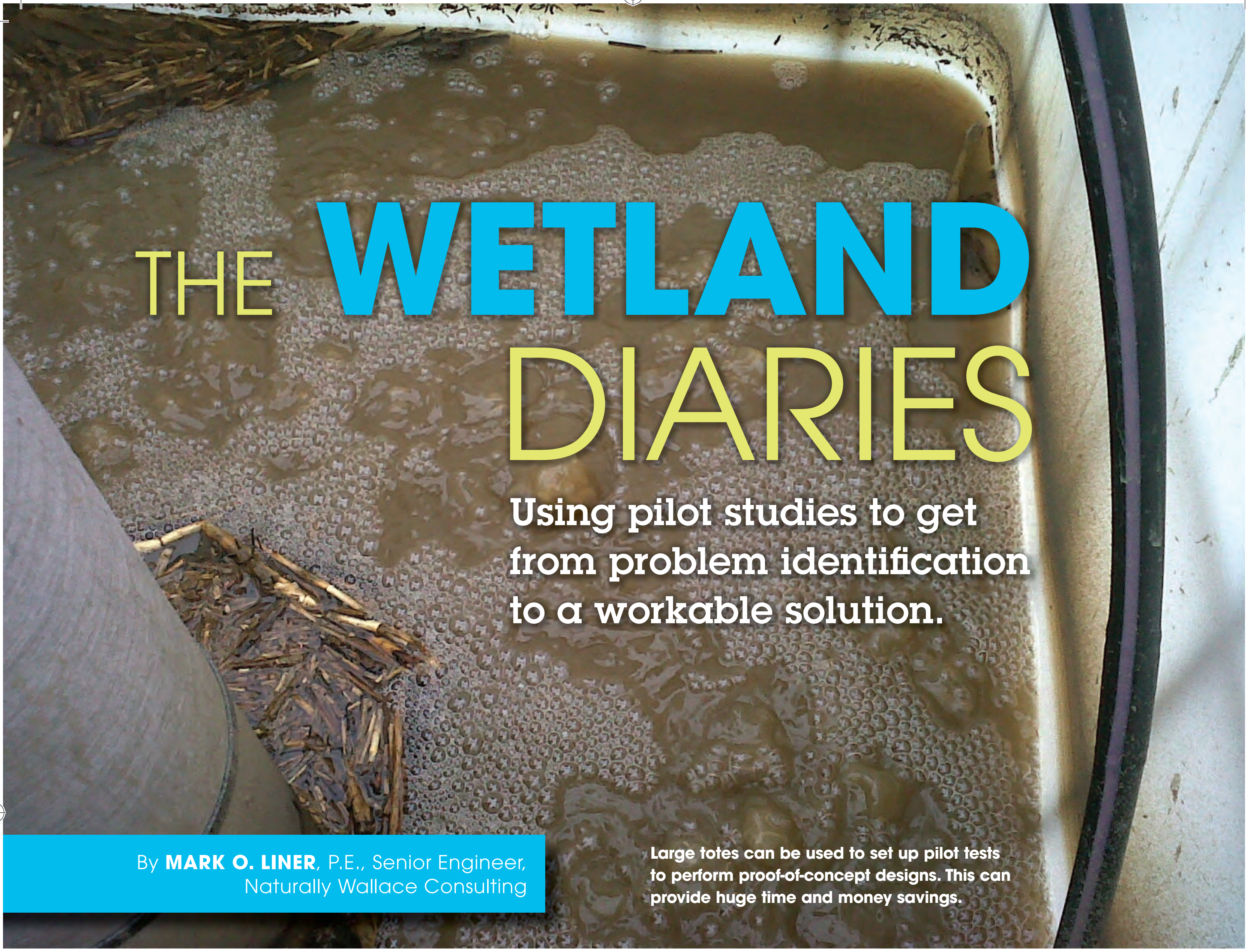
THE WETLAND DIARIES

Using pilot studies to get from problem identification to a workable solution.

By **MARK O. LINER**, P.E., Senior Engineer, Naturally Wallace Consulting



Large totes can be used to set up pilot tests to perform proof-of-concept designs. This can provide huge time and money savings.

Getting from Point A (knowing you have a problem and it is not going away) to Point B (having a working solution with demonstrated compliance) is often not a straightforward or simple journey, particularly in wastewater and stormwater treatment. Providers can offer different strategies for a problem, but seldom offer the overall package to solve the problem. Consulting engineers can provide a report evaluating different technologies, but not proof that each technology would work at a given facility. Equipment vendors can provide test data, but generally only offer one technology, which may or may not be the best alternative.

The fastest and lowest-risk method of getting from Point A (the problem) to Point B (the fix) is to test different technologies, compare the cost and benefits, and collect real data to demonstrate capability. Pilot testing was common in the 1940s and '50s. Its use is coming back into the spotlight as a means of getting information quicker and at a lower cost. A case in point is constructed treatment systems such as lagoons and wetlands. Because these systems are not manufacturer-specific, multiple configurations can be tested against each other at the pilot scale.

Pilot testing specialized treatment systems

There are a handful of treatment systems that can be constructed with minimal specialized equipment or labor. They include, among others, anaerobic lagoons, recirculating gravel filters and constructed wetlands. It is true that insulated covers, pumps and blowers are needed to complete these systems, but little else needs to be brought in from off site. Constructed systems tend to find a home in facilities that can afford to trade mechanical complexity for land. Mines, airports, landfills and petrochemical facilities have turned to lagoons and wetlands when no sewage plant was nearby to accept their wastewater or stormwater.

Often, the rub is that the wastewater needing treatment is unique; an Internet search provides little direction or confidence on what might be the best treatment train for a given set of parameters. For example, Buffalo Niagara International Airport decided to pilot test an aerated wetland to examine the rate at which deicing fluid in cold stormwater could be degraded. The only way to go forward with confidence, in this case, was to build a model in a walk-in freezer, and give it a test run. The results more than proved the concept and were ultimately used to size the system now being operated at the airport.

Another issue is the lack of knowledge in the field. Engineering programs are not overflowing with students investigating the finer points of modeling aerated lagoon performance. The knowledge base on how to use lagoons or other constructed systems is varied and unlikely to be of use for an oil production facility in Colombia or Azerbaijan. The quick way to bridge the knowledge gap would be to build a pilot-scale model and run it on site. The following case studies provide an overview of how pilot facilities have been used to support final design of constructed wastewater treatment systems.

Leachate from landfills can be a complex medium to clean. The above tests allowed various treatment trains to be tested and resulted in a successful final design.

A goldmine in South America needed a low maintenance system to treat ammonia. The test above helped determine the proposed systems abilities and properly size the final product for their needs.

Glycol in Buffalo, N. Y.

Buffalo Niagara International Airport annually used over 200,000 gallons of glycol-based product for aircraft and pavement deicing. The spent deicing compounds were collected within the airport's stormwater collection system and required treatment prior to discharge. To evaluate the ability of an aerated gravel bed to treat the stormwater onsite, a treatability study was conducted on a pilot-scale treatment system. Results from the testing demonstrated 95 percent treatment and were used as a basis for sizing the full-scale 10,000 pounds of BOD5/d treatment system.

BTEX in Casper, Wyo.

A pilot scale, subsurface, vertical-flow wetland was constructed at the former BP refinery in Casper, Wyo., to determine degradation rates for chlorinated organics. In particular, the water required treatment for BETX in cold weather. The four-cell pilot system, operated in 2002, provided insight into the value of utilizing aeration within the wetland system to expedite the treatment rate. The value of a mulch cover for bed insulation was also investigated. Treatment rates from the pilot project

Pilot testing can be done with more sophisticated tanks, mixer and sensors right on site under actual conditions that are expected in order to provide the highest quality proof of concept.

were used to design the full-scale system, which was capable of treating up to 11,400 m3/d of gasoline-contaminated groundwater. The full-scale system achieved compliance levels within one week of startup.

Ammonia in the Pacific Northwest

A large-scale pilot study was undertaken to assist in the process selection for a landfill leachate treatment design. The pilot system was configured to investigate how continuous or intermittent aeration would affect performance of a wetland-based treatment system. In particular, the pilot provided data on the use of an anaerobic ammonium oxidation process for the conversion of ammonia and nitrate to nitrogen gas.

The results of the pilot work quantified the value of employing different modes of aeration: intermittent aeration achieved 400 percent more nitrogen removal when compared to the continuously aerated system. The clear difference in treatment performance was not only instrumental in selecting a mode of aeration for the system, but also served as a simple proof-of-concept for a biological process that was not widely (or purposely) employed with natural treatment systems.

Ammonia in Suriname

A remote goldmine in South America was in need of a low O&M system to treat ammonia from the cyanide-laden water in the tailings pond. Over 16,000 m3/day of water required treatment prior to discharge to the adjacent river. A treatability test was conducted to determine the rates of ammonia removal and to support the sizing of the wetland system.

The testing was done in three phases. In the initial phase, artificial leachate was formulated and tested in a wetland reactor in a laboratory. During the second phase of testing, actual water from the site was shipped to the laboratory for testing in the same reactor. During final phase of testing, a reactor was constructed and tested on site. Results from the testing demonstrated successful removal of ammonia with no inhibition of nitrification.

Phenol in South America

A petrochemical facility in South America is currently using facultative lagoons to provide treatment for water produced at the facility. Additional treatment for phenols is required and the facility is in the process of investigating the use of an aerated lagoon to provide polishing of effluent. An onsite pilot with scaled hydraulic detention times and airflows was constructed on site to investigate the ability of such a system to meet discharge limits. The pilot test is ongoing, however initial results indicate successful removal of phenols and ammonia.

Organic Nitrogen in the United Kingdom

A factory in the U.K. was faced with either modifying their existing treatment capacity or building a new furnace and stack to thermally oxidize the increased load from the production facility. The low-flow, high-concentration wastewater contained significant concentrations of hydrocarbons and nitrogen compounds. To investigate biological treatment of the mix, a series of biological reactors were constructed on site. The pilot is ongoing. Results to date indicate a high level of organics removal, with variable treatment of ammonia.

Getting from point A to point B in these cases has been a simple matter of running a quick proof-of-concept pilot test. Lab scientists and civil engineers are left with little to ponder when the onsite pilot test has demonstrated 90-percent removal efficiency over a few months of running. The use of simple pilot studies, like the ones provided here, provides confidence in the final constructed systems, particularly for treatment of unique wastewaters, in which there is little to no precedent. ***PE***

Mark O. Liner, P.E., is a senior engineer with Naturally Wallace Consulting, Vadnais Heights, Minn.. Mark can be reached at mark.liner@naturallywallace.com to answer any questions.

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