

# ***Rain Gardens for Your Jersey-Friendly Yard***

***Changing Climate, Changing Yards  
Ocean County College***

***September 30, 2023***

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# 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.*

[www.water.rutgers.edu](http://www.water.rutgers.edu)

# What happens to the rain in our watersheds?



It runs off of rooftops and pavement...

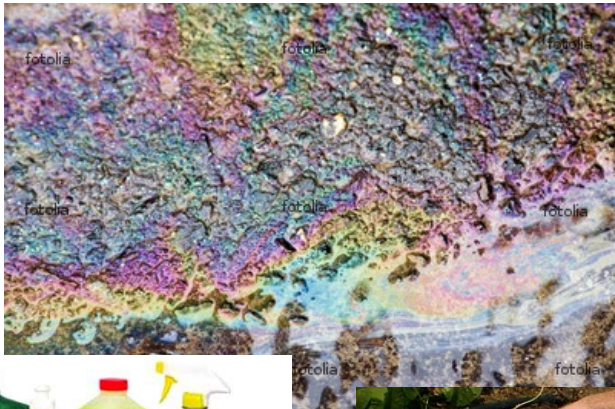
# What is stormwater?

Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.

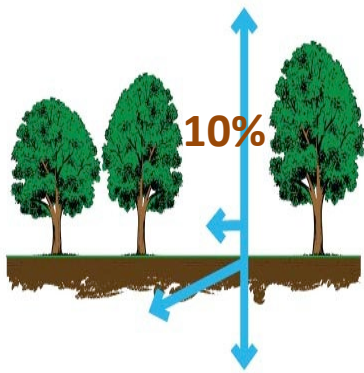


# Examples of Nonpoint Source Pollution

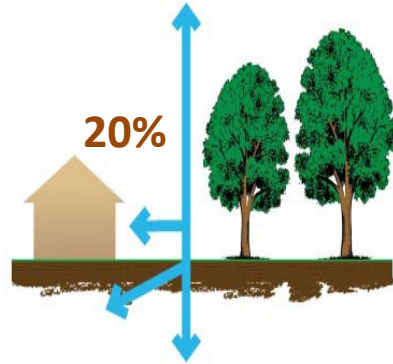
- Oil and grease from cars
- Fertilizers
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment



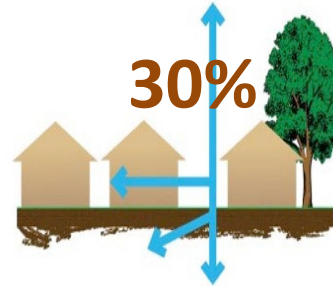
# The Impact of Development on Stormwater Runoff



*more development*



→ *More impervious surfaces*



→ *more stormwater runoff*

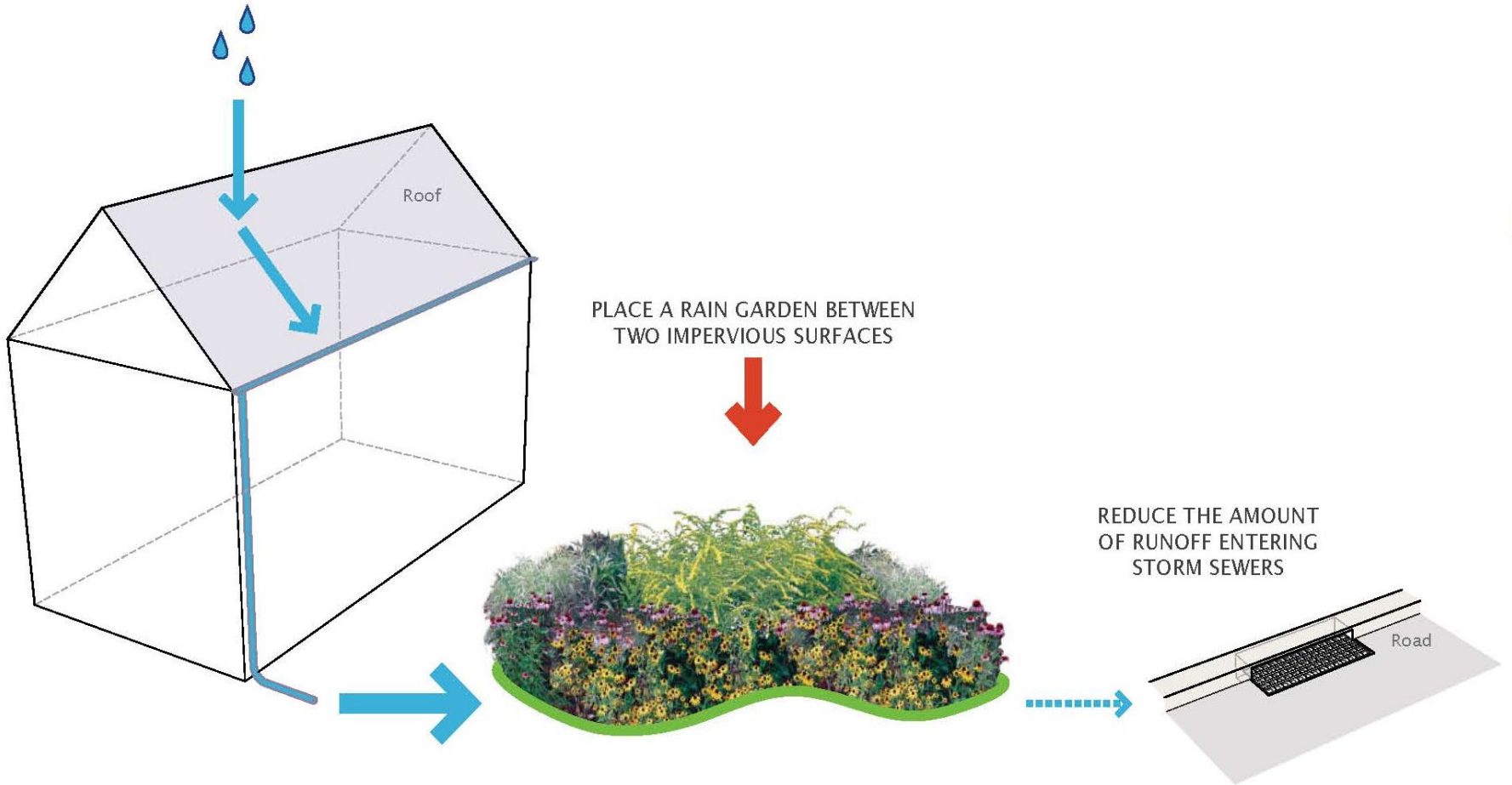


# Connected or Disconnected?





# The Solution...



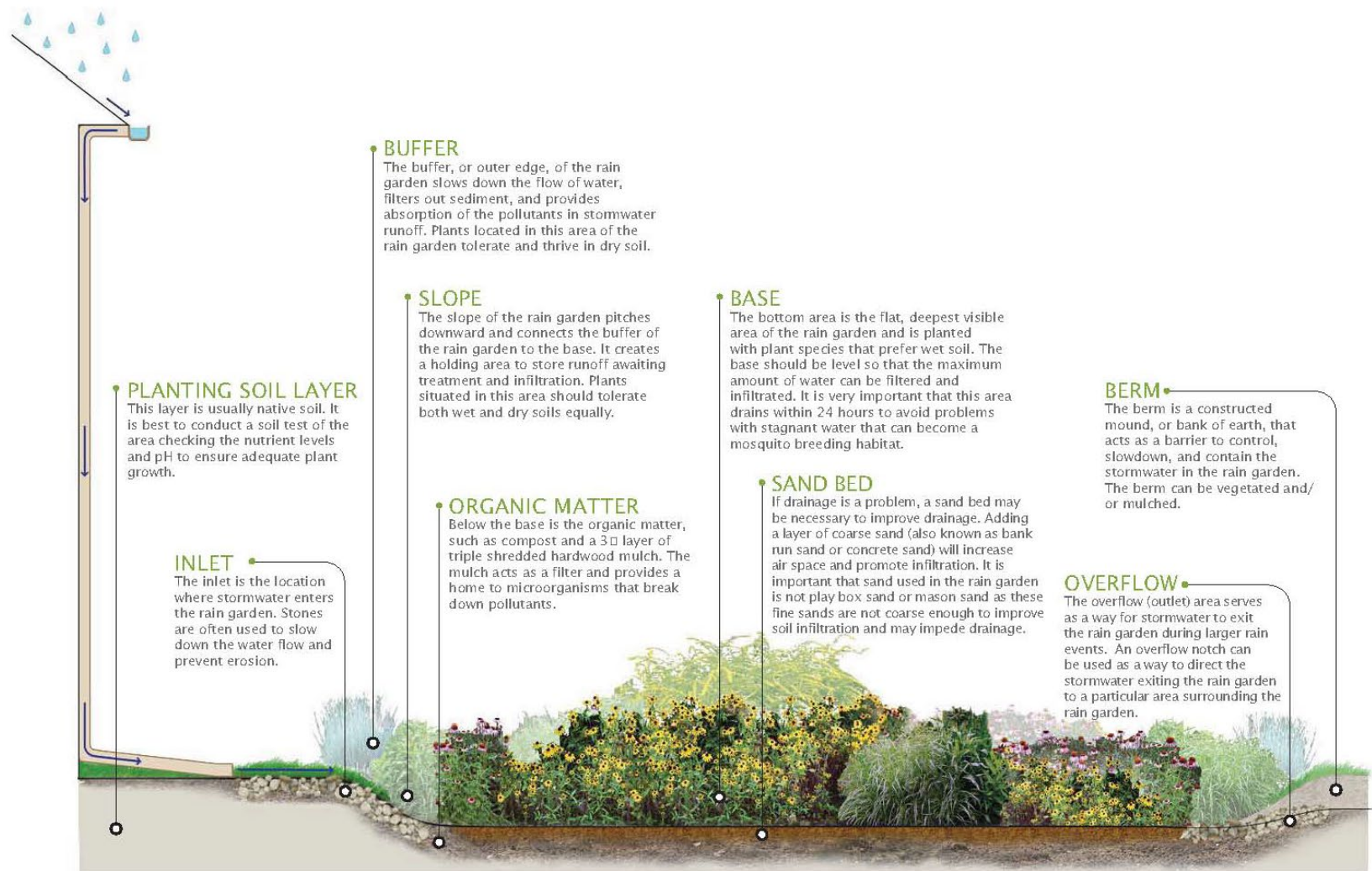
# Rain Gardens

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.





# PARTS OF A RAIN GARDEN



### PLANTING SOIL LAYER

This layer is usually native soil. It is best to conduct a soil test of the area checking the nutrient levels and pH to ensure adequate plant growth.

### INLET

The inlet is the location where stormwater enters the rain garden. Stones are often used to slow down the water flow and prevent erosion.

### BUFFER

The buffer, or outer edge, of the rain garden slows down the flow of water, filters out sediment, and provides absorption of the pollutants in stormwater runoff. Plants located in this area of the rain garden tolerate and thrive in dry soil.

### SLOPE

The slope of the rain garden pitches downward and connects the buffer of the rain garden to the base. It creates a holding area to store runoff awaiting treatment and infiltration. Plants situated in this area should tolerate both wet and dry soils equally.

### ORGANIC MATTER

Below the base is the organic matter, such as compost and a 3" layer of triple shredded hardwood mulch. The mulch acts as a filter and provides a home to microorganisms that break down pollutants.

### BASE

The bottom area is the flat, deepest visible area of the rain garden and is planted with plant species that prefer wet soil. The base should be level so that the maximum amount of water can be filtered and infiltrated. It is very important that this area drains within 24 hours to avoid problems with stagnant water that can become a mosquito breeding habitat.

### SAND BED

If drainage is a problem, a sand bed may be necessary to improve drainage. Adding a layer of coarse sand (also known as bank run sand or concrete sand) will increase air space and promote infiltration. It is important that sand used in the rain garden is not play box sand or mason sand as these fine sands are not coarse enough to improve soil infiltration and may impede drainage.

### BERM

The berm is a constructed mound, or bank of earth, that acts as a barrier to control, slowdown, and contain the stormwater in the rain garden. The berm can be vegetated and/or mulched.

### OVERFLOW

The overflow (outlet) area serves as a way for stormwater to exit the rain garden during larger rain events. An overflow notch can be used as a way to direct the stormwater exiting the rain garden to a particular area surrounding the rain garden.



SITE SELECTION & DESIGN

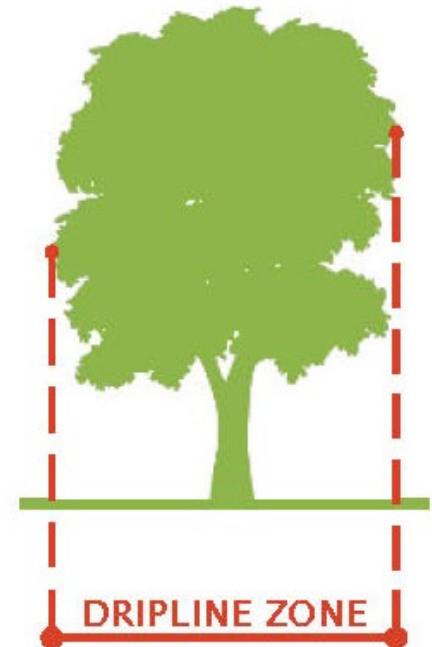
# PLANNING YOUR RAIN GARDEN





# SITE SELECTION

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







# CALL BEFORE YOU DIG

## LOCATE YOUR UTILITY LINES!

*Call BEFORE You Dig!*

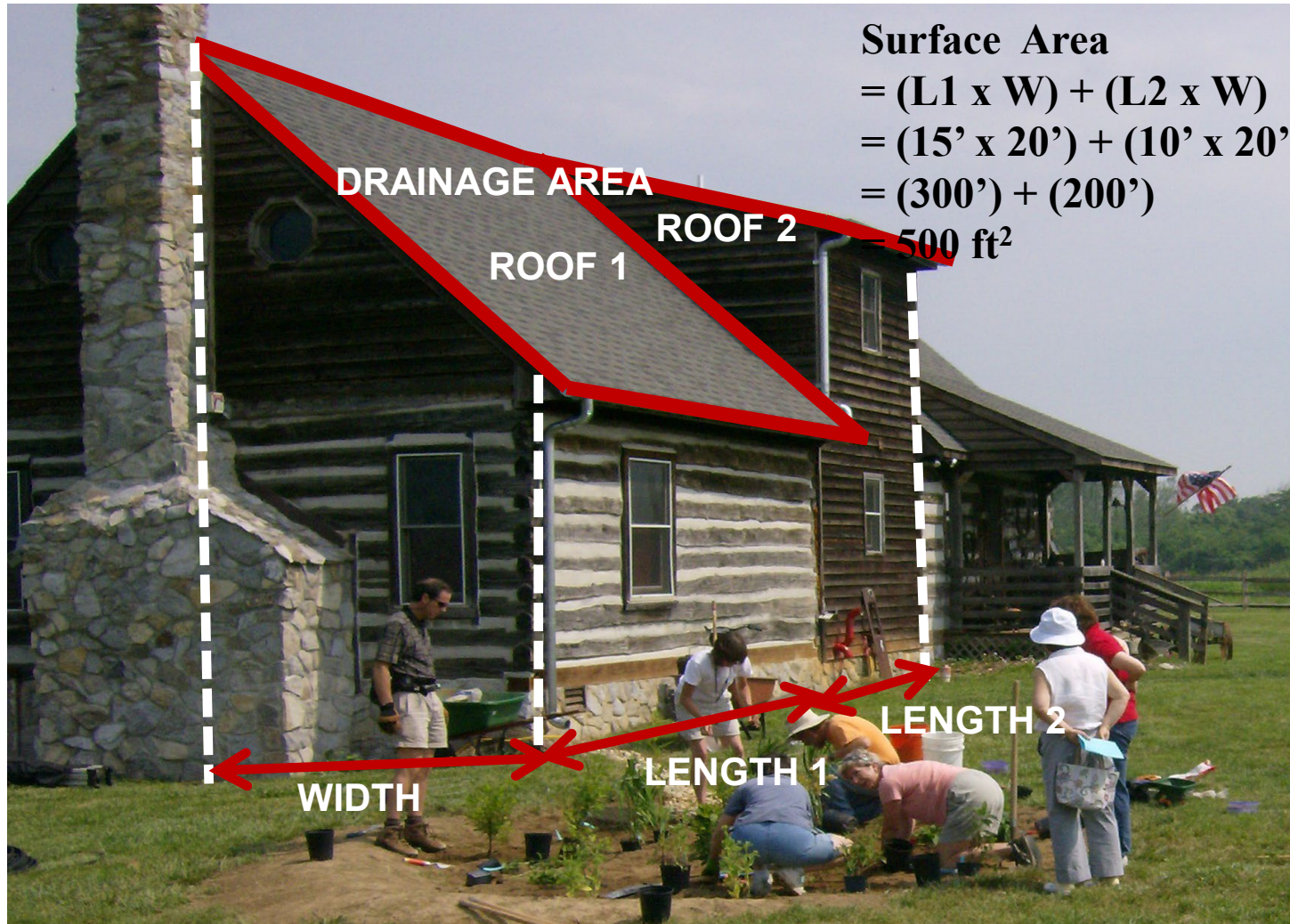
*NJ One Call  
1-800-272-1000*

*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**

$$= (L1 \times W) + (L2 \times W)$$

$$= (15' \times 20') + (10' \times 20')$$

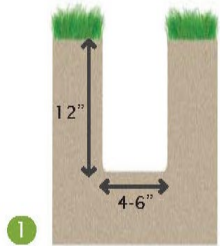
$$= (300') + (200')$$

$$= 500 \text{ ft}^2$$

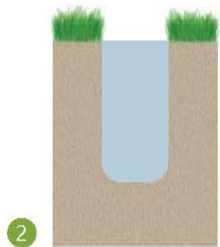




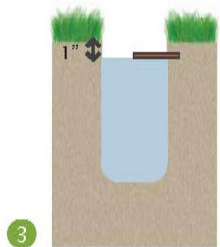
# CHECK YOUR SOIL



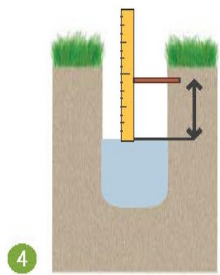
1



2



3



4

- 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



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



- 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 <sup>2</sup>	200 ft <sup>2</sup>	100 ft <sup>2</sup>	75 ft <sup>2</sup>
750 ft <sup>2</sup>	350 ft <sup>2</sup>	150 ft <sup>2</sup>	112 ft <sup>2</sup>
1,000 ft <sup>2</sup>	400 ft <sup>2</sup>	200 ft <sup>2</sup>	149 ft <sup>2</sup>
1,500 ft <sup>2</sup>	600 ft <sup>2</sup>	300 ft <sup>2</sup>	224 ft <sup>2</sup>
2,000 ft <sup>2</sup>	800 ft <sup>2</sup>	400 ft <sup>2</sup>	299 ft <sup>2</sup>

\*SOIL TEXTURE AMENDMENTS NEEDED

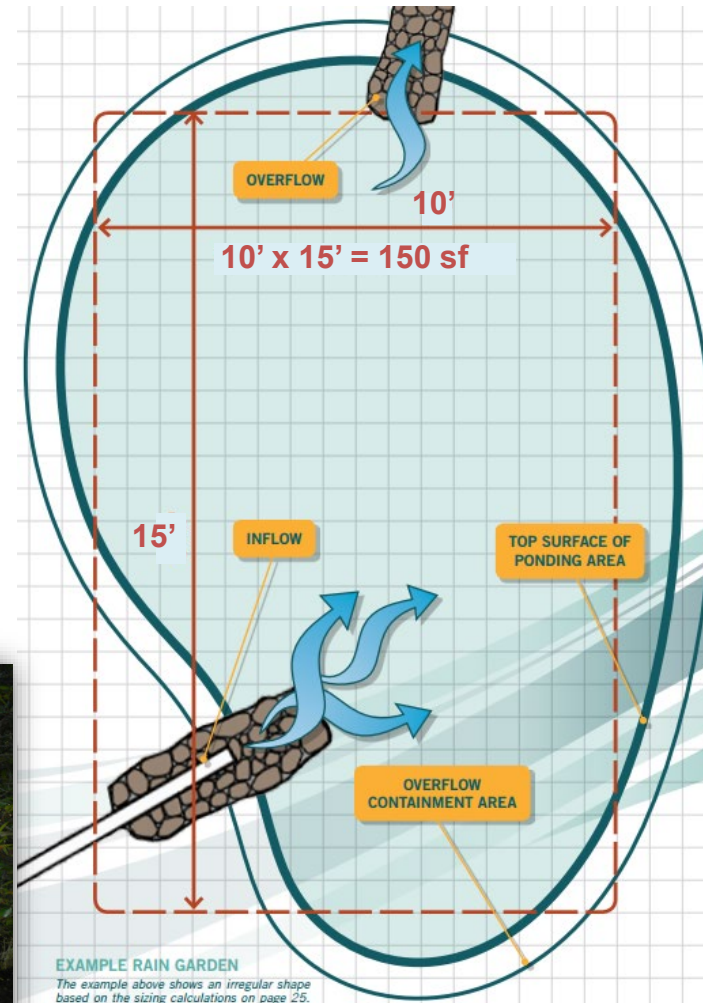
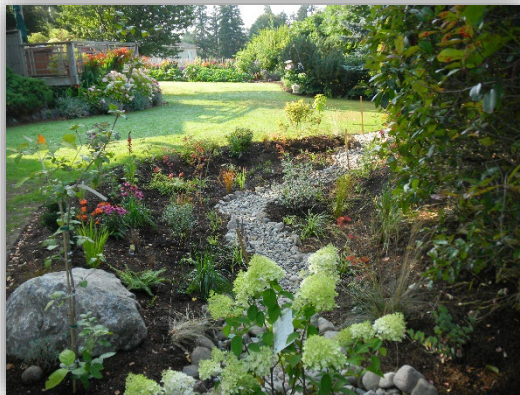
# RAIN GARDENS

## Typical Size

Modified from Rain Garden Handbook for Western WA

What is a typical rain garden size?

- Typically 100-200 square feet.
- A 100 square foot rain garden will often receive water from an area 5 to 10 times larger than the rain garden..





# SOIL AMENDMENTS

- Soil amendments improve the rain garden's infiltration rate and help the plants grow





# DETERMINING THE INLET AND OVERFLOW

- 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 (River Stone)



# 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)





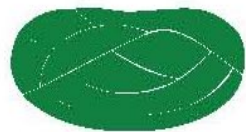
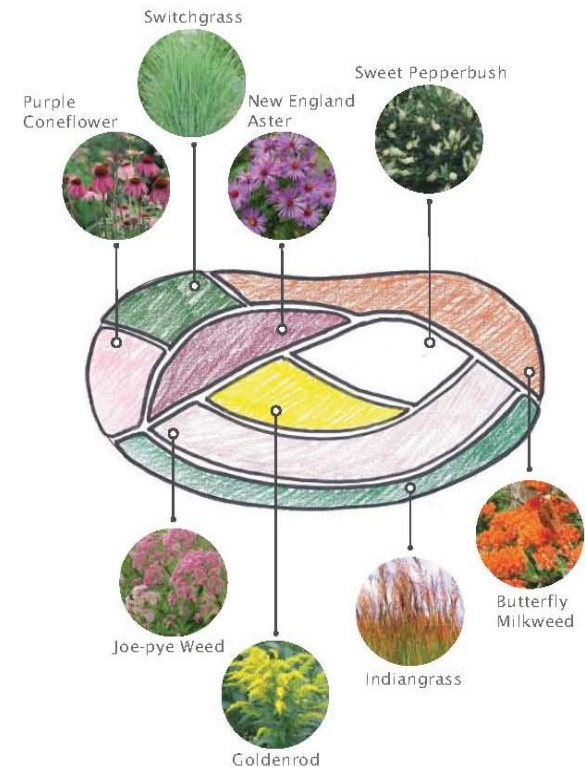


# RAIN GARDEN DESIGN

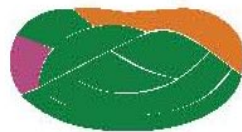
## SHAPING YOUR RAIN GARDEN

- 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

Butterfly Habitat Rain Garden: Planting Plan



May



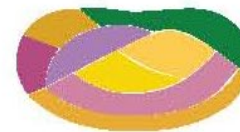
June



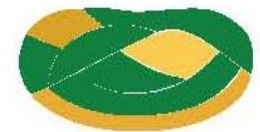
July



August



September



October



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

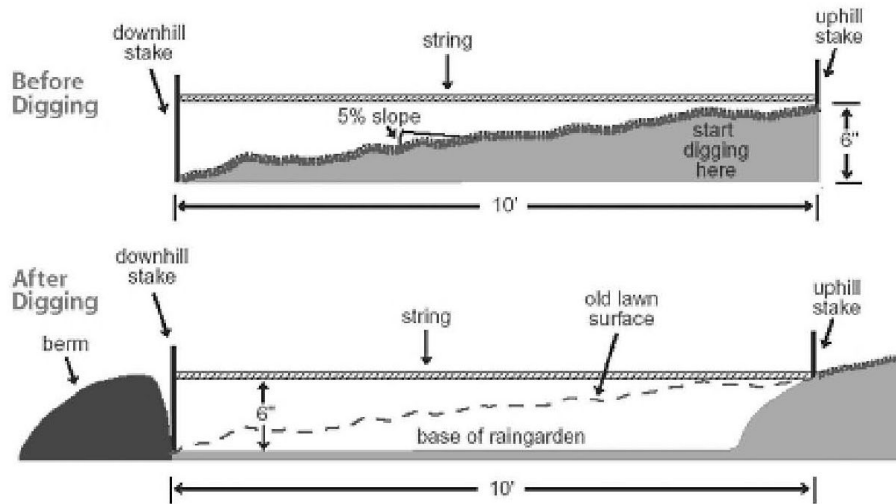
- Add soil amendments, if necessary



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

# STEP FOUR

- Prepare the berm, if necessary



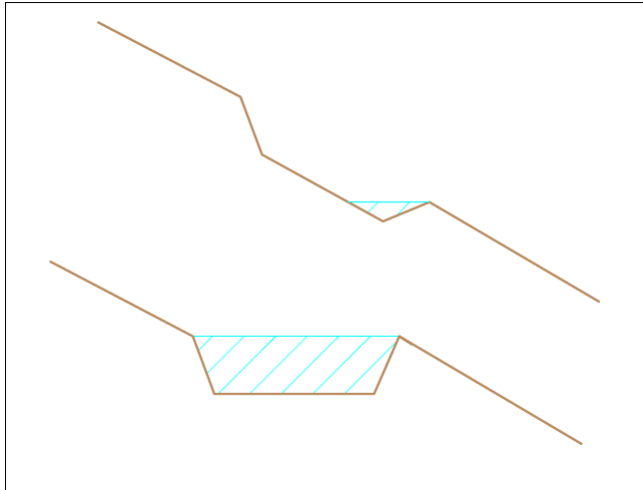
# STEP FIVE

- 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





**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](http://www.water.rutgers.edu)

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

# RAIN GARDEN PLANTING DESIGN



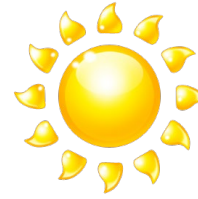
# DESIGN AESTHETICS

- 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...

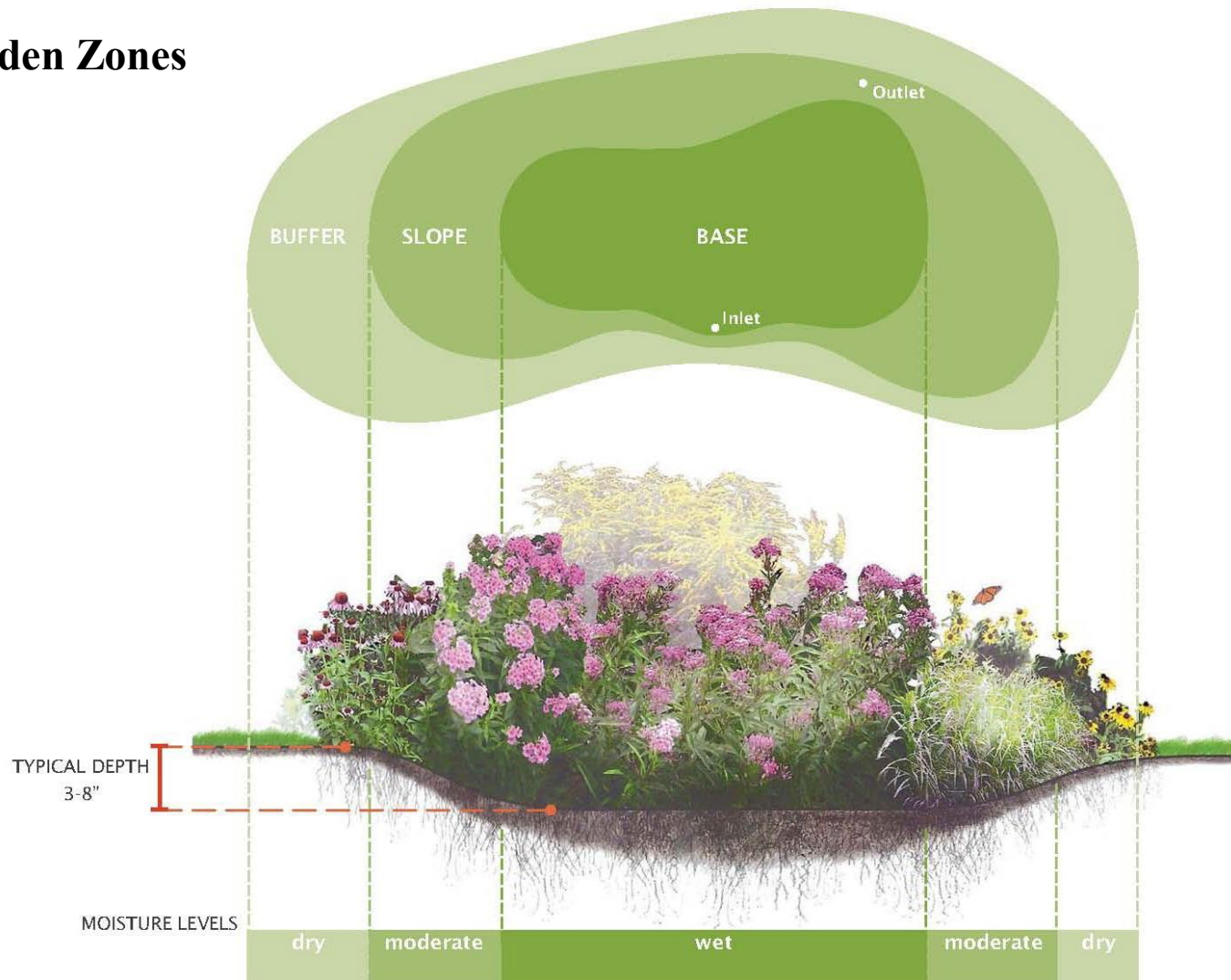


*Courtesy of Pinelands Nursery & Supply*



# 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

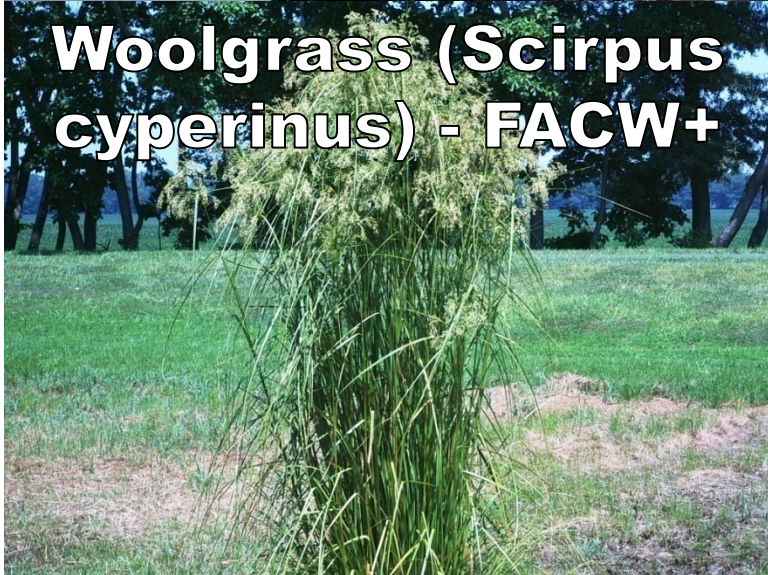
**Switchgrass**  
**(*Panicum virgatum*) - FAC**



**Tussock Sedge**  
**(*Carex stricta*) - OBL**



**Woolgrass (*Scirpus cyperinus*) - FACW+**



**Little Bluestem**  
**(*Schizachyrium scoparium*) - FACU**



# 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



# WILDFLOWERS



# 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



**Summersweet  
(*Clethra alnifolia*) - FAC+**



**Winterberry Holly  
(*Ilex verticillata*) - FACW+**



**River Birch  
(*Betula nigra*) - FACW**



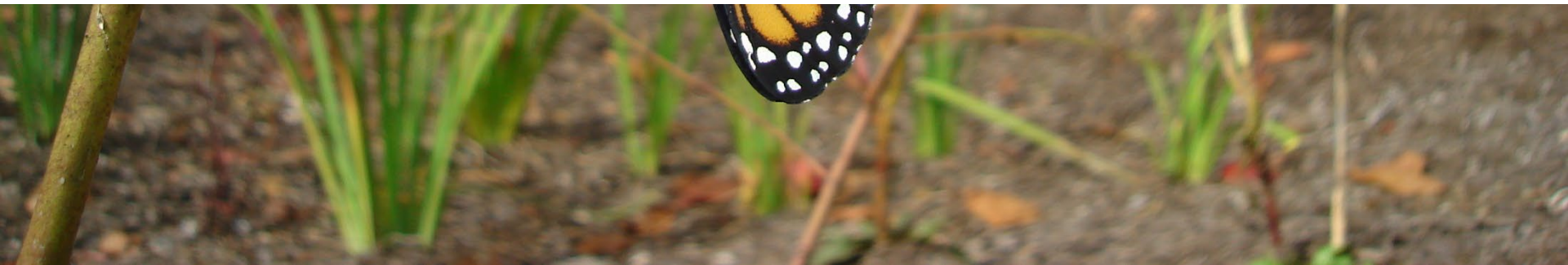
**Inkberry Holly  
(*Ilex glabra*) - FACW-**





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)

# Climate Change in New Jersey

- More warm extremes and fewer cold extremes
- Heavy rains become more intense
- More intense dry spells
- Rising sea level with increased frequency and intensity of coastal flooding



# NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

## Rainfall Amounts in Inches

County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

### Future Adjusted (per NJDEP Factors 2023)

County	2-YR	10-YR	100-YR
Atlantic	4.04	6.40	12.37
Bergen	4.01	6.24	11.60
Burlington	3.93	6.11	11.63
Camden	3.91	6.17	11.84
Cape May	3.93	6.29	11.52
Cumberland	3.92	6.16	12.18
Essex	4.09	6.37	11.52
Gloucester	3.92	6.21	12.06
Hudson	3.94	5.97	10.22
Hunterdon	4.02	6.15	11.40
Mercer	3.84	5.86	11.33
Middlesex	3.99	6.20	11.48
Monmouth	4.02	6.22	11.26
Morris	4.35	6.71	12.19
Ocean	4.04	6.34	11.41
Passaic	4.20	6.64	12.93
Salem	3.91	6.15	11.15
Somerset	3.97	6.21	12.15
Sussex	3.99	6.06	11.37
Union	4.07	6.36	11.73
Warren	4.01	6.11	10.71

# DETERMINING THE SIZE OF THE RAIN GARDEN FOR CLIMATE CHANGE

## Rain Garden Sizing Table

Based on New Jersey's Water Quality Design Storm (1.5" of rain over 2 hours)

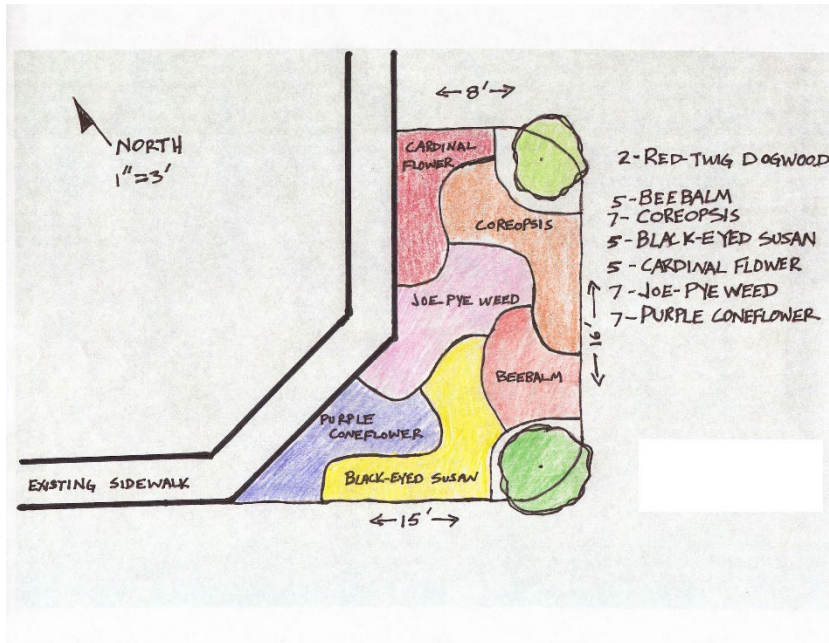
Drainage Area	Size of 3" Deep Rain Garden CLAY SOIL*	Size of 6" Deep Rain Garden SILTY SOIL	Size of 8" Deep Rain Garden SANDY SOIL
500 ft <sup>2</sup>	250 ft <sup>2</sup>	125 ft <sup>2</sup>	94 ft <sup>2</sup>
750 ft <sup>2</sup>	438 ft <sup>2</sup>	188 ft <sup>2</sup>	140 ft <sup>2</sup>
1,000 ft <sup>2</sup>	500 ft <sup>2</sup>	250 ft <sup>2</sup>	186 ft <sup>2</sup>
1,500 ft <sup>2</sup>	750 ft <sup>2</sup>	375 ft <sup>2</sup>	280 ft <sup>2</sup>
2,000 ft <sup>2</sup>	1000 ft <sup>2</sup>	500 ft <sup>2</sup>	374 ft <sup>2</sup>

\*SOIL TEXTURE  
AMENDMENTS NEEDED

# Installed Rain Gardens from the Rain Garden Rebate Program

# Design Example for Roof Runoff

## Design



## Installed Rain Garden

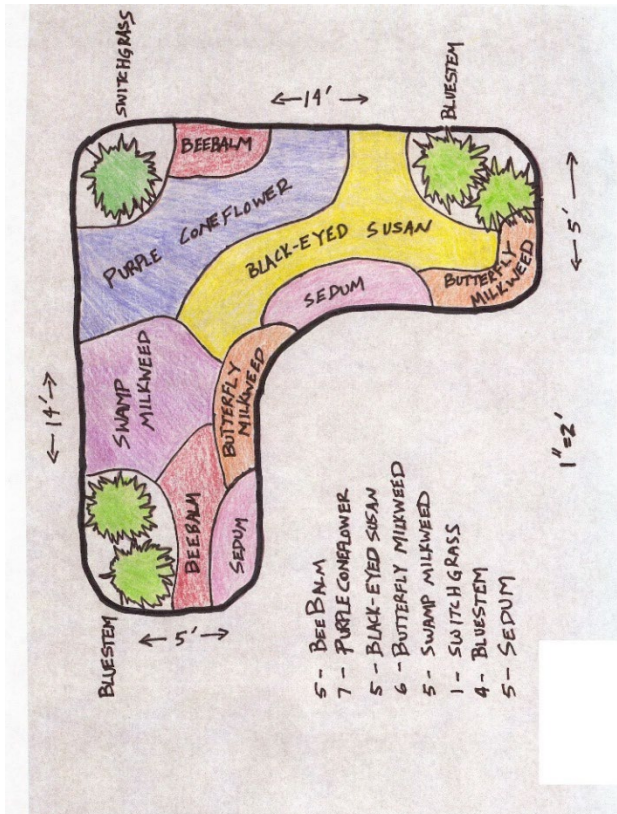






# Design Example for Parking Lot Runoff

## Design



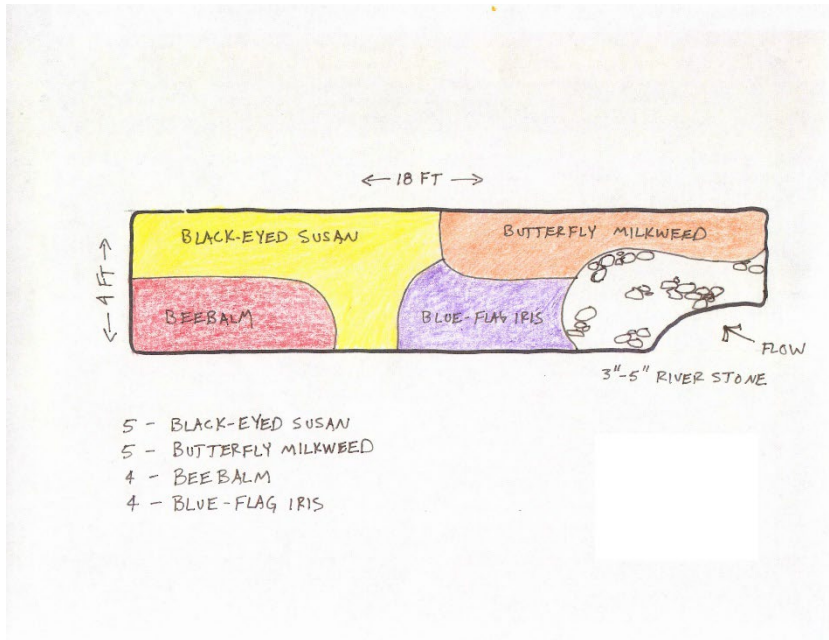
## Installed Rain Garden



# Roof, Sump Pump and Driveway Runoff – WOW!

## Design

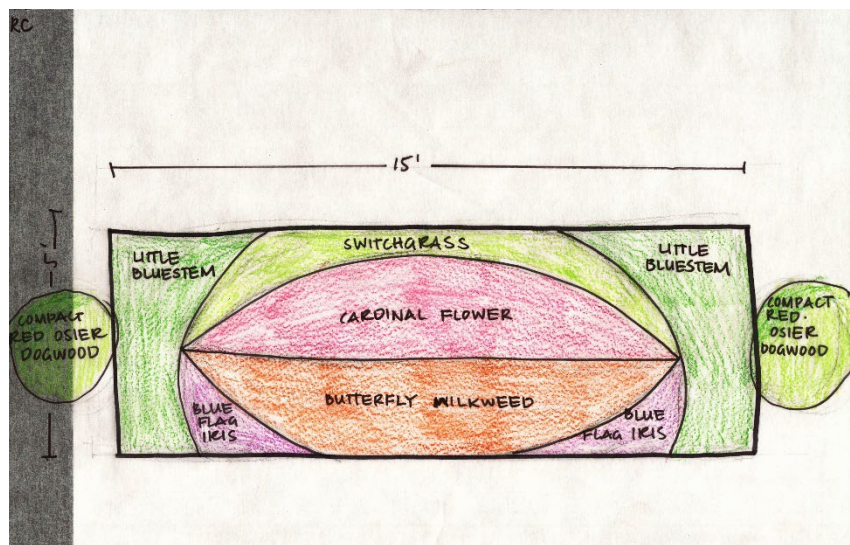
## Installed Rain Garden





# Roof Runoff from Rain Barrel Overflow

## Design

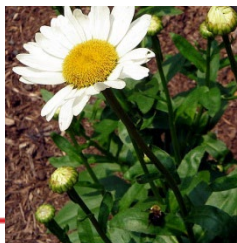


## Installed Rain Garden





# Lots of Rain Gardens









**Rain Garden**  
This garden is designed to capture and filter rainwater from the roof and driveway, reducing runoff and preventing erosion. It is a great way to conserve water and improve the health of the surrounding landscape.





116





10/12/2018



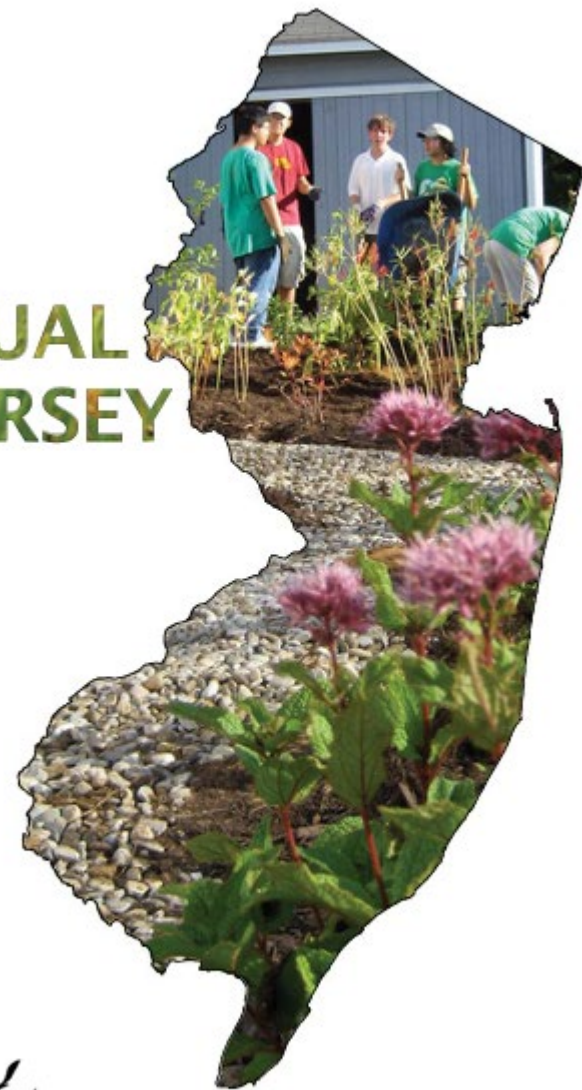
10/12/2015

## Season 2



10/12/2018

# RAIN GARDEN MANUAL OF NEW JERSEY







# Rain Garden 4+

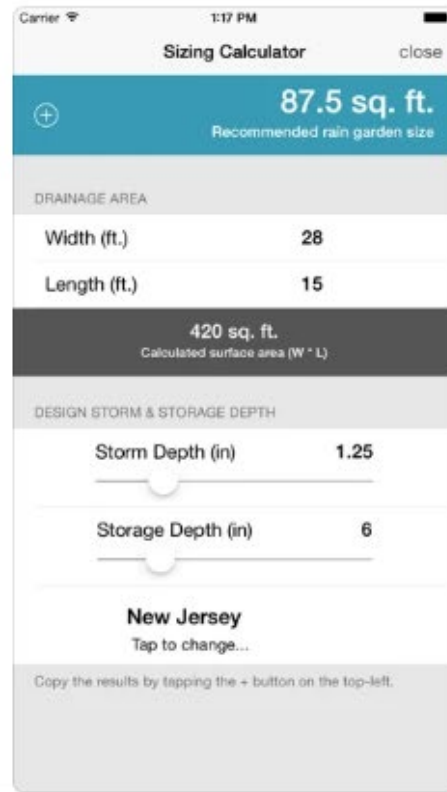
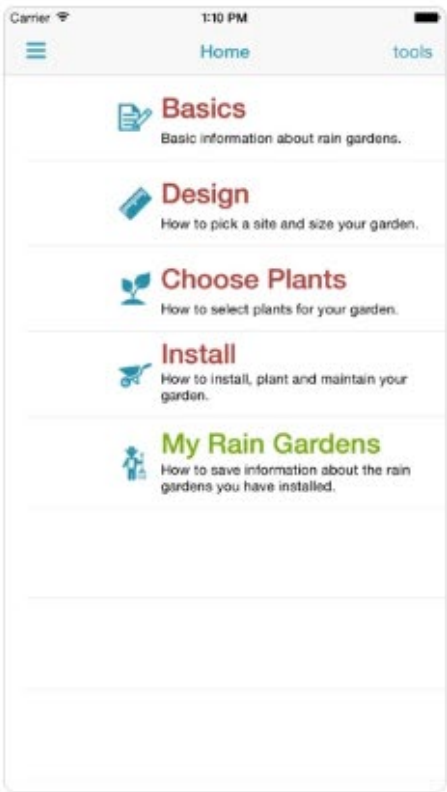
University of Connecticut

Designed for iPhone

★★★★☆ 2.6 • 11 Ratings

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## iPhone Screenshots



# ***THANK YOU!***

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