



CASE STUDY:

RESIDENTIAL RAIN GARDEN
DESIGN AND
CONSTRUCTION

COUNTY REGULATIONS

WRITE DPWES DIRECTOR FOR PERMISSION PRIOR TO BUILDING RAIN GARDEN

- Chapter 118 (*Chesapeake Bay Preservation Ordinance*)
 - » Safe Approach – No disturbance in a Resource Protection Area (RPA)
- Fairfax County Code
 - » Chapter 104 (*Erosion and Sediment Control*)
 - Rain gardens are exempt if land disturbance is < 2,500 sf, per 104-1-7(m)(1 & 10), and not in RPAs.
- Fairfax County Public Facilities Manual
 - » Section 6-0202.3 (*Storm Drainage*)
 - Requires that discharges from a development site be discharged into a receiving channel that will contain the 2-year storm event within its bed and banks at nonerosive velocities or, if not possible due to existing conditions, demonstrate no adverse impact and a proportional improvement.
 - *It is ridiculous to apply this regulation to rain gardens (should allow level spreaders or provide a small drainage area exemption).*
- Fairfax County Zoning Ordinances
 - » Section 2-601 (Paragraphs 1 & 2) (*Land Regulations*)
 - Only allows the removal and/or addition of sod & soil up to a depth of 18” if disturbance is less than 2,500 sf.
 - Allows for the removal of soil from a floodplain, according to the above restrictions. No addition of soils is allowed, unless applicant provides verification that no increase to 100-yr water surface elevation occurs. (NOTE: Major floodplains are also RPAs, so NO disturbance)
 - Requires approved grading plan if greater than 2,500 sf of disturbance.
 - » Section 2-602 (Paragraphs 1 - 4)
 - No changes in natural drainage channels, and no filling or change in contours within any floodplain, wetland or RPA (unless approved per Chapter 118 of the Fairfax County Code)
 - » Section 2-903 (Paragraph 7) (*Floodplain Regulations*)
 - No disturbance in major floodplains (> 360 acres) without a special exemption.
 - » Section 17-103, 104 (*Site Plans*)
 - If your property is a type that requires a site plan (in lieu of a single family subdivision plan) such as a townhouse, condominium, office, etc. the 2,500 sf becomes 250 sf!

WHERE ARE YOU ALLOWED TO BUILD A RAIN GARDEN WITHOUT A PLAN SUBMISSION?

As long as it:

1. Is not in an RPA
 - » *Fairfax County Code Chapter 118*
2. Does not disturb more than 2,500 sf on a single family detached home lot
 - » *Fairfax County Code 104-1-7(m)(1&10)*
3. Does not disturb more than 250 sf everywhere else
 - » *Fairfax County Zoning Ordinance Section 17-104*
4. Does not have a depth greater than 18" and area of disturbance greater than 2,500 sf
 - » *Fairfax County Zoning Ordinance Section 2-601 (18" is an interpretation issue)*
5. Does not alter natural drainage or contours in any floodplain, wetland or RPA (without special exemption)
 - » *Fairfax County Zoning Ordinance Section 2-602*

And, remember:

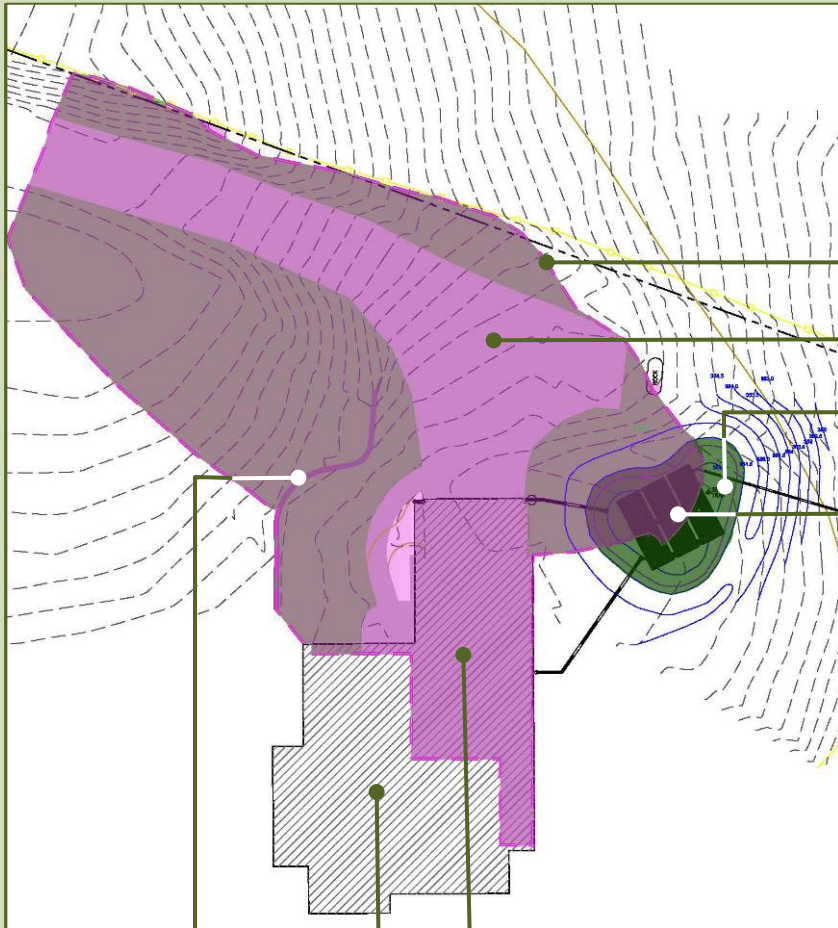
- All disturbances must provide adequate outfall for underdrains and overflow.
 - » *Fairfax County Public Facilities Manual Section 6-0202.3*
- **To be safe, ALWAYS write DPWES Director for permission prior to building rain garden!**

WATERSHED CONDITIONS

- 0.24 acre (10,448 sf) Drainage Area
 - » 0.10 acre (4,470 sf) Impervious Cover
 - 70% house & porch
 - 30% driveway & sidewalks
- Clay Soils
 - » $k_{\text{sat}} = 5.55 \text{ E}^{-7} \text{ cm/s}$



SITE PLAN



Rain garden drainage area - 0.24 acres (10,448 sf)

Impervious area (drive, house) - 0.1 acres (4,470 sf)

Rain garden footprint (565 ft²)

Storm chambers

Outdoor patio and portion of house drains to this rain garden

Portion of house drains to 2nd rain garden

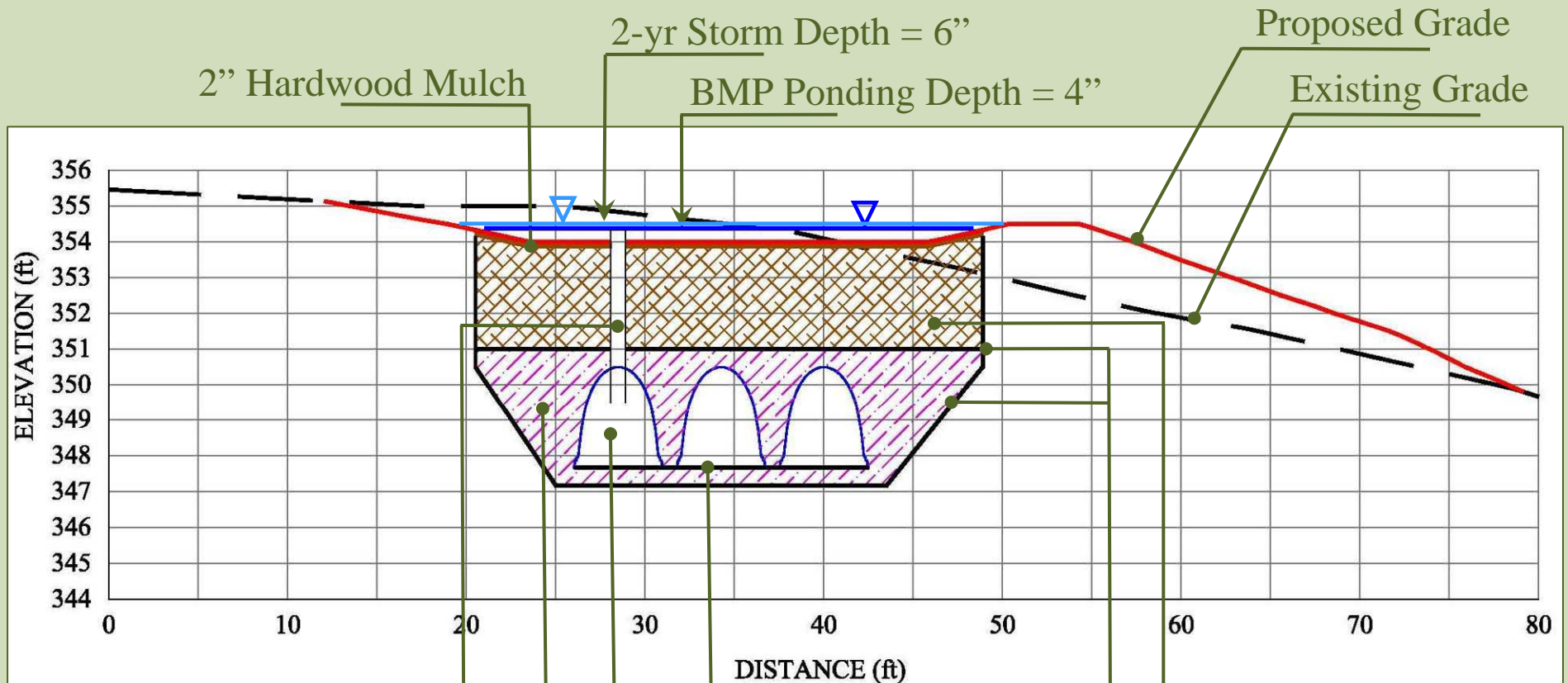
Retaining Wall



Wetland

Studies and Solutions, Inc.

RAIN GARDEN CROSS SECTION



5 LF 10" SCH. 40 PVC Pipe
with 10" Agridrain collar &
grate (set 4" above cell floor)

3.83' Rock Fill (dia 1"-2")

Stabilization Netting

Storm Chambers (Typical)

3' Bioretion Soil Mix

Nonwoven Filter Fabric

DESIGN CRITERIA

1. Water Quality Control (BMP)

- » Footprint captures 1/2" runoff from impervious areas
 - Maximum 4" ponding depth improves bio-diversity (many use 6-12")

2. Water Quantity Control (1" outflow orifice)

- » Runoff Volume
 - Exceeds "energy balance" requirements
- » Peak Flow Rate
 - Provides 7-hr detention for 1-yr storm
 - 0.4" outflow orifice required for 24-hr detention
 - Reduces pre-development 2-year rate by 82%
- » Assume no infiltration in underlying soil

3. Adequate Overland Relief (Structure flooding)

- » 100-year storm confirmed

4. Confirm planting media infiltration

- » Bioretention soil mix testing



Wetland

Studies and Solutions, Inc.

BIORETENTION SOIL MIX TESTING

(WITH STONE & NON-
WOVEN FILTER FABRIC)



RAIN GARDEN CONSTRUCTION

EXCAVATION & SITE GRADING



INSTALLING STORM CHAMBERS (WITH INLETS)



1 – 2” CRUSHED STONE



INSTALLING FILTER FABRIC



Wetland
Studies and Solutions, Inc.

BIO-RETENTION SOIL MIX



Wetland
Studies and Solutions, Inc.

OUTLET PIPE & EROSION CONTROL



Wetland
Studies and Solutions, Inc.

TESTING ...IT WORKS!





PLANT INSTALLATION (IN THE RAIN...)



LANDSCAPING



Wetland
Studies and Solutions, Inc.

LET IT RAIN!



RAIN GARDEN STORAGE VS. RAIN BARREL STORAGE

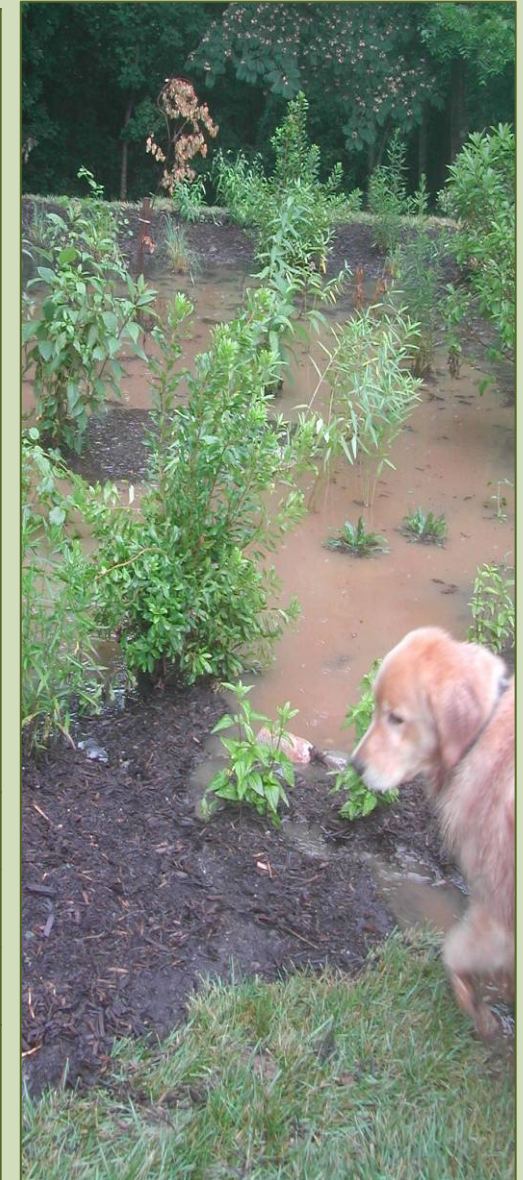


- **Rain Garden Storage** **968 ft³**
 - » Storm Chamber Volume 450 ft³
 - » Rock Void Volume 518 ft³
 - (1" - 2" dia, 40% voids)
- **Rain Barrel Storage** **14.8 ft³**
 - » 55 gallons (7.4 ft³)
 - » (if empty!)



COST ESTIMATE

ITEM	QTY	UNIT	UNIT COST	TOTAL COST
DESIGN & SURVEY	---	Lump Sum	\$12,500.00	\$12,500
CONSTRUCTION				
MATERIALS				
- E&S Controls	---	Lump Sum	\$140.00	\$140
- Storm Chambers	6	Each	\$350.00	\$2,100
- Pipe	---	Lump Sum	\$1,100.00	\$1,100
- Filter Fabric	1,460	Sq ft	\$0.10	\$150
- Stone	70	Tons	\$15.00	\$1,025
- Bioretention Soils	60	Cu yd	\$50.00	\$3,000
- Mulch	10	Cu yd	\$33.00	\$330
- Misc. Hardware	---	Lump Sum	\$250.00	\$250
LABOR				
BOBCAT	40	Hours	\$27.50	\$1,100
PLANTING				
Materials	---	Lump Sum	\$1,650.00	\$1,650
Labor	---	Lump Sum	\$2,800.00	\$2,800
TOTAL				\$38,845





www.wetlandstudies.com

Wetland

Studies and Solutions, Inc.