Sizing Worksheet - HM-3 Constructed Wetland

Designer: Project Proponent: Date: Project: Location:	
Type of Vegetation: (Check type used or describe "Other")	___ Native Grasses ___ Irrigated Turf Grass ___ Emergent Aquatic Plants (specify type / density)* ___ Other ____________________ *Describe Species Density and Mix:______________________________________ ____ ____ __________________
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)Diameter	D = _____ feet
2) Area	A = _____ square feet
Multiple Orifice Outlet	
1) Area per row of perforations	A = _____ square inches
2) Perforation Diameter (2 inches max.)	D = _____
3) No. of Perforations (columns) per Row	Perforations = _____
4) No. of Rows (4 inch spacing)	Rows = _____
5) Total Orifice Area (Area per row) x (Number of Rows)	Area = _____ square inches

Step 1: Determine water quality design volume		
1-1. Enter project drainage area, A 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 Table C-1, C_p	C_p =	
1-4. Calculate runoff coefficient, $C = 0.95*imp + C_p\ (1\text{-}imp)$	C =	
1-5. Enter design rainfall depth of the storm, P_i (in)	P_i =	in
1-6. Calculate rainfall depth, $P = P_i/12$	P =	ft
1-7. Calculate water quality design volume, $SQDV = 43560 \bullet P * A_{project} * C$	SQDV =	ft^3
Step 2: Determine Wetland Location, Wetland Type and Preliminary Geometry Based on Site Constraints		
2-1. Based on site constraints, determine the wetland geometry and the storage available by developing an elevation-storage relationship for the wetland. For this simple example, assume a trapezoidal geometry for cell 1 (forebay) and cell 2. The wetland does not have extended detention.		
2-2. Enter the total surface area of the wetland footprint based on site constraints, A_{tot}	A_{tot} =	ft^2
2-3. Enter the length of the wetland footprint based on site constraints, L_{tot}	L_{tot} =	ft
2-4. Calculate the width of the wetland footprint, $W_{tot} = A_{tot} / L_{tot}$	W_{tot} =	ft
2-5. Enter interior side slope as length per unit height (min = 3), Z	Z =	
2-6. Enter desired freeboard depth, d_{fb}	d_{fb} =	ft
2-7. Calculate the length of the water quality volume surface area including the internal berm but excluding freeboard, $L_{wq\text{-}tot} = L_{tot} - 2Zd_{fb}$	$L_{wq\text{-}tot}$ =	ft
2-8. Calculate the width of the water quality volume surface area including the internal berm but excluding freeboard, $W_{wq\text{-}tot} = W_{tot} - 2Zd_{fb}$	$W_{wq\text{-}tot}$ =	ft
2-9. Calculate the total water quality volume surface area including the internal berm and excluding freeboard, $A_{wq\text{-}tot} = L_{wq\text{-}tot} \bullet W_{wq\text{-}tot}$	$A_{wq\text{-}tot}$ =	ft^2
2-10. Enter the width of the internal berm (6 ft min), W_{berm}	W_{berm} =	ft
2-11. Enter the length of the internal berm, $L_{berm} = W_{wq\text{-}tot}$	L_{berm} =	ft

2-12. Calculate the area of the berm, $A_{berm} = W_{berm} \bullet L_{berm}$	A_{berm} =	ft^2
2-13. Calculate the water quality volume surface area excluding the internal berm and freeboard, $A_{wq} = A_{wq\text{-}tot} - A_{berm}$	A_{wq} =	ft^2
Step 3: Determine Dimensions of forebay		
3-1. Enter the percentage of SQDV in forebay (30-50% required), $\%V_1$	$\%V_1$ =	%
3-2. Calculate the active volume of forebay (includes water quality volume + sediment storage volume), $V_1 = SQDV \bullet \%V_1$	V_1 =	ft^3
3-3. Enter desired average depth of forebay1 (2-4 ft including sediment storage of 1 ft), d_1	d_1 =	ft
3-4. Calculate the surface area for the water quality volume of forebay, $A_1 = V_1 / d_1$	A_1 =	ft^2
3-5. Enter the width of forebay, $W_1 = W_{av\text{-}tot} = L_{berm}$	W_1 =	ft
3-6. Calculate the length of forebay (<u>Note:</u> inlet and outlet should be configured to maximize the residence time), $L_1 = A_1 / W1$	L_1 =	ft
Step 4: Determine Dimensions of Cell 2		
4-1. Calculate the active volume of Cell 2, $V_2 = SQDV - V_1$	V_2 =	ft^3
4-2. Calculate surface area of Cell 2, $A_2 = A_{wq} - A_1$	A_2 =	ft^2
4-3. Enter width of Cell 2, $W_2 = W_1 = W_{wq\text{-}tot} = L_{berm}$	W_2 =	ft
4-4. Calculate top length of Cell 2, $L_2 = A_2 / W_2$	L_2 =	ft
4-5. Verify that the length-to-width ratio of Cell 2 is at least 3:1 with ≥ 4:1 preferred. If the length-to-width ratio is less than 3:1, modify input parameters until a ratio of at least 3:1 is achieved. If the input parameters cannot be modified as a result of site constraints, another site for the pond should be chosen, $LW_2 = L_2 / W_2$	LW_2 =	
4-6. Enter percent of surface area of very shallow zone, $\%A_{vs}$	$\%A_{vs}$ =	%
4-7. Calculate very shallow zone surface area, $A_{vs} = A_2 \bullet \%A_{vs}$	A_{vs} =	ft^2
4-8. Enter average depth of very shallow zone (0.1 - 1 ft), d_{vs}	d_{vs} =	ft
4-9. Calculate volume of very shallow zone, $V_{vs} = A_{vs} \bullet d_{vs}$	V_{vs} =	ft^3
4-10. Enter width of very shallow zone, $W_{vs} = W_2$	W_{vs} =	ft
4-11. Calculate length of very shallow zone, $L_{vs} = A_{vs} / W_{vs}$	L_{vs} =	ft

4-12. Enter percent of surface area of shallow zone, $\%A_s$	$\%A_s$ =	%
4-13. Calculate surface area of shallow zone, $A_s = A_2 \bullet \%A_s$	A_s =	ft^2
4-14. Enter average depth of shallow zone (1 - 3 ft), d_s	d_s =	ft
4-15. Calculate volume of shallow zone, $V_s = A_s \bullet d_s$	V_s =	ft^3
4-16. Enter width of shallow zone, $W_s = W_2$	W_s =	ft
4-17. Calculate length of shallow zone, $L_s = A_s / W_s$	L_s =	ft
4-18. Calculate surface area of deep zone, $A_{deep} = A_2 - A_{vs} - A_s$	A_{deep} =	ft^2
4-19. Calculate volume of deep zone, $V_{deep} = V_2 - V_{vs} - V_s$	V_{deep} =	ft^3
4-20. Calculate average depth of deep zone (3 - 5 ft), $d_{deep} = V_{deep} / A_{deep}$	d_{deep} =	ft
4-21. Enter width of deep zone, $W_{deep} = W_2$	W_{deep} =	ft
4-22. Calculate length of deep zone, $L_{deep} = A_{deep} / W_{deeo}$	L_{deep} =	ft
Step 5: Ensure Design Requirements and Site Constraints are Achieved		
5-1. Check design requirements and site constraints. Modify design geometry until requirements are met. If the chosen site for the wetland is inadequate to meet the design requirements, choose a new location for the wetland or select an alternative treatment BMP.		
Step 6: Size Outlet Structure		
6-1. The wetland outlet pipe shall be sized, at a minimum, to pass flows greater than the stormwater quality design peak flow for off-line basins or flow from the capital storm for on-line basins.		
Step 7: Determine Emergency Spillway Requirements		
7-1. 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.		