

Rain Garden Design for Home Owners an Alabama Smart Yards Program

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What is a Rain Garden?

- The book “Rain Gardening in the South” says, “Rain gardens are ecologically designed gardens for drought, deluge and everything in between”

Helen Kraus & Annie Spafford (authors)



Small Rain Garden

First and foremost it's a garden!



all gardens need planning and care

Specifically a rain garden

- is often designed to catch the **first inch** of rain water from a given area
- its design usually includes amended soils and plants to help increase infiltration
- and its infiltration helps treat pollutants and potential pathogens



They are more than pretty gardens

- They are miniature bio-retention areas



Photo courtesy NCSU BAE

How do they help?

- They trap non-point source pollution
- They slow down the flow of storm water
- They reduce the harmful deposits into streams and other surface waters



Rain gardens are More ...

- They protect nearby streams and lakes
- The soil micro-organisms trap & degrade pollutants
 - Excess garden chemicals
 - Bacteria – pet waste
 - Petroleum products
 - Nutrient runoff – especially phosphorus

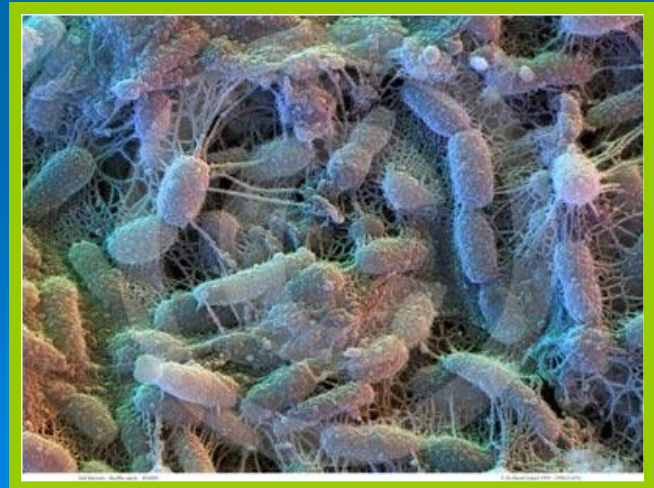


Alabama
Clean Water
Partnership



Cleansers & Filters

- Soil chemistry
 - Beneficial soil bacteria
 - Chemical forces of plant roots
- These trap and breakdown possible pollutants
- Some harmful organisms die from desiccation when the garden dries out



Things to avoid....



Ponding



Low spots that naturally stand in water for days after large rains are not good sites for rain gardens

Because of



Anopholes sp.

To avoid mosquitoes remember!

48 hours

Desired time to drain the
rain garden of standing
water

4 - 10 days

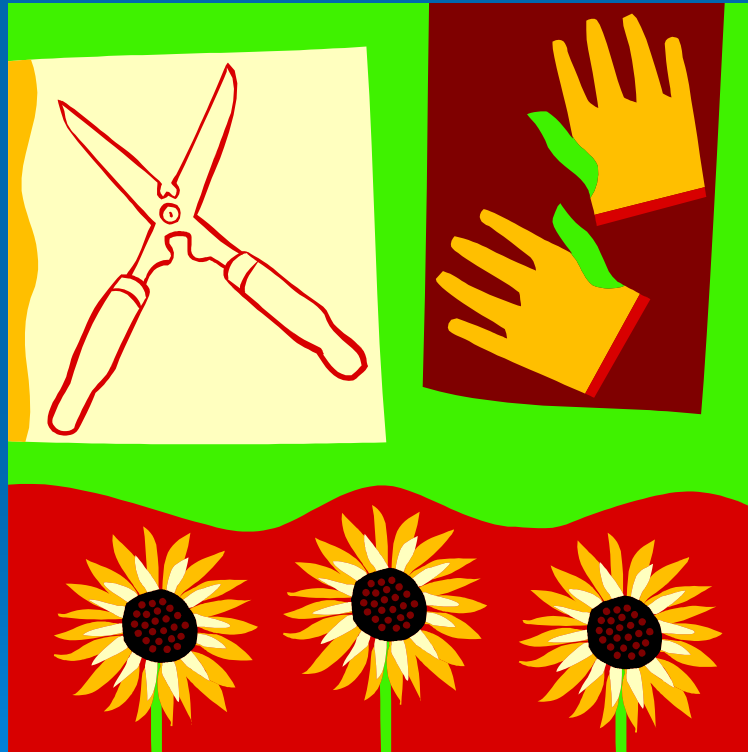
Days needed for
mosquito development
from egg to adult



General guidelines to consider



Where do you place a rain garden?



Where you catch the desired runoff and can maximize infiltration

Rain gardens
should ideally be
placed in full or
intermediate
sunlight to
facilitate drying but
shade is possible if
relatively well
drained



Ideally place at least 10 feet from any building foundation



Rain gardens should **NOT** be placed
over septic tanks or field lines



Areas where water puddles long enough to form small ponds are not ideal for rain gardens but possibly could be a created wetland



Choose a relatively flat section of your yard that has well-drained soil.

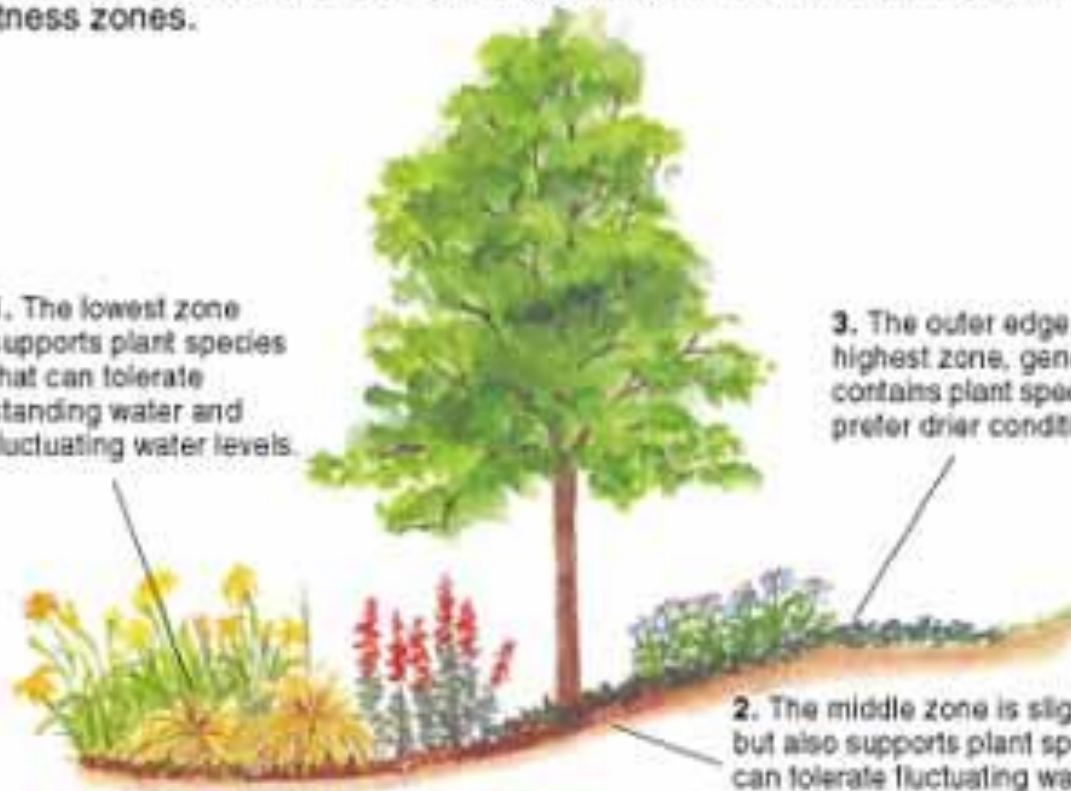


They may be large enough to incorporate trees and other woody plants

How to plan a Rain Garden

Your Rain Garden is composed of woody plants (trees and shrubs) and herbaceous species (flowers, grasses and ground covers) planted in three wetness zones.

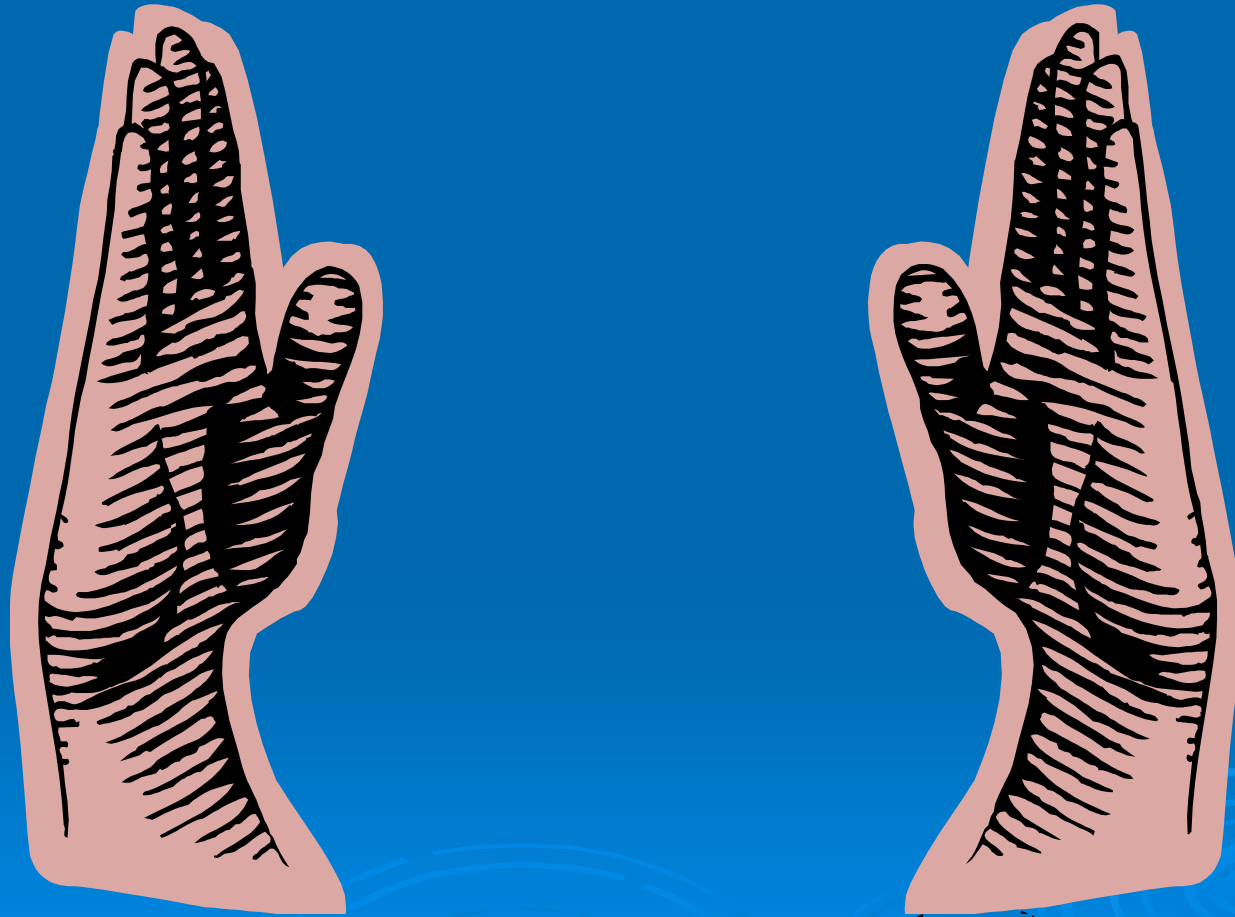
1. The lowest zone supports plant species that can tolerate standing water and fluctuating water levels.



3. The outer edge, or highest zone, generally contains plant species that prefer drier conditions.

2. The middle zone is slightly drier but also supports plant species that can tolerate fluctuating water levels.

But what size should it be?



Two rules: 1. Obey all rules 2. There are no rules

- Rain gardens can be any size and any shape



Deciding a Shape

- It should fit into the landscape
- Should be large enough to catch first inch of rain of a given area
- Paved areas may dictate shape



Orient the garden so that runoff hits the 'long' side of the garden first



Three Factors in Sizing

- Size of drainage area
 - Pavement
 - Roof
 - Lawn, etc
- Native soil characteristics
 - Clay
 - Sand
 - Loam
- Garden depression based on slope
 - Depth at center



Determining the drainage area

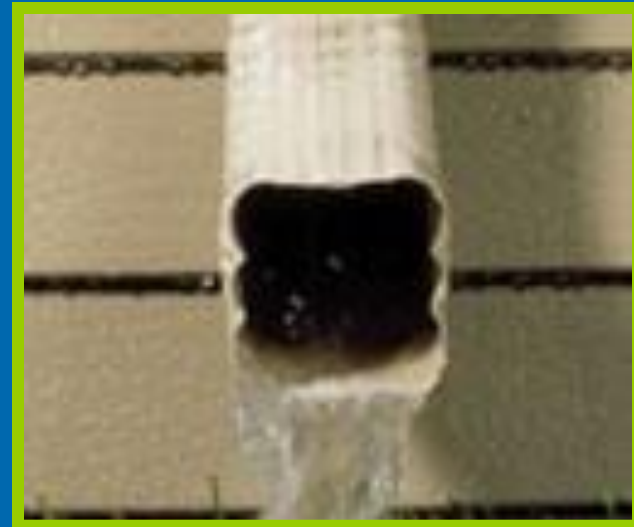
- Estimate how much water your rain garden will receive
- A one inch rain will produce .62 gallons of water per square foot of impervious surface



2000 sq/ft roof = 1240 gallons per inch of rain

Determine Drainage Area

- Survey the area
- Determine what areas might drain into the rain garden



Determine the Drainage Area

Example:

- Your roof is 60 ft by 40 ft – or 2400 ft²
(A downspout drains about $\frac{1}{4}$ of the roof)
- **2400 x $\frac{1}{4}$ = 600 ft² garden x .62 = 374 gal**
- This means 1” of rain generates approximately 374 gallons of water at one downspout

Choose a runoff capture depth and a rain garden ponding depth.

runoff capture depth:

the amount of rainfall that you want the rain garden to treat; usually 1 inch for Alabama



rain garden ponding depth:
the depth to which water will pond in the rain garden before overflowing; usually 3 to 6 inches



Determine the size of the rain garden.

For a **3-inch** ponding depth:

$$\text{rain garden size} = \frac{\text{total impervious area}}{10}$$

For a **6-inch** ponding depth:

$$\text{rain garden size} = \frac{\text{total impervious area}}{20}$$

OR... for impervious very large areas :

<http://www.bae.ncsu.edu/topic/raingarden/sizing.htm>

Impermeable Surface Area	Required Size of Rain Garden	Potential Rain Garden Dimensions	Required Size of Rain Garden	Potential Rain Garden Dimensions
	6" Ponding Depth	(ftXft)	3" Ponding Depth	(ftXft)
800 ft ²	40 ft ²	4X10, 5X8, 6X7	80 ft ²	7X12, 8X10, 9X9
1000 ft ²	50 ft ²	5X10, 6X8	100 ft ²	7x15, 10X10
1200 ft ²	60 ft ²	4X15, 5X12, 6X10, 8X8	120 ft ²	10X12, 8X15
1400 ft ²	70 ft ²	5X14, 7X10	140 ft ²	10X14, 7X20
1600 ft ²	80 ft ²	7X12, 8X10, 9X9	160 ft ²	8X20, 10X16
1800 ft ²	90 ft ²	6X15, 7X13, 8X12, 9X10	180 ft ²	9X20, 10X18, 12X15
2000 ft ²	100 ft ²	7x15, 10X10	200 ft ²	10X20, 14X15
2500 ft ²	125 ft ²	8X16, 10X13	250 ft ²	10X25, 13X20, 15X17
3000 ft ²	150 ft ²	10X15, 12X13	300 ft ²	10X30, 15X20
3500 ft ²	175 ft ²	9X20, 12X15	350 ft ²	14X25, 18X20
4000 ft ²	200 ft ²	10X20, 14X15	400 ft ²	16X25, 20X20
5000 ft ²	250 ft ²	10X25, 13X20, 15X17	500 ft ²	20X25

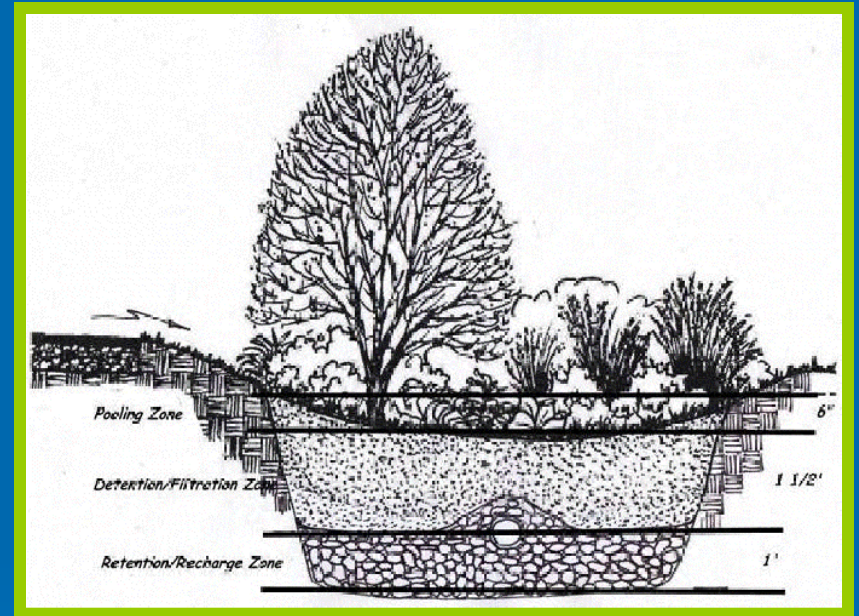


Impermeable Surface Area

- 800 ft²
- 1000 ft²
- 1200 ft²
- 1400 ft²
- 1600 ft²
- 1800 ft²
- 2000 ft²
- 2500 ft²
- 3000 ft²
- 3500 ft²
- 4000 ft²
- 5000 ft²

Impermeable Surface Area	Required Size of Rain Garden	Potential Rain Garden Dimensions
	6" Ponding Depth	(ftXft)
800 ft ²	40 ft ²	4X10, 5X8, 6X7
1000 ft ²	50 ft ²	5X10, 6X8
1200 ft ²	60 ft ²	4X15, 5X12, 6X10, 8X8
1400 ft ²	70 ft ²	5X14, 7X10
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Building a Catchment Basin?

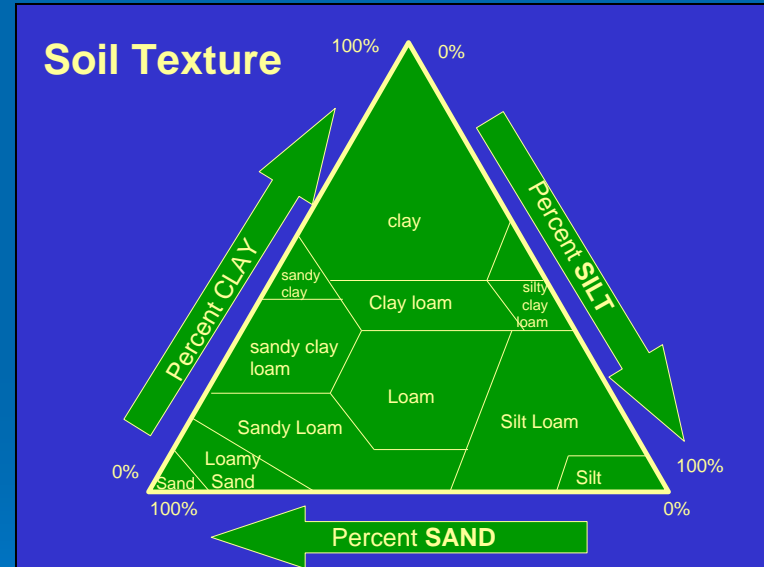


- Deeper reservoir requires less surface size – smaller footprint

Determining the Soil Type

➤ Three general soil types:

- Sandy – large particles
- Silt – intermediate sized
- Clay – small particles



Test Infiltration of the Soil by...

- Digging a hole 12" deep and 6" wide (post hole digger)
- Fill the hole with water 2 or 3 times to thoroughly saturate the soil
- Fill the hole with water again and wait



How Long Does it Take to Drain?

- **Rapid percolation (Sandy):** Water drains out of the hole within an hour
- **Moderate percolation (Loamy):** Water drains out of the hole within 8 hours
- **Slow percolation (Clayey):** Water does not completely drain within 24 hours
- **Soils** that don't perk well won't work well unless excavated deeply and soil totally replaced

Garden Depth

- Most rain gardens are dug in a bowl shape
- Depth of the rain garden depends on the slope of the surrounding area



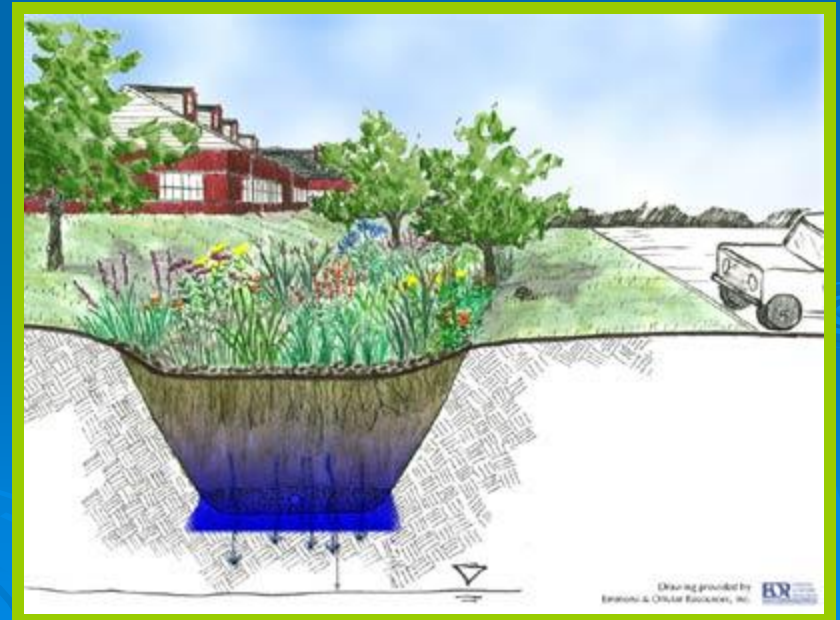
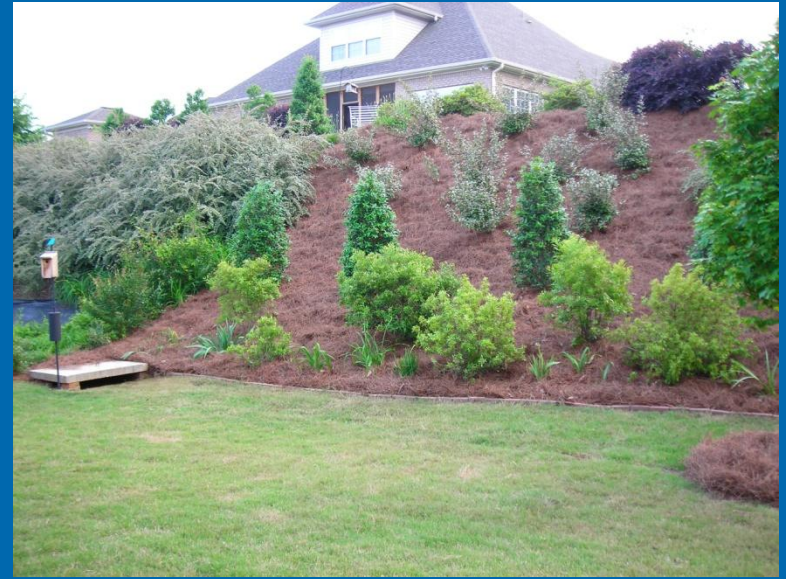
Garden Depth

- If the surrounding area is perfectly flat
- The garden only needs to be 3-4 inches deep



Garden Depth

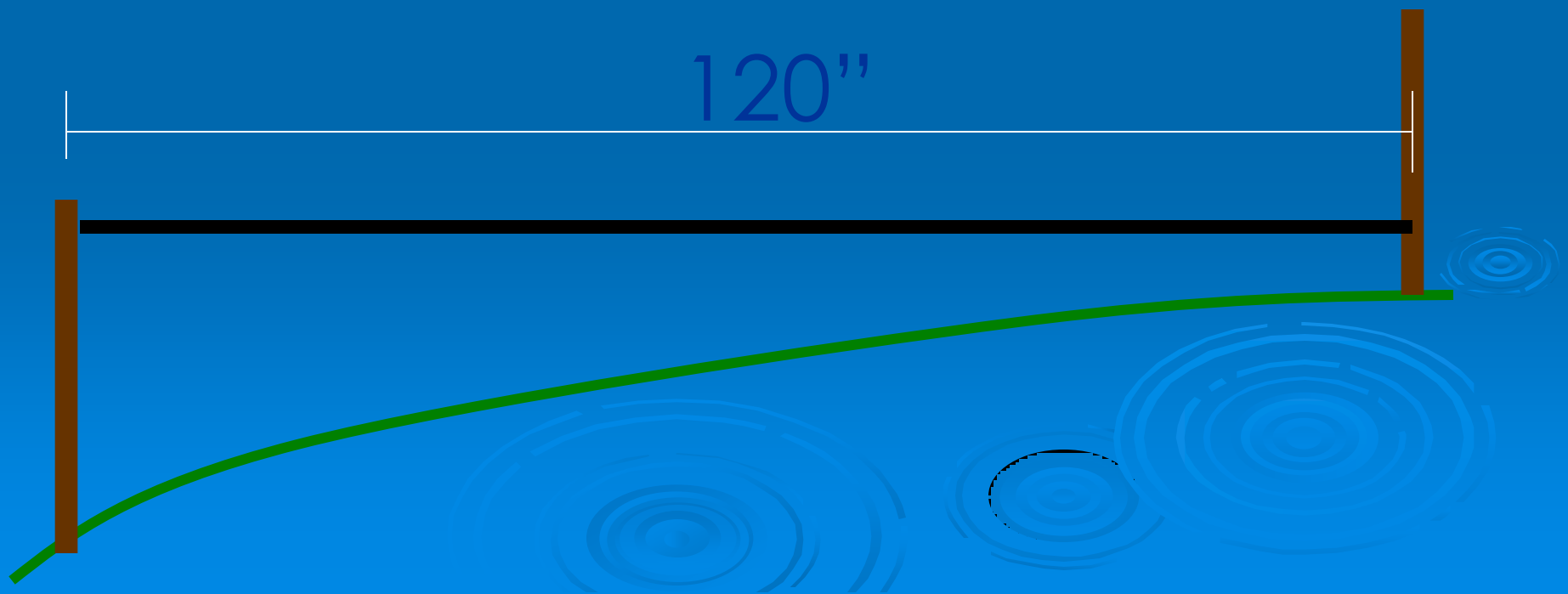
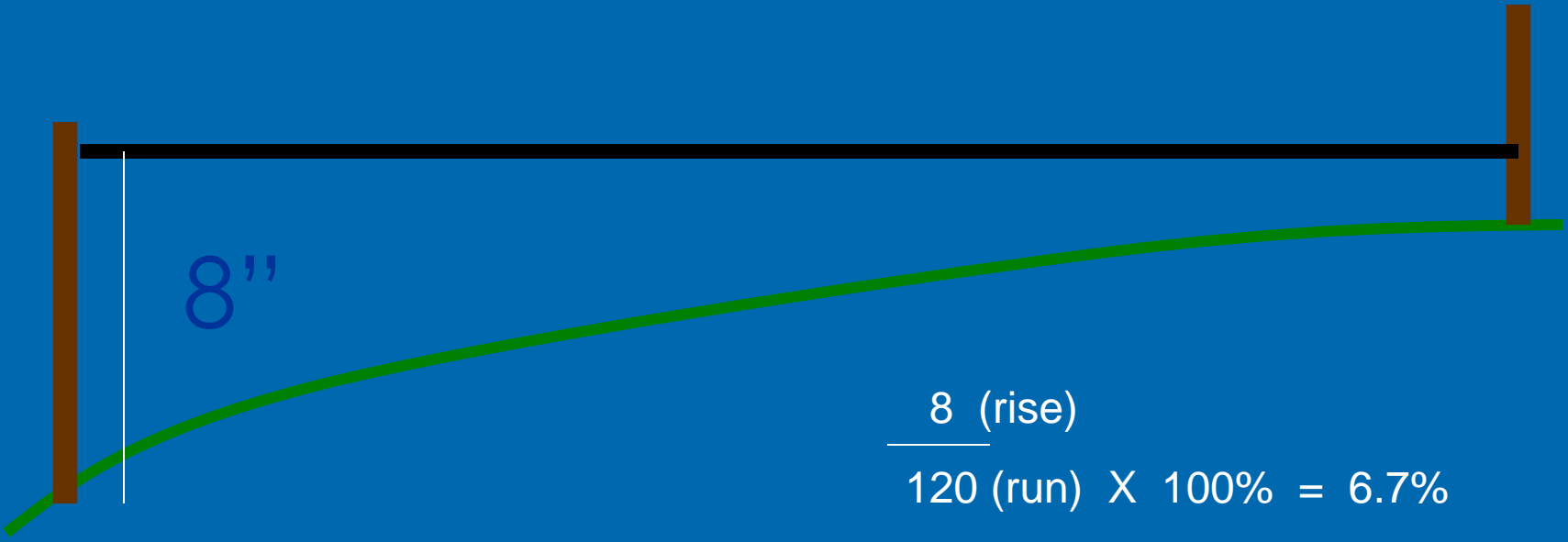
- However, most areas are not perfectly flat
- Center depression should be no deeper than 8"
- Greater slope needs greater depression



Determining the Slope

- Pound 2 stakes into the ground about 15 feet apart
- Tie a string between the 2 stakes and level it
- Measure the distance between the 2 stakes
- Then measure the height of the string on the downhill stake
- **Divide the height by the distance and multiply by 100**

(rise over run)



Suggested Garden Depth

Slope	Depression Depth
◀4%	3 – 5 inches
5 – 7%	6 – 7 inches
8 – 12%	8 inches
▶12%	unacceptable

Greater than 12% slope would require professional design to insure adequate capacity

Construction & Installation



Construction

- Dig the hole deeper if augmentation is necessary
(note: depth depends on type soil surrounding the rain garden)
- Sand – 12” (depth from rim to bottom)
- Clay – 24-36” (building a catchment area)
(heavy clay soil should be replaced or heavily amended – adding a little sand to heavy clay does not help)

Ideal Soil Mix

- 50-60% sand
- 20-30% topsoil
- 20-30% compost
- clay content <10%

In a Pinch

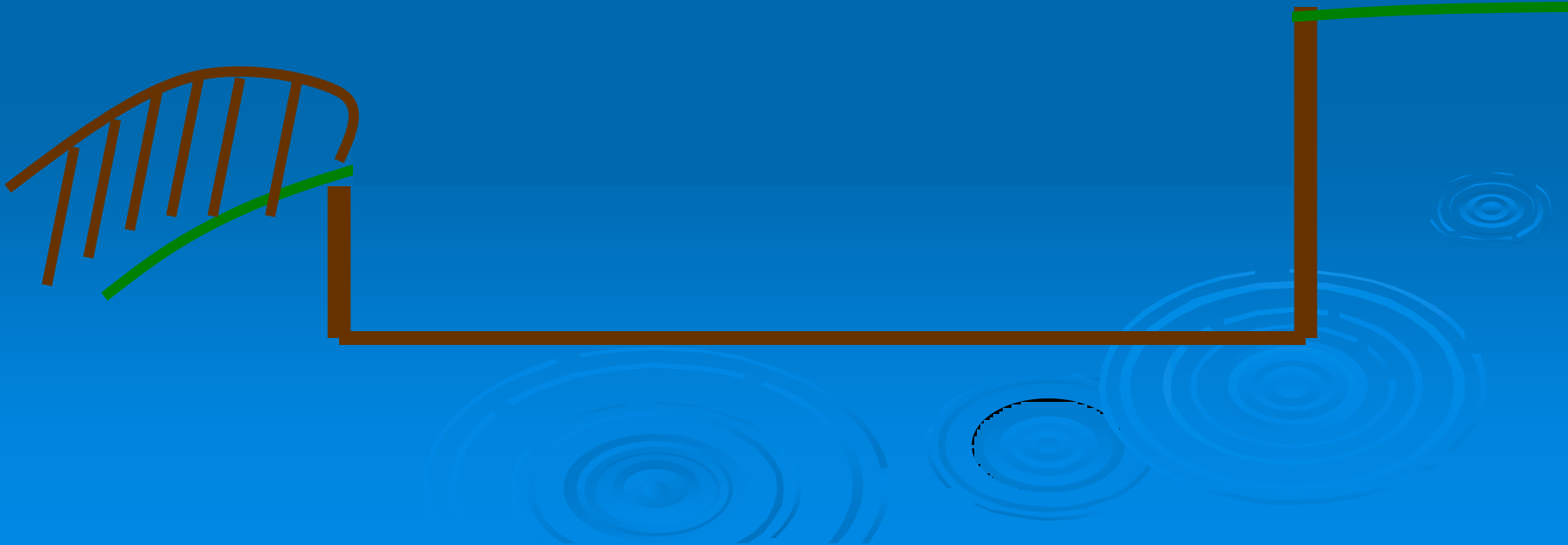
30% sand, 30% compost or fine pine bark, and 30% existing soil

Construction

- Call before you dig! 811
- Possible tools to collect
 - tape measure
 - carpenter's level
 - wooden stakes
 - string
 - small backhoe or friends
 - shovels
 - rakes
 - trowels
 - 2x4 boards (optional)

Construction

- Make a berm on down-hill side with soil removed from rain garden basin
- This helps prevent wash-out
- And stops initial run-off



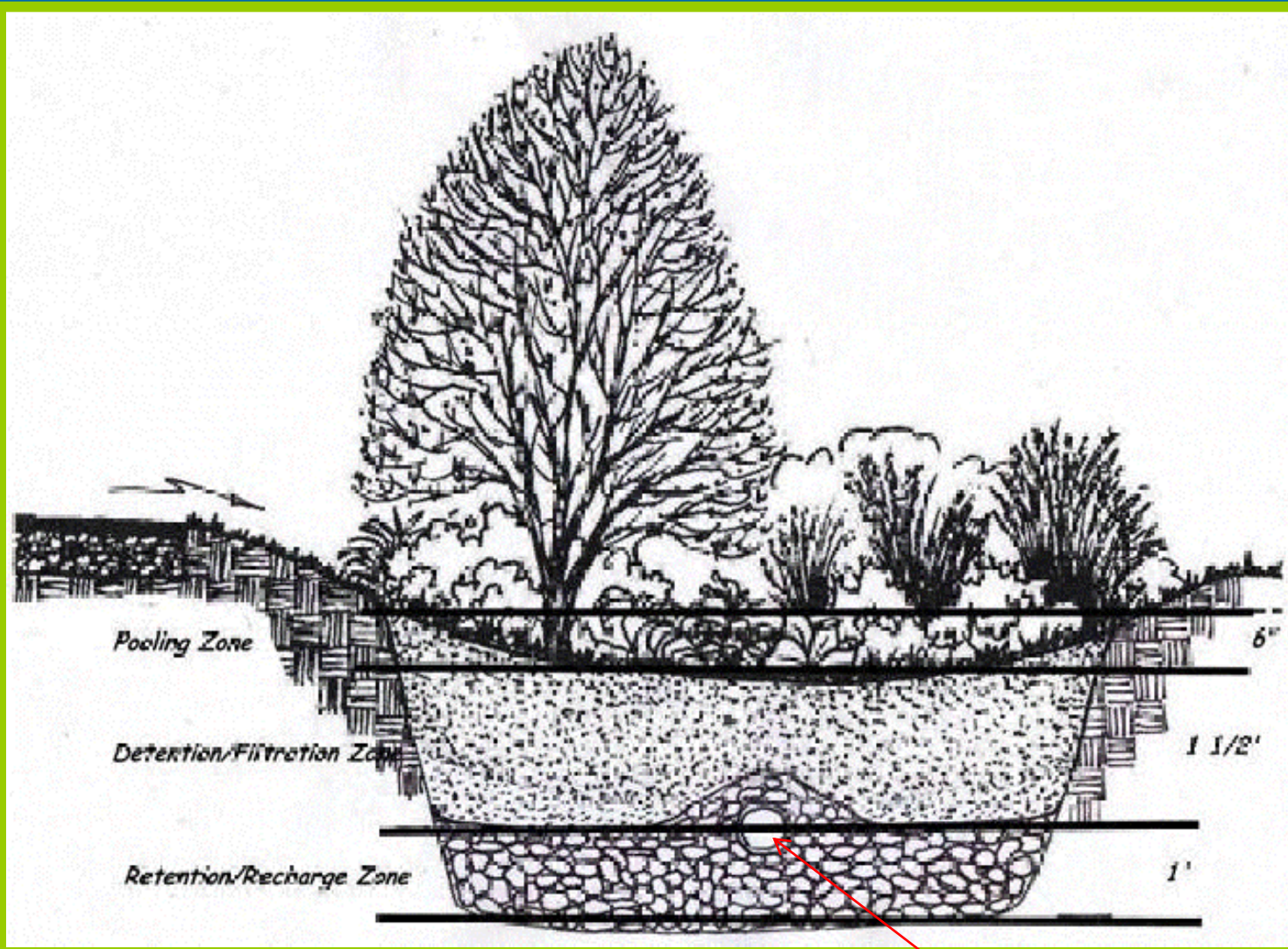
Installation



- Stabilize the berm with sod, native grass or sedge

Installation

- Prepare your site
 - kill the grass or original plants
- Lay out garden outline
- Dig the hole
- Use left over soil to create a berm
- Replace or amend the soil – if dense clay
- If basin is deep fill the bottom of the hole with 3” of gravel
- Fill the hole with amended soil/backfill



Drain may be needed if surrounding soil does not drain well

Any Size Offers Benefits

- Anything to slow down the rush of the first inch of rain water
 - Increase percolation
 - Hold water to filter and cleanse
 - Decrease runoff



Planting the Garden

- Don't fight the site
 - Use plants appropriate for the area
- Use your imagination
 - Plant for butterflies, hummingbirds, a color theme, or
- If you don't like it - Change it!
 - Gardens are dynamic



Rain Garden Underdrain Installation

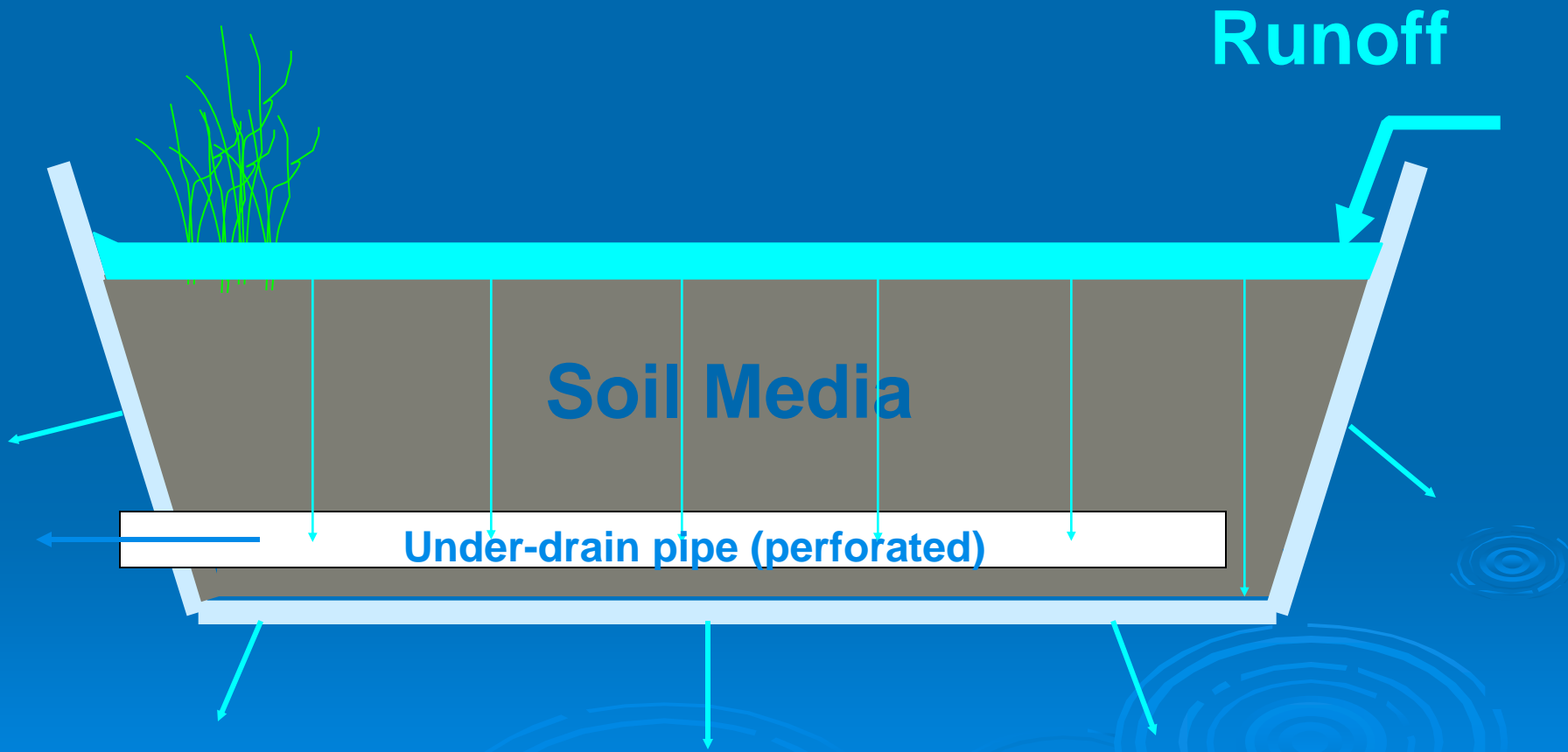


- When is an underdrain needed?
- How to design and install?

When to Consider an Underdrain -

- The soil has a high clay content.
- The test hole fails to drain quickly. Within 2 days (48hrs) of filling.
- Elevation differences allow water to drain away from the rain garden area. (in other words you have somewhere for the drain to exit the excess water)

Rain Garden – Underdrain System



To function properly, underdrain MUST drain to a lower elevation!



Consider with
underdrains:

More cost!

More digging!

More time!

More labor!



Use the same method used to size a rain garden – underdrain or no underdrain





Inlets from
downspouts

Outlet: (lower elevation)

Inlets





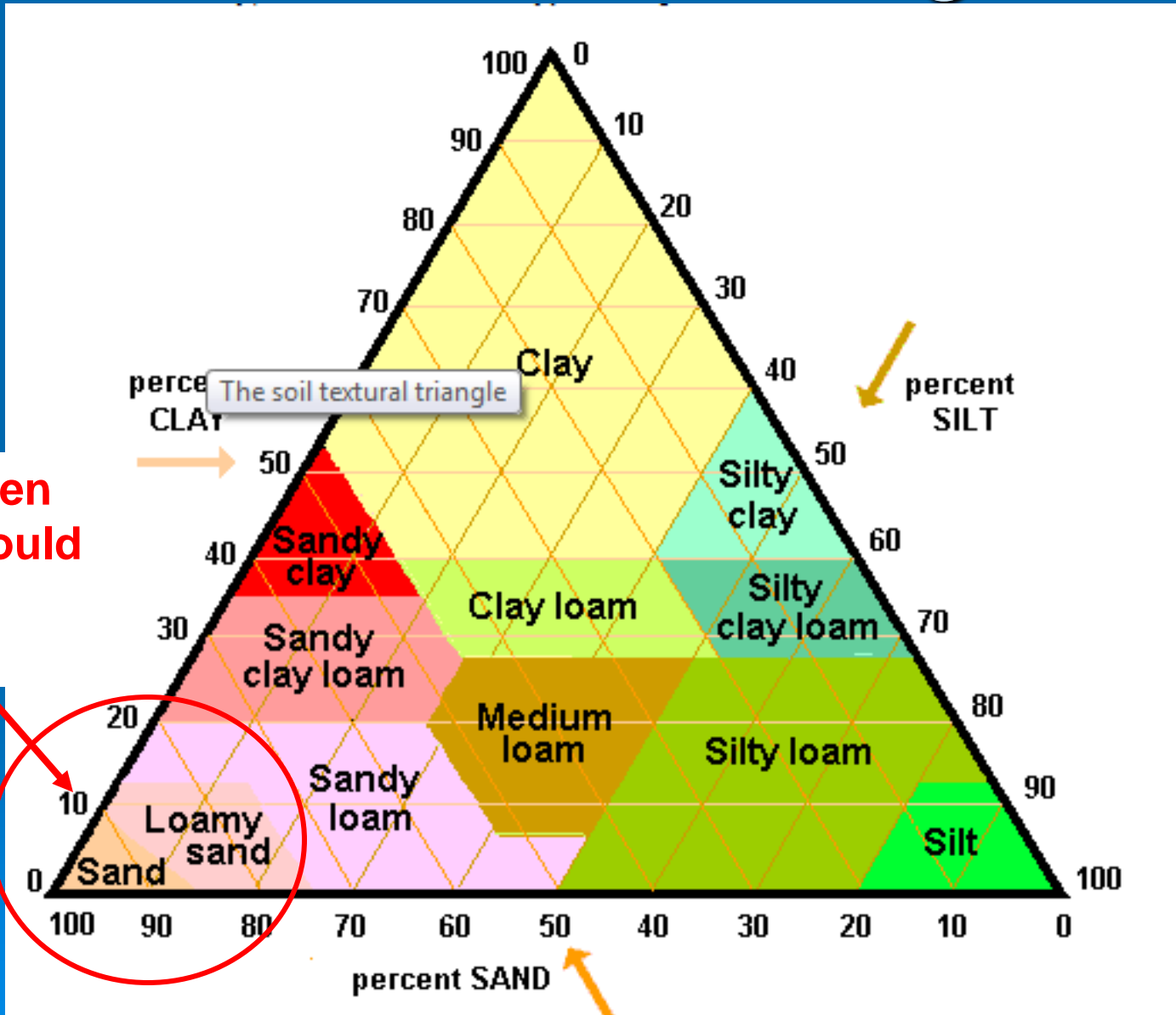
**Note Impermeable Layer -
(Compacted soil from old
parking lot)**

Summary: The “Ideal” Rain Garden soil for underdrain applications

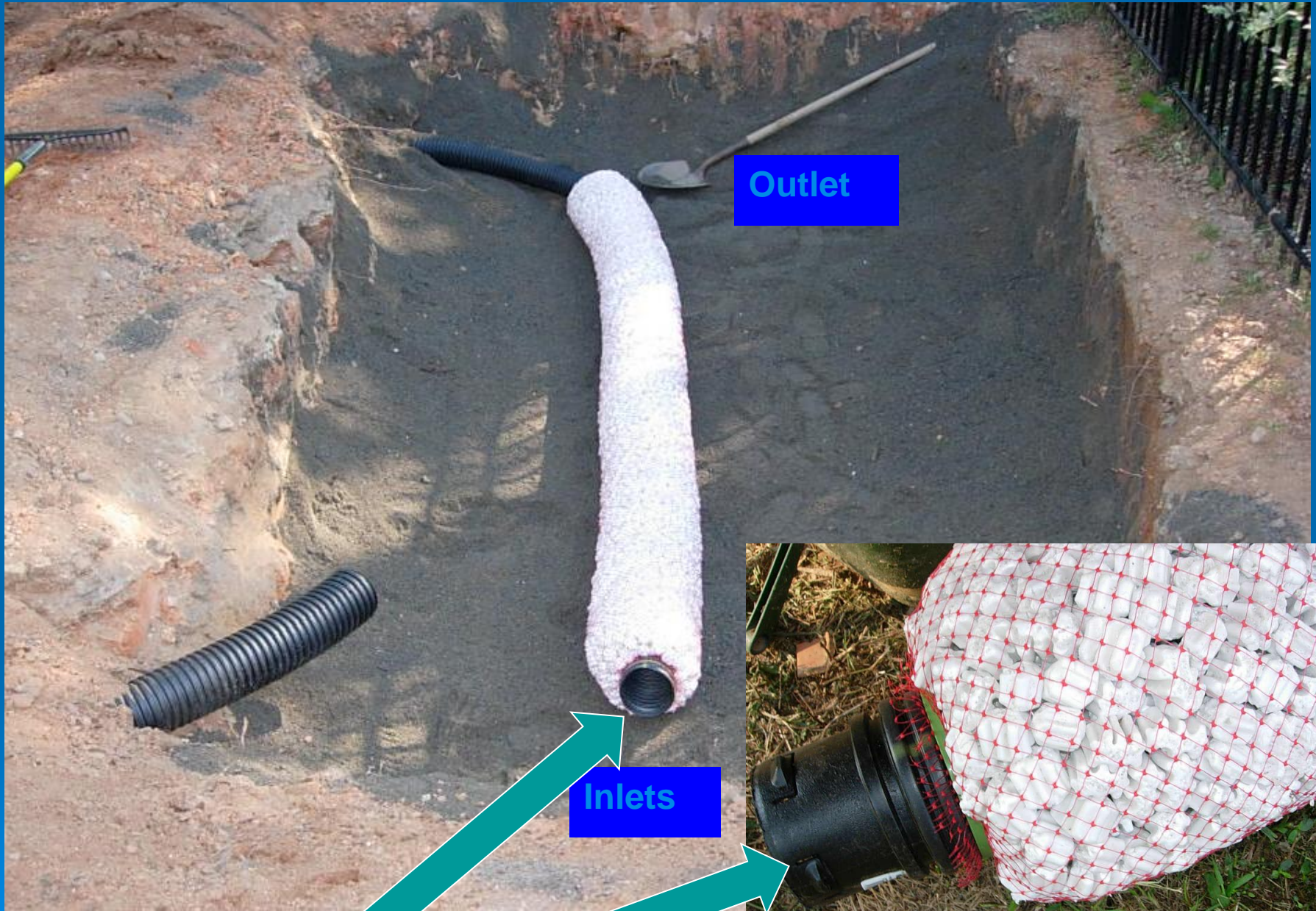
- Premixed soil media
 - 85% coarse sand
 - 10% clay-silt (topsoil)
 - 2-5% organic matter (bark fines are good - also called soil conditioner)
- Locally available



Soil Texture Triangle



Rain garden media should be in this range



Outlet

Inlets

Plug end as seen on right

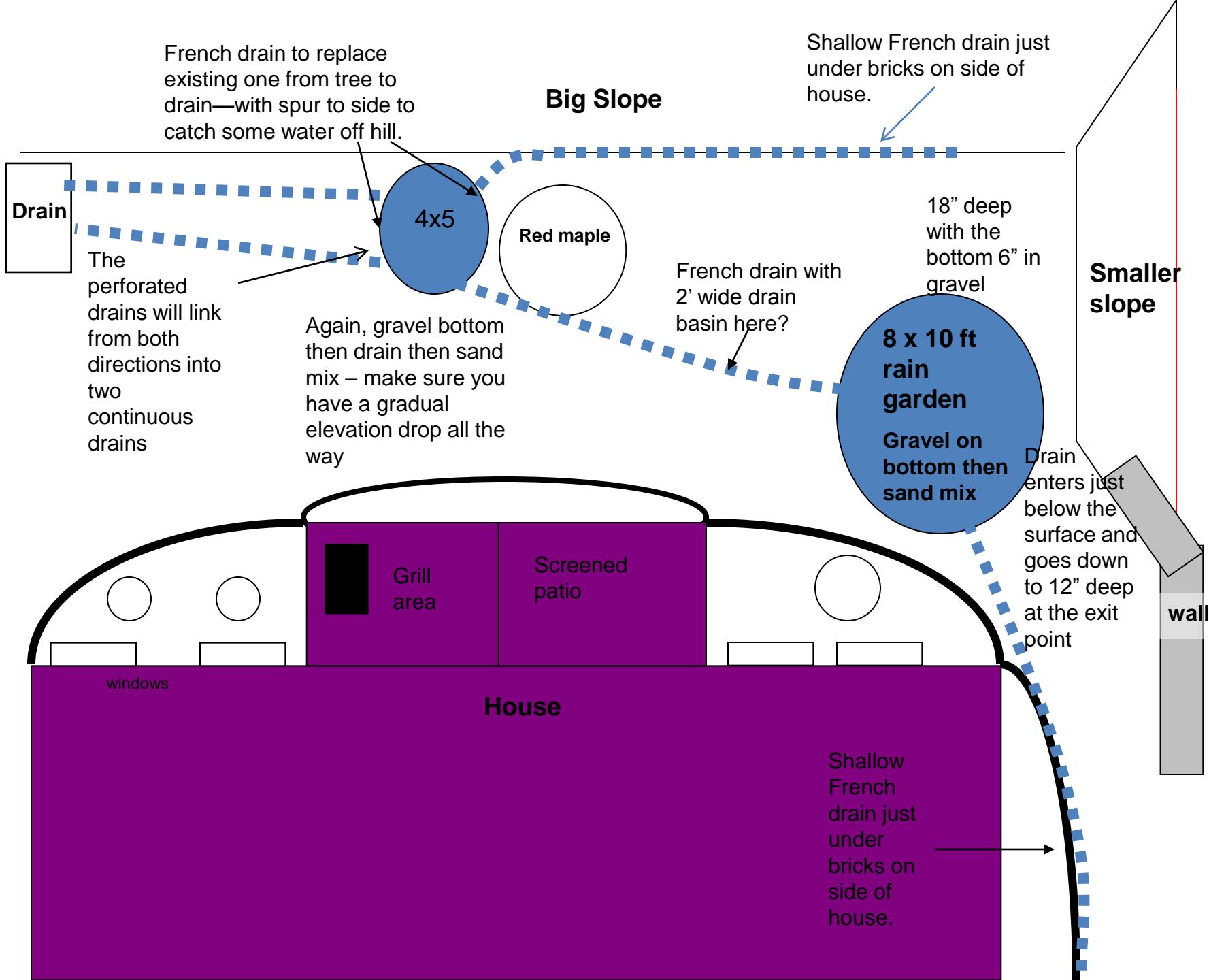




Outlet connection







Questions

