

# Green Infrastructure Overview

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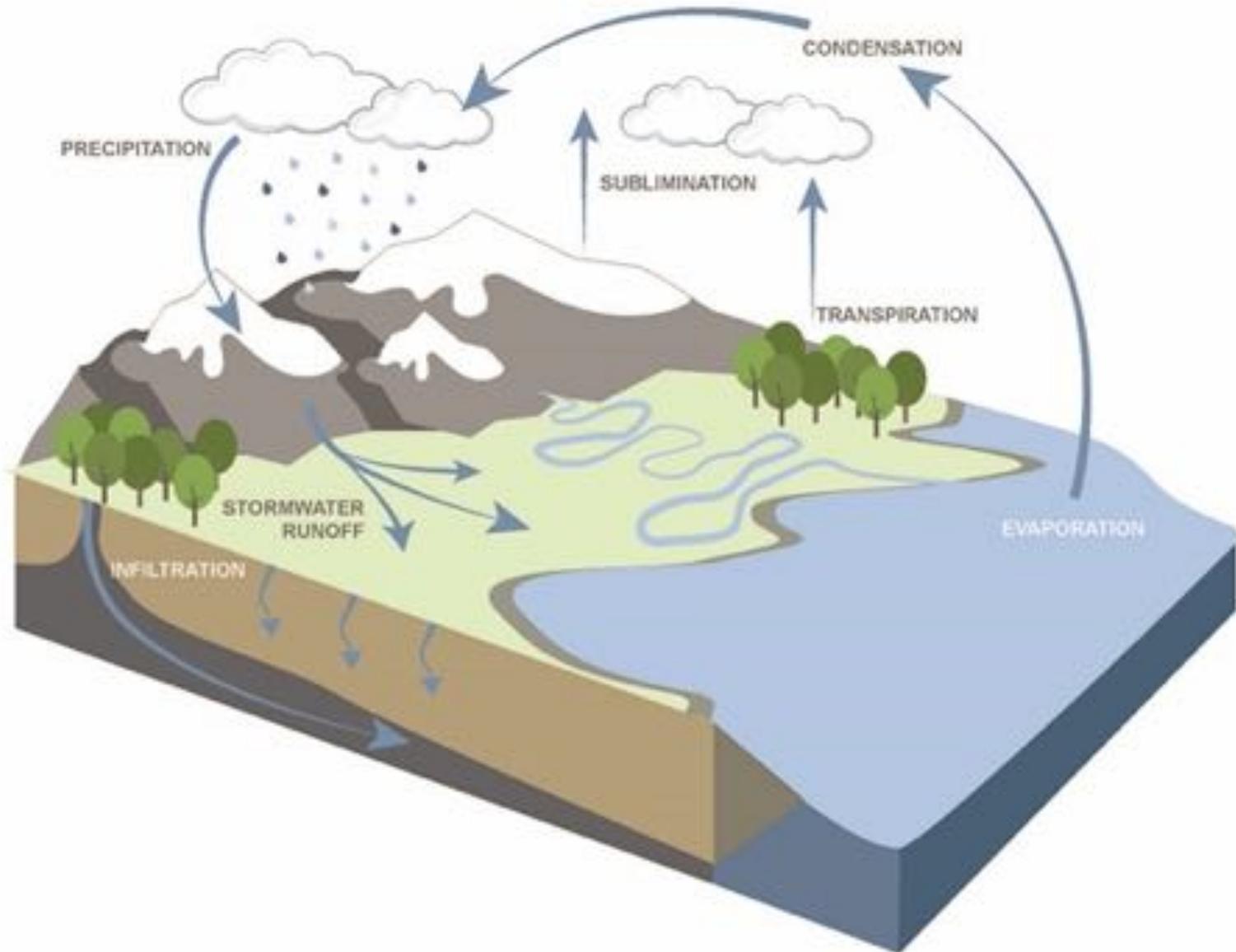
**RUTGERS**  
New Jersey Agricultural  
Experiment Station



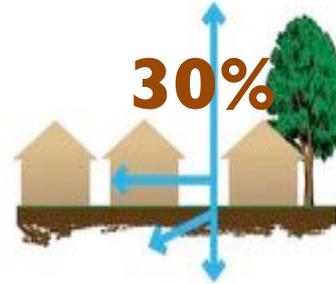
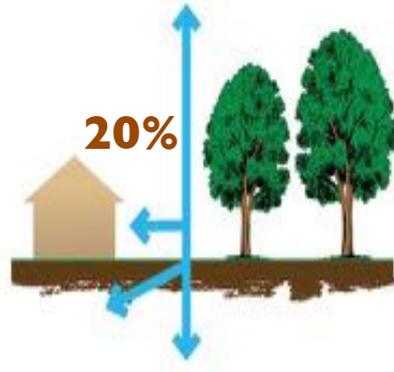
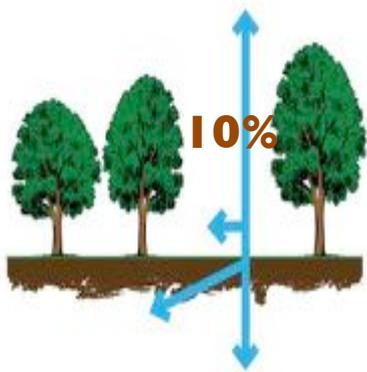
**JERSEY WATER  
WORKS**  
Smart infrastructure. Strong communities.

**Sea Grant**  
NJ Sea Grant Consortium

# The Natural Water Cycle



# Impervious Surfaces



*More development*



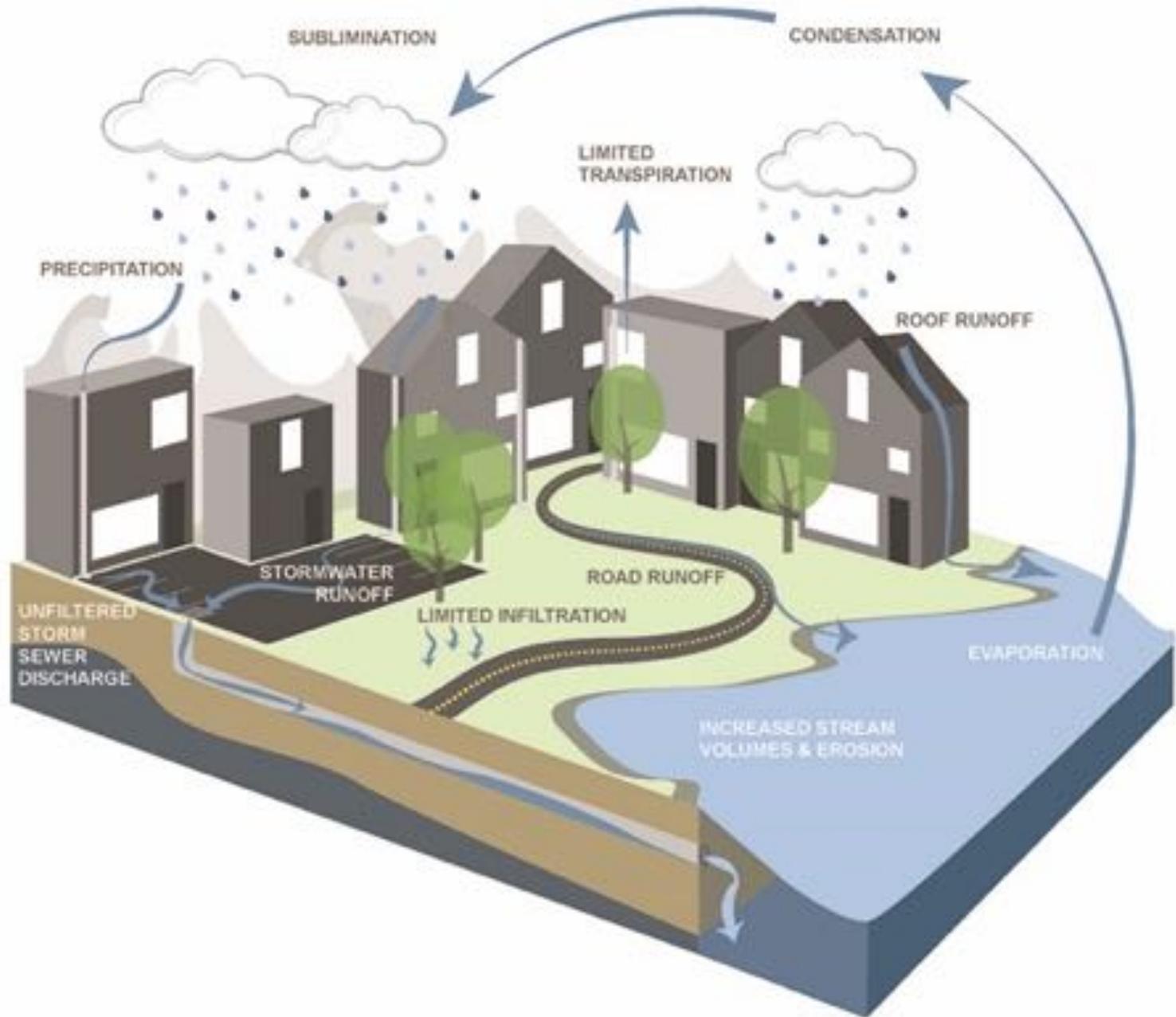
*More impervious surfaces*



*More stormwater runoff*



# The Urban Water Cycle



# 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



# Is Green Infrastructure a solution?

...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.

# TYPES OF BIORETENTION



## Larger Bioretention Systems

- Single-family lots
- Commercial areas
- Parking lots



## Planters & Planter Boxes

- Highly urban areas
- Right-of-way and adjacent to buildings



## Rain Gardens

- Single-family lots
- Small commercial areas



## Bioretention Swales/ Bioswales/Vegetated Swales

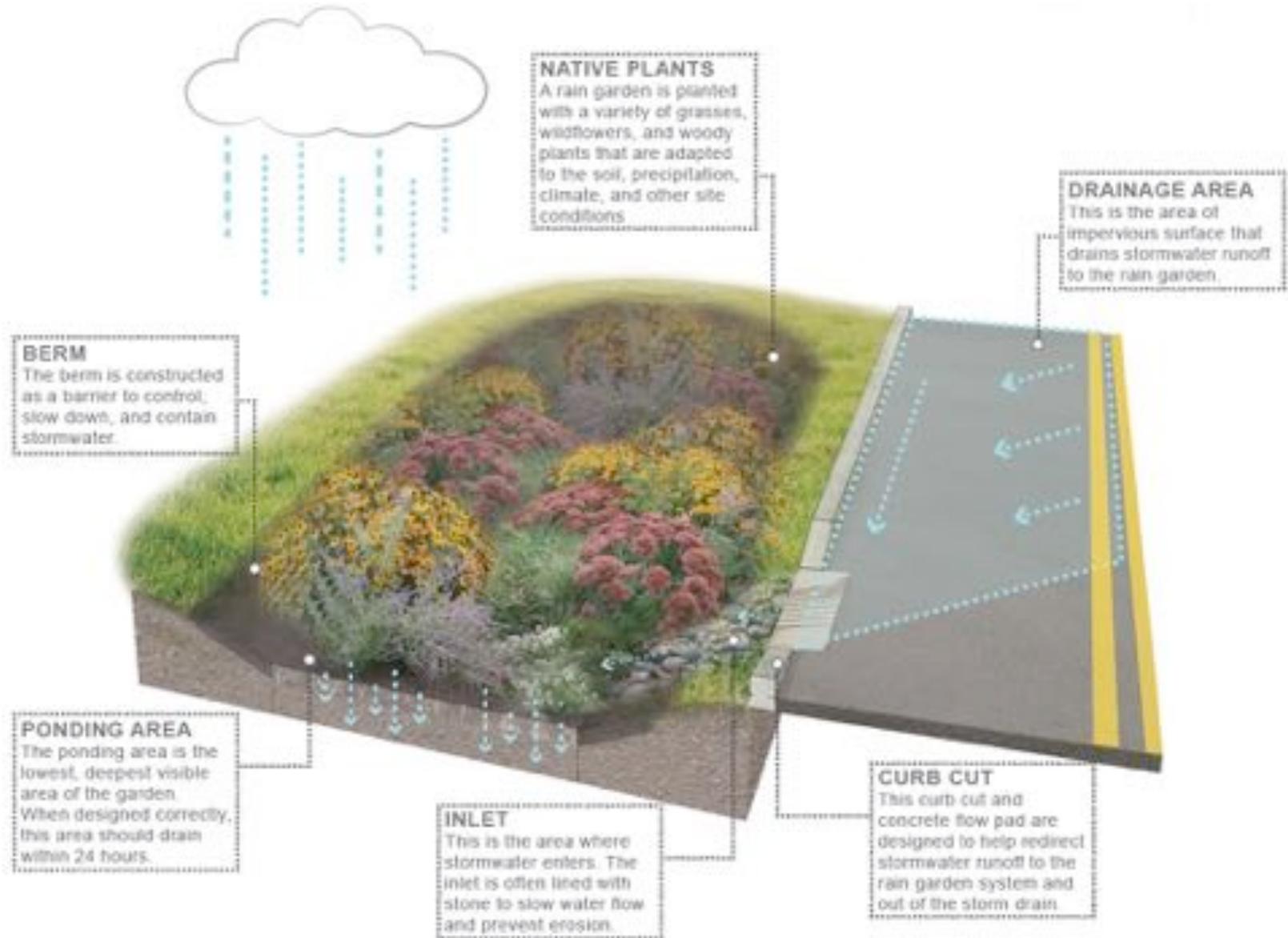
- Typically in right-of-way



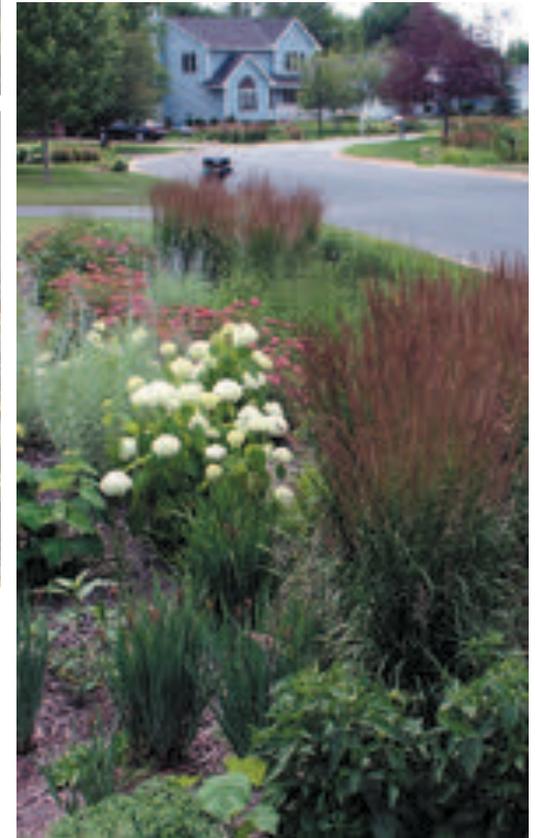
## Vegetated Curb Extensions

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

# Rain Gardens



# Lots of Rain Gardens











# 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.

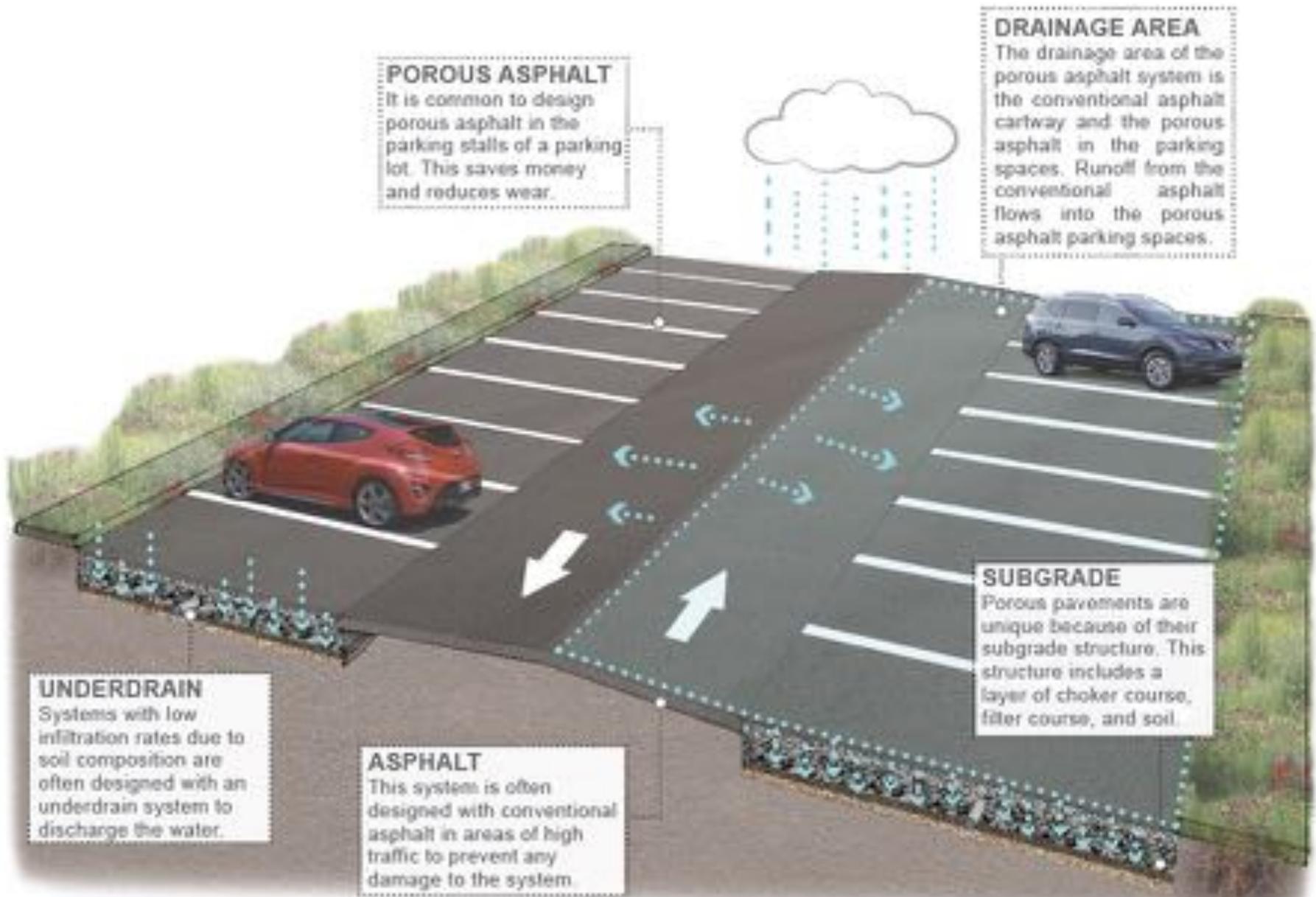




# Curb Extensions

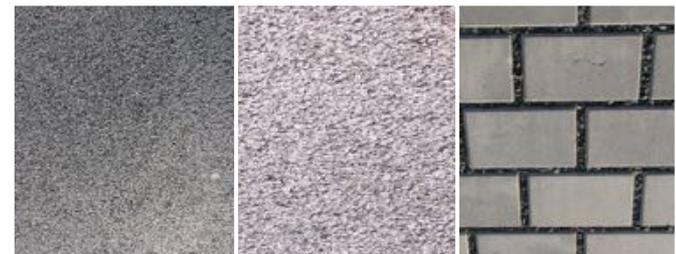


# Permeable Pavement



# Permeable Pavements

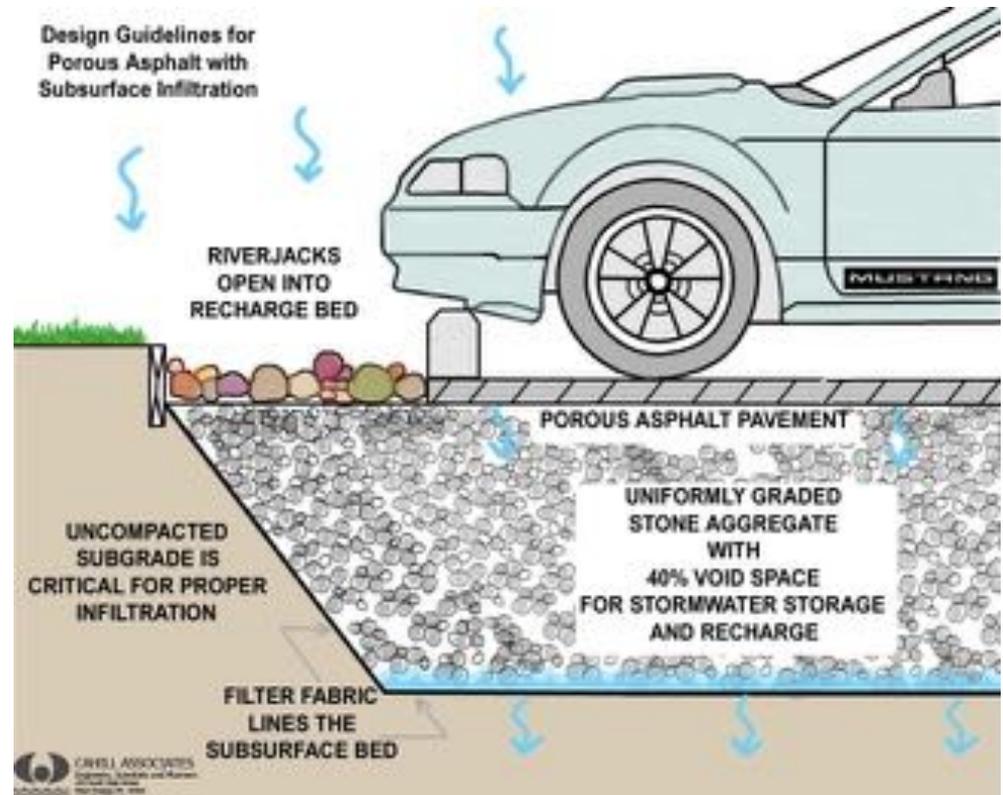
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable pavers systems are concrete pavers with infiltration between the spaces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



A photograph showing a sidewalk made of pervious concrete. The sidewalk is light gray and has a porous, aggregate-like texture. It runs parallel to a brick building on the left and an asphalt road on the right. A concrete curb separates the sidewalk from the road. In the background, there are trees and a clear blue sky.

**Pervious Concrete**

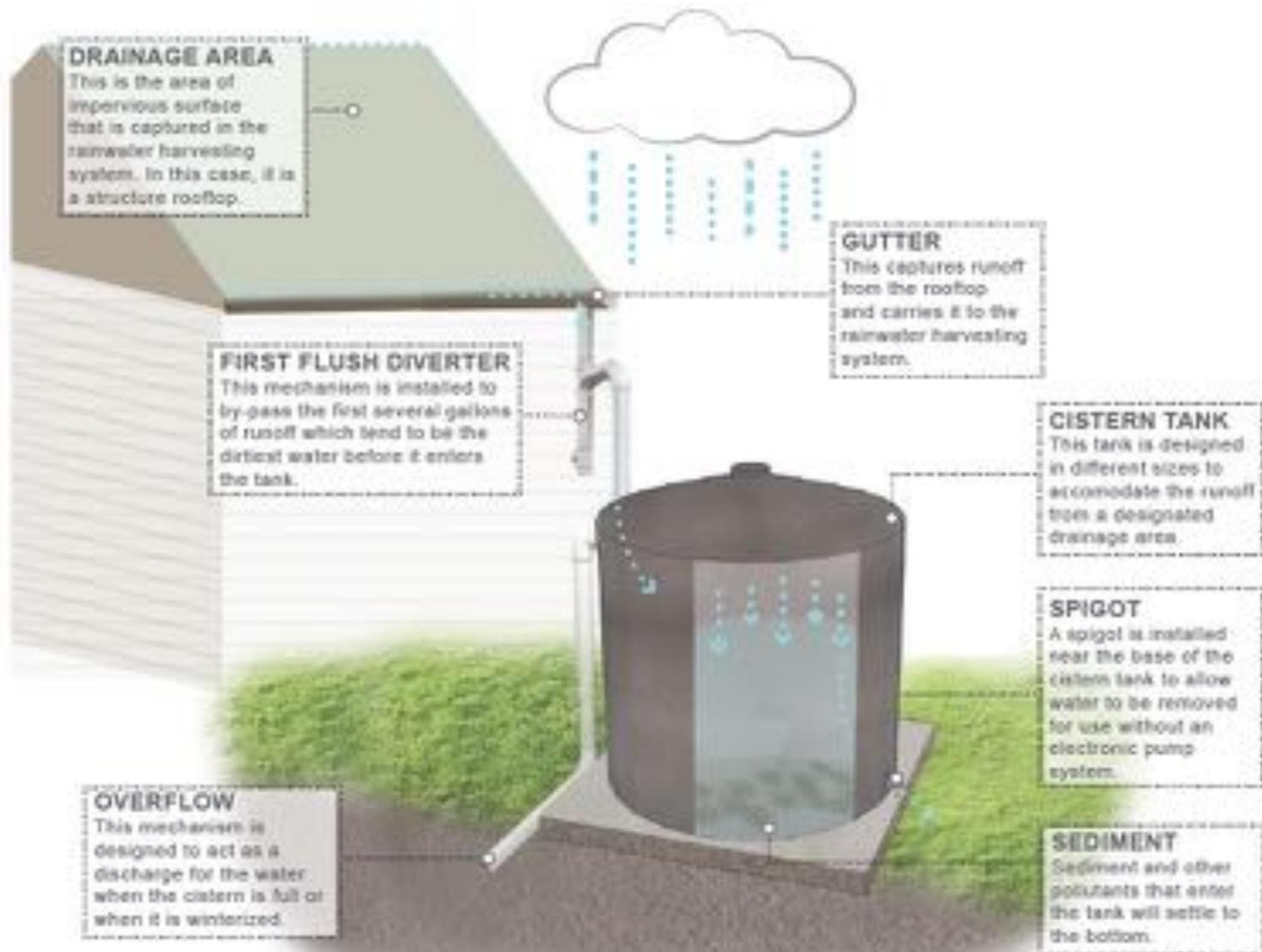


**Permeable Pavers**

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 surrounded by autumn foliage, including fallen leaves and a pile of straw or hay. A dark vehicle is partially visible in the upper left corner.

**Grass Pavers**

# Rainwater Harvesting Systems



# Rain Barrels



# Cisterns









**Let's get back to flooding – bioretention is an option but does it take up too much space?**



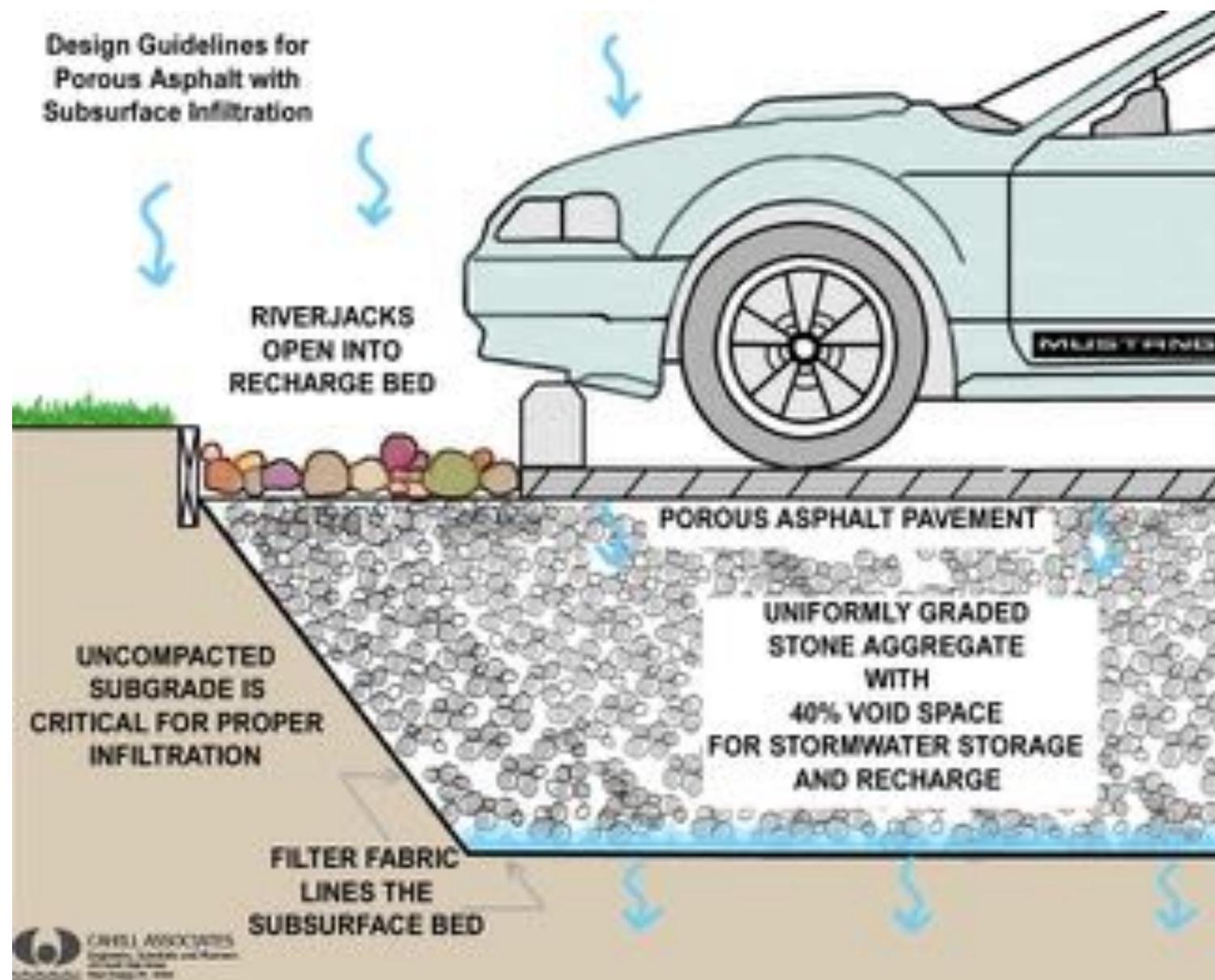


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**Design Guidelines for  
Porous Asphalt with  
Subsurface Infiltration**



## What if ...

*every time we repave a parking lot in New Jersey, we convert it into a stormwater management system. For every acre of parking lot, we can capture stormwater runoff from the 100-year storm from four to five acres of impervious surfaces. When we include a rain garden, we can further increase the benefits.*

**In the  
meantime, do  
your part and  
install a rain  
garden.**

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# Questions?

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