INTERNATIONAL MUNICIPAL LAWYERS ASSOCIATION

2011 Annual Conference

Chicago, IL

A Greener City:

Green Infrastructure, Water Quality, and Quality of Life

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Metropolitan Government of Nashville and Davidson County

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I. Introduction

Green infrastructure, broadly defined here as natural systems that provide services to people, played a central role in two of Nashville's most recent environmental success stories: its first-ever Open Space Master Plan and the creation of incentives for developers to install green infrastructure for stormwater management. Although these two initiatives use the term "green infrastructure" in two different contexts, a unifying theme is the connection between natural systems and improved quality of life.

II. Green Infrastructure in Open Space Planning

Green infrastructure is used in open space planning to refer to the broad network of natural resources in a community. Its definition is discussed in the following excerpt from Nashville's Open Space Master Plan:

> This can be thought of as two types of infrastructure: **gray** and **green**. **Gray infrastructure** refers to traditional built structures, such as roads, utilities, railways, airports and sewers. It is planned and maintained and is considered to be a basic necessity and an investment in the future. **Green infrastructure** refers to the services provided by open spaces. Green infrastructure includes tree-lined streets, community gardens, parks, greenways, pocket parks, farmland, forestland, waterways, and bluffs.[1]

Just as gray infrastructure provides services – such as treating and delivering water, or providing roads and bridges for transportation – the services provided by green infrastructure include filtering stormwater, helping prevent erosion and mitigate flooding, trapping air pollutants, sequestering carbon dioxide, and providing recreational and social amenities for visitors and residents.

1. Infrastructure as Investment

Thinking about open space in terms of infrastructure underscores its importance as an investment. A city that fails to invest in its gray infrastructure will be unable to accommodate growth. That is true of green infrastructure as well. It is necessary to strategically preserve open space and other forms of green infrastructure both for the environmental the quality of life benefits they provide. In order to compete for high-skilled jobs and talent – a major component of economic development – a city must provide amenities such as parks, greenways, attractive streetscapes and views, and clean waterways. That likely is why parks and greenways have been shown to increase the value of nearby properties.[2]

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[1] Nashville's Open Space Master Plan is available at www.nashville.gov/sustainability.

[2] *See* Robert Wood Johnson Foundation, *The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design*, May 2010, *available at* www.activelivingresearch.org.

2. Nashville's Open Space Plan

The Metropolitan Government of Nashville and Davidson County[3] commissioned its open space plan because we recognized the value of planning for conservation just as we would plan for development. With that in mind, we established a three-step planning process. The first step was to inventory Davidson County's current natural resources using GIS mapping technologies. That inventory identified and catalogued critical forestland, water resources, agricultural land, bikeways and greenways, and historical attractions. In the next phase, the planning team – which was composed of a public-private partnership between Metro Government and the Land Trust for Tennessee, with consulting assistance from The Conservation Fund – then solicited community input to help prioritize those resources and come up with a big-picture vision for the plan. Finally, the planning team worked with a community advisory board to come up with themes that represented the public priorities and a vision for an implementable plan.

The priority themes identified in the plan are:

- Connecting wildlife and water networks;
- Supporting urban and rural farming;
- Connecting people to the green infrastructure network, and
- Preserving historic and iconic resources.

Those themes are related in large part to the public benefits of green infrastructure. For instance, the connection between wildlife corridors and water networks are crucial to plant and wildlife habitat and the quality of rivers and streams. It is important to maintain those connections to the greatest degree possible to avoid the environmental degradation that comes with fragmented forests, wetlands, and stream buffers.

Urban and rural farming is important in that it simultaneously preserves open space and makes productive use for the land. It can also improve quality of life by providing greater access to healthy, fresh foods in areas where that food is otherwise inaccessible.

Without an emphasis on connecting people to the green infrastructure network, the quality of life benefits of open space preservation would largely be lost. As a result, the plan emphasizes distribution of parks throughout the county along with pedestrian, greenway and bikeway access.

The big-picture vision for Nashville's open space network includes adding a large park in the Southeast quadrant of the county, which currently is the only corner of the county without one. Because the Cumberland River plays such a

[3] In 1963, the city of Nashville and Davidson County consolidated into a single metropolitan government. As a result, the Nashville Open Space Plan encompasses all of Davidson County.

large role in Nashville's identity and network of natural resources, the plan also calls for prioritizing protection of land in each of the nine bends in the river within the county. The vision also includes improving the green infrastructure in the downtown and emphasizing connectivity throughout the green infrastructure network.

If you are interested in further details regarding Nashville's open space planning process, goals, and policy recommendations, you may access the plan at www.nashville.gov/sustainability.

III. Managing Stormwater with Green Infrastructure

Green infrastructure in the stormwater management context has a more narrow focus on the management of stormwater on developed land. The Metro Nashville Code defines green infrastructure as:

> [A]n approach to wet weather management that is cost-effective, sustainable, and environmentally friendly, which incorporates management approaches and technologies that infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies. Green Infrastructure practices include, but are not limited to open space, rain gardens, porous pavements, green roofs, trees and tree boxes, swales, and curb extensions.[4]

This can be simply described as development practices that mimic natural hydrology to the greatest extent possible. These practices that mimic, preserve, or restore natural hydrology, or harvest rainwater for reuse, are often referred to as "low impact development" or "LID."

Green infrastructure through LID is an attractive alternative to gray infrastructure because it offers multiple environmental and social benefits, is aesthetically pleasing, and often is cheaper to install and maintain than traditional built infrastructure. Despite its attractiveness, however, LID is not widely adopted in Nashville. That is in part because stormwater management is highly regulated and, until now, regulations have not provided incentives for creative, green solutions. The ancillary benefits of green infrastructure also may not offer an immediate or tangible return on investment for developers. Finally, LID practices are still relatively new. Most engineers are more comfortable and familiar with traditional stormwater management practices, and will therefore default to those practices for the purposes of regulatory compliance.

The future of stormwater regulation does not, however, lie with those traditional techniques. As discussed below, upcoming regulations soon will require green infrastructure practices on new developments and significant redevelopments wherever feasible.

[4] Metropolitan Government of Nashville and Davidson County Code of Laws § 15.64.010.

1. Regulatory Framework

Stormwater runoff from construction sites, new developments, and significant redevelopments is regulated locally by Metro Nashville's Stormwater Management Manual. Those regulations stem from the federal Clean Water Act (CWA) provisions governing urban stormwater runoff. The CWA, passed in 1972, establishes a comprehensive program "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[5] To achieve that goal, the CWA requires the U.S. Environmental Protection Agency to control discharges of pollutants from point sources (think drains and pipes) through the issuance of National Pollutant Discharge Elimination System ("NPDES") permits.[6]

The CWA's initial emphasis on industrial point sources had a significant positive impact on water quality, but it became apparent over time that, largely due to stormwater runoff and other nonpoint sources of pollution, those controls were not sufficient to meet Congress' ambitious water quality goals. That resulted in the Water Quality Act of 1987, which added § 402(p) to the CWA.[7] Section 402(p) requires permits for stormwater discharges from municipal separate storm sewer systems ("MS4s") and industrial sources.[8]

Among other requirements, the statute states that permits for discharges from MS4s shall:

> [R]equire controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants.[9]

Consistent with that section, EPA regulations specify that NPDES permits for discharges from MS4s must include conditions requiring "best management practices (BMPs) to control or abate the discharge of pollutants."[10] The implication for Nashville is that, in order for it to allow stormwater to discharge into a waterway from one of its storm drains, it must have regulations in place requiring developers to install and maintain stormwater management controls that are approved as BMPs. Metro Nashville has codified its BMPs in Volume 4 of its Stormwater Management Manual.[11]

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[5] Clean Water Act § 101(a), 33 U.S.C. § 1251(a).
[6] CWA § 402, 33 U.S.C. § 1342.
[7] CWA § 402(p), 33 U.S.C. § 1342(p).
[8] *Id*.
[9] CWA § 402(p)(3)(B)(iii), 33 U.S.C. § 1342 (emphasis added).
[10] 40 Code Fed. Reg. 122.44(k).
[11] Nashville's Stormwater Management Manual Volume 4 is available at http://www.nashville.gov/stormwater/regs/SwMgt_ManualVol04_2009.asp.

2. Pollution Reduction vs. Runoff Reduction

For BMPs to be enforceable and consistent, they must be guided by some sort of performance criteria. Currently, Metro Nashville's BMPs for permanent stormwater management are subject to a pollution reduction goal of 80% reduction in the total suspended solids (TSS) contained in the stormwater runoff from a site.[12] That goal can be satisfied by the sum of a number of BMPs installed on a site, which could include structural controls such as filters.

There is a growing desire on the part of regulators to incorporate green infrastructure into permit requirements. The EPA Office of Water committed in a recent memo to work with interested communities to incorporate green infrastructure into their NPDES permits.[13]The memo highlighted the development of performance criteria as one of the primary hurdles to doing so.[14] Unlike BMPs that are designed to remove pollutants from runoff, green infrastructure keeps water from leaving the site altogether. As a result, upcoming regulations will favor reductions in runoff quantity instead of reduction in pollution levels.

3. Nashville's Draft MS4 Permit

On July 28, 2011, the State of Tennessee Department of Environment and Conservation released a draft copy of Nashville's upcoming NPDES permit. The draft permit states a clear preference for green infrastructure practices and expressly ties the performance of green infrastructure to runoff reduction. Under the heading, "Performance Standards," the draft permit requires Metro to "implement and enforce permanent stormwater controls that are comprised of runoff reduction and pollutant removal. Runoff reduction is the preferred control practice as it can achieve both volume control and pollutant removal."[15] Under the heading "Runoff Reduction (infiltration or green infrastructure)," the permit calls for management measures that are designed, built and maintained to capture through green infrastructure practices the first inch of rain that falls on the site.[16]

The fact that Nashville's draft permit strongly favors runoff reduction does not mean that traditional structural controls are impermissible. In fact, West Virginia's general MS4 permit recently withstood an administrative appeal in large part because it included traditional means of compliance as an alternative to

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[12] Volume 4 of Nashville's Stormwater Management Manual states:

> Long-term BMP selection must be based upon the ability to meet Metro's requirement of an 80% TSS reduction of an average annual urban pollutant load. Select permanent treatment practices based upon the TSS reduction provided, the proposed land use, and the level of maintenance required.

[13] Memorandum from Nancy Stoner and Cynthia Giles to EPA Regional Administrators, *Protecting Water Quality with Green Infrastructure in EPA Water Permitting and Enforcement Programs*, Apr 20, 2011, at 1.

[14] *Id*. at 2 (emphasis added). For additional information on national trends in green infrastructure regulation, see http://cfpub.epa.gov/npdes/greeninfrastructure/regulators.cfm.

[15] Draft NPDES MS4 Permit § 3.2.5.2.

[16] Draft NPDES MS4 Permit § 3.2.5.2.1.

green infrastructure.[17] In Nashville's draft permit, if green infrastructure is not possible due to site conditions, then the site will still have to treat the stormwater with current BMPs to the 80% TSS reduction standard.[18]

4. Nashville's LID Manual[19]

Although the effective date for the runoff reduction requirement is not specified in Nashville's draft NPDES permit, it is clear that runoff reduction through green infrastructure practices will be the standard post-construction stormwater management approach at some point in the next 2-3 years. With that in mind, and because of the many benefits associated with green infrastructure, Nashville just released a draft of a fifth Volume of its Stormwater Management Manual (the LID Manual), which is focused exclusively on incentives for low impact development and the associated design standards. Once the LID Manual is signed into law, developers will be able to choose between Volume 4 (BMPs measured by pollution reduction) and Volume 5 (LID measured by runoff reduction, including incentives) to comply with Nashville's stormwater regulations.

The goal of the LID Manual is to accelerate installation of green infrastructure throughout Nashville and familiarize developers and engineers with the LID design standards before they become the preferred management practice under Nashville's new permit.

The LID Manual was completed after an eight-month public stakeholder process that solicited the input of developers, engineers, and other community members as to the most effective incentives. While the Manual still needs to go through a formal notice and comment period before it is finalized, the completed draft includes the following incentives for sites that meet the runoff reduction standard for green infrastructure (meaning that it is designed, built, and maintained to capture through green infrastructure practices the first inch of rain that falls on the site):

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[17] In *City of Bluefield, et al. v. Mandirola, at al.*, the Circuit Court of Kanawha County upheld the decision of the West Virginia Environmental Quality Board, which dismissed an administrative appeal of West Virginia's MS4 general permit , which specifically challenged the green infrastructure provisions in that permit. *City of Bluefield*, Civil Action No. 10-AA-71, at 2-3 (Cir. Ct. Kanawha Cty. W. Vir., Dec. 14, 2010). The central argument in the challenge to the permit appeared to be that the soils, climate, and topography of West Virginia made the permit unworkable across the various jurisdictions covered by the permit. *Id*. at 4. The Court dismissed that argument as irrelevant to the permit's lawfulness because the permit allows for alternate means of compliance where on-site retention of stormwater is infeasible. *Id*. at 5.

[18] Draft NPDES MS4 Permit § 3.2.5.2.2. The permit specifically lists the following exceptions to the application of runoff reduction requirements: (1) Where a potential for introducing pollutants into the groundwater exists, unless pretreatment is provided; (2) Where pre-existing soil contamination is present in areas subject to contact with infiltrated runoff; (3) Presence of sinkholes or other karst features; and (4) Where pre-development infiltrative capacity of soils limit selection of runoff reduction management measures.

[19] For more information on Nashville's LID Manual, contact Rebecca Dohn with Nashville's Metro Water Services at rebecca.dohn@nashville.gov.

- A 75% reduction in the stormwater user fee associated with the site.
- A waiver of the plan review fees for the site grading and water/sewer plans.
- Requirements for stormwater detention quantity are reduced. This is a requirement that a site detain enough water during a storm (through ponds, for instance) to keep the rate that stormwater runs off the site post-development the same as the pre-development rate.

The LID Manual includes additional incentives for infill development and green roofs. These incentives lower the runoff reduction threshold for qualifying for the incentives above:

- For infill development, a site qualifies for the above incentives if it captures through green infrastructure practices the first half inch of rain that falls on the site.
- For sites that install green roofs that meet the design criteria in the manual, the runoff reduction threshold is essentially waived and the site qualifies for the above incentives.

Metro adder the additional incentives for infill development and green roofs because of the ancillary benefits of those green infrastructure practices. Infill development is encouraged from a stormwater perspective because infill sites typically have impervious surfaces anyway. Infill is also a key component of "smart growth," which encourages denser urban neighborhoods, improved access to transit, and reduced reliance on cars.

Green roofs are encouraged because they often serve as small rooftop parks, thereby providing social benefits. They also make buildings more energy efficient by absorbing heat in the summer that otherwise would be transferred into the building, and they reduce the amount of heat that is reflected off of the roof, thereby reducing what is known as the heat island effect. Because of the multiple benefits of green roofs, Nashville's stormwater division is also exploring the idea of a green roof rebate program to further incentivize developers to install green roofs.

IV. Conclusion

Green infrastructure is highly desirable, whether on a large scale or small. A city with green infrastructure has more trees, more plants, cleaner water, cleaner air, and more outdoor recreational opportunities. In other words, it is a more enjoyable place to be. Nashville's Open Space Master Plan and LID Manual are two big steps in that direction.