

## Critical Biomass

### One Georgia city solves expansion challenges with a biological reactor wastewater treatment system.

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Located in southeast Georgia between the Okefenokee Swamp and the St. Marys River, the city of Folkston has been blessed — and stressed — with residential and commercial growth over the last two decades.

In 1990, the city expanded its wastewater treatment facility by adding a storage pond, a land application system, and a three-cell constructed wetland system. Although the facility has functioned as required, the wetland system has not met expectations.

The treatment plant expansion was intended to increase the capacity to 0.84 mgd, with an ultimate capacity of 1.08 mgd based on the wetlands' ability to meet the National Pollutant Discharge Elimination System permit, which requires an ammonia concentration of less than 10 mg/L in the winter and less than 5 mg/L in the summer. During most summer months the wetlands are unable to meet the lower permit limits and are shut down. During drier periods in the summer, the land application system and discharge to nearby Spanish Creek handle the flows from the wetlands, but during the wetter periods they cannot treat the increased flow.

The expansion of a nearby prison also created problems for the city's wastewater treatment plant. A population increase from 1,680 to 2,780 by the end of 2008 meant that the prison would generate more wastewater than the city's residential population does.

Folkston uses aerated lagoons followed by constructed wetlands for treating its wastewater. The inability of the plant to meet ammonia limits prevented it from being able to take on the larger flow created by the prison expansion. The city needed wastewater treatment equipment that met the following criteria:

- Ability to fit within existing property boundaries
- Simple operation
- Minimum construction cost and time
- Ability to be integrated into the existing flow scheme with minimal disruption to plant operation
- Reliable nitrification during dry and wet seasons, with low operator attention.

The solution was a moving bed biological reactor (MBBR) system from Siemens Water Technologies Corp. to upgrade the lagoon. The system incorporates a biofilm process in a completely stirred reactor, with no sludge recirculation required. It uses plastic, engineered biomass carriers that supply a large surface area conducive to biomass growth, as well as helical

openings that generate easy mass transfer into the biofilm.

Biofilm develops on the inside of the plastic carriers, which move freely in suspension in the reactor tank, oxidizing ammonia nitrogen in the wastewater. Oxygen is delivered to the carriers through coarse bubble aeration, which also keeps the carriers mixed and in suspension. Media are retained in the tank via stainless steel cylindrical retention screens.

Design engineer P.C. Simonton & Associates Inc. had three goals when selecting the tanks: to keep costs at a minimum, use as much existing infrastructure as possible, and incorporate a turnkey system into a 500-square-foot operating footprint.

The site is located in a flat area near existing effluent pumps. By placing the tanks between the existing lagoon and the existing wetlands, the majority of operations would be kept within 200 feet of the operating facility while integrating the system seamlessly with existing infrastructure and, in turn, reducing construction and man-hour costs. The system's tanks, blowers, aeration piping, and media are provided as a turnkey package, further reducing costs and adding ease of use and convenience to the end user. The Siemens system was installed at a fraction of the cost of typical waste-water treatment, providing a savings of approximately \$800,000 in installation costs to the city.



Siemens Water Technologies Corp.

## HOW IT WORKS

Each train has three individual reactors to facilitate high-rate ammonia removal in the first stage (where the bulk ammonia concentration was high) and low-rate polishing in the third stage. The staging allowed for a smaller footprint and less media volume, which helped minimize costs. Each stage contains one 10-inch diameter wedge wire retention screen, sized for peak hydraulic flows with minimal headloss. The screen is kept free of debris by aeration headers located directly underneath and carriers continually knocking into the screen.

**Airflow to the moving bed biological reactor is controlled by the Smart AGAR control system by using luminescent dissolved oxygen probes and a programmable logic controller based control panel. The probes send signals to the PLC that is used to control the positive displacement blower motor speed via variable frequency drives. The operator sets the desired dissolved oxygen concentration at the operator interface, depending on the season and effluent requirements.**

The system began meeting the effluent ammonia limit less than two weeks after start-up. Influent and effluent samples were analyzed regularly for the first four months.

Samples taken from each stage of the treatment train indicated that the majority of the nitrification was occurring in the first stage where the media sees the highest ammonia concentration. Stages two and three had lower removal rates as the ammonia concentration was diminished, making these stages polishing reactors.

After leaving the system, the wastewater flows to the newly installed effluent pump station, where the water is pumped to the existing constructed wetlands before being sent through an ultraviolet disinfection process and finally discharged to Spanish Creek, which feeds St. Marys River, which serves as the border between Georgia and Florida and is a popular fishing waterway.

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