Storm Water Impact Analysis

Domino's Zebulon

1000 Hendricks Drive
Zebulon, NC 27597

Prepared by:

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Brandon Wright

Project #: 2023018

Since 1918

Project Overview:

This narrative describes the routing analysis (pre- vs post-) as depicted on the sheets titled "Pre-Development and Post-Development Drainage Area Map".

The proposed project site is located at 1000 Hendricks Drive, Zebulon, NC.

The existing property consists primarily of managed lawn. There is one existing dry detention pond that will remain. This pond was initially sized for all three properties to utilize it for stormwater detention. The proposed impervious area for the Domino's project in less than what the pond was initially designed for in the final condition. The new project consists of 1 commercial building (restaurant), parking lot, driveway connections and a slight road widening.

Refer to the attached Post Development DA Map for the routing study area.

The existing dry pond was initially designed to collect storm water from 3 developments in the immediate area. The purpose of this study is to make sure that our development will adequately work with the existing dry pond.

Existing Conditions (Routing Analysis):

Refer to the Pre-Developed Drainage Area Map of this report. The existing property consists of managed lawn with a ditch near the south property corner.

The site generally slopes from north to south. The onsite project area is 0.93 acres for the Domino's site specifically. For this study, all 3 developments that discharge to the dry pond will be considered onsite equating to 2.84 acres. There are currently 2 other commercial developments that drain to the dry detention pond on our site.

There is offsite drainage area totaling 3.62 acres of existing agricultural crops from the north, which enters the property as shown on the Pre-Developed DA Map.

The entire property drains to the south under the Powell driveway pipe (Downstream Pipe A), then under the Tripp Road cross pipe (Downstream Pipe B), and eventually flows into an unnamed tributary of the Cape Fear River. The offsite stream index is 18-(10.5).

The Soils Survey mapping shows that the soils on the site are predominately Ur (Urban Land):

The USGS and soils survey maps indicate that there are no streams onsite. There are no known wetlands on the property. FEMA FIRM 3720270600K indicates that there is no regulatory floodplain on the property, and the site lies within Zone X.

Post-Developed Conditions (Routing Analysis):

Refer to the Post-Developed Drainage Area Map of this report. The project includes 1 commercial building, parking lot, and an existing dry detention pond. Refer to the Site Plan sheet for all lot impervious allocations. The project includes minor road widening on E. Jones Street.

Total Proposed Onsite Impervious for this Study = 1.23 AC

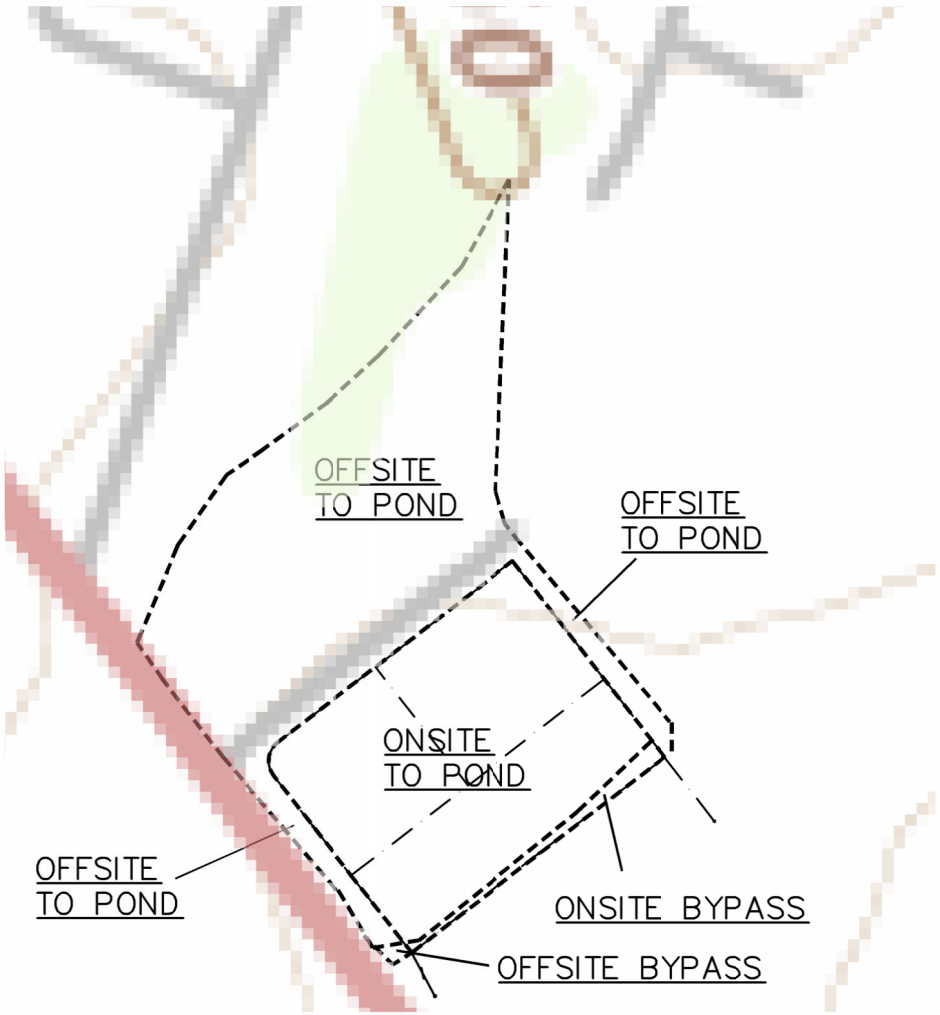
Proposed Offsite Impervious = 0.42 AC

Predeveloped Conditions:

Onsite:
A = 2.84 acres
CN = 60
Offsite:
A = 3.62 acres
CN = 68
A = 0.42 acres
CN = 98
Combined:
A = 6.88 acres
CN = 67
(SCS Method)

Predeveloped Runoff Summary

	Predeveloped Runoff
Year	CFS
1	1.73
2	3.19
5	5.88
10	8.37
25	12.11
100	18.93



PREDEVELOPED CONDITIONS

ONSITE:
A=2.84 ACRES
CN=60
OFFSITE:
A=3.62 ACRES
CN=68
A=0.42 ACRES
CN= 98
COMBINED:
A=6.88 ACRES
CN=67
(SCS METHOD)

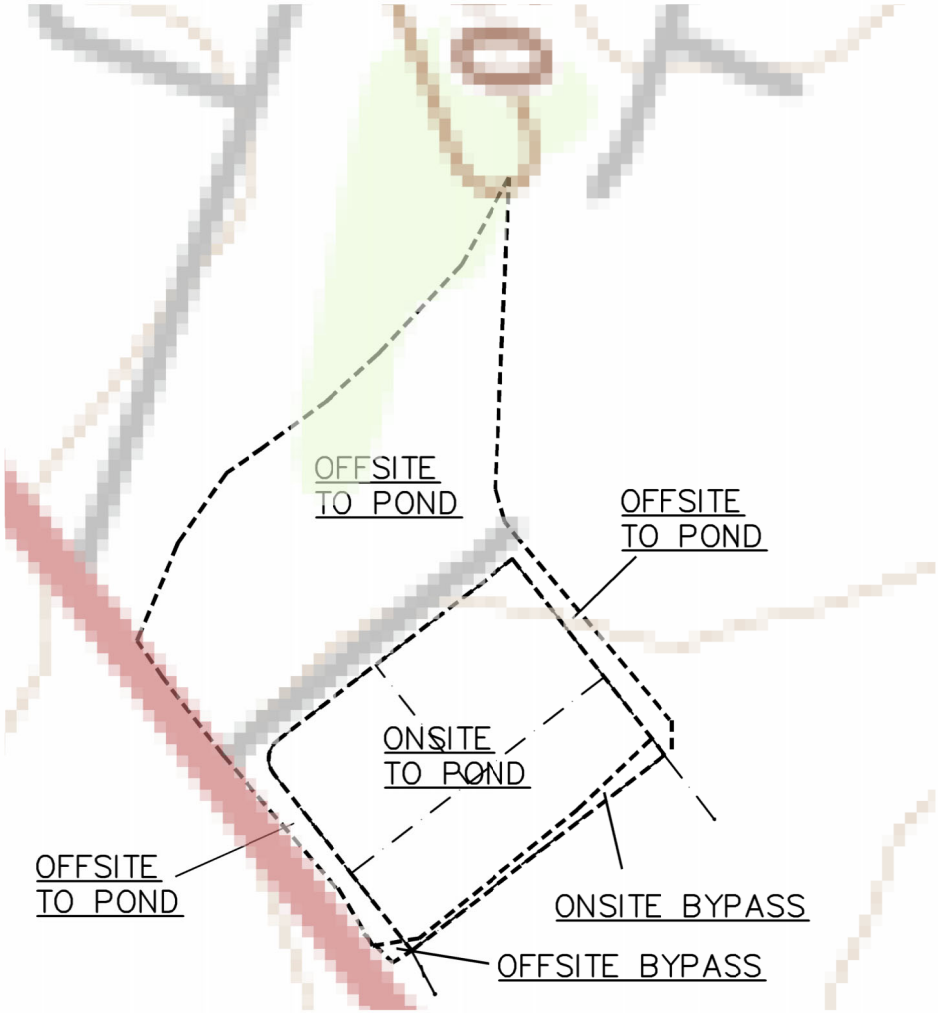
SONIC
EXISTING CONDITIONS
TWISTED 52°

Final Developed Conditions:

Onsite to Pond:
A = 1.57 acres
CN = 68
A = 1.22 acres
CN = 98
Offsite to Pond:
A = 3.61 acres
CN = 68
A = 0.42 acres
CN = 98
Combined:
A = 6.82 acres
CN = 75
(Reservoir Routing)

Onsite Bypass:
A = 0.03 acres
CN = 68
A = 0.02 acres
CN = 98
Offsite Bypass:
A = 0.01 acres
CN = 68
Combined:
A = 0.06 acres
CN = 78
(SCS Method)

	Predeveloped Runoff	Final Developed Runoff
Year	CFS	CFS
2	3.58	3.12
5	6.59	3.74
10	9.36	6.59
25	13.53	11.12
100	21.12	18.97



FINAL DEVELOPED CONDITIONS

TO POND
ONSITE:
A=1.57 ACRES
CN=68
A=1.22 ACRES
CN=98
OFFSITE:
A=3.61 ACRES
CN=68
A=0.42 ACRES
CN=98
COMBINED:
A=6.82 ACRES
CN=78
(RESERVOIR ROUTING)

BYPASS
ONSITE
A=0.03 ACRES
CN=68
A=0.02 ACRES
CN=98
OFFSITE
A=0.01 ACRES
CN=68
COMBINED
A=0.06 ACRES
CN=78
(SCS METHOD)

SONIC
FINAL DEVELOPED CONDITIONS
TWISTED 52°

Methodology:

Hydrologic and hydraulic routing calculations were performed using Hydraflow Hydrographs software. Time of concentrations were calculated using the TR-55 segmented approach. Hydrologic calculations utilized the NRCS SCS Method within the Hydraflow software. The stormwater dry detention pond was routed within the Hydraflow software, which uses the Storage Indication Method.

Conclusions:

Through the use of the existing stormwater dry detention pond, this project detains the 100-yr storm onsite:

	Predeveloped Runoff	Final Developed Runoff	Water Surface Elevation
Year	CFS	CFS	FT
2	3.58	3.12	333.83
5	6.59	3.74	334.51
10	9.36	6.59	334.89
25	13.53	11.12	335.24
100	21.12	18.97	335.72

List of Appendices:

- Maps
  - Pre-Developed Drainage Area Map
  - Post-Developed Drainage Area Map
  - Soils Survey Map
  - FEMA Firmette
  - USGS Map

- Calculations
  - Table of Subareas, Land Uses, & Curve Numbers
  - Peak Flow Summary
  - Hydraflow Routing Report


SHEET FLOW
300 LF @ 2.0%
SHALLOW
CONCENTRATED FLOW
450 LF @ 1.4%
CHANNEL FLOW (PIPE)
118 LF @ 1.6%
CHANNEL FLOW (DITCH)
160 LF @ 0.8%
Pearces Rd
Jones St
Landdicks Dr
Arendell Ave
96
Zebulon Elementary
N


SHEET FLOW
300 LF @ 2.0%
SHALLOW
CONCENTRATED FLOW
450 LF @ 1.4%
CHANNEL FLOW (PIPE)
118 LF @ 1.6%
CHANNEL FLOW (DITCH)
0 LF @ 1.6%
CHANNEL FLOW (PIPE)
83 LF @ 0.5%
Pearces Rd
Arendell Ave
Landricks Dr
Jones St
Zebulon Elementary
96
N

NOAA Atlas 14, Volume 2, Version 3
Location name: Zebulon, North Carolina, USA*
Latitude: 35.8383°, Longitude: -78.3233°
Elevation: 335 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.405** (0.369-0.444)	**0.468** (0.428-0.512)	**0.530** (0.485-0.580)	**0.601** (0.548-0.657)	**0.670** (0.609-0.732)	**0.728** (0.658-0.795)	**0.780** (0.701-0.851)	**0.827** (0.739-0.904)	**0.880** (0.780-0.963)	**0.930** (0.818-1.02)
10-min	**0.646** (0.590-0.710)	**0.748** (0.685-0.819)	**0.849** (0.777-0.929)	**0.961** (0.877-1.05)	**1.07** (0.970-1.17)	**1.16** (1.05-1.27)	**1.24** (1.11-1.35)	**1.31** (1.17-1.43)	**1.39** (1.23-1.52)	**1.46** (1.29-1.61)
15-min	**0.808** (0.737-0.887)	**0.941** (0.861-1.03)	**1.07** (0.983-1.18)	**1.22** (1.11-1.33)	**1.35** (1.23-1.48)	**1.47** (1.33-1.60)	**1.57** (1.41-1.71)	**1.65** (1.48-1.81)	**1.75** (1.55-1.92)	**1.84** (1.62-2.02)
30-min	**1.11** (1.01-1.22)	**1.30** (1.19-1.42)	**1.53** (1.40-1.67)	**1.76** (1.61-1.92)	**2.00** (1.82-2.19)	**2.21** (2.00-2.42)	**2.40** (2.16-2.62)	**2.57** (2.30-2.81)	**2.79** (2.47-3.05)	**2.98** (2.62-3.27)
60-min	**1.38** (1.26-1.52)	**1.63** (1.49-1.78)	**1.96** (1.79-2.14)	**2.29** (2.09-2.51)	**2.67** (2.42-2.92)	**3.00** (2.71-3.27)	**3.30** (2.97-3.60)	**3.61** (3.23-3.95)	**4.00** (3.55-4.38)	**4.35** (3.82-4.77)
2-hr	**1.62** (1.46-1.79)	**1.91** (1.74-2.10)	**2.32** (2.11-2.56)	**2.76** (2.50-3.03)	**3.27** (2.94-3.59)	**3.74** (3.35-4.10)	**4.19** (3.73-4.59)	**4.66** (4.13-5.10)	**5.29** (4.63-5.79)	**5.86** (5.09-6.44)
3-hr	**1.71** (1.55-1.90)	**2.03** (1.85-2.24)	**2.47** (2.25-2.74)	**2.96** (2.68-3.26)	**3.54** (3.18-3.90)	**4.08** (3.65-4.49)	**4.62** (4.10-5.08)	**5.20** (4.57-5.71)	**5.97** (5.20-6.57)	**6.71** (5.77-7.39)
6-hr	**2.05** (1.87-2.27)	**2.43** (2.22-2.68)	**2.97** (2.70-3.27)	**3.55** (3.23-3.91)	**4.27** (3.85-4.68)	**4.94** (4.43-5.41)	**5.62** (4.99-6.14)	**6.34** (5.58-6.93)	**7.34** (6.37-8.02)	**8.28** (7.10-9.07)
12-hr	**2.41** (2.20-2.66)	**2.86** (2.62-3.15)	**3.51** (3.21-3.86)	**4.22** (3.84-4.64)	**5.11** (4.62-5.60)	**5.96** (5.34-6.50)	**6.82** (6.05-7.43)	**7.76** (6.80-8.44)	**9.06** (7.82-9.86)	**10.3** (8.77-11.2)
24-hr	**2.85** (2.65-3.09)	**3.46** (3.21-3.74)	**4.38** (4.06-4.74)	**5.14** (4.75-5.55)	**6.20** (5.71-6.69)	**7.07** (6.48-7.64)	**8.00** (7.29-8.64)	**8.99** (8.14-9.73)	**10.4** (9.34-11.3)	**11.6** (10.3-12.6)
2-day	**3.30** (3.07-3.56)	**3.98** (3.71-4.30)	**5.02** (4.66-5.41)	**5.85** (5.42-6.31)	**7.02** (6.47-7.58)	**7.98** (7.32-8.61)	**8.99** (8.21-9.71)	**10.1** (9.13-10.9)	**11.6** (10.4-12.6)	**12.9** (11.4-14.0)
3-day	**3.51** (3.27-3.77)	**4.22** (3.93-4.54)	**5.29** (4.92-5.68)	**6.14** (5.70-6.60)	**7.35** (6.79-7.90)	**8.33** (7.66-8.96)	**9.36** (8.57-10.1)	**10.5** (9.51-11.3)	**12.0** (10.8-13.0)	**13.3** (11.9-14.4)
4-day	**3.71** (3.46-3.98)	**4.46** (4.16-4.78)	**5.56** (5.18-5.95)	**6.44** (5.99-6.89)	**7.67** (7.11-8.22)	**8.68** (8.00-9.30)	**9.73** (8.93-10.4)	**10.8** (9.89-11.7)	**12.4** (11.2-13.4)	**13.7** (12.3-14.8)
7-day	**4.31** (4.03-4.61)	**5.16** (4.82-5.52)	**6.35** (5.93-6.80)	**7.31** (6.81-7.82)	**8.64** (8.02-9.24)	**9.71** (8.99-10.4)	**10.8** (9.97-11.6)	**12.0** (11.0-12.9)	**13.6** (12.4-14.7)	**15.0** (13.5-16.2)
10-day	**4.92** (4.61-5.25)	**5.87** (5.50-6.26)	**7.12** (6.67-7.59)	**8.11** (7.59-8.64)	**9.47** (8.83-10.1)	**10.6** (9.81-11.3)	**11.7** (10.8-12.5)	**12.8** (11.8-13.7)	**14.4** (13.2-15.5)	**15.7** (14.3-16.9)
20-day	**6.60** (6.21-7.03)	**7.82** (7.36-8.32)	**9.33** (8.77-9.93)	**10.5** (9.88-11.2)	**12.2** (11.4-12.9)	**13.5** (12.6-14.3)	**14.8** (13.8-15.8)	**16.2** (15.0-17.2)	**18.0** (16.6-19.3)	**19.5** (17.8-20.9)
30-day	**8.20** (7.74-8.70)	**9.67** (9.13-10.3)	**11.4** (10.7-12.0)	**12.7** (11.9-13.4)	**14.4** (13.5-15.3)	**15.8** (14.8-16.8)	**17.1** (16.0-18.2)	**18.5** (17.2-19.7)	**20.4** (18.9-21.7)	**21.8** (20.1-23.3)
45-day	**10.4** (9.90-11.0)	**12.3** (11.6-12.9)	**14.2** (13.4-14.9)	**15.6** (14.8-16.5)	**17.6** (16.6-18.6)	**19.0** (18.0-20.1)	**20.5** (19.3-21.7)	**22.0** (20.6-23.3)	**23.9** (22.3-25.4)	**25.4** (23.6-27.0)
60-day	**12.5** (11.9-13.2)	**14.7** (13.9-15.4)	**16.7** (15.9-17.6)	**18.4** (17.4-19.3)	**20.4** (19.4-21.5)	**22.0** (20.8-23.2)	**23.6** (22.2-24.9)	**25.1** (23.6-26.5)	**27.1** (25.4-28.7)	**28.6** (26.7-30.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

NOAA Atlas 14, Volume 2, Version 3
Location name: Zebulon, North Carolina, USA*
Latitude: 35.8383°, Longitude: -78.3233°
Elevation: 335 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.86** (4.43-5.33)	**5.62** (5.14-6.14)	**6.36** (5.82-6.96)	**7.21** (6.58-7.88)	**8.04** (7.31-8.78)	**8.74** (7.90-9.54)	**9.36** (8.41-10.2)	**9.92** (8.87-10.8)	**10.6** (9.36-11.6)	**11.2** (9.82-12.3)
10-min	**3.88** (3.54-4.26)	**4.49** (4.11-4.91)	**5.09** (4.66-5.57)	**5.77** (5.26-6.30)	**6.41** (5.82-7.00)	**6.95** (6.29-7.60)	**7.43** (6.68-8.11)	**7.86** (7.03-8.59)	**8.35** (7.40-9.14)	**8.79** (7.73-9.64)
15-min	**3.23** (2.95-3.55)	**3.76** (3.44-4.12)	**4.30** (3.93-4.70)	**4.86** (4.44-5.32)	**5.41** (4.92-5.91)	**5.87** (5.31-6.42)	**6.26** (5.63-6.84)	**6.61** (5.91-7.23)	**7.01** (6.21-7.67)	**7.36** (6.46-8.07)
30-min	**2.22** (2.02-2.43)	**2.60** (2.38-2.84)	**3.05** (2.79-3.34)	**3.52** (3.21-3.85)	**4.01** (3.64-4.38)	**4.42** (4.00-4.83)	**4.80** (4.31-5.23)	**5.15** (4.60-5.63)	**5.57** (4.94-6.10)	**5.96** (5.23-6.53)
60-min	**1.38** (1.26-1.52)	**1.63** (1.49-1.78)	**1.96** (1.79-2.14)	**2.29** (2.09-2.51)	**2.67** (2.42-2.92)	**3.00** (2.71-3.27)	**3.30** (2.97-3.60)	**3.61** (3.23-3.95)	**4.00** (3.55-4.38)	**4.35** (3.82-4.77)
2-hr	**0.807** (0.731-0.894)	**0.956** (0.870-1.05)	**1.16** (1.06-1.28)	**1.38** (1.25-1.52)	**1.64** (1.47-1.79)	**1.87** (1.68-2.05)	**2.10** (1.86-2.29)	**2.33** (2.06-2.55)	**2.64** (2.32-2.90)	**2.93** (2.54-3.22)
3-hr	**0.569** (0.516-0.633)	**0.675** (0.615-0.746)	**0.823** (0.748-0.911)	**0.985** (0.892-1.09)	**1.18** (1.06-1.30)	**1.36** (1.22-1.50)	**1.54** (1.36-1.69)	**1.73** (1.52-1.90)	**1.99** (1.73-2.19)	**2.23** (1.92-2.46)
6-hr	**0.342** (0.311-0.379)	**0.405** (0.370-0.447)	**0.495** (0.451-0.545)	**0.593** (0.538-0.652)	**0.712** (0.643-0.781)	**0.825** (0.739-0.903)	**0.938** (0.833-1.03)	**1.06** (0.931-1.16)	**1.22** (1.06-1.34)	**1.38** (1.18-1.51)
12-hr	**0.200** (0.182-0.220)	**0.237** (0.217-0.261)	**0.291** (0.266-0.320)	**0.350** (0.319-0.385)	**0.424** (0.383-0.464)	**0.494** (0.443-0.539)	**0.565** (0.502-0.616)	**0.643** (0.564-0.700)	**0.751** (0.649-0.818)	**0.856** (0.727-0.932)
24-hr	**0.118** (0.110-0.128)	**0.143** (0.133-0.155)	**0.182** (0.169-0.197)	**0.214** (0.197-0.231)	**0.258** (0.237-0.278)	**0.294** (0.270-0.318)	**0.333** (0.303-0.360)	**0.374** (0.339-0.405)	**0.433** (0.389-0.470)	**0.482** (0.429-0.525)
2-day	**0.068** (0.063-0.074)	**0.082** (0.077-0.089)	**0.104** (0.097-0.112)	**0.121** (0.112-0.131)	**0.146** (0.134-0.157)	**0.166** (0.152-0.179)	**0.187** (0.170-0.202)	**0.209** (0.190-0.226)	**0.241** (0.217-0.262)	**0.267** (0.238-0.292)
3-day	**0.048** (0.045-0.052)	**0.058** (0.054-0.063)	**0.073** (0.068-0.078)	**0.085** (0.079-0.091)	**0.102** (0.094-0.109)	**0.115** (0.106-0.124)	**0.129** (0.119-0.140)	**0.145** (0.132-0.156)	**0.166** (0.150-0.180)	**0.184** (0.164-0.200)
4-day	**0.038** (0.036-0.041)	**0.046** (0.043-0.049)	**0.057** (0.053-0.062)	**0.067** (0.062-0.071)	**0.079** (0.074-0.085)	**0.090** (0.083-0.096)	**0.101** (0.092-0.108)	**0.112** (0.102-0.121)	**0.129** (0.116-0.139)	**0.142** (0.127-0.154)
7-day	**0.025** (0.023-0.027)	**0.030** (0.028-0.032)	**0.037** (0.035-0.040)	**0.043** (0.040-0.046)	**0.051** (0.047-0.055)	**0.057** (0.053-0.061)	**0.064** (0.059-0.069)	**0.071** (0.065-0.076)	**0.081** (0.073-0.087)	**0.089** (0.080-0.096)
10-day	**0.020** (0.019-0.021)	**0.024** (0.022-0.026)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.039** (0.036-0.042)	**0.043** (0.040-0.046)	**0.048** (0.045-0.051)	**0.053** (0.049-0.057)	**0.060** (0.055-0.064)	**0.065** (0.059-0.070)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.025** (0.023-0.026)	**0.028** (0.026-0.029)	**0.030** (0.028-0.032)	**0.033** (0.031-0.035)	**0.037** (0.034-0.040)	**0.040** (0.037-0.043)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.020** (0.018-0.021)	**0.021** (0.020-0.023)	**0.023** (0.022-0.025)	**0.025** (0.023-0.027)	**0.028** (0.026-0.030)	**0.030** (0.027-0.032)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.011)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.019** (0.017-0.020)	**0.020** (0.019-0.021)	**0.022** (0.020-0.023)	**0.023** (0.021-0.025)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.021)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	SCS Runoff	3.577	2	740	20,671	------	------	------	Pre-Developed Total
3	SCS Runoff	6.210	2	738	31,529	------	------	------	Post Development (To Pond)
4	SCS Runoff	0.126	2	722	330	------	------	------	Post Development (Bypass)
6	Reservoir	3.104	2	764	31,526	3	33.83	6,846	Pond Route
8	Combine	3.116	2	764	31,856	4, 6,	------	------	Post Development (Detained)

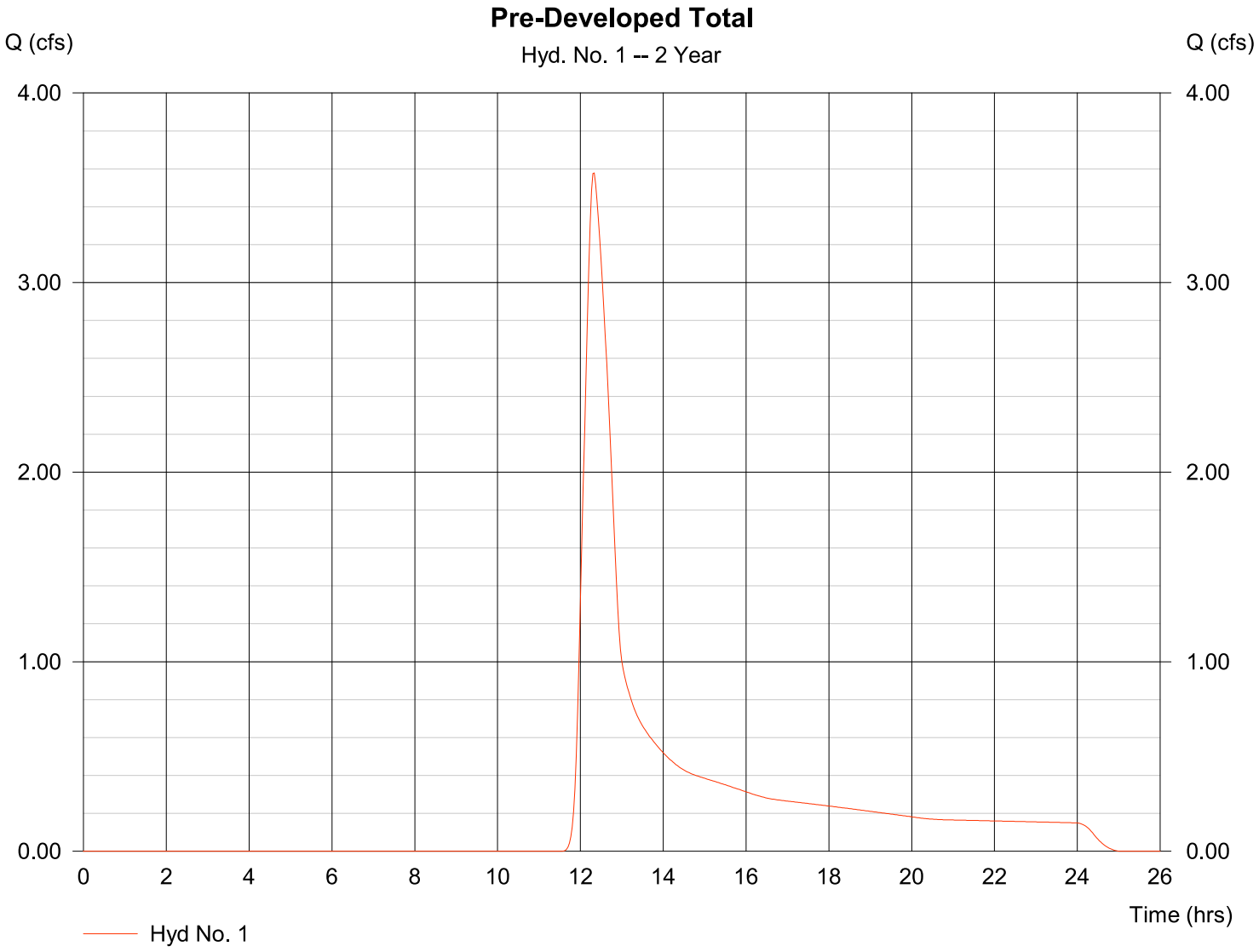
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 1

Pre-Developed Total

Hydrograph type	= SCS Runoff	Peak discharge	= 3.577 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 20,671 cuft
Drainage area	= 6.880 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.50 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 1

Pre-Developed Total

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.46		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 33.05**	**+**	**0.00**	**+**	**0.00**	**=**	**33.05**
Shallow Concentrated Flow							
Flow length (ft)	= 450.00		0.00		0.00		
Watercourse slope (%)	= 1.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.91		0.00		0.00		
Travel Time (min)	**= 3.93**	**+**	**0.00**	**+**	**0.00**	**=**	**3.93**
Channel Flow							
X sectional flow area (sqft)	= 4.50		1.76		0.00		
Wetted perimeter (ft)	= 5.60		4.70		0.00		
Channel slope (%)	= 0.08		1.60		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=1.21						
			6.51				
					0.00		
Flow length (ft)	({0})160.0		118.0		0.0		
Travel Time (min)	**= 2.20**	**+**	**0.30**	**+**	**0.00**	**=**	**2.50**

Total Travel Time, Tc ..... 39.50 min

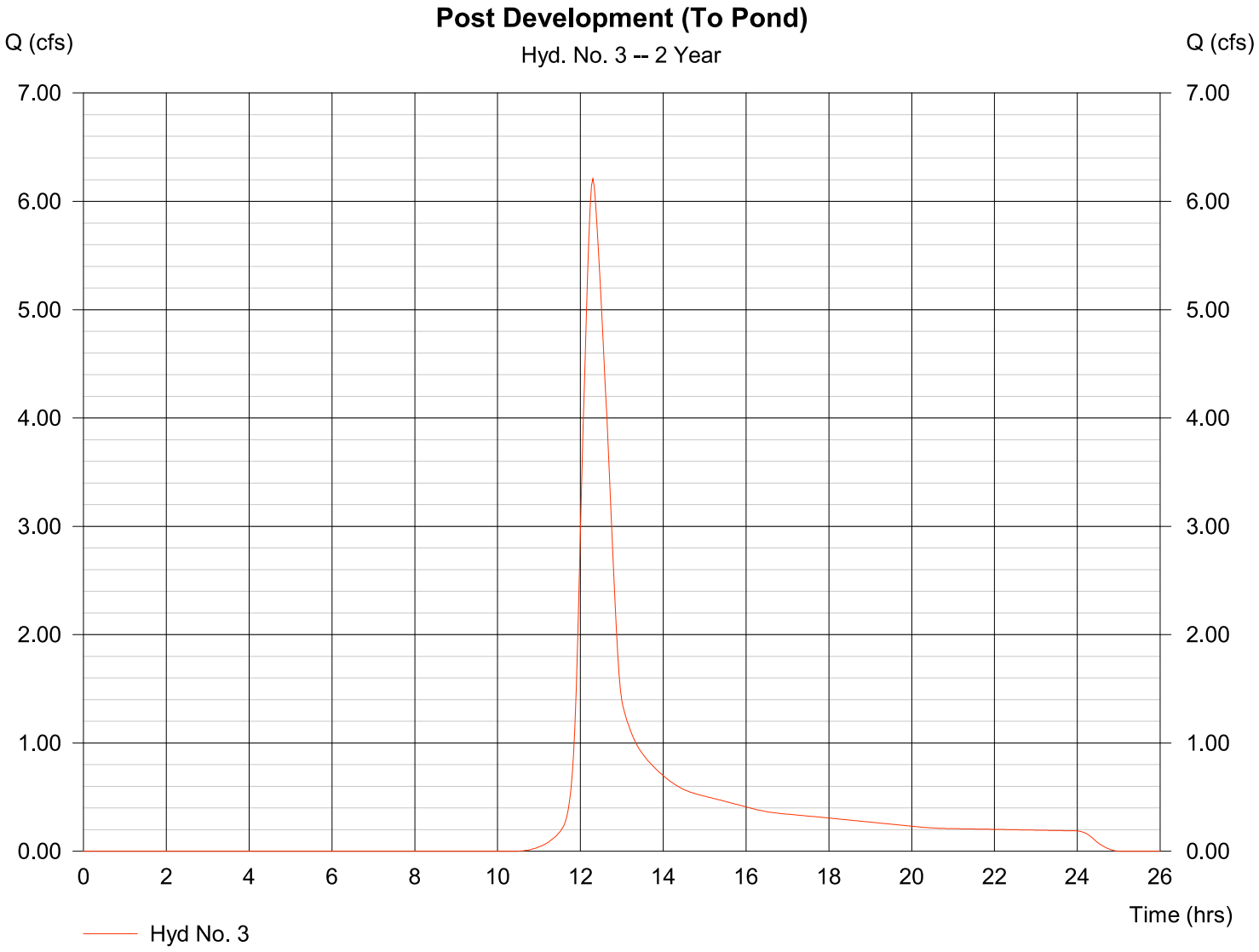
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 3

Post Development (To Pond)

Hydrograph type	= SCS Runoff	Peak discharge	= 6.210 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 31,529 cuft
Drainage area	= 6.820 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Post Development (To Pond)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.46		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 33.05**	**+**	**0.00**	**+**	**0.00**	**=**	**33.05**
Shallow Concentrated Flow							
Flow length (ft)	= 450.00		0.00		0.00		
Watercourse slope (%)	= 1.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.91		0.00		0.00		
Travel Time (min)	**= 3.93**	**+**	**0.00**	**+**	**0.00**	**=**	**3.93**
Channel Flow							
X sectional flow area (sqft)	= 4.50		1.76		1.76		
Wetted perimeter (ft)	= 5.60		4.70		4.70		
Channel slope (%)	= 1.60		1.60		0.50		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=5.43						
			6.51				
					3.64		
Flow length (ft)	({0})60.0		118.0		83.0		
Travel Time (min)	**= 0.18**	**+**	**0.30**	**+**	**0.38**	**=**	**0.87**

Total Travel Time, Tc ..... 37.80 min

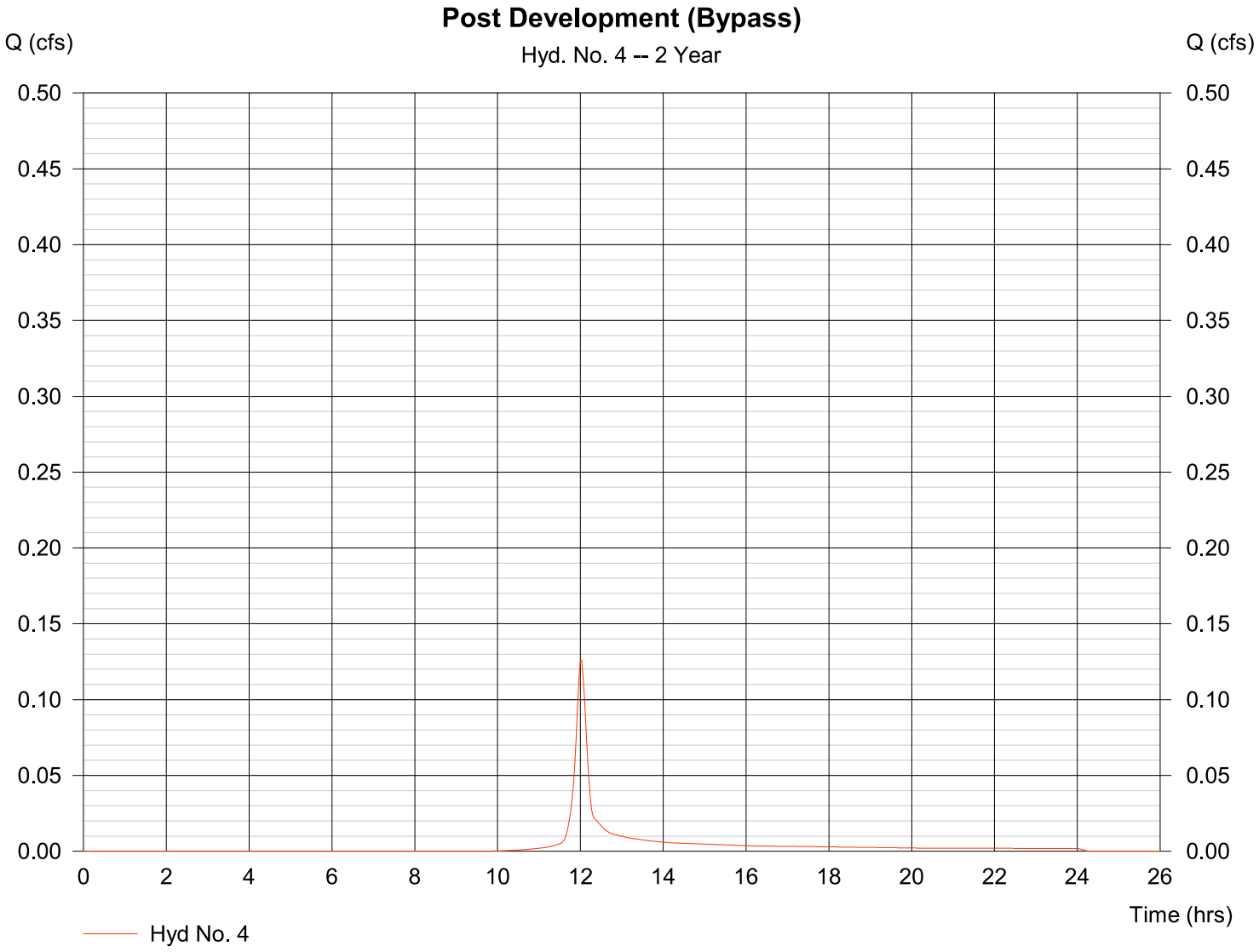
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 4

Post Development (Bypass)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.126 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 330 cuft
Drainage area	= 0.060 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

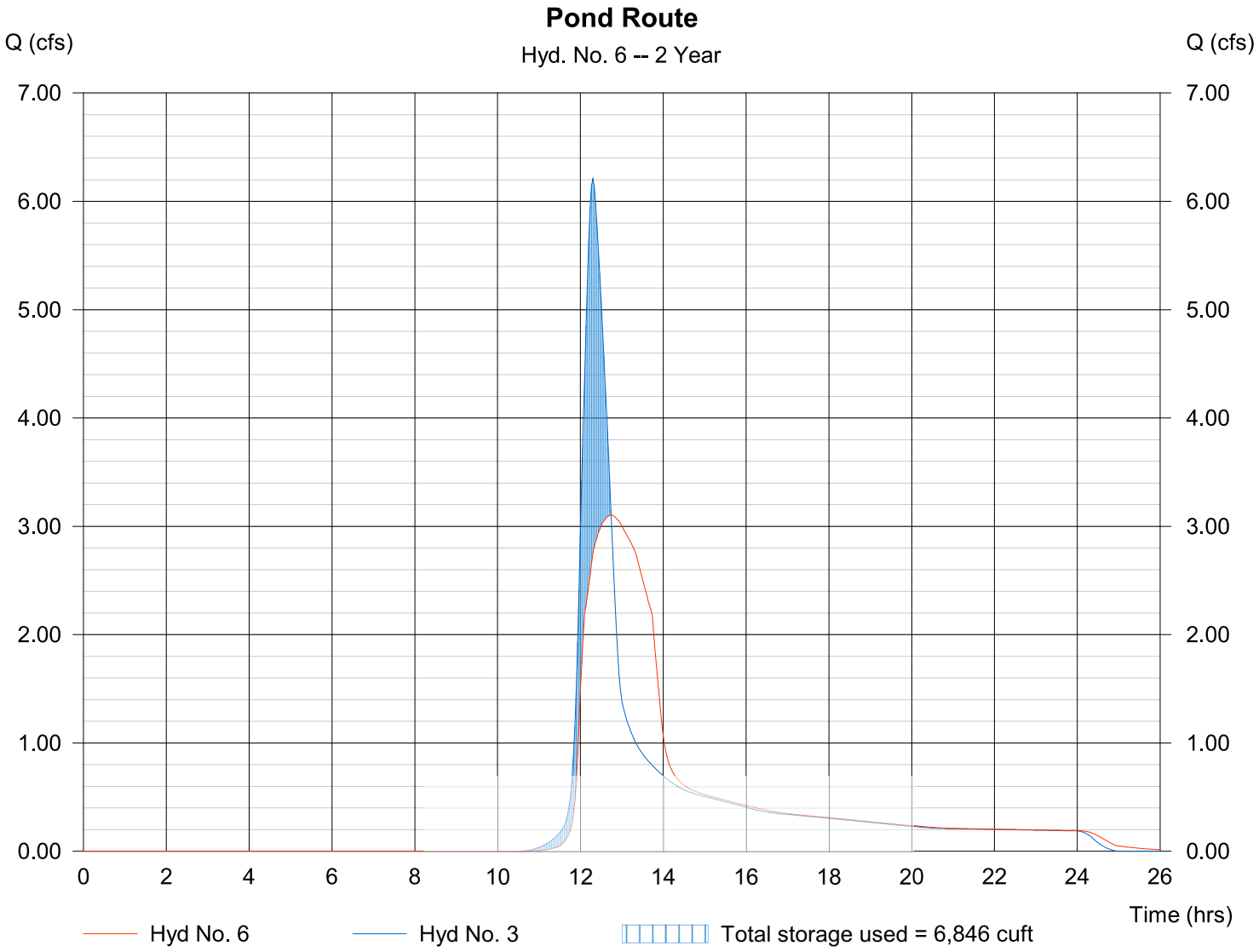
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	3.104 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.73 hrs
Time interval	=	2 min	Hyd. volume	=	31,526 cuft
Inflow hyd. No.	=	3 - Post Development (To Pond)	Max. Elevation	=	33.83 ft
Reservoir name	=	Dry Detention Pond	Max. Storage	=	6,846 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Pond No. 1 - Dry Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 31.70 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	31.70	00	0	0
1.30	33.00	2,500	1,625	1,625
1.80	33.50	6,755	2,314	3,939
2.30	34.00	10,689	4,361	8,300
2.80	34.50	11,308	5,499	13,799
3.30	35.00	11,935	5,811	19,610
3.80	35.50	12,569	6,126	25,736
4.30	36.00	13,208	6,444	32,180

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	10.00	0.00	0.00
Span (in)	= 24.00	10.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 31.70	31.70	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	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	Yes	No	No

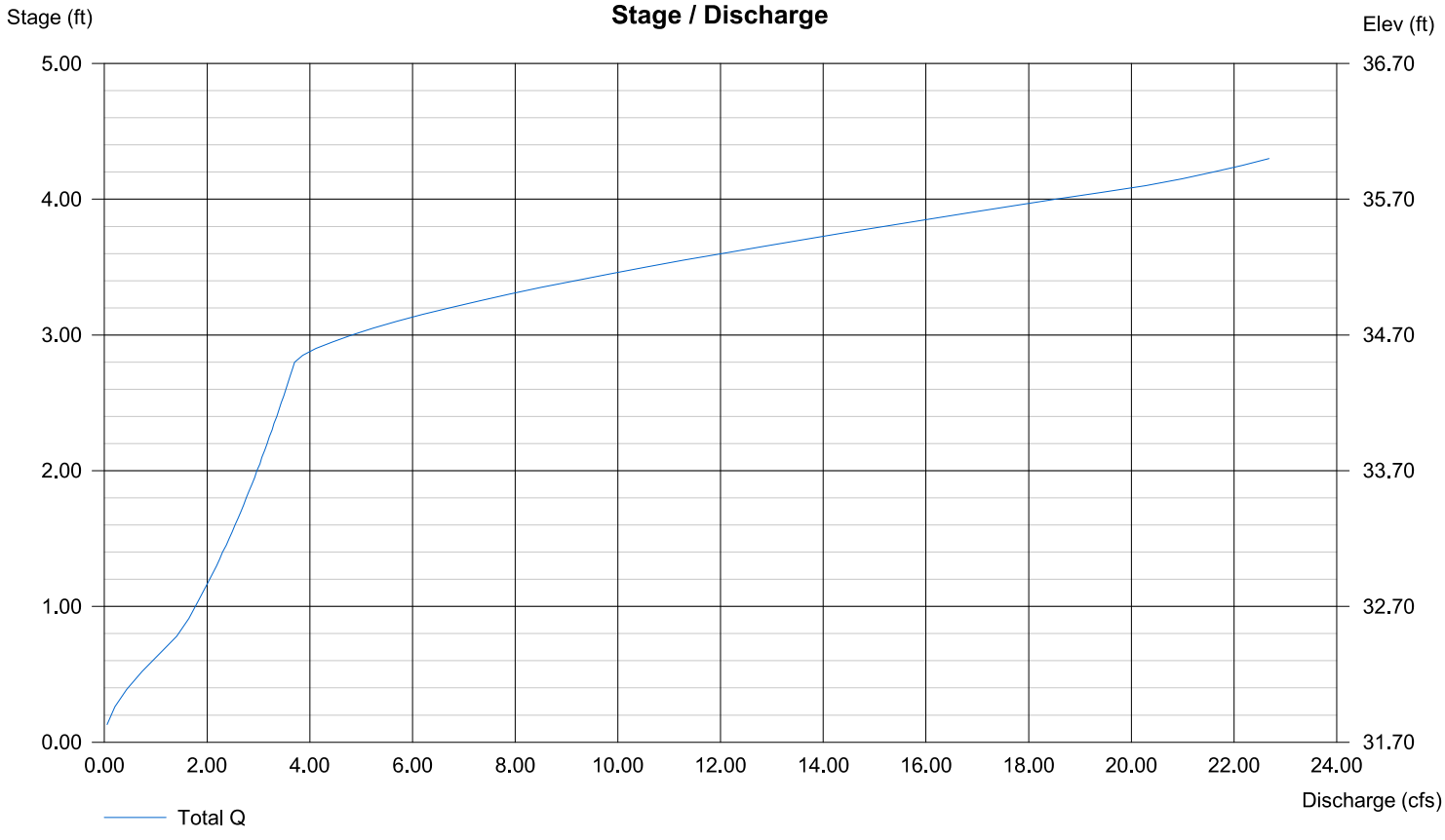
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.50	0.00	0.00	0.00
Crest El. (ft)	= 34.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	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).



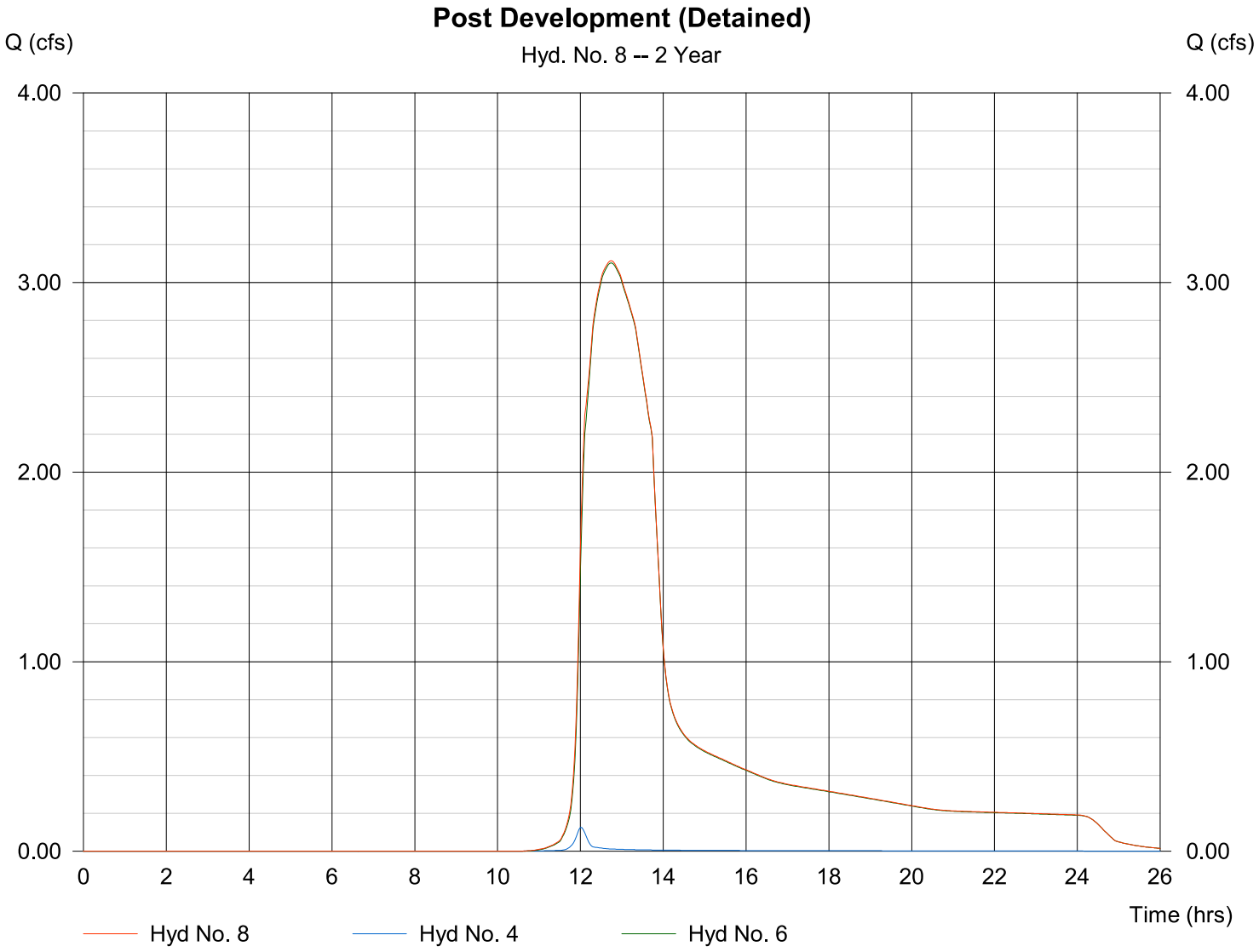
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 8

Post Development (Detained)

Hydrograph type	= Combine	Peak discharge	= 3.116 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.73 hrs
Time interval	= 2 min	Hyd. volume	= 31,856 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.060 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	SCS Runoff	6.586	2	738	34,595	------	------	------	Pre-Developed Total
3	SCS Runoff	9.822	2	738	48,443	------	------	------	Post Development (To Pond)
4	SCS Runoff	0.190	2	720	493	------	------	------	Post Development (Bypass)
6	Reservoir	3.725	2	768	48,440	3	34.51	13,882	Pond Route
8	Combine	3.741	2	768	48,933	4, 6,	------	------	Post Development (Detained)

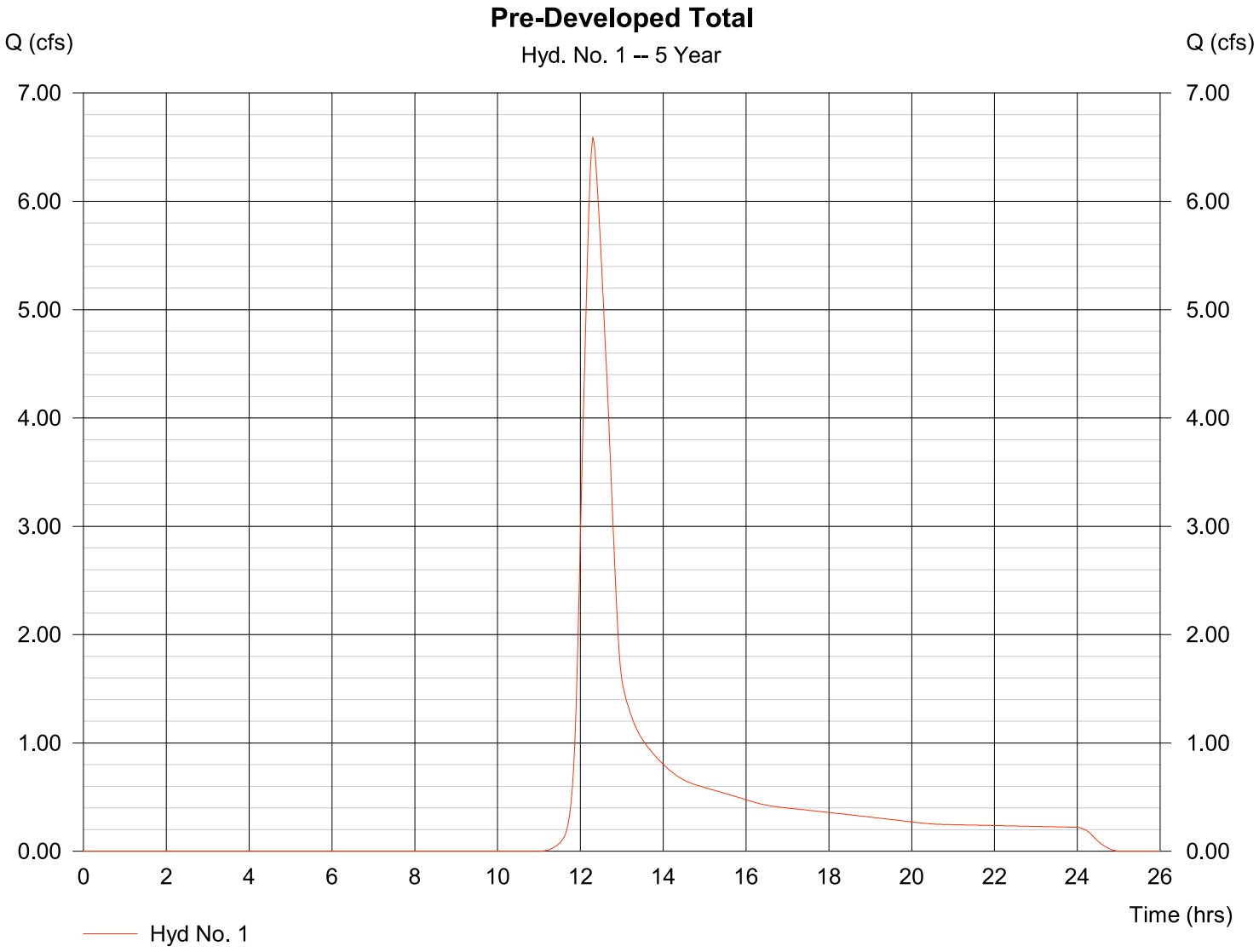
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 1

Pre-Developed Total

Hydrograph type	= SCS Runoff	Peak discharge	= 6.586 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 34,595 cuft
Drainage area	= 6.880 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.50 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 3

Post Development (To Pond)

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.822 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.30 hrs
Time interval	=	2 min	Hyd. volume	=	48,443 cuft
Drainage area	=	6.820 ac	Curve number	=	75
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	37.80 min
Total precip.	=	4.38 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

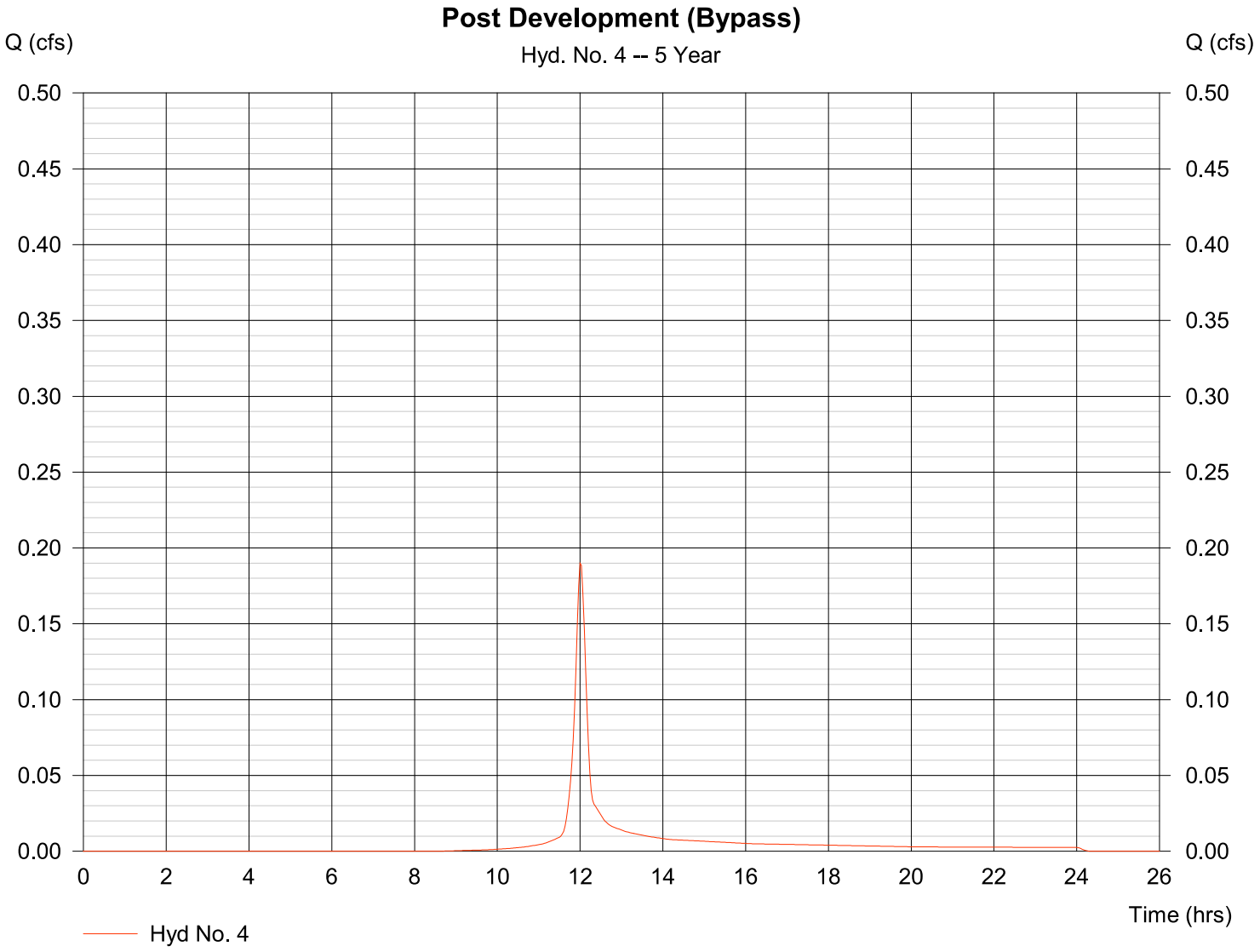
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 4

Post Development (Bypass)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.190 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 493 cuft
Drainage area	= 0.060 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

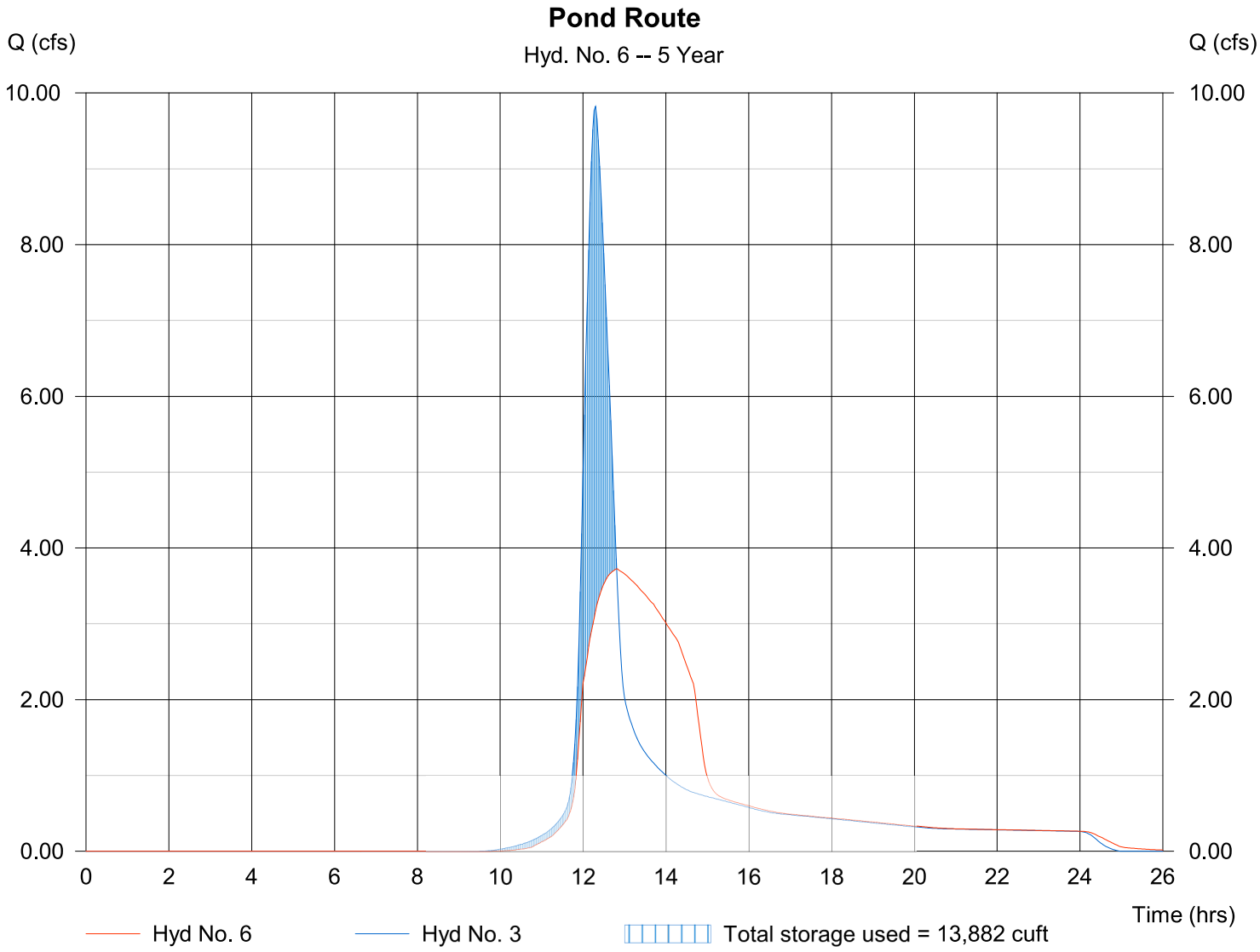
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	3.725 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.80 hrs
Time interval	=	2 min	Hyd. volume	=	48,440 cuft
Inflow hyd. No.	=	3 - Post Development (To Pond)	Max. Elevation	=	34.51 ft
Reservoir name	=	Dry Detention Pond	Max. Storage	=	13,882 cuft

Storage Indication method used.



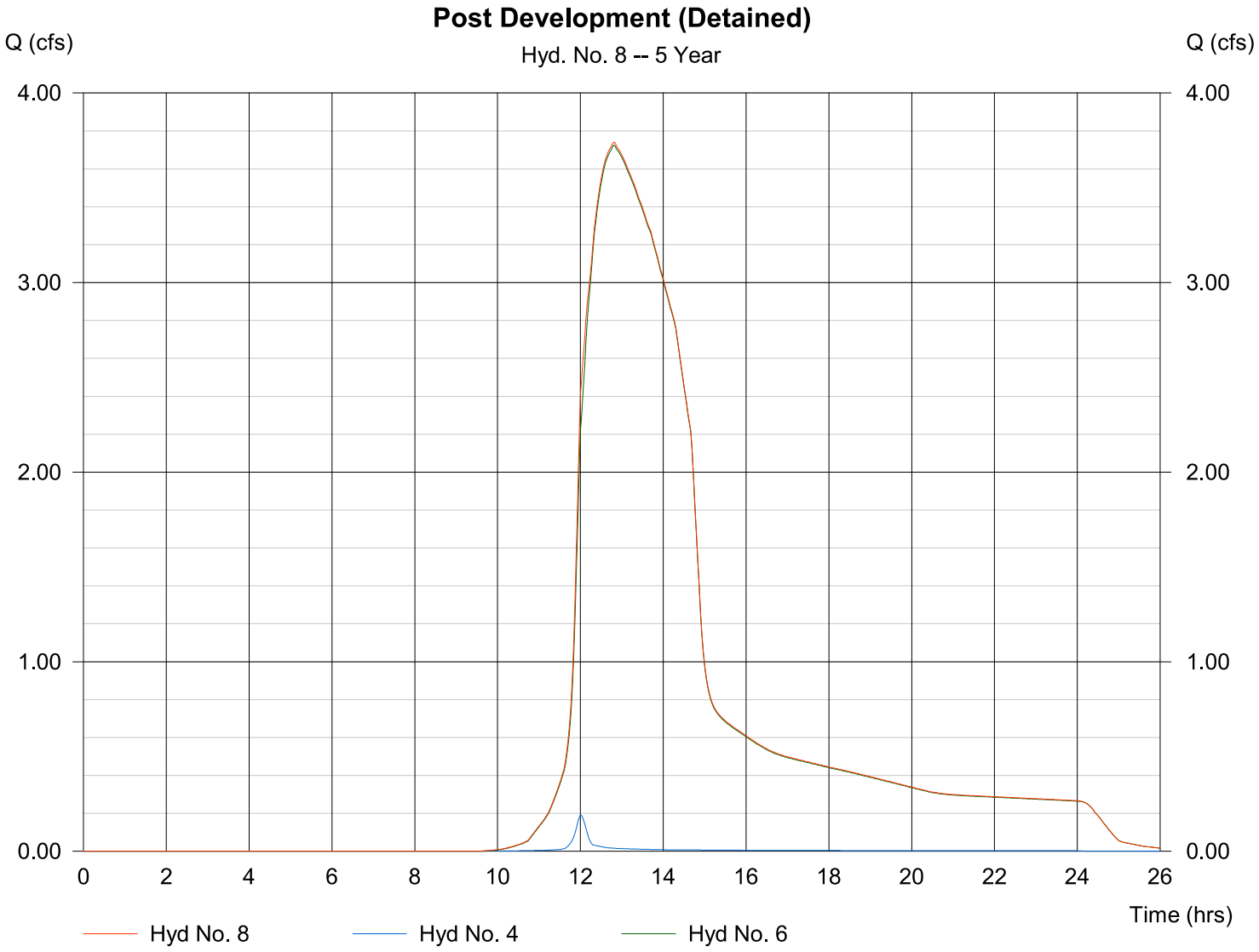
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 8

Post Development (Detained)

Hydrograph type	= Combine	Peak discharge	= 3.741 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.80 hrs
Time interval	= 2 min	Hyd. volume	= 48,933 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.060 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	SCS Runoff	9.360	2	738	47,481	------	------	------	Pre-Developed Total
3	SCS Runoff	13.00	2	738	63,458	------	------	------	Post Development (To Pond)
4	SCS Runoff	0.245	2	720	636	------	------	------	Post Development (Bypass)
6	Reservoir	6.570	2	762	63,455	3	34.89	18,282	Pond Route
8	Combine	6.592	2	762	64,091	4, 6,	------	------	Post Development (Detained)

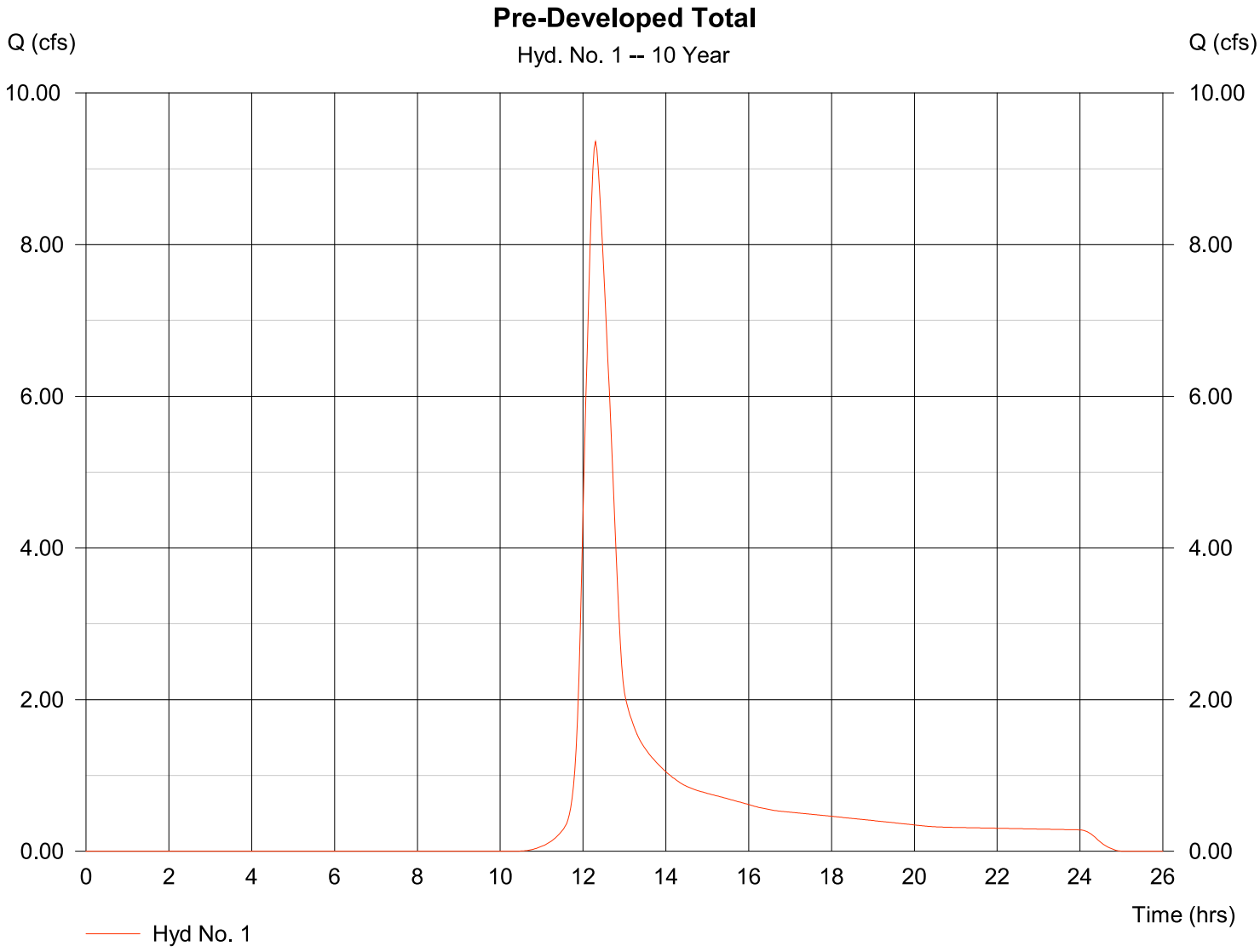
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 1

Pre-Developed Total

Hydrograph type	= SCS Runoff	Peak discharge	= 9.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 47,481 cuft
Drainage area	= 6.880 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.50 min
Total precip.	= 5.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



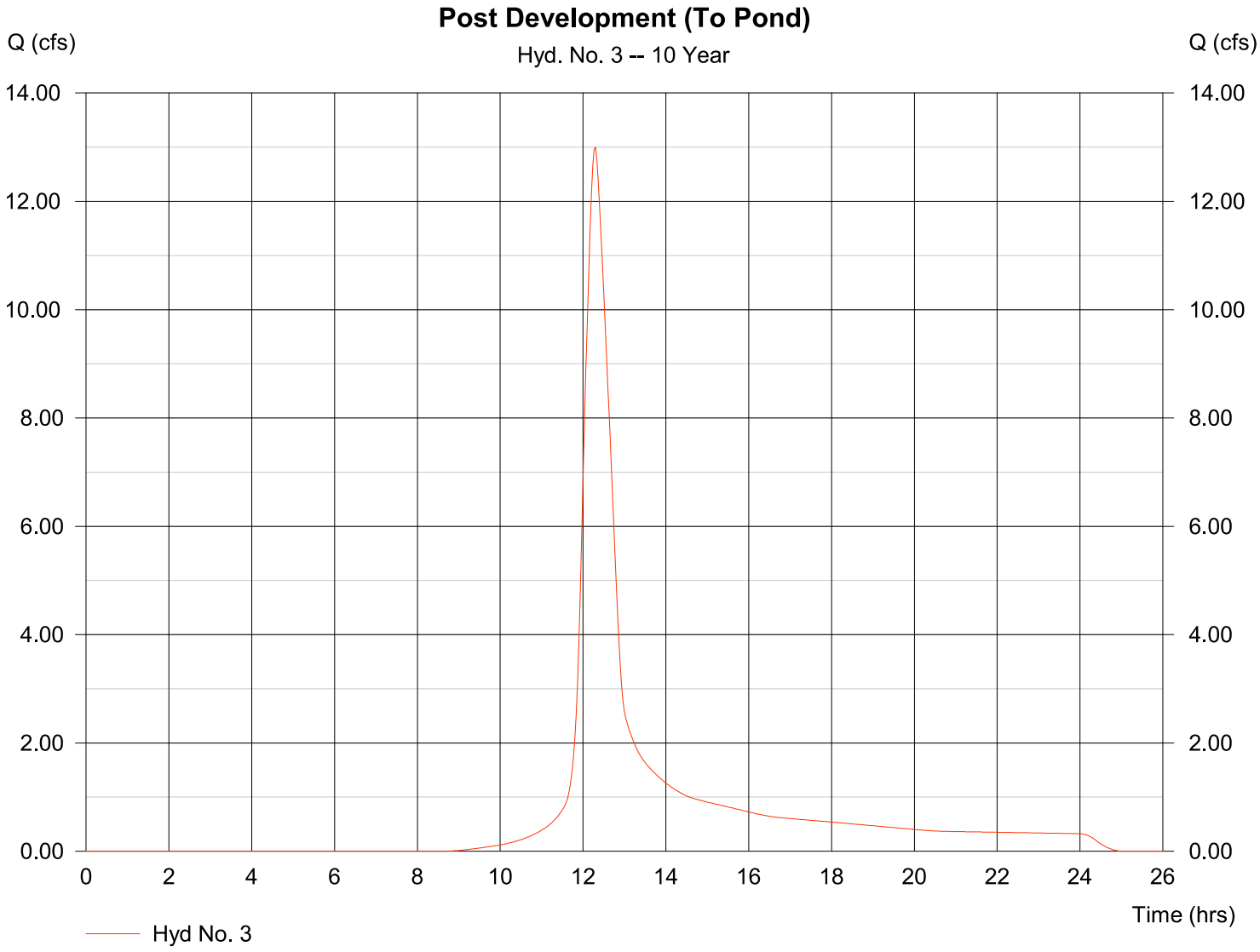
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 3

Post Development (To Pond)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.00 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 63,458 cuft
Drainage area	= 6.820 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 5.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



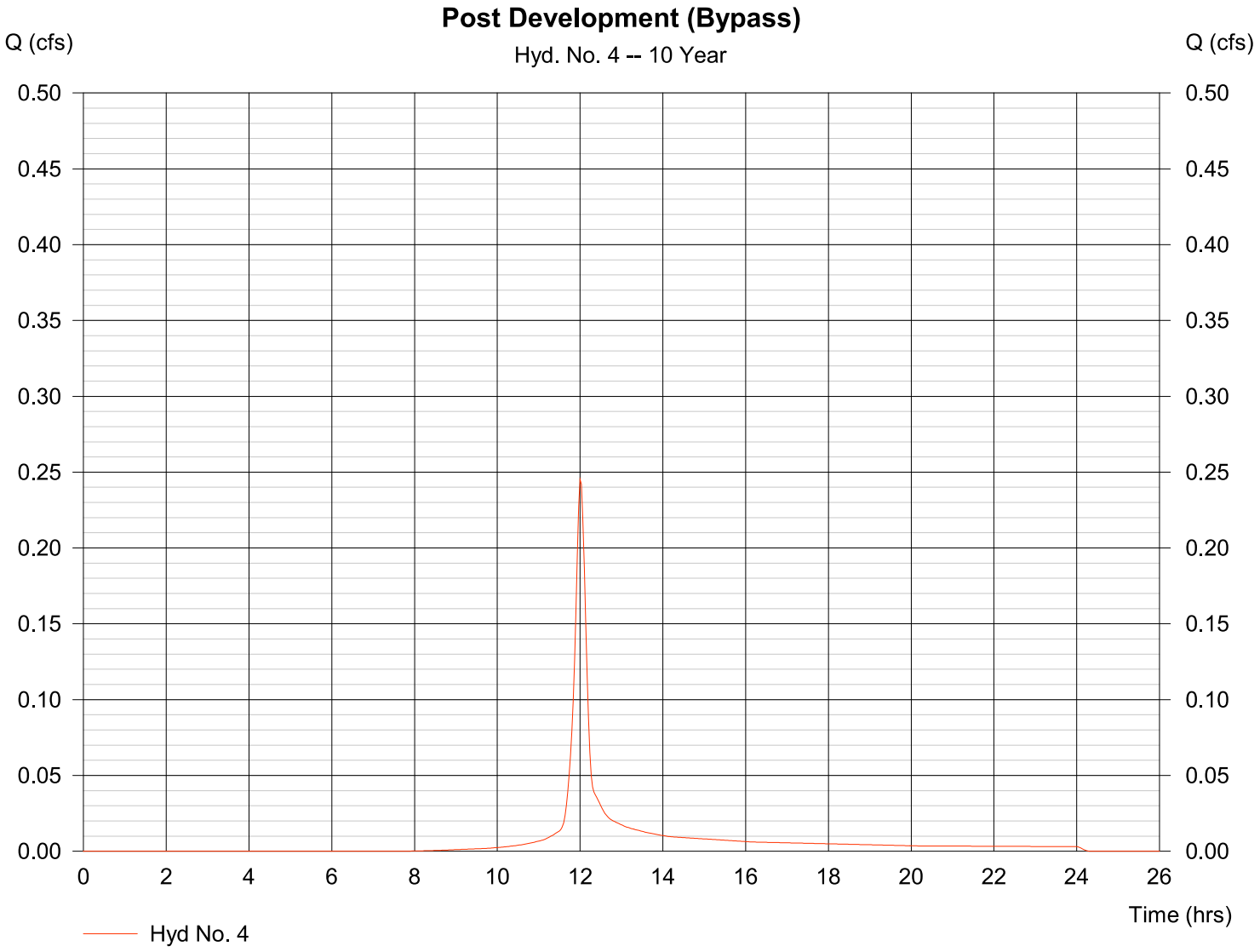
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 4

Post Development (Bypass)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.245 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 636 cuft
Drainage area	= 0.060 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

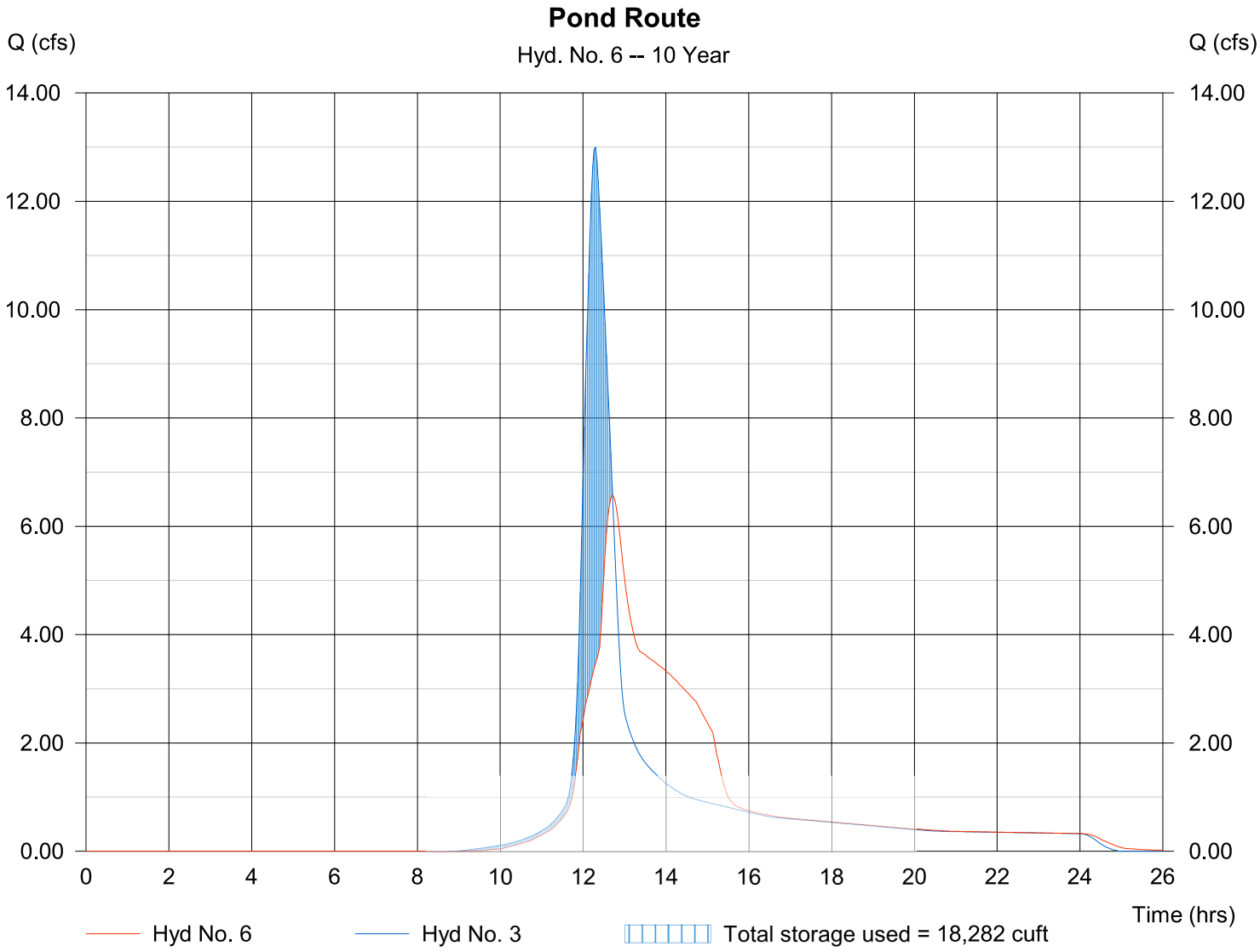
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	6.570 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.70 hrs
Time interval	=	2 min	Hyd. volume	=	63,455 cuft
Inflow hyd. No.	=	3 - Post Development (To Pond)	Max. Elevation	=	34.89 ft
Reservoir name	=	Dry Detention Pond	Max. Storage	=	18,282 cuft

Storage Indication method used.



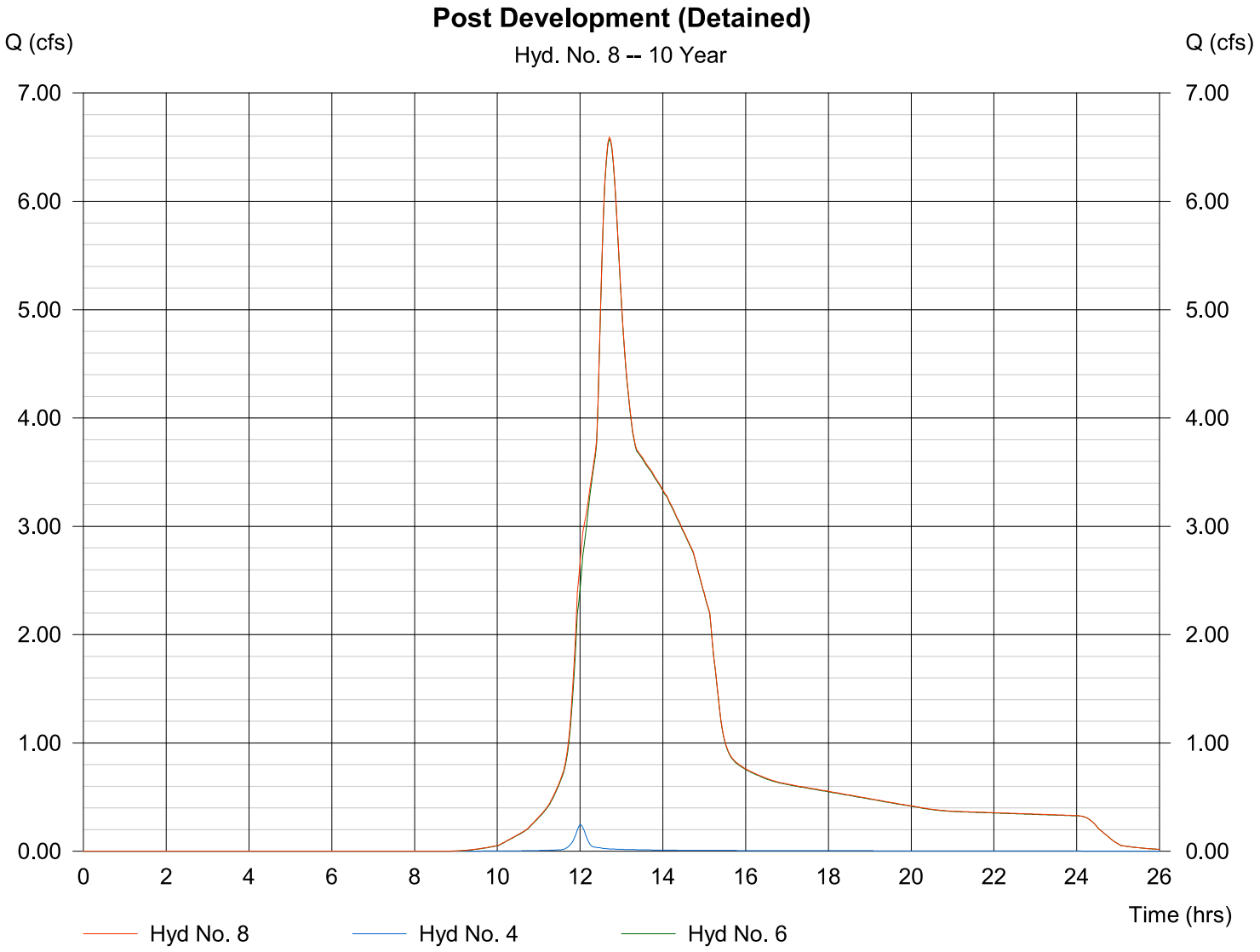
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 8

Post Development (Detained)

Hydrograph type	= Combine	Peak discharge	= 6.592 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.70 hrs
Time interval	= 2 min	Hyd. volume	= 64,091 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.060 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	SCS Runoff	13.53	2	738	66,979	------	------	------	Pre-Developed Total
3	SCS Runoff	17.60	2	736	85,488	------	------	------	Post Development (To Pond)
4	SCS Runoff	0.324	2	720	844	------	------	------	Post Development (Bypass)
6	Reservoir	11.09	2	756	85,485	3	35.24	22,521	Pond Route
8	Combine	11.12	2	756	86,328	4, 6,	------	------	Post Development (Detained)

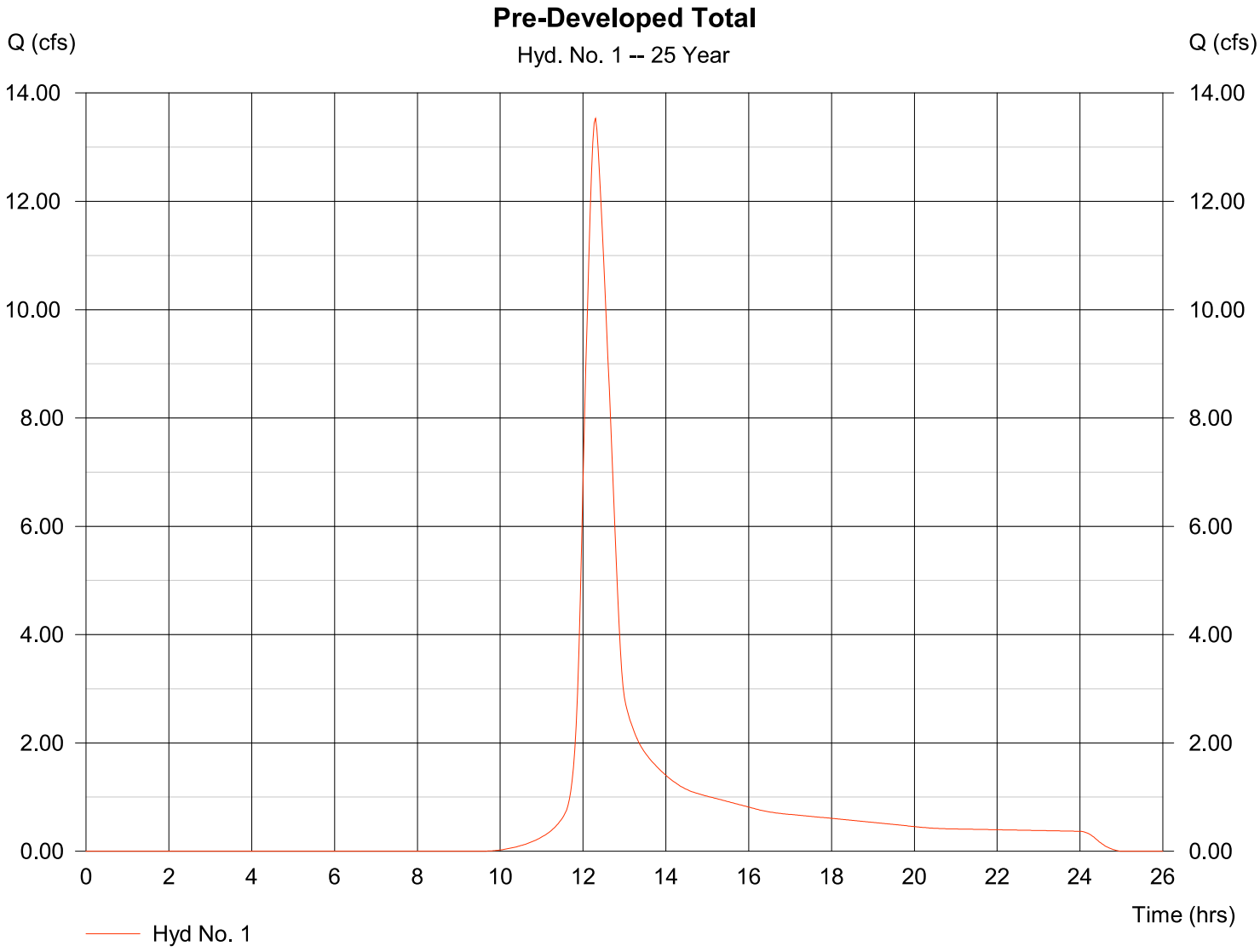
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 1

Pre-Developed Total

Hydrograph type	= SCS Runoff	Peak discharge	= 13.53 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 66,979 cuft
Drainage area	= 6.880 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.50 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



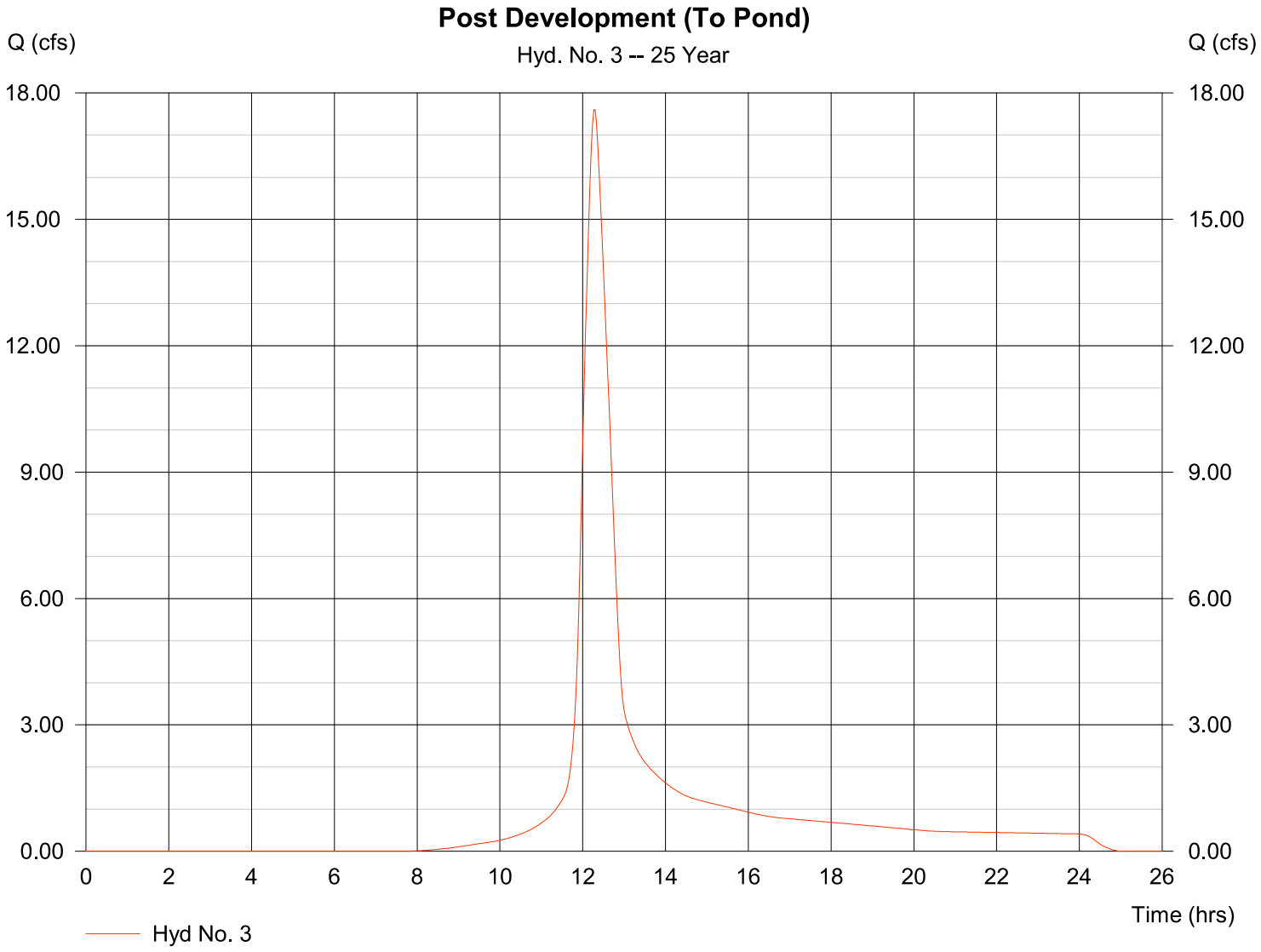
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 3

Post Development (To Pond)

Hydrograph type	= SCS Runoff	Peak discharge	= 17.60 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 85,488 cuft
Drainage area	= 6.820 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



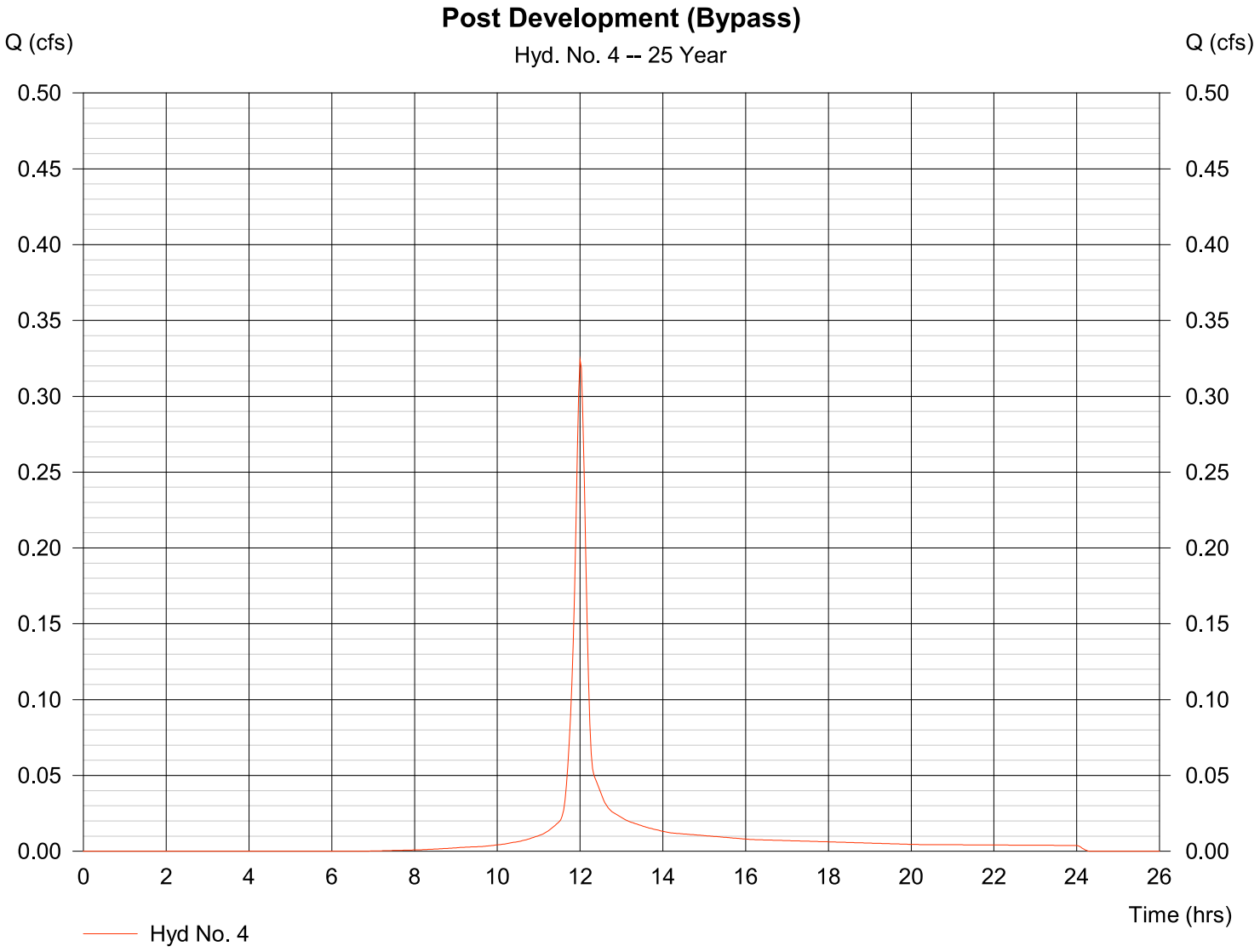
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 4

Post Development (Bypass)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.324 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 844 cuft
Drainage area	= 0.060 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

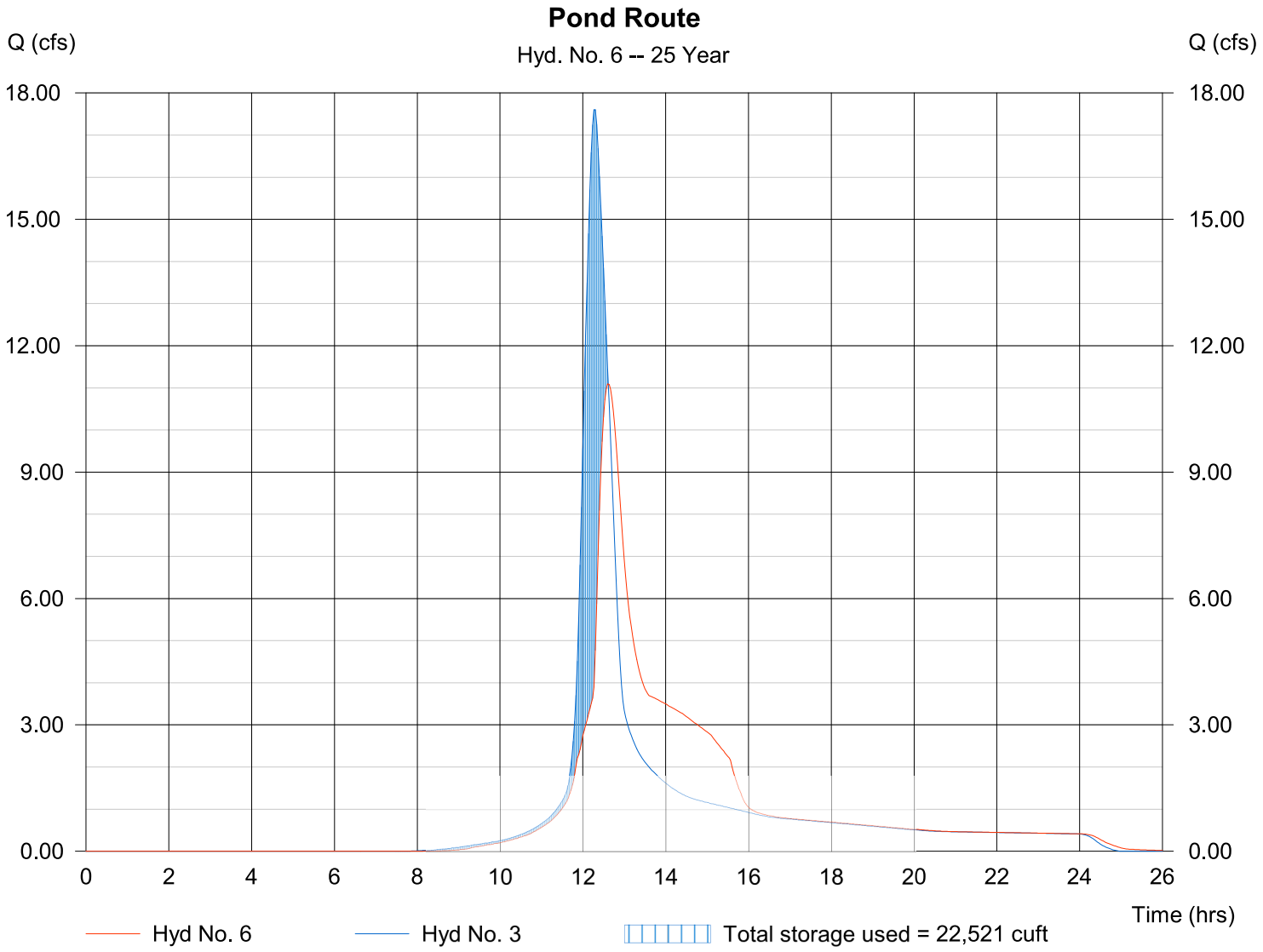
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	11.09 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	85,485 cuft
Inflow hyd. No.	=	3 - Post Development (To Pond)	Max. Elevation	=	35.24 ft
Reservoir name	=	Dry Detention Pond	Max. Storage	=	22,521 cuft

Storage Indication method used.



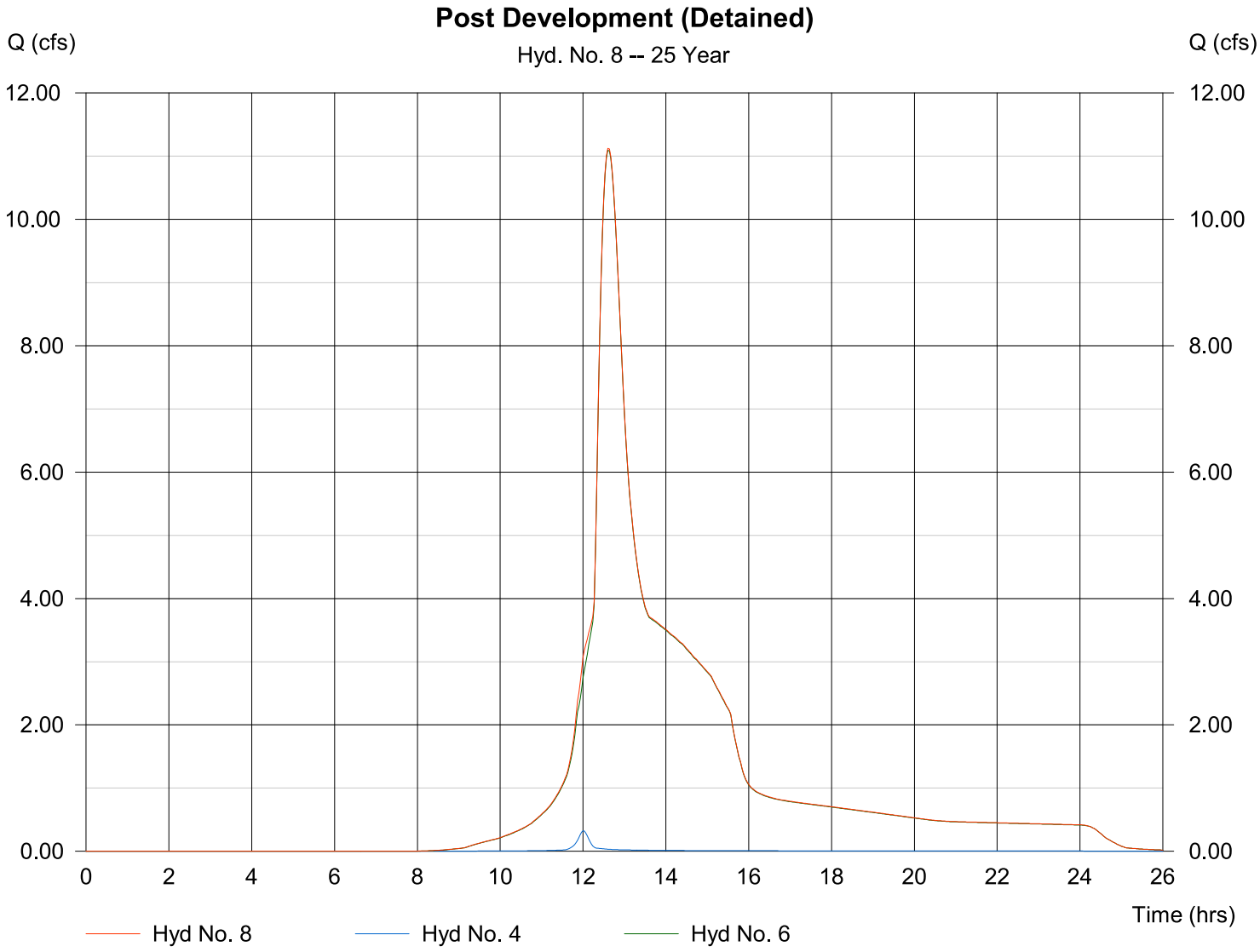
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 8

Post Development (Detained)

Hydrograph type	= Combine	Peak discharge	= 11.12 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 86,328 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.060 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	SCS Runoff	21.12	2	738	102,926	------	------	------	Pre-Developed Total
3	SCS Runoff	25.75	2	736	124,815	------	------	------	Post Development (To Pond)
4	SCS Runoff	0.461	2	720	1,211	------	------	------	Post Development (Bypass)
6	Reservoir	18.92	2	752	124,811	3	35.72	28,599	Pond Route
8	Combine	18.97	2	752	126,022	4, 6,	------	------	Post Development (Detained)

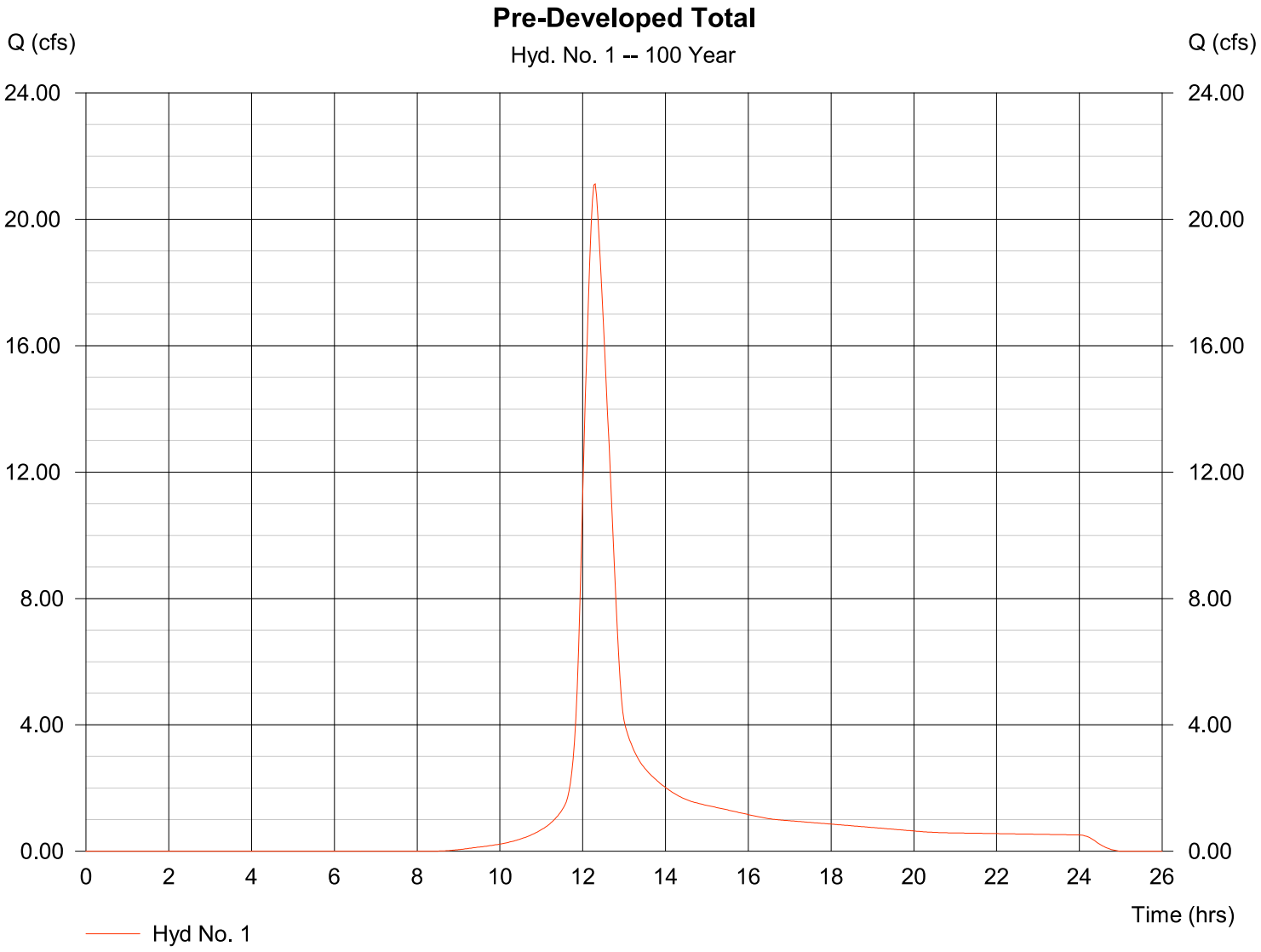
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 1

Pre-Developed Total

Hydrograph type	= SCS Runoff	Peak discharge	= 21.12 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 102,926 cuft
Drainage area	= 6.880 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 39.50 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



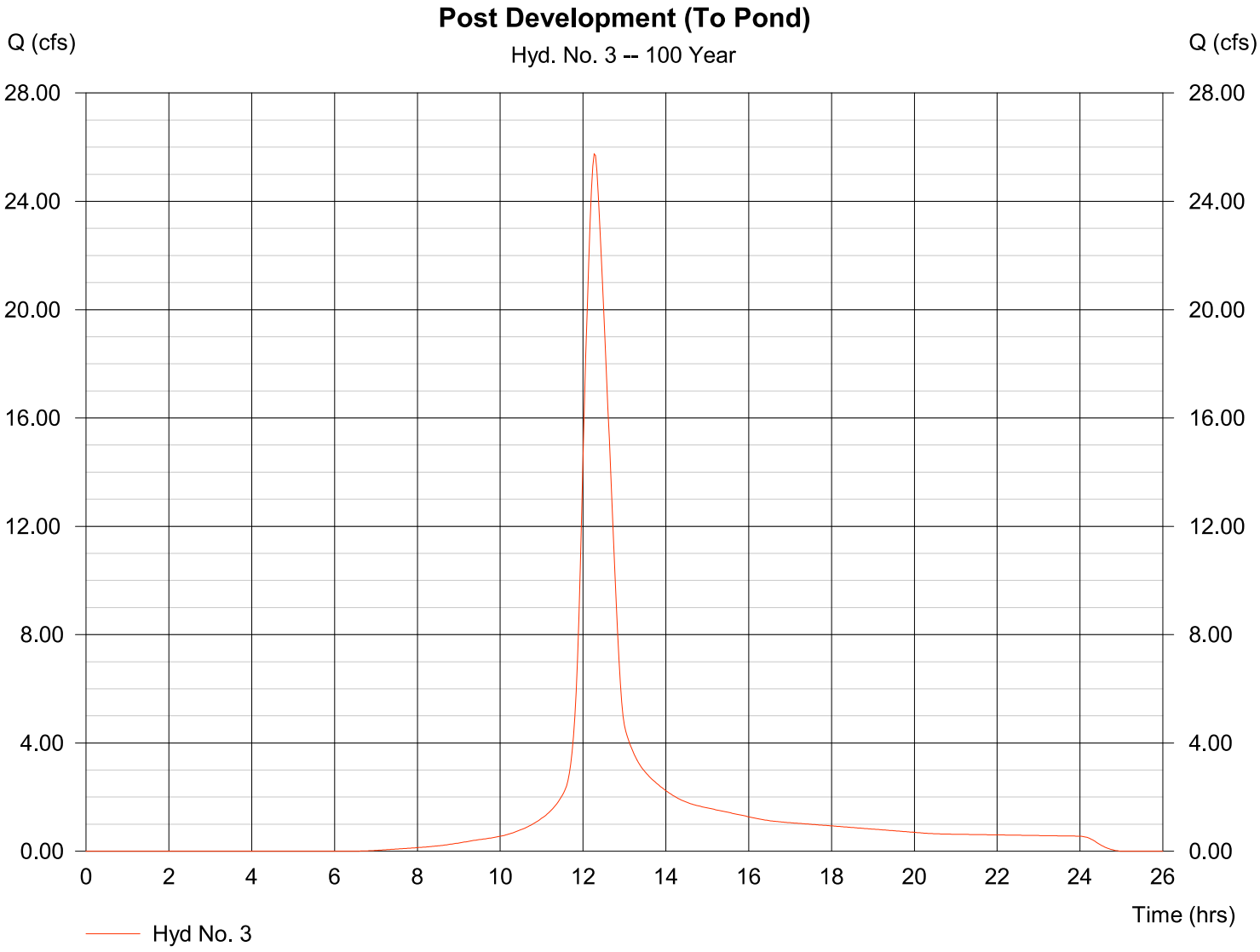
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 3

Post Development (To Pond)

Hydrograph type	= SCS Runoff	Peak discharge	= 25.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 124,815 cuft
Drainage area	= 6.820 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



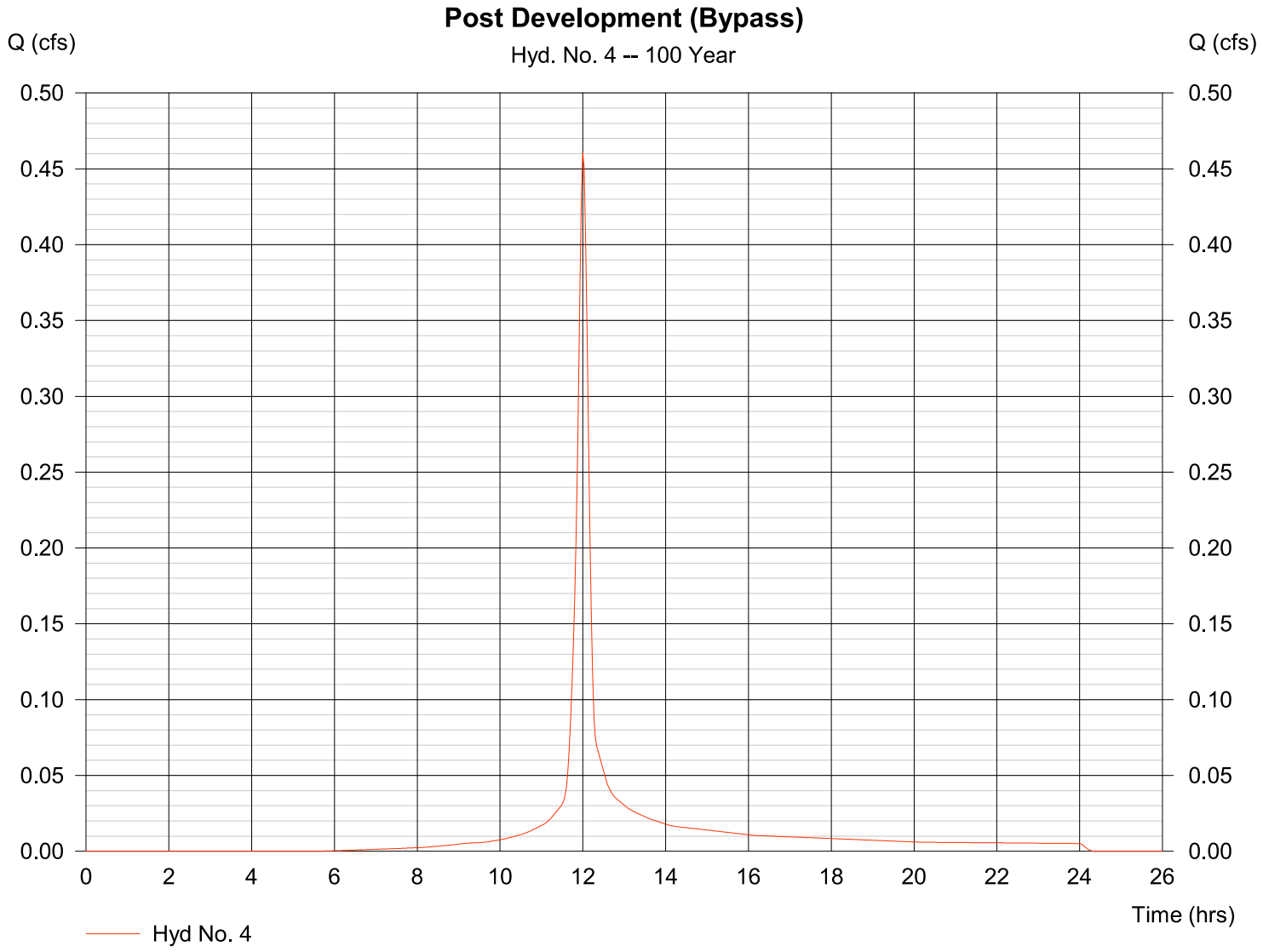
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 4

Post Development (Bypass)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.461 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,211 cuft
Drainage area	= 0.060 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

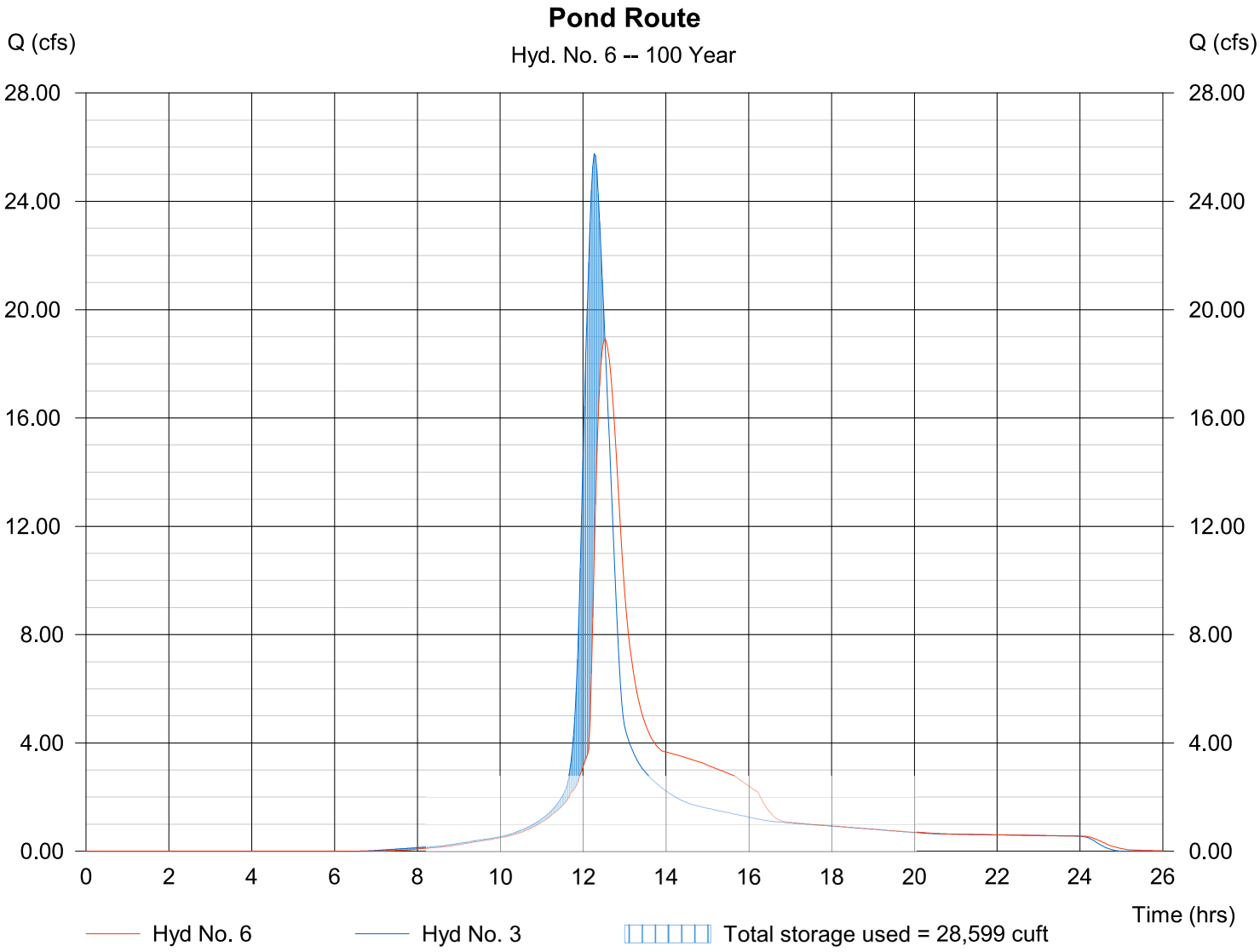
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 6

Pond Route

Hydrograph type	=	Reservoir	Peak discharge	=	18.92 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.53 hrs
Time interval	=	2 min	Hyd. volume	=	124,811 cuft
Inflow hyd. No.	=	3 - Post Development (To Pond)	Max. Elevation	=	35.72 ft
Reservoir name	=	Dry Detention Pond	Max. Storage	=	28,599 cuft

Storage Indication method used.



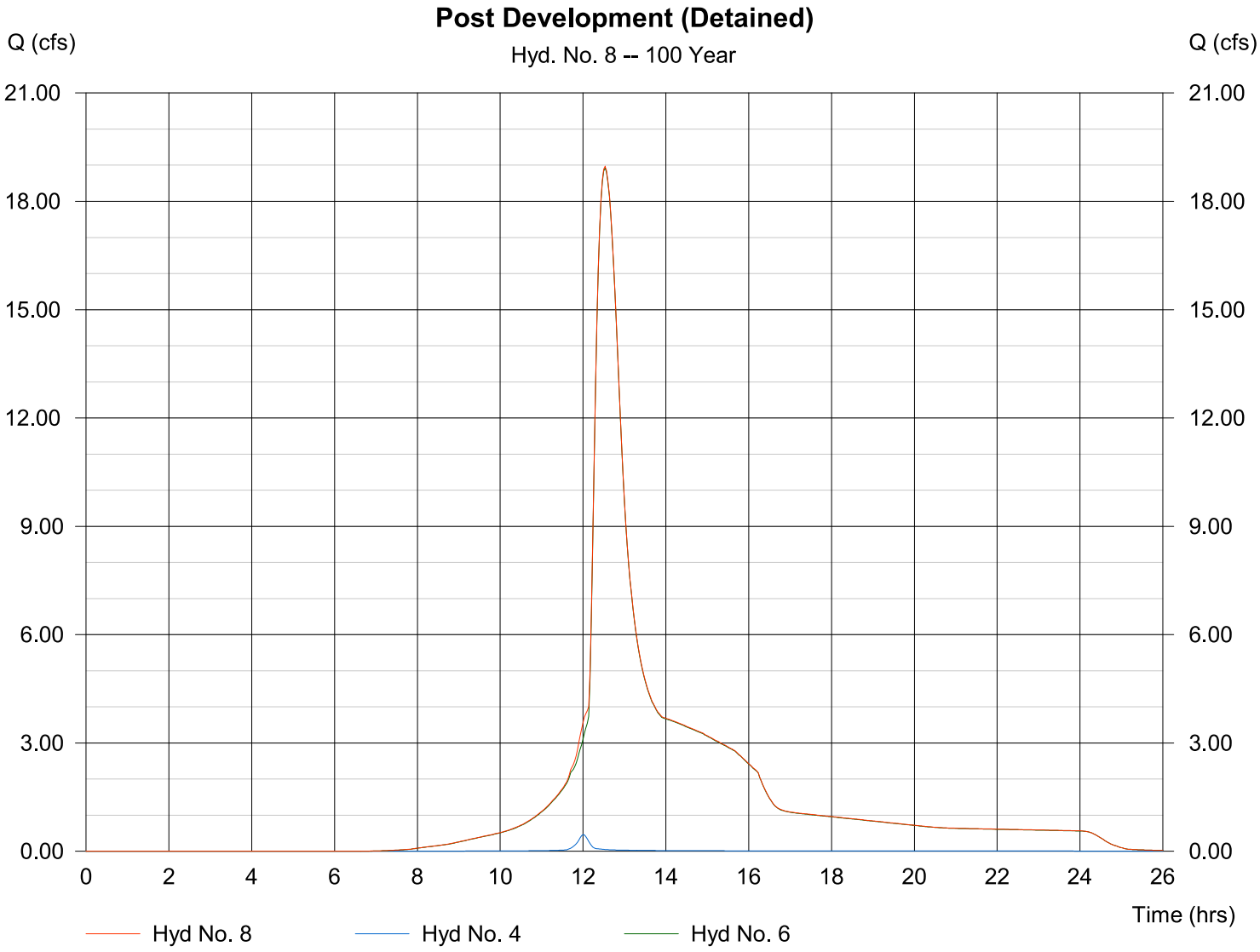
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 05 / 23 / 2024

Hyd. No. 8

Post Development (Detained)

Hydrograph type	= Combine	Peak discharge	= 18.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 126,022 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.060 ac




GREEN PACE R
64
264
96
264
WAKELON ST
Bus
64
Zebulon
OLD BUNN RD
N M C DR
W JUDD ST
N CHURCH ST
W FRANKLIN ST
Little Cr
E GANNON AVE
Alt
264
E NORTH ST
97
N POPLAR ST
W GLENN ST
W NORTH ST
WORTH HINTON RD
LAUREL LEAF RD
BRAEMAR HIGHLAND DR
WATER PLANT RD
WEDGEWOOD AVE
STRATFORD DR
E HORTON ST
E VANCE ST
W SYCAMORE ST
W HORTON ST
E BARBEE AVE
W BARBEE ST
PO
97
PONY RD
MACK TODD RD
W BARBEE ST EXD
Bus
64
TEMPLE JOHNSON RD
S ARENDELL AVE
CARROLL HEIGHTS RD
96
S WAKEFIELD ST
PERRY CURTIS RD
MISSION BELLE LN
PULLEY GORDON RD
ASHTON GLEN DR
MOSS RD
RICE RD
EARPSBORO CHAMBLEE RD
96
Morphus
Bridge
Little River
Pleasant
Grove Cem
Earpsboro

National Flood Hazard Layer FIRMette

FEMA

78°19'43"W 35°50'33"N

0 250 500 1,000 1,500 2,000 Feet 1:6,000

78°19'5"W 35°50'3"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/18/2024 at 8:32 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Wake County, North Carolina

January 18, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:732 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Wake County, North Carolina
Survey Area Data: Version 25, Oct 2, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 24, 2022—May 9, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ur	Urban land	1.1	100.0%
Totals for Area of Interest		**1.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Wake County, North Carolina

Ur—Urban land

Map Unit Setting

National map unit symbol: 2qwpc
Elevation: 70 to 1,400 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 54 to 63 degrees F
Frost-free period: 190 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Impervious layers over human-transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

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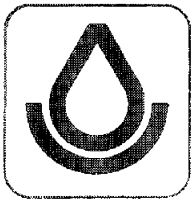
SOIL SURVEY

Wake County North Carolina



Issued November 1970

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

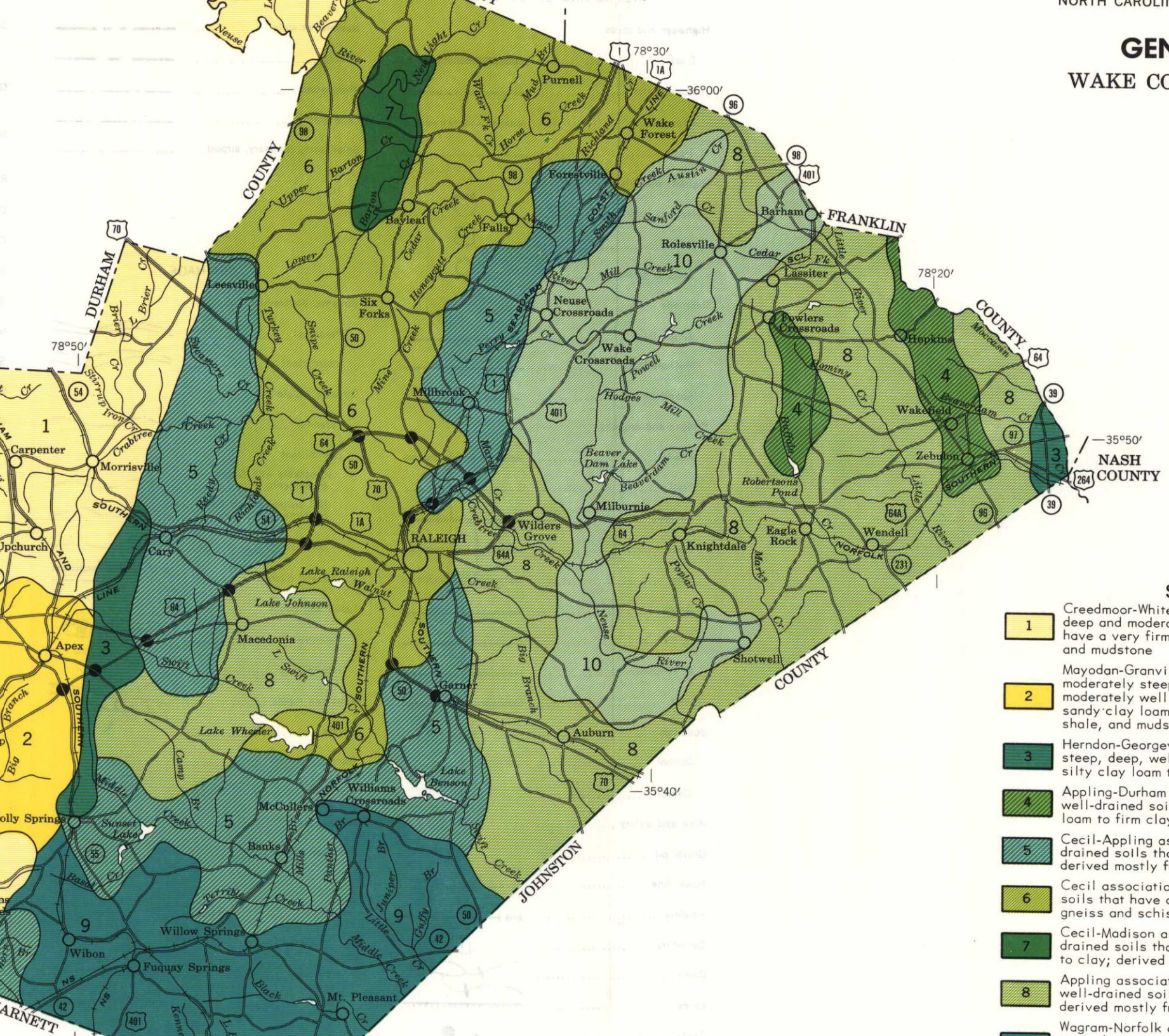
NORTH CAROLINA AGRICULTURAL EXPE

GENERAL SOIL M

WAKE COUNTY, NORTH C

Scale 1:253 440

1 0 1 2 3 4



SOIL ASSOCIATIONS

1 Creedmoor-White Store association: Gent
deep and moderately deep, moderately we
have a very firm clayey subsoil; derived f
and mudstone

2 Mayodan-Granville-Creedmoor association
moderately steep, deep or moderately dee
moderately well drained soils that have a
sandy clay loam to very firm clay; derive
shale, and mudstone

3 Herndon-Georgeville association: Gently
steep, deep, well-drained soils that have
silty clay loam to clay; derived from phyl

4 Appling-Durham association: Gently slop
well-drained soils that have a subsoil of f
loam to firm clay; derived mostly from gra

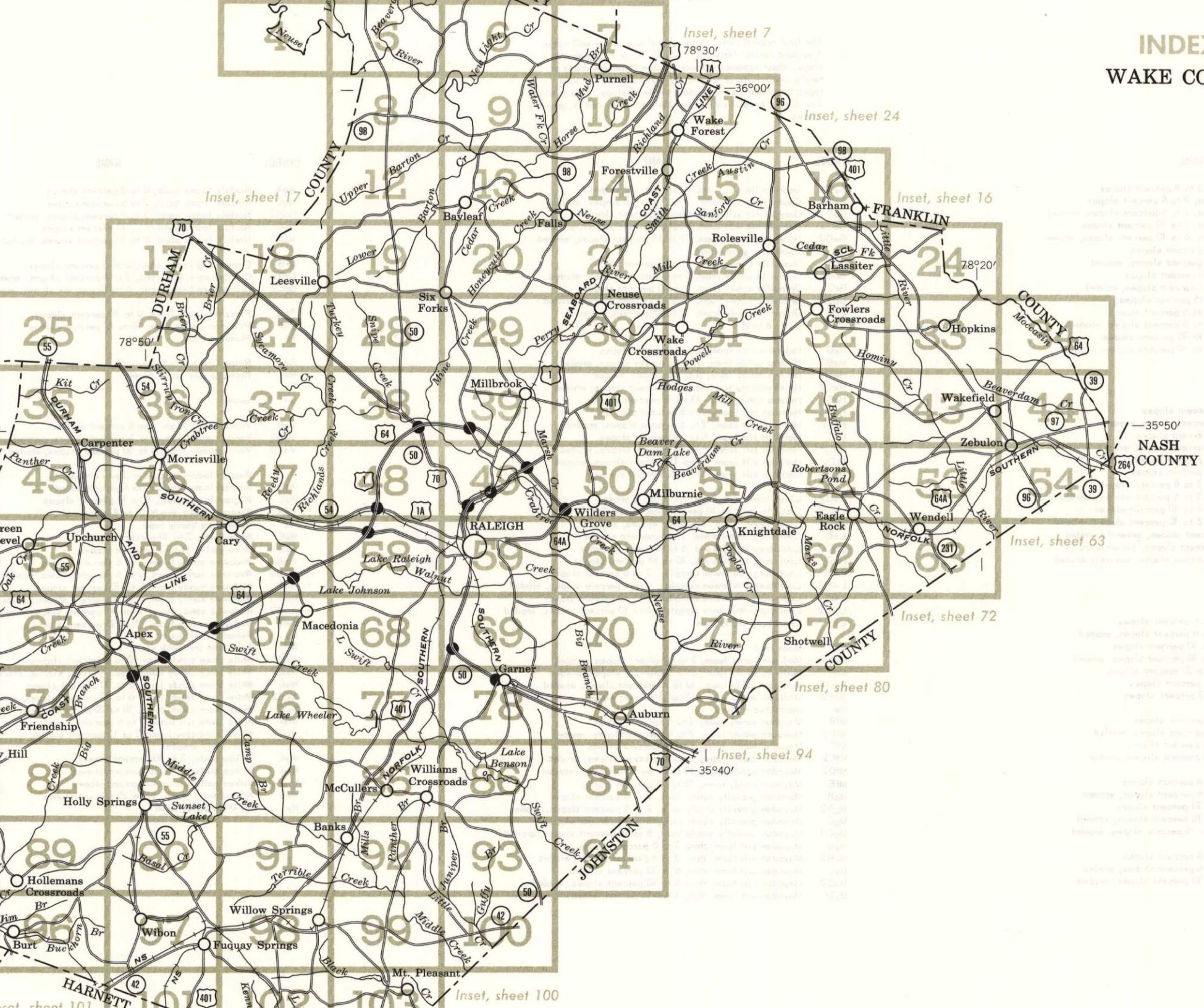
5 Cecil-Appling association: Gently slopin
drained soils that have a subsoil of firm c
derived mostly from granite, gneiss, and s

6 Cecil association: Gently sloping to stee
soils that have a subsoil of firm red clay;
gneiss and schist

7 Cecil-Madison association: Gently slopin
drained soils that have a subsoil of red, f
to clay; derived mostly from gneiss and sc

8 Appling association: Gently sloping to m
well-drained soils that have a subsoil of f
derived mostly from granite, gneiss, and s

Wagram-Norfolk association: Nearly level


INDEX TO M
WAKE COUNTY, NC
Scale 1:253
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Inset, sheet 7
Inset, sheet 24
Inset, sheet 17
Inset, sheet 16
Inset, sheet 63
Inset, sheet 72
Inset, sheet 80
Inset, sheet 94
Inset, sheet 100
78°30′
36°00′
78°50′
78°20′
35°50′
35°40′
COUNTY
DURHAM
FRANKLIN
NASH COUNTY
JOHNSTON
HARNETT
Purnell
Wake Forest
Forestville
Barham
Rolesville
Lassiter
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Lake Benson
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SOUTHERN
SEABOARD
COAST LINE
NORFOLK AND SOUTHERN


PROJECT AREA
Beaverdam Creek
Moccasin Creek
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CEMETERY
SOUTHERN
ApB2
ApC2
DuB
DuC
DuB2
LoC
LoD
Wn
Wy
Wo
Cn
Me
WmC2
WmB2
WkE
WwC
WwE
CeB2
ClC3
Gu
Au
WaB
WaC
NoA
NoB
AgB2
AgC2
AgC
ApD
VaB2
VaC2
HrB2
HrC2
HrC
HrE
GeB2
GeC2
HrD2
Ro
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