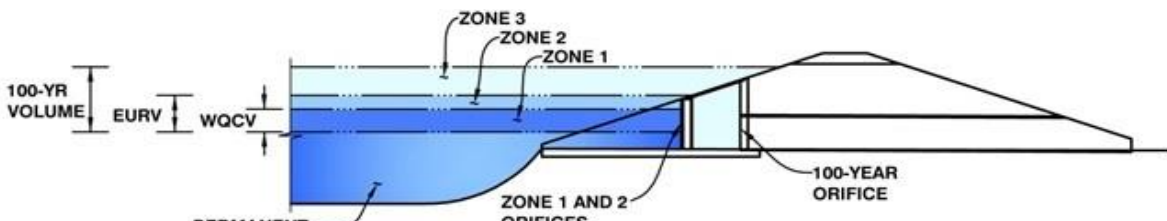


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Kristin Estates

Basin ID: Overall Pond Design (WQCV Override)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	158.00	acres
Watershed Length =	4,420	ft
Watershed Length to Centroid =	1,210	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	2.00%	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 =	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) =	0.029	acre-feet
Excess Urban Runoff Volume (EURV) =	0.148	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.082	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.157	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.224	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.987	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.996	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	6.749	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	13.211	acre-feet
Approximate 2-yr Detention Volume =	0.083	acre-feet
Approximate 5-yr Detention Volume =	0.118	acre-feet
Approximate 10-yr Detention Volume =	0.168	acre-feet
Approximate 25-yr Detention Volume =	0.251	acre-feet
Approximate 50-yr Detention Volume =	0.621	acre-feet
Approximate 100-yr Detention Volume =	1.707	acre-feet

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.029	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.119	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.559	acre-feet
Total Detention Basin Volume =	1.707	acre-feet
Initial Surge Volume (ISV) =	user	ft ³
Initial Surge 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_{ISV}) =	user	ft ²
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	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

SEE WQCV CALCULATION
PROVIDED IN THIS
DOCUMENT

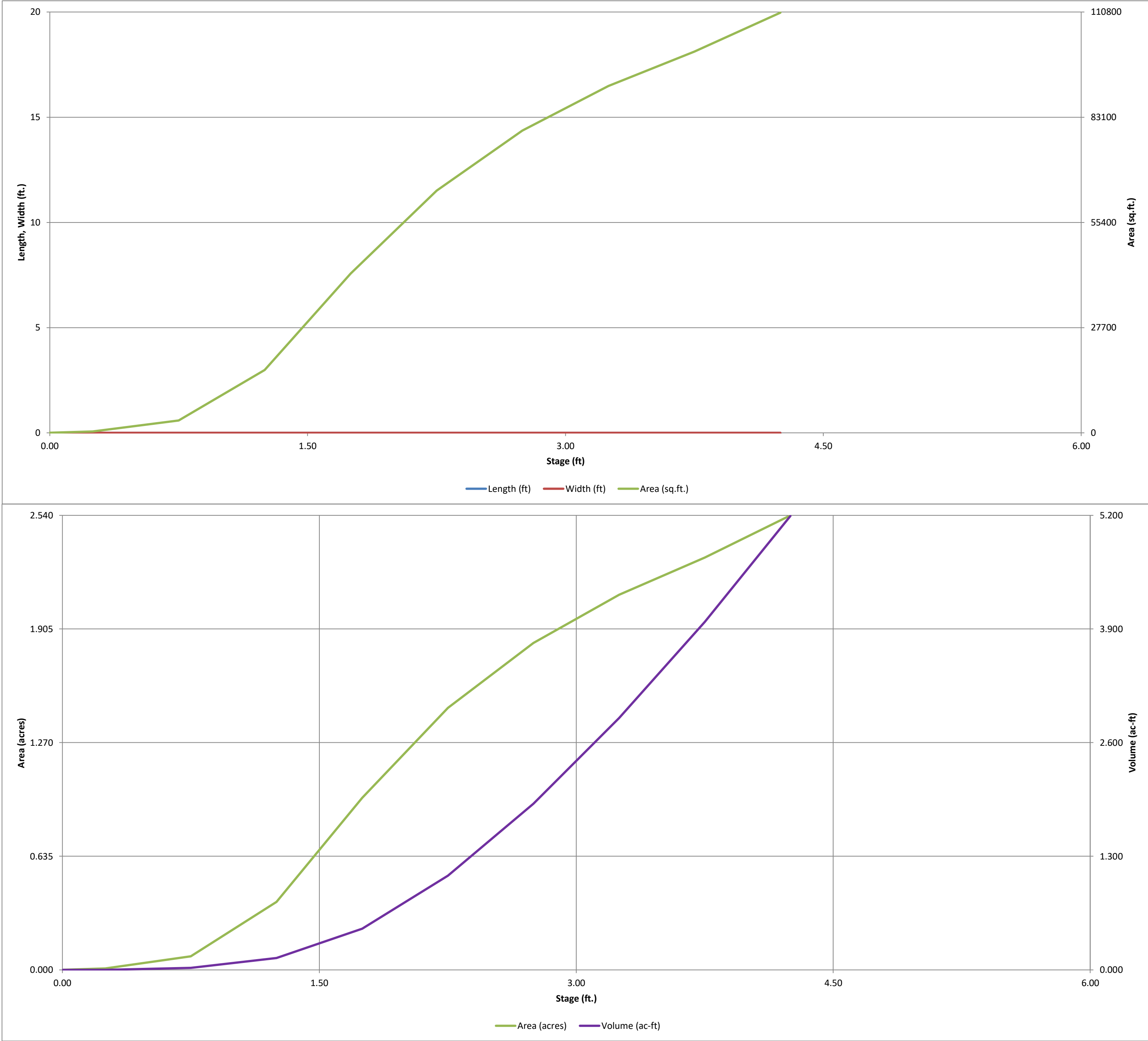
Optional User Overrides

0.029	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

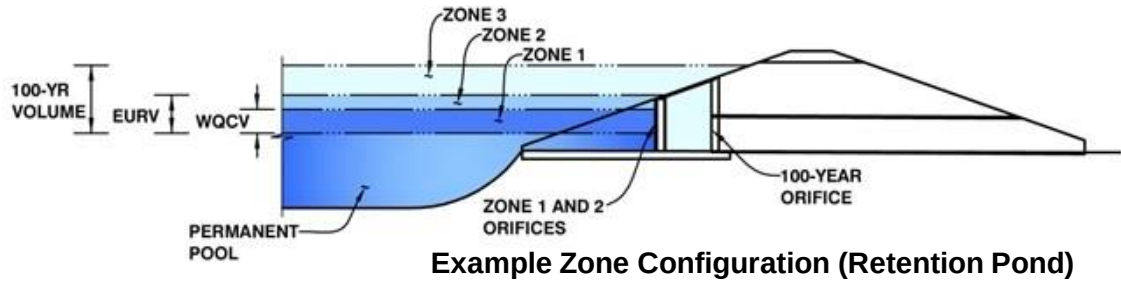
MHFD-Detention, Version 4.06 (July 2022)



DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Kristin Estates
Basin ID: Overall Pond Design (WQCV Override)



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.83	0.029	Orifice Plate
Zone 2 (EURV)	1.29	0.119	Weir&Pipe (Restrict)
Zone 3 (100-year)	2.65	1.559	Weir (No Pipe)
Total (all zones)		1.707	

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)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 1.29 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

Calculated Parameters for Plate
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	0.67						
Orifice Area (sq. inches)	0.25	1.77						

	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)

Invert of Vertical Orifice = Not Selected ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = N/A inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = Not Selected ft²
Vertical Orifice Centroid = N/A feet

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

Overflow Weir Front Edge Height, Ho = 1.30 ft (relative to basin bottom at Stage = 0 ft)
Weir Front Edge Length OR Weir Bottom Length = 10.00 feet
Weir Grate Slope OR Weir Side Slopes = 0.00 H:V
Horiz. Length of Weir Sides = 5.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H_g = 1.30 feet
Overflow Weir Slope Length = N/A feet
Grate Open Area / 100-yr Orifice Area = 19.69
Overflow Grate Open Area w/o Debris = 34.80 ft²
Overflow Grate Open Area w/ Debris = 17.40 ft²

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

Depth to Invert of Outlet Pipe = 1.01 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 18.00 inches
Restrictor Plate Height Above Pipe Invert = 18.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = 1.77 ft²
Outlet Orifice Centroid = 0.75 feet
Half-Central Angle of Restrictor Plate on Pipe = 3.14 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 2.20 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 75.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth= 0.54 feet
Stage at Top of Freeboard = 3.74 feet
Basin Area at Top of Freeboard = 2.30 acres
Basin Volume at Top of Freeboard = 3.96 acre-ft

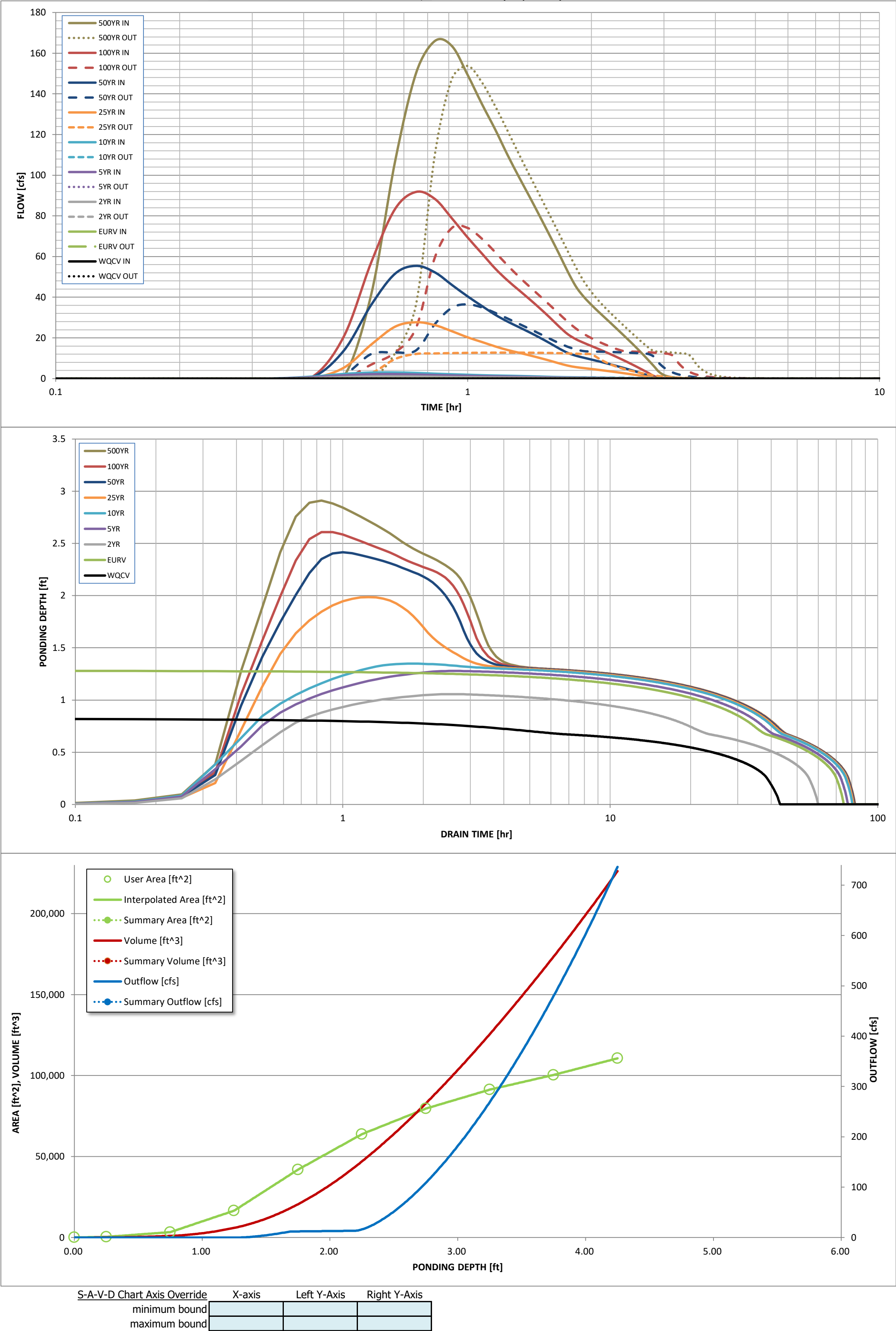
Routed Hydrograph Results

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 =									
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.029	0.148	0.082	0.157	0.224	1.987	3.996	6.749	13.211
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.082	0.157	0.224	1.987	3.996	6.749	13.211
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.1	2.1	3.0	27.7	55.4	91.8	166.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.18	0.35	0.58	1.05
Peak Inflow Q (cfs) =	N/A	N/A	1.1	2.1	3.0	27.7	55.4	91.8	166.0
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.1	0.6	12.8	36.5	74.1	153.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.0	0.2	0.5	0.7	0.8	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.4	0.4	0.4
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) =	39	62	52	64	63	28	13	4	3
Time to Drain 99% of Inflow Volume (hours) =	42	69	56	72	73	42	35	27	11
Maximum Ponding Depth (ft) =	0.83	1.29	1.06	1.28	1.35	1.99	2.41	2.61	2.91
Area at Maximum Ponding Depth (acres) =	0.12	0.43	0.26	0.40	0.48	1.19	1.58	1.72	1.91
Maximum Volume Stored (acre-ft) =	0.030	0.152	0.072	0.144	0.175	0.719	1.322	1.635	2.181

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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	0.00
	0:15:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	0:20:00	0.00	0.00	0.02	0.03	0.03	0.02	0.03	0.03	0.04
	0:25:00	0.00	0.00	0.26	0.63	0.94	0.18	0.36	0.48	0.92
	0:30:00	0.00	0.00	0.74	1.59	2.27	5.27	13.59	20.48	41.26
	0:35:00	0.00	0.00	1.05	2.11	2.95	16.69	36.19	57.07	106.68
	0:40:00	0.00	0.00	1.10	2.14	3.01	25.49	51.55	83.37	150.27
	0:45:00	0.00	0.00	1.02	1.97	2.76	27.70	55.41	91.79	166.04
	0:50:00	0.00	0.00	0.90	1.71	2.40	26.25	52.20	88.29	163.47
	0:55:00	0.00	0.00	0.78	1.51	2.12	23.25	46.01	78.71	149.39
	1:00:00	0.00	0.00	0.70	1.34	1.87	20.29	40.43	69.43	135.07
	1:05:00	0.00	0.00	0.62	1.18	1.65	17.98	35.70	61.50	122.56
	1:10:00	0.00	0.00	0.56	1.06	1.50	15.82	31.40	54.13	110.03
	1:15:00	0.00	0.00	0.51	0.97	1.38	14.05	28.04	48.28	99.07
	1:20:00	0.00	0.00	0.46	0.87	1.27	12.69	25.26	43.44	89.13
	1:25:00	0.00	0.00	0.41	0.77	1.13	11.38	22.64	38.88	79.54
	1:30:00	0.00	0.00	0.36	0.68	0.99	10.08	20.02	34.44	70.32
	1:35:00	0.00	0.00	0.31	0.58	0.85	8.79	17.42	30.03	61.46
	1:40:00	0.00	0.00	0.27	0.50	0.73	7.51	14.83	25.64	52.70
	1:45:00	0.00	0.00	0.24	0.45	0.66	6.37	12.63	21.85	45.22
	1:50:00	0.00	0.00	0.23	0.42	0.61	5.62	11.22	19.32	40.12
	1:55:00	0.00	0.00	0.21	0.38	0.56	5.14	10.23	17.54	36.18
	2:00:00	0.00	0.00	0.19	0.35	0.51	4.69	9.34	15.97	32.71
	2:05:00	0.00	0.00	0.17	0.31	0.46	4.26	8.46	14.48	29.50
	2:10:00	0.00	0.00	0.15	0.28	0.40	3.82	7.58	12.99	26.41
	2:15:00	0.00	0.00	0.13	0.24	0.35	3.38	6.70	11.51	23.38
	2:20:00	0.00	0.00	0.11	0.21	0.30	2.95	5.83	10.04	20.44
	2:25:00	0.00	0.00	0.09	0.17	0.25	2.52	4.96	8.57	17.58
	2:30:00	0.00	0.00	0.08	0.13	0.19	2.09	4.10	7.11	14.71
	2:35:00	0.00	0.00	0.06	0.10	0.14	1.65	3.23	5.65	11.85
	2:40:00	0.00	0.00	0.04	0.06	0.10	1.22	2.36	4.18	8.99
	2:45:00	0.00	0.00	0.02	0.03	0.05	0.79	1.50	2.72	6.12
	2:50:00	0.00	0.00	0.01	0.01	0.03	0.37	0.64	1.27	3.29
	2:55:00	0.00	0.00	0.01	0.01	0.02	0.10	0.19	0.44	1.70
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.03	0.06	0.16	0.95
	3:05:00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.07	0.54
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.32
	3:15:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.18
	3:20:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.08
	3:25:00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.02
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]