



# Growing With the Flow: Reversing the History of Urban Hydrology

by Chris Estes, RLA, ASLA

Around the country interest is building in volume-reducing Best Management Practices (BMPs) that take a portion of runoff out of the storm water equation. Old and new research has resulted in a broader understanding of storm water infiltration while putting to rest some storm water myths.

Not too many years ago flooding was deemed a conveyance issue. Draining watersheds with speed by making channels and storm water infrastructure larger and more hydraulically efficient was the objective.

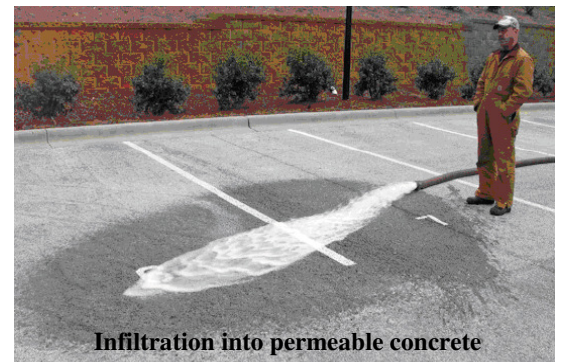
*To be able to reverse the hydrologic and environmental impacts of runoff from urban areas is truly a ground breaking concept.*

Timing of peak flows was (and still is) a train of site specific calculations with little consideration for downstream. The fact that development drastically increases the downstream size of floodplains and major waterways was (and still is) the accepted notion. However, floodplains in developed areas are not infinite in their ability to grow, and sooner or later become a more precarious state of affairs with additions of complex levee systems that allow flood elevations to climb above the surrounding topography.

Times are changing. The broader watershed view works somewhat in reverse. We are now looking at methods to neutralize and reverse the effects of development-induced runoff caused by impervious area. We can reduce or eliminate excess runoff with the goal of shrinking the downstream flood liability. We now have the tools to allow us to quantify potential reductions in post development runoff resulting from a variety of techniques that retain and infiltrate at least 90% of the annual rainfall events.

Runoff from an acre of pavement can be as much as ten to twenty-five times greater than the runoff from an acre of grass. In urban areas, 30% to 40% of the rainfall runs directly into the nearest stream. In heavily urbanized areas, such as central business districts, precipitation runoff can be more than fifty percent. Compare this to the amount of runoff from woodlands, which is often less than five percent. In some regions infiltrating the 2-year storm can reduce the 100 year storm to the predevelopment level.

One sign of this change in philosophy is the recent 2009 EPA Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act. This guidance prescribes two options to be used. Option 1 requires the prevention of off-site discharge of precipitation for all events less than or equal to the 95th percentile rainfall event. An example 95th percentile storm would be Columbus' 0.75 inches. Option 2 would allow a site specific hydrologic analysis to determine the pre-development runoff conditions to be retained post-construction utilizing techniques that infiltrate, evapotranspire, and/or harvest this volume.



Infiltration into permeable concrete

Storm water regulations in Alabama, South Carolina and Georgia already encourage the use of infiltration as part of their storm water solution. In 2006 the North Carolina BMP Manual added porous pavements to its infiltration tool box.

Not too long ago this practice would have been deemed by many people in North Carolina as expensive and impractical, if not impossible, especially in clay soils. However, this has been proven not to be the case

Inside This Issue	
2010 Expo a Success	2
Upcoming Events	2
Sustainable BMPs	3
BMP Review: Site Design	4

## 2010 Storm Water Expo a Success

The 8th Annual Central Ohio Storm Water and Erosion Control Expo was held on March 11 at the Longaberger Alumni House on the OSU campus. This year's event had record attendance with over 150 people from 15 counties across Ohio.

Chris Estes, President of Estes Design, a North Carolina based firm, spoke about infiltration in clay soils. He pointed out that, while clay soils infiltrate slowly, they will still take in a considerable volume of storm water.

Harry Kallipolitis, Storm Water Coordinator for the Ohio EPA, presented "Effective Storm Water Management and Complying with Ohio's NPDES Storm Water Permits". His explanation of their decision making process was followed by a question and answer period.

Jeffrey Koehn and Jamie Leeseberg of M-E Companies discussed the parking lot they designed for Roush Honda in Westerville. This project was centered around one of the



largest areas of permeable concrete in Ohio. They also talked about their work at the Cincinnati Zoo where they are retrofitting the storm water infrastructure using storm water re-use systems, bioretention, and permeable pavements.

Speakers also included Mike Menoes and Phil De Groot from Hydrosphere Engineering and Stephanie Suter from Franklin Soil and Water. The speaker presentations from the Expo are available on-line at [www.coe-sceexpo.org](http://www.coe-sceexpo.org).

Many thanks to our sponsors, Stormtech and M-E Companies, for their support this year. And thanks to Dave Rutter of MORPC, Kaylee Port from Union SWCD, Chad Lucht from Fairfield SWCD, and Deba Moehler and Traci Aquara from Heart of Ohio RC&D for their help with organizing the event. We hope to see you all next year for the 9th Annual Central Ohio Storm Water and Erosion Control Expo.



### Upcoming Workshops and Events

The Ohio Contractors Association is hosting CESSWI exam review sessions and exams on May 13 and 14. A CPESC exam will be conducted on May 14 at the OCA office at 1313 Dublin Road. Contact Chris Engle for more information at [chengle@ohiocontractors.org](mailto:chengle@ohiocontractors.org). All those wishing to sit for the exams must be pre-approved by CESSWI or CPESC, Inc. For application details contact them at [info@cesswi.org](mailto:info@cesswi.org) or at [info@cpesc.org](mailto:info@cpesc.org).

The Ohio Stormwater Association is presenting the 2010 Ohio Stormwater Conference in June in Sandusky, Ohio. A choice of tours starts it off on June 9 followed on June 10 and 11 with the workshops that provide 4 tracks. The tracks cover watershed planning, program management, practice planning and design, and modeling and research. For more information and to register for this event on-line visit [www.ohioswa.com](http://www.ohioswa.com).

The Storm Water Training Council will hold a free full-day workshop for MS4 communities entitled Best Management Practice #6—Pollution Prevention at Municipal Garages. The workshop will be held at Lakeland Community College in Kirtland, OH on May 20, 2010, followed by an optional municipal garage tour. For an agenda and to register go to <https://ohioepa.webex.com/mw03061b/mywebex/>.

# Sustainable BMPs

As we continue to recognize the concepts and products of green technologies, sustainability, and smart growth policies, the function, application, and limitations of “green” practices needs to be recognized.

Sustaining our water quality through storm water Best Management Practices (BMPs) starts with the recognition of the inherent value of the existing natural resources. Most development sites have existing features whose preservation or enhancement could directly affect storm water requirements. Using natural features to design a site is a hallmark of LID practices and is a component of LEED certification.

The use of storm water BMPs, both nonstructural and structural, requires proper site design and sizing, correct installation and implementation, and proper maintenance in order to provide the long term water quality function and sustainability we hope to achieve. Relatively new technologies and ideas often require new skills, special methods for installation, and a long term approach to sustained maintenance. Throughout the industry, educating and cross training the personnel involved with all aspects of “green” practice implementation are necessary for the long term sustainable management of these systems.

To ensure the performance of storm water BMPs, proper installation and an understanding of the intended function is important. Hydraulic separator devices can be compromised by a reversed connection or misaligned inlet. Often, problems result with infiltration BMPs from construction phasing, sedimentation, and soil compaction during construction. Nonstructural BMPs like tree preservation and setbacks are important resources to site development but their innate abilities can be quickly impacted by construction activity, landscape and maintenance crews, or other long term site management practices like snow removal, deicing products, and pesticide and fertilizer application.

Maintenance for many “green” storm water technologies also requires a level of familiarity with the intended operation of the BMP. Underground storm water facilities often require the use of vacuum trucks for periodic maintenance. The volume and types of liquids and solids stored in these devices can affect the maintenance procedures and costs associated with the cleanout. For example, smaller vacuum trucks may require more trips to empty the storage volume, additional jetting may be needed that also can affect the volume removed and the equipment used, and special disposal of the contents or OSHA qualified inspectors may be required by local or state governments.

Nonstructural storm water BMPs can include subtle land forms that are to be maintained in perpetuity. These pose a special problem for long term maintenance because equally

subtle changes may occur over time that are not easily recognized as affecting the intended function.

We need to recognize that these are **managed BMPs** that emulate natural processes and design them with the forethought to perform a function for a specific area over a period of time. We should anticipate and expect cost, maintenance, failure and repair, and ultimately learning.

## Growing with the Flow (cont'd)

in North Carolina’s Piedmont soils. For example, research conducted by Estes Design, Inc. and UNCC has shown that typical clay soils have ample capacity to infiltrate the required volume to meet pre-development conditions. Techniques such as properly designed and constructed bio-infiltration and porous pavements have been monitored for periods of 3 years or more with no evidence of failure either hydraulically or structurally. High infiltration rates are not necessary to meet predevelopment hydrology conditions. Properly designed and constructed infiltration BMPs function 24 hours a day everyday.



Pervious concrete and infiltration basin captures the 2-year 24-hour storm

With the advancement of porous pavement technology, we can now retrofit existing urban areas to meet the pre-development hydrology goals. To be able to reverse the hydrologic and environmental impacts of runoff from urban areas is truly a ground breaking concept.

Careful consideration should be taken when implementing storm water infiltration, but it is here to stay. Clay soils can be predictable if assessed correctly. Infiltration is a storm water solution that is necessary to reach pre-development hydrology goals. Correctly implemented storm water infiltration can be the most important and effective of all the storm water management strategies available, because it truly treats the cause rather than the symptoms.

Estes, Chris. “Growing With the Flow: Reversing the History of Urban Hydrology.” Flash-Flood News. Winter 2010.



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## **BMP Review: Site Design**

Too often business as usual is to wipe the slate clean and start from scratch when developing a site plan. Instead of clearing and leveling a site to conform to a preconceived plan, incorporate the unique elements that exist on each piece of land and develop a site plan based on these existing resources.

When first considering a site for development a few objectives should be kept in mind. First, preserve the natural drainage systems and water resources. Then, minimize imperviousness of the proposed project. Next, assess all natural resources such as woodlots, slopes, large trees, wetlands, waterways, and riparian areas. The impacts of the proposed design on the existing natural resources should not be overlooked. These existing resources, down to the underlying soils, existing drainage patterns, or the last remaining tree, can have a direct effect on the storm water permit requirements and infrastructure needed for development. They can also have an impact on storm water far downstream from the site.



Incorporating the function of existing natural resources can reduce storm water volume requirements. That, in turn, reduces conveyance infrastructure and storage costs and can add to the site aesthetics which means faster occupancy and sale for both commercial and residential sites. The remaining natural resources may seem insignificant, but the cumulative incremental loss of natural resources results in a slow decline of the urban environment and sustainable living.

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