

DRAINAGE STATEMENT

for

MPB Realty, LLC

Proposed Popeyes Restaurant & Fast Food Restaurant

470 Eagle Rock Avenue (CR 611)

Block 153, Lot 38

Township of West Orange

Essex County, NJ

Prepared by:



**DYNAMIC
ENGINEERING**

1904 Main Street
Lake Como, NJ 07719
(732) 974-0198

A handwritten signature in dark ink, appearing to read 'MB', is positioned above a horizontal line.

Matthew J. Bersch, PE
NJ Professional Engineer License #54522

October 2022
DEC# 1021-99-025

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I. Drainage Statement

This Drainage Statement has been prepared to define and analyze the stormwater drainage conditions that would occur as a result of the improvements to Block 153, Lot 38, as shown on the Township of West Orange Tax Map Sheet No. 84, located in the Township of West Orange, Essex County, New Jersey. The subject site consists of 1.05 acres (45,713 SF) and is located at 470 Eagle Rock Avenue.

Under existing conditions, the site is developed as a restaurant with associated parking, landscaping and lighting. The existing development has an impervious coverage of 88.3% (36,177 SF) and is located in the B-2 – General Business Zone. The proposed development consists of the demolition of the existing restaurant and the construction of 2,537 SF Popeyes fast-food restaurant with a drive-thru and a second approximately 2,800 SF fast-food restaurant with a drive-thru. The second tenant is still to be confirmed. Additional site amenities include parking, landscaping, lighting and trash enclosures. As a result of the proposed development, the total impervious surface area will be decreased by 3,482 SF, resulting in a proposed impervious coverage of 71.5% (32,695 SF).

Based upon the fact that the proposed improvements will result in more than one (1) acre of land disturbance, this project is classified as a “major development” and is subject to compliance with the Stormwater Regulations set forth in NJAC 7:8. However, the project is reducing motor vehicle surface area and impervious coverage from existing to proposed conditions. As such, per NJAC 7:8-5.5, the project is not required to meet the stormwater runoff quality standards as the motor vehicle surface area onsite will not be increased by more than ¼ acre from existing to proposed conditions. However, the site has been designed to meet the stormwater runoff quantity and groundwater recharge standards set forth by the Township of West Orange Land Development Ordinance and NJAC 7:8. Per NJAC 7:8-5.6(b).1, the stormwater runoff quantity requirements are met through demonstration that the post-construction runoff hydrographs for the 2, 10- and 100-year storm events do not exceed at any point in time, the pre-construction runoff hydrographs for the same storm events. Per NJAC 7:8-5.4(b).1.i, the groundwater recharge requirements are met through demonstration that greater than one hundred (100) percent of the average annual pre-construction groundwater recharge volume for the site is being maintained, due to the reduction in impervious coverage as a result of the proposed development.

In existing conditions, a majority of the stormwater runoff from the area to be disturbed is conveyed via overland flow to the proposed onsite inlets which connect to the existing stormwater infrastructure within Rosney Terrace. Stormwater runoff from Rosney Terrace ultimately discharges into the existing stormwater infrastructure within Eagle Rock Avenue. The remaining stormwater runoff from the site discharges directly to the existing inlet along Eagle Rock Avenue via overland flow. As such, one point of analysis can be considered for the overall development.

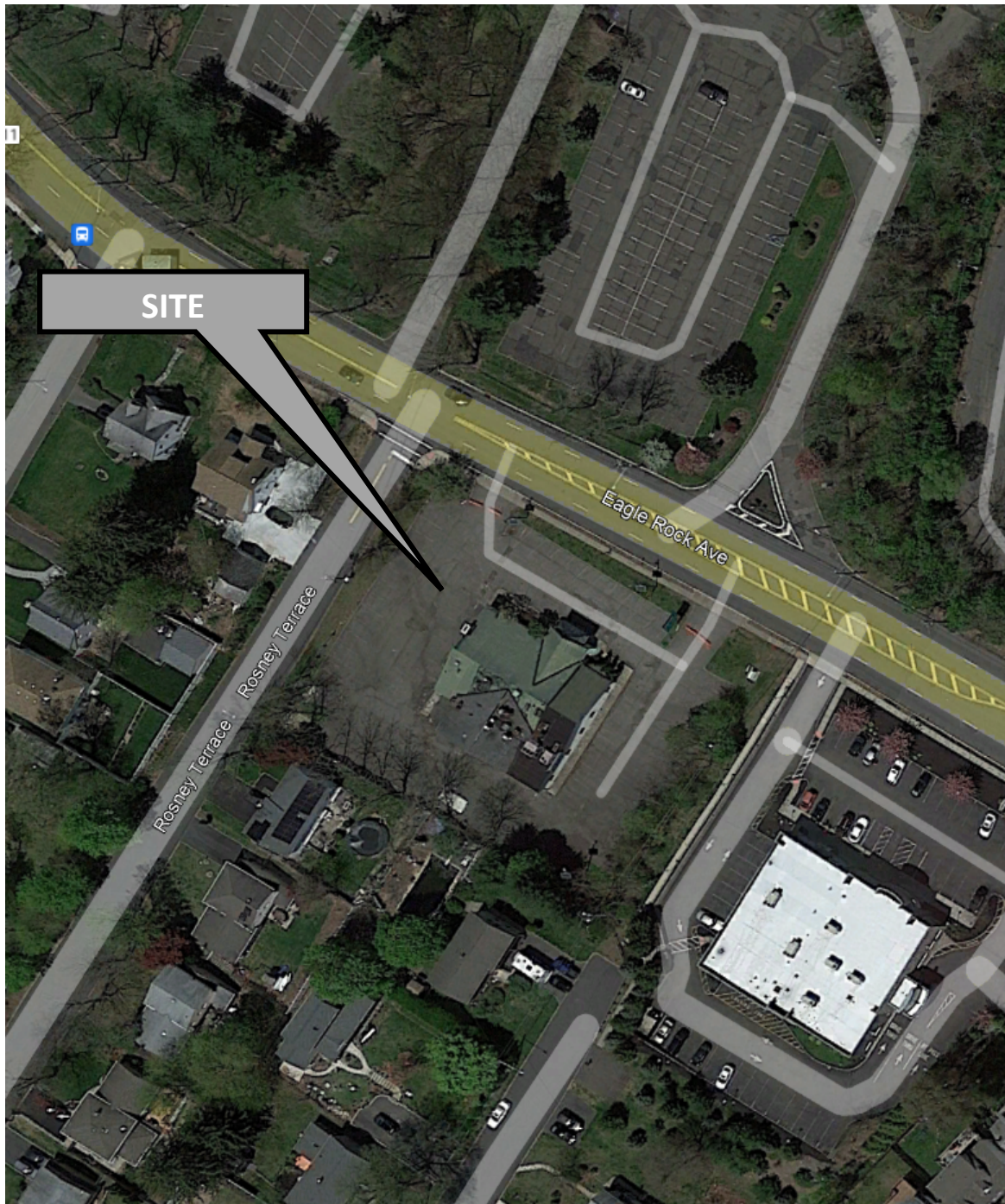
Stormwater runoff resulting from the proposed improvements has been designed to maintain existing drainage patterns. Three additional inlets are proposed within the site to assist in collecting stormwater

runoff from impervious areas, which are routed via 12" reinforced concrete pipes to the existing inlet to the north of the site. Due to the reduction in impervious coverage, the peak discharge runoff rates for the 2-, 10- & 100-year design storms have been reduced. As such, there shall be no adverse impacts to the properties located upstream and downstream of the site.

In conclusion, the proposed project has been designed to ensure safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns or adjacent properties. We anticipate that the proposed project will not significantly impact the existing drainage infrastructure located within the surrounding area.

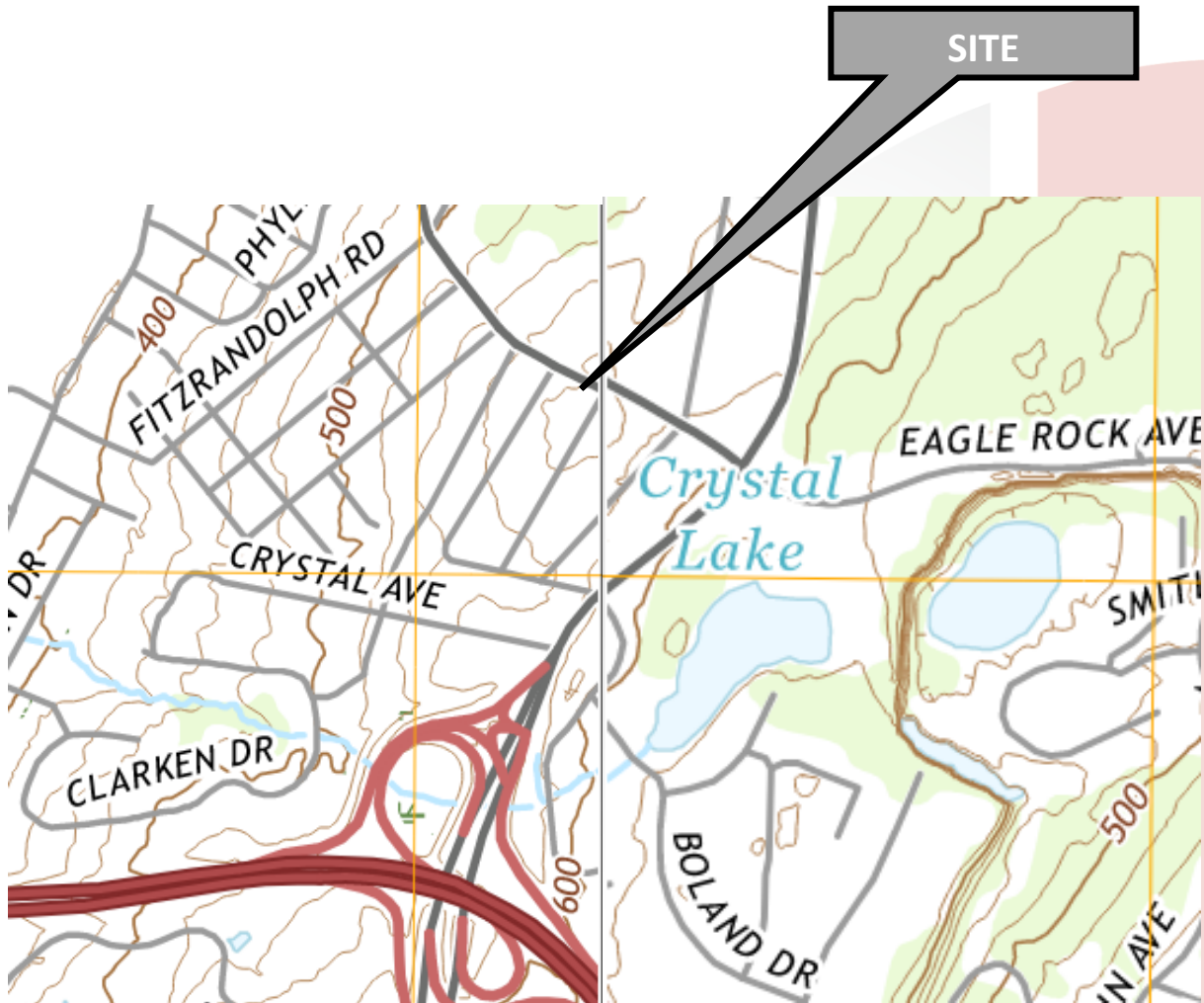
APPENDIX

LOCATION MAP



Location Map

USGS MAP



USGS Map

NRCS WEB SOIL SURVEY

Hydrologic Soil Group—Essex County, New Jersey



Map Scale: 1:1,010 if printed on A landscape (11" x 8.5") sheet.

0 10 20 40 60 Meters

0 45 90 180 270 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

10/29/2021
Page 1 of 4

MAP LEGEND**Area of Interest (AOI)**
 Area of Interest (AOI)
Soils**Soil Rating Polygons**

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

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 1:12,000.

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: Essex County, New Jersey
Survey Area Data: Version 17, Aug 30, 2021

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

Date(s) aerial images were photographed: May 9, 2020—Oct 15, 2020

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BouC	Boonton - Urban land, Boonton substratum complex, 8 to 15 percent slopes	C	1.3	61.0%
URBONB	Urban land, Boonton substratum, 0 to 8 percent slopes		0.8	39.0%
Totals for Area of Interest			2.1	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TIME OF CONCENTRATION (TC) CALCULATIONS



1904 Main Street, Lake Como, NJ 07719
(732) 974-0198

Date: 10/21/2022
Project: Proposed Popeyes & Fast Food Restaurant
Project No: 1021-99-025

Calculated By: DG
Checked By: MB

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Existing
Drainage Area: Site

• Sheet Flow :

1. Surface Description
2. Manning's Roughness Coefficient, n
3. Flow Length, L { total $L \leq 100$ ft }
4. Two-Year 24-hour Rainfall, p_2 for ... Essex County
5. Land Slope, s (ft/ft)
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$

AB				
Smooth Surfaces				
0.011				
100.0 ft				
3.44 in				
0.022 ft/ft				
0.019 hr	+	0.000 hr	+	0.000 hr = 0.019 hr

• Shallow Concentrated Flow :

7. Surface Description
8. Flow Length, L
9. Watercourse Slope, s
10. Average velocity, V { see Figure 3.1 }
11. Travel Time, $T_t = \frac{L}{3600 V}$

BC				
Paved				
94.0 ft				
0.462 ft/ft				
13.82 ft/s				
0.002 hr	+	0.000 hr	+	0.000 hr = 0.002 hr

• Channel Flow :

12. Pipe Diameter, D
13. Cross-Sectional Flow Area, A
14. Wetted Perimeter, p_w
15. Hydraulic Radius, $r = A / p_w$
16. Channel Slope, s
17. Pipe Material
18. Manning's Roughness Coefficient, n
19. Velocity, $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$
20. Flow Length, L
21. Travel Time, $T_t = \frac{L}{3600 V}$
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }

0.000 hr	+	0.000 hr	+	0.000 hr = 0.000 hr
				0.021 hr
				1.2 min



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Calculated By: DG
Checked By: MB

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Proposed
Drainage Area: Site

• Sheet Flow :

1. Surface Description
2. Manning's Roughness Coefficient, n
3. Flow Length, L { total $L \leq 100$ ft }
4. Two-Year 24-hour Rainfall, p_2 for .. Essex County ..
5. Land Slope, s (ft/ft)
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$

AB					
Smooth Surfaces					
0.011					
100.0 ft					
3.44 in		3.44 in		3.44 in	
0.024 ft/ft					
0.018 hr	+	0.000 hr	+	0.000 hr	=

• Shallow Concentrated Flow :

7. Surface Description
8. Flow Length, L
9. Watercourse Slope, s
10. Average velocity, V { see Figure 3.1 }
11. Travel Time, $T_t = \frac{L}{3600 V}$

BC					
Paved					
111.0 ft					
0.031 ft/ft					
3.60 ft/s					
0.009 hr	+	0.000 hr	+	0.000 hr	=

• Channel Flow :

12. Pipe Diameter, D
13. Cross-Sectional Flow Area, A
14. Wetted Perimeter, p_w
15. Hydraulic Radius, $r = A / p_w$
16. Channel Slope, s
17. Pipe Material
18. Manning's Roughness Coefficient, n
19. Velocity, $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$
20. Flow Length, L
21. Travel Time, $T_t = \frac{L}{3600 V}$
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }

CD					
12 in					
0.785 sf					
3.1 ft					
0.3 ft					
0.035 ft/ft					
RCP					
0.013					
8.46 ft/s					
50.0					
0.002 hr	+	0.000 hr	+	0.000 hr	=

0.028 hr
1.7 min

RUNOFF CURVE NUMBER (CN) CALCULATIONS – EXISTING



DYNAMIC ENGINEERING

EXISTING DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Proposed Popeye's & Fast Food Restaurant
 Job #: 1021-99-025
 Location: West Orange, NJ

Computed By: DG
 Checked By: MB
 Date: 10/21/2022

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG B - Open Space Area (acre)	HSG B - Open Space Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
Study Area Site	0.84	36,782	98	0.07	3,045	61	0.14	5,966	74	70	0.21	1.05	6
Total	0.84	36,782		0.07	3,045		0.14	5,966			0.21	1.05	

Per County Soil Survey -	URBONB	HSG	B	Soil	Urban Land, Boonton substratum, 0 to 8 percent slopes
Per County Soil Survey -	BouC	HSG	C	Soil	Boonton - Urban Land, Boonton substratum complex, 8 to 15 percent slopes

Description	Runoff Curve Number (CN) (HSG B)	Runoff Curve Number (CN) (HSG C)
Impervious Surface	98	98
Open Space (lawn) (good)	61	74

RUNOFF CURVE NUMBER (CN) CALCULATIONS – PROPOSED



**DYNAMIC
ENGINEERING**

PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Proposed Popeyes & Fast Food Restaurant Computed By: DG
 Job #: 1021-99-025 Checked By: MB
 Location: West Orange, NJ Date: 10/21/2022

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
Study Area Site	0.76	33,296	98	0.18	8,035	74	0.10	4,321	80	76	0.28	1.05	6
Total	0.76	33,296		0.18	8,035		0.10	4,321			0.28	1.05	

Per County Soil Survey -	BouC	HSG	C	Soil	Boonton - Urban Land, Boonton substratum complex, 8 to 15 percent slopes
Per County Soil Survey -	URBONB	HSG	D	Soil	Urban Land, Boonton substratum, 0 to 8 percent slopes

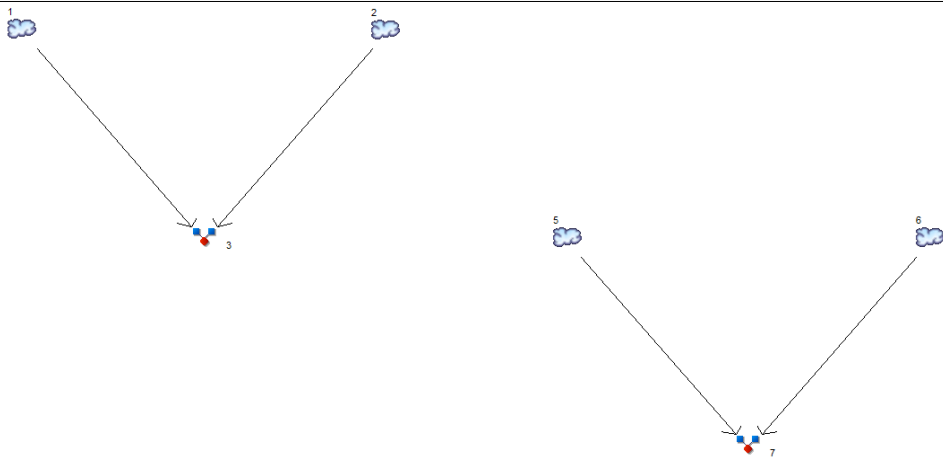
Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80

**HYDROGRAPH SUMMARY REPORTS – EXISTING
AND PROPOSED CONDITIONS 2 YR. 10 YR. & 100
YR.**

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Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.1



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Existing Site (Impervious)
2	SCS Runoff	Existing Site (Pervious)
3	Combine	Existing Total
5	SCS Runoff	Proposed Site (Impervious)
6	SCS Runoff	Proposed Site (Pervious)
7	Combine	Proposed Total

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-----	-----	2.723	-----	-----	4.157	-----	-----	6.918	Existing Site (Impervious)
2	SCS Runoff	-----	-----	0.221	-----	-----	0.532	-----	-----	1.222	Existing Site (Pervious)
3	Combine	1, 2	-----	2.944	-----	-----	4.689	-----	-----	8.140	Existing Total
5	SCS Runoff	-----	-----	2.463	-----	-----	3.761	-----	-----	6.259	Proposed Site (Impervious)
6	SCS Runoff	-----	-----	0.423	-----	-----	0.882	-----	-----	1.839	Proposed Site (Pervious)
7	Combine	5, 6	-----	2.886	-----	-----	4.643	-----	-----	8.098	Proposed Total
Proj. file: 2021-11-01 2, 10, 100 yr.gpw										Monday, Oct 24, 2022	

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	2.723	1	724	9,167	---	-----	-----	Existing Site (Impervious)
2	SCS Runoff	0.221	1	724	694	---	-----	-----	Existing Site (Pervious)
3	Combine	2.944	1	724	9,861	1, 2	-----	-----	Existing Total
5	SCS Runoff	2.463	1	724	8,294	---	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	0.423	1	724	1,260	---	-----	-----	Proposed Site (Pervious)
7	Combine	2.886	1	724	9,553	5, 6	-----	-----	Proposed Total
2021-11-01 2, 10, 100 yr.gpw					Return Period: 2 Year			Monday, Oct 24, 2022	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Monday, Oct 24, 2022

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.840 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2.723 cfs

Time to peak = 724 min

Hyd. volume = 9,167 cuft

Curve number = 98

Hydraulic length = 0 ft

Time of conc. (Tc) = 2.00 min

Distribution = Custom

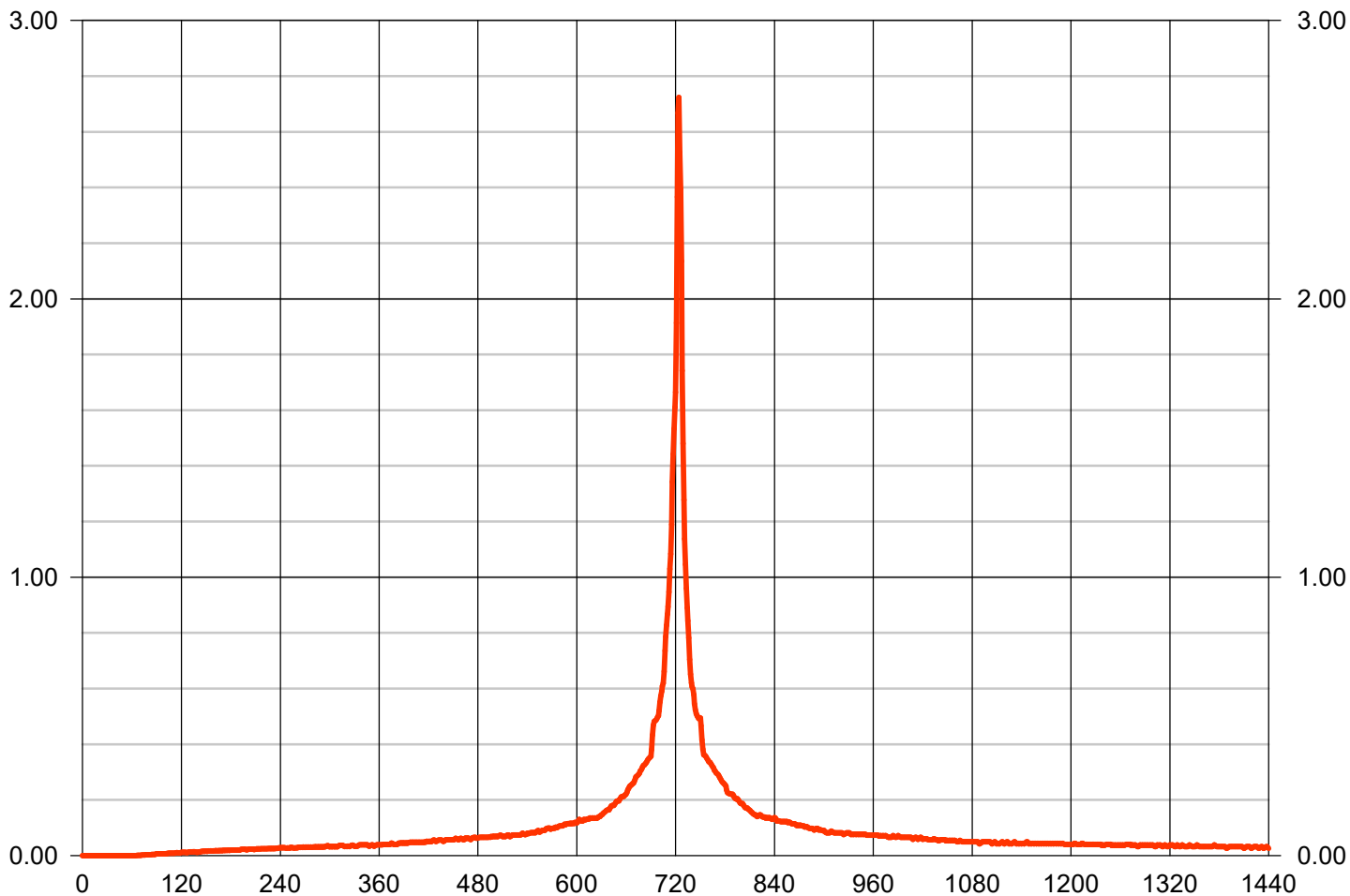
Shape factor = 484

Existing Site (Impervious)

Q (cfs)

Hyd. No. 1 -- 2 Year

Q (cfs)



— Hyd No. 1

Time (min)

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Monday, Oct 24, 2022

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.210 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.221 cfs

Time to peak = 724 min

Hyd. volume = 694 cuft

Curve number = 70

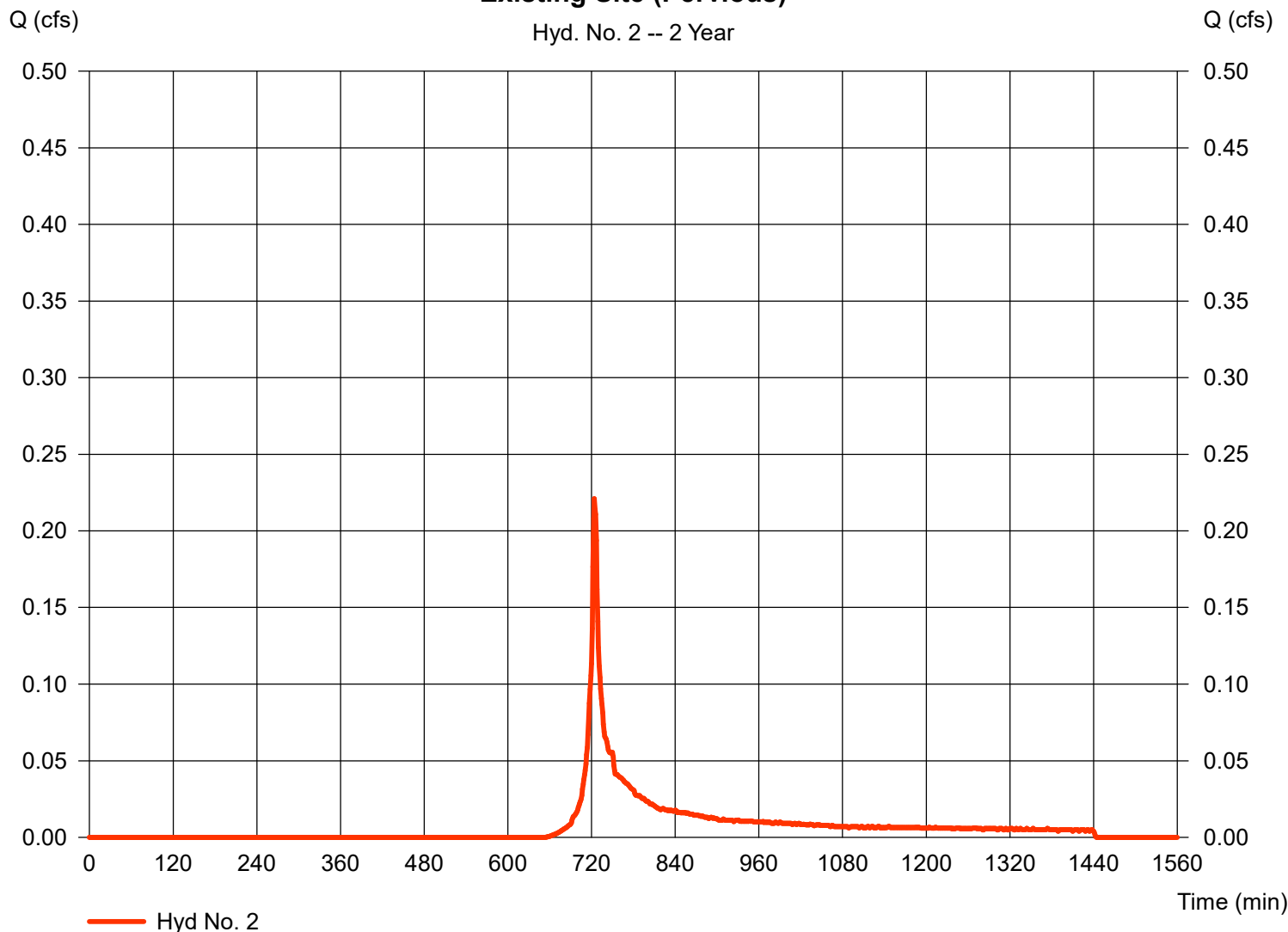
Hydraulic length = 0 ft

Time of conc. (Tc) = 2.00 min

Distribution = Custom

Shape factor = 484

Existing Site (Pervious)

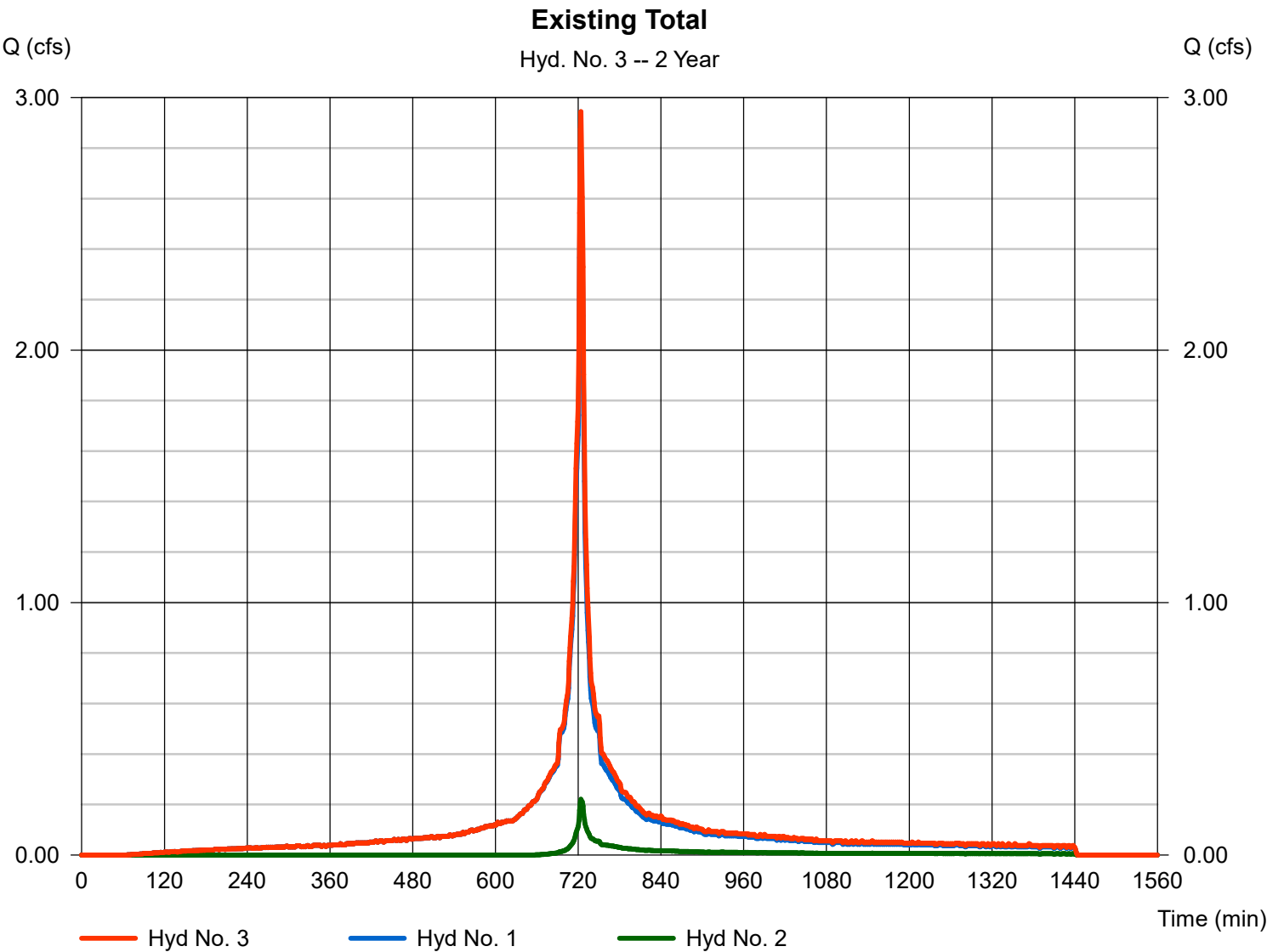


Hydrograph Report

Hyd. No. 3

Existing Total

Hydrograph type	= Combine	Peak discharge	= 2.944 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 9,861 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

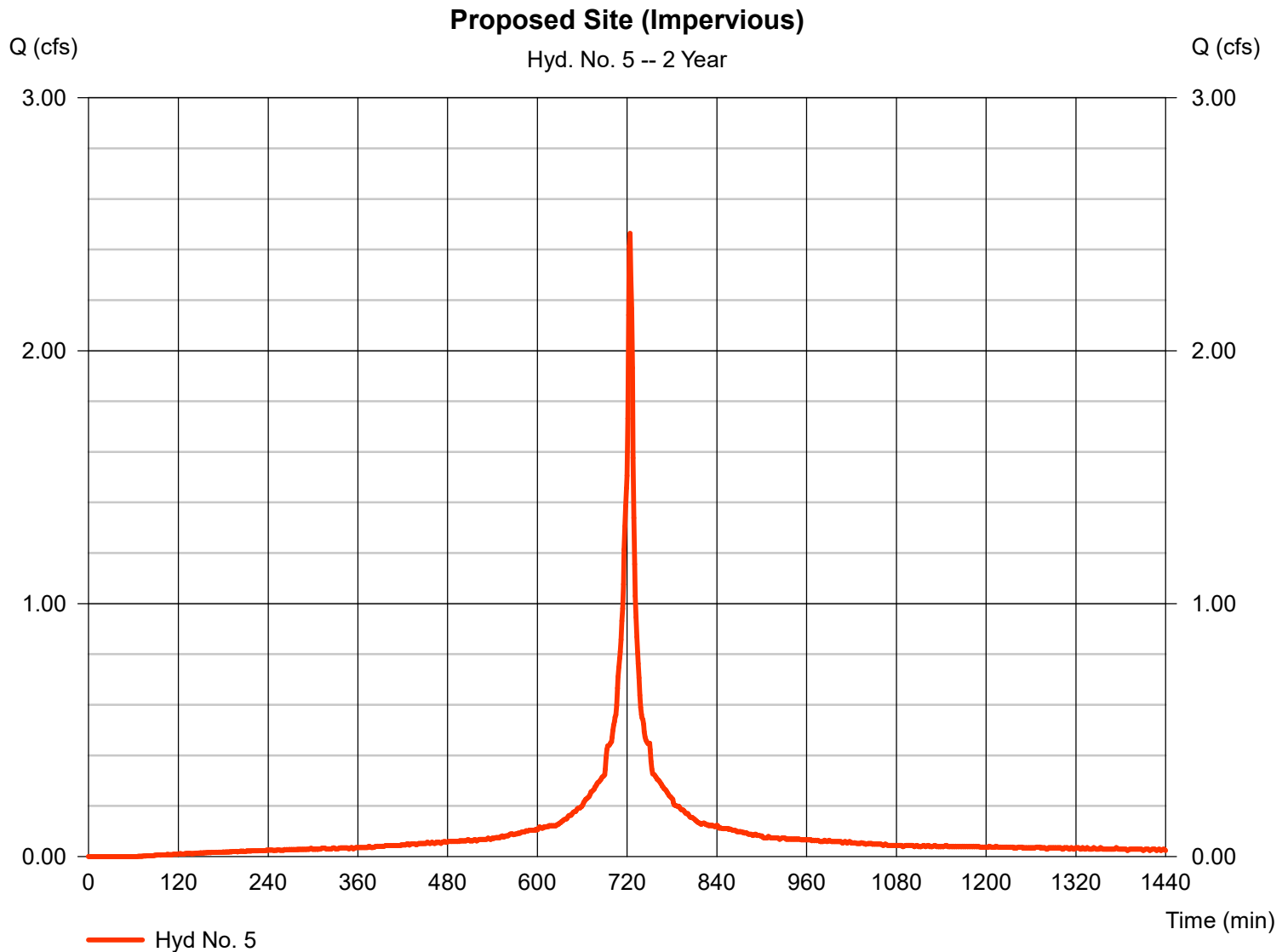
Monday, Oct 24, 2022

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 0.760 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 3.44 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2.463 cfs
 Time to peak = 724 min
 Hyd. volume = 8,294 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Monday, Oct 24, 2022

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.280 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.423 cfs

Time to peak = 724 min

Hyd. volume = 1,260 cuft

Curve number = 76

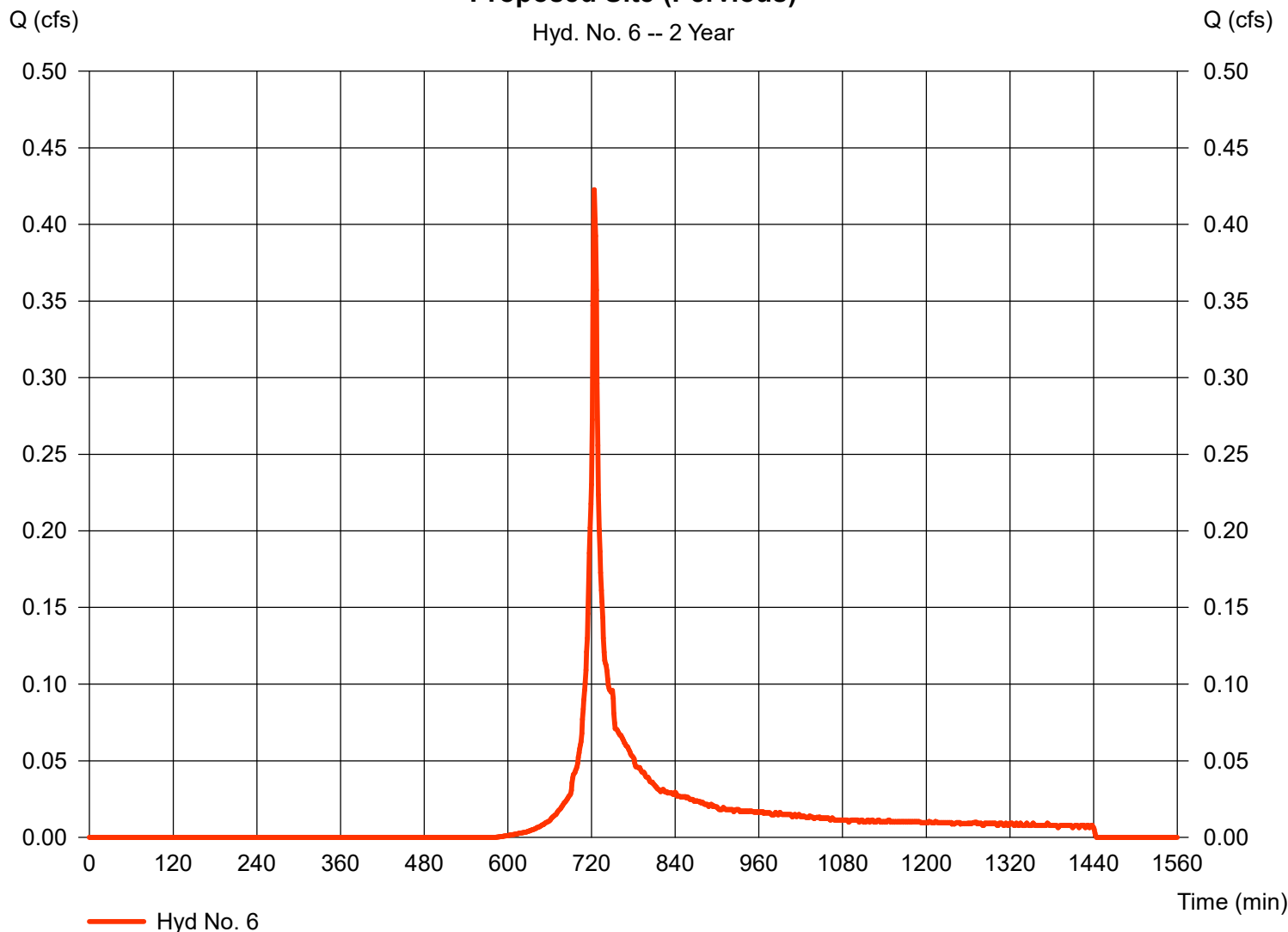
Hydraulic length = 0 ft

Time of conc. (Tc) = 2.00 min

Distribution = Custom

Shape factor = 484

Proposed Site (Pervious)



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

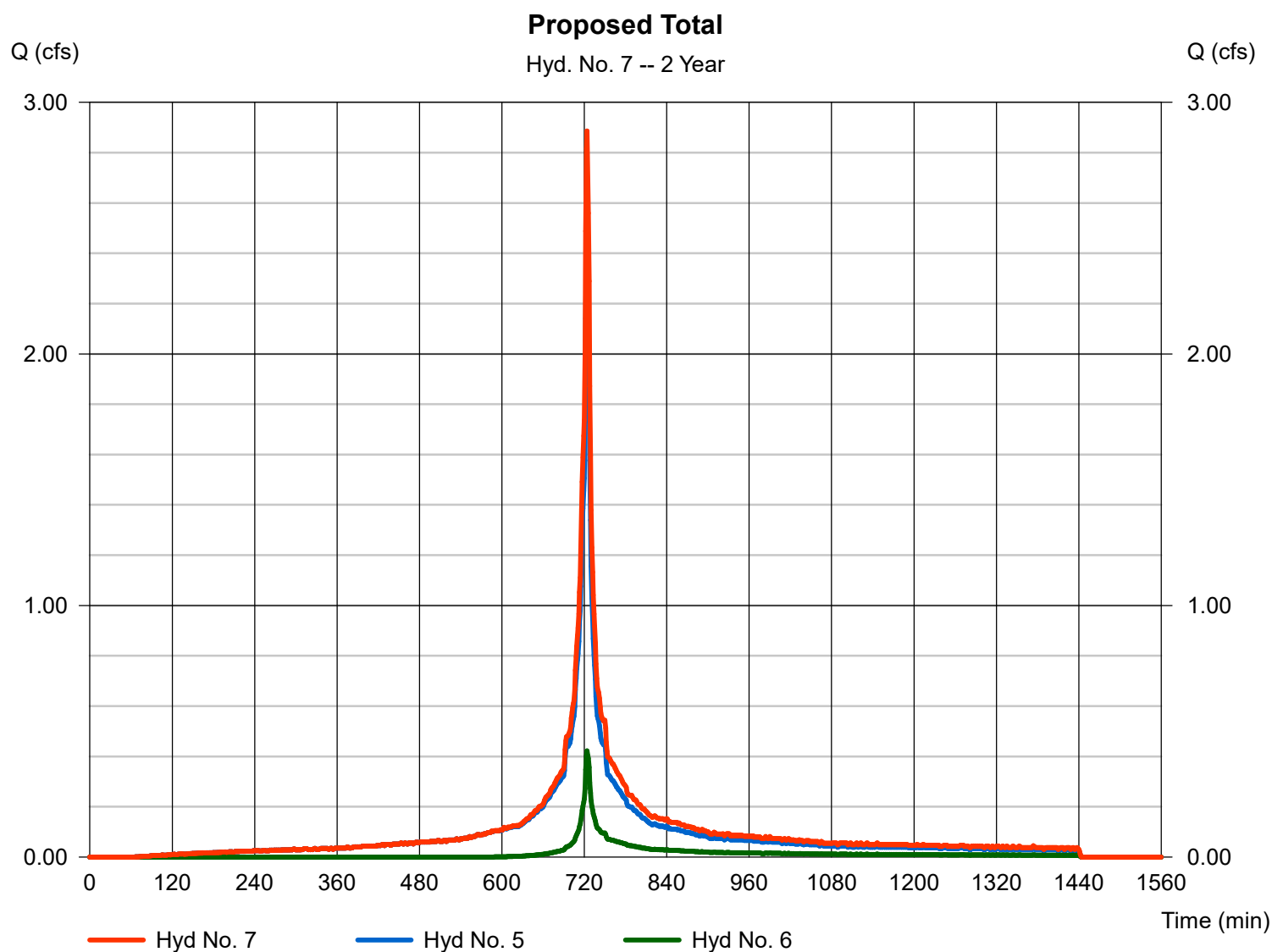
Monday, Oct 24, 2022

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
 Storm frequency = 2 yrs
 Time interval = 1 min
 Inflow hyds. = 5, 6

Peak discharge = 2.886 cfs
 Time to peak = 724 min
 Hyd. volume = 9,553 cuft
 Contrib. drain. area = 1.040 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	4.157	1	724	14,244	---	-----	-----	Existing Site (Impervious)
2	SCS Runoff	0.532	1	724	1,573	---	-----	-----	Existing Site (Pervious)
3	Combine	4.689	1	724	15,817	1, 2	-----	-----	Existing Total
5	SCS Runoff	3.761	1	724	12,888	---	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	0.882	1	724	2,590	---	-----	-----	Proposed Site (Pervious)
7	Combine	4.643	1	724	15,477	5, 6	-----	-----	Proposed Total
2021-11-01 2, 10, 100 yr.gpw					Return Period: 10 Year			Monday, Oct 24, 2022	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

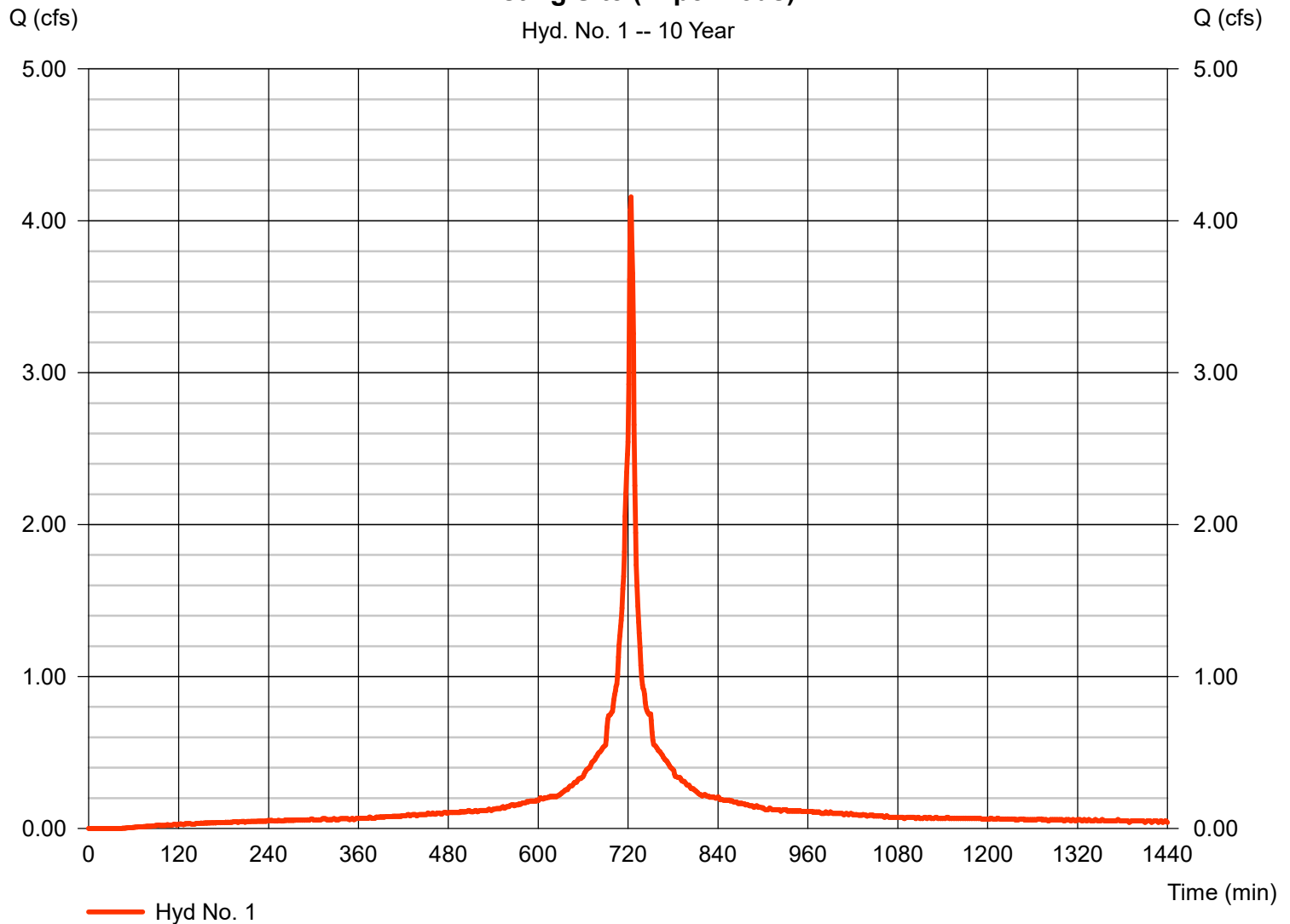
Monday, Oct 24, 2022

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.157 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 14,244 cuft
Drainage area	= 0.840 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 2.00 min
Total precip.	= 5.22 in	Distribution	= Custom
Storm duration	= NOAA Atlas 14 Type-D.cds	Shape factor	= 484

Existing Site (Impervious)



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

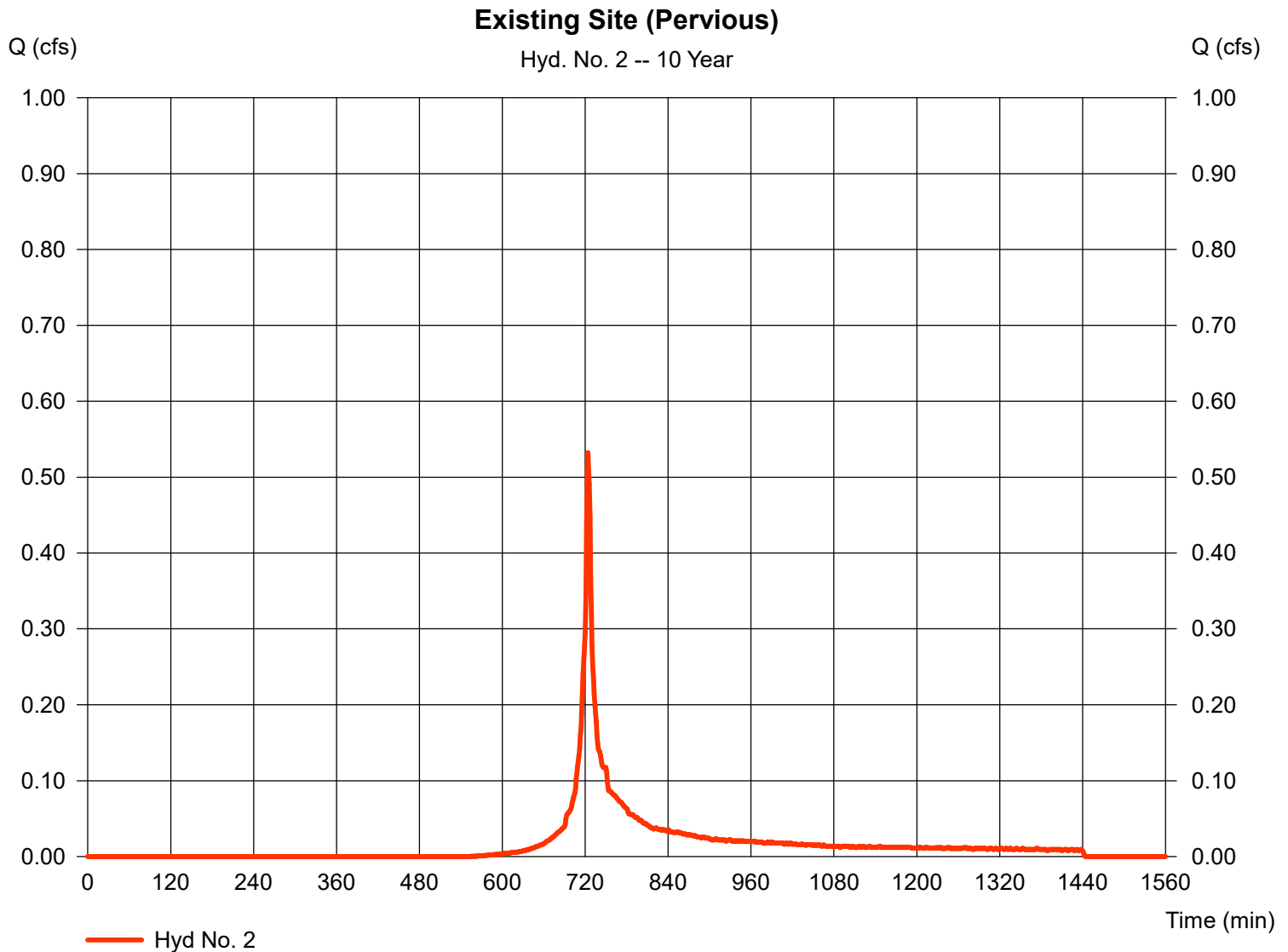
Monday, Oct 24, 2022

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.210 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.532 cfs
 Time to peak = 724 min
 Hyd. volume = 1,573 cuft
 Curve number = 70
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

13

Hydraflow Hydrographs by Intelisolve v9.1

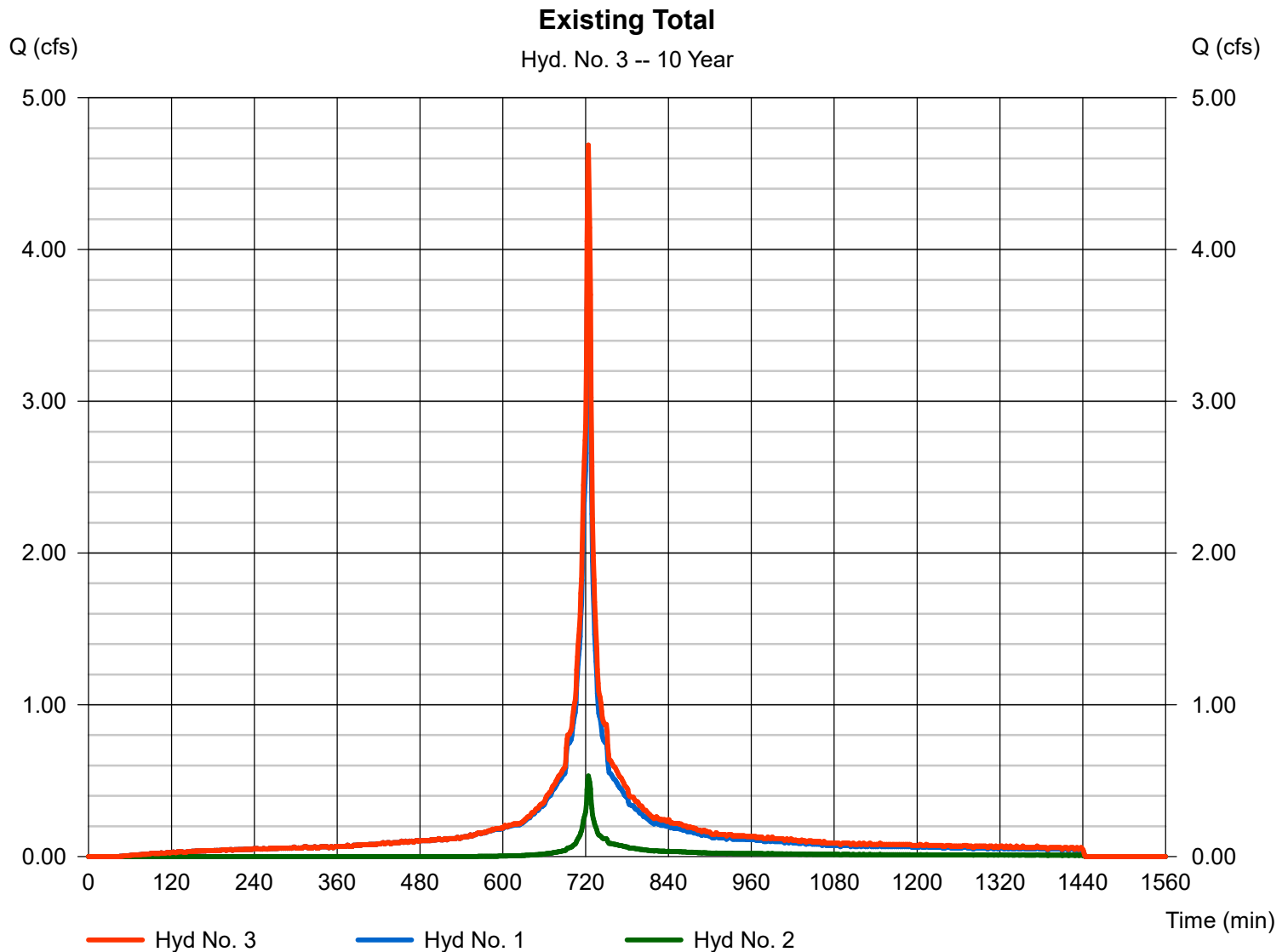
Monday, Oct 24, 2022

Hyd. No. 3

Existing Total

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyds. = 1, 2

Peak discharge = 4.689 cfs
Time to peak = 724 min
Hyd. volume = 15,817 cuft
Contrib. drain. area = 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

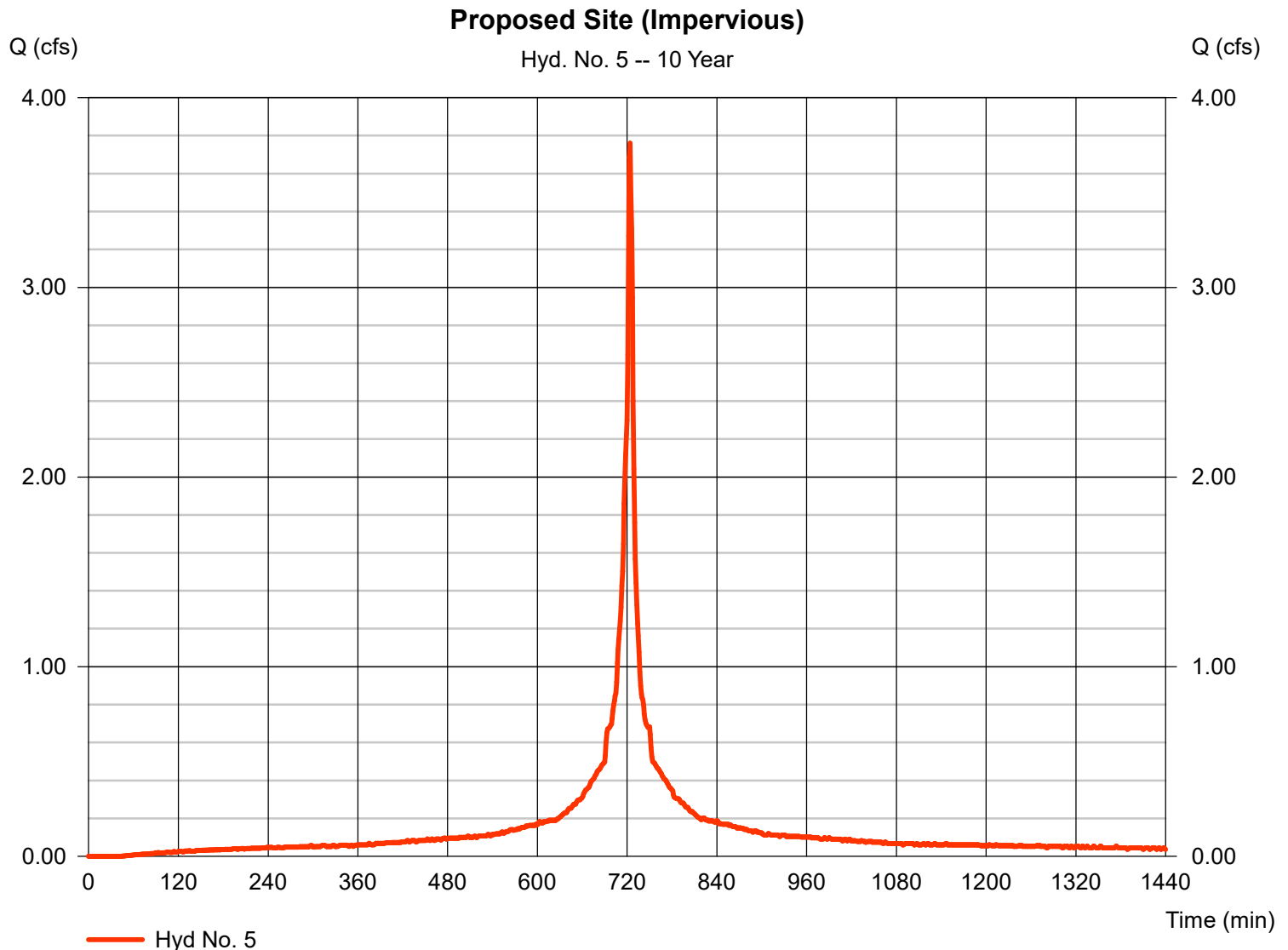
Monday, Oct 24, 2022

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.760 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 3.761 cfs
 Time to peak = 724 min
 Hyd. volume = 12,888 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

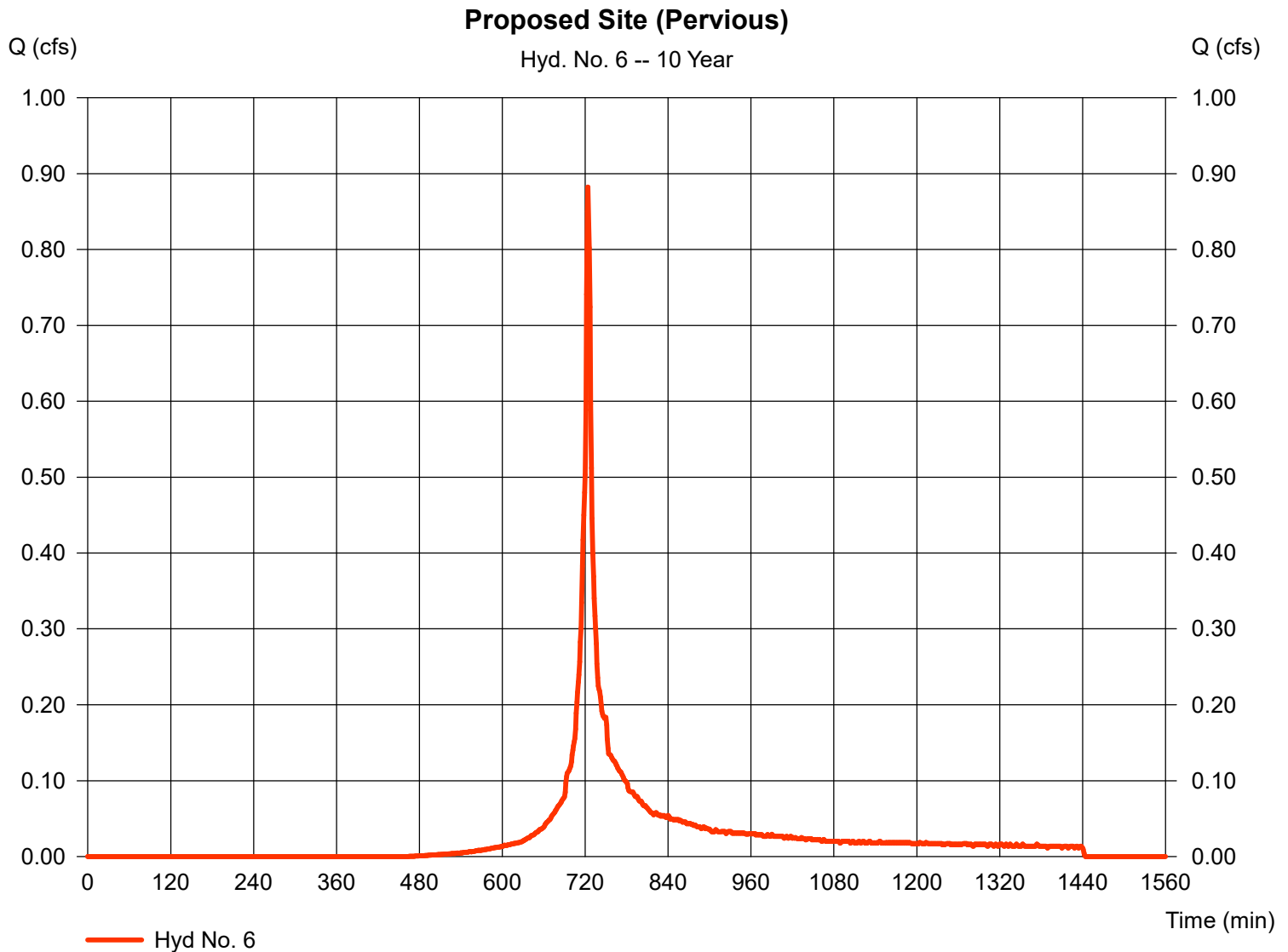
Monday, Oct 24, 2022

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.280 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.882 cfs
 Time to peak = 724 min
 Hyd. volume = 2,590 cuft
 Curve number = 76
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

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Hydraflow Hydrographs by Intelisolve v9.1

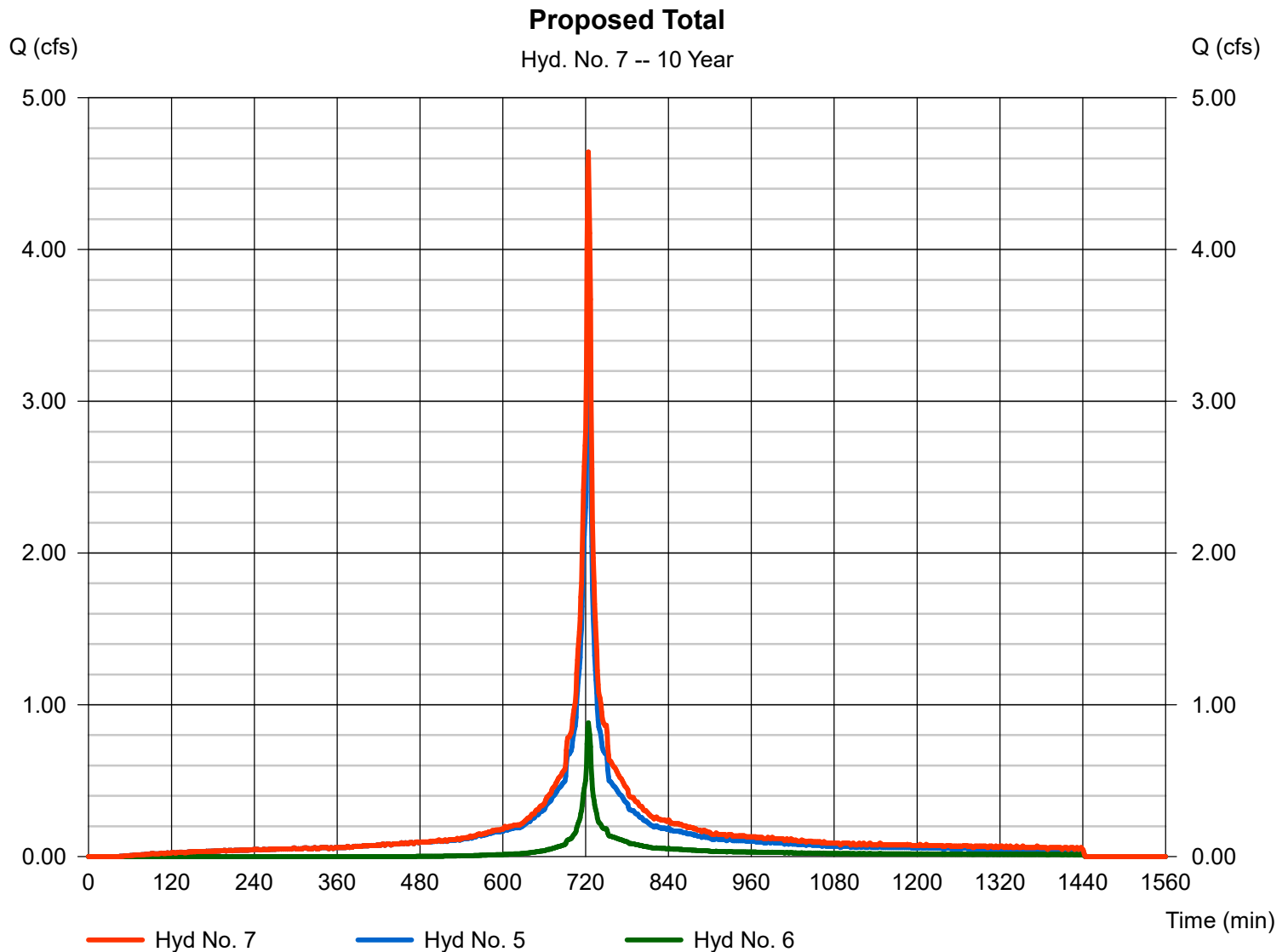
Monday, Oct 24, 2022

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyds. = 5, 6

Peak discharge = 4.643 cfs
Time to peak = 724 min
Hyd. volume = 15,477 cuft
Contrib. drain. area = 1.040 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	6.918	1	724	24,069	----	-----	-----	Existing Site (Impervious)
2	SCS Runoff	1.222	1	724	3,599	----	-----	-----	Existing Site (Pervious)
3	Combine	8.140	1	724	27,668	1, 2	-----	-----	Existing Total
5	SCS Runoff	6.259	1	724	21,777	----	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	1.839	1	724	5,490	----	-----	-----	Proposed Site (Pervious)
7	Combine	8.098	1	724	27,267	5, 6	-----	-----	Proposed Total
2021-11-01 2, 10, 100 yr.gpw					Return Period: 100 Year			Monday, Oct 24, 2022	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

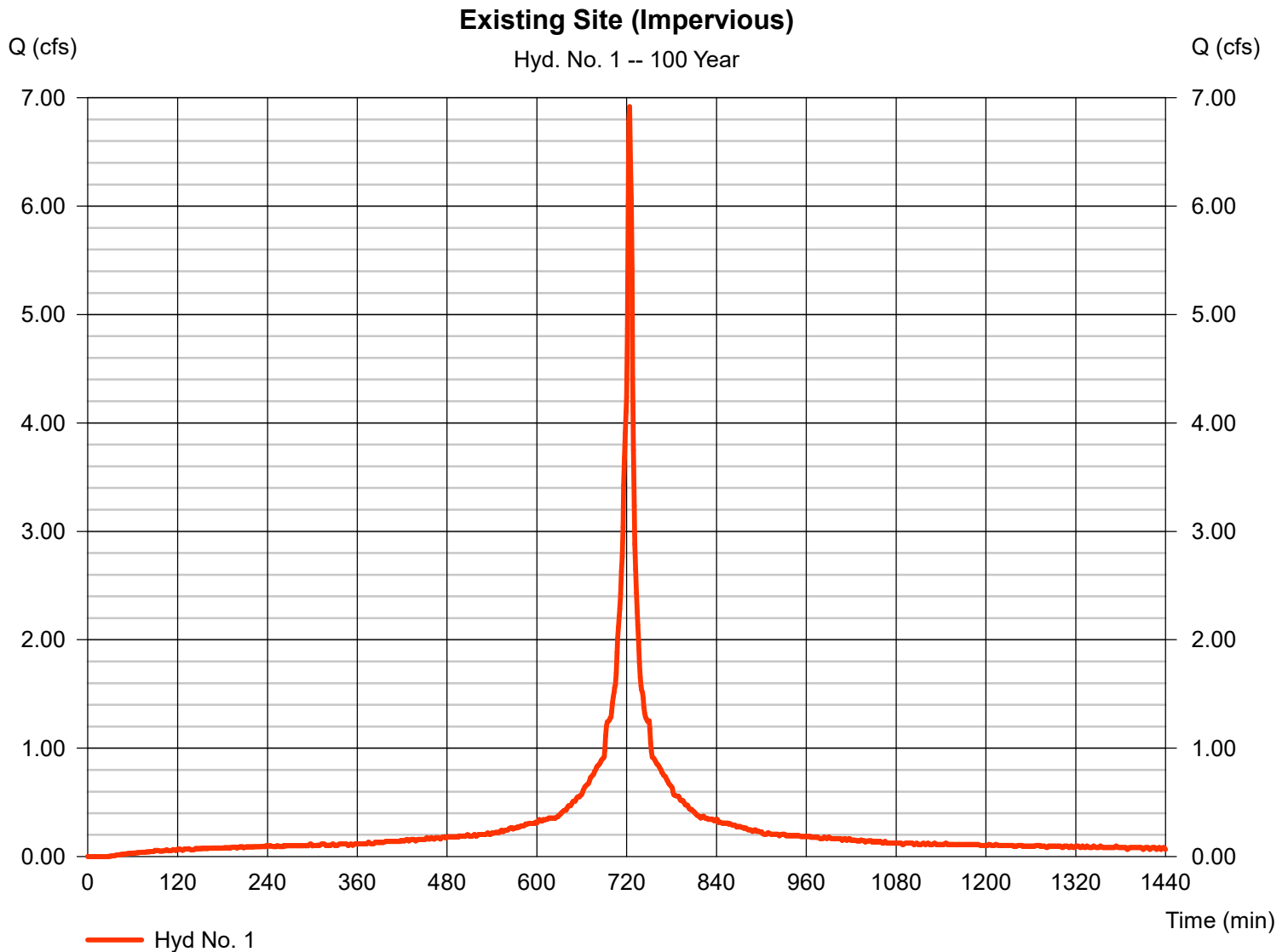
Monday, Oct 24, 2022

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.840 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 6.918 cfs
 Time to peak = 724 min
 Hyd. volume = 24,069 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

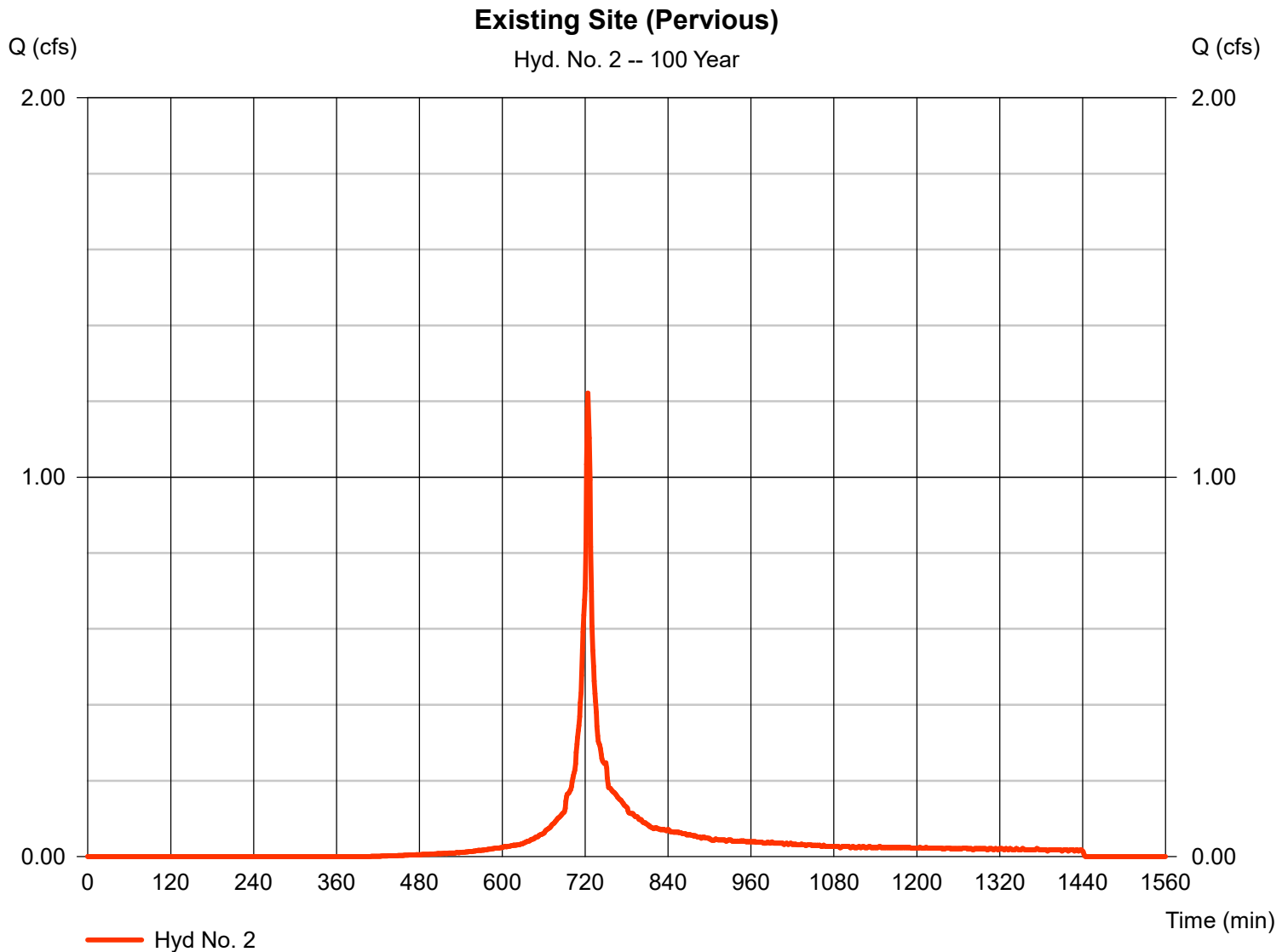
Monday, Oct 24, 2022

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.210 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 1.222 cfs
 Time to peak = 724 min
 Hyd. volume = 3,599 cuft
 Curve number = 70
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

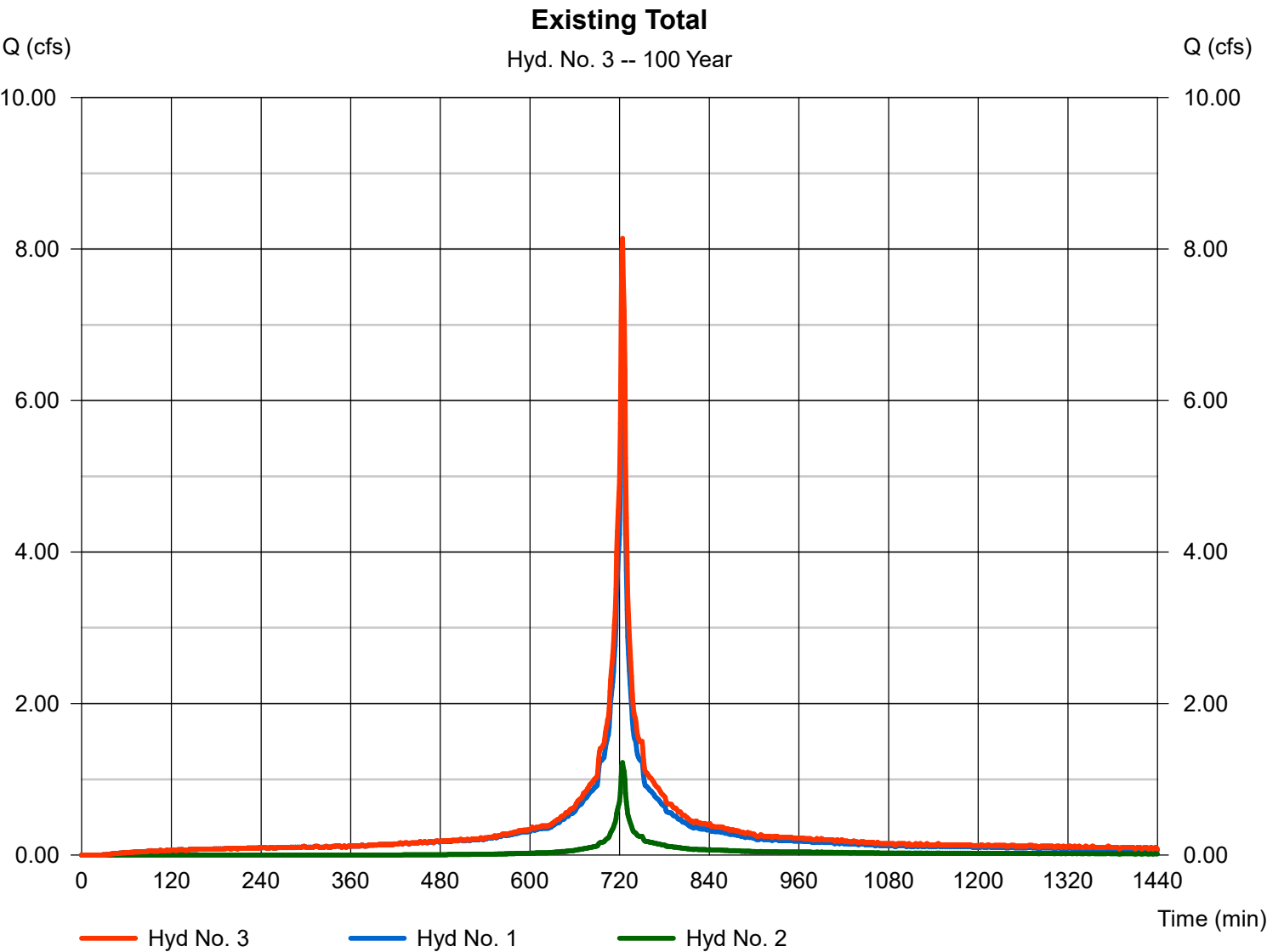
Hydraflow Hydrographs by Intelisolve v9.1

Monday, Oct 24, 2022

Hyd. No. 3

Existing Total

Hydrograph type	= Combine	Peak discharge	= 8.140 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 27,668 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

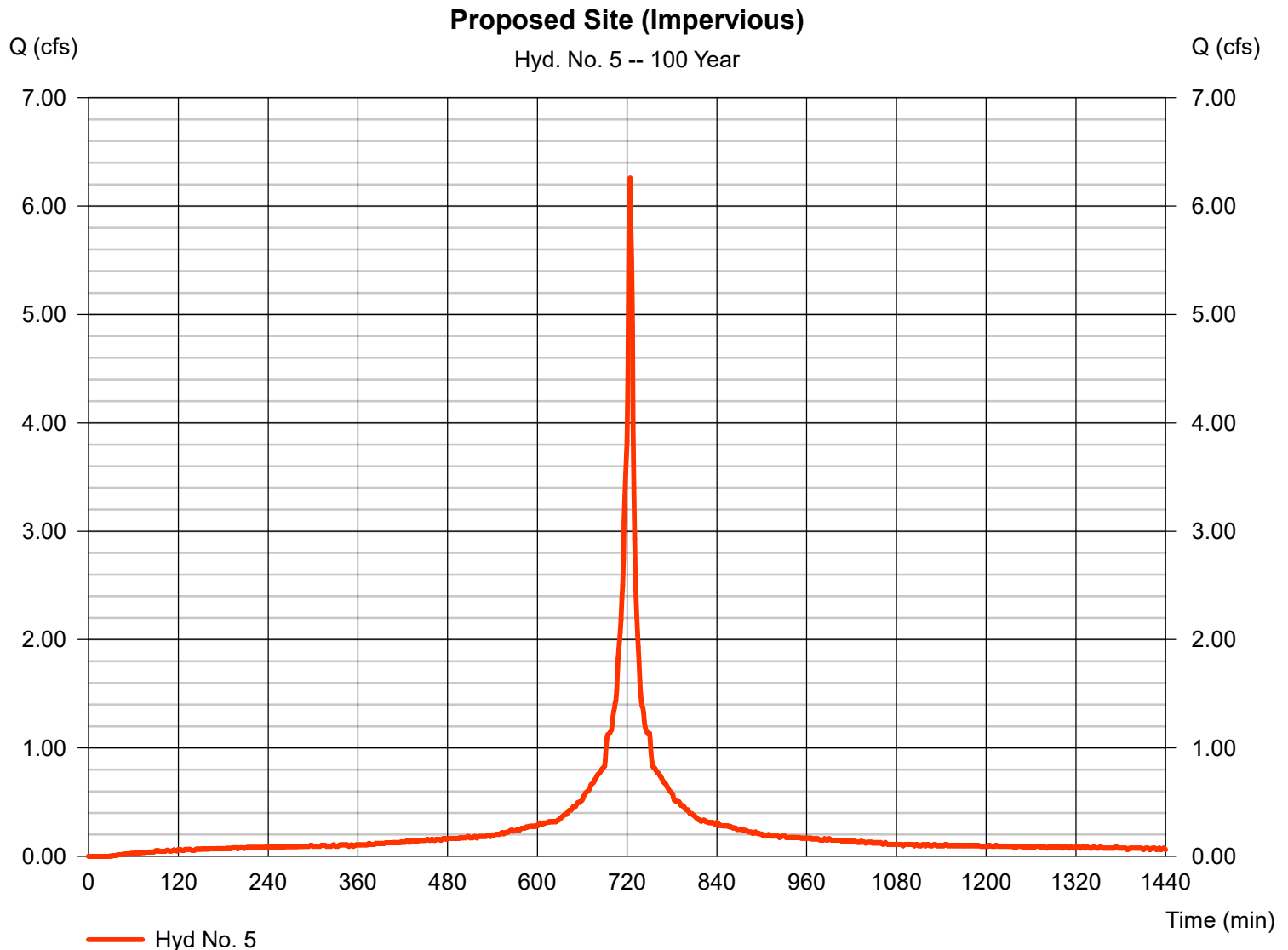
Monday, Oct 24, 2022

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.760 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 6.259 cfs
 Time to peak = 724 min
 Hyd. volume = 21,777 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

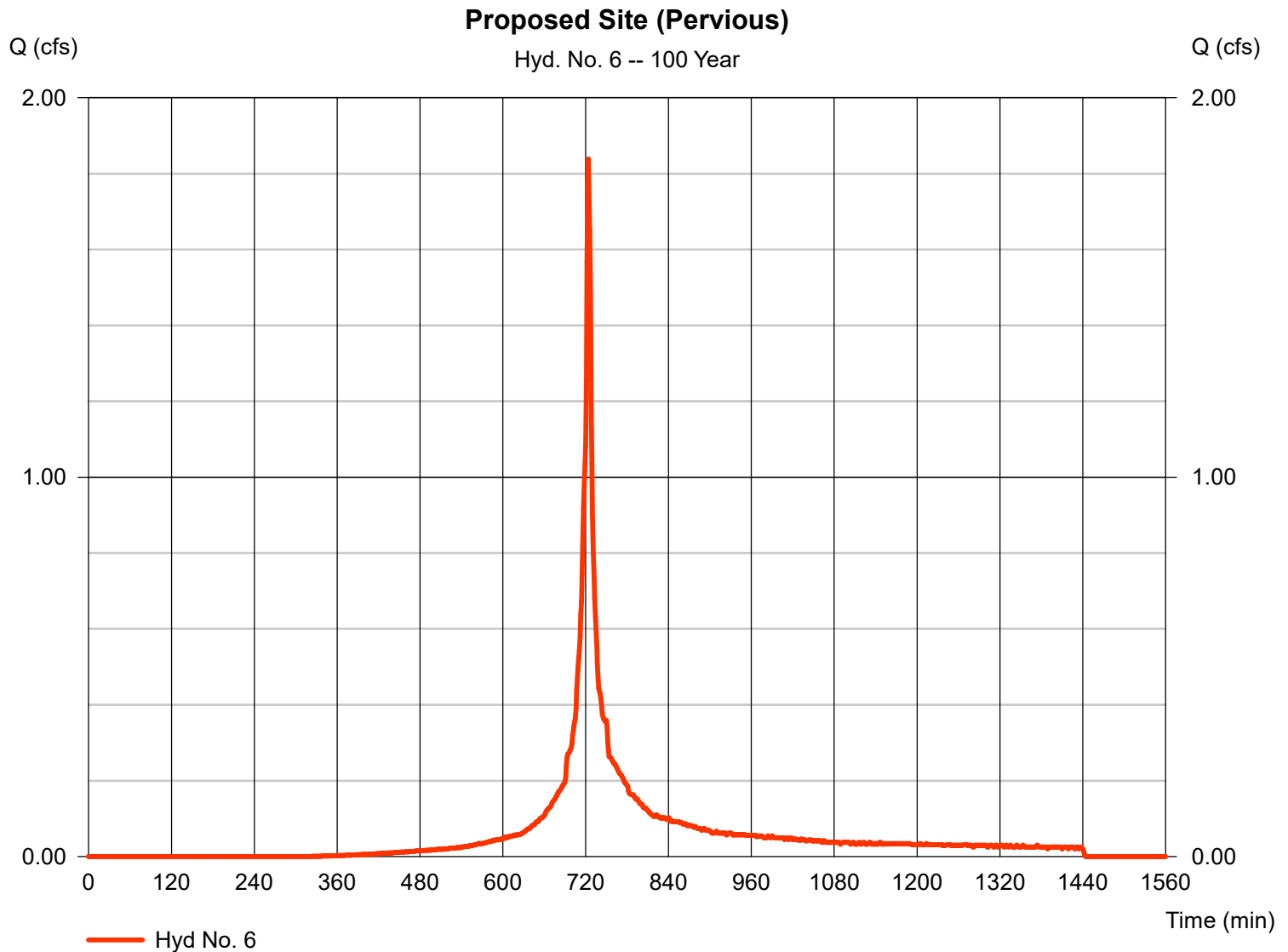
Monday, Oct 24, 2022

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.280 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 1.839 cfs
 Time to peak = 724 min
 Hyd. volume = 5,490 cuft
 Curve number = 76
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 2.00 min
 Distribution = Custom
 Shape factor = 484

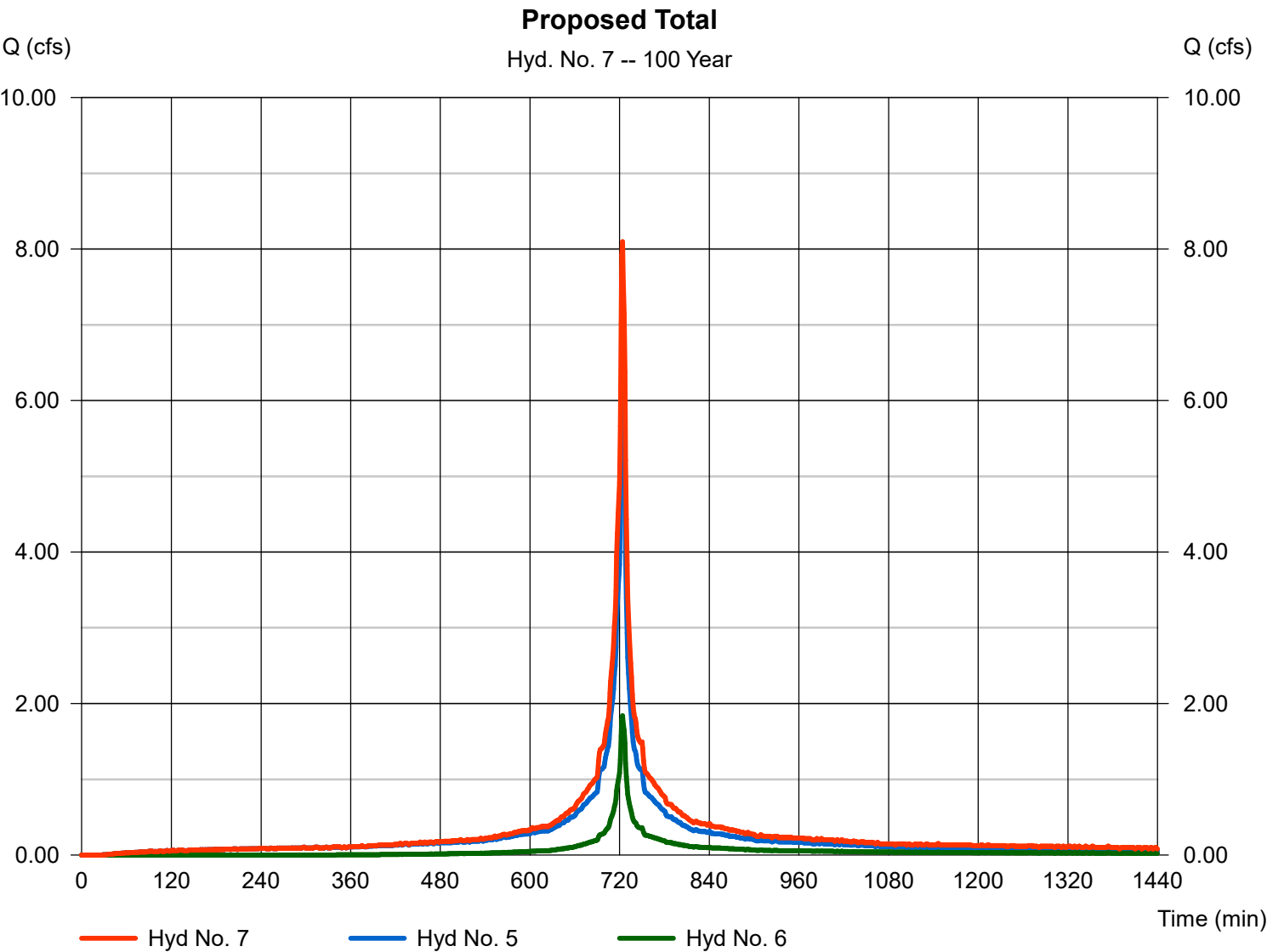


Hydrograph Report

Hyd. No. 7

Proposed Total

Hydrograph type	= Combine	Peak discharge	= 8.098 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 27,267 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.040 ac



Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisolve v9.1

Monday, Oct 24, 2022

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	-----
2	69.8703	13.1000	0.8658	-----
3	0.0000	0.0000	0.0000	-----
5	79.2597	14.6000	0.8369	-----
10	88.2351	15.5000	0.8279	-----
25	102.6072	16.5000	0.8217	-----
50	114.8193	17.2000	0.8199	-----
100	127.1596	17.8000	0.8186	-----

File name: SampleFHA.idf

$$\text{Intensity} = B / (T_c + D)^E$$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: Essex County.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.44	0.00	0.00	5.22	6.44	0.00	8.66
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	1.25	3.44	0.00	0.00	5.22	6.44	0.00	8.66

**MULTI-HYDROGRAPH PLOT – EXISTING AND
PROPOSED SUPERIMPOSED 2 YR. 10 YR & 100 YR.**

Multi-Hydrograph Plot

Hyd. No. 3

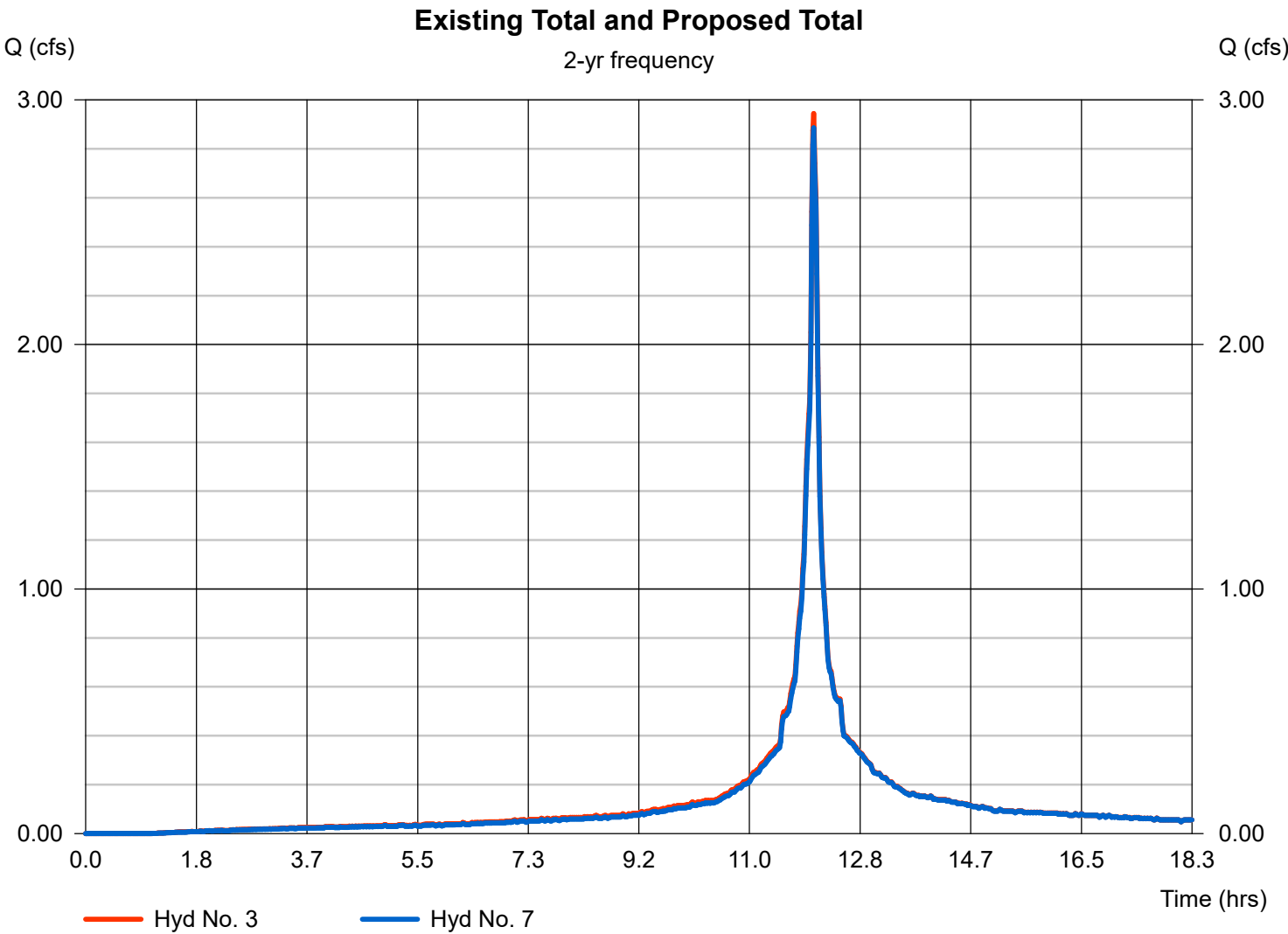
Existing Total

Hydrograph type = Combine
Peak discharge = 2.944 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 9,861 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 2.89 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 9,553 cuft



Multi-Hydrograph Plot

Hyd. No. 3

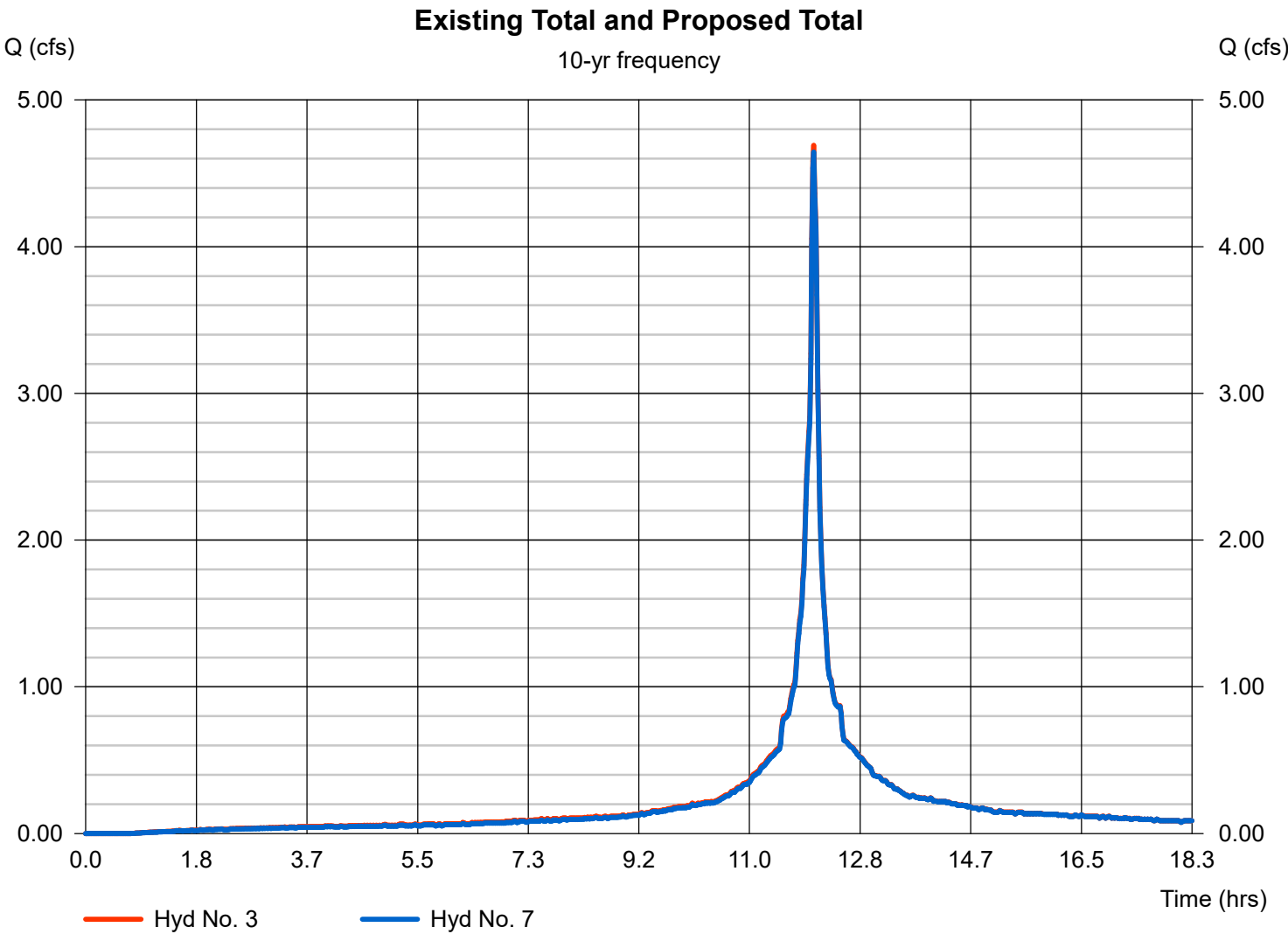
Existing Total

Hydrograph type = Combine
Peak discharge = 4.689 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 15,817 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 4.64 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 15,477 cuft



Multi-Hydrograph Plot

Hyd. No. 3

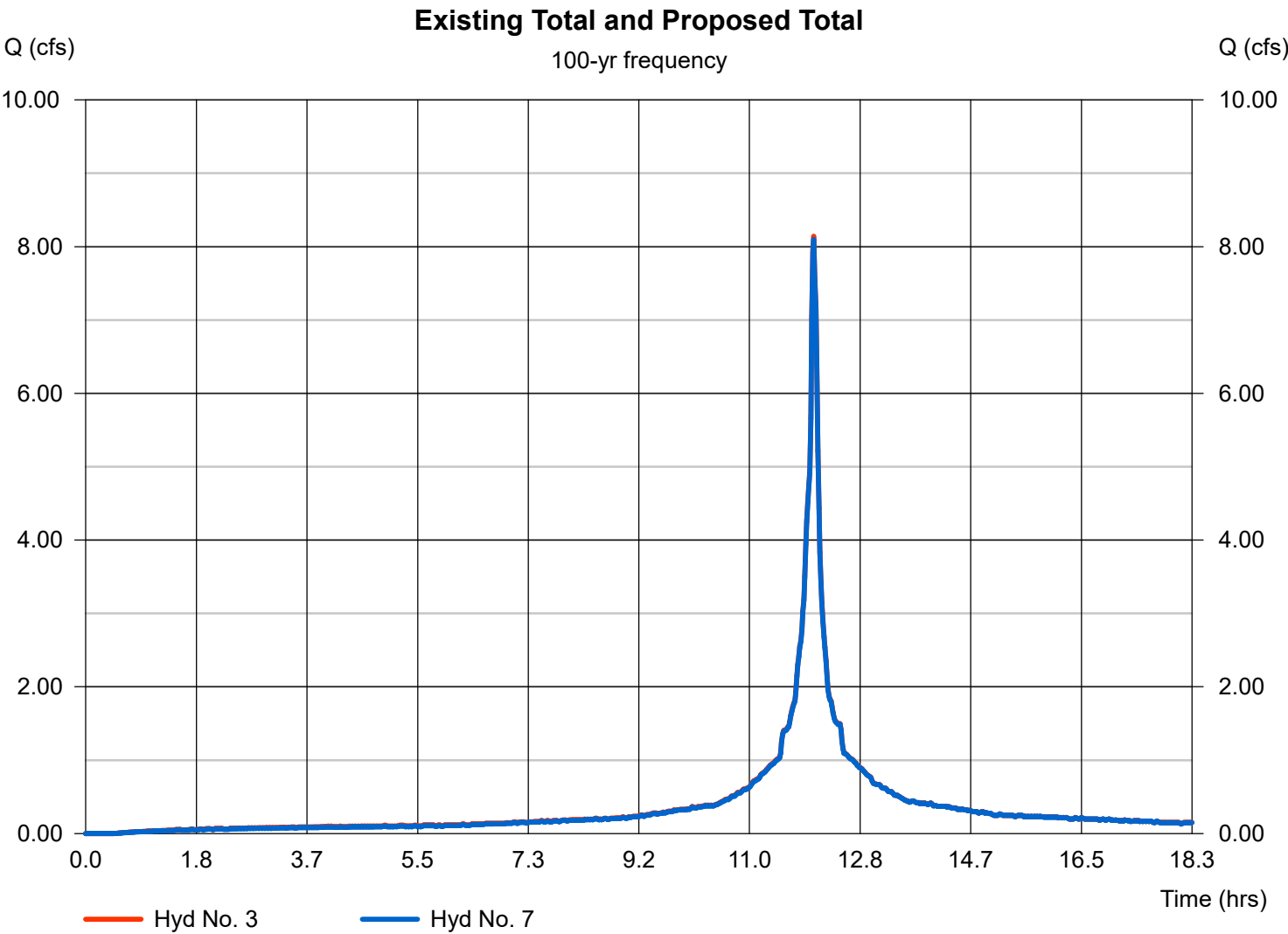
Existing Total

Hydrograph type = Combine
Peak discharge = 8.140 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 27,668 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 8.10 cfs
Time to peak = 12.07 hrs
Hyd. Volume = 27,267 cuft



**STORMWATER COLLECTION SYSTEM
CLACULATIONS (PIPE SIZING)**



DYNAMIC ENGINEERING

Stormwater Collection System Calculations

Project: Proposed Popeyes & Fast Food Restaurant

Job #: 1021-99-025

Location: West Orange, NJ

Design Storm: 25 Year

Computed By: DG

Checked By: MB

Date: 10/21/2022

NOTES:

1) Design method used is Rational Method, unless otherwise noted.

2) Refer to Weighted Runoff Coefficient table
for calculation of incremental areas and C values

PIPE SECTION		SUBCATCHMENT AREA	INCREMENTAL		CUMULATIVE	TIME OF CONCENTRATION			I	PEAK RUNOFF		PIPING INPUT			PIPING DATA		
FROM	TO	Area (Acres)	"C"	A x C Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum. for Pipe (CFS)	Dia. (In)	Length (Ft)	Man. "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Pipe Velocity (fps)
Inlet 1	Inlet 2	0.26	0.83	0.22	0.22	10.00	0.04	10.00	6.80	1.50	1.50	12	27.0	0.013	0.0721	9.56	12.18
Inlet 2	Inlet 3	0.14	0.78	0.11	0.33	10.00	0.30	10.04	6.80	0.75	2.24	12	93.0	0.013	0.0127	4.01	5.11
Inlet 3	Inlet Existing A	0.17	0.78	0.13	0.46	10.00	0.41	10.34	6.80	0.88	3.13	12	138.0	0.013	0.0151	4.38	5.58
Inlet 15	Inlet Existing A	0.27	0.86	0.23	0.23	10.00	0.10	10.00	6.80	1.56	1.56	12	50.0	0.013	0.0346	6.62	8.43
Inlet Existing A	Inlet Rosney ROW	0.05	0.35	0.02	0.71	10.00	0.02	10.75	6.68	0.13	4.74	12	21.0	0.013	0.1386	13.26	16.89

DRAINAGE & INLET AREA MAPS