PRELIMINARY STORM DRAINAGE REPORT
COVINGTON WOODS II
LANSING, KANSAS

Prepared for:

ZIMMERMAN PROPERTIES DEVELOPMENT, LLC
1329 E. Lark Street
Springfield, Missouri 65804

Prepared by:

KAW VALLEY ENGINEERING, INC.
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August 21, 2023

KVE Project No. C23D1644

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EXHIBITS
- Exhibit A – Proposed Grading Plan
- Exhibit B – Existing Drainage Area Map
- Exhibit C – Proposed Drainage Area Map
- Exhibit D – Pond Pack Analysis

INTRODUCTION

The development of Covington Woods II is being proposed on approximately 4.73-acres south of West Kay Street, and north of West Mary Street in Lansing, Kansas. With authorization from Zimmerman Properties Development, LLC, Kaw Valley Engineering, Inc. has completed a preliminary study of the existing site conditions and the proposed storm drainage systems associated with the development.

PURPOSE OF STUDY

The purpose of this study is to analyze the existing and future storm water drainage conditions and flows associated with the proposed development, and to provide an analysis of the proposed storm water detention system to ensure that the developed discharge from the site will be less than or equal to the pre-developed site discharge for the 100-year and more frequent storm events.

EXISTING CONDITIONS

The project site currently consists of grasses and slopes ranging from gentle to moderate. Runoff from the property currently discharges via overland flow to the northwest into an existing drainage ditch and pipe system. Approximately 0.86-acres of the property currently discharge via overland flow to the east. See Exhibit B for the Existing Drainage Area Map.

DESCRIPTION OF PROPOSED IMPROVEMENTS

The project will include the construction of three multi-family buildings (totaling 52 units), a clubhouse, maintenance building, associated utilities, drives and parking. The proposed improvements will increase the runoff from the site due to the construction of impervious surfaces associated with the project. The site will be graded to capture the majority of the improved site runoff and convey it by a proposed underground storm sewer system to a detention basin located in the northwest corner of the property. The detention basin will restrict the developed discharge rates to levels at or below pre-developed discharge rates for the 100-year and more frequent storm events. See Exhibit A for the proposed grading plan.

EXISTING DRAINAGE ANALYSIS

To determine the effectiveness of the proposed detention system, an existing discharge rate from the drainage area had to be determined. The allowable discharge rate for a 100-year rainfall event from the detention basin was used to size the basin to ensure the 100-year event will not overtop the basin. The runoff area used to calculate the existing runoff rate is the portion of the property that drains to the west. Two proposed areas bypass the detention basin and are undetained. These two undetained areas, totaling 0.79-acres, have been removed from the existing contributing area to account for them in the allowable release rate. The 0.86-acres

located on the east side of the property is excluded from the existing runoff rate calculation due to it's drainage area draining separately to the east. The effective existing drainage area is that of the total site less the east drainage area and the two undetained drainage areas, which totals 3.07 acres.

Pond Pack was used to calculate the existing runoff rates with the Modified Rational method for the 100-year and more frequent storm events. The existing time of concentration was calculated to be approximately 11 minutes. The rainfall intensities for the site are obtained from Section 5600 Storm Drainage Systems and Facilities, Kansas City APWA. A Runoff Coefficient (C) of 0.30, for undeveloped areas, is used for the existing analysis. The analysis indicates the existing runoff rates are 3.89-cfs for the 2-year storm, 5.38-cfs for the 10-year storm, and 7.61-cfs for the 100-year storm.

DEVELOPED DRAINAGE ANALYSIS

Pond Pack was used to route the developed runoff through the on-site detention basin to determine the effectiveness of the detention basin at limiting the developed discharge from the site. Approximately 0.79-acres are not detained. The impervious area in the undetained areas has been added to the detained impervious area to account for these surfaces in the detention calculations.

The detention calculations were performed using the Modified Rational method for the 100-year and more frequent storm events. The developed runoff coefficients of the detained and undetained areas are 0.65 and 0.3 respectively, which is calculated from the percent impervious area using 0.3 for permeable surfaces and 0.9 for impervious surfaces. The time of concentration was assumed to be 5 minutes for the developed site.

As previously stated, the developed runoff calculations were performed using the Modified Rational method.

DETENTION SYSTEM

The storm water detention basin will be located at the northwest corner of the property. The detention basin will have minimum and maximum elevations of 832.0 ft. and 840.0 ft. with maximum side slopes of 3:1 for ease of maintenance.

The detention basin will discharge through a 4'x4' concrete structure fabricated to have two orifices that will control the release of the 100-year and more frequent storm events. The lower orifice will have an 8 in. diameter with an invert elevation of 832.0 ft. and the upper orifice will have a 10 in. diameter with an invert elevation of 835.5 ft. The 4'x4' concrete outlet structure will discharge to an 18" culvert. A 20 ft. earthen emergency weir will be constructed at an elevation of 838.0 ft. to discharge the detention basin in storm events greater than the 100-year event.

Through the use of the outlet structure the detention basin will discharge 2.96-cfs at a water surface elevation of 835.62 ft. in a 2-year rainfall event, 4.9-cfs at a water surface elevation of 836.45 ft. in a

10-year rainfall event, and 6.63-cfs at a water surface elevation of 837.46 ft. in a 100-year rainfall event. The proposed detention system will not adversely affect the proposed structures or neighboring property.

DRAINAGE ANALYSIS RESULTS

Pond Pack was used to route the runoff area through its storm water detention basin to determine the effectiveness of the detention basin to adequately limit the developed runoff rates for the 100-year and more frequent storm events. Table 1 is a summary of the Pond Pack analysis of the detention basin for developed conditions. The Pond Pack analysis can be seen in Exhibit D.

DETENTION BASIN ANALYSIS RESULTS SUMMARY

Return Period Storm (Year)	Existing Runoff (cfs)	Developed Runoff Directed To Detention (cfs)	Detention Basin Release Rate (cfs)	Runoff Reduction (cfs)	Maximum Water Surface Elevation (ft)	Maximum Storage Volume (ac-ft)
2	3.89	8.27	2.96	0.93	835.62	0.167
5	4.73	9.97	3.97	0.76	836.13	0.210
10	5.38	11.33	4.90	0.48	836.45	0.239
25	6.24	13.14	5.64	0.60	836.83	0.276
50	6.93	14.38	6.20	0.73	837.17	0.313
100	7.61	15.80	6.63	0.98	837.46	0.346

CONCLUSIONS

The proposed storm water detention system will provide storage to limit the developed storm water runoff associated with the Covington Woods II project to levels below the existing runoff rates for the 100-year and more frequent storm events.

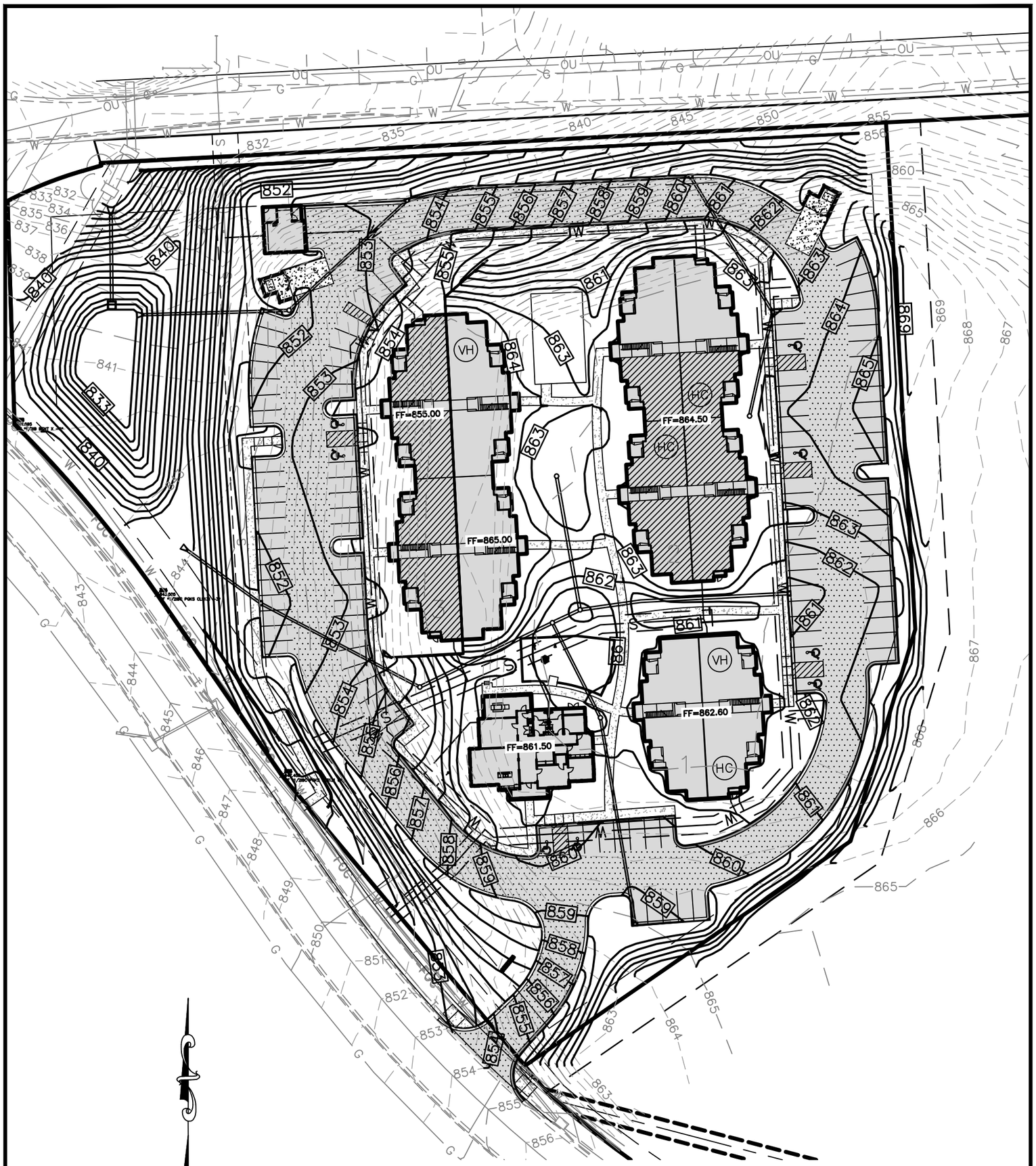
Respectfully submitted,
Kaw Valley Engineering, Inc

Kyle G. Kippes, P.E.
Project Manager

KYLE G. KIPPES LICENSED 20913 8-21-23 KANSAS PROFESSIONAL ENGINEER

Noah J. Coleman, EIT
Staff Engineer

EXHIBIT A
PROPOSED GRADING PLAN



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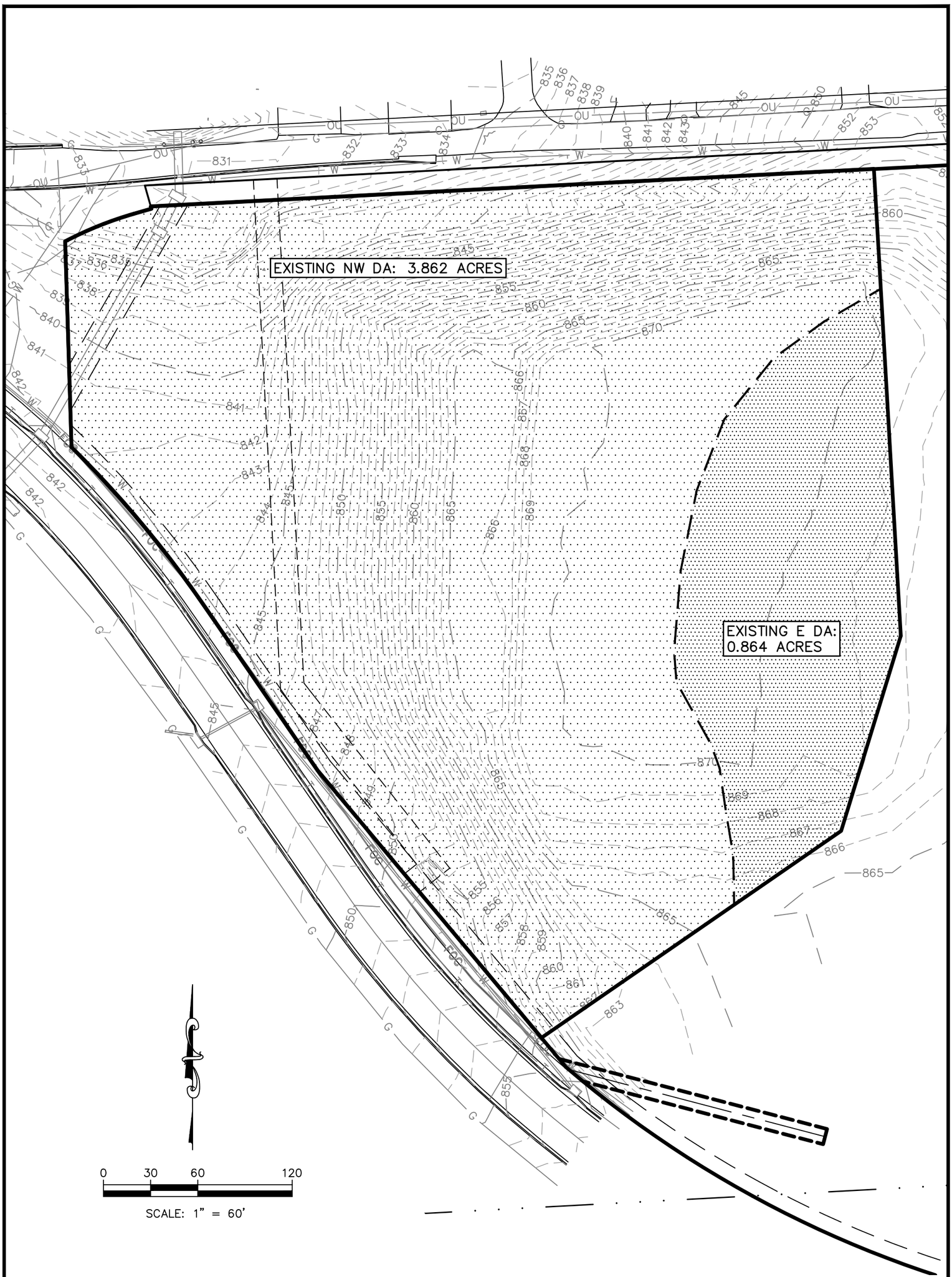
GRADING EXHIBIT

08-18-2023

1644PGRADE

EXHIBIT B
EXISTING DRAINAGE AREA MAP



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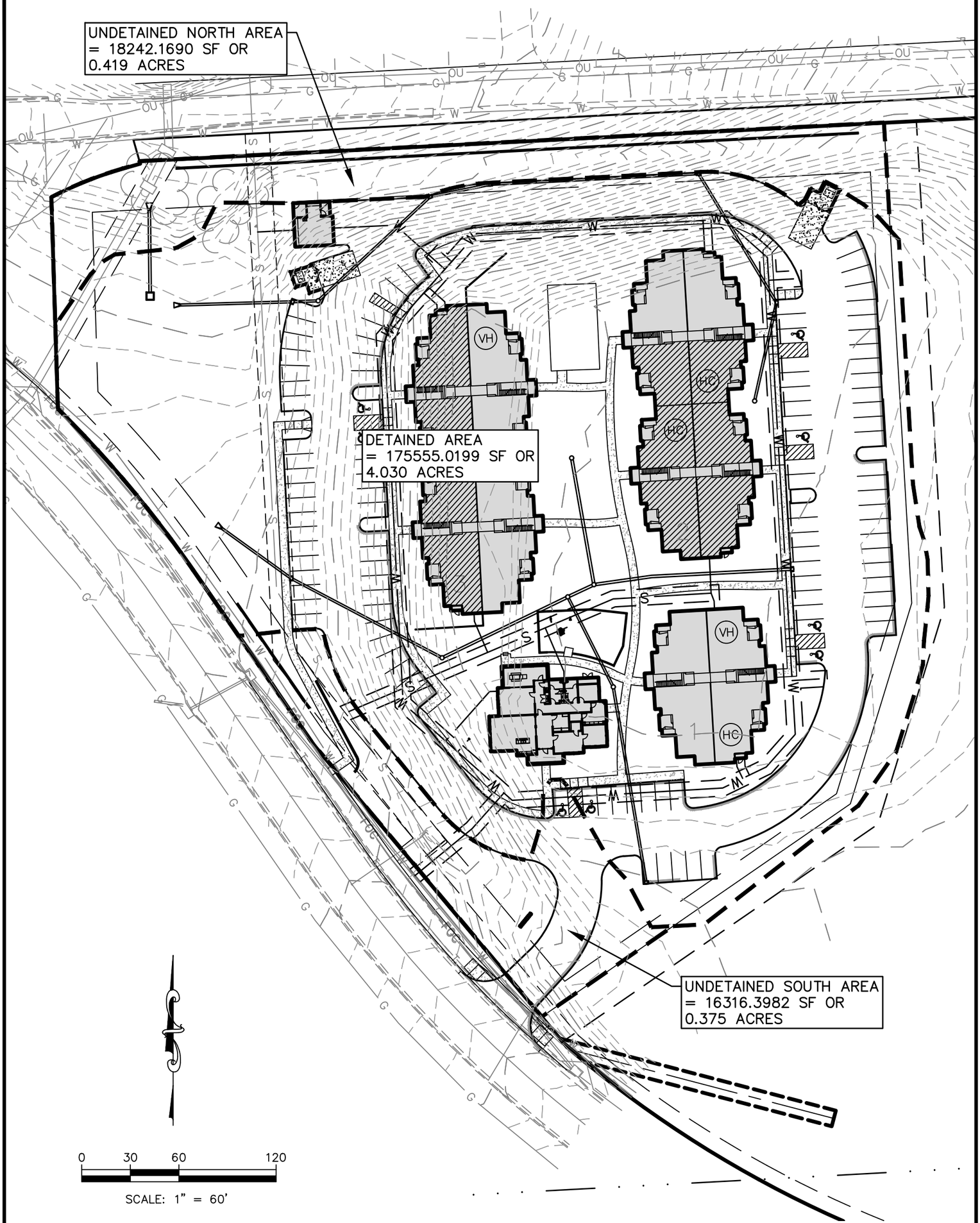
EXISTING DRAINAGE AREA MAP

08-17-2023
1644EXDAM

EXHIBIT C
PROPOSED DRAINAGE AREA MAP



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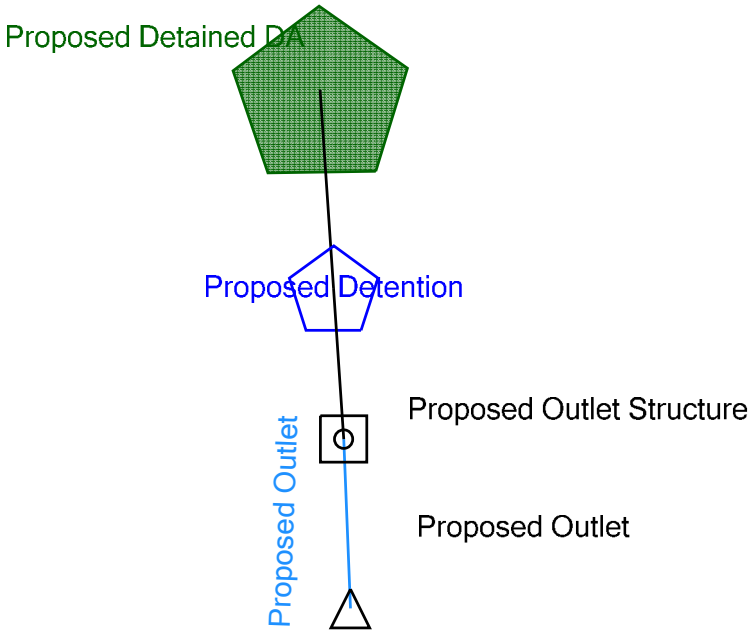
PROPOSED DRAINAGE AREA MAP

08-17-2023
1644PDAM

EXHIBIT D
POND PACK ANALYSIS

Scenario: Base



Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Element Details			
Label	Composite Outlet Structure - 1	Notes	

Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	840.00 ft
Pond	Proposed Detention	Increment (Headwater)	0.50 ft
Minimum (Headwater)	832.00 ft		

SpotElevation (ft)

Tailwater Setup	
Tailwater Type	Free Outfall

Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure	
Outlet Structure Type	Weir

Outlet Structure (IDs and Direction)			
Outlet ID	20' Earth Weir	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Weir)			
Weir	Irregular Weir	Weir Coefficient	3.60 (ft^0.5)/s
Vary Coefficient with Depth	False		

Irregular Weir Cross-section

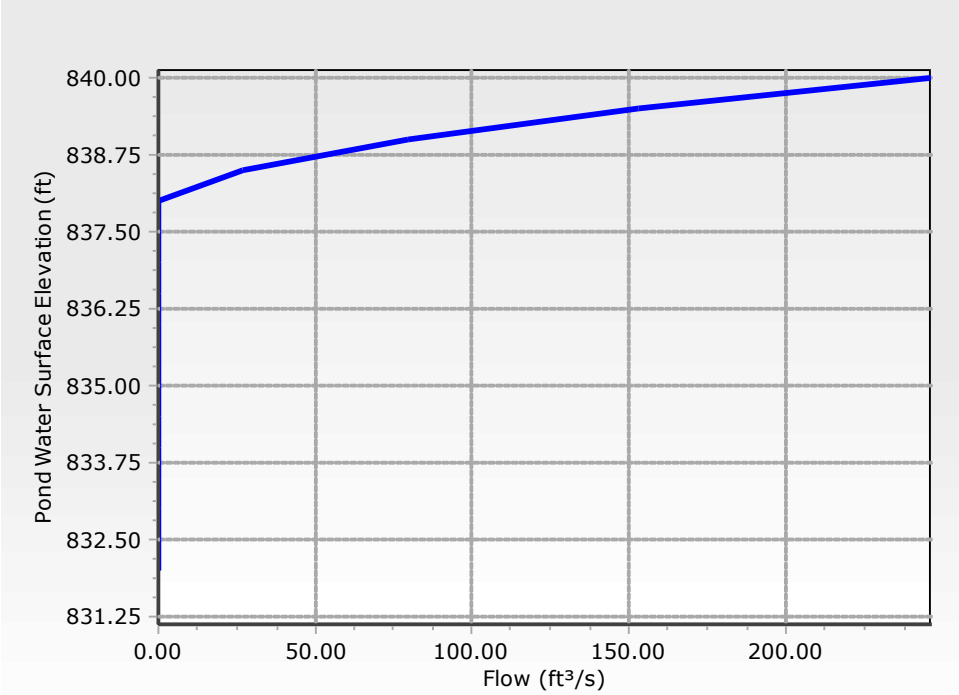
Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Irregular Weir Cross-section

Station (ft)	Elevation (ft)
0.00	2.00
6.00	0.00
26.00	0.00
32.00	2.00

Outlet Structure (Common)	
Elevation	838.00 ft

Outlet Structure (Weir, Advanced)	
User Defined Table	False



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 20' Earth Weir (Irregular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 20' Earth Weir (Irregular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
832.00	0.00	(N/A)	0.00
832.50	0.00	(N/A)	0.00
833.00	0.00	(N/A)	0.00
833.50	0.00	(N/A)	0.00
834.00	0.00	(N/A)	0.00
834.50	0.00	(N/A)	0.00
835.00	0.00	(N/A)	0.00
835.50	0.00	(N/A)	0.00
836.00	0.00	(N/A)	0.00
836.50	0.00	(N/A)	0.00
837.00	0.00	(N/A)	0.00
837.50	0.00	(N/A)	0.00
838.00	0.00	(N/A)	0.00
838.50	26.81	(N/A)	0.00
839.00	79.64	(N/A)	0.00
839.50	153.32	(N/A)	0.00
840.00	246.85	(N/A)	0.00

Computation Messages
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 20' Earth Weir (Irregular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Computation Messages
WS below an invert; no flow.
Max.H=.50; Max.Htw=free out;; W(ft) =23.00
Max.H=1.00; Max.Htw=free out;; W(ft) =26.00
Max.H=1.50; Max.Htw=free out;; W(ft) =29.00
Max.H=2.00; Max.Htw=free out;; W(ft) =32.00

Outlet Structure	
Outlet Structure Type	Orifice

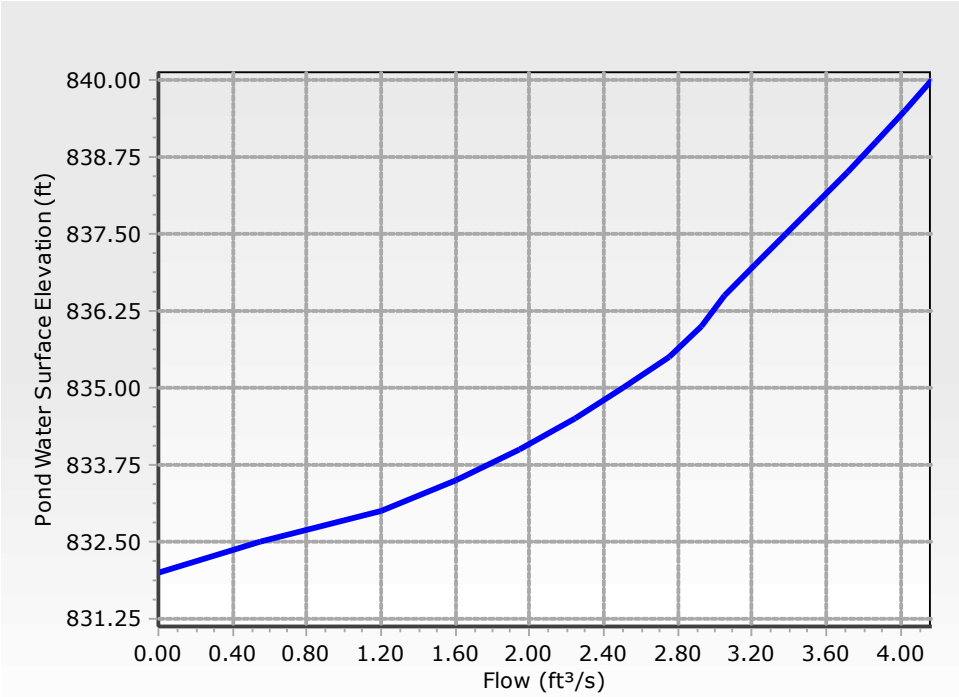
Outlet Structure (IDs and Direction)			
Outlet ID	8" Low	Downstream ID	18" Culvert
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	1	Orifice Diameter	8.0 in

Outlet Structure (Common)	
Elevation	832.00 ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 8" Low (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
832.00	0.00	0.00	0.00	0.00
832.50	0.54	832.50	832.29	832.29
833.00	1.20	833.00	832.49	832.49
833.50	1.61	833.50	832.58	832.58
834.00	1.95	834.00	832.66	832.66
834.50	2.24	834.50	832.72	832.72
835.00	2.51	835.00	832.77	832.77
835.50	2.75	835.50	832.81	832.81
836.00	2.93	836.00	832.96	832.96
836.50	3.06	836.50	833.19	833.19
837.00	3.22	837.00	833.33	833.33
837.50	3.39	837.50	833.43	833.43
838.00	3.55	838.00	833.53	833.53
838.50	3.72	838.50	833.61	833.61
839.00	3.87	839.00	833.69	833.69
839.50	4.03	839.50	833.76	833.76

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 8" Low (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
840.00	4.17	840.00	833.84	833.84

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft³/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
CRIT.DEPTH CONTROL Vh= .143ft
Dcr= .357ft CRIT.DEPTH Hev= .00ft
H =.51
H =.92
H =1.34
H =1.78
H =2.23
H =2.69
H =3.04
H =3.31
H =3.67
H =4.07
H =4.47
H =4.89
H =5.31
H =5.74

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 8" Low (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Message
H =6.16

Outlet Structure			
Outlet Structure Type	Orifice		

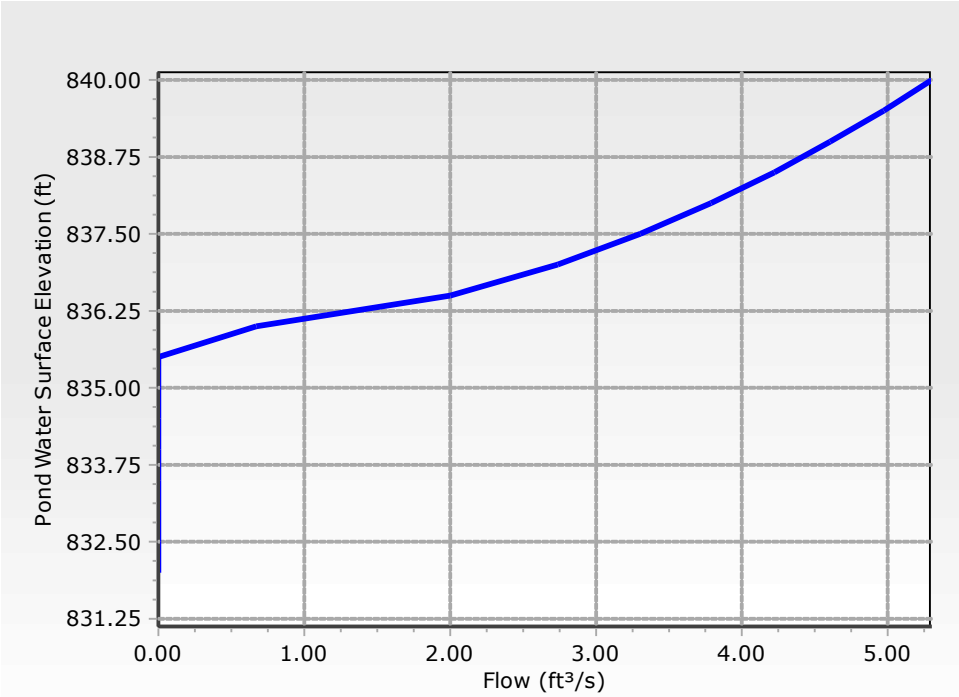
Outlet Structure (IDs and Direction)			
Outlet ID	10" High	Downstream ID	18" Culvert
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	1	Orifice Diameter	10.0 in

Outlet Structure (Common)	
Elevation	835.50 ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 10" High (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
832.00	0.00	0.00	0.00	0.00
832.50	0.00	0.00	0.00	832.29
833.00	0.00	0.00	0.00	832.49
833.50	0.00	0.00	0.00	832.58
834.00	0.00	0.00	0.00	832.66
834.50	0.00	0.00	0.00	832.72
835.00	0.00	0.00	0.00	832.77
835.50	0.00	0.00	0.00	832.81
836.00	0.68	836.00	Free Outfall	832.96
836.50	2.00	836.50	Free Outfall	833.19
837.00	2.73	837.00	Free Outfall	833.33
837.50	3.30	837.50	Free Outfall	833.43
838.00	3.79	838.00	Free Outfall	833.53
838.50	4.22	838.50	Free Outfall	833.61
839.00	4.61	839.00	Free Outfall	833.69
839.50	4.97	839.50	Free Outfall	833.76

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 10" High (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
840.00	5.30	840.00	Free Outfall	833.84

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft³/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
WS below an invert; no flow.
CRIT.DEPTH CONTROL Vh= .137ft Dcr= .362ft CRIT.DEPTH Hev= .00ft
H =.58
H =1.08
H =1.58
H =2.08
H =2.58
H =3.08
H =3.58

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 10" High (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = 18" Culvert (Culvert-Circular)

Message
H =4.08

Outlet Structure

Outlet Structure Type	Culvert	Culvert Type	Circular

Outlet Structure (IDs and Direction)

Outlet ID	18" Culvert	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)

Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

Culvert Data

Number of Barrels	1	Downstream Invert	831.00 ft
Length	90.00 ft	Diameter	18.0 in
Upstream Invert	831.90 ft		

Unsubmerged->Submerged

Specify Transitions	False	Compute Inlet Control Only	False

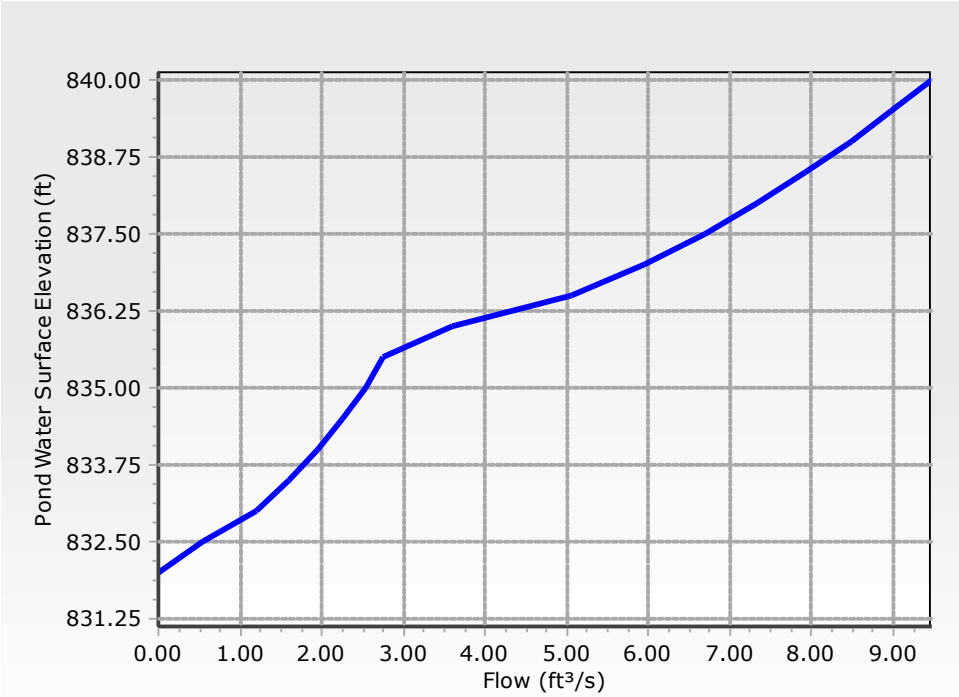
Culvert Coefficients

Inlet Description	Concrete - Groove end projecting	C	0.0317
Chart	Chart 1	Y	0.6900
Nomograph	Nomograph 3	Manning's n	0.013
Equation Form	Form 1	Ke	0.200
K	0.0045	Kr	0.000
M	2.0000	Slope Correction Factor	-0.500

Culvert (Advanced)

Convergence Tolerance	0.00 ft	Specify Number of Backwater Sections	False

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 18" Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 11.30 ft³/s
Upstream ID = 8" Low, 10" High
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
832.00	0.00	0.00	0.00	Free Outfall
832.50	0.54	832.29	Free Outfall	Free Outfall
833.00	1.20	832.49	Free Outfall	Free Outfall
833.50	1.61	832.58	Free Outfall	Free Outfall
834.00	1.95	832.66	Free Outfall	Free Outfall
834.50	2.25	832.72	Free Outfall	Free Outfall
835.00	2.53	832.77	Free Outfall	Free Outfall
835.50	2.75	832.81	Free Outfall	Free Outfall
836.00	3.60	832.96	Free Outfall	Free Outfall
836.50	5.06	833.19	Free Outfall	Free Outfall
837.00	5.96	833.33	Free Outfall	Free Outfall
837.50	6.69	833.43	Free Outfall	Free Outfall
838.00	7.34	833.53	Free Outfall	Free Outfall
838.50	7.93	833.61	Free Outfall	Free Outfall
839.00	8.48	833.69	Free Outfall	Free Outfall

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 18" Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 11.30 ft³/s
Upstream ID = 8" Low, 10" High
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
839.50	8.99	833.76	Free Outfall	Free Outfall
840.00	9.47	833.84	Free Outfall	Free Outfall

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft³/s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.01	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message
WS below an invert; no flow.
CRIT.DEPTH CONTROL Vh= .095ft Dcr= .273ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .147ft Dcr= .410ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .173ft Dcr= .476ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .193ft Dcr= .526ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .210ft Dcr= .566ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .226ft Dcr= .602ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .238ft Dcr= .630ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = 18" Culvert (Culvert-Circular)

Mannings open channel maximum capacity: 11.30 ft³/s
Upstream ID = 8" Low, 10" High
Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL Vh= .282ft Dcr= .725ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .356ft Dcr= .866ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .403ft Dcr= .943ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .443ft Dcr= 1.001ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .480ft Dcr= 1.050ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .515ft Dcr= 1.091ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .550ft Dcr= 1.128ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .584ft Dcr= 1.160ft CRIT.DEPTH Hev= .00ft
INLET CONTROL... Submerged: HW =1.94

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

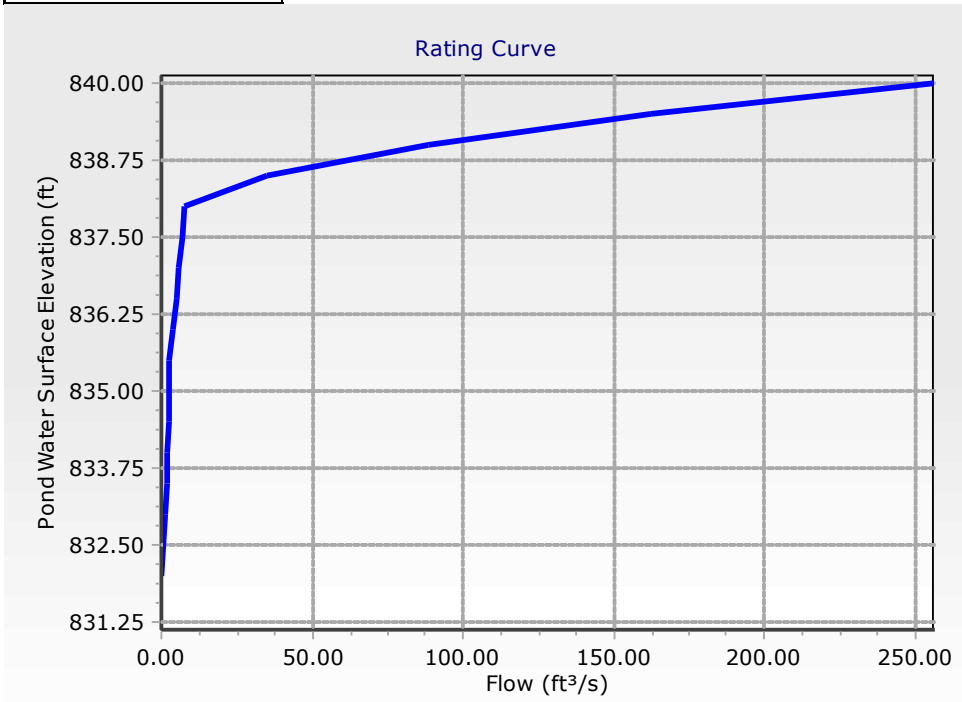
Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
832.00	0.00	(N/A)	0.00
832.50	0.54	(N/A)	0.00
833.00	1.20	(N/A)	0.00
833.50	1.61	(N/A)	0.00
834.00	1.95	(N/A)	0.00
834.50	2.24	(N/A)	0.00
835.00	2.51	(N/A)	0.00
835.50	2.75	(N/A)	0.00
836.00	3.60	(N/A)	0.00
836.50	5.06	(N/A)	0.00
837.00	5.96	(N/A)	0.00
837.50	6.69	(N/A)	0.00
838.00	7.34	(N/A)	0.00
838.50	34.73	(N/A)	0.00
839.00	88.11	(N/A)	0.00
839.50	162.31	(N/A)	0.00
840.00	256.32	(N/A)	0.00

Contributing Structures
(no Q: 8" Low,10" High,18" Culvert,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,18" Culvert (no Q: 10" High,20' Earth Weir)
8" Low,10" High,18" Culvert (no Q: 20' Earth Weir)

Composite Outlet Structure Detailed Report: Composite Outlet Structure - 1

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Contributing Structures
8" Low,10" High,18" Culvert (no Q: 20' Earth Weir)
8" Low,10" High,18" Culvert (no Q: 20' Earth Weir)
8" Low,10" High,18" Culvert (no Q: 20' Earth Weir)
8" Low,10" High,18" Culvert (no Q: 20' Earth Weir)
8" Low,10" High,18" Culvert,20' Earth Weir
8" Low,10" High,18" Culvert,20' Earth Weir
8" Low,10" High,18" Culvert,20' Earth Weir
8" Low,10" High,18" Culvert,20' Earth Weir



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Subsection: Modified Rational Grand Summary

Modified Rational Method

Q = CiA * Units Conversion; Where conversion = 43560 / (12 * 3600)

Frequency (years)	Area (ft^2)	Adjusted C Coefficient	Duration (hours)	Intensity (in/h)	Flow (Peak) (ft^3/s)	Flow (Allowable) (ft^3/s)	Volume (inflow) (ac-ft)	Volume (Storage) (ac-ft)
2	175,555.000	0.650	0.350	3.132	8.27	3.89	0.239	0.129
2	175,555.000	0.650	0.350	3.132	8.27	3.89	0.239	0.129
10	175,555.000	0.650	0.367	4.289	11.33	5.38	0.343	0.184
100	175,555.000	0.650	0.383	5.981	15.80	7.61	0.501	0.265
5	175,555.000	0.650	0.367	3.775	9.97	4.73	0.302	0.162
50	175,555.000	0.650	0.383	5.444	14.38	6.93	0.456	0.241
25	175,555.000	0.650	0.367	4.975	13.14	6.24	0.398	0.213

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Proposed Detained DA	2-year	2	0.239	0.100	8.27
Proposed Detained DA	5-year	5	0.297	0.100	9.97
Proposed Detained DA	10-year	10	0.337	0.100	11.33
Proposed Detained DA	25-year	25	0.391	0.100	13.14
Proposed Detained DA	50-year	50	0.452	0.100	14.38
Proposed Detained DA	100-year	100	0.496	0.100	15.80

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Proposed Outlet	2-year	2	0.239	0.400	2.96
Proposed Outlet	5-year	5	0.297	0.400	3.97
Proposed Outlet	10-year	10	0.337	0.400	4.90
Proposed Outlet	25-year	25	0.391	0.400	5.64
Proposed Outlet	50-year	50	0.452	0.450	6.20
Proposed Outlet	100-year	100	0.496	0.450	6.63

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Proposed Detention (IN)	2-year	2	0.239	0.100	8.27	(N/A)	(N/A)
Proposed Detention (OUT)	2-year	2	0.239	0.400	2.96	835.62	0.167
Proposed Detention (IN)	5-year	5	0.297	0.100	9.97	(N/A)	(N/A)
Proposed Detention (OUT)	5-year	5	0.297	0.400	3.97	836.13	0.210
Proposed Detention (IN)	10-year	10	0.337	0.100	11.33	(N/A)	(N/A)
Proposed Detention (OUT)	10-year	10	0.337	0.400	4.90	836.45	0.239
Proposed Detention (IN)	25-year	25	0.391	0.100	13.14	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Proposed Detention (OUT)	25-year	25	0.391	0.400	5.64	836.83	0.276
Proposed Detention (IN)	50-year	50	0.452	0.100	14.38	(N/A)	(N/A)
Proposed Detention (OUT)	50-year	50	0.452	0.450	6.20	837.17	0.313
Proposed Detention (IN)	100-year	100	0.496	0.100	15.80	(N/A)	(N/A)
Proposed Detention (OUT)	100-year	100	0.496	0.450	6.63	837.46	0.346

Subsection: Elevation-Area Volume Curve

Return Event: 100 years

Label: Proposed Detention

Storm Event: IDF Curve Equation - 1 - 100 Year

Scenario: 100-year

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
832.00	0.0	10.000	0.000	0.000	0.000
833.00	0.0	1,741.000	1,882.947	0.014	0.014
834.00	0.0	2,326.000	6,079.353	0.047	0.061
835.00	0.0	2,974.000	7,930.119	0.061	0.122
836.00	0.0	3,737.000	10,044.742	0.077	0.198
837.00	0.0	4,656.000	12,564.267	0.096	0.295
838.00	0.0	5,733.000	15,555.512	0.119	0.414
839.00	0.0	7,281.000	19,474.803	0.149	0.563
840.00	0.0	8,736.000	23,992.388	0.184	0.746

Subsection: Elevation-Volume-Flow Table (Pond)
Label: Proposed Detention
Scenario: 2-year

Return Event: 2 years
Storm Event: IDF Curve Equation - 1 - 2 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Elevation-Volume-Flow Table (Pond)
Label: Proposed Detention
Scenario: 5-year

Return Event: 5 years
Storm Event: IDF Curve Equation - 1 - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Elevation-Volume-Flow Table (Pond)

Label: Proposed Detention

Scenario: 10-year

Return Event: 10 years

Storm Event: IDF Curve Equation - 1 - 10 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Elevation-Volume-Flow Table (Pond)

Label: Proposed Detention

Scenario: 25-year

Return Event: 25 years

Storm Event: IDF Curve Equation - 1 - 25 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Elevation-Volume-Flow Table (Pond)

Label: Proposed Detention

Scenario: 50-year

Return Event: 50 years

Storm Event: IDF Curve Equation - 1 - 50 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Elevation-Volume-Flow Table (Pond)

Label: Proposed Detention

Scenario: 100-year

Return Event: 100 years

Storm Event: IDF Curve Equation - 1 - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (ft²)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
832.00	0.00	0.000	10.000	0.00	0.00	0.00
832.50	0.54	0.002	503.723	0.00	0.54	1.63
833.00	1.20	0.014	1,741.000	0.00	1.20	8.18
833.50	1.61	0.036	2,022.927	0.00	1.61	19.03
834.00	1.95	0.061	2,326.000	0.00	1.95	31.44
834.50	2.24	0.089	2,640.059	0.00	2.24	45.52
835.00	2.51	0.122	2,974.000	0.00	2.51	61.37
835.50	2.75	0.158	3,344.621	0.00	2.75	79.15
836.00	3.60	0.198	3,737.000	0.00	3.60	99.67
836.50	5.06	0.244	4,183.884	0.00	5.06	123.11
837.00	5.96	0.295	4,656.000	0.00	5.96	148.55
837.50	6.69	0.351	5,180.506	0.00	6.69	176.60
838.00	7.34	0.414	5,733.000	0.00	7.34	207.55
838.50	34.73	0.484	6,483.901	0.00	34.73	268.86
839.00	88.11	0.563	7,281.000	0.00	88.11	360.45
839.50	162.31	0.650	7,991.944	0.00	162.31	477.06
840.00	256.32	0.746	8,736.000	0.00	256.32	617.52

Subsection: Level Pool Pond Routing Summary
Label: Proposed Detention (IN)
Scenario: 2-year

Return Event: 2 years
Storm Event: IDF Curve Equation - 1 - 2 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	8.27 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	2.96 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	835.62 ft
Volume (Peak)	0.167 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.239 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.239 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: Proposed Detention (IN)
Scenario: 5-year

Return Event: 5 years
Storm Event: IDF Curve Equation - 1 - 5 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	9.97 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	3.97 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	836.13 ft
Volume (Peak)	0.210 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.297 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.297 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary

Label: Proposed Detention (IN)

Scenario: 10-year

Return Event: 10 years

Storm Event: IDF Curve Equation - 1 - 10 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	11.33 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	4.90 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	836.45 ft
Volume (Peak)	0.239 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.337 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.337 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary

Label: Proposed Detention (IN)

Scenario: 25-year

Return Event: 25 years

Storm Event: IDF Curve Equation - 1 - 25 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	13.14 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	5.64 ft³/s	Time to Peak (Flow, Outlet)	0.400 hours

Elevation (Water Surface, Peak)	836.83 ft
Volume (Peak)	0.276 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.391 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.391 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary

Label: Proposed Detention (IN)

Scenario: 50-year

Return Event: 50 years

Storm Event: IDF Curve Equation - 1 - 50 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	14.38 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	6.20 ft³/s	Time to Peak (Flow, Outlet)	0.450 hours

Elevation (Water Surface, Peak)	837.17 ft
Volume (Peak)	0.313 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.452 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.452 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary

Label: Proposed Detention (IN)

Scenario: 100-year

Return Event: 100 years

Storm Event: IDF Curve Equation - 1 - 100 Year

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	832.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	15.80 ft³/s	Time to Peak (Flow, In)	0.100 hours
Flow (Peak Outlet)	6.63 ft³/s	Time to Peak (Flow, Outlet)	0.450 hours

Elevation (Water Surface, Peak)	837.46 ft
Volume (Peak)	0.346 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.496 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.496 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years
Label: Proposed Detention (OUT) Storm Event: IDF Curve Equation - 1 - 2 Year
Scenario: 2-year

Peak Discharge	2.96 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	0.239 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.88	1.51	1.91	2.18
0.250	2.40	2.58	2.74	2.96	2.85
0.500	2.71	2.63	2.56	2.48	2.40
0.750	2.32	2.24	2.15	2.06	1.97
1.000	1.87	1.77	1.67	1.57	1.46
1.250	1.35	1.25	1.07	0.85	0.68
1.500	0.54	0.18	0.06	0.02	0.01
1.750	0.00	0.00	(N/A)	(N/A)	(N/A)

Subsection: Pond Routed Hydrograph (total out) Return Event: 5 years
Label: Proposed Detention (OUT) Storm Event: IDF Curve Equation - 1 - 5 Year
Scenario: 5-year

Peak Discharge	3.97 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	0.297 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.98	1.63	2.06	2.36
0.250	2.59	2.89	3.48	3.97	3.85
0.500	3.45	3.16	2.90	2.72	2.65
0.750	2.57	2.50	2.42	2.34	2.26
1.000	2.17	2.08	1.99	1.89	1.79
1.250	1.69	1.60	1.48	1.37	1.27
1.500	1.12	0.89	0.71	0.57	0.25
1.750	0.08	0.03	0.01	0.00	0.00

Subsection: Pond Routed Hydrograph (total out)

Label: Proposed Detention (OUT)

Scenario: 10-year

Return Event: 10 years

Storm Event: IDF Curve Equation - 1 - 10 Year

Peak Discharge	4.90 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	0.337 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.07	1.71	2.17	2.49
0.250	2.74	3.42	4.31	4.90	4.71
0.500	4.13	3.61	3.31	3.04	2.78
0.750	2.69	2.61	2.54	2.46	2.38
1.000	2.30	2.22	2.13	2.04	1.95
1.250	1.85	1.74	1.65	1.54	1.43
1.500	1.32	1.22	1.01	0.80	0.64
1.750	0.44	0.15	0.05	0.02	0.01
2.000	0.00	0.00	(N/A)	(N/A)	(N/A)

Subsection: Pond Routed Hydrograph (total out)

Label: Proposed Detention (OUT)

Scenario: 25-year

Return Event: 25 years

Storm Event: IDF Curve Equation - 1 - 25 Year

Peak Discharge	5.64 ft³/s
Time to Peak	0.400 hours
Hydrograph Volume	0.391 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.18	1.81	2.30	2.64
0.250	3.28	4.34	5.27	5.64	5.52
0.500	5.13	4.55	3.99	3.53	3.24
0.750	2.97	2.74	2.67	2.59	2.52
1.000	2.44	2.36	2.28	2.19	2.10
1.250	2.01	1.92	1.82	1.72	1.62
1.500	1.51	1.40	1.30	1.19	0.95
1.750	0.76	0.60	0.34	0.11	0.04
2.000	0.01	0.00	0.00	0.00	(N/A)

Subsection: Pond Routed Hydrograph (total out)

Label: Proposed Detention (OUT)

Scenario: 50-year

Return Event: 50 years

Storm Event: IDF Curve Equation - 1 - 50 Year

Peak Discharge	6.20 ft³/s
Time to Peak	0.450 hours
Hydrograph Volume	0.452 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.22	1.89	2.39	2.74
0.250	3.71	5.04	5.71	6.15	6.20
0.500	5.95	5.53	5.14	4.57	4.00
0.750	3.54	3.24	2.97	2.74	2.67
1.000	2.60	2.52	2.44	2.36	2.28
1.250	2.20	2.10	2.02	1.93	1.82
1.500	1.72	1.63	1.51	1.40	1.30
1.750	1.20	0.95	0.76	0.61	0.35
2.000	0.12	0.04	0.01	0.00	0.00
2.250	0.00	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Pond Routed Hydrograph (total out)

Label: Proposed Detention (OUT)

Scenario: 100-year

Return Event: 100 years

Storm Event: IDF Curve Equation - 1 - 100 Year

Peak Discharge	6.63 ft³/s
Time to Peak	0.450 hours
Hydrograph Volume	0.496 ac-ft

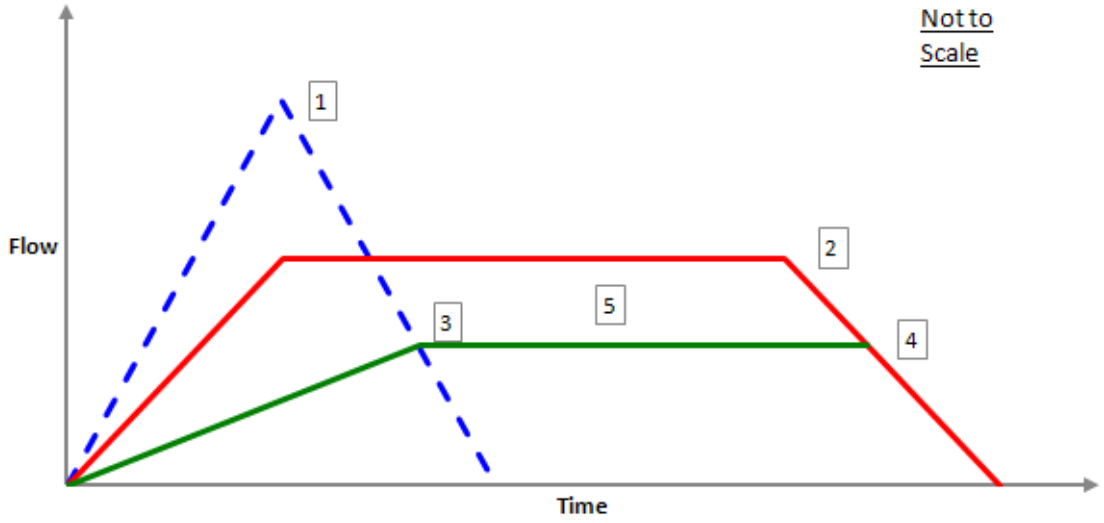
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.25	1.96	2.48	3.06
0.250	4.37	5.47	6.14	6.56	6.63
0.500	6.37	6.03	5.64	5.24	4.72
0.750	4.14	3.62	3.32	3.04	2.79
1.000	2.69	2.61	2.54	2.46	2.38
1.250	2.30	2.22	2.13	2.04	1.95
1.500	1.85	1.75	1.65	1.54	1.43
1.750	1.32	1.23	1.01	0.81	0.64
2.000	0.45	0.15	0.05	0.02	0.01
2.250	0.00	0.00	(N/A)	(N/A)	(N/A)

Subsection: Modified Rational Graph
Label: Proposed Detained DA
Scenario: 2-year

Return Event: 2 years
Storm Event: IDF Curve Equation - 1 - 2 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.350 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.350	hours
Intensity (Modified Rational, Peak)	5.409	in/h	Intensity (Modified Rational, Critical)	3.132	in/h
Flow (Modified Rational, Peak)	14.29	ft³/s	Flow (Modified Rational, Critical)	8.27	ft³/s

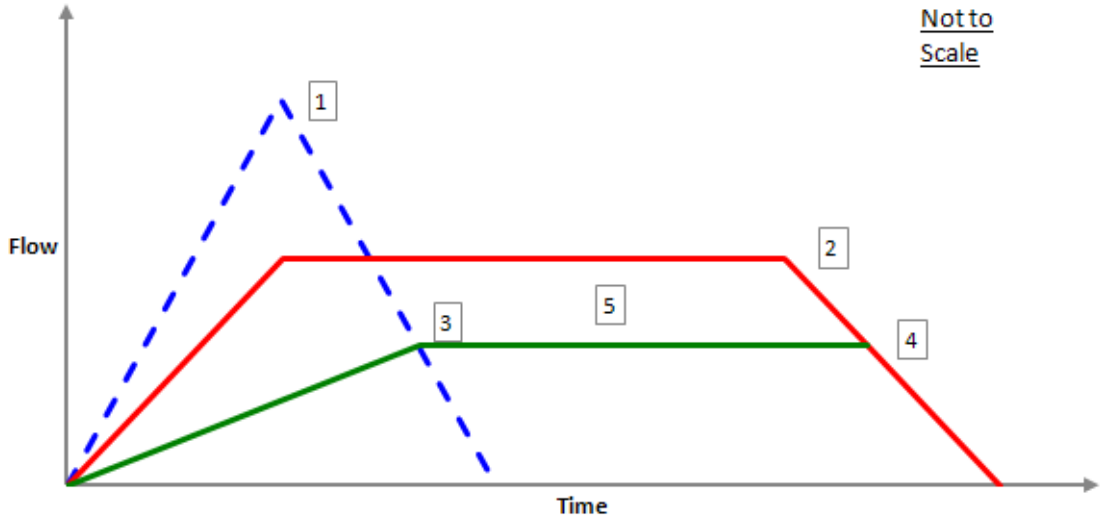
[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.394 hours
Flow (Modified Rational, Allowable)	3.89 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.144	hours	Storage (Modified Rational, Estimated)	0.129	ac-ft
Flow (Modified Rational, Allowable)	3.89	ft³/s			

Subsection: Modified Rational Graph
Label: Proposed Detained DA
Scenario: 5-year

Return Event: 5 years
Storm Event: IDF Curve Equation - 1 - 5 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.367 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.367	hours
Intensity (Modified Rational, Peak)	6.471	in/h	Intensity (Modified Rational, Critical)	3.775	in/h
Flow (Modified Rational, Peak)	17.09	ft³/s	Flow (Modified Rational, Critical)	9.97	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.410 hours
Flow (Modified Rational, Allowable)	4.73 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.144	hours	Storage (Modified Rational, Estimated)	0.162	ac-ft
Flow (Modified Rational, Allowable)	4.73	ft³/s			

Subsection: Modified Rational Graph

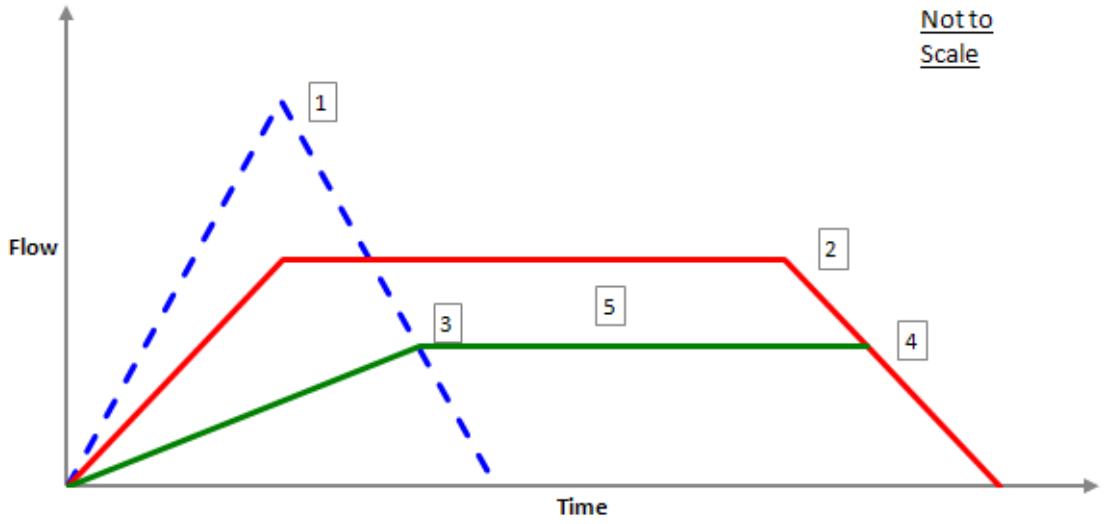
Label: Proposed Detained DA

Scenario: 10-year

Return Event: 10 years

Storm Event: IDF Curve Equation - 1 - 10 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.367 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.367	hours
Intensity (Modified Rational, Peak)	7.353	in/h	Intensity (Modified Rational, Critical)	4.289	in/h
Flow (Modified Rational, Peak)	19.42	ft³/s	Flow (Modified Rational, Critical)	11.33	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.410 hours
Flow (Modified Rational, Allowable)	5.38 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.144	hours	Storage (Modified Rational, Estimated)	0.184	ac-ft
Flow (Modified Rational, Allowable)	5.38	ft³/s			

Subsection: Modified Rational Graph

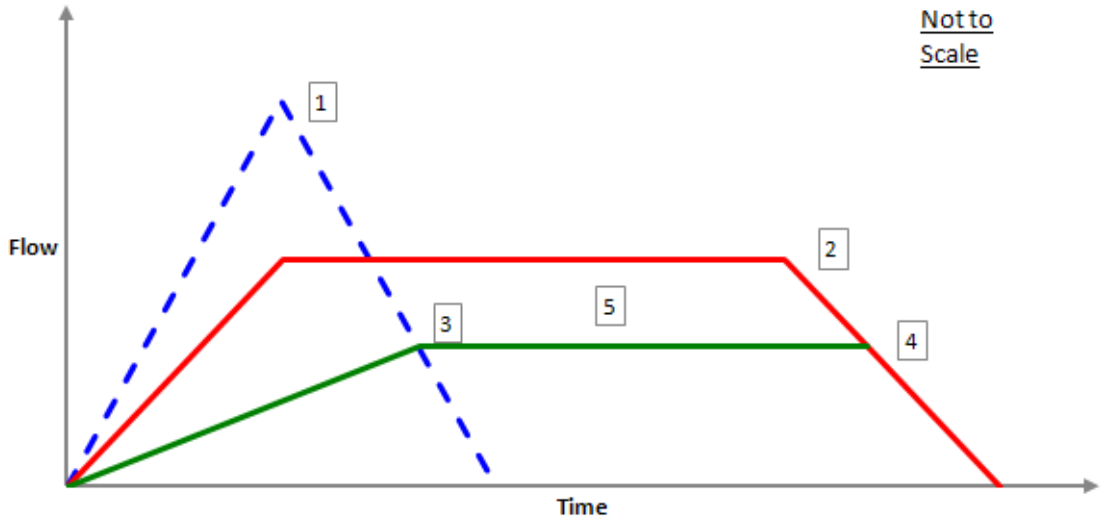
Label: Proposed Detained DA

Scenario: 25-year

Return Event: 25 years

Storm Event: IDF Curve Equation - 1 - 25 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.367 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.367	hours
Intensity (Modified Rational, Peak)	8.529	in/h	Intensity (Modified Rational, Critical)	4.975	in/h
Flow (Modified Rational, Peak)	22.53	ft³/s	Flow (Modified Rational, Critical)	13.14	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.410 hours
Flow (Modified Rational, Allowable)	6.24 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.144	hours	Storage (Modified Rational, Estimated)	0.213	ac-ft
Flow (Modified Rational, Allowable)	6.24	ft³/s			

Subsection: Modified Rational Graph

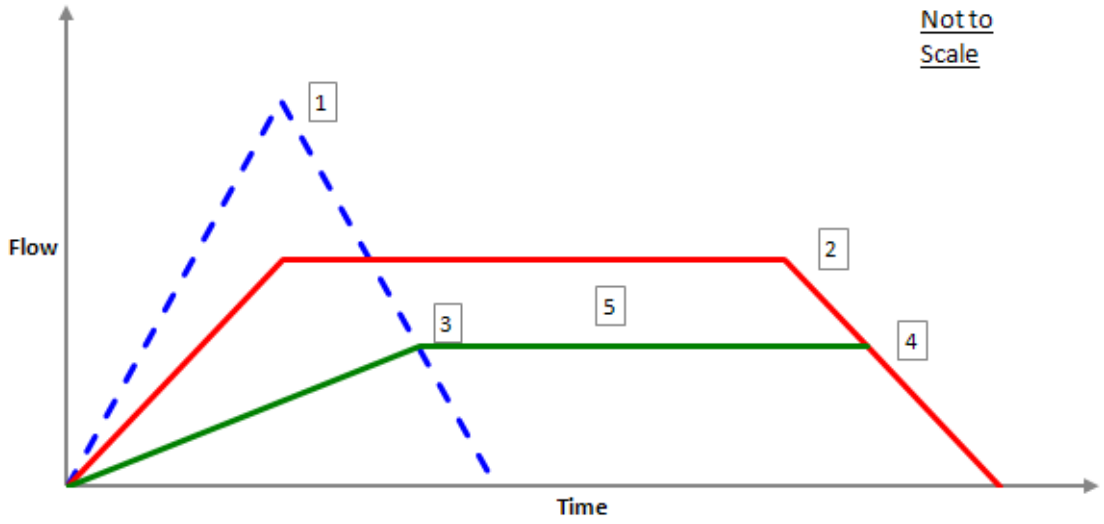
Label: Proposed Detained DA

Scenario: 50-year

Return Event: 50 years

Storm Event: IDF Curve Equation - 1 - 50 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.383 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.383	hours
Intensity (Modified Rational, Peak)	9.395	in/h	Intensity (Modified Rational, Critical)	5.444	in/h
Flow (Modified Rational, Peak)	24.82	ft³/s	Flow (Modified Rational, Critical)	14.38	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.427 hours
Flow (Modified Rational, Allowable)	6.93 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.143	hours	Storage (Modified Rational, Estimated)	0.241	ac-ft
Flow (Modified Rational, Allowable)	6.93	ft³/s			

Subsection: Modified Rational Graph

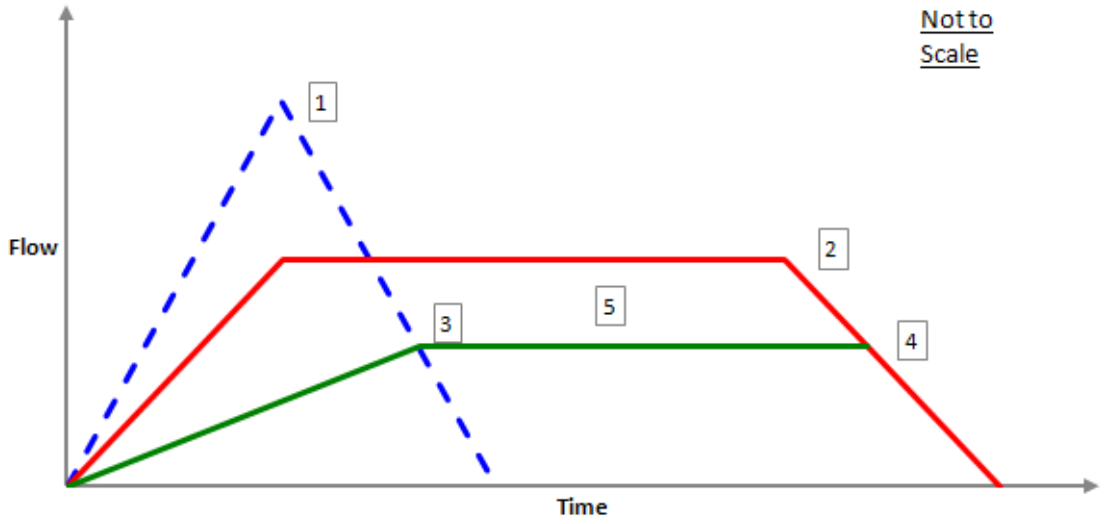
Label: Proposed Detained DA

Scenario: 100-year

Return Event: 100 years

Storm Event: IDF Curve Equation - 1 - 100 Year

Method Type	Method T
Time of Duration (Modified Rational, Critical)	0.383 hours



[1]			[2]		
Time of Concentration (Modified Rational, Composite)	0.083	hours	Time of Duration (Modified Rational, Critical)	0.383	hours
Intensity (Modified Rational, Peak)	10.323	in/h	Intensity (Modified Rational, Critical)	5.981	in/h
Flow (Modified Rational, Peak)	27.27	ft³/s	Flow (Modified Rational, Critical)	15.80	ft³/s

[3]	
First Outflow Breakpoint (Modified Rational, Method T)	0.427 hours
Flow (Modified Rational, Allowable)	7.61 ft³/s

[4]			[5]		
Second Outflow Breakpoint (Modified Rational)	0.143	hours	Storage (Modified Rational, Estimated)	0.265	ac-ft
Flow (Modified Rational, Allowable)	7.61	ft³/s			

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