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Charlotte Water, North Carolina

Utilizes Smart Sewer Technology to Eliminate Sanitary Sewer Overflows

Charlotte Water, the largest water and wastewater utility provider in the Carolinas, received an Administrative Order from the Environmental Protection Agency (EPA), mandating the reduction of sanitary sewer overflows (SSOs) occurring throughout the sewer collection system. SSOs numbered 419 at the beginning of the order in FY2007, corresponding to 10.8 overflows per 100 miles of pipe.

More than a million customers are served by Charlotte Water in the City of Charlotte and greater Mecklenburg County. The utility's collection system includes 4,562 miles of wastewater mains, 78 lift stations, and seven wastewater treatment plants that process more than 85 million gallons of water per day.

Highlights:

- Reduced number of SSOs by nearly 70%

- Prevented 60 SSOs with real-time alarms in FY2023

- Utilized SNAP to identify high-risk locations based on spill probability

- Deferred $400,000 in equipment replacement costs

The Challenge

To combat the overflows, Charlotte Water initiated massive rehabilitation and relief sewer projects. The completion of those projects and the release from the Administrative Order in 2012 caused an operational shift to a broader condition assessment and operations-based approach. Charlotte Water looked for a more automated way to proactively monitor hotspots in the system in order to preserve the utility's assets and resources.

The Solution

Charlotte Water deployed SmartCover's real-time satellite sewer monitoring technology in targeted creek basin hotspots to prevent SSO's, reduce inflow and infiltration (I&I) in the system, and drive cleaning schedules.

Charlotte Water utilized SmartCover's unique risk assessment tool, Smart Nodal Analysis Protocol (SNAP), which helped identify and prioritize system locations where spills were most likely to occur.

Based on the Vulnerability Self-Assessment Tool developed by Sandia National Labs after the 9/11 terrorist attacks, SNAP incorporated Charlotte Water's field historical data with the physical properties of the collection system to identify and prioritize locations for smart sewer monitoring. This analysis allowed Charlotte Water to greatly reduce spill risks while minimizing the costs of basin coverage.

The SNAP tool incorporated the evaluation of the probability of an event and the potential consequence of that event. Spill probability included elements such as previous spills, intense cleaning areas, aging infrastructure, I&I regions, lift stations, etc. as compared with the evaluation of the consequences of a spill where it could potentially occur such as schools, parks, commercial areas, rivers, lakes, etc.
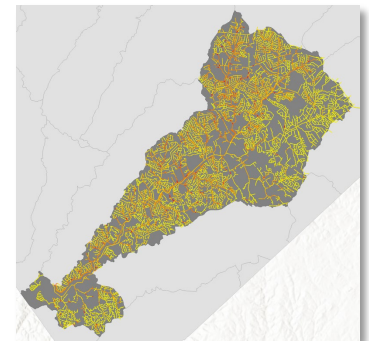

Spill Consequence x
Spill Probability = Spill Risk

The Results

Through the evolution of their team and program to include smart sewer technology, Charlotte Water reduced the number of SSOs by nearly 70% through FY2022. During FY2023, spills were reduced another 24%. The real-time alarms prevented 33 SSO's in FY2022 and more than 60, in FY2023, preserving public health, the environment, utility assets and resources.

The integration of real-time analytics and data has also helped Charlotte's program evolve into an optimized cleaning program, driving prescriptive maintenance leading to the preservation of money and resources by cleaning on an as-needed basis rather than on a rigid schedule.

Prescriptive maintenance work was grouped by location, decreasing unnecessary driving, minimizing wear and tear on combination trucks, extending their service life, and delaying additional $400,000 replacement costs for vehicles. By not overcleaning the pipe, additional repairs were eliminated, lowering operational risk to labor, and saving internal and contracted costs.
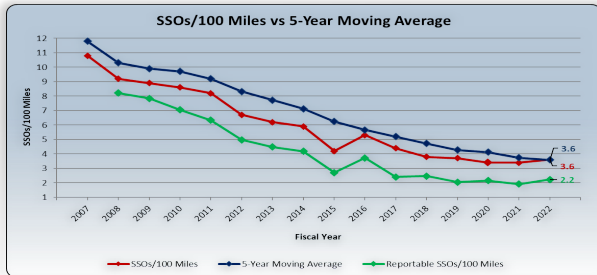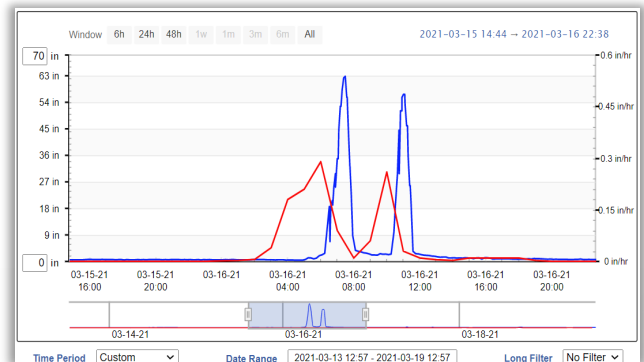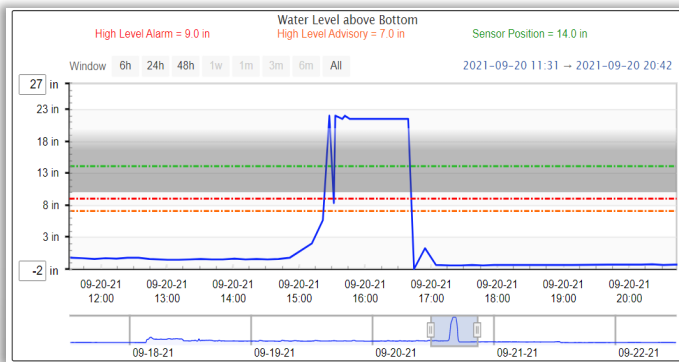

SSOs per 100 miles of pipe

Charlotte Water identified unusually high-water levels and cleared out a blockage, preventing a spill.
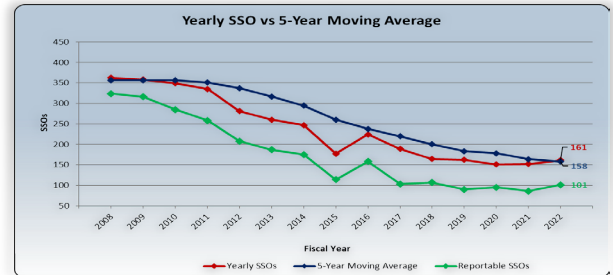
SSOs per Fiscal Year

The data generated from targeted creek basins combined with NOAA rain data showed impacts of rain on I&I.

Conclusion

Charlotte Water has successfully leveraged smart sewer technology to address their specific infrastructure needs. In addition to a better overall understanding of their system, they have prevented sanitary sewer overflows and enhanced its cleaning program, in turn optimizing resources and preserving utility assets and capital investment funds.

The integration of smart sewer technology has allowed improved visualization of site conditions leading to a more proactive versus reactive decision-making process. These 24/7/365 'eyes and ears' of the sewer system have brought peace of mind knowing sewers are being monitored, data is automatically analyzed and plenty of advance notice is provided to assist operators in protecting public health.

With more than 450 units currently installed in targeted creek basins to monitor trends, Charlotte Water will continue protecting their collection system by expanding remote monitoring to additional basins over the coming years to preserve assets, reduce SSOs and maximize cleaning efficiency.