

## APPENDIX 23-H

### SIMPLIFIED STORMWATER BMP

Regulated activities that will result in between 1,001 and 3,000 square feet of Regulated Impervious Surface Area shall provide an infiltration-type structural BMP that will store a minimum of 75% of the Recharge Volume (Rev) as defined by the Stormwater Ordinance. The remaining 25% of the Recharge Volume may either be directed to an infiltration-type structure BMP or reused, evapotranspired, or infiltration through nonstructural BMPs. One or more of the following BMPs may be used to meet the 75% of the Recharge Volume (Rev) through the infiltration-type structural BMP:

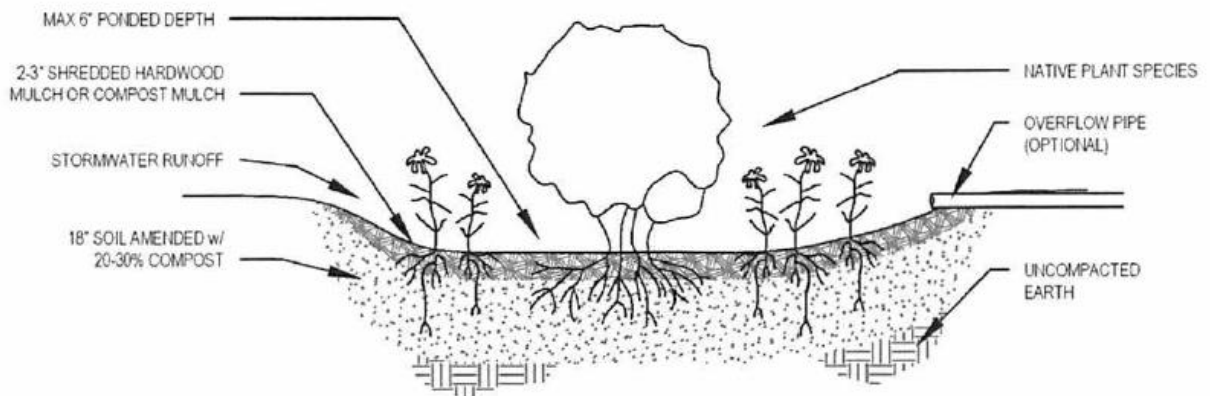
- (a) Rain Gardens - also referred to as bioretention, rain gardens are a method of treating relatively small volumes of stormwater by allowing water to pond in a surface depression. Native species are planted within the depression to improve water quality as well as aesthetics. Water quality improvements are achieved through filtration and settling of particles through a layer of mulch and through infiltration into the surrounding soil. Plant life also contributes to pollutant uptake and improvement of water quality. Construction of a rain garden shall be performed after all other areas of the site are stabilized to avoid clogging. During construction, compaction of the subgrade soil shall be avoided, and construction shall be performed with only light machinery. Additional resources on rain gardens can be found online:

[https://www.dep.state.pa.us/dep/subject/adv coun/stormwater/manual\\_draftjan05/section06-structuralbmps-part1.pdf](https://www.dep.state.pa.us/dep/subject/adv coun/stormwater/manual_draftjan05/section06-structuralbmps-part1.pdf)

[https://www.stormwaterpa.org/assets/media/BMP\\_manual/chapter\\_6/Chapter\\_6-4-5.pdf](https://www.stormwaterpa.org/assets/media/BMP_manual/chapter_6/Chapter_6-4-5.pdf)

<https://www.epa.gov/soakuptherain/soak-rain-rain-gardens>

#### TYPICAL RAIN GARDEN CONFIGURATION



**Sizing:**

STEP 1 - Determine Area of Total New Impervious Surfaces (A)

STEP 2 - Determine Required Infiltration Volume (Rev)

$$\text{Rev (cubic feet)} = A \text{ (square feet)} * 20 \text{ CF} / 100 \text{ SF}$$

STEP 3 - Sizing of Select Infiltration Method

$$(\text{Rev}) = (\text{Depth}) \times (\text{Width}) \times (\text{Length})$$

Example:

STEP 1 – Determine Area of Total New Impervious Surfaces

Suppose total impervious surfaces = 2,000 square feet

STEP 2 - Determine Required Infiltration Volume (Rev)

$$\text{Rev (cubic feet)} = A \text{ (square feet)} * 20 \text{ CF} / 100 \text{ SF}$$

$$\text{Rev} = (2,000 \text{ square feet}) * 20 \text{ CF} / 100 \text{ SF}$$

$$\text{Rev} = 400 \text{ Cubic Feet}$$

STEP 3 - Sizing of Select Infiltration Method

Suppose a ponded depth of 0.5 feet (maximum ponded depth) is desired.

$$(\text{Rev}) = (\text{Depth}) \times (\text{Width}) \times (\text{Length})$$

$$(400 \text{ cubic feet}) = (0.5 \text{ ft}) \times (\text{Width}) \times (\text{Length})$$

$$(\text{Width}) \times (\text{Length}) = \text{Surface Area} = 800 \text{ square feet (possibly 20 feet} \times \text{40 feet)}$$

### Construction Issues:

The following must be addressed during construction to ensure proper function:

- Do not allow sediment to wash back into the bed during construction.
- A minimum of 18” of amended soils shall be provided.
- Amended soil shall be premixed (vs. mixed on-site) and certified as providing an infiltration rate of at least 1” per hour.
- Avoid compaction of the bottom. This can limit the infiltration capacity.
- An overflow pipe can be used to direct excess water to a particular location. If an overflow pipe is used, it shall be placed at the top of the depression, such that water is still allowed to pond.
- Plants used in the rain garden must be tolerant of both wet and dry conditions, as well as be suitable for your light and soil conditions. Plant selection guidance can be found in the internet links listed above.
- If elevated groundwater is encountered, a 4” underdrain wrapped in 6” of clean stone may be added to the bottom of the basin, below the amended soil mixture, and daylighted downstream of the basin.

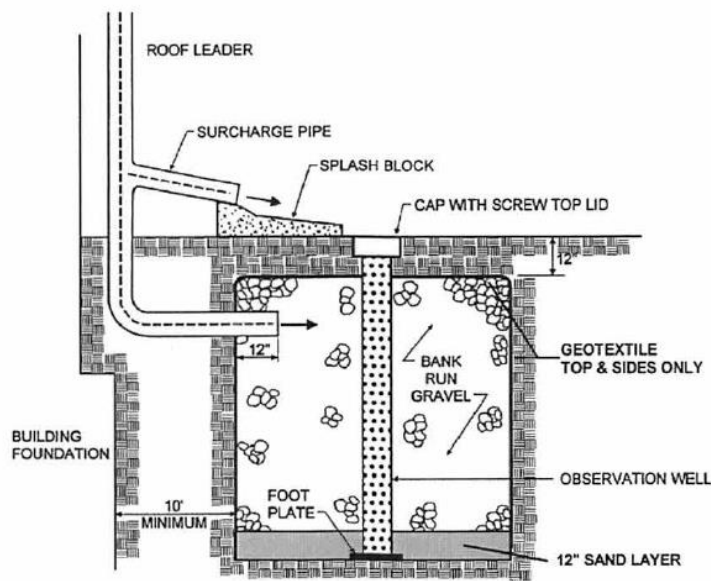
### Maintenance Issues:

Rain Gardens require the following regular maintenance:

- While vegetation is being established, watering, pruning, and weeding may be required.
- Dead plant material must be removed every year. Perennial plantings may be cut down at the end of the growing season.
- Mulch shall be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire area may require mulch replacement.
- Rain Gardens shall be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, or any other conditions that negatively impact the functionality of the system.
- During periods of extended drought, Rain Gardens may require watering.
- Trees and shrubs shall be inspected twice per year to evaluate health.

- (b) Dry wells - Dry wells are effective methods of infiltrating runoff from roof leaders. These facilities shall be located a minimum of ten (10) feet from the building foundation to avoid seepage problems. A dry well can be either a structural prefabricated chamber or an excavated pit filled with aggregate. Construction of a dry well shall be performed after all other areas of the site are stabilized to avoid clogging. During construction, compaction of the subgrade soil shall be avoided, and construction shall be performed with only light machinery. Depth of dry wells in excess of three and one half (3 ½) feet should be avoided. Gravel fill shall be an average one and one-half to two and one-half (1.5 to 2.5) inches in diameter and shall be homogeneously graded. Dry wells shall not be installed in areas where elevated groundwater exist or within Type D (Hydrologic Soil Group) soil areas.

### TYPICAL DRY WELL CONFIGURATION



Source: Maryland Stormwater Design Manual

Note: Acceptable geotextiles include Mirafi 140N, Amoco 4547, Geotex 451 or approved equal.  
Bank run gravel should be 1.5" to 2.5" in diameter (AASHTO #2 stone is preferable).

#### Sizing:

STEP 1 - Determine Area of Total New Impervious Surfaces (A)

STEP 2 - Determine Required Infiltration Volume (Rev)

$$\text{Rev (cubic feet)} = A \text{ (square feet)} * 20 \text{ CF} / 100 \text{ SF}$$

STEP 3 - Sizing of Select Infiltration Method

$$(\text{Rev}) / (0.4) = (\text{Depth}) \times (\text{Width}) \times (\text{Length})$$

Note: Rev is divided by 0.4 to account for the void space in the stone bed.

Example:

STEP 1 – Determine Area of Total New Impervious Surfaces

Suppose total impervious surfaces = 2,000 square feet

STEP 2 - Determine Required Infiltration Volume (Rev)

Rev (cubic feet) = A (square feet) \* 20 CF / 100 SF

Rev = (2,000 square feet) \* 20 CF / (100 SF)

Rev = 400 Cubic Feet

STEP 3 - Sizing of Select Infiltration Method

Suppose a bed depth of 3 feet is desired.

(Rev) / (0.4) = (Depth) x (Width) x (Length)

(400 cubic feet) / (0.4) = (3 feet) x (Width) x (Length)

(Width) x (Length) = Surface Area = 333.3 square feet (possibly 15 feet x 22 feet)

Construction Issues:

The following must be addressed during construction to ensure proper function:

- Do not allow sediment to wash back into the bed during construction.
- Avoid compaction of the bottom. This can limit the infiltration capacity.
- Observation well shall be constructed of perforated pipe such that the level of water in the well is the same as the level of water in the bed.
- Geotextile shall overlap a minimum of 16 inches at seams.

Maintenance Issues:

- Dry Wells require the following regular maintenance:
- Inspect Dry Wells at least four times a year, as well as after every storm exceeding 1 inch of rain.
- Dispose of sediment, debris/trash, and any other waste material removed from a Dry Well at suitable disposal/recycling sites and in compliance with local, state, and federal waste regulations.
- Evaluate the drain-down time of the Dry Well to ensure the maximum time of 72 hours is not exceeded. If drain-down times are exceeding the maximum, drain the Dry Well via pumping and clean out perforated piping, if included.
- Regularly clean out gutters and ensure proper connections to facilitate the effectiveness of the dry well.
- Replace filter screen that intercepts roof runoff as necessary.
- If an intermediate sump box exists, clean it out at least once per year.

Worksheet 3. Nonstructural BMP Credits																					
<b>PROTECTED AREA</b>																					
1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	_____ Ac.																				
1.2 Area of Riparian Forest Buffer Protection	_____ Ac.																				
3.1 Area of Minimum Disturbance/Reduced Grading	_____ Ac.																				
<b>TOTAL</b>	<b>_____ Ac.</b>																				
<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Site Area</td> <td style="padding: 5px;"><i>minus</i></td> <td style="padding: 5px;">Protected Area</td> <td style="padding: 5px;">=</td> <td style="padding: 5px;">Stormwater Management Area</td> </tr> <tr> <td style="text-align: center; padding: 5px;"><input style="width: 100px; height: 20px;" type="text"/></td> <td style="text-align: center; padding: 5px;">-</td> <td style="text-align: center; padding: 5px;"><input style="width: 100px; height: 20px;" type="text"/></td> <td style="text-align: center; padding: 5px;">=</td> <td style="text-align: center; padding: 5px;"><input style="width: 200px; height: 20px;" type="text"/></td> </tr> <tr> <td colspan="4" style="padding: 5px;"></td> <td style="padding: 5px;"> <div style="font-size: 2em;">↗</div> </td> </tr> <tr> <td colspan="4" style="padding: 5px;"></td> <td style="padding: 5px;"> <i>This is the area that requires stormwater management</i> </td> </tr> </table>		Site Area	<i>minus</i>	Protected Area	=	Stormwater Management Area	<input style="width: 100px; height: 20px;" type="text"/>	-	<input style="width: 100px; height: 20px;" type="text"/>	=	<input style="width: 200px; height: 20px;" type="text"/>					<div style="font-size: 2em;">↗</div>					<i>This is the area that requires stormwater management</i>
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<b>VOLUME CREDITS</b>																					
<b>3.1 Minimum Soil Compaction</b>																					
Lawn _____ ft <sup>2</sup>	x 1/4" x 1/12 = _____ ft <sup>3</sup>																				
Meadow _____ ft <sup>2</sup>	x 1/3" x 1/12 = _____ ft <sup>3</sup>																				
<b>3.3 Protect Existing Trees</b>																					
<i>For Trees within 100 feet of impervious area:</i>																					
Tree Canopy _____ ft <sup>2</sup>	x 1/2" x 1/12 = _____ ft <sup>3</sup>																				
_____	_____																				
<b>5.1 Disconnect Roof Leaders to Vegetated Areas</b>																					
<i>For runoff directed to areas protected under 5.8.1 and 5.8.2</i>																					
Roof Area _____ ft <sup>2</sup>	x 1/3" x 1/12 = _____ ft <sup>3</sup>																				
<i>For all other disconnected roof areas</i>																					
Roof Area _____ ft <sup>2</sup>	x 1/4" x 1/12 = _____ ft <sup>3</sup>																				
<b>5.2 Disconnect Non-Roof impervious to Vegetated Areas</b>																					
<i>For Runoff directed to areas protected under 5.8.1 and 5.8.2</i>																					
Impervious Area _____ ft <sup>2</sup>	x 1/3" x 1/12 = _____ ft <sup>3</sup>																				
<i>For all other disconnected roof areas</i>																					
Impervious Area _____ ft <sup>2</sup>	x 1/4" x 1/12 = _____ ft <sup>3</sup>																				
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<small>* For use on Worksheet 5</small>																					