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Industrywide Stormwater Initiative

The green industry can play a major role in improving stormwater management by implementing best management practices, green infrastructure techniques and low impact development methods.

by Steven N. Rodie and Kelly A. Feehan

Land development, site design and landscape maintenance can significantly impact urban water quality and water resources. All three areas have important, long-standing connections to the green industry. So how much of a role does a typical green industry company or professional have in urban water quality and resources? Potentially huge, especially if your company needs to implement stormwater management techniques and best management practices (BMPs).

Historically, urban stormwater runoff has contributed to a variety of serious water resource impacts, including sediment and chemical pollution, flooding and elevated water temperatures. These impacts were viewed as part of the "cost" of doing business in the development and construction industries, and it was assumed that the nearest stream or wetland could effectively absorb whatever went down the storm drain.

As the true costs of these impacts become better quantified and the significance of water-quality impairment better understood, stringent federal, state and local regulations, together with the ever-increasing demands to limit urban and suburban stormwater impacts, have radically changed the face of site-development and site-maintenance practices.

Concentrated stormwater runoff, as a result of impervious surface construction and other changes to the developed land hydrology, has led to significant erosion and pollution problems along virtually every urban and suburban stream and water body.

A stormwater detention cell near the front entrance of the Carl T. Curtis National Park Service Midwest Regional Headquarters, Omaha, NE, detains and filters water on this site adjacent to the Missouri River.

PHOTOS COURTESY OF STEVEN N. RODIE

Best management practices for stormwater management

Soil management
- Don't stockpile soil on impermeable surfaces during lawn renovation or landscape projects.
- Amend soils to improve water infiltration and drainage.
- Protect slopes with groundcover plants.
- Promptly seed bare areas to protect them from soil erosion.
- Core-aerate lawns.

Reduce pollutants
- Keep work areas clean.
- Avoid overapplying fertilizers and pesticides.
- Use or sell low-phosphorus fertilizers.
- Use or sell nontoxic pesticides and those least likely to drift or leach.
- Avoid fertilizer and pesticide applications prior to heavy rainfall or to saturated soils.
- Water-in granules.
- Store fertilizers and pesticides out of reach of runoff/flood waters.
- Mix and load fertilizers and pesticides on approved pads.
- When cleaning tanks, dispose of rinsate correctly.
- Dispose of excess pesticides, pesticide containers and yard waste correctly.
- Be prepared to clean up spills promptly and correctly.

Irrigation management
- Avoid excess irrigation and watering of impermeable surfaces.
- Encourage clients to maintain automatic irrigation systems.
- Select and sell adapted plants requiring less water, fertilizer and pesticides.
- Use and sell permeable (porous) materials for hardscapes.

Reduce/slow runoff
- Redirect downspouts to grassy areas, plant beds, rain gardens or rain barrels.

Instead of managing stormwater as a liability to be removed from a site as quickly as possible, it is now being detained on-site for water-quality and water-quantity enhancement, and managed as a resource for soil moisture and groundwater recharge.

In response to this enhanced cost awareness, a new stormwater management paradigm now exists. Instead of managing stormwater as a liability to be removed from a site as quickly as possible, it is now being detained on-site for water-quality and water-quantity enhancement, and managed as a resource for soil moisture and groundwater recharge.

The green industry has a significant role to play in addressing this new management approach. Landscape construction and management practices must meet new regulations and BMP standards. Companies are identifying in-house expertise, as well as value-added services and projects, that can be expanded to support stormwater management strategies and practices. In addition, the green industry has an important, on-going role in informing clientele about the need for management changes and the collective impact that property owners can have in addressing urban stormwater issues. In its entirety, this new role reflects substantial opportunities for industry growth and profit.

Defining the problem. Effective stormwater management must address two issues simultaneously: runoff quality and runoff quantity. As rainwater, snowmelt and irrigation flow across ground surfaces, a variety of elements are picked up and transported to adjoining streams or water bodies. These elements include sediment from improperly managed construction sites and eroding stream banks; excess fertilizers, herbicides, insecticides and ice-melting chemicals; oil, grease and toxic chemicals; and bacteria and nutrients from pet wastes.

In addition, the runoff water temperature can be drastically raised as it flows over impermeable (paved) surfaces, which is detrimental to stream and lake habitat. This collective water-quality impairment, which can't be attributed to one source, is referred to as "nonpoint source pollution." The EPA states that nonpoint source pollution is the current leading cause of water pollution.

As runoff flows across impermeable surfaces in urbanized landscapes, the volumes and rates of runoff concentration become significantly greater in comparison to predevelopment runoff. Undeveloped land has the capability to absorb almost all of the precipitation that typically occurs; developed land lacks almost all capacity for infiltration.

The initial surge of stormwater runoff from impervious surfaces is not only much greater in volume (and thus more costly to design for and contain), but also typically contains the highest amounts of pollutants. In combination, water-quality and water-quantity impacts represent a serious and costly urban watershed problem that requires a variety of strategies to address.

Addressing the problem. The EPA, under the authority of the Clean Water Act, has implemented a wide range of stormwater management regulations as part of the Non-Point Discharge Elimination System. These regulations were initially implemented in large cities, but through phasing requirements, they have cascaded down to smaller towns and cities throughout the country. The regulations require communities to design programs that will reduce the discharge of pollutants to the "maximum extent practicable," protect water quality and satisfy the appropriate water-quality requirements of the Clean Water Act. Program implementation includes achievement of measurable goals to satisfy the following six minimum control measures:

- public education — inform individuals and households about ways to reduce stormwater pollution;
- public involvement — involve the public in the development, implementation and review of a community's stormwater management program;
- illicit discharge detection and elimination — identify and eliminate illicit discharges and spills to storm-drain systems;
- construction — communities and construction site operators address stormwater runoff from active construction sites;
- post-construction — communities, developers and property owners address stormwater runoff after construction

activities have been completed; and
- pollution prevention/good housekeeping — communities address stormwater runoff from their own facilities and activities.

The bottom line of the regulations is that changes must occur in each of the communities required to implement programs, and the changes must lead to beneficial improvements to stormwater management. The associated bottom line for the green industry is a monetary bottom line. Nurseries, landscape designers and landscape contractors stand to gain a substantial share of the design, installation and management of stormwater projects that will allow measurable progress to be made in achieving stormwater management objectives.

BMPs. There are a wide variety of stormwater management BMPs recommended to address water-quality and water-quantity concerns (sidebar, page 16). Many should look familiar — they have long been standard operating procedure for the green industry. Good housekeeping on jobsites, thorough cleanup at job completion and proper application of chemicals have always been associated with quality work and happy clients. Not all site practices, however, have been scrutinized. If topsoil washed off a site or construction equipment tracked mud onto paved streets, the effects were likely ignored.

A Storm Water Pollution Prevention Plan must be developed and rigidly implemented for virtually all construction sites. Regular inspections and reports are part of the process (not to mention significant potential fines for sites that are not in compliance). In the past, fertilizer that was broadcast onto paved surfaces or lawn clippings that blew onto city streets may have been left to be washed away by the next rain.

Education programs and local regulation are addressing more environmentally sound management practices, such as requiring the sweeping or blowing of all excess fertilizer, lawn clippings and organic matter back onto turf areas or landscape beds and requiring soil tests to prove the need for phosphorous fertilizers prior to application.

Where new methods and approaches are proposed, the cost of change (including the perceived "hassle factor") may seem inappropriate to some for the benefit derived. In contrast, however, the costs attributed to current water-quality and water-quantity problems, whether they be pollution, sedimentation, flooding or loss of habitat, are better understood, and when the equation is compared, we really can't afford not to implement the documented BMPs.

Strict regulations and fines are now in place to help ensure that the lack of erosion and sediment controls on this site is not ignored.

A rain garden constructed on a church site in Kansas City, MO, helps to filter and detain runoff from parking lot and street surfaces. The rain garden is part of the 10,000 Rain Gardens Program developed to help manage stormwater in Kansas City.

Green infrastructure. Green infrastructure encompasses a wide variety of approaches and technologies aimed at effective stormwater management. It focuses on the capture and slow release of runoff. Traditional infrastructure forces water to quickly run off a site, across impervious surfaces, and into stormwater inlets and pipes. Green infrastructure captures surface flows and holds or slows down runoff. As this occurs, runoff is filtered as it recharges soil moisture and groundwater, and is more readily available to support healthy landscape plant growth. Green infrastructure emulates the natural hydrology cycle in processing stormwater and, as a result, provides a cost-effective, sustainable approach to stormwater management.

The most effective green infrastructure typically includes natural areas that still function as natural areas. Forests, wetlands and prairies are all capable of absorbing and processing stormwater. Through sensitive design, these areas form the basic structure for regional and community stormwater management.

Where natural stormwater management no longer exists, landscape designers, contractors and maintenance professionals can help successfully implement the following technologies and practices.

Rain gardens and bioretention cells: Surface or roof runoff is directed into shallow, 4- to 8-inch, landscaped depressions planted with deep-rooted, native or well-adapted plant species in which water infiltrates within 12 to 48 hours. Rain gardens designed with an underdrain system to enhance infiltration are classified as bioretention cells.

Swales: A swale is a vegetated, open-

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Vegetated swales have replaced traditional curb/gutter stormwater collection in conservation subdivision developments, like Prairie Crossing, Grayslake, IL, that have implemented successful stormwater management strategies.

A view of the green roof at the American Society of Landscape Architects headquarters, Washington, DC. The mounds are filled with rigid insulation to reduce weight while enhancing the visibility of plants from the street. The grated walking surface beyond the deck has *Sedum* growing below it for additional roof plant coverage.

channel management practice designed specifically to filter, infiltrate and accommodate stormwater runoff for a specified water-quality volume.

Vegetated filter strips: Vegetated filter strips treat sheet flow from adjacent, nonporous surfaces. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, as well as providing some infiltration into underlying soils.

Porous pavements: Porous pavement is a permeable pavement surface, often built with an underlying stone reservoir that temporarily stores surface runoff before it infiltrates into the subsoil. Types include porous asphalt, pervious concrete, permeable pavers and structurally enhanced turf or grass pavers.

Green roofs: Green roofs absorb, store and evapotranspire precipitation, thereby acting as a stormwater management system and reducing overall peak flow discharge to a stormsewer system. Additional benefits include reduction of urban heat island effects, increased thermal insulation and energy efficiency, increased acoustic insulation and increased durability and lifespan compared to conventional roofs.

On-lot treatments: A variety of on-lot treatment options exist, but all can be placed in one of three categories: practices that infiltrate rooftop runoff (such as a dry well), practices that divert runoff to a pervious area (such as redirecting a roof downspout to a landscape bed, rain garden or turf area rather than onto a driveway or directly into a stormsewer connection) and practices that store runoff for later use (such as rain barrels and cisterns).

Low-impact development: Low-impact development (LID) is an umbrella under which the technologies and practices mentioned above (among others) are collectively implemented. The goal of LID is to restore the natural, predeveloped ability of an urban site to absorb stormwater. LID integrates small-scale measures scattered throughout the development site. Constructed green spaces, native landscaping and a variety of innovative bioretention and infiltration techniques capture and manage stormwater on-site.

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LID reduces peak runoff by allowing rainwater to soak into the ground, evaporate into the air or collect in storage receptacles for irrigation and other beneficial uses. In areas with slow drainage or infiltration, LID captures the first flush before excess stormwater is diverted into traditional storm conveyance systems. The result is development that more closely maintains predevelopment hydrology. Furthermore, LID has been shown to be cost-effective and, in some cases, cheaper than using traditional stormwater management techniques.

A wide variety of benefits can result from the implementation of green infrastructure. Not only do these techniques lead to tangible improvement of stormwater quality and quantity objectives, but they can be less expensive to build, operate and maintain. Green infrastructure may never replace traditional stormwater facilities and structures, but given that studies have shown the estimated cost of green infrastructure at approximately 10 percent of traditional infrastructure, it is definitely worth serious consideration for future stormwater management programs.

The future looks promising for the growth and profitability of industry-supported BMPs, as well as professional roles in green infrastructure design, installation

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Prairie Crossing, Grayslake, IL, reflects many of the "green" best management practices now encouraged to successfully manage stormwater quantity and quality issues on developed land.

Pervious concrete allows water to quickly infiltrate the surface and subsurface layers while providing the structural soundness of a paved surface.

Vegetated paving surfaces allow water infiltration and generate cooler surface temperatures while providing a structural framework to support vehicle parking.

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and management. Beyond growth associated with regulatory requirements, national programs that support green infrastructure, such as the Sustainable Sites Initiative (www.sustainablesites.org), are destined to create a significant amount of additional demand for green industry products, services and expertise. Caveats are few, but they do exist. Some key ones include:

- New paradigms must be accepted. The shift in stormwater management philosophy is crucial to overall green infrastructure success, and paradigms can be very difficult to change.
- Early implementation of green infrastructure practices must be done well and be able to show some initial success.
- It can be difficult to quantify the collective benefits and costs associated with green infrastructure. The better we can accomplish this, and the better the demonstration projects are that illustrate methods and successes, the more success the overall effort will have.
- Green infrastructure does not replace effective land-use planning. Quality land planning should preserve natural green infrastructure prior to development. Existing infrastructure is typically a lot less expensive and usually more effective than the best-planned, human-made infrastructure.

Green infrastructure is not an end to itself; it is an important part of an equation aimed at a successful approach to better and more cost-effective stormwater management.

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Stormwater management online resources

- Green Industry Best Management Practices (BMPs) for the Conservation and Protection of Water Resources in Colorado, www.greenco.org/bmp_list.htm
- Green Infrastructure — Key Resources, http://cfpub.epa.gov/npdes/greeninfrastructure/resources.cfm
- Low Impact Development Center Inc., www.lowimpactdevelopment.org
- Low Impact Development Design Strategies: An Integrated Design Approach (EPA 841-B-00-003), www.epa.gov/owow/nps/lid/lidnatl.pdf
- Low Impact Development — Urban Design Tools, www.lid-stormwater.net
- National Menu of Stormwater Best Management Practices, http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

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