Application note
Fond du Lac & Alyza

Enhanced biological and chemical phosphorus control at Fond du Lac WRRF

Online orthophosphate monitoring ensures consistent phosphorus compliance

Lighthouse on Lake Winnebago, Wisconsin, USA

Author
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End user: Fond du Lac WRRF

Xylem's role: YSI Alyza IQ PO4 analyzer

Project results: Minimal ferric use through reliable EBPR performance and online orthophosphate monitoring.

Overview

The Fond du Lac Regional Wastewater Treatment & Resource Recovery Facility (WRRF) is an advanced 8-10 MGD facility that plays a critical role in protecting the water quality of Lake Winnebago. Operating under a six-month average phosphorus limit of 0.6 mg/L, the utility uses a hybrid approach–combining enhanced biological phosphorus removal (EBPR) with automated chemical dosing–to ensure consistent nutrient compliance.

Fond du Lac WRRF leverages smart instrumentation to monitor treatment performance in real time and only employs chemical phosphorus removal when necessary. The result is a sustainable, responsive system that supports both biological performance and regulatory compliance.

Challenge: Meeting low phosphorus limits with Bio-P and smart dosing

Fond du Lac WRRF has implemented biological phosphorus removal using a 3-pass activated sludge system. Process conditions are monitored and optimized with YSI online sensors measuring oxidation-reduction potential (ORP), ammonium, and dissolved oxygen (DO), creating an environment that supports the growth of phosphorus-accumulating organisms (PAOs) responsible for biological phosphorus removal.

3-pass activated sludge system at Fond du Lac WRRF. Pass 1 (ORP controlled) and Pass 2 (ammonium controlled) shown.

> "It gives us instant data, right where it matters."
>
> Alex Krause, Assistant Superintendent

Historically, the facility relied on an orthophosphate analyzer located in the final effluent to control chemical dosing for phosphorus removal. However, this downstream location introduced a 3–4 hour lag between the ferric dosing point (at the end of the aeration basins) and orthophosphate measurements–making real-time adjustments difficult and forcing a reactive approach.

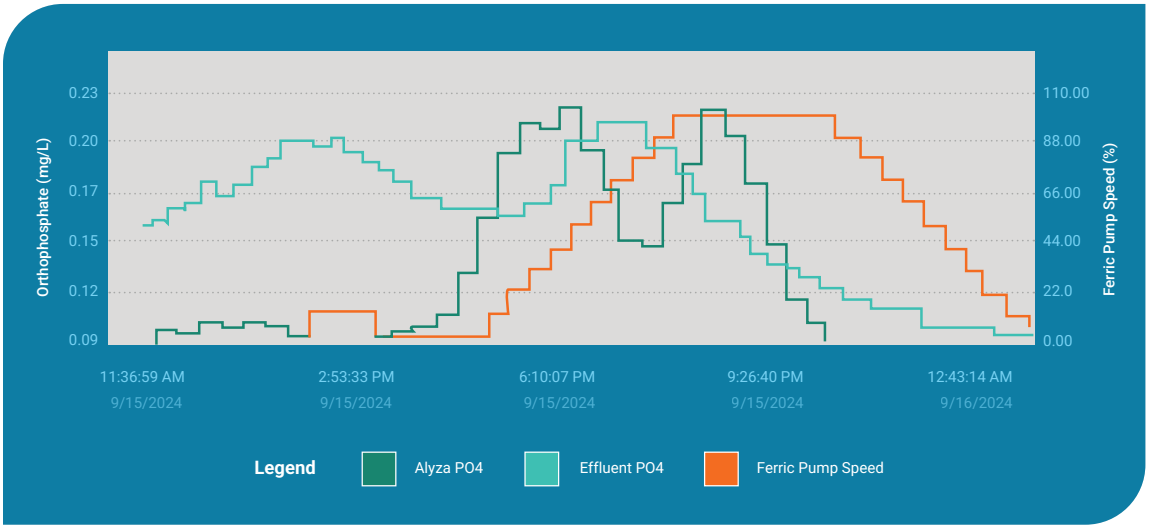
To address this, the team installed a second orthophosphate analyzer –the YSI Alyza IQ PO4–outdoors in the aeration outlet channel, directly where ferric is dosed.

The Alyza works in tandem with the existing effluent analyzer to provide real-time insight into upstream phosphorus conditions and enable faster, more accurate control of chemical dosing.

Solution: Dual analyzer control enables responsive, reliable phosphorus removal

Fond du Lac's control strategy now relies on two orthophosphate analyzers; the YSI Alyza IQ PO4 analyzer at the aeration outlet (monitoring PO_4 levels just before ferric is dosed) and the effluent orthophosphate analyzer (as a final compliance check).

Both analyzers report to SCADA every 15 minutes. If either analyzer reads above 0.15 mg/L, ferric dosing is enabled. Once active, a stepwise control strategy modulates ferric pump speed based on orthophosphate levels. This conservative, dual-point system offers fast feedback at the dosing location while ensuring final effluent compliance. It also accounts for the natural diurnal fluctuations in phosphorus load.



SCADA trend showing data from September 2024

- Alyza orthophosphate [dark aqua]
- Effluent orthophosphate [light aqua]
- Responsive ferric pump speed [orange]

The data above illustrates the relationship between orthophosphate concentrations and ferric dosing at Fond du Lac WRRF. The Alyza IQ PO4 analyzer detects a rise in soluble orthophosphate following a biological treatment shift. In response, the ferric pump speed increases to provide chemical phosphorus removal.

Shortly afterward, both the analyzer and final effluent measurements show a steady decline in orthophosphate levels, confirming effective phosphorus reduction. This trend highlights the plant's use of real time data from the Alyza to monitor biological performance and initiate timely ferric dosing to maintain permit compliance.

Outdoor Alyza IQ PO4 analyzer installed at the aeration outlet channel, providing real-time orthophosphate measurements to SCADA.

Results: Reliable compliance, minimal chemical use

Fond du Lac WRRF has consistently maintained effluent phosphorus levels below the 0.6 mg/L limit, and in many cases, below 0.075 mg/L. Thanks to the stability of the EBPR process, the team has been able to significantly reduce chemical use – while keeping the chemical system live and ready for dosing at any time.

> "Our bio-P is working well, we haven't had to dose in months. But we're ready if that ever changes..."
>
> Alex Krause, Assistant Superintendent

Operations: Analyzer performance in the field

Despite the outdoor installation, the Alyza analyzer has performed well across all seasons. The team at Fond du Lac cleans the Alyza filter weekly and replaces reagents every 6 months.

Operators report no unexpected downtime. The system is considered a dependable part of daily operations and critical to long-term phosphorus compliance. The analyzers have tracked closely with lab data and require minimal maintenance.

> "The Alyza just works. It's right at the dosing point and easy to integrate into SCADA."
>
> Alex Krause, Assistant Superintendent

Conclusion: A model for sustainable nutrient control

Fond du Lac's approach illustrates how layering biological and chemical phosphorus removal–guided by dual online analyzers–creates a resilient, efficient treatment system.

By placing the Alyza analyzer at the dosing point, the plant gains fast, actionable data, avoids dosing delays, and ensures phosphorus stays under control even during load spikes. This strategy demonstrates how WRRFs can minimize chemical usage, protect biological performance, and meet low phosphorus limits.

Alyza IQ PO4 analyzer shown operating in both spring and winter conditions at Fond du Lac WRRF.

Sources:

1. Alex Krause, Interviewed by Adrienne Stenz. Assistant Superintendent, Fond du Lac WRRF. Conducted December 2024.

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