

Marco Island Wastewater Treatment Plant

Application: Rapid upgrade with ZeeWeed* MBR Packaged Plant

Capacity: 3 MGD (11,356 m³/d)

Location: Marco Island, Florida, United States

Commissioned: January 2007



Challenge

Marco Island more than doubles its population to more than 38,000 during the winter season as tourists surge onto the island to escape cooler climates. Since 1972, a conventional wastewater treatment plant (WWTP) has served the growing community on this small 24-square mile island in Florida's Ten Thousand Islands area.

The WWTP has been expanded three times over the years, increasing treatment capacity to 3.5 MGD (13,250 m³/d) for the rising numbers of permanent residents and tourists. As growth continued, plans began for another plant expansion to further increase capacity as more residences receive sewer services and the number of septic systems on the island is reduced.

An expansion with conventional technology is impossible since the site cannot accommodate a larger plant footprint. Commercial development occupies land to the north and west, while a water treatment plant and marina are on land to the south. With a waterway on the east side, the city would have to incorporate new, more compact technology to achieve the desired site improvements.

Solution

Marco Island selected a Z-MOD* Packaged Plant from GE's Water & Process Technologies to replace the existing conventional system and increase treatment capacity at the WWTP.

The pre-engineered, modular systems provide a highly compact footprint that would enable the city to achieve a build-out capacity of 5 MGD (18,930 m³/d) without increasing the plant footprint. Additionally, the skid-mounted, plug-and-play components of the system could be quickly delivered to ensure the project was completed before the peak of the tourist season, and would also provide the flexibility that the city needed to meet its construction objectives.

The first phase of the MBR expansion was completed during the city's annual low flow period, where an existing 1 MGD (3,785 m³/d) contact stabilization package plant was converted to a 3 MGD Modified Ludzack-Ettinger (MLE) operating mode followed by the ZeeWeed MBR system. The contact stabilization tank was converted to anoxic and aerobic tankage and four 1-MGD (3,785 m³/d), skid-mounted Z-MOD-X filtration trains were installed.

The remaining two contact stabilization plants remained in service during the construction. The ZeeWeed MBR receives most of the flow into the plant and only a minimal flow would go to the two remaining contact stabilization plants.

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The MBR system will also provide high quality reuse water for the island, which will reduce demand of potable supplies by creating a continuous, drought-proof supply for golf course and residential property irrigation. Reuse water will be a fraction of the cost of potable water—just 58¢ per 1000 gallons (3.785 m³) compared to \$3.02 per 1000 gallons (3.785 m³) for potable water.

Process Overview

The ZeeWeed MBR at Marco Island WWTP will first pass the wastewater through a 0.08 inch (2 mm) fine screen and then flow into a 0.5 MG (1,890 m³) equalization tank. From this tank, the wastewater will flow into the bioreactor; first for denitrification in the anoxic zone and then nitrification in the aerobic zone. Following biological treatment, the mixed liquor from the aeration basin will be distributed among the four trains of ZeeWeed membranes.

Each membrane train has a tank designed to hold a total of six cassettes of reinforced hollow fiber membranes. With a nominal pore size of 0.04 microns, the membranes will remove virtually all suspended particles from the mixed liquor, including harmful pathogens.

Since ZeeWeed MBR removes solids by filtration rather than settling, the process is much more effective than conventional treatments, and can operate at a much higher mixed liquor suspended solids (MLSS) concentrations. The Marco Island MBR will operate its bioreactor at an MLSS of 8,000 to 12,000 mg/L, compared to 3,000 to 5,000 mg/L for a conventional system, resulting in a much more compact plant footprint.

Membrane fibers will be automatically cleaned with a clean-in-place backpulsing process that forces permeate water back through the membranes. This will dislodge any particles that may adhere to the membranes. Aeration of the membranes is also used to scour debris from the fibers, to provide mixing within the process tank, and provide oxygen for the microorganisms.

When necessary, in-tank chemical cleaning can also be automatically performed if membrane fouling reduces permeability below a specified performance level. The flexible four-train system gives operators the ability to schedule cleaning during periods of low demand, when one train can be offline, while the others continue operating to meet design capacity.

Treated effluent will flow into a chlorine contact tank and will then be pumped to two on-site 0.5 MG (1,890 m³/d) reuse water storage tanks. These tanks are already in use at the existing plants and are connected to high service pumps that provide reuse water for irrigation at the Marco Island Golf Course, Hideaway Beach, the elementary school, several condominiums and hotels, and the Marco Shores Golf Course.

Typical Effluent for Marco Island WWTP		
Parameter	Raw Wastewater	Treated Effluent
BOD (mg/L)	240	≤ 5
TSS (mg/L)	200	≤ 5
NH3-N (mg/L)	36	≤ 1
Nitrate (mg/L)	N/A	≤ 12
Turbidity (NTU)	N/A	≤ 2

