

Project Worksheets, Design Tables & Construction Notes – Rain Barrel/Cistern

The following guidance has been provided for those regulated activities that qualify as a Minor Land Disturbance. This volume represents the amount of runoff to be permanently removed (managed on-site through reuse, infiltration, evaporation, or transpiration) per the Ephrata Township Storm Water Management Ordinance. The volume does not account for the rate of percolation into the ground.

Variables:

A = Impervious Area in square feet (sq. ft.)

V = Required Rain Barrel/Cistern Volume in gallons

Compute Total Required Volume:

$$V = 1.5 \times A$$

or;

$$V = 1.5 \times \text{_____ (impervious area in sq. ft.)} = \text{_____ (required rain barrel/cistern volume in gallons).}$$

$$\text{Storage Provided in Circular Cistern (cu. ft.)} = [\text{Radius (ft.)}]^2 \times [\text{Height (ft.)}] \times (3.14)$$

$$\text{Storage Provided in Circular Cistern (gal)} = [\text{Radius (ft.)}]^2 \times [\text{Height (ft.)}] \times (3.14) \times (7.48)$$

Sizing Chart for Rain Barrels and Cisterns

Impervious Area (sq. ft.)	Gallons of Storage in Cistern
1000	1496
1250	1870
1500	2244
1750	2618
2000	2992
2250	3366
2500	3740
2750	4114
3000	4488
3250	4862
3500	5236
3750	5610
4000	5984
4250	6358
4500	6732
4750	7106
5000	7480

Project Worksheets, Design Tables & Construction Notes – Rain Garden

The following guidance has been provided for those regulated activities that qualify as a Minor Land Disturbance. This volume represents the amount of runoff to be permanently removed (managed on-site through reuse, infiltration, evaporation, or transpiration) per the Ephrata Township Storm Water Management Ordinance. The volume does not account for the rate of percolation into the ground.

Variables:

A1 = Impervious Area in square feet (sq. ft.)

A2 = Required Rain Garden Surface Area in square feet (sq. ft.)

A2 = 0.4 x A1

or;

A2 = 0.4 x _____ (impervious area in sq. ft.) = _____ (required rain garden surface area in sq. ft.).

Storage Provided = (Length) x (Width) x (Ponding Depth)

(or for irregular shapes) Storage Provided = (Surface Area) x (Ponding Depth)

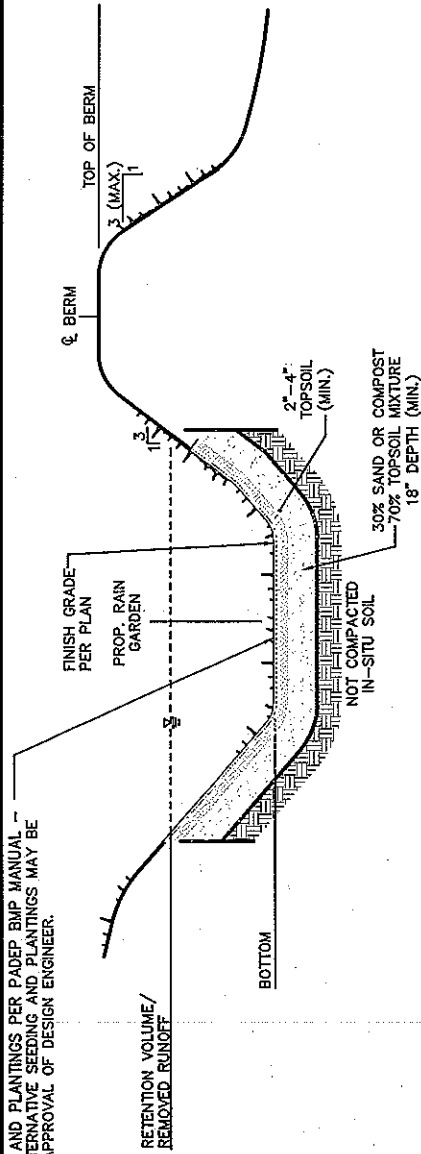
Sizing Chart for Rain Garden

Impervious Area (sq. ft.)	Square Feet of Rain Garden Surface Area (6" depth)
1000	400
1250	500
1500	600
1750	700
2000	800
2250	900
2500	1000
2750	1100
3000	1200
3250	1300
3500	1400
3750	1500
4000	1600
4250	1700
4500	1800
4750	1900
5000	2000

Rain Garden Construction - General Notes

1. Use the worksheet and table to compute the required volume in the rain garden (in cubic feet) for all proposed impervious areas. The calculated total volume is the minimum requirement for on-site construction. The actual horizontal dimensions of the rain garden may vary to fit specific site configurations and constraints, but the vertical depth of the rain garden should not exceed six (6) inches. The total volume of the rain garden must be equal to or greater than the required minimum.
2. Multiple rain gardens may also be utilized. If multiple rain gardens are desired, the volume for each rain garden should be a proportional amount of the calculated total storage volume (i.e. utilizing two [2] rain gardens, if sixty {60} percent of the total roof area is piped to one rain garden, then that rain garden should be sized for sixty [60] percent of the total required minimum volume. The second rain garden would then be sized for the remaining forty [40] percent of the total required minimum volume).
3. Based on the calculations of the required rain garden dimensions computed using the worksheets and table, stake out the locations of the rain garden corners. Staking is critical and should outline the location of the rain garden. The rain garden shall be located as far as possible downslope from the proposed home. A minimum of ten (10) feet of undisturbed soil shall be provided between the rain garden and any adjoining building or structure. Maintain a minimum of ten (10) feet between the rain garden and any property lines and road rights-of-way. Rain gardens shall be located beside or downslope (not upslope of) and a minimum of ten (10) feet from any component of any on-lot sewage disposal system or on-lot sewage disposal system replacement absorption area.
4. Excavation of the rain garden shall be conducted from outside of the rain garden perimeter, using equipment which has a bucket on a reaching arm (backhoe or trackhoe). No equipment shall be permitted in or on the rain garden area. The bottom and sides of the rain garden shall be chiseled or ripped to break up any smearing or compaction that may have occurred during excavation. The side slopes of the rain garden should be no steeper than 3:1 (three [3] feet horizontal to one [1] foot vertical). The planting soil depth in the bottom of the rain garden shall be at least eighteen (18) inches deep and should be a mixture of thirty (30) percent organic material (compost) and seventy (70) percent topsoil.
5. Backfill the rain garden with amended soils to proposed bottom elevation of facility. Connect roof drain leaders from downspouts to rain garden and contact Ephrata Township for an observation.
6. At this time, before planting and placement of compost layer, the Township shall be notified for inspection of the facility to verify proper installation.
7. Following the Township observation, plant vegetation in the rain garden and add a two (2) inch to three (3) inch layer of shredded mulch or leaf compost. The amended soils should be overfilled to allow for settlement and lightly hand tamped in place. Pre-soaking the amended soils is recommended prior to planting. The plant selection should be suited to a variety of wet and dry weather conditions.

PROVIDE SEEDING AND PLANTINGS PER PADEP BMP MANUAL - APPENDIX B.1. ALTERNATIVE SEEDING AND PLANTINGS MAY BE APPROVED UPON APPROVAL OF DESIGN ENGINEER.



RAIN GARDEN CROSS SECTION

NOT TO SCALE

RAIN GARDEN:

RAIN GARDEN AREA TO BE SEEDED AND PLANTED AS SPECIFIED PER APPENDIX B OF THE PENNSYLVANIA STORMWATER BEST MANAGEMENT PRACTICES MANUAL. WE SUGGEST THE USE OF ERNST CONSERVATION SEED MIX ERNMX-180, WHICH CONTAINS MANY OF THE PLANTS LISTED IN THIS APPENDIX SECTION.

WHILE VEGETATION IS BEING ESTABLISHED IN THE RAIN GARDEN, PRUNING AND WEEDING MAY BE REQUIRED. DETRITUS MATERIAL MAY NEED TO BE REMOVED ANNUALLY OR AS NEEDED TO MAINTAIN PROPER FUNCTION OF THE RAIN GARDEN. PERENNIAL PLANTINGS (IF PRESENT) MAY BE CUT DOWN AT THE END OF THE GROWING SEASON. THE RAIN GARDEN SHOULD BE INSPECTED AT LEAST TWO TIMES PER YEAR FOR SEDIMENT BUILDUP, EROSION, AND VEGETATIVE CONDITIONS (HEALTH). ANY DEAD OR DISEASED VEGETATION SHALL BE REPLACED IMMEDIATELY. DURING PERIODS OF EXTENDED DROUGHT, RAIN GARDEN AREAS MAY REQUIRE WATERING.

OPERATION AND MAINTENANCE SCHEDULE

1. THE PROPERTY OWNER SHALL OWN, MAINTAIN AND BE RESPONSIBLE FOR ALL STORMWATER MANAGEMENT AND PERMANENT BMP FACILITIES (I.E. RAIN GARDENS, SWALES AND LEVEL SPREADERS) THAT ARE LOCATED OUTSIDE OF STREET RIGHT-OF-WAYS AS PROPOSED ON THE PLANS.
2. THE OWNER SHALL CONDUCT A VISUAL INSPECTION OF ALL STORMWATER MANAGEMENT AND PERMANENT BMP FACILITIES AT LEAST ONCE EVERY THREE MONTHS AND IMMEDIATELY AFTER STORM EVENTS. SUCH VISUAL EXAMINATION SHALL AT LEAST INVOLVE AN EXAMINATION OF THE STORMWATER COLLECTION CONVEYANCE AND BMP FACILITIES FOR DEBRIS DEPOSITION (SUCH AS TRASH), BUT SHALL NOT BE LIMITED TO AGGREGATE MATERIAL, LEAVES, GRASS CLIPPINGS, SOIL AND TRASH), AND AN EXAMINATION OF THE STORMWATER BMP FACILITIES FOR SOIL AND STRUCTURAL SETTLEMENT, DEPRESSIONS, SINKHOLES, SEEPS, STRUCTURAL CRACKING, ANIMAL BURROWS, EXCESSIVE VEGETATION, CLOGGING, EROSION AND FOUNDATION MOVEMENT.
3. THE OWNER SHALL REMOVE ANY ACCUMULATION OF DEBRIS AND REPAIR ANY DAMAGE TO THE STORMWATER MANAGEMENT AND PERMANENT BMP FACILITIES. REPAIRS SHALL BE MADE USING MATERIAL THAT MEETS OR EXCEEDS THE SPECIFICATIONS PROVIDED ON THE PLANS.
4. THE OWNER IS REQUIRED TO MAINTAIN A RECORD OF ALL INSPECTIONS, REPAIRS AND MAINTENANCE ACTIVITIES ASSOCIATED WITH THE STORMWATER MANAGEMENT AND PERMANENT BMP FACILITIES AT THIS PROJECT SITE. THE OWNER SHALL IMMEDIATELY NOTIFY THE TOWNSHIP AND THE CHESTER COUNTY CONSERVATION DISTRICT PRIOR TO INITIATING ANY MAJOR REPAIR ACTIVITIES (SUCH AS REPAIRS THAT MAY BE REQUIRED BECAUSE OF SETTLEMENT, SINKHOLES, SEEPS, STRUCTURAL CRACKING OR FOUNDATION MOVEMENT).
5. THE OWNER SHALL ALSO COMPLY WITH ANY OTHER MAINTENANCE NOTES INCLUDED ON THE LAND DEVELOPMENT PLANS.

RAIN GARDENS:

1. MULCH AND INSTALL EROSION PROTECTION AT SURFACE FLOW ENTRANCES WHERE NECESSARY.
2. WHILE VEGETATION IS BEING ESTABLISHED, PRUNING AND WEEDING MAY BE REQUIRED.
3. DETRITUS MAY ALSO NEED TO BE REMOVED EVERY YEAR. PERENNIAL PLANTINGS MAY BE CUT DOWN AT THE END OF THE GROWING SEASON.
4. MULCH SHOULD BE RE-SPREAD WHEN EROSION IS EVIDENT AND BE REPLISHED AS NEEDED. ONCE EVERY 2 TO 3 YEARS THE ENTIRE AREA MAY REQUIRE MULCH REPLACEMENT.
5. BIORETENTION AREAS SHOULD BE INSPECTED AT LEAST TWO TIMES PER YEAR FOR SEDIMENT BUILDUP, EROSION, VEGETATIVE CONDITIONS, ETC.
6. DURING PERIODS OF EXTENDED DROUGHT, BIORETENTION AREAS MAY REQUIRE WATERING.
7. TREES AND SHRUBS SHOULD BE INSPECTED TWICE PER YEAR TO EVALUATE HEALTH.
8. WEEDING WILL BE NEEDED THE FIRST COUPLE OF YEARS. REMOVE BY HAND ONLY THOSE PLANTS THAT ARE POSITIVELY IDENTIFIED AS WEEDS. IN THE THIRD YEAR AND BEYOND, THE NATIVE GRASSES, SEDGES, RUSHES, AND WILDFLOWERS WILL BEGIN TO MATURE AND WILL OUT-COMPETE THE WEEDS. WEEDING ISOLATED PATCHES MIGHT STILL BE NEEDED ON OCCASION AND INVASIVE SPECIES SHOULD ALWAYS BE REMOVED.

NOTE: IF UNSUITABLE SOIL IS ENCOUNTERED OR IF SOIL IS COMPACTED SO INFILTRATION IS ELIMINATED OR REDUCED, EXCAVATE OUT THE UNSUITABLE SOIL (24" DEPTH) AND REPLACE WITH SOIL OF THE FOLLOWING SPECIFICATION:

1. UTILIZE TOPSOIL GRADED FROM OTHER ON-SITE AREAS (CLEANED AND DRAINED).
2. USE SILT LOAM SOIL WITH MAXIMUM 10% CLAY; COMPOST (ORGANIC ADJUMENT) 5% TO 10% MAXIMUM.

RAIN GARDEN MIX - ERNMX-180

BOTANICAL NAME	COMMON NAME
20.00% <i>Panicum rigidulum</i> , PA ecotype	Redtop Panic Grass, PA Ecotype
20.00% <i>Schizachyrium scoparium</i> , Eastern ecotype	Little Bluestem, Eastern Ecotype
10.00% <i>Elymus virginicus</i>	Virginia Wild Rye
5.00% <i>Carex vulpinoidea</i>	Cox. Sedge
5.00% <i>Chasmodon latifolium</i>	River Oats
5.00% <i>Echinacea purpurea</i>	Purple Coneflower
5.00% <i>Liatris spicata</i>	Marsh (Dense) Blazing Star (Spiked Gayfeather)
5.00% <i>Rudbeckia hirta</i>	Black-eyed Susan
3.00% <i>Monarda fistulosa</i>	Wild Bergamot
3.00% <i>Pentstemon digitalis</i>	Tall White Beard Tongue
2.00% <i>Andropogon gerardii</i> , 'M Ecotype'	'M Ecotype' Big Bluestem
2.00% <i>Asclepias incarnata</i>	Swamp Milkweed
2.00% <i>Aster novae-angliae</i>	New England Aster
2.00% <i>Baptisia australis</i>	Blue False Indigo
2.00% <i>Ceanothus americanus</i>	Rough Avenia
2.00% <i>Senna hebecarpa</i>	Wild Senna
2.00% <i>Tradescantia ohioensis</i>	Ohio Spiderwort
2.00% <i>Verbena hastata</i>	Blue Vervain
2.00% <i>Zizia aurea</i>	Golden Alexanders
1.00% <i>Agrastis perennans</i>	Autumn Bentgrass
100.00%	SEEDING RATE: 15LB. PER ACRE OR 1/3 - 1/2 LB. PER 1,000 SQ. FT.

RAIN GARDEN SEQUENCE OF CONSTRUCTION

1. INSTALL TEMPORARY SEDIMENT CONTROL BMPs AS SHOWN ON THE PLANS.
2. COMPLETE SITE GRADING. IF APPLICABLE, CONSTRUCT CURB CUTS OR OTHER INFLOW ENTRANCE BUT PROVIDE PROTECTION SO THAT THE DRAINAGE IS PROHIBITED FROM ENTERING THE CONSTRUCTION AREA.
3. STABILIZE GRADING WITHIN THE LIMIT OF DISTURBANCE EXCEPT WITHIN THE RAIN GARDEN AREA. RAIN GARDEN BED AREAS MAY BE USED AS TEMPORARY SEDIMENT TRAPS PROVIDED THAT THE PROPOSED FINISHED ELEVATION OF THE BED IS 12" LOWER THAN THE BOTTOM ELEVATION OF THE SEDIMENT TRAP.
4. EXCAVATE RAIN GARDEN TO PROPOSED, INVERT DEPTH AND SCARIFY THE EXISTING SOIL SURFACES. DO NOT COMPACT IN-SITU SOILS.
5. BACKFILL RAIN GARDEN WITH AMENDED SOIL AS SHOWN ON PLANS AND SETTLEMENT. OVERFILLING IS RECOMMENDED TO ACCOUNT FOR SETTLEMENT. LIGHT HAND TAMPING IS ACCEPTABLE IF NECESSARY.
6. PRESOAK THE PLANTING SOIL PRIOR TO PLANTING VEGETATION TO AID IN SETTLEMENT.
7. COMPLETE FINAL GRADING TO ACHIEVE PROPOSED DESIGN ELEVATIONS, AS SPECIFIED ON PLANS.
8. PLANT VEGETATION USING ERNST CONSERVATION SEED MIX ERNMX-180.
9. MULCH AND INSTALL EROSION PROTECTION AT SURFACE FLOW ENTRANCES WHERE NECESSARY.

EXHIBIT C
TYPICAL RAIN GARDEN DETAIL

RETTEW

RETTEW Associates, Inc.
3820 Columbia Ave. Lancaster, PA 17603
Phone (717) 394-3721 • Fax (717) 394-1063

DRAWN BY: _____
DATE: 5/6/14
SCALE: NOT TO SCALE
DWG. NO. 011142014