Institute for Catastrophic Loss Reduction

Building resilient communities

Designed for Safer Living®

Handbook for reducing

Basement flooding

Designed for Safer Living® *is a program endorsed by Canada's insurers to promote disaster-resilient homes.*

Handbook for reducing

Basement flooding

Institute for Catastrophic Loss Reduction

2009

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Published by
Institute for Catastrophic Loss Reduction
20 Richmond Street East, Suite 210
Toronto, Ontario, Canada M5C 2R9

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ISBN: 978-0-9784841-0-1
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Part 1:
Introduction

This handbook provides information on how you can reduce your chances and your neighbours' chances of having basement flooding. There are 20 flood reduction options in this handbook, including:

Option 1: Talk to your municipal government about basement flooding

Option 2: Inform your municipal government about basement flooding that you've experienced

Option 3: Hire a licensed plumber to conduct a detailed plumbing investigation on your home

Option 4: Check your insurance policy, or talk to your insurance broker or insurance provider about basement flood coverage

Option 5: Avoid pouring fats, oils and grease down household drains

Option 6: Keep storm sewer grates clear

Option 7: Seal cracks in foundation walls and basement floor

Option 8: Considerations for overland flood entry-points

Option 9: Reduce home water use during heavy rainfall events

Option 10: Maintain eavestroughs and downspouts

Option 11: Avoid storing items directly on the basement floor

Option 12: Downspout disconnection, extension and splash pads

Option 13: Lot grading, backfilling and swales

Option 14: Weeping tiles, sump-pits and sump-pumps

Option 15: Mainline, normally open backwater valve

Option 16: Maintain sewer laterals

Option 17: Severance of storm sewer lateral

Option 18: Considerations for reverse sloped driveways

Option 19: Window wells and window well covers

Option 20: Avoid remodelling or finishing basements

This handbook also provides some background information and descriptions of municipal sewer and stormwater management issues that have led to basement flooding problems. It is our hope that this handbook will provide useful guidance to any homeowner who would like to reduce their chances of having basement flooding.

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Part 3: Background

Homeowners do not often think about sewer systems and stormwater management in their community until there is a problem. Sewer systems are one of the most important parts of modern cities, and in many ways, make our current way of life possible. Not only do they help our communities and homes stay dry, they also help prevent serious public health problems. These systems have been very effective in servicing Canadian cities through conveying sewage and stormwater away from homes and city streets and keeping potential health impacts and flooding at bay. However, there have been many cases where these systems have not worked as intended.

In the past few years, there have been several **urban flooding** events that have resulted in basement flooding in both larger and smaller communities across the country. Urban flooding has occurred in Edmonton, Saskatoon, Winnipeg, Toronto, Montréal, Moncton and many other larger communities. Urban flooding has also occurred in Prince George and Port Alberni, B.C., Stratford and Peterborough, Ontario as well as in many other smaller communities. Indeed, almost no urban community is immune to urban flooding.

There will always be a chance that basement flooding will occur, no matter what municipalities or private homeowners do to reduce the risk.

Severe weather events and other factors that lead to basement flooding are extremely difficult to predict. It is impossible to account for every potential scenario in the design of municipal stormwater management and sewer infrastructure, and basement flooding isn't always the fault of municipal governments.

While adopting flood reduction measures outlined in this handbook will reduce the chances that a homeowner will experience basement flooding, there will always be a risk that basements will be flooded.

Municipal governments across Canada are working hard to reduce urban flood problems. Many cities are replacing and updating aging sewer systems and building additional capacity into existing systems. However, improving sewer infrastructure is an expensive and long-term process. In many cases, these projects will take several years to complete.

Photo: Brian Campbell

While your municipal government can take extensive actions to reduce basement flooding, there will always be a chance that homeowners will experience flooding. In this handbook you will find an explanation of your home's drainage system, why basement flooding happens and what you can do to help reduce this problem for you and your neighbours.

Part 4:
Why should you protect your home from basement flooding?

Basement flooding can cause significant damage to your personal property and can have serious repercussions for the livability of your home. Basement flood impacts include:

- Damage to basement flooring and wall materials.
- Loss of furniture and entertainment systems.
- Damage to irreplaceable sentimental items.
- Food spoilage.
- Damage to furnaces, water heaters, and the home's electrical system.
- Structural damage to the home, including possible damage to the foundation.
- Damage to property stored in the basement.

Aside from reducing damages to your house and personal property, by reducing basement flooding you can protect yourself and your family from possible health impacts from a flood event, including respiratory problems from dampness and mould growth. Also, when you experience basement flooding, you increase the chances that your neighbours will have flooding. When a large amount of water enters your basement, this water can enter your floor drain and overload the **sanitary sewer** in your community, which can contribute to **sewer backup** in your neighbourhood.

In many cases, basement flooding damages are uninsurable. As explained later in this handbook, most homeowners are not covered for damages caused by **overland flooding** and **infiltration flooding**. Most insurance companies will provide coverage for sewer backup damages. Coverage for sewer backup damage is often included in typical home insurance policies, but in many cases a separate endorsement must be purchased for this type of coverage. Talk to your insurance broker or insurance provider to find out if you have coverage for sewer backup damages.

Part 5:
If your home has a basement, you can have basement flooding

You might think that since you live on top of a hill, or since you've never had any problems with basement flooding in the past that you are safe. This is not necessarily the case. Flooding events in several communities have affected many people who were thought to have lived in areas where basement flooding could not occur.

Also, much of the sewer infrastructure in Canada is getting older. Many communities have had problems with cracked underground sewer pipes, which allow a constant flow of **groundwater** into the system; a situation that can reduce the ability of the system to handle heavy rainfall. Further, climate change will increase the frequency and intensity of heavy rainfall events. That means that the heavy rainfalls of the past will occur more often in the future, causing more flood events.

Definitions

Definitions of technical words and terms that are **highlighted in bold** can be found in the glossary on page 44 at the end of this handbook.

Homeowners can have problems with basement flooding even when there has been no major rainfall event. The condition of your own **sanitary sewer lateral**, the underground pipe that connects your home to the municipal **sanitary sewer** system, can result in sewer backup, especially when there are problems with build-up of debris in your lateral or in the municipal sanitary sewer system.

All things considered, it is a good idea for any homeowner to protect their home from basement flooding – it is better to be safe than sorry.

Actions taken by homeowners who have never experienced basement flooding can reduce the risk for those who have

- Many basement flood reduction actions, including disconnecting weeping tiles and downspouts from the municipal sewer system, require the cooperation of many homeowners in a neighbourhood.
- In many cases, more than half the homes in a particular neighbourhood must disconnect their downspouts from the municipal sewer system to reduce basement flood risk from sewer backup.

Part 6:
What is basement flooding and why does it happen?

A lot of thought has been put into keeping water out of your home and reducing flooding in your community. Eavestroughs and downspouts are designed to direct roof water away from your home, and help to keep your basement dry. Proper lot grading also helps keep water away from your foundation and basement walls, directing it to municipal stormwater infrastructure. However, when these systems are not working properly in your home, much of the runoff from your roof can end up in your basement or your neighbours' basements.

Diagrams

The fold out diagrams on pages 52 through 54 at the end of this handbook show how infiltration flooding, overland flooding and sewer backup flooding can enter a typical two-storey home.

Extremely severe rainstorm events can overwhelm municipal infrastructure and lead to flooding. More often than not, basement flooding is a result of **overland flooding**, **infiltration flooding** or **sewer backup**, or a combination of two or all three of these types of flooding.

The diagram on page 51 at the end of this handbook shows some of the conditions that can cause basement flooding in a typical two-storey home.

How much water spills from your roof?

- Many communities across Canada experience several 10 mm and a few 25 mm rainfall events each year.
- Several Canadian communities have experienced severe rainfall events with more than 100 mm of rainfall, and some communities have had more than 250 mm during a severe rainfall event.
- A 25 mm rainfall event will shed 840 litres of water from a two-storey, 1800 sq ft. home with a 900 sq ft. roof, while a 250 mm event will shed 8,400 litres from the same roof.

To find how much water your roof sheds during a 10 mm and 25 mm rain event, see the chart on page 43 at the end of this handbook.

Overland flooding

Canadian communities are designed to safely handle a certain amount of snow-melt and rainfall. When new communities are designed, municipal engineers and planners build underground sewer pipes and create **overland flow routes** to help convey stormwater and snowmelt away from urban areas. In many cases, streets, ditches, **swales** and even parks have been designed to carry water away from residential areas. All of these **stormwater management** structures and strategies can help reduce basement flooding.

Underground pipes are extremely expensive to build and install, and to offset this cost, municipal officials must build them to handle only a limited amount of rainfall and snowmelt. In most cases, underground stormwater pipes are designed to handle rainstorms that occur **once every five years** on average, or in other words, rainstorms that have a 20% chance of occurring in any given year. However, older parts of cities often have underground pipes that can only handle storms that occur **once every two years** on average, or in other words, rainstorms that have a 50% chance of occurring in any given year.

Managing stormwater

- Many older neighbourhoods do not have overland flow routes, and rely entirely on underground pipes. In many cases, these pipes may be combined sewers, which convey both stormwater and sanitary sewage.
- Neighbourhoods that rely strictly on underground pipes and have combined sewers may be at a higher risk of basement flooding.
- Talk to your municipal government to find out what types of stormwater management strategies are used in your neighbourhood.

In newer subdivisions, including those built during and after the 1970s, **overland flow routes** were built to handle rainfall events that exceed the capacity of underground pipes. Overland flow routes may include streets with heightened curbs or ditches that run next to roadways. Generally, overland flow routes are designed to handle a rainstorm that has a 1% chance of occurring in any given year, or a rainstorm that might occur **once every one hundred years**. Again, overland stormwater management infrastructure must be designed to handle a limited capacity to help offset their considerable cost.

In the event that a rainfall or snowmelt event exceeds the capacity of underground pipes, or when a rainstorm exceeds the capacity of overland flow routes, overland flooding can occur. During the flood event, water will flow in areas that it usually would not, including through residential areas and over private properties. In older neighbourhoods, a lack of overland flow routes significantly increases the chances that overland flooding will occur. This flood water can then enter basements through windows, doors, vents and other openings. Overland flood water can also enter a home through reverse sloped driveways.

Although overland flooding will generally consist of relatively clean rainwater, it may wash soil and mud into your basement, or it may be tainted with chemicals, pet waste, salt, or other contaminates from city streets and local buildings.

The diagram on page 52 at the end of this handbook shows how overland flooding can enter a typical two-storey home.

Infiltration flooding

After a few days of steady rain, when spring snow-melt occurs or during an extreme rainfall event, the soil around your home can become saturated with water. Steady snow-melt and precipitation can also raise the ground water level to a point where it is higher than your basement floor.

Make sure you know your coverage: Infiltration and overland flooding

- The vast majority of insurance companies in Canada do not provide coverage for damages that are caused by overland and infiltration flooding.
- Not everyone's insurance policy is the same: Talk to your insurance provider or broker to find out the limits of your coverage.

This groundwater can infiltrate into basements through cracks in basement walls (or foundation walls) and cracks in basement floors. Infiltration flooding can be a significant problem in older homes where mortar has weakened over the years and cracks have developed in stone or cinder block foundations. Homes that do not have a **weeping tile**, where the weeping tile has not been maintained, or where there is poor lot drainage also have a greater chance of suffering from infiltration flooding.

The diagram on page 53 at the end of this handbook shows how infiltration flooding can enter a typical two-storey home.

Sewer backup

Sanitary sewage is generated by the use of toilets, sinks, drains and other home water uses. Because this type of sewage contains a high degree of contaminants and can pose a significant risk to human health and the environment, it requires treatment at sewage treatment facilities before it is released back into the environment. Sanitary sewage is collected through **sanitary sewer laterals,** which connect homes and buildings to underground sanitary sewer pipes.

Storm sewage consists of excess surface water, resulting from rainfall or snowmelt that has collected in streets, sidewalks, roofs and parking lots in urban areas. Various methods are used to channel this water to underground **storm sewer** pipes, including **swales** and **catch basins**. Although storm sewage is significantly cleaner than sanitary sewage, it can be contaminated with pet waste, salt and other contaminants picked up from city streets and other urban surfaces.

In most cases, your neighbourhood is serviced by underground sewage pipes that are either **combined**, **separated** or **partially separated**. These pipes carry either sanitary sewage, storm sewage, or a combination of both to sanitary sewage treatment facilities and nearby lakes, streams and rivers.

Combined sewer systems convey a combination of sanitary sewage and storm sewage, which is conveyed to sewage treatment facilities before being released into local surface water, including lakes, streams and rivers.

Combined sewers are designed to automatically bypass treatment facilities and re-route excess sewage to local surface water bodies when they become overwhelmed. This automatic bypass is called a **combined sewer overflow (CSO)**, and it helps to protect sewage treatment facilities from damage and also helps to reduce the chances of sewer backup in buildings. However, as CSOs result in the release of raw, untreated sewage, they can have a significant negative impact on local surface water quality. Reduced water quality can have a negative impact on aquatic life, and can also reduce the recreational qualities of lakes and rivers. As homeowners' weeping tile and downspout connections can contribute a substantial amount of water to the combined sewer, they can increase the chances that CSOs will occur.

Make sure you know your coverage: Sewer backup

- Most insurance companies will provide coverage for sewer backup damages. Sewer backup coverage is often included in home insurance policies, but in many cases a separate endorsement must be purchased for this type of coverage.
- Not everyone's insurance policy is the same: Talk to your insurance provider or broker to find out if you have coverage for sewer backup damage.

Have you made an insurance claim for sewer backup damages in the past?

- There have been cases where homeowners who've made a claim for sewer backup damage have had difficulty in receiving payouts for later sewer backup damages.
  - In some cases, homeowners who have made repeated claims for sewer backup damage have experienced capping of their eligible sewer backup payouts, or cancellation of sewer backup coverage altogether.
  - If you have made a claim for sewer backup damage, talk to your insurance provider or broker to find out if it affected your sewer backup coverage.

Separated sewer systems have two individual pipes that are designed to convey only sanitary sewage and only storm sewage. The separation of the different types of sewage allows municipal engineers to direct sanitary sewage to treatment facilities, while storm sewage is allowed to flow into nearby lakes, streams and rivers with less intensive treatment. In some cases, neighbourhoods are serviced by partially separated sewers, which include sections that are combined and sections that are separated.

Sewer backup can happen when municipal **sanitary**, **combined**, or **storm sewer** systems receive more water than they can handle. Excess water can cause the sewers to "**surcharge**," and push water backwards through home sewer laterals and cause sewage to backup into the home through basement floor drains, toilets and sinks. Excessive surcharge in the municipal sewer can create high pressures around basement floors and the foundation, which can cause structural damage to the home. For example, excess pressure in pipes beneath the home can result in heaving of basement floors, especially when improper backwater valves are used (see Option 15). When **weeping tiles** are connected to the municipal system through **sanitary sewer laterals** or **storm sewer laterals**, sewage can be forced back into the weeping tiles, resulting in possible structural damage to the home.

If a home has a **storm sewer lateral** and the municipal **storm sewer** surcharges, water can be forced out of the storm sewer lateral and can enter the **sanitary sewer lateral**, resulting in sewer backup in the home and can also contribute to sewer backup in the neighbourhood (see Option 17).

The diagram on page 54 at the end of this handbook shows how sewer backup can enter a typical two-storey home.

Which type of flooding should you be concerned about?

In many cases, homeowners can experience damages from all types of flooding, including overland flooding, infiltration flooding and sewer backup – sometimes all at once. It is very difficult to tell which parts of which communities will be subject to each type of flooding, so it is best to protect yourself from all types of flooding.

Does it make a difference if my home is serviced by a combined or separated sewer?

Neighbourhoods that are serviced by combined sewers may be at a greater risk of experiencing sewer backup, as these types of sewers can receive more stormwater than they can handle. However, areas serviced by separated sewer systems can also experience sewer backup. Older separated sewers can experience high levels of **infiltration and inflow**, where excess water enters the sanitary system through cracks that have developed over time, as well as cross-connections, where storm sewers have accidentally or illegally been connected into the sanitary system. Stormwater can also inflow directly into the sanitary system from the surface through manhole lids, increasing the chances of sewer backup.

New or old neighbourhood? Does it make a difference?

Over time, drainage and stormwater management standards have become more stringent in Canadian communities. Newer communities and neighbourhoods are often better suited to handle rainfall and snowmelt events than older communities. However, being in a new neighbourhood does not guarantee that a homeowner will not have basement flooding.

For example, high rates of basement flooding can result in significant amounts of water entering sanitary sewer systems through basement floor drains, which can place significant stress on sanitary sewers and cause sewer backup. As well, nature can throw many events at us that cannot be reasonably planned for. In these cases, the last line of defence is actions taken by the homeowner to reduce basement flooding in their own home.

Part 7:
What can I do to help stop basement flooding in my home and community?

Although governments can play a substantial role in managing basement flood risk by updating and improving stormwater management infrastructure, there are many things that you can do in your home and on your property to reduce the risk of basement flooding. You can make a difference in reducing the risk of basement flooding in two ways:

1. **Protecting your own home from damages, and**

2. **Reducing your home and property's contributions of water to municipal stormwater and sanitary sewer infrastructure.**

Depending on your experience and comfort level, you may be able to complete many of the flood reduction options described in this handbook yourself. If you are not comfortable with this type of work, you should hire a professional to do the work for you. For more intensive flood reduction options, including Options 13 through 19, you will likely need the assistance of professionals. Regardless of whether you hire a professional or do the work yourself, you should discuss flood reduction options with your municipal government (Option 1) and hire a licensed plumber to conduct a detailed plumbing investigation on your home (Option 3) before taking action.

Before you do any work on your home, make sure you have the proper permits from your municipal government

- Securing permits for all appropriate flood reduction actions will help to ensure that proper materials and construction practices are applied, and that devices like backwater valves and sump-pumps have been located in the proper places in respect to the drainage and plumbing characteristics of your home.

The next part of this handbook outlines some best practices for basement flood reduction that require less time and money to implement, and can help reduce your chances and your neighbour's chances of having basement flooding.

Part 8:
Simple and inexpensive things you can do to protect yourself

Option 1: Visit your municipal government's website or contact the public works, utilities or building department to find out about basement flooding

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Review your municipality's website or talk to officials in your municipal government about basement flooding. In most cases, they will be able to point you toward useful information on flood problems in your community, and what homeowners can do to reduce flooding in their homes and neighbourhood. Here are a few questions you should consider when talking to your municipal government:

What is your municipality doing to address flooding in your community and neighbourhood?

Has the municipality conducted any engineering studies on flooding in your community? If they have, do the studies provide recommendations on what homeowners can do to reduce flood risk?

Are any sewer system improvements planned in your area?

Are there any upcoming flood related public meetings or workshops that you could attend to learn more about basement flooding?

Are there any opportunities to share your experience with basement flooding (for example, at public meetings)?

Who should I talk to?

- In most cases, you should talk to the officials responsible for buildings and drainage services in your municipality to discuss flood reduction options.

These officials are often located within building departments, public works departments or utilities departments.

Does your municipality provide flood reduction guidance and education for homeowners?

In most cases, your municipal government is the best source of information on how to reduce flooding in your home and neighbourhood.

Does your municipal government provide financial assistance for basement flood reduction measures?

Some municipalities provide partial financial assistance for homeowners to install or alter plumbing and lot characteristics to reduce flood risk. Financial assistance may be provided for:

- Disconnecting eavestrough downspouts (see Option 12).

- Disconnecting **weeping tiles** from sanitary sewer laterals and installing **sump-pits** and **sump-pumps** (see Option 14).
- Installing **backwater valves** (see Option 15).

Talk to your municipal government to see if there is a similar program in your community. Your municipal government may also inspect and repair sewer laterals as a free service on a one-time basis.

IMPORTANT

Basement flood reduction information provided by your municipal government should take precedence over recommendations made in this handbook.

Does your municipality provide a list of pre-qualified plumbers and contractors?

Hiring plumbers and contractors recommended by your municipal government will help to ensure that the right construction practices and materials are used when flood reduction measures are incorporated into your home. Using pre-qualified professionals will also ensure that the right plumbing devices are installed properly, and that you are getting a fair price for plumbing work.

Ask about all necessary permits, underground utility location services and inspection services

When talking to your municipal government, ask about all required permits, site visits and inspections that will be required for changes to your home's plumbing and lot drainage. Remember to ask about underground utility locating policies and services, which may be required to identify the location of your home's sewer laterals and other underground services before you dig up sections of your lot to access weeping tiles or sewer laterals.

Underground utility location and inspection services provided by municipal governments or utility companies may take several days or possibly weeks to complete, so inquire about them early in the process. These services may be free or may require a payment. As well, your municipal government may require work to be completed within a limited time-frame after underground utility location or inspection services have been performed. If you are hiring a professional to work on your home, ensure that they have discussed all of the necessary procedures with the municipal government, and that any site work that will be completed by utility companies or your municipal government is coordinated so that your flood reduction work goes smoothly.

Option 2: Talk to your government about basement flooding that you've experienced

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

If you have basement flooding, let your municipal government know about it during or after the event. In many cases, municipal governments may ask homeowners to fill out a questionnaire or comment on their experience at public meetings. Municipal governments can use this information to identify solutions and carry out work on reducing flood risk in your neighbourhood.

If possible, record the following details when you have basement flooding so you can report them to your municipal government. Try to take pictures or videos of the flooding and flood damage. **DO NOT** gather this information unless it is safe to do so. Do not enter your basement while it is being flooded or when there is water present. This could lead to drowning or electrical shock.

- What was the date and time of flooding?
- Did the basement flooding occur because of rain, snow-melt or a combination of rain and snow-melt?
- Approximately how long was the rainstorm? Did the rainstorm appear to be extremely heavy, moderate or light?
- Were you using internal pumbing such as dishwashers, showers or laundry machines during the flooding?
- Was there any overland flooding in your neighbourhood?
  - Was it flowing over private properties?
  - If there was water flowing over the surface outside of your home, approximately how deep was it?
- How deep was the water in your basement?
- How did the water get into your home?
  - Did it get in through windows, doors or vents?
  - Did it seep in through cracks in the basement walls and floor?
  - Did it come up through plumbing fixtures and floor drains?
- How did the water leave your basement?
  - Did it eventually flow out through floor drains or did you have it pumped out?
- If you had a sump-pump, did it work properly?
- If you had a backwater valve, did it work properly?
- Did you hire a contractor, plumber, repair crew or cleaning crew to investigate the flooding incident or make repairs?
- Did you make an insurance claim?
- Was your claim denied or approved?

See the fold out questionaire on page 56 at the end of this handbook

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Option 3: Hire a licensed plumber to conduct a detailed plumbing investigation on your home

Each home is unique. A plumber or contractor who is fully versed in home and municipal drainage systems can help you understand the risk of flooding in your home. Some homes may have only a sanitary sewer lateral and some homes may have both a **sanitary sewer lateral** and a **storm sewer lateral**. Understanding the risks of flooding and the nature of your plumbing and sewer connections will help to ensure that the best course of action is taken to reduce future flooding in your home.

Before you install...

■ A detailed plumbing investigation should be completed before you install any basement flood reduction devices, or alter the drainage inside or outside of your home in any way.

If possible, hire contractors or plumbers who have been pre-approved and recommended by your municipal government.

Contact the public works, utilities or building department in your municipal government and ask for a list of contractors or plumbers who have been pre-approved to carry out work related to basement flooding.

A detailed plumbing investigation may involve the use of closed circuit television (CCTV) camera inspections. This type of inspection will help to identify the type of connections that a home has to the municipal sewer system and the nature of the home's plumbing.

Option 4: Check your insurance policy, or talk to your insurance provider or broker

Who will this help?
- Homeowner

Types of flooding this will help reduce
- None, but most Canadian insurers will provide coverage for damages caused by sewer backup

Here are a few points to consider when thinking about your home insurance coverage for basement flooding:

- Does your home insurance policy cover sewer backup damage?
- Did you know that the vast majority of Canadian homeowners are not covered for damages caused by overland flooding or infiltration flooding?
- There have been cases where homeowners who have made repeated claims for sewer backup damage have experienced capping of their eligible sewer backup payouts, or cancellation of sewer backup coverage altogether.

Talk to your insurance provider or broker to find out about what types of flood damages are covered under your policy. Trying to make a claim after you have suffered basement flood damages is not a good way to find out that you didn't have the proper coverage, or that some types of flooding are uninsurable.

You should also make sure that your insurance policy is up-to-date, and reflects any up-grades or renovations you have made to your home. This will increase the chances that you will receive an adequate payout from your insurance company when you make an insurance claim.

Option 5: Avoid pouring fats, oils and grease down your drains

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Sewer backup

Fats, oils and grease (FOGS) are by-products of preparing food and cleaning dishes, pots and pans. Over time, FOGS can build up in your sanitary lateral, or in the municipal sanitary sewer and cause blockages, which can result in sewer backup.

Instead of rinsing grease down your kitchen drain, wipe it off with a paper towel and put it in with your food waste, or wait until the grease congeals and dispose of it with your food waste. If you have FOGS to dispose of that won't congeal, pour them into a disposable water tight container and place the container in the garbage.

If you have a lot of FOGS to dispose of, talk to your municipal government to see if there is a disposal program for large quantities of household FOGS.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland

Option 6: Keep storm sewer grates clear

When storm sewer grates are clogged with yard waste, leaves, garbage, snow and ice or other debris, less water will enter the storm sewer system. When water can't get into the sewer system, there is an increased chance that it will flow onto private properties and then into homes and basements. Here are a few things you can do to help keep storm sewer grates clear and working properly:

- Does your community have a yard waste pickup program? If it does, wait until the day that your yard waste will be picked up before placing it on the curb.
- If you live in an older neighbourhood that is densely-treed, watch for blockages in storm sewer grates from fallen leaves, especially during the fall months.
- Put out your garbage on collection days only.
- If you notice that a sewer grate is clogged with any debris including snow and ice, clear it out or let your municipal government know about it. If a storm sewer grate is repeatedly blocked or has a poor ability to drain water from the surface, it may be a sign of a larger problem in the **catch basin**. If you notice such a sewer grate, inform your municipal government. It may well save you and your neighbours from having basement flood damages.

Storm sewer grates that are free of debris are better able to handle stormwater flows and can reduce overland flooding.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Infiltration
- Sewer backup

Option 7: Seal cracks in foundation walls and basement floor

Sealing cracks is a simple way to help reduce basement flooding in your home and neighbourhood. Sealing cracks will help you reduce the chances that you'll have infiltration flooding, and can reduce the amount of flood water that enters the municipal sanitary sewer system through your basement floor drain. In many cases, cracks can be effectively sealed from inside the basement, and you will not have to dig anywhere beside the foundation to repair them.

Talk to a plumber, contractor or check your local hardware or home improvement store for the best types of products for this job. If cracks appear to be severe, you may require the assistance of a qualified contractor or structural engineer, as severe cracks may represent a structural issue with the home and may require more substantial repairs.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup

Option 8: Considerations for overland flood entry-points

During an overland flood event, water can enter basements from unsealed openings in basement walls. These openings may include gaps between the basement wall and the framing around windows and doors, gaps around electrical wiring, phone and television cables and gaps around pipes and other services that enter the basement. Cracks in brickwork can also provide entry-points for overland floodwater. These gaps should be indentified and sealed.

Newer windows that have been properly installed are better able to hold back floodwater than older windows where framing, weather stripping and sealants have deteriorated. Newer window frames made from synthetic materials, rather than wood, can also help to reduce the chances that water will enter the basement.

The gap between door and window frames can be sealed to reduce the chances that water will seep between the door or window and the wall. The use of proper weather stripping in windows and doors can also reduce the chances that overland flooding will enter the basement. There are also opportunities to use glass in basement windows that is stronger and better able to hold back overland flood water. Talk to a qualified contractor to explore these and other options for sealing water entry-points in your basement.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Sewer backup

Option 9: Reduce home water use during heavy rainfall events

During a heavy rainfall event, do whatever you can to reduce the amount of water you are putting into the municipal sewer system. The more stress placed on the municipal system, the greater the chances that you or your neighbours will have sewer backup problems. This is especially important if you have a backwater valve (see Option 15).

Waiting to do your laundry, run your dishwasher or use the bathroom until a few hours after a severe rainfall event can help reduce your chances and your neighbours' chances of basement flooding.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Option 10: Maintain eavestroughs and downspouts

Regularly clean and maintain your eavestroughs and downspouts to make sure they are not clogged with debris. When eavestroughs and downspouts are clogged, water can pour over the side of eavestroughs, fall close to your home, and then run down the side of your foundation. Water can also pour into window wells, which may be connected to weeping tiles through a drainage pipe (the diagram on page 41 shows how window wells may be connected into the weeping tile). If this water enters your weeping tile, or your basement through cracks in the foundation, this will increase the chances that you and your neighbours will have basement flooding.

Who will this help?
- Homeowner

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Option 11: Avoid storing items directly on the basement floor

Keep things a few inches off the floor in your basement. If you are storing things on shelves, try not to use the bottom shelf, or try placing items on a solid foundation a few inches or feet off the ground. For example, arrange cinder blocks or bricks beneath important items to help raise them off the ground. If you must keep important documents or items in the basement, store them in water-tight plastic containers to reduce their chances of being damaged if the basement floods.

If you can find out what a likely flood level might be in your home, you should elevate your possessions based on that level. Talk to your municipal government to see if this information is available.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Option 12: Downspout disconnection, extensions and splash pads

Downspouts are designed to convey water from eavestroughs and down the side of the house. Downspouts often direct water to the surface of the lot, but in many cases they may be connected to the weeping tile or the sanitary sewer lateral. When connected to the municipal sewer system, eavestrough downspouts can contribute a substantial amount of water to these systems. Because of the environmental impacts resulting from **combined sewer overflows** and the increase in flood risk connected eavestroughs cause, it is illegal to connect downspouts to municipal sewer systems in many Canadian communities.

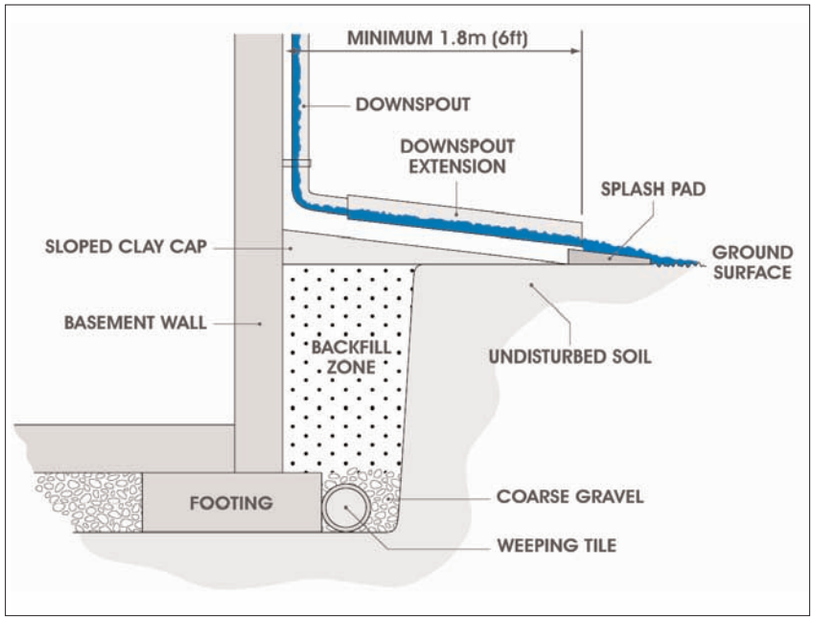
These downspouts are connected to the underground municipal sewer system.

In some cases, downspouts may be connected to the municipal storm sewer system through a separate storm sewer lateral. If your downspout leads to an underground pipe, you should contact the department responsible for urban drainage in the municipal government. They should be able to tell you if your downspout should be connected to the sewer system, or if it should be directed over your lot. Identifying what the downspout is connected to should be part of the detailed plumbing investigation in your home (see Option 3).

Downspout extensions

- Downspout extensions should be directed at least 1.8 metres (6 ft) away from the home, and the flows should be directed over permeable surfaces, such as lawns or gardens, and not paved surfaces including driveways or walkways.
- Talk to your municipal government to ensure that the flow from the downspout connection is directed to an appropriate municipal drainage system.

Downspout extension



When the downspout is disconnected from an underground pipe, the remaining exposed pipe leading underground should be capped to stop extra water from entering the sewer system. A 1.8 metre extension should be placed on the downspout to ensure that water is kept away from the home, and splash pads should be used help prevent erosion at the discharge point. Downspout water should be directed over a **permeable** surface, including lawns and gardens. A pipe can be used to direct flow to a lawn if the area surrounding the downspout is paved.

When downspouts are directed over a lot's surface, they create the potential for damage, including flooding, erosion and ice build up, for neighbouring properties. You should consult your municipal government to ensure that downspouts are directing flows in a manner that does not negatively affect neighbouring properties.

A further benefit of disconnecting downspouts is that water from downspouts can be directed over **permeable** surfaces, thereby reducing the amount of water that enters municipal sewer systems. Reducing water that enters these systems can decrease the risk of flooding for you and your neighbours, and can reduce the environmental impacts of stormwater flows.

You may also consider installing a rain barrel when you are disconnecting your downspout. This will allow you to store some of the water that flows off of your roof so that you can use it during dry periods in the summer. If a rain barrel is to be installed, consider the following points:

- Rain barrels are not designed to capture a large volume of water during a storm, and will overflow during heavy downpours.
- Make sure that, when the barrel has filled with water during prolonged rain events, overflow is directed away from your foundation wall and onto a splash pad at least 1.8 metres away from your home.
- During the winter, the rain barrel should be disconnected from the downspout to prevent damage from ice build-up in the barrel.
- Some municipalities will provide a partial subsidy for installing a rain-barrel, as they can help to reduce water use during the dry summer months.
- Water collected in rain barrels is unsuitable for drinking or other domestic uses, and should only be used to water gardens and lawns.

Follow manufacturer's instructions for installation, operation and maintenance for the rain barrel.

Part 9:
Measures that are highly effective, but may require more effort

There are many options available to protect your home and your community from basement flooding, some of which are easy to do, and some a little harder. In many cases, it is the more substantive measures that are the most effective measures to reduce basement flooding. Many of these measures may require the assistance of a licensed professional and advice from your municipal government.

Municipal governments require permits for the plumbing and drainage improvements described in this handbook. Talk to your municipal government to make sure you or the person you have hired have the proper permits to undertake these flood reduction measures.

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup
- Infiltration

Option 13: Lot grading, backfilling and swales

Lot Grading

If you've ever had a look around newly constructed homes, you might notice that yards are gently graded away from houses. When a yard is graded in this manner, it helps keep water away from the home and foundation, and helps keep the basement dry. Most municipal governments in Canada have bylaws that require lot grading that directs water away from the home, as a properly graded yard can substantially reduce basement flood and moisture problems.

Over time, however, yards can lose this slope for a number of reasons. For example, landscaping work can impact lot grading, and over time, soil may settle and result in lot grading that directs water toward the home and foundation. New decks, additions to homes or alterations to your neighbour's properties can also affect lot grading around your home.

The diagram on page 55 at the end of this handbook shows lot grading that directs water flows away from the home.

When regrading lots to direct water flows away from the home, the following points should be considered:

- A drop of 10 to 15 cm over 1.5 metres from the wall of your home may be required to adequately direct water away from the home.
- Lot grading should direct water to an acceptable drainage outlet that can direct flows to municipal conveyance systems. Consult your local government to ensure that water from your lot is directed to the right place.

- Ensure that lot grading does not direct water in such a way as to create ice build-up on neighbouring properties or sidewalks.
- Ensure that water flows from your lot do not negatively affect neighbouring properties.

Swales

Swales are grassy depressions, like a shallow ditch, that help direct the flow of water away from homes. Swales generally direct water toward drainage infrastructure, including roadways or storm sewer catch basins. The same factors that affect lot grading can affect swales. For example, landscaping and the settling of soil can both damage swales.

Rear-yard swales direct flows to a catch basin in this image. Rear-yard catch basins and swales shouldn't be covered or filled in with backyard sheds, fences or other structures, and rear-yard catch basins should be kept clear to reduce backyard flooding.

Sheds and fences should not be placed in a manner that blocks drainage paths or catch basins. Consult your municipality to see if a drainage plan for your subdivision exists, and ensure you maintain the intended drainage plan if you are going to alter your yard by building fences or sheds.

Considerations for lot grading

- Check your lot to see if your yard slopes away from your home. You should check everywhere, including under stairs and decks. The soil directly beside your foundation wall should be approximately 10 cm to 15 cm higher than the soil 1.5 metres away from the foundation.
- If you notice that the backfill has settled beside your foundation wall, fill it in with a solid, compactable soil – like clay – so that there is a constant slope away from the foundation.
- Talk to the department in your municipal government that is responsible for building inspections and stormwater drainage about swales and lot grading. Ask them where swales should be on your property, and where water from your lot should be directed.

Backfill

When your home was constructed, the basement was dug from undisturbed soil. After the foundation was completed, soil was pushed back into the gap between your foundation walls and the undisturbed soil. This soil is not as compact as the rest of the undisturbed soil surrounding the foundation. This less compact soil is more permeable, and allows water to infiltrate into the ground beside the foundation.

A gap around the basement wall in a home that is under construction.

Permeable soil next to the foundation can increase the chances of infiltration flooding in the home, and can increase flows into the weeping tile. If the weeping tile is connected to the municipal sewer system, excess water can increase overland flooding and sewer backup risk in the neighbourhood. If the weeping tile has been disconnected from the municipal system and is drained into a sump-pit, the sump-pump will have to run longer to pump excess water flows from the weeping tile.

As part of the lot grading improvements, a compact soil should be used to fill in any depressed areas directly beside the foundation wall. A compact soil, such as clay, should also be used to "cap" the backfill area, and should be properly sloped to keep water away from the home.

Option 14: Weeping tiles, sump-pits and sump-pumps

Who will this help?

- Homeowner
- Neighbourhood

Types of flooding this will help reduce

- Overland
- Sewer backup
- Infiltration

Weeping tiles

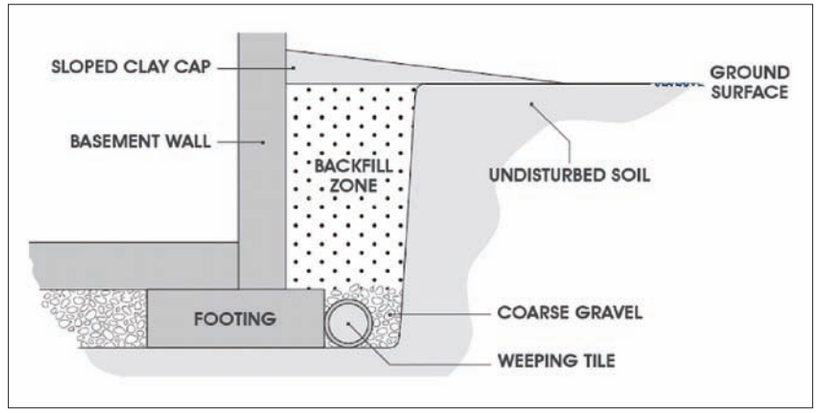
A **foundation drain** is an underground perforated pipe, or weeping tile, that runs along the bottom of a home's foundation. The weeping tile helps keep the basement free of excess moisture, and is also very useful for helping to reduce infiltration flooding. The water that is conveyed by the weeping tile is relatively clean, and does not normally require treatment at sanitary sewage treatment facilities.

Here are some questions you should consider when thinking about foundation drains and weeping tiles:

Does my home have a foundation drain?

An assessment of whether or not your home has a foundation drain should be conducted during the detailed plumbing investigation of your home (see Option 3). Older Canadian homes, for example those built before the 1940s or 1950s, may not have foundation drains. If you find that your home does not have a foundation drain, you should consider having one installed. Make sure that you have the proper permits from your municipal government and that the work is undertaken by licensed trades people. This will likely be an expensive job; however, it can have a substantial impact on reducing water damage in your basement.

Weeping tile



Are there any problems with the foundation drain?

Over time, weeping tiles may become clogged with debris or may collapse in some sections. When weeping tiles are not in good working order, they will not be able to effectively remove water from the foundation. A review of the foundation drainage should be included as part of the detailed plumbing investigation of the home (see Option 3).

If the home has older weeping tiles made of clay or concrete, the replacement of the entire system with new perforated plastic pipes may be necessary, as older weeping tiles are more susceptible to collapsing and blockages. If replacing the entire weeping tile is not possible, patch-work replacements of sections of the tile could be completed.

For a simple blockage due to a build up of soil or debris, and if there are no significant blockages or collapses in the weeping tile, a professional plumber or contractor might be able to flush the system from smaller access points, which can be dug from around the foundation walls. If the weeping tile must be replaced, installation of a clean-out port with access from the surface should be considered to allow easier maintenance in the future.

What is the weeping tile connected to?
It used to be a common practice in many Canadian communities to connect weeping tiles to a home's sanitary sewer lateral. This allowed water to drain away from the foundation without the need for a sump-pump. However, over time, it became apparent that this practice contributed a substantial amount of water to municipal sanitary sewer systems, contributing to sewer backup problems.

The diagram on page 51 at the end of this handbook shows how weeping tiles may be connected to the municipal sewer system through a home's sanitary sewer lateral.

Disconnecting your weeping tile from the sanitary or storm sewer can help to reduce the amount of water that enters the municipal sewer system during a heavy rainfall event. This can help reduce the chances that you and your neighbours will experience sewer backup, and can also reduce the risk of structural damage to the home.

If the weeping tile is connected to the storm sewer lateral, water can be pushed back into the weeping tile during a storm sewer surcharge. This can result in both structural damage to the home (including cracking or heaving in foundation walls and basement floors) and increased rates of infiltration flooding.

Other flood reduction options, including Options 10 and 12 in this handbook, can have an impact on foundation drainage. During a heavy rainfall event, or in instances where the water table is very high, a substantial amount of water can enter the weeping tile. Also, poor lot grading that directs water toward the home, backfill problems and poorly maintained eavestroughs and downspouts can increase the flow of water into the weeping tile.

Disconnection of the weeping tile from the municipal sewer system requires the installation of a **sump-pit** and **sump-pump**.

Sump-pits and sump-pumps

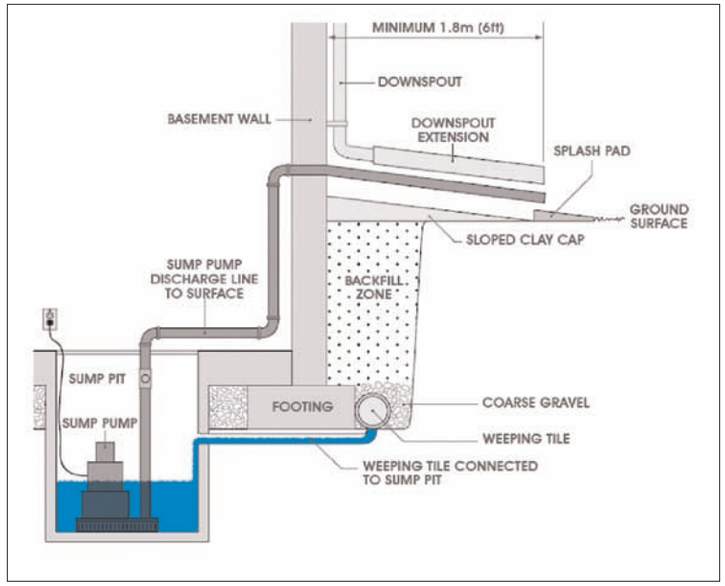
Water from the weeping tile should be directed to a sump-pit, and then pumped out of the sump-pit using a sump-pump. The location of the sump-pit depends on how weeping tiles are connected to the pit under the basement floor. Sump-pits are normally located where service connections enter the home (for example, where the sanitary sewer lateral enters the home).

In many cases, water from the weeping tile should be pumped to the surface of the home's lot. If water is to be pumped onto the lot, the same precautions should be taken for the sump-pump discharge pipe as the downspout extension (Option 12):

- Ensure that the discharge point is at least 1.8 metres away from the home.
- Use a splash pad at the discharge point.

Care must be taken to ensure that this water does not affect neighbouring properties. Where lot sizes are too small or where lots cannot be graded in a manner that will keep water away from homes, a pipe may be used to carry the discharge away from neighbouring properties to municipal conveyance systems that can handle weeping tile discharge. Some municipalities may allow you to direct this water to the municipal sewer system to prevent ice build up in the winter. Talk to your municipal government to make sure that water is pumped to the right place.

Sump-pump installation



When weeping tiles are disconnected from sewer laterals, a sump-pit and sump-pump must be installed. The sump-pump is used to pump water from the weeping tiles to the lot's surface. In some cases, municipal governments may recommend using a sump-pump to pump weeping tile water to the municipal sewer system.

Sump-pumps are usually designed to pump a low volume of water at a slow rate. While they can effectively remove water from weeping tiles, they will not be able to pump water out of the basement fast enough to prevent damage when the basement is flooding.

Maintenance

Sump-pumps are prone to blockage and possible failure if they are not routinely inspected and maintained. On-going maintenance will help to ensure the sump-pump will continue to operate over a long time period. A homeowner can inspect the sump-pump by pouring water into the sump-pit, and seeing whether or not the pump starts automatically. Check the manufacturer's instructions for the pump or talk to your municipal government about proper maintenance and inspections for the pump.

Should the sump-pump discharge water to the surface or the sewer?

- Depending on the characteristics of your lot and the nature of the municipal sewer system, some municipalities may recommend discharging your sump-pump onto your lot's surface, or into the municipal sewer system.
- If your lot is too small to handle the sump-pump discharge, the surface of your lot is not permeable, or if your home is close to your neighbours' homes, pumping water to the surface of your lot may create flooding problems for neighbouring properties.
- Weeping tiles should not be discharged into the sanitary sewer unless special approval has been granted by your municipal government.
- Talk to your municipal government to find out where you should discharge your sump-pump.

Backup sump-pumps and power supplies

Most sump-pumps rely on electricity and will not operate during a power outage. It is also possible that a sump-pump could have a mechanical failure when it is most needed. If a sump-pump stops running during a storm, water from the weeping tile could flood the basement.

Backup sump-pumps and backup power supplies can help to make sure that sump-pumps operate during a power outage. Here are some backup options to consider:

1 Install a backup battery powered sump-pump in the sump-pit along with the main sump-pump. The main sump-pump can be set to run when the water in the sump-pit is at a relatively low level, and the battery powered pump can be set to automatically run when the water in the sump-pit is at a higher level.

2 Install a backup sump-pump that uses the municipal drinking water system for power. This unit can be connected to your home drinking water system, and as long as there is water pressure in your home, this type of sump-pump will continue to operate. As with the battery powered backup pump, this type of pump may be installed in the same sump-pit as the main sump-pump.

3 Consider installing a generator to provide backup power. A generator must be specially wired into your home's electrical system and must be located outside of the home. Generators may use propane, diesel or gasoline for fuel. Some generators can be connected to the home's natural gas connection, ensuring that it will not run out of fuel when it is running for extended periods. The backup generator system can also be used to power other electronic appliances in your home, for example, fridges and freezers.

Emergency generators can provide backup power for sump-pumps and other household electric appliances during power outages.

If you are thinking about installing a backup generator, you should thoroughly review your options. Talk to your municipal government, your electric utility provider and a licensed electrician about this option. The generator should be installed in a manner that is consistent with relevant electrical codes in your area and all relevant building and electrical permits should be attained before you proceed with this work.

Who will this help?

- Homeowner

Types of flooding this will help reduce

- Sewer backup

Option 15: Mainline, normally open backwater valve

After a thorough plumbing inspection by a qualified professional has been completed, and after you have talked to your municipal government about appropriate actions you can take to reduce basement flooding in your neighbourhood, you can consider installing a backwater valve. Mainline backwater valves are placed directly into the sewer lateral at the foot of your basement wall, and serve to reduce the risk of sewer backup in your home.

The proper installation of a mainline backwater valve can be complicated. In an existing home, installation will require breaking up the concrete basement floor and cutting a section out of the sanitary sewer lateral. You will need the assistance of a licensed plumber to install a mainline backwater valve. Talk to your municipal government to see if they have a list of pre-approved plumbers who can install backwater valves.

Proper installation and placement of the backwater valve is extremely important!

- The valve should be installed based on manufacturer's installation instructions, which have specifications for placement and grading.
- Proper placement and installation of the backwater valve is extremely important. If placed in the wrong location relative to other plumbing fixtures on the sanitary lateral, the valve could be bypassed and provide no protection.
- If the valve is placed in the wrong location, sewer backup pressure can build up and crack the basement floor and lead to flooding.
- If the weeping tiles are still connected to the sanitary sewer lateral downstream of the valve, sewage could be forced back into the weeping tiles and lead to structural damage to the foundation, and can also lead to infiltration flooding.

Like any other part of the home, backwater valves require periodic maintenance to ensure proper performance over time. An improperly maintained valve may fail during a flood event. Most mainline backwater valves come with a see-through top so that you can check

to see if it is clogged with debris. The valve should be checked regularly to ensure that it will function properly when it is needed. You will likely need the help of a qualified plumber to carry out maintenance of the valve.

In order to drain your foundation drain when the backwater valve is closed, you should also disconnect your **weeping tile** from the sanitary sewer, which will require the installation of a **sump-pump** and **sump-pit** (see Option 14). If weeping tiles are connected to the sanitary lateral, weeping tile drainage may backup into the basement when the backwater valve is closed, as this water will have no other way out of the home. Disconnecting the weeping tile from the sanitary sewer lateral will also reduce the chances that water will backup into the weeping tile and cause structural damage and infiltration flooding in the home.

Maintenance tips for backwater valves

- Ensure the valve is free of obstructions.
- Ensure the valve can maintain a seal when closed.
- Remember to always tighten removed caps and access ports sufficiently to maintain a closed seal after the valve has been inspected.

For proper operation of the backwater valve, **sewer cleanout ports** must be properly capped and sealed. The placement of the sewer cleanout relative to the backwater valve will vary depending on the nature of the home's plumbing system.

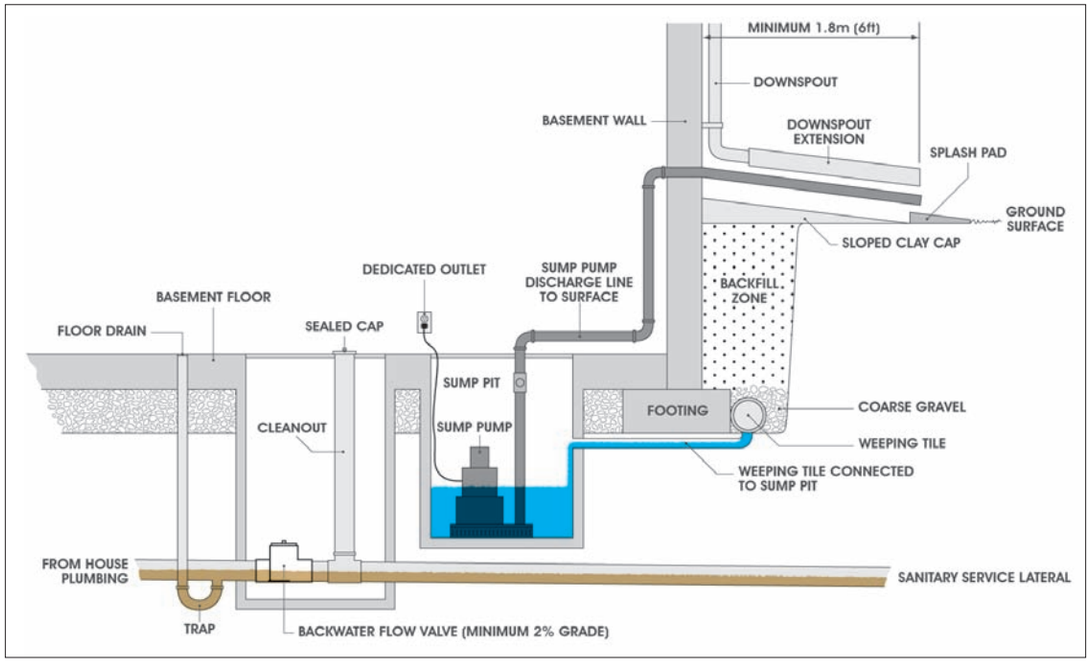
Important considerations for backwater valves

- Ensure proper plumbing permits have been attained from the municipal government before a backwater valve is installed.
- You should install the type of backwater valve that is recommended by your municipal government. In most cases, this will be the normally open (or open-port) mainline backwater valve. This valve is installed directly into the sanitary sewer lateral, and serves to protect all home plumbing fixtures from sewer backup.
- Other types of backwater valves, such as the "plug type" valve that is installed directly into basement floor drains, are not advised. This type of backwater valve may prevent water from entering the basement, but it allows sewer backup pressure to build up underneath the basement floor. This pressure can cause heaving, cracking and potential structural damage to the home.

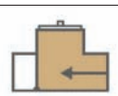
Important backwater valve information

- **After a backwater valve has been installed, do not use plumbing, for example, flushing toilets, running dishwashers, washing machines, or running taps, etc. during intense rainfall events.**
- **If the home plumbing is used when the backwater valve is closed, water will have no outlet until the valve has opened. Water will not be able to exit your home and will backup through floor drains in your basement.**
- **If you're not sure if the valve is closed, check it – you should be able to see it through the clear, plastic top.**

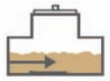
Backwater valve



Backwater valve operation



Closed position
Prevents surcharge from backing up into building.



Open position
Allows normal operation of the sewer lateral.

Normally open backwater valves stay open until a sewer surcharge occurs. An open valve allows sewer gasses to vent properly, and are the only type of backwater valve allowed to be installed in sanitary sewer laterals under many provincial building codes. When a sewer surcharge occurs, the sewage pushes the valve closed. When the valve is closed, sewage cannot get in, or out, of a building.

Option 16: Maintain your sewer laterals

Who will this help?
- Homeowner
- Neighbourhood

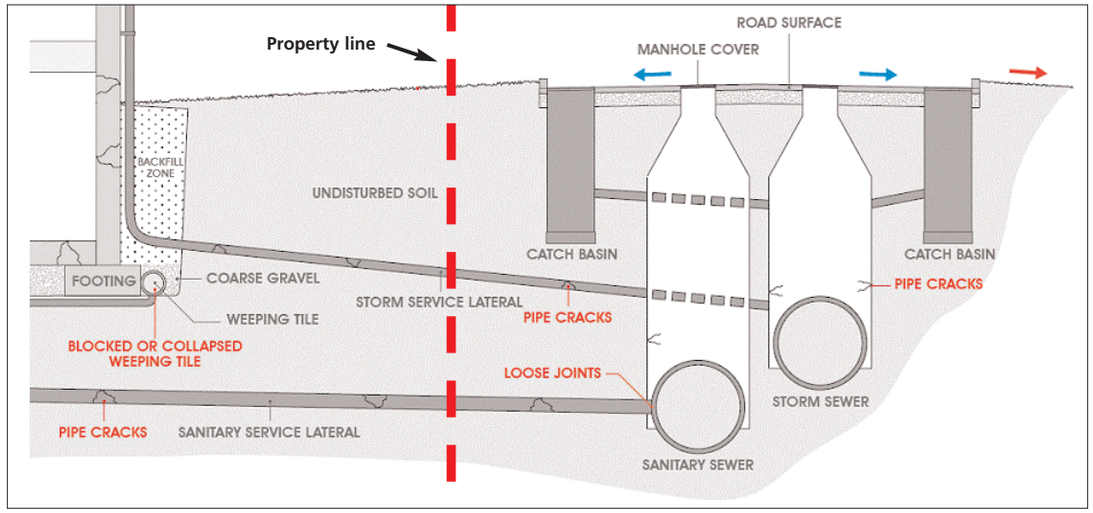
Types of flooding this will help reduce
- Sewer backup

Sewer laterals, which connect a home's plumbing system to the municipal underground sewer system, should be regularly maintained. Over time, cracks in sewer laterals can emerge from tree roots and shifting soil. Cracks can allow groundwater into your lateral, which can increase stress on the municipal sanitary sewer system, thereby increasing the chances of sewer backup. As well, loose joints where laterals are connected to home plumbing or the municipal sewer system can increase the risk of sewer backup.

Over time, the sanitary sewer lateral may also become clogged with fats, oils and grease (FOGS) or other debris, which can restrict flows and cause sewer backup (see Option 5). This may especially be a problem in older homes when the lateral has not been routinely maintained. Sewer laterals are accessed through the **cleanout port**, which may be located either inside of the basement or outside of the home, close to where the lateral enters the home.

To find out how well your sanitary sewer lateral has been maintained, you should talk to a licensed plumber who can carry out an assessment of your lateral.

Propety line



Where does your responsibility end and the municipality's start? *Depending on the policies of your municipal government, your responsibility for sewer laterals may either end at the property line or at the point where the lateral connects with the municipal sewer system. Responsibilities for maintenance of the lateral will depend on where your responsibility ends and the municipality's begins.*

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup

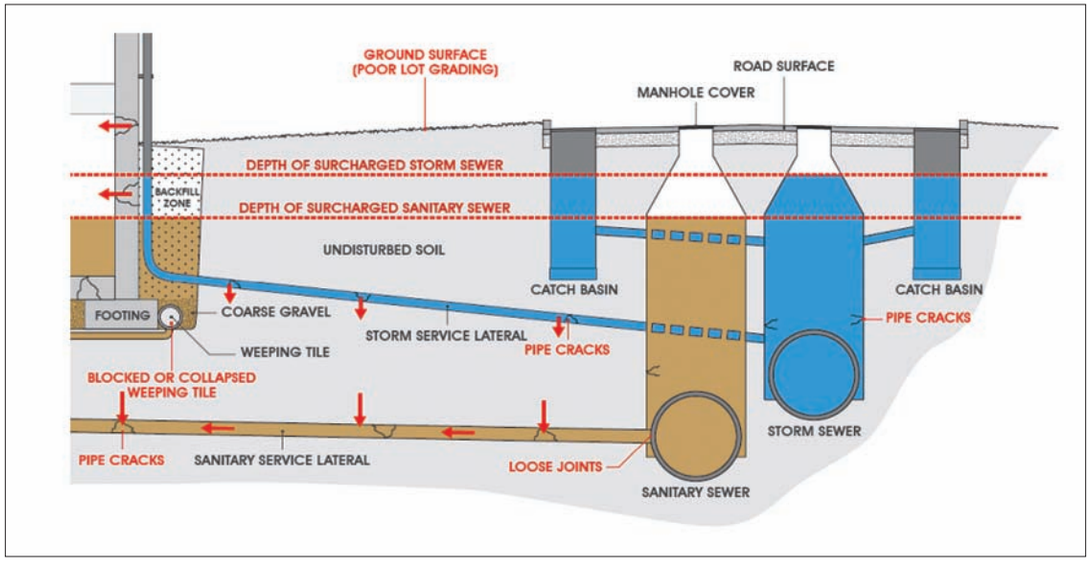
Option 17: If you have a storm sewer connection, consider severing it as close to the municipal sewer system as possible

Sewer backup can occur not only when the municipal sanitary sewer system surcharges, but also when the municipal storm sewer system surcharges. A surcharging storm sewer can force water back into home storm sewer lateral connections. This water can then **exfiltrate** from (or be forced out of) storm sewer laterals. If the storm sewer lateral and the sanitary sewer lateral are close together, water that has exfiltrated from the storm sewer lateral can enter the sanitary sewer lateral and cause sewer backup in the home.

The storm sewer lateral should be severed as close to the municipal storm sewer as possible. This will reduce the chances that water will exfiltrate from the storm sewer lateral into the sanitary sewer lateral, thereby reducing the risk of sewer backup.

In the image below, the home's eavestrough downspout is connected to a storm sewer lateral. In some homes, weeping tiles may also be connected to the storm sewer lateral. If the weeping tiles are

Storm sewer lateral



***Some homes have both a storm sewer lateral and a sanitary sewer lateral**. When a surcharge occurs in the municipal storm sewer, stormwater can be forced back into a home's storm sewer lateral. Water that has been forced back into the storm sewer lateral may then **exfiltrate** from (or be forced out of) the storm sewer lateral and into the sanitary sewer lateral. This situation can increase the risk of sewer backup for both homeowners and neighbourhoods.*

connected to the storm sewer lateral, a sump-pit and sump-pump should be installed to direct foundation drainage to the lot's surface to allow for proper foundation drainage after the storm sewer lateral is severed (see Option 14).

High amounts of exfiltration from storm laterals into sanitary laterals can create significant excess flows of water in sanitary sewer systems. These excess flows can increase the risk of sewer backup for everyone in a neighbourhood. If a large group of homeowners sever storm sewer laterals that are subject to exfiltration, sewer backup risk can be reduced for everyone in the neighbourhood.

You will need permits from your municipal government and the assistance of professionals to sever your storm sewer lateral. Talk to your municipal government about this option before you consider severing your storm sewer lateral.

Option 18: Considerations for reverse sloped driveways

Who will this help?
- Homeowner
- Neighbourhood

Types of flooding this will help reduce
- Overland
- Sewer backup

Reverse sloped driveways may be considered a necessity in high-density neighbourhoods, where there is no room for external garages. Reverse sloped driveways, however, create a significant flood risk as they can direct overland stormwater flows into homes. Water that enters homes through reverse sloped driveways can cause damage, and can also contribute to sewer backup problems if this water enters basement floor drains.

Catch basins are located at the bottom of reverse sloped driveways to drain water to the municipal **storm sewer** system. When there is a **surcharge** in the municipal storm sewer system, **stormwater** can be forced back into catch basins, where it will then flow into basements, garages and **weeping tiles**. Your municipality may recommend installing **backwater valves** into reverse sloped driveway catch basins to reduce stormwater backup.

As this type of backwater valve is located outside of the home, it is susceptible to blockages from debris and ice, and will require periodic inspections and maintenance. If downspouts or weeping tiles are

connected to catch basins, they should be disconnected before a backwater valve is installed. Talk to your municipal government to see if they recommend this option, and ask for information on proper installation of this type of backwater valve.

Ensuring that reverse sloped driveways do not have a constant slope into the home from the street can also reduce the chances that water will enter the home. A 15 cm high-point between the surface of the street and the point where the reverse-sloped driveway begins to slope down toward the home can reduce the chances that overland flooding will enter the home through the reverse sloped driveway.

In some cases, the reversed sloped driveway catch basin may be connected into the home's weeping tile system or sanitary sewer lateral, which would increase sewer backup risk for both the home and the neighbourhood. If the catch basin is connected to the sanitary sewer, talk to your municipal government about connecting it to the proper municipal sewer system. Identification of which municipal sewer system sloped driveway catch basins are connected to should be part of the detailed plumbing investigation of the home (see Option 3).

Who will this help?

- Homeowner
- Neighbourhood

Types of flooding this will help reduce

- Overland
- Sewer backup
- Infiltration

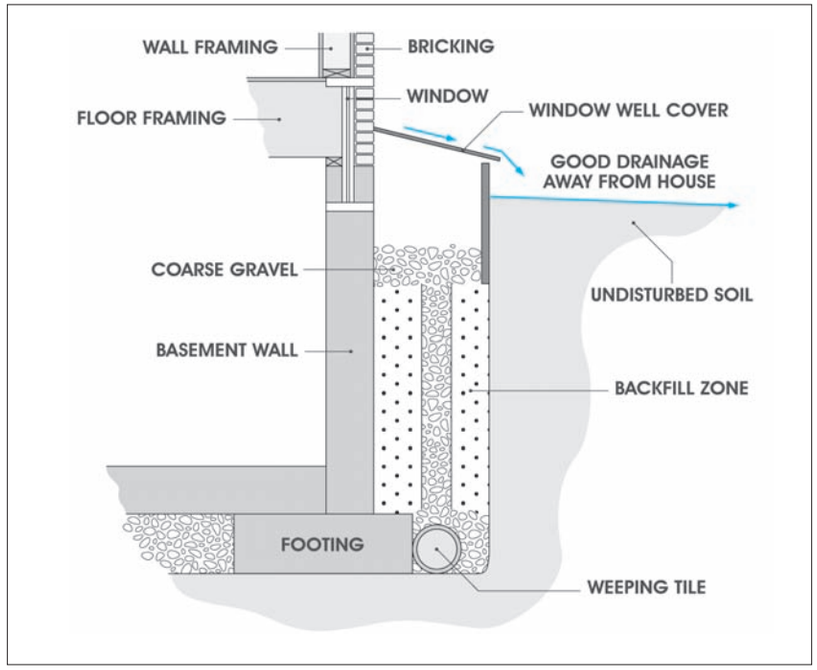
Option 19: Window wells and window well covers

Window wells can help improve drainage around your basement windows. Improved drainage can help to prevent water from entering your basement, and can also reduce dampness in your home. Window wells can also help to prevent rotting of window sills, which may compromise the ability of your windows to hold back flood water.

Window wells should be installed around all windows that are close to or below the lot's surface. The outer edges of the window well should fit snugly against the foundation wall, and the bottom of the well should be a least 15 cm below the underside of the window. A mixture of coarse material such as gravel and soil should be placed in the well. Below ground window wells must be drained, otherwise they will fill up like a tub and pour through the seal of the window into the basement. Therefore, window wells normally drain into the weeping tile under the home.

The direct linkage from the surface to the foundation drain can cause overloading of the weeping tiles and increase the chances that water will enter the basement. Therefore, proper lot grading to shed overland water away from window wells and building walls is essential (see Option 13). Additionally, if there is the potential for a large volume of roof water to overflow the eavestroughs and spill directly into the window well, or if large amounts of rain can fall in the well, a window well cover should be installed to divert this rainwater away from the window and house. In this way, the window well cover can reduce the chances that water will enter the basement through the window, and will reduce the amount of water that enters the foundation drainage system.

Wondow wells and covers



Window wells can help improve lot drainage, reduce dampness in basements and protect the home from flooding. *Window well covers should be installed to prevent water from entering the basement through basement windows and to reduce the amount of surface water that enters the weeping tile.*

Who will this help?

- Homeowner

Types of flooding this will help reduce

- Infiltration
- Overland
- Sewer backup

Option 20: Avoid finishing basements and storing expensive, valuable or irreplaceable items in your basement

All types of basement flooding, including infiltration, overland and sewer backup flooding, can lead to considerable damages to the home and property within the home. Even if municipal governments and private homeowners have taken all reasonable actions to reduce basement flooding, there will always be a chance that basement flooding will occur.

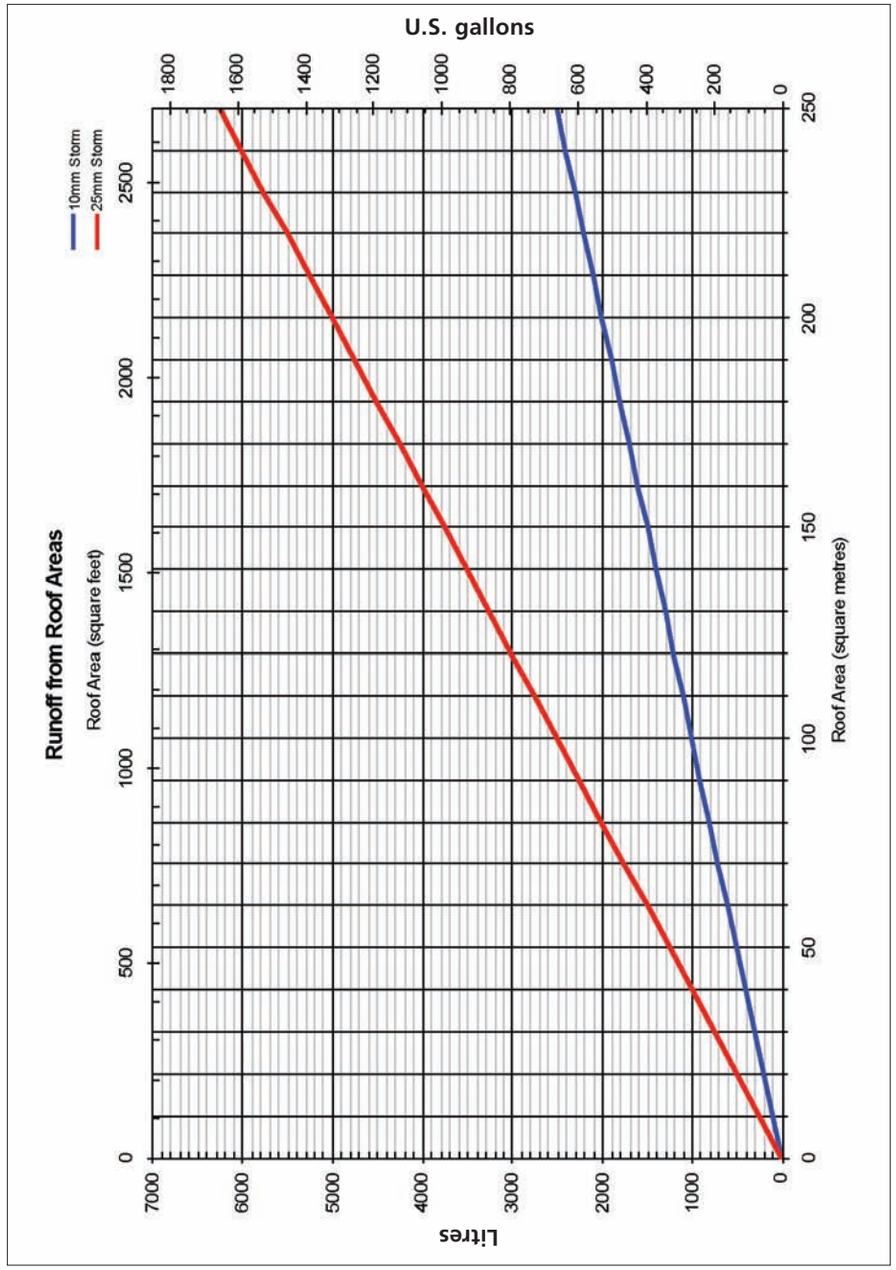
Finished basements experience far greater damages than unfinished basements when the basement floods.

Insurance companies and municipal governments have begun to recognize that one of the main culprits for damages in basement flooding events is the use of finished basements as additional living spaces. When flooding happens in a finished basement, damages can be very significant because of damages to carpeting and floor coverings, drywall and wall coverings, not to mention damage to home theatre equipment and furniture.

In many cases, damages caused by basement flooding are not eligible for insurance coverage, especially those caused by overland flooding and infiltration flooding.

If your basement is subject to infiltration, overland or sewer backup flooding, consider leaving it unfinished and only using it for limited storage. This may be the best way to prevent severe damages when the basement floods.

How much water flows from a roof?



A significant amount of water can be shed from a roof during a rainfall event. To find out how much water can be shed from your roof during a rainfall event, find your roof size on this chart. If you have a two-storey home, divide the square footage of your home in half. This will give you a rough estimate of the size of your roof.

Glossary

Backwater valve (sometimes referred to as a backflow valve): A valve that is placed in the sewer lateral that helps to prevent water from backing up from the municipal sewer into the basement.

Catch basin: Catch basins direct surface stormwater to the underground storm or combined sewer system. Catch basins can be seen in the diagram on page 55, at the end of this handbook.

Cleanout port: Cleanout ports allow for access to the home's sewer laterals for cleaning and maintenance purposes. Cleanout ports may be located either in the basement, close to where the sanitary sewer lateral enters the basement, or outside of the home, usually somewhere close to the foundation or between the home and the street.

Combined sewer: A sewer that has been designed to convey both sanitary sewage and storm sewage. This type of sewer often services older areas of Canadian communities.

Combined sewer overflow (CSO): Combined sewers are designed to automatically bypass treatment facilities and re-route excess, untreated sewage to local surface water bodies when they become overwhelmed with excess sanitary and storm sewage. This automatic bypassing is called a combined sewer overflow.

Exfiltrate: Exfiltration occurs when high pressure water or sewage is forced out of sewer pipes or sewer laterals through cracks or loose joints in the pipes.

Foundation drain: See "Weeping tile."

Groundwater: Water that is contained within soil and between rocks below the earth's surface.

Infiltration and inflow: Infiltration occurs when **groundwater** infiltrates into the **sanitary sewer** system (for example, through cracks in pipes and loose pipe joints). Inflow occurs when excess stormwater enters the sanitary system directly, for example, through downspout connections, leaky manholes, and cross-connections where parts of the storm sewer system have been accidentally or illegally connected into the sanitary sewer system.

Infiltration flooding: Flooding that enters the home through cracks in the basement floors and walls. This water "infiltrates" through the ground and into the basement.

One in five year storm: A storm that has a 1 in 5 chance of occurring in any given year.

One in one hundred year storm: A storm that has a 1 in 100 chance of occurring in any given year.

One in two year storm: A storm that has a 1 in 2 chance of occurring in any given year.

Overland flooding: Water that flows over the surface of public and private property, and can enter homes and buildings through doors, windows, vents, and other above-ground openings.

Overland flow route: A pre-determined route that is designed to direct overland rainwater and snow-melt flow in a controlled manner. Overland flow routes may include streets with heightened curbs or ditches, and often direct flows to nearby lakes, streams or rivers or to underground storm sewer systems.

Permeable and impermeable: Permeable surfaces, including grassy yards, have the ability to absorb a limited amount of rainfall. Impermeable surfaces, including paved driveways and roofs, have no ability to absorb rainwater. Soil may also be permeable or impermeable. For example, the backfill area around a home may be composed of more pervious soils, and undisturbed soils may be less pervious.

Sanitary sewage: Sewage that is created by use of a building's plumbing (for example, sinks, toilets, dishwashers, laundry machines) and is considered a highly contaminated health hazard.

Sanitary sewer: An underground sewer-pipe that is designed to convey only sanitary sewage.

Sanitary sewer lateral: An underground pipe that connects a home's plumbing to the municipal sanitary or combined sewer system.

Sewer backup: Sewage that is forced back through storm and sanitary sewer laterals from sanitary, storm or combined sewers. Sewage flooding typically enters lower levels of a home through plumbing fixtures, including floor drains, sewer cleanouts and basement toilets, sinks and showers.

Storm sewage: Storm sewage is created directly by rainfall and snowmelt. This water is cleaner than sanitary sewage, but can be contaminated with chemicals and debris.

Storm sewer: An underground sewer-pipe that is designed to convey only stormwater flows.

Storm sewer lateral: An underground pipe that connects a home to the underground, municipal storm sewer system.

Stormwater management: The practice of managing overland and underground water flows created by rainfall and snow-melt. Stormwater management is commonly the responsibility of the municipal government.

Sump-pit: A sump-pit collects water from the home's weeping tiles.

Sump-pump: A sump-pump is a device that is placed into the sump-pit to pump weeping tile discharge out of the basement.

Surcharge: The technical term for water backup in a sewer pipe due to insufficient capacity from overloading or blockage. See "Sewer backup."

Swale: A grassy, shallow ditch-like depression used to direct stormwater flows.

Urban flooding: Urban flooding occurs in urban areas, where there is a high concentration of buildings and impermeable surfaces, such as roadways, parking lots and roofs. This type of flooding can result from heavy rainfall, snowmelt or surcharging sewer systems. Urban flooding can occur in areas that are not at risk of flooding from rivers or other natural surface water bodies.

Weeping tile: A series of tiles or a perforated pipe located along the bottom of a building's foundation that is used to collect and drain groundwater away from the building.

Aknowledgements

ICLR gratefully acknowledges the assistance of Cathy Derksen, Bill Mungall, Randy Van Straaten, Gina Ferris, Paul Cutbush, Paul Morrissette, Carol Jardine and Daryl Wiebe for their review of a draft of this handbook and for their helpful comments.

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About the Institute for Catastrophic Loss Reduction

The Institute for Catastrophic Loss Reduction (ICLR), established in 1998, is a world-class centre for multi-disciplinary disaster prevention research and communications. ICLR is an independent, not-for-profit research institute founded by the insurance industry and affiliated with the University of Western Ontario. ICLR staff and research associates are recognized internationally for their expertise in wind and seismic engineering, atmospheric science, risk perception, hydrology, economics, geography, health science, and public policy, among other disciplines.

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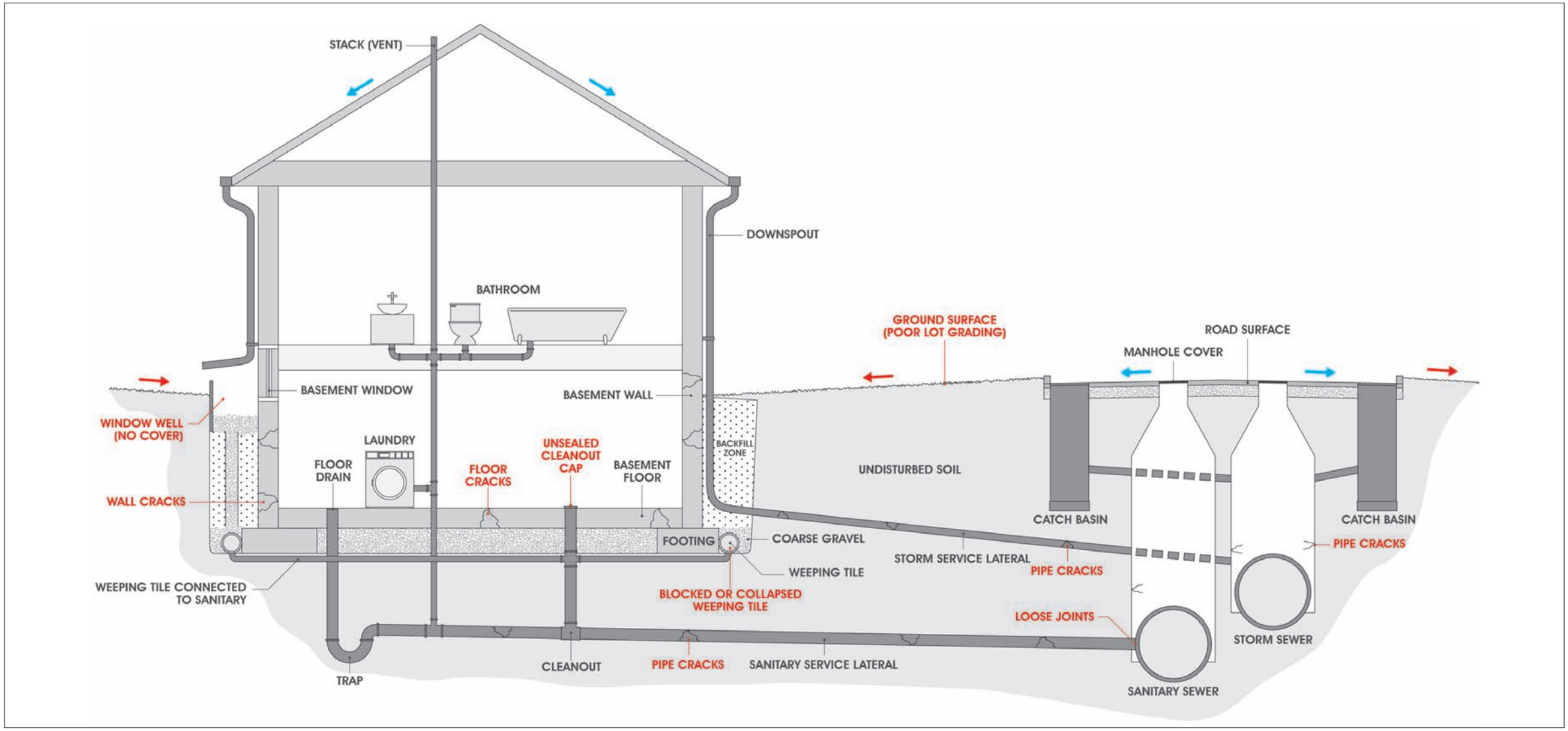
Notes

How flooding can occur in a home: Infiltration flooding, overland flooding and sewer backup

Some conditions that can lead to basement flooding

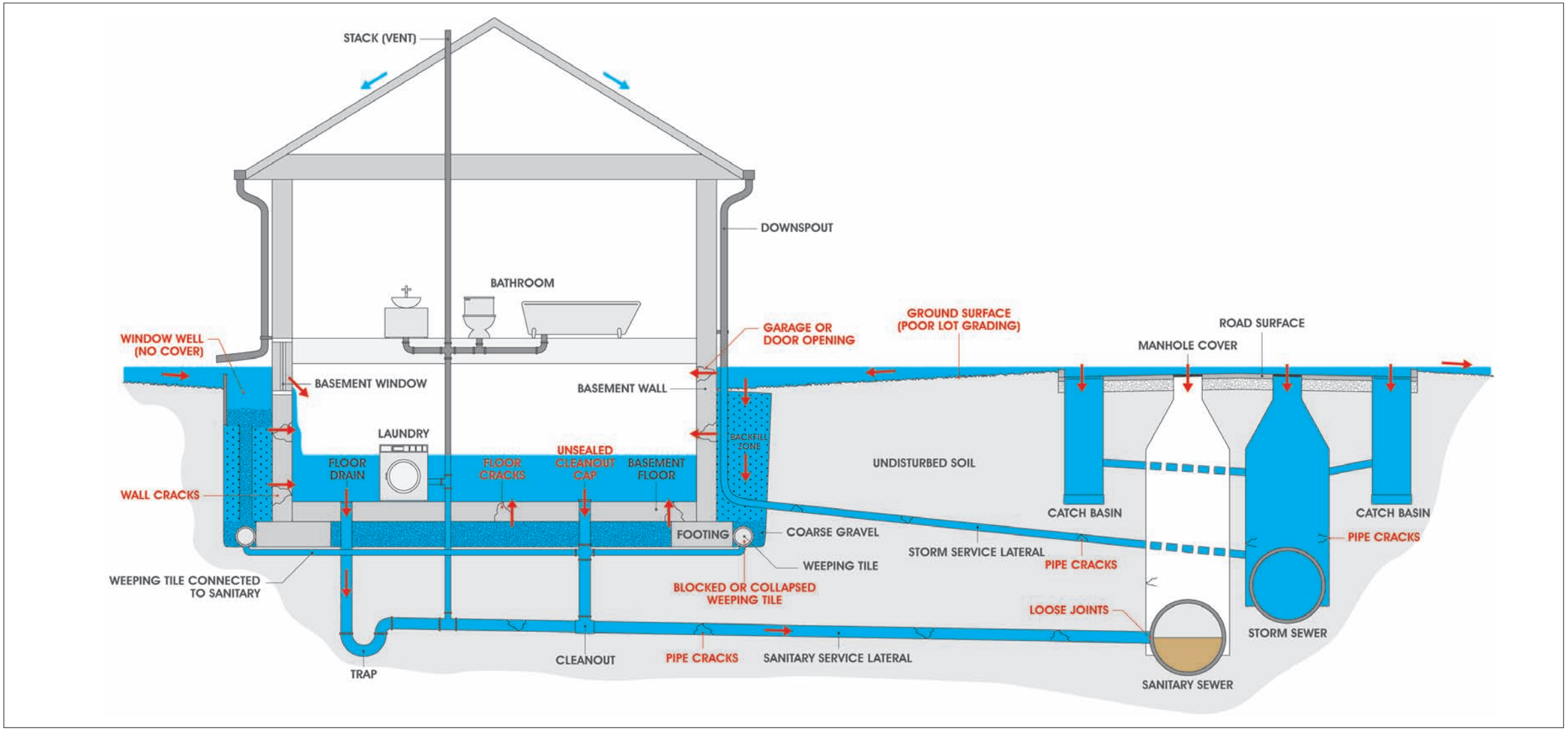


What to look for in this diagram

This diagram shows a home that is at risk of basement flooding from infiltration flooding, overland flooding and sewer backup. In this diagram:

- The cracks in the foundation wall and basement floor are unsealed.
- Downspouts are connected to the municipal sewer system or are discharging too close to the foundation.
- The yard is improperly graded and sloped toward the home.
- The weeping tiles are connected to the sanitary sewer lateral.
- The weeping tiles have not been maintained and are damaged.
- There is no backwater valve in place.
- The sewer laterals have not been maintained, are cracked and have loose joints.
- The storm sewer lateral has not been severed and is prone to exfiltration.
- The backfill area beside the foundation wall is uncapped.
- The sewer cleanout is uncapped and unsealed.
- There is no window well cover in place.

Overland flooding

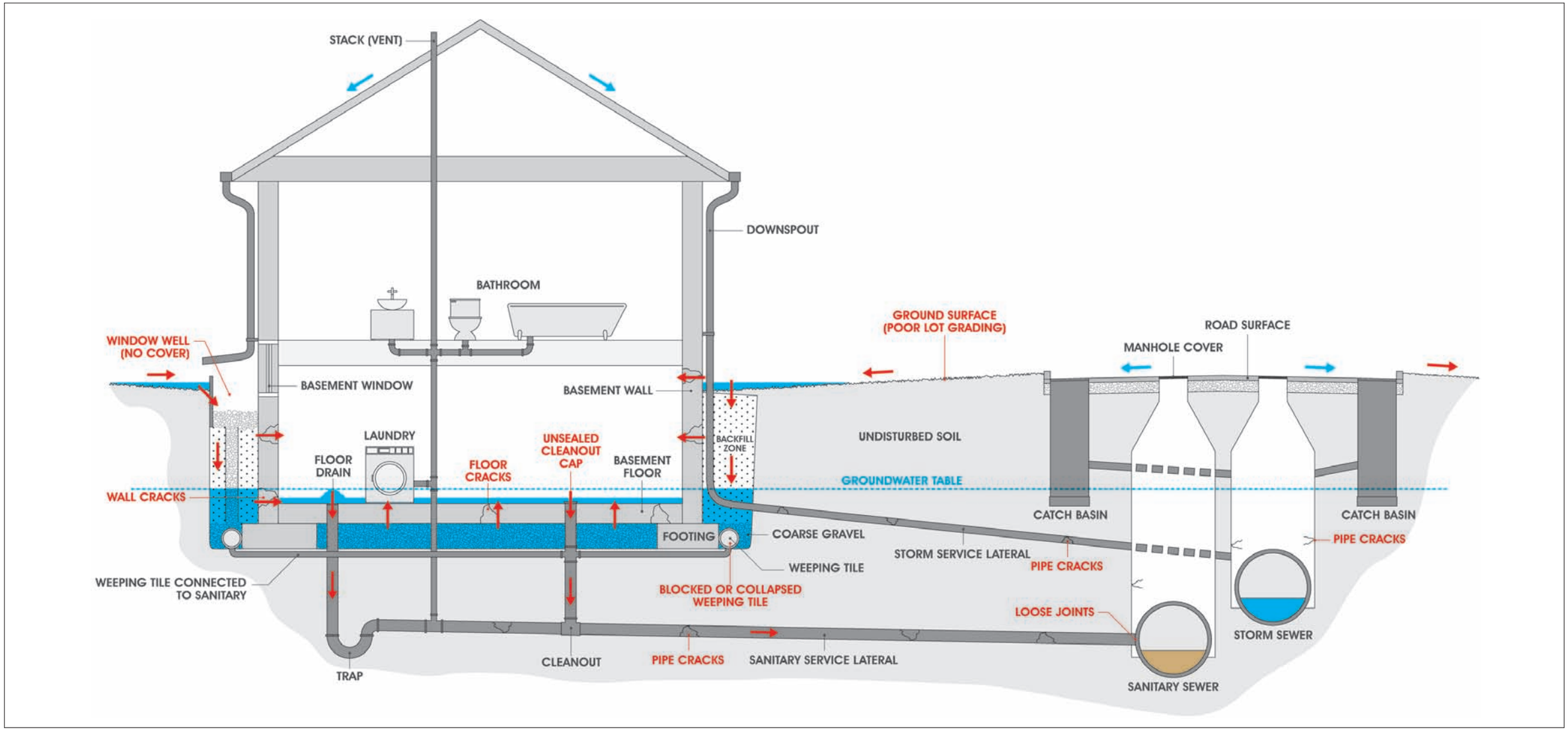


What to look for in this diagram

This diagram shows how overland flooding can enter a home, and how overland flooding can increase the risk of sewer backup in a neighbourhood. In this diagram:

- Excess surface water caused by snow-melt or a heavy downpour has caused the underground storm sewer to surcharge, and it is no longer able to convey water from the surface.
- Improper lot grading is directing surface water toward the home.
- Flood water is entering the home through the uncovered window well and the basement window. Flood water is also entering the home through other openings, including doors.
- Flood water has entered the backfill zone, and is entering the home through cracks in the foundation wall.
- Flood water in the basement is entering the sanitary sewer lateral through the basement floor drain and is entering the municipal sanitary sewer system. Excess water in the sanitary sewer system will increase sewer backup risk in the neighbourhood.

Infiltration flooding

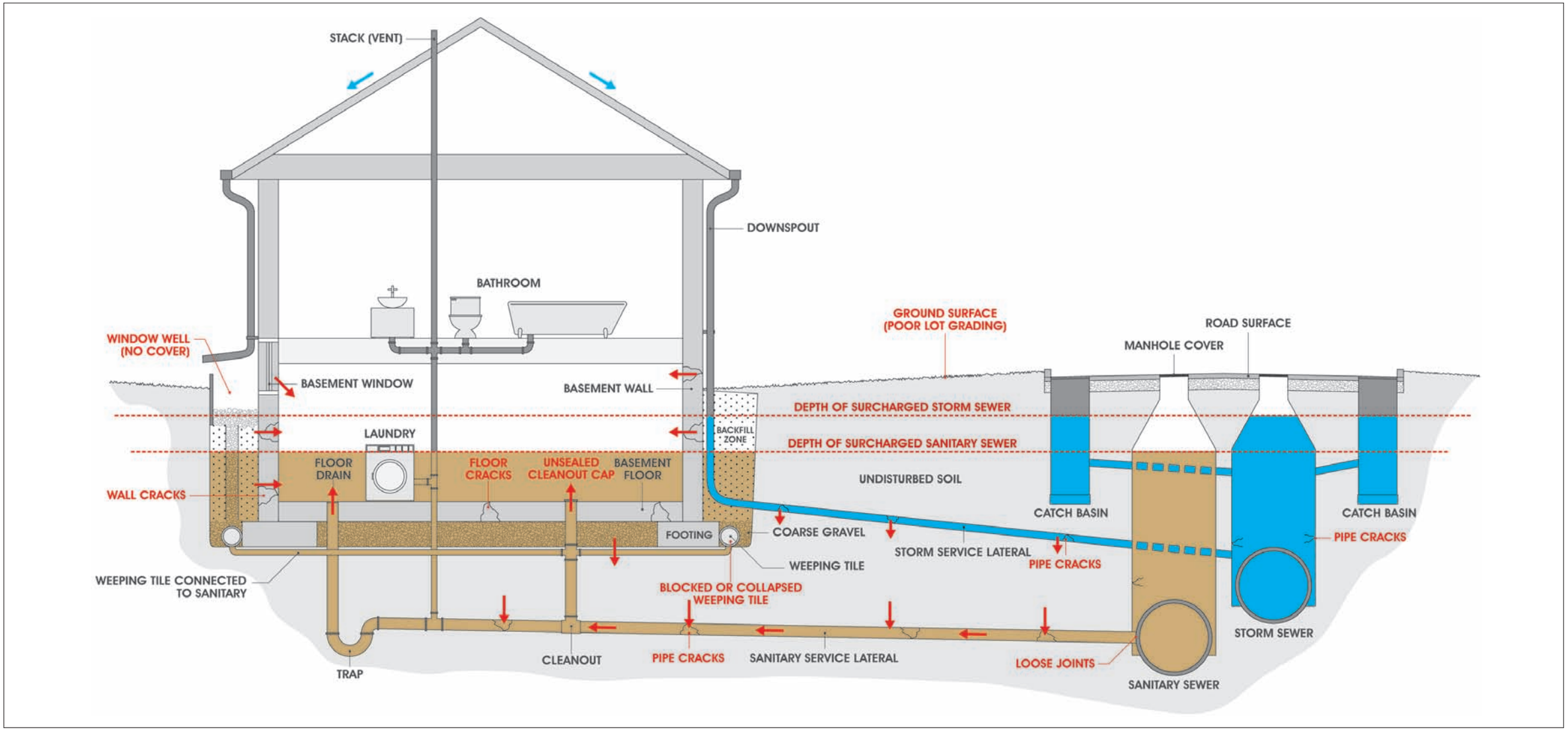


What to look for in this diagram

This diagram shows how infiltration flooding can enter a home. In this diagram:

- The groundwater level is higher than the basement floor.
- This groundwater is entering the home through cracks in the basement floor and foundation walls.
- Surface water has entered the backfill zone and is entering the basement through cracks in the foundation walls.
- The weeping tile is in disrepair and is unable to remove water from the foundation area.

Sewer backup

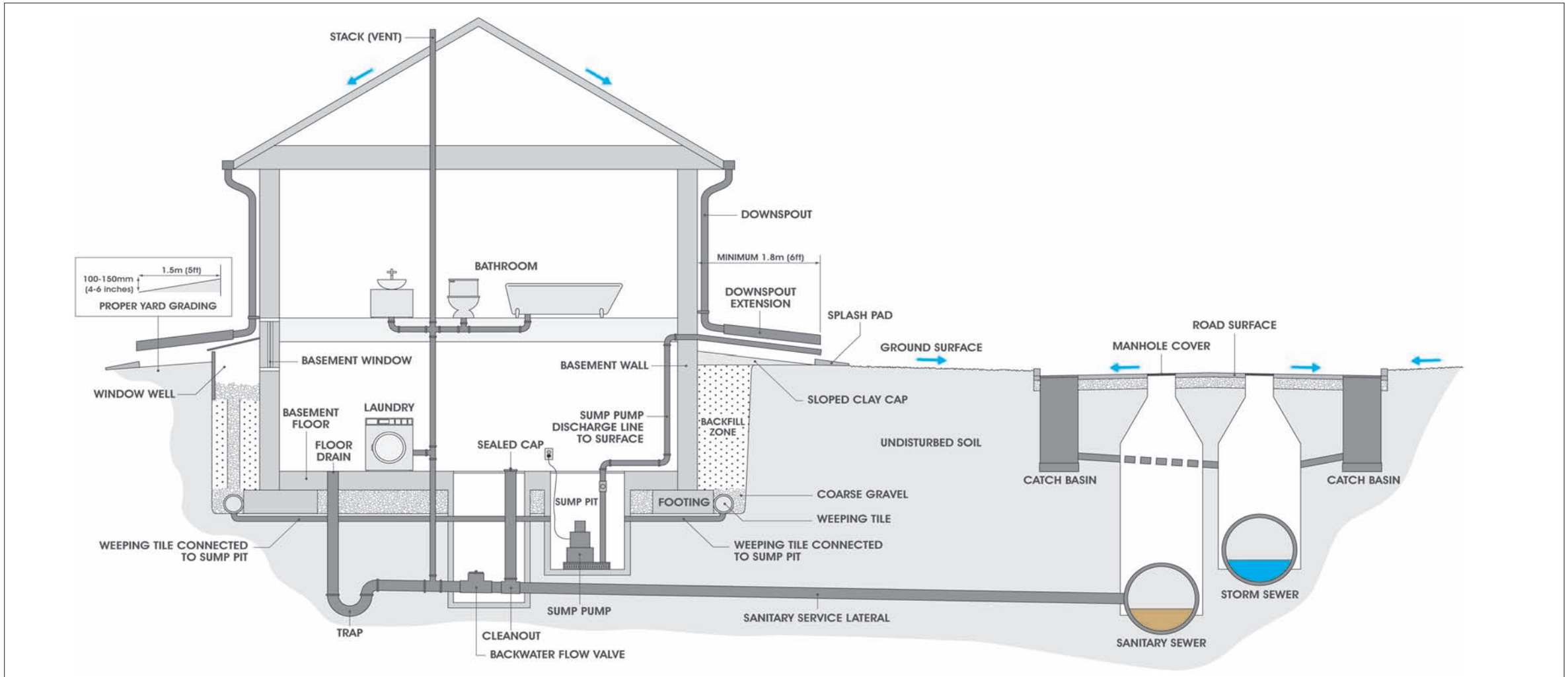


What to look for in this diagram

This diagram shows how sewer backup can enter a home. In this diagram:

- The sanitary sewer is surcharging and pushing sewage back into the home through the sanitary sewer lateral.
- Sewage is entering the basement through plumbing fixtures, including the basement floor drain and the unsealed sewer cleanout.
- Because the weeping tiles are connected to the sanitary sewer, sewage has been forced into the weeping tiles and is infiltrating into the basement through cracks in the basement walls.
- In this instance, the municipal storm sewer is also surcharging, and forcing storm sewage into the home`s storm sewer lateral. High pressure storm sewage is exfiltrating from the storm sewer lateral and entering the sanitary sewer lateral, thereby increasing the amount of sewage that enters the basement.
- The home`s sanitary sewer lateral is also in disrepair, and water is entering through cracks and loose joints.

Basement flood reduction in a typical two-storey home



What to look for in this diagram

The home in this image has been retrofitted with options recommended in this handbook.

To reduce overland flooding, infiltration flooding and sewer backup:

- A properly graded yard directs water away from the home.
- The backfill zone has been capped with an impermeable soil.
- The downspouts have been disconnected from the municipal sewer system.
- Extensions on the eavestrough downspouts and sump-pump discharge pipe keep water away from the home.
- A cover has been placed on the window well.

To reduce infiltration flooding:

- Cracks in the foundation walls and basement floor have been sealed.
- Weeping tiles have been repaired and are in good working order.

To reduce sewer backup:

- A mainline, normally open backwater valve has been installed in the sanitary sewer lateral.
- Weeping tiles are drained into a sump-pit, and water is pumped from the basement to the lot's surface using a sump-pump.
- Cracks and loose joints in the sanitary sewer lateral have been repaired.
- The storm sewer lateral has been severed.

Talk to your government about basement flooding that you've experienced

If you have basement flooding, let your municipal government know about it during or after the event. In many cases, municipal governments may ask homeowners to fill out a questionnaire or comment on their experience at public meetings. Municipal governments can use this information to identify solutions and carry out work on reducing flood risk in your neighbourhood.

If possible, record the following details when you have basement flooding so you can report them to your municipal government. Try to take pictures or videos of the flooding and flood damage. **Do not gather this information unless it is safe to do so. Do not enter your basement while it is being flooded or when there is water present. This could lead to drowning or electrical shock.**

1 How old is your home? _____ Years

2 What was the time and date of the basement flooding you experienced?

_____ _____ _____ _____
Time (am or pm) Day Month Year

3 Did the basement flooding occur because of rain, snow-melt or a combination of rain and snow-melt?

☐ Rain ☐ Snowmelt ☐ A combination of both
☐ The basement flooding was caused by neither rain nor snowmelt
☐ I/We were using internal pumbing such as dishwashers, showers or laundry machines during the flooding

If basement flooding occurred during a rainstorm, approximately how long was the rainstorm?

_____ _____
Minutes Hours

Did the rainstorm appear to be extremely heavy, moderate or light?
☐ Heavy ☐ Moderate ☐ Light

4 Was there any overland flooding in your neighbourhood when you experienced basement flooding? ☐ Yes ☐ No

Did it flow over private properties or did it flow over municipal property, including roadways and parks? ☐ Private property ☐ Municipal property

If there was water flowing over the surface outside of your home, how deep was it?

_____ _____
Centimetres Metres

5 How deep was the flood water in your basement?

_____ _____
Centimetres Metres

6 How did the water get into your basement?

Did the water:
– Get in through windows, doors or vents? ☐ Yes ☐ No
– Seep in through cracks in the basement walls and floor? ☐ Yes ☐ No
– Come up through plumbing fixtures and floor drains? ☐ Yes ☐ No
– Enter your basement in anther way? ☐ Yes ☐ No

Explain how the flood water entered your basement in another way:

_____

7 How did the water leave your basement?

Did it eventually flow out through floor drains? ☐ Yes ☐ No

Did you have it pumped out? ☐ Yes ☐ No

8 If you had a sump-pump, did it work properly? ☐ Yes ☐ No
☐ Did not have sump-pump

9 If you had a backwater valve, did it work properly? ☐ Yes ☐ No
☐ Did not have a backwater valve

10 Did you hire a contractor, plumber, repair crew or cleaning crew to investigate the flooding incident or make repairs? ☐ Yes ☐ No

Did they explain how the flooding occurred in the basement or identify the type of flooding that you experienced? ☐ Yes ☐ No

What did they say about the cause or type of flooding you experienced?

_____

11 Did you make an insurance claim for damages caused by basement flooding?
☐ Yes ☐ No

If you did make an insurance claim, was your claim approved or denied?
☐ Approved ☐ Denied

If your claim was denied, did your insurance provider tell you why? Please provide details:

_____

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