

Introduction to Green Infrastructure

Passport to Green Jobs and Careers | GALA

30 Demarest Street at Clinton Hill Early Learning Center

March 18, 2026

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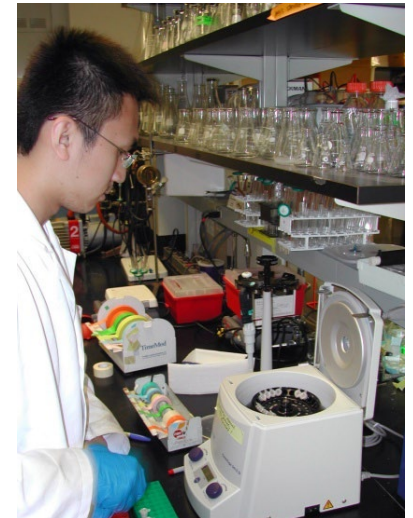


RUTGERS
New Jersey Agricultural
Experiment Station



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.

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.

Water Quality



Water Quantity (flooding)



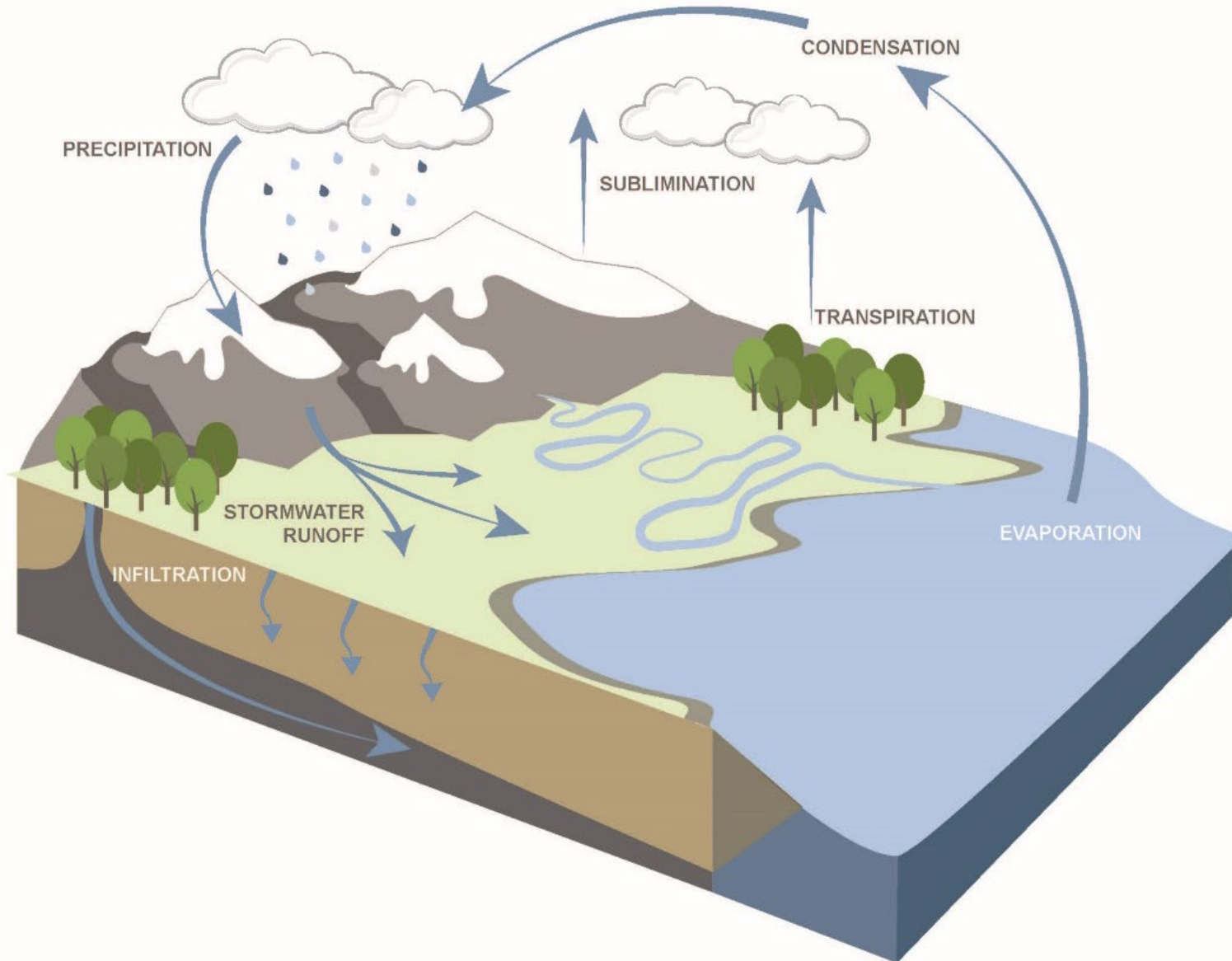
More Flooding



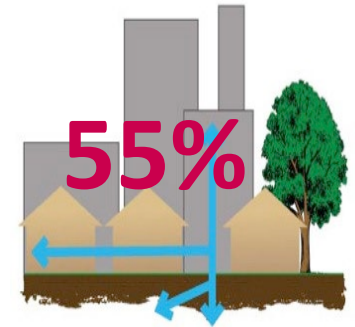
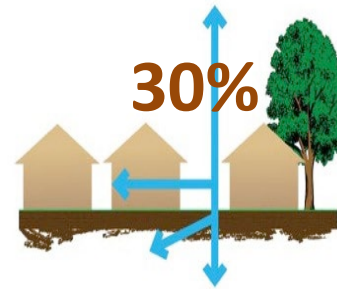
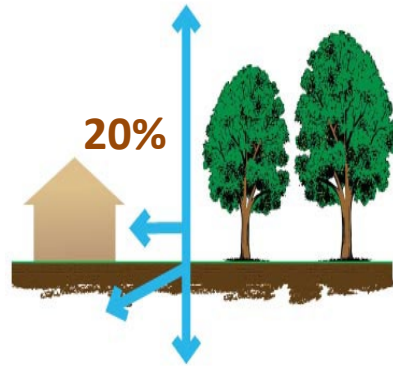
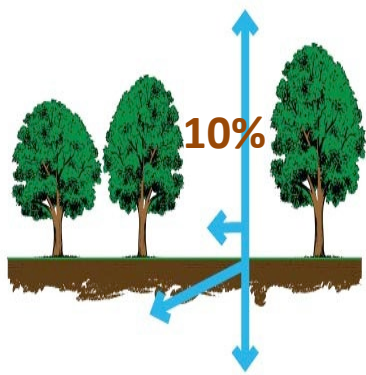
And even more flooding



The Natural Hydrologic Cycle



The Impact of Development on Stormwater Runoff



More development



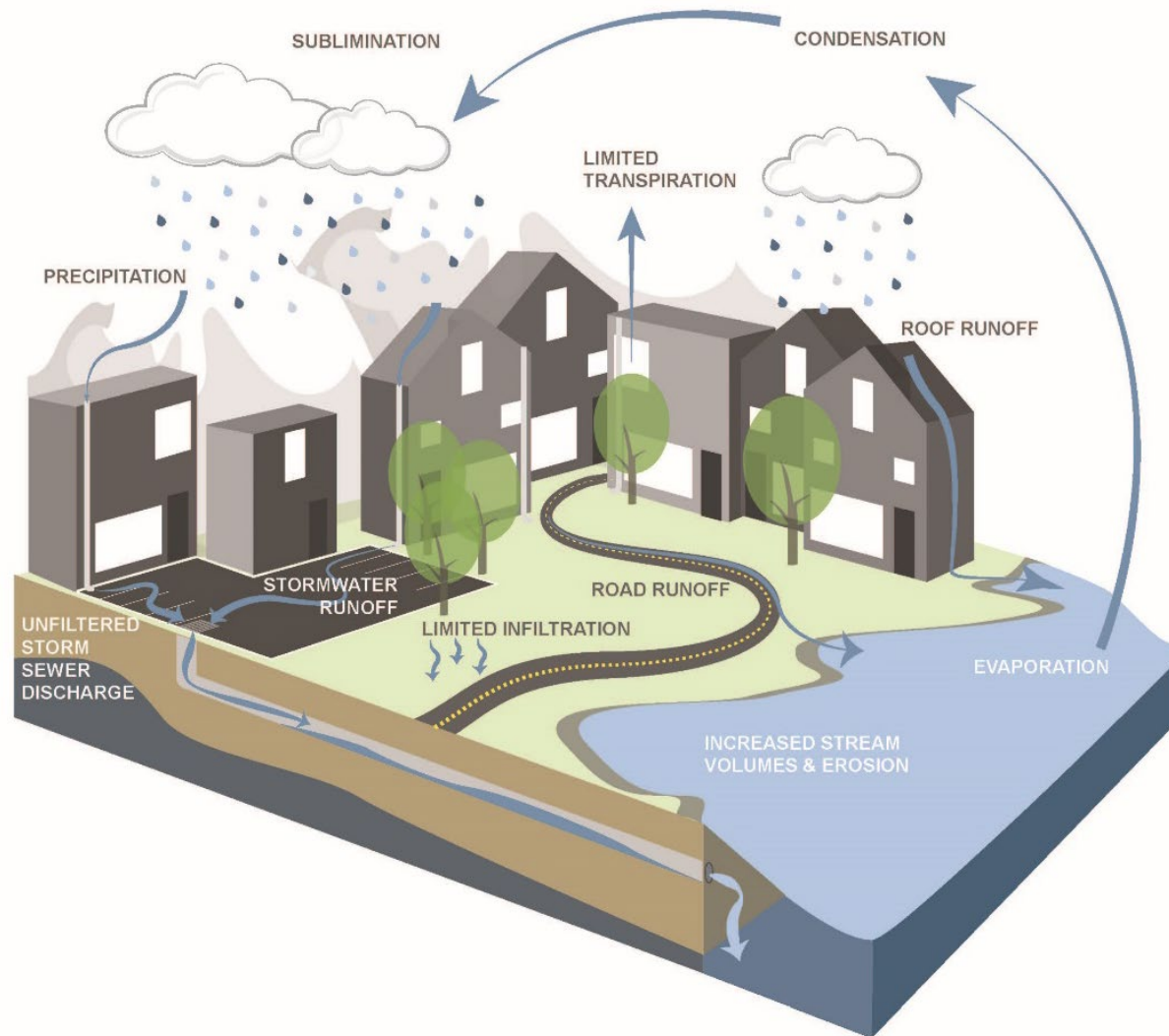
More impervious surfaces



More stormwater runoff

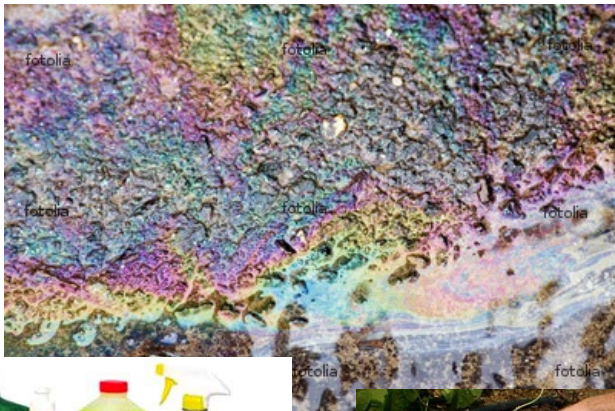


The Urban Hydrologic Cycle



Examples OF Nonpoint Source Pollution

- 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

Bioretention Systems

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



Permeable Pavements

Rainwater Harvesting

- Rain Barrels
- Cisterns



Dry Wells

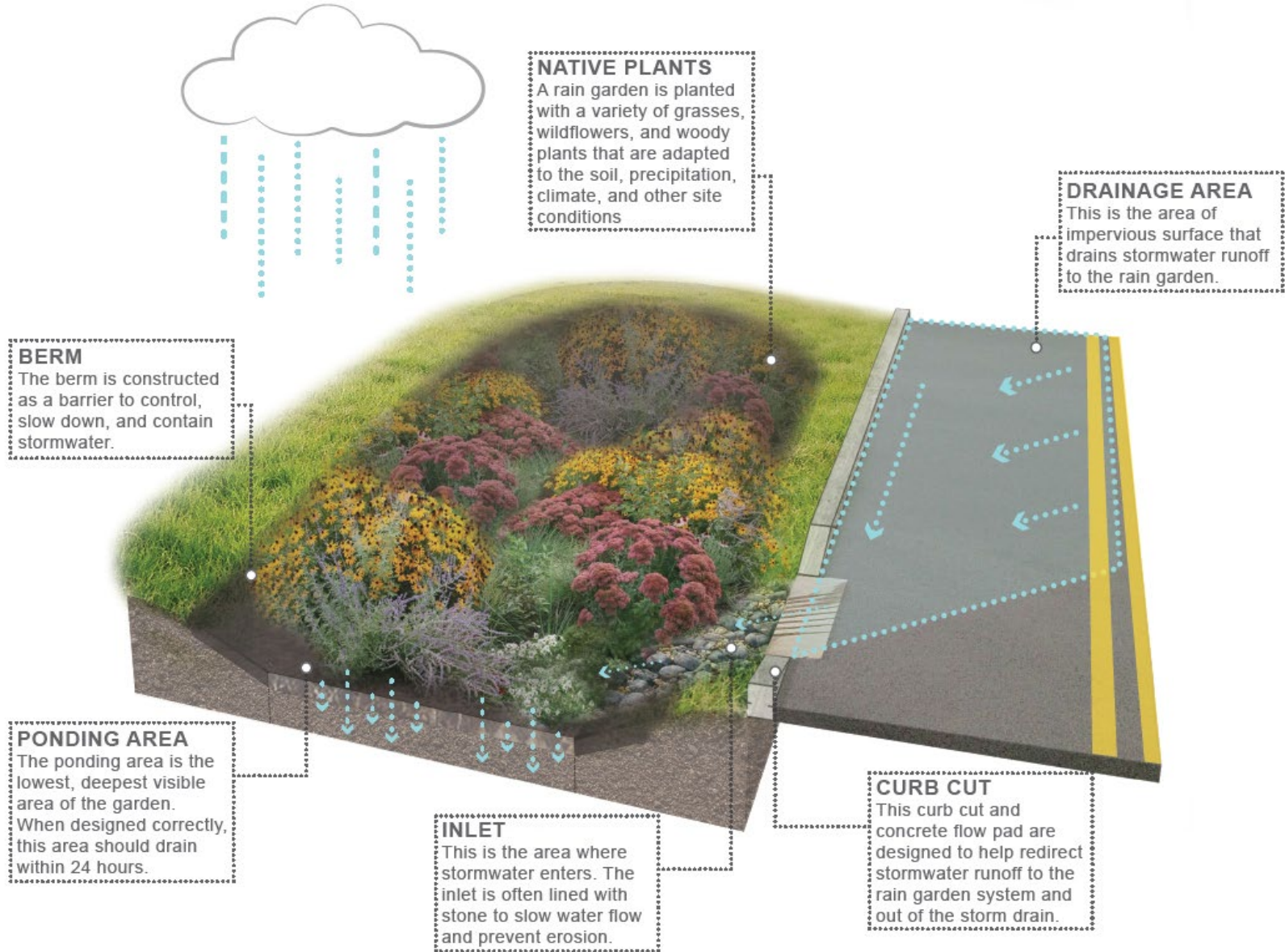
Rooftop Systems

- Green Roofs
- Blue Roofs

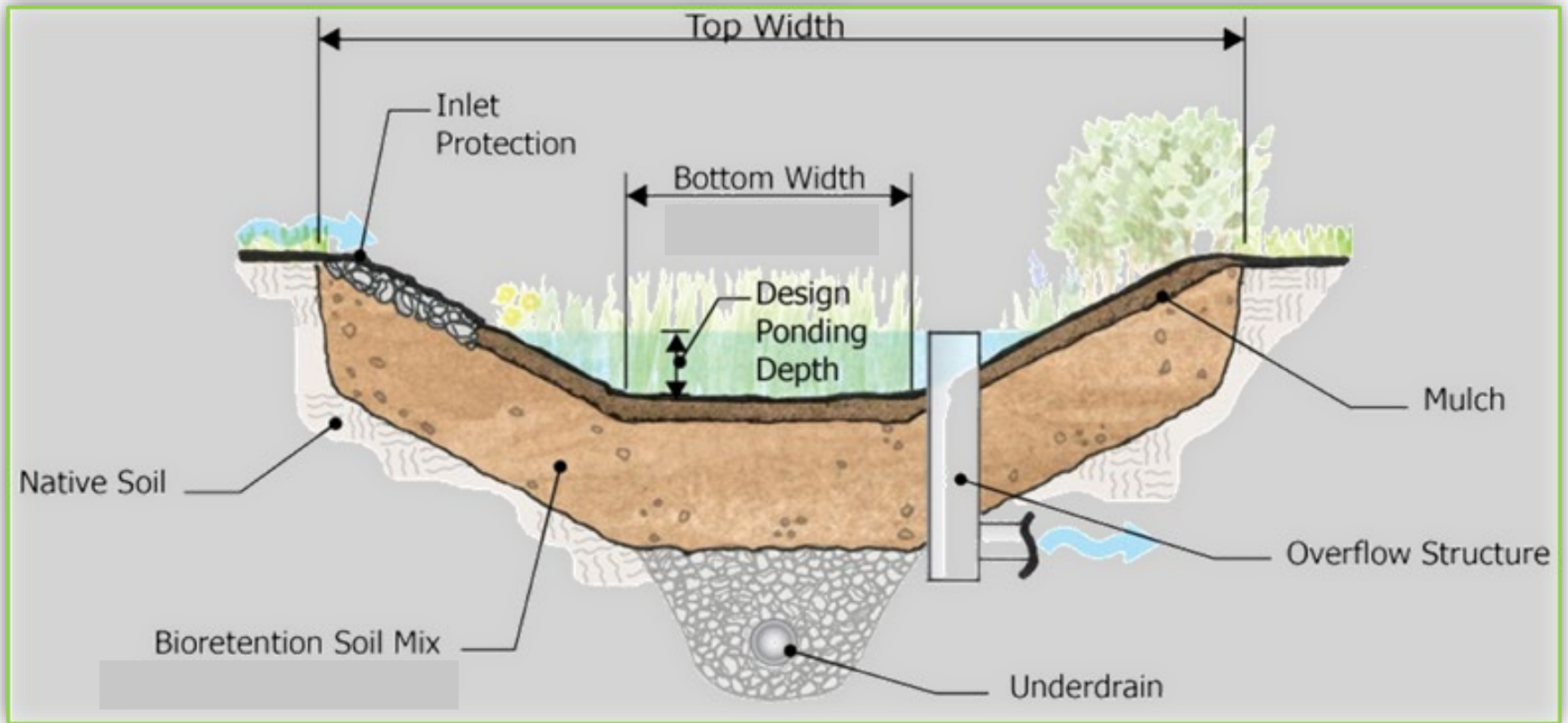


Parker Urban Greenscapes. 2009.

Rain Gardens

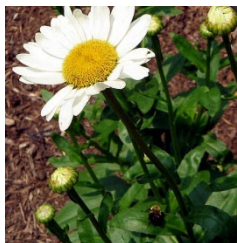


Rain Garden Cross-Section





Lots of Rain Gardens







Rain Garden
This garden is designed to capture and filter rainwater runoff from the roof and driveway. It helps reduce the amount of water that enters the storm sewer system, which can help prevent flooding and water pollution. The plants in this garden are chosen for their ability to absorb and filter water, and they also provide habitat for wildlife.





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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

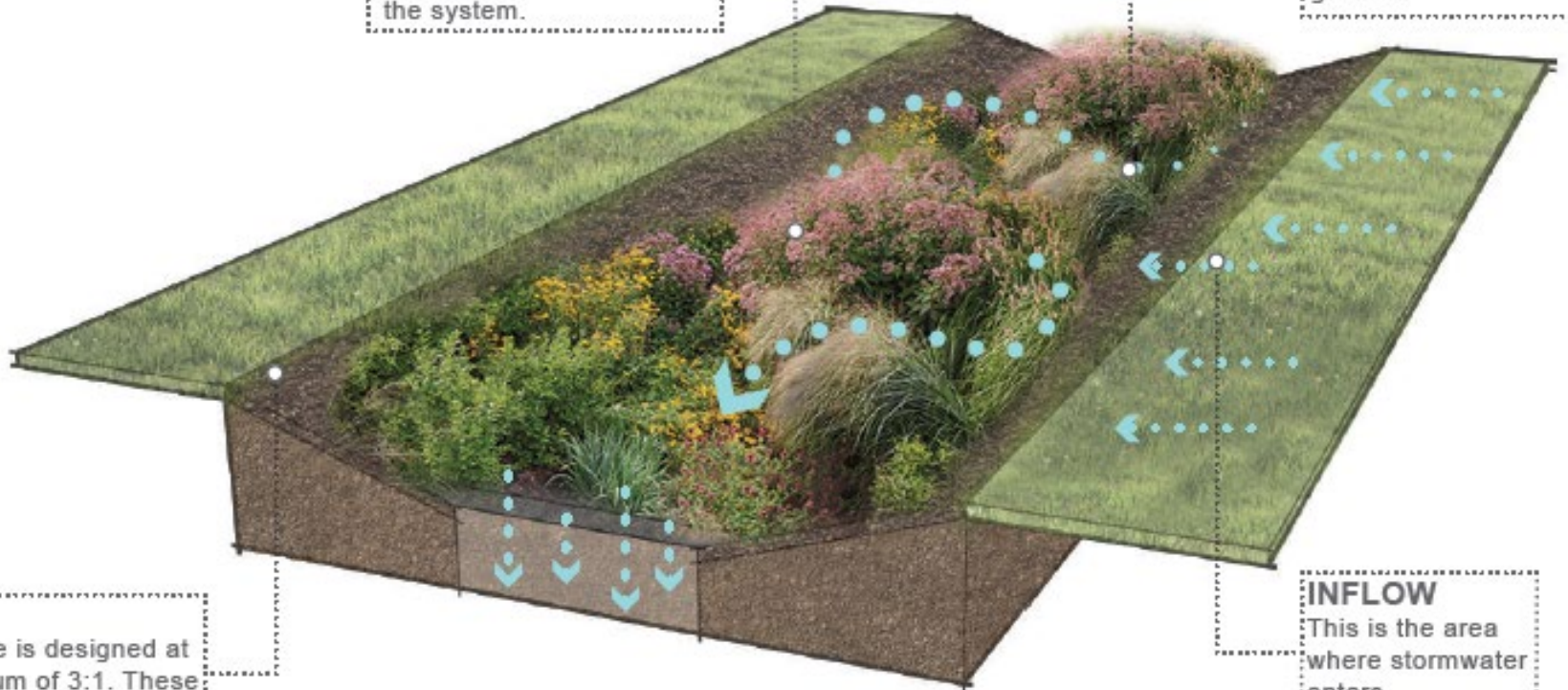
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

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

NATIVE PLANTS

A stormwater planter is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions.

CURB CUT

This curb cut and concrete flow pad are designed to help redirect stormwater runoff to the rain garden system and out of the storm drain.

CONCRETE WALL

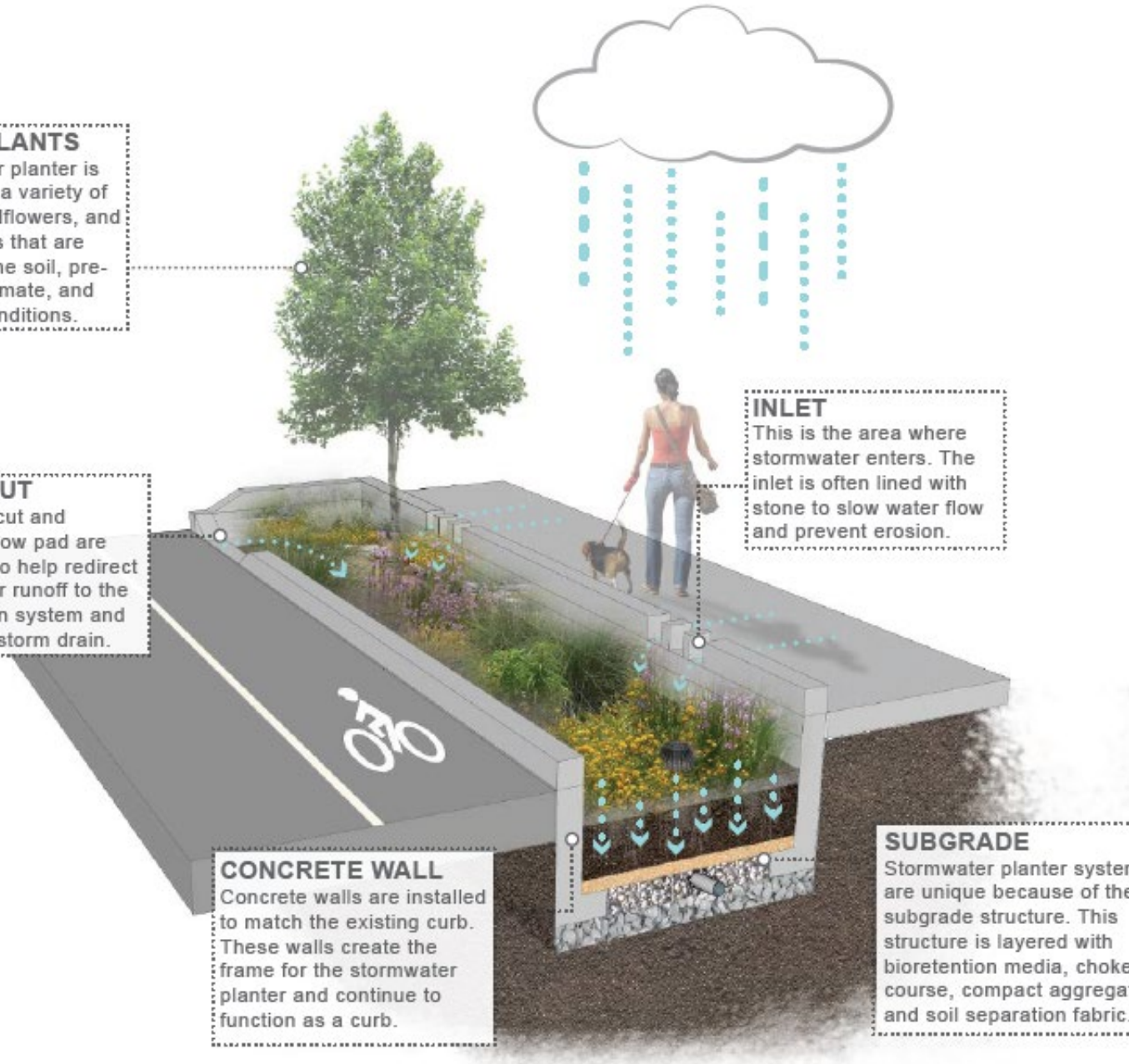
Concrete walls are installed to match the existing curb. These walls create the frame for the stormwater planter and continue to function as a curb.

INLET

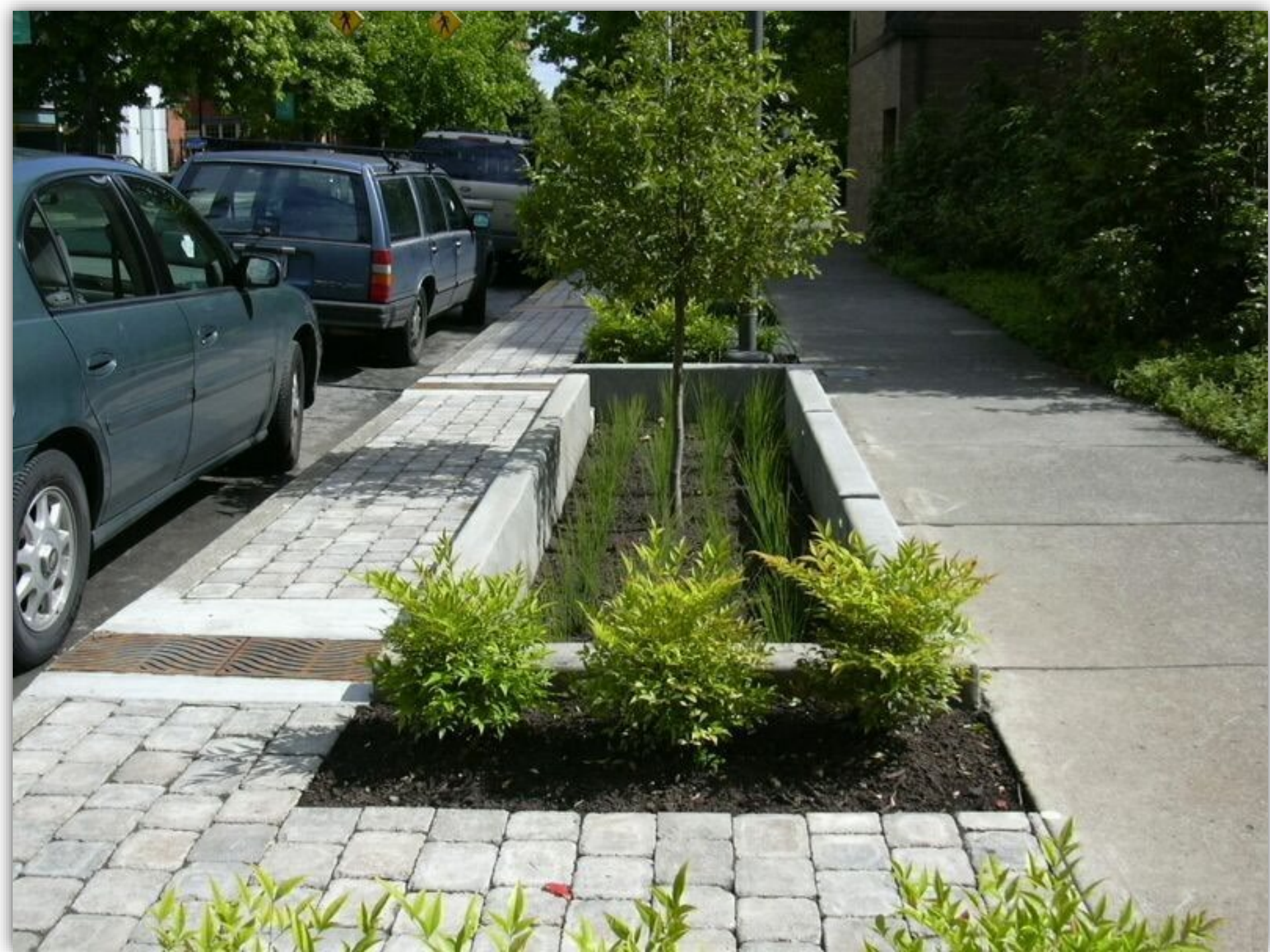
This is the area where stormwater enters. The inlet is often lined with stone to slow water flow and prevent erosion.

SUBGRADE

Stormwater planter systems are unique because of their subgrade structure. This structure is layered with bioretention media, choker course, compact aggregate, and soil separation fabric.







Curb Extensions



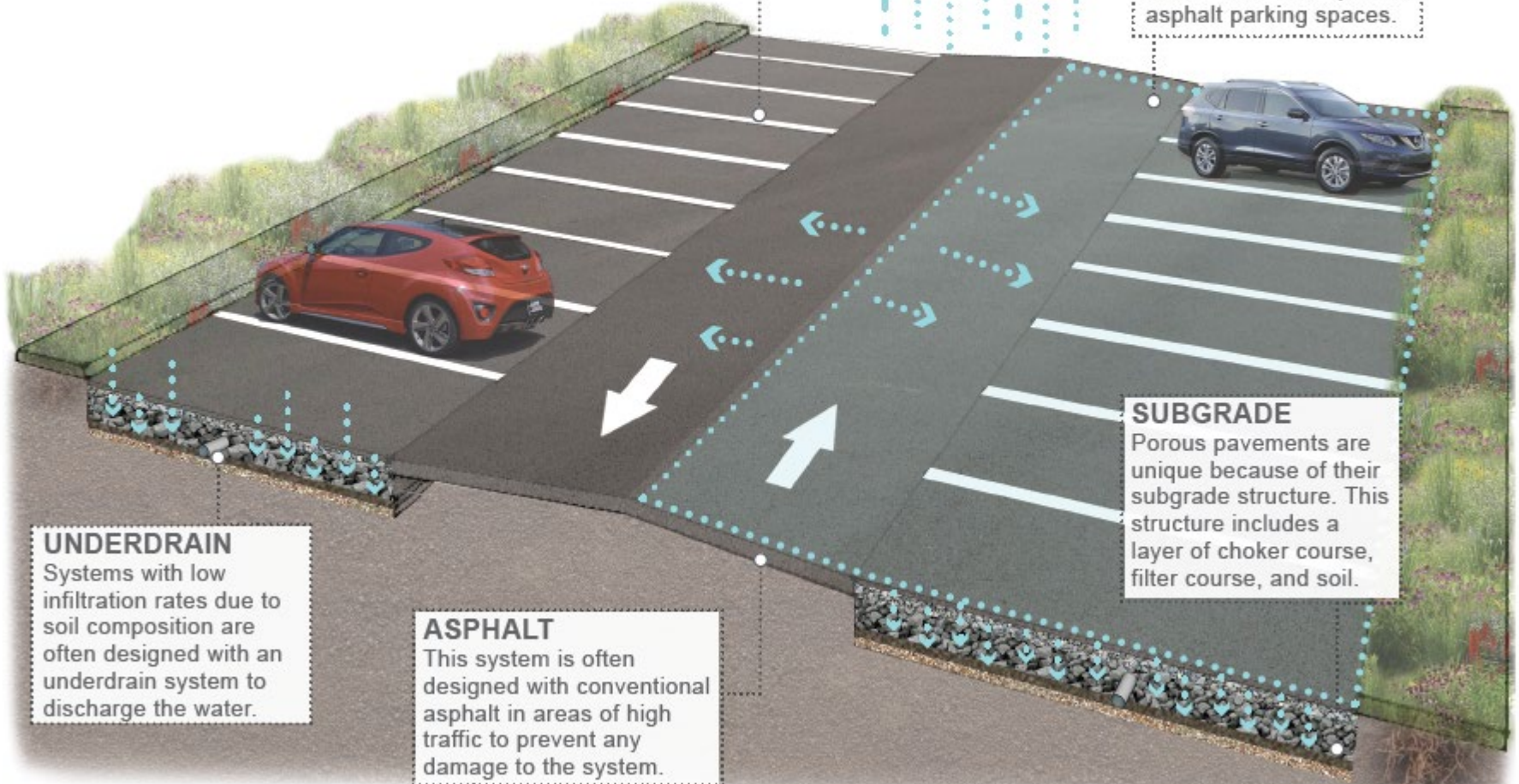
Permeable Pavement

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.



UNDERDRAIN

Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.

ASPHALT

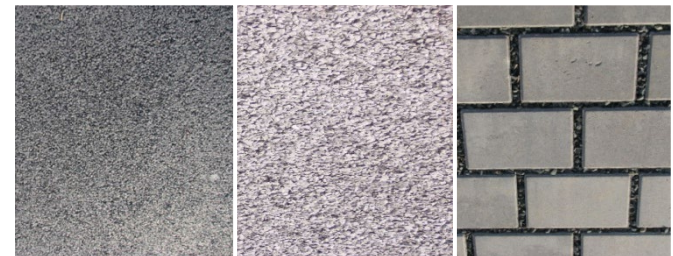
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

SUBGRADE

Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.

Permeable Pavements

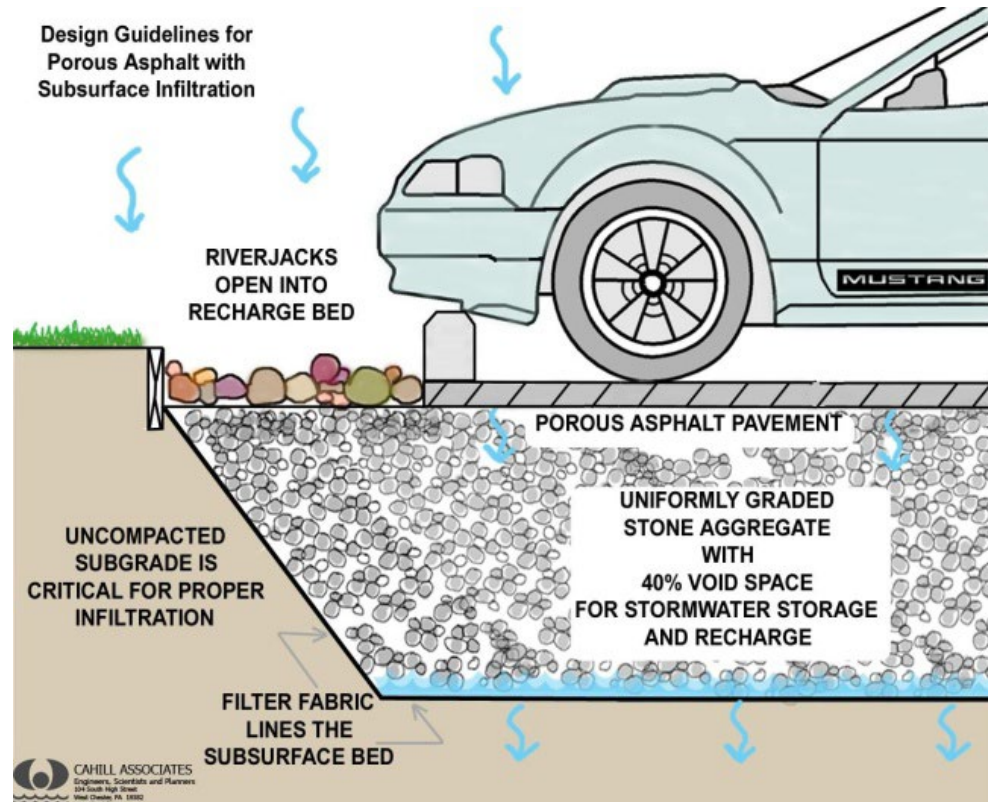
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable paver systems are concrete pavers with infiltration between the spaces 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

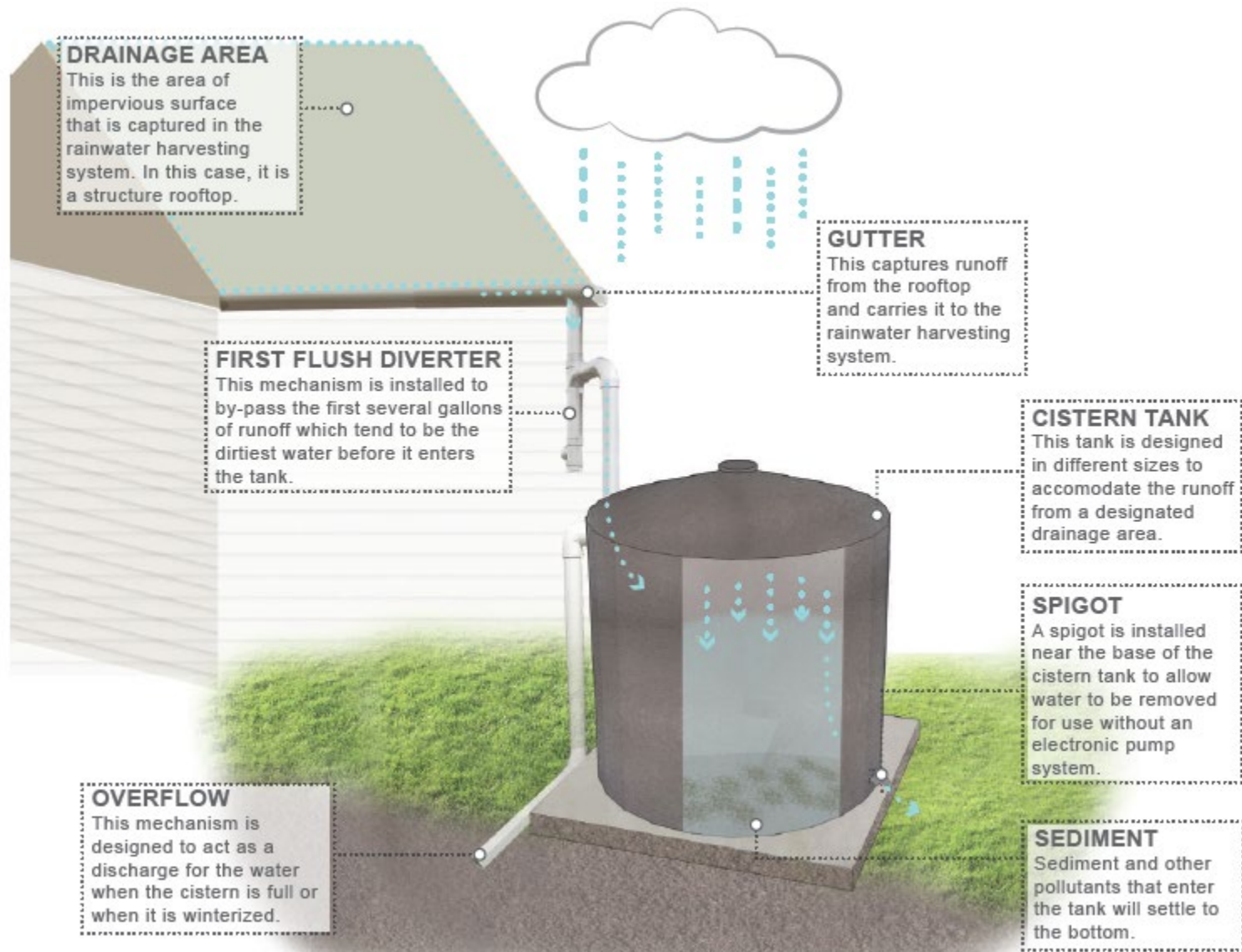


Permeable Pavers

A photograph showing a driveway paved with interlocking concrete grass pavers. The pavers are arranged in a grid pattern, with green grass growing through the openings. The driveway is covered with fallen autumn leaves and some dry grass. In the background, there is a chain-link fence and a dark vehicle parked on the left side. The overall scene is outdoors during autumn.

Grass Pavers

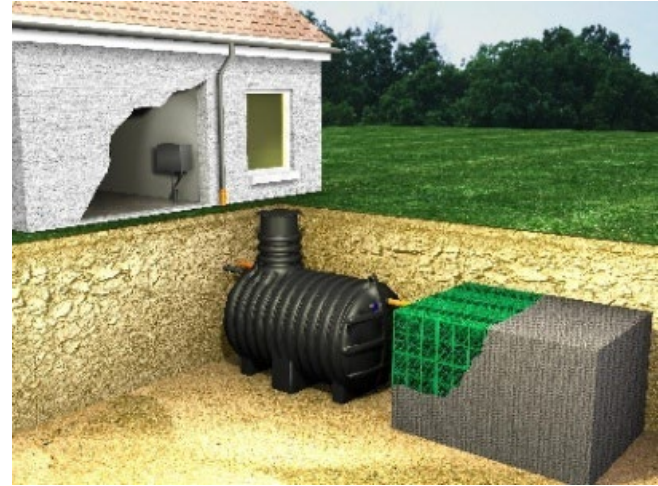
Rainwater Harvesting Systems



Rain Barrels



Cisterns



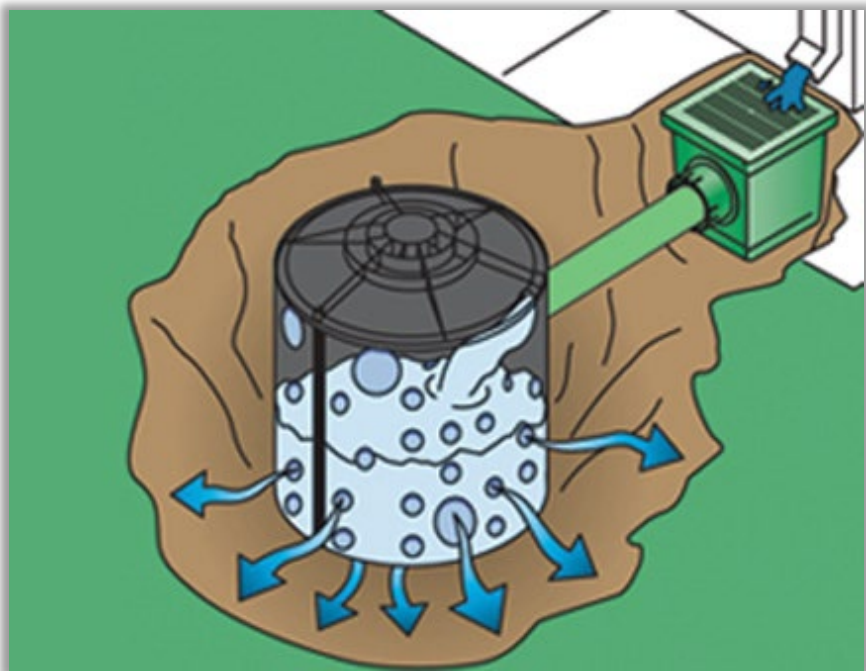
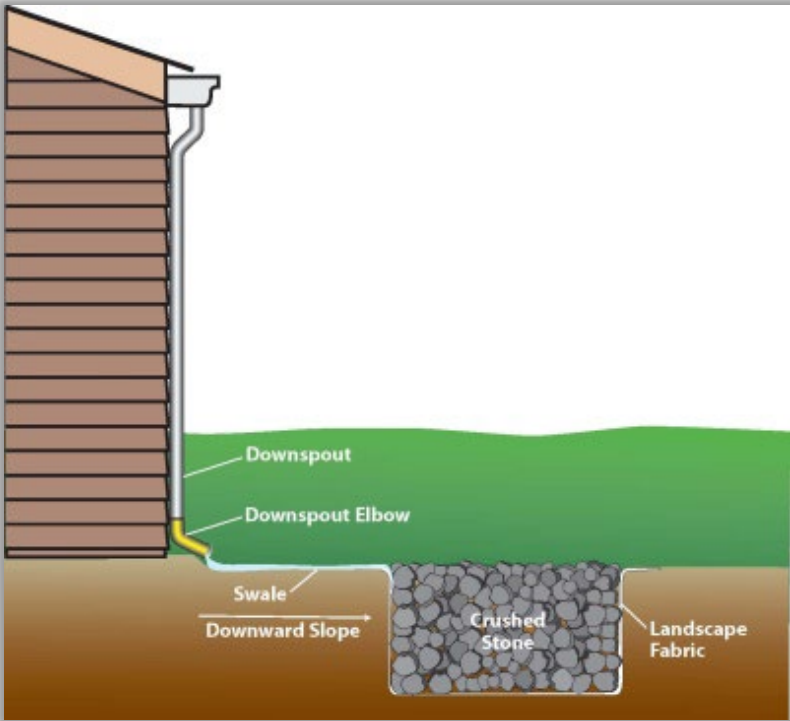




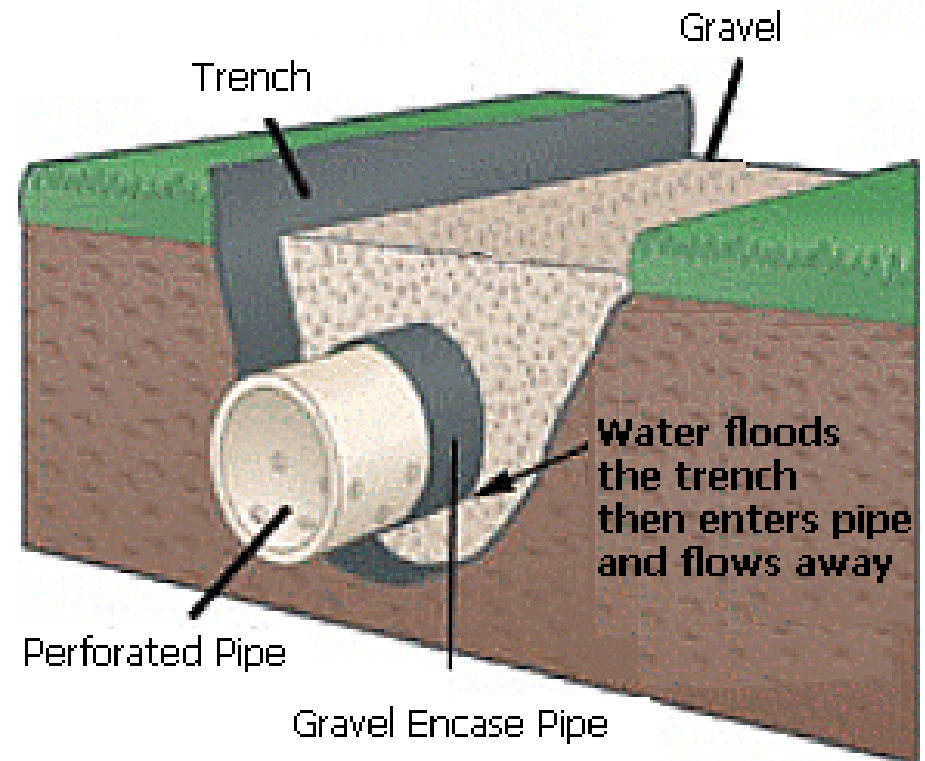




Dry Wells



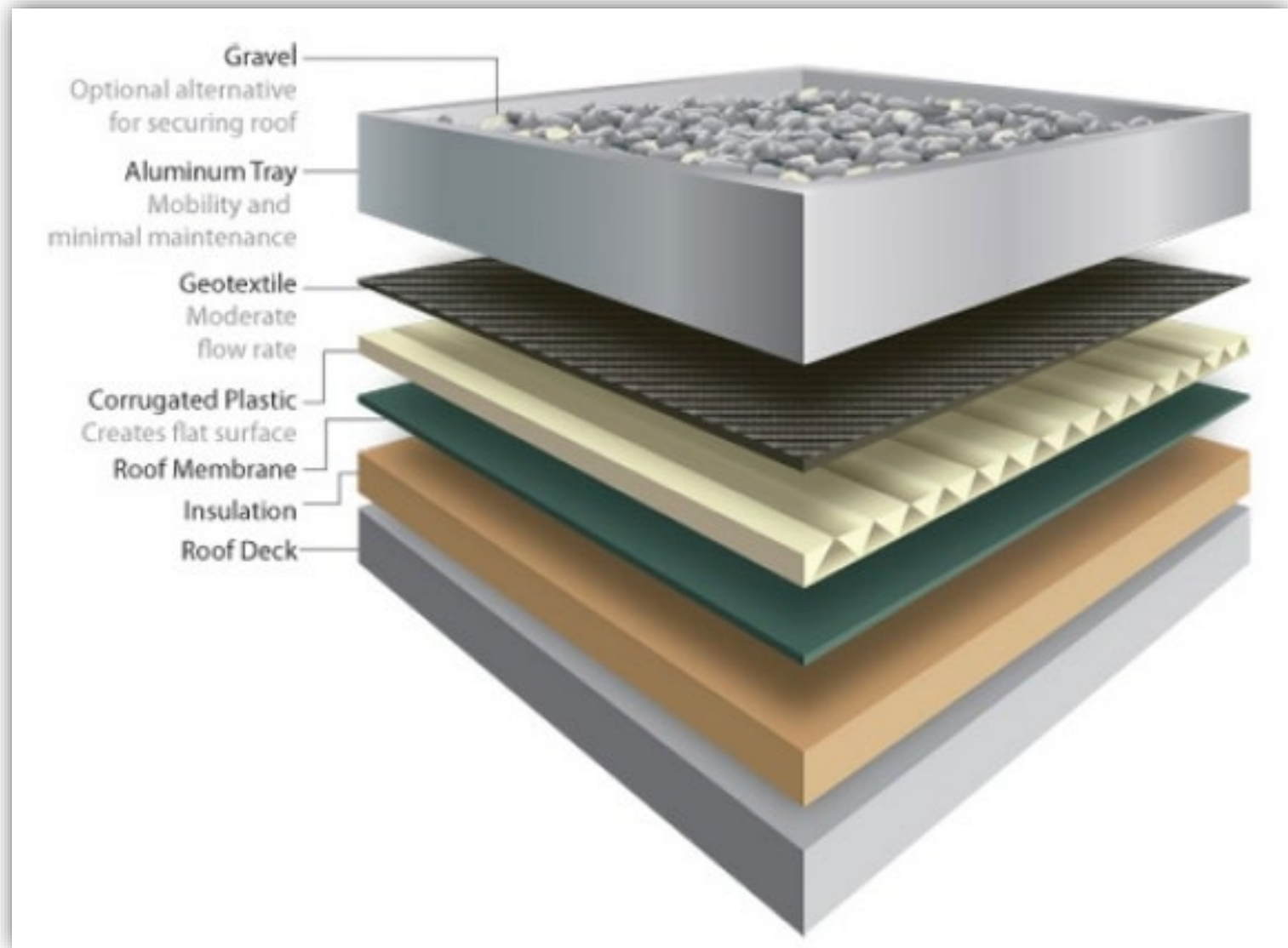
Infiltration Trench



Rooftop Practices – Green Roof



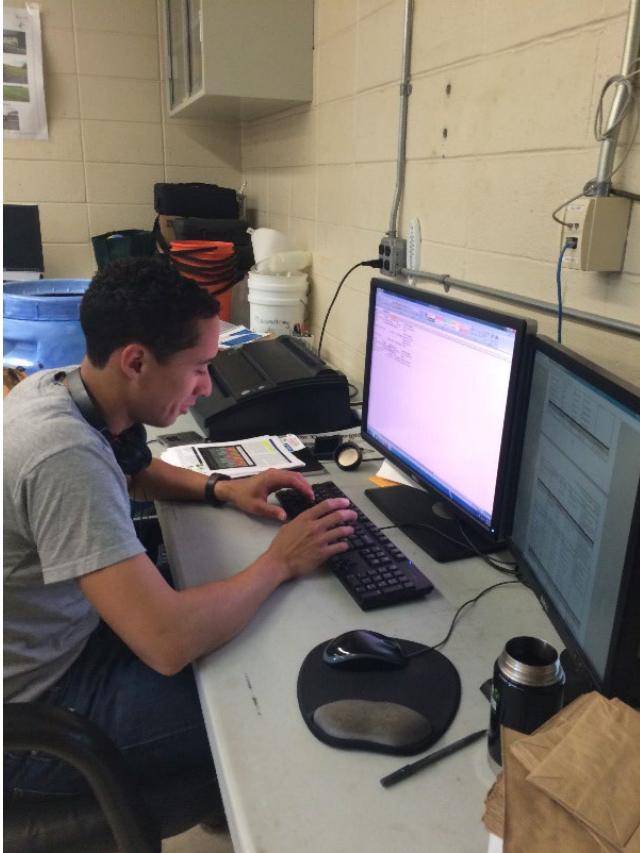
Rooftop Practices – Blue Roof





Stormwater Wetlands

Identifying Sites for Green Infrastructure





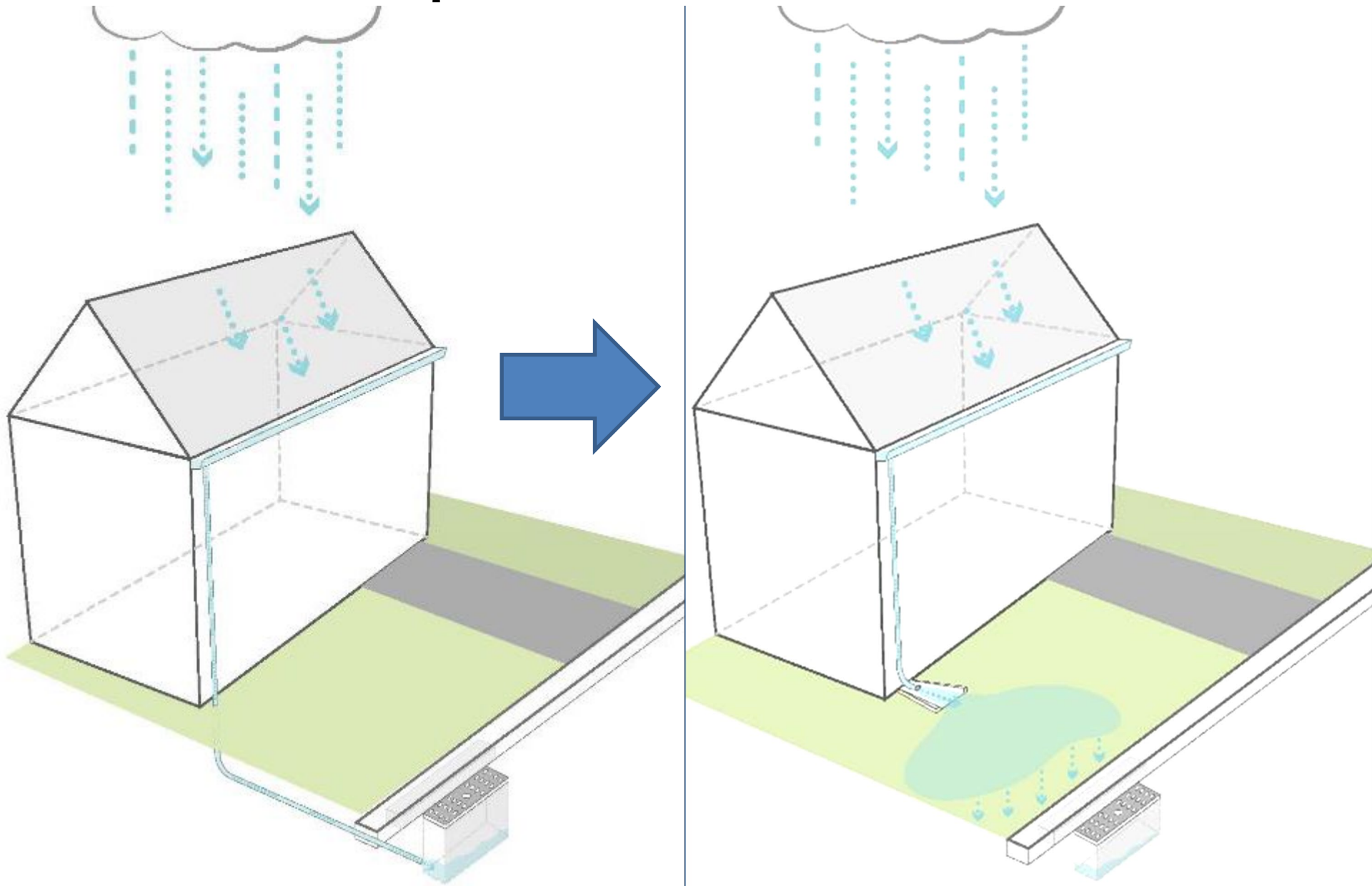
It is all about
controlling runoff
from impervious
surfaces



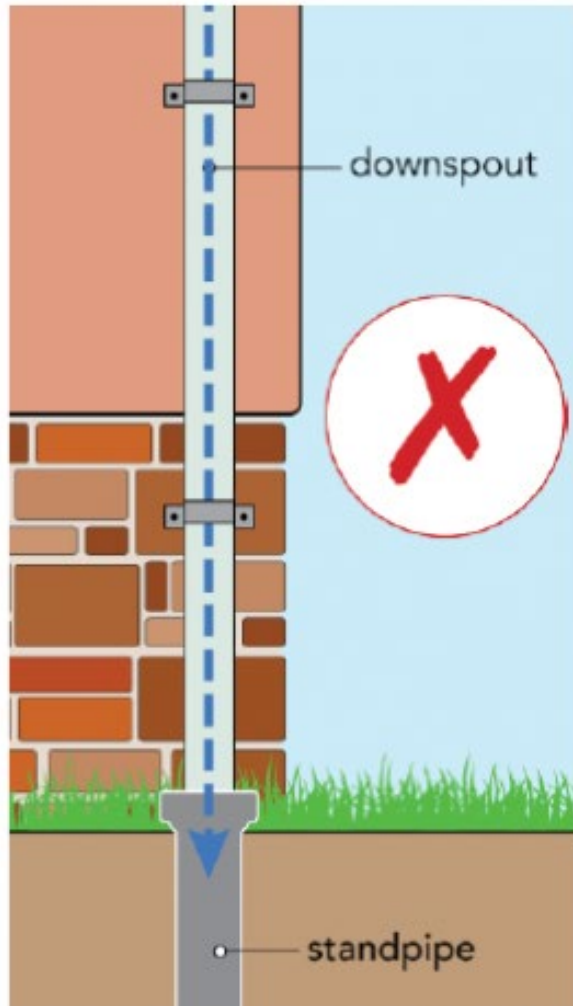
Connected or Disconnected?



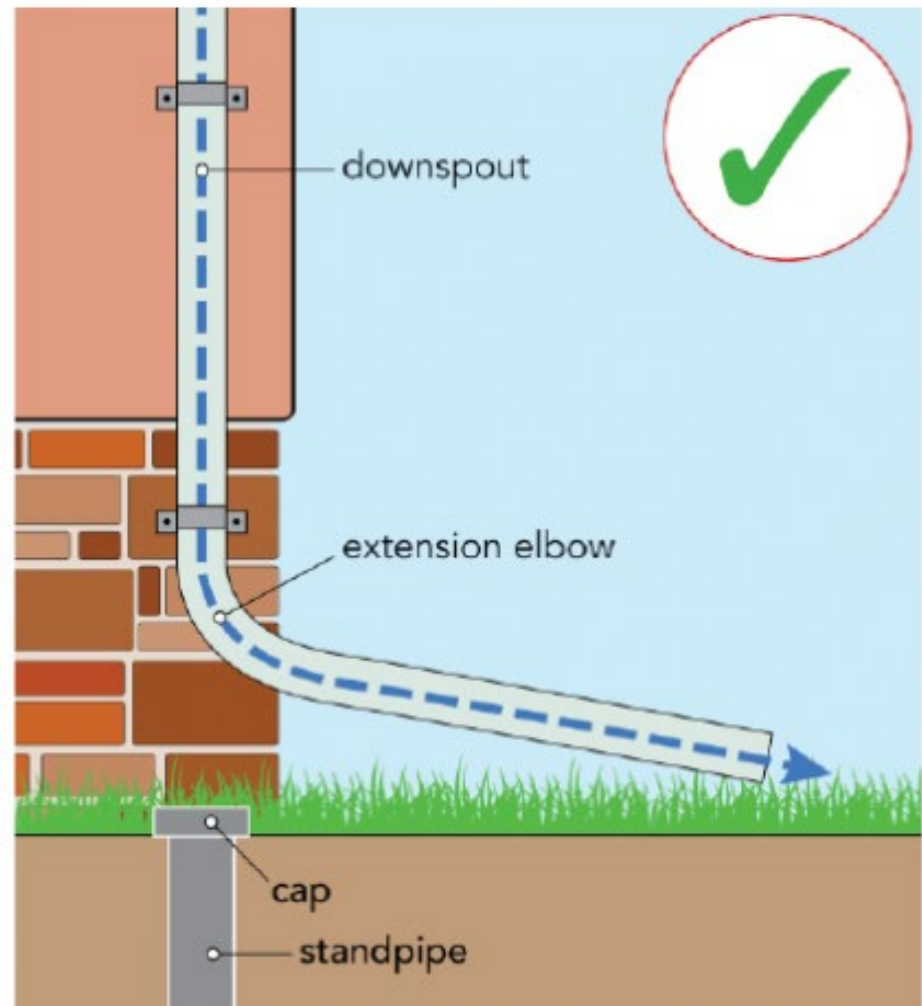
Simple Disconnection



Downspout Disconnection



**DOWNSPOUT CONNECTED
TO SEWER SYSTEM**



**DOWNSPOUT DISCONNECTED
FROM SEWER SYSTEM**

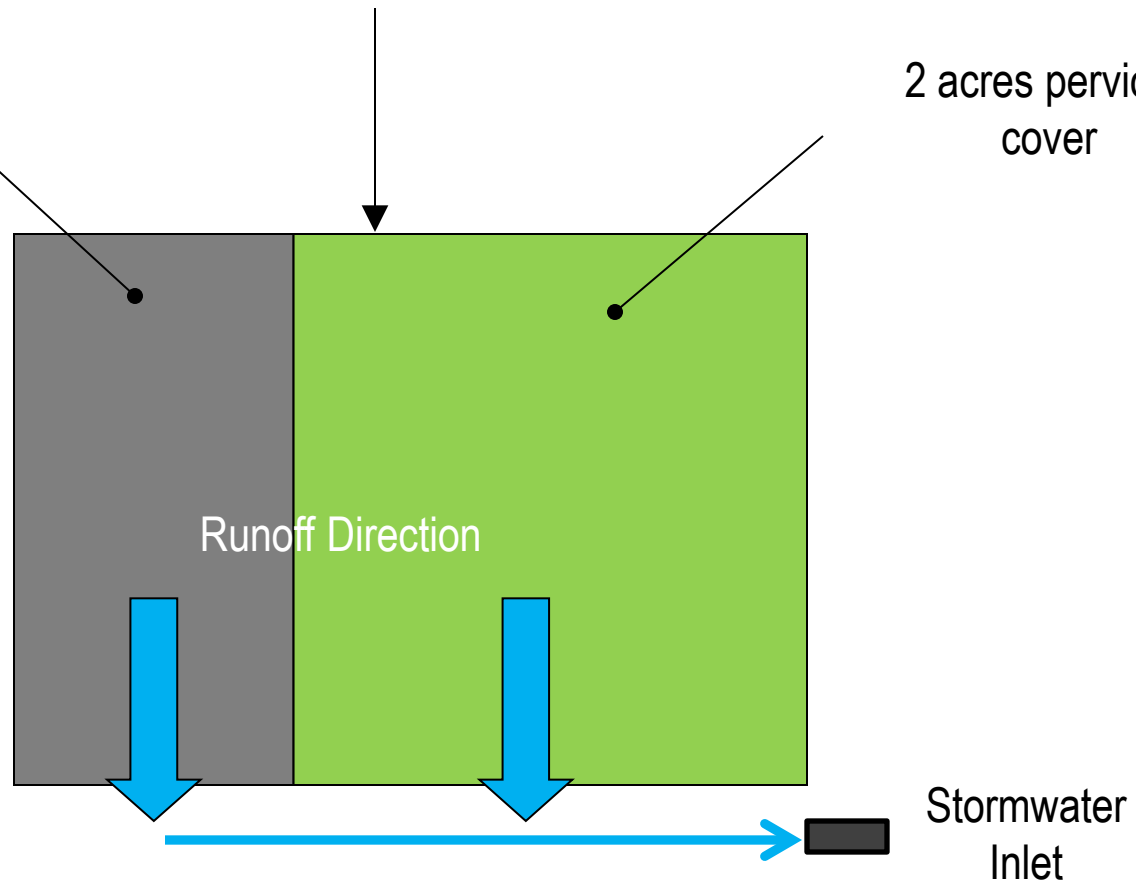
Another Example of Simple Disconnection

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

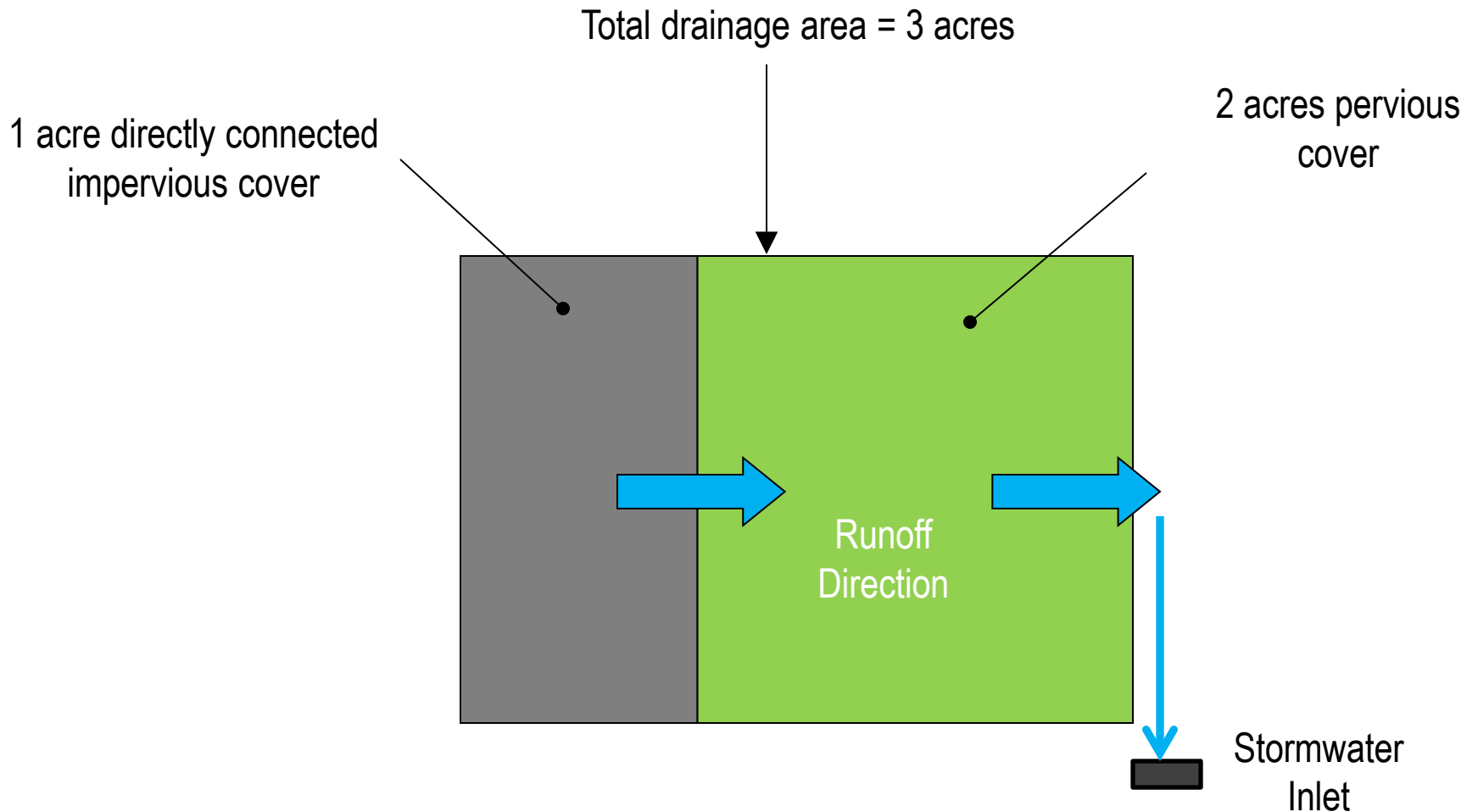
Total drainage area = 3 acres

1 acre directly connected
impervious cover

2 acres pervious
cover

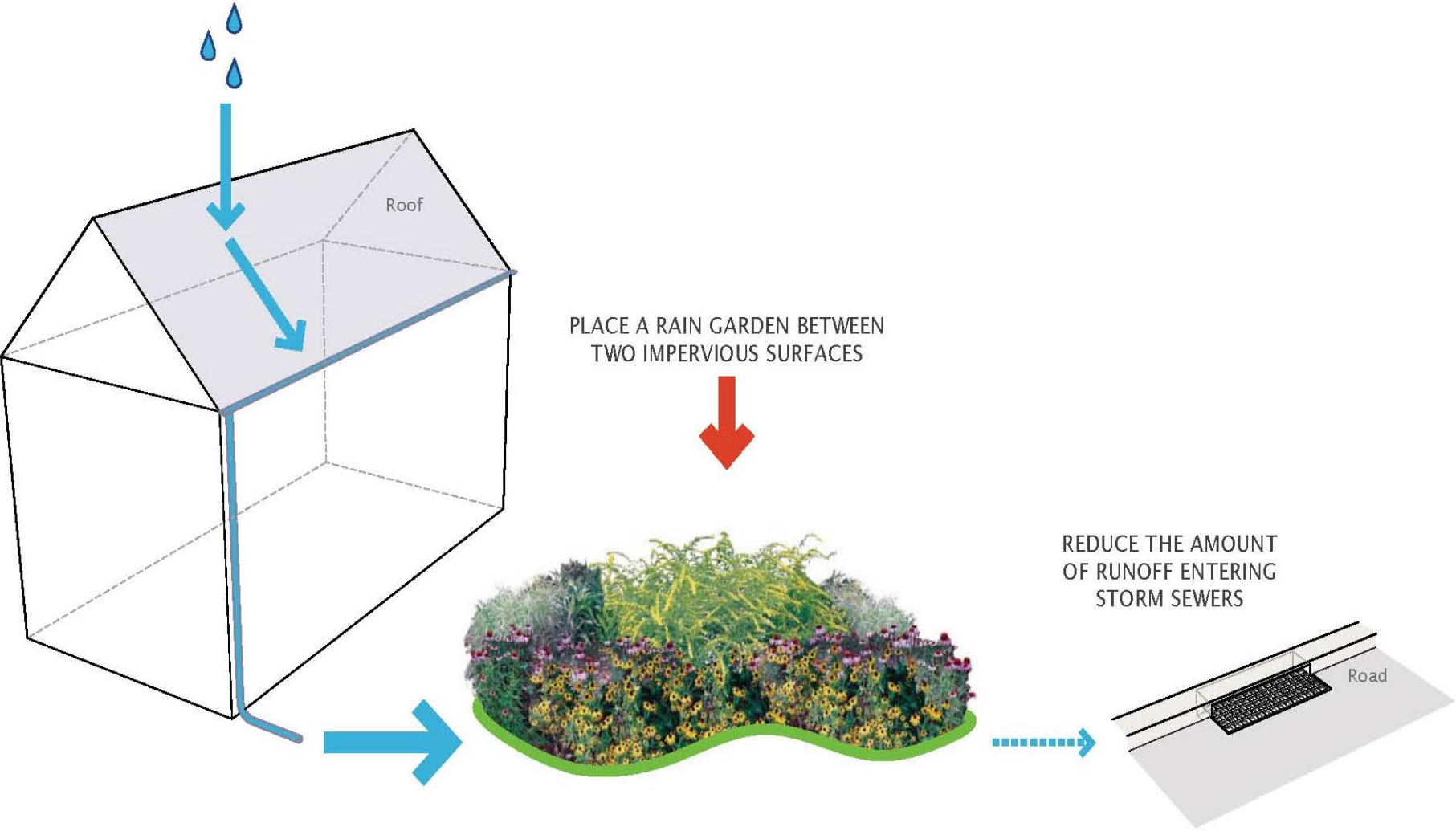


For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**

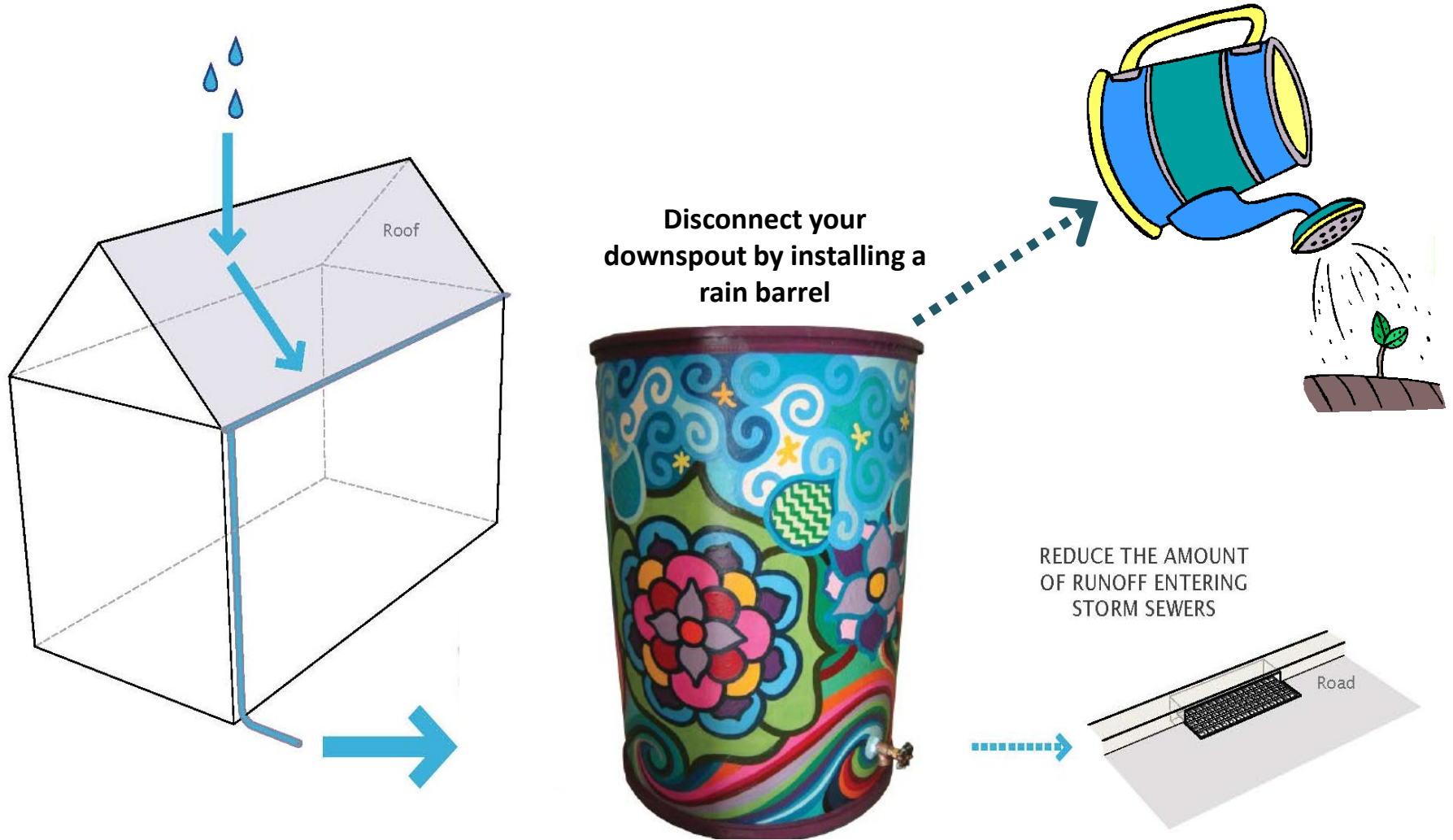


	Volume of Runoff		
Design Storm	Connected (gallons)	Disconnected (gallons)	Percent Difference
1.25 inches (water quality storm)	28,500	4,360	85%

Disconnect with a rain garden



Disconnect to a Rain Barrel or Cistern



Impervious area is now "disconnected" 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:

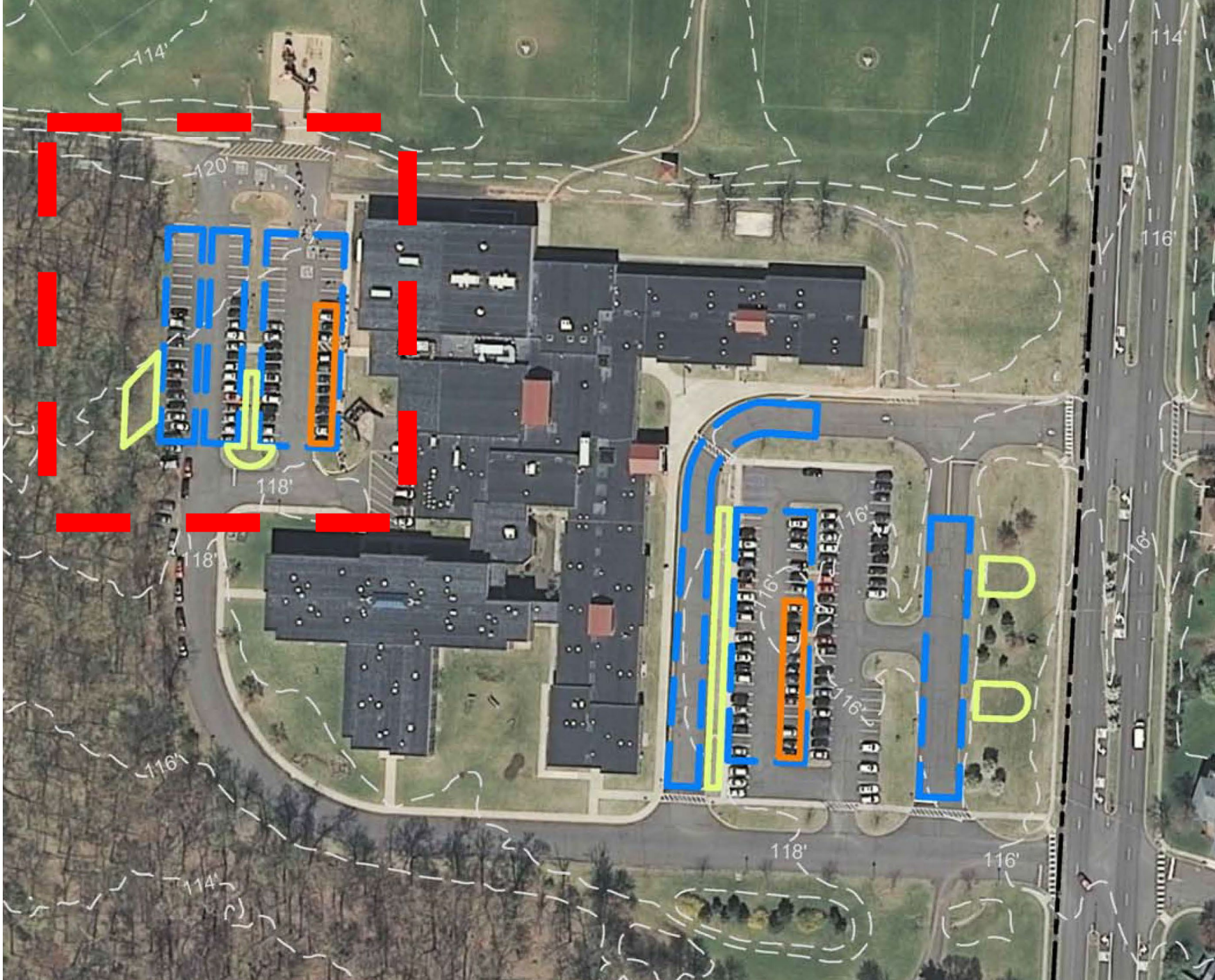
- ✓ Schools
 - ✓ Places of Worship
 - ✓ Libraries
 - ✓ Municipal Building
 - ✓ Public Works
 - ✓ Firehouses
 - ✓ Post Offices
 - ✓ Elks or Moose Lodge
 - ✓ Parks/ Recreational Fields
- 20 to 40 sites are entered into a PowerPoint
 - Site visits are conducted

Google or Bing Maps

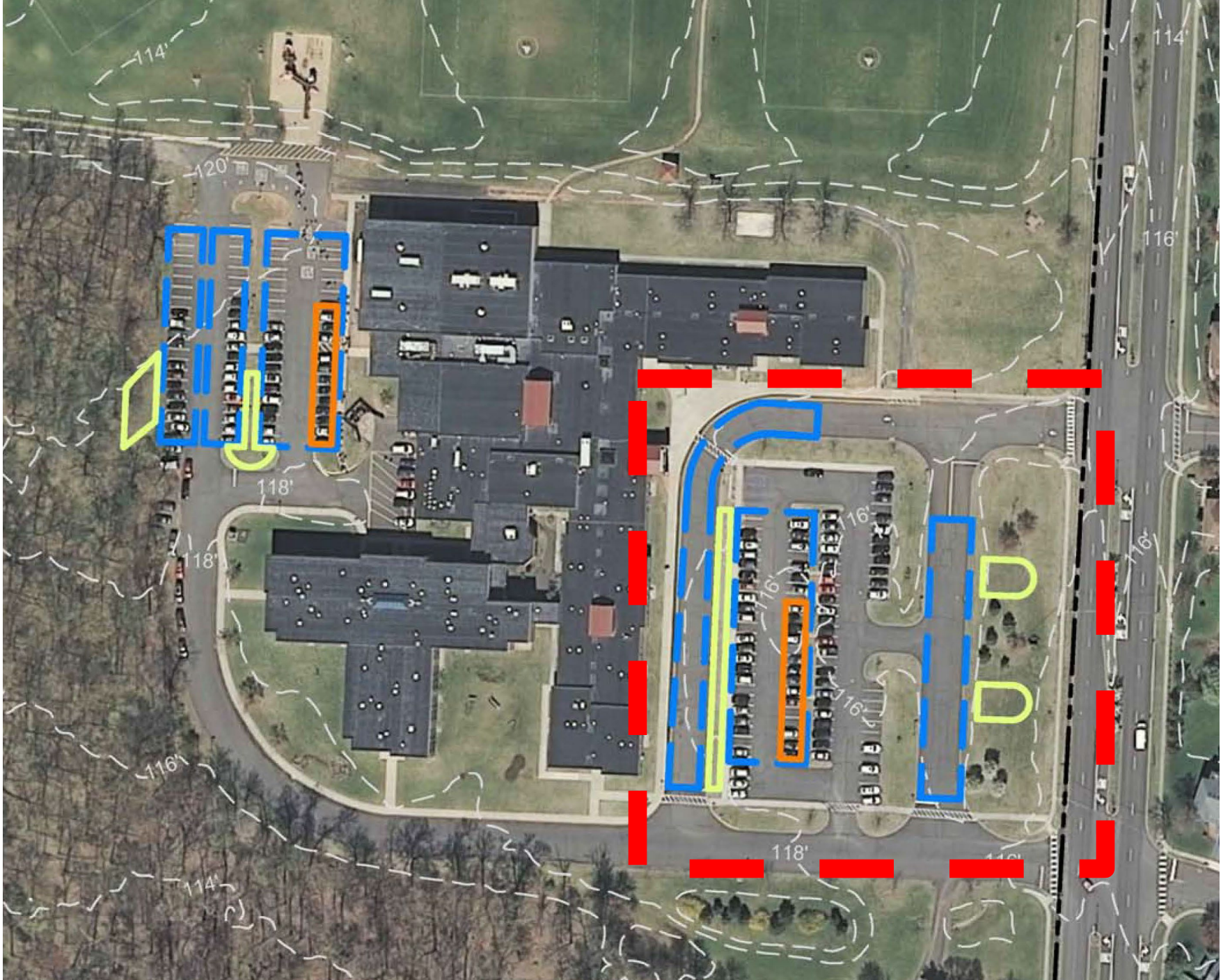
- Go to Google or Bing Maps
- Type in address
- Aerial or birds eye view
- “Snip It” (MS Windows Accessory)
- Insert into PowerPoint
- “Crop It”

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

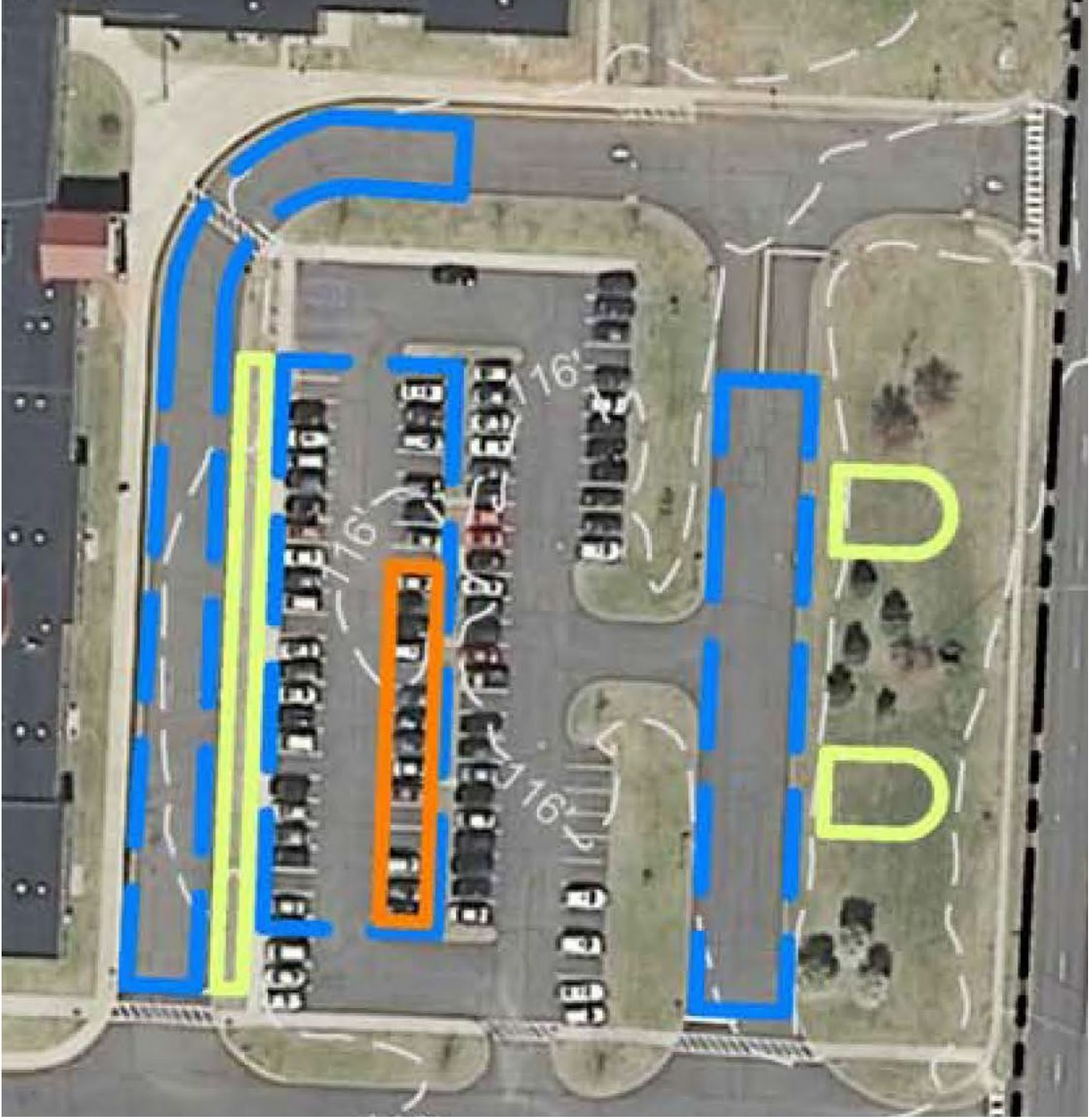






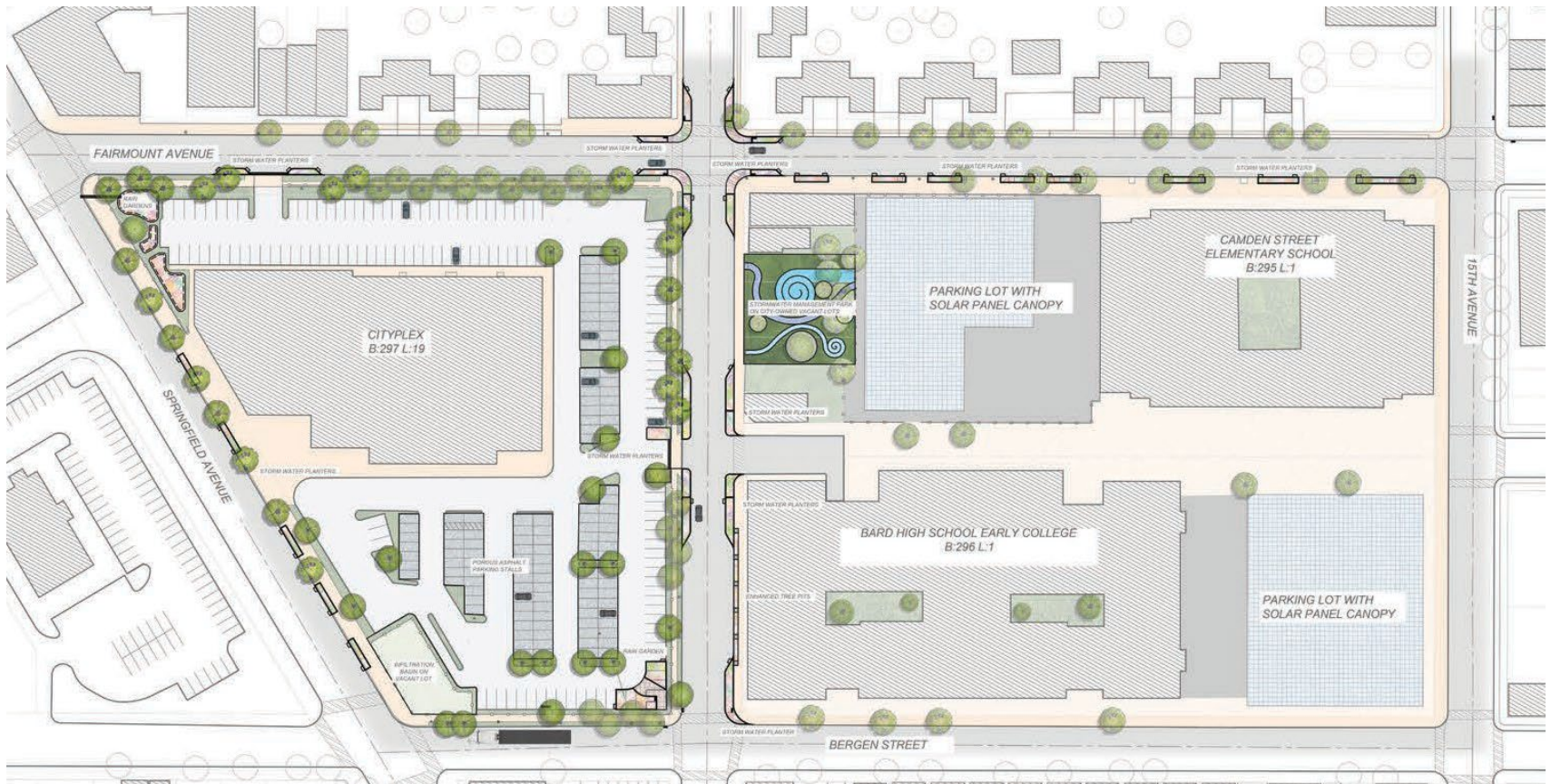






What is happening in Newark?

Add pictures of Clinton and Badget



FAIRMOUNT AVENUE GREEN STREET CONCEPT PLAN

FAIRMOUNT AVENUE, 16TH AVENUE, SPRINGFIELD AVENUE,
CITYPLEX 12 NEWARK, ESSEX COUNTY, NEW JERSEY



CITYPLEX 12 RAIN GARDEN

CITYPLEX 12, 16TH AVENUE, BERGEN STREET NEWARK,
ESSEX COUNTY, NEW JERSEY



16TH AVENUE STORMWATER PLANTERS

16TH AVENUE, CITYPLEX 12, BARD HIGH SCHOOL EARLY COLLEGE NEWARK, ESSEX COUNTY, NEW JERSEY

FAIRMOUNT AVENUE GREEN STREET

GREEN INFRASTRUCTURE IMPLEMENTATION PROJECT
 360-394 SPRINGFIELD AVENUE, NEWARK
 ESSEX COUNTY, NEW JERSEY
 BLOCK: 297 LOT: 19

PROJECT DESCRIPTION:

VARIOUS RAIN GARDENS AND STORMWATER PLANTERS CAN BE INSTALLED THROUGHOUT FAIRMOUNT AVENUE, 1611 AVENUE, AND SPRINGFIELD AVENUE. A TOTAL OF 73,630 S.F. OF IMPERVIOUS COVER CAN BE TREATED BY 6,245 S.F. OF BEST MANAGEMENT PRACTICES INCLUDING STORMWATER PLANTERS, RAIN GARDENS, AND TREE PITS.

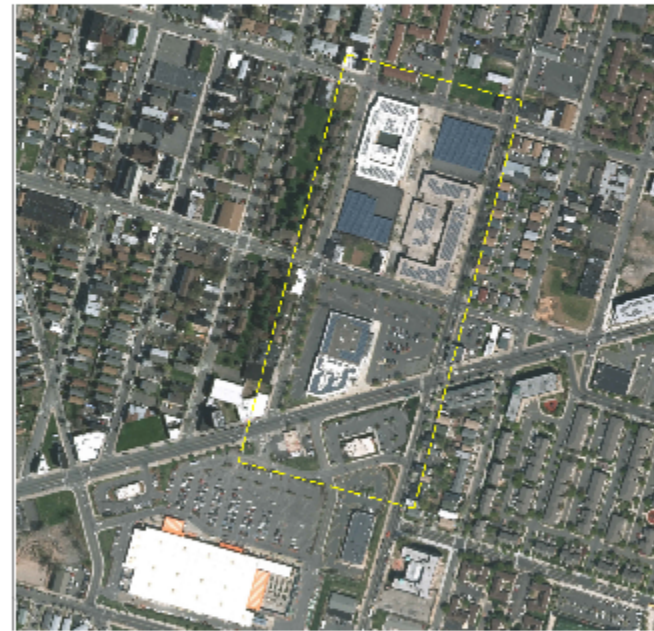
LIST OF DRAWINGS:

SHEET NAME	TITLE
COVER	COVER SHEET
P-1	EXISTING CONDITIONS
P-2	OVERVIEW PLAN
P-3 TO P-12	SITE PLANS 1-10
DT-1	STORMWATER PLANTER DETAILS
DT-2	RAIN GARDEN DETAILS
DT-3	CURB CUT DETAILS
DT-4	SOIL EROSION & SEDIMENT CONTROL DETAILS
DT-5	TREE PIT AND STREET PLANTING DETAILS

GENERAL NOTES:

1. SURVEY CONDUCTED BY RUTGERS COOPERATIVE EXTENSION WATER RESOURCES PROGRAM. ALL ELEVATIONS ARE RELATIVE TO THE 100.00 BUNGLEWARK POINT.
2. EXISTING SOILS ARE URBAN LAND BOONTON SUBSTRATUM WHICH ARE CLASSIFIED AS AN UNRANKED HYDROLOGICAL SOIL GROUP BASED ON THE NACS WULF SOIL SURVEY (www.survey.sc.egov.usda.gov). AN INFILTRATION TEST IS RECOMMENDED PRIOR TO MOBILIZATION VIA ENGINEER'S DISCRETION.
3. ANY OVERHEAD AND UNDERGROUND UTILITIES SHOWN ARE FROM FIELD OBSERVATIONS AND ARE NOT A COMPLETE REPRESENTATION. A UTILITY MARKOUT NEEDS TO BE CONDUCTED PRIOR TO MOBILIZATION BY THOSE RESPONSIBLE FOR EXCAVATION. IN ONE CALL: 811 OR 500.272.1000

LOCATION MAP:



LEGEND:

- EXISTING OWNERS AREA
- EDGE OF PAVEMENT
- EXISTING CENTERLINE
- EXISTING FENCE
- EXISTING TREELINE
- EXISTING TREE/SHRUB
- ▭ EXISTING BUILDING
- ⊕ EXISTING MANHOLE
- ⊕ EXISTING FIRE HYDRANT
- ⊕ EXISTING UTILITY POLE
- ⊕ EXISTING LIGHT POLE
- ▭ EXISTING CATCH BASIN
- PROPERTY LINES
- ▭ PROPOSED GREEN INFRASTRUCTURE

DATE: 08/14/2024
 TIME: 10:00 AM
 PROJECT: FAIRMOUNT AVENUE GREEN STREET
 DRAWN BY: [Signature]
 CHECKED BY: [Signature]

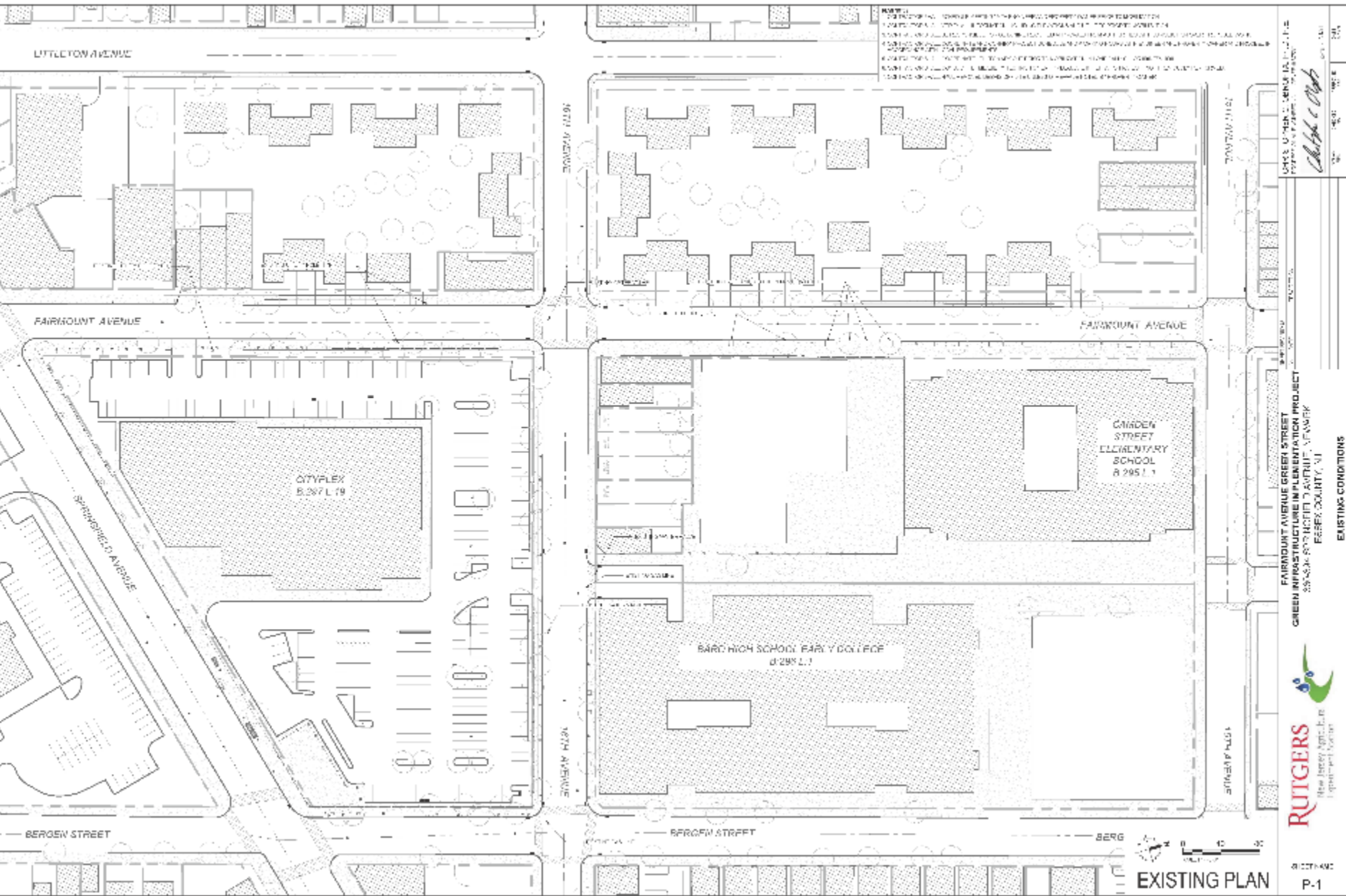
NO.	DESCRIPTION	DATE	BY

FAIRMOUNT AVENUE GREEN STREET
 GREEN INFRASTRUCTURE IMPLEMENTATION PROJECT
 360-394 SPRINGFIELD AVENUE, NEWARK
 ESSEX COUNTY, NJ
 COVER SHEET



08/14/2024
 COVER

NOTES:
 1. EXISTING CONDITIONS SHOWN FOR THIS PROJECT ARE BASED ON THE MOST RECENT AVAILABLE RECORD DRAWINGS AND FIELD SURVEY DATA.
 2. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE NOT TO BE CONSIDERED AS A GUARANTEE OF ACCURACY OR COMPLETENESS.
 3. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE NOT TO BE CONSIDERED AS A GUARANTEE OF ACCURACY OR COMPLETENESS.
 4. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE NOT TO BE CONSIDERED AS A GUARANTEE OF ACCURACY OR COMPLETENESS.
 5. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE NOT TO BE CONSIDERED AS A GUARANTEE OF ACCURACY OR COMPLETENESS.



DATE: 10/15/2024
 PROJECT: GREEN INFRASTRUCTURE IN PLEASANTON PROJECT
 DRAWN BY: [Signature]

FAIRMOUNT AVENUE GREEN STREET
 GREEN INFRASTRUCTURE IN PLEASANTON PROJECT
 88-534-500 HOTEL AVENUE NETWORK
 FERRY COUNTY, WI
 EXISTING CONDITIONS



EXISTING PLAN

ADD PICTURE OF FAIRMOUNT

Coming Soon to Newark!

National Green Infrastructure Certification Program (NGICP)

The National Green Infrastructure Certification Program (NGICP) sets national certification standards for green infrastructure construction, inspection, and maintenance workers.

Envirocert International Inc.

www.envirocert.org

RUTGERS

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