

Sizing Worksheet - HM-1 Dry Extended Detention Basin

Designer: Project Proponent: Date: Project: Location:	
Type of Vegetation:	Native Grasses _____ Irrigated Turf _____ Other _____
Outflow Collection: Outlet Type (check one)	Single Orifice _____ Multi-orifice Plate _____ Perforated Pipe _____ Other _____
Depth of water above bottom orifice	Depth = _____ feet
Single Orifice Outlet 1) Total Area 2) Diameter or W x L	A = _____ square inches D = _____ inches
Multiple Orifice Outlet 1) Area per row of perforations 2) Perforation Diameter (2 inches max.) 3) No. of Perforations (columns) per Row 4) No. of Rows (4 inch spacing) 5) Total Orifice Area (Area per row) x (Number of Rows)	A = _____ square inches D = _____ Perforations = _____ Rows = _____ Area = _____ square inches
Step 1: Determine water quality design volume	
1-1. Enter Project area (acres), $A_{project}$ If this BMP captures runoff from a portion of the project area, enter the tributary area	$A_{project} =$ _____ acres
1-2. Enter Project impervious fraction, Imp (e.g. 60% = 0.60)	$Imp =$ _____
1-3. Determine pervious runoff coefficient using <u>Table C-1</u> , C_p	$C_p =$ _____

1-4. Calculate runoff coefficient, $C = 0.95 * imp + C_p (1 - imp)$	C =	
1-5. Enter design rainfall depth of the storm (in), P_i	$P_i =$	in
1-6. Calculate rainfall depth (ft), $P = P_i / 12$	P =	ft
1-7. Calculate water quality design volume (ft ³), $SQDV = 43560 * C * P * A_{project}$	SQDV =	ft ³
Step 2: Calculate the volume of the active basin		
2-1. Calculate basin active volume (includes water quality design volume + sediment storage volume) (ft ³), $V_a = 1.20 \times SQDV$	$V_a =$	ft ³
Step 3: Determine Detention Basin Location and Preliminary Geometry Based on Site Constraints		
3-1. Based on site constraints, determine the basin geometry and the storage available by developing an elevation-storage relationship for the basin. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2.		
3-2. Enter the total surface area of the basin footprint based on site constraints (ft ²), A_{tot}	$A_{tot} =$	ft ²
3-3. Enter the length of the basin footprint based on site constraints (ft), L_{tot}	$L_{tot} =$	ft
3-4. Calculate the width of the basin footprint (L:W = 1.5:1 min) (ft), $W_{tot} = A_{tot} / L_{tot}$	$W_{tot} =$	ft
3-5. Enter interior side slope as length per unit height (H:V, min = 3), Z	Z =	
3-6. Enter desired freeboard depth (ft), d_{fb} (min: 2 ft on-line; 1 ft offline)	$d_{fb} =$	ft
3-7. Calculate the length of the active volume surface area including the internal berm but excluding freeboard, $L_{av-tot} = L_{tot} - 2Zd_{fb}$	$L_{av-tot} =$	ft
3-8. Calculate the width of the active volume surface area including the internal berm but excluding freeboard, $W_{av-tot} = W_{tot} - 2Zd_{fb}$	$W_{av-tot} =$	ft
3-9. Calculate the total active volume surface area including the internal berm and excluding freeboard, $A_{av-tot} = L_{av-tot} \times W_{av-tot}$	$A_{av-tot} =$	ft ²
3-10. Enter the width of the internal berm (6 ft min), W_{berm}	$W_{berm} =$	ft
3-11. Enter the length of the internal berm (ft), $L_{berm} = W_{av-tot}$	$L_{berm} =$	ft

3-12. Calculate the area of the berm (ft ²), $A_{berm} = W_{berm} \times L_{berm}$	$A_{berm} =$	ft ²
3-13. Calculate the surface area excluding the internal berm and freeboard (ft ²), $A_{av} = A_{av-tot} - A_{berm}$	$A_{av} =$	ft ²
Step 4: Determine Dimensions of forebay		
4-1. Enter the percentage of V_a in forebay (5-15% required), $\%V_1$	$\%V_1 =$	%
4-2. Calculate the active volume of forebay, $V_1 = V_a \cdot \%V_1$	$V_1 =$	ft ³
4-3. Enter a desired average depth for the active volume of forebay, d_1	$d_1 =$	ft
4-4. Calculate the surface area for the active volume of forebay, $A_1 = V_1 / d_1$	$A_1 =$	ft ²
4-5. Enter the width of forebay, $W_1 = W_{av-tot} = L_{berm}$	$W_1 =$	ft
4-6. Calculate the length of forebay (<u>Note</u> : inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W_1$	$L_1 =$	ft
Step 5: Determine Dimensions of Cell 2		
5-1. Calculate the active volume of Cell 2, $V_2 = V_a - V_1$	$V_2 =$	ft ³
5-2. Calculate the surface area of the active volume of Cell 2, $A_2 = A_{av} - A_1$	$A_2 =$	ft ²
5-3. Calculate the average depth for the active volume of Cell 2, $d_2 = V_2 / A_2$	$d_2 =$	ft
5-4. Enter the width of Cell 2, $W_2 = W_1 = W_{av-tot} = L_{berm}$	$W_2 =$	ft
5-5. Calculate the length of Cell 2, $L_2 = A_2 / W_2$	$L_2 =$	ft
5-6. Calculate the width of Cell 2 at half of d_2 , $W_{mid2} = W_2 - Zd_2$	$W_{mid2} =$	ft
5-7. Calculate the length of Cell 2 at half of d_2 , $L_{mid2} = L_2 - Zd_2$	$L_{mid2} =$	ft
5-8. Verify that the length-to-width ratio of Cell 2 at half of d_2 is at least 1.5:1 with $\geq 2:1$ preferred. If the length-to-width ratio is less than 1.5:1, modify input parameters until a ratio of at least 1.5:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the basin should be chosen, $LW_{mid2} = L_{mid2} / W_{mid2}$	$LW_{mid2} =$	

Step 6: Ensure Design Requirements and Site Constraints are Achieved

6-1. Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the basin is inadequate to meet the design requirements, choose a new location or alternative treatment BMP.

Step 7: Size Outlet Structure

7-1. The total drawdown time for the basin should be 36-48 hours. The outlet structure shall be designed to release the bottom 50% of the detention volume (half-full to empty) over 24-32 hours, and the top half (full to half-full) in 12-16 hours. A primary overflow should be sized to pass the peak flow rate from the developed capital design storm.

Step 8: Determine Emergency Spillway Requirements

8-1. For online basins, an emergency overflow spillway should be sized to pass flows greater than the design peak runoff discharge rate for the 100-yr, 24-hr storm in order to prevent overtopping of the walls or berms in the event that a blockage of the riser occurs. For offline basins, an emergency spillway or riser should be sized to pass the 100-yr, 24-hr post-development peak storm water runoff discharge rate directly to the downstream conveyance system or another acceptable discharge point. For sites where the emergency spillway discharges to a steep slope, an emergency overflow riser, in addition to the spillway should be provided.