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Application note

Scioto Reserve Water Reclamation Facility Meets Discharge Limits for Total Inorganic Nitrogen with the IQ SENSOR NET

The Delaware County (Ohio), USA Regional Sewer District faces unique environmental challenges. Delaware County features a large amount of undeveloped land. Combined with the county's proximity to Columbus (State capital and most populous city of the U.S. state of Ohio), this has created intense demand for housing, resulting in explosive population growth. The current county population of 185,000 reflects an increase of 75,000 people since 2000.
The county also is crisscrossed by sensitive watersheds:
The Olentangy River is a State Scenic River, while Alum Creek and the Scioto River are both impounded and serve as sources of drinking water for the Columbus metropolitan area. These conditions have resulted in a fairly decentralized approach to wastewater treatment and effluent disposal. The county owns and operates nine water resource recovery facilities and the treated water is applied to land or discharged to surface water.

In 2012, after years of significant population growth and increases in daily flows, two of the land application facilities, the Tartan Fields and Scioto Reserve wastewater treatment facilities' discharge permits were modified by the Ohio Environmental Protection Agency (EPA), requiring a new limit of 10 mg/L total inorganic nitrogen (TIN). Treated effluent from these facilities is used for golf course irrigation. The county faced the possibility of a significant capital investment in order to meet an 18-month compliance schedule. Operators went to work trying to identify an operating strategy that could achieve discharge requirements without an expensive engineering solution. The initial strategy was to create an anoxic zone by maintaining low dissolved oxygen (DO) in the first pass of the two-pass aeration tank by cycling blowers on and off, allowing denitrification to occur in the settled biomass. Some denitrification did occur, but a TIN of 10 mg/L in composited effluent could not always be achieved. In order to dial in the optimum operating strategy and to identify times and conditions of underperformance, a more thorough evaluation was required.

Assessment
Identifying the right equipment and instrumentation is always a challenge when there is a need to upgrade a facility or address new compliance regulations. To help with this task, the county took advantage of the Ohio EPA Compliance Assistance Unit (CAU) to perform an assessment and help the plant determine the appropriate upgrades. The CAU typically starts its assessment with feedback from the plant

Figure 1: Anoxic Zone with floating mixer (TriOxmatic®, VARiON® and SensoLyt® Sensors in background)

needs to address. As it works through the assessment, the CAU is not partial to any brand of instrumentation, as the CAU will implement whatever is necessary to completely understand issues at the facility. In the assessment at Tartan Fields and Scioto Reserve, the primary goal was to determine nitrate levels in and after the anoxic zones to ensure appropriate denitrification had taken place in the process. The CAU installed an IQ SENSOR NET (IQSN) 2020 XT monitoring and control system from WTW, a Xylem brand, to monitor critical parameters in real time. The IQSN provided a modular plug-and-play system to

WTW
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continuously monitor ammonium, nitrate, dissolved oxygen, pH and oxidation-reduction potential in the oxic and anoxic zones using a single networked monitoring system. With the IQSN simple cabling infrastructure—running one cable that provides both power and data transfer—the CAU was able to get the instrumentation up and running quickly to get the information it was seeking.

A Balancing Act

The real-time monitoring data showed that the on-off operating strategy was able to meet target compliance concentrations intermittently, but it was a balancing act. During periods in which ammonium concentrations were lowest, nitrate concentrations were higher, indicating that more time was required for denitrification. If insufficient time was provided for nitrification, ammonium would spike and nitrate would be lower. The online monitoring demonstrated clearly and quickly that meeting the new requirements was going to require more than a change in operating strategy.

The next step for the county was to design and build anoxic zones to provide a more reliable and consistent solution for the denitrification process. Needs were identified, a plan was drawn up and the renovations were implemented. The upgrades included installing a wooden baffle and a floating downdraft mixer in addition to removing some diffusers in the first pass. The Delaware County Sewer District maintenance department was able to perform the retrofit construction itself versus bringing in an outside contractor, enabling significant cost savings for the county.

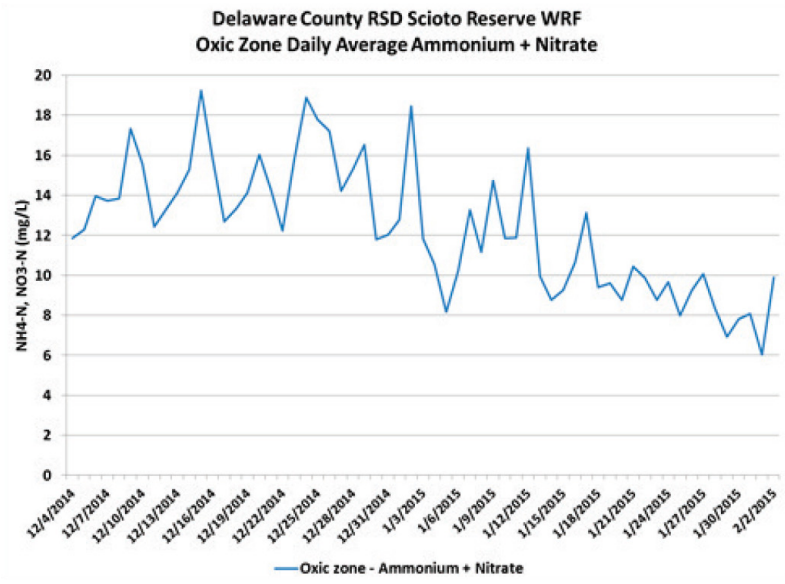

Figure 2: Oxic Zone Average for Ammonium and Nitrate

Once the renovations were done and the anoxic zones were integrated into the plant flow, there was a need to monitor the treatment process in certain locations within the facility to be sure that the overall process was doing what it needed to do: meet the new TIN compliance parameters as established by Ohio EPA. The CAU returned and redeployed the IQSN to assess the result and determine if additional improvements to provide internal mixed liquor recirculation were required. It determined that both the Tartan Fields and Scioto Reserve facilities had seen a TIN level of 10 mg/L, well within Ohio EPA compliance per the new guidelines. What the plant operators did not expect to find were the other efficiencies gained with the IQSN.

Upgrades to Meet Compliance

Over the course of the four weeks that the CAU was on site doing the assessment, the plant operator was able to see the realtime data obtained from the IQSN for nitrate, DO, NH_4, pH and ORP. The data provided great visibility into the biological health of the plant. Once the county saw the data could be assessed long term to analyze trend patterns and, as a result, impact the way the plant was actually run, it came to the conclusion that it needed to have the system in each of the plants. "EPA compliance states that we need to monitor certain criteria and stay within certain parameters with those criteria, as they apply to effluent discharge," said Mark Chandler, operations superintendent for Delaware County. "Being able to obtain real-time data was the first step to meeting compliance, but it also gave us the ability to analyze trends in plant activity. These trend data have enabled us to progress from simple monitoring and data collection to facilitate actual control of the operation to optimize efficiency. Coming full circle with it has been a really impressive evolution of what we're able to do with our process. And we can fine-tune the outcome on a daily, almost hourly, basis."

Chandler said that the operators of the Delaware County plants now can fine tune the biological health of their facilities to a point that was not previously possible, addressing fluctuations that occur due to rain events, warmer and cooler ambient temperatures, or weekend versus weekday activities. "The IQSN data have given us visibility into the well-being of the plants that we're only now beginning to appreciate. It's a powerful tool that will only make us more efficient as time goes on," he said.

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The Reveal

Monitoring the biological health of the plant now is standard practice throughout all Delaware County treatment facilities. The data are utilized to affect adjustments to control operations-like controlling blower runs and identifying opportunities to shut down a blower in a facility– thus reducing energy costs over the long term.

The district recently purchased the IQSN system for its largest facility, the Alum Creek Water Reclamation Facility, replacing and expanding a previous-generation monitoring system.

The new network will monitor ammonium, nitrate and DO in the facility's aeration basins.

Ammonium, nitrate, pH and DO will be monitored in its treated effluent before it discharges into Alum Creek.

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Do you have further questions?
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August 2021