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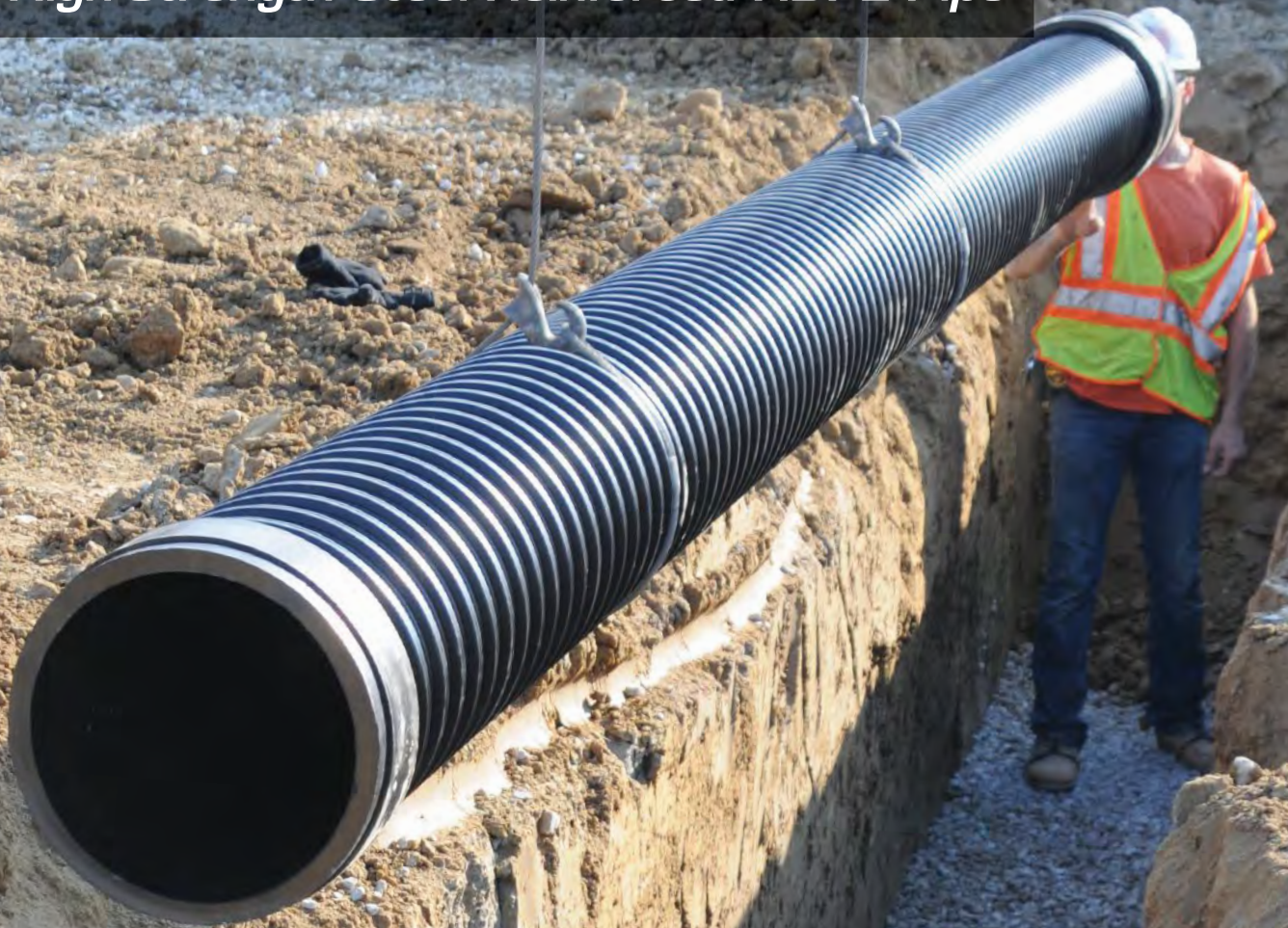


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# FEATURES



**COVER STORY 20**

## 10 Modeling Stormwater Systems

A variety of software helps engineers model flows, avert CSOs, and more.  
*By Carol Brzozowski*

## 20 No Longer a Pipe Dream

Relining systems and using lightweight pipes make underground pipe repair easier.  
*By Janis Keating*

## 30 Monitoring Water Quality in the Field

New equipment allows accurate onsite samples.  
*By Carol Brzozowski*

## 36 Guardians at the Grate

Inlet protection devices keep trash, pollutants—and sometimes alligators—out of the system.  
*By Steve Goldberg*

## 42 Cleaner Streets

Street sweeping can reduce water and air pollution.  
*By Margaret Buranen*



# Departments

6 Editor's Comments

52 Showcase

55 Spotlight

57 Marketplace

57 Advertiser's Index

58 Reader Profile

**58**

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**EDITOR**  
Janice Kaspersen - [jkaspersen@forester.net](mailto:jkaspersen@forester.net)

**PRODUCTION EDITOR**  
William Warner

**MANAGING PRODUCTION EDITOR**  
Brianna Benishek

**WEBSITE EDITOR**  
Nadia English - [nenglish@forester.net](mailto:nenglish@forester.net)

**ASSISTANT EDITOR**  
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**MARKETING COORDINATOR, EDUCATION & TRAINING**  
Amber McEldowney - [amceldowney@forester.net](mailto:amceldowney@forester.net)

**DIRECTOR OF EDUCATION & TRAINING**  
Beth Tompkins - [btompkins@forester.net](mailto:btompkins@forester.net)

**CONFERENCE SALES & MARKETING**  
Brigette Burich - [bburich@forester.net](mailto:bburich@forester.net)

**CONFERENCE DIRECTOR**  
Scott Nania - [snania@forester.net](mailto:snania@forester.net)

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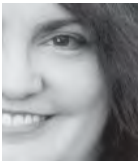


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# Checks and Balances

By Janice Kaspersen

In our last issue, I commented on the new direction EPA has taken with regard to the national stormwater rule; after many delays, the agency has said it is deferring the rule and concentrating instead on supporting communities in addressing their stormwater challenges through “incentives, technical assistance, and tools”—in other words, through voluntary measures rather than new regulations.

Part of EPA’s difficulty in formulating a new rule has been, I believe, the constant push and pull from both sides of the spectrum. Environmental groups want strong regulations to protect water quality—in fact, the event that prompted the new rulemaking effort several years ago was a settlement with the Chesapeake Bay Foundation to strengthen the stormwater program. On the other hand, businesses and the development community oppose aspects of any rule that would cost a great deal of money to implement or that might hinder new development. “Often these competing interests play out in court,” I wrote last time. And since then, another US Supreme Court decision has further shaped how stormwater will be managed.

In early May, the Supreme Court declined to hear a review of a long-running stormwater case, *Los Angeles County Flood Control District v. Natural Resources Defense Council*. In 2008, environmental groups, led by NRDC, had sued the county because of untreated stormwater runoff discharging to the Pacific Ocean via the Los Angeles and San Gabriel rivers. The county argued that because much of the pollution comes from sources out of its jurisdiction and beyond its control, it should not be solely responsible for the

cleanup. Lower courts had ruled in favor of the environmental groups, and with this last decision to deny further review, the case has finally come to an end: Los Angeles County is responsible for treating the polluted runoff.

Environmental groups, particularly NRDC, are hailing this as a long-overdue victory, and it may in fact be a blueprint for how such cases will be handled elsewhere. However, as I noted in *Erosion Control* magazine earlier this month (<http://bit.ly/1o6GJe5>), a recent decision in an air-quality case—one that also dealt with pollutants crossing jurisdictional boundaries, in which the Supreme Court held the pollutant generators partly responsible—could potentially set a somewhat different precedent.

All of this highlights the extent to which our pollution control measures are influenced by legal actions and arguments before the courts. Some groups, such as NRDC and Waterkeeper Alliance, have long used lawsuits

as a powerful tool to ensure clean water laws are being enforced. Lawsuits can sometimes be a maddeningly slow way to move forward, but they’re an important part of the pollution control process we’ve put in place—together with regulations like the existing stormwater rule, and with the efforts that cities, counties, and states put forward voluntarily in the interests of good environmental stewardship. Legal cases—even two like these, with seemingly conflicting outcomes—ensure that we keep reexamining and refining the rules we have in place.

Have you seen your local regulations influenced by national court cases—or have you been involved in such a case yourself? Do you see effective alternatives to this process?

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# Modeling Stormwater Systems

A variety of software helps engineers model flows, avert CSOs, and more.

BY CAROL BRZOZOWSKI

In King County, WA, modeling software is being used to address 19 combined sewer overflow (CSO) locations that are not controlled to the state standard of one event per year, says Bob Swarner, supervisor of the Modeling and GIS group for the Wastewater Treatment Division of the county's Department of Natural Resources and Parks.

"We're under a consent decree from EPA and our state Department of Ecology to finish those projects to bring them all under control by 2030," he says.

The county system's conveyance pipes total about 355 miles, with about 10 times that amount of pipe draining into them from local systems, Swarner says.

Although there is a separate sec-

tion in King County's Wastewater Treatment Division that handles stormwater, Swarner's group is involved in the combined sewer system section and is responsible for simulating the stormwater as it gets into the combined sewer pipes.

To accomplish the goal of getting the projects finished by 2030, Swarner and his team are using software from DHI to create models to simulate

how much rainfall runoff and infiltration from the soil gets into the pipes, and they perform long-term simulations to figure out what size control facilities are needed to control the combined sewer overflows to one event per year at each location.

As a result of the effort, King County has planned two “fairly large” treatment plants for stormwater-related treatment, nine storage projects, one conveyance project, and three green infrastructure projects, one of which is now under construction, Swarner notes.

The city of Seattle also has several CSOs that are not controlled to one event per year and is using stormwater software to help bring those under control, Swarner adds.

“We are using software to simulate what the existing system does, what it would be under our proposed facilities, and what will happen under the city’s proposed CSO projects,” he says.

Historically, King County has been using DHI’s MOUSE, MOdel for Urban SEwers, a computer program designed to model urban wastewater and stormwater collection systems. Presently, the county is moving to MIKE URBAN to keep current with software developments.

MIKE URBAN is an urban water modeling software that is designed to be user-friendly and accommodate workflow, openness, flexibility and GIS integration, physical soundness, efficiency, and stability of simulation engines. It covers all water in the city, including stormwater drainage systems. It includes two-dimensional overland flow, combined or separate sewer systems, and water distribution systems. MIKE URBAN completely integrates GIS and water modeling. MIKE URBAN modules address such issues as rainfall and runoff, pipe flow, control, overland flow, pollution transport and biological processes.

At one time, King County was using in-house software. “The reason we originally went with the DHI software is because we were applying this to our separated sewer system, and the MOUSE software had a really good ability to characterize inflow and infiltration in a separated

system, which is largely long-term and rapid infiltration,” says Swarner. “We’ve had quite a bit of success over the last 10 years of modeling with that, so we’ve decided to apply that same model to our combined system and found we’re getting really good results with that as well.”

Swarner notes that with the software, there is a definite learning curve, especially on the variable infiltration module. “We found it works

really well once you come off the learning curve,” he adds.

The ability to simulate varying infiltration rates into pipes is very important, as that “can be the most significant portion of a hydrograph,” notes Swarner. “What’s important is to get good software that can simulate that well if that is a prevalent response to your system,” he says. “It’s also important to find software that has a lot of control flexibility in the way you can

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### Making the Job Easier

Software makes a stormwater manager’s job much easier, says Rizwan Hamid, P.E., president of Aqualyze. “Almost everywhere now, people use software to do their preliminary analyses,” he points out.

Software to help manage stormwa-

ter ranges from public domain software such as EPA’s SWMM 5 modeling platform, which can be supported by Aqualyze’s h3O Modeling Suite, to software that can cost thousands of dollars.

“Depending on what your budget is, what your goals are, and how far you want to go in the process, you can choose from various options,” says Hamid of the software offerings on the market.

Aqualyze is a small engineering consulting firm specializing in modeling, analysis, and design of sanitary, stormwater, and combined sewers and related software development.

The company created QP Manager, a sanitary flow and rainfall analysis and data management software, that it uses for its clients and sells to end users. The software is designed to offer users full control over managing an ongoing flow monitoring project or analyzing data from an already completed project.

An advanced charting component allows quick charting of large amounts of data as well as the ability to superimpose time series data from multiple meters and rain gauges. Other features include integration with Google Earth and automatic generation of intensity duration frequency (IDF) curves based on user-defined IDF templates, scatter plots for data quality checks, and dry- and wet-weather analysis modules.

“It’s a data management and analysis software for time series data, such as precipitation, flow, depth, and velocity, or other any type of long-term data that engineers use to get an understanding on how the system reacts and responds to rainfall,” notes Hamid.

Readings are collected through installed flow meters in pipes or flow gauges in streams that produce data points at predefined time steps, such as five or 15 minutes. This observed data indicates the velocity, volume, and depth of water at each time step and how it changes between dry- and wet-weather conditions, thus providing important insight to stormwater engineers and managers into the appropriate course of action to take, such as flood control strategies and new pipe designs.

QP Manager serves as a tool to help users do their work faster and more efficiently without the human error that may occur through populating data on a spreadsheet, says Hamid. QP Manager is used on almost every basin planning project done by Aqualyze, he adds.

“In a typical wastewater or combined sewer basin planning project,

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“We could do iteration after iteration.

We could understand a lot of different dynamics, as well as the history of flows through that area.

**Understanding the hydrology was key, and the software was how we accomplished that.”**

the first thing an engineer does is install flow meters,” he says. “We access that data, put it into our software, and then analyze the characteristics of that basin under dry- and wet-weather conditions.” Distinct patterns will emerge based on the land use and weather conditions.

“We can do flow balancing using output from the software where you want to make sure the law of conservation of mass holds. For example,

you have a certain amount of water coming in at point A and then at a downstream point B you have more contribution, which should make B bigger than A,” says Hamid. “If that’s not the case, you need to go in and do some more investigation. Is your meter data in error, or is there something else going on? It’s one step in the process.”

Output from software goes into other planning tools that engineers

use—mainly hydraulic modeling—for stormwater systems, sanitary sewer systems, and combined sewer systems.

“You build a model and calibrate it to current conditions, and when you’re ready to do design analysis, you can say ‘What happens if I make this pipe bigger? What will happen if I build a storage tank here? What will happen if I take all of the flow and divert it somewhere else?’” he says. “Software provides the basis to build a hydraulic model through analyzing existing data from the basin.”

### **Yauger Park Regional Stormwater Facility**

Elsewhere in Washington, the Davido Consulting Group (DCG) and Clear Creek Solutions (CCS) were selected in 2009 by the city of Olympia to assist in designing the proposed expansion of a joint-use recreation and stormwater flow control facility—Yauger Park Regional Stormwater Facility Expansion Phase 1.

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Project goals and site constraints included factors such as maintaining use of ball fields, trails, and other recreation facilities; expanding available detention volume; improving water-quality facilities; providing public parking; and improving maintenance access to stormwater facilities at the park.

DCG worked with Olympia's Public Works Department as well as parks staff to define several conceptual approaches, identify parking alternatives, and calculate additional stormwater detention volume, estimating preliminary construction costs for each approach.

CCS provided the hydrologic and hydraulic modeling using WWHM4—with its combined HSPF and SWMM software—to analyze existing flooding problems and evaluate proposed solutions.

The modeling included the sizing of water-quality treatment wetlands, bioretention facilities, and permeable pavement surfaces.

DCG assisted the city in successfully obtaining federal American Recovery and Reinvestment Act funding for the project and designed the \$2 million green infrastructure water-quality treatment facility, which includes the treatment wetlands, bioretention facilities, permeable pavement, water harvesting, and park amenities such as bicycle shelters, trails, boardwalk, and disc golf course improvements. The project was completed in 2011.

One of the challenges was vegetation, says Andy Haub,

Olympia's planning and engineering manager.

"We created a wetland and turned it into a well-vegetated area with passive recreational use, so one of the challenges was to really understand the hydraulics of the site so that we could get the right plants in there to survive," he says. "It's doing really well."

The software played a key role in achieving the desired result, Haub says. "We could do iteration after iteration. We could understand a lot of different dynamics, as well as the history of flows through that area. Understanding the hydrology was key, and the software was how we accomplished that."

### Tailoring Solutions

Klotz Associates is a Houston, TX-based firm that provides engineering design and consulting support services for stormwater projects for the public sector, including cities, counties, and the state.

The firm also provides services in other areas such as water and wastewater facilities, transportation, highways, street improvements, traffic-related issues, ports, environmental projects, and drainage.

Even if an engineering project relates to other types of services, drainage or stormwater conveyance improvements are typically involved, points out Tom Ramsey, senior vice president with Klotz Associates.

The company's president, Wayne Klotz, is past president

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(2009) of the American Society of Civil Engineers, which grades the nation's infrastructure and in 2013 gave it a D+. As such, the firm is very attuned to the issues facing infrastructure, including stormwater systems, Ramsey notes.

"Wayne spent many hours with White House staff. He was on every national network for a year addressing infrastructure in general and a need to focus on infrastructure," he says. "Our firm has benefitted from understanding the scope and the depth of the problem."

With the US being a relatively young country, "much of our infrastructure has been built in the last 50 years, and if you put a timeline on the lifespan of most infrastructure, like 50 years or so, we're coming up on the need to address all of these," says Ramsey.

Storm sewers are often addressed at the same time as street improvements or water and sewer improvements, Ramsey points out. "They're all in the same right of way, and they all should be dealt with at the same time. To go back and do one in one year and the other the next year is a big issue in the context of total dollars spent."

Municipal entities that don't have the resources internally to invest in stormwater software can hire firms such as Klotz Associates to provide that service for them. Occasionally, municipalities have a software preference, Ramsey says.

Klotz Associates has used XP Solutions' software for master drainage plans in several Texas counties and municipalities. "All of them need to know that their project—whether it's a detention basin, or they're about to upgrade their storm sewer—is within the context of a regional plan. Xpswmm has been used on many occasions—not necessarily exclusively—to help answer those questions," says Ramsey.

Some clients ask for a conceptual analysis. "They'll say they really want to fine-tune this," says Ramsey. "The merit of xpswmm is that it takes a lot of guessing out. If we're going to size a storm sewer, most communities we work with want to be sure we provide the best solution for the most value."

A software design could confirm, for example, that a city could get by with an 8-foot by 8-foot box culvert instead of one measuring 10 feet by 10 feet. "Now you've just saved your client hundreds of thousands of dollars because you took the time to answer a specific question and not a general question," says Ramsey.

In choosing the appropriate software for stormwater management, Ashley Francis, an associate engineer with Klotz, says it's important to know a client's level of technological savviness and the robustness of the solution being sought.

"In Texas, not everything needs a perfect, over-analyzed, over-optimized solution when it's in the planning or feasibility stage. You don't want an overkill solution if that's not necessary," she says. "There are other clients who say they want to know that the drainage features of their project have been analyzed from every angle possible to know this is going to work because we understand the drainage issues in the region. If a client needs us to make a very complicated

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bioretention ponds or swales and permeable paving. Calculators within the program are designed to size individual drainage systems. An analysis yields information on how well the design will control flows and pollutant removal. Fully engineered drainage designs can be exported back to the base map or CAD program.

In dealing with stormwater engineering issues in Texas, weather patterns are a challenge, Ramsey points out. "In the Houston area, we get 40-plus inches of rain a year," he says. "We don't have high mountains in Houston. We're in the coastal plain. We don't have the benefit of much grade. So when you get eight or nine inches in a day, that's a lot for our systems to handle."

A design that can lower the water surface elevation 6 inches is a "big deal," adds Ramsey. In contrast, for those living in mountainous areas such as Colorado, "you've got plenty of grade and you're trying to slow the water down."

"The only way you're going to understand what the water is doing and how the stormwater is interacting with each event is that you have the tools necessary to answer those questions."

To that end, Klotz Associates has utilized XP Solutions' xpswmm for 10 years. Ten years ago, Ramsey was involved in a presentation to a nearby city whose officials needed to understand clearly what could happen in a 10-, 25- or 100-year event.

"We did a good 2D model with xpswmm and were graphically able to represent that to them," he says. "When they saw the water literally coming out of the tops of the manholes and going into people's yards and into their homes, they said, 'We need to proceed,'" notes Ramsey, adding that the small municipality totally redesigned its storm sewer system.

"Xpswmm offered them that ability

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to understand and see exactly what happens. It was effective—at least to those elected officials—to understand what happens in a fairly routine event.”

It’s especially important to be on top of such matters in areas like Houston, one of the fastest-growing metropolitan areas in the US, he says. “We have so many people moving here, and there’s a need to deal with our infrastructure. When you’re in a growing mode, there are more funding opportunities to deal with it, rather than when you’ve got people moving out of town and you’re trying to deal with an aging infrastructure.”

Francis says her company uses the XP Solutions’ software for stormwater management plans, master drainage plans, for 1D and 2D urban floodplain models, optimizing traditional detention ponds, and determining BMPs as well as for LID infrastructure. Klotz Associates has found new ways to use the software beyond traditional applications, she notes. “We’ve used xpswmm to do something as abstract as calibrate local hydrologic data to a real-time rain gauge,” she says.

Francis is presently working on a feasibility study using xpdrainage and will put the final design into xpswmm. “It’s a new thing in a class of its own,” she says of xpdrainage. “It’s a drainage design package that allows you to graphically do feasibility studies and conceptual analysis all the way through final design for stormwater.”

The software features a “heavy emphasis” on LID

integration into stormwater and storm sewer management, Francis says. “It’s been designed so that landscape architects, in addition to civil engineers, can utilize the software and come up with concepts that work and make numbers work and not have to do a great deal of design analysis up front.”

Francis says xpdrainage has been “invaluable” for her company in doing LID feasibility studies. Case in point: a park-and-ride facility in the Houston area for a local transportation agency. Essentially a large parking lot, such a site can be “the worst-case scenario” with respect to stormwater, she says.

“You need a lot of detention. There’s a lot of water moving and we need to clear up water effectively and very quickly because we have pedestrians and car traffic. This site needs to be designed very well from a drainage perspective.” She used xpdrainage for a preliminary LID infrastructure design, taking the first draft to the 50% stage.

“I reconfigured the storm sewer and added on LID features at the downstream end of that reconfigured design,” she says. “I was able to find out what we could do differently, and even at the 50% design stage, I was able to save up to \$300,000 for storm sewer infrastructure.”

Based on that, Francis and her team decided to go with linear bioretention. She says she was able to eliminate the need for having “one massive detention pond” and created micro-drainage through decentralized drainage facilities.

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Permeable pavement is under consideration.

“Detention is the feature that we decided was going to be most effective,” says Francis. “We decreased the size of the aboveground detention, which allows for more public space for people to interact with at the park-and-ride. It will not just be a concrete parking lot.”

She found xpdrainage to be user-friendly. “It was really fun and interactive to use, which you can’t always say about software,” she says. “It takes it a notch above xpswmm, so they’ve outdone themselves. It’s easy to train young engineers on, as far as sizing and scoping and introducing them to how to get design done.”

The design also maximizes footprint, Francis adds. “Land is less expensive here than it is, for instance, in upstate New York when it comes to sizing and siting facilities,” she says. “But when considering LID features, you do anything you can to optimize the site for your client, for the sake of the project and ultimately for water quality.”

In doing so, “you’re achieving that benefit ahead of time before you have these MS4 permits that become required and before our stormwater regulations start necessitating some of these things we’re doing proactively.”

In using xpdrainage on the park-and-ride project, Francis says she’s getting a glimpse into future prospects regarding the use of software in stormwater management. “We’re really pushing the envelope with this software. In addition to xpswmm, it’s a vehicle that’s helping Klotz drive innovation forward here locally in what we can do. We can give our clients optimized solutions cheaper and faster. We’re going to move the industry forward by utilizing these things that are moving our individual work flow forward.”

Most municipal clients are unaware of what software an independent engineering consulting firm uses, but only care that it delivers results, Francis points out.

“This is how Klotz is providing value to the clients,” she says. “They don’t know that these things are out there. They don’t know we can help them in this way with efficiency. Our team starts by asking the question: ‘How can we innovate and not have this be like every other project we’ve done?’”

“We use XP Solutions’ software because we understand how to use our tools efficiently and effectively, so we integrated xpdrainage to test it out and it’s proved its point so far. For the client, it’s a matter of proving it works and standing by your numbers.”

“Water doesn’t know what city it’s in—it just leaves,” says Ramsey. “If I’m sitting in a city adjacent to Houston, and the city of Houston has done some incredibly correct xpswmm modeling and understands exactly what’s happening to the water, then if that other city doesn’t show up with the ability to engage technologically, their engineers are left guessing.”

“You don’t want to be the city that shows up to a discussion on stormwater not having done xpswmm while everyone else who shows up has done modeling.”

*Carol Brzozowski specializes in topics related to stormwater and technology.*

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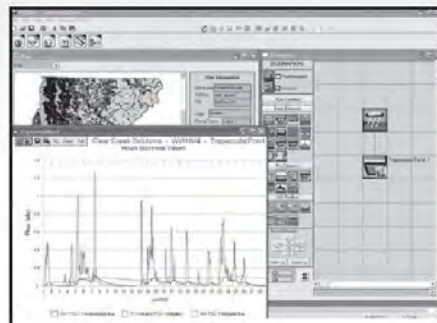
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Photos: Advanced Drainage Systems

# No Longer a Pipe Dream

Relining systems and using lightweight pipes make underground pipe repair easier.

BY JANIS KEATING

**A** pipe's age, along with normal wear and tear, can cause systems to break down. During the winter of 2013–14, record cold temperatures across much of the nation also caused pipe failures, often in water mains. At such times especially, it's important to fix the problem quickly—not only to resume service, but also to keep crews in dangerous weather for the shortest time possible. Many cities these days are finding a variety of solutions to help get the job done.

## Taking Care in Tight Spaces

Even in good years, winters in Maine can be long and difficult, so projects must be completed quickly between April and November. During that period in 2012, the city of Lewiston continued its combined sewer overflow (CSO) separation initiative along Oak Street. The challenges piled up: Crews had to work around a massive rock ledge, old buildings sat virtually on the edge of the trench, and an existing sewer was found to be leaking.

“Although we usually hit clay, sometimes when digging

we hit rock. Of course, in the earlier months, it was difficult to tell which was which, as the frost line here goes down to about four feet,” says Jeffrey D. Beale, P.E., project engineer for Lewiston Public Works. “The existing pipes were already fairly deep. Water mains are five-and-a-half feet down—nothing’s situated less than that. We had to use a big jackhammer on the excavator, because the houses were right there behind the sidewalk—there was not enough room to blast safely. The rock was very hard and didn’t want to break up very easily. We made some test holes every 25 feet to know how deep the rock was.”

The city’s in-house engineering department used flexibility in permitting and designing the project. Local engineers were used for construction inspection, as well as trusted local contractors who were very familiar with the city’s infrastructure. Locally manufactured products were also sought to address all challenges—within the project’s budget and timeline. “I designed the plan myself at the city engineering office,” says Beale. “Gendron & Gendron did the work, and E. J. Prescott was the pipe supplier.”

The pipe supplied was Hilliard, OH’s Advanced Drainage Systems SaniTite HP pipe.

“The city of Portland had used ADS pipe the year before. Another engineer had consulted with the City and knew of the product, so SaniTite sounded like a good idea. Concrete pipe would’ve been more expensive, as well as taking more time to install,” says Beale. Another advan-

tage of the ADS pipe: it can be used in any soil type; it stands up to 1.5 to 14 pH.

Of course, once excavation began, there were more problems than just sewer separation. “Electric wires aren’t underground, but the phone lines are, which were laid in concrete, but some in very old tile, which broke apart easily when you got near them,” continues Beale. “But that’s not to say the electric lines didn’t cause difficulties. Gendron had to buy a special excavator, a Volvo 305 with no rear counterweight, so the machine could get past the buildings. They dug down three feet into the street, so the excavator could sit in the hole and reach everything. Even at that level, if the operator opened the excavator’s roof, he’d hit the overhead wires. Then, of course, we found a large sewer that had to be relined with SaniTite, because it was leaking.”

The Oak Street project had some deep cuts—down 25 to 30 feet in certain areas. Maneuvering the pipe was difficult, especially since one city block was only 40 to 50 feet across. In such a congested area, dug-out material had to be loaded into dump trucks and sent off for storage; there was nowhere to store it onsite. Once the installation was completed and compacted, material was hauled back in to reconstruct the roadway. With such a complicated install, it took a six-member crew eight months to install 800 feet of pipe. Typically, a “normal” project of this size would take just a few days.



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The CMP pipes were much lighter in weight than equivalent concrete pipes, and came in much longer lengths—20 feet versus concrete's 8 feet.

joints were leaking —there were no gaskets in the pipe—so they had to install another 400 feet of 48-inch SaniTite HP pipe to segmentally slipline and rehabilitate the sewer pipe,” explains Beaulé. “With the effluent pouring into the trench, it was decided

However, the ADS pipes made the job easier in many respects. Joints, bends, and “Ts” could be made to spec, which was a boon, since the pipe trails were very complex. The system included 90-degree and 45-degree connections, and some 22-degree bends; ADS even made a pipe that came up at a 45-degree angle, and back at another 45-degree angle.

“The CSO project was very challenging and time consuming. When the crew got near a more-than-50-year-old, 60-inch concrete transmission sewer main, they found the

that we needed to do something quickly, and sliplining seemed to be the best option since we already had a big hole opened. We didn't have to bypass the flows; the crew just pushed the new pipe through. We would have had to set up more bypass pumps if we'd had to replace the pipe.”

Work continues on Oak St. “Other separation work is being done around the city. Three other contracts are wrapping up this year. We have been working on stormwater and sewer separation for the last 15 years—this is the final year of a \$30 million plan,” concludes Beaulé.

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## Good Pipe Goes Pharr

“Replacing” is usually much more difficult than “installing,” and few things illustrate that better than upgrading underground pipes. During installation, except for some vegetation, the area was likely empty land; however, development quickly makes that same land crowded with homes, shops, and other buildings—all of which belong to someone other than the city. In addition to saving money during repairs, city crews must be careful not to disrupt property owners’ land or utilities—at least, not for long lengths of time.

In fall 2012, during the ongoing effort to replace aging and inadequate storm drainage systems, the city of Pharr, TX, and the Texas General Land Office upgraded a smaller reinforced concrete pipe (RCP) drainage system. The task included a main trunk line of large box culverts that collected surface runoff from nearly 320 acres of densely populated residential and commercial areas. With such tight site constraints, the needed concrete boxes would be difficult to install; in addition, the manufacturing



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**Contech’s fittings are used extensively to eliminate manholes, elbows, and junction boxes.**

costs and logistics required were expensive and exceeded the project’s budget.

“This area was mostly residential, with some commercial sites,” says Pharr City engineer William Ueckert Jr., P.E. “Some of the existing stormwater pipes were 30 to 40 years old, and some were undersized for the population growth we’d had during the years. We had a budget; the original bids were for reinforced concrete pipe. Contech said we could save money—maybe \$200,000—with its pipe.”

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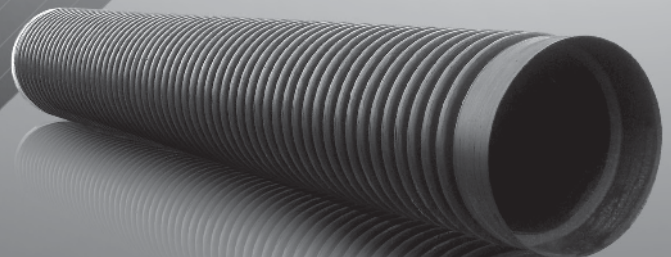


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**The InfraSteel arrived in segments. No crane needed—pipes were easily lifted with lighter equipment, by way of convenient lift eyes.**

Contech Engineered Solutions of West Chester, OH, manufactures a variety of pipes for many applications: corrugated metal pipe (CMP), PVC, HDPE, and steel-reinforced polyethylene (SRPE). Pharr selected Contech's polymer-coated Ultra Flo, a hydraulically efficient CMP with a smooth interior surface. A local subcontractor made the Contech pipes; shipping pipe all the way from Ohio would not have been cost effective.

CMP's lesser weight was also a bonus. "We didn't require a crane on this project, due to weight of Contech's material. The pipe was loaded and installed with a front-end loader," explains Ueckert. "As much of this was in a

residential area, a crane would be extremely heavy and might have damaged the streets. Plus, we would have had to close the streets completely if using a crane. The pipes assembled faster, as well, as these came in 20-foot segments, whereas concrete pipe is only eight feet. So Contech was not only less weight, but also more efficient, time-wise." The installation took approximately six months, well under the original time estimated.

In the original plans, a 36-inch pipe had been specified to go through a 48-inch casing pipe bored under the highway. However, because of Ultra Flo's thinner wall, the pipe used was 42 inches, increasing flow capacity. "Under



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**Right: The InfraSteel liner fully installed. The pipe caps on the roofline were insertion points for the flowable fill mix. Once the mix had set completely, the caps were sheared off and the holes welded.**

highways, and within their rights of way, TxDOT requires casing on any size of pipe. That isn't really relining, but a protection for the inner pipe," says Ueckert. "If repairs have to be made, all the State Highway Department has to do is pull the pipe from the casing."

Contech modeled the system internally to ensure hydraulic equivalency of 78-inch round pipe to 8-foot-by-4-foot and 7-foot-by-5-foot boxes. The 12-gauge polymer coating provided added durability and the required service life. "The Ultra Flo is sort of like a galvanized pipe, but it's steel, coated inside and out with a black polymer coating, which keeps acid soils from eroding the pipe,"

notes Ueckert.

All told, there was \$90,000 in savings to the city. "With the tight constraints of the project in a residential area, the alternative solution of using Ultra Flo was the answer," says Ueckert.

"This project was the first time we'd used Contech. Saenz Utility Contractors, not city workers, performed the work; this was its first Contech project too, and it had no problems. Since then, we've used this product on two other projects, and a private firm now constructing a mall area is using that pipe as well. We're very happy with it. For drainage projects, I'd definitely recommend that pipe."

Photos: St. Lawrence County

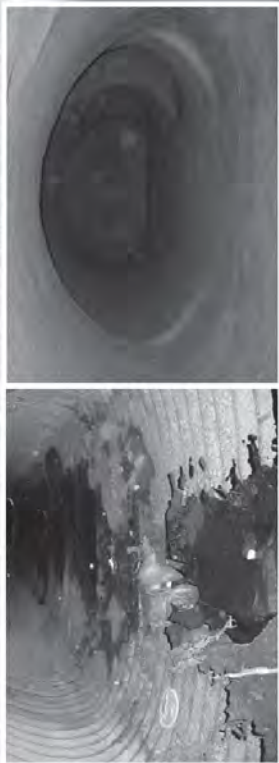


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### Many Hands Make Pipe Work

As frustrating as detours can be in a city, in a rural area they can add up to miles of driving around. When two culverts in St. Lawrence County, NY—one under State Route 12, another under County Route 47—needed to be repaired, lessening the impact for residents was a major concern. “Replacing the culvert would have meant rerouting traffic for some time, and sometimes to go around is a *long* way around—24 miles in this case,” says St. Lawrence County senior civil engineer Andrew Willard, P.E.

Willard and Ernest Olin, P.E., NYSDOT resident engineer for St. Lawrence County, often “talk shop,” and did so especially at this time, when they both faced a similar problem. “Andy [Willard] had seen the InfraSteel product at a trade show and brought up the possibility of a shared services arrangement, where our departments could aid each other to install this product on the state system and the county system,” says Olin.

A product of Birmingham, Alabama’s Precision Pipe & Products Inc., InfraSteel, a permanent culvert rehabilitation system, has been designed to offer cost-effective and environmentally friendly alternatives to culvert preservation and rehabilitation.

Just a few years earlier, severe flooding had caused a collapse of the roadway above CR 47’s culvert. “This culvert was coming up for replacement project soon anyway. It dated from the 1960s, the bottom was rusted through, and it was losing soil underneath,” explains Willard. “At first, the only realistic option was total replacement, as the culvert was too large for a typical round slipliner; there would have been too much loss of hydraulics with round, as the existing structure was a corrugated metal pipe arch [CMPA]. We’ve been very proactive in the last several years looking at new technology, such as GRS-IBS [Geosynthetic Reinforced Soil Integrated Bridge

System]—we’ve done 14 GRS-IBS systems—and the use of recycled thermoplastic structural sections. InfraSteel seemed like a great idea.”

Olin faced similar problems with SR 12’s culvert. “Invert paving was eliminated due to doubts of structural integrity, as there’s not much cover over the culvert; the shallow cover would not absorb much of the highway loads. Basic sliplining was discounted as well, due to the diminished hydraulic capacity. We simply could not afford to lose any capacity at this location. Without the InfraSteel liner our only course of action was a total replacement, which would likely be done by contract, would be costly, and take a minimum of two or three years to come to fruition.”

A distinct advantage: InfraSteel was made to order. “The host pipe was carefully measured by DOT engineering staff and the order was placed

**“Replacing” is usually much more difficult than “installing,” and few things illustrate that better than upgrading underground pipes.**

July 31, 2013, and the InfraSteel liner arrived September 11, 2013. The order consisted of nine pieces of liner in total, six 10-foot and three 8-foot pipe arch-shaped pieces 131 by 81 inches,” explains Olin. “In addition, Precision’s cost came in under our discretionary purchasing limits; therefore this was within reach for our crews to purchase and to use. We didn’t have to contract the work.”

“InfraSteel is a smooth, half-inch plate structural steel pipe, which arrived in sections,” says Willard. “For shipping and handling you can’t put it in full length—the culvert we relined was 104 feet, and you can’t put something that size at the end of a truck. Plus, the steel weighs about



St. Lawrence County

2010's late-summer flood took out not only beaver dams upstream, but also part of CR 47. The aging culvert beneath the road could not handle all the water.

500 pounds per linear foot. However, it was really easy to put it in with an excavator, to unload and set the sections on the frame. We'd made a framework from a used box beam to set the pipe sections on, to weld together outside the host pipe. With a dozer on one end and an end-loader on the other, after welding, we could pull and push the liner into the host pipe. The InfraSteel pipe came to match dimensions of the CMPA 'as installed'—not the same shape as 'design,' due to settlement. We took custom measurements, and Precision rolled it to those specs, just enough smaller to fit the existing pipe. The host pipe is 10-gauge pipe, 0.14 of inch, so the InfraSteel is much sturdier." It's estimated that the InfraSteel inserts will have a 50- to 100-year life.

As the pipe arrived in sections, no huge equipment was required. "We didn't want to use a crane to lift the pipes, because that would mean a lane closure for several days," says Willard. "We wanted to do this with minimum obstruction to the public. As each piece of pipe was 8 to 10 feet long, an excavator could unload it with ease. Precision makes the pipe with beveled edges, to prep for welding, as well as installing lift eyes on the sections, so they're easily lifted. I know of no one else who's doing this heavy steel pipe

for relining. Our culverts are too large for plastic liners; water flows are too high."

The liner was cost-effective, and so was the installation. "A formal shared service agreement was drawn up. The SLC Highway Department would aid NYSDOT with welding the liner together, and we in return would grout the liner on the county system. A general site safety plan was developed and gone over in the field prior to starting work, which included a lifting plan, a plan for welding, and working safely with this liner," explains Olin. "There was initially a learning curve to figure out the most efficient way to join and weld the liners together. Cullom Walker of Precision Pipe was onsite, offering technical expertise the entire time. Crews found small porta-power hydraulic rams invaluable in mating the liners together. There were three crews of two welders each initially working simultaneously, 'pairing' the liners in an adjacent staging area, working off two pieces of straight boxbeam guiderail of 20-foot lengths. Once we partially inserted the first paired liner into the host pipe, a second 'mated pair' was brought over to the outlet of the host pipe, joined, and pushed in partially—and so on, until all the liners were joined and inserted. The crews welded steel channel into

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the bottom of the host pipe to minimize friction and the force to push the liner. It took five days to join all the liner and push it into the host pipe.”

As the insert was slightly smaller than the original culvert, and the original was breaking down, those spaces needed to be filled. “The entire interstitial space, and also the space beneath the pipe, was pressure-grouted with a flowable fill mix, CLSM 500PSI,” says Willard. “Ernie’s NYSDOT crew had

a concrete pump, so they did that part of the job, just as we added welders to their job. Working in cooperation made the projects faster for both of us.”

“Water was diverted through the new liner prior the grouting, and grout was pumped through bungs at different locations welded into the liner pipe,” adds Olin.

“The only real issue we ran into—we were lucky, we did our pipe second, SR 12 was the ‘guinea pig’—was

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The corrugated pipe is still visible at the inlets and outlets. Additional riprap was added, to improve energy dissipation.



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that we did keep the water flowing through the pipe when putting it in, so we had some water issues. We finally resorted to welding bales to finish the welding. Water was a little bit of a battle for us. We maintained the stream flowing through the host pipe during installation. Initial flows were such that the space between the host pipe and liner handled the flow of water without issue. During the project, rain increased the stream flow and we needed to use the liner for flows, making welding difficult. We used temporary dams to hold the water back for short intervals to weld the liner. Looking back, if we do this in the future, we’d think of doing some pumping. It’s difficult to make welds underwater; getting to see what you’re doing is a good thing,” chuckles Willard. “Speaking of water: hydraulics improve with smooth-lined pipe, opposed to the existing corrugated pipe. Therefore, the water speed went up, perhaps two to three feet per second more—so we needed to add more riprap to the end of the new pipe, for energy dissipation.”

Olin notes the cost savings of the InfraSteel reline for the SR 12 project: “It cost \$85,000; to replace the culvert would have cost \$360,000.”

Not only “cash money” was saved; time, and residents’ patience, were spared. “We never shut traffic completely off. There was some short-term single lane, flagging for unloading, and so on,” says Willard. “If we had



replaced our culvert, not only would it have taken much more time, but it also would have required 5,600 yards of excavation. With the relining, we were able to stay within the right of way for this section of two-lane road. Our savings took into account the cost to the public; if we'd had to replace the culvert, close that section of CR 47, and make people detour around, what would it cost them? At last count, the road was used by 702 cars a day. The detour around would have entailed 24 miles. So—for six weeks, seven days a week, 702 cars driving 24 extra miles, at the federal deduction standard of 56.5 cents a mile—that figure is just shy of \$400,000.”

This was the first time Willard and Olin had used InfraSteel. “We maintain several hundred culverts in the county—260 in the 4- to 20-foot span range, and 2,128 under a 4-foot span—and I don’t doubt we will be relining another in the future,” says Willard.

“Use InfraSteel again? Yes. If I run into that kind of situation again I will. In fact, I have one in mind right now,” concludes Olin. ♠

*Janis Keating is a frequent contributor to Forester Media publications.*

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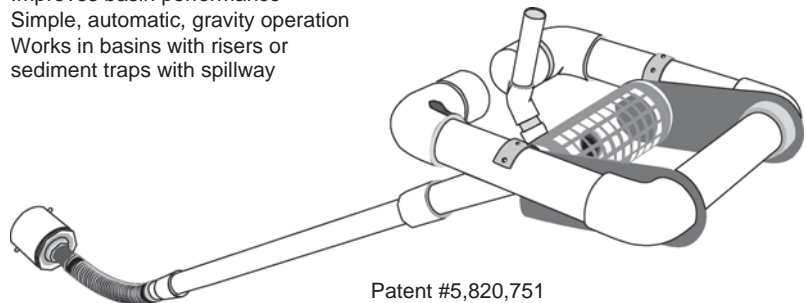


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# Monitoring Water Quality in the Field

New equipment for obtaining accurate onsite samples

BY CAROL BRZOZOWSKI

**F**rom studying the effects of urban land use on fish communities to observing the effect that stormwater quantity has on water quality, stormwater managers, biologists, and university researchers are employing various monitoring and sampling tools and techniques in an effort to achieve optimal results.

To determine the impact of urban land use on fish communities in salt marshes, Madeline Wedge, a recent Master's graduate of Auburn University, used HOBO U24 Conductivity Data Loggers from Onset to measure temperature and salinity conditions in creeks in a study conducted from the winter of 2011 through February 2013.

Through the study, Wedge learned that conductivity loggers allowed for measurements over a whole year instead of one-time captures of salinity data. She also discovered urban tidal creeks demonstrated more rapid changes in salinity in response to rain

events compared to reference marshes. Another conclusion: the changes in salinity were related to changes in the fish community.

Wedge, who now works as an adjunct faculty member at Vincennes University in Indiana as well as a herpetology technician for the Indiana Department of Natural Resources, had a background as a fisheries technician prior to starting her master's degree project at Auburn University.

Christopher Anderson of the Wetland and Riparian Ecology Lab of Auburn University, who served as Wedge's advisor, had an interest in how urban land use affected the fish communities in salt marshes.

"With my background in fish, we were able to come up with this project



**Protective housing for an underwater data logger**

looking at how urban land use along a small regional coastal area in Alabama and Florida was impacting the salt marshes in the tidal creek systems and the fish communities that lived in there,” says Wedge.

There are a number of fish that use salt marshes, she says.

“Typically, we think of the red fish and the speckled trout that use it more on a temporary basis. They’ll use it as young or in seasonal use as adults, but they don’t spend their whole lives there,” she says. “What I chose to focus on instead were these small bait-fish that people often use. They’ll live their entire lives in the salt marshes down there.”

Wedge’s project focused on the salt marshes dominated by black needlerush, common along the Alabama and Florida coast in that area of the Panhandle. Black needlerush is commonly planted in constructed wetlands and used for the treatment of dilute organic wastes, according to the United States Department of Agriculture Natural Resources Conservation Service.

When Wedge originally started sampling, she used a handheld device to capture a one-time measure of salinity and temperature at the site. She was sampling at four marshes along the creek that were dominated by black needlerush.

“When I was taking those one-time measures, we would see the salinity at the farthest upstream marsh was lower than the one closest to the mouth, but I wasn’t really seeing the differences I originally anticipated in the salinity with those one-time measures,” notes Wedge.

She says her advisor indicated he believed they were missing some key factors associated with the salinity as an effect from the rain because they were unable to be out there and sample on an ongoing basis.

“We did see changes in the fish, but not so much in those one-time salinity measures,” says Wedge.

That prompted them to look for other equipment that would allow them to continually track the salinity and temperature and see if after the study was done they could combine the results with rain data.

“We didn’t actually measure the flow, but we feel that the salinity definitely gives you an idea if you wind up with rain data—which we haven’t fully done yet but were anticipating to do—then you could say there was a rain event and this is what happened to the salinity,” she says.

Wedge and her advisor chose to use HOBO U24 Conductivity Data Loggers, which are available for freshwater and saltwater applications.

Onset’s HOBO U24-002-C is designed to be a cost-effective data logger for measuring salinity, conductivity, and temperature in saltwater environments with relatively small changes in salinity ( $\pm 5,000 \mu\text{S}/\text{cm}$ ) such as saltwater bays, or to detect salinity events such as upwelling, rainstorm, and discharge events.

The logger features a non-contact sensor for longevity and two user-selectable ranges providing measurements



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Co-founder Charles E. Watt, 1923-2014, pioneered the use of automated equipment to perform percolation testing for stormwater retention basin construction. Protected by Design and Method Patents #7640792 B2 and #8091409 B2 (trademark pending).



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from 100 to 55,000  $\mu\text{S}/\text{cm}$ . The housing is designed to not corrode in saltwater.

HOBOWare Pro software enables start/end-point calibration to compensate for any fouling and provides easy conversion to specific conductance and salinity using the Practical Salinity Scale 1978. A USB optical interface is designed to provide high-speed, reliable salinity data offload in wet environments. The product is compatible with the HOBOWaterproof Shuttle for data retrieval and transport.

Wedge set the loggers to read data every five minutes. "I probably could have set them to read at lower frequency every 10 to 15 minutes and still would have captured data, but I wanted to be a little more conservative and take more measurements, which allowed us to pick them up every two months," she says. "If I had bumped it up to 10 or 15 minutes, we would have been able to keep them out there for longer, but it turned out that having them being picked up every two months was probably good. In the tidal creeks, there is a lot of silt and other things coming down, and it was good to check on the equipment and make sure the cases I put them in were still operating and that stuff wasn't growing on them too much so we wouldn't be able to access them anymore."

The HOBOWare connectivity loggers allowed Wedge and Anderson to have equipment at the site measuring on an ongoing basis so they could observe changes in the fish. "We got about a year's worth of data out of those loggers," says

Wedge. "They only overlapped with my fish study for two sampling periods. But it definitely gave me a good idea of what happens in a year at those urban creeks compared to our reference creeks, which typically had forested areas within a 500-meter radius of our sampling area."

Wedge says she and Anderson noted sharper declines and increases in the salinity at these urban creeks, typically in response to rain events.

"I got very lucky; there were a number of heavy rain events that would hit all of my creeks so I could see how they were each impacted by those big rain events coming through," she says. "The reference creeks certainly showed more resilience to a rain event. The urban creeks would rapidly decline in their salinity, getting closer and closer to the freshwater, and in some cases in the heaviest rain events it would actually sit at freshwater or above zero parts per thousand for a number of days before climbing up. Some of the reference creeks would get low and at times would get to freshwater concentrations—very low salinity—but they never really stayed there for a long period of time. They would always increase in their salinity after those measurements."

In her study, Wedge found that urban creeks did exhibit differences in their fish communities compared to the reference creeks.

"This was likely tied to the changes in salinity that we found," she says.

From the study's results, Wedge says that going forward, it is advisable in urban development or housing developments located near tidal creeks have more water retention plans, either with fewer impervious surfaces or the creation of water retention ponds to help mitigate freshwater flushings into the tidal creeks.

## Researching Green Infrastructure

Michael Borst is an engineer with EPA for the National Risk Management Resource Laboratory. He researches the performance and effectiveness of green infrastructure as it is applied in urban communities.

Borst uses In-Situ's Level Troll 500 Water Level Data Logger. In-Situ is one of several pressure transducer suppliers that EPA uses in its field sites when looking at how communities are better controlling their stormwater, he says. Borst and his team use the instruments to look at water volume and how it's captured.

The vented Level Troll 500 is designed to measure and record water level, pressure, and temperature and is available in six different pressure ranges from 5 psig to 500 psig. It automatically compensates for barometric pressure, significantly reducing time required to post process data.

The data logger is used to measure water level where the highest accuracy levels are required and where groundwater or surface water is open to the atmosphere. The user can choose from linear, fast linear, and event logging modes. It integrates with telemetry systems, SCADA/PLC systems, and third-party data loggers and samplers.

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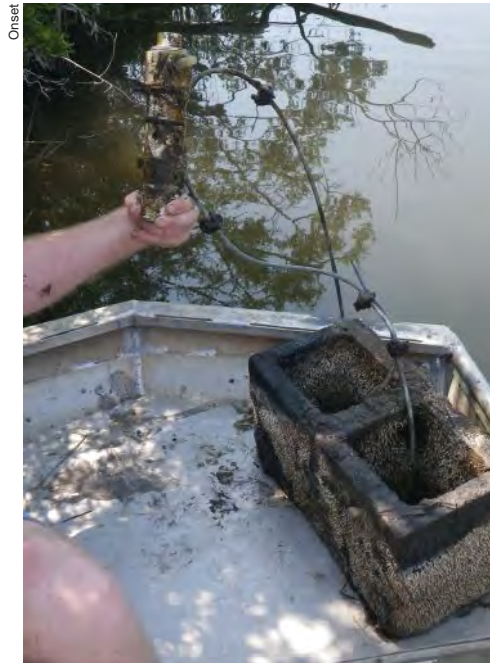
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Borst's advice to stormwater managers setting up a monitoring program in a given area is to plan the monitoring before construction starts. "Trying to do it after the fact makes life much more complicated and much more expensive than if there had been an investment before the shovels hit the ground," he says.

"The next thing to think about is that you're not in a laboratory environment," adds Borst. "What you're using has to have some level of robustness to make sure it's going to be there when you come back, that the flowing water is not going to hurt it, and that it can take the occasional hit. It's not like you're going to drive a truck over it, but you're not in a condition where you can treat it very delicately, so you have to plan that in as well."

Redundancy also is key, Borst says. "In most applications, once it's in, it's in and there's no going back for try two," he says. "The cost of putting in second instruments is much less than having an instrument fail."



Measuring creek temperature and salinity

## Working on Construction Sites

Ryan and Brady Watt were seeking a way to measure the rate of percolation of turbid water so they could properly size stormwater detention approaches on the construction sites they developed through their construction company, Watt Construction, in California. As part of that effort, Ryan Watt invented the Stormwater Infiltrometer, which is the flagship product of their other company, Stormwater Percolation Consultants.

The system determines the rate of percolation in natural soil. It creates turbid water by adding local soil to the water to fabricate stormwater runoff for the purposes of testing BMP devices or facilities to meet retention-based performance standards.

The turbid water generator used for BMP performance certification is capable of creating synthetic stormwater runoff of 0 to 1,000 nephelometric turbidity units (NTUs). Atmospheric conditions can result in fluctuations in data.

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“Turbid water is supposed to be representative of stormwater runoff,” says Brady Watt.

“Ryan developed a machine with a sediment hopper, using native soil from the area filtered through screens and loaded into the hopper. A worm drive gear at the bottom of the funnel pushes the dirt and drops it through a hole into a mixing box.”

The water is introduced. An electronic motor can be set at various speeds to determine the rate at which the worm drive gear rotates or revolves, which affects the amount of sediment added to the water, thus affecting turbidity.

“The turbid water is then dumped into a ring that has a float device in it,” explains Brady Watt. “There are many types—it can be inches marked on the side wall of the ring or it can be an electronic float that communicates to a data logger, from which we can pick up data from either onsite with a laptop computer or remotely with smart-

phone technology.”

The Stormwater Infiltrometer is powered by electricity, generator or solar power, and is designed for remote locations. Water comes from municipal sources, which can be held in storage tanks and gravity-fed into the system.

The Watt brothers first tried out the system on their own project site in Los Angeles County. The trial-run project was conducted on a 160-acre subdivision where the Watts are developing 80 lots.

“Our data has been approved by a licensed soils engineer who worked with us on our projects; it was submitted to Los Angeles County and was approved,” says Brady Watt. “The percolation rate is essential

for the engineers to determine the size of a retention basin, since we’re required to retain all stormwater runoff onsite.”

The system was next used by the Watts acting as subcontractors for another company, which is developing a site of 300 solar panels in the desert. The soils engineers were Earth Systems in southern California.

“They had two sites they had predetermined for the location of a retention basin,” says Brady Watt. “We had to use solar power in a very remote area. We had two separate sites on that job with two machines working full time. We had to truck in water to storage tanks and use solar power for energy to run the equipment.”

Earth Systems used the data in calculating the size of the needed retention basins. ♠

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*Carol Brzozowski specializes in topics related to stormwater and technology.*

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# Guardians at the Grate

Inlet protection devices keep trash, pollutants—and sometimes alligators—out of the system.

BY STEVE GOLDBERG

Located in the South Bay area of Los Angeles County, CA, Machado Lake once was known as a prime bird-watching location but has suffered numerous indignities in recent years. It has become a dumping ground for unwanted snakes and a variety of trash, as well as a repository for pesticides. It even became notorious for an alligator that mysteriously appeared and resisted all attempts at capture for many years, managing to famed “Crocodile Hunter” Steve Irwin, who was brought in to try to bring relief to worried neighbors.

But now six cities around the lake have joined together in what Terry Flury refers to as the Machado Lake Project. Flury, who is with United Storm Water in southern California, explains that this initial phase is to prevent trash from entering the lake.

Subsequently, pollution reduction will also be addressed.

“We’re putting in mass BMP devices—we’re actually putting in what we call an automated retractable screen (ARS),” he says. “We’re installing ARS units all over those six cities surrounding the lake.” The cities are Torrance, Lomita, Rancho Palos Verdes, Palos Verdes Estates, Rolling Hills Estates, and Carson.

“We’re putting in those devices, as well as our connector pipe screen, what we call CPS inserts,” he says. “These CPS inserts are five-millimeter screens that go inside the

catch basins, over the storm drain outlet pipe. This is considered a full-capture device, which prevents items as small as cigarette butts from entering the storm drains. This is joined with the ARS units, which keep out large debris, like bottles, cans, diapers, and the like.”



An automated retractable screen unit

During a large storm, when stormwater reaches about half of the curb height the ARS opens to prevent street flooding, allowing everything—water and debris—into the storm drain. “However, whatever it lets in is still prevented by the CPS unit from getting into the storm drain system,” he notes.

The system is being used throughout California. “We’re putting in these devices up in the San Francisco Bay area, and we put in around 10,000 of the screens for the county of Los Angeles alone. It’s been an ongoing project for us the last couple years.

“It’s sort of been like inventing the wheel, then improving it. For the last seven or eight years, these automatic retractable screens have been around, but they really haven’t worked very well. So recently we’ve come up with a device that is simple, but has been very effective, and it works really well with trash.”

Flury says Los Angeles County requires that all BMP stormwater products undergo testing in order to be approved. The county maintains a testing facility at San Gabriel Dam, where it runs hydraulic tests on various products to verify that they are functional.

“You have to pass muster through the engineering department of the county of Los Angeles before you can put any devices in, for any city within the county boundaries,” says Flury.

“When the county tests these devices at the San Gabriel Dam, they have a very neat system. They have a double catch basin, and they have a 6% grade with the curb that they set up with a big 2.5-foot-diameter pipe coming from a pump system, from the lake. They are able to generate whatever cubic-feet-per-minute flow they want down that grade into the catch basin. In behind the catch basin they have a weir, and the weir is marked per foot, so they can measure water flow.

“Say we put in our screen in the catch basin that’s in front of the weir. With the water flow that enters our screen, we are able to tell when it goes into the next basin, the bypass, how much water actually goes into our screen, and thus give them a mark of how many cubic feet per second they can handle.

“The only problem is that they have been doing this for the past five or six years, but they don’t test it with trash,” he continues. “During a first-flush event, you get anything and everything going down that curb system. You get leaves and twigs and branches and paper bags, and they don’t test for that. That’s been the real killer of these screens.

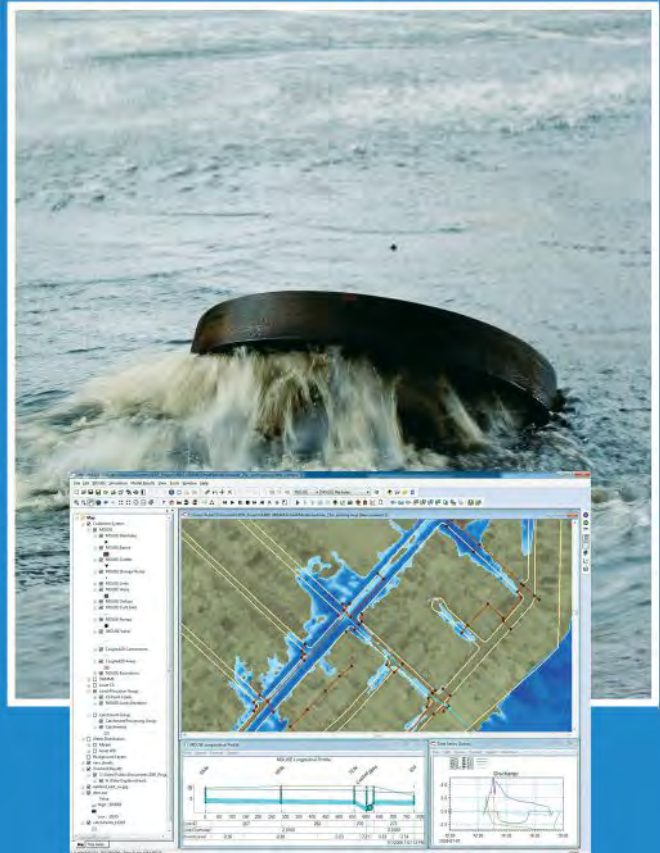
“So we’ve done our own homework on that, and we have a catch basin next to our facility that we use to test, and we’ve come up with a device that works well with trash.”

Flury notes one result of the county’s failure to fully test these stormwater BMP devices. “There was a company that recently went out of business that was a competitor of ours. They sold the city of Los Angeles an ARS screen that was well thought out. It was a very nice looking screen, probably one of the better-looking screens that I’ve ever seen.

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“But it had a major flaw, and that flaw was that it would open up beautifully with fresh water coming at the curb, but the moment that trash hit it, it didn’t open at all. They put in maybe 15,000 of these screens all over the city of Los Angeles, and they had nothing but problems with them.

“There were a lot of issues,” he adds. “They had flooding; they had accidents during the flooding, major lawsuits—and all of this because of the trash. Yet this device went through the testing program and passed.”

According to Flury, United Storm Water has tried to assist the county in upgrading its processes.

“We’ve even had the county come over to our facility when we conduct our testing,” he says. “We put every type of trash that you would find in a first-flush event down the curb. Then we run our vacuum truck upstream and let the water come down naturally. We showed the county that this is the way we think all these screens should be tested. They took that to heart, and they’re currently trying to come up with a system to do that. Their concern is that with the dam, they have to have a trap system to prevent all that trash from getting into the dam. To me that is no problem; you just plug it off or have a filter system down below. But it’s definitely something that they’re working on.”

Not a lot of maintenance is required with these capture devices. “United Storm Water is known for cleaning catch basins,” says Flury. “We do an annual contract with the county where we clean out about 8,500 storm drains four times a year. So we’re constantly doing that.

“The county has told the cities within its borders it’s generally best that if these devices are put in the catch basins, they should be cleaned four times a year. But a lot of the cities that don’t have the flora and fauna all over the place, and they can get away with three times a year easily, with no problem. The cities that have major tree-lined streets are the ones that have to be done quite often.”

Now, about that alligator . . .

“Somebody had him as a pet, and

it grew and grew and grew, and the next thing you know, some people were at the park where the lake is, and they saw an alligator come out and grab a duck out of the water.

“Then they called the alligator guy from Australia, because nobody could get the alligator out. And he couldn’t either. A couple years after he left, the alligator vanished somewhere, and nobody saw it for a while.

“To make a long story short, they finally saw it and were able to capture it, and it was taken to the zoo.”

Indeed, Machado Lake is now on its way to being both cleaner and safer.

### **The Benefits of Baskets**

“Each year, thousands of pounds of nutrient-rich sediments, leaves, and trash debris are transported directly into many of our local lakes from untreated stormwater associated with impervious streets, parking lots, and driveways,” commented Sergio Duarte, senior environmental specialist in the Environmental Protection Division (EPD) in Orange County, FL, at a 2013 North American Lake Management Society conference. “These pollutants negatively impact the water quality, use, and enjoyment of the local lakes. That is why stormwater catch basin insert filter baskets (CBI) have become a useful option for Orange County’s Lake Management Program. The CBIs are installed directly into the existing stormwater curb or grate inlet infrastructure and capture debris such as sand, leaves, and trash while allowing the water to drain into the stormwater system.”

In a recent interview, Duarte notes that Orange County—which includes the city of Orlando and a dozen nearby communities—has contracted with Suntree Technologies since 2008, and in 2014 currently has more than 600 filter baskets in 16 lake basins. “Orange County plans to install an average of 200 filter baskets per year for the next three years to cover additional lake basins,” he adds.

“We originally went with the baskets with the idea that they were going to supplement the street

sweeping program. At that time, all we had in mind was to have a secondary device to help us trap the debris that the street sweepers were missing. Over time, we evolved with the baskets, and we did realize that the baskets were really useful to also protect existing stormwater systems of any type.

“This includes, for example, inlets that are connected to retention ponds, or a structure that has a direct outfall to a lake,” he says. “We found that just having a basket there was reducing the flow of sediment to those stormwater treatment areas. In other words, what the baskets were doing is extending the life, or maintaining the performance, of those ponds or outfall pipes.

“The baskets are primarily used for two simple reasons. One is to trap sediment during the rainy season. In Florida, we get a lot of heavy rains. The other purpose is to trap leaves during the fall. Those are the two main materials that we are trapping.”

He adds, “Sediment is the killer of retention ponds, because they will fill over time, and they will then not perform as expected. So the baskets proved to be a way to extend the life of these systems, or a way to minimize the maintenance frequency of those ponds. We have ponds that we used to have to clean every five years or so, but with the baskets, we have seen that the ponds can go longer without that type of cleaning or maintenance.

“We noticed the same thing with outfall pipes. We used to have a lot of sediment accumulation in the outfall pipes, and with the baskets we don’t have sediment buildup at the same rate. So we have been really happy with this added best management practice.

“The other thing is that the baskets are also good for BMP treatment trains. We have second-generation baffle boxes, and in many areas we install inlet baskets in the system immediately upstream. So the baskets help us to trap a portion of the sediment, thereby having less sediment going into the baffle boxes.”

He notes that it’s easier to clean

a basket than a baffle box. “When you’re cleaning a baffle box, you actually need to bring a vacuum truck, and you have to do pumping. There is a lot of work to do. But with the baskets as part of a treatment train, they are very cost effective and can be readily cleaned by a team of two in a matter of minutes.”

Duarte says the county has 36 lake taxing districts, which provide most of the funding for this ongoing catch basin project. “We have close to 700 water bodies in Orange County, distributed among 12 drainage basins. But we have just a handful of lakes covered with baskets. This is why we are continuing the program of adding as many as 200 each year.”



**Cleaning the baskets**

Orange County Environmental Protection Division

originally envisioned primarily to assist the street sweeping program in keeping trash out of the storm drains, they have also served to reduce organic and sediment loads to stormwater ponds, and have been responsible for significantly reducing the amounts of total phosphorus and total nitrogen in the system.

According to research done by Orange County EPD

Encompassing 99 square miles, the various bodies of water make up about 10% of the area of the county. Lake Holden, Lake Conway, Lake Jessamine, Lake Tibet, and Lake Lawne are a few of the lakes currently serviced with a variety of curb inlet and grate inlet baskets.

Although the baskets were

in 2013, catch basin inserts with monthly cleanings have averaged removal of 0.44 pound per month of total nitrogen and 0.11 pound per month of total phosphorus. However, Duarte says further research is needed to test catch basin insert removal rates based on existing pollutant pre-loads and the size of



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the inlet or catch basin insert micro-basins (the drainage area associated with each such inlet).

“Compared to other baskets,” he says, “Suntree baskets have a multi-stage filtration based on three different types of mesh sizes. The smallest mesh in the bottom of the basket can trap fine sediment, compared to other baskets in the market. With some of the other baskets, you don’t get that kind of ability.

“So we’ve been attracted to that fact, that they are useful to us during Florida’s rainy season to trap sediments, as well as during the fall, winter, and spring months when we get a lot of leaf and oak tree acorn litter loads in residential areas.”

He adds that all of the county’s Suntree baskets are custom made. “I’ve been so grateful that Suntree has been able to work with us in that sense. We have different types of drains—we have grate and curb inlets. Some are old-fashioned shallow inlets, and we’ve had to struggle with those.

“We also developed, with Suntree, a procedure where the baskets are uniquely labeled, secured with locks and tethers, and installed without causing street flooding during the rainy season. Over the years we have worked with them, determining where these baskets will work and where they will not. We have been learning a lot.”

He continues, “We had some shallow baskets, and then we learned

later that this probably wasn’t the best way to go, because they were too shallow. In some cases, they were blocking more than one-third of the pipe opening and inducing flooding.”

Duarte says that the baskets are generally cleaned out on a monthly basis. “In some areas, though, we have increased the sweeping frequency, to help the baskets. It’s easier to adjust the sweeping frequency than the cleaning frequency of the baskets, in most cases.”

Of the greatest importance is that the baskets appear to be doing their jobs well. “The value of a BMP is related to its pollutant removal capacity,” he explains, “so we have looked at studies reviewing the performance of those baskets in terms of the type of material that they remove, the weight, and so on. We have also done our own lab samples to examine removal efficiencies in terms of total phosphorus, total nitrogen, and metals.

“We love them, and we have been studying them very closely. For us, they are one of the most inexpensive BMPs. You don’t have to tear apart the existing infrastructure, as with some other BMPs, and you don’t have to get involved with land purchases, as is the case for the construction of stormwater ponds or other type of BMPs.

“This is something with which we can just go to a neighborhood and get it in place. It’s a ready-to-go BMP,

and so inexpensive. They are easy to install and maintain, they have a simple bypass technology, and they are durable. They are a good supplement to the street sweeping program, as a BMP treatment train.”

### Light Rail in Phoenix

A 3-mile light rail project was underway in Phoenix, AZ, but the portion of the project devoted to inlet protection was not going well.

“The contractor had ordered, originally, a bunch of green fabric, almost like angle-iron curved inlet protection,” describes Cary Winters of UltraTech International. “It was four feet wide, and it had a fabric around it, so it looked like the letter ‘L.’ They wanted to stick that up against a curb inlet, and then nail it in or shoot it in with concrete shot and a piece of wire.

“It was a real old-school way of going about things. The problem was that people would drive by, and there wasn’t much support there. It wasn’t fastened in well and it wasn’t flush to the curb, so people would knock off the curb inlet protection. It would end up down the street, so the street was being littered, and they had to constantly put them back in place. It was kind of a nightmare.

“Finally, they got a bunch of steel wire and took concrete shots, and shot each one into the curb to hold it in place. This was time consuming, but an even bigger issue was that a lot of the curbs they were doing



UltraTech

Gutter Guard Plus units stay in place even with heavy traffic.



were brand new. They were rebuilding the sidewalks and the curbs, and they couldn't use the concrete shots with the brand new curbs, because it needed to have a finished look when they turned it back over to the state."

After a few months, the contractor decided there had to be a better solution and purchased about 100 of UltraTech's 4-foot-wide Gutter Guard Plus units. "These incorporate a little triangular piece of foam," explains Winters. "Two or three months into the project, they had no issues with those getting taken away with street sweepers and buses. They wedge themselves into the curb inlets extremely well. They are flush against it, so it keeps the sediment and the debris and the trash out of the drain, but it still allows the stormwater to flow through it."

According to Winters, these units permit a flow rate of 456 gallons per minute.

"The SWPPP [stormwater pollution prevention plan] mandates that they have to protect the storm drains, so this product keeps them compliant, and it also prevents hundreds of man hours of headaches. Another nice thing is that when they need to move them, they can just un-wedge them out of the curb inlet. Let's say they are going to go do the next mile stretch; they don't have to unfasten all the shots, and they don't have to move all these big, bulky things around. These are lightweight, with foam and PVC with fabric around them. So they just un-wedge them and take them down the street and put them in another drain.

"They were concerned with rocks and pieces of concrete and gravel and larger pieces of trash coming off the jobsite. With the Gutter Guard Plus unit in place, there's only about an inch of space, so you can't get much in there."

Winters adds that the units are

for temporary inlet protection, for the duration of the project. When it is completed, Winters expects the contractor to bring the Gutter Guard Plus devices out to the next jobsite.

"It's fairly reusable," he says. "The product is really just a blocker, not a filter that's going to get saturated. It just stops things from entering the storm drain."

He notes, however, that the product isn't limited to temporary

construction projects. "You can use this as permanently as you'd like. We have industrial companies that aren't doing any construction, but constantly get debris in their storm inlets, so they use this product. It can be used as long as you want, as long as the foam doesn't degrade. It can potentially last years and years." ♦

*Steve Goldberg writes on issues related to erosion control and the environment.*

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# Cleaner Streets

Street sweeping can reduce water and air pollution.

BY MARGARET BURANEN

Street sweeping is such a basic task performed by municipalities and other governmental agencies that it can be taken for granted by local residents. It is, after all, simple enough for a child to watch and understand. That simplicity can obscure its importance in reducing pollution in stormwater runoff and improving the quality of a community's water supply.

Street sweeping by its name suggests a maintenance activity performed in cities and towns, in areas where there is lots of vehicular traffic. However, indirect or intermittent connections to streets add street sweeping to the duties of some non-municipal agencies, such as a flood control district in Arizona.

Established in 1959, the Flood Control District of Maricopa County identifies flood hazard situations and works to prevent floods and control damage. The agency's purpose is to reduce the risk of injury, loss of life, and property damage from flooding in the county.

The district is responsible for

providing regional flood protection for 3.9 million residents in all of Maricopa County and local flood protection in unincorporated Maricopa County. (The district is not responsible for all flood control within the county, as some municipalities handle their own floodplain management.)

Since its establishment, the district has facilitated the planning, design, and construction of more than 100 flood control structures. This number includes 22 dams or flood retarding structures that are located in critical flood hazard areas throughout the county.

The district was formed in response to significant flooding events that plagued Maricopa County during its early history. The area's Sonoran Desert environment floods readily because of its unique soil and topography characteristics; winter and summer rainy seasons; and numerous natural riverbeds, washes, and channels.

During a rainstorm, these normally dry waterways can quickly become raging rivers, causing widespread overland flooding when unchecked. Initially the district focused on build-

ing dams, basins, and channels to prevent flooding.

Unprecedented population growth and development in Maricopa County in recent years has changed the district's emphasis. Now the agency focuses on maintaining its flood control structures as well as educating citizens about flood hazards, identifying specific hazard areas so county residents can avoid building homes there, and controlling development that directly impacts waterways. The latter is accomplished through a mandated drainage administration and floodplain management regulation program.

The district operates and maintains flood control structures with a commitment to minimizing environmental impacts on air and water while enhancing the quality of life for residents living near them. These facilities were designed to blend with the desert environment, providing flood protection along with hiking trails, bike paths, and open space for Maricopa County residents.

"We use the sweeper for dust control and trackout issues," says Gregory Browne, field supervisor and shop

foreman with the district's Operations and Maintenance Division. "Whenever we have to cross a road, we use the sweeper." The district has a Schwarze M6 Avalanche sweeper purchased last year.

Trucks travel across acres of dirt taking workers to inspect or repair the dams and other flood control facilities. The dust they have disturbed and gravel carried back out has to be removed from the public roads they use for the agency to be in compliance with regulations.

"Nothing's paved," explains Browne. "When the trackout dries, it creates a problem with air pollution, so we use the sweeper year around."

Geography sometimes makes things worse for local residents. "Phoenix is surrounded by mountains, so sometimes we don't get enough air circulation, and we can get air pollution—a kind of smog," he says.

The street and road sweeping is part of the work done by a crew of 10. "They have about 40 pieces of big equipment and use whatever is needed that day," says Browne.

### "Where Fun Begins"

Freeport, TX, lies on the Gulf of Mexico, near Galveston. The city's motto, "Where Fun Begins," references the area's beautiful beaches.

Freeport covers about 26 square miles. Its streets have 720 catch basins. To keep all of that clean and reduce pollution in stormwater runoff, the city relies on a Tymco Model 600 sweeper.

"We've been pleased with it," says Jeff Pynes, city manager. "We've literally had no maintenance issues."

The Tymco 600 is a regenerative air sweeper with a high-efficiency, multipart cylindrical centrifugal dust separator. Because it continuously cleans the air in a closed-loop system, it keeps dust and fine particulates inside the hopper. There is no need for additional filters or baffles that must be cleaned or replaced.

Instead of featuring a telescoping hydraulic cylinder, the dumping system is raker-assisted, making it easier to remove sticky debris. This sweeper was designed with few moving parts

for less maintenance. Its self-cleaning blower is made of a lightweight aluminum alloy.

Even in this warm Gulf Coast climate, the temperature sometimes drops low enough to cause icing on bridges. "We get requests from the county to clean up after they've sanded the bridge over the Brazoria River," says Pynes.

The street sweeper has also been used in an unusual situation. It was

an essential part of a pilot community bicycle race.

"We cleared the entire bike route for bikers riding 40, 50, or 60 miles. The sweeper was the lead vehicle, out ahead of the riders," explains Pynes.

The riders were very appreciative because the Freeport crew covered the race course the day before and also the day of the race. They had smooth, clean streets on which to ride, with much less chance of a fall or a flat tire.

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The street sweeper got a lot of attention during the bike race, but everyday reaction from members of the public has also been positive. “You can definitely see where it’s been,” adds Pynes.

Freeport’s Tymco sweeper gets heavy usage. “It runs three or four days a week year around, and we do quarterly maintenance on every manhole,” says Pynes.

In recent years Freeport has seen some \$20 billion worth of investment in liquified natural gas infrastructure.

“We have a lot of 18-wheeler traffic, so our roads get dirty,” explains Pynes. “We manage street cleaning by the map; everything is color-coded. Residential streets are cleaned at least twice a year, downtown streets once a month.”

As might be expected, corrosion is more likely to occur in a humid or salt-water area such as Freeport. Mindful of this, Pynes says, “We got the stainless steel tank. It only costs a little more to do it right the first time.”

The street sweeper also performs

public education and awareness duties. On the back is assign that reads, “Join us as we keep Freeport clean.”

As for street sweeping reducing pollutants in stormwater, Pynes says, “We know it’s a fact. That’s why we sweep so much and have an aggressive maintenance schedule.”

Freeport purchased its street sweeper by making four annual payments. The cost is part of the streets department budget.

“It’s paid for itself by what we save,” he says.

### MDTA

Maryland Transportation Authority (MDTA) is an independent agency responsible for construction, maintenance, and operation of toll facilities within the state. The eight toll facilities consist of two tunnels, four bridges, and two major thoroughfares.

Collectively these facilities handle a major portion of traffic in the state. Set up in 1971, MDTA is funded by

Elgin Sweeper



An Elgin Eagle at work in Douglas County, NE

the tolls it collects from drivers who use its facilities.

MDTA is very involved in managing stormwater at its facilities, joining other entities’ efforts to reduce runoff and pollution going into the Chesapeake Bay and its tributaries. The agency developed a GIS database of the drainage networks at its facilities and installed infrastructure for treatment and infiltration.

MDTA also works to reduce pollution in runoff on the roads of its toll facilities through a regular sweeping program. The sweeper of choice is the A7000 model from Schwarze Industries, now known as the A7 Tornado. The sweepers are painted school-bus yellow for better visibility to motorists.

These Schwarze regenerative air sweepers have a 20-year track record in the US and abroad. They’re AQMD-certified and can pick up particles as small as PM<sub>10</sub>. The sawtooth drop-down screen’s larger area removes the need for a screen vibrator.

The sweeping crews at the Inter-county Connector and the Fort McHenry Tunnel each have two A7000/A7 Tornado sweepers. At

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## Spring Cleaning in Douglas County

When Douglas County, NE, has seen the last snowfall of the season, the county highway department gets ready for a big spring cleaning of the streets and roads. Crew members bring out their Elgin Eagle mechanical sweeper.

With 214 miles of road to clean, there is plenty of sand, salt, and grime to remove. The annual spring cleanup

is done in preparation for the county's annual highway restriping program.

With a population of more than 500,000, Douglas is the state's most populous county, home to more than a quarter of Nebraska's residents. Its county seat is Omaha, the state's largest city and metropolitan area.

While Omaha and other municipalities within the county are responsible for cleaning streets within their boundaries, the county highway department

John F. Kennedy Memorial Highway, Baltimore Harbor Tunnel, William Preston Lane Jr. Memorial (Bay) Bridge, and Harry Nice Memorial Bridge, each crew has one of the sweepers.

"They're basically on the road every day, for cleaning up after accidents and for general cleaning," says Jim Loukas, fleet manager for MDTA.

Crews number about 14 to 16, plus support staff in accompanying dump trucks. The trucks are for accident prevention, keeping vehicle traffic from running into the sweepers.

Loukas says that the agency has been pleased with the Schwarz sweepers. "The guys seem to like it. They're the end users, so we like to get their input."

He adds, "We have the multi-alarms, the weight calculator so it doesn't overflow, weight indicator on the axle. We like the ease of use of the controls."

With all of the salt used on the roads and shoulders during Maryland winters, it only made sense to order the sweepers with stainless steel hoppers to prevent corrosion. The tanks are pressure-washed after they are used.

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handles that chore for all the roads under its jurisdiction in the unincorporated areas. Those roads get a lot of traffic.

Winters in Omaha are long and cold. Windy conditions cause snow drifts that require more snowplowing and treating of the roads. To give vehicles better traction on the snow and ice, the highway department spreads a combination of sand/salt and calcium chloride salt.

But the return of spring's warmer temperatures offers an opportunity to rid the county highways of any remaining sand and debris in preparation for the application of new centerlines, edgelines, crosswalks, stop bars, arrows, and other road stripes.

The combined process of road sweeping and restriping takes several months, according to Floyd Stenneche, Douglas County highway superintendent.

"Before buying our current sweeper a couple of years ago, we used skid-steer loaders with brush

Eagle Sweeper



**Each spring, road salt and sand are removed before road restriping begins.**

attachments for our spring sweeping," says Stenneche. "The Eagle is so much more productive and does a

better job overall. It also keeps us on schedule for the restriping project. The crew never has to slow down or

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wait for the sweeper the way they did when we used skid steers.”

Stenneche explains that the county highway department maps out a route covering all 214 miles of road that require restriping every year. The sweeper needs to stay several miles ahead of the striping crew to keep the project on schedule.

The Douglas County Highway Department employs three trained sweeper operators, who drive the Eagle sweeper on alternate shifts. A three-person crew handles the restriping process, assisted by one or two flagers in higher-traffic areas.

A typical Omaha winter produces multiple weather events requiring application of deicer and sand. Stenneche says the usual mixture applied to the roads is half salt and half sand pre-wetted with calcium chloride. But when temperatures dip below 18 degrees Fahrenheit—as they frequently do during mid-winter—the mixture includes a higher percentage of treated sand with calcium chloride to compensate for the salt’s reduced effectiveness.

Although the salt leaves little residue, by winter’s end a large amount of sand remains on the roads, especially along curbs and shoulders. Other debris has also accumulated throughout the winter and needs to be removed.

“We primarily sweep the sand as a requirement for prepping the roads for restriping,” says Stenneche. “Sweeping also improves traffic safety and benefits the environment by preventing sand from getting into the storm sewers.” He notes that intersections with turn lanes particularly accumulate a large amount of sand that needs to be swept and removed.

There is another reason for sweeping the roads. Doing so prevents accumulated sand from migrating onto private residential and commercial property, protecting property owners from any potential damage from the sand and keeping them from having to do cleanup work to remove the sand from their property.

“The sweeper does a very thorough job of removing the sand in a

“Sweeping also improves traffic safety and benefits the environment by preventing sand from getting into the storm sewers.”

safe and environmentally sensitive way,” says Stenneche.

He explains the sweeper works in tandem with a “flusher” truck—

a dump truck fitted with a 500-gallon water tank and high-pressure hose nozzles. These nozzles loosen and wash sand and other debris from

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Geotechnical Engineer, Genesee Geotechnical

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concrete dividers and traffic islands that the sweeper can't reach.

In addition to using it as the spring cleaning workhorse, the Douglas County crew members use their Elgin Eagle sweeper for cleaning up a variety of spills that happen from time to time. It performs well at sweeping material such as gravel, wet concrete, trash, and farm waste.

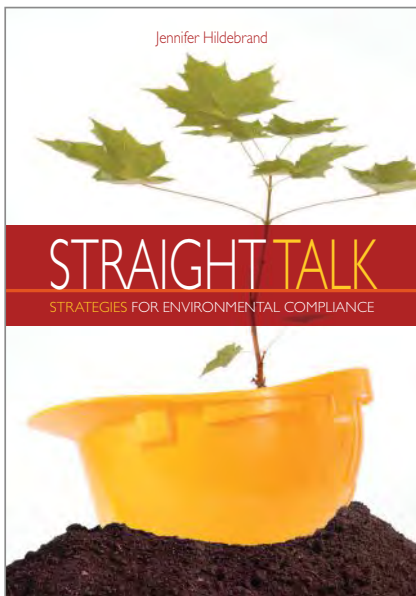
Stenneche says the sweeper also proves its value in cleaning up in the aftermath of windstorms that can litter the county roads with brush and various other materials. The department also uses the sweeper to keep its own equipment yard clean, saving dozens of man-hours per year compared with the previous use of skid steers.

The Elgin Eagle four-wheel mechanical sweeper is equipped with a no-jam conveyor, 4.5-cubic-yard hopper, 280-gallon water tank, and a variable height lift system. It sweeps a path 10 feet wide.

Missouri City, TX



Missouri City uses Tymco DST-6 dustless sweepers.



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The sweeper is suited for applications requiring versatility. It is capable of sweeping bulky items such as hubcaps, mufflers, and damaged tire treads from the road.

Stenneche says that the Douglas County Highway Department receives excellent service and support from the local Elgin Sweeper dealer, Nebraska Environmental Products, based in Lincoln. "We're in our third season with the sweeper, and it's been very reliable," he adds.

### Missouri City, TX

Missouri City, TX, was established along the first rail line to operate in Texas. The line later became part of the famous Sunset Route from Los Angeles to New Orleans.

The city's name comes from land developers who promoted the new community to St. Louis residents. They suggested moving there as a way to escape Missouri winters.

"We backdoor Houston. We're near Sugarland and Stafford, and have 72,000 in population," says Sharon Valiante, assistant director of public works for the city.

"We sweep every residential street twice a year and major thoroughfares at least three times a year," says Valiante. "We have some light industrial sections that need extra sweeping."

She explains, "There's a small section of the city that we own. We have a lot of municipal districts that do their own sweeping. We govern what they do through our stormwater ordinance."

To keep its 600 lane miles of streets clean, the Missouri City Department of Public Works uses two Tymco DST-6 dustless machines, painted white. That particular model of sweeper is an unusual choice.

"We own dustless sweepers because we have some light industry,"

## With two machines, one is always available: "When one machine needs preventive maintenance, we use the other one."

says Valiante. "We turn on that dustless control in those areas."

The light industries include "a lot

of landscapers with mulch, concrete suppliers, heavy trucks driving out of gravel yards," says Valiante.

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She adds, “We get a lot of rain, so the trucks track mud out onto the streets. Then the mud dries and turns into dust. We require the companies to clean up after their trucks, but there’s still a lot of dust.”

Missouri City’s street sweeping is a concentrated effort by one employee. He does community service work in the daytime and most of the street sweeping in the early evenings, before dark, when traffic is not heavy. Sweeping has to be done year around.

The street sweeping program generates favorable response from the city’s residents. “They love to see the sweeper with the Missouri City logo in their neighborhoods,” reports Valiante. “They wave to the driver, and even give him cookies.”

With two machines, one is always available: “When one machine needs preventive maintenance, we use the other one.”

Valiante says that her department has been very pleased with the

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Tymo Model 600, Tier 4

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**Jerald Fifield**  
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HydroDynamics, Inc.



**Tina Wills**  
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Tymo sweepers. “We like them, and my fleet maintenance supervisor likes them.”

Even for a smaller city such as Missouri City, Valiante prefers to have the street sweeping done in house, by municipal employees. “It’s more cost effective instead of contracting it out, and we set our own times for work. We can sweep whenever we need to.”

The sweepers are included within Missouri City’s capital budget. “Our program is to replace them at every 10 years,” says Valiante.

Like the other cities and departments profiled, Missouri City’s Department of Public Works performs street sweeping, in part, to be in compliance with federal water-quality regulations. “We have a stormwater program that gets audited every year by a consultant. The result is sent to the Texas Department of Environmental Quality,” says Valiante.

It is obvious that the directors of these varied street sweeping programs are keenly aware not only

of the need to comply with federal water pollution laws, but also of how much the efforts of their workers contribute to public health.

The street sweeping work that they oversee is also noticed by members of the public, in both residential and commercial districts. That high degree of visibility, plus the ease of understanding the work being done, offer opportunities for educating local residents about good stormwater management. ♠

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AP/M Permaform	<a href="http://www.permaform.net">www.permaform.net</a>	26
Best Management Products	<a href="http://www.bmpinc.com">www.bmpinc.com</a>	18
Bio Clean Environmental	<a href="http://www.biocleanenvironmental.net">www.biocleanenvironmental.net</a>	12
Borgert Products	<a href="http://www.borgertproducts.com">www.borgertproducts.com</a>	16
Brentwood Industries	<a href="http://www.brentwoodindustries.com">www.brentwoodindustries.com</a>	55
Clear Creek Solutions Inc.	<a href="http://www.clearcreeksolutions.com">www.clearcreeksolutions.com</a>	19
Crumpler Plastic Pipe Inc.	<a href="http://www.cpp-pipe.com">www.cpp-pipe.com</a>	22
DHI Software	<a href="http://www.dhigroup.com">www.dhigroup.com</a>	37
DOGIPOT	<a href="http://www.dogipot.com">www.dogipot.com</a>	32
Filterra Bioretention Systems/KriStar	<a href="http://www.filterra.com">www.filterra.com</a>	Cover 3
Filtrex International LLC	<a href="http://www.filtrex.com">www.filtrex.com</a>	Cover 4
Greyline Instruments Inc.	<a href="http://www.greyline.com">www.greyline.com</a>	19
Hi-Vac Corp.	<a href="http://www.hi-vac.com">www.hi-vac.com</a>	43
In-Situ Inc.	<a href="http://www.in-situ.com">www.in-situ.com</a>	18
Invisible Structures Inc.	<a href="http://www.invisiblestructures.com">www.invisiblestructures.com</a>	15
IPEX Inc.	<a href="http://www.ipexinc.com">www.ipexinc.com</a>	Cover 2
J. W. Faircloth & Son	<a href="http://www.fairclothskimmer.com">www.fairclothskimmer.com</a>	29
Kanaflex Corp.	<a href="http://www.kanaflex-usa.com">www.kanaflex-usa.com</a>	3
Lane Enterprises	<a href="http://www.lane-enterprises.com">www.lane-enterprises.com</a>	23
Modular Wetlands	<a href="http://www.modularwetlands.com">www.modularwetlands.com</a>	14
Oldcastle Precast- Specialty Products	<a href="http://www.oldcastleprecast.com">www.oldcastleprecast.com</a>	5
Pine Hall Brick Co. Inc.	<a href="http://www.pinehallbrick.com">www.pinehallbrick.com</a>	17
Plastic Solutions Inc.	<a href="http://www.plastic-solution.com">www.plastic-solution.com</a>	35
Plastics Pipe Institute	<a href="http://www.plasticpipe.org">www.plasticpipe.org</a>	21
Precision Pipe & Products Inc.	<a href="http://www.precisionpipe.com">www.precisionpipe.com</a>	27
RainWise Inc.	<a href="http://www.rainwise.com">www.rainwise.com</a>	29
StormChamber	<a href="http://www.stormchambers.com">www.stormchambers.com</a>	22
StormTrap LLC	<a href="http://www.stormtrap.com">www.stormtrap.com</a>	24
Stormwater Percolation Consultants LLC	<a href="http://www.stormwaterpercolationconsultants.com">www.stormwaterpercolationconsultants.com</a>	31
Thirsty Duck LP	<a href="http://www.thirstyduckinc.com">www.thirstyduckinc.com</a>	7
Tymco	<a href="http://www.tymco.com">www.tymco.com</a>	45
Ultratech International Inc.	<a href="http://www.stormwater-products.com">www.stormwater-products.com</a>	13
Uni-Group USA	<a href="http://www.uni-groupusa.org">www.uni-groupusa.org</a>	17
United Storm Water Inc.	<a href="http://www.unitedstormwater.com">www.unitedstormwater.com</a>	39
XP Solutions	<a href="http://www.xpsoftware.com">www.xpsoftware.com</a>	11

# Katie Rousseau

BY CAROL BRZOWSKI

For many, the word “great” in Great Lakes describes more than just the size of the five lakes that surround the Michigan peninsula and whose shorelines are accessible to six US states and Ontario, Canada. “Great” also describes the immense ecological, economic, and recreational value that the lakes—which contain 21% of the world’s surface fresh water—provide. One of the lakes’ biggest advocates is Katie Rousseau, associate director of the Clean Water Supply Program for American Rivers, an organization dedicated to protecting and restoring the nation’s rivers. Rousseau is on staff at the organization’s Midwest Great Lakes field office. Her mission is to improve existing efforts for clean water, focusing on increasing the use of green infrastructure to reduce polluted stormwater, flooding, and sewer overflows. To that end, Rousseau works on policy issues, public outreach, and education, not just locally but on a national level as well. She matches organizations, businesses, and people with the right resources to help them meet their goal of using green infrastructure. That work entails a broad range of tasks.

“I’ve worked on very local issues such as installing rain gardens and selling rain barrels, and on broader policy issues such as the US Environmental Protection Agency’s national stormwater rulemaking,” says Rousseau. “I think of my job as coordinating, catalyzing, and advocating for green infrastructure for clean water and more sustainable communities.”

## What She Does Day to Day

“Recently, I’ve been reviewing and analyzing local codes and ordinances and recommending how to improve them to facilitate better stormwater management practices,” says Rousseau. She bases her effort on American Rivers’ publication *Local Water Policy Innovation*, which provides nationwide examples of codes and ordinances. She also reviews master plans, hosts workshops, and works with local governments to help frame and advance their green infrastructure goals.

## What Led Her Into This Field

Rousseau has a scientific and technical background, but it was a class at The Ohio University on conservation of natural resources that truly piqued her interest in the topic. Rousseau was finishing her teaching degree and went on to teach earth sciences in Maryland for several years. But her enjoyment of that class kept tugging at her heart. “I liked teaching, but realized that I was more interested in conservation issues on a broader level,” says Rousseau. She began interning with GIS firms, worked as a GIS technician for Lucas County, OH, and returned to graduate school for a Masters of Science degree in geography, focusing on watershed planning. She joined American Rivers in 2007. Rousseau says she regards conservation as “the perfect way to stay engaged with people” while utilizing her technical expertise.

## What She Likes Best About Her Work

Rousseau derives her greatest sense of joy in “knowing I’m working on an issue bigger than just me, that it affects everyone and is part of a growing national trend,” she notes.

## Her Biggest Challenge

In a recent blog post for American Rivers, Rousseau points out that combined sewer overflows (CSO) remain a problem in many older industrial cities, including those around the Great Lakes. Cities are slowly separating the systems into dedicated pipes for stormwater and wastewater. Wastewater is treated and distributed back into Lake Erie, from which the region gets its drinking water. Stormwater is not treated, Rousseau points out, adding it gets discharged into the creeks, rivers, and streams. That wouldn’t be a problem if the stormwater was clean, but it’s not, she says, adding that it contains pollutants such as oil, grease, fertilizer, and garbage from roadways, farm fields, rooftops, and other hard surfaces. Green infrastructure will alleviate the strain on the region’s antiquated sewer systems, says Rousseau. She says her biggest challenge

is to push municipalities beyond the minimum standards and help them think of ways to be innovative.

“Local governments are under a lot of pressure, so we try to bring resources to them,” she says. “I’ll continue to work with those interested local governments on how to think about innovative ways to manage water. This includes showing them how it could work. We bring examples from other places in the areas of planning, permits, and finance, and we host technical transfer tours. When things change, it’s always inspiring.”



Frequent contributor **Carol Brzowski** specializes in topics related to stormwater and technology.

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The Filtererra® Bioretention System by KRISTAR uses conventional tree box filter design criteria that has proven to be effective in the removal of ultra-fine and dissolved pollutants normally found in stormwater runoff. Can be used in conjunction with various water storage systems including the CUDO® Water Storage System.



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