Green Infrastructure Champions Program

This program is partially funded by the Rutgers New Jersey Agricultural Experiment Station, The Geraldine R. Dodge Foundation, and NJ Sea Grant Consortium and is a collaboration of the Rutgers Cooperative Extension Water Resources Program, the Green Infrastructure Subcommittee of Jersey Water Works, and Duke Farms.
Green Infrastructure Champion Training: Part 5

“Green Infrastructure Planning and Implementation for Sustainable Jersey Points”

March 13, 2020
Duke Farms
Hillsborough, NJ

water.rutgers.edu
Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) 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 community water resources issues using sustainable and practical science-based solutions.
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.
Sustainable Jersey is a nonprofit organization that provides tools, training and financial incentives to support communities as they pursue sustainability programs.

http://www.sustainablejersey.com/
March 2020 Sustainability Hero: David Kois, Hillsborough Township

Monthly recognition program for heroes in the Sustainable Jersey program

About Sustainable Jersey

Sustainable Jersey is a nonprofit organization that provides tools, training and financial incentives to help New Jersey communities become more sustainable.

Participating Communities

View the map of Sustainable Jersey communities. Search the completed actions database and sort by county, actions and certification status.

Upcoming Events

- 2020 New Jersey Sustainability Summit Bell Works
  JUN 12, 2020 - 08:00 AM TO 04:15 PM

- 14th Annual Mercer County Sustainability Day ICC Futureworks
  JUN 17, 2020 - 08:00 AM TO 04:15 PM
<table>
<thead>
<tr>
<th>Sustainable Jersey Action Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Arts &amp; Creative Culture</td>
</tr>
<tr>
<td>• Brownfields</td>
</tr>
<tr>
<td>• Community Partnership &amp; Outreach</td>
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<tr>
<td>• Diversity &amp; Equity</td>
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<tr>
<td>• Emergency Management &amp; Resiliency</td>
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<td>• Energy</td>
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<td>• Green Design</td>
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<td>• Health &amp; Wellness</td>
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<tr>
<td>• Innovation Projects</td>
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<tr>
<td>• <strong>Land Use &amp; Transportation</strong></td>
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<tr>
<td>• Local Economies</td>
</tr>
<tr>
<td>• Natural Resources</td>
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<tr>
<td>• Operations &amp; Maintenance</td>
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<tr>
<td>• Public Information &amp; Engagement</td>
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<tr>
<td>• Sustainability &amp; Climate Planning</td>
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<td>• Waste Management</td>
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</table>
Land Use & Transportation Action Item

- **Sustainable Land Use Pledge** (10 Points)
- **Build-Out Analysis** (10 Points)
- **Bicycle and Pedestrian Audits** (5 Points)
- **Bicycle and or Pedestrian Plan** (10 Points)
- **Adopt a Complete Streets Policy** (10 Points)
- **Institute Complete Streets** (10 Points)
- **Effective Parking Management** (10 Points)
- **Green Infrastructure Planning** (5 Points)
- **Green Infrastructure Implementation** (10 Points)
- **Enhanced Stormwater Management Control Ordinance** (10 Points)
- **Green Building and Environmental Sustainability Element** (10 Points)
- **Historic Preservation Element** (10 Points)
- **Smart Workplaces** (5 Points)
- **Transit-Oriented Development Supportive Zoning** (20 Points)
Green Infrastructure Planning

5 Points 10 Points 20 Points

New Action February 2018

Green Infrastructure Implementation

10 Points 15 Points 20 Points

New Action February 2018

See Handouts
What is a green infrastructure plan (and why do we need one)?
The Natural Hydrologic Cycle
More development + impervious surfaces =

More impervious surfaces → More stormwater runoff
The Urban Hydrologic Cycle
+ green infrastructure =

- Green Roofs
- Rainwater Harvesting
- Tree Filter/Planter Boxes
- Rain Gardens/Bioretention Systems
- Permeable Pavements
- Vegetated Swales or Bioswales
- Natural Retention Basins
- Green Streets
The Natural Hydrologic Cycle
Water Quantity Impacts of Urbanization

- Disruption of natural water balance
  - Less infiltration
  - More runoff
  - Less evapotranspiration (maybe)

- Increased flood peaks
  - Flashy streams
  - More frequent flooding
  - Increased bankfull flows (more erosion and downcutting)

- Lower dry weather flows
Water Quality Impacts of Urbanization (increased nonpoint source pollution)

- Oil and grease from cars
- Fertilizers
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment
Sustainable Jersey

Green Infrastructure Planning Action

1. Impervious Cover Assessment (ICA) (5 points)

2. Green Infrastructure Action Plan (a.k.a. Impervious Cover Reduction Action Plan or RAP) (5 points)

3. Green Infrastructure Strategic Plan (a.k.a. Green Infrastructure Feasibility Study) (10 points)
Impervious Cover Assessment (ICA)
Impervious Cover Assessment

- Analysis completed by watershed and by municipality
- Use 2015 Land Use data to determine impervious cover
- Calculate runoff volumes for water quality, 2, 10 and 100 year design storm and annual rainfall
- Contain three concept designs
## Information from GIS

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<th>Acres</th>
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<th>LABEL15</th>
<th>TYPE15</th>
<th>IS15</th>
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<td>Watershed</td>
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<td>Impervious Cover (ac)</td>
<td>%</td>
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<td>-----------------</td>
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<tr>
<td>Alquatka Branch</td>
<td>1,026.8</td>
<td>14.3</td>
<td>1.4%</td>
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<tr>
<td>Barton Run</td>
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<td>9.3%</td>
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<tr>
<td>Cooper River</td>
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<tr>
<td>Kettle Run</td>
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<td>99.5</td>
<td>6.9%</td>
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<tr>
<td>Lake Pine</td>
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<td>180.9</td>
<td>6.4%</td>
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<td>4.5%</td>
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<tr>
<td>Pennsauken Creek</td>
<td>2,951.5</td>
<td>1,025.8</td>
<td>35.1%</td>
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<td>Rancocas Creek</td>
<td>4,116.9</td>
<td>846.9</td>
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<td>Total</td>
<td>18,929.1</td>
<td>2,884.3</td>
<td>15.5%</td>
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</table>
Calculate stormwater runoff volumes from impervious surfaces

\[ \text{IC (ac)} \times 43,560 \text{ ft}^2/\text{ac} \times \text{rainfall (ft)} \times 7.48 \text{ gal/ft}^3 = \text{gallons of runoff} \]

Divide by 1,000,000 to get millions of gallons (Mgal)

Note: Calculation is only for stormwater runoff volume from impervious surfaces. During heavy rainfall events, the soil becomes saturated and the entire municipality acts like an impervious surface.
<table>
<thead>
<tr>
<th>Subwatershed</th>
<th>NJ Water Quality Storm (MGal)</th>
<th>Annual Rainfall of 44&quot; (MGal)</th>
<th>2-Year Design Storm (3.3&quot;) (MGal)</th>
<th>10-Year Design Storm (5.0&quot;) (MGal)</th>
<th>100-Year Design Storm (8.2&quot;) (MGal)</th>
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<td>Alquatka Branch</td>
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<td>2.0</td>
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<td>Barton Run</td>
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<td>49.0</td>
<td>72.8</td>
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<td>Cooper River</td>
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<td>9.5</td>
<td>14.0</td>
<td>22.4</td>
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<td>Lake Pine</td>
<td>6.1</td>
<td>216.1</td>
<td>17.2</td>
<td>25.5</td>
<td>40.8</td>
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<tr>
<td>Mullica River</td>
<td>0.6</td>
<td>20.1</td>
<td>1.6</td>
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<tr>
<td>Pennsauken Creek</td>
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<td>1,225.5</td>
<td>97.5</td>
<td>144.8</td>
<td>231.2</td>
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<td>Rancocas Creek</td>
<td>28.7</td>
<td>1,011.8</td>
<td>80.5</td>
<td>119.6</td>
<td>190.9</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>97.9</strong></td>
<td><strong>3,445.9</strong></td>
<td><strong>274.1</strong></td>
<td><strong>407.2</strong></td>
<td><strong>650.0</strong></td>
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</table>
Green Infrastructure Action Plan
(a.k.a. Impervious Cover Reduction Action Plan or RAP)
**Green Infrastructure Action Plan**

ICA (Tier1) + the following:

1. Community engagement
2. Potential green infrastructure sites
3. Site level analysis including concept plans, information sheets, and project costs
4. Investment/funding strategy for green infrastructure projects
5. Short-term 5-year goal
1. Community Engagement
2. Identify Potential Green Infrastructure Site

• Sites with impervious surfaces that are directly connected
• Sites with a lawn area that can be converts 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
✓ Houses 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
Let’s get started! Download aerial photograph of “Look Here First Sites”?

- Go to Google or Bing Maps
- Type in address
- Aerial or birds eye view
- “Snip It”
- Insert into Powerpoint
- “Crop It”

- Schools
- House of Worship
- Libraries
- Municipal Building
- Public Works
- Firehouses
- Post Offices
- Elks or Moose Lodge
- Parks/ Rec Fields
Marlton Elementary School

190 Tomlinson Mill Rd,
Evesham Township, NJ 08053
Marlton Elementary School
190 Tomlinson Mill Rd,
Evesham Township, NJ 08053

P.P. = Porous Pavement
RG. = Rain Garden

P.P. Look at contours for parking lots to see flow of run off

Disconnect downsputs to go into Rain Garden

2 inlets for overflow of Rain Garden

Curb cut to allow flow to go into Rain Garden

inlet for overflow
Marlton Elementary School
190 Tomlinson Mill Rd, Evesham Township, NJ 08053

1) Porous pavement?
2) Rain Gardens
3) Red arrow (Water Flow)
Rain Garden: disconnect downspouts and install rain garden
Green Infrastructure Manual:
http://water.rutgers.edu/GreenInfrastructureGuidanceManual.html
Green Infrastructure Brochure:
Green Infrastructure CHECKLIST:
http://water.rutgers.edu/GreenInfrastructureGuidanceManual.html
Also found on pages 132-135 in the Manual

<table>
<thead>
<tr>
<th>GENERAL INFORMATION</th>
<th>Site ID:</th>
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<tbody>
<tr>
<td>Name (person(s)) completing assessment:</td>
<td>Date:</td>
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<tr>
<td>Location Address and Cross Streets:</td>
<td>Neighborhood:</td>
</tr>
<tr>
<td>Name of Nearest Waterway:</td>
<td>Property Owner / Tax Parcel ID/Street Segment:</td>
</tr>
<tr>
<td>Contact Information:</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SITE DESCRIPTION</th>
<th></th>
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<tbody>
<tr>
<td>Description of site and relative visibility to the public (public or private property, lot size, current use, streetscape, etc.):</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>OBSERVATIONS</th>
<th>NOTES/REMARKS</th>
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</thead>
<tbody>
<tr>
<td>1) What is the source of stormwater runoff and where does it flow (on map or aerial photo indicate water flow direction and existing storm drains)? Is there a noticeable source or deposit of sediment?</td>
<td></td>
</tr>
<tr>
<td>2) What is the direction and relative slope of the site and/or street? (indicate on map or aerial photo)</td>
<td></td>
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<tr>
<td>3) Where on the site are impervious areas and estimate area in square feet (i.e. rooftops, parking lots, sidewalks)? For streetscapes, what is the building setback and/or sidewalk width?</td>
<td></td>
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<tr>
<td>4) Do paved areas appear to be in poor condition (cracks, settling, vegetation growth, etc.) or do they appear newly paved or reconstructed?</td>
<td></td>
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<tr>
<td>5) Does stormwater runoff from impervious areas flow directly to the sewer system (such as roof runoff directed into a storm drain)?</td>
<td></td>
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<tr>
<td>6) Are there opportunities to redirect and disconnect runoff (downspouts, grassed areas, tree pits, curb extensions)?</td>
<td></td>
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<tr>
<td>7) How many stormwater catch basins are visible? Note location on maps and general condition, i.e., clogged, functioning, shallow (&lt; 3 ft), or deep (&gt; 3 ft)?</td>
<td></td>
</tr>
<tr>
<td>8) Is there evidence of ponding water at the site or flooded streets or intersections? (Indicate reasons; i.e., due to clogged drains, high water table, etc.)</td>
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<tr>
<td>9) Are there mature trees/vegetation at the site? What types of plants would be appropriate at the site (sun or shade tolerant, height or site line restrictions)?</td>
<td></td>
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<tr>
<td>10) Where are utilities on the site or in the right of way that could conflict with construction (sewer pipes, utility poles, water, gas, etc.)?</td>
<td></td>
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<tr>
<td>11) Does pedestrian safety need to be addressed? Will parking or bus stops be impacted by construction?</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>RAIN GARDENS</th>
<th>YES</th>
<th>NO</th>
<th>COMMENTS</th>
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<tr>
<td>1) Are there visible, exterior downspouts on any buildings?</td>
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<tr>
<td>2) Are there unpaved areas suitable for landscaping?</td>
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<tr>
<td>3) Is the site subject to ponding or flooding?</td>
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<tr>
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<tr>
<td>1) Are there nearby buildings with visible exterior downspouts?</td>
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<td></td>
<td></td>
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<tr>
<td>2) Is there a community garden nearby or other use for collected rainwater?</td>
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<table>
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<th>TREE PITS, TRENCHES, AND STREETSCAPE STRATEGIES</th>
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<tr>
<td>1) Does stormwater flow across sidewalks or along the curb?</td>
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<tr>
<td>2) Are there existing tree, landscaping or tree pits near the street?</td>
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<td>1) Are there large areas of pavement on the site and are any paved areas not heavily used (i.e. fire lane, overflow)?</td>
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<td></td>
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<tr>
<td>2) Are existing impervious areas in poor condition and in need of replacement?</td>
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<th>CURB EXTENSIONS AND STORMWATER PLANTERS</th>
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<tr>
<td>1) Is this a heavily used pedestrian crossing? Are there pedestrian crosswalks that would be safer if shortened?</td>
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<td>2) Is the intersection or street at a location where stormwater can be collected before it enters a storm drain?</td>
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<table>
<thead>
<tr>
<th>OTHER STRATEGIES</th>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
3. Site level analysis including concept plans, information sheets, and costs
Evesham Township
Impervious Cover Assessment
Kettle Run Fire Rescue, 498 Hopewell Road

**PROJECT LOCATION:**

**SITE PLAN:**

1. **BIORETENTION SYSTEM:** A rain garden can be used to capture, treat, and infiltrate runoff from the roof of the building. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating wildlife habitat while managing stormwater.

2. **RAINWATER HARVESTING SYSTEM:** A cistern can capture stormwater that drains from the building's rooftop. Connecting the downspouts to the cistern will allow the stormwater to be harvested and used for cleaning fire trucks.
Evesham Township
Impervious Cover Assessment
Barton Run Swim Club, 100 Lakeside Drive

PROJECT LOCATION:

SITE PLAN:

1. BIORETENTION SYSTEM: On this property rain gardens can be used to reduce sediment and nutrient loading on local waterways by retrofitting the parking islands. The rain gardens will capture, treat, and infiltrate runoff from the parking lot.

2. POROUS PAVEMENT: Parking spaces close to the pool house can be converted to porous asphalt. Porous pavement promotes groundwater recharge and filters stormwater.

1. BIORETENTION SYSTEM

2. POROUS PAVEMENT
Evesham Township
Impervious Cover Assessment
Marlton Elementary School, 190 Tomlinson Mill Road

PROJECT LOCATION:

SITE PLAN:

1. BIORETENTION SYSTEM: On this property rain gardens can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. There are opportunities to install rain gardens near entrances to the school.

2. POROUS PAVEMENT: Porous pavement promotes groundwater recharge and filters stormwater. The parking spots close to the school can be retrofitted with porous pavement.

1 BIORETENTION SYSTEM

2 POROUS PAVEMENT
### Marlton Elementary School
#### Green Infrastructure Information Sheet

| Location: | 190 Tomlinson Mill Road  
|           | Evesham Township, NJ 08053 |
| Municipality: | Evesham Township |
| Subwatershed: | Barton Run |

#### Green Infrastructure Description:
bioretention system (rain garden)  
porous pavement

#### Targeted Pollutants:
total nitrogen (TN), total phosphorus (TP),  
total suspended solids (TSS) in surface runoff

#### Mitigation Opportunities:
recharge potential: yes  
stormwater peak reduction potential: yes  
total suspended solids removal potential: yes

#### Stormwater Captured and Treated Per Year:
bioretention system #1: 234,446 gal.  
bioretention system #2: 35,331 gal.  
bioretention system #3: 117,562 gal.  
bioretention system #4: 128,192 gal.  
porous pavement #1: 517,980 gal.  
porous pavement #2: 133,362 gal.

#### Existing Conditions and Issues:
Marlton Elementary School is surrounded by impervious surface such as asphalt and concrete. The downspouts on the building are connected directly to the sewer system. Bringing runoff from the roof and parking lots directly into the sewer systems leads to sediment and other solids being dumped into local waterways as nonpoint source pollution. High volumes of rain in the sewer system also contributes to flooding.

#### Proposed Solution(s):
Two areas of porous pavement have been proposed within the school parking lot near the catch basins so that the runoff can infiltrate into the ground, instead of going directly to local waterways via the catch basins. The porous pavement would be in parking spaces to avoid the strain of vehicular traffic.

Four potential rain garden sites were identified. The first garden could be located inside the lawn area at the school entrance. The downspouts from the three sides of the building surrounding the rain garden can be redirected so that the rainfall from the roof can be captured, treated, and filtered by the rain garden instead of flowing into the sewer system. The second rain garden can also treat runoff from the roof. The third rain garden could collect stormwater from the vehicle entrance via curb cuts and trench drains. The final rain garden proposal is on the northeastern side of the building and will also use downspouts to capture runoff from the parking lot.

#### Anticipated Benefits:
Since the bioretention systems are designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. Bioretention systems would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal to the local residents of Evesham Township.

#### Estimated Cost:
Rain garden #1 would need to be approximately 2,250 square feet. At $5 per square foot, the estimated cost is $11,250.  
Rain garden #2 would need to be approximately 339 square feet. At $5 per square foot, the estimated cost is $1,695.  
Rain garden #3 would need to be approximately 1,128 square feet. At $5 per square foot, the estimated cost is $5,640.  
Rain garden #4 would need to be approximately 1,230 square feet. At $5 per square foot, the estimated cost is $6,150.

The porous asphalt #1 would cover 3,550 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $88,750.  
The porous asphalt #2 would cover 914 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $22,850.

The total cost of the project will thus be approximately $136,335.
Estimated Project Costs

**Estimated Cost:**
Rain garden #1 would need to be approximately 2,250 square feet. At $5 per square foot, the estimated cost is $11,250.
Rain garden #2 would need to be approximately 339 square feet. At $5 per square foot, the estimated cost is $1,695.
Rain garden #3 would need to be approximately 1,128 square feet. At $5 per square foot, the estimated cost is $5,640.
Rain garden #4 would need to be approximately 1,230 square feet. At $5 per square foot, the estimated cost is $6,150.

The porous asphalt #1 would cover 3,550 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $88,750.
The porous asphalt #2 would cover 914 square feet and have a 2-foot stone reservoir under the surface. At $25 per square foot, the cost of the porous asphalt system would be $22,850.

The total cost of the project will thus be approximately $136,335.
MARLTON ELEMENTARY SCHOOL

Subwatershed: Barton Run
Site Area: 2,037,458 sq. ft.
Address: 190 Tomlinson Mill Road
Evesham, NJ 08053
Block and Lot: Block 39, Lot 1.01, 1.02

Stormwater is currently directed to existing catch basins. Parking spots by the north and west buildings can be replaced with porous asphalt to capture and infiltrate stormwater runoff from the parking lot. Rain gardens adjacent to the building can capture, treat, and infiltrate roof runoff before it reaches the existing catch basin. 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>sq. ft.</td>
<td>TP</td>
</tr>
<tr>
<td>26</td>
<td>526,875</td>
<td>25.4</td>
</tr>
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<thead>
<tr>
<th>Recommended Green Infrastructure Practices</th>
<th>Recharge Potential (Mgal/yr)</th>
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<th>Maximum Volume Reduction Potential (gal/storm)</th>
<th>Peak Discharge Reduction Potential (cu. ft./second)</th>
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<tr>
<td>Bioretention systems</td>
<td>0.516</td>
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</table>
4. Investment/funding strategy for green infrastructure projects

1. Township Funding: Capital Improvement Fund and Tree Fund
2. Volunteers – Scouts, community groups, etc
3. Local, State, and/or Federal Grants
   - National Fish and Wildlife Foundation
   - US EPA
   - NJDEP
   - Sustainable Jersey
   - ANJEC
4. Stormwater Utility
5. Incentive Programs – any ideas?
## 5. Short term (5 years) goal

<table>
<thead>
<tr>
<th>Existing Municipal Impervious Cover</th>
<th>Recommended Short Term (less than 5 years) Impervious Cover Management Goal (%)</th>
<th>Recommended Short Term Impervious Cover Management Goal (acres)</th>
</tr>
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<tbody>
<tr>
<td>0% to 10%</td>
<td>1%</td>
<td>10 acres</td>
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<td>10.1% to 25%</td>
<td>2%</td>
<td>15 acres</td>
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<td>&gt;25%</td>
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Green Infrastructure Strategic Plan
(a.k.a. Green Infrastructure Feasibility Study)
Green Infrastructure Strategic Plan

ICA (Tier 1) and GI Action Plan (Tier 2) + the following:

- Additional green infrastructure sites
- Policy recommendations
- Water quality and quantify benefits
- Implementation agenda
- Long-term 5-20 year goals
Stormwater is currently directed to existing catch basins. Parking spots by the north and west buildings can be replaced with porous asphalt to capture and infiltrate stormwater runoff from the parking lot. Rain gardens adjacent to the building can capture, treat, and infiltrate roof runoff before it reaches the existing catch basin. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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<tr>
<td></td>
<td>TN 266.1</td>
<td></td>
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<tr>
<td></td>
<td>TSS 2,419.1</td>
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</tr>
<tr>
<td></td>
<td>From the 1.25&quot; Water Quality Storm</td>
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<td></td>
<td>For an Annual Rainfall of 44&quot;</td>
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CURRENT CONDITION
CONCEPT DESIGN
CONCEPT DESIGN
Policy Recommendations

- Update stormwater management plan and stormwater control ordinance to incorporate green infrastructure requirements
- Update municipal master plan
- Update zoning ordinance to eliminate barriers for green infrastructure
Street Width

2. Are curb extensions that narrow the roadway (such as pinchpoints, gateways, and chicanes) permissible?

3. Are permeable paving materials allowable on low-use streets and/or parking lanes?

Right-of-Way Width

7. If street trees are required, is the planting area required to be at least 6 feet to provide sufficient rooting space to support large trees?
10. Can a landscaped island be created within the cul-de-sac?

- Yes, and the cul-de-sac must be graded to the island with an overflow to the storm drain system, so that it can be used for stormwater treatment (2 pts.)
- Yes, but curbing is required or the island must be raised, limiting its use for stormwater treatment (1 pt.)
Vegetated Open Channels

12. Are open section vegetated channels allowed where density, topography, soils, and slope permit?

13. Are runoff reduction practices permissible within curb extensions or landscape strips?
Parking Lots

24. Can pervious materials be used for parking areas, including spillover or special event parking? (2 pts.)
Parking Lot Runoff

26. Is a minimum percentage of a parking lot required to be landscaped? (2 pts.)

27. Is the use of runoff reduction practices within landscaped areas, setbacks, or parking areas allowed? (give yourself 2 pts.)

28. Are flush curbs and/or curb cuts and depressed landscaped areas allowed so that runoff can be directed into vegetated landscaped islands or runoff reduction practices?
29. Are dimensions for landscaped areas sufficient to plant large trees?
   • Yes, a minimum width 6 feet or greater is specified
   • No, a minimum width less than 6 feet is specified

30. Do vegetated stormwater management areas count toward required landscape minimums?
Sidewalks

42. Are alternative sidewalk designs that provide sufficient soil rooting volume for street trees (e.g., pop-outs or bulb-outs, curving sidewalks, tree islands) allowed?

43. Are alternative sidewalk construction materials that increase infiltration allowed?

Driveways

45. Can pervious materials (e.g., grass, gravel, permeable pavers, etc.) be used for residential driveways? (2 pts.)
Rooftop Runoff

56. Can downspouts be disconnected such that rooftop runoff flows to storage tanks, pervious areas, runoff reduction practices, etc.? (2 pts.)

57. Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops? (2 pts.)

58. Is temporary storage of rainwater in storage tanks (e.g., rain barrels or cisterns) permitted?
Rooftop Runoff (cont’d)

59. Do the stormwater BMP design specifications for green roofs address structural concerns (e.g. how to determine design load of roof)?

60. Do local plumbing codes allow harvested rainwater for exterior uses such as irrigation and non-potable interior uses such as toilet flushing?
Buffer Systems
and
Buffer Management
and
Clearing and Grading
Tree Conservation

78. Are trees and native plant materials permissible for landscaping in yards, common areas, and other open spaces?

• Yes, some portion of landscaping must be include trees and other native vegetation provided in recommended species list. (2 pts.)

• Yes, trees and native vegetation are allowed per recommended species list (1 pt.)

• No, landscaping ordinance requires turfgrass or includes vegetation height standards that preclude use of native plants
Stormwater Outfalls

83. Does the stormwater code contain special treatment criteria for discharges to impaired or sensitive waters, such as natural wetlands, lakes, trout streams, nutrient-sensitive estuaries, drinking water supplies, etc.? (2 pts.)
Stormwater Codes

86. Do codes define rainwater harvesting and establish acceptable uses for rainwater (e.g., irrigation and toilet flushing) and corresponding treatment requirements?

87. Does the stormwater code include specific standards to reduce post-construction runoff volume (not just peak rate)?

- Yes, runoff/volume reduction is required for most new development and redevelopment sites (2 pts.)
- Yes, the standards apply to some sites or are included as an alternative compliance method (1 pt.)
88. Does the code require or have incentives for consideration of runoff reduction concepts early in the site planning process?

- Yes, there are provisions for a pre-application meeting or similar (2 pts.)
- Yes, but the meetings are not mandatory for applicants (1 pt.)
Off-Site Compliance

94. If off-site stormwater compliance is authorized, is some percentage of treatment required on-site?

- Yes, applicants must provide on-site treatment to some level and provide documentation (2 pts.)
- No, many sites have automatic access to off-site compliance
### Long term (5 to 20 years) goal

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<td>2%</td>
<td>25 acres</td>
</tr>
<tr>
<td>10.1% to 25%</td>
<td>5%</td>
<td>50 acres</td>
</tr>
<tr>
<td>&gt;25%</td>
<td>10%</td>
<td>80 acres</td>
</tr>
</tbody>
</table>
Implementation Agenda

• Funding piece from Tier 2
• Maintenance and Monitoring
• Responsible Parties
• Timeframe
Maintenance and Monitoring

• Every green infrastructure practices must have a maintenance plan
• Annual inspections required
• NJDEP provides guidance on maintenance and monitoring of green infrastructure practices. Go to: https://www.njstormwater.org/maintenance_guidance.htm
Responsible Parties

- Municipality
- Municipal Utility Authority
- Stormwater Utility
- Non-publicly owned property – memorandum of understanding (MOU) identifies responsibly parties
Timeframe

• Depends on available resources (Funding and Labor)
• Good idea to have a targeted number of projects per year
30 slides have been added to the end of this presentation that talks about how green infrastructure works. You have already seen these slides in the first presentation.

If you want to learn more about green infrastructure, please check out our e-Learning tool at: 
www.water.rutgers.edu/Green%20Infrastructure%20Overview%20vC4%20No%20Menu%20CD/story.html
How to use your green infrastructure plan
Impervious Cover Assessment

• Draws attention to problems
• Identifies impervious cover criteria (i.e., 2%, 10%, and 25%)
• Provides some concepts for green infrastructure opportunities
• Great conversation starter
Green Infrastructure Action Plan

• Identifies 10 to 20 projects on public or quasi-public lands
• Gives municipality examples of types of projects needed to fix problem
• Moves the conversation to project choice instead of willingness to do a project
• Sets realistic goals
Resources for You!

http://water.rutgers.edu/Projects/GreenInfrastructureChampions/GIC.html
Projects & Programs - Municipal/Community Training

Green Infrastructure Champions Program

Introduction

Green Infrastructure Champions are key players in implementing green infrastructure as a stormwater management approach town by town. Green Infrastructure Champions will be able to:

- Enhance their knowledge through green infrastructure workshops, seminars, and personal research
- Engage community leaders to adopt green infrastructure as a stormwater management solution by updating ordinances and municipal master plans
- Encourage local non-governmental organizations (NGOs) and schools to incorporate green infrastructure in their existing landscaping
QUESTIONS?
It is all about controlling runoff from impervious surfaces
Step 1: Depave
Step 2: Simple Disconnection
Downspout Disconnection

- Downspout connected to sewer system
- Downspout disconnected from sewer system
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
So Many Barrels to Choose From...
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.

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

**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.

**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.
Or Larger Rainwater Harvesting Systems…
Rooftop runoff is now “disconnected” from flowing directly into the storm sewer system.
Bioretention Systems/Rain Gardens

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.

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.

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.
Lots of Rain Gardens
Step 3: Convert to Permeable Pavement

**POUROUS 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
• 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**

[Diagram showing components of a porous asphalt system]

Design Guidelines for Porous Asphalt with Subsurface Infiltration

RIVERJACKS OPEN INTO RECHARGE BED

POROUS ASPHALT PAVEMENT

UNCOMPACTED SUBGRADE IS CRITICAL FOR PROPER INFILTRATION

FILTER FABRIC LINES THE SUBSURFACE BED

UNIFORMLY GRADED STONE AGGREGATE WITH 40% VOID SPACE FOR STORMWATER STORAGE AND RECHARGE
Porous Asphalt
Pervious Concrete
Permeable Pavers
Other Green Infrastructure Practices

• Bioswale
• Stormwater Planters
• Green Roofs
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 blankets for stabilization.

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

FUNCTIONS

• Improves stormwater management
• Improves air quality
• Temperature regulation (moderation of Urban Heat Island Effect)
• Carbon dioxide/oxygen exchange
• Increased urban wildlife habitat
• Great for new construction

COMPONENTS
Modular System Specifications

Parker Urban Greenscapes.

SIDE VIEW

LiveRoof Standard Module
Moisture Portals™
LiveRoof Engineered Soil
LiveRoof Green Roof Plants (Minimum 95% Soil Coverage at Installation)
Minimum 40-mil Polypropylene or EPDM Slip Sheet, Edges Overlapped & Seamed
EPDM, TPO or PVC Waterproofing Membrane
Bonding Adhesive
Insulation
Insulation Adhesive

TOP VIEW

Drainage Holes
Ergonomic Handles

Parker Urban Greenscapes.
Green Infrastructure Champions Program

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

Rutgers
New Jersey Agricultural Experiment Station

Jersey Water Works
Smart infrastructure. Strong communities.

Sea Grant
NJ Sea Grant Consortium

The Geraldine R. Dodge Foundation
Imagine a Better New Jersey

Duke Farms