# *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

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## ITEM DESCRIPTION

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# 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 |

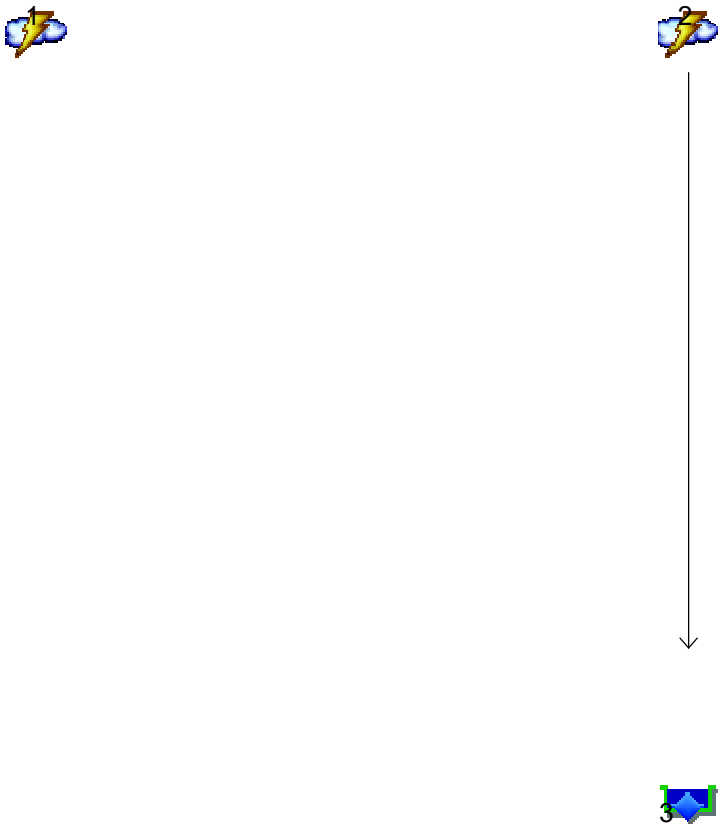
## CONCLUSION

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

# Hydrograph Summary Report

# Watershed Model Schematic





# Multi-Hydrograph Plot



## Hyd. No. 1

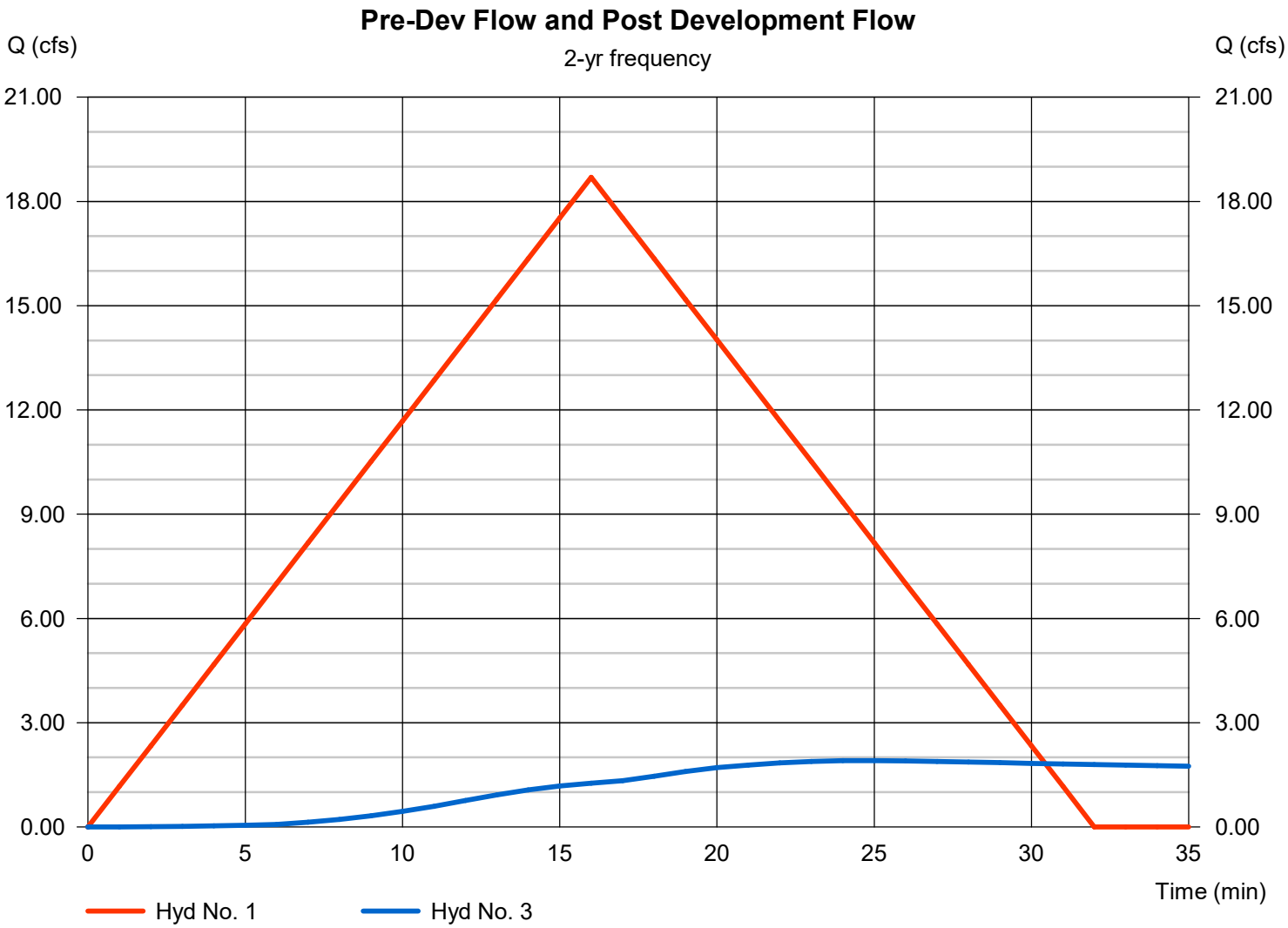
Pre-Dev Flow

| | | |
|---|---|---|
| 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

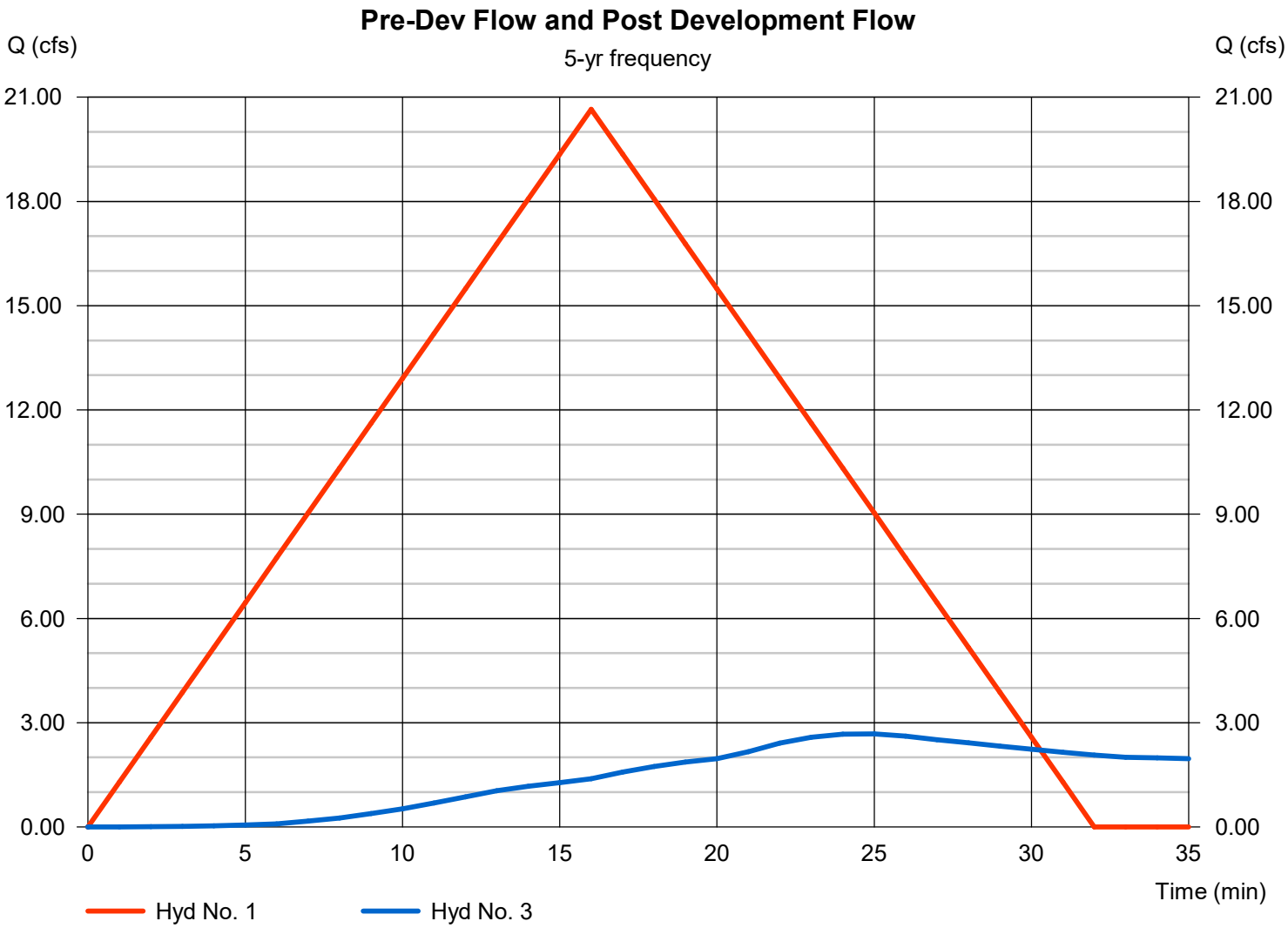
Pre-Dev Flow

| | | |
|---|---|---|
| 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

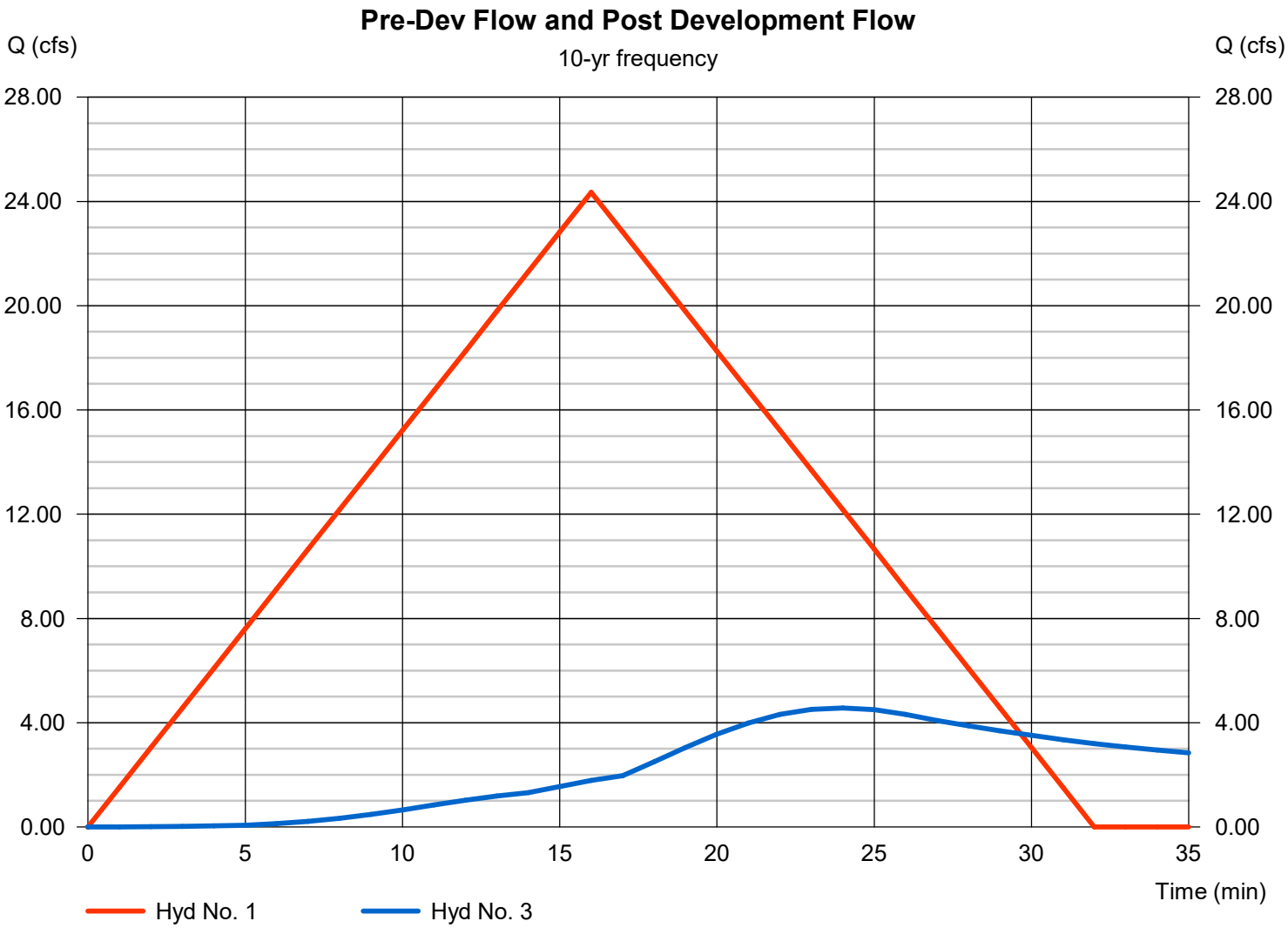
Pre-Dev Flow

| | | |
|---|---|---|
| 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

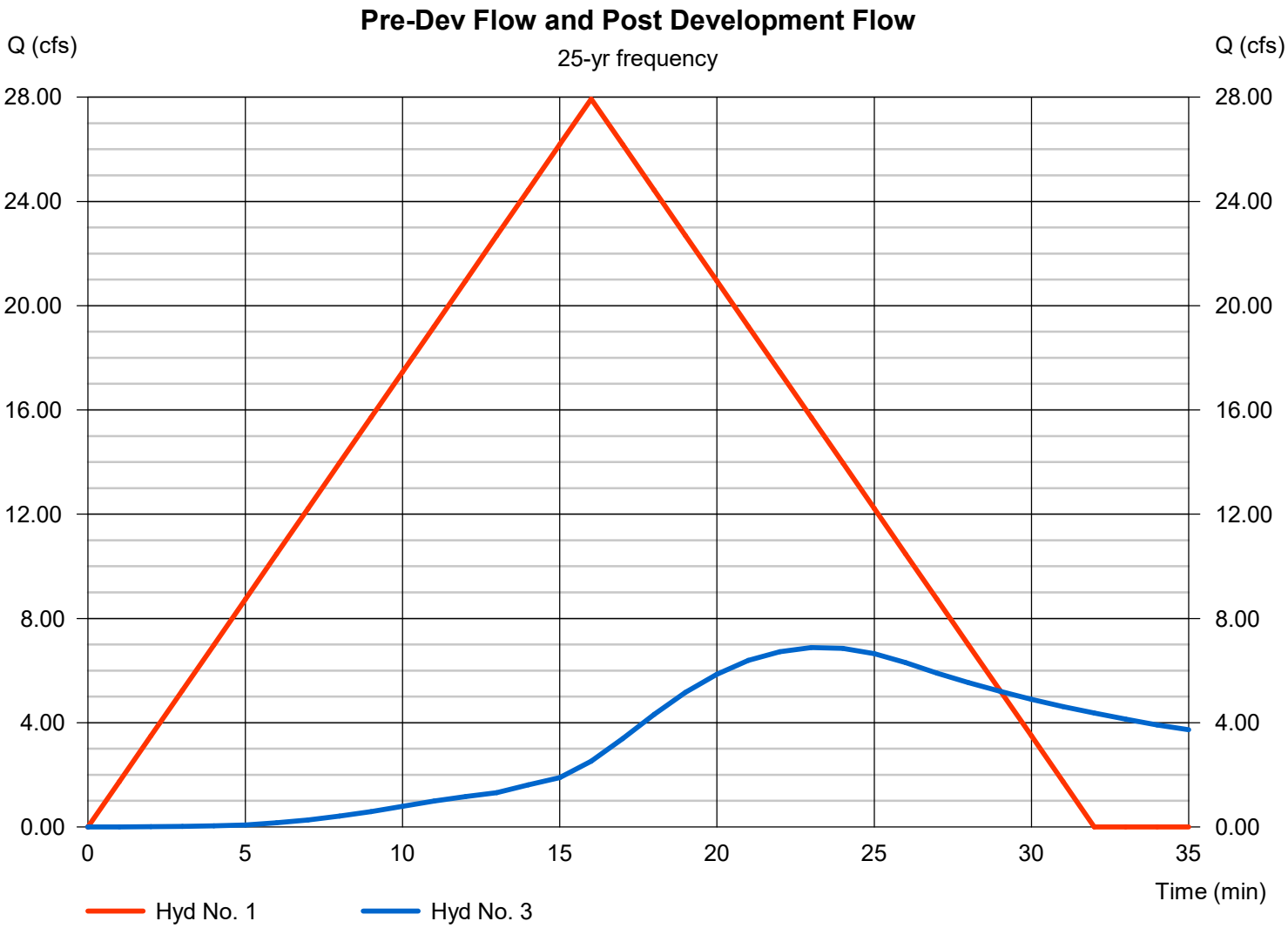
Pre-Dev Flow

| | | |
|---|---|---|
| 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

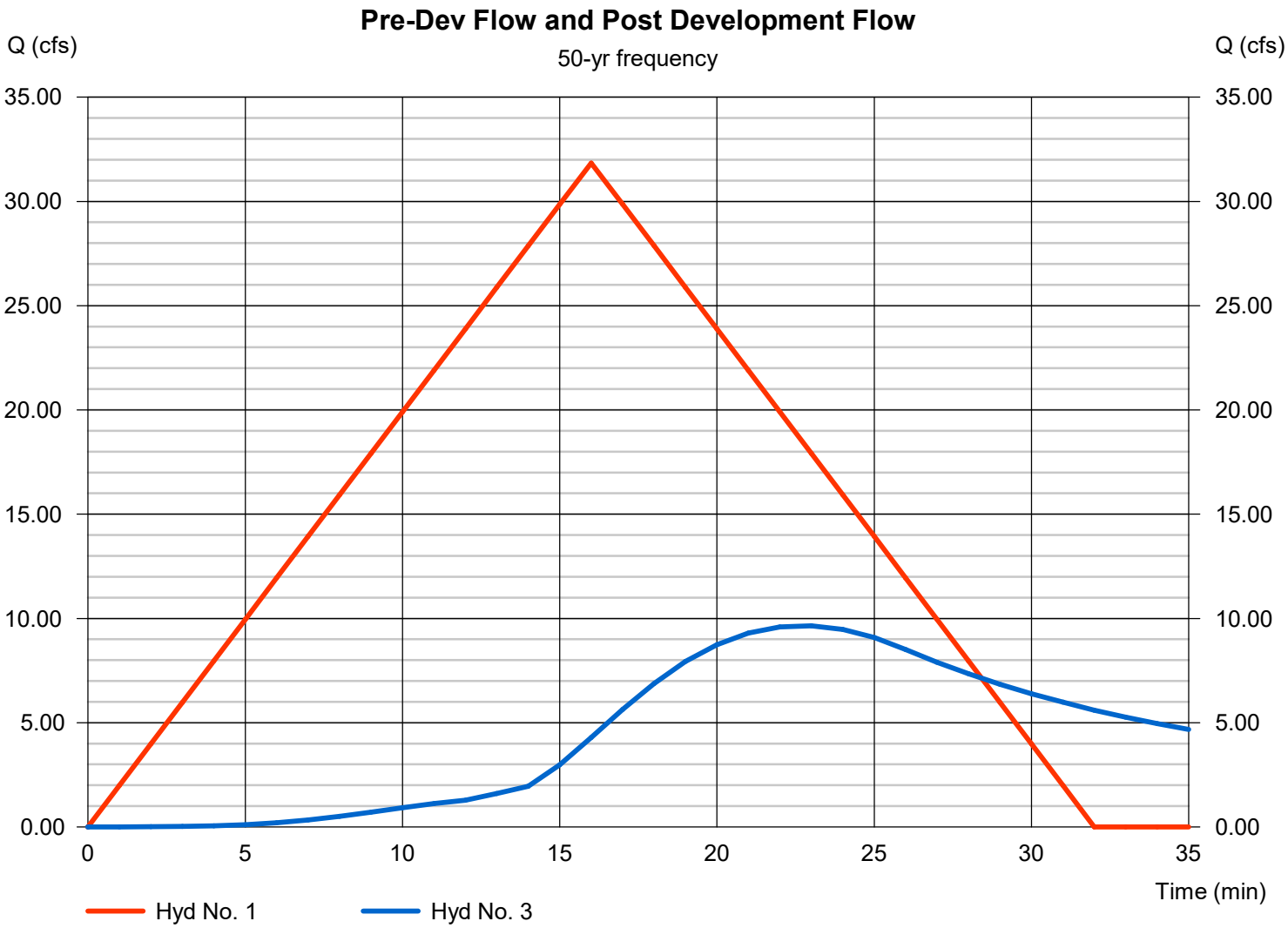
Pre-Dev Flow

| | | |
|---|---|---|
| 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

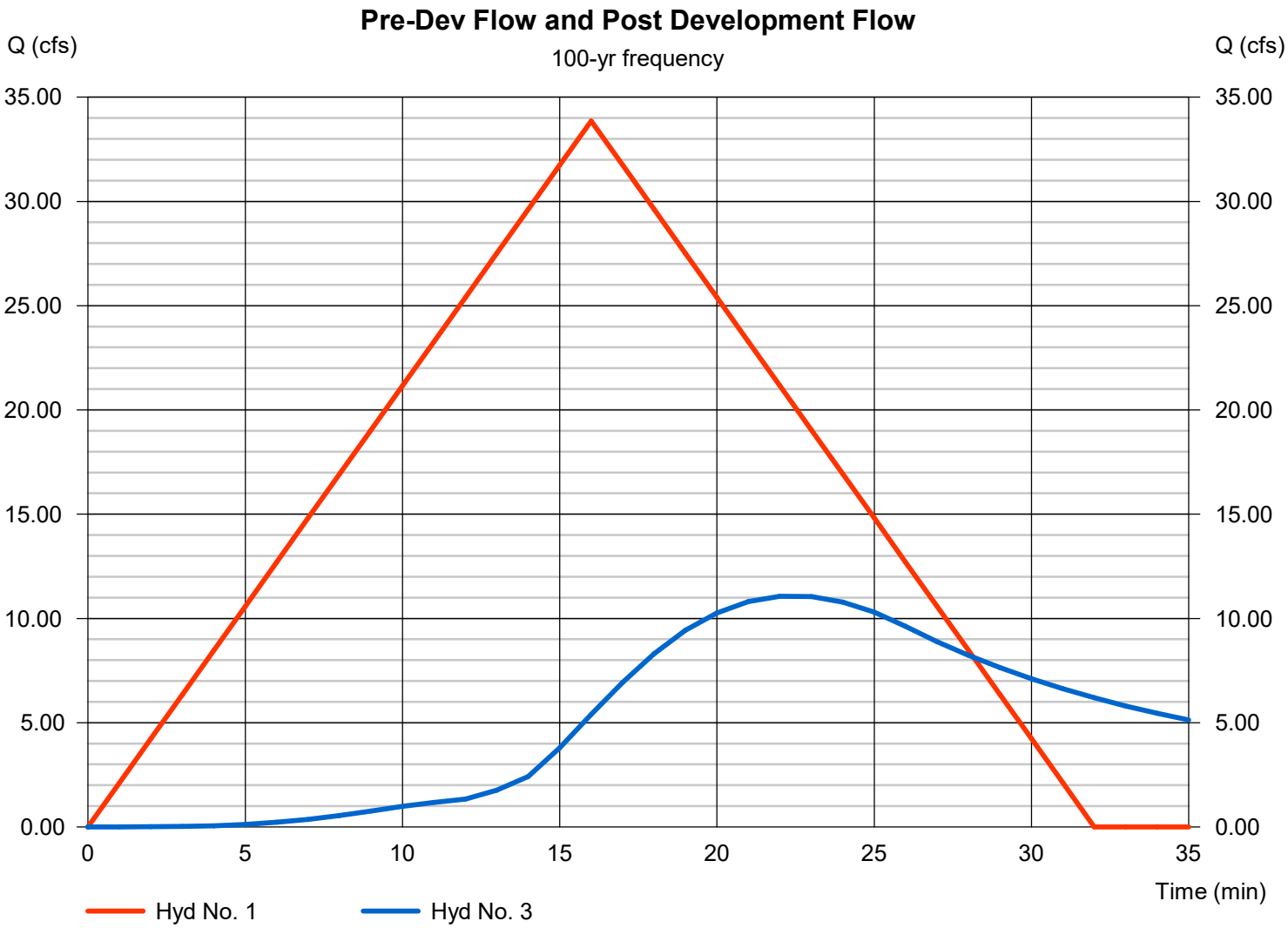
Pre-Dev Flow

| | | |
|---|---|---|
| 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 |

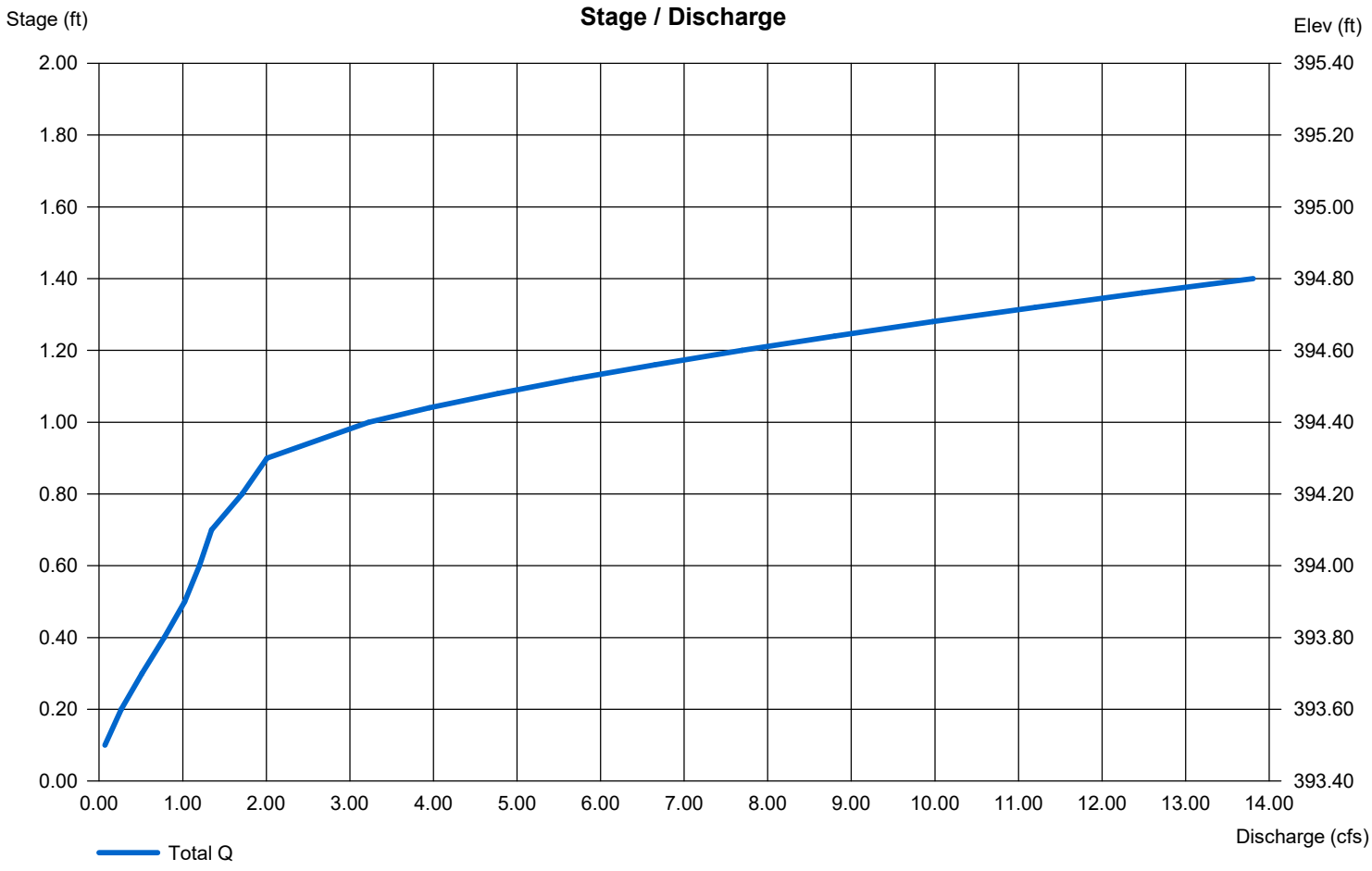
### Weir Structures

| | [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 |

# 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 | 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 |

# Hydrograph Summary Report

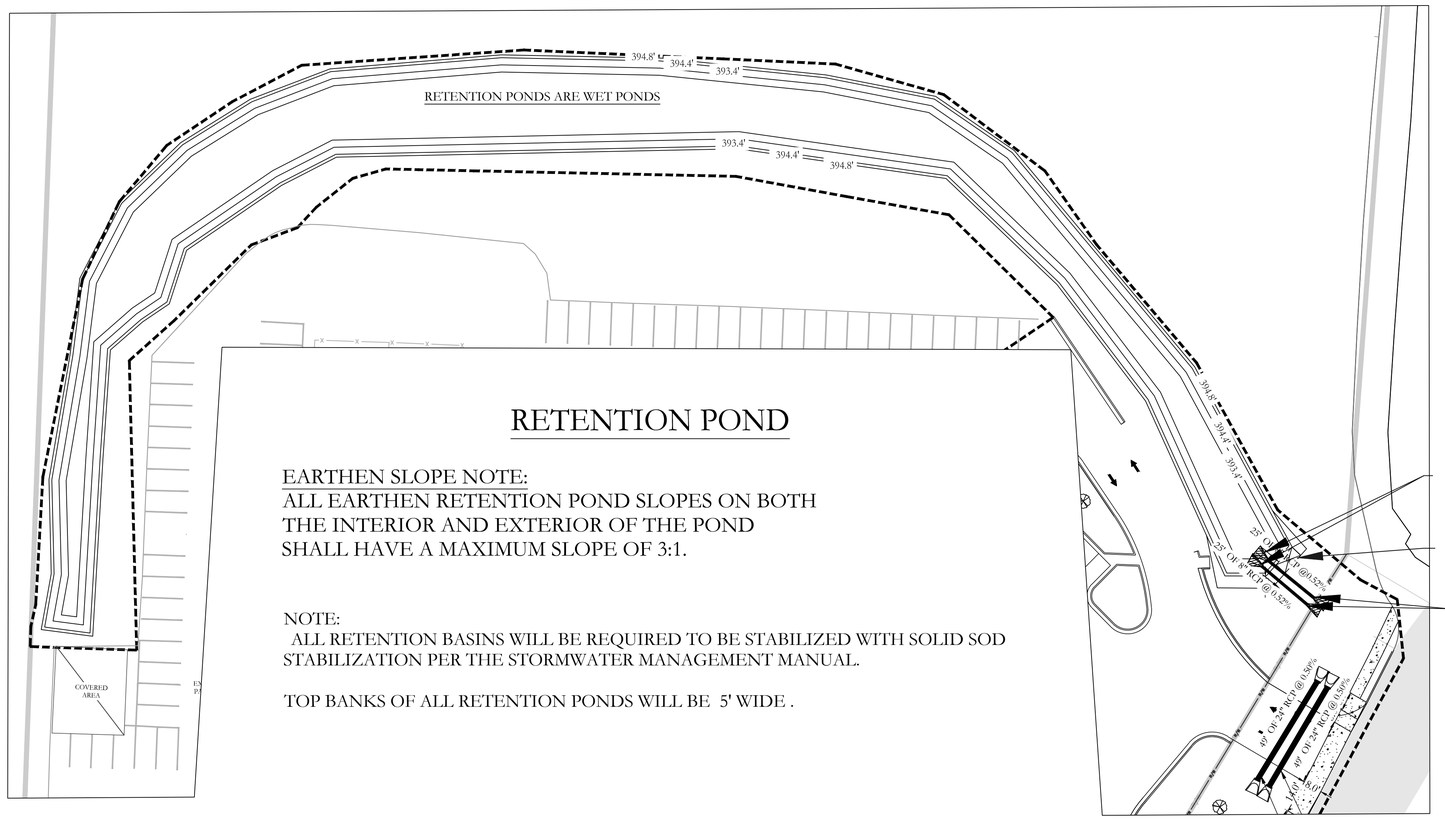
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

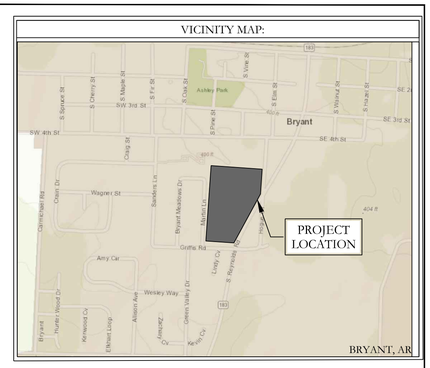
| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Rational | 31.84 | 1 | 16 | 30,570 | ------ | ------ | ------ | 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 |

# 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 | 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 |




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**

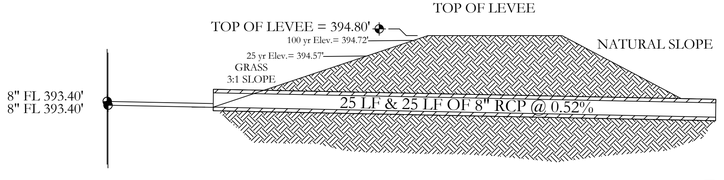
The routine inspection of the ponds areas and discharge pipes will identify needed repairs and non-routine maintenance. These items may include but not be limited to:

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

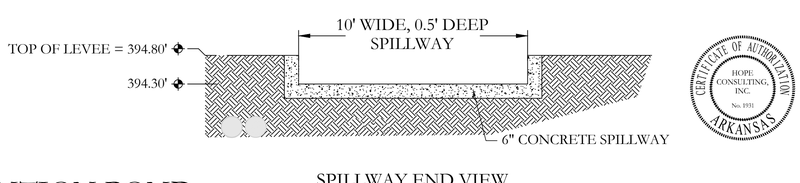
-Sediment from the site may accumulate in the pond bottom and reduce the pond to below design volume requirements. The pond should be excavated if the pond bottom elevation reached a level that allows excessive aquatic growth or reduces the pond efficiency such, that the sediments are passing the discharge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

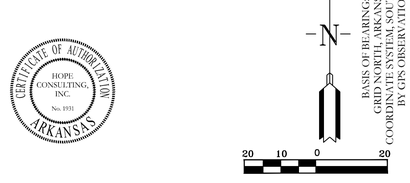



OUTLET SECTION
NTS




SPILLWAY END VIEW
NTS

# RETENTION POND




HOPE CONSULTING
ENGINEERS - SURVEYORS
129 N. Main Street,
Benton, Arkansas 72015
PH. (501)315-2626
FAX (501) 315-0024
www.hopeconsulting.com

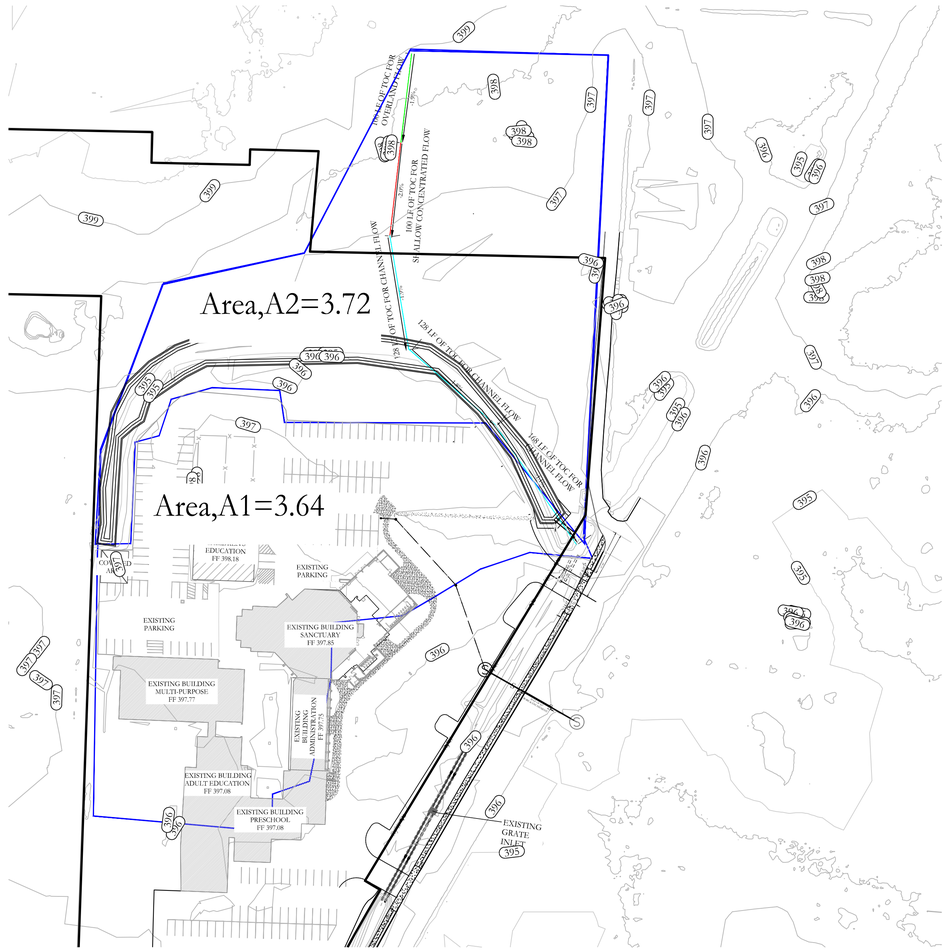
FOR USE AND BENEFIT OF:
FIRST SOUTHERN BAPTIST CHURCH OF BRYANT

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

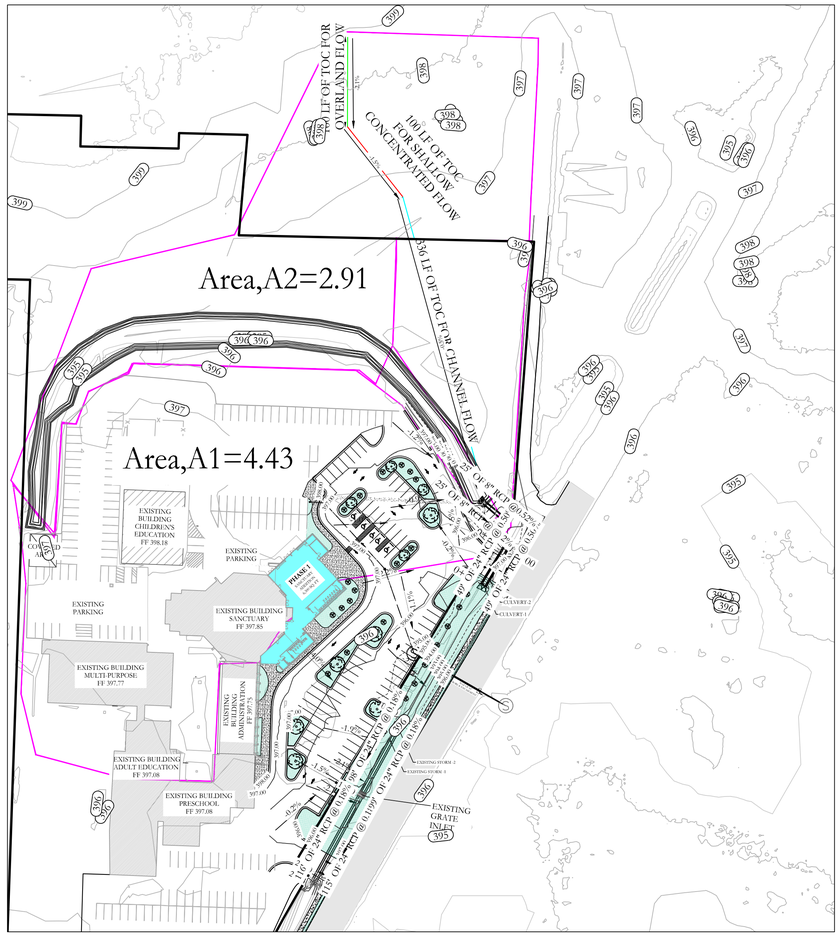
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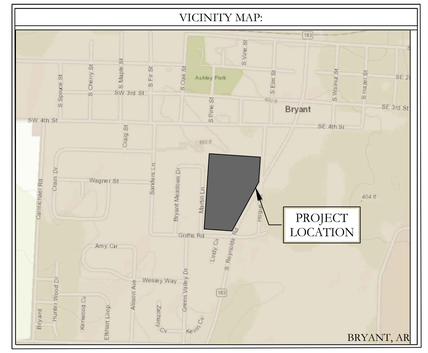
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Pre Development




Post Development




OVERLAND FLOW
SHALLOW CONCENTRATED FLOW
CHANNEL FLOW

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', L1 = 128, L2 = 128, L3 = 164'
$S_1 = 1.9\%$; $S_2 = 1.8\%$; $S_3 = 1.1\%$
n = 0.15, R = 0.22
$\therefore V = \frac{1.49}{n}(R)^{.67} \times (S)^{.05}$
$\therefore V_1 = 0.49$, $V_2 = 0.48$, $\therefore V = 1.35$, $V_3 = 0.38$

Total TOC = 16.16 min
$\therefore$ Rainfall Intensity, I = 7.4 in/hr
Area, A = 7.36 ac
Run-off Co-efficient (Cumulative) = 0.65 [$C_1 = 0.36$, $C_2 = 0.95$]
$\therefore$ 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%, $V = \frac{1.49}{n} R^{.67} S^{.5}$; n = 0.013
$\therefore V = 2.95$

$\therefore$ Total TOC = 12.75 min

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

CERTIFICATE OF AUTHORIZATION — HOPE CONSULTING, INC. — No. 1931 — ARKANSAS

N

80 40 0 80

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

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

HOPE CONSULTING ENGINEERS - SURVEYORS
129 N. Main Street,
Benton, Arkansas 72015
PH. (501)315-2626
FAX (501) 315-0024
www.hopeconsulting.com

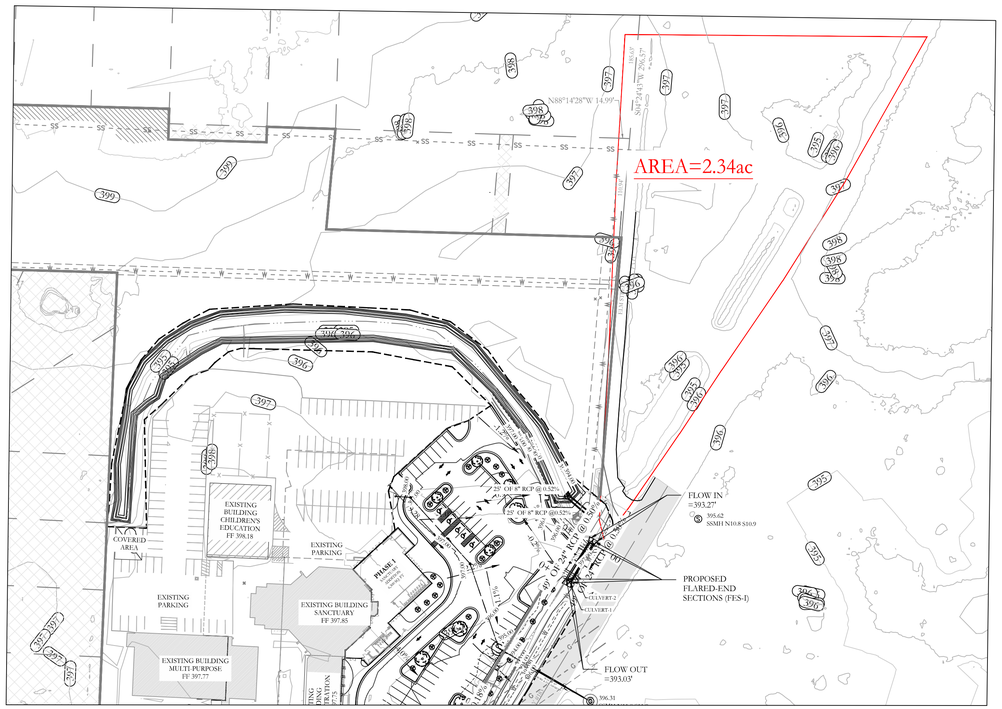
FOR USE AND BENEFIT OF:
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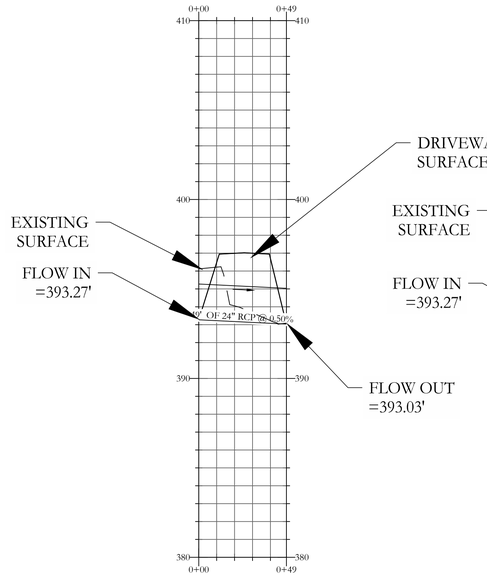
FSCB EXPANSION & REMODEL PHASE 1
DRAINAGE CALCULATIONS
604 S REYNOLDS ROAD
BRYANT, SALINE COUNTY, ARKANSAS

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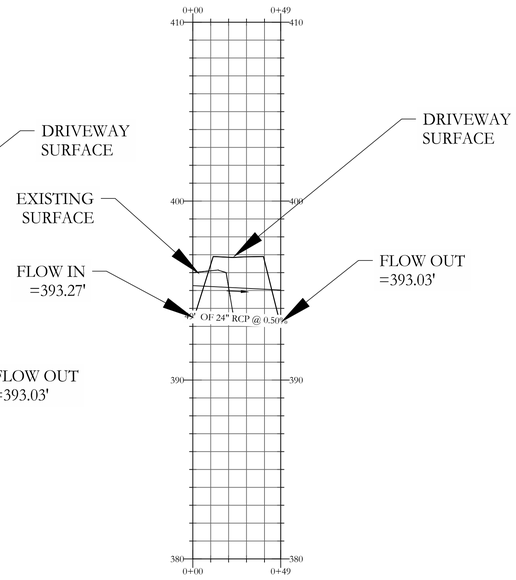
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| 500 | 01S | 14W | 0 | 34 | 310 | 62 | 1664 |

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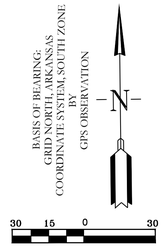




CULVERT-1 PROFILE




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'

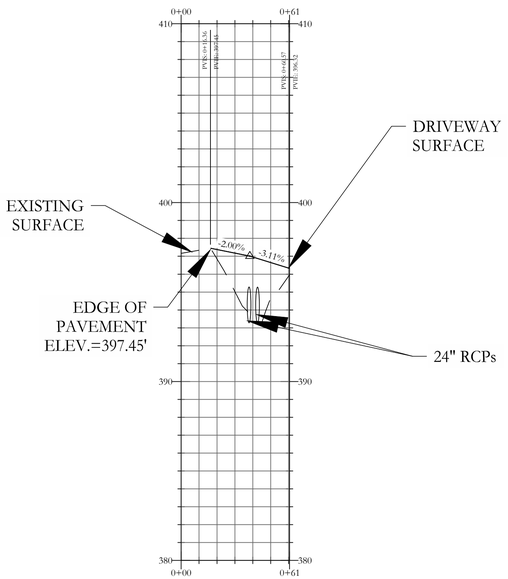
**DRAINAGE CALCULATION**

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

HOPE CONSULTING
ENGINEERS - SURVEYORS
129 N. Main Street,
Benton, Arkansas 72015
PH. (501)315-2626
FAX (501) 315-0024
www.hopeconsulting.com

FOR USE AND BENEFIT OF:
FIRST SOUTHERN BAPTIST CHURCH OF BRYANT

FSCB EXPANSION & REMODEL PHASE 1

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

| | | | |
|---|---|---|---|
| DATE: | 08-28-2024 | C.A.D. BY: | DRAWING NUMBER: |
| REVISED: | 09-23-2024 | CHECKED BY: | 24-0260 |
| SHEET: | | SCALE: | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 500 | 01S | 14W | 0 | 12 | 310 | 62 | 1664 |

CERTIFICATE OF AUTHORIZATION HOPE CONSULTING, INC. No. 1931 ARKANSAS

STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No. 20876 KAZI TAMZIDUL ISLAM

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