Urban Stormwater Retrofit Projects

By Dan Rafter

Small spaces, creative solutions

The city of Santa Monica's new policies were clear: Significant best management practices (BMPs) must be in place to protect all 13 of the sub-watersheds in its boundaries from pollution. That meant some serious planning for Neal Shapiro, urban runoff management coordinator for the California city.

The treatment of stormwater is especially important at the city's Centinela sub-watershed. Stormwater runoff from this site runs into the Sawtelle Channel, a large storm drain conduit that runs next to Santa Monica's Mar Vista Park, a public park that is part of the Centinela shed. From there, the stormwater runoff eventually flows to Ballona Creek, a nearly 9-mile waterway that eventually drains into the Santa Monica Bay.

Runoff that escapes the Centinela sub-watershed untreated, then, would eventually end up in the bay, a situation no one wants.

Shapiro, though, faced a set of unique challenges largely because of the sub-watershed's urban location. He had to deal not only with commissioners and regulators in his own city, but also with those in bordering Los Angeles, because the Centinela sub-watershed treats both dry-weather and wet-weather runoff from the western portions of that city, as well as from Santa Monica itself.

Shapiro and Santa Monica officials decided, in the plans for their Westside Water Quality Improvement Project, to treat the runoff with a two-stage system consisting of a concrete

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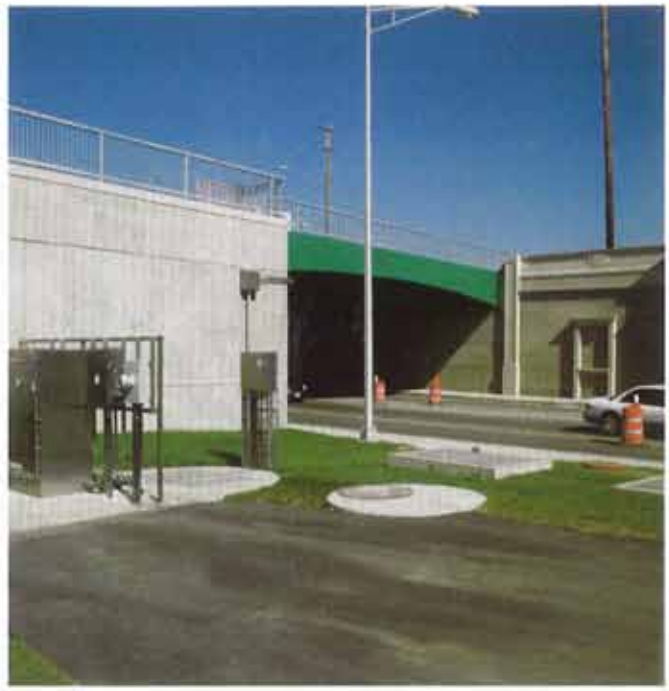
StormFilter, 300 feet of underground diversion pipeline, and a baffle box. But, again, the treatment system's urban location presented challenges. Because the work would be taking place in a public park, Shapiro had to work closely with park district officials. He also had to schedule some work to coincide with another job at Mar Vista Park, the installation of synthetic turf in an existing field.

"Because of the location of the project, we did have to take several additional steps. The location made scheduling more of a challenge," Shapiro says. "The city already had a parks project going on. We had to get our project going quicker than we had originally anticipated so that we could get that diversion pipeline in. It required some real hustling to get that one done in time."

Shapiro is hardly alone in facing challenges that are a direct result of a stormwater treatment project's urban location. Working on projects in crowded areas requires creative solutions, flexible work schedules, and the ability to quickly change plans.



Stormwater engineers and contractors will have to face these challenges more frequently. The stormwater infrastructure is aging quickly in municipalities across the country. In some cases, stormwater treatment systems were built long before federal and state water-quality regulations became more stringent. In both cases, construction crews and engineers must retrofit these existing systems, whether they require complete rebuilding or more minor tweaks.

And doing so will require construction crews to operate in spaces that are often cramped, while diverting heavy vehicular traffic. Engineers need to draft creative plans for getting this urban retrofitting work done, while disrupting as little as possible the lives of commuters and city residents.

It's a difficult job, but also one that will be keeping stormwater pros busy for a long time.

"I think we're going to see an even greater need for these urban retrofitting projects," says Jim Lenhart, chief technology officer with Contech Stormwater Solutions in Scarborough, ME. "The NPDES [National Pollutant Discharge Elimination System] regulations have definitely had an impact. For a lot of municipalities to meet their permit requirements, they have to go back into existing infrastructure and retrofit."

There is no reason to have stormwater treatment systems if they do not do the job either because of aging or because they weren't installed properly in the first place, he says.

"If we stop all development today, that's not going to stop the problem," Lenhart says. "We are going to have to go back and retrofit the systems that aren't doing a good enough job anyway. Somebody once told me that just because we are requiring effective treatment systems for all new construction, that doesn't mean we are making the problem go away. We are just slowing it down."

It's not only aging infrastructure and tougher permit requirements that are causing an increase in the number of urban retrofitting projects. As urban areas grow in population,

they need a greater number of homes and businesses. This increases the amount of impervious surfaces in a community.

In a sort of chain reaction, the greater amount of parking lots and other paved surfaces means that municipalities must install larger pipes and more efficient treatment systems to handle the increased and quicker-flowing runoff.

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While the increase in business is undoubtedly positive for stormwater professionals, urban retrofit projects are not always easy tasks. Treating stormwater runoff and installing BMPs that are effective can prove challenging when projects are tackled in crowded urban areas where space is often limited.

And working in urban areas often means dealing with a host of regulatory bodies, as Shapiro from Santa Monica discovered during his city's work with the Westside Water Quality Improvement Project.

Working in crowded urban areas also means that construction crews must work around utilities. This, too, can pose conflicts. And resolving them often means that municipalities and property owners must spend a significant amount of money.

"Obviously, when you're dealing with tight spaces, the work has to be a bit more surgical," says Lenhart. "We also find that

costs typically are higher with a retrofit than with a new project. Normally, the installed costs of these systems are a lot less than when you are retrofitting an existing system. For any technology, for the dollars spent per gallons-per-minute treated, they tend to be more expensive than new construction costs."

Treating Runoff in Santa Monica

Shapiro's work with the city of Santa Monica's Westside Water Quality Improvement Project in the Centinela subwatershed began in November 2004.

"We find that costs typically are higher with a retrofit than with a new project. For any technology, [retrofits] tend to be more expensive than new construction costs."

That's when construction crews first began installing 300 feet of diversion pipeline under an athletic field at Santa Monica's Mar Vista Park.

Construction crews tackled this work earlier than expected to take advantage of a turf-replacement job already taking place at the athletic field. This meant, of course, that installers had to work quickly.

But that was just one wrinkle to the project.

The Mar Vista Park location provided the ideal location for treating both dry- and wet-weather runoff. Unfortunately, the runoff from the site—which goes into the Sawtelle Channel, into nearby Ballona Creek, and finally into the Santa Monica Bay—runs not only through Santa Monica, but through portions of West Los Angeles, too.

This meant that engineers had to earn permits and approvals from several regulatory bodies before construction work could begin.

Fortunately, the city did gain all the permits it needed. Engineers then designed a two-stage system to treat the runoff. First, plans called for a Stormwater Management StormFilter designed by Contech. This product filters a full range of pollutants commonly found in urban runoff, including soluble heavy metals, oil, grease, and nutrients.

The filter basically resembles a large concrete barrel with individual cartridges. Each cartridge contains different filtering materials to remove different types of pollutants. This product treats the low-flow and dry-weather flow.

The system's second level of protection comes from Bio Clean Environmental Services' Nutrient Separating Baffle Box, which catches the solids, floatables, sediment, and debris from wet-weather flows. Both the Baffle Box and the StormFilter capture oils and grease.

The new treatment system began working in the fall of 2006. Since then, it's handled the heaviest runoffs without any problems, Shapiro says.

"It's working very well," he says. "Everything is underground. The treatment system is under one of the parking lots, so no one even knows it is there. I think it was a win-win project. We're treating runoff from both Santa Monica and from West Los Angeles. I think that's a good deal."

For Noonan, working within the confined space of an urban setting was far from unusual. He tackles numerous projects in Chicago and its suburban communities where cramped quarters, busy highway traffic, and existing utilities are common.

"We do a lot of work trying to integrate new systems with stormwater systems that already exist," Noonan says. "You almost never are working on a fresh start. So you are always worried about the impact that you might have on an existing system. There are so many unknowns. It's like working on an old house. When you pressurize those old pipes, you may end up springing a few leaks."

Reconstructing Doremus

Traffic congestion was the impetus for another urban stormwater project that required work in cramped locations, this one in New Jersey in the winter of 2004.

The New Jersey Department of Transportation commissioned work to widen the lanes and shoulders of Doremus Avenue, the main street serving the dock areas of Port Newark. The job also required construction crews to install about 9,500 feet of new storm sewer lines that would discharge safely into the Passaic River.

One challenge was to keep pollutants in the surrounding soil from entering the system. The water and sediment of the Lower Passaic River watershed are contaminated with dioxin, PCBs, DDT, heavy metals, and hydrocarbons, all of which remain in the soil. It's little surprise that such pollution exists: Doremus Avenue is now flanked by nearly 400 large industrial plants, including those specializing in electroplating, metal finishing, pharmaceutical manufacturing, and refinery operations. The trucks that use the road daily also bring their own residual oil and gas pollution to the area.

It was essential, then, to make sure that these harmful chemicals and pollutants did not escape into the river or into the new storm sewer lines. The area, with its high concentration of pollutants, has become an area of concern for the New Jersey Department of Environmental Protection and the New Jersey Department of Transportation. It was up to the engineers with design consultant Louis Berger Associates of East Orange, NJ, to come up with a stormwater system that would keep the chemicals and other pollutants out of the Lower Passaic River.

The engineers eventually decided to install corrugated polyethylene pipe from Advanced Drainage Systems (ADS), a manufacturer of pipes, drain basins, and chambers. Hong Sun, project manager with Louis Berger Associates, says the drainpipe on this project could not be vulnerable to anything that was in the soil. The engineers also required a pipe that could be manufactured in custom lengths and had as few joints as possible.

"The only way we could prevent polluted groundwater from getting into the new storm drain system was to use pipe that could give us the flow characteristics, stand up to the harsh environment, and have a gasket that would securely seal the pipe joints," Sun says. "We knew from the very beginning concrete pipe wouldn't work. It wouldn't be able to give us the seal or stand up to the environment."

The pipe connections and seals also had to withstand heavy loads, including a significant amount of truck traffic loaded with shipping containers from the port.

Even with careful planning, surprises popped up. Construction crews, as often happens in urban areas, discovered underground utilities and structures that were never identified on the original plans. This is not too surprising; construction crews over the years had built, rebuilt, dug up, and changed the Doremus Avenue area significantly. The area, in fact, has been in a constant state of growth and change for more than 100 years, leaving an uncharted twist of pipelines, gas lines, water mains, and sanitary sewer mains. High-voltage electrical feeds carrying power for the New Jersey Transit and Amtrak also ran under the construction area.

To make the construction process run smoothly, construction crews provided ADS with measurements for different pipe lengths throughout the project. ADS then custom made what was needed to complete the different phases of construction. In all, ADS supplied 206 custom-made lengths of pipe ranging from 15 to 60 inches in diameter.

Construction crews also had to deal with the traffic that routinely travels Doremus Avenue, a major truck route. Crews could not shut down or detour this traffic.

To solve this problem, crews completed the job in two phases. First, crews built the sewer inlets and cross pipes on the upstream side of the road. They built these cross pipes to the centerline of the road.

In the second phase, crews installed the trunk line down the middle of the road's northbound lane and connected the cross pipes to the trunk line. This part of the job required the nonstandard lengths of pipe that ADS had to manufacture. Crews used nitrile gaskets to seal each pipe joint. The high concentration of petroleum-based contaminants in the soil could have harmed standard polyisoprene rubber gaskets.

Jim Goddard, chief engineer for ADS, says the challenges construction crews encountered on the Doremus Avenue project are not uncommon on urban retrofit projects.

"You never know what is in the ground before you start digging," Goddard says. "The bigger cities, the older cities, there are things under the ground that no one even knows what they are anymore. Ever seem them open a hole in Manhattan? It's shocking. There's a spaghetti of stuff down there. Who knows what it all is?"

Like other engineers, Goddard, too, says stormwater pros need to get comfortable working in cramped, urban areas. The industry will only see more of these projects in the future.

"We are seeing more efforts to move people back into cities, away from suburban sprawl," Goddard says. "That is going to change the construction environment within the city in a significant way. This is an issue that is coming into play in the near term. This is not happening 10 years down the road. This is happening fairly quickly."

Dan Rafter is a technical writer based in Illinois.