INNOVATIVE DESIGN. **CLASSIC RESULTS.**

FINAL DRAINAGE REPORT FOR FOOTHILLS FARM CAMPUS FILING NO. 2 AMENDMENT TO MASTER DEVELOMENT DRAINAGE PLAN FOR MARKETPLACE AT INTERQUEST AND FINAL DRAINAGE REPORT FOR MARKETPLACE AT INTERQUEST FILING NO. 1 AND FILING NO. 2

(APPENDIX PART 2)

Prepared for:

ALLISON VALLEY DEVELOPMENT COMPANY, LLC
1755 TELSTAR DRIVE, SUITE 211
COLORADO SPRINGS, CO 80920
(719) 867-2279

Job no. 2399.86

CLASSIC CONSULTING

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ClassicConsulting.net

FINAL DRAINAGE REPORT FOR FOOTHILLS FARM CAMPUS FILING NO. 2

Engineer's Statement

This report and plan for the drainage design of **Foothills Farm Campus Filing No. 2** was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Design and Technical Criteria and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

SIGNATURE (Affix Seal): ______________________ 6/27/19

Catherine M. Tessin, Colorado P.E. No. 45004 Date

Developer's Statement

Allison Valley Development Company, LLC hereby certifies that the drainage facilities for **Foothills Farm Campus Filing No. 2** shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of **Foothills Farm Campus Filing No. 2**, guarantee that final drainage design review will absolve **Allison Valley Development Company, LLC.** and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Allison Valley Development Co., LLC a Colorado Limited Liability Company

Name of Developer

______________________ 6/26/19

Authorized Signature Date

Steve Rossoll

Printed Name

Director of Development

La Plata Communities, Inc. A Colorado Corporation, Manager

Title

1755 Telstar Drive, Suite 211, Colorado Springs, CO 80920

Address:

City of Colorado Springs Statement:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

Anna Bergmark 07/08/2019

For City Engineer Date

Conditions:

CLASSIC CONSULTING ENGINEERS & SURVEYORS

POND D

IRF

EDB BMP FOREBAY WORKSHEETS

IMPACT STRUCTURE CALCS

OVERFLOW WEIR RIP RAP

RIP RAP OUTLET SIZING

HGLS

Pond D

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	
Max Intensity for Optional User Defined Storm	2.51496		

Designer: CMT
Company: CCES
Date: June 10, 2019
Project: FOOTHILLS FARM CAMPUS FIL 2 ENT - POND D TRIBUTARY
Location: CO. SPRINGS

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	DP 1	DP2	DP3	DP4	BASIN AA									
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand									
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	23.400	7.730	4.360	1.990	2.120									
Directly Connected Impervious Area (DCIA, acres)	21.060	6.680	3.920	1.790	0.210									
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000									
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000									
Separate Pervious Area (SPA, acres)	2.340	1.050	0.440	0.200	1.910									
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C									

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	23.400	7.730	4.360	1.990	2.120									
Directly Connected Impervious Area (DCIA, %)	90.0%	86.4%	89.9%	89.9%	9.9%									
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Separate Pervious Area (SPA, %)	10.0%	13.6%	10.1%	10.1%	90.1%									
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000									
I_a Check	1.000	1.000	1.000	1.000	1.000									
f / I for WQCV Event:	1.6	1.6	1.6	1.6	1.6									
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5									
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4									
f / I for Optional User Defined Storm CUHP:	0.39	0.39	0.39	0.39	0.39									
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00									
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00									
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00									
IRF for Optional User Defined Storm CUHP:	1.00	1.00	1.00	1.00	1.00									
Total Site Imperviousness: I_{total}	90.0%	86.4%	89.9%	89.9%	9.9%									
Effective Imperviousness for WQCV Event:	90.0%	86.4%	89.9%	89.9%	9.9%									
Effective Imperviousness for 5-Year Event:	90.0%	86.4%	89.9%	89.9%	9.9%									
Effective Imperviousness for 100-Year Event:	90.0%	86.4%	89.9%	89.9%	9.9%									
Effective Imperviousness for Optional User Defined Storm CUHP:	90.0%	86.4%	89.9%	89.9%	9.9%									

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%									

Total Site Imperviousness:	85.0%
Total Site Effective Imperviousness for WQCV Event:	85.0%
Total Site Effective Imperviousness for 5-Year Event:	85.0%
Total Site Effective Imperviousness for 100-Year Event:	85.0%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	85.0%

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	CMT
Company:	CCES
Date:	June 27, 2019
Project:	FOOTHILLS FARM CAMPUS FIL 2 POND D- 60" FOREBAY SIZING
Location:	CO SPRINGS

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 85.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.850
C) Contributing Watershed Area	Area = 39.600 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= 1.167 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed i) Percentage of Watershed consisting of Type A Soils ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 0 % HSG_B = 100 % $HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 3.766 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 3.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.035 ac-ft
B) Actual Forebay Volume	V_F = 0.035 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 30.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 203.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.06 cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir
G) Rectangular Notch Width	Calculated W_N = 9.7 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**CMT**
Company:	**CCES**
Date:	**June 27, 2019**
Project:	**FOOTHILLS FARM CAMPUS FIL 2 POND D- 60" FOREBAY SIZING**
Location:	**CO SPRINGS**

6. Trickle Channel A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 190 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 2.34 inches
E) Total Outlet Area	A_{ot} = 24.30 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 153 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 95.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 749 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1055 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 8.13 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 125.56 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**CMT**
Company:	**CCES**
Date:	**June 27, 2019**
Project:	**FOOTHILLS FARM CAMPUS FIL 2 POND D- 60" FOREBAY SIZING**
Location:	**CO SPRINGS**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

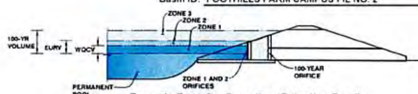
Pond D

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: POND D FINAL

Basin ID: FOOTHILLS FARM CAMPUS FIL NO. 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	39.60	acres	Note: L / W Ratio < 1	
Watershed Length =	1,250	ft	L / W Ratio = 0.9	
Watershed Slope =	0.080	ft/ft		
Watershed Imperviousness =	85.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	1.195	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	3.754	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	3.190	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.174	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.118	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	6.142	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.941	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.993	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.1 in.) =	10.140	acre-feet	3.10	inches
Approximate 2-yr Detention Volume =	2.993	acre-feet		
Approximate 5-yr Detention Volume =	3.924	acre-feet		
Approximate 10-yr Detention Volume =	4.838	acre-feet		
Approximate 25-yr Detention Volume =	5.183	acre-feet		
Approximate 50-yr Detention Volume =	5.381	acre-feet		
Approximate 100-yr Detention Volume =	5.628	acre-feet		

Stage-Storage Calculation

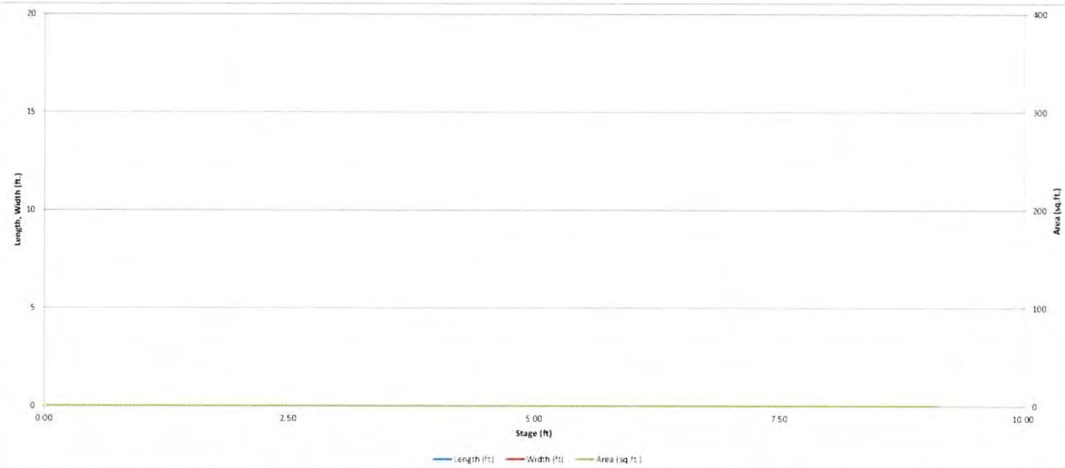
Zone 1 Volume (WQCV) =	1.195	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.560	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.873	acre-feet
Total Detention Basin Volume =	5.628	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

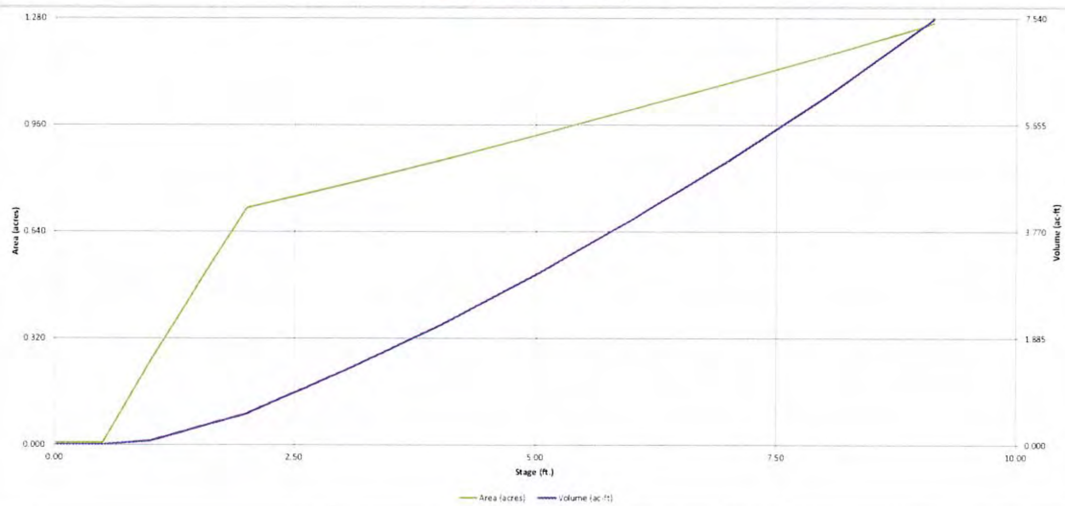
Depth Increment = 1 ft

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	--	--	--	250	0.006		
	--	0.50	--	--	--	250	0.006	123	0.003
6620	--	1.00	--	--	--	11,029	0.253	2,835	0.065
6621	--	2.00	--	--	--	30,917	0.710	23,609	0.542
6622	--	3.00	--	--	--	33,983	0.780	56,367	1.294
6623	--	4.00	--	--	--	37,151	0.853	91,934	2.111
6624	--	5.00	--	--	--	40,418	0.928	130,719	3.001
6625	--	6.00	--	--	--	43,786	1.005	172,821	3.967
6626	--	7.00	--	--	--	47,255	1.085	218,341	5.012
6627	--	8.00	--	--	--	50,824	1.167	267,381	6.138
6628	--	9.00	--	--	--	54,493	1.251	320,039	7.347
6628.14	--	9.14	--	--	--	55,110	1.265	327,712	7.523

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)





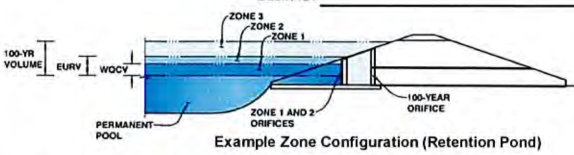
Pond D

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Pond D

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.88	1.195	Orifice Plate
Zone 2 (EURV)	5.79	2.560	Orifice Plate
Zone 3 (100-year)	7.56	1.873	Weir&Pipe (Restrict)
		5.628	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^2
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 =	5.79	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	23.20	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.93	3.86					
Orifice Area (sq. inches)	6.73	7.20	8.50					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.79	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	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_t =	5.79	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	1.77	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	17.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	8.50	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	42.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	9.62	N/A	ft^2
Outlet Orifice Centroid =	1.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.60	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	165.00	feet
Spillway End Slopes =	6.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

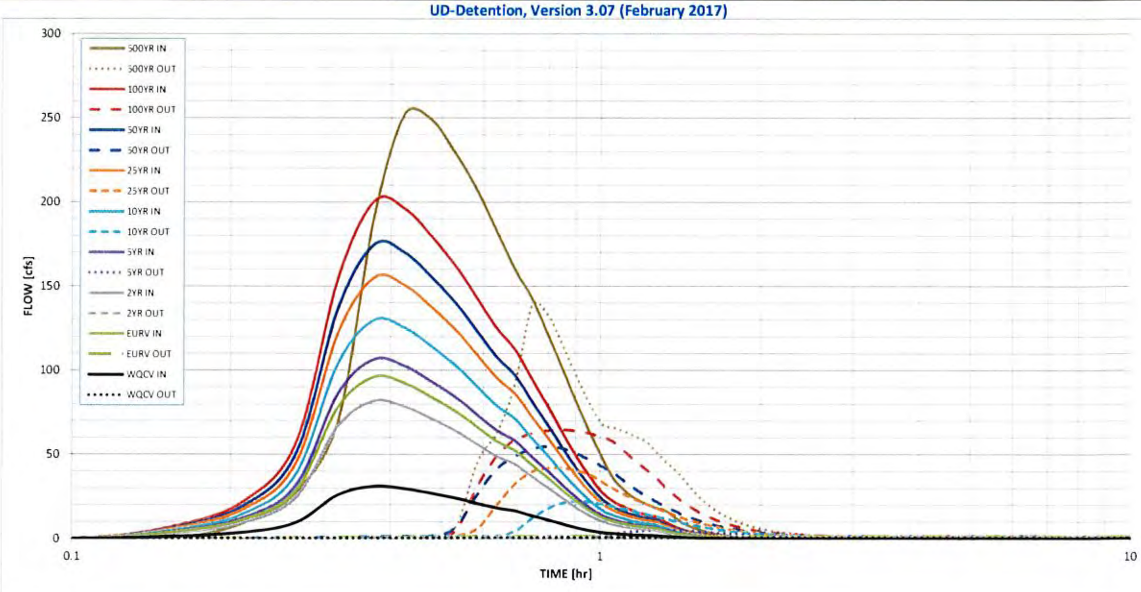
Spillway Design Flow Depth=	0.54	feet
Stage at Top of Freeboard =	9.14	feet
Basin Area at Top of Freeboard =	1.27	acres

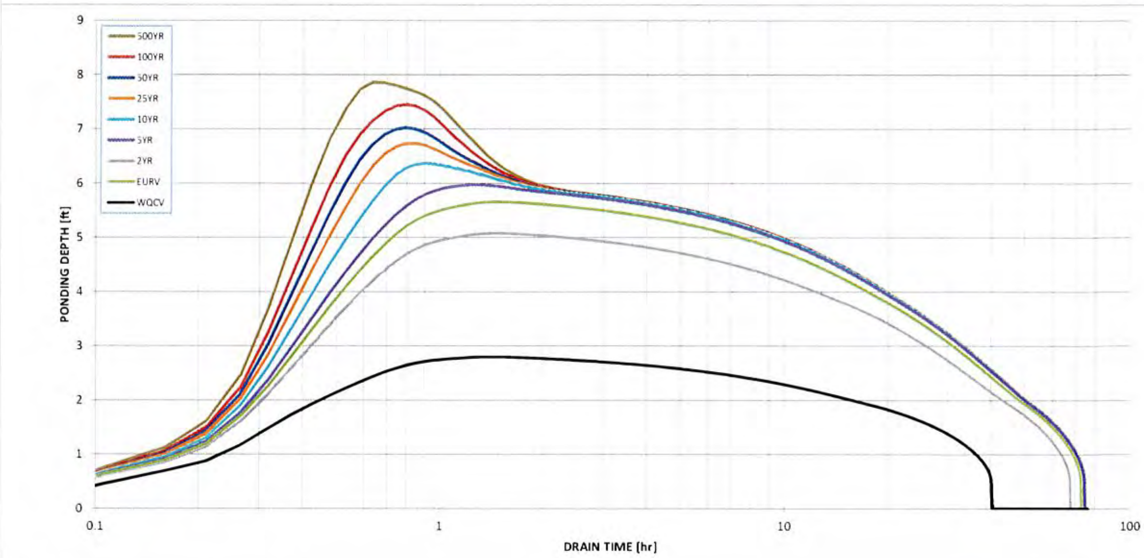
Routed Hydrograph Results

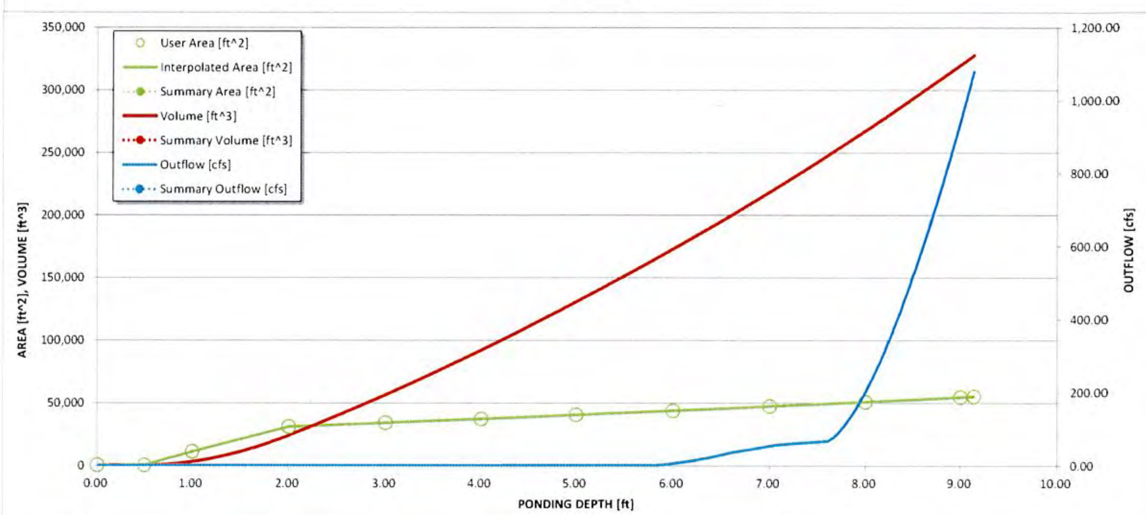
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.10
Calculated Runoff Volume (acre-ft) =	1.195	3.754	3.190	4.174	5.118	6.142	6.941	7.993	10.140
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.195	3.756	3.192	4.176	5.114	6.136	6.936	7.994	10.145
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.32	0.97	1.34	1.78	2.57
Predevelopment Peak Q (cfs) =	0.0	0.0	0.7	1.233	12.5	38.5	53.1	70.3	101.8
Peak Inflow Q (cfs) =	31.0	95.9	81.7	106.4	129.7	155.0	174.6	200.5	252.6
Peak Outflow Q (cfs) =	0.6	1.4	1.2	5.068	22.1	41.7	54.6	64.5	138.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.1	1.8	1.1	1.0	0.9	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	1.2	2.4	3.1	3.7	4.1
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	67	62	68	67	65	64	63	60
Time to Drain 99% of Inflow Volume (hours) =	40	71	66	72	72	71	71	71	70
Maximum Ponding Depth (ft) =	2.80	5.65	5.08	5.97	6.37	6.73	7.02	7.45	7.86
Area at Maximum Ponding Depth (acres) =	0.77	0.98	0.93	1.00	1.03	1.06	1.09	1.12	1.16
Maximum Volume Stored (acre-ft) =	1.132	3.620	3.066	3.937	4.334	4.712	5.034	5.498	5.976

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	3.18 min
Hydrograph Constant	1.573

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:03:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:06:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:09:32	1.35	4.01	3.45	4.41	5.28	6.17	6.83	7.67	9.26
0:12:43	3.67	11.10	9.51	12.27	14.80	17.49	19.53	22.17	27.32
0:15:54	9.42	28.51	24.41	31.49	38.01	44.90	50.15	56.93	70.19
0:19:05	25.87	78.18	66.97	86.34	104.16	122.97	137.30	155.76	191.80
0:22:16	30.98	95.89	81.69	106.37	129.71	154.97	174.62	200.49	252.61
0:25:26	29.62	92.14	78.39	102.36	125.24	150.20	169.77	195.68	248.45
0:28:37	26.96	83.85	71.33	93.23	114.25	137.24	155.30	179.26	228.22
0:31:48	24.15	75.53	64.20	83.98	102.96	123.73	140.04	161.70	205.96
0:34:59	20.93	66.02	56.04	73.47	90.20	108.54	122.97	142.14	181.39
0:38:10	18.20	57.61	48.85	64.14	78.82	94.91	107.58	124.40	158.86
0:41:20	16.51	52.04	44.17	57.90	71.04	85.42	96.71	111.70	142.30
0:44:31	13.70	43.58	36.94	48.53	59.68	71.93	81.59	94.44	120.81
0:47:42	11.25	36.09	30.56	40.21	49.51	59.73	67.78	78.51	100.53
0:50:53	8.75	28.55	24.12	31.87	39.35	47.61	54.14	62.84	80.77
0:54:04	6.60	22.02	18.55	24.61	30.49	36.97	42.10	48.95	63.08
0:57:14	4.80	16.41	13.78	18.39	22.85	27.80	31.72	36.97	47.80
1:00:25	3.68	12.33	10.38	13.79	17.08	20.71	23.59	27.42	35.32
1:03:36	3.01	9.93	8.38	11.09	13.69	16.55	18.81	21.82	28.00
1:06:47	2.55	8.36	7.06	9.33	11.51	13.91	15.79	18.30	23.45
1:09:58	2.23	7.28	6.16	8.12	10.00	12.07	13.69	15.86	20.28
1:13:08	2.01	6.51	5.51	7.26	8.94	10.77	12.22	14.14	18.05
1:16:19	1.85	5.97	5.05	6.65	8.18	9.85	11.17	12.91	16.47
1:19:30	1.36	4.44	3.75	4.96	6.13	7.43	8.46	9.83	12.67
1:22:41	0.99	3.21	2.72	3.59	4.43	5.36	6.10	7.09	9.13
1:25:52	0.73	2.38	2.01	2.65	3.28	3.97	4.52	5.26	6.78
1:29:02	0.54	1.77	1.49	1.97	2.44	2.96	3.36	3.91	5.03
1:32:13	0.39	1.29	1.09	1.44	1.79	2.17	2.48	2.88	3.72
1:35:24	0.28	0.93	0.78	1.04	1.29	1.57	1.79	2.08	2.69
1:38:35	0.20	0.67	0.57	0.75	0.93	1.14	1.29	1.51	1.95
1:41:46	0.13	0.47	0.39	0.53	0.66	0.80	0.91	1.07	1.39
1:44:56	0.08	0.30	0.25	0.34	0.43	0.52	0.60	0.70	0.92
1:48:07	0.04	0.17	0.14	0.19	0.25	0.30	0.35	0.42	0.55
1:51:18	0.02	0.08	0.06	0.09	0.11	0.14	0.17	0.20	0.27
1:54:29	0.00	0.02	0.02	0.02	0.03	0.04	0.05	0.06	0.09
1:57:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:00:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:04:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:07:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:10:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:13:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:16:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:19:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:23:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:26:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:29:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:32:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:35:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:39:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:42:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:45:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:48:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:51:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:54:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:58:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:01:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:04:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:07:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:10:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:13:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:17:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:23:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:26:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:29:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:33:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:36:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:39:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:42:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:48:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

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

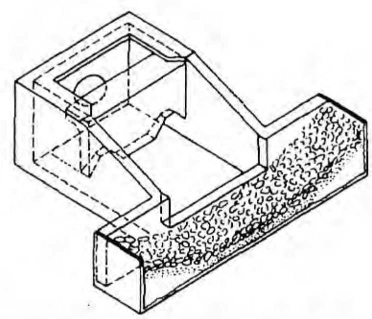
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Pmod D

Section 6

Stilling basin for pipe or open channel outlets (Basin VI)



THE stilling basin developed in these tests is an impact-type energy dissipator, contained in a relatively small boxlike structure, which requires no tail water for successful performance. Although the emphasis in this discussion is placed on use with pipe outlets, the entrance structure may be modified for use with an open channel entrance.

Generalized design rules and procedures are presented to allow determining the proper basin size and all critical dimensions for a range of discharges up to 339 cubic feet per second and velocities up to about 30 feet per second. Greater discharges may be handled by constructing multiple units side by side. The efficiency of the basin in accomplishing energy losses is greater than a hydraulic jump of the same Froude number.

The development of this short impact-type basin was initiated by the need for some 50 or more stilling structures on a single irrigation project. The need was for relatively small basins providing energy dissipation independent of a tail water curve or tail water of any kind.

Since individual model studies on 50 small stilling structures were too costly a procedure, tests were made on a single setup which was modified as necessary to generalize the design for the range of expected operations.

Test Procedure

Hydraulic models. Hydraulic models were used to develop the stilling basin, determine the discharge limitations, and obtain dimensions for the various parts of the basin. Basins 1.6 to 2.0 feet wide were used in the tests. The inlet pipe was 6⅜ inches, inside diameter, and was equipped with a slide gate well upstream from the basin entrance so that the desired relations between head, depth, and velocity could be obtained. The pipe was transparent so that backwater effects in the pipe could be studied. Discharges of over 3 cubic feet per second and velocities up to 15 feet per second

TABLE 11.—*Stilling basin dimensions (Basin VI). Impact-type energy dissipator.*

Suggested pipe size [1]		Max discharge	Feet and inches										Inches					
Dia in.	Area (sq ft)	Q	W	H	L	a	b	c	d	e	f	g	t_w	t_f	t_b	t_p	K	Suggested riprap size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19) [3]
18	1.77	[2] 21	5-6	4-3	7-4	3-3	4-1	2-4	0-11	0-6	1-6	2-1	6	6½	6	6	3	4.0
24	3.14	38	6-9	5-3	9-0	3-11	5-1	2-10	1-2	0-6	2-0	2-6	6	6½	6	6	3	7.0
30	4.91	59	8-0	6-3	10-8	4-7	6-1	3-4	1-4	0-8	2-6	3-0	6	6½	7	7	3	8.5
36	7.07	85	9-3	7-3	12-4	5-3	7-1	3-10	1-7	0-8	3-0	3-6	7	7½	8	8	3	9.0
42	9.62	115	10-6	8-0	14-0	6-0	8-0	4-5	1-9	0-10	3-0	3-11	8	8½	9	8	4	9.5
48	12.57	151	11-9	9-0	15-8	6-9	8-11	4-11	2-0	0-10	3-0	4-5	9	9½	10	8	4	10.5
54	15.90	191	13-0	9-9	17-4	7-4	10-0	5-5	2-2	1-0	3-0	4-11	10	10½	10	8	4	12.0
Pond D 60	19.63	236	14-3	10-9	19-0	8-0	11-0	5-11	2-5	1-0	3-0	5-4	11	11½	11	8	6	13.0
72	28.27	339	16-6	12-3	22-0	9-3	12-9	6-11	2-9	1-3	3-0	6-2	12	12½	12	8	6	14.0

[1] Suggested pipe will run full when velocity is 12 feet per second or half full when velocity is 24 feet per second. Size may be modified for other velocities by Q = AV, but relation between Q and basin dimensions shown must be maintained.

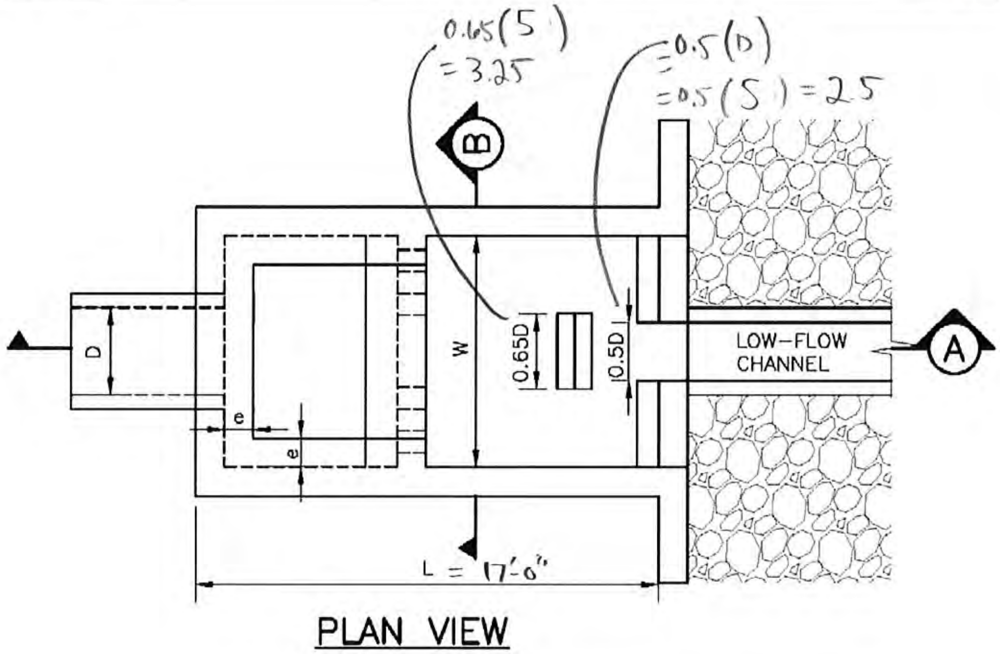
[2] For discharges less than 21 second-feet, obtain basin width from curve of Fig. 42. Other dimensions proportional to W: $H=\frac{3W}{4}$, $L=\frac{4W}{3}$, $d=\frac{W}{6}$, etc.

[3] Determination of riprap size explained in Sec. 10.

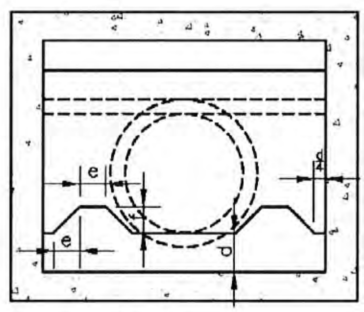
66" pond G

$\frac{9}{8'\text{-}8''}$

Pond D



$W=2.94D[\frac{V}{(gD)^{0.5}}]^{0.556}$	H=3/4 W c=1/2 W
V=VELOCITY, [FT/S]	L=4/3 W d=1/6 W
$D=(A)^{0.5}$	a=1/2 W e=1/12 W
	b=3/8 W f=1/8 W
A=AREA OF FLOW [SF]	t=1/12 W (SUGGESTED MIN)



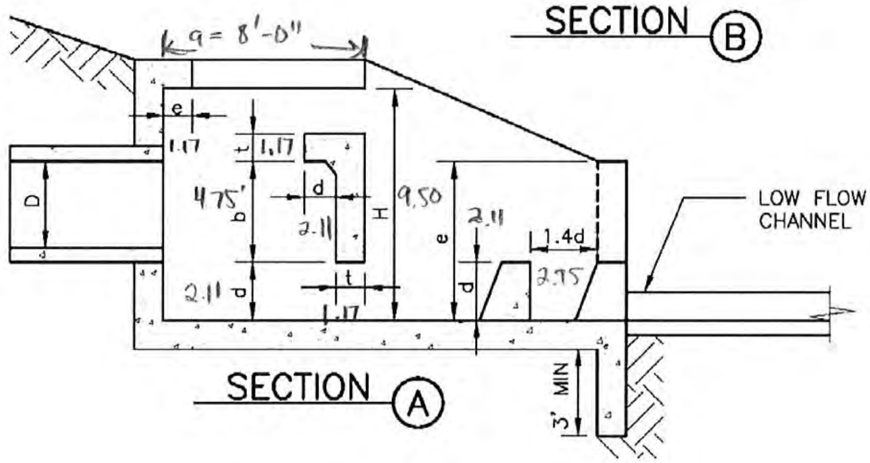


Figure 9-45. UDFCD modified USBR type VI impacts stilling basin (general design dimensions)

Worksheet for POND D INFLOW 60"

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00800	ft/ft
Diameter	5.00	ft
Discharge	203.00	ft^3/s

Results

Normal Depth	3.61	ft
Flow Area	15.19	ft^2
Wetted Perimeter	10.16	ft
Hydraulic Radius	1.50	ft
Top Width	4.48	ft
Critical Depth	4.06	ft
Percent Full	72.2	%
Critical Slope	0.00617	ft/ft
Velocity	13.37	ft/s
Velocity Head	2.78	ft
Specific Energy	6.39	ft
Froude Number	1.28	
Maximum Discharge	250.57	ft^3/s
Discharge Full	232.93	ft^3/s
Slope Full	0.00608	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	72.23	%
Downstream Velocity	Infinity	ft/s

Worksheet for POND D INFLOW 60"

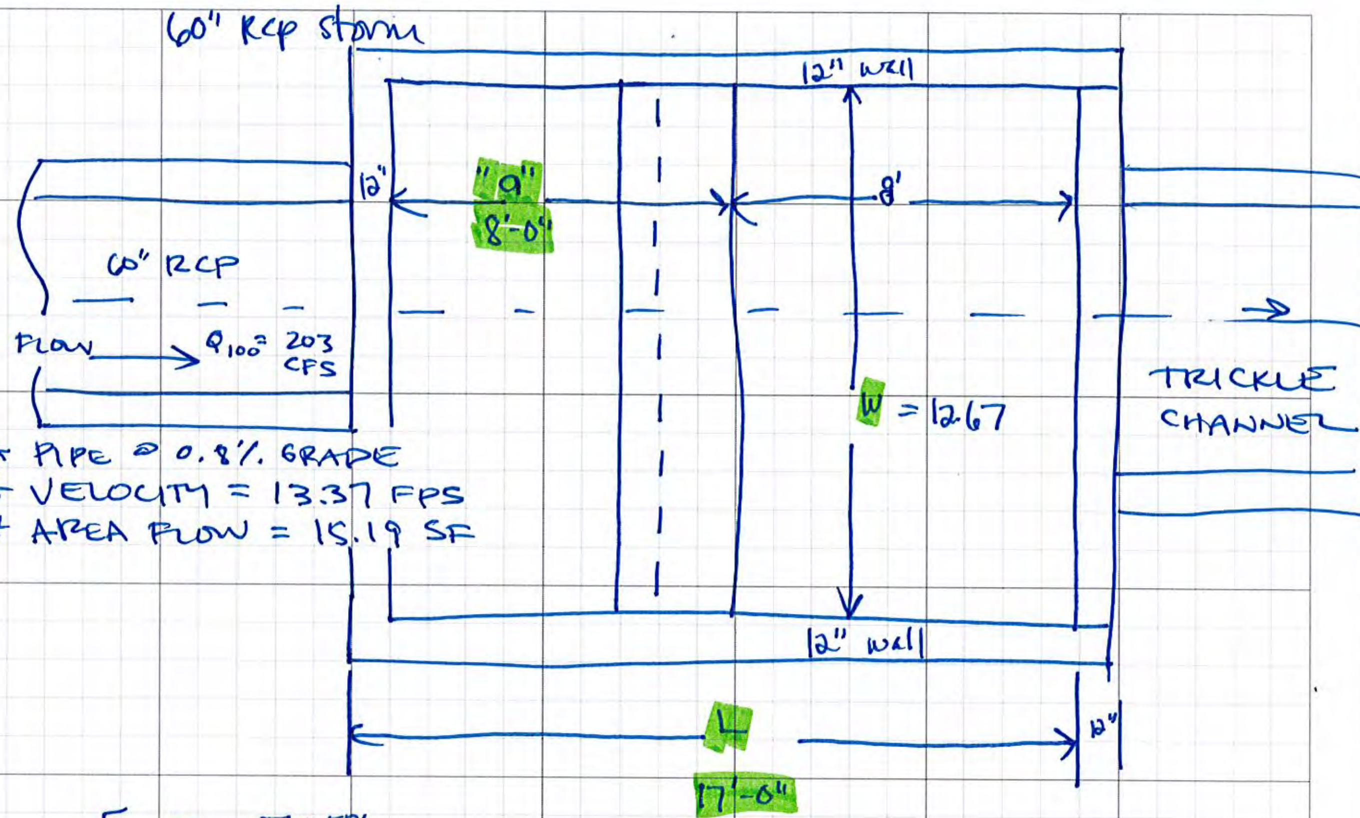
GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.61	ft
Critical Depth	4.06	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00617	ft/ft

CLASSIC
CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Project: Pond D stilling basin calcs
Date:
Contact:
Phone:
By:

NOTES
- ☐ Telephone Record
- ☐ Note to the File
- ☐ Job Information
- ☐ Meeting Minutes
- ☐



* PIPE @ 0.8% GRADE
* VELOCITY = 13.37 FPS
* AREA FLOW = 15.19 SF

$$W = 2.94\,D\left[\frac{V}{gD^{0.5}}\right]^{0.556}$$

$D = A^{0.5}$
$= 15.19^{0.5}$
$D = 3.89$

$$W = 2.94\,(3.89)\left[\frac{13.37}{\left[(32.2)(3.89)\right]^{0.5}}\right]^{0.556}$$

$$W = 11.437\left[1.195\right]^{0.556}$$

$W = \underline{12.627}$ use $\boxed{12.67'}$

$t = 1/12\,W = 1.05$ use 1.167 or 1'-1"
$H = 3/4\,W = 9.50$
$L = 4/3\,W = 16.89$ use 16.91 or 16'-11" use 17'
$a = 1/2\,W = 6.33'$
$b = 3/8\,W = 4.751$
$c = 1/2\,W = 6.33'$
$d = 1/6\,W = 2.11$
$e = 1/12\,W = 1.05$
$f = 1/8\,W = 1.58$

Pond D

Figure 13-12c. Emergency Spillway Protection

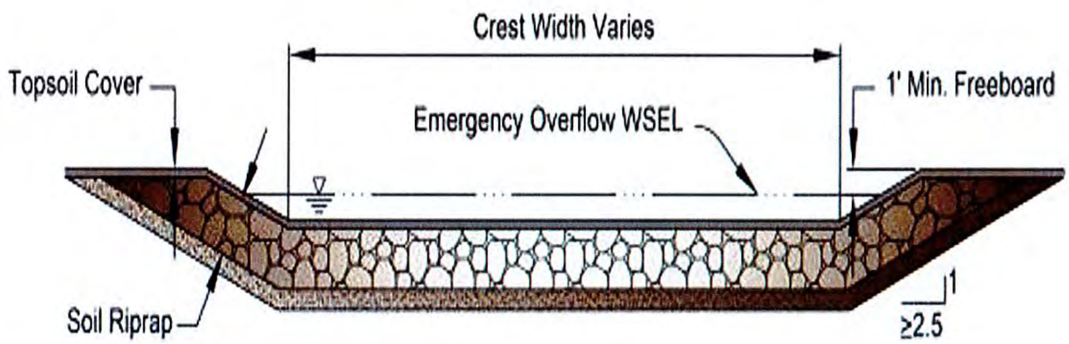
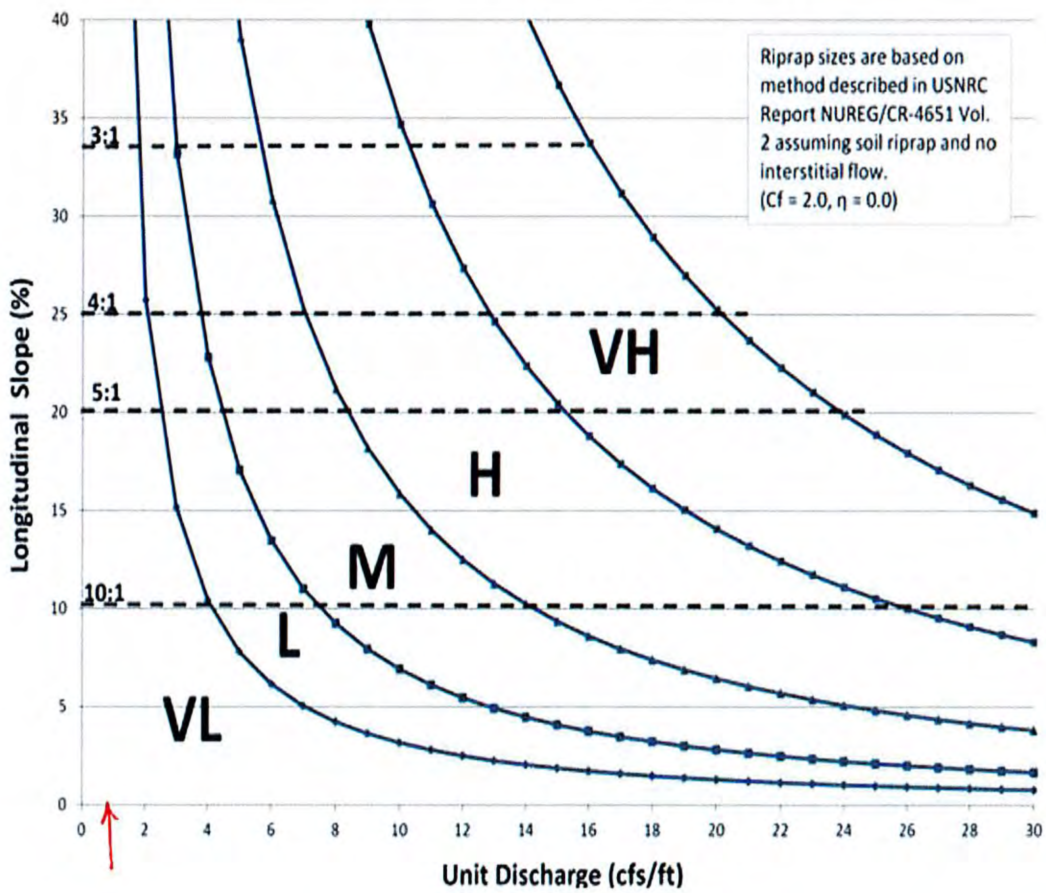


Figure 13-12d. Riprap Types for Emergency Spillway Protection

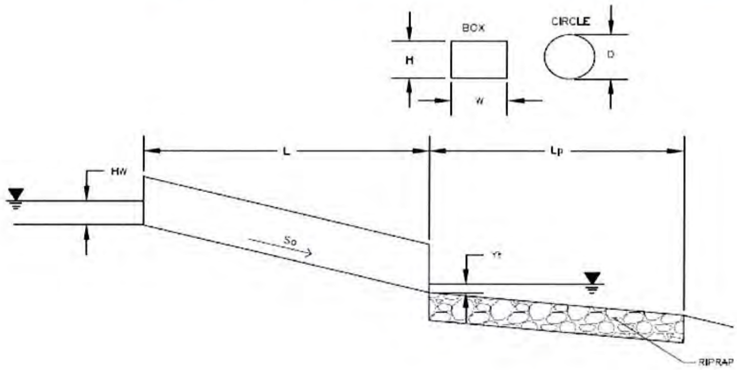


Q_{100} = 200 cfs Unit Discharge = $\frac{200}{165 \text{ LF}}$ = 1.21 use type VL

Pond D
Outlet to BS creek

Determination of Culvert Headwater and Outlet Protection

Project: **FARM 5**
Basin ID: **TEMP RUNDOWN**



Soil Type:
Choose One:
◉ Sandy
○ Non-Sandy

Design Information (Input):

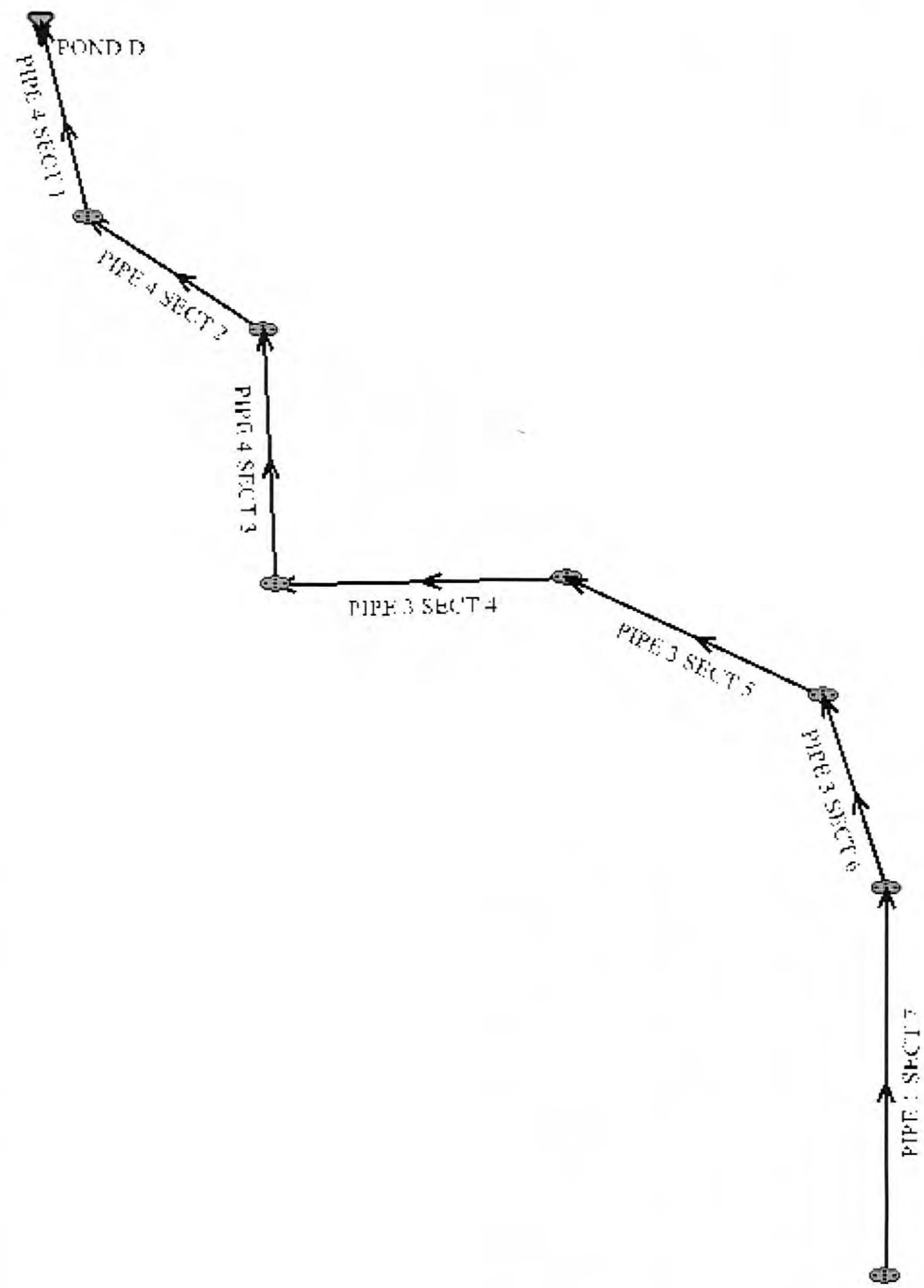
	Design Discharge	Q =	64.5	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	42	inches
	Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:			OR	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	1	
	Inlet Elevation	Elev IN =	6616.5	ft
	Outlet Elevation OR Slope	Elev OUT =	6615.83	ft
	Culvert Length	L =	133.61	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =	6615.83	ft
	Max Allowable Channel Velocity	V =	5	ft/s

Tailwater ELEVATION is less than outlet elevation, using 0.4 x RISE as Yt

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.40	ft
Flow Area at Max Channel Velocity	A_t =	12.90	ft^2
Culvert Cross Sectional Area Available	A =	9.62	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.78	
Sum of All Losses Coefficients	k_s =	2.28	ft
Culvert Normal Depth	Y_n =	2.60	ft
Culvert Critical Depth	Y_c =	2.52	ft
Tailwater Depth for Design	d =	3.01	ft
Adjusted Diameter OR Adjusted Rise	D_a =	-	ft
Expansion Factor	$1/(2^*\tan(\Theta))$ =	4.67	
Flow/Diameter$^{2.5}$ OR Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	2.81	$ft^{0.5}/s$
Froude Number	Fr =	0.93	
Tailwater/Adjusted Diameter OR Tailwater/Adjusted Rise	Yt/D =	0.40	
Inlet Control Headwater	HW_I =	4.19	ft
Outlet Control Headwater	HW_O =	3.93	
Design Headwater Elevation	**HW =**	**6,620.69**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.20**	
Minimum Theoretical Riprap Size	d_{50} =	8	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**27**	**ft**
Width of Protection	**T =**	**10**	**ft**

Pond D
mainline outfall



System Input Summary - POND D OUTFALL 5 YEAR

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.35
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.99
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6621.48

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	Sub Basin Information: 5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND D	6626.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 1	6634.96	110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 2	6637.11	110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 3	6643.55	110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 4	6647.20	104.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 5	6649.04	104.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 6	6654.69	104.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 1 SECT 7	6659.53	91.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND D	0.00	0.00	0.00	0.00	0.00	680.26	0.16	0.09	110.00	
PIPE 4 SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.00	
PIPE 4 SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.00	
PIPE 4 SECT 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.00	
PIPE 3 SECT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.00	
PIPE 3 SECT 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.00	
PIPE 3 SECT 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	104.00	
PIPE 1 SECT 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients Mannings n	Bend Loss	Lateral Loss	Given Dimensions Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 4 SECT 1	31.31	6624.15	0.8	6624.41	0.013	0.03	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 4 SECT 2	139.68	6624.40	0.8	6625.52	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 4 SECT 3	246.20	6625.83	1.0	6628.29	0.013	0.18	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 4	186.46	6628.59	1.0	6630.45	0.013	1.32	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 5	105.72	6630.45	1.0	6631.51	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 6	307.82	6631.51	1.0	6634.59	0.013	0.38	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 1 SECT 7	232.80	6634.89	1.6	6638.61	0.013	0.05	0.00	CIRCULAR	60.00 in	60.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Velocity (fps)	Critical Flow Depth (in)	Velocity (fps)	Normal Flow Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 4 SECT 1	238.09	12.13	35.90	8.97	28.65	11.89	1.54	Supercritical	110.00	0.00	
PIPE 4 SECT 2	233.57	11.90	35.90	8.97	28.97	11.72	1.51	Supercritical	110.00	0.00	
PIPE 4 SECT 3	261.14	13.30	35.90	8.97	27.17	12.73	1.70	Supercritical	110.00	0.00	
PIPE 3 SECT 4	261.14	13.30	34.86	8.79	26.33	12.54	1.71	Supercritical	104.00	0.00	
PIPE 3 SECT 5	261.14	13.30	34.86	8.79	26.33	12.54	1.71	Supercritical	104.00	0.00	
PIPE 3 SECT 6	261.14	13.30	34.86	8.79	26.33	12.54	1.71	Supercritical	104.00	0.00	
PIPE 1 SECT 7	330.32	16.82	32.51	8.38	21.53	14.37	2.20	Supercritical	91.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.

- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing Rise	Existing Span	Calculated Rise	Calculated Span	Used Rise	Used Span	Area (ft^2)	Comment
PIPE 4 SECT 1	110.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 4 SECT 2	110.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 4 SECT 3	110.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 4	104.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 5	104.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 6	104.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 1 SECT 7	91.00	CIRCULAR	60.00 in	60.00 in	42.00 in	42.00 in	60.00 in	60.00 in	19.63	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6621.48

Element Name	Invert Elev. Downstream (ft)	Invert Elev. Upstream (ft)	Downstream Manhole Losses Bend Loss (ft)	Downstream Manhole Losses Lateral Loss (ft)	HGL Downstream (ft)	HGL Upstream (ft)	EGL Downstream (ft)	EGL Friction Loss (ft)	EGL Upstream (ft)
PIPE 4 SECT 1	6624.15	6624.41	0.00	0.00	6626.79	6627.40	6628.49	0.16	6628.65
PIPE 4 SECT 2	6624.40	6625.52	0.10	0.00	6627.50	6628.51	6628.95	0.81	6629.76
PIPE 4 SECT 3	6625.83	6628.29	0.09	0.00	6628.60	6631.28	6630.61	1.92	6632.53
PIPE 3 SECT 4	6628.59	6630.45	0.58	0.00	6631.86	6633.36	6633.22	1.33	6634.55
PIPE 3 SECT 5	6630.45	6631.51	0.09	0.00	6633.44	6634.42	6635.09	0.52	6635.61
PIPE 3 SECT 6	6631.51	6634.59	0.17	0.00	6634.58	6637.50	6636.15	2.55	6638.69
PIPE 1 SECT 7	6634.89	6638.61	0.02	0.00	6637.51	6641.32	6639.88	2.53	6642.41

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Pond D
mainline outfall

System Input Summary - POND D OUTFALL 100 YEAR

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.35
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.99
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6621.48

Manhole Input Summary:

Element Name	Given Flow: Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND D	6626.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 1	6634.96	203.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 2	6637.11	203.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4 SECT 3	6643.55	203.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 4	6647.20	192.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 5	6649.04	192.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3 SECT 6	6654.69	192.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 1 SECT 7	6659.53	169.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND D	0.00	0.00	0.00	0.00	0.00	2316.76	0.09	0.05	203.00	
PIPE 4 SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	203.00	
PIPE 4 SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	203.00	
PIPE 4 SECT 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	203.00	
PIPE 3 SECT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	192.00	
PIPE 3 SECT 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	192.00	
PIPE 3 SECT 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	192.00	
PIPE 1 SECT 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	169.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Elevation: Slope (%)	Elevation: Upstream Invert (ft)	Loss Coefficients: Mannings n	Loss Coefficients: Bend Loss	Loss Coefficients: Lateral Loss	Given Dimensions: Cross Section	Given Dimensions: Rise (ft or in)	Given Dimensions: Span (ft or in)
PIPE 4 SECT 1	31.31	6624.15	0.8	6624.41	0.013	0.03	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 4 SECT 2	139.68	6624.40	0.8	6625.52	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 4 SECT 3	246.20	6625.83	1.0	6628.29	0.013	0.18	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 4	186.46	6628.59	1.0	6630.45	0.013	1.32	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 5	105.72	6630.45	1.0	6631.51	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3 SECT 6	307.82	6631.51	1.0	6634.59	0.013	0.38	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 1 SECT 7	232.80	6634.89	1.6	6638.61	0.013	0.05	0.00	CIRCULAR	60.00 in	60.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity: Flow (cfs)	Full Flow Capacity: Velocity (fps)	Critical Flow: Depth (in)	Critical Flow: Velocity (fps)	Normal Flow: Depth (in)	Normal Flow: Velocity (fps)	Normal Flow: Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 4 SECT 1	238.09	12.13	48.77	11.88	42.60	13.62	1.32	Supercritical	203.00	0.00	
PIPE 4 SECT 2	233.57	11.90	48.77	11.88	43.24	13.40	1.28	Supercritical	203.00	0.00	
PIPE 4 SECT 3	261.14	13.30	48.77	11.88	39.76	14.70	1.52	Supercritical	203.00	0.00	
PIPE 3 SECT 4	261.14	13.30	47.54	11.51	38.24	14.54	1.55	Pressurized	192.00	186.46	
PIPE 3 SECT 5	261.14	13.30	47.54	11.51	38.24	14.54	1.55	Pressurized	192.00	105.72	
PIPE 3 SECT 6	261.14	13.30	47.54	11.51	38.24	14.54	1.55	Supercritical Jump	192.00	206.41	
PIPE 1 SECT 7	330.32	16.82	44.71	10.77	30.41	16.92	2.11	Supercritical	169.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
PIPE 4 SECT 1	203.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	
PIPE 4 SECT 2	203.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	
PIPE 4 SECT 3	203.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 4	192.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 5	192.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 3 SECT 6	192.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 1 SECT 7	169.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	

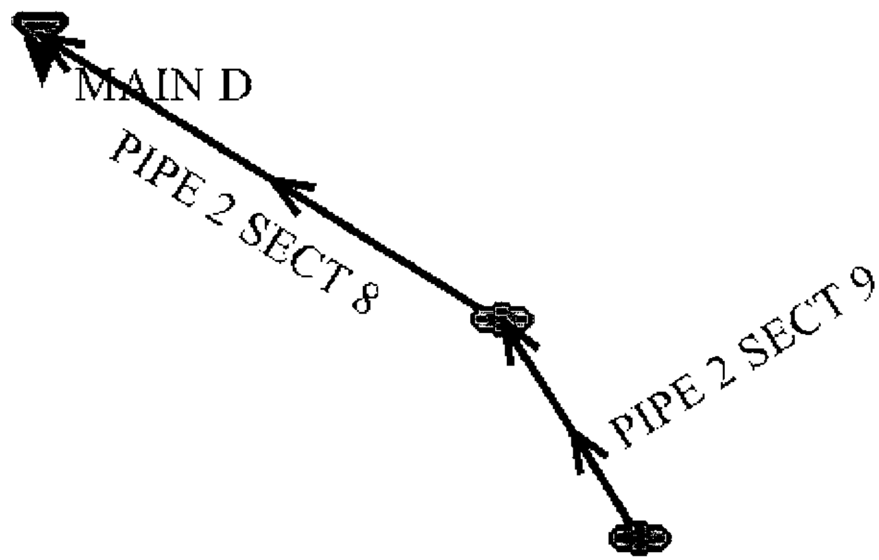
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6621.48

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 4 SECT 1	6624.15	6624.41	0.00	0.00	6627.70	6628.47	6630.58	0.09	6630.66
PIPE 4 SECT 2	6624.40	6625.52	0.33	0.00	6629.33	6629.58	6631.00	0.78	6631.77
PIPE 4 SECT 3	6625.83	6628.29	0.30	0.00	6629.88	6632.35	6632.50	2.05	6634.54
PIPE 3 SECT 4	6628.59	6630.45	1.96	0.00	6635.02	6636.03	6636.50	1.01	6637.51
PIPE 3 SECT 5	6630.45	6631.51	0.30	0.00	6636.32	6636.90	6637.81	0.57	6638.38
PIPE 3 SECT 6	6631.51	6634.59	0.56	0.00	6637.46	6638.55	6638.94	1.66	6640.61
PIPE 1 SECT 7	6634.89	6638.61	0.06	0.00	6638.61	6642.34	6641.86	2.27	6644.14

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MAIN D
PIPE 2 SECT 8
PIPE 2 SECT 9

System Input Summary – STM-MAIN F – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6637.50

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Sub Basin Information: Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN D	6654.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2 SECT 8	6655.18	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2 SECT 9	6655.84	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN D	0.00	0.00	0.00	0.00	0.00	9.38	1.92	0.27	18.00	
PIPE 2 SECT 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	
PIPE 2 SECT 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 2 SECT 8	59.98	6637.09	1.5	6637.99	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 2 SECT 9	30.00	6637.99	1.5	6638.44	0.013	0.11	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 2 SECT 8	50.37	10.26	17.24	6.17	12.39	9.40	1.88	Supercritical	18.00	0.00	
PIPE 2 SECT 9	50.37	10.26	17.24	6.17	12.39	9.40	1.88	Supercritical	18.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing Rise	Existing Span	Calculated Rise	Calculated Span	Used Rise	Used Span	Used Area (ft^2)	Comment
PIPE 2 SECT 8	18.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	
PIPE 2 SECT 9	18.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6637.50

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 2 SECT 8	6637.09	6637.99	0.00	0.00	6638.12	6639.43	6639.50	0.52	6640.02
PIPE 2 SECT 9	6637.99	6638.44	0.02	0.00	6639.45	6639.88	6640.40	0.07	6640.47

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-MAIN F – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6638.55

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN D	6654.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2 SECT 8	6655.18	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2 SECT 9	6655.84	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN D	0.00	0.00	0.00	0.00	0.00	17.55	1.94	0.14	34.00	
PIPE 2 SECT 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	
PIPE 2 SECT 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 2 SECT 8	59.98	6637.09	1.5	6637.99	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 2 SECT 9	30.00	6637.99	1.5	6638.44	0.013	0.11	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 2 SECT 8	50.37	10.26	23.79	8.15	18.05	11.02	1.73	Supercritical	34.00	0.00	
PIPE 2 SECT 9	50.37	10.26	23.79	8.15	18.06	11.02	1.73	Supercritical	34.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 2 SECT 8	34.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
PIPE 2 SECT 9	34.00	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

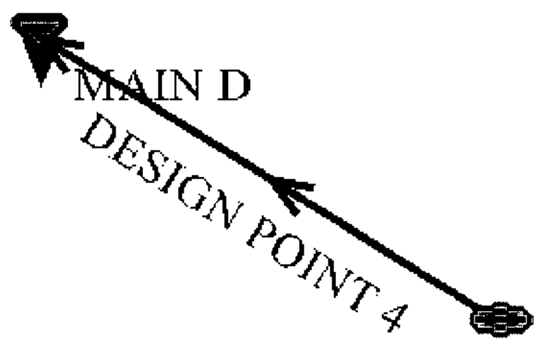
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6638.55

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 2 SECT 8	6637.09	6637.99	0.00	0.00	6638.59	6639.97	6640.48	0.52	6641.00
PIPE 2 SECT 9	6637.99	6638.44	0.08	0.00	6640.05	6640.42	6641.38	0.07	6641.45

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MAIN D
DESIGN POINT 4

System Input Summary – STM-MAIN H – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6628.51

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN D	6637.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DESIGN POINT 4	6643.59	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN D	0.00	0.00	0.00	0.00	0.00	4.18	1.91	0.31	8.00	
DESIGN POINT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
DESIGN POINT 4	30.67	6625.82	1.0	6626.13	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
DESIGN POINT 4	41.13	8.38	11.29	4.74	8.97	6.49	1.56	Supercritical Jump	8.00	19.40	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
DESIGN POINT 4	8.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6628.51

Element Name	Invert Elev. Downstream (ft)	Invert Elev. Upstream (ft)	Downstream Manhole Losses Bend Loss (ft)	Downstream Manhole Losses Lateral Loss (ft)	HGL Downstream (ft)	HGL Upstream (ft)	EGL Downstream (ft)	EGL Friction Loss (ft)	EGL Upstream (ft)
DESIGN POINT 4	6625.82	6626.13	0.00	0.00	6628.51	6628.52	6628.55	0.01	6628.56

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-MAIN H – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6629.58

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN D	6637.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DESIGN POINT 4	6643.59	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN D	0.00	0.00	0.00	0.00	0.00	7.76	1.93	0.17	15.00	
DESIGN POINT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
DESIGN POINT 4	30.67	6625.82	1.0	6626.13	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow					Surcharged Length (ft)	Comment
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)		
DESIGN POINT 4	41.13	8.38	15.67	5.78	12.53	7.72	1.53	Pressurized	15.00	30.67	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
DESIGN POINT 4	15.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

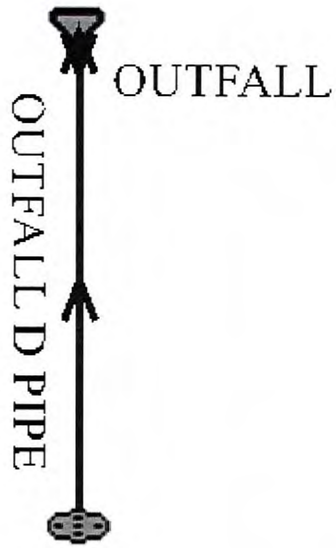
Grade Line Summary:

Tailwater Elevation (ft): 6629.58

Element Name	Invert Elev. Downstream (ft)	Invert Elev. Upstream (ft)	Downstream Manhole Losses Bend Loss (ft)	Downstream Manhole Losses Lateral Loss (ft)	HGL Downstream (ft)	HGL Upstream (ft)	EGL Downstream (ft)	EGL Friction Loss (ft)	EGL Upstream (ft)
DESIGN POINT 4	6625.82	6626.13	0.00	0.00	6629.58	6629.62	6629.72	0.04	6629.77

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Outlet pipe
Pond D to BS
Creek



System Input Summary – POND D OUTFALL – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6615.83

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL	6621.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OUTFALL D PIPE	6624.79	5.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL	0.00	0.00	0.00	0.00	0.00	3.41	1.49	4.23	5.07	
OUTFALL D PIPE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.07	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
OUTFALL D PIPE	133.61	6615.83	0.5	6616.50	0.013	0.00	0.00	CIRCULAR	42.00 in	42.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity		Critical Flow		Normal Flow						
	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
OUTFALL D PIPE	71.43	7.42	8.11	3.90	7.58	4.29	1.14	Supercritical	5.07	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
OUTFALL D PIPE	5.07	CIRCULAR	42.00 in	42.00 in	18.00 in	18.00 in	42.00 in	42.00 in	9.62	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6615.83

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
OUTFALL D PIPE	6615.83	6616.50	0.00	0.00	6616.46	6617.18	6616.75	0.66	6617.41

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – OUTFALL POND D 100 YEAR

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.35
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.99
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6621.00

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND D	6626.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 1	6634.96	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 2	6637.11	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 3	6643.55	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 4	6647.20	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 5	6649.04	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 6	6654.69	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 7	6659.53	184.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND D	0.00	0.00	0.00	0.00	0.00	780.03	0.24	0.14	184.00	
PIPE 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	
PIPE 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	184.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Elevation: Slope (%)	Elevation: Upstream Invert (ft)	Loss Coefficients: Mannings n	Loss Coefficients: Bend Loss	Loss Coefficients: Lateral Loss	Given Dimensions: Cross Section	Given Dimensions: Rise (ft or in)	Given Dimensions: Span (ft or in)
PIPE 1	76.40	6621.00	1.0	6621.76	0.013	0.03	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 2	139.68	6621.76	1.0	6623.16	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 3	246.20	6623.85	1.0	6626.31	0.013	0.18	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 4	186.46	6626.81	1.3	6629.23	0.013	1.32	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 5	105.72	6629.23	1.3	6630.60	0.013	0.20	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 6	307.82	6630.59	1.3	6634.59	0.013	0.38	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 7	232.80	6634.89	1.6	6638.61	0.013	0.05	0.00	CIRCULAR	60.00 in	60.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity: Flow (cfs)	Full Flow Capacity: Velocity (fps)	Critical Flow: Depth (in)	Critical Flow: Velocity (fps)	Normal Flow: Depth (in)	Normal Flow: Velocity (fps)	Normal Flow: Froude Number	Normal Flow: Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 1	261.14	13.30	46.59	11.25	37.15	14.41	1.57	Supercritical	184.00	0.00	
PIPE 2	261.14	13.30	46.59	11.25	37.15	14.41	1.57	Supercritical	184.00	0.00	
PIPE 3	261.14	13.30	46.59	11.25	37.15	14.41	1.57	Supercritical	184.00	0.00	
PIPE 4	297.75	15.16	46.59	11.25	34.12	15.96	1.84	Supercritical Jump	184.00	97.96	
PIPE 5	297.75	15.16	46.59	11.25	34.12	15.96	1.84	Supercritical	184.00	0.00	
PIPE 6	297.75	15.16	46.59	11.25	34.12	15.96	1.84	Supercritical	184.00	0.00	
PIPE 7	330.32	16.82	46.59	11.25	32.00	17.28	2.08	Supercritical	184.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).

- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PIPE 1	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 2	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 3	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 4	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 5	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 6	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 7	184.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6621.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 1	6621.00	6621.76	0.00	0.00	6624.09	6625.64	6627.32	0.29	6627.61
PIPE 2	6621.76	6623.16	0.27	0.00	6625.92	6627.04	6628.08	0.92	6629.01
PIPE 3	6623.85	6626.31	0.25	0.00	6627.29	6630.19	6630.17	1.99	6632.16
PIPE 4	6626.81	6629.23	1.80	0.00	6632.59	6633.11	6633.96	1.12	6635.08
PIPE 5	6629.23	6630.60	0.27	0.00	6633.39	6634.48	6636.02	0.42	6636.45
PIPE 6	6630.59	6634.59	0.52	0.00	6635.00	6638.47	6637.39	3.05	6640.44
PIPE 7	6634.89	6638.61	0.07	0.00	6638.54	6642.49	6642.19	2.27	6644.46

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

POND G

IRF

EDB BMP FOREBAY WORKSHEETS

IMPACT STRUCTURE CALCS

OVERFLOW WEIR RIP RAP

RIP RAP OUTLET SIZING

HGLS

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.75	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	
Max Intensity for Optional User Defined Storm	2.51496		

Designer: CMT
Company: CCES
Date: June 27, 2019
Project: FOOTHILLS FARM CAMPUS FIL 2 ENT - POND G TRIBUTARY
Location: CO. SPRINGS

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	DP 5	DP6	DP7	DP8	DP9	DP10	DP11	DP12	DP13	DP14	DP15	DP16	BB & R & T	OFFSITE
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	2.370	3.070	3.230	1.350	0.880	0.660	1.030	0.720	0.470	3.110	1.210	9.110	7.840	34.590
Directly Connected Impervious Area (DCIA, acres)	2.020	2.610	2.950	1.290	0.750	0.560	0.880	0.580	0.380	0.622	0.600	8.050	4.155	24.697
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Separate Pervious Area (SPA, acres)	0.350	0.460	0.280	0.060	0.130	0.100	0.150	0.140	0.090	2.488	0.610	1.060	3.685	9.893
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C	C	C	C	C	C	C	C

CALCULATED RESULTS (OUTPUT)

	DP 5	DP6	DP7	DP8	DP9	DP10	DP11	DP12	DP13	DP14	DP15	DP16	BB & R & T	OFFSITE
Total Calculated Area (ac, check against input)	2.370	3.070	3.230	1.350	0.880	0.660	1.030	0.720	0.470	3.110	1.210	9.110	7.840	34.590
Directly Connected Impervious Area (DCIA, %)	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Separate Pervious Area (SPA, %)	14.8%	15.0%	8.7%	4.4%	14.8%	15.2%	14.6%	19.4%	19.1%	80.0%	50.4%	11.6%	47.0%	28.6%
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I_a Check	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f / I for WQCV Event:	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
f / I for Optional User Defined Storm CUHP:	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
IRF for WQCV Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IRF for Optional User Defined Storm CUHP:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total Site Imperviousness: I_{total}	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%
Effective Imperviousness for WQCV Event:	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%
Effective Imperviousness for 5-Year Event:	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%
Effective Imperviousness for 100-Year Event:	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%
Effective Imperviousness for Optional User Defined Storm CUHP:	85.2%	85.0%	91.3%	95.6%	85.2%	84.8%	85.4%	80.6%	80.9%	20.0%	49.6%	88.4%	53.0%	71.4%

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

	DP 5	DP6	DP7	DP8	DP9	DP10	DP11	DP12	DP13	DP14	DP15	DP16	BB & R & T	OFFSITE
WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
User Defined CUHP CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Total Site Imperviousness:	72.0%
Total Site Effective Imperviousness for WQCV Event:	72.0%
Total Site Effective Imperviousness for 5-Year Event:	72.0%
Total Site Effective Imperviousness for 100-Year Event:	72.0%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	72.0%

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Pond G total inflow

Designer:	CMT
Company:	CCES
Date:	June 10, 2019
Project:	FOOTHILLS FARM CAMPUS FIL 2 POND G - TOTAL INFLOW
Location:	CO SPRINGS

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 72.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.720
C) Contributing Watershed Area	Area = 69.640 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ● Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN} = ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$ = 1.612 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$ = ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed i) Percentage of Watershed consisting of Type A Soils ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 10 % HSG_B = 90 % $HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 5.625 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$ = ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.048 ac-ft
B) Actual Forebay Volume	V_F = 0.050 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 30.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 223.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.46 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ● Wall with Rect. Notch ○ Wall with V-Notch Weir
G) Rectangular Notch Width	Calculated W_N = 10.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: CMT
Company: CCES
Date: June 10, 2019
Project: FOOTHILLS FARM CAMPUS FIL 2 POND G - TOTAL INFLOW
Location: CO SPRINGS

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 346 sq ft
C) Outlet Type	Choose One: ● Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 2.23 inches
E) Total Outlet Area	A_{ot} = 28.20 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 211 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 173.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 878 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1237 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 8.13 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 125.56 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**CMT**
Company:	**CCES**
Date:	**June 10, 2019**
Project:	**FOOTHILLS FARM CAMPUS FIL 2 POND G - TOTAL INFLOW**
Location:	**CO SPRINGS**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	 Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Pond G
36" tributary

Designer:	CMT
Company:	CCES
Date:	June 10, 2019
Project:	MAIN A 36" POND G FOREBAY SIZING
Location:	CO SPRINGS FOOTHILLS FARM CAMPUS FIL. 2

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 72.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.720

C) Contributing Watershed Area — Area = 18.030 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ● Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) — V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = 0.417 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = 10 %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = 90 %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = 0 %

J) Excess Urban Runoff Volume (EURV) Design Volume
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

$EURV_{DESIGN}$ = 1.456 ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.013 ac-ft

B) Actual Forebay Volume — V_F = 0.015 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 18.0 in

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 79.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 1.58 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ● Wall with Rect. Notch
- ○ Wall with V-Notch Weir

Flow too small for berm w/ pipe

G) Rectangular Notch Width — Calculated W_N = 6.7 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**CMT**
Company:	**CCES**
Date:	**June 10, 2019**
Project:	**MAIN A 36" POND G FOREBAY SIZING**
Location:	**CO SPRINGS FOOTHILLS FARM CAMPUS FIL. 2**

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 346 sq ft

C) Outlet Type

Choose One
- ◉ Orifice Plate
- ○ Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 2.23 inches

E) Total Outlet Area — A_{ot} = 28.20 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 6 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = 55 cu ft

C) Initial Surcharge Provided Above Micropool — V_s = 173.0 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 878 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*

Other (Y/N): N

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 1237 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 8.13 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 125.56 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: CMT
Company: CCES
Date: June 10, 2019
Project: MAIN A 36" POND G FOREBAY SIZING
Location: CO SPRINGS FOOTHILLS FARM CAMPUS FIL. 2

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ○ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Pond G
66" tributary

Designer:	CMT
Company:	CCES
Date:	June 10, 2019
Project:	FOOTHILLS FARM CAMPUS FIL 2 POND G - 66" FOREBAY SIZING
Location:	CO SPRINGS

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 72.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.720
C) Contributing Watershed Area	Area = 51.610 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One ○ Water Quality Capture Volume (WQCV) ● Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$	V_{DESIGN} = ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$ = 1.195 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$ = ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed i) Percentage of Watershed consisting of Type A Soils ii) Percentage of Watershed consisting of Type B Soils iii) Percentage of Watershed consisting of Type C/D Soils	 HSG_A = 10 % HSG_B = 90 % $HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 4.169 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$ = ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.036 ac-ft
B) Actual Forebay Volume	V_F = 0.052 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 30.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 223.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.46 cfs
E) Forebay Discharge Design	Choose One ○ Berm With Pipe ● Wall with Rect. Notch ○ Wall with V-Notch Weir
G) Rectangular Notch Width	Calculated W_N = 10.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**CMT**
Company:	**CCES**
Date:	**June 10, 2019**
Project:	**FOOTHILLS FARM CAMPUS FIL 2 POND G - 66" FOREBAY SIZING**
Location:	**CO SPRINGS**

6. Trickle Channel A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 346 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 2.23 inches
E) Total Outlet Area	A_{ot} = 28.20 square inches
8. Initial Surcharge Volume A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 6 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 156 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 173.0 cu ft
9. Trash Rack A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 878 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1237 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 8.13 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 125.56 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	CMT
Company:	CCES
Date:	June 10, 2019
Project:	FOOTHILLS FARM CAMPUS FIL 2 POND G - 66" FOREBAY SIZING
Location:	CO SPRINGS

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
○ Irrigated
● Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

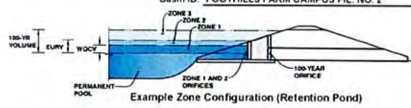
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: POND G

Basin ID: FOOTHILLS FARM CAMPUS FIL. NO. 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB			
Watershed Area =	69.64	acres		
Watershed Length =	1,700	ft		
Watershed Slope =	0.080	ft/ft		
Watershed Imperviousness =	72.00%	percent		
Percentage Hydrologic Soil Group A =	10.4%	percent		
Percentage Hydrologic Soil Group B =	89.6%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			
Water Quality Capture Volume (WQCV) =	1.650	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	5.611	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	4.593	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.080	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.639	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.524	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	10.969	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	12.849	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.1 in.) =	16.646	acre-feet	3.10	inches
Approximate 2-yr Detention Volume =	4.310	acre-feet		
Approximate 5-yr Detention Volume =	5.719	acre-feet		
Approximate 10-yr Detention Volume =	7.160	acre-feet		
Approximate 25-yr Detention Volume =	7.771	acre-feet		
Approximate 50-yr Detention Volume =	8.127	acre-feet		
Approximate 100-yr Detention Volume =	8.693	acre-feet		

Stage-Storage Calculation

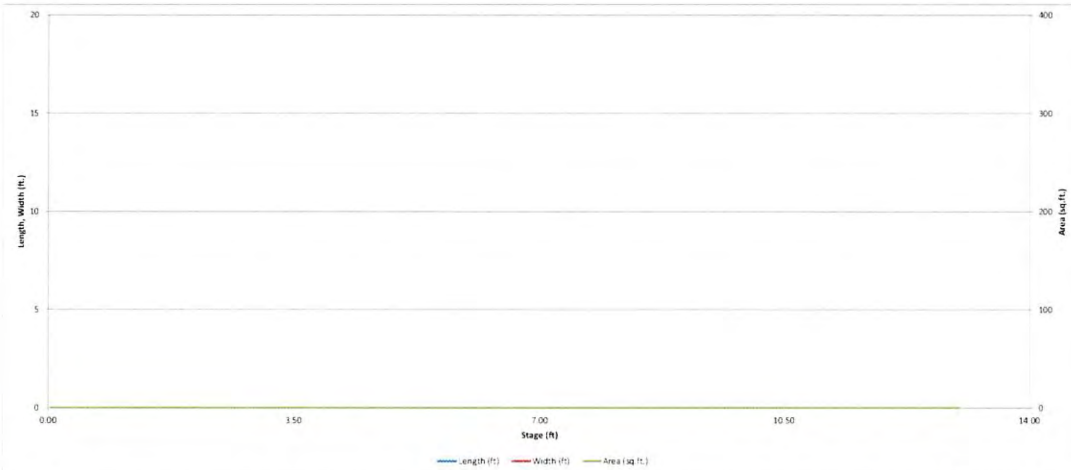
Zone 1 Volume (WQCV) =	1.650	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.961	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.082	acre-feet
Total Detention Basin Volume =	8.693	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

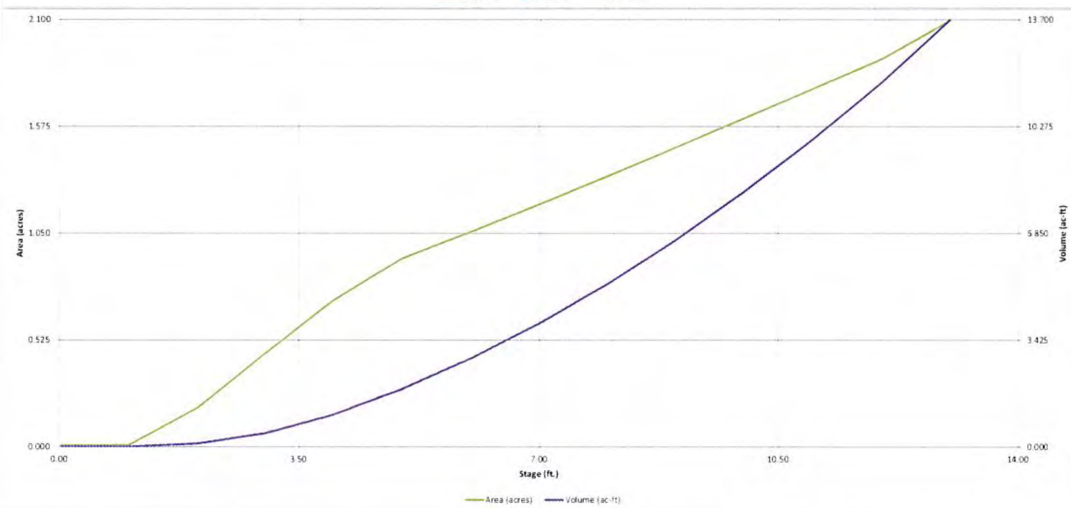
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	250	0.006		
6600.5	--	0.50	--	--	--	250	0.006	123	0.003
6601	--	1.00	--	--	--	347	0.008	271	0.006
6602	--	2.00	--	--	--	8,313	0.191	4,521	0.104
6603	--	3.00	--	--	--	20,064	0.461	18,793	0.431
6604	--	4.00	--	--	--	31,322	0.719	44,486	1.021
6605	--	5.00	--	--	--	40,286	0.925	80,290	1.843
6606	--	6.00	--	--	--	46,070	1.058	123,468	2.834
6607	--	7.00	--	--	--	51,969	1.193	172,487	3.960
6608	--	8.00	--	--	--	57,980	1.331	227,462	5.222
6609	--	9.00	--	--	--	64,097	1.471	288,500	6.623
6610	--	10.00	--	--	--	70,313	1.614	355,705	8.166
6611	--	11.00	--	--	--	76,630	1.759	429,177	9.853
6612	--	12.00	--	--	--	83,047	1.906	509,015	11.685
6613	--	13.00	--	--	--	91,299	2.096	596,188	13.687

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



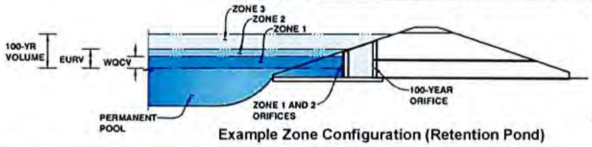


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: POND G

Basin ID: FOOTHILLS FARM CAMPUS FILING NO. 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.79	1.650	Orifice Plate
Zone 2 (EURV)	8.29	3.961	Orifice Plate
'one 3 (100-year)	10.33	3.082	Weir&Pipe (Restrict)
		8.693	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^2
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 =	8.30	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	33.20	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.77	5.53					
Orifice Area (sq. inches)	5.00	11.00	12.20					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	8.30	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	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, H_t =	8.30	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	1.78	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	22.40	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.20	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	48.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	200.00	feet
Spillway End Slopes =	6.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

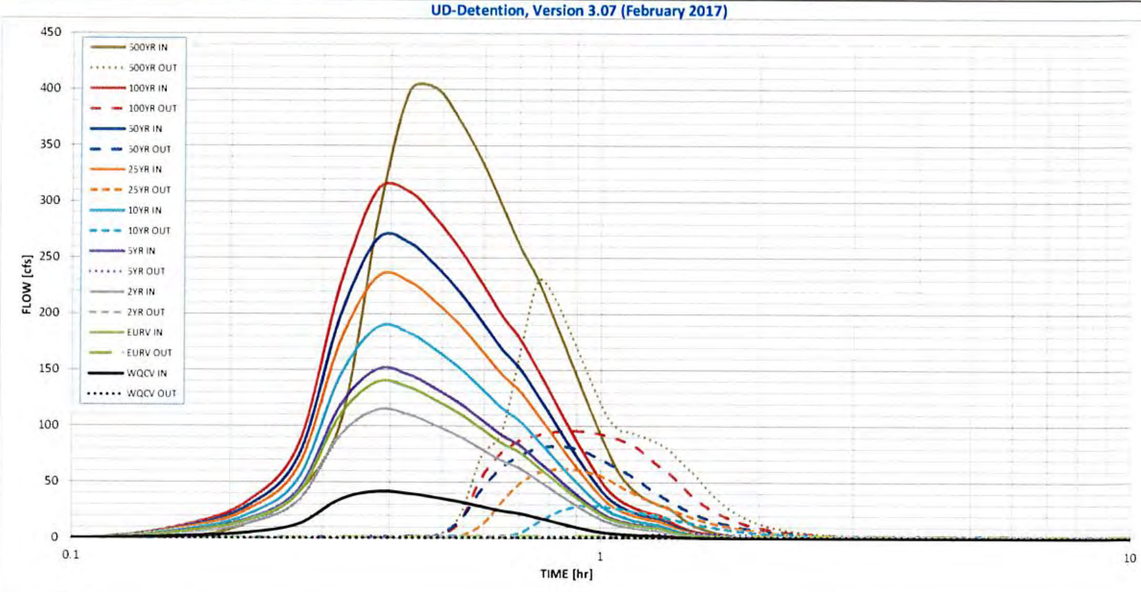
Spillway Design Flow Depth=	0.63	feet
Stage at Top of Freeboard =	12.13	feet
Basin Area at Top of Freeboard =	1.93	acres

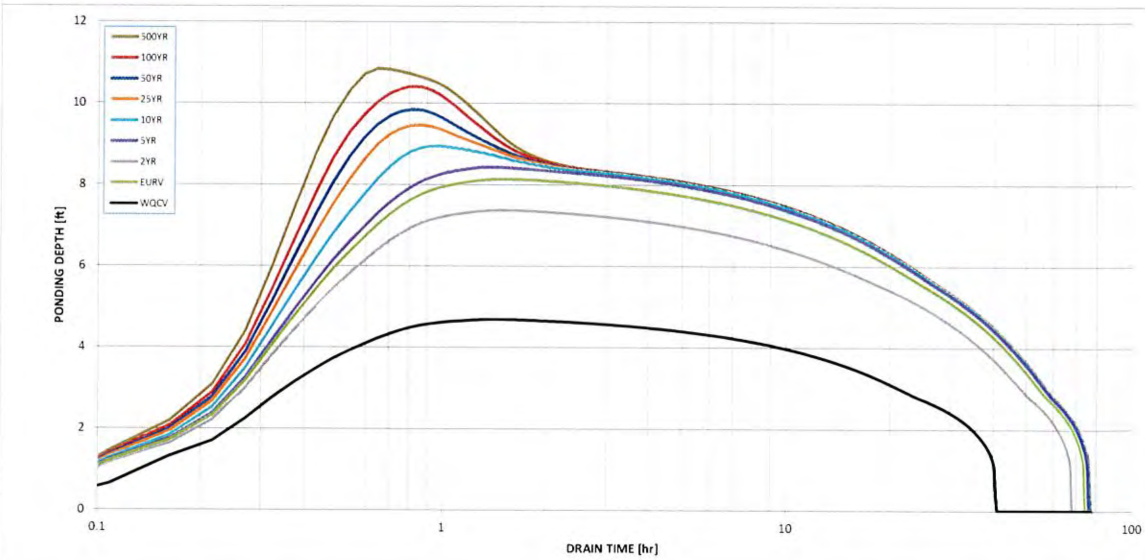
Routed Hydrograph Results

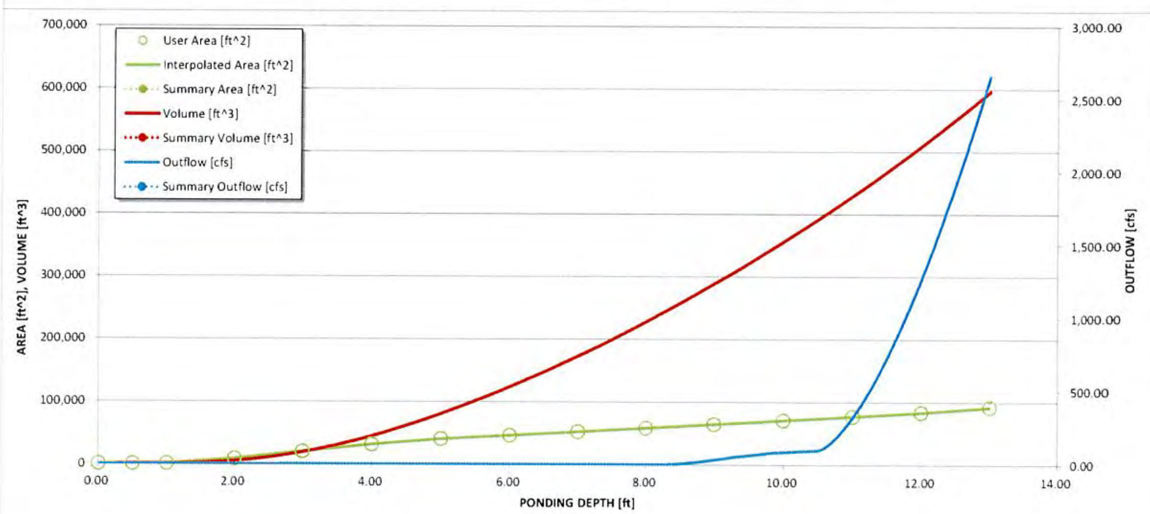
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.10
Calculated Runoff Volume (acre-ft) =	1.650	5.611	4.593	6.080	7.639	9.524	10.969	12.849	16.646
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.649	5.599	4.590	6.070	7.627	9.518	10.958	12.834	16.633
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.28	0.88	1.23	1.67	2.47
Predevelopment Peak Q (cfs) =	0.0	0.0	1.2	2.000	19.8	61.0	85.8	116.1	172.0
Peak Inflow Q (cfs) =	41.8	139.1	114.5	150.5	188.0	233.1	267.1	311.1	400.4
Peak Outflow Q (cfs) =	0.9	2.0	1.8	4.463	28.9	61.7	82.1	95.6	228.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.2	1.5	1.0	1.0	0.8	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	1.2	2.7	3.6	4.2	4.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	65	60	67	65	62	61	59	56
Time to Drain 99% of Inflow Volume (hours) =	40	71	65	73	72	71	71	70	68
Maximum Ponding Depth (ft) =	4.69	8.13	7.37	8.43	8.94	9.46	9.84	10.40	10.85
Area at Maximum Ponding Depth (acres) =	0.86	1.35	1.24	1.39	1.46	1.54	1.59	1.67	1.74
Maximum Volume Stored (acre-ft) =	1.558	5.396	4.411	5.793	6.535	7.300	7.909	8.823	9.573

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
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]
3.24 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:03:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:06:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:09:43	1.81	5.60	4.71	6.00	7.25	8.64	9.63	10.83	13.01
1.543	0:12:58	4.92	15.79	13.15	16.99	20.86	25.36	28.66	32.80	40.73
	0:16:12	12.65	40.54	33.76	43.63	53.58	65.16	73.64	84.32	104.83
	0:19:26	34.72	111.07	92.53	119.50	146.63	178.10	201.14	230.08	285.54
	0:22:41	41.80	139.10	114.54	150.49	187.98	233.07	267.12	311.08	398.79
	0:25:55	40.00	134.55	110.38	145.83	183.23	228.74	263.47	308.72	400.41
	0:29:10	36.41	122.84	100.60	133.23	167.77	209.96	242.25	284.44	370.34
	0:32:24	32.67	110.72	90.64	120.11	151.32	189.46	218.66	256.82	334.53
	0:35:38	28.36	97.07	79.35	105.36	132.97	166.77	192.69	226.61	295.78
	0:38:53	24.64	84.85	69.31	92.13	116.36	146.03	168.78	198.56	259.29
	0:42:07	22.35	76.42	62.51	82.92	104.52	130.90	151.07	177.43	231.02
	0:45:22	18.61	64.28	52.45	69.82	88.31	111.01	128.44	151.30	197.99
	0:48:36	15.32	53.34	43.49	57.97	73.39	92.34	106.91	126.01	165.07
	0:51:50	11.98	42.46	34.51	46.20	58.71	74.12	86.00	101.63	133.72
	0:55:05	9.09	32.93	26.69	35.87	45.71	57.85	67.23	79.58	105.01
	0:58:19	6.66	24.73	19.97	26.97	34.49	43.80	50.99	60.52	80.28
	1:01:34	5.07	18.45	14.95	20.10	25.61	32.39	37.63	44.67	59.52
	1:04:48	4.14	14.77	12.01	16.07	20.39	25.71	29.79	35.23	46.58
	1:08:02	3.50	12.41	10.10	13.50	17.11	21.54	24.94	29.44	38.74
	1:11:17	3.06	10.78	8.78	11.71	14.82	18.63	21.55	25.40	33.34
	1:14:31	2.75	9.63	7.85	10.46	13.22	16.60	19.18	22.59	29.58
	1:17:46	2.52	8.81	7.19	9.56	12.08	15.15	17.49	20.58	26.90
	1:21:00	1.86	6.62	5.37	7.21	9.18	11.62	13.50	16.01	21.21
	1:24:14	1.36	4.78	3.89	5.20	6.62	8.37	9.72	11.53	15.30
	1:27:29	1.00	3.54	2.87	3.86	4.91	6.21	7.22	8.56	11.33
	1:30:43	0.74	2.63	2.14	2.87	3.65	4.61	5.36	6.35	8.40
	1:33:58	0.53	1.94	1.57	2.11	2.69	3.41	3.97	4.70	6.23
	1:37:12	0.38	1.39	1.13	1.52	1.94	2.47	2.87	3.41	4.53
	1:40:26	0.28	1.01	0.82	1.10	1.41	1.78	2.08	2.46	3.27
	1:43:41	0.19	0.71	0.57	0.78	1.00	1.27	1.48	1.76	2.36
	1:46:55	0.12	0.46	0.37	0.51	0.66	0.84	0.99	1.18	1.59
	1:50:10	0.06	0.27	0.21	0.30	0.39	0.50	0.59	0.71	0.97
	1:53:24	0.02	0.13	0.10	0.14	0.19	0.25	0.29	0.36	0.51
	1:56:38	0.00	0.04	0.03	0.04	0.06	0.08	0.10	0.12	0.19
	1:59:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	2:03:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:06:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:09:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:12:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:16:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:19:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:22:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:25:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:29:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:32:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:38:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:42:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:48:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:51:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:58:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:01:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:04:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:07:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:11:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:14:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:17:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:24:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:27:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:33:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:46:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:53:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

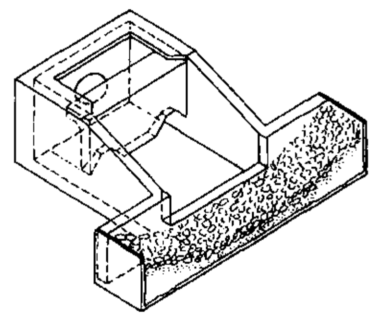
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Section 6

Stilling basin for pipe or open channel outlets (Basin VI)



THE stilling basin developed in these tests is an impact-type energy dissipator, contained in a relatively small boxlike structure, which requires no tail water for successful performance. Although the emphasis in this discussion is placed on use with pipe outlets, the entrance structure may be modified for use with an open channel entrance.

Generalized design rules and procedures are presented to allow determining the proper basin size and all critical dimensions for a range of discharges up to 339 cubic feet per second and velocities up to about 30 feet per second. Greater discharges may be handled by constructing multiple units side by side. The efficiency of the basin in accomplishing energy losses is greater than a hydraulic jump of the same Froude number.

The development of this short impact-type basin was initiated by the need for some 50 or more stilling structures on a single irrigation project. The need was for relatively small basins providing energy dissipation independent of a tail water curve or tail water of any kind.

Since individual model studies on 50 small stilling structures were too costly a procedure, tests were made on a single setup which was modified as necessary to generalize the design for the range of expected operations.

Test Procedure

Hydraulic models. Hydraulic models were used to develop the stilling basin, determine the discharge limitations, and obtain dimensions for the various parts of the basin. Basins 1.6 to 2.0 feet wide were used in the tests. The inlet pipe was 6⅝ inches, inside diameter, and was equipped with a slide gate well upstream from the basin entrance so that the desired relations between head, depth, and velocity could be obtained. The pipe was transparent so that backwater effects in the pipe could be studied. Discharges of over 3 cubic feet per second and velocities up to 15 feet per second

TABLE 11.—*Stilling basin dimensions (Basin VI). Impact-type energy dissipator.*

Suggested pipe size [1]		Max discharge Q	Feet and inches										Inches					
Dia in.	Area (sq ft)		W	H	L	a	b	c	d	e	f	g	t_w	t_f	t_b	t_p	K	Suggested riprap size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19) [3]
18	1.77	[2] 21	5–6	4–3	7–4	3–3	4–1	2–4	0–11	0–6	1–6	2–1	6	6½	6	6	3	4.0
24	3.14	38	6–9	5–3	9–0	3–11	5–1	2–10	1–2	0–6	2–0	2–6	6	6½	6	6	3	7.0
30	4.91	59	8–0	6–3	10–8	4–7	6–1	3–4	1–4	0–8	2–6	3–0	6	6½	7	7	3	8.5
36	7.07	85	9–3	7–3	12–4	5–3	7–1	3–10	1–7	0–8	3–0	3–6	7	7½	8	8	3	9.0
42	9.62	115	10–6	8–0	14–0	6–0	8–0	4–5	1–9	0–10	3–0	3–11	8	8½	9	8	4	9.5
48	12.57	151	11–9	9–0	15–8	6–9	8–11	4–11	2–0	0–10	3–0	4–5	9	9½	10	8	4	10.5
54	15.90	191	13–0	9–9	17–4	7–4	10–0	5–5	2–2	1–0	3–0	4–11	10	10½	10	8	4	12.0
Pond D ← 60	19.63	236	14–3	10–9	19–0	8–0	11–0	5–11	2–5	1–0	3–0	5–4	11	11½	11	8	6	13.0
72	28.27	339	16–6	12–3	22–0	9–3	12–9	6–11	2–9	1–3	3–0	6–2	12	12½	12	8	6	14.0

[1] Suggested pipe will run full when velocity is 12 feet per second or half full when velocity is 24 feet per second. Size may be modified for other velocities by Q=AV, but relation between Q and basin dimensions shown must be maintained.

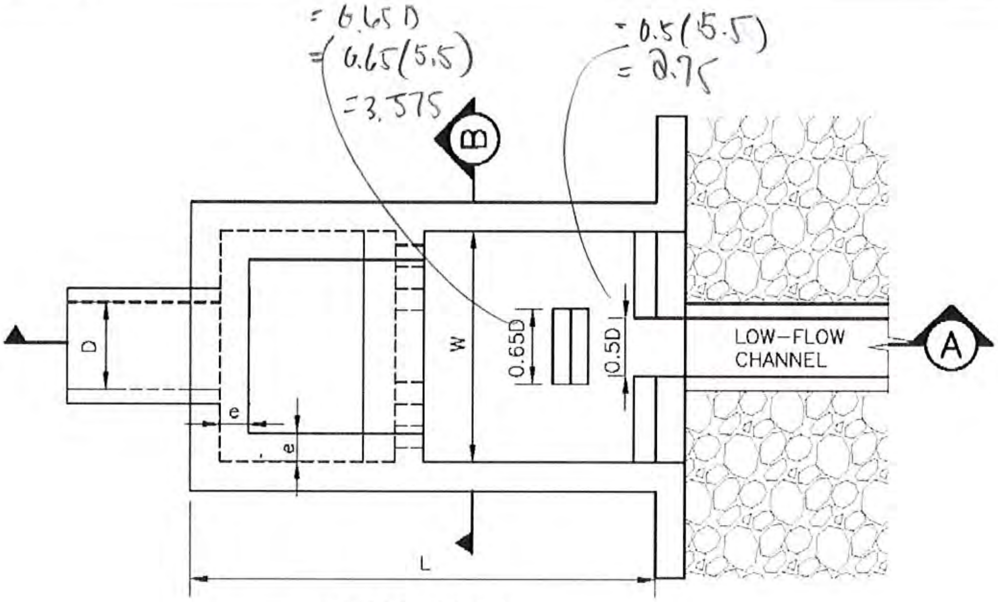
[2] For discharges less than 21 second-feet, obtain basin width from curve of Fig. 42. Other dimensions proportional to W: $H=\frac{3W}{4}$, $L=\frac{4W}{3}$, $d=\frac{W}{6}$, etc.

[3] Determination of riprap size explained in Sec. 10.

66" pond G

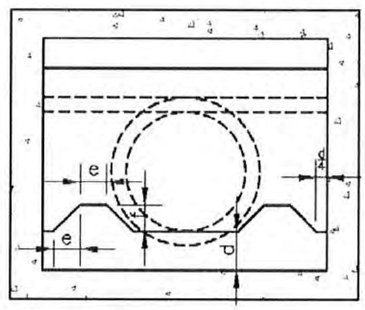
$\frac{9}{8'\text{-}8''}$

Pond 6

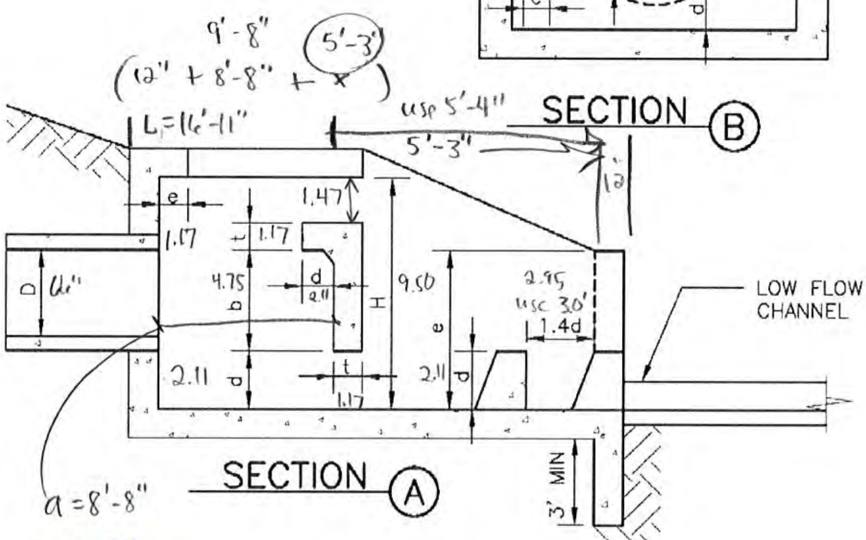


PLAN VIEW

$W=2.94D[\frac{V}{(gD)^{0.5}}]^{0.556}$	H=3/4 W c=1/2 W
V=VELOCITY, [FT/S]	L=4/3 W d=1/6 W
	a=1/2 W e=1/12 W
$D=(A)^{0.5}$	b=3/8 W f=1/8 W
A=AREA OF FLOW [SF]	t=1/12 W (SUGGESTED MIN)



SECTION B



SECTION A

L= 16.89
= 16'-11''
9 8

total L = 17'-11'' use 18 ft

Figure 9-45. UDFCD modified USBR type VI impacts stilling basin (general design dimensions)

5' 3''

total base = 12.67 + 12'' + 12''

= 14.67'

Worksheet for POND G INFLOW 66"

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Diameter	5.50	ft
Discharge	223.00	ft^3/s

Results

Normal Depth	4.23	ft
Flow Area	19.63	ft^2
Wetted Perimeter	11.78	ft
Hydraulic Radius	1.67	ft
Top Width	4.63	ft
Critical Depth	4.18	ft
Percent Full	77.0	%
Critical Slope	0.00515	ft/ft
Velocity	11.36	ft/s
Velocity Head	2.01	ft
Specific Energy	6.24	ft
Froude Number	0.97	
Maximum Discharge	255.42	ft^3/s
Discharge Full	237.44	ft^3/s
Slope Full	0.00441	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	76.99	%
Downstream Velocity	Infinity	ft/s

Worksheet for POND G INFLOW 66"

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	4.23	ft
Critical Depth	4.18	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00515	ft/ft

CLASSIC CONSULTING ENGINEERS & SURVEYORS SM
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Project: Pond 6 · 66" stilling basin
Date:
Contact:
Phone:
By:

NOTES
- ❑ Telephone Record
- ❑ Note to the File
- ❑ Job Information
- ❑ Meeting Minutes
- ❑

$$W = 2.94\,D\left[\frac{V}{gD^{0.5}}\right]^{0.556}$$

V = velocity (fps)
V = 11.36

$D = (A)^{0.5}$
A = area flow (SF)
A = 19.63 sf

$D = 19.63^{0.5}$
$D = 4.43$

$$W = 2.94(4.43)\left[\frac{11.36}{[(32.2)(4.43)]^{0.5}}\right]^{0.556}$$

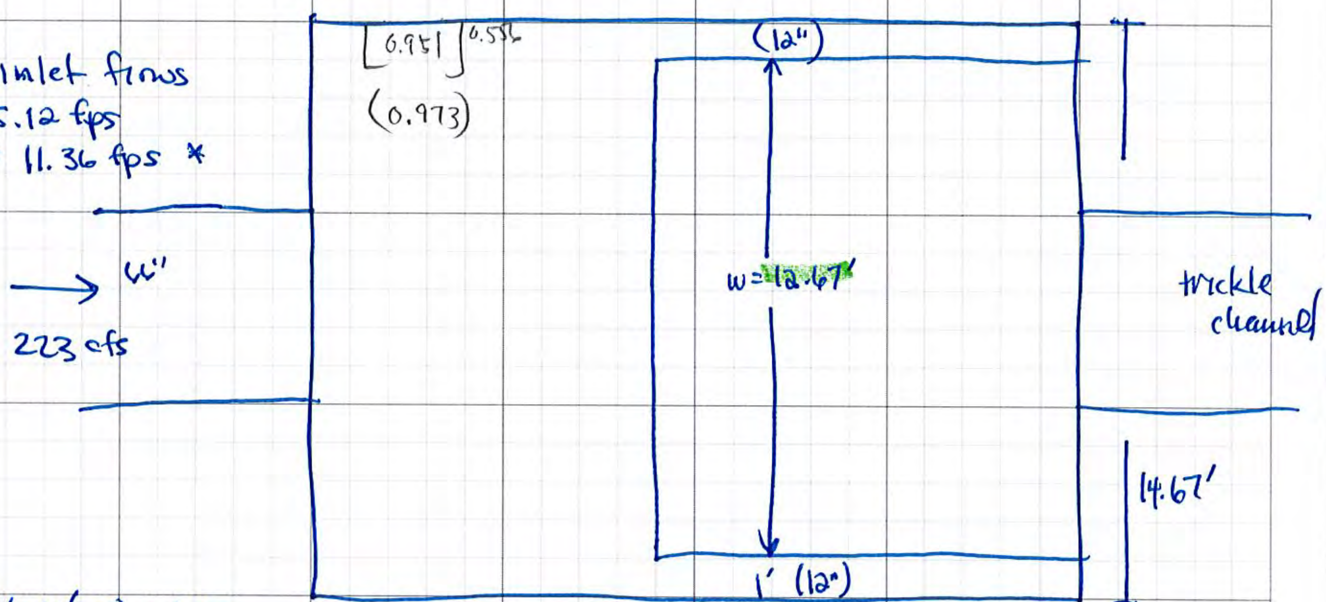
$$\frac{11.36}{11.943}$$

$[0.951]^{0.556}$

(0.973)

W = 12.667

@ 223 cfs inlet flows
66" @ 1% = 15.12 fps
* 66" @ 0.5% = 11.36 fps *



t = 1/12 W (min) = 1.05

H = 3/4 W = 9.50

L = 4/3 W = 16.89

a = 1/2 W = 6.33

b = 3/8 W = 4.75

c = 1/2 W = 6.33

d = 1/6 W = 2.11

e = 1/12 W = 1.05

f = 1/8 W = 1.58

Ph: 719.785.0790 Fax: 719.785.0799

Figure 13-12c. Emergency Spillway Protection

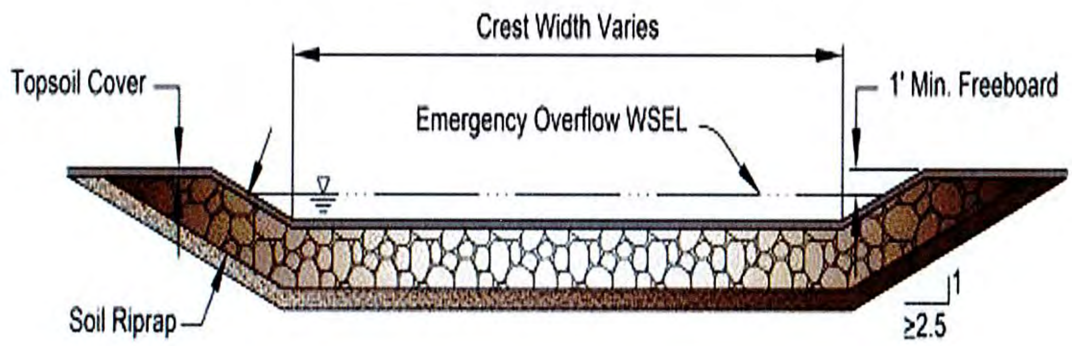
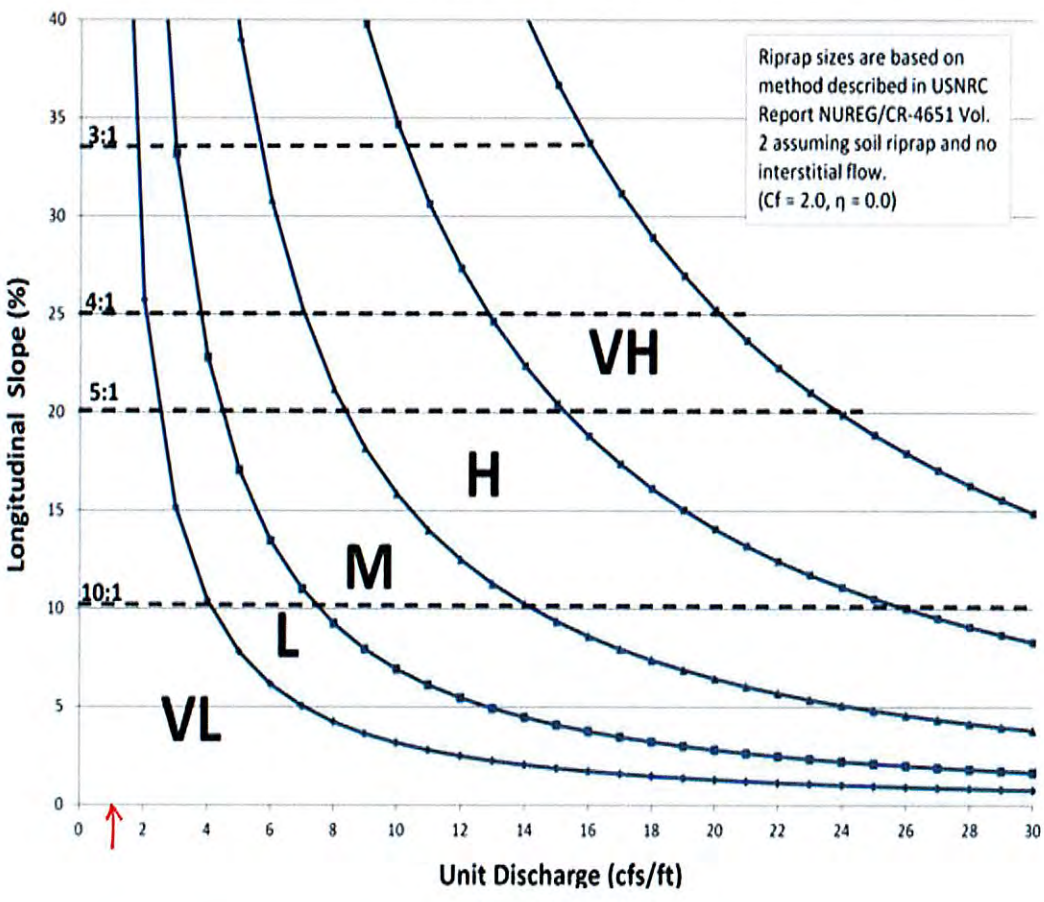


Figure 13-12d. Riprap Types for Emergency Spillway Protection

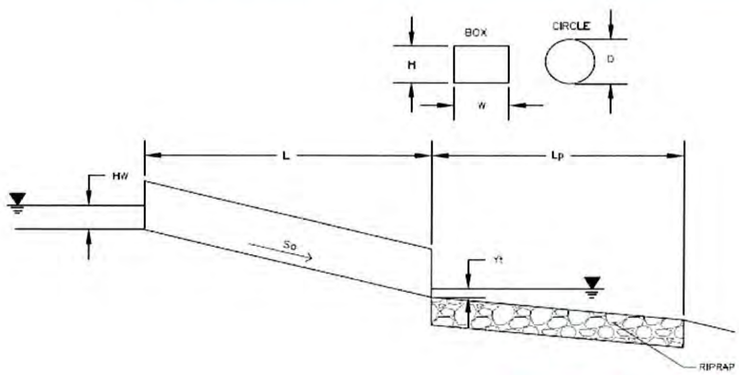


Q_{100} = 311 cfs Unit Discharge = $\frac{311}{200\text{ LF}}$ = 1.55 use type VL

Pond 6
Outlet to BS creek

Determination of Culvert Headwater and Outlet Protection

Project: **FARM 5**
Basin ID: **TEMP RUNDOWN**



Soil Type:
Choose One:
◉ Sandy
○ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

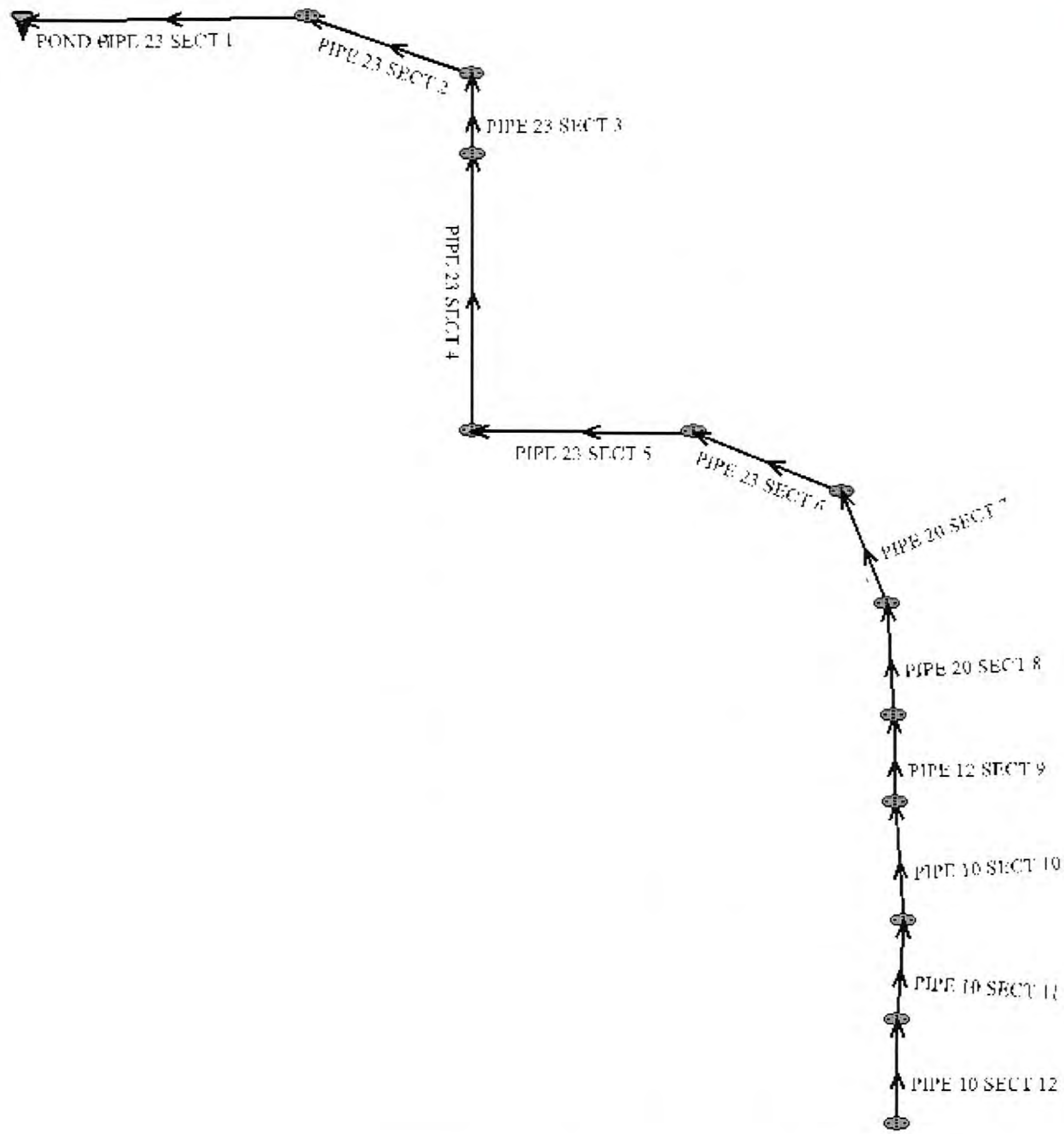
Design Discharge	Q =	95.6	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	48	inches
Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:		OR	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	6597.5	ft
Outlet Elevation OR Slope	Elev OUT =	6585.5	ft
Culvert Length	L =	450.05	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =	6585.5	ft
Max Allowable Channel Velocity	V =	5	ft/s

Tailwater ELEVATION is less than outlet elevation, using 0.4 x RISE as Yt

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.60	ft
Flow Area at Max Channel Velocity	A_t =	19.12	ft^2
Culvert Cross Sectional Area Available	A =	12.57	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	2.21	
Sum of All Losses Coefficients	k_s =	3.71	ft
Culvert Normal Depth	Y_n =	1.78	ft
Culvert Critical Depth	Y_c =	2.96	ft
Tailwater Depth for Design	d =	3.48	ft
Adjusted Diameter OR Adjusted Rise	D_a =	2.89	ft
Expansion Factor	1/(2*tan(Θ)) =	6.38	
Flow/Diameter$^{2.5}$ OR Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	2.99	$ft^{0.5}/s$
Froude Number	Fr =	2.69	**Supercritical!**
Tailwater/Adjusted Diameter OR Tailwater/Adjusted Rise	Yt/D =	0.55	
Inlet Control Headwater	HW_I =	5.01	ft
Outlet Control Headwater	HW_O =	-5.19	
Design Headwater Elevation	**HW =**	**6,602.51**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.25**	
Minimum Theoretical Riprap Size	d_{50} =	11	in
Nominal Riprap Size	d_{50} =	12	in
UDFCD Riprap Type	**Type =**	**M**	
Length of Protection	**L_p =**	**40**	**ft**
Width of Protection	**T =**	**11**	**ft**

Pond 6
mainline storm
outfall



System Input Summary - POND G 66" TRIBUTARY 5 YEAR

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.35
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.99
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6603.84

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow Total Known Flow (cfs)	Local Contribution (cfs)	Sub Basin Information Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND G	6611.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 1	6614.42	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 2	6623.49	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 3	6625.92	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 4	6633.31	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 5	6635.07	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 6	6634.16	127.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20 SECT 7	6636.65	129.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20 SECT 8	6642.57	129.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 12 SECT 9	6643.26	102.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 10	6645.13	99.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 11	6649.97	99.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 12	6650.46	99.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND G	0.00	0.00	0.00	0.00	0.00	2346.35	0.05	0.03	127.00	
PIPE 23 SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00	
PIPE 23 SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00	

PIPE 23 SECT 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00
PIPE 23 SECT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00
PIPE 23 SECT 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00
PIPE 23 SECT 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	127.00
PIPE 20 SECT 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	129.00
PIPE 20 SECT 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	129.00
PIPE 12 SECT 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102.00
PIPE 10 SECT 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.00
PIPE 10 SECT 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.00
PIPE 10 SECT 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.00

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 23 SECT 1	10.00	6606.63	0.5	6606.68	0.013	0.03	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 2	50.00	6606.68	0.5	6606.93	0.013	0.38	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 3	20.00	6606.93	0.5	6607.03	0.013	0.38	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 23 SECT 4	241.95	6608.03	1.8	6612.39	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 5	162.28	6613.46	1.5	6615.89	0.013	1.32	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 6	119.81	6615.89	1.5	6617.69	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 20 SECT 7	141.44	6618.23	1.0	6619.64	0.013	0.09	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 20 SECT 8	190.87	6619.64	1.0	6621.55	0.013	0.18	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 12 SECT 9	248.54	6622.04	0.8	6624.03	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 10 SECT 10	76.14	6624.53	0.8	6625.14	0.013	0.05	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 10 SECT 11	245.25	6625.14	0.8	6627.10	0.013	0.06	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 10 SECT 12	41.68	6627.11	0.8	6627.44	0.013	0.06	0.00	CIRCULAR	60.00 in	60.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 23 SECT 1	238.09	10.02	37.58	9.09	34.29	10.18	1.19	Supercritical	127.00	0.00	
PIPE 23 SECT 2	238.09	10.02	37.58	9.09	34.29	10.18	1.19	Supercritical	127.00	0.00	
PIPE 23 SECT 3	184.66	9.40	38.68	9.49	36.56	10.14	1.11	Supercritical	127.00	0.00	
PIPE 23 SECT 4	451.75	19.01	37.58	9.09	23.94	16.33	2.37	Supercritical	127.00	0.00	
PIPE 23 SECT 5	412.39	17.36	37.58	9.09	25.14	15.28	2.16	Supercritical	127.00	0.00	
PIPE 23 SECT 6	412.39	17.36	37.58	9.09	25.14	15.28	2.16	Supercritical	127.00	0.00	
PIPE 20 SECT 7	336.71	14.17	37.89	9.14	28.34	13.23	1.74	Supercritical	129.00	0.00	
PIPE 20 SECT 8	336.71	14.17	37.89	9.14	28.34	13.23	1.74	Supercritical	129.00	0.00	
PIPE 12 SECT 9	301.17	12.68	33.51	8.42	26.47	11.45	1.57	Supercritical	102.00	0.00	
PIPE 10 SECT 10	233.57	11.90	33.97	8.63	27.27	11.40	1.52	Supercritical	99.00	0.00	
PIPE 10 SECT 11	233.57	11.90	33.97	8.63	27.27	11.40	1.52	Supercritical	99.00	0.00	
PIPE 10 SECT 12	233.57	11.90	33.97	8.63	27.27	11.40	1.52	Supercritical	99.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
PIPE 23 SECT 1	127.00	CIRCULAR	66.00 in	66.00 in	54.00 in	54.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 2	127.00	CIRCULAR	66.00 in	66.00 in	54.00 in	54.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 3	127.00	CIRCULAR	60.00 in	60.00 in	54.00 in	54.00 in	60.00 in	60.00 in	19.63	
PIPE 23 SECT 4	127.00	CIRCULAR	66.00 in	66.00 in	42.00 in	42.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 5	127.00	CIRCULAR	66.00 in	66.00 in	48.00 in	48.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 6	127.00	CIRCULAR	66.00 in	66.00 in	48.00 in	48.00 in	66.00 in	66.00 in	23.76	
PIPE 20 SECT 7	129.00	CIRCULAR	66.00 in	66.00 in	48.00 in	48.00 in	66.00 in	66.00 in	23.76	
PIPE 20 SECT 8	129.00	CIRCULAR	66.00 in	66.00 in	48.00 in	48.00 in	66.00 in	66.00 in	23.76	
PIPE 12 SECT 9	102.00	CIRCULAR	66.00 in	66.00 in	48.00 in	48.00 in	66.00 in	66.00 in	23.76	
PIPE 10 SECT 10	99.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 10 SECT 11	99.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	
PIPE 10 SECT 12	99.00	CIRCULAR	60.00 in	60.00 in	48.00 in	48.00 in	60.00 in	60.00 in	19.63	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6603.84

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 23 SECT 1	6606.63	6606.68	0.00	0.00	6609.64	6609.81	6611.05	0.04	6611.09
PIPE 23 SECT 2	6606.68	6606.93	0.17	0.00	6610.41	6610.41	6611.26	0.15	6611.41
PIPE 23 SECT 3	6606.93	6607.03	0.25	0.00	6610.66	6610.66	6611.68	0.06	6611.73
PIPE 23 SECT 4	6608.03	6612.39	0.02	0.00	6610.68	6615.52	6614.17	2.64	6616.80
PIPE 23 SECT 5	6613.46	6615.89	0.59	0.00	6616.11	6619.02	6619.18	1.13	6620.30
PIPE 23 SECT 6	6615.89	6617.69	0.02	0.00	6619.04	6620.82	6621.61	0.49	6622.10
PIPE 20 SECT 7	6618.23	6619.64	0.04	0.00	6620.86	6622.80	6623.31	0.79	6624.09
PIPE 20 SECT 8	6619.64	6621.55	0.08	0.00	6622.88	6624.71	6624.72	1.28	6626.00
PIPE 12 SECT 9	6622.04	6624.03	0.01	0.00	6624.72	6626.82	6626.28	1.64	6627.92
PIPE 10 SECT 10	6624.53	6625.14	0.02	0.00	6626.84	6627.97	6628.82	0.31	6629.13
PIPE 10 SECT 11	6625.14	6627.10	0.02	0.00	6627.99	6629.93	6629.43	1.66	6631.09
PIPE 10 SECT 12	6627.11	6627.44	0.02	0.00	6629.95	6630.27	6631.40	0.03	6631.43

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary - POND G 66" TRIBUTARY 100 YEAR

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Table

Time	Intensity
5	8.68
10	6.93
20	5.19
30	4.16
40	3.44
60	2.42
120	0.67

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.35
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.99
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6603.84

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND G	6611.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 1	6614.42	223.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 2	6623.49	223.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 3	6625.92	223.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 4	6633.31	226.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 5	6635.07	223.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 23 SECT 6	6634.16	226.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20 SECT 7	6636.65	216.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 20 SECT 8	6642.57	216.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 12 SECT 9	6643.26	189.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 10	6645.13	179.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 11	6649.97	179.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 10 SECT 12	6650.46	179.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND G	0.00	0.00	0.00	0.00	0.00	7234.29	0.03	0.02	223.00	
PIPE 23 SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.00	
PIPE 23 SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.00	

PIPE 23 SECT 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.00
PIPE 23 SECT 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	226.00
PIPE 23 SECT 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.00
PIPE 23 SECT 6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	226.00
PIPE 20 SECT 7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	216.00
PIPE 20 SECT 8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	216.00
PIPE 12 SECT 9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.00
PIPE 10 SECT 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	179.00
PIPE 10 SECT 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	179.00
PIPE 10 SECT 12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	179.00

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
PIPE 23 SECT 1	10.00	6606.63	0.5	6606.68	0.013	0.03	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 2	50.00	6606.68	0.5	6606.93	0.013	0.38	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 3	20.00	6606.93	0.5	6607.03	0.013	0.38	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 23 SECT 4	241.95	6608.03	1.8	6612.39	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 5	162.28	6613.46	1.5	6615.89	0.013	1.32	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 23 SECT 6	119.81	6615.89	1.5	6617.69	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 20 SECT 7	141.44	6618.23	1.0	6619.64	0.013	0.09	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 20 SECT 8	190.87	6619.64	1.0	6621.55	0.013	0.18	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 12 SECT 9	248.54	6622.04	0.8	6624.03	0.013	0.05	0.00	CIRCULAR	66.00 in	66.00 in
PIPE 10 SECT 10	76.14	6624.53	0.8	6625.14	0.013	0.05	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 10 SECT 11	245.25	6625.14	0.8	6627.10	0.013	0.06	0.00	CIRCULAR	60.00 in	60.00 in
PIPE 10 SECT 12	41.68	6627.11	0.8	6627.44	0.013	0.06	0.00	CIRCULAR	60.00 in	60.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 23 SECT 1	238.09	10.02	50.13	11.52	50.68	11.39	0.98	Subcritical	223.00	0.00	
PIPE 23 SECT 2	238.09	10.02	50.13	11.52	50.68	11.39	0.98	Subcritical	223.00	0.00	
PIPE 23 SECT 3	184.66	9.40	60.00	11.36	60.00	11.36	0.00	Pressurized	223.00	20.00	
PIPE 23 SECT 4	451.75	19.01	50.46	11.60	33.01	19.02	2.28	Supercritical	226.00	0.00	
PIPE 23 SECT 5	412.39	17.36	50.13	11.52	34.58	17.70	2.06	Supercritical	223.00	0.00	
PIPE 23 SECT 6	412.39	17.36	50.46	11.60	34.86	17.75	2.06	Supercritical	226.00	0.00	
PIPE 20 SECT 7	336.71	14.17	49.36	11.33	38.43	15.04	1.63	Supercritical	216.00	0.00	
PIPE 20 SECT 8	336.71	14.17	49.36	11.33	38.43	15.04	1.63	Supercritical	216.00	0.00	
PIPE 12 SECT 9	301.17	12.68	46.17	10.65	37.90	13.39	1.46	Supercritical	189.00	0.00	
PIPE 10 SECT 10	233.57	11.90	45.98	11.09	39.36	13.11	1.36	Supercritical	179.00	0.00	
PIPE 10 SECT 11	233.57	11.90	45.98	11.09	39.36	13.11	1.36	Supercritical	179.00	0.00	
PIPE 10 SECT 12	233.57	11.90	45.98	11.09	39.36	13.11	1.36	Supercritical	179.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing		Calculated		Used			Comment
			Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	
PIPE 23 SECT 1	223.00	CIRCULAR	66.00 in	66.00 in	66.00 in	66.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 2	223.00	CIRCULAR	66.00 in	66.00 in	66.00 in	66.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 3	223.00	CIRCULAR	60.00 in	60.00 in	66.00 in	66.00 in	60.00 in	60.00 in	19.63	
PIPE 23 SECT 4	226.00	CIRCULAR	66.00 in	66.00 in	54.00 in	54.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 5	223.00	CIRCULAR	66.00 in	66.00 in	54.00 in	54.00 in	66.00 in	66.00 in	23.76	
PIPE 23 SECT 6	226.00	CIRCULAR	66.00 in	66.00 in	54.00 in	54.00 in	66.00 in	66.00 in	23.76	
PIPE 20 SECT 7	216.00	CIRCULAR	66.00 in	66.00 in	60.00 in	60.00 in	66.00 in	66.00 in	23.76	
PIPE 20 SECT 8	216.00	CIRCULAR	66.00 in	66.00 in	60.00 in	60.00 in	66.00 in	66.00 in	23.76	
PIPE 12 SECT 9	189.00	CIRCULAR	66.00 in	66.00 in	60.00 in	60.00 in	66.00 in	66.00 in	23.76	
PIPE 10 SECT 10	179.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	
PIPE 10 SECT 11	179.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	
PIPE 10 SECT 12	179.00	CIRCULAR	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	60.00 in	19.63	

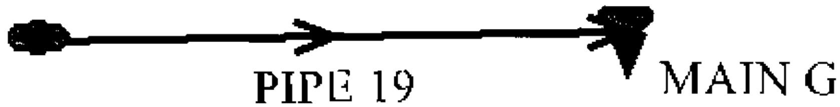
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6603.84

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 23 SECT 1	6606.63	6606.68	0.00	0.00	6610.81	6610.90	6612.87	0.05	6612.92
PIPE 23 SECT 2	6606.68	6606.93	0.52	0.00	6612.05	6612.23	6613.44	0.19	6613.63
PIPE 23 SECT 3	6606.93	6607.03	0.76	0.00	6612.99	6613.14	6615.00	0.15	6615.14
PIPE 23 SECT 4	6608.03	6612.39	0.07	0.00	6613.21	6616.59	6616.40	2.28	6618.68
PIPE 23 SECT 5	6613.46	6615.89	1.81	0.00	6618.40	6620.07	6621.20	0.93	6622.13
PIPE 23 SECT 6	6615.89	6617.69	0.07	0.00	6620.14	6621.89	6623.69	0.29	6623.98
PIPE 20 SECT 7	6618.23	6619.64	0.12	0.00	6622.01	6623.75	6624.94	0.81	6625.75
PIPE 20 SECT 8	6619.64	6621.55	0.23	0.00	6623.98	6625.66	6626.36	1.30	6627.66
PIPE 12 SECT 9	6622.04	6624.03	0.05	0.00	6625.71	6627.88	6627.98	1.65	6629.64
PIPE 10 SECT 10	6624.53	6625.14	0.06	0.00	6627.94	6628.97	6630.48	0.40	6630.88
PIPE 10 SECT 11	6625.14	6627.10	0.08	0.00	6629.05	6630.93	6631.09	1.75	6632.84
PIPE 10 SECT 12	6627.11	6627.44	0.08	0.00	6631.01	6631.27	6633.06	0.12	6633.18

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


PIPE 19
MAIN G

System Input Summary – STM-MAIN B – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6624.71

Manhole Input Summary:

		Given Flow		Sub Basin Information							
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6642.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 19	6643.36	37.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	19.07	1.94	0.13	37.00	
PIPE 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 19	40.00	6624.05	1.0	6624.45	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 19	66.88	9.46	23.74	7.48	19.12	9.70	1.51	Supercritical	37.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 19	37.00	CIRCULAR	36.00 in	36.00 in	30.00 in	30.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6624.71

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 19	6624.05	6624.45	0.00	0.00	6625.64	6626.43	6627.10	0.19	6627.30

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-MAIN B – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6625.66

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6642.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 19	6643.36	68.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	34.90	1.95	0.07	68.00	
PIPE 19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 19	40.00	6624.05	1.0	6624.45	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
PIPE 19	66.88	9.46	36.00	9.62	36.00	9.62	0.00	Pressurized	68.00	40.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
PIPE 19	68.00	CIRCULAR	36.00 in	36.00 in	42.00 in	42.00 in	36.00 in	36.00 in	7.07	Existing height is smaller than the suggested height. Existing width is smaller than the suggested width. Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6625.66

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 19	6624.05	6624.45	0.00	0.00	6627.05	6627.46	6628.49	0.41	6628.90

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MAIN G PIPE 11

System Input Summary – STM-MAIN C – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6626.82

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6645.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 11	6645.05	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	6.22	1.93	0.20	12.00	
PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 11	30.00	6627.03	2.0	6627.63	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 11	58.16	11.85	13.94	5.37	9.25	9.33	2.20	Supercritical	12.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing Rise	Existing Span	Calculated Rise	Calculated Span	Used Rise	Used Span	Used Area (ft^2)	Comment
PIPE 11	12.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6626.82

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 11	6627.03	6627.63	0.00	0.00	6627.80	6628.79	6629.15	0.09	6629.24

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-MAIN C – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6627.88

Manhole Input Summary:

Element Name	Given Flow: Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6645.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 11	6645.05	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	11.33	1.94	0.11	22.00	
PIPE 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 11	30.00	6627.03	2.0	6627.63	0.013	0.00	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity: Flow (cfs)	Full Flow Capacity: Velocity (fps)	Critical Flow: Depth (in)	Critical Flow: Velocity (fps)	Normal Flow: Depth (in)	Normal Flow: Velocity (fps)	Normal Flow: Froude Number	Normal Flow: Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 11	58.16	11.85	19.14	6.66	12.79	11.03	2.16	Supercritical	22.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing: Rise	Existing: Span	Calculated: Rise	Calculated: Span	Used: Rise	Used: Span	Area (ft^2)	Comment
PIPE 11	22.00	CIRCULAR	30.00 in	30.00 in	21.00 in	21.00 in	30.00 in	30.00 in	4.91	

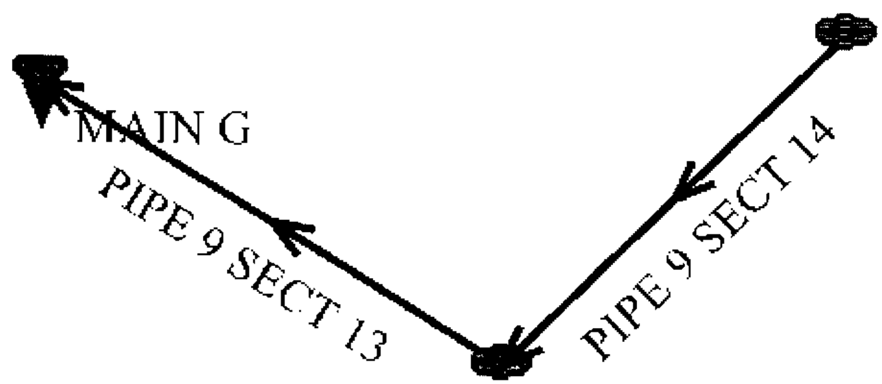
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6627.88

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
PIPE 11	6627.03	6627.63	0.00	0.00	6628.23	6629.22	6629.61	0.31	6629.91

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


MAIN G
PIPE 9 SECT 13
PIPE 9 SECT 14

System Input Summary – STM-MAIN E – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6630.27

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6650.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9 SECT 13	6651.82	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9 SECT 14	6651.15	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	5.25	1.91	0.35	10.00	
PIPE 9 SECT 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	
PIPE 9 SECT 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 9 SECT 13	43.34	6629.94	7.0	6632.97	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 9 SECT 14	20.00	6633.27	7.0	6634.67	0.013	0.79	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 9 SECT 13	108.81	22.17	12.68	5.07	6.14	13.83	4.07	Supercritical	10.00	0.00	
PIPE 9 SECT 14	108.81	22.17	12.68	5.07	6.14	13.83	4.07	Supercritical	10.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PIPE 9 SECT 13	10.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PIPE 9 SECT 14	10.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6630.27

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 9 SECT 13	6629.94	6632.97	0.00	0.00	6630.45	6634.03	6633.42	1.01	6634.43
PIPE 9 SECT 14	6633.27	6634.67	0.02	0.00	6634.05	6635.54	6636.75	0.00	6636.75

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – STM-MAIN E – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6631.27

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
MAIN G	6650.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9 SECT 13	6651.82	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIPE 9 SECT 14	6651.15	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
MAIN G	0.00	0.00	0.00	0.00	0.00	8.82	1.93	0.21	17.00	
PIPE 9 SECT 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	
PIPE 9 SECT 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
PIPE 9 SECT 13	43.34	6629.94	7.0	6632.97	0.013	0.03	0.00	CIRCULAR	30.00 in	30.00 in
PIPE 9 SECT 14	20.00	6633.27	7.0	6634.67	0.013	0.79	0.00	CIRCULAR	30.00 in	30.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity: Flow (cfs)	Full Flow Capacity: Velocity (fps)	Critical Flow: Depth (in)	Critical Flow: Velocity (fps)	Normal Flow: Depth (in)	Normal Flow: Velocity (fps)	Normal Flow: Froude Number	Normal Flow: Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PIPE 9 SECT 13	108.81	22.17	16.73	6.04	8.02	16.13	4.12	Supercritical	17.00	0.00	
PIPE 9 SECT 14	108.81	22.17	16.73	6.04	8.02	16.13	4.12	Supercritical	17.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing: Rise	Existing: Span	Calculated: Rise	Calculated: Span	Used: Rise	Used: Span	Used: Area (ft^2)	Comment
PIPE 9 SECT 13	17.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	
PIPE 9 SECT 14	17.00	CIRCULAR	30.00 in	30.00 in	18.00 in	18.00 in	30.00 in	30.00 in	4.91	

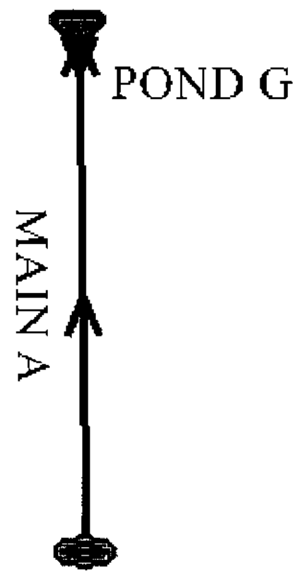
- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6631.27

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PIPE 9 SECT 13	6629.94	6632.97	0.00	0.00	6631.27	6634.36	6634.64	0.29	6634.93
PIPE 9 SECT 14	6633.27	6634.67	0.07	0.00	6634.44	6635.19	6637.98	0.00	6637.98

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.


POND G
MAIN A

System Input Summary – MAIN A – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6603.30

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND G	6609.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAIN A	6613.85	38.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND G	0.00	0.00	0.00	0.00	0.00	19.68	1.93	0.19	38.00	
MAIN A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
MAIN A	60.00	6603.30	0.5	6603.60	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
MAIN A	47.31	6.69	24.07	7.57	24.43	7.44	0.97	Subcritical	38.00	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
MAIN A	38.00	CIRCULAR	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6603.30

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
MAIN A	6603.30	6603.60	0.00	0.00	6605.31	6605.66	6606.19	0.30	6606.50

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – MAIN A – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6603.30

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND G	6609.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAIN A	6613.85	79.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
POND G	0.00	0.00	0.00	0.00	0.00	40.56	1.95	0.07	79.00	
MAIN A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.00	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
MAIN A	50.04	6603.30	0.5	6603.55	0.013	0.00	0.00	CIRCULAR	36.00 in	36.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
MAIN A	47.27	6.69	36.00	11.18	36.00	11.18	0.00	Pressurized	79.00	50.04	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
MAIN A	79.00	CIRCULAR	36.00 in	36.00 in	48.00 in	48.00 in	36.00 in	36.00 in	7.07	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

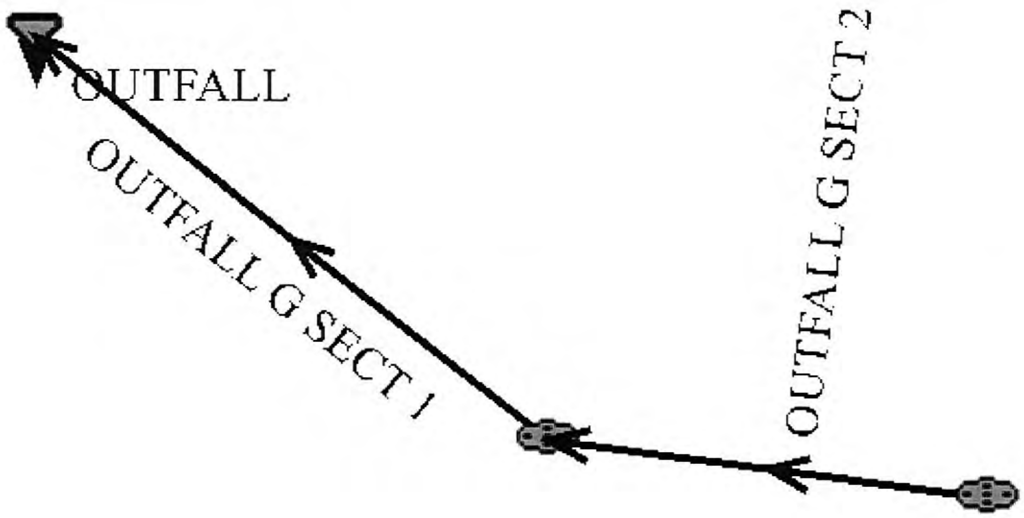
Grade Line Summary:

Tailwater Elevation (ft): 6603.30

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
MAIN A	6603.30	6603.55	0.00	0.00	6606.30	6607.00	6608.24	0.70	6608.94

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Pond G
Outlet pipe to
BS creek



System Input Summary – POND G OUTFALL – 5 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 5
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6585.50

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL	6590.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OUTFALL G SECT 1	6604.00	4.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OUTFALL G SECT 2	6608.30	4.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL	0.00	0.00	0.00	0.00	0.00	4.49	0.90	16.73	4.06	
OUTFALL G SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.06	
OUTFALL G SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.06	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
OUTFALL G SECT 1	324.25	6585.50	2.6	6593.93	0.013	0.00	0.00	CIRCULAR	48.00 in	48.00 in
OUTFALL G SECT 2	125.80	6594.23	2.6	6597.50	0.013	0.08	0.00	CIRCULAR	48.00 in	48.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
OUTFALL G SECT 1	232.24	18.48	6.98	3.59	4.41	7.03	2.48	Supercritical	4.06	0.00	
OUTFALL G SECT 2	232.24	18.48	6.98	3.59	4.41	7.03	2.48	Supercritical	4.06	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing Rise	Existing Span	Calculated Rise	Calculated Span	Used Rise	Used Span	Used Area (ft^2)	Comment
OUTFALL G SECT 1	4.06	CIRCULAR	48.00 in	48.00 in	18.00 in	18.00 in	48.00 in	48.00 in	12.57	
OUTFALL G SECT 2	4.06	CIRCULAR	48.00 in	48.00 in	18.00 in	18.00 in	48.00 in	48.00 in	12.57	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6585.50

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
OUTFALL G SECT 1	6585.50	6593.93	0.00	0.00	6585.87	6594.51	6586.63	8.08	6594.71
OUTFALL G SECT 2	6594.23	6597.50	0.00	0.00	6594.60	6598.08	6595.36	2.92	6598.28

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

System Input Summary – POND G OUTFALL – 100 YR HGL REPORT

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in): 0.42
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6585.50

Manhole Input Summary:

Element Name	Ground Elevation (ft)	Given Flow: Total Known Flow (cfs)	Given Flow: Local Contribution (cfs)	Sub Basin Information: Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
OUTFALL	6590.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OUTFALL G SECT 1	6604.00	95.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OUTFALL G SECT 2	6608.30	95.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

Element Name	Local Contribution: Overland Time (min)	Gutter Time (min)	Basin Tc (min)	Intensity (in/hr)	Local Contrib (cfs)	Total Design Flow: Coeff. Area	Intensity (in/hr)	Manhole Tc (min)	Peak Flow (cfs)	Comment
OUTFALL	0.00	0.00	0.00	0.00	0.00	51.50	1.86	0.71	95.60	
OUTFALL G SECT 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.60	
OUTFALL G SECT 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.60	

Sewer Input Summary:

Element Name	Sewer Length (ft)	Elevation: Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Loss Coefficients: Mannings n	Bend Loss	Lateral Loss	Given Dimensions: Cross Section	Rise (ft or in)	Span (ft or in)
OUTFALL G SECT 1	324.25	6585.50	2.6	6593.93	0.013	0.00	0.00	CIRCULAR	48.00 in	48.00 in
OUTFALL G SECT 2	125.80	6594.23	2.6	6597.50	0.013	0.08	0.00	CIRCULAR	48.00 in	48.00 in

Sewer Flow Summary:

Element Name	Full Flow Capacity Flow (cfs)	Full Flow Capacity Velocity (fps)	Critical Flow Depth (in)	Critical Flow Velocity (fps)	Normal Flow Depth (in)	Normal Flow Velocity (fps)	Normal Flow Froude Number	Normal Flow Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
OUTFALL G SECT 1	232.24	18.48	35.56	9.58	21.46	17.58	2.65	Supercritical	95.60	0.00	
OUTFALL G SECT 2	232.24	18.48	35.56	9.58	21.46	17.58	2.65	Supercritical	95.60	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

Element Name	Peak Flow (cfs)	Cross Section	Existing Rise	Existing Span	Calculated Rise	Calculated Span	Used Rise	Used Span	Used Area (ft^2)	Comment
OUTFALL G SECT 1	95.60	CIRCULAR	48.00 in	48.00 in	36.00 in	36.00 in	48.00 in	48.00 in	12.57	
OUTFALL G SECT 2	95.60	CIRCULAR	48.00 in	48.00 in	36.00 in	36.00 in	48.00 in	48.00 in	12.57	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6585.50

Element Name	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
OUTFALL G SECT 1	6585.50	6593.93	0.00	0.00	6587.29	6596.89	6592.09	6.23	6598.32
OUTFALL G SECT 2	6594.23	6597.50	0.07	0.00	6596.97	6600.46	6600.82	1.07	6601.89

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.