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STORMWATER MANAGEMENT SERIES

Part 1: Stormwater management trends

Expert commentary on industry developments and new challenges

By Bob Drake and Shanon Fauerbach, P.E.

The project site now retains runoff from a 10-year storm event, assisting in the reduction of flooding downstream. This green solution also provided an aesthetically pleasing site feature and significantly reduced the project site's total impervious area footprint and disconnected directly connected impervious areas to the municipal separate storm sewer system.

In this Q&A, which is the first article in a three-part series updating stormwater professionals on the intricacies of this quickly evolving field, **CE News** editors asked various experts (see "Meet our respondents" below) to consider and comment on important topics, including: technology, federal legislation, sustainability issues, and more. Read on and find their thoughtful responses, along with industry updates and pertinent resources.

In what ways has stormwater management technology evolved in the last five years?

Kimball: The technology has evolved a great deal, especially with regards to data. The data that is used in modeling can be much more precise based on the instrumentation that can be used. Also, certain types of BMPs that couldn't previously be modeled using the standard software five years ago can now be modeled easily without purchasing additional software.

O'Neal: The improvement and increased availability of off-the-shelf or proprietary devices is providing more options

Meet our respondents

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Struggling to incorporate feasible solutions to mitigate stormwater runoff to the satisfaction of the local agency, California Watershed Engineering assisted the owner of a commercial and retail center in Downey, Calif., by engineering a green solution that included the use of porous pavers throughout the parking area, allowing maximum onsite subsurface storage and infiltration of urban and stormwater runoff.

for developers and project proponents to select treatment that fits their project best. The advancement of third-party review of these proprietary devices is improving the available data that supports the additional cost (compared with doing nothing) by quantifying and demonstrating improved pollutant removals.

The second way that stormwater management has advanced is in the use of low impact development (LID) as treatment control for pollutants, in most cases, providing more options to reduce pollutant loadings in stormwater runoff from a project site. On the other hand, in some cases LID has evolved to the point that it may limit development or constrain the landowner's options.

Pereira: Stormwater management technologies have gradually shifted from mainly focusing on the removal of trash and oil and grease to tackling other pollutants of concern such as bacteria, metals, and nutrients. There has also been a fundamental shift from proprietary BMPs to the incorporation of less expensive LID design techniques, which are less intrusive, contribute to the overall harmony and flow of a project site, and their operation and maintenance needs are easily integrated into routine landscape maintenance activities. Implementation is now being looked at more holistically, incorporating the treatment of multiple pollutants versus a single pollutant.

Schultz: Many smaller commercial sites lend themselves well to biodetention basins and swales that collect and filter parking-lot runoff while reducing flow volumes and removing pollutants. Such sites traditionally required very expensive underground storage for stormwater management, which in many cases would wreck the economics of the project. Utilizing green stormwater strategies allows us to reduce stored volumes so significantly that underground storage is no longer necessary. The client can then apply the money saved to other aspects of the project. Green stormwater management solutions can be scalable for sites as large as 100 acres down to 0.5 acres.

Center for Watershed Protection releases stormwater BMP performance verification checklist

The Center for Watershed Protection announced the release of a new tool for its post-construction stormwater management project, Managing Stormwater in Your Community. Tool No. 8 is a downloadable checklist that helps local program authorities provide a consistent set of questions for applicants proposing to use manufactured and proprietary BMPs. Download the tool at www.cwp.org/postconstruction.

What technologies and design tools look particularly promising for the next five years?

Kimball: The technology our firm finds most promising deals with the treatment of stormwater and the removal of hydrocarbons, nitrogen, etc. A great number of products have recently come onto the market that will significantly improve stormwater runoff quality.

Pereira: LID design features appear to be the most promising over the long term. However, additional influent, effluent, and groundwater water-quality monitoring is necessary to clearly establish pollutant load relationships and provide water-quality data for future project planning to address challenging Total Maximum Daily Loads for impaired receiving water bodies, and not to impact drinking water sources.

Which technologies are most popular with your clients and why?

O'Neal: The trend is still to meet compliance at minimum cost, so low-cost alternatives or technologies are generally the most popular. Because of limited data on BMP performance and long-term maintenance costs, it is difficult to justify even a slight increase in cost, even if there is a benefit to water quality. Therefore, low-cost technologies are favored over higher tech or more advanced performance options.

Pereira: Our clients typically prefer BMP and LID solutions that are non-proprietary and easily integrated into proposed landscaping areas so as to not limit the project site's developable land area. The most common solutions we use to mitigate stormwater runoff and reduce a project site's effective imperious area include: bioretention systems, vegetated swales, infiltration trenches, and porous materials to allow subsurface storage and infiltration of runoff in paved areas.

Vasquez: The popularity of technologies typically relates to their cost. If there is sufficient land, grassy swales are a popular option, combined with disconnected impervious surfaces and curbs to control and direct runoff to the swale.

Cisterns are also popular because the water is reused for irrigation, which may be applied toward LEED points.

Pervious concrete and asphalt are also good options, because the cost difference from standard concrete and asphalt is not as significant as some believe. But this technique is limited by the type of soil, which must be prepared properly. In addition, these surfaces require more maintenance.

The U.S. Environmental Protection Agency (EPA) is focusing on, among other things, watershed-level management of water, including stormwater. From a civil engineering perspective, how does such an approach impact design and analysis of stormwater management projects?

Lacarra: Watershed-level management will require extensive funding — which neither the EPA nor states have been able to provide — to develop watershed computer models that show the hydrologic and water-quality conditions, including groundwater, to assist stormwater managers in making sound decisions about impacts and where to emphasize improvements. Until funding becomes available for information and

Virginia Water Resources Research Center releases stormwater BMP decision support tool

The Virginia Water Resources Research Center (VWRRC) released a report titled, Virginia's Stormwater Impact Evaluation: Developing an Optimization Tool for Improved Site Development, Selection and Placement of Stormwater Runoff BMPs, which describes the development of an optimization tool for stormwater BMP selection based on physical site characteristics; local, state, and federal pollution control ordinances; and implementation and long-term maintenance costs. The report can be downloaded at: www.vwrrc.vt.edu/pdfs/specialreports/SR-44%20USEPA%20BMP%20Optimization%20Project%20Final%20Report.pdf.

data management, it is extremely difficult to manage at the watershed level.

A related issue is the ability for permit writers (state or EPA) to adjust to the change from jurisdictionally targeted permits to multi-stakeholder watershed programs. The Clean Water Act was not intended to regulate at a watershed level and will also need to be re-vamped to provide the appropriate policy framework that is currently lacking.

Without the appropriate regulatory framework in place it is difficult to accurately assess the scope of the impact to design and analysis of stormwater management projects.

Pereira: A watershed-level management approach lends itself to more initial project planning to integrate multi-use solutions that not only benefit water quality but provide other amenities, such as improved flood control, water conservation techniques, groundwater recharge, open space and wildlife habitat creation/preservation, and recreational enhancements. From our project experience, we find that this approach fosters a greater sense of community and ultimately results in better project designs that fully integrate the culture of the surrounding area and produce desired outcomes.

Vasquez: The impact is greater than ever, taking into account not only the watershed within a development area, such as a 10-acre housing project, but the impacts on the watershed upstream and downstream from the development site. This requires a complex analysis and a complex stormwater management solution. For example, if runoff must be captured, but the size of the site limits the size of the detention basin(s), then the basin may have to be installed downstream, which complicates the analysis, as well as the solution.

EPA Launches "Healthy Watersheds" initiative and website

EPA has launched a new initiative called "Healthy Watersheds" that emphasizes protection and conservation of aquatic ecosystems. The initiative is being introduced on a new website, www.epa.gov/healthywatersheds, which provides information on tools to identify and protect healthy watersheds and their components. The website provides critical information for making strategic decisions to both protect and restore our nation's waters.

How does the American Recovery and Reinvestment Act (ARRA) impact funding available for stormwater management projects?

Kimball: While there is no specific language in the bill that directly funds stormwater projects, there are some areas that could affect stormwater infrastructure. Energy Efficiency Grants allocated $3.2 billion and stress green building projects. Stormwater runoff can be reduced by vegetative or green roofs that absorb and retain water that would otherwise run off the surface. Another option is the Community Development Block Grant Program, which was allocated $1 billion. Previous uses of this grant program have included stormwater infrastructure. Finally, $4 billion was allocated to the EPA's Clean Water State Revolving Funds, which favor green infrastructure that reduces and captures stormwater runoff.

Lacarra: ARRA has very limited funding available for stormwater projects compared to the magnitude and scope of municipal stormwater permit requirements affecting local government and the erosion control mandates for construction projects. Funding for stormwater management is generally a secondary item that may be covered by ARRA funding; and then it only includes the project's compliance requirements if they are mandatory. For example, preparation of a stormwater pollution prevention plan (SWPPP) is mandated for a construction project of more than one acre. Funding for this construction project might include funding for a SWPPP.

What role does stormwater management play in Leadership in Energy & Environmental Design (LEED) projects? Do you think enough LEED projects capitalize on the impact that smart stormwater designs can have on these projects?

Kimball: Stormwater management itself does not provide a significant number of credits in LEED project certification. However, the stormwater credits that are currently available could often be utilized to a greater extent and could be the difference between a gold or platinum certification. Stormwater management is an inherent design component of any new construction, and with more stringent regulations, advanced stormwater techniques are now required on a majority of new projects. These guidelines are often more intense than what is required for LEED certification credits and therefore should be viewed as "easy points" for the certification process. In some instances, they might even be capable of being used for "Innovation in Design" credits, which further enhance their attractiveness during the LEED process.

Schultz: Stormwater management plays a critical role in the Sustainable Sites credit 6.1 (Quantity Control) and credit 6.2 (Quality Control). In credit 6.1, the designer must either prevent the post-development discharge from exceeding that of the pre-development rate, or decrease the volume of runoff by 25 percent or more for the two-year, 24-hour design storm. Both of these objectives can be achieved by implementing a number of management strategies, e.g. infiltration-biodetention basins and swales, vegetated roofs, pervious paving, and stormwater harvesting, which can be used for irrigation, toilet and urinal flushing, or custodial purposes.

Credit 6.2 focuses on stormwater quality control to effectively treat 90 percent of the annual average rainfall using acceptable BMPs. The combination of BMPs must be able to remove 80 percent of the total suspended solid load based on existing monitoring reports. Many of the strategies that help reduce the quantity of stormwater runoff also contribute to improving its quality.

In regard to stormwater management, what other issues, ideas, or concerns are on your mind?

Kimball: A more streamlined approach to both regulation development and implementation across different geographical areas is an issue that could be reviewed more stringently. This would allow more consistent development and implementation of management practices.

Another issue would be that of uniform, mathematical modeling procedures for BMP implementation. The use of various BMPs is becoming the norm in the stormwater industry. While many BMPs and variations exist, a uniform method for mathematically modeling and predicting their impacts on overall site hydrology are still lacking. "Rule-of-thumb" methods are often utilized; however, a more uniform approach taking several factors into account would certainly benefit in the proper use and design of stormwater BMPs. In addition, it would reduce often over-sized BMPs and thus accomplish their required goal at a lower cost to the client.

Lacarra: The long-term impacts on groundwater quality and soil stability when LID and infiltration treatment controls are applied extensively in a watershed, but designed only at a project level is of concern.

Vasquez: In California, the new general construction permit from the California Water Resources Control Board is out for public review and, once adopted, it will be more stringent than the recent EPA stormwater permit requirements. It will apply to all construction sites of one acre or more. Its impact will depend, in part, on how close a construction site is to a 303(d) list water body, and it may require advanced treatment before stormwater is discharged. If the stormwater has to be treated, there will be more limitations on the discharge, requiring more sampling at construction sites.

Hydromodification — the effects of a development on the watershed downstream — will be part of the new permit as well. This will require a complicated analysis and could involve a complex solution to minimize the impact on the downstream watershed. ■