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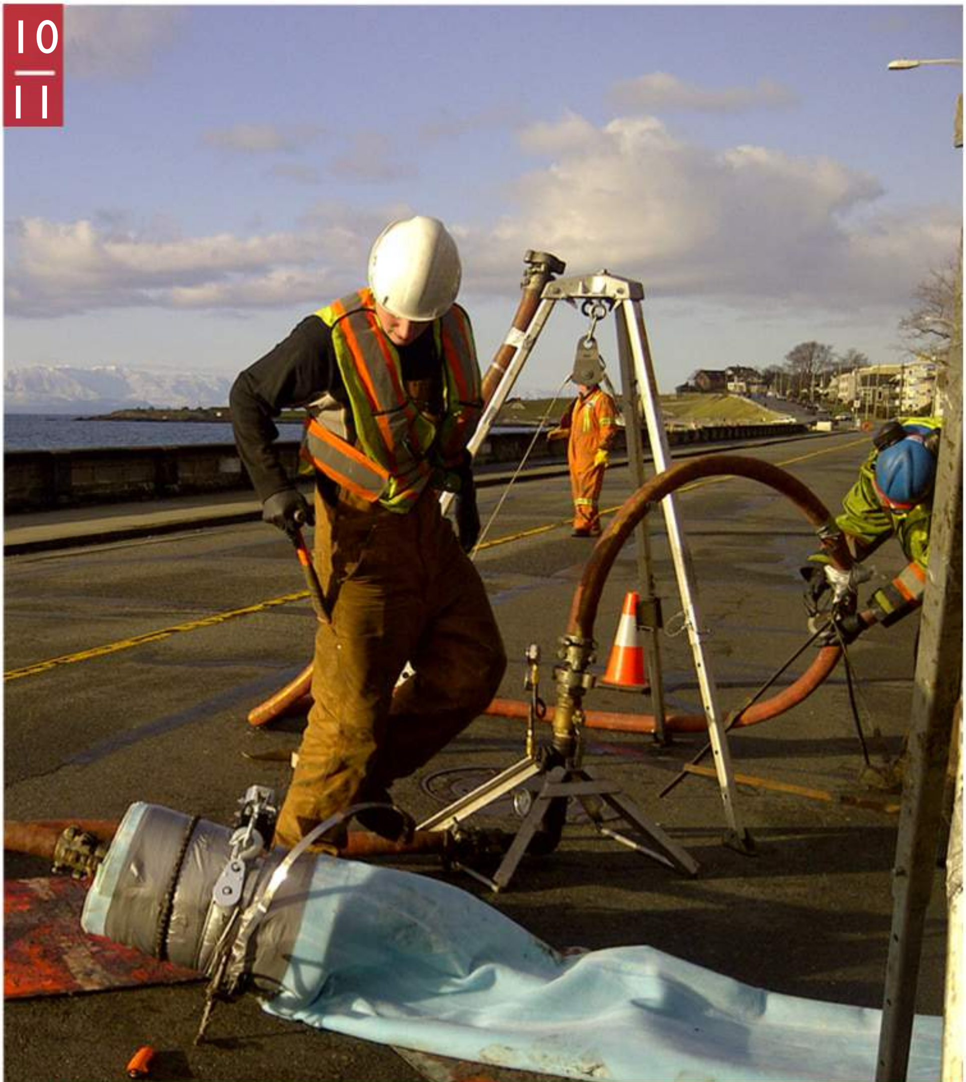

VICTORIA

Reducing Inflow and Infiltration

Source: City of Victoria

THE SCIENCE

Extreme rainfall events temporarily increase demands on stormwater systems and increase the volume of rainwater flowing into streams and rivers, but, in theory, should have a relatively small impact on flows through independent sanitary pipes to treatment facilities. However, many municipalities experience alarming growth in flows through sanitary sewers, increasing the costs of wastewater treatment and increasing the risk of flooding. There are a number of actions local governments can take to control and reduce the inflow and infiltration of excess water into sanitary sewer systems. Reduced volumes of rainwater in sanitary sewers provide savings to the community because they can reduce the need to spend on increased sanitary system capacity and wastewater treatment costs. More importantly, less rainwater in sanitary systems reduces the risk of sanitary sewer backup damage to homes.

The 2012 Canadian Infrastructure Report Card noted that 40 to 50 percent of participating local governments have no data on the state of their buried infrastructure. The study estimated that perhaps 20 percent of Canada's wastewater and stormwater infrastructure was in "fair" to "very poor" condition. Local governments likely need more than $55 billion to replace these failing systems, beyond the significant funds also needed to modernize infrastructure for drinking water, roads and address other pressing needs.

The risk of preventable damage due to aging sewers and wastewater infrastructure is often most acute in older neighbourhoods across Canada. Some storm and wastewater systems are being required to serve for decades beyond their original design, and to cope with a significant increase in demand. Canadians experience extensive damage each year from sanitary waste backing up into homes, and environmental damage as untreated sanitary waste is discharged into streams and lakes. These losses, triggered by extreme rainfall, are largely preventable.

THE TRIGGER

In 2009 the Capital Regional District's Liquid Waste Management Plan mandated that each municipality in the region should not be exposed to peak wet weather sanitary sewer flows that exceed four times average dry weather flows. Flows in the City of Victoria were known to be above this target. The City needed to establish and implement a plan to better control the inflow and infiltration of rainwater into the sanitary sewer system.

The James Bay area within the City of Victoria was largely developed in the late 1800s. Much of the sewer infrastructure in the area consists of vitrified clay pipes with butt-joints for sewer mains and laterals. Aging infrastructure is highly vulnerable to inflow and infiltration of stormwater during heavy rainfall events. Extreme rain events can bring a sudden surge in the volume of water passing through the sewers and can result in the backup of sanitary waste into homes and the discharge of untreated sewer water into the environment.

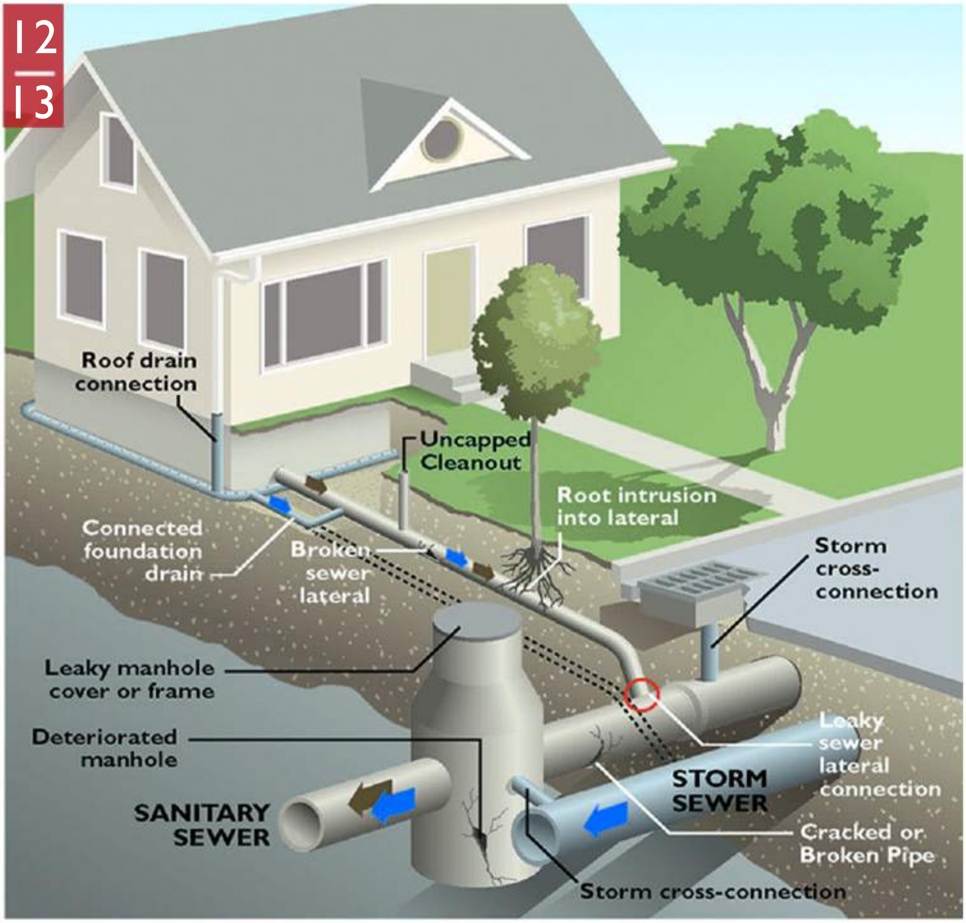

Figure 3: *Different sources of Inflow and Infiltration (Source: B.C. Capital Regional District)*

THE APPROACH

During the planning phase, the project focused on determining how stormwater was entering sanitary sewer pipes in the James Bay area. This involved video inspections of the sewer system, smoke and dye tests, and the collection of flow monitoring data. Through this phase, the James Bay area was divided into smaller sections and isolated sources of inflow and infiltration were identified in each section.

During the subsequent design phase, four different approaches to reduce inflow and infiltration were tested, with a focus on the use of trenchless technologies. This included mainline rehabilitation using pipe bursting and cured-in-place pipe lining, lateral rehabilitation using pipe bursting and cured-in-place lining, manhole rehabilitation using a coating system and internal chimney seals, and stormwater inflow redirection through the elimination of cross connections.

During the evaluation phase, flow monitoring was conducted to measure the reduction of stormwater in sanitary sewer pipes once the rehabilitation work was completed. Rehabilitation was conducted in three of four sub-catchment areas so the fourth basin would provide a benchmark for evaluating progress.

THE OUTCOME

Victoria's study in James Bay revealed that mainline and lateral sewer rehabilitation contributed to a 60 percent reduction in stormwater inflow and infiltration. Moreover, the study also found that manhole rehabilitation and stormwater inflow reduction were not effective in reducing inflow and infiltration when conducted as individual measures with no attention to sewer main and laterals.

The City of Victoria was unlucky with the timing of its study since very few rainfall events happened during the time allocated for data collection. However, the study was successful in that it now provides Victoria with a blueprint for future inflow and infiltration reduction programs in the City. Other objectives were related to the elimination or reduction of sanitary sewer overflows, the improvement of public safety by lowering the risk of sewer collapse, the reduction of future sewage treatment costs and public education. Investments in local research and testing like Victoria's study in James Bay provides important knowledge to support future actions by the City to address long-term issues.

A WORD FROM VICTORIA

The study conducted by the City of Victoria helped the engineering department to establish a long-term plan to best manage their current infrastructure and decide in which cases they should adopt renewal or rehabilitation practices. According to Adam Steele, Sewer and Stormwater Quality Technologist Underground Utilities for the City of Victoria, the study gave the team more confidence in the effectiveness of specific methods and helped them decide which technologies were the most appropriate under specific circumstances. "It also helped to identify sufficient flow monitoring timelines pre- and post-renewal/rehabilitation to quantify the success of our I&I reduction program," said Mr. Steele.

When asked what advice he would give to other municipalities that would like to conduct a similar study, Mr. Steele said, "As new technologies emerge, being able to evaluate them through an exercise like this is useful to help justify rehabilitation and renewal expenditures." He also recommended a minimum of one year for data collection during the study period to cover a range of rain storm intensities and durations. Having an appropriate area with similarly sized catchments and similar inflow and intrusion rates through the different catchments is important in comparing the effectiveness of the technologies used.