Green Compliance

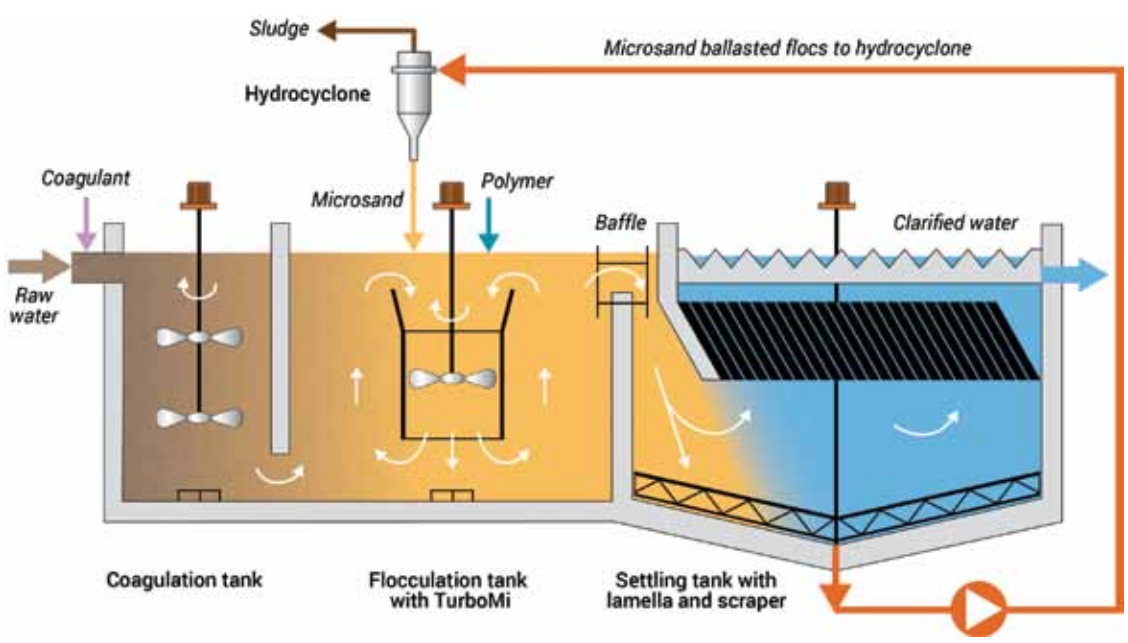
Rhode Island wastewater treatment facility upgrade meets advanced water quality standards

By David C. Bowen & Kevin Cleary

The town of Smithfield, R.I.'s wastewater treatment plant (WWTP) has a licensed average design flow capacity of 3.5 million gal per day (mgd), and discharges treated effluent into the environmentally sensitive receiving waters of the Woonasquatucket River, which flows to Narragansett Bay. In 2007, the Rhode Island Department of Environmental Management (RIDEM) issued a revised Rhode Island Pollution Discharge Elimination System (RIPDES) discharge permit, which imposed more stringent water quality discharge requirements, including a year-round effluent zinc concentration of 50.1 µg/L (daily maximum and monthly average), and a seasonal effluent phosphorus concentration of 0.2 mg/L between April and October. The town retained Wright-Pierce, a Northeast-based engineering firm, to provide services for all phases of the tertiary treatment upgrade project to bring the town into compliance with the new permit. The project scope involved wastewater facility planning; pilot testing of multiple wastewater treatment technologies; identifying and recommending improvements; multi-disciplinary design, including structural, mechanical and electrical engineering; permitting; construction administration; and testing.

The town entered into a consent agreement with RIDEM to develop a wastewater facility plan with recommended improvements that included an aggressive design phase implementation plan and schedule to comply with the permitting terms. Initially, a "no-build" alternative concept was evaluated as a possible solution. Emphasis was placed on further evaluation and optimizing the performance of the existing facility using the existing tertiary filtration systems with chemical feed optimization. Investigations revealed, however, that the use of the existing disc filters had limitations attributed to hydraulic capacity and pore size; therefore, the no-build alternative concept would not reliably satisfy the new RIPDES permit. Wright-Pierce evaluated several other tertiary treatment technologies, including effluent filtration, ballasted flocculation, dissolved air floatation and membrane filtration. Ballasted

Figure 1. Ballasted Flocculation Process



flocculation and dissolved air floatation then were pilot tested to determine their performance.

Fitting the Bill

Ballasted flocculation ultimately was selected as the best solution for the WWTP tertiary upgrade because it demonstrated that it could reliably meet the stringent RIPDES permit limits, had a proven track record and was the lowest-cost alternative of all the technologies evaluated. Although the Kruger ACTIFLO Classic system was the ballasted flocculation system that was pilot tested, the ACTIFLO Turbo system ultimately was selected because it provided a reduced footprint to meet existing facility site constraints. The system also provided the advantage of one less process tank while still accomplishing the same treatment.

The use of the ACTIFLO Turbo system at the Smithfield facility was the first tertiary wastewater treatment ballasted flocculation utilization in Rhode Island, and one of the first in the region using this new manufactured technology.

The technology is a combination of chemical precipitation and physical settling properties of dissolved zinc and phosphorus. It utilizes a combination of chemicals to achieve zinc and phosphorus precipitation and flocculation along with sand particles to provide enhanced settling within a small clarifier, resulting in a clean discharge.

Project Challenges

The relatively complex technology required that facility staff have sufficient understanding of chemical precipitation process and resulting chemical feed control, as well as capabilities to properly maintain and operate mechanical, electrical and control systems.

The small riverside site also presented some challenges. The design layout had to accommodate truck maneuverability within the existing turning radius for plant operations (e.g., for chemical deliveries). In addition, deep excavation supports were required due to the new facility being within 5 ft of an existing building, and the facility bottom being approximately 14 ft deeper than the original facility. Construction site dewatering also was necessary because of proximity to the river.

Noise control also was a consideration during construction because the facility is in a residential area. Maintaining facility operations during the construction process was an additional design and construction phasing challenge.

The project had an aggressive design phase schedule to meet the consent agreement.

Ongoing Improvements

The new facilities achieve and exceed current and projected discharge limits as mandated by the RIDEM/RIPDES permit. The project resulted in high-quality treatment facility effluent discharge, helping to protect and enhance the water quality of the environmentally sensitive Woonasquatucket River and Narragansett Bay. The upgraded facility supports ongoing improvement of water quality and the related, enhanced recreational and economic development opportunities for the broader community. In addition, application of the turbo technology provides flexibility to meet future, more stringent permit limits.

The design was recognized as meeting the U.S. Environmental Protection Agency's eligible standard for energy consumption, sustainable operations and efficiency. The project also qualified for funding through Rhode Island Clean Water Finance Agency under Green Project Reserve status, and was constructed within less than 1% of the engineer's cost estimate. In addition, the town was able to obtain principal forgiveness of approximately $1.4 million. w&wd

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WRITE IN 109