

Chesapeake Bay is considered one of America's—and the world's—most productive estuaries, providing public recreation, public and commercial transportation, and fishing in one of the country's most populated areas. Yet, the bay has been the source of much environmental concern for years.

Chemical contaminants, air pollution, landscape changes, erosion, and over-harvesting of fish and shellfish stress the bay and its wildlife; however, the bay's biggest challenge is nutrient pollution, particularly from nitrogen and phosphorus. The excess runoff and discharges of these nutrients come from farms, pavement, wastewater treatment plants and other sources in the Chesapeake Bay watershed, which includes parts of New York,

caps limiting TN and TP discharged by wastewater plants to 3 mg/L and 0.3 mg/L, respectively.

Plant Upgrade

One of the newest sewage treatment plant upgrades is occurring at the city of Baltimore's Back River Wastewater Treatment Plant (WWTP). First constructed in the early 20th century, the plant is situated east of the city on the shore of the Back River. With an average flow of 188 million gal per day (mgd) and a peak flow of 300 mgd, the plant serves approximately 1.3 million residents in a 140-sq-mile area of the city of Baltimore and Baltimore County.

Approximately 35,000 lb of nitrogen and 6,000 lb of phosphorus enter the Back River plant each day. The planned modifications to the plant will result in TN reductions of more than 90%, compared with current reductions of just 70%. The project



Cleaning Up the Back River

By Gary Lohse

World's largest denitrification filtration system currently under construction in Baltimore

Pennsylvania, Delaware, West Virginia, Virginia, Maryland and the District of Columbia. This pollution fuels the growth of algae blooms that impact water quality and aquatic life, resulting in the bay being placed on the U.S. Environmental Protection Agency's (EPA) List of Impaired Waters.

The Chesapeake Bay Foundation has tracked the bay's pollution levels for many years, and notes that progress is being made. Phosphorus and nitrogen levels have consistently declined over the past several years; however, many believe that government and industry are still playing "catch up" after years of less-than-stellar environmental stewardship. According to William C. Baker, president of the Chesapeake Bay Foundation, "Much of the bay and many local waterways don't provide healthy habitat for fish, oysters and other aquatic life. Pollution has cost thousands of jobs and continues to put human health at risk."

To respond to the threat of the Chesapeake's endangered ecosystem, many states are tightening their regulatory parameters for total nitrogen (TN) and total phosphorous (TP). In fact, the TN and TP regulations in the Chesapeake Bay watershed are among the most stringent in the nation. As a result, many wastewater treatment plants and industries in the watershed have been installing new equipment to reduce the amount of nutrients that are discharged into the bay's tributaries. Of the six states within the bay's watershed, Maryland has the most stringent regulations. Its Chesapeake Bay Tributary Strategy, released in 2004, established point source

includes the construction of a 300-mgd pumping station, modifications to the plant's existing activated sludge facilities, underground utilities, and communication and plant process control systems.

TETRA Denite fixed-film biological denitrification technology from Severn Trent Services was chosen for this massive project. The technology will reduce the high level of nutrients discharged into Chesapeake Bay as part of a \$24-million contract with Archer Western Contractors LLC of Atlanta. Upon completion, the installation will be the largest fixed-film denitrification system in the world, taking that designation from Baltimore's 81-mgd Patapsco WWTP, which also used the technology.

The fixed-film biological denitrification system removes nitrate-nitrogen and total suspended solids (TSS) in a single treatment step. The process also serves as a deep bed filtration system capable of removing suspended solids to virtually any final effluent requirement. It is used as the final treatment step in TN removal to help facilities meet discharge limits of 3 mg/L.

The specifically sized and shaped granular media used in the process are an ideal support medium for denitrifying bacteria and the deep bed environment is conducive to efficient nitrate-nitrogen and solids removal. The media provide contact between wastewater and biomass, and hydraulic short-circuiting is negligible even during plant upsets. It allows for heavy capture of solids of at least 1 lb of solids per square foot of filter surface area (4.88 kg per cubic meter) before backwashing is required.

Filters & Dedicated Equipment

The design engineer for the Back River WWTP project, Whitman, Reardon & Associates LLP of Baltimore, conducted all studies related to the enhanced nutrient removal program at the plant and designed the first phase of upgrades for the facility. The project's unique design will consist of 52 filters—four sets of 13 11-ft-by-8-in.-by-100-ft filters. Each filter set will have dedicated equipment—backwash and chemical pumps with spares as well as clearwells and mudwells. In addition, each system will have dedicated backwash blowers and a shared spare between two sets of filters. The filter sets were designed to operate independently due to varying flows, allowing the filter sets to be backwashed simultaneously. This design eliminates downtime for backwashing and provides greater operational flexibility in meeting the stringent Total Maximum Daily Load limits established by the Maryland Department of the Environment and EPA.

After project completion, the Back River WWTP's effluent quality will be less than 5 mg/L TSS, less than 1 mg/L nitrate-nitrogen and less than 4 mg/L TN.

"It is no surprise that the state of Maryland has become a national leader when it comes to setting high standards for its wastewater treatment facilities," said Ed Kuchtjak, project manager for



Severn Trent Services. "The state receives effluent from each of the other five states in the bay watershed and is the treatment endpoint before wastewater effluent enters the bay. The Back River and Patapsco plants play important roles in the success of the Chesapeake Bay Restoration Program by providing efficient, reliable wastewater systems to enhance and sustain a healthy quality of life for citizens in the region; and the TETRA Denite technology will continue to dramatically improve

wastewater quality and help these plants meet stringent effluent discharge standards."

All upgrades to the facility are scheduled for completion by December 2016. **w&wd**

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