Paraprofessional Watershed Restoration Training

March 19, 2014
Room 223, Environmental Sciences Building
New Brunswick, NJ

Christopher C. Obropta, Ph.D., P.E.
Email: obropta@envsci.rutgers.edu

Jessica Brown, EIT
jess@envsci.rutgers.edu

www.water.rutgers.edu
Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.
OVERVIEW

1. What is a watershed?
2. Where does precipitation go?
3. Land Use/Land Cover Changes
4. Nonpoint Source Pollution
5. How can we better manage stormwater?
WHAT IS A WATERSHED?

- An *area of land* that water flows *across, through, or under* on its way to a stream, river, lake, ocean or other body of water.

- A watershed is like one big bathtub...

Do you know what a watershed is?

*We’re All In the Same Bathtub*

*Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension*
HYDROLOGIC CYCLE

Courtesy of www.fgmorph.com
WHERE DOES PRECIPITATION GO?

1. It can *run off*
WHERE DOES PRECIPITATION GO?

2. It can be *absorbed* by plants and used for photosynthesis and other biological processes
WHERE DOES PRECIPITATION GO?

3. It can *infiltrate* through the soil surface and percolate downward to groundwater *aquifers*
WHERE DOES PRECIPITATION GO?

4. It can *evaporate*

*Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension*
The Impact of Development on Stormwater Runoff

More development → More impervious surfaces → More stormwater runoff

- 10%
- 20%
- 30%
- 55%
# Land Use/Land Cover Changes

## Land Use

**How Land is Used by Humans:**
- Agriculture
- Industry
- Urban
- Residential
- Recreation

## Land Cover

**Biological and Physical Features of the Land:**
- Forests
- Grasslands
- Agricultural Fields
- Rivers, Lakes
- Buildings, Parking Lots
# LAND USE/LAND COVER CHANGES

<table>
<thead>
<tr>
<th>DEVELOPED AREA</th>
<th>UNDEVELOPED AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>30% evapotranspiration</td>
<td>40% evapotranspiration</td>
</tr>
<tr>
<td>55% runoff</td>
<td>10% runoff</td>
</tr>
<tr>
<td>10% shallow infiltration</td>
<td>25% shallow infiltration</td>
</tr>
<tr>
<td>5% deep infiltration</td>
<td>25% deep infiltration</td>
</tr>
</tbody>
</table>
The **Urban** Hydrologic Cycle

- Condensation
- Evaporation
- Much less infiltration
  - Roofs, roads & paths stop infiltration
- Low groundwater flow
- More runoff:
  - More
  - No rain: streams dry up
  - Rain: streams flood
- Soil
- Bedrock
Combined Sewer Systems (CSOs)

**DURING DRY WEATHER**
Normal sewage flow is contained within the system and flows to the Wastewater Treatment Plant.

**DURING STORMY WEATHER**
The combination of stormwater and sewage can exceed normal capacity and overflows into area waterways.
WATER POLLUTION SOURCES

POINT SOURCE POLLUTION  NONPOINT SOURCE POLLUTION

Environmental Health Perspective, National Institute of Health
POINT SOURCE POLLUTION

- Comes from a specific source, like a pipe
- Factories, industry, municipal treatment plants
- Can be monitored and controlled by a permit system (NPDES)
NONPOINT SOURCE POLLUTION (NPS)

- Associated with stormwater runoff
- Runoff collects pollutants on its way to a sewer system or water body
- It cannot be traced to a direct discharge point such as a wastewater treatment facility
EXAMPLES OF NPS

• Oil and grease from cars
• Fertilizers
• Animal waste
• Grass clippings
• Septic systems

• Sewage leaks
• Household cleaning products
• Litter
• Agriculture
• Sediment
Impacts from Changing the Landscape

*Hydrologic* Effects:
- Disruption of natural water balance
- Increased flood peaks
- Increased stormwater runoff
- More frequent flooding
- Increased bankfull flows
- Lower dry weather flows
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
How NJ’s regulations change the way we manage stormwater
Stormwater Management
It is all about controlling runoff from impervious surfaces
The Hydrologic Cycle

Source: J.J. Skupien.
We must deal with impacts from impervious cover.

Are there impervious surfaces that you can eliminate?

If we can't eliminate it, can we reduce it?

If we can't eliminate or reduce it, can we disconnect it?

Are there impervious surfaces that you can harvest rainwater for reuse?

Are there conveyance systems that can be converted to bioswales?
Eliminate it!
Reduce It!
Pervious 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
Pervious Pavements

**FUNCTIONS**

- 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
Pervious Pavement
Pervious Pavements
Disconnect It!
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

Runoff Direction

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

Total drainage area = 3 acres

1 acre directly connected

2 acres pervious cover

Impervious cover

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 (water quality storm)</td>
<td>28,500</td>
<td>4,360</td>
<td>85%</td>
</tr>
</tbody>
</table>
Disconnection with Rain Water Harvesting

Disconnect your downspout by installing a rain barrel.

Impervious area is now “disconnected” from flowing directly into the storm sewer system.
So Many Barrels to Choose From...
Or Larger Rainwater Harvesting Systems...
Rooftop runoff is now "disconnected" from flowing directly into the storm sewer system.
Lots of Rain Gardens
Green Infrastructure is ...

...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 includes:

- Green Roofs
- Rainwater Harvesting
- Planter Boxes
- Rain Gardens
- Permeable Pavements
- Vegetated Swales
- Natural Retention Basins
- Trees & Urban Forestry
- Brownfield Redevelopment
Rainwater Harvesting

FUNCTIONS

• Collecting, filtering and storing water from roof tops, paved and unpaved areas for multiple uses.

• Harvested water can be used for nonpotable or potable purposes after testing and treatment.

• Surplus water after usage can be used for recharging ground water.

• Systems can range in size from a simple PVC tank or cistern to a contractor designed and built tank/sump with water treatment facilities.
Rainwater Harvesting

Samuel Mickle School Rainwater Harvesting System
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

**COMPONENTS**

- Vegetation
- Growing Medium
- Drainage, Aeration, Water Storage and Root Barrier
- Insulation
- Membrane Protection and Root Barrier
- Roofing Membrane
- Structural Support
Green Roof Design

Modular System Specifications:

SIDEB VIEW

- LiveRoof Standard Module
- Moisture Ports™
- 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

4 1/2" 3 1/4" 1"

TOP VIEW

- Drainage Holes
- Ergonomic Handle

Parker Urban Greenscapes.
Pervious Pavements

- Underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil
- Porous asphalt and pervious concrete are manufactured without "fine" materials, and incorporate void spaces to allow infiltration
- Grass pavers are concrete interlocking blocks or synthetic fibrous grid systems with open areas designed to allow grass to grow within the void areas
- Ideal application for porous pavement is to treat a low traffic or overflow parking area
Pervious Pavements

FUNCTIONS

• Manage stormwater runoff
• Minimize site disturbance
• Possibility of 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
Pervious Pavement
Pervious Pavements
Bioretention Systems & Rain Gardens

**Traditional Approach**

Design Dry Detention Basin:
- Treat Water Quality Storm (1.25” rain over 24 hours)
- Detain for 18 hours (residential) or 36 hours (commercial)
- Minimum outflow orifice = three inches
- Use Concrete Low Flow Channels to Minimize Erosion

**New Approach**

- Combines settling of detention basin with physical filtering and absorption processes
- Provides very high pollutant removal efficiencies
- More aesthetically pleasing than conventional detention basins
- Can be incorporated into the landscapes of individual homes
Bioretention Systems & Rain Gardens

Bioretention Systems & Rain Gardens

**BUFFER**
The buffer surrounds a rain garden, slows down the flow of water into the rain garden, filters out sediment, and provides absorption of pollutants in stormwater runoff.

**DEPRESSION**
The depression is the area of the rain garden that slopes down into the ponding area. It serves as a holding area and stores runoff awaiting treatment and infiltration.

**PLANTING SOIL LAYER**
This layer is usually native soil. It is best to conduct a soil test of the area checking the nutrient levels and pH to ensure adequate plant growth.

**INLET**
The inlet is the location where stormwater enters the rain garden. Stones are often used to slow down the water flow and prevent erosion.

**PONDING AREA**
The ponding area is the lowest, deepest visible area of the rain garden. The ponding area should be level so that the maximum amount of water can be held and infiltrated. It is very important that this area drains within 24 hours to avoid problems with stagnant water that can become mosquito breeding habitat.

**ORGANIC MATTER**
Below the ponding area is the organic matter, such as compost and a 3rd layer of triple shredded hardwood mulch. The mulch acts as a filter and provides a home to microorganisms that break down pollutants.

**SAND BED**
If drainage is a problem, a sand bed may be necessary to improve drainage. Adding a layer of coarse sand (also known as bank run sand or concrete sand) will increase air space and promote infiltration. It is important that sand used in the rain garden is not play box sand or mason sand as these fine sands are not coarse enough to improve soil infiltration and may impede drainage.

**BERM**
The berm is a constructed mound, or bank of earth, that acts as a barrier to control, slow down, and contain the stormwater in the rain garden. The berm can be vegetated and/or mulched.

**OVERFLOW**
The overflow (outlet) area serves as a way for stormwater to exit the rain garden during larger rain events. An overflow notch can be used as a way to direct the stormwater exiting the rain garden to a particular area surrounding the rain garden.
Curb Extensions/Green Streets

Curb extension with a planted swale that captures stormwater from the gutter: Portland, OR (Credit: Abby Hall)
BREAK

Let’s go outside!
It is all about controlling runoff from impervious surfaces.
We must deal with impacts from impervious cover

Are there impervious surfaces that you can eliminate?

If we can't eliminate it, can we reduce it?

If we can't eliminate or reduce it, can we disconnect it?

Are there impervious surfaces that you can harvest rainwater for reuse?

Are there conveyance systems that can be converted to bioswales?
Paraprofessionals

Here is what you’re gonna do!
Desktop Analysis
Site Visits
Site Visit Checklist

☐ Organized route with directions
☐ Camera!
☐ Measurement tools — tape measure comes in handy!
☐ Aerials
☐ Notes pages
☐ Contact information for Site Owner
☐ List of constraints to refer to
☐ A friend to go with
Stormwater Best Management Practice Opportunities

Royce Brook Watershed - Hillsborough Township

<table>
<thead>
<tr>
<th>Project Identifier</th>
<th>Geographic Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>R5 - Parking Lot Next to Triangle School</td>
<td>N40° 58' 46.26&quot; W074° 2' 38.76&quot;</td>
</tr>
</tbody>
</table>

**Site Description and BMP Implementation Opportunities:** This site is the overflow parking lot and paved playground lot for Triangle Elementary School on South Triangle Road. The site is adjacent to Royce Brook. The parking lot flows to a single catch basin at the south end of the parking lot, which dumps directly into the Royce Brook. The parking lot is in fair condition. The paved playground lot does not have any catch basins but rather flows onto the grassed area adjacent to the lot and ultimately into the stream. The paved playground lot is in fair condition. The flow from the parking lot can be diverted to a bioretention system bypassing the existing catch basin. There is ample area for the bioretention system. The design and construction of this bioretention basin or rain garden can be incorporated into the fourth grade science curriculum at the elementary school. The paved playground lot could be converted to pervious asphalt and serve as an outstanding demonstration project for the watershed.
Document Recommendations
### Royce Brook Watershed Restoration and Protection Plan
#### BMP Information Sheet

<table>
<thead>
<tr>
<th>Project ID: R5 - Parking Lot Next to Triangle School</th>
<th>Municipalities: Hillsborough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: South Triangle Road at Triangle Elementary School</td>
<td>Subwatershed: Royce Brook</td>
</tr>
</tbody>
</table>

### BMP Description:
- Bioretention System/Rain Garden and Educational Program
- Targeted Pollutants: Total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff

### Existing Conditions and Issues:
This site is the overflow parking lot for Triangle Elementary School on South Triangle Road. The site is adjacent to Royce Brook. The parking lot flows into a single catch basin at the south end of the parking lot, which dumps directly into the Royce Brook. The parking lot surface is in fair condition. The pollutants that accumulate in the parking lot are directly discharged to Royce Brook during storm events with no level of treatment. Additionally, the stormwater runoff is quickly discharged to the stream, contributing to the stream’s flashy hydrology, which cause bank erosion, downcutting, and localized flooding.

### Proposed Solution(s):
The flow from the parking lot (12,000 square feet in size) can be diverted to a bioretention system or rain garden bypassing the existing catch basin. There is ample area for the rain garden, which would be approximately 2,400 square feet in size with a depth of six to eight inches. The design and construction of this bioretention basin or rain garden can be incorporated into the fourth grade science curriculum at the elementary school. The RCE Water Resources Program has a Stormwater Management in Your School Yard program that could be incorporated into the 4th grade curriculum. The students could gain knowledge and increase their awareness of issues associated with stormwater runoff while building a BMP on the school grounds that actually helps address some of the problems.
Anticipated Benefits:
The rain garden would be designed to capture, treat and infiltrate the water quality design storm (1.25 inches of rain over two hours). Since 90% of the annual rainfall in New Jersey comes in storms events less than water quality design storm, the rain garden would remove 90% of the TN, TP, and TSS on an annual basis. Pathogens and Bacteria such as E. coli and Fecal Coliform will be reduced by up to 90% as well. A rain garden would also provide ancillary benefits, such as enhanced wildlife habitat and aesthetic appeal to surrounding property owners. The Triangle Elementary School is located at the proposed site. Rutgers Cooperative Extension Water Resources Program could present the *Stormwater Management in Your School Yard* curriculum to students and then include them in the rain garden design and planting efforts as an augmentation to the in-class lessons. It can also be used as a demo project to launch educational programming for Hillsborough Department of Public Works staff.

Possible Funding Sources:
319(h) grants from the New Jersey Department of Environmental Protection
Soil Conservation District of Somerset-Union Counties
Hillsborough Township
Sustainable Jersey
Triangle School Home and School Association

Partners/Stakeholders:
Rutgers Cooperative Extension
Stony Brook-Millstone Watershed Association
### Royce Brook Watershed Restoration and Protection Plan

#### BMP Information Sheet

<table>
<thead>
<tr>
<th>Task</th>
<th>Task Description</th>
<th>Unit Cost</th>
<th>Quantity</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Complete topographic survey and soils test</td>
<td></td>
<td></td>
<td>$500</td>
</tr>
<tr>
<td>2</td>
<td>Prepare final design</td>
<td></td>
<td></td>
<td>$1,000</td>
</tr>
<tr>
<td>3</td>
<td>Activities for BMP installation</td>
<td>Unit Cost</td>
<td>Quantity</td>
<td>Estimated Cost</td>
</tr>
<tr>
<td></td>
<td>Plant materials</td>
<td>$0.50/sq.ft.</td>
<td>2,400</td>
<td>$1,200</td>
</tr>
<tr>
<td></td>
<td>Soil amendments (course sand)</td>
<td>$35/cu.yd.</td>
<td>10</td>
<td>$350</td>
</tr>
<tr>
<td></td>
<td>Mulch</td>
<td>$25/cu.yd.</td>
<td>20</td>
<td>$500</td>
</tr>
<tr>
<td></td>
<td>Installation (assume volunteer-based effort)</td>
<td>$25.22/hr*</td>
<td>30 people</td>
<td>$3,027 (no charge)</td>
</tr>
<tr>
<td></td>
<td>Supervision of volunteers</td>
<td>$1,000</td>
<td>1</td>
<td>$1,000</td>
</tr>
<tr>
<td></td>
<td>Educational Programs (Schools and DPW)</td>
<td>$2,000</td>
<td>1</td>
<td>$2,000</td>
</tr>
<tr>
<td></td>
<td>Contingency (10%)</td>
<td>-</td>
<td>-</td>
<td>$655</td>
</tr>
</tbody>
</table>

**Total Estimated Project Cost**: $7,205

*Based on New Jersey State Value for Volunteer Time as reported by the Corporation for National and Community Service*
Quantify Load Reductions of Proposed BMPs?

- Based upon land use of your site, determine pollutant loads from site and amount of runoff.
- Based upon ability of recommended BMP to reduce pollutants, determine amount of pollutant load to be reduced by recommended BMPs.
- Put it in an easy to read table – DEP likes that.
Table 3-1: Pollutant Loads by Land Cover

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>TP load (lbs/acre/yr)</th>
<th>TN load (lbs/acre/yr)</th>
<th>TSS load (lbs/acre/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High, Medium Density Residential</td>
<td>1.4</td>
<td>15</td>
<td>140</td>
</tr>
<tr>
<td>Low Density, Rural Residential</td>
<td>0.6</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Commercial</td>
<td>2.1</td>
<td>22</td>
<td>200</td>
</tr>
<tr>
<td>Industrial</td>
<td>1.5</td>
<td>16</td>
<td>200</td>
</tr>
<tr>
<td>Urban, Mixed Urban, Other Urban</td>
<td>1.0</td>
<td>10</td>
<td>120</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1.3</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>Forest, Water, Wetlands</td>
<td>0.1</td>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>Barrenland/Transitional Area</td>
<td>0.5</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Best Management Practice (BMP)</td>
<td>Adopted TSS Removal Rate (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioretention System</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constructed Stormwater Wetland</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Well</td>
<td>Volume Reduction Only^1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended Detention Basin</td>
<td>40 to 60^2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltration Structure</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufactured Treatment Device</td>
<td>See N.J.A.C. 7:8-5.7(d)^3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pervious Paving System</td>
<td>Volume Reduction Or 80^6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Filter</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetative Filter</td>
<td>60-80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Pond</td>
<td>50-90^5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

^1 See text below.
^2 Final rate based upon detention time. See Chapter 9.
^3 To be determined through testing on a case-by-case basis. See text below.
^4 If system includes a runoff storage bed that functions as an infiltration basin. See Chapt
^5 Final rate based upon pool volume and detention time. See Chapter 9.
<table>
<thead>
<tr>
<th>Best Management Practice (BMP)</th>
<th>Total Phosphorous Removal Rate (%)</th>
<th>Total Nitrogen Removal Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioretention Basin</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Constructed Stormwater Wetland</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Extended Detention Basin</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Infiltration Basin</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Manufactured Treatment Devices</td>
<td>See N.J.A.C. 7:8-5.7(d)</td>
<td>See N.J.A.C. 7:8-5.7(d)</td>
</tr>
<tr>
<td>Pervious Paving</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Sand Filter</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Vegetative Filter</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Wet Pond</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>
Pollutant Load Reductions for Royce Brook Project

<table>
<thead>
<tr>
<th>Site</th>
<th>Area (acres)</th>
<th>Aerial Loads</th>
<th></th>
<th>Loads</th>
<th></th>
<th>Reductions in Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TP (lbs/ac/yr)</td>
<td>TN (lbs/ac/yr)</td>
<td>TSS (lbs/ac/yr)</td>
<td>TP (lbs/yr)</td>
<td>TN (lbs/yr)</td>
</tr>
<tr>
<td>R5</td>
<td>0.28</td>
<td>2.1</td>
<td>22</td>
<td>200</td>
<td>0.59</td>
<td>6.21</td>
</tr>
</tbody>
</table>

Stormwater Treated and Infiltrated by BMP:

12,300 square feet * 44 inches * ft/12in * 0.90 = 40,590 cu.ft.

40,590 cu.ft. * 7.48 gallons per cubic foot = 303,613 gallons
Picture is worth 1,000 words
A rain garden can be built on the green space, and we can cut the curb near the drainage inlet to lead rain water to the rain garden. One overflow stone weir can be built near the river side. Therefore, overflows from rain garden can flows to river.
How this can be used to develop plans?

• Develop an Impervious Cover Reduction Action Plan
• Develop a Watershed Restoration Plan
How the plans can be used to implement projects?

• Implementing community projects
• Developing local ordinances
• Identification of mitigation for new development and redevelopment
Stormwater Mitigation Plan Online Tool

Hamilton Township Possible Green Infrastructure Sites
A look at delineated sites that offer possibilities for implementing best management practices to mitigate flooding associated with stormwater runoff
Greenwood Elementary School

Area (sq. ft.): 83,374; Block: 1884; Lot: 1

Impervious Cover (sq. ft.): 75, 121; Percent Impervious: 90%; Total Runoff from Impervious Surfaces for the 1.25" Quality Storm (gal): 58,536


Recharge Potential:_____; Total Suspended Solids Removal Potential:_____; Stormwater Peak Reduction Potential: ______

Suitable for: Bioretention (with underdrain system), Bioretention (infiltration), Dry Pond, Grass Swale, Infiltration Trench, Porous Pavement, Vegetated Filter Strips
An Example
What would you design for this site?
Observations
• Lots of impervious cover
• No stormwater management
• Lots of open space for potential BMPs

Questions
• Are there downspouts?
• Are they connected?
• Is there curb along the parking lot?
• Which way is the parking lot graded?
• What is the condition of the parking lot?
Other Questions

• Do the soils around the Ag Museum 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 BMPs?
• Is the project a high priority?
Soil Considerations

- Web Soil Survey (websoilsurvey.nrcs.usda.gov)
<table>
<thead>
<tr>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallsington bedrock substratum variant loam, 0 to</td>
<td>2.3</td>
<td>59.3%</td>
</tr>
<tr>
<td>2 percent slopes, rarely flooded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matapeake silt loam, 0 to 2 percent slopes</td>
<td>0.5</td>
<td>13.0%</td>
</tr>
<tr>
<td>Mattapex silt loam, 0 to 2 percent slopes</td>
<td>1.0</td>
<td>24.7%</td>
</tr>
<tr>
<td>Nixon moderately well drained variant loam, 0 to</td>
<td>0.1</td>
<td>3.0%</td>
</tr>
<tr>
<td>5 percent slopes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals for Area of Interest</td>
<td>3.8</td>
<td>100%</td>
</tr>
</tbody>
</table>
FavAr—Fallsington bedrock substratum variant loam, 0 to 2 percent slopes, rarely flooded

Map Unit Composition
- Fallsington variant, bedrock substratum, rarely flooded, and similar soils: 85 percent

Properties and qualities
- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Drainage class: Poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 0 to 12 inches

Interpretive groups
- Hydrologic Soil Group: D
<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Rating</th>
<th>Rating reasons (numeric values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FavAr</td>
<td>Very limited</td>
<td>- Depth to perched zone of saturation (1.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Restrictive substratum (1.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Restrictive horizon (1.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Not Permitted - Flooding (1.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Not Permitted - Hydric Soil (1.00)</td>
</tr>
<tr>
<td>MbrA</td>
<td>Not limited</td>
<td></td>
</tr>
<tr>
<td>MbuA</td>
<td>Somewhat limited</td>
<td>- Depth to apparent zone of saturation (0.83)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NkrB</td>
<td>Somewhat limited</td>
<td>- Depth to apparent zone of saturation (0.83)</td>
</tr>
</tbody>
</table>
Presenting the information
Presenting Data

1. Consider the audience
2. Make sure you have something to present!
3. Organize data in Watershed Management Plan format – even if pieces are missing
4. Create a “standard” PowerPoint.
5. Provide handout/samples
6. Take a friend/Call RCE
Consider the Audience

- Host Agency
- School kids
- NJDEP
- Environmental Commissions, Planning Boards
- Watershed Planning Advisory Committee

- What are your goals of presenting the data?
  - Assistance?
  - Marketing support?
  - Awareness?
Make sure you have something to present
Make sure you have something to present
Organization of data

Create a “standard” PowerPoint and handouts

Outline for Watershed Restoration and Protection Plans January 2013

- Executive Summary/Abstract
- Introduction
  - Project Description/Background
  - TMDLs in Watershed
- Watershed Description/Characterization
  - Watershed Boundary, Municipalities
  - Topography
  - Subwatersheds/HUCs
  - Hydrology (Streams, Rivers, Lakes, Ponds)
  - Land Use
  - Soils
  - Impairment Status of HUCs (from Integrated List)
- Assessment of Water Quality
  - In this section be sure to provide an identification of any causes of impairment and definite/possible pollutant sources. Identify sources at subcategory level along with estimates of the extent present.
    - Historical Water Quality
    - Visual Assessment Findings & Assessment
    - Chemical Monitoring Findings
    - Biological Assessments
    - Assessment of Ecosystem Health Findings
      - Fecal coliform, E. coli
- Management Measures, Targeted BMPs
  - A description of feasible nonpoint source management measures to implement and a description of the critical areas where these will be needed implemented. This is the section that includes the short descriptions of potential BMPs for problems identified (Paraprofessional Training Program). This section also includes the detailed information sheets and concept plans for several BMPs that are representative of the BMPs identified with the short descriptions.
  - Pollutant Load Reductions
    - Estimated Pollutant Loads Before & After Management Measures/BMPs
      - Models
      - Areal Loading Coefficients
  - Plan Implementation
    - Provide estimates of technical and financial assistance/costs/sources and authorities needed to implement planned measures:
      - Implementation Schedule for Planned Management Measures
      - Interim Measurable Milestones Determining Whether Measures are Being Implemented
      - Criteria to Determine that Loading Reductions are Being Achieved
      - Education Component
      - Monitoring Component

Here is the link to the Tenkiller Brook Restoration Plan:
http://water.rutgers.edu/Projects/Tenkiller/Tenkiller_Restoration_Plan.pdf
Appendix for the Tenkiller Plan:
http://water.rutgers.edu/Projects/Tenkiller/Tenkiller_Restoration_Plan_AppendixA.pdf
http://water.rutgers.edu/Projects/Tenkiller/Tenkiller_Restoration_Plan_AppendixB.pdf
http://water.rutgers.edu/Projects/Tenkiller/Tenkiller_Restoration_Plan_AppendixC.pdf
http://water.rutgers.edu/Projects/Tenkiller/Tenkiller_Restoration_Plan_AppendixD.pdf

1 Maps/tables/charts of these are an accompany text; note that maps may include more than one of these items at a time.

2 Depending on what data is available, not all sections of this outline may be included.
Resources Available to You
Resources Available to You

- Jessica Brown  (jess@envsci.rutgers.edu)
- Lisa Galloway Evrard  (Evrard@rci.rutgers.edu)
- Steve Yergeau  (syergeau@envsci.rutgers.edu)
- Kyle Gourley  (kgourley@envsci.rutgers.edu)

http://www.water.rutgers.edu/Program_Staff/Default.htm
Resources Available to You

- http://www.water.rutgers.edu/Projects/Paraprofessionals/Paraprofessionals.html
PICK A WATERSHED OR A MUNICIPALITY