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Rutgers Cooperative Extension
Water Resources Program

Community-based Projects for Addressing Flooding and Improving Water Quality – Low Cost Solutions

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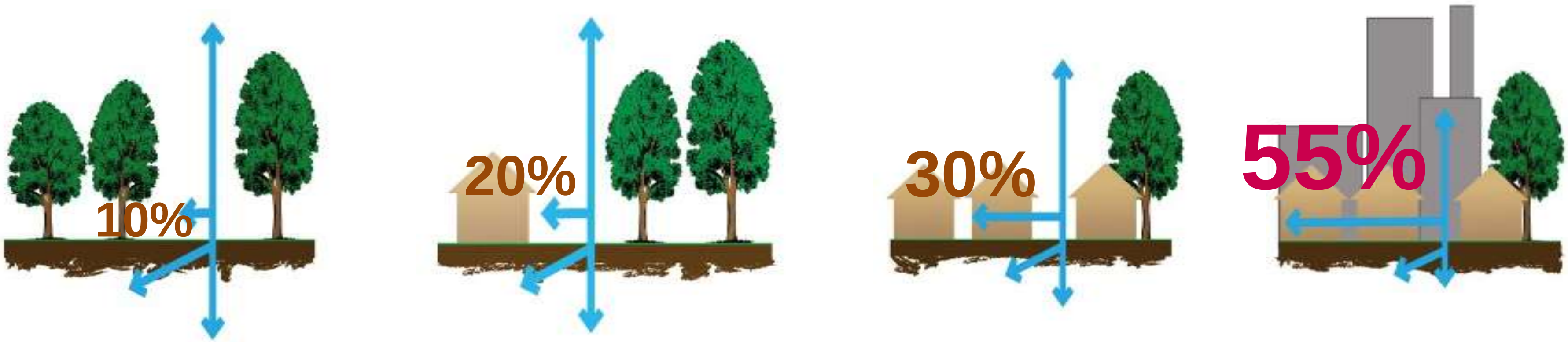
What is Stormwater?

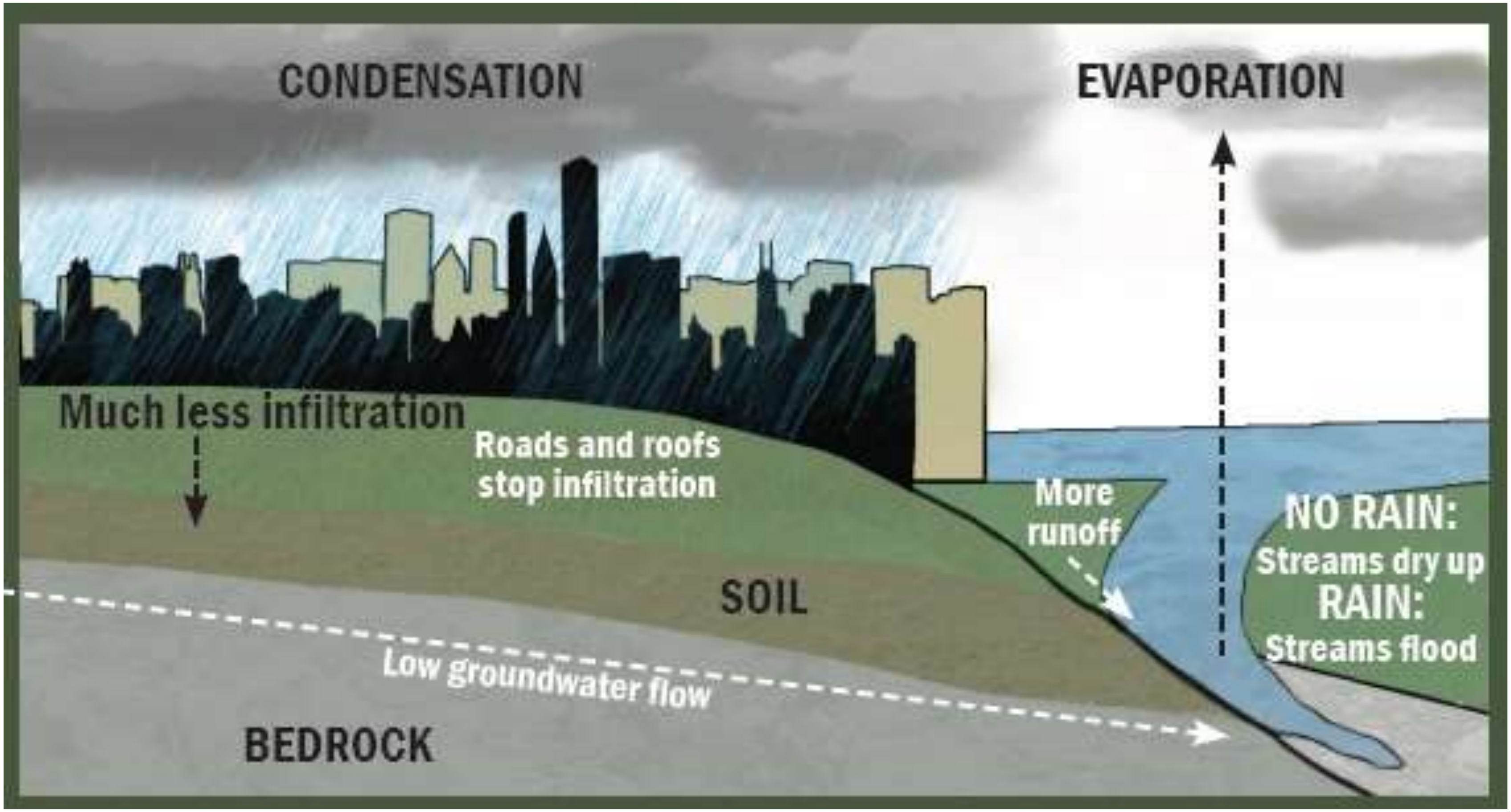
Stormwater is the water from rain or melting snows that can become "runoff," flowing over the ground surface and returning to lakes and streams.

The Impact of Development on Stormwater Runoff



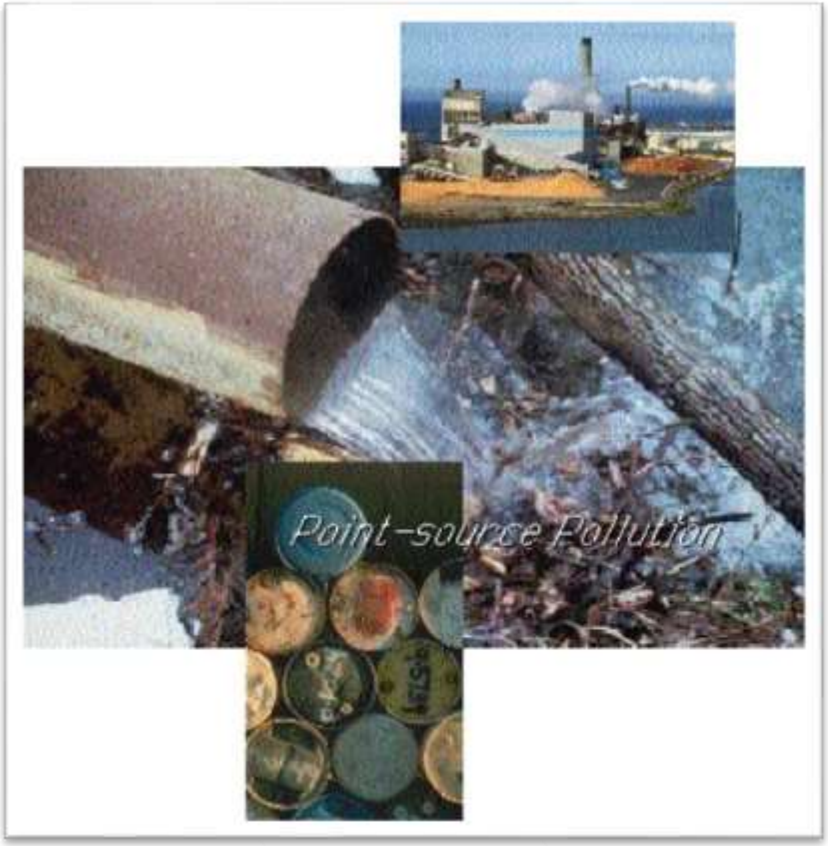
More development → *More impervious surfaces* → *More stormwater runoff*

The <u>Urban</u> Hydrologic Cycle



Water Pollution Sources

POINT SOURCE POLLUTION



NONPOINT SOURCE POLLUTION

Environmental Health Perspective, National Institute of Health

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



TO MINIMIZE IMPACT OF STORMWATER RUNOFF, YOU MUST CONTROL 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?

Eliminate it!

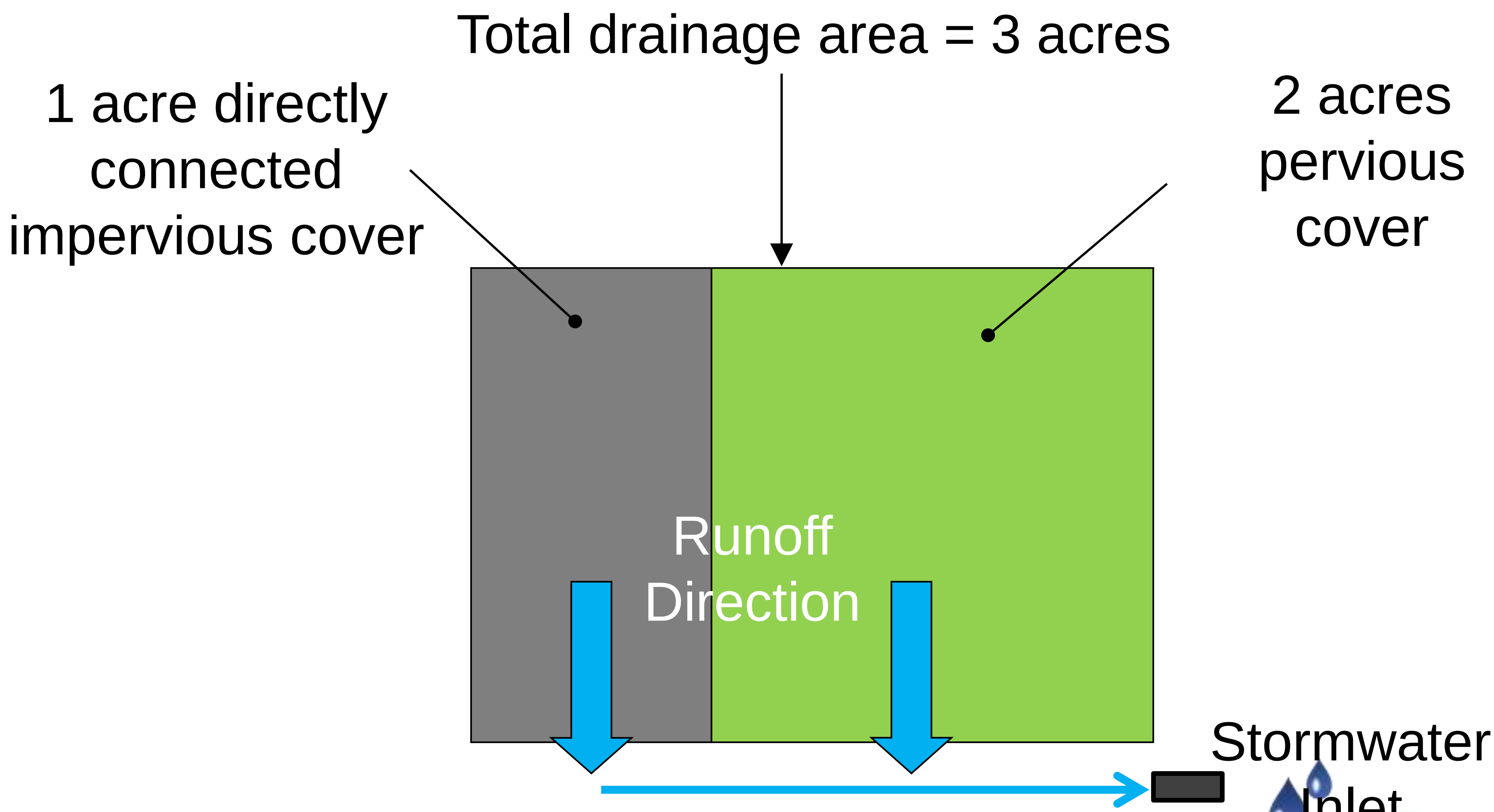
Reduce It!

Pervious Pavements:

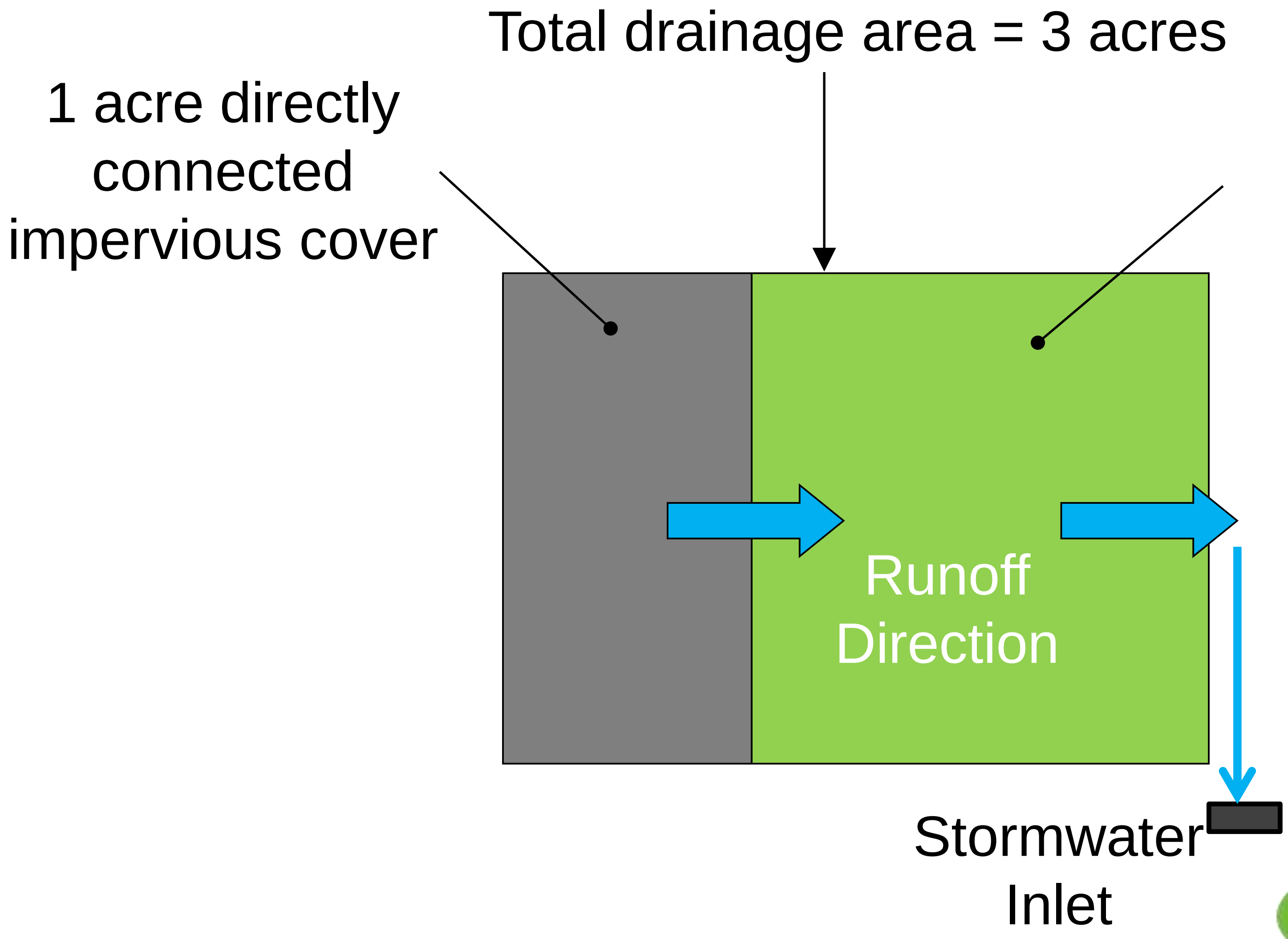
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking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

Disconnect it!

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



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



	Volume of Runoff		
Design Storm	**Connected (gallons)**	**Disconnected (gallons)**	**Percent Difference**
1.25 inches (water quality storm)	28,500	4,360	85%

WHAT IS GREEN INFASTRUCTURE?

Green infrastructure is an approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green Infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies.

USEPA. 2009. Green Infrastructure Manual.

Rain Garden in Holmdel, NJ

Native NJ Purple Coneflower

Pervious Pavers

GREEN INFASTRUCTURE DESIGN APPROACHES

1 – GREEN ROOF

Unilever/Parker Urban Greenscapes. 2009. Green Infrastructure Manual.

Basic Info:

- high quality water proofing and root repellant system
- lightweight growing medium and plants

Benefits:

- Economic benefits (savings on energy heating and cooling costs)
- Improved air quality
- Carbon dioxide/oxygen exchange
- Amenity space and aesthetics
- Sound insulation

2 – RAINWATER HARVESTING: CISTERN

Basic Info:
- Capture, diversion, and storage of rainwater

Benefits:
- Eliminates need for complex and costly distribution systems
- Provides additional water source
- Landscape irrigation
- Reduces flow to stormwater drains
- Reduces non-point source pollution
- Delays expansion of existing water treatment plants
- Reduces consumers' utility bills

2 – RAINWATER HARVESTING: RAIN BARREL

Residential Rain Barrel

Basic Info:

- Capture, diversion, and storage of rainwater

Benefits:

- Saves drinking water
- Irrigates the landscape
- Reduces utility bills
- Prevents basement flooding
- Reduces pollution

So many barrels to choose from…

3 – PERMEABLE PAVEMENT

Basic Info:

- Allows runoff to flow through the surface to an underlying storage layer

Benefits:

- Manage stormwater runoff
- Alternative to costly traditional stormwater management methods
- Mitigation of urban heat island effect
- Contaminant removal as water moves through layers of system

4 – VEGETATED SWALE

Basic Info:
- Broad, shallow channel with a dense stand of vegetation covering the side slopes and bottom
- Traps pollutants

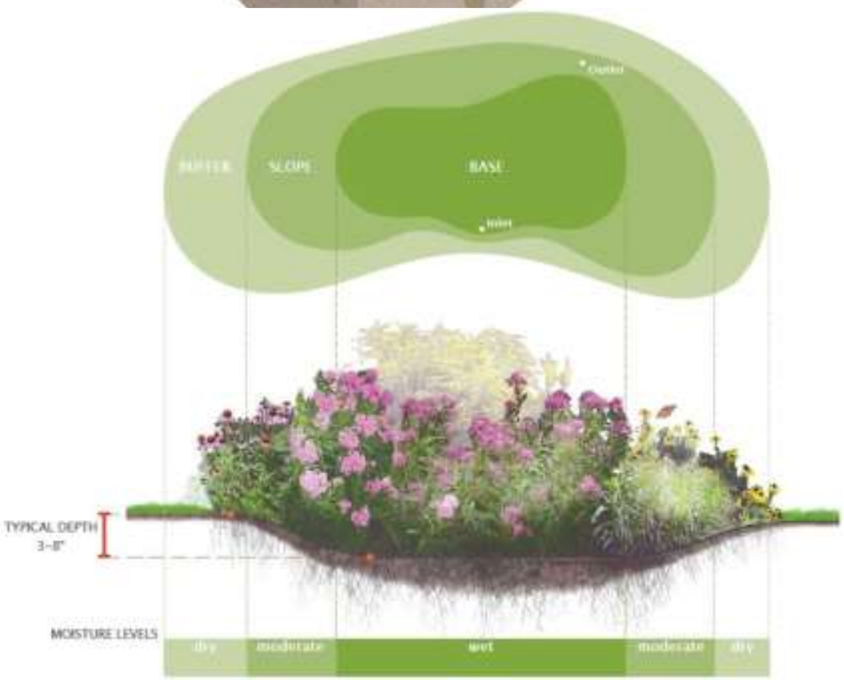
Benefits:
- Reduced peak flows
- Removal of pollutants
- Promotion of runoff infiltration
- Lower capital costs.

5 – NATURAL STORMWATER BASIN

Basic Info:
- Broad, shallow channel with a dense stand of vegetation covering the side slopes and bottom
- Traps pollutants

Benefits:
- Reduced peak flows
- Removal of pollutants
- Promotion of runoff infiltration
- Lower capital costs.

6 – RAIN GARDEN



What is a rain garden?

A rain garden is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater.

Lots of Rain Gardens











What is the next step for municipalities?

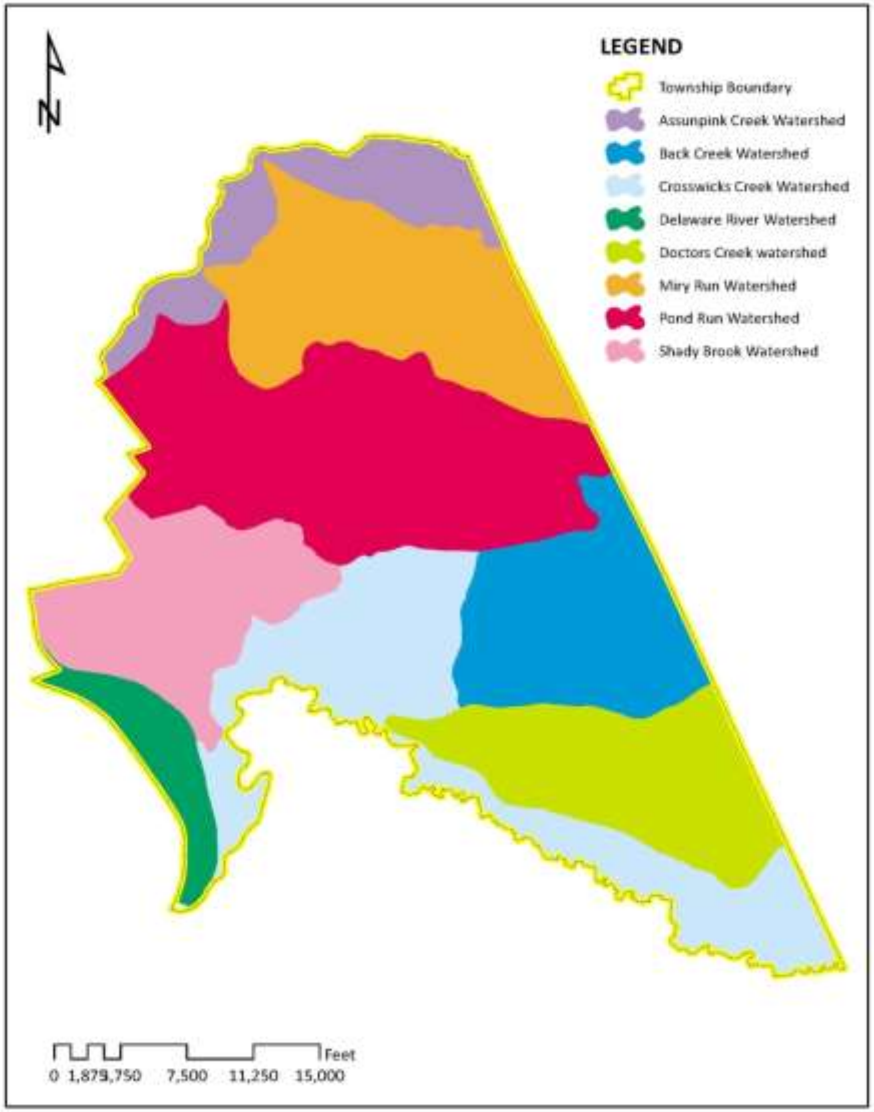
Plans to fix the problems

- Regional Stormwater Management Plans
- Watershed Restoration Plans
- Integrated Water Quality Plans
- Impervious Cover Assessments and Reduction Action Plans

Impervious Cover Assessment

Impervious Cover Assessment

- Analysis completed by watershed and by municipality
- Use 2007 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



Watershed	Total Area (ac)	Impervious Cover (ac)	%
Pond Run	5,956	1,797	30.5
Miry Run	3,716	1,026	28.0
Shady Brook	2,838	822.5	29.5
Assunpink Creek	1,809	429.3	24.0
Doctors Creek	3,053	232.0	7.60
Back Creek	2,980	563.0	19.0
Delaware River and Crosswicks Creek	5,489	804.2	16.0
TOTAL	25,841	5,674	22.7

Subwatershed	NJ Water Quality Storm (MGal)	Annual Rainfall of 44" (MGal)	2-Year Design Storm (3.3”) (MGal)	10-Year Design Storm (5.0”) (MGal)	100-Year Design Storm (8.2”) (MGal)
Pond Run	61.0	2,147.0	161.0	244.0	405.0
Miry Run	34.8	1,225.8	91.9	139.3	231.2
Shady Brook	27.9	982.7	73.7	111.7	185.4
Assunpink Creek	14.6	512.9	38.5	58.3	96.8
Doctors Creek	7.9	277.2	20.8	31.5	52.3
Back Creek	19.1	672.7	50.4	76.4	126.9
Delaware River and Crosswicks Creek	27.3	960.8	72.1	109.2	181.3
TOTAL	192.6	6,779.2	508.4	770.4	1,278.8

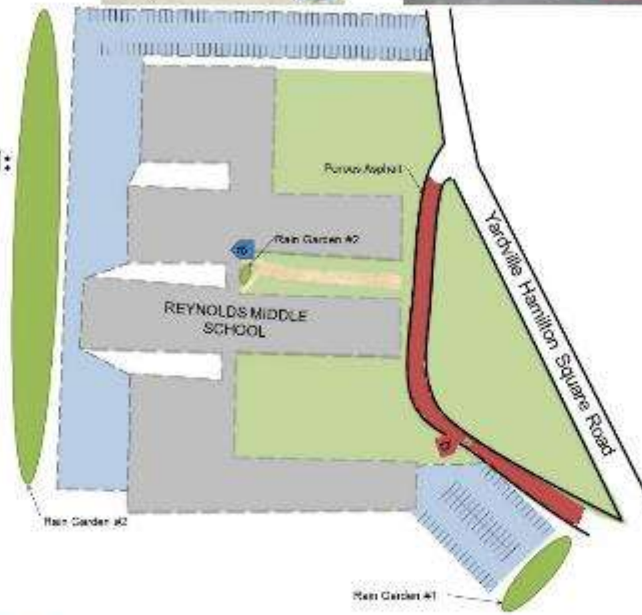
Hamilton Township
Impervious Cover Assessment
Reynolds Middle School

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PHOTOS:

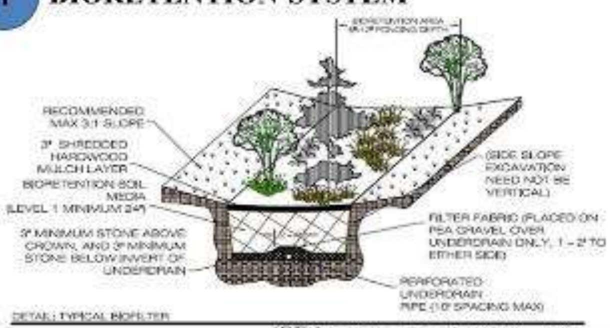
SITE PLAN:



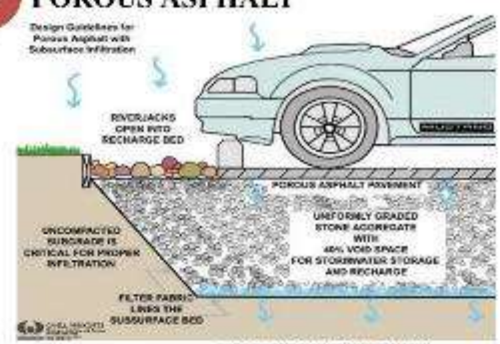
BIORETENTION SYSTEM: A bioretention system/rain garden should be installed on a triangular piece of lawn near the front of the building. Currently there is a connected downspout that is directing runoff to the pavement. Rain gardens also can be used to capture runoff from the parking lots in the southeast corner of the site and north side of the property. The bioretention system would also capture runoff from the asphalt in the back of the school. A bioretention system would intercept, infiltrate, and treat runoff from a portion of the school's rooftop.

POROUS ASPHALT: The front drive would be replaced with porous asphalt. The area around an existing catch basin shows water pooling in the front drive.

1 BIORETENTION SYSTEM



2 POROUS ASPHALT

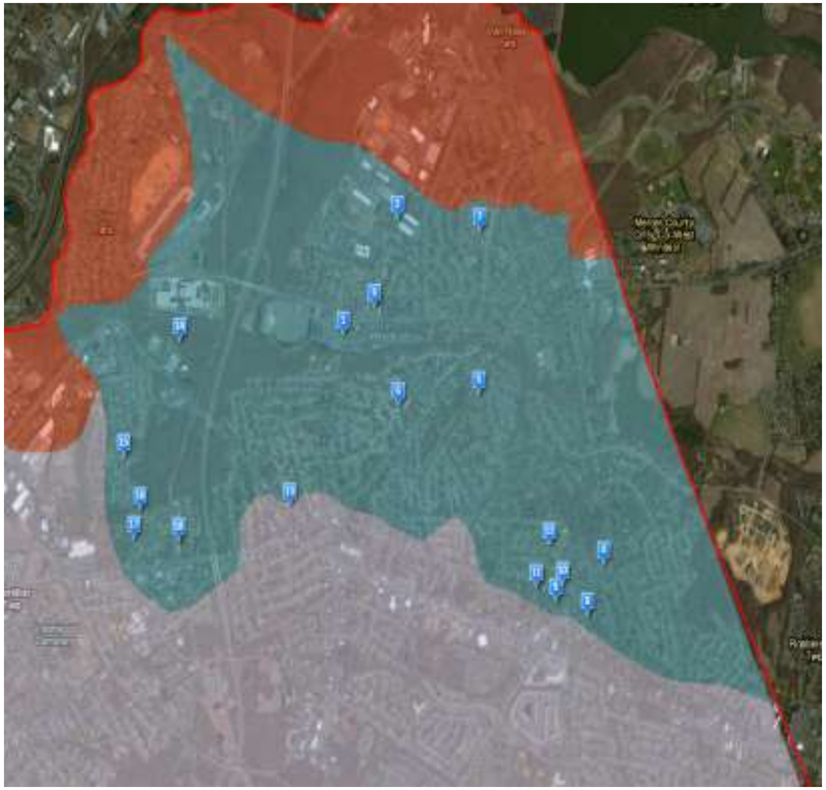


Impervious Cover Reduction Action Plan

Miry Run Watershed Location Map

Project Sites

1. Clover Square
2. Ibis Plaza Office Suites
3. University Plaza
4. Nottingham Volunteer Fire Company
5. St. Mark United Methodist Church
6. Morgan Elementary School
7. University Heights/H.D. Morrison Elementary School
8. Hamilton Square Baptist Church
9. Greater Victory Ministries
10. Hamilton Township School District
11. First Presbyterian Church
12. Baseball Fields
13. Our Lady of Sorrows School
14. Merlin Industries Inc.
15. Enterprise Volunteer Fire Co.
16. Christ Presbyterian Church



Nottingham Volunteer Company

At this site, there is a potential to replace parking lot islands with tree filter systems and install cistern to harvest rainwater from the rooftop to wash the fire trucks. According to the NRCS soil survey, the soils are suitable for infiltration at this site.

Address	Latitude	Longitude
200 Mercer Street	40.233412	-74.65753

			Existing Loads (lbs/year)		
Area (sq.ft.)	Lot	Block	TP	TN	TSS
153,281	24.01	1839	5.3	56.3	703.8

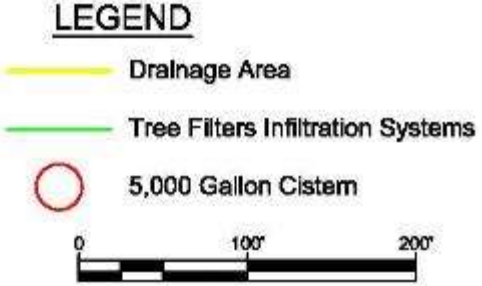
Nottingham Volunteer Company (cont'd)

Impervious Cover		Runoff Volume (Mgal)	
%	Square feet	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
72	110,362	0.23	3.03

Recommended BMP	Recharge Potential (Mgal/yr)	Total Suspended Solids Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu.ft./second)
Tree Filter Systems	0.146	24	1,541	0.40
Cistern	0.055	18	461	0.32

Estimate cost is $16,675 for 667 square feet of tree filter systems with two feet of porous media. Estimate cost is $10,000 for 5,000 gallon cistern.

Nottingham Volunteer Company
Lot 24.01 Block 1839



St. Mark United Methodist Church

For this site, a large portion of the parking lot can be captured in a bioretention system. According to the NRCS soil survey, the soils are suitable for infiltration at this site.

Address	Latitude	Longitude
465 Paxson Avenue	40.24428	-74.671402

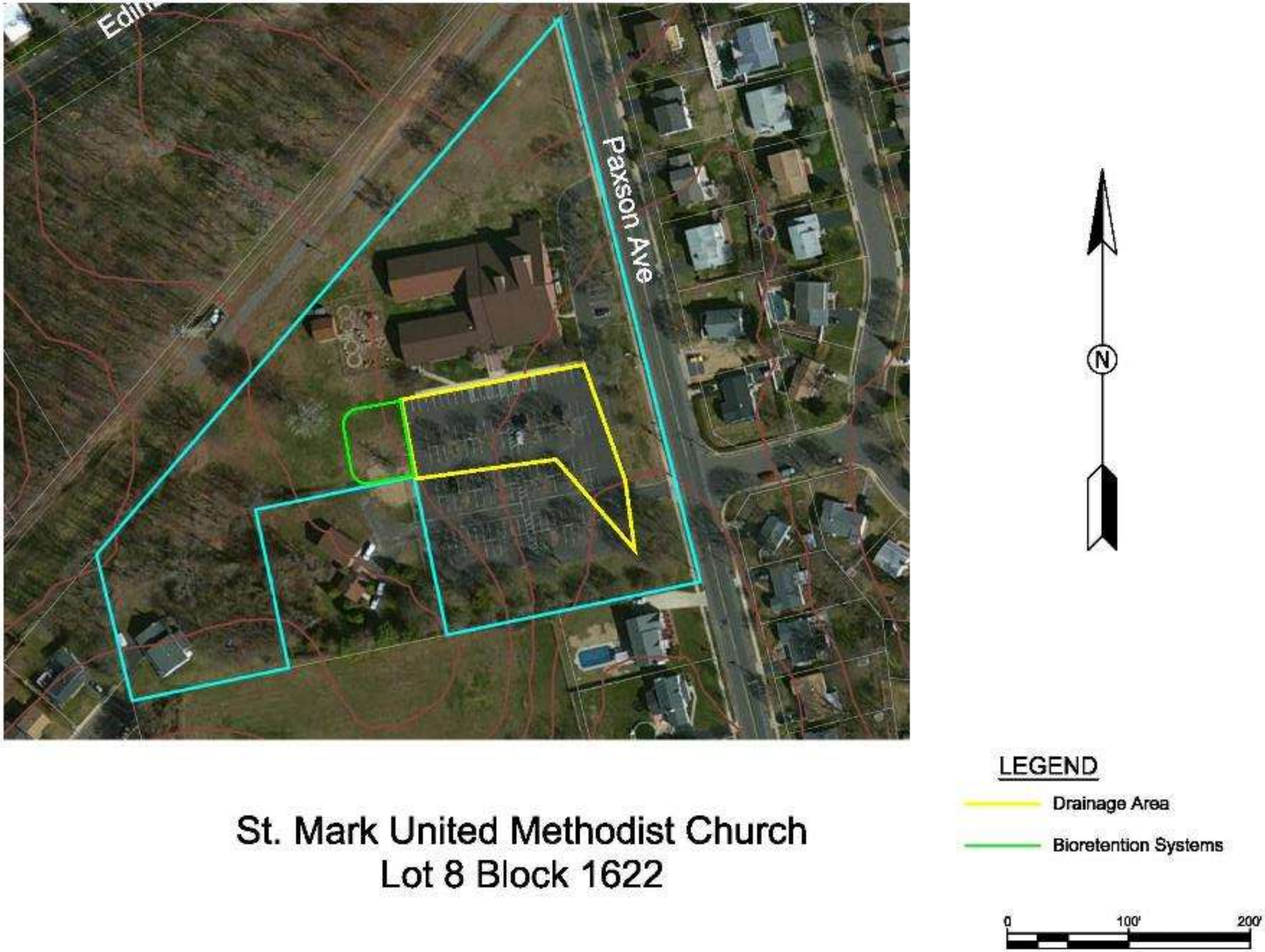
			Existing Loads (lbs/year)		
Area (sq.ft.)	Lot	Block	TP	TN	TSS
284,082	8	1622	9.8	104.3	1304.3

St. Mark United Methodist Church (cont'd)

Impervious Cover		Runoff Volume (Mgal)	
%	Square feet	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
40	113,633	0.23	3.12

Recommended BMP	Recharge Potential (Mgal/yr)	Total Suspended Solids Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu.ft./second)
Bioretention System	0.785	131	8,289	2.17

Estimate cost is $37,675 for 7,535 square feet of bioretention system.



St. Mark United Methodist Church
Lot 8 Block 1622

Summary of Projects in the Stormwater Mitigation Plan

Watersheds	Number of Projects	Total Area of Project Sites (ac)	Impervious Cover (ac)	Potential Management Area (ac)
Assunpink Creek	4	61.62	37.73	9.48
Back Creek	8	88.18	44.95	12.13
Crosswicks Creek	8	145.08	94.30	3.50
Doctors Creek	2	14.71	3.64	0.47
Miry Run	16	122.73	57.21	7.52
Pond Run	16	214.82	79.88	7.79
Shady Brook	15	98.13	65.17	4.17
TOTALS	69	745.28	382.88	45.06

Summary of Projects in the Stormwater Mitigation Plan

Watersheds	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)
Assunpink Creek	10.760	1,801	113,570	29.67
Back Creek	13.763	2,304	145,258	37.97
Crosswicks Creek	3.967	664	41,870	10.94
Doctors Creek	0.536	90	5661	1.48
Miry Run	7.280	1,428	76,724	23.56
Pond Run	8.755	1,479	92,233	26.40
Shady Brook	4.694	792	49,474	13.05
TOTALS	49.756	8,558	524,790	143.07

Summary of Projects in the Stormwater Mitigation Plan

Watersheds	Total Cost ($)	Impervious Cover Treated %
Assunpink Creek	$963,199	25.1%
Back Creek	$701,594	27.0%
Crosswicks Creek	$492,689	3.7%
Doctors Creek	$25,731	13.0%
Miry Run	955,314	13.2%
Pond Run	$975,080	9.8%
Shady Brook	$550,861	6.4%
TOTALS	$4,664,468	11.8%

Conclusion

- Plans are a conduit for funding
- Impervious Cover Reduction Action Plan can easily be converted into a Stormwater Mitigation Plan
- Wide range in cost of projects (Eagle Scout Projects to Stimulus Money Projects)
- Foundation for stormwater utilities, watershed restoration plans, and integrated water quality plans,
- Plans are quick and easy to develop

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Questions?

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