

- Pre-development release rate into East Tributary=141cfs/458cfs in the 5yr/100 yr storm at this pond outfall (Design Pt. 2, Table 6.2 in MDDP). See Design Point 46 for discussion on flows in creek from this pond
- Pond Bottom Elevation: 5706.00

Design: Composite, WQ/EURV by Full Spectrum Excel Worksheets, 5/100yr by Hydraflow

	WQ	EURV	5-yr	100-yr
Peak Inflow	63.1cfs	181.4cfs	167.5cfs	519.1cfs
Peak Outflow	1.4cfs	7.3cfs	126.3cfs	453.2cfs
Ponding Depth	3.92ft	6.27ft	7.49ft	8.42ft
Stored Volume	3.29ac-ft	9.52ac-ft	13.01ac-ft	15.86ac-ft
Spillway Stage	7.00ft, 52' wide			
Structure Type:	3'x30' flat top outlet structure (cdot type d) with top at stage 6.60ft			

#### Detention Pond D2 (Full Spectrum Design, Ultimate Conditions)

This is an on-site permanent full spectrum detention pond that includes water quality and discharges directly into the East Tributary. Pond D2 is a typical full spectrum pond is designed using the UDCF Full Spectrum spreadsheets. There are no ponds in series for the "D" basins. The outlet structure is a standard 4'x20' full spectrum sloped outlet structure and the overflow spillway is a weir set above the outlet structure designed by the full spectrum spreadsheets to match pre-developed rates. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas.

- Watershed Area: 89 acres (Ultimate Area)
- Watershed Imperviousness: 55%
- Hydrologic Soils Group C/D **see calc. sheet redlines.**
- Forebay: 1.635ac-ft (see spreadsheet in appendix) divided between two forebays
- Zone 1 WQCV: 1.53ac-ft, WSEL: 5697.72
- Zone 2 EURV: 3.93ac-ft, WSEL: 5699.13, Top EURV set at 5699.60, 4'x20' outlet with 10:1 slope, 9.2cfs
- (5-yr): 5.3ac-ft, WSEL: 5699.90, 14.2cfs
- Zone 3 (100-yr): 8.77ac-ft, WSEL: 5701.70, 145cfs
- Pipe Outlet: 54" RCP at 0.5% with no restrictor plate
- Overflow Spillway: 30' wide bottom, elevation=5702.00, 4:1 side slopes, flow depth=1.64' at 277.1cfs
- Pre-development release rate into creek compliance from full spectrum pond spreadsheets
- Pond Bottom Elevation: 5695.00

Design: Full Spectrum Excel Worksheets Only

	WQ	EURV	5-yr	100-yr
Peak Inflow	32.1cfs	90.1cfs	122.9cfs	288.3cfs
Peak Outflow	0.7cfs	9.2cfs	14.2cfs	145.0cfs
Ponding Depth	2.72ft	4.13ft	4.90ft	6.70ft
Stored Volume	1.53ac-ft	3.95ac-ft	5.29ac-ft	8.77ac-ft

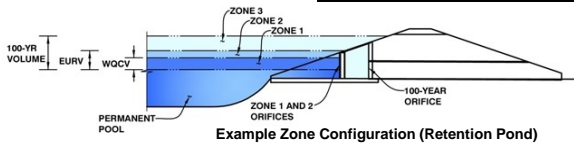


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **Lorson East MDDP (100.013)**

Basin ID: **Pond C5 (only used for WQCV and EURV) Do not use for 2-100-yr Storm Event!!!!!!**



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.01	3.515	Orifice Plate
Zone 2 (EURV)	6.57	6.868	Rectangular Orifice
Zone 3 (User)	6.60	0.100	Weir&Pipe (Restrict)
<b>Total</b>		<b>10.482</b>	

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

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

**Calculated Parameters for Underdrain**

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

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
 Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
 Orifice Plate: Orifice Vertical Spacing =  inches  
 Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

**Calculated Parameters for Plate**

WQ Orifice Area per Row =  ft<sup>2</sup>  
 Elliptical Half-Width =  feet  
 Elliptical Slot Centroid =  feet  
 Elliptical Slot Area =  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	1.34	2.67					
Orifice Area (sq. inches)	9.21	9.21	9.21					

	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)**

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="4.01"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="6.57"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	<input type="text" value="6.00"/>	<input type="text" value="N/A"/>	inches
Vertical Orifice Width =	<input type="text" value="18.68"/>	<input type="text" value=""/>	inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.78"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Vertical Orifice Centroid =	<input type="text" value="0.25"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="6.60"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	<input type="text" value="30.00"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Open Area % =	<input type="text" value="80%"/>	<input type="text" value="N/A"/>	% grate open area/total area
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>1</sub> =	<input type="text" value="6.60"/>	<input type="text" value="N/A"/>	feet
Over Flow Weir Slope Length =	<input type="text" value="30.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="5.73"/>	<input type="text" value="N/A"/>	should be ≥ 4
Overflow Grate Open Area w/o Debris =	<input type="text" value="72.00"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	<input type="text" value="36.00"/>	<input type="text" value="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 =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="48.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="48.00"/>	<input type="text" value=""/>	inches

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

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="12.57"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Outlet Orifice Centroid =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="3.14"/>	<input type="text" value="N/A"/>	radians

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

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

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =  feet  
 Stage at Top of Freeboard =  feet  
 Basin Area at Top of Freeboard =  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) =	3.515	10.382	9.890	14.020	17.354	22.326	26.255	31.112	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	3.517	10.386	6.877	8.575	17.689	26.716	34.728	37.807	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.14	0.39	0.89	1.17	1.52	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	2.9	24.2	65.9	151.4	199.8	259.3	0.0
Peak Inflow Q (cfs) =	63.1	181.4	138.8	167.5	201.6	385.7	450.0	519.1	#N/A
Peak Outflow Q (cfs) =	2.5	7.3	5.1	6.2	108.7	107.6	313.7	326.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	1.7	1.4	1.6	1.3	#N/A
Structure Controlling Flow =	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	1.1	1.9	1.9	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) =	38	54	49	52	53	50	48	47	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	58	52	55	59	58	58	57	#N/A
Maximum Ponding Depth (ft) =	3.92	6.27	5.05	5.58	7.23	7.55	8.00	8.04	#N/A
Area at Maximum Ponding Depth (acres) =	2.47	2.80	2.66	2.72	2.92	2.96	3.02	3.03	#N/A
Maximum Volume Stored (acre-ft) =	3.298	9.524	6.195	7.619	12.301	13.213	14.560	14.711	#N/A

Adjust to be  
1 or less

## Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	USER	USER	USER	USER	USER	USER	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.53 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:32	0.00	0.00	29.00	36.00	51.00	62.00	64.00	65.00	#N/A
Hydrograph Constant 1.105	0:09:04	0.00	0.00	66.00	81.00	120.00	139.00	173.00	175.00	#N/A
	0:13:35	2.65	6.62	96.00	117.00	181.00	213.00	275.00	283.00	0.00
	0:18:07	7.32	19.57	124.00	151.00	248.00	313.00	391.00	461.00	0.00
	0:22:39	18.80	50.29	135.00	164.00	291.00	375.00	440.00	509.00	0.00
	0:27:11	51.57	137.40	138.80	167.50	301.00	385.70	450.00	519.10	0.00
	0:31:43	63.09	181.40	124.00	145.00	272.00	362.00	435.00	476.00	0.00
	0:36:14	60.59	178.56	93.00	112.00	224.00	306.00	415.00	396.00	0.00
	0:40:46	55.14	164.07	73.00	89.00	197.00	264.00	360.00	336.00	0.00
	0:45:18	49.64	148.07	53.00	65.00	163.00	210.00	297.00	264.00	0.00
	0:49:50	43.37	130.43	42.00	52.00	138.00	182.00	235.00	225.00	0.00
	0:54:22	37.83	114.23	29.00	36.00	96.00	151.00	202.00	183.00	0.00
	0:58:53	34.19	102.31	18.00	24.00	67.00	120.00	165.00	149.00	0.00
	1:03:25	28.61	86.89	8.00	17.00	39.00	85.00	136.00	119.00	0.00
	1:07:57	23.68	72.31	7.40	11.00	33.00	78.00	109.80	117.00	0.00
	1:12:29	18.72	58.12	6.90	10.00	29.00	72.00	98.00	113.00	0.00
	1:17:01	14.42	45.40	6.30	10.00	25.00	67.00	86.00	98.00	0.00
	1:21:32	10.74	34.41	5.70	8.40	24.00	64.00	79.00	91.00	0.00
	1:26:04	8.07	25.42	5.40	7.50	22.00	59.00	75.00	86.00	0.00
	1:30:36	6.51	20.14	4.70	6.80	21.00	50.00	71.00	83.00	0.00
	1:35:08	5.48	16.87	4.50	6.10	20.00	41.00	68.00	80.00	0.00
	1:39:40	4.77	14.58	4.00	5.60	20.00	37.00	64.00	78.00	0.00
	1:44:11	4.27	12.98	3.60	5.20	19.00	34.00	60.00	75.00	0.00
	1:48:43	3.92	11.84	3.10	4.80	19.00	33.00	50.00	72.00	0.00
	1:53:15	2.91	9.12	3.00	4.40	18.00	32.00	42.90	69.00	0.00
	1:57:47	2.11	6.57	2.50	4.10	18.00	31.00	38.00	66.00	0.00
	2:02:19	1.56	4.88	2.40	3.80	17.00	31.00	35.00	63.00	0.00
	2:06:50	1.16	3.62	2.30	3.50	17.00	30.00	34.00	58.00	0.00
	2:11:22	0.85	2.68	2.20	3.20	17.00	29.00	33.00	46.00	0.00
	2:15:54	0.61	1.94	1.90	3.00	17.00	29.00	32.00	40.00	0.00
	2:20:26	0.44	1.40	1.70	3.00	17.00	28.00	31.00	37.00	0.00
2:24:58	0.31	1.00	1.50	3.00	16.00	28.00	30.00	35.00	0.00	
2:29:29	0.20	0.66	1.30	3.00	15.00	27.00	30.00	35.00	0.00	
2:34:01	0.11	0.40	1.00	2.30	15.00	27.00	29.00	33.00	0.00	
2:38:33	0.05	0.20	0.90	2.00	14.00	26.00	29.00	33.00	0.00	
2:43:05	0.01	0.06	0.80	1.80	14.00	26.00	28.00	32.00	0.00	
2:47:37	0.00	0.00	0.20	1.70	9.00	25.00	28.00	32.00	0.00	
2:52:08	0.00	0.00	0.00	1.60	5.00	25.00	27.00	31.00	0.00	
2:56:40	0.00	0.00	0.00	1.00	3.00	24.00	27.00	31.00	0.00	
3:01:12	0.00	0.00		0.90	2.00	24.00	27.00	31.00	0.00	
3:05:44	0.00	0.00		0.00	1.00	23.00	26.00	30.00	0.00	
3:10:16	0.00	0.00		0.00	0.00	23.00	26.00	30.00	0.00	
3:14:47	0.00	0.00		0.00	0.00	20.00	25.00	28.00	0.00	
3:19:19	0.00	0.00			0.00	20.00	25.00	28.00	0.00	
3:23:51	0.00	0.00			0.00	20.00	25.00	28.00	0.00	
3:28:23	0.00	0.00			0.00	15.00	20.00	25.00	0.00	
3:32:55	0.00	0.00				10.00	20.00	25.00	0.00	
3:37:26	0.00	0.00				5.00	20.00	25.00	0.00	
3:41:58	0.00	0.00				1.00	15.00	20.00	0.00	
3:46:30	0.00	0.00				0.00	15.00	20.00	0.00	
3:51:02	0.00	0.00				0.00	10.00	16.00	0.00	
3:55:34	0.00	0.00					10.00	16.00	0.00	
4:00:05	0.00	0.00					8.00	11.00	0.00	
4:04:37	0.00	0.00					8.00	11.00	0.00	
4:09:09	0.00	0.00					6.00	8.00	0.00	
4:13:41	0.00	0.00					4.00	6.00	0.00	
4:18:13	0.00	0.00					2.00	4.00	#N/A	
4:22:44	0.00	0.00					1.00	2.00	#N/A	
4:27:16	0.00	0.00					0.00	1.00	#N/A	
4:31:48	0.00	0.00					0.00	0.00	#N/A	
4:36:20	0.00	0.00						0.00	#N/A	
4:40:52	0.00	0.00						0.00	#N/A	
4:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
4:49:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
4:54:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
4:58:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:03:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:08:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:12:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:17:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:21:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	
5:26:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A	

Replace the SSD sheet.

