

# Plant Experiments with Efficient Mixing Technology

Following a major plant upgrade in 2017, a historic city begins testing even more efficient mixing at its wastewater treatment plant.

Albion is located in south-central Michigan. Tenney Peabody, Albion's first permanent settler, arrived in 1833. In 1835 she was followed by other early settlers from Albion Township, NY, from whence the city derives its current name.

## Scope

Albion completed the update of several components of its four-MGD plant in the fall 2017. Afterwards, plant superintendent Kent Phillips became interested in testing the impact that optimizing his mixing might have on other aspects of his conventional activated sludge process with enhanced biological phosphorus removal.

The plant is well configured for this type of experiment. It is a conventional activated sludge process with two parallel trains. The parallel trains make it easy to tweak one and observe how it impacts the effluent from that side while holding the other train constant. Phillips' initial theory was that modulating the speed to maintain mixing while reducing surface "churning" would reduce his DO in this part of the process. Reduced DO could improve his biological phosphorus removal and allow him to reduce his chemical and energy use.

An opportunity arose to refine the treatment process when Phillips contacted trusted Xylem distributor Kennedy Industries to arrange a field demonstration of the company's new 4220 mixer.

## Solution

The 4200 series mixers represent a significant departure from present day compact mixers, even though they look almost exactly the same, and they do the same job in about the same way (a rotating propeller creating thrust and ultimately bulk flow in the tank to be mixed). The radical part of the new mixer design is that the 4220 mixer employs an IE4 equivalent permanent magnet motor, enabling previously unobtainable motor efficiency.



Xylem's Flygt 4220 mixer shown with its predecessor - note the larger more efficient propeller.

**Customer:** City of Albion, MI  
**Challenge:** Refine the treatment process  
**Solution:** 4220

Also, integrated advanced controls and power electronics in the motor allow the adjustment of thrust and energy consumption to adapt to process changes as well as providing continuous communication with the operator. The mixer basically cares for itself and it can easily be controlled remotely by operators or other systems like SCADA or system controller via ModBus.

Removing an old mast-mounted mixer and replacing it with a 4200 series is easy.

- They do not create an inrush current (soft start by design) so the electrical provisions for a higher power rated mixer can easily accommodate a 4200 of similar thrust.
- The 4200 series mixers do not need a motor starter, so installation is simplified, especially when starting from scratch.

### Results

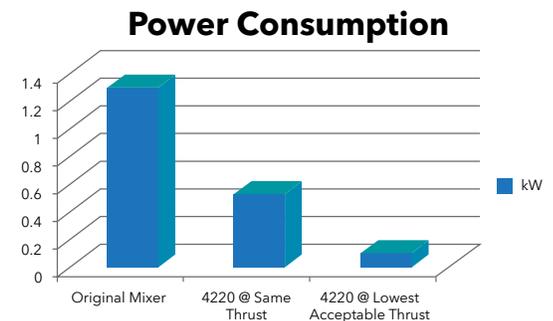
The 4220 was placed in a 16-ft long by 13-ft wide by 15-ft deep anoxic tank, replacing an existing compact mixer that drew a continuous 1.3 kW. Installation was completed August 2, 2017, after which the mixer was run at the recommended thrust for the first few days based on the manufacturer's mixer sizing tool. Right away the 4220 was drawing a cool 0.53kW to produce the same thrust as the original did for 1.3kW. After that, Phillips began experimenting. He found he was able to run the mixer at much lower speeds and still maintain adequate mixing. In the end, he was able to turn the 4220 down from 180 to 100 RPM where it drew a mere 0.10kW while still providing sufficient mixing in the experimental tank. The test showed that there can be dramatic opportunities for right sizing mixer thrust, when the equipment is available to take advantage of it.

The 4220 comes in 1.5-, 2-, 3-, and 4-horsepower models. A four-horsepower mixer can operate at any lower power level and perform with the same high efficiency as a lower power model.

The old mixer was drawing 1.3kW. In the end, Phillips found he could turn the 4220 all the way down to 0.1 kW-eight percent of what the old mixer used-and still have satisfactory mixing.



Tank side controls provide easy access to a host of mixer functions.



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