First Southern Baptist Church of Bryant

604 S REYNOLDS ROAD, BRYANT, AR 72022

DRAINAGE REPORT

FOR
City of Bryant, Saline County, AR

September 2024

Owner & Developer: Peter Cunningham.

By:

HOPE
CONSULTING
ENGINEERS - SURVEYORS

TABLE OF CONTENTS

ITEM DESCRIPTION

1. Narrative & Summary
2. Hydrograph Report

Narrative & Summary

PROJECT TITLE

First Southern Baptist Church of Bryant

PROJECT PROPERTY OWNER

Peter Cunningham

PROJECT LOCATION

604 S Reynolds Road, Bryant, AR

PROJECT DESCRIPTION

The proposed development is on South Reynolds Road, Bryant, AR. Total development site area is 7.58 acres.

DRAINAGE ANALYSIS

On Site Drainage- Rational method was used to determine the existing and proposed flows from proposed site. There will be one retention pond to detain water from this development. Detailed drainage calculations considering the future expected development have been conducted to determine the required detention pond and culvert dimensions. Summary of the calculations are below:

Retention Pond

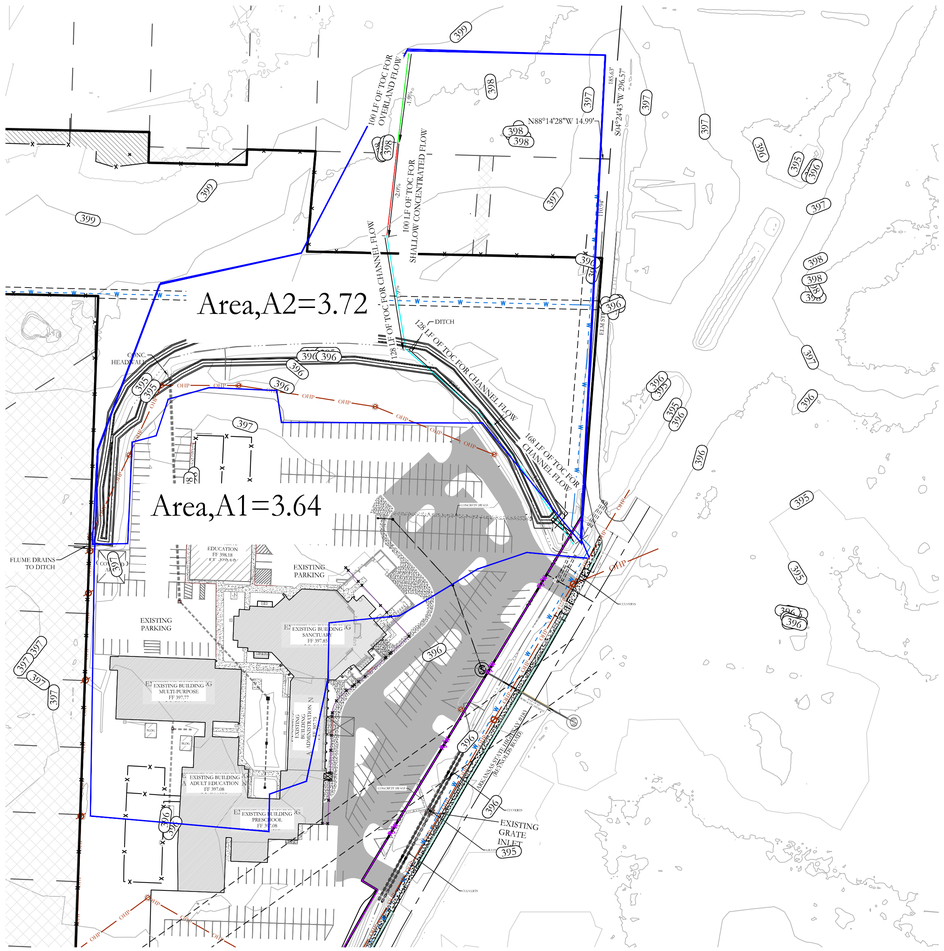
- Pond is situated on the north-east side of the property.
- Pre-development area 7.36 acres.
- Post-development area 7.34 acres.
- Pre-development runoff cumulative coefficient 0.65.
- Post-development runoff cumulative coefficient 0.72
- Pond has a bottom area of 16,570 sqft with bottom elevation of 393.4'.
- Two 8'' RCPs with 0.52% slope is proposed for outflow pipes.

Peak flows for Pre and post development phase of onsite area have been tabulated below-

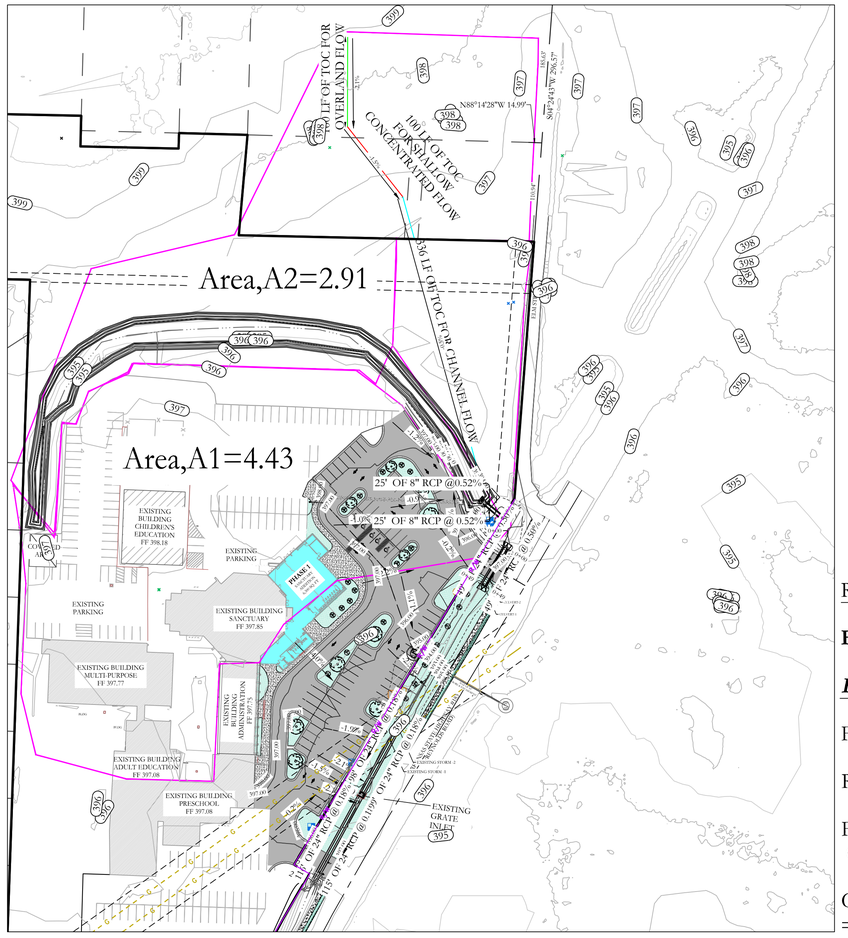
Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	18.69	22.67	1.911
5-Year	20.65	25.15	2.677
10-Year	24.35	29.23	4.569
25-Year	27.93	33.44	6.883
50-Year	31.84	38.07	9.645
100-Year	33.86	40.40	11.06

CONCLUSION

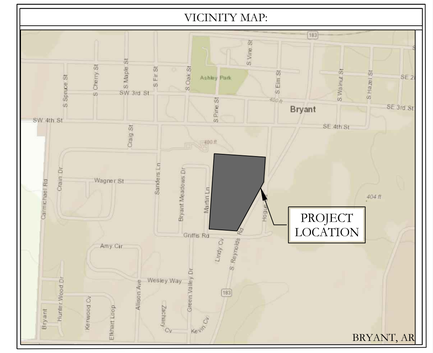
From the onsite drainage calculation, it is seen that there is decrease in flow for all storm events due to the proposed retention pond.



Pre Development



Post Development



OVERLAND FLOW
SHALLOW CONCENTRATED FLOW
CHANNEL FLOW

RUNOFF CO-EFFICIENT CALCULATIONS:

FOR 100 YR,

FOR PRE-DEVELOPMENT:

FOR AREA , A1

RUNOFF CO-EFF. C1=0.95 (ASPHALT)

[PAGE-55 , BRYANT STANDARD STORM DRAINAGE MANUAL]

FOR AREA , A2
C2=0.36 (>75% GRASS COVER)

CUMMULATIVE CO-EFF.
= [(0.95*3.64)+(3.72*0.36)]/7.36
=0.65

FOR POST-DEVELOPMENT:

FOR AREA , A1

RUNOFF CO-EFF. C1=0.95 (ASPHALT)

[PAGE-55 , BRYANT STANDARD STORM DRAINAGE MANUAL]

FOR AREA , A2
C2=0.36 (>75% GRASS COVER)

CUMMULATIVE CO-EFF.
= [(0.95*4.43)+(2.91*0.36)]/7.34
=0.72

Drainage Calculations:

TOC Calculations for 100 yr:

Pre-Development:

Overland Flow:
$t_1 = 0.88\left[\frac{NL}{S^{0.5}}\right]^{0.467}$
$= 10.25$ min
N = 0.30
L = 100'
S = 1.9%

Shallow Concentrated Flow:
$t_{scc} = \frac{L}{60V}$
$= 0.73$ min
$V = 16.1345(S)^{.5}$; S = 2.0%
$= 2.28$
L = 100'

Channel Flow:
$t_{cs} = \frac{L}{60V}$
$= 5.19$ min
L = 420'
$L_1 = 128$; $L_2 = 128$; $L_3 = 164'$
$S_1 = 1.9\%$; $S_2 = 1.8\%$; $S_3 = 1.1\%$
n = 0.15 . R = 0.22
$V = \frac{1.49}{n}(R)^{.67} \times (S)^{.05}$
$V_1 = 0.43$
$V_2 = 0.48$ ∴ V = 1.35
$V_3 = 0.38$

Total TOC = 16.16 min
∴ Rainfall Intensity, I = 7.4 in/hr
Area, A = 7.36 ac
Run-off Co-efficient (Cumulative) = 0.65 [$C_1 = 0.36$, $C_2 = 0.95$]
∴ Discharge, Q = CIA = 35.40 cfs

Post-Development: (Without-Detention)

Overland Flow:
$t_1 = 10.015$ min
N = 0.30
L = 100' ; S = 2.1%

Shallow Concentrated Flow:
$t_{scc} = 0.84$ min
$V = 16.1345(S)^{.5}$
S = 1.5%
L = 100'

Channel Flow:
$t_{sc} = 1.89$ min
L = 336'
S = 0.5%
$V = \frac{1.49}{n} R^{.67} S^{.45}$; n = 0.013
∴ V = 2.95

∴ Total TOC = 12.78 min

∴ Rainfall Intensity, I = 7.8 in/hr
Area, A = 7.34 ac.
∴ Cummulative Run-off coefficient = 0.72
∴ Total Discharge, Q = CIA
∴ Q = 41.22 cfs

Peak flows for Pre and post development phase of onsite area have been tabulated below-

Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	18.69	22.67	2.319
5-Year	20.65	25.15	3.152
10-Year	24.35	29.23	5.424
25-Year	27.93	33.44	8.087
50-Year	31.84	38.07	11.15
100-Year	33.86	40.40	12.73

LEGEND
- Found Aliquot Corner
- Found monument
- Set ½" Rebar
- Computed point
(M)- Measured
(P) - Plat/Deed
- Fence

CERTIFICATE OF AUTHORIZATION
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BASIS OF BEARING:
GRID NORTH, ARKANSAS
COORDINATE SYSTEM, SOUTHZONE
BY GPS OBSERVATION

80 40 0 80

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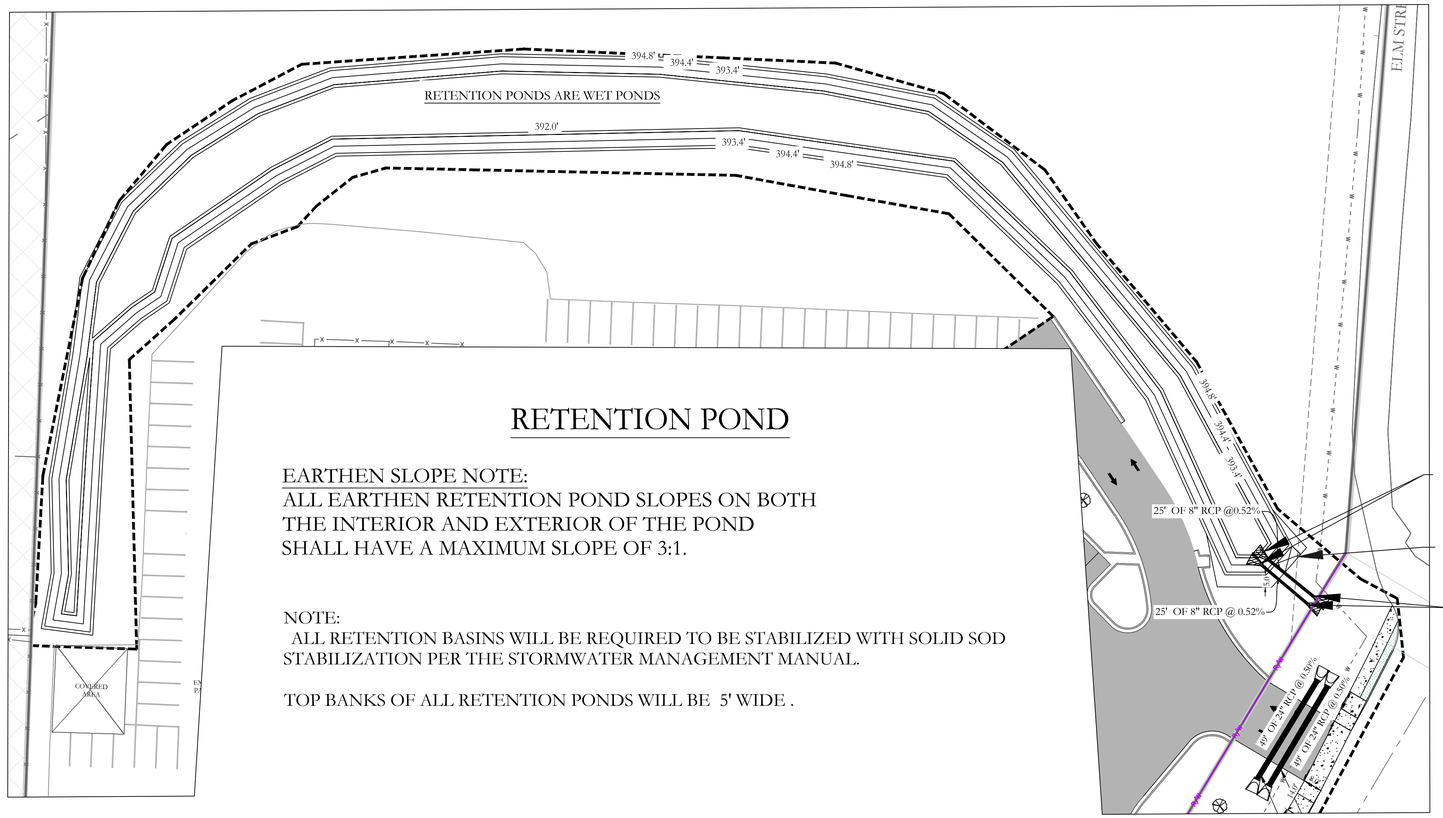
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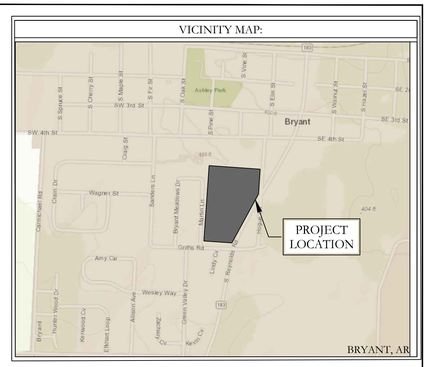
FSCB EXPANSION & REMODEL PHASE 1
DRAINAGE CALCULATIONS
604 S REYNOLDS ROAD
BRYANT, SALINE COUNTY, ARKANSAS

DATE:	10/3/2024	C.A.D. BY:	DRAWING NUMBER:
REVISED:		CHECKED BY:	24-0260
SHEET:	C-5.0	SCALE:	

500	01S	14W	0	34	310	62	1664

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DETENTION POND MAINTENANCE PLAN

Background

The Retention ponds are located on the periphery of the subdivision.They are designed to temporarily detain stormwater to meet water quantity criteria before discharging off the property.

Routine Maintenance:

The property owners association will maintain the drainage easements . Routine maintenance will include but not be limited to:

-Mowing of the bank slopes and area around the pond on a monthly basis during the growing season and as needed during the cooler months.

-The outlet pipe from the pond and other areas will be inspected monthly for debris which could inhibit the proper flow of discharge. Any debris will be removed immediately and disposed of or placed in a location to prevent future maintenance and to not cause impact up or downstream of the structure.

-Trash will be removed from around the pond to prevent entering the pond. Generally, the site should be kept free of loose trash which could be carried off site by wind or rain.

-Inspect the pond and outlet pipe for non-routine maintenance need.

Periodic or Non-Routine Maintenance

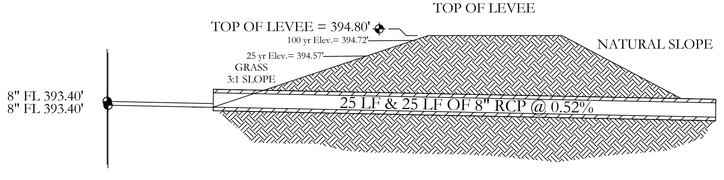
The routine inspection of the ponds areas and discharge pipes will identify needed repairs and non-routine maintenance. These items may include but not be limited to:

-Re-growth of trees on or around the pond bank. These should be cut and removed from the pond area.

-Sediment from the site may accumulate in the pond bottom and reduce the pond to below design volume requirements. The pond should be excavated if the pond bottom elevation reached a level that allows excessive aquatic growth or reduces the pond efficiency such, that the sediments are passing the discharge structure and release off site.

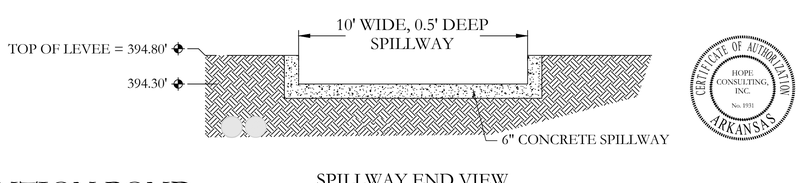
-Stabilization or re-grading of side slopes may be required periodically or after excessive rain events. Any disturbance of slopes should be reseeded or may require installation of erosion control materials until seeding can reestablish adequate grasses to prevent future erosion.

-Any other maintenance or repairs which would minimize other maintenance to the pond or outfall structures.

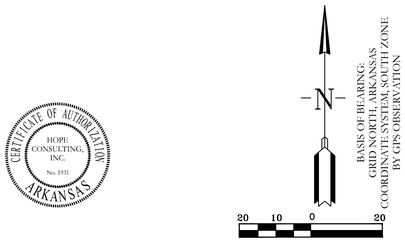


OUTLET SECTION
NTS

RETENTION POND



SPILLWAY END VIEW
NTS



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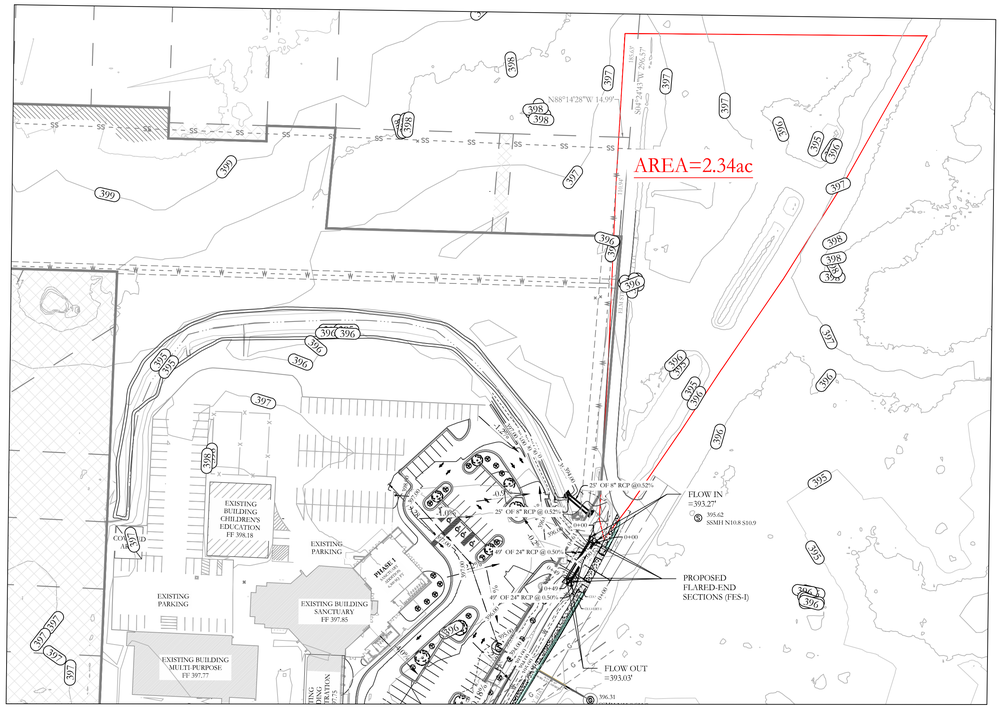
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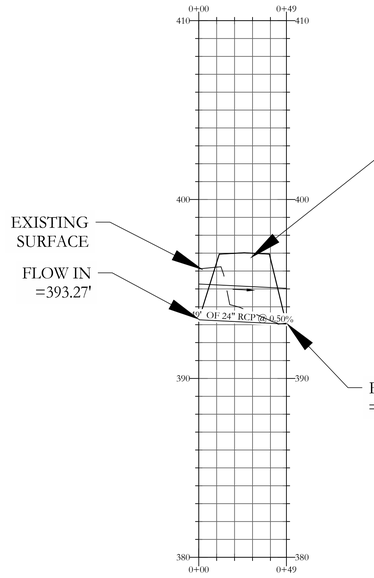
FSCB EXPANSION & REMODEL PHASE 1
RETENTION POND
604 S. REYNOLDS ROAD
BRYANT, SALINE COUNTY, ARKANSAS

DATE:	10/3/2024	C.A.D. BY:	DRAWING NUMBER:
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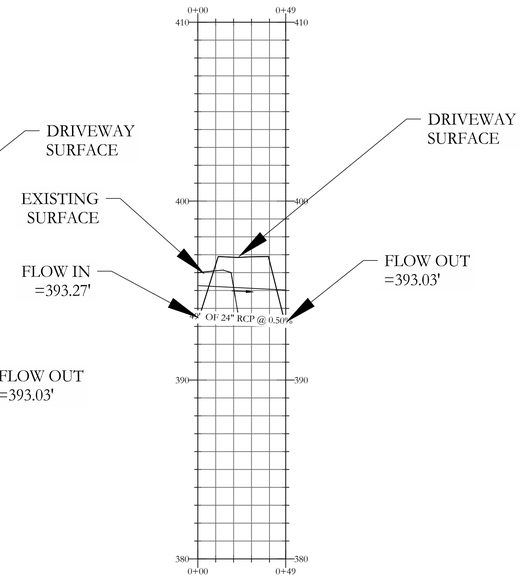
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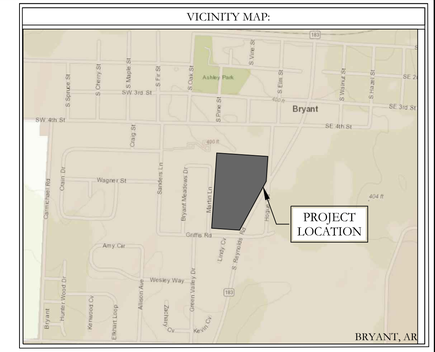


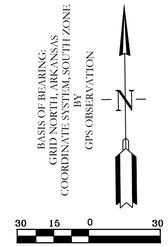


CULVERT-1 PROFILE



CULVERT-2 PROFILE





Edge of pavement elev. =397.45'
Proposed Driveway Surface elev. =397.00'

10 yr Storm Discharge Elevation=394.97'
50 yr Storm Discharge Elevation =395.28'

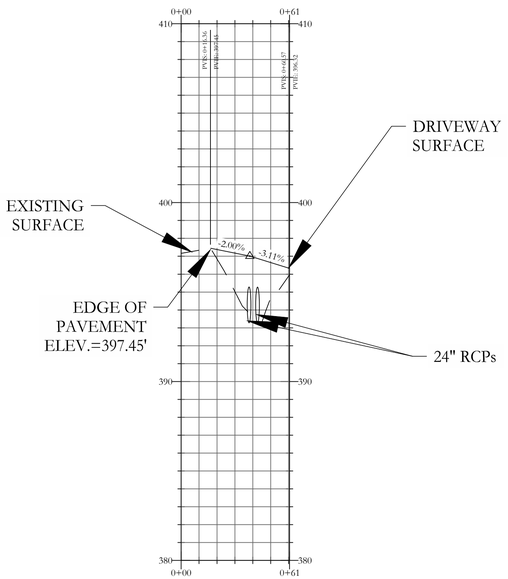
DRAINAGE CALCULATION

Discharge, Q_{10}= 0.83*6.3*2.34 =12.24 cfs
Discharge, Q_{50}= 0.92*7.9*2.34 =17.00 cfs

Discharge from Detention Outlets:
Discharge, Q_{10}= 4.569 cfs
Discharge, Q_{50}=9.645 cfs

Total Discharge, Q_{10}=16.81 cfs
Q_{50}=26.65 cfs

For 24" RCP pipes,
10 yr Storm Discharge Elevation, d_{10} =394.97'
50 yr Storm Discharge Elevation, d_{50} =395.28'



DRIVEWAY PROFILE

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DRAINAGE EXHIBIT
604 S REYNOLDS ROAD
BRYANT, SALINE COUNTY, ARKANSAS

DATE:	08-28-2024	C.A.D. BY:	DRAWING NUMBER:
REVISED:	10-03-2024	CHECKED BY:	24-0260
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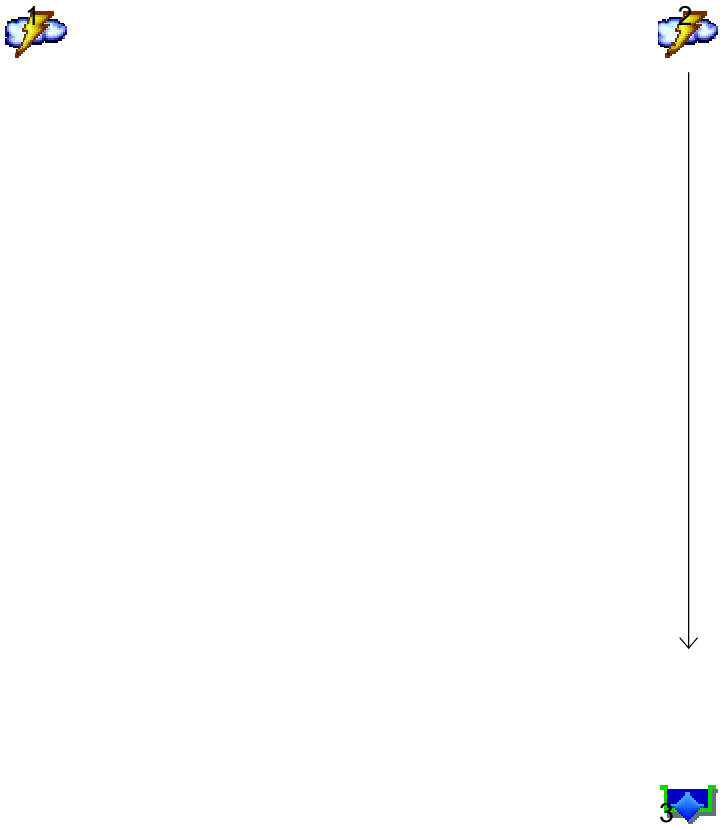
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STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No. 20876 KAZI TAMZIDUL ISLAM

K:\AND Projects\24-0260\Drawings\Civil\24-0260 FSCB EXPANSION & REMODEL_08-27-2024.DWG

Hydrograph Summary Report

Watershed Model Schematic



Multi-Hydrograph Plot

Hyd. No. 1

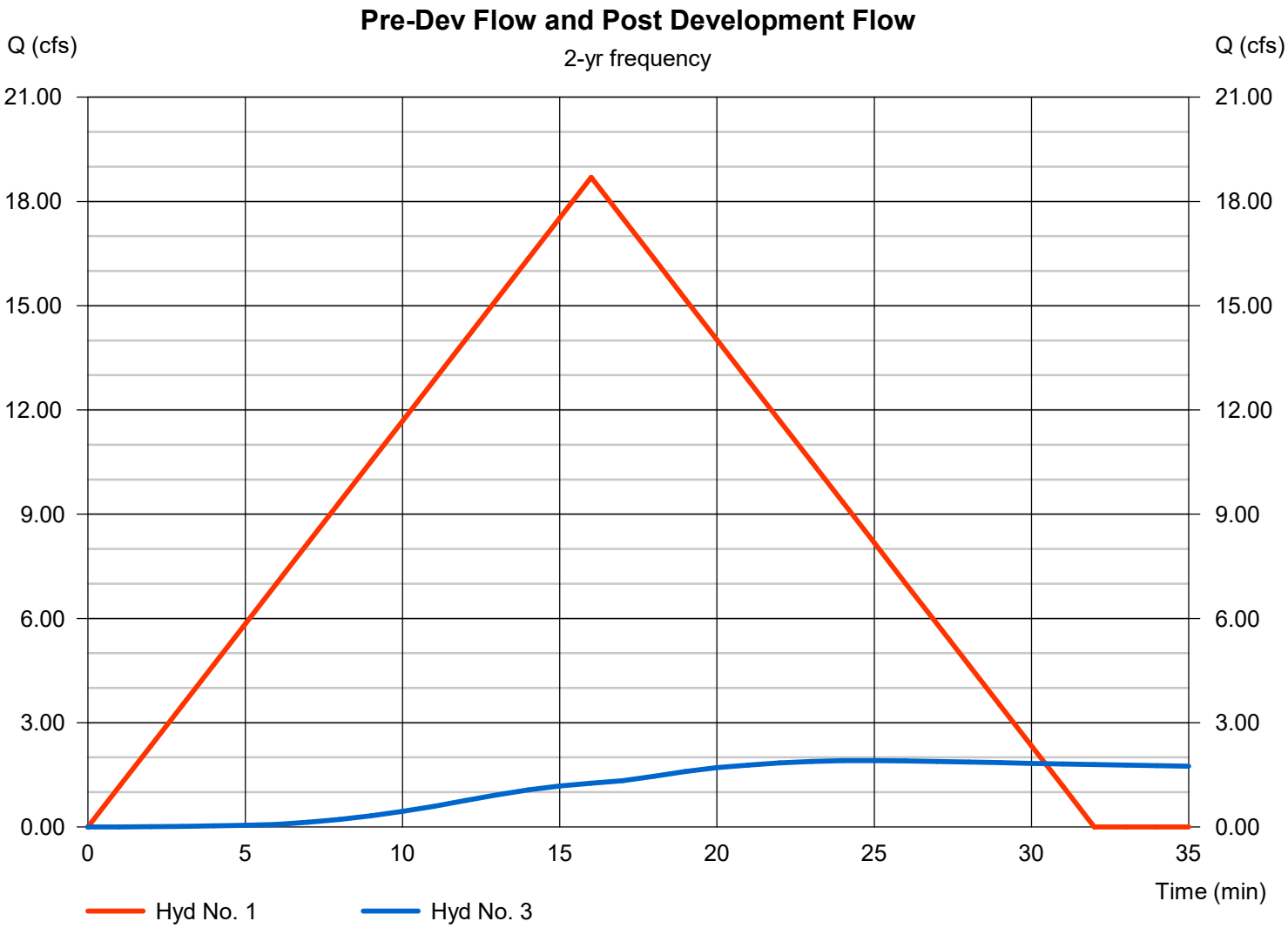
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	18.69 cfs
Time to peak	=	16 min
Hyd. Volume	=	17,943 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	1.91 cfs
Time to peak	=	25 min
Hyd. Volume	=	17,652 cuft



Multi-Hydrograph Plot

Hyd. No. 1

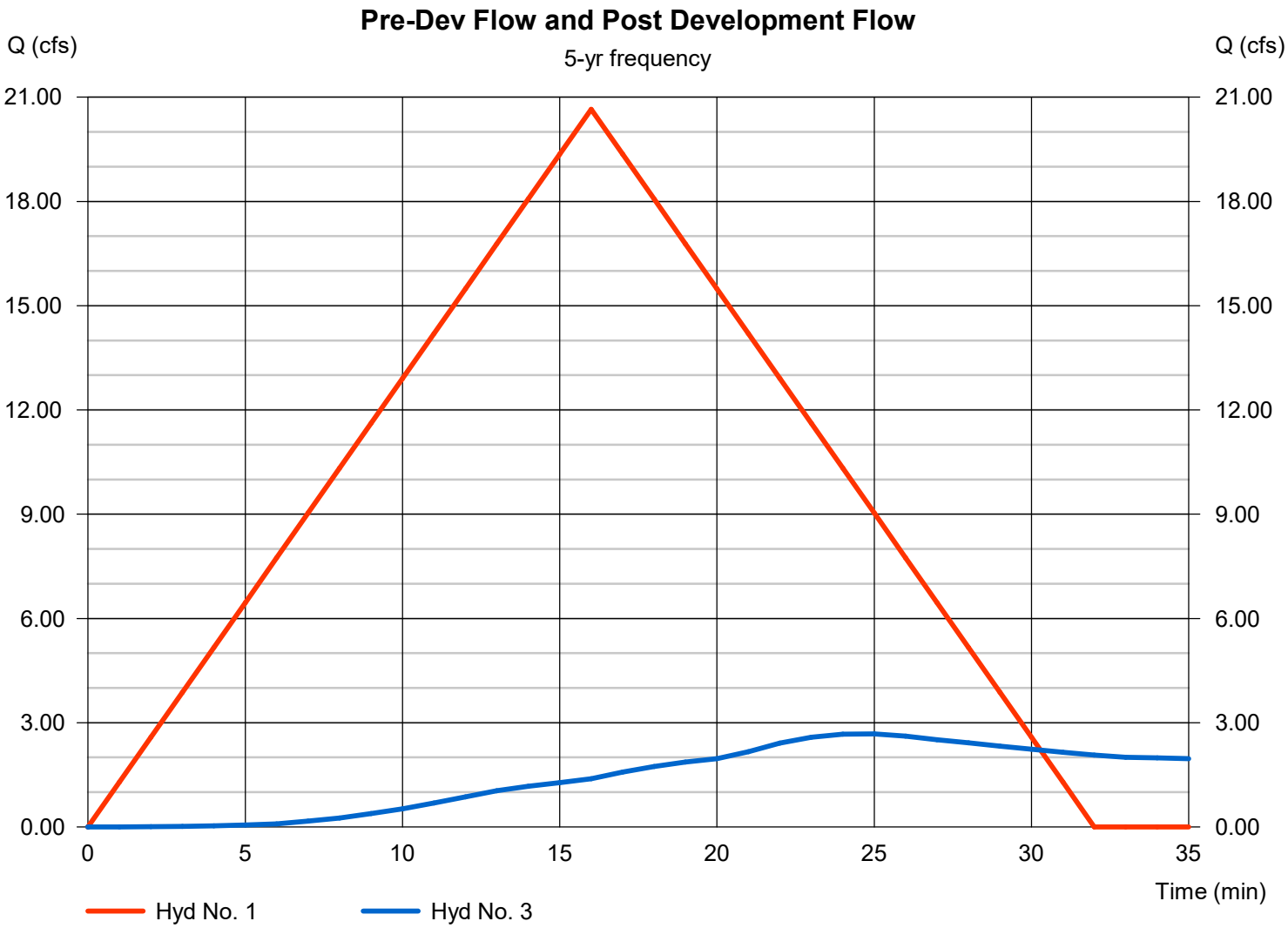
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	20.65 cfs
Time to peak	=	16 min
Hyd. Volume	=	19,826 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	2.68 cfs
Time to peak	=	25 min
Hyd. Volume	=	19,588 cuft



Multi-Hydrograph Plot

Hyd. No. 1

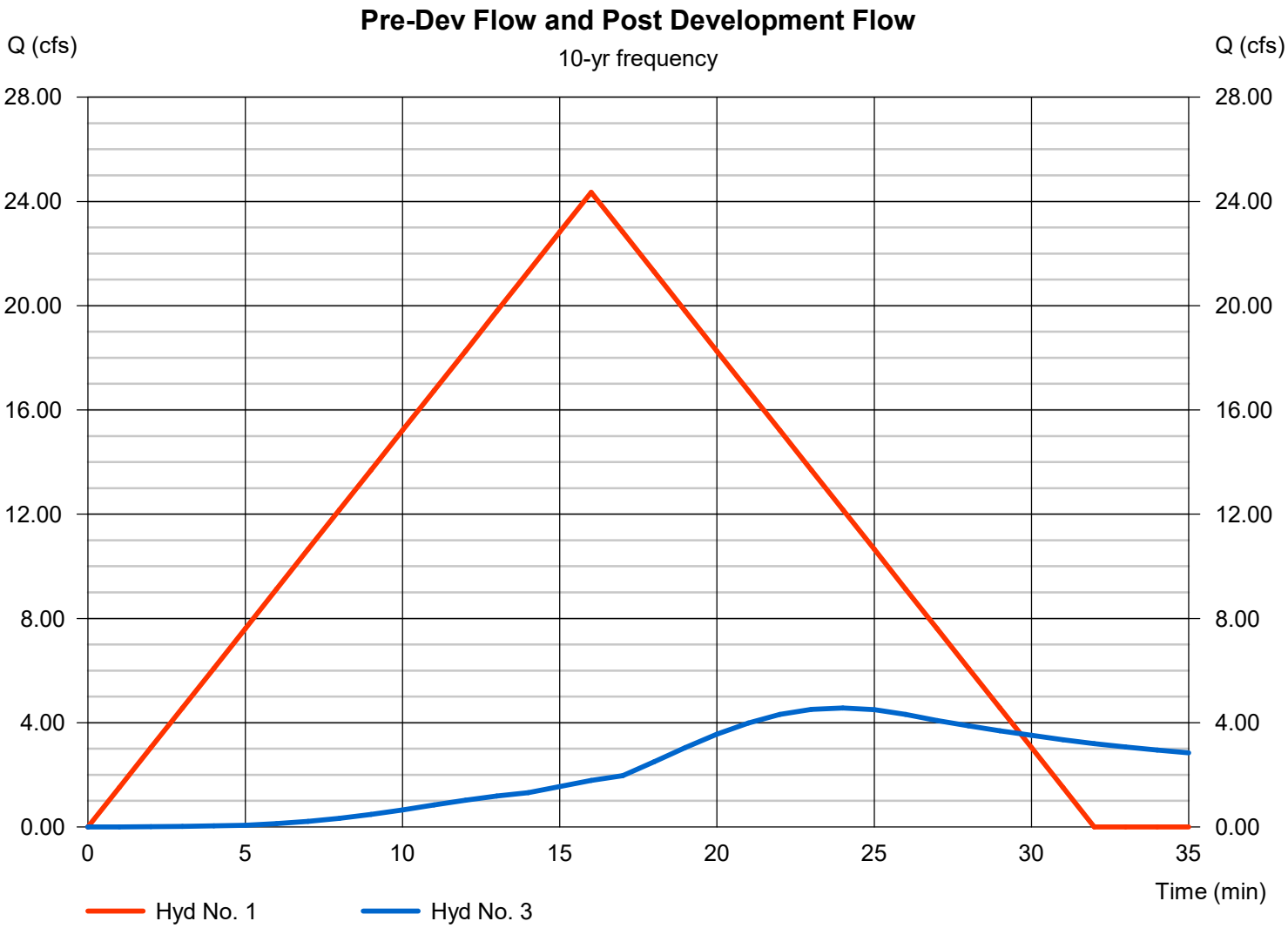
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	24.35 cfs
Time to peak	=	16 min
Hyd. Volume	=	23,373 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	4.57 cfs
Time to peak	=	24 min
Hyd. Volume	=	22,771 cuft



Multi-Hydrograph Plot

Hyd. No. 1

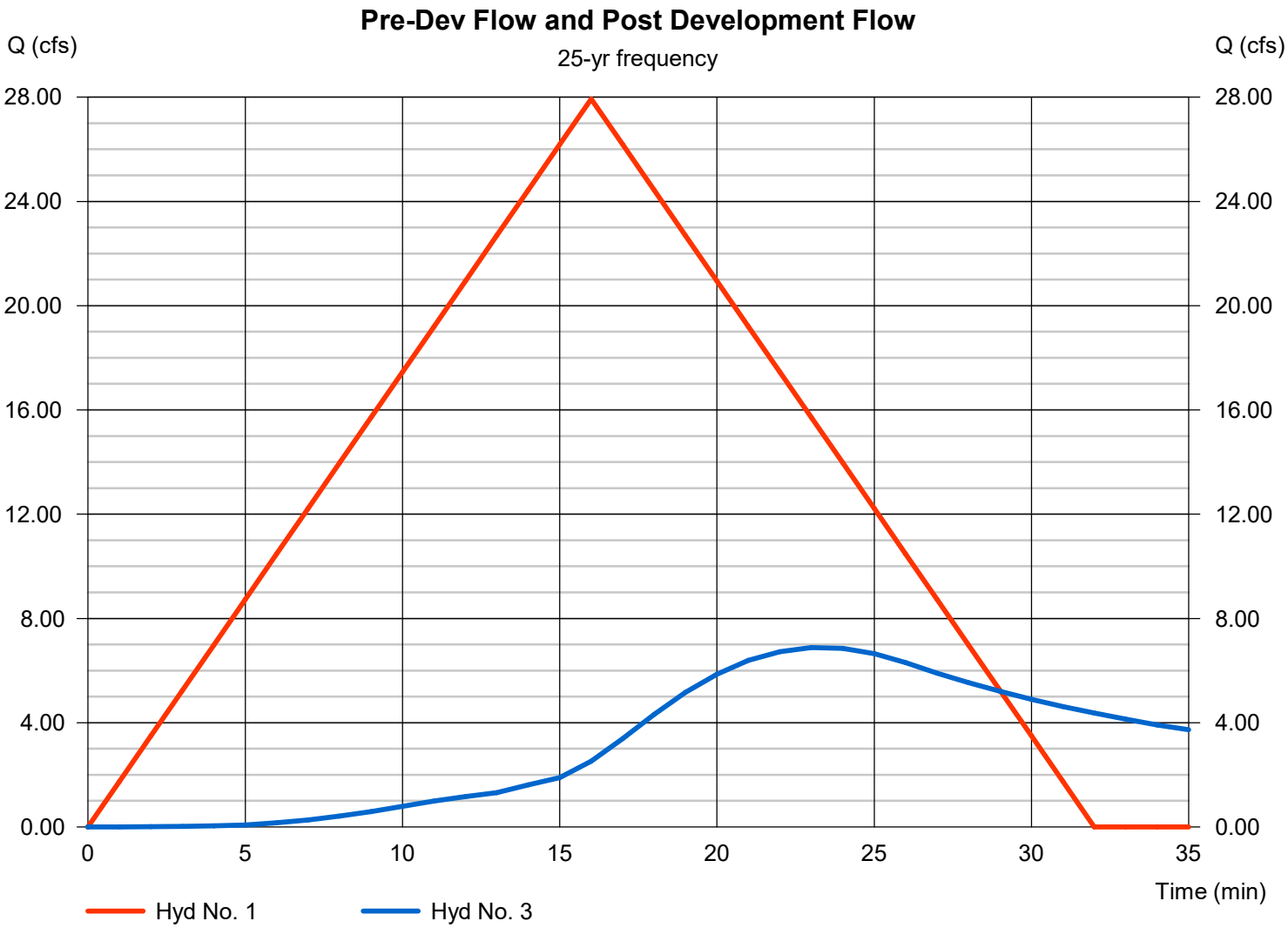
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	27.93 cfs
Time to peak	=	16 min
Hyd. Volume	=	26,812 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	6.88 cfs
Time to peak	=	23 min
Hyd. Volume	=	26,060 cuft



Multi-Hydrograph Plot

Hyd. No. 1

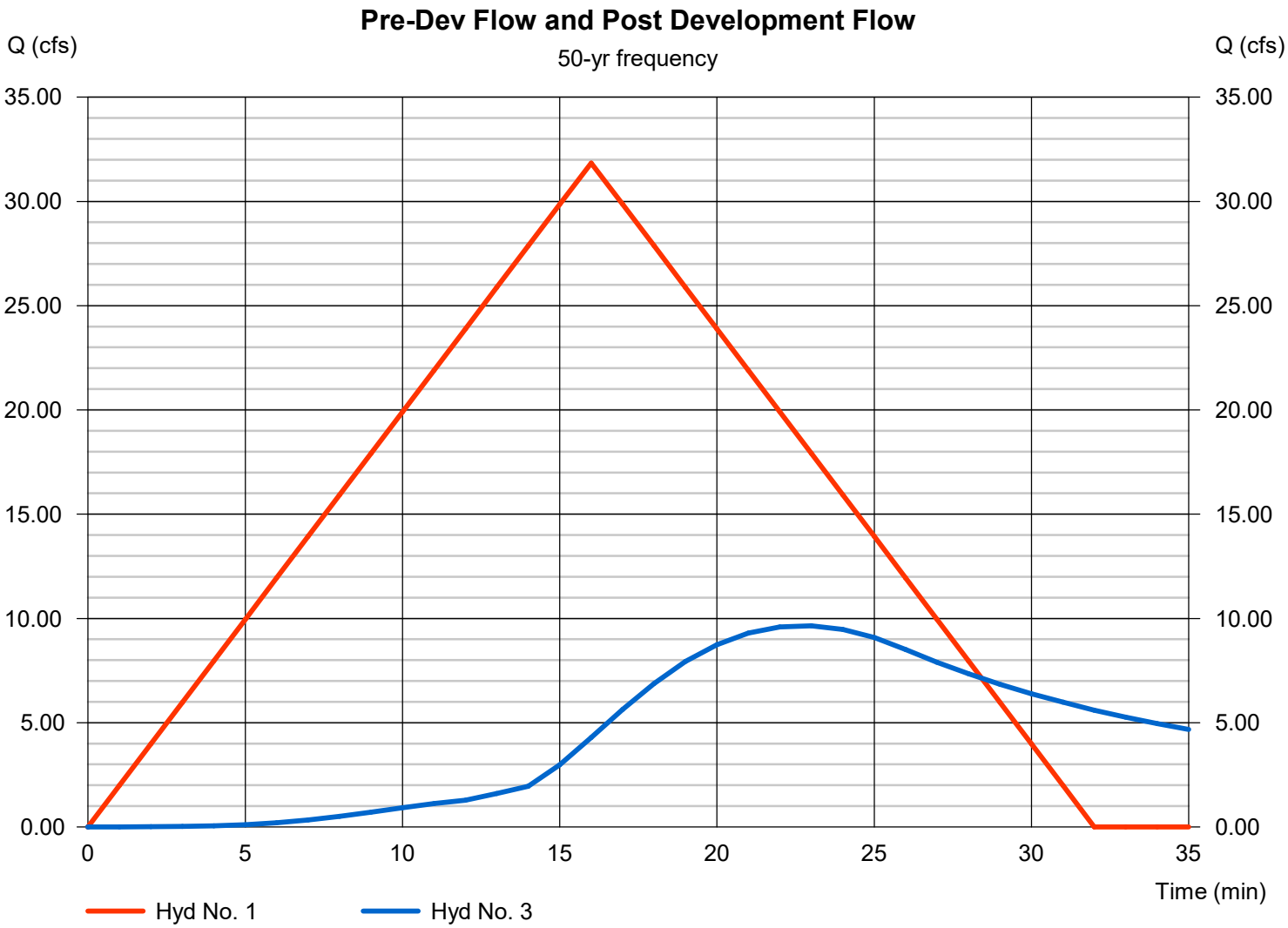
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	31.84 cfs
Time to peak	=	16 min
Hyd. Volume	=	30,570 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	9.64 cfs
Time to peak	=	23 min
Hyd. Volume	=	29,672 cuft



Multi-Hydrograph Plot

Hyd. No. 1

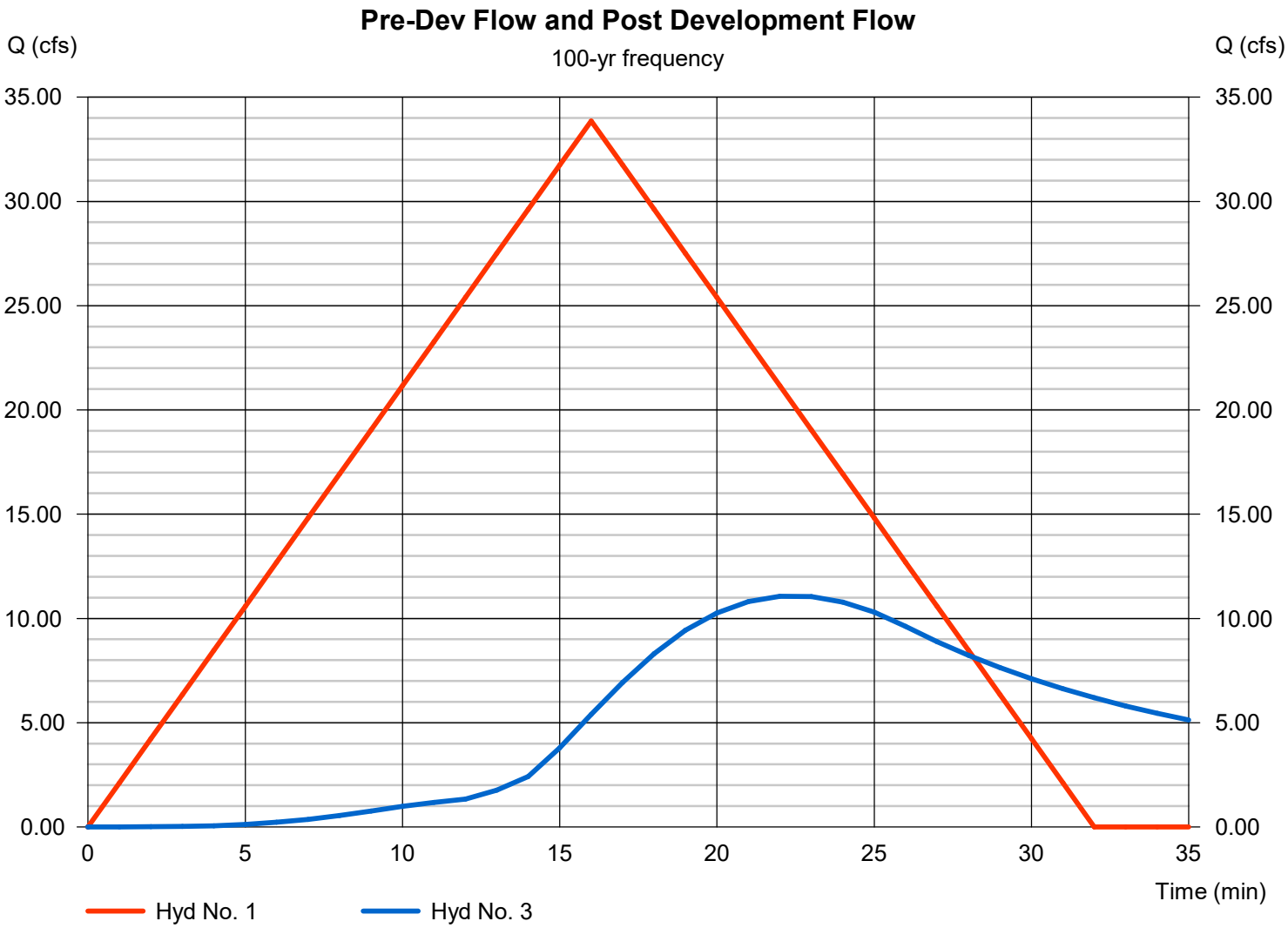
Pre-Dev Flow

Hydrograph type	=	Rational
Peak discharge	=	33.86 cfs
Time to peak	=	16 min
Hyd. Volume	=	32,504 cuft

Hyd. No. 3

Post Development Flow

Hydrograph type	=	Reservoir
Peak discharge	=	11.06 cfs
Time to peak	=	22 min
Hyd. Volume	=	31,482 cuft



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025 Wednesday, 09 / 4 / 2024

Pond No. 1 - Retention Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 393.40 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	393.40	16,570	0	0
1.00	394.40	21,182	18,827	18,827
1.40	394.80	23,045	8,842	27,669

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	8.00	Inactive	Inactive
Span (in)	= 8.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 393.40	393.40	0.00	0.00
Length (ft)	= 25.00	25.00	0.00	0.00
Slope (%)	= 0.52	0.52	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

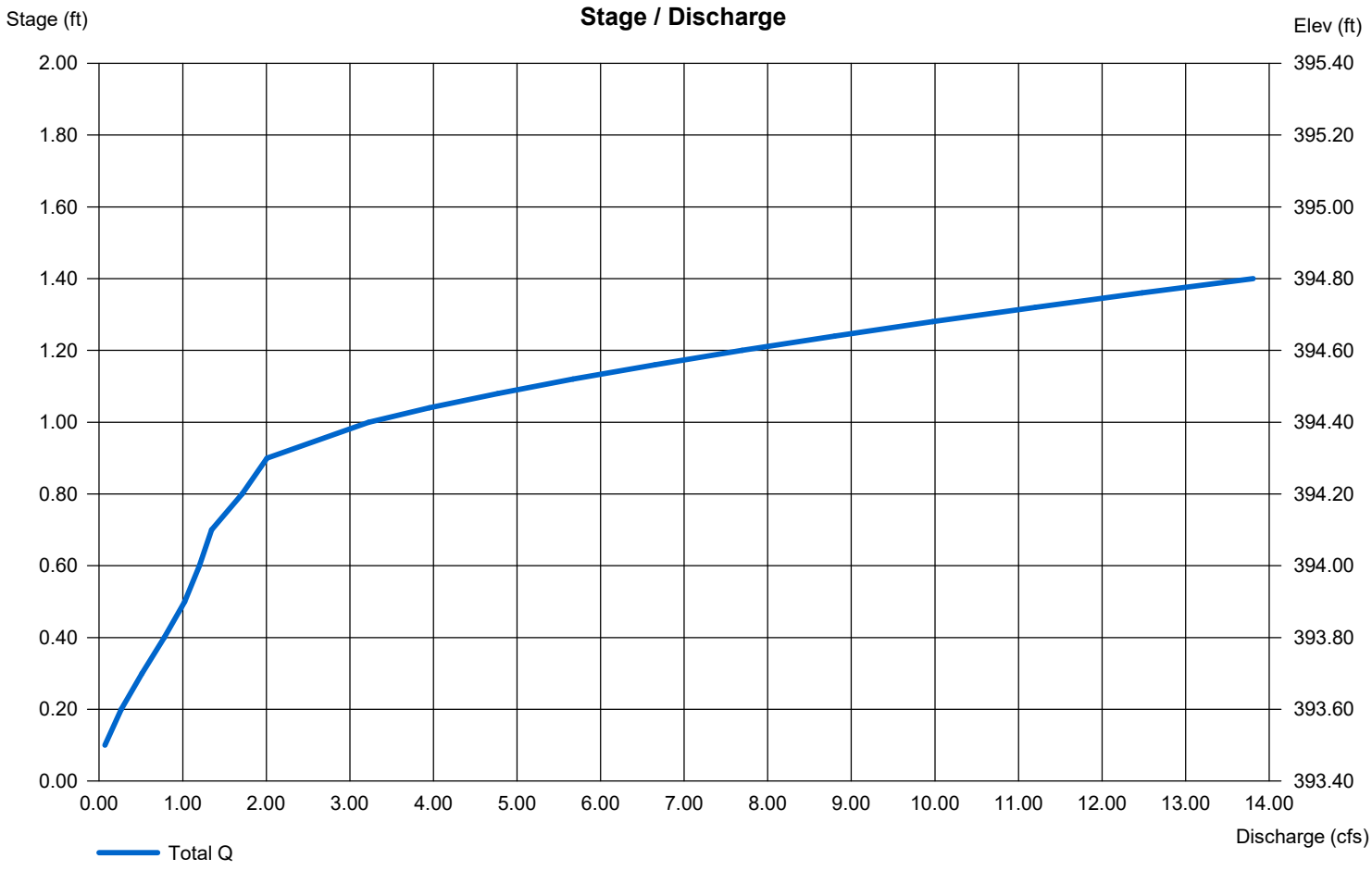
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 394.30	0.00	0.00	0.00
Weir Coeff.	= 3.03	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	18.69	1	16	17,943	------	------	------	Pre-Dev Flow
2	Rational	22.67	1	13	17,679	------	------	------	Development Generated Flow
3	Reservoir	1.911	1	25	17,652	2	394.27	16,333	Post Development Flow

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	20.65	1	16	19,826	------	------	------	Pre-Dev Flow
2	Rational	25.15	1	13	19,614	------	------	------	Development Generated Flow
3	Reservoir	2.677	1	25	19,588	2	394.35	17,979	Post Development Flow

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	24.35	1	16	23,373	------	------	------	Pre-Dev Flow
2	Rational	29.23	1	13	22,797	------	------	------	Development Generated Flow
3	Reservoir	4.569	1	24	22,771	2	394.47	20,378	Post Development Flow

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	27.93	1	16	26,812	------	------	------	Pre-Dev Flow
2	Rational	33.44	1	13	26,086	------	------	------	Development Generated Flow
3	Reservoir	6.883	1	23	26,060	2	394.57	22,563	Post Development Flow

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1	Rational	31.84	1	16	30,570	------	------	------	Pre-Dev Flow
2	Rational	38.07	1	13	29,698	------	------	------	Development Generated Flow
3	Reservoir	9.645	1	23	29,672	2	394.67	24,768	Post Development Flow

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1	Rational	33.86	1	16	32,504	------	------	------	Pre-Dev Flow
2	Rational	40.40	1	13	31,509	------	------	------	Development Generated Flow
3	Reservoir	11.06	1	22	31,482	2	394.72	25,801	Post Development Flow