Your SEWER and Everything you DON'T Know about it!

Wednesdays@Knox, Knox Presbyterian Church, Waterloo, January 2024

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NORTON ENGINEERING

Chronology of a Sewer Expert

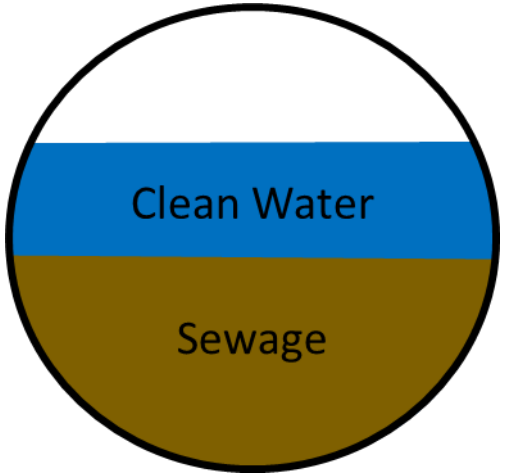
- B.A.Sc. Ottawa 1987; M.A.Sc. Toronto 1990 (P.Eng. 33 yrs)
- I spend ***half*** of my time in the field and entering sewers
- **City Engineer** for 2 years;
- I studied the BUILDING CODES – essential for sewers
- Established **Norton Engineering** in 2015
- Infrastructure Columnist for **CBC Radio 1** across Ontario since 2016
- Major media contributor in to print, radio and TV
- Chair and primary contributor to **national, provincial and municipal sewer standards and guidelines**

Primary Message that will Shock You

- Clean water is leaking into sewers at an alarming rate, both in NEW construction (subdivisions) and EXISTING sewers.
- This is an environmental, social, and financial *disaster.*
- There are efficient and cost-effective solution to remove this clean water, within our existing legislative framework.

“Leakage” is rainwater, groundwater and drinking water leaking into the sewer

What does Clean Water Leaking into a Sewer Look Like?



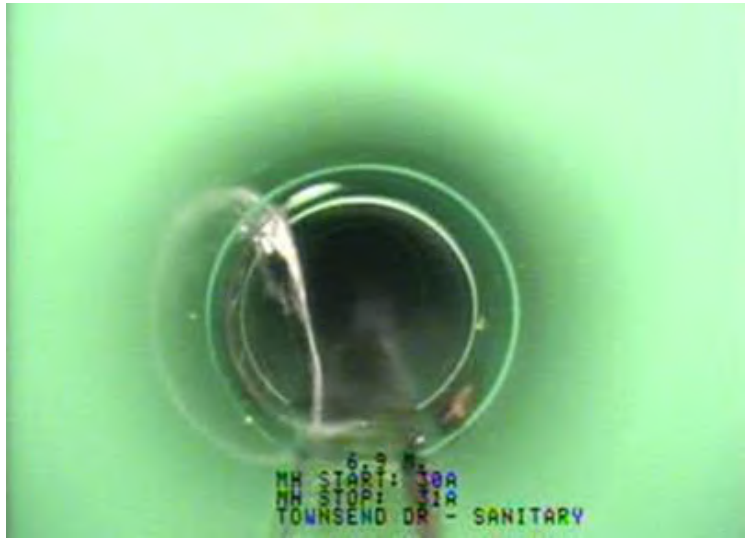
The blue portion represents the clean water in sewers. It's as high as 40% across Ontario

This room in the sewer (capacity) could be used to:

- Reduce routine flooding
- Reduce catastrophic flooding
- Provide additional re$ilience again$t climate change
- Allow more new development (housing) by freeing up capacity
- Reduce treatment costs
- Reduce legal costs in the event of flooding
- Delay the need to expand wastewater treatment plants
- Ensure sewers reach their design life (leaking sewers fail sooner)

What does this Clean Water Cost Residents?

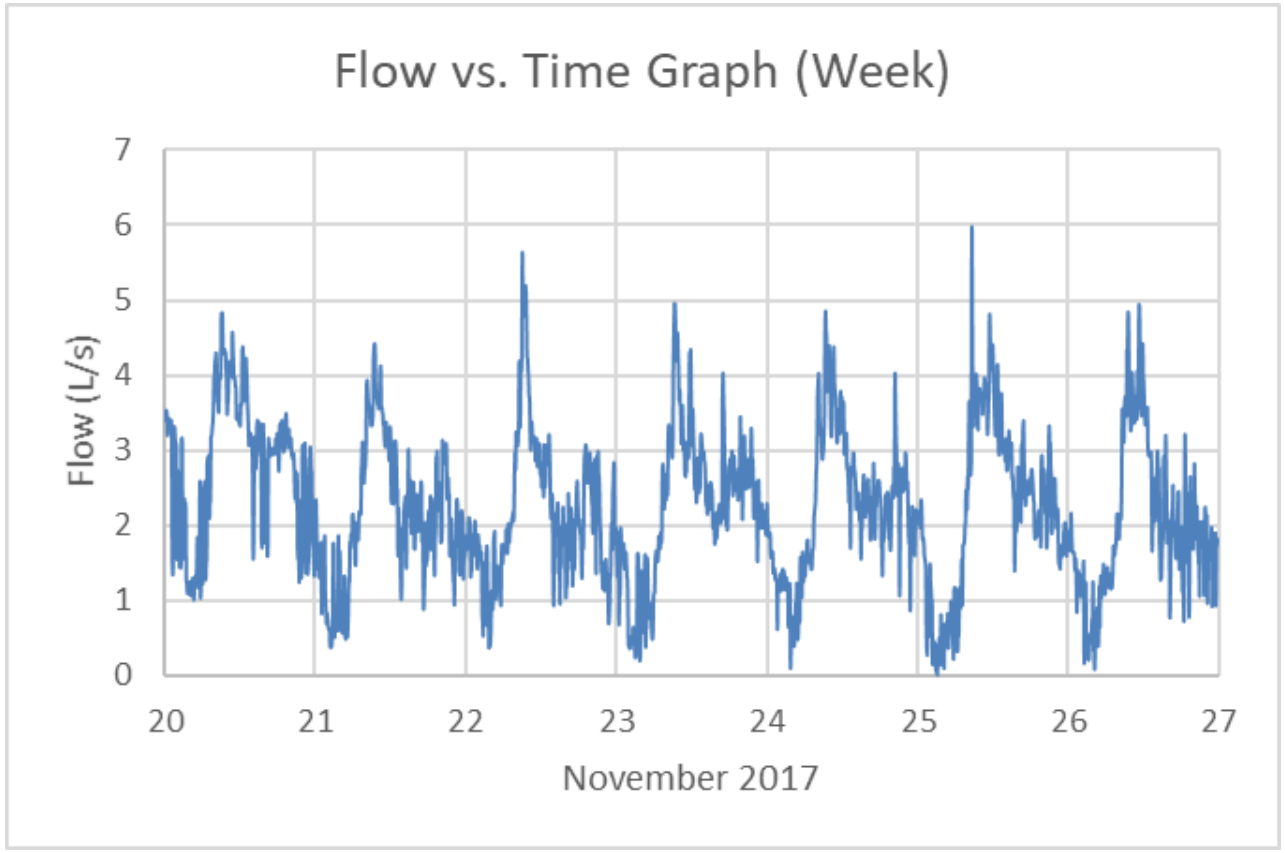
A garden hose delivers about 1 L/s



This is a leak at the property line in a brand-new subdivision sewer

A single **1 L/s** of I/I costs $100,000 a year to treat
at the Wastewater Treatment Plant: *all residents pay for this!*

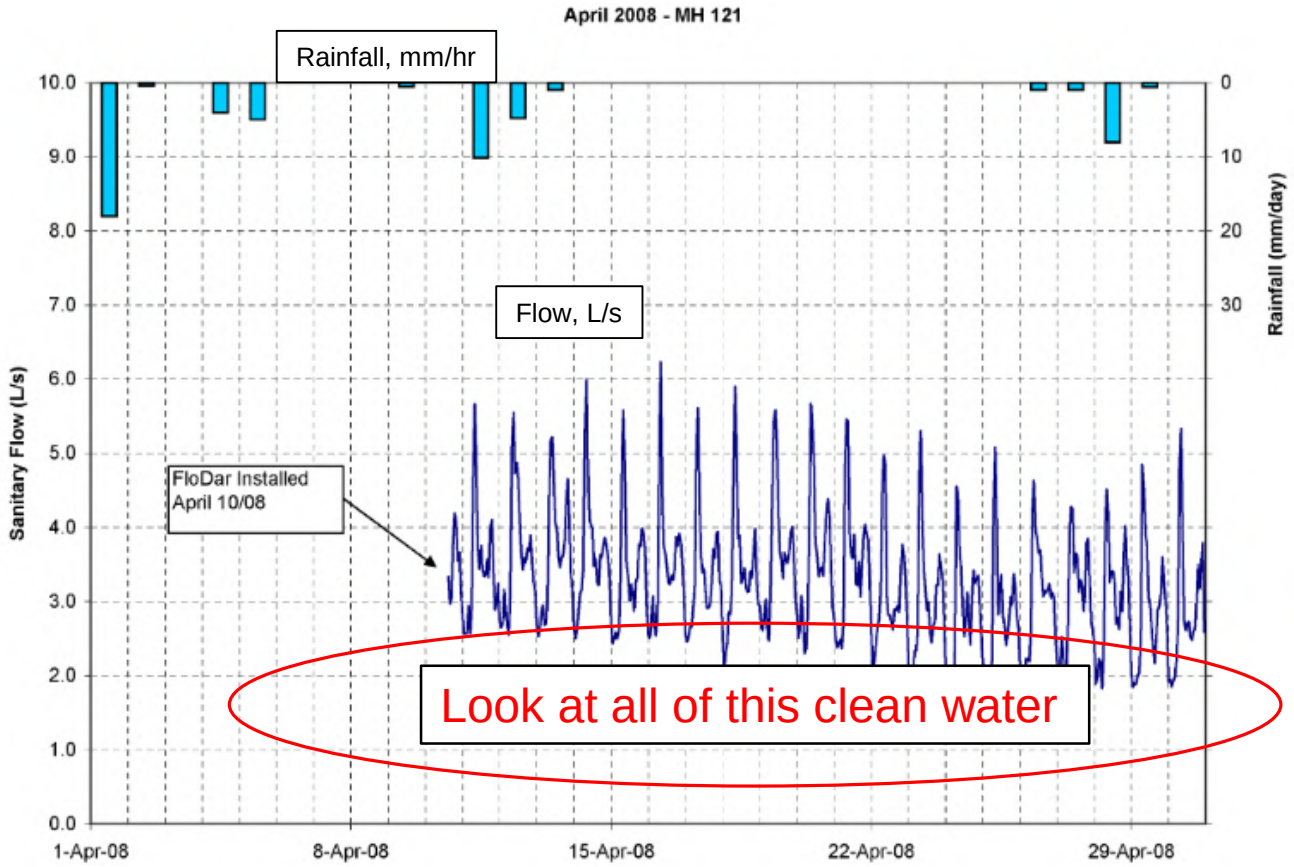
Expected Sewage Flow Daily Pattern



Civil Engineering 101:

- Sewage flow shows a daily 2-humped pattern: morning and evening peak
- In a new residential subdivision, sewage flows is expected to be virtually zero overnight

My Findings: New Subdivision in St. Jacobs, Ontario, 2005
DRY WEATHER



Norton Engineering Primary Research:

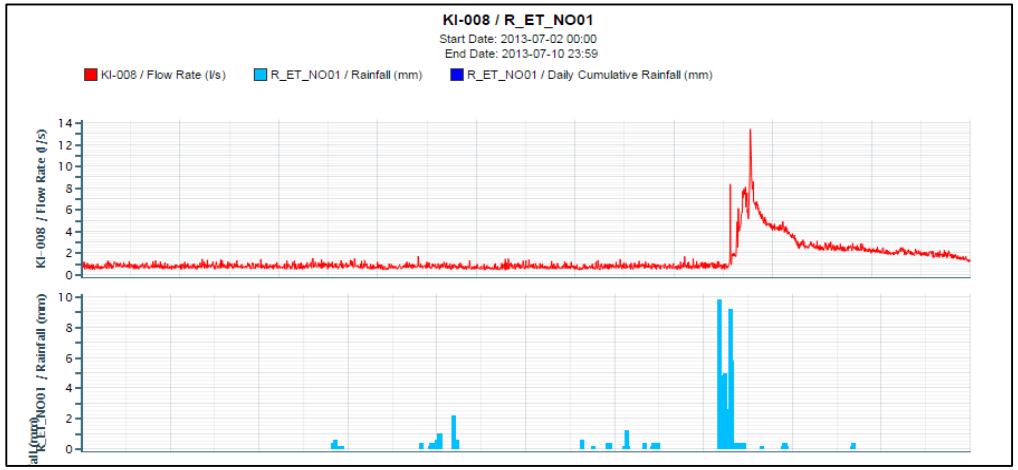
New Sewers are Leaking *Excessively (Norton, 2015)*

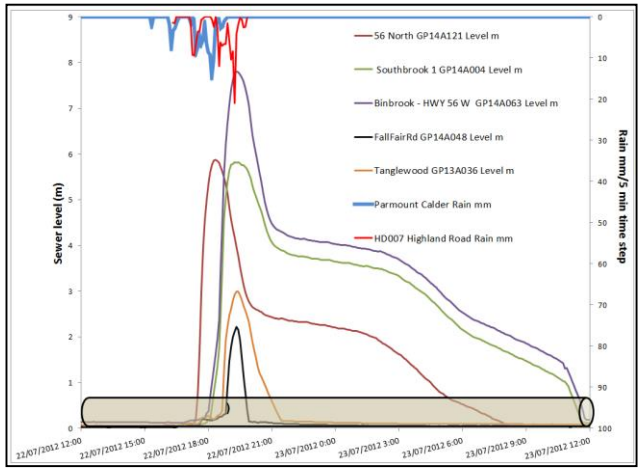
- Data collected since 2005 shows that new sewers show excessive **leakage** at inception, often more than the long-term allowable amount
- The engineering, building and development industries were **unaware** of this
- Leaking occurs in both **public** and **private** side sewers

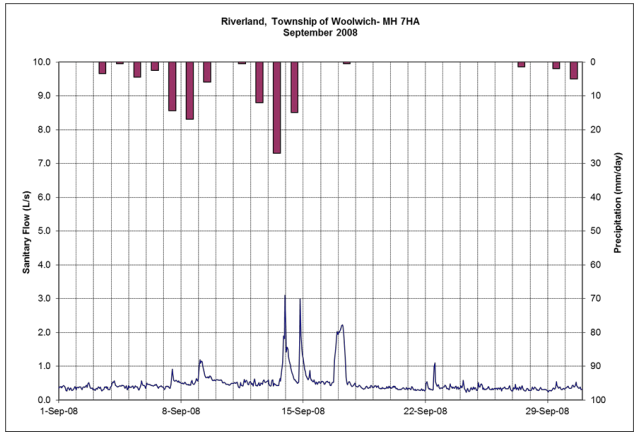
Norton survey of Ontario municipalities, 2015 to 2017
n=35

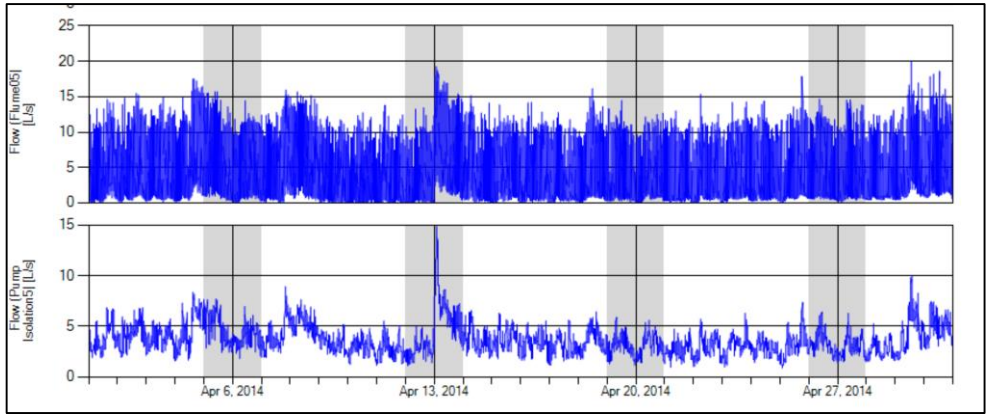
Norton Engineering Primary Research: DRY and WET Weather

Typical data received from across Ontario *(Norton, 2015)*









Why Is this Happening (Public Side)

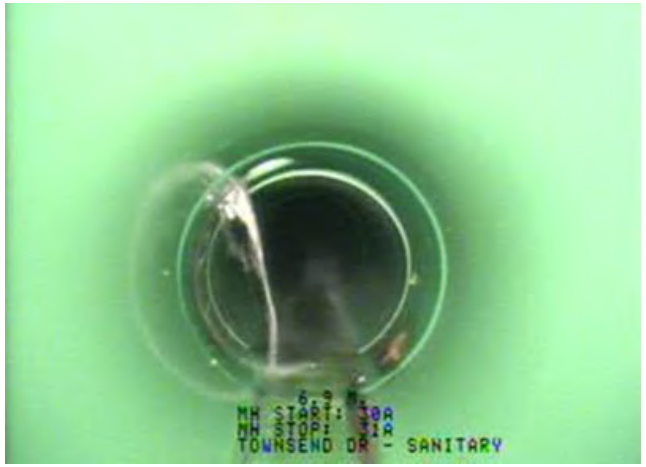
Norton findings, 2015 to present

Issues on the Public Side (governed by Provincial Guidelines & Specifications; ultimately owned by the municipality):

- Required tests not being performed
- Best available technologies not being applied or not available
- Inspection by the developer's engineering consultant
- Insufficient municipal staff to oversee work
- Perceived or actual political pressure
- Professionals who work with I/I disappear after public side complete
- Municipalities do not check flows in new construction

Why Is this Happening (Private Side)

Norton findings, 2015 to present



We can inspect sewers by CCTV camera, launched from the mainline sewer or the basement cleanout

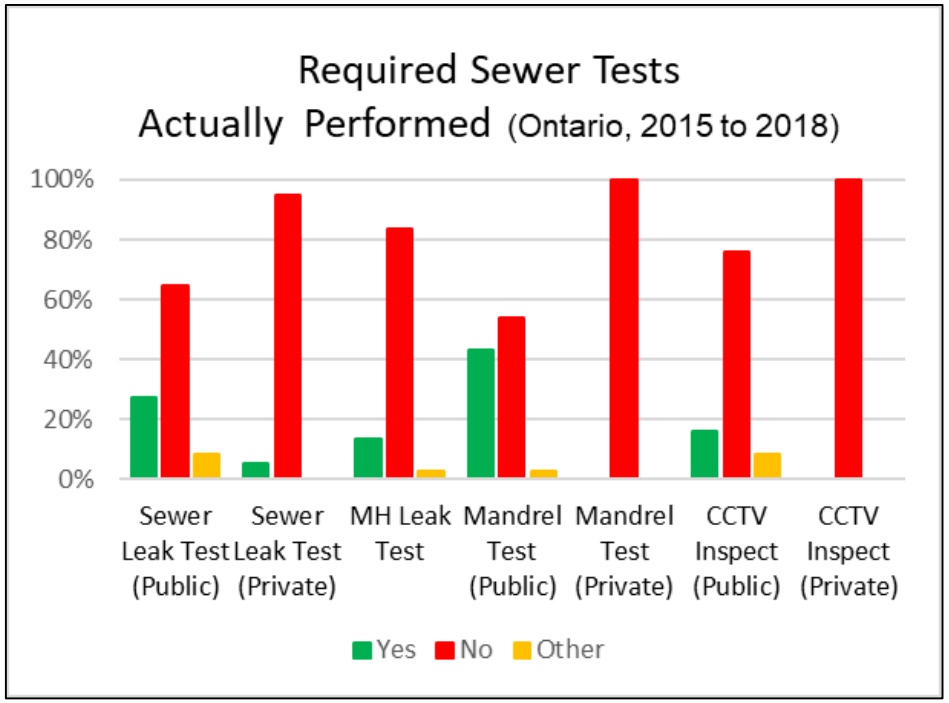
Issues on the Private Side (governed by the Building Code; ultimately owned by the homeowner):

- The Building Codes was not developed with sewers in mind
- Building staff are not trained in sewer systems
- Installation methodology for PVC pipe & PVC pipe type was not picked up by the Codes
- Building Code interpretation
- There is a single, one-time inspection of private side sewer
- Inspection of the connection at property line not explicitly called for

Ontario Survey Results: Which Tests are Actually Being Performed?

Norton findings, 2015 to present

- Public side infrastructure must be constructed, tested and accepted according to standard construction **specifications**
- Private side infrastructure must be constructed, tested and accepted according to Building Code **specifications**
- Municipal staff are reporting that we are not performing the majority of these tests



Mandatory Testing in Ontario. This graph should be 100% green bars. We have a problem.

Best Practices Public Side: Measure Performance of New Sewers

Flow Monitor all New Subdivisions

Norton just accepted public side sewers from another new subdivision!

- This has been Norton's primary recommendation to virtually eliminate clean water leaking into new subdivision sewers (since 2007).
- This recommendation informed the new MECP Sewer Design Standards (Norton is MECP's technical expert).
- At least 30 municipalities have started flow monitoring of new sewers as a direct result of Norton's research.

How National Sewer Standards Develop

1. Inflow and Infiltration in New Sanitary Sewer Systems
2. Efficient and Cost-Effective I/I Program

National Standard of Canada

Draft Standard D 3682-320-7: ***Mitigation of the Risks of Inflow and Infiltration in New Sanitary Sewer Systems*** (BNQ)

Developed 2015 to 2023

National Standard of Canada

SCC Guideline: ***Developing an Efficient and Cost-Effective I/I Program*** (awarded to BNQ 2023)

Developed 2019 to ~2025

SCC Seed Documents are Free and Public

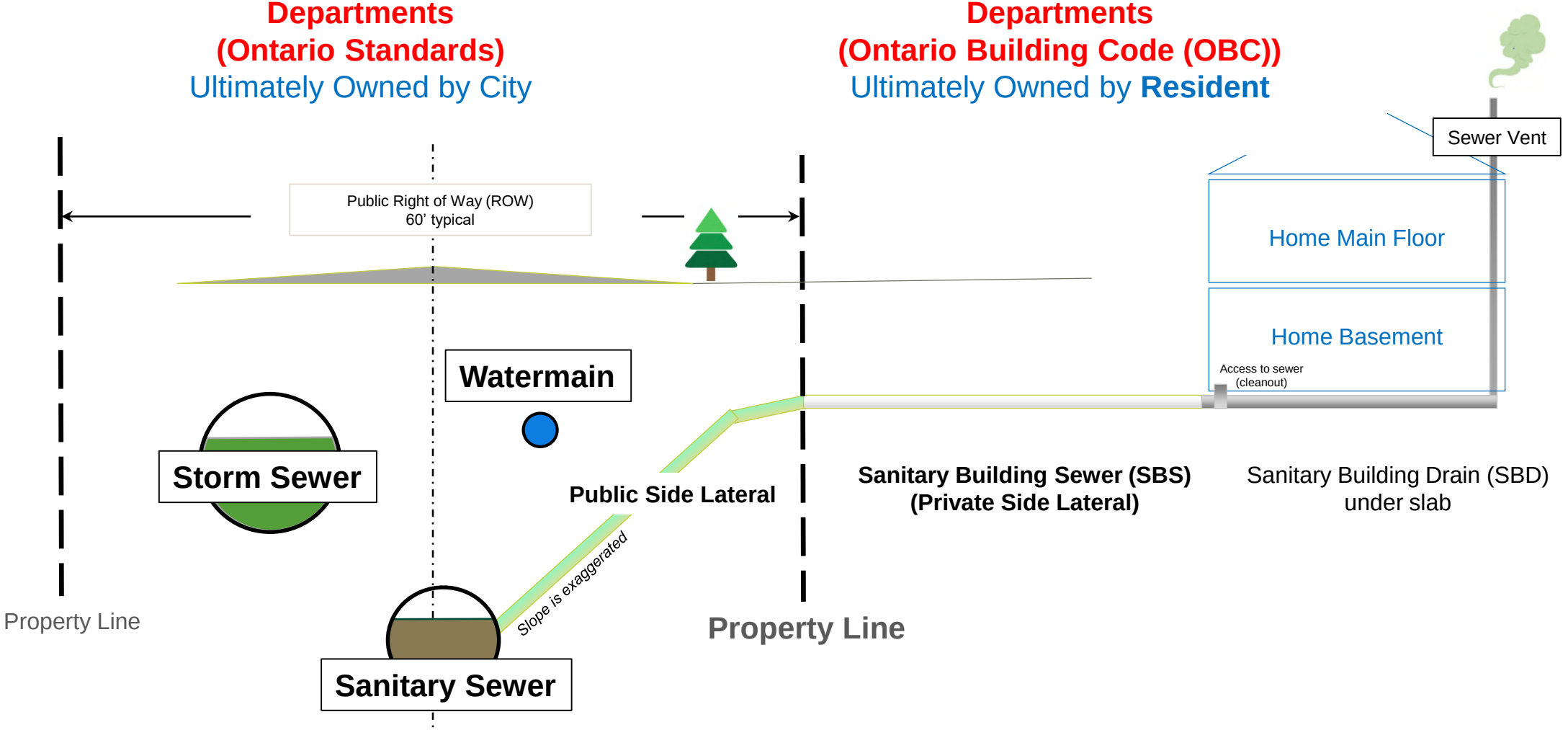
https://www.scc.ca/en/about-scc/publications/general/developing-efficient-and-cost-effective-inflow-and-infiltration-i-i-reduction-program

https://www.scc.ca/en/news-events/news/2019/reducing-risk-inflow-and-infiltration-new-sewer-construction

Cross Section of Municipal Infrastructure

Under the Jurisdiction of Engineering Departments
(Ontario Standards)
Ultimately Owned by City

Under the Jurisdiction of Building Departments
(Ontario Building Code (OBC))
Ultimately Owned by **Resident**



What belongs in SEWERS - An Easy Guide

Alas, residents are not getting the message.

Sewer clogged with non flushable items

- Flush NOTHING except the three “Ps”: **Pee, Poo, or Paper**
- **Never** flush anything that will attract fats, oil or grease to it, like sanitary products, wipes, incontinence products, dental floss, paper towel, etc., etc. (i.e. non-dispersible items).
- **Never** pour fats, oil or grease down your sink. It sticks to anything that doesn’t disperse and causes blockages and backups.

Never, ever do this

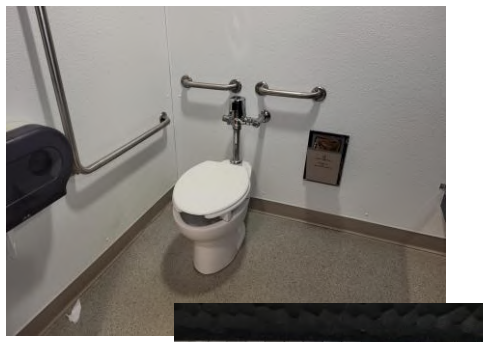
Women's Washroom Stalls

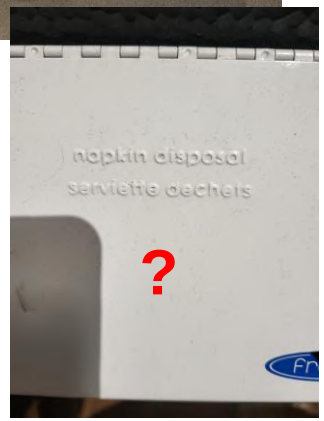
Oops, the Codes forgot to consider user requirements!!!

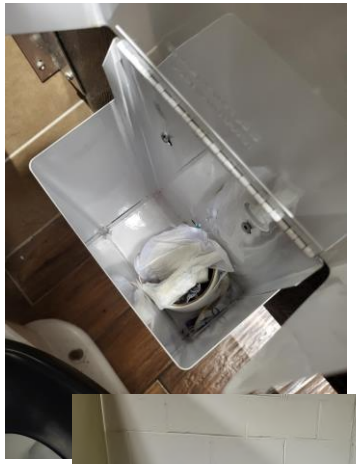
- Women's washroom stalls do not contain a sink, counter, paper towel or trash can!
- Women menstruate (duh).
- Absent a trash can, we have few options but to flush this material!
- We need this to change NOW, not in 10 years.

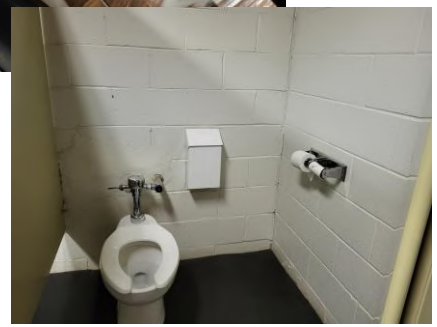
The National Plumbing Code (and therefore Provincial Building Codes) contain no special equipment in women's stalls.

What we DO see in Women's stalls









No means of disposal of product, no place to wash hands.

Homemade signs by business owners

Men’s Washroom Stalls

Men also flush deleterious material!

- Men flush incontinence products, flushable wipes, condoms, etc.
- Absent a trash can, men also flush things that they should not.
- Boys learn by watching their father.
- We need information and a trash can, in *all* stalls, to educate everyone.

This is a *Catastrophe* for Sewers and Residents

Lake Ontario after a storm

- Our wastewater treatment plants are FULL of trash, much of it women's menstrual products.
- Women are out of the house 10 to 12 hours a day, and we deal with menstruation in public washrooms.
- We need this to change NOW, not in 10 years.

A Two-Step Solution is Needed NOW!

Norton's efficient and cost-effective solution

1. Change the **National Building Code** and the Provincial Codes (e.g. **Ontario Building Code**) to require a certain number of women's stalls to have a sink and counter (and by default, paper towel and trash can), and at least a trash can in men's stalls.

2. Retrofit all existing public washrooms with a trash can and information sign: "Sewers are NOT Trash Cans".

These changes will save $$$ for utilities, substantially reduce sewer backups, reduce unsightly overflows to receivers, improve the environment, and **finally** introduce *menstrual equity* in Ontario and Canada

1. Norton Proposed Changes to the Ontario Building Code

We simply need to add a column to the **eight (8)** tables in Article 3.7.4.3. (Tables A to I) and in Articles 3.7.4.4. to 3.7.4.9 to also specify number of water closets (stalls) with **sink and counter,** for a variety of occupancies

Table 3.7.4.3.A.
Water Closets for Assembly Occupancies

Forming Part of Sentence 3.7.4.3.(1)

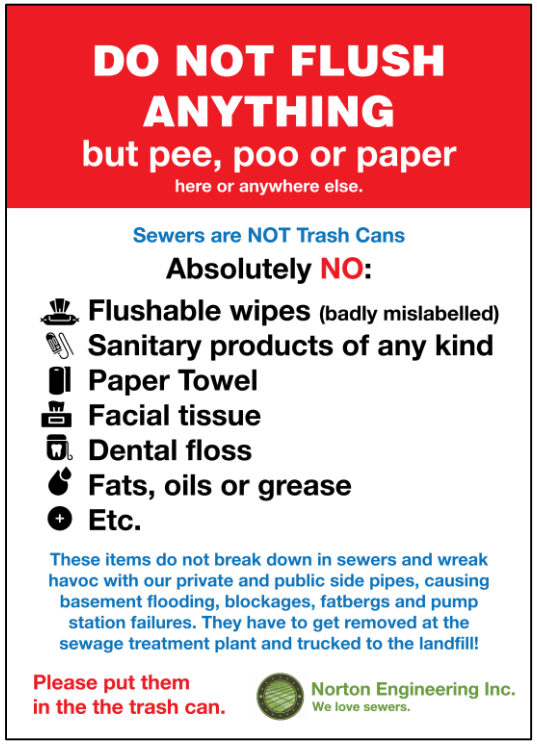
Item	Column 1 Number of Persons of Each Sex	Column 2 Minimum Number of Water Closets for Males	Column 3 Minimum Number of Water Closets for Females	Column 4 Minimum Number of Water Closets with **Sink and Counter** for Females
1.	1 - 25	1	1	1
2.	26 - 50	1	2	1
3.	51 - 75	2	3	1
4.	76 - 100	2	4	1
5.	101 - 125	3	5	1
6.	126 - 150	3	6	2
7.	151 - 175	4	7	2
8.	176 - 200	4	8	3
9.	201 - 250	5	9	3
10.	251 - 300	5	10	3
11.	301 - 350	6	11	4
12.	351 - 400	6	12	4
13.	Over 400	7 plus 1 for each additional increment of 200 males in excess of 400	13 plus 1 for each additional increment of 100 females in excess of 400	30% of stalls

Norton's Proposed Changes to OBC, 2023

I meet with the Ministry of Municipal Affairs and Housing (who oversee the OBC) this month.

2. Initiate a Retrofit “Sewers are NOT Trash Cans” and Public Education Program

- Change the National Plumbing Code and the Ontario Building Code to *require a sink, counter, paper towel and trash can in* **30% of Women’s stalls**
- Retrofit our existing public buildings by installing an information sign about sewers, and adding a trash can
- The program pays for itself after a single averted plumbing call
- Please buy a $20 sign today and take it to your local or Regional Councilor



This sign was developed after 9 years of research

This is How Much Municipalities can SAVE with a Norton “Sewers are NOT Trash Cans” and Public Education Program

- Help your RESIDENTS avoid blockages on their private side sewers
- Reduce plumbing calls at your own facilities (arenas, pools, seniors centers, etc.)
- Reduce callouts to Operations to unblock laterals (public/private)
- Reduce pumping station failures
- Reduce the amount of trash that needs to be trucked to landfill from the WWTP
- Help BUSINESS OWNERS reduce plumbing calls at their shops/restaurants

All by installing a Norton sign and a trash can inside all washroom stalls.

The Media has Championed this Information

See **Norton** discuss private side sewers and women's washroom stalls:

- TVO's the Agenda with Steve Paikin (20 minutes - June 19 2023)
  https://www.tvo.org/podcasts/the-agenda-with-steve-paikin-audio/the-sewer-lady-on-how-to-avoid-flooding

- CBC Radio 1 Morning Show KW (8 minutes - June 29 2023)
  https://www.cbc.ca/player/play/2241426499736

- CTV News at 6 (2 minutes – July 14 2023)
  https://kitchener.ctvnews.ca/plumbing-problem-kitchener-ont-engineer-pushing-to-change-canada-s-plumbing-code-1.6480544

- City*NEWS* The Mike Farwell Show (45 minutes, July 18 2023)
  https://kitchener.citynews.ca/2023/07/18/tuesday-july-18th-2023/ (MINUTE 1:26)

What about Rainwater from Downspouts

Directly Connected to the Sanitary Sewer?

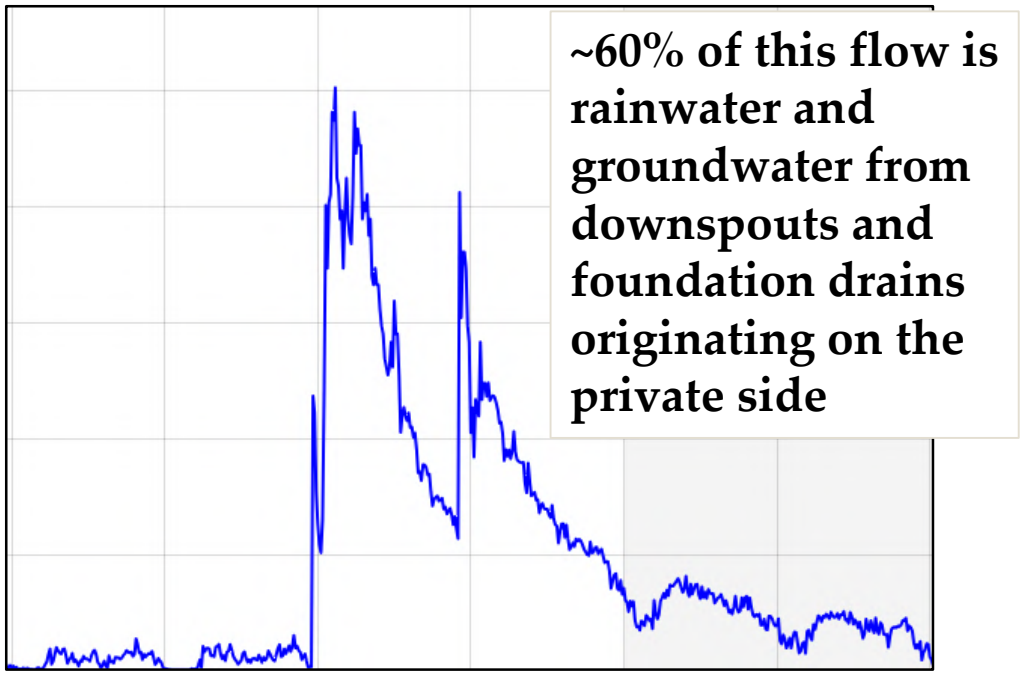
- Unless the municipality enforces downspout disconnection our wastewater treatment plants (WWTPs) continue to treat this clean water, and we continue to build bigger and bigger WWTPs.
- Downspouts connected to the sanitary sewer substantially increase YOUR RISK of flood, and YOUR NEIGHBOURS' RISK!
- It is illegal, today, per all Sewer Use By-Laws in Ontario, to connect rain water or ground water to the sanitary sewer

Look at the amount of flow from one roof leader!

What about DOWNSPOUTS Connected to the Sanitary Sewer?

- Prior to about 1988, it was **legal** to connect roof water (*clean water*) to the sanitary sewer.
- However, it is illegal, today, per all Sewer Use By-Laws in Ontario.
- By-laws are enforceable in present time.
- Connected downspouts are a proximate cause of flooding everywhere!

This is what sewage flow looks like after rainfall:



What happens to sewer flow when it rains?

We use flow monitors inside manholes to measure sewer flow

Once rainwater or groundwater gets into a sewer, it becomes sewage

This is a small rainstorm.
You can see the flow increases substantially when it rains.

This is a big rainstorm!
Oops! What do you think this does to our sewer systems?

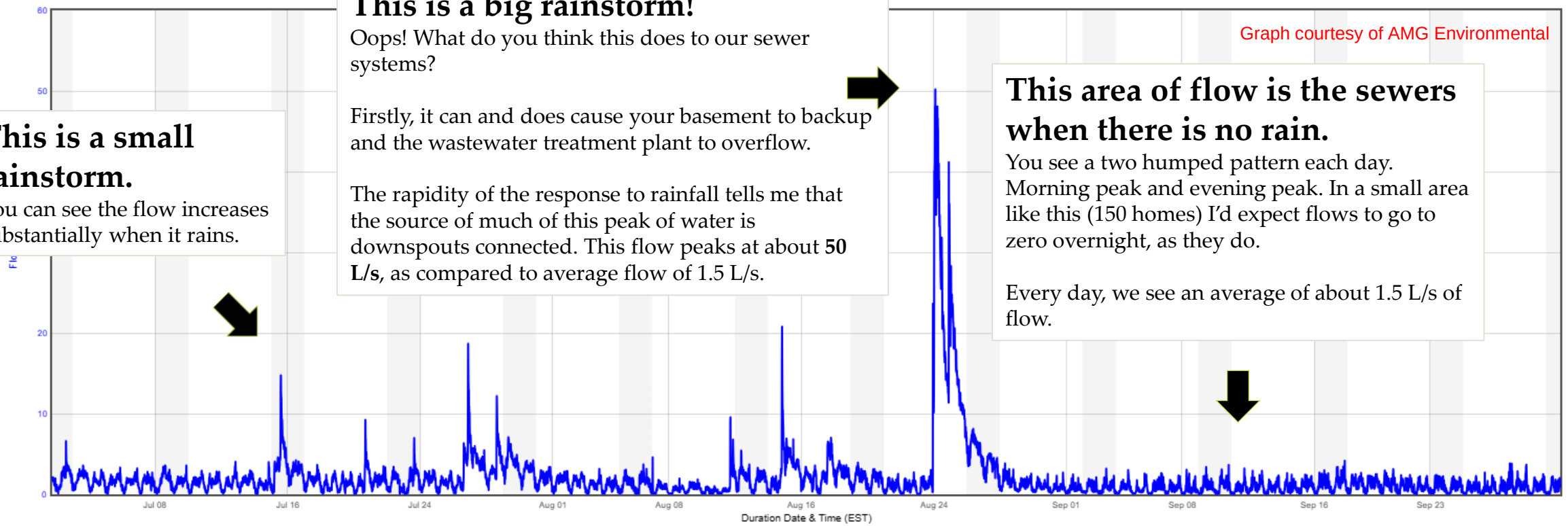
Firstly, it can and does cause your basement to backup and the wastewater treatment plant to overflow.

The rapidity of the response to rainfall tells me that the source of much of this peak of water is downspouts connected. This flow peaks at about **50 L/s**, as compared to average flow of 1.5 L/s.

This area of flow is the sewers when there is no rain.
You see a two humped pattern each day. Morning peak and evening peak. In a small area like this (150 homes) I'd expect flows to go to zero overnight, as they do.

Every day, we see an average of about 1.5 L/s of flow.

Graph courtesy of AMG Environmental



Sewer flow (L/s) vs. Time (days)

Norton has a Simple Solution to Disconnect Roof Leaders

- Let's do this together, as a society: #ontarioroofleaderdisconnectionday #nationalroofleaderdisconnectionday
- What are we waiting for? Climate change is HERE.
- We have to change our behavior – and make it socially unacceptable to have connected roofs (see The Agenda w. Steve Paikin, June 2023).

We must explain to residents that connected roofs increase flood risk for you *and* your neighbours – it substantially increases the water level (hydraulic grade line) in the sewer!

Each and every connected roof costs ~$2,000 per house per year to treat.

All residents pay for this!

Best Practices for Residents:

Operating and Maintaining YOUR SEWER

- If you are a homeowner, you are the proud owner of a sewer (house to property line) and the sewer under your basement floor (“sanitary building drain”)

- Like all If your private sewer lateral is in poor condition Get your sewer CCTV inspected NOW and **Maintain your lateral!**

- A plumber can CCTV inspect your private sewer for about $300. Don’t wait for a flood! Take action now. It is now best practice on the private side also (see CAN/CSA Z800-18 – Basement Flood Protection and Risk Reduction)

Best Practices for Residents:

How to keep Rats out of your House


GTA

Toronto's rats are multiplying, spreading — and winning. So why aren't we doing anything to stop them?

By Amy Dempsey Staff Reporter
Wed., June 5, 2019 | 17 min. read

Article was updated Jun. 06, 2019

Rat infestation in Scarborough – getting into basements via the sanitary sewer

Rats live in sewers


WATERLOO REGION

This is why you should keep your basement toilet seat closed: sewer expert

By Robert Williams Record Reporter
Fri., June 26, 2020 | 2 min. read

Article was updated Jun. 26, 2020

- Rats can get into your house through defects in your sewer, or by swimming up through your basement toilet (really). **Keep the basement toilet lid down at all times**.

- If your private sewer lateral is in poor condition (holes are not uncommon) that's an easy way for rats to get in. Get your sewer CCTV inspected NOW and **Maintain your lateral!**

How do Sewer Rats End Up in the Toilet?

Sewer rats, which are commonly known as Norway rats, are exceptional swimmers. They can paddle with their legs and use their long tails as rudders to guide them in the right direction. They're also long-distance swimmers. Certain species of rats can hold their breath for three minutes and tread water for up to three days. Some sewer rats can swim more than a mile. There is plenty of pipe for them to run in as well.

Rats, on the other hand, don't fare well when they're hungry, so when food becomes short, they go on the hunt for new locations to eat. The sewer, of course, provides easy access to your drain pipes and food in your home. Rats will also consume feces if there aren't any other food sources accessible. When you consider that rats have hinged rib cages, which allows them to enter your home through narrow pipes, it's easy to see how they could end up in your toilet bowl.

Source: 1-Tom-Plumber (USA)

Best Practices for Residents:

Your Sump Pump

- Check your sump pump spring and fall. Fill the sump with water to ensure that the pump engages.
- If your sump pump never runs, how do you know it’s operational?
- Sump pumps have a design life of 10 to 15 years.
- If your sump pump runs frequently, it means you are depending on it to protect your home. You should consider a **backup sump pump** and/or **backup power**. Water alarms to your phone are also available. Call your plumber.
- Disconnecting your sump pump and re-routing the water to the sanitary sewer is **illegal** and substantially increases your risk and your neighbors' risk of flood!

Sump water illegally connected to the sanitary sewer

Best Practices for Residents:

Ensure that your roof gutters and downspouts are always clear and in good working order

- If your gutters are blocked with leaves, the rainwater can overtop them and then runs down the wall of your house.
- This water can easily get into your weeping tiles (foundation drains) and add more water than the system can handle.
- Potential Result? Basement flood.
- 5” gutters provide more protection than 4”

Best Practices for Residents:

Check your insurance policy

- Most insurance policies **only cover sewer backup** (i.e. when the public side sewer gets surcharged, or your personal sewer gets blocked).

- Overland flooding (i.e. stormwater that gets down your basement wall) is typically **not included** in a standard policy.

- The average basement flood costs $60,000 *(I recommend buying the extra insurance).*

Your insurance may not cover this kind of flooding
(the type expected with climate change)

What can YOUR municipality do?

Norton's **Big 5** Efficient and Cost-Effective Solutions

- Flow monitor all new subdivision sewers to ensure they meet allowable leakage values.
- Adopt a Norton "Sewers are NOT Trash Cans" program. ROI = 100%.
- Enforce your sewer use by-law to disconnect downspouts, by appealing to residents with public education.
- Have building inspectors inspect basement plumbing for illegal diversion of sump water to sanitary, every time they visit a home.

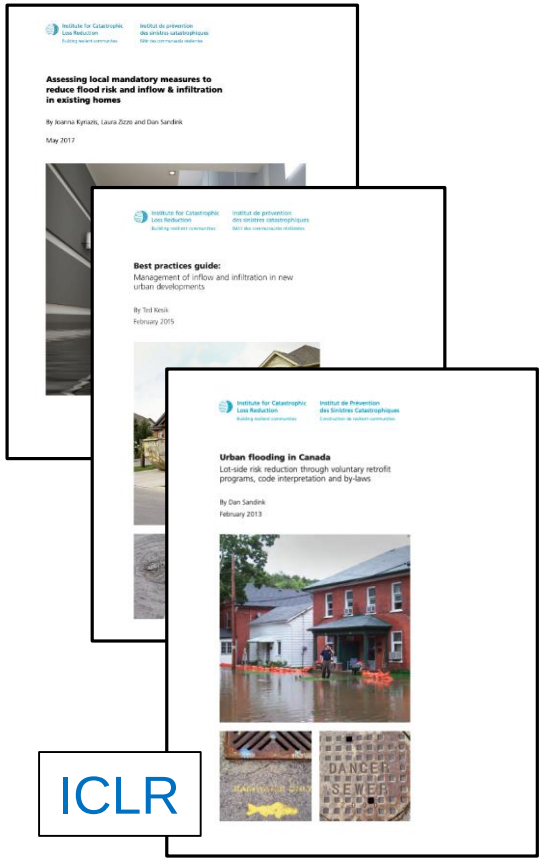
Ask Your Municipal, Ontario or Canadian Politician about Leaking Sewers

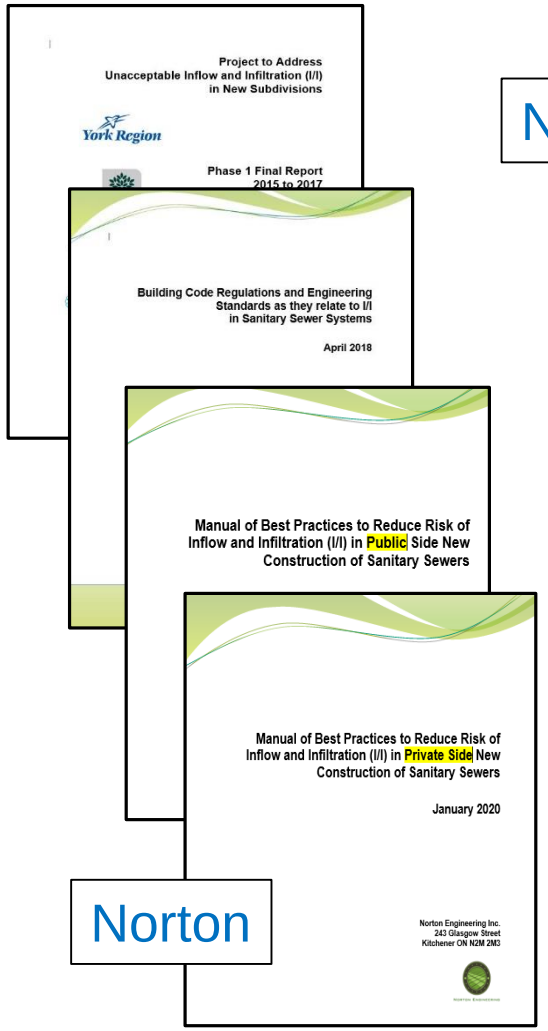
- There are now two national sewer guidelines: best practices for new sewers and best practices for existing sewers.

- Norton is working to get things changed at the provincial and federal level, as it has been virtually impossible for municipalities to effect these simple best practices.

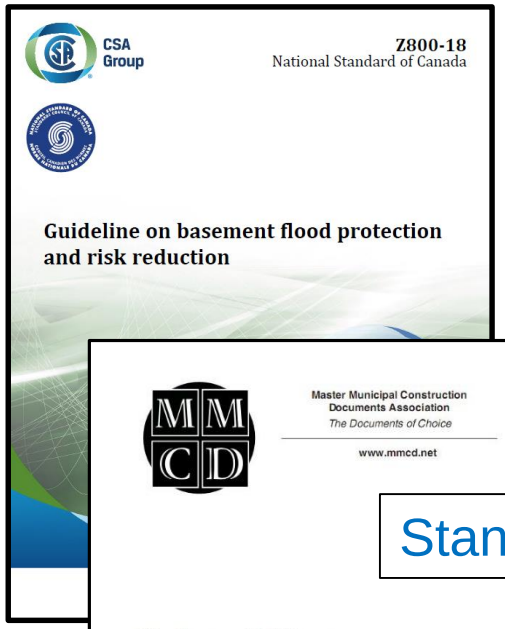
Waterloo Liberal MP the Honourable Bardish Chagger has been supporting Norton's work for years

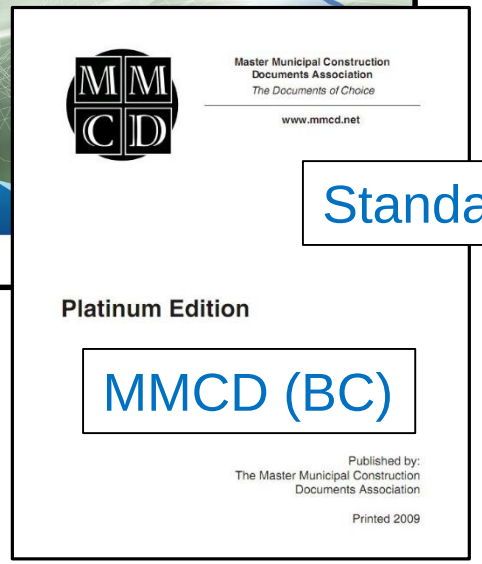
There is an enormous amount of background research on Sewers

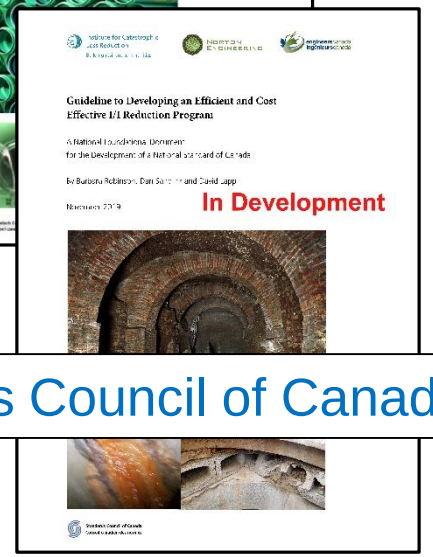




National Research Canada







Standards Council of Canada

QUESTIONS?