



AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

SUCCESS STORIES

PLANT NAME AND LOCATION

RIVIERA UTILITIES WASTEWATER TREATMENT PLANT AT WOLF CREEK – FOLEY, AL

DESIGN DAILY FLOW / PEAK FLOW

3.5 MGD (13,250 m³/day) / 6.0 MGD (22,700 m³/day)

AQUA-AEROBIC SOLUTION

AquaNereda[®] Aerobic Granular Sludge Technology

Riviera Utilities WWTP at Wolf Creek Upgrades to State-of-the-Art AquaNereda[®] Aerobic Granular Sludge Technology to Meet Growing Demand and Future-Proof the Plant

Located near the Gulf Shores of southern Alabama, the City of Foley is a coastal community with Southern charm. The area is a popular destination noted for its easy access to recreational water activities, top-rated golf courses, and quaint historic downtown. Due to the region's reliance on healthy bodies of water, the utility's primary mission is to serve as stewards for the area's dynamic aquatic environment.

The Riviera Utilities Wastewater Treatment Plant at Wolf Creek serves its community of approximately 20,000 residents and had been operating a biological treatment system consisting of a 35-year-old extended aeration oxidation ditch process. The plant was rated for 2.0 MGD and needed to expand capacity to 3.5 MGD due to growing demand. Instead of taking the traditional approach of adding an additional oxidation ditch to increase treatment capacity, Riviera Utilities had the desire to "future-proof" the plant and prepare to meet more stringent effluent requirements, including Biological Nutrient Removal (BNR) that were anticipated to be enacted in the future. For these reasons and others, Aerobic Granular Sludge (AGS) technology was the treatment process selected to achieve these goals.

The AquaNereda[®] Aerobic Granular Sludge System represents a step-change in the wastewater treatment industry. This new system at the Wolf Creek plant consists of three aerobic granular sludge reactors operating similar to a continuous flow system with a Fill/Draw phase that alternates between reactors. Downstream polishing is performed by AquaDisk[®] Pile Cloth Media Filters to produce Class B reuse-quality water. Although not currently required by permit to achieve Total Nitrogen (TN) limit, the inherent BNR properties of AGS provide TN removal now and for future permit limits.

Since start-up in January 2020, the plant has consistently met effluent requirements.

The AquaNereda[®] Technology was highly appealing as an innovative approach to secondary treatment for a number of reasons:

- The innate BNR capabilities provided by the layered microbial community of the granules enables the system to meet future TN and Total Phosphorus (TP) limits.
- The excellent setting properties of aerobic granular sludge allows for MLSS of 8 g/L or higher, which greatly minimizes footprint requirements.
- The robust nature of the granules provides better protection against the plant's salinity disruptions compared to conventional activated sludge.
- The AquaNereda[®] process is designed to provide the lowest lifecycle cost compared to other processes.



AquaNereda[®] Reactors
Riviera Utilities Wastewater Treatment Plant at Wolf Creek – Foley, AL

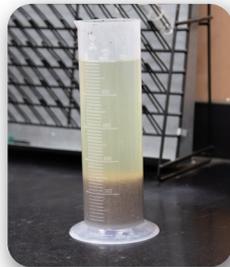
AVERAGE OPERATING DATA - 2020

LOADING	DESIGN INFLUENT	AVG INFLUENT	DESIGN EFFLUENT	AVG EFFLUENT*
Flow MGD (avg)	3.5	2.1	--	--
Flow MGD (peak)	6.0	4.4	--	--
BOD ₅ mg/l	275	204	5	3.6
TSS mg/l	235	292	10	3.5
NH ₃ -N mg/l	42	19.6	1.0	0.8
TN mg/l	--	--	5.0 [†]	4.2 [‡]
TP mg/l	7.5	6.0 [‡]	1.5 [†]	1.3 [‡]

*Following tertiary filtration for BOD and TSS <5 mg/L †Future limit ‡Grab samples

STARTUP AND GRANULATION

The AquaNereda® system was seeded at startup with conventional activated sludge from the site's existing oxidation ditches. Despite being a poorer quality flocculent sludge absent of BNR qualities, initial granule development was rapid with granules greater than 600 µm in size measured within one month of startup. Effluent quality met permitted levels within 30 days of startup. Within several months, granules up to 2,000 µm developed (10x larger than the minimum diameter to be called a granule by definition). By September 2020, the system had achieved the target Sludge Volume Index (SVI) 5/30 ratio of 1.2, indicating excellent settling properties of the matured biomass (see image above).



5-minute Settle Time with AquaNereda® in Foley, AL

FOOTPRINT

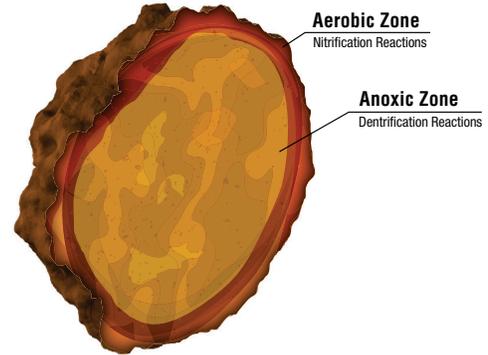
The AquaNereda® technology allows for significant footprint reduction when compared to conventional activated sludge processes due to the high operating MLSS and enhanced settling capabilities. By selecting the AquaNereda technology, the owner will be able to expand treatment capacity to a future average flow of 10 MGD within the existing site. An expansion of the plant's existing oxidation ditch process would have limited the facility to an average flow of only 3.5 MGD.

ENERGY

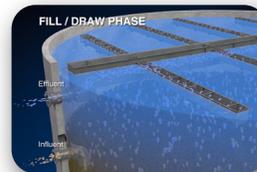
The AquaNereda® technology exhibits energy savings of up to 50% compared to conventional processes due to reduced equipment needs and more efficient aeration. Following the change to the AquaNereda process, the Wolf Creek plant observed a specific energy consumption rate of less than 0.3 kW-hr/m³. This has resulted in an overall power cost reduction of approximately 40%.

AquaNereda® TECHNOLOGY PROCESS

Aerobic granular sludge is a microbial biomass that has grown into a granular shape as opposed to the flocculent nature of conventional activated sludge. Granules are developed and kept in the process through hydraulic and biological selection mechanisms. A granule must have a diameter of at least 200 µm in order to allow for a dissolved oxygen gradient through the granule enabling simultaneous nitrification/denitrification and enhanced biological phosphorus removal.



The AquaNereda® technology is a batch process that operates based on an optimized cycle structure. The different phases of the cycle are summarized below:



1. FILL/DRAW: Raw influent enters the reactor while treated effluent is decanted during a simultaneous Fill/Draw phase. Anaerobic conditions promote phosphorus removal.



2. REACT: Biological reduction of organics, nitrogen, and phosphorus occurs during the React phase of the cycle.



3. SETTLE: Solids separation occurs during a rapid Settle phase. Sludge wasting strategies preferentially select for fast-settling sludge.

CUSTOMER SATISFACTION

Aqua-Aerobic Systems is dedicated to ensuring customer satisfaction. Our commitment to producing quality equipment and process designs and providing superior customer service has led to an extremely happy customer in Foley, AL.

"The AquaNereda® process was selected in order to future-proof our investment for wastewater treatment for the next 25 years...Granular sludge is the wave of the future...Aqua-Aerobic is an outstanding supplier and highly invested in the future development of this technology in North America" - Lee Kibler, Superintendent of Water and Wastewater Operations, Riviera Utilities.