



Miami Conservancy District Uses Nitrate Screening as Conjunctive Management Tool

Tasked with monitoring a watershed covering nearly 4,000 square miles, almost 2,300 miles of rivers and streams, and a huge aquifer that provides drinking water for more than 1.2 million people, water quality monitoring specialists at the Miami Conservancy District (MCD) in Dayton, Ohio, have their hands full.

The District – established in 1913 to protect Dayton from flooding – has grown into a multifaceted entity renowned for leadership in a wide variety of programs dedicated to managing, monitoring, conserving and educating the public about local water resources. Aggressive data gathering programs support dozens of District projects that address both surface water and groundwater, so both the quantity and quality of MCD’s data points are vital.

Mike Ekberg, MCD’s manager of water monitoring, envisions a program in which on-site readings for nitrate could screen for locations that merit more detailed, more expensive lab tests. With a full nitrogen lab workup – quantifying nitrate, nitrite, ammonia and total Kjeldahl nitrogen (TKN) – running \$85 per sample, screening could save the District a substantial sum of money and help it focus its resources on key sites.

“If you want to have the full speciation of nitrogen, you’re kind of stuck going the lab route,” says Ekberg. “But we have some areas we know have a high number of wells that have high levels of nitrate. If I wanted to do some screening to find out where the hot spot is, I could spot-check in the field and home in on the area where I want to follow up with lab testing.”

For example, Ekberg notes, if MCD had used a screening approach to nitrate testing in a well-testing program it conducted several years ago, the District could have paid for lab samples only on wells where in-situ testing showed nitrate levels of 5 mg/L or higher. That would have limited the need for lab samples to just eight of 33 wells in the study, saving \$2,125 in testing fees.

Screening Tool

In an effort to develop the field screening approach as part of MCD’s Groundwater Quality Monitoring Network program, which includes

sampling at 131 wells, Ekberg and his team have compared lab samples with data gathered with a YSI Professional Plus handheld multiparameter instrument outfitted with nitrate and ammonium sensors. Ekberg says the results were consistently good. Although the Pro Plus only delivers readings to the hundredth of a mg/L rather than the lab results’ data to four decimal places, the portable instrument provides a reliable red flag to indicate whether nitrates are running higher than natural background levels, and if so, roughly how much higher.

“As a screening tool, it’s excellent,” he notes. “It’s also great for surface water. We’re tracking nutrients for a water quality trading program designed to reduce nitrogen and phosphorus levels in the Great Miami River Watershed. A nitrate probe is good because we can spot check between scheduled water sampling dates and see whether we need to do additional monitoring.”

Ekberg also uses the Pro Plus in the District’s Test Your Well program, in which local high school students analyze well samples provided by residents. The Pro Plus instrument provides a quick, reliable way to test dozens of samples at

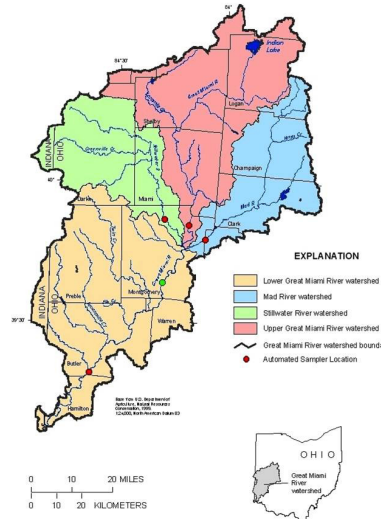
a time or to help students who are confused by colored test strips quantify the nitrate levels in a test jar.

Conjunctive Management

MCD’s far-reaching programs reflect a national trend toward conjunctive management, which identifies the hydrologic ties between groundwater and surface water, then coordinates research and decision-making for the linked system. Because the District’s broad mission involves monitoring and managing both groundwater and surface water, the conjunctive management approach is a natural fit.

“We recognize that a lot of our programs overlap, and that dealing with one also has ramifications on the other,” says Ekberg. “For instance, we do a lot of programming in our area to encourage best management practices for storm water. Many of those practices, like low-impact development, also have impacts in protecting groundwater.”

(continued)



The 4,000-square-mile Great Miami watershed has rich surface water and groundwater resources. In such areas, conjunctive management – recognizing and simultaneously managing the linked surface and subsurface water resources – is a vital approach. Thorough water quality sampling helps.

“Another example is the Mad River watershed, which is a tributary of the Great Miami River,” he adds. “The Mad River is heavily groundwater-fed. Eighty percent of the flow in that river is base flow and comes from the underlying aquifer. Sampling of wells in the aquifer has shown elevated levels of nitrate are not uncommon. To get toward our goals of reducing nitrate in the Mad River, we’ll have to deal with nitrate in the groundwater.”

MCD’s experience reflects a growing worldwide trend toward conjunctive management principles, says Laura St. Pierre, assistant product manager at YSI Inc. in Yellow Springs, Ohio.

“More and more people are making the connection between groundwater and surface water – both in terms of hydrology and management,” St. Pierre says. “Technology gives us the ability to monitor, track and understand a vast amount of water quality data. That makes it possible for entities such as the Miami Conservancy District to do a tremendous job of helping residents, regulators and other stakeholders in its watershed comprehend what’s happening above and below ground. In the end, innovative data gathering and testing protocols yield better decision-making on all levels. Mike Ekberg and his team are right at the forefront of gathering data in ways that reflect and serve the holistic nature of the hydrologic system.”

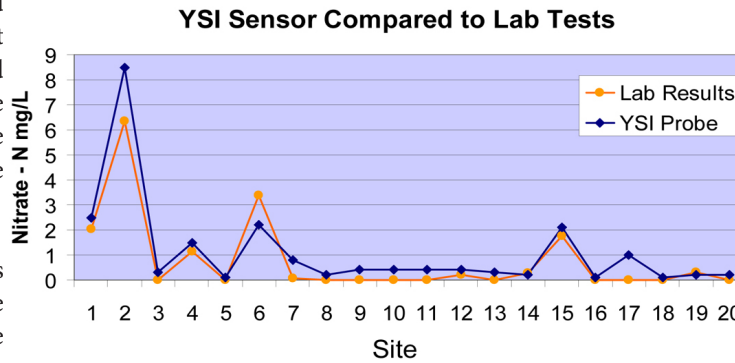
Rugged, Reliable

The Pro Plus is designed to deliver quick, reliable results in all types of field conditions. Its rugged, field-worthy design includes Mil-Spec connectors and the instrument maintains an IP-67 waterproof standard even when the battery cover is removed. To ensure durability, the Pro Plus is drop-tested at the factory at all angles, and is backed by a three-year warranty.

Ekberg’s experience with other YSI instruments, including multiparameter sondes and a field meter for testing pH, temperature and conductivity, set high expectations for durability and customer service. Another advantage is the portability of the Pro Plus. “It’s easy to carry with you wherever you go,” he says. “Walking down a steep streambank to get to the water, you don’t want something too cumbersome.”

A few minutes in the lab every couple of days before heading out into the field keeps the probe accurate, he says. “Calibration of the

nitrate probe is pretty easy,” he notes. “You can do a calibration inside of three to five minutes. If you’re doing ammonium and nitrate, you might spend seven to ten minutes to calibrate.”



The YSI Pro Plus instrument with nitrate sensor data compared to more expensive lab results. The handheld nitrate sampling with the Pro Plus correlates closely with the lab data and indicates its usefulness as an effective field screening tool.

Though MCD’s Pro Plus is outfitted with nitrate and ammonium probes, St. Pierre points out that probes for dissolved oxygen (DO), conductivity, pH, ORP and chloride are also available.

Arsenic Study

In fact, Ekberg says he is planning to add an ORP sensor to MCD’s Pro Plus for use as a screening tool in an upcoming groundwater arsenic study. Naturally occurring arsenic deposits may be an unseen challenge for many residents in the Great Miami River watershed, Ekberg notes. In fact, U.S. Geologic Survey teams found a cluster of wells in the area testing as high as 80 parts per billion (ppb), well above the national drinking water standard of 10 ppb.

“Arsenic tends to be present in groundwater that has a negative ORP – it’s a reducing condition,” he points out. “We’re going to screen waters using the ORP probe and use that to help us see which areas ought to be candidates to have high arsenic, and to see if the relationship between ORP and arsenic holds true.”

That would allow MCD to map and track arsenic in well water and focus the \$15-per-sample testing program where it was most likely to generate useful information on levels of contamination.

As more districts look both above and beneath the riverbed for insight on their watersheds – and do it with shrinking resources – accurate, efficient screening will play an increasingly important role in water quality management.

For additional information on the Miami Conservancy District, please visit: www.miamiconservancy.org

For additional information including specifications on YSI instruments, please visit: www.ysi.com or www.ysi.com/proplus

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