RAIN GARDENS

Presented By:
Don Hearl
Old Rag Chapter
Virginia Master Naturalists

RAIN GARDEN TOPICS

- **DESCRIPTION**
- **BENEFITS**
- **COMPONENTS**
- **LAYOUT AND DESIGN**
- **CONSTRUCTION**
- **PLANTS**
- **MAINTENANCE**
- **CASE STUDY – Stephanie DeNicola**

RUNOFF – WHAT'S THE PROBLEM?

- **Just 1 inch of rain falling on 1 acre of paved surface equals 27,000 gallons of polluted runoff.**
- **Thousands of miles of waterways in the Chesapeake Bay region have been legally designated as "impaired" (meaning polluted) by suburban and urban runoff under the federal Clean Water Act.**
- **Excess nitrogen and phosphorus, which fuels algal blooms that ultimately cause the Bay's dead zone, is still largely driven by precipitation, which washes contaminants into our waterways.**
- **With the watershed's ever-growing population pollution from urban and suburban runoff has become the only major source of nitrogen pollution in the Bay still growing.**
- **This reflects the need for increasing runoff management efforts.**

Credit: CBF -

WHERE DOES OUR RUNOFF GO?

Credit: CBF

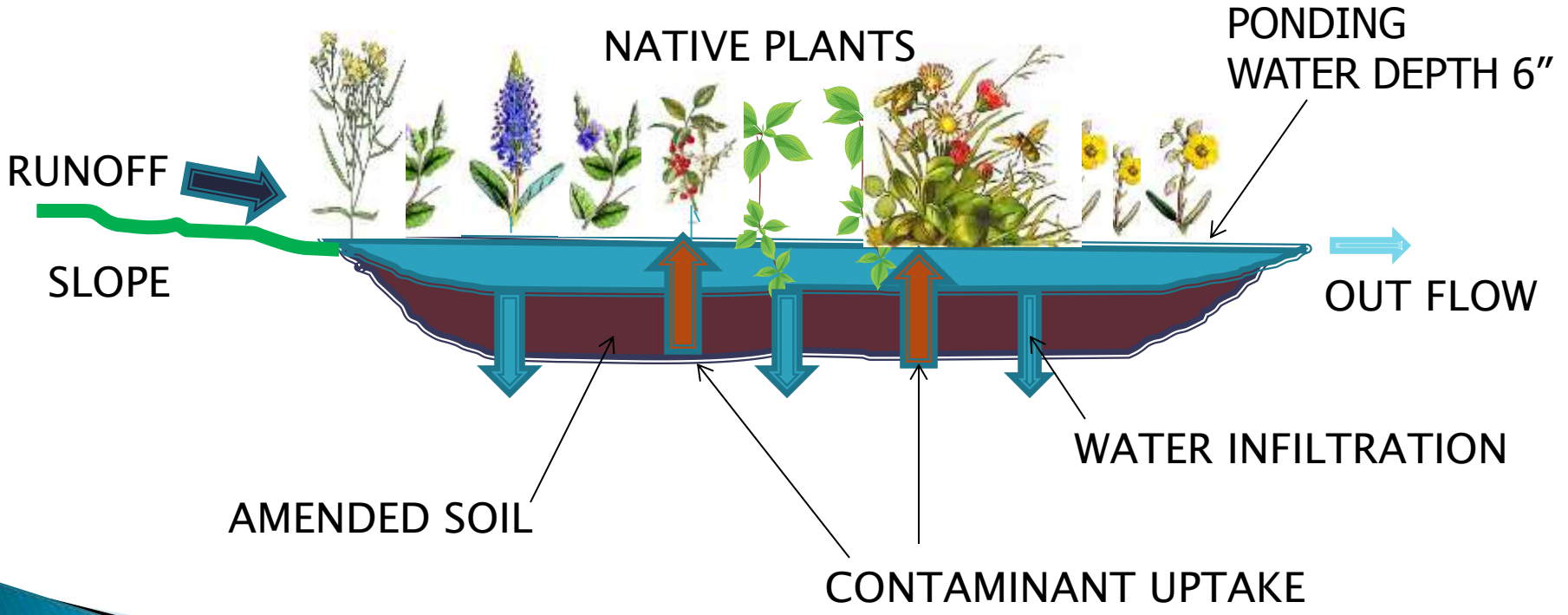
WHAT IS A RAIN GARDEN?

- A depression excavated in the ground on a natural slope where runoff occurs
- A rain garden is planted with a variety of grasses, wildflowers, and woody plants.
- Plants are adapted to the soil, precipitation, climate, and other specific site conditions.
- Native plants with deeper root systems facilitate infiltration and also survive through periods of drought.
- Rain gardens will mimic the hydrologic cycle and are designed to temporarily hold and soak in rain water runoff.

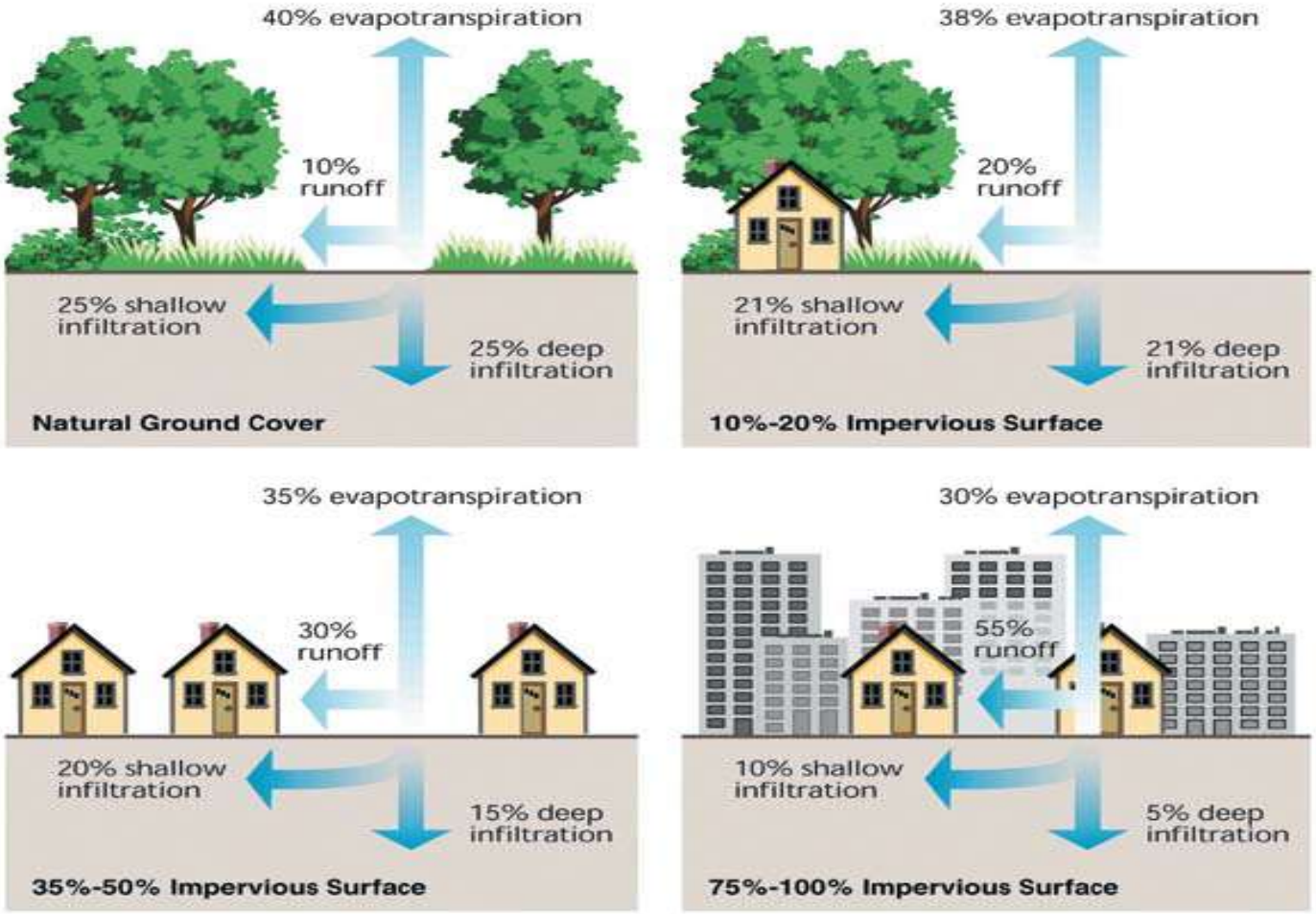
WHY RAIN GARDENS?

- **REDUCE STORMWATER RUN OFF**
  - The US EPA estimates that pollutants carried by rainwater runoff account for 70% of all water pollution.
- **REDUCE EROSION**
- **IMPROVES DOWN STREAM WATER QUALITY**
  - Rain gardens are effective in removing up to 90% of nutrients and chemicals and up to 80% of sediments from rainwater runoff
  - Rain gardens allow 30% more water to soak into the ground.
- **INDIVIDUALS CAN MAKE A DIFFERENCE BY PLANTING RAIN GARDENS**
  - Creates wildlife habitat
  - Aesthetically pleasing

RAIN GARDEN CROSS SECTION

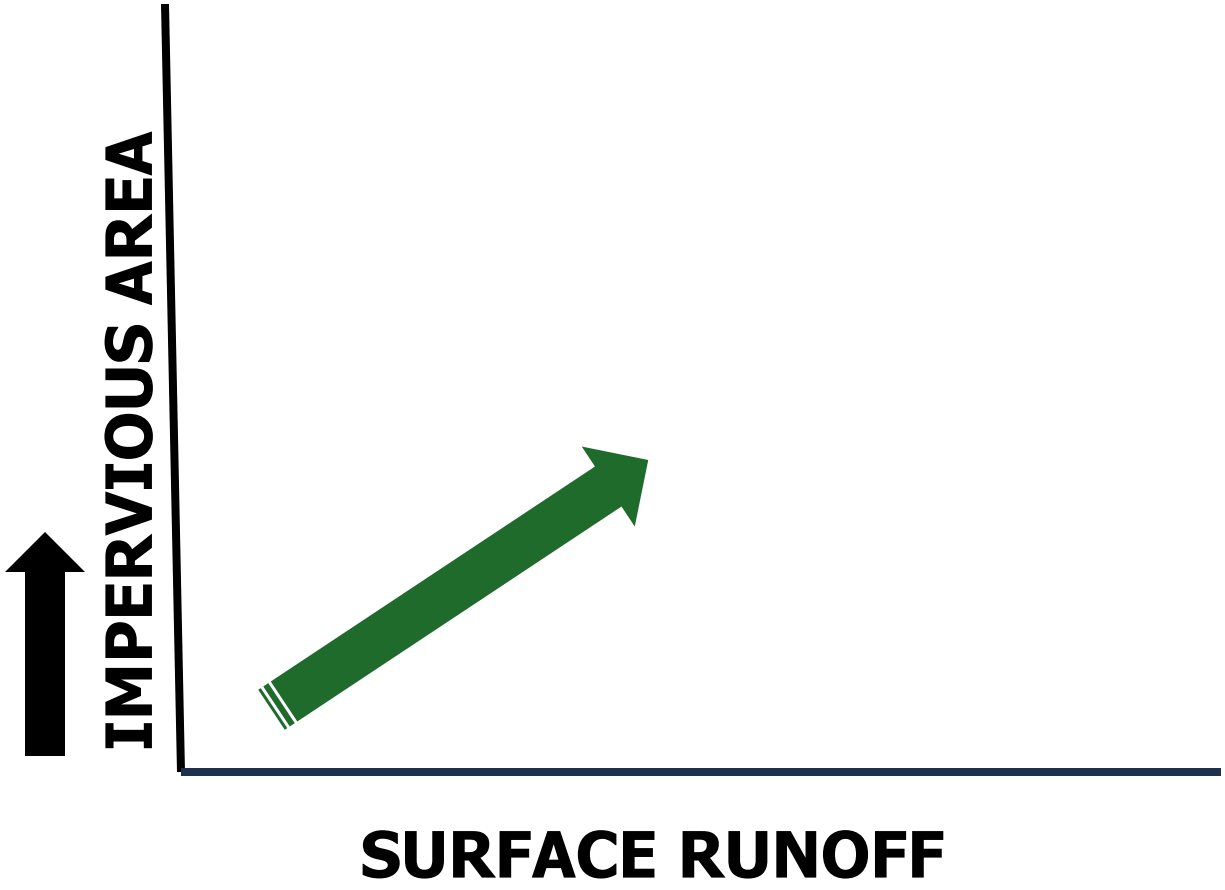


FACTORS AFFECTING RUNOFF RATE



SOURCE: VDOF

IMPACT FROM LOSS OF NATURAL AREAS



UNCONTROLLED RUNOFF

REQUIREMENTS FOR A RAIN GARDEN

- A rain garden requires:
  - Area where water can collect and infiltrate
  - Plants to maintain infiltration rates
  - Diverse microbe communities
  - Water holding capacity
- Space should be sized for projected runoff
- Length should be two times the width
- Garden should drain completely in 24 - 48 hours to prevent mosquito breeding
- A long term commitment to maintaining the garden is required for a successful outcome.

ELEMENTS OF RAIN GARDEN

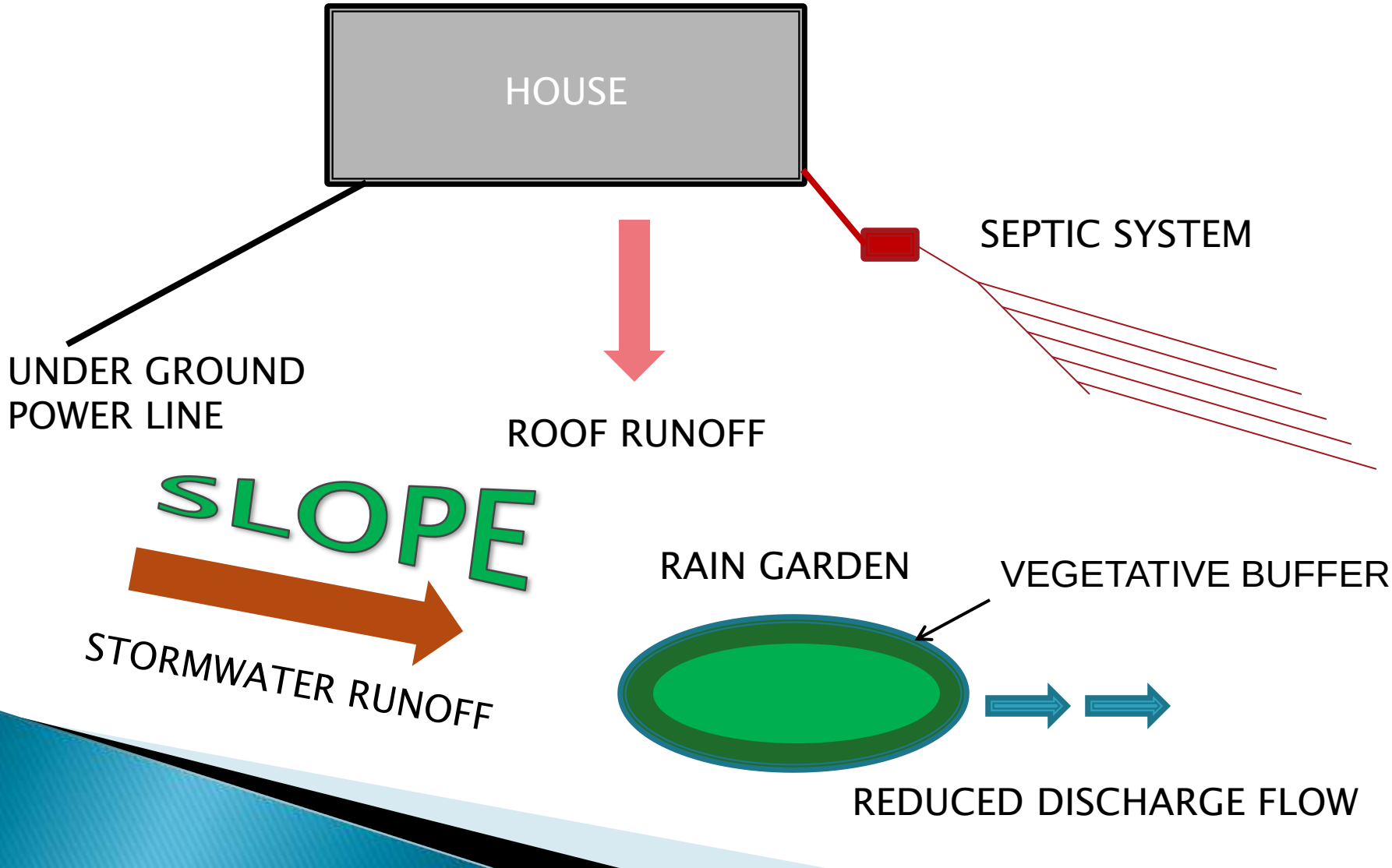
- A grass buffer strip around the garden that will slow the velocity of the runoff
- A mulch layer to provide a medium for the biological activities to occur and keep the soil moist
- Plants that use the runoff for moisture and source of nutrients
- A soil layer where the plant roots will collect moisture and nutrients for growth
- A ponding area or depression of the garden to provide storage needed for runoff
- A berm that is at least six inches of soil or rocks that works like a dam to pond the runoff.

Credit: Rain Gardens Tech. Guide – VDOF

GARDEN LOCATION CONSIDERATIONS

- To select a location for the rain garden, begin by observing your yard during a rainfall event.
- Notice where water is flowing from, and where it is going.
- Rain gardens should ideally be located between the source of runoff (roofs and driveways) and the runoff destination (drains, streams, low spots, etc.).
- Be sure to consider the following:
  - The garden should not be within 10 feet of the house foundation
  - Gardens should be located at least 25 feet from a septic system drainfield
  - Gardens should not be placed within 25 feet of a well head
  - Make sure to avoid underground utility lines
  - The best location for the garden will be in partial to full sun
  - Rain gardens should be constructed where the water table is at least 2’ below the surface of the soil.

RAIN GARDEN SITE PLACEMENT



SITE SELECTION

SELECT SITE WITH NATURAL DRAINAGE

CHECK SOIL FOR INFILTRATION RATE

- Dig a 12-inch deep hole at the proposed site of your rain garden and fill it completely with water.
- Allow the water to sit for at least an hour so that the soil can saturate.
- Refill the hole so it is full.
- From this point on, observe to see if the water drains into the soil.
- If the water drains within 48 hours, the site is suitable for a rain garden, however it is highly recommended that the soil be amended with compost and sand.
- If the water does not drain in 48 hours, select a different location or amend or replace the soil or install an under drain.
- Run infiltration test more than once to confirm results.

SIZING THE GARDEN AREA

- **Step One: Calculate the square footage of the Impervious Surfaces.**
  - Roof - 50 ft. x 50 ft. = 2500 sq. ft.
  - Driveway - 12 ft. x 20 ft. = 240 sq. ft.
  - Concrete Patio - 15 ft. x 12 ft. = 180 sq. ft.
  - Total impervious surface = 2920 sq. ft. = runoff surface area
- **Step Two: Calculate the square footage of the Pervious Surfaces.**
  - Lawn Area 50 ft. x 30 ft. = 1500 sq. ft.

RUNOFF COEFFICIENT

- Coefficient is a number representing the ability of a surface to absorb water
- A high coefficient indicates an impervious surface such as a roof or concrete driveway
- A low coefficient indicates a surface such as turf grass, which can absorb a significant amount of rain water
- Coefficients must be established for each surface from which runoff will flow into the rain garden.
- If only a portion of a roof will flow to rain garden only that percentage of roof area should be considered.

Simplified Table of Rational Method Runoff Coefficients

Ground Cover	Runoff Coefficient, c
Lawns	0.05 - 0.35
Forest	0.05 - 0.25
Cultivated land	0.08 - 0.41
Meadow	0.1 - 0.5
Parks, cemeteries	0.1 - 0.25
Unimproved areas	0.1 - 0.3
Pasture	0.12 - 0.62
Residential areas	0.3 - 0.75
Business areas	0.5 - 0.95
Industrial areas	0.5 - 0.9
Asphalt streets	0.7 - 0.95
Brick streets	0.7 - 0.85
Roofs	0.75 - 0.95
Concrete streets	0.7 - 0.95

Step Three: Multiply the square footage obtained in Steps One and Two by the appropriate runoff coefficient by 7% of runoff. 7 % = the percentage of the total runoff area

Impervious surfaces = 0.9
Pervious surfaces = .25

2920 sq. ft. (impervious surfaces) x 0.07 (percent of runoff) x 0.9 (runoff value) = 184 sq. ft.

1500 sq. ft. (lawn area) x 0.07 (percent of drainage) x 0.25 (runoff value) = 26 sq. ft.

Add pervious & impervious surfaces = 210 SF

CONSTRUCTION LAYOUT

- Determine area requirement based on runoff calculations
- Stake out garden outline
- Check elevations using grade rod and line level or construction level
- Adjust proposed excavated area to fit topography
- Make a sketch of proposed site and select plants to best suit the design, temperature zone, and degree of sunlight or shade

STEPS TO DESIGN AND CONSTRUCT A RAIN GARDEN

1. Inventory the site for existing plants, under ground utilities, septic system, well, structures
2. Analyze the site (soil conditions, water flow, % of sun light)
3. Determine type of rain garden (underdrain or no underdrain)
4. Design a garden &/or choose a template
   a. Ensure that design layout meshes with the site conditions and topography.
   b. Create a map of what you will plant based on your site and design ideas
   c. Create a list of plants to buy (Plant schedule) and plants to move/reinstall
   d. Determine what soil amendments and/or pipe required

CONSTRUCTION STEPS (CONTINUED)

5. Prepare area (Site Preparation)
    a. Layout the plan on the ground
    b. Excavate and install underdrainage if you are providing underdrains
    c. Add appropriate soil amendments
    d. Edge bed as desired
6. Purchase plants and mulch
7. Layout plants according to the plan; adjust as necessary
8. Install plants
9. Apply mulch
10. Water garden during establishment period and maintain as needed

EXCAVATING RAIN GARDEN AREA

TOWN OF WASHINGTON, VA

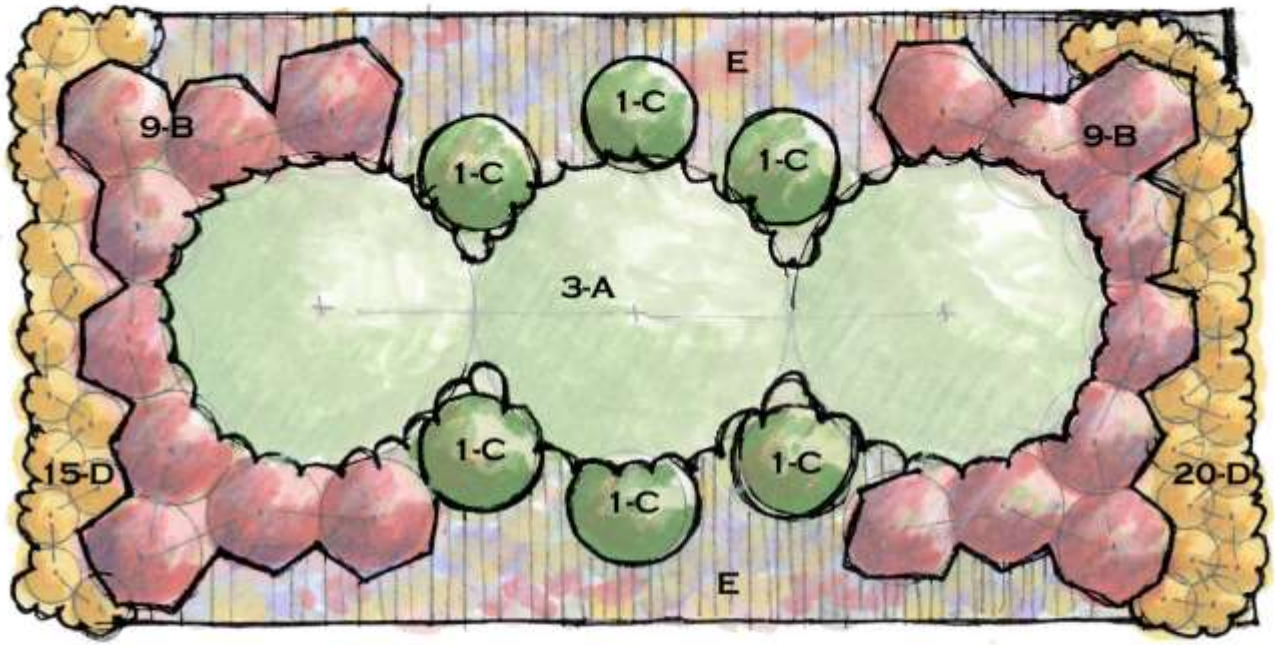
PLANTING CONSIDERATIONS

- Remember, always use native plants
- Select plants from available lists that can tolerate fluctuating levels of soil wetness.
- Plants that can tolerate wet conditions should be planted in areas that retain water over the longest time period.
- Less water tolerant plants should be placed near the edge of the garden or on mounds within the rain garden to elevate the roots above the ponded water level.
- Mulch with 2-3 inches of hardwood mulch.
- Avoid lighter mulches that tend to float

PLANT SELECTION

- **What kind of plants should I use?**
  - Always use native plants
  - Use container-grown plants with a well-established root system
- **What are the best plants for where I live?**
  - Plant species is determined by the type of rain garden and also the amount of available sunlight. Plants that are native to your area should need the least maintenance – they are adapted to the climate
- **Lay out the plants in the garden before planting**

PLANTING LAYOUT AND PLANT TYPES



A - *Ilex opaca* (American Holly), 8' o.c.
B - *Vaccinum corymbosum* (Highbush Blueberry), 3' o.c.
C - *Rhododendron viscosum* (Swamp Azalea), or *Cornus sericea* (Redosier Dogwood),
or *Ilex glabra nana* (Dwarf Inkberry)
D - *Hemerocallis hybrids* (Hybrid daylilies *e.g.* 'Happy Returns'), 12" o.c. or *Phlox subulata* (Thrift), 12" o.c.
E - Wildflower Mix, 85 SF; sample mix:
50% *Rudbeckia hirta* (Black-Eyed Susan)
20% *Echinacea purpurea* (Purple Coneflower),
20% *Liatrus spicata* (Blazing-Star),
10% *Asclepias tuberosa* (Butterfly Weed)

If using plants (vs. seed) for wildflowers, space 18" o.c. (19 -*Rudbeckia*, 8 - *Echinacea*, 8- *Liatrus*, 4 - *Asclepias*) <seeding is lower cost but higher maintenance option due to need for nurturing seedlings>
note: o.c. = on center

The Low Impact Development Center, Inc.

National Fish and Wildlife Foundation

FOR THE BIRDS RAINGARDEN
450 SF
Full Sun-Pt. Shade
All zones
Scale:1/4"=1'

N

0 2 4

PLANT SELECTION

TYPICAL PLANT LIST

- **Perennials**
- Blue Star (3) – *Amsonia tabernaemontana*
- Lady Fern (2) – *Athyrium felix-femina*
- Butterflyweed (1) – *Asclepias tuberosa*
- Swamp Milkweed (3) – *Asclepias incarnata*
- Climbing Aster (3) – *Aster carolinianus*
- False Indigo (1,2) – *Baptisia species*
- Boltonia (3) – *Boltonia asteriodes*
- Turtlehead (3) – *Chelone glabra*
- Green and Gold (2) – *Chrysogonum virginianum*
- Mouse Ear Coreopsis (2) – *Coreopsis auriculata*
- Tickseed (1,2) – *Coreopsis lanceolata*
- Swamp Coreopsis (2) – *Coreopsis rosea*
- Joe Pye Weed (3) – *Eupatorium dubium*
- Swamp Sunflower (3) – *Helianthus angustifolius*
- Swamp Mallow (3) – *Hibiscus moscheutos*
- Texas Star (3) – *Hibiscus coccineus*
- Blue Flag Iris (3) – *Iris virginica*
- Cardinal Flower (3) – *Lobelia cardinalis*
- Cinnamon Fern (3) – *Osmunda cinnamomea*
- Royal Fern (3) – *Osmunda regalis*
- Garden Phlox (2) – *Phlox paniculata*
- Moss Pinks (1,2) – *Phlox subulata*
- Rudbeckia (1,2) – *Rudbeckia fulgida*
- Green Headed Coneflower (3) – *Rudbeckia laciniata*
- Goldenrod (3) – *Solidago rugosa*
- Ironweed (3) – *Vernonia novaboracensis*

TYPICAL PLANT LIST

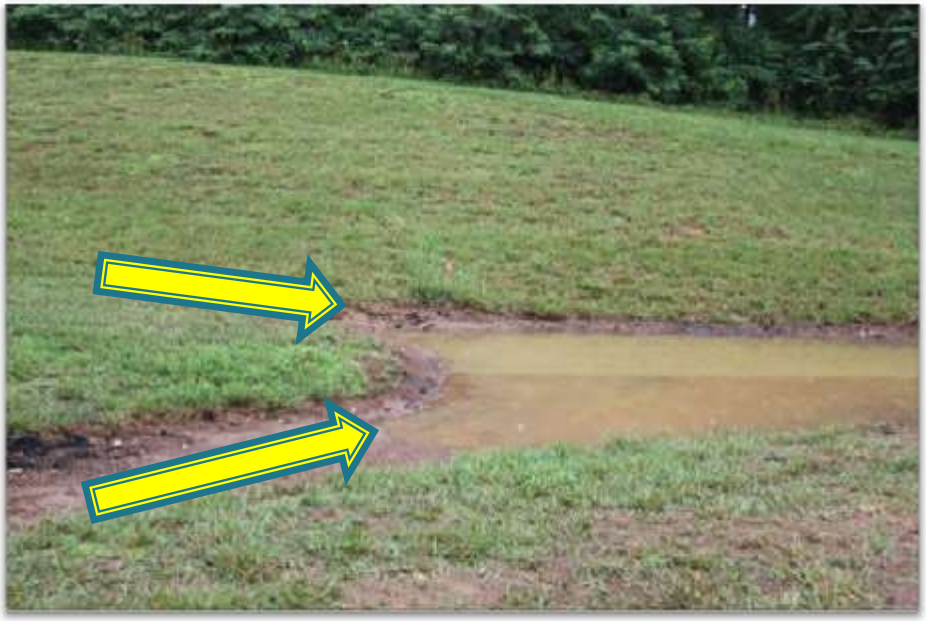
- **Shrubs**
- Chokeberry – *Aronia arbutifolia*
- Beautyberry – *Callicarpa americana*
- Sweet Shrub – *Calycanthus floridus*
- Buttonbush – *Cephalanthus occidentalis*
- Pepperbush – *Clethra alnifolia*
- Strawberry Bush – *Euonymous americanus*
- Winterberry – *Ilex verticillata*
- Virginia Willow – *Itea virginica*
- Spicebush – *Lindera benzion*
- Possumhaw – *Viburnum nudum*

HOW TO PLANT

- Select a variety of plants suited for the hardiness zone of the garden.
- Dig the hole for each plant twice as wide as the plant container and deep enough to keep the crown of the young plant right at the soil line
- Firmly tamp the soil around plant roots to eliminate air pockets.
- Lightly tamp down the soil around the plant to eliminate air pockets.
- Plant water tolerant plants in the deepest area of the garden.
- Place more typical plants around the drier edge areas.
- Water immediately after planting, and then water twice weekly until the plants are well established.
- After the first growing season watering will not be necessary unless there is a lengthy drought.
- Add mulch two inches thick, but avoid burying new plants.
- Remove weeds as required

DIRECTING FLOW TO THE SITE

- Following garden location selection additional water may be diverted to site.
- Flexible plastic pipe can be used to direct water from downspouts and collecting areas to the rain garden.
- Be sure to factor this additional water flow into your garden sizing calculations.



TOO MUCH RAIN CAN RESULT IN LOSS OF GARDEN SOIL

WASH OUT MAY REQUIRE GARDEN REDESIGN OR EXPANSION

ENHANCING GARDEN PERFORMANCE

- For very well drained soils, adding compost to the top layer of the garden will allow plants to establish themselves better and also allow the garden to retain more water. If you have compacted soils, you may add gravel or mulch to improve infiltration, or preferably a backyard wetland may be installed.

GARDEN MAINTENANCE

- On going maintenance is necessary to keep the garden healthy and functioning
- Remove dead vegetation
- Mulch annually
  - Mulching is an important part of rain garden maintenance. Mulch keeps the soil moist, allowing for easy infiltration of rain water. Un-mulched surfaces may develop into a hard, impervious layer.
  - Mulching also protects plants and reduces weed growth. Each spring, rain gardens should be re-mulched with 2-3 inches of hardwood mulch.

TYPICAL MAINTENANCE ACTIVITIES

Activity	Schedule
•Remulch void areas •Treat diseased trees and shrubs •Mow turf areas	As needed
•Water plants daily for 2 weeks	At project completion
•Inspect soil and repair eroded areas •Remove litter and debris	Monthly
•Remove and replace dead and diseased vegetation	Twice per year
•Add mulch •Replace tree stakes and wires	Once per year

Source: EPA .ETA and Biohabitats, 1993)

SOURCE MATERIALS CREDIT

- Virginia Department of Forestry
- EPA - Native Landscaping
- Rutgers Cooperative Research & Extension, (NJAES)
- Rain Garden Network
- Chesapeake Bay Foundation

ADDITIONAL RESOURCES

Potomac Watershed Partnership
http://www.potomacwatershed.net/
Virginia Department of Forestry
http://www.dof.virginia.gov/
Chesapeake Bay Foundation
http://www.cbf.org/
Virginia Native Plant Society
Has a list of nurseries that carry native plants.
http://www.vnps.org/
Department of Conservation and Recreation
"Native Plants for Conservation, Restoration and Landscaping"
http://www.dcr.virginia.gov/natural_heritage/nativeplants.shtml
Blue Ridge Community College
http://www1.brcc.edu/murray/research/Rain_Garden/default.htm
Virginia Tech Soil Sampling Laboratory
http://www.ext.vt.edu/pubs/compost/452-129/452-129.html#toc
http://www.ext.vt.edu/pubs/waterquality/426-043/426-043.html
Virginia Cooperative Extension
http://www.ext.vt.edu/resources/
EPA Native Landscaping
http://www.epa.gov/greenacres/
Additional Rain Garden Web sites
http://www.urbanwaterquality.org/RainGardens/rgindex1.htm

FINAL THOUGHT

"Restoring a national treasure like the Chesapeake Bay and its thousands of miles of rivers and streams is a large and important effort. It requires governments, businesses, and individuals—each of us—to do our part. We need to cooperate and reduce pollution from all sectors—agriculture, wastewater treatment plants, and air. Certainly, controlling urban and suburban polluted runoff should be a top priority".

Cheasapeake Bay Foundation – Polluted Runoff 2014

Questions?

Community Connections

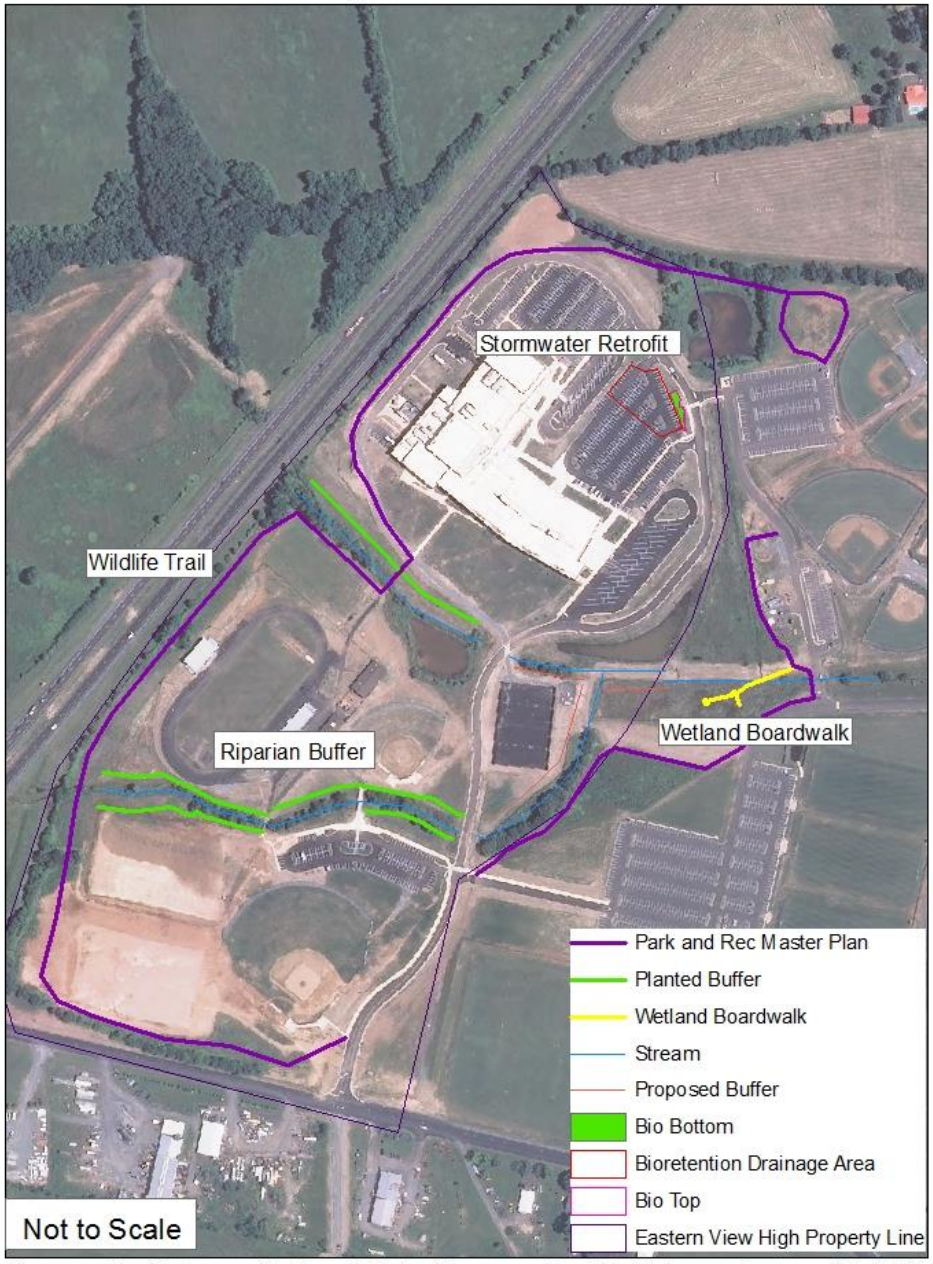
Making Wetlands Accessible to All

Main Partners

CULPEPER SOIL AND WATER
CONSERVATION DISTRICT

Live here. Play here.
CULPEPER COUNTY
PARKS & RECREATION

Eastern View High School Outdoor Classroom

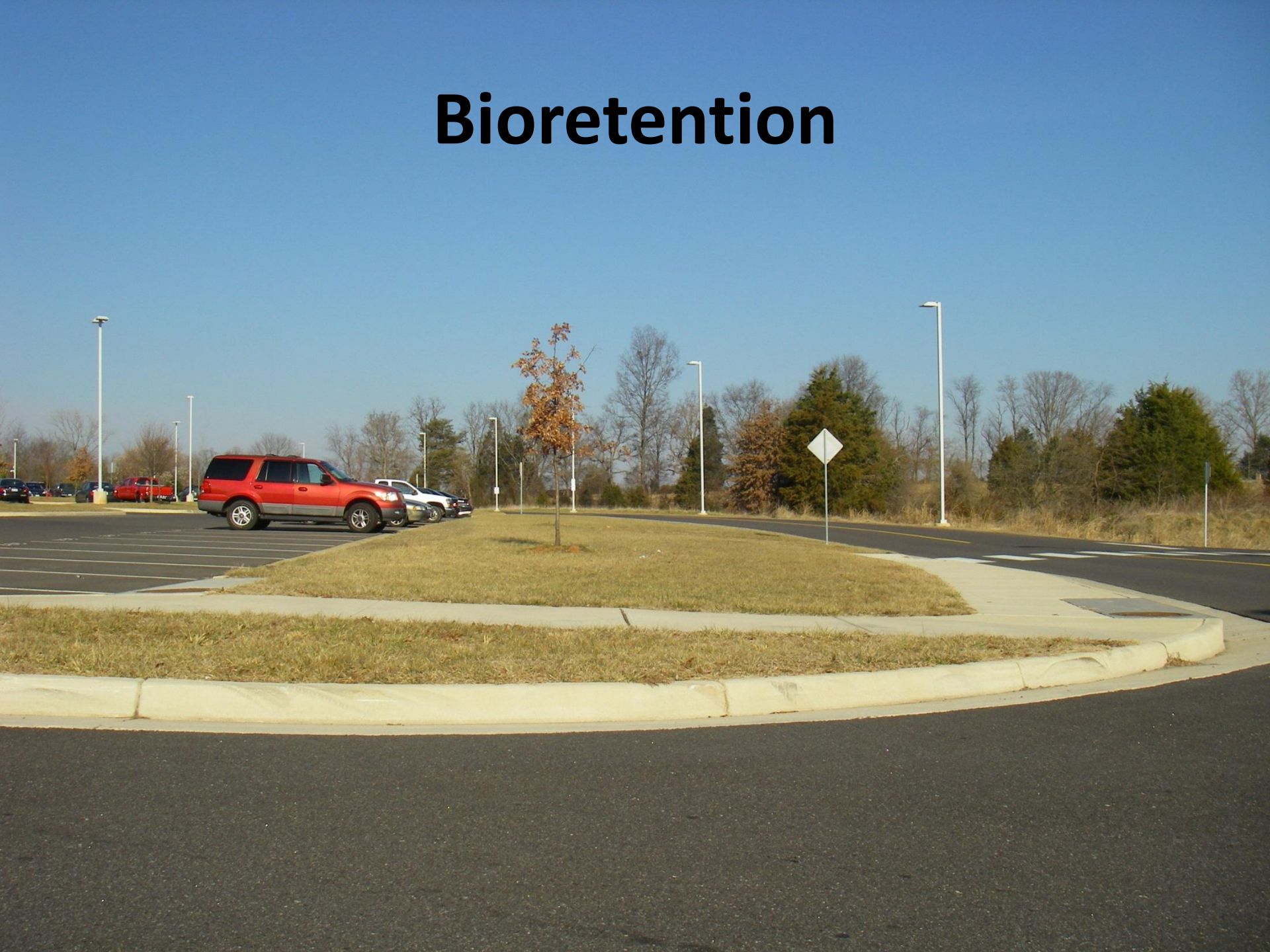


Prepared by Culpeper Soil and Water Conservation District January 10, 2011

Funding

- Virginia Dept. of Forestry
- National Fish & Wildlife Foundation
- Dept. of Environmental Quality
- Vaughn Bassett

Bioretention



Raingarden during construction

Outdoor Classroom at EVHS

Courtesy of the Star Exponent

Additional Partners

Virginia Department of Game and Inland Fisheries

VIRGINIA DEPARTMENT OF FORESTRY

ENVIROTHON

Audubon

PIEDMONT ENVIRONMENTAL COUNCIL
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VIRGINIA STATE UNIVERSITY

Vaughan-Bassett
furniture company

Virginia Naturally

DEQ
Virginia Department of Environmental Quality

NRCS Natural Resources Conservation Service

Virginia Master Naturalist

Virginia Master Gardener Program

Wetsel Middle School

- Madison, VA
- Had a flooding and sediment issue
- Converted part of the parking lot into a raingarden

Virginia Conservation Assistance Program (VCAP)

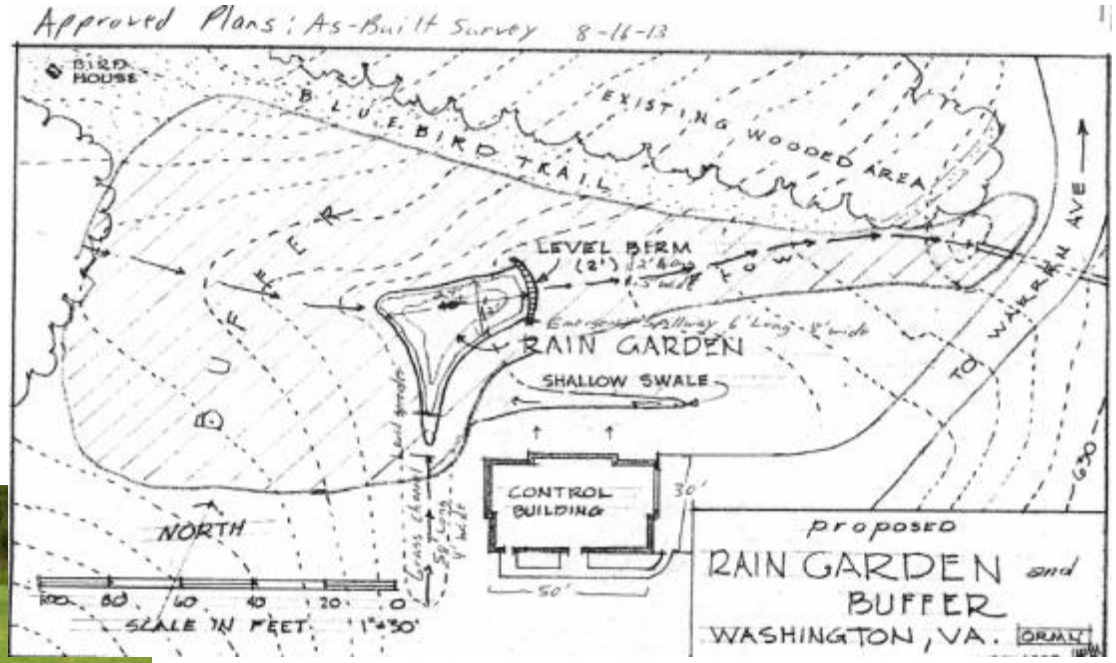
Financial Incentive Program for Residential and Commercial Properties

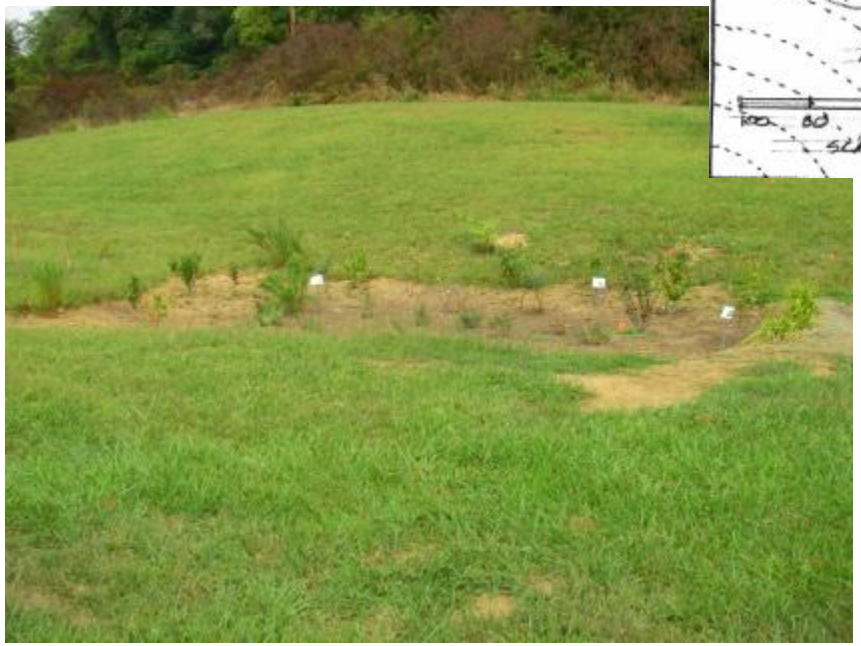
Pet Waste Station

Culpeper Sports Complex 2013

Lake of the Woods
Keaton Lake Beach 2013

Town Washington WWTP



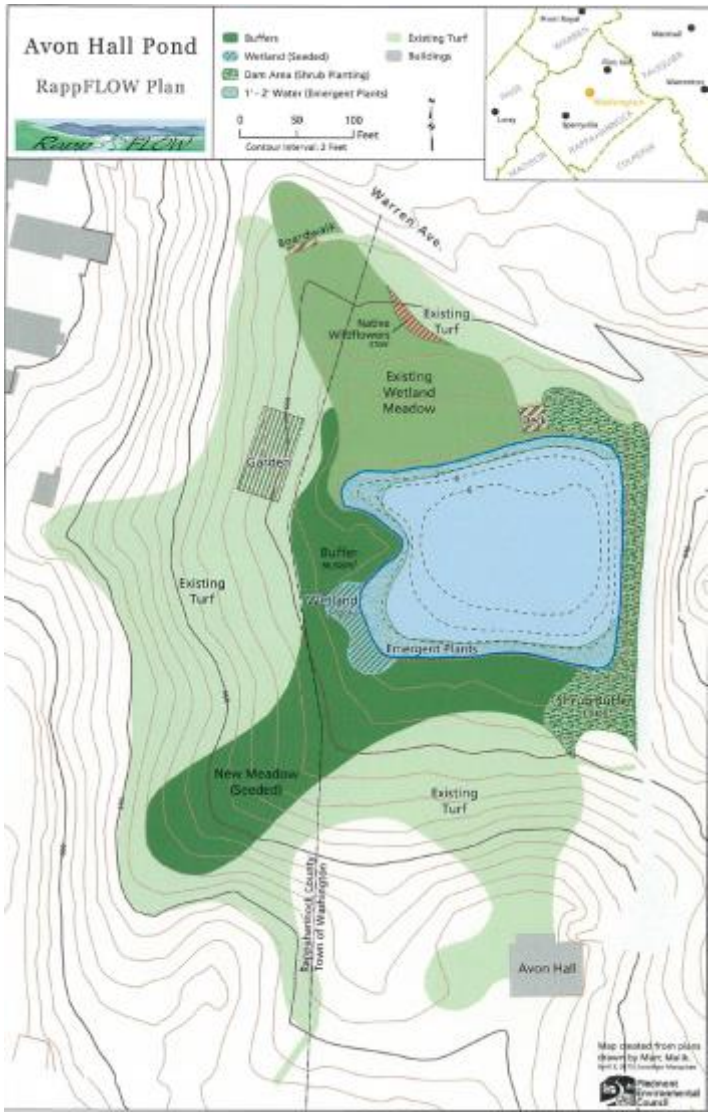


September 2013

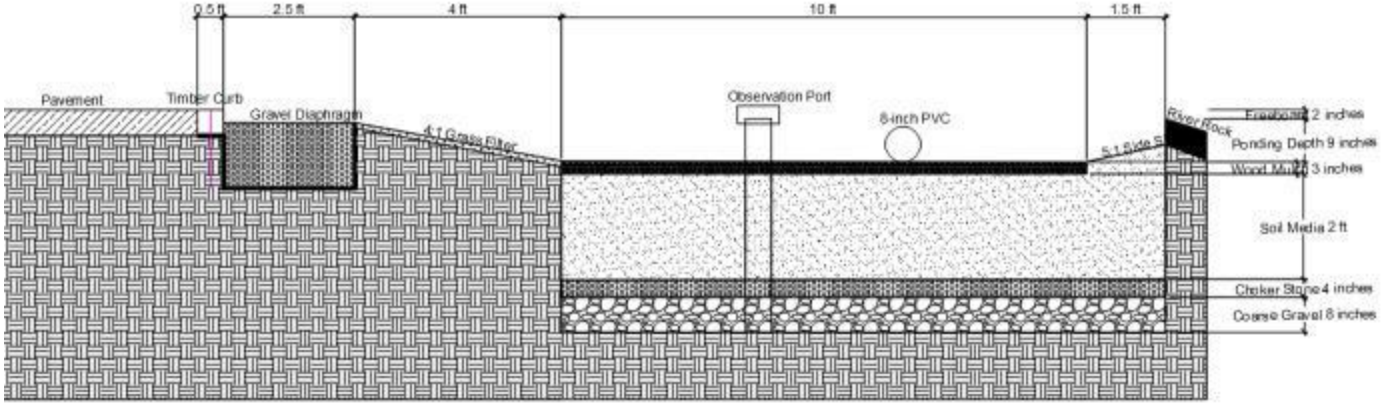
Avon Hall

September 2013

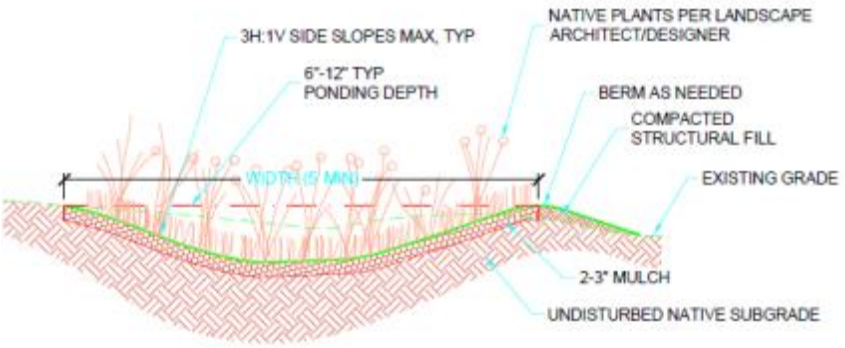
October 2014



Wetsel Middle School



Pearl Sample Elementary



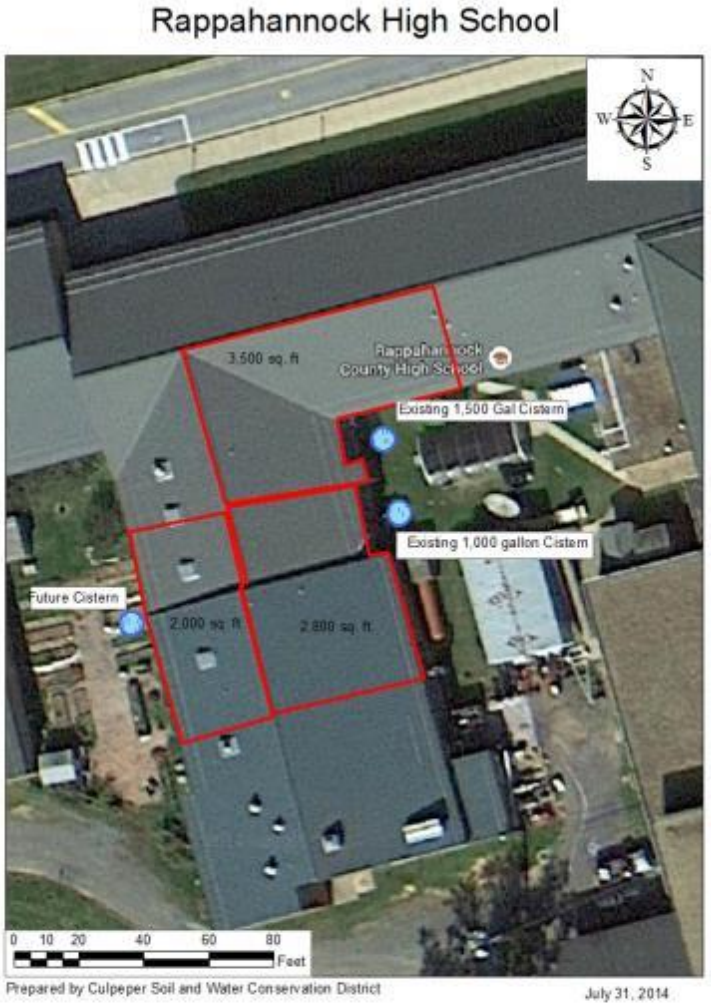
Lake of the Woods Association

Virginia Environmental Endowment

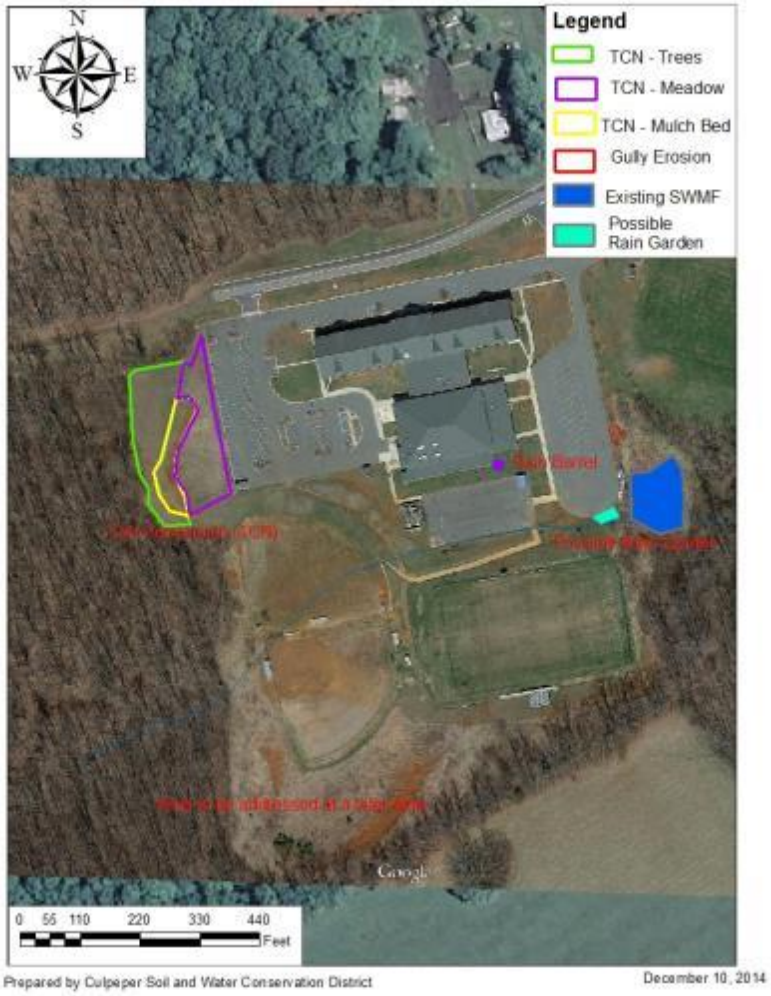
NFWF

Gordon-Barbour Elementary

Rappahannock High School

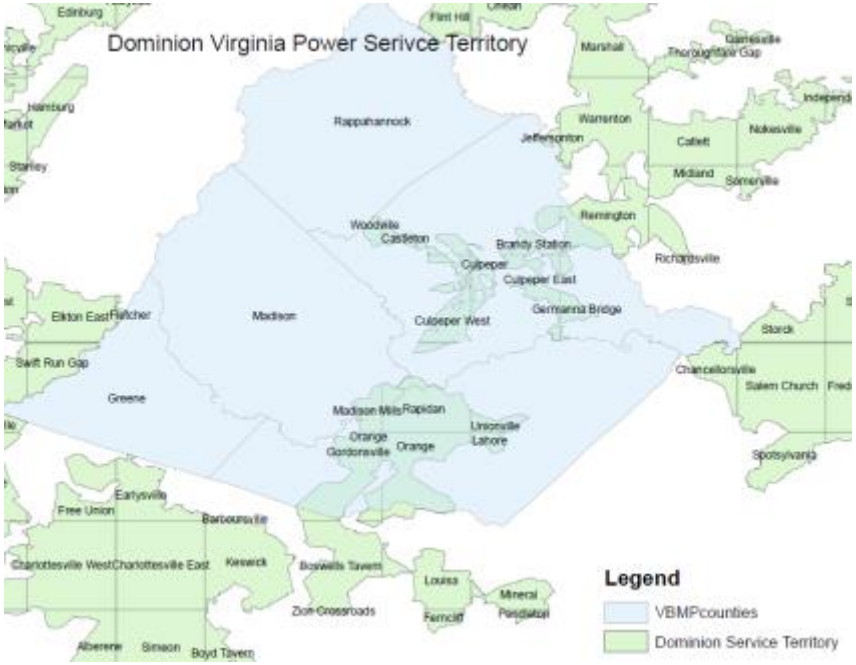


Prospect Heights Middle School



Future Opportunities

- Dominion Power Grant
- Chesapeake Bay Restoration Fund
- DCR Nutrient Management Grant
- DEQ York River Basin Grant



Questions?

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