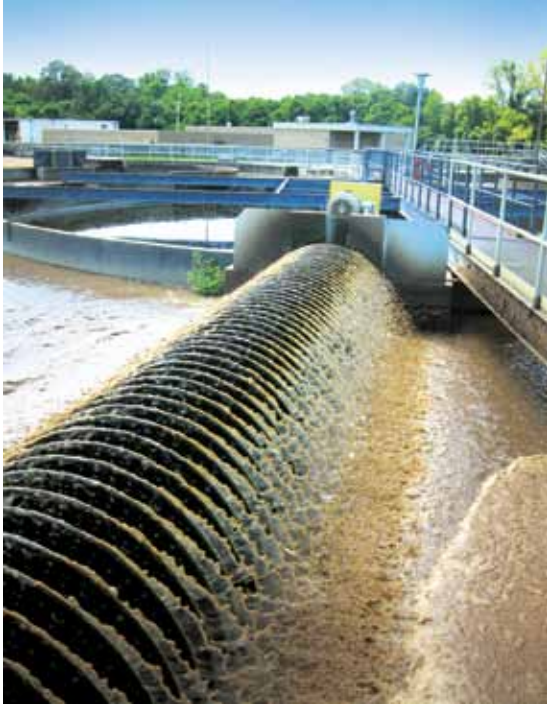
Disc Aerators Replace Brush Aerators, Adding Capacity, Performance



In 2006, engineers at HDR began planning efforts to increase capacity at the city of St. Charles, Mo.'s Missouri River Wastewater Treatment Plant. The landlocked plant had limited opportunities for physical expansion. HDR needed a solution that fit within the existing infrastructure, which included three parallel-operated oxidation ditches, each 12 ft deep with 1.06-million-gal capacities.

HDR specified the need to replace the plant's oxygenation system of brush aerators and internal "boat clarifiers." The brush aerators were experiencing problems with icing and shaft breakage, and many of the aeration "stars" were corroded and had broken off. The boat clarifiers—originally designed as a pre-clarification step to lower the solids loading rate on the existing final clarifiers—were inefficient and interfered with channel velocity, causing mixed liquor suspended solids to settle in the basins.

HDR was familiar with Siemens' disc aerator technology and contacted the company to determine if the St. Charles plant was an appropriate application. Upon evaluation, Siemens confirmed that existing tank widths were ideal for VLR-mounted, high-density polyethylene (HDPE) disc aerators. Disc aerators utilize nodules and dimples molded into the HDPE to transfer energy and oxygen into wastewater. Each disc is capable of adding 2.5 lb of oxygen per hour per disc at 21 in. of disc immersion and 55-rpm disc speed. This lower maximum immersion level was sufficient for the plant, making it ideal for the VLR-mounted disc aerator design.

Fulfilling Requirements

In 2010, the brushes and boat clarifiers were replaced with 12 VLR-mounted disc aerators—four per oxidation ditch. The design fulfilled the oxygen requirement at a new 7.54-million-gal-per-day design flow, which allowed for treatment of higher organic loading within the existing structures. Demolishing the boat clarifiers increased the available volume of the oxidation ditches. With the removal of the boat clarifiers, a second final clarifier was added.

After startup, it became apparent that the new disc aeration design delivered additional benefits. Plant operators noted that noise and odors were reduced. Discs slide through the water more easily and have a smaller gearbox requirement than brush aerators, resulting in less operational noise. Discs also provide better mixing, minimizing dead zones. Fewer odors result from maintaining good oxygenation within the basins.

Placing the existing oxidation ditches in a series flow pattern created independent environmental zones in each ditch. Controlling the oxygen transfer capacity of each zone increases the nutrient removal capacity of the plant by allowing for denitrification of recycled nitrates, as well as simultaneous nitrification/denitrification. This process allows some of the influent ammonia to be converted from nitrite directly to nitrogen gas, reducing energy consumption and total nitrogen discharges. Controlling the dissolved oxygen of the first tank in the series also enhances the biological phosphorus removal capacity of the system.

The series flow pattern increases the efficiency of treatment without increasing tank volume. Bacteria capable of nitrifying ammonia first create nitrite, and then nitrate, from the incoming wastewater. Return activated sludge is recycled from the clarifiers. Denitrifying bacteria use the chemically combined oxygen to stabilize influent biological oxygen demand, rather than absorbing mechanically injected dissolved oxygen. Reducing mechanical oxygen injection reduces purchased power. Siemens' design model indicates the new treatment system is 20% to 25% more energy efficient than the parallel brush aerator installation.

Since the disc aerators have been installed, the focus of the plant's maintenance personnel has shifted from emergency maintenance of the old system to lower-cost, preventative maintenance. The disc aerators provide access platforms to the drives and outboard bearings, making them easier to access. Greasing of bearings and oil changes are conducted on schedule, and probes are cleaned every day to assure dependable readings. Because the discs have no deterioration or corrosion, the expected lifetime of the system is about 20 years. WWD

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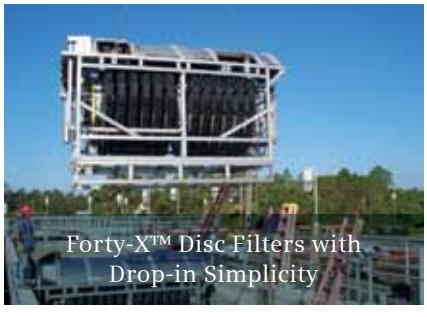

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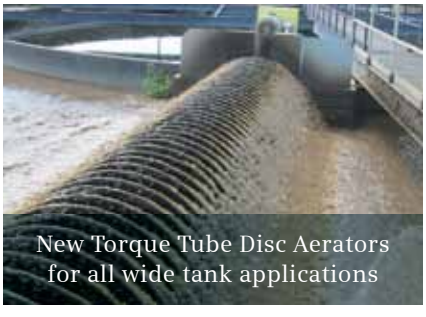

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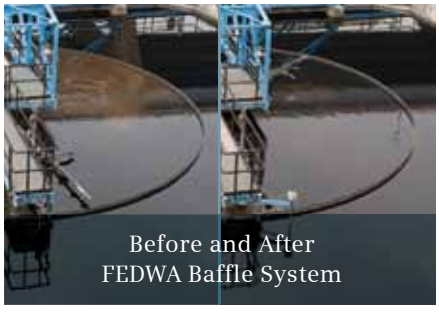

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