

DRAINAGE STATEMENT

for

MPB Realty, LLC

Proposed Popeyes Restaurant & Sonic 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
Last Revised June 2023
DEC# 1021-99-025

TABLE OF CONTENTS

	<u>Page No.</u>
I. Introduction	3
II. Existing Drainage Conditions.....	3
III. Proposed Drainage Conditions.....	4
IV. Runoff Rate Reduction Performance	4
V. Groundwater Recharge	4
VI. Water Quality	4
VII. Conclusion.....	5

APPENDIX

- Location Map
- USGS Map
- NRCS Web Soil Survey
- Time of Concentration (Tc) Calculations
- Runoff Curve Number (CN) Calculations – Existing
- Runoff Curve Number (CN) Calculations – Proposed
- Hydrograph Summary Reports – Existing and Proposed Conditions 2 yr. 10 yr. & 100 yr.
- Multi-Hydrograph Plot – Existing and Proposed Conditions Superimposed 2 yr. 10 yr. & 100 yr.
- Stormwater Collection System Calculations (Pipe Sizing)
- Drainage & Inlet Area Maps

I. Introduction

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. In existing conditions, the subject site consists of 1.07 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 80.5% (36,974 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 a 2,525 SF Popeyes restaurant with a drive-thru and a 1,484 SF Sonic restaurant with a drive-thru. Additional site amenities include parking, landscaping, lighting and a trash enclosures. The proposed development will provide a total impervious coverage of 68.8% (31,436 SF), resulting in a 5,538 SF (11.7%) reduction. In addition, the project will result in a decrease in motor vehicle surface area of approximately 4,133 SF from 28,325 SF to 24,192 SF. Per the Natural Resources Conservation Service Web Soil Survey, a portion of the property is located within unclassified Urban Land soil. To be conservative, the analysis utilized HSG B in existing conditions and HSG D in proposed for disturbed areas within the Urban Land soil.

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 will result in a decrease in motor vehicle surface area and impervious coverage from existing to proposed conditions. As such, the project does not increase regulated motor vehicle surface by more than one-quarter acre and is therefore not required to meet the stormwater runoff quality standards under NJAC 7:8-5.5 and Township of West Orange Ordinance §25-29.4.q.

A hydrological evaluation is provided for the 2-, 10-, and 100-year storm events utilizing the Urban Hydrology for Small Watersheds TR55 Method to confirm compliance with the stormwater runoff quantity and groundwater recharge standards set forth by the Township of West Orange Land Development Ordinance and NJAC 7:8.

II. Existing Drainage Conditions

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.

III. Proposed Drainage Conditions

In proposed conditions, stormwater runoff from the project area has been designed to maintain existing drainage patterns. The project proposes to remove the existing onsite inlets and provide six (6) new inlets within the site to assist in collecting stormwater runoff from impervious areas. The proposed inlets are connected via an underground conveyance system consisting of 12" and 15" reinforced concrete pipes discharging to the existing inlet within Rosney Terrace. Stormwater runoff from the building roofs are collected and conveyed underground via 6" PVC roof leaders to the proposed inlets.

IV. Runoff Rate Reduction Performance

Due to the reduction in impervious coverage, the volume and 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.

Study Area Site		
Design Storm	Ex. Peak Flow (cfs)	Prop. Peak Flow (cfs)
2	2.913	2.803
10	4.640	4.553
100	8.056	8.012

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. Appended are the superimposed hydrographs for reference.

V. Groundwater Recharge

Per NJAC 7:8-5.4(b).2, the project is not subject to the groundwater recharge requirement as it is within the Metropolitan Planning Area (PA1) which is classified as an Urban Redevelopment Area.

VI. Water Quality

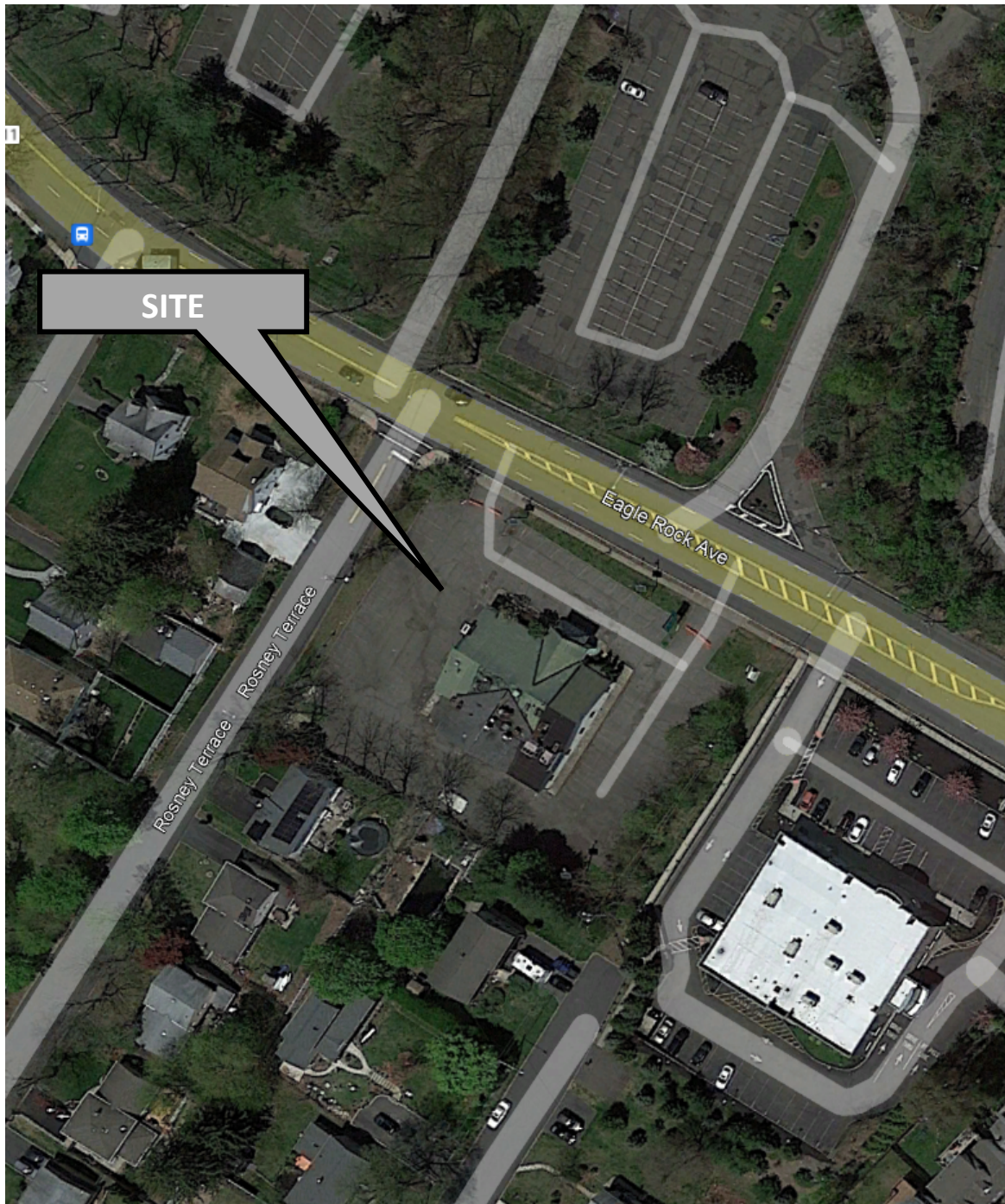
Per NJAC 7:8-5.5(a), the project is not required to meet the stormwater runoff quality standards as the project results in a decrease in motor vehicle surface area. This reduction provides a decrease in total suspended solid (TSS) generation for the site, improving the quality of stormwater runoff leaving the site.

VII. Conclusion

In conclusion, the proposed project has been designed to ensure the safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns or adjacent properties. The project is designed to comply with the stormwater runoff quantity and groundwater recharge requirements set forth under NJAC 7:8 and the Township of West Orange Land Use Ordinance. With this stated, it is evident that the proposed development will not have a negative impact on or within the vicinity of the site, and the increase in pervious coverage will benefit the area.

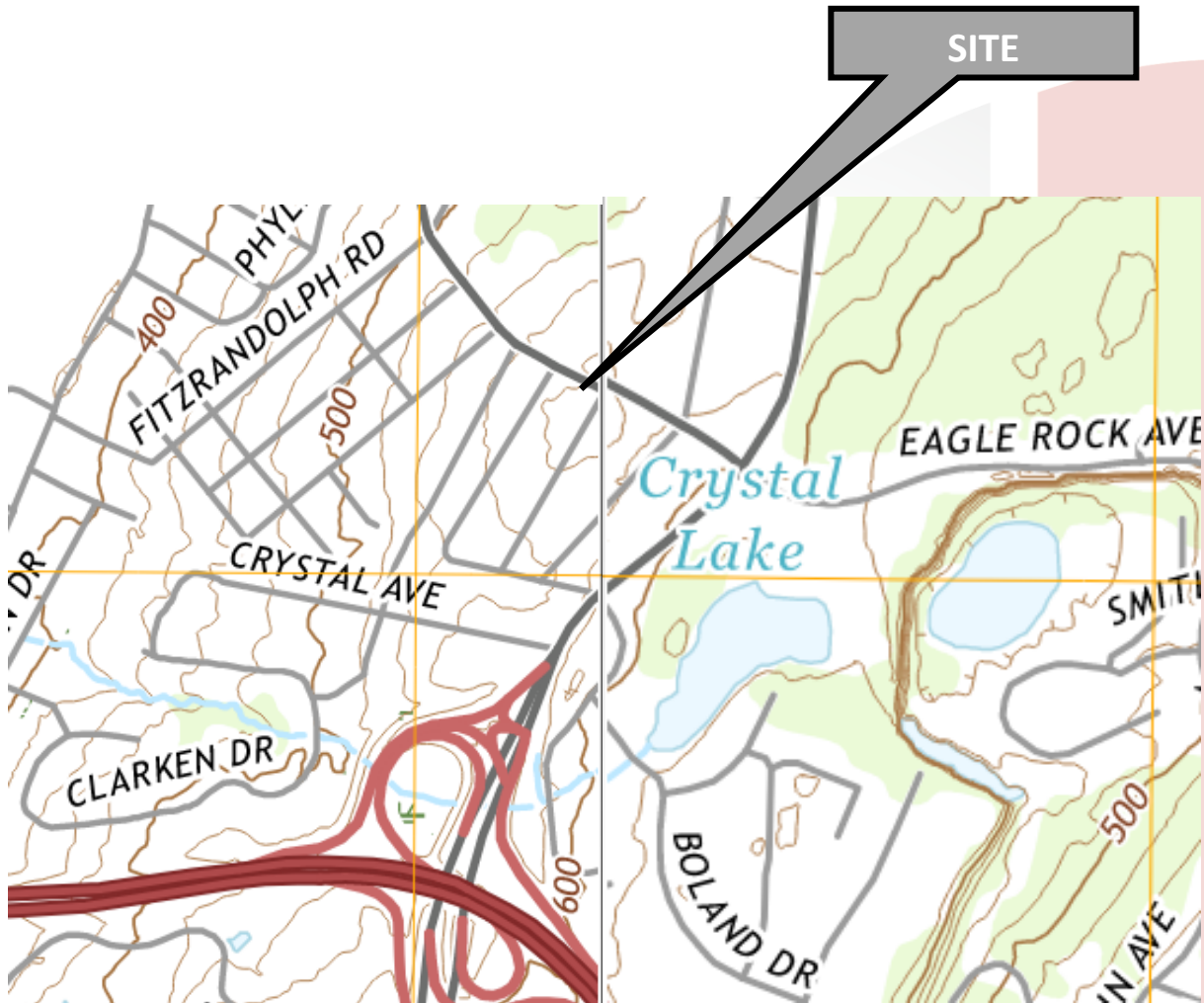
APPENDIX

LOCATION MAP



Location Map

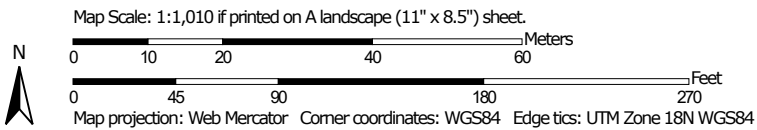
USGS MAP



USGS Map

NRCS WEB SOIL SURVEY

Hydrologic Soil Group—Essex County, New Jersey



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: 7/6/2023
Project: Proposed Popeyes & Sonic Restaurant
Project No: 1021-99-025

Calculated By: DG
Checked By: MB

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Proposed
Drainage Area: Site

• Sheet Flow :

	AB	BC	CD	
1. Surface Description	Short Grass, Prairie	Short Grass, Prairie	Smooth Surfaces	
2. Manning's Roughness Coefficient, n	0.15	0.15	0.011	
3. Flow Length, L { total $L \leq 100$ ft }	13.0 ft	24.0 ft	30.0 ft	
4. Two-Year 24-hour Rainfall, p_2 for .. <u>Essex County</u>	3.44 in	3.44 in	3.44 in	
5. Land Slope, s (ft/ft)	0.126 ft/ft	0.024 ft/ft	0.027 ft/ft	
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$	0.015 hr	0.047 hr	0.007 hr	= 0.068 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, $T_t = \frac{L}{3600 V}$	0.000 hr	0.000 hr	0.000 hr	= 0.000 hr

• Channel Flow :

	DE	EF	FG	
12. Pipe Diameter, D	12 in	12 in	15 in	
13. Cross-Sectional Flow Area, A	0.785 sf	0.785 sf	1.227 sf	
14. Wetted Perimeter, p_w	3.1 ft	3.1 ft	3.9 ft	
15. Hydraulic Radius, $r = A / p_w$	0.3 ft	0.3 ft	0.3 ft	
16. Channel Slope, s	0.027 ft/ft	0.081 ft/ft	0.046 ft/ft	
17. Pipe Material	RCP	RCP	RCP	
18. Manning's Roughness Coefficient, n	0.013	0.013	0.013	
19. Velocity, $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$	7.47 ft/s	12.95 ft/s	11.32 ft/s	
20. Flow Length, L	93.0	55.0	39.0	
21. Travel Time, $T_t = \frac{L}{3600 V}$	0.003 hr	0.001 hr	0.001 hr	= 0.006 hr
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }				0.074 hr
				4.4 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: 3/30/2023

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	4
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: 7/6/2023

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	0.72	31,512	98	0.24	10,603	74	0.08	3,546	80	76	0.32	1.05	4
Total	0.72	31,512		0.24	7,650		0.08	3,546			0.32	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

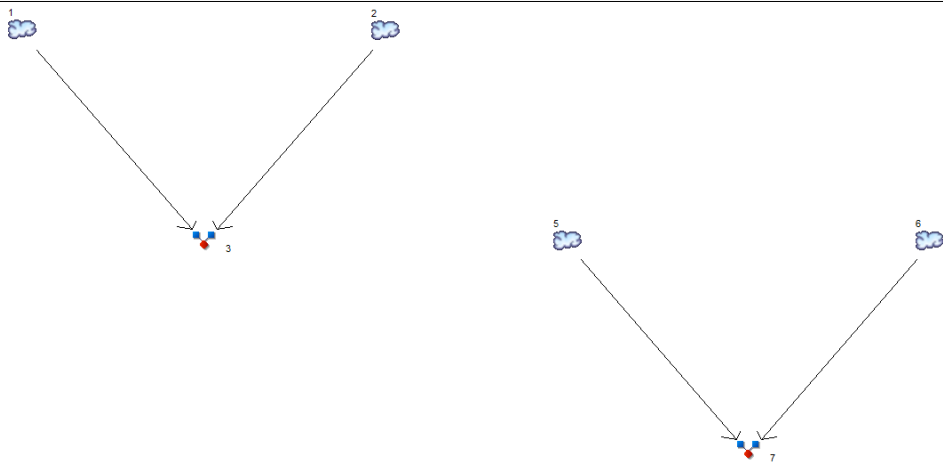
Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80

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

Watershed Model Schematic	1
Hydrograph Return Period Recap	2
2 - Year	
Summary Report	3
Hydrograph Reports	4
Hydrograph No. 1, SCS Runoff, Existing Site (Impervious)	4
Hydrograph No. 2, SCS Runoff, Existing Site (Pervious)	5
Hydrograph No. 3, Combine, Existing Total	6
Hydrograph No. 5, SCS Runoff, Proposed Site (Impervious)	7
Hydrograph No. 6, SCS Runoff, Proposed Site (Pervious)	8
Hydrograph No. 7, Combine, Proposed Total	9
10 - Year	
Summary Report	10
Hydrograph Reports	11
Hydrograph No. 1, SCS Runoff, Existing Site (Impervious)	11
Hydrograph No. 2, SCS Runoff, Existing Site (Pervious)	12
Hydrograph No. 3, Combine, Existing Total	13
Hydrograph No. 5, SCS Runoff, Proposed Site (Impervious)	14
Hydrograph No. 6, SCS Runoff, Proposed Site (Pervious)	15
Hydrograph No. 7, Combine, Proposed Total	16
100 - Year	
Summary Report	17
Hydrograph Reports	18
Hydrograph No. 1, SCS Runoff, Existing Site (Impervious)	18
Hydrograph No. 2, SCS Runoff, Existing Site (Pervious)	19
Hydrograph No. 3, Combine, Existing Total	20
Hydrograph No. 5, SCS Runoff, Proposed Site (Impervious)	21
Hydrograph No. 6, SCS Runoff, Proposed Site (Pervious)	22
Hydrograph No. 7, Combine, Proposed Total	23
IDF Report	24

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	-----	-----	2.696	-----	-----	4.116	-----	-----	6.851	Existing Site (Impervious)
2	SCS Runoff	-----	-----	0.224	-----	-----	0.533	-----	-----	1.215	Existing Site (Pervious)
3	Combine	1, 2	-----	2.913	-----	-----	4.640	-----	-----	8.056	Existing Total
5	SCS Runoff	-----	-----	2.311	-----	-----	3.528	-----	-----	5.872	Proposed Site (Impervious)
6	SCS Runoff	-----	-----	0.500	-----	-----	1.037	-----	-----	2.150	Proposed Site (Pervious)
7	Combine	5, 6	-----	2.803	-----	-----	4.553	-----	-----	8.012	Proposed Total
Proj. file: 2023-07-06 2, 10, 100 yr.gpw										Friday, Jul 7, 2023	

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	2.696	1	725	9,778	----	-----	-----	Existing Site (Impervious)
2	SCS Runoff	0.224	1	726	740	----	-----	-----	Existing Site (Pervious)
3	Combine	2.913	1	725	10,518	1, 2	-----	-----	Existing Total
5	SCS Runoff	2.311	1	725	8,381	----	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	0.500	1	726	1,584	----	-----	-----	Proposed Site (Pervious)
7	Combine	2.803	1	726	9,964	5, 6	-----	-----	Proposed Total
2023-07-06 2, 10, 100 yr.gpw					Return Period: 2 Year			Friday, Jul 7, 2023	

Hydrograph Report

Hydroflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

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	= 2.696 cfs
Time to peak	= 725 min
Hyd. volume	= 9,778 cuft
Curve number	= 98
Hydraulic length	= 0 ft
Time of conc. (Tc)	= 4.00 min
Distribution	= Custom
Shape factor	= 484

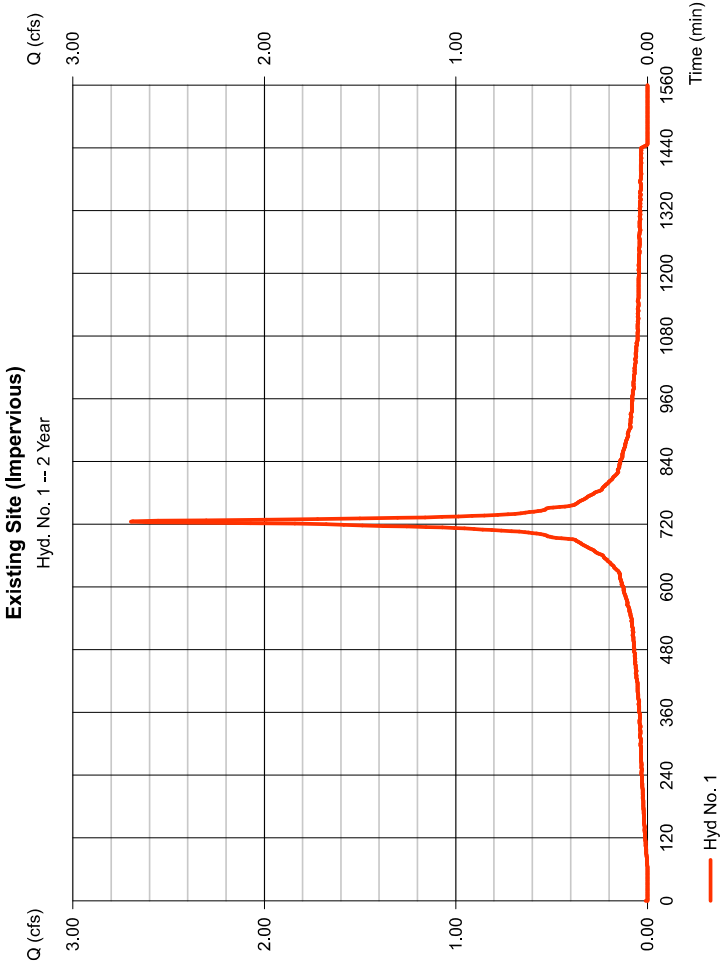
Hydroflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

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	= 0.224 cfs
Time to peak	= 726 min
Hyd. volume	= 740 cuft
Curve number	= 70
Hydraulic length	= 0 ft
Time of conc. (Tc)	= 4.00 min
Distribution	= Custom
Shape factor	= 484



Hydrograph Report

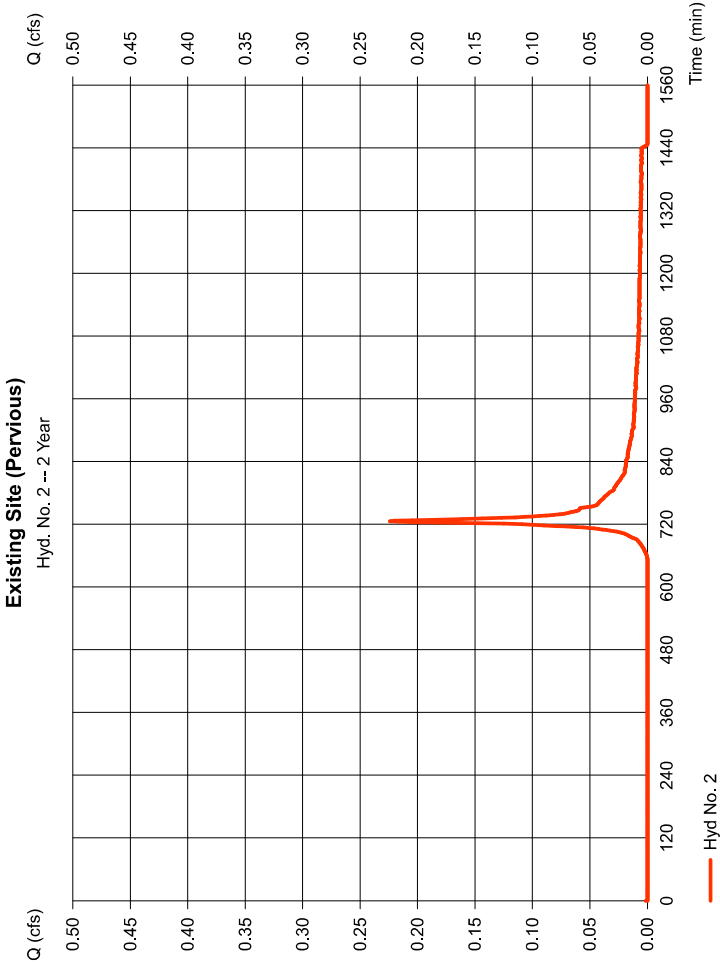
Friday, Jul 7, 2023

Hydroflow Hydrographs by Intellisolve v8.1

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.224 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 740 cuft
Drainage area	= 0.210 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 4.00 min
Total precip.	= 3.44 in	Distribution	= Custom
Storm duration	= NOAA Atlas 14 Type-D.cds	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 3

Existing Total

Hydrograph type	=	Combine	Peak discharge	=	2,913 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	10,518 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	1,050 ac

Hydrograph Report

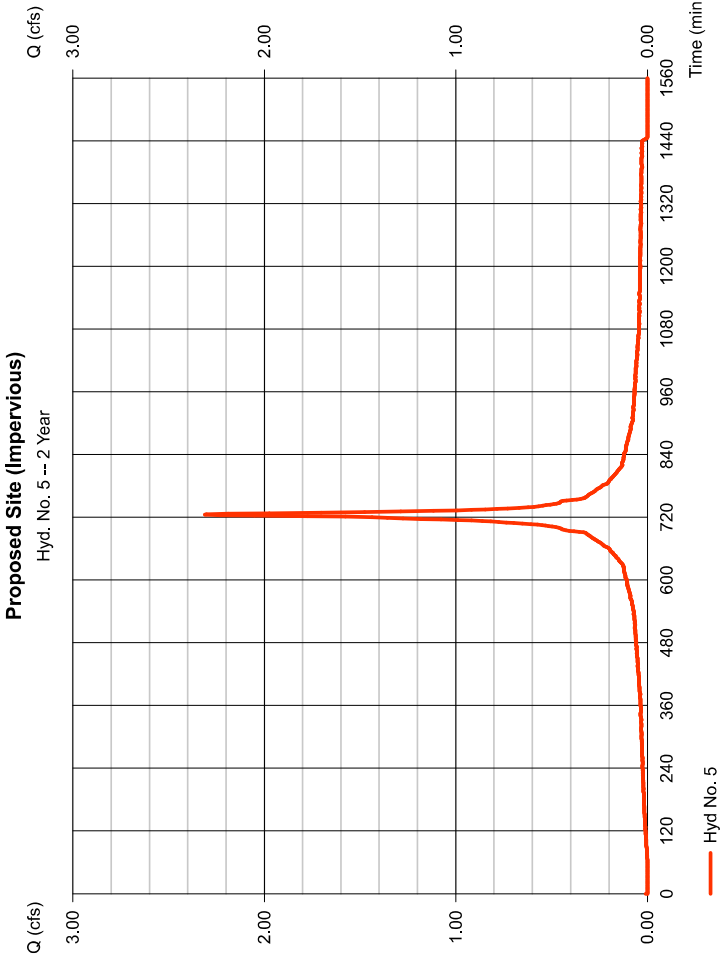
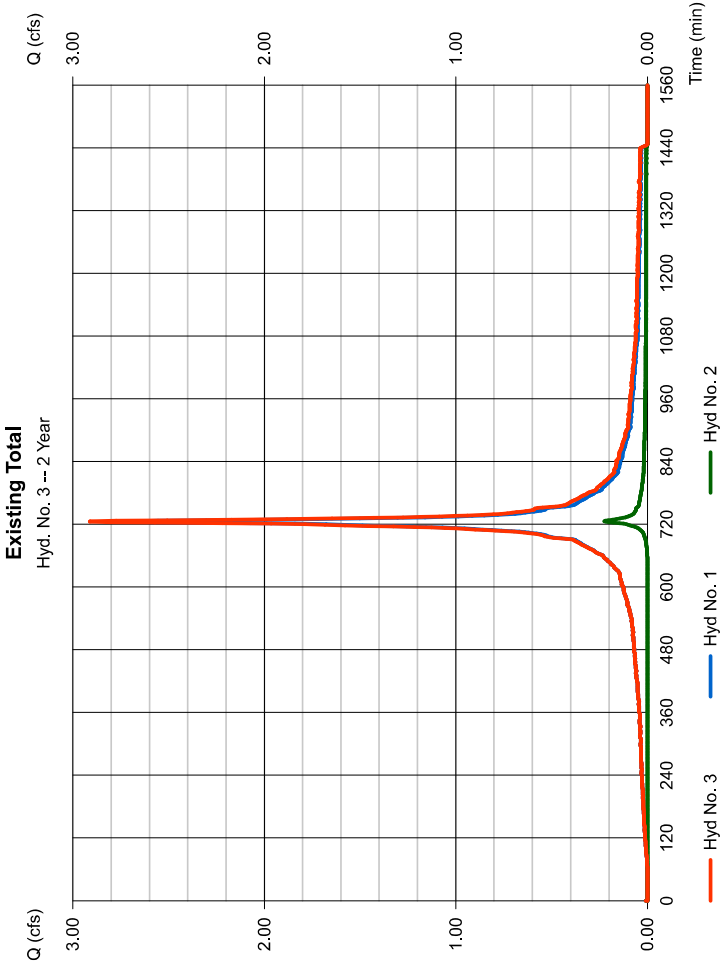
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	2,311 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	8,381 cuft
Drainage area	=	0.720 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	4.00 min
Total precip.	=	3.44 in	Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds	Shape factor	=	484

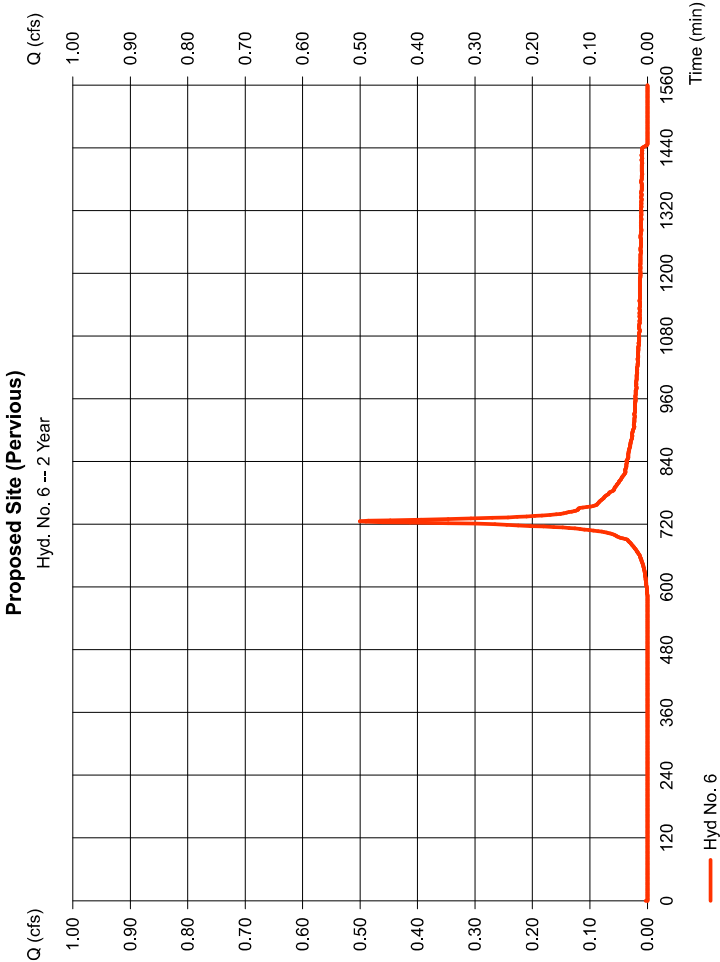


Hydrograph Report

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.500 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	1,584 cuft
Drainage area	=	0.330 ac	Curve number	=	76
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	4.00 min
Total precip.	=	3.44 in	Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds	Shape factor	=	484

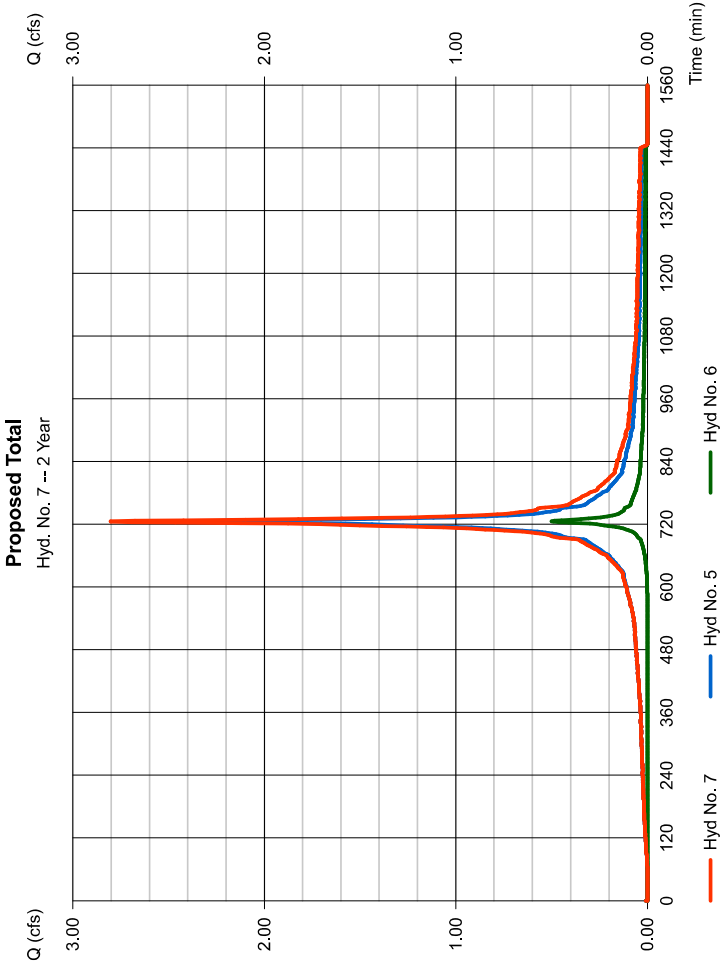


Hydrograph Report

Hyd. No. 7

Proposed Total

Hydrograph type	=	Combine	Peak discharge	=	2.803 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	9,964 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	1.050 ac



Hydrograph Summary Report

Hydratflow Hydrographs by Intellisolve 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	4,116	1	725	15,194	---	---	---	Existing Site (Impervious)
2	SCS Runoff	0,533	1	726	1,678	---	---	---	Existing Site (Pervious)
3	Combine	4,640	1	725	16,871	1, 2	---	---	Existing Total
5	SCS Runoff	3,528	1	725	13,023	---	---	---	Proposed Site (Impervious)
6	SCS Runoff	1,037	1	726	3,256	---	---	---	Proposed Site (Pervious)
7	Combine	4,553	1	725	16,279	5, 6	---	---	Proposed Total

2023-07-06 2, 10, 100 yr.gpw

Return Period: 10 Year

Friday, Jul 7, 2023

Hydrograph Report

Hydratflow Hydrographs by Intellisolve v9.1

Friday, Jul 7, 2023

Hyd. No. 1

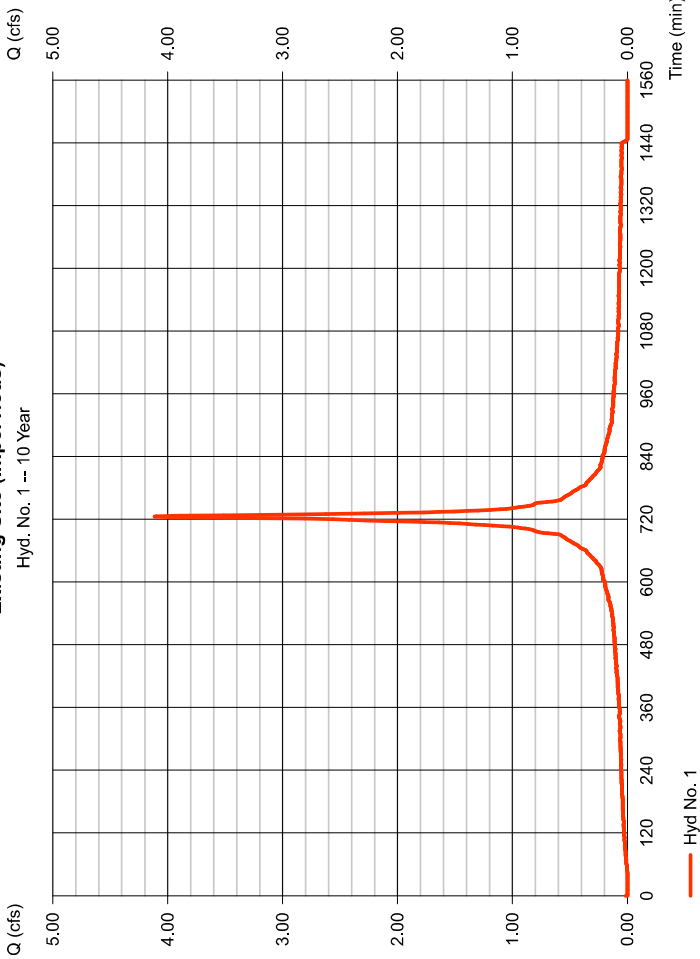
Existing Site (Impervious)

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 0.840 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.22 in
Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 4,116 cfs
Time to peak = 725 min
Hyd. volume = 15,194 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 4.00 min
Distribution = Custom
Shape factor = 484

Existing Site (Impervious)

Hyd. No. 1 -- 10 Year



Hydrograph Report

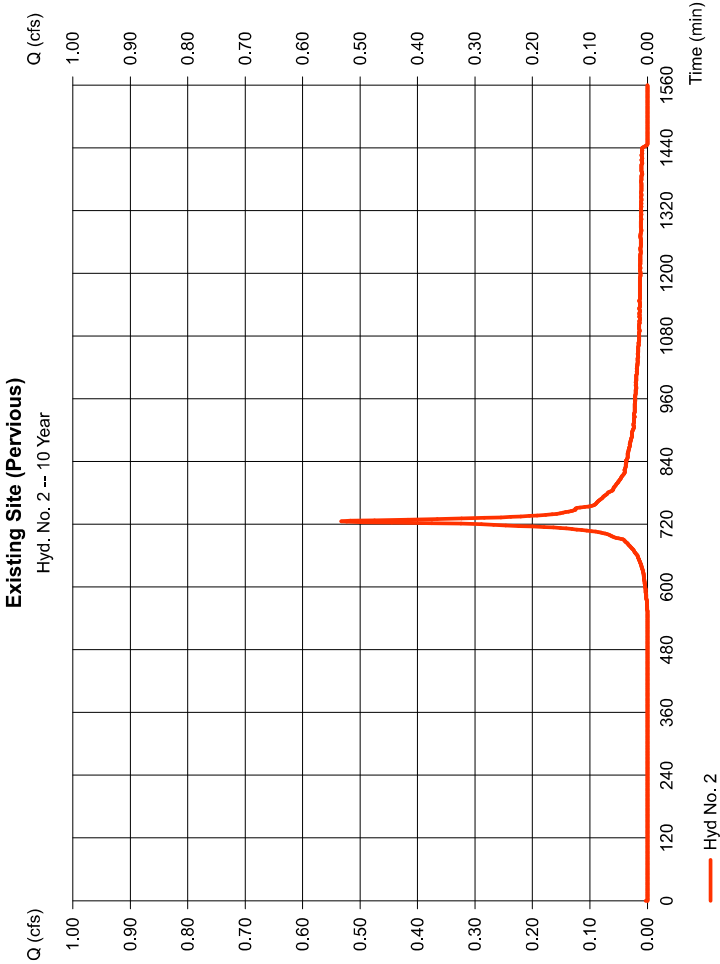
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.533 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	1,678 cuft
Drainage area	=	0.210 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	4.00 min
Total precip.	=	5.22 in	Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds	Shape factor	=	484



Hydrograph Report

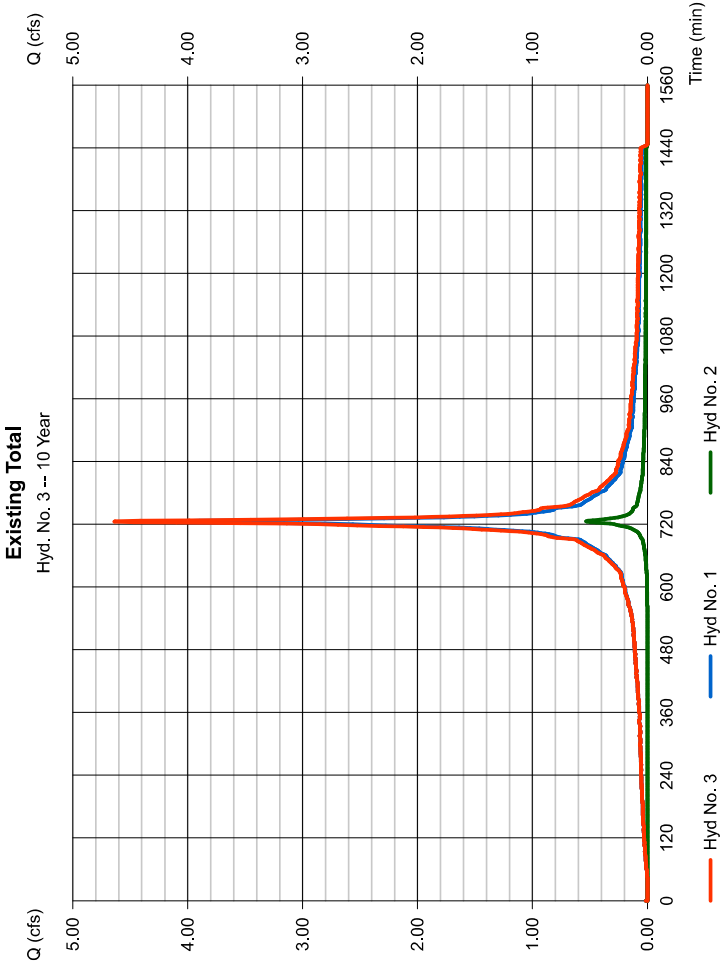
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 3

Existing Total

Hydrograph type	=	Combine	Peak discharge	=	4.640 cfs
Storm frequency	=	10 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	16,871 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	1.050 ac



Hydrograph Report

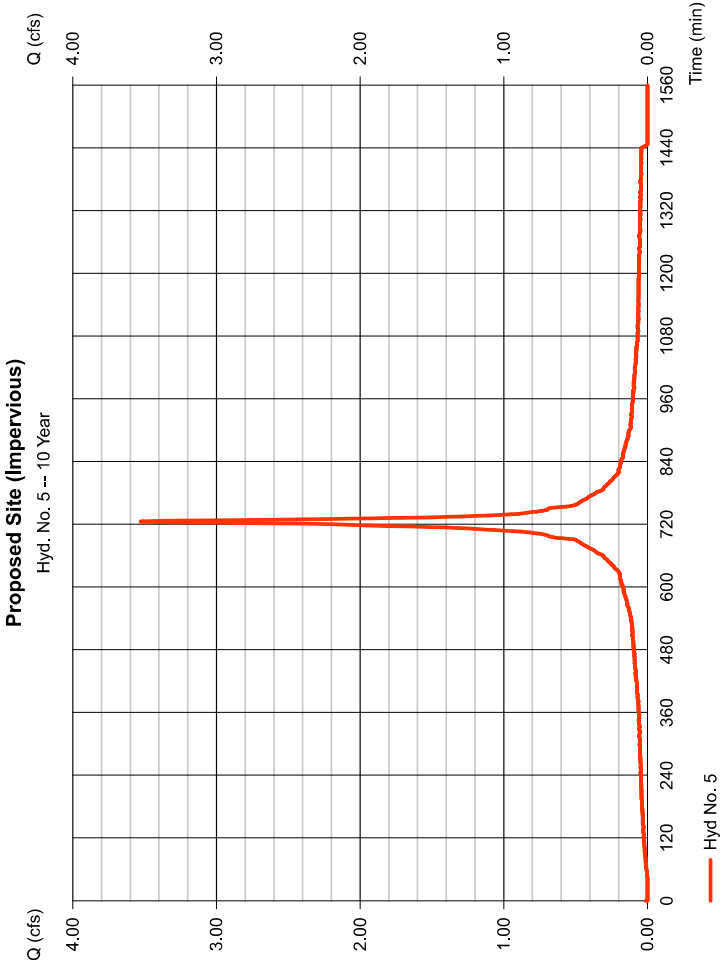
Hydraflo Hydrographs by Intellisphere v8.1

Friday, Jul 7, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type	=	SCS Runoff		Peak discharge	=	3.528 cfs
Storm frequency	=	10 yrs		Time to peak	=	725 min
Time interval	=	1 min		Hyd. volume	=	13,023 cuft
Drainage area	=	0.720 ac		Curve number	=	98
Basin Slope	=	0.0 %		Hydraulic length	=	0 ft
Tc method	=	USER		Time of conc. (Tc)	=	4.00 min
Total precip.	=	5.22 in		Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds		Shape factor	=	484



Hydrograph Report

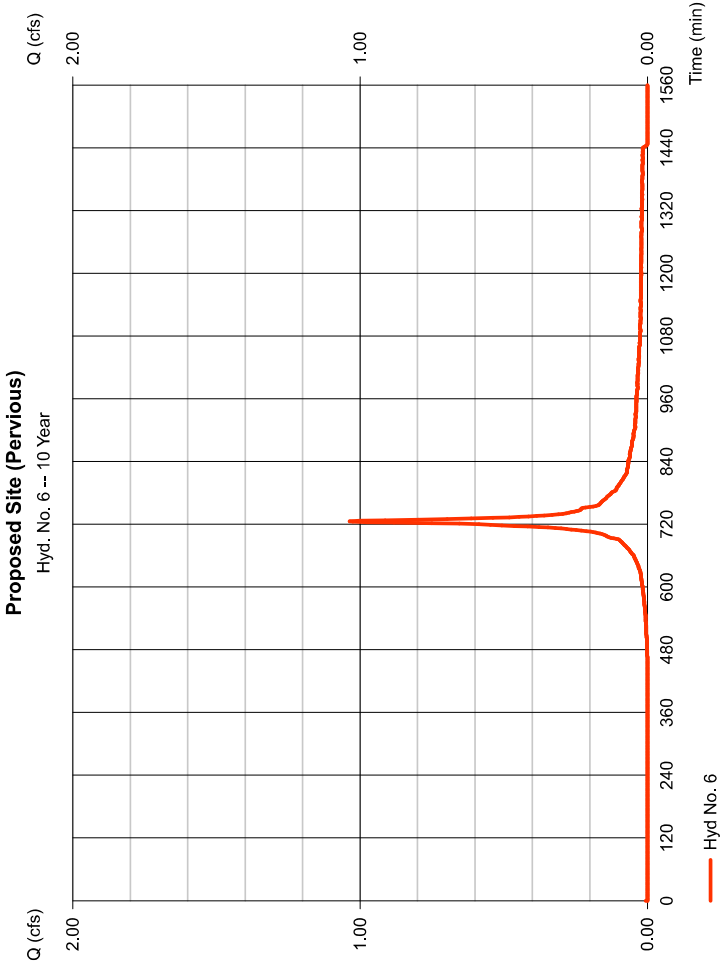
Hydraflo Hydrographs by Intellisphere v8.1

Friday, Jul 7, 2023

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type	=	SCS Runoff		Peak discharge	=	1.037 cfs
Storm frequency	=	10 yrs		Time to peak	=	726 min
Time interval	=	1 min		Hyd. volume	=	3,256 cuft
Drainage area	=	0.330 ac		Curve number	=	76
Basin Slope	=	0.0 %		Hydraulic length	=	0 ft
Tc method	=	USER		Time of conc. (Tc)	=	4.00 min
Total precip.	=	5.22 in		Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds		Shape factor	=	484



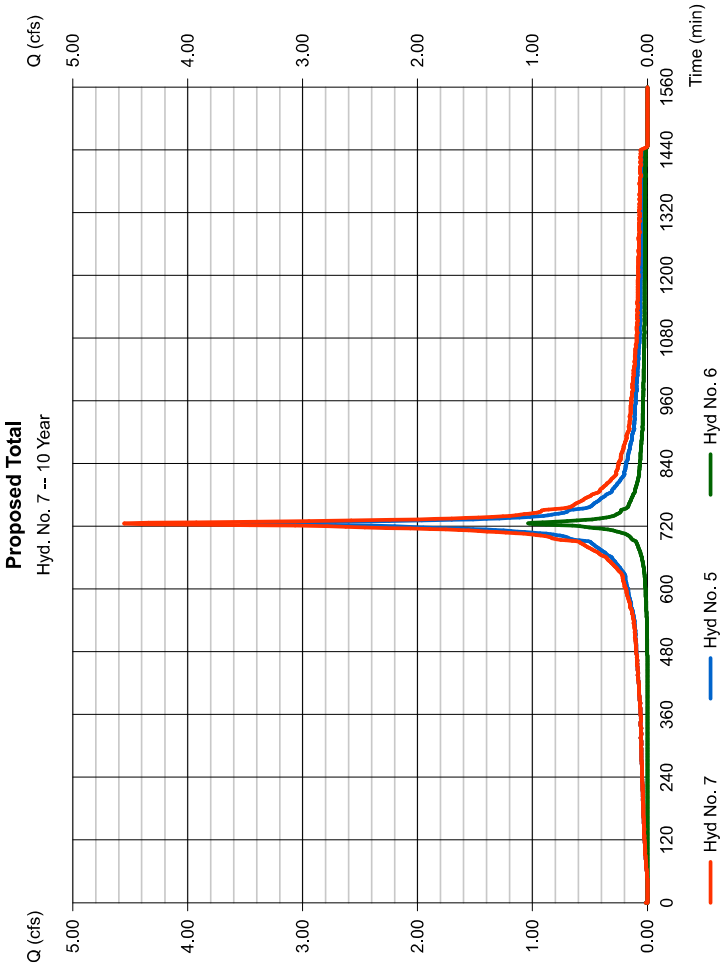
Hydrograph Report

Hydroflow Hydrographs by Intellisolve v9.1		Friday, Jul 7, 2023	
Hyd. No. 7			
Proposed Total			
Hydrograph type	= Combine	Peak discharge	= 4,553 cfs
Storm frequency	= 10 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 16,279 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1,050 ac

Hydrograph Summary Report

Hydroflow Hydrographs by Intellisolve 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	6,851	1	725	25,674	---	---	---	Existing Site (Impervious)
2	SCS Runoff	1,215	1	726	3,839	---	---	---	Existing Site (Pervious)
3	Combine	8,056	1	725	29,513	1, 2	---	---	Existing Total
5	SCS Runoff	5,872	1	725	22,006	---	---	---	Proposed Site (Impervious)
6	SCS Runoff	2,150	1	726	6,902	---	---	---	Proposed Site (Pervious)
7	Combine	8,012	1	725	28,908	5, 6	---	---	Proposed Total
2023-07-06 2, 10, 100 yr.gpw						Return Period: 100 Year		Friday, Jul 7, 2023	



Hydrograph Report

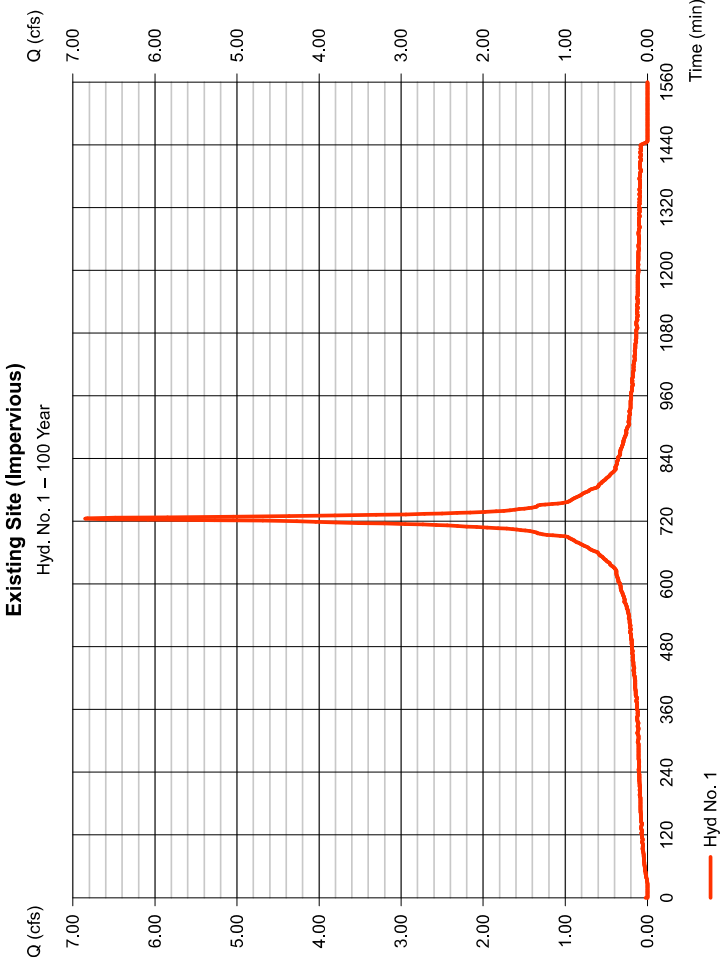
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type	=	SCS Runoff		Peak discharge	=	6.851 cfs
Storm frequency	=	100 yrs		Time to peak	=	725 min
Time interval	=	1 min		Hyd. volume	=	25,674 cuft
Drainage area	=	0.840 ac		Curve number	=	98
Basin Slope	=	0.0 %		Hydraulic length	=	0 ft
Tc method	=	USER		Time of conc. (Tc)	=	4.00 min
Total precip.	=	8.66 in		Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds		Shape factor	=	484



Hydrograph Report

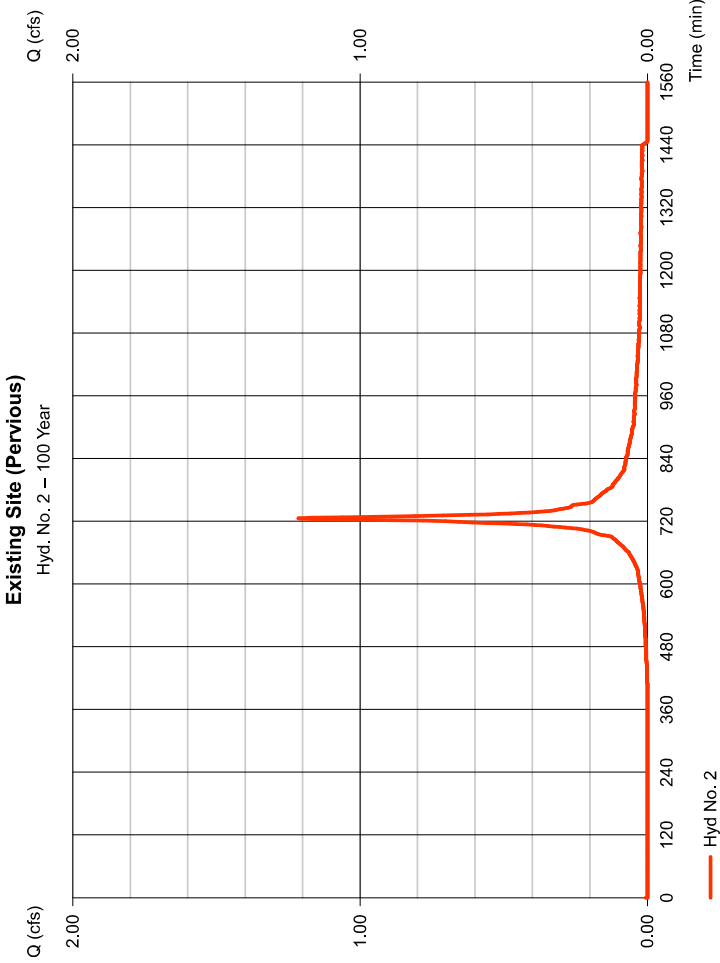
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type	=	SCS Runoff		Peak discharge	=	1.215 cfs
Storm frequency	=	100 yrs		Time to peak	=	726 min
Time interval	=	1 min		Hyd. volume	=	3,839 cuft
Drainage area	=	0.210 ac		Curve number	=	70
Basin Slope	=	0.0 %		Hydraulic length	=	0 ft
Tc method	=	USER		Time of conc. (Tc)	=	4.00 min
Total precip.	=	8.66 in		Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds		Shape factor	=	484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 3

Existing Total

Hydrograph type	=	Combine	Peak discharge	=	8,056 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	29,513 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	1,050 ac

Hydrograph Report

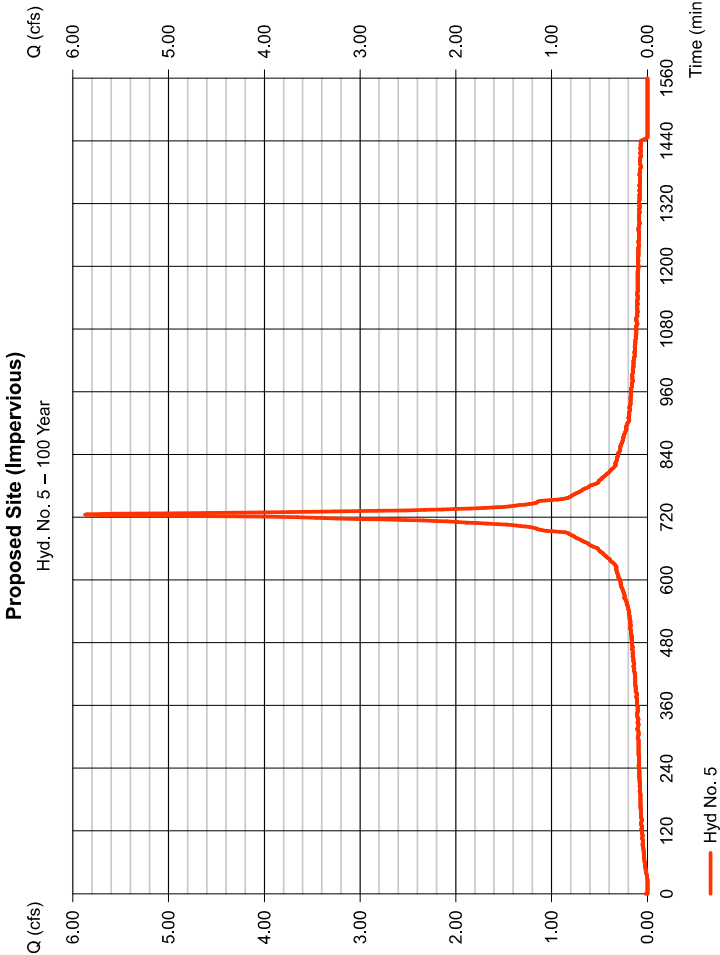
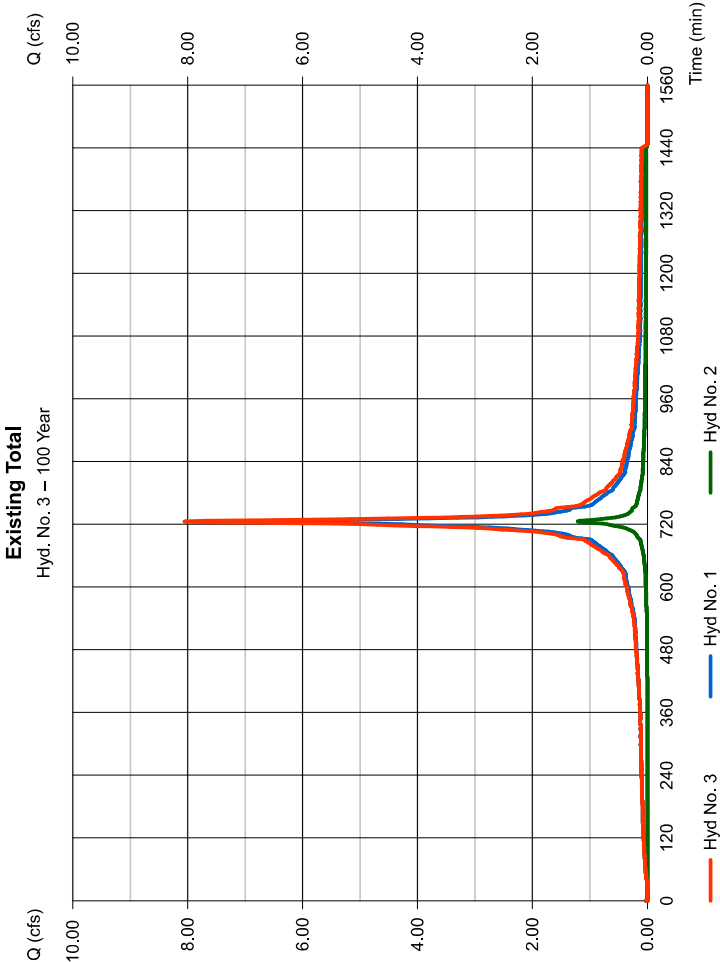
Hydraflow Hydrographs by Intellisolve v8.1

Friday, Jul 7, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	5,872 cfs
Storm frequency	=	100 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	22,006 cuft
Drainage area	=	0.720 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	4.00 min
Total precip.	=	8.66 in	Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds	Shape factor	=	484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v8.1

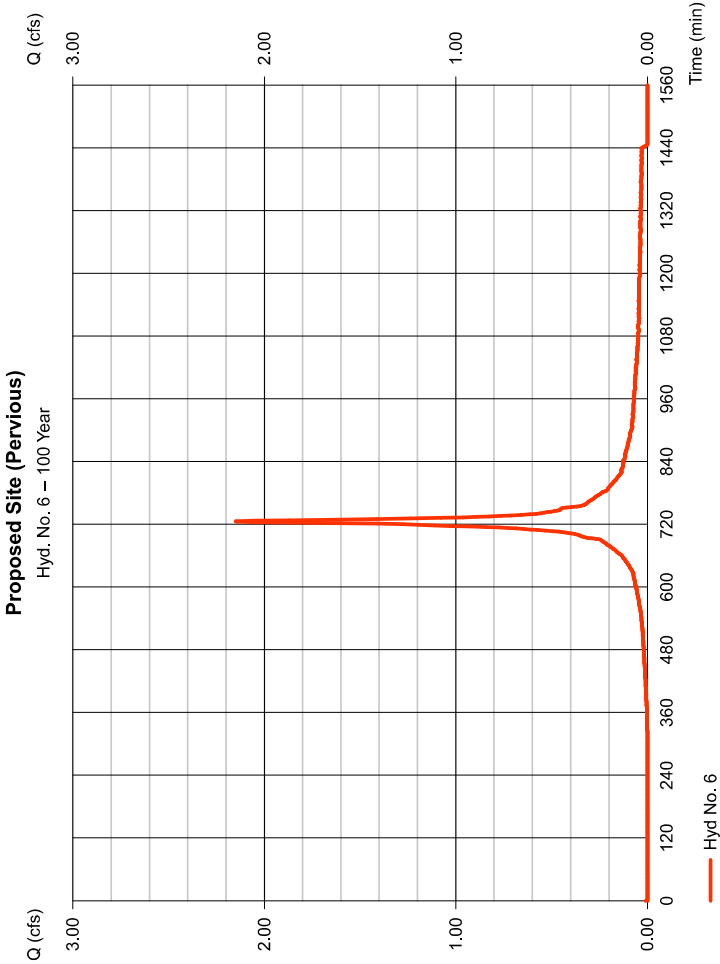
Friday, Jul 7, 2023

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 0.330 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.66 in
Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2,150 cfs
Time to peak = 726 min
Hyd. volume = 6,902 cuft
Curve number = 76
Hydraulic length = 0 ft
Time of conc. (Tc) = 4,00 min
Distribution = Custom
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v8.1

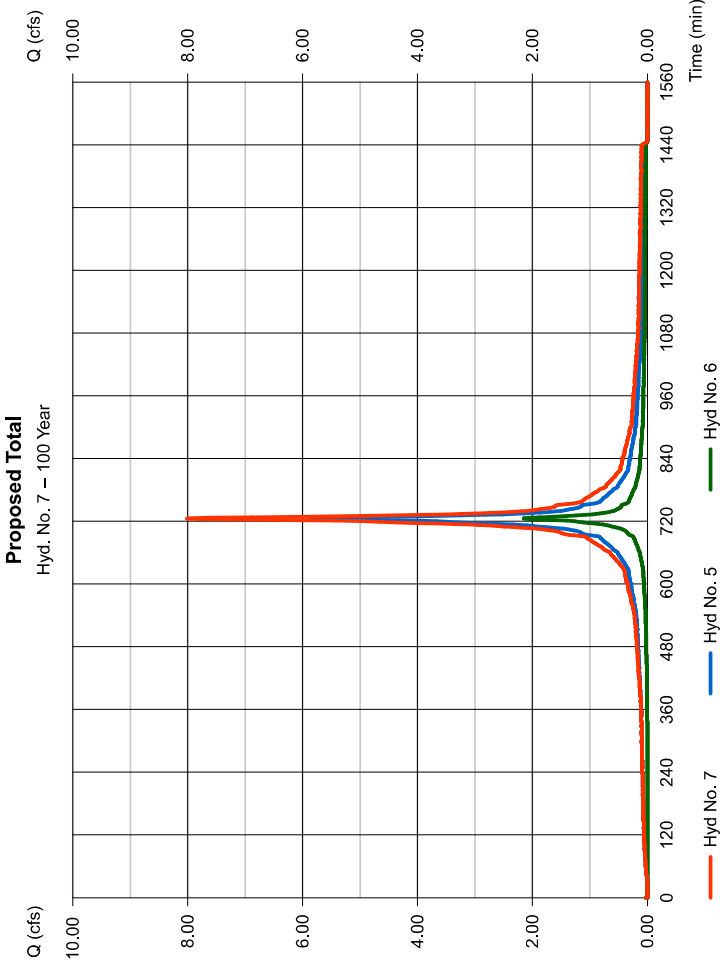
Friday, Jul 7, 2023

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyds. = 5, 6

Peak discharge = 8,012 cfs
Time to peak = 725 min
Hyd. volume = 28,908 cuft
Contrib. drain. area = 1,050 ac



Hydraflow Rainfall Report

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

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)									
	5 min	10	15	20	25	30	35	40	45	50
1	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
3	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
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03

Tc = time in minutes. Values may exceed 60.

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

Precip. file name: Essex County.pcp

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

Multi-Hydrograph Plot

Hyd. No. 3

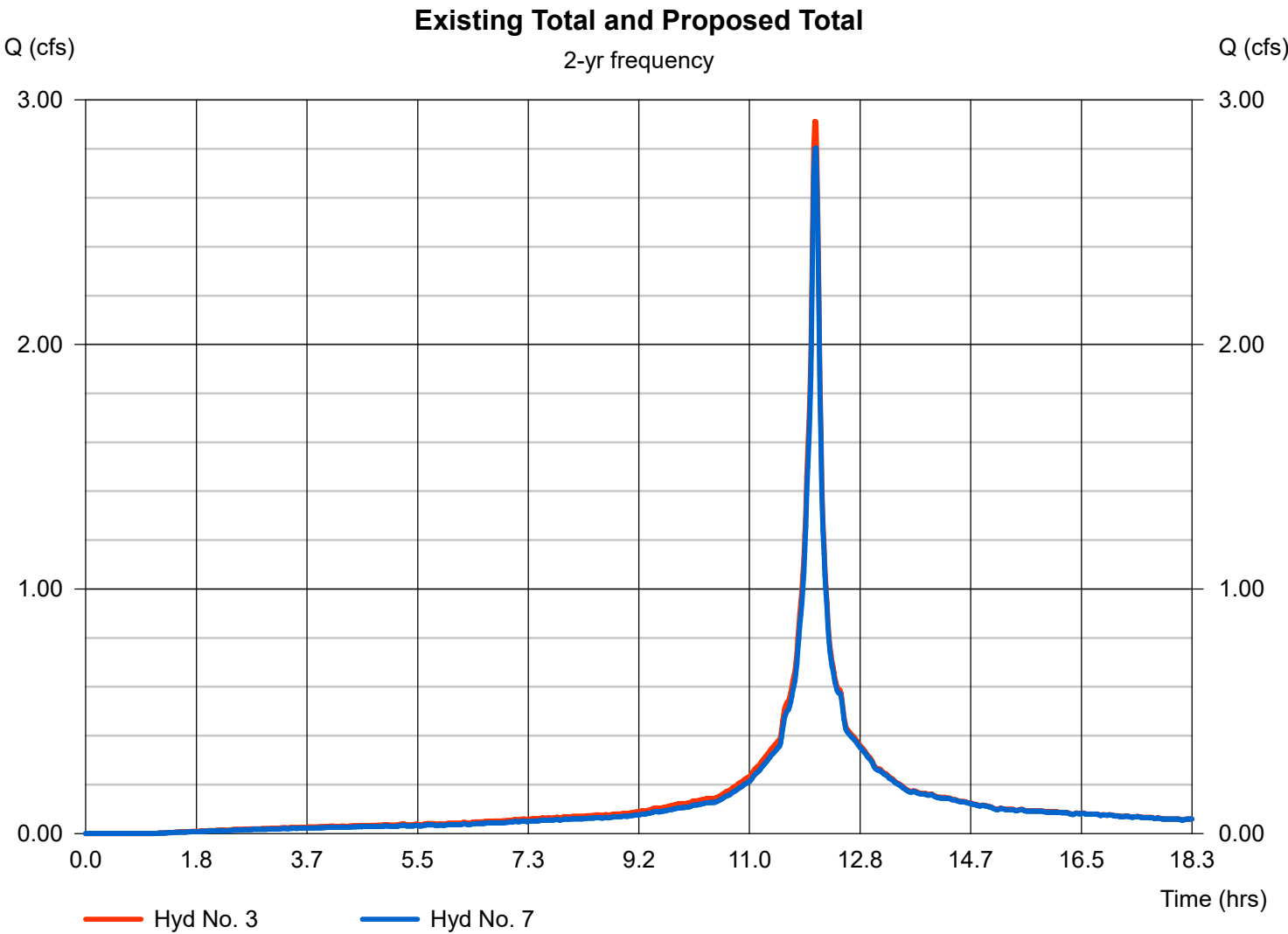
Existing Total

Hydrograph type = Combine
Peak discharge = 2.913 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 10,518 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 2.80 cfs
Time to peak = 12.10 hrs
Hyd. Volume = 9,964 cuft



Multi-Hydrograph Plot

Hyd. No. 3

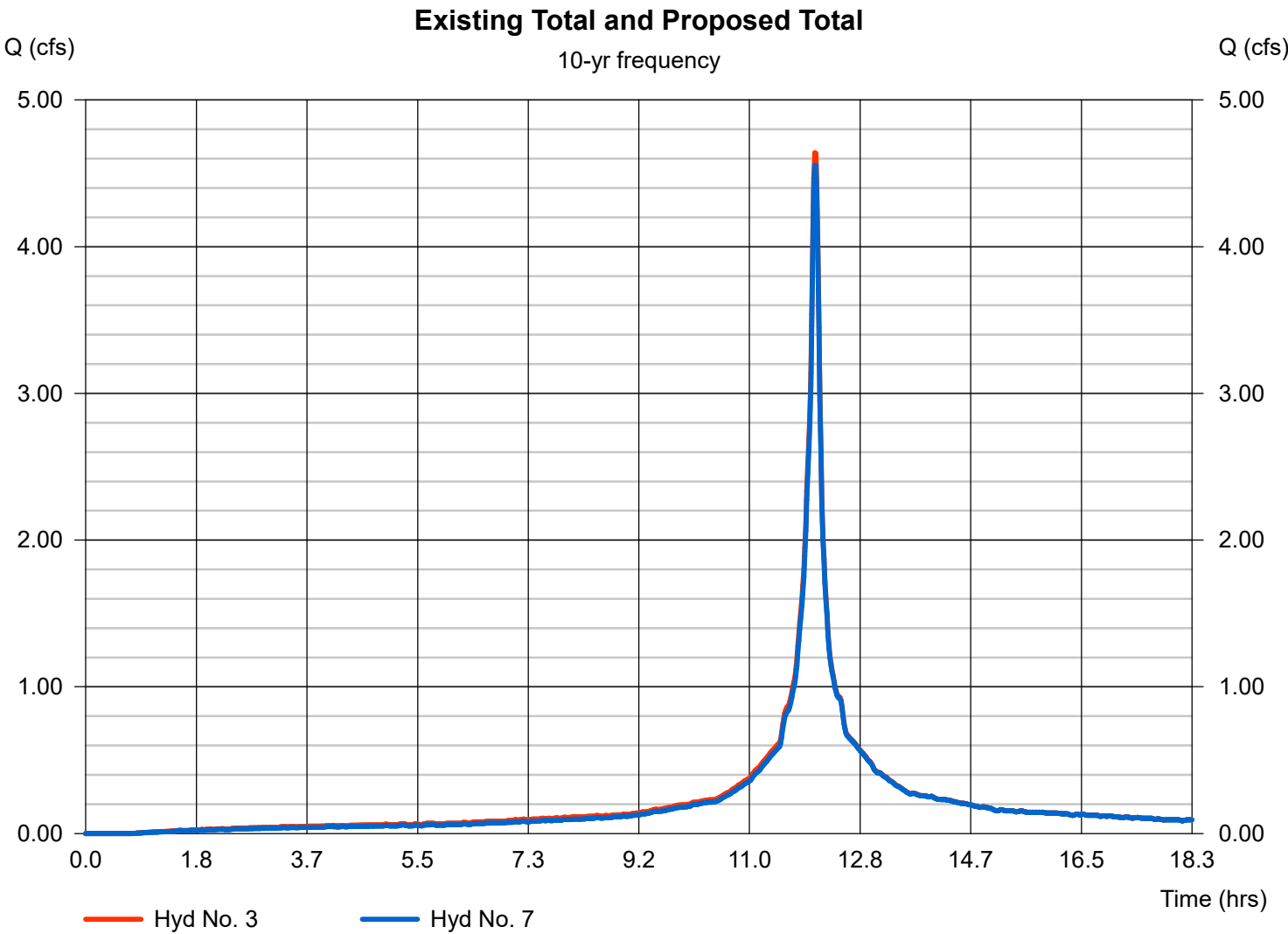
Existing Total

Hydrograph type = Combine
Peak discharge = 4.640 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 16,871 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 4.55 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 16,279 cuft



Multi-Hydrograph Plot

Hyd. No. 3

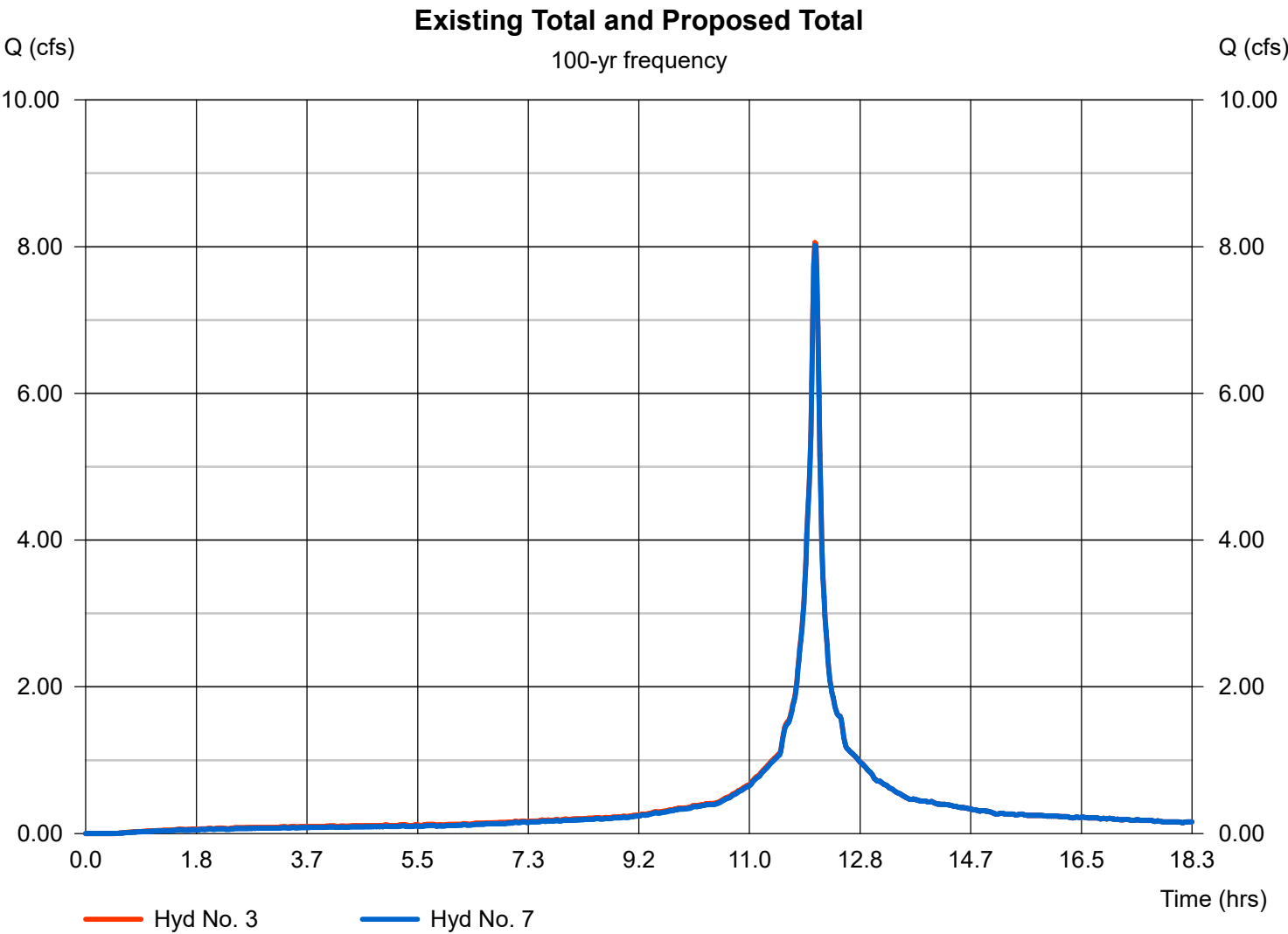
Existing Total

Hydrograph type = Combine
Peak discharge = 8.056 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 29,513 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 8.01 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 28,908 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: 7/6/2023

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 A-112	Inlet A-111	0.15	0.80	0.12	0.12	10.00	0.21	10.00	6.80	0.82	0.82	12	93.0	0.013	0.0268	5.83	7.43
Inlet A-111	Inlet A-110	0.11	0.88	0.10	0.22	10.00	0.07	10.21	6.80	0.68	1.50	12	55.0	0.013	0.0813	10.15	12.93
Sonic Roof	Inlet A-140	0.03	0.95	0.03	0.03	10.00	0.10	10.00	6.80	0.20	0.20	6	55.0	0.010	0.0576	1.75	8.92
Popeyes Roof	Inlet A-131	0.06	0.95	0.06	0.06	10.00	0.21	10.00	6.80	0.41	0.41	6	46.0	0.010	0.0100	0.73	3.72
Inlet A-131	Inlet A-140	0.08	0.67	0.05	0.11	10.00	0.21	10.21	6.80	0.34	0.75	12	60.0	0.013	0.0112	3.77	4.80
Inlet A-140	Manhole A-130	0.23	0.72	0.17	0.31	10.00	0.19	10.42	6.80	1.16	2.11	12	53.0	0.013	0.0100	3.56	4.54
Manhole A-130	Inlet A-120	0.00	0.00	0.00	0.31	10.00	0.33	10.61	6.68	0.00	2.07	12	91.0	0.013	0.0100	3.56	4.54
Inlet A-120	Inlet A-110	0.19	0.75	0.14	0.45	10.00	0.30	10.94	6.68	0.94	3.01	12	118.0	0.013	0.0202	5.06	6.45
Inlet A-110	Existing Inlet	0.12	0.94	0.11	0.78	10.00	0.06	11.24	6.56	0.72	5.12	15	39.0	0.013	0.0459	13.83	11.28

DRAINAGE & INLET AREA MAPS