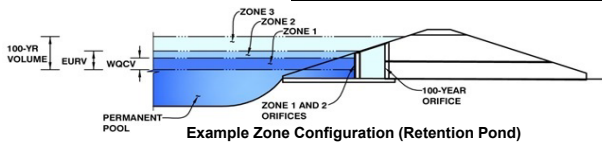# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Table Rock Homestead

Basin ID: Pond B2

Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	0.43	acres
Watershed Length =	660	ft
Watershed Length to Centroid =	330	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	80.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Note: L / W Ratio > 8

L / W Ratio = 23.3

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Optional User Overrides

Water Quality Capture Volume (WQCV) =	0.009	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.045	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.024	acre-feet	0.92	inches
5-yr Runoff Volume (P1 = 1.19 in.) =	0.032	acre-feet	1.19	inches
10-yr Runoff Volume (P1 = 1.44 in.) =	0.040	acre-feet	1.44	inches
25-yr Runoff Volume (P1 = 1.81 in.) =	0.052	acre-feet	1.81	inches
50-yr Runoff Volume (P1 = 2.12 in.) =	0.063	acre-feet	2.12	inches
100-yr Runoff Volume (P1 = 2.46 in.) =	0.075	acre-feet	2.46	inches
500-yr Runoff Volume (P1 = 3.34 in.) =	0.107	acre-feet	3.34	inches
Approximate 2-yr Detention Volume =	0.023	acre-feet		
Approximate 5-yr Detention Volume =	0.031	acre-feet		
Approximate 10-yr Detention Volume =	0.038	acre-feet		
Approximate 25-yr Detention Volume =	0.049	acre-feet		
Approximate 50-yr Detention Volume =	0.056	acre-feet		
Approximate 100-yr Detention Volume =	0.063	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.009	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.009	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H$_{total}$) =	1.00	ft
Depth of Trickle Channel (H$_{TC}$) =	N/A	ft
Slope of Trickle Channel (S$_{TC}$) =	N/A	ft/ft
Slopes of Main Basin Sides (S$_{main}$) =	4	H:V
Basin Length-to-Width Ratio (R$_{L/W}$) =	1	

**Total detention volume is less than 100-year volume.**

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	0.00		16.1	16.1	259		0.006		
	0.10		16.9	16.9	285		0.007	27	0.001
	0.20		17.7	17.7	313		0.007	57	0.001
	0.30		18.5	18.5	342		0.008	90	0.002
	0.40		19.3	19.3	372		0.009	126	0.003
	0.50		20.1	20.1	404		0.009	164	0.004
	0.60		20.9	20.9	437		0.010	206	0.005
	0.70		21.7	21.7	471		0.011	252	0.006
	0.80		22.5	22.5	506		0.012	301	0.007
	0.90		23.3	23.3	543		0.012	353	0.008
Zone 1 (WQCV)	1.00		24.1	24.1	581		0.013	409	0.009
	1.10		24.9	24.9	620		0.014	469	0.011
	1.20		25.7	25.7	660		0.015	533	0.012
	1.30		26.5	26.5	702		0.016	601	0.014
	1.40		27.3	27.3	745		0.017	674	0.015
	1.50		28.1	28.1	789		0.018	750	0.017
	1.60		28.9	28.9	835		0.019	832	0.019
	1.70		29.7	29.7	882		0.020	917	0.021
	1.80		30.5	30.5	930		0.021	1,008	0.023
	1.90		31.3	31.3	979		0.022	1,103	0.025
	2.00		32.1	32.1	1,030		0.024	1,204	0.028
	2.10		32.9	32.9	1,082		0.025	1,310	0.030
	2.20		33.7	33.7	1,135		0.026	1,420	0.033
	2.30		34.5	34.5	1,190		0.027	1,537	0.035
	2.40		35.3	35.3	1,246		0.029	1,658	0.038
	2.50		36.1	36.1	1,303		0.030	1,786	0.041
	2.60		36.9	36.9	1,361		0.031	1,919	0.044
	2.70		37.7	37.7	1,421		0.033	2,058	0.047
	2.80		38.5	38.5	1,482		0.034	2,203	0.051
	2.90		39.3	39.3	1,544		0.035	2,355	0.054
	3.00		40.1	40.1	1,608		0.037	2,512	0.058
	3.10		40.9	40.9	1,672		0.038	2,676	0.061
	3.20		41.7	41.7	1,739		0.040	2,847	0.065
	3.30		42.5	42.5	1,806		0.041	3,024	0.069
	3.40		43.3	43.3	1,875		0.043	3,208	0.074
	3.50		44.1	44.1	1,944		0.045	3,399	0.078
	3.60		44.9	44.9	2,016		0.046	3,597	0.083
	3.70		45.7	45.7	2,088		0.048	3,802	0.087
	3.80		46.5	46.5	2,162		0.050	4,015	0.092
	3.90		47.3	47.3	2,237		0.051	4,234	0.097
	4.00		48.1	48.1	2,313		0.053	4,462	0.102
	4.10		48.9	48.9	2,391		0.055	4,697	0.108
	4.20		49.7	49.7	2,470		0.057	4,940	0.113

Note: This Sand Filter intercepts and treats the WQCV only.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Table Rock Homestead
Basin ID: Pond B2

Example Zone Configuration (Retention Pond)
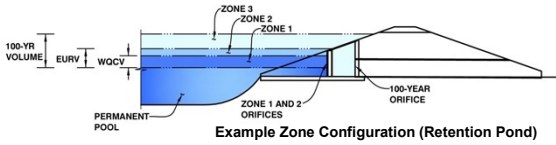
	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.009	Filtration Media
Zone 2			
Zone 3			
Total (all zones)		0.009	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft²
Underdrain Orifice Diameter =	0.46	inches	Underdrain Orifice Centroid =	0.02	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =		ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		sq. inches	Elliptical Slot Area =	N/A	ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Not Selected	Not Selected		Calculated Parameters for Overflow Weir	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =			feet
Overflow Weir Front Edge Length =			feet	Overflow Weir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Grate Open Area / 100-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft²
Overflow Grate Type =				Overflow Grate Open Area w/ Debris =			ft²
Debris Clogging % =			%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft²
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	1.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.12	feet
Spillway Crest Length =	5.00	feet	Stage at Top of Freeboard =	2.12	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.03	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.03	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).
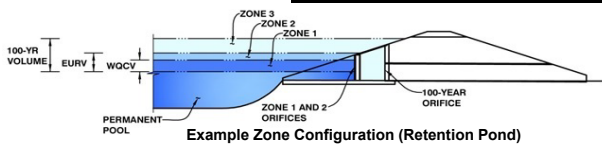
	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.92	1.19	1.44	1.81	2.12	2.46	3.34
CUHP Runoff Volume (acre-ft) =	0.009	0.045	0.024	0.032	0.040	0.052	0.063	0.075	0.107
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.024	0.032	0.040	0.052	0.063	0.075	0.107
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.1	0.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.00	0.00	0.02	0.10	0.21	0.49
Peak Inflow Q (cfs) =	N/A	N/A	0.2	0.3	0.3	0.5	0.6	0.7	1.0
Peak Outflow Q (cfs) =	0.0	7.9	0.2	0.2	0.3	0.5	0.6	0.7	1.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	252.5	178.5	58.0	15.3	8.2	5.4
Structure Controlling Flow =	Filtration Media	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	0	15	15	15	14	14	13	12
Time to Drain 99% of Inflow Volume (hours) =	**12**	0	16	16	16	16	16	16	15
Maximum Ponding Depth (ft) =	0.98	2.64	1.04	1.06	1.07	1.09	1.12	1.12	1.17
Area at Maximum Ponding Depth (acres) =	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.009	0.045	0.010	0.010	0.010	0.011	0.011	0.011	0.012

Project: Table Rock Homestead

Basin ID: Pond C1

Example Zone Configuration (Retention Pond)

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Media Surface	0.00		13.8	13.8	192		0.004		
	0.10		14.6	14.6	214		0.005	20	0.000
	0.20		15.4	15.4	238		0.005	43	0.001
	0.30		16.2	16.2	264		0.006	68	0.002
	0.40		17.0	17.0	290		0.007	96	0.002
	0.50		17.8	17.8	318		0.007	126	0.003
	0.60		18.6	18.6	347		0.008	159	0.004
	0.70		19.4	19.4	378		0.009	196	0.004
	0.80		20.2	20.2	410		0.009	235	0.005
	0.90		21.0	21.0	443		0.010	278	0.006
Zone 1 (WQCV)	1.00		21.8	21.8	477		0.011	324	0.007
	1.10		22.6	22.6	513		0.012	373	0.009
	1.20		23.4	23.4	549		0.013	426	0.010
	1.30		24.2	24.2	588		0.013	483	0.011
	1.40		25.0	25.0	627		0.014	544	0.012
	1.50		25.8	25.8	668		0.015	608	0.014
	1.60		26.6	26.6	710		0.016	677	0.016
	1.70		27.4	27.4	753		0.017	750	0.017
	1.80		28.2	28.2	797		0.018	828	0.019
	1.90		29.0	29.0	843		0.019	910	0.021
	2.00		29.8	29.8	890		0.020	997	0.023
	2.10		30.6	30.6	939		0.022	1,088	0.025
	2.20		31.4	31.4	988		0.023	1,184	0.027
	2.30		32.2	32.2	1,039		0.024	1,286	0.030
	2.40		33.0	33.0	1,092		0.025	1,392	0.032
	2.50		33.8	33.8	1,145		0.026	1,504	0.035
	2.60		34.6	34.6	1,200		0.028	1,621	0.037
	2.70		35.4	35.4	1,256		0.029	1,744	0.040
	2.80		36.2	36.2	1,313		0.030	1,873	0.043
	2.90		37.0	37.0	1,372		0.031	2,007	0.046
	3.00		37.8	37.8	1,432		0.033	2,147	0.049
	3.10		38.6	38.6	1,493		0.034	2,293	0.053
	3.20		39.4	39.4	1,556		0.036	2,446	0.056
	3.30		40.2	40.2	1,619		0.037	2,604	0.060
	3.40		41.0	41.0	1,684		0.039	2,770	0.064
	3.50		41.8	41.8	1,751		0.040	2,941	0.068
	3.60		42.6	42.6	1,818		0.042	3,120	0.072
	3.70		43.4	43.4	1,887		0.043	3,305	0.076
	3.80		44.2	44.2	1,957		0.045	3,497	0.080
	3.90		45.0	45.0	2,029		0.047	3,697	0.085
	4.00		45.8	45.8	2,101		0.048	3,903	0.090
	4.10		46.6	46.6	2,175		0.050	4,117	0.095
	4.20		47.4	47.4	2,251		0.052	4,338	0.100

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	0.34	acres
Watershed Length =	880	ft
Watershed Length to Centroid =	440	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	80.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Note: L / W Ratio > 8

L / W Ratio = 52.38

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Optional User Overrides

Water Quality Capture Volume (WQCV) =	0.007	acre-feet			acre-feet
Excess Urban Runoff Volume (EURV) =	0.036	acre-feet			acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.019	acre-feet	0.92	inches	
5-yr Runoff Volume (P1 = 1.19 in.) =	0.026	acre-feet	1.19	inches	
10-yr Runoff Volume (P1 = 1.44 in.) =	0.032	acre-feet	1.44	inches	
25-yr Runoff Volume (P1 = 1.81 in.) =	0.041	acre-feet	1.81	inches	
50-yr Runoff Volume (P1 = 2.12 in.) =	0.050	acre-feet	2.12	inches	
100-yr Runoff Volume (P1 = 2.46 in.) =	0.060	acre-feet	2.46	inches	
500-yr Runoff Volume (P1 = 3.34 in.) =	0.086	acre-feet	3.34	inches	
Approximate 2-yr Detention Volume =	0.018	acre-feet			
Approximate 5-yr Detention Volume =	0.024	acre-feet			
Approximate 10-yr Detention Volume =	0.030	acre-feet			
Approximate 25-yr Detention Volume =	0.039	acre-feet			
Approximate 50-yr Detention Volume =	0.044	acre-feet			
Approximate 100-yr Detention Volume =	0.050	acre-feet			

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.007	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.007	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft³
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H$_{total}$) =	1.00	ft
Depth of Trickle Channel (H$_{TC}$) =	N/A	ft
Slope of Trickle Channel (S$_{TC}$) =	N/A	ft/ft
Slopes of Main Basin Sides (S$_{main}$) =	4	H:V
Basin Length-to-Width Ratio (R$_{L/W}$) =	1	

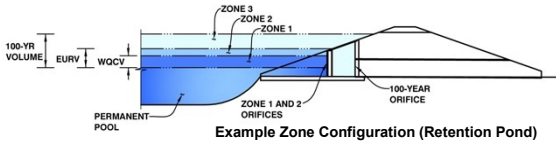**Total detention volume is less than 100-year volume.**

Note: This Sand Filter intercepts and treats the WQCV only.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Table Rock Homestead
Basin ID: Pond C1

Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.007	Filtration Media
Zone 2			
Zone 3			
Total (all zones)		0.007	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft²
Underdrain Orifice Diameter =	0.41	inches	Underdrain Orifice Centroid =	0.02	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =		ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		sq. inches	Elliptical Slot Area =	N/A	ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Not Selected	Not Selected		Calculated Parameters for Overflow Weir	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =			feet
Overflow Weir Front Edge Length =			feet	Overflow Weir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Grate Open Area / 100-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft²
Overflow Grate Type =				Overflow Grate Open Area w/ Debris =			ft²
Debris Clogging % =			%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft²
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	1.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.09	feet
Spillway Crest Length =	4.00	feet	Stage at Top of Freeboard =	2.09	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.02	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.02	acre-ft

Routed Hydrograph Results   *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.92	1.19	1.44	1.81	2.12	2.46	3.34
CUHP Runoff Volume (acre-ft) =	0.007	0.036	0.019	0.026	0.032	0.041	0.050	0.060	0.086
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.019	0.026	0.032	0.041	0.050	0.060	0.086
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.00	0.00	0.01	0.07	0.14	0.35
Peak Inflow Q (cfs) =	N/A	N/A	0.1	0.2	0.2	0.3	0.3	0.4	0.6
Peak Outflow Q (cfs) =	0.0	6.3	0.1	0.2	0.2	0.3	0.4	0.4	0.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	278.2	195.1	67.6	16.5	8.7	5.1
Structure Controlling Flow =	Filtration Media	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	0	16	16	16	15	15	14	13
Time to Drain 99% of Inflow Volume (hours) =	**12**	**0**	**17**	**17**	**17**	**17**	**16**	**16**	**16**
Maximum Ponding Depth (ft) =	0.97	2.56	1.04	1.05	1.06	1.08	1.09	1.10	1.13
Area at Maximum Ponding Depth (acres) =	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.007	0.036	0.008	0.008	0.008	0.008	0.008	0.009	0.009

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Table Rock Homestead

Basin ID: Pond D1
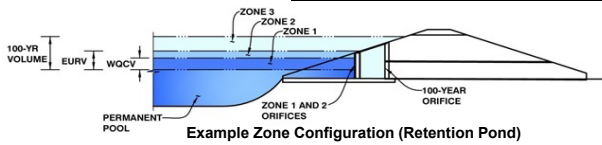
Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	0.20	acres
Watershed Length =	390	ft
Watershed Length to Centroid =	195	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	80.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Note: L / W Ratio > 8

L / W Ratio = 17.28

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Optional User Overrides

Water Quality Capture Volume (WQCV) =	0.004	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.021	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.011	acre-feet	0.92	inches
5-yr Runoff Volume (P1 = 1.19 in.) =	0.015	acre-feet	1.19	inches
10-yr Runoff Volume (P1 = 1.44 in.) =	0.019	acre-feet	1.44	inches
25-yr Runoff Volume (P1 = 1.81 in.) =	0.024	acre-feet	1.81	inches
50-yr Runoff Volume (P1 = 2.12 in.) =	0.029	acre-feet	2.12	inches
100-yr Runoff Volume (P1 = 2.46 in.) =	0.035	acre-feet	2.46	inches
500-yr Runoff Volume (P1 = 3.34 in.) =	0.050	acre-feet	3.34	inches
Approximate 2-yr Detention Volume =	0.011	acre-feet		
Approximate 5-yr Detention Volume =	0.014	acre-feet		
Approximate 10-yr Detention Volume =	0.018	acre-feet		
Approximate 25-yr Detention Volume =	0.023	acre-feet		
Approximate 50-yr Detention Volume =	0.026	acre-feet		
Approximate 100-yr Detention Volume =	0.030	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.004	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.004	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H$_{total}$) =	1.00	ft
Depth of Trickle Channel (H$_{TC}$) =	N/A	ft
Slope of Trickle Channel (S$_{TC}$) =	N/A	ft/ft
Slopes of Main Basin Sides (S$_{main}$) =	4	H:V
Basin Length-to-Width Ratio (R$_{L/W}$) =	1	

Total detention volume is less than 100-year volume.

Depth Increment = 0.10 ft

| Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	0.00		9.7	9.7	94		0.002		
	0.10		10.5	10.5	110		0.003	10	0.000
	0.20		11.3	11.3	127		0.003	22	0.001
	0.30		12.1	12.1	146		0.003	36	0.001
	0.40		12.9	12.9	166		0.004	51	0.001
	0.50		13.7	13.7	187		0.004	69	0.002
	0.60		14.5	14.5	210		0.005	89	0.002
	0.70		15.3	15.3	234		0.005	111	0.003
	0.80		16.1	16.1	259		0.006	136	0.003
	0.90		16.9	16.9	285		0.007	163	0.004
Zone 1 (WQCV)	1.00		17.7	17.7	313		0.007	193	0.004
	1.10		18.5	18.5	342		0.008	225	0.005
	1.20		19.3	19.3	372		0.009	261	0.006
	1.30		20.1	20.1	403		0.009	300	0.007
	1.40		20.9	20.9	436		0.010	342	0.008
	1.50		21.7	21.7	470		0.011	387	0.009
	1.60		22.5	22.5	506		0.012	436	0.010
	1.70		23.3	23.3	542		0.012	488	0.011
	1.80		24.1	24.1	580		0.013	544	0.012
	1.90		24.9	24.9	619		0.014	604	0.014
	2.00		25.7	25.7	660		0.015	668	0.015
	2.10		26.5	26.5	701		0.016	736	0.017
	2.20		27.3	27.3	745		0.017	809	0.019
	2.30		28.1	28.1	789		0.018	885	0.020
	2.40		28.9	28.9	834		0.019	966	0.022
	2.50		29.7	29.7	881		0.020	1,052	0.024
	2.60		30.5	30.5	929		0.021	1,143	0.026
	2.70		31.3	31.3	979		0.022	1,238	0.028
	2.80		32.1	32.1	1,029		0.024	1,338	0.031
	2.90		32.9	32.9	1,081		0.025	1,444	0.033
	3.00		33.7	33.7	1,135		0.026	1,555	0.036
	3.10		34.5	34.5	1,189		0.027	1,671	0.038
	3.20		35.3	35.3	1,245		0.029	1,793	0.041
	3.30		36.1	36.1	1,302		0.030	1,920	0.044
	3.40		36.9	36.9	1,361		0.031	2,053	0.047
	3.50		37.7	37.7	1,420		0.033	2,192	0.050
	3.60		38.5	38.5	1,481		0.034	2,337	0.054
	3.70		39.3	39.3	1,543		0.035	2,489	0.057
	3.80		40.1	40.1	1,607		0.037	2,646	0.061
	3.90		40.9	40.9	1,672		0.038	2,810	0.065
	4.00		41.7	41.7	1,738		0.040	2,980	0.068
	4.10		42.5	42.5	1,805		0.041	3,158	0.072
	4.20		43.3	43.3	1,874		0.043	3,341	0.077

Note: This Sand Filter intercepts and treats the WQCV only.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Table Rock Homestead
Basin ID: Pond D1

Example Zone Configuration (Retention Pond)
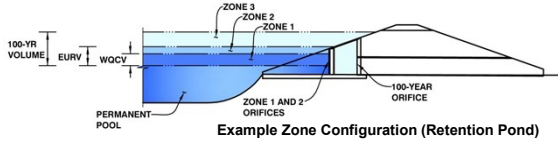
	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.004	
Zone 2			
Zone 3			
Total (all zones)		0.004	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft²
Underdrain Orifice Diameter =	0.30	inches	Underdrain Orifice Centroid =	0.01	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =		ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		sq. inches	Elliptical Slot Area =	N/A	ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Not Selected	Not Selected		Calculated Parameters for Overflow Weir	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =			feet
Overflow Weir Front Edge Length =			feet	Overflow Weir Slope Length =			feet
Overflow Weir Grate Slope =			H:V	Grate Open Area / 100-yr Orifice Area =			
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft²
Overflow Grate Type =				Overflow Grate Open Area w/ Debris =			ft²
Debris Clogging % =			%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft²
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	1.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.10	feet
Spillway Crest Length =	3.00	feet	Stage at Top of Freeboard =	2.10	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.02	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.02	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.92	1.19	1.44	1.81	2.12	2.46	3.34
CUHP Runoff Volume (acre-ft) =	0.004	0.021	0.011	0.015	0.019	0.024	0.029	0.035	0.050
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.011	0.015	0.019	0.024	0.029	0.035	0.050
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.00	0.00	0.01	0.10	0.22	0.54
Peak Inflow Q (cfs) =	N/A	N/A	0.1	0.1	0.2	0.2	0.3	0.4	0.5
Peak Outflow Q (cfs) =	0.0	3.7	0.1	0.1	0.2	0.3	0.3	0.4	0.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	#DIV/0!	#DIV/0!	135.6	14.8	9.7	5.0
Structure Controlling Flow =	Filtration Media	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	13	0	16	16	16	15	15	14	13
Time to Drain 99% of Inflow Volume (hours) =	**13**	0	17	17	17	17	17	16	16
Maximum Ponding Depth (ft) =	0.94	2.34	1.04	1.05	1.06	1.09	1.10	1.12	1.14
Area at Maximum Ponding Depth (acres) =	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.004	0.021	0.005	0.005	0.005	0.005	0.005	0.005	0.005