Section 3.8 Bioretention (BR)

Bioretention is a shallow landscaped depression that temporarily allows runoff to pond and then filter through an engineered soil media prior to being discharged to an underdrain or absorbing into the underlying soil. Bioretention provides both runoff reduction and pollutant removal.

A. Purpose

- This practice is intended to treat runoff from single lots, multiple lots and/or commercial rooftops.
- Should be located in common areas or within drainage easements, to treat a combination of roadway and lot runoff.

B. Site Criteria

- Drainage area shall be less than 2 acres. The impervious portion of the drainage area shall be greater than 2,500 SF. Drainage area must include impervious surfaces.
- If contributing drainage area is less than 0.5 acres, see Rain Garden (practice 3.4)
- Cannot be placed on wetland soils.
- Cannot be placed within the areas designated as the FEMA 100-year flood plain, 1% annual chance flood plain, or by the locality as within the 100-year flood plain, whichever is most stringent.
- Depth to water table and bedrock should be greater than 2 feet below the bottom of the practice. Coastal areas or areas with seasonal high water table can have a 1-foot separation if equipped with a large-diameter underdrain. See Stormwater Handbook on Bioretention.
- If the seasonal high water table is identified as a potential concern based on field or desktop analysis, it should be verified by a professional soil scientist (Contact Extension, NRCS, or Society of Professional Soil Scientists for local providers).
- The site does not need subsoils capable of absorbing stormwater runoff (infiltration rate < 0.25 inches/hour) when an underdrain and outfall, designed to meet program criteria, are used. See Design Criteria for details.
- Steep slopes may utilize low-profile (less than 3 feet) block retaining walls. Low permeability geotextile fabric and a footer drain shall be used behind the wall.
- Shall be 10 feet from foundations (including basement and crawl space walls, slabs on grade), greater if upgradient. May not be appropriate where there is significant risk for basement seepage. See the Virginia Stormwater Handbook for setback details.
- Impact on septic drain fields should be evaluated prior to application submission. Consult local setback requirements.

C. Design Criteria

- Level 1 without an underdrain is considered a baseline design. Level 2 is required when the infiltration rate of the native soils is less than 0.5 inches/hour. If a Level 2 design is required by the infiltration rate, refer to the Virginia Stormwater Management Handbook for design criteria. All further design criteria refer to a Level 1 design.
- Shall be sized to capture the 1-inch volume of runoff based on the contributing drainage area, corresponding runoff value and storage depth (See Appendix A.1 for Calculations).
- Ponded water should be retained no longer than 48 hours. Ensure design includes the appropriate numbers of adequately sized underdrain pipes to meet this residence time. Minimum underdrain pipe diameter shall be 4 inches. Underdrain pipe shall be dual walled HDPE, schedule 40 PVC, or equivalent. A cleanout port must be provided at the end of the underdrain.
  Must have engineered soil media of 80-90% sand by volume; 10-20 % soil fines by volume; and 3-5% leaf compost by weight. For simplification, the soil media could be made (DIY) from a Sand-Soil-Leaf Compost ratio of 4:1:3 by volume. The engineered soil media must be clean (free from debris and weed seeds) and homogenous or well-mixed. Test datasheet should be provided by vendor.
- The engineered soil media should have a minimum depth of 24 inches and a maximum depth of 48 inches.
- Ponding depth can range from 3 to 12 inches, with 6 inches being typical. The ponding depth should be based on site conditions and plant tolerances.
- Optional gravel layer should be composed of at least 3 inches of choker stone (VDOT #8 or pea gravel) over a layer of clean and washed gravel (VDOT #5 or #57).
- Appropriate pretreatment practices for each inlet shall be provided. Typical pretreatment for this practice includes gravel diaphragm or forebay. See Appendix B for options.
- Adequate conveyance of stormwater into and out of the practice shall be in accordance with procedures outlined in Appendix A.3 of this manual.
- Design the overflow system to control flows associated with the 2- and 10-year design storms so that velocities are non-erosive at the outlet point.
- The outlet device should be designed to pass flows greater than the treatment volume and/or equal to the 100-year storm event. See Calculations in Appendix A.2.
- Minimum planting density of 75% shall be achieved within two years of installation. Required density and minimum ground covers for all plantings will be based on mature size of approved species.
- Plant species must be considered native or nativity uncertain by the *Flora of Virginia.* Annual plants and harvestable vegetables are not allowed in the landscape plan and are not eligible for cost share. See Helpful Technical References.

Suggested Spacing	
Perennials	1-2 feet
Grasses	2-3 feet
Small Shrubs (<6 feet)	3-5 feet
Large Shrubs (> 6 feet)	6-8 feet
Small Trees (< 25 feet)	25 feet
Medium Trees (<40 feet)	30 feet
Large Trees (> 40 feet)	35 feet

D. Design Plan Components

- A design plan with a professional seal must be submitted by the applicant; or a waiver of liability may be accepted on a case-by-case basis (Form 5). The district must be notified of any proposed changes to the approved design. Changes to the approved design may jeopardize cost share reimbursement. The Steering Committee has discretion to approve or deny cost share reimbursement in the event of design changes.
- Information required in the design plan includes (see VCAP Submission Checklist for a comprehensive list):
  - Soil map and/or a soil assessment indicating water table and bedrock depths and other limiting factors.
  - Infiltration test results.
  - Sizing calculations for the practice and outlet structure (See Calculations in Appendix A)

- Landscape including: species, rate of seeding or planting density, minimum quantity and sizing of planting stock, and method of establishment. Only viable, high-quality seed or planting stock should be used. Plant list can include the common plant name but must include the scientific name.
    a. Planting list must include the complete scientific name (genus and species) and common name of the plant species. For example, *Cornus florida*, flowering dogwood or *Itea virginica* "Little Henry", Virginia Sweetspire.
- A statement regarding compliance with any permitting requirements or local codes.
- Other information as requested by the local District.

- Verification by a licensed professional may be required by the District to confirm practice installation per the approved design.
- It is the VCAP participant's responsibility to ensure that any contractors meet all local codes and responsibilities.

E. Operation and Maintenance

- First year maintenance will include:
    - Weekly watering during the growing season, as necessary to ensure survival.
    - Stabilizing bare or eroding areas.
    - Replace dead, dying or diseased plants.
    - Removal of unwanted and invasive plant species.
- Annual Routine Maintenance
    - Spot weeding, erosion repair, and removal of trash, debris, and invasive species at least twice a year or as needed.
    - Replace dead, dying or diseased plants as necessary.
    - Cut back perennials as needed in early spring.
    - Prune shrubs and trees as needed in late winter. Spring flowering shrubs may be pruned lightly in mid-summer.
    - Supplement wood mulch to maintain consistent depth.
- Maintain all structural components of the practice--such as inlets, pretreatments and outlets—in good working order.
- All vegetated areas that drain to the practice must be maintained in full vegetative cover (>75%) with no scour areas.
- Applying fertilizer after vegetation has been established is prohibited in keeping with the VCAP goal of reducing nutrient pollution.

F. Cost-Share Rates/Incentives

- See District Guide to VCAP for practice cost-share rates and caps.
- Cost-share for the removal of invasive species is only allowable within the footprint of the bioretention. Invasive species removal outside of the footprint of the bioretention is not eligible for cost-share and is to be addressed in the Operation and Maintenance Plan. Invasive or noxious species are identified by the DCR invasive species list and/or the USDA noxious weed list.
- Eligible costs may include: excavation, grading, installation costs (backfill, planting/seeding), plant material, engineered soil media, stone, geotextile fabric, erosion and sediment control when necessary, mulch, pre-treatment costs, underdrain costs, outlet/overflow structure.

G. Technical References

- Virginia Stormwater Management Handbook, Version 1.0. 2024. Virginia Department of Environmental Quality.
- Virginia Cooperative Extension. Urban Water-Quality Management: Rain Garden Plants. 2015. 426-043.
- RainScapes Planting Designs for Rain Gardens, 2020 edition, RainScapes Program of the Department of Environmental Protection, Montgomery County, Maryland.
- Virginia Botanical Associates. Digital Atlas of the Virginia Flora (http://www.vaplantatlas.org). c/o Virginia Botanical Associates, Blacksburg.