Tackling Tough Stormwater Issues

California county responds to stringent stormwater regulations.

In 1987, congress made stormwater a public enemy. In amending the Clean Water Act of 1972, lawmakers identified urban runoff as a significant polluter of the nation's surface waters. Since then, municipal public works officials have been aggressively trying to remove the contaminants that are washed off parking lots and rooftops and into streams, lakes, and oceans.

The science of cleaning up stormwater has evolved and improved since 1987, often to meet the new, more stringent regulations that have been adopted. As environmental regulatory agencies and legislators have raised the bar, engineers, scientists, and public works officials have designed new ways to clean the rainwater that washes through our cities. In San Diego County, a new "treatment train" is being utilized that will potentially keep dangerous pollutants like heavy metals and hydrocarbons out of San Diego River. If the demonstration project is successful, the techniques used will be replicated throughout the state and across the country.

"We hope to show that this method is not only effective, but also cost effective when compared to other best management practices," said Dennis Verrilli, AICP, project manager for the San Diego County Department of General Services. If Verrilli is right, public works planners will have an important new weapon in the war against stormwater pollution.

Rigorous Regulations

San Diego County's Department of General Services has a jurisdiction covering about 3,600 sq mi of unincorporated area. The San Diego region includes the County of San Diego and 18 separate cities. These communities already were complying with CWA regulations in the early 1990s, but in 2001 the Regional Water Quality Control Board (RWQCB) adopted new regulations that were much tougher than previously existing laws.

"The new permits went into serious detail on the jurisdiction's responsibility to identify and reduce stormwater pollutants," said Verrilli. "This was quite a mandate, substantially more intensive and comprehensive than previous regulations."

The new regulations called on municipal governments to inventory public facilities and identify those that had the highest potential for stormwater pollution generation, then come up with individual stormwater management plans for each. San Diego County elected officials and administrators enthusiastically endorsed the new regulations and gave their full support to the departments of public works and general services to develop new treatment measures.

"We had a lot of political and management support for the work we were doing, so we decided to showcase our demonstration project," said Verrilli. "We applied for $1.7 million and selected the county operations center, our largest facility, as our first project. We felt it would be an excellent opportunity to demonstrate best management practices to control stormwater runoff."

The county operations center (COC) is large, covering 35 acres. On the property are offices, garages, paint shops, and lots of parking. Such a facility would naturally produce an offensive blend of oil, grease, brake dust, metal shavings, antifreeze, and routine trash such as paper and plastic. An analysis of the facility's drainage revealed that almost all the rainwater converged at one location before leaving the site and entering the storm sewer. This made it an ideal test for a point source treatment device.

Richard Watson, AICP, is president of

The second half of the treatment train is lowered into place. This 8-ft by 16-ft precast concrete vault contains some of the components that will become the media filtration device.

a Southern California planning and consulting firm. He is actively involved with the California Storm Water Quality Association, so he is familiar with the problems and regulations associated with urban runoff. He consulted on the San Diego County project, including the design of the treatment train used at the COC.

"This was actually a combination project," Watson explained. "There are two components, porous pavement and the treatment train. The treatment train is actually two treatment units, each designed to remove a different type of pollutant. The water first goes through a continuous deflective separation (CDS) device that removes trash and debris, as well as oil and grease. The stormwater then flows through a CDS media filtration system, which removes smaller particles including brake dust and other metals. We are still in the testing phase, experimenting with different filters to determine which does the best job of removing these contaminants."

Treatment Train

The CDS system, manufactured by CDS Technologies, Inc., (www.cdstech.com) is entirely self-operating, relying on water hydraulics and gravity. Stormwater runoff enters a diversion chamber where a weir guides the flow into the unit's separation chamber. Inside the separation chamber are free-floating absorbent booms, each about 2.25 in. wide by 12 in. long. The booms collect much of the oil and other hydrocarbons that enter the unit. Inside the chamber, the flowing water forms a vortex. Centrifugal force spins the water outward through a self-cleaning screen while floatables and larger suspended solids remain in the center of the separation chamber. The trash and suspended solids gently settle into a sump where they remain until they are removed. The stormwater, now free of debris, passes from the device and re-enters the flow heading downstream. (For an animated demonstration of how these CDS systems work, go to www.cdstech.com and click on Storm Water.)

This initial CDS cleaning takes care of the bigger trash, but San Diego's new stormwater regulations require a higher level of cleaning before the water re-enters the environment. After leaving the CDS device, stormwater then enters the media filtration system for further cleaning—the second phase of the treatment train.

A crate of perlite-filled cylindrical cartridges sits ready for installation at the job site. Forty-two of these cartridges are placed within the media filtration device. Each measures about 18 in. by 22 in.

"The CDS unit acts as a preliminary screening device followed by a finer filtration unit," explained Mark Cuneo, P.E., CDS Technologies regional manager in Southern California. "The media filtration unit allows the department of general services to target specific pollutants that may come off this particular facility. With this process they can build a treatment train that can address the specific elements found on this site. This system is adaptable to meet county regulations of the future, which are certain to be even more strenuous."

The CDS unit in this particular design will handle seven cu ft per second of runoff. The cylindrical separation screen (2400 micron aperture) is 5.6 ft in diameter and 4 ft tall, and fits into a 96-in. diameter manhole. The downstream filtration unit is smaller, designed to treat 1.75 cu ft per second. The disparity in size was the result of budget limitations.

The media filtration system was placed in a vault measuring 8 ft by 16 ft. Inside the vault are 42 perlite-filled cylindrical cartridges, each cartridge measuring about 18 in. in diameter and 22 in. tall.

"The perlite media was identified to deal with the smaller suspended solids," said Cuneo. "As they monitor the system and identify specific pollutants, the media can be changed to address those pollutants."

Once it passes through the filtration system, the stormwater, now free of almost all suspended solids and debris, re-enters the storm drain system, which carries it to the San Diego River.

"The filtration unit was designed to pick up smaller materials through filtration rather than just gravity," said Watson. "It removes a lot of the hydrocarbons and much of the suspended solids. But a significant concern is the metals. From brake dust you get both copper and zinc. Lead, copper, and zinc are most prevalent in urban stormwater discharge, and they are now the subject of regulation. We are trying to find out what filtration material will best remove those metals."

Easy Installation

Installing San Diego's treatment train proved to be a big, but uncomplicated, project. The units required significant excavation in a confined space, but the assembly of the pieces was rather easy.

"It's not brain surgery to put these in," noted Don Witmer, project manager for Anderson Piping, Lakeside, CA. "The only difficulty was the proximity of the units, the logistics of shoring, the placement of the shores, and the back-

The structure in the left foreground is the opening to the CDS unit. In the bottom right corner of the photograph is the junction/flow control structure. The other two openings provide access to the media filtration device.

fill. It was a pretty simple construction job on our end."

Witmer noted that excavation for the CDS unit required a hole 23 ft deep. Excavation for the filtration unit was 20 ft. The precast units arrived and were placed the same day.

Maintenance on the two devices is described as minimal. "We don't know for certain, but we anticipate the system will need to be cleaned twice a year," said Cuneo. "The CDS unit can be cleaned with a combination sewer cleaner or vacuum truck. For the filtration unit, the media filled cartridges can be removed and replaced, or just the media within the cartridges can be replaced."

The maintenance costs represent a significant savings over alternative stormwater cleaning devices. According to Verrilli, it would take 40 to 50 drain inlet insert filters to do the job now being done by the CDS treatment train.

"We would have to maintain all those filters regularly and we would also have to do quite a lot of parking lot sweeping and other source control types of BMP," said Verrilli. "When you compare that with the cost of installing the treatment train and maintaining it, I think you find a very favorable outcome."

Media Monitoring

Now that the treatment train is in place and operational, the department of general services will do extensive monitoring to determine the effectiveness of the process and how to refine it to remove the specific pollutants that drain from the county operations center.

"I think the results of the system are being demonstrated already," said Verrilli. "Once the monitoring results are in after the next rainy season, we will apply for a second grant that will allow us to expand the filtration capacity at the operations center. But first we have to know that it is cost competitive as well as environmentally beneficial for this process to be accepted."

The initial results are promising enough that the department of general services is already using underground centralized treatment units at some new facilities—two libraries and a skilled nursing facility.

"If we have continued good results, we want to demonstrate the process to other county facilities, municipalities, and the industry at large," said Verrilli. "It's not always easy to change the opinions of architects and engineers. We have to prove that this system is effective. We consider it an outreach to the industry." GE