

Laying the Groundwork for Stormwater Control

A “green” mindset informs sewer district’s approach to reducing overflows.



Deb Leonard, communications manager for the Metropolitan Sewer District of Greater Cincinnati, speaks with contractors installing lighting along the east end of the Lick Run Greenway project. (Photography by Amy E. Voigt)

As the Metropolitan Sewer District of Greater Cincinnati tackles one of the largest public works projects in city history, primarily aimed at reducing combined sewer overflows into local waterways, it’s taking an unconventional approach: opting for “green” solutions whenever possible.

Since it formally began taking steps to reduce combined sewer overflows in 2009 as dictated by a consent decree negotiated with the United States Environmental Protection Agency, the utility has embraced everything from small-scale swales, green rooftops and rain gardens to larger endeavors, such as retention basins and stream-restoration projects.

“We’ve built a lot of above-ground storage and conveyance features that can either convey or hold back stormwater for a period of time until there’s sufficient capacity restored to the sewer system,” says Diana Christy, the utility’s executive director. “We’ve tried to make the best decisions possible [about using green techniques] from a cost standpoint and in terms of effectiveness for reducing combined sewer overflows.”

The roughly \$1 billion first phase of the massive public works initiative, called Project Groundwork, is scheduled for completion this summer. And it has attracted national attention for its innovative use of eco-friendly solutions to CSOs that for decades have degraded water quality in the Ohio, Little Miami and Great Miami rivers, as well as smaller creeks and waterways.

In fact, the EPA considers one major component of the first-phase initiatives — the Lick Run Greenway project (“lick” is an old-fashioned colloquialism for “stream”) — as a national model for sustainable, hybrid stormwater management that innovatively marries traditional sewer infrastructure with green strategies.

The project’s centerpiece is as green as clover: a roughly 1-mile-long bio-engineered stream, surrounded by green space, that empties into Mill Creek, a tributary to the Ohio River, just west of downtown Cincinnati.

The engineered stream exemplifies the district’s philosophy to divert stormwater from combined sewers whenever possible, instead of looking only at end-of-pipe solutions. The Lick Run Greenway annually diverts about 500 million gallons of stormwater from combined sewers and reduces combined sewer overflows by 400 million gallons, says Deb Leonard, the district’s communications manager.

Diversion tactics

Initiatives like the Lick Run Greenway reflect the utility’s overarching preference for green solutions — as long as they don’t cost more and are equally or more effective than traditional sewer infrastructure improvements.

While often necessary, more traditional solutions for solving CSOs are costly and can lead to demand for expanded wastewater treatment facilities, which also are expensive. For example, EPA officials had suggested the district build a deep tunnel that would store excess wastewater during heavy rainfalls until the treatment plant has enough capacity to handle it. But a project like that could easily cost half a billion dollars or more, Leonard says.

“End-of-pipe solutions don’t get at the root causes of combined sewer overflows,” she explains. “We believe that front-of-pipe solutions go after the root of the problem by collecting stormwater and diverting it from combined sewers.

“We frame it as green versus gray infrastructure,” she adds. “We try to think outside the box and go after the main culprit in combined sewer overflows, which is rainwater.”

The district serves a 290-square-mile area that covers Hamilton County and small portions of several surrounding counties. The system features about 3,000 miles of sewer lines, with 1,800 miles of sanitary sewers and roughly 1,200 miles of combined sewers, plus an additional 36 miles of dedicated stormwater sewers installed specifically to reduce CSOs.

The system also includes more than 100 pump stations, approximately 94,000 manholes and seven major wastewater treatment plants that treat about 160 mgd. The utility employs approximately 600 people and serves roughly 226,000 residential, commercial and industrial customers.

Some sewer cleaning, maintenance and inspection work is handled in-house, but larger projects are contracted out.

“Our employees focus on our customer-facing and priority work that’s generated primarily through service requests from the public and from our asset-management program, to mitigate risk,” Leonard says. “This allows our employees to be the ones interacting with the public.”

Employees use robotic inspection cameras made by RapidView IBAK and Envirosight; inspection and mapping/analytics technology developed by SubterraAI; SL-RAT acoustic-assessment equipment from InfoSense; Envirosight pole cameras; and Red Dawg jetting nozzles manufactured by Texas Underground.

The utility also relies on combination jet/vac trucks from Aquatech (Hi-Vac) and camera and jetting trucks built out by Sewer Equipment.

Significant progress

The district’s wet-weather program started more than a decade ago after the EPA issued two negotiated consent decrees. At issue was an average of 14 billion gallons of annual combined sewer overflows at more than 200 permitted outfalls into local waterways in Hamilton County.

The first phase consists of 133 separate projects that already are yielding promising results. Combined sewer overflows have declined to 8 billion gallons from 14 billion annually. At the district’s worst sanitary sewer overflow site in the northern suburb of Reading, annual overflow events decreased significantly, from 47 down to eight.

Furthermore, monitoring performed by the Midwest Biodiversity Institute shows significant improvement in water quality and aquatic habitat in local waterways, Leonard says.

“For example, the water quality in the lower portion of Mill Creek, a tributary of the Ohio River, is steadily improving,” she says. “Most sites that were rated as poor or very poor in 1992 have now improved to fair, good and, in a few instances, exceptional quality. The creek has also seen nine new fish species, including smallmouth bass, which do not tolerate pollution well.”

Waterway revival

The centerpiece of the district’s green strategies is the \$100 million Lick Run Greenway project. In essence, it involved the reincarnation of an old waterway by “daylighting,” or bringing back to the surface, an approximately 1-mile-long section of the “lick,” which empties into Mill Creek.

A bit of history provides some perspective. In the 1800s, Lick Run naturally flowed into Mill Creek, which in turn empties into the Ohio River. The watershed around it absorbed heavy rainfalls.

But as the watershed was developed commercially and filled with buildings and impervious streets, sidewalks and parking lots, more stormwater flowed into the creek and caused flooding. It also became a dumping ground for household waste and sewage, creating a public health hazard.

It worked well for a while. But by the mid-1900s, the sewer line started to overflow into Mill Creek during heavy rainfalls. Eventually, it became the district's worst CSO site, Leonard says.

No deep tunnel

The EPA then mandated a deep storage tunnel as a solution, but the district persuaded the agency that a green solution, including a bio-engineered stream, would provide a much less expensive yet still effective solution. In 2013, the district began "bio-engineering" the stream along a course that runs just south of its original route.

"We selected the Lick Run watershed for green solutions because it's in a perfect bowl-shaped basin with a lot of vegetated hillsides, so we knew it could collect a lot of stormwater there," Leonard says.

The project also used other green strategies, such as bioswales and detention basins, along with conventional infrastructure improvements such as dedicated storm sewers, including a 1.5-mile-long stormwater conveyance box that runs under the creek to handle large rainfalls.

In addition, the district integrated green space and walking paths along the course of the now resurrected stream, built five bridges over the stream, and reconfigured roads. Moreover, 92 buildings were removed to make room for the project, which started in July 2017 and should be finished this summer.

"It's essentially a stormwater-management and CSO-reduction project that looks like a park," Leonard says. "It's a really cool project — the largest and most unique of 19 different green wet-weather projects in the Lower Mill Creek area, which encompasses four different watersheds."

More than infrastructure

"The Lick Run Greenway definitely is the centerpiece of all the work we did in phase one," Christy says. "It really shows what you can do by coupling green infrastructure with more traditional solutions. But it's not cost-effective to go completely green. You still need underground storage and conveyance capacity."

As a bonus, the Lick Run Greenway also reinvigorated a rundown area of Cincinnati as well as returned the area to more of its natural state.

"This valley used to be a place where water drained from the hillsides," Christy says. "But it became a corridor of strip malls and junkyards and a lot of abandoned and underutilized properties."

She continues, explaining that "having all of that standing between two major one-way thoroughfares wasn't a very good use of that land. But thanks to the greenway, space that was an eyesore now contains small parks and walking trails for the community. It was a very transformational project, not just a new sewer line."

Leonard and other leaders hope it will be a catalyst for economic development. "We're not in the business of economic development, but we hope that if we build it, [businesses] will come. That was part of the idea behind the green solution."

The flip side of that, however, is that it's not always easy to acquire all the land needed for such large projects.

"There was resistance from some property owners," Christy says. "And it can be expensive if you have to acquire real estate, so sometimes it's cheaper to take a more traditional approach to stormwater management."

Eco-friendly tactics

The district also has helped design and construct smaller-scale, low-impact green development projects that are not part of Project Groundwork, such as rain gardens, cisterns, "living" rooftops and permeable-pavement projects. To accomplish this, the district partnered with about 20 community organizations such as schools, hospitals, businesses and even the Cincinnati Zoo to install green projects on their properties.

"We learned that these smaller-scale projects are great, but they're not sufficient for the immensity of the problem we have with sewer overflows," Leonard notes. "Most of them might divert, say, 10 million gallons of water from combined sewers, which is a drop in the bucket."

"We never counted any of these projects as part of the consent decree, but we tried them out to see if they'd work," she continues. "In all, we've determined that they divert about 120 million gallons of stormwater from combined sewers annually."

Long road ahead

Completion of the first phase of the wet-weather program is just one step in what remains a long journey for the district. It will take decades to complete the second phase and meet the criteria set out in the consent decrees, Leonard says.

Cost is a major factor, especially when the district still must maintain an existing sewer system that in some locations is more than 100 years old. Moreover, revenue is another limiting factor. The majority of the improvements are funded by ratepayer revenue, along with a smattering of grants and low-interest loans from the Ohio EPA.

"We can't raise rates above what the community can afford to pay, which is why the projects are spread out over so many years," she explains. "This is a marathon, not a sprint."

It's not yet known what projects the second phase of the project will include. In summer 2019, city officials proposed 73 projects spread out over 10 years with an estimated cost of \$800 million, and Hamilton County proposed 28 wet-weather projects over a five-year span at a cost of \$450 million.

But the district is in an unusual position because its workers technically are City of Cincinnati employees, but Hamilton County is in charge of the system and owns some of its assets. As a result, it will take time to forge an agreement, which also must be negotiated with the EPA.

Committed to green

The interim step in the process is what the district calls a “bridge phase,” which includes 26 wet-weather projects aimed at further reducing overflows. The estimated cost is \$61 million. Implementing a bridge phase ensures work doesn’t stop completely while second-phase negotiations continue.

In the end, it’s clear the district can’t use just green efforts to fulfill the consent decree. But district officials are passionate about using such strategies as much as possible. In fact, the utility created a green infrastructure department with three dedicated employees, which underscores how serious it is about implementing more eco-friendly solutions to better control stormwater.

Nonetheless, fulfilling any large consent decree has to include a combination of methods and strategies — it can’t all be done green, Christy notes.

“At the end of the day, we have compliance obligations,” she says. “And if we can’t meet those with green solutions, then we have to go to more conventional approaches.”

Leonard adds that green projects simply aren’t feasible everywhere because they’re dependent on topography. “But we’re committed to doing them wherever possible and where we can get the biggest bang for our buck.”