



Please include the County standard signature block

June 12, 2020

Ms. Elizabeth Nijkamp
El Paso County
325 Akers Drive
Colorado Springs, CO 80922

Add PCD File No. WSEO201

RE: **Major Amendment – Drainage Letter**
Front Range Midway Solar Project
Fountain, CO

Please revise to:
Amendment to the
Preliminary Drainage Report

Dear Ms. Kijkamp:

CORE is writing this Drainage letter in support of the Major Amendment application to the Wind/Solar Energy Generation Overlay (WSE-O) district approved on April 24, 2018 (WSEO-17-001) for the Front Range Midway Solar Project (Project). Since the WSEO-17-001 approval in 2018, the FRMW Project design has been optimized resulting in changes to the Project boundary, layout and infrastructure. Per WSEO-17-001, many of the FRMW Project details remain the same, including the Applicant’s intent to construct, operate, and maintain a 100.2-megawatt (MW) photovoltaic solar energy generation facility. The facilities included in the approved WSEO-17-001 included proposed solar panels, a project substation, and meteorological monitoring devices. The Project now includes the details for an Operations & Management facility and energy storage facility utilizing battery technology that will be coupled to the solar facility. The developable ground has also been reduced thus the project footprint has been revised to fit within the new project limits.

The minor basins within the site largely remained the same. The revised project layout removed the majority of the solar panels within basin A5 from the original approved permit. For this amendment, the original basin A5 has been divided into basins A5A and A5B. Panel layouts in basins A1, A6, and A7 stayed relatively the same. Panels in A8 were reduced with basin A10 and A11 still containing the largest concentration of panels. Basin A9 was combined with basin 12 from the original approved permit and now extends to the northeast corner of the property. Basin 12 has been redefined as the southeastern tip of the project with no development proposed.

The hydrology has been updated to represent the revised project footprint. Current rational method and Colorado Urban Hydrograph Procedure spreadsheets were used to determine the minor (5-yr) and major (100-yr) storm runoff. NOAA Atlas 14, volume 8, version 2, point precipitation frequency estimates from the Fountain station were used when calculating the hydrology. Extended Detention Basins have been recalculated utilizing the Mile High Flood District Detention spreadsheet version 4.03. The calculations are attached.

Sincerely,
CORE Consultants, Inc.

David Bacci P.E. #42104
Senior Project Engineer

Please include in your narrative a general description of any changes or the elimination of any of the proposed extended detention basins.

As this basin has been relocated, please provide a description of the flow in this basin.

**NOAA Atlas 14, Volume 8, Version 2 FOUNTAIN
Station ID: 05-3063**



Location name: Fountain, Colorado, USA*
Latitude: 38.6778°, Longitude: -104.7014°
Elevation:
Elevation (station metadata): 5560 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

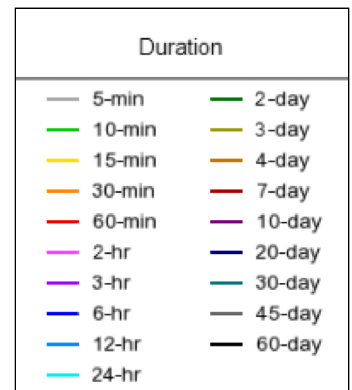
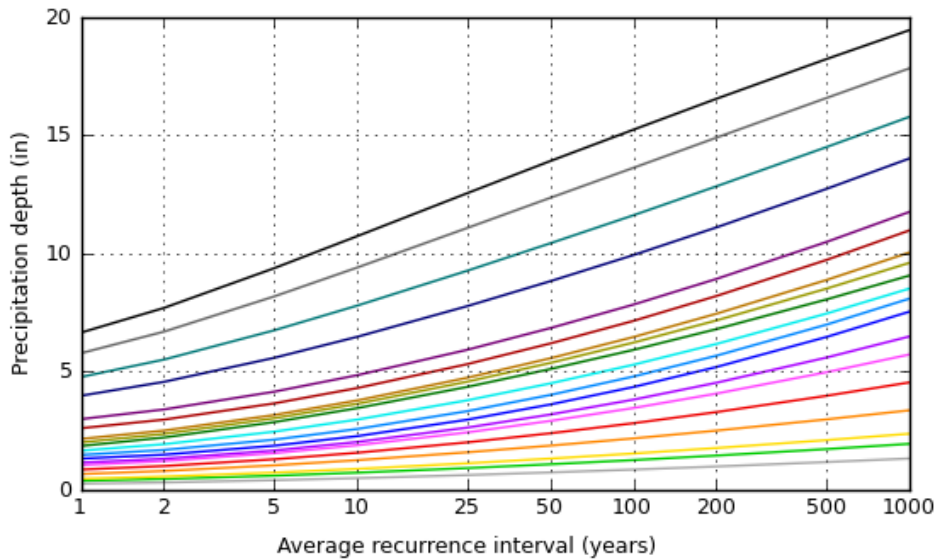
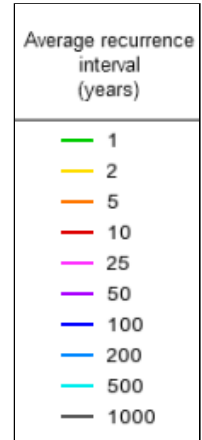
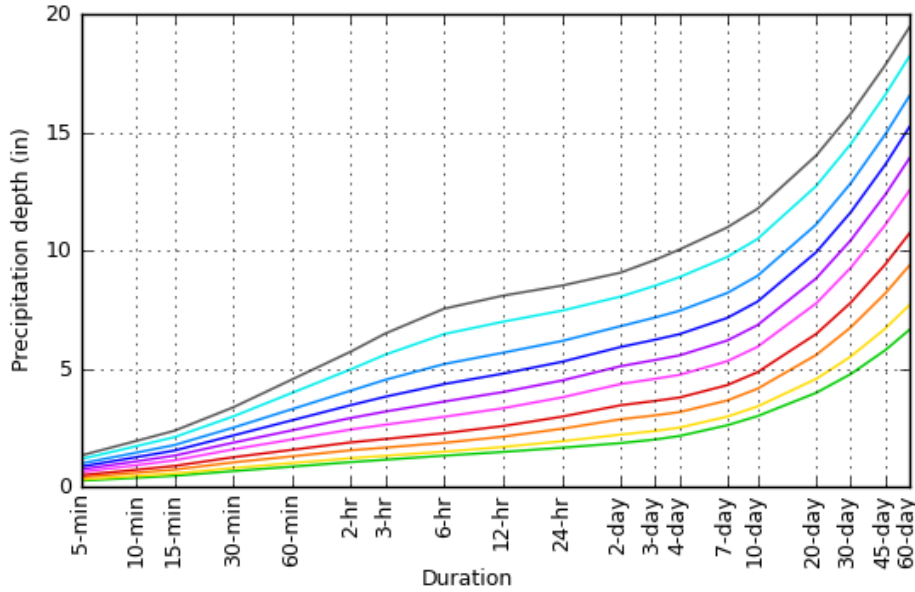
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.267 (0.215-0.337)	0.319 (0.257-0.403)	0.413 (0.331-0.524)	0.500 (0.398-0.637)	0.631 (0.489-0.852)	0.743 (0.558-1.01)	0.863 (0.623-1.21)	0.994 (0.684-1.44)	1.18 (0.777-1.76)	1.33 (0.847-2.00)
10-min	0.390 (0.315-0.493)	0.467 (0.376-0.590)	0.605 (0.485-0.767)	0.732 (0.583-0.933)	0.925 (0.716-1.25)	1.09 (0.817-1.49)	1.26 (0.912-1.77)	1.46 (1.00-2.10)	1.73 (1.14-2.57)	1.95 (1.24-2.93)
15-min	0.476 (0.384-0.601)	0.569 (0.458-0.720)	0.737 (0.591-0.936)	0.892 (0.711-1.14)	1.13 (0.874-1.52)	1.33 (0.997-1.81)	1.54 (1.11-2.16)	1.78 (1.22-2.56)	2.11 (1.39-3.14)	2.38 (1.51-3.57)
30-min	0.674 (0.543-0.851)	0.804 (0.648-1.02)	1.04 (0.835-1.32)	1.26 (1.00-1.61)	1.59 (1.23-2.15)	1.88 (1.41-2.56)	2.18 (1.57-3.06)	2.51 (1.73-3.63)	2.99 (1.96-4.44)	3.37 (2.14-5.06)
60-min	0.864 (0.696-1.09)	1.01 (0.815-1.28)	1.30 (1.04-1.65)	1.57 (1.25-2.01)	2.01 (1.57-2.74)	2.40 (1.81-3.29)	2.82 (2.04-3.98)	3.29 (2.27-4.78)	3.98 (2.63-5.95)	4.55 (2.89-6.83)
2-hr	1.05 (0.854-1.32)	1.22 (0.988-1.53)	1.56 (1.25-1.96)	1.89 (1.51-2.39)	2.43 (1.92-3.31)	2.92 (2.22-4.00)	3.46 (2.53-4.87)	4.08 (2.84-5.90)	4.98 (3.32-7.40)	5.73 (3.68-8.54)
3-hr	1.16 (0.939-1.45)	1.32 (1.07-1.65)	1.67 (1.35-2.10)	2.03 (1.63-2.56)	2.64 (2.09-3.59)	3.19 (2.44-4.37)	3.82 (2.81-5.37)	4.53 (3.18-6.56)	5.60 (3.76-8.31)	6.49 (4.19-9.65)
6-hr	1.33 (1.08-1.65)	1.50 (1.22-1.86)	1.87 (1.52-2.34)	2.28 (1.84-2.85)	2.97 (2.38-4.04)	3.61 (2.80-4.94)	4.35 (3.23-6.10)	5.20 (3.69-7.49)	6.47 (4.39-9.56)	7.54 (4.92-11.1)
12-hr	1.49 (1.22-1.83)	1.69 (1.39-2.09)	2.13 (1.74-2.64)	2.58 (2.09-3.21)	3.33 (2.68-4.47)	4.02 (3.12-5.43)	4.80 (3.58-6.65)	5.68 (4.06-8.10)	6.99 (4.78-10.2)	8.09 (5.33-11.9)
24-hr	1.66 (1.37-2.04)	1.94 (1.60-2.38)	2.46 (2.02-3.03)	2.98 (2.43-3.68)	3.79 (3.04-5.00)	4.50 (3.51-6.00)	5.30 (3.97-7.25)	6.17 (4.43-8.70)	7.46 (5.14-10.8)	8.52 (5.67-12.4)
2-day	1.86 (1.54-2.26)	2.22 (1.84-2.71)	2.87 (2.37-3.51)	3.46 (2.84-4.25)	4.36 (3.49-5.66)	5.11 (3.99-6.72)	5.92 (4.46-8.00)	6.80 (4.91-9.47)	8.05 (5.59-11.5)	9.07 (6.10-13.1)
3-day	2.01 (1.67-2.44)	2.37 (1.97-2.88)	3.03 (2.51-3.69)	3.64 (3.00-4.46)	4.58 (3.69-5.93)	5.37 (4.21-7.04)	6.23 (4.72-8.39)	7.17 (5.21-9.95)	8.51 (5.95-12.2)	9.61 (6.50-13.8)
4-day	2.16 (1.80-2.61)	2.51 (2.09-3.05)	3.17 (2.63-3.85)	3.79 (3.12-4.62)	4.74 (3.84-6.14)	5.57 (4.38-7.29)	6.47 (4.92-8.70)	7.45 (5.44-10.3)	8.88 (6.23-12.7)	10.0 (6.83-14.4)
7-day	2.61 (2.18-3.14)	2.98 (2.49-3.59)	3.66 (3.05-4.42)	4.31 (3.57-5.23)	5.32 (4.33-6.84)	6.19 (4.91-8.06)	7.15 (5.48-9.56)	8.20 (6.03-11.3)	9.73 (6.89-13.8)	11.0 (7.53-15.7)
10-day	3.00 (2.51-3.59)	3.41 (2.86-4.09)	4.15 (3.47-5.00)	4.85 (4.03-5.87)	5.93 (4.83-7.57)	6.84 (5.43-8.85)	7.84 (6.02-10.4)	8.92 (6.59-12.2)	10.5 (7.46-14.8)	11.8 (8.11-16.8)
20-day	3.98 (3.36-4.75)	4.57 (3.85-5.45)	5.59 (4.69-6.68)	6.47 (5.41-7.78)	7.77 (6.33-9.76)	8.82 (7.03-11.3)	9.93 (7.66-13.0)	11.1 (8.24-15.0)	12.7 (9.12-17.8)	14.0 (9.78-19.8)
30-day	4.78 (4.04-5.67)	5.51 (4.66-6.55)	6.75 (5.69-8.04)	7.79 (6.53-9.33)	9.27 (7.55-11.5)	10.4 (8.32-13.2)	11.6 (8.98-15.1)	12.8 (9.56-17.2)	14.5 (10.4-20.1)	15.8 (11.1-22.2)
45-day	5.78 (4.91-6.83)	6.69 (5.68-7.92)	8.18 (6.92-9.71)	9.40 (7.91-11.2)	11.1 (9.02-13.6)	12.4 (9.87-15.5)	13.6 (10.6-17.6)	14.9 (11.1-19.8)	16.6 (12.0-22.8)	17.8 (12.6-25.0)
60-day	6.65 (5.66-7.84)	7.70 (6.54-9.08)	9.37 (7.94-11.1)	10.7 (9.05-12.8)	12.5 (10.2-15.4)	13.9 (11.1-17.3)	15.2 (11.8-19.5)	16.5 (12.4-21.9)	18.2 (13.2-24.9)	19.4 (13.8-27.2)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

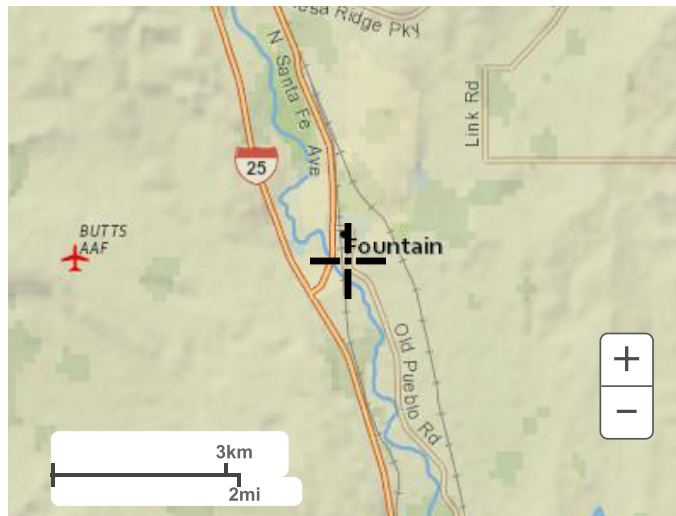
PDS-based depth-duration-frequency (DDF) curves
 Latitude: 38.6778°, Longitude: -104.7014°



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Maps & aerials

Small scale terrain



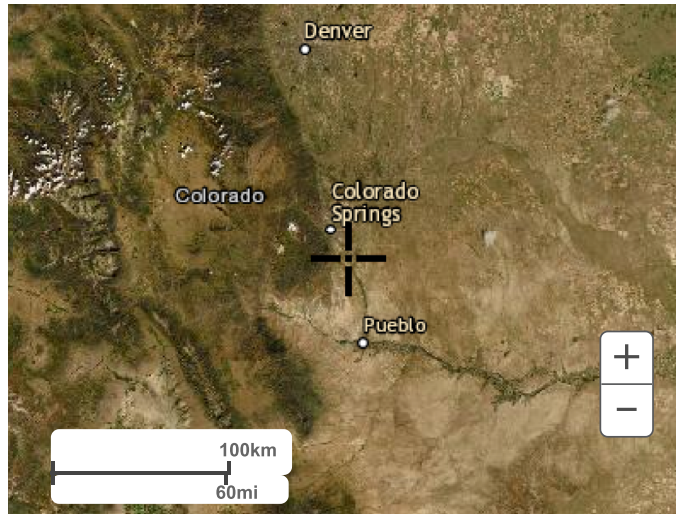
Large scale terrain



Large scale map



Large scale aerial



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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

COMPOSITE BASIN - WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-3

				Lawns				
				Clay Soil				
		Streets: Gravel	Gravel	2-7% Slope	>7% Slope	Historic		
% Imperv.		80.00%	40.00%	2.00%	2.00%	2.00%	Total	Percent
BASIN	Design Point	Area	Area	Area	Area	Area	Area	Impervious
A-1	1	-	-	-	-	31.30	31.30	2.0%
A-2	2	-	-	-	-	72.65	72.65	2.0%
A-3	3	-	-	-	-	107.81	107.81	2.0%
A-4	4	-	-	-	-	33.49	33.49	2.0%
A-5B	5B	-	-	-	-	10.24	10.24	2.0%
A-6	6	-	-	-	-	34.04	34.04	2.0%
A-7	7	-	-	-	-	55.40	55.40	2.0%
A-8	8	-	-	-	-	89.54	89.54	2.0%
A-9	9	-	-	-	-	48.32	48.32	2.0%
A-12	12	-	-	-	-	28.57	28.57	2.0%

FRONT RANGE MID

CORE Project #: 19-177

Prepared By: DJB

It appears this may be your historic design not developed.

COMPOSITE DEVELOPED BASIN -WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-4

i = % imperviousness/100 expressed as a decimal
C_A = Runoff coefficient for NRCS HSG A soils
C_B = Runoff coefficient for NRCS HSG B soils
C_{CD} = Runoff coefficient for NRCS HSG C and D soils.
 Natural Resource Conservation Service (NRCS)

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i + 0.025$	$C_A = 0.78i + 0.110$	$C_A = 0.65i + 0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i + 0.057$	$C_B = 0.63i + 0.249$	$C_B = 0.56i + 0.328$	$C_B = 0.47i + 0.426$	$C_B = 0.37i + 0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i + 0.035$	$C_{C/D} = 0.74i + 0.132$	$C_{C/D} = 0.56i + 0.319$	$C_{C/D} = 0.49i + 0.393$	$C_{C/D} = 0.41i + 0.484$	$C_{C/D} = 0.32i + 0.588$

Basin ID	% Imperv.	<i>i</i>	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A-1	2.0%	0.02	A	0.01	0.01	0.01	0.13	31.30	31.30	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-2	2.0%	0.02	A	0.01	0.01	0.01	0.13	72.65	72.65	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-3	2.0%	0.02	A	0.01	0.01	0.01	0.13	107.81	107.81	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-4	2.0%	0.02	A	0.01	0.01	0.01	0.13	33.49	33.49	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-5B	2.0%	0.02	A	0.01	0.01	0.01	0.13	10.24	10.24	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-6	2.0%	0.02	A	0.01	0.01	0.01	0.13	34.04	34.04	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						

Basin ID	% Imperv.	<i>i</i>	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A-7	2.0%	0.02	A	0.01	0.01	0.01	0.13	55.40	55.40	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-8	2.0%	0.02	A	0.01	0.01	0.01	0.13	89.54	89.54	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-9	2.0%	0.02	A	0.01	0.01	0.01	0.13	48.32	48.32	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-12	2.0%	0.02	A	0.01	0.01	0.01	0.13	28.57	28.57	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

TIME OF CONCENTRATION CALCULATIONS

-REFERENCE UDFCD Vol.1 Section 2.4

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

SF-2 Heavy Meadow 2.50 Short Grass Pasture & Lawns 7.00 Grassed Waterway 15.00
 Tillage/field 5.00 Nearly Bare Ground 10.00 Paved Area & Shallow Gutter 20.00

SUB-BASIN DATA			INITIAL / OVERLAND TIME				CHANNEL / TRAVEL TIME T(t)						T(c) CHECK (URBANIZED BASINS)		FINAL T(c)	
DRAIN BASIN	AREA ac.	C(5)	Length ft.	Elev Change	Slope %	T(i) min	Length ft.	Elev Change	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq. 6-5	min.
A-1	31.30	0.05	300	2.7	0.9	34.1	1170	34.9	3.0	7.0	1.2	16.1	50.2	2.0%	37.8	37.8
A-2	72.65	0.05	300	3.1	1.0	32.4	1665	22.1	1.3	7.0	0.8	34.4	66.8	2.0%	51.6	51.6
A-3	107.81	0.05	300	5.5	1.8	26.8	2883	45.3	1.6	7.0	0.9	54.8	81.6	2.0%	67.0	67.0
A-4	33.49	0.05	300	2.2	0.7	36.2	3635	44.7	1.2	7.0	0.8	78.0	114.2	2.0%	84.5	84.5
A-5B	10.24	0.05	300	6.0	2.0	26.1	908	33.7	3.7	7.0	1.3	11.2	37.3	2.0%	34.1	34.1
A-6	34.04	0.05	300	4.6	1.5	28.4	1318	24.3	1.8	7.0	1.0	23.1	51.5	2.0%	43.1	43.1
A-7	55.40	0.05	300	8.8	2.9	23.0	2169	50.2	2.3	7.0	1.1	33.9	56.9	2.0%	51.3	51.3
A-8	89.54	0.05	300	5.3	1.8	27.2	3108	77.7	2.5	7.0	1.1	46.8	74.0	2.0%	61.0	61.0
A-9	48.32	0.05	300	8.9	3.0	22.9	2163	70.0	3.2	7.0	1.3	28.6	51.5	2.0%	47.3	47.3
A-12	28.57	0.05	300	5.0	1.7	27.7	2235	49.0	2.2	7.0	1.0	35.9	63.6	2.0%	52.8	52.8

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

RATIONAL METHOD PEAK RUNOFF

5-Year STORM Rainfall Depth-Duration-Frequency (1-hr) = 1.3

SF-3

-REFERENCE UDFCD Vol. 1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	5yr Runoff COEFF	T(c) min	C x A	I in/hr	Q cfs
1	A-1	31.30	0.05	37.8	1.61	1.77	2.9
2	A-2	72.65	0.05	51.6	3.73	1.45	5.4
3	A-3	107.81	0.05	67.0	5.54	1.22	6.8
4	A-4	33.49	0.05	84.5	1.72	1.04	1.8
5B	A-5B	10.24	0.05	34.1	0.53	1.89	1.0
6	A-6	34.04	0.05	43.1	1.75	1.63	2.9
7	A-7	55.40	0.05	51.3	2.85	1.46	4.2
8	A-8	89.54	0.05	61.0	4.60	1.30	6.0
9	A-9	48.32	0.05	47.3	2.48	1.54	3.8
12	A-12	28.57	0.05	52.8	1.47	1.43	2.1

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

RATIONAL METHOD PEAK RUNOFF

100-YR STORM

SF-3 Rainfall Depth-Duration-Frequency (1-hr) = **2.82**

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	100yr RUNOFF COEFF C	T(c) min	C x A	I in/hr	Q cfs
1	A-1	31.30	0.49	37.83	15.41	3.84	59.23
2	A-2	72.65	0.49	51.62	35.76	3.15	112.65
3	A-3	107.81	0.49	66.99	53.06	2.64	140.33
4	A-4	33.49	0.49	84.51	16.48	2.25	37.10
5B	A-5B	10.24	0.49	34.12	5.04	4.10	20.65
6	A-6	34.04	0.49	43.09	16.75	3.54	59.34
7	A-7	55.40	0.49	51.27	27.27	3.16	86.30
8	A-8	89.54	0.49	60.97	44.07	2.82	124.26
9	A-9	48.32	0.49	47.25	23.78	3.34	79.38
12	A-12	28.57	0.49	52.77	14.06	3.11	43.67

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

COMPOSITE BASIN - WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-3

				Lawns				
				Clay Soil				
		Streets: Gravel	Gravel	2-7% Slope	>7% Slope	Historic		
% Imperv.		80.00%	40.00%	2.00%	2.00%	2.00%	Total	Percent
BASIN	Design Point	Area	Area	Area	Area	Area	Area	Impervious
A-1	1	1.48	-	-	-	29.82	31.30	5.7%
A-2	2	4.82	-	-	-	67.83	72.65	7.2%
A-3	3	-	-	-	-	107.81	107.81	2.0%
A-4	4	-	-	-	-	33.49	33.49	2.0%
A-5B	5B	1.20	-	-	-	9.54	10.74	10.7%
A-6	6	1.24	-	-	-	32.80	34.04	4.8%
A-7	7	1.87	-	-	-	53.53	55.40	4.6%
A-8	8	2.08	-	-	-	87.46	89.54	3.8%
A-9	9	1.55	-	-	-	46.77	48.32	4.5%
A-12	12	-	-	-	-	28.57	28.57	2.0%

FRONT RANGE MID

CORE Project #: 19-177

Prepared By: DJB

COMPOSITE DEVELOPED BASIN -WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-4

i = % imperviousness/100 expressed as a decimal

C_A = Runoff coefficient for NRCS HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

Natural Resource Conservation Service (NRCS)

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Basin ID	% Imperv.	i	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A-1	5.7%	0.06	A	0.02	0.02	0.03	0.15	31.30	31.30	0.03	0.08	0.17	0.51
			B	0.03	0.04	0.10	0.45						
			C or D	0.03	0.08	0.17	0.51						
A-2	7.2%	0.07	A	0.03	0.03	0.03	0.17	72.65	72.65	0.04	0.09	0.19	0.51
			B	0.04	0.05	0.12	0.46						
			C or D	0.04	0.09	0.19	0.51						
A-3	2.0%	0.02	A	0.01	0.01	0.01	0.13	107.81	107.81	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-4	2.0%	0.02	A	0.01	0.01	0.01	0.13	33.49	33.49	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						
A-5B	10.7%	0.11	A	0.05	0.05	0.06	0.19	10.74	10.74	0.07	0.12	0.21	0.53
			B	0.06	0.08	0.14	0.48						
			C or D	0.07	0.12	0.21	0.53						
A-6	4.8%	0.05	A	0.02	0.02	0.02	0.15	34.04	34.04	0.03	0.07	0.17	0.50
			B	0.02	0.03	0.10	0.45						
			C or D	0.03	0.07	0.17	0.50						

Basin ID	% Imperv.	<i>i</i>	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A-7	4.6%	0.05	A	0.02	0.02	0.02	0.15	55.40	55.40	0.03	0.07	0.17	0.50
			B	0.02	0.03	0.09	0.45						
			C or D	0.03	0.07	0.17	0.50						
A-8	3.8%	0.04	A	0.01	0.01	0.02	0.14	89.54	89.54	0.02	0.07	0.16	0.50
			B	0.02	0.02	0.09	0.44						
			C or D	0.02	0.07	0.16	0.50						
A-9	4.5%	0.05	A	0.01	0.02	0.02	0.15	48.32	48.32	0.03	0.07	0.17	0.50
			B	0.02	0.03	0.09	0.45						
			C or D	0.03	0.07	0.17	0.50						
A-12	2.0%	0.02	A	0.01	0.01	0.01	0.13	28.57	28.57	0.01	0.05	0.15	0.49
			B	0.01	0.01	0.07	0.44						
			C or D	0.01	0.05	0.15	0.49						

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

TIME OF CONCENTRATION CALCULATIONS

-REFERENCE UDFCD Vol.1 Section 2.4

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

SF-2

Heavy Meadow 2.50 Short Grass Pasture & Lawns 7.00 Grassed Waterway 15.00
 Tillage/field 5.00 Nearly Bare Ground 10.00 Paved Area & Shallow Gutter 20.00

SUB-BASIN DATA			INITIAL / OVERLAND TIME				CHANNEL / TRAVEL TIME T(t)						T(c) CHECK (URBANIZED BASINS)		FINAL T(c)	
DRAIN BASIN	AREA ac.	C(5)	Length ft.	Elev Change	Slope %	T(i) min	Length ft.	Elev Change	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq. 6-5	min.
A-1	31.30	0.08	300	2.7	0.9	33.1	1170	34.9	3.0	7.0	1.2	16.1	49.3	5.7%	36.6	36.6
A-2	72.65	0.09	300	3.1	1.0	31.1	1665	22.1	1.3	7.0	0.8	34.4	65.5	7.2%	48.9	48.9
A-3	107.81	0.05	300	5.5	1.8	26.8	2883	45.3	1.6	7.0	0.9	54.8	81.6	2.0%	67.0	67.0
A-4	33.49	0.05	300	2.2	0.7	36.2	3635	44.7	1.2	7.0	0.8	78.0	114.2	2.0%	84.5	84.5
A-5B	10.74	0.12	300	6.0	2.0	24.3	908	33.7	3.7	7.0	1.3	11.2	35.5	10.7%	31.7	31.7
A-6	34.04	0.07	300	4.6	1.5	27.8	1318	24.3	1.8	7.0	1.0	23.1	50.9	4.8%	41.9	41.9
A-7	55.40	0.07	300	8.8	2.9	22.5	2169	50.2	2.3	7.0	1.1	33.9	56.4	4.6%	49.8	49.8
A-8	89.54	0.07	300	5.3	1.8	26.8	3108	77.7	2.5	7.0	1.1	46.8	73.6	3.8%	59.7	59.7
A-9	48.32	0.07	300	8.9	3.0	22.4	2163	70.0	3.2	7.0	1.3	28.6	51.1	4.5%	46.0	46.0
A-12	28.57	0.05	300	5.0	1.7	27.7	2235	49.0	2.2	7.0	1.0	35.9	63.6	2.0%	52.8	52.8

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

RATIONAL METHOD PEAK RUNOFF

5-Year STORM Rainfall Depth-Duration-Frequency (1-hr) = 1.3

SF-3

-REFERENCE UDFCD Vol. 1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	5yr Runoff COEFF	T(c) min	C x A	I in/hr	Q cfs
1	A-1	31.30	0.08	36.6	2.56	1.81	4.6
2	A-2	72.65	0.09	48.9	6.82	1.51	10.3
3	A-3	107.81	0.05	67.0	5.54	1.22	6.8
4	A-4	33.49	0.05	84.5	1.72	1.04	1.8
5B	A-5B	10.74	0.12	31.7	1.32	1.98	2.6
6	A-6	34.04	0.07	41.9	2.54	1.66	4.2
7	A-7	55.40	0.07	49.8	4.04	1.49	6.0
8	A-8	89.54	0.07	59.7	5.93	1.32	7.8
9	A-9	48.32	0.07	46.0	3.48	1.56	5.4
12	A-12	28.57	0.05	52.8	1.47	1.43	2.1

FRONT RANGE MIDWAY SOLAR PROJECT

CORE Project #: 19-177

Prepared By: DJB

RATIONAL METHOD PEAK RUNOFF

100-YR STORM

SF-3 Rainfall Depth-Duration-Frequency (1-hr) = **2.82**

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF			
DESIGN POINT	DRAIN BASIN	AREA ac.	100yr RUNOFF COEFF C	T(c) min	C x A	I in/hr	Q cfs
1	A-1	31.30	0.51	36.56	15.88	3.93	62.36
2	A-2	72.65	0.51	48.86	37.30	3.27	121.82
3	A-3	107.81	0.49	66.99	53.06	2.64	140.33
4	A-4	33.49	0.49	84.51	16.48	2.25	37.10
5B	A-5B	10.74	0.53	31.66	5.67	4.29	24.30
6	A-6	34.04	0.50	41.90	17.15	3.61	61.84
7	A-7	55.40	0.50	49.84	27.87	3.22	89.84
8	A-8	89.54	0.50	59.72	44.74	2.86	127.90
9	A-9	48.32	0.50	46.04	24.28	3.39	82.41
12	A-12	28.57	0.49	52.77	14.06	3.11	43.67

EXISTING 5-YR

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5A	A5A	5	0.316	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.62
A10	A10	5	0.370	0.856	1.425	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.62
A11	A11	5	0.345	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.62

EXISTING 5-YR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5A	Existing 5-yr Storm	0.157	0.256	58.1	12.91	30.2	9.12	21.5	163	733,623	0.24	173,242	50.0	36	173,257	0.18
A10	Existing 5-yr Storm	0.157	0.268	77.7	17.50	40.4	12.37	29.2	143	858,967	0.24	202,842	60.0	32	202,840	0.14
A11	Existing 5-yr Storm	0.157	0.262	79.0	17.42	41.1	12.31	29.0	131	800,560	0.24	189,049	60.0	30	189,031	0.13

EXISTING 100-YR

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5A	A5A	100	0.316	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A10	A10	100	0.370	0.856	1.425	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A11	A11	100	0.345	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81

EXISTING 100-YR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5A	Existing 100-yr Storm	0.156	0.255	58.1	12.85	30.2	9.08	21.4	163	733,623	1.84	1,349,173	60.0	248	1,349,302	1.23
A10	Existing 100-yr Storm	0.156	0.267	77.7	17.43	40.4	12.31	29.0	143	858,967	1.84	1,579,688	70.0	233	1,579,673	0.99
A11	Existing 100-yr Storm	0.156	0.261	79.0	17.35	41.1	12.26	28.9	131	800,560	1.84	1,472,275	70.0	215	1,472,127	0.97

PROPOSED 5-YR

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5A	A5A	5	0.316	0.479	1.072	0.014	2.2	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.78
A10	A10	5	0.370	0.856	1.425	0.019	4.3	0.35	0.05	3.00	0.50	0.0018	0.00	0.09	0.04	3.52
A11	A11	5	0.345	0.785	1.525	0.019	4.3	0.35	0.05	3.00	0.50	0.0018	0.00	0.09	0.04	3.52

PROPOSED 5-YR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5A	Proposed 5-yr Storm	0.156	0.255	58.1	12.86	30.2	9.09	21.4	163	733,623	0.24	174,696	50.0	36	174,712	0.18
A10	Proposed 5-yr Storm	0.150	0.257	77.5	16.78	40.3	11.86	28.0	143	858,967	0.26	222,537	60.0	35	222,533	0.15
A11	Proposed 5-yr Storm	0.150	0.251	78.8	16.71	41.0	11.81	27.9	131	800,560	0.26	207,405	60.0	32	207,385	0.14

PROPOSED 100-YR

Summary of CUHP Input Parameters (Version 2.0.0)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5A	A5A	100	0.316	0.479	1.072	0.014	2.2	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	2.00
A10	A10	100	0.370	0.856	1.425	0.019	4.3	0.35	0.05	3.00	0.50	0.0018	0.00	0.09	0.04	3.92
A11	A11	100	0.345	0.785	1.525	0.019	4.3	0.35	0.05	3.00	0.50	0.0018	0.00	0.09	0.04	3.92

PROPOSED 100-YR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0)

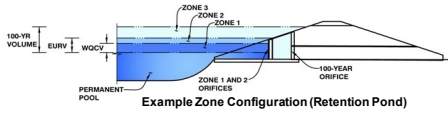
Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5A	Proposed 100-yr Storm	0.156	0.254	58.1	12.81	30.2	9.05	21.3	163	733,623	1.84	1,350,808	60.0	248	1,350,947	1.23
A10	Proposed 100-yr Storm	0.148	0.254	77.5	16.63	40.3	11.75	27.7	143	858,967	1.86	1,601,749	70.0	236	1,601,695	1.00
A11	Proposed 100-yr Storm	0.148	0.249	78.7	16.56	40.9	11.70	27.6	131	800,560	1.86	1,492,836	70.0	217	1,492,709	0.98

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD- Detention, Version 4.03 (May 2020)

Project: **Front Range - Midway Solar Project**

Basin ID: **Basin A1**



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	31.30	acres
Watershed Length =	1,470	ft
Watershed Length to Centroid =	530	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	5.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQC 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) =	0.106	acre-feet
Excess Urban Runoff Volume (EURV) =	0.142	acre-feet
2-yr Runoff Volume (P1 = 1.01 in.) =	0.209	acre-feet
5-yr Runoff Volume (P1 = 1.3 in.) =	0.706	acre-feet
10-yr Runoff Volume (P1 = 1.57 in.) =	1.295	acre-feet
25-yr Runoff Volume (P1 = 2.01 in.) =	2.582	acre-feet
50-yr Runoff Volume (P1 = 2.4 in.) =	3.589	acre-feet
100-yr Runoff Volume (P1 = 2.82 in.) =	4.886	acre-feet
500-yr Runoff Volume (P1 = 3.98 in.) =	8.083	acre-feet
Approximate 2-yr Detention Volume =	0.095	acre-feet
Approximate 5-yr Detention Volume =	0.300	acre-feet
Approximate 10-yr Detention Volume =	0.455	acre-feet
Approximate 25-yr Detention Volume =	0.605	acre-feet
Approximate 50-yr Detention Volume =	0.651	acre-feet
Approximate 100-yr Detention Volume =	1.002	acre-feet

Optional User Overrides

		acre-feet
		acre-feet
	1.01	inches
	1.30	inches
	1.57	inches
	2.01	inches
	2.40	inches
	2.82	inches
	3.98	inches

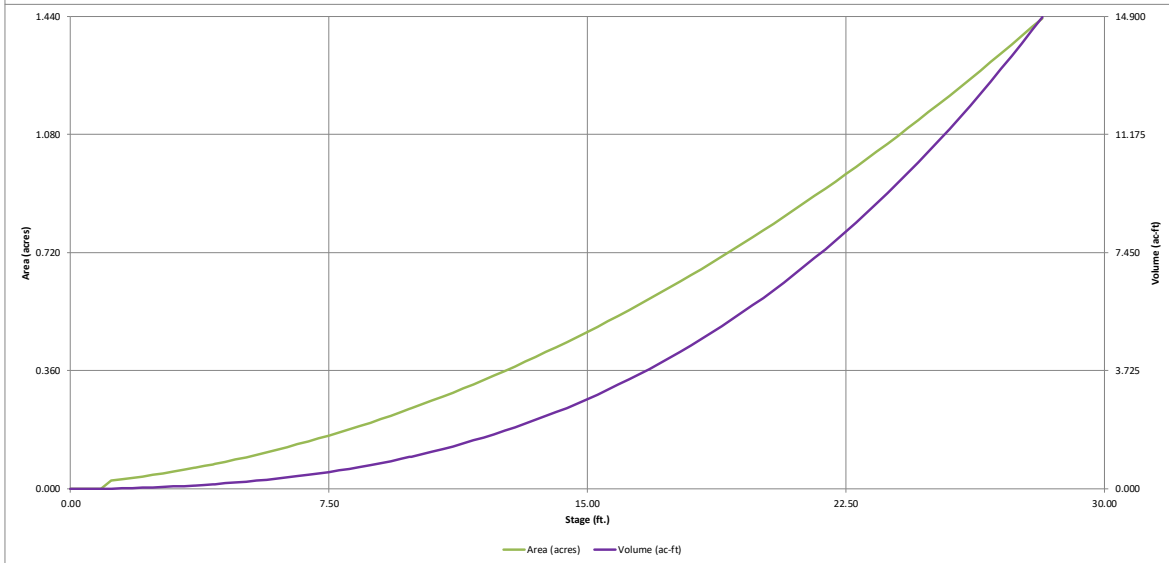
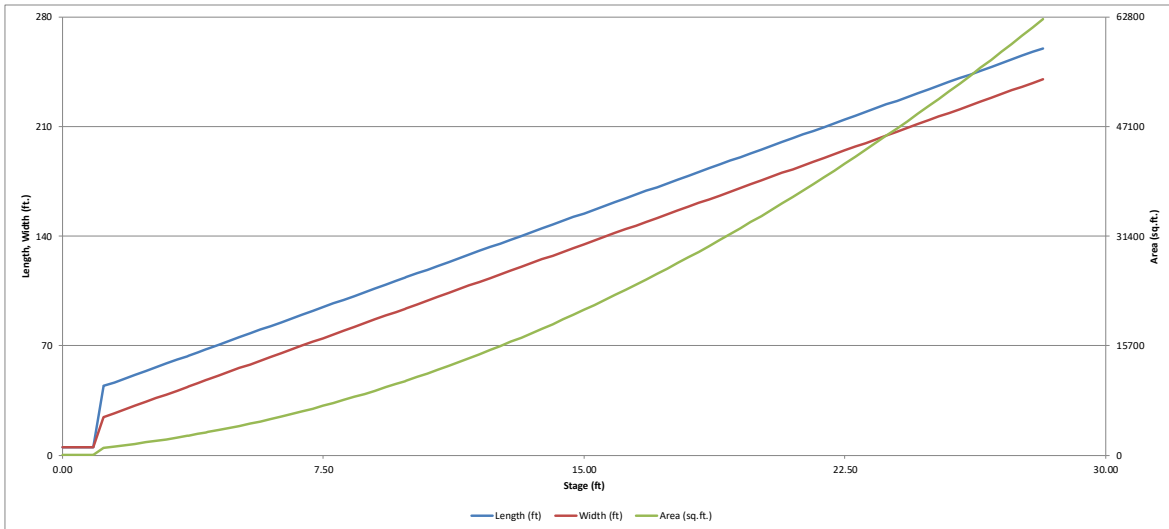
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.106	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.036	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.860	acre-feet
Total Detention Basin Volume =	1.002	acre-feet
Initial Surcharge Volume (ISV) =	14	ft ³
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H _{total}) =	9.90	ft
Depth of Trickle Channel (H _{tc}) =	0.50	ft
Slope of Trickle Channel (S _{tc}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	28	ft ²
Surcharge Volume Length (L _{ISV}) =	5.3	ft
Surcharge Volume Width (W _{ISV}) =	5.3	ft
Depth of Basin Floor (H _{FLOOR}) =	0.19	ft
Length of Basin Floor (L _{FLOOR}) =	44.0	ft
Width of Basin Floor (W _{FLOOR}) =	24.3	ft
Area of Basin Floor (A _{FLOOR}) =	1,069	ft ²
Volume of Basin Floor (V _{FLOOR}) =	80	ft ³
Depth of Main Basin (H _{MAIN}) =	8.71	ft
Length of Main Basin (L _{MAIN}) =	113.7	ft
Width of Main Basin (W _{MAIN}) =	94.0	ft
Area of Main Basin (A _{MAIN}) =	10,683	ft ²
Volume of Main Basin (V _{MAIN}) =	43,930	ft ³
Calculated Total Basin Volume (V _{total}) =	1.011	acre-feet

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		5.3	5.3	28		0.001		
ISV	0.50		5.3	5.3	28		0.001	14	0.000
	0.60		5.3	5.3	28		0.001	17	0.000
	0.90		5.3	5.3	28		0.001	25	0.001
Floor	1.19		44.0	24.3	1,069		0.025	109	0.002
	1.20		44.1	24.4	1,074		0.025	119	0.003
	1.50		46.5	26.8	1,244		0.029	467	0.011
	1.80		48.9	29.2	1,426		0.033	867	0.020
	2.10		51.3	31.6	1,619		0.037	1,323	0.030
	2.40		53.7	34.0	1,824		0.042	1,840	0.042
	2.70		56.1	36.4	2,040		0.047	2,419	0.056
	3.00		58.5	38.8	2,267		0.052	3,065	0.070
	3.30		60.9	41.2	2,507		0.058	3,780	0.087
	3.60		63.3	43.6	2,757		0.063	4,570	0.105
Zone 1 (WQCV)	3.63		63.6	43.8	2,783		0.064	4,653	0.107
	3.90		65.7	46.0	3,020		0.069	5,436	0.125
Zone 2 (EURV)	4.14		67.6	47.9	3,238		0.074	6,187	0.142
	4.20		68.1	48.4	3,293		0.076	6,383	0.147
	4.50		70.5	50.8	3,579		0.082	7,413	0.170
	4.80		72.9	53.2	3,875		0.089	8,531	0.196
	5.10		75.3	55.6	4,184		0.096	9,739	0.224
	5.40		77.7	58.0	4,503		0.103	11,042	0.253
	5.70		80.1	60.4	4,835		0.111	12,443	0.286
	6.00		82.5	62.8	5,178		0.119	13,944	0.320
	6.30		84.9	65.2	5,532		0.127	15,550	0.357
	6.60		87.3	67.6	5,898		0.135	17,265	0.396
6.90		89.7	70.0	6,275		0.144	19,090	0.438	
7.20		92.1	72.4	6,664		0.153	21,031	0.483	
7.50		94.5	74.8	7,065		0.162	23,090	0.530	
7.80		96.9	77.2	7,477		0.172	25,271	0.580	
8.10		99.3	79.6	7,900		0.181	27,577	0.633	
8.40		101.7	82.0	8,335		0.191	30,013	0.689	
8.70		104.1	84.4	8,782		0.202	32,580	0.748	
9.00		106.5	86.8	9,240		0.212	35,283	0.810	
9.30		108.9	89.2	9,710		0.223	38,125	0.875	
9.60		111.3	91.6	10,191		0.234	41,110	0.944	
Zone 3 (100-year)	9.85		113.3	93.6	10,600		0.243	43,708	1.003
	9.90		113.7	94.0	10,683		0.245	44,241	1.016
	10.20		116.1	96.4	11,188		0.257	47,521	1.091
	10.50		118.5	98.8	11,703		0.269	50,954	1.170
	10.80		120.9	101.2	12,230		0.281	54,544	1.252
	11.10		123.3	103.6	12,769		0.293	58,294	1.338
	11.40		125.7	106.0	13,319		0.306	62,207	1.428
	11.70		128.1	108.4	13,881		0.319	66,286	1.522
	12.00		130.5	110.8	14,454		0.332	70,536	1.619
	12.30		132.9	113.2	15,039		0.345	74,960	1.721
12.60		135.3	115.6	15,635		0.359	79,561	1.826	
12.90		137.7	118.0	16,243		0.373	84,343	1.936	
13.20		140.1	120.4	16,863		0.387	89,308	2.050	
13.50		142.5	122.8	17,493		0.402	94,461	2.169	
13.80		144.9	125.2	18,136		0.416	99,805	2.291	
14.10		147.3	127.6	18,790		0.431	105,344	2.418	
14.40		149.7	130.0	19,455		0.447	111,080	2.550	
14.70		152.1	132.4	20,132		0.462	117,018	2.686	
15.00		154.5	134.8	20,821		0.478	123,161	2.827	
15.30		156.9	137.2	21,521		0.494	129,512	2.973	
15.60		159.3	139.6	22,232		0.510	136,074	3.124	
15.90		161.7	142.0	22,955		0.527	142,852	3.279	
16.20		164.1	144.4	23,690		0.544	149,849	3.440	
16.50		166.5	146.8	24,436		0.561	157,067	3.605	
16.80		168.9	149.2	25,193		0.578	164,511	3.777	
17.10		171.3	151.6	25,962		0.596	172,184	3.953	
17.40		173.7	154.0	26,743		0.614	180,090	4.134	
17.70		176.1	156.4	27,535		0.632	188,231	4.321	
18.00		178.5	158.8	28,339		0.651	196,612	4.514	
18.30		180.9	161.2	29,154		0.669	205,236	4.712	
18.60		183.3	163.6	29,981		0.688	214,106	4.915	
18.90		185.7	166.0	30,819		0.708	223,226	5.125	
19.20		188.1	168.4	31,669		0.727	232,598	5.340	
19.50		190.5	170.8	32,530		0.747	242,228	5.561	
19.80		192.9	173.2	33,403		0.767	252,118	5.788	
20.10		195.3	175.6	34,287		0.787	262,271	6.021	
20.40		197.7	178.0	35,183		0.808	272,691	6.260	
20.70		200.1	180.4	36,090		0.829	283,382	6.506	
21.00		202.5	182.8	37,009		0.850	294,347	6.757	
21.30		204.9	185.2	37,940		0.871	305,589	7.015	
21.60		207.3	187.6	38,882		0.893	317,111	7.280	
21.90		209.7	190.0	39,835		0.914	328,919	7.551	
22.20		212.1	192.4	40,800		0.937	341,014	7.829	
22.50		214.5	194.8	41,776		0.959	353,400	8.113	
22.80		216.9	197.2	42,764		0.982	366,081	8.404	
23.10		219.3	199.6	43,764		1.005	379,060	8.702	
23.40		221.7	202.0	44,775		1.028	392,340	9.007	
23.70		224.1	204.4	45,797		1.051	405,926	9.319	
24.00		226.5	206.8	46,832		1.075	419,820	9.638	
24.30		228.9	209.2	47,877		1.099	434,026	9.964	
24.60		231.3	211.6	48,934		1.123	448,547	10,297	
24.90		233.7	214.0	50,003		1.148	463,388	10,638	
25.20		236.1	216.4	51,083		1.173	478,550	10,986	
25.50		238.5	218.8	52,175		1.198	494,039	11,342	
25.80		240.9	221.2	53,278		1.223	509,856	11,705	
26.10		243.3	223.6	54,393		1.249	526,006	12,075	
26.40		245.7	226.0	55,519		1.275	542,493	12,454	
26.70		248.1	228.4	56,657		1.301	559,319	12,840	
27.00		250.5							

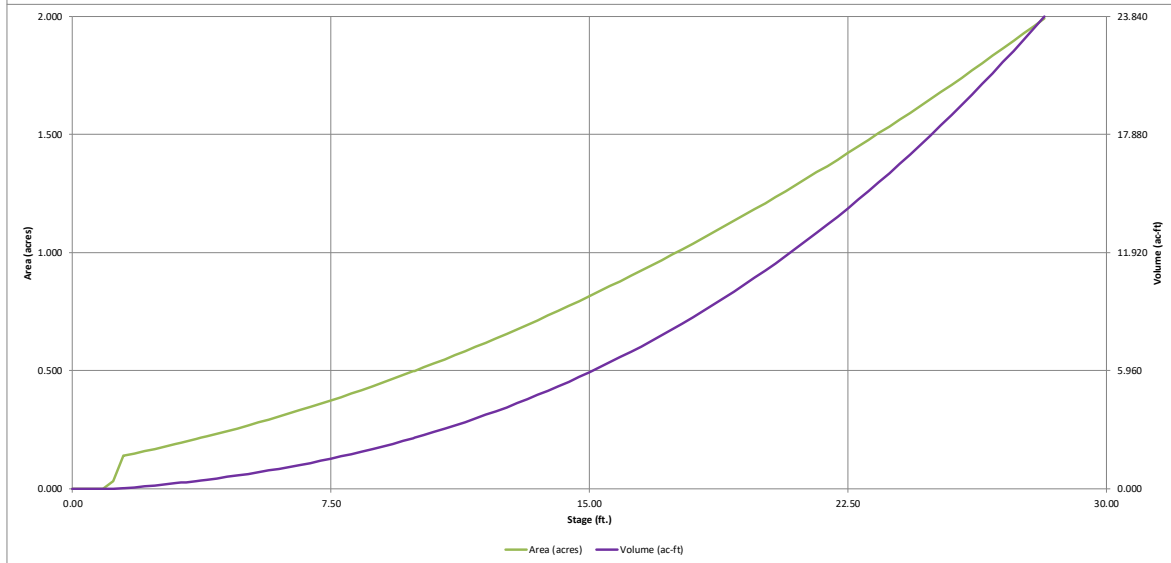
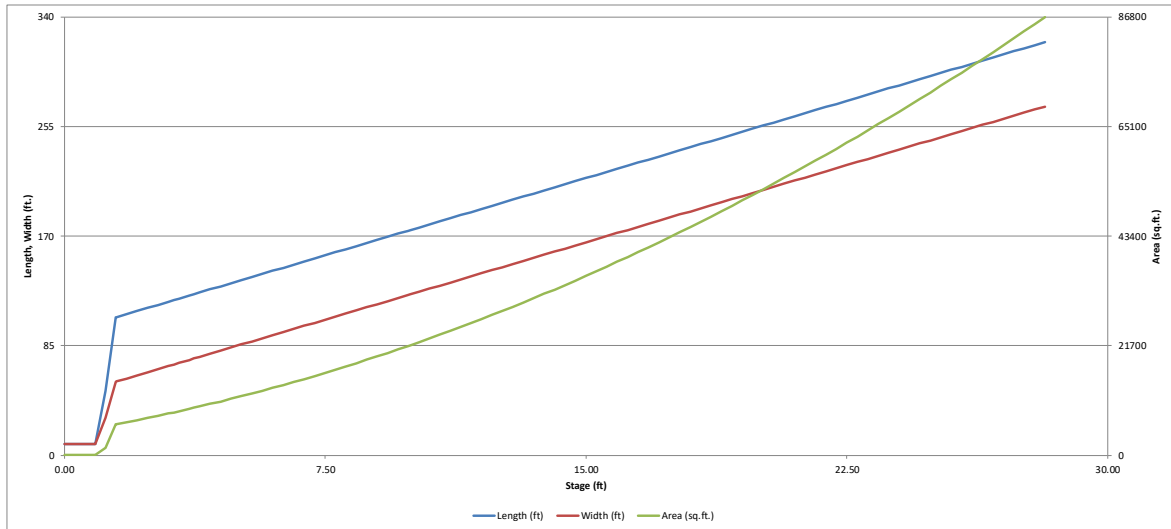
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

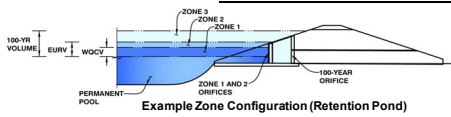


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Front Range - Midway Solar Project**

Basin ID: **Basin ASB**



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	10.74	acres
Watershed Length =	1,208	ft
Watershed Length to Centroid =	514	ft
Watershed Slope =	0.033	ft/ft
Watershed Imperviousness =	10.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQC 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) =	0.064	acre-feet
Excess Urban Runoff Volume (EURV) =	0.096	acre-feet
2-yr Runoff Volume (P1 = 1.01 in.) =	0.107	inches
5-yr Runoff Volume (P1 = 1.3 in.) =	0.286	inches
10-yr Runoff Volume (P1 = 1.57 in.) =	0.493	inches
25-yr Runoff Volume (P1 = 2.01 in.) =	0.933	inches
50-yr Runoff Volume (P1 = 2.4 in.) =	1.280	inches
100-yr Runoff Volume (P1 = 2.82 in.) =	1.722	inches
500-yr Runoff Volume (P1 = 3.98 in.) =	2.820	inches
Approximate 2-yr Detention Volume =	0.066	acre-feet
Approximate 5-yr Detention Volume =	0.157	acre-feet
Approximate 10-yr Detention Volume =	0.213	acre-feet
Approximate 25-yr Detention Volume =	0.286	acre-feet
Approximate 50-yr Detention Volume =	0.315	acre-feet
Approximate 100-yr Detention Volume =	0.457	acre-feet

Optional User Overrides

		acre-feet
		acre-feet
	1.01	inches
	1.30	inches
	1.57	inches
	2.01	inches
	2.40	inches
	2.82	inches
	3.98	inches

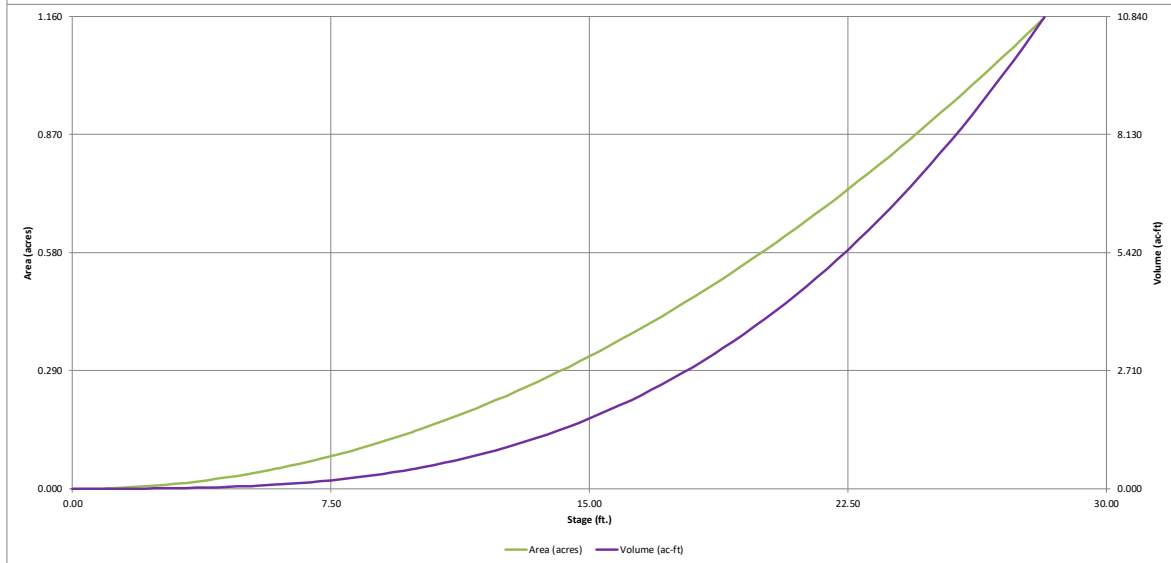
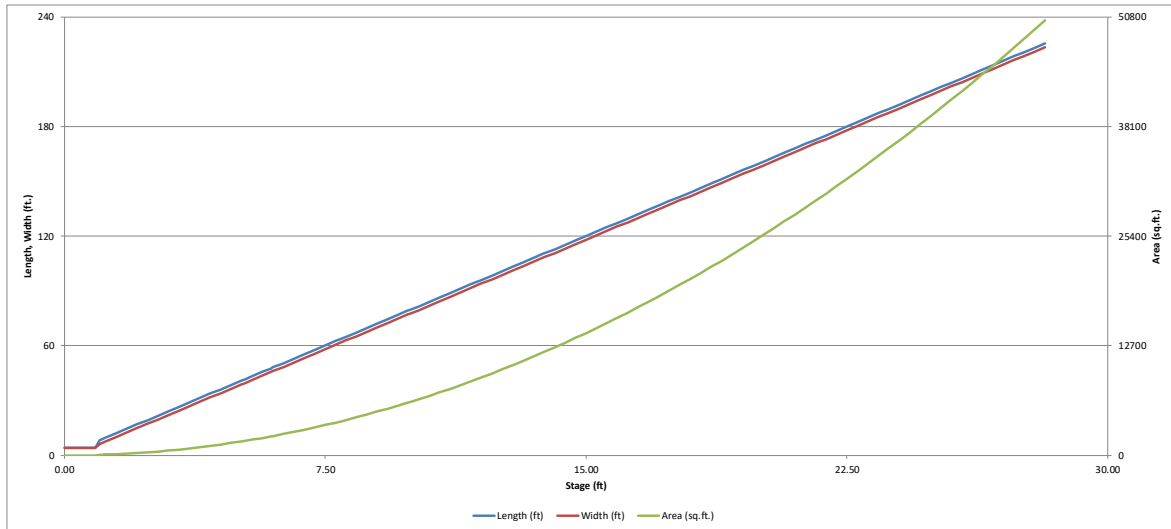
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.064	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.033	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.361	acre-feet
Total Detention Basin Volume =	0.457	acre-feet
Initial Surcharge Volume (ISV) =	8	ft ³
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H _{total}) =	9.90	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	17	ft ²
Surcharge Volume Length (L _{SV}) =	4.1	ft
Surcharge Volume Width (W _{SV}) =	4.1	ft
Depth of Basin Floor (H _{FLOOR}) =	0.02	ft
Length of Basin Floor (L _{FLOOR}) =	8.2	ft
Width of Basin Floor (W _{FLOOR}) =	6.1	ft
Area of Basin Floor (A _{FLOOR}) =	50	ft ²
Volume of Basin Floor (V _{FLOOR}) =	1	ft ³
Depth of Main Basin (H _{MAIN}) =	8.88	ft
Length of Main Basin (L _{MAIN}) =	79.2	ft
Width of Main Basin (W _{MAIN}) =	77.1	ft
Area of Main Basin (A _{MAIN}) =	6,107	ft ²
Volume of Main Basin (V _{MAIN}) =	19,851	ft ³
Calculated Total Basin Volume (V _{total}) =	0.456	acre-feet

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		4.1	4.1	17		0.000			
ISV	0.50		4.1	4.1	17		0.000	8	0.000	
	0.60		4.1	4.1	17		0.000	10	0.000	
	0.90		4.1	4.1	17		0.000	15	0.000	
	1.02		8.2	6.1	50		0.001	17	0.000	
Floor	1.20		9.6	7.5	72		0.002	28	0.001	
	1.50		12.0	9.9	119		0.003	56	0.001	
	1.80		14.4	12.3	177		0.004	101	0.002	
	2.10		16.8	14.7	247		0.006	164	0.004	
	2.40		19.2	17.1	328		0.008	250	0.006	
	2.70		21.6	19.5	421		0.010	362	0.008	
	3.00		24.0	21.9	526		0.012	504	0.012	
	3.30		26.4	24.3	642		0.015	679	0.016	
	3.60		28.8	26.7	769		0.018	890	0.020	
	3.90		31.2	29.1	908		0.021	1,142	0.026	
	4.20		33.6	31.5	1,059		0.024	1,436	0.033	
	4.50		36.0	33.9	1,221		0.028	1,778	0.041	
	4.80		38.4	36.3	1,394		0.032	2,170	0.050	
	5.10		40.8	38.7	1,579		0.036	2,616	0.060	
	Zone 1 (WQCV)	5.20		41.6	39.5	1,644		0.038	2,777	0.064
		5.40		43.2	41.1	1,776		0.041	3,119	0.072
Zone 2 (EURV)	5.70		45.6	43.5	1,984		0.046	3,682	0.085	
	5.95		47.6	45.5	2,166		0.050	4,201	0.096	
Zone 3 (100-year)	6.00		48.0	45.9	2,204		0.051	4,310	0.099	
	6.30		50.4	48.3	2,435		0.056	5,006	0.115	
	6.60		52.8	50.7	2,677		0.061	5,772	0.133	
	6.90		55.2	53.1	2,932		0.067	6,613	0.152	
	7.20		57.6	55.5	3,197		0.073	7,532	0.173	
	7.50		60.0	57.9	3,474		0.080	8,533	0.196	
	7.80		62.4	60.3	3,763		0.086	9,618	0.221	
	8.10		64.8	62.7	4,063		0.093	10,792	0.248	
	8.40		67.2	65.1	4,375		0.100	12,057	0.277	
	8.70		69.6	67.5	4,699		0.108	13,418	0.308	
	9.00		72.0	69.9	5,033		0.116	14,878	0.342	
	9.30		74.4	72.3	5,380		0.124	16,439	0.377	
	9.60		76.8	74.7	5,738		0.132	18,106	0.416	
	9.90		79.2	77.1	6,107		0.140	19,883	0.456	
	10.20		81.6	79.5	6,488		0.149	21,772	0.500	
	10.50		84.0	81.9	6,880		0.158	23,777	0.546	
10.80		86.4	84.3	7,284		0.167	25,901	0.595		
11.10		88.8	86.7	7,700		0.177	28,148	0.646		
11.40		91.2	89.1	8,127		0.187	30,522	0.701		
11.70		93.6	91.5	8,565		0.197	33,026	0.758		
12.00		96.0	93.9	9,015		0.207	35,662	0.819		
12.30		98.4	96.3	9,477		0.218	38,436	0.882		
12.60		100.8	98.7	9,950		0.228	41,349	0.949		
12.90		103.2	101.1	10,434		0.240	44,407	1.019		
13.20		105.6	103.5	10,930		0.251	47,611	1.093		
13.50		108.0	105.9	11,438		0.263	50,966	1.170		
13.80		110.4	108.3	11,957		0.274	54,475	1.251		
14.10		112.8	110.7	12,488		0.287	58,142	1.335		
14.40		115.2	113.1	13,030		0.299	61,969	1.423		
14.70		117.6	115.5	13,584		0.312	65,961	1.514		
15.00		120.0	117.9	14,149		0.325	70,120	1.610		
15.30		122.4	120.3	14,726		0.338	74,451	1.709		
15.60		124.8	122.7	15,314		0.352	78,957	1.813		
15.90		127.2	125.1	15,914		0.365	83,641	1.920		
16.20		129.6	127.5	16,525		0.379	88,506	2.032		
16.50		132.0	129.9	17,148		0.393	93,557	2.148		
16.80		134.4	132.3	17,782		0.408	98,796	2.268		
17.10		136.8	134.7	18,428		0.423	104,228	2.393		
17.40		139.2	137.1	19,085		0.438	109,854	2.522		
17.70		141.6	139.5	19,754		0.453	115,680	2.656		
18.00		144.0	141.9	20,435		0.469	121,708	2.794		
18.30		146.4	144.3	21,127		0.485	127,942	2.937		
18.60		148.8	146.7	21,830		0.501	134,385	3.085		
18.90		151.2	149.1	22,545		0.518	141,041	3.238		
19.20		153.6	151.5	23,272		0.534	147,913	3.396		
19.50		156.0	153.9	24,010		0.551	155,005	3.558		
19.80		158.4	156.3	24,759		0.568	162,320	3.726		
20.10		160.8	158.7	25,520		0.586	169,862	3.899		
20.40		163.2	161.1	26,293		0.604	177,634	4.078		
20.70		165.6	163.5	27,077		0.622	185,639	4.262		
21.00		168.0	165.9	27,873		0.640	193,881	4.451		
21.30		170.4	168.3	28,680		0.658	202,363	4.646		
21.60		172.8	170.7	29,498		0.677	211,090	4.846		
21.90		175.2	173.1	30,328		0.696	220,064	5.052		
22.20		177.6	175.5	31,170		0.716	229,288	5.264		
22.50		180.0	177.9	32,023		0.735	238,767	5.481		
22.80		182.4	180.3	32,888		0.755	248,503	5.705		
23.10		184.8	182.7	33,764		0.775	258,501	5.934		
23.40		187.2	185.1	34,652		0.796	268,763	6.170		
23.70		189.6	187.5	35,551		0.816	279,293	6.412		
24.00		192.0	189.9	36,462		0.837	290,095	6.660		
24.30		194.4	192.3	37,385		0.858	301,172	6.914		
24.60		196.8	194.7	38,319		0.880	312,527	7.175		
24.90		199.2	197.1	39,264		0.901	324,164	7.442		
25.20		201.6	199.5	40,221		0.923	336,087	7.715		
25.50		204.0	201.9	41,189		0.946	348,298	7.996		
25.80		206.4	204.3	42,169		0.968	360,801	8.283		
26.10		208.8	206.7	43,161		0.991	373,600	8.577		
26.40		211.2	209.1	44,164		1.014	386,699	8.877		
26.70		213.6	211.5	45,178		1.037	400,100	9.185		
27.00		216.0	213.9	46,204		1.061	413,807	9.500		
27.30		218.4	216.3	47,242		1.085	427,823	9.821		
27.60		220.8	218.							

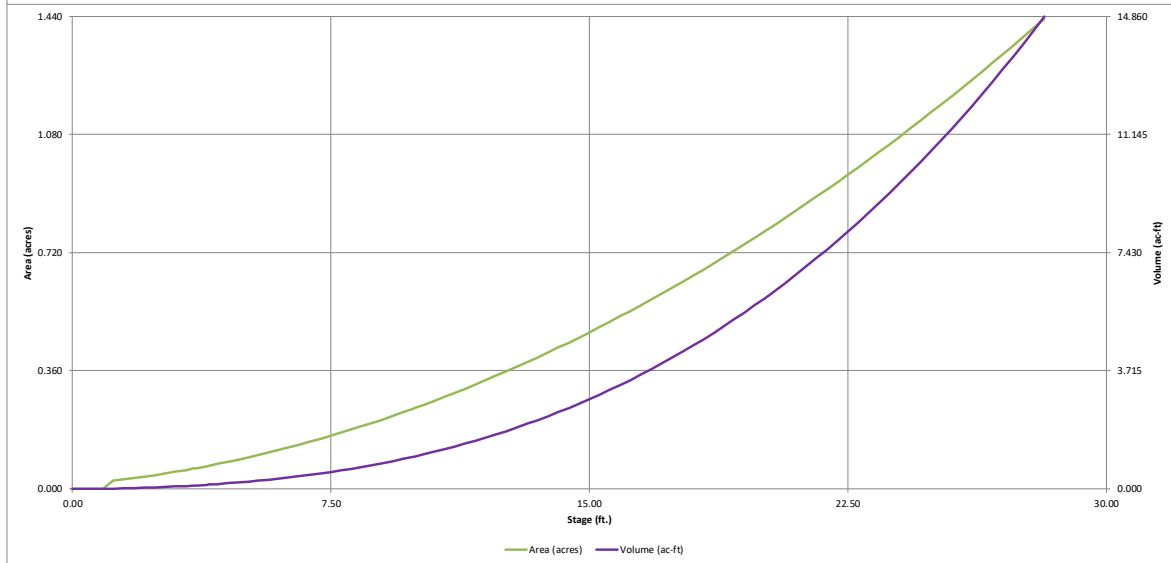
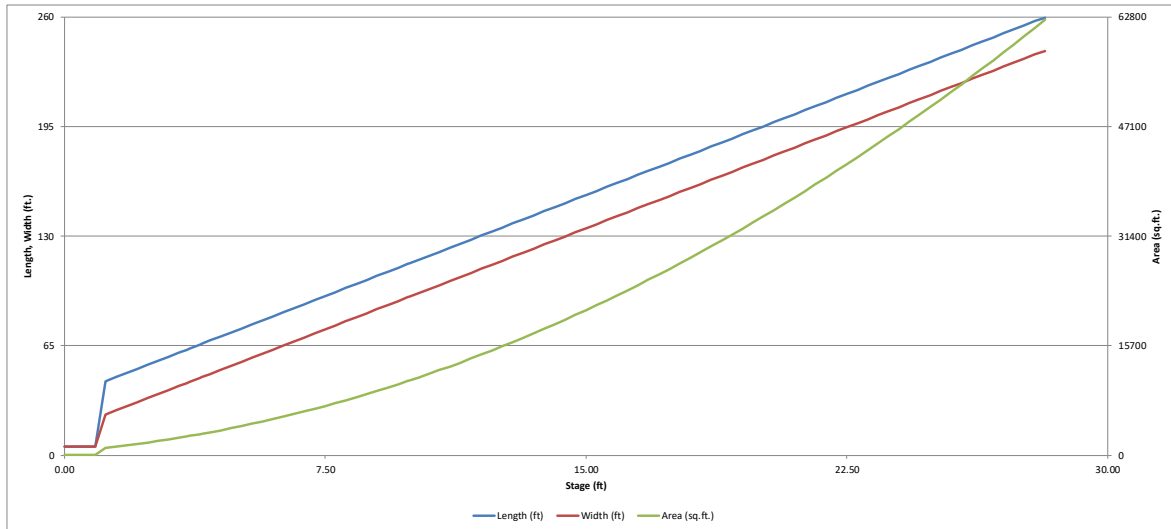
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



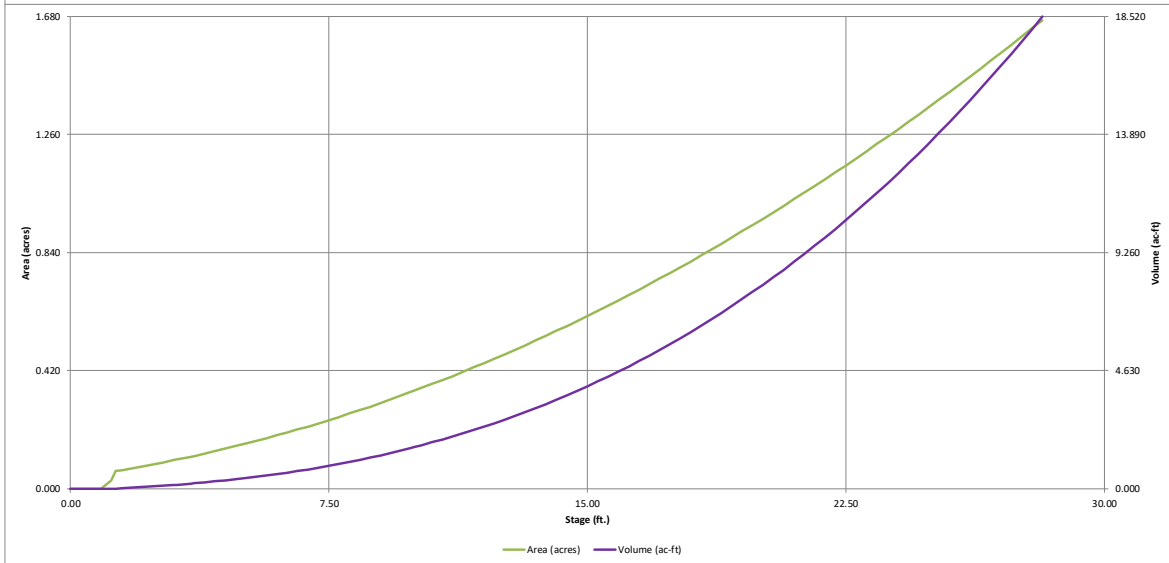
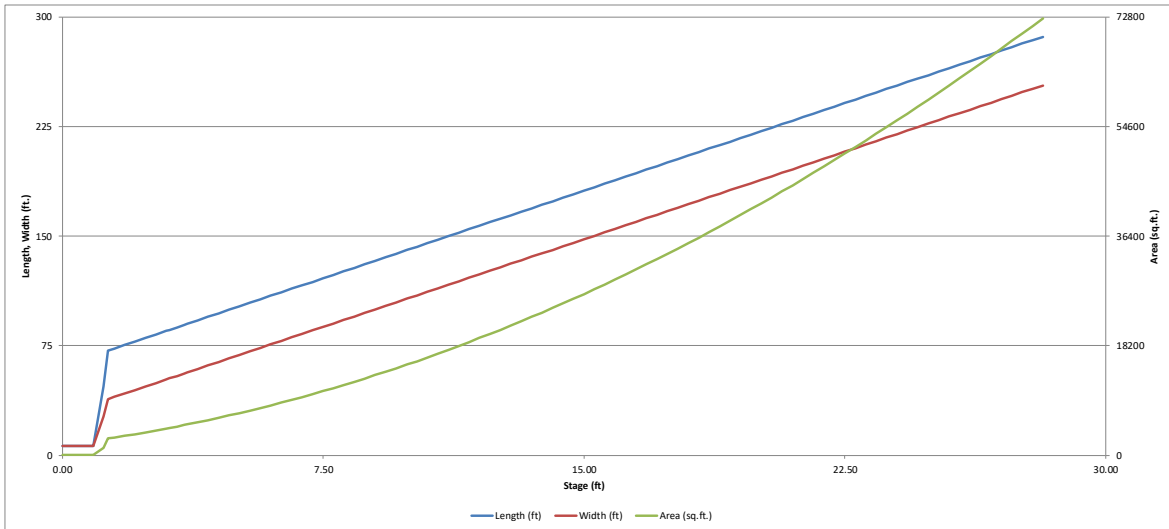
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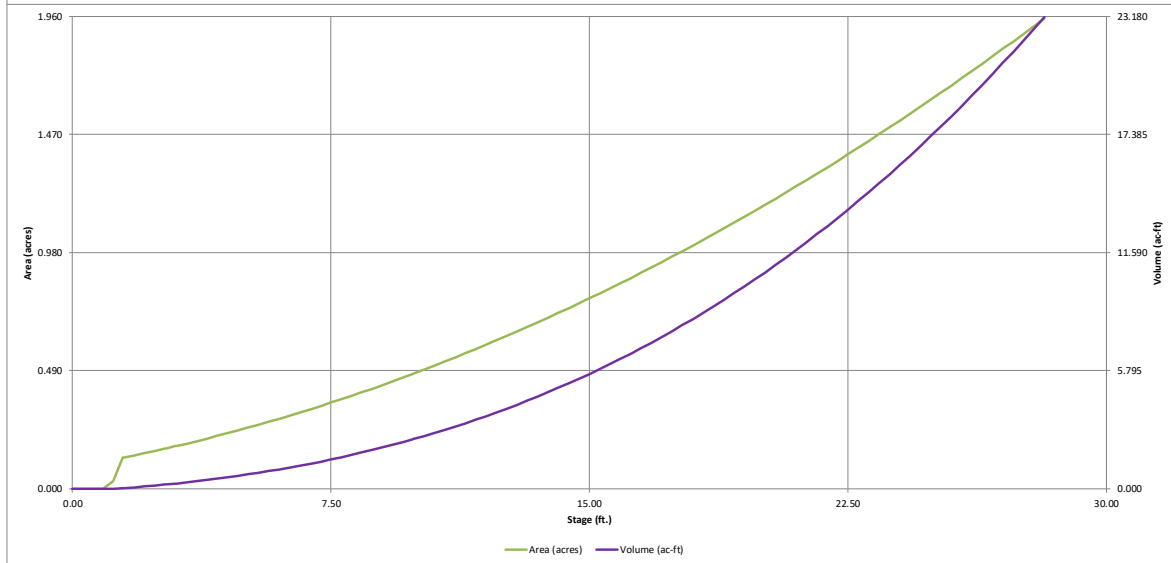
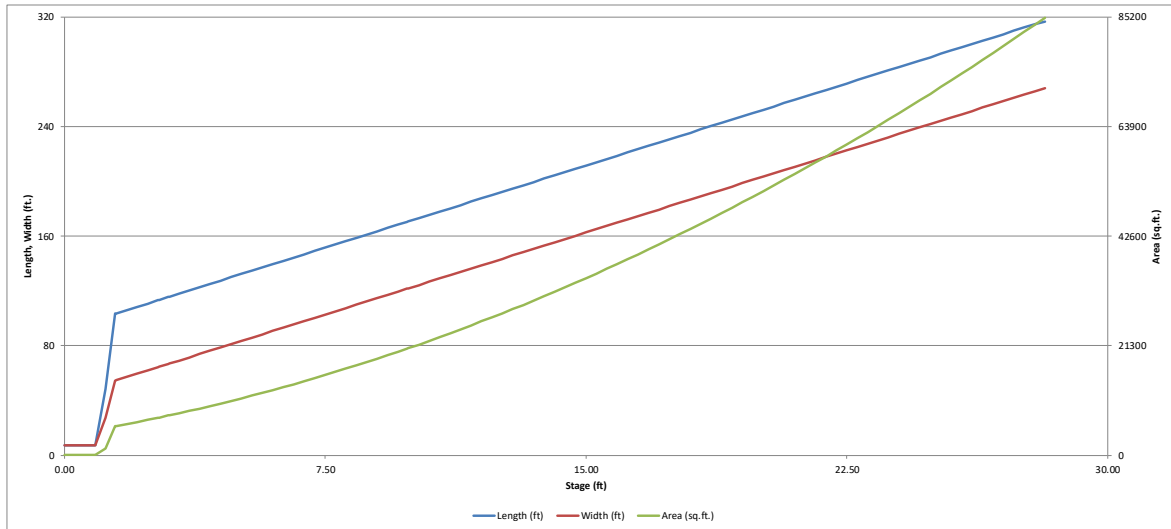
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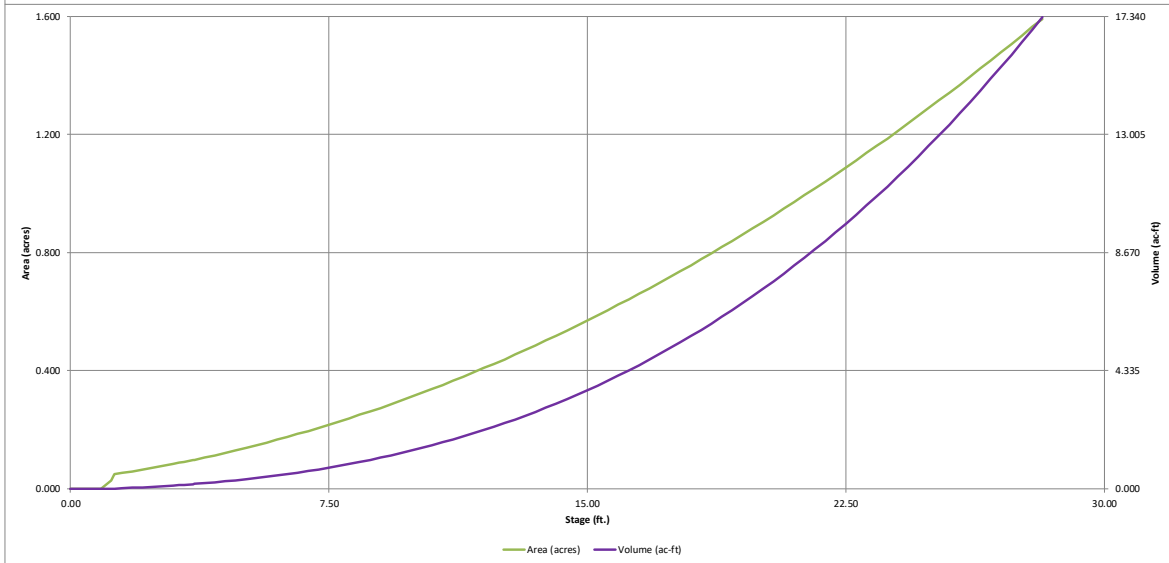
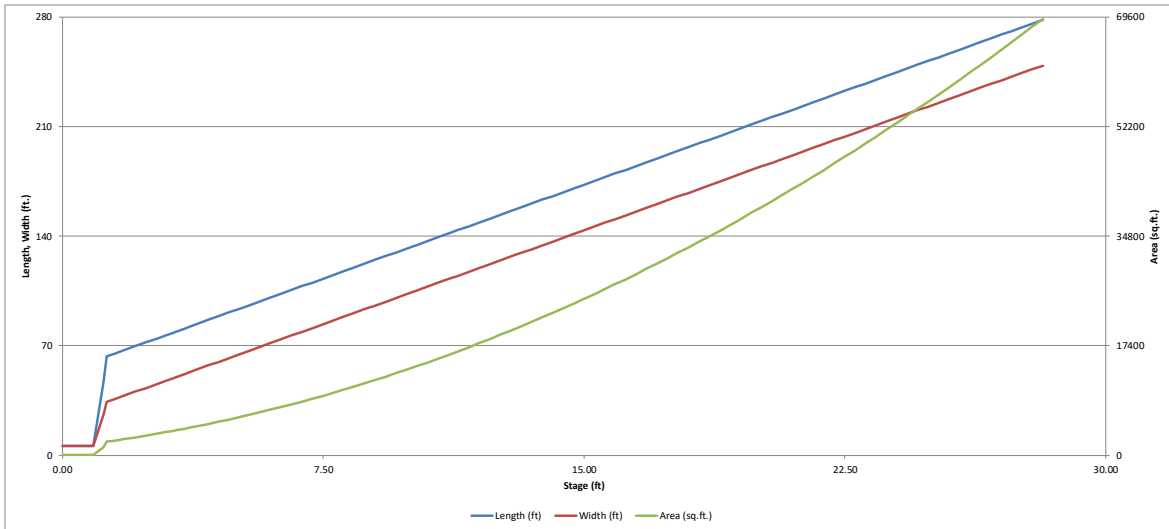
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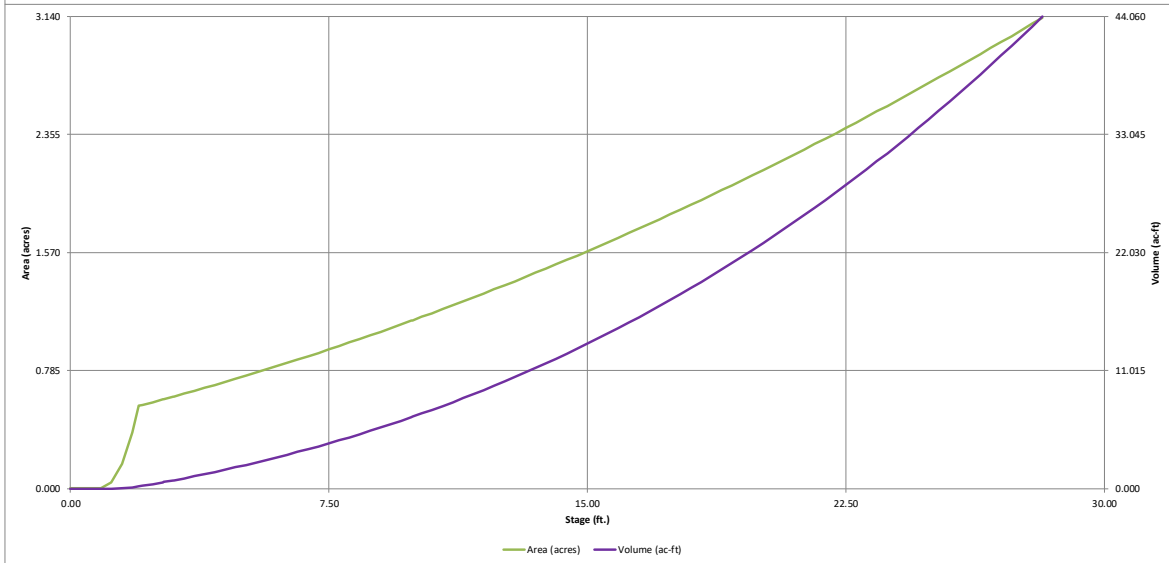
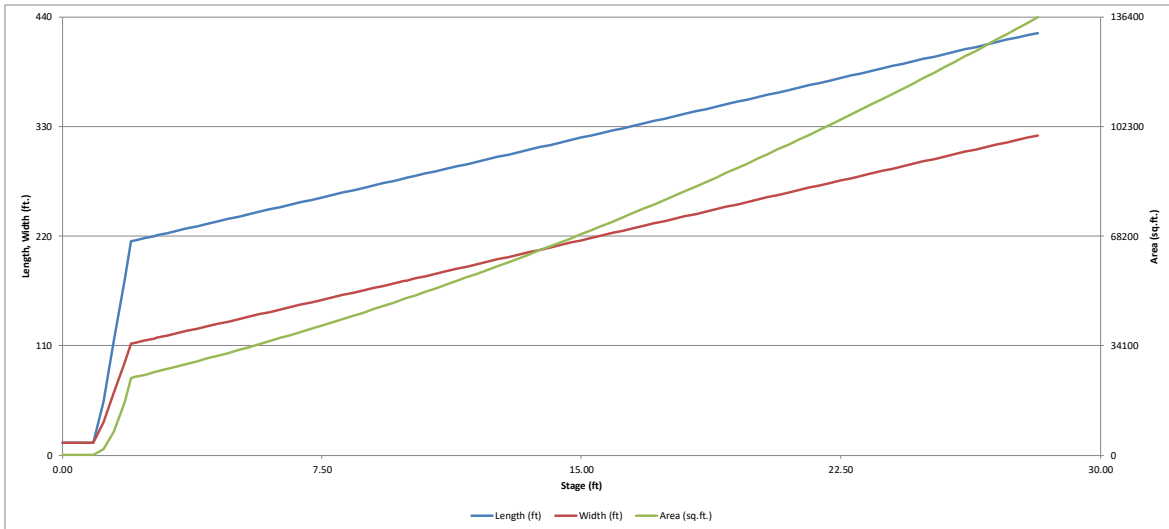
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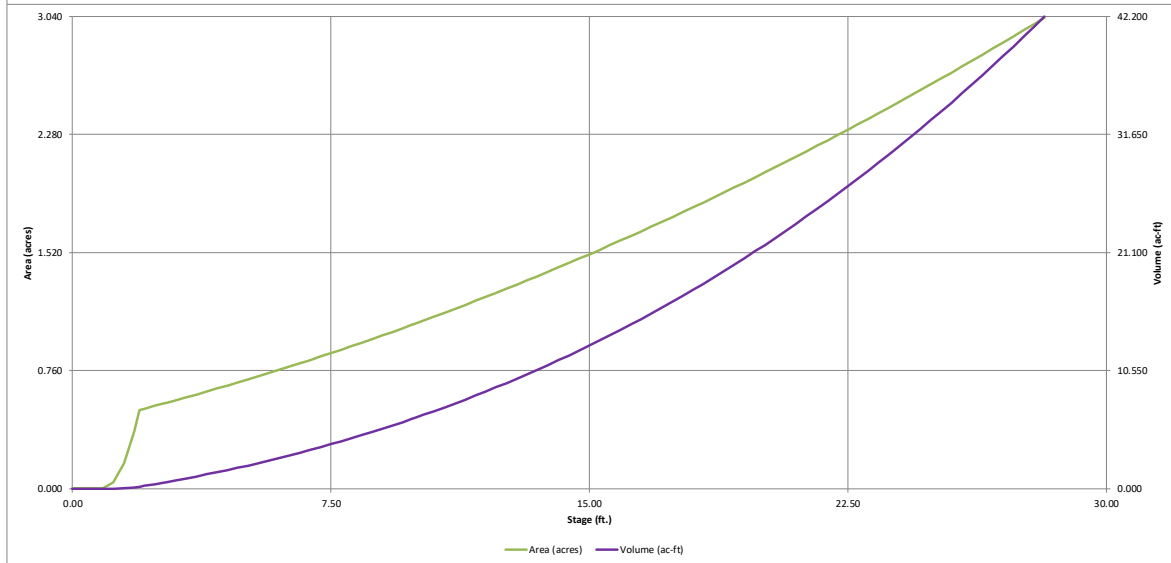
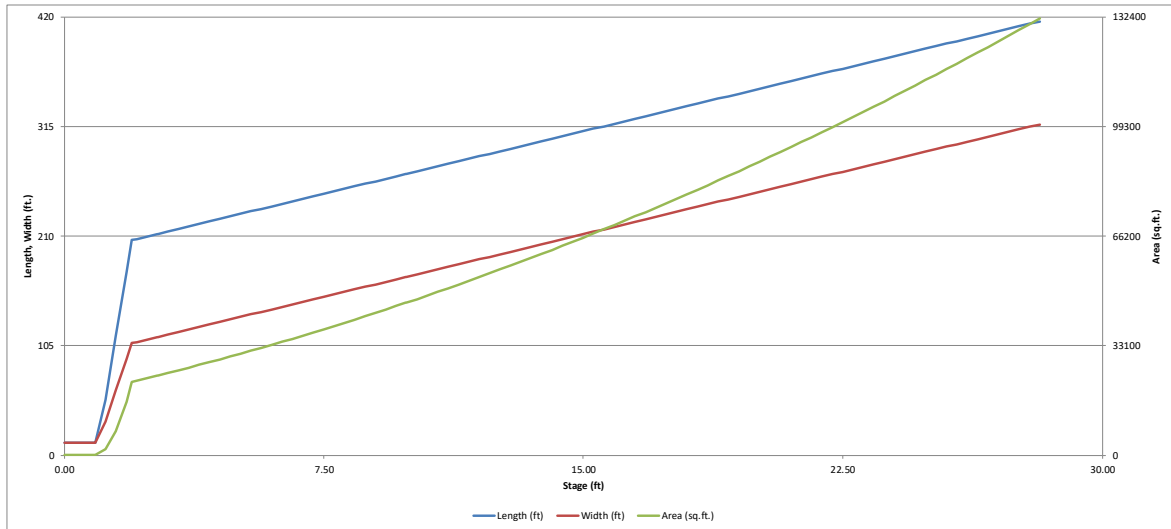
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MHFD-Detention, Version 4.03 (May 2020)

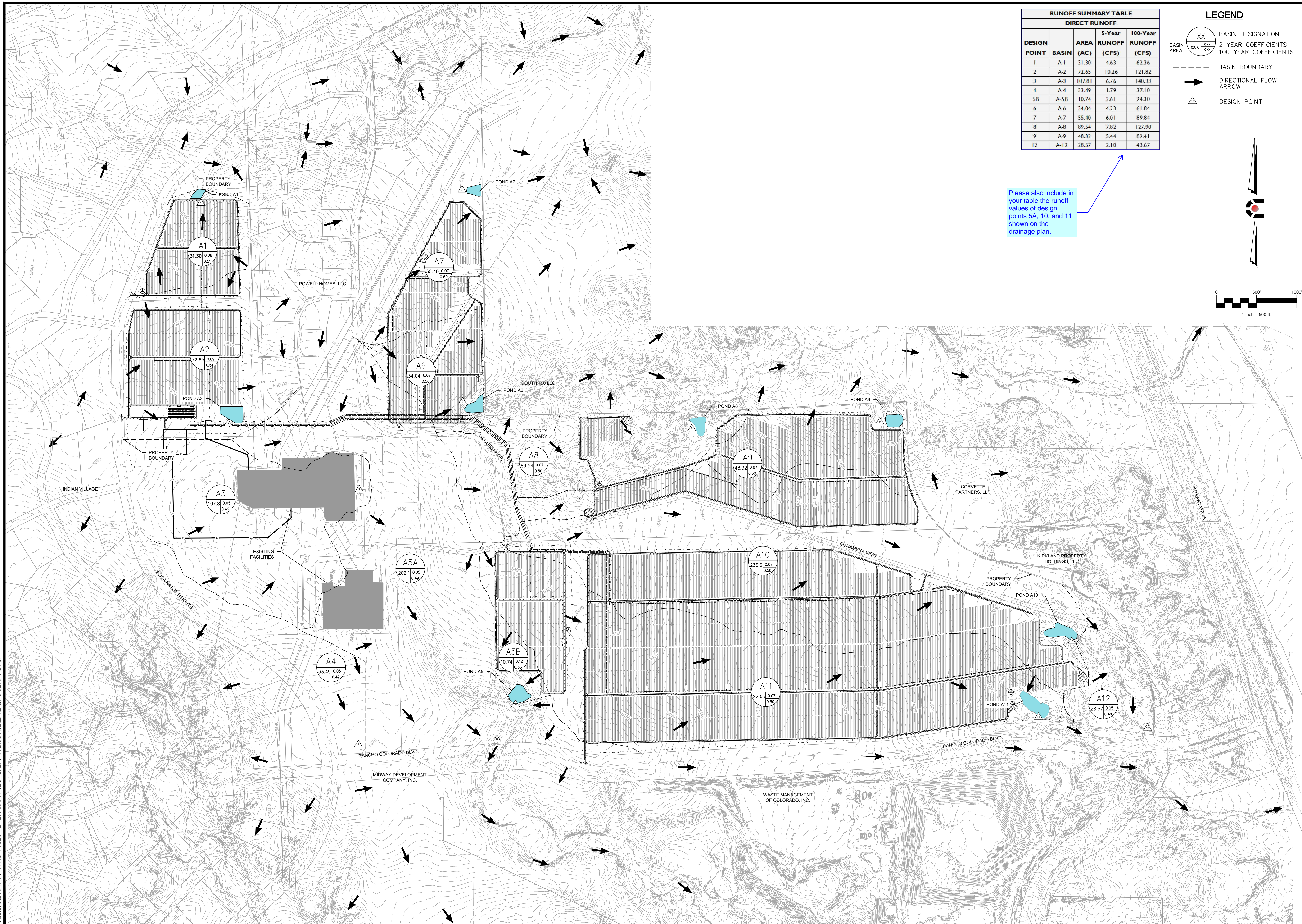


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



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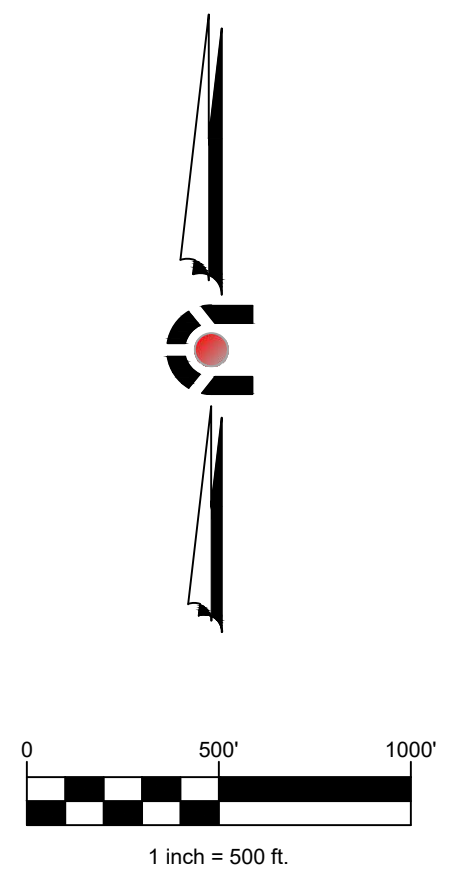


RUNOFF SUMMARY TABLE				
DIRECT RUNOFF				
DESIGN POINT	BASIN	AREA (AC)	5-Year RUNOFF (CFS)	100-Year RUNOFF (CFS)
1	A-1	31.30	4.63	62.36
2	A-2	72.65	10.26	121.82
3	A-3	107.81	6.76	140.33
4	A-4	33.49	1.79	37.10
5B	A-5B	10.74	2.61	24.30
6	A-6	34.04	4.23	61.84
7	A-7	55.40	6.01	89.84
8	A-8	89.54	7.82	127.90
9	A-9	48.32	5.44	82.41
12	A-12	28.57	2.10	43.67

LEGEND

- XX BASIN DESIGNATION
- XXX 2 YEAR COEFFICIENTS
- XXX 100 YEAR COEFFICIENTS
- BASIN BOUNDARY
- ➔ DIRECTIONAL FLOW ARROW
- △ DESIGN POINT

Please also include in your table the runoff values of design points 5A, 10, and 11 shown on the drainage plan.



CIVIL ENGINEERING
DEVELOPMENT CONSULTING
NATURAL RESOURCES CONSULTING
LAND SURVEYING
303.703.4444
1950 W. Litchton Blvd., Ste. 109
Litchton, CO 80120

CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND UTILITIES.
CORE ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY UTILITIES SHOWN ON THIS DRAWING HAVE BEEN LOCATED FROM THE BEST AVAILABLE INFORMATION. TO SHOW THE LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

#	REVISION DESCRIPTION	DATE BY
1	ERRATA #1	10/20/2020 DJB

FRONT RANGE MIDWAY SOLAR PROJECT
EL PASO COUNTY, FOUNTAIN, CO

EXHIBIT
OVERALL DRAINAGE MAP

DESIGNED BY: DJB
DRAWN BY: DJB
CHECKED BY: DJB
JOB NO. 19-177
SHEET 1 OF 1



**PRELIMINARY DRAINAGE REPORT
FOR
FRONT RANGE – MIDWAY SOLAR PROJECT
EL PASO COUNTY, CO
(WSEO 17-001)**

PREPARED FOR:

TRADEWIND ENERGY, INC.
FRONT RANGE – MIDWAY SOLAR
16105 W. 113TH STREET SUITE 105
LENEXA, KS 66219
PHONE: (913) 888-9463
CONTACT: SCOTT ZIEMETZ

PREPARED BY:

CORE CONSULTANTS, INC.
1950 W. LITTLETON BOULEVARD, SUITE 109
LITTLETON, CO 80120
PHONE: 303-703-4444
CONTACT: DAVID BACCI
CORE PROJECT NUMBER: 17-012

FEBRUARY 26, 2018

APPROVAL BLOCKS

I. DESIGN ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

David Bacci, P.E. #42104



Date

II. OWNER/DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all the requirements specified in this Drainage Report and Plan.

Dave Tadarola

Development Manager

III. EL PASO COUNTY STATEMENT:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Jennifer Irvine P.E.,
County Engineer / ECM Administrator

Date



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FIRM MAP
SCS SOILS MAPS
PERCENT IMPERVIOUS CALCULATIONS
RUNOFF COEFFICIENT CALCULATIONS
TIME OF CONCENTRATION CALCULATIONS
RATIONAL METHOD CALCULATIONS FOR DETERMINING 2 AND 100-YEAR RUNOFF RATES
CUHP CALCULATIONS
EXTENDED DETENTION BASIN CALCULATIONS
DRAINAGE PLAN

I. GENERAL LOCATION AND DESCRIPTION

A. SITE LOCATION

This Final Drainage Report provides remediation for changes in the drainage patterns resulting from the development of the proposed Front Range – Midway Solar Project. The Project would consist of a 100 megawatt (MW) distributed generation photovoltaic solar facility that would encompass approximately 1,085 acres in El Paso County (EPC), Colorado. The Project is located west of Interstate-25 (I-25) approximately 20 miles south of downtown Colorado Springs on private and county owned lands. The Project is bound on the west by county lands and by dispersed residential development to the northwest and southwest, by rangeland to the north, by a gravel pit to the east, and by the Midway Waste Management Landfill to the south. Other facilities in the near vicinity include the Pikes Peak International Raceway approximately 1.5 miles to the north and the Fort Carson Military Reservation approximately one mile to the west. The Mountain States Telephone compound is also located within the project area. Front Range - Midway Solar Project is located in Section 20, Township 17 South, Range 65 West of the 6th Principal Meridian, El Paso County, Colorado. A vicinity map for the site can be found in Appendix A.

B. DESCRIPTION OF PROPERTY

The project area is flat to gently rolling, at elevations ranging from approximately 5,360 to 5,520 feet. The site has naturally occurring slopes ranging from 2 to 10 percent and is covered with native grass and very few deciduous trees. Surface runoff is to the north, south and east. Runoff from the northern portion of the site flows north into two separate conveyances. After merging into one conveyance, these flows continue east under I25 through a series of bridges and eventually into Fountain Creek. Flows from the southeast portion of the site flow east under I25 through an existing box culvert and continue east into Fountain Creek. Flows from the southwest portion of the site flow south into Sand Creek then under I25 through a series of bridges and continue into Fountain Creek which flows to the south along the east side of I-25 to Pueblo where it joins the Arkansas River. The proposed improvements to the site consist of a 100 megawatt (MW) photovoltaic solar array, distribution poles, a meteorological station, inverters, site access roads, and other necessary ancillary features. The soils vary throughout the site and include mainly Wilid Silt Loam, (Hydrologic soil group C), Fort Loam (Hydrologic soil group C), Kim Loam (Hydrologic soil group B) and Schamber Razor (Hydrologic soil group A). A soils map has been provided and can be found in Appendix A.

II. DRAINAGE BASINS AND SUB-BASINS

A. MAJOR DRAINAGE BASINS

The existing drainage patterns for the major basin will follow the historic patterns. Front Range – Midway Solar site will drain east and cross under I25 in 3 locations

eventually outfalling into Fountain Creek. Fountain Creek flows to the south along the east side of I-25 and is part of the Arkansas River basin

The site falls within Zone X, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 08041C1155F, 08041C1160F, 08041C1170F, and 08041C1165F. A copy of the FIRM map can be found in Appendix A.

B. MINOR DRAINAGE BASINS

Minor Drainage Basins for Front Range – Midway Solar Project have been delineated per the preliminary layout of the solar arrays. Layout of the arrays and access roads may change during the preliminary development of the site. Overall, the proposed drainage patterns for the sub-basins will follow the historic patterns prior to development. For sub-basins within the site, runoff will drain to the north, south and east.

Basin (A1) will flow north to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the northeast into an east-flowing conveyance and through a series of bridges under I25 to Fountain Creek.

Basin (A2) will flow southeast to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the northeast and into an east-flowing conveyance then through a series of bridges under I25 to Fountain Creek.

Basin (A3) will flow to the east and will be collected in an existing Extended Detention Basin. Flowrates or flow patterns within this basin will not be affected by this development.

Basin (A4) will flow to the south and eventually into Sand Creek. Flowrates or flow patterns within this basin will not be affected by this development.

Basin (A5) will flow southeast to a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the south into Sand Creek. Sand Creek crosses I25 through a series of bridges and flows into Fountain Creek.

Basin (A6) flows east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

Basin (A7) flows northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

Basin (A8) will flow to the northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek.

Basin (A9) will flow to the northeast into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff overland to the east through a series of bridges under I25 to Fountain Creek.

Basin (A10) will flow to the east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic flowrate to the southeast into a conveyance that continues east under I25 through an existing box culvert eventually flowing into Fountain Creek.

Basin (A11) will flow to the east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic flowrate to the southeast into a conveyance that continues east under I25 through an existing box culvert eventually flowing into Fountain Creek.

Basin (A12) flows east into a proposed Extended Detention Basin. The outlet structure for this extended detention basin will release the historic runoff to the east through a series of bridges under I25 to Fountain Creek

The developed minor basins will include pole mounted solar arrays with native ground beneath and 3" thick gravel access roads constructed of $\frac{3}{4}$ " gravel on top of 12" re-compacted soil. The development will slightly increase the imperviousness of the site due to the addition of gravel roads. Extended Detention Basins have been designed to mitigate the increase in runoff. A total of 9 extended detention basins will be designed during the construction document design phase. The extended detention basins will be privately owned and maintained.

III. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

This Final Drainage Report is in accordance with El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. These manuals were used as a basis of design for the site. All applicable tables, figures, and charts from the referenced reports and criteria manuals used in the drainage design of the site can be found in

Appendix B. The report will analyze the minor (5-year) and major (100-year) storm events.

B. DRAINAGE STUDIES, MASTER PLANS, AND SITE CONSTRAINTS

There are no previous drainage studies, master plans or site constraints for this development.

C. HYDROLOGY

A combination of the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP) was used to determine the flow rates for various basins within the site. Basins Larger than 160 acres were evaluated using CUHP. The rational method was used for all other basins. The sub-basins were delineated based on the existing topography for the project. Flow rates for each basin can be found in Appendix A. Stormwater Management Model (SWMM) is typically used in conjunction with CUHP when the routing of extended detention basins, channels and/or storm networks as necessary. Because this site is located at the top of a basin; each basin flows into its own extended detention basin or separate concentrated point. Because of this, no routing is required and SWMM was not used. The impervious panels are going to be pole mounted with the ground underneath them to remain vegetated. The gravel access roads will be constructed to slow surface flows and promote infiltration back into the ground. As a result, there will be very slight increase in runoff once the development is constructed.

The intensity-frequency curves used in the Rational Method calculations were taken from the El Paso County Drainage Criteria Manual. All drainage facilities were analyzed and designed for both the minor (5-year) and major (100-year) storm events. Time of concentration calculations were used to determine the rainfall intensity. The development of the site will slightly increase the imperviousness of the site; therefore, detention will be required in various locations for the development. These calculations also can be found in Appendix A.

D. HYDRAULICS

Hydraulic calculations for street and inlet capacity will not be necessary for this development.

E. WATER QUALITY ENHANCEMENT

Water quality measures within the extended detention basins will be required and will be designed during the construction design process. The design will employ the Four-Step process for selecting structural BMP's as described in the El Paso Drainage Criteria Manual.

IV. STORMWATER MANAGEMENT FACILITY DESIGN

A. STORMWATER CONVEYANCE FACILITIES

The general concept for the drainage design is to maintain the historic drainage patterns and release rates for the site. By doing this, it reduces the impact to the existing channels and ultimately Fountain Creek and Sand Creek. No public infrastructure is proposed within this site.

B. STORMWATER STORAGE FACILITIES

Extended Detention Basins for the site will be required. Basins A1-A2 and A5-A12 will have Extended Detention Basins within their respective basins. Extended Detention Basins will be designed per the El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. Extended Detention Basin calculations can be found in Appendix A.

C. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

Water quality measures within the extended detention basins will be required. Outlet structures, micro pools and essential components of the outlet structures will be designed per the El Paso County Drainage Criteria Manual and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual*. Outlet structure calculations can be found in Appendix A.

D. FLOODPLAIN MODIFICATION

There will be no modification to the floodplain.

E. ADDITIONAL PERMITTING REQUIREMENTS

No additional permitting will be required for this site.

F. GENERAL

All applicable tables, figures, and charts from the referenced reports and criteria manuals used in the drainage design of the site can be found in Appendix B. The site is not going to be platted at this time therefore no drainage fees are due.



REFERENCES

- A. El Paso County Drainage Criteria Manual, Volumes 1 and 2.
- B. Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood Control District, June 2001, Revised June 2004.



APPENDIX A

HYDROLOGIC CALCULATIONS

VICINITY MAP

FIRM MAP

SOILS MAP

CIA CALCULATIONS

CUHP CALCULATIONS

EXTENDED DETENTION BASIN CALCULATIONS

DRAINAGE PLAN



PROJECT: FRONT RANGE - MIDWAY SOLAR
VICINITY MAP
DATE: 07/21/2017



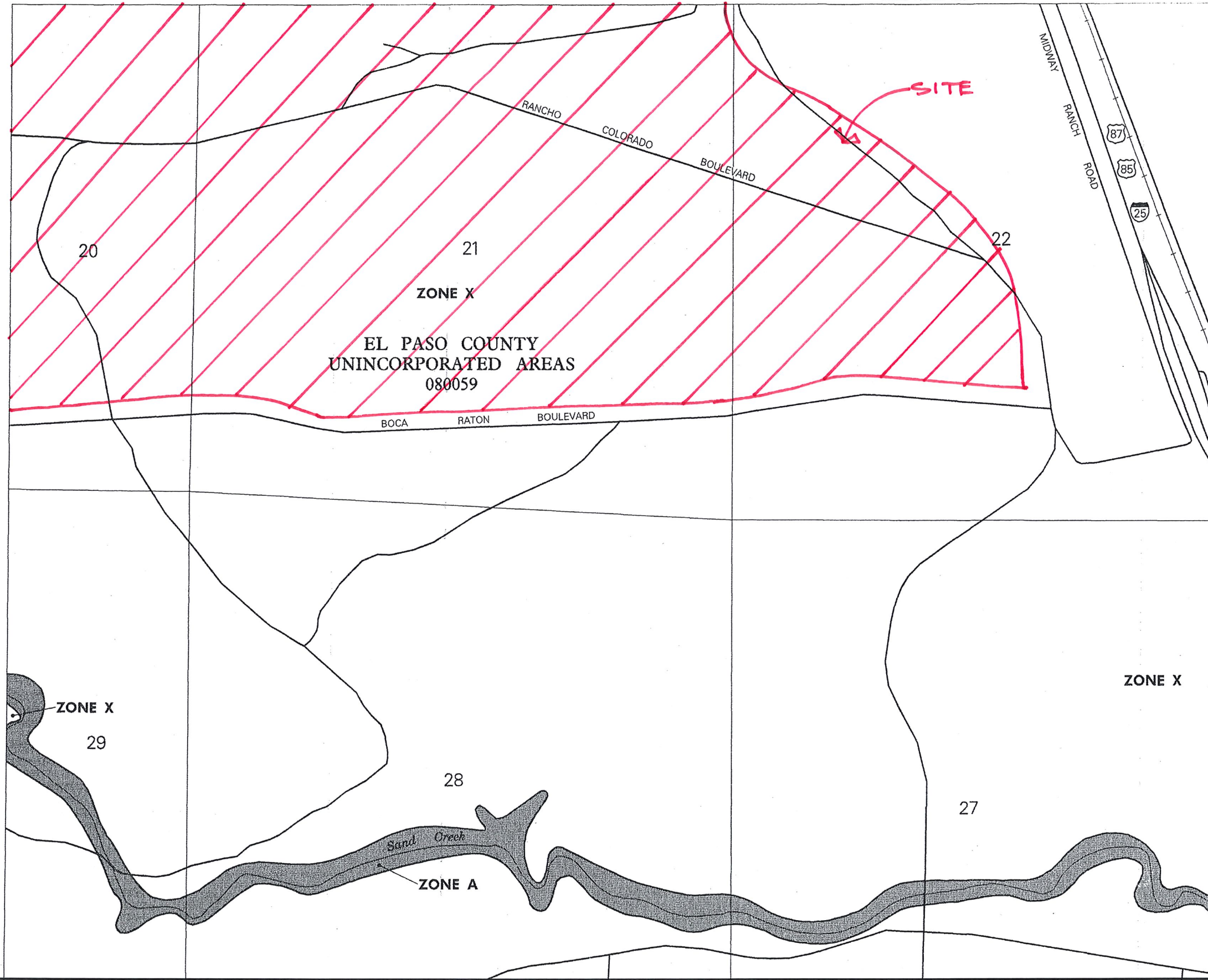
CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING
303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

104°41'15"
38°33'45"

JOINS PANEL 1160



APPROXIMATE SCALE IN FEET
1000 0 1000



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM
FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS**

PANEL 1170 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1170	F

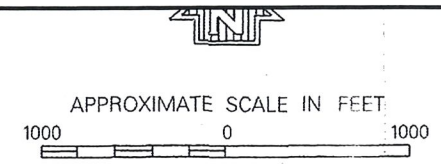
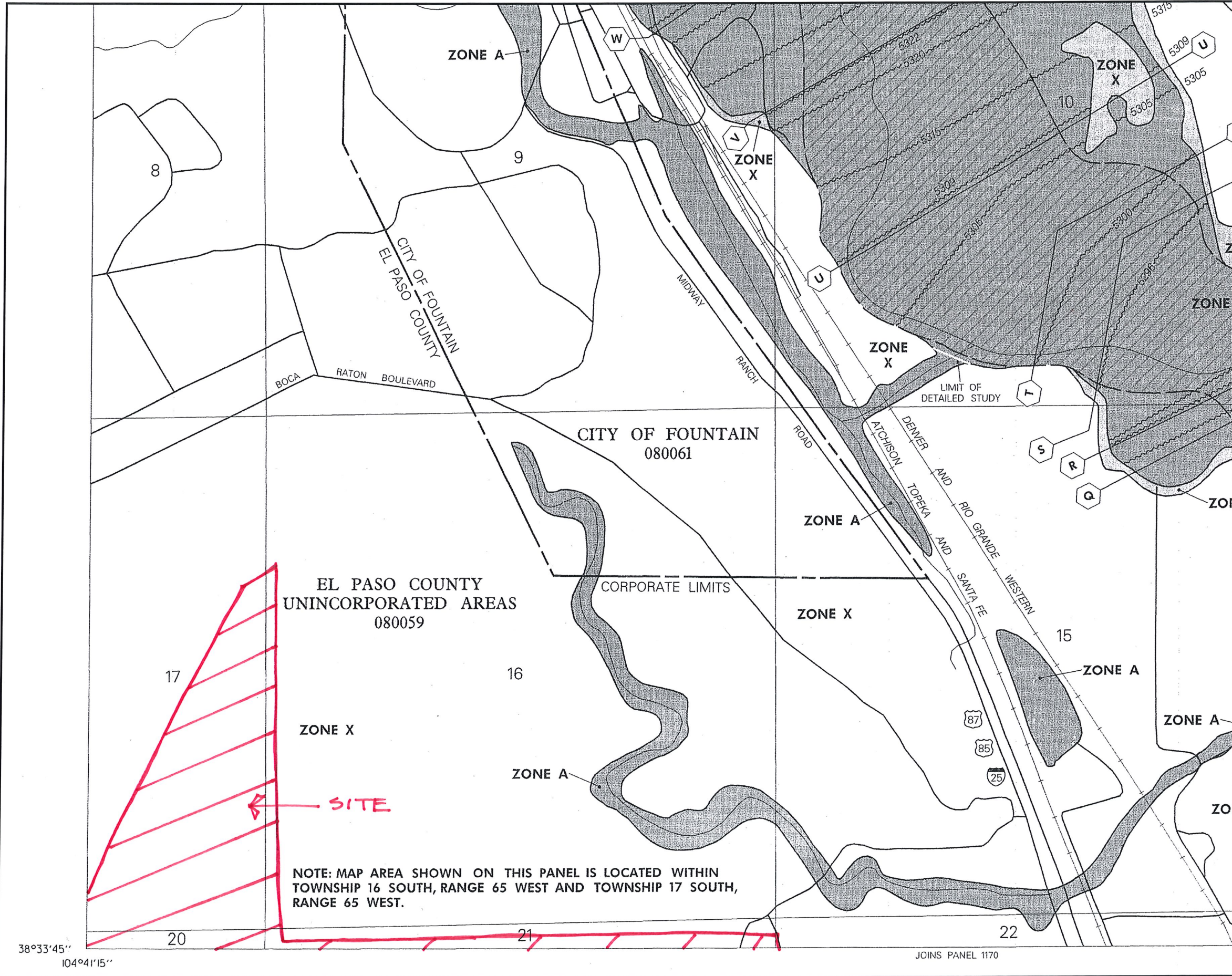


Federal Emergency Management Agency

**MAP NUMBER
08041C1170 F**

**EFFECTIVE DATE:
MARCH 17, 1997**

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM
FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS**

PANEL 1160 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1160	F
FOUNTAIN, CITY OF	080061	1160	F

**MAP NUMBER
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**EFFECTIVE DATE:
MARCH 17, 1997**

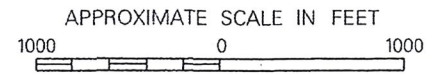
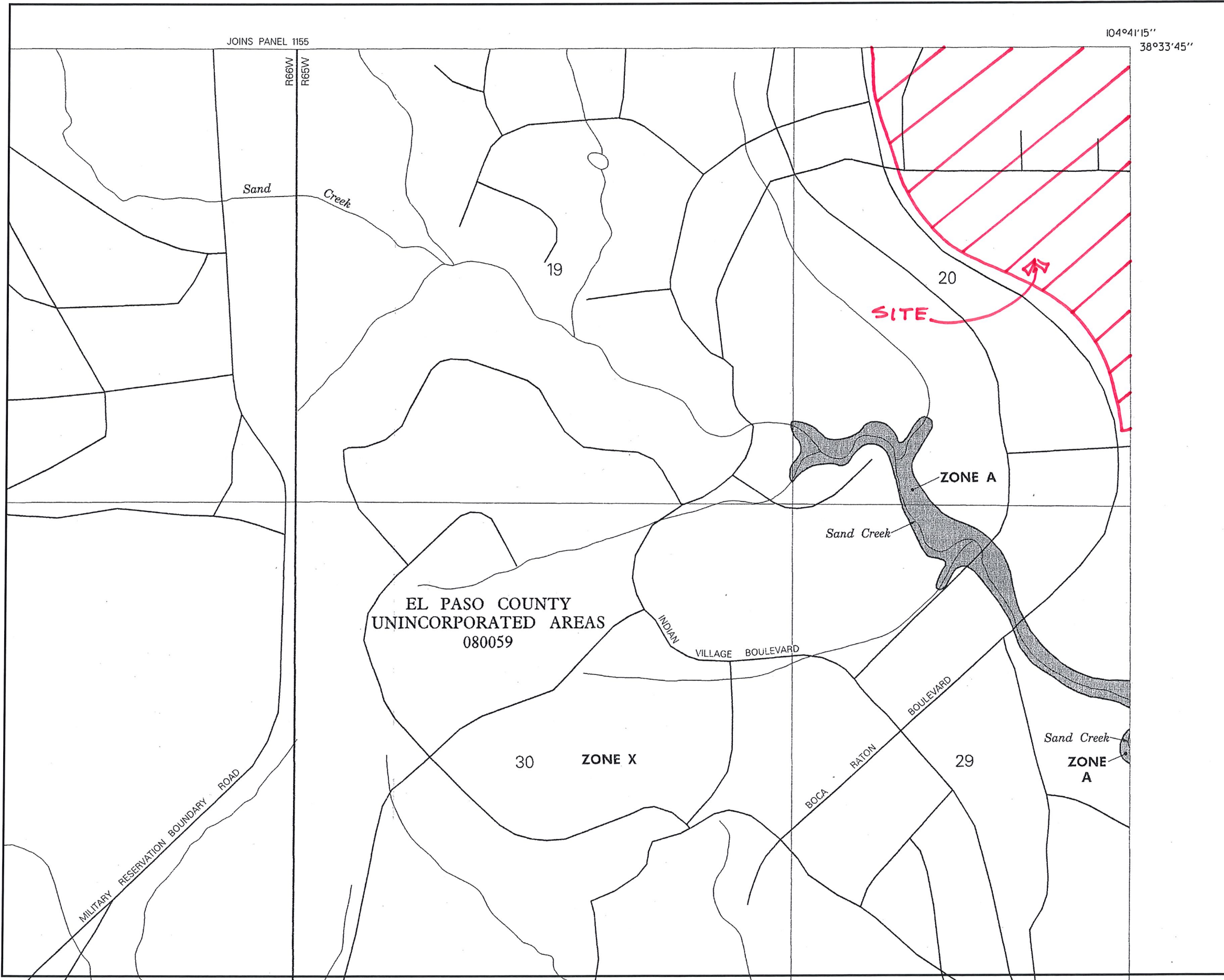


Federal Emergency Management Agency

38°33'45"
104°41'15"

JOINS PANEL 1170

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NATIONAL FLOOD INSURANCE PROGRAM

FIRM FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 1165 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1165	F

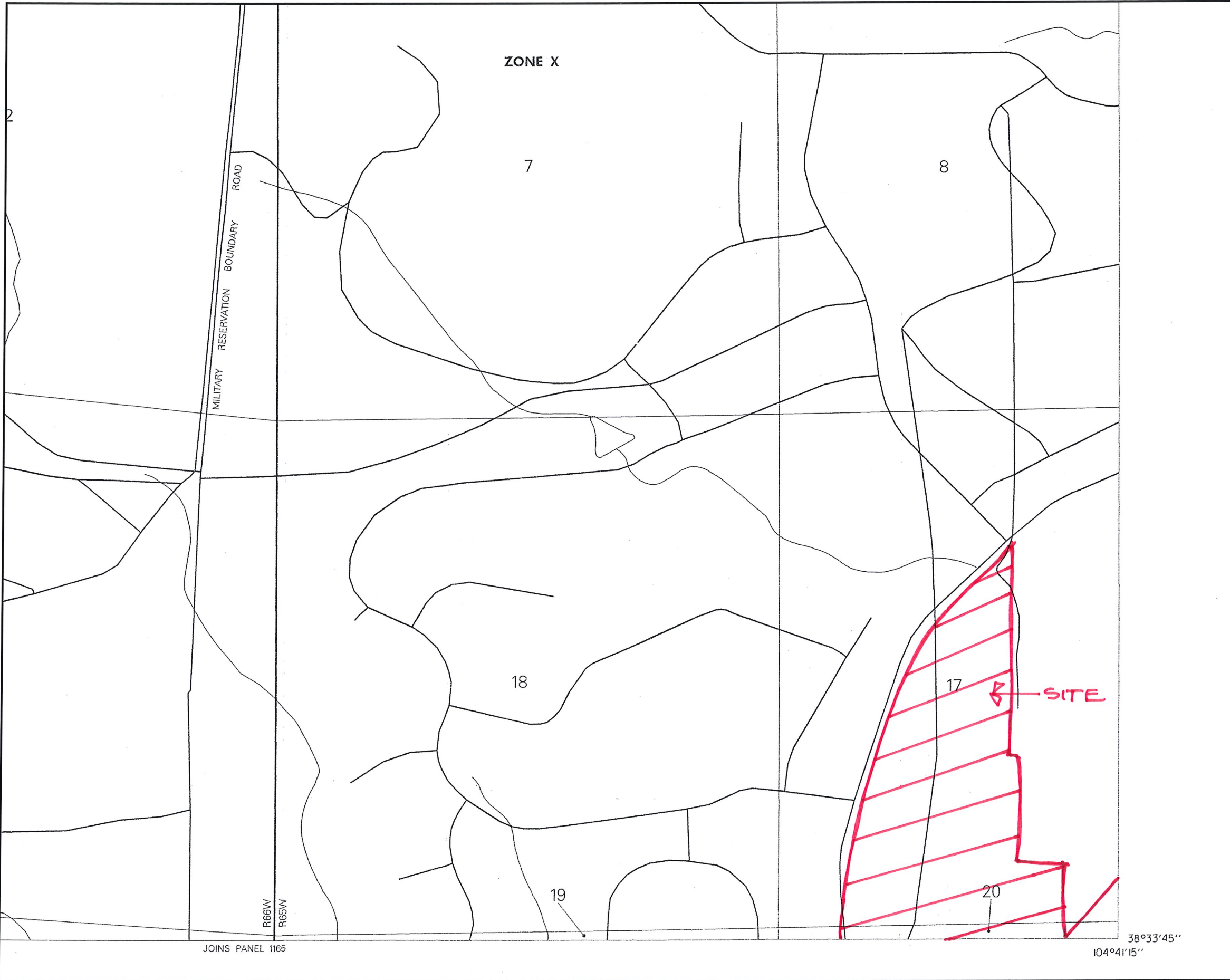
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EFFECTIVE DATE:
MARCH 17, 1997



Federal Emergency Management Agency

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APPROXIMATE SCALE IN FEET
 1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM
 FLOOD INSURANCE RATE MAP**

**EL PASO COUNTY,
 COLORADO AND
 INCORPORATED AREAS**

PANEL 1155 OF 1300
 (SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
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FOUNTAIN, CITY OF	083061	1:55	F

**MAP NUMBER
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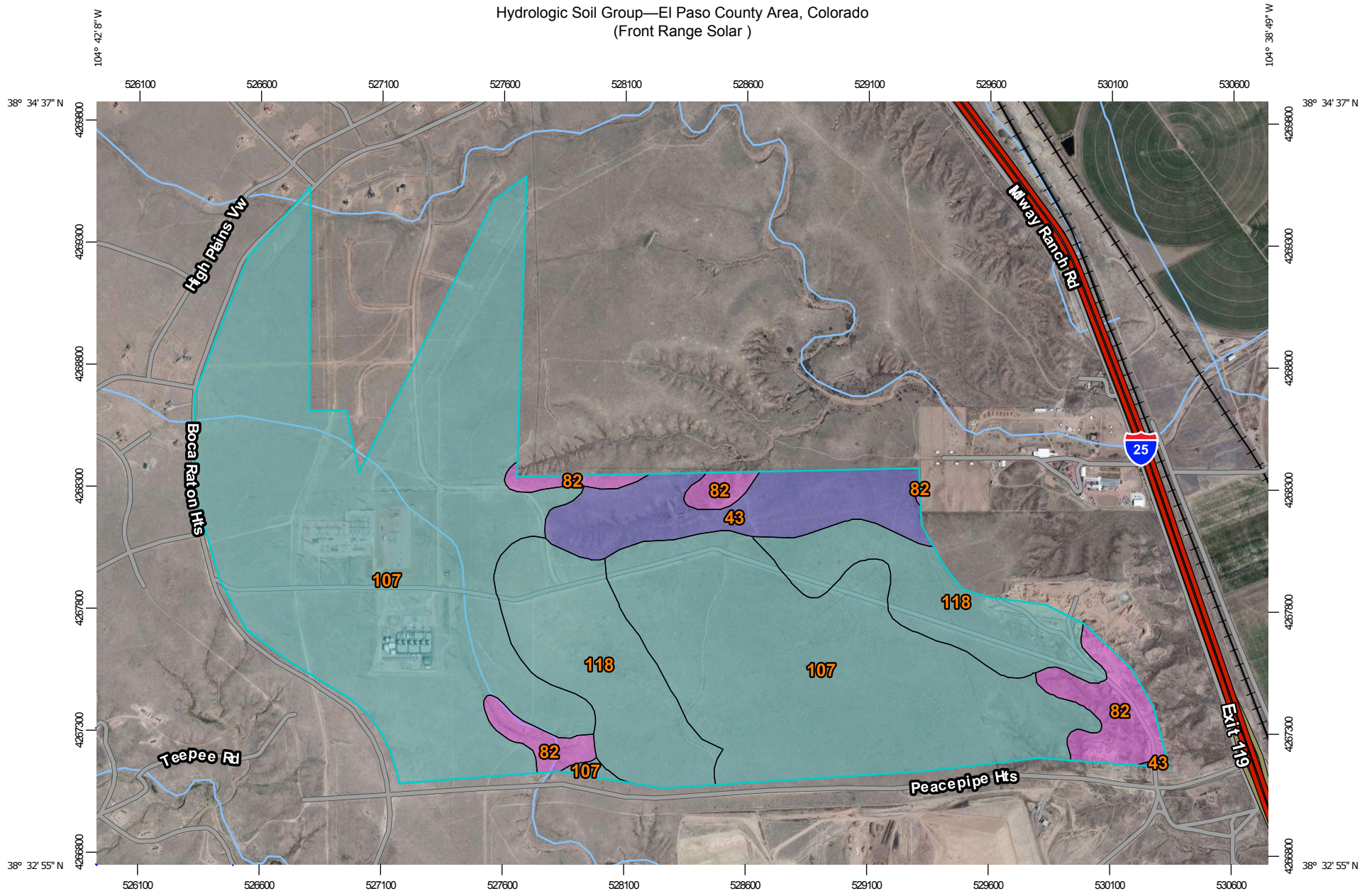
**EFFECTIVE DATE:
 MARCH 17, 1997**



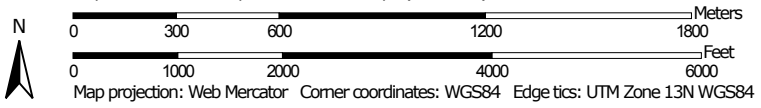
Federal Emergency Management Agency

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Hydrologic Soil Group—El Paso County Area, Colorado
(Front Range Solar)




Map Scale: 1:22,000 if printed on A landscape (11" x 8.5") sheet.



Hydrologic Soil Group—El Paso County Area, Colorado
(Front Range Solar)

MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points





-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available


Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
43	Kim loam, 1 to 8 percent slopes	B	88.1	7.4%
82	Schamber-Razor complex, 8 to 50 percent slopes	A	65.6	5.5%
107	Willid silt loam, 0 to 3 percent slopes	C	841.7	70.5%
118	Fort loam, 1 to 5 percent slopes, cool	C	198.6	16.6%
Totals for Area of Interest			1,194.0	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

COMPOSITE BASIN - WEIGHTED "C" CALCULATIONS

-REFERENCE UDFCD Vol.1 RUNOFF Table 6-3

	Residential				Lawns						Total Area	Percent Impervious
	Single Family			Multi-Unit (attached)	Roof	Gravel Road	Substation	Clay Soil		Historic		
	0.25 acres	3 DU's/Ac 3,0000 sf 2 story	5 DU's/Ac 3,000 sf 2 story					2-7% Slope	>7% Slope			
% Imperv.	45.00%	48.00%	63.00%	75.00%	90.00%	80.00%	40.00%	2.00%	2.00%	2.00%		
BASIN	Area	Area	Area	Area	Area	Area	Area	Area	Area	Area		
A1	0.00					1.47				27.87	29.34	5.9%
A2	0.00					2.89	2.07			72.37	77.33	5.9%
A3	0.00					0.00				106.70	106.70	2.0%
A4	0.00					0.00				31.31	31.31	2.0%
A6	0.00					1.77				46.21	47.98	4.9%
A7	0.00					1.77				57.91	59.68	4.3%
A8	0.00					1.76				86.05	87.81	3.6%
A9	0.00					1.37				31.49	32.86	5.3%
A12	0.00					0.57				10.40	10.97	6.1%
TOTAL	0.00	0.00	0.00	0.00	0.00	19.62	2.07	0.00	0.00	913.76	935.45	3.7%

FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

COMPOSITE DEVELOPED BASIN -WEIGHTED "C" CALCULATIONS

-REFERENCE EL PASO COUNTY DRAINAGE CRITERIA MANUAL

$$C = \frac{\sum_{i=1}^n C_i A_i}{A_t}$$

Eq 5-2
El Paso County DCM

"C"
Frequency

10		100		
A&B	C&D	A&B	C&D	
0.15	0.25	0.2	0.3	Historic
0.8	0.8	0.85	0.85	Gravel
0.5	0.6	0.6	0.7	Substation

Basin ID	% Imperv.	i	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A1	5.9%	0.06	A	0.02	0.02	0.18	0.23	29.34	29.34	0.03	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.23						
			C or D	0.03	0.08	0.28	0.33						
A2	5.9%	0.06	A	0.02	0.02	0.18	0.24	77.33	77.33	0.03	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.24						
			C or D	0.03	0.08	0.28	0.33						
A3	2.0%	0.02	A	0.01	0.01	0.15	0.20	106.70	106.70	0.01	0.05	0.25	0.30
			B	0.01	0.01	0.15	0.20						
			C or D	0.01	0.05	0.25	0.30						
A4	2.0%	0.02	A	0.01	0.01	0.15	0.20	31.31	31.31	0.01	0.05	0.25	0.30
			B	0.01	0.01	0.15	0.20						
			C or D	0.01	0.05	0.25	0.30						
A6	4.9%	0.05	A	0.02	0.02	0.17	0.22	47.98	47.98	0.03	0.07	0.27	0.32
			B	0.02	0.03	0.17	0.22						
			C or D	0.03	0.07	0.27	0.32						

Basin ID	% Imperv.	<i>i</i>	Soil Type	Runoff Coefficients, C				Basin Area	Total Area	Weighted Runoff Coefficients, C			
				2-Year	5-Year	10-Year	100-Year			2-Year	5-Year	10-Year	100-Year
A7	4.3%	0.04	A	0.01	0.02	0.17	0.22	59.68	59.68	0.02	0.07	0.27	0.32
			B	0.02	0.03	0.17	0.22						
			C or D	0.02	0.07	0.27	0.32						
A8	3.6%	0.04	A	0.01	0.01	0.16	0.21	87.81	87.81	0.02	0.06	0.26	0.31
			B	0.02	0.02	0.16	0.21						
			C or D	0.02	0.06	0.26	0.31						
A9	5.3%	0.05	A	0.02	0.02	0.18	0.23	32.86	32.86	0.03	0.08	0.27	0.32
			B	0.03	0.03	0.18	0.23						
			C or D	0.03	0.08	0.27	0.32						
A12	6.1%	0.06	A	0.02	0.02	0.18	0.23	29.34	29.34	0.04	0.08	0.28	0.33
			B	0.03	0.04	0.18	0.23						
			C or D	0.04	0.08	0.28	0.33						

FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

$T_c = 1.87 (1.1 - C_{10})L^{0.5}s^{-0.33}$ (El Paso County DCM Vol. 1)

Prepared By: GMV

TIME OF CONCENTRATION CALCULATIONS

-REFERENCE UDFCD Vol.1 Section 2.4

NRCS Conveyance factors, K -REFERENCE UDFCD Vol.1 RUNOFF Table 6-2

SF-2 Heavy Meadow 2.50 Short Grass Pasture & Lawns 7.00 Grassed Waterway 15.00
 Tillage/field 5.00 Nearly Bare Ground 10.00 Paved Area & Shallow Gutter 20.00

SUB-BASIN DATA			INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)		FINAL T(c)	
DRAIN BASIN	AREA ac.	C(10)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	% IMPER-VIOUS	USDCM Eq. 6-5	min.
A1	29.34	0.28	300	1.0%	26.6	1009	2.8%	7.00	1.2	14.0	40.6	5.9%		40.6
A2	77.33	0.28	300	1.3%	24.2	2086	0.7%	7.00	0.6	57.9	82.1	5.9%		82.1
A3	106.70	0.25	300	2.0%	21.9	2874	1.5%	7.00	0.9	53.2	75.1	2.0%		75.1
A4	31.31	0.25	300	1.7%	23.3	3634	1.2%	7.00	0.8	75.7	99.0	2.0%		99.0
A6	47.98	0.27	300	1.3%	24.4	1578	1.8%	7.00	0.9	29.2	53.6	4.9%		53.6
A7	59.68	0.27	300	2.7%	19.5	2169	2.2%	7.00	1.0	36.2	55.7	4.3%		55.7
A8	87.81	0.26	300	1.7%	23.0	3108	1.9%	7.00	1.0	51.8	74.8	3.6%		74.8
A9	32.86	0.27	300	2.7%	19.4	1597	3.6%	7.00	1.3	20.5	39.9	5.3%		39.9
A12	10.97	0.28	300	2.3%	20.1	196	4.6%	7.00	1.5	2.2	22.3	6.1%		22.3

FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

RATIONAL METHOD PEAK RUNOFF

10-YR STORM

SF-3

Rainfall Depth-Duration-Frequency (1-hr) = 1.55

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF				TOTAL RUNOFF				REMARKS
DESIGN POINT	DRAIN BASIN	AREA ac.	10yr RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr	Q cfs	
1	A1	29.34	0.28	40.6	8.14	2.02	16.5					
2	A2	77.33	0.28	82.1	21.65	1.26	27.3					
3	A3	106.70	0.25	75.1	26.68	1.34	35.8					
4	A4	31.31	0.25	99.0	7.83	1.11	8.7					
6	A6	47.98	0.27	53.6	12.97	1.69	21.9					
7	A7	59.68	0.27	55.7	15.89	1.65	26.2					
8	A8	87.81	0.26	74.8	22.92	1.35	30.9					
9	A9	32.86	0.27	39.9	8.97	2.04	18.3					
12	A12	10.97	0.28	22.3	3.06	2.88	8.8					

FRONT RANGE - MIDWAY SOLAR

CORE Project #: 17-012

Prepared By: GMV

RATIONAL METHOD PEAK RUNOFF

100-YR STORM

SF-3

Rainfall Depth-Duration-Frequency (1-hr) = **2.58**

-REFERENCE UDFCD Vol.1 EQ 5-1 & EQ 6-1

BASIN INFORMATON				DIRECT RUNOFF				TOTAL RUNOFF				REMARKS
DESIGN POINT	DRAIN BASIN	AREA ac.	100yr RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	SUM C x A	I in/hr	Q cfs	
1	A1	29.34	0.33	40.6	9.61	3.37	32.3					
2	A2	77.33	0.33	82.1	25.62	2.10	53.8					
3	A3	106.70	0.30	75.1	32.01	2.24	71.6					
4	A4	31.31	0.30	99.0	9.39	1.84	17.3					
6	A6	47.98	0.32	53.6	15.37	2.81	43.2					
7	A7	59.68	0.32	55.7	18.88	2.74	51.7					
8	A8	87.81	0.31	74.8	27.31	2.24	61.2					
9	A9	32.86	0.32	39.9	10.61	3.40	36.1					
12	A12	10.97	0.33	22.3	3.61	4.79	17.3					

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Existing 2 Yr.

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Existing 2 Yr	0.157	0.255	58.4	12.93	30.3	9.14	21.6	160	722,867	0.05	38,675	50.0	8	38,680	0.04
A10	Existing 2 Yr	0.157	0.277	81.7	18.91	42.5	13.36	31.5	151	955,935	0.05	51,145	65.0	8	51,135	0.03
A11	Existing 2 Yr	0.157	0.264	78.6	17.46	40.9	12.34	29.1	134	813,146	0.05	43,505	60.0	7	43,502	0.03

Summary of CUHP Input Parameters (Version 2.0.0) - Existing 2 Yr.

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	2	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53
A10	A10	2	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53
A11	A11	2	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.53

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Existing 100 Yr

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Existing 100 Yr	0.156	0.253	58.3	12.85	30.3	9.08	21.4	160	722,867	1.84	1,329,393	60.0	243	1,329,567	1.22
A10	Existing 100 Yr	0.156	0.276	81.7	18.79	42.5	13.28	31.3	151	955,935	1.84	1,758,017	70.0	250	1,757,673	0.95
A11	Existing 100 Yr	0.156	0.263	78.6	17.35	40.9	12.26	28.9	134	813,146	1.84	1,495,420	70.0	219	1,495,317	0.98

Summary of CUHP Input Parameters (Version 2.0.0) - Existing 100 Yr.

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	100	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A10	A10	100	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A11	A11	100	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Proposed 2 Yr.

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Proposed 2 Yr.	0.154	0.250	58.3	12.70	30.3	8.98	21.2	160	722,867	0.06	44,815	50.0	9	44,822	0.05
A10	Proposed 2 Yr.	0.153	0.270	81.6	18.43	42.4	13.02	30.7	151	955,935	0.07	62,244	60.0	9	62,228	0.04
A11	Proposed 2 Yr.	0.152	0.256	78.5	16.96	40.8	11.99	28.3	134	813,146	0.07	54,219	60.0	8	54,216	0.04

Summary of CUHP Input Parameters (Version 2.0.0) - Proposed 2 Yr.

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
A5	A5	2	0.311	0.479	1.072	0.014	3.1	0.35	0.05	3.00	0.50	0.0018	0.00	0.06	0.03	2.38
A10	A10	2	0.411	0.856	1.692	0.019	3.5	0.35	0.05	3.00	0.50	0.0018	0.00	0.07	0.04	2.70
A11	A11	2	0.350	0.785	1.525	0.019	3.7	0.35	0.05	3.00	0.50	0.0018	0.00	0.07	0.04	2.85

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.0) - Proposed 100 Yr.

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A5	Proposed 100 Yr.	0.156	0.253	58.3	12.85	30.3	9.08	21.4	160	722,867	1.84	1,329,393	60.0	243	1,329,567	1.22
A10	Proposed 100 Yr.	0.156	0.276	81.7	18.79	42.5	13.28	31.3	151	955,935	1.84	1,758,017	70.0	250	1,757,673	0.95
A11	Proposed 100 Yr.	0.156	0.263	78.6	17.35	40.9	12.26	28.9	134	813,146	1.84	1,495,420	70.0	219	1,495,317	0.98

Summary of CUHP Input Parameters (Version 2.0.0) - Proposed 100 Yr.

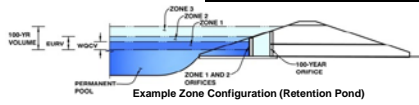
Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Horton's Infiltration Parameters			DCIA Level and Fractions			
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	Percent Eff. Imperv.
A5	A5	100	0.311	0.479	1.072	0.014	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A10	A10	100	0.411	0.856	1.692	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81
A11	A11	100	0.350	0.785	1.525	0.019	2.0	0.35	0.05	3.00	0.50	0.0018	0.00	0.04	0.02	1.81

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A1**



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	29.34 acres
Watershed Length =	2,200 ft
Watershed Slope =	0.030 ft/ft
Watershed Imperviousness =	5.90% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQCV) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.138 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.116 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.345 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	3.650 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.109 acre-feet
Approximate 5-yr Detention Volume =	0.331 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	0.852 acre-feet

Optional User Override 1-hr Precipitation	
1.19	inches
1.50	inches
	inches
	inches
	inches
	inches
2.52	inches
	inches

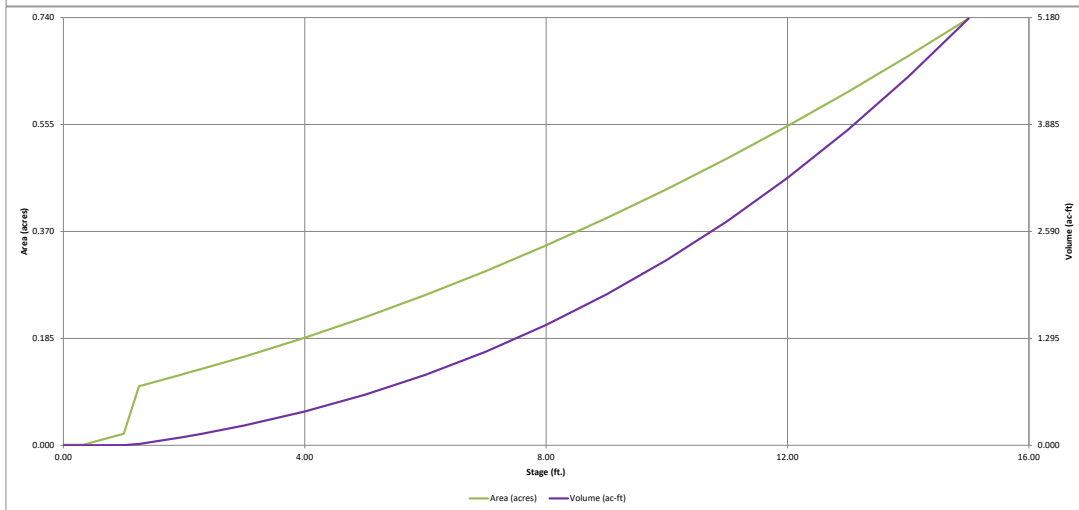
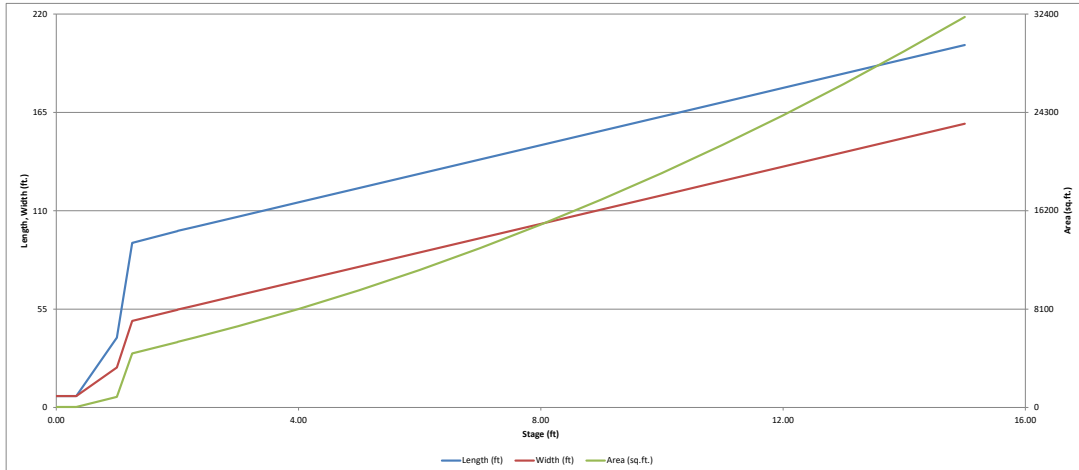
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.035	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.714	acre-feet
Total Detention Basin Volume =	0.852	acre-feet
Initial Surcharge Volume (ISV) =	13	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	41	ft ²
Surcharge Volume Length (L _{ISV}) =	6.4	ft
Surcharge Volume Width (W _{ISV}) =	6.4	ft
Depth of Basin Floor (H _{100yr}) =	0.42	ft
Length of Basin Floor (L _{100yr}) =	92.7	ft
Width of Basin Floor (W _{100yr}) =	48.7	ft
Area of Basin Floor (A _{100yr}) =	4,515	ft ²
Volume of Basin Floor (V _{100yr}) =	703	ft ³
Depth of Main Basin (H _{main}) =	4.75	ft
Length of Main Basin (L _{main}) =	130.7	ft
Width of Main Basin (W _{main}) =	86.7	ft
Area of Main Basin (A _{main}) =	11,328	ft ²
Volume of Main Basin (V _{main}) =	36,384	ft ³
Calculated Total Basin Volume (V _{total}) =	0.852	acre-feet

Depth Increment = 1 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		6.4	6.4	41		0.001		
ISV	0.33		6.4	6.4	41		0.001	13	0.000
	1.00		39.0	22.4	873		0.020	93	0.002
Floor	1.25		92.1	48.4	4,454		0.102	726	0.017
	2.00		96.6	54.6	5,384		0.124	4,383	0.101
Zone 1 (WQCV)	2.01		96.8	54.8	5,408		0.124	4,490	0.103
Zone 2 (EURV)	2.29		101.0	57.0	5,757		0.132	6,053	0.139
	3.00		106.7	62.7	6,687		0.154	10,467	0.240
	4.00		114.7	70.7	8,106		0.186	17,853	0.410
	5.00		122.7	78.7	9,653		0.222	26,721	0.613
Zone 3 (100-year)	6.00		130.7	86.7	11,328		0.260	37,201	0.854
	7.00		138.7	94.7	13,131		0.301	49,419	1.135
	8.00		146.7	102.7	15,061		0.346	63,505	1.458
	9.00		154.7	110.7	17,120		0.393	79,585	1.827
	10.00		162.7	118.7	19,307		0.443	97,788	2.245
	11.00		170.7	126.7	21,622		0.496	118,242	2.714
	12.00		178.7	134.7	24,065		0.552	141,075	3.239
	13.00		186.7	142.7	26,636		0.611	166,415	3.820
	14.00		194.7	150.7	29,335		0.673	194,390	4.463
	15.00		202.7	158.7	32,162		0.738	225,128	5.168

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

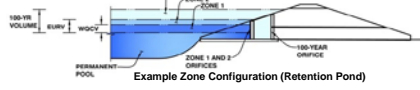


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A2**



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	77.33 acres
Watershed Length =	2,282 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	6.80% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.308 acre-feet
Excess Urban Runoff Volume (EURV) =	0.424 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.360 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.995 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	9.689 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.336 acre-feet
Approximate 5-yr Detention Volume =	0.953 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	2.390 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	2.52 inches

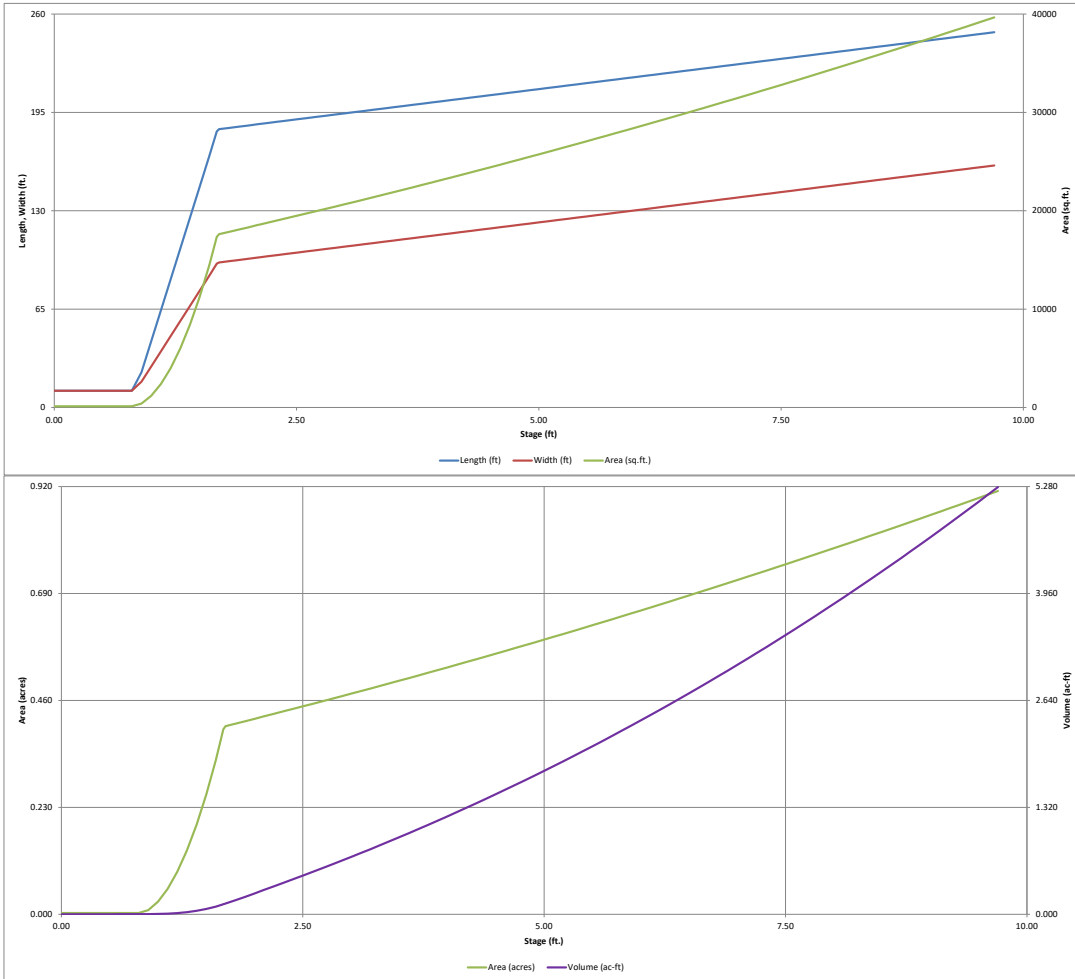
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.308 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.116 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.966 acre-feet
Total Detention Basin Volume =	2.390 acre-feet
Initial Surcharge Volume (ISV) =	40 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 H:V
Basin Length-to-Width Ratio (R _{LR}) =	2
Initial Surcharge Area (A _{ISV}) =	122 ft ²
Surcharge Volume Length (L _{ISV}) =	11.0 ft
Surcharge Volume Width (W _{ISV}) =	11.0 ft
Depth of Basin Floor (H _{100yr}) =	0.85 ft
Length of Basin Floor (L _{100yr}) =	183.8 ft
Width of Basin Floor (W _{100yr}) =	95.7 ft
Area of Basin Floor (A _{100yr}) =	17,598 ft ²
Volume of Basin Floor (V _{100yr}) =	5,416 ft ³
Depth of Main Basin (H _{main}) =	4.32 ft
Length of Main Basin (L _{main}) =	218.4 ft
Width of Main Basin (W _{main}) =	130.3 ft
Area of Main Basin (A _{main}) =	28,462 ft ²
Volume of Main Basin (V _{main}) =	98,625 ft ³
Calculated Total Basin Volume (V _{total}) =	2,391 acre-feet

Depth Increment = 0.1 ft		Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool									
ISV	0.00		11.0	11.0	122		0.003		
	0.33		11.0	11.0	122		0.003	39	0.001
	0.40		11.0	11.0	122		0.003	48	0.001
	0.50		11.0	11.0	122		0.003	60	0.001
	0.60		11.0	11.0	122		0.003	72	0.002
	0.70		11.0	11.0	122		0.003	84	0.002
	0.80		11.0	11.0	122		0.003	96	0.002
	0.90		23.3	17.0	397		0.009	116	0.003
	1.00		43.7	27.0	1,182		0.027	192	0.004
	1.10		64.1	37.0	2,374		0.055	366	0.008
	1.20		84.5	47.0	3,975		0.091	680	0.016
	1.30		104.9	57.0	5,984		0.137	1,175	0.027
	1.40		125.3	67.0	8,400		0.193	1,890	0.043
	1.50		145.7	77.0	11,225		0.258	2,868	0.066
	1.60		166.1	87.0	14,457		0.332	4,149	0.095
Floor									
	1.68		182.4	95.0	17,337		0.398	5,419	0.124
	1.70		183.9	95.8	17,627		0.405	5,770	0.132
	1.80		184.7	96.6	17,852		0.410	7,544	0.173
	1.90		185.5	97.4	18,077		0.415	9,340	0.214
	2.00		186.3	98.2	18,304		0.420	11,159	0.256
	2.10		187.2	99.1	18,556		0.426	13,187	0.303
Zone 1 (WQC)									
	2.12		187.4	99.3	18,601		0.427	13,558	0.311
	2.20		188.0	99.9	18,785		0.431	15,054	0.346
	2.30		188.8	100.7	19,016		0.437	16,944	0.389
Zone 2 (EURV)									
	2.39		189.5	101.4	19,225		0.441	18,665	0.428
	2.40		189.6	101.5	19,249		0.442	18,857	0.433
	2.50		190.4	102.3	19,482		0.447	20,793	0.477
	2.60		191.2	103.1	19,711		0.453	22,753	0.522
	2.70		192.0	103.9	19,953		0.458	24,737	0.568
	2.80		192.8	104.7	20,190		0.464	26,744	0.614
	2.90		193.6	105.5	20,429		0.469	28,775	0.661
	3.00		194.4	106.3	20,669		0.474	30,830	0.708
	3.10		195.2	107.1	20,910		0.480	32,909	0.755
	3.20		196.0	107.9	21,153		0.486	35,012	0.804
	3.30		196.8	108.7	21,396		0.491	37,139	0.853
	3.40		197.6	109.5	21,642		0.497	39,291	0.902
	3.50		198.4	110.3	21,888		0.502	41,468	0.952
	3.60		199.2	111.1	22,135		0.508	43,669	1.003
	3.70		200.0	111.9	22,384		0.514	45,895	1.054
	3.80		200.8	112.7	22,635		0.520	48,146	1.105
	3.90		201.6	113.5	22,886		0.525	50,422	1.158
	4.00		202.4	114.3	23,139		0.531	52,723	1.210
	4.10		203.2	115.1	23,393		0.537	55,050	1.264
	4.20		204.0	115.9	23,648		0.543	57,402	1.318
	4.30		204.8	116.7	23,905		0.549	59,779	1.372
	4.40		205.6	117.5	24,162		0.555	62,183	1.428
	4.50		206.4	118.3	24,422		0.561	64,612	1.483
	4.60		207.2	119.1	24,682		0.567	67,067	1.540
	4.70		208.0	119.9	24,944		0.573	69,548	1.597
	4.80		208.8	120.7	25,207		0.579	72,056	1.654
	4.90		209.6	121.5	25,471		0.585	74,590	1.712
	5.00		210.4	122.3	25,736		0.591	77,150	1.771
	5.10		211.2	123.1	26,003		0.597	79,737	1.831
	5.20		212.0	123.9	26,271		0.603	82,351	1.891
	5.30		212.8	124.7	26,541		0.609	84,991	1.951
	5.40		213.6	125.5	26,811		0.616	87,659	2.012
	5.50		214.4	126.3	27,083		0.622	90,354	2.074
	5.60		215.2	127.1	27,357		0.628	93,076	2.137
	5.70		216.0	127.9	27,631		0.634	95,825	2.200
	5.80		216.8	128.7	27,907		0.641	98,602	2.264
Zone 3 (100-year)									
	5.90		217.6	129.5	28,184		0.647	101,406	2.328
	6.00		218.4	130.3	28,462		0.653	104,239	2.393
	6.10		219.2	131.1	28,742		0.660	107,099	2.459
	6.20		220.0	131.9	29,023		0.666	109,987	2.525
	6.30		220.8	132.7	29,305		0.673	112,904	2.592
	6.40		221.6	133.5	29,588		0.679	115,848	2.660
	6.50		222.4	134.3	29,873		0.686	118,821	2.728
	6.60		223.2	135.1	30,159		0.692	121,823	2.797
	6.70		224.0	135.9	30,446		0.699	124,853	2.866
	6.80		224.8	136.7	30,735		0.706	127,912	2.936
	6.90		225.6	137.5	31,025		0.712	131,000	3.007
	7.00		226.4	138.3	31,316		0.719	134,117	3.079
	7.10		227.2	139.1	31,608		0.726	137,263	3.151
	7.20		228.0	139.9	31,902		0.732	140,439	3.224
	7.30		228.8	140.7	32,197		0.739	143,644	3.298
	7.40		229.6	141.5	32,493		0.746	146,878	3.372
	7.50		230.4	142.3	32,791		0.753	150,143	3.447
	7.60		231.2	143.1	33,090		0.760	153,437	3.522
	7.70		232.0	143.9	33,390		0.767	156,761	3.599
	7.80		232.8	144.7	33,691		0.773	160,115	3.676
	7.90		233.6	145.5	33,994		0.780	163,499	3.753
	8.00		234.4	146.3	34,298		0.787	166,913	3.832
	8.10		235.2	147.1	34,603		0.794	170,359	3.911
	8.20		236.0	147.9	34,910		0.801	173,834	3.991
	8.30		236.8	148.7	35,217		0.808	177,340	4.071
	8.40		237.6	149.5	35,526		0.816	180,878	4.152
	8.50		238.4	150.3	35,837		0.823	184,446	4.234
	8.60		239.2	151.1	36,148		0.830	188,045	4.317
	8.70		240.0	151.9	36,461		0.837	191,675	4.400
	8.80		240.8	152.7	36,775		0.844	195,337	4.484
	8.90		241.6	153.5	37,091		0.851	199,031	4.569
	9.00		242.4	154.3	37,408		0.859	202,756	4.655
	9.10		243.2	155.1	37,726		0.866	206,512	4.741
	9.20		244.0	155.9	38,045		0.873	210,300	4.828
	9.30		244.8	156.7	38,365		0.881	214,121	4.916
	9.40		245.6	157.5	38,687		0.888	217,974	5.004

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

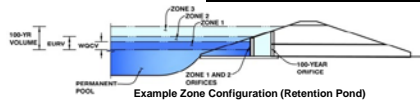
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A5**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	199.14 acres
Watershed Length =	4.884 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.10% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.383 acre-feet
Excess Urban Runoff Volume (EURV) =	0.468 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.381 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.655 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	24.208 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.355 acre-feet
Approximate 5-yr Detention Volume =	1.604 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	4.400 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	1.19 inches
	1.50 inches
	2.52 inches

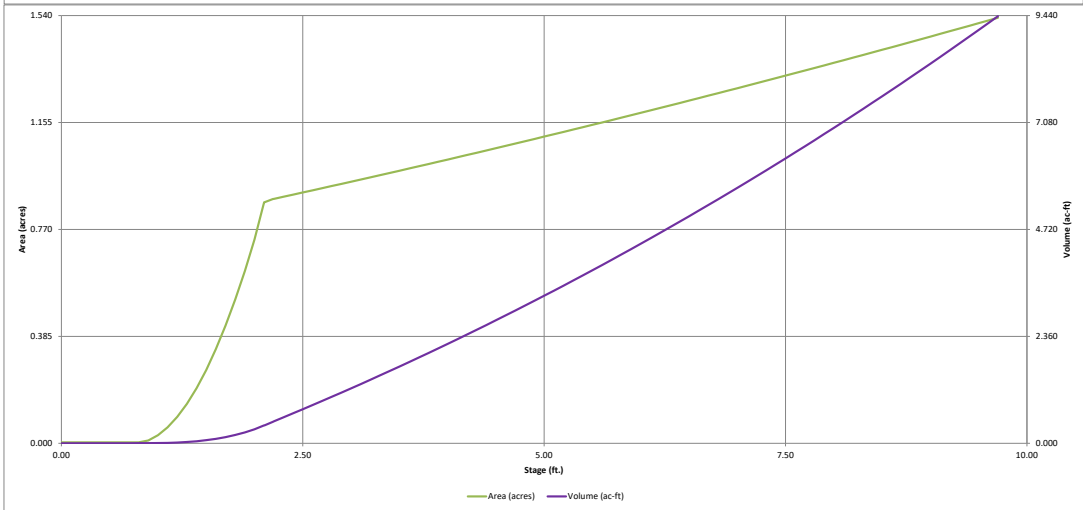
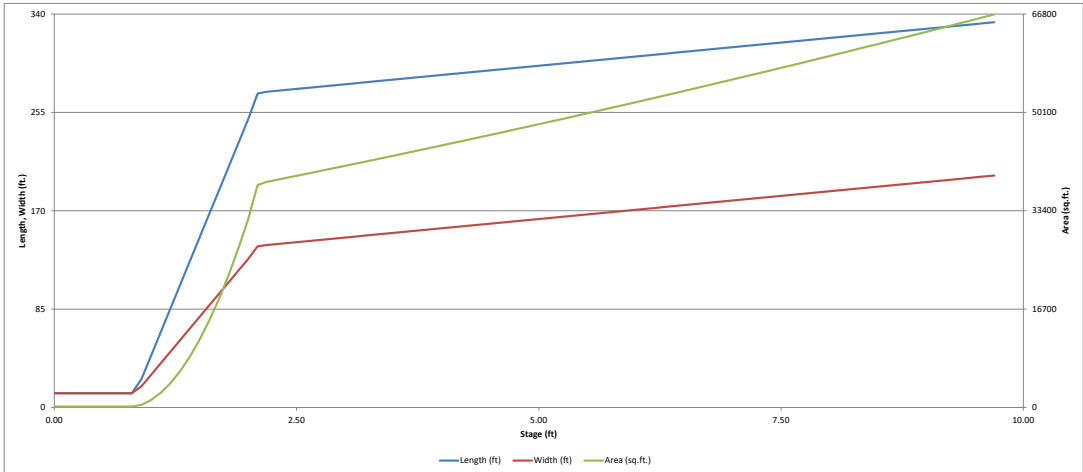
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.383 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.085 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.933 acre-feet
Total Detention Basin Volume =	4.400 acre-feet
Initial Surcharge Volume (ISV) =	50 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2
Initial Surcharge Area (A _{ISV}) =	152 ft ²
Surcharge Volume Length (L _{ISV}) =	12.3 ft
Surcharge Volume Width (W _{ISV}) =	12.3 ft
Depth of Basin Floor (H ₁₀₀) =	1.27 ft
Length of Basin Floor (L ₁₀₀) =	272.2 ft
Width of Basin Floor (W ₁₀₀) =	139.7 ft
Area of Basin Floor (A ₁₀₀) =	38,019 ft ²
Volume of Basin Floor (V ₁₀₀) =	17,227 ft ³
Depth of Main Basin (H _{main}) =	3.90 ft
Length of Main Basin (L _{main}) =	303.3 ft
Width of Main Basin (W _{main}) =	170.9 ft
Area of Main Basin (A _{main}) =	51,828 ft ²
Volume of Main Basin (V _{main}) =	174,339 ft ³
Calculated Total Basin Volume (V _{total}) =	4,401 acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acres)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		12.3	12.3	152		0.003		
ISV	0.33		12.3	12.3	152		0.003	49	0.001
	0.40		12.3	12.3	152		0.003	59	0.001
	0.50		12.3	12.3	152		0.003	74	0.002
	0.60		12.3	12.3	152		0.003	89	0.002
	0.70		12.3	12.3	152		0.003	105	0.002
	0.80		12.3	12.3	152		0.003	120	0.003
	0.90		24.6	18.3	450		0.010	143	0.003
	1.00		45.0	28.3	1,273		0.029	226	0.005
	1.10		65.4	38.3	2,504		0.057	411	0.009
	1.20		85.8	48.3	4,143		0.095	740	0.017
	1.30		106.2	58.3	6,190		0.142	1,253	0.029
	1.40		126.6	68.3	8,645		0.198	1,992	0.046
	1.50		147.0	78.3	11,508		0.264	2,996	0.069
	1.60		167.4	88.3	14,779		0.339	4,307	0.099
	1.70		187.8	98.3	18,458		0.424	5,965	0.137
	1.80		208.2	108.3	22,545		0.518	8,012	0.184
	1.90		228.6	118.3	27,040		0.621	10,488	0.241
	2.00		249.0	128.3	31,943		0.733	13,434	0.308
Zone 1 (WQC)	2.09		269.4	138.3	37,254		0.855	16,890	0.388
	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Floor	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Zone 2 (EURV)	2.19		272.9	140.4	38,304		0.879	20,698	0.475
	2.20		272.9	140.5	38,337		0.880	21,082	0.484
	2.30		273.7	141.3	38,668		0.888	24,932	0.572
	2.40		274.5	142.1	39,001		0.895	28,815	0.662
	2.50		275.3	142.9	39,335		0.903	32,732	0.751
	2.60		276.1	143.7	39,670		0.911	36,682	0.842
	2.70		276.9	144.5	40,006		0.918	40,666	0.934
	2.80		277.7	145.3	40,344		0.926	44,684	1.026
	2.90		278.5	146.1	40,683		0.934	48,735	1.119
	3.00		279.3	146.9	41,023		0.942	52,820	1.213
	3.10		280.1	147.7	41,365		0.950	56,940	1.307
	3.20		280.9	148.5	41,708		0.957	61,093	1.403
	3.30		281.7	149.3	42,052		0.965	65,281	1.499
	3.40		282.5	150.1	42,398		0.973	69,504	1.596
	3.50		283.3	150.9	42,744		0.981	73,761	1.693
	3.60		284.1	151.7	43,092		0.989	78,053	1.792
	3.70		284.9	152.5	43,442		0.997	82,379	1.891
	3.80		285.7	153.3	43,792		1.005	86,741	1.991
	3.90		286.5	154.1	44,144		1.013	91,138	2.092
	4.00		287.3	154.9	44,497		1.022	95,570	2.194
	4.10		288.1	155.7	44,851		1.030	100,037	2.297
	4.20		288.9	156.5	45,207		1.038	104,540	2.400
	4.30		289.7	157.3	45,564		1.046	109,079	2.504
	4.40		290.5	158.1	45,922		1.054	113,653	2.609
	4.50		291.3	158.9	46,282		1.062	118,263	2.715
	4.60		292.1	159.7	46,643		1.071	122,910	2.822
	4.70		292.9	160.5	47,005		1.079	127,592	2.929
	4.80		293.7	161.3	47,368		1.087	132,311	3.037
	4.90		294.5	162.1	47,733		1.096	137,066	3.147
	5.00		295.3	162.9	48,099		1.104	141,857	3.257
	5.10		296.1	163.7	48,466		1.113	146,685	3.367
	5.20		296.9	164.5	48,834		1.121	151,550	3.479
	5.30		297.7	165.3	49,204		1.130	156,452	3.592
	5.40		298.5	166.1	49,575		1.138	161,391	3.705
	5.50		299.3	166.9	49,947		1.147	166,367	3.819
	5.60		300.1	167.7	50,321		1.155	171,381	3.934
	5.70		300.9	168.5	50,696		1.164	176,432	4.050
	5.80		301.7	169.3	51,072		1.172	181,520	4.167
	5.90		302.5	170.1	51,449		1.181	186,646	4.285
	6.00		303.3	170.9	51,828		1.189	191,810	4.403
	6.10		304.1	171.7	52,208		1.199	197,012	4.523
	6.20		304.9	172.5	52,589		1.207	202,252	4.643
	6.30		305.7	173.3	52,972		1.216	207,530	4.764
	6.40		306.5	174.1	53,356		1.225	212,846	4.886
	6.50		307.3	174.9	53,741		1.234	218,201	5.009
	6.60		308.1	175.7	54,127		1.243	223,594	5.133
	6.70		308.9	176.5	54,515		1.251	229,026	5.258
	6.80		309.7	177.3	54,904		1.260	234,497	5.383
	6.90		310.5	178.1	55,294		1.269	240,007	5.510
	7.00		311.3	178.9	55,686		1.278	245,556	5.637
	7.10		312.1	179.7	56,079		1.287	251,144	5.765
	7.20		312.9	180.5	56,473		1.296	256,772	5.895
	7.30		313.7	181.3	56,868		1.306	262,439	6.025
	7.40		314.5	182.1	57,265		1.315	268,146	6.156
	7.50		315.3	182.9	57,663		1.324	273,892	6.288
	7.60		316.1	183.7	58,062		1.333	279,678	6.421
	7.70		316.9	184.5	58,462		1.342	285,504	6.554
	7.80		317.7	185.3	58,864		1.351	291,371	6.689
	7.90		318.5	186.1	59,267		1.361	297,277	6.825
	8.00		319.3	186.9	59,671		1.370	303,224	6.961
	8.10		320.1	187.7	60,077		1.379	309,212	7.099
	8.20		320.9	188.5	60,484		1.389	315,240	7.237
	8.30		321.7	189.3	60,892		1.398	321,308	7.376
	8.40		322.5	190.1	61,301		1.407	327,418	7.516
	8.50		323.3	190.9	61,712		1.417	333,569	7.658
	8.60		324.1	191.7	62,124		1.426	339,760	7.800
	8.70		324.9	192.5	62,537		1.436	345,994	7.943
	8.80		325.7	193.3	62,952		1.445	352,269	8.087
	8.90		326.5	194.1	63,368		1.455	358,584	8.232
	9.00		327.3	194.9	63,785		1.464	364,942	8.378
	9.10		328.1	195.7	64,203		1.474	371,341	8.525
	9.20		328.9	196.5	64,623		1.484	377,782	8.673
	9.30		329.7	197.3	65,044		1.493	384,266	8.822
	9.40		330.5	198.1	65,466		1.503	390,791	8.971
	9.50</								

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

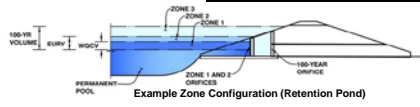
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A6**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	47.98 acres
Watershed Length =	1,777 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.50% percent
Percentage Hydrologic Soil Group A =	5.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	95.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.127 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.103 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.405 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	5.636 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.096 acre-feet
Approximate 5-yr Detention Volume =	0.392 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.092 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	inches
	inches
	inches
	2.52 inches

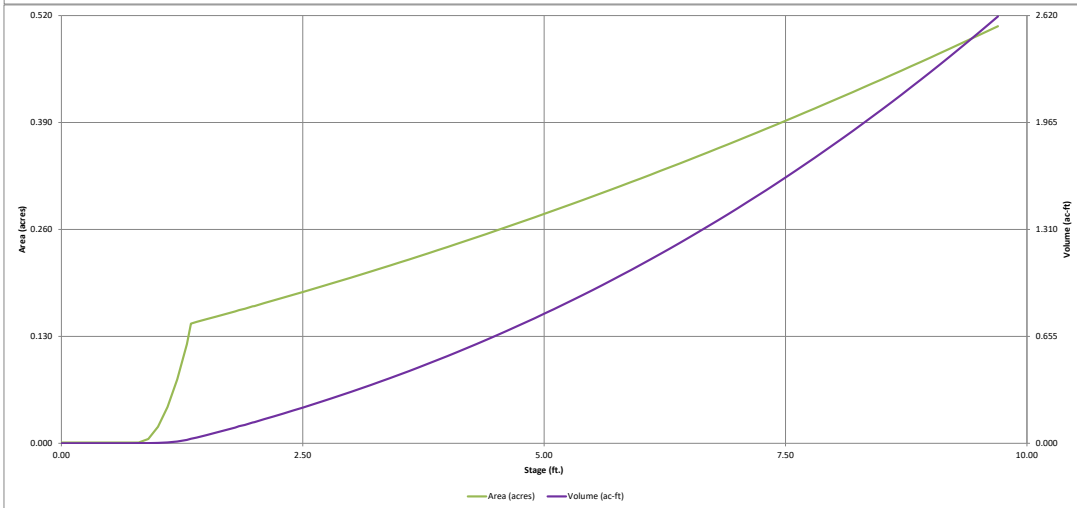
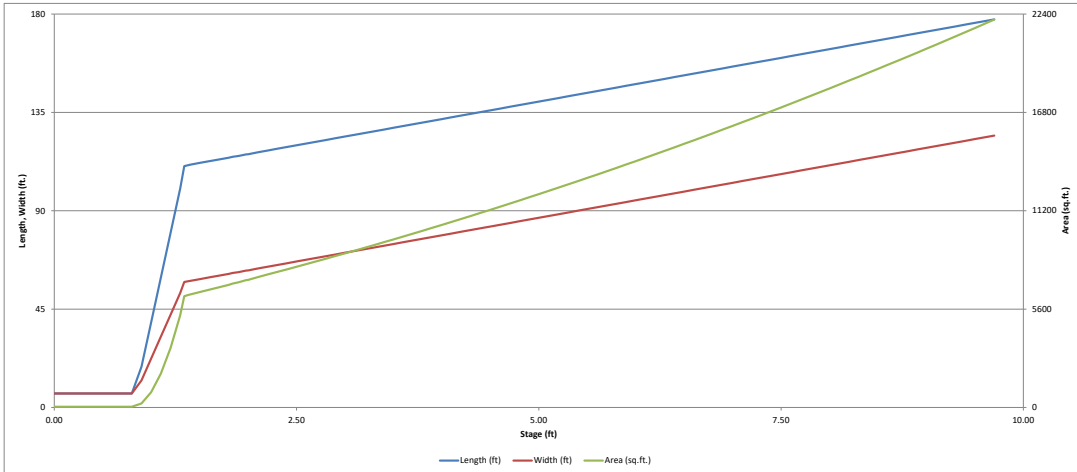
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.103 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.023 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.965 acre-feet
Total Detention Basin Volume =	1.092 acre-feet
Initial Surcharge Volume (ISV) =	14 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2
Initial Surcharge Area (A _{ISV}) =	41 ft ²
Surcharge Volume Length (L _{ISV}) =	6.4 ft
Surcharge Volume Width (W _{ISV}) =	6.4 ft
Depth of Basin Floor (H ₁₀₀) =	0.51 ft
Length of Basin Floor (L ₁₀₀) =	110.7 ft
Width of Basin Floor (W ₁₀₀) =	57.5 ft
Area of Basin Floor (A ₁₀₀) =	6,367 ft ²
Volume of Basin Floor (V ₁₀₀) =	1,179 ft ³
Depth of Main Basin (H _{main}) =	4.66 ft
Length of Main Basin (L _{main}) =	148.0 ft
Width of Main Basin (W _{main}) =	94.8 ft
Area of Main Basin (A _{main}) =	14,025 ft ²
Volume of Main Basin (V _{main}) =	46,342 ft ³
Calculated Total Basin Volume (V _{total}) =	1,092 acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		6.4	6.4	41		0.001		
ISV	0.33		6.4	6.4	41		0.001	13	0.000
	0.40		6.4	6.4	41		0.001	16	0.000
	0.50		6.4	6.4	41		0.001	20	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.70		6.4	6.4	41		0.001	28	0.001
	0.80		6.4	6.4	41		0.001	32	0.001
	0.90		18.6	12.4	231		0.005	41	0.001
	1.00		39.0	22.4	875		0.020	93	0.002
	1.10		59.4	32.4	1,926		0.044	230	0.005
	1.20		79.8	42.4	3,385		0.078	492	0.011
	1.30		100.2	52.4	5,253		0.121	921	0.021
Floor	1.34		110.4	57.4	6,340		0.146	1,210	0.028
	1.40		111.1	57.9	6,433		0.148	1,530	0.035
	1.50		111.9	58.7	6,568		0.151	2,180	0.050
	1.60		112.7	59.5	6,706		0.154	2,844	0.065
	1.70		113.5	60.3	6,844		0.157	3,521	0.081
	1.80		114.3	61.1	6,984		0.160	4,212	0.097
Zone 1 (WQC)	1.84		114.7	61.5	7,054		0.162	4,563	0.105
	1.90		115.1	61.9	7,125		0.164	4,918	0.113
Zone 2 (EURV)	1.98		115.8	62.6	7,253		0.166	5,565	0.128
	2.00		115.9	62.7	7,267		0.167	5,637	0.129
	2.10		116.8	63.6	7,425		0.170	6,445	0.148
	2.20		117.6	64.4	7,570		0.174	7,195	0.165
	2.30		118.4	65.2	7,716		0.177	7,959	0.183
	2.40		119.2	66.0	7,863		0.181	8,738	0.201
	2.50		120.0	66.8	8,012		0.184	9,532	0.219
	2.60		120.8	67.6	8,162		0.187	10,341	0.237
	2.70		121.6	68.4	8,313		0.191	11,165	0.256
	2.80		122.4	69.2	8,466		0.194	12,004	0.276
	2.90		123.2	70.0	8,620		0.198	12,858	0.295
	3.00		124.0	70.8	8,775		0.201	13,728	0.315
	3.10		124.8	71.6	8,932		0.205	14,613	0.335
	3.20		125.6	72.4	9,089		0.209	15,514	0.356
	3.30		126.4	73.2	9,248		0.212	16,431	0.377
	3.40		127.2	74.0	9,409		0.216	17,364	0.399
	3.50		128.0	74.8	9,570		0.220	18,313	0.420
	3.60		128.8	75.6	9,733		0.223	19,278	0.443
	3.70		129.6	76.4	9,897		0.227	20,259	0.465
	3.80		130.4	77.2	10,062		0.231	21,257	0.488
	3.90		131.2	78.0	10,229		0.235	22,272	0.511
	4.00		132.0	78.8	10,397		0.239	23,303	0.535
	4.10		132.8	79.6	10,566		0.243	24,351	0.559
	4.20		133.6	80.4	10,737		0.246	25,416	0.583
	4.30		134.4	81.2	10,909		0.250	26,499	0.608
	4.40		135.2	82.0	11,082		0.254	27,598	0.634
	4.50		136.0	82.8	11,256		0.258	28,715	0.659
	4.60		136.8	83.6	11,432		0.262	29,849	0.685
	4.70		137.6	84.4	11,609		0.266	31,001	0.712
	4.80		138.4	85.2	11,787		0.271	32,171	0.739
	4.90		139.2	86.0	11,966		0.275	33,359	0.766
	5.00		140.0	86.8	12,147		0.279	34,564	0.793
	5.10		140.8	87.6	12,329		0.283	35,788	0.822
	5.20		141.6	88.4	12,512		0.287	37,030	0.850
	5.30		142.4	89.2	12,697		0.291	38,291	0.879
	5.40		143.2	90.0	12,883		0.296	39,570	0.908
	5.50		144.0	90.8	13,070		0.300	40,867	0.938
	5.60		144.8	91.6	13,259		0.304	42,184	0.968
	5.70		145.6	92.4	13,448		0.309	43,519	0.999
	5.80		146.4	93.2	13,639		0.313	44,874	1.030
	5.90		147.2	94.0	13,832		0.318	46,247	1.062
	6.00		148.0	94.8	14,025		0.322	47,640	1.094
	6.10		148.8	95.6	14,220		0.326	49,052	1.126
	6.20		149.6	96.4	14,416		0.331	50,484	1.159
	6.30		150.4	97.2	14,613		0.335	51,935	1.192
	6.40		151.2	98.0	14,812		0.340	53,407	1.226
	6.50		152.0	98.8	15,012		0.345	54,898	1.260
	6.60		152.8	99.6	15,213		0.349	56,409	1.295
	6.70		153.6	100.4	15,416		0.354	57,941	1.330
	6.80		154.4	101.2	15,620		0.359	59,492	1.366
	6.90		155.2	102.0	15,825		0.363	61,065	1.402
	7.00		156.0	102.8	16,031		0.368	62,657	1.438
	7.10		156.8	103.6	16,239		0.373	64,271	1.475
	7.20		157.6	104.4	16,448		0.378	65,905	1.513
	7.30		158.4	105.2	16,658		0.382	67,560	1.551
	7.40		159.2	106.0	16,869		0.387	69,237	1.589
	7.50		160.0	106.8	17,082		0.392	70,934	1.628
	7.60		160.8	107.6	17,296		0.397	72,653	1.668
	7.70		161.6	108.4	17,511		0.402	74,394	1.708
	7.80		162.4	109.2	17,728		0.407	76,156	1.748
	7.90		163.2	110.0	17,946		0.412	77,939	1.789
	8.00		164.0	110.8	18,165		0.417	79,745	1.831
	8.10		164.8	111.6	18,386		0.422	81,572	1.873
	8.20		165.6	112.4	18,607		0.427	83,422	1.915
	8.30		166.4	113.2	18,830		0.432	85,294	1.958
	8.40		167.2	114.0	19,055		0.437	87,189	2.002
	8.50		168.0	114.8	19,280		0.443	89,105	2.046
	8.60		168.8	115.6	19,507		0.448	91,044	2.090
	8.70		169.6	116.4	19,735		0.453	93,006	2.135
	8.80		170.4	117.2	19,964		0.458	94,991	2.181
	8.90		171.2	118.0	20,195		0.464	96,999	2.227
	9.00		172.0	118.8	20,427		0.469	99,030	2.273
	9.10		172.8	119.6	20,660		0.474	101,084	2.321
	9.20		173.6	120.4	20,895		0.480	103,162	2.368
	9.30		174.4	121.2	21,131		0.485	105,263	2.417
	9.40		175.2	122.0	21,368		0.491	107,388	2.465
	9.50		176.0	122.8	21,606		0.496	109,537	2.515
	9.60		176.8	123.6	21,846		0.502		

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

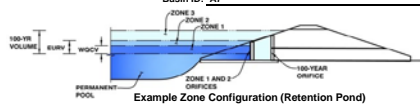
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A7**



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	59.68 acres
Watershed Length =	2,133 ft
Watershed Slope =	0.013 ft/ft
Watershed Imperviousness =	4.20% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.153 acre-feet
Excess Urban Runoff Volume (EURV) =	0.195 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.161 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.577 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	7.321 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.150 acre-feet
Approximate 5-yr Detention Volume =	0.556 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.498 acre-feet

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	2.52 inches

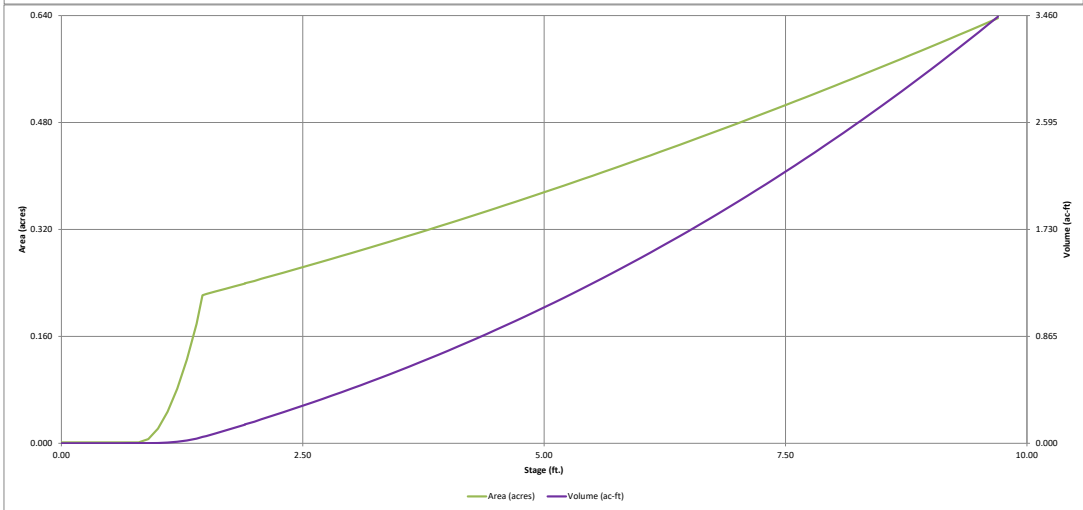
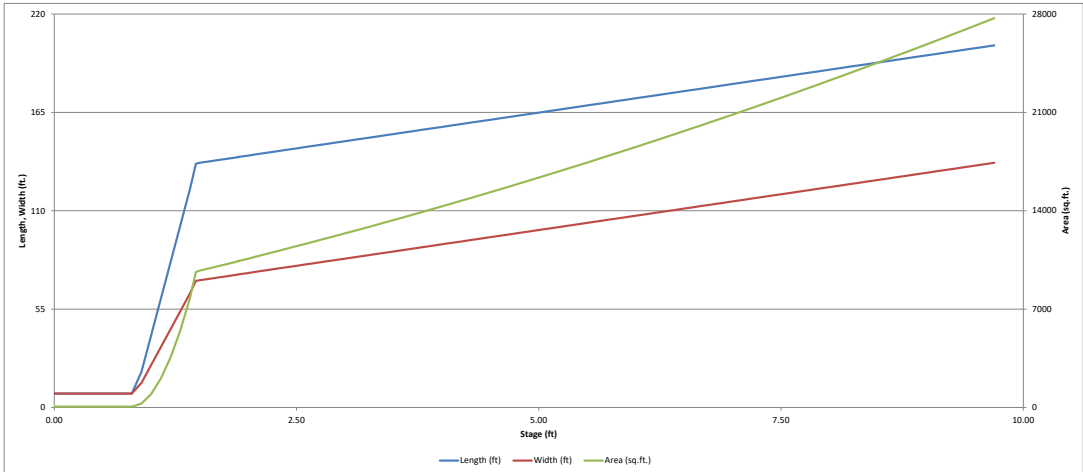
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.153 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.042 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.303 acre-feet
Total Detention Basin Volume =	1.498 acre-feet
Initial Surcharge Volume (ISV) =	20 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2
Initial Surcharge Area (A _{ISV}) =	61 ft ²
Surcharge Volume Length (L _{ISV}) =	7.8 ft
Surcharge Volume Width (W _{ISV}) =	7.8 ft
Depth of Basin Floor (H ₁₀₀) =	0.63 ft
Length of Basin Floor (L ₁₀₀) =	136.6 ft
Width of Basin Floor (W ₁₀₀) =	70.9 ft
Area of Basin Floor (A ₁₀₀) =	9,687 ft ²
Volume of Basin Floor (V ₁₀₀) =	2,213 ft ³
Depth of Main Basin (H _{main}) =	4.54 ft
Length of Main Basin (L _{main}) =	172.9 ft
Width of Main Basin (W _{main}) =	107.2 ft
Area of Main Basin (A _{main}) =	18,539 ft ²
Volume of Main Basin (V _{main}) =	62,975 ft ³
Calculated Total Basin Volume (V _{total}) =	1,498 acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		7.8	7.8	61		0.001		
ISV	0.33		7.8	7.8	61		0.001	19	0.000
	0.40		7.8	7.8	61		0.001	24	0.001
	0.50		7.8	7.8	61		0.001	30	0.001
	0.60		7.8	7.8	61		0.001	36	0.001
	0.70		7.8	7.8	61		0.001	42	0.001
	0.80		7.8	7.8	61		0.001	48	0.001
	0.90		20.0	13.8	276		0.006	60	0.001
	1.00		40.4	23.8		0.022	118	0.003	
	1.10		60.8	33.8	2,054		0.047	265	0.006
	1.20		81.2	43.8	3,556		0.082	543	0.012
	1.30		101.6	53.8	5,465		0.125	990	0.023
	1.40		122.0	63.8	7,782		0.179	1,649	0.038
Floor	1.46		136.3	70.8	9,647		0.221	2,258	0.052
	1.50		136.8	71.1	9,734		0.223	2,549	0.059
	1.60		137.6	71.9	9,901		0.227	3,631	0.081
	1.70		138.4	72.7	10,069		0.231	4,629	0.104
	1.80		139.2	73.5	10,239		0.235	5,545	0.127
	1.90		140.0	74.3	10,410		0.239	6,577	0.151
Zone 1 (WQC)	1.90		140.1	74.4	10,427		0.239	6,681	0.153
	2.00		140.8	75.1	10,582		0.243	7,627	0.175
Zone 2 (EURV)	2.07		141.5	75.8	10,721		0.246	8,479	0.195
	2.10		141.7	76.0	10,773		0.247	8,801	0.202
	2.20		142.5	76.8	10,948		0.251	9,887	0.227
	2.30		143.3	77.6	11,124		0.255	10,991	0.252
	2.40		144.1	78.4	11,301		0.259	12,112	0.278
	2.50		144.9	79.2	11,480		0.264	13,251	0.304
	2.60		145.7	80.0	11,660		0.268	14,408	0.331
	2.70		146.5	80.8	11,841		0.272	15,583	0.358
	2.80		147.3	81.6	12,023		0.276	16,776	0.385
	2.90		148.1	82.4	12,207		0.280	17,988	0.413
	3.00		148.9	83.2	12,392		0.284	19,218	0.441
	3.10		149.7	84.0	12,578		0.289	20,466	0.470
	3.20		150.5	84.8	12,766		0.293	21,733	0.499
	3.30		151.3	85.6	12,955		0.297	23,019	0.528
	3.40		152.1	86.4	13,145		0.302	24,324	0.558
	3.50		152.9	87.2	13,337		0.306	25,648	0.589
	3.60		153.7	88.0	13,529		0.311	26,991	0.620
	3.70		154.5	88.8	13,723		0.315	28,354	0.651
	3.80		155.3	89.6	13,919		0.320	29,736	0.683
	3.90		156.1	90.4	14,115		0.324	31,138	0.715
	4.00		156.9	91.2	14,313		0.329	32,560	0.747
	4.10		157.7	92.0	14,512		0.333	34,001	0.781
	4.20		158.5	92.8	14,713		0.338	35,462	0.814
	4.30		159.3	93.6	14,914		0.342	36,943	0.848
	4.40		160.1	94.4	15,117		0.347	38,445	0.883
	4.50		160.9	95.2	15,322		0.352	39,967	0.918
	4.60		161.7	96.0	15,527		0.356	41,509	0.953
	4.70		162.5	96.8	15,734		0.361	43,072	0.989
	4.80		163.3	97.6	15,942		0.366	44,656	1.025
	4.90		164.1	98.4	16,151		0.371	46,261	1.062
	5.00		164.9	99.2	16,362		0.376	47,887	1.099
	5.10		165.7	100.0	16,574		0.380	49,533	1.137
	5.20		166.5	100.8	16,787		0.385	51,201	1.175
	5.30		167.3	101.6	17,002		0.390	52,891	1.214
	5.40		168.1	102.4	17,218		0.395	54,602	1.253
	5.50		168.9	103.2	17,435		0.400	56,334	1.293
	5.60		169.7	104.0	17,653		0.405	58,089	1.334
	5.70		170.5	104.8	17,873		0.410	59,865	1.374
	5.80		171.3	105.6	18,093		0.415	61,663	1.416
Zone 3 (100-year)	5.90		172.1	106.4	18,316		0.420	63,484	1.457
	6.00		172.9	107.2	18,539		0.426	65,326	1.500
	6.10		173.7	108.0	18,764		0.431	67,192	1.543
	6.20		174.5	108.8	18,990		0.436	69,079	1.586
	6.30		175.3	109.6	19,217		0.441	70,990	1.630
	6.40		176.1	110.4	19,446		0.446	72,923	1.674
	6.50		176.9	111.2	19,676		0.452	74,879	1.719
	6.60		177.7	112.0	19,907		0.457	76,858	1.764
	6.70		178.5	112.8	20,139		0.462	78,860	1.810
	6.80		179.3	113.6	20,373		0.468	80,886	1.857
	6.90		180.1	114.4	20,608		0.473	82,935	1.904
	7.00		180.9	115.2	20,844		0.479	85,007	1.951
	7.10		181.7	116.0	21,082		0.484	87,104	2.000
	7.20		182.5	116.8	21,320		0.489	89,224	2.048
	7.30		183.3	117.6	21,560		0.495	91,368	2.098
	7.40		184.1	118.4	21,802		0.501	93,536	2.147
	7.50		184.9	119.2	22,045		0.506	95,728	2.198
	7.60		185.7	120.0	22,288		0.512	97,945	2.249
	7.70		186.5	120.8	22,534		0.517	100,186	2.300
	7.80		187.3	121.6	22,780		0.523	102,452	2.352
	7.90		188.1	122.4	23,028		0.529	104,742	2.405
	8.00		188.9	123.2	23,277		0.534	107,057	2.458
	8.10		189.7	124.0	23,527		0.540	109,397	2.511
	8.20		190.5	124.8	23,779		0.546	111,763	2.566
	8.30		191.3	125.6	24,032		0.552	114,153	2.621
	8.40		192.1	126.4	24,286		0.558	116,569	2.676
	8.50		192.9	127.2	24,541		0.563	119,010	2.732
	8.60		193.7	128.0	24,798		0.569	121,477	2.789
	8.70		194.5	128.8	25,056		0.575	123,970	2.846
	8.80		195.3	129.6	25,316		0.581	126,489	2.904
	8.90		196.1	130.4	25,576		0.587	129,033	2.962
	9.00		196.9	131.2	25,838		0.593	131,604	3.021
	9.10		197.7	132.0	26,101		0.599	134,201	3.081
	9.20		198.5	132.8	26,366		0.605	136,824	3.141
	9.30		199.3	133.6	26,631		0.611	139,474	3.202
	9.40		200.1	134.4	26,898		0.617	142,151	3.263
	9.50		200.9	135.2	27,166		0.624	144,854	3.325
	9.60		201.7	136.0	27,				

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

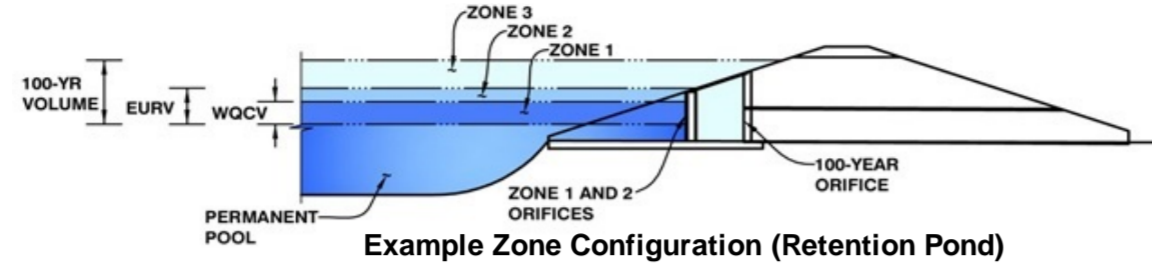


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A8**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	87.81	acres
Watershed Length =	2,421	ft
Watershed Slope =	0.024	ft/ft
Watershed Imperviousness =	3.90%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.210	acre-feet
Excess Urban Runoff Volume (EURV) =	0.264	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.218	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.816	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	10.745	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.203	acre-feet
Approximate 5-yr Detention Volume =	0.788	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	2.136	acre-feet

Optional User Override	
1-hr Precipitation	
	1.19 inches
	1.50 inches
	2.52 inches

Stage-Storage Calculation

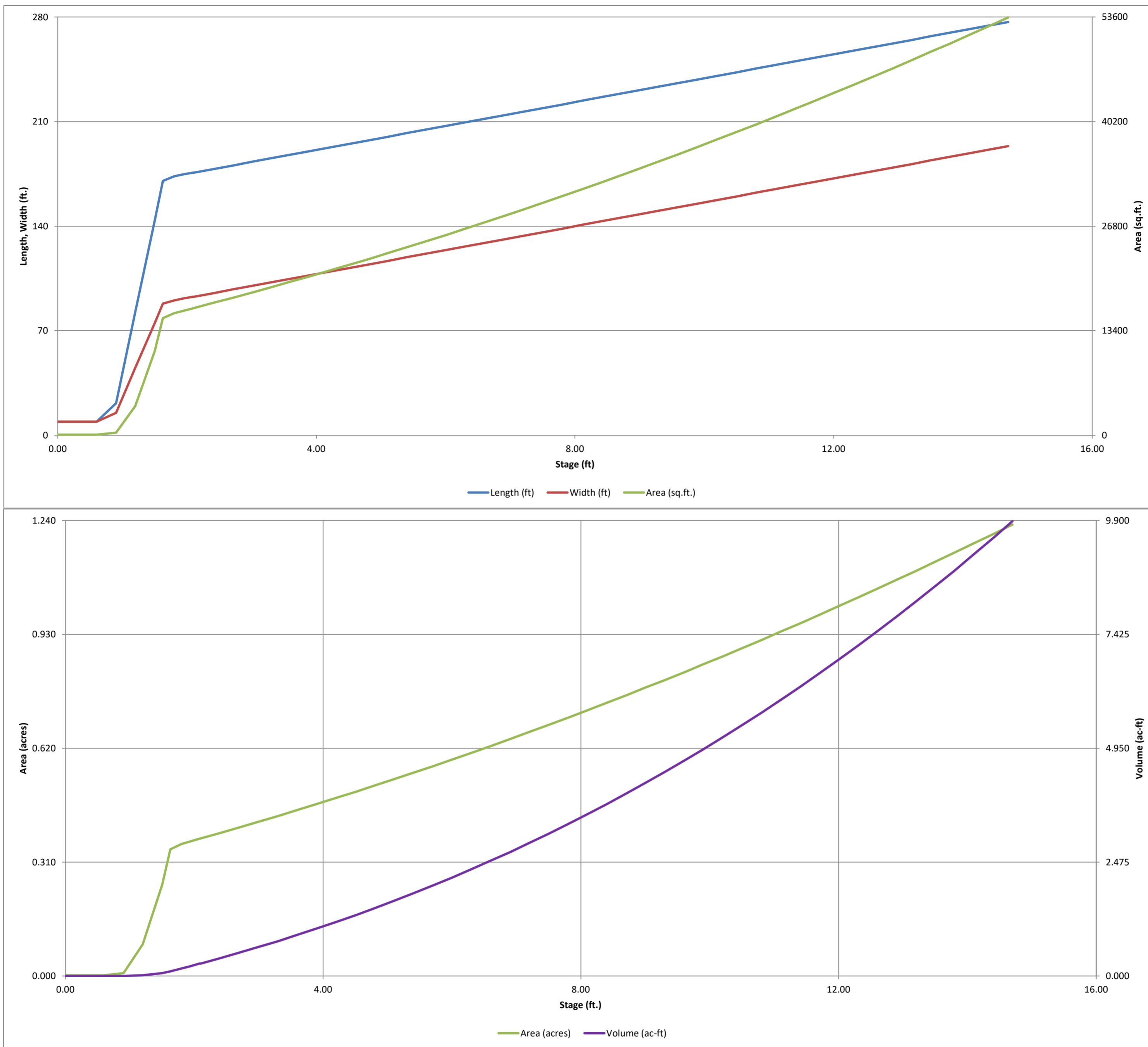
Zone 1 Volume (WQCV) =	0.210	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.054	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.871	acre-feet
Total Detention Basin Volume =	2.136	acre-feet
Initial Surcharge Volume (ISV) =	27	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	83	ft ²
Surcharge Volume Length (L _{ISV}) =	9.1	ft
Surcharge Volume Width (W _{ISV}) =	9.1	ft
Depth of Basin Floor (H _{FLOOR}) =	0.80	ft
Length of Basin Floor (L _{FLOOR}) =	172.0	ft
Width of Basin Floor (W _{FLOOR}) =	89.0	ft
Area of Basin Floor (A _{FLOOR}) =	15,306	ft ²
Volume of Basin Floor (V _{FLOOR}) =	4,397	ft ³
Depth of Main Basin (H _{MAIN}) =	4.37	ft
Length of Main Basin (L _{MAIN}) =	207.0	ft
Width of Main Basin (W _{MAIN}) =	123.9	ft
Area of Main Basin (A _{MAIN}) =	25,657	ft ²
Volume of Main Basin (V _{MAIN}) =	88,563	ft ³
Calculated Total Basin Volume (V _{total}) =	2,136	acre-feet

Depth Increment = 0.3 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		9.1	9.1	83		0.002		
ISV	0.33		9.1	9.1	83		0.002	27	0.001
	0.60		9.1	9.1	83		0.002	49	0.001
	0.90		21.4	15.1	323		0.007	80	0.002
	1.20		82.6	45.1	3,724		0.085	596	0.014
	1.50		143.8	75.1	10,798		0.248	2,682	0.062
Floor	1.63		170.3	88.1	15,003		0.344	4,352	0.100
	1.80		173.3	90.3	15,645		0.359	6,980	0.160
Zone 1 (WQCV)	1.93		174.4	91.4	15,941		0.366	9,191	0.211
Zone 2 (EURV)	2.08		175.6	92.6	16,262		0.373	11,606	0.266
	2.10	User Input	175.8	92.7	16,305		0.374	11,931	0.274
	2.40		178.2	95.1	16,955		0.389	16,920	0.388
	2.70		180.6	97.5	17,617		0.404	22,105	0.507
	3.00		183.0	99.9	18,290		0.420	27,491	0.631
	3.30		185.4	102.3	18,975		0.436	33,080	0.759
	3.60		187.8	104.7	19,671		0.452	38,877	0.892
	3.90		190.2	107.1	20,379		0.468	44,884	1.030
	4.20		192.6	109.5	21,098		0.484	51,106	1.173
	4.50		195.0	111.9	21,829		0.501	57,544	1.321
	4.80		197.4	114.3	22,572		0.518	64,204	1.474
	5.10		199.8	116.7	23,326		0.535	71,088	1.632
	5.40		202.2	119.1	24,091		0.553	78,201	1.795
	5.70		204.6	121.5	24,868		0.571	85,544	1.964
Zone 3 (100-year)	6.00		207.0	123.9	25,657		0.589	93,123	2.138
	6.30		209.4	126.3	26,457		0.607	100,939	2.317
	6.60		211.8	128.7	27,268		0.626	108,998	2.502
	6.90		214.2	131.1	28,091		0.645	117,301	2.693
	7.20		216.6	133.5	28,926		0.664	125,854	2.889
	7.50		219.0	135.9	29,772		0.683	134,658	3.091
	7.80		221.4	138.3	30,629		0.703	143,718	3.299
	8.10		223.8	140.7	31,499		0.723	153,037	3.513
	8.40		226.2	143.1	32,379		0.743	162,618	3.733
	8.70		228.6	145.5	33,271		0.764	172,466	3.959
	9.00		231.0	147.9	34,175		0.785	182,582	4.192
	9.30		233.4	150.3	35,090		0.806	192,972	4.430
	9.60		235.8	152.7	36,017		0.827	203,638	4.675
	9.90		238.2	155.1	36,955		0.848	214,583	4.926
	10.20		240.6	157.5	37,905		0.870	225,812	5.184
	10.50		243.0	159.9	38,867		0.892	237,328	5.448
	10.80		245.4	162.3	39,839		0.915	249,133	5.719
	11.10		247.8	164.7	40,824		0.937	261,232	5.997
	11.40		250.2	167.1	41,820		0.960	273,628	6.282
	11.70		252.6	169.5	42,827		0.983	286,325	6.573
	12.00		255.0	171.9	43,846		1.007	299,326	6.872
	12.30		257.4	174.3	44,876		1.030	312,634	7.177
	12.60		259.8	176.7	45,918		1.054	326,253	7.490
	12.90		262.2	179.1	46,972		1.078	340,186	7.810
	13.20		264.6	181.5	48,037		1.103	354,437	8.137
	13.50		267.0	183.9	49,113		1.127	369,009	8.471
	13.80		269.4	186.3	50,201		1.152	383,906	8.813
	14.10		271.8	188.7	51,301		1.178	399,131	9.163
	14.40		274.2	191.1	52,412		1.203	414,688	9.520
	14.70		276.6	193.5	53,534		1.229	430,579	9.885

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

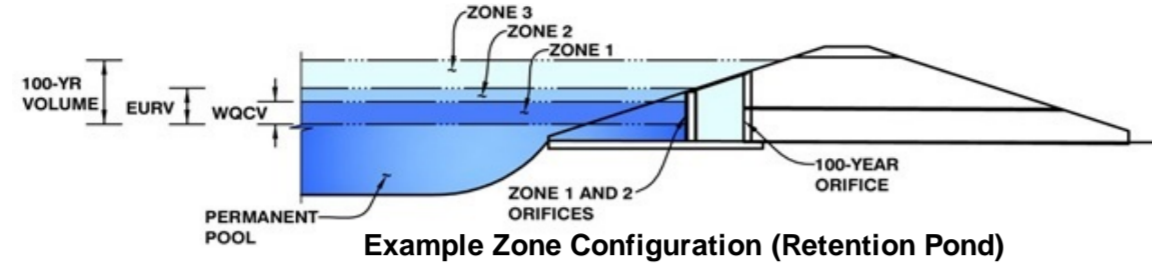


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A9**



Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	32.86	acres
Watershed Length =	1,854	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	5.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.103	acre-feet
Excess Urban Runoff Volume (EURV) =	0.135	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.113	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.358	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.064	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.105	acre-feet
Approximate 5-yr Detention Volume =	0.344	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.903	acre-feet

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

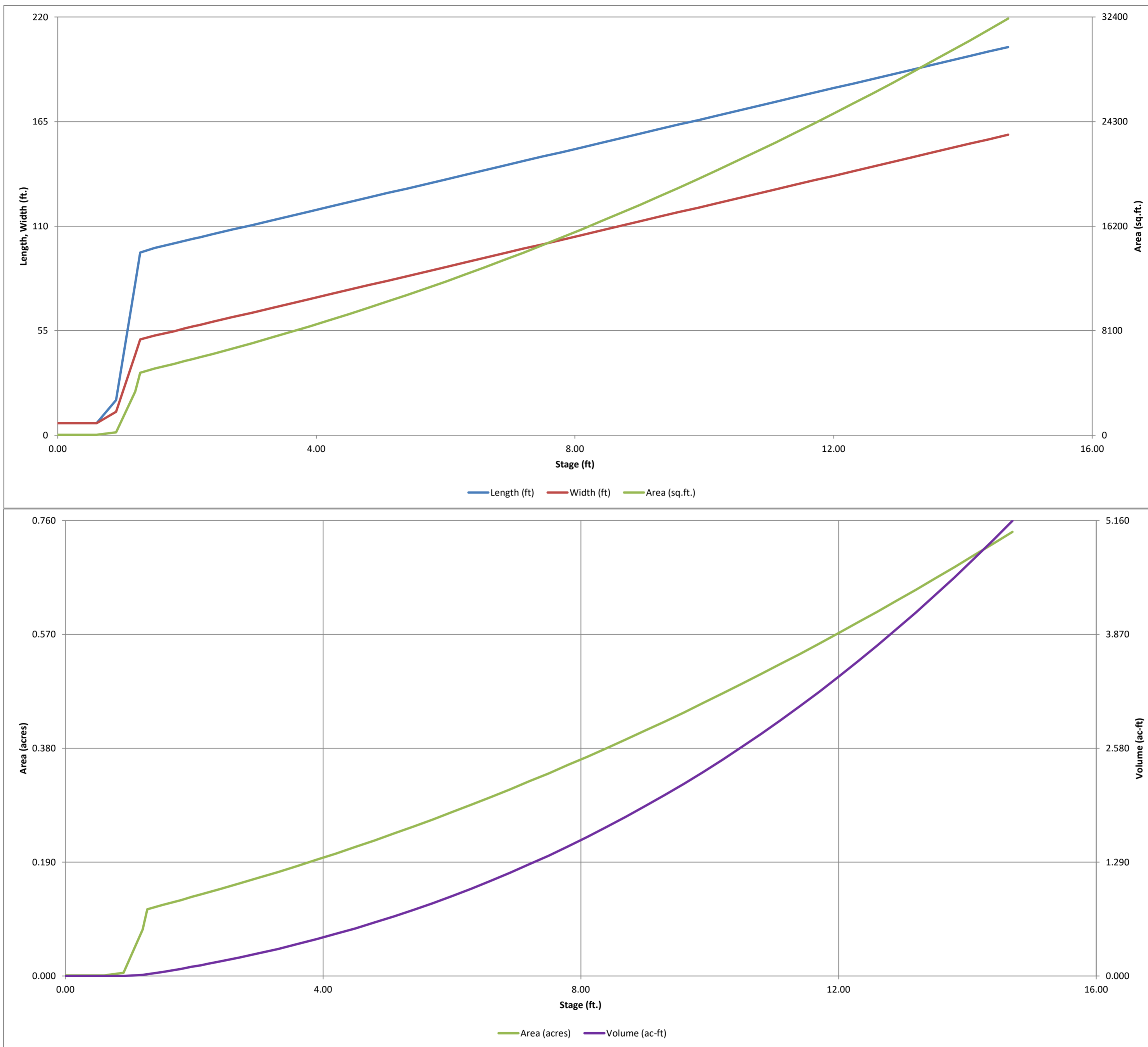
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.032	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.768	acre-feet
Total Detention Basin Volume =	0.903	acre-feet
Initial Surcharge Volume (ISV) =	13	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	41	ft ²
Surcharge Volume Length (L _{ISV}) =	6.4	ft
Surcharge Volume Width (W _{ISV}) =	6.4	ft
Depth of Basin Floor (H _{FLOOR}) =	0.44	ft
Length of Basin Floor (L _{FLOOR}) =	96.7	ft
Width of Basin Floor (W _{FLOOR}) =	50.7	ft
Area of Basin Floor (A _{FLOOR}) =	4,903	ft ²
Volume of Basin Floor (V _{FLOOR}) =	796	ft ³
Depth of Main Basin (H _{MAIN}) =	4.73	ft
Length of Main Basin (L _{MAIN}) =	134.6	ft
Width of Main Basin (W _{MAIN}) =	88.5	ft
Area of Main Basin (A _{MAIN}) =	11,907	ft ²
Volume of Main Basin (V _{MAIN}) =	38,526	ft ³
Calculated Total Basin Volume (V _{total}) =	0.903	acre-feet

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)
Depth Increment = 0.3 ft									
Top of Micropool	0.00		6.4	6.4	41		0.001		
ISV	0.33		6.4	6.4	41		0.001	13	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.90		18.6	12.4	230		0.005	41	0.001
	1.20		79.8	42.4	3,382		0.078	491	0.011
Floor	1.27		96.1	50.4	4,843		0.111	818	0.019
	1.50		98.5	52.4	5,161		0.118	1,925	0.044
	1.80		100.9	54.8	5,529		0.127	3,528	0.081
Zone 1 (WQCV)	1.96		102.2	56.2	5,743		0.132	4,486	0.103
	2.10		103.4	57.3	5,922		0.136	5,303	0.122
Zone 2 (EURV)	2.20		104.2	58.1	6,051		0.139	5,901	0.135
	2.40		105.8	59.7	6,313		0.145	7,138	0.164
	2.70		108.2	62.1	6,716		0.154	9,092	0.209
	3.00		110.6	64.5	7,130		0.164	11,168	0.256
	3.30		113.0	66.9	7,556		0.173	13,371	0.307
	3.60		115.4	69.3	7,993		0.184	15,703	0.360
	3.90		117.8	71.7	8,442		0.194	18,168	0.417
	4.20		120.2	74.1	8,903		0.204	20,770	0.477
	4.50		122.6	76.5	9,375		0.215	23,511	0.540
	4.80		125.0	78.9	9,858		0.226	26,396	0.606
	5.10		127.4	81.3	10,353		0.238	29,427	0.676
	5.40		129.8	83.7	10,860		0.249	32,609	0.749
	5.70		132.2	86.1	11,378		0.261	35,944	0.825
Zone 3 (100-year)	6.00		134.6	88.5	11,907		0.273	39,437	0.905
	6.30		137.0	90.9	12,449		0.286	43,090	0.989
	6.60		139.4	93.3	13,001		0.298	46,907	1.077
	6.90		141.8	95.7	13,565		0.311	50,892	1.168
	7.20		144.2	98.1	14,141		0.325	55,047	1.264
	7.50		146.6	100.5	14,728		0.338	59,377	1.363
	7.80		149.0	102.9	15,327		0.352	63,885	1.467
	8.10		151.4	105.3	15,937		0.366	68,575	1.574
	8.40		153.8	107.7	16,559		0.380	73,449	1.686
	8.70		156.2	110.1	17,192		0.395	78,511	1.802
	9.00		158.6	112.5	17,837		0.409	83,765	1.923
	9.30		161.0	114.9	18,493		0.425	89,214	2.048
	9.60		163.4	117.3	19,161		0.440	94,862	2.178
	9.90		165.8	119.7	19,840		0.455	100,712	2.312
	10.20		168.2	122.1	20,531		0.471	106,767	2.451
	10.50		170.6	124.5	21,233		0.487	113,032	2.595
	10.80		173.0	126.9	21,947		0.504	119,508	2.744
	11.10		175.4	129.3	22,673		0.520	126,201	2.897
	11.40		177.8	131.7	23,410		0.537	133,113	3.056
	11.70		180.2	134.1	24,158		0.555	140,248	3.220
	12.00		182.6	136.5	24,918		0.572	147,609	3.389
	12.30		185.0	138.9	25,689		0.590	155,200	3.563
	12.60		187.4	141.3	26,472		0.608	163,024	3.743
	12.90		189.8	143.7	27,267		0.626	171,085	3.928
	13.20		192.2	146.1	28,073		0.644	179,385	4.118
	13.50		194.6	148.5	28,891		0.663	187,929	4.314
	13.80		197.0	150.9	29,720		0.682	196,721	4.516
	14.10		199.4	153.3	30,560		0.702	205,762	4.724
	14.40		201.8	155.7	31,412		0.721	215,058	4.937
	14.70		204.2	158.1	32,276		0.741	224,611	5.156

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

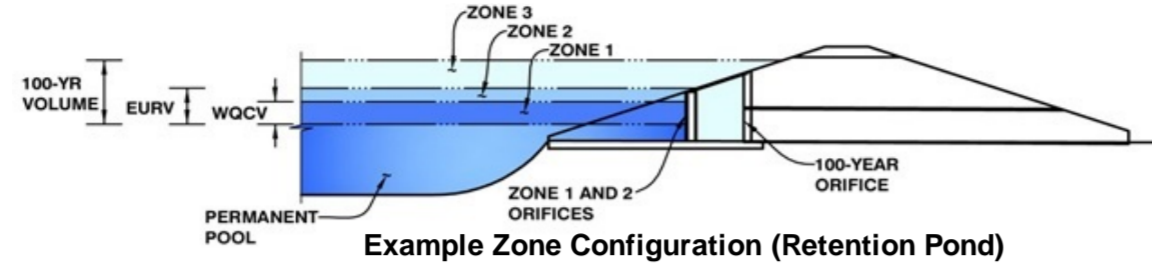


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A10**



Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	263.34	acres
Watershed Length =	7.992	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	3.50%	percent
Percentage Hydrologic Soil Group A =	5.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	95.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.568	acre-feet
Excess Urban Runoff Volume (EURV) =	0.695	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.565	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.225	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	30.934	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.526	acre-feet
Approximate 5-yr Detention Volume =	2.150	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.991	acre-feet

Optional User Override	
1-hr Precipitation	
1.19	inches
1.50	inches
	inches
	inches
	inches
	inches
	inches
	inches
	inches
	inches

Stage-Storage Calculation

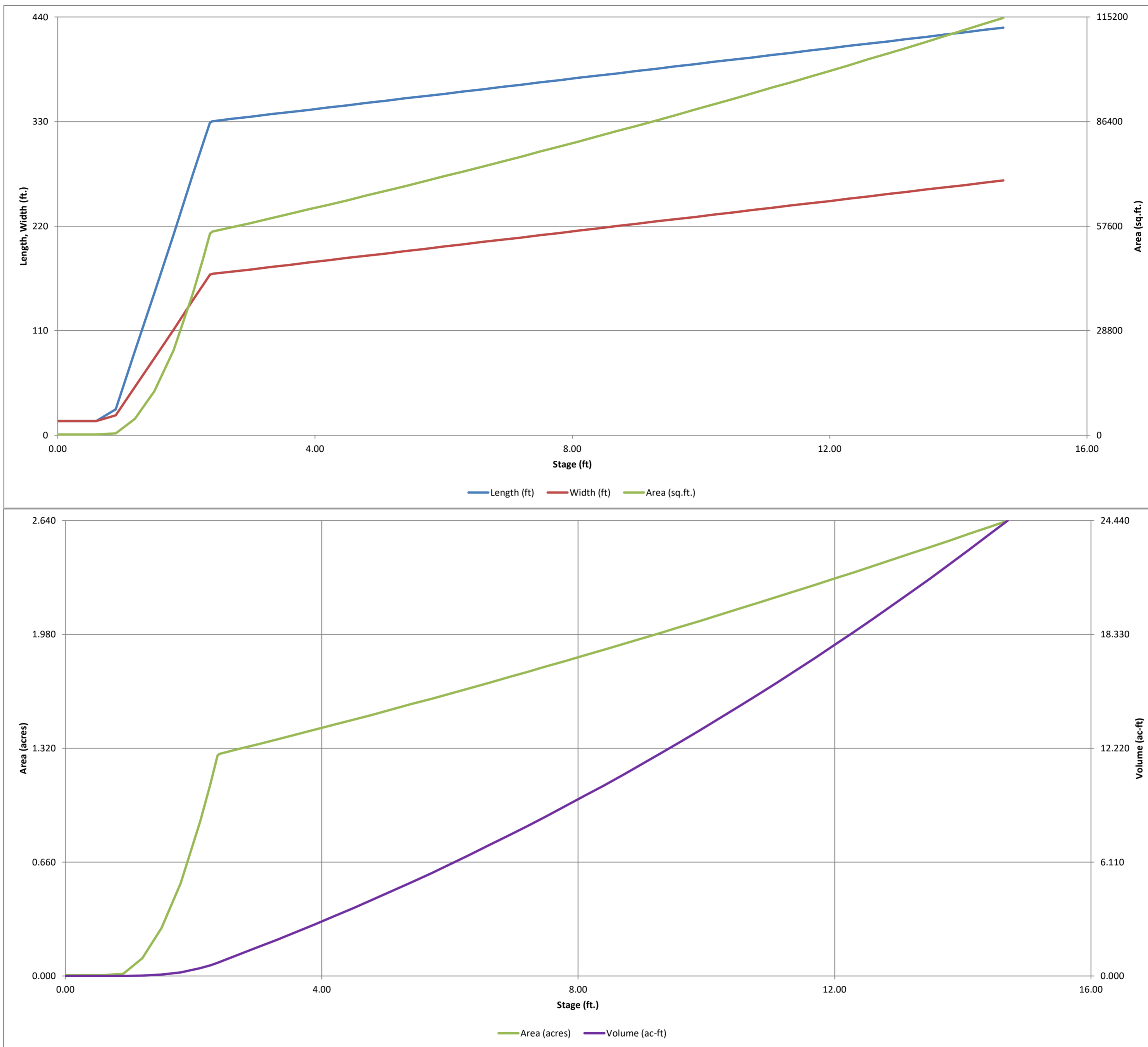
Zone 1 Volume (WQCV) =	0.568	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.297	acre-feet
Total Detention Basin Volume =	5.991	acre-feet
Initial Surcharge Volume (ISV) =	74	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	225	ft ²
Surcharge Volume Length (L _{ISV}) =	15.0	ft
Surcharge Volume Width (W _{ISV}) =	15.0	ft
Depth of Basin Floor (H _{FLOOR}) =	1.54	ft
Length of Basin Floor (L _{FLOOR}) =	330.1	ft
Width of Basin Floor (W _{FLOOR}) =	169.5	ft
Area of Basin Floor (A _{FLOOR}) =	55,951	ft ²
Volume of Basin Floor (V _{FLOOR}) =	30,753	ft ³
Depth of Main Basin (H _{MAIN}) =	3.63	ft
Length of Main Basin (L _{MAIN}) =	359.1	ft
Width of Main Basin (W _{MAIN}) =	198.5	ft
Area of Main Basin (A _{MAIN}) =	71,281	ft ²
Volume of Main Basin (V _{MAIN}) =	230,060	ft ³
Calculated Total Basin Volume (V _{total}) =	5,992	acre-feet

Depth Increment = 0.3 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		15.0	15.0	225		0.005		
ISV	0.33		15.0	15.0	225		0.005	72	0.002
	0.60		15.0	15.0	225		0.005	133	0.003
	0.90		27.2	21.0	572		0.013	210	0.005
	1.20		88.4	51.0	4,510		0.104	880	0.020
	1.50		149.6	81.0	12,120		0.278	3,283	0.075
	1.80		210.8	111.0	23,402		0.537	8,520	0.196
	2.10		274.1	142.0	38,918		0.893	18,078	0.415
Zone 1 (WQCV)	2.26		306.7	158.0	48,460		1.112	25,054	0.575
Zone 2 (EURV)	2.37		329.2	169.0	55,627		1.277	30,775	0.706
Floor	2.37		329.2	169.0	55,627		1.277	30,775	0.706
	2.40		330.3	169.7	56,051		1.287	32,453	0.745
	2.70		332.7	172.1	57,257		1.314	49,449	1.135
	3.00		335.1	174.5	58,474		1.342	66,808	1.534
	3.30		337.5	176.9	59,703		1.371	84,535	1.941
	3.60		339.9	179.3	60,944		1.399	102,631	2.356
	3.90		342.3	181.7	62,196		1.428	121,102	2.780
	4.20		344.7	184.1	63,459		1.457	139,950	3.213
	4.50		347.1	186.5	64,734		1.486	159,178	3.654
	4.80		349.5	188.9	66,020		1.516	178,791	4.104
	5.10		351.9	191.3	67,318		1.545	198,792	4.564
	5.40		354.3	193.7	68,628		1.575	219,183	5.032
	5.70		356.7	196.1	69,949		1.606	239,970	5.509
Zone 3 (100-year)	6.00		359.1	198.5	71,281		1.636	261,154	5.995
	6.30		361.5	200.9	72,625		1.667	282,739	6.491
	6.60		363.9	203.3	73,981		1.698	304,730	6.996
	6.90		366.3	205.7	75,348		1.730	327,129	7.510
	7.20		368.7	208.1	76,727		1.761	349,940	8.034
	7.50		371.1	210.5	78,117		1.793	373,166	8.567
	7.80		373.5	212.9	79,518		1.825	396,811	9.110
	8.10		375.9	215.3	80,931		1.858	420,878	9.662
	8.40		378.3	217.7	82,356		1.891	445,371	10.224
	8.70		380.7	220.1	83,792		1.924	470,293	10.796
	9.00		383.1	222.5	85,240		1.957	495,648	11.379
	9.30		385.5	224.9	86,699		1.990	521,438	11.971
	9.60		387.9	227.3	88,170		2.024	547,668	12.573
	9.90		390.3	229.7	89,652		2.058	574,342	13.185
	10.20		392.7	232.1	91,146		2.092	601,461	13.808
	10.50		395.1	234.5	92,651		2.127	629,030	14.441
	10.80		397.5	236.9	94,168		2.162	657,053	15.084
	11.10		399.9	239.3	95,697		2.197	685,532	15.738
	11.40		402.3	241.7	97,237		2.232	714,472	16.402
	11.70		404.7	244.1	98,788		2.268	743,876	17.077
	12.00		407.1	246.5	100,351		2.304	773,746	17.763
	12.30		409.5	248.9	101,925		2.340	804,087	18.459
	12.60		411.9	251.3	103,511		2.376	834,902	19.167
	12.90		414.3	253.7	105,109		2.413	866,195	19.885
	13.20		416.7	256.1	106,718		2.450	897,969	20.615
	13.50		419.1	258.5	108,338		2.487	930,227	21.355
	13.80		421.5	260.9	109,970		2.525	962,973	22.107
	14.10		423.9	263.3	111,614		2.562	996,210	22.870
	14.40		426.3	265.7	113,269		2.600	1,029,942	23.644
	14.70		428.7	268.1	114,936		2.639	1,064,173	24.430

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

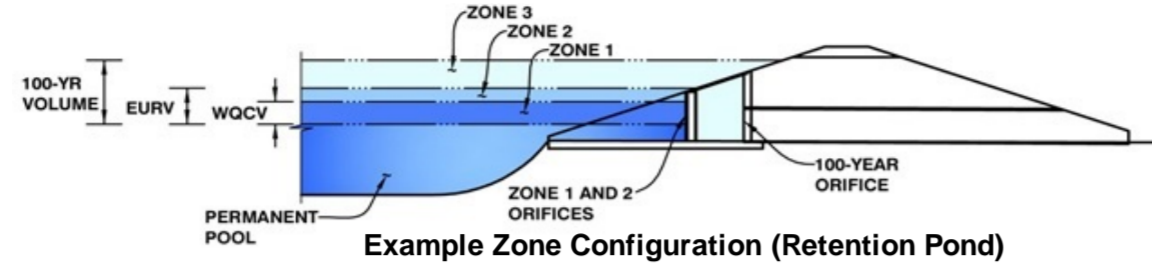


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A11**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	224.01	acres
Watershed Length =	8,048	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	3.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.509	acre-feet
Excess Urban Runoff Volume (EURV) =	0.637	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.523	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.028	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	27.367	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.488	acre-feet
Approximate 5-yr Detention Volume =	1.959	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.329	acre-feet

1.19	inches
1.50	inches
2.52	inches

Stage-Storage Calculation

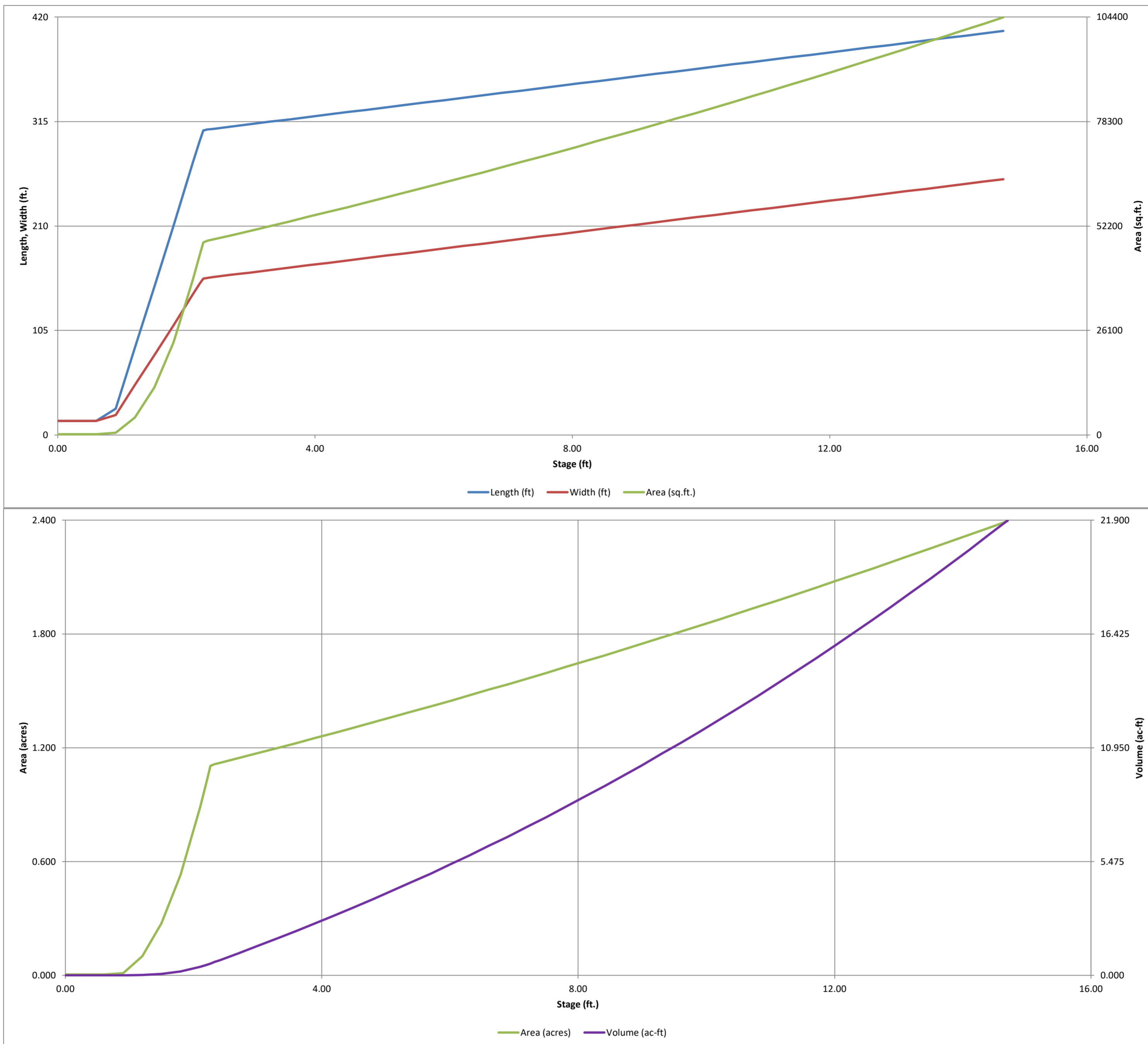
Zone 1 Volume (WQCV) =	0.509	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.692	acre-feet
Total Detention Basin Volume =	5.329	acre-feet
Initial Surcharge Volume (ISV) =	67	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	202	ft ²
Surcharge Volume Length (L _{ISV}) =	14.2	ft
Surcharge Volume Width (W _{ISV}) =	14.2	ft
Depth of Basin Floor (H _{FLOOR}) =	1.43	ft
Length of Basin Floor (L _{FLOOR}) =	306.5	ft
Width of Basin Floor (W _{FLOOR}) =	157.5	ft
Area of Basin Floor (A _{FLOOR}) =	48,260	ft ²
Volume of Basin Floor (V _{FLOOR}) =	24,633	ft ³
Depth of Main Basin (H _{MAIN}) =	3.74	ft
Length of Main Basin (L _{MAIN}) =	336.4	ft
Width of Main Basin (W _{MAIN}) =	187.4	ft
Area of Main Basin (A _{MAIN}) =	63,025	ft ²
Volume of Main Basin (V _{MAIN}) =	207,340	ft ³
Calculated Total Basin Volume (V _{total}) =	5.329	acre-feet

Depth Increment = 0.3 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		14.2	14.2	202		0.005		
ISV	0.33		14.2	14.2	202		0.005	65	0.001
	0.60		14.2	14.2	202		0.005	119	0.003
	0.90		26.4	20.2	534		0.012	189	0.004
	1.20		87.6	50.2	4,400		0.101	837	0.019
	1.50		148.8	80.2	11,937		0.274	3,196	0.073
	1.80		210.0	110.2	23,146		0.531	8,366	0.192
	2.10		273.3	141.2	38,587		0.886	17,834	0.409
Zone 1 (WQCV)	2.21		295.7	152.2	45,009		1.033	22,427	0.515
Floor	2.26		305.9	157.2	48,091		1.104	24,754	0.568
Zone 2 (EURV)	2.33	User Input	307.0	158.0	48,510		1.114	28,140	0.646
	2.40		307.6	158.6	48,771		1.120	31,545	0.724
	2.70		310.0	161.0	49,895		1.145	46,344	1.064
	3.00		312.4	163.4	51,031		1.172	61,483	1.411
	3.30		314.8	165.8	52,179		1.198	76,964	1.767
	3.60		317.2	168.2	53,338		1.224	92,791	2.130
	3.90		319.6	170.6	54,508		1.251	108,968	2.502
	4.20		322.0	173.0	55,691		1.278	125,498	2.881
	4.50		324.4	175.4	56,884		1.306	142,383	3.269
	4.80		326.8	177.8	58,089		1.334	159,629	3.665
	5.10		329.2	180.2	59,306		1.361	177,238	4.069
	5.40		331.6	182.6	60,534		1.390	195,214	4.481
	5.70		334.0	185.0	61,774		1.418	213,560	4.903
Zone 3 (100-year)	6.00		336.4	187.4	63,025		1.447	232,279	5.332
	6.30		338.8	189.8	64,288		1.476	251,376	5.771
	6.60		341.2	192.2	65,562		1.505	270,853	6.218
	6.90		343.6	194.6	66,848		1.535	290,714	6.674
	7.20		346.0	197.0	68,145		1.564	310,963	7.139
	7.50		348.4	199.4	69,454		1.594	331,602	7.613
	7.80		350.8	201.8	70,774		1.625	352,636	8.095
	8.10		353.2	204.2	72,106		1.655	374,068	8.587
	8.40		355.6	206.6	73,449		1.686	395,901	9.089
	8.70		358.0	209.0	74,804		1.717	418,139	9.599
	9.00		360.4	211.4	76,171		1.749	440,785	10.119
	9.30		362.8	213.8	77,549		1.780	463,842	10.648
	9.60		365.2	216.2	78,938		1.812	487,315	11.187
	9.90		367.6	218.6	80,339		1.844	511,206	11.736
	10.20		370.0	221.0	81,752		1.877	535,520	12.294
	10.50		372.4	223.4	83,176		1.909	560,258	12.862
	10.80		374.8	225.8	84,611		1.942	585,426	13.440
	11.10		377.2	228.2	86,058		1.976	611,026	14.027
	11.40		379.6	230.6	87,517		2.009	637,062	14.625
	11.70		382.0	233.0	88,987		2.043	663,537	15.233
	12.00		384.4	235.4	90,468		2.077	690,455	15.851
	12.30		386.8	237.8	91,962		2.111	717,820	16.479
	12.60		389.2	240.2	93,466		2.146	745,633	17.117
	12.90		391.6	242.6	94,982		2.180	773,900	17.766
	13.20		394.0	245.0	96,510		2.216	802,624	18.426
	13.50		396.4	247.4	98,049		2.251	831,808	19.096
	13.80		398.8	249.8	99,600		2.287	861,455	19.776
	14.10		401.2	252.2	101,162		2.322	891,569	20.468
	14.40		403.6	254.6	102,736		2.358	922,153	21.170
	14.70		406.0	257.0	104,321		2.395	953,211	21.883

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

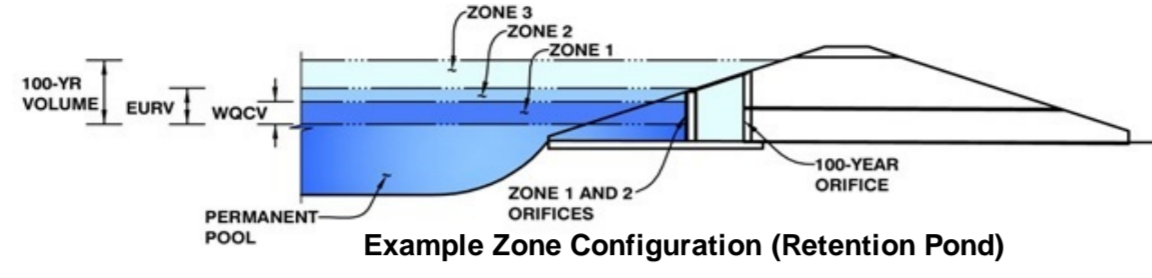


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A12**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	10.97	acres
Watershed Length =	444	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	6.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.043	acre-feet
Excess Urban Runoff Volume (EURV) =	0.059	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.050	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.140	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.373	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.047	acre-feet
Approximate 5-yr Detention Volume =	0.134	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.337	acre-feet

Note: L / W Ratio < 1
L / W Ratio = 0.4

Optional User Override
1-hr Precipitation

1.19	inches
1.50	inches
	inches
	inches
	inches
	inches
2.52	inches
	inches

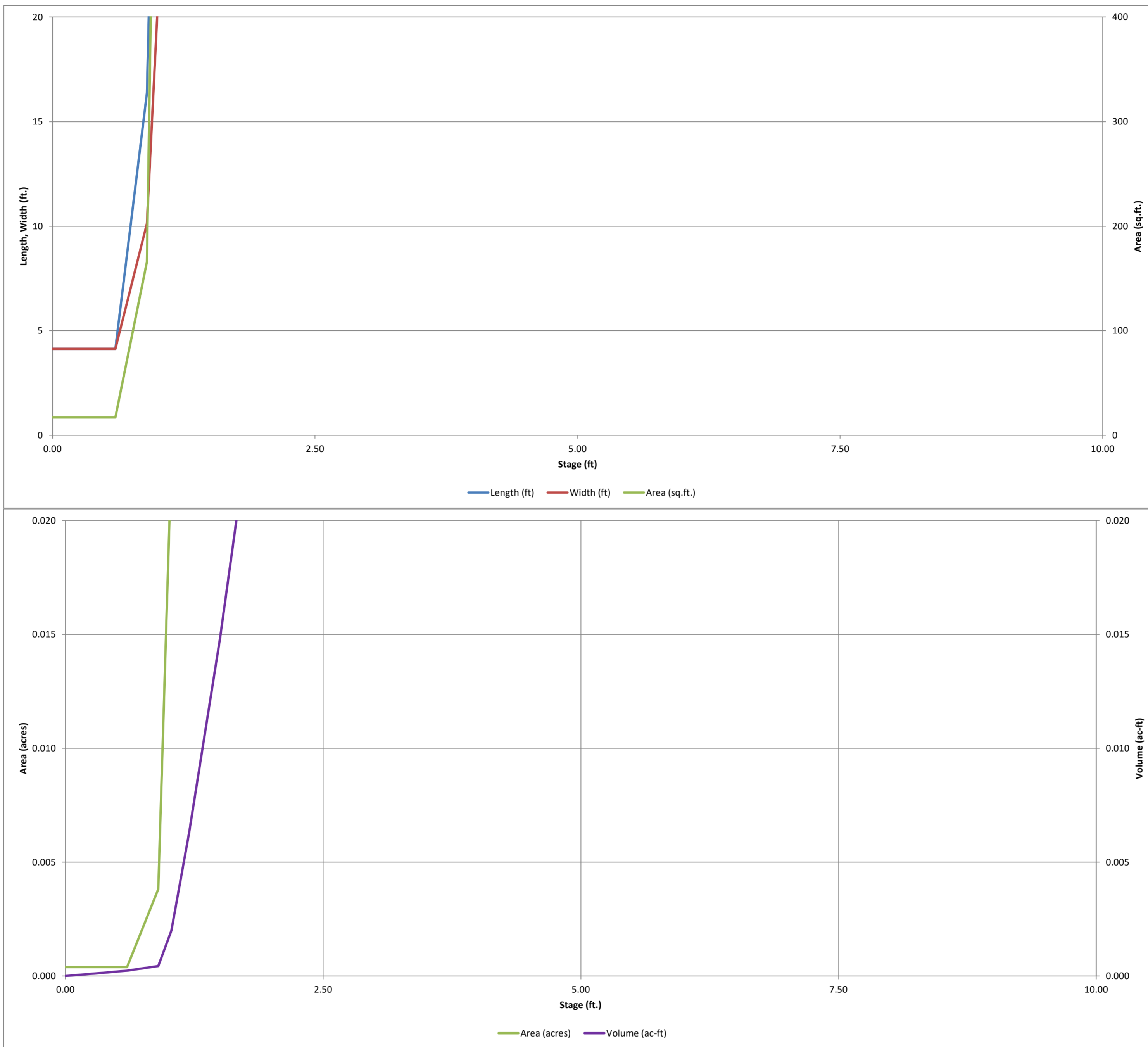
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.016	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.278	acre-feet
Total Detention Basin Volume =	0.337	acre-feet
Initial Surcharge Volume (ISV) =	6	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	17	ft ²
Surcharge Volume Length (L _{ISV}) =	4.1	ft
Surcharge Volume Width (W _{ISV}) =	4.1	ft
Depth of Basin Floor (H _{FLOOR}) =	0.20	ft
Length of Basin Floor (L _{FLOOR}) =	44.4	ft
Width of Basin Floor (W _{FLOOR}) =	23.9	ft
Area of Basin Floor (A _{FLOOR}) =	1,059	ft ²
Volume of Basin Floor (V _{FLOOR}) =	80	ft ³
Depth of Main Basin (H _{MAIN}) =	4.97	ft
Length of Main Basin (L _{MAIN}) =	84.2	ft
Width of Main Basin (W _{MAIN}) =	63.6	ft
Area of Main Basin (A _{MAIN}) =	5,357	ft ²
Volume of Main Basin (V _{MAIN}) =	14,583	ft ³
Calculated Total Basin Volume (V _{total}) =	0.337	acre-feet

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		4.1	4.1	17		0.000		
ISV	0.33		4.1	4.1	17		0.000	5	0.000
	0.60		4.1	4.1	17		0.000	10	0.000
	0.90		16.4	10.1	166		0.004	19	0.000
Floor	1.03		42.9	23.1	992		0.023	87	0.002
	1.20		45.7	25.2	1,150		0.026	274	0.006
	1.50		48.1	27.6	1,325		0.030	645	0.015
	1.80		50.5	30.0	1,513		0.035	1,070	0.025
	2.10		53.0	32.4	1,718		0.039	1,571	0.036
Zone 1 (WQCV)	2.28		54.4	33.9	1,843		0.042	1,891	0.043
	2.40	User Input	55.4	34.8	1,929		0.044	2,118	0.049
Zone 2 (EURV)	2.63		57.2	36.7	2,099		0.048	2,581	0.059
	2.70		57.8	37.2	2,151		0.049	2,729	0.063
	3.00		60.2	39.6	2,385		0.055	3,410	0.078
	3.30		62.6	42.0	2,630		0.060	4,162	0.096
	3.60		65.0	44.4	2,887		0.066	4,989	0.115
	3.90		67.4	46.8	3,156		0.072	5,895	0.135
	4.20		69.8	49.2	3,436		0.079	6,884	0.158
	4.50		72.2	51.6	3,727		0.086	7,958	0.183
	4.80		74.6	54.0	4,030		0.093	9,121	0.209
	5.10		77.0	56.4	4,344		0.100	10,377	0.238
	5.40		79.4	58.8	4,670		0.107	11,729	0.269
	5.70		81.8	61.2	5,008		0.115	13,180	0.303
Zone 3 (100-year)	5.99		84.1	63.6	5,345		0.123	14,681	0.337
	6.00		84.2	63.6	5,357		0.123	14,734	0.338
	6.30		86.6	66.0	5,717		0.131	16,395	0.376
	6.60		89.0	68.4	6,089		0.140	18,166	0.417
	6.90		91.4	70.8	6,473		0.149	20,050	0.460
	7.20		93.8	73.2	6,868		0.158	22,050	0.506
	7.50		96.2	75.6	7,274		0.167	24,171	0.555
	7.80		98.6	78.0	7,692		0.177	26,416	0.606
	8.10		101.0	80.4	8,122		0.186	28,788	0.661
	8.40		103.4	82.8	8,563		0.197	31,291	0.718
	8.70		105.8	85.2	9,016		0.207	33,927	0.779
	9.00		108.2	87.6	9,480		0.218	36,701	0.843
	9.30		110.6	90.0	9,956		0.229	39,616	0.909
	9.60		113.0	92.4	10,443		0.240	42,676	0.980
	9.90		115.4	94.8	10,942		0.251	45,883	1.053
	10.20		117.8	97.2	11,452		0.263	49,242	1.130
	10.50		120.2	99.6	11,974		0.275	52,756	1.211
	10.80		122.6	102.0	12,507		0.287	56,427	1.295
	11.10		125.0	104.4	13,052		0.300	60,261	1.383
	11.40		127.4	106.8	13,608		0.312	64,260	1.475
	11.70		129.8	109.2	14,176		0.325	68,427	1.571
	12.00		132.2	111.6	14,755		0.339	72,766	1.670
	12.30		134.6	114.0	15,346		0.352	77,281	1.774
	12.60		137.0	116.4	15,949		0.366	81,975	1.882
	12.90		139.4	118.8	16,563		0.380	86,852	1.994
	13.20		141.8	121.2	17,188		0.395	91,914	2.110
	13.50		144.2	123.6	17,825		0.409	97,166	2.231
	13.80		146.6	126.0	18,474		0.424	102,610	2.356
	14.10		149.0	128.4	19,134		0.439	108,251	2.485
	14.40		151.4	130.8	19,805		0.455	114,092	2.619
	14.70		153.8	133.2	20,488		0.470	120,135	2.758

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

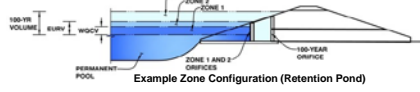
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A2**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	77.33 acres
Watershed Length =	2,282 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	6.80% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.308 acre-feet
Excess Urban Runoff Volume (EURV) =	0.424 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.360 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.995 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	9.689 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.336 acre-feet
Approximate 5-yr Detention Volume =	0.953 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	2.390 acre-feet

Optional User Override 1-hr Precipitation
1.19 inches
1.50 inches
2.52 inches

Stage-Storage Calculation

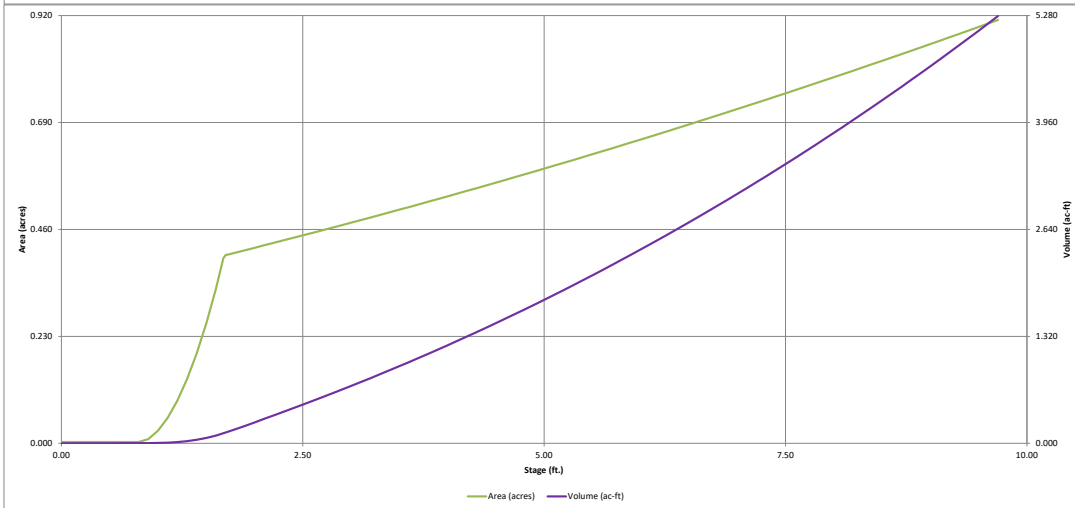
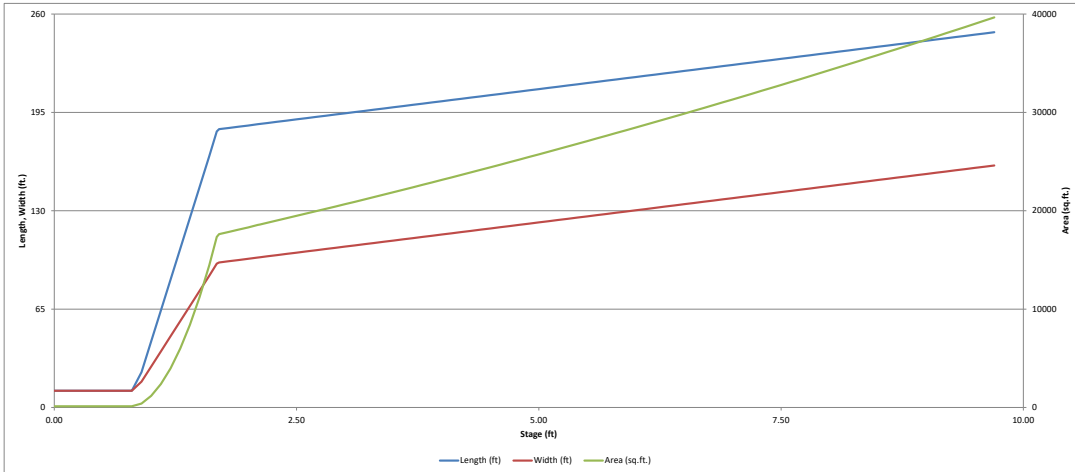
Zone 1 Volume (WQC) =	0.308 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.116 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.966 acre-feet
Total Detention Basin Volume =	2.390 acre-feet
Initial Surcharge Volume (ISV) =	40 ft³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{main}) =	4 ft/V
Basin Length-to-Width Ratio (R _{TL}) =	2

Initial Surcharge Area (A _{ISV}) =	122 ft²
Surcharge Volume Length (L _{ISV}) =	11.0 ft
Surcharge Volume Width (W _{ISV}) =	11.0 ft
Depth of Basin Floor (H _{f,100yr}) =	0.85 ft
Length of Basin Floor (L _{f,100yr}) =	183.8 ft
Width of Basin Floor (W _{f,100yr}) =	95.7 ft
Area of Basin Floor (A _{f,100yr}) =	17,598 ft²
Volume of Basin Floor (V _{f,100yr}) =	5,416 ft³
Depth of Main Basin (H _{main}) =	4.32 ft
Length of Main Basin (L _{main}) =	218.4 ft
Width of Main Basin (W _{main}) =	130.3 ft
Area of Main Basin (A _{main}) =	28,462 ft²
Volume of Main Basin (V _{main}) =	98,625 ft³
Calculated Total Basin Volume (V_{total}) =	2,391 acre-feet

Depth Increment = 0.1 ft		Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (ft²)	Volume (ft³)	Volume (ac-ft)
Top of Micropool		0.00	11.0	11.0	122		0.003		
ISV		0.33	11.0	11.0	122		0.003	39	0.001
		0.40	11.0	11.0	122		0.003	48	0.001
		0.50	11.0	11.0	122		0.003	60	0.001
		0.60	11.0	11.0	122		0.003	72	0.002
		0.70	11.0	11.0	122		0.003	84	0.002
		0.80	11.0	11.0	122		0.003	96	0.002
		0.90	23.3	17.0	397		0.009	116	0.003
		1.00	43.7	27.0	1,182		0.027	192	0.004
		1.10	64.1	37.0	2,374		0.055	366	0.008
		1.20	84.5	47.0	3,975		0.091	680	0.016
		1.30	104.9	57.0	5,984		0.137	1,175	0.027
		1.40	125.3	67.0	8,400		0.193	1,890	0.043
		1.50	145.7	77.0	11,225		0.258	2,868	0.066
		1.60	166.1	87.0	14,457		0.332	4,149	0.095
Floor		1.68	182.4	95.0	17,337		0.398	5,419	0.124
		1.70	183.9	95.8	17,627		0.405	5,770	0.132
		1.80	184.7	96.6	17,852		0.410	7,544	0.173
		1.90	185.5	97.4	18,077		0.415	9,340	0.214
		2.00	186.3	98.2	18,304		0.420	11,159	0.256
		2.10	187.2	99.1	18,556		0.426	13,187	0.303
Zone 1 (WQC)		2.12	187.4	99.3	18,601		0.427	13,558	0.311
		2.20	188.0	99.9	18,785		0.431	15,054	0.346
		2.30	188.8	100.7	19,016		0.437	16,944	0.389
Zone 2 (EURV)		2.39	189.5	101.4	19,225		0.441	18,665	0.428
		2.40	189.6	101.5	19,249		0.442	18,857	0.433
		2.50	190.4	102.3	19,482		0.447	20,793	0.477
		2.60	191.2	103.1	19,717		0.453	22,753	0.522
		2.70	192.0	103.9	19,953		0.458	24,737	0.568
		2.80	192.8	104.7	20,190		0.464	26,744	0.614
		2.90	193.6	105.5	20,429		0.469	28,775	0.661
		3.00	194.4	106.3	20,669		0.474	30,830	0.708
		3.10	195.2	107.1	20,910		0.480	32,909	0.755
		3.20	196.0	107.9	21,153		0.486	35,012	0.804
		3.30	196.8	108.7	21,396		0.491	37,139	0.853
		3.40	197.6	109.5	21,642		0.497	39,291	0.902
		3.50	198.4	110.3	21,888		0.502	41,468	0.952
		3.60	199.2	111.1	22,135		0.508	43,669	1.003
		3.70	200.0	111.9	22,384		0.514	45,895	1.054
		3.80	200.8	112.7	22,635		0.520	48,146	1.105
		3.90	201.6	113.5	22,886		0.525	50,422	1.158
		4.00	202.4	114.3	23,139		0.531	52,723	1.210
		4.10	203.2	115.1	23,393		0.537	55,050	1.264
		4.20	204.0	115.9	23,648		0.543	57,402	1.318
		4.30	204.8	116.7	23,905		0.549	59,779	1.372
		4.40	205.6	117.5	24,162		0.555	62,183	1.428
		4.50	206.4	118.3	24,422		0.561	64,612	1.483
		4.60	207.2	119.1	24,682		0.567	67,067	1.540
		4.70	208.0	119.9	24,944		0.573	69,548	1.597
		4.80	208.8	120.7	25,207		0.579	72,056	1.654
		4.90	209.6	121.5	25,471		0.585	74,590	1.712
		5.00	210.4	122.3	25,736		0.591	77,150	1.771
		5.10	211.2	123.1	26,003		0.597	79,737	1.831
		5.20	212.0	123.9	26,271		0.603	82,351	1.891
		5.30	212.8	124.7	26,541		0.609	84,991	1.951
		5.40	213.6	125.5	26,811		0.616	87,659	2.012
		5.50	214.4	126.3	27,083		0.622	90,354	2.074
		5.60	215.2	127.1	27,357		0.628	93,076	2.137
		5.70	216.0	127.9	27,631		0.634	95,825	2.200
		5.80	216.8	128.7	27,907		0.641	98,602	2.264
Zone 3 (100-year)		5.90	217.6	129.5	28,184		0.647	101,406	2.328
		6.00	218.4	130.3	28,462		0.653	104,239	2.393
		6.10	219.2	131.1	28,742		0.660	107,099	2.459
		6.20	220.0	131.9	29,023		0.666	109,987	2.525
		6.30	220.8	132.7	29,305		0.673	112,904	2.592
		6.40	221.6	133.5	29,588		0.679	115,848	2.660
		6.50	222.4	134.3	29,873		0.686	118,821	2.729
		6.60	223.2	135.1	30,159		0.692	121,823	2.797
		6.70	224.0	135.9	30,446		0.699	124,853	2.866
		6.80	224.8	136.7	30,735		0.706	127,912	2.936
		6.90	225.6	137.5	31,025		0.712	131,000	3.007
		7.00	226.4	138.3	31,316		0.719	134,117	3.079
		7.10	227.2	139.1	31,608		0.726	137,263	3.151
		7.20	228.0	139.9	31,902		0.732	140,439	3.224
		7.30	228.8	140.7	32,197		0.739	143,644	3.298
		7.40	229.6	141.5	32,493		0.746	146,878	3.372
		7.50	230.4	142.3	32,791		0.753	150,143	3.447
		7.60	231.2	143.1	33,090		0.760	153,437	3.522
		7.70	232.0	143.9	33,390		0.767	156,761	3.599
		7.80	232.8	144.7	33,691		0.773	160,115	3.676
		7.90	233.6	145.5	33,994		0.780	163,499	3.753
		8.00	234.4	146.3	34,298		0.787	166,913	3.832
		8.10	235.2	147.1	34,603		0.794	170,359	3.911
		8.20	236.0	147.9	34,910		0.801	173,834	3.991
		8.30	236.8	148.7	35,217		0.808	177,340	4.071
		8.40	237.6	149.5	35,526		0.816	180,878	4.152
		8.50	238.4	150.3	35,837		0.823	184,446	4.234
		8.60	239.2	151.1	36,148		0.830	188,045	4.317
		8.70	240.0	151.9	36,461		0.837	191,675	4.400
		8.80	240.8	152.7	36,775		0.844	195,337	4.484
		8.90	241.6	153.5	37,091		0.851	199,031	4.569
		9.00	242.4	154.3	37,408		0.859	202,756	4.655
		9.10	243.2	155.1	37,726		0.866	206,512	4.741
		9.20	244.0	155.9	38,045		0.873	210,301	4.828
		9.30	244.8	156.7	38,365		0.881	214,121	4.916
		9.40	245.6	157.5	38,687		0.888	217,974	5.004
		9.50	246.4	158.3	39,010		0.896	221,859	5.093
		9.60	247.2	159.1	39,335		0.903	225,776	5.183
		9.70	248.0	159.9	39,661		0.910	229,726	5.274

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

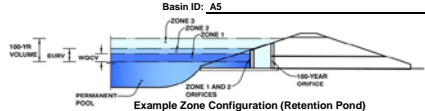
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A5**



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	199.14 acres
Watershed Length =	4.884 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.10% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	100.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.383 acre-feet
Excess Urban Runoff Volume (EURV) =	4.468 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.381 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.655 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	24.208 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.355 acre-feet
Approximate 5-yr Detention Volume =	1.604 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	4.400 acre-feet

Optional User Override
1-hr Precipitation

1.19	inches
1.50	inches
2.52	inches

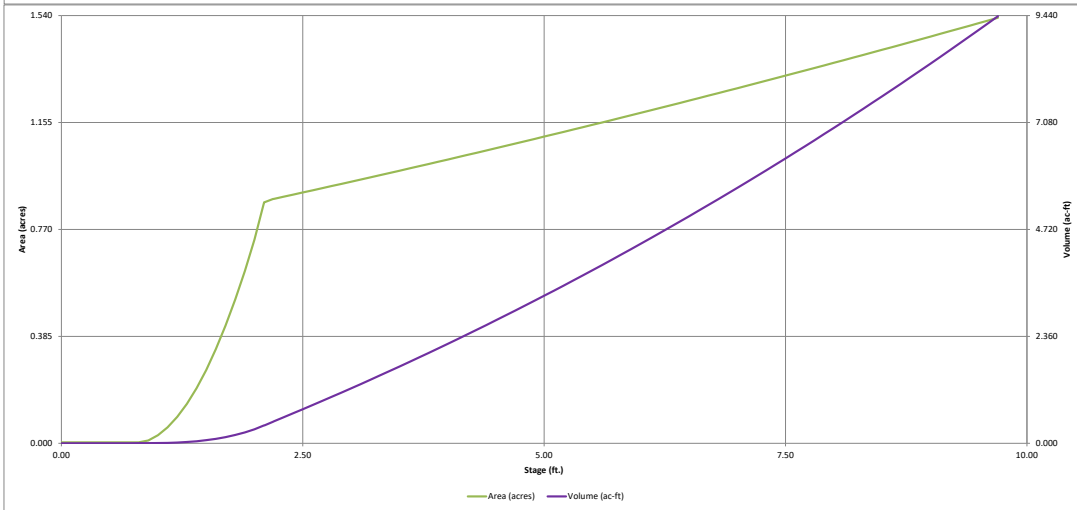
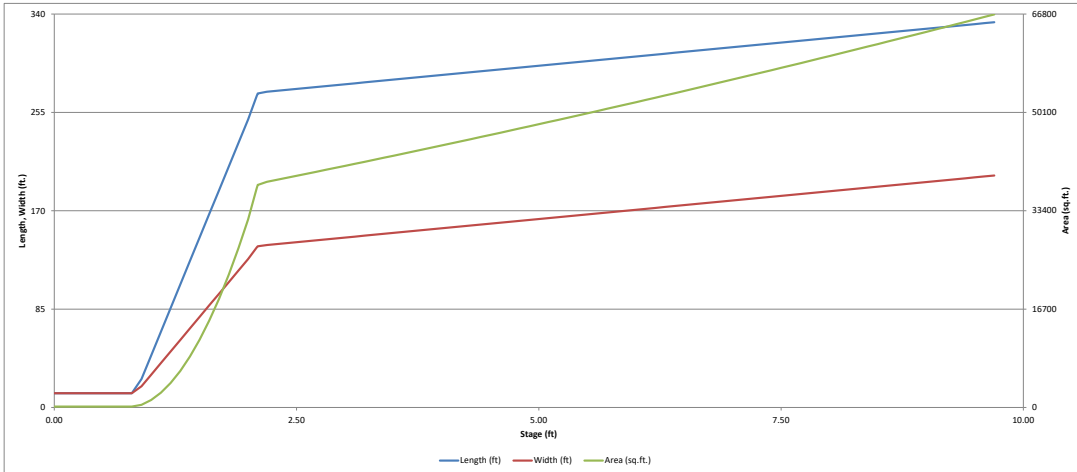
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.383 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.085 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.933 acre-feet
Total Detention Basin Volume =	4.400 acre-feet
Initial Surcharge Volume (ISV) =	50 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H _{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{MB}) =	4 H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2
Initial Surcharge Area (A _{IS}) =	152 ft ²
Surcharge Volume Length (L _{IS}) =	12.3 ft
Surcharge Volume Width (W _{IS}) =	12.3 ft
Depth of Basin Floor (H _{DF}) =	1.27 ft
Length of Basin Floor (L _{DF}) =	272.2 ft
Width of Basin Floor (W _{DF}) =	139.7 ft
Area of Basin Floor (A _{DF}) =	38,019 ft ²
Volume of Basin Floor (V _{DF}) =	17,227 ft ³
Depth of Main Basin (H _{MB}) =	3.90 ft
Length of Main Basin (L _{MB}) =	303.3 ft
Width of Main Basin (W _{MB}) =	170.9 ft
Area of Main Basin (A _{MB}) =	51,828 ft ²
Volume of Main Basin (V _{MB}) =	174,339 ft ³
Calculated Total Basin Volume (V _{Total}) =	4,401 acre-feet

Depth Increment = 0.1 ft									
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool									
ISV	0.00		12.3	12.3	152		0.003	0.000	
	0.33		12.3	12.3	152		0.003	49	0.001
	0.40		12.3	12.3	152		0.003	59	0.001
	0.50		12.3	12.3	152		0.003	74	0.002
	0.60		12.3	12.3	152		0.003	89	0.002
	0.70		12.3	12.3	152		0.003	105	0.002
	0.80		12.3	12.3	152		0.003	120	0.003
	0.90		24.6	18.3	450		0.010	143	0.003
	1.00		45.0	28.3	1,273		0.029	226	0.005
	1.10		65.4	38.3	2,504		0.057	411	0.009
	1.20		85.8	48.3	4,143		0.095	740	0.017
	1.30		106.2	58.3	6,190		0.142	1,253	0.029
	1.40		126.6	68.3	8,645		0.198	1,992	0.046
	1.50		147.0	78.3	11,508		0.264	2,996	0.069
	1.60		167.4	88.3	14,779		0.339	4,307	0.099
	1.70		187.8	98.3	18,458		0.424	5,965	0.137
	1.80		208.2	108.3	22,545		0.518	8,012	0.184
	1.90		228.6	118.3	27,040		0.621	10,488	0.241
	2.00		249.0	128.3	31,943		0.733	13,434	0.308
Zone 1 (WQC)									
	2.09		269.4	138.3	37,254		0.855	16,890	0.388
	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Floor									
	2.10		271.4	139.3	37,808		0.868	17,266	0.396
Zone 2 (EURV)									
	2.19		272.9	140.4	38,304		0.879	20,698	0.475
	2.20		272.9	140.5	38,337		0.880	21,082	0.484
	2.30		273.7	141.3	38,668		0.888	24,932	0.572
	2.40		274.5	142.1	39,001		0.895	28,815	0.662
	2.50		275.3	142.9	39,335		0.903	32,732	0.751
	2.60		276.1	143.7	39,670		0.911	36,682	0.842
	2.70		276.9	144.5	40,006		0.918	40,666	0.934
	2.80		277.7	145.3	40,344		0.926	44,684	1.026
	2.90		278.5	146.1	40,683		0.934	48,735	1.119
	3.00		279.3	146.9	41,023		0.942	52,820	1.213
	3.10		280.1	147.7	41,365		0.950	56,940	1.307
	3.20		280.9	148.5	41,708		0.957	61,093	1.403
	3.30		281.7	149.3	42,052		0.965	65,281	1.499
	3.40		282.5	150.1	42,398		0.973	69,504	1.596
	3.50		283.3	150.9	42,744		0.981	73,761	1.693
	3.60		284.1	151.7	43,092		0.989	78,053	1.792
	3.70		284.9	152.5	43,442		0.997	82,379	1.891
	3.80		285.7	153.3	43,792		1.005	86,741	1.991
	3.90		286.5	154.1	44,144		1.013	91,138	2.092
	4.00		287.3	154.9	44,497		1.022	95,570	2.194
	4.10		288.1	155.7	44,851		1.030	100,037	2.297
	4.20		288.9	156.5	45,207		1.038	104,540	2.400
	4.30		289.7	157.3	45,564		1.046	109,079	2.504
	4.40		290.5	158.1	45,922		1.054	113,653	2.609
	4.50		291.3	158.9	46,282		1.062	118,263	2.715
	4.60		292.1	159.7	46,643		1.071	122,910	2.822
	4.70		292.9	160.5	47,005		1.079	127,592	2.929
	4.80		293.7	161.3	47,368		1.087	132,311	3.037
	4.90		294.5	162.1	47,733		1.096	137,066	3.147
	5.00		295.3	162.9	48,099		1.104	141,857	3.257
	5.10		296.1	163.7	48,466		1.113	146,685	3.367
	5.20		296.9	164.5	48,834		1.121	151,550	3.479
	5.30		297.7	165.3	49,204		1.130	156,452	3.592
	5.40		298.5	166.1	49,575		1.138	161,391	3.705
	5.50		299.3	166.9	49,947		1.147	166,367	3.819
	5.60		300.1	167.7	50,321		1.155	171,381	3.934
	5.70		300.9	168.5	50,696		1.164	176,432	4.050
	5.80		301.7	169.3	51,072		1.172	181,520	4.167
	5.90		302.5	170.1	51,449		1.181	186,646	4.285
	6.00		303.3	170.9	51,828		1.189	191,810	4.403
	6.10		304.1	171.7	52,208		1.199	197,012	4.523
	6.20		304.9	172.5	52,589		1.207	202,252	4.643
	6.30		305.7	173.3	52,972		1.216	207,530	4.764
	6.40		306.5	174.1	53,356		1.225	212,846	4.886
	6.50		307.3	174.9	53,741		1.234	218,201	5.009
	6.60		308.1	175.7	54,127		1.243	223,594	5.133
	6.70		308.9	176.5	54,515		1.251	229,026	5.258
	6.80		309.7	177.3	54,904		1.260	234,497	5.383
	6.90		310.5	178.1	55,294		1.269	240,007	5.510
	7.00		311.3	178.9	55,686		1.278	245,556	5.637
	7.10		312.1	179.7	56,079		1.287	251,144	5.765
	7.20		312.9	180.5	56,473		1.296	256,772	5.895
	7.30		313.7	181.3	56,868		1.306	262,439	6.025
	7.40		314.5	182.1	57,265		1.315	268,146	6.156
	7.50		315.3	182.9	57,663		1.324	273,892	6.288
	7.60		316.1	183.7	58,062		1.333	279,678	6.421
	7.70		316.9	184.5	58,462		1.342	285,504	6.554
	7.80		317.7	185.3	58,864		1.351	291,371	6.689
	7.90		318.5	186.1	59,267		1.361	297,277	6.825
	8.00		319.3	186.9	59,671		1.370	303,224	6.961
	8.10		320.1	187.7	60,077		1.379	309,212	7.099
	8.20		320.9	188.5	60,484		1.389	315,240	7.237
	8.30		321.7	189.3	60,892		1.398	321,308	7.376
	8.40		322.5	190.1	61,301		1.407	327,418	7.516
	8.50		323.3	190.9	61,712		1.417	333,569	7.658
	8.60		324.1	191.7	62,124		1.426	339,760	7.800
	8.70		324.9	192.5	62,537		1.436	345,994	7.943
	8.80		325.7	193.3	62,952		1.445	352,269	8.087
	8.90		326.5	194.1	63,368		1.455	358,584	8.232
	9.00		327.3	194.9	63,785		1.464	364,942	8.378
	9.10		328.1	195.7	64,203		1.474	371,341	8.525
	9.20		328.9	196.5	64,623		1.484	377,782	8.673
	9.30		329.7	197.3	65,044		1.493	384,266	8.822
	9.40		330.5	198.1	65,466		1.503	390,791	8.971
	9.50		331.3	198.9	65,890		1.513	397,359	9.122
	9.60		332.1	199.7	66,315		1.522	403,969	9.274
	9.70		332.9	200.5	66,741		1.532	410,622	9.427

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

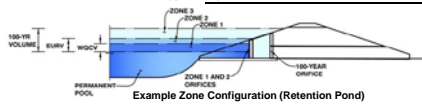
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
 Basin ID: **A6**



Required Volume Calculation

Selected BMP Type =	EDB
Watershed Area =	47.98 acres
Watershed Length =	1,777 ft
Watershed Slope =	0.014 ft/ft
Watershed Imperviousness =	3.50% percent
Percentage Hydrologic Soil Group A =	5.0% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C:D =	95.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input
Water Quality Capture Volume (WQC) =	0.103 acre-feet
Excess Urban Runoff Volume (EURV) =	0.127 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.103 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.405 acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	5.636 acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000 acre-feet
Approximate 2-yr Detention Volume =	0.096 acre-feet
Approximate 5-yr Detention Volume =	0.392 acre-feet
Approximate 10-yr Detention Volume =	0.000 acre-feet
Approximate 25-yr Detention Volume =	0.000 acre-feet
Approximate 50-yr Detention Volume =	0.000 acre-feet
Approximate 100-yr Detention Volume =	1.092 acre-feet

Optional User Override 1-hr Precipitation	
1.19	inches
1.50	inches
	inches
	inches
	inches
2.52	inches

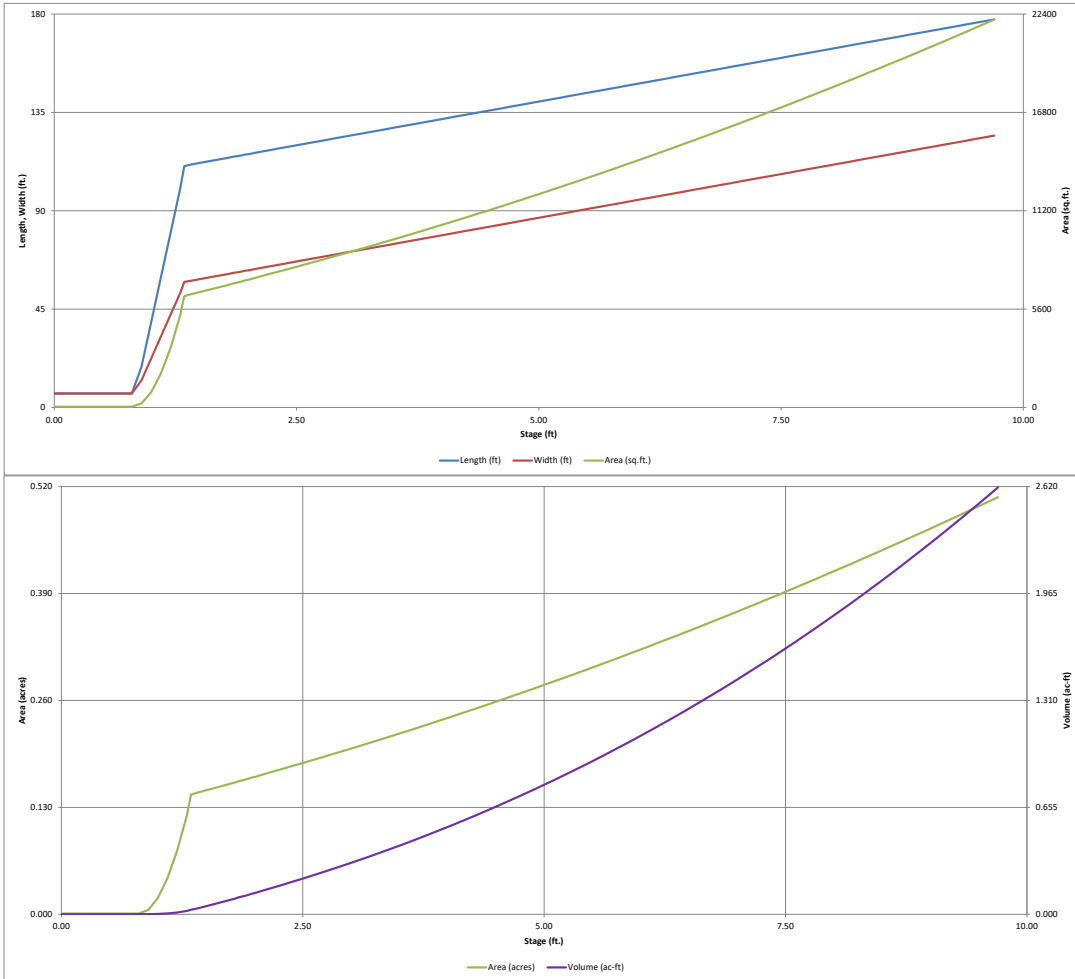
Stage-Storage Calculation

Zone 1 Volume (WQC) =	0.103 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.023 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.965 acre-feet
Total Detention Basin Volume =	1.092 acre-feet
Initial Surcharge Volume (ISV) =	14 ft ³
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H_{total}) =	6.00 ft
Depth of Trickle Channel (H _{TC}) =	0.50 ft
Slope of Trickle Channel (S _{TC}) =	0.005 ft/ft
Slopes of Main Basin Sides (S _{MB}) =	4 ft ¹ /ft
Basin Length-to-Width Ratio (R_{L/W}) =	2
Initial Surcharge Area (A _{ISV}) =	41 ft ²
Surcharge Volume Length (L _{SV}) =	6.4 ft
Surcharge Volume Width (W _{SV}) =	6.4 ft
Depth of Basin Floor (H ₁₀₀) =	0.51 ft
Length of Basin Floor (W ₁₀₀) =	110.7 ft
Width of Basin Floor (W ₁₀₀) =	57.5 ft
Area of Basin Floor (A ₁₀₀) =	6,367 ft ²
Volume of Basin Floor (V ₁₀₀) =	1,179 ft ³
Depth of Main Basin (H _{MB}) =	4.66 ft
Length of Main Basin (L _{MB}) =	148.0 ft
Width of Main Basin (W _{MB}) =	94.8 ft
Area of Main Basin (A _{MB}) =	14,025 ft ²
Volume of Main Basin (V _{MB}) =	46,342 ft ³
Calculated Total Basin Volume (V_{total}) =	1.092 acre-feet

Depth Increment = 0.1 ft											
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (ft²)	Volume (ft³)	Volume (ac-ft)		
Top of Micropool	0.00		6.4	6.4	41		0.001				
ISV	0.33		6.4	6.4	41		0.001	13	0.000		
	0.40		6.4	6.4	41		0.001	16	0.000		
	0.50		6.4	6.4	41		0.001	20	0.000		
	0.60		6.4	6.4	41		0.001	24	0.001		
	0.70		6.4	6.4	41		0.001	28	0.001		
	0.80		6.4	6.4	41		0.001	32	0.001		
	0.90		18.6	12.4	231		0.005	41	0.001		
	1.00		39.0	22.4	875		0.020	93	0.002		
	1.10		59.4	32.4	1,926		0.044	230	0.005		
	1.20		79.8	42.4	3,385		0.078	492	0.011		
	1.30		100.2	52.4	5,253		0.121	921	0.021		
Floor	1.34		110.4	57.4	6,340		0.146	1,210	0.028		
	1.40		111.1	57.9	6,433		0.148	1,530	0.035		
	1.50		111.9	58.7	6,568		0.151	2,180	0.050		
	1.60		112.7	59.5	6,706		0.154	2,844	0.065		
	1.70		113.5	60.3	6,844		0.157	3,521	0.081		
	1.80		114.3	61.1	6,984		0.160	4,212	0.097		
Zone 1 (WQC)	1.84		114.7	61.5	7,054		0.162	4,563	0.105		
	1.90		115.1	61.9	7,125		0.164	4,918	0.113		
Zone 2 (EURV)	1.98		115.8	62.6	7,253		0.166	5,565	0.128		
	2.00		115.9	62.7	7,267		0.167	5,637	0.129		
	2.10		116.8	63.6	7,425		0.170	6,445	0.148		
	2.20		117.6	64.4	7,570		0.174	7,195	0.165		
	2.30		118.4	65.2	7,716		0.177	7,959	0.183		
	2.40		119.2	66.0	7,863		0.181	8,738	0.201		
	2.50		120.0	66.8	8,012		0.184	9,532	0.219		
	2.60		120.8	67.6	8,162		0.187	10,341	0.237		
	2.70		121.6	68.4	8,313		0.191	11,165	0.256		
	2.80		122.4	69.2	8,466		0.194	12,004	0.276		
	2.90		123.2	70.0	8,620		0.198	12,858	0.295		
	3.00		124.0	70.8	8,775		0.201	13,728	0.315		
	3.10		124.8	71.6	8,932		0.205	14,613	0.335		
	3.20		125.6	72.4	9,089		0.209	15,514	0.356		
	3.30		126.4	73.2	9,248		0.212	16,431	0.377		
	3.40		127.2	74.0	9,409		0.216	17,364	0.399		
	3.50		128.0	74.8	9,570		0.220	18,313	0.420		
	3.60		128.8	75.6	9,733		0.223	19,278	0.443		
	3.70		129.6	76.4	9,897		0.227	20,259	0.465		
	3.80		130.4	77.2	10,062		0.231	21,257	0.488		
	3.90		131.2	78.0	10,229		0.235	22,272	0.511		
	4.00		132.0	78.8	10,397		0.239	23,303	0.535		
	4.10		132.8	79.6	10,566		0.243	24,351	0.559		
	4.20		133.6	80.4	10,737		0.246	25,416	0.583		
	4.30		134.4	81.2	10,909		0.250	26,499	0.608		
	4.40		135.2	82.0	11,082		0.254	27,598	0.634		
	4.50		136.0	82.8	11,256		0.258	28,715	0.659		
	4.60		136.8	83.6	11,432		0.262	29,849	0.685		
	4.70		137.6	84.4	11,609		0.266	31,001	0.712		
	4.80		138.4	85.2	11,787		0.271	32,171	0.739		
	4.90		139.2	86.0	11,966		0.275	33,359	0.766		
	5.00		140.0	86.8	12,147		0.279	34,564	0.793		
	5.10		140.8	87.6	12,329		0.283	35,788	0.822		
	5.20		141.6	88.4	12,512		0.287	37,030	0.850		
	5.30		142.4	89.2	12,697		0.291	38,291	0.879		
	5.40		143.2	90.0	12,883		0.296	39,570	0.908		
	5.50		144.0	90.8	13,070		0.300	40,867	0.938		
	5.60		144.8	91.6	13,259		0.304	42,184	0.968		
	5.70		145.6	92.4	13,448		0.309	43,519	0.999		
	5.80		146.4	93.2	13,639		0.313	44,874	1.030		
	5.90		147.2	94.0	13,832		0.318	46,247	1.062		
	6.00		148.0	94.8	14,025		0.322	47,640	1.094		
Zone 3 (100-year)	6.10		148.8	95.6	14,220		0.326	49,052	1.126		
	6.20		149.6	96.4	14,416		0.331	50,484	1.159		
	6.30		150.4	97.2	14,613		0.335	51,935	1.192		
	6.40		151.2	98.0	14,812		0.340	53,407	1.226		
	6.50		152.0	98.8	15,012		0.345	54,898	1.260		
	6.60		152.8	99.6	15,213		0.349	56,409	1.295		
	6.70		153.6	100.4	15,416		0.354	57,941	1.330		
	6.80		154.4	101.2	15,620		0.359	59,492	1.366		
	6.90		155.2	102.0	15,825		0.363	61,065	1.402		
	7.00		156.0	102.8	16,031		0.368	62,657	1.438		
	7.10		156.8	103.6	16,239		0.373	64,271	1.475		
	7.20		157.6	104.4	16,448		0.378	65,905	1.513		
	7.30		158.4	105.2	16,658		0.382	67,560	1.551		
	7.40		159.2	106.0	16,869		0.387	69,237	1.589		
	7.50		160.0	106.8	17,082		0.392	70,934	1.628		
	7.60		160.8	107.6	17,296		0.397	72,653	1.668		
	7.70		161.6	108.4	17,511		0.402	74,394	1.708		
	7.80		162.4	109.2	17,728		0.407	76,156	1.748		
	7.90		163.2	110.0	17,946		0.412	77,939	1.789		
	8.00		164.0	110.8	18,165		0.417	79,745	1.831		
	8.10		164.8	111.6	18,386		0.422	81,572	1.873		
	8.20		165.6	112.4	18,607		0.427	83,422	1.915		
	8.30		166.4	113.2	18,830		0.432	85,294	1.958		
	8.40		167.2	114.0	19,055		0.437	87,189	2.002		
	8.50		168.0	114.8	19,280		0.443	89,105	2.046		
	8.60		168.8	115.6	19,507		0.448	91,044	2.090		
	8.70		169.6	116.4	19,735		0.453	93,006	2.135		
	8.80		170.4	117.2	19,964		0.458	94,991	2.181		
	8.90		171.2	118.0	20,195		0.464	96,999	2.227		
	9.00		172.0	118.8	20,427		0.469	99,030	2.273		
	9.10		172.8	119.6	20,660		0.474	101,084	2.321		
	9.20		173.6	120.4	20,895		0.480	103,162	2.368		
	9.30		174.4	121.2	21,131		0.485	105,263	2.417		
	9.40		175.2	122.0	21,368		0.491	107,388	2.465		
	9.50		176.0	122.8	21,606		0.496	109,537	2.515		
	9.60		176.8	123.6	21,846		0.502	111,710	2.565		
	9.70		177.6	124.4	22,087		0.507	113,906	2.615		

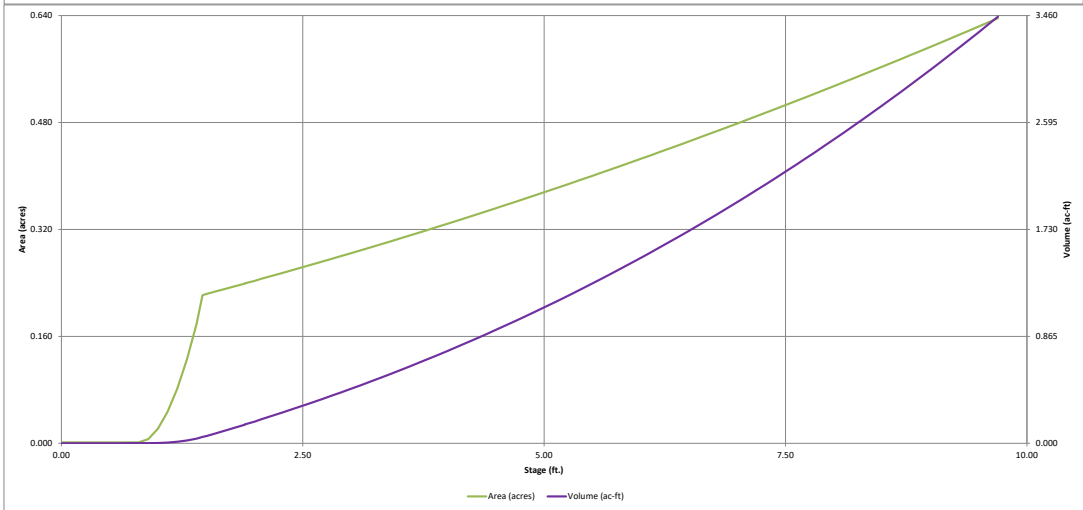
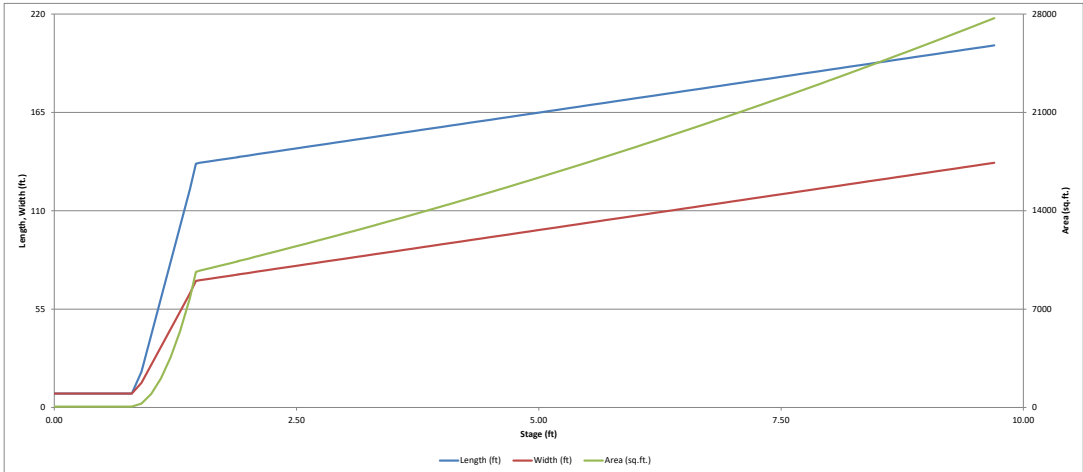
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

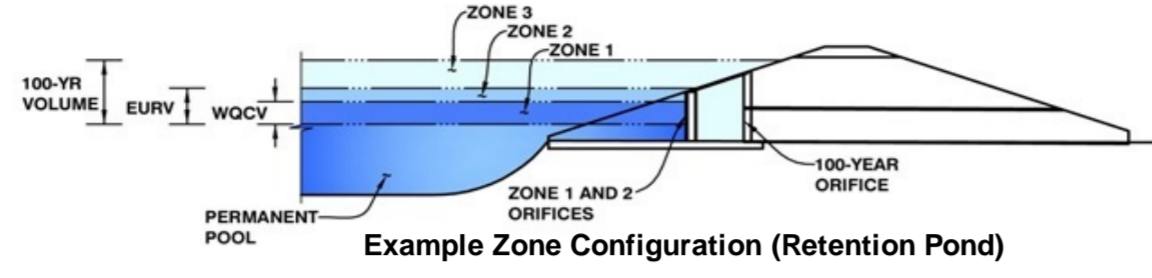
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Front Range - Midway Solar
Basin ID: A8



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Table listing required volume calculations including Watershed Area (87.81 acres), Watershed Length (2.421 ft), Watershed Slope (0.024 ft/ft), Watershed Imperviousness (3.90%), Percentage Hydrologic Soil Groups A, B, and C/D, and various runoff and detention volumes for different return periods.

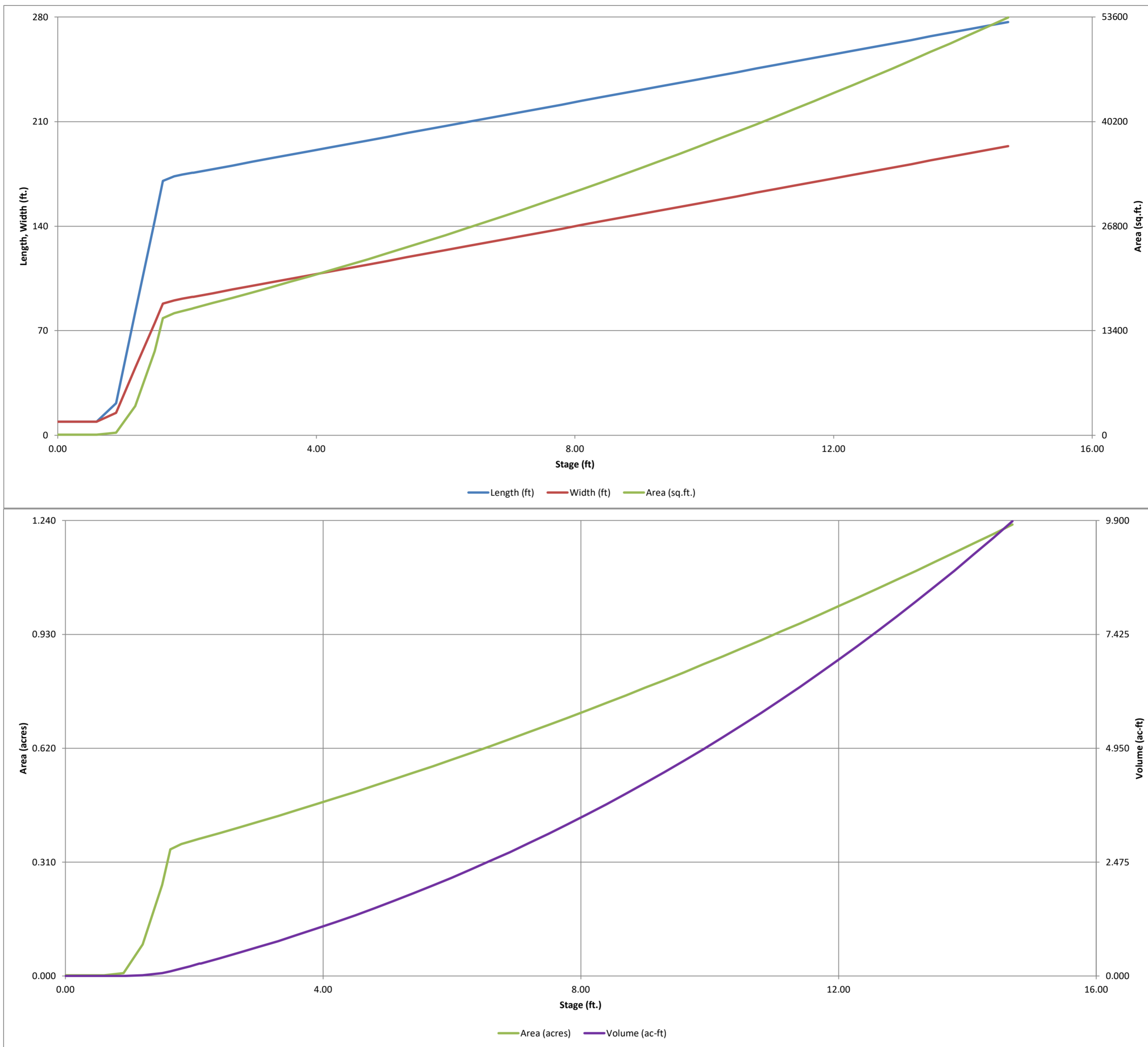
Stage-Storage Calculation

Table listing stage-storage calculations including Zone 1 Volume (0.210 acre-feet), Zone 2 Volume (0.054 acre-feet), Zone 3 Volume (1.871 acre-feet), Total Detention Basin Volume (2.136 acre-feet), Initial Surcharge Volume (ISV) (27 ft^3), Initial Surcharge Depth (ISD) (0.33 ft), Total Available Detention Depth (H_tot) (6.00 ft), Depth of Trickle Channel (H_TC) (0.50 ft), Slope of Trickle Channel (S_TC) (0.005 ft/ft), Slopes of Main Basin Sides (S MAIN) (4 H:V), Basin Length-to-Width Ratio (R_L/W) (2), Initial Surcharge Area (A_ISV) (83 ft^2), Surcharge Volume Length (L_ISV) (9.1 ft), Surcharge Volume Width (W_ISV) (9.1 ft), Depth of Basin Floor (H_FLOOR) (0.80 ft), Length of Basin Floor (L_FLOOR) (172.0 ft), Width of Basin Floor (W_FLOOR) (89.0 ft), Area of Basin Floor (A_FLOOR) (15,306 ft^2), Volume of Basin Floor (V_FLOOR) (4,397 ft^3), Depth of Main Basin (H_MAIN) (4.37 ft), Length of Main Basin (L_MAIN) (207.0 ft), Width of Main Basin (W_MAIN) (123.9 ft), Area of Main Basin (A_MAIN) (25,657 ft^2), Volume of Main Basin (V_MAIN) (88,563 ft^3), and Calculated Total Basin Volume (V_TOT) (2,136 acre-feet).

Main stage-storage table with columns: 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), and Volume (ac-ft). Rows include Top of Micropool, ISV, Floor, Zone 1 (WQCV), Zone 2 (EURV), and Zone 3 (100-year) stages.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

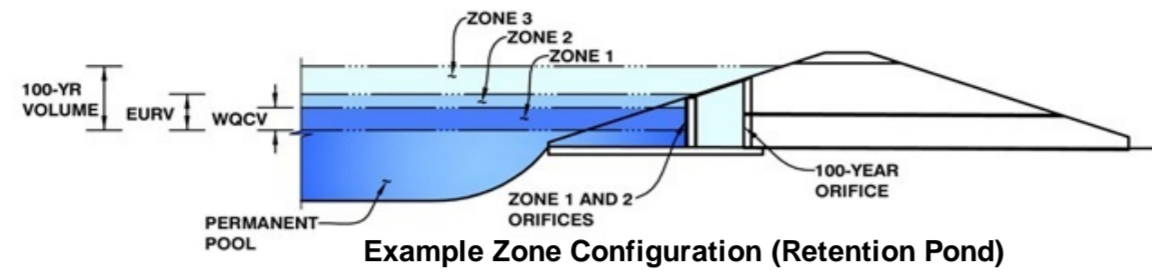
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**
Basin ID: **A9**



Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	32.86	acres
Watershed Length =	1,854	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	5.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.103	acre-feet
Excess Urban Runoff Volume (EURV) =	0.135	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.113	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.358	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.064	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.105	acre-feet
Approximate 5-yr Detention Volume =	0.344	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.903	acre-feet

Optional User Override 1-hr Precipitation
1.19 inches
1.50 inches
2.52 inches

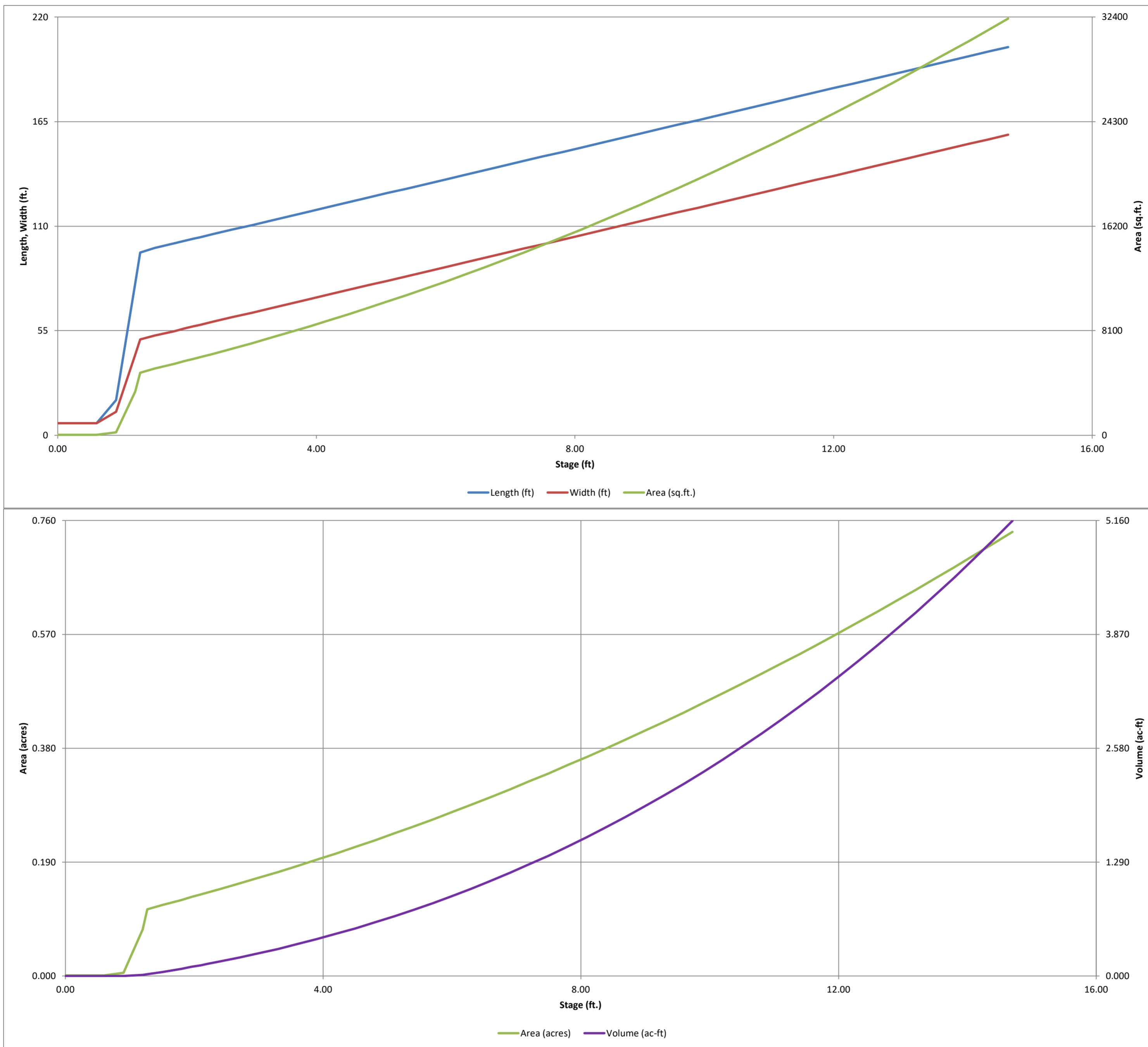
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.103	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.032	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.768	acre-feet
Total Detention Basin Volume =	0.903	acre-feet
Initial Surge Volume (ISV) =	13	ft³
Initial Surge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surge Area (A _{ISV}) =	41	ft²
Surcharge Volume Length (L _{SV}) =	6.4	ft
Surcharge Volume Width (W _{SV}) =	6.4	ft
Depth of Basin Floor (H _{FLOOR}) =	0.44	ft
Length of Basin Floor (L _{FLOOR}) =	96.7	ft
Width of Basin Floor (W _{FLOOR}) =	50.7	ft
Area of Basin Floor (A _{FLOOR}) =	4,903	ft²
Volume of Basin Floor (V _{FLOOR}) =	796	ft³
Depth of Main Basin (H _{MAIN}) =	4.73	ft
Length of Main Basin (L _{MAIN}) =	134.6	ft
Width of Main Basin (W _{MAIN}) =	88.5	ft
Area of Main Basin (A _{MAIN}) =	11,907	ft²
Volume of Main Basin (V _{MAIN}) =	38,526	ft³
Calculated Total Basin Volume (V _{total}) =	0.903	acre-feet

Depth Increment =	0.3		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)
Top of Micropool	0.00		6.4	6.4	41		0.001		
ISV	0.33		6.4	6.4	41		0.001	13	0.000
	0.60		6.4	6.4	41		0.001	24	0.001
	0.90		18.6	12.4	230		0.005	41	0.001
	1.20		79.8	42.4	3,382		0.078	491	0.011
Floor	1.27		96.1	50.4	4,843		0.111	818	0.019
	1.50		98.5	52.4	5,161		0.118	1,925	0.044
	1.80		100.9	54.8	5,529		0.127	3,528	0.081
Zone 1 (WQCV)	1.96		102.2	56.2	5,743		0.132	4,486	0.103
	2.10		103.4	57.3	5,922		0.136	5,303	0.122
Zone 2 (EURV)	2.20		104.2	58.1	6,051		0.139	5,901	0.135
	2.40		105.8	59.7	6,313		0.145	7,138	0.164
	2.70		108.2	62.1	6,716		0.154	9,092	0.209
	3.00		110.6	64.5	7,130		0.164	11,168	0.256
	3.30		113.0	66.9	7,556		0.173	13,371	0.307
	3.60		115.4	69.3	7,993		0.184	15,703	0.360
	3.90		117.8	71.7	8,442		0.194	18,168	0.417
	4.20		120.2	74.1	8,903		0.204	20,770	0.477
	4.50		122.6	76.5	9,375		0.215	23,511	0.540
	4.80		125.0	78.9	9,858		0.226	26,396	0.606
	5.10		127.4	81.3	10,353		0.238	29,427	0.676
	5.40		129.8	83.7	10,860		0.249	32,609	0.749
	5.70		132.2	86.1	11,378		0.261	35,944	0.825
Zone 3 (100-year)	6.00		134.6	88.5	11,907		0.273	39,437	0.905
	6.30		137.0	90.9	12,449		0.286	43,090	0.989
	6.60		139.4	93.3	13,001		0.298	46,907	1.077
	6.90		141.8	95.7	13,565		0.311	50,892	1.168
	7.20		144.2	98.1	14,141		0.325	55,047	1.264
	7.50		146.6	100.5	14,728		0.338	59,377	1.363
	7.80		149.0	102.9	15,327		0.352	63,885	1.467
	8.10		151.4	105.3	15,937		0.366	68,575	1.574
	8.40		153.8	107.7	16,559		0.380	73,449	1.686
	8.70		156.2	110.1	17,192		0.395	78,511	1.802
	9.00		158.6	112.5	17,837		0.409	83,765	1.923
	9.30		161.0	114.9	18,493		0.425	89,214	2.048
	9.60		163.4	117.3	19,161		0.440	94,862	2.178
	9.90		165.8	119.7	19,840		0.455	100,712	2.312
	10.20		168.2	122.1	20,531		0.471	106,767	2.451
	10.50		170.6	124.5	21,233		0.487	113,032	2.595
	10.80		173.0	126.9	21,947		0.504	119,508	2.744
	11.10		175.4	129.3	22,673		0.520	126,201	2.897
	11.40		177.8	131.7	23,410		0.537	133,113	3.056
	11.70		180.2	134.1	24,158		0.555	140,248	3.220
	12.00		182.6	136.5	24,918		0.572	147,609	3.389
	12.30		185.0	138.9	25,689		0.590	155,200	3.563
	12.60		187.4	141.3	26,472		0.608	163,024	3.743
	12.90		189.8	143.7	27,267		0.626	171,085	3.928
	13.20		192.2	146.1	28,073		0.644	179,385	4.118
	13.50		194.6	148.5	28,891		0.663	187,929	4.314
	13.80		197.0	150.9	29,720		0.682	196,721	4.516
	14.10		199.4	153.3	30,560		0.702	205,762	4.724
	14.40		201.8	155.7	31,412		0.721	215,058	4.937
	14.70		204.2	158.1	32,276		0.741	224,611	5.156

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

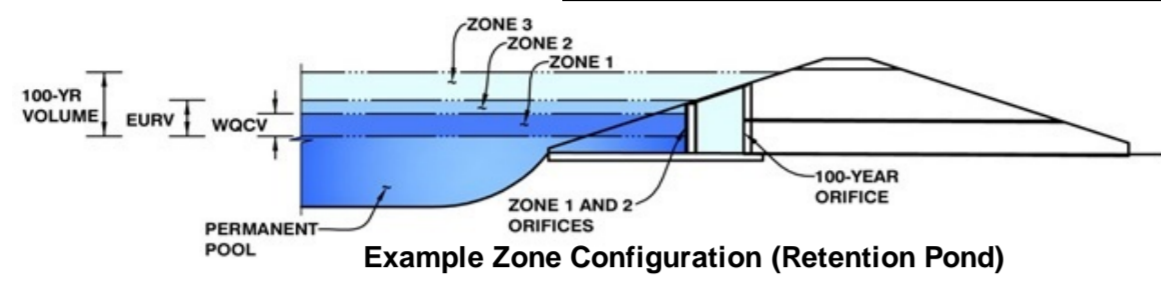
UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Front Range - Midway Solar
Basin ID: A10



Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	263.34	acres
Watershed Length =	7.992	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	3.50%	percent
Percentage Hydrologic Soil Group A =	5.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	95.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.568	acre-feet
Excess Urban Runoff Volume (EURV) =	0.695	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.565	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.225	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	30.934	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.526	acre-feet
Approximate 5-yr Detention Volume =	2.150	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.991	acre-feet

Optional User Override	
1-hr Precipitation	
1.19	inches
1.50	inches
	inches
	inches
	inches
2.52	inches
	inches

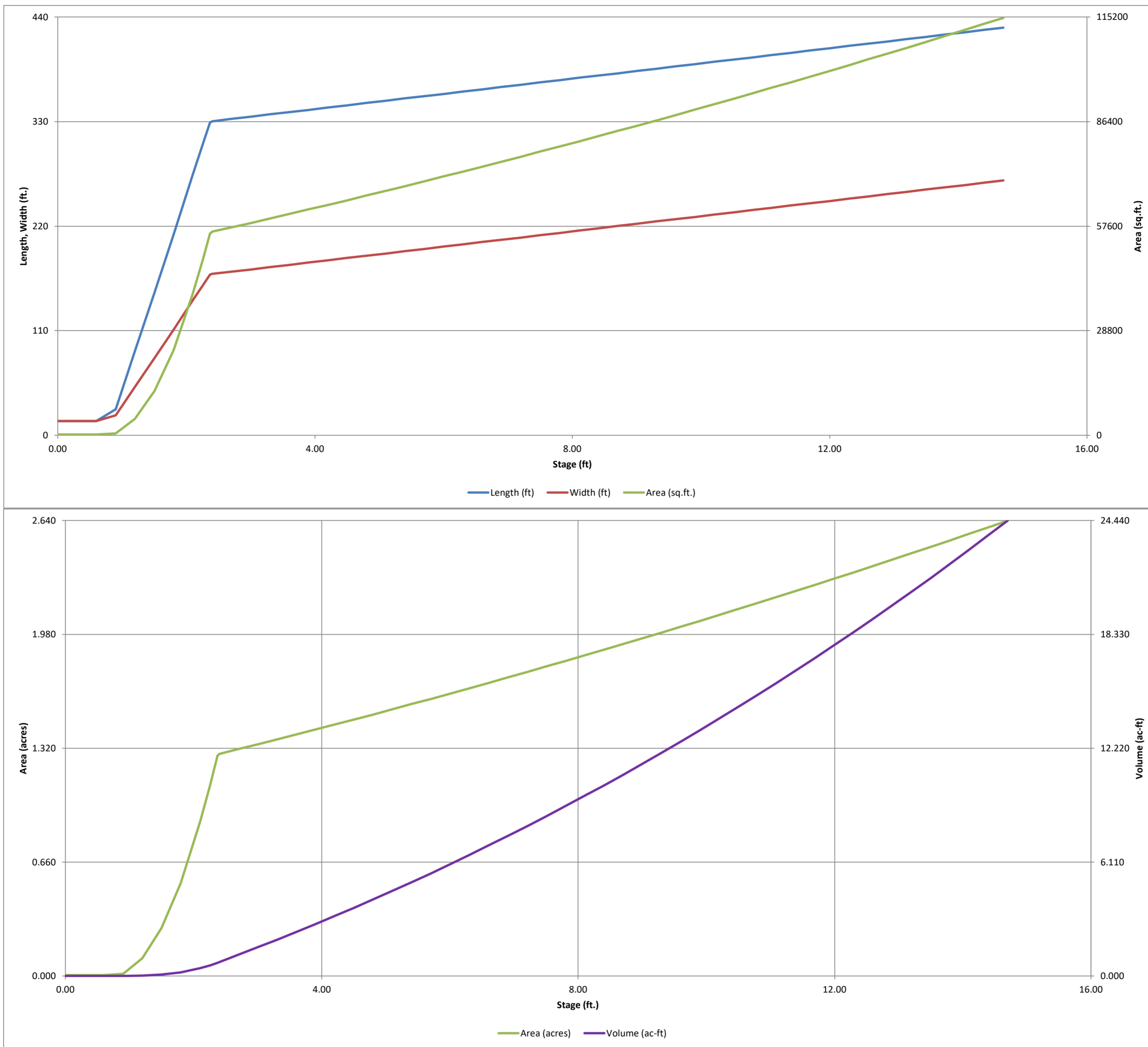
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.568	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.297	acre-feet
Total Detention Basin Volume =	5.991	acre-feet
Initial Surcharge Volume (ISV) =	74	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	225	ft ²
Surcharge Volume Length (L _{ISV}) =	15.0	ft
Surcharge Volume Width (W _{ISV}) =	15.0	ft
Depth of Basin Floor (H _{FLOOR}) =	1.54	ft
Length of Basin Floor (L _{FLOOR}) =	330.1	ft
Width of Basin Floor (W _{FLOOR}) =	169.5	ft
Area of Basin Floor (A _{FLOOR}) =	55,951	ft ²
Volume of Basin Floor (V _{FLOOR}) =	30,753	ft ³
Depth of Main Basin (H _{MAIN}) =	3.63	ft
Length of Main Basin (L _{MAIN}) =	359.1	ft
Width of Main Basin (W _{MAIN}) =	198.5	ft
Area of Main Basin (A _{MAIN}) =	71,281	ft ²
Volume of Main Basin (V _{MAIN}) =	230,060	ft ³
Calculated Total Basin Volume (V _{TOTAL}) =	5,992	acre-feet

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)
Depth Increment = 0.3 ft									
Top of Micropool	0.00		15.0	15.0	225		0.005		
ISV	0.33		15.0	15.0	225		0.005	72	0.002
	0.60		15.0	15.0	225		0.005	133	0.003
	0.90		27.2	21.0	572		0.013	210	0.005
	1.20		88.4	51.0	4,510		0.104	880	0.020
	1.50		149.6	81.0	12,120		0.278	3,283	0.075
	1.80		210.8	111.0	23,402		0.537	8,520	0.196
	2.10		274.1	142.0	38,918		0.893	18,078	0.415
Zone 1 (WQCV)	2.26		306.7	158.0	48,460		1.112	25,054	0.575
Zone 2 (EURV)	2.37		329.2	169.0	55,627		1.277	30,775	0.706
Floor	2.37		329.2	169.0	55,627		1.277	30,775	0.706
	2.40		330.3	169.7	56,051		1.287	32,453	0.745
	2.70		332.7	172.1	57,257		1.314	49,449	1.135
	3.00		335.1	174.5	58,474		1.342	66,808	1.534
	3.30		337.5	176.9	59,703		1.371	84,535	1.941
	3.60		339.9	179.3	60,944		1.399	102,631	2.356
	3.90		342.3	181.7	62,196		1.428	121,102	2.780
	4.20		344.7	184.1	63,459		1.457	139,950	3.213
	4.50		347.1	186.5	64,734		1.486	159,178	3.654
	4.80		349.5	188.9	66,020		1.516	178,791	4.104
	5.10		351.9	191.3	67,318		1.545	198,792	4.564
	5.40		354.3	193.7	68,628		1.575	219,183	5.032
	5.70		356.7	196.1	69,949		1.606	239,970	5.509
Zone 3 (100-year)	6.00		359.1	198.5	71,281		1.636	261,154	5.995
	6.30		361.5	200.9	72,625		1.667	282,739	6.491
	6.60		363.9	203.3	73,981		1.698	304,730	6.996
	6.90		366.3	205.7	75,348		1.730	327,129	7.510
	7.20		368.7	208.1	76,727		1.761	349,940	8.034
	7.50		371.1	210.5	78,117		1.793	373,166	8.567
	7.80		373.5	212.9	79,518		1.825	396,811	9.110
	8.10		375.9	215.3	80,931		1.858	420,878	9.662
	8.40		378.3	217.7	82,356		1.891	445,371	10.224
	8.70		380.7	220.1	83,792		1.924	470,293	10.796
	9.00		383.1	222.5	85,240		1.957	495,648	11.379
	9.30		385.5	224.9	86,699		1.990	521,438	11.971
	9.60		387.9	227.3	88,170		2.024	547,668	12.573
	9.90		390.3	229.7	89,652		2.058	574,342	13.185
	10.20		392.7	232.1	91,146		2.092	601,461	13.808
	10.50		395.1	234.5	92,651		2.127	629,030	14.441
	10.80		397.5	236.9	94,168		2.162	657,053	15.084
	11.10		399.9	239.3	95,697		2.197	685,532	15.738
	11.40		402.3	241.7	97,237		2.232	714,472	16.402
	11.70		404.7	244.1	98,788		2.268	743,876	17.077
	12.00		407.1	246.5	100,351		2.304	773,746	17.763
	12.30		409.5	248.9	101,925		2.340	804,087	18.459
	12.60		411.9	251.3	103,511		2.376	834,902	19.167
	12.90		414.3	253.7	105,109		2.413	866,195	19.885
	13.20		416.7	256.1	106,718		2.450	897,969	20.615
	13.50		419.1	258.5	108,338		2.487	930,227	21.355
	13.80		421.5	260.9	109,970		2.525	962,973	22.107
	14.10		423.9	263.3	111,614		2.562	996,210	22.870
	14.40		426.3	265.7	113,269		2.600	1,029,942	23.644
	14.70		428.7	268.1	114,936		2.639	1,064,173	24.430

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

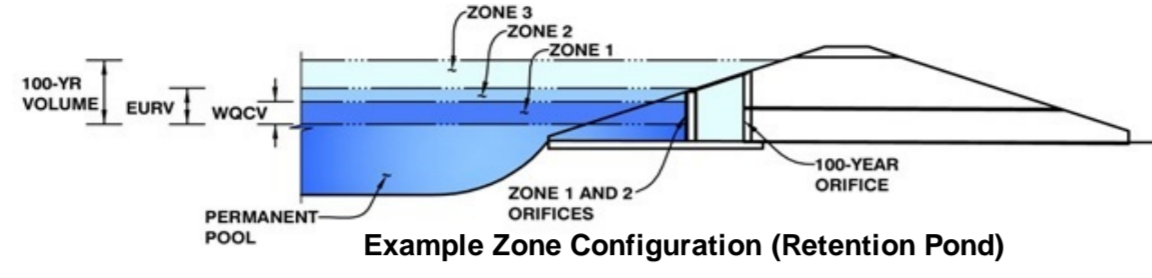


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A11**



Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	224.01	acres
Watershed Length =	8,048	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	3.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.509	acre-feet
Excess Urban Runoff Volume (EURV) =	0.637	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.523	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.028	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	27.367	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.488	acre-feet
Approximate 5-yr Detention Volume =	1.959	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	5.329	acre-feet

1.19	inches
1.50	inches
2.52	inches

**Optional User Override
1-hr Precipitation**

Stage-Storage Calculation

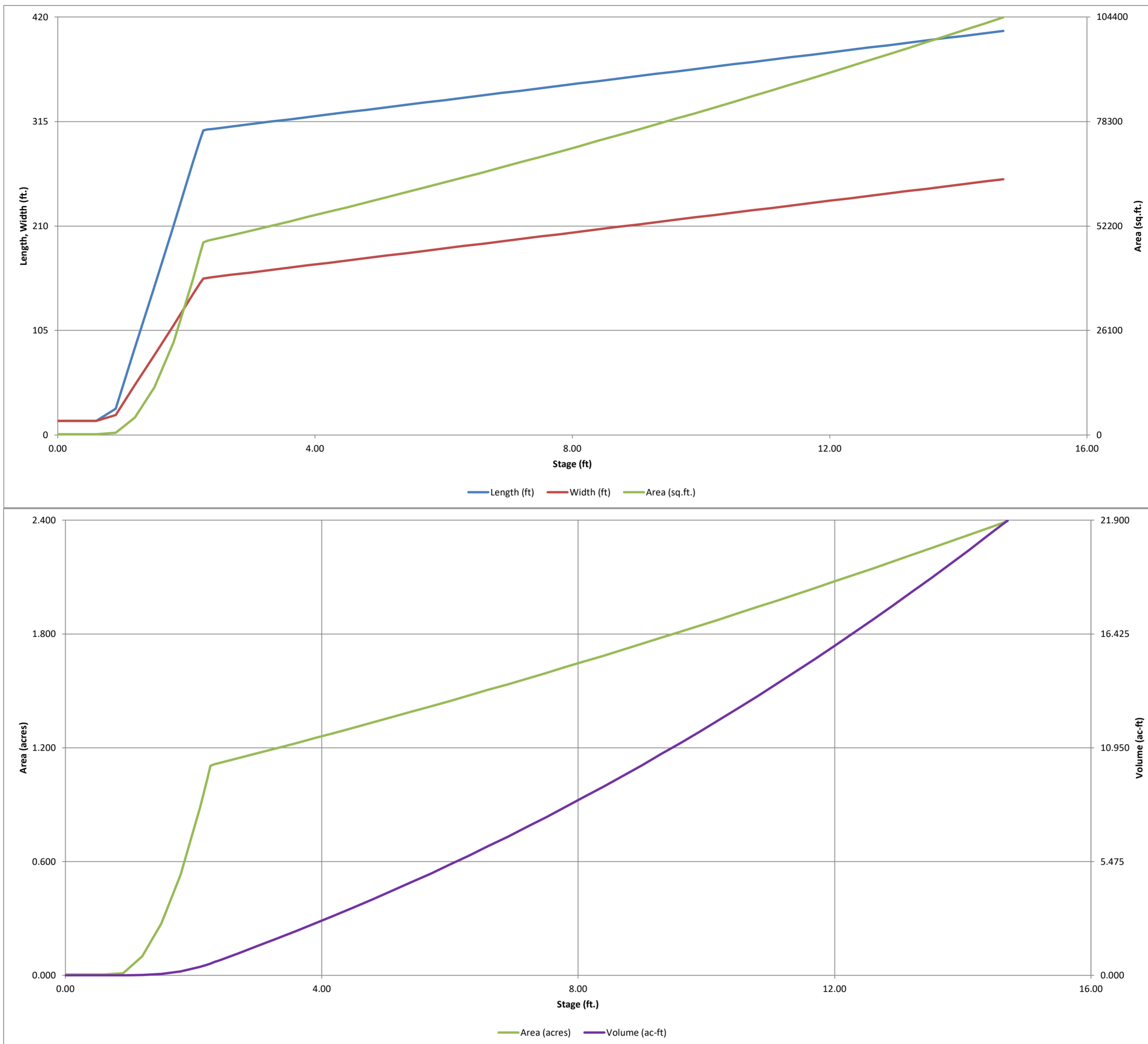
Zone 1 Volume (WQCV) =	0.509	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.127	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.692	acre-feet
Total Detention Basin Volume =	5.329	acre-feet
Initial Surcharge Volume (ISV) =	67	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	202	ft ²
Surcharge Volume Length (L _{ISV}) =	14.2	ft
Surcharge Volume Width (W _{ISV}) =	14.2	ft
Depth of Basin Floor (H _{FLOOR}) =	1.43	ft
Length of Basin Floor (L _{FLOOR}) =	306.5	ft
Width of Basin Floor (W _{FLOOR}) =	157.5	ft
Area of Basin Floor (A _{FLOOR}) =	48,260	ft ²
Volume of Basin Floor (V _{FLOOR}) =	24,633	ft ³
Depth of Main Basin (H _{MAIN}) =	3.74	ft
Length of Main Basin (L _{MAIN}) =	336.4	ft
Width of Main Basin (W _{MAIN}) =	187.4	ft
Area of Main Basin (A _{MAIN}) =	63,025	ft ²
Volume of Main Basin (V _{MAIN}) =	207,340	ft ³
Calculated Total Basin Volume (V _{total}) =	5.329	acre-feet

Depth Increment = 0.3 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		14.2	14.2	202		0.005		
ISV	0.33		14.2	14.2	202		0.005	65	0.001
	0.60		14.2	14.2	202		0.005	119	0.003
	0.90		26.4	20.2	534		0.012	189	0.004
	1.20		87.6	50.2	4,400		0.101	837	0.019
	1.50		148.8	80.2	11,937		0.274	3,196	0.073
	1.80		210.0	110.2	23,146		0.531	8,366	0.192
	2.10		273.3	141.2	38,587		0.886	17,834	0.409
Zone 1 (WQCV)	2.21		295.7	152.2	45,009		1.033	22,427	0.515
Floor	2.26		305.9	157.2	48,091		1.104	24,754	0.568
Zone 2 (EURV)	2.33		307.0	158.0	48,510		1.114	28,140	0.646
	2.40		307.6	158.6	48,771		1.120	31,545	0.724
	2.70		310.0	161.0	49,895		1.145	46,344	1.064
	3.00		312.4	163.4	51,031		1.172	61,483	1.411
	3.30		314.8	165.8	52,179		1.198	76,964	1.767
	3.60		317.2	168.2	53,338		1.224	92,791	2.130
	3.90		319.6	170.6	54,508		1.251	108,968	2.502
	4.20		322.0	173.0	55,691		1.278	125,498	2.881
	4.50		324.4	175.4	56,884		1.306	142,383	3.269
	4.80		326.8	177.8	58,089		1.334	159,629	3.665
	5.10		329.2	180.2	59,306		1.361	177,238	4.069
	5.40		331.6	182.6	60,534		1.390	195,214	4.481
	5.70		334.0	185.0	61,774		1.418	213,560	4.903
Zone 3 (100-year)	6.00		336.4	187.4	63,025		1.447	232,279	5.332
	6.30		338.8	189.8	64,288		1.476	251,376	5.771
	6.60		341.2	192.2	65,562		1.505	270,853	6.218
	6.90		343.6	194.6	66,848		1.535	290,714	6.674
	7.20		346.0	197.0	68,145		1.564	310,963	7.139
	7.50		348.4	199.4	69,454		1.594	331,602	7.613
	7.80		350.8	201.8	70,774		1.625	352,636	8.095
	8.10		353.2	204.2	72,106		1.655	374,068	8.587
	8.40		355.6	206.6	73,449		1.686	395,901	9.089
	8.70		358.0	209.0	74,804		1.717	418,139	9.599
	9.00		360.4	211.4	76,171		1.749	440,785	10.119
	9.30		362.8	213.8	77,549		1.780	463,842	10.648
	9.60		365.2	216.2	78,938		1.812	487,315	11.187
	9.90		367.6	218.6	80,339		1.844	511,206	11.736
	10.20		370.0	221.0	81,752		1.877	535,520	12.294
	10.50		372.4	223.4	83,176		1.909	560,258	12.862
	10.80		374.8	225.8	84,611		1.942	585,426	13.440
	11.10		377.2	228.2	86,058		1.976	611,026	14.027
	11.40		379.6	230.6	87,517		2.009	637,062	14.625
	11.70		382.0	233.0	88,987		2.043	663,537	15.233
	12.00		384.4	235.4	90,468		2.077	690,455	15.851
	12.30		386.8	237.8	91,962		2.111	717,820	16.479
	12.60		389.2	240.2	93,466		2.146	745,633	17.117
	12.90		391.6	242.6	94,982		2.180	773,900	17.766
	13.20		394.0	245.0	96,510		2.216	802,624	18.426
	13.50		396.4	247.4	98,049		2.251	831,808	19.096
	13.80		398.8	249.8	99,600		2.287	861,455	19.776
	14.10		401.2	252.2	101,162		2.322	891,569	20.468
	14.40		403.6	254.6	102,736		2.358	922,153	21.170
	14.70		406.0	257.0	104,321		2.395	953,211	21.883

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

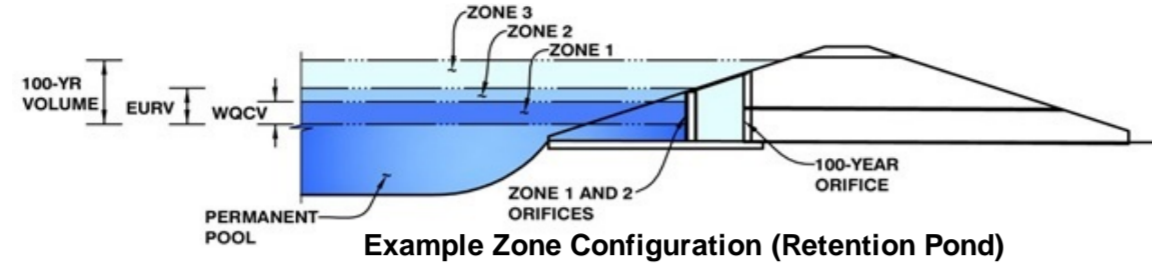


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Front Range - Midway Solar**

Basin ID: **A12**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	10.97	acres
Watershed Length =	444	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	6.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.043	acre-feet
Excess Urban Runoff Volume (EURV) =	0.059	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.050	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.140	acre-feet
10-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
25-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
50-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.373	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.047	acre-feet
Approximate 5-yr Detention Volume =	0.134	acre-feet
Approximate 10-yr Detention Volume =	0.000	acre-feet
Approximate 25-yr Detention Volume =	0.000	acre-feet
Approximate 50-yr Detention Volume =	0.000	acre-feet
Approximate 100-yr Detention Volume =	0.337	acre-feet

Note: L / W Ratio < 1
L / W Ratio = 0.4

Optional User Override 1-hr Precipitation	1.19	inches
	1.50	inches
		inches
		inches
		inches
	2.52	inches
		inches

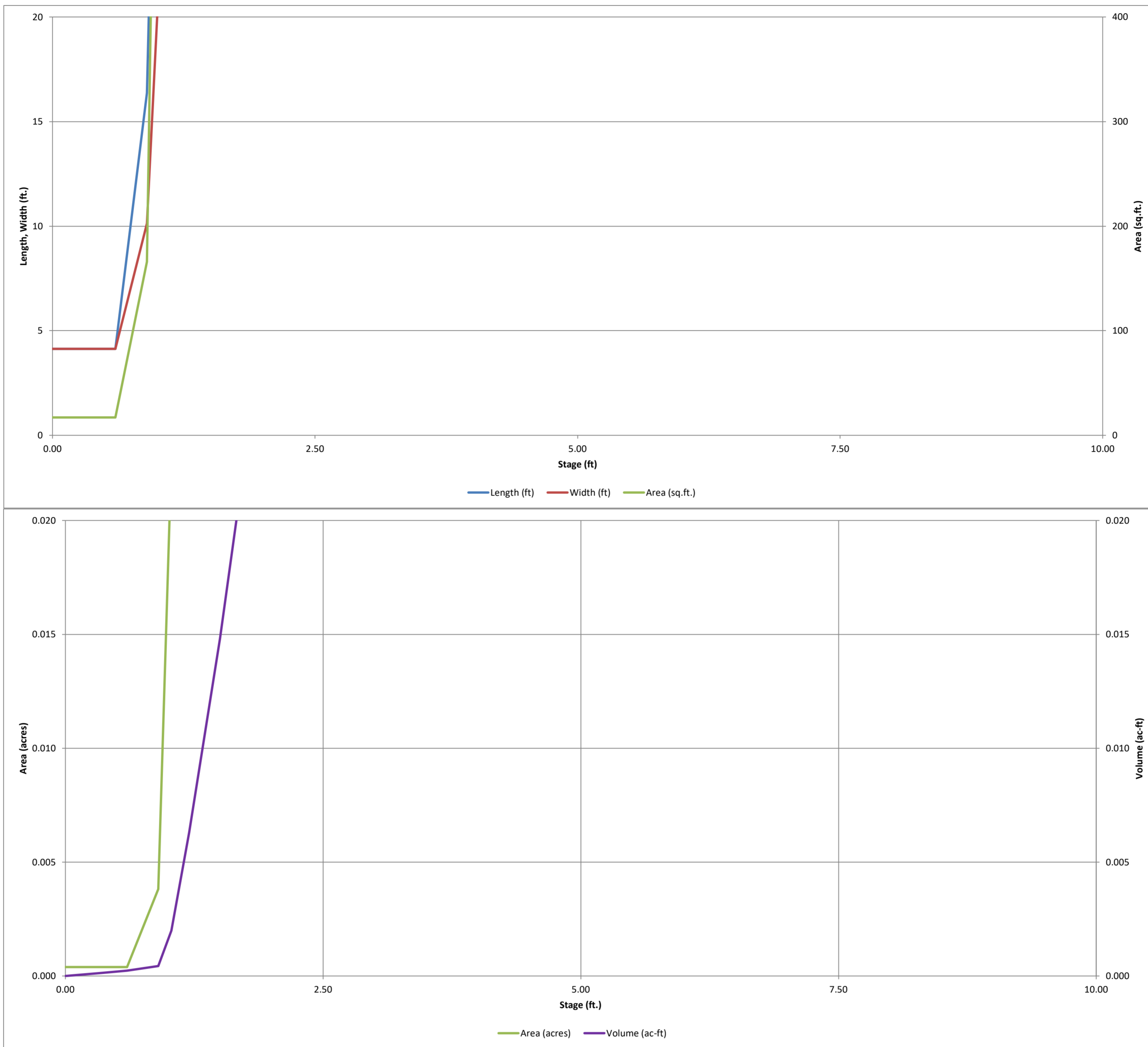
Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.016	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.278	acre-feet
Total Detention Basin Volume =	0.337	acre-feet
Initial Surcharge Volume (ISV) =	6	ft ³
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H _{total}) =	6.00	ft
Depth of Trickle Channel (H _{TC}) =	0.50	ft
Slope of Trickle Channel (S _{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S _{main}) =	4	H:V
Basin Length-to-Width Ratio (R _{L/W}) =	2	
Initial Surcharge Area (A _{ISV}) =	17	ft ²
Surcharge Volume Length (L _{ISV}) =	4.1	ft
Surcharge Volume Width (W _{ISV}) =	4.1	ft
Depth of Basin Floor (H _{FLOOR}) =	0.20	ft
Length of Basin Floor (L _{FLOOR}) =	44.4	ft
Width of Basin Floor (W _{FLOOR}) =	23.9	ft
Area of Basin Floor (A _{FLOOR}) =	1,059	ft ²
Volume of Basin Floor (V _{FLOOR}) =	80	ft ³
Depth of Main Basin (H _{MAIN}) =	4.97	ft
Length of Main Basin (L _{MAIN}) =	84.2	ft
Width of Main Basin (W _{MAIN}) =	63.6	ft
Area of Main Basin (A _{MAIN}) =	5,357	ft ²
Volume of Main Basin (V _{MAIN}) =	14,583	ft ³
Calculated Total Basin Volume (V _{total}) =	0.337	acre-feet

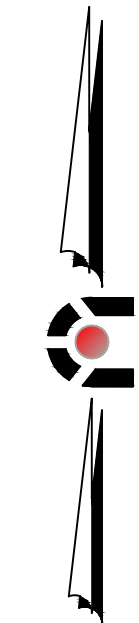
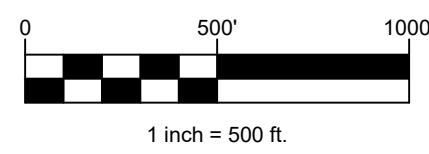
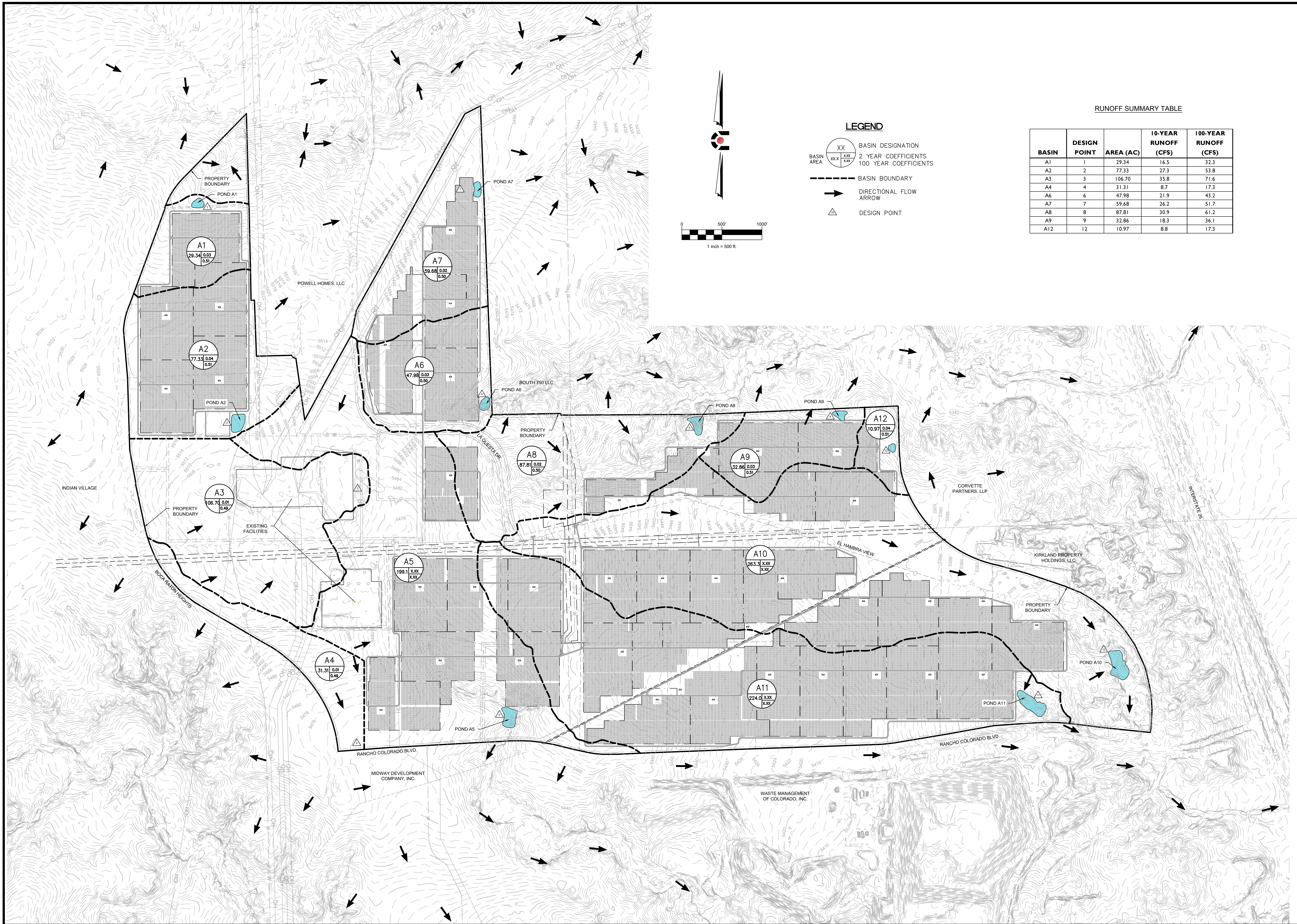
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		4.1	4.1	17		0.000		
ISV	0.33		4.1	4.1	17		0.000	5	0.000
	0.60		4.1	4.1	17		0.000	10	0.000
Floor	0.90		16.4	10.1	166		0.004	19	0.000
	1.03		42.9	23.1	992		0.023	87	0.002
Zone 1 (WQCV)	1.20		45.7	25.2	1,150		0.026	274	0.006
	1.50		48.1	27.6	1,325		0.030	645	0.015
	1.80		50.5	30.0	1,513		0.035	1,070	0.025
	2.10		53.0	32.4	1,718		0.039	1,571	0.036
	2.28		54.4	33.9	1,843		0.042	1,891	0.043
Zone 2 (EURV)	2.40		55.4	34.8	1,929		0.044	2,118	0.049
	2.63		57.2	36.7	2,099		0.048	2,581	0.059
	2.70		57.8	37.2	2,151		0.049	2,729	0.063
	3.00		60.2	39.6	2,385		0.055	3,410	0.078
	3.30		62.6	42.0	2,630		0.060	4,162	0.096
Zone 3 (100-year)	3.60		65.0	44.4	2,887		0.066	4,989	0.115
	3.90		67.4	46.8	3,156		0.072	5,895	0.135
	4.20		69.8	49.2	3,436		0.079	6,884	0.158
	4.50		72.2	51.6	3,727		0.086	7,958	0.183
	4.80		74.6	54.0	4,030		0.093	9,121	0.209
	5.10		77.0	56.4	4,344		0.100	10,377	0.238
	5.40		79.4	58.8	4,670		0.107	11,729	0.269
	5.70		81.8	61.2	5,008		0.115	13,180	0.303
	5.99		84.1	63.6	5,345		0.123	14,681	0.337
	6.00		84.2	63.6	5,357		0.123	14,734	0.338
6.30		86.6	66.0	5,717		0.131	16,395	0.376	
6.60		89.0	68.4	6,089		0.140	18,166	0.417	
6.90		91.4	70.8	6,473		0.149	20,050	0.460	
7.20		93.8	73.2	6,868		0.158	22,050	0.506	
7.50		96.2	75.6	7,274		0.167	24,171	0.555	
7.80		98.6	78.0	7,692		0.177	26,416	0.606	
8.10		101.0	80.4	8,122		0.186	28,788	0.661	
8.40		103.4	82.8	8,563		0.197	31,291	0.718	
8.70		105.8	85.2	9,016		0.207	33,927	0.779	
9.00		108.2	87.6	9,480		0.218	36,701	0.843	
9.30		110.6	90.0	9,956		0.229	39,616	0.909	
9.60		113.0	92.4	10,443		0.240	42,676	0.980	
9.90		115.4	94.8	10,942		0.251	45,883	1.053	
10.20		117.8	97.2	11,452		0.263	49,242	1.130	
10.50		120.2	99.6	11,974		0.275	52,756	1.211	
10.80		122.6	102.0	12,507		0.287	56,427	1.295	
11.10		125.0	104.4	13,052		0.300	60,261	1.383	
11.40		127.4	106.8	13,608		0.312	64,260	1.475	
11.70		129.8	109.2	14,176		0.325	68,427	1.571	
12.00		132.2	111.6	14,755		0.339	72,766	1.670	
12.30		134.6	114.0	15,346		0.352	77,281	1.774	
12.60		137.0	116.4	15,949		0.366	81,975	1.882	
12.90		139.4	118.8	16,563		0.380	86,852	1.994	
13.20		141.8	121.2	17,188		0.395	91,914	2.110	
13.50		144.2	123.6	17,825		0.409	97,166	2.231	
13.80		146.6	126.0	18,474		0.424	102,610	2.356	
14.10		149.0	128.4	19,134		0.439	108,251	2.485	
14.40		151.4	130.8	19,805		0.455	114,092	2.619	
14.70		153.8	133.2	20,488		0.470	120,135	2.758	

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



December 21, 2015, X:\174202 FRONT RANGE MIDWAY SOLAR DEVELOPMENT REPORT\DRAWINGS\DRAINAGE\MAPS\CD-DRAIN\MAP DWG - 001.LAR



LEGEND

- XX
XXX
XXX BASIN DESIGNATION
- XX
XXX
XXX 2 YEAR COEFFICIENTS
- XX
XXX
XXX 100 YEAR COEFFICIENTS
- BASIN BOUNDARY
- ➔ DIRECTIONAL FLOW ARROW
- △ DESIGN POINT

RUNOFF SUMMARY TABLE

BASIN	DESIGN POINT	AREA (AC)	10-YEAR RUNOFF (CFS)	100-YEAR RUNOFF (CFS)
A1	1	29.34	16.5	32.3
A2	2	77.33	27.3	53.8
A3	3	106.70	35.8	71.6
A4	4	31.31	8.7	17.3
A6	6	47.98	21.9	43.2
A7	7	59.68	26.2	51.7
A8	8	87.81	30.9	61.2
A9	9	32.86	18.3	36.1
A12	12	10.97	8.8	17.3

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 CORE ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS, HORIZONTAL AND VERTICAL ALIGNMENT, DEPTH, OR ANY OTHER INFORMATION. IT IS THE USER'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL UTILITIES FROM THE COMPETENCY OF ANY CONSTRUCTION ACTIVITIES.



REVISIONS	DATE	BY
#	DESCRIPTION	

FRONT RANGE MIDWAY SOLAR
OVERALL DRAINAGE MAP
FOUNTAIN, CO

INITIAL PLAN
 RELEASE: 12/12/2017
 DESIGNED BY: GMV
 DRAWN BY: GMV
 CHECKED BY: DB

JOB NO.
 17-012
 SHEET
 1 OF 1

CIVIL ENGINEERING
 DEVELOPMENT CONSULTING
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