

Buffalo Sewer Authority

Wet weather operational optimization and real-time control system store and capture 3.5 billion gallons of cso volume for less than \$0.01 per gallon

At the turn of the century, Buffalo was the eighth largest city in the U.S., a gateway for commerce and manufacturing due to its early embrace of hydroelectric power generated from nearby Niagara Falls. To accommodate its projected growth, Buffalo built a (then) state-of-the-art combined sewer system that collected and transmitted sanitary and storm water flows within a single pipe system to the Buffalo River, Scajaquada Creek and the Niagara River.

By mid-century, the city added a massive wastewater treatment facility and upgraded its sewer system to accommodate at least 750,000 people. This allowed the city to capture dry weather sewer flows and send them to the plant, but the combined sewer system was still designed to send the vast majority of wet weather flows to the city's receiving waters.

The challenge

Due to its mid-20th century sewer design, Buffalo still typically experiences nearly two billion gallons of combined sewer overflow (CSO) annually, discharging into its receiving waterways.

As the level of national awareness for the need to protect our nation's water resources continued to grow, federal and state regulators pursued a consent decree in 2006 requiring enhancements to Buffalo's collection system. Recognizing the generally inadequate stormwater capabilities of their existing combined sewer system, the Buffalo Sewer Authority (BSA) developed a comprehensive watershed improvement plan with grey, green and smart sewer solutions. After years of negotiations, the City and its partners came to an agreement and in 2014, BSA received approval of its long-term control plan for CSO abatement, with an estimated budget of \$525 million. With the City facing limited funds from a reduced taxpayer base, BSA needed an innovative solution to address CSOs that was cost-effective, so the city once again embraced pioneering technology.

The solution

City officials knew they couldn't continue operating their collection system the same way they had been since the 1950s, and costly investments in new gray infrastructure like tunnels and storage tanks were deemed infeasible for some areas of the collection system. Xylem, along with BSA's talented team of engineers and consultants, worked together to create a **real-time control system** (RTC) across the entire city.



SSO/CSO Prediction and Prevention dashboard showing the available capacity in BSA's major interceptors in real-time, with surcharging, backflow, or overflow warnings.

Program highlights:

- Significant reductions in combined sewer overflow activations and volume
- Cost of less than \$0.01 of real-time control infrastructure investment per gallon captured
- 3.5 billion gallons of CSO volume have been stored and captured to date
- More sewage is now being captured and treated safely instead of overflowing into Buffalo's receiving waters during wet weather

The strategy leveraged new technology to optimize existing infrastructure, building and controlling inline storage vaults that transformed Buffalo's massive gravity sewer system into a managed conveyance and storage system. The goal of the system is to minimize and/or eliminate CSOs using **Xylem Vue's SSO/CSO Prediction and Prevention applications**. Sixteen sites were identified, as part of the City's 2014 Long-Term Control Plan, for inline storage and optimal conveyance throughout the city. BSA selected the sites based on maximum return of investment, with the first two sites chosen for implementation as a representative sample of all the sites.

The results

As of today, nine storage sites are now live and BSA is working to build and commission multiple additional RTC sites, with dynamic control also planned for integration into future gray infrastructure projects.

What's truly exciting is that, since the beginning of the program in 2016, **Buffalo has captured more than 3.5 billion gallons of CSO volume** during wet weather events for treatment. And, by coordinating control between RTC sites, BSA has new opportunities to optimize storage and conveyance capacity across their collection system using only existing infrastructure.

The resulting smart sewer system, utilizing the Xylem Vue software and analytics platform, also helps BSA make continuous progress towards mitigating CSOs as they implement their long-term control plan. As each wet weather event provides more data, BSA can expect increasing levels of system intelligence, resulting in additional operations and maintenance cost reductions, as well as further reductions in CSOs.

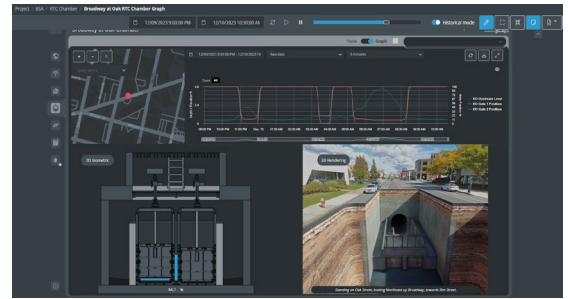
BSA's real-time control program is achieving outcomes unpredicted in the original design with even more sewage than estimated now capable of being safely stored, conveyed, treated and released to receiving waters as clean water effluent in a wider variety of weather conditions. By helping to revolutionize the clean water industry while also recognizing significant return on investment from their real-time control sites, Buffalo is regaining its reputation as a national and international leader.

Ultimately, BSA's real-time control system is helping prevent overflow events at a cost of less than \$0.01 per gallon. The RTC retrofits, and additional minimally invasive green and gray infrastructure improvements, will enable critical environmental progress at a far more sustainable cost to residents.

"Our real-time control program, led by the team at Xylem, has delivered more than four times the expected performance. It is hands down the most cost-effective program in our long-term control plan."



OJ McFoy, Former General Manager for Buffalo Sewer



SSO/CSO Prediction and Prevention provides a historical playback of real-time control sites, providing both 2D and 3D animations of historical gate positions and water levels for in-line storage structures.