# GREEN INFRASTRUCTURE APPROACHES HELP MIMIC NATURAL WATER CYCLES

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Green Infrastructure Approaches Help Mimic Natural Water Cycles

Green infrastructure is an approach to stormwater management that protects, restores or mimics the natural water cycle. Natural processes can be used to provide important services by protecting against flooding or excessive heat, or helping to improve air, soil and water quality. When nature is utilized in an infrastructure system, it is called "green infrastructure", whereas "gray infrastructure" is the term often used for engineered structures. Green infrastructure is most often associated with stormwater management systems.

Green infrastructure is a form of low impact development (LID), a term used to describe a land planning and engineering design approach to manage post-construction stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. Conventional stormwater infrastructure is designed to move stormwater rapidly away from the built environment, whereas green infrastructure reduces and treats stormwater at its source while delivering environmental, social and economic benefits.

Green infrastructure incorporates natural systems into engineered systems to provide clean water, conserve ecosystem values and functions, and offer a wide array of ancillary benefits to people and wildlife. Examples would include planting trees and restoring wetlands, instead of building a new water treatment plant, or restoring floodplains instead of building taller levees. Similarly, existing resources left in place can become part of a green infrastructure plan, such as retaining trees along streams.

**Taking a Green Infrastructure Approach**

Stormwater management strategies that treat stormwater runoff close to its source through recognized practices are a component of green infrastructure. This includes infiltration, treatment by soils or vegetation, or stormwater stored for reuse.

Green infrastructure solutions can be applied on different scales, from single residences to corporate buildings – or even entire communities. Green infrastructure practices include rain gardens, permeable pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting systems. At a large scale, the preservation and restoration of natural landscapes (such as forests, floodplains and wetlands) are components of green infrastructure.

Some examples of green infrastructure practices already in use include:

- Permeable pavements in parks, basketball courts, parking lots and alleys;
- Rain gardens and bioretention systems at schools, parking lots and other public facilities;
- Constructed wetlands for management and treatment of stormwater runoff;
- Green roofs on buildings to retain rainfall and reduce "heat island" effect.

Many forward-looking U.S. cities already implement green infrastructure, including New York, Chicago, Portland, Seattle, San Francisco, Minneapolis-St. Paul, Milwaukee, Kansas City, Toledo, Cincinnati and Philadelphia.

**Regulatory Issues**

Regulations can provide an effective foundation for consistent implementation of green infrastructure across a community, state or region. In many cases, green infrastructure is often identified as the preferred option for stormwater management under federal and state regulations and guidance documents.

While the federal government does not mandate the use of green infrastructure, the U.S. Environmental Protection Agency (EPA) encourages the use of green infrastructure approaches to manage stormwater. EPA's Office of Water has released policy memos supporting integration of green infrastructure into National Pollutant Discharge Elimination System (NPDES) permits and Combined Sewer Overflow (CSO) remedies.

A few states have LID requirements, which includes green infrastructure, but post-construction stormwater discharges generally are regulated by the municipality. The National Association of Homebuilders (NAHB) conducted a study of 50 municipalities, finding that only one lacked any form of green infrastructure in its stormwater requirements.

While LID requirements varied, common best management practices include buffer strips, rain gardens, rain barrels, stormwater ponds, basins, porous pavement, and green roofs. Some form of incentive is available in many municipalities. These are primarily financial, such as credits applied against fees and general charges associated with requirements or below-market-rate loans. Most governments adopting LID include some form of long-term maintenance requirements.

States whose communities have incorporated LID or green infrastructure into stormwater management include Arkansas, California, Colorado, Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, North Carolina, Oregon, Vermont and Washington.

The NAHB study demonstrates that green infrastructure is prevalent across the country and its use is likely to expand because of the benefits provided. As the use of green infrastructure becomes more common, builders and developers should understand the options available, as well the green infrastructure practices that may be the most practical for their region and climate.

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**KEYWORDS:** Green Building Business & Trade Green Business Green Professionals Sustainability Business Energy Energy Efficiency Markets, Regulation & Policy Environment Conservation Recycling Water Eco-Living, Consumption & Travel Technology, Innovation & Solutions Green Innovations Sustainable Solutions People, Social Action & Community Engagement Community Social Development Black & Veatch green infrastructure stormwater management Environmental Regulations low impact development LID