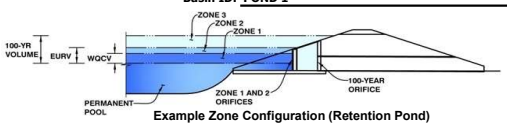
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: URBAN LANDING FILING NO. 1 - FDR

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	21.67	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	27.40%	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.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.258	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.605	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.620	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.032	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.414	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.002	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.440	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.029	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.1 in.) =	4.087	acre-feet	3.10	inches
Approximate 2-yr Detention Volume =	0.429	acre-feet		
Approximate 5-yr Detention Volume =	0.618	acre-feet		
Approximate 10-yr Detention Volume =	0.920	acre-feet		
Approximate 25-yr Detention Volume =	1.082	acre-feet		
Approximate 50-yr Detention Volume =	1.141	acre-feet		
Approximate 100-yr Detention Volume =	1.362	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.258	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.347	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.757	acre-feet
Total Detention Basin Volume =	1.362	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_{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

Depth Increment = 0.50 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)
Top of Micropool	--	0.00	--	--	--	90	0.002		
68	--	1.50	--	--	--	2,143	0.049	1,675	0.038
70	--	3.50	--	--	--	8,773	0.201	12,591	0.289
72	--	5.50	--	--	--	11,058	0.254	32,422	0.744
74	--	7.50	--	--	--	13,471	0.309	56,951	1.307
75	--	8.50	--	--	--	14,994	0.344	71,183	1.634

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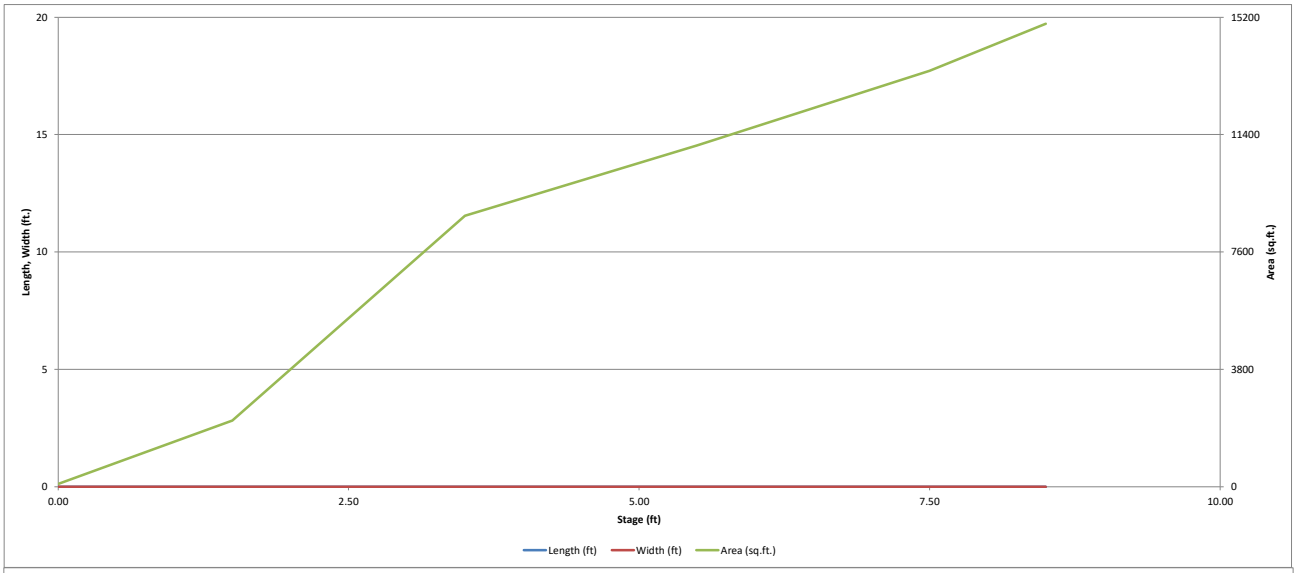

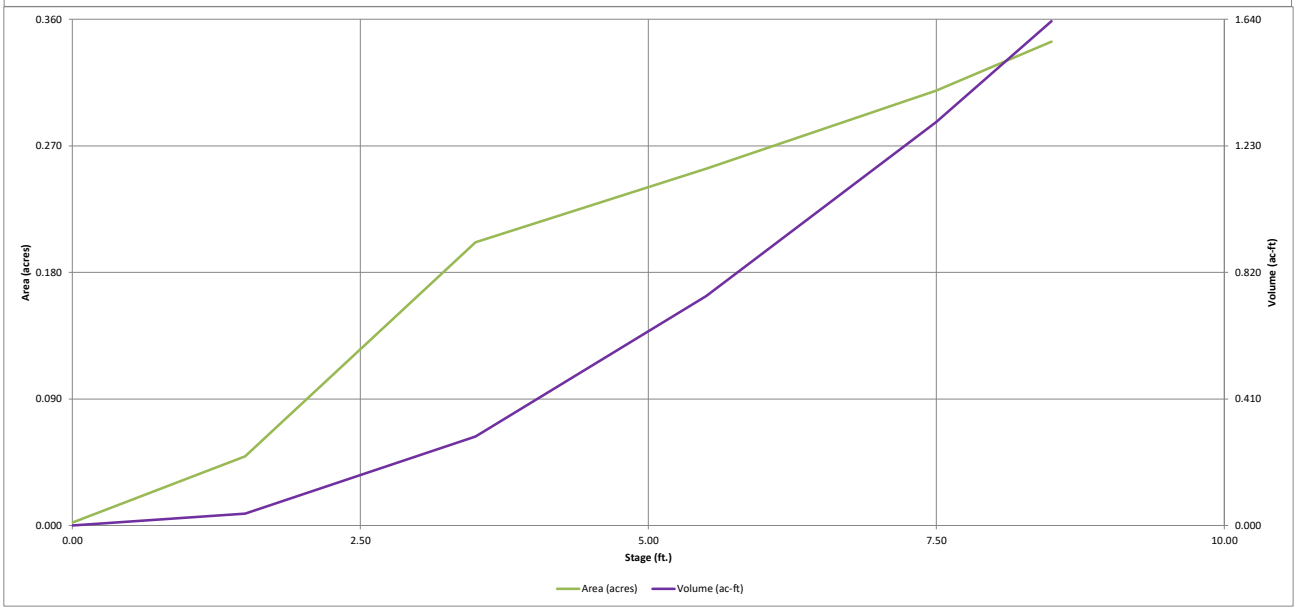

DETENTION BASIN OUTLET STRUCTURE DESIGN

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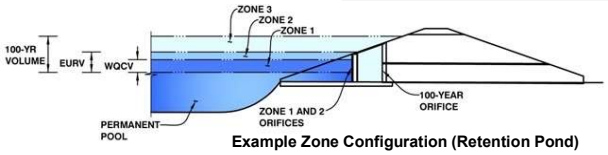
Project: URBAN LANDING FILING NO. 1 - FDR

Basin ID: POND 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.35	0.258	Orifice Plate
Zone 2 (EURV)	4.94	0.347	Orifice Plate
Zone 3 (100-year)	7.68	0.757	Weir&Pipe (Restrict)
Total (all zones)		1.362	

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 = [ ] ft^2

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)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 5.00 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = 20.00 inches

Orifice Plate: Orifice Area per Row = N/A sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

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	1.70	3.40					
Orifice Area (sq. inches)	0.99	1.76	1.76					

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.00	N/A	feet
Overflow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.31	N/A	
Overflow Grate Open Area w/o Debris =	22.96	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.48	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	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 =	24.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 7.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 20.00 feet

Spillway End Slopes = 3.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.70 feet

Stage at Top of Freeboard = 8.70 feet

Basin Area at Top of Freeboard = 0.34 acres

Basin Volume at Top of Freeboard = 1.63 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	1.19	1.50	1.75	2.00	2.25	2.52	3.10
CUHP Runoff Volume (acre-ft) =	0.258	0.605	0.620	1.032	1.414	2.002	2.440	3.029	4.087
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.620	1.032	1.414	2.002	2.440	3.029	4.087
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.5	7.1	10.7	18.8	23.6	29.8	40.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		7.0				31.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.32	0.49	0.87	1.09	1.43	1.88
Peak Inflow Q (cfs) =	N/A	N/A	8.0	13.3	17.4	26.4	31.9	38.7	51.4
Peak Outflow Q (cfs) =	0.1	0.3	0.2	3.8	7.8	16.1	21.4	29.4	44.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.9	0.9	0.9	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.3	0.7	0.9	1.3	1.6
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) =	38	55	56	56	52	48	46	43	40
Time to Drain 99% of Inflow Volume (hours) =	**41**	60	61	63	62	59	58	56	53
Maximum Ponding Depth (ft) =	3.35	4.94	4.81	5.56	5.87	6.33	6.57	6.90	7.22
Area at Maximum Ponding Depth (acres) =	0.19	0.24	0.24	0.26	0.26	0.28	0.28	0.29	0.30
Maximum Volume Stored (acre-ft) =	0.260	0.606	0.575	0.760	0.837	0.965	1.032	1.124	1.222

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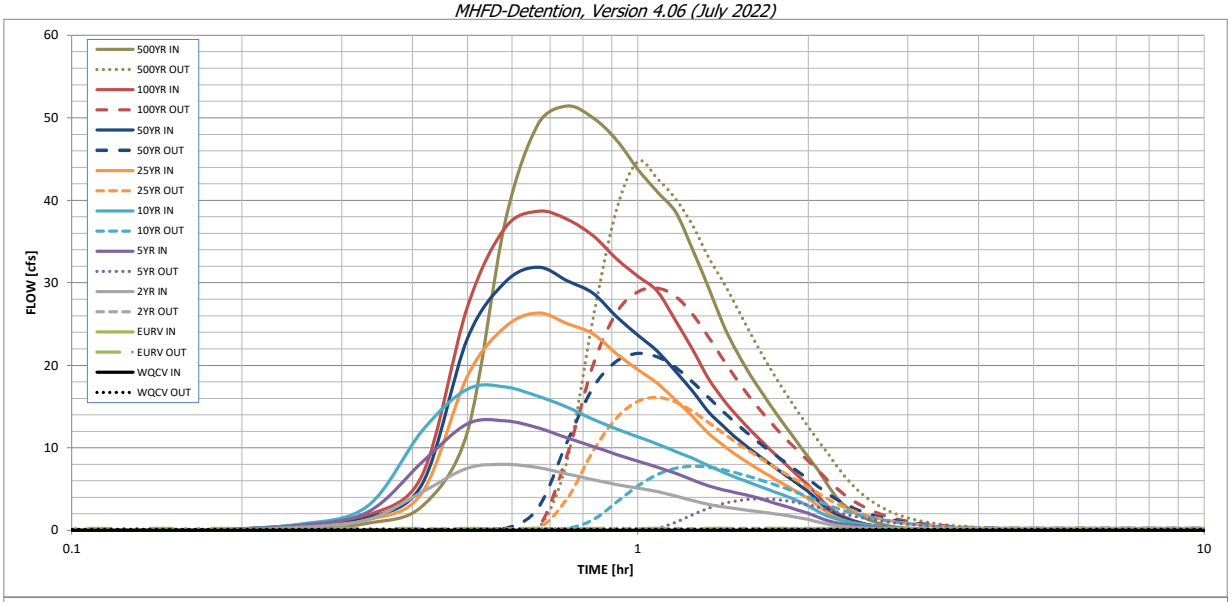

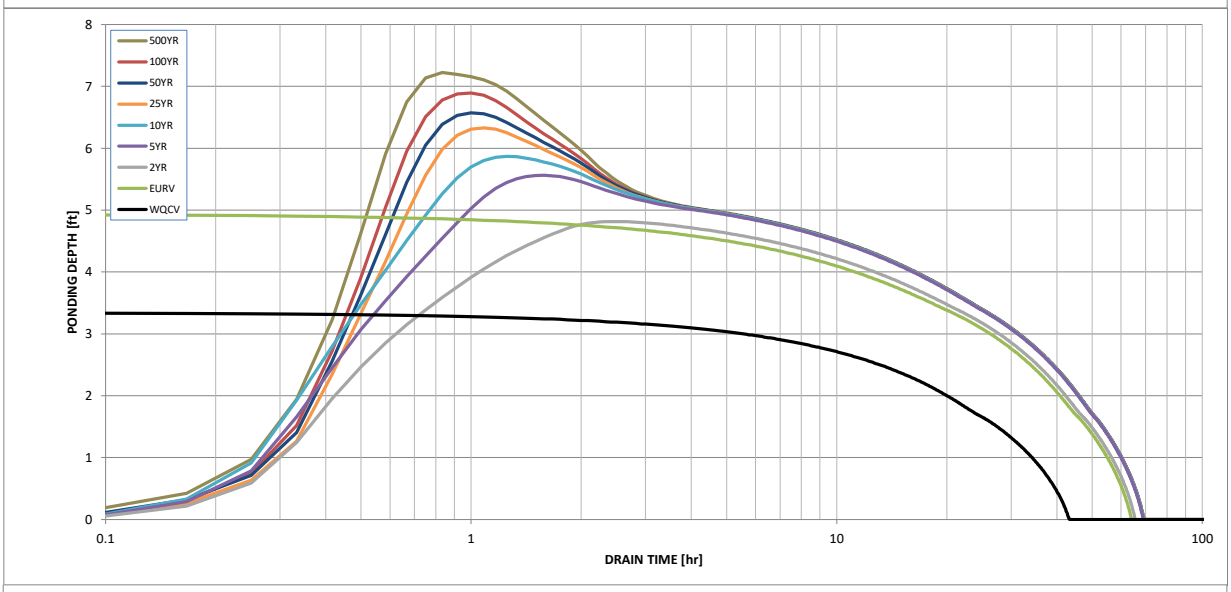

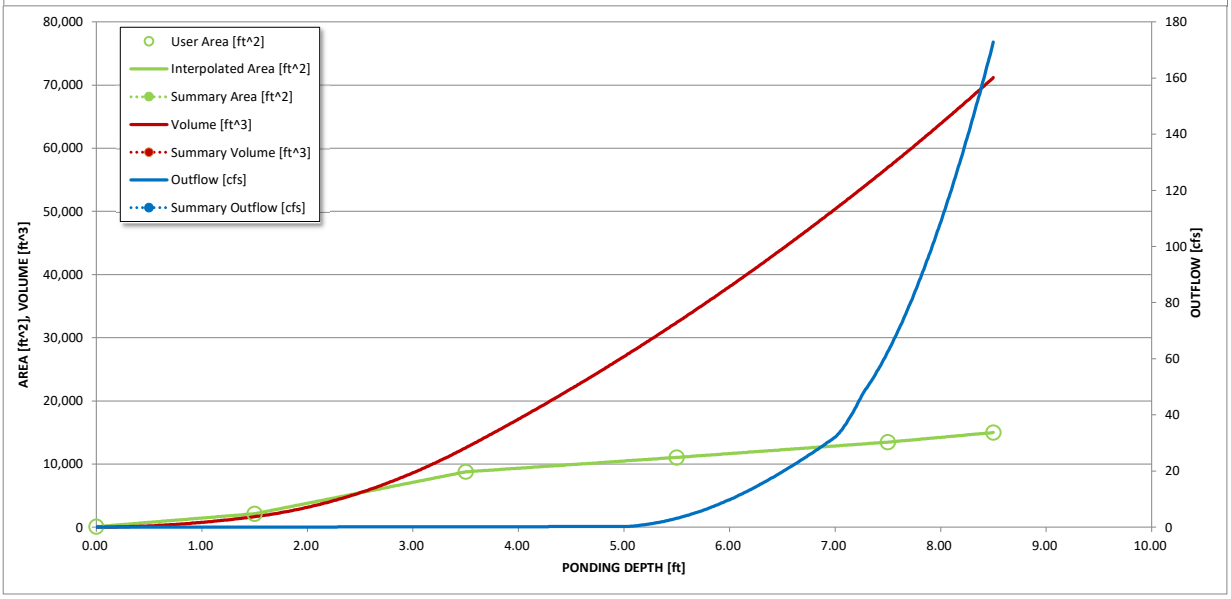

S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

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	0.04	0.00	0.13
	0:15:00	0.00	0.00	0.35	0.58	0.72	0.49	0.62	0.60	0.87
	0:20:00	0.00	0.00	1.29	2.21	2.97	1.29	1.53	1.84	2.97
	0:25:00	0.00	0.00	4.67	8.30	12.13	4.63	5.66	6.74	11.94
	0:30:00	0.00	0.00	7.55	12.91	17.12	18.71	23.28	27.10	37.48
	0:35:00	0.00	0.00	7.98	13.27	17.39	24.66	30.09	36.69	49.24
	0:40:00	0.00	0.00	7.62	12.42	16.25	26.36	31.90	38.69	51.43
	0:45:00	0.00	0.00	6.83	11.20	14.95	25.05	30.25	37.71	50.01
	0:50:00	0.00	0.00	6.14	10.18	13.47	23.82	28.75	35.71	47.33
	0:55:00	0.00	0.00	5.56	9.20	12.30	21.42	25.90	32.92	43.76
	1:00:00	0.00	0.00	5.11	8.40	11.35	19.49	23.67	30.79	40.99
	1:05:00	0.00	0.00	4.69	7.64	10.45	17.80	21.69	28.95	38.56
	1:10:00	0.00	0.00	4.14	6.91	9.56	15.76	19.25	25.39	33.97
	1:15:00	0.00	0.00	3.61	6.11	8.72	13.76	16.84	21.87	29.45
	1:20:00	0.00	0.00	3.16	5.41	7.83	11.76	14.38	18.39	24.88
	1:25:00	0.00	0.00	2.84	4.91	7.03	10.28	12.59	15.83	21.48
	1:30:00	0.00	0.00	2.60	4.52	6.35	9.03	11.07	13.81	18.74
	1:35:00	0.00	0.00	2.39	4.17	5.73	7.98	9.79	12.12	16.41
	1:40:00	0.00	0.00	2.19	3.72	5.17	7.04	8.63	10.59	14.32
	1:45:00	0.00	0.00	1.99	3.29	4.63	6.19	7.58	9.19	12.39
	1:50:00	0.00	0.00	1.80	2.87	4.12	5.38	6.57	7.87	10.58
	1:55:00	0.00	0.00	1.55	2.46	3.57	4.61	5.61	6.62	8.87
	2:00:00	0.00	0.00	1.31	2.06	2.96	3.86	4.70	5.47	7.29
	2:05:00	0.00	0.00	1.02	1.59	2.28	2.97	3.59	4.15	5.48
	2:10:00	0.00	0.00	0.76	1.18	1.73	2.14	2.57	2.93	3.91
	2:15:00	0.00	0.00	0.57	0.90	1.37	1.52	1.87	2.11	2.87
	2:20:00	0.00	0.00	0.46	0.72	1.11	1.13	1.40	1.55	2.15
	2:25:00	0.00	0.00	0.37	0.58	0.91	0.85	1.07	1.14	1.60
	2:30:00	0.00	0.00	0.30	0.48	0.73	0.65	0.82	0.84	1.18
	2:35:00	0.00	0.00	0.25	0.38	0.59	0.50	0.63	0.60	0.86
	2:40:00	0.00	0.00	0.20	0.31	0.46	0.38	0.48	0.43	0.61
	2:45:00	0.00	0.00	0.16	0.24	0.36	0.29	0.36	0.30	0.44
	2:50:00	0.00	0.00	0.13	0.19	0.28	0.22	0.28	0.24	0.34
	2:55:00	0.00	0.00	0.10	0.15	0.22	0.17	0.22	0.19	0.27
	3:00:00	0.00	0.00	0.08	0.11	0.17	0.14	0.17	0.15	0.21
	3:05:00	0.00	0.00	0.06	0.09	0.13	0.11	0.13	0.12	0.17
	3:10:00	0.00	0.00	0.05	0.06	0.10	0.08	0.10	0.09	0.12
	3:15:00	0.00	0.00	0.03	0.04	0.07	0.06	0.07	0.06	0.09
	3:20:00	0.00	0.00	0.02	0.03	0.05	0.04	0.05	0.04	0.06
	3:25:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.03
	3:30:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:35:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	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