Green Infrastructure Champions Program

This program is partially funded by the Rutgers New Jersey Agricultural Experiment Station, The Geraldine R. Dodge Foundation, NJ Sea Grant Consortium, The William Penn Foundation and is a collaboration of the Rutgers Cooperative Extension Water Resources Program and the Green Infrastructure Subcommittee of Jersey Water Works.

Please enter your full name and affiliation in the chat. This is how we will take attendance.
Green Infrastructure Champion Training: Part 1
“How to identify green infrastructure projects in your town”

January 15, 2021
Virtual Workshop
Welcome and Introduction

Christopher C. Obropta, Ph.D., P.E.
Phone: 908-229-0210
Email: obropta@envsci.rutgers.edu

www.water.rutgers.edu
Rutgers Cooperative Extension helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.
Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.
Environmental County Agents

The Environmental County Agents teach people new skills and information so they can make better informed decisions and improvements to their businesses and personal lives.

- Michele Bakacs, Middlesex and Union
- Pat Rector, Morris and Somerset, RETIRED
- Amy Rowe, Essex and Passaic
- Mike Haberland, Camden and Burlington
- Sal Mangiafico, Salem and Cumberland
- Steve Yergeau, Ocean and Atlantic
Green Infrastructure Champion

Green Infrastructure Champions are key players in implementing green infrastructure as a stormwater management approach in their community.
Rutgers inputs to the Green Infrastructure Champion Program

• Training classes on various aspects of green infrastructure planning and implementation
• Professional staff to provide technical support to develop a design for a green infrastructure demonstration project
• Networking opportunities with other Green Infrastructure Champions for mutual support
• Assistance with grant writing and submission
Short-term Results/Impacts
GI Champions will:

• Increase their knowledge and awareness about green infrastructure practices, planning, and implementation

• Gain a skill set to allow them to engage community leaders, schools, and non-governmental organizations (NGOs) and advocate for green infrastructure as a stormwater management solution

• Identify funding opportunities and secure funding for green infrastructure
Long-term Results/Impacts

• Green infrastructure practices are installed throughout the community
• Green infrastructure becomes a standard in the community for addressing stormwater problems
• Localized flooding is reduced
• Water quality improves
• Community become more resilient to extreme weather events
STORMWATER BASICS
Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.
The Natural Hydrologic Cycle
The Impact of Development on Stormwater Runoff

More development $\rightarrow$ More impervious surfaces $\rightarrow$ More stormwater runoff
The Urban Hydrologic Cycle
EXAMPLES OF NPS

- Oil and grease from cars
- Fertilizers
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment
History of Stormwater Management
1st Attempt at Stormwater Management

Capture all runoff, pipe it, and send it directly to the river . . . prior to mid 1970’s
2nd Iteration of Stormwater Management

Capture runoff, detain it, release it slowly to the river…mid 1970’s to 2004

- Detain peak flow during large storm events for 18 hours (residential) or 36 hours (commercial)
- Reduce downstream flooding during major storms
- Use concrete low flow channels to minimize erosion, reduce standing water, quickly discharge low flows
- Does not manage runoff from smaller storms allowing stormwater to pass through the system
- Directly discharges stormwater runoff to nearby stream, waterway, or municipal storm sewer system (at a controlled/managed rate)
3rd Generation of Stormwater Management

- Reduce stormwater runoff volume
- Reduce peak flows and flooding
  ...and...
- Maintain infiltration and groundwater recharge
- Reduce pollution discharged to local waterways

abc Action News, August 27, 2012
4th Generation of Stormwater Management (Starting March 2, 2021)

• All major development must use green infrastructure to comply with the New Jersey Stormwater Regulations
Green Infrastructure

...an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly.

Green Infrastructure projects:
- capture,
- filter,
- absorb, and
- reuse

stormwater to maintain or mimic natural systems and treat runoff as a resource.
Green Infrastructure

Stormwater management practices that protect, restore, and mimic the native hydrologic condition by providing the following functions:

- Infiltration
- Filtration
- Storage
- Evaporation
- Transpiration
Green Infrastructure Practices

Bioretention Systems
- Rain Gardens
- Bioswales
- Stormwater Planters
- Curb Extensions
- Tree Filter Boxes

Permeable Pavements

Rainwater Harvesting
- Rain barrels
- Cisterns

Dry Wells

Rooftop Systems
- Green Roofs
- Blue Roofs
TYPES OF BIORETTENTION

Bioretention Cells
- Single-family lots
- Commercial areas
- Parking lots

Rain Gardens
- Single-family lots
- Small commercial areas

Bioretention Swales/
Bioswales/Vegetated
Swales
- Typically in right-of-way

Planters & Planter Boxes
- Highly urban areas
- Right-of-way and adjacent to buildings

Vegetated Curb Extensions
- Bioretention incorporated into right-of-way in urban and suburban areas
Rain Gardens

NATIVE PLANTS
A rain garden is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.

BERM
The berm is constructed as a barrier to control, slow down, and contain stormwater.

PONDING AREA
The ponding area is the lowest, deepest visible area of the garden. When designed correctly, this area should drain within 24 hours.

INLET
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

DRAINAGE AREA
This is the area of impervious surface that drains stormwater runoff to the rain garden.

CURB CUT
This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.
Rain Garden Cross-Section
Lots of Rain Gardens
Bioswale

NATIVE PLANTS
A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.

CONVEYANCE
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

SLOPE
The slope is designed at a maximum of 3:1. These slopes often require erosion control materials for stabilization.

INFLOW
This is the area where stormwater enters.
Stormwater Planters

**Native Plants**
A stormwater planter is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.

**Curb Cut**
This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.

**Concrete Wall**
Concrete walls are installed to match the existing curb. These walls create the frame for the stormwater planter and continue to function as a curb.

**Inlet**
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

**Subgrade**
Stormwater planter systems are unique because of their subgrade structure. This structure is layered with bioretention media, choker course, compact aggregate, and soil separation fabric.
Stormwater Planter Cross-section
Permeable Pavement

POROUS ASPHALT
It is common to design porous asphalt in the parking stalls of a parking lot. This saves money and reduces wear.

DRAINAGE AREA
The drainage area of the porous asphalt system is the conventional asphalt cartway and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.

UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.

ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

SUBGRADE
Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.
Permeable Pavements

• Underlying stone reservoir
• Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
• Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
• Permeable pavers systems are concrete pavers with infiltration between the spaces of the pavers
• Ideal application for porous pavement is to treat a low traffic or overflow parking area
ADVANTAGES

• Manage stormwater runoff
• Minimize site disturbance
• Promote groundwater recharge
• Low life cycle costs, alternative to costly traditional stormwater management methods
• Mitigation of urban heat island effect
• Contaminant removal as water moves through layers of system

COMPONENTS

Design Guidelines for Porous Asphalt with Subsurface Infiltration
Porous Asphalt
Pervious Concrete
Permeable Pavers
Grass Pavers
Rainwater Harvesting Systems

DRAINAGE AREA
This is the area of impervious surface that is captured in the rainwater harvesting system. In this case, it is a structure rooftop.

FIRST FLUSH DIVERTER
This mechanism is installed to by-pass the first several gallons of runoff which tend to be the dirtiest water before it enters the tank.

GUTTER
This captures runoff from the rooftop and carries it to the rainwater harvesting system.

CISTERN TANK
This tank is designed in different sizes to accommodate the runoff from a designated drainage area.

SPIGOT
A spigot is installed near the base of the cistern tank to allow water to be removed for use without an electronic pump system.

OVERFLOW
This mechanism is designed to act as a discharge for the water when the cistern is full or when it is winterized.

SEDIMENT
Sediment and other pollutants that enter the tank will settle to the bottom.
Rain Barrels
Cisterns
Dry Wells
Infiltration Trench
Rooftop Practices – Green Roof
Rooftop Practices – Blue Roof
Stormwater Wetlands
Identifying Sites for Green Infrastructure
It is all about controlling runoff from impervious surfaces.
Connected or Disconnected?
Simple Disconnection
Downspout Disconnection

Downspout Connected to Sewer System

Downspout Disconnected from Sewer System
Another Example of Simple Disconnection

For 1.25 inch storm, 3,811 cubic feet of runoff = 28,500 gallons

Total drainage area = 3 acres

1 acre directly connected impervious cover

2 acres pervious cover

Stormwater Inlet
For 1.25 inch storm, 581 cubic feet of runoff = 4,360 gallons

Total drainage area = 3 acres

1 acre directly connected impervious cover

2 acres pervious cover

Runoff Direction

Stormwater Inlet
<table>
<thead>
<tr>
<th>Design Storm</th>
<th>Connected (gallons)</th>
<th>Disconnected (gallons)</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25 inches</td>
<td>28,500</td>
<td>4,360</td>
<td>85%</td>
</tr>
</tbody>
</table>
Disconnect with a rain garden

PLACE A RAIN GARDEN BETWEEN TWO IMPERVIOUS SURFACES

REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS
Disconnect to a Rain Barrel or Cistern

Disconnect your downspout by installing a rain barrel

Impervious area is now "**disconnected**" from flowing directly into the storm sewer system

REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS
SITE SELECTION
What are good sites?

• Sites with impervious surfaces that are directly connected
• Sites with a lawn area that can be converted to accept stormwater runoff
• Sites with highly visibility – good educational opportunities
• Sites in impaired watersheds
• Sites on municipal owned land/public land
• Sites that provide partnership opportunities
WE LOOK HERE FIRST:

✓ Schools
✓ Places of Worship
✓ Libraries
✓ Municipal Building
✓ Public Works
✓ Firehouses
✓ Post Offices
✓ Elks or Moose Lodge
✓ Parks/Recreational Fields

• 20 to 40 sites are entered into a PowerPoint
• Site visits are conducted
Google or Bing Maps

- Go to Google or Bing Maps
- Type in address
- Aerial or birds eye view
- “Snip It” (MS Windows Accessory)
- Insert into Powerpoint
- “Crop It”
Auten Road School in Hillsborough, NJ
281 Auten Rd, Hillsborough Township, NJ 08844
Pittsgrove Baptist Church

Subwatershed: Salem River
Site Area: 696,419 sq. ft.
Address: 368 Daretown Road
Elmer, NJ 08318
Block and Lot: Block 59, Lot 14, 17

Rain gardens can be installed in the turfgrass area at the front of the church and behind the church. The gardens would capture, treat, and infiltrate runoff from the roof of the building and the parking area. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

<table>
<thead>
<tr>
<th>Impervious Cover</th>
<th>Existing Loads from Impervious Cover (lbs/yr)</th>
<th>Runoff Volume from Impervious Cover (Mgal)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TP</td>
<td>TN</td>
</tr>
<tr>
<td>%</td>
<td>sq. ft.</td>
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</tr>
<tr>
<td>5</td>
<td>34,224</td>
<td>1.6</td>
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</table>

Recommended Green Infrastructure Practices

<table>
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<tr>
<th>Bioretention systems</th>
<th>Recharge Potential (Mgal/yr)</th>
<th>TSS Removal Potential (lbs/yr)</th>
<th>Maximum Volume Reduction Potential (gal/storm)</th>
<th>Peak Discharge Reduction Potential (cu. ft./second)</th>
<th>Estimated Size (sq. ft.)</th>
<th>Estimated Cost</th>
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</thead>
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<tr>
<td></td>
<td>0.107</td>
<td>18</td>
<td>7,840</td>
<td>0.29</td>
<td>1,050</td>
<td>$5,250</td>
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</table>
CURRENT CONDITION
CONCEPT DESIGN
Site Visits
What are we looking for during our site visit?

1. What are sources of stormwater and where does it flow?
2. What is the direction and relative slope of site?
3. Where are impervious surfaces on the site?
4. What is the condition of the paved areas?
5. Are impervious surfaces directly connected?
6. Are there opportunities to disconnect?
7. Are there stormwater catch basins?
What are we looking for during our site visit (cont’d)?

9. Is there evidence of ponding water on site?  
10. Where are the utilities on the site?  
11. Are there pedestrian safety issues?
Other Questions

• Do the soils infiltrate?
• Who own the property? Will they be open to installing stormwater management measures?
• Are there potential partners to help with the project?
• Do we need permits for altering this site with stormwater best management practices?
• Does the building have a basement?
• Can we lose parking spaces?
• Who will maintain the green infrastructure practices?
• Is the project a high priority?
THINGS YOU SHOULD BRING ON A SITE VISIT

Aerial photo
Pencil
Tape measure and/or measuring wheel
Camera
GI CHECKLIST – GI Manual
Next Class

✓ How to identify green infrastructure projects in your town

2. Moving from planning to implementation of green infrastructure – Jan. 29th

3. Maintaining green infrastructure practices/projects – Feb. 12th

4. Stormwater management regulations, policies, and ordinances – Feb. 26th
Resources for You!
Our green infrastructure initiative in urban centers focuses on capturing stormwater with cost-effective practices before it enters the combined sewer systems.

ABOUT US

Rutgers Cooperative Extension
Water Resources Program

G.H. Cook Campus
14 College Farm Road
New Brunswick, NJ 08901

www.water.rutgers.edu

~Creating Solutions for Water Resources Issues in New Jersey~

Our mission is to identify and address community water resources issues using sustainable and practical science-based solutions.
Projects & Programs

Agricultural Watershed Planning & Implementation

- Watershed Restoration & Protection Plan for Assiscunk Creek, Burlington County, NJ
- Assiscunk Creek Watershed Agricultural Mini-Grant Program
- Biofilter Wetland at Harrow Run, Water Quality Evaluation of Pollutant Removal Efficiency from a Tailwater Recovery System
- Watershed Restoration Plan for the Upper Cohanse River Watershed
- Upper Cohanse River Watershed Agricultural Mini-Grant Program
- Watershed Restoration Plan for the Upper Salem River Watershed
- Upper Salem River Watershed Agricultural Mini-Grant Program

Green Infrastructure Program

- Camden Green Infrastructure Initiative
- Fixing Flooding: One Community at a Time
- Innovative Solutions using Green Infrastructure Conference
- Green Infrastructure Education and Implementation Program
- Green Infrastructure Guidance Manual for New Jersey
- Green Infrastructure Solutions for New Jersey Conference
Keep the Rain from the Drain ~ Impervious Cover Reduction Program

- Impervious Cover Assessments and Impervious Cover Reduction Action Plans for Coastal Communities
- National Fish and Wildlife Foundation ~ Incorporating Green Infrastructure Resiliency in the Raritan River Basin
- Impervious Cover Assessments, Impervious Cover Reduction Action Plans, and Green Infrastructure Reduction Action Plans for New Jersey Future’s Mainstreaming Green Infrastructure Program
- Salem County and Cumberland County, NJ ~ Impervious Cover Assessments and Impervious Cover Reduction Action Plans
- William Penn Foundation - Technical Support Program for Municipalities and Watershed Partners
### Hunterdon County

<table>
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<tr>
<th>Township</th>
<th>ICA</th>
<th>RAP</th>
<th>RAP Web Map</th>
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<tr>
<td>Delaware Twp</td>
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<td>Franklin Twp</td>
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<td>East Amwell Twp</td>
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<td>Raritan Twp</td>
<td>ICA</td>
<td>RAP</td>
<td>RAP Web Map</td>
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<tr>
<td>Flemington Boro</td>
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<td>RAP</td>
<td>RAP Web Map</td>
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<tr>
<td>Readington Twp</td>
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### Middlesex County

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<td>RAP</td>
<td>RAP Web Map</td>
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<tr>
<td>North Brunswick Twp</td>
<td>ICA</td>
<td>RAP</td>
<td>RAP Web Map</td>
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### New Jersey Highlands Watershed Cluster

<table>
<thead>
<tr>
<th>Township</th>
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<th>RAP Web Map</th>
<th>Feasibility Study</th>
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<tr>
<td>Alpha</td>
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<td>Feasibility Study</td>
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<td>Branchville</td>
<td>ICA</td>
<td>RAP</td>
<td>RAP Web Map</td>
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<td>Mount Arlington</td>
<td>ICA</td>
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<td>Greenwich</td>
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<td>Mount Olive</td>
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E-learning Tools

- *Inventory and Assessment of Your Stormwater Infrastructure* (January, 2017)


- *Ideas and Resources for Implementing Green Infrastructure in Your Community - Planning documents, programs, and ordinances* (May, 2016)

- *Impervious Cover Assessment (ICA) and Impervious Cover Reduction Action Plan: The Answer to All Your Problems* (December, 2015)


- *Understanding Your Impervious Cover Assessment (ICA) Report* (March, 2015)
E-learning Tools

- *Inventory and Assessment of Your Stormwater Infrastructure* (January, 2017)


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- *Understanding Your Impervious Cover Assessment (ICA) Report* (March, 2015)
New Development: Adequate Regulations Exist

Inadequate Enforcement

Why Are We Here?

Approval for a developer's stormwater management plan lies solely with the municipality.
Staff to Contact

Sara Mellor, Program Associate, graduated in May 2010 from Rutgers, The State University of New Jersey, with a B.S. in Environmental Policy, Institutions, and Behaviors. Sara interned with the Water Resources Program from May 2009 to May 2010 and has worked part time as a Program Coordinator with the Water Resources Program from May 2010 to May 2011. During the internship and tenure as a Program Coordinator, Sara has participated in water quality sampling, flow monitoring, and stream visual assessments for watershed restoration and protection plans, assisted in the coordination, construction, and maintenance of rain gardens, helped develop and run rain barrel workshops, organized the "One Barrel at a Time Co-op," created flyers, press releases, and other forms of promotional materials for the program, supported Water Resources Program staff in community educational outreach projects, supervised project volunteers, researched ways to inform the public about the importance of conserving water, and contributed to the development of evaluation tools to measure programmatic impact. As a Program Associate with the Rutgers Cooperative Extension Water Resources Program, Sara will be coordinating and presenting rain barrel workshops throughout New Jersey, designing, constructing, and coordinating the installation of rain gardens and natural landscaped systems throughout New Jersey, and participating in community and youth outreach projects pertaining to water resources.

Room 105, 848-932 6747, saramellor@envsci.rutgers.edu
QUESTIONS?
Green Infrastructure Champions Program

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