

WHAT IS GREEN INFRASTRUCTURE?

Sustainable Solutions to Urban Water & Wastewater Challenges



Credit: Pastore Ryan, LLC.

Green Infrastructure refers to ecological systems, both natural and engineered, that act as living infrastructure. Green Infrastructure elements are planned and managed primarily for stormwater control, but also exhibit social, economic and environmental benefits.

—www.wcel.org

Fact: Providing tree cover for an additional 25% of your residential lot, diverting your downspouts to rain gardens, replacing half of your lawn with native gardens and using vegetated drainage swales instead of stormwater pipes decreases the total costs by \$46,286! These strategies reduce peak discharge of stormwater by 44%." —(<http://greenvalues.cnt.org/calculator>)



Credit: Roofscapes, Inc.



Credit: The Portland Bureau of Environmental Services

CASE STUDY

In the 1990s, New York City avoided spending \$6–\$8 billion on new grey infrastructure water filtration and treatment plants by instead purchasing and protecting watershed land in the Catskill Mountains for about \$1.5 billion.

BENEFITS OF GREEN INFRASTRUCTURE

- Create habitat for birds, butterflies & other wildlife
- Increase water conservation
- Reduce water pollution in nearby rivers and streams
- Recharge local groundwater
- Reduce potential of flooding
- Use as an educational & research tool
- Eliminate standing water
- Reduce construction of drainage & retention systems
- Community beautification
- Delay & reduce peak stormwater runoff flow rates
- Decrease erosion
- Reduce sewer overflow events
- Increase carbon sequestration
- Reduce urban heat island effect & energy costs
- Improve air quality
- Provide additional recreational space
- Filter runoff pollution & improve water quality
- Improve human health
- Increase land value

—www.epa.gov



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EXAMPLES OF GREEN INFRASTRUCTURE

A **rain garden** (or **bioretention basin**) is a planted depression that is designed to absorb rainwater from impervious areas such as roofs, drive-ways, walkways, and compacted lawn areas. Rain gardens reduce runoff by allowing stormwater to soak into the ground, as opposed to flowing into storm drains and surface waters, which can cause erosion, water pollution, flooding, and diminished groundwater. (www.epa.gov)



Credit: Land and Water, Inc. www.landandwater.com

A **green roof** (also known as **eco-roof**, **vegetated roof** or **living roof**) is a roof of a building that is partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane. Green roofs are widely used for their stormwater management and energy savings potential, as well as their aesthetic benefits. Green roofs absorb stormwater and release it back into the atmosphere through evaporation and plant transpiration, while draining excess runoff and reducing the urban heat island effect. (www.epa.gov)



Green roof at Mountain Equipment Coop, Toronto, Canada



A **bioswale** (or **vegetated swale**) is a wide, shallow channel with a dense stand of native vegetation covering the side slopes and bottom. Swales can be natural or constructed and are designed to promote infiltration, reduce the flow velocity of stormwater runoff and to maximize the time water spends in the swale, which aids the trapping of particulate pollutants and silt. A common application is around parking lots, where automotive pollution running off of the parking lot is treated before entering the watershed. (www.epa.gov)



CASE STUDY:
Arnold, Missouri, has dramatically reduced taxpayers' cost of disaster relief and flood damage repair by purchasing threatened properties and creating a greenway in the flood plain. (<http://www.greeninfrastructure.net/Benefits>)



Credit: Pastore Ryan, LLC.

Permeable paving (also known as **pervious paving** or **porous pavement**), is a term used to describe paving methods for roads, parking lots and walkways. Porous asphalt, concrete, paving stones or bricks allow the precipitation to infiltrate through to the soil below. (www.epa.gov)

Credit: sustainability.unc.edu & www.thcahill.com



CASE STUDY:

Landsat images for the Charlotte, NC, area covering a time span from 1984 to 2003 revealed a 20% loss in tree cover and open space, while urban surfaces increased by 127%. The loss of green infrastructure, valued at \$5.3 billion, dramatically increased the volume of stormwater that the county manages.

Credit: Timothy R. Toland Department of Landscape Architecture, SUNY ESF



A **rainwater tank** (or **rain barrel**) is a water tank which is used to collect and store rain water, typically from rooftops via rain gutters. Rainwater tanks collect and store harvested rain for home use, watering gardens, washing cars, agriculture, and for retention of stormwater for release at later time. (greenhouse.gov.au)

CASE STUDY:

"Chicago has approximately 1,900 miles of public alleys; that's approximately 3,500 acres of paved impermeable surface. If all of the alleys in Chicago were green alleys, up to 80% of the rainwater falling on these surfaces throughout the year could pass through permeable paving back into the earth, thereby reducing localized flooding, recharging groundwater and saving taxpayer money that would otherwise be spent treating stormwater."
(www.cityofchicago.org/environment)

Credit: www.lid-stormwater.net



Urban forestry is the care and management of urban forests, such as urban trees, for the purpose of improving the urban environment (www.lpb.org).

- Trees are natural buffers to harsh weather conditions
- Trees reduce air conditioning and heating bills
- Trees prevent erosion and absorb stormwater
- Trees convert carbon dioxide to oxygen and remove toxins from the air
- Trees reduce noise pollution and provide habitat

Credit: Cornell Cooperative Extension of Onondaga County



GREEN INFRASTRUCTURE: COMMONLY USED TERMS

Better Site Design/Conservation Design: An approach to residential and commercial development that can simultaneously reduce pollutant loads, conserve natural areas, save money, and increase property values. Better Site Design promotes three main goals for new development sites: reduce the amount of impervious cover, increase the amount of natural lands set aside for conservation, and to better integrate stormwater treatment systems on-site. (www.epa.gov)

Biodiversity: The relative abundance and variety of plant and animal species within a given ecosystem, biome or for the entire Earth. Biodiversity is often used as a measure of the health of biological systems. (wikipedia.org)

Downspout Disconnection: Disconnecting downspouts from the municipal sewer system allows roof water to drain to lawns and gardens, allowing water to infiltrate as plants and soils filter pollutants. (portlandonline.com)

Evapotranspiration: A combination of evaporation from free water surfaces and transpiration of water vapor from plant surfaces to the atmosphere. (www.crh.noaa.gov)

Low Impact Development (LID) refers to systems and practices that use or mimic natural processes to infiltrate, evapotranspire or reuse stormwater or runoff on the site where it is generated. (www.epa.gov)

Leadership in Energy and Environmental Design (LEED) - A Rating System that is administered by the US Green Building Council (USGBC) and is currently the most accepted benchmark for the design, construction, and operation of high performance green buildings and neighborhood developments in the U.S.

Smart Growth: A range of development and conservation strategies intended to protect our natural environment while simultaneously making our communities more attractive, economically stronger, and more socially diverse. Smart Growth communities conserve resources by reinvesting in existing infrastructure, reclaiming historic buildings, and by designing neighborhoods that have shops, offices, schools, churches, parks, and other amenities within walking or biking-distance of residential areas. (www.epa.gov)

Sustainable Infrastructure: A set of policies, approaches and planned expenditures that provide for consistently effective water infrastructure systems over the long term. 'Water infrastructure' generally refers to the pumps, plants, pipes and other physical assets that make up our systems, including those for drinking water, wastewater and stormwater. (www.epa.gov)

Urban Heat Island Effect: A measurable increase in ambient urban air temperatures resulting primarily from the replacement of vegetation with buildings, roads, and other heat-absorbing infrastructure. (www.evergreen-design.net)

ADDITIONAL RESOURCES:

These links can also be found on the Syracuse University Environmental Finance Center website
<http://efc.syracusecoe.org/>

Natural Resources Defense Council (NRDC), 2006 Rooftops to Rivers Green Strategies for Controlling Stormwater and Combined Sewer Overflows
<http://www.nrdc.org/water/pollution/rooftops/contents.asp>

The Low Impact Urban Development Center, Low Impact Development (LID) Urban Design Tools
<http://www.lid-stormwater.net>

U.S. Environmental Protection Agency Managing Wet Weather with Green Infrastructure
<http://epa.gov/npdes/greeninfrastructure>

The Green Infrastructure Planning Guide
<http://greeninfrastructure.eu/>

Stormwater Best Management Practices
<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>



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