Basement Flood Risk Reduction
City of Winnipeg

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Outline

- Background
- Winnipeg Floodway
- Rain Events
- Winnipeg Sewer System
- Basement Flooding
- Flood Reduction Measures
Where is Winnipeg?
A Few Facts About Winnipeg

- Capital of Manitoba
- Founded in 1874
- Population of 750,000
- Area of about 500 km²

Is as the bottom of the “Red River Valley”
- Formed by the glacial lake Agassiz
- Which is a low laying flood plain – very flat
- Has 4 major rivers:
  - Red, Assiniboine, La Salle, Seine
ICLR - BFRR Strategy

2nd largest watershed in Canada
1M Km2
7M People
Flows into Lake Wpg; 10th Largest
Red, Wpg, Sask. Rivers; 60% of flow
Output via Nelson River to Hud Bay
Below – 1950 Flood
Legislative Building

Above – 1950 Flood
University of Manitoba
Below – 1997 Flood
South of the Inlet Control Structure

Above – 1997 Flood
Inlet control Structure
1997

Red River is usually 150m (490ft) wide.

Here it’s 65Km (40.6mi) wide.
Inlet Control Structure

- Idea was born from the 1950 flood.
- Completed in 1968 at a cost of $63M

- 1997 flood prompted a servicing review; 700 yr LOS
- Floodway expansion; 2005-2008; $665M
- NB: 1826 flood was 40% bigger than 1997
- Est. to have saved Manitoba $32B in Flood Damage
Winnipeg Flood Protection

- Shellmouth Dam
  - Completed in 1972
  - Controls flows along Assiniboine River
    - Reduces Flow; flood years
    - Augments Flow; dry years

- Winnipeg’s Primary Dykes
  - Maintains levels below 20 feet James Ave.
  - Few houses need sandbagging.
City of Wpg rain gauge network

- Started in 1988
- Expanded to 32 stations
- Built system to deal with spatial variability of thunderstorms
Since 2010, rainfall events posted on the City’s website.
City also posts significant rains on their website and analysis

- What makes a significant rainstorm
  - Total amount
  - Rainfall intensity
  - Multiple rainstorms

- City has had significant rainstorm flooding events in 1993, 2000, 2005 and 2010 and these are posted on website

Rainfall reports

May 29, 2010 (7:30 a.m. approximate start time) to May 30, 2010 (12:00 p.m. approximate stop time)

Heavy rain event summary

- Performance of Hawthorne lift station
- Performance of Beaulieu lift station

Heavy rain and high river levels put many unprotected homes at risk of basement flooding on May 28 and 29, 2010.

Heavy rain passed through the city on Saturday, May 29 and Sunday, May 30. The east side of the city was hardest hit with over 100 millimeters of rain. Saturday’s rain drenched ground that was already saturated by significant rainstorms on May 27 – 28 and May 24 – 25.

During Saturday’s rainstorm the Red River was between 12.7 and 15.3 James Avenue datum and rose to 18.3 feet by June 1 – an increase of 9.2 feet in five days. This is 11.8 feet above normal summer water levels at James and close to 18 feet above normal in the south end of the city. Creeks and streams were also noticeably higher – Sturgeon Creek overtopped Ness Avenue for a number of days and Ness had to be closed.

With heavy rains every summer, there is a significant risk of overloaded sewers backing up through house sewer lines and flowing into basements that aren’t protected. Although basement flooding is a risk at any time of the year, the risk increases with high river levels because the sewer system must then rely more heavily on pumping stations rather than gravity to carry the rainfall runoff.

The wastewater system operated at full capacity (given river levels) during the storm. We maintain all the systems, including 74 lift stations and 30 plus flood pumping stations regularly on a year round basis. We respond to high level and other alarms and during storms on a priority basis. Crews worked around the clock.
Extreme Rainfall Events

• An extreme rainfall event (like in 2000 and 2005) will cause:
  – Localized temporary street flooding
  – May cause basement flooding

• Rain Intensity & Duration is the key to flooding or no flooding; other factors are:
  – Antecedent soil conditions
  – Back to back rainstorms
  – Level of Service
  – River levels
  – BW Valve, Sump Pit, Lot Grading
May 2010-No household flooding!
Waverley West and WhyteRidge SRB Lakes
Storm Retention Basins
Winnipeg Sewer System

- Combined Sewers; Pre-1960
- Separated Sewers
Sewer District Types

The sewer system is complex and includes gravity and pumping facilities.
Winnipeg Sewer System

- Pollution Control Centers
- Interceptor Sewer systems
- CSO locations
- Land drainage outlet
  - Red and Assiniboine
- Major Rivers

Legend:
- Water Pollution Control Centre
- Secondary Treatment
- WPCC Service Area Boundary
- Combined Sewer Area
- Separate Sewer Area

ICLR - BFRR Strategy
Older parts of the city (pre-1960) are combined
~ 27% of the city is in a combined sewer area
Your basement is connected to every other basement

**BOTH systems can experience basement flooding**
Winnipeg’s CS System

- During dry weather, sewage is intercepted and transported to WPCCs for treatment.
- Prior to 1939 all wastewater flowed into rivers.
Combined Sewers

- Combined sewer areas present a number of potential issues
  - Older parts of the City (1900 to 1960)
  - A single pipe that carries both sewage and urban runoff
  - Originally flowed to rivers, interceptor sewer install in 1935, divert 2.75 x DWF to NEWPCC
  - Approximately 27% of City has combined sewers that overflow during rainfall and snowmelt events
In 1977, the city adopted the current storm sewer relief program. The program was to upgrade all the separate sewer districts to a 10-year level of protection and all combined sewer districts to a 5-year level of protection with relief piping, followed by further upgrading to a 10-year level by supplemental methods. Implementation was recommended to proceed successively, beginning with the most historically flood prone districts, and continuing until all districts met the prescribed level of service. The storm sewer

- **1977 – City Council adopts the current BFRP**
- **Levels of Service (LOS)**
  - Separate sewer districts – 10 Yr LOS
  - Combined sewer districts – 5 Yr LOS
  - Followed by 10 Yr LOS to proceed successively
Basement Flood Relief Program

ICLR - BFRR Strategy
The City is taking action to **REDUCE** the risk of basement flooding

- Invested more than $300 million since 1977
- Installing storm relief sewers
- Converting combined sewers to separate storm and wastewater sewers
Who is at Risk?

Everyone with a structure below grade...

- Basements
- Crawl spaces

...that is connected to the sewer

- Floor drain
- Toilet/sink/washing machine/showers/tubs
- Weeping tiles connected to a sewer
Basement Flood Relief Program

- Spent over $300M to date
- Budgeted annually
- Methods used
  - Increase hydraulic capability (SRS)
  - Hydraulic balancing
  - WW separation
  - LDS separation
- Prioritization B/C ratio
Customer Data

Based on acquired customer data:

- Basements flooded due to:
  - Penetration of walls / foundation
  - Floor drains
  - Basement windows / openings
  - Weeping tiles

- Source of flood water
  - Rainwater
  - Wastewater
# Flooding Reduction Measures

<table>
<thead>
<tr>
<th>Flooding Risk</th>
<th>Source</th>
<th>City of Winnipeg</th>
<th>Residents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overland Flooding</td>
<td>Flood Waters</td>
<td>Primary Dykes, Sandbagging, Flood Pumps, Sewer Cleaning, BFR Program</td>
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<td>Foundation/Walls</td>
<td>Surface Water</td>
<td>BFR Program</td>
<td>Sealants/Membranes, Lot Grading</td>
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<td>Floor Drain</td>
<td>Sewer</td>
<td>BFR Program</td>
<td>Backwater Valve</td>
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<tr>
<td>Weeping Tiles</td>
<td>Surface/Grd Water</td>
<td>BFR Program</td>
<td>Sump Pump</td>
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</tbody>
</table>
Things YOU Can Do…

1. Install (and maintain!) a backwater valve

- Intended to protect basement plumbing
- Mandated in By-law as of 1979
- National Plumbing Code of Canada provides criteria
- Different applications/properties might have specific requirements
- Work with a licensed plumber and engineer
Install (and maintain!) an in-line backwater valve

Typical Household Backwater Valve Installation

Normally open

Normally closed

ICLR - BFRR Strategy
Things YOU Can Do…

Backflow Prevention Devices

- installed in the basement floor drain
- are NOT recommended as they ONLY protect the floor drain from sewer backup and NOT the entire basement plumbing
Things YOU Can Do...

2. Install a sump pit drainage system

Ensure your sump pump discharge hose is correctly placed!

It is ILLEGAL to redirect your discharge hose to ANY part of the building plumbing!
Things YOU Can Do…

2. Install a sump pit drainage system

Ensure your sump pump discharge hose is **correctly** placed!

It is **ILLEGAL** to redirect your discharge hose to **ANY** part of the building plumbing!

- Consists of a sump pit and pump
  - Sump pit collects water from weeping tiles
  - Sump pump discharges the water outside your property

- Mandated in By-law as of 1990
- Details in Building By-law
- Section 23 – Subsurface Drainage
Things YOU Can Do...

3. Improve drainage around your property

- Downspout emptying too close to basement wall
- Water pooling against basement wall
- Soil settled near wall
- Water enters basement through crack in basement wall
- Weeping tile collects seepage
- PROPER DRAINAGE

- Drainage improvements: redirect runoff away from wall
- Extend downspout
- Fill with black earth or soil containing clay
- Soil settled near wall
- Basement wall
- Cover with topsoil and sod
- PROPER DRAINAGE

ICLR - BFRR Strategy
Things YOU Can Do…

4. Take care of your sewer

You own the sewer pipe from your building to the City’s sewer, including the part under your property and the part under City property.

- Don’t throw garbage down sinks or toilets
- Use grease traps and grit interceptors
- Keep your service pipe clear of roots
- Preventative/regular maintenance – video inspection, periodic cleaning
There is a right way and a wrong way to place your sump pump hose!

Wrong way
According to the City of Winnipeg, the Sump Pump bylaw, it is an offense to allow water from your sump pump to drain directly onto neighboring properties, houses, sidewalks, or streets.

Right way
Discharge the water from your sump pump onto your own property.

Tips!
- Direct the flow from your sump pump away from your home, preferably onto a garden area or non-paved surfaces.
- Keep the end of the hose well away from your property line so that the water does not flow onto the street, lane or sidewalks.
- Move the hose often so that the ground does not become soggy and wet.
- Use the flow from your sump pump to water grass, shrubs and trees.

If you have questions about sump pumps and sump pump discharge, contact our Customer Service Centre:
- by phone at 985-5858
  Monday to Friday, 8:30 am to 4:30 pm
- by email at
  water_customer_service@winnipeg.ca

ICLR - BFRR Strategy
Subsidy for eligible installations

<table>
<thead>
<tr>
<th>Category 1 – In-line backwater valve only</th>
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<tbody>
<tr>
<td>• 60% of the invoiced cost, including eligible labour, materials, permit(s), and taxes, up to a maximum of $1,000</td>
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<tr>
<th>Category 2 – Sump pit drainage system only</th>
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<tbody>
<tr>
<td>• 60% of the invoiced cost, including eligible labour, materials, permit(s), and taxes, up to a maximum of $2,000</td>
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<tr>
<th>Category 3 – Both in-line backwater valve and sump pit drainage system</th>
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<tbody>
<tr>
<td>• 60% of the invoiced cost, including eligible labour, materials, permit(s), and taxes, up to a maximum of $3,000</td>
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Subsidy Conditions

- One time only per property for each eligible installation
- Applications must be received within one year of the date of final inspection
- Subject to available funding and provided on a first-come, first-served basis
- Not eligible for the subsidy:
  - labour by the homeowner
  - maintenance or replacement of an existing installation
  - associated interior and exterior restorations or improvements
  - installation of a backflow prevention device in a floor drain
Eligibility Criteria

- Current owner of a residential building at the time of installation
- No outstanding taxes or debts owed to the City of Winnipeg
- Final inspection date must be within one year of submission.
- Any plumbing or electrical contractor you hire must be licensed by the City of Winnipeg.
- Ensure that appropriate permits are obtained and arrange for the necessary inspection.
- Drain water collected in the sump pit drainage system in compliance with the City of Winnipeg Lot Grading By-law
Flood Reduction Measures

Risk Reduction Measures Taken:
- Floodway - 1968
  - Expanded - 2005
- Basement Flood Relief Program (1977 – Ongoing)
  - Constructing Relief Works
  - Public Education
- Newly Built Homes
  - Backwater Valve Mandated in By-Law - 1979
  - Sump Pumps Mandated in By-Law - 1990
- Sewer Cleaning and Inspection (1998 - Ongoing)
- Inlet Restriction Studies
- Inflow & Infiltration Studies
Questions