Paraprofessional Watershed Restoration Training

October 10, 2017
Rutgers Cook Campus
New Brunswick, NJ

RUTGERS
New Jersey Agricultural Experiment Station

Water Resources Program

water.rutgers.edu

Welcome and Introduction

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www.water.rutgers.edu

Introductions

- Your name
- Your WMA and host agency
- Where you went to college
- What was your major
- One interesting fact about you

Sponsorship

This course is brought to you by the Dodge Foundation, the New Jersey Agricultural Experiment Station, and the New Jersey Department of Environmental Protection.

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.

Water Resources Program

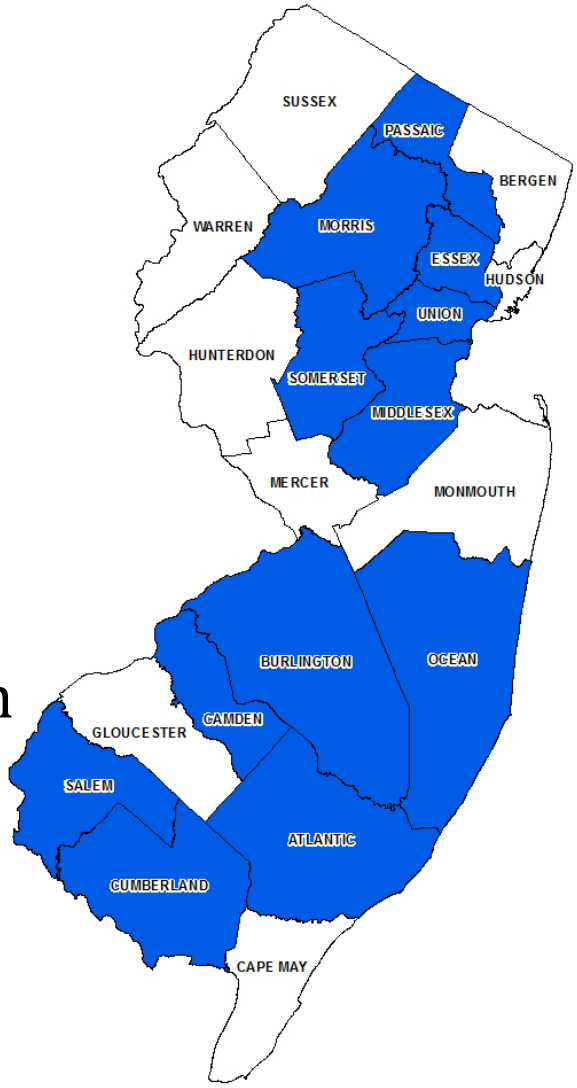
The Water Resources Program is one of many specialty programs under Rutgers Cooperative Extension.

Our Mission is to identify and address community water resources issues using sustainable and practical science-based solutions.

Environmental County Agents

The Environmental County Agents teach pe
new skills and information so they can mak
better informed decisions and improvemer
their businesses and personal lives.

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



STORMWATER BASICS

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.

WHAT IS A WATERSHED?

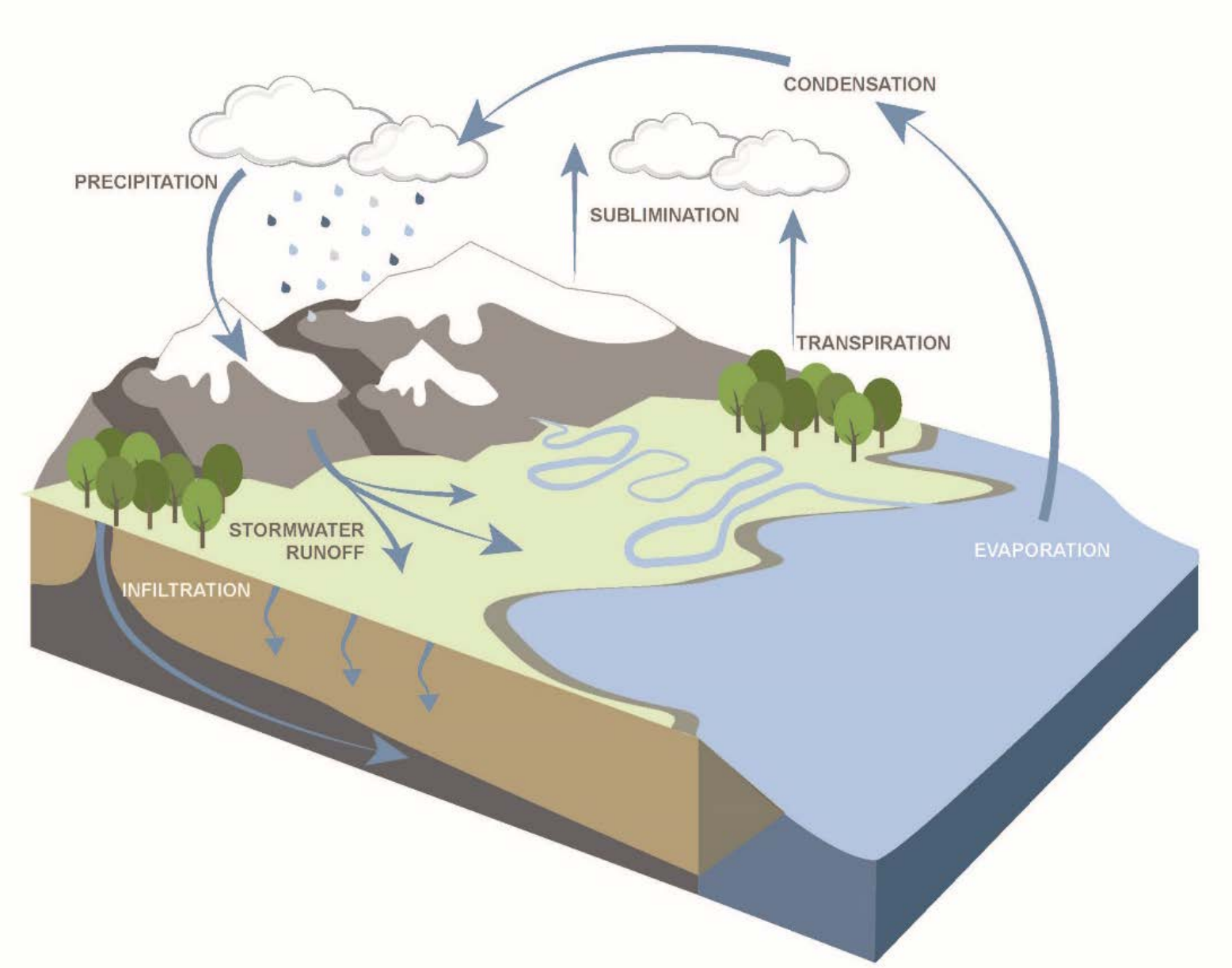
- An area of land that water flows across, through, or under on its way to a stream, river, lake, ocean or other body of water.

- A watershed is like one big bathtub...

Do you know what a watershed is?

Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension

The Natural Hydrologic Cycle



WHERE DOES PRECIPITATION GO?

1. It can *run off*

Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension

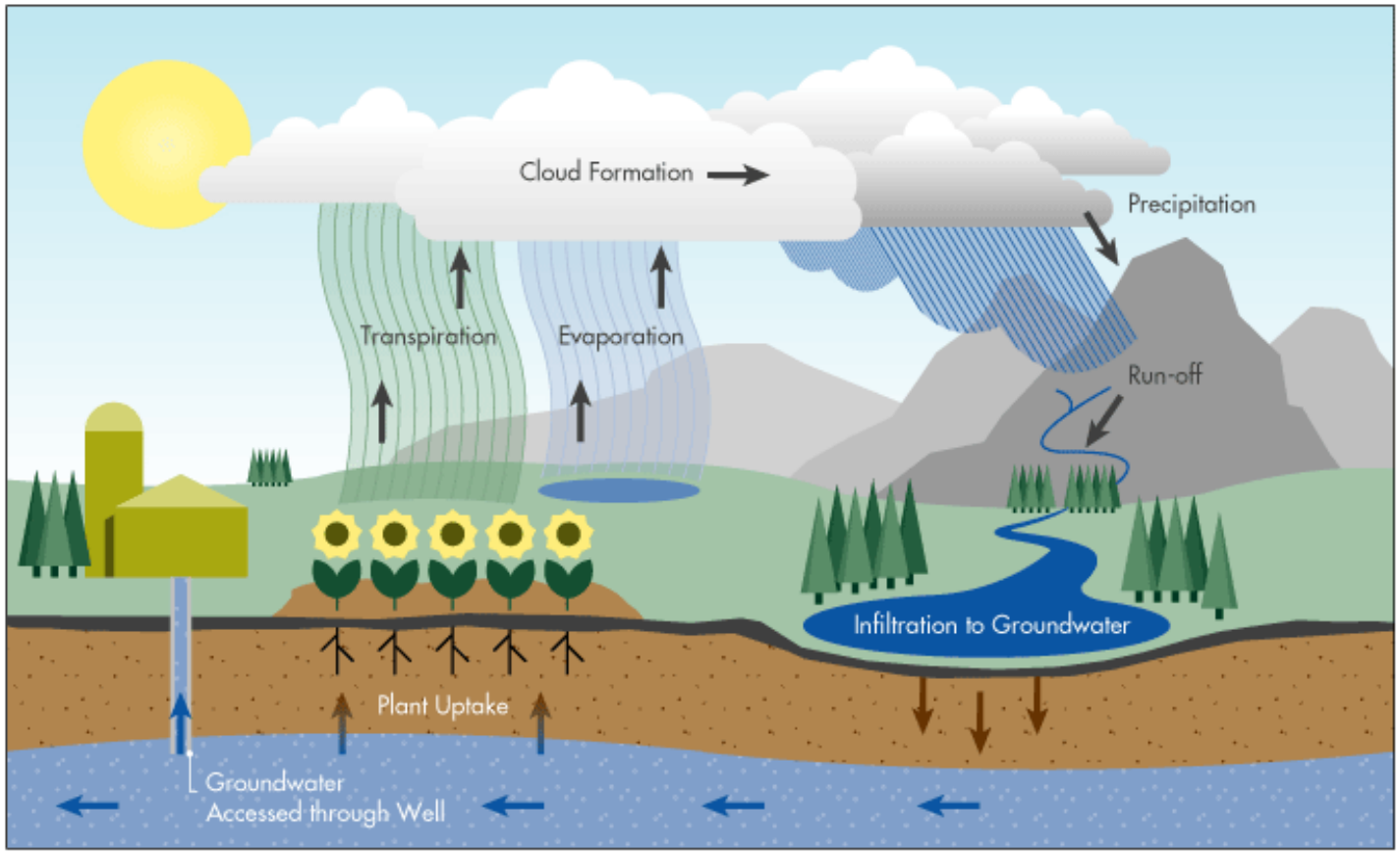
WHERE DOES PRECIPITATION GO?

2. It can be *absorbed* by plants and used for photosynthesis and other biological processes

Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension

WHERE DOES PRECIPITATION GO?

3. It can *infiltrate* through the soil surface and percolate downward to groundwater *aquifers*



Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension

WHERE DOES PRECIPITATION GO?

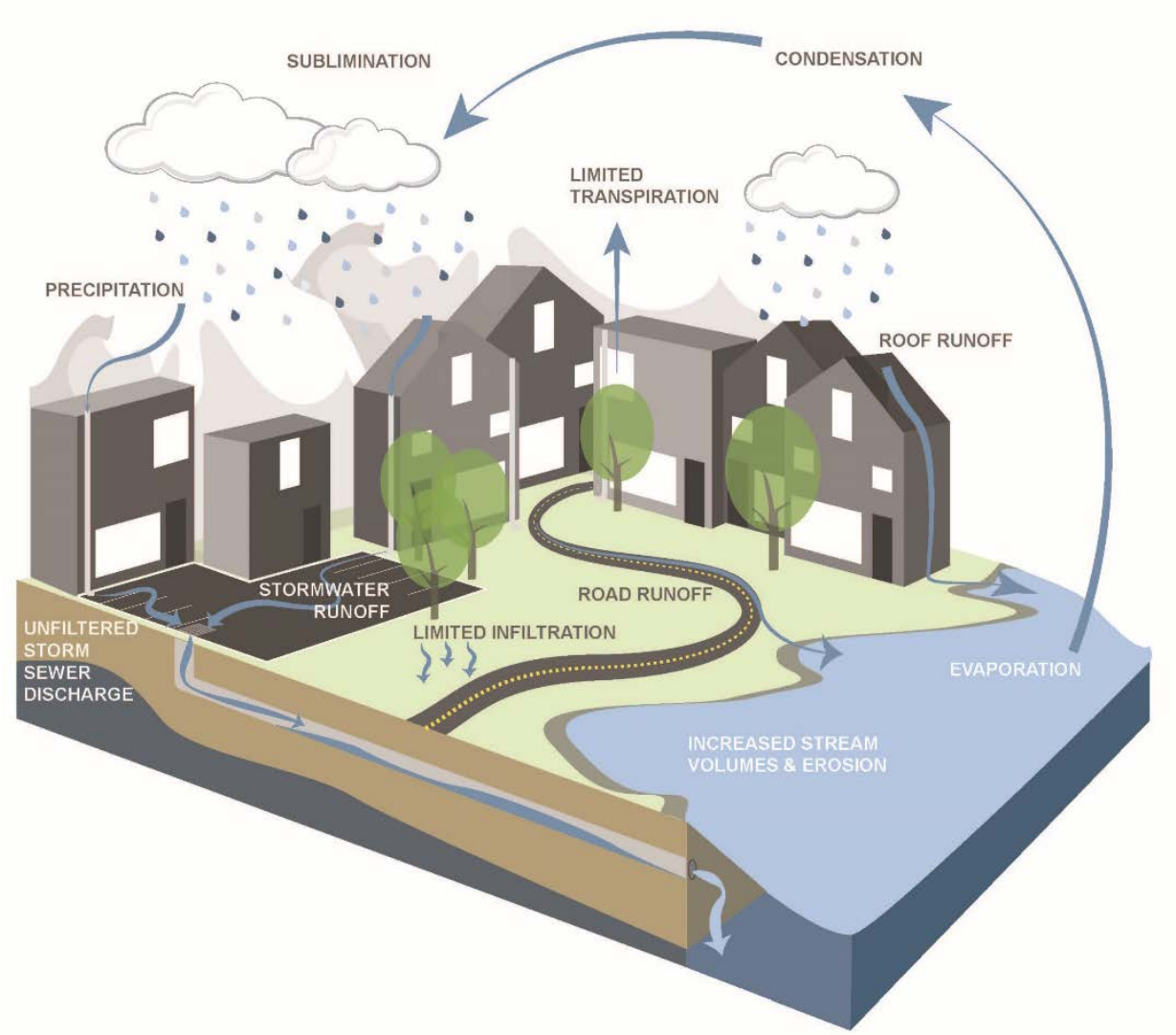
4. It can *evaporate*

Courtesy of Texas Watershed Stewards, Texas A&M AgriLife Extension

The Impact of Development on Stormwater Runoff

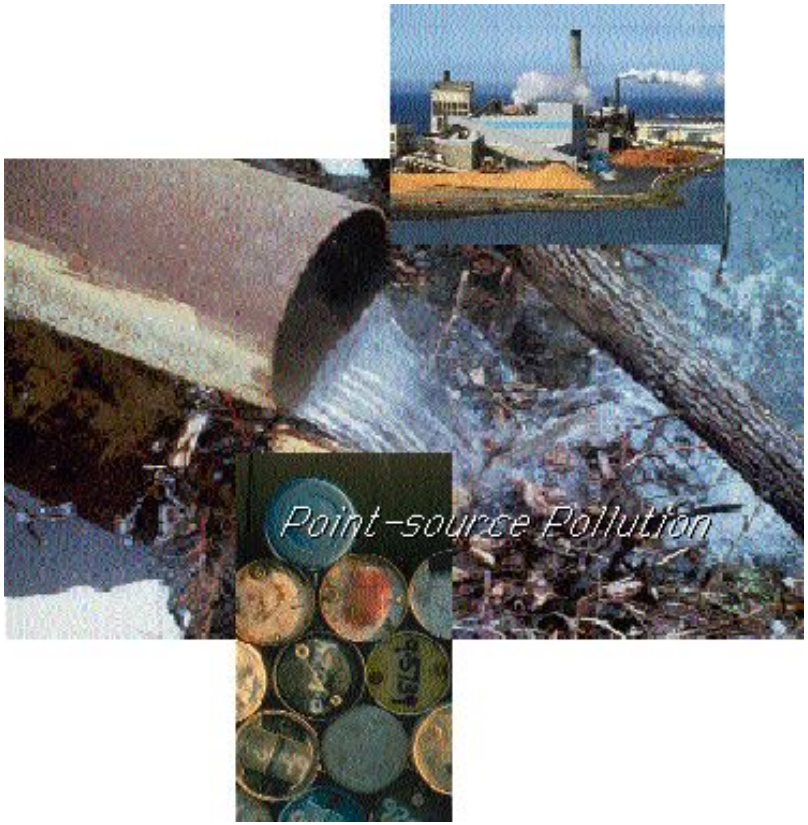
More development → *More impervious surfaces* → *More stormwater runoff*

The Urban Hydrologic Cycle



WATER POLLUTION SOURCES

POINT SOURCE POLLUTION



NONPOINT SOURCE POLLUTION

Environmental Health Perspective, National Institute of Health

POINT SOURCE POLLUTION

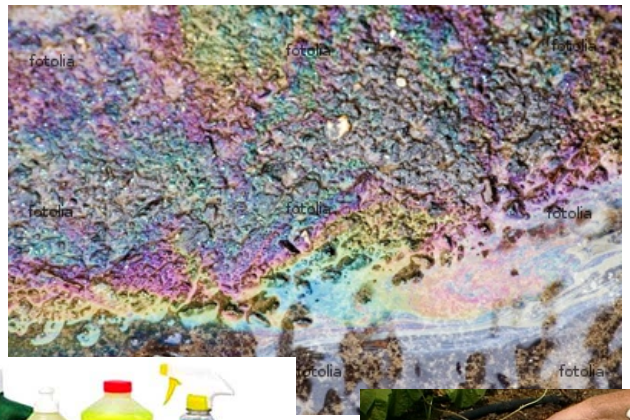
- Comes from a specific source, like a pipe
- Factories, industry, municipal treatment plants
- Can be monitored and controlled by a permit system (NPDES)

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

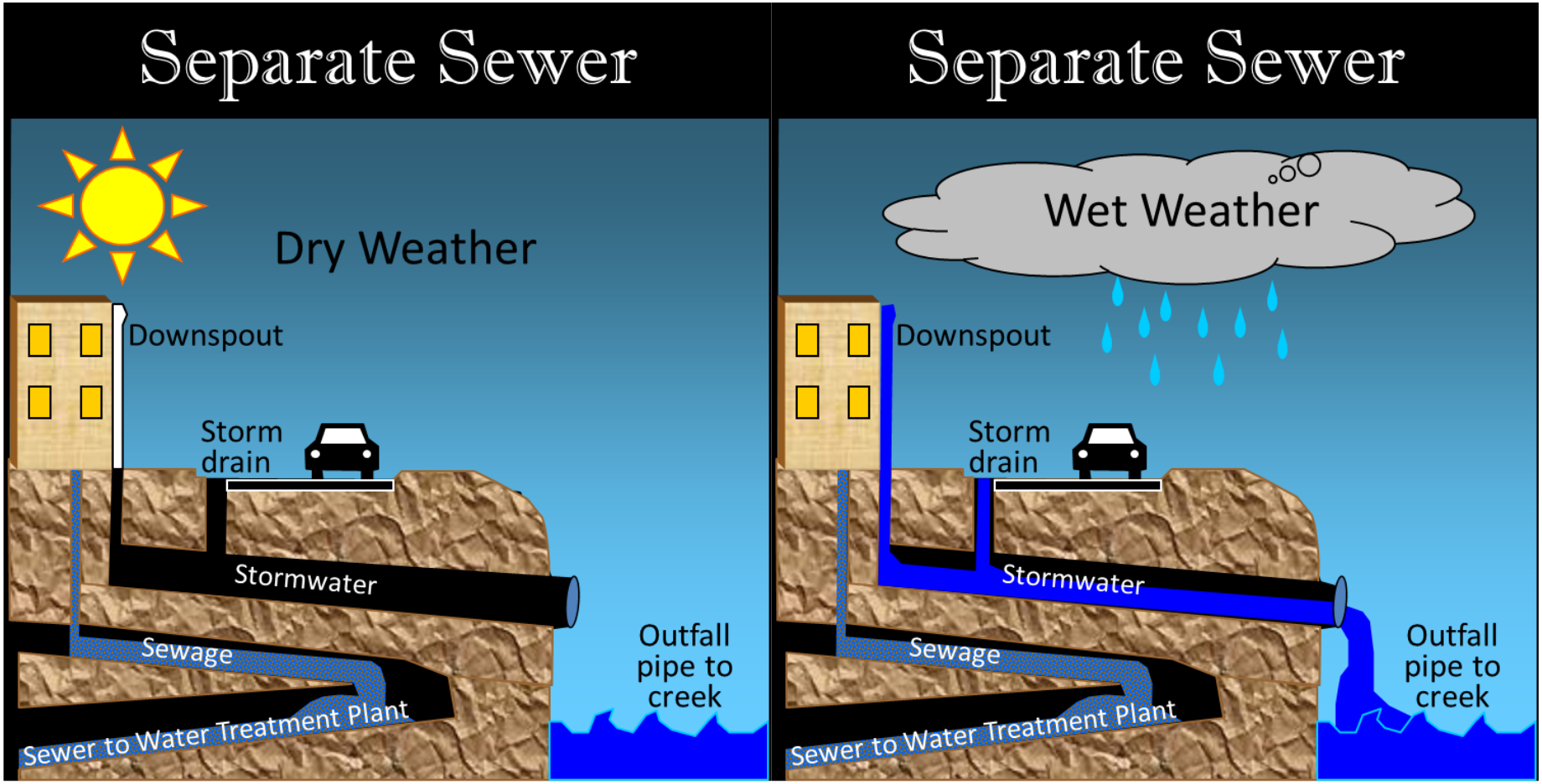


Impacts from Changing the Landscape

Hydrologic Effects:

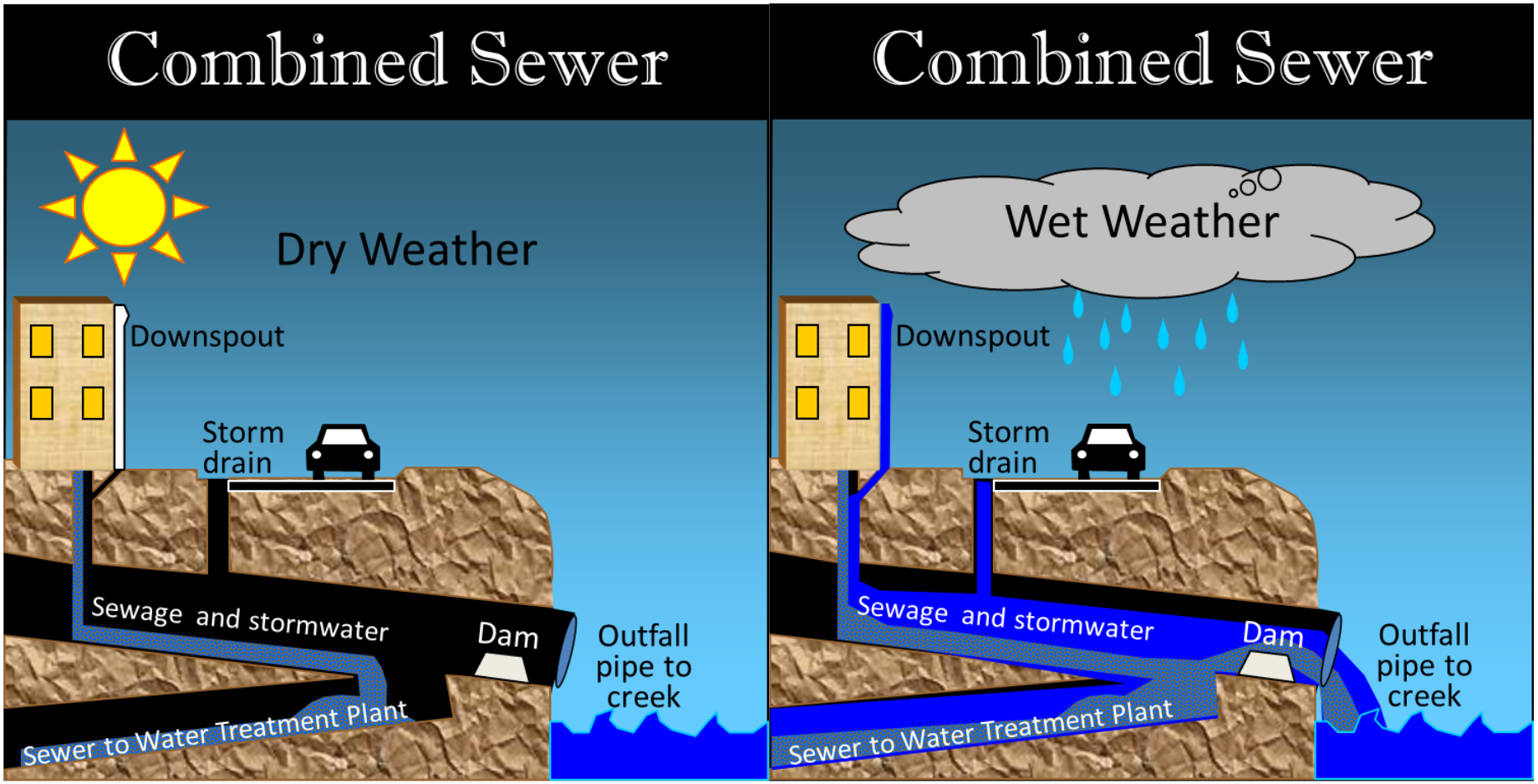
- Disruption of natural water balance
- Increased flood peaks
- Increased stormwater runoff
- More frequent flooding
- Increased bankfull flows
- Lower dry weather flows

Urban Sewer Systems - Separate



SOURCE: Philadelphia Water Department

Urban Sewer Systems - Combined



SOURCE: Philadelphia Water Department

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

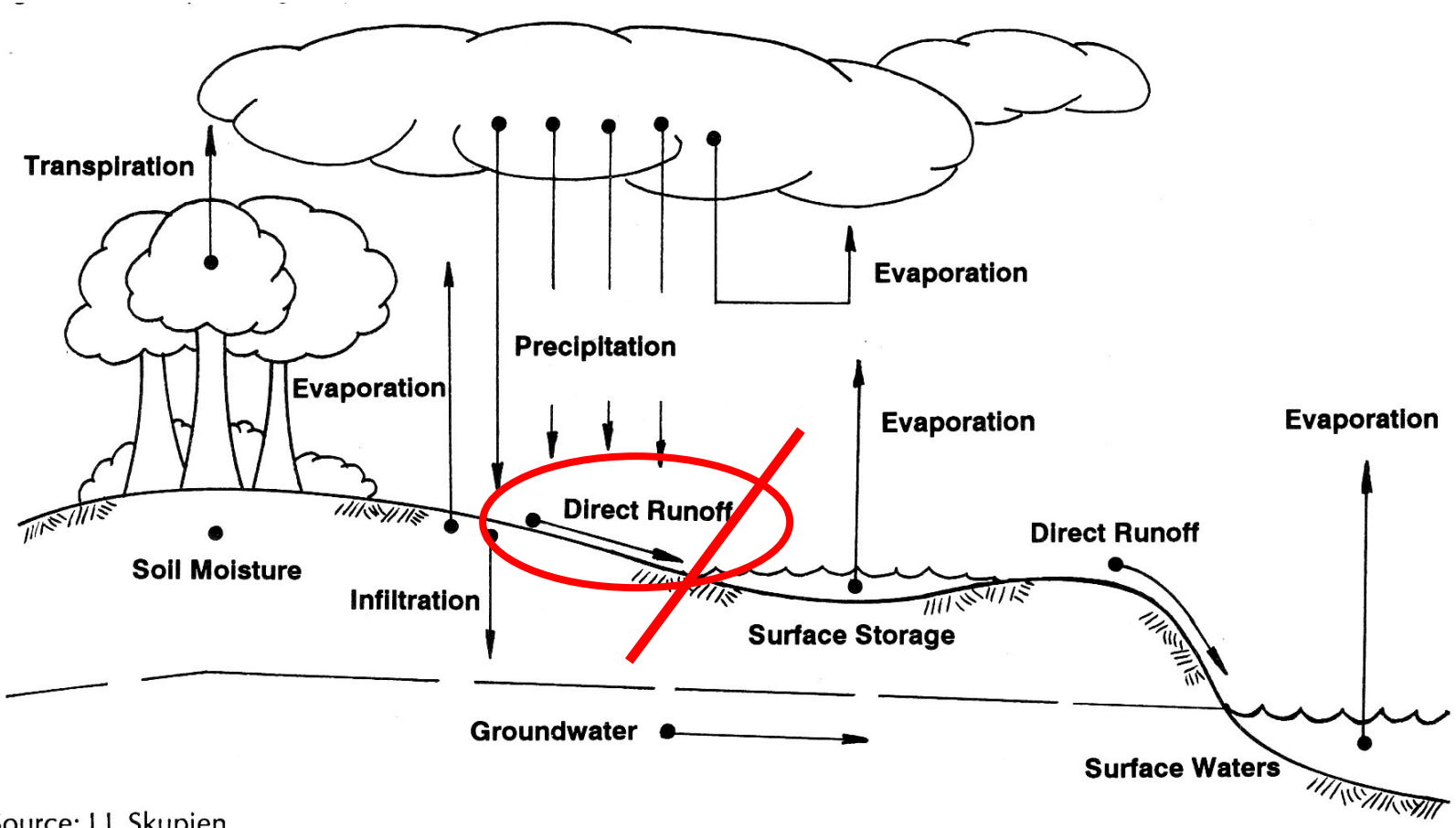
How NJ's regulations change the way we manage stormwater

Break

STORMWATER MANAGEMENT

It is all about controlling runoff from impervious surfaces

The Hydrologic Cycle



Source: J.J. Skupien.

Addressing impervious cover

Can we eliminate it?

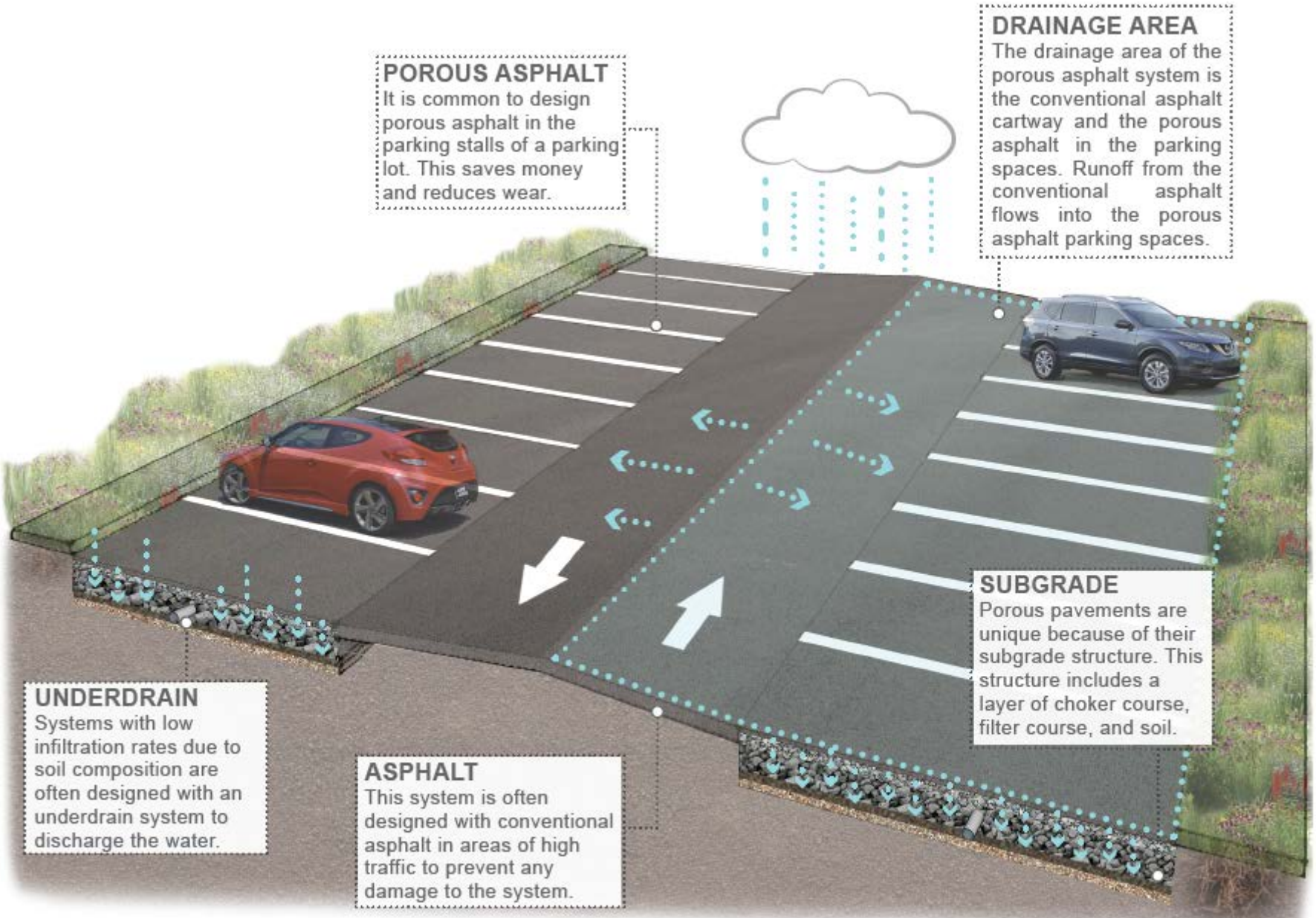
Can we change it?

Can we disconnect it?

Can we reuse it?

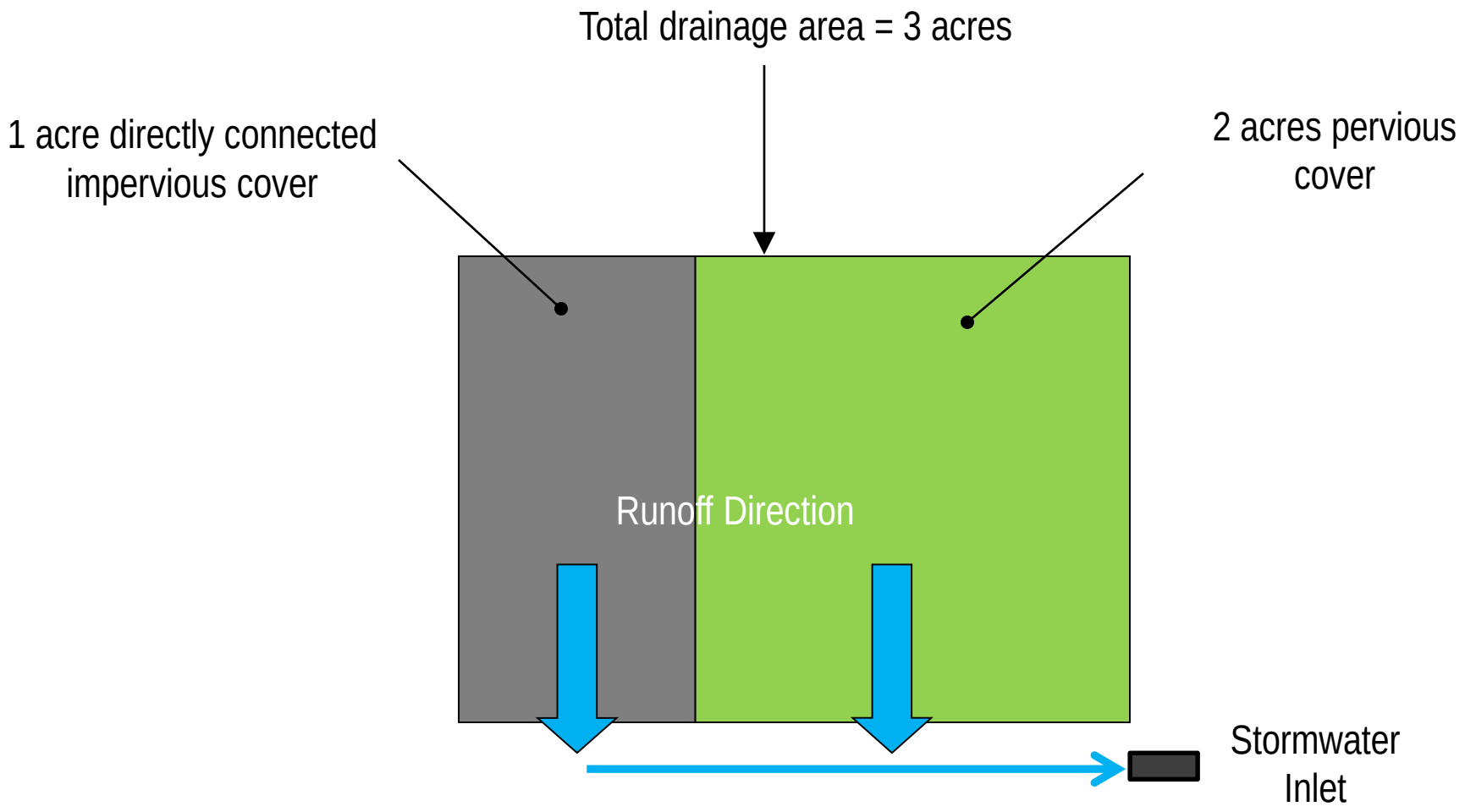
Eliminate it!

Change it!

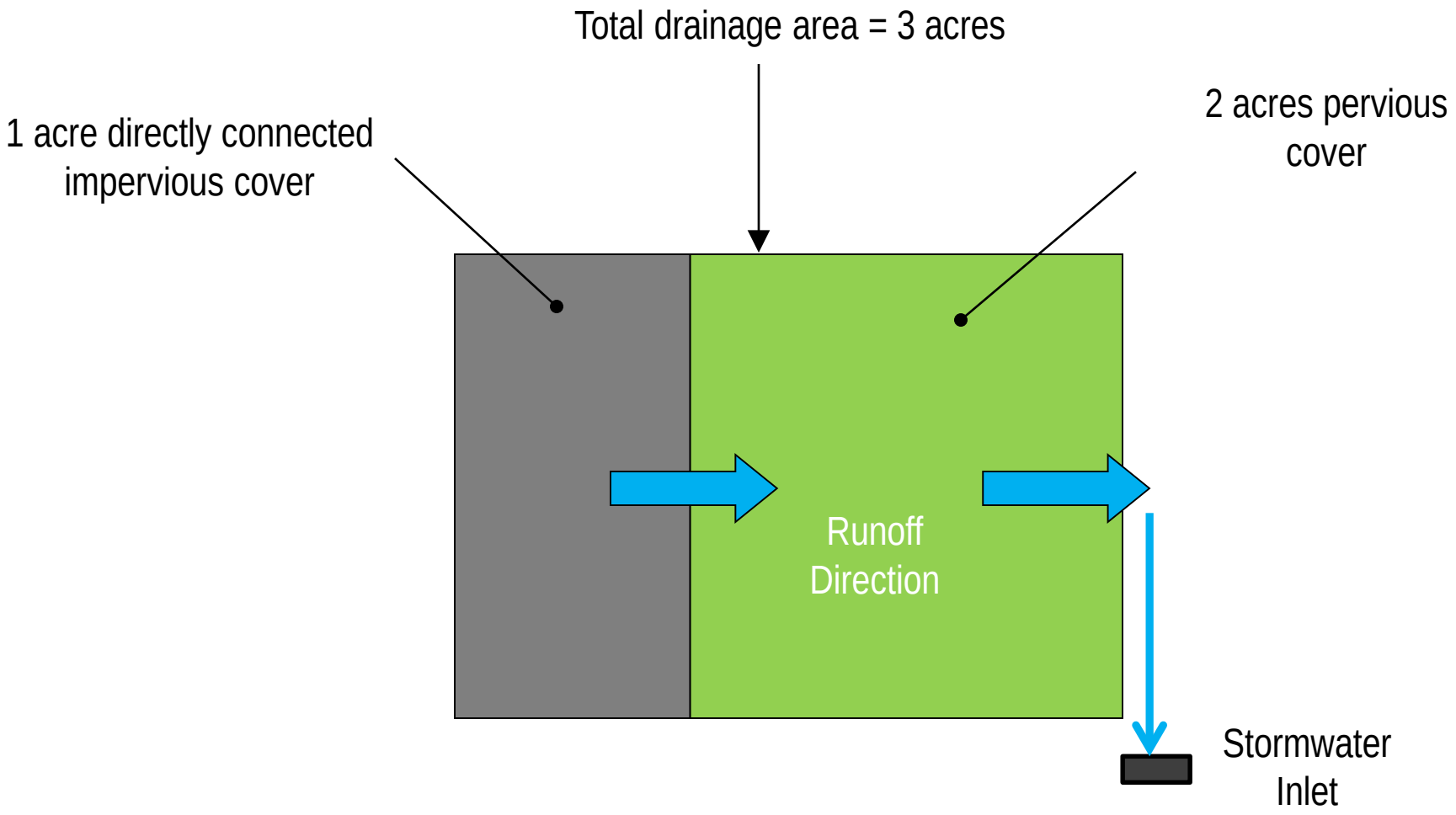

POROUS ASPHALT
It is common to design porous asphalt in the parking stalls of a parking lot. This saves money and reduces wear.
DRAINAGE AREA
The drainage area of the porous asphalt system is the conventional asphalt cartway and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.
SUBGRADE
Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.
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.

Disconnect It!

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

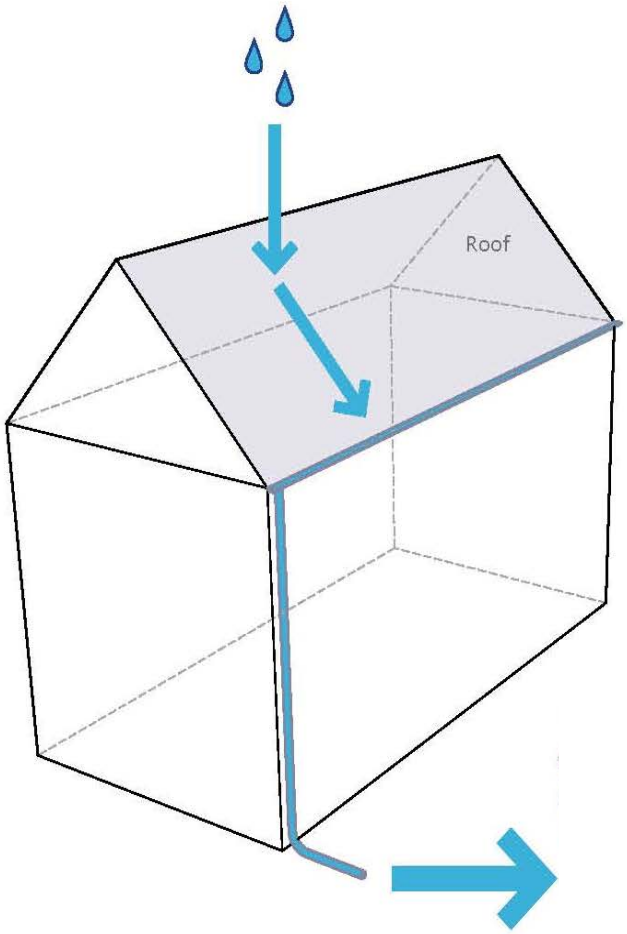


For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**



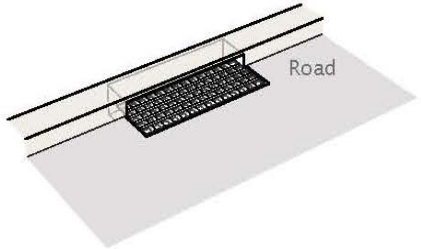
	Volume of Runoff		
Design Storm	**Connected (gallons)**	**Disconnected (gallons)**	**Percent Difference**
1.25 inches (water quality storm)	28,500	4,360	85%

Reuse it!



Disconnect your downspout by installing a rain barrel

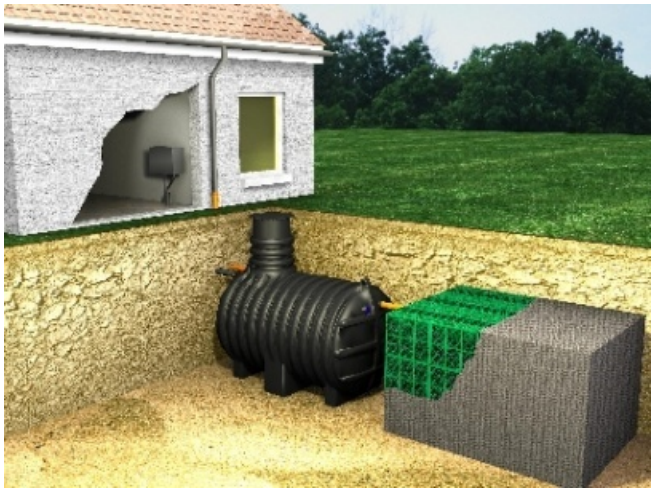
REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS



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

So Many Barrels to Choose From…

Or Larger Rainwater Harvesting Systems…



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 includes:

- Green Roofs
- Rainwater Harvesting
- Tree Filter/Planter Boxes
- Rain Gardens/Bioretention Systems
- Permeable Pavements
- Vegetated Swales or Bioswales
- Natural Retention Basins
- Green Streets

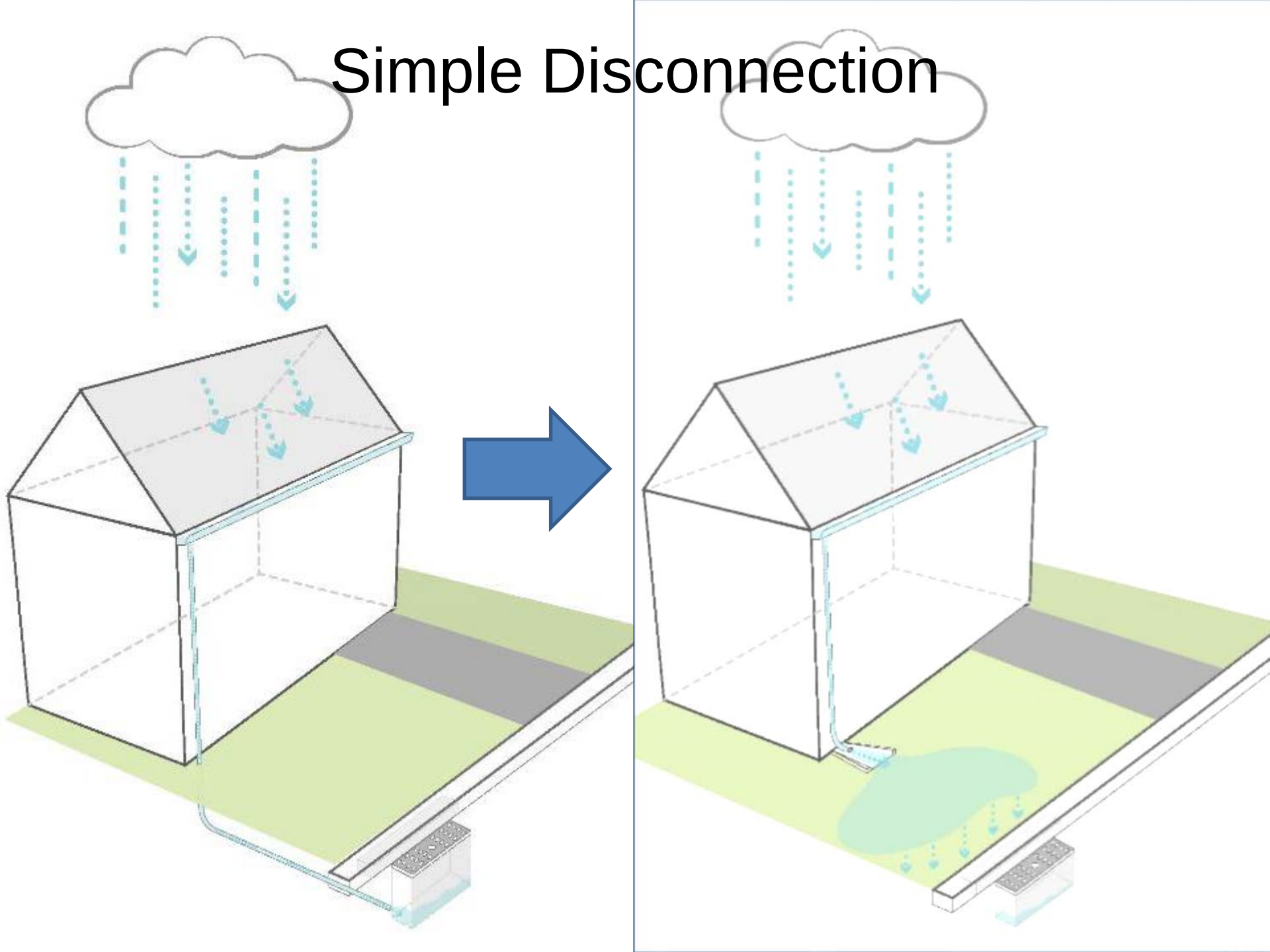




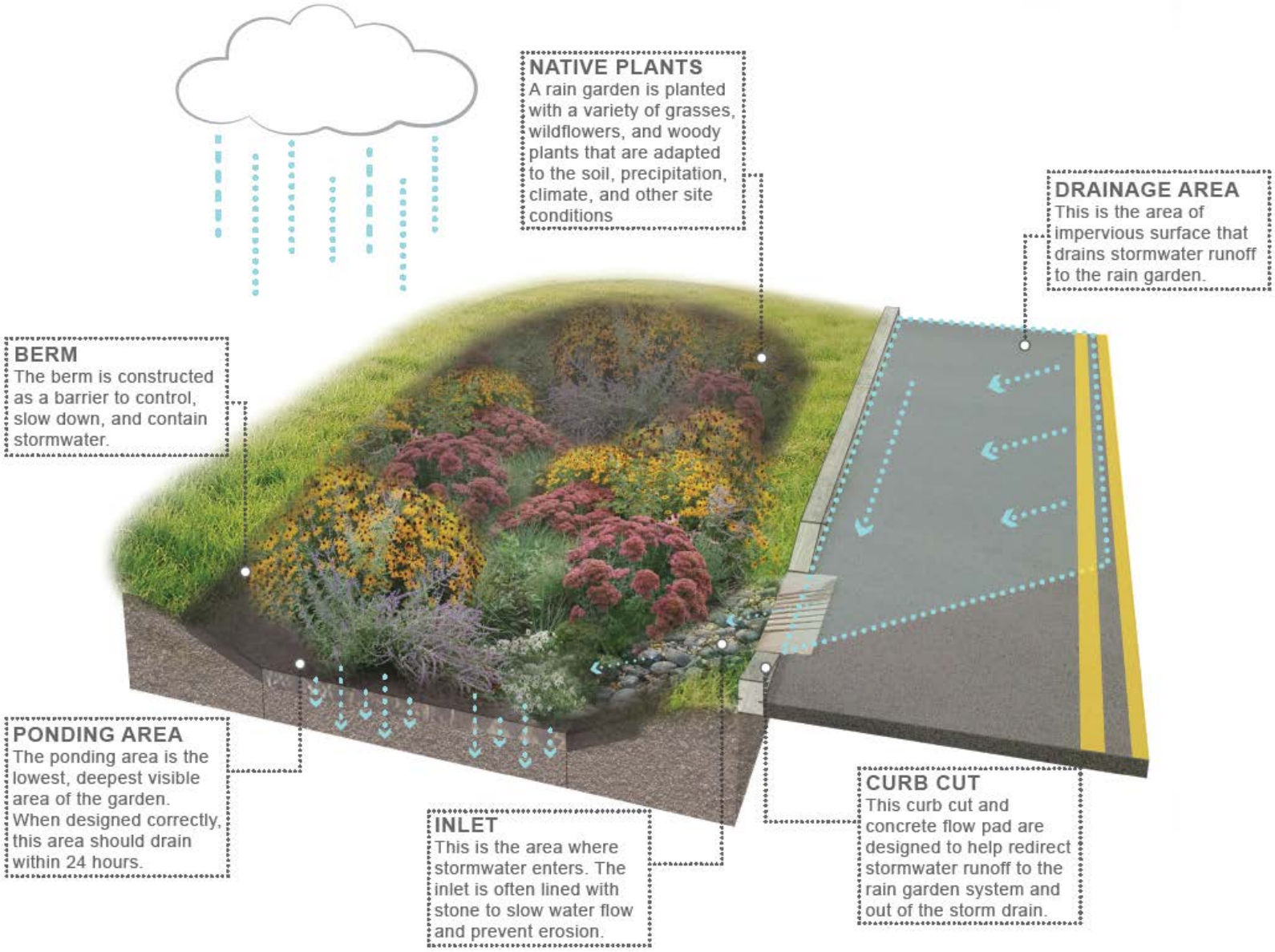



Parker Urban Greenscapes. 2009.

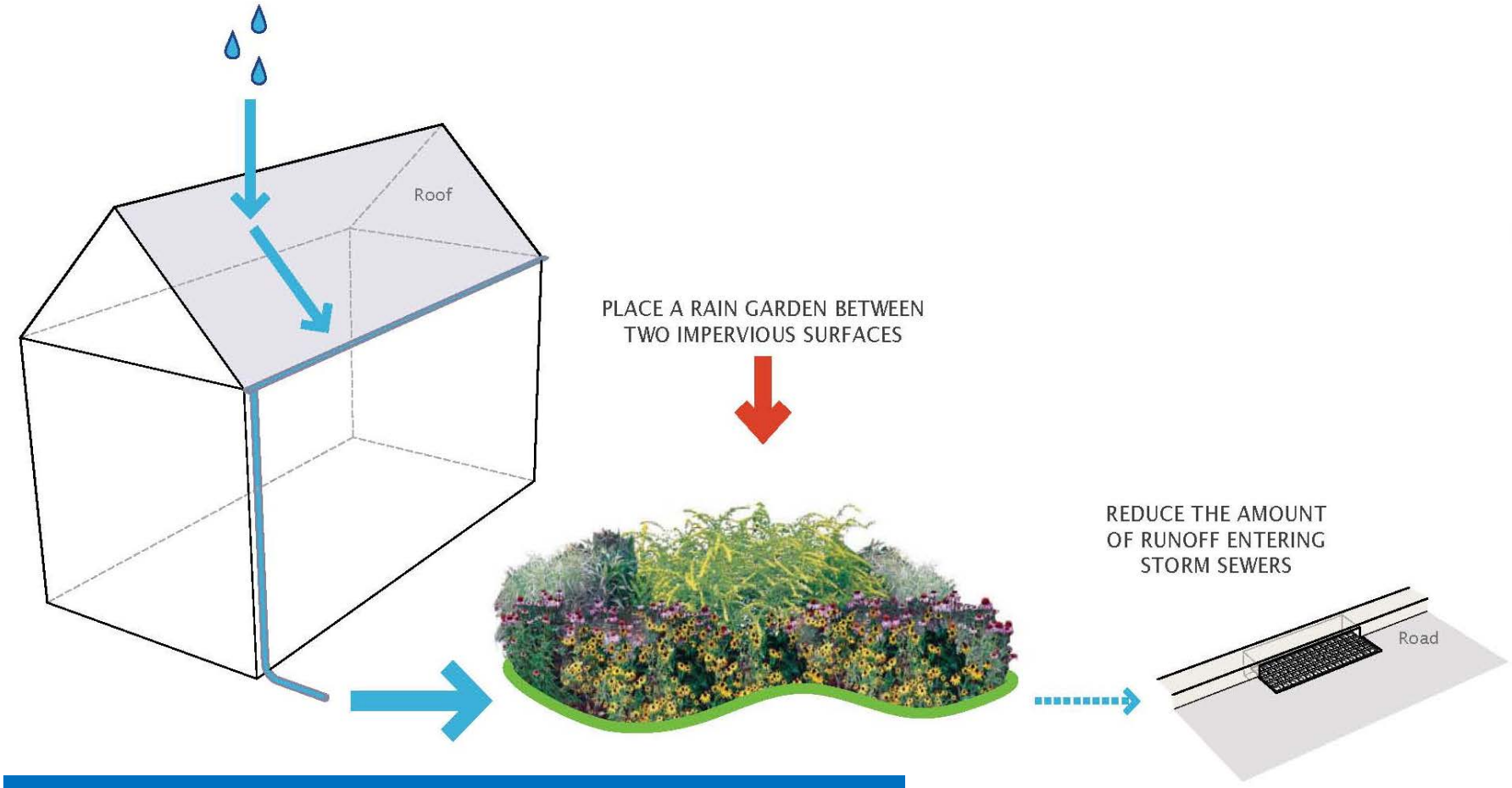
Simple Disconnection



Bioretention Systems/Rain Gardens



Disconnection with Rain Gardens



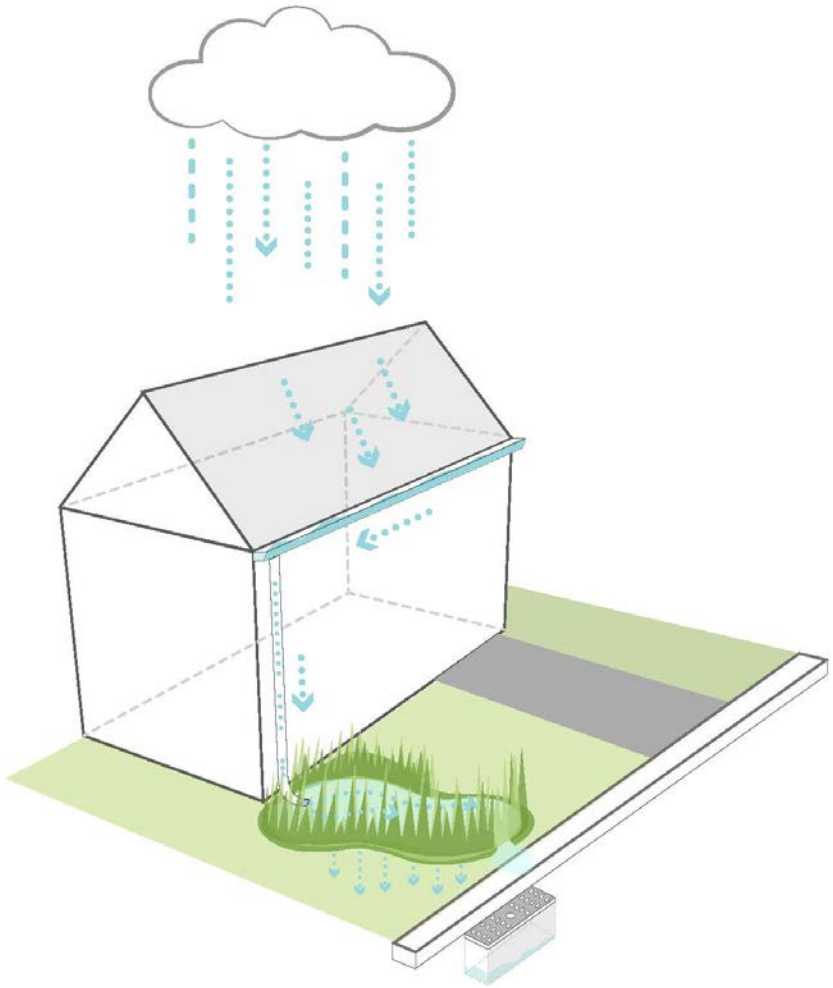
Rooftop runoff is now ***"disconnected"*** from flowing directly into the storm sewer system

Lots of Rain Gardens

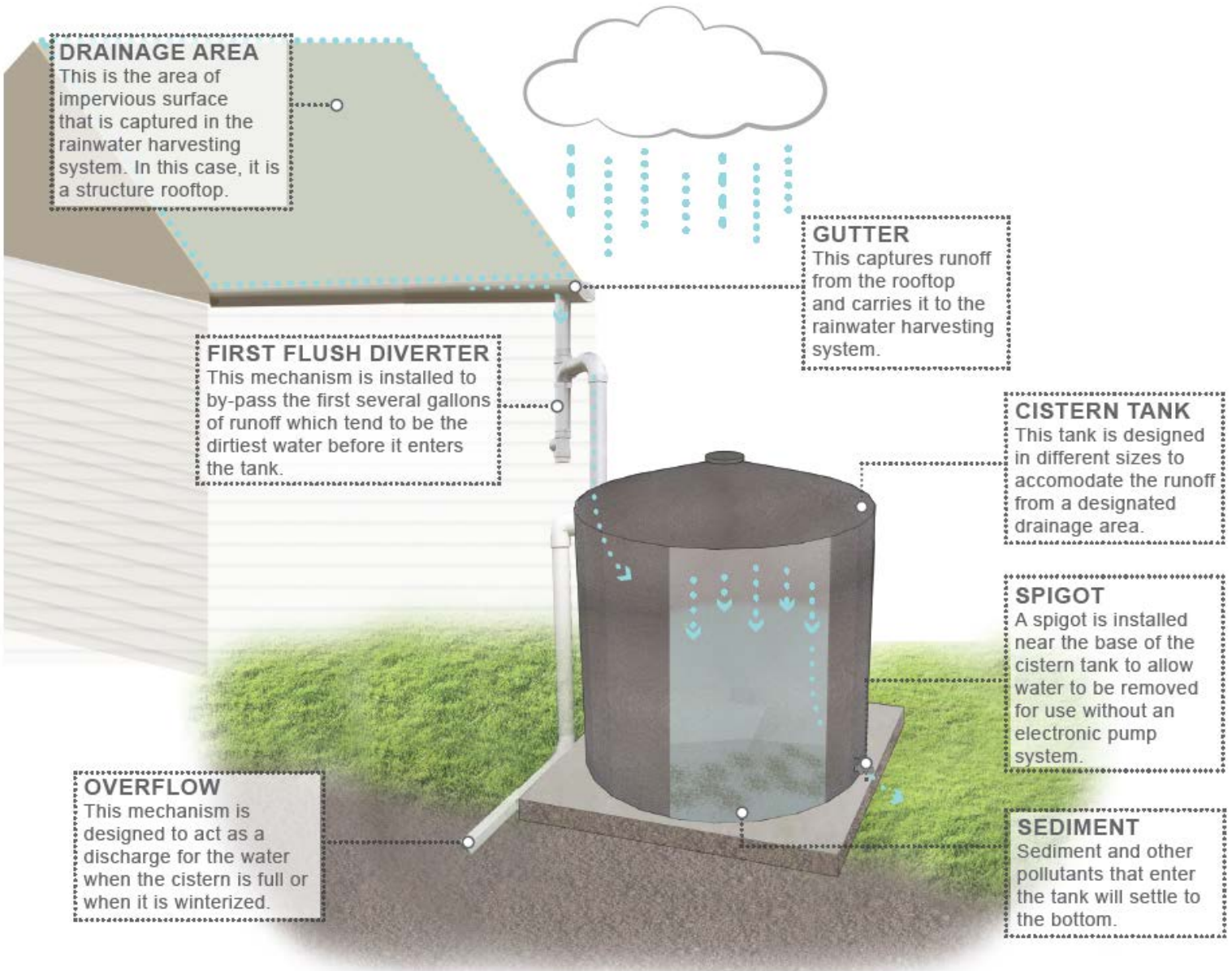

116

Bioretention Systems/Rain Gardens

- Rain gardens can be implemented throughout communities to begin the process of re-establishing the natural function of land.
- They offer one of the quickest and easiest methods to reduce runoff and help protect our water resources.



Rainwater Harvesting Systems

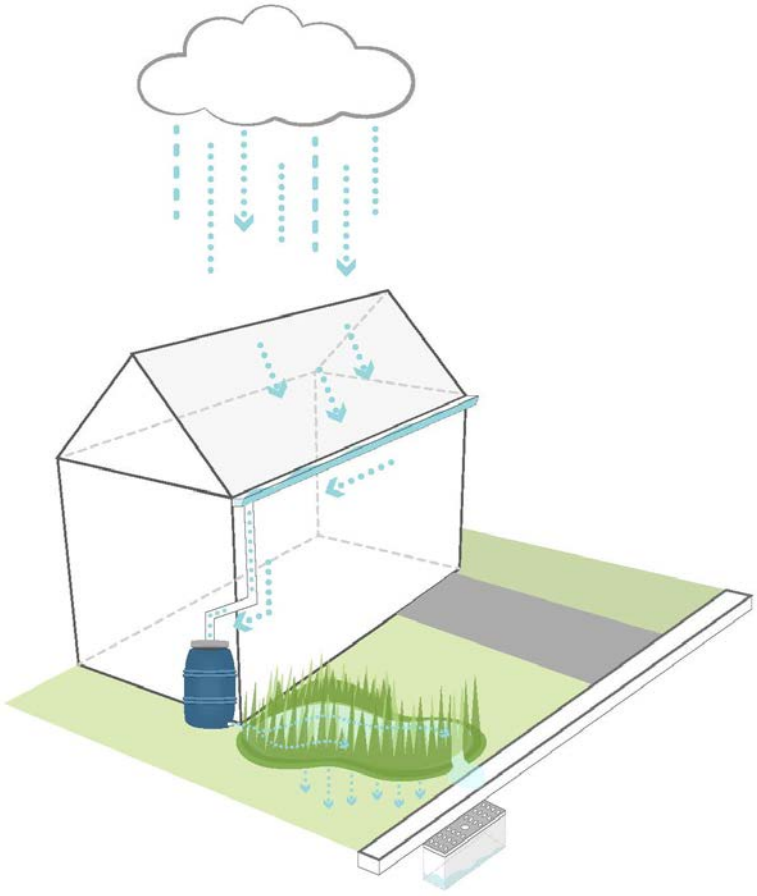



3M
Post-it

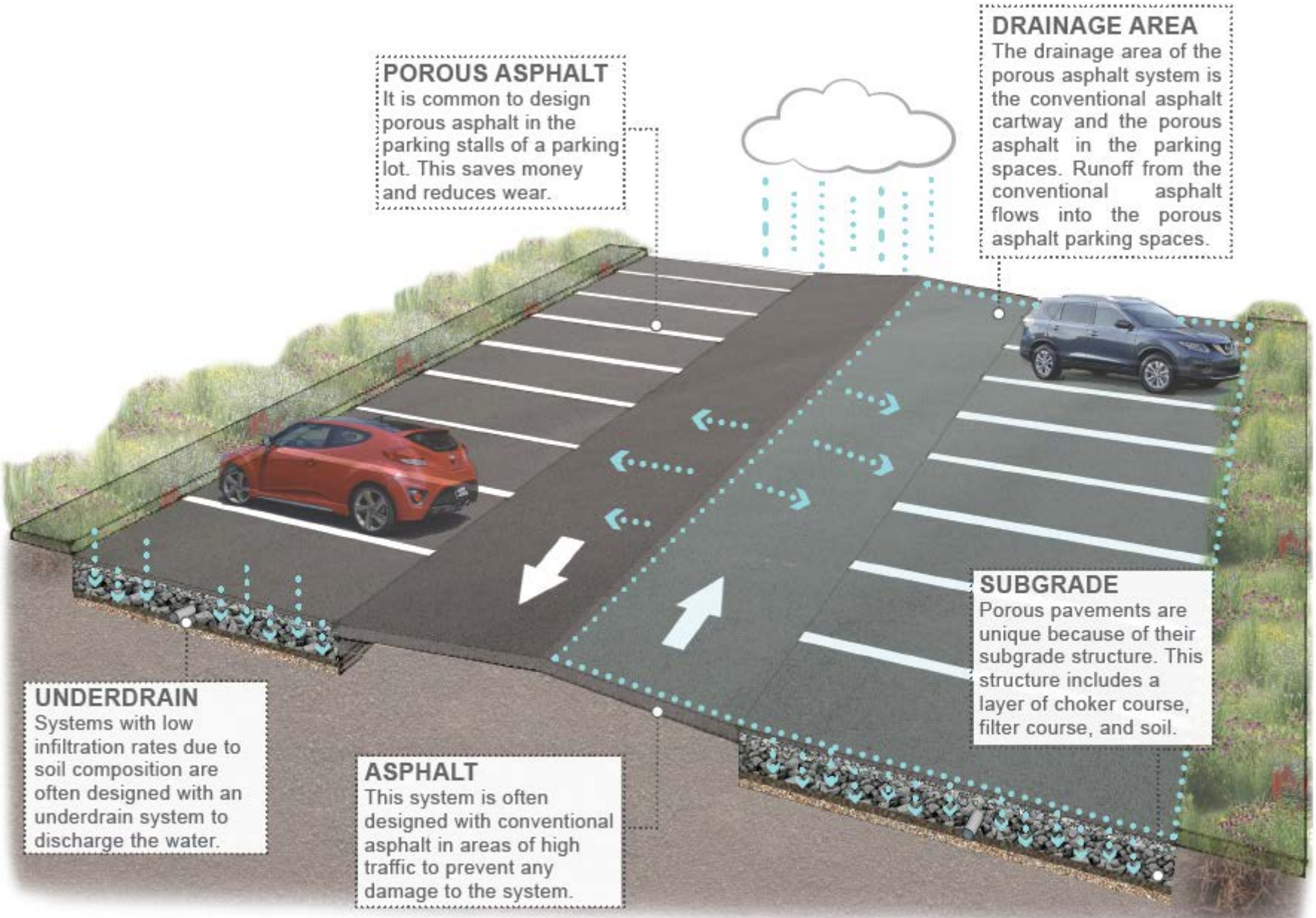

WARNING
NEIGHBORHOOD WATCH PROTECTED AREA
NO PARKING THIS SIDE

Rainwater Harvesting Systems

- These systems are often paired with other green infrastructure practices to increase their storage capacity or efficiency.
- Are commonly paired with a vegetative system to capture the overflow from the system once it has reached full capacity.

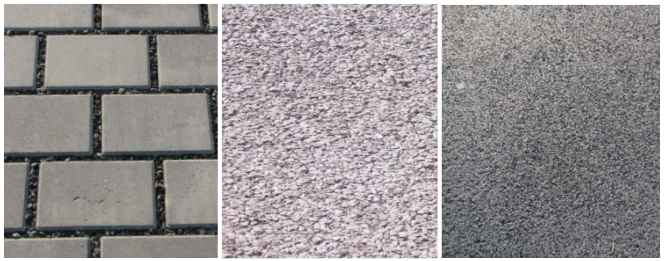


Permeable Pavements



Permeable Pavements

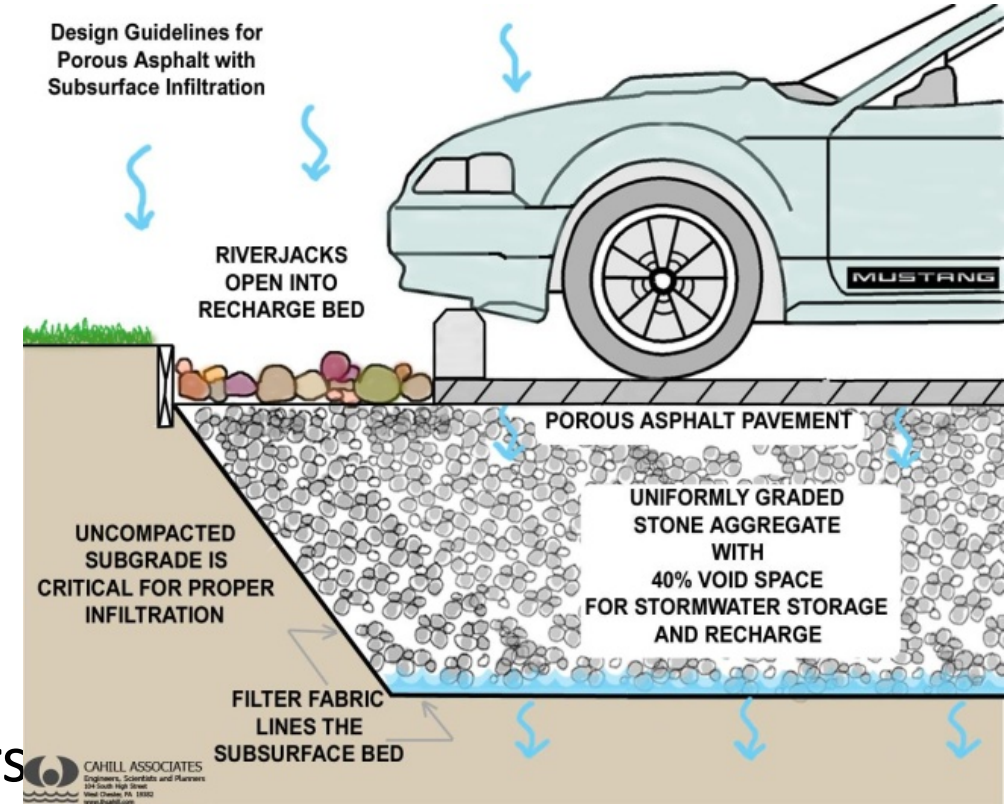
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking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

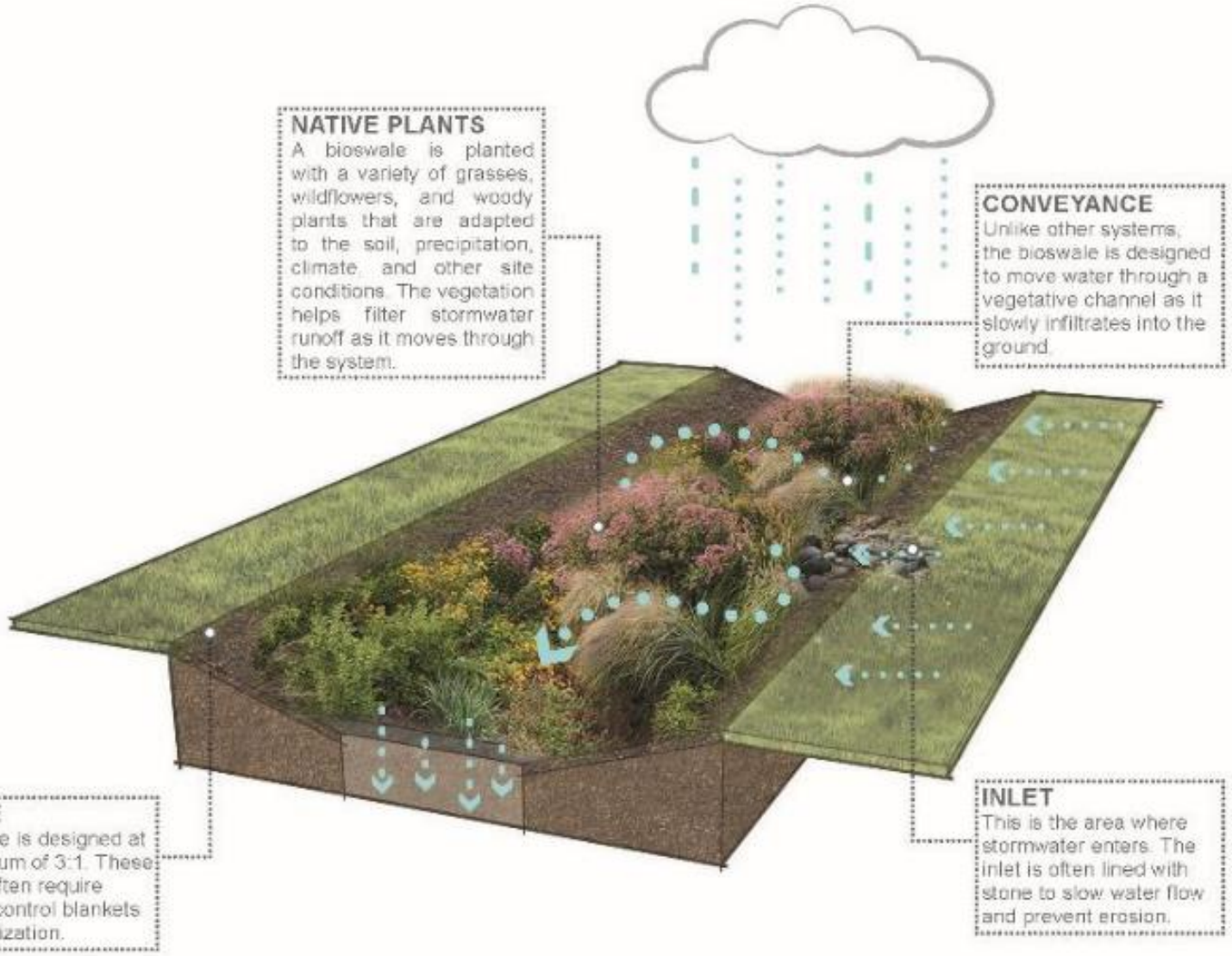


Porous Asphalt


82

Grass Pavers

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.

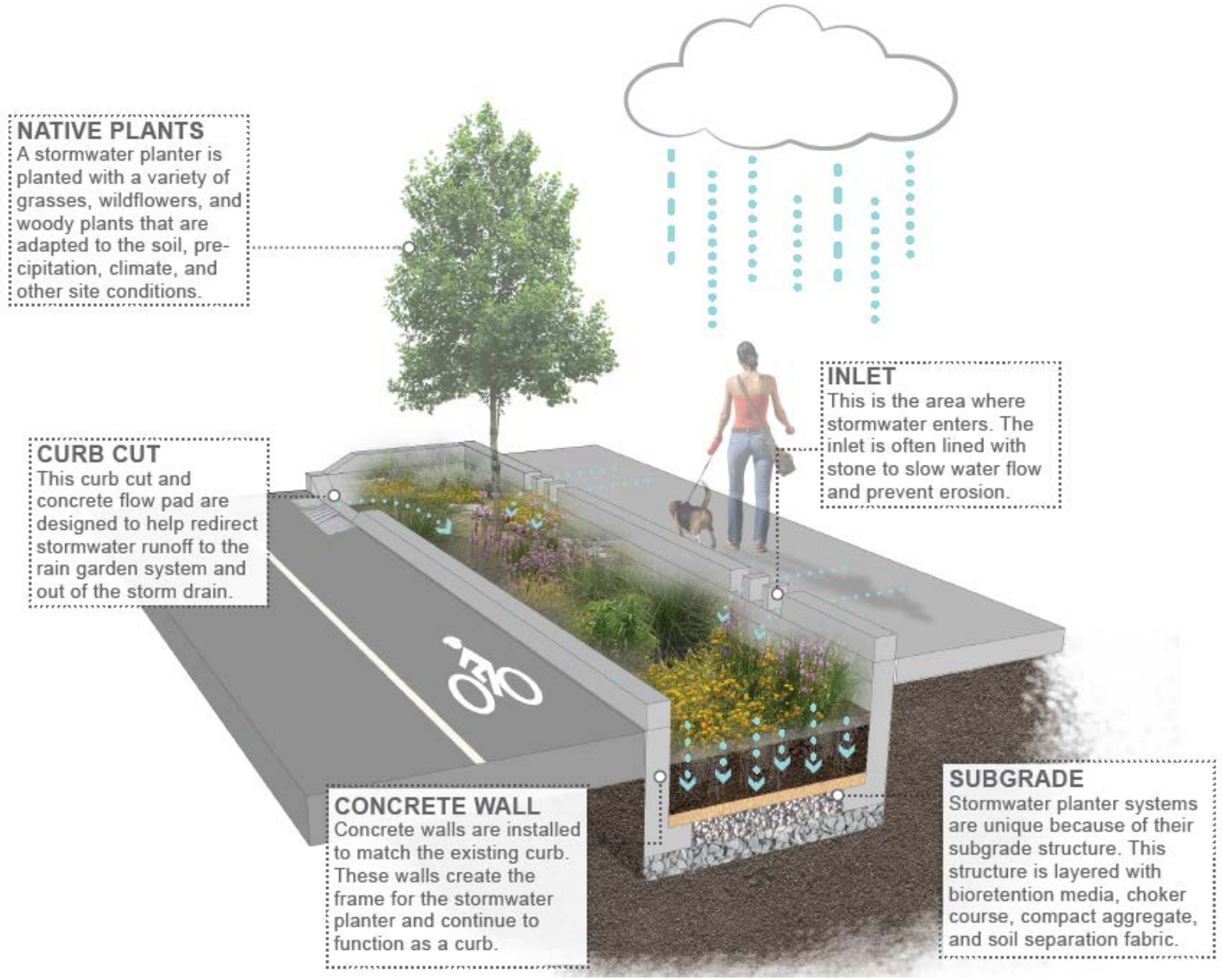
ADVANTAGES

- Transports stormwater
- Filters stormwater
- Infiltrates stormwater
- Aesthetically pleasing
- Creates wildlife habitat

DISADVANTAGES

- Maintenance including sediment and trash removal
- High flow can cause erosion
- Hazard for vehicles

STORMWATER PLANTERS



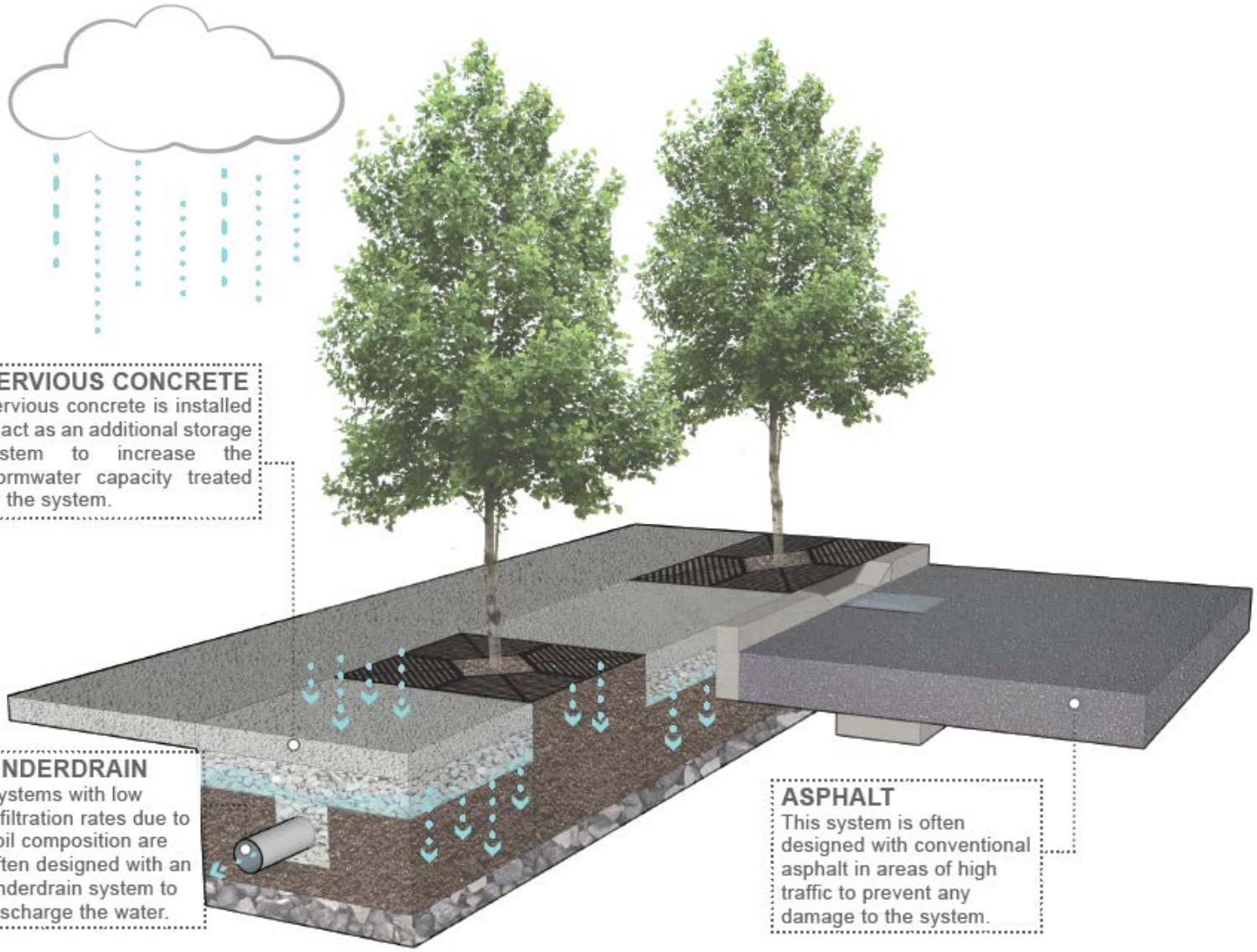
ADVANTAGES

- Combines settling with physical filtering and absorption processes
- Provides very high pollutant removal efficiencies
- More aesthetically pleasing and can be incorporated into the landscapes of most streetscapes
- Provided wildlife habitat
- Sequesters carbon
- Produces oxygen

DISADVANTAGES

- Requires maintenance (weeding, pruning, mulching)
- Collects trash
- Can release nutrients from bioretention soil mix
- May not be aesthetically appealing to everyone
- Can be expensive due to curbing and sidewalk removal
- Utilities can be a problem to work around
- Possible tripping hazard

TREE FILTER BOXES IN A STREETSCAPE



ADVANTAGES

- Easy to incorporate into streetscapes
- Provides shading and helps with heat island effect
- Enhance aesthetics
- Provided wildlife habitat
- Sequesters carbon
- Produces oxygen

DISADVANTAGES

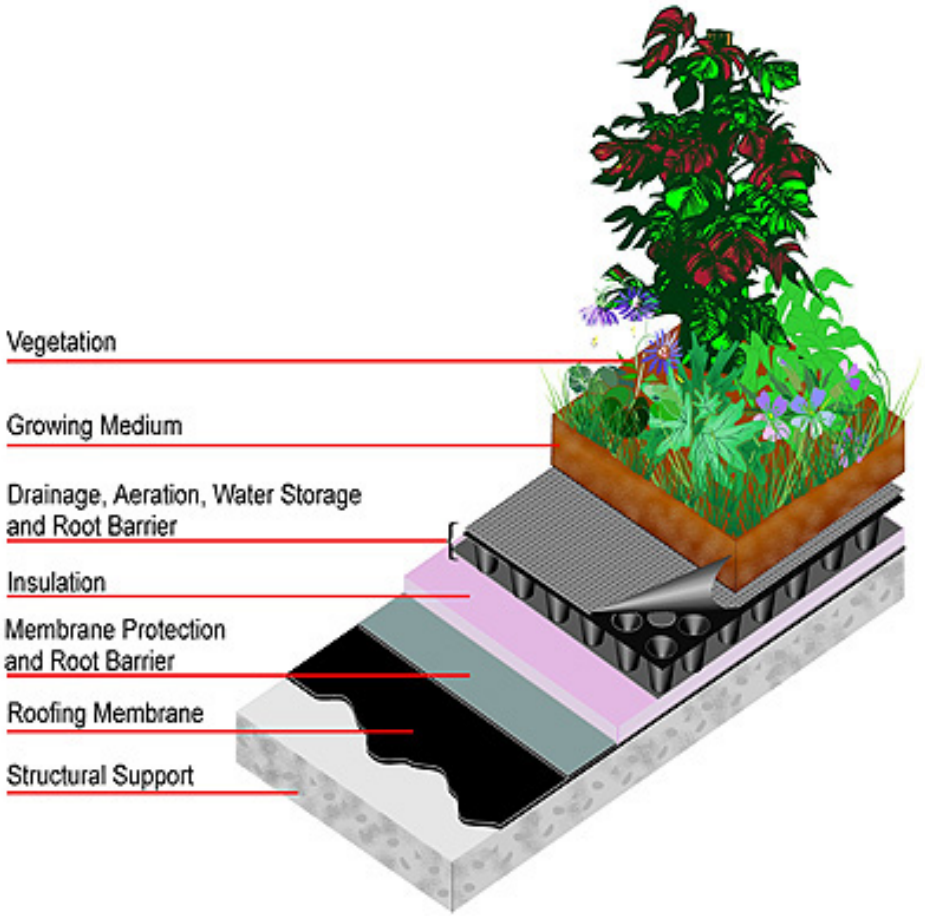
- Can be expensive
- Tree filter box has little storage capacity unless incorporated into an enhanced tree pit system
- Maintenance – trees need pruning
- Wildlife habitat – too many birds; can stimulate local car wash business

GREEN ROOFS

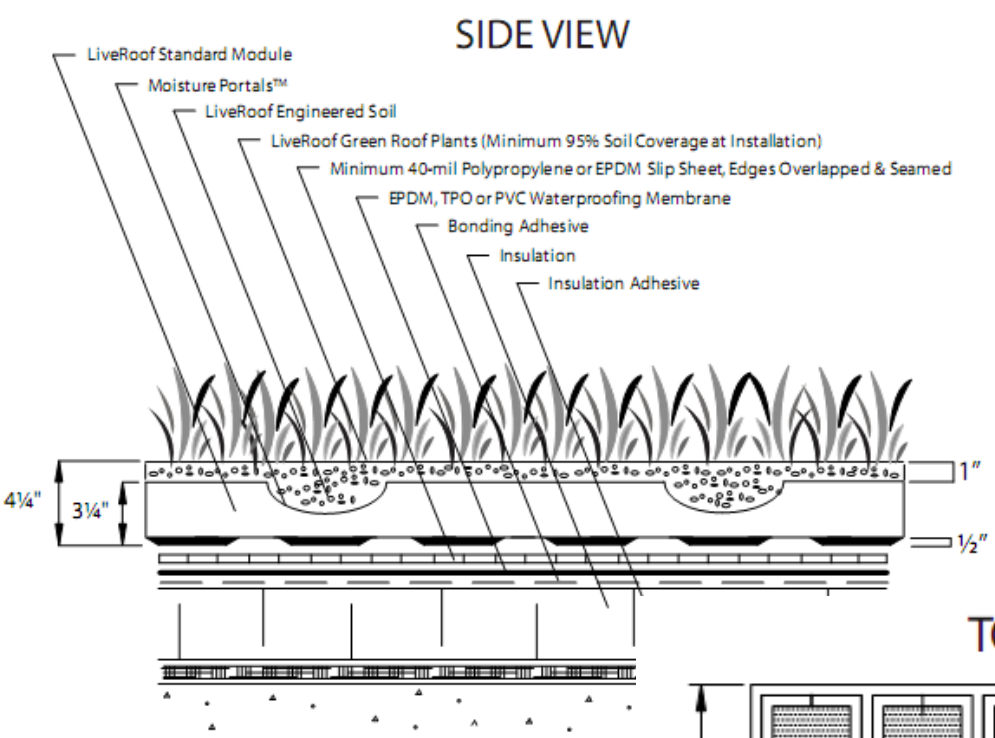
FUNCTIONS

- 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

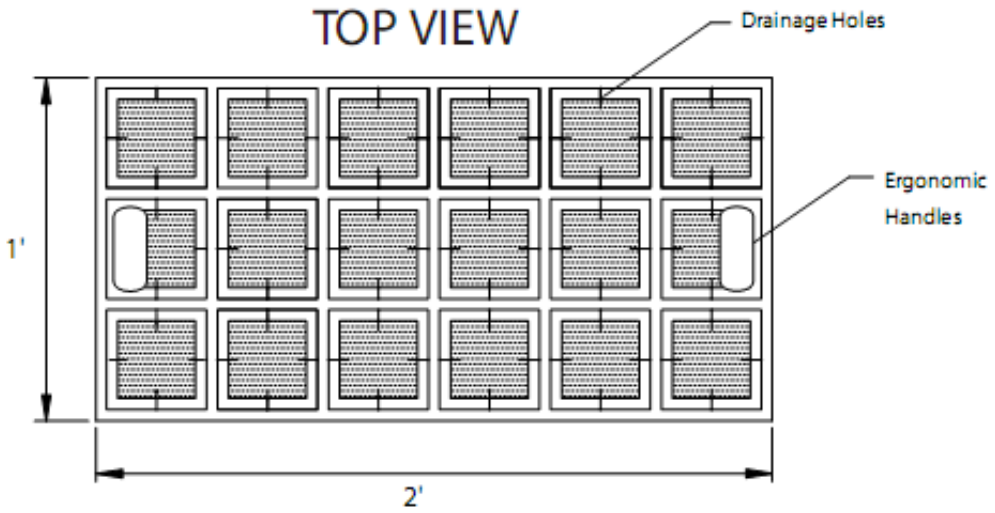
COMPONENTS



Modular System Specifications




Parker Urban Greenscapes.



DISADVANTAGES

- Very expensive
- Minimal stormwater management (up to ½ inch of rain)
- Very heavy and hard to retrofit on existing roof
- Facility managers tend to not be very supportive – “roof will leak”
- Did I mention – very expensive

The Paraprofessional Process Part I and Field Site Visit

What are good sites?

- 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

Google or Bing Maps

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

Let’s Get To Work

- Divide into six teams
- Each team will receive a site
- Each team will identify where green infrastructure can be installed on that site
- One person from each team will present recommendations for the site

LUNCH

AUTEN ROAD SCHOOL

Address: 281 Auten Road, Hillsborough, NJ 08844

property line 2012 Aerial: NJOIT, OGIS

1

2

GREEN INFRASTRUCTURE RECOMMENDATIONS

Auten Road School

- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 75' 150'

AUTEN ROAD SCHOOL

Subwatershed: Royce Brook

Site Area: 2,128,895 sq. ft.

Address: 281 Auten Road
Hillsborough, NJ 08844

Block and Lot: Block 150, Lot 10

Runoff from the parking lot can be managed with several rain gardens. Additional stormwater can be infiltrated with pervious pavement. A preliminary soil assessment suggests that the soils have suitable characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
14	295,524	14.2	149.3	1,356.9	0.230	8.11

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.751	126	55,576	2.09	7,500	$37,500
Pervious pavements	0.701	117	51,911	1.95	4,615	$115,375

MOUTAIN VIEW PLAZA

Address: 856 US Highway 206, Hillsborough, NJ 08844

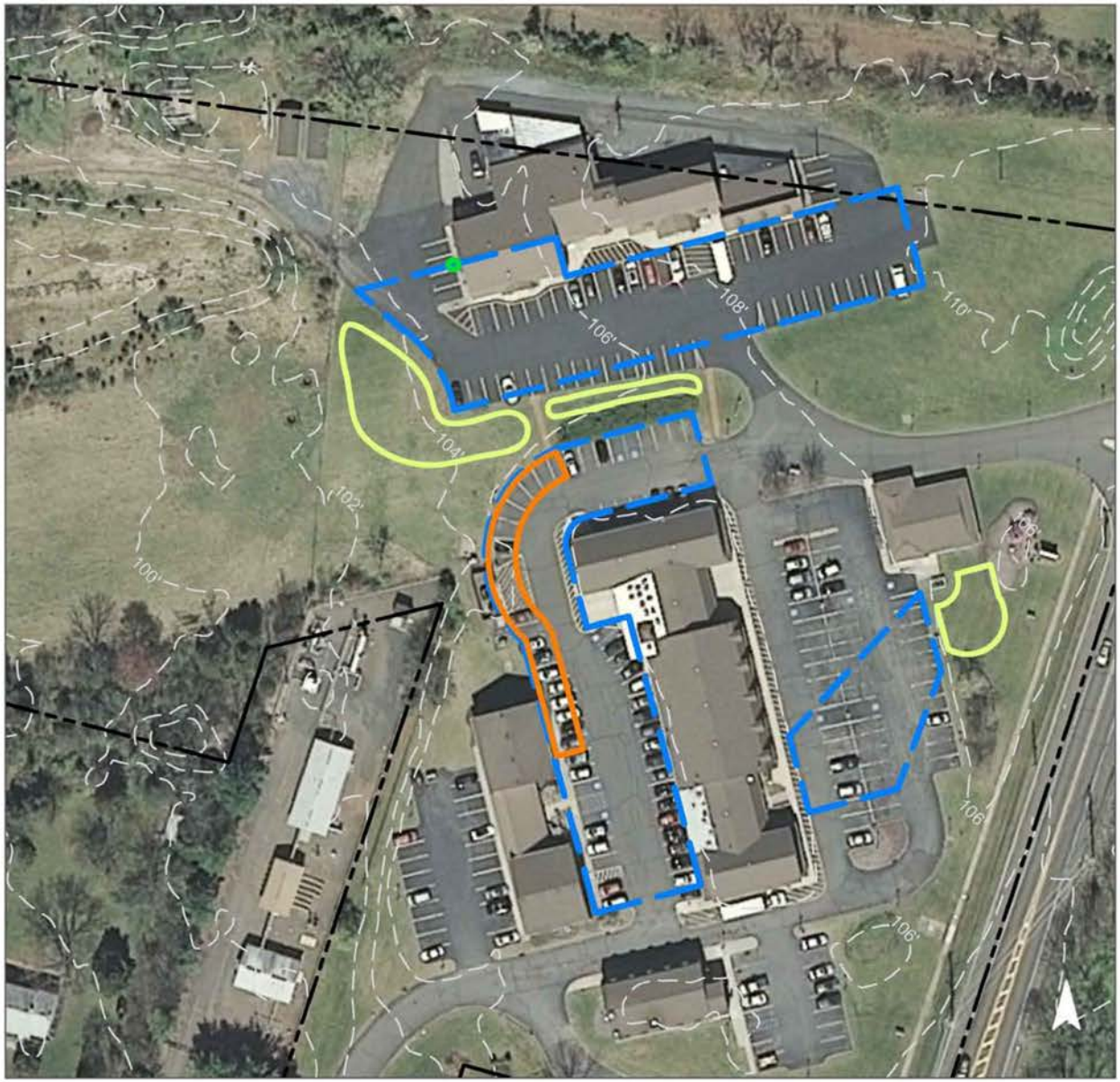
property line 201 Aerial: NJOIT, OGIS

1

2

3

GREEN INFRASTRUCTURE RECOMMENDATIONS



Mountain View Plaza

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

MOUNTAIN VIEW PLAZA

Subwatershed: Pike Run

Site Area: 503,957 sq. ft.

Address: 856 US Highway 206
Hillsborough, NJ 08844

Block and Lot: Block 177, Lot 24.02

Several rain gardens can capture, treat, and infiltrate stormwater. Pervious pavement can infiltrate additional runoff. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
38	190,333	9.2	96.1	873.9	0.148	5.22

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.845	141	62,570	2.35	8,065	$40,325
Pervious pavements	0.605	101	44,805	1.68	3,860	$96,500

NEW JERSEY REGIONAL DAY SCHOOL

Address: 425 Johnston Avenue, Jersey City, NJ 07304, Ward F

property line 2012 Aerial: NJOIT, OGIS

1

2

1) New Jersey Regional Day School

- disconnection
- permeable pavement
- bioretention systems
- drainage area
- property line
- 2012 Aerial: NJOIT, OGIS

425 Johnston Avenue,
Jersey City, NJ 07304, Ward F

RUTGERS
New Jersey Agricultural Experiment Station

0' 50' 100'

New Jersey Regional Day School is a public school campus with ample open lawn and parking areas. Downspouts can be diverted t demonstration rain gardens in lawn areas adjacent to the building. Parking areas could manage stormwater runoff through the additio of permeable pavement.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	From the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
60.5	120,726	5.8	61.0	554.3	0.094	3.31

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.245	41	18,072	0.68	2,390	$11,950
Disconnection	-	-	-	-	-	$1,250
Permeable pavement	0.499	84	36,749	1.38	4,500	$112,500

EVERGREEN SENIOR CENTER

Address: 400 Inman Avenue, Colonia, NJ 07067

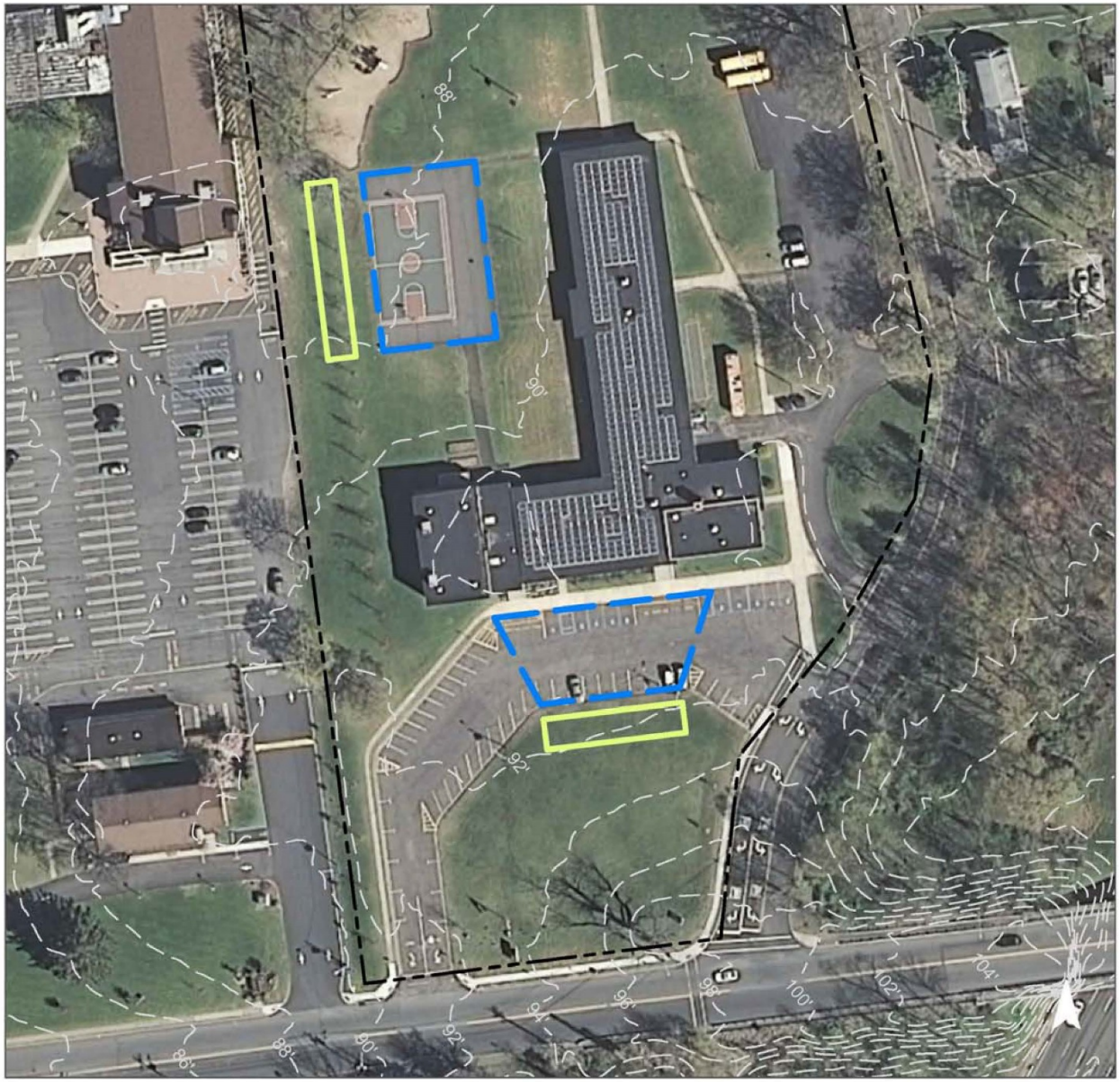
property line 2012 Aerial: NJOIT, OGIS

1

2

3

GREEN INFRASTRUCTURE RECOMMENDATIONS



Evergreen Senior Center

- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

EVERGREEN SENIOR CENTER

Subwatershed: Rahway River
Robinsons Branch

Site Area: 238,582 sq. ft.

Address: 400 Inman Avenue
Colonia, NJ 07067

Block and Lot: Block 508, Lot 2.02

Bioretention systems can capture, treat, and infiltrate runoff from the tennis courts and the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
38	91,645	4.4	46.3	420.8	0.071	2.51

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.411	69	30,174	1.13	3,946	$19,730

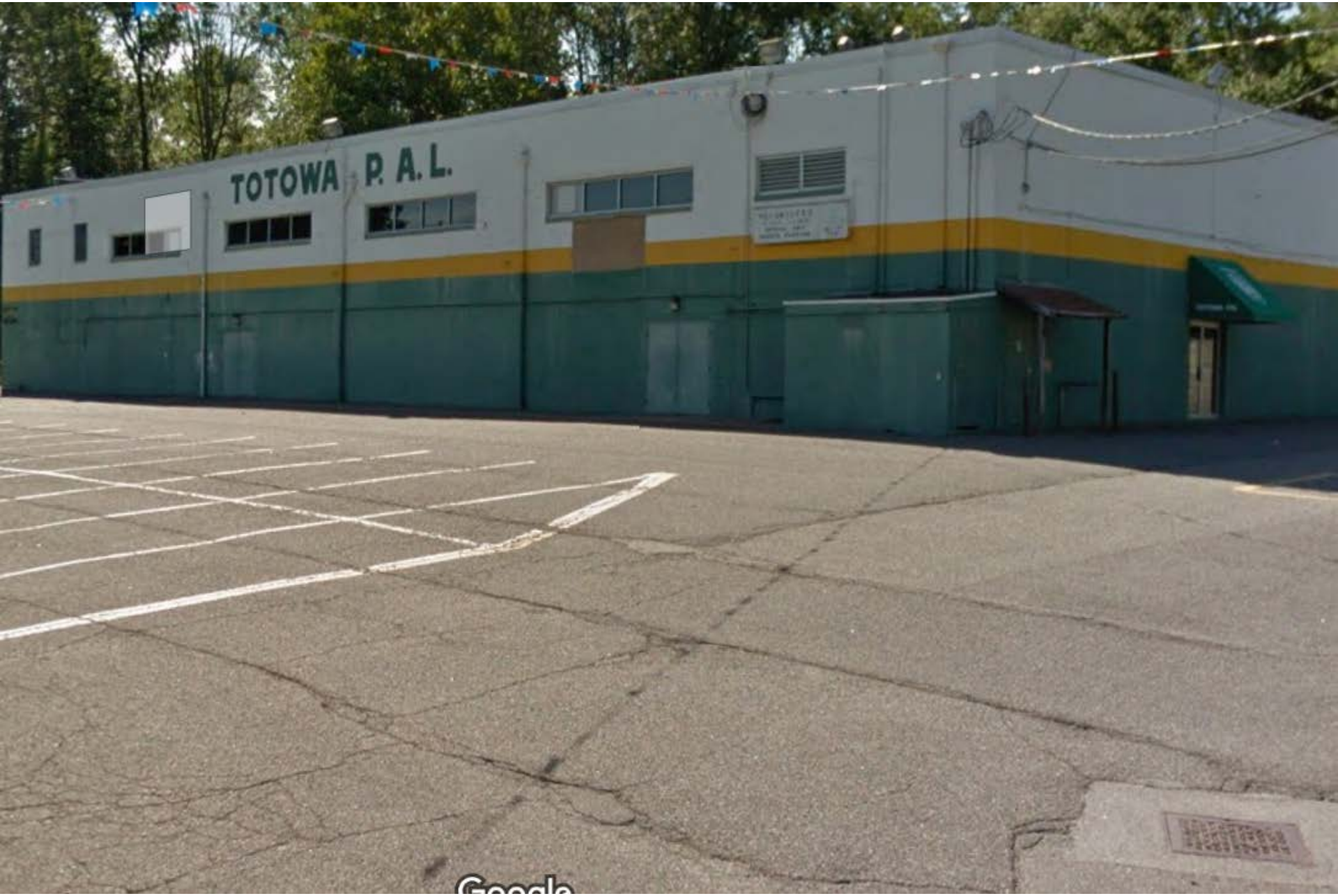
TOTOWA P.A.L.

Address: Chamberlain Avenue, Totowa, NJ 07512

property line 201 Aerial: NJOIT, OGIS

1

2



Totowa P.A.L.

Chamberlain Avenue,
Totowa, NJ 07512

pervious pavement

drainage area

property line

2015 Aerial: NJOIT, OGIS

RUTGERS
New Jersey Agricultural Experiment Station

0' 20' 40'

Sections of parking spaces can be replaced with porous asphalt. The porous asphalt will manage stormwater runoff from the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	From the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
16.5	142,214	6.9	71.8	653.0	0.111	3.90

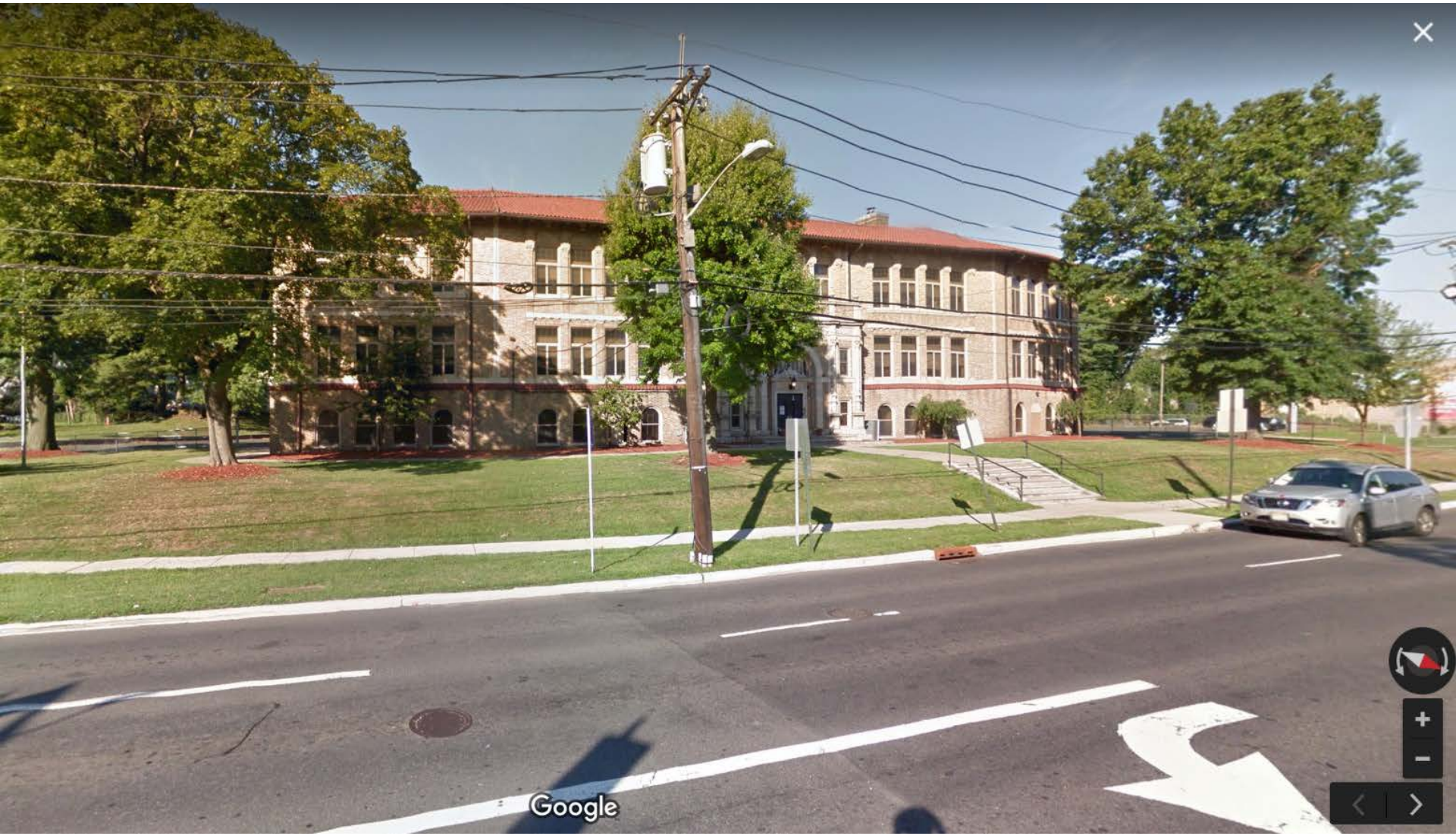
Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.615	103	45,649	1.80	7,200	$180,000

BELLEVILLE ELEMENTARY SCHOOL #10

Address: 527 Belleville Avenue, Belleville, NJ 07109

property line 2015 Aerial: NJOIT, OGIS

BELLEVILLE ELEMENTARY SCHOOL #10
(Front of School)



Directly Connected Downspouts

Directly Connected Downspouts

Belleville Elementary School #10

- bioretention system
- rainwater harvesting
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0' 20' 40'

RUTGERS
New Jersey Agricultural Experiment Station

527 Belleville Avenue,
Belleville, NJ 07109



The paved area adjacent to the building can be depaved and replaced with a rain garden to capture, treat, and infiltrate rooftop runoff. Rainwater can be harvested by installing cisterns around the building. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	From the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
66	66,110	3.2	33.4	303.5	0.052	1.81

Recommended Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.098	16	7,532	0.28	960	$4,800
Rainwater harvesting	0.060	10	4,600	0.17	5,000 (gal)	$10,000

PASSAIC VALLEY SEWERAGE COMMISSION

"Protecting Public Health and the Environment"

RUTGERS

New Jersey Agricultural Experiment Station

Next Step: Site Visit

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?

Let's Go Check It Out

<u>You should bring</u>:

Aerial photo

Pencil

Tape measure

Camera

GI CHECKLIST – GI Manual

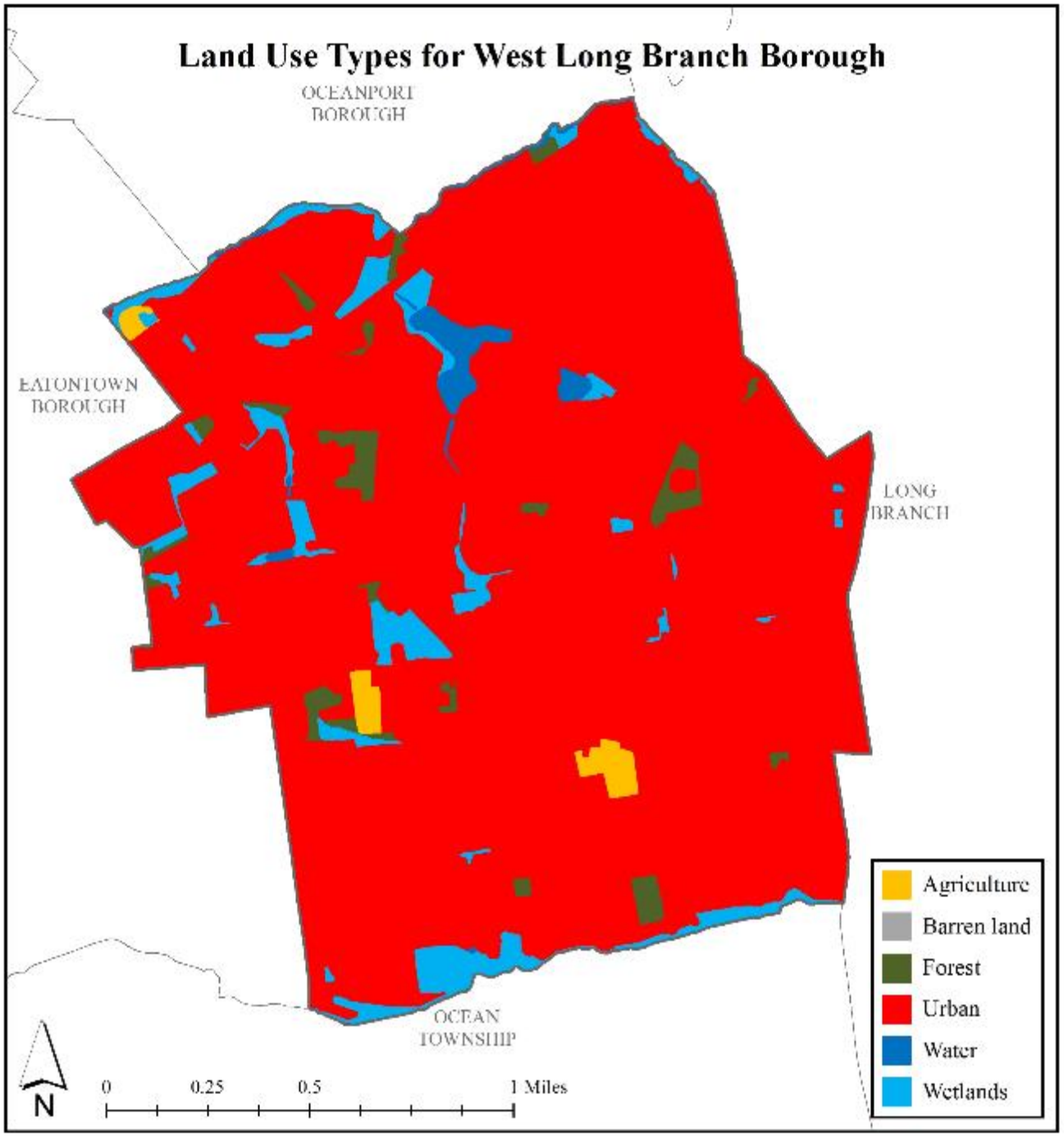
What can you do?

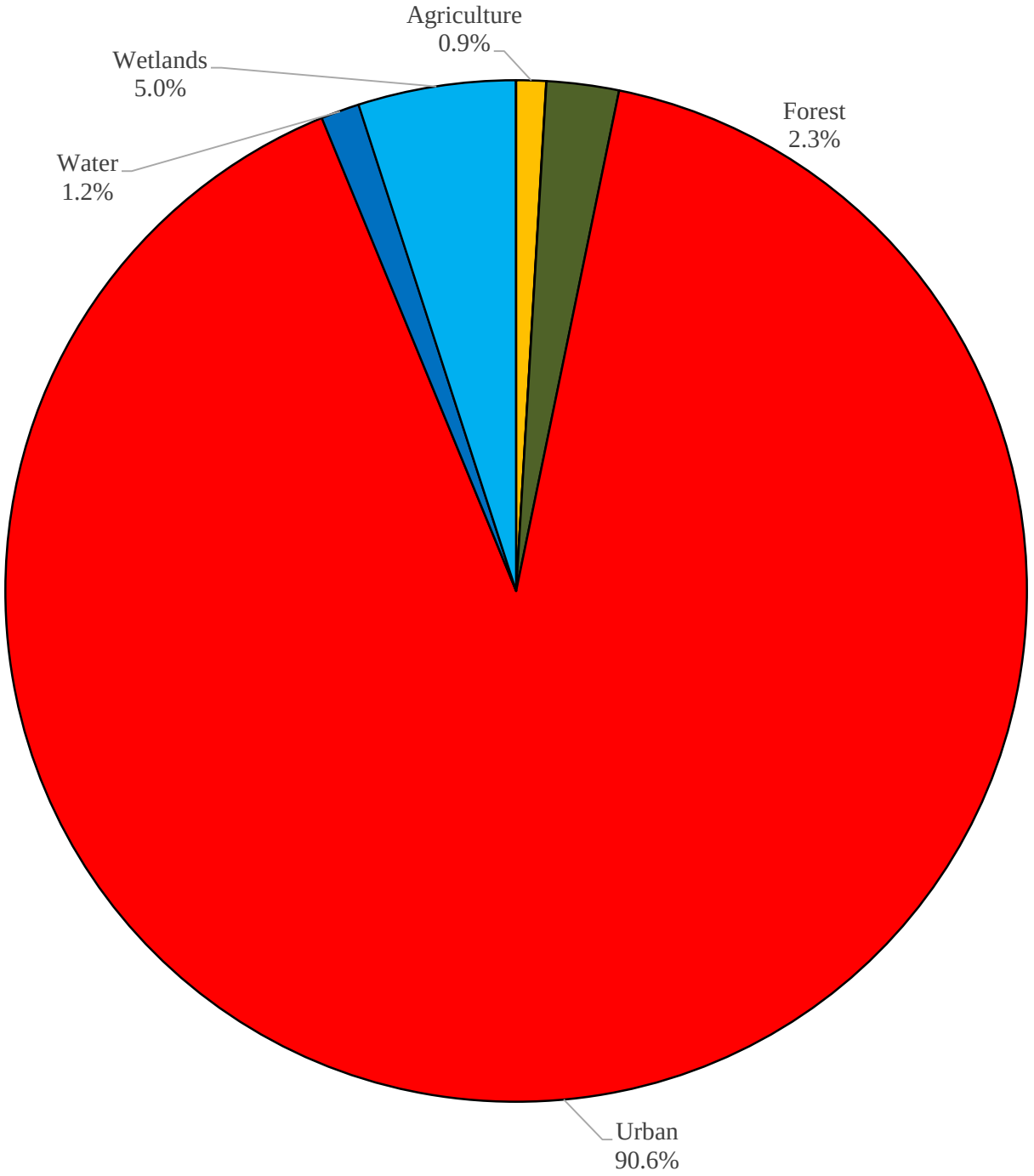
- Prepare an Impervious Cover Assessment (ICA)
- Prepare an Impervious Cover Reduction Action Plan (RAP)
- Prepare a Green Infrastructure Feasibility Study
- Identify sites to incorporate in existing plans
- Implement a green infrastructure project
- Educate youth and adults on stormwater management, impervious cover, and green infrastructure
- Be a **Connector**, a **Maven**, or a **Salesman**

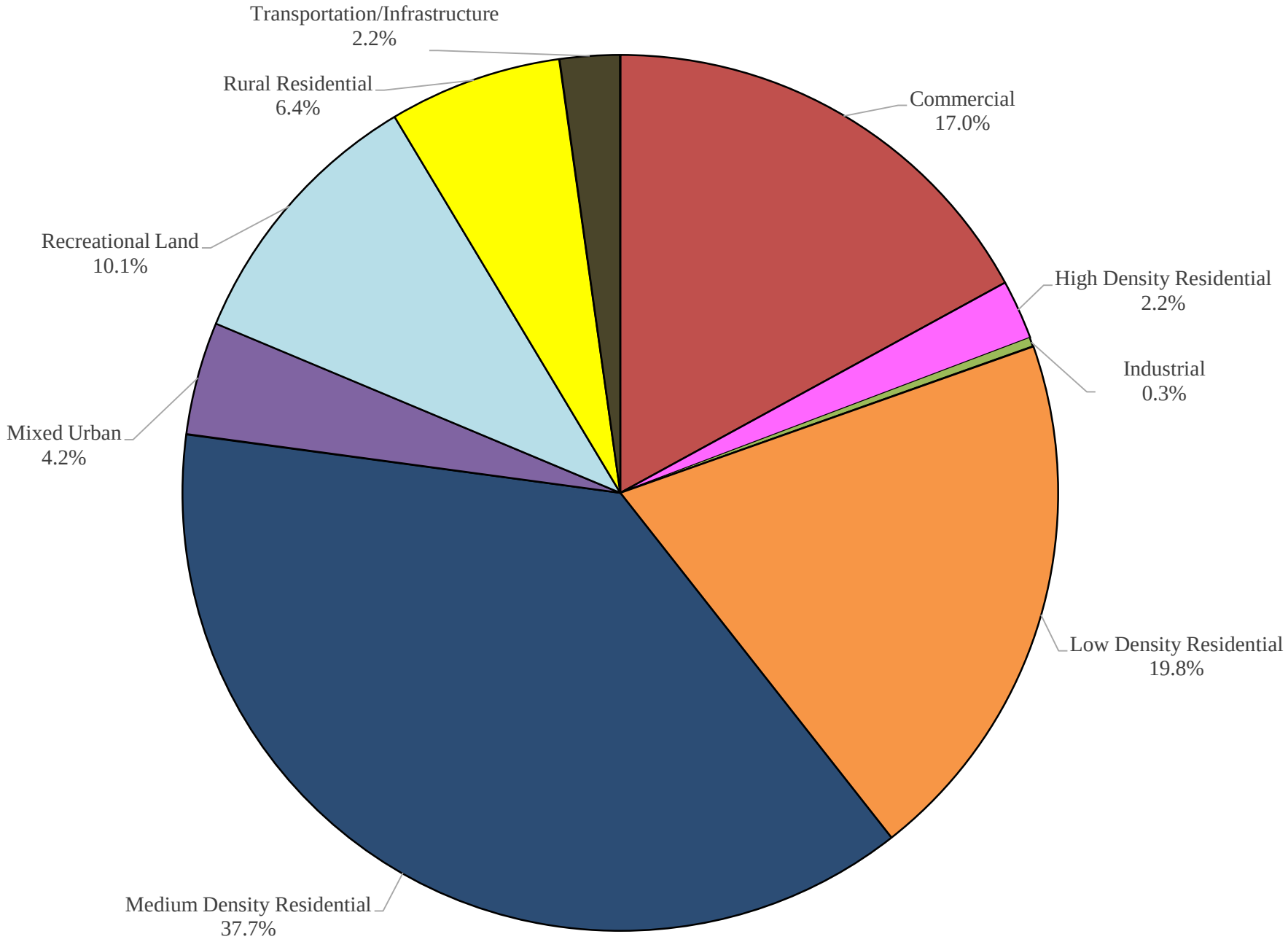
Impervious Cover Assessments (ICAs)

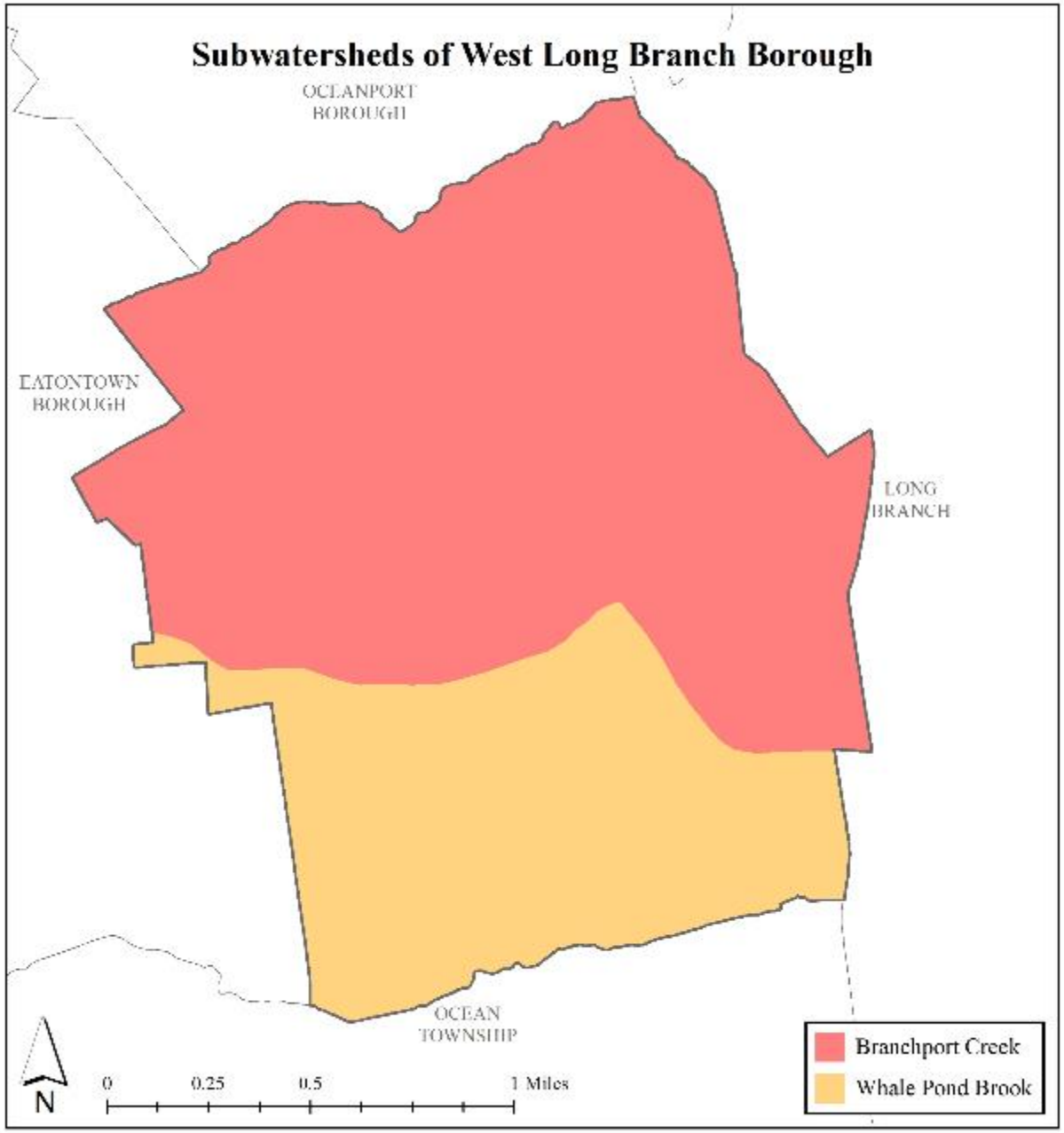
Impervious Cover Assessment

- Scare the hell out of the municipality
- 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


Land Use Types for West Long Branch Borough
OCEANPORT BOROUGH
EATONTOWN BOROUGH
LONG BRANCH
OCEAN TOWNSHIP
Agriculture
Barren land
Forest
Urban
Water
Wetlands
N
0
0.25
0.5
1 Miles


Agriculture
0.9%
Wetlands
5.0%
Forest
2.3%
Water
1.2%
Urban
90.6%


Transportation/Infrastructure
2.2%
Rural Residential
6.4%
Commercial
17.0%
Recreational Land
10.1%
High Density Residential
2.2%
Industrial
0.3%
Mixed Urban
4.2%
Low Density Residential
19.8%
Medium Density Residential
37.7%


Subwatersheds of West Long Branch Borough
OCEANPORT BOROUGH
EATONTOWN BOROUGH
LONG BRANCH
OCEAN TOWNSHIP
N
0
0.25
0.5
1 Miles
Branchport Creek
Whale Pond Brook

Watershed	Total Area (ac)	Impervious Cover (ac)	%
Branchport Creek	1,258	436	35.3%
Whale Pond Brook	596	156	26.2%
Total	1,854	592	32.3%

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)
Branchport Creek	15	521	40	62	105
Whale Pond Brook	5	186	14	22	38
Total	20	707	55	84	143

WE LOOK HERE FIRST:

- ✓Schools
- ✓Churches
- ✓Libraries
- ✓Municipal Building
- ✓Public Works
- ✓Firehouses
- ✓Post Offices
- ✓Elks or Moose Lodge
- ✓Parks/ Recreational Fields

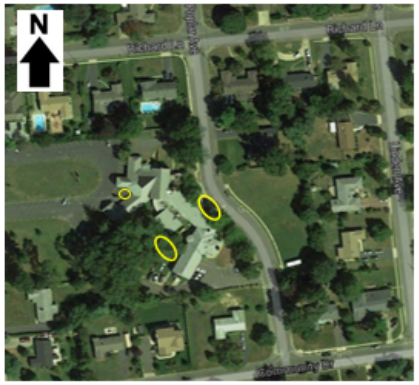
- 20 to 40 sites are entered into a PowerPoint
- Site visits are conducted

West Long Branch Borough
Impervious Cover Assessment

West Long Branch Community Center, 116 Locust Avenue

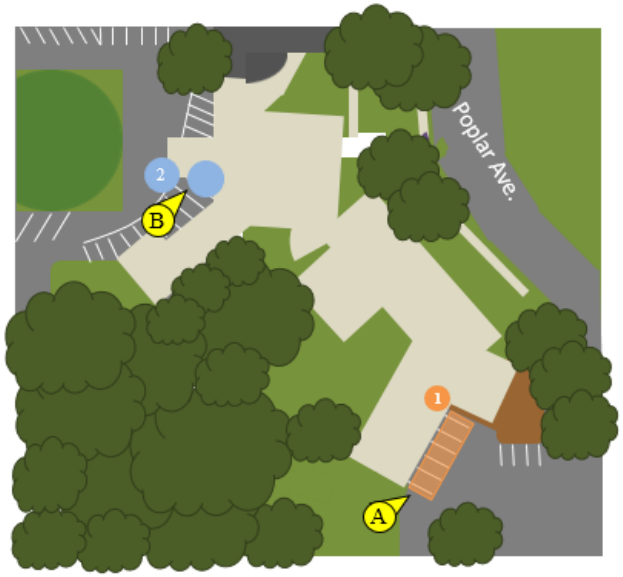
RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



SITE PLAN:

N



A

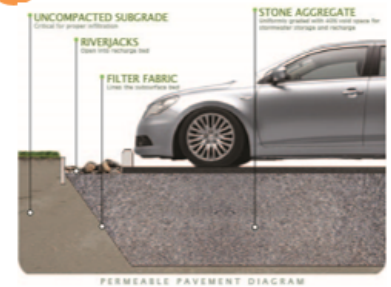
B

1. **BIORETENTION SYSTEMS:** Rain gardens will be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has multiple areas where downspouts can be disconnected, and rain gardens implemented.

2. **RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a cistern. The water can be used for gardening and landscaping around the community center.

3. **EDUCATIONAL PROGRAM:** The RCE Water Resources Program, *Stormwater Management in Your Schoolyard*, can be delivered at West Long Branch Community Center to educate township residents about stormwater management and engage them in designing and building the bioretention systems.

1 PERVIOUS PAVEMENT



PERMEABLE PAVEMENT DIAGRAM

2 RAINWATER HARVESTING SYSTEM

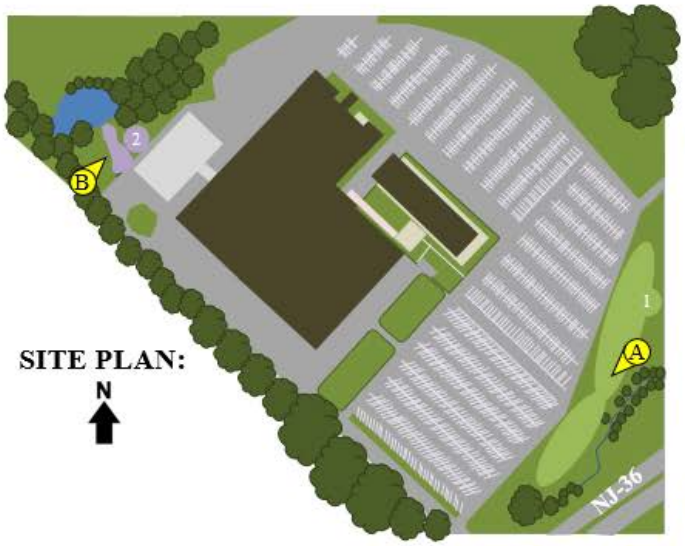
3 EDUCATIONAL PROGRAM

West Long Branch Borough
Impervious Cover Assessment

West Long Branch Home Security Alarm Systems, 185 NJ-36

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



A

B

1. **BIORETENTION SYSTEM:** A rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has a turf grass area where a rain garden can be built to catch runoff from the parking lot.
2. **BIOSWALE:** A bioswale is a vegetated system that conveys stormwater while removing sediment and nutrients. It can be installed in the eroded canal.

1 BIORETENTION SYSTEM

2 BIOSWALE

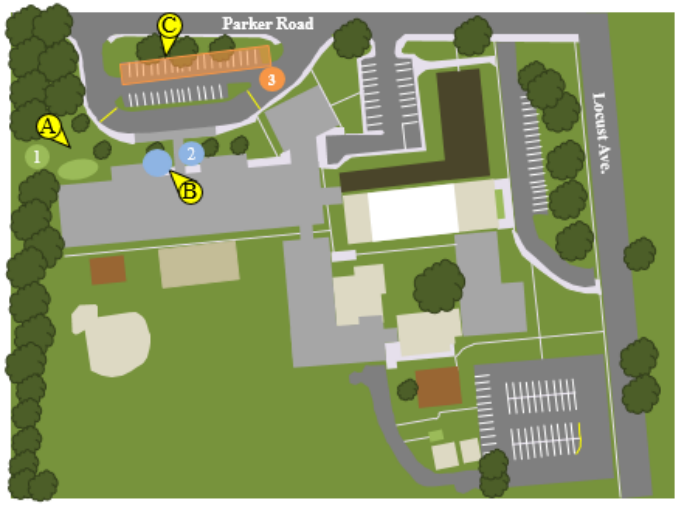
West Long Branch Borough
Impervious Cover Assessment
Betty McElmon Elementary School, 20 Parker Road

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PLAN:

N

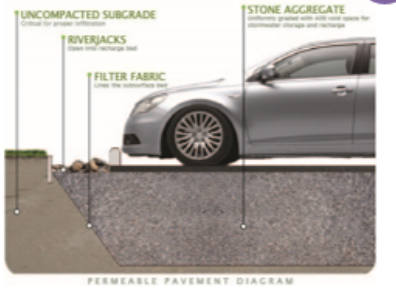


1. **BIORETENTION SYSTEM:** A rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. This site has an area where downspouts can be disconnected, and a rain garden implemented.
2. **RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a cistern. The water can be used for gardening and landscaping around the school.
3. **PERVIOUS PAVEMENT:** Portions of the northwest parking lot can be converted to pervious pavement. This can allow for infiltration of runoff from the parking lot.
4. **EDUCATIONAL PROGRAM:** The RCE Water Resources Program, *Stormwater Management in Your Schoolyard*, can be delivered at Betty McElmon Elementary School to educate the students about stormwater management and engage them in designing and building the bioretention systems.

1 BIORETENTION SYSTEM

2 RAINWATER HARVESTING SYSTEM

3 PERVIOUS PAVEMENT



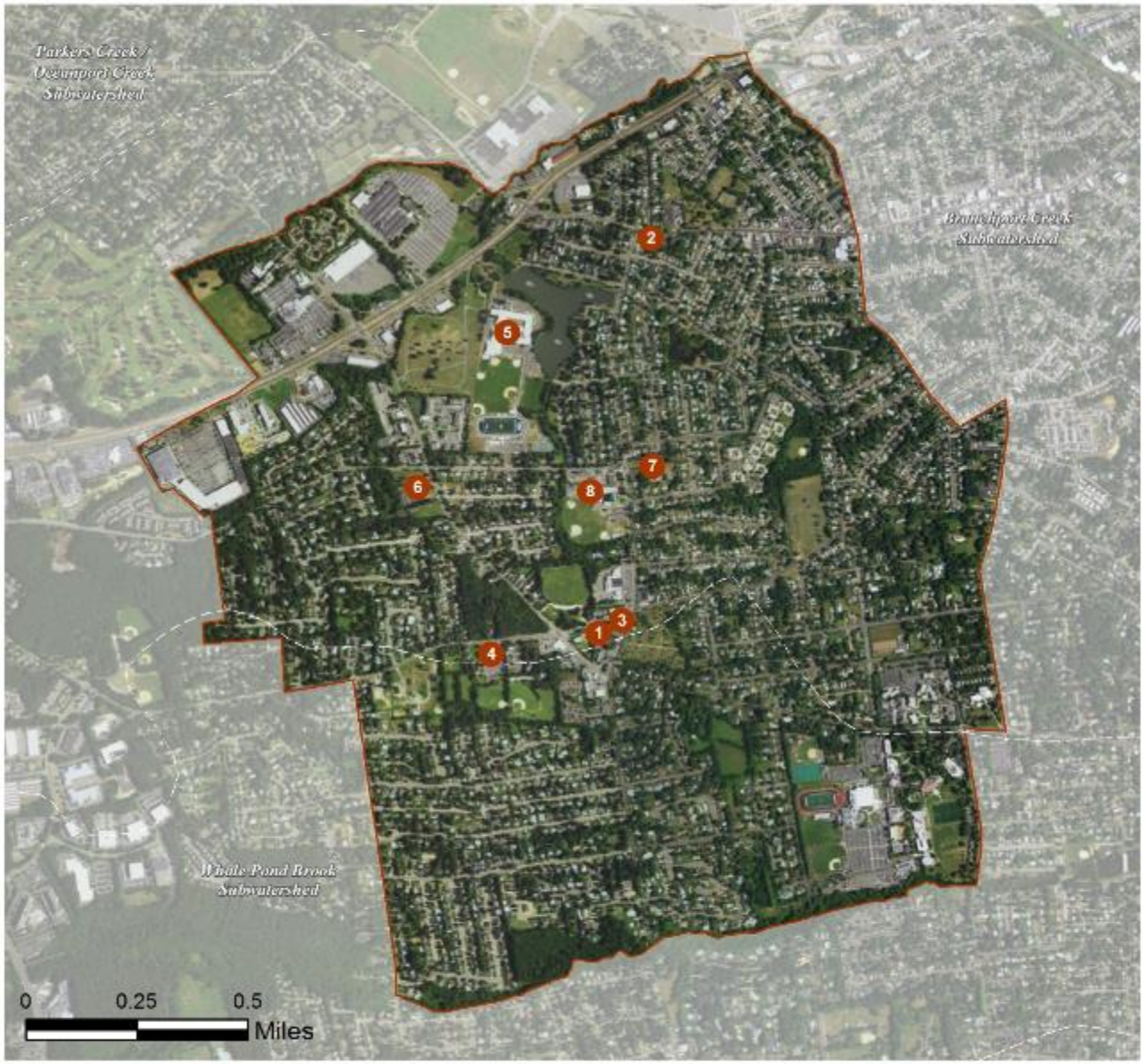
4 EDUCATIONAL PROGRAM

Impervious Cover Reduction Action Plans (RAPs)

Impervious Cover Reduction Action Plan

- A comprehensive document with many opportunities for green infrastructure
- A living document
- Shovel ready projects
- Projects for all ages (youth to seniors)
- Provides mitigation opportunities for developers
- Site level analysis

WEST LONG BRANCH BOROUGH: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE BRNACHPORT CREEK SUBWATERSHED:

1. Frank Antonides Elementary School
2. Lutheran Church Reformation
3. Old First United Methodist Church
4. Saint Jerome's Catholic Church and School
5. Shore Regional High School
6. Sovereign Bank
7. West Long Branch Community Center
8. West Long Branch Public School

FRANK ANTONIDES ELEMENTARY SCHOOL

Subwatershed: Branchport Creek

Site Area: 107,870 sq. ft.

Address: 198-208 Wall Street
West Long Branch, NJ 07764

Block and Lot: Block 20, Lot 13, 15

Parking spots can be replaced with pervious pavement to capture and infiltrate parking lot and roof runoff. A cistern can be installed adjacent to the building to harvest rainwater that can be used to conduct car wash fundraisers A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
56	60,568	2.9	30.6	278.1	0.047	1.66

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavements	0.238	40	18,057	0.49	2,340	$58,500
Rainwater harvesting systems	0.036	6	1,000	0.08	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Frank Antonides Elementary School

- disconnected downspouts
- pervious pavements
- rainwater harvesting
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

West Long Branch Borough

RUTGERS
New Jersey Agricultural Experiment Station


1 Frank Antonides Elementary School


2 Lutheran Church Reformation


3 Old First United Methodist Church

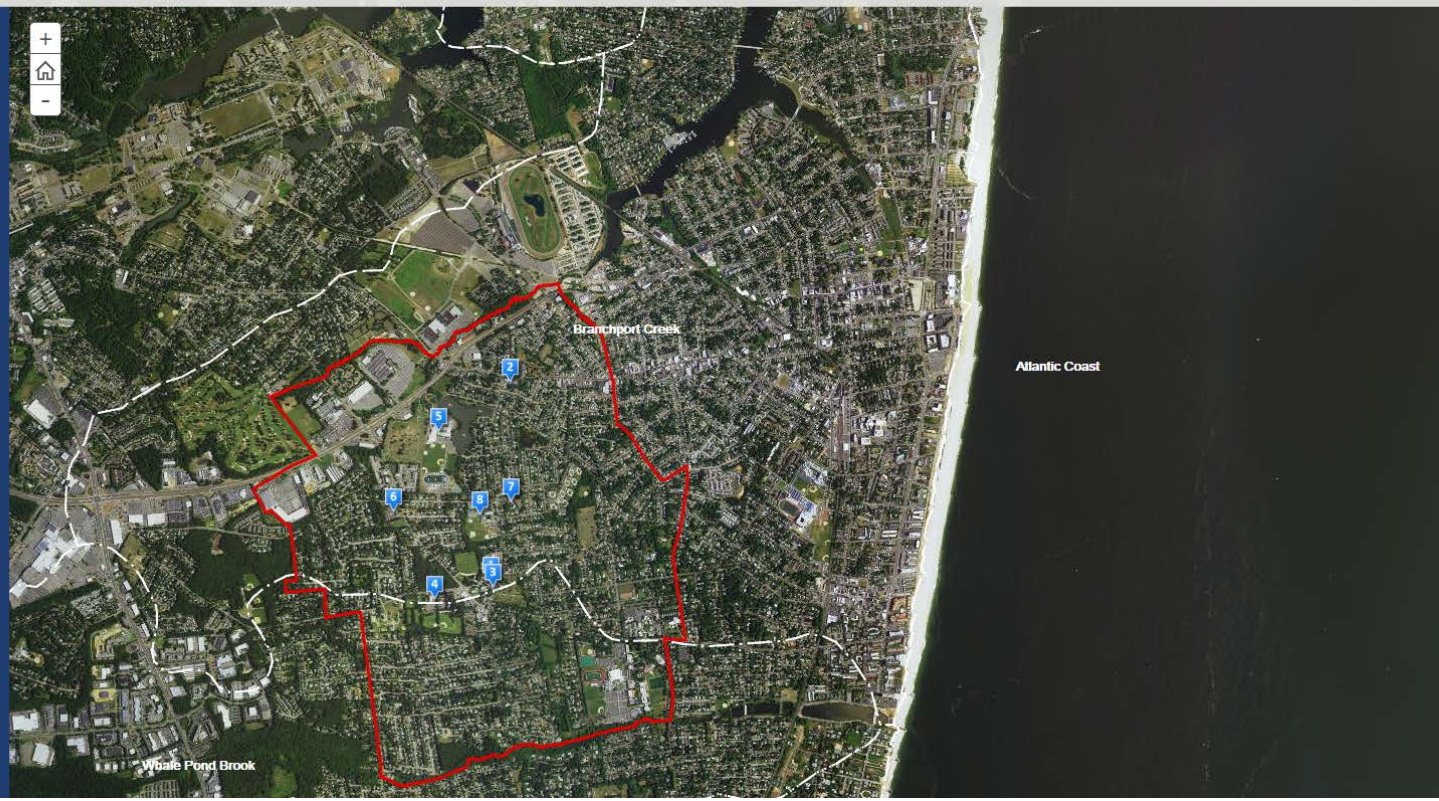

4 Saint Jerome's Catholic Church and School


5 Shore Regional High School


6 Sovereign Bank

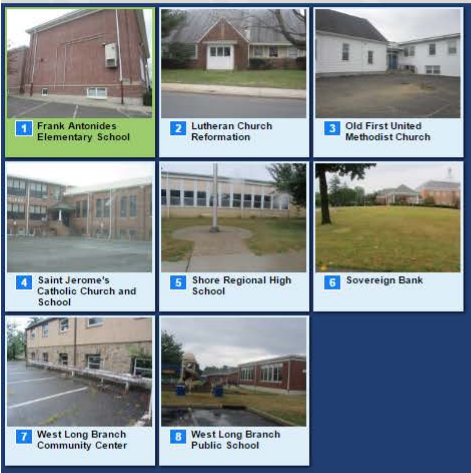

7 West Long Branch Community Center

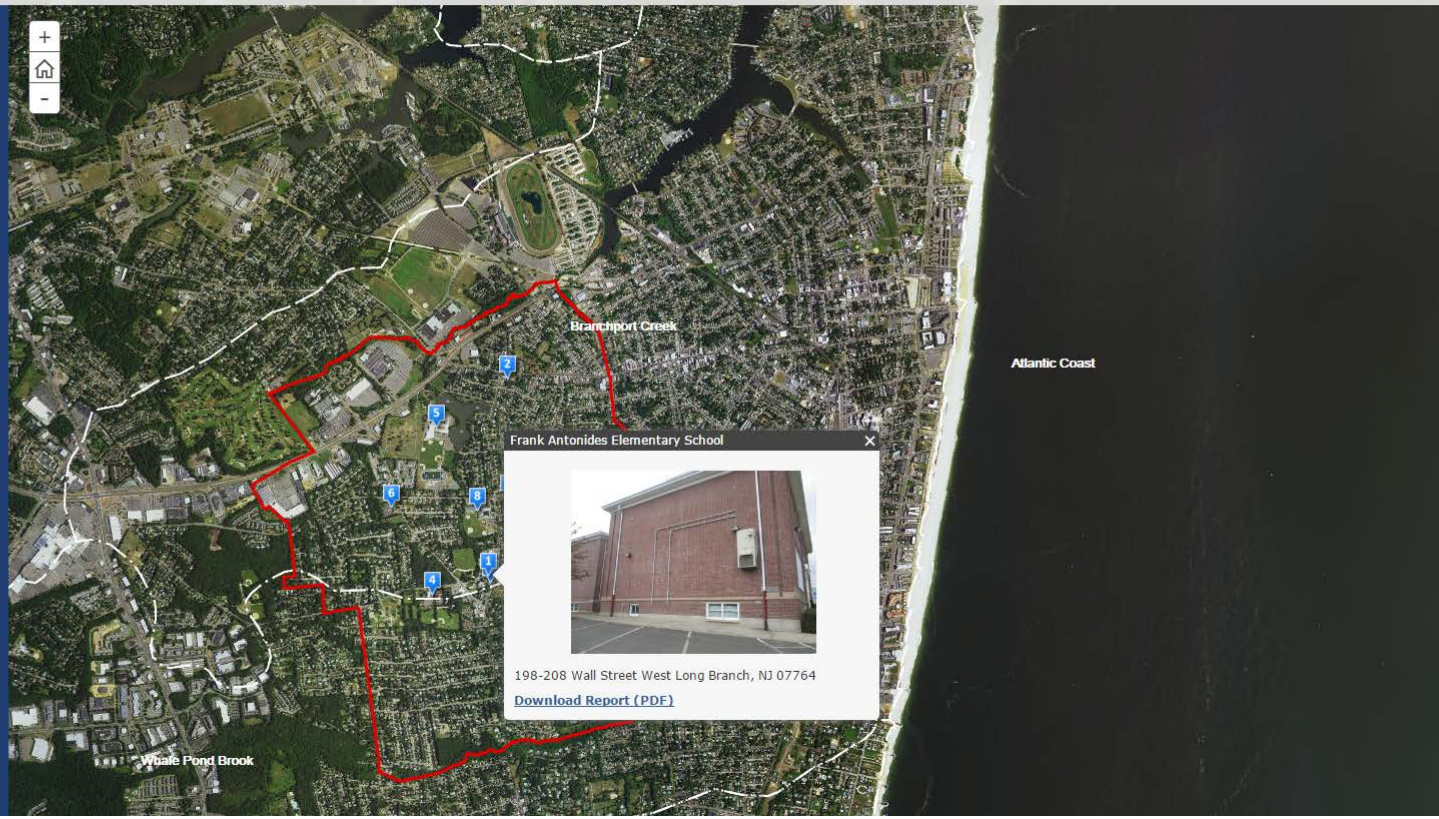

8 West Long Branch Public School



West Long Branch Borough

RUTGERS
New Jersey Agricultural Experiment Station





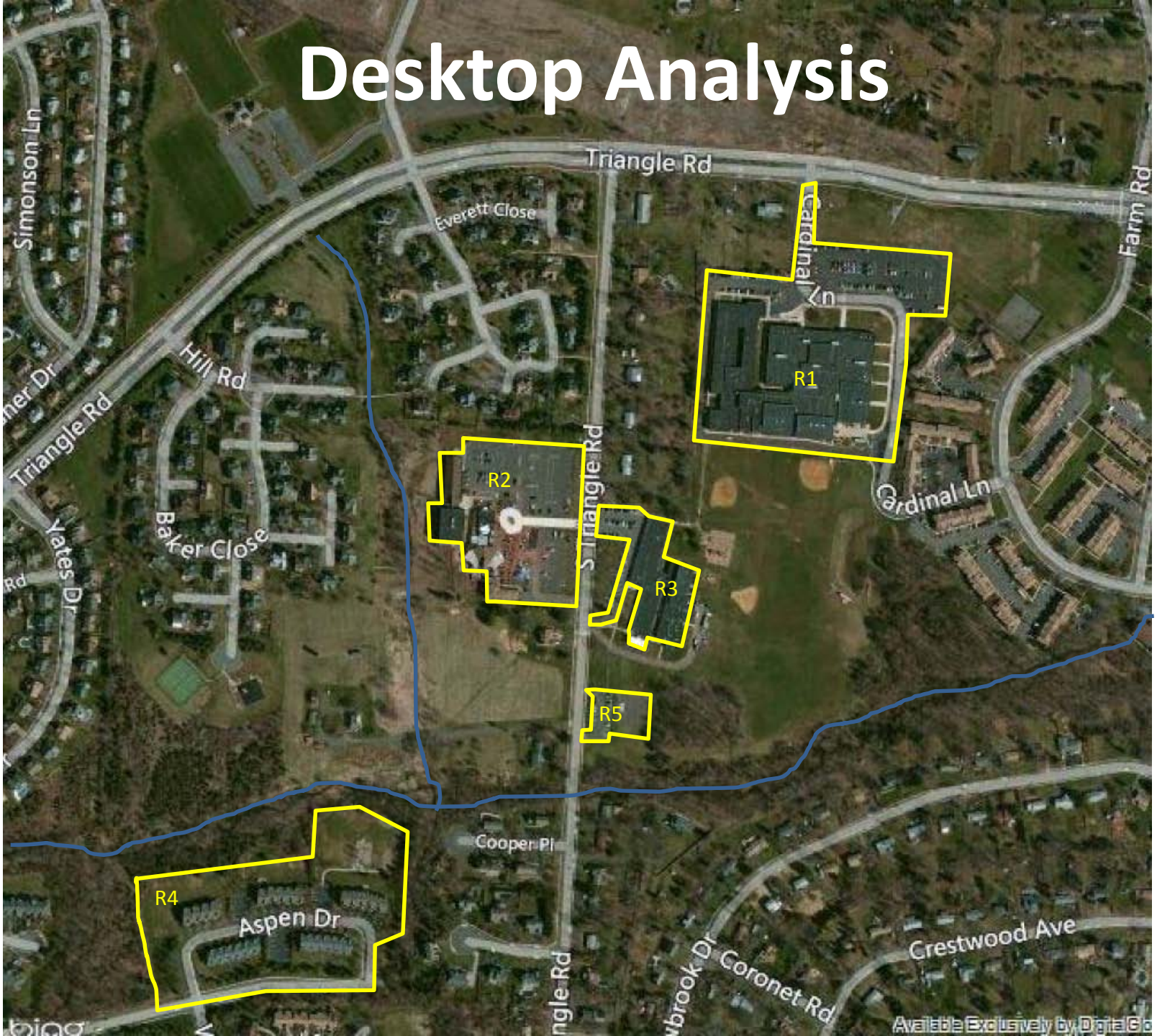
Green Infrastructure Feasibility Studies

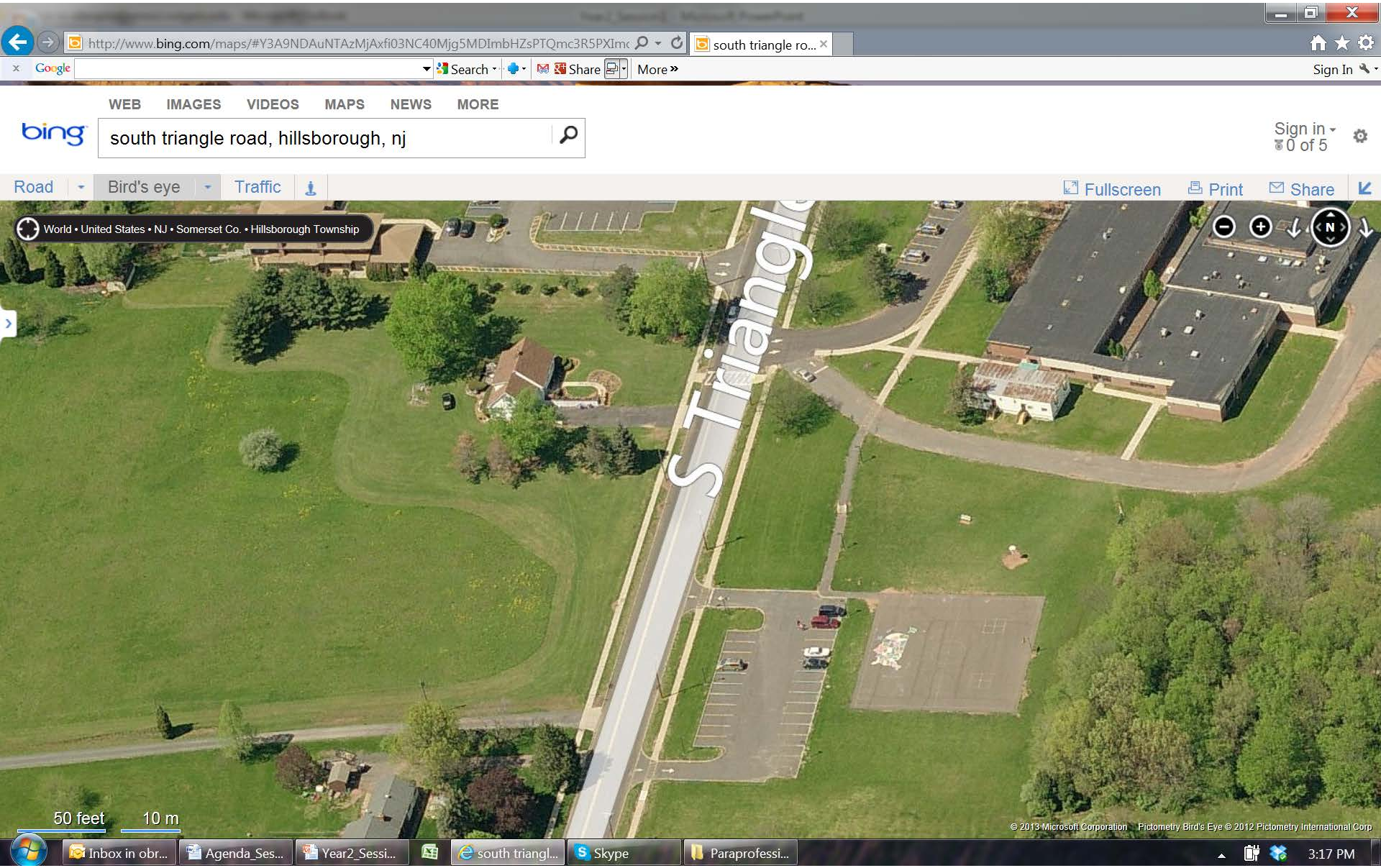
Impervious Cover Reduction Action Plan

- A high-end visual presentation of opportunities
- Provides green infrastructure overview
- Incorporates ICA and RAP information
- User-friendly format

Idenfity Sites to Incorporate into Existing Plans

Desktop Analysis

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south triangle ro...
Google
Search
Share
More
Sign In
WEB
IMAGES
VIDEOS
MAPS
NEWS
MORE
bing
south triangle road, hillsborough, nj
Sign in
0 of 5
Road
Bird's eye
Traffic
Fullscreen
Print
Share
World • United States • NJ • Somerset Co. • Hillsborough Township
S Triangle
N
50 feet
10 m
© 2013 Microsoft Corporation Pictometry Bird's Eye © 2012 Pictometry International Corp
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Agenda_Ses...
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south triangl...
Skype
Paraprofessi...
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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

Site Photos:

Stormwater Best Management Practice Opportunities

Royce Brook Watershed - Hillsborough Township

Project Identifier	**Geographic Coordinates**	
R5 - Parking Lot Next to Triangle School	N40° 58' 46.26"	W074° 2' 38.76"

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
(BMP or GI Information Sheets)

- Location, municipality, and subwatershed
- BMP description and targeted pollutants
- Existing conditions and issues
- Proposed solutions
- Anticipated benefits
- Possible funding sources
- Partners/stakeholders
- Estimated cost

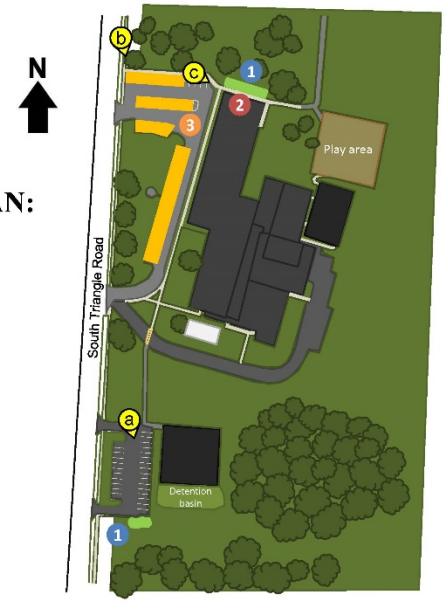
Create A Concept Plan

Hillsborough Township
Impervious Cover Assessment
Triangle Elementary School-156 South Triangle Road

RUTGERS New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PLAN:



SITE PHOTOS:

a

b

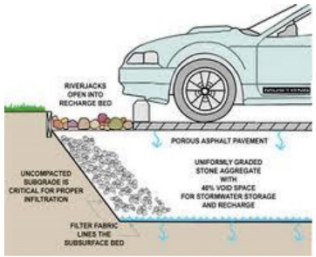
c

1. **BIORETENTION SYSTEM:** Bioretention systems should be installed near the smaller parking lot as well as along the side of the school. A bioretention system will reduce runoff and allow stormwater infiltration, decreasing the amount of contaminants that reach the catch basin.
2. **TRENCH DRAIN:** Trench drains should be installed to allow the roof runoff to drain under the sidewalks into the bioretention systems.
3. **POROUS ASPHALT:** Porous asphalt promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM

2 TRENCH DRAIN

3 POROUS ASPHALT



GREEN INFRASTRUCTURE RECOMMENDATIONS

Memory Park

- bioretention / rain gardens
- pervious pavements
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 75' 150'

MEMORY PARK

Subwatershed: Paulins Kill

Site Area: 9,886,292 sq. ft.

Address: 111 Moran Street
Newton, NJ 07860

Block and Lot: Block 5.06, Lot 1

Rain gardens adjacent parking lot can capture, treat, and infiltrate roof runoff. Parking spots in the lot to the west of the field can b replaced with porous asphalt to help capture stormwater runoff. A preliminary soil assessment suggests that the soils have suitabl drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
14	223,348	10.8	112.8	1,025.5	0.174	6.13

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.641	107	47,004	1.77	6,150	$30,750
Pervious pavements	0.222	37	16,262	0.61	1,100	$27,500

Implement a Green Infrastructure Project

Funding Implementation

- Leverage existing projects
- Build partnerships
- Write grants

Who should I partner with?

Locally

- RCE Environmental County Agents
- Municipal Green Teams (Sustainable Jersey)
- Green Teams for Schools (Sustainable Jersey)
- Environmental Commissions
- Boy Scouts and Girl Scouts

Statewide

- The Nature Conservancy
- Association of Environmental Commissions
- Trust for Public Lands
- New Jersey Tree Foundation

Grant/Funding Opportunities

- Sustainable Jersey ($10k and $35k)
- ANJEC
- NJDEP
- NJ American Waters
- Home and School Associations

EDUCATE !

Be a Connector, Maven, or Saleman!


WORMWOOD
2250

Resources for You!

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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.

News

- In the News - October 3, 2017
- SEBS/NJAES Newsroom

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Projects & Programs

Agricultural Watershed Planning & Implementation	**Municipal/Community Training**
Green Infrastructure Program	**Rain Gardens & Rain Barrels**
Keep the Rain from the Drain ~ Impervious Cover Reduction Program	**Watershed Planning & Implementation**
Municipal Stormwater Management	

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 Cohansey River Watershed
- Upper Cohansey River Watershed Agricultural Mini-Grant Program
- Watershed Restoration Plan for the Upper Salem River Watershed
- Upper Salem River Watershed Agricultural Mini-Grant Program

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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

Delaware Twp
- *ICA*
- *RAP*
- *RAP web map*

Franklin Twp
- *ICA*
- *RAP*
- *RAP web map*

East Amwell Twp
- *ICA*
- *RAP*
- *RAP web map*

Raritan Twp
- *ICA*
- *RAP*
- *RAP web map*

Flemington Boro
- *ICA*
- *RAP*
- *RAP web map*

Readington Twp
- *ICA*
- *RAP*
- *RAP web map*

MIDDLESEX COUNTY

Dunellen Boro
- *ICA*
- *RAP*
- *RAP web map*

North Brunswick Twp
- *ICA*
- *RAP*
- *RAP web map*

NEW JERSEY HIGHLANDS WATERSHED CLUSTER

Alpha
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Lopatcong
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Branchville
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Mount Arlington
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Greenwich
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

Mount Olive
- *ICA*
- *RAP*
- *RAP web map*
- *Feasibility Study*

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- *Inventory and Assessment of Your Stormwater Infrastructure* (January, 2017)
- *Green Infrastructure Overview: Examples and Properties of a Variety of Stormwater Managment Solutions* (November, 2016)
- *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)
- *Asking the Right Questions in Stormwater Review* (April, 2015)
- *Understanding Your Impervious Cover Assessment (ICA) Report* (March, 2015)

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New Development: Adequate Regulations Exist

Inadequate Enforcement

Staff to Contact

Hollie DiMuro, Program Associate, graduated in May 2015 from Rutgers, The State University of New Jersey with a B.S. in Environmental Planning and Design and a minor in Environmental Policy, Institutions, and Behaviors. Hollie interned with the Water Resources Program from May 2014 to July 2015. During her internship, Hollie assisted with rain barrel workshops, participated in the construction and maintenance of rain gardens, and she assisted with the design of stormwater best management practices and green infrastructure practices for municipalities within the Raritan River Basin. In her role as a Program Associate, Hollie will be providing technical support to the Water Resources Program by organizing and coordinating municipal action teams to promote green stormwater infrastructure in New Jersey's urban and suburban communities. She also will be assisting the Water Resources Program with grant management and project resource allocation.

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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.

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QUESTIONS?
https://rutgers.qualtrics.com/jfe/form/SV_7ZL9NjXnza2P7fL