



# Case Studies & Solutions

IQ SENSORNET - WASTEWATER PROCESS MONITORING AND CONTROL

# CASE STUDIES AND SOLUTIONS



## Table of Contents

- 3** Reduce Chemical Costs by Monitoring Orthophosphate  
Brookfield, Wisconsin
- 5** Meet Discharge Limits for Total Inorganic Nitrogen  
Delaware County, Ohio
- 7** Maximizing Efficiency  
Springfield, Illinois
- 9** Meeting Strict Discharge Limits  
Englewood, Colorado
- 11** Aeration Control Optimization  
Missoula, Montana
- 13** Total Suspended Solids Monitoring for Process Stability  
Overland Park, Kansas
- 15** Keeping Operating Costs Low and Effluent Quality High  
Northeast Ohio
- 17** Plant Optimization Leads to Cost Savings  
London, Ontario

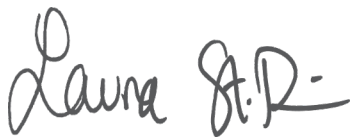
# Improve Operational Efficiency with Continuous Data

Whether you are looking to reduce energy consumption by monitoring dissolved oxygen to control wastewater aeration, or you would like to understand how to meet strict discharge limits for phosphorus or nitrate, this case study brochure examines how eight water resource recovery facilities are using the YSI IQ SensorNet to monitor and control their wastewater process and meet their unique, individual plant needs.

## See why facilities are choosing YSI:

- UltraClean™ ultrasonic cleaning reduces maintenance
- Reliable ion selective electrodes
- Compatibility with digital BUS communications
- One-cable for both power and communication; simplifies installation
- Reliable ammonia and nitrate combination sensors
- Network system offers redundancy and can be expanded
- Full Range of UV-Vis spectral sensors

YSI is excited to bring you this case study brochure to demonstrate how wastewater treatment facilities are saving money, reducing energy consumption and improving their plant's operational efficiency. See how your facility can benefit from the IQ SensorNet system.



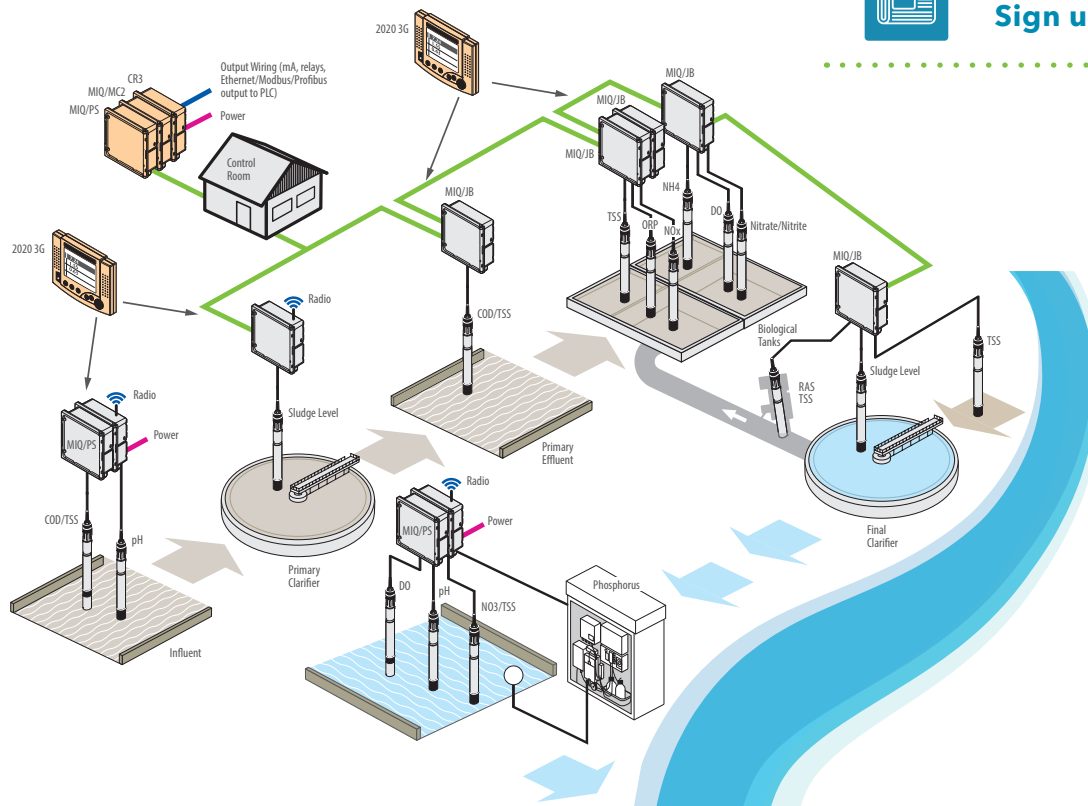
Product Segment Manager, Process



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# BROOKFIELD, WISCONSIN

## Objective:

Reduce Chemical  
Costs by Monitoring  
Orthophosphate



Rick Wenzel holding the 0.45 micron filter membrane for the P700 Orthophosphate Analyzer

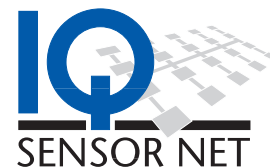
## Acknowledgements:

Many thanks to Rick Wenzel, Process Supervisor at the Fox River Water Pollution Control Center, for providing his experience with the IQ SensorNet system and sensors.

**The City of Brookfield** covers almost 27 square miles and is home to 40,000 residents. It is a major business, retail and industrial hub in southeastern Wisconsin. Brookfield is geographically unique because the city straddles the sub-continental divide. The western portion of the city flows to the Fox River Water Pollution Control Center (FRWPCC), operated by the City of Brookfield.

## The Challenge

The FRWPCC is an activated sludge plant with tertiary filtration designed for an average flow of 12.5 million gallons per day (MGD) and a peak wet weather flow of 50 MGD. The plant complies with a 1.0 mg total phosphorus (TP)/L discharge limit by adding alum to secondary treatment (simultaneous precipitation). The problem with this method is that treatment required an average dosage of over 8,000 gallons per month of alum at a cost that often exceeded \$10,000! FRWPCC needed a solution that would reduce chemical usage and ultimately, save the city money. The facility was also looking for an overall cost-effective solution that would allow them to meet a more stringent limit of 0.075 mg TP/L in the future. FRWPCC sought ways to reduce chemical usage through better control of the chemical feed. Manual adjustment of the chemical pumps based on infrequent grab sampling tended to err on the conservative side to ensure compliance. However, the result was overdosing and high chemical costs. Continuous monitoring was crucial in determining the correct dose and proper timing of the alum.



## The Solution

Rick Wenzel, Process Supervisor for the Control Center, considered many options before recommending the IQ SensorNet P700 Orthophosphate Analyzer (figure 1) from YSI. Low reagent consumption and user-defined automatic calibration to a standard were the key differentiators from other options.

The P700 was installed in the filter building to continuously monitor the orthophosphate concentration in filtered effluent. The monitoring system consists of a lightweight 0.45 micron sample filter on a slide rail (figure 2), sample tubing, a 2020 XT controller, and a handrail-mounted cabinet which houses the sample pump, photometer assembly, and chemistry. The phosphate measurement is displayed as PO<sub>4</sub>-P and the measurement value is reported to the central SCADA system via a 4-20 mA output. The output signal is used to directly control the dosage of alum to the secondary treatment system by adjusting the speed of chemical metering pumps.

## The Results

The monitoring system has allowed FRWPCC to reduce chemical usage and operating costs, and provided valuable insights into treatment dynamics. Alum usage was reduced by over 5,500 gallons in the first 5 months of operation, saving the district an average of \$1500 per month! This comes to an annual average savings of \$18,000.

With the YSI IQ SensorNet P700 Orthophosphate Analyzer, the operators were able to monitor orthophosphate concentrations and adjust the feed pumps based on those measurements.

Furthermore, the data provided Rick with important information that was missing before. "I was surprised at how the trend graph looked throughout the day (figure 3). For instance, we can see the effects of ongoing construction projects and what that is doing to our process." The data also revealed regularly occurring peaks, often on weekends, which is attributed to poor aeration control interfering with biological phosphorus removal. The plant is optimistic that an aeration system overhaul, currently in progress, will correct that situation. Rick and his team continue to seek ways to improve phosphorus removal. They are looking into purchasing a second P700 analyzer to monitor the sidestream from digestion and dewatering.



Figure 1: YSI IQ SensorNet P700 Orthophosphate Analyzer



## Savings with Continuous Online Monitoring and Control

	Prior to P700	After P700
Alum usage	8,000 gallons per month	6,890 gallons per month
Cost for alum	\$10,000 per month	\$8,500 per month
Savings	---	\$1500/month \$18,000/year



Figure 2: P700 Orthophosphate Analyzer 0.45 micron filter membrane on a slide rail

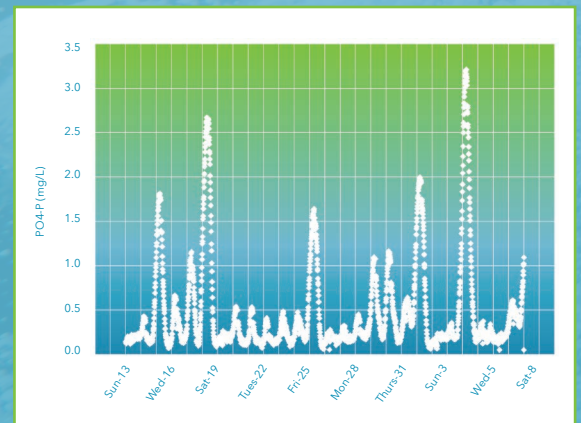


Figure 3: Trend Graph



# DELAWARE COUNTY, OHIO

## Objective:

Meeting Discharge Limits for Total Inorganic Nitrogen



Anoxic Zone with floating mixer; TriOxmatic (dissolved oxygen), VARiON (ammonium, nitrate), and SensoLyt (pH, ORP) sensors in background

## Acknowledgements:

Jon van Dommelen  
Ohio EPA Compliance Assistance Unit

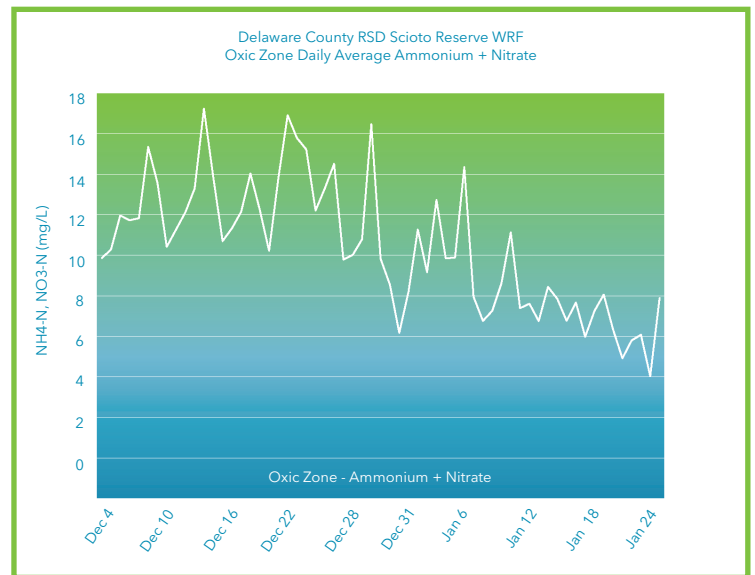
The Delaware County (Ohio) Regional Sewer District faces unique environmental challenges. Delaware County features a large amount of undeveloped land. Combined with the county's proximity to Columbus, this has created intense demand for housing, resulting in explosive population growth and increased daily flow.

## The Challenge

In 2012, after years of significant population growth and daily flow increase, 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). The county faced the possibility of a significant capital investment in order to meet an 18-month compliance schedule.

## The Solution

The county had a voluntary assessment from Ohio EPA's Compliance Assistance Unit (CAU) completed and the assessment determined the primary goal was to evaluate nitrate levels in and after the anoxic zones to ensure appropriate denitrification in the process. The CAU installed an IQ SensorNet (IQSN) 2020 XT monitoring and control system from YSI, to monitor critical parameters in real time. The IQSN provided a modular plug-and-play system to continuously monitor ammonium, nitrate, dissolved oxygen, pH and oxidation-reduction potential (ORP) in the oxic and anoxic zones using a single networked monitoring system. With the IQSN's simple one-cable networking design - the CAU was able to get the instrumentation up and running quickly to get the information it needed.



Logged data from the 2020 XT Controller can be downloaded and analyzed. This chart shows daily average measurements simulating compliance level monitoring.

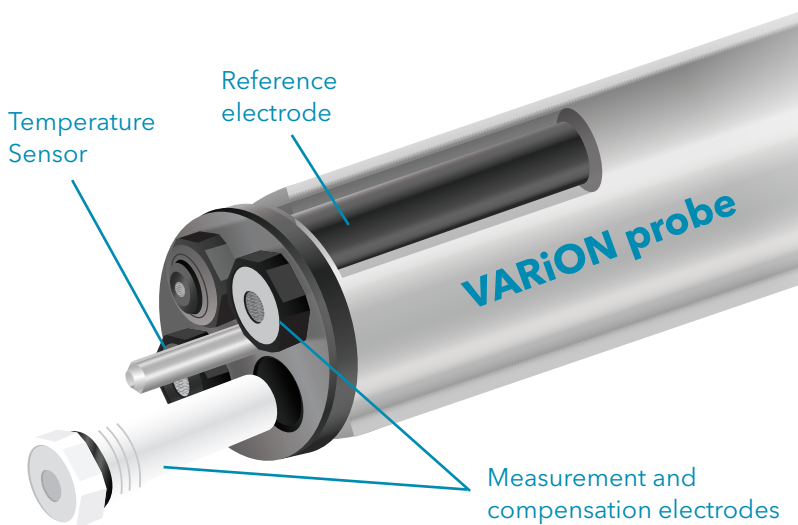
## The Results

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.

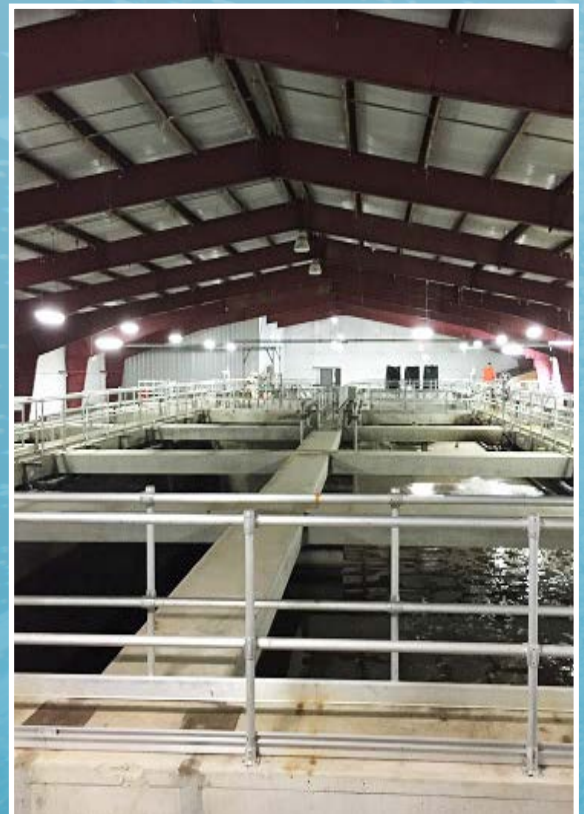
Once the renovations were complete and the anoxic zones were integrated into the plant flow, the CAU determined that both the Tartan Fields and Scioto Reserve facilities had seen a TIN level of 10 mg/L, well within Ohio EPA compliance per the new guidelines. What the plant operators did not expect to find were the other efficiencies gained with the IQSN.

“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.”



VARiON probe



Inside the Scioto Reserve facility



# SPRINGFIELD, ILLINOIS

## Objective:

Maximizing  
Efficiency



Spring Creek employees reviewing data on the YSI IQ SensorNet 2020 XT Controller

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The Sugar Creek facility is in the early stages of a \$54.4 million upgrade, complete with an IQ SensorNet monitoring and control system, tied into SCADA. It will provide necessary improvements to Spring Creek's sister facility and both operations will have cutting edge technology that will establish them as a model water resource recovery facility (WRRF).

### Acknowledgements:

Many thanks to Brian Tucker, SMSD Operations Supervisor, for providing his experience with the IQ SensorNet system and sensors.

**The Springfield Metro Sanitary District** (SMSD) was formed in 1924 to address the challenges of a growing community where raw sewage flowed into the streams and ditches, threatening the drinking water supply and creating unpleasant conditions.

The district's first action was to build the Spring Creek Wastewater Treatment Plant, which came online in 1928 to serve Springfield and surrounding towns.

The Spring Creek plant was built as a conventional activated sludge facility. In 2012, it was converted to vertical-loop reactor (VLR) technology, essentially an oxidation ditch turned on its side. The process consists of a series of reactors operated in aerobic, anoxic and anaerobic conditions to facilitate and optimize the removal of organics and nutrients.

### The Challenge

At the original facility, plant operators and support team manually pulled samples for laboratory analysis from the various treatment stages numerous times a day to confirm that the plant was performing in accordance with its permit. The lab measurements also enabled operators to monitor process efficiency and make needed adjustments. The process was effective but labor intensive and based on methods developed decades ago when treatment requirements were less stringent.

### The Solution

In the early 2000s, the district began planning for upgrades of the Spring Creek plant to address increased demand and meet new regulatory guidelines for phosphorus and nitrogen.

The team selected the IQ SensorNet (IQSN) monitoring and control system from YSI. It provides real-time, continuous monitoring anywhere in the process for up to 20 wastewater parameters. The system continuously monitors DO, pH and ORP at various process stages to maintain optimum conditions for nitrification, denitrification and biological phosphorus removal.

The primary advantage of the system to the Spring Creek team was the system's ability to communicate with the SCADA system over Profibus. It was important to monitor the parameters necessary to meet the new permit limits, but tying the data back into the SCADA for ultimate control brought the renovated plant to a new level of efficiency and effectiveness.

For Brian Tucker, SMSD operations supervisor, the automation and efficiency that the YSI IQSN provided, and the ease with which it is installed and implemented, meant a level of monitoring and control that wasn't possible earlier in his career.



“In the past, the control component would typically be based on trend data instead of actual, real-time measurements. That requires a fair amount of educated guesses as to what was actually happening in the basins and throughout the plant. The IQSN changes all that.”

### The Results

Tucker and his team can now set the required parameter levels at the various locations throughout the facility. Tying that data back into SCADA, the system can turn mixing equipment on or off, open and close control valves, and increase or decrease return rates on the fly, responding in real time to what is happening in the process. Most of the sensors are self-cleaning, so very little maintenance is necessary.

Being able to fine-tune the entire process, from influent through the final discharge into Spring Creek, means significant cost savings, mostly in energy reduction.

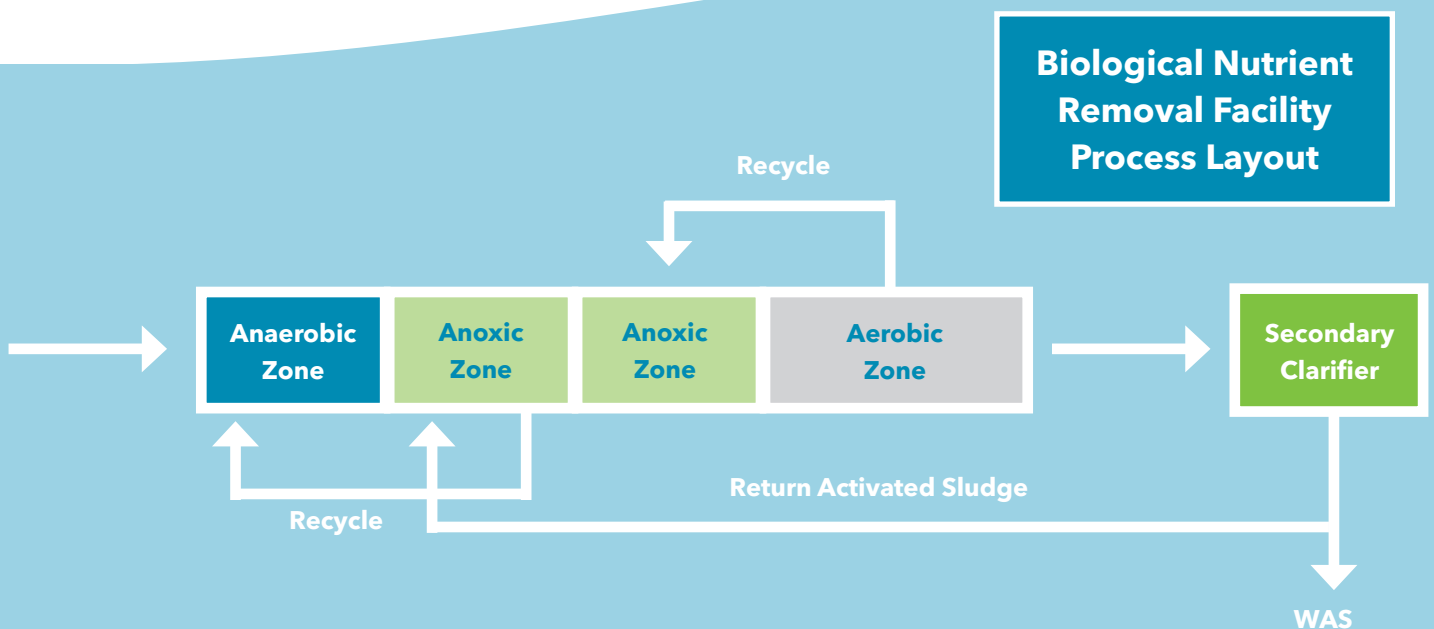
Blowers and motors run only when needed, at specific levels and speeds. Mixing equipment can mostly shut down overnight, when nutrient levels are down and flows are lowest. As the sensors monitor DO at the cascade post-aeration basin, the SCADA system can increase or decrease blower power. Optimized use of the blowers further enhances efficiency.

Being able to monitor the parameters necessary to meet the new EPA regulations was one thing, but being able to tie the data back in to the SCADA for ultimate plant control was something entirely different - and something that would bring the renovated plant into an entirely new high-tech era of efficiency, effectiveness, and automation.



Aerial view of the Spring Creek Wastewater Treatment Plant

PHOTO:  
Courtesy of Terry Farmer Photography



# LITTLETON ENGLEWOOD, COLORADO

## Objective:

Online Monitoring  
of Ammonium  
and Nitrate Helps  
Facility Meet Strict  
Discharge Limits

### The Littleton Englewood Wastewater Treatment Plant

(LEWWTP) was founded in 1977 as a pure oxygen activated sludge plant, and is the third largest publicly owned treatment works in the state of Colorado. The plant receives sewage from Littleton and Englewood, as well as 21 smaller districts in the service area. In 2009, a \$110 million construction project was completed which transformed the plant into a fifty million gallons per day (mgd) trickle filter/solids contact facility with post nitrification and post denitrification capabilities.

The large advanced treatment plant is required to exceed secondary treatment requirements and remove ammonia from wastewater, working in compliance with local, state and federal regulations applicable to wastewater treatment and discharge.



Check out the Littleton Englewood  
story in the following video:  
<http://bit.ly/IQSNcolorado>

### The Challenge

Daily maximum discharge limits for ammonia and total inorganic nitrogen (TIN) require exceptional performance at the LEWWTP. Operators needed a solution for monitoring and controlling nitrification and denitrification in real-time across their multiple-stage biological process.

### The Solution

Online process monitoring is a key element of the LEWWTP process control strategy. The IQ SensorNet 2020 XT system from YSI was selected because it provided the most accurate results and involved the least amount of operator attention in side-by-side trials with competing dissolved oxygen monitoring systems. Furthermore, operators recognized that the network configuration and modularity of the equipment meant that the monitoring system could be easily expanded to help them solve problems with nitrification and denitrification.

By continuously measuring the amount of ammonia in the aeration basin, the team is able to monitor the contribution of ammonia from the return of anaerobic sludge dewatering centrate to the aeration basin. An ammonia concentration target is entered into the SCADA system and the centrate pump output is varied to attain the desired concentration in the aeration basin. By monitoring and controlling the amount of ammonia present, the ammonia loading to the nitrification process is kept within target ranges, which improves efficiency in the conversion of ammonia into nitrate.



IQSN sensors in effluent



## The Results

DO, ammonium, and nitrate sensors were installed at critical locations to monitor the process and control distribution of wastewater for the most efficient treatment. Optical UV nitrate sensors were deployed at the influent and effluent of the solids contact tanks (SCT) where the objective was to remove BOD and push nitrification downstream to the nitrifying trickling filters (NTF) as intended. Ammonium ion selective electrode (ISE) sensors were installed in the centrate return to control transfer of stored centrate and to avoid overload of the biological treatment process. Ammonium sensors in the pre-chlorination tanks are used to control the bypass of ammonia-rich secondary effluent around the nitrification process, thereby maintaining the critical ammonia to chlorine ratio for efficient operation of the effluent chloramination disinfection process.

The versatility of the multi-sensor IQ SensorNet allows the facility to solve several problems using a single system, not only contributing significant cost savings, but also enabling multiple probes to be used in a variety of locations throughout the plant. The facility has also been able to automate sections of its treatment procedures based on the information that has been collected by the system, significantly accelerating processes. Due to the local weather conditions, the plant was previously unable to use probes that required water to be pumped from an outdoor location to an indoor analyzer as it was highly likely it would freeze in the winter. The IQ SensorNet does not have this problem and the plant can continue to function in freezing weather conditions.

Previously, data was manually retrieved from the field. Now it is automated with continuous monitoring and control via the IQ SensorNet system. The information that is collected from the various probes are analyzed for trends and patterns. This can be used to learn more about the finer details of the operation and further increase long term productivity and efficiency.



The IQ SensorNet 2020 XT Controller



ViSolid (total suspended solids) probe in insertion mount



The IQ SensorNet 2020 XT Controller enduring the Colorado winter

# MISSOULA, MONTANA

## Objective:

Optical DO  
Monitoring Makes  
Aeration Control  
Optimization  
Possible

**The Missoula** 12 mgd wastewater treatment plant is effectively reducing phosphorus with a low-cost solution that doesn't require chemicals or filtration. The plant utilizes the Johannesburg Process with a plug-flow arrangement of seven baffles cells.

## The Challenge

The Missoula WWTP operations team could not rely on their 10-year-old dissolved oxygen (DO) probes. "Whenever there was a problem with the activated sludge aeration control system, the first thing we would do is check the DO probes; clean them, calibrate them and then wait half a day," according to Gene Connell, treatment supervisor. "We were spending four hours per week just maintaining the DO probes," Gene adds.



IQ SensorNet 2020 XT Controller showing DO measurements



IQSN FDO Sensor

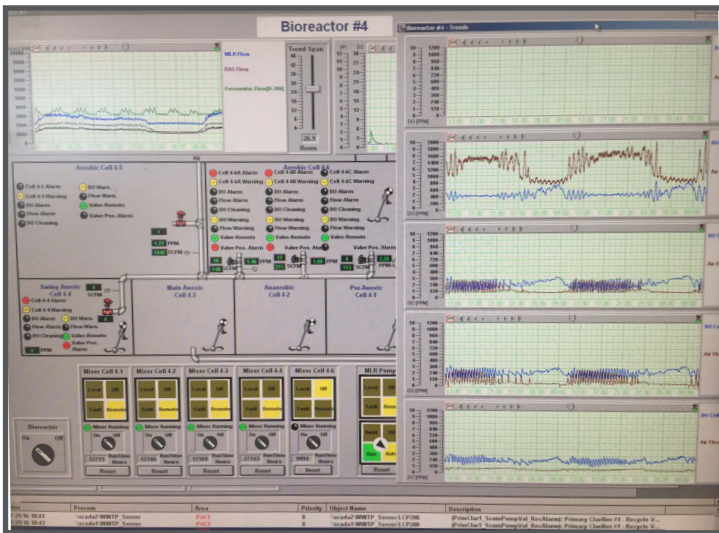
## Acknowledgements:

Many thanks to Gene Connell, Missoula WWTP treatment supervisor, for providing his experience with the IQ SensorNet system and sensors.

## The Solution

Missoula sought to achieve more reliable measurements and lower maintenance with modern optical DO technology. There are a lot of choices when it comes to wastewater process DO probes and the Missoula WWTP evaluated a couple of brands before they settled on the FDO sensor from YSI. The Missoula team was confident in the YSI brand, but one of the deciding factors was the innovative configuration of the IQ SensorNet (IQSN) system which allowed them to network all 20 DO probes together on the same controller, reducing hardware requirements and simplifying installation. Each of the monitoring locations is linked together with a single cable which sends both power and communications throughout the network. A local electrical contractor was hired to install the system. The contractor was very impressed with the IQSN system's ease of installation. The design of the system allows them to estimate installation costs with confidence making YSI their first choice for future projects.

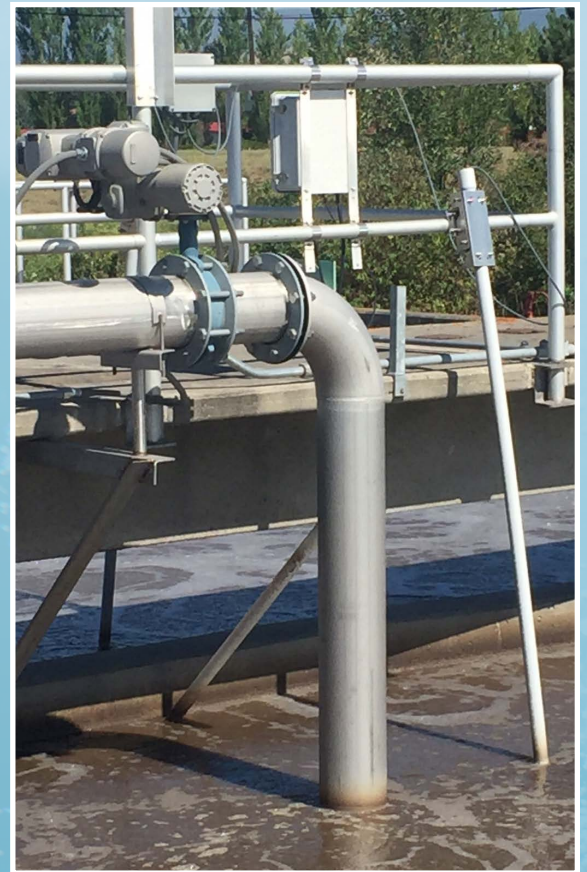




Bioreactor #4 Trends, Displayed as Graphs

### The Results

Maintenance requirements for the DO probes have been reduced to 1 hour per week, freeing up the team to focus on further optimization of the treatment process. Gene calls the new probes a “game-changer”. He adds, “We trust the DO measurement, it is right on.” The DO probes are installed towards the end of each aeration basin to keep the DO at or below the target range. As a result, energy efficiency has improved which has led to substantial cost savings. The total air flow has been reduced and the precision of the DO control system has increased. The team is pleased with the ability to better control the process.



IQ SensorNet FDO sensor in the aeration tank



Blowers run more efficiently by monitoring dissolved oxygen



# OVERLAND PARK, KANSAS

## Objective:

Total Suspended  
Solids Monitoring  
for Process Stability



Inside the Douglas L. Smith  
Middle Basin Plant

## Acknowledgements:

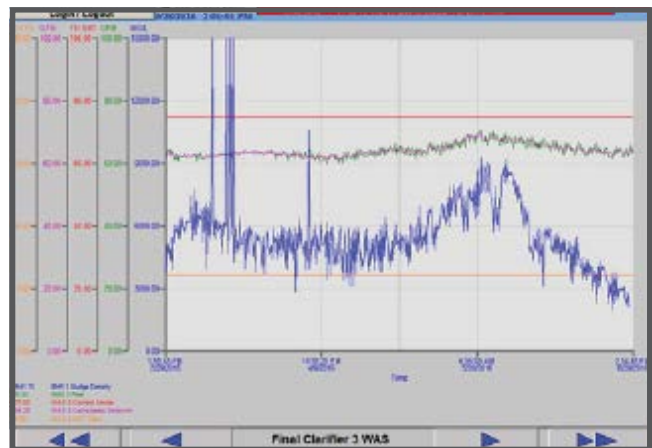
Many thanks to Doug Nolkemper, Operations Engineer at the Douglas L. Smith Middle Basin treatment plant, for providing his experience with the IQ SensorNet system and sensors.

## The Challenge

Inconsistent secondary clarifier performance limited the quality of effluent that the **Douglas L. Smith Middle Basin** advanced wastewater treatment facility in Overland Park, Kansas, could produce. The Operations Engineer sought to achieve the lowest total suspended solids (TSS) and most consistent effluent by controlling the solids retention time (SRT). In order to implement this solution, a new monitoring system was required for continuous online measurement of TSS in the mixed liquor suspended solids (MLSS) and return activated sludge (RAS). The desired characteristics of the new monitoring system were long-term accuracy and simple maintenance. Furthermore, it had to be applicable at the other treatment facilities owned by Johnson County.

## The Solution

Based on project specifications, three monitoring system suppliers were selected for an on-site demonstration. The competing TSS sensors were placed side-by-side in an aeration basin and performance was compared over a 2-month trial period. Accuracy was verified with gravimetric analysis of grab samples collected near the sensors and maintenance activities were logged. The IQ SensorNet (IQSN) system from YSI, had the highest accuracy and the least maintenance due to its unique, integrated self-cleaning system and was selected for permanent installation. IQSN ViSolid TSS sensors were installed at the oxic end of each of the four treatment trains to monitor MLSS. Additionally, insertion mounted ViSolid sensors were installed into RAS pipelines. According to Doug Nolkemper, the Operations Engineer, "If it works in MLSS it will work in RAS", because RAS is just concentrated mixed liquor. Measurements from the sensors are output to the SCADA system through 4-20 mA signals. The target SRT is maintained by automatic adjustment of the sludge wasting rate using a formula programmed into the Allen Bradley PLC and calculated using the online monitoring data.



Screen shot from SCADA system showing MLSS monitoring data and automated waste activated sludge control





Inside the Douglas L. Smith Middle Basin Plant

**Results**

The monitoring system at the facility has been operating reliably with minimal maintenance requirements. The UltraClean™ ultrasonic cleaning system effectively prevents fouling, without a wiper or any replaceable parts. Sensors are removed from the process and manually cleaned every 6 months. The long-term reliability of the measurement is important for automation. The design of the monitoring system is also important. According to Nolkemper, "The MLSS and RAS values from the sensors cancel each other out in the algorithm. It isn't the absolute accuracy that is critical as much as the consistency."

The IQ SensorNet system has also been successfully implemented at two other facilities owned by the utility. The Operations Engineer has been a steady, guiding force but admits that success cannot be achieved without team involvement when he states, "Proper implementation [of process monitoring and automation] requires a long-term relationship - champion it, believe in it, get it right, then get the operators on board." This attitude has produced award-winning performance. Two of the facilities owned by the utility have earned Platinum status from the National Association of Clean Water Agencies (NACWA) for excellence in permit compliance.

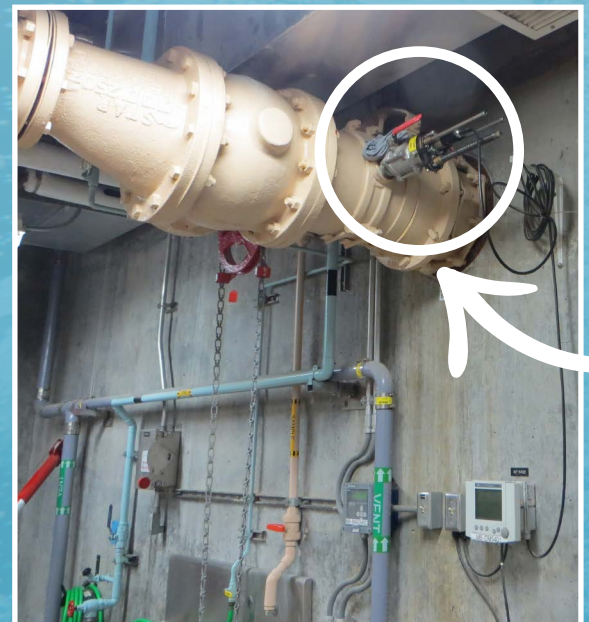


The IQ SensorNet system in this case study consists of the following solutions:

- IQ SensorNet Controller
- IQ 700 ViSolid Total Suspended Solids sensor
- MIQ/PS power supply module
- MIQ/CR3 output module
- WA 700/10 retractable armature



IQ 700 ViSolid total suspended solids sensor



ViSolid sensor insertion mount in RAS pipeline

# NORTHEAST OHIO

## Objective:

Keeping Operating Costs Low and Effluent Quality High



IQ SensorNet ultrasonic cleaning, UltraClean, is capable of preventing biofouling of the sensors in very harsh conditions saving time and money on sensor maintenance.

**Northeast Ohio** - Providing the best value to wastewater customers requires a team of operators that have a deep sense of ownership and are committed to continuous improvement. Such is the case for the operating team at one mid-sized wastewater treatment plant whose progressive attitude and a philosophy of “do it right” led them to an investment in online instrumentation and SCADA for compliance monitoring and control.

### The Challenge

An advanced level of wastewater treatment is provided for an average daily flow of 2 mgd. The flow sheet consists of equalization, preliminary treatment, primary settling, trickling filters, a 2-stage activated sludge system, and tertiary filters. The National Pollutant Discharge Elimination System (NPDES) discharge permit requires monitoring of pH, total suspended solids (TSS), and 5-day carbonaceous biochemical oxygen demand (CBOD5) in the influent, and limits the pH and the concentration of TSS, CBOD5, ammonia-nitrogen (NH3-N), and dissolved oxygen (DO) in the treated effluent.

### The Solution

The wastewater plant invested in SCADA and the YSI IQ SensorNet (IQSN) online process monitoring system several years ago. The superintendent liked the IQSN overall, especially the ability to measure up to 20 parameters on a single network. The original system installed consisted of a universal controller (2020 XT); seven sensors including two pH (Sensolyt), three DO (TriOxmatic), and two TSS (ViSolid); a Modbus module for communication with the PLC; and a spare sensor connection cable for calibrating sensors in the lab.

The most critical objective for any wastewater treatment plant is compliance with the discharge permit. Continuous measurements from a pH sensor in the influent, and pH and DO sensors in the effluent, directly satisfy discharge permit reporting requirements and verify compliance with discharge permit limitations. Additional sensors deployed in the treatment system enable operators to automatically control operating parameters to ensure cost-effective compliance. The activated sludge aeration system represents the bulk of treatment and the largest portion of operating costs. Therefore, as the superintendent puts it, “It seems unwise to not fine-tune the aeration system to the greatest extent possible.”

Mixed liquor suspended solids (MLSS) concentration and DO concentration are critical operating parameters for the activated sludge system. If the concentration of either is inadequate, treatment performance degrades and discharge permit violations occur. On the other hand, excessive levels result in wasted energy and higher operating costs that must be passed on to ratepayers.



A novel method is utilized to maintain the desired MLSS concentration in each stage of the activated sludge system by automated sludge wasting.

First, sludge is wasted every 8 hours on a timer. This is important to steady the operation of the biological system and reduce the potential for upset, especially over weekends and holidays when the plant is not fully staffed. Excess sludge from the first stage is wasted to the second stage; excess sludge from the second stage is co-settled in the primary settling tanks. Second, the amount of sludge wasted is based on the difference between the MLSS setpoint and the current reading from a ViSolid sensor located at the tail end of each stage. Third, the amount of sludge wasted is adjusted based on the most recent half hour settling test result entered by the operator to prevent too much or too little wasting if sludge settleability changes or the sensor calibration drifts unexpectedly.

The UltraClean ultrasonic cleaning system prevents fouling of the sensor. In total, maintenance requires not more than 15 minutes of operator attention per week.

Dissolved oxygen setpoints are also maintained automatically. Modulating valves on the air supply piping to each of the first and second stage aeration basins are adjusted directly in response to readings from TriOxmatic dissolved oxygen sensors installed at the tail end of each stage. Implementation of DO control in the activated sludge system, in addition to other improvements including installation of a smaller blower, has allowed realization of substantial energy saving.

In addition to verifying compliance with the discharge permit, measurements from the online DO sensor in the effluent are used to directly maintain compliance. An automated valve opens to increase air flow to the post aeration tank if effluent DO falls below the set point.

The plant's existing IQSN system was expanded after the original project to provide online monitoring of the treatment process. It was a simple matter of purchasing additional sensors, mounting them into the desired locations, and connecting them into the existing IQSN network. Two VisoTurb turbidity sensors were installed, one in the influent to the tertiary filters and the other in the final effluent channel to monitor the performance of the second stage activated sludge system and the tertiary filters. The turbidity sensors detect small changes in the quality of wastewater before it becomes visually apparent. Operators trend the measurements from the online turbidity sensors to stay ahead of the process and enable proactive adjustments before bigger problems could occur.



An IQ SensorNet module mounted tank side along with sensors for continuous process monitoring and control.

### Results

The utility has not raised user fees in 15 years. A big reason for that is the commitment of the wastewater department team. It was their progressive attitude and desire to “stay ahead of the curve” that gave rise to the project to install the SCADA system and online sensors. The investment has paid off. At the time of project completion, user fees were above the median for the state. Today, user fees are 12 percent below the median. A high level of performance is also achieved despite substantial industrial wastewater loadings. Over 98% of TSS and CBOD5 are removed on average and monthly average effluent ammonia-nitrogen did not exceed 0.3 mg/L during the most recent three-year period.

# LONDON, ONTARIO

## Objective:

Plant Optimization  
Leads to Increased  
Energy Efficiency  
and Cost Savings



The effluent channel with effluent probes, measuring DO, pH, temperature and TSS

### Acknowledgements

Many thanks to Mark Spitzig for providing his experience with the IQ SensorNet system and sensors. Mark is the manager of Wastewater Treatment Operations/Maintenance for the City of London, Ontario.

### The Challenge

As one of the largest cities in the Canadian province of Ontario, the City of London is home to over 300,000 people. And as is the case with many of the municipalities across North America, aging infrastructure presents tremendous challenges that need to be addressed.

Within the City of London, the Environmental Services Department (ESD) Wastewater Treatment Operations (WTO) Division manages six wastewater treatment plants located along the Thames River and Dingman Creek, along with 36 pumping stations. The Department takes great pride in the services they provide to the community, but the six plants (Greenway; Adelaide; Pottersburg; Vauxhall; Oxford; Southland), which collectively handle over 200,000 cubic meters of waste per day, range in age from at least 50 years old to over 100 years old.

It was essential for the City of London and the ESD to continue to provide efficient and cost-effective services to their residents, and the optimization of their facilities seemed to be the key component. Instead of being overwhelmed by the challenge, they took it on as an opportunity to make their facilities and services even better than they had been historically.

### The Solution

To begin the plant optimization process, the city researched the benefits of the Process and Systems Upgrade (PSU) program offered by Ontario Power Authority (OPA) to tap into any available funding. London started with an assessment of the Vauxhall plant, which included a detailed engineering study (funded by OPA) to identify the equipment and technology necessary to address the needs of the facility. It was determined that the PSU would address energy optimization and ultimately plant efficiency utilizing online technology.

The ESD then established Adelaide as an online instrumentation pilot plant, and put out a bid to find the best supplier to partner with for the project. "YSI diligently put together a comprehensive monitoring solution that met our needs," says Mark Spitzig, Wastewater Treatment Operations/Maintenance manager for the City of London. YSI worked closely with plant's technical team and the local representative organization, SPD Sales Ltd., to determine the ideal instrumentation and probes to be installed in the channel and insertion mounted in key locations throughout the plant.

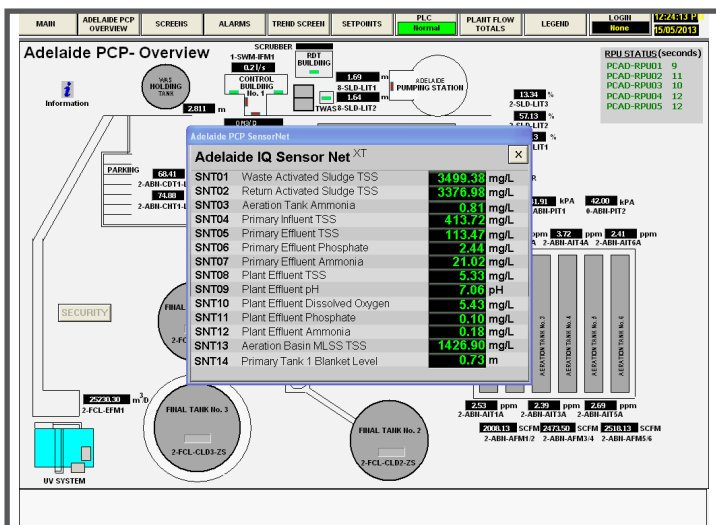
The sensors would measure typical parameters such as dissolved oxygen, temperature, total suspended solids, sludge level, pH and ammonia. All monitoring and online process instrumentation was tied in to a YSI IQ SensorNet 2020, a universal controller, which was then tied in to the SCADA system via Profibus DP.



According to Spitzig, the YSI products offered both short term ease of installation and long term benefits. "From the start, the YSI solution was an easy choice," says Spitzig. "The simple one-cable design - being able to run one cable that provides both power and data-transfer made so much sense. The system enables the addition of more probes or instrumentation at any point down the road, with minimal interruption to our day-to-day operations."

The new network also enables the Adelaide plant to tie in complimentary, non-YSI products without any rework or major adjustments. It's essentially plug and play.

Back at Vauxhall, the installation of the online monitoring probes in strategic locations will enable the monitoring of key parameters as often as necessary, allowing the plant to maintain compliance as well as optimize process efficiencies. Much of the new instrumentation provides the ability to set alarms when certain parameters reach pre-determined min/max levels.



Screen capture of the SCADA system PCP overview, showing various parameters measured by the online monitoring system.

## Results

As with any upgrade to an existing facility, it is essential to keep the plant running smoothly during the renovation and upgrade process. The interference with plant operations during installation was minimal with the single-cable system, which incorporated some of the existing components within the plant but also deployed current, up-to-date technology.

Once the conduit, instrumentation and probes were installed, the new technology was tied into the existing plant SCADA system via Profibus, which now provides plant personnel with a clear picture of the online monitoring activity.



Two of the TSS probes from YSI, after 30 days in the channel. The probe at the top does not have UltraClean ultrasound technology; the probe at the bottom utilizes UltraClean technology.



Aerial view of the City of London, Ontario's Adelaide Wastewater Treatment Operation

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