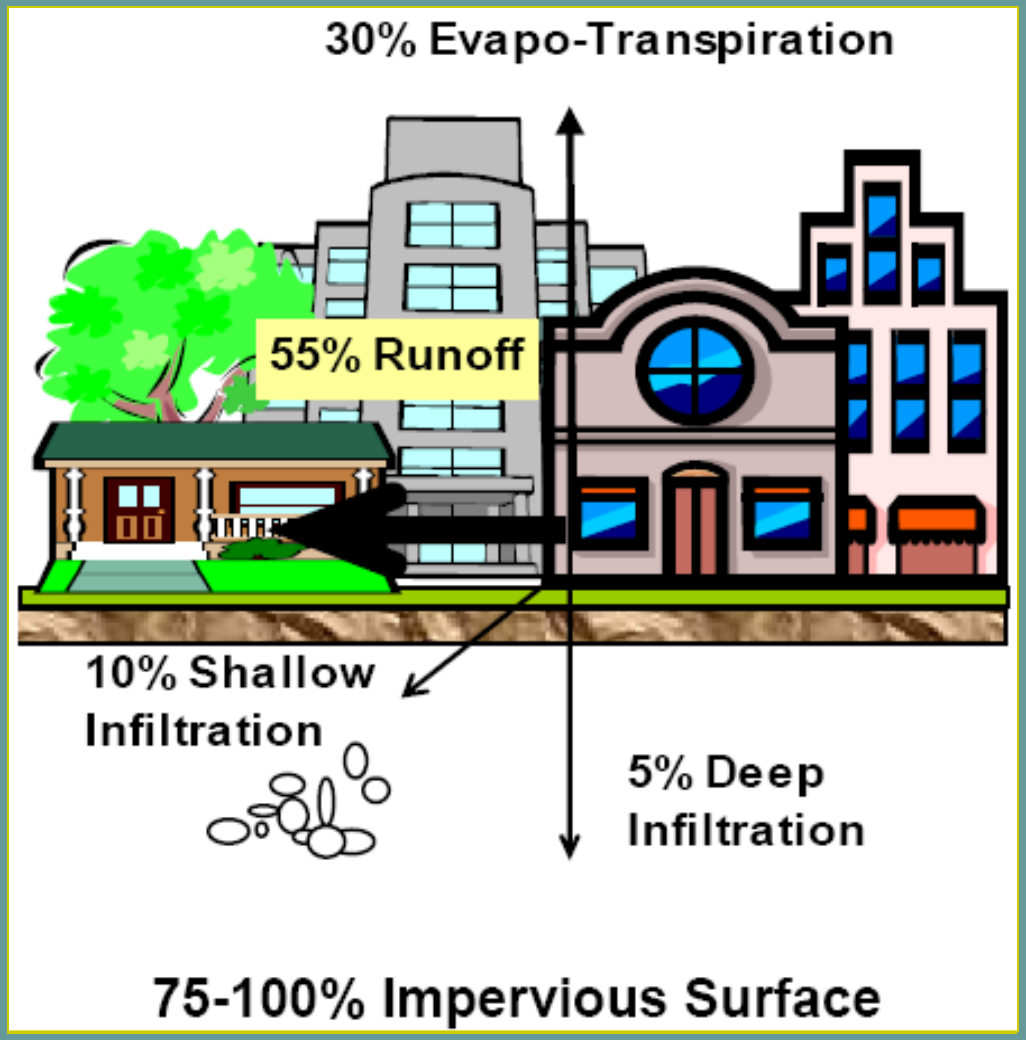
# Low Impact Development

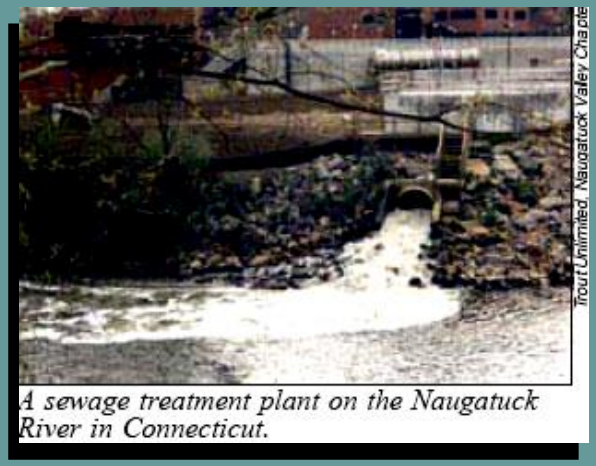
## for your homes, businesses & streets


# What's the problem anyways?

## Development Impacts the Water Cycle



# In the past, our main pollution concern was Point Source Pollution



*A sewage treatment plant on the Naugatuck River in Connecticut.*

# Our current most pressing pollution concern is Non-Point Source Pollution

# *Impervious Surfaces*


These surfaces included cement, asphalt, roofing, gravel roads and compacted soils that prevent percolation of runoff into the ground

# Development Pressure

# Pollutants in Vermont's Water

Nutrients: Phosphorus, Nitrogen – lawns, golf courses

Pathogens: E. Coli – septic systems, wastewater treatment plants

Sediment : construction, stream bank erosion

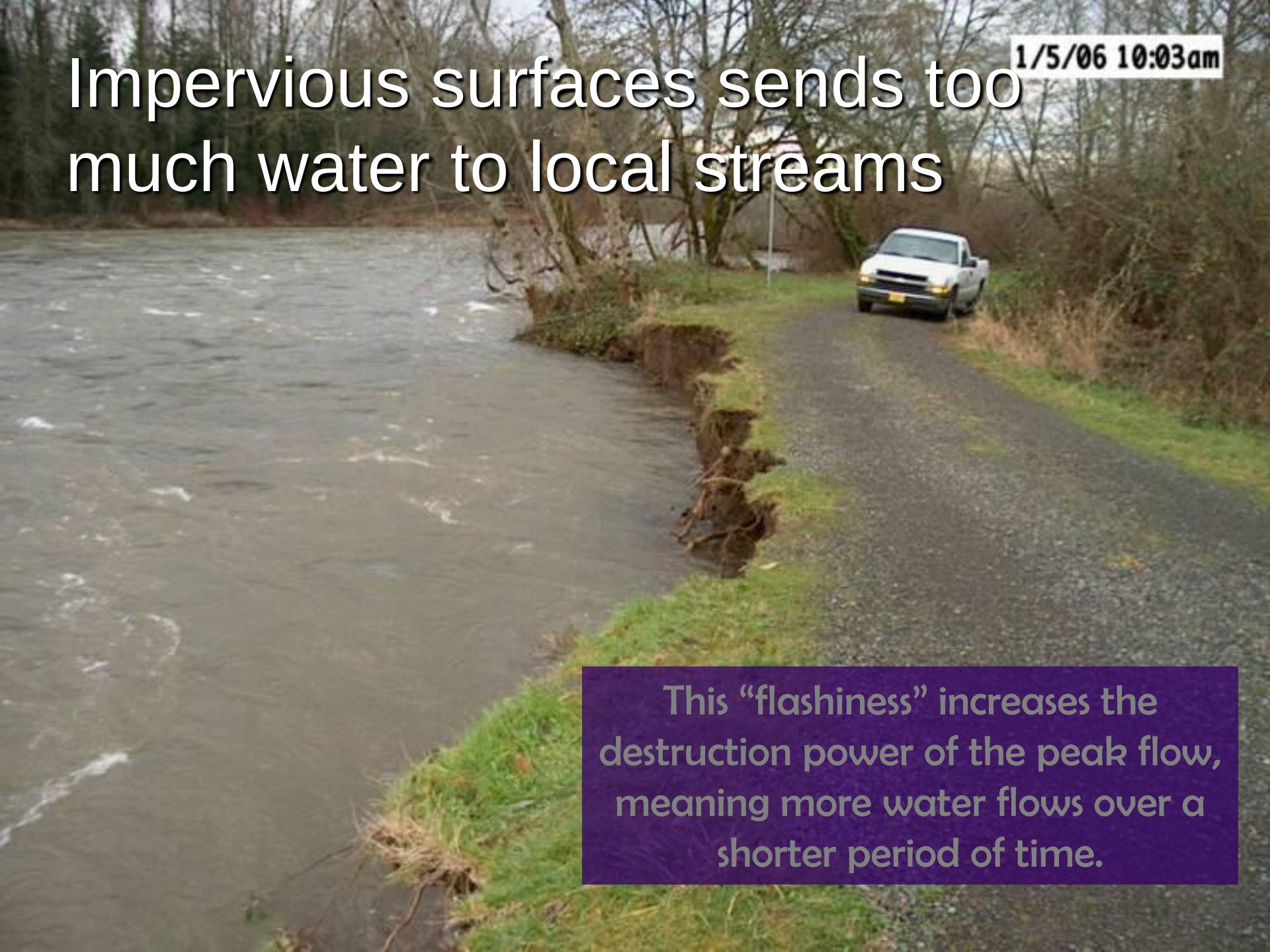
Toxic Contaminants: Heavy metals, mercury, PCBs, chlorides, pesticides – landfills, combustion of coal, solid-waste incinerators

Excess Algae: reduces oxygen in water

Acid Rain: combustion of fossil fuels (coal, oil and gas)

www.vtwaterquality.org/wqd_mgtplan/swms_appB.htm

# Impervious surfaces sends too much water to local streams

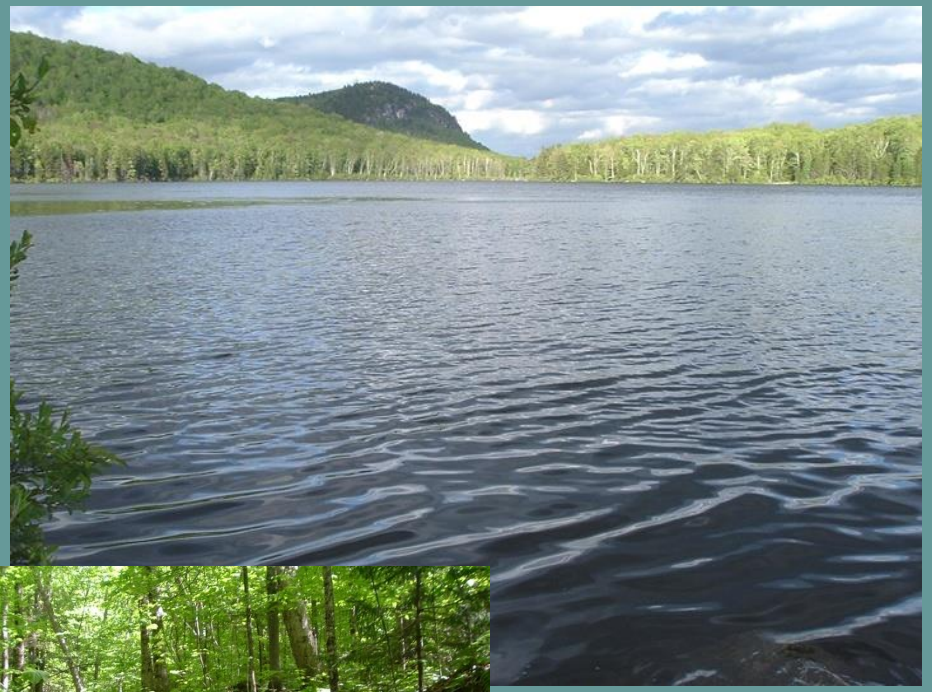



This “flashiness” increases the destruction power of the peak flow, meaning more water flows over a shorter period of time.


NASA Satellite image taken on Sept. 2, 2011

# What are the Water Issues in Your Town?

- Flooding
- Water quality
- Drinking water
- Stream alterations
- Wildlife habitat
- Sensitive wildlife
- Erosion Hazards



# The Low Impact Development Shift

## Regional & Centralized

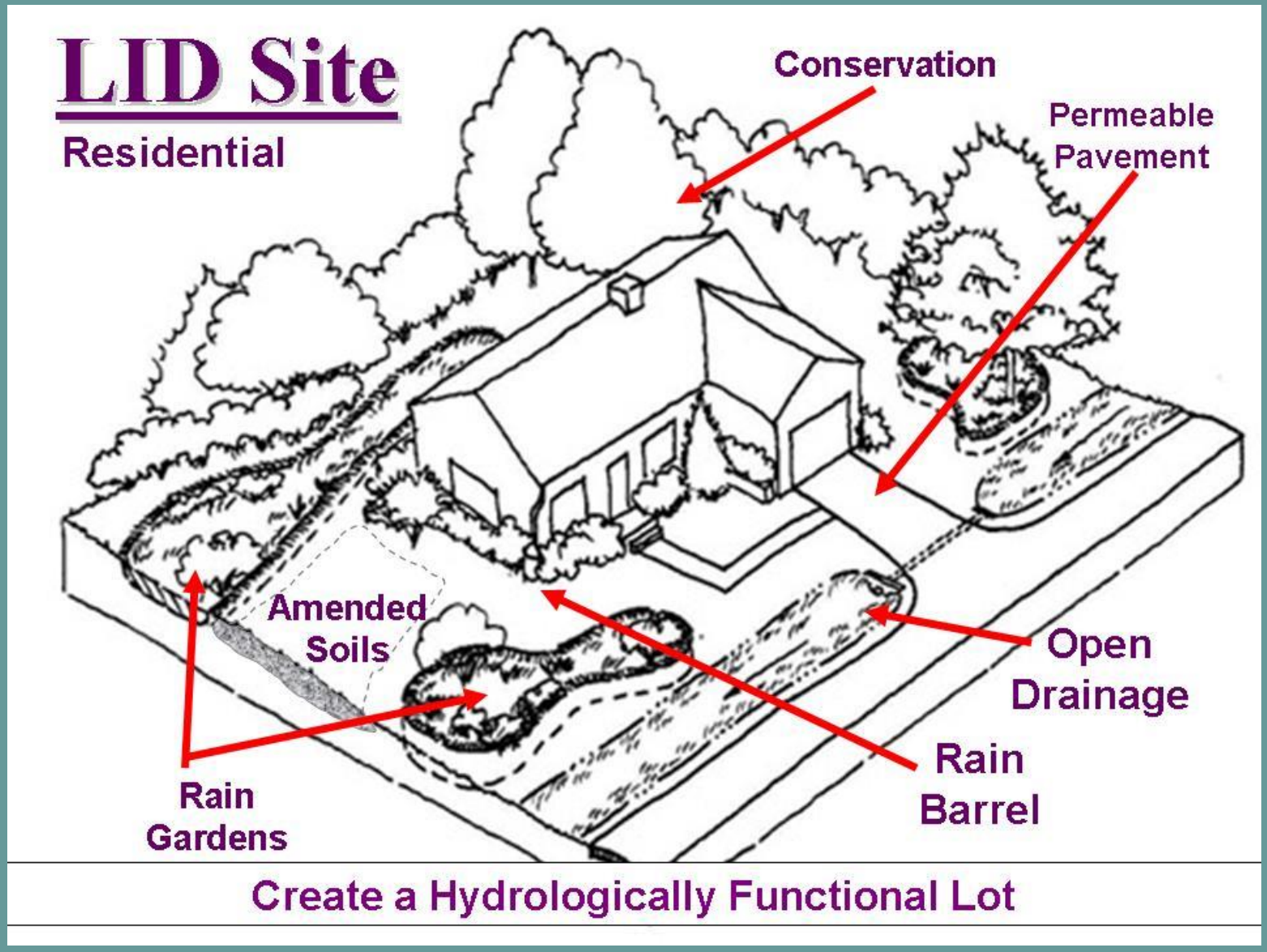
drain, direct, dispatch

- Pipe, channel, sewer
- Expansive drainage
- Large control structures
- Intensive engineering
- Built capital Investment

## Decentralized & Distributed

Slow, spread, soak

- Don’t generate or accelerate runoff
- Low energy design
- Integrated design
- Extensive planning & education → DIY
- Human and natural capital investment


LID Site
Residential
Conservation
Permeable
Pavement
Amended
Soils
Open
Drainage
Rain
Barrel
Rain
Gardens
Create a Hydrologically Functional Lot

# LID Goals

- Stormwater management should *not* be seen as *waste disposal* but as a RESOURCE MANAGEMENT


- Include small, cost-effective landscape features at the lot level that treat stormwater.

# Conventional Stormwater Management Practices

- Stormwater Ponds
  - Detention (dry)
  - Retention (wet)
- Underground infiltration sands filters
- Storm drain and culvert infrastructure

# LID Practices

- Bio-retention and rain gardens
- Disconnect downspout from storm system
- Vegetated Swales
- Water harvesting systems- rain barrels or cisterns
    - Milton HS has underground cisterns
- Green roofs
- Permeable pavement & concrete
- Subsurface gravel wetlands

# Rain Barrels and Cisterns

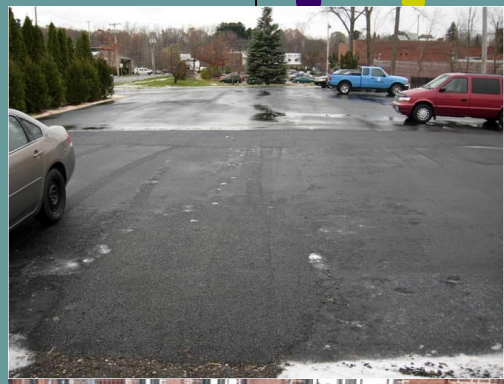
- Water harvesting from roofs of building
- Reduces stress on treated public water supply during
- Can be used for gardening, car washing, equipment cleaning and other non-potable use
- Easy to install and maintain
- Variable sizes
- Can be installed under ground or disconnected in winter month

# Green Roofs

- Types
  - Intensive
  - Extensive – Heritage Aviation Hanger
- Consisting of
  - Lightweight growing medium
  - Plants
  - Drainage system
  - Waterproofing layer

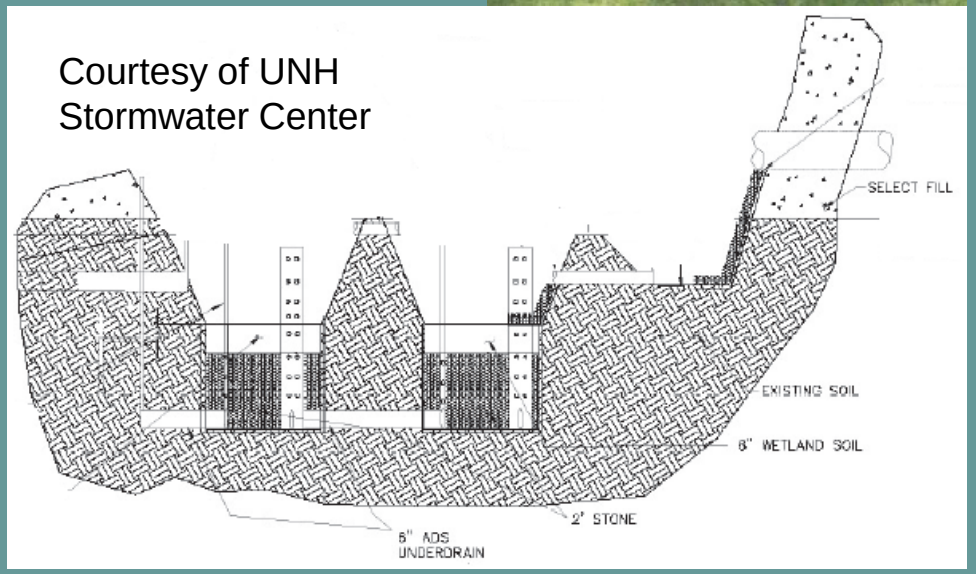

# Permeable Pavement

- Whole System
  - Permeable surface course
  - Stone/sand sub-base
  - Drainage system
- Surface course material
  - Asphalt
  - Concrete
  - Grid-block pavers
  - Plastic grid pavers

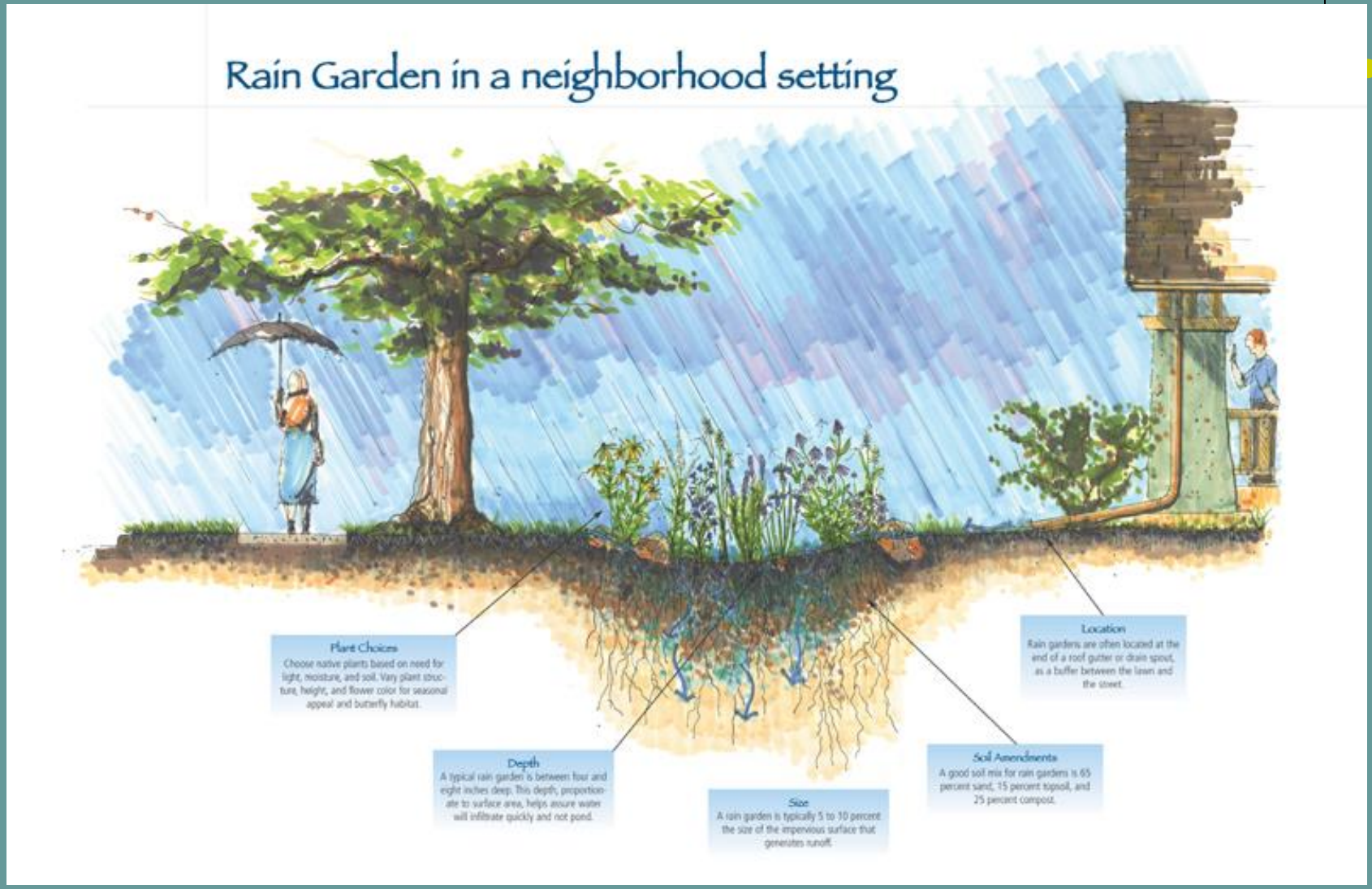


# Subsurface Gravel Wetland

- A modification of a constructed wetland
  - Stormwater travels laterally through subsurface drains
- Consisting of
  - Subsurface gravel layer and drain
  - Soil medium
  - Wetland plants



# What is a Rain Garden?




Functional gardens designed to capture & infiltrate water running off roofs and roads

Size of garden calculated based on amount of water entering garden

Soils, plants and microbes remove the pollutants as the water absorbs into the ground

# Location

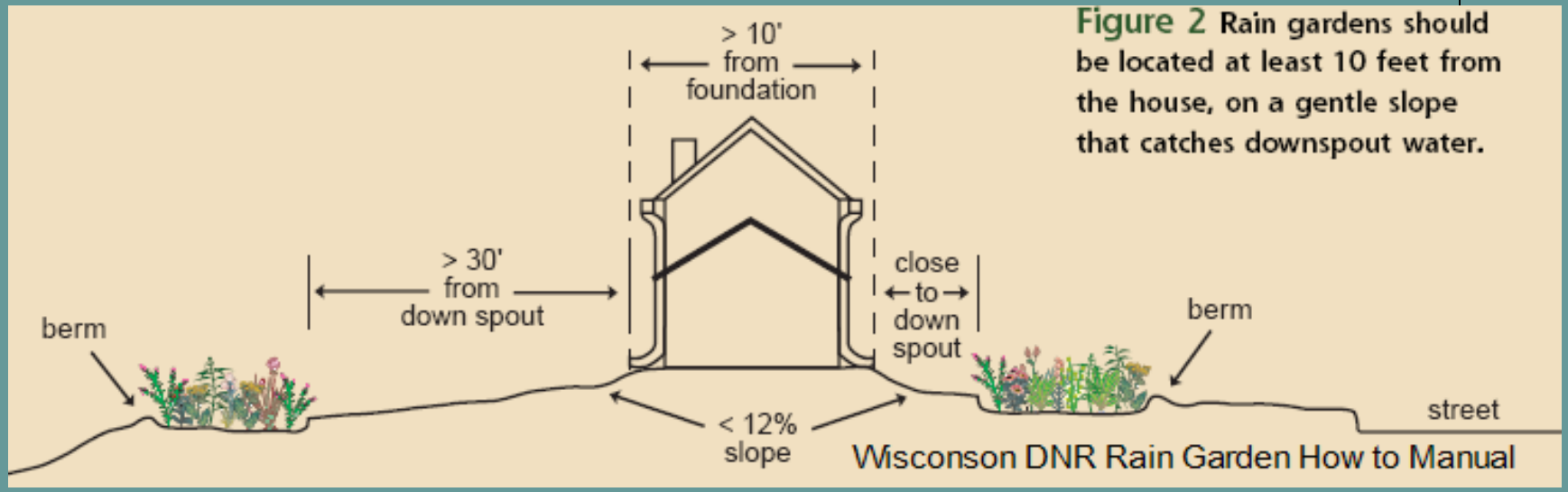
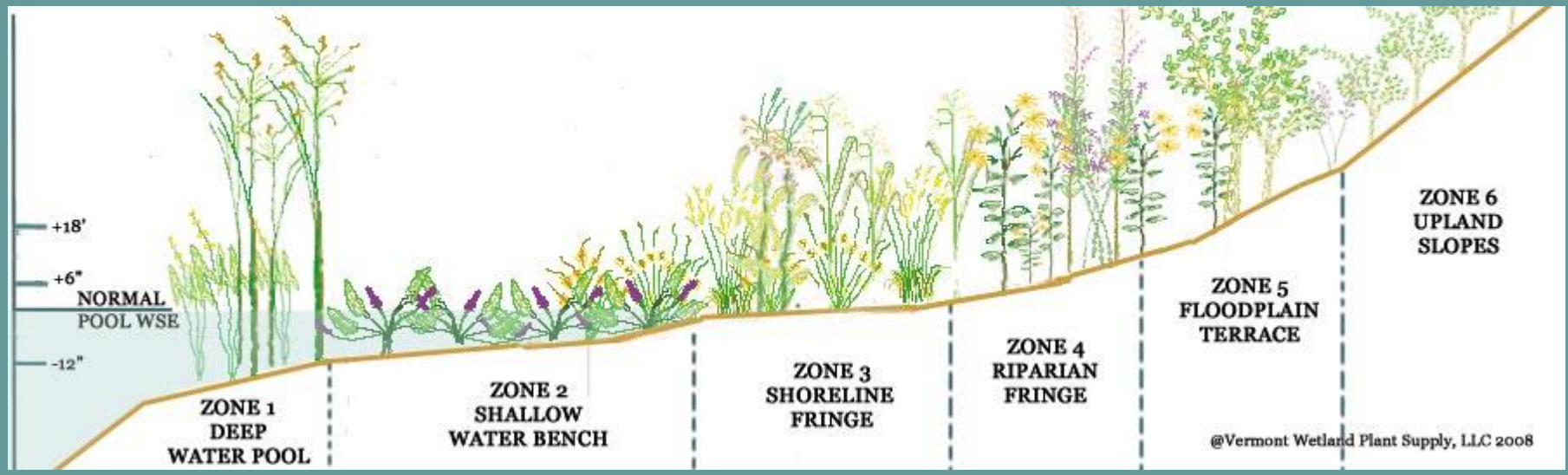



Figure 2 Rain gardens should be located at least 10 feet from the house, on a gentle slope that catches downspout water.

Consider….

- What's the purpose of a rain garden in a particular spot?
- Can you find a good place (or two, or more) for a rain garden?
- What water would you like to capture?


+18'
+6"
NORMAL
POOL WSE
-12"
ZONE 1
DEEP
WATER POOL
ZONE 2
SHALLOW
WATER BENCH
ZONE 3
SHORELINE
FRINGE
ZONE 4
RIPARIAN
FRINGE
ZONE 5
FLOODPLAIN
TERRACE
ZONE 6
UPLAND
SLOPES
@Vermont Wetland Plant Supply, LLC 2008

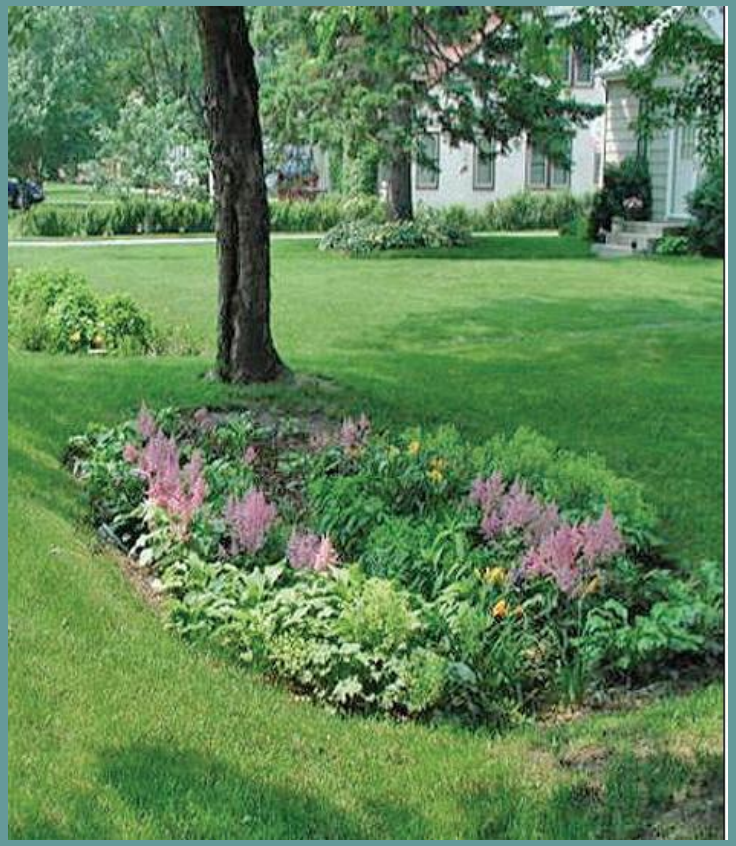
# Size of Rain Garden

Depends on:

A. Size of impervious area (roof, lawn, driveway)

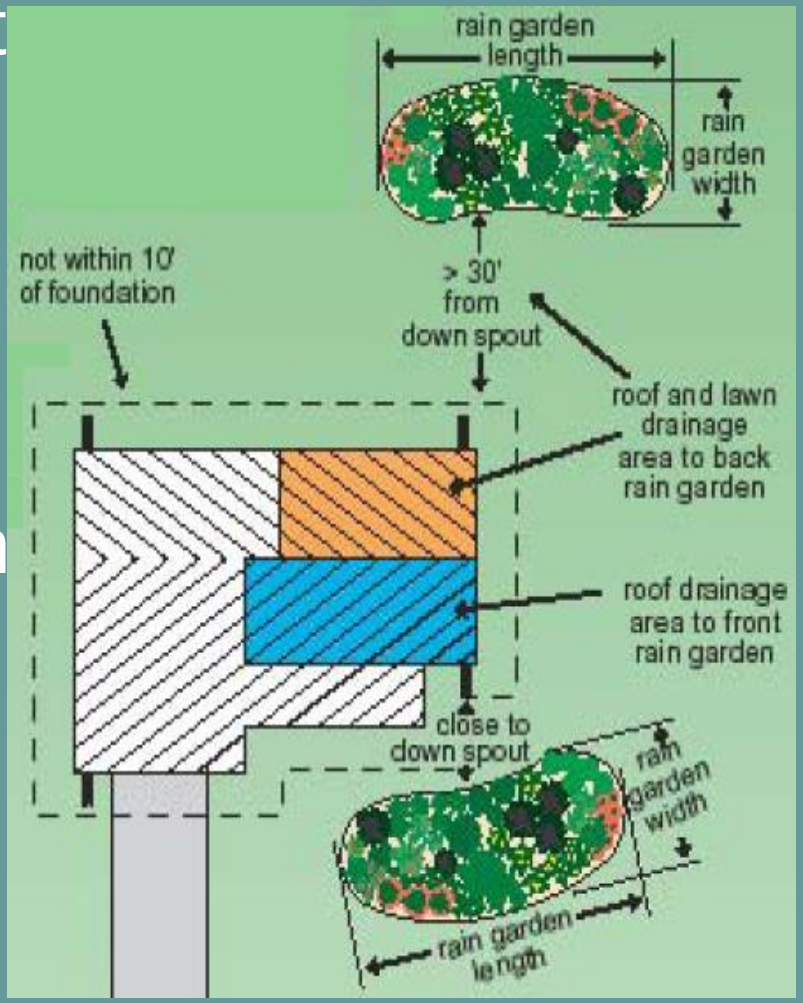
B. Soil type

C. Slope



# A. SIZE OF IMPERVIOUS AREA

- Identify portion of roof that will drain into the rain garden
- Measure square foot by multiplying length by width
  - hang onto this number, you will need it later



# B. SOIL TYPE

- Conduct soil ribbon test
  - Sand: no clumping
  - Silt: a ribbon <1.5”
  - Clay: a ribbon >1.5”

- Test the infiltration
  - Dig a hole and fill with water. Does it drain in 24 hrs?
    - If so, suitable for rain garden
    - If not, infiltration poor and look for another location

# C. CALCULATING SLOPE

- Slope determines depth of garden
- Rain gardens need to be level to evenly distribute water

$$\frac{\text{height}}{\text{width}} \times 100 = \%\ \text{slope}$$

| Slope | Depth |
|---|---|
| 4% | 3-5 in |
| 5-7% | 6-7in |
| 8-12% | 8 in+ |

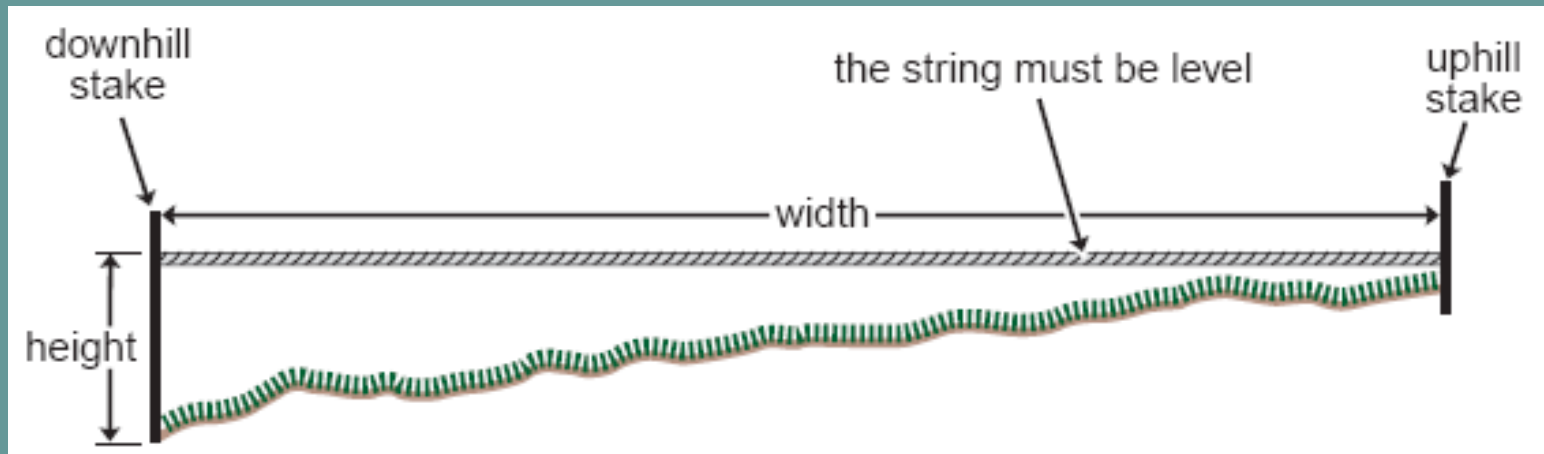



**Figure 3** The string should be tied to the base of the uphill stake, then tied to the downhill stake at the same level.

# Rain Garden Sizing Exercise

- House roof drainage area- 815 sq ft
- Silty soil
- 3% slope

How big should the garden be?

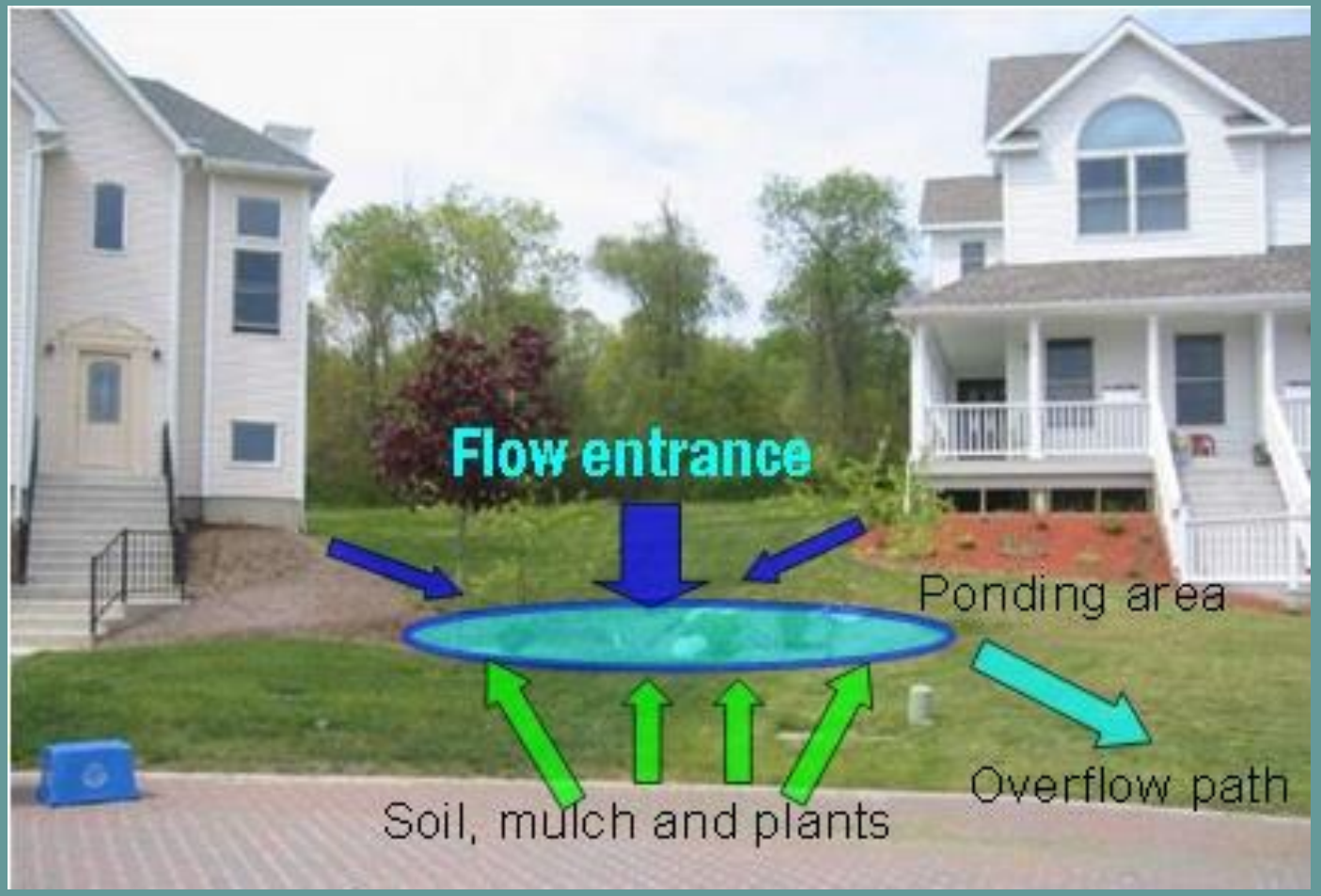
| Slope | Depth |
|---|---|
| < 4% | 3-5 in |
| 5-7% | 6-7in |
| 8-12% | 8 in+ |

Size Factor Chart

| Depth | 3-5 in | 6-7 in | 8 in + |
|---|---|---|---|
| Sand | 0.19 | 0.15 | 0.08 |
| Silt | 0.34 | 0.25 | 0.16 |
| Clay | 0.43 | 0.32 | 0.20 |

**.34** Size Factor x **815** Drainage Area (sq. ft) = **277 sq. ft** Size of Garden

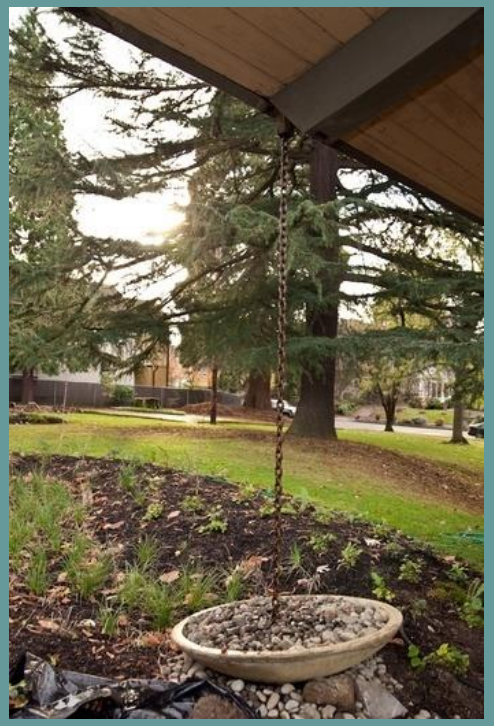
# Designing The Rain Garden



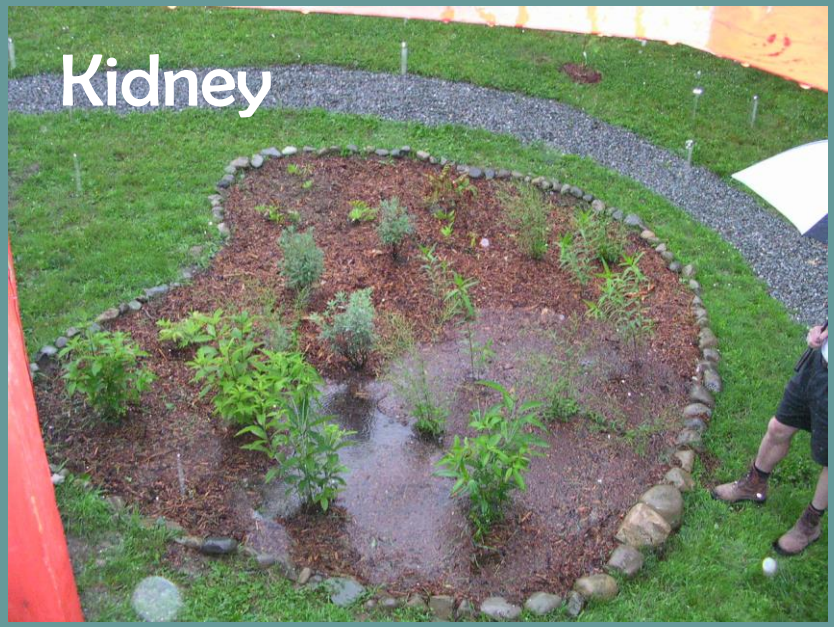

Need to consider: how water is directed to garden & where water could overflow to

# Directing Water to Rain Garden

- Dig depressed grass trench or trench for extender pipe
- Redirect downspout
- Connect extender pipe to downspout



# Shape of Rain Garden



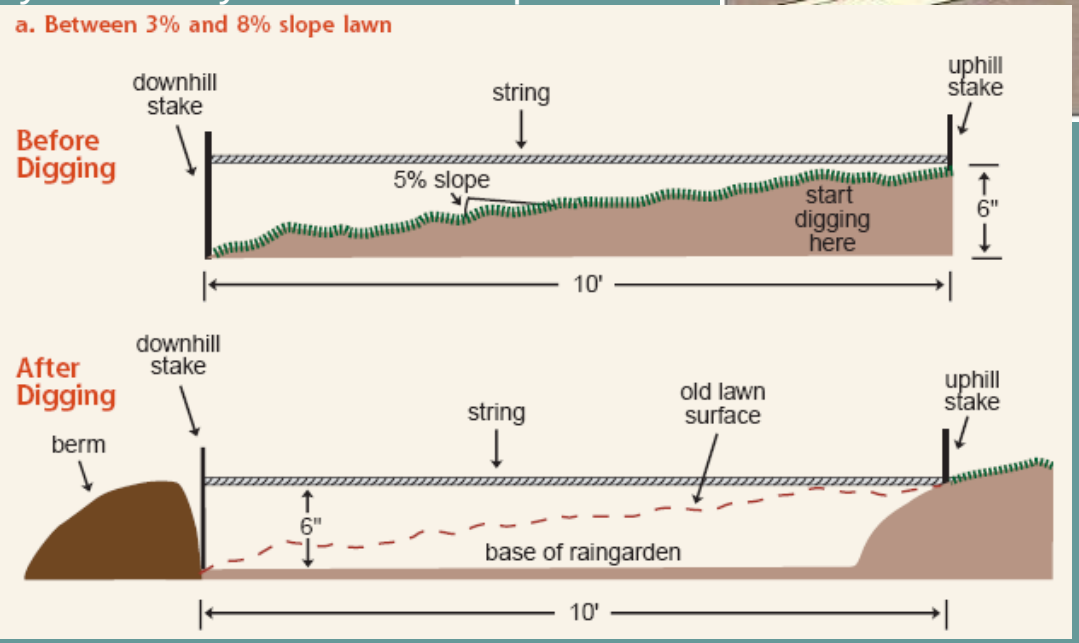


Linear

# Building the Rain Garden

A Level Bed is Key – Think Terraces

Start digging on the uphill side until you reach your desired depth



# The Berm

- Water naturally wants to flow downhill
- The berm is built on three sides as a wall
- It will be highest at downhill side and gradually taper off as it goes uphill
- It should be well compacted soil, gently sloped on the sides, and seeded with grasses

# Plant Choices

New England Aster

swamp milkweed

Red Osier Dogwood

- Taller plants
  Asters, spiked blazing star, swamp milkweed, joe pye weed, lilies, iris
- Preferably native plants
- Adapted to flood plain or moist soils
- Add compost before planting

Joe Pye Weed

# Contact Information

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