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Managing Infiltration and Inflow in the Wastewater Collection System

The summer tourism season in Estes Park is upon us. What does that mean for Upper Thompson Sanitation District? The influx of tourists and seasonal residents to Estes Park during the summer results in operational changes to the District's wastewater collection and treatment infrastructure. In the summer months the average hydraulic and solids loading into the collection system and treatment plant more than double to create an intensified environment of process control.

In previous articles I have discussed challenges the District faces to keep the 40-year-old wastewater treatment plant in excellent working order. In this article I will explain the three major components of wastewater flow in a sanitary sewer system and the importance of regular maintenance, repair, and rehabilitation of the underground sewer lines.

Water flow into the collection system is comprised of 1) sanitary wastewater from residential and commercial sources, 2) groundwater infiltration, and 3) rainfall derived inflow from surface sources. Sewer systems will experience some level of infiltration and inflow (I/I) as a result of age, installation quality, and proximity to I/I sources such as creeks, rivers, lakes, and storm water channels. Small quantities of I/I are acceptable and incorporated into the design of collection and treatment systems. However, large quantities of I/I put undue strain on the collection and treatment systems, which, in turn, affect the District's operation and capital budgets and directly impact services rates. Although I/I is typically low in solids, I/I causes dilution of the wastewater resulting in decreased solids removal efficiencies and increased pumping power costs. The 2013 flood is an extreme example of excessive I/I entering the District's wastewater collection and treatment system. The 2013 flood resulted in increased infiltration from an elevated groundwater table and increased inflow from high creek and river flows. Although the creeks and river levels dropped over a few months, the groundwater table remained elevated and resulted in infiltration for well over a year.

As collection pipes are located underground and out of sight, problems often go undetected until unplanned emergencies occur throughout the system. System emergencies include sewer backups that result in sanitary sewer overflows (SSOs). SSOs, if not contained, cause contamination of nearby freshwater creeks, rivers, and lakes as well as regulatory fines from the State of Colorado. The District monitors, inspects, and assesses the condition of more than 92 miles of collection system using jetting and televising equipment. Pipe damage and other causes for sewer backups are identified and repaired to minimize unexpected emergency costs and disruption of service. The continued inspection and assessment of the collection system allows the District to manage risk, avoid emergencies, prioritize repair and replacement projects, and plan for future expenditures.

Interestingly, one of the most common problems District staff encounter while assessing sewer line condition is root intrusion. Roots enter the collection system through cracks in pipes, searching for water. Root intrusion leads to obstructions of the sewer line flow and sanitary sewer overflows, if not eliminated. Accordingly, District Rules and Regulations prohibit landscaping within sewer line easements to limit root intrusion of sewer lines and to provide access for system operation and maintenance.

Clay pipe was the standard material used in the early 1970's to build sewer lines. Much of the UTSD collection system is 40-year-old clay pipe and is in need of repair and/or replacement with modern materials such as PVC pipe. It is difficult to determine the quantity of inflow and infiltration in a collection system due to cracks, joints, and displaced pipes. District inspections and assessments lead to the development of a priority list for maintenance, rehabilitation, and repair of the sewer system to reduce I/I. Annually the District budgets for maintenance, incremental repairs, and rehabilitation of the collection system. Approximately 62% of the District's 2016 capital budget is allocated to sewer line improvement projects such as point repairs, manhole rehabilitation, collection line replacement, and force main rehabilitation.

The hydraulic capacity, or flow, is a primary performance measure for a wastewater collection system and treatment plant. Sewer systems and treatment plants are designed around expected average and peak flows. Excess I/I including storm water and groundwater entering the sewer system displaces wastewater flow capacity, burdens operation and maintenance processes, and reduces the life expectancy of treatment structures and equipment. The District's planned infrastructure improvements reduce I/I and allows future collection system upgrades. As a result, treatment plant capacity expansion projects are implemented for wastewater customers instead of inflow and infiltration.

Open House and BBQ

Join Upper Thompson Sanitation District for its 2nd Annual Open House on Friday, June 24, 2016, from 4 to 7 pm. Bring your family to enjoy burgers, hot dogs, and refreshments; chat with the staff; meet the Board of Directors; and tour the treatment plant. We are celebrating our 45th anniversary and 40 years of wastewater service to the Estes Park community. See what happens at the end of the sanitary sewer line – the finale of your flush!