Collection and Reuse of Stormwater

The phrase "urban environment" does not have to be an oxymoron.

A group in Southern California is out to prove that a thoroughly urban city like Los Angeles can successfully coexist with Mother Nature. Their goal is to clean up stormwater runoff so that it does not pollute nearby waterways, and then store the water for irrigating lawns and landscapes, thus reducing the city's need to import water from other areas. It's an ambitious goal, to be sure, but one that is attainable thanks in part to modern water management technologies.

Transagency Resources for Environmental and Economic Sustainability (T.R.E.E.S.) recently partnered with the Los Angeles Department of Public Works and the Los Angeles Unified School District in a demonstration stormwater management project. T.R.E.E.S. is a division of TreePeople, a non-profit group founded in Southern California in 1973 to educate and motivate people to take an active role in preserving the "urban forest." Using a grant funded by two Los Angeles County park bond measures with provisions for water quality improvements, they installed technologies that will clean and store rainwater runoff so that it can be used later to irrigate grass and landscaping. Even more importantly, the project will help reduce the amount of trash and pollutants that were flowing into nearby Santa Monica Bay. The project, installed at Open Charter Magnet School on West 77th Street in Los Angeles, has other attractive benefits.

"Installing the stormwater facility

To create a stormwater retention vault, the pit is lined with a tough 40-mil PVC material before the individual units are lowered into place. The PVC materials will then be wrapped around the units and backfill added. This underground vault will store about 110,000 gal of stormwater runoff.

Units are so lightweight they can be moved into position with a hand truck. Made of polypropylene, they can be stacked up to 2.5 meters high (about 8 ft). Properly installed, they create a storage vault with 94 percent void space and a load-bearing strength rated at H-20.

also gave us an opportunity to replace a patch of asphalt with a nice t-ball field and walking track," noted Rebecca Drayse of T.R.E.E.S. She was project manager and was instrumental in coordinating the entire effort. "We think this is an excellent point-source reduction measure. There was a huge storm drain in front of the school that carried the pollutants from the buses and cars straight to Santa Monica Bay. This project will virtually eliminate all those pollutants." If successful the project is certain to be replicated at schools and other public venues across the city. The result will be a cleaner bay and more green space for everyone.

Waste Not, Want Not

As part of its mission, T.R.E.E.S. seeks to coordinate various groups and government agencies to accomplish important environmental projects. The Open Charter Magnet School effort is a prime example.

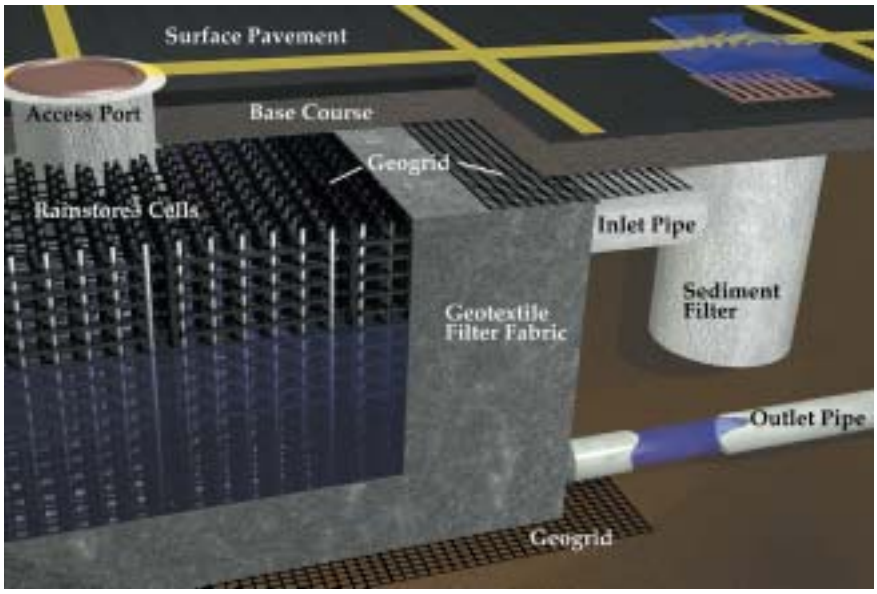
According to Drayse, the big-picture concept is to "have the entire city function as an 'urban forest watershed' and restore some of nature's cycles. We have paved a lot of our land here, and it is obviously causing some environmental problems, including polluted runoff that is getting into local waterways," said Drayse. "There are new water quality regulations which include TMDLs (total maximum daily loads) that will help reduce the amount of pollution. The city and county are looking at ways to meet those regulations. Projects such as this one will be an important part of the solution."

Stormwater management is an example of how, in the past, American cities have taken a reactionary approach to public works issues. The traditional concrete and steel stormwater conveyance systems were a single-purpose solution that got rid of stormwater, but created other problems.

"Los Angeles City and County have a good flood control system. However, we don't have enough drinking water, so we import it from other regions," explained Michael Drennan, P.E. Drennan worked for the engineering firm of MWH (www.mwhglobal.com) at the time of the Open Charter Magnet School job and was his firm's project manager. Like many engineers, Drennan is adjusting his problem-solving skills to incorporate "sustainable design" concepts, a new way of thinking about environmental issues that takes a long-view of public works problems.

"As we look at how the system evolved over time we realize that the way we designed the (stormwater) system was reactionary and single purpose in its approach," said Drennan. "If you think about multiple objectives like flooding, pollution reduction, and water supply, then you might design a system like we did at Open Charter, which manages stormwater as a resource rather than a waste."

Drennan is now a vice president with



Stormwater enters through a storm drain where heavier suspended solids settle out before the water flows through the inlet pipe into the storage chamber. The high void space and structural stability of the assembled cells creates a high-capacity underground vault with a much smaller footprint than gravel cisterns. The Open Charter Magnet School installation also has a unit to remove smaller suspended solids.

Brown and Caldwell (www.brownandcaldwell.com), and the Southern California Watershed Management Service leader. One of the principles of sustainability is the elimination of waste. Modern engineering should "evaluate and optimize the full life-cycle of products and processes, to approach the state of natural systems in which there is no waste." This according to a document called *The Hannover Principles* by William McDonough. McDonough's principles were adopted by the World Congress of the International Union of Architects and the American Institute of Architects in 1993. It could be considered the official birth of the sustainable design movement.

A New Underground Movement

In designing the Open Charter Magnet School stormwater management plan, engineers sought to capture water from the entire site—playgrounds, rooftops, and landscaped areas as well as the school parking lot. The water is conveyed to the headworks of the system where it goes through a Vortechnics, Inc. (www.vortechnics.com) stormwater treatment device to remove suspended solids and floatables. The water then goes into an underground storage cistern to be used later. Underground cisterns are nothing new, but technology has made it possible to create high-capacity storage with a smaller footprint than ever before, an important factor in a densely populated place like Los Angeles.

Engineers for the Open Charter Magnet School project chose a product called Rainstore3 (Invisible Structures, www.invisiblestructures.com). The system requires a pit large enough to accommodate a specified amount of water, in this case 110,000 gal. In the pit is placed a 40-mil PVC liner, a geogrid layer, and stacks of individual Rainstore3 units, each one measuring 40 in. by 40 in. by 4 in. The units are comprised of 36 thin-walled cylindrical columns made of polypropylene plastic. The units are stacked in columns up to 2.5 meters high—about eight feet—with 94 percent void space.

"One of the benefits of the Invisible Structures system is you have a very high storage capacity for the amount of structure you install," explained Drennan. "With a gravel pit you lose about two-thirds of the storage capacity because water can only be stored between the gravel. So Invisible Structures reduces excavation and backfill costs and covers a smaller footprint. It turned out to be quite a bit more cost effective than gravel."

The cells have an H-20 load capacity, which is strong enough to support any street-legal vehicle. Because the technology is structural, the engineers could redesign the above-ground space to accommodate both parking and a playground.

"In addition to improving water quality and flood protection, this project has created a better play environment for the kids," said Mike Mullin, a biologist and assistant division manager with the Los Angeles Department of Public Works' Bureau of Sanitation Watershed Protection Division. "It also reduced the urban heat budget by removing asphalt."

Even when a rain event exceeds the storage capacity of the vault, the stormwater passes through the treatment unit before continuing downstream to Santa Monica Bay. Depending on design requirements, the system can be either a retention unit or a detention system; if the PVC liner is not installed the stormwater simply percolates back into the ground.

A Model of Teamwork

This demonstration project is being closely watched by others in Southern California who are concerned about meeting the new TMDL regulations. "I have been barraged with calls for more information about this project," said Drayse. "We have seen a great deal of interest in alternative technologies such as Rainstore as ways to solve some of the area's water quality and supply problems."

Although it is too early to call the Open Charter Magnet School project an unqualified success, there are high hopes that the system will significantly reduce polluted runoff from the campus and reduce its need for imported water. The program also serves as a model of how private and public interests can work together to solve difficult problems.

"This project may become a model for future projects," said Mullin. "Three agencies were involved, the Los Angeles City Department of Public Works, the Los Angeles Unified School District, and TreePeople. It's not unique to have partnerships, but it is unique when they work out so well." GE