

Report to Civic Works Committee

To: Chair and Members
Civic Works Committee

From: Kelly Scherr, P.Eng., MBA, FEC
Deputy City Manager, Environment and Infrastructure

Subject: Unwanted Water: Quantifying Inflow and Infiltration in
London's Wastewater Sewer System

Date: December 14, 2021

Recommendation

That on the recommendation of Deputy City Manager, Environment and Infrastructure, the following report on quantifying the impacts of the City's unwanted water issues **BE RECEIVED** for information.

Executive Summary

Purpose

The purpose of this report is to provide more detail to Council on the unwanted rain and groundwater entering the City's wastewater collection system. This unwanted water is the primary cause of sewage bypasses and overflows to the Thames River and residential basement flooding. This is the third of a series of reports on the problem of unwanted water in the City's sewer system.

Context

The City's wastewater sewer system is intended to collect household sewage (showers, sinks, and toilets), commercial sewage (restaurants, offices, retailers), and industrial sewage (large and small industries). Wastewater flows from a building and are conveyed through a network of sewers to a wastewater treatment plant. The wastewater treatment plant treats the water which is then discharged to the Thames River. All other water, for example rainwater and groundwater, is not intended to enter the sewer system. In the field of civil engineering these unwanted sources of water are referred to as "inflow and infiltration", but for the purposes of this initiative, the term "unwanted water" is used to describe any water that is not intended to be collected by the wastewater sewer system. Unwanted water is the primary cause of overflows and bypasses of wastewater into the Thames River and the primary cause of basement flooding.

Linkage to the Corporate Strategic Plan

This recommendation supports the following 2019-2023 Strategic Plan areas of focus:

- Building a Sustainable City:
 - London's infrastructure is built, maintained, and operated to meet the long-term needs of our community by replacing aged and failing infrastructure with new materials and sizing new infrastructure to accommodate future development; and
 - Protect and enhance waterways, wetlands, and natural areas.

Analysis

1.0 Background Information

1.1 Previous Reports Related to this Matter

- Civic Works Committee – Sept 21, 2021 – Agenda Item #2.3: Sewage Overflows and Bypasses Into the Thames River – Sanitary Cross Connections

- Civic Works Committee – April 20, 2021 – Agenda Item #2.3: Sewage Overflows and Bypasses Into the Thames River
- Civic Works Committee – April 17, 2018 - Agenda Item # 2.5: London Pollution Prevention and Control Plan - Final Master Plan

2.0 Discussion and Considerations

2.1 Where does unwanted water come from?

All wastewater collection systems servicing large Cities across North America experience some degree of unwanted water. The sources of unwanted water in the City of London's wastewater collection system have been studied in detail in the City of London for many years and are well understood. These sources can be grouped into four categories: combined sewers; weeping tile and downspout connections; an aging sewer system; and illegal connections in areas built in the 1980-2020s. The following sections will describe these sources in further detail.

Combined Sewers

A major contributor of unwanted water in London historically has been combined sewers. Combined sewers were constructed up until the early 1960s and were designed to carry both wastewater and stormwater in the same pipe. Rather than the stormwater traveling to a stormwater treatment pond or the river, the stormwater was sent to the wastewater treatment plant. Over the last 20 years, the City has been aggressively replacing combined sewers with modern sanitary and storm sewer systems. Currently, only 1% of the City of London's sewer system are combined sewers.

Weeping Tile and Downspout Connections

Currently the largest sources of unwanted water in London's sewer system are weeping tile and downspout connections. Prior to 1984, the building code allowed connection of a home's weeping tiles to the City's sanitary sewer system allowing in large amounts of rain and groundwater. There are an estimated 50,000 weeping tile connections contributing unwanted water to the City's sanitary collection system.

The Basement Flooding Grant Program provides a 90% subsidy to separate weeping tiles from the sanitary sewer and install sump pumps and backflow valves. This protects the individual property from basement flooding and eliminates some unwanted water from the sanitary system. The Targeted Weeping Tile Disconnection Program is a City-led program that separates weeping tiles from the sanitary sewer in targeted neighbourhoods to realize a noticeable reduction in unwanted water in the sanitary system and produce a neighbourhood-wide benefit.

An Aging Sewer System

As sewer pipes age they eventually start to deteriorate. This results in cracks, breaks, and open joints between pipe sections and connections. Groundwater can then infiltrate through these small cracks and open joints. Sewer video inspections often find locations where the amount of groundwater flowing into a sewer is similar to the flow of water from a household sink faucet. When there are heavy or sustained rainfall events, the groundwater level will rise and infiltration increases in pipes, adding to the unwanted water in the wastewater collection system. This problem has historically been addressed by either replacing sewers through the City's Infrastructure Renewal Program or relining sewers through the City's Sewer Lining Program. New technologies are emerging that are also capable of lining sewer maintenance holes which could eliminate additional sources of unwanted water.

Illegal connections in Areas Built in the 1980-2020s

Large quantities of unwanted water can also be observed in newer areas of the city constructed between the 1980s and 2020s. Although new sewers are constructed to minimize unwanted water, there are situations where illegal connections are made to the sewer system without the City's approval. Examples include:

- Post-construction sump pump connections – sump pumps that have either been connected to the main sewer vent or directed to a laundry tub,
- Clean out caps being left off the sanitary sewer clean out, which turns the sanitary drain into a weeping tile, and
- Draining of rainwater from open basements during new home construction.

2.2 How much unwanted water does the City of London experience?

A 2018 study completed by KPMG identified that the City of London, when compared with neighbouring municipalities of similar size, experienced approximately 2.5 times the amount of inflow and infiltration into our wastewater collection systems as other similar municipalities. Using a high-level approach, KPMG estimated that in 2017 these extraneous flows imposed an additional operational cost of \$1 million on the City's wastewater treatment plants. However, this cost estimate only considered the operational cost of wastewater treatment facilities, and likely significantly underestimates the true cost to the City associated with this issue.

As a follow-up to the KPMG study, City Staff have undertaken a more detailed review to quantify the amount of unwanted water treated at our wastewater treatment plants. The review of City data suggests that the KPMG estimate of unwanted water is low. In 2019 the proportion of unwanted water treated at London's treatment plants was 44%. Figure 1 provides a historical representation of the inflow and infiltration rate.

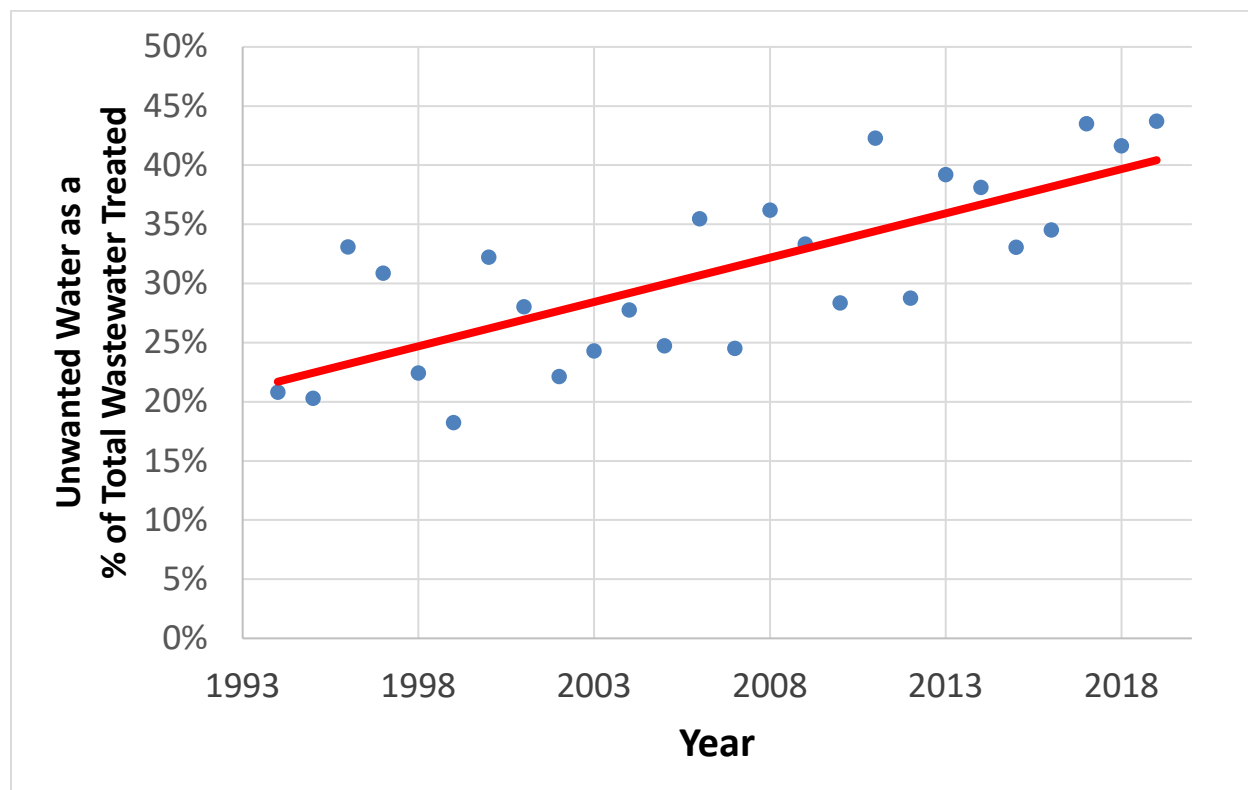


Figure 1: Unwanted water treated as a percentage of total wastewater volume.

Several factors may be responsible for the observed trend, which has increased over time:

- The elimination of some overflow locations from the sewer system, as was recommended by the 2018 Pollution Prevention Control Plan, has resulted in less flow discharged to the environment, but more flows conveyed to wastewater facilities.

- Climate change has been identified as increasing the severity of storm events experienced in the City. Western Researchers recently reported that a 100-year-flood in London is now occurring every 30 years. This may be increasing the amount of extraneous flow entering our sewers.
- Ongoing deterioration of sewers, allowing greater potential for infiltration.

2.3 Operational Impacts from I/I

KPMG estimated that unwanted water results in additional operating costs at the City's wastewater treatment plants of \$1 Million per year. Although the methodology of determining this number was not provided, based on our estimates of reduced energy and chemical costs, a \$1 Million per year savings is a reasonable estimate at this preliminary stage of the investigation. Based on an evaluation of 2018 potable water and wastewater data, unwanted water is estimated to account for an additional cost of \$400,000 per year in additional energy to power the City's wastewater pumping stations. Thus, at a high level it imposes an additional annual operational cost of \$1.4 Million.

2.4 Environmental Impacts of Unwanted Water

Unwanted water and the associated high wet-weather flows result in basement flooding as well as the overflow and bypass of untreated wastewater into the environment. These impacts present a health risk to the public and our environment. With the City pursuing the removal of overflows from the wastewater collection system, our wastewater treatment plants are being pushed harder and occasional bypasses and overflows are the result. Making efforts to reduce the wet weather flows that produce these events can improve our performance. Addressing unwanted water is the most effective way of achieving these results.

The City continues to monitor the quantity of overflows and bypasses, both at the wastewater treatment plants as well as at direct overflow points in the collection system. As well, the Thames River is sampled on a regular basis as part of a monitoring program at ten locations. Water quality in the Thames River has improved significantly since river monitoring was initiated in 1963. The dissolved oxygen levels have increased. Wastewater treatment has improved from 90% efficiency in the 1960's to the present where 99% of the Biological Oxygen Demand (BOD) is removed. London's plants perform better than typical wastewater secondary treatment processes that have a removal efficiency of between 85% and 95% for BOD.

3.0 A Strategy for Reducing Unwanted Water

Staff propose to undertake a detailed investigation into all the sources of unwanted water in London in order to provide recommended solutions for Council's consideration. The goals of strategy are to both reduce the risk of basement flooding and reduce and eliminate sewage bypasses and overflows.

Phases of this work will include:

1. Provide a detailed evaluation of each of the following sources of unwanted water:
 - a. Combined sewers,
 - b. Weeping tile and downspout connections,
 - c. An aging sewer system, and
 - d. Illegal connections in Areas Built in the 1980-2020s.
2. Develop a working list of policies, projects, and programs to address each source of unwanted water,
3. Evaluate possible solutions to address the unwanted water problem, and
4. Establish a plan of recommended solutions for reducing unwanted water in the City of London.

The evaluation of these options will follow a process similar to an Environmental Assessment in which the risks, opportunities, and impacts of each option are considered against multiple criteria including:

- social impact,
- environmental benefit,
- technical feasibility and risk,
- cost and administrative difficulty, and
- potential for reduction of unwanted water.

The results of the analysis will be brought back to committee as a series of reports. The intention is to complete this analysis so that any resulting projects can be incorporated into the next multi-year budget process.

Conclusion

Unwanted water has been an issue associated with London's wastewater collection systems for many years. While recent progress has been made to remove combined sewers, the volume of unwanted water remains high causing overflows and bypasses to the Thames River and causing residential basement flooding. It is recommended that the strategy outlined in this report be implemented with the intention of incorporating the results into the next multi-year budget submission.

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