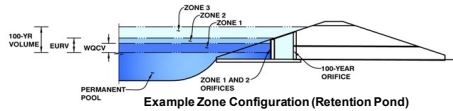


MHFD-Detention, Version 4.06 (July 2022)

Basin ID: Pond 1

Example Zone Configuration (Retention Pond)

7457.1

Selected BMP Type =	EDB	
Watershed Area =	14.89	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	415	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	15.80%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Group C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths = User Input		

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

Water Quality Capture Volume (WQCV) =	0.121	acre-feet
Excess Urban Runoff Volume (EURV) =	0.229	acre-feet
2-yr Runoff Volume ($P1 = 0.92$ in.) =	0.123	acre-feet
5-yr Runoff Volume ($P1 = 1.22$ in.) =	0.249	acre-feet
10-yr Runoff Volume ($P1 = 1.44$ in.) =	0.439	acre-feet
25-yr Runoff Volume ($P1 = 1.82$ in.) =	0.970	acre-feet
50-yr Runoff Volume ($P1 = 2.13$ in.) =	1.323	acre-feet
100-yr Runoff Volume ($P1 = 2.47$ in.) =	1.812	acre-feet
500-yr Runoff Volume ($P1 = 3.36$ in.) =	2.900	acre-feet
Approximate 2-yr Detention Volume =	0.119	acre-feet
Approximate 5-yr Detention Volume =	0.185	acre-feet
Approximate 10-yr Detention Volume =	0.332	acre-feet
Approximate 25-yr Detention Volume =	0.474	acre-feet
Approximate 50-yr Detention Volume =	0.520	acre-feet
Approximate 100-yr Detention Volume =	0.675	acre-feet

Zone 1 Volume (WQCV) =	0.121	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.109	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.445	acre-feet
Total Detention Basin Volume =	0.675	acre-feet
Initial Surcharge Volume (ISV) =	user	ft ³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

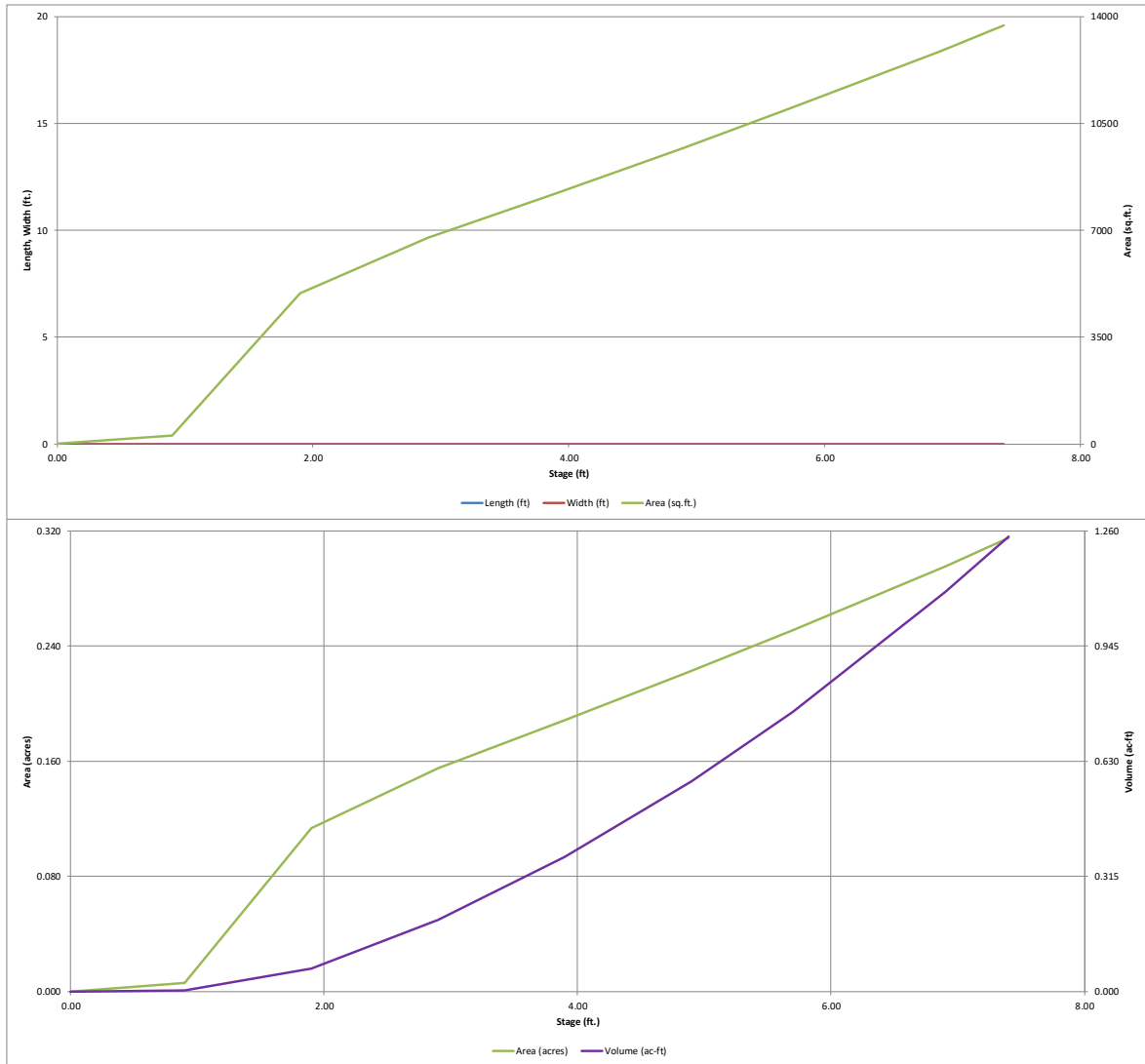
Initial Surcharge Area (A_{S1})	=	user	ft ²
Surcharge Volume Length (L_{S1})	=	user	ft
Surcharge Volume Width (W_{S1})	=	user	ft
Depth of Basin Floor (H_{FLOOR})	=	user	ft
Length of Basin Floor (L_{FLOOR})	=	user	ft
Width of Basin Floor (W_{FLOOR})	=	user	ft
Area of Basin Floor (A_{FLOOR})	=	user	ft ²
Volume of Basin Floor (V_{FLOOR})	=	user	ft ³
Depth of Main Basin (H_{MAIN})	=	user	ft
Length of Main Basin (L_{MAIN})	=	user	ft
Width of Main Basin (W_{MAIN})	=	user	ft
Area of Main Basin (A_{MAIN})	=	user	ft ²
Volume of Main Basin (V_{MAIN})	=	user	ft ³
Calculated Total Basin Volume (V_{TOTAL})	=	user	acre-feet

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.44	inches
1.82	inches
2.13	inches
2.47	inches
3.36	inches

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Depotion, Version 4.06 (July 2022)

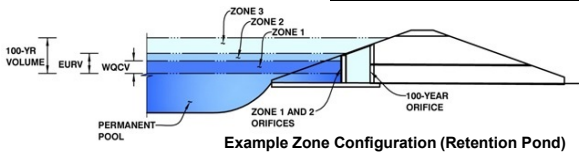


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Iron Ridge Subdivision

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.37	0.121	Orifice Plate
Zone 2 (EURV)	3.11	0.109	Circular Orifice
Zone 3 (100-year)	5.34	0.445	Weir&Pipe (Restrict)
Total (all zones)		0.675	

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

Underdrain Orifice Invert Depth = N/A ft (distance below the filtration media surface)
Underdrain Orifice Diameter = N/A inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft²
Underdrain Orifice Centroid = N/A 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 = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 2.60 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = N/A sq. inches

WQ Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (required)	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)	0.00	1.60						
Orifice Area (sq. inches)	0.60	0.79						

	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)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice = 3.00 N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 3.07 N/A ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 0.38 N/A inches

Vertical Orifice Area = 0.00 N/A ft²
Vertical Orifice Centroid = 0.02 N/A feet

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

Calculated Parameters for Overflow Weir

Overflow Weir Front Edge Height, H_o = 3.83 N/A ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 4.00 N/A feet
Overflow Weir Gate Slope = 0.00 N/A H:V
Horiz. Length of Weir Sides = 5.00 N/A feet
Overflow Gate Type = Type C Gate N/A
Debris Clogging % = 50% N/A %

Height of Gate Upper Edge, H_u = 3.83 N/A feet
Overflow Weir Slope Length = 5.00 N/A feet
Gate Open Area / 100-yr Orifice Area = 6.74 N/A
Overflow Gate Open Area w/o Debris = 13.92 N/A ft²
Overflow Gate Open Area w/ Debris = 6.96 N/A ft²

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Depth to Invert of Outlet Pipe = 1.50 N/A ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 24.00 N/A inches
Restrictor Plate Height Above Pipe Invert = 15.00 inches

Outlet Orifice Area = 2.07 N/A ft²
Outlet Orifice Centroid = 0.71 N/A feet
Half-Central Angle of Restrictor Plate on Pipe = 1.82 N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage = 5.70 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 16.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Spillway Design Flow Depth = 0.63 feet
Stage at Top of Freeboard = 7.33 feet
Basin Area at Top of Freeboard = 0.31 acres
Basin Volume at Top of Freeboard = 1.22 acre-ft

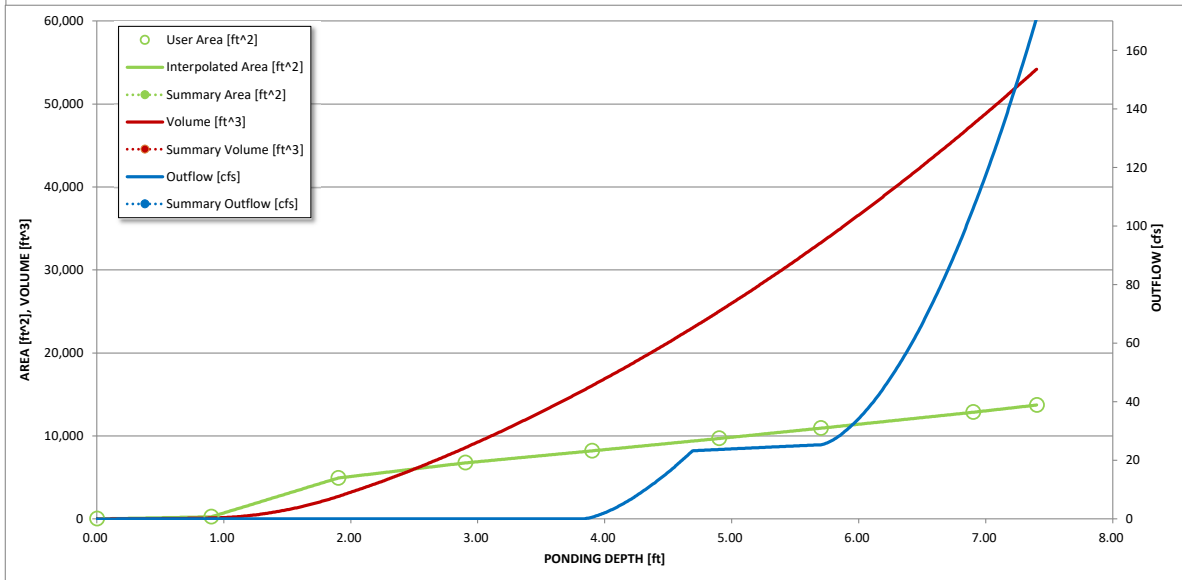
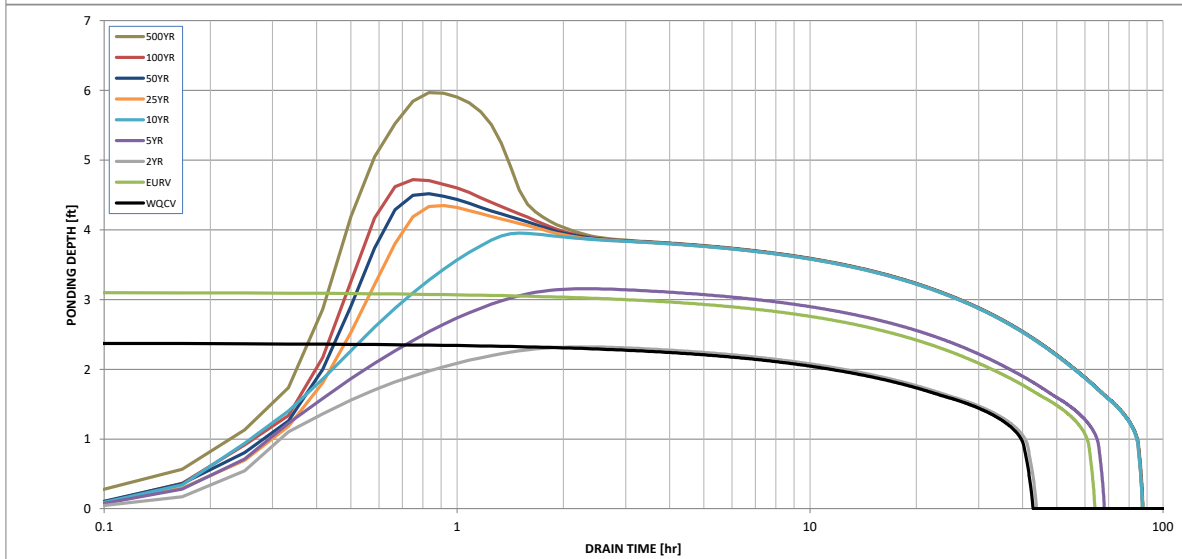
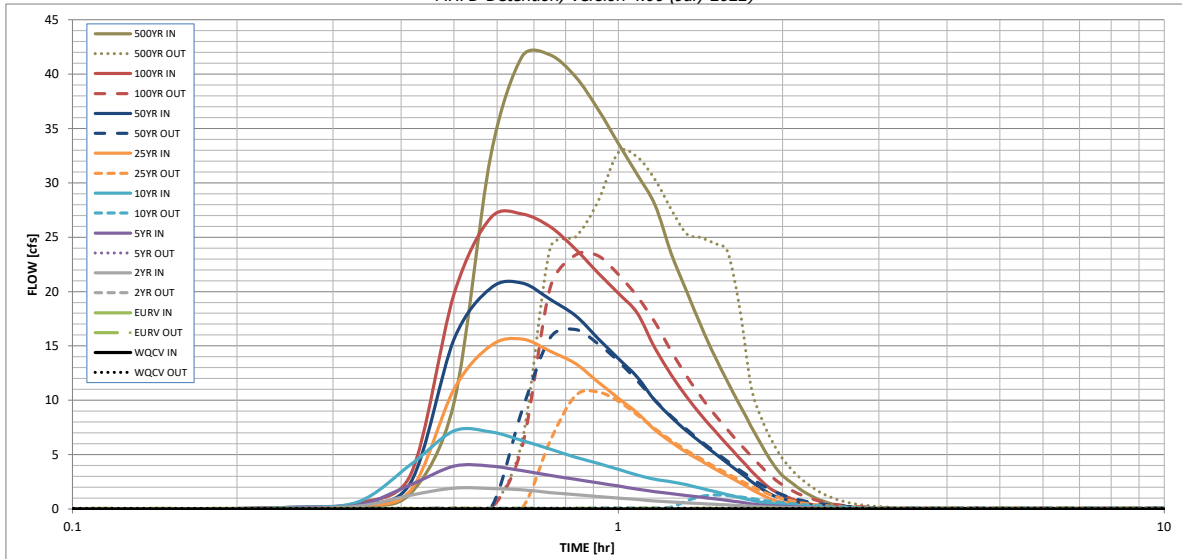
Routed Hydrograph Results

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 =	N/A	N/A	0.92	1.20	1.44	1.82	2.13	2.47	3.36
One-Hour Rainfall Depth (in) =	0.121	0.229	0.123	0.249	0.439	0.970	1.323	1.812	2.900
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.123	0.249	0.439	0.970	1.323	1.812	2.900
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	1.7	4.8	13.4	18.4	24.7	39.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.12	0.32	0.90	1.24	1.66	2.63
Peak Inflow Q (cfs) =	N/A	N/A	1.9	4.0	7.2	15.6	20.8	27.1	41.8
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	1.3	10.8	16.5	23.3	32.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.0	0.3	0.8	0.9	0.9	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.8	1.2	1.7	1.9
Max Velocity through Gate 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) =	40	59	41	63	79	71	67	62	53
Time to Drain 99% of Inflow Volume (hours) =	42	62	43	66	84	81	79	77	72
Maximum Ponding Depth (ft) =	2.38	3.11	2.32	3.15	3.95	4.34	4.51	4.72	5.97
Area at Maximum Ponding Depth (acres) =	0.13	0.16	0.13	0.16	0.19	0.20	0.21	0.22	0.26
Maximum Volume Stored (acre-ft) =	0.122	0.230	0.113	0.237	0.376	0.455	0.490	0.533	0.830

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

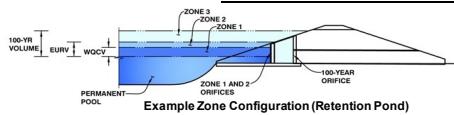
Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	0:15:00	0.00	0.00	0.05	0.10	0.14	0.11	0.16	0.16	0.27
	0:20:00	0.00	0.00	0.25	0.36	0.66	0.31	0.39	0.57	1.46
	0:25:00	0.00	0.00	1.27	2.23	4.08	1.74	2.44	3.17	9.74
	0:30:00	0.00	0.00	1.92	3.93	7.17	11.00	15.59	19.74	32.48
	0:35:00	0.00	0.00	1.89	3.95	7.08	15.02	20.32	26.80	41.62
	0:40:00	0.00	0.00	1.76	3.52	6.31	15.63	20.77	27.13	41.75
	0:45:00	0.00	0.00	1.51	3.08	5.51	14.51	19.28	25.97	39.80
	0:50:00	0.00	0.00	1.31	2.73	4.77	13.39	17.80	23.93	36.83
	0:55:00	0.00	0.00	1.15	2.41	4.20	11.71	15.73	21.75	33.62
	1:00:00	0.00	0.00	1.01	2.11	3.65	10.19	13.84	19.84	30.75
	1:05:00	0.00	0.00	0.87	1.82	3.13	8.84	12.12	18.02	28.00
	1:10:00	0.00	0.00	0.74	1.60	2.73	7.28	9.99	14.81	23.50
	1:15:00	0.00	0.00	0.64	1.42	2.49	6.14	8.46	12.34	20.05
	1:20:00	0.00	0.00	0.57	1.24	2.23	5.21	7.19	10.35	16.86
	1:25:00	0.00	0.00	0.50	1.08	1.91	4.44	6.13	8.66	14.12
	1:30:00	0.00	0.00	0.43	0.94	1.62	3.71	5.14	7.23	11.77
	1:35:00	0.00	0.00	0.37	0.79	1.34	3.06	4.23	5.91	9.62
	1:40:00	0.00	0.00	0.31	0.64	1.07	2.43	3.38	4.69	7.64
	1:45:00	0.00	0.00	0.25	0.49	0.82	1.84	2.57	3.55	5.79
	1:50:00	0.00	0.00	0.20	0.36	0.62	1.28	1.82	2.52	4.20
	1:55:00	0.00	0.00	0.17	0.29	0.49	0.86	1.27	1.75	3.06
	2:00:00	0.00	0.00	0.14	0.25	0.41	0.62	0.96	1.29	2.36
	2:05:00	0.00	0.00	0.12	0.20	0.33	0.44	0.69	0.91	1.72
	2:10:00	0.00	0.00	0.09	0.15	0.26	0.31	0.50	0.63	1.23
	2:15:00	0.00	0.00	0.07	0.12	0.20	0.22	0.36	0.43	0.86
	2:20:00	0.00	0.00	0.06	0.09	0.15	0.16	0.26	0.28	0.59
	2:25:00	0.00	0.00	0.05	0.07	0.12	0.12	0.19	0.18	0.39
	2:30:00	0.00	0.00	0.04	0.05	0.09	0.08	0.14	0.13	0.27
	2:35:00	0.00	0.00	0.03	0.04	0.06	0.06	0.10	0.09	0.20
	2:40:00	0.00	0.00	0.02	0.03	0.05	0.04	0.08	0.07	0.15
	2:45:00	0.00	0.00	0.02	0.02	0.04	0.03	0.06	0.06	0.12
	2:50:00	0.00	0.00	0.01	0.02	0.03	0.02	0.04	0.04	0.09
	2:55:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.07
	3:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.05
	3:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.03
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.06 (July 2022)

Basin ID: POND 2

Example Zone Configuration (Retention Pond)

Selected BMP Type =	EDB	
Watershed Area =	9.48	acres
Watershed Length =	1,093	ft
Watershed Length to Centroid =	250	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	17.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths = User Input		

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

Water Quality Capture Volume (WQCV) =	0.082	acre-feet
Excess Urban Runoff Volume (EUCV) =	0.161	acre-feet
2-yr Runoff Volume ($P1 = 0.92$ in.) =	0.087	acre-feet
5-yr Runoff Volume ($P1 = 1.2$ in.) =	0.170	acre-feet
10-yr Runoff Volume ($P1 = 1.44$ in.) =	0.293	acre-feet
25-yr Runoff Volume ($P1 = 1.82$ in.) =	0.628	acre-feet
50-yr Runoff Volume ($P1 = 2.13$ in.) =	0.853	acre-feet
100-yr Runoff Volume ($P1 = 2.47$ in.) =	1.162	acre-feet
500-yr Runoff Volume ($P1 = 3.36$ in.) =	1.852	acre-feet
Approximate 2-yr Detention Volume =	0.084	acre-feet
Approximate 5-yr Detention Volume =	0.130	acre-feet
Approximate 10-yr Detention Volume =	0.227	acre-feet
Approximate 25-yr Detention Volume =	0.318	acre-feet
Approximate 50-yr Detention Volume =	0.350	acre-feet
Approximate 100-yr Detention Volume =	0.450	acre-feet

Zone 1 Volume (WQCV) =	0.082	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.079	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.289	acre-feet
Total Detention Basin Volume =	0.450	acre-feet
Initial Surcharge Volume (ISV) =	user	ft ³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Bases (S_{main}) =	user	Ht/V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

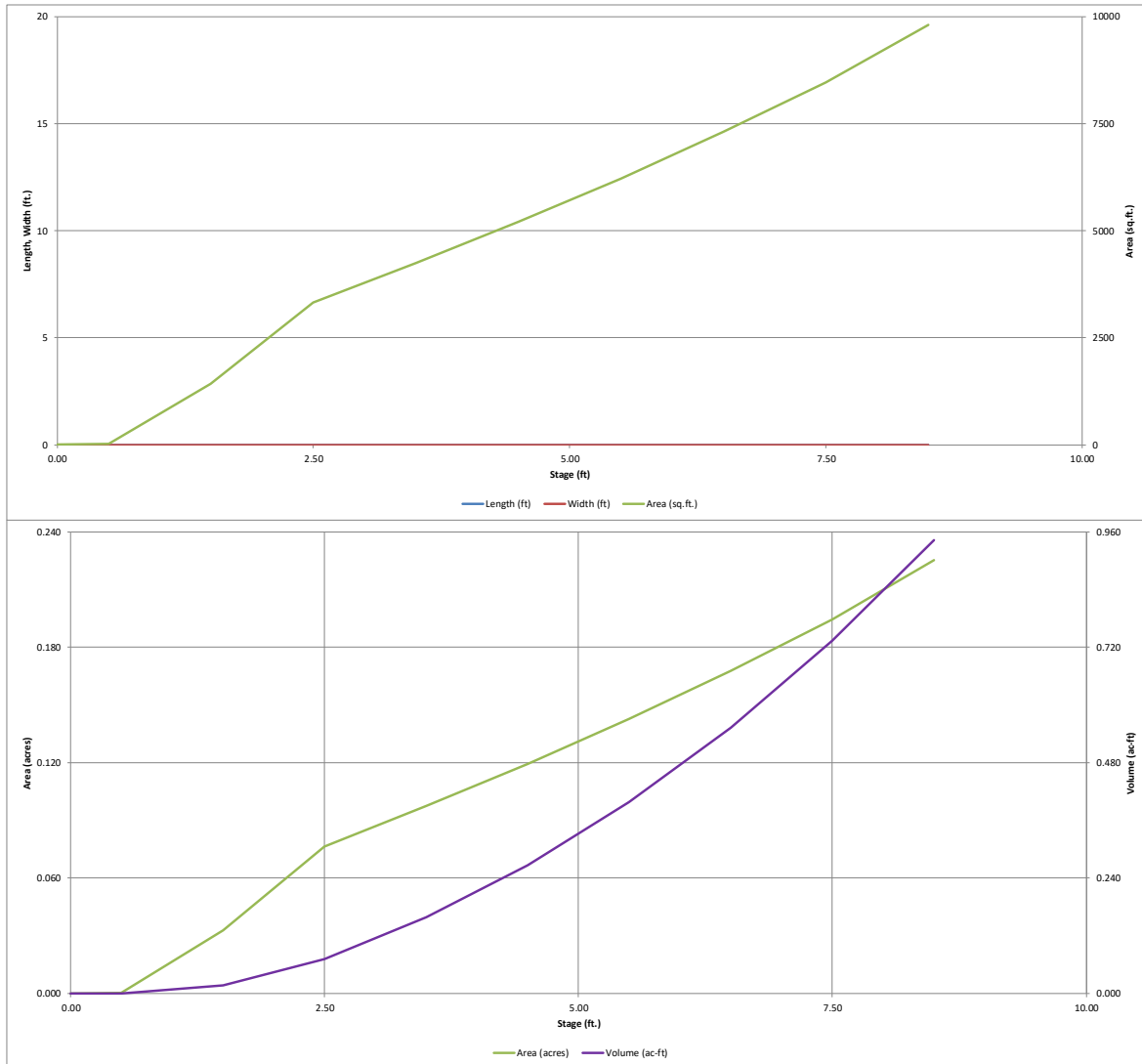
Initial Surcharge Area (A_{S1})	=	user	ft ²
Surcharge Volume Length (L_{S1})	=	user	ft
Surcharge Volume Width (W_{S1})	=	user	ft
Depth of Basin Floor (H_{FLOOR})	=	user	ft
Length of Basin Floor (L_{FLOOR})	=	user	ft
Width of Basin Floor (W_{FLOOR})	=	user	ft
Area of Basin Floor (A_{FLOOR})	=	user	ft ²
Volume of Basin Floor (V_{FLOOR})	=	user	ft ³
Depth of Main Basin (H_{MAIN})	=	user	ft
Length of Main Basin (L_{MAIN})	=	user	ft
Width of Main Basin (W_{MAIN})	=	user	ft
Area of Main Basin (A_{MAIN})	=	user	ft ²
Volume of Main Basin (V_{MAIN})	=	user	ft ³
Calculated Total Basin Volume (V_{TOTAL})	=	user	acre-feet

Depth Increment =

Optional User Overrides	
	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.44	inches
1.82	inches
2.13	inches
2.47	inches
3.36	inches

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Depotion, Version 4.06 (July 2022)

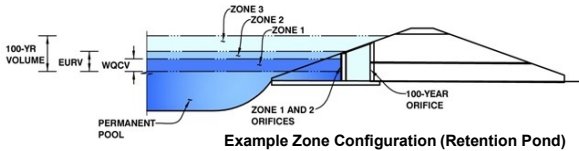


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **IRON RIDGE SUBDIVISION**

Basin ID: **POND 2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.65	0.082	Orifice Plate
Zone 2 (EURV)	3.54	0.079	Circular Orifice
Zone 3 (100-year)	5.86	0.289	Weir&Pipe (Restrict)
Total (all zones)		0.450	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = 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)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	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)	0.00	1.75						
Orifice Area (sq. inches)	0.44	0.44						

	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)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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

Calculated Parameters for Overflow Weir

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Gate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Gate Type =
Debris Clogging % = %

Height of Gate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Gate Open Area / 100-yr Orifice Area =
Overflow Gate Open Area w/o Debris = ft²
Overflow Gate Open Area w/ Debris = ft²

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

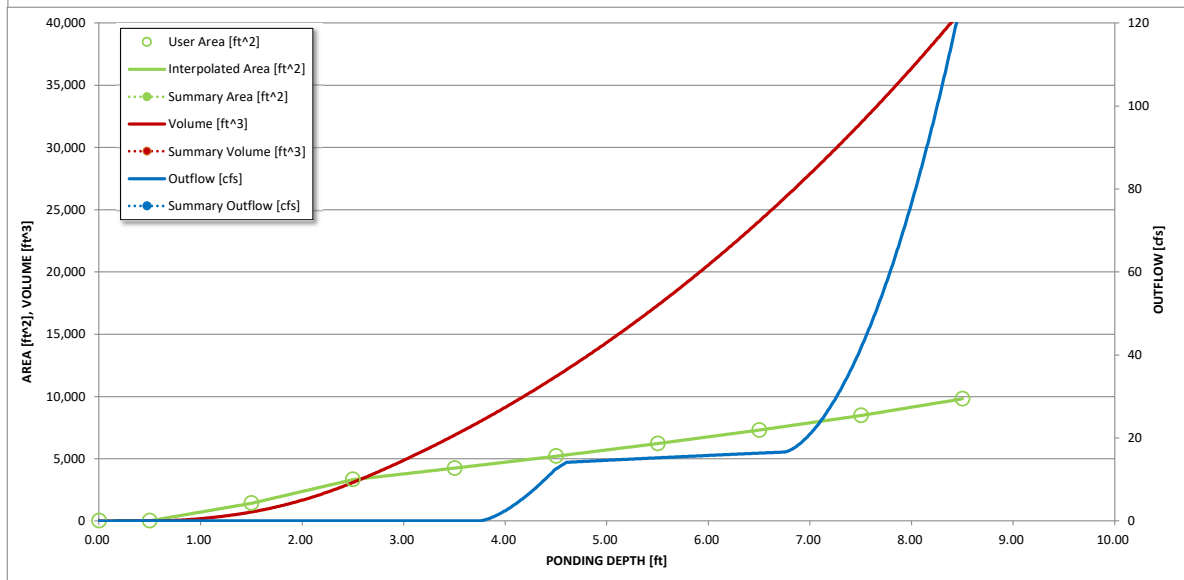
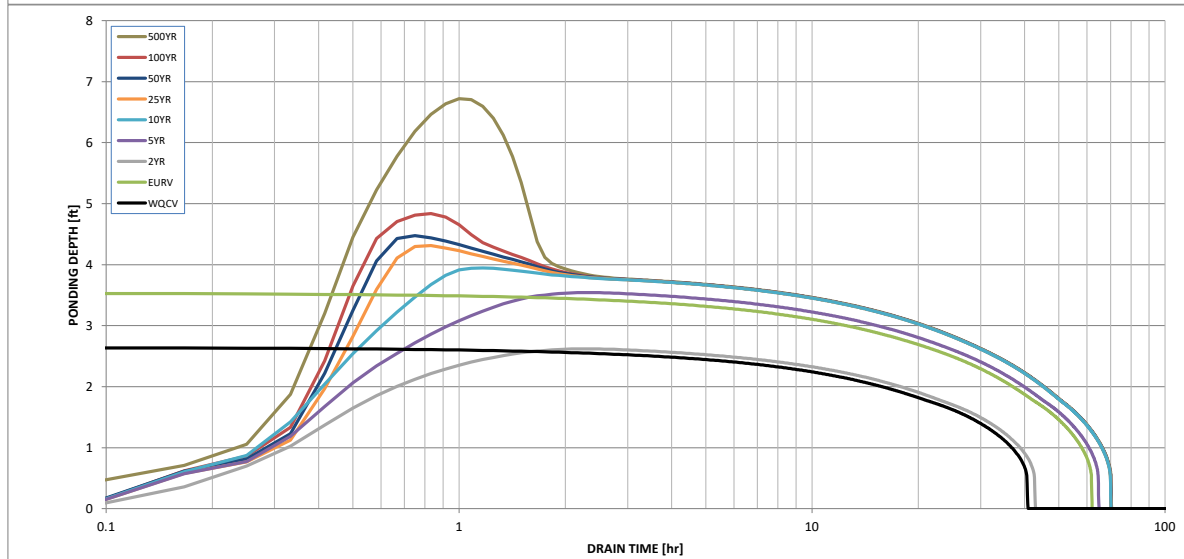
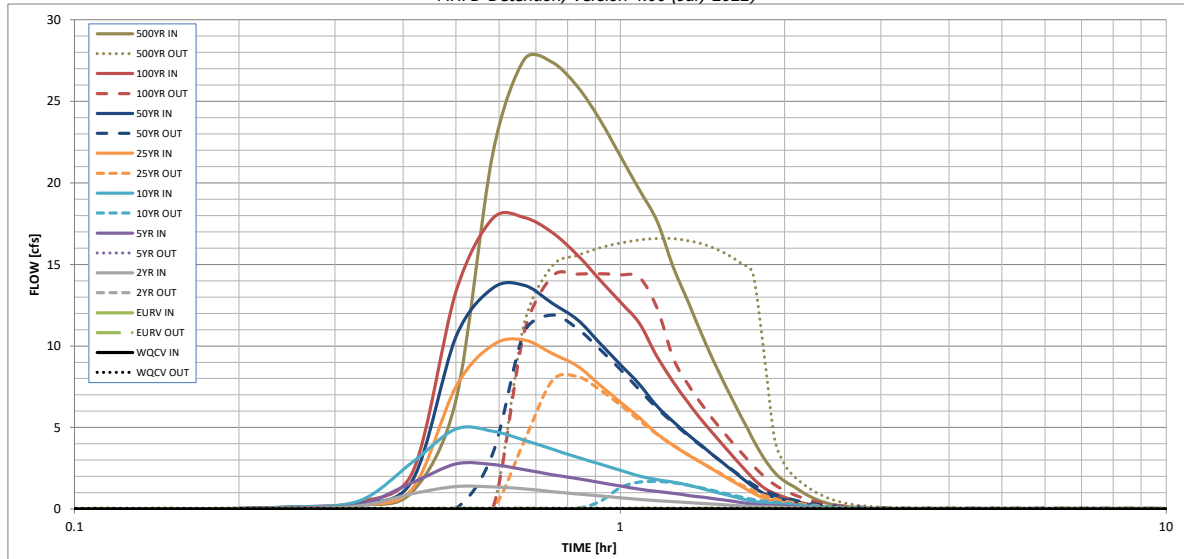
Routed Hydrograph Results

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 =	N/A	N/A	0.92	1.20	1.44	1.82	2.13	2.47	3.36
One-Hour Rainfall Depth (in) =	0.082	0.161	0.087	0.170	0.293	0.628	0.853	1.162	1.852
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.087	0.170	0.293	0.628	0.853	1.162	1.852
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	1.1	3.1	8.6	11.9	15.9	25.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	1.1	3.1	8.6	11.9	15.9	25.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.02	0.12	0.33	0.91	1.25	1.68	2.66
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	1.4	2.8	4.9	10.4	13.7	17.9	27.6
Peak Inflow Q (cfs) =	0.0	0.1	0.0	0.1	1.7	8.1	11.9	14.4	16.6
Peak Outflow Q (cfs) =	N/A	N/A	N/A	0.0	0.5	0.9	1.0	0.9	0.7
Ratio Peak Outflow to Predevelopment Q =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Structure Controlling Flow =	N/A	N/A	N/A	N/A	0.3	1.3	1.9	2.3	2.6
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Gate 2 (fps) =	38	58	40	60	63	56	52	47	39
Time to Drain 97% of Inflow Volume (hours) =	40	61	42	63	67	65	63	61	56
Time to Drain 99% of Inflow Volume (hours) =	2.64	3.54	2.62	3.54	3.94	4.31	4.47	4.83	6.72
Maximum Ponding Depth (ft) =	0.08	0.10	0.08	0.10	0.11	0.12	0.12	0.13	0.17
Area at Maximum Ponding Depth (acres) =	0.082	0.162	0.080	0.161	0.203	0.243	0.263	0.307	0.589
Maximum Volume Stored (acre-ft) =									

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
	0:15:00	0.00	0.00	0.04	0.08	0.11	0.09	0.13	0.13	0.22
	0:20:00	0.00	0.00	0.20	0.29	0.52	0.25	0.31	0.46	1.09
	0:25:00	0.00	0.00	0.94	1.63	2.89	1.29	1.79	2.29	6.68
	0:30:00	0.00	0.00	1.39	2.76	4.91	7.50	10.57	13.33	21.77
	0:35:00	0.00	0.00	1.35	2.74	4.78	10.06	13.54	17.81	27.55
	0:40:00	0.00	0.00	1.25	2.42	4.23	10.37	13.73	17.88	27.40
	0:45:00	0.00	0.00	1.07	2.11	3.68	9.53	12.62	16.96	25.92
	0:50:00	0.00	0.00	0.92	1.87	3.18	8.78	11.63	15.59	23.90
	0:55:00	0.00	0.00	0.81	1.64	2.76	7.62	10.19	14.06	21.64
	1:00:00	0.00	0.00	0.70	1.41	2.37	6.56	8.86	12.70	19.58
	1:05:00	0.00	0.00	0.60	1.21	2.03	5.61	7.66	11.41	17.68
	1:10:00	0.00	0.00	0.51	1.08	1.80	4.62	6.32	9.35	14.83
	1:15:00	0.00	0.00	0.45	0.96	1.65	3.91	5.37	7.80	12.65
	1:20:00	0.00	0.00	0.39	0.84	1.46	3.31	4.54	6.49	10.54
	1:25:00	0.00	0.00	0.34	0.72	1.24	2.79	3.83	5.37	8.71
	1:30:00	0.00	0.00	0.29	0.61	1.03	2.29	3.15	4.39	7.11
	1:35:00	0.00	0.00	0.24	0.51	0.82	1.83	2.52	3.49	5.64
	1:40:00	0.00	0.00	0.20	0.39	0.64	1.39	1.93	2.65	4.29
	1:45:00	0.00	0.00	0.16	0.29	0.48	0.99	1.38	1.88	3.10
	1:50:00	0.00	0.00	0.14	0.23	0.39	0.66	0.96	1.30	2.24
	1:55:00	0.00	0.00	0.12	0.20	0.33	0.48	0.72	0.96	1.71
	2:00:00	0.00	0.00	0.10	0.18	0.28	0.37	0.57	0.73	1.36
	2:05:00	0.00	0.00	0.08	0.14	0.23	0.27	0.42	0.52	0.98
	2:10:00	0.00	0.00	0.07	0.11	0.18	0.19	0.31	0.36	0.70
	2:15:00	0.00	0.00	0.05	0.08	0.14	0.14	0.23	0.24	0.48
	2:20:00	0.00	0.00	0.04	0.06	0.10	0.10	0.16	0.16	0.33
	2:25:00	0.00	0.00	0.03	0.05	0.08	0.07	0.12	0.11	0.23
	2:30:00	0.00	0.00	0.02	0.04	0.06	0.05	0.09	0.08	0.17
	2:35:00	0.00	0.00	0.02	0.03	0.04	0.04	0.07	0.06	0.12
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.03	0.05	0.05	0.09
	2:45:00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.04	0.07
	2:50:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.05
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.04
	3:00:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00