

April 08, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



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**RE: HOMESTEAD FILING 2 – PRELIMINARY ACCEPTANCE PUNCHLIST FOR FULL SPECTRUM DETENTION POND 1**

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Dear Mr. Reese,

The El Paso County punchlist from 11/28/2023 site walk identified a few inconsistencies within Pond 1 when compared to the approved construction documents.

1. Micro screen installed with V-wire bars are horizontal and not vertical
2. Pond outfall not installed per plans. Plunge pool approved, 8' x 30' riprap pad installed. Discuss need for concrete cut-off wall
3. Shown plain riprap around forebay, instead of soil riprap
4. Restrictor Plate Height
5. Flat portion of Section A-A (spillway) is installed at less than 20 ft wide.

Horizontal Microscreen

In response to the horizontal V-wire microscreen, the Sterling Ranch Metro District is responsible for maintenance of this pond and is aware the horizontal V-wire orientation will need to be monitored and cleaned more frequently than a vertical orientation. Additionally, the horizontal V-wire performs as intended and functionality is not adversely affected by a horizontal orientation, with the necessary monitoring and maintenance. Therefore, I recommend that the microscreen be accepted "as-is".

Pond Outfall

The pond outfall was constructed with an 8' x 30' Type L riprap pad. The riprap pad provides the necessary energy dissipation for the pond outfall. See attached riprap sizing for verification. This as-built condition is temporary, as the outfall will be modified to discharge onto a grouted boulder drop-structure with the Sand Creek Channel Improvements. Therefore, I recommend that the riprap pad as constructed be accepted as the Pond 1 outfall erosion protection. A concrete cut-off wall is not necessary in our opinion. Any undermining should be filled with Type L Riprap, should it occur. We believe the observed undermining was a result of incomplete riprap placement.

Forebay Riprap

The reason for calling out soil riprap for the forebay protection is that soil riprap gives a finished look and can be revegetated, however; both clean riprap and soil riprap are acceptable erosion protection treatments around the forebay. Therefore, I recommend the clean riprap remain around the forebay.

Restrictor Plate Height

The approved construction plans called out a restrictor plate height of 21.75" above the outfall pipe invert, however the UD-Detention workbook included in the approved FDR specified a height of 13.3". The plate was installed at 14" above the as-built invert, according to surveyed data. The as-built plans and as-built UD-Detention workbook reflect this as-built condition.

### Spillway Width

The spillway was proposed at 20' in the approved construction documents. However, it was constructed 16' wide. The UD-Detention 3.07 spreadsheet for Pond 1 has been updated with the 16' spillway width and confirms the spillway will pass the undetained 100-year flow with 1.0' freeboard. Therefore, I recommend the 16' spillway remain as is.

Respectfully submitted,



**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

530.391.7635



$$H_a = \frac{(H + Y_n)}{2}$$

Equation 9-19

Where the maximum value of  $H_a$  shall not exceed  $H$ , and:

$D_a$  = parameter to use in place of  $D$  in Figure 9-38 when flow is supercritical (ft)

$D_c$  = diameter of circular culvert (ft)

$H_a$  = parameter to use in place of  $H$  in Figure 9-39 when flow is supercritical (ft)

$H$  = height of rectangular culvert (ft)

$Y_n$  = normal depth of supercritical flow in the culvert (ft)

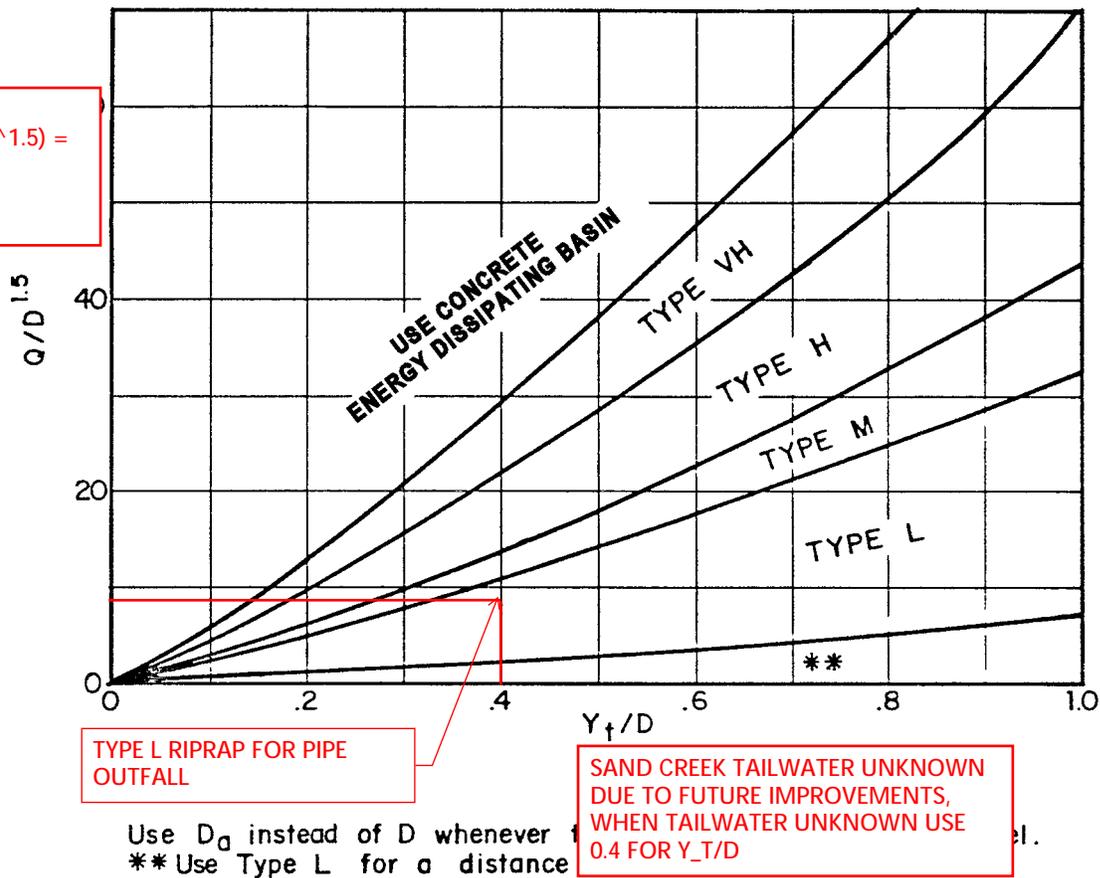


Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for  $Q/D^{2.5} \leq 6.0$ )

June 24, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



**RE: HOMESTEAD FILING 2 – VOLUME CERTIFICATION LETTER FOR FULL SPECTRUM DETENTION POND 1**

---

Dear Mr. Reese,

Based upon survey of the as-built condition of Homestead Filing 2 Pond 1, the required storage volume for WQCV, EURV and 100-year is provided. Additionally, the release rate for Pond 1 is at or below the historic 100-yr design storm level.

Although the 5-yr peak out-flow rate exceeds the original design by 2.1 cfs, it still meets the required drain time guidance. The outfall to Sand Creek was designed to remain stable for the peak 100-year release rate, therefore, the outfall is adequate to handle the peak 5-yr as-built anticipated flow rate of 2.8 cfs. The peak 5-yr flow rate of Sand Creek per the "Final Design Report For Sand Creek Restoration" is 533.2 cfs, and therefore the 0.39% increase in flow is negligible in All Terrain's opinion.

It is our opinion that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements. The PCM(s) provide the required storage volume and meet the required release rates, stage areas, elevations, and outlet dimensions, as documented by the attached revised MHFD-Detention spreadsheet that shows the as-built conditions.

I hereby certify that Pond 1 has been reasonably constructed, to the best of my knowledge and belief, per the approved Pond 1 design.

Respectfully submitted,

A handwritten signature in black ink that reads "Nicholas Jokerst".

**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

530.391.7635



May 30, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



**RE: HOMESTEAD FILING 2 – VOLUME CERTIFICATION LETTER FOR FULL SPECTRUM DETENTION POND 1**

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Dear Mr. Reese,

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It is our opinion that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements. The PCM(s) provide the required storage volume and meet the required release rates, stage areas, elevations, and outlet dimensions, as documented by the attached revised MHFD-Detention spreadsheet that shows the as-built conditions.

I hereby certify that Pond 1 has been reasonably constructed, to the best of my knowledge and belief, per the approved Pond 1 design.

Respectfully submitted,

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**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

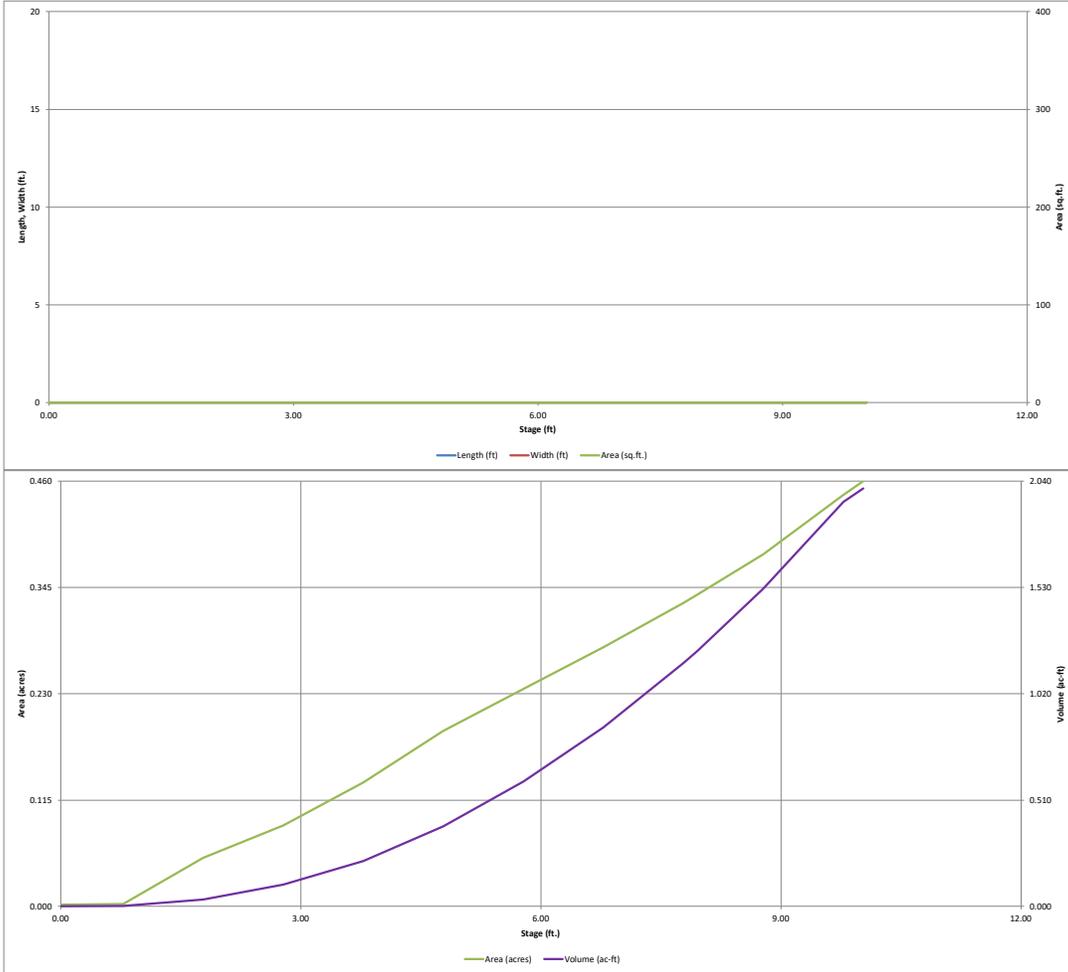
530.391.7635





**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

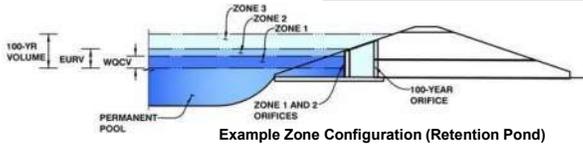


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **Homestead At Sterling Ranch Filing No. 2**

Basin ID: **FSD Pond 1 - As-Built Condition**



**Example Zone Configuration (Retention Pond)**

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.15	0.262	Orifice Plate
Zone 2 (EURV)	6.52	0.508	Orifice Plate
Zone 3 (100-year)	8.55	0.642	Weir&Pipe (Restrict)
		1.412	Total

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

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

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A	feet

**User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)**

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	6.52	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.06	3.90						
Orifice Area (sq. inches)	1.42	1.42						
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

**User Input: Vertical Orifice (Circular or Rectangular)**

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

**Calculated Parameters for Vertical Orifice**

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.97	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	% grate open area/total area
Debris Clogging % =	50%	N/A	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, Hc =	6.97	N/A	feet
Over Flow Weir Slope Length =	3.16	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.98	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	13.28	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	6.64	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.55	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	14.00		inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.90	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.66	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.74	N/A	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =	8.55	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	16.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	0.92	feet
Stage at Top of Freeboard =	10.47	feet
Basin Area at Top of Freeboard =	0.46	acres

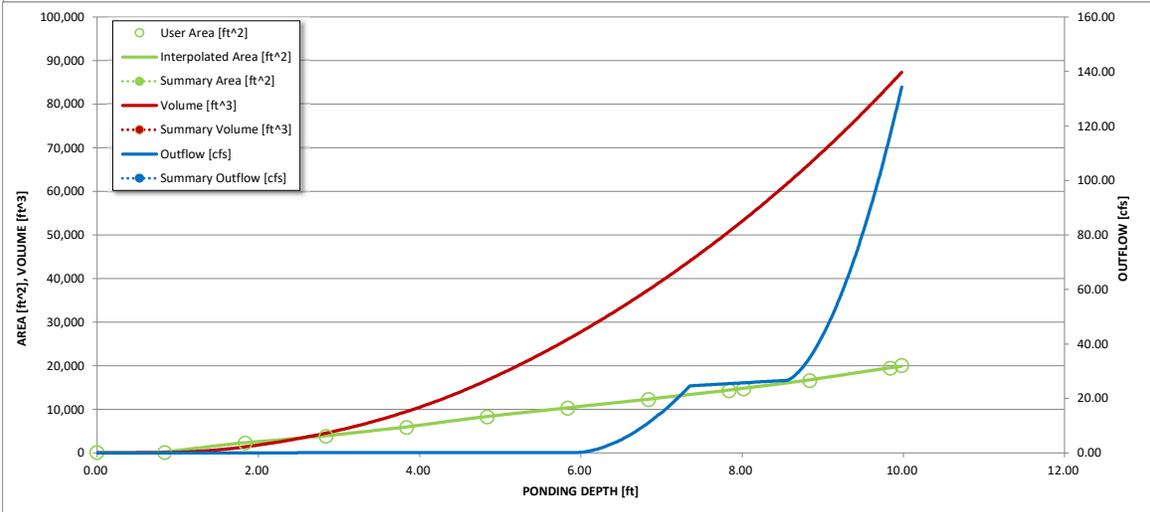
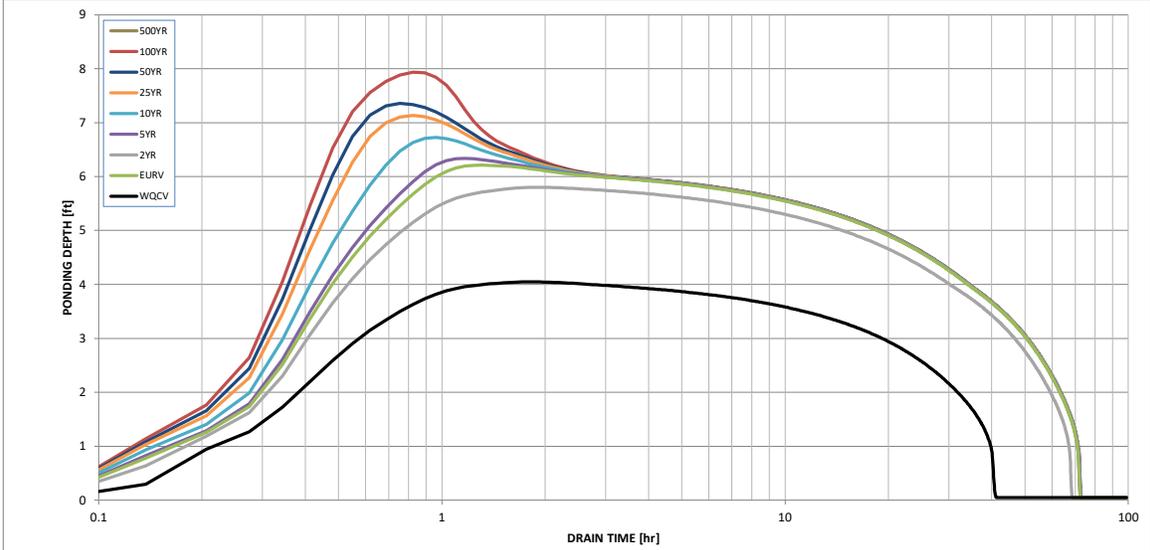
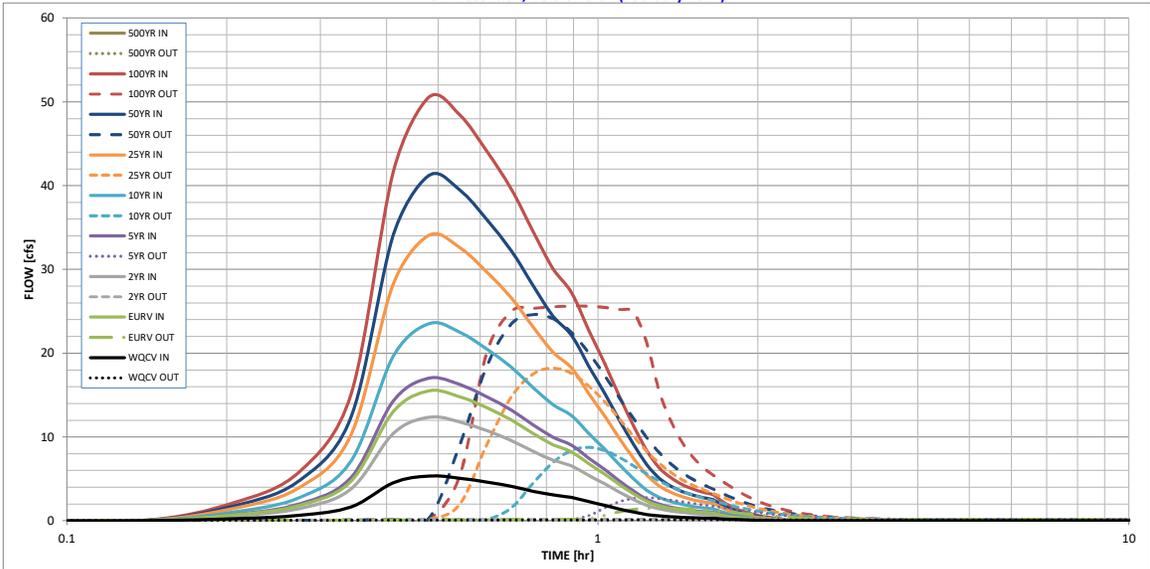
8.02 (cannot input value less than 8.55 due to workbook formulas. Causes error, will not accept lesser value.)

**Routed Hydrograph Results**

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.177	1.710	2.073	2.550	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.176	1.710	2.074	2.551	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.27	0.84	1.16	1.55	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.4	4.4	13.9	19.2	25.5	0.0
Peak Inflow Q (cfs) =	5.3	15.5	12.4	17.0	23.5	34.1	41.2	50.5	#N/A
Peak Outflow Q (cfs) =	0.1	1.5	0.2	2.8	8.8	18.2	24.6	25.6	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	6.3	2.0	1.3	1.3	1.0	#N/A
Structure Controlling Flow =	Plate	Overflow Grate 1	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	0.10	N/A	0.2	0.6	1.4	1.8	1.9	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	64	66	65	62	60	58	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	70	67	70	69	68	68	67	#N/A
Maximum Ponding Depth (ft) =	4.05	6.21	5.80	6.34	6.73	7.13	7.36	7.94	#N/A
Area at Maximum Ponding Depth (acres) =	0.15	0.25	0.24	0.26	0.28	0.30	0.31	0.34	#N/A
Maximum Volume Stored (acre-ft) =	0.247	0.690	0.589	0.721	0.826	0.943	1.010	1.196	#N/A

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



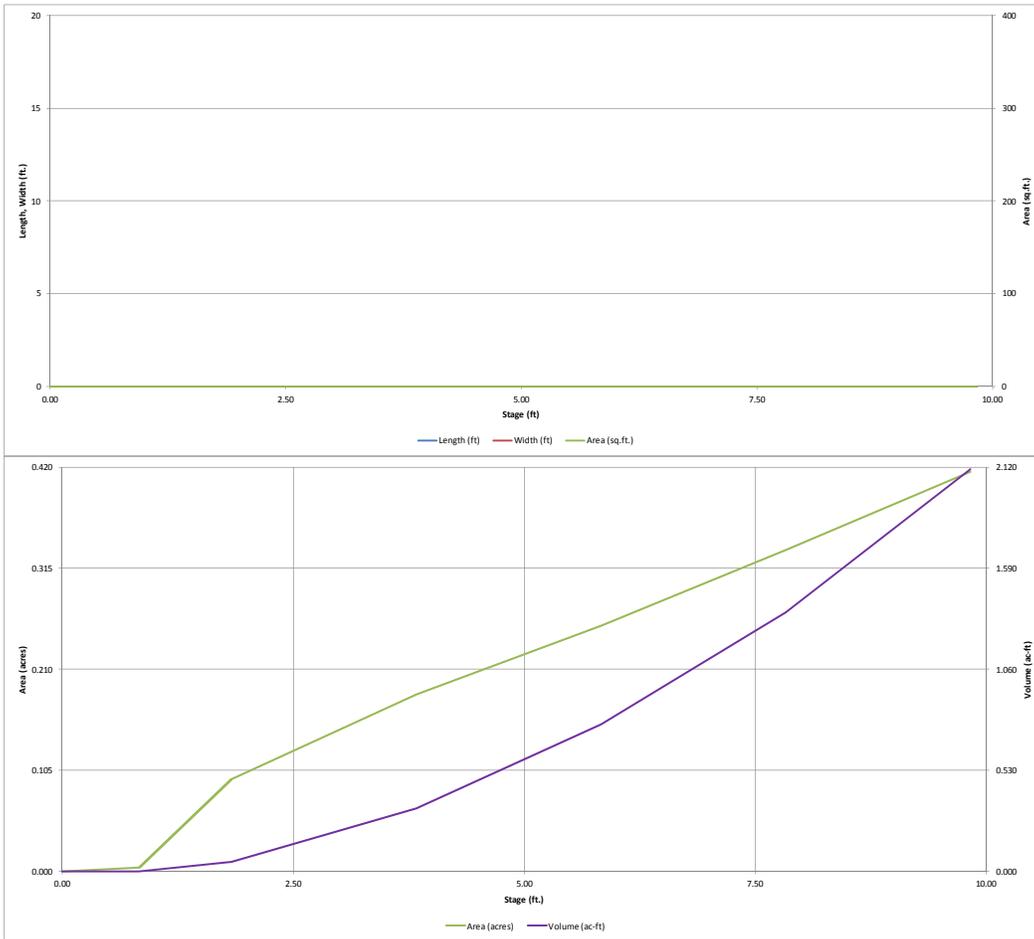
**S-A-V-D Chart Axis Override**

	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

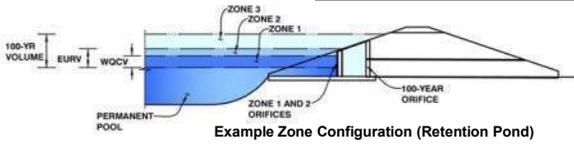


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: \_\_\_\_\_

Basin ID: \_\_\_\_\_



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.45	0.262	Orifice Plate
Zone 2 (EURV)	5.84	0.508	Orifice Plate
Zone 3 (100-year)	8.00	0.642	Weir&Pipe (Restrict)
		1.412	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.84	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	23.40	inches
Orifice Plate: Orifice Area per Row =	1.19	sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.264E-03	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.95	3.89					
Orifice Area (sq. inches)	1.19	1.19	1.19					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.84	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>1</sub> =	6.81	N/A	feet
Overflow Weir Slope Length =	3.07	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.21	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.88	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	6.44	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	13.30		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.79	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.63	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	7.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	17.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

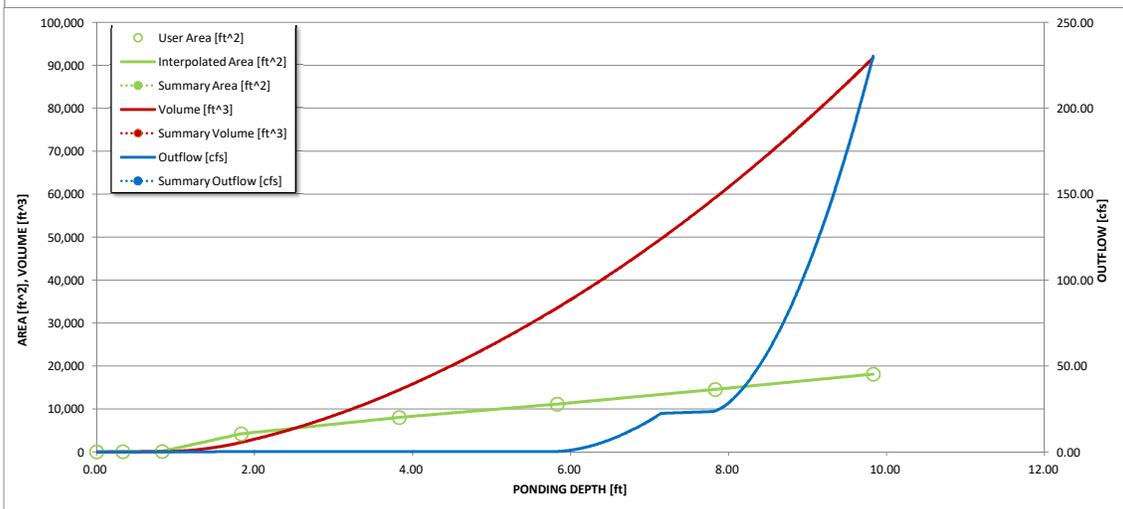
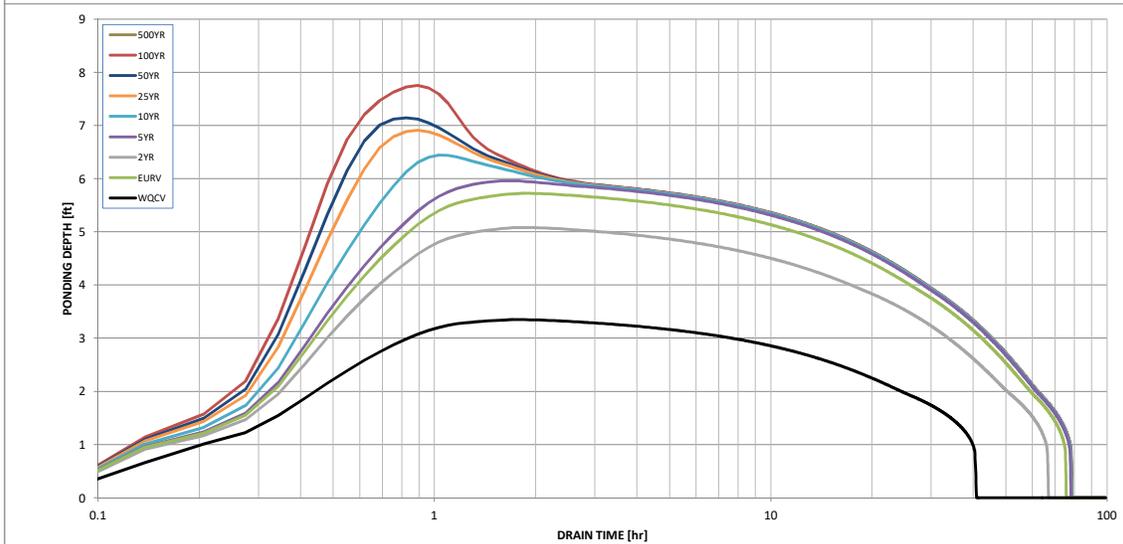
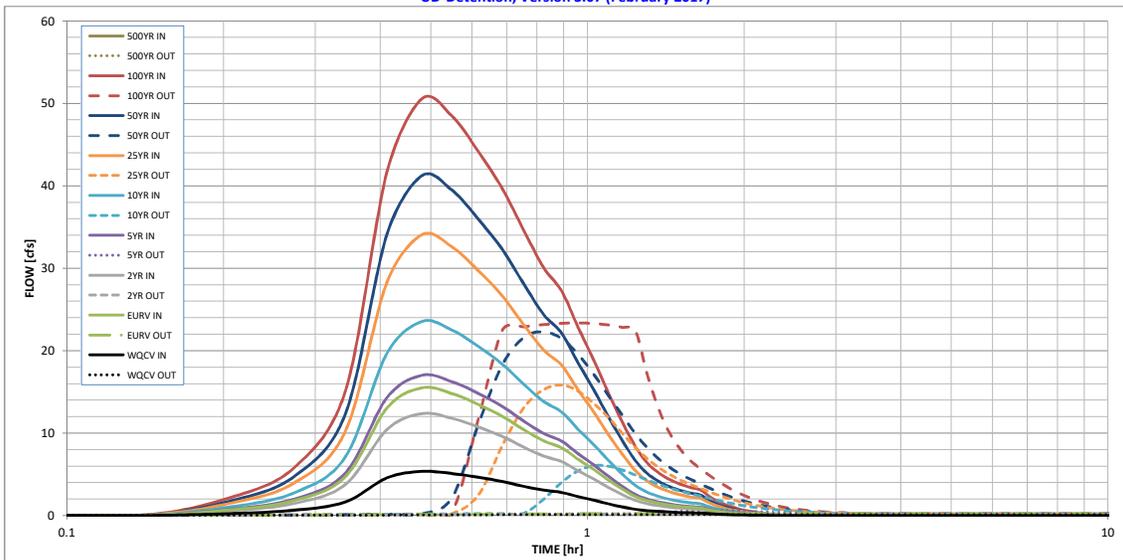
Spillway Design Flow Depth =	0.89	feet
Stage at Top of Freeboard =	9.69	feet
Basin Area at Top of Freeboard =	0.41	acres

### Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.262	0.771	0.614	0.847	1.177	1.710	2.073	2.550	0.000
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Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	0.4	4.4	13.9	19.2	25.5	0.0
Peak Inflow Q (cfs) =	5.3	15.5	12.4	17.0	23.5	34.1	41.2	50.5	#N/A
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.7	6.0	15.8	22.3	23.4	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.4	1.1	1.2	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.4	1.2	1.7	1.8	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	69	62	71	69	66	63	61	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	73	65	76	75	74	73	72	#N/A
Maximum Ponding Depth (ft) =	3.35	5.72	5.08	5.96	6.44	6.91	7.15	7.75	#N/A
Area at Maximum Ponding Depth (acres) =	0.16	0.25	0.23	0.26	0.28	0.30	0.31	0.33	#N/A
Maximum Volume Stored (acre-ft) =	0.245	0.741	0.588	0.802	0.932	1.067	1.137	1.331	#N/A

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

January 29, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



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**RE: HOMESTEAD FILING 2 – PRELIMINARY ACCEPTANCE PUNCHLIST FOR NORTH SAND FILTER BASIN**

---

Dear Mr. Reese,

The El Paso County punchlist from 11/28/2023 site walk identified a few inconsistencies within the North Sand Filter Basin when compared to the approved construction documents.

1. Spillway constructed with plain riprap instead of soil riprap

**Spillway Riprap**

The reason for calling out soil riprap for the spillway protection is that soil riprap gives a finished look and can be revegetated, however; both clean riprap and soil riprap are acceptable erosion protection treatments for the spillway. Therefore, I recommend the clean riprap remain within the spillway.

Respectfully submitted,

A handwritten signature in black ink that reads "Nicholas Jokerst".

**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

530.391.7635



April 08, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



**RE: HOMESTEAD FILING 2 – VOLUME CERTIFICATION LETTER FOR NORTH SAND FILTER BASIN**

---

Dear Mr. Reese,

Based upon a survey of the as-built condition of Homestead Filing 2 North Sand Filter Basin, the required storage volume for WQCV, EURV and 100-year is provided. Additionally, the release rate for the North Sand Filter Basin is at historic levels. It is our opinion that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements. The PCM(s) provide the required storage volume and meet the required release rates, stage areas, elevations, and outlet dimensions, as documented by the attached revised MHFD-Detention spreadsheet that shows the as-built conditions.

I hereby certify that the Homestead Filing 2 North Sand Filter Basin has been reasonably constructed, to the best of my knowledge and belief, to the approved design.

Respectfully submitted,

A handwritten signature in black ink that reads "Nicholas Jokerst".

**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

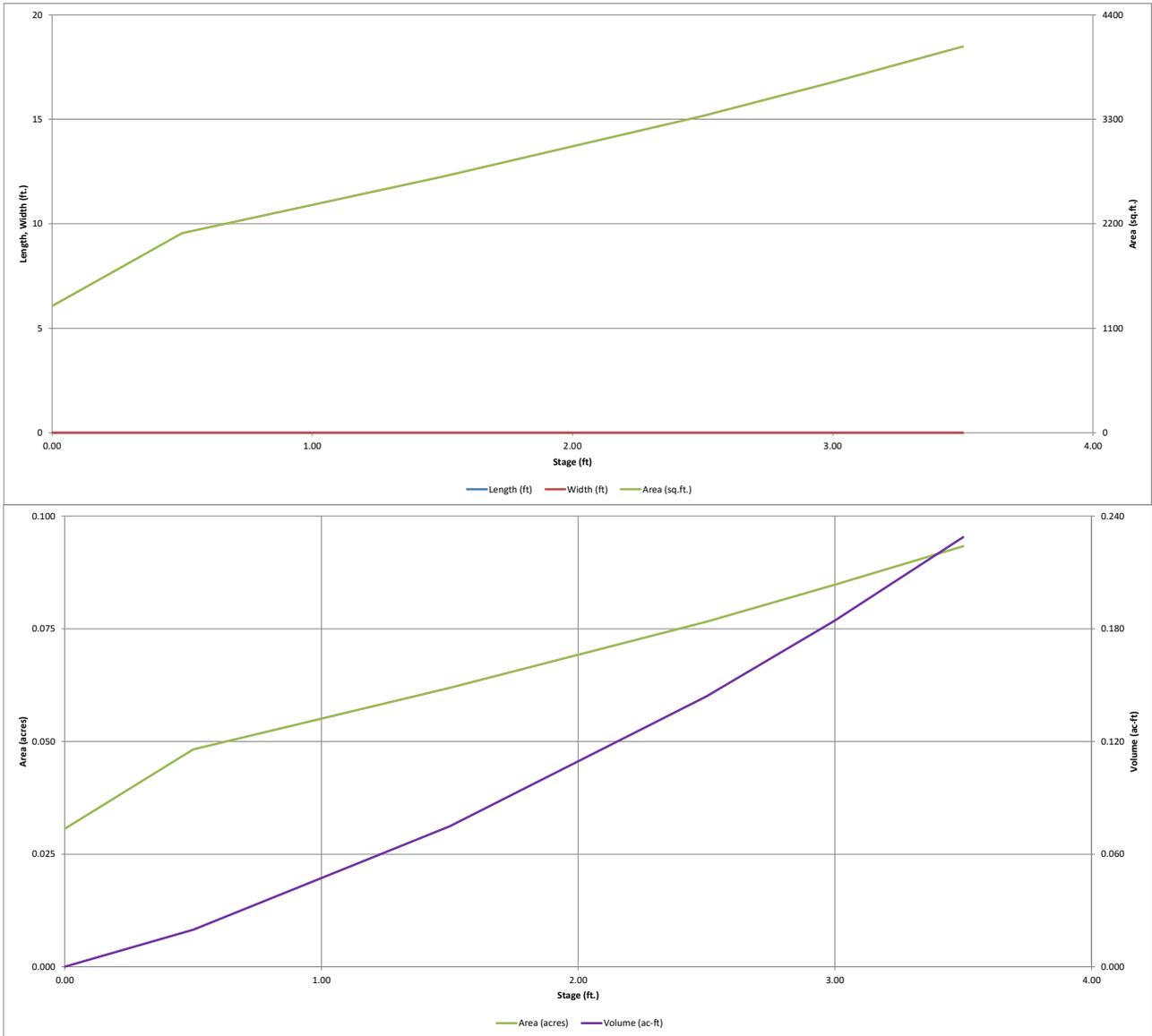
530.391.7635





# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.04 (February 2021)*

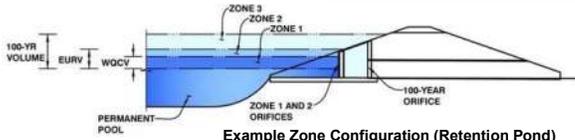


# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD- Detention, Version 4.04 (February 2021)*

**Project: Homestead at Sterling Ranch Filing No. 2**

**Basin ID: Sand Filter - Basin X1 AS-BUILT**



**Example Zone Configuration (Retention Pond)**

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.24	0.008	Filtration Media
Zone 2 (EURV)	0.57	0.015	Rectangular Orifice
Zone 3 (100-year)	1.16	0.031	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>0.054</b>	

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

Underdrain Orifice Invert Depth =	2.10	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.46	inches

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	0.0	ft <sup>2</sup>
Underdrain Orifice Centroid =	0.02	feet

**User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)**

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A							
Orifice Area (sq. inches)	N/A							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**User Input: Vertical Orifice (Circular or Rectangular)**

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.35	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.51	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	4.00		inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.06	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.21	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.21	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>1</sub> =	1.25	N/A	feet
Overflow Weir Slope Length =	2.21	N/A	feet
Grate Open Area / 100-yr Orifice Area =	28.68	N/A	
Overflow Grate Open Area w/o Debris =	3.40	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	1.70	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	2.50		inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.12	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.12	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.95	N/A	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =	3.73	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	12.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.42	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	0.09	feet
Stage at Top of Freeboard =	5.24	feet
Basin Area at Top of Freeboard =	0.09	acres
Basin Volume at Top of Freeboard =	0.23	acre-ft

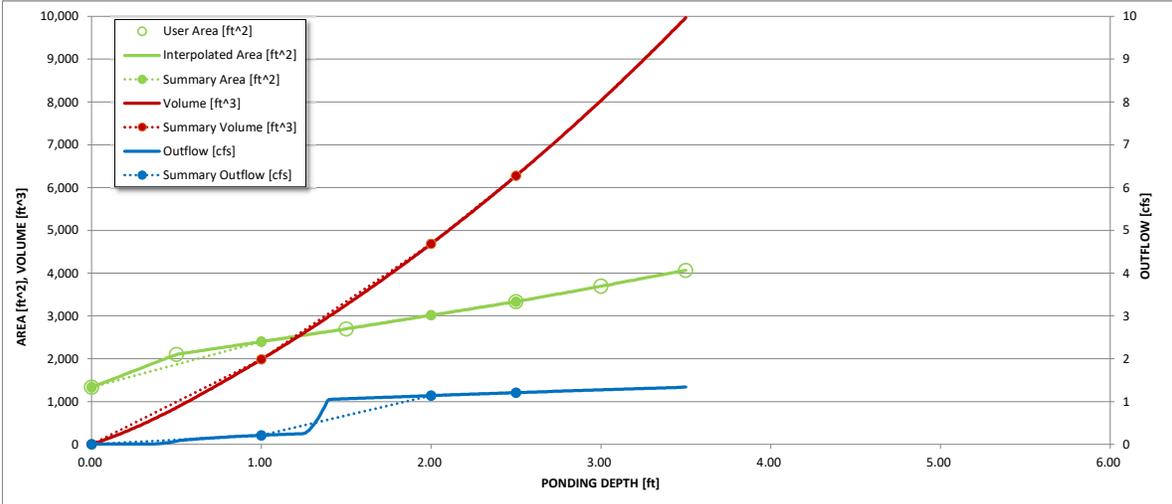
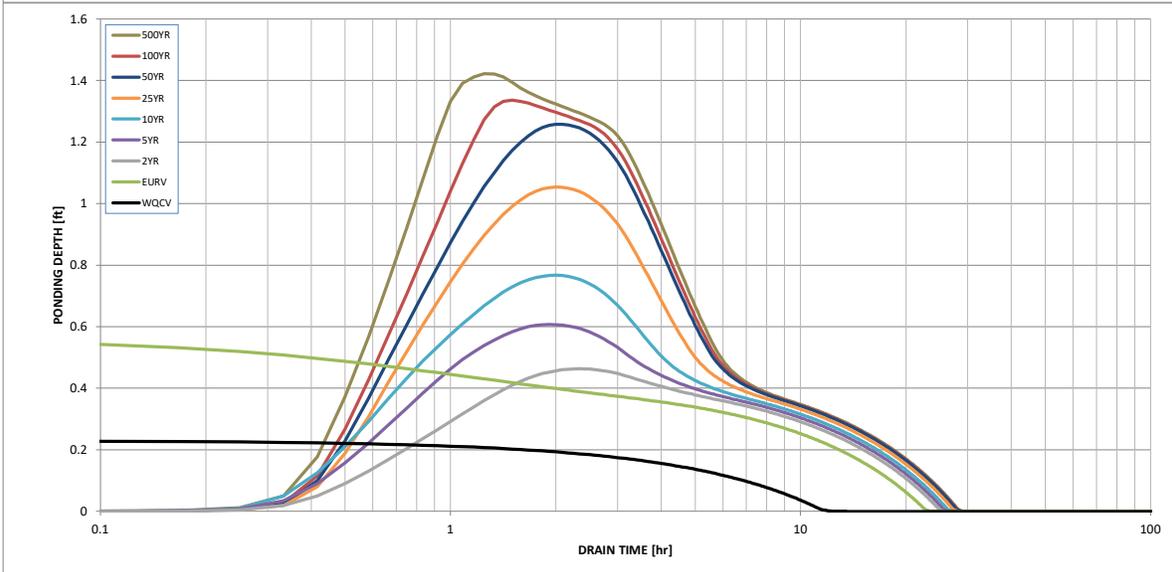
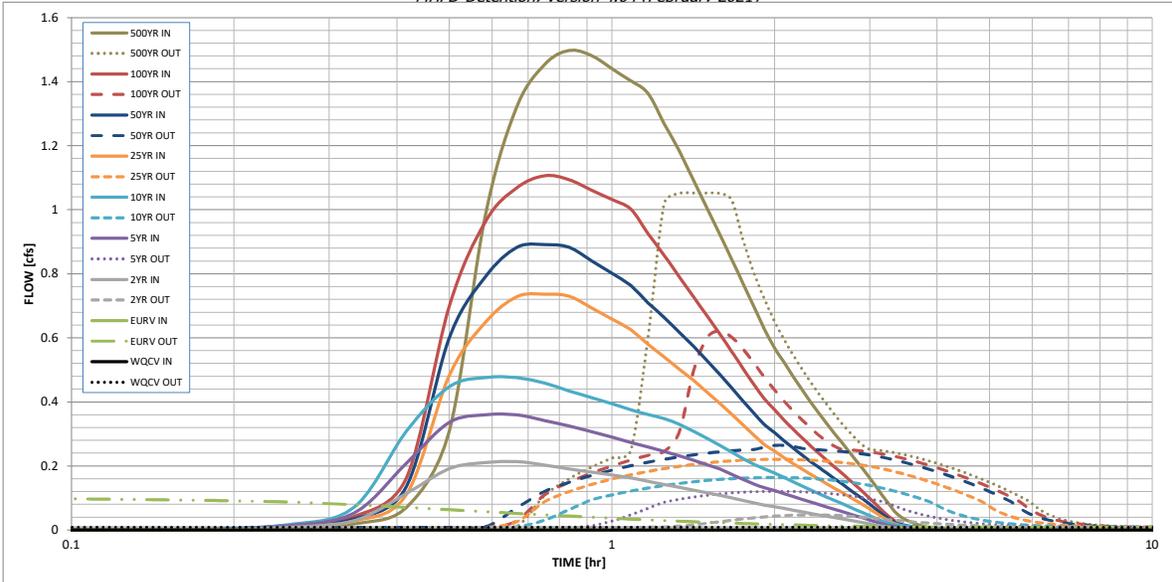
**Routed Hydrograph Results**

*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.008	0.023	0.024	0.041	0.056	0.081	0.099	0.124	0.171
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.024	0.041	0.056	0.081	0.099	0.124	0.171
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	0.6	0.7	0.9	1.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.22	0.33	0.61	0.76	0.97	1.36
Peak Inflow Q (cfs) =	N/A	N/A	0.2	0.4	0.5	0.7	0.9	1.1	1.5
Peak Outflow Q (cfs) =	0.0	0.1	0.0	0.1	0.2	0.2	0.3	0.6	1.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.5	0.4	0.4	0.7	0.8
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1					
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.1
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	11	22	24	24	24	24	24	23	21
Time to Drain 99% of Inflow Volume (hours) =	12	23	25	25	26	26	27	27	26
Maximum Ponding Depth (ft) =	0.24	0.57	0.46	0.61	0.77	1.05	1.26	1.34	1.42
Area at Maximum Ponding Depth (acres) =	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06
Maximum Volume Stored (acre-ft) =	0.008	0.023	0.018	0.025	0.033	0.048	0.060	0.064	0.070

# DETENTION BASIN OUTLET STRUCTURE DESIGN

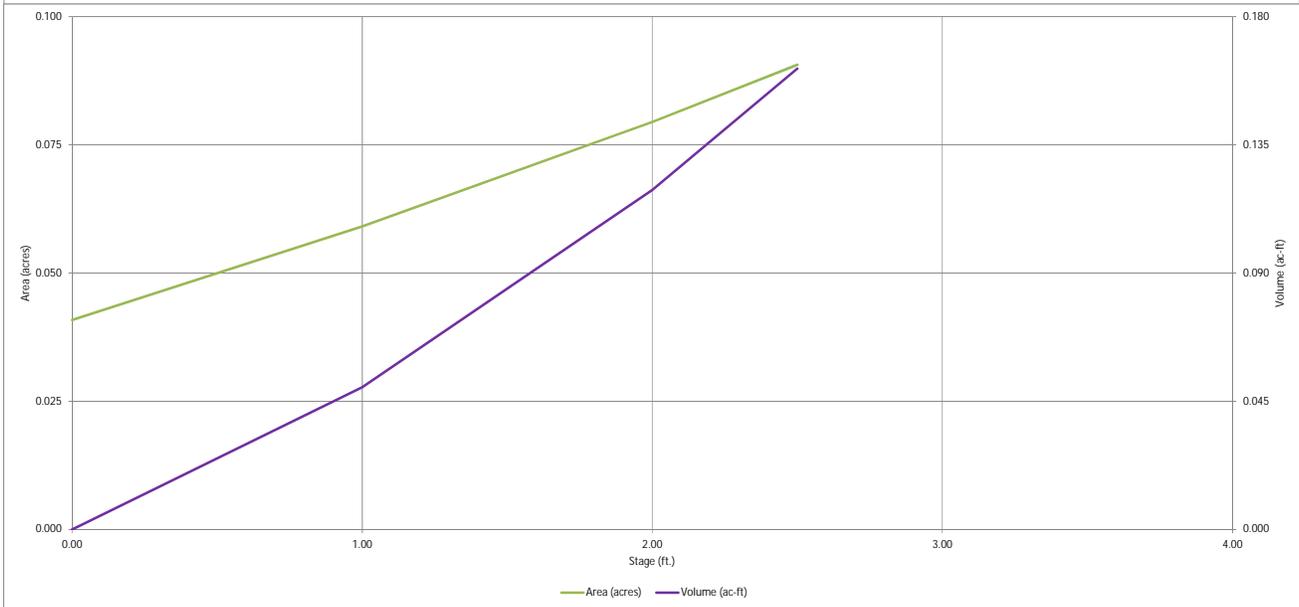
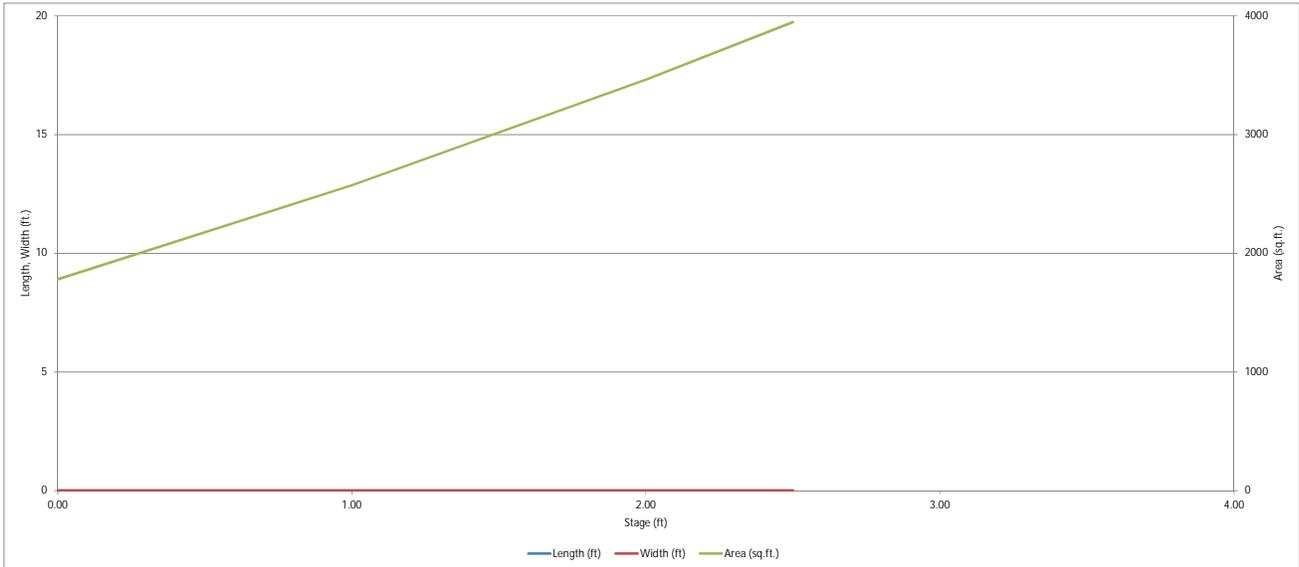
*MHFD-Detention, Version 4.04 (February 2021)*



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



FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"

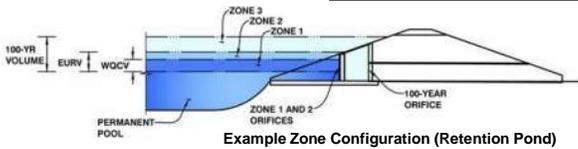


**FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"**

**DETENTION BASIN OUTLET STRUCTURE DESIGN**

*MHFD-Detention, Version 4.04 (February 2021)*

Project: Homestead at Sterling Ranch Filing No. 2  
Basin ID: Sand Filter - Basin X1 - Existing



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WOCV)	0.20	0.008	Filtration Media
Zone 2 (EURV)	0.51	0.015	Rectangular Orifice
Zone 3 (100-year)	1.08	0.031	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>0.054</b>	

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

Underdrain Orifice Invert Depth =	2.10	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft <sup>2</sup>
<b>Underdrain Orifice Diameter =</b>	<b>0.46</b>	<b>inches</b>	Underdrain Orifice Centroid =	0.02	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WOCV and/or EURV in a sedimentation BMP)

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

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A							
Orifice Area (sq. inches)	N/A							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected
Invert of Vertical Orifice =	0.35	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.06
Depth at top of Zone using Vertical Orifice =	0.51	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08
Vertical Orifice Height =	2.00	N/A	inches		
Vertical Orifice Width =	4.00		inches		

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	0.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Gate Upper Edge, Hi =	0.75
Overflow Weir Front Edge Length =	2.21	N/A	feet	Overflow Weir Slope Length =	2.21
Overflow Weir Gate Slope =	0.00	N/A	H:V	Gate Open Area / 100-yr Orifice Area =	28.68
Horiz. Length of Weir Sides =	2.21	N/A	feet	Overflow Gate Open Area w/o Debris =	3.40
Overflow Gate Type =	Type C Gate	N/A		Overflow Gate Open Area w/ Debris =	1.70
Debris Clogging % =	50%	N/A	%		

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	2.10	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.12
Outlet Pipe Diameter =	12.00	N/A	inches	Outlet Orifice Centroid =	0.12
<b>Restrictor Plate Height Above Pipe Invert =</b>	<b>2.50</b>	<b>inches</b>		Half-Central Angle of Restrictor Plate on Pipe =	0.95

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Spillway Design Flow Depth =	0.14	feet
Spillway Invert Stage =	2.50	ft (relative to basin bottom at Stage = 0 ft)	Stage at Top of Freeboard =	4.14	feet
Spillway Crest Length =	5.00	feet	Basin Area at Top of Freeboard =	0.09	acres
Spillway End Slopes =	4.00	H:V	Basin Volume at Top of Freeboard =	0.16	acre-ft
Freeboard above Max Water Surface =	1.50	feet			

**Routed Hydrograph Results**

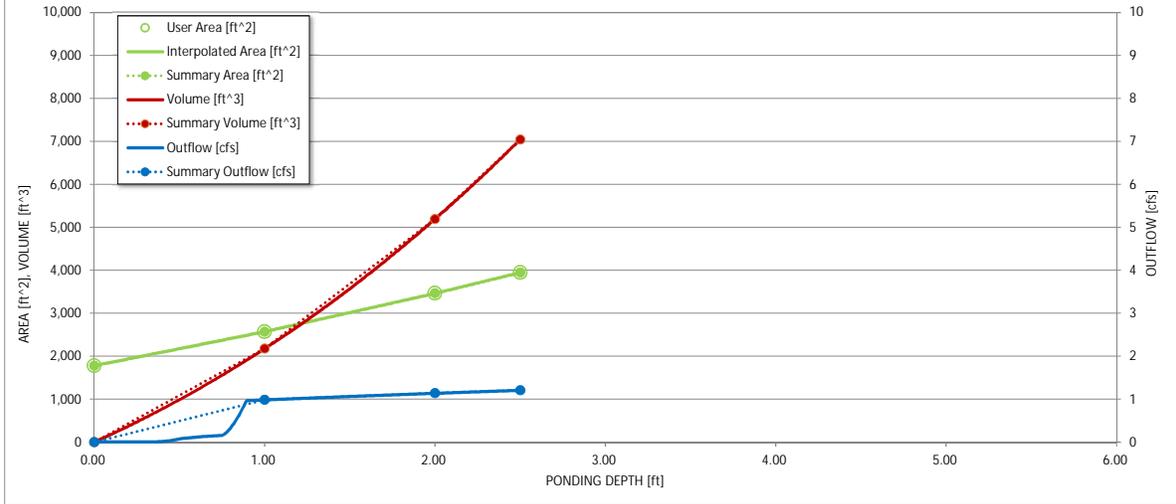
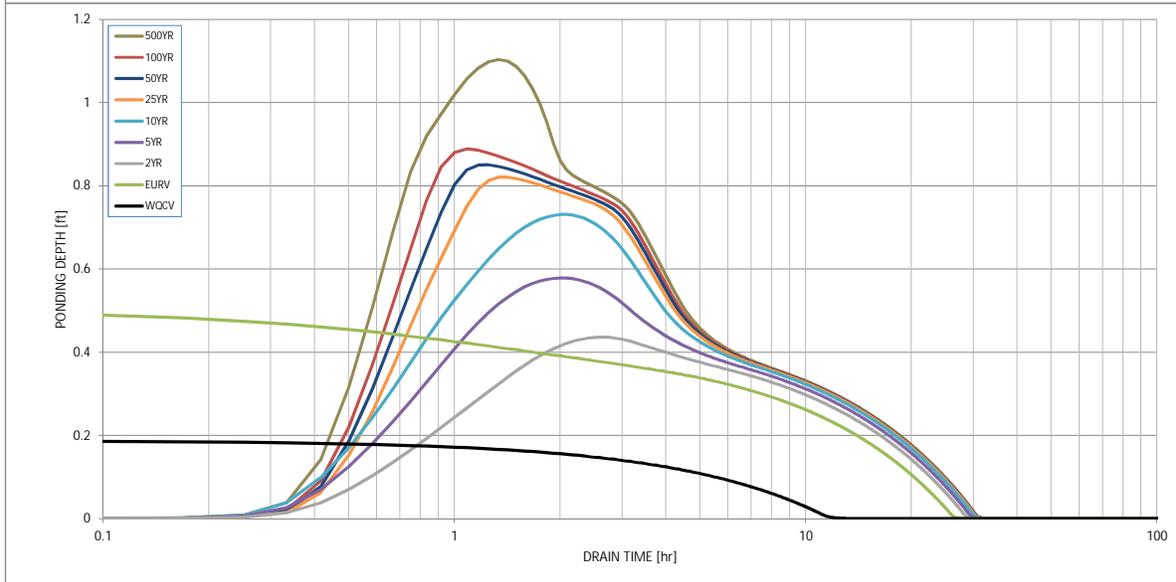
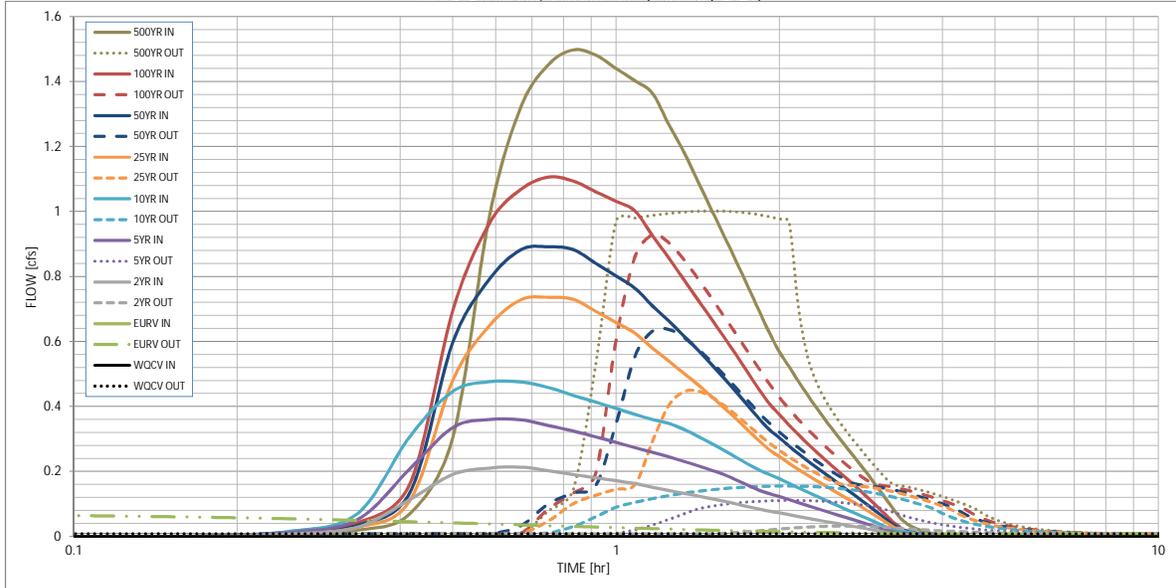
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

	WOCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period									
One-Hour Rainfall Depth (in)	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft)	0.008	0.023	0.024	0.041	0.056	0.081	0.099	0.124	0.171
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.024	0.041	0.056	0.081	0.099	0.124	0.171
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.1	0.2	0.3	0.6	0.7	0.9	1.2
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.08	0.22	0.33	0.61	0.76	0.97	1.36
Peak Inflow Q (cfs)	N/A	N/A	0.2	0.4	0.5	0.7	0.9	1.1	1.5
Peak Outflow Q (cfs)	0.0	0.1	0.0	0.1	0.2	0.4	0.6	0.9	1.0
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.6	0.5	0.8	0.9	1.0	0.8
Structure Controlling Flow	Filtration Media	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1				
Max Velocity through Gate 1 (fps)	N/A	N/A	N/A	N/A	N/A	0.1	0.1	0.2	0.2
Max Velocity through Gate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	12	26	28	28	28	27	27	26	24
Time to Drain 99% of Inflow Volume (hours)	12	26	29	29	30	30	30	29	29
Maximum Ponding Depth (ft)	0.19	0.51	0.44	0.58	0.73	0.82	0.85	0.89	1.10
Area at Maximum Ponding Depth (acres)	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06
Maximum Volume Stored (acre-ft)	0.008	0.023	0.019	0.026	0.035	0.040	0.041	0.043	0.056

**FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE  
REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"**

**DETENTION BASIN OUTLET STRUCTURE DESIGN**

*MHFD-Detention, Version 4.04 (February 2021)*



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

January 29, 2025

Attn: Gleen Reese  
Stormwater Engineer  
El Paso County - Department of Public Works  
3275 Akers Drive  
Colorado Springs, CO 80922



---

**RE: HOMESTEAD FILING 2 – PRELIMINARY ACCEPTANCE PUNCHLIST FOR SOUTH SAND FILTER BASIN**

---

Dear Mr. Reese,

The El Paso County punchlist from 11/28/2023 site walk identified a few inconsistencies within the South Sand Filter Basin when compared to the approved construction documents.

1. Spillway constructed with plain riprap instead of soil riprap

Spillway Riprap

The reason for calling out soil riprap for the spillway protection is that soil riprap gives a finished look and can be revegetated, however; both clean riprap and soil riprap are acceptable erosion protection treatments for the spillway. Therefore, I recommend the clean riprap remain within the spillway.

Respectfully submitted,

A handwritten signature in black ink that reads "Nicholas Jokerst".

**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

njokerst@allterraineng.com

530.391.7635



April 08, 2025

Attn: Gleen Reese

Stormwater Engineer

El Paso County - Department of Public Works

3275 Akers Drive

Colorado Springs, CO 80922



---

**RE: HOMESTEAD FILING 2 – VOLUME CERTIFICATION LETTER FOR SOUTH SAND FILTER BASIN**

---

Dear Mr. Reese,

Based upon a survey of the as-built condition of Homestead Filing 2 South Sand Filter Basin, the required storage volume for WQCV, EURV and 100-year is provided. Additionally, the release rate for the South Sand Filter Basin is at historic levels. It is our opinion that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, revegetation or other ground cover, and that the improvements (public improvements, common development improvements, site grading and paving) meet or exceed the minimum design requirements. The PCM(s) provide the required storage volume and meet the required release rates, stage areas, elevations, and outlet dimensions, as documented by the attached revised MHFD-Detention spreadsheet that shows the as-built conditions.

I hereby certify that the Homestead Filing 2 South Sand Filter Basin has been reasonably constructed, to the best of my knowledge and belief, to the approved design.

Respectfully submitted,

A handwritten signature in black ink that reads "Nicholas Jokerst".

**NICHOLAS JOKERST, PE**

**All Terrain Engineering LLC**

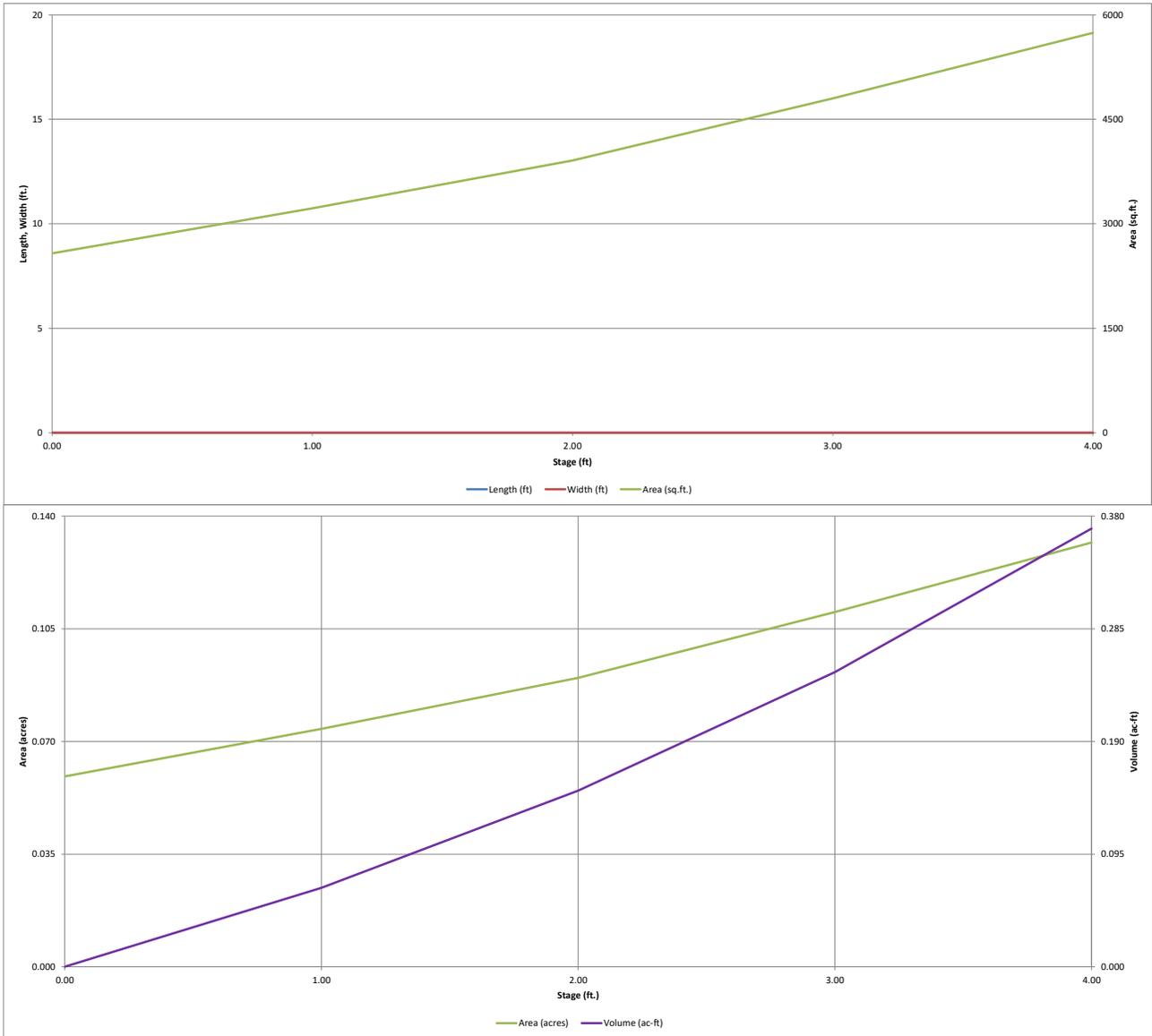
njokerst@allterraineng.com

530.391.7635



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.04 (February 2021)*

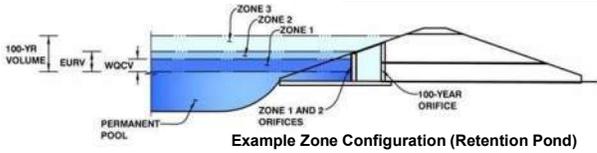


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

**Project:** Homestead at Sterling Ranch Filing No. 2

**Basin ID:** Sand Filter - Basin Y1, W1, X2 AS-BUILT



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.40	0.024	Filtration Media
Zone 2 (EURV)	1.03	0.044	Rectangular Orifice
Zone 3 (100-year)	2.15	0.093	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>0.162</b>	

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

Underdrain Orifice Invert Depth =	2.00	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.80	inches

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	0.0	ft <sup>2</sup>
Underdrain Orifice Centroid =	0.03	feet

**User Input:** Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A							
Orifice Area (sq. inches)	N/A							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**User Input:** Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.03	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	4.00	N/A	inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.06	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	0.58	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.21	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.21	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>u</sub> =	0.58	N/A	feet
Overflow Weir Slope Length =	2.21	N/A	feet
Grate Open Area / 100-yr Orifice Area =	10.98	N/A	
Overflow Grate Open Area w/o Debris =	3.40	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	1.70	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	15.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.50	N/A	inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.31	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.22	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.16	N/A	radians

**User Input:** Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	2.73	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.05	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	0.22	feet
Stage at Top of Freeboard =	4.00	feet
Basin Area at Top of Freeboard =	0.13	acres
Basin Volume at Top of Freeboard =	0.37	acre-ft

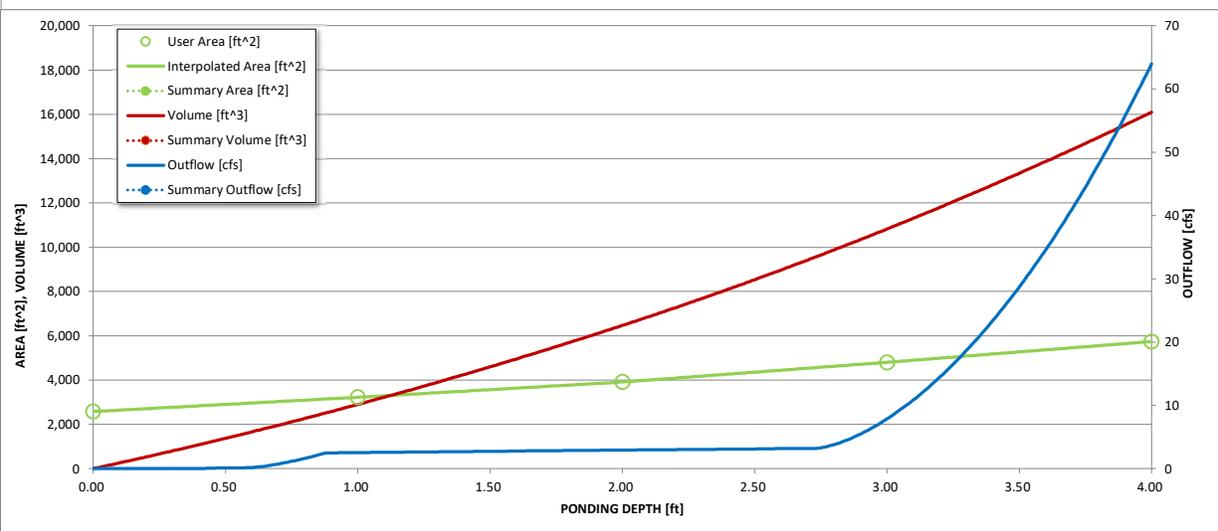
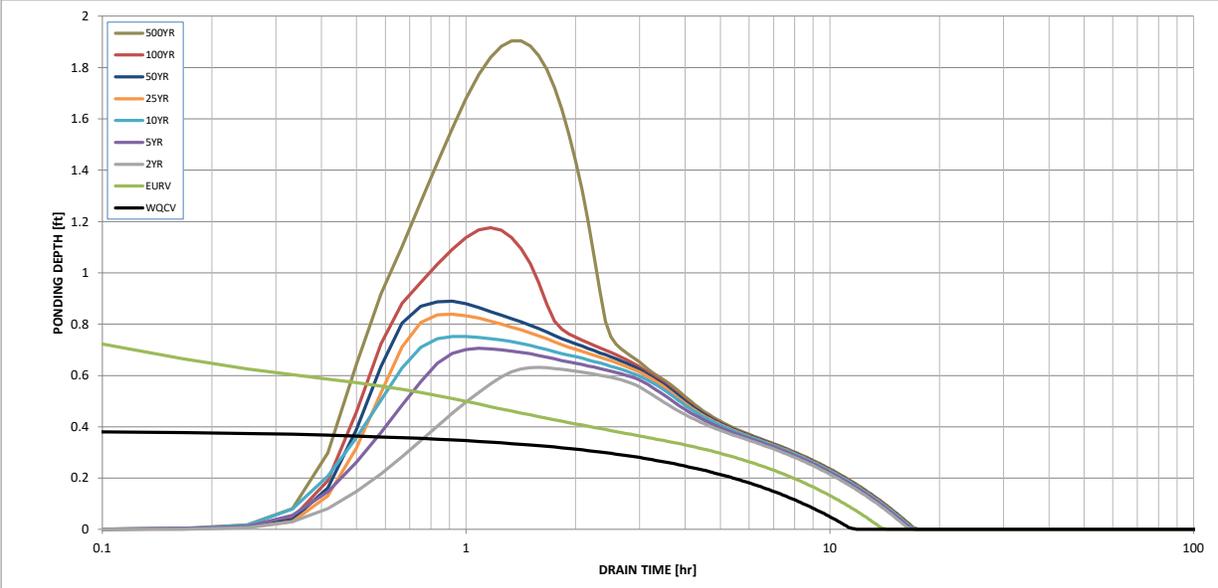
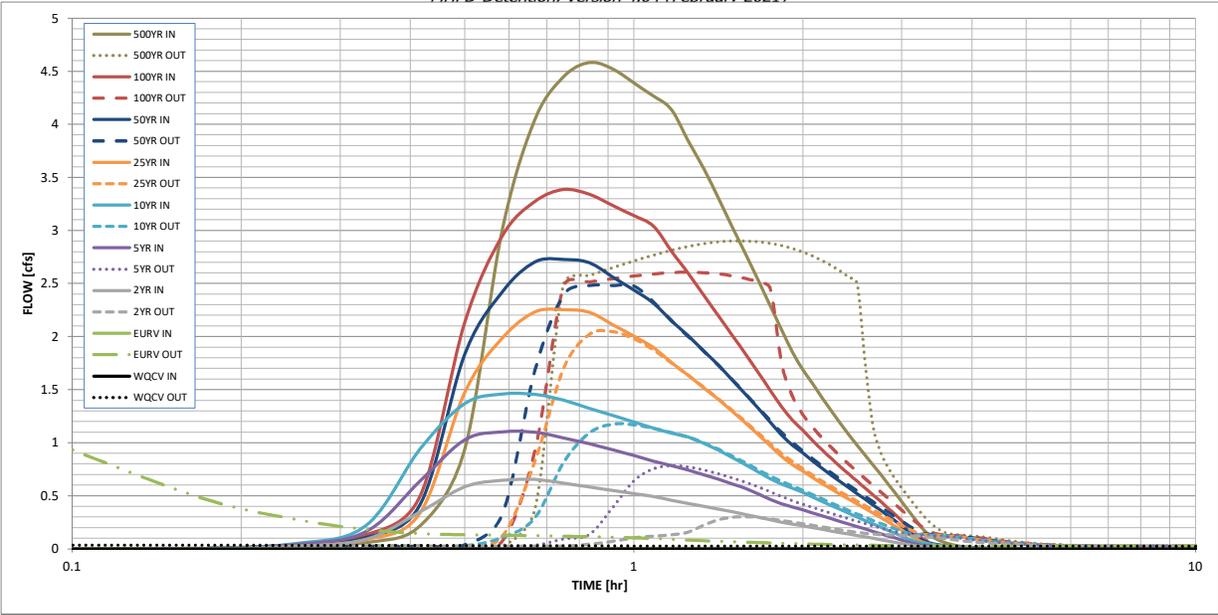
## Routed Hydrograph Results

*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.024	0.069	0.071	0.122	0.169	0.243	0.297	0.372	0.512
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.071	0.122	0.169	0.243	0.297	0.372	0.512
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	0.6	0.9	1.7	2.1	2.7	3.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.08	0.22	0.34	0.62	0.78	1.00	1.40
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	1.1	1.5	2.3	2.7	3.4	4.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.3	0.8	1.2	2.0	2.5	2.6	2.9
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.3	1.3	1.2	1.2	1.0	0.8
Peak Outflow Q (cfs) =	N/A	N/A	N/A	1.3	1.3	1.2	1.2	1.0	0.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.3	1.2	1.2	1.0	0.8
Structure Controlling Flow =	Vertical Orifice 1	Outlet Plate 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.68	0.04	0.2	0.3	0.5	0.7	0.7	0.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	11	13	16	15	14	13	13	12	10
Time to Drain 99% of Inflow Volume (hours) =	12	14	16	16	16	16	16	15	15
Maximum Ponding Depth (ft) =	0.39	1.04	0.63	0.71	0.75	0.84	0.89	1.18	1.90
Area at Maximum Ponding Depth (acres) =	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.09
Maximum Volume Stored (acre-ft) =	0.024	0.070	0.040	0.045	0.049	0.054	0.058	0.079	0.140

# DETENTION BASIN OUTLET STRUCTURE DESIGN

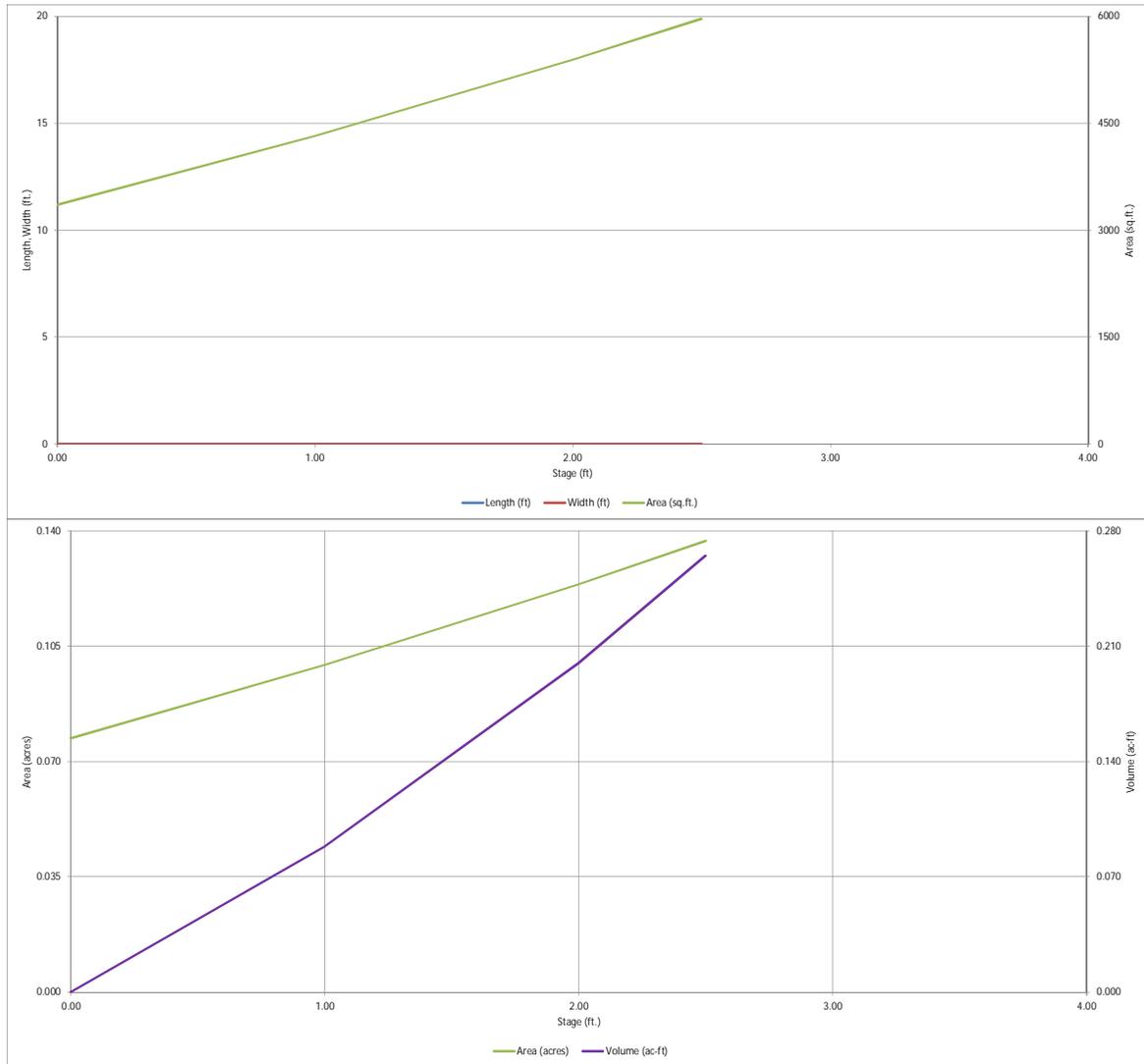
*MHFD-Detention, Version 4.04 (February 2021)*



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



FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"



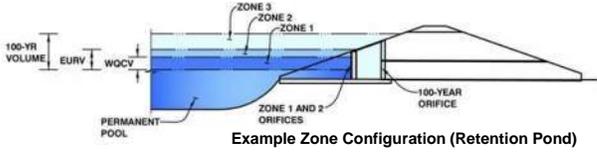
**FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"**

**DETENTION BASIN OUTLET STRUCTURE DESIGN**

*MHFD-Detention, Version 4.04 (February 2021)*

Project: **Homestead at Sterling Ranch Filing No. 2**

Basin ID: **Sand Filter - Basin Y1, W1, X2 - Existing**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.31	0.024	Filtration Media
Zone 2 (EURV)	0.80	0.044	Rectangular Orifice
Zone 3 (100-year)	1.69	0.093	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>0.162</b>	

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

Underdrain Orifice Invert Depth =	2.10	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.80	inches

Underdrain Orifice Area =	0.0	ft <sup>2</sup>
Underdrain Orifice Centroid =	0.03	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

WQ Orifice Area per Row =	N/A	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A							
Orifice Area (sq. inches)	N/A							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	4.00	N/A	inches

Vertical Orifice Area =	0.06	ft <sup>2</sup>
Vertical Orifice Centroid =	0.08	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.21	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.21	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Height of Grate Upper Edge, H <sub>u</sub> =	1.00	feet
Overflow Weir Slope Length =	2.21	feet
Grate Open Area / 100-yr Orifice Area =	10.98	
Overflow Grate Open Area w/o Debris =	3.40	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	1.70	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	15.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.50	N/A	inches

Outlet Orifice Area =	0.31	ft <sup>2</sup>
Outlet Orifice Centroid =	0.22	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.16	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	2.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	10.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.50	feet

Spillway Design Flow Depth =	0.22	feet
Stage at Top of Freeboard =	3.72	feet
Basin Area at Top of Freeboard =	0.14	acres
Basin Volume at Top of Freeboard =	0.26	acre-ft

**Routed Hydrograph Results**

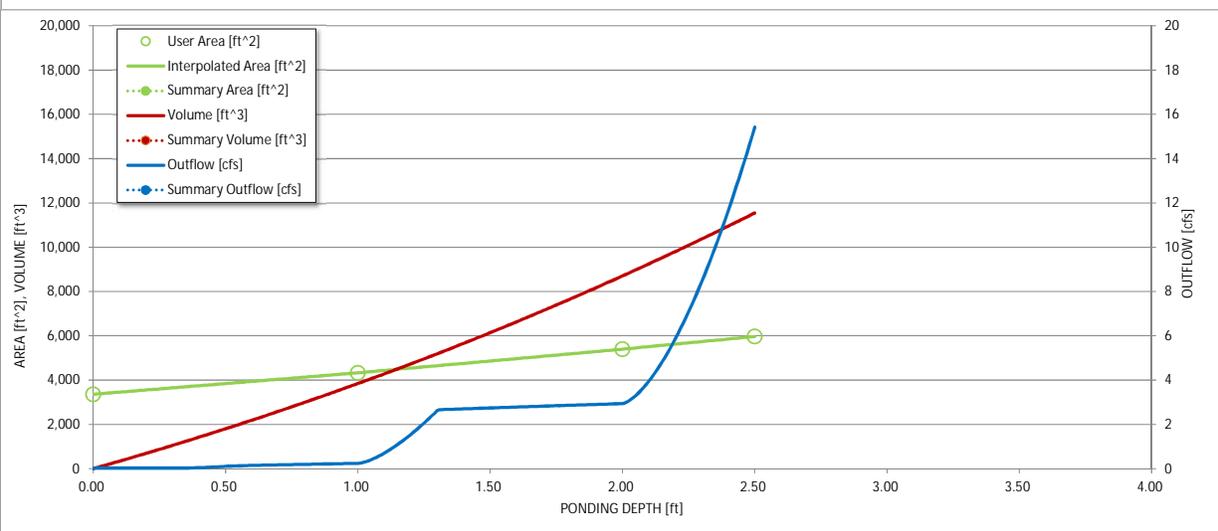
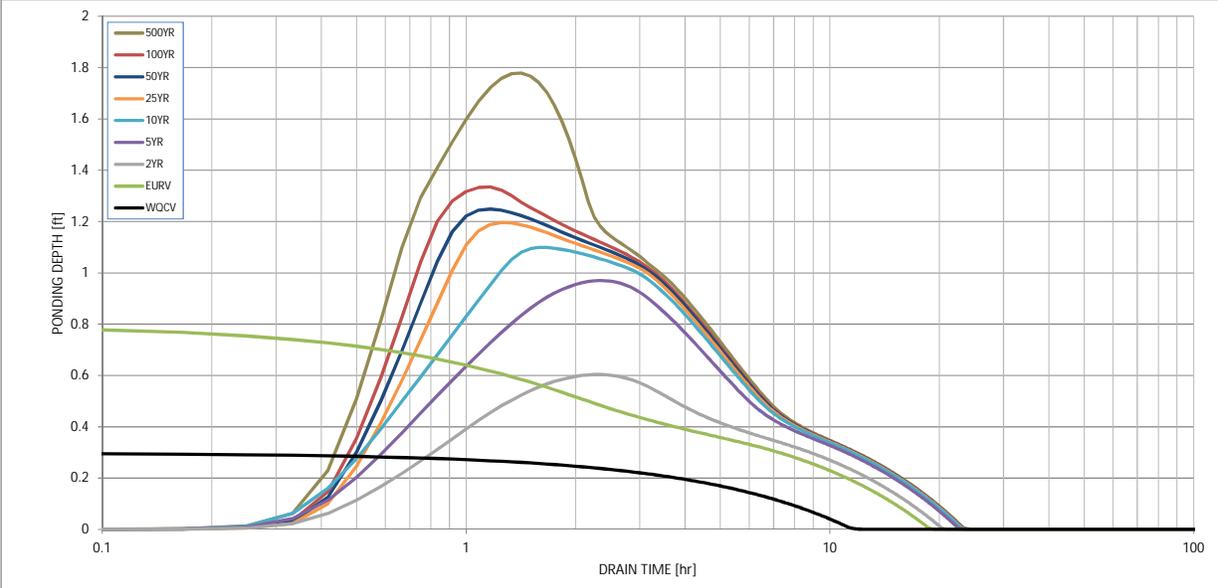
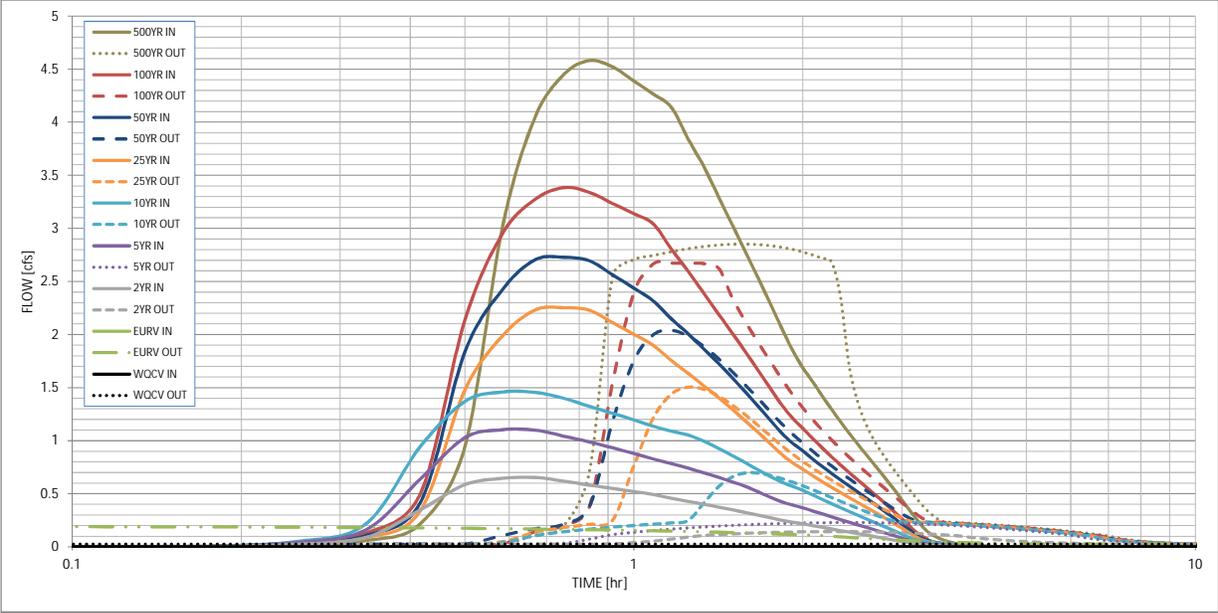
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in)	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft)	0.024	0.069	0.071	0.122	0.169	0.243	0.297	0.372	0.512
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.071	0.122	0.169	0.243	0.297	0.372	0.512
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.2	0.6	0.9	1.7	2.1	2.7	3.8
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.08	0.22	0.34	0.62	0.78	1.00	1.40
Peak Inflow Q (cfs)	N/A	N/A	0.7	1.1	1.5	2.3	2.7	3.4	4.6
Peak Outflow Q (cfs)	0.0	0.2	0.1	0.2	0.7	1.5	2.0	2.7	2.9
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.4	0.8	0.9	1.0	1.0	0.7
Structure Controlling Flow	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	N/A	0.1	0.4	0.5	0.7	0.7
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	11	18	20	21	21	20	19	18	16
Time to Drain 99% of Inflow Volume (hours)	12	19	20	22	22	22	22	22	21
Maximum Ponding Depth (ft)	0.30	0.81	0.60	0.97	1.10	1.20	1.25	1.33	1.78
Area at Maximum Ponding Depth (acres)	0.08	0.10	0.09	0.10	0.10	0.10	0.11	0.11	0.12
Maximum Volume Stored (acre-ft)	0.024	0.070	0.050	0.085	0.097	0.108	0.113	0.122	0.172

FROM APPROVED "ADDENDUM 2 TO THE FINAL DRAINAGE REPORT FOR HOMESTEAD 2 AT STERLING RANCH FILING NO. 2"

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention*. Version 4.04. (February 2021)



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