advance the HFPP as a key disaster risk reduction program in Canada.

1.1 Rising Economic Costs of Natural Disasters and Flooding in Canada

The impacts of extreme weather events are bearing ever-increasing costs to governments, insurers and, by extension, all Canadians [i]. According to Public Safety Canada, the number of natural disasters for which provinces and territories required and obtained federal assistance under the Disaster Financial Assistance Arrangements (DFAA) increased dramatically between 1970 and 2015 *(see Figure 2)*.[ii] Similarly, the Office of the Auditor General of Canada has noted that from 2009 to 2015, DFAA's compensation to provinces and territories was greater than any of the previous 39 fiscal years combined. [iii] The DFAA's spending on flooding accounted for 75 percent of all weather-related expenditures. [iv]

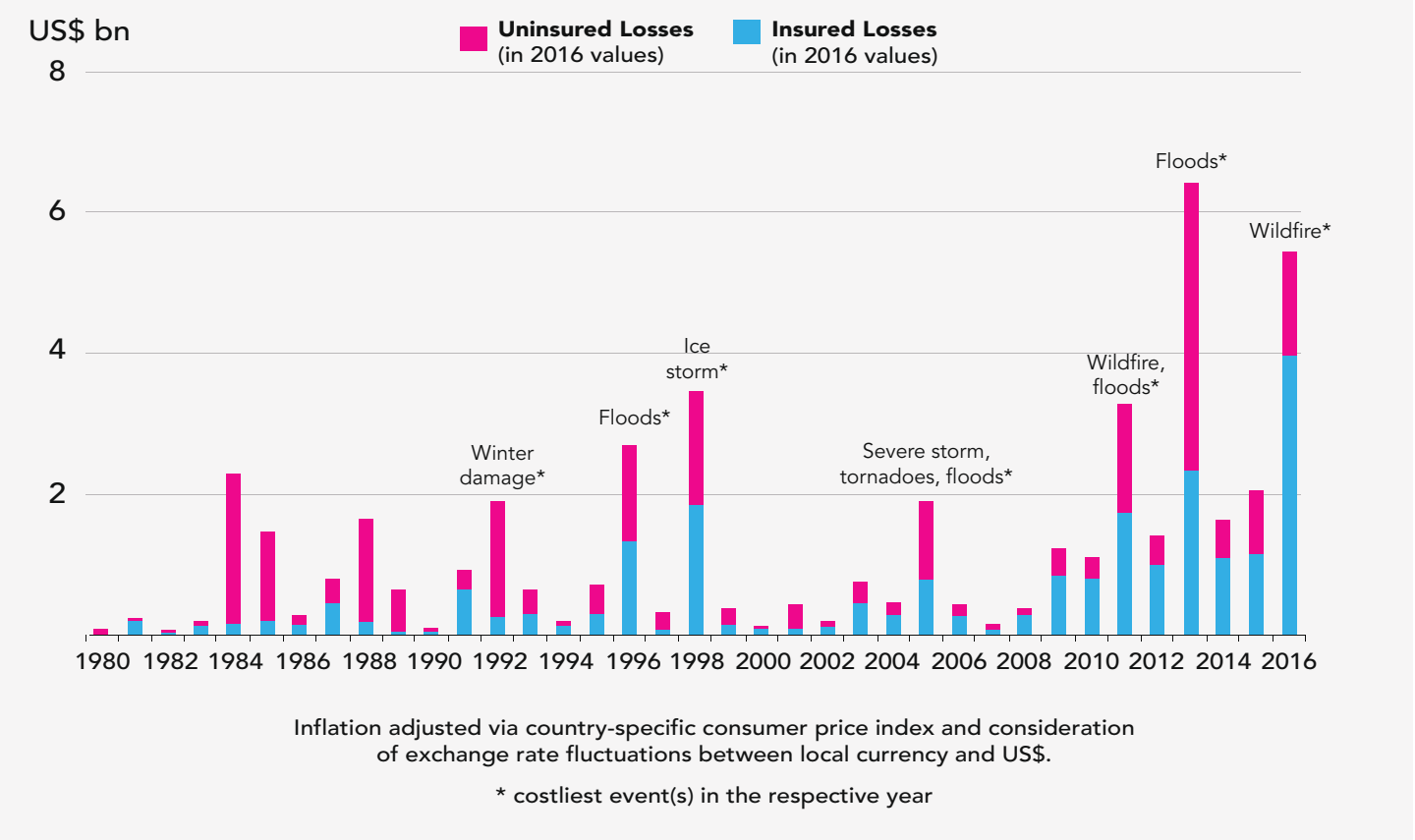
Figure 2: Number of Natural Disasters in Canada Requiring Disaster Financial Assistance Arrangements for Provinces and Territories (1970 to 2015)



Source: Public Safety Canada. 2016-2017 Evaluation of the Disaster Financial Assistance Arrangements.

Catastrophic insurable losses for the property and casualty insurance sector in Canada are also on the rise. According to the Insurance Bureau of Canada (IBC), "property and casualty insurance payouts from extreme weather have more than doubled every five to 10 years since the 1980s."[v] While insurable payouts averaged $400 million per year over the period of 1983 to 2008, for the last seven of eight years leading up to 2016, extreme insurance payouts exceeded $1 billion in Canada. As shown in *Figure 3*, the insurance gap in Canada is significant: for every dollar of insured losses in Canada, there are three to four dollars of uninsured losses that are borne by government, homeowners and businesses across the country.

Figure 3: Catastrophic Insured Losses in Canada (1980 –2016): Overall and Insured, 2016 $ USD



Source: 2017 Munich Re, Geo Risks Research, NatCatSERVICE. As of February 2017.

1.2 Repeated Flooding Stresses Canada's Mortgage Holders

According to IBC, approximately 20 percent of Canadian households are at high risk of overland and sanitary sewer flooding, and approximately 10 percent are at very high risk of flooding.[vi] The latter group, representing 1.8 million households, is located in areas of Canada where repeated flooding may cause insurance companies to limit flood insurance coverage or withdraw it altogether. Limited or no flood insurance coverage is a significant concern - flood damages can cost homeowners tens of thousands of dollars to repair. For example, as per the US National Flood Insurance Program, a 15 cm flood in a 2,000-square-foot home is likely to cause about $40,000 in flood damages. With limited or no flood insurance, it may be challenging for homeowners to cover the cost of $40,000 on their own – to illustrate, as of 2016 the Canadian Payroll Association reported that almost half of working Canadians are living paycheque to paycheque, and one in four Canadians would not be able to afford $2,000 if an emergency arose the following month.

Consequently, there is an emerging risk facing Canada's mortgage market. In the future, flood-related mortgage default rates may increase, as saving rates remain low and more households are subject to debilitating flooding.

1.3 Flooding Gives Rise to Lawsuits

As floods continue to stress infrastructure in Canada, damage personal property and endanger human health, there are growing legal implications in the form of negligence lawsuits. Flood-related lawsuits involve homeowners, developers, local governments, conservation authorities, First Nations and Indigenous peoples, provinces, as well as private businesses. **Table 1** provides examples of flood-related lawsuits in Canada, demonstrating the need for flood-resilience at all levels to limit legal risks.

Table 1: Examples of Stormwater Management and Flood-Related Lawsuits in Canada

Case Name (Year)	Description (damages, cost and settlement amounts included where identified)	Defendants
Anderson et al v Manitoba et al, 2017 MBCA 14 (CanLII) (ongoing) **Manitoba**	A $950M class action lawsuit was brought forward by 4,000 residents of four First Nations following severe flooding in the spring of 2011. A flood resulted in damage to property and the evacuation of many people from their homes. Plaintiffs brought claims of negligence, nuisance and breach of treaty rights, alleging that the Government of Manitoba caused the flooding through its operation of flood control measures and the water control works that affected the water levels around the four First Nations. The class action lawsuit was certified in January 2017 and is moving forward.	Province, Manitoba Association of Native Fire Fighters
Muskoka Class Action, 2016 (ongoing) **Ontario**	A $900M class action was launched by Muskoka residents, cottage owners and business owners against the province of Ontario after damages were caused by flooding and high water levels. Plaintiffs allege that the Ministry of Natural Resources was negligent for failing to control water levels. The claim is ongoing.	Province
Cerra et al. v. The Corporation of the City of Thunder Bay, 2012 (ongoing) **Ontario**	Floods in May 2012 resulted in severe damage in Thunder Bay. Plaintiffs allege negligence in repair, inspection and maintenance of the water pollution control plant, as well as lack of diligent operation and supervision at the time of the flood (including an allegation that alarms were ignored). The $300M claim is ongoing. The court certified action on consent in 2013.	Municipality
Maple Ridge Class Action. 2010 [ix] ongoing) **British Columbia**	Fifteen households filed a class action lawsuit against a developer and contractor, two engineering firms and the City of Maple Ridge after a 2010 flood. Plaintiffs allege that defendants were negligent, arguing construction failure, faulty workmanship and design, failure to inspect basements for leaks and failure to repair leaks as requested. Plaintiffs also argue that the houses were not waterproofed to code, despite the municipality's inspection, review and issuance of permits. The trial was scheduled to begin in 2016. The claim is ongoing.	Municipality, developer, contractor, engineering firms
Panza et al v. The Corporation of the City of Mississauga et al., 2012 **Ontario**	Upper and lower tier municipalities, the province and the conservation authority were all named as defendants in a negligence claim related to systemic flooding in the Lisgar area of Mississauga over several years. The $200M action was withdrawn before trial. However, this case shows the potential for systemic flooding to give rise to class action lawsuits.	Province, municipality, conservation authority
Dicaire v. Chambly, 2008 (QueCA) **Quebec**	The Quebec Court of Appeal dismissed a class action by owners of 1,723 homes that flooded in 1997 when sewers backed up following heavy rains. The court ruled that the sewers were designed, as provincial guidelines required; to cope with a "5-year storm," and the town was not obliged to do more. However, the court noted that current design standards might not protect municipalities in future lawsuits, in light of "recent climate phenomena" and other scientific advances.	Municipality
McLaren v. Stratford (City), 2005 CanLII 19801 **Ontario**	A major flood in the City of Stratford after severe rainfall in 2002 left many with sewage in their basement. Plaintiffs claimed negligence in design, construction operation and maintenance of the system. The class action was certified by the court in 2005 and the case was settled in 2010, eight years after the flood. Stratford settled for $7.7M after already spending $1.3M in emergency relief, and then upgraded the system to a 250-year storm standard.	Municipality

Source: Zizzo Strategy. Legal Risks and Requirements to Address Flood Resilience. Prepared for the Intact Centre on Climate Adaptation. April 2017.

1.4 Flooding Causes Mental Distress, Impacts Health of Canadians

Mental health impacts associated with flooding can include general mental distress, anxiety, Post-Traumatic Stress Disorder (PTSD), and depression. Mental distress is defined as "sufficient intensity to disrupt a person's normal life patterns. [x]"

In Canada, several studies have found that both in the immediate and over the long-term, Canadians experienced mental distress because of flooding:

- A 2017 study of 200 households in Montreal that experienced flooding found that "almost 70% of respondents reported having suffered from anxiety, sleep disturbances or concentration problems since the floods [xi]"
- A 2004 study of 176 households in Manitoba found that over a third experienced psychological distress [xii]
- A 2016 study of men and women affected by the 2013 Alberta floods found an 164% increase in anti-anxiety medication and a 232% increase in sleeping aids for women in High River, one of the worst hit areas [xiii]
- A 2000 study of Saguenay-Lac-St-Jean residents following 1996 floods found that 12% had to take sick leave or were absent from work, and 6% took an early retirement [xiv]

Preliminary findings from a study supported by the Intact Centre of 100 households in flood-affected neighbourhoods in Southern Ontario confirms this mental distress. **Three years after living through a flood, 50% of households are still worried about flooding when it rains – compared to 2% of households who have never lived through a flood.** The quotes below further illustrate the impact that flooding has had on people's lives:

- "It's always on my mind" – woman aged 25-64 who dreams of disasters
- "Most of the impacts were psychological" – man aged 25-64
- "It's always in the back of your mind" – woman aged 65 or older
- "Some days I just wanted to run away" – woman aged 25-64
- "When we have bad weather, you worry" – woman aged 25-64
- "It's something you never want to experience again in your life" – man aged 65 or older
- "It's just an awful, awful experience" – woman aged 25-64

In conclusion, reducing flood risk not only reduces the physical damages and financial losses, it also mitigates a significant source of mental distress to homeowners.

1.5 Home Flood Protection Assessment: Helping Homeowners Protect their Biggest Investment in Life

Homeowners have the most to gain from reducing the risk of flooding at their homes. A Home Flood Protection Assessment identifies priority actions to reduce risk and provides information resources to help homeowners take action. The Home Flood Protection report clearly outlines simple activities that can be completed by the average homeowner, as well as more complex actions that are best undertaken by a qualified professional. The report also identifies other items that require further investigation (e.g. closed circuit television inspection of a sewer lateral or foundation drain).

Carol Solis, a Home Flood Protection Assessment participant in Burlington whose family experienced two devastating sewer back-up floods in 2014, explains the benefits of the program:

"During the assessment I learned about all the different ways that water might enter my home and the top actions I can take to reduce my risk. I also learned about the subsidies in Halton Region that can help me take action. I would recommend having an assessment to anyone who wants to understand what they need to do to protect their home and personal belongings. The assessment is $125, a small price to pay to have peace of mind."

The vast majority of action items identified during the assessment are non-technical, cost-effective installation measures that homeowners can complete over a weekend after a trip to their local hardware store. Examples include installing window well covers, extending downspouts to direct water away from the home's foundation and installing gutter guards on eaves troughs. Homeowners also learn about the importance of seasonal maintenance activities to protect their homes year round. Examples include testing sump pumps and back-up batteries, cleaning out backwater valves and removing debris from on-street storm sewer grates.

CHAPTER 2. HOME FLOOD PROTECTION PROGRAM

The Intact Centre developed the Home Flood Protection Program to help homeowners reduce their risk of basement flooding, and minimize damage if flooding occurs. The HFPP consists of the following key components, described in more detail below:

1. Home Flood Protection Assessment
2. HFPP Assessor Training
3. HFPP Mobile Application, Secure Portal and Database
4. Communication and Outreach Materials

The funding sources for HFPP development and the return on investment are also presented.

2.1 Home Flood Protection Assessment

To address evolving residential flood challenges, the HFPP offers homeowners a customized flood-risk evaluation known as the 'Home Flood Protection Assessment'. The assessment takes approximately 1.5 hours to complete. It begins with an assessor conducting a 5 minute interview with the homeowner to discuss their past flood experiences, actions taken to reduce flood risk and the key concerns that they would like the assessment to address. The homeowner and the Assessor then review 50 points of potential water entry outside the home and inside the home and discuss preventative maintenance activities completed at the home. Each assessed item then receives a score of good, intermediate, poor or needs further investigation. Items that receive a poor or needs further investigation prompt the assessor to review a variety of practical options the homeowner can take to reduce risk.

Following the assessment, the homeowner receives a report featuring a concise summary of the top actions they can take to reduce risk. The report also includes comprehensive appendices that include a detailed scoring of assessed items as well as comprehensive resource links to help homeowners take action (see *Appendix A*). Homeowners may opt to receive electronic seasonal reminders of the maintenance activities they need to conduct to limit flood risk going forward.

Development of the Home Flood Protection Assessment

The Home Flood Protection Assessment content was developed January - December 2016. To develop the content, the Intact Centre completed a review of literature on residential flood vulnerability, home inspection programs, and a national stakeholder consultation with home inspectors, municipal engineers, engineering consultants, plumbers, landscape designers, insurance representatives, conservation authorities, academe and non-governmental organizations. See *Appendix B* for examples of literature reviewed and *Appendix C* for key stakeholders consulted.

The beta version of the assessment tool and assessment process was tested at 15 homes in December of 2016. Based on feedback from the participants, the report language was refined to improve readability and the assessment process was simplified to shorten the time required to conduct an assessment. In the spring and summer of 2017, a secure database, an online portal and a mobile assessment application (HFPP App) was created and tested to support the delivery of HFPP. Assessors, customer service and quality assurance team members from the environmental consulting AET Group were also trained during this time to prepare for the program launch in August 2017.

2.2 HFPP Assessor Training

The Intact Centre developed and executed a 5-day online and 2-day in-person training program for HFPP assessors to deliver Home Flood Protection Assessments. The HFPP assessors trainees were required to have a minimum of 3-5 years of experience in home inspection, landscape and home construction or related fields. Accordingly, the HFPP training enhances the existing knowledge that the assessors already possess. As part of the training, each HFPP assessor is required to achieve a minimum of 80% on all online training tests and to successfully complete two on-site HFPP Assessments, including the completion of two HFPP reports.

The same group of stakeholders that was engaged in the development of the Home Flood Protection Assessment content *(see Appendix C)* was also engaged to develop training materials. In addition, the Intact Centre retained three specialists in the fields of municipal engineering, landscaping, and home inspection to develop curriculum and deliver the training. Each specialist had over 20 years of practical experience in their respective fields and a minimum of 5 years of experience developing and delivering curriculum.

2.3 HFPP Mobile Application, Secure Portal and Database

To guarantee data security, streamline and automate data collection and analysis for the Home Flood Protection Assessment, the Intact Centre created tools, including:

- **A mobile application** to document the Home Flood Protection Assessment in a standardized format;
- **A secure online portal** to allow different users (homeowners, assessors, quality assurance personnel and Intact Centre administrators) to access relevant HFPP information and for Customer Service Representatives to manage appointments for assessors and keep notes of communication with customers; and
- **An internal database** to store and query data effectively.

This combination of tools facilitate time-saving and consistency in report generation and quality assurance review following a Home Flood Protection Assessment. Automatic report notifications, maintenance reminders and customer satisfaction surveys are also sent to homeowners through the Portal, using the information stored securely in the Database.

The overall security features of the Portal and Database meet the requirements for public institutions as set out in Canada's Provincial and Territorial Freedom of Information and Protection of Privacy Acts.

Notably, the tools developed for the HFPP can support more than 20,000 customers without additional development, using its built-in scalability. With minimal additional development, the tools can be scaled even further (e.g., to allow for Canada-wide deployment of the HFPP).

The Portal and the Database were designed and developed in such a manner that they can be hosted in a cloud-based environment, or on servers at the University of Waterloo.

2.4 Communication and Outreach

From the onset of the program, effective communication and outreach to homeowners was identified as a pivotal step to secure program uptake and implementation. Based on research into best practices for outreach, the Intact Centre determined that a two-pronged outreach strategy for HFPP promotion would be most appropriate, consisting of 1) targeted (neighbourhood-based) campaigns; and 2) broad-based marketing campaigns.

The following approaches were included in targeted (neighbourhood-based) campaigns:

- **Community events:** participation in community events, local tradeshows, conferences, meetings and workshops to promote the program.
- **Door-to-door campaigns:** delivering information about the program in-person to encourage registration for Home Flood Protection Assessments.
- **Door hanger campaigns:** advertising information about the program through door hangers.
- **City Councilor newsletters:** sharing information about the program and promoting registration to specific neighbourhoods

The following approaches were included in the broad-based marketing campaigns:

- **Traditional media:** participation in interviews on television, radio, in newspapers and magazines to describe the program and encourage residents to sign up for the Home Flood Protection Assessments.
- **Social media:** sharing of content about the program through Facebook, LinkedIn and Twitter.
- **Municipal website:** sharing of content about the program on the City of Burlington website
- **Paid advertising:** advertising in newspapers and on social media.
- **Engagement with local community leaders:** ensuring strong program support from community leaders and influencers and encouraging them to share information about the program using social media and personal communication.
- **Engagement with real estate agents and insurance brokers:** providing information about the program to real estate agents and insurance brokers so that they can facilitate Home Flood Protection Assessment uptake for their clients.

Initial testing of the outreach approaches from August until October have yielded some important key learnings. All of the approaches above will be further tested during the remainder of the Burlington pilot in 2018 to further evaluate their effectiveness and generate lessons learned for a wider HFPP roll out. See Chapter 3 for a discussion of initial key findings.

2.5 Program Funding and Return on Investment

The development and delivery of the program received financial support from Intact Financial Corporation, the Ontario Ministry of Environment and Climate Change, the City of Burlington and participating homeowners (who pay a subsidized fee of $125.00 for Home Flood Protection Assessments).

The Return on Investment (ROI) for the HFPP was calculated as $1 yielding $13 in avoided basement flood damage costs over 10 years. The formula for the ROI calculation assumes $40,000 as the average basement flood costs that can occur in a given year, a $300.00 fee to conduct Home Flood Protection Assessment and that 10% of homes that participated in HFPP do not experience basement flooding, over the 10-year time frame, due to application of the HFPP:

- The cost of HFPP applied to 1,000 homes = $300,000
- The return (avoided flood cost), assuming 10% of homes do not flood = 10% x 1,000 homes x $40,000/home = $4,000,000
- ROI = $300,000 investment yields $4,000,000 savings = 1:13 over 10 years

The ROI calculation of 1:13 does not include costs to operationalize home improvements identified through the Home Flood Protection Assessment, increases to property value, or return relative to risk adjustments in flood insurance premiums.

CHAPTER 3. BURLINGTON PILOT OF THE HOME FLOOD PROTECTION PROGRAM

3.1 About Burlington, Ontario

Burlington, Ontario is a medium-sized city (population of 183,314) located at the west end of the Greater Toronto Area within the Regional Municipality of Halton. On August 4, 2014, Burlington experienced a flash flood event, during which over 190 millimeters of rain fell over eight hours. According to the City of Burlington, "the record rainfall caused significant flooding and damage in parts of the city. Roads, highways and more than 3,000 homes were flooded [xv]."

Following the flood event, the city hired AMEC Foster Wheeler to conduct a Flood Vulnerability, Prioritization and Mitigation Study. Based on the study, the city approved an additional $20.4 million to funds already budgeted for storm water infrastructure improvements. These additional funds are to be applied over the next ten years on storm water management capital upgrades, such as larger creek culverts and creek channel improvements [xvi] .

Halton Region also completed outreach in flood-impacted neighbourhoods and offered 100% subsidies for downspout disconnections, backwater valve installations and sump pump installations to the worst-hit homes in 2014 and 2015.

At the end of 2016, Burlington City council approved $50,000 in funding to support the pilot of the Home Flood Protection Program in 2017. Funding supported the completion of a portion of initial assessments as well as the development of free online resources designed to help homeowners take action to reduce flood risk.

In view of extensive outreach to flood-impacted neighbourhoods in the past by Halton Region, the Intact Centre was guided to direct targeted marketing at those neighbourhoods that were not hard-hit by flooding in 2014, but which were equally vulnerable based on the age of homes and condition of municipal infrastructure.

3.2. HFPP Pilot to Date

The HFPP pilot formally launched in Burlington on August 4, 2017, three years after the devastating flood of 2014. The launch event featured an address by Mayor of Burlington Rick Goldring, MPP Eleanor McMahon, City Councilor Paul Sharman as well as an HFPP program participant, Audrey Bailey. The media visited Audrey Bailey's home to discuss her experience and key learnings from participating in the Home Flood Protection Assessment.

To date, the Intact Centre has deployed the following communication and outreach approaches, with a comprehensive promotions support from the City of Burlington.

Targeted (neighbourhood-based) campaigns:

- **Community events:** Two neighbourhood advisory committee meetings were conducted to gather community feedback in reference to the program. To encourage registration, three community events were attended by program staff.
- **Council newsletters:** Three City councilors sent two newsletters each to their Ward residents in targeted neighbourhoods.
- **Door to door campaign:** Door-to-door promotions for HFPP were cancelled two days after initiation in early August at the request of the City due to fraudulent door to door campaigns (unrelated to the HFPP) that were operating in the City at the time, leading to high volumes of public complaints.
- **Door hangers:** At the request of the City, the door to door campaign was replaced by a door hanger campaign in target neighbourhoods –15,000 door hangers were distributed to four target neighbourhoods

Broad-based marketing campaigns:

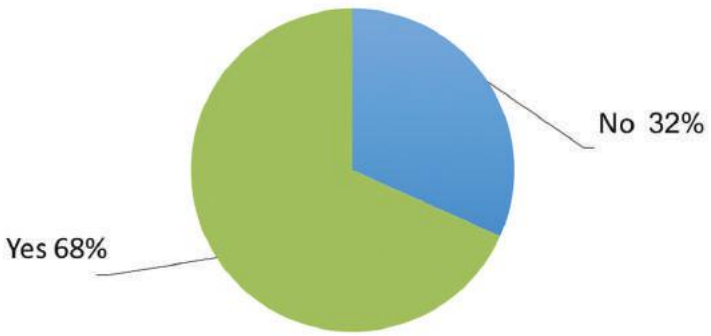
- **Traditional media:** The HFPP was profiled on television (e.g., CBC News, CTV News, TVO, CHCH News), on radio programs (e.g., CBC Radio, The Current); as well as in numerous national and local newspapers (Globe and Mail, Global News, Canadian Underwriter, Inside Halton). See *Appendix D* for examples of media coverage received. for examples of media coverage received.
- **Social media:** Information about the program was shared through Facebook (@HomeFloodProtect), Twitter (@ICCA_ Canada) and LinkedIn. Posts were shared by the City, City Councilors, the Mayor of Burlington, Burlington MPP Eleanor McMahon, local residents, non-profits and businesses. Paid advertising through Facebook featuring participant testimonials was also completed.
- **Municipal promotions:** The City of Burlington issued a media release following the launch event and posted detailed information about the program on the City website.
- **Newspaper advertising:** The Intact Centre promoted the HFPP program through two paid advertisements and two advertorials featuring program participant testimonials in the Burlington Post in October 2017.
- **Engagement with real estate agents:** The Intact Centre engaged with real estate brokers in Hamilton-Burlington, at a trade show, and made a series of presentations to realtors, including the Realtors Association of Hamilton-Burlignton (RAHB). Broader engagement with real estate agents will commence in 2018 to encourage them to purchase the HFPP as a value-add service for house buyers and sellers.
- **Engagement with insurance brokers:** A meeting with a large Canadian property and casualty insurer was completed in mid-October to review results of marketing approaches and to provide guidance on the promotions strategy. Discussion is underway regarding methods to engage insurance brokers in HFPP promotion and initial brokerage presentations have been set for 2018.

3.3. Key Findings

Based on interim HFPP results, the Intact Centre has determined the following:

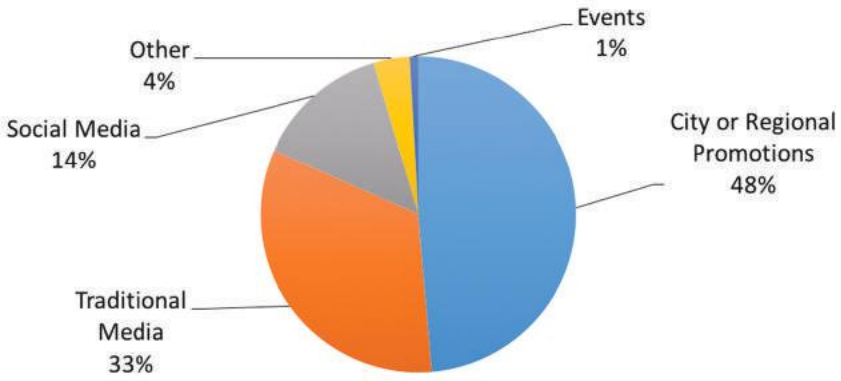
- **Highest demand for HFPP is from residents with past flood experience:** Although significant efforts were made to target promotions to homeowners with no past flood experience, the majority of registrations were received from people with past flood experience (68% of registrations). *See Figure 4 for the percentage of program participants who have experienced previous flooding.*

Figure 4: Previous Flood Experience



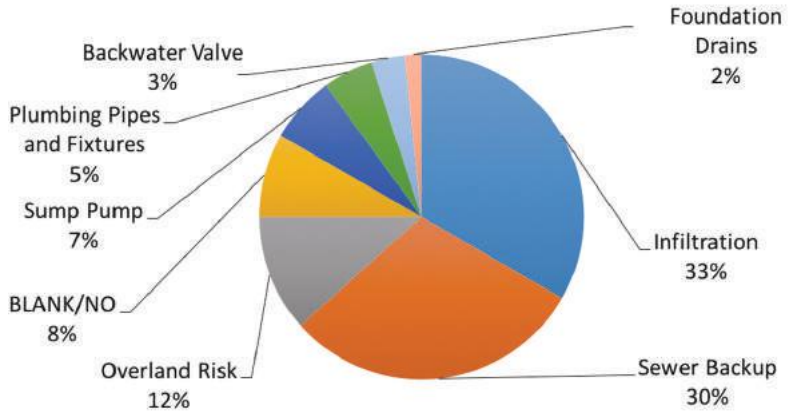
- **Trusted, confidential, third-party service delivery is important:** 48% of registrants reported that they learned about the program from City or Regional promotions. Key elements of successful promotions included City logos and endorsements by trusted City officials and political figures. Due to the prominence of aggressive and fraudulent door-to-door promotions in Burlington in 2017, third-party service delivery and confidentiality of services was noted as critical by participating residents. *See Figure 5 for a breakdown of primary registration information sources.*

Figure 5: Homeowner Primary Registration Info Source



- **Real estate agents and insurance brokers represent a major promotional opportunity:** Initial discussions with real estate agents and insurance brokers indicated their substantial interest in promoting the HFPP. HFPP is a value-add that provides direct benefit to clients and helps real estate agents, and insurance brokers stand out in front of competitors.
- **Optimum timing of promotions is March to June:** Based on consultations with the City's engineering and communications departments, and a review of the City's most highly attended community events and consultations with local realtors, the Intact Centre determined that the best time to promote HFPP registration is March to June. Spring melts and heavy rains typically help put flood protection at top of mind for most homeowners. March to June is also a time when the majority of homeowners are conducting home renovations and gardening projects, which can be informed by Home Flood Protection Assessments.
- **Top flood risk concerns vary:** The top flood risk concerns noted by Burlington residents varied widely, with the largest percentage (33%) expressing concerns about basement infiltration flooding (where groundwater seeps through basement walls and floors), followed by 30% of residents expressing concerns about sanitary sewer backup risk (where water enters the home through sump pits or drains), and 12% expressing overland flood concerns (where water travels over the land and enters the home through above ground openings such as windows and doors) *See Figure 6 for the top flood risk concerns of participants.*

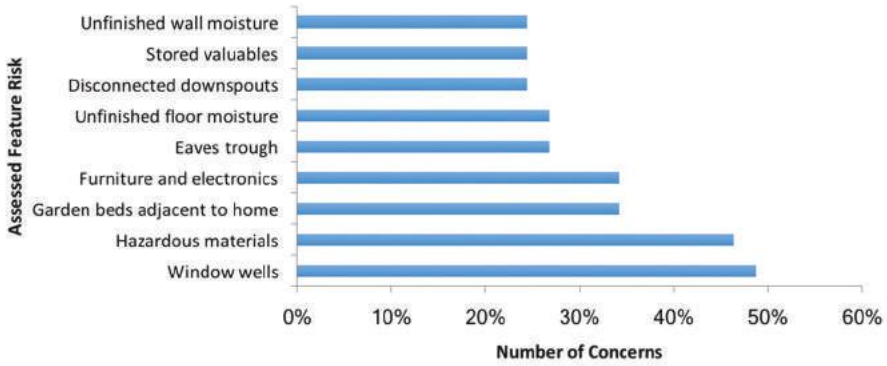
Figure 6: Top Flood Risk Concerns of Participants



•**Top flood issues identified through HFPP Assessments:** The most common flood issues identified through HFPP Assessments in Burlington included:

- improperly installed or inadequate window wells (50% of assessed properties);
- presence of unsecured hazardous materials stored on basement floors (47% of assessed properties);
- presence of furniture and electronics susceptible to water damage in the basement (35% of assessed properties);
- poor grading of garden beds located outside homes (35% of assessed properties);
- high levels of moisture on basement floors (25% of assessed properties); and
- downspouts depositing water less than 1m from the foundation (25% of assessed properties).
- *See Figure 7 for the top assessed flood risk features identified.*

Figure 7: Top Assessed Flood Risk Features Identified



- **Top Areas for Further Investigation:** 50% of assessment reports prioritized further investigation to determine the suitability of backwater valve installation to reduce the risk of sanitary sewer backup. Further investigation of the condition of the sanitary sewer lateral was identified as a priority for 82% of participants. To encourage action, the Intact Centre provided residents with tips on where to find the following information: local contractors, Regional subsidies, and City plumbing grant information.

Customer Satisfaction: A customer satisfaction survey indicated overall satisfaction with the HFPP Assessments as "very high" by 66% of participants and "high" by 33% *(see Figure 8)*. Satisfaction with the HFPP assessors was also "very high" for 66% of assessments, and "high" for 33%. Report satisfaction was ranked "very high" by 50% and "high" by 50% of HFPP participants *(see Figure 9)*.

Figure 8: Customer Assessment Satisfaction

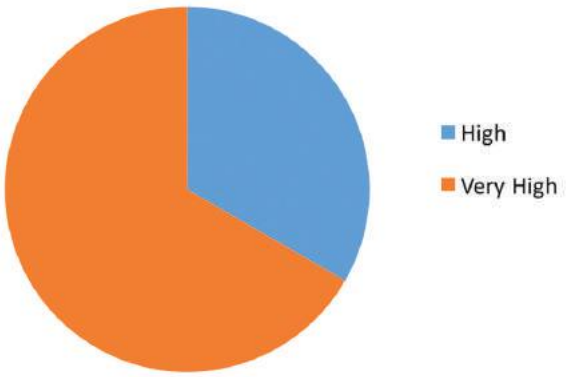
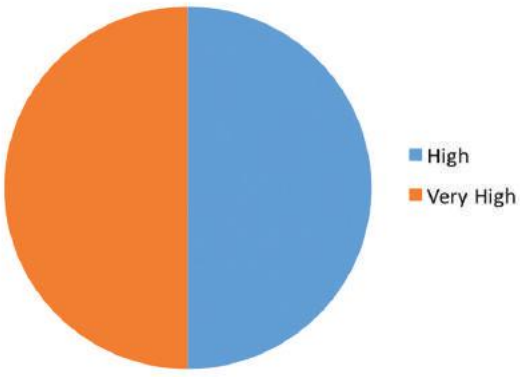


Figure 9: Customer Report Satisfaction



Chapter 4. Next Steps

The Home Flood Protection Program offers a practical means to help protect Canadians from the costliest impacts associated with natural disasters in Canada - basement flooding. The Intact Centre will continue to test the HFPP in various communities throughout 2018. Having the opportunity to gather additional program promotions and assessment data will ensure that the program has the community-tested insights necessary to create a practical, cost-effective model for nation-wide program delivery.

Through operationalizing the HFPP, everybody wins:

- **Homeowners** are educated on the importance of flood risk reduction and on means to take direct action to protect their homes from basement flooding. In so doing, they protect both their properties and help to ensure their peace of mind every time it rains.

- **Governments** realize substantial financial benefits of home flood protection ($1 invested in HFPP yields $13 in avoided basement flood damage costs over 10 years). The HFPP increases uptake of current subsidy programs and initiatives to limit basement flood risk (e.g., backwater valve installation programs, downspout disconnect programs, and sump-pump/ back-up battery installation programs).

  For governments, the HFPP supports the Build Back Better mandate of the Pan-Canadian Framework on Clean Growth and Climate Change, the Sendai Principles and Disaster Risk Reduction initiatives.

- **Businesses,** including retailers (e.g., home hardware stores), as well as home inspectors, plumbers and landscape designers benefit from increased demand from their services following HFPP assessments.

  Intact Financial Corporation, the largest property and casualty insurer in Canada, recently made a public statement recognizing the value of assessing flood risks and taking action to reduce these risks. Accordingly, they will provide Home Flood Protection Assessment participants who have acted upon report recommendations, with a 5-15% discount on their total home insurance premium.

"Severe weather events caused by climate change are increasing and impacting communities across Canada. Water damage is now the leading cause of personal property claims. Over the last 10 years, water losses for personal property claims have doubled to 40% (of $ paid in losses). There are a number of improvements that Canadians can take to better protect their homes and communities against water damage. **By taking these steps, Canadians could lower their annual premiums - anywhere from 5 to 15%.** *Those who live in municipalities who make climate resilient infrastructure a priority could also benefit from more affordable premiums, higher coverage limits and enhanced insurance coverage."*
- Intact Financial Corporation, 2017

APPENDIX A: SAMPLE HOME FLOOD PROTECTION ASSESSMENT REPORT

HOME FLOOD
PROTECTION PROGRAM

UNIVERSITY OF WATERLOO

Prepared for John Smith
123 Any Rd
Burlington, ON

Date Completed: September 10, 2017
Assessor Name: Cheryl Evans
Assessor Email: c8evans@uwaterloo.ca

Prepared on behalf of AET Group
www.aet98.com
1-877-876-9235

Table of Contents

INTRODUCTION

What Does This Report Include?

This report includes an easy to read summary of top ranked items for priority action that have received a "poor/ needs further investigation" score or require specific mention based on questions asked by the homeowner. It also provides a record of all gathered information and provides additional helpful resources to help homeowners take action to reduce flood risk.

How Are Assessed Features Scored?

Assessors use the standardized assessment tool provided to guide them through a visual assessment of the property and to ask a list of preventative maintenance questions to homeowners. The information gathered is then compared to the tool's scoring definitions, developed by the University in Waterloo in concert with a wide variety of national experts in the area of basement flood risk reduction. Assessed Features are assigned scores of "Good- Best Practice", "Intermediate" or "Poor/ Needs Further Investigation" based on where they fall within these definitions. Any Assessed Features not accessible for observation and any preventative maintenance questions that are not completed by the homeowner are marked "Not Recorded."

What Does This Report Not Include?

Beyond summarizing the report findings related to assessed items that received a score of "poor/needs further investigation" or require specific mention based on questions asked by the homeowner the report does not formally state a prioritized approach for addressing deficiencies. It is up to Homeowner to decide which actions they will take and in what order.

To ensure program impartiality the report does not recommend specific contractors, suppliers or products. The report also does not provide in-depth drawings or tailored step-by-step instructions to complete projects at the home to address deficiencies.

How Was Information for this Report Gathered?

This contents of this report have been gathered by examining the physical condition of a variety of features inside and outside the home using simple tools such as a moisture meter, humidity gauge, flashlight and measuring tape. A verbal preventative maintenance questionnaire has also been completed with the homeowner or their designate.

Reporting Time Frame

This report documents the observed condition of physical features of the home and the preventative maintenance information gathered from the Homeowner on the day of the Assessment only.

Follow-Up Support Provided

Your assessment fee includes the equivalent of a 15 minute email follow-up conversation with your Assessor. Our customer service team can also answer your basic questions at 1-877-876-9235. For ongoing support, visit homefloodprotect.ca to register for our e-newsletter that includes important preventative maintenance reminders. For do-it-yourself tips and Homeowner Success stories, like us on Facebook @HomeFloodProtect.

What is Included in the Additional Resources Section?

A list of easy to read, highly practical, online links is provided to help Homeowners take action to reduce flood risk. These include how-to fact sheets and videos, local subsidy information, questions to ask your *insurance* provider and tips about hiring contractors.

DEFINITION OF TERMS

Scoring of Assessment

Each assessed item is assigned a score based on the standardized criteria laid out in the Home Flood Protection Assessment ranking system.

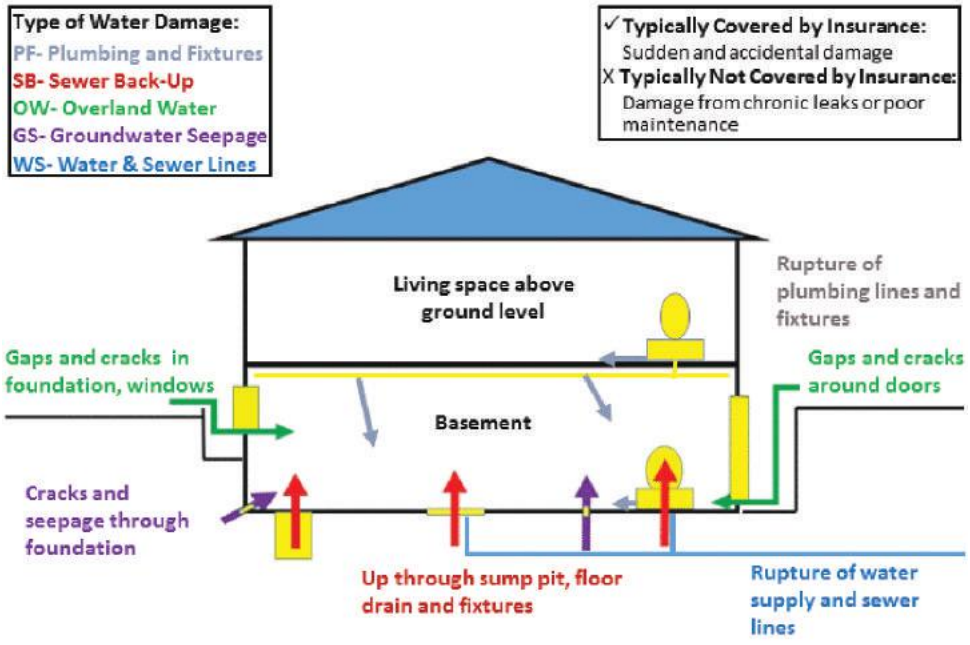
Score	Description
Good- Best practice	Observed or reported in good condition or reported maintenance practice
Intermediate	Observed or reported in intermediate condition or reported maintenance practice
Poor/ Needs Further Investigation	Observed or reported in poor condition or reported maintenance practice or needs further investigation
Not Reported	Unobserved or unreported observed condition or reported maintenance practice
Out of Scope	Out of scope for this assessment but worthy of further consideration

UNDERSTANDING DIFFERENT TYPES OF WATER DAMAGE RISKS AT YOUR HOME

The diagram and the definitions below are provided to help you understand the types of water damage that may affect any home due to deterioration of physical features, lack of preventative maintenance or water backup from municipal sewer systems during extreme weather events.

These water damage types are referenced in your Home Flood Protection Assessment Report to help you understand the types of water damage risks that have been identified at your home and your opportunities to reduce risk. Please see the customized list of maintenance best practices listed in your report to help you develop your preventative maintenance routine.

Insurance Coverage Considerations:
Sudden and accidental water damage is typically covered by insurers, however damage due to slow leaks or lack of preventative maintenance is typically not covered. Since there is no industry-wide, standard language used to define water damage types you may find using the terms and descriptions in this document helpful when working with your insurer to determine which coverage is best for you. Please note that not all insurance companies provide all types of coverages for all homes. See the "Questions for Your Insurance Provider" document in the Additional Resources section of the report for additional information.



Typical Insurance Policy Coverage for Sudden and Accidental Damage	Code	Type of Water Damage	Simple Definition
Included	PF	Plumbing and Fixtures	Water that enters your home from a tear or rupture of plumbing pipes or fixtures (e.g. toilets, hot water heaters, dish washers)
Optional	SB	Sewer Back-Up	Water that flows from the sanitary or storm sewer or your home's foundation drains and backs up into your home through the sump pit, toilets and drains
Optional	OW	Overland Water	Water that flows from a lake or river, heavy rain or rapid snow melt and enters through cracks and gaps in your home's exterior from a point at or above ground level
Optional	GS	Ground Water	Water that has saturated the ground and enters your home below ground level through gaps, cracks and seepage through your home's foundation
Optional	WS	Water and Sewer Lines	Water that enters your home due a tear or rupture of a water supply and/or sewer lines

CLIENT INFORMATION SUMMARY

Type of Home	**Single Detached**
Ownership	**Owner**
Type of Ownership	**Freehold**
Consents To Study	**Yes**
Length of Time in Home	**0-5 years**
Plan to Stay in Home	**Over 10 years**
Year Home Was Built	**1973**
Era of Neighbourhood development	**Between 1940 and 1970**
Home Layout	**2 Storey**
Home Size	**Between 2000-4000 sq ft**
Lot Size	**Over 1 acre**
Basement Type	**Fully finished**
Foundation Type	**Poured concrete**
Soil Type	**Clay**
Property within CA Regulated Area	**No**
Flood Plain Hazard Level if Known	
Water Supply	**Well**
Sewage Service	**Septic**
Weather Conditions	**Cloudy, 23 degrees**

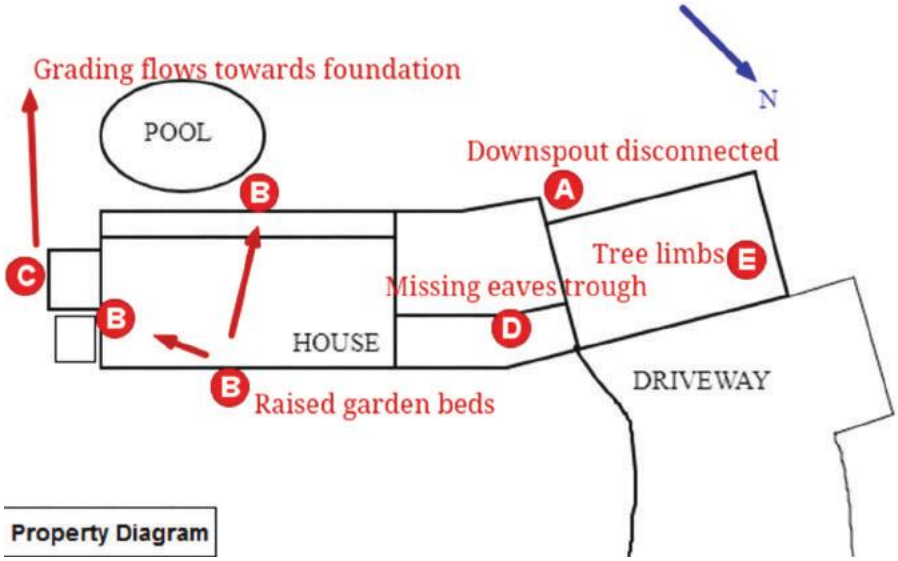
REPORTED PAST WATER DAMAGE SUMMARY

Past Water Damage to Your Lot and Exterior Structures	
Have you experienced any type of water damage to your lot and/or exterior structures (decks, garages, sheds) in the past?	Yes
What was the cause of the water damage?	Rain fall or snow melt originating on your property.
What category would the water damage fit into (total damage to structures or content)	Between $5,000 and $25,000
What actions did you take to reduce your risk of future water damage outside your home?	Completing repairs or upgrades, Completing maintenance activities.
What is your level of concern about experiencing water damage to your lot or exterior structures in the future?	High
Please list your top 2 water damage-related questions you have about your lot or exterior structures	How is the water entering the house. Concerns with the septic system.

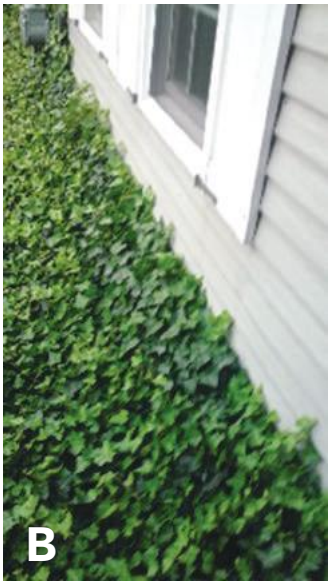
Past Water Damage To Your Home	
Have you experienced water in your basement or any type of water damage inside your home in the past?	Yes
What was the cause of the water damage?	Seepage through walls or floors.
What category would the water damage fit into (Total damage to structures or content)	Between $5,000 and $25,000
What actions did you take to reduce your future risk of indoor water damage?	Completing repairs or upgrades, Completing maintenance activities.
What is your level of concern about experiencing water damage to your home is in the future?	High
Please list top 2 water-damage related questions you have about your home	Will the new system keep the water out of the basement. Wanted more information about sump pump operation.

OUTSIDE ASSESSMENT SUMMARY
TOP-RANKED OPPORTUNITIES TO REDUCE FLOOD RISK

All features and maintenance practices that were assessed as "poor/ needs further investigation", require specific mention based on questions asked by the homeowner or are marked as "out of scope" but deserve further consideration, have been compiled into this summary.



Property Diagram

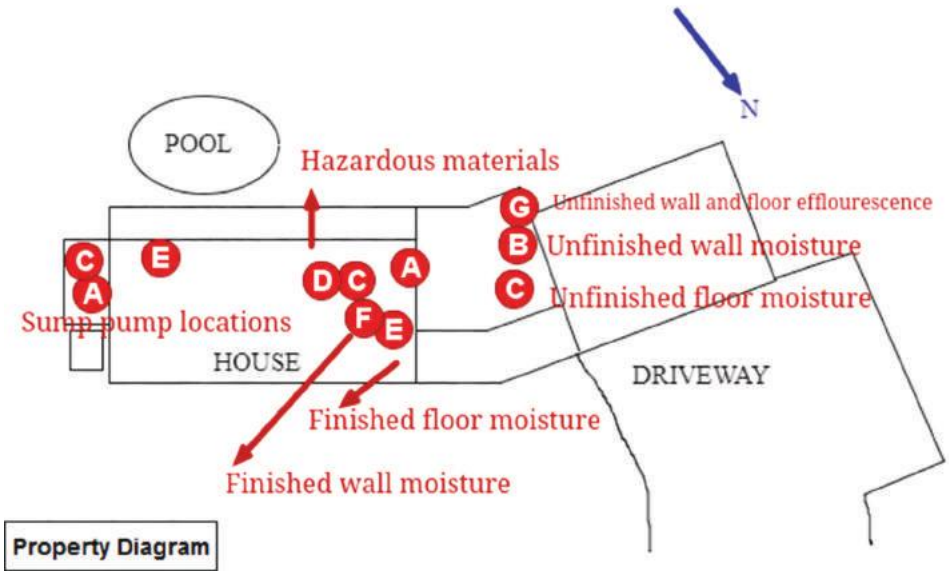


Assessed Features

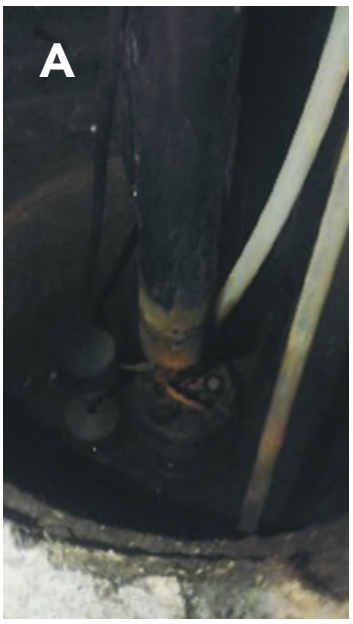
Fig	Assessed Feature Description	Type of Water Damage	Challenge	Opportunity to Reduce Risk
	Condition of trees- Do trees pose any property damage risk or flood risk? Healthy and well pruned trees whose limbs do not hang over buildings and hydro lines reduce property damage risk during extreme weather events. Trees planted too close to foundations or sewer lines pose a risk of root damage and can contribute to flood risk.	**SB, WS, GS**	Trees appear to be in poor condition./ Many tree limbs hang over the home, driveway or hydro lines./ The position of trees represent high risk to the home's foundation or sewer lateral.	See **E** on **Outside Assessment** diagram. Some large tree limbs are hanging over the garage and pose damage risk during significant wind and ice storms. Consider contacting a certified arborist to assess tree health and prune as required.
B	**Garden beds adjacent to home - Do garden beds and foundation plantings pose risk of infiltration of water into the basement or limit drying potential of foundation?** Garden beds adjacent to the home's foundation pose a risk of infiltration of water into the basement unless soil is graded at least 5% away from foundation, soil and mulch are less than 8" from top of foundation. Trees that will reach a height of 30'(10m) or more are a minimum of 15' (5m) from foundations and shrubs are minimum of 6' (2m) from foundations. Dense plantings close to foundation limit drying potential of foundation and present increased risk of foundation deterioration.	**GS**	Foundation plantings provide poor light and air circulation between plantings and foundation. Less than 8" of foundation remains exposed. Trees that will reach height of 30'(10m) or are closer than 12'(4m) from foundation and shrubs are closer than 3'(1m) from foundation. The garden bed has less than 2-3% slope away from the foundation and water drains poorly away from the foundation.	See **B** on **Outside Assessment** diagram. Heavily prune back plantings to improve light and air circulation. Remove plantings that are too close to foundation. Correct grade to minimum 5% slope to ensure water flows away from foundation.
C	**Grading at foundation- Does the grading and surface cover within 10' (3m) direct water away from your foundation?** There is an increased risk of infiltration to the basement if the grade at foundation slopes away from the foundation at less than 5% for landscaped surfaces and 1-2% for paved surfaces and if the surface may absorb water.	**OW, GS**	Grading is flat or slopes toward the foundation. The surface is highly water absorbent.	See **C** on **Outside Assessment** diagram. Repair grading to achieve at least 5% slope for landscaped surface and 1-2% for paved surfaces. Replace surface with non-water absorbent material.
D	**Eaves troughs- Are eaves troughs adequately sized and in adequate condition to reduce flood risk?** Eaves troughs should fully wrapping around building, are 5" for asphalt shingles or 6" for steel roof, are in good condition and have downspouts placed at a minimum of every 30-40', to decrease likelihood of overflow and risk of basement flooding.	**GS**	Eaves troughs do not wrap around entire building, are in poor repair, contain a high amount of debris, and do not have downspouts placed every 30-40'. Eaves troughs are undersized and/or do not have 5" eaves trough for asphalt shingles or 6" for metal roof.	See **D** on **Outside Assessment** diagram. Contact qualified professional to install eaves troughs where missing, install eaves trough of 5" for asphalt shingles and install downspouts every 30-40'. Repair existing eaves troughs. Remove debris.
A	**Connected downspouts- Are downspouts connected to SANITARY OR STORM sewer increasing sewer backup risk?** Downspouts that connect to foundation drains that in turn drain to the sanitary or storm sewer increase the likelihood of sewer backup into the home. Disconnecting these downspouts and directing water to downspouts that direct water at least 10'(3m) away from foundation or to drainage swale reduces risk of sewer backup. Water should not be directed onto adjacent properties. Note: Connection of downspouts to the sanitary sewer is illegal. Identifying the below ground connection of the drain is outside of scope of this assessment. Consult with your municipality about whether disconnection is right for your property and hire a qualified professional to complete this work.	**SB**	**Note: Only a qualified professional can formally identify the condition of this item. Note: Check with the Region regarding eligibility for disconnection and subsidy.**	See **A** on **Outside Assessment** diagram. Further investigation into the condition of the underground drainage piping and its connections with a closed circuit camera is recommended by a qualified contractor. This may be a potential source of water infiltration into the basement.
	Disconnected downspouts- Are downspouts (that are not presently connected into underground pipes) directing water safely away from your home to reduce flood risk? There is increased risk of groundwater seepage if water is not directed away from home less than 10' (3m) from foundation or to a drainage swale. Water should not be directed onto adjacent private property.	**GS**	If applicable, caps are not securely in place over pipe to foundation drains where downspout was formerly connected. Downspouts deposit water at foundation, or direct water between 0-3' (0-1m) from the foundation OR Water is directed onto adjacent private property.	Properly secure downspout connections to ensure water moves freely to a minimum of 10' (3m) away from the foundation.

INSIDE ASSESSMENT SUMMARY
TOP-RANKED OPPORTUNITIES TO REDUCE FLOOD RISK

All features and maintenance practices that were assessed as "poor/ needs further investigation", require specific mention based on questions asked by the homeowner or are marked as "out of scope" but deserve further consideration, have been compiled into this summary.



Property Diagram



Assessed Features

Fig	Assessed Feature Description	Type of Water Damage	Challenge	Opportunity to Reduce Risk
	Foundation drain- Is a foundation drain (weepers) present? If so, is it functioning properly to drain water away from your foundation? Depending on the age of your house it may or may not have a foundation drain or it may have a drain that is old and in poor condition. Missing or clogged drains increase the risk of basement infiltration flooding. Foundation drains that are connected to sanitary or storm sewers increase the risk of sewer backup related flooding. Note: Foundation drains are not common before 1950. Determining the condition of the foundation drain is outside of scope of this assessment. Consult a qualified professional.	**GS, OW, SB**	**Note: Only a qualified professional can formally identify the condition of this item or recommend if one would be right for your home. Note: Check with the Region regarding eligibility for subsidy.**	Your home is over 40 years old. A damaged or collapsed foundation drain is a possible source of high levels of water infiltration at your home. Consider working with a qualified professional to assess and repair your foundation drain if necessary to ensure that water is efficiently collected from your foundation and sent to your sump pit.
A	**Sump pump- Is your sump pump in good condition, how often does it run?** A sump pump reduces risk of basement flooding by gathering and expelling water from foundation drains. It will have limited capacity to reduce flood risk of water entering the basement in other ways. Consider installing and maintaining an alarm: Having an alarm to alert the homeowner to sump pump failure can reduce flood risk.	**SB**	Sump pump is present and homeowner reports it is not functioning well, sump pumps runs more than 10 times per year.	See **A** on **Inside Assessment** diagram. You noted that your sump pump is not functioning consistently. This puts your home at increased risk of flooding. Clean and repair your sump pump and replace if necessary. Hire a qualified professional for installation. Consider purchasing a sump pump alarm for additional monitoring. Note: Check with Region regarding eligibility for subsidy for purchase of sump pump. Plumbing permits required by City.
	Back-up sump pump- Is there a backup sump pump and is it in good condition? Having a back-up sump pump provides an extra safeguard if the primary pump stops working	**SB**	Back-up sump pump is NOT present OR Back-up sump pump is present and homeowner reports it is not functioning well .	Purchase back-up sump pumps. Consider hiring a qualified professional for installation.
	Unfinished wall efflourescence- Is there evidence of efflourescence on your walls, indicating water movement through the foundation? Efflourescence (mineral deposits) indicate that water is slowly entering walls from outside and exiting again through evaporation, leaving behind mineral deposits.	**GS**	Significant evidence of efflourescence (large areas of solid coverage of white flakes).	See **G** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove efflourescence and seal with masonry waterproofing paint.
B	**Unfinished wall moisture- Are there high levels of moisture on the surface of your walls, indicating potential leaks or infiltration?** High levels of moisture on wall surfaces indicate source of water infiltration, increased risk of mold damage.	**GS**	High moisture levels in some areas of wall surface.	See **B** on **Inside Assessment** diagram. Examine sources of moisture from inside and outside the home. Hire qualified professional as needed to diagnose and repair moisture or mold problems.
	Unfinished floor efflourescence- Is there evidence of efflourescence on floors, indicating water movement through the foundation? Efflourescence, or mineral deposits indicate that water is slowly entering floors from below and exiting again through evaporation, leaving behind mineral deposits.	**GS**	Significant evidence of efflourescence.	See **G** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), consult with professional about foundation drain performance, clean and paint with masonry waterproofing paint.

Assessed Features

Fig	Assessed Feature Description	Type of Water Damage	Challenge	Opportunity to Reduce Risk
C	**Unfinished floor moisture- Are there high levels of moisture, indicating water entry into basement?** High levels of moisture in floor surface indicate source of water infiltration, increased risk of mold damage and flooding.	**GS**	High moisture levels are present in some areas of floor surface.	See **C** on **Inside Assessment** diagram. Examine sources of moisture from inside and outside the home. Hire qualified professional as needed to diagnose and repair moisture or mold problems.
	Finished walls- Are water stains or high moisture levels indicating source of water infiltration? Evidence of moisture on walls surface may indicate a leak, higher risk of mold growth and flood damage.	**GS**	Walls have water stains, evidence of mold, mm indicates high concern.	See **F** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove and replace damaged materials. Consult a professional if concerned about mold.
	Finished floors- Are there high levels of moisture, indicating water entry into basement? High levels of moisture on floor surface indicates source of water infiltration, increased risk of mold damage.	**GS**	Major evidence of water damage, strong mildew smell.	See **E** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove and replace damaged materials. Consult a professional if evidence of mold.
	Basement indoor sources of moisture- Minimizing and managing indoor sources of excessive humidity is essential to limit mold growth.	**N/A**	Fan is present but can't hold piece of tissue when running, OR fan is not present OR fan is run for less than 10 minutes after shower or bath. Furnace humidifiers operate in the summer, items are stored that increase humidity. Dehumidifier is not keeping relative humidity between 30-50%.	Consider running more than one dehumidifier. Ensure moisture is kept at between 30-50%.
D	**Hazardous materials- Are hazardous materials stored in a way that represents a contamination risk during a flood?** There is a risk of leak and contamination of the basement if a flood occurs.	**N/A**	Hazardous materials are not sealed in waterproof containers and/or are stored on the floor.	See **D** on **Inside Assessment** diagram. Remove hazardous material from basement or to avoid contamination threat, or seal hazardous materials in waterproof containers and store at least 12" off the floor and at least 3" away from walls.

Assessed Features

Fig	Maintenance Feature Description	Type of Water Damage	Challenge	Opportunity to Reduce Risk
	Unfinished wall crack maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never checks for cracks, fills cracks, removes sources of water buildup at foundation as needed (corrects drainage, repairs eaves troughs and/or removes snow in winter, seals foundation from outside in extreme cases). Consults with professional regarding foundation drain in case of major problems.	Check for cracks once per season, fill cracks, remove sources of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases). Consult with professional regarding foundation drain in case of major problems.
	Unfinished wall efflourescence maintenance- Regular inspection provides insights into water infiltration risks and regular prevention reduces risk of larger problems developing.	**GS**	Never checks for evidence of efflourescence, addresses sources of water buildup at foundation, cleans and repaints with masonry waterproofing paint as required.	Once per season check for evidence of efflourescence. Address sources of water buildup at foundation. Clean and repaint with masonry waterproofing paint as required.
	Unfinished floor crack maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never checks for cracks once per season, fills cracks, removes source of water buildup at foundation as needed (corrects drainage, repairs eaves troughs and/or removes snow in winter, seals foundation from outside in extreme cases). Consults with professional regarding foundation drain in case of major problems.	Check for cracks once per season, fill cracks, remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases). Consult with professional regarding foundation drain in case of major problems.
	Unfinished floor efflourescence maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing. practices	**GS**	Never checks for evidence of efflourescence, addresses sources of water buildup at foundation, cleans and repaints with masonry waterproofing paint as required.	Once per season check for evidence of efflourescence. Address sources of water buildup at foundation. Clean and repaint with masonry waterproofing paint as required.
	Finished floor maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never check for water damage, signs of mold growth. Ensure humidity at between 30-50% by running dehumidifier if necessary. If water damage and/or mold evident, consults professional for remediation.	Each season check for water damage, signs of mold growth. Ensure humidity at between 30-50% by running dehumidier if necessary. If water damage, mold evident, consult professional for remediation.
	Indoor plumbing and fixtures maintenance- Are your plumbing and fixtures and their connections to water and sewer in good repair to prevent flooding? Regular review and repair of leaks and broken seals in toilets, taps, pipes and water heaters reduce risk of basement flooding.	**PF**	Toilets, taps, pipes and water heaters are not inspected by homeowner, inspected and repaired by plumber as needed.	Each season inspect toilets, taps, pipes and water heaters for leaks and signs of wear. Repair or replace items with the assistance of a plumber as needed.

ADDITIONAL RESOURCES

Home Flood Protection Program Frequently Asked Questions

Homeowner Resource List

Questions to Ask Your Insurance Provider

Contractors Serving Burlington, Ontario

Outside Assessment Form

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Overland Drainage of Property			
Overland drainage of property- How well does the water flow on the property? Within 24 hours, rain and snow melt need to drain freely away from home's foundation to a drainage ditch, water course, municipal storm sewer, empty through a drainage swale or soak into property at least 10' (3m) away from foundation of home to reduce basement flood risk.	**OW**	Water drains freely on property and in nearby storm drains and does not pool for over 24 hours.	No action is required.
Overland drainage maintenance- Regular monitoring and removal of debris from water flow paths on the surface of private property and adjacent municipal property (where applicable) is of critical important to reduce risk of water backing up, moving toward a home's foundation and posing an overland flood risk.	**OW**	Once per season or when major storm events are predicted, checks for and removes debris and obstructions from water flow paths including swales and nearby storm drains.	Once per season or when major storm events are predicted, check for and remove debris and obstructions in swales and nearby storm drains. If nearby storm drains are free of debris but are still not draining within 24 hours, contact the City.
Landscaping			
Condition of trees- Do trees pose any property damage risk or flood risk? Healthy and well pruned trees whose limbs do not hang over buildings and hydro lines reduce property damage risk during extreme weather events. Trees planted too close to foundations or sewer lines pose a risk of root damage and can contribute to flood risk.	**SB, WS, GS**	Trees appear to be in poor condition./ Many tree limbs hang over the home, driveway or hydro lines./ The position of trees represent high risk to the home's foundation or sewer lateral.	See **E** on **Outside Assessment** diagram. Some large tree limbs are hanging over the garage and pose damage risk during significant wind and ice storms. Consider contacting a certified arborist to assess tree health and prune as required.
Tree maintenance- Regular tree maintenance enhances tree health and reduces risk of damage to hydro lines and property during extreme weather events.	**SB, WS, GS**	Once per season checks condition of trees and waters during drought periods.	Once per season check condition of trees. Water during drought periods. If concerned about tree on City property contact City for assistance. If concerned about tree on your property contact certified arborist for help.
Garden beds adjacent to home - Do garden beds and foundation plantings pose risk of infiltration of water into the basement or limit drying potential of foundation? Garden beds adjacent to the home's foundation pose a risk of infiltration of water into the basement unless soil is graded at least 5% away from foundation, soil and mulch are less than 8" from top of foundation. Trees that will reach a height of 30'(10m) or more are a minimum of 15' (5m) from foundations and shrubs are minimum of 6' (2m) from foundations. Dense plantings close to foundation limit drying potential of foundation and present increased risk of foundation deterioration.	**GS**	Foundation plantings provide poor light and air circulation between plantings and foundation. Less than 8" of foundation remains exposed. Trees that will reach height of 30'(10m) or are closer than 12'(4m) from foundation and shrubs are closer than 3'(1m) from foundation. The garden bed has less than 2-3% slope away from the foundation and water drains poorly away from the foundation.	See **B** on **Outside Assessment** diagram. Heavily prune back plantings to improve light and air circulation. Remove plantings that are too close to foundation. Correct grade to minimum 5% slope to ensure water flows away from foundation.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Landscaping maintenance- Regular landscaping maintenance ensures that water flows away from the foundation at a minimum of 10' (3m) and maximizes the ability of rain and snow melt to be soaked into lawns and gardens in other areas, reducing risk of water pooling and potentially making its way into the basement.	**GS**	Once per year corrects grading issues within 10' (3m) of foundation, applies mulch to garden beds, aerates lawn.	Once per year correct grading issues within 10' (3m) of foundation, apply mulch to garden beds, aerate lawns.
Driveways, Walkways and Patios			
Impervious (waterproof surface such as asphalt and interlocking pavers) driveway- Is the slope and condition of your driveway adequate to reduce flood risk? There is an increased risk of overland flow or infiltration-related flooding if paving directs water toward foundation or cracked surface permits water infiltration less than 10' (3m) from foundation.	**GS**	Impermeable driveway directs water away from foundation, small number of cracks or gaps are present.	Seal cracks, fill gaps, remove weeds to prevent additional damage.
Impervious (waterproof) driveway maintenance- Regular inspection and repair of driveway can reduce risk of basement flooding and buildup of winter ice.	**GS**	Once per season checks for evidence of pooling and ice buildup, repairs grading, seals cracks, fills gaps, removes weeds.	Once per season check for evidence of pooling, ice buildup, repair grading, seal cracks, fill gaps, remove weeds.
Walkways and patios- Are your walkways and patios graded properly and in adequate condition to reduce flood risk? There is increased risk of overland flow or groundwater seepage if paving directs water toward foundation or cracked surface permits water infiltration less than 10' (3m) from foundation.	**OW, GS**	Walkway directs water away from foundation, small number of cracks or gaps are present.	Seal cracks, fill gaps, remove weeds to prevent additional damage.
Walkways and patios maintenance- Regular inspection and repair of driveway can reduce risk of basement flooding and buildup of winter ice.	**OW, GS**	Once per season checks for evidence of pooling, ice buildup, repairs grading, seals cracks, fill gaps, removes weeds.	Once per season check for evidence of pooling, ice buildup, repair grading, seal cracks, fill gaps, remove weeds. Replace if surface in very poor condition.
Grading at Foundation			
Grading at foundation- Does the grading and surface cover within 10' (3m) direct water away from your foundation? There is an increased risk of infiltration to the basement if the grade at foundation slopes away from the foundation at less than 5% for landscaped surfaces and 1-2% for paved surfaces and if the surface may absorb water.	**OW, GS**	Grading is flat or slopes toward the foundation. The surface is highly water absorbent.	See C on Outside Assessment diagram. Repair grading to achieve at least 5% slope for landscaped surface and 1-2% for paved surfaces. Replace surface with non-water absorbent material.
Grading at foundation maintenance- Regular review and correction of foundation grading can reduce basement flood risk.	**OW, GS**	Each year checks for signs of water pooling or ice formation; corrects grading to achieve at least 5% for landscaped surfaces and 1-2% for paved surfaces.	Each season check for signs of water pooling or ice formation, repair grading to at least 5% for landscaped surfaces and 1-2% for paved surfaces.
Eaves Troughs and Downspouts			
Eaves troughs- Are eaves troughs adequately sized and in adequate condition to reduce flood risk? Eaves troughs should fully wrapping around building, are 5" for asphalt shingles or 6" for steel roof, are in good condition and have downspouts placed at a minimum of every 30-40', to decrease likelihood of overflow and risk of basement flooding.	**GS**	Eaves troughs do not wrap around entire building, are in poor repair, contain a high amount of debris, and do not have downspouts placed every 30-40'. Eaves troughs are undersized and/or do not have 5" eaves trough for asphalt shingles or 6" for metal roof.	See D on Outside Assessment diagram. Contact qualified professional to install eaves troughs where missing, install eaves trough of 5" for asphalt shingles and install downspouts every 30-40'. Repair existing eaves troughs. Remove debris.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Eaves trough maintenance- Keeping eaves troughs in good repair and free of debris prevents water from overflowing at foundation and reduces flood risk.	**GS**	Once per year during heavy water flow, eaves troughs are checked for leaks, debris and blockage. Repairs, replacements and debris removals are completed as needed.	Each season during heavy water flow, check for leaks, debris and blockage. Repair, replace and clean out as needed.
Connected downspouts- Are downspouts connected to SANITARY OR STORM sewer increasing sewer backup risk? Downspouts that connect to foundation drains that in turn drain to the sanitary or storm sewer increase the likelihood of sewer backup into the home. Disconnecting these downspouts and directing water to downspouts that direct water at least 10'(3m) away from foundation or to drainage swale reduces risk of sewer backup. Water should not be directed onto adjacent properties. **Note: Connection of downspouts to the sanitary sewer is illegal. Identifying the below ground connection of the drain is outside of scope of this assessment. Consult with your municipality about whether disconnection is right for your property and hire a qualified professional to complete this work.**	**SB**	**Note: Only a qualified professional can formally identify the condition of this item. Note: Check with the Region regarding eligibility for disconnection and subsidy.**	See **A** on **Outside Assessment** diagram. Further investigation into the condition of the underground drainage piping and its connections with a closed circuit camera is recommended by a qualified contractor. This may be a potential source of water infiltration into the basement.
Disconnected downspouts- Are downspouts (that are not presently connected into underground pipes) directing water safely away from your home to reduce flood risk? There is increased risk of groundwater seepage if water is not directed away from home less than 10' (3m) from foundation or to a drainage swale. Water should not be directed onto adjacent private property.	**GS**	If applicable, caps are not securely in place over pipe to foundation drains where downspout was formerly connected. Downspouts deposit water at foundation, or direct water between 0-3' (0-1m) from the foundation OR Water is directed onto adjacent private property.	Properly secure downspout connections to ensure water moves freely to a minimum of 10' (3m) away from the foundation.
Downspout maintenance- maintaining adequate sizing, good repair and regular cleanout of downspouts reduces basement flood risk.	**GS**	Once per season checks to make sure downspout extensions secured, free of leaks, depositing water 9 ' (3m) from foundation or to drainage swale and that water is not flowing onto adjacent property.	Once per year check to make sure downspout extensions secured, free of leaks, depositing water 10 ' (3m) from foundation or to drainage swale and that water is not flowing onto adjacent property.
Foundation			
Foundation structure- Is your foundation in adequate condition to help prevent flooding? Cracks and damage to your foundation put your basement at increased risk of flooding.	**GS**	Foundation appears to be in moderate condition, areas of moderate moisture retention are identified, any cracks are less than 1/4" (6mm), some finishing gaps are present(e.g. missing parging).	Clean cracks and fill with expanding polyurethane. Replace missing finishes (e.g. patch missing parging). Consider consulting with qualified foundation repair contractors to further identify risks.
Foundation structure maintenance- Regular review of foundation condition can provide clues about broad water penetration risks to the home and regular repair of foundation cracks can help prevent larger issues from developing.	**GS**	Once per year checks for cracks and gaps, repairs as required.	Once per season check for cracks and finishing details, fill cracks, repair finishes as required. Contact qualified foundation repair contractors when cracks greater than 1/4" (6mm) appear.
Foundation clearance maintenance- Keeping stored items (e.g. wood piles) at least 6" away from foundation is important to maximize air flow and reduce risk of foundation damage. Keeping snow piles at least 3'(1m) away from foundation, clearing window openings of snow and ice at all times reduces risk of basement flooding. It also reduces health risks by keeping any furnace, dryer, gas supply or hot water vents clear.	**GS**	Stored items are kept at least 6" from foundation. As dictated by snow storm events, keeps snow piles 3' (1m) away from foundation and keeps window openings clear of snow piles, ensures vents are clear.	Store items at least 6" from foundation. At intervals dictated by snow storms, regularly keep snow piles 3' (1m) away from foundation and keep window openings clear of snow piles. Ensure vents are clear.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Foundation efflourescence- Are there signs of efflourescence on the foundation that could indicate moisture problems? Efflourescence (mineral deposits) indicate water moving through masonry, evaporating, leaving minerals behind. Presence of efflourescence can indicate water issues that can lead to spalling or structural damage.	**GS**	No evidence of efflourescence.	No action required.
Foundation moisture content- Is your foundation showing high levels of water retention? High levels of moisture at surface of foundation can indicate infiltration presence, can pose risk of longer term damage to foundation.	**GS**	Moderate level of moisture at surface is indicated.	Reduce flow of water to masonry by correcting grading, maintaining eaves troughs, repairing foundation drains, sealing cracks on driveway, shoveling snow away from walls in winter. Contact qualified foundation repair contractor if problem persists.
Exterior Water Sources			
Hose bib maintenance- Regular review and repair of leaks and closing and draining of water lines in the winter can reduce risk of basement flooding.	**OW, GS**	Spring, summer, fall checks for leaks, repairs as necessary. In the winter outdoor water supply is shut off and water line is drained.	Spring, summer, fall check for leak, repairs as necessary. In the winter shut off outdoor water supply and drain water line.
Sump pump discharge- Is your sump pump drain pipe directed far enough away from your foundation to help prevent flooding and also not putting neighbouring properties at risk? Increased risk of infiltration and/or increased running of sump pump if drain pipe deposits water less than 15' (5m) from foundation or does not direct it to a drainage swale. Water should not be directed onto adjacent private property.	**OW, GS**	Sump pump drain pipe is present and drains at least 15' (5m) from foundation or to drainage swale, is not directing water onto adjacent property.	No action required.

Inside Assessment Form

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Floor Drain			
Floor drain- Is your floor drain clear of physical barriers to water flow and in adequate condition to reduce flood risk? There is an increased risk of flooding if the path that water flows to the drain is blocked. Safety note: Standing water should be present it the trap to prevent sewer gases from entering the home.	**SB**	Floor drain is present, demonstrates clear flow path of water to drain, drain is in good condition, free of debris, standing water is present in trap.	No action required.
Floor drain maintenance- A properly maintained drain will maximize flow of water away from the home, reducing flood risk.	**SB**	Each year clears the path of water to drain, tops up standing water in trap, removes any debris from drain. In case of blockage, strange smell, lack of water in trap, contacts a licensed plumber.	Each season check for clear flow path for water to drain, standing water in trap, no debris. In case of blockage, strange smell, lack of water in trap, contact licensed plumber.
Basement sanitary sewer lateral cleanout- Is your cleanout present and accessible? An easily accessible basement sanitary sewer lateral cleanout makes it easier to clean out sewer lines when necessary to prevent sewer backup.	**SB**	Basement sanitary sewer lateral cleanout is easily accessible.	No action required.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Foundation Drain (Weepers)			
Foundation drain- Is a foundation drain (weepers) present? If so, is it functioning properly to drain water away from your foundation? Depending on the age of your house it may or may not have a foundation drain or it may have a drain that is old and in poor condition. Missing or clogged drains increase the risk of basement infiltration flooding. Foundation drains that are connected to sanitary or storm sewers increase the risk of sewer backup related flooding. Note: Foundation drains are not common before 1950. Determining the condition of the foundation drain is outside of scope of this assessment. Consult a qualified professional.	**GS, OW, SB**	**Note: Only a qualified professional can formally identify the condition of this item or recommend if one would be right for your home. Note: Check with the Region regarding eligibility for subsidy.**	Your home is over 40 years old. A damaged or collapsed foundation drain is a possible source of high levels of water infiltration at your home. Consider working with a qualified professional to assess and repair your foundation drain if necessary to ensure that water is efficiently collected from your foundation and sent to your sump pit.
Sump Pit and Pump			
Sump pit- Is your sump pit in good repair? Having a sump pit in good condition reduces risk of basement flooding by providing a location for collecting and removal of water from foundation drains.	**SB**	Sump pit has a sealed cap, is in good condition (free of cracks and holes) and is free of debris.	No action required.
Sump pit maintenance- Regular inspection and maintenance of the sump pit ensures that water is properly contained and limits moisture escape into the home.	**SB**	Every season checks sump pit, repairs cracks or damage, removes debris.	Every season check sump pit, repair cracks or damage, remove debris.
Sump pump connection- Does your sump pump discharge water to the surface of your property to reduce sewer backup risk? There is increased risk of sewer backup if the sump pump connected to storm or sanitary sewer systems. **Note: Determining if the connection of the sump pump drain is to the storm or sanitary sewer is outside of scope of this assessment. Consult a qualified professional.**	**OW, GS**	Sump pump discharges water to absorbent surface at least 15' away from foundation outside home, or to a drainage swale, does not direct water onto adjacent private property.	No action required.
Sump pump- Is your sump pump in good condition, how often does it run? A sump pump reduces risk of basement flooding by gathering and expelling water from foundation drains. It will have limited capacity to reduce flood risk of water entering the basement in other ways. Consider installing and maintaining an alarm: Having an alarm to alert the homeowner to sump pump failure can reduce flood risk.	**SB**	Sump pump is present and homeowner reports it is not functioning well, sump pumps runs more than 10 times per year.	See **A** on **Inside Assessment** diagram. You noted that your sump pump is not functioning consistently. This puts your home at increased risk of flooding. Clean and repair your sump pump and replace if necessary. Hire a qualified professional for installation. Consider purchasing a sump pump alarm for additional monitoring. Note: Check with Region regarding eligibility for subsidy for purchase of sump pump. Plumbing permits required by City.
Back-up sump pump- Is there a backup sump pump and is it in good condition? Having a back-up sump pump provides an extra safeguard if the primary pump stops working.	**SB**	Back-up sump pump is NOT present OR Back-up sump pump is present and homeowner reports it is not functioning well .	Purchase back-up sump pumps. Consider hiring a qualified professional for installation.
Sump pump(s) maintenance- Regular monitoring and repair of the sump pump(s) ensures that they will be ready when needed to remove water from basement.	**SB**	Each season and when an extreme rain or melt event predicted, sump pump(s) are tested, repaired or replaced as required.	Each season and when an extreme rain or melt event predicted, test sump pump(s) and clean, repair or replace as required.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Back-up power source- Is there a backup power source available for a minimum of 12 hours? Having back-up power supply reduces risk of basement flooding by providing short term power supply for sump pumps and alarms in case or power outage. **Consider installing and maintaining an alarm:** Having an alarm to alert the homeowner about back-up power failure can reduce risk of flood damage.	**SB**	Back-up battery or generator is present and is reported by homeowner to be functioning poorly OR there is no back-up power supply. Check with your insurance company about discounts for installing sump pump backup batteries and monitored alarm systems.	Purchase and install back-up power supply.
Exposed Foundation Walls and Floors			
Unfinished wall cracks- Are your foundation walls in adequate condition to reduce flood risk and showing no signs of water infiltration? There is an increased risk of infiltration with cracks. Mineral deposits on walls (efflourescence) indicates water entering walls from outside and exiting walls inside.	**GS**	Cracks of less than1/4" (6mm wide) are present and minor evidence of mineral deposits is present.	Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), clean and fill small cracks with expanding polyurethane foam.
Unfinished wall crack maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never checks for cracks, fills cracks, removes sources of water buildup at foundation as needed (corrects drainage, repairs eaves troughs and/or removes snow in winter, seals foundation from outside in extreme cases). Consults with professional regarding foundation drain in case of major problems.	Check for cracks once per season, fill cracks, remove sources of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases). Consult with professional regarding foundation drain in case of major problems.
Unfinished wall efflourescence- Is there evidence of efflourescence on your walls, indicating water movement through the foundation? Efflourescence (mineral deposits) indicate that water is slowly entering walls from outside and exiting again through evaporation, leaving behind mineral deposits.	**GS**	Significant evidence of efflourescence (large areas of solid coverage of white flakes).	See **G** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove efflourescence and seal with masonry waterproofing paint.
Unfinished wall efflourescence maintenance- Regular inspection provides insights into water infiltration risks and regular prevention reduces risk of larger problems developing.	**GS**	Never checks for evidence of efflourescence, addresses sources of water buildup at foundation, cleans and repaints with masonry waterproofing paint as required.	Once per season check for evidence of efflourescence. Address sources of water buildup at foundation. Clean and repaint with masonry waterproofing paint as required.
Unfinished wall moisture- Are there high levels of moisture on the surface of your walls, indicating potential leaks or infiltration? High levels of moisture on wall surfaces indicate source of water infiltration, increased risk of mold damage.	**GS**	High moisture levels in some areas of wall surface.	See **B** on **Inside Assessment** diagram. Examine sources of moisture from inside and outside the home. Hire qualified professional as needed to diagnose and repair moisture or mold problems.
Unfinished floor cracks- Are there cracks in your floor that provide potential water entry sites to your basement? There is an increased risk of infiltration with cracks. Mineral deposits indicate water entering walls from outside.	**GS**	Cracks are less than1/4" (6mm wide) , minor evidence of water entry.	Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), consult with professional about foundation drain performance, clean and fill small cracks with expanding polyurethane foam.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Unfinished floor crack maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never checks for cracks once per season, fills cracks, removes source of water buildup at foundation as needed (corrects drainage, repairs eaves troughs and/or removes snow in winter, seals foundation from outside in extreme cases). Consults with professional regarding foundation drain in case of major problems.	Check for cracks once per season, fill cracks, remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases). Consult with professional regarding foundation drain in case of major problems.
Unfinished floor efflourescence- Is there evidence of efflourescence on floors, indicating water movement through the foundation? Effloures-cence, or mineral deposits indicate that water is slowly entering floors from below and exiting again through evaporation, leaving behind mineral deposits.	**GS**	Significant evidence of efflourescence.	See **G** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), consult with professional about foundation drain performance, clean and paint with masonry waterproofing paint.
Unfinished floor efflourescence maintenance- Regular inspection provides insights into water infiltration risks and regular repairs reduce risk of larger problems developing. practices	**GS**	Never checks for evidence of efflourescence, addresses sources of water buildup at foundation, cleans and repaints with masonry waterproofing paint as required.	Once per season check for evidence of efflourescence. Address sources of water buildup at foundation. Clean and repaint with masonry waterproofing paint as required.
Unfinished floor moisture- Are there high levels of moisture, indicating water entry into basement? High levels of moisture in floor surface indicate source of water infiltration, increased risk of mold damage and flooding.	**GS**	High moisture levels are present in some areas of floor surface.	See **C** on **Inside Assessment** diagram. Examine sources of moisture from inside and outside the home. Hire qualified professional as needed to diagnose and repair moisture or mold problems.
Finished Walls and Floors			
Finished walls- Are water stains or high moisture levels indicating source of water infiltration? Evidence of moisture on walls surface may indicate a leak, higher risk of mold growth and flood damage.	**GS**	Walls have water stains, evidence of mold, mm indicates high concern.	See **F** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove and replace damaged materials. Consult a professional if concerned about mold.
Finished wall maintenance- Regular review provides insights into water infil-tration risks and regular repairs reduce risk of larger problems developing.	**GS**	Each year checks for water damage, signs of mold growth, ensures humidity at between 30-50% by running dehu-midifier if necessary. If water damage and/or mold is evident, consults a professional for remediation.	Each season check for water damage and signs of mold growth. Ensure humidity at between 30-50% by running dehumidier if necessary. If water damage or mold is evident, consult professional for remediation.
Finished floors- Are there high levels of moisture, indicating water entry into basement? High levels of moisture on floor surface indicates source of water infiltration, increased risk of mold damage.	**GS**	Major evidence of water damage, strong mildew smell.	See **E** on **Inside Assessment** diagram. Remove source of water buildup at foundation as needed (correct drainage, repair eaves troughs and/or remove snow in winter, seal foundation from outside in extreme cases), remove and replace damaged materials. Consult a professional if evidence of mold.
Finished floor maintenance- Regular inspection provides insights into water in-filtration risks and regular repairs reduce risk of larger problems developing.	**GS**	Never check for water damage, signs of mold growth. Ensure humidity at between 30-50% by running dehumidi-fier if necessary. If water damage and/or mold evident, consults professional for remediation.	Each season check for water damage, signs of mold growth. Ensure humidity at between 30-50% by running dehu-midier if necessary. If water damage, mold evident, consult professional for remediation.

Assessed Feature and Why It Matters	Type of Water Damage	Assessment	Opportunity to Reduce Risk
Furniture and Electronics			
Furniture and electronics- Are furniture and electronics at risk of damage in the event of a flood? The risk of realizing damage to furniture and electronics from flooding can be greatly reduced by raising the height of items off the floor and selecting water resistant and washable furnishings.	**N/A**	Furniture items have non-absorbent surfaces up to 6" and electronics are stored at least 6" off the floor.	Select furniture items that have non-absorbent surfaces up to 12" and store electronics at least 12" off the floor.
Plumbing Fixtures			
Indoor plumbing and fixtures maintenance- Are your plumbing and fixtures and their connections to water and sewer in good repair to prevent flooding? Regular review and repair of leaks and broken seals in toilets, taps, pipes and water heaters reduce risk of basement flooding.	**PF**	Toilets, taps, pipes and water heaters are not inspected by homeowner, inspected and repaired by plumber as needed.	Each season inspect toilets, taps, pipes and water heaters for leaks and signs of wear. Repair or replace items with the assistance of a plumber as needed.
Storage and Limiting Indoor Humidity			
Stored valuables- Are your valuables at risk of damage during a flood or at risk of mold and mildew growth? Removing valuable items from the basement, sealing them in water-tight containers, raising items off the floor and moving them away from walls helps to reduce risk of flood damage and mold and mildew growth.	**N/A**	Valuables are stored in sealed, non-absorbent containers at least 12" off the floor, at least 6" away from walls OR no valuables are stored in the basement.	No action required.
Basement indoor sources of moisture- Minimizing and managing indoor sources of excessive humidity is essential to limit mold growth.	**N/A**	Fan is present but can't hold piece of tissue when running, OR fan is not present OR fan is run for less than 10 minutes after shower or bath. Furnace humidifiers operate in the summer, items are stored that increase humidity. Dehumidifier is not keeping relative humidity between 30-50%.	Consider running more than one dehumidifier. Ensure moisture is kept at between 30-50%.
Hazardous materials- Are hazardous materials stored in a way that represents a contamination risk during a flood? There is a risk of leak and contamination of the basement if a flood occurs.	**N/A**	Hazardous materials are not sealed in waterproof containers and/or are stored on the floor.	See **D** on **Inside Assessment** diagram. Remove hazardous material from basement or to avoid contamination threat, or seal hazardous materials in waterproof containers and store at least 12" off the floor and at least 3" away from walls.

APPENDIX B: LITERATURE REVIEWED

Behaviour Change Literature Reviewed

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APPENDIX C: STAKEHOLDERS ENGAGED IN THE HOME FLOOD PROTECTION PROGRAM DEVELOPMENT

Allan Magi, Executive Director, Capital Works Department, City of Burlington

Cary Clark, Manager of Development Engineering and Stormwater, City of Burlington

Chris Rol, Senior Policy Advisor, Insurance Bureau of Canada

Dan Sandink, Director of Research, Institute for Catastrophic Loss Reduction

Frank Mossman, Property and Liability Insurance Inspector, Intact (Atlantic Canada)

Gerry Lashley, Director of Personal Property Insurance, Intact (Atlantic and Ontario)

Grant Murphy, Business Owner and Municipal Engineer, Two Point Oh! E-Learning Services

Hashim Javed, Engineer, Project Manager II, Water & Wastewater System Services Public Works, Halton Region

Jamie Shawn Mahoney, Financial Reporting & Insurance Analyst, University of Waterloo

Jitender Singh, Technical Advisor, Canadian Codes Centre, National Research Council, Canada

Kevin Snyder, Senior Field Claims Representative, Intact Insurance

Larry Freiburger, Director of Operations, AET Engineering Consultants

Luke Kuzio, Contract Coordinator, Procurement & Contract Services, University of Waterloo

Michael Albanese, Business Owner, Avesi Stormwater and Landscape Solutions

Nickola Voegelin, Legal Counsel & Co-Chair of the Copyright Advisory Committee, University of Waterloo

Paul Allan, Real Estate Agent and Team Leader, KW Keller Williams Golden Triangle Realty Inc.

Richard Simpson, Professional Plumber, Business Owner, Town Councillor, Town of Innisfil

Rod McGilvary, Home Inspector, Baseline Inspections

Ron Bolender, Home Inspector and Business Owner, Ron the House Doctor

Sian Williams, (former) Senior Legal Counsel, University of Waterloo

Steve Kee, Director of Media & Digital Communications, Insurance Bureau of Canada

APPENDIX D: EXAMPLES OF MEDIA COVERAGE ON HOME FLOOD PROTECTION PROGRAM

2017

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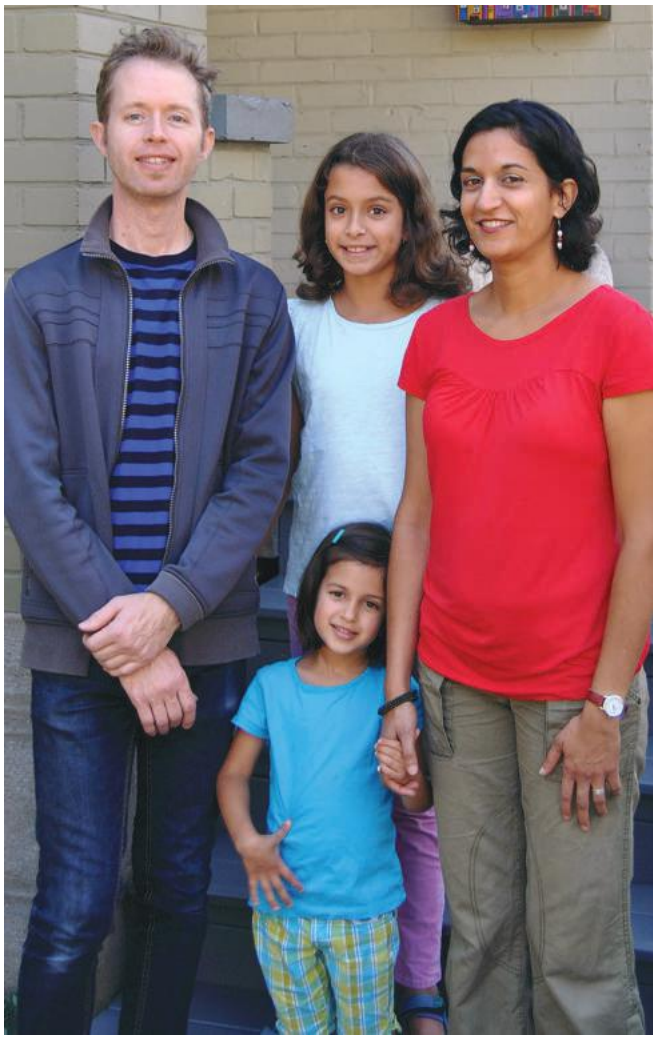
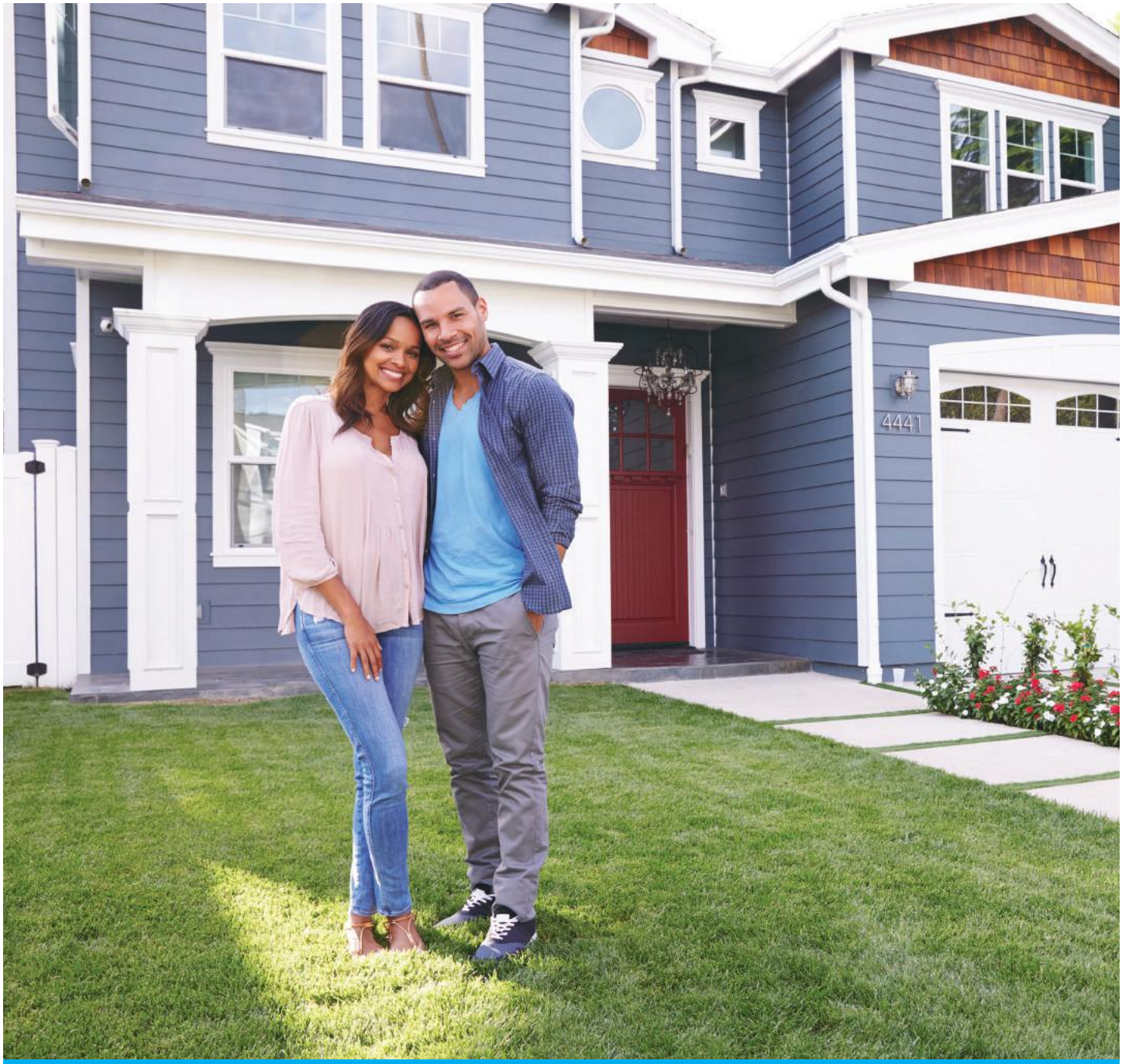
PARTICIPANT TESTIMONIALS

◀ "After going through two devastating sewer back-up floods in 2014, my family and I wanted to learn what we could do to protect our new home from flooding. I would recommend having an assessment to anyone who wants to understand what they need to do to protect their home and their personal belongings. The assessment is $125, a small price to pay to have peace of mind."
– Carol Solis (Burlington, Ontario)



"A few years ago we experienced a flooded basement from sump pit overflow. We also have chronic dampness in parts of our basement. From our assessment we learned we can upgrade our sump pump, install a backup battery and flood alarm and make some inexpensive changes to our downspouts to help us keep water out of our basement even during the biggest storms. The $125 assessment fee is an investment that could save any family thousands of dollars in future." ▶
– Zainab & Patrick Moghal (Waterloo, Ontario)



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UNIVERSITY OF WATERLOO

INTACT CENTRE ON CLIMATE ADAPTATION

HOME FLOOD PROTECTION PROGRAM