Stormwater Integrated Resource Planning (SIRP)
Susan Ancel – Director One Water Planning

ICLR Friday Forum Presentation – July 16th 2021

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Planning for a flood-resilient future

EPCOR is working to reduce the risk of flooding in Edmonton due to extreme weather.

Our goals are to:
1. Identify areas of Edmonton that have the highest risk of impact from stormwater flooding.
2. Develop drainage infrastructure and programs to effectively address those risks.
3. Educate homeowners on the actions they can take to reduce their risks.

Our Stormwater Integrated Resource Plan (SIRP) builds on initial work by the City of Edmonton before September 2017.
What we’ve been working on

EPCOR has been reporting on the Stormwater Integrated Resource Plan (SIRP) to City Council’s Utility Committee:

February 2018
- SIRP approach
- Public engagement plan

April 2018
- Insurance industry perspective
- Industry Update Scheduled for August 2021 Utility committee

June 2018
- Risk framework working model
- Validating how capacity, condition and social data will be included

October 2018
- Public’s top priorities
- Risk ranking of sub-basins

May 2019
- Capital and Operational program plan based on the risk framework

2020-2021 Funding Approvals at Utility Committee November 2019
Future Years Funding in Each Subsequent PBR period
Focused approach to challenge what is considered a “known” or fixed design requirement

Risks managed considering protection, mitigation, response and recovery alternatives

Technique Used in EPCOR Water since 1993
SIRP Flood Mitigation Options

- Trunks and Sewer Separation
- Outfalls and Control Gates
- Ponds and Road grading
- Maintenance Programs

- Emergency Response
- Weather Forecasting
- Low Impact Development
- Insurance and Building Flood Proofing
Aligned with City Climate Change Adaptation Project

**Climate Hazards**

**Community Assets**

SIRP will take vulnerability analysis to the local level for stormwater related hazards

**Impacts**

- Direct
- Indirect Service
- Direct Service

**City-Wide Vulnerability Risk Assessment**
Industry Engagement

Insurance Bureau of Canada
- National Round Table on Flood Proofing
- Community Awareness Building
- Linking Utility Engineering with Insurance Risk Community

Intact Centre on Climate Adaptation – Best Practices
- Greenfield Development
- Home Flood Proofing
- Existing System Resiliency

CWN – Municipal Consortium
- Consortium Leadership Group Meeting
- Blue Cities Conference

Other Communities Sharing Approaches
- Toronto / Ottawa / Calgary / Saskatoon / Halifax
- CVC (Mississauga) / New York / Philadelphia / Anglian Water
Objectives

• Test potential reduction of uncertainty in flood hazard maps with the use of richer datasets
• Propose appropriate mechanisms that allow relevant data to be accessed/shared to support more accurate flood risk evaluation

Communities Involved:
- Edmonton, AB
- Halifax, NS
- Regina, SK
- Tecumseh, ON
- Windsor, ON

Synopsis Report Released Oct 2019

Mitigation \ Insurance \ Disaster Recovery
Finding the Balance – Multi-party Discussions

When do you Build to Avoid vs. Rely on Insurance or Disaster Response?

Changing dynamic between Insurance and Disaster Recovery Eligibility

Overland Flood Insurance Available – only 50% in Alberta have opted for it

Design standards consistency? – Greenfield vs. Existing urban areas

Private Property Flood-Proofing vs. Utility Infrastructure Investment

How Can Utilities Influence Customers to Protect themselves?

Once Mitigated how does the Insurance Community know the risk is lowered?

We can’t fix everything at once – can Green infrastructure (Public and Private) alone mitigate this risk until we get there?
Risk Consequence by Stormwater Sub-basin

- Risk Considered through Four Perspectives

- Risk Level indicates Exposure to the Risk is present in the basin – It does not mean all properties in the sub-basin are exposed to the Risk

- Goal is to prioritize the sub-basins for flood mitigation
From the Property Owner and Insurance Perspective risk is about exposure over the lifetime of the property vs. picking a design standard. SIRP approach considers the full range of storms.

<table>
<thead>
<tr>
<th>Storm Scenario</th>
<th>Percent Likelihood Over Time</th>
<th>SIRP Likelihood Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In One Year</td>
<td>Over 30 years</td>
</tr>
<tr>
<td>1:20</td>
<td>5.00%</td>
<td>78.54%</td>
</tr>
<tr>
<td>1:50</td>
<td>2.00%</td>
<td>45.45%</td>
</tr>
<tr>
<td>1:75</td>
<td>1.33%</td>
<td>33.15%</td>
</tr>
<tr>
<td>1:100</td>
<td>1.00%</td>
<td>26.03%</td>
</tr>
<tr>
<td>1:200</td>
<td>0.50%</td>
<td>13.96%</td>
</tr>
</tbody>
</table>
### Multiple GIS Data Sets

#### Capacity Data Set
- Sanitary Surcharge Modelling
- Overland Flooding Modelling
- 311 Flooding Reports
- Underpass Flood Modelling
- River Valley Neighbourhood Modelling
- Insurance Flood Maps – Fluvial and Pluvial w/o pipe network
- Alberta North Saskatchewan Fluvial Flood Maps

#### Condition Data Set
- Drainage Pipes – Storm/Sanitary
- Stormwater Control Elements
- Stormwater Management Ponds
- Outfalls
- Historical Maintenance - Blockages, root intrusion, catch basin cleaning, sewer flushing frequency
- Financial Damage Depth Curves

#### Data Source
- Utility
- Municipality
- Province
- Insurance

#### Critical Buildings and Facilities
- Hospitals
- Fire Halls, Police and Ambulance Stations
- Emergency Relief Shelters
- Seniors Homes, Long term Care Facilities
- Schools – Elementary through University
- Shopping Malls
- Recreation \ Leisure Centers
- Transit Centers & LRT Corridors
- Water\Wastewater Plants, Reservoirs and Pump stations
- Electrical Sub-stations
In August 2018, 1,500 Edmontonians completed a comprehensive survey about flood impacts.

They learned about how flooding can impact public health and safety, social well-being, and the environment, and have financial consequences.

Max Diff Survey approach considering 50 scenarios for major and extreme flood impacts in the community

<table>
<thead>
<tr>
<th>Health and safety</th>
<th>Social issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="health.png" alt="Health" /></td>
<td><img src="social.png" alt="Social" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
<th>Financial losses</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="environment.png" alt="Environment" /></td>
<td><img src="financial.png" alt="Financial" /></td>
</tr>
</tbody>
</table>

*This survey is among the most difficult to complete that I have ever taken. The ethical calculus necessary to make choices between awful and terrible outcomes was difficult...We all need to think these things through and contribute to the tough and expensive compromises that lie ahead.*

– Verbatim comment from the survey
Top Priorities for Edmontonians

For the city overall, citizens put the greatest priority on protecting against health and safety and social impacts from flooding.

Financial and environmental impacts were ranked as less important.

Impacts that were reversible, temporary or insurable were of lower relative importance.

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**Major Flood Impacts**
Relative Importance Scores

- Health and Safety: 63
- Social: 57
- Financial: 46
- Environment: 29

*Health and safety impacts were twice as important as environmental impacts.*

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**Extreme Flood Impacts**
Relative Importance Scores

- Health and Safety: 70
- Social: 56
- Financial: 42
- Environment: 31

*In extreme flood impact scenarios, health and safety became even more important.*
Maps highlight Basins at Risk over multiple storms
Risk Colored Maps are also available showing risk level for Each Storm
Combined Risk

Recommended Weighting

A to E – we will develop Flood Capital and Operational Programs

F to G - Flood mitigation is opportunistic with other work such as paving or asset renewal

Map last updated October 2018
**SLOW.**
We slow the entry of stormwater into the drainage network by absorbing it in green infrastructure and holding it in ponds, creating space in the collection system during storm events.
- Ponds ($470M), Low Impact Development ($420 - 570M)

**MOVE.**
We move excess water safely away from areas at risk, quickly and efficiently.
- Tunnels, Trunks and Sewer Separation ($300M)

**SECURE.**
We help secure individual properties in higher risk areas against sewer backups, overland flooding and river flooding.
- Enhanced Flood Proofing ($60M), Outfalls and Control Gates ($30M), Inflow and Infiltration Reduction ($100M)

**PREDICT.**
We predict and manage the movement of stormwater through smart sensors and technologies that integrate into the collection system.
- Monitoring and Controls ($70M)

**RESPOND.**
We respond through the fast rollout of flood barriers, traffic diversions and public communications to protect life, safety and property.
- Emergency Response Equipment ($45M)
Theme Driver #1
Increased Risk of Basement Flooding due to Surface Ponding

Multiple Paths for Water to Enter Home
- Inflow \ Infiltration to Sanitary line
- Foundation Walls and Foundation Drains
- Window wells

Strong Correlation of locations of Predicted ponding locations and historical basement flooding records
Theme Driver # 2
Edmonton Convective Storm Patterns Support
Low Impact Development (LID) as a Flood Mitigation Option

- Lower Storm Intensities surround core High Intensity Part of Storm
- Opportunity to Fully Capture Lower Intensity Volumes Prior to Reaching the Trunk Network
- More Capacity in Trunk Network for the Higher Intensity Storm Volumes
- Reduction of flows impacts wide area of City due to Trunk Network Configuration
City of Edmonton – 2016 Scenarios

- Utility committee to select a design scenario
- Grey Infrastructure focus
- Public and Utility Owned locations
- 80 year implementation schedule

<table>
<thead>
<tr>
<th>Capital Type</th>
<th>Scenario 1 (1:100 Large)</th>
<th>Scenario 2 (1:50 Large)</th>
<th>Scenario 3 (1:100 Small)</th>
<th>Scenario 4 (1:50 Small)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Tunnels</td>
<td>$1,730 M</td>
<td>$1,570 M</td>
<td>$655 M</td>
<td>$605 M</td>
</tr>
<tr>
<td>Local Pipe Upgrades</td>
<td>$415 M</td>
<td>$385 M</td>
<td>$365 M</td>
<td>$350 M</td>
</tr>
<tr>
<td>Large Ponds</td>
<td>$635 M</td>
<td>$560 M</td>
<td>$555 M</td>
<td>$515 M</td>
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<tr>
<td>Sewer Separation</td>
<td>$1,900 M</td>
<td>$930 M</td>
<td>$970 M</td>
<td>$735 M</td>
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<tr>
<td>Total</td>
<td>$4.6 Billion</td>
<td>$3.4 Billion</td>
<td>$2.5 Billion</td>
<td>$2.2 Billion</td>
</tr>
</tbody>
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SIRP – EPCOR Recommendation

- Risk Based Prioritization
- Grey and Green Infrastructure
- Public, Utility and Private owned locations
- Recommended 20 year implementation

<table>
<thead>
<tr>
<th>Capital Type</th>
<th>Estimated Minimum Cost</th>
</tr>
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<tbody>
<tr>
<td>SLOW - Ponds – Big and Small</td>
<td>$470 M</td>
</tr>
<tr>
<td>SLOW - Low Impact Development</td>
<td>$470M</td>
</tr>
<tr>
<td>SECURE - Outfalls and Control Gates</td>
<td>$30M</td>
</tr>
<tr>
<td>SECURE – Inflow\Infiltration Reduction</td>
<td>$100M</td>
</tr>
<tr>
<td>SECURE – Enhanced Building Flood Proofing</td>
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<td>PREDICT - Monitoring and Controls</td>
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<tr>
<td>RESPOND - Emergency Response</td>
<td>$45M</td>
</tr>
<tr>
<td>MOVE - Trunks and Pipe Separation</td>
<td>$300 M</td>
</tr>
<tr>
<td>Total</td>
<td>$1.6 Billion</td>
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</tbody>
</table>
Operational Recommendations

Reduced Capital Expenses enabled through increased operational resources to engage community in implementation of solutions involving green infrastructure and improve awareness of how to better protect private property

18 staff positions - $2.2M/year
- Four management/engineering positions for Dry ponds, LID, Monitoring and Controls and Enhanced Building Flood Proofing
- Six technologists for LID, Monitoring and Controls, Emergency Response and Enhanced Building Flood Proofing
- Four field labour positions for LID and ditches and swales maintenance
- Four specialized field operators for mechanical, electrical and controls maintenance for the new outfall gates and monitoring and controls

Targeted Backwater Valve Subsidy - Program $32M
- 40,000 High risk Properties at $800/property
- Also considering additional subsidies based on property need/primary risk factor
Capital and Operational Costs and Timing to Implement – 20 Year Scenario selected by Utility Committee – with some components being completed in 10 years. Impact to the Rates considering other initiative

Alternative Rate Structures – based on Pervious vs. Impervious Areas for future PBR

Who pays? – all lots or only those adjacent to a Stormwater pipe? What about culverts and ditches?

Stormwater Capture on Private Properties? Permitting required to manage. Rate structure to incentivize as part of PBR renewal

Capitalization of Green Infrastructure? Requires a storage component. Who maintains and owns the tree or vegetation – SLA developed with City for BGN work

EPCOR contributing Capital to Flood proofing or Green infrastructure on private property? Additional financial analysis required to demonstrate least cost to rate payers.
Questions

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