Analyzing the Bioretention Construction Sequence

Avoiding future problems through careful installation procedures, construction inspection and first year maintenance

20 Steps to Better Bioretention
Step 1: Protect Bioretention Areas During Construction

Don’t start installation until site is built out and pervious areas are stabilized

Keep construction equipment out of open bioretention sites
Should Bioretention Areas be used as ESC Traps During Construction?

Yes, for closed bioretention systems
No, for open bioretention systems
SILT TRAP CONVERSION TO BIOFILTER

PROFILE

FIELD EXISTING WET STORAGE

SOIL MIX (2):
50% SAND
30% TOPSOIL
20% LEAF COMPOST

PEA GRAVEL (#3)

#78 STONE

UNDERDRAIN GRAVEL TO SAPROLITE (VARIABLE)

#57 STONE

rip / till subsoil - 24"

DEEP ROCK DITCH ALONG CONTOUR - 1.5' #57 STONE ON TOP OF 0.5' #78 STONE - CAPPED WITH RIVER STONE

UNDERDRAIN PIPE TO DAYLIGHT @ 1% SLOPE (MIN. PERFORATED BELOW BIOFILTER; NON-PERFORATED)

4"-20 SLOT WELL SCREEN FOR PERFORATED SECTION
40 PVC FOR NON-PERFORATED SECTIONS

WILDLIFE PRESERVE, RIPARIAN BUFFER AND/OR NATURAL SWALE (TYP.)

TRANSITION ZONE (SEE PERFORMANCE STANDARDS)

MULCH PLANTING STRIP (VARIABLE SHAPE) = 600 SF

PLANT WITH GROUNDCOVER, SHRUBS AND TREES AS PER LANDSCAPE / NURSERY PROFESSIONAL

YARD DRAINAGE

HOUSE (TYP.)

PLAN VIEW

* LOTS 7-11: RIPARIAN BUFFER ALONG TRIBUTARY STREAM
LOTS 12-15, 18-21, 27-35: TRANSITION ZONE TO WILDLIFE PRESERVE

Check Dam

New Weir to 1' Above Soil Media Capped with River Stone

New Berm Elevation to 1' Above Weir

Boulder Outlet Protection (See Detail)

Soil Mix (2):
50% Sand
30% Topsoil
20% Leaf Compost

Deep Rock Ditch Along Contour - 1.5' #57 Stone on Top of 0.5' #78 Stone, Capped with River Stone

Filter Fabric (Sides Only)

Biofilter

Boulder Outlet Protection (See Detail)
Step 2: Make Sure the Original Design Still Works*

Make sure to study the soil borings

Verify the actual contributing drainage area boundaries

Confirm inlet and outlet elevations

* Subtle changes in grading, paving and drainage can really screw up an otherwise fine design
Step 3: Excavate From the Side

Prevent compaction of the precious bottom by keeping heavy equipment on the outside.

For larger bioretention areas use a cell construction approach- break it into 500 to 1000 sf temporary cells with earth bridges between.
Step 4: Implement Project ESC Controls

A single storm can ruin your project
Bioretention ESC Tips

• Block inlets to off-line bioretention cells

• Temporary diversion for on-line cells

• Rapidly stabilize cut side-slopes

• Temporary sheeting

• Cell Construction

• Work fast!
Step 5 Protect the Bottom

Make sure bottom is level

Rip soils to maintain porosity

Add Sandwich or Stonewich
Step 6 Install Filter fabric on Sides Only

Roll by Hand

Access Ramp
Step 7 Lay Down Stone Layer

Clean washed stone

Depth depends on design

Choker layer of pea gravel
Step 8 Install Underdrain, if Needed

Determine how efficient your drains will be

Provide at least 0.5% positive drainage

Make sure correct ends are capped

Set vertical cleanout pipes*
Step 9 Add Filter Media

Make sure pre-mix meets standards, add in one foot lifts, allow for 10% settlement, rake out to final ponding depth a few days later.
Step 10 Lay Down Surface Cover

- Mulch, turf or stone
- Inspect thickness of layer
- Make sure ponding depth is within 9 to 12” range
Step 11 Establish Final Elevations and Dig Planting Holes

- Match plants to correct places
- 3 foot deep holes for trees (away from underdrains)
- Stake planting locations
Step 12 Install Landscaping Materials

- Post nursery care is critical
- Make sure water is available
- Stake trees if sand media used
- Initial spot fertilization
Step 13 Stabilize Perimeter Side Slopes and Buffer

Make sure these vulnerable areas are protected by silt fences, geotextiles, and/or hydroseeding
Step 14 Construction Inspection

Critical Inspection Points

• Ready to Install?
• Inverts/Elevations
• Inlets/Curb Cuts
• Underdrain (pipe material, perforations)
• Filter media
• Side Slope Grading
• Secondary E&S Measures
• Plants
Step 15 First Growing Season Maintenance

Regular watering first few months
Spot re-seeding
Remove/replace dead plants
Remove sediment accumulation at inlets
Repair erosion on sideslopes
Step 16 Final Construction Inspection

- 6 to 12 months after installation
- Inspect after a decent storm
- Last chance to reinforce plantings
Step 17 Facility Acceptance

Make sure it's working well before releasing performance bond.

Log it in to local maintenance tracking system.
Step 18 Bioretention Rehabilitation

Do Not Pass Go, until You Fix the Mistakes
Step 19 Bioretention Maintenance

Maintenance = Vegetation Management
KEEPING THINGS ON THE LEVEL
Source: Friends of the Rappahannock