

Xylem technology helps Hampton Roads Sanitation District achieve landmark nutrient removal

The Chesapeake Bay, the largest bay in the United States, has long faced environmental pressures from excess nutrient runoff.

To protect this vital ecosystem, the U.S. Environmental Protection Agency established strict regulations, requiring significant reductions in nitrogen and phosphorus entering the bay. For the Hampton Roads Sanitation District (HRSD) in southeastern Virginia, meeting these stringent new limits was a monumental task. Serving 1.7 million people across 18 jurisdictions, HRSD operates nine major treatment plants that discharge into the bay's streams. The district needed a forward-thinking, reliable, and cost-effective strategy to upgrade its facilities, enhance its nutrient removal processes, and ensure compliance without overburdening its customers. This challenge prompted a partnership to find an innovative solution that would not only meet regulatory demands but also set a new standard for sustainable wastewater treatment and long-term operational efficiency. HRSD embarked on a journey to transform its infrastructure, aiming for superior environmental stewardship.

Challenge

HRSD was faced with one of the strictest nutrient discharge limits in the country: a total nitrogen (TN) limit of 3 mg/L and a total phosphorus (TP) limit of 0.3 mg/L. Achieving this level of nutrient removal required a fundamental shift in their treatment philosophy. The conventional approach of using large anoxic zones for denitrification was space-intensive and costly to build. Furthermore, the district needed a solution that could be seamlessly integrated into its existing infrastructure across multiple plants, each with unique layouts and operational parameters. The primary obstacle was to intensify the biological treatment process to remove more nitrogen in a smaller physical footprint. This meant finding a technology that could provide highly efficient mixing in anoxic zones to maximize contact between microorganisms and wastewater, thereby enhancing the denitrification process. Failure to meet the new regulations would result in significant financial penalties and environmental consequences, making the search for an effective and economical solution a top priority for the district.



Aerial view of a state-of-the-art wastewater treatment facility, showcasing advanced infrastructure and sustainable operations.

Customer

Hampton Roads Sanitation District (HRSD), Virginia

Challenge

Meet exceptionally strict EPA nutrient limits for the Chesapeake Bay, requiring major upgrades to nitrogen and phosphorus removal processes across nine treatment plants.

Xylem solution

Installed over 100 Flygt 4400 submersible mixers to intensify the biological nutrient removal process, enabling efficient denitrification within a smaller footprint and ensuring consistent compliance with new environmental regulations.

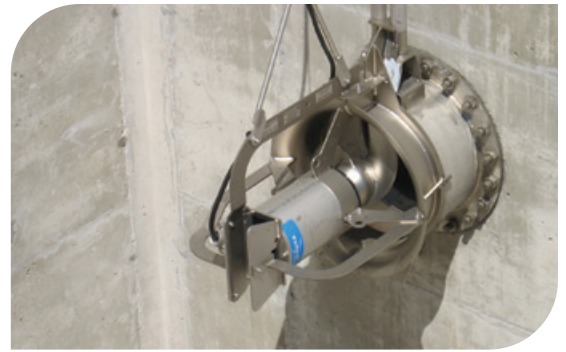
Solution

HRSD partnered with Xylem to implement a state-of-the-art solution centered on the Flygt 4400 series of submersible compact mixers. These mixers were specifically chosen for their ability to create the ideal flow conditions necessary for efficient biological nutrient removal. The installation began at the James River Treatment Plant, where 16 Flygt mixers were installed in a new four-stage nutrient removal process. The mixers' unique design and powerful, gentle stirring action ensured that solids remained suspended without causing shear that could damage the delicate biological flocs. This optimized the denitrification process, allowing the plant to consistently meet the stringent new nutrient limits.

The success at the James River plant became a model for the entire district. Over the next decade, HRSD systematically upgraded its other facilities, installing more than 100 Flygt mixers across its network of treatment plants. This district-wide standardization brought significant operational benefits. "The commonality of equipment throughout our plants helps our maintenance staff," noted John S. Miller of HRSD. "Our technicians have a high degree of familiarity and expertise with the equipment, which helps with troubleshooting and preventative maintenance." This streamlined approach not only enhanced reliability but also reduced maintenance costs. The results were remarkable: HRSD successfully achieved its goal of meeting the low nutrient limits, protecting the health of the Chesapeake Bay. The implementation of Xylem's Flygt mixers proved to be a cost-effective and highly efficient strategy, enabling HRSD to intensify its treatment process within existing facility footprints.

Results

The collaboration between HRSD and Xylem demonstrates a powerful model for meeting ambitious environmental goals through innovative technology. By standardizing on Flygt submersible mixers, the district not only complied with some of the nation's strictest water quality regulations but also created a more efficient, reliable, and cost-effective operation. This long-term strategy has solidified HRSD's position as a leader in sustainable wastewater management. The ongoing partnership ensures that the district's facilities will continue to operate at peak performance, safeguarding the Chesapeake Bay for future generations. HRSD's success serves as an inspiring example of how strategic investment in the right technology can yield profound environmental and operational rewards.



Flygt submersible pump ensuring efficient nutrient removal in a robust setup.



Maintenance underway in an aeration basin equipped with fine-bubble diffusers for optimized oxygen transfer and nutrient removal.

"To achieve the low effluent total nitrogen concentrations we needed, we were looking for a robust and reliable mixing system for our anoxic zones that would operate continuously."

John S. Miller, P.E., BCEE, Chief of Technical Services, HRSD

