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Celebrating over 45 years in business

June 4, 2024

El Paso County
Planning & Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910

ATTN: Brad Walters,
Inspection Supervisor

SUBJECT: 8140 Cessna Drive
Meadow Lake Airport Hanger
Pond Acceptance Letter PPR 2138

Gentlemen

In accordance with the approved construction drawings for 8140 Cessna Drive, improvements were made to construct the private full spectrum detention pond including water quality facility in compliance with the current El Paso County Drainage Criteria and the approved Final Drainage Report for this project.

Based upon this information, periodic site visits by personnel during significant/key phases of the stormwater BMP installation and our as-built surveys, personnel of this office are of the opinion that the detention and stormwater BMP's have been construction in general compliance with the approved design plans and specifications as filed with El Paso County.

Statement OF Engineer of Record

To the best of my knowledge, information and belief, for the reference project above, the improvements have been constructed in general compliance with the approved design plans and specificiations as filed with El Paso County. The facilities provide the required storage volume and will meet the required release rates, as documented by the attached UD-Detention design form.

_____

Oliver E. Watts
Colorado PE-LS 9853
For and on behalf of Oliver E. Watts Consulting Engineer, Inc.

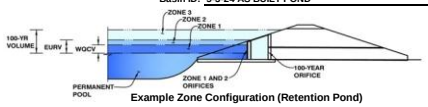
Attachments: Pond As-Built Drawings

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: 8140 Cessna Drive

Basin ID: 5-3-24 AS BUILT POND



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	2.94	acres	
Watershed Length =	610	ft	
Watershed Slope =	0.016	ft/ft	
Watershed Imperviousness =	46.00%	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	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =			
Water Quality Capture Volume (WQCV) =	0.048	acre-feet	
Excess Urban Runoff Volume (EURV) =	0.152	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.104	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.137	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.169	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.212	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.269	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.337	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.41 in.) =	0.536	acre-feet	3.41 inches
Approximate 2-yr Detention Volume =	0.098	acre-feet	
Approximate 5-yr Detention Volume =	0.129	acre-feet	
Approximate 10-yr Detention Volume =	0.158	acre-feet	
Approximate 25-yr Detention Volume =	0.194	acre-feet	
Approximate 50-yr Detention Volume =	0.218	acre-feet	
Approximate 100-yr Detention Volume =	0.248	acre-feet	

Optional User Override 1-hr Precipitation

Stage-Storage Calculation

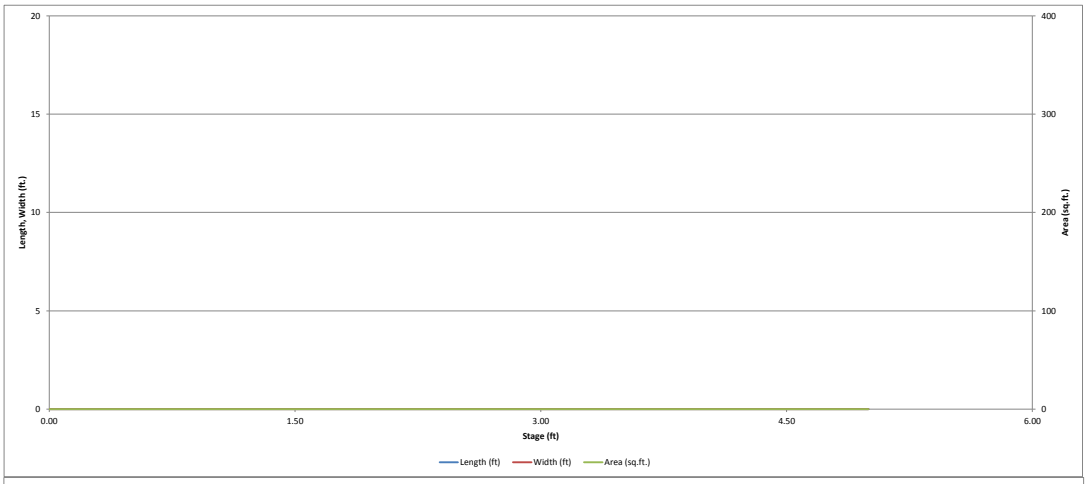
Zone 1 Volume (WQCV) =	0.048	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.104	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.095	acre-feet
Total Detention Basin Volume =	0.248	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

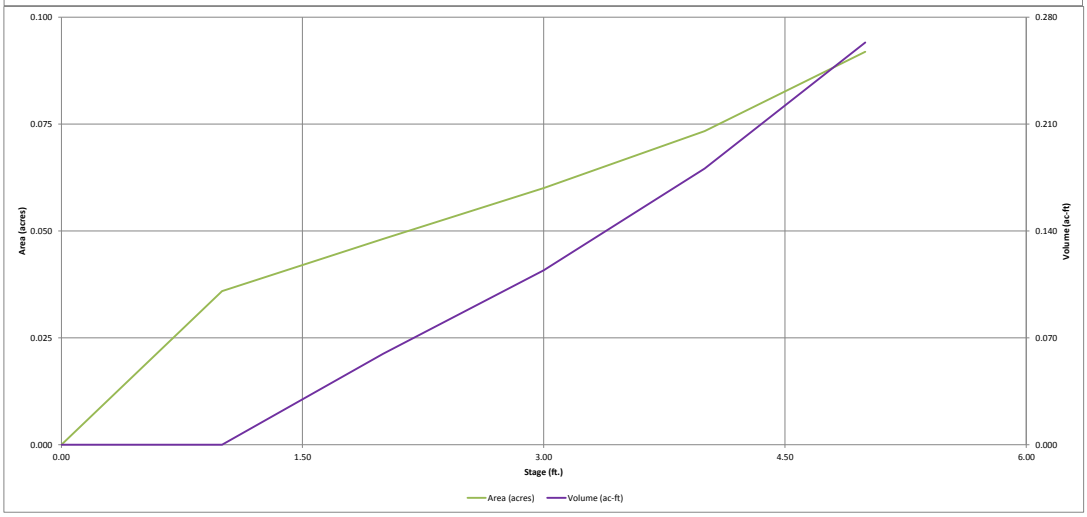
Depth Increment = ft

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	--	0.10	--	--	--	0	0.000		
	--	1.00	--	--	--	1,566	0.036		
	--	2.00	--	--	--	2,097	0.048	2,594	0.060
	--	3.00	--	--	--	2,616	0.060	4,971	0.114
	--	4.00	--	--	--	3,196	0.073	7,877	0.181
	--	5.00	--	--	--	4,004	0.092	11,477	0.263

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



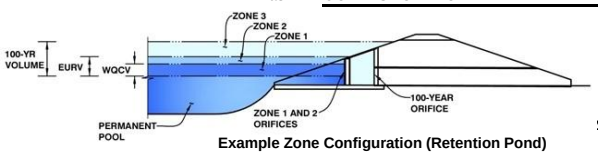


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: 8140 CESSNA DRIVE

Basin ID: 5-3-24 AS BUILT POND



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.74	0.048	Orifice Plate
Zone 2 (EURV)	3.60	0.104	Orifice Plate
Zone 3 (100-year)	4.83	0.095	Not Utilized
		0.248	Total

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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.13	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.04	2.09					
Orifice Area (sq. inches)	2.00	2.00	2.00					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	0.00	n/a	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	N/A	N/A	feet
Overflow Weir Front Edge Length =	N/A	N/A	feet	Over Flow Weir Slope Length =	N/A	N/A	feet
Overflow Weir Slope =	N/A	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	N/A	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	N/A	N/A	feet	Overflow Grate Open Area w/o Debris =	N/A	N/A	ft^2
Overflow Grate Open Area % =	N/A	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	N/A	N/A	ft^2
Debris Clogging % =	N/A	N/A	%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A	ft^2
Circular Orifice Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.21	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.28	feet
Spillway Crest Length =	10.00	feet	Stage at Top of Freeboard =	4.99	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.09	acres
Freeboard above Max Water Surface =	0.50	feet			

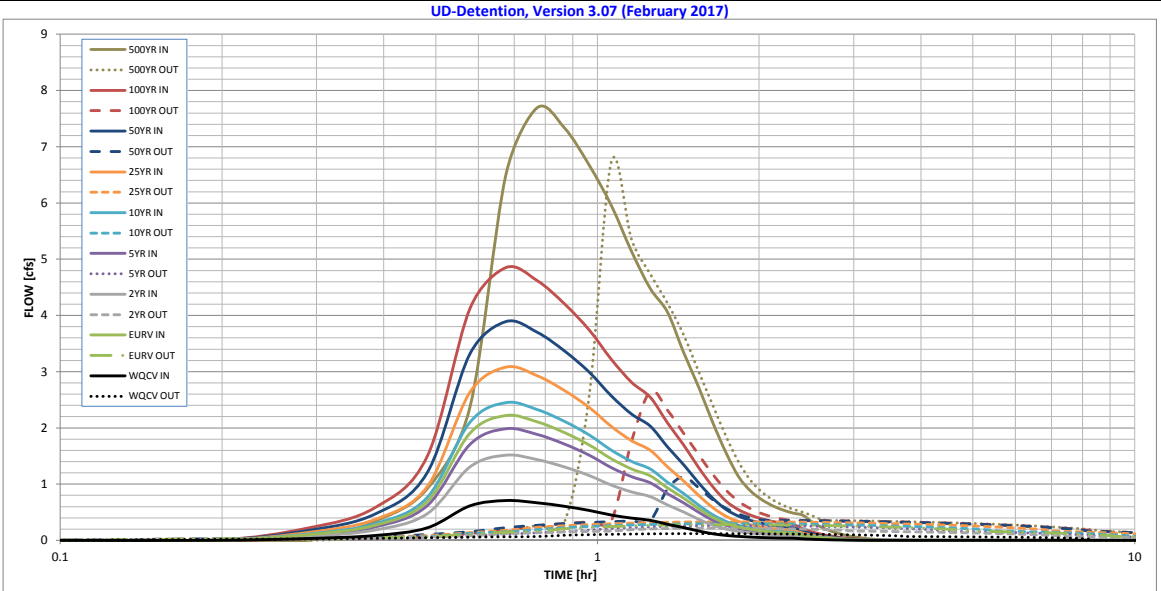
Calculated Parameters for Spillway

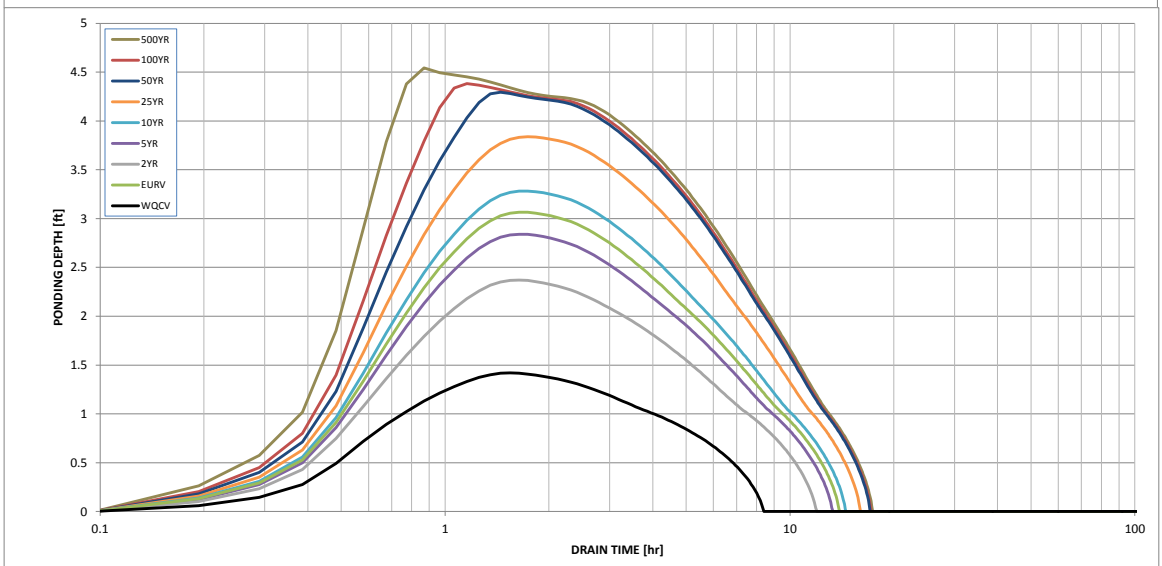
Routed Hydrograph Results

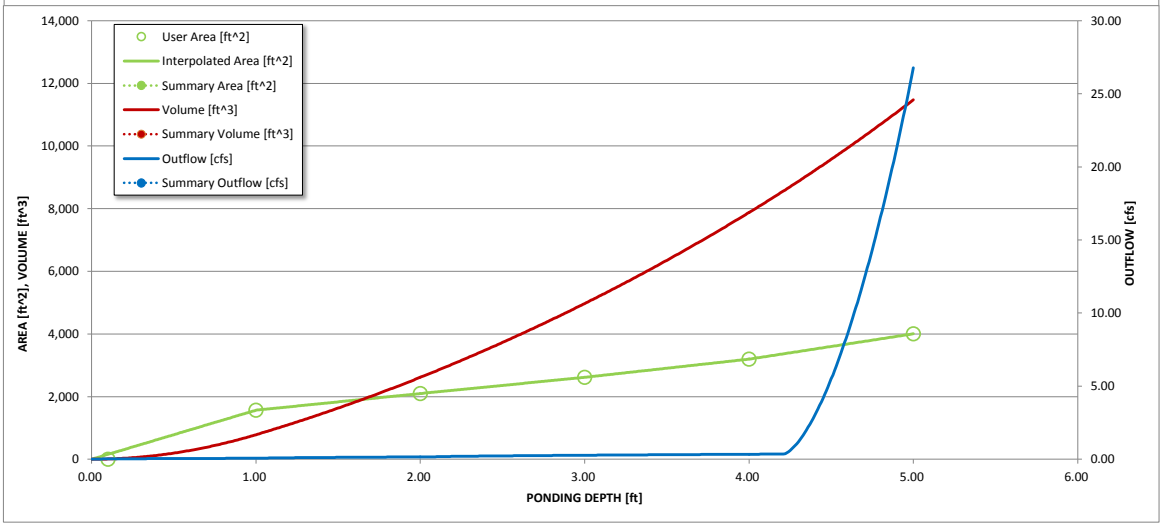
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.41
Calculated Runoff Volume (acre-ft) =	0.048	0.152	0.104	0.137	0.169	0.212	0.269	0.337	0.536
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.048	0.152	0.103	0.136	0.168	0.212	0.268	0.336	0.535
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.16	0.39	0.98
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.1	2.9
Peak Inflow Q (cfs) =	0.7	2.2	1.5	2.0	2.5	3.1	3.9	4.9	7.7
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	0.3	0.3	1.1	2.6	6.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	21.3	10.4	5.2	2.4	2.3	2.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	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) =	8	12	11	12	13	14	15	14	13
Time to Drain 99% of Inflow Volume (hours) =	8	13	11	13	14	15	16	16	16
Maximum Ponding Depth (ft) =	1.42	3.07	2.37	2.84	3.28	3.84	4.30	4.38	4.54
Area at Maximum Ponding Depth (acres) =	0.04	0.06	0.05	0.06	0.06	0.07	0.08	0.08	0.08
Maximum Volume Stored (acre-ft) =	0.034	0.118	0.079	0.105	0.131	0.169	0.203	0.210	0.223

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	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]
5.79 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph Constant	0:11:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:17:22	0.03	0.10	0.07	0.09	0.11	0.14	0.18	0.22	0.34
0.863	0:23:10	0.09	0.27	0.18	0.24	0.30	0.37	0.47	0.58	0.92
	0:28:57	0.22	0.69	0.47	0.62	0.76	0.96	1.21	1.50	2.36
	0:34:44	0.61	1.90	1.31	1.70	2.10	2.63	3.31	4.12	6.50
	0:40:32	0.71	2.22	1.52	1.98	2.45	3.08	3.89	4.85	7.69
	0:46:19	0.67	2.11	1.44	1.88	2.33	2.93	3.70	4.62	7.34
	0:52:07	0.61	1.91	1.31	1.71	2.12	2.67	3.37	4.20	6.68
	0:57:54	0.53	1.70	1.16	1.52	1.88	2.37	2.99	3.74	5.96
	1:03:41	0.45	1.45	0.98	1.29	1.61	2.03	2.57	3.22	5.14
	1:09:29	0.40	1.27	0.86	1.13	1.40	1.77	2.24	2.81	4.48
	1:15:16	0.36	1.15	0.78	1.02	1.27	1.60	2.03	2.54	4.06
	1:21:04	0.29	0.93	0.63	0.83	1.03	1.31	1.66	2.08	3.34
	1:26:51	0.23	0.75	0.51	0.67	0.83	1.06	1.35	1.69	2.73
	1:32:38	0.17	0.56	0.38	0.50	0.63	0.80	1.02	1.29	2.09
	1:38:26	0.12	0.41	0.27	0.36	0.45	0.58	0.75	0.95	1.55
	1:44:13	0.09	0.30	0.20	0.27	0.33	0.43	0.55	0.69	1.13
	1:50:01	0.07	0.24	0.16	0.21	0.26	0.33	0.43	0.54	0.87
	1:55:48	0.06	0.20	0.13	0.17	0.22	0.28	0.35	0.44	0.72
	2:01:35	0.05	0.17	0.11	0.15	0.19	0.24	0.30	0.38	0.61
	2:07:23	0.04	0.15	0.10	0.13	0.16	0.21	0.26	0.33	0.54
	2:13:10	0.04	0.13	0.09	0.12	0.15	0.19	0.24	0.30	0.48
	2:18:58	0.04	0.12	0.08	0.11	0.14	0.17	0.22	0.28	0.45
	2:24:45	0.03	0.09	0.06	0.08	0.10	0.13	0.16	0.20	0.33
	2:30:32	0.02	0.07	0.04	0.06	0.07	0.09	0.12	0.15	0.24
	2:36:20	0.01	0.05	0.03	0.04	0.05	0.07	0.09	0.11	0.18
	2:42:07	0.01	0.04	0.02	0.03	0.04	0.05	0.06	0.08	0.13
	2:47:55	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.06	0.09
	2:53:42	0.01	0.02	0.01	0.02	0.02	0.02	0.03	0.04	0.07
	2:59:29	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05
	3:05:17	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.03
	3:11:04	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
	3:16:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:22:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:28:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:34:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:51:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:57:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:26:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:32:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:43:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:49:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:01:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:18:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:24:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:41:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:53:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:58:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:04:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:10:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:16:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:22:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:27:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:33:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:39:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:45:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:51:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:56:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

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.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]