Changing Trends in Water Use
Managing Impacts on Water and Wastewater Systems

November 21, 2018

CWN Webinars
Connecting water professionals to decision-ready knowledge
Insights for the water sector
helping decision-makers move forward

Canadian Water Network frames what is known and unknown in a way that usefully informs the choices being made.

cwn-rce.ca
Canadian Trends in Water Use

From 2011 to 2015

- The number of people served by WTPs increased by 6% ↑
- Potable water volume processed by WTPs decreased by 2% ↓
- Average per capita daily residential water use decreased by 6.5% ↓

(Statistics Canada)
Potential Drinking Water System Impacts from Decreasing Water Use
Potential Wastewater Collection & Treatment Impacts
Webinar Speakers

**Simon Horsley**
Water Quality Lead
Stantec

**Abhishek Bhargava**
Senior Manager of Operations
Gold Bar WWTP
EPCOR

**Luke Kurach**
Manager of System Condition Assessment
EPCOR Drainage

**Fernando Sacluti**
General Supervisor
Infrastructure Planning Group
EPCOR
Water Demand and Water Age

How demand affects water quality and what to do about it

Canadian Water Network
Nov 21, 2018
Agenda

1. Water Age and Water Quality
2. Mitigation
3. Conclusions
Agenda

1 Water Age and Water Quality

2 Mitigation

3 Conclusions
Water Age and Water Quality

Distribution systems are:

- Biological reactors
- Chemical reactors

Which means...

Water age = reaction time
Two buckets of reactions....

**BULK**
- Cl₂ decay
- DBPs
- Solids deposition

**PIPE**
- Cl₂ decay
- Some DBPs
- Solids re-entrainment
“We hold these truths to be self-evident: that all pipes are created unequal.”

e.g. smaller diameter pipes associated with higher rates of disinfectant decay
Tanks also provide a place for rxns...

Chlorine residuals

Chlorine decay rates (same data)
Here’s the bad news…

If demand declines, all pipes and tanks are not equally impacted.

Non uniform impact…reduction in demand serves as a water age multiplier.

Problematic, as we treat and operate to manage the oldest 10% of water.
Agenda

1. Water Age and Water Quality
2. Mitigation
3. Conclusions
Mitigation

The theory... take chlorine for example. Losses due to bulk + pipe rxns * time...
Mitigation

The theory... take chlorine for example. Losses due to bulk + pipe reactions * time

Option A – Reduce water age (reaction time)
- localized flushing (manual, auto-flushers)
- Water age blending (PSs, PRVs etc.)
- tank management (trend tank water age)
Mitigation

The theory... take chlorine for example. Losses due to bulk + pipe rxns * time

Option B - Adjust the Bulk Reaction Conditions
- Boost chlorine (example shown)
- Reduce bulk demand (reduces losses)
Mitigation

The theory... take chlorine for example. Losses due to bulk + pipe rxns * time

Option C - Adjust the Pipe Reaction Conditions

Reduce pipe reactions (cleaning, rehab, also linked to bulk chemistry)
Mitigation

Water quality models...

...predict, plan, prepare
What does ‘average’ water quality actually mean?
Agenda

1. Water Age and Water Quality
2. Mitigation
3. Conclusions
Conclusions

Demand = water age = reaction time

More reaction time = less disinfectant, more biofilm, more DBPs, more corrosion byproducts

System is not uniformly impacted – highest retention times receive highest impact

As we treat and operate to oldest fraction of water, this creates disproportionate challenges
Mitigation options:

1. Reduce reaction time (water age)

2. Reduce reaction rate (bulk, pipe)

3. Plan and prepare...water quality models are best tool
Thanks for tuning in!

Questions & Comments?

simon.horsley@stantec.com

Water Quality Lead
Edmonton: Population and Wastewater

Edmonton: Population Vs Annual Wastewater Volume

Edmonton: Population and Solids


- Population
- Digested Sludge (tonnes)

- ~50%
- ~13%
Corrosion Issues

Luke Kurach, P.Eng
Manager, System Condition Assessment
EPCOR Drainage
Corrosion Issues

- Drainage System
- Issues
- Mitigation
Drainage System

SANITARY
- PIPES
  - Local Sewer
  - Small Trunk Sewer
  - Large Trunk Sewer
  - Force Main
  - Service Connections
- OTHER
  - Storage Tank & Pipes
  - Pump Stations
  - Manholes

COMBINED
- PIPES
  - Local Sewer
  - Small Trunk Sewer
  - Large Trunk Sewer
  - Force Main
- OTHER
  - Storage Pipes
  - Pump Stations
  - Manholes
  - Catchbasin Manholes

STORM
- PIPES
  - Local Sewer
  - Small Trunk Sewer
  - Large Trunk Sewer
  - Force Main
  - Foundation Drain
  - Service Connections
- OTHER
  - Storage Tank & Pipes
  - Pump Stations
  - Manholes
  - Catchbasin Manholes
  - Catchbasin Leads
  - Catchbasins
  - Wet Lakes
  - Constructed Wetlands
  - Dry Ponds
  - Outfalls
  - Swales
  - Culverts

Local Sewer: <600mm Diameter
Small Trunk Sewer: 600mm <1200mm Diameter
Large Trunk Sewer: >=1200mm Diameter
## Drainage System

### Sanitary and Combined System

<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Sanitary</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Trunks (Km)</td>
<td>74</td>
<td>92</td>
</tr>
<tr>
<td>Small Trunks (Km)</td>
<td>133</td>
<td>129</td>
</tr>
<tr>
<td>Storage Tanks (cu.m)</td>
<td>22,329</td>
<td></td>
</tr>
<tr>
<td>Storage Pipes (cu.m)</td>
<td>27,436</td>
<td>460</td>
</tr>
<tr>
<td>Pump Stations (ea.)</td>
<td>72</td>
<td>3</td>
</tr>
</tbody>
</table>
Hydrogen Sulfide Corrosion
  • Costly premature replacement or rehabilitation of assets
  • Social Costs
Trunk Sewers, Storage Tanks and Pipes, Pump Stations, Manholes, Chambers
Varying degrees of severity
Age and locations vary
Issues

- Visual Inspection
- Multi-Sensor Inspections
- Core Samples
## Issues

### Sanitary and Combined System

<table>
<thead>
<tr>
<th>Location</th>
<th>Corrosion Severity</th>
<th>Odour Complaints</th>
<th>Low Slope/ Velocities</th>
<th>Long Retention Time/ Storage</th>
<th>Drop Structures, Forcemain Discharge</th>
<th>High Turbulence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High</td>
<td>High</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>2</td>
<td>High</td>
<td></td>
<td></td>
<td>✗</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Med-High</td>
<td></td>
<td></td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Med-High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High</td>
<td>High</td>
<td></td>
<td>✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>8</td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Trunk Inspections and Odour Mitigation synergy
- Identify locations with high likelihood of failure
  - Pipe attributes
  - Odour Complaints

Inspections
- Multi Sensor Inspection (MSI)
  - CCTV, LiDAR, Sonar, Gas + Temperature
- Visual Walk-Through

Monitoring

New construction to consider corrosion potential and mitigation measures
Rehabilitation to consider corrosion resistant materials
Mitigation

- Design considerations should be made specifically to address the potential for corrosion.
- Corrosion problems should be identified early.
- Conduct Inspections, as part, or supplementary to proactive trunk inspection program. This will provide necessary information to better understand and predict corrosion.
- Cleaning of trunk sewers to remove accumulation of debris, as this can be an effective deterrent to the corrosion process. Again, inspection data (sonar) can provide some quantification of debris for planning and implementation.
- Mitigate or slow down the potential for corrosion by providing corrosion resistant liners at time of constructing trunks, or considered when rehabilitating existing ones.
- Develop and maintain a sewer map with odour complaints, sewer inspection data, gas monitoring.
- Consider other possible corrosion control methods:
  - Reduce the dissolved sulfide content of the wastewater
  - Provide ventilation of the enclosed area or sewer
Thanks
Odour Mitigation in Edmonton

Fernando Sacluti, P.Eng
General Supervisor, Infrastructure Planning
Drainage Services - Planning & Engineering
November 21, 2018
Odourous Locations

- Catch basins
- Manholes
- Pumpstations
- Real time control units
- Combined sewer outfalls
Ongoing Activities

- **Improve Odour Database**
  - Monitors/sensors to measure sewer air composition and pressure
  - Water meter readers have “sniffers”

- **Continue work on projects in impacted neighbourhoods**
  - Deep trunk sewer inspection
  - Manhole sealing and flap installation
  - Drop structure design

- **Improve design standards for new construction**

- **Research & Development with academia and industry**
Identified 1,100 potential odour projects in 157 neighbourhoods.

Preliminary prioritization to estimate investment requirements and rate impact.

Approximately $460M required:
- Capital: $370M
- Operation & Maintenance: $90M

Identified two implementation options and time frames.
Proposed Implementation Options

■ Implementation Plans:
  • Systematic Approach
  • Primary Hotspot Priority Approach

■ Delivery Time Frames:
  • 10-year
  • 20-year
  • 25-year
Systematic Plan

- Widespread initial benefits across the city
- Optimize allocation of construction resources across the city
- Improved synergy with other street level construction projects
- Frequency of odour reporting is not a factor.

Odour reduction in 9 to 25 years in primary hotspots.
Primary Hotspot Priority Option

- Odour reduction occurs first in areas with greatest customer report frequency
- Public engagement is concentrated and streamlined
- Fewer construction disruptions in certain neighbourhoods

Odour reduction in 5 to 11 years in primary hotspots.
Primary Hotspot Only Option

- Odour reduction occurs in areas with greatest customer report frequency
- Allows time to proactively gather more data from across the city
- Approximately $310M
  - South of the river: $200M
  - North of the river: $110M
Preference for moderate changes in customer rates
Meaningful public engagement on individual projects
Coordination with other projects across the city
Meaningful performance metrics
Next Steps

- Public engagement starting late 2018 to early 2019
- Present a detailed business case to the rate regulator in Q2 2019
Thank You