Green Infrastructure Champions Program

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

RUTGERS
New Jersey Agricultural Experiment Station

The Geraldine R. DODGE FOUNDATION
IMAGINE A BETTER NEW JERSEY

Sea Grant
NJ Sea Grant Consortium

Please enter your full name and affiliation in the chat. This is how will take attendance.

JERSEY WATER WORKS
Smart infrastructure. Strong communities.

WILLIAM PENN FOUNDATION

Green Infrastructure Champion Training: Part 1

"How to identify green infrastructure projects in your town"

January 14, 2022
Virtual Class

RUTGERS
New Jersey Agricultural Experiment Station

water.rutgers.edu

Welcome and Introduction

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

www.water.rutgers.edu

Rutgers Cooperative Extension

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.

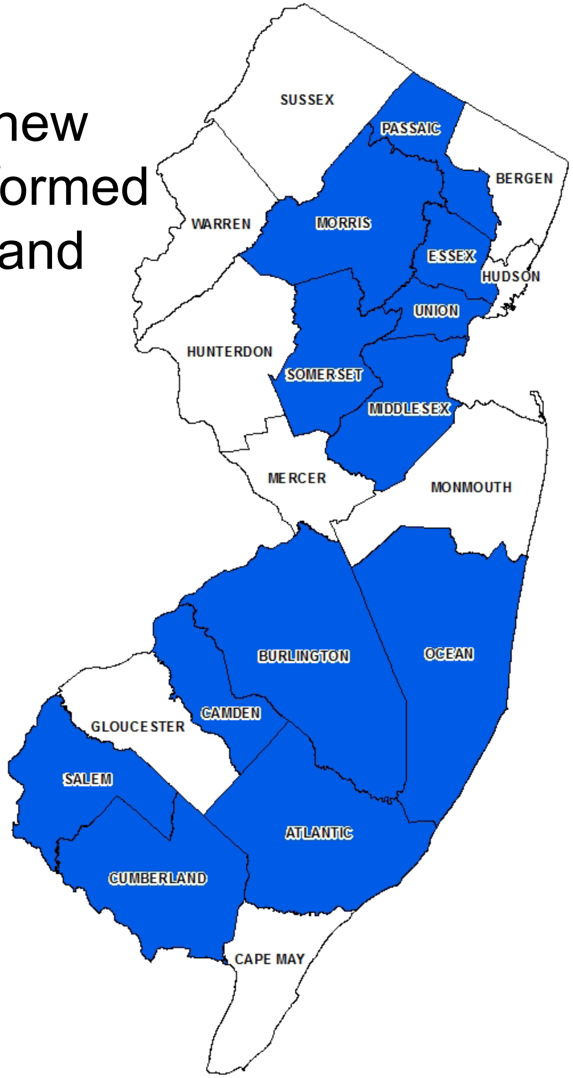
Water Resources Program

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

Environmental County Agents

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

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



Green Infrastructure Champion

Green Infrastructure Champions are key players in implementing green infrastructure as a stormwater management approach in their community.

Rutgers inputs to the Green Infrastructure Champion Program

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

Short-term results/impacts
Green Infrastructure Champions will:

- Increase their knowledge and awareness about green infrastructure practices, planning, and implementation
- Gain a skill set to allow them to engage community leaders, schools, and non-governmental organizations (NGOs) and advocate for green infrastructure as a stormwater management solution
- Identify funding opportunities and secure funding for green infrastructure

Long-term results/impacts

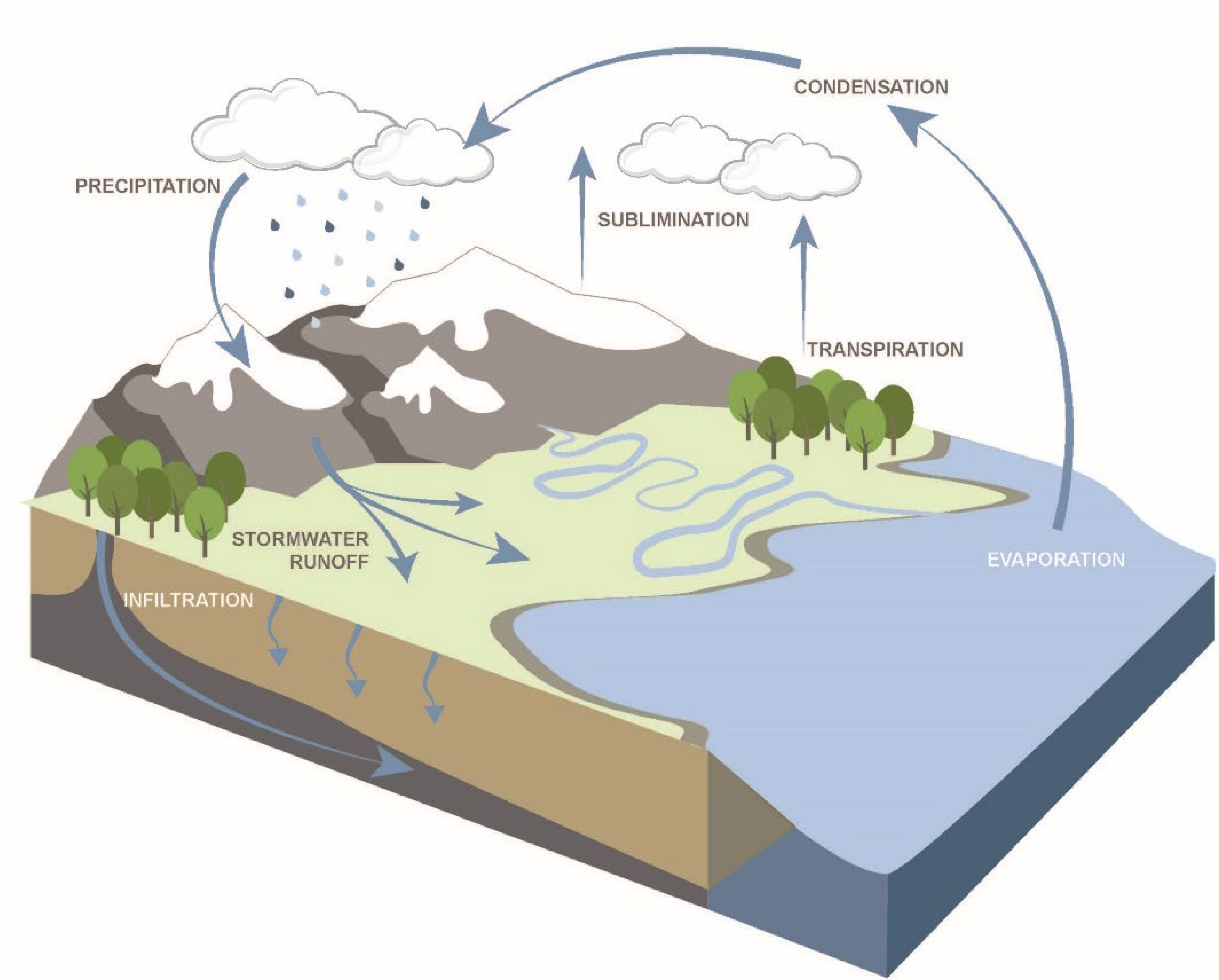
- Green infrastructure practices are installed throughout the community
- Green infrastructure becomes a standard in the community for addressing stormwater problems
- Localized flooding is reduced
- Water quality improves
- Community become more resilient to extreme weather events

Stormwater Basics

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.

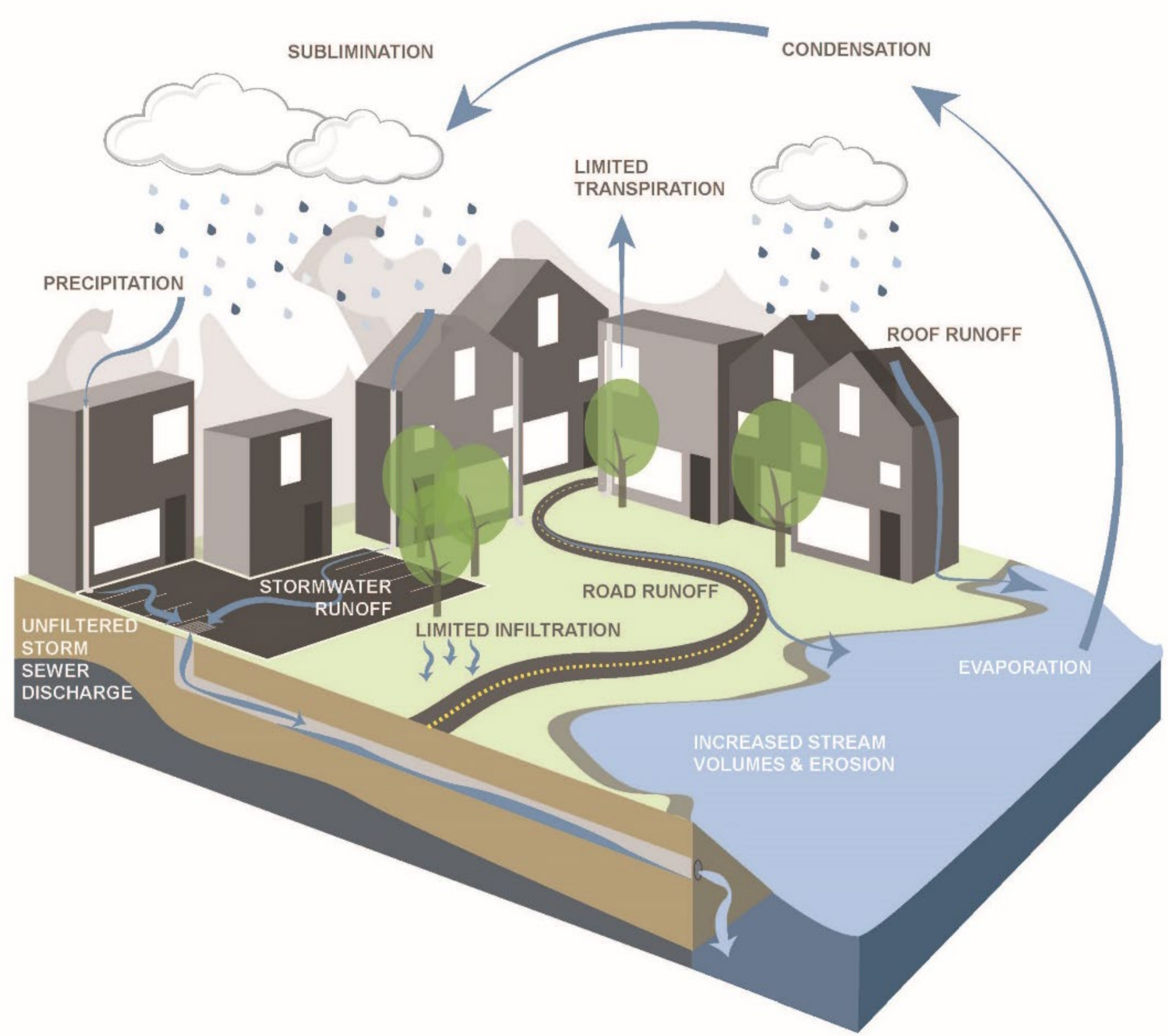
The Natural Hydrologic Cycle



The Impact of Development on Stormwater Runoff

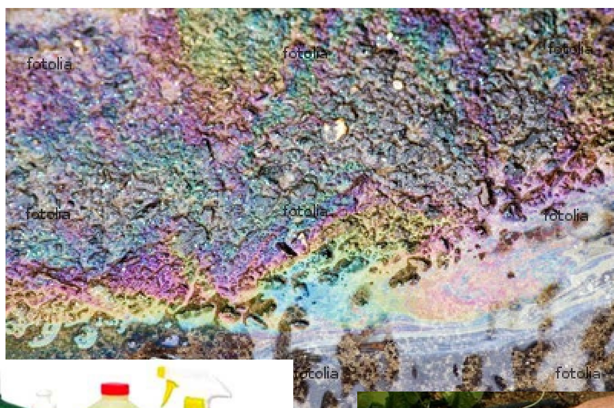
More development → *More impervious surfaces* → *More stormwater runoff*

The Urban Hydrologic Cycle



EXAMPLES OF NPS

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



History of Stormwater Management

1st Attempt at Stormwater Management

Capture all runoff, pipe it, and send it directly to the river . . .prior to mid 1970's

2nd Iteration of Stormwater Management

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

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

3rd Generation of Stormwater Management

- Reduce stormwater runoff volume
- Reduce peak flows and flooding

…and….

- Maintain infiltration and groundwater recharge
- Reduce pollution discharged to local waterways

ABC Action News, August 27, 2012

4th Generation of Stormwater Management (Started March 2, 2021)

- All major development must use green infrastructure to comply with the New Jersey Stormwater Regulations

Green Infrastructure

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

Green Infrastructure projects:

- capture,
- filter,
- absorb, and
- reuse

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

Green Infrastructure

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

- Infiltration
- Filtration
- Storage
- Evaporation
- Transpiration

Green Infrastructure Practices

<u>Bioretention Systems</u>

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

<u>Permeable Pavements</u>

<u>Rainwater Harvesting</u>

- Rain Barrels
- Cisterns

<u>Dry Wells</u>

<u>Rooftop Systems</u>

- Green Roofs
- Blue Roofs

Parker Urban Greenscapes. 2009.

TYPES OF BIORETENTION

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

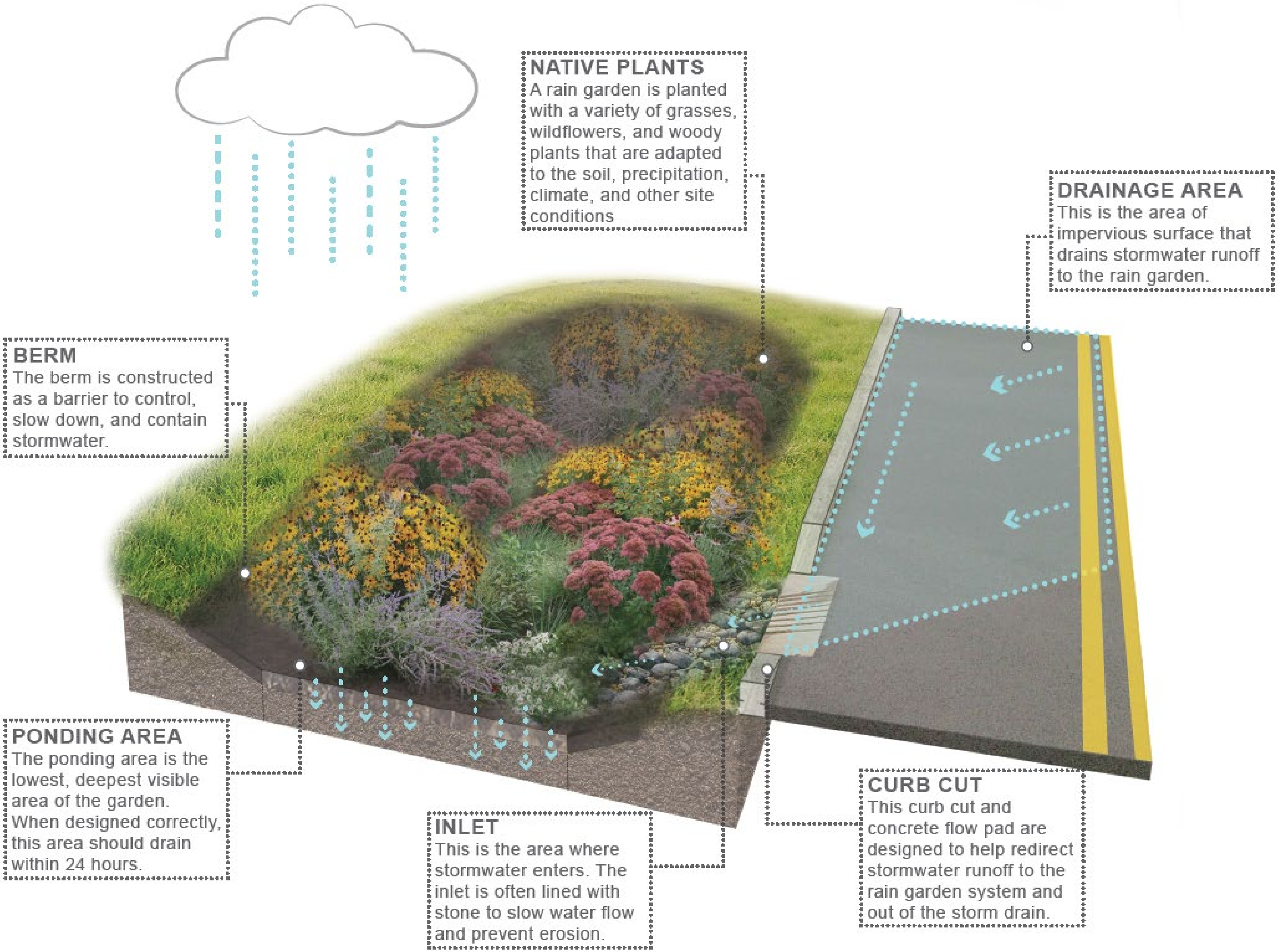
Rain Gardens
- Single-family lots
- Small commercial areas

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

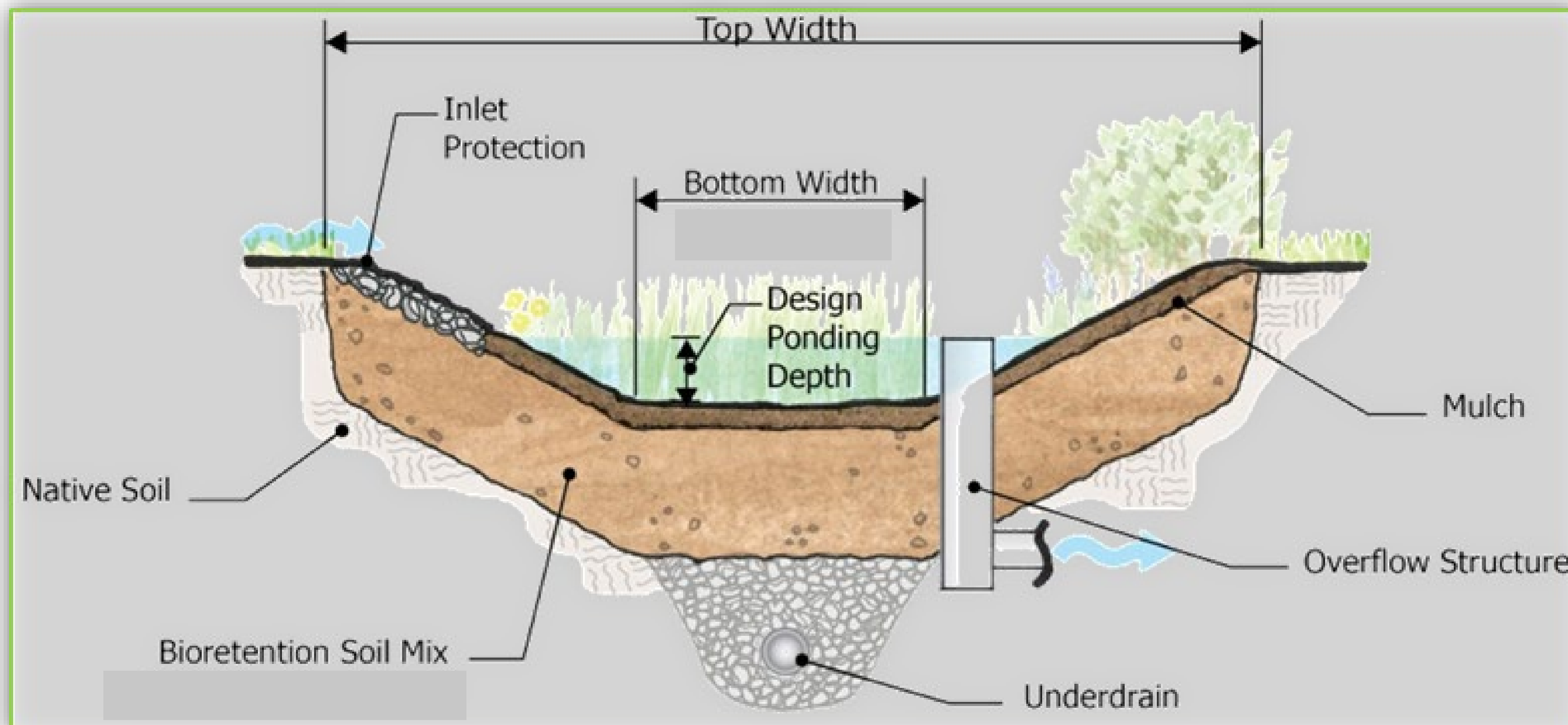
Planters & Planter Boxes
- Highly urban areas
- Right-of-way and adjacent to buildings

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

Rain Gardens



Rain Garden Cross-Section

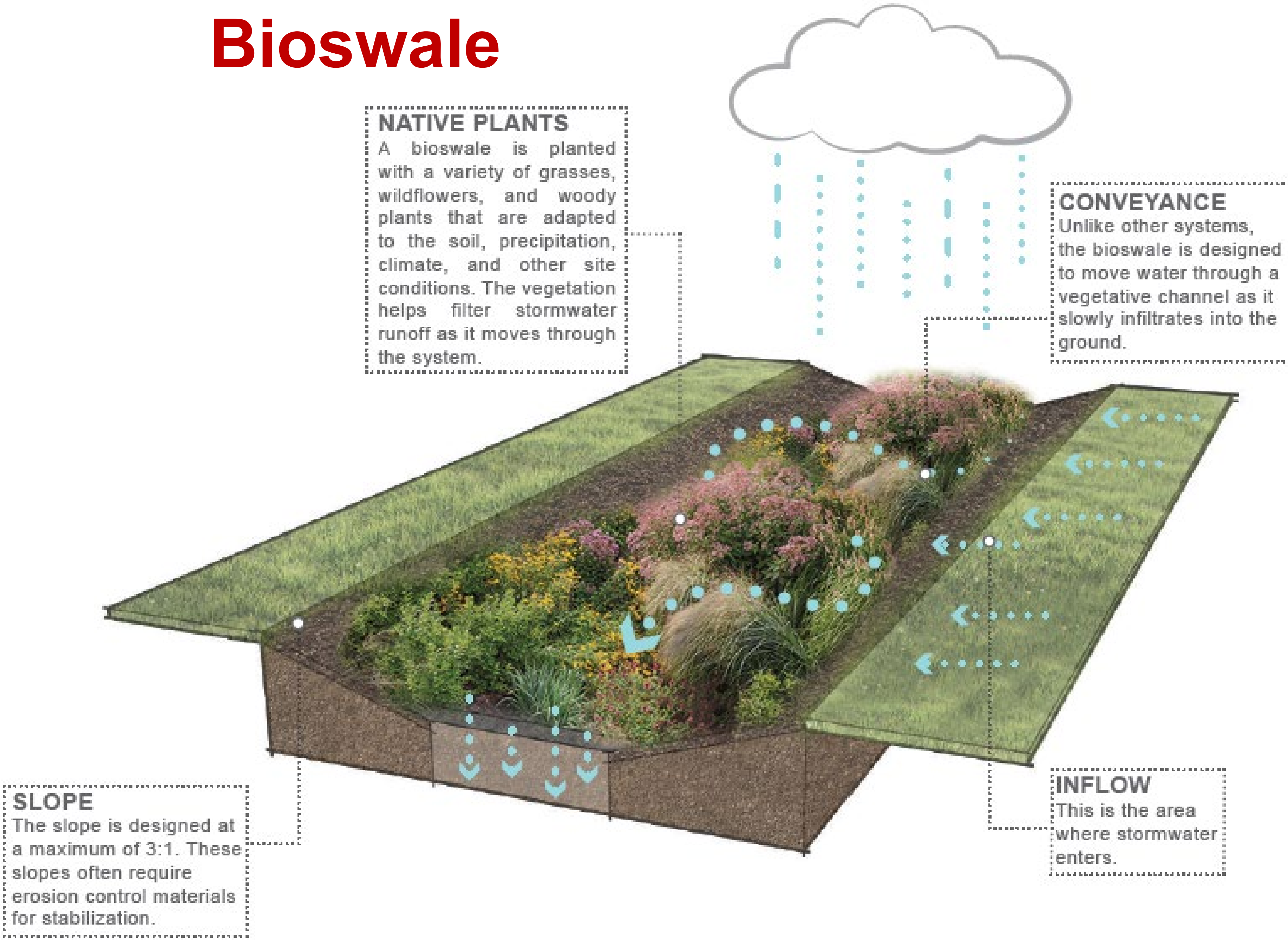



8. 2. 2004

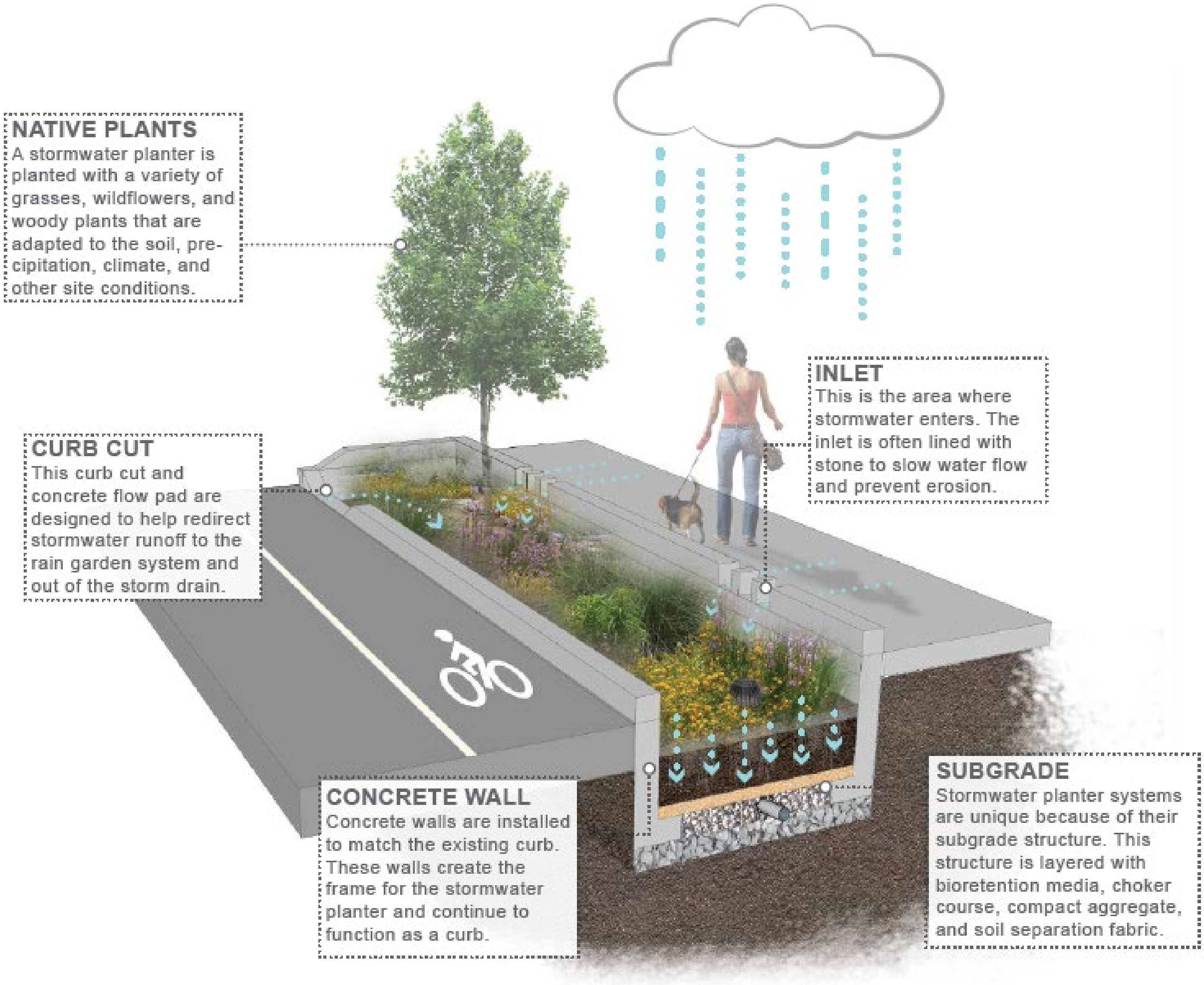
Lots of Rain Gardens

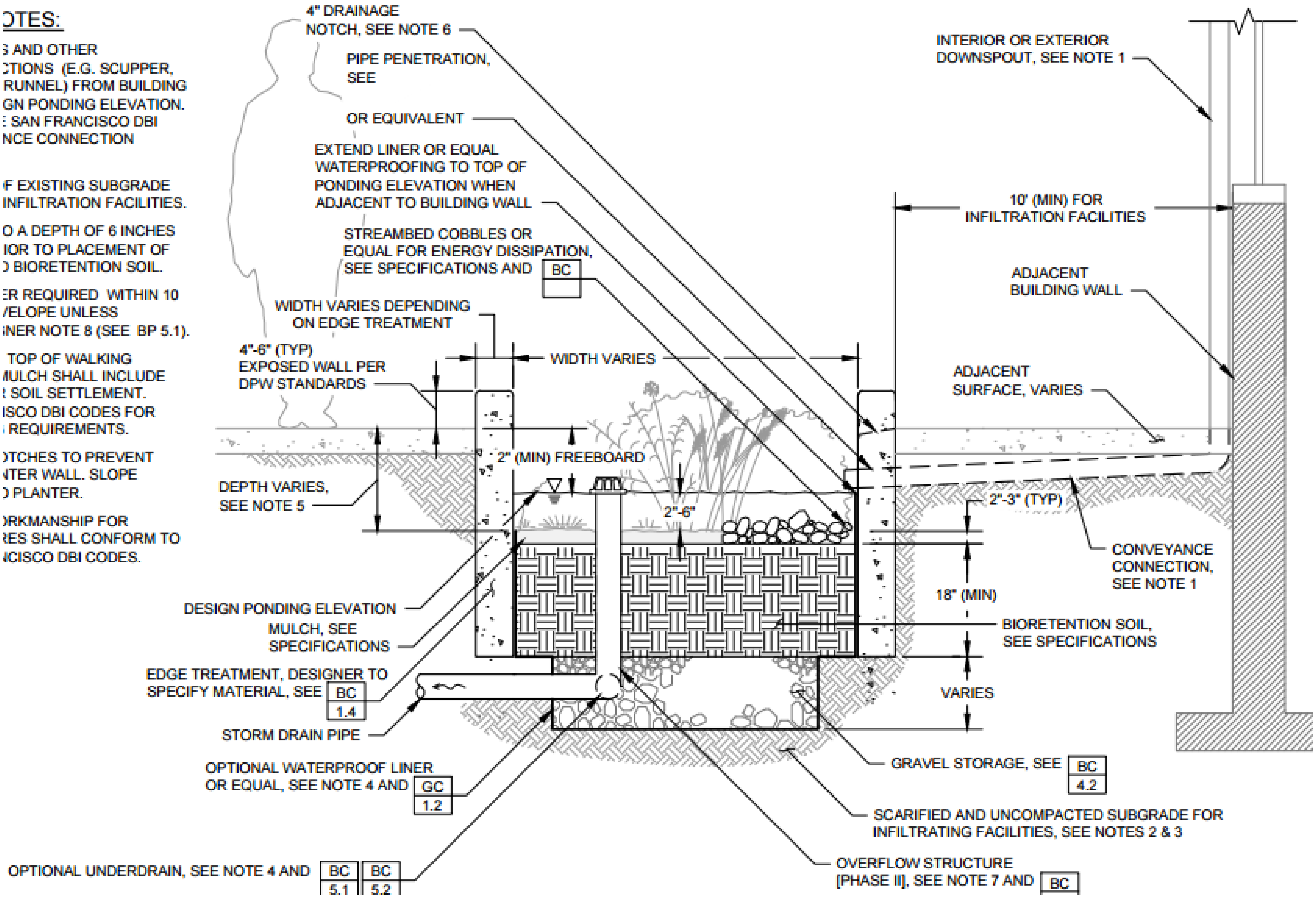

116

Bioswale


NATIVE PLANTS
A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.
CONVEYANCE
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.
SLOPE
The slope is designed at a maximum of 3:1. These slopes often require erosion control materials for stabilization.
INFLOW
This is the area where stormwater enters.

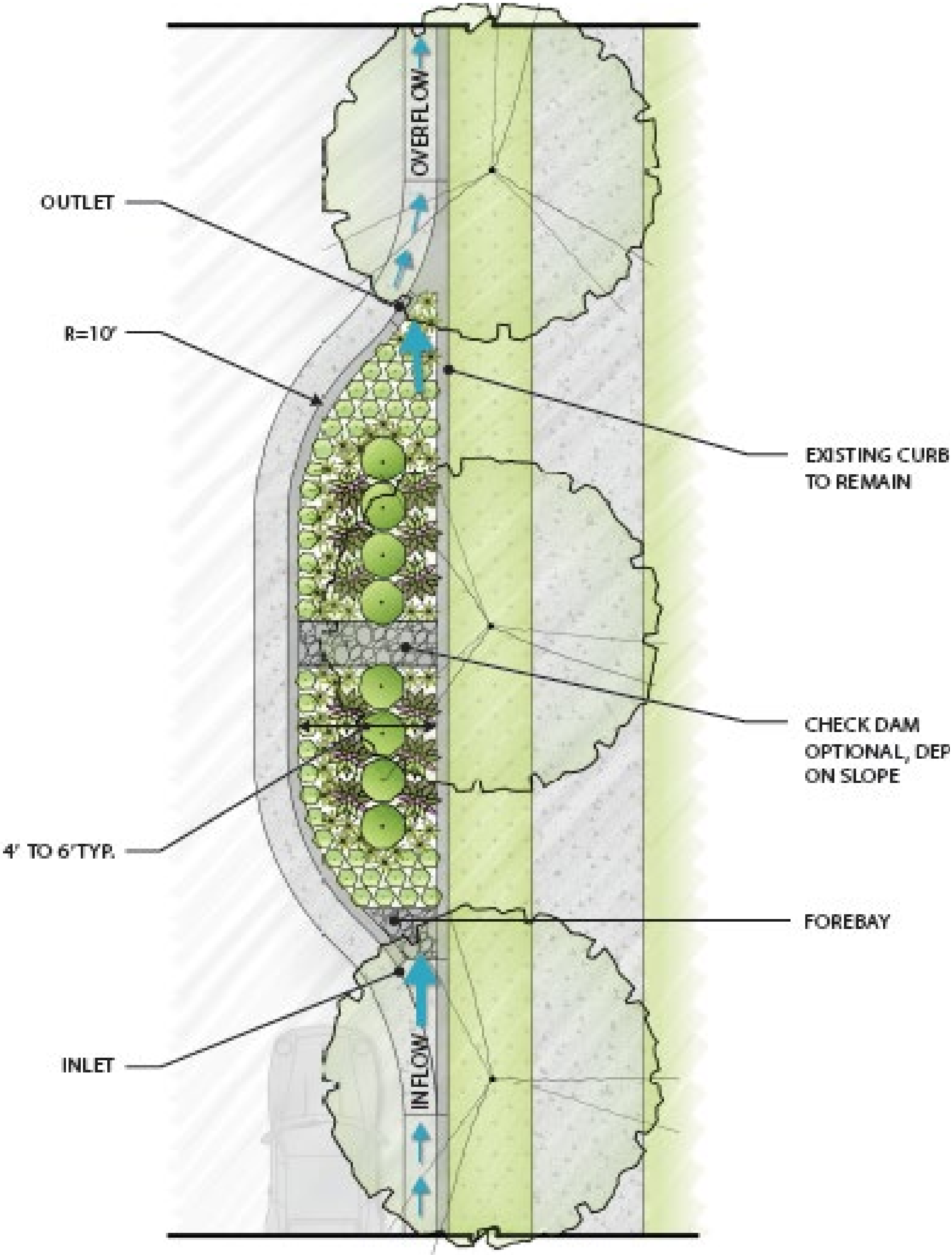
Stormwater Planters



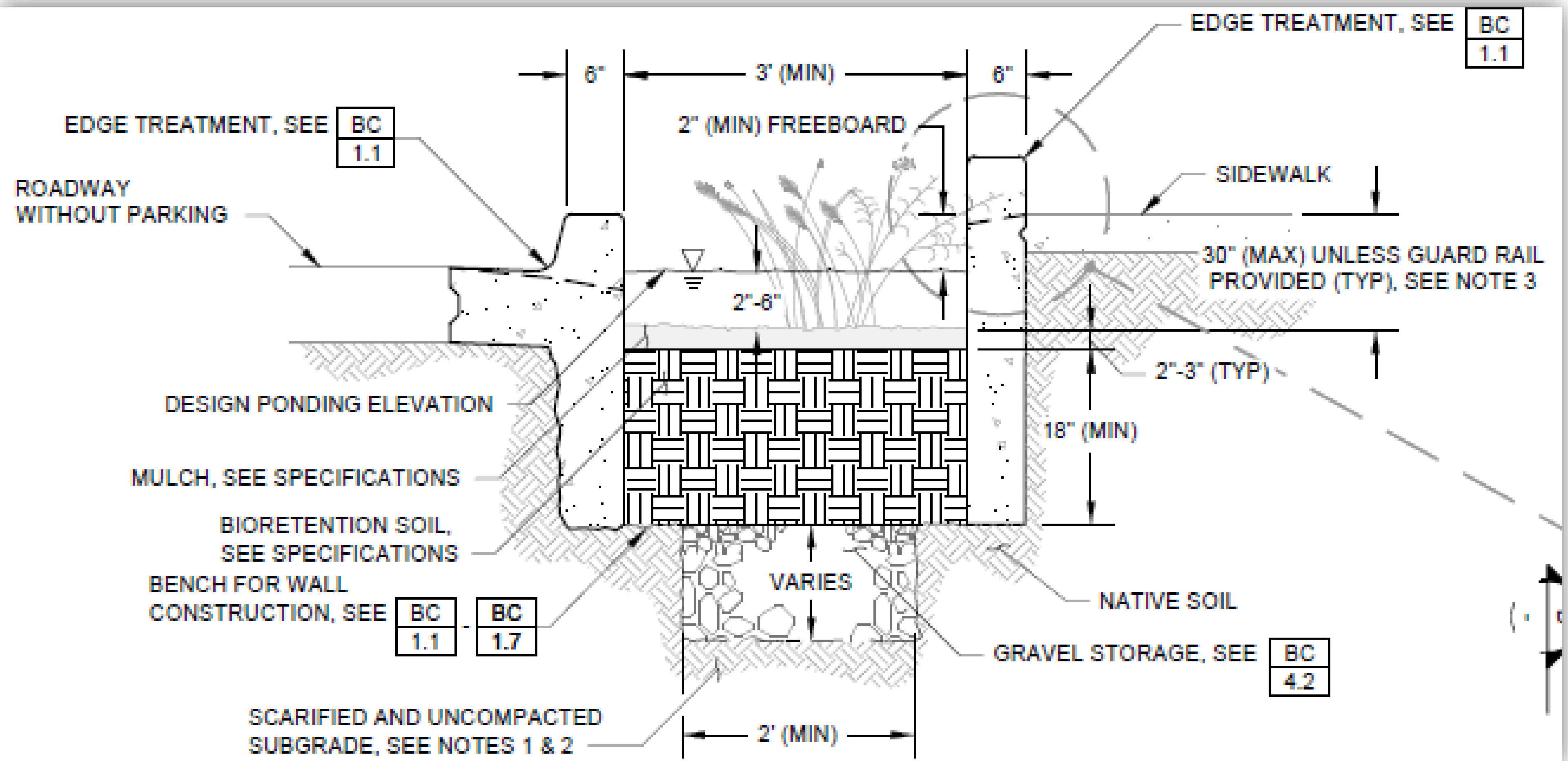


Stormwater Planter Cross-section

Curb Extensions

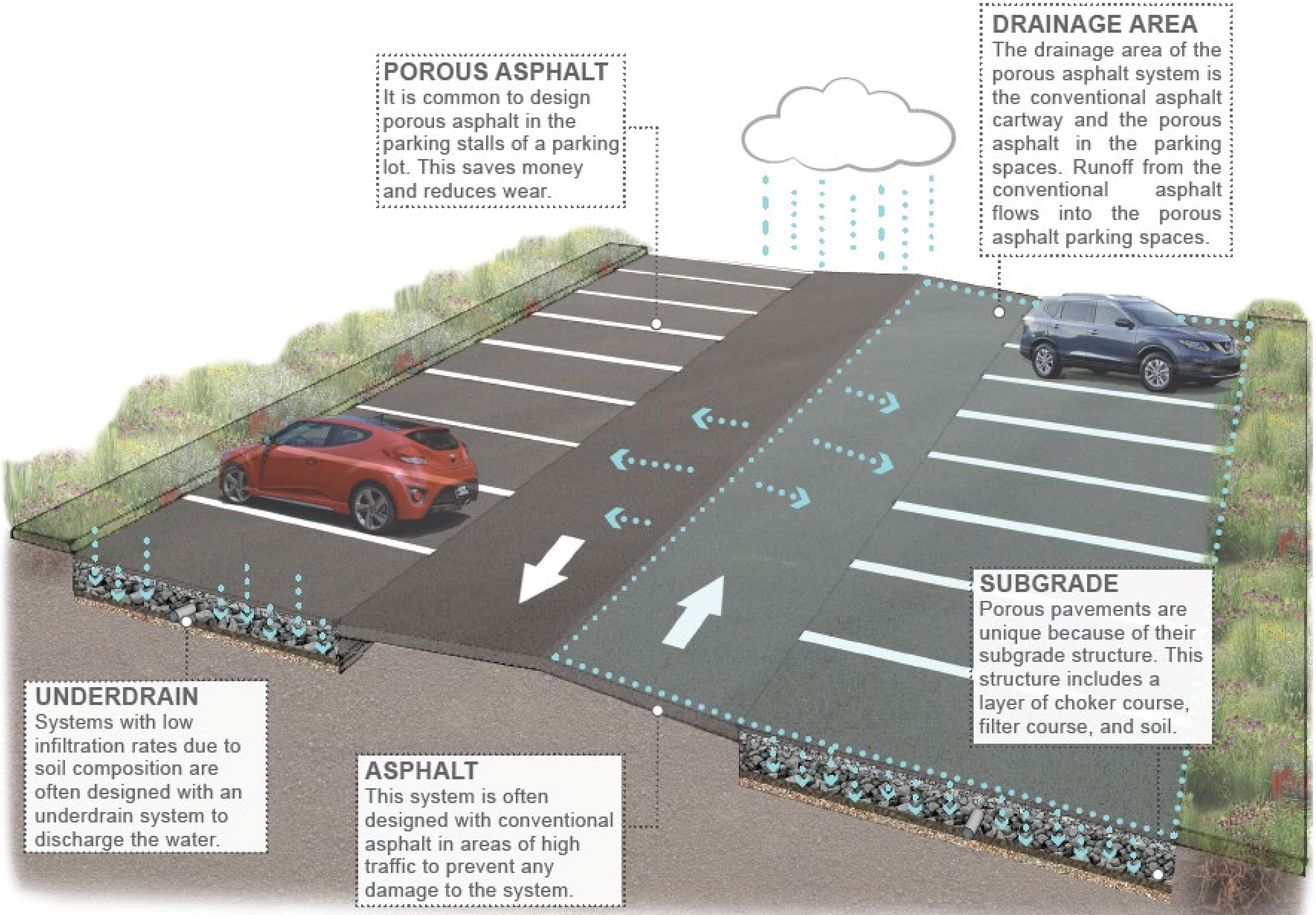


NOTE:
Graphic adapted f
Portland, OR Storm
Manual Details



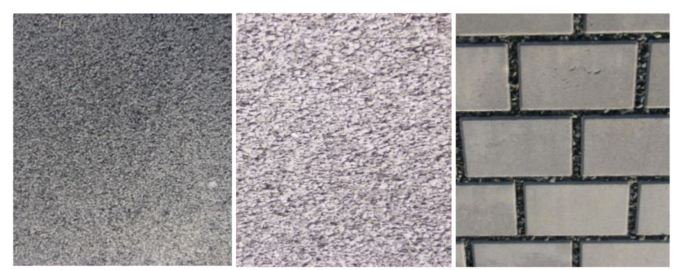
EDGE TREATMENT, SEE BC 1.1
6"
3' (MIN)
6"
EDGE TREATMENT, SEE BC 1.1
2" (MIN) FREEBOARD
ROADWAY WITHOUT PARKING
SIDEWALK
2"-6"
30" (MAX) UNLESS GUARD RAIL PROVIDED (TYP), SEE NOTE 3
2"-3" (TYP)
DESIGN PONDING ELEVATION
18" (MIN)
MULCH, SEE SPECIFICATIONS
BIORETENTION SOIL, SEE SPECIFICATIONS
BENCH FOR WALL CONSTRUCTION, SEE BC 1.1 - BC 1.7
VARIES
NATIVE SOIL
GRAVEL STORAGE, SEE BC 4.2
SCARIFIED AND UNCOMPACTED SUBGRADE, SEE NOTES 1 & 2
2' (MIN)

Permeable Pavement



Permeable Pavements

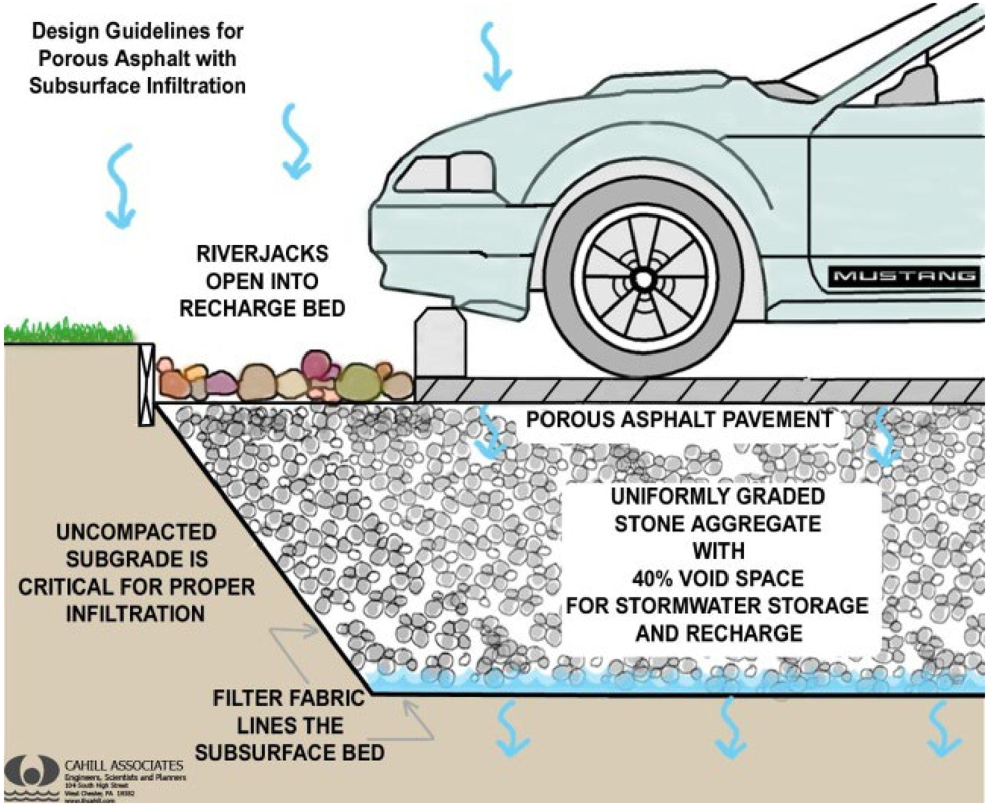
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable paver systems are concrete pavers with infiltration between the spaces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



ADVANTAGES

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

COMPONENTS



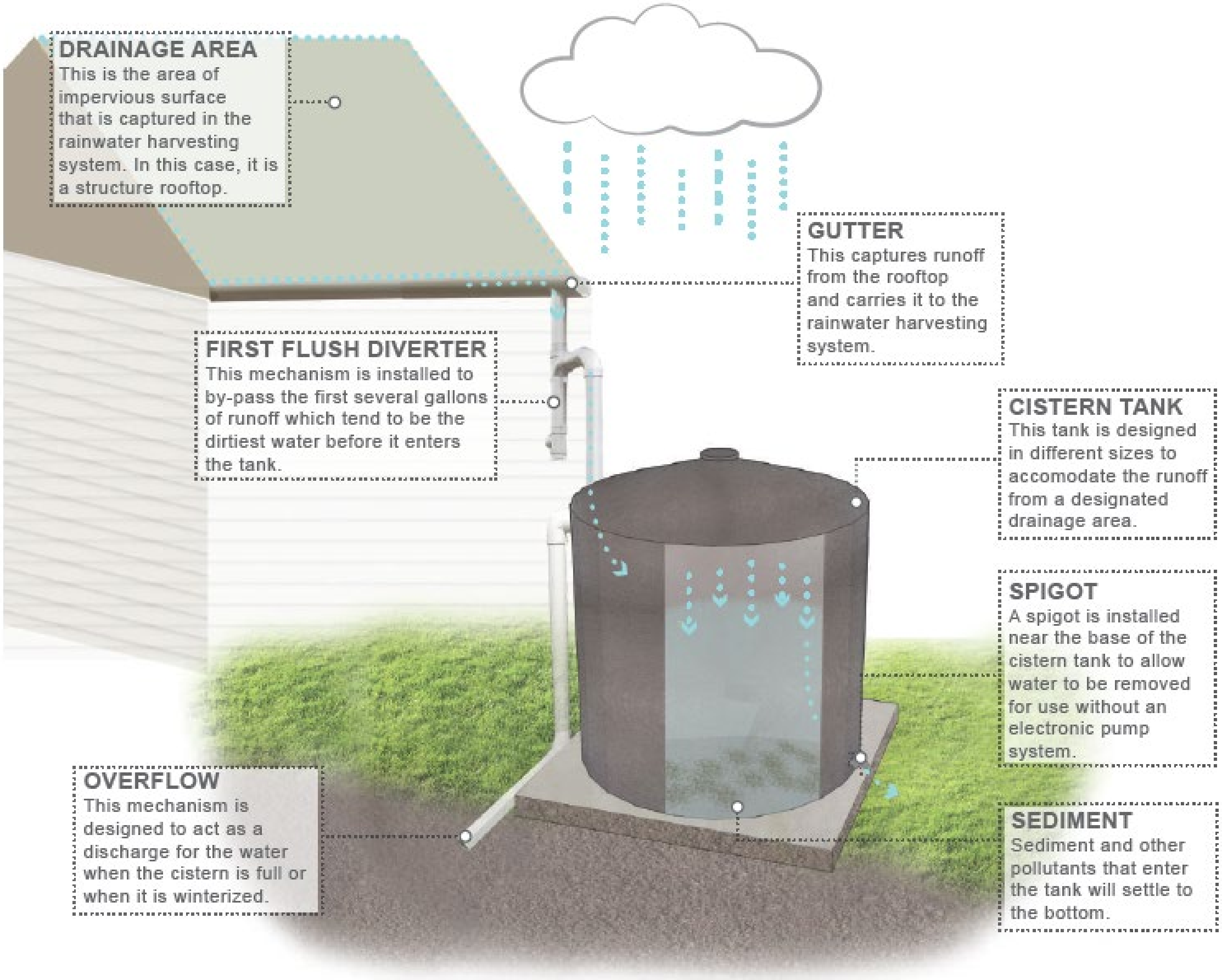
Porous Asphalt


Pervious Concrete


Permeable Pavers

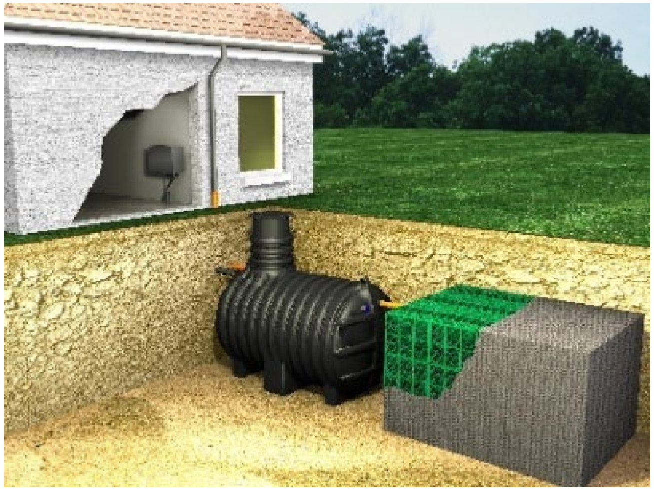
Grass Pavers

Rainwater Harvesting Systems



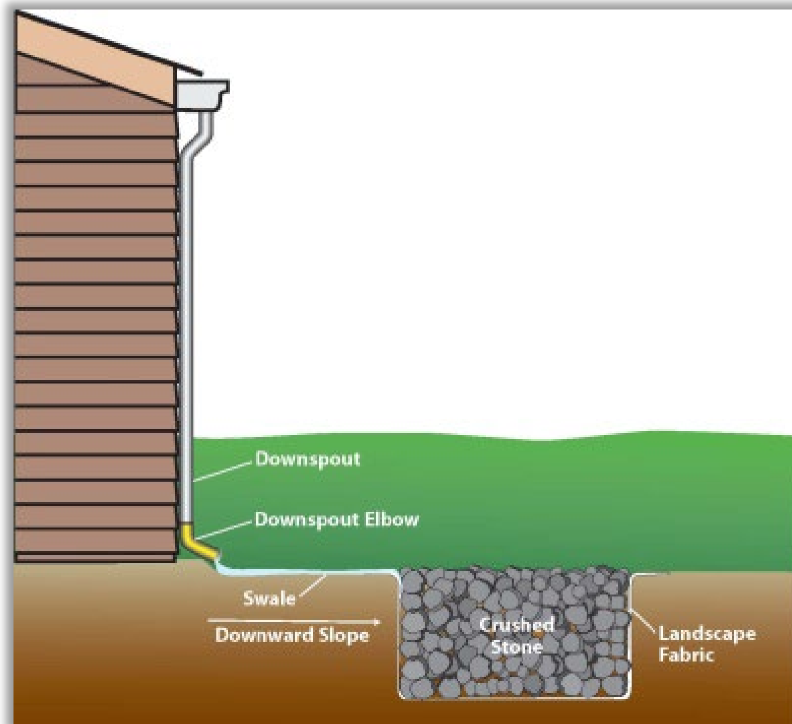
Rain Barrels

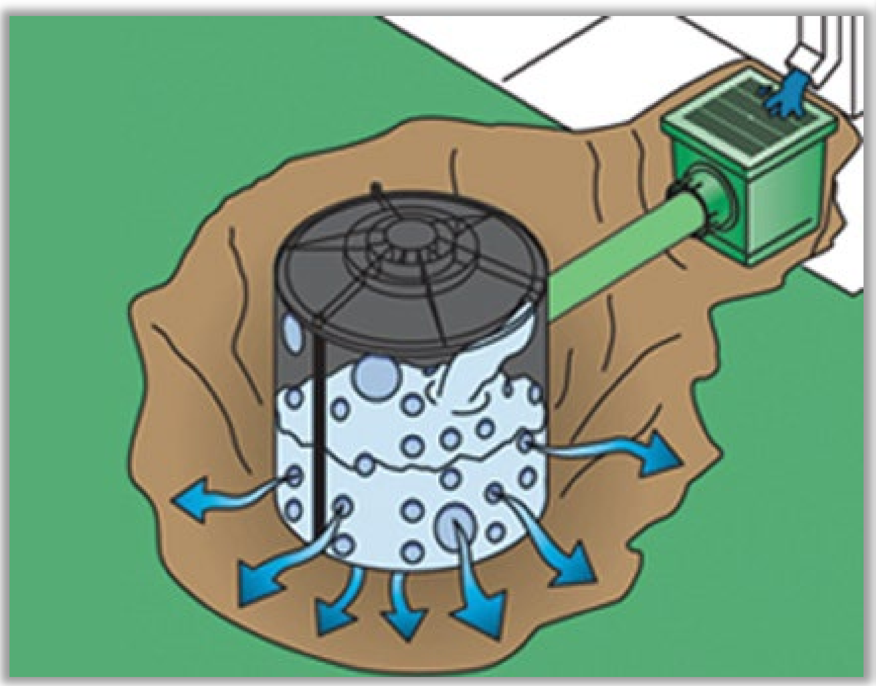
Cisterns



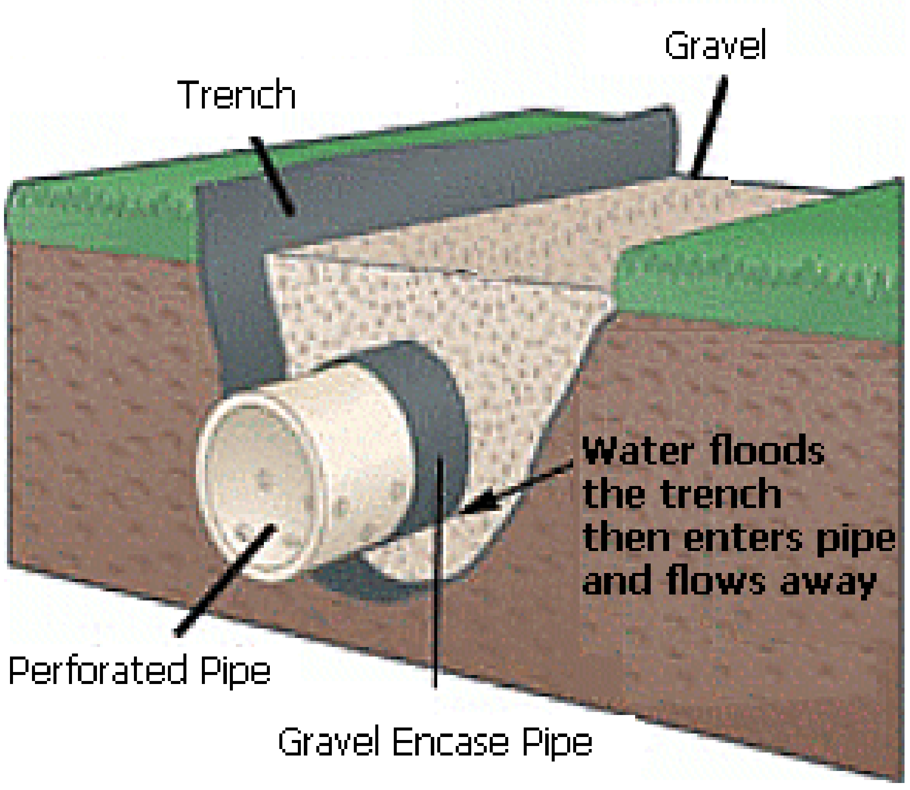

3M

Dry Wells


Downspout
Downspout Elbow
Swale
Downward Slope
Crushed Stone
Landscape Fabric

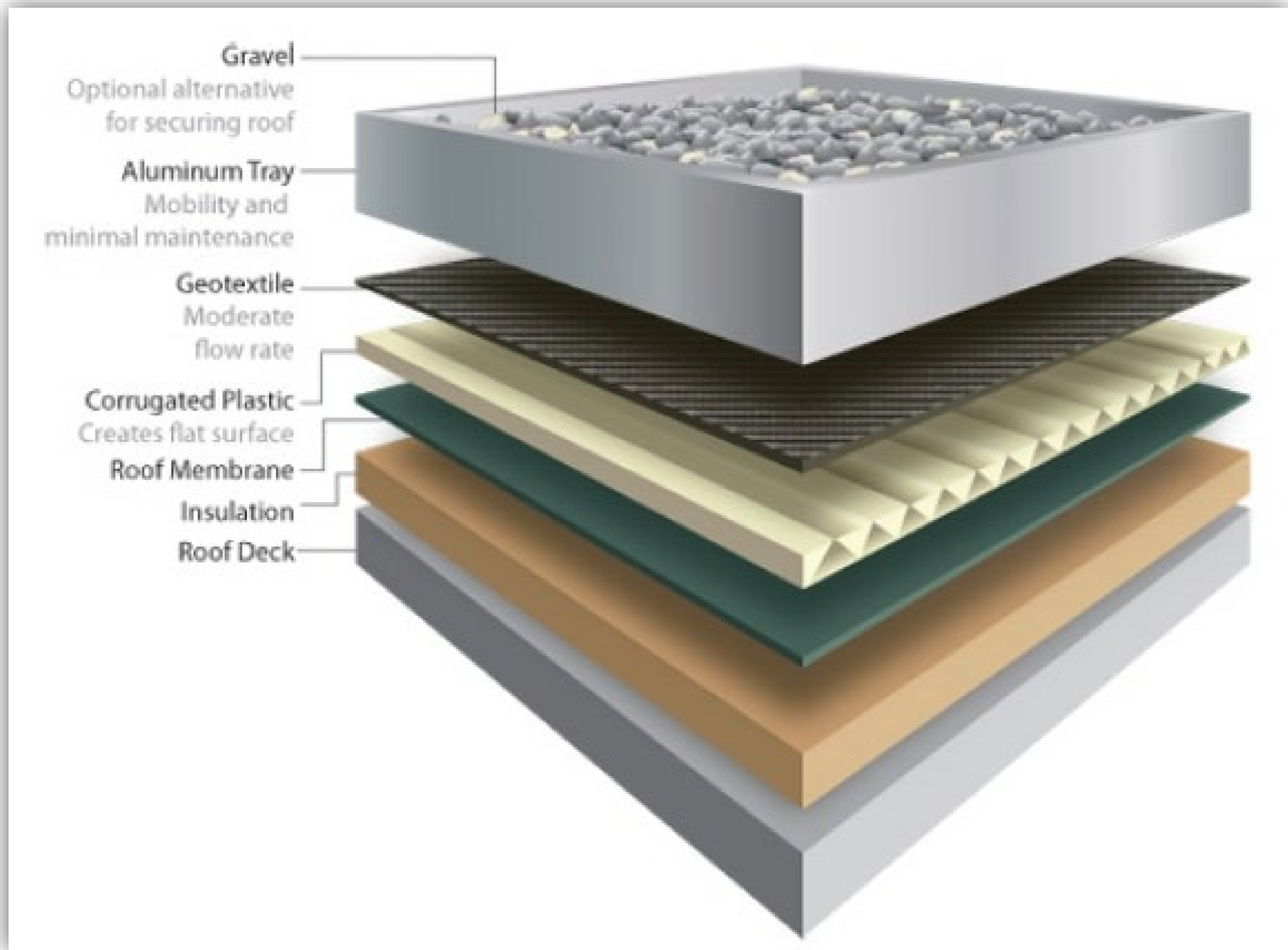


Infiltration Trench



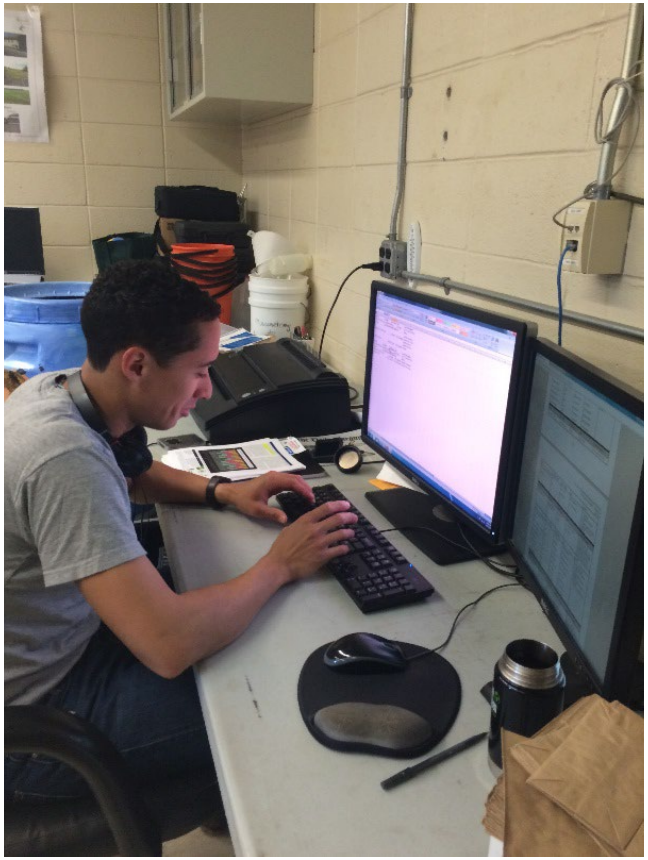
Rooftop Practices – Green Roof

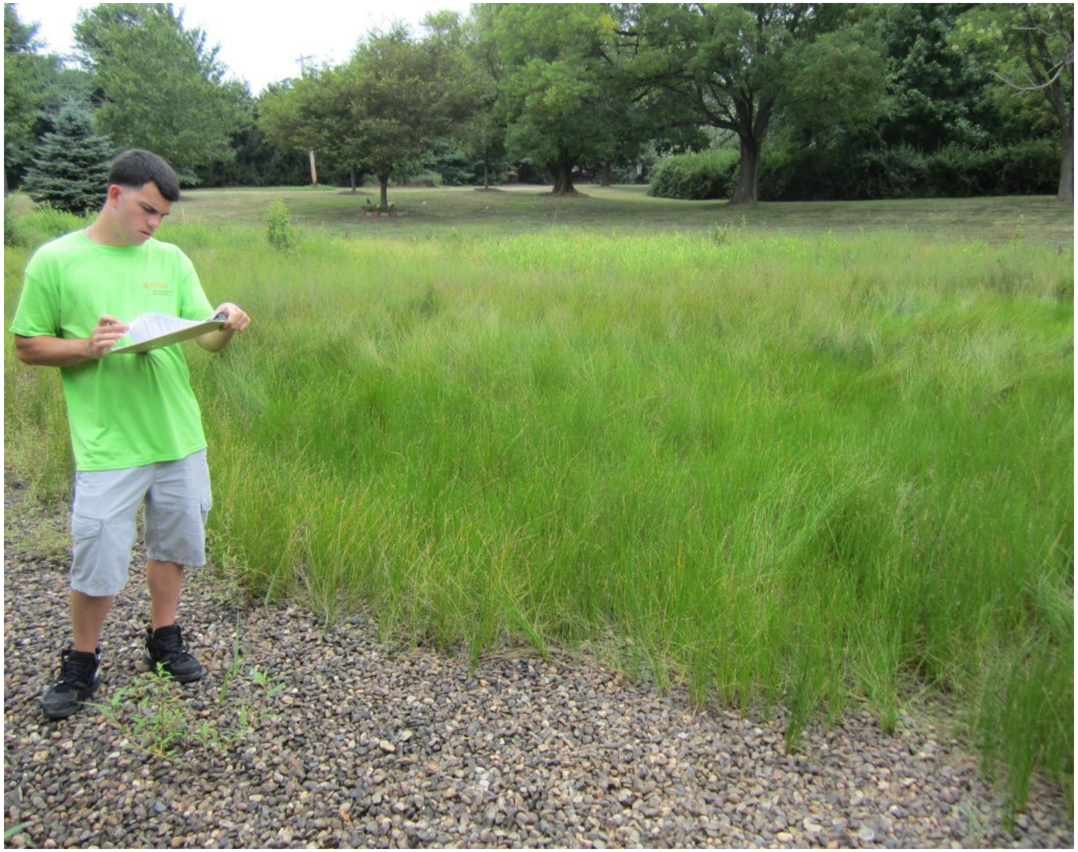
Rooftop Practices – Blue Roof




Stormwater Wetlands

Identifying Sites for Green Infrastructure



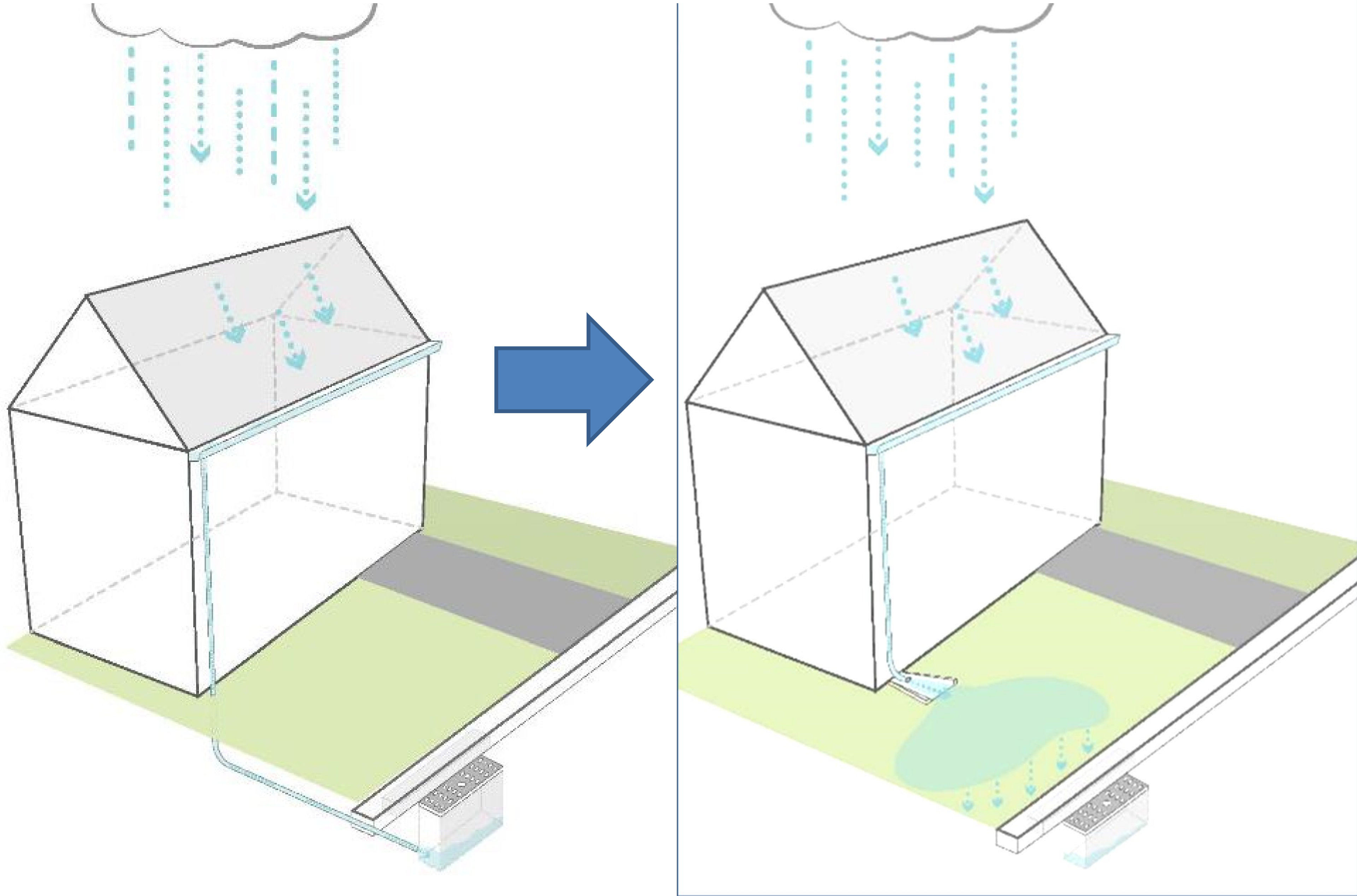


RUTGERS
New Jersey Agricultural
Experiment Station

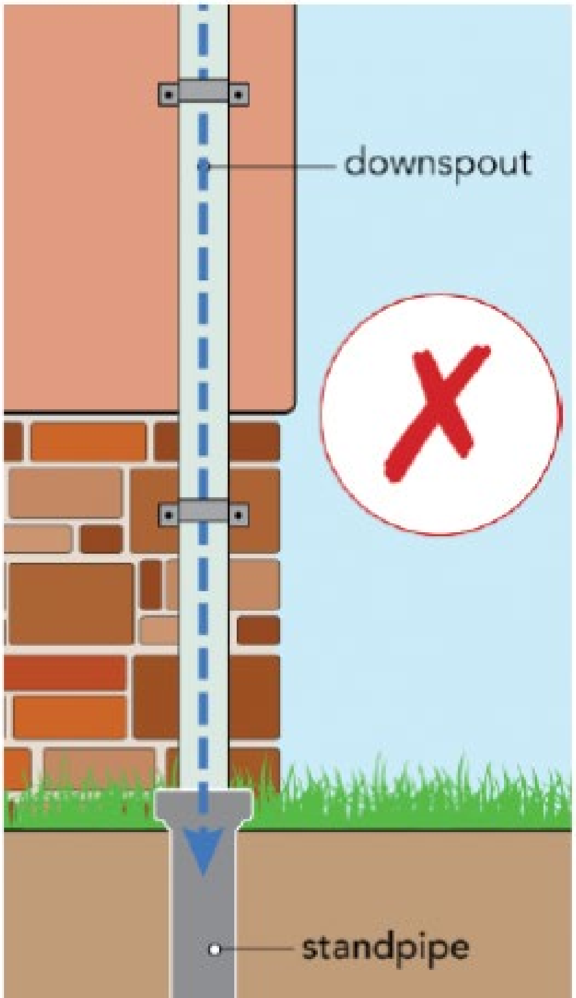
It is all about controlling runoff from impervious surfaces

Connected or Disconnected?

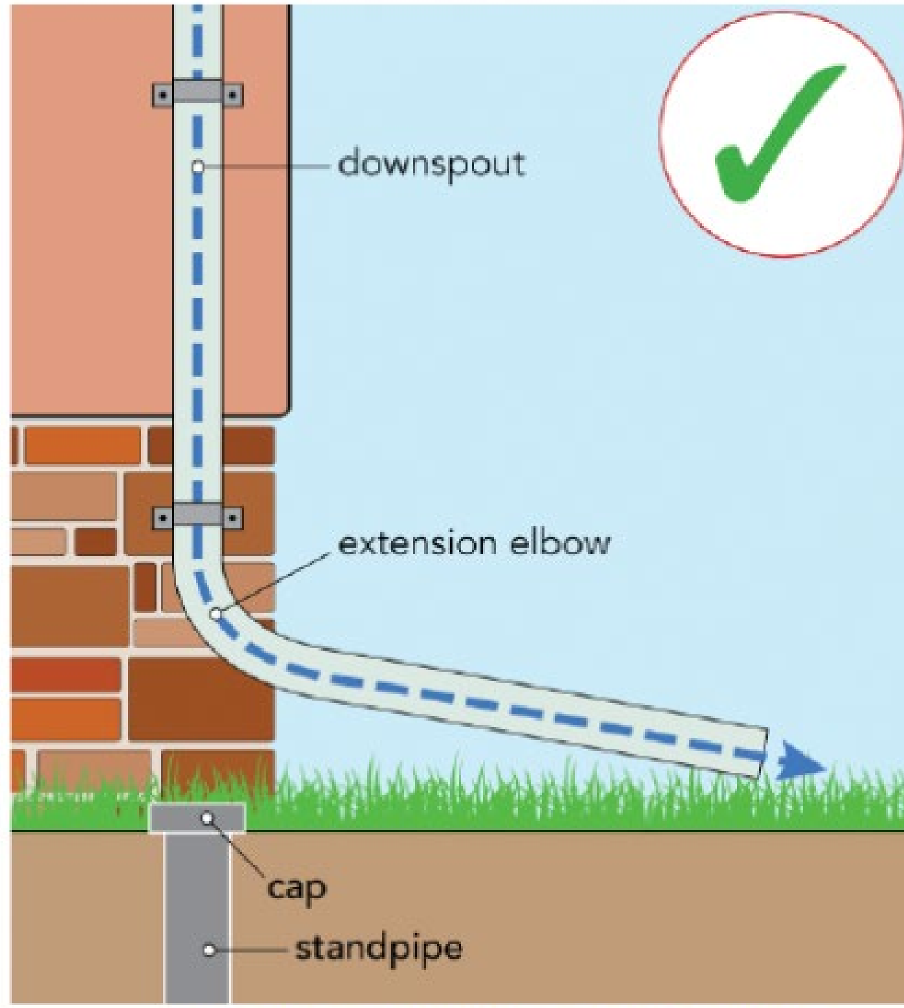
Simple Disconnection



Downspout Disconnection



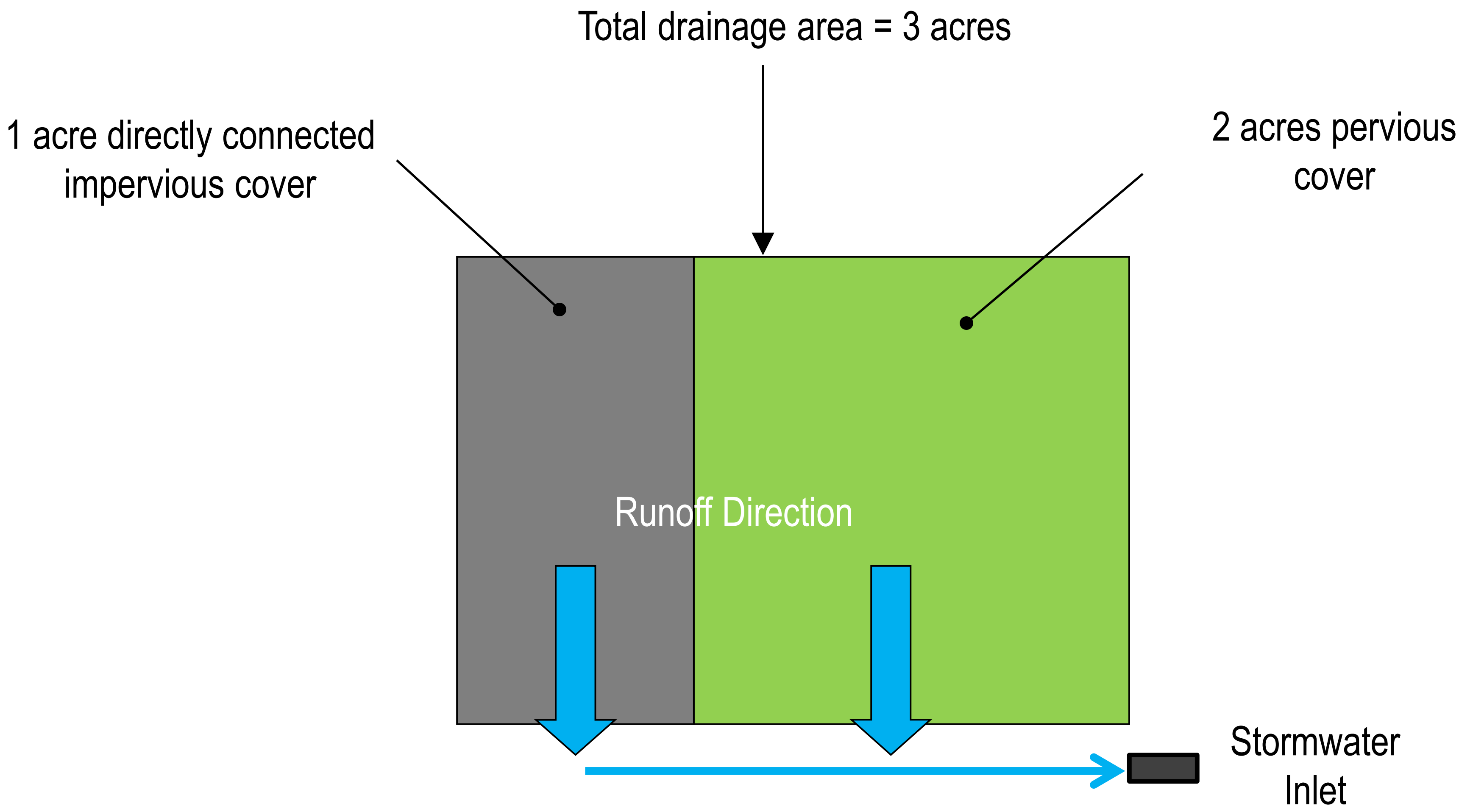
DOWNSPOUT CONNECTED TO SEWER SYSTEM



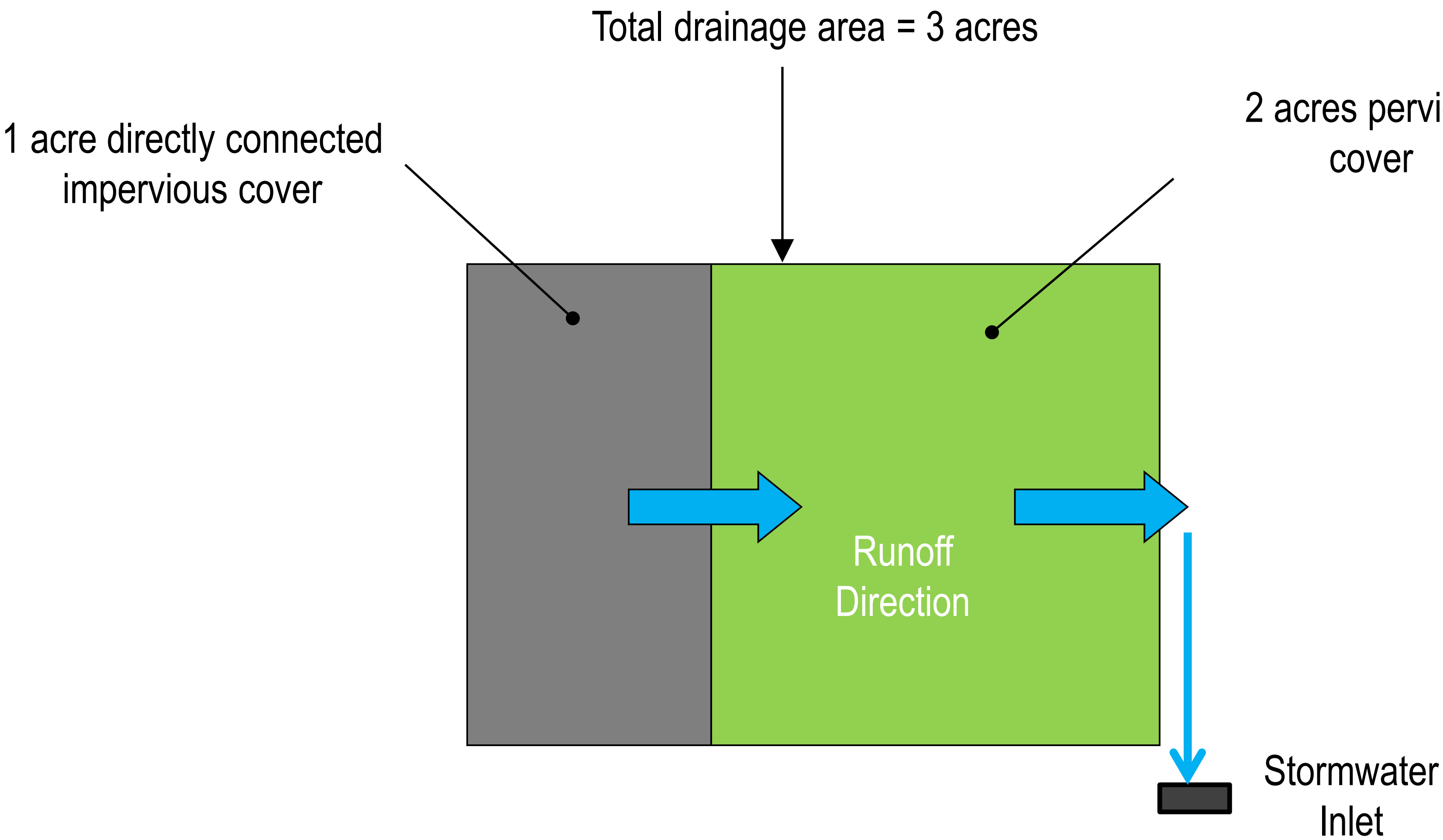
DOWNSPOUT DISCONNECTED FROM SEWER SYSTEM

Another Example of Simple Disconnection

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

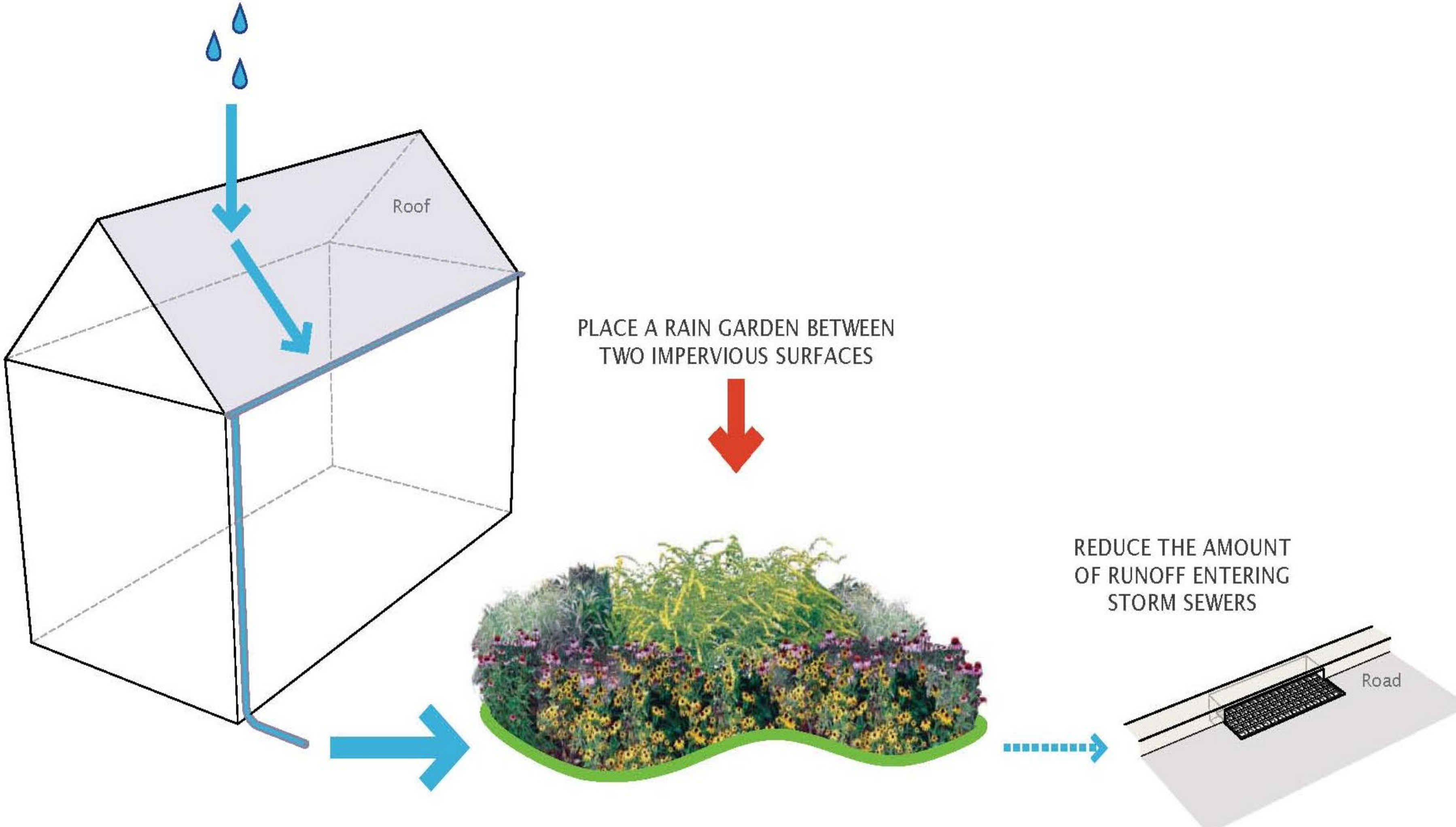


For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**

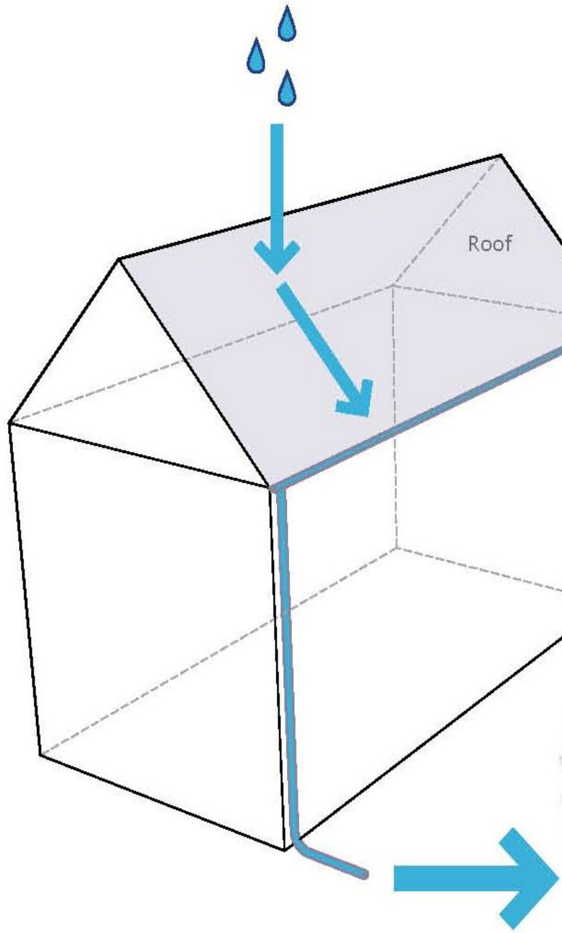


	Volume of Runoff		
Design Storm	**Connected (gallons)**	**Disconnected (gallons)**	**Percent Difference**
1.25 inches (water quality storm)	28,500	4,360	85%

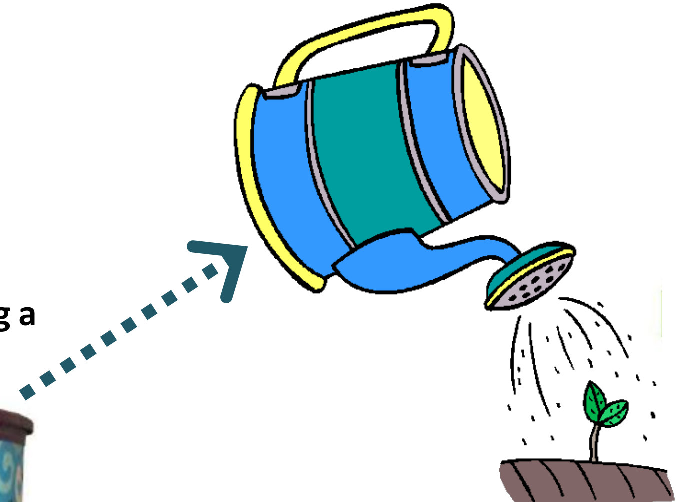
Disconnect with a rain garden



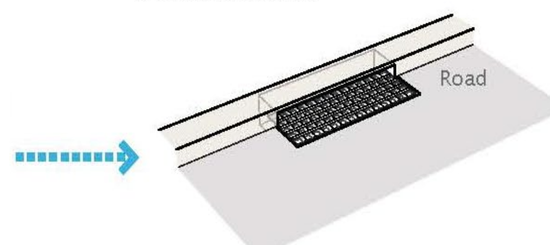
Disconnect to a Rain Barrel or Cistern



Disconnect your downspout by installing a rain barrel



REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS



Impervious area is now ***<u>"disconnected"</u>*** from flowing directly into the storm sewer system

Site Selection

What are good sites?

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

WE LOOK HERE FIRST:

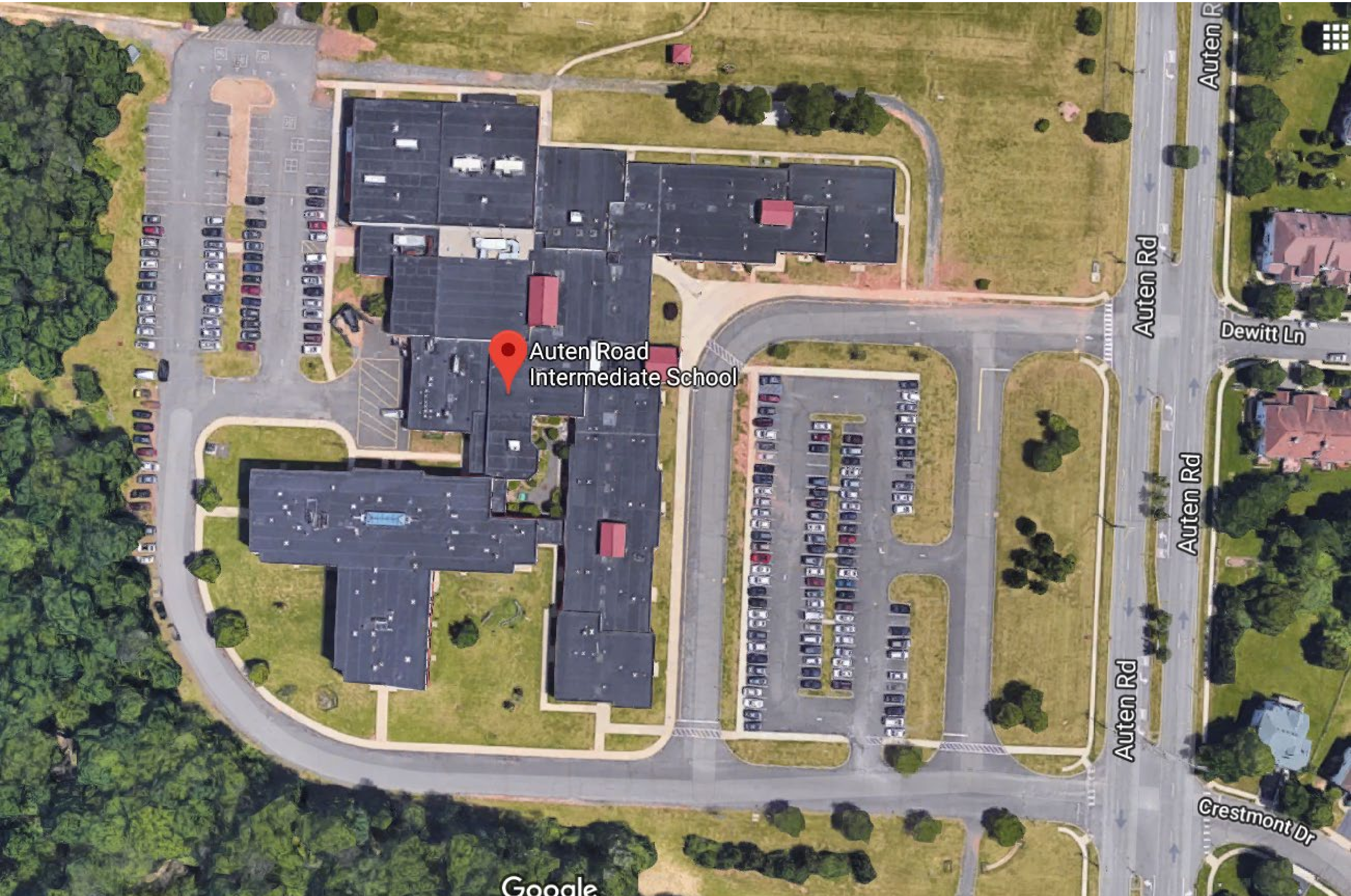
- ✓ Schools
- ✓ Places of Worship
- ✓ Libraries
- ✓ Municipal Building
- ✓ Public Works
- ✓ Firehouses
- ✓ Post Offices
- ✓ Elks or Moose Lodge
- ✓ Parks/ Recreational Fields

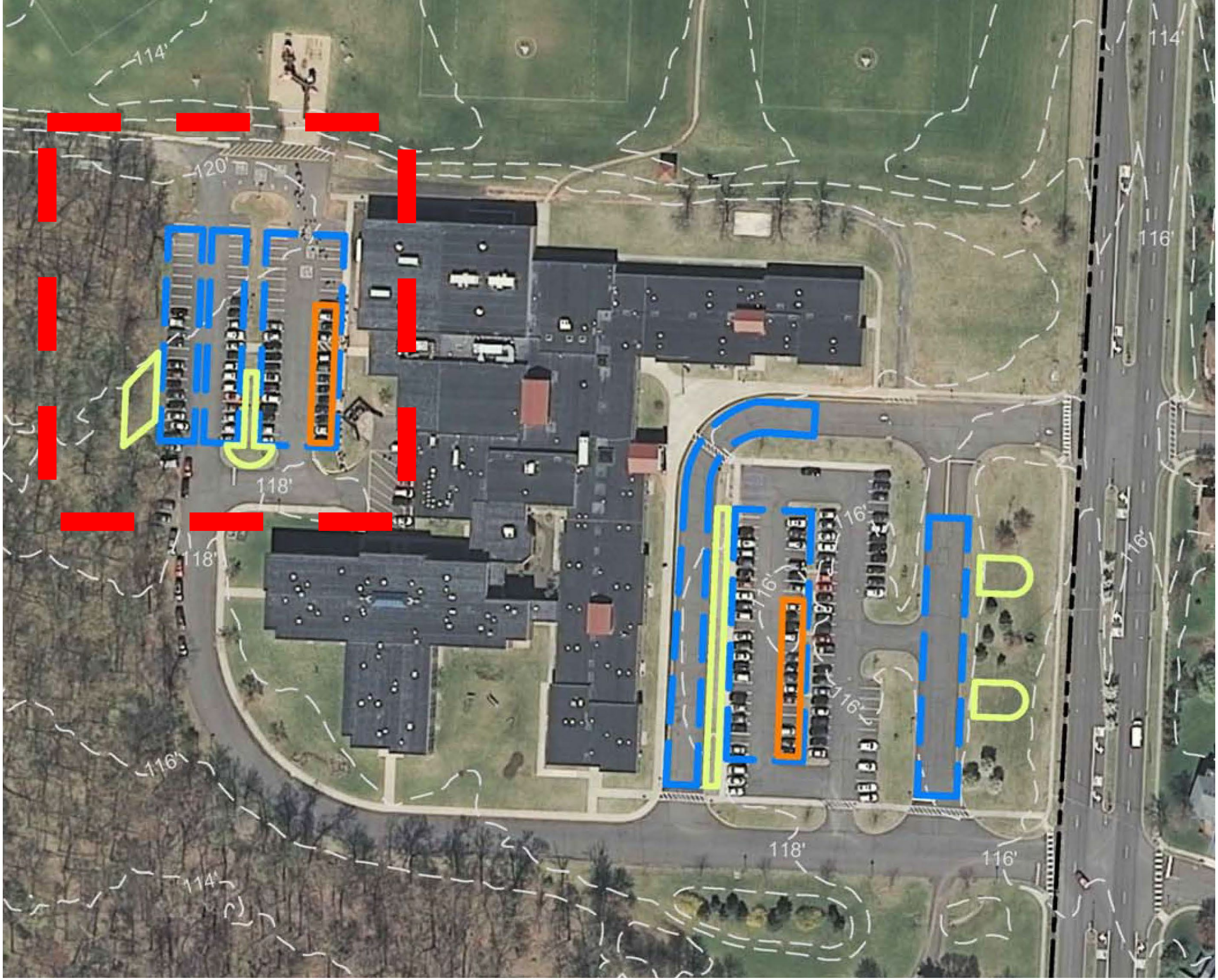
- 20 to 40 sites are entered into a PowerPoint
- Site visits are conducted

Google or Bing Maps

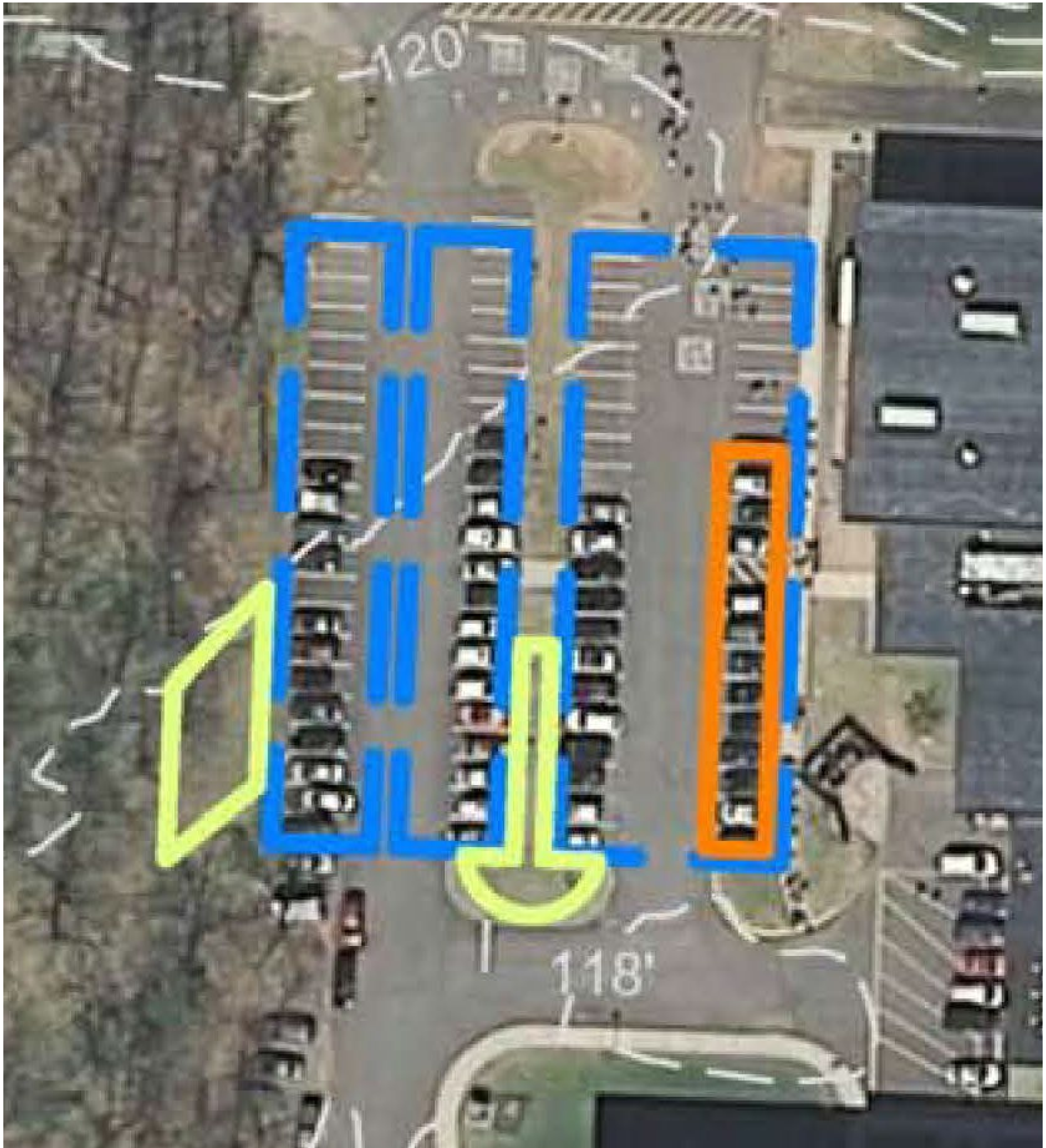
- Go to Google or Bing Maps
- Type in address
- Aerial or birds eye view
- “Snip It” (MS Windows Accessory)
- Insert into PowerPoint
- “Crop It”

Auten Road School in Hillsborough, NJ
281 Auten Rd, Hillsborough Township, NJ 08844

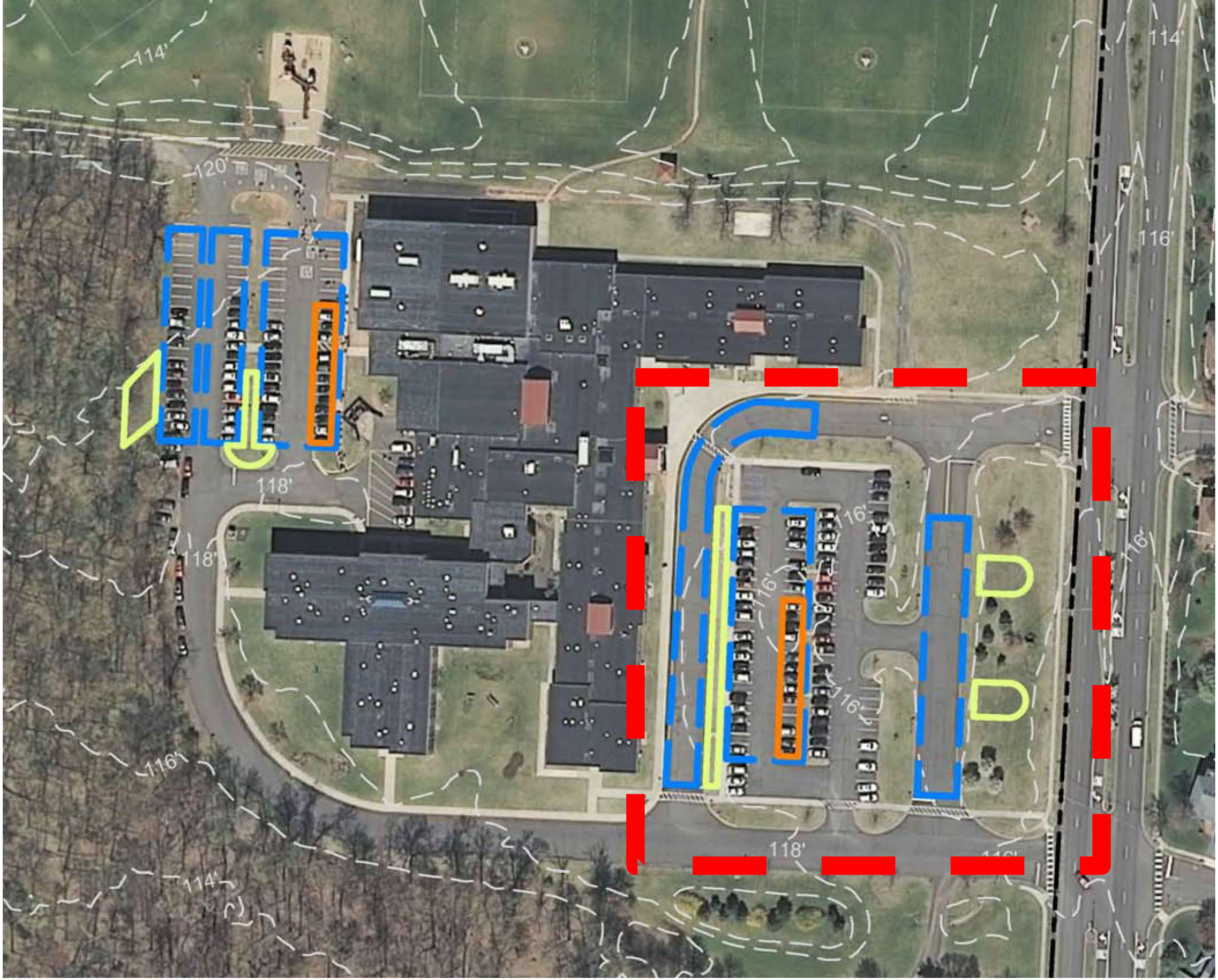




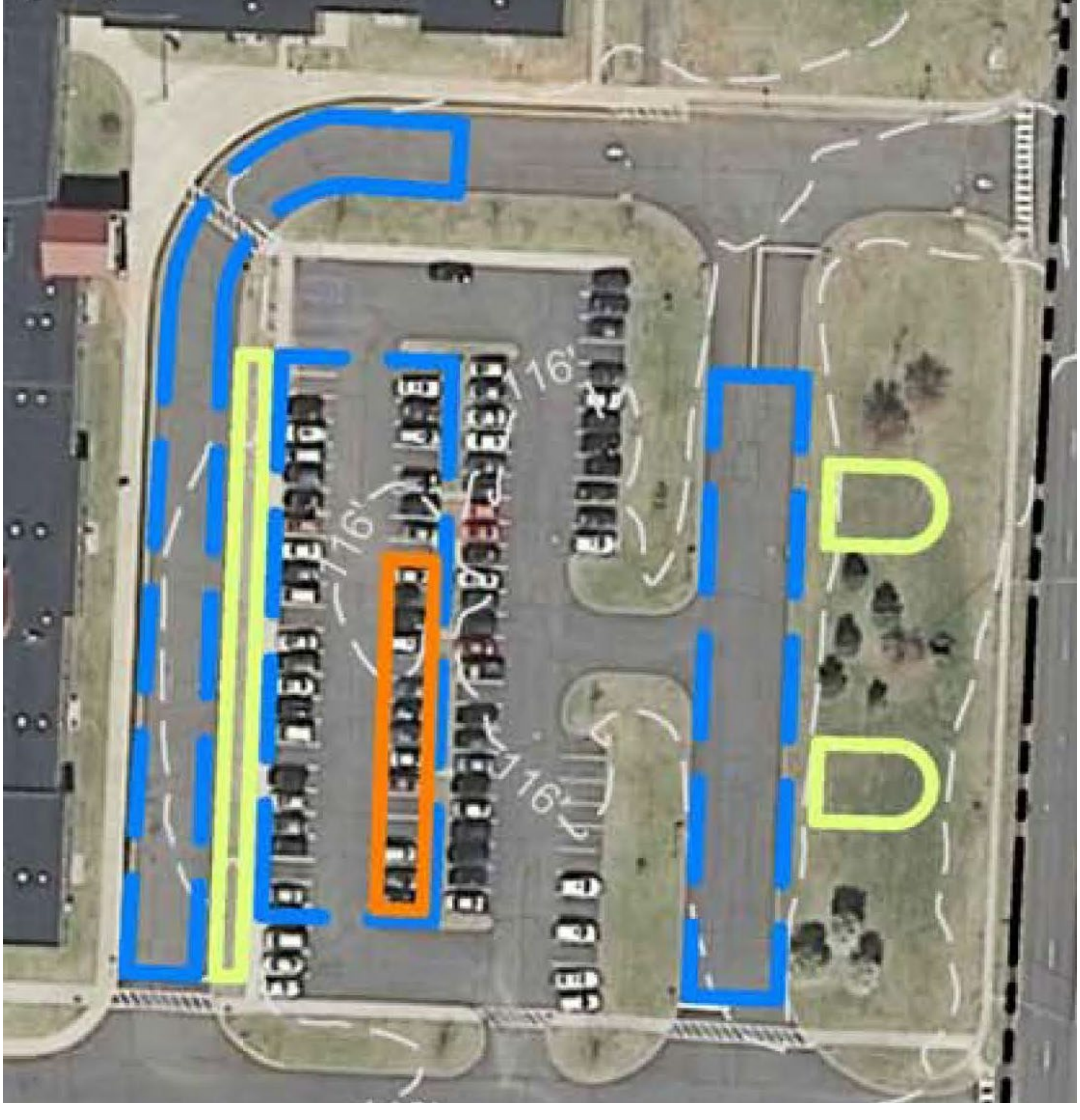
114'
120'
118'
118'
116'
114'
114'
116'
116'
116'
116'
116'
118'
116'



120'
118'



114'
120'
118'
118'
116'
114'
114'
116'
116'
116'
116'
116'
118'


116'
116'
116'


©2016 Google


1


4
NO.2
ENGINE 37-103
2
IN LOVING MEMORY OF
OUR DEPARTED SISTERS
1973


5


8


1


5
ANY TIME
NO IDLING ZONE
IT'S THE LAW


6
STOP


7
NO PARKING
ANY TIME

8


3


4

"Protecting Public Health and the Environment"

RUTGERS

New Jersey Agricultural
Experiment Station

"Protecting Public Health and the Environment"

RUTGERS

New Jersey Agricultural Experiment Station

Pittsgrove Baptist Church

RUTGERS
New Jersey Agricultural Experiment Station

Subwatershed: Salem River

Site Area: 696,419 sq. ft.

Address: 368 Daretown Road
Elmer, NJ 08318

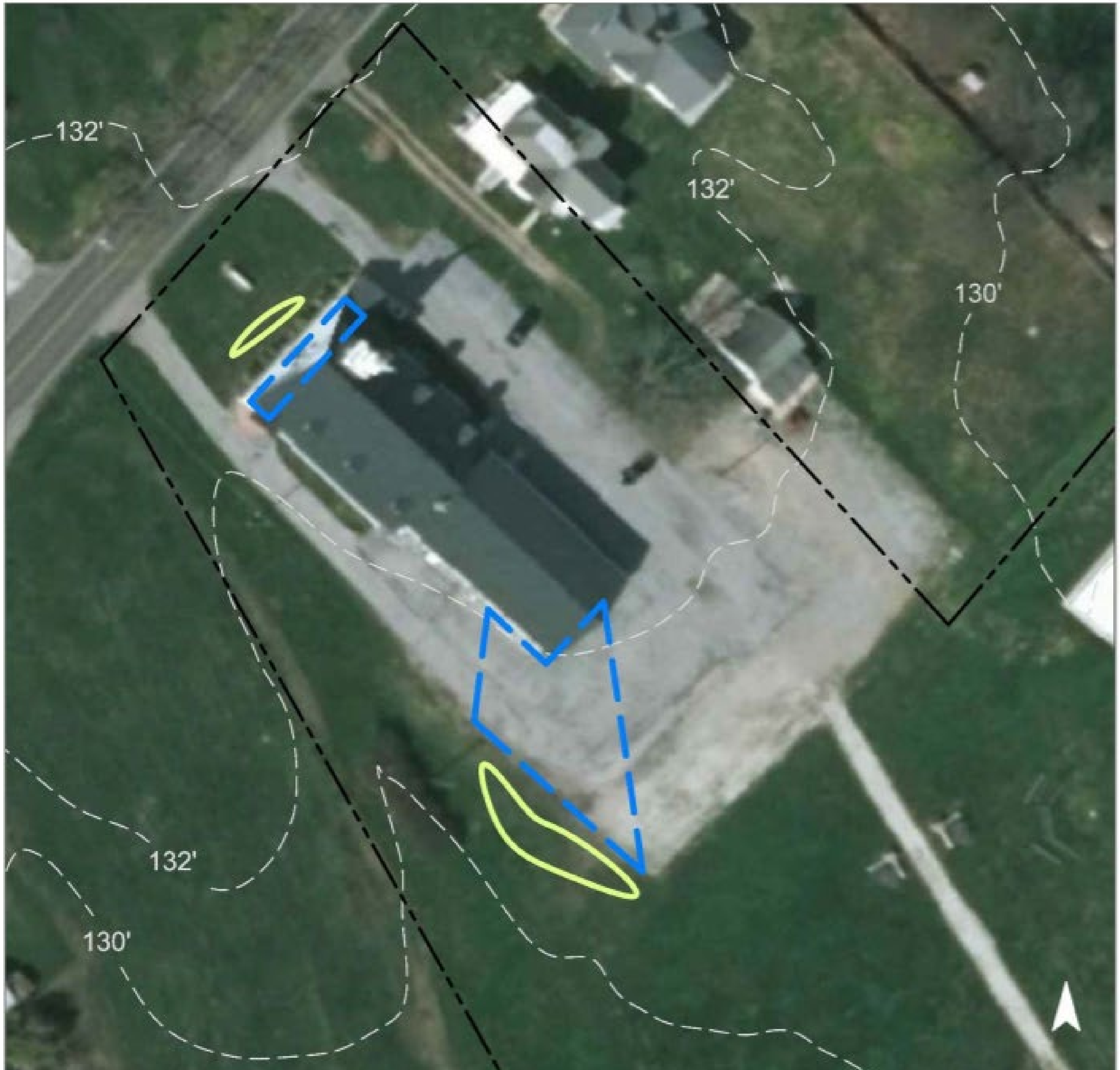
Block and Lot: Block 59, Lot 14, 17

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

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"
5	34,224	1.6	17.3	157.1	0.027	0.94

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	0.107	18	7,840	0.29	1,050	$5,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Pittsgrove Baptist Church

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

CURRENT CONDITION

CONCEPT DESIGN

Site Visits

What are we looking for during our site visit?

1. What are sources of stormwater and where does it flow?
2. What is the direction and relative slope of the 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 the site?
10. Where are the utilities on the site?
11. Are there pedestrian safety issues?

Other Questions

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

THINGS YOU SHOULD BRING ON A SITE VISIT

Aerial photo

Pencil

Tape measure and/or measuring wheel

Camera

GREEN INFRASTRUCTURE CHECKLIST – Green Infrastructure Manual

Green Infrastructure
Site Assessment Checklist

GENERAL INFORMATION		Site ID:
Name person(s) completing assessment:		Date:
Location Address and Cross Streets:	Neighborhood:	
Name of Nearest Waterway:	Property Owner / Tax Parcel ID/Street Segment:	
Contact Information:		
SITE DESCRIPTION		
Description of site and relative visibility to the public (public or private property, lot size, current use, streetscape, etc):		

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

Green Infrastructure
Site Assessment Checklist

Choose suggested best management practices (BMPs) or indicate other. Include site photos and a description of recommended BMP location.

BIORETENTION SYSTEMS (RAIN GARDENS)	YES	NO	COMMENTS
1) Are there visible, exterior downspouts on any buildings?			
2) Are there unpaved areas suitable for landscaping?			
3) Is the site subject to ponding or flooding?			
RAINWATER HARVESTING	**YES**	**NO**	**COMMENTS**
1) Are there nearby buildings with visible exterior downspouts?			
2) Is there a community garden nearby or other use for collected rainwater?			
TREE PITS, TRENCHES, AND STREETSCAPE STRATEGIES	**YES**	**NO**	**COMMENTS**
1) Does stormwater flow across sidewalks or along the curb?			
2) Are there existing trees, landscaping or tree pits near the street?			
2) Can water be directed from the street/curb into adjacent areas?			
POROUS PAVEMENT	**YES**	**NO**	**COMMENTS**
1) Are there large areas of pavement on the site and are any paved areas not heavily used (i.e. fire lane, overflow)?			
2) Are existing impervious areas in poor condition and in need of replacement?			
CURB EXTENSIONS AND STORMWATER PLANTERS	**YES**	**NO**	**COMMENTS**
1) Is this a heavily used pedestrian crossing? Are there pedestrian crosswalks that would be safer if shortened?			
2) Is the intersection or street at a location where stormwater can be collected before it enters a storm drain?			
OTHER STRATEGIES	**YES**	**NO**	**COMMENTS**

Next Class

- ✓ How to identify green infrastructure projects in your town
2. Moving from planning to implementation of green infrastructure – Jan. 28th
3. Maintaining green infrastructure practices/projects – Feb. 11th
4. Stormwater management regulations, policies, and ordinances – Feb. 25th

RESOURCES FOR YOU!

Rutgers | School of Environmental and Biological Sciences | Search Rutgers

RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

Search This Site | Go

- HOME PAGE
- About the Program
- Staff
- Projects & Programs
- Recent Presentations
- Water Pages
- Fact Sheets
- E-learning Tools
- Useful Links

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

Connect With Us

HOME PAGE
About the Program
Staff
Projects & Programs
Recent Presentations
Water Pages
Fact Sheets
E-learning Tools
Useful Links

Connect With Us

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

Top of Page

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*


QUESTIONS?

Green Infrastructure Champions Program

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

RUTGERS
New Jersey Agricultural Experiment Station

The Geraldine R. DODGE FOUNDATION
IMAGINE A BETTER NEW JERSEY

Sea Grant
NJ Sea Grant Consortium

JERSEY WATER WORKS
Smart infrastructure. Strong communities.

WILLIAM PENN FOUNDATION