

# City of Richmond

City reduces CSOs by 180 million gallons annually and avoids \$725M in capital costs thanks to real-time decision intelligence

The City of Richmond's combined sewer system dates back to the 1800s and currently serves a population of nearly 230,000. It is the largest in the state and has a drainage area of 19 square miles with 25 outfalls. For decades, Richmond's Department of Public Utilities has been working to reduce combined sewer overflows (CSOs) that impact the community and quality of life at-large. In 2020, the General Assembly of Virginia mandated Richmond to update its CSO Control Plan by July 2024 and to complete construction of the new plan by July 2035, highlighting the importance of this project.

## The challenge

The General Assembly also required the creation of an Interim Plan (for short- term projects which could be started within one year of submitting the Plan) which had to be completed by July 1, 2027. The aim was to make quantifiable, positive improvements to both operational costs and overall water quality. This was to be followed by a new Final Plan which was submitted in June 2024.

Richmond had historically relied on a static hydraulic model to identify and quantify combined sewer system overflows. However, this method is not always accurate because it does not consider critical factors that can impact the wastewater system, such as population shifts, rainfall disparity across the city, and system upgrades or degradations. The City began addressing these limitations in 2018 when it partnered with Xylem to install a series of real-time sensors across the piping network to increase the visibility of its combined sewer system.

Richmond turned to Xylem once again for this project as it required a partner with the specific technology and expertise to help them analyze its data, provide actionable insights, and make justifiable project recommendations.

## The solution

The city uses a real-time decision support system (RT-DSS), based on the [Xylem Vue](#) platform and its Unified Network Management application. This digital solution provides field staff and operators with recommendations based on forecast rules and logic, including overflow points and volume, current weather conditions, rainfall disparity and capacity. All this data is easily accessible via an interactive web-based platform that can be customized to visualize analytics and system status based on Richmond's needs.



The Xylem Vue's Unified Network Management application dashboard predicts flow to the plant over the next 12 hours and offers the City of Richmond guidance around whether or not to use a Wet Weather UV system.

## Program highlights:

- Richmond reduced the cost of its Final Plan from \$1.3 billion to \$575 million
- Expected CSO reduction of 182 million gallons annually
- CSO reduction will be achieved at an average of \$0.18 per gallon, which is 70% less than previous mitigation projects
- Improved performance of H&H model due to use of real-time data
- Extended real-time sensor network has increased system visibility, providing operators with more accurate flow data and recommendations to optimize capacity

The RT-DSS combines real-time data, hydraulic and hydrological models, and Xylem's data analytics. This combination of both real-time and modeled data provides optimized operational conditions for several real-time control sites that are designed to capture more flow. Furthermore, by integrating the controls of these sites to enable system-wide intelligence —where sites share their capacities and constraints— the City of Richmond is maximizing wet weather flow capture and minimizing combined sewer overflows.

## The results

Richmond is now measuring the real-time response of its system using current weather conditions as well as identifying when an overflow occurs and tracking the volume that is discharged. This collected data has also been used to provide updates to the City's hydrologic and hydraulic (H&H) model and improve its level of accuracy.

Xylem harnessed this data to perform advanced modeling work, running simulations to determine which projects would have the largest impact. These results were combined with cost evaluations and additional project-specific community, environmental, and operational benefits, to generate a list of ten projects which were included in the City's Interim Plan to comply with legislation.

The projects identified by Xylem Vue's application are expected to reduce annual CSO volume by approximately 182 million gallons, at an average mitigation cost of only \$0.18 per gallon, which is over 70% less than in previous CSO reduction projects.

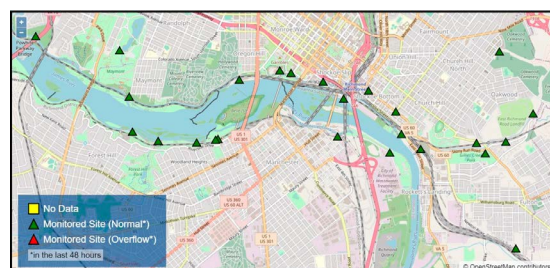
The City is also leveraging the solution to make optimized financial decisions and provide new levels of transparency to its ratepayers and the community. By leveraging the existing infrastructure to the best of its ability and providing real-time operational guidance, Richmond was able to reduce the cost of its Final Plan from \$1.3 billion to \$575 million, thus reducing the financial burden on its ratepayers. Additionally, Xylem developed a publicly accessible online map powered by real-time data from the system which provides alerts for any CSOs that have occurred within the last 48 hours. This resource identifies areas of the river that have experienced overflows and enables residents to make informed decisions about when and where to plan activities in the James River.

Together with Xylem, Richmond has established real-time network visibility across its sewer system to predict flows, optimize capacity, and enable intelligent, data-driven decision-making more accurately. Thanks to the actionable plan the City now has in place, it has been able to identify more cost effective solutions and avoid having to deploy unnecessarily expensive infrastructure. It is now on the path to regulatory compliance and to achieving transformative outcomes for both the utility and the community it serves.

"The whole concept and process of putting meters out into the collection system and getting data to work with, as opposed to relying predominantly on modelling, and with minimal, actual, hard, observed data has been a significant benefit."



Robert Stone,  
Deputy Director for City of Richmond  
Department of Public Utilities



The public-facing online map developed by Xylem and recently released by the City of Richmond provides those looking to use the James River with up-to-date information regarding recent CSO activity.