ANJEC
Local Environment Matters

An ANJEC Resource Paper

Stormwater Management for Municipalities:
Green Infrastructure designs and options

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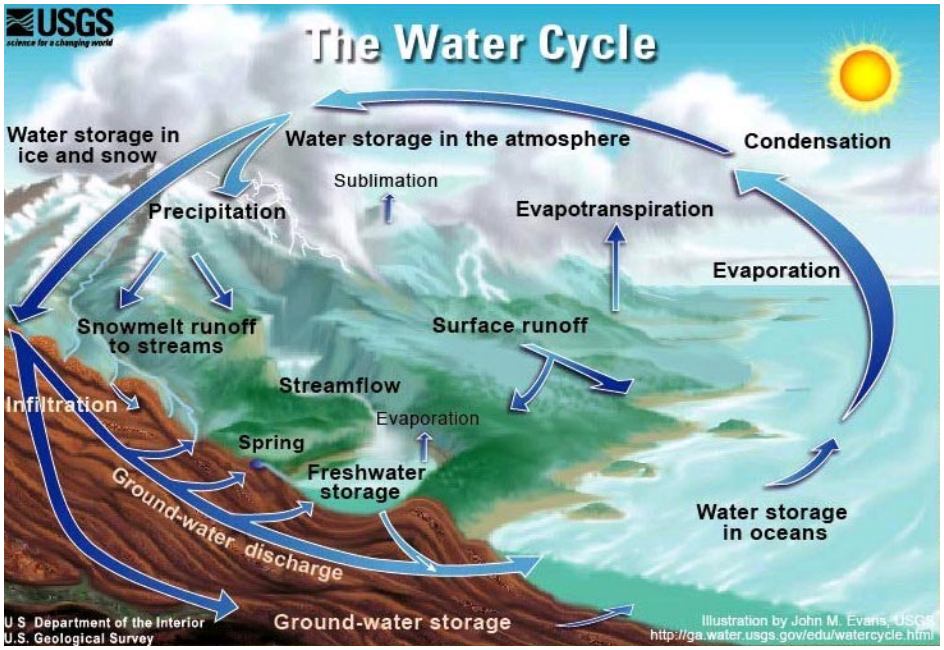
INSIDE

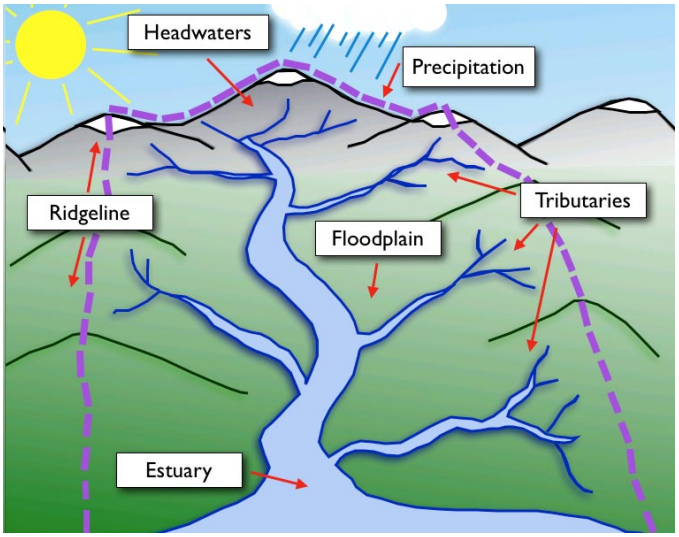
What is Green Infrastructure?

In simple terms, Green Infrastructure (GI) is an approach to manage stormwater either onsite, or close to a developed site that mimics natural processes by soaking up and storing water. GI techniques use low impact development (LID) land management approaches that restore or maintain pre-development hydrological conditions.

The New Jersey Department of Environmental Protection (NJDEP) defines GI as methods of stormwater management that reduce wet weather/stormwater volume or flow, or that change the characteristics of the flow into combined or separate sanitary or storm sewers or surface waters. It does this by allowing the stormwater to infiltrate, to be treated by vegetation or soils; or to be stored for reuse. Rather than "exporting" stormwater to streams and rivers using concrete pipes, tubes, known as "gray" infrastructure, GI uses porous materials, native plants, or temporary storage methods that allow stormwater to soak into the ground to recharge the groundwater and aquifers.



The Water Cycle
Source: USGS, 2014



The Hydrological Cycle
Darron Gedge's Geography Channel Published on May 27, 2015"

Unlike traditional piped infrastructure, green infrastructure uses high performance landscaping and hardscaping to meet stormwater requirements. These techniques can also provide wildlife habitat, improve air quality, reduce the urban heat island effect, improve appearance and increase property value. GI can include:

- Rain gardens / bioretention basins
- Bioswales
- Native meadows
- Constructed wetlands
- Porous pavement
- Cisterns/rain barrels
- Green roofs
- Community forestry

Why Use Green Infrastructure?

Why deal with stormwater onsite when we have traditionally used gray infrastructure to shuttle it to a different location? New Jersey municipalities are currently faced with a myriad of water-related issues due to unmanaged stormwater runoff. GI will improve water quality as well as manage the volume of stormwater to reduce flooding. According to a 2014 report from NJDEP, over 98 percent of our monitored waters do not meet one or more water quality standards. NJDEP acknowledges that stormwater is a significant contributor to the degradation of our water. Nationwide, stormwater contributes at least sixty percent to the overall pollution in our waters. As stormwater moves across roofs, parking lots, sidewalks, streets, urban lawns and agricultural land, the free flowing surface runoff picks up pollution along the way. This polluted stormwater runoff then washes directly into our waterways, often through gray infrastructure such as storm drains, seriously impairing our water quality. This nonpoint source pollution (NPS) can include:

- Fertilizer
- Pesticides
- Road salt
- Pet waste
- Gasoline
- Septic leachate
- Sediment
- Litter.

Pollution becomes even more problematic in communities with combined storm and sewer infrastructure. When treatment plants receiving both sewage and stormwater reach capacity, both untreated stormwater and raw sewage are discharged directly to local streams and rivers through combined sewer overflows (CSOs).

Even small rainfall events can also cause flooding issues. It does not take much impervious road surface to create massive quantities of runoff: One inch of rain that falls on one mile of a narrow (30-foot) two-lane road produces over 98,000 gallons of stormwater (using USGS calculator: *https://water.usgs.gov/edu/activity-howmuchrain.php*) By developing and redeveloping land, these problems have intensified as we have "interrupted the natural water cycle" (see water cycle diagrams on pages 1 and 3).

Changing climate has also resulted in more frequent and intense storm events, adding to the State's water resource problems. In 2018, there were 64.09 inches of precipitation – the wettest year in NJ since record keeping began in 1895. It has been estimated that it will take $16 billion dollars to fix NJ stormwater issues.

Using GI methodology, we can begin to "restore the natural water cycle" to manage stormwater in a more effective way. By allowing stormwater to infiltrate into the ground, the potential for flooding is reduced and NPS pollution can be adsorbed and treated, thus improving the water quality of streams, lakes and rivers. The use of green stormwater infrastructure encourages the idea that stormwater is a resource that

The Water Cycle

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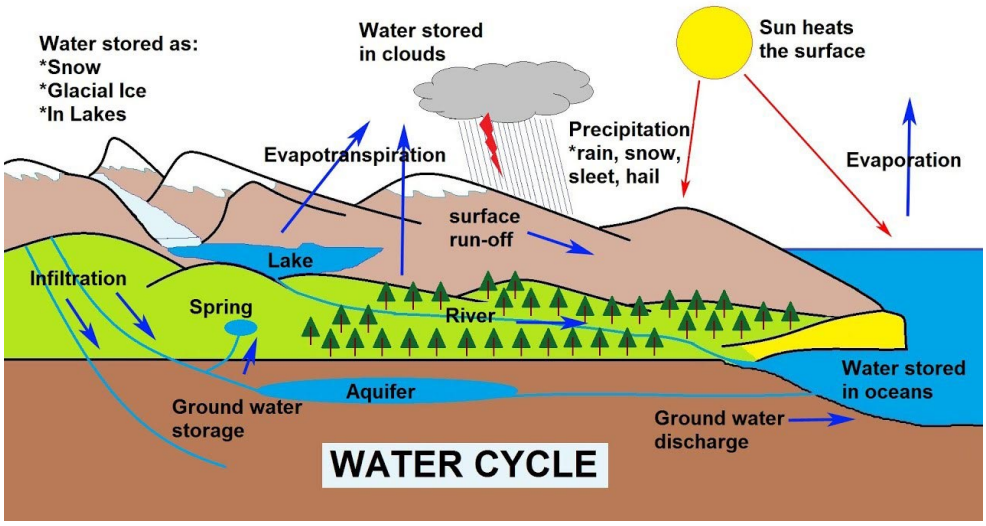


can be used, instead of being treated as a nuisance that needs to be removed as quickly as possible.

What Must Municipalities Do?

By law, stormwater management is not optional. New Jersey's stormwater rule and Best Management Practices (BMP) Manual *(www.njstormwater.org/bmp_manual2.htm)* require that stormwater management standards in new major developments be met by incorporating non-structural stormwater management strategies (ie GI) to the "maximum extent practicable" (NJAC 7:8). On 12/3/18, NJDEP announced its proposal to significantly change the State's stormwater management rules (NJAC 7:8), to require use of green infrastructure to meet stormwater management standards for water quality, recharge and volume control, replacing the requirement that major developments incorporate non-structural stormwater management strategies to the "maximum extent practicable." While these rule changes come into effect, municipalities can begin to optimize the use of GI for new developments and for retrofitting older sites where there is little or no stormwater management. More information about stormwater and options for management can be found in the ANJEC Resource Paper "Municipal Options for Stormwater Management, 2011."

Common Types of Green Infrastructure Strategies

Rain gardens / bioretention basins

Rain gardens or bioretention basins are landscaped, shallow depressions that capture rainwater, allowing it to percolate slowly into the ground. Stormwater runoff from impervious surfaces such as roofs or parking lots is diverted into the rain garden / bioretention basin where it is temporarily stored. Native, deep-rooted perennial flowering plants, shrubs, trees and grasses help water drain more deeply into the soil, maximizing infiltration and groundwater recharge. Meanwhile, the plants and soil help break down the NPS pollution in the runnoff. It is important that the soil structure allow water to drain within a 24-72 hour time frame following a storm event to avoid mosquito breeding and allow for storage space for subsequent rainfall. If not, adding coarse sand to the soil or gravel below the rain garden will help the rain garden function properly.
A useful guide for planning, installing and maintaining a rain garden is available through the Rutgers Cooperative Extension at: *http://water.rutgers.edu/Rain_Gardens/RGWebsite/RainGardenManualofNJ.html*. This manual also includes an appendix that has a rain garden plant list and sample design models.

Bioswales

Bioswales have some similarities to rain gardens, but are generally longer and deeper vegetated channels that slow and filter stormwater flows. Bioswales are generally designed with a perforated underdrain or rock trench to aid in the conveyance of stormwater when soils poorly drain. To facilitate stormwater infiltration, soils are generally amended with compost, sand or engineered soil. A common application for bioswales is around parking lots, where substantial automotive pollution settles on the paving and is then flushed by rain. Bioswales capture and treat polluted stormwater runoff as it percolates through the vegetation and soil media.

Parking area bioswale

Image by U.S. Environmental Protection Agency

The treated water then either infiltrates into the ground or is released to the watershed or storm sewer through the underdrain. More information on bioswales can be found at *https://conservationtools.org/library_items/1886-Bioswales-Vegetated-Swales-Fact-Sheet.*

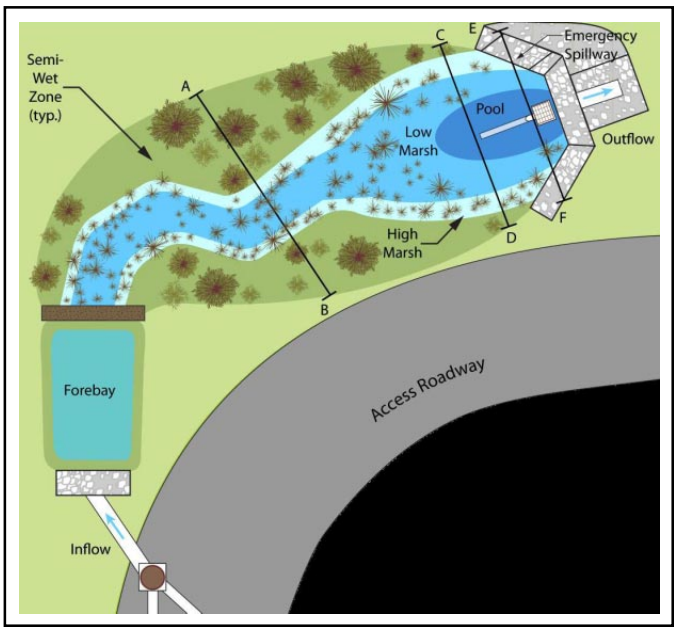
Native meadows

Conventional turf-covered detention basins can be converted to native meadows by removing the grass and replacing it with native perennial plants and grasses. Conventional detention basins capture and temporarily store stormwater runoff, slowly releasing the water downstream at a controlled rate which helps control flooding of waterways, but they are not effective at reducing pollution or stormwater volume. In naturalized detention basins, the native flowering plants and grasses, having deeper roots, are more efficient at rainwater infiltration and pollution removal. There are many benefits to this naturalized approach, including providing important native pollinator habitat that beautifies the neighborhood; preventing stream degradation; restoring water quality; capturing and treating NPS pollution; replenishing groundwater and recharging aquifers; and minimizing facility maintenance requirements, since they only need to be mowed once or twice a year. More information is available at *https://njaes.rutgers.edu/fs1195/* and you can download a basin conversion guide through the Pennsylvania Environmental Council at *https://pecpa.org/wp-content/uploads/PEC_BasinRetrofitGuide.pdf*.

Constructed wetlands

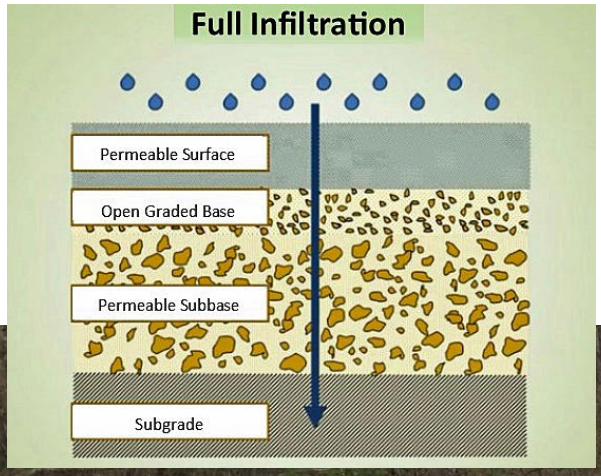
Constructed wetlands are designed to remove a wide range of pollutants from large land development sites. Stormwater runoff flows through an open marsh system where pollutants are removed through settling, uptake and filtration by the vegetation. In addition to pollutant removal and volume control, standard constructed wetlands can also be used to provide wildlife habitat and to enhance the aesthetics of a site. For more information on wetland regulations, refer to N.J.A.C. 7:7A Freshwater Wetlands Protection Act Rules. Standard constructed wetlands consist of a pre-treatment zone, and a combination of two or more of the following components: pool zone, marsh zone and semi-wet zone. Standard constructed wetlands must have a maintenance plan and should be protected by easement, deed restriction, ordinance or other legal measures that prevents its neglect, adverse alteration or removal. More information on constructed wetlands can be found in Chapter 9 of the NJ BMP Manual: *www.njstormwater.org/bmp_manual2.htm* and at *www.epa.gov/wetlands/constructed-wetlands.*

Typical plan view of a constructed wetland system



Porous / permeable pavement

A pervious paving system consists of a durable, permeable surface, which allows rain to move through it. The permeable surface is placed over a transition layer and a storage bed of open-graded, clean stone aggregate, devoid of fine particles. Materials used for pervious pavement systems include: pervious concrete, porous asphalt, interlocking pavers and pour-in-place permeable paving materials. In all cases, stormwater temporarily held in the storage area below the pavement slowly percolates into the soil allowing for pollutants to be removed as it passes through the soil and recharges the underlying groundwater. As soils below pervious pavement tend to be wetter than soils under traditional pavement, the water in the soil also traps heat, so pervious pavement does not freeze as quickly as standard pavement. That means less salt is needed for de-icing in the winter. Before considering using pervious pavement, you must determine if the underlying soils are porous enough to allow sufficient infiltration of rainwater during a storm event. If not an underground conveyance system is required. See *www.pwdplanreview.org/manual/chapter-4/4.2-porous-pavement* for additional information.



Cisterns / rain barrels

Cisterns and rain barrels are storage tanks designed to capture and store stormwater for non-potable uses such as irrigation, toilet flushing, or industrial processes. Typically, stormwater is diverted from roof areas to rain barrels or cisterns by way of roof gutters and downspouts. Large debris and sediment are filtered out using screens before the runoff enters the rain barrel or cistern. Cisterns are used for larger rooftops and can capture and store between 100 and 10,000 gallons of runoff while, rain barrels are used for smaller roofs and can only hold about 55 gallons each.

Rain barrels are typically located adjacent to buildings at a single downspout location, whereas cisterns may be located above or below ground and usually receive stormwater runoff from larger rooftops or ground-level run off.

There are several things to consider before installing a rain barrel or cistern. One, ensure there is a stable path for overflows from the rain barrel or cistern. Two, underground cisterns may need special permits and the location for overflows may also need approvals, so check with your municipality. Three, pollutants can be deposited on roofs or in parking lots; therefore, never consume water collected from cisterns/rain barrels or use it to wash anything that will later be consumed. More information on cisterns can be found at *www.conteches.com/knowledge-center/pdh-article-series/cistern-design-considerations-for-large-rainwater-harvesting-systems.*

Porous pavement parking lot

Green roofs

Green roofs involve the creation of "contained" green space on top of a structure. Rain water is soil etc. captured in planted containers where it is returned to the atmosphere through transpiration and evaporation. While traditional roofs absorb sunlight and radiate heat into the surrounding air, green roofs cool the air through evapotranspiration, keeping the rooftop cooler and transferring less heat to the ambient air. Green roofs can be designed to retain the entire roof runoff from the Water Quality Design Storm (WQDS) i.e. 1.25 inches of rain in two hours (NJAC 7:8-5.5), or they can be designed to reduce roof runoff produced by larger storms as described in the New Jersey Stormwater Best Management Practices Manual (*www.njstormwater.org/bmp_manual2.htm*). Green roofs, however, are not without challenges; they require greater structural support and are expensive to install. This technology has become very well established in Europe.

Community forestry

Urban trees and the tree canopy can serve as green infrastructure by routing rainfall to various components of the hydrologic cycle. Stormwater can be intercepted, transpired, and infiltrated deeper into the soil along root channels to help recharge the water table. Urban forestry is suitable for both public and private properties, including rights-of-way and near existing buildings and homes. Trees also improve air quality and have heat reduction benefits. Urban forestry policies can include increasing existing canopy goals; planting new trees; and enacting tree protection ordinances to preserve existing mature trees. Ongoing maintenance and care is critical for any urban forestry plan as is the balance of canopy goals with power utility concerns. Refer to this article for more information on the role of trees in stormwater management: *www.ncbi.nlm.nih.gov/pmc/articles/PMC6134866/.*

When Should GI Be Considered?

Ideally, GI practices should be incorporated from the very beginning of the site design and planning process. Engineers and site planners should look at the topography of the site and consider where stormwater might flow naturally and then use GI methods to mimic these natural flows in the development site plan design.

GI can also be incorporated in "retrofitting projects" at previously developed sites that may not have existing stormwater management infrastructure or where installed conventional practices no longer meet the desired water quality or reduction of storm water flow to local waterways. Retrofitting areas with GI, such as rain gardens, bioswales, native meadows or cisterns, are economically practical for these locations, while permeable paving or engineered wetlands may be more cost prohibitive.

Who Should Use GI and Where Should GI Be Used?

Anyone can incorporate green infrastructure into their buildings or homes.

- Homeowners might divert stormwater from a downspout into a rain garden or collect it in a rain barrel for later use on their lawn or flower garden.
- Schools can incorporate a rain garden as a functional outdoor classroom or install cisterns for irrigation of landscape or fields.
- Municipally or publicly owned properties can utilize bioswales along parking lots, convert conventional detention basins to meadows, install rain gardens at municipal properties, install porous paving in parking lots and sidewalks, or plant trees to increase tree canopy.
- Private businesses or land owners can improve their impact on the environment by redesigning their parking lots with porous paving, connecting their building runoff to a rain garden or installing cisterns for water reuse.
- Developers should utilize GI to meet the nine nonstructural strategies listed in the NJ DEP's stormwater rule (NJAC 7:8) for stormwater management.
- Municipal engineers and planners play a critical role in assuring that developers utilize GI in projects for stormwater management.
- Look for GI opportunities when your municipality repairs, resurfaces or replaces roadways and parking lots; when repairing or replacing damaged sidewalks and curbs; when upgrading or replacing utilities in the public right-of-way; or redeveloping vacant or abandoned properties.

Comparison of Several Best Management Stormwater Practices[1]

BMP Practice	Pollution Removal Efficiency*	Groundwater Recharge	Stormwater Runoff Quantity Reduction	Capital and Operation/ Maintenance Costs
Rain Gardens / Bioretention Basin	TSS – Medium-High TN – Low-Medium TP – Low-High	Yes	Yes	Low-Medium
Bioswales	TSS – Medium-High TN – Low-Medium TP – Low-High	Partial	Partial	Low-Medium
Native Meadows	TSS – High TN – Low-Medium TP – Low-Medium	Yes	Yes	Low
Constructed Wetlands	TSS – High TN – Low-Medium TP – Medium	No	Yes	Medium-High
Porous Pavement	TSS – High TN – Medium-High TP – Medium-High	Yes (no underdrain)	Yes	Medium-High
Cisterns	TSS – None-Low** TN – None-Low** TP – None-Low**	Yes**	Yes	Low
Green Roofs	TSS – High TN – High TP – High	No	Yes	High
Conventional dry detention basin	TSS – None-Low TN – Low-Medium TP – Low	No	No	Low-Medium

* TSS – Total Suspended Solids, TN – Total Nitrogen, TP – Total Phosphorus
** with water reuse for irrigation

[1] Adapted from:
- US DOT Environmental Toolkit "Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring" *www.environment.fhwa.dot.gov/Env_topics/water/ultraurban_bmp_rpt/uubmp3p1.aspx#t6;*
- Massachusetts Stormwater Handbook: *www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards*
- Minnesota Stormwater Manual *https://stormwater.pca.state.mn.us*
- NJ Stormwater Best Management Practices Manual *www.njstormwater.org/bmp_manual2.htm*

What Role Can ECs Play in Promoting GI in Your Township?

- Conduct a review and assessment of your community zoning, land use regulations and ordinances and determine where new ordinances are needed or where old ones need modification. Is there any language that would limit the installation of GI, such as the requirement for concrete curbing on parking lots? Do the current ordinances allow for the installation of porous concrete, asphalt or other permeable material as alternatives to traditional concrete and asphalt for parking lots or sidewalks? Do landscape design elements facilitate water conservation through the use of native drought-tolerant plants that capture, manage and recharge stormwater? Does your municipality have Tree Protection, a Riparian Buffer or a Stream Corridor Protection Ordinances?
- Review your town's current Master Plan. Does the it incorporate sustainable, low impact development policies and principles? If not, work towards adding these elements when the Master Plan is updated. Review the Land Use Element of the Master Plan. Are the topics of resiliency and green infrastructure incorporated as elements for the future vision of land uses within the community?
- Evaluate your municipality's current Stormwater Management Plan (MSWMP) and Stormwater Pollution Prevention Plan (SPPP). Do they go beyond the NJDEP's minimum requirements? Provide advice on ways to modify it, including strong, clear definitions for green infrastructure, redevelopment and bioretention. Refer to NJ Future's guidance document for assistance in creating an individual MSWMP. *https://gitoolkit.njfuture.org/plan/#update-and-create-plans*
- Work towards improving the current Stormwater Ordinance to raise standards – for example, include strong, clear definitions for green infrastructure, redevelopment and bioretention; define a "major development" with a smaller area of disturbance than the State's model ordinance; extend ordinance applicability to minor developments and redevelopments.
- Does your municipality's MS4 permit include specific language that supports or prioritizes green infrastructure? Work with your town on ways to update the MS4 permit.
- Work with municipal administration and land use board to update the development application process to promote the use of green infrastructure early in the design phase by including a Green Infrastructure Checklist based on Sustainable Jersey action item *www.sustainablejersey.com/actions-certification/actions/#open/action/483.*
- Your Environmental Commission can implement a demonstration project on public property utilizing GI to lead by example.
- During an EC review of a developer's site plan, pay close attention to the stormwater element features and how GI is being incorporated. Ask the right questions – what percent of the development has impervious surface? Is GI being utilized to manage stormwater runoff? If not, why? Can additional features be added to the design such as pervious paving, rain gardens, bioswales, cisterns (above or below), green roofs, dry wells etc? Will there be additional stormwater impact on local streams or rivers? Keep in mind that in undeveloped natural areas only 10 percent of rain water flows directly into streams or rivers, 50 percent recharges the groundwater, and the remaining 40 percent is accounted for by plant uptake and evapotranspiration. In areas with greater than 25 percent impervious cover, surface water quality is severely deteriorated – incorporating GI would help maintain water quality by mimicking a natural system.

How Can It Be Done?

- Prepare a Green Infrastructure Strategic Plan for the municipality, see Sustainable Jersey: *www.sustainablejersey.com/actions-certification/actions/#open/action/568.* An example plan from Hoboken can be downloaded from *www.adaptationclearinghouse.org/resources/hoboken-new-jersey-green-infrastructure-strategic-plan.html.*
- Ensure your municipal engineers or contractors receive training in GI. Note: all design engineers and other individuals that review the

stormwater management design for development and redevelopment projects must complete the NJ approved stormwater management design review course (see *www.nj.gov/dep/stormwater/training.htm*) once every five years, preferably annually.
- Train your grounds people in maintenance of GI – make people aware and part of the project.
- Use volunteers to help maintain a successful, functioning, beautiful project. Does your town have a Green Team, Garden Club or Rotary that might be interested? What about a group of Scouts, or school environmental club?

There are a number of resources to help you implement GI projects in your town. Rutgers Cooperative Extension Water Resources Program, can aid a municipality in creating a Green Infrastructure Plan by creating an Impervious Cover Reduction Action Plan (RAP), This includes an Impervious Cover Assessment (ICA) as well as a conceptual plan to reduce stormwater runoff by developing GI plans at appropriate locations within the municipality. See Hammonton Impervious Cover Assessment and Reduction Action Plan: *http://water.rutgers.edu/Recent_Presentations/Obropta_ICA-Feasbility%20Study-Hammonton.pdf*

By incorporating GI requirements in Master Plans and Municipal Land Use Ordinances, developers will be required to implement GI into their construction plans. In addition, municipal engineers and site planners can recommend GI for major and minor development site plans.

To train municipal officials and public workers on GI, there are a number of online training resources available:
- Green Infrastructure Overview – *http://water.rutgers.edu/Green%20Infrastructure%20Overview%20vC4%20No%20Menu%20CD/story.html*
- Asking the Right Questions in Stormwater Review created by ANJEC and Rutgers to assist with MS4 permit compliance – *http://water.rutgers.edu/Projects/MunicipalOfficialTraining/E-Tool%20(FINAL)/story.html?usp=send_form*. Pursuant to the MS4 Part IV.B.5.f. 2018 permit, all municipalities with a Tier A MS4 permit must have all their municipal boards and governing body members who review and approve applications for development and redevelopment projects complete this interactive training tool within 6 months of commencement of their duties. Once per term of service thereafter, they must review at least one of the tools offered under the post construction stormwater management website. It is optional for Tier B municipalities.
- NJDEP's stormwater training page *(https://njstormwater.org/training.htm)* contains presentations, videos, and links to aid in the implementation of a stormwater management program and provides assistance in meeting permit requirements related to Municipal Separate Storm Sewer Systems (MS4s).
- The US Environmental Protection Agency (EPA) has a number of webcasts about GI that can be accessed at *www.epa.gov/green-infrastructure/green-infrastructure-webcast-series.*

Funding Your GI Projects and Planning Strategies

With the passage of the *Clean Water and Flood Reduction Act* in March 2019, municipalities, counties and certain authorities in NJ can opt to establish local stormwater utilities. Stormwater utilities, which already exist in more than 40 states, are meant to manage the rain and snow from storms. Fees proportional to the amount of impervious surfaces contributing to stormwater runoff such as roofs and parking lots would be assessed on businesses, residents and tax-exempt properties. The municipality in turn spends the collected revenue on improving stormwater infrastructure. More information will become available once a guidance document is available from the NJ DEP.

Here are some other Grant and Loan sources for GI projects:
- Sustainable Jersey – For municipalities that participate in Sustainable Jersey, small grants up to $30,000 can be obtained for green infrastructure projects.
- NJ American Water – Municipalities served by NJ American Water can apply for environmental grants up to $10,000 for a green infrastructure project
- NJDEP – A number of grant and loan programs are available through the NJDEP that can be used to fund green infrastructure projects, such as the Water Quality Restoration Grants for

Nonpoint Source Pollution – *www.nj.gov/dep/grantandloanprograms/* for all NJDEP grant/loan opportunities.

- The New Jersey Water Bank (formerly New Jersey Environmental Infrastructure Financing Program – NJEIFP) Low interest loans are available for qualifying projects – *www.nj.gov/dep/dwq/mface_njeifp.htm*
- NJ Urban Community ForestryStewardship Grant – *www.state.nj.us/dep/parksandforests/forest/community/grants-csip.html*
- EPA Green Infrastruture Funding sources can be found at – *www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities*
- Transportation Alternative Program (TAP) Grants – *www.fhwa.dot.gov/environment/transportation_alternatives/*
- Community Development Block Grant Program – *www.hud.gov/program_offices/comm_planning/communitydevelopment/programs.*

Examples of Municipal GI Projects

Pilesgrove Municipal Complex Rain Garden

A 1,650-square-foot rain garden was installed in 2015 at the Pilesgrove municipal building. The rain garden captures and infiltrates stormwater runoff from the municipal building's parking lot to prevent nonpoint source pollution. The project was installed in partnership with Pilesgrove Township, the Association of New Jersey Environmental Commissions (ANJEC), and the Rutgers Cooperative Extension Water Resources Program. Annual stormwater capture: an estimated 332,100 gallons.

Paterson Public School Cistern Installation

In 2015 a 2500 gallon cistern was installed at Paterson Public School #5. This project captures stormwater runoff from an approximately 1060-square-foot rooftop. Stakeholders in the project were Passaic Valley Sewerage Commission, Rutgers Cooperative Extension Water Resources Program, Paterson Public School #5, and National American Water Management. Funding was through the Passaic Valley Sewerage Commission. Annual capture is estimated at 13,000 gallons.

Cistern in Paterson

Mt Holly/Eastampton – Naturalized Detention Basins

Four detention basins were converted from turf grass to meadows using a native grass and wildflower seed mixture to cover a total of 2.50 acres in 2015 as part of an NJ American Water Environmental Grant. The project was installed in partnership with the Mt Holly Township, Eastampton Township, corresponding Environmental Committees/ Commissions, Burlington County Parks, and Rutgers Cooperative Extension. The two larger basins in Eastampton (2.0 acres total) drain from a 100-acre development of which 47 acres are impervious. One of these basins is pictured below.

Detention basin in Easthampton

Alternative Project for Rain Garden / Porous Paving

Garrison Memorial Park, Woodstown NJ – Rain Garden / Porous Paving

Two rain gardens, a 1,250-square-foot plot in the back of the property and a 1,075-square-foot rain garden (adjacent to the parking lot) were installed between 2016 and 2017 at the Garrison Veteran Memorial Park to deal with stormwater runoff and flooding issues. In 2017, a 1,425-square-foot porous paving parking area within the parking lot was also constructed. The two rain gardens and porous paving help to infiltrate stormwater runoff from the parking lot to prevent nonpoint source pollution into the Salem River. The project was installed in partnership with Woodstown Township, the Woodstown-Pilesgrove Joint Environmental Commissions, the Association of New Jersey Environmental Commissions (ANJEC), and the Rutgers Cooperative Extension Water Resources Program. Annual stormwater capture: an estimated 181,000 gallons.

Garrison Park

Porous paving
Courtesy of Rutgers

Additional Resources

Georgetown Climate Center Green Infrastructure Tool Kit
www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/green-infrastructure-strategies-and-techniques.html

NJ Green Infrastructure Municipal Tool Kit
https://gitoolkit.njfuture.org/

NJ Developers' Green Infrastructure Guide *https://developersguide.njfuture.org/what-is-green-infrastructure/*

Rutgers Green Infrastructure Guidance Manual:
http://water.rutgers.edu/Green_Infrastructure_Guidance_Manual/2015-03-31_Manual.compressed.pdf

NJ DEP - Green Infrastructure in NJ
www.nj.gov/dep/gi/

Hoboken Green Infrastructure Strategic Plan
https://togethernorthjersey.com/?grid-portfolio=hoboken-green-infrastructure-strategic-plan

Passaic Stormwater Management Guidance Document
www.passaiccountynj.org/Appendix_A1_3-11-19.pdf

NJ Futures Green Infrastructure Resources:
www.njfuture.org/issues/environment-and-agriculture/water-sewer/green-infrastructure/resources/

Green Infrastructure Opportunities that Arise During Municipal Operations *www.epa.gov/sites/production/files/2015-09/documents/green_infrastructure_roadshow.pdf*

The 2019 Watershed Green Infrastructure Symposium
https://thewatershed.org/wrap-up-of-stormwater-utilities-symposiumreen-infrastructure-and-stormwater-utilities-symposium/

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ANJEC is a statewide nonprofit organization that informs and assists environmental commissioners and interested citizens in preserving and protecting New Jersey's environment.

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