MBR Ups Capacity

By Mark Drake

Growing tourist destination upgrades and expands its WWTP

In recent years, the robust growth of residential and commercial development in the Outer Banks of North Carolina has put a strain on many area wastewater services. The Monteray Shores Wastewater Treatment Plant (WWTP) in Corolla, at the northern end of the Outer Banks, was no exception.

The existing treatment facility, though well operated and maintained, was limited to a maximum hydraulic capacity of 180,000 gal per day (gpd) and originally was configured only for biochemical oxygen demand, total suspended solids and ammonia removal. Additional capacity and improved capabilities would be required, or development would be forced to come to a halt.

The WWTP was further challenged by substantial swings in influent flows, which fluctuate heavily depending on the season in this tourist destination. Combined with the hydraulic and treatment performance limitations of the original plant, this created a unique set of challenges requiring a significant overhaul.

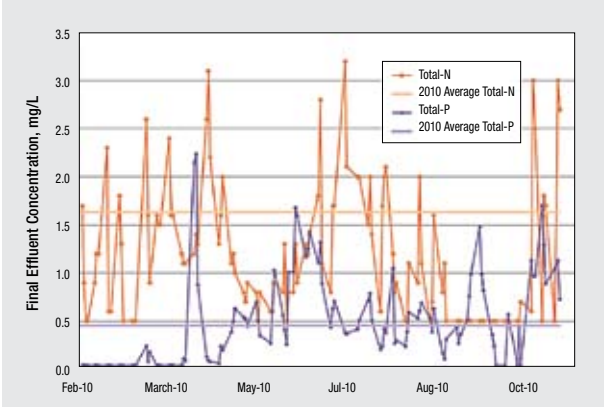
Plant Overview

The original Monteray Shores WWTP consisted of an extended aeration plant using a circular tank with a central clarifier. As is often the case along North Carolina's coast, disposal of the treated effluent is accomplished via rapid infiltration basins (RIBs) that allow the effluent to percolate through sandy soils into the ground. To properly upgrade the facility, more area for RIBs would be needed in addition to the expansion of the treatment facility itself.

Options for expansion were limited because the existing site was restricted by an apartment complex on one side and retail stores on the other. Footprint constraints were further compounded by the setback requirements for RIBs (the minimum distance allowed from the RIBs to adjacent property lines). Fortunately, state regulations allow reduced setbacks for systems that produce reclaimed water and remove total nitrogen (TN) and total phosphorus (TP).

The project engineer thoroughly evaluated several options and determined that a membrane bioreactor (MBR) upgrade was the best alternative for meeting all of the plant's requirements. The technology allowed the plant to utilize much of its existing infrastructure, and it could be configured with multiple membrane trains that could be brought online during the busy tourist season and taken offline as needed during the low-flow seasons. The plant would use a process that was capable of TN and TP removal to less than 4 mg/L and 2 mg/L.

Figure 1. Final Effluent Concentrations



Process Solution

The existing extended aeration plant was converted to a four-stage biological treatment process comprised of anaerobic, primary anoxic, aeration and secondary anoxic zones. This fit well into the existing structure to create two parallel treatment trains, with tank volume left over to utilize for aerobic sludge digestion and storage. The retrofit to create two trains also helped minimize

Population growth drove the need for additional capacity and capabilities at the Monteray Shores WWTP.

plant downtime during construction, as the system began treating the influent wastewater as soon as the first biological treatment train was complete, while construction took place on the second train.

Prior to converting the existing WWTP, new headworks (rotary drum fine screens and grit removal) and steel membrane tanks were constructed. The rotary drum screens have perforated openings of 2 mm to prevent items that could damage the membranes from entering the process. Each membrane tank has five membrane modules installed, with space for a sixth if more capacity is needed in the future. The membrane modules utilize flat-sheet membrane elements with an average pore size of 0.08 µm.

Each membrane tank has a dedicated permeate pump, scour aeration blower and return activated sludge pump. The dedicated pumping and aeration equipment provides needed flexibility to the system, which allows it to process flows that can vary from 50,000 gpd in the winter to 520,000 gpd in the summer.

Conclusion

The expansion of the Monteray Shores WWTP to a new NEOSEP MBR system has increased the hydraulic capacity to 0.52 million gal per day while upgrading to a nutrient removal process that consistently achieves low effluent TN and TP levels. The upgrade also proved to be cost-effective, thanks in part to the unique retrofit solution that made optimum use of the existing treatment structures. The Monteray Shores WWTP now is well equipped to handle the many busy tourist seasons to come. MT

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