

Nelson Engineering Associates, Inc.

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Drainage System Design Report
Preliminary and Final Site Plan

Syed Brothers Management, LLC

Tax Block 4104, Tax Lot 15
Township of Neptune
Monmouth County, New Jersey

Date:

April 27, 2020

Prepared By:



(SEAL)

Matthew R. DuBois, PE
File Number: 190403

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Scope of Project:

The subject property, 3655 Route 33, is currently developed as a Gulf station along the highway frontage with approximately one third of an acre of open lawn in the rear of the site. The lot drains overland in an generally southwesterly direction toward Route 33 and the catch basins at the intersection of Route 33 with West Jumping Brook Road.

The applicant is seeking to expand the existing building to provide 3 additional service bays as well as a second floor office. The improvements will also consist of additional parking in the rear of the building and a subsurface stormwater management system to control the runoff from the new improvements.

The hydrograph generation uses the NRCS¹ method, the Time of Concentration calculations use TR-55². The calculations use the latest NRCS precipitation values from the Long Branch / Oakhurst weather station which exceed the standard precipitation values for Monmouth County at njstormwater.org/rainfalldata.htm

Applicability of Stormwater Regulations:

“Major Development” is defined in the ordinance as “any "development" that provides for ultimately disturbing one (1) or more acres of land or increasing impervious surface by one-quarter (1/4) acre or more. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.”

The project proposes to disturb 0.45 acres including a storm sewer connection and sidewalk construction in the West Jumping Brook Road right-of-way. The impervious area is increased by 7,137 square feet (0.16 acres). Therefore the project is not a “Major Development” and is not subject to the requirements of the Stormwater Management ordinance at Section 528. Therefore, the project has been designed to comply with the requirements of the Standards for Soil Erosion and Sediment Control in New Jersey.

Stormwater Runoff Summary:

The project captures runoff from the roof of the addition and the new parking area through the use of roof drains, grading, and storm inlets. Runoff is then directed to an underground detention basin consisting of four lengths of 36” diameter pipe, each 120 feet long. The stormwater is then held and slowly released to the storm drain at the intersection of West Jumping Brook Road and Route 33 where the site previously discharged. The front of the property remains largely unchanged with 0.432 acres of impervious continuing to enter the inlet via overland flow.

Existing Conditions

	Impervious	Open Space	Total Existing
2 Year Peak Rate	0.345 cfs	0.001 cfs	0.345 cfs
10 Year Peak Rate	0.537 cfs	0.028 cfs	0.537 cfs
100 Year Peak Rate	0.923 cfs	0.519 cfs	1.439 cfs

Basin Operations

	Impervious	Open Space	Total to Basin	Basin Discharge
2 Year Peak Rate	0.863 cfs	0 cfs	0.863 cfs	0.158 cfs
10 Year Peak Rate	1.345 cfs	0.009 cfs	1.345 cfs	0.194 cfs
100 Year Peak Rate	2.311 cfs	0.166 cfs	2.477 cfs	0.267 cfs

¹ United States National Resources Conservation Service, formerly the United States Soil Conservation Service

² *Urban Hydrology for Small Watersheds* by the United States Department of Agriculture

Proposed Conditions

	Basin Discharge	Uncontrolled Impervious	Uncontrolled Open Space	Total Developed
2 Year Peak Rate	0.158 cfs	0.020 cfs	0 cfs	0.162 cfs
10 Year Peak Rate	0.194 cfs	0.031 cfs	0.006 cfs	0.205 cfs
100 Year Peak Rate	0.267 cfs	0.053 cfs	0.102 cfs	0.370 cfs

Compliance with the Standard for Off-Site Stability:

This section analyzes the two main areas of concern. The point of discharge for each system, and the downstream impacts from the proposed stormwater management systems.

Point of Discharge Stability:

Where there is a well defined waterway below the point of discharge, Point of Discharge Stability can be demonstrated by retaining pre-developed runoff characteristics. The proposed stormwater management system discharges to an existing storm sewer system with new peak discharge rates below currently existing rates.

Downstream of the Point of Discharge:

In lieu of performing a comprehensive watershed analysis, a detention facility can be designed to reduce peak flows to 50% and 75% respectively of the pre-development peak rate.

Downstream Stability Peak Rates

	Total Existing	Total Developed	Post-development Peak Reduction
2 Year Peak Rate	0.345 cfs	0.162 cfs	47.0%
10 Year Peak Rate	0.537 cfs	0.205 cfs	38.2 %
100 Year Peak Rate	1.439 cfs	0.370 cfs	25.7 %

For both the 2 and 10 year return period storm events, the peak rate of runoff is reduced to levels at least 50% and 75% of existing.

Conclusion:

The project meets the requirements of the Standards for Soil Erosion and Sediment Control in New Jersey by capturing the runoff from the proposed addition and new parking area and releasing it at rates of at least 50% and 75% of the pre-development peak rates for the 2 and 10 year storm events.

WORKSHEETS

WORKSHEET #2 : RUN-OFF CURVE NUMBER AND RUN-OFF							
PROJECT:	190403 Syed Brothers Management, LLC			BY:	MRD	DATE:	4/29/2020
LOCATION:	Nephtune Township			CHK:		DATE:	
CIRCLE ONE:	<input checked="" type="radio"/> PRESENT DEVELOPED		<input type="radio"/> Undisturbed Area				
1. RUN-OFF CURVE NUMBER (CN)							
SOIL NAME AND HYDROLOGIC SOIL GROUP (APPENDIX A)	COVER DESCRIPTION (type, treatment, hydrologic condition, percent impervious, unconnected/connected impervious area)	CN			AREA	PRODUCT OF CN x AREA	
		Table 2-2	Fig. 2-3	Fig. 2-4	ACRES MI**2 %		
EvuB / KkhB	Impervious areas	98			0.432	42.34	
HSG A						0.00	
						0.00	
						0.00	
						0.00	
						0.00	
						0.00	
TOTALS =					0.432	42.34	
CN (weighted) =	total product =	42.336	=	98.00	USE CN =	98	
	total area	0.432					
2. RUN-OFF							
				STORM #1	STORM #2	STORM #3	
FREQUENCY.....(yr.)							
RAINFALL, P (24 HOUR).....(in.)							
RUN-OFF, Q.....(in.)							
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)							

WORKSHEET #2 : RUN-OFF CURVE NUMBER AND RUN-OFF						
PROJECT:	190403 Syed Brothers Management, LLC	BY:	MRD	DATE:	4/29/2020	
LOCATION:	Neptune Township	CHK:		DATE:		
CIRCLE ONE:	PRESENT DEVELOPED	Existing Site				
1. RUN-OFF CURVE NUMBER (CN)						
SOIL NAME AND HYDROLOGIC SOIL GROUP (APPENDIX A)	COVER DESCRIPTION (type, treatment, hydrologic condition, percent impervious, unconnected/connected impervious area)	Table 2-2	Fig. 2-3	Fig. 2-4	AREA ACRES MI**2 %	PRODUCT OF CN x AREA
EvuB / KkhB	Impervious areas	98			0.105	10.29
HSG A	Open Space	39			0.340	13.26
						0.00
						0.00
						0.00
						0.00
						0.00
TOTALS =					0.445	23.55
CN (weighted) =	$\frac{\text{total product}}{\text{total area}} =$	$\frac{23.55}{0.445}$	=	52.92	USE CN =	53
2. RUN-OFF						
		STORM #1	STORM #2	STORM #3		
FREQUENCY.....(yr.)						
RAINFALL, P (24 HOUR).....(in.)						
RUN-OFF, Q.....(in.)						
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)						

WORKSHEET #2 : RUN-OFF CURVE NUMBER AND RUN-OFF						
PROJECT:	190403 Syed Brothers Management, LLC	BY:	MRD	DATE:	4/29/2020	
LOCATION:	Neptune Township	CHK:		DATE:		
CIRCLE ONE:	PRESENT <u>DEVELOPED</u>	Flow to Detention Basin				
1. RUN-OFF CURVE NUMBER (CN)						
SOIL NAME AND HYDROLOGIC SOIL GROUP (APPENDIX A)	COVER DESCRIPTION (type, treatment, hydrologic condition, percent impervious, unconnected/connected impervious area)	Table 2-2	Fig. 2-3	Fig. 2-4	AREA ACRES MI**2 %	PRODUCT OF CN x AREA
		CN				
EvuB / KkhB	Impervious areas	98			0.263	25.77
HSG A	Open Space	39			0.109	4.25
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
TOTALS =					0.372	30.03
CN (weighted) =	total product =	30.025	=	80.71	USE CN =	81
	total area	0.372				
2. RUN-OFF						
		STORM #1	STORM #2	STORM #3		
FREQUENCY.....(yr.)						
RAINFALL, P (24 HOUR).....(in.)						
RUN-OFF, Q.....(in.)						
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)						

WORKSHEET #2 : RUN-OFF CURVE NUMBER AND RUN-OFF						
PROJECT:	190403 Syed Brothers Management, LLC	BY:	MRD	DATE:	4/29/2020	
LOCATION:	Neptune Township	CHK:		DATE:		
CIRCLE ONE:	PRESENT <u>DEVELOPED</u>	Developed Overland Flow				
1. RUN-OFF CURVE NUMBER (CN)						
SOIL NAME AND HYDROLOGIC SOIL GROUP (APPENDIX A)	COVER DESCRIPTION (type, treatment, hydrologic condition, percent impervious, unconnected/connected impervious area)	CN			AREA	PRODUCT OF CN x AREA
		Table 2-2	Fig. 2-3	Fig. 2-4	ACRES MI**2 %	
EvuB / KkhB	Impervious areas	98			0.006	0.59
HSG A	Open Space	39			0.067	2.61
						0.00
						0.00
						0.00
						0.00
						0.00
TOTALS =					0.073	3.20
CN (weighted) =	total product =	3.201	=	43.85	USE CN =	44
	total area	0.073				
2. RUN-OFF						
		STORM #1	STORM #2	STORM #3		
FREQUENCY.....(yr.)						
RAINFALL, P (24 HOUR).....(in.)						
RUN-OFF, Q.....(in.)						
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)						

TR55 Tc Worksheet

Hyd. No. 3

Existing Open Space

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>		<u>Totals</u>	
Sheet Flow								
Manning's n-value	= 0.150		0.011		0.011			
Flow length (ft)	= 85.0		0.0		0.0			
Two-year 24-hr precip. (in)	= 3.40		0.00		0.00			
Land slope (%)	= 3.80		0.00		0.00			
Travel Time (min)	= 6.46	+	0.00	+	0.00	=	6.46	
Shallow Concentrated Flow								
Flow length (ft)	= 0.00		0.00		0.00			
Watercourse slope (%)	= 0.00		0.00		0.00			
Surface description	= Unpaved		Paved		Paved			
Average velocity (ft/s)	= 0.00		0.00		0.00			
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00	
Channel Flow								
X sectional flow area (sqft)	= 0.00		0.00		0.00			
Wetted perimeter (ft)	= 0.00		0.00		0.00			
Channel slope (%)	= 0.00		0.00		0.00			
Manning's n-value	= 0.015		0.015		0.015			
Velocity (ft/s)	= 0.00		0.00		0.00			
Flow length (ft)	= 0.0		0.0		0.0			
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00	
Total Travel Time, Tc							=	6.50 min

HYDROGRAPHS

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.24

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	----	-----	1.418	----	-----	2.210	----	-----	3.796	Undisturbed Area
2	SCS Runoff	----	-----	0.345	----	-----	0.537	----	-----	0.923	Existing Impervious
3	SCS Runoff	----	-----	0.001	----	-----	0.028	----	-----	0.519	Existing Open Space
4	Combine	2, 3	-----	0.345	----	-----	0.537	----	-----	1.439	Total Existing Runoff
5	SCS Runoff	----	-----	0.863	----	-----	1.345	----	-----	2.311	Controlled Impervious
6	SCS Runoff	----	-----	0.000	----	-----	0.009	----	-----	0.166	Controlled Open Space
7	Combine	5, 6	-----	0.863	----	-----	1.345	----	-----	2.477	Total to Basin
8	Reservoir	7	-----	0.158	----	-----	0.194	----	-----	0.267	Routed Basin
9	SCS Runoff	----	-----	0.020	----	-----	0.031	----	-----	0.053	Uncontrolled Impervious
10	SCS Runoff	----	-----	0.000	----	-----	0.006	----	-----	0.102	Uncontrolled Open Space
11	Combine	8, 9, 10	-----	0.162	----	-----	0.205	----	-----	0.370	Total Developed Runoff

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.24

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	1.418	2	724	4,802	----	----	----	Undisturbed Area
2	SCS Runoff	0.345	2	724	1,167	----	----	----	Existing Impervious
3	SCS Runoff	0.001	2	1324	10	----	----	----	Existing Open Space
4	Combine	0.345	2	724	1,177	2, 3	----	----	Total Existing Runoff
5	SCS Runoff	0.863	2	724	2,924	----	----	----	Controlled Impervious
6	SCS Runoff	0.000	2	1324	3	----	----	----	Controlled Open Space
7	Combine	0.863	2	724	2,927	5, 6	----	----	Total to Basin
8	Reservoir	0.158	2	750	2,926	7	94.11	903	Routed Basin
9	SCS Runoff	0.020	2	724	67	----	----	----	Uncontrolled Impervious
10	SCS Runoff	0.000	2	1324	2	----	----	----	Uncontrolled Open Space
11	Combine	0.162	2	742	2,994	8, 9, 10	----	----	Total Developed Runoff

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

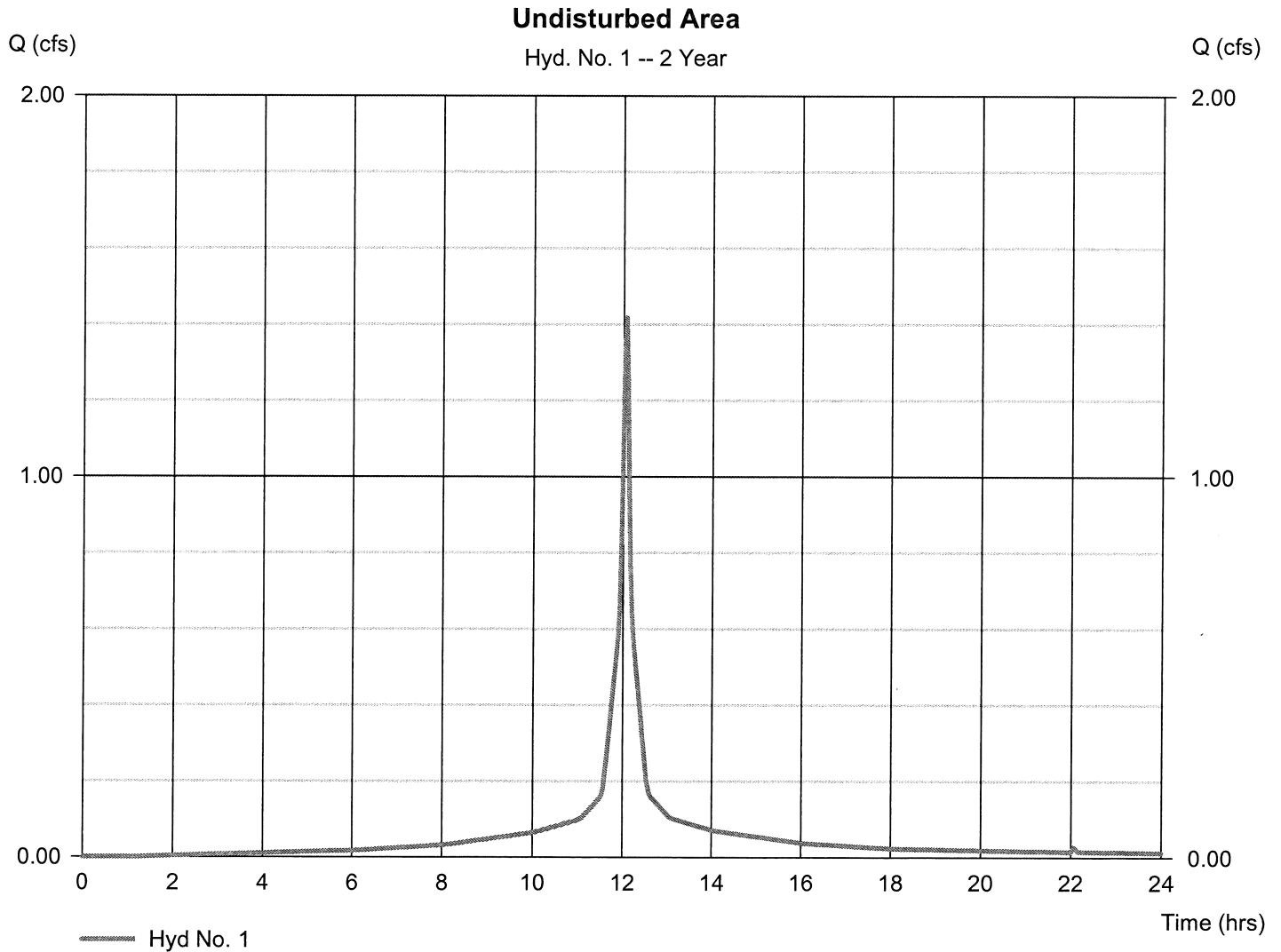
Wednesday, Apr 29, 2020

Hyd. No. 1

Undisturbed Area

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.432 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 1.418 cfs
Time to peak = 12.07 hrs
Hyd. volume = 4,802 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



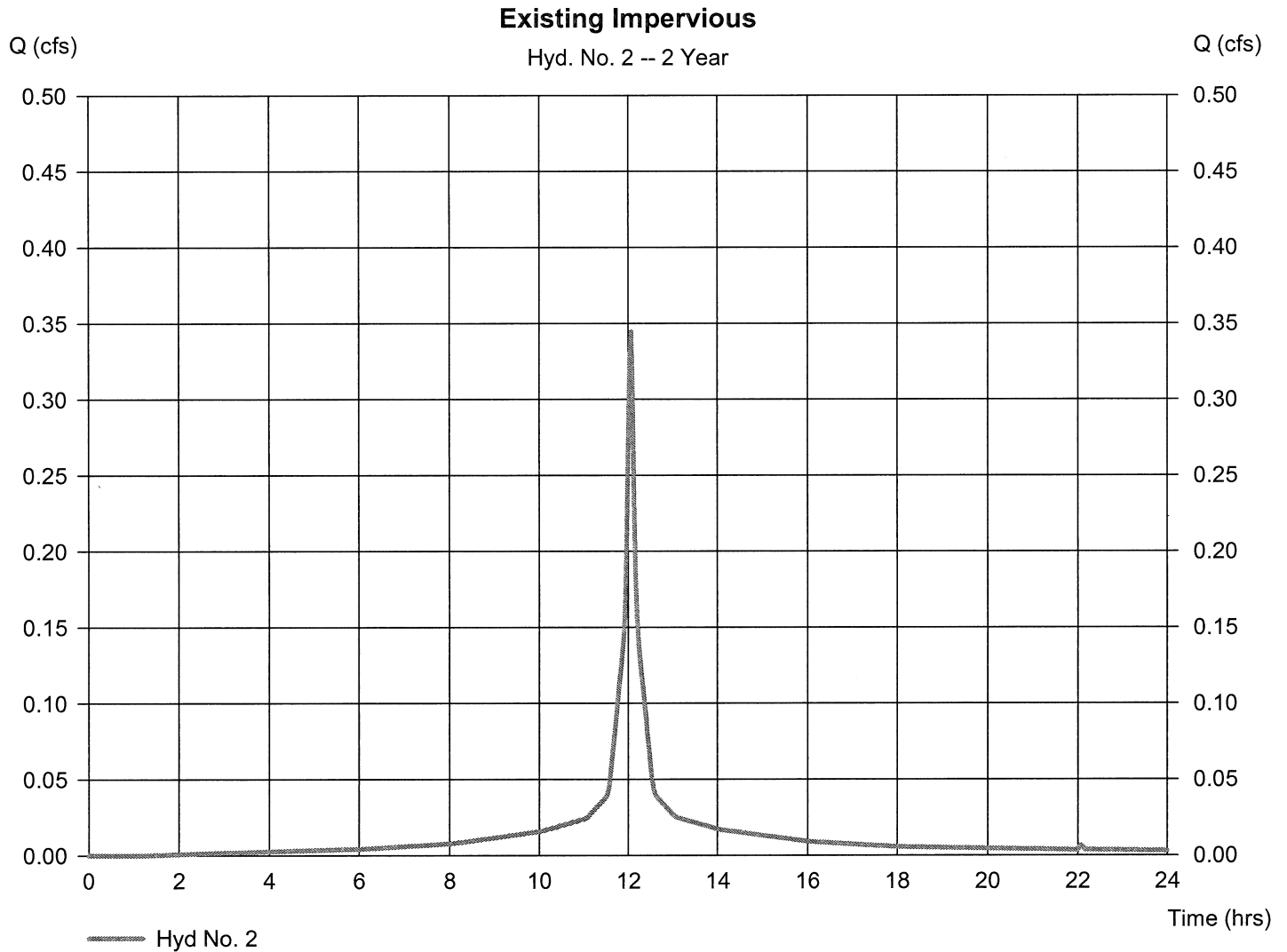
Hydrograph Report

Hyd. No. 2

Existing Impervious

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.105 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 0.345 cfs
Time to peak = 12.07 hrs
Hyd. volume = 1,167 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



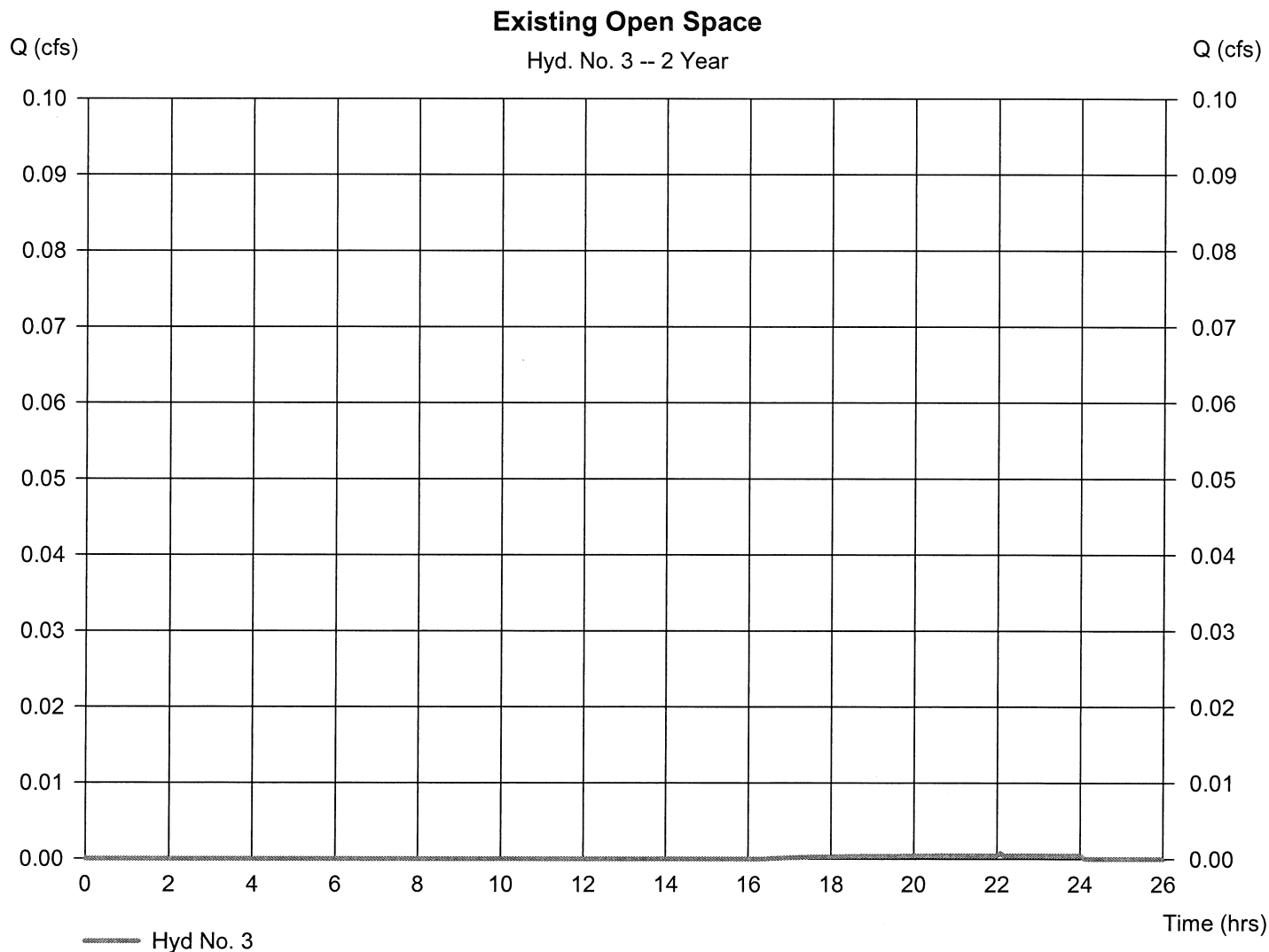
Hydrograph Report

Hyd. No. 3

Existing Open Space

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.340 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 0.001 cfs
Time to peak = 22.07 hrs
Hyd. volume = 10 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.50 min
Distribution = Type III
Shape factor = 484



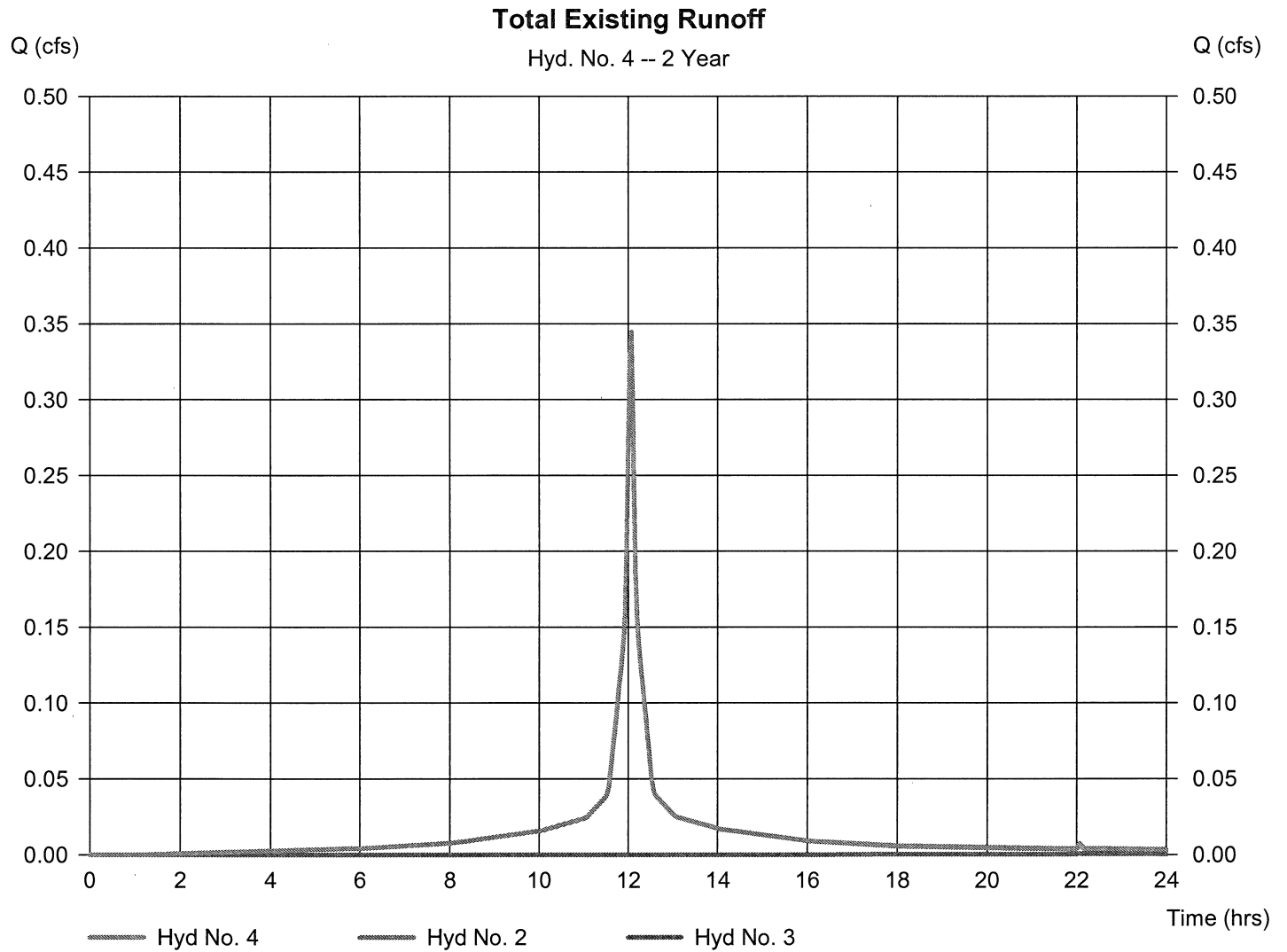
Hydrograph Report

Hyd. No. 4

Total Existing Runoff

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 3

Peak discharge = 0.345 cfs
Time to peak = 12.07 hrs
Hyd. volume = 1,177 cuft
Contrib. drain. area = 0.445 ac



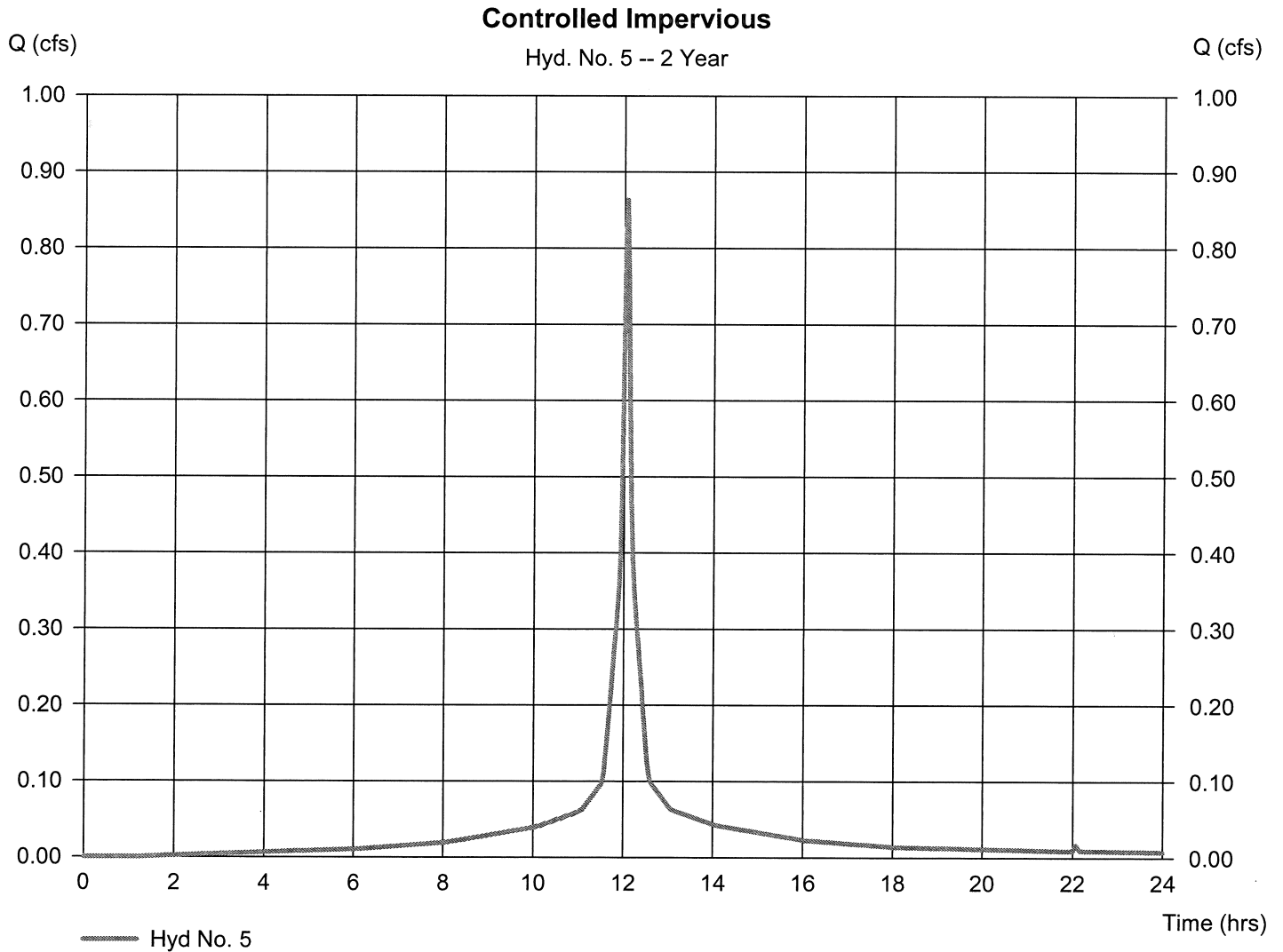
Hydrograph Report

Hyd. No. 5

Controlled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.263 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 0.863 cfs
Time to peak = 12.07 hrs
Hyd. volume = 2,924 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484

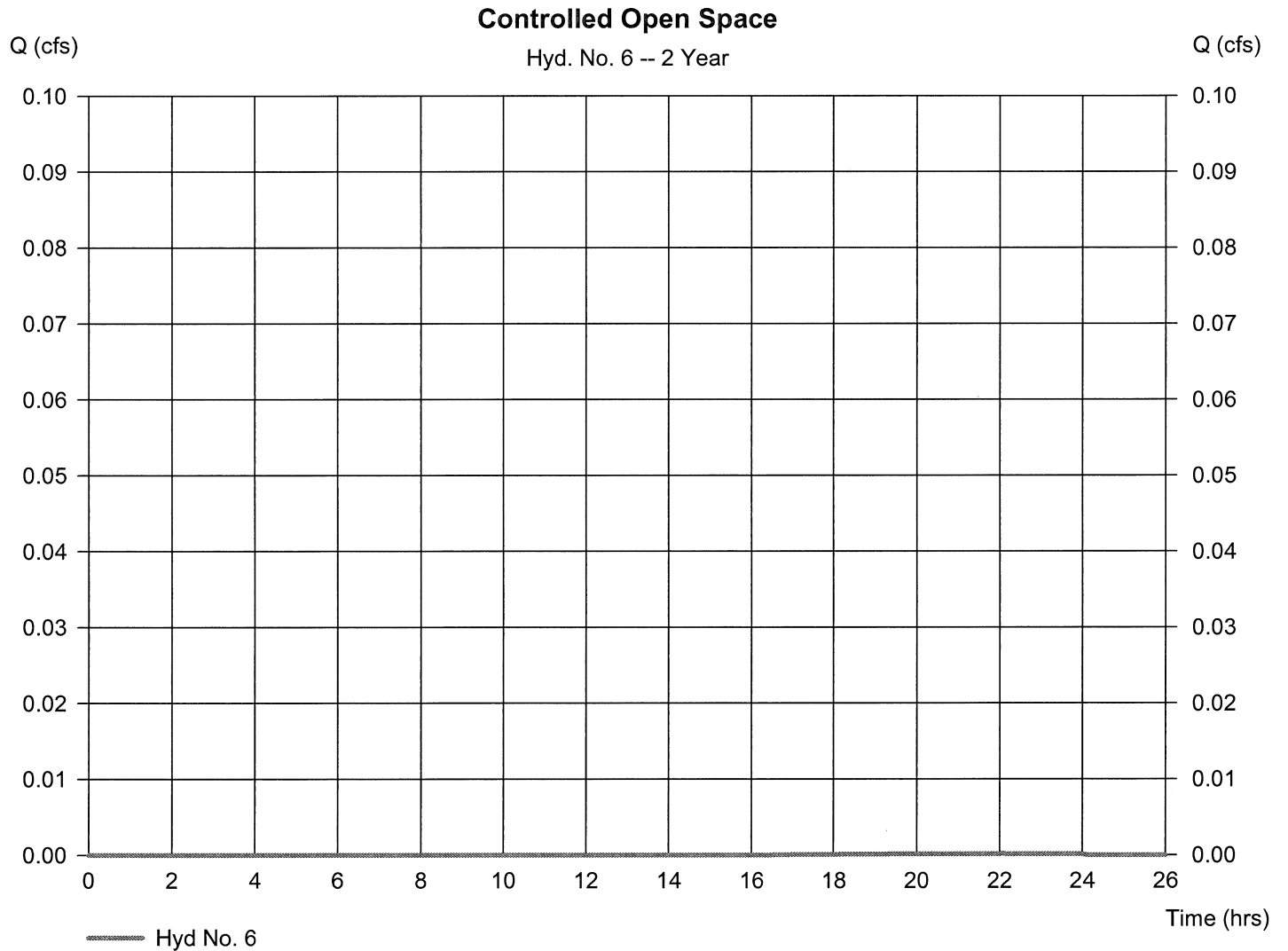


Hydrograph Report

Hyd. No. 6

Controlled Open Space

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 22.07 hrs
Time interval	= 2 min	Hyd. volume	= 3 cuft
Drainage area	= 0.109 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v9.24

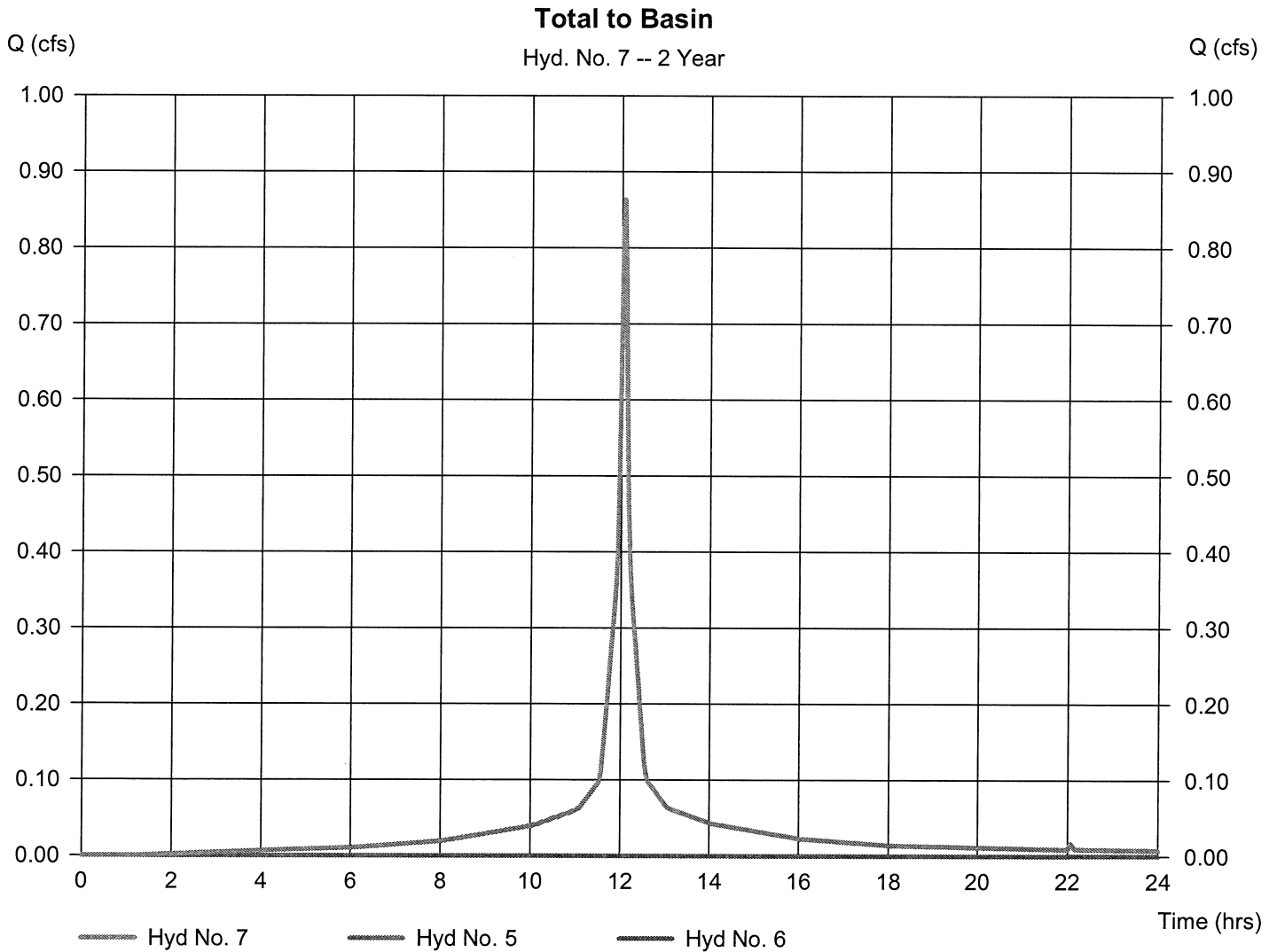
Wednesday, Apr 29, 2020

Hyd. No. 7

Total to Basin

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

Peak discharge = 0.863 cfs
Time to peak = 12.07 hrs
Hyd. volume = 2,927 cuft
Contrib. drain. area = 0.372 ac



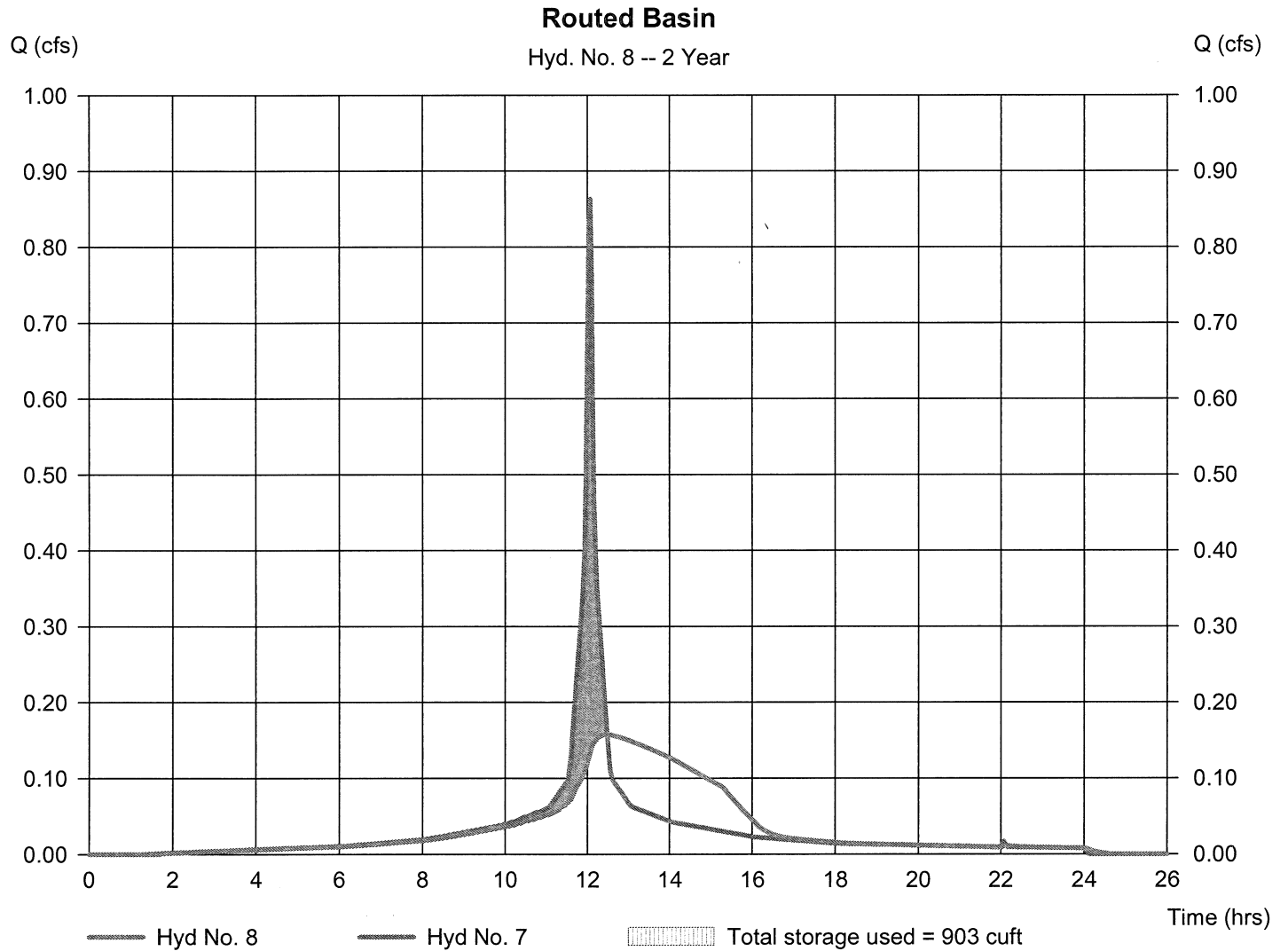
Hydrograph Report

Hyd. No. 8

Routed Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.158 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 2,926 cuft
Inflow hyd. No.	= 7 - Total to Basin	Max. Elevation	= 94.11 ft
Reservoir name	= (4) 36 inch Pipe Field 120 ft long	Max. Storage	= 903 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

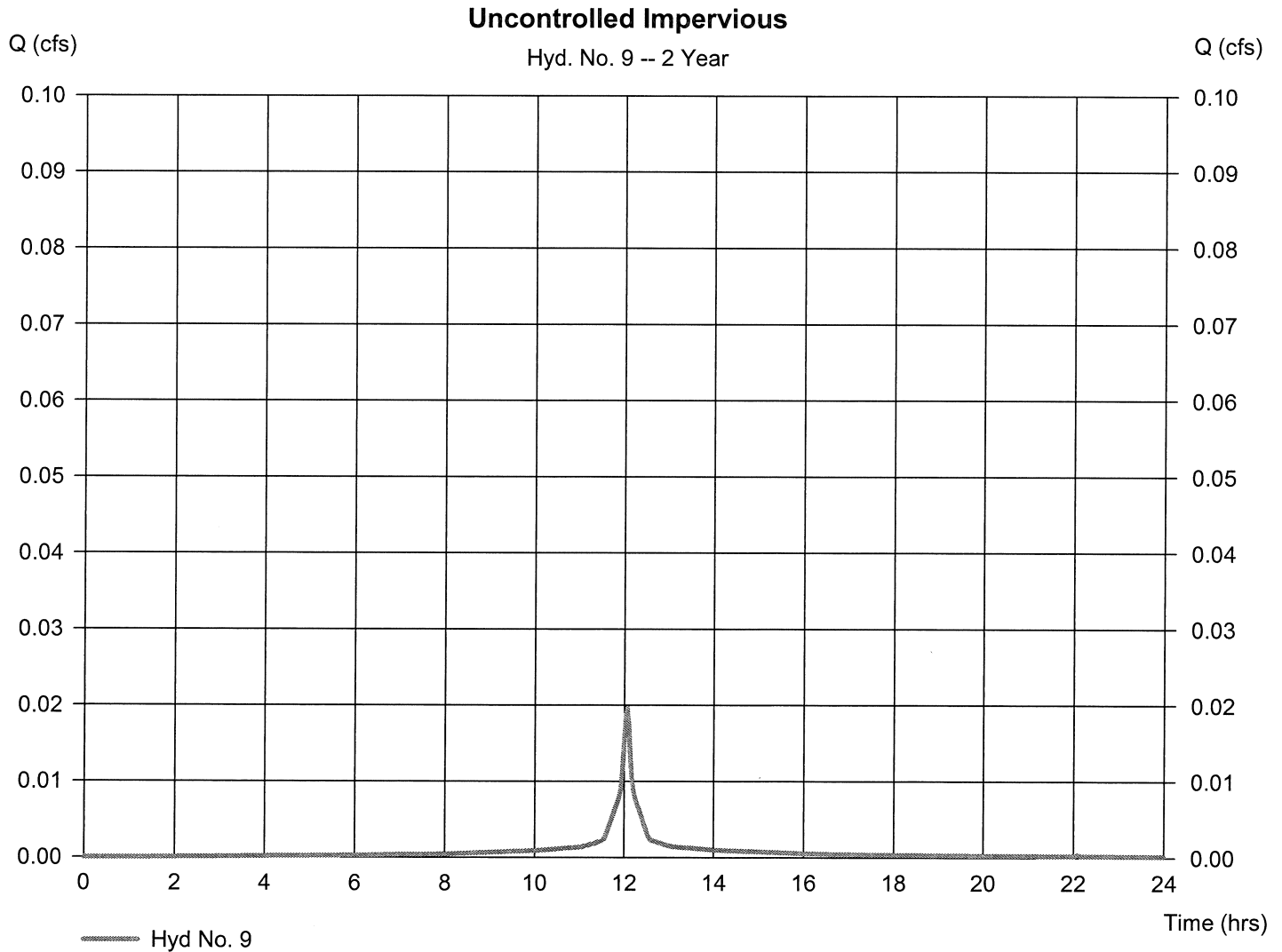
Wednesday, Apr 29, 2020

Hyd. No. 9

Uncontrolled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.006 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 0.020 cfs
Time to peak = 12.07 hrs
Hyd. volume = 67 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



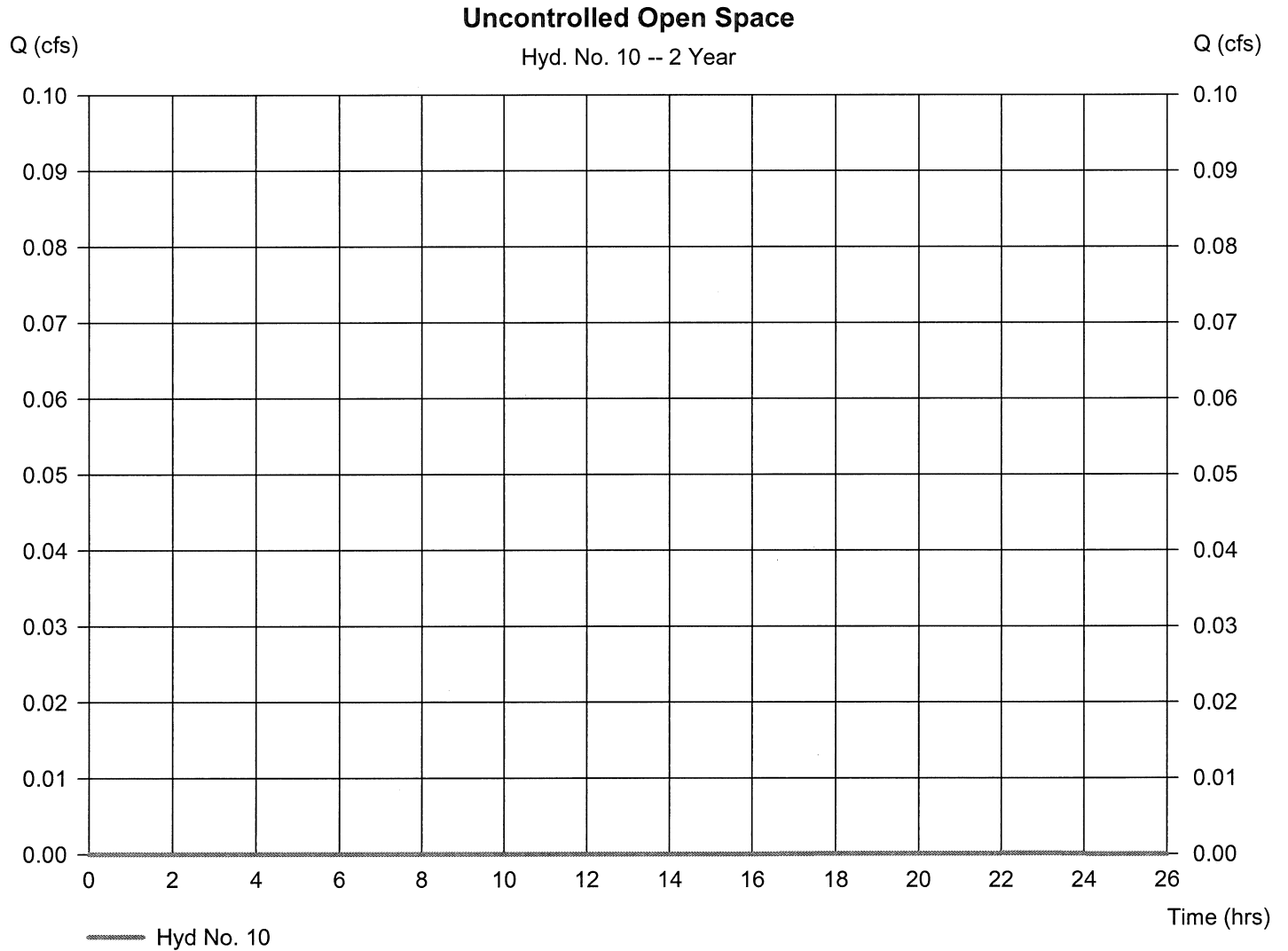
Hydrograph Report

Hyd. No. 10

Uncontrolled Open Space

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.067 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = 22.07 hrs
Hyd. volume = 2 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



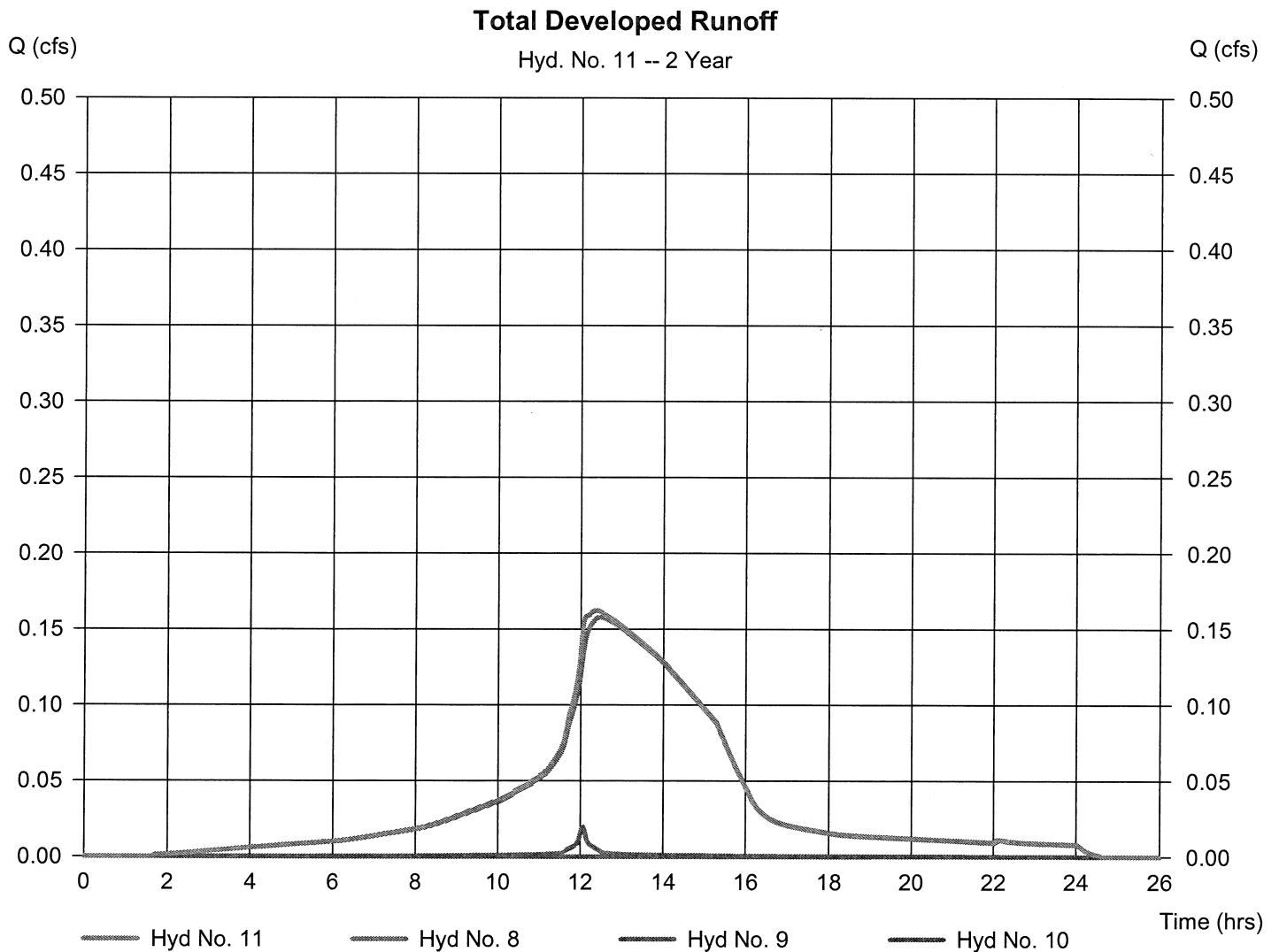
Hydrograph Report

Hyd. No. 11

Total Developed Runoff

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 8, 9, 10

Peak discharge = 0.162 cfs
Time to peak = 12.37 hrs
Hyd. volume = 2,994 cuft
Contrib. drain. area = 0.073 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.24

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	2.210	2	724	7,619	----	----	----	Undisturbed Area
2	SCS Runoff	0.537	2	724	1,852	----	----	----	Existing Impervious
3	SCS Runoff	0.028	2	742	339	----	----	----	Existing Open Space
4	Combine	0.537	2	724	2,191	2, 3	----	----	Total Existing Runoff
5	SCS Runoff	1.345	2	724	4,639	----	----	----	Controlled Impervious
6	SCS Runoff	0.009	2	742	109	----	----	----	Controlled Open Space
7	Combine	1.345	2	724	4,747	5, 6	----	----	Total to Basin
8	Reservoir	0.194	2	752	4,746	7	94.58	1,599	Routed Basin
9	SCS Runoff	0.031	2	724	106	----	----	----	Uncontrolled Impervious
10	SCS Runoff	0.006	2	742	67	----	----	----	Uncontrolled Open Space
11	Combine	0.205	2	744	4,919	8, 9, 10	----	----	Total Developed Runoff
190403 Drainage 4-29-2020 (new rainfall).gpw Return Period: 20 Year								Wednesday, Apr 29, 2020	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

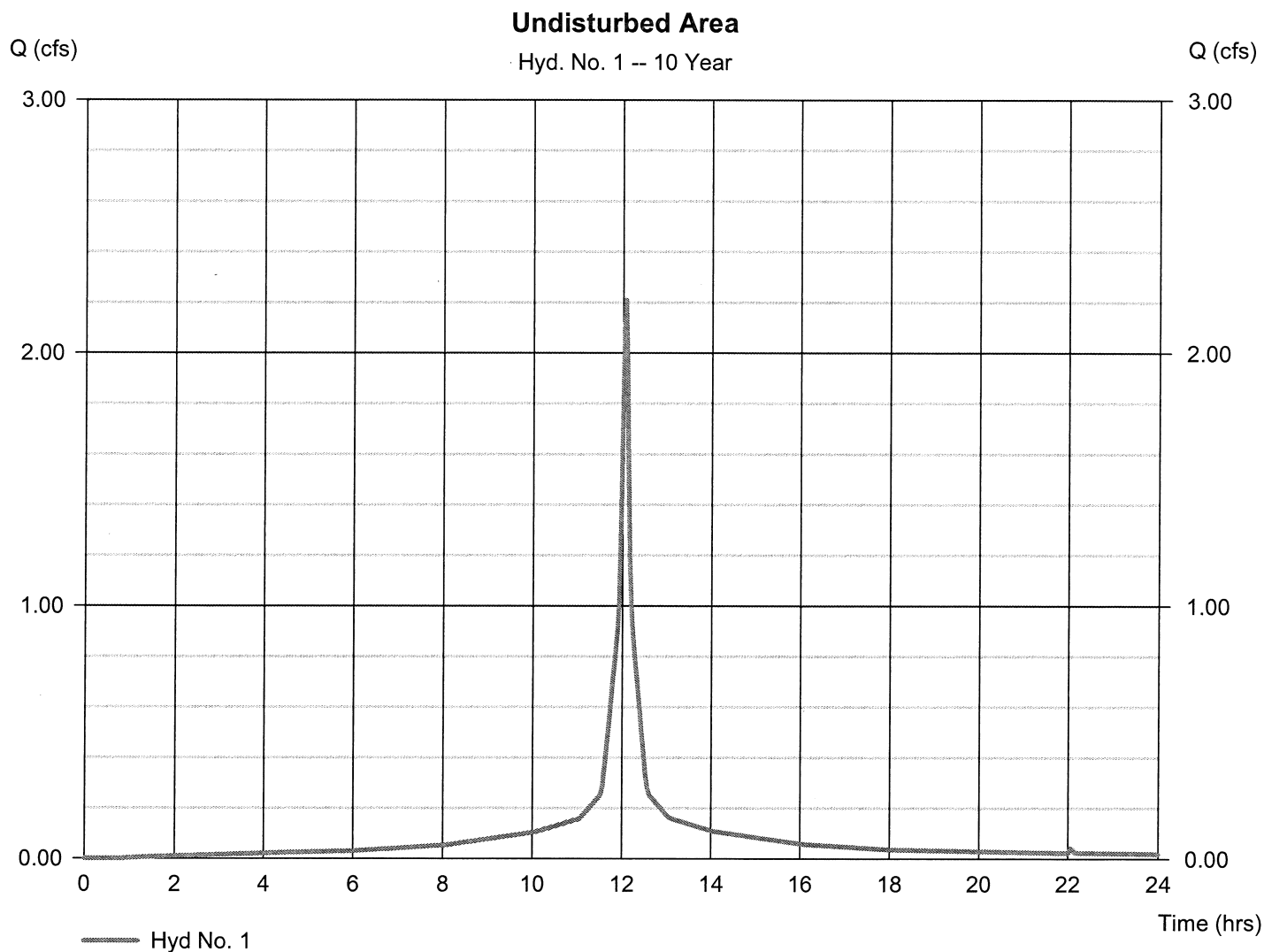
Wednesday, Apr 29, 2020

Hyd. No. 1

Undisturbed Area

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.432 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 2.210 cfs
Time to peak = 12.07 hrs
Hyd. volume = 7,619 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intellisolve v9.24

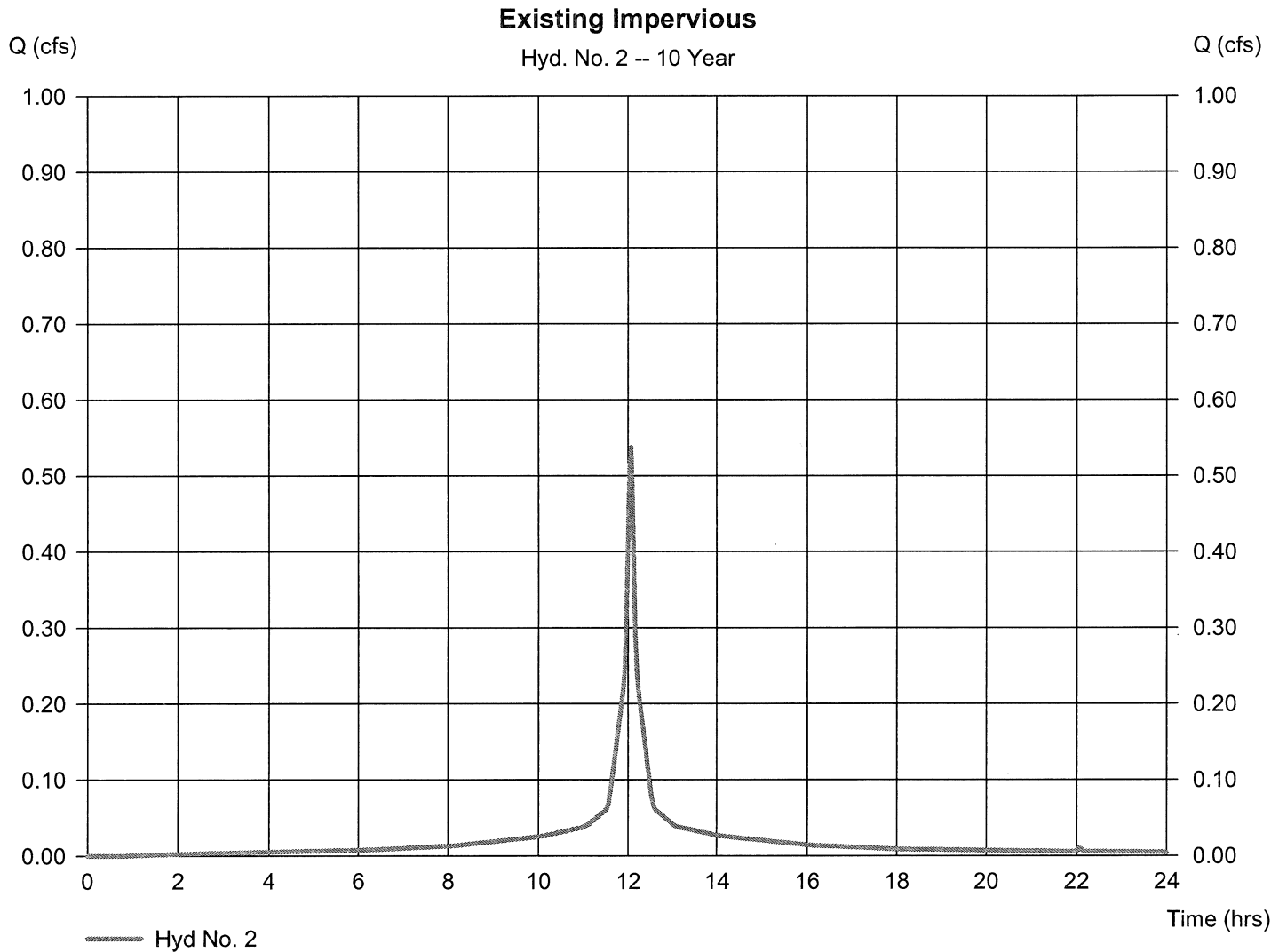
Wednesday, Apr 29, 2020

Hyd. No. 2

Existing Impervious

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.105 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 0.537 cfs
Time to peak = 12.07 hrs
Hyd. volume = 1,852 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

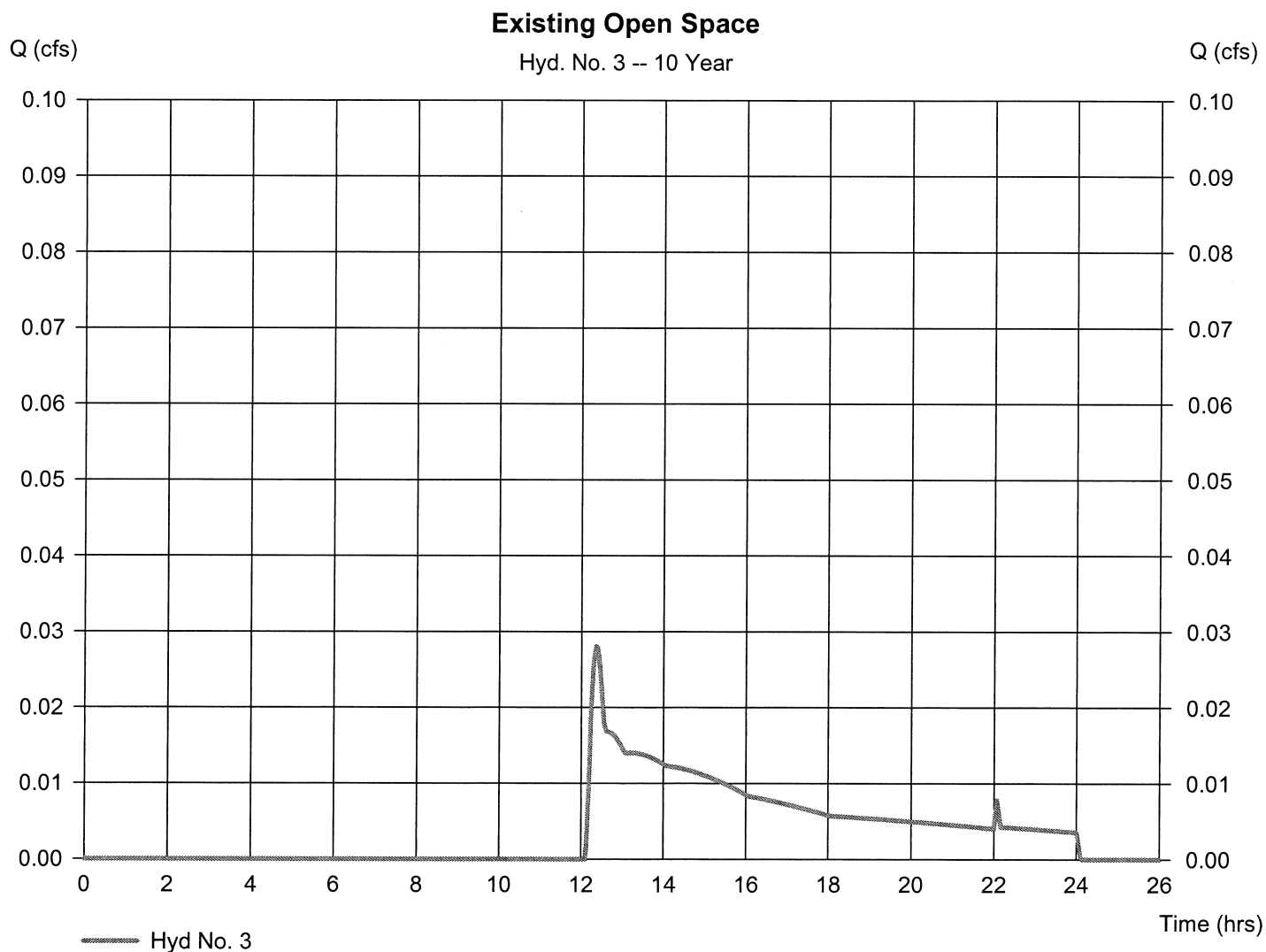
Wednesday, Apr 29, 2020

Hyd. No. 3

Existing Open Space

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.340 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 0.028 cfs
Time to peak = 12.37 hrs
Hyd. volume = 339 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.50 min
Distribution = Type III
Shape factor = 484



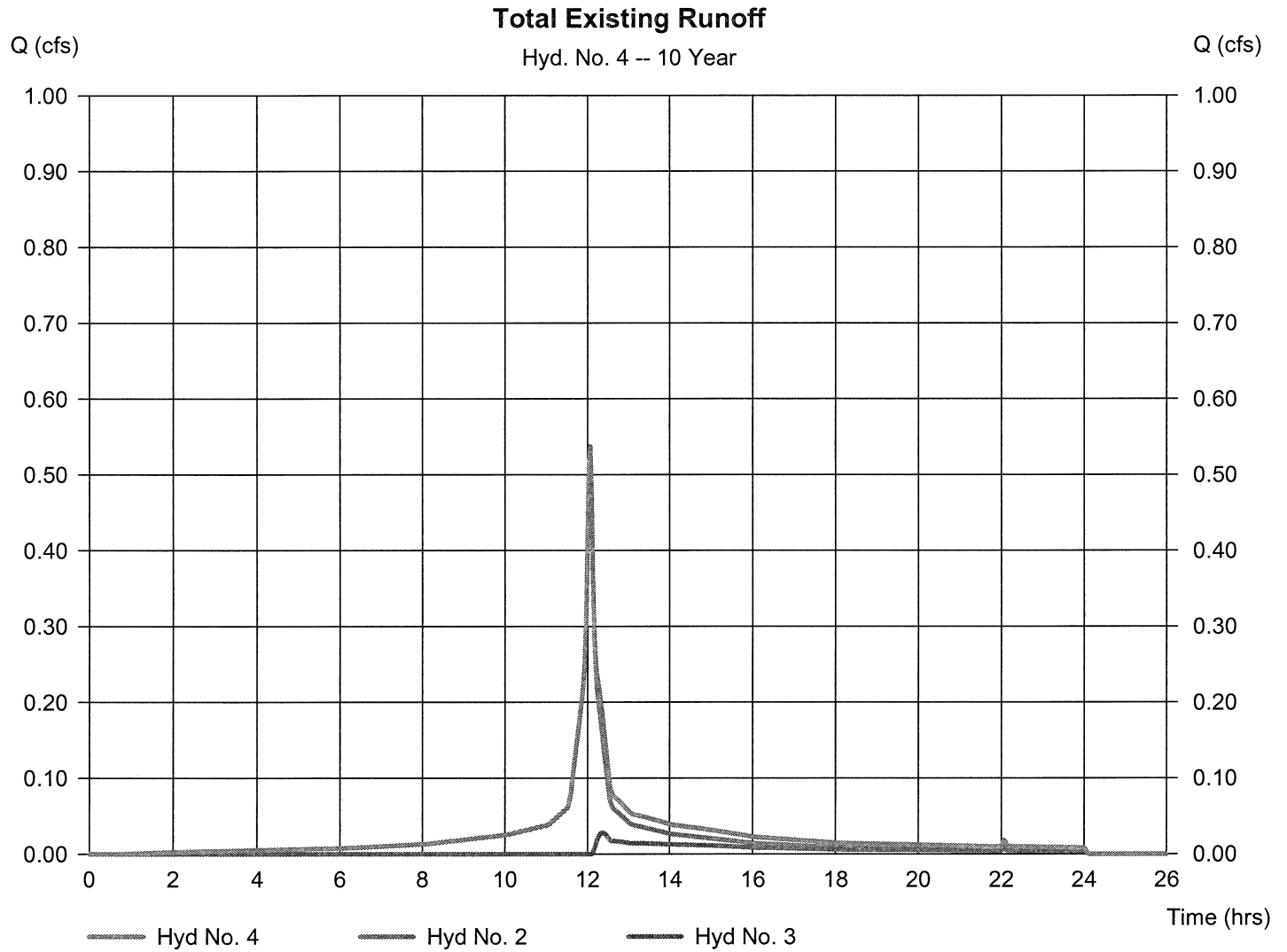
Hydrograph Report

Hyd. No. 4

Total Existing Runoff

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 3

Peak discharge = 0.537 cfs
Time to peak = 12.07 hrs
Hyd. volume = 2,191 cuft
Contrib. drain. area = 0.445 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

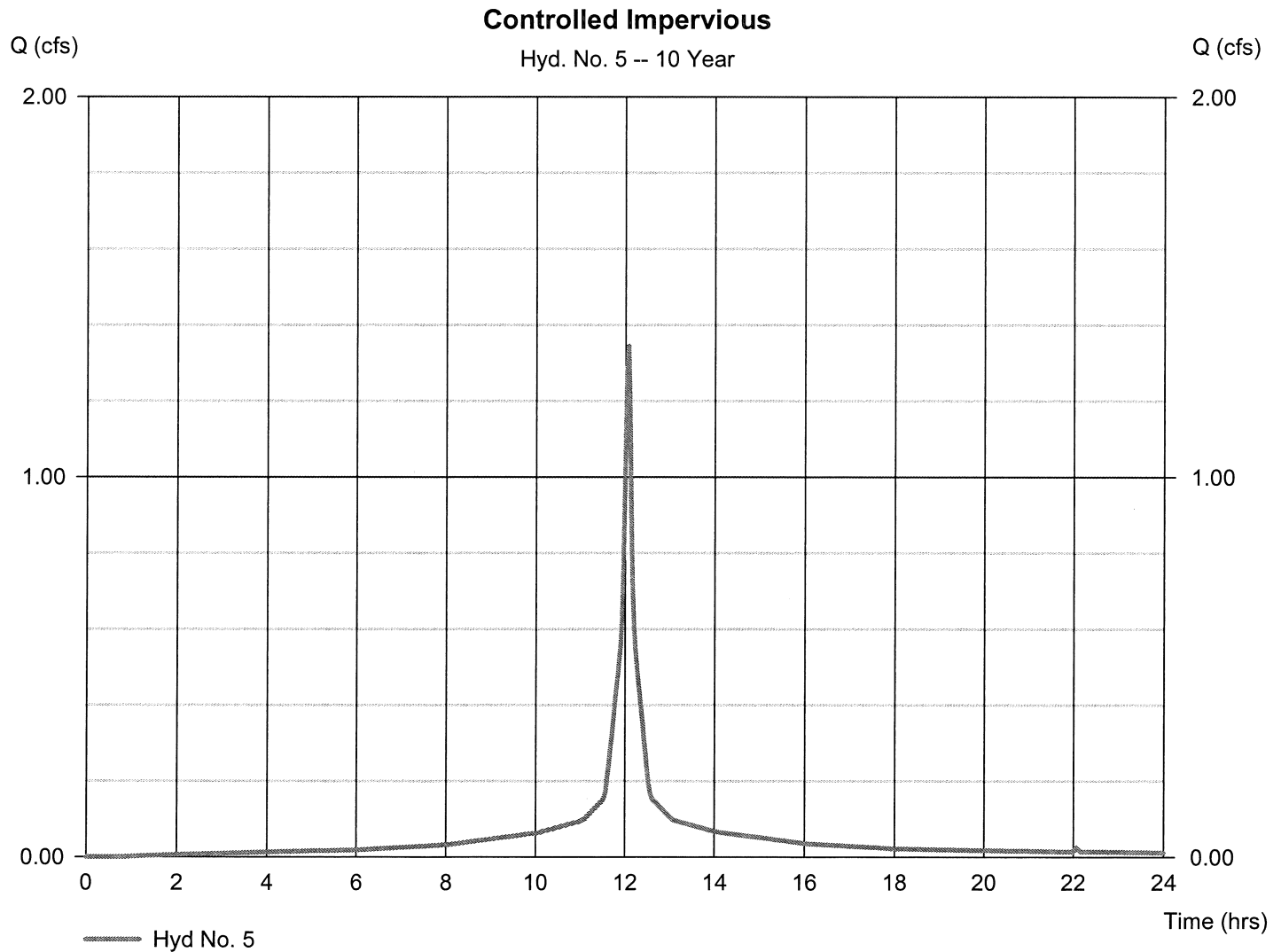
Wednesday, Apr 29, 2020

Hyd. No. 5

Controlled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.263 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 1.345 cfs
Time to peak = 12.07 hrs
Hyd. volume = 4,639 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



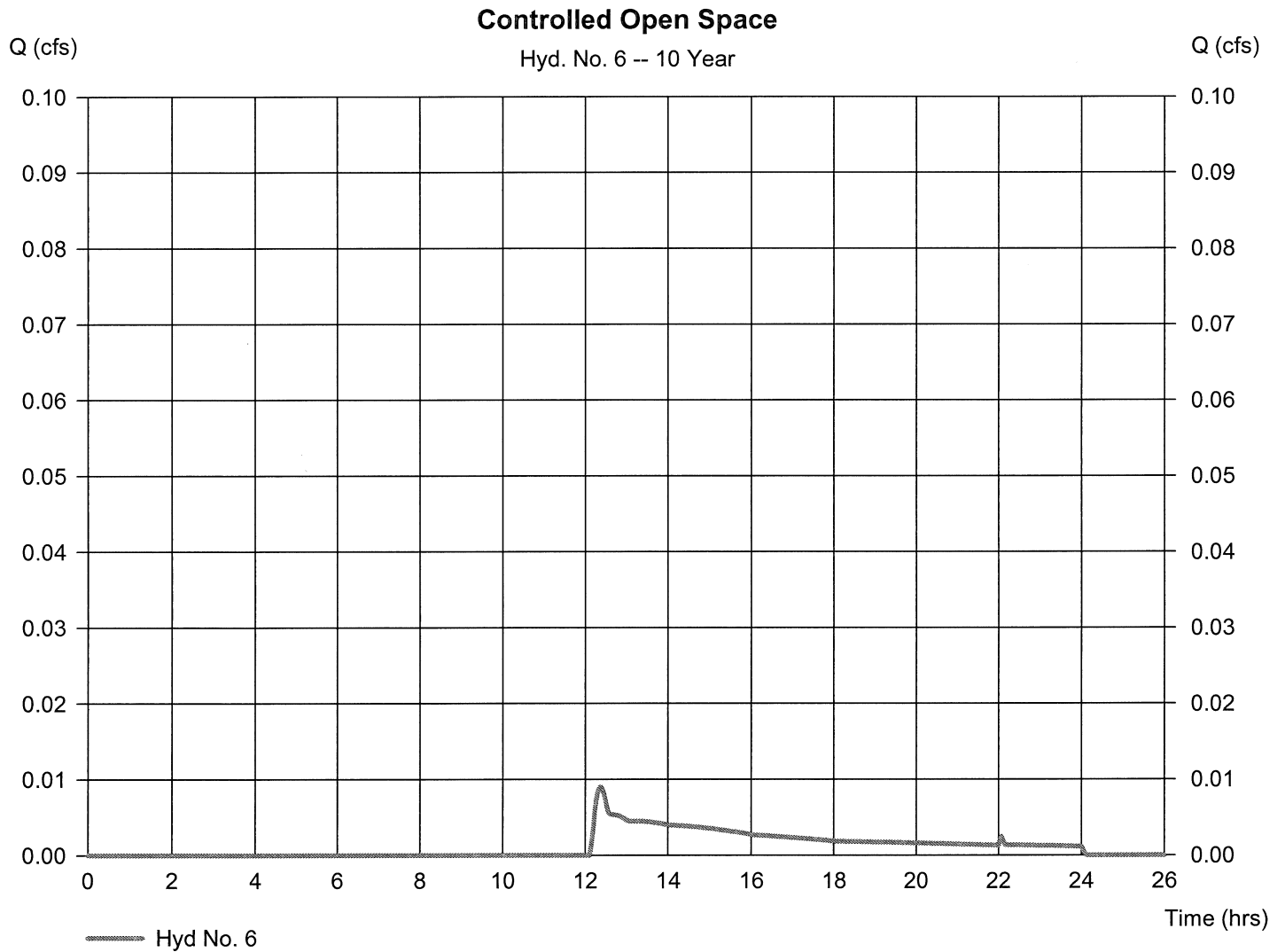
Hydrograph Report

Hyd. No. 6

Controlled Open Space

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.109 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 0.009 cfs
Time to peak = 12.37 hrs
Hyd. volume = 109 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

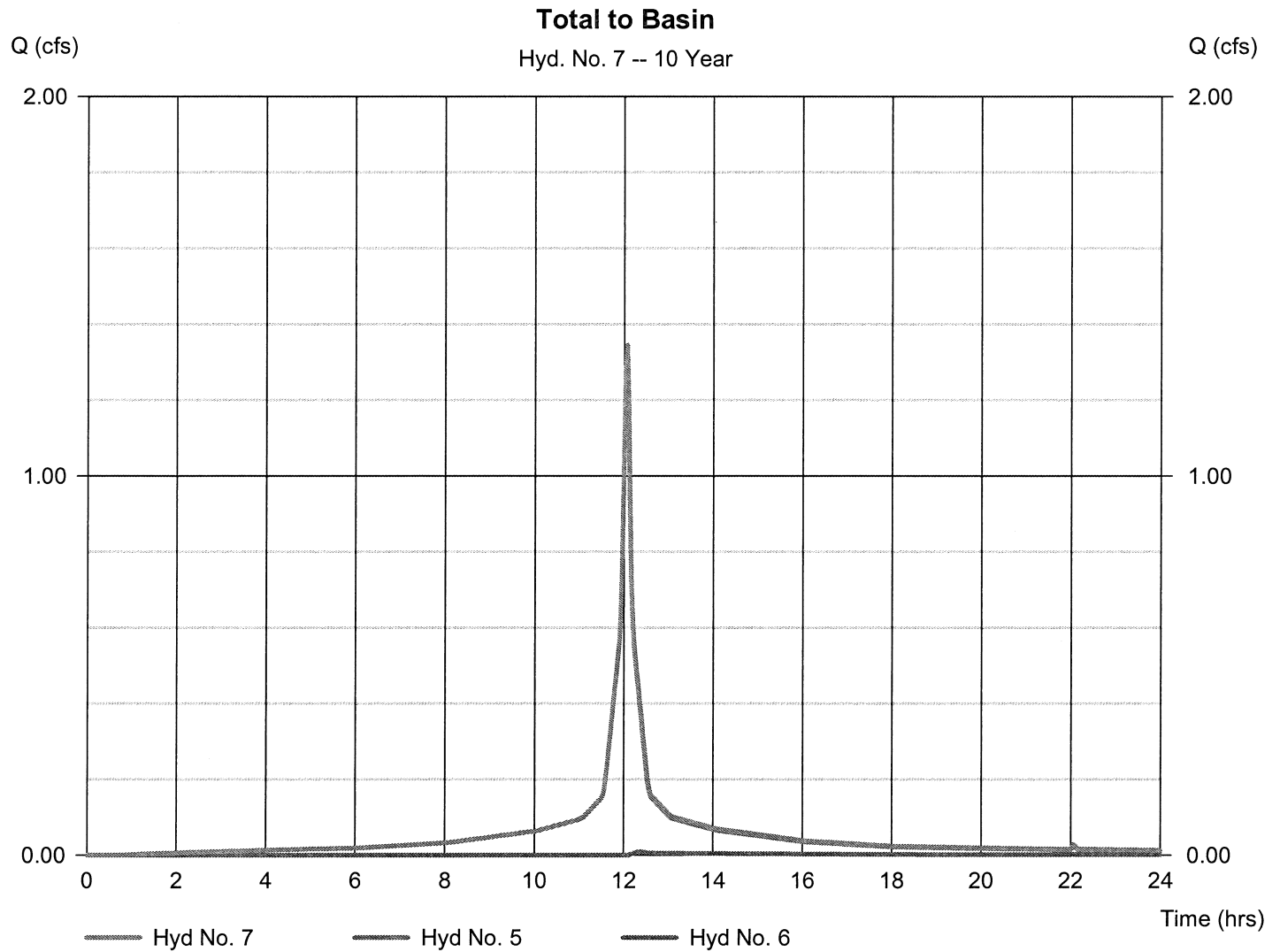
Wednesday, Apr 29, 2020

Hyd. No. 7

Total to Basin

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 5, 6

Peak discharge = 1.345 cfs
Time to peak = 12.07 hrs
Hyd. volume = 4,747 cuft
Contrib. drain. area = 0.372 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

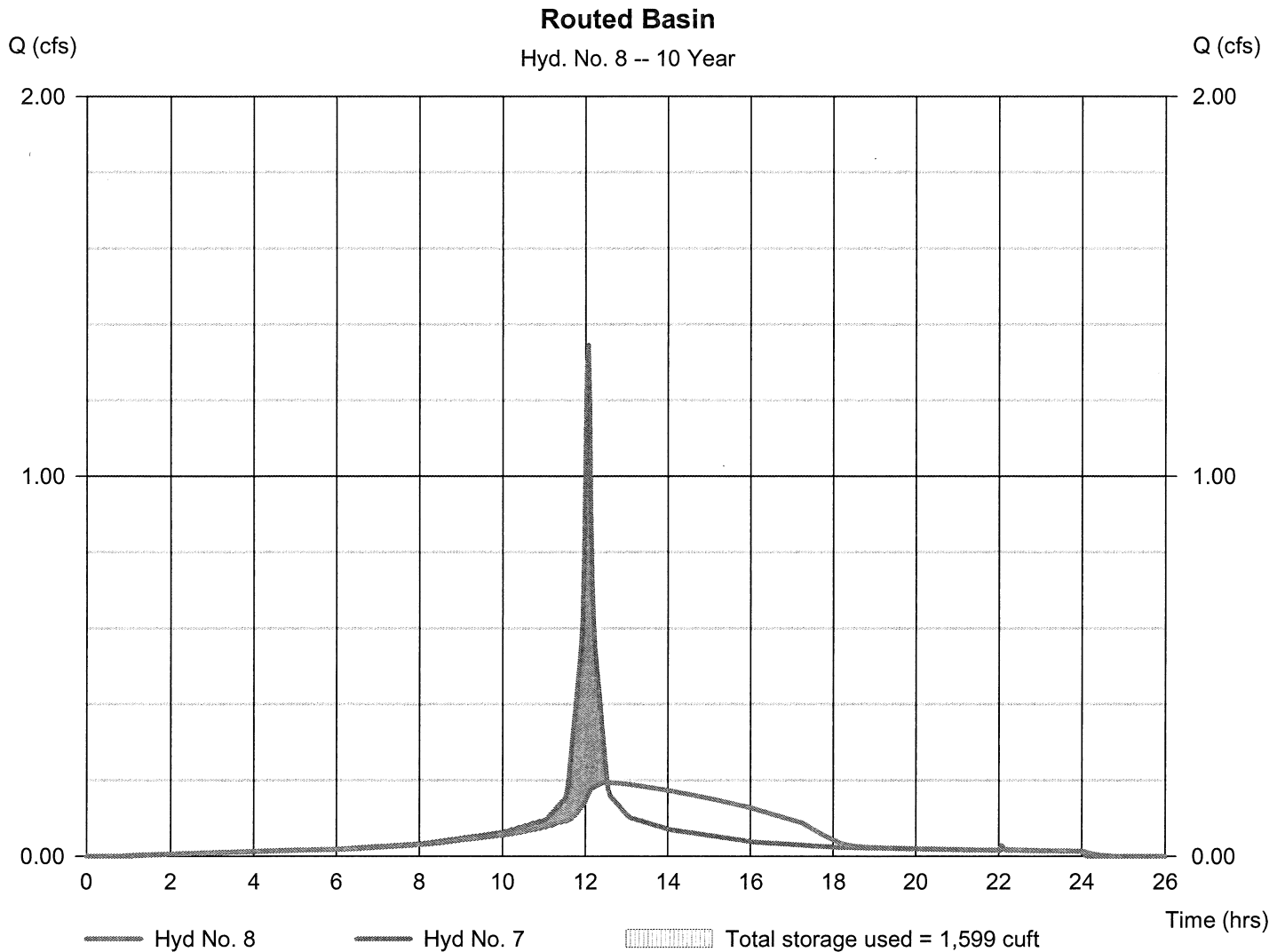
Wednesday, Apr 29, 2020

Hyd. No. 8

Routed Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.194 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 4,746 cuft
Inflow hyd. No.	= 7 - Total to Basin	Max. Elevation	= 94.58 ft
Reservoir name	= (4) 36 inch Pipe Field 120 ft long	Max. Storage	= 1,599 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

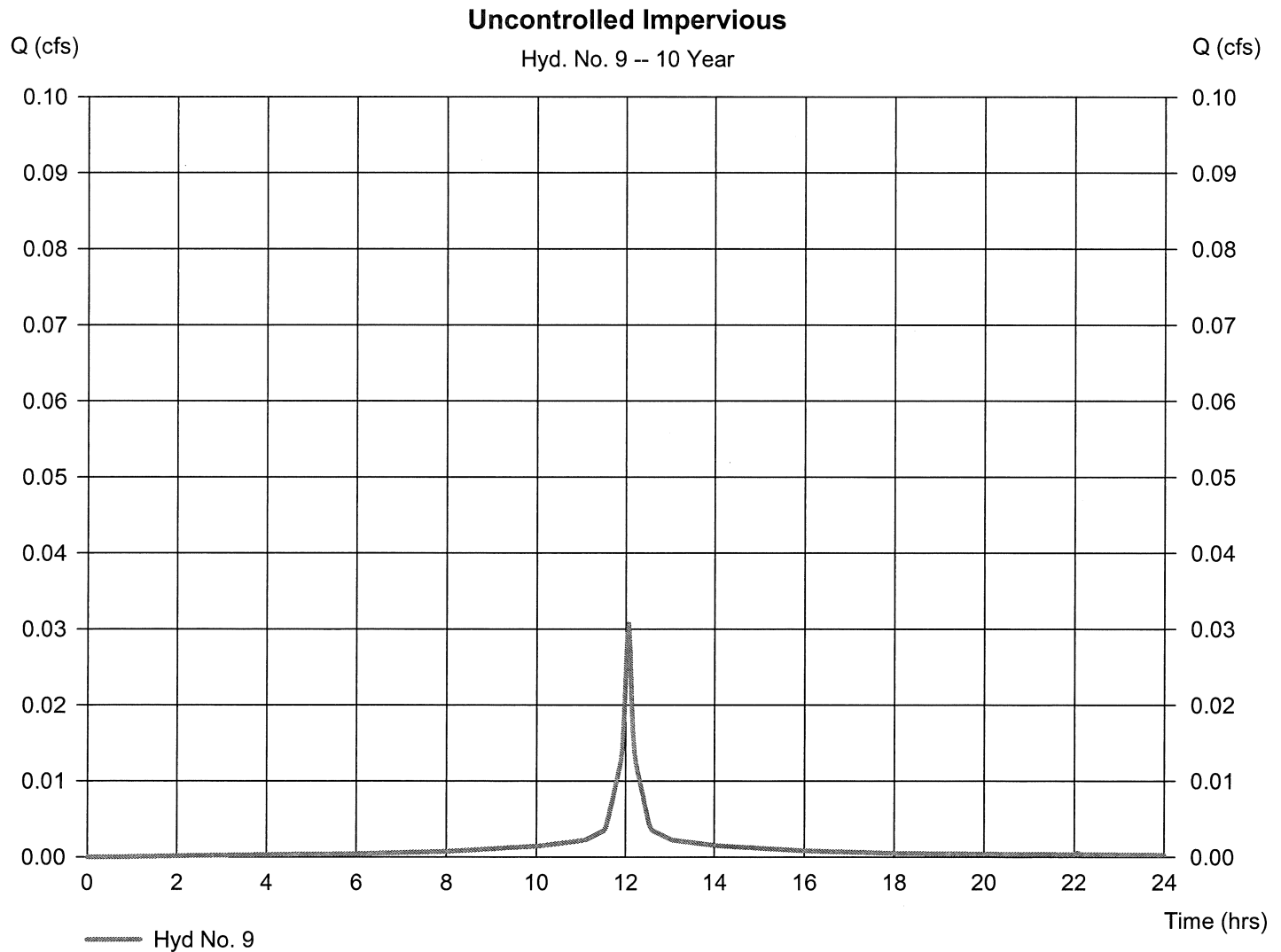
Wednesday, Apr 29, 2020

Hyd. No. 9

Uncontrolled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.006 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 0.031 cfs
Time to peak = 12.07 hrs
Hyd. volume = 106 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



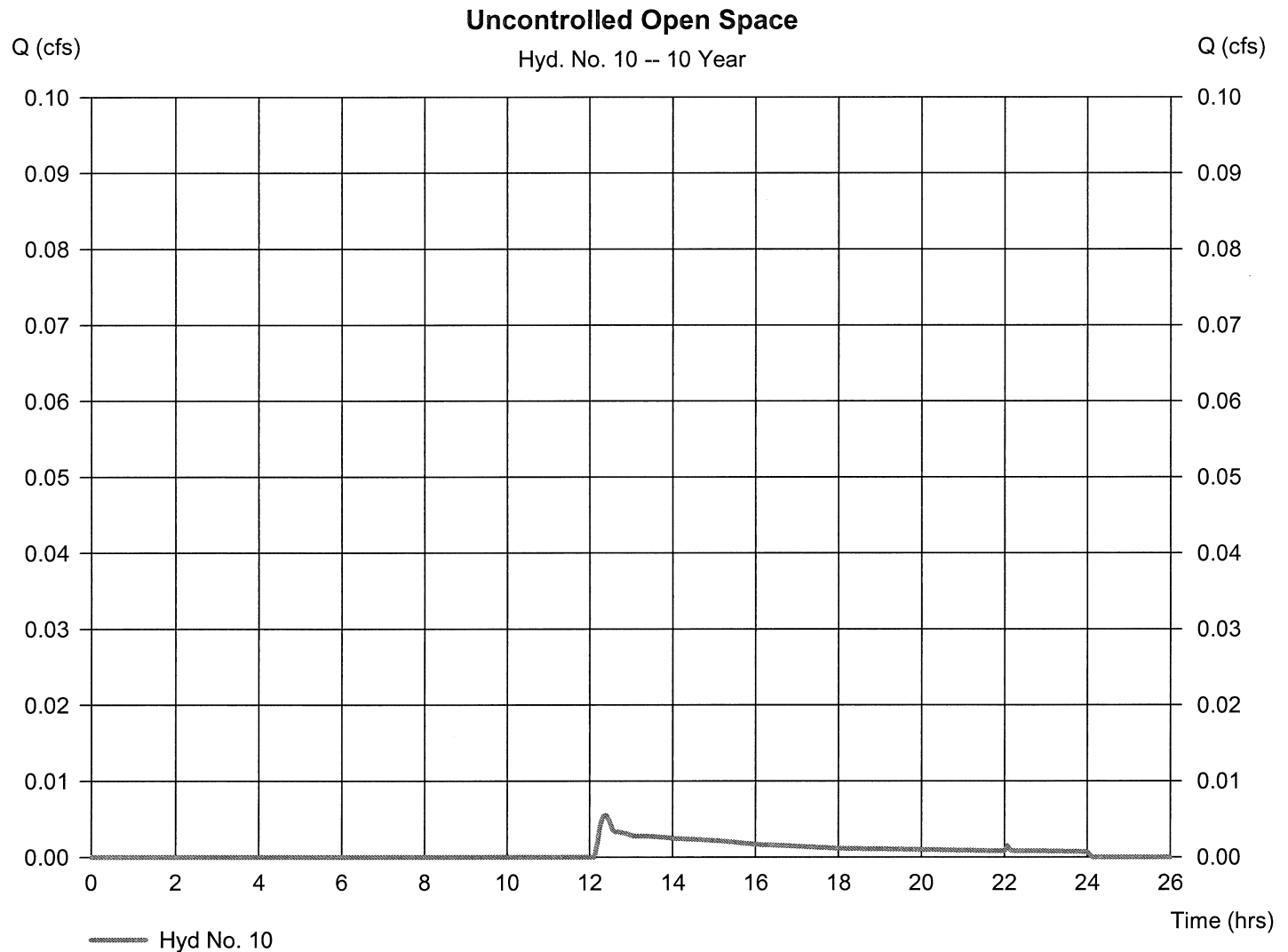
Hydrograph Report

Hyd. No. 10

Uncontrolled Open Space

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.067 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.42 in
Storm duration = 24 hrs

Peak discharge = 0.006 cfs
Time to peak = 12.37 hrs
Hyd. volume = 67 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

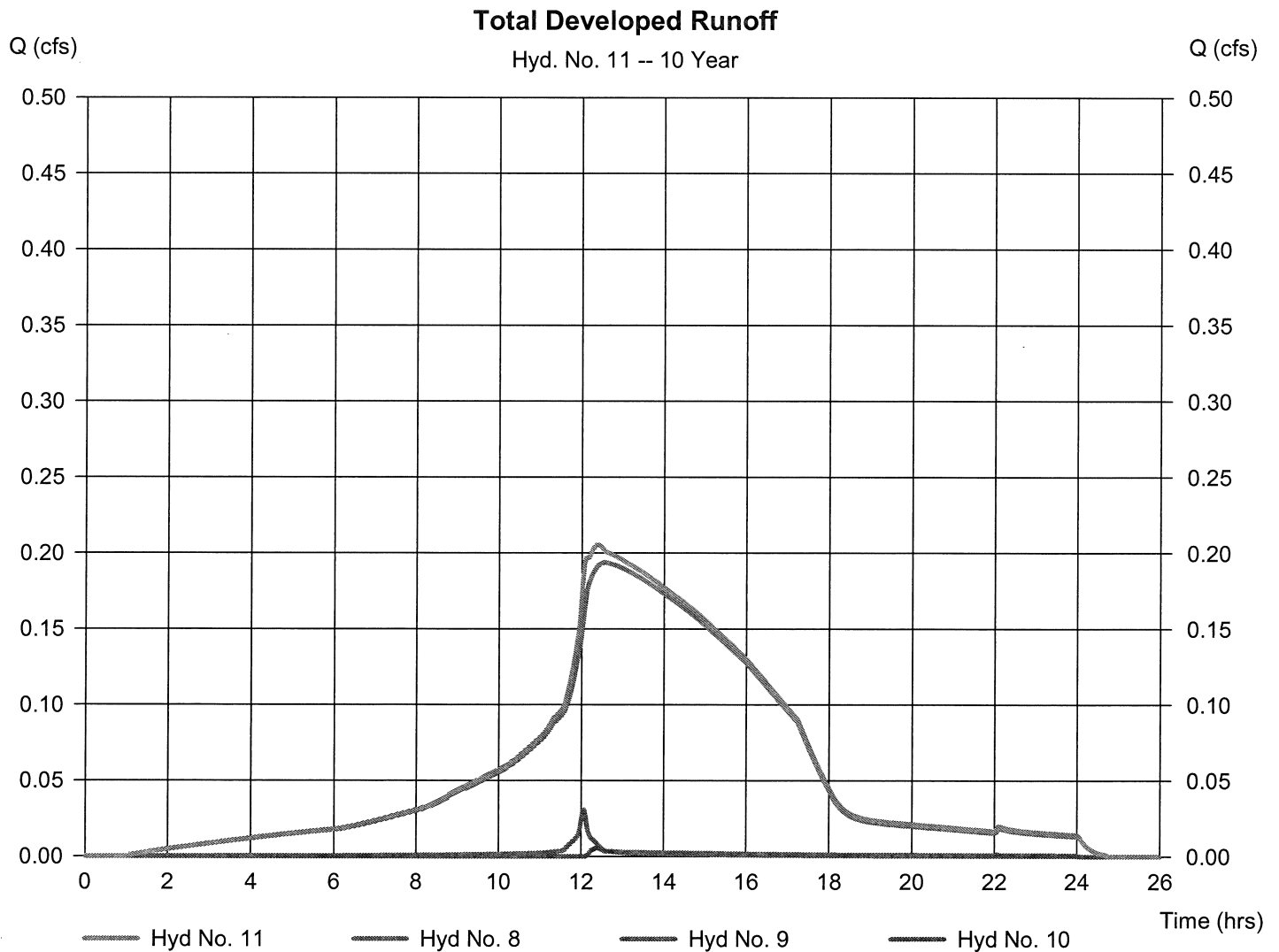
Wednesday, Apr 29, 2020

Hyd. No. 11

Total Developed Runoff

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 8, 9, 10

Peak discharge = 0.205 cfs
Time to peak = 12.40 hrs
Hyd. volume = 4,919 cuft
Contrib. drain. area = 0.073 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.24

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	3.796	2	724	13,289	----	----	----	Undisturbed Area
2	SCS Runoff	0.923	2	724	3,230	----	----	----	Existing Impervious
3	SCS Runoff	0.519	2	726	2,009	----	----	----	Existing Open Space
4	Combine	1.439	2	724	5,239	2, 3	----	----	Total Existing Runoff
5	SCS Runoff	2.311	2	724	8,091	----	----	----	Controlled Impervious
6	SCS Runoff	0.166	2	726	644	----	----	----	Controlled Open Space
7	Combine	2.477	2	724	8,735	5, 6	----	----	Total to Basin
8	Reservoir	0.267	2	764	8,734	7	95.84	3,347	Routed Basin
9	SCS Runoff	0.053	2	724	185	----	----	----	Uncontrolled Impervious
10	SCS Runoff	0.102	2	726	396	----	----	----	Uncontrolled Open Space
11	Combine	0.370	2	726	9,314	8, 9, 10	----	----	Total Developed Runoff
190403 Drainage 4-29-2020 (new rainfall).gpw								Return Period: 300 Year	Wednesday, Apr 29, 2020

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

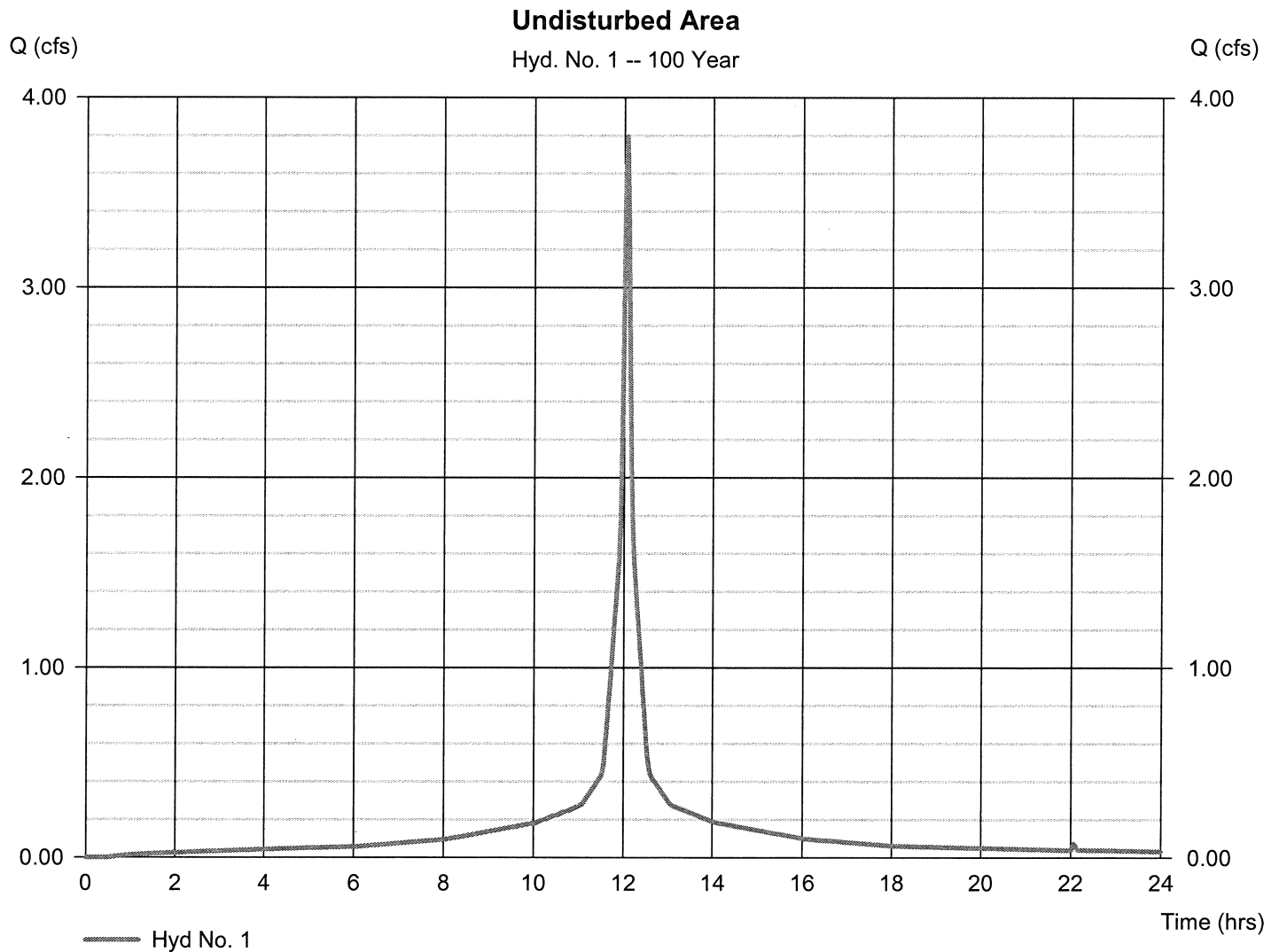
Wednesday, Apr 29, 2020

Hyd. No. 1

Undisturbed Area

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.432 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 3.796 cfs
Time to peak = 12.07 hrs
Hyd. volume = 13,289 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



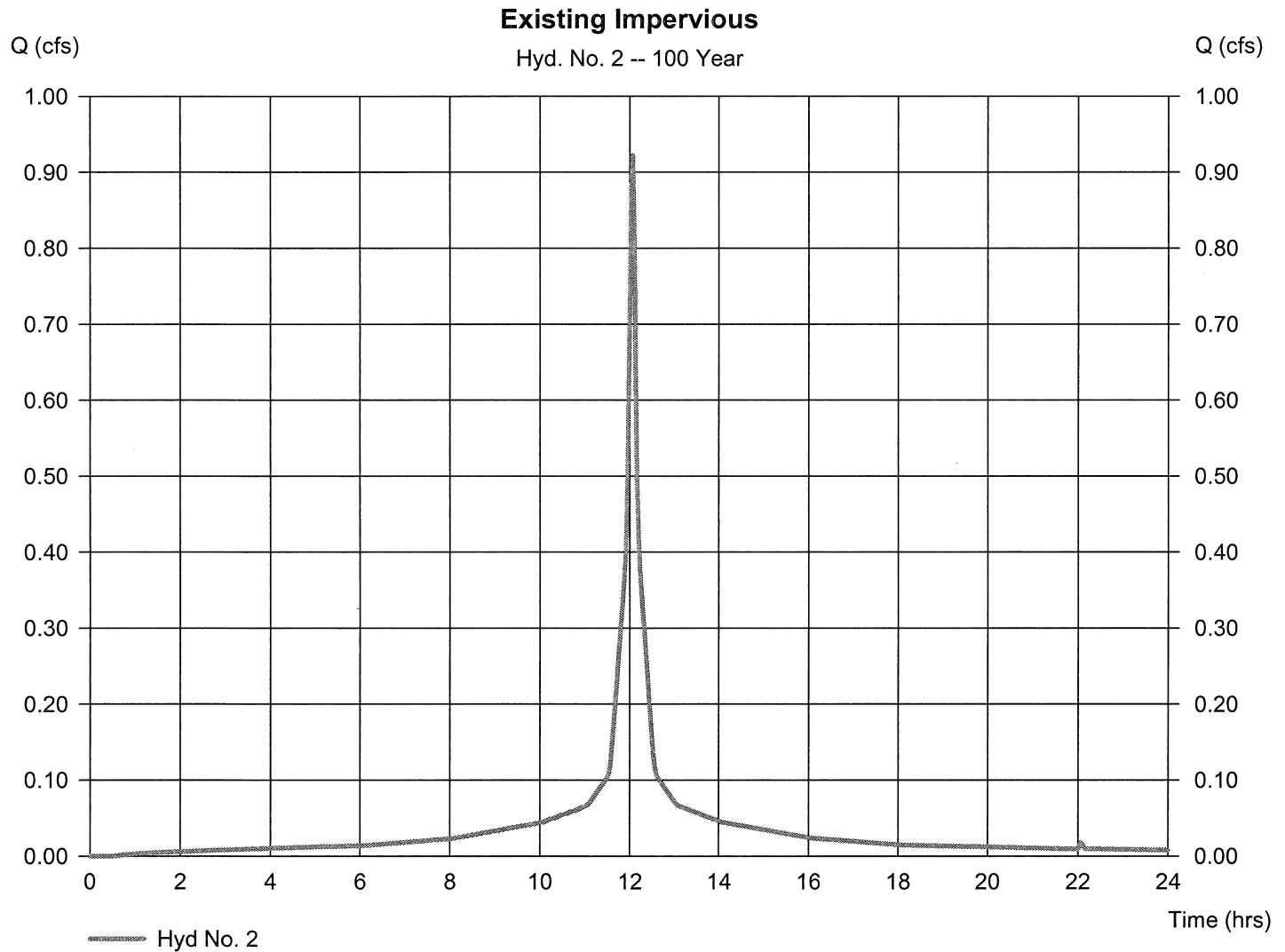
Hydrograph Report

Hyd. No. 2

Existing Impervious

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.105 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 0.923 cfs
Time to peak = 12.07 hrs
Hyd. volume = 3,230 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



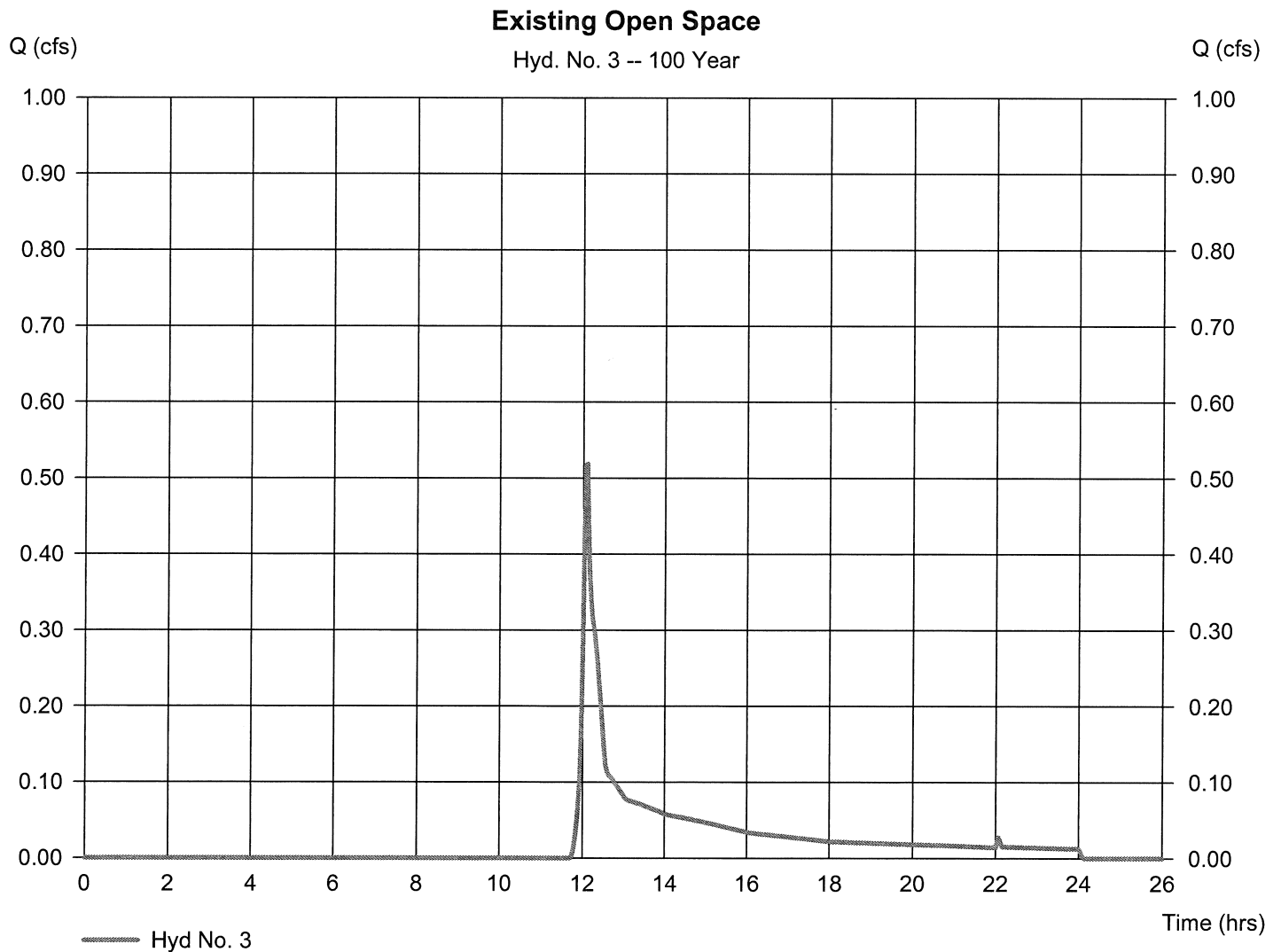
Hydrograph Report

Hyd. No. 3

Existing Open Space

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.340 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 0.519 cfs
Time to peak = 12.10 hrs
Hyd. volume = 2,009 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.50 min
Distribution = Type III
Shape factor = 484



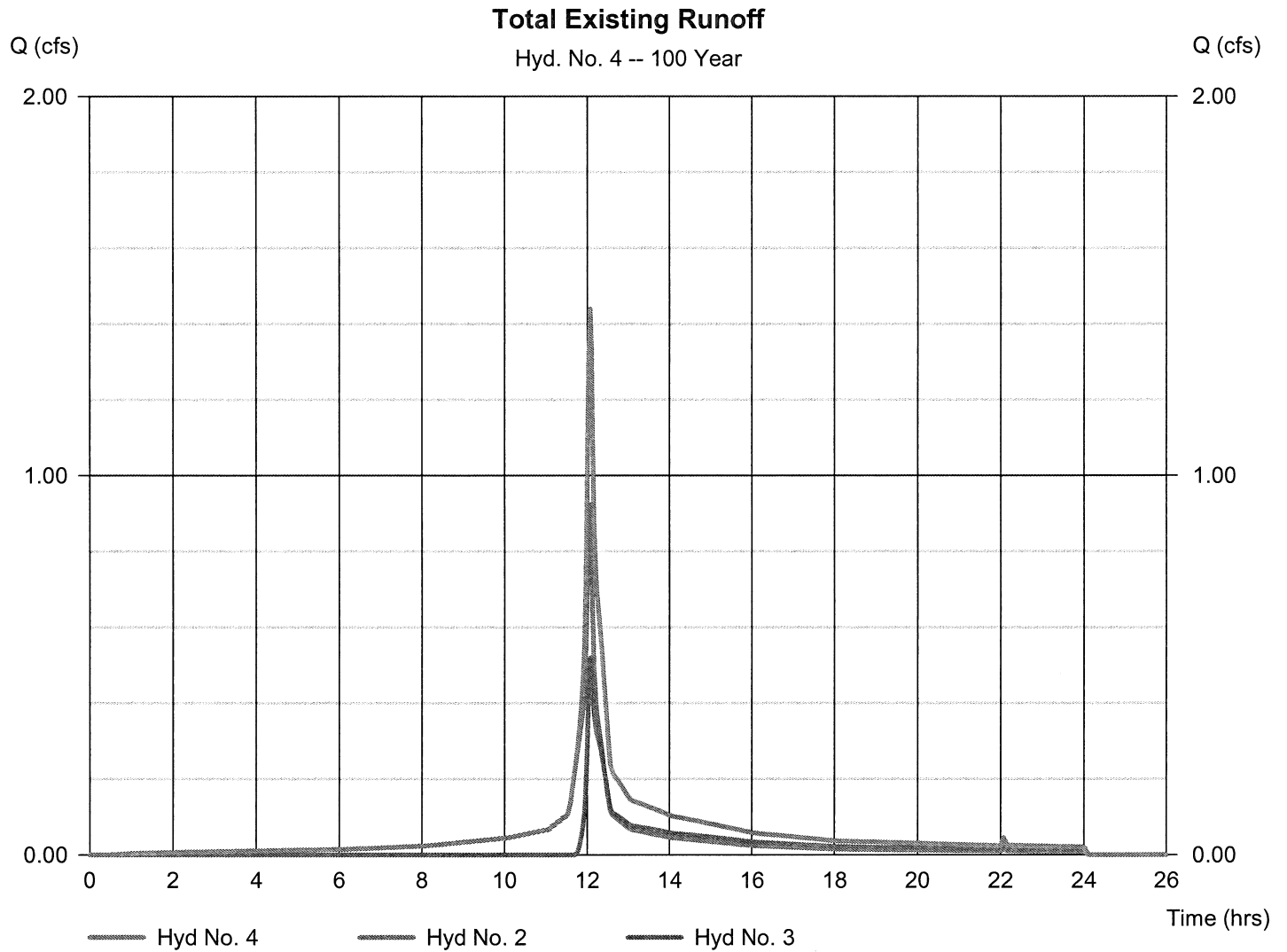
Hydrograph Report

Hyd. No. 4

Total Existing Runoff

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 3

Peak discharge = 1.439 cfs
Time to peak = 12.07 hrs
Hyd. volume = 5,239 cuft
Contrib. drain. area = 0.445 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

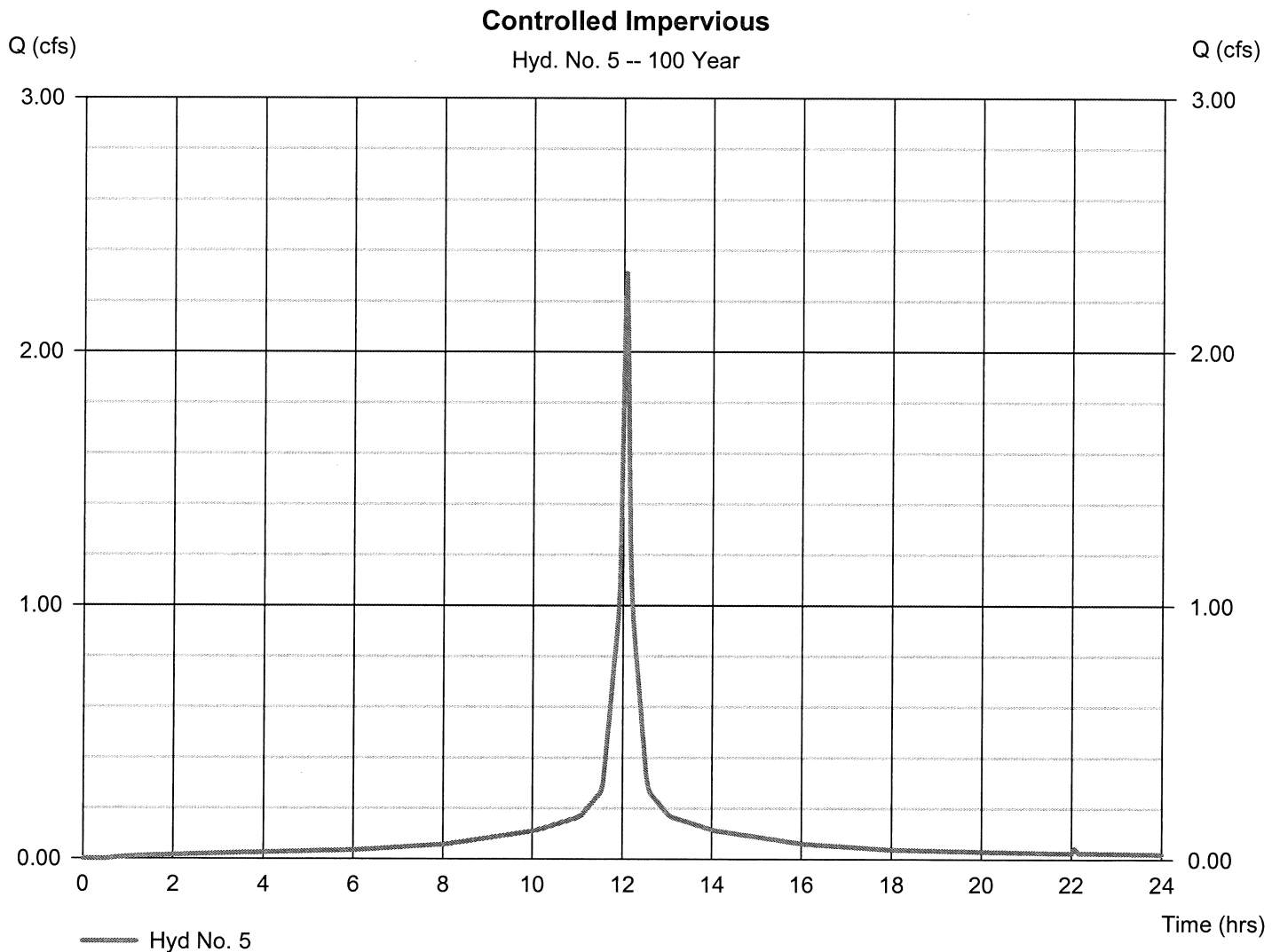
Wednesday, Apr 29, 2020

Hyd. No. 5

Controlled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.263 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 2.311 cfs
Time to peak = 12.07 hrs
Hyd. volume = 8,091 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



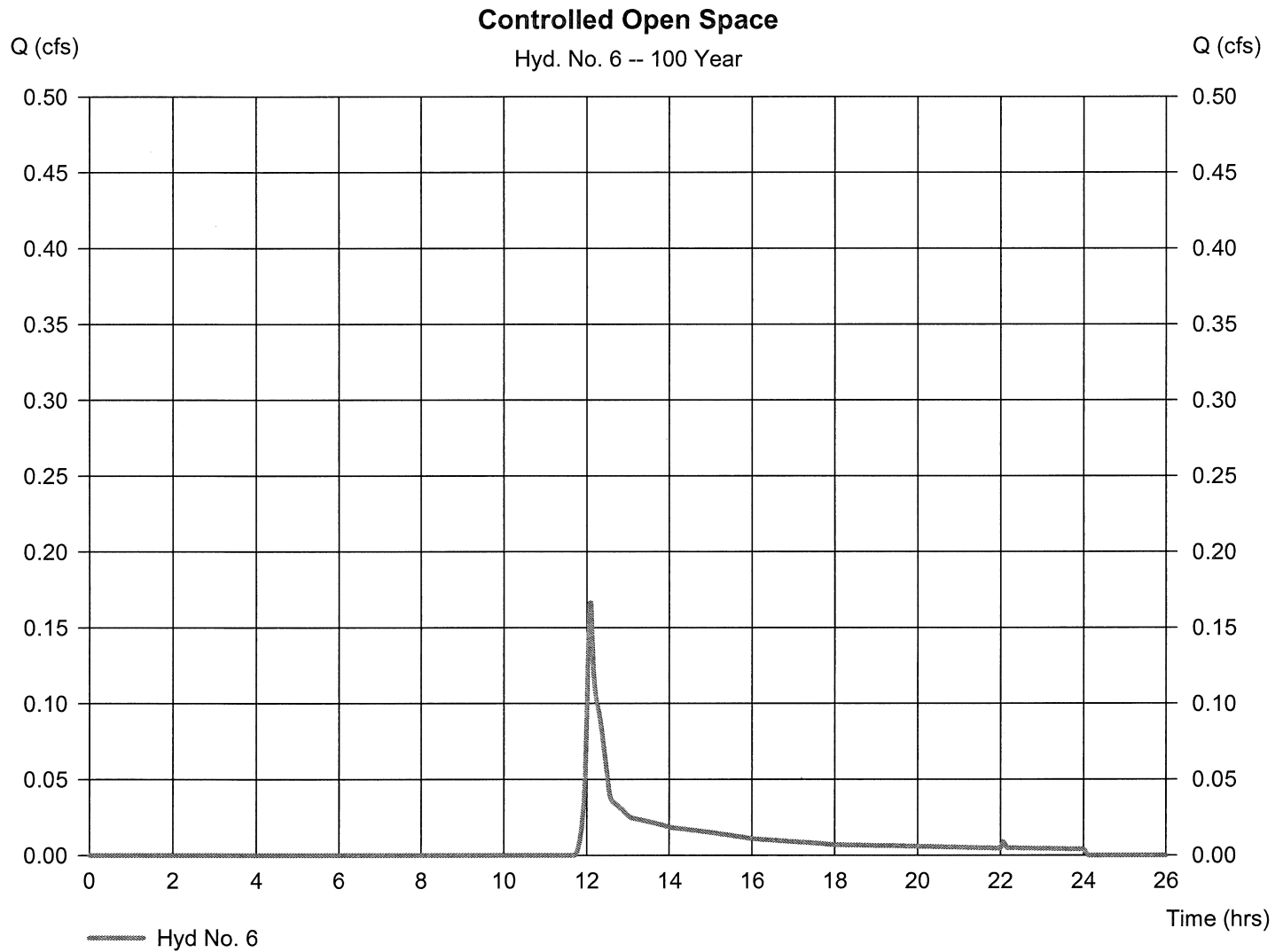
Hydrograph Report

Hyd. No. 6

Controlled Open Space

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.109 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 0.166 cfs
Time to peak = 12.10 hrs
Hyd. volume = 644 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

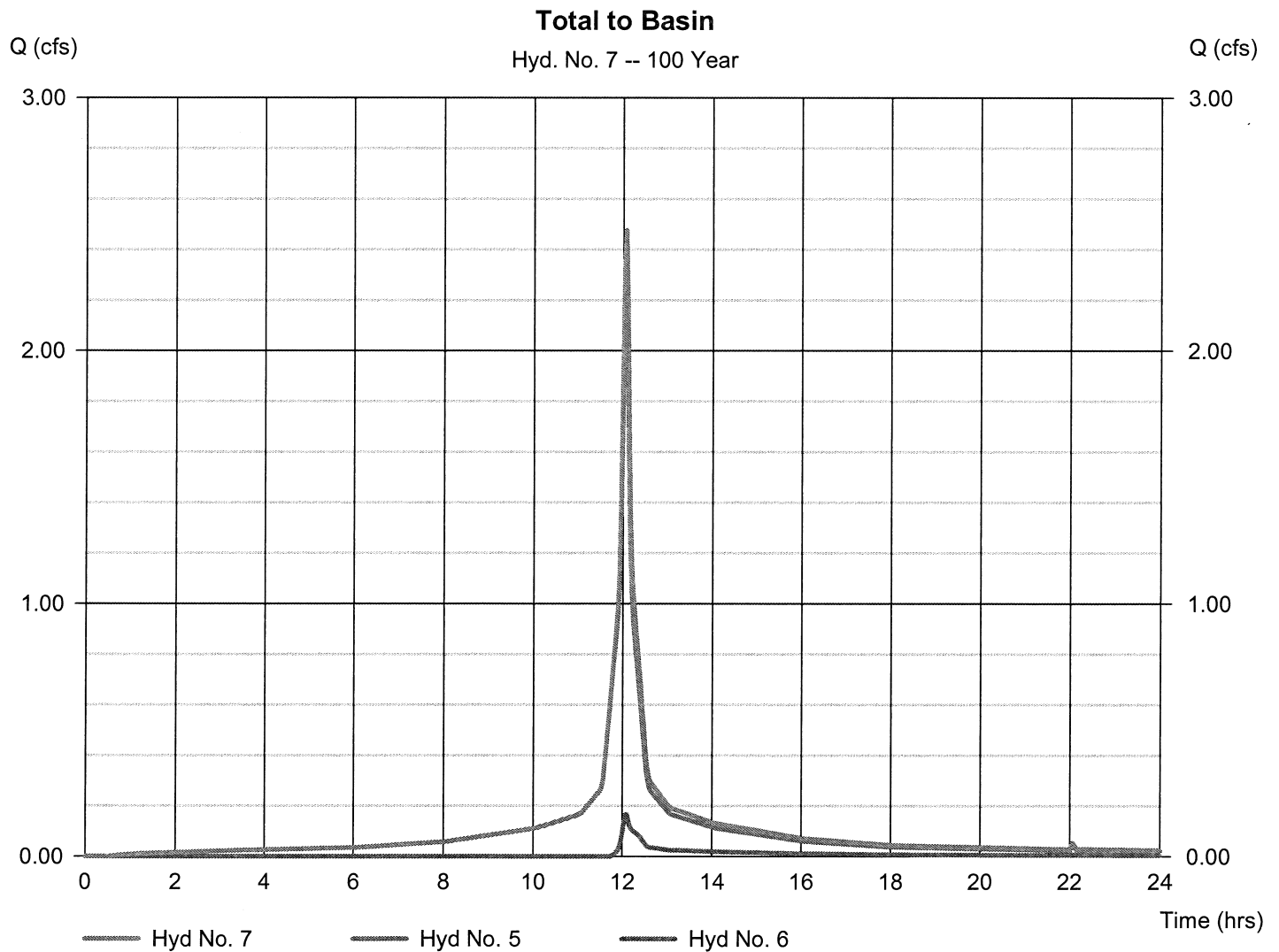
Wednesday, Apr 29, 2020

Hyd. No. 7

Total to Basin

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 5, 6

Peak discharge = 2.477 cfs
Time to peak = 12.07 hrs
Hyd. volume = 8,735 cuft
Contrib. drain. area = 0.372 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

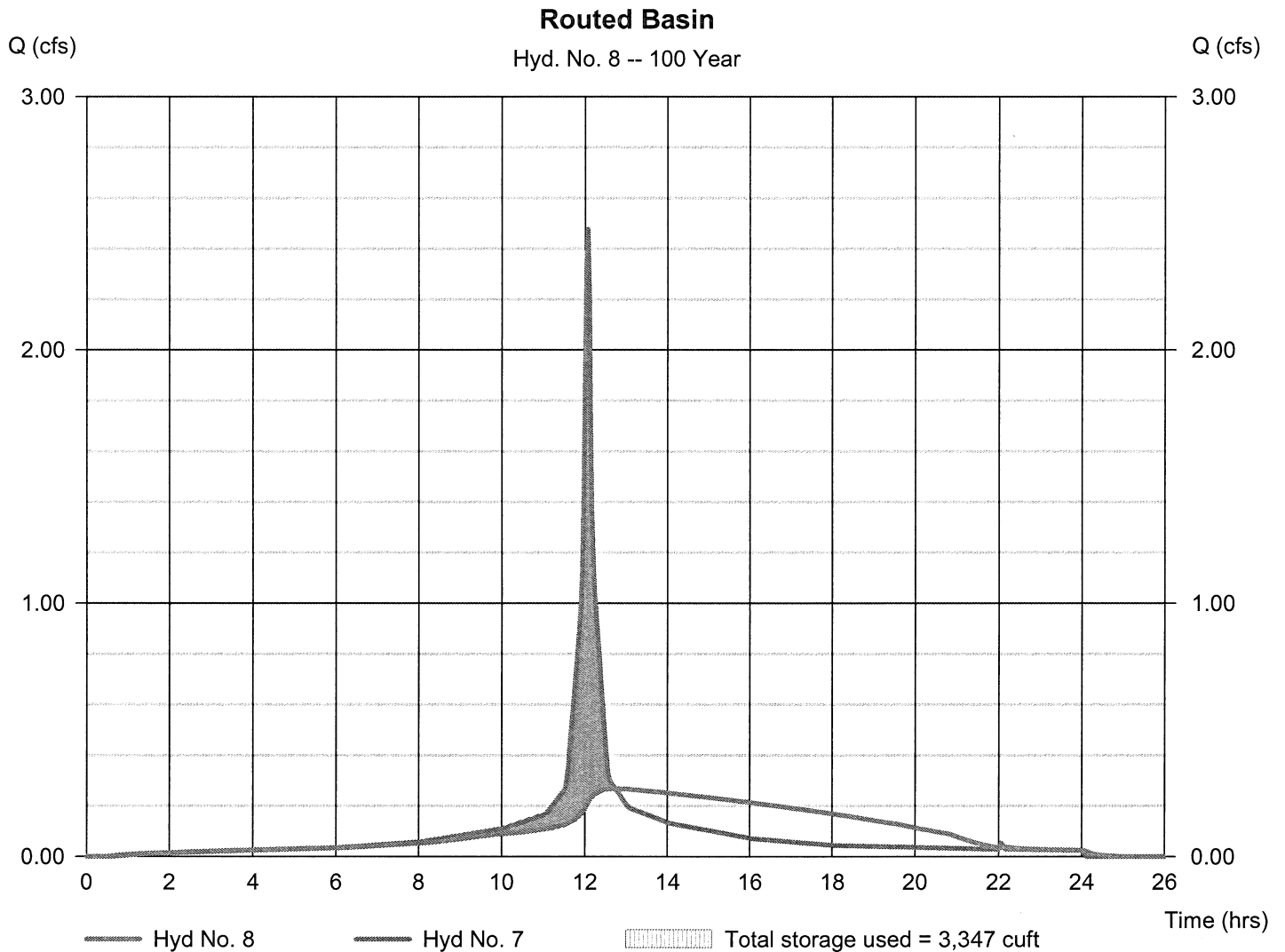
Wednesday, Apr 29, 2020

Hyd. No. 8

Routed Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.267 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.73 hrs
Time interval	= 2 min	Hyd. volume	= 8,734 cuft
Inflow hyd. No.	= 7 - Total to Basin	Max. Elevation	= 95.84 ft
Reservoir name	= (4) 36 inch Pipe Field 120 ft long	Max. Storage	= 3,347 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

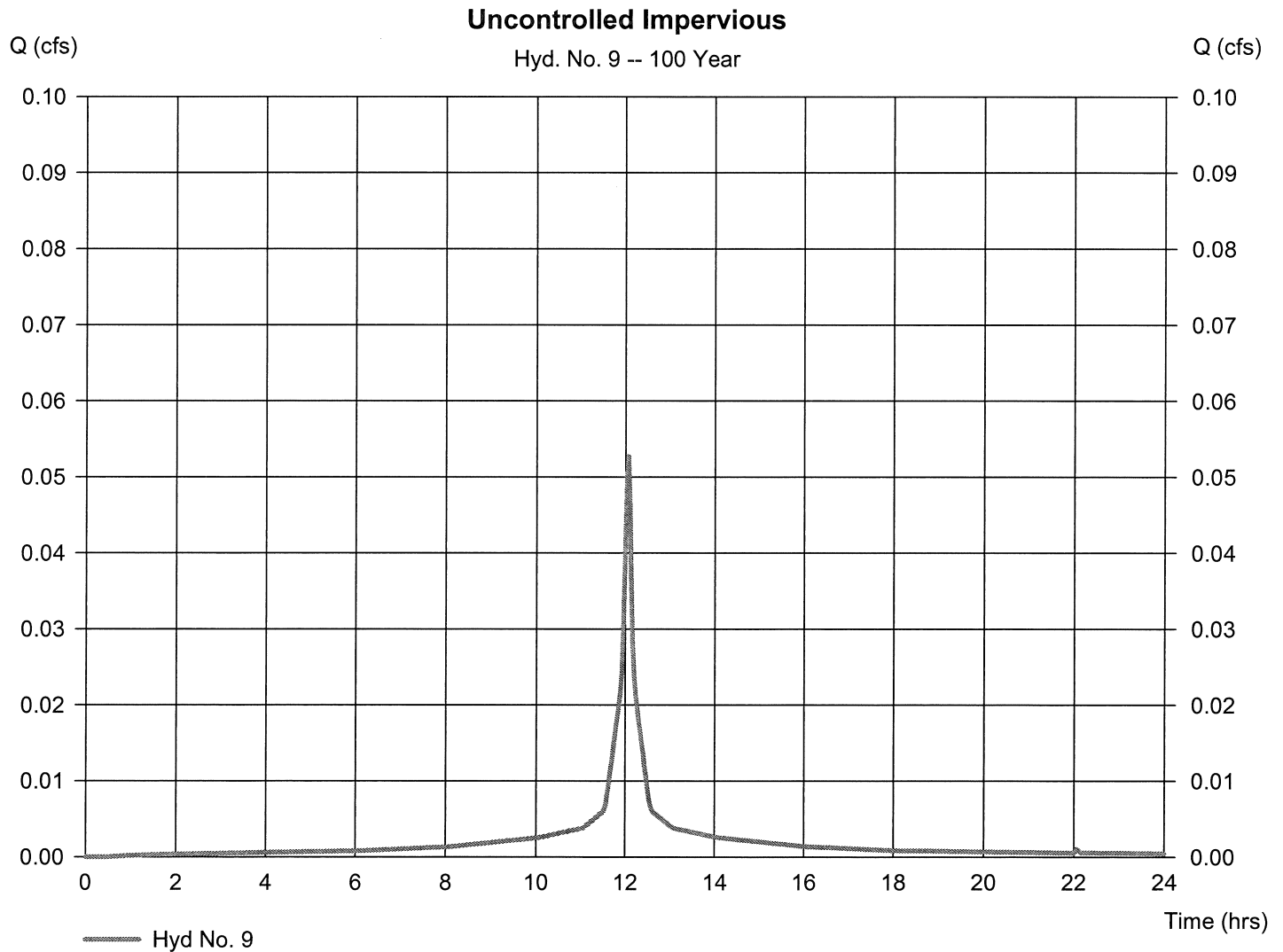
Wednesday, Apr 29, 2020

Hyd. No. 9

Uncontrolled Impervious

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.006 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 0.053 cfs
Time to peak = 12.07 hrs
Hyd. volume = 185 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



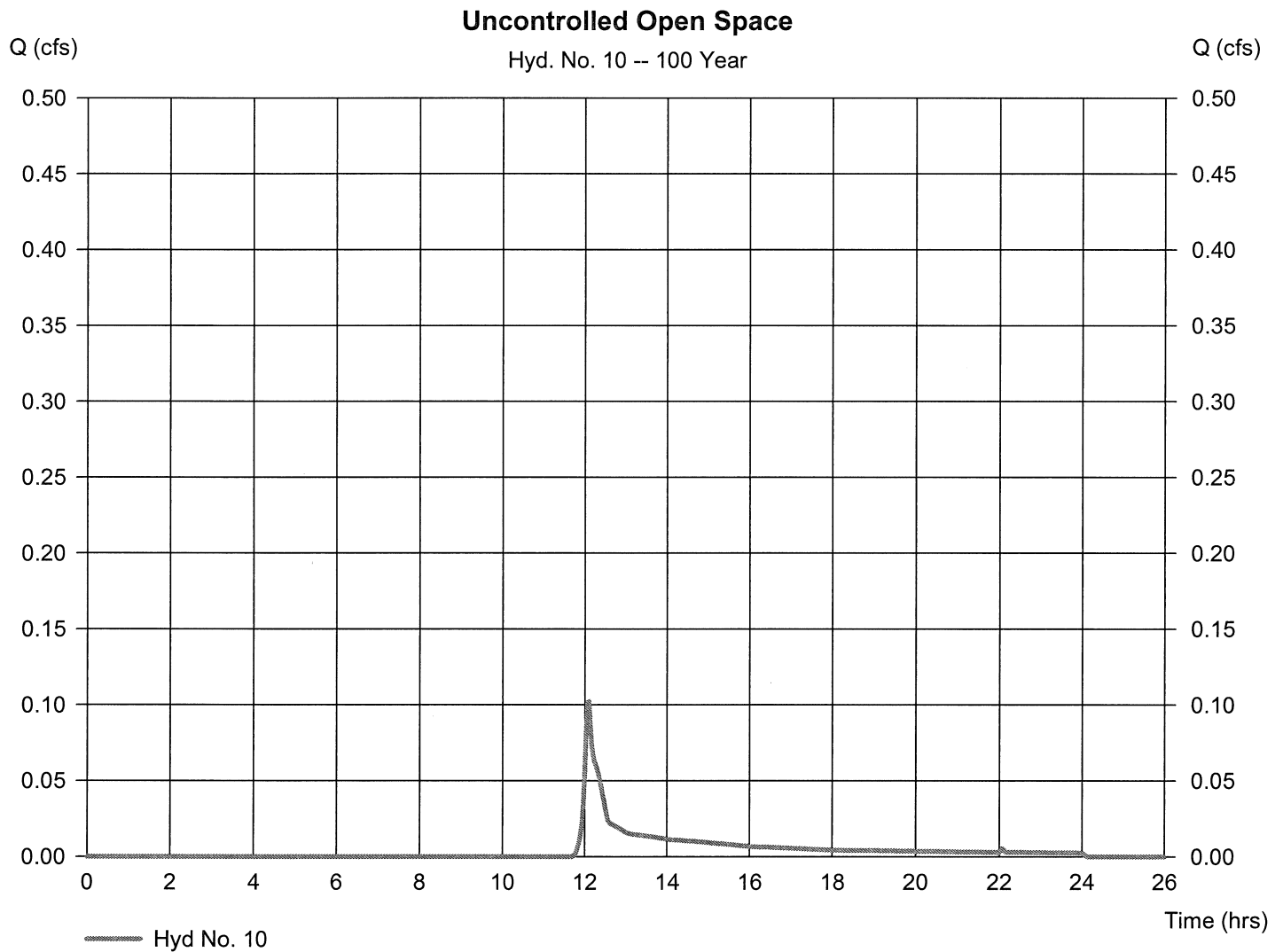
Hydrograph Report

Hyd. No. 10

Uncontrolled Open Space

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.067 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 9.28 in
Storm duration = 24 hrs

Peak discharge = 0.102 cfs
Time to peak = 12.10 hrs
Hyd. volume = 396 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.24

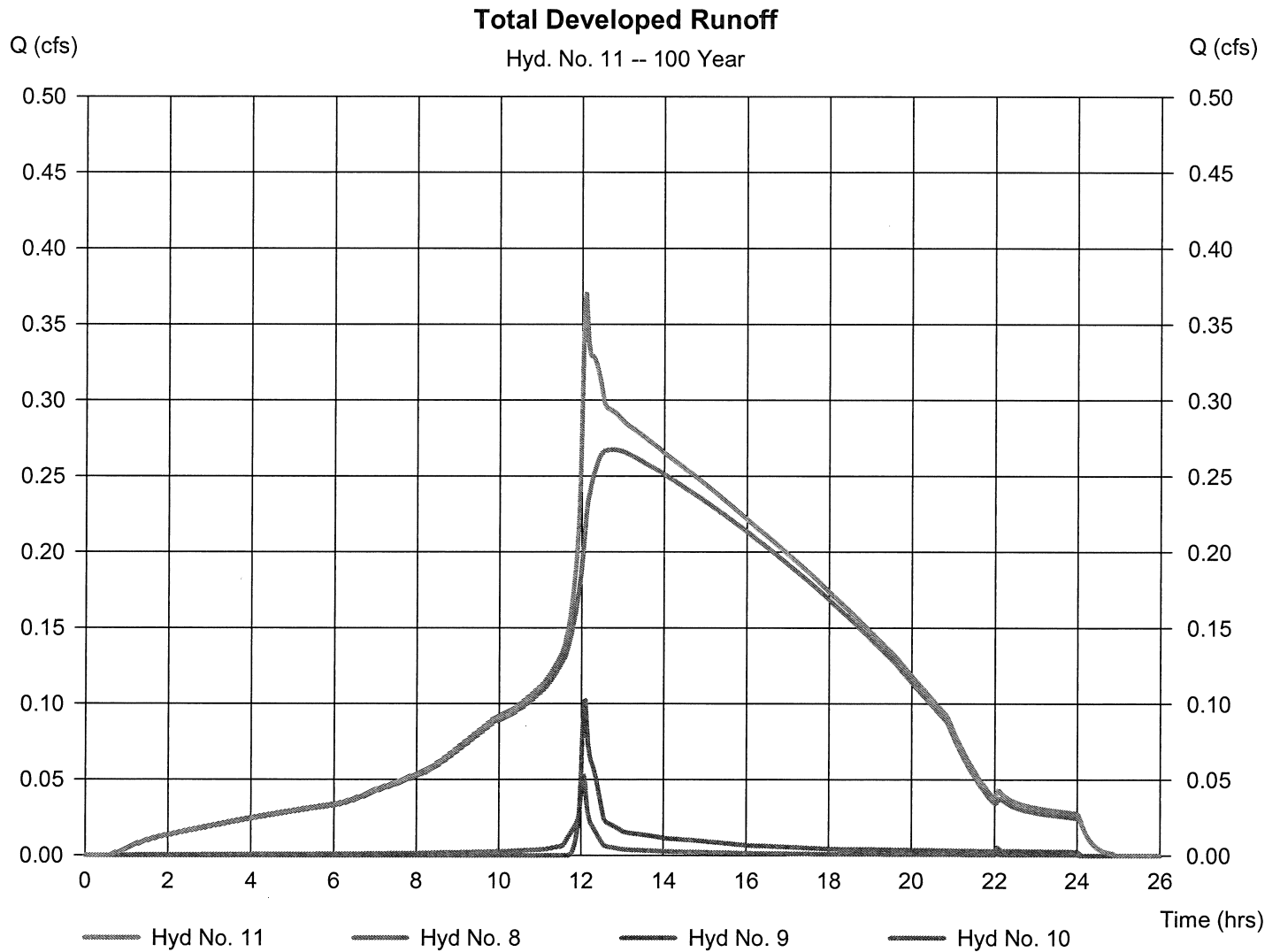
Wednesday, Apr 29, 2020

Hyd. No. 11

Total Developed Runoff

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 8, 9, 10

Peak discharge = 0.370 cfs
Time to peak = 12.10 hrs
Hyd. volume = 9,314 cuft
Contrib. drain. area = 0.073 ac



APPENDIX

Pond Report

Hydraflow Hydrographs by Intelisolve v9.24

Wednesday, Apr 29, 2020

Pond No. 1 - (4) 36 inch Pipe Field 120 ft long

Pond Data

UG Chambers - Invert elev. = 93.16 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 120.00 ft, No. Barrels = 4, Slope = 0.10%, Headers = Yes

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	93.16	n/a	0	0
0.31	93.47	n/a	147	147
0.62	93.78	n/a	326	473
0.94	94.10	n/a	409	882
1.25	94.41	n/a	455	1,337
1.56	94.72	n/a	476	1,814
1.87	95.03	n/a	477	2,290
2.18	95.34	n/a	455	2,745
2.50	95.66	n/a	409	3,154
2.81	95.97	n/a	326	3,480
3.12	96.28	n/a	147	3,627

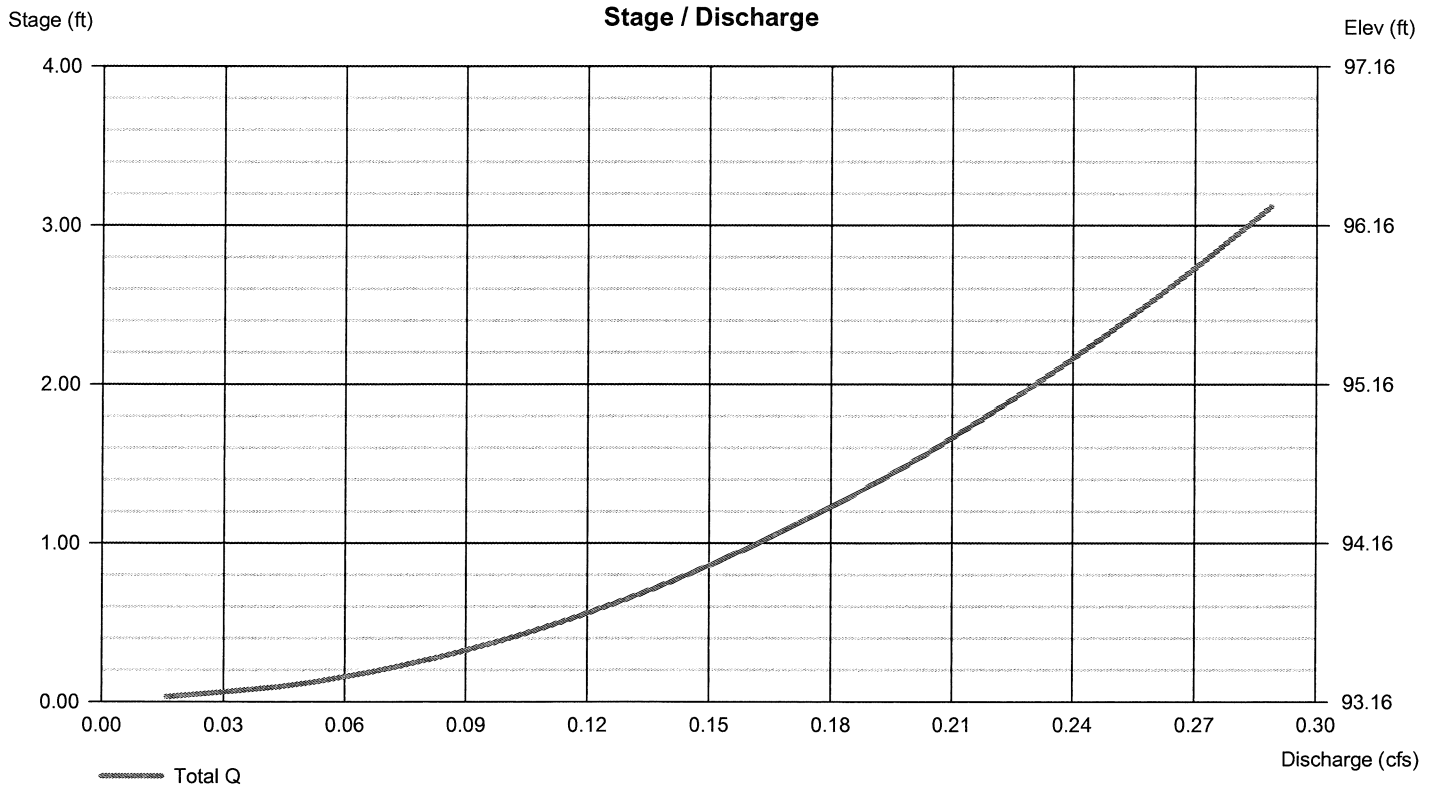
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	2.50	0.00	0.00
Span (in)	= 12.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 90.00	93.08	0.00	0.00
Length (ft)	= 136.00	0.00	0.00	0.00
Slope (%)	= 0.50	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)	= 16.00	0.00	0.00	0.00
Crest El. (ft)	= 97.80	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
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).





Nelson Engineering Associates, Inc.

1750 Bloomsbury Avenue • Ocean, NJ 07712
(732) 918-2180 • FAX: (732) 918-0697

3655 Highway 33
Neptune Township, Monmouth County, NJ

NEAI File # 190403

Date & Time: Monday August 19, 2019 at 8:30 AM
Witnessed By: N/A

Weather conditions at time of test: 75° F, partly cloudy
From: N/A
page 1 of 2

Soil Log Ground Surface Elevation: 98.1 **SB#1** Soil boring at west portion of recharge system

<u>Depth</u>	<u>Description</u>	<u>Munsell</u>
0" - 22"	Topsoil, pale brown dry silt loam with 5% gravel and a clear (2.5" Max) boundary	10 YR 6/3
22" - 40"	Very pale brown sandy loam, subangular structure, dry, friable, and with a clear (2.5" Max.) boundary	10 YR 7/3
40" - 51"	Light gray sand, fine granular structure, dry, friable, and with a clear (2.5" Max.) boundary	10 YR 7/2
51" - 65"	Light yellowish brown silty sand, fine granular structure, moist, friable, and with a clear (2.5" Max.) boundary	10 YR 6/4
65" - 70"	Reddish yellow sand with some silt and 10% gravel throughout, medium to fine granular structure, moist, loose, and with a clear (2.5" Max.) boundary	7.5 YR 6/8
70" - 77"	Light yellowish brown sandy clay loam with 10% gravel throughout, massive structure, moist, slightly plastic, and with a clear (2.5" Max.) boundary	10 YR 6/4
77" - 90"	Yellow clay coated sand with 20% gravel throughout, medium granular structure, moist, loose and slightly sticky, boring terminated at 90" due to excessively coarse fragments	10 YR 7/6

No water seepage encountered Expected seasonal high water table (SHWT) elevation: deeper than 90.6
Depth to expected seasonal high water table (SHWT): deeper than 90" = 7.5' Sample taken at 60"

Soil Log Ground Surface Elevation: 99.4 **SB#2** Soil boring at east portion of recharge system


<u>Depth</u>	<u>Description</u>	<u>Munsell</u>
0" - 16"	Topsoil, pale brown dry silt loam with 5% gravel and a clear (2.5" Max) boundary	10 YR 6/3
16" - 25"	Very pale brown sandy loam, subangular structure, dry, friable, and with a clear (2.5" Max.) boundary	10 YR 7/3

25" - 108" Light yellowish brown silty sand with 25% gravel throughout,
medium to fine granular structure, moist, and friable

10 YR 6/4

No water seepage encountered Expected seasonal high water table (SHWT) elevation: deeper than 90.4
Depth to expected seasonal high water table (SHWT): deeper than 108" = 9.0' Sample taken at 60"

The expected seasonal high water table (SHWT) elevation at the proposed recharge system is deeper than elevation 90.4. It is recommended to set the bottom of any recharge structure at least two feet above at the SHWT (elevation 92.4 or higher).


Matthew R. DuBois, P.E.
(SEAL)

8/19/2019
Date





Nelson Engineering Associates, Inc.

1750 Bloomsbury Avenue • Ocean, NJ 07712
(732) 918-2180 • FAX: (732) 918-0697

CONSTANT HEAD TUBE PERMEAMETER TEST
3655 Highway 33
Neptune Township, Monmouth County, NJ

NEAI File # 190403
Date of test: Monday August 19, 2019

Undisturbed Disturbed

SB#1

Sample Depth: 60"


	<u>REPLICATE A</u>	<u>REPLICATE B</u>
SAMPLE LENGTH (CM) =	7.4	7.4
SAMPLE AREA (CM2) =	31.65	31.65
TIME (SEC) =	600	600
VOLUME (ML) =	92	95
HEAD (CM) =	49.9	49.9
PERMEABILITY (CM/SEC) =	0.0007	0.0007
PERMEABILITY (IN/HR) =	1.0	1.1
PERMEABILITY CLASS =	K-2	K-2

SB#2

Sample Depth: 60"

	<u>REPLICATE A</u>	<u>REPLICATE B</u>
SAMPLE LENGTH (CM) =	7.4	7.4
SAMPLE AREA (CM2) =	31.65	31.65
TIME (SEC) =	300	300
VOLUME (ML) =	210	195
HEAD (CM) =	49.9	50.1
PERMEABILITY (CM/SEC) =	0.0033	0.0030
PERMEABILITY (IN/HR) =	4.6	4.3
PERMEABILITY CLASS =	K-3	K-3

I hereby certify, to the best of my professional knowledge and belief, that the above information is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58: 10A-et. Seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

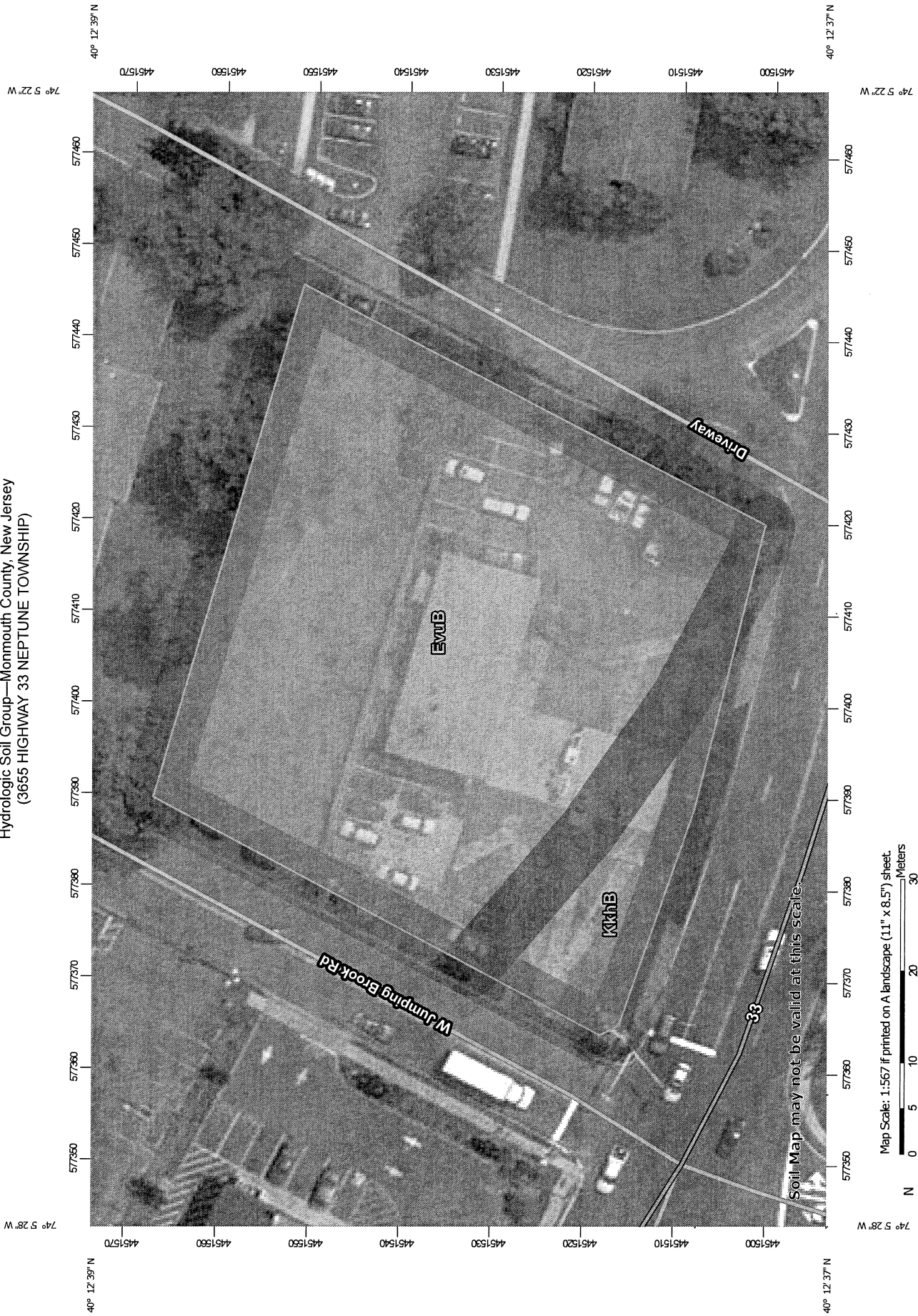


Matthew R. DuBois, P.E.
(SEAL)

8/19/2019
Date

- MORE THAN 20 IN/HR = K-5
- 6 - 20 IN/HR = K-4
- 2 - 6 IN/HR = K-3
- 0.6 - 2 IN/HR = K-2
- 0.2 - 0.6 IN/HR = K-1
- LESS THAN 0.2 IN/HR = K-0







































Hydrologic Soil Group—Monmouth County, New Jersey
(3655 HIGHWAY 33 NEPTUNE TOWNSHIP)



Map Scale: 1:567 if printed on A landscape (11" x 8.5") sheet.

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

MAP LEGEND

Area of Interest (AOI)		Area of Interest (AOI)		C
Soils		A		C/D
Soil Rating Polygons		A/D		D
		B		Not rated or not available
		A/D		Water Features
		B		Streams and Canals
		B/D		Transportation
		C		Rails
		C/D		Interstate Highways
		D		US Routes
		Not rated or not available		Major Roads
				Local Roads
Soil Rating Lines		A		Background
		A/D		Aerial Photography
		B		
		B/D		
		C		
		C/D		
		D		
		Not rated or not available		
Soil Rating Points		A		
		A/D		
		B		
		B/D		

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: Monmouth County, New Jersey
Survey Area Data: Version 12, Sep 15, 2018

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

Date(s) aerial images were photographed: Aug 8, 2014—Sep 23, 2014

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
EvuB	Evesboro-Urban land complex, 0 to 5 percent slopes	A	0.7	86.6%
KkhB	Klej loamy sand-Urban land complex, 0 to 5 percent slopes	A/D	0.1	13.4%
Totals for Area of Interest			0.8	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.

