Department of Public Works Rain Garden Training

Presented at the library in Long Branch, NJ

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September 4, 2019

Rutgers Cooperative Extension

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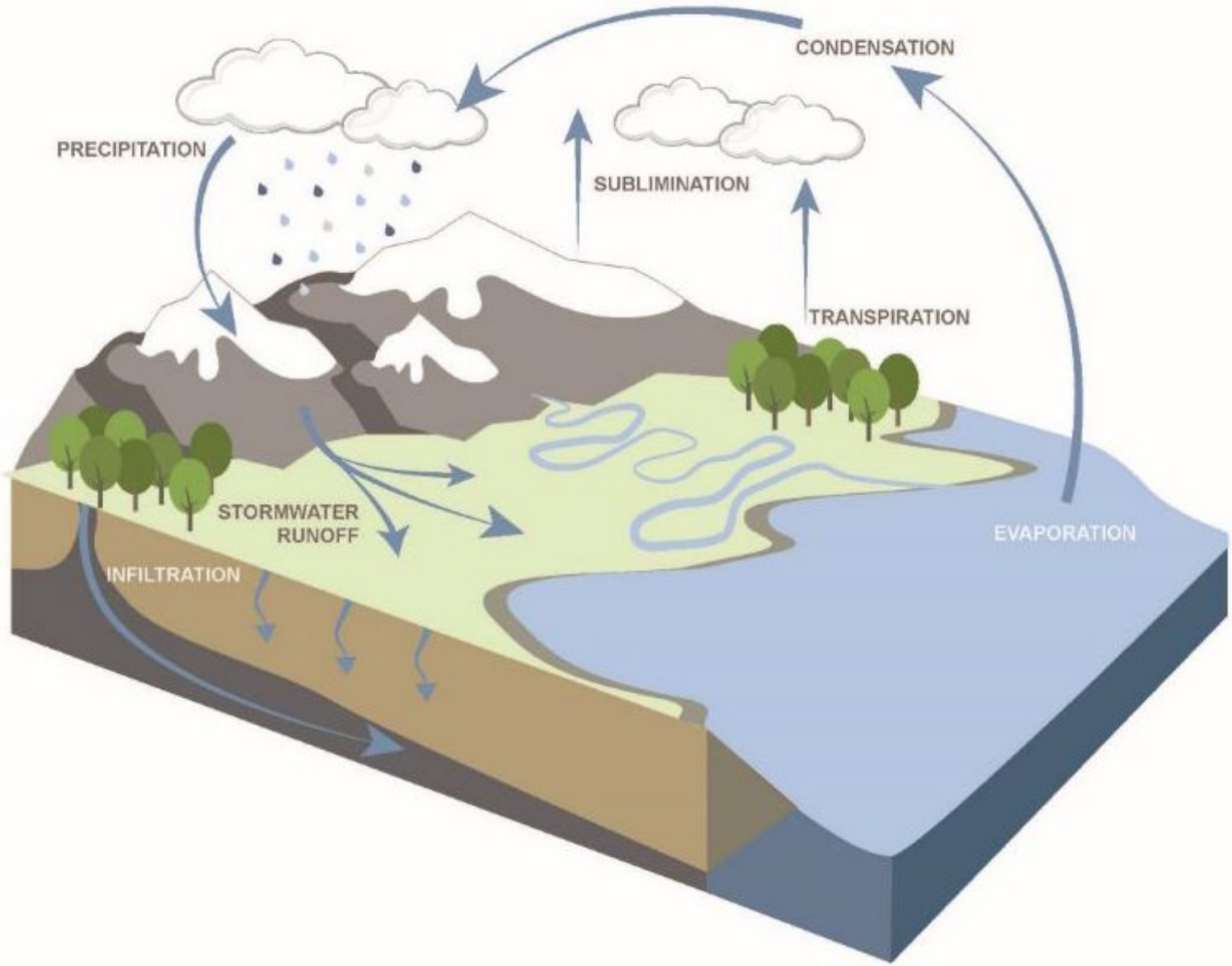
New Jersey Agricultural Experiment Station

Water Resources Program

Water Resources Program

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

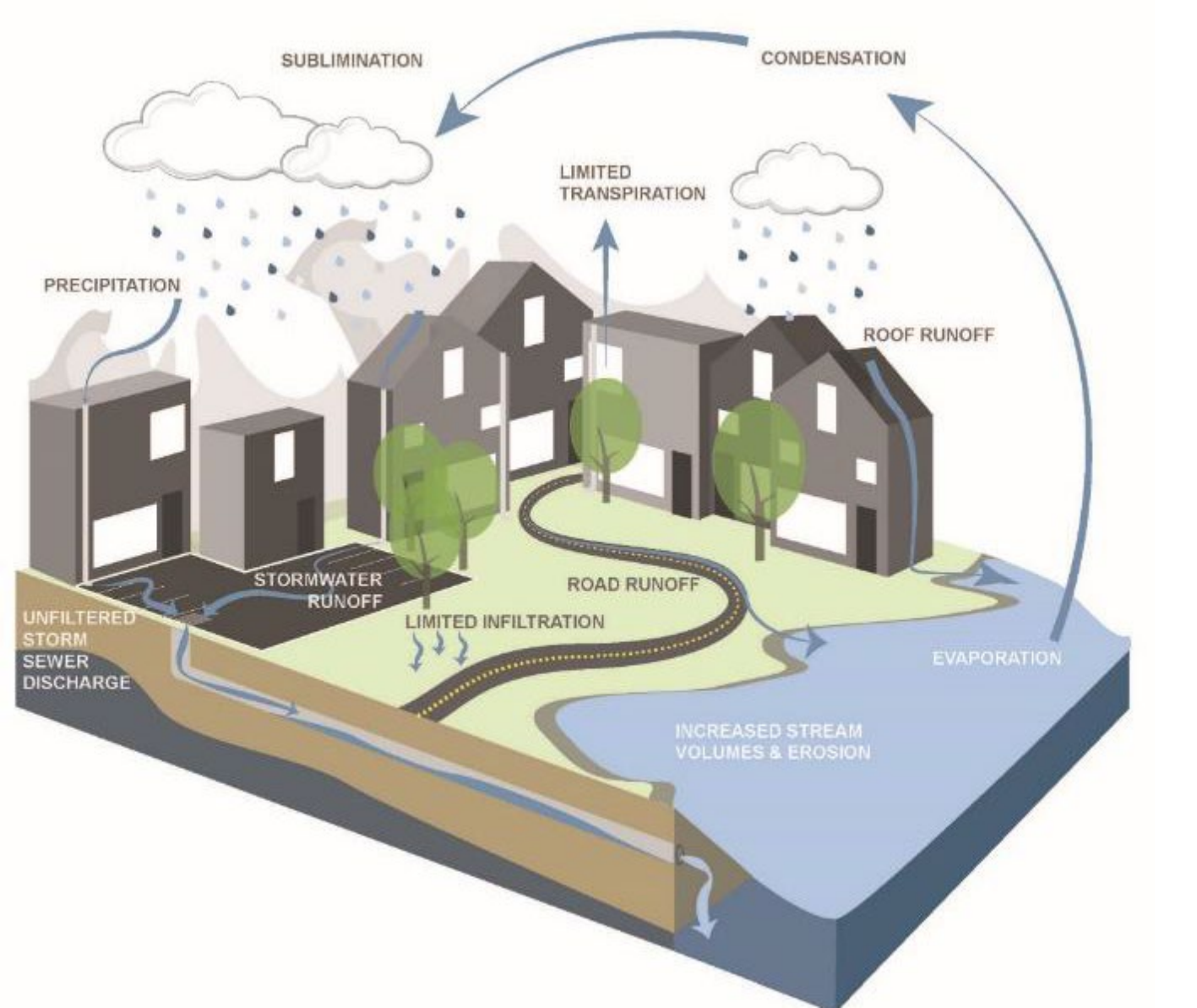
The Natural Hydrologic Cycle



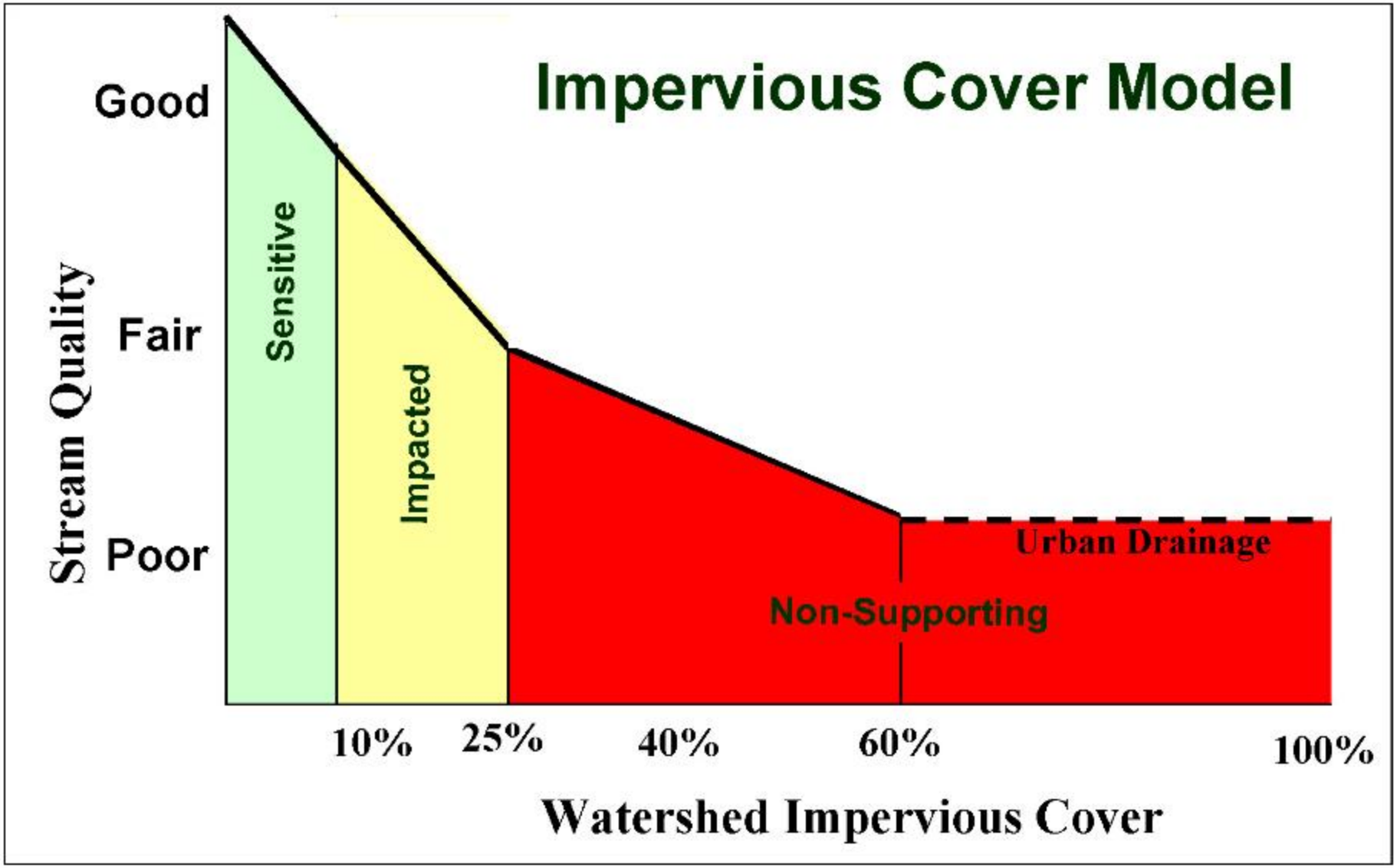
The Impact of Development on Stormwater Runoff

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

The Urban Hydrologic Cycle



Original ICM developed based on 200+ reports and papers



Reference: Tom Schueler and Lisa Fraley-McNeal, Symposium on Urbanization and Stream Ecology, May 23 and 24, 2008

How are we dealing with these issues?

- Municipal Separate Storm Sewer System (MS4) Permit
- New Jersey Stormwater Management Regulations (N.J.A.C. 7:8)
  - Municipal Stormwater Management Plan
  - Municipal Stormwater Control Ordinance
  - Stormwater Mitigation Plan
- Clean Stormwater and Flood Reduction Act (Stormwater Utility Act)

MS4 Permit

- Municipal Separate Storm Sewer System (MS4)
- All NJ municipalities have MS4 permits
- General Permit for Tier A, Tier B, Public Complexes, and Highway Agencies
- EPA Requirement

MS4 Permit …

requires municipalities to develop and implement a program to reduce discharges of pollutants entering our waters from stormwater systems to the maximum extent practical.

Stormwater Management Regulations N.J.A.C. 7:8

- Sets forth stormwater management goals for new development:
  - Reduce flood damage
  - Reduce soil erosion
  - Protect public safety through proper design and operation of stormwater management basins
  - Minimize increases in peak runoff
  - Maintain groundwater recharge
  - Protect water quality
- Sets forth the required components of regional and municipal stormwater management plans

Stormwater Management Key Objectives

- Use nonstructural management strategies
- Protect communities from increases in stormwater volume and peak flows as a result of new development
- Maintain groundwater recharge
- Protect waterways from pollution carried in stormwater runoff

NJ.com, August 28, 2011

The approval of a developer's stormwater management plans lies **solely** with the municipality.

What happens to the rain in our watersheds?

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.

Pollutants Found in Runoff

Sediment
Soil particles transported from their source

Toxics
- Pesticides
  - Herbicides
  - Fungicides
  - Insecticides
- Metals (naturally occurring in soil, automotive emissions/ tires)
  - Lead
  - Zinc
  - Mercury
- Petroleum Hydrocarbons (automotive exhaust and fuel/oil)

Debris
Litter and illegal dumping

Biochemical Oxygen Demand (BOD)
- Oxygen depleting material
  - Leaves
  - Organic material

Nutrients
- Various types of materials that become dissolved and suspended in water (commonly found in fertilizer and plant material):
  - Nitrogen (N)
  - Phosphorus (P)

Bacteria/ Pathogens
Originating from:
- Pets
- Waterfowl
- Failing septic systems

Thermal Stress
Heated runoff, removal of streamside vegetation

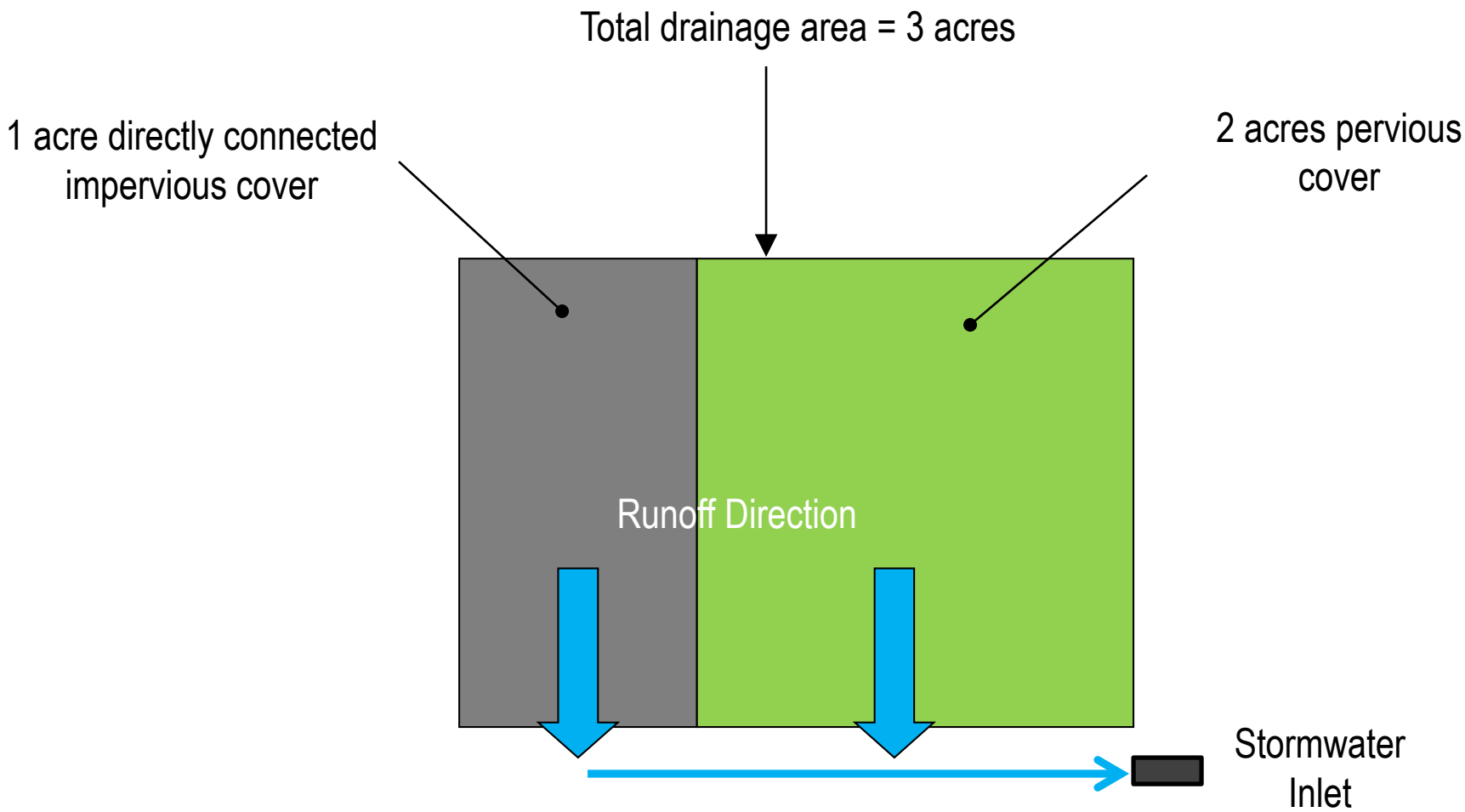
It is all about controlling runoff from impervious surfaces

Impervious surfaces

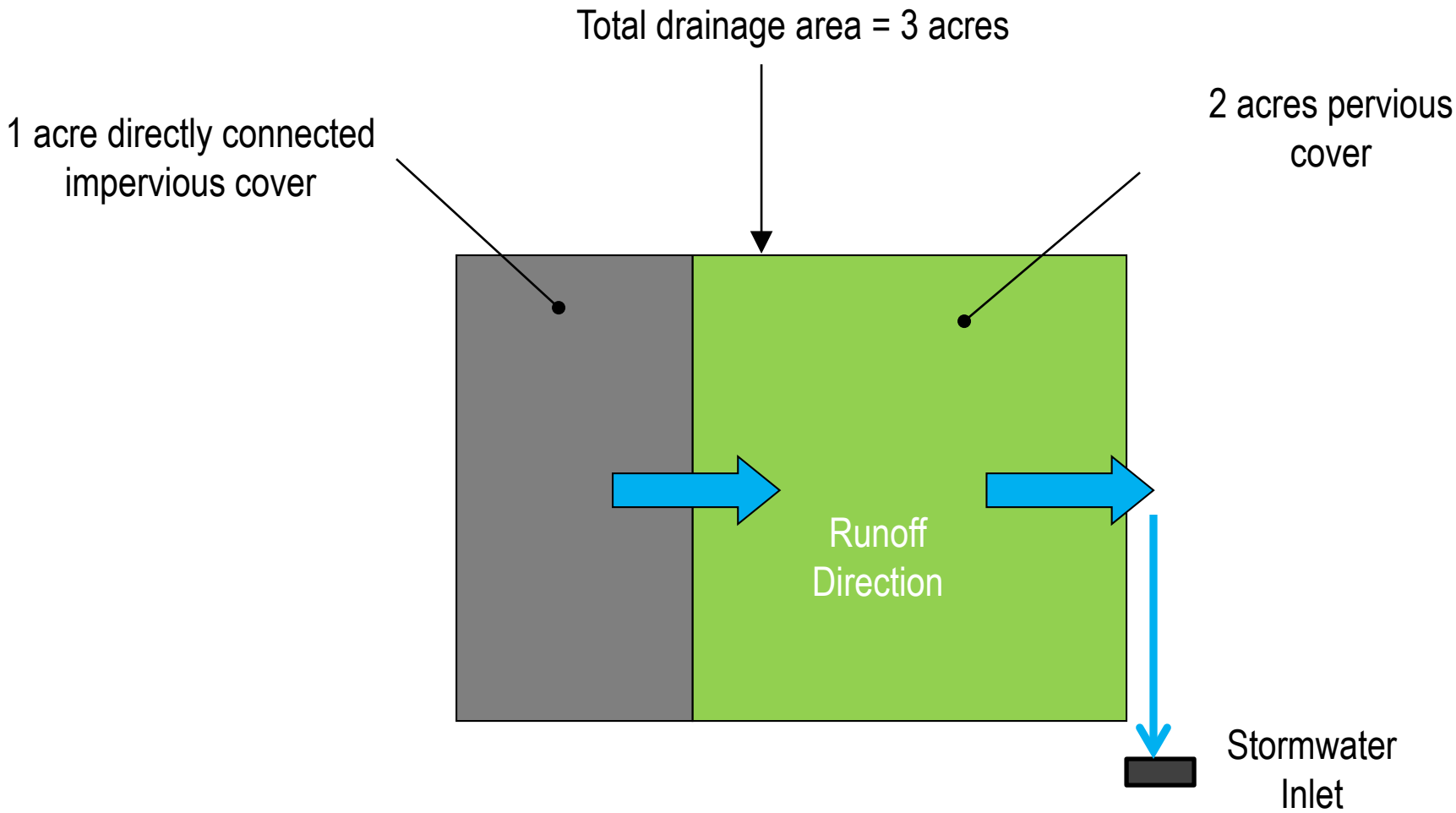
Connected or Disconnected?

Example of Simple Disconnection

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

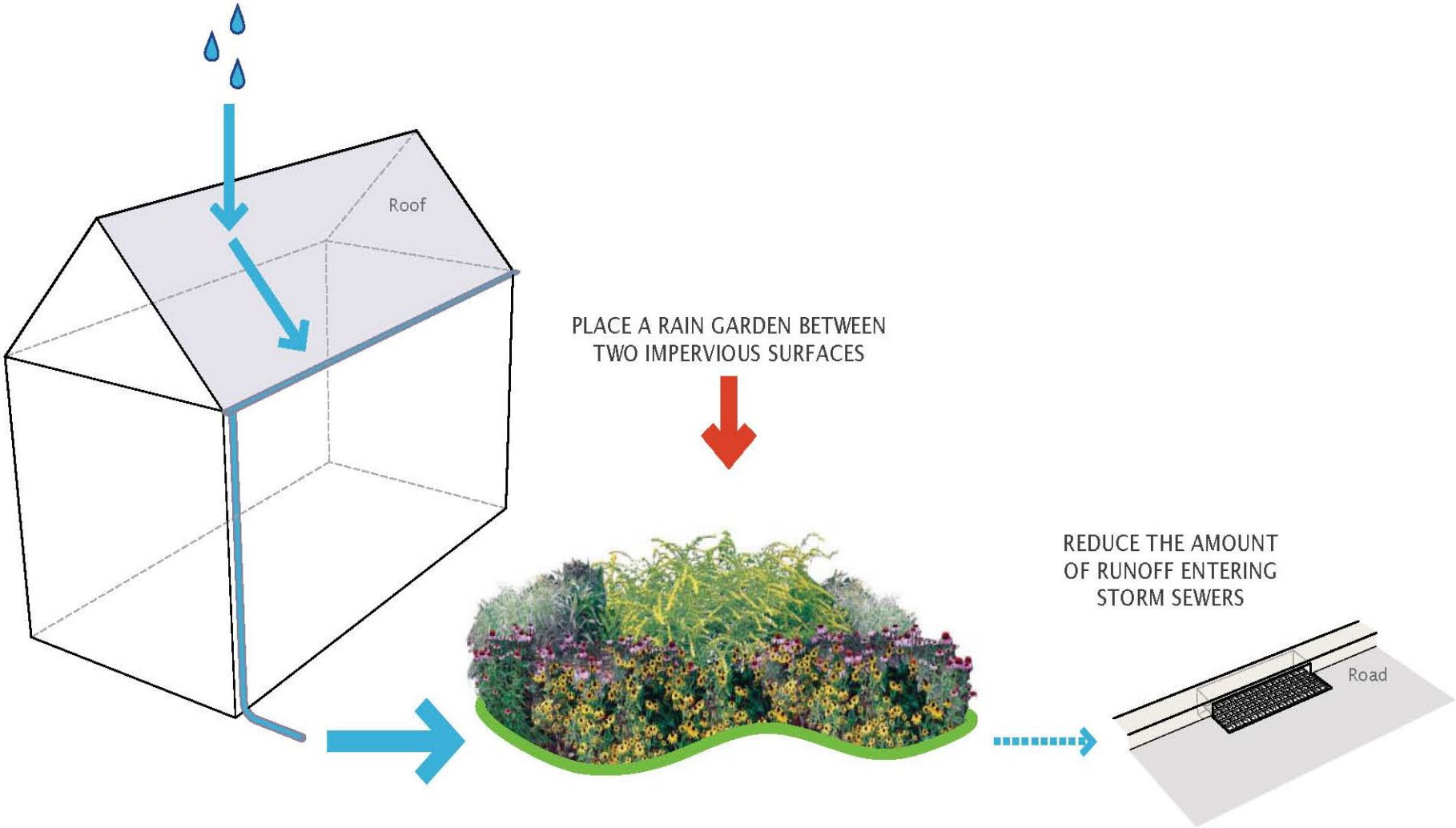


For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**



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

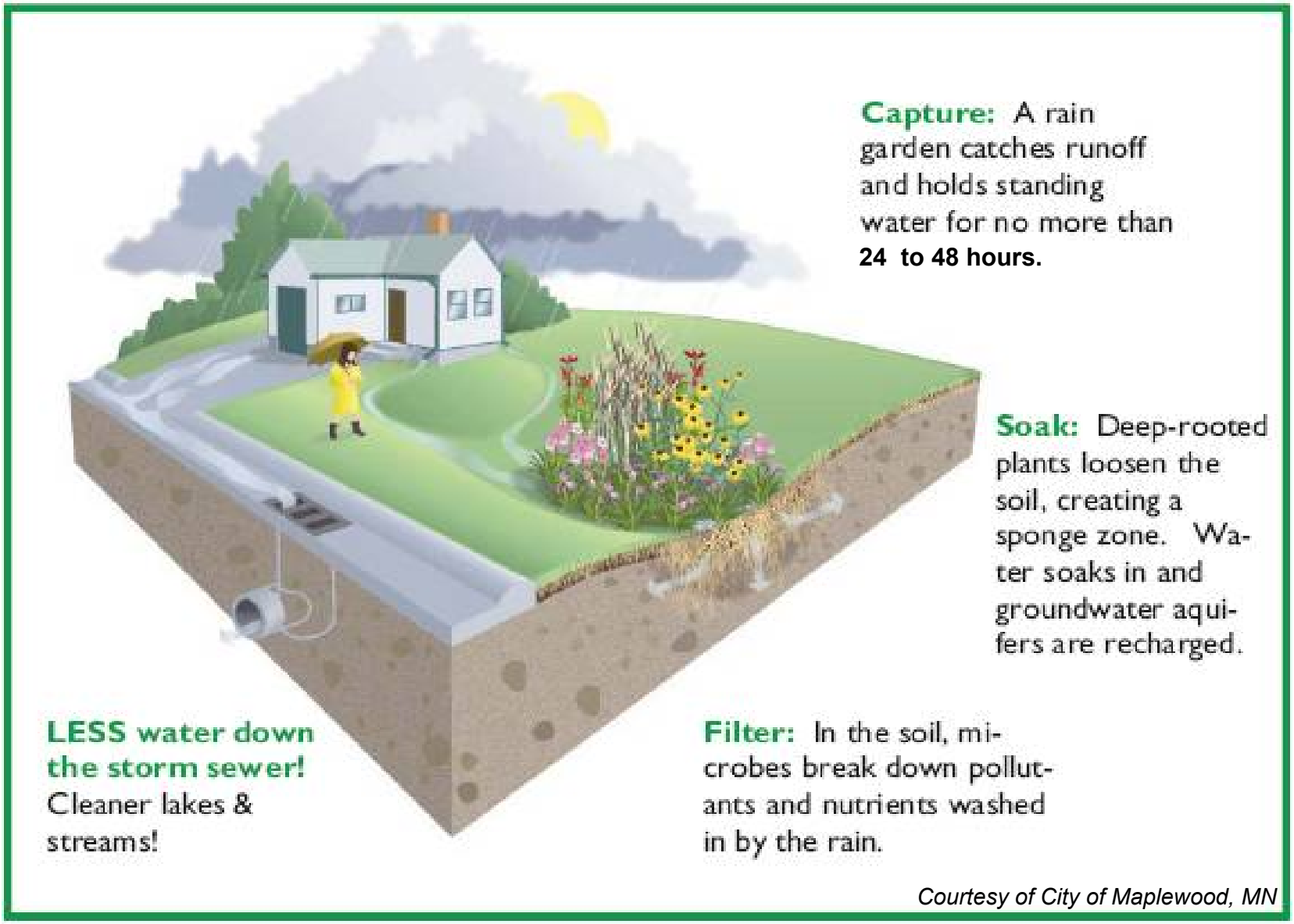
The Solution…



Rain Gardens

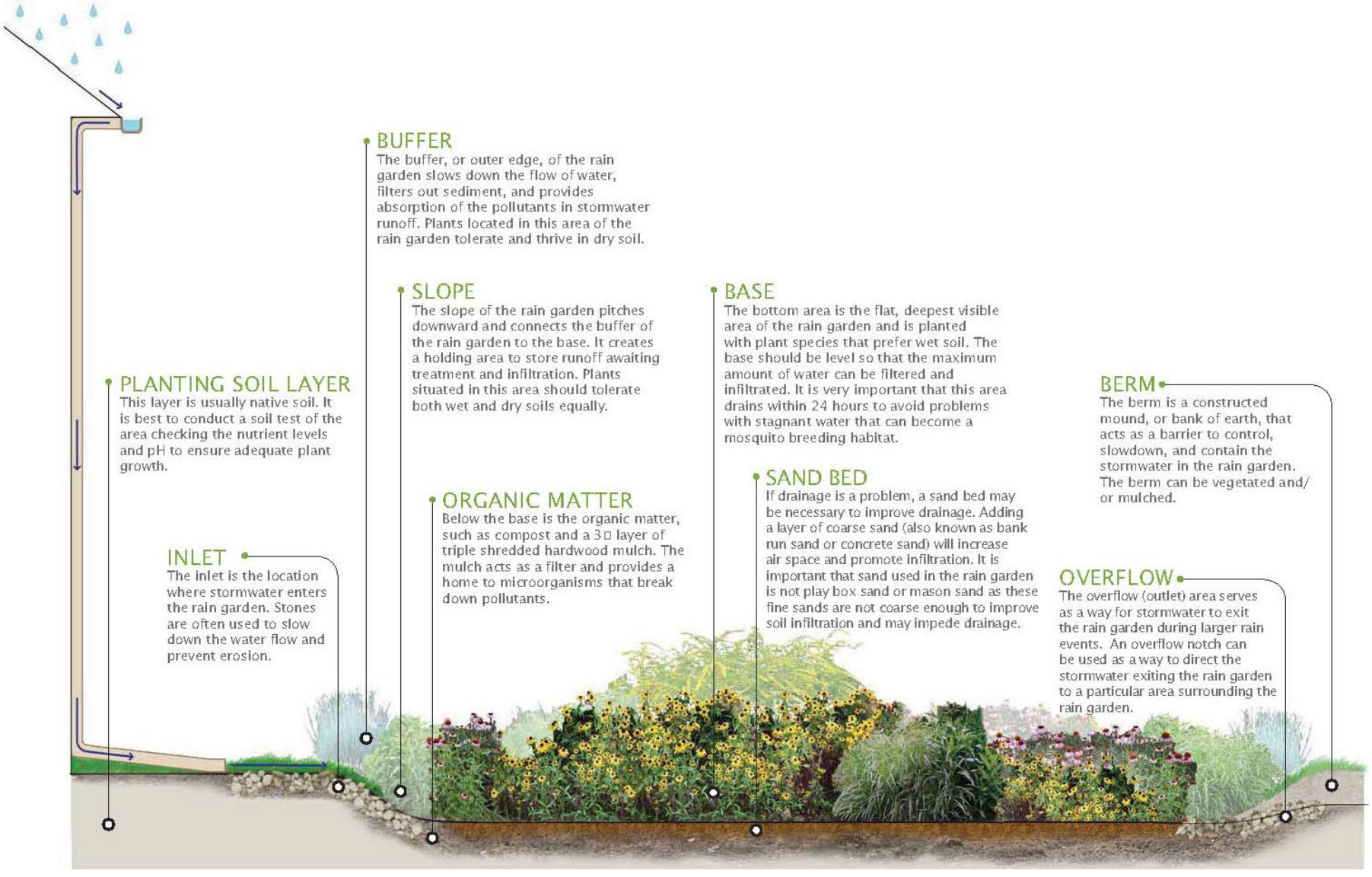
A rain garden is a landscaped, shallow depression that is designed to intercept, treat, and infiltrate stormwater at the source before it becomes runoff. The plants used in the rain garden are native to the region and help retain pollutants that could otherwise harm nearby waterways.

Rain Gardens



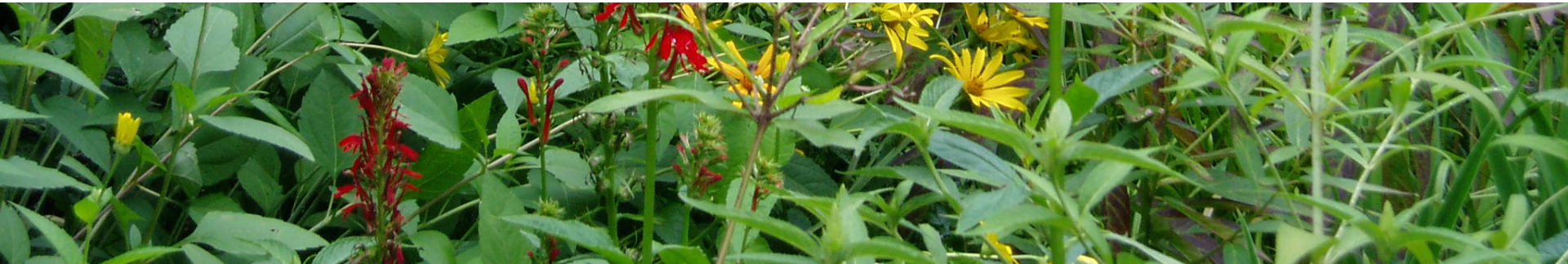
Courtesy of City of Maplewood, MN

PARTS OF A RAIN GARDEN



SITE SELECTION & DESIGN

PLANNING YOUR RAIN GARDEN



SITE SELECTION

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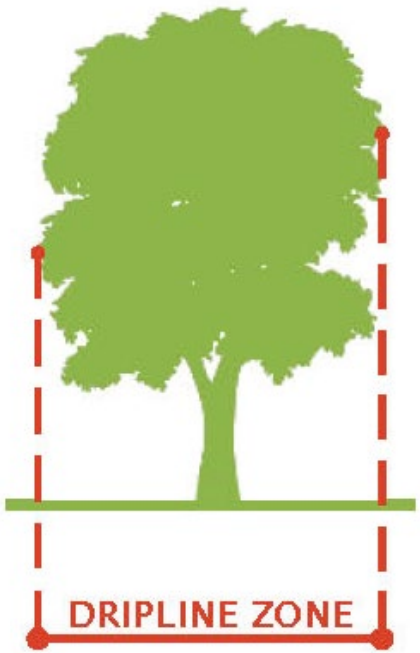
1. Next to a building with a basement, rain garden should be located min. 10’ from building; no basement: 2’ from building
2. Do not place rain garden within 25’ of a septic system
3. Do not situate rain garden in soggy places where water already ponds
4. Avoid seasonably-high water tables within 2’ of rain garden depth
5. Consider flat areas first – easier digging
6. Avoid placing rain garden within dripline of trees
7. Provide adequate space for rain garden




8. 2. 2004


Rain Garden
Water Quality and Habitat Enhancement Project
This garden is designed to intercept, treat, and infiltrate stormwater at the source, before it becomes runoff. The plants are native to the region and help retain pollutants that could otherwise harm nearby waterways.
Rain gardens are beautiful, low-maintenance, and inexpensive gardens that you can install at home.
www.water.rutgers.edu

CALL BEFORE YOU DIG

LOCATE YOUR UTILITY LINES!

Call BEFORE You Dig!

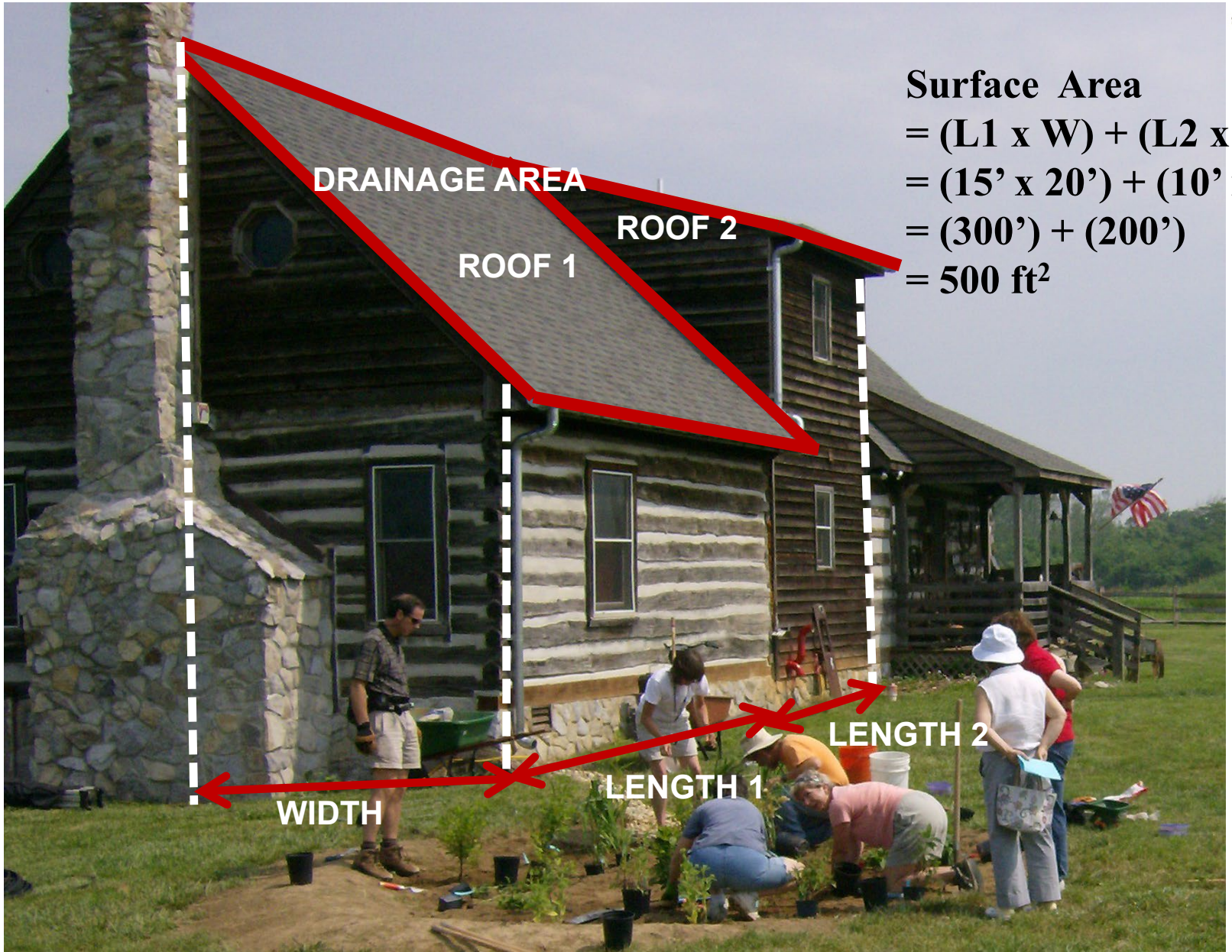
NJ One Call
1-800-272-1000

The different colors of the markout flags represent specific utilities.

- *ELECTRIC*
- *GAS, OIL, STEAM*
- *COMMUNICATIONS, CATV*
- *WATER*
- *SEWER*

- **NJ One Call: 1-800-272-1000**
- Free markout of underground gas, water, sewer, cable, telephone, and electric utility lines
- Call at least 3 full working days, but not more than 10 days, prior to planned installation date
- Do not place rain garden within 5' horizontally and 1' vertically from any utilities

DRAINAGE AREA CALCULATION



Surface Area
= (L1 x W) + (L2 x W)
= (15’ x 20’) + (10’ x 20’)
= (300’) + (200’)
= 500 ft^2

DRAINAGE AREA: THE ROOFTOP SCENARIO

CHECK YOUR SOIL

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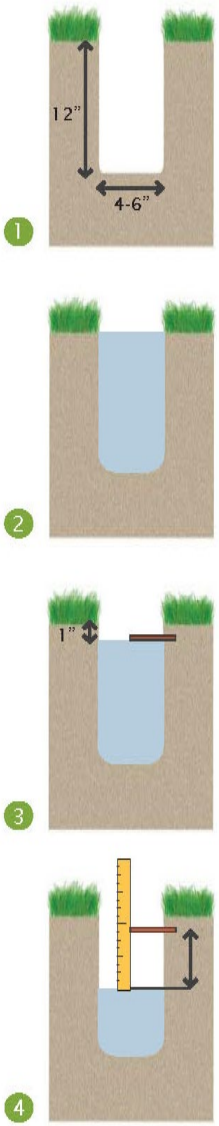

- Infiltration/Percolation Test
  1. Dig a hole in the proposed rain garden site (12" deep, 4-6" wide)
  2. Fill with water to saturate soil and then let stand until all the water has drained into the soil
  3. Once water has drained, refill the empty hole again with water so that the water level is about 1" from the top of the hole
  4. Check depth of water with a ruler every hour for at least 4 hours
  5. Calculate how many inches of water drained per hour

DETERMINING THE DEPTH OF THE RAIN GARDEN

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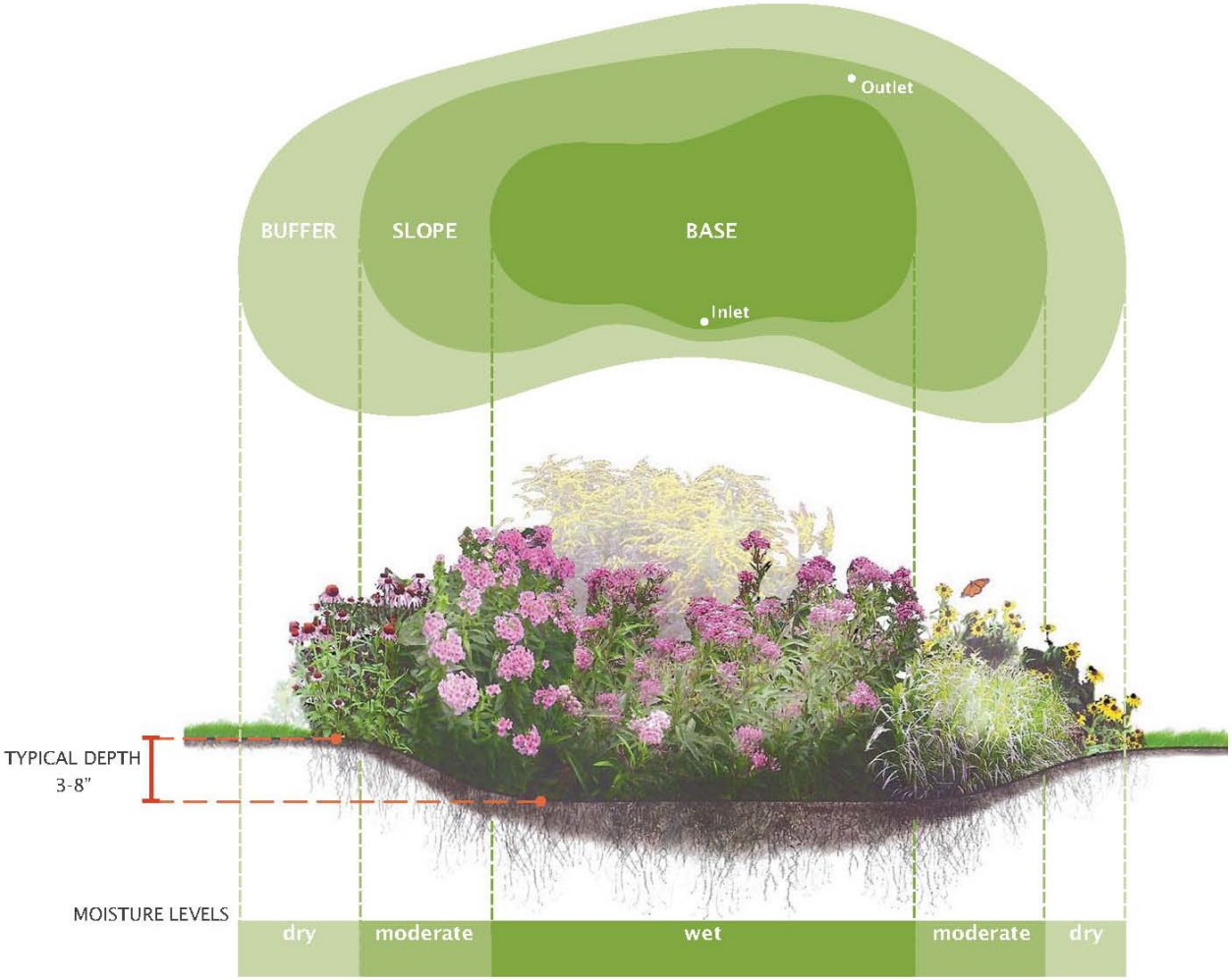

DETERMINING THE DEPTH OF THE RAIN GARDEN

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6" DEEP RAIN GARDEN - NO SOIL AMENDMENTS

3" DEEP RAIN GARDEN - SOIL AMENDMENTS

- Depth of rain garden is dependent upon the soil texture found at the site of the rain garden
- Depth is usually 3-8 inches

DETERMINING THE SIZE OF THE RAIN GARDEN

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- The size of the rain garden is dependent upon the amount of runoff entering the rain garden

Rain Garden Sizing Table

Based on New Jersey's Water Quality Design Storm (1.25" of rain over 2 hours)

Drainage Area	Size of 3" Deep Rain Garden CLAY SOIL*	Size of 6" Deep Rain Garden SILTY SOIL	Size of 8" Deep Rain Garden SANDY SOIL
500 ft^2	200 ft^2	100 ft^2	75 ft^2
750 ft^2	350 ft^2	150 ft^2	112 ft^2
1,000 ft^2	400 ft^2	200 ft^2	149 ft^2
1,500 ft^2	600 ft^2	300 ft^2	224 ft^2
2,000 ft^2	800 ft^2	400 ft^2	299 ft^2

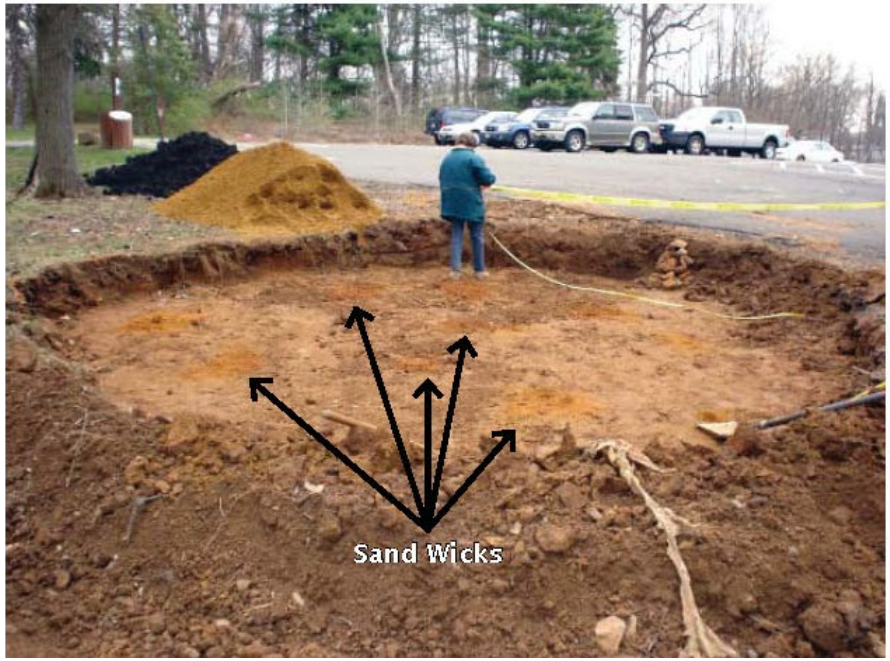
*SOIL TEXTURE AMENDMENTS NEEDED

SOIL TEXTURE AMENDMENTS

- Soil texture amendments improve the rain garden's infiltration rate.

SOIL QUALITY AMENDMENTS

- Soil quality amendments improve the rain garden's growing conditions for plants
- Improve soil's nutrient capacity



REMEMBER:
Your rain garden should NOT be permanently filled with water – it should drain within 24 hours.

DETERMINING THE INLET AND OVERFLOW

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- Stormwater runoff enters the rain garden from an **inlet**
- Stormwater exits through the **overflow**

PREVENTING EROSION

- Slope no greater than 3:1
- Slow down velocity of water flowing through rain garden
  - Add rocks to inlet area

DETERMINING MULCH QUANTITY

- Allow for a 3” depth mulch (triple-shredded hardwood with no dye) to be spread throughout the entire rain garden
- Every 100 square feet of rain garden needs 1 cubic yards (3” depth)

RAIN GARDEN DESIGN

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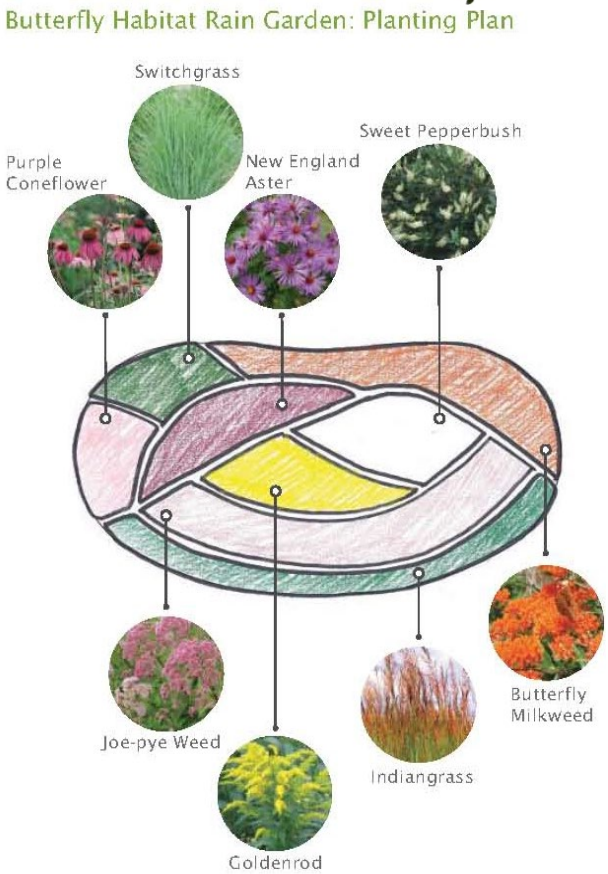
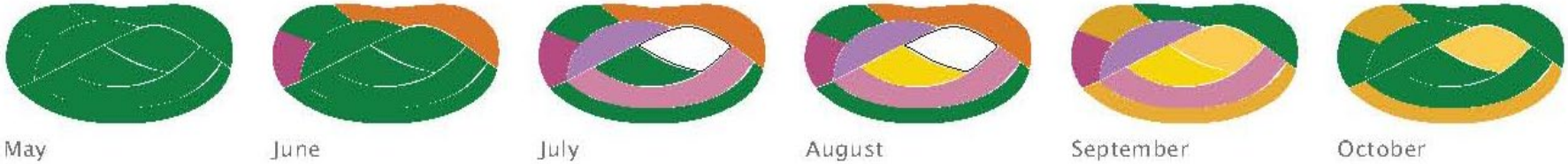
SHAPING YOUR RAIN GARDEN

- Use a garden hose or rope to outline the desired shape of your rain garden on the ground
- Many rain gardens are in the shape of a circle or kidney bean, but your rain garden can take on whatever shape you prefer





SELECTING PLANTS FOR YOUR RAIN GARDEN

- The success of your rain garden depends on selecting the right plants for the right place
- Plant your rain garden with plants adapted for your specific site
- **Native plants** can thrive without a lot of care, extra water, fertilizer, or pesticides
- **Native plants** are tolerant to dry and wet conditions

PLANT SELECTION

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Select species based upon the following qualities:

- Plant size
- Moisture tolerances
- Sun preferences
- Plant aggressiveness
- Salt tolerance
- Habitat creation

PLANTING DESIGN TIPS

- Plants that prefer wet conditions should be planted in the deepest part (the base) of the rain garden
- Create depth in the rain garden by placing large and tall plants in the back, smaller plants in the front
- Plant masses of the same species together in odd numbers
- Incorporate plants that have visual interest in the fall and winter
- Native plants provide habitat to animals and require less watering

QUESTIONS?

THE FUN PART!

INSTALLING YOUR RAIN GARDEN

STEP ONE

- Delineate rain garden area

- Remove existing grass with a shovel or machinery

STEP TWO

- Excavate to design depth based on necessary storage and soil amendment requirements

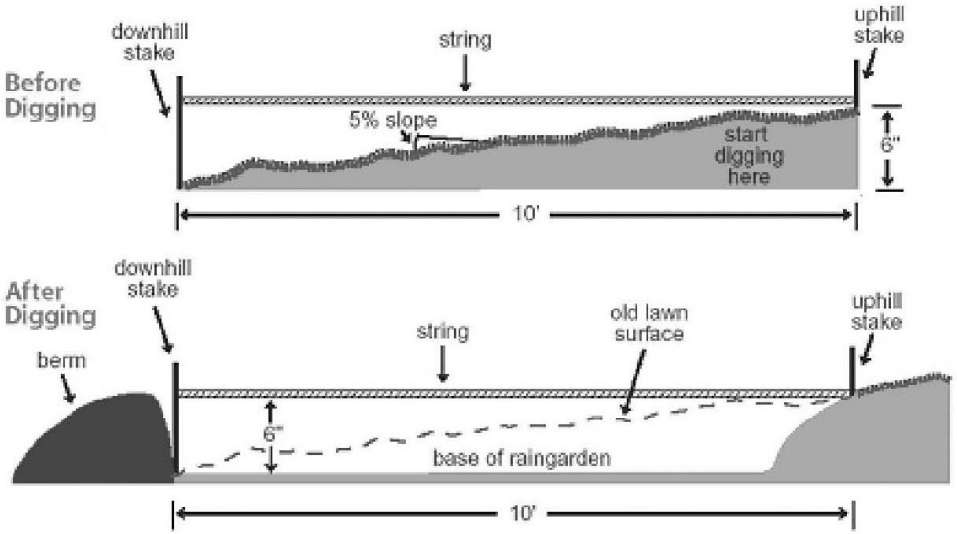
STEP THREE

- Add soil amendments, if necessary

- Combine amendments with existing soil using shovels or rototiller
- Loosen and prepare soil for grading and planting

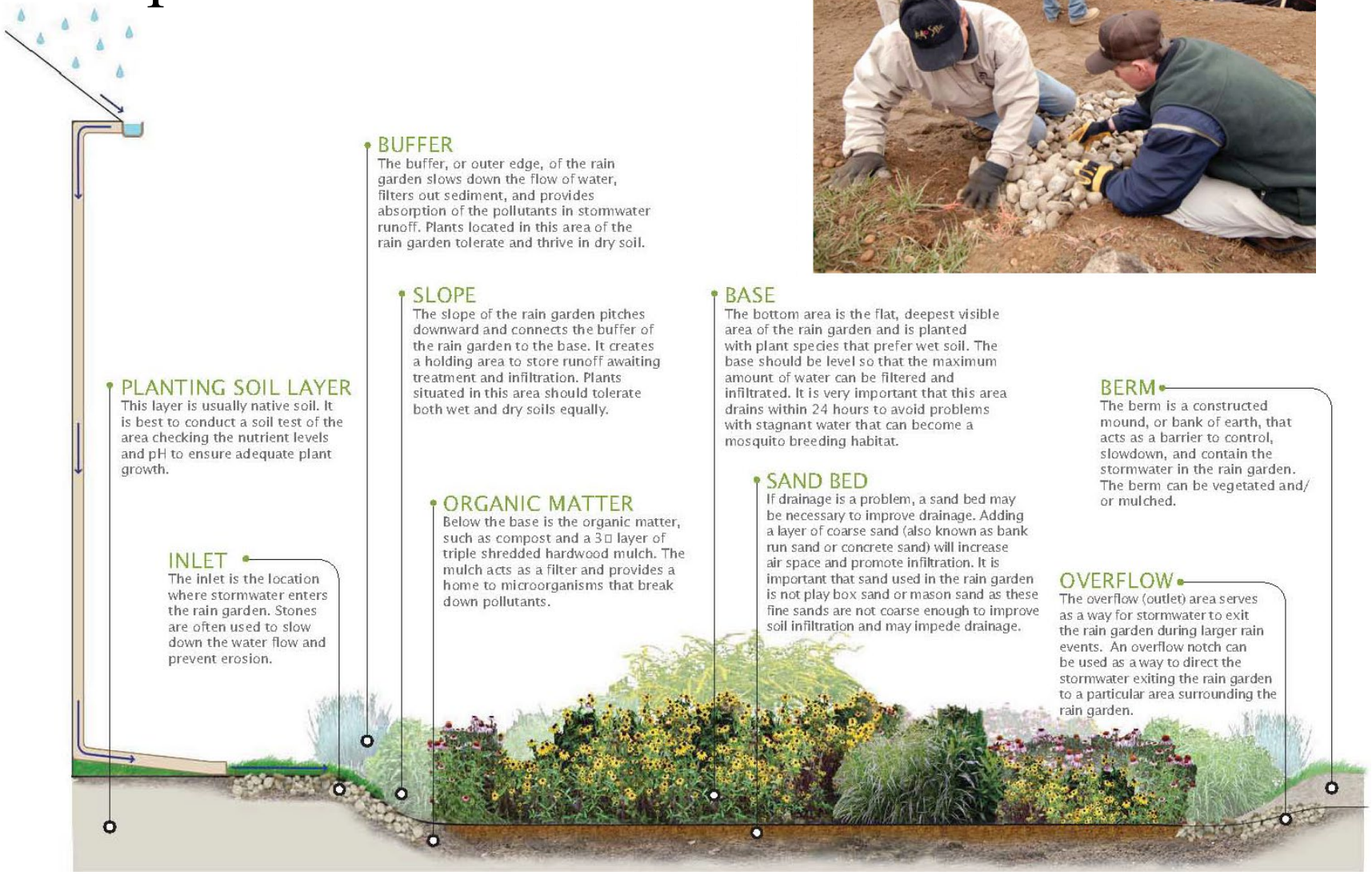
STEP FOUR

- Prepare the berm, if necessary



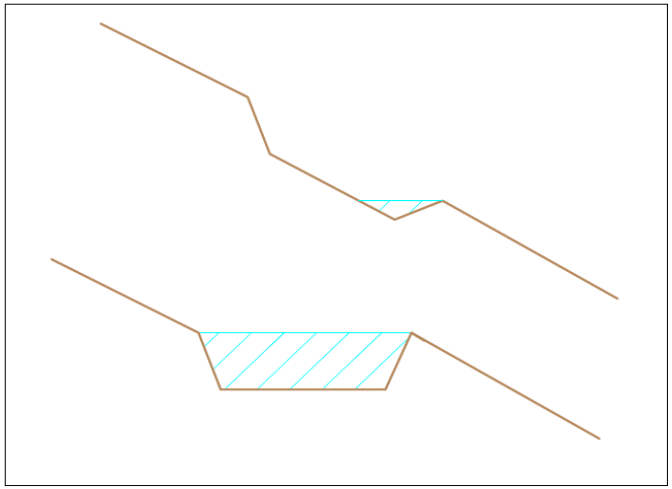
STEP FIVE

- Prepare the overflow



STEP SIX

- Level the rain garden base



STEP SEVEN

- Plant native species







STEP EIGHT

- Apply mulch

- Allow for a 3” depth mulch (triple-shredded hardwood with no dye) to be spread throughout the entire rain garden
- For every 100 square feet of rain garden, you will need about 1 cubic yard of mulch (3” depth)

STEP NINE

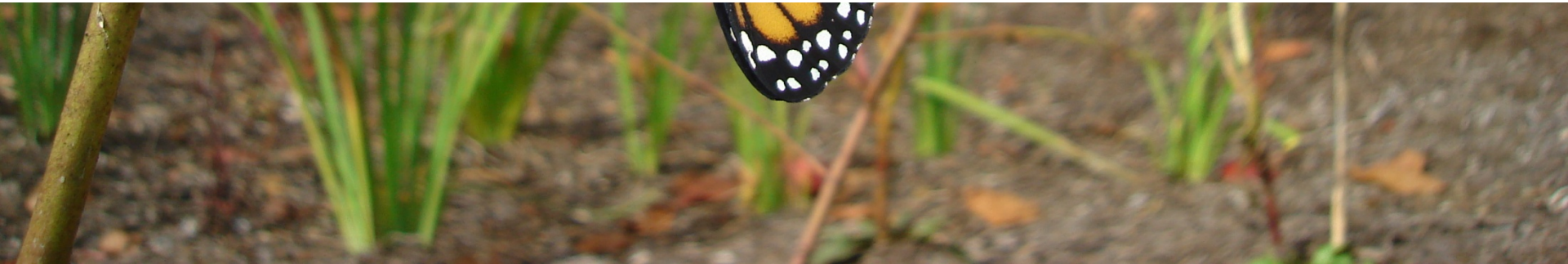
- Water Plants

STEP TEN

- Appreciate a job well done

INSPECTION AND MAINTENANCE

MAINTAINING YOUR RAIN GARDEN



MAINTENANCE MEASURES

WEEKLY TASKS:

1. Watering
2. Weeding
3. Inspecting

ANNUAL TASKS:

1. Mulching
2. Pruning
3. Re-planting
4. Removing sediment
5. Soil Testing
6. Harvesting Plants
7. Cleaning of Gutters
8. Replacing materials (stone, landscape fabric)

DETAILED MAINTENANCE PRACTICES

- For detailed maintenance practices go to the Rain Garden Rebate Program website to view a Maintenance PowerPoint Presentation

RAIN GARDEN PLANTING DESIGN

DESIGN AESTHETICS

- Formal or traditional design
  - Shrub bed
  - Perennial garden
  - Hedges
- Naturalized planting & design
  - Butterfly garden
  - Meadow (warm season grasses & wildflowers)
  - Buffer plantings

SITE CONSTRAINTS

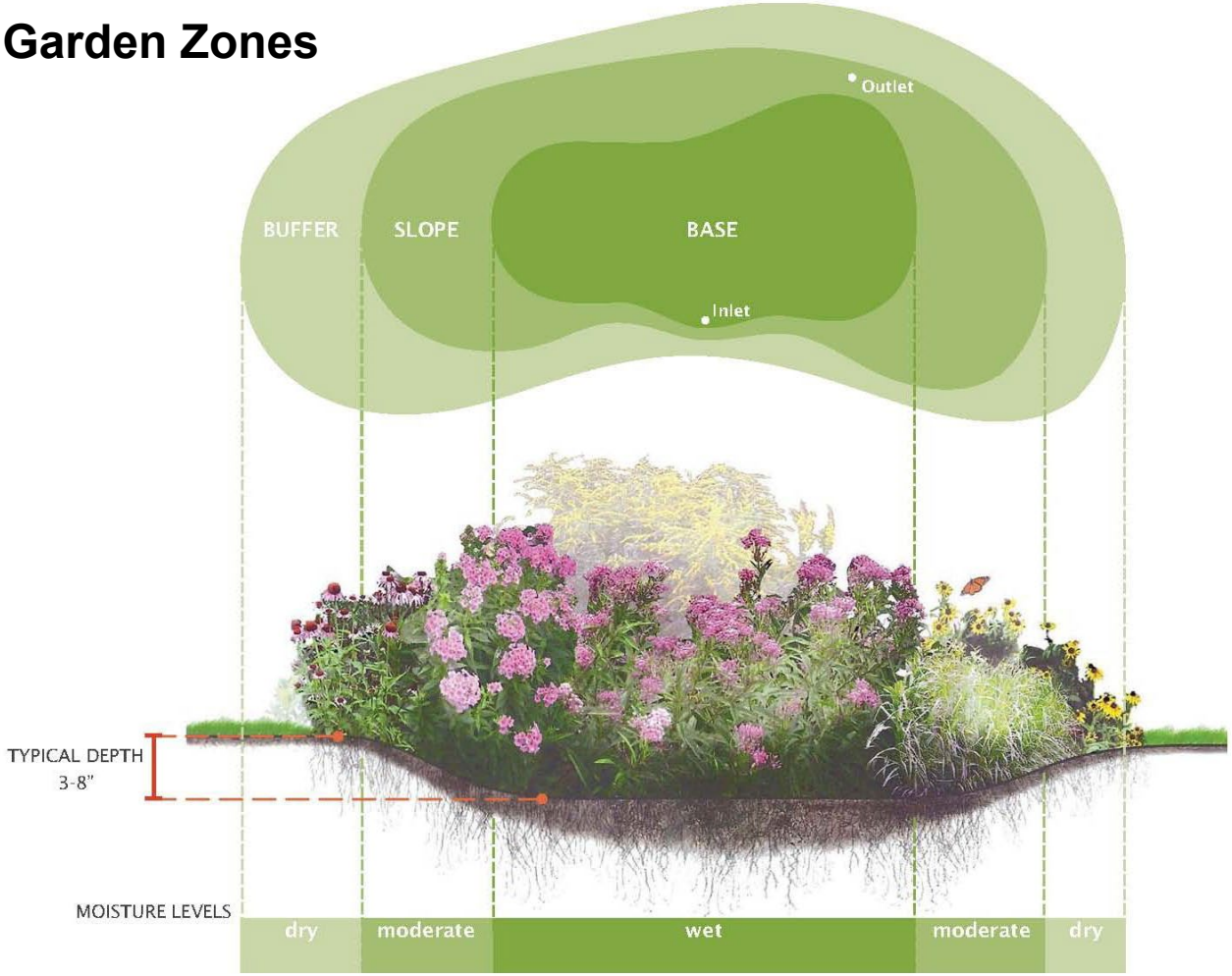
- Sun vs. shade
- Exposure/wind
- Soil characteristics
- Hydrologic conditions
- Road salts
- Vehicle/pedestrian traffic

PLANTS IN THE RIGHT PLACE…

Courtesy of Pinelands Nursery & Supply

PLANTING DESIGN: Wet + Dry Conditions

Rain Garden Zones



SELECTING PLANT SPECIES

- Mature plant size
  - Proximity to buildings and utility lines
  - Pruning and shaping
- Seasonal interest
  - Flowers
  - Fall color
  - Winter character
- Beneficial wildlife
  - Flowers for butterflies
  - Fruits for song birds

GRASSES & GROUND COVERS

BUFFER

- Broomsedge
- Bearberry
- Panic grass
- Switchgrass
- Little bluestem
- Indiangrass

BASE

- Big bluestem
- Virginia wild-rye
- Switchgrass
- Wool grass

SLOPE

- Bluejoint grass
- Sedges
- Fowl mannagrass
- Softrush

GRASSES & GROUND COVERS

WILDFLOWERS & FERNS

BUFFER

- Butterfly milkweed
- Wild indigo
- Purple coneflower
- Beebalm
- Black-eyed susan

BASE

- New England aster
- New York aster
- Columbine
- Coreopsis
- Joe-pye weed
- Blazing star
- Sensitive fern
- Cinnamon fern
- Ironweed

SLOPE

- Swamp milkweed
- Marsh marigold
- Turtlehead
- Boneset
- Rose-mallow/hibiscus
- Blueflag iris
- Cardinal flower
- Blue lobelia
- Monkey flower
- Royal fern

WILDFLOWERS & FERNS

TREES & SHRUBS

BUFFER

- Hackberry
- Red Bud
- Pepperbush
- American Holly
- Bayberry
- Witchhazel
- White Oak
- Red Oak
- Arrowwood Viburnum

BASE

- Red Maple
- Service Berry
- River Birch
- Silky Dogwood
- Red-twig Dogwood
- Inkberry Holly
- Winterberry
- Sweetbay Magnolia

SLOPE

- River Birch
- Buttonbush
- Silky Dogwood
- Green Ash
- Swamp White Oak
- Pin Oak
- Cranberrybush Viburnum

TREES & SHRUBS

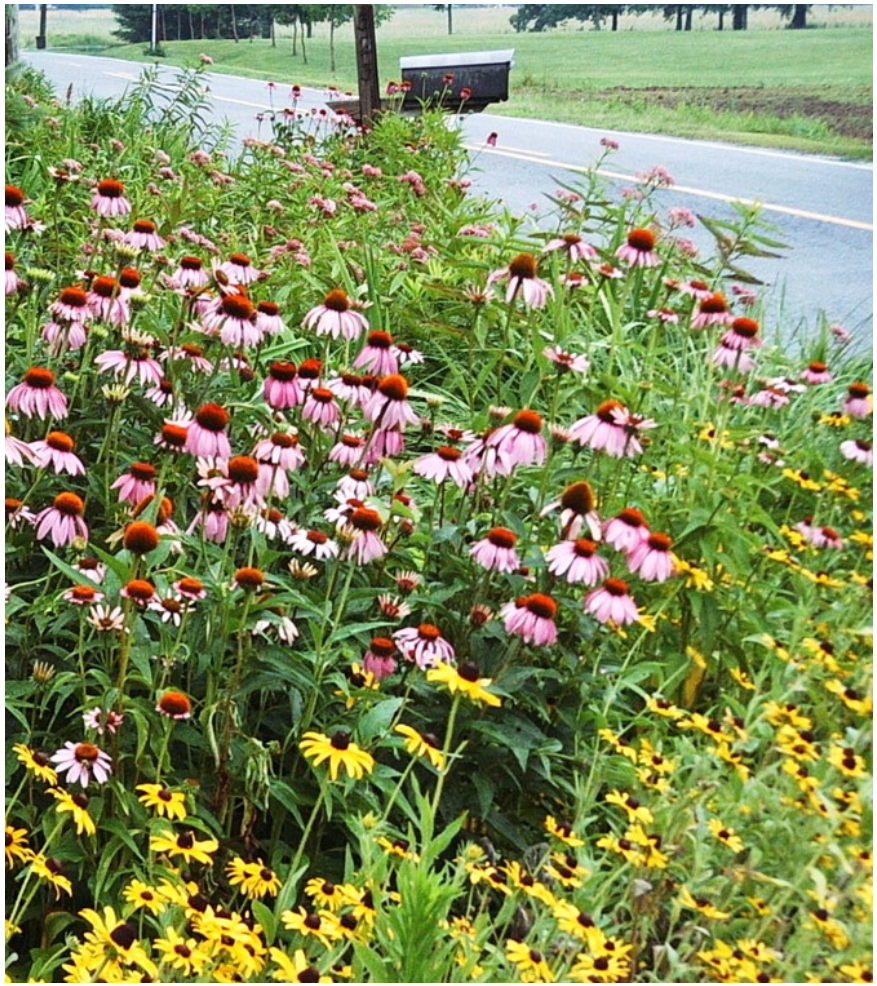
PLANTING DESIGN

- Native Species
- Tolerance of both wet + dry conditions
- Mature size of plants
- Aesthetics (layering, clustering, unity)
- Value for wildlife

PLANTING DESIGN: Native Plants

NATIVE PLANTS:

- Provide habitat areas
- Adapted to local conditions (soil, temperature, weather)
- Attract other natives (migratory birds, beneficial insects and butterflies)
- Reduce the need for irrigation
- Reduce the need for maintenance
- Reduce the use of fertilizer
- Reduce the use of pesticides
- Absorb water more efficiently than turf-style grasses



PLANTING DESIGN: Mature Size of Plants

At time of installation

Springfield Township Municipal Annex Building
Springfield, NJ

First growing season

Second growing season

Third growing season

Fourth growing season

RUTGERS
New Jersey Agricultural
Experiment Station

Questions?

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