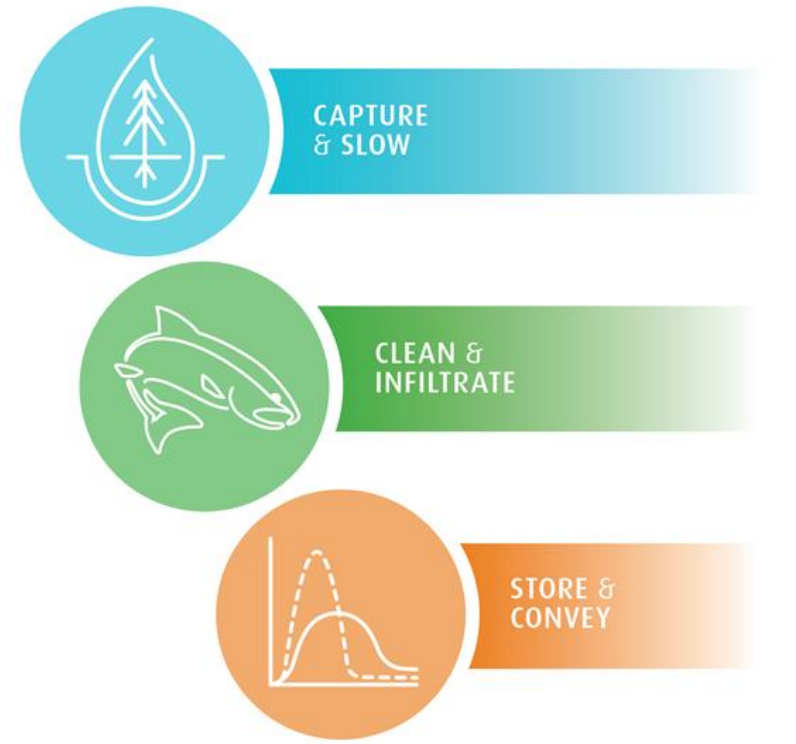

SUPPLEMENTAL 2 – LEAKY SANITARY SEWERS & GREEN STORMWATER INFRASTRUCTURE FOR STORMWATER MANAGEMENT PRACTICES

Green Stormwater Infrastructure Design Guidelines for the Capital Region

SPRING 2019

Leaky Sewers & Green Stormwater Infrastructure Management Practices[1]

This section is divided into the following headings:

- Overview
- Interaction between leaky sewers and green infrastructure
- Research to date
- Who's responsible for leaky sewers
- How municipalities identify areas with leaky sewers
- Recommendations.

Overview

Sewer systems deteriorate over time resulting in sewer pipes that are leaky. Stormwater cross-connections (i.e., roof drains connected to the sanitary sewer system) are not permitted under the plumbing code and further contribute to sewer leakiness. A certain amount of sewer leakiness is unavoidable and is accounted for in typical sewer design. However, if leakage rates are high, the capacity of the sewer system can be overwhelmed, resulting in sewer overflows to the environment and basement flooding.

Leaky sewers may also interact with green infrastructure. The interactions may be positive, negative, or neutral. It's important to understand the site-specific interactions between green infrastructures and leaky sewers. It's also important for municipalities and homeowners to inspect their sewer pipes and to maintain/repair them to address sewer leakiness, as appropriate.

Interaction between Leaky Sewers and Green Stormwater Infrastructure

The interactions between leaky sewers and green infrastructure are site-specific and may include 1 or more of the following:

1. Leaky sewers can act as a "drainage field". By repairing them, more stormwater stays in the ground which supports the goals of green stormwater infrastructure.
2. Leaky sewers may leak sewage to the environment resulting in contamination, etc. This is against the principles of green infrastructure.
3. Actions that decrease the amount of water entering leaky sewers will decrease the likelihood of downstream sewer overflows, beach closures, etc. Conversely, actions that increase the amount of water entering leaky sewers may contribute to these negative outcomes.
4. Green infrastructure can reduce the potential for water entering leaky sewers by capturing and infiltrating stormwater into the ground. This reduces the potential for clean water to enter leaky sewers on site or downstream.

[1] Authored by: Opus International Consultants (Canada) Limited

5. Green infrastructure may be used as a tool for addressing improper stormwater cross-connections (i.e., stormwater pipes directly connected to the sewer). This is done by redirecting stormwater away from the sewer system to green infrastructure which infiltrates into the ground. This is especially valuable in areas with combined or semi-combined sewers. Examples of stormwater infrastructure that may be cross-connected include downspouts, foundation drains and sump pumps.
6. Green stormwater infrastructure facilities (such as those discussed in this document) are generally designed to increase stormwater infiltration into the ground instead of being directed into the stormwater drainage system. However, if there are leaky sanitary sewers located downslope of the green stormwater infrastructure, the water may drain into these sewers reducing the benefits of the green infrastructure.
7. Green infrastructure may raise the water table resulting in more water entering leaky sewers.

Research to Date

To date, minimal research has been carried out looking at the interactions between leaky sewers and green infrastructure.

One of the few organizations to carry out such research is the Milwaukee Metropolitan Sewerage District.[2] They commissioned 4 studies which evaluated the infiltration of porous pavements, rain gardens, and stormwater ponds into nearby sewers. Of note:

- The study authors recommended that smaller-scale green stormwater infrastructure facilities should be at least 3 m (10 feet) away horizontally from sewer pipes in order to reduce the chances of infiltration into the sewer pipes.
- No infiltration into sewer pipes was detected from large-scale stormwater ponds located 18 m (60 feet) from sewer the pipes. Tests were not completed on ponds located closer than 18 m.

It's preferable to build Green Stormwater Infrastructure (GSI) away from sewer pipes.

More research on the relationships between green infrastructure and leaky sewers would be greatly beneficial. Research linking the effects of green infrastructure to leaky sewers and the effects of soil types on this relationship would provide governments with increased knowledge on the use of their suite of stormwater management tools.

[2] Fresh Coast Green Solutions – Weaving Milwaukee's Green and Grey Infrastructure into a Sustainable Future, Milwaukee Metropolitan Sewerage District
https://www.mmsd.com/application/files/8514/8779/6598/SustainBookletweb1209.pdf

Who's Responsible for Leaky Sewers

The local governments within the CRD are responsible for the municipal sewer mains and the portion of laterals located between the mains and the property line.

Property owners are responsible for sewer laterals located between their homes/buildings and the property line.

The exception to this is in Oak Bay where property owners are responsible for the full length of their sewer laterals between the home/building and the municipal sewer main.

How Municipalities Identify Areas with Leaky Sewers

The municipalities in the CRD routinely collect data on the condition of their sewer system. They understand that sewer systems deteriorate over time and require periodic inspection, maintenance, repair and eventual replacement. Leakiness is an indication of sewer health. To identify sources of leakiness, municipalities use the following methods:

Figure 1 Construction Specifier Magazine. Photo Credit: City of North Bay

1. **Flow monitoring** involves measuring sewer flows over time and analyzing the data along with rainfall data to quantify sewer leakiness.
2. **Closed circuit television inspections** use a video camera to record the condition of a sewer pipe. The video footage is reviewed to identify locations of sewer pipe defects and leakages.
3. **Dye testing** can be used to confirm connections within the sewer system. A non-toxic dye is added to a pipe and a downstream sewer manhole is monitored for the presence of the dye.
4. **Smoke testing** is used to identify stormwater cross-connections to the sanitary sewer system. Smoke is injected into a sanitary sewer manhole and the surrounding area is monitored to see where smoke comes to the surface. The smoke is non-toxic, stainless, odourless and vegetable based. Smoke testing is a key tool for identifying cross-connections from private properties.

Municipalities also encourage property owners to get camera inspections of their private property sewer laterals and maintain their pipes, when appropriate.

Figure 2 Infiltration basin located away from sewer pipes. Photo Credit: Construction Specifier Magazine

Recommendations

1. Site-specific interaction between leaky sewers and green infrastructure should be considered prior to undertaking work related to leaky sewers or green infrastructure.
2. When practical, smaller-scale green infrastructures should be located at least 3 m (10 feet) away horizontally from sewer pipes in order to reduce the chances groundwater draining into leaky sewer pipes.

   It's understood, however, that this recommendation may not be suitable in some situations. For example:

   - The use of permeable paving above a sewer lateral in an area with good drainage.
   - The use of green infrastructure in a narrow municipal "right-of-way" where conditions found to be acceptable.

   Site-specific expert judgement should be used to determine when the use of green infrastructure within 3 m of a sewer is considered practical.
3. Green infrastructure should receive strong consideration when addressing the issue of stormwater cross-connections (stormwater pipes directly connected to the sewer). This is especially important in areas with combined sewers or semi-combined sewers.
4. Fixing leaky sewers will improve the performance of GSI facilities.