City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
   - Geography
   - Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING
   
   Small Scale Household Solutions

   Large Scale Infrastructure Solutions
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND  
- Geography  
- Two sewer systems
TWO SEPARATE SEWER SYSTEMS

STORM SEWERS

SANITARY SEWERS
( Domestic Sewers )
STORM SEWER SYSTEM

- conveys RAINWATER
- NOT connected to homes
- destination: South Saskatchewan River
SANITARY SEWER SYSTEM

- CONVEYS *DOMESTIC SEWAGE*
- *ALWAYS* CONNECTED TO EVERY HOME
- DESTINATION: *WASTEWATER TREATMENT PLANT*
TWO SEPARATE SEWER SYSTEMS

STORM SEWERS

- ▶ NO Household Sewage

SANITARY SEWERS
(Domestic Sewers)

- ▶ NO roof or downspout leaders
- ▶ NO catchbasins
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND  
- Geography
- Two sewer systems

2 – HOW BASEMENTS FLOOD
- Seepage
- Weeping Tile: the Seepage Solution
- Sanitary Sewer Backup from Weeping Tile Overflows
HOUSEHOLD SEEPAGE FLOODING
HOUSEHOLD SEEPAGE FLOODING

SEEPAGE FLOODING  Saskatoon homes built before 1960
WEEPING TILE – The Modern Solution to Seepage Flooding
WEARING TILE CONNECTED TO SANITARY SEWER

WEARING TILE – The Modern Solution to Seepage Flooding
Weeping Tile into Floor Drain
WEEPING TILE CONNECTED TO SANITARY SEWER

Weeping Tile into Floor Drain In Saskatoon: 1960 - 2003
SANITARY SEWER BACKUP - WEEPING TILE OVERLOAD

Rain water enters the sanitary sewer through the weeping tile.

Rain water exits as a sewer backup.
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
   - Geography
   - Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING

   Small Scale Household Solutions
   
   - Sump Pits
   
   - Backwater Valves
WEEPING TILE CONNECTED TO SANITARY SEWER

Weeping Tile into Floor Drain In Saskatoon: 1960 - 2003
The "Modern" Sump Pit Solution
Weeping Tile connected to a Sealed Sump Pit
WEEPING TILE DRAINS TO STORM SEWER SYSTEM

Weeping Tile into Sealed Sump Pit → Saskatoon Homes 2004 - 2011
THE BACKWATER VALVE SOLUTION
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
   - Geography
   - Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING

Small Scale Household Solutions

City of Saskatoon – Basement Flooding Solutions

- Sump Pits
- Backwater Valves
- Flood Protection Program
- City of Saskatoon subsidizes SELECTED HOMES to upgrade plumbing to the January 1, 2004 standard.
Flood Protection Program

- Funded with a $3.00 Levy / water meter (raised to $4.50 in 2007)
- HOMES DEEMED TO BE AT RISK of sewer backup may upgrade plumbing with a backwater valve and sump pit
- Program PAYS 100% of costs up to a ceiling of $2500 ($3000 in 2010)

Offered Flood Protection Program
- 2005: 567
- 2007: 427
- 2010: 346
- Total: 1340

Participation Rate
- 2005: 51%
- 2007: 52%
- 2010: 53%
- Total: 52%

- 85% Effective in eliminating damage from sewer backup
- 96% Effective in REDUCING damage from sewer backup
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
   - Geography
   - Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING

Small Scale Household Solutions

Large Scale Infrastructure Solutions

   - Saskatoon’s Severe Rain Events
City of Saskatoon Severe Rain Events

24 hour rainfall record

96.6 mm

75.0 mm in 45 minutes

> 2000 Flooded Homes

1983 JUN-24

2000+
City of Saskatoon Severe Rain Events

mm of RAIN

1983 JUN-24

1994 MAY-17

47.4mm

50 Flooded Homes

2000+ 50
City of Saskatoon Severe Rain Events

- 160mm of rain
- Wettest 30 days since 1939
- 800 flooded homes
- 30 DAY RAIN

1994 MAY-17: 50
2005 JUN-29: 800
City of Saskatoon Severe Rain Events

mm of RAIN

102 mm

OLD 24hr RECORD

NEW 24hr RECORD

500 Flooded Homes

1983 JUN-24
1994 MAY-17
2005 JUN-29
2007 JUN-17

2000+ 50 800 500
City of Saskatoon Severe Rain Events

1994 MAY-17: 50
2005 JUN-29: 800
2007 JUN-17: 500
2007 AUG-17/19: 200

NEW 48hr RECORD

200 Flooded Homes

mm of RAIN

108 mm
59.2 mm
46.8 mm
AUG 17 – 2007 7:10pm MESO SCALE CONVECTIVE COMPLEX
## TOP TEN Highest Rainfall Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>520mm</td>
</tr>
<tr>
<td>1923</td>
<td>420mm</td>
</tr>
<tr>
<td>2005</td>
<td>385mm</td>
</tr>
<tr>
<td>1912</td>
<td>374mm</td>
</tr>
<tr>
<td>1942</td>
<td>366mm</td>
</tr>
<tr>
<td>2006</td>
<td>366mm</td>
</tr>
<tr>
<td>1911</td>
<td>362mm</td>
</tr>
<tr>
<td>1927</td>
<td>360mm</td>
</tr>
<tr>
<td>1991</td>
<td>351mm</td>
</tr>
<tr>
<td>2007</td>
<td>350mm</td>
</tr>
</tbody>
</table>
Conclusions:

New Approach to Assessing the Effect of Storms and a New Solution

2005-2010: 4 of the 10 wettest years

MESO SCALE CONVECTIVE COMPLEX
Cumulonimbus Thunderstorm
Synoptic Rain Events – combined with antecedent rainfall
1 in 100 year events - Intensity/Duration/Frequency (IDF) Curves

New Approach to Assessing the Effect of Storms and a New Solution
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
- Geography
- Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING

Small Scale Household Solutions

Large Scale Infrastructure Solutions

- “Saskatoon’s Savage Rain..."
SANITARY SEWER PIPE DESIGN

- minimum flow speeds
- self-cleaning
- deep enough to prevent freezing
- not too deep to maintain / build
- cannot be designed for extreme events
SANITARY SEWER STORAGE TANK (Superpipe) CONCEPT

PUMPED to SANITARY SEWER after storm subsides
Matching Superpipe Influence Zones to Flood Risk Zones

Superpipe Size = Estimated Volume of Flooded Basements
“SUPERPIPE” Project

Local Engineering

Local Contractors

Local Construction Management

Locally Manufactured Pipe
<table>
<thead>
<tr>
<th>Year</th>
<th>Litres Produced</th>
<th>Cost</th>
<th>Sr. Gov’t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.1 million</td>
<td>$1.2 million</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>2.4 million</td>
<td>$2.5 million</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>1.0 million</td>
<td>$1.9 million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.4 million</td>
<td>$0.9 million</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>1.1 million</td>
<td>$1.5 million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5 million</td>
<td>$2.2 million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$10.2 million</td>
<td>$19.3 million</td>
<td>51%</td>
</tr>
<tr>
<td>2011</td>
<td>1.6 million</td>
<td>$2.4 million</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>1.1 million</td>
<td>$1.7 million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.7 million</td>
<td>$2.6 million</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>1.6 million</td>
<td>$2.4 million</td>
<td></td>
</tr>
</tbody>
</table>
City of Saskatoon – Basement Flooding Solutions

1 - BACKGROUND
   - Geography
   - Two sewer systems

2 – HOW BASEMENTS FLOOD

3 – PROGRAMS TO REDUCE THE RISK OF FLOODING

Small Scale Household Solutions

Large Scale Infrastructure Solutions
SUMMARY:

BASEMENT FLOODING:

- Sanitary sewers will overflow during a severe rain
- Different combinations of storms and rainfalls may cause overflows
- Weeping tile allows rain water into sanitary sewers
- Pipe conveyance or resizing cannot solve overflows

SOLUTIONS:

- Backwater valves are at least 85% effective
- Storage tanks can be designed to capture overflows
ACKNOWLEDGEMENTS:

City of Regina

City of Winnipeg
www.saskatoon.ca
“B” – Basement Flooding