



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

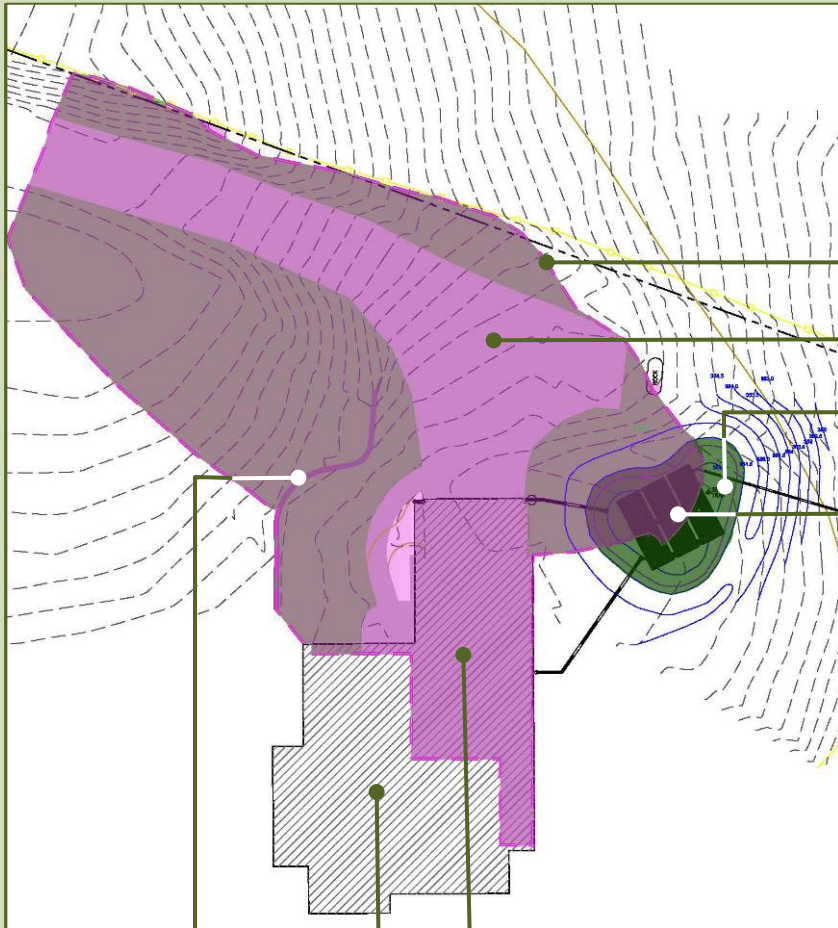
- 0.24 acre (10,448 sf) Drainage Area
 - » 0.10 acre (4,470 sf) Impervious Cover
 - 70% house & porch
 - 30% driveway & sidewalks
- Clay Soils
 - » $k_{\text{sat}} = 5.55 \text{ E}^{-7} \text{ cm/s}$



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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

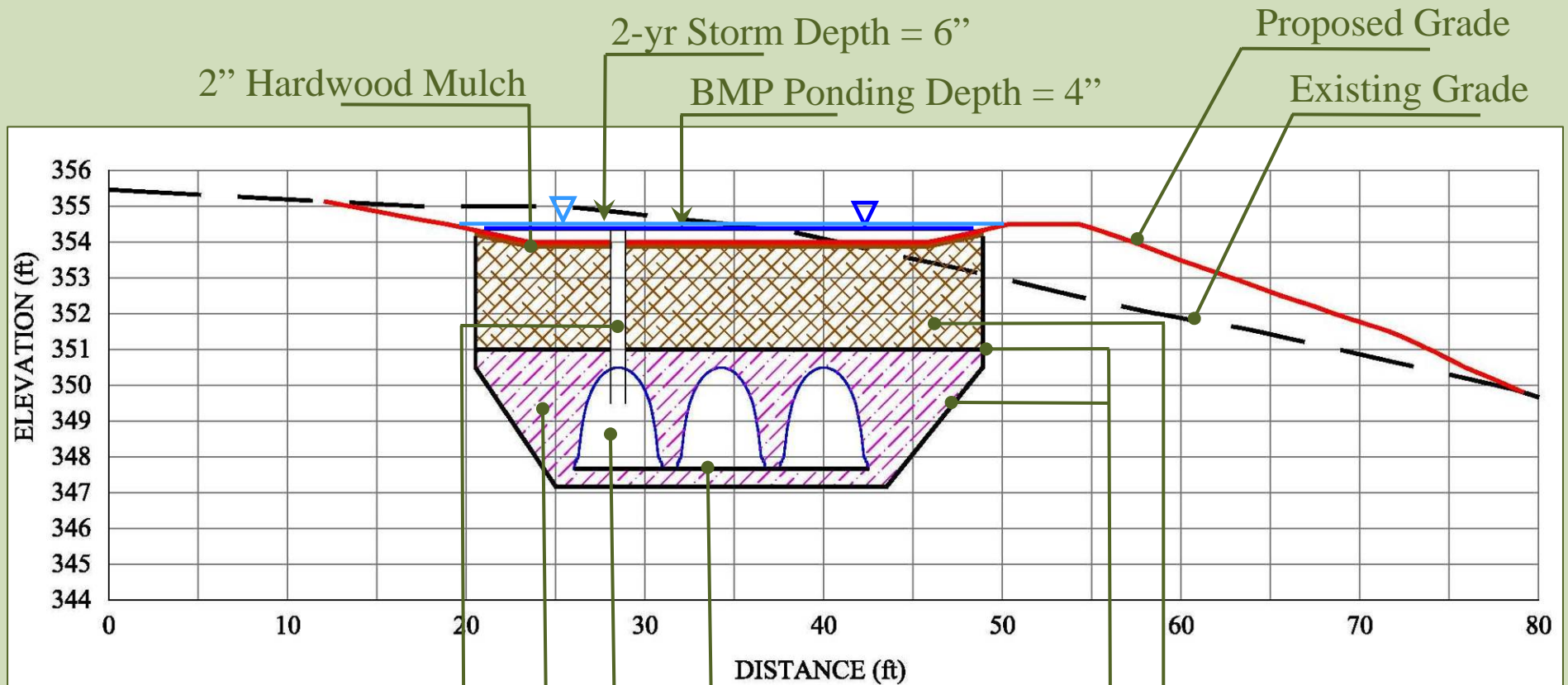
Retaining Wall



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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' Bioentention Soil Mix

Nonwoven Filter Fabric

DESIGN CRITERIA

1. Water Quality Control (BMP)

- » Footprint captures ½” 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



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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



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BIO-RETENTION SOIL MIX



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OUTLET PIPE & EROSION CONTROL



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TESTING ...IT WORKS!





PLANT INSTALLATION (IN THE RAIN...)



LANDSCAPING



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LET IT RAIN!



RAIN GARDEN STORAGE VS. RAIN BARREL STORAGE

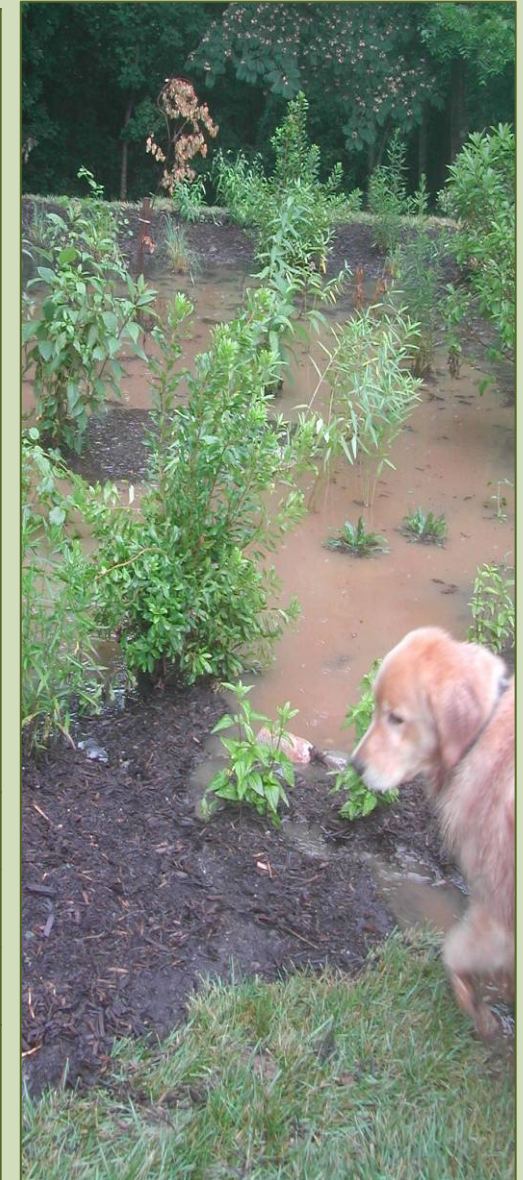


- **Rain Garden Storage** **968 ft³**
 - » Storm Chamber Volume 450 ft³
 - » Rock Void Volume 518 ft³
 - (1" - 2" dia, 40% voids)
- **Rain Barrel Storage** **14.8 ft³**
 - » 55 gallons (7.4 ft³)
 - » (if empty!)



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	---	Lump Sum	\$12,700.00	\$12,700
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





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