Stormwater Management Report
for
Reyco Office Park
394 Route 79

Block 153, Lot 7

Township of Marlboro
Monmouth County, New Jersey

August 19, 2020

Prepared by:

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I. Description of Site

The project site is known as Block 153, Lot 7 as depicted on the Township of Marlboro Tax Maps Sheet No. 31. The street address of the property is 394 Route 79 (New Jersey State Highway). The nearest cross streets are Brown Road to the south and Beacon Hill Road to the north.

The tract consists of approximately 2.441 acres of land in the C-S Commercial Service District Zone. A portion of the is vacant and wooded.

Presently, the front of the site is developed and occupied by a two-story dwelling situated along the highway. This dwelling is to be demolished. At the rear of the property, there is a second dwelling utilized for a non-residential use. Access to the site is from the State Highway via split driveway.

View of existing dwelling (to be demolished)

Beyond the rear of the property is the Sandy Brook, which is a tributary to the Deep Run, a non-Category 1 stream in Monmouth County. Prior to design of the plans, the stream corridor was evaluated in the field, and any associated freshwater wetlands were flagged. The wetlands line is plotted on Sheet 2 of the drawings and the actual line is situated off site.

The NJDEP verified the wetlands line by Letter of Interpretation dated June 11, 2020 establishing a 50-foot wide transition area. The transition area is plotted on the plans.

Proposed Site Plan

The applicant proposes to demolish the dwelling along the highway and construct a 16,260 S.F. single-story flex building. Parking will be provided for 22 cars and a new trash enclosure provided. Access to the site will remain unchanged.

Ancillary improvements include a paved parking lot, stormwater management, landscaping, and lighting.

Applicability of the Stormwater Management Rules (7:8-1.6)

The project will disturb in excess of one acre and proposes more than ¼ of new impervious. Therefore, in accordance with N.J.A.C. 7:8-1.2 it is classified as a major development.

The purpose of this report is to demonstrate that the proposed development will comply with the peak rate of runoff, groundwater recharge, and water quality requirements of N.J.A.C. 7:8.

II. Land Characteristics

A. Soils

According to the "Soil Survey of Monmouth County, New Jersey", the soils types found on the site consist of:

Evesboro Sand, 0 to 5 percent slopes and 5 to 10 percent slopes (approximately 100% of development area)

The Evesboro Series soils are classified as hydrologic Type 'A' soils.

Soil logs were performed in the field on September 22, 2020 by Robert Burdick, P.E. and are included in Appendix 3 of this report for review. Seasonal high water table depths in the vicinity of the proposed basin are from 8'-2" to 9'-0" below the surface.

B. Topography & Drainage Patterns

The property is consistently sloped from north to south but has two distinct drainage areas. The site high point is situated along the northern common lot line with Lot 6. The corresponding elevation (NAVD '88 datum) is approximately 103. From the highpoint, the property slopes southeast towards the common lot line with Lot 11 (elevation 86). The average slope across the land is between 5% and 7%. The second drainage area is from the same high point, but drains directly south towards Lot 8 (elevation 87). The average slope across this portion of the lot is between 2% and 7%.

Upon completion of development, this drainage pattern will not change. Runoff will still flow towards the two discharge points. However, it will be at a reduced rate of runoff as per N.J.A.C. 7:8.

III. Hydrologic Methodology

In order to quantify the pre and post development peak rates of runoff, the Natural Resources Conservation Service (formerly SCS) TR-55 Method was used. The N.R.C.S. Method presents simplified procedures to calculate storm water runoff volume, peak rated of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the Unites States.[1] The TR-55 model is generally used in analyzing watersheds under three (3) square miles (about 2,000 acres). The main parameters are described below:

CN = Curve Number. Based on soils, plant cover, amount of impervious areas, interception, and surface storage.

Tc = Time of Concentration. The time is takes from the most hydraulically distant point in a watershed to travel to a point of interest.

Lag Time = The distance from the center of mass of excess rainfall to the peak discharge. The lag equation is expressed as:

$$T_{lag} = \frac{L^{0.8} \times (S+1)^{0.7}}{1900 \times \sqrt{Y}}$$

L = length of the longest drainage path (feet)

S, the potential maximum retention of the soil in inches is expressed as:

$$S = (1000 / CN) - 10$$

Y = Average land slope (percent)

Empirically, the Lag Time has been expressed as 0.6Tc

A = Drainage Area (acres). The watershed area that contributes to the point of interest.

Rainfall = The 24-hour uniform rainfall amount imposed on the watershed. The rainfall amounts for Monmouth County, as revised in August 2012 are as follows:

Storm Event	24-hour Rainfall (inches)
1	2.79
2	3.38
5	4.38
10	5.23
25	6.53
100	8.94

[1] United States Department of Agriculture, Soil Conservation Service, Engineering Division, Technical Release 55

IV. Existing Drainage Conditions

The portion of the lot to be disturbed is partially impervious, partially maintained grass, and partially wooded. The analysis of the runoff patterns has been divided into three (3) distinct areas as depicted on the Pre-Development Drainage Area Map. These areas are as follows:

DA-1A (To East) – This area is the portion of the lot which will be disturbed and flows to the east.

DA-1B (To East) – This area is the portion of the lot which will not be disturbed and flows to the east.

DA-2 (To South) – This area is the portion of the lot which will be disturbed and flows to the south.

The Time of Concentration paths are depicted on the Drainage Area Map and a spreadsheet enclosed in Appendix 1 contains the associated calculations. The corresponding CN for each drainage area are enclosed in Appendix 1.

Existing Conditions

DA-1A
Area = 0.62 acres
CN = 79
Tc = 19.6 minutes
2-yr. storm runoff = 0.75 cfs (3,350 C.F.)
10-yr. storm runoff = 1.52 cfs (6,695 C.F.)
100-yr. storm runoff = 3.19 cfs (14,293 C.F.)

DA-1B
Area = 0.48 acres
CN = 79
Tc = 19.6 minutes
2-yr. storm runoff = 0.58 cfs (2,594 C.F.)
10-yr. storm runoff = 1.17 cfs (5,183 C.F.)
100-yr. storm runoff = 2.47 cfs (11,066 C.F.)

DA-2
Area = 1.23 acres
CN = 82
Tc = 19.1 minutes
2-yr. storm runoff = 1.72 cfs (7,592 C.F.)
10-yr. storm runoff = 3.28 cfs (14,549 C.F.)
100-yr. storm runoff = 6.63 cfs (29,995 C.F.)

V. Post Development Drainage Conditions

This application results in an increase of impervious coverage. Therefore, a stormwater management system is proposed to attenuate the increase in peak rate of runoff leaving the site. The existing building, as well as the entire roof area of the proposed building and parking lot will drain into an underground ground detention system. Part of the center portion of the site (grass areas) will flow via pipe flow into the basin, while the remaining areas will flow to the rear of the property brook towards the brook.

Based on soils testing, the soils are classified as K0 with an infiltration rate of 0.0 inches per hour. For the purposes of design, the assumed soil infiltration rate was 0.0 inches per hour. Although this conflicts with the Monmouth County Soils Data, it is more practical to rely on the field tested rates and not the standard hydrologic group 'A' soil characteristics.

The Post-Developed Drainage Area to the detention basin consists of the majority of the developed portion of the site, including roof and parking areas, which will be captured by a system of catch basins and inlets. The inflow hydrographs were separated out between pervious and impervious to better model the actual catchment area. Some overland areas will flow into the proposed detention basin. The hydrograph results are summarized below:

Proposed Condition – To Detention Basin 1 (Hydrograph 4)

Area = 1.10 acres
CN = 98 (impervious areas)
CN = 79 (pervious areas)
Tc = 10.0 minutes
2-yr. storm runoff = 2.69 cfs (11,344 C.F.)
10-yr. storm runoff = 4.33 cfs (18,426 C.F.)
100-yr. storm runoff = 7.74 cfs (33,325 C.F.)

The area in the front of the property which mostly consists of the existing driveway lot will runoff undetained towards the south. This area has been quantified as follows:

Proposed Condition – DA-2 (Hydrograph 6)

Area = 0.76 acres
CN = 81
Tc = 17.4 minutes
2-yr. storm runoff = 1.01 cfs (4,491 C.F.)
10-yr. storm runoff = 1.97 cfs (8,725 C.F.)
100-yr. storm runoff = 4.04 cfs (18,196 C.F.)

A second offsite-direct area located in the rear of the building, and contains mostly lawn areas, will drain towards the brook. This area has been quantified as follows:

Proposed Condition –DA-1B (Hydrograph 3)

Area = 0.48 acres
CN = 79
Tc = 18.0 minutes
2-yr. storm runoff = 0.58 cfs (2,594 C.F.)
10-yr. storm runoff = 1.17 cfs (5,183 C.F.)
100-yr. storm runoff = 2.47 cfs (11,066 C.F.)

Proposed Detention Basin – Routing Results (Hydrograph 5)

STORM EVENT	INFLOW	PEAK ELEVATION	OUTFLOW
2-year	2.69 cfs	86.39	0.35 cfs
10-year	4.33 cfs	86.97	0.80 cfs
100-year	7.74 cfs	88.14	2.42 cfs

The basin contains an outlet control structure with a 4" diameter orifice at elevation 85.50 and a 4" weir at elevation 86.40. Assuming zero infiltration, it is not expected that the water level will reach 88.33 (the top of the underground pipes) other than during a greater than 100-year frequency storm. In that case, the water will overflow the weir an be discharged through the outlet pipe, similar to the other storms.

Compliance with Runoff Quantity Requirements (7:8-5.4-3)

The N.J.D.E.P. regulates the runoff quantity requirements for Major Developments at N.J.A.C. 7:8-5.4(a)3. The rules permit an applicant to demonstrate compliance with the quantity requirements by selecting one (1) of the four (4) choices listed in subparts i. thru iv. These are provided below:

> i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;
>
> ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10 and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;
>
> iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed; or
>
> iv. In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (a)3i, ii and iii above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

Item i. above does not apply to the project. This choice is frequently selected when a site discharges to an isolated low area with no runoff leaving the site or when the net increase of impervious coverage is zero.

Item ii. above does not apply to the project since there will be a net increase of impervious surfaces.

Item iv. above does not apply to the project since the site is not located within a tidal flood hazard area.

Item iii. above is commonly known as the peak rate of runoff reductions or the "cutbacks". When a project proposes a net increase in impervious (pre vs post development) and a detention system is required, engineering designs demonstrate that this part of the rule is satisfied. **This is the portion of the regulations that is applicable to the project.**

VI. Pre vs. Post Peak Rate of Runoff Comparison

The installation of a below ground detention system will address the requirements for the peak rate of runoff reductions since the runoff will be temporarily captured and stored. During storm events, the basin will fill with water and any excess runoff will spill out from the overflow structure and flow towards the brook. For the analysis, the basin infiltration rate was assumed to be zero.

The table below summarizes the post-developed combined hydrograph results for the disturbed portion of the lot which flows to the east.

TO EAST, DISTURBED AREA – PRE VS. POST (HYDROGRAPH #5)

STORM EVENT	EXISTING PEAK RATE OF RUNOFF	PERMITTED PEAK RATE *	PROPOSED PEAK RATE OF RUNOFF	COMPLIES
2-year	0.75 cfs	0.68 (50%)	0.35 cfs	YES
10-year	1.52 cfs	1.14 (75%)	0.80 cfs	YES
100-year	3.19 cfs	2.55 (80%)	2.42 cfs	YES

* Expressed as a percentage of the Existing Peak Rate of Runoff

The table below summarizes the post-developed combined hydrograph results for the undisturbed portion of the lot which flows to the east.

TO EAST, UNDISTURBED AREA – PRE VS. POST

STORM EVENT	EXISTING PEAK RATE OF RUNOFF	PROPOSED PEAK RATE OF RUNOFF	DIFFERENCE	INCREASE
2-year	0.58 cfs	0.58 cfs	0.00 cfs	NO
10-year	1.17 cfs	1.17 cfs	0.00 cfs	NO
100-year	2.47 cfs	2.47 cfs	0.00 cfs	NO

The table below summarizes the post-developed combined hydrograph results for the portion of the lot which flows to the south.

TO SOUTH, UNDISTURBED AREA – PRE VS. POST

STORM EVENT	EXISTING PEAK RATE OF RUNOFF	PROPOSED PEAK RATE OF RUNOFF	DIFFERENCE	INCREASE
2-year	1.72 cfs	1.01 cfs	-0.71 cfs	NO
10-year	3.28 cfs	1.97 cfs	-1.31 cfs	NO
100-year	6.63 cfs	4.04 cfs	-2.59 cfs	NO

Compliance with Groundwater Recharge (7:8-5.4-2)

The site is exempt from groundwater recharge since the soils are not capable of providing any infiltration as per the on site soil logs.

Compliance with Water Quality Standards (7:8-5.5)

N.J.A.C. 7:8 states that water quality measures are applicable when greater than ¼ acre of new impervious surfaces are added. However, existing impervious areas are not subject to water quality requirements. Not all impervious surfaces are subject to water quality requirements. Roof runoff is considered clean, so is the runoff from patios and decks. For the subject site, water quality measures are applicable to the areas subject to new vehicular traffic only.

The project meets water quality as follows:

Due to the extremely poor quality of the site soils, water quality cannot be addressed through nonstructural means or by using infiltration. Therefore, the site will need to incorporate a pre-treatment device. The water quality inflow storm is 1.90 cfs. Based on this flow, a HydroWorks Hydrofilter Model HF-B24-17-4 is required. This is an inline filter which has manufactured cartridges and a weir wall to control the flow through the filter.

VII. Soil Erosion and Sediment Control

Compliance with Soil Erosion & Sediment Control Act Rules (N.J.A.C. 2:90)

The project includes design features to prevent the transport of soil into downstream waterways during and after construction. This includes stabilized soil stockpiles, construction entrance pads, and silt fence. Soil Erosion and Sediment Control plans are included in the set of drawings and should be referenced for more detail.

Compliance with Erosion Control (N.J.A.C. 7:8-5.4-1)

Demonstrating compliance with Erosion Control is also regulated by the state stormwater standards. As stated above, a design for the implementation of soil erosion and sediment control devices is included in the plan set. The plans will be submitted to the Freehold Soil Conservation District for review & certification. The project does not contain any new/non-existing point discharges or introduce new sediment into existing stream channels.

VIII. Conclusions

The development of the property results in an increase in impervious surfaces. A stormwater management system is proposed to attenuate an increase of runoff in the 2-year, 10-year, and 100-year storms. The design complies with the requirements of N.J.A.C. 7:8. As a result, there will not be any downstream detriments.

Appendix 1
Existing Runoff Calculations

East Point Engineering, LLC
11 South Main Street
Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [x] Present [ ] Developed — Existing DA-1

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.00	0.00
HSG 'D'	GRAVEL	91			0.00	0.00
HSG 'D'	GRASS/WOODS COMBINATION	79			1.10	86.90

1. Use only one CN source per line

Totals ➡ 1.10 | 86.90

CN (weighted) = tot.prod. / tot. area = 86.90 / 1.10 = 79.0 ; Use CN ➡ **79**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

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Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [x] Present [ ] Developed — Existing DA-2

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area [x] acres / mi² / %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.15	14.70
HSG 'D'	GRAVEL	91			0.06	5.46
HSG 'D'	GRASS/WOODS COMBINATION	79			1.02	80.58
1. Use only one CN source per line				Totals ➡	1.23	100.74

CN (weighted) = tot.prod. / tot. area = 100.74 / 1.23 = 81.9 ; Use CN ➡ **82**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

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Marlboro, NJ 07746
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Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [x] Present [ ] Developed — Existing DA-1

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

		Segment ID			
1. Surface description (table 3-1)……..		AB			
2. Manning's roughness coefficient, n (table 3-1)……		WOODS			
3. Flow length, L (total L ≤ 300 ft.)……	ft	0.400			
4. Two-year 24-hour rainfall, p_2 ……..	in	150			
5. Land slope, s ……	ft/ft	3.4			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t……..	hr	0.060			
		0.31	+		= 0.31

Shallow Concentrated Flow

		Segment ID			
7. Surface description (paved or unpaved)……		BC			
8. Flow Length, L……..	ft	UNPAVED			
9. Watercourse slope, s……..	ft/ft	200			
10. Average velocity, V (figure 3-1)……	ft/s	0.045			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr	3.2			
		0.02	+		= 0.02

Channel Flow

		Segment ID			
12. Cross sectional flow area, a……..	ft^2				
13. Wetted perimeter, P_w ……	ft				
14. Hydraulic radius, r=a/P_w Compute r……	ft				
15. Channel slope, s……	ft/ft				
16. Manning's roughness coefficient, n……					
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V……..	ft/s				
18. Flow length, L……..	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr				
			+		= 0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 0.33

min **19.6**

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Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [x] Present [ ] Developed — Existing DA-2

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

		Segment ID				
		AB				
1. Surface description (table 3-1)……..		WOODS				
2. Manning's roughness coefficient, n (table 3-1)……		0.400				
3. Flow length, L (total L ≤ 300 ft.)……	ft	150				
4. Two-year 24-hour rainfall, p_2 ……..	in	3.4				
5. Land slope, s ……	ft/ft	0.067				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t……..	hr	0.30	+		=	0.30

Shallow Concentrated Flow

		Segment ID				
		BC				
7. Surface description (paved or unpaved)……		UNPAVED				
8. Flow Length, L……..	ft	225				
9. Watercourse slope, s……..	ft/ft	0.031				
10. Average velocity, V (figure 3-1)……	ft/s	2.8				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr	0.02	+		=	0.02

Channel Flow

		Segment ID				
12. Cross sectional flow area, a……..	ft^2					
13. Wetted perimeter, P_w ……	ft					
14. Hydraulic radius, r=a/P_w Compute r……	ft					
15. Channel slope, s……	ft/ft					
16. Manning's roughness coefficient, n……						
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V……..	ft/s					
18. Flow length, L……..	ft					
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr		+		=	0.00
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)……					hr	0.32
					min	**19.1**

Watershed Model Schematic

1 - Existing DA-1A

2 - Existing DA-1B

3 - Existing DA-2

Legend

Hyd.	Origin	Description
1	SCS Runoff	Existing DA-1A
2	SCS Runoff	Existing DA-1B
3	SCS Runoff	Existing DA-2

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.23

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	-------	-------	0.751	-------	-------	1.515	-------	-------	3.191	Existing DA-1A
2	SCS Runoff	-------	-------	0.581	-------	-------	1.173	-------	-------	2.470	Existing DA-1B
3	SCS Runoff	-------	-------	1.716	-------	-------	3.284	-------	-------	6.633	Existing DA-2

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

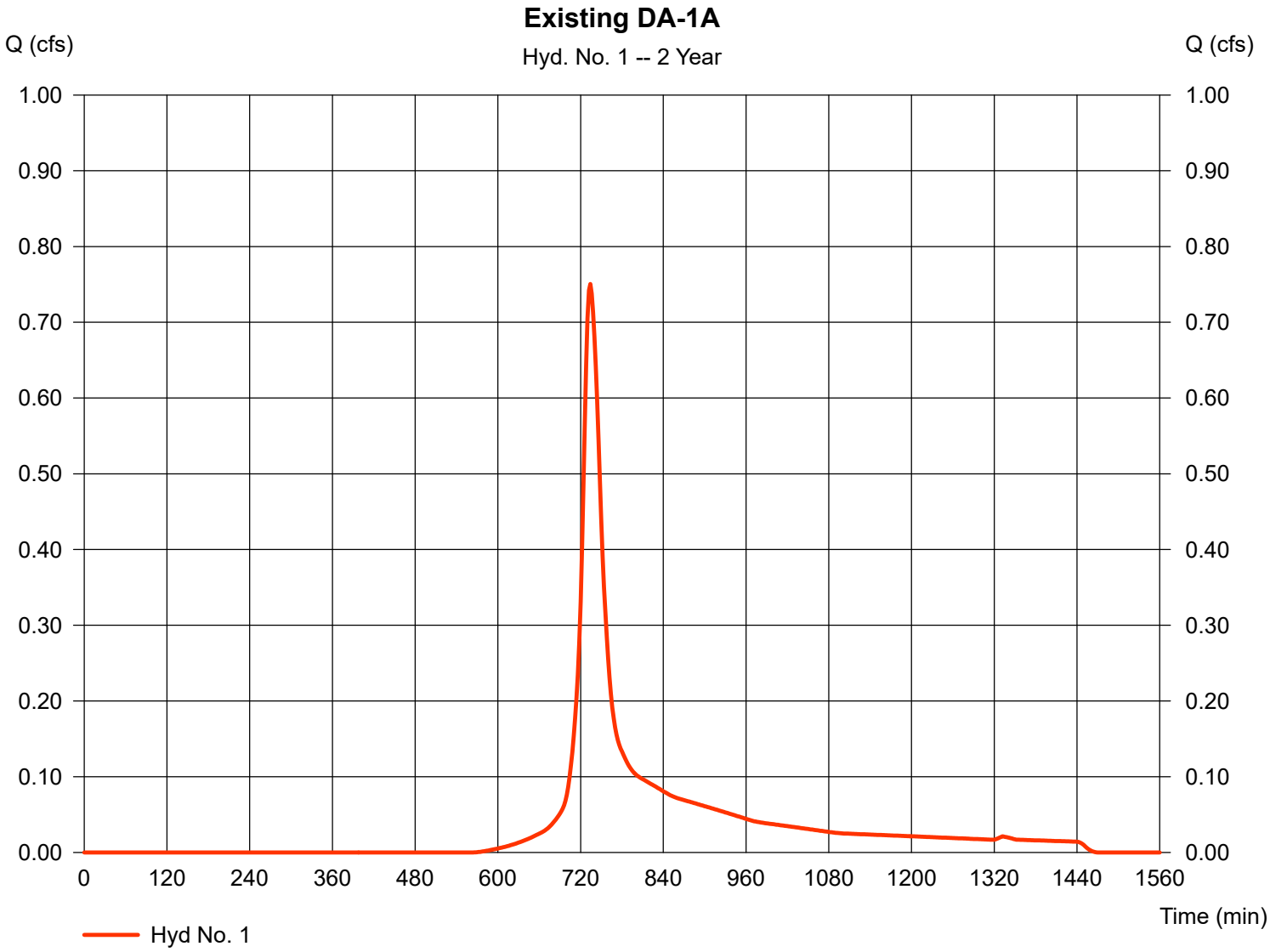
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.751	2	734	3,350	----	------	------	Existing DA-1A
2	SCS Runoff	0.581	2	734	2,594	----	------	------	Existing DA-1B
3	SCS Runoff	1.716	2	734	7,592	----	------	------	Existing DA-2

Hydrograph Report

Hyd. No. 1

Existing DA-1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.751 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	3,350 cuft
Drainage area	=	0.620 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

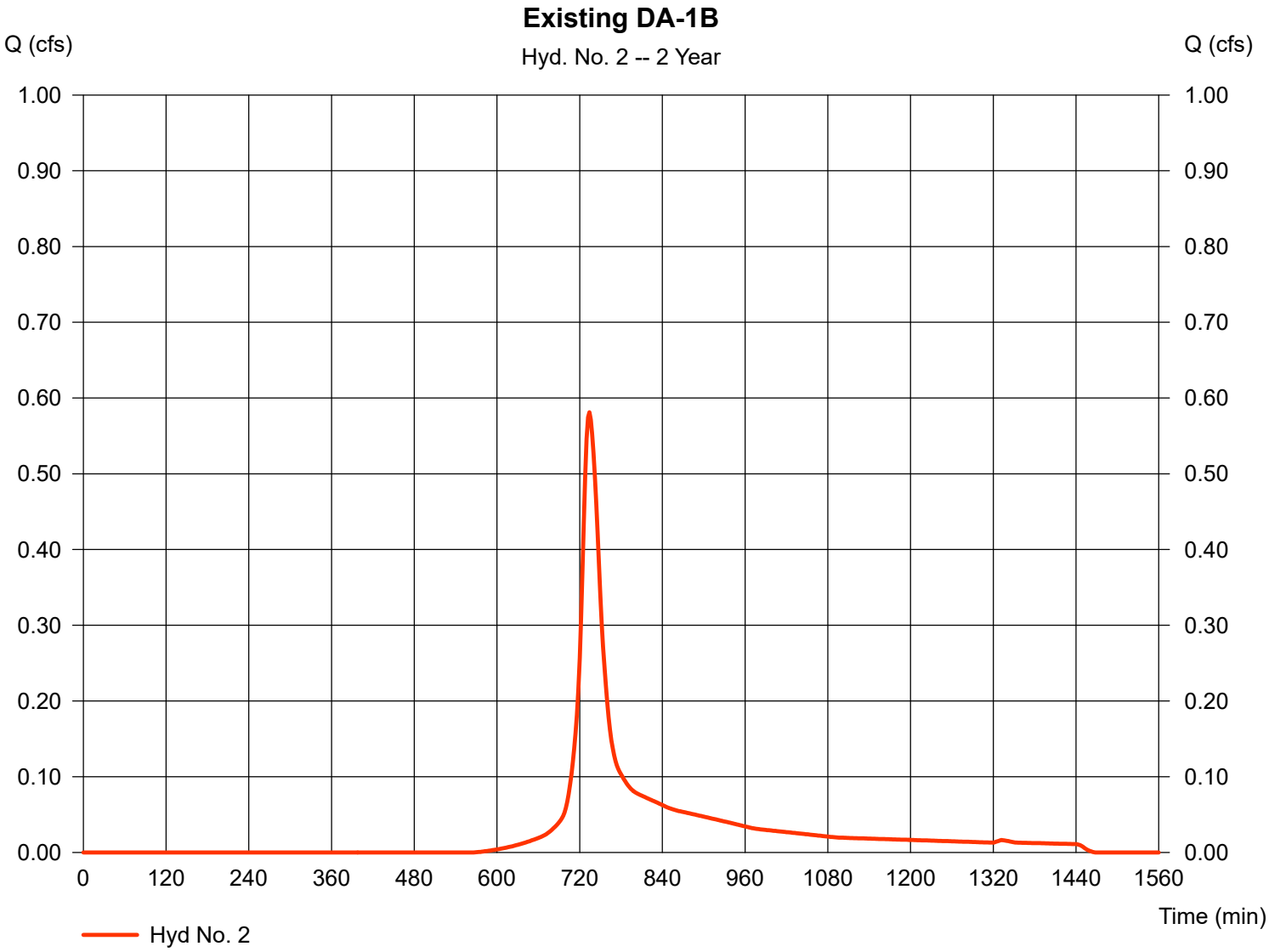


Hydrograph Report

Hyd. No. 2

Existing DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.581 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	2,594 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

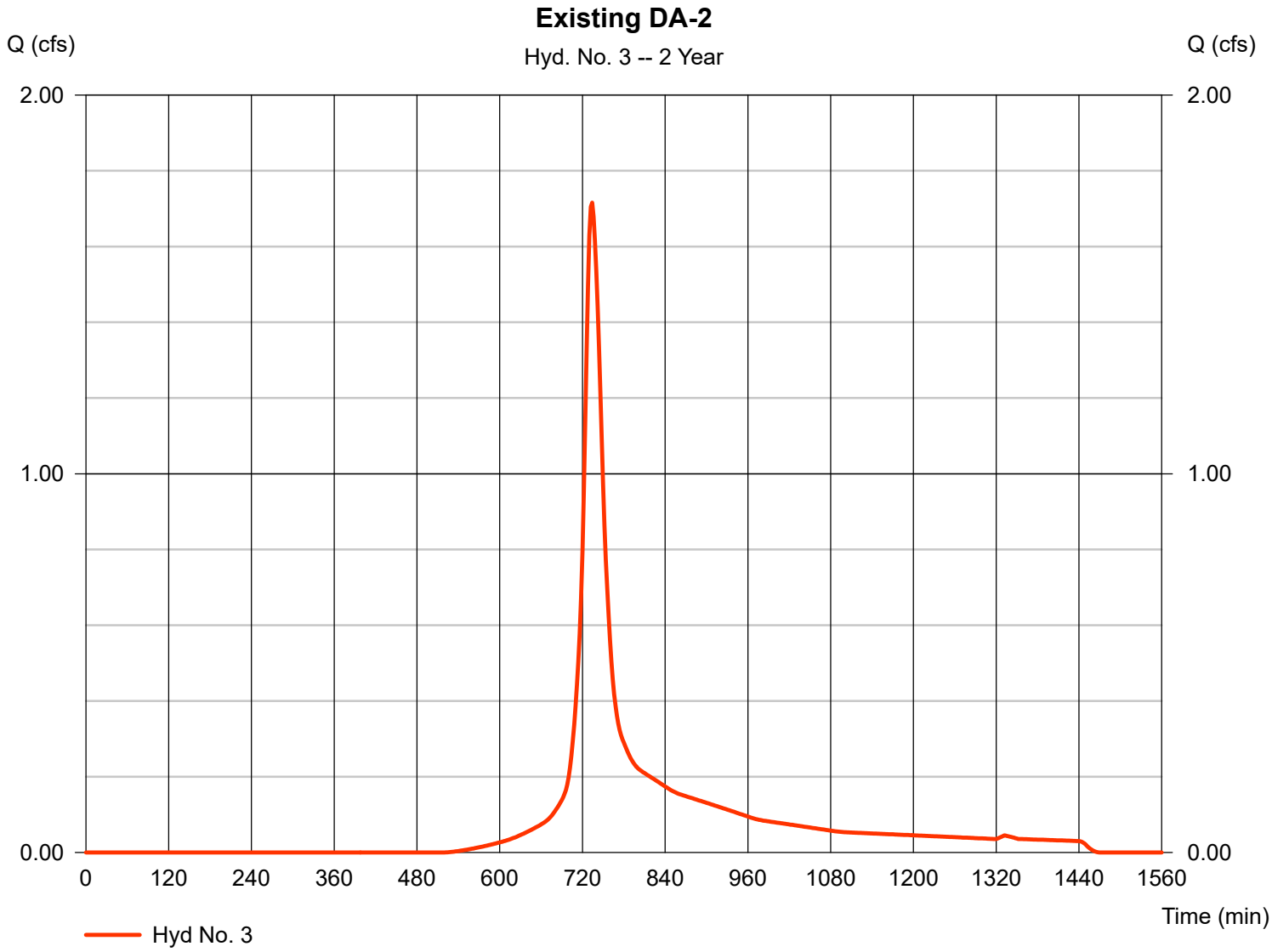


Hydrograph Report

Hyd. No. 3

Existing DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.716 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	7,592 cuft
Drainage area	=	1.230 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.10 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

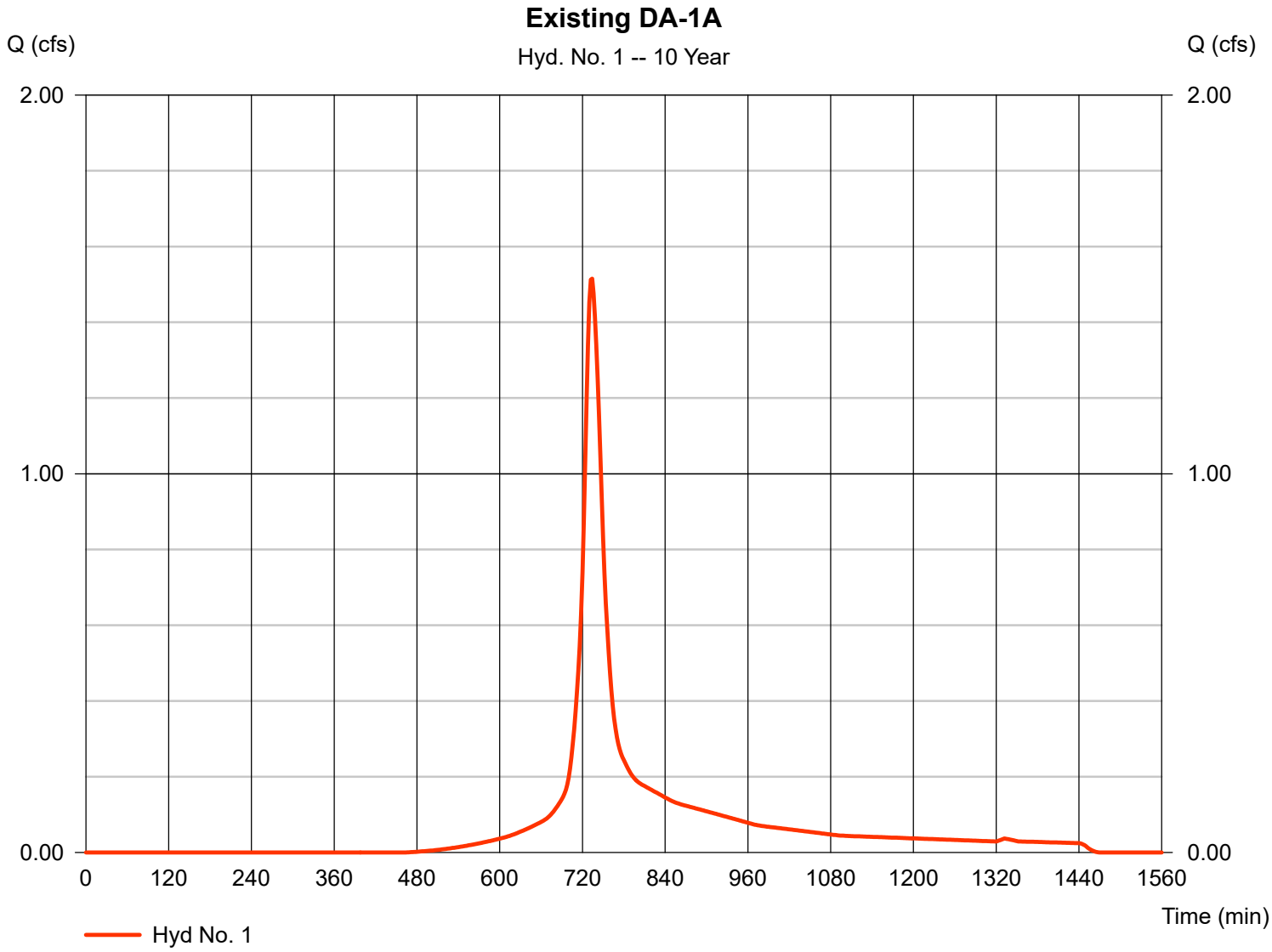
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	1.515	2	734	6,695	----	------	------	Existing DA-1A
2	SCS Runoff	1.173	2	734	5,183	----	------	------	Existing DA-1B
3	SCS Runoff	3.284	2	732	14,549	----	------	------	Existing DA-2

Hydrograph Report

Hyd. No. 1

Existing DA-1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.515 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	6,695 cuft
Drainage area	=	0.620 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

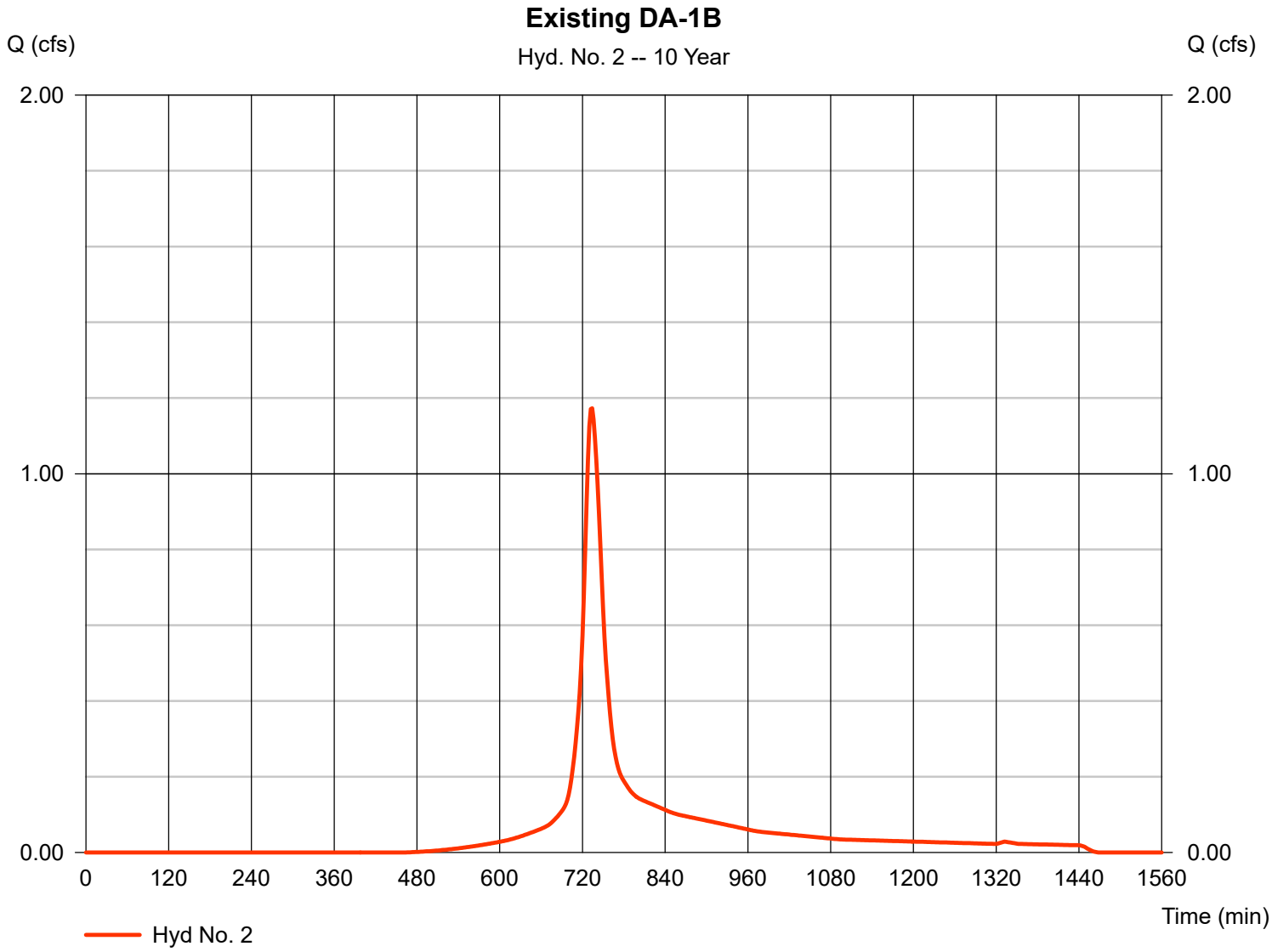


Hydrograph Report

Hyd. No. 2

Existing DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.173 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	5,183 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

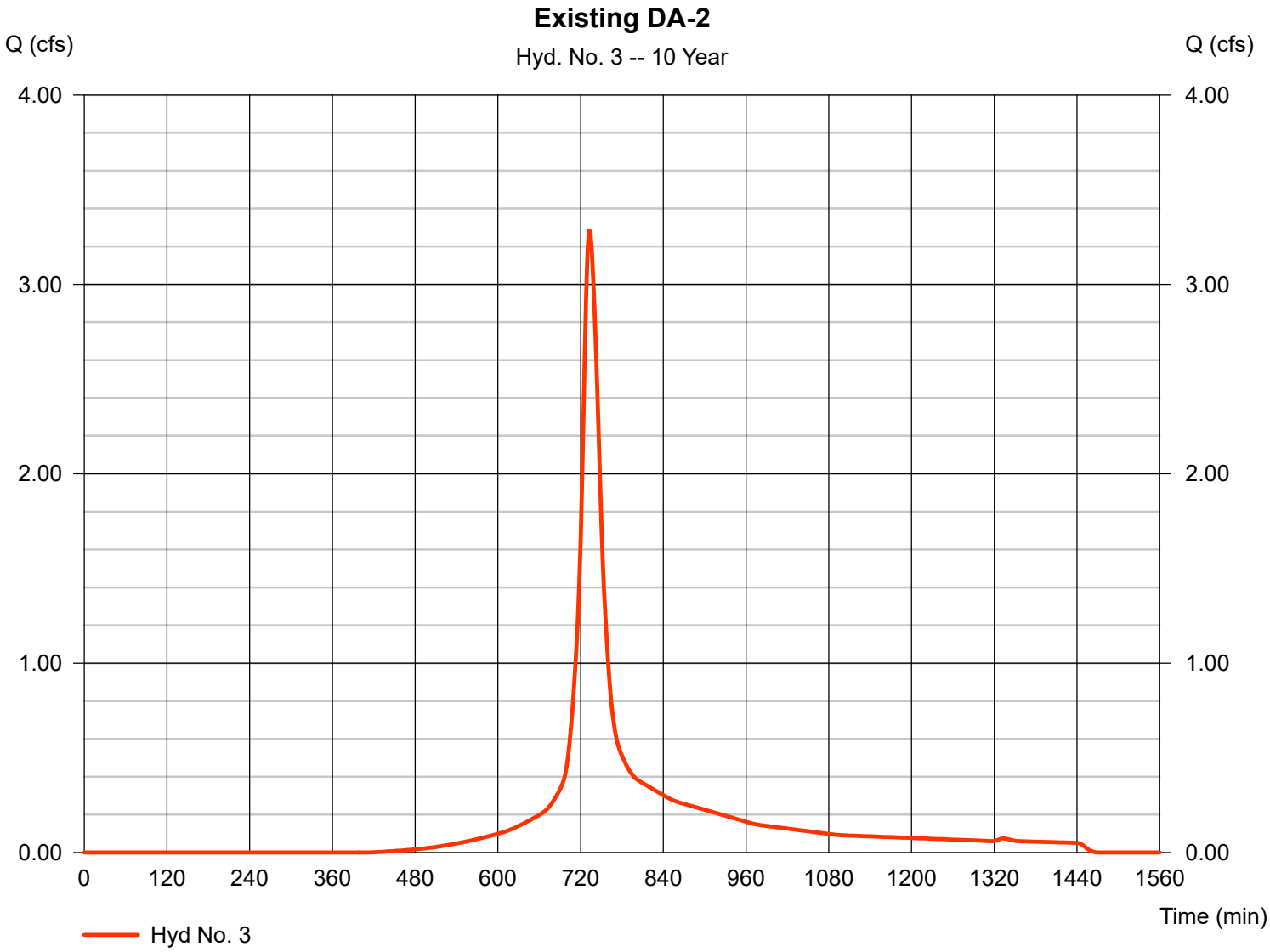


Hydrograph Report

Hyd. No. 3

Existing DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.284 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	14,549 cuft
Drainage area	=	1.230 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.10 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

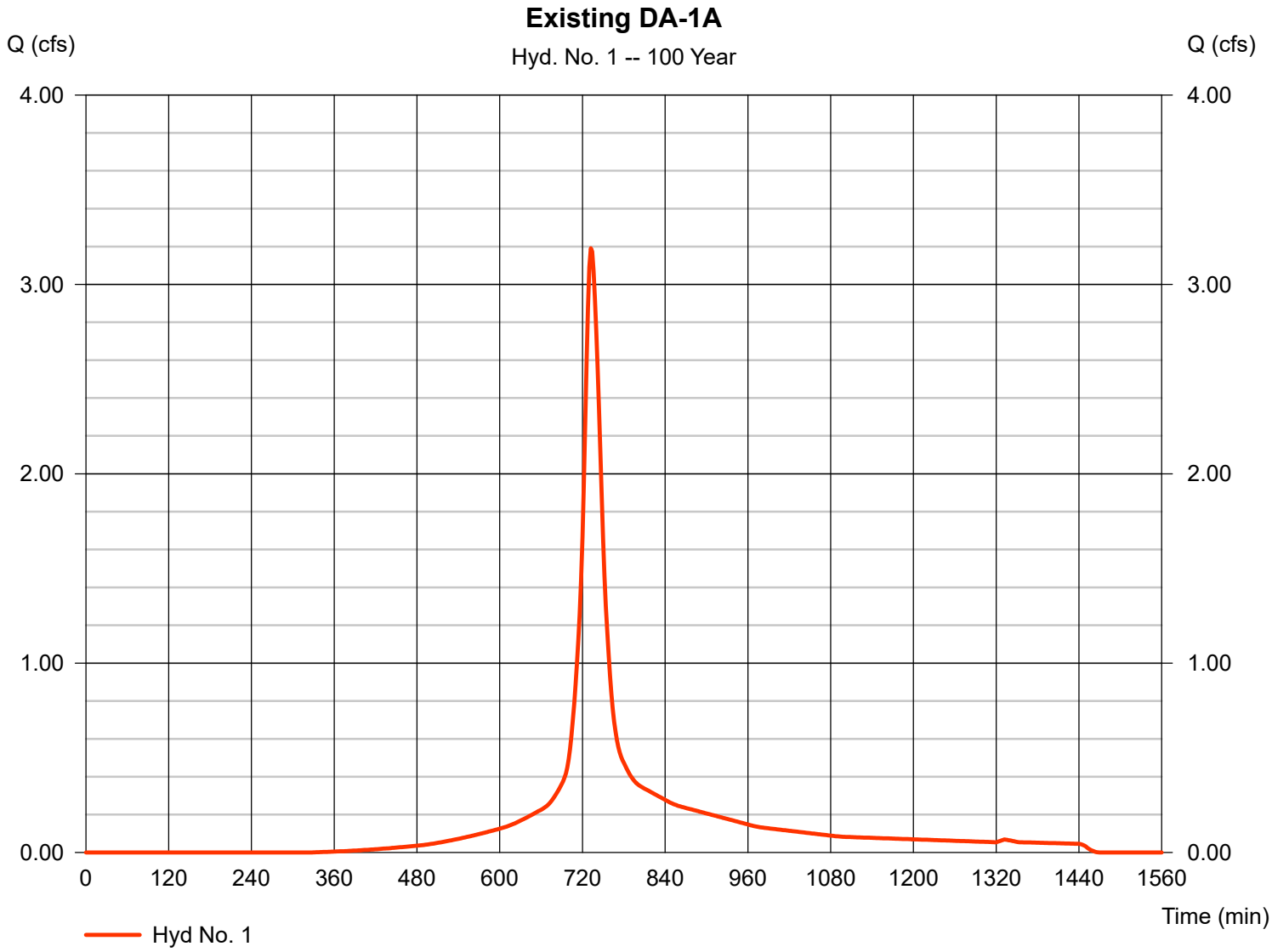
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	3.191	2	732	14,293	----	------	------	Existing DA-1A
2	SCS Runoff	2.470	2	732	11,066	----	------	------	Existing DA-1B
3	SCS Runoff	6.633	2	732	29,995	----	------	------	Existing DA-2

Hydrograph Report

Hyd. No. 1

Existing DA-1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.191 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	14,293 cuft
Drainage area	=	0.620 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

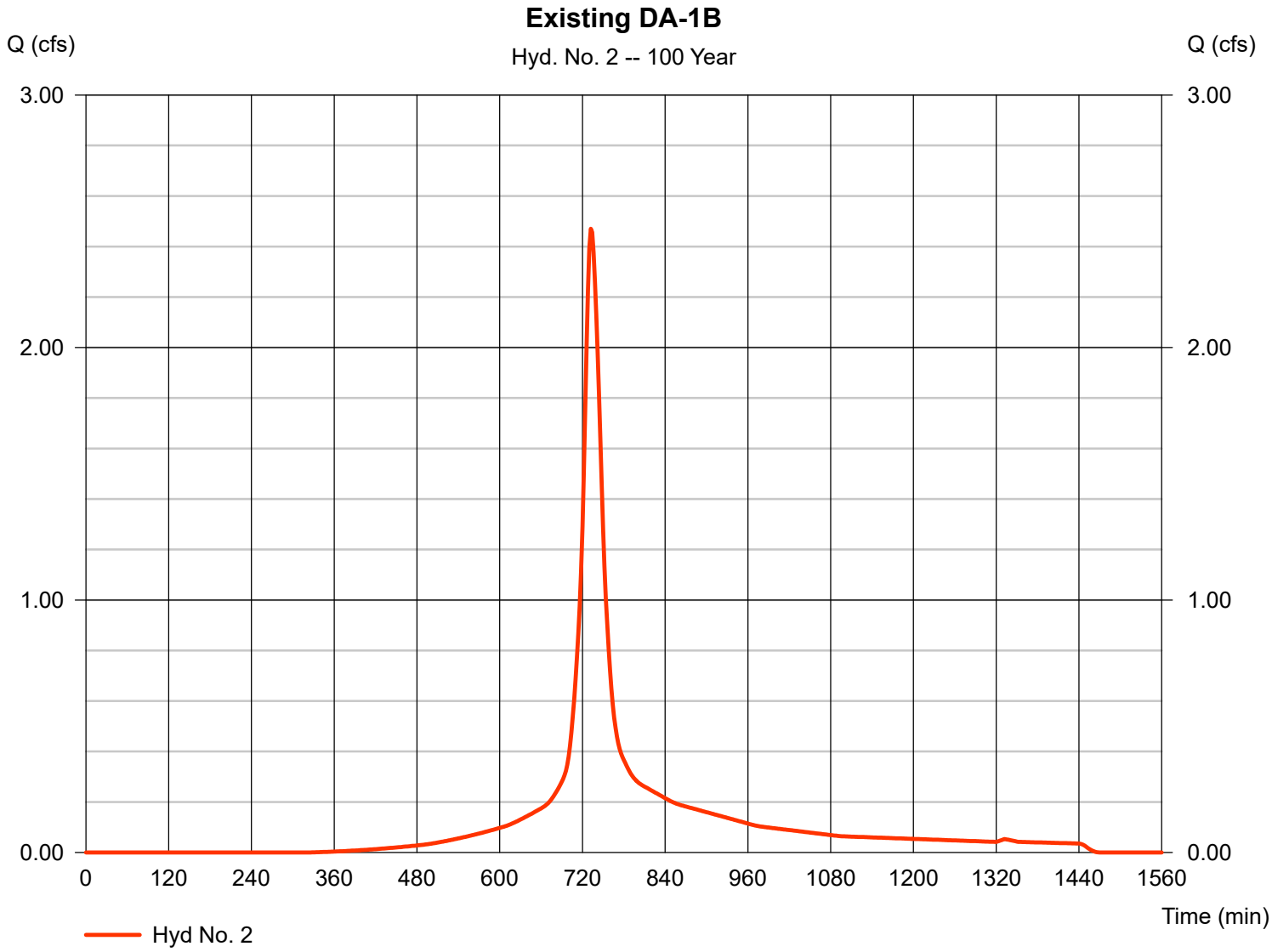


Hydrograph Report

Hyd. No. 2

Existing DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.470 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	11,066 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.60 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

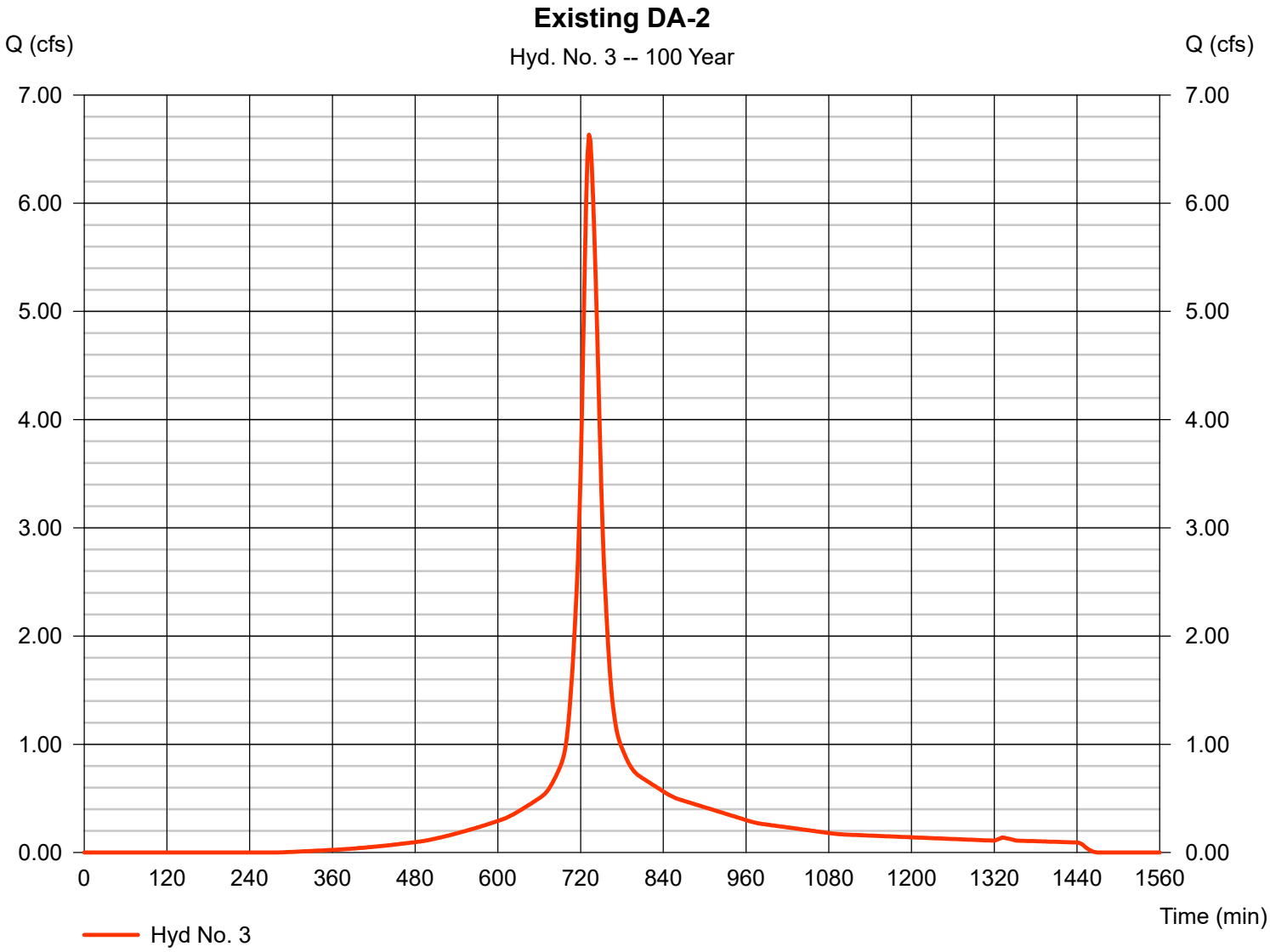


Hydrograph Report

Hyd. No. 3

Existing DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.633 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	29,995 cuft
Drainage area	=	1.230 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	19.10 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Appendix 2
Proposed Runoff Calculations & Detention Basin Routing

East Point Engineering, LLC
11 South Main Street
Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: ☐ Present ☒ Developed — Proposed DA-1A (IMPERVIOUS)

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area (x) acres / mi² / %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.83	81.34
HSG 'D'	GRAVEL	91			0.00	0.00
HSG 'D'	GRASS/WOODS COMBINATION	79			0.00	0.00

1. Use only one CN source per line

Totals ➡ 0.83 | 81.34

CN (weighted) = tot.prod. / tot. area = 81.34 / 0.83 = 98.0 ; Use CN ➡ **98**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

East Point Engineering, LLC
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Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: ☐ Present ☒ Developed — Proposed DA-1A (PERVIOUS)

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area (x) acres / mi² / %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.00	0.00
HSG 'D'	GRAVEL	91			0.00	0.00
HSG 'D'	GRASS/WOODS COMBINATION	79			0.27	21.33

1. Use only one CN source per line

Totals ➡ 0.27 | 21.33

CN (weighted) = tot.prod. / tot. area = 21.33 / 0.27 = 79.0 ; Use CN ➡ **79**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

East Point Engineering, LLC
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Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: ☐ Present ☒ Developed — Proposed DA-1B

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area (x) acres / mi² / %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.00	0.00
HSG 'D'	GRAVEL	91			0.00	0.00
HSG 'D'	GRASS/WOODS COMBINATION	79			0.48	37.92

1. Use only one CN source per line

Totals ➡ 0.48 | 37.92

CN (weighted) = tot.prod. / tot. area = 37.92 / 0.48 = 79.0 ; Use CN ➡ **79**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

East Point Engineering, LLC
11 South Main Street
Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 2: Runoff curve number and runoff

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: ☐ Present ☒ Developed — Proposed DA-2

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area (x) acres / mi² / %	Product of CN x Area
HSG 'D'	BUILDINGS & PAVEMENT	98			0.09	8.82
HSG 'D'	GRAVEL	91			0.00	0.00
HSG 'D'	GRASS/WOODS COMBINATION	79			0.67	52.93

1. Use only one CN source per line

Totals ➡ 0.76 | 61.75

CN (weighted) = tot.prod. / tot. area = 61.75 / 0.76 = 81.3 ; Use CN ➡ **81**

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr	2	10	100
Rainfall, P (24-hour)…….	in			
Runoff, Q……	in			

Use P and CN with table 2-1, figure 2-1, or equation 2-3 abd 2-4

East Point Engineering
11 South Main Street
Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [ ] Present [x] Developed — Proposed DA-2

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

Segment ID		AB	BC		
1. Surface description (table 3-1)……..		WOODS	GRASS		
2. Manning's roughness coefficient, n (table 3-1)……		0.400	0.240		
3. Flow length, L (total L ≤ 300 ft.)……	ft	55	95		
4. Two-year 24-hour rainfall, p_2 ……..	in	3.4	3.4		
5. Land slope, s ……	ft/ft	0.073	0.063		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t……..	hr	0.13	+ 0.14	=	0.27

Shallow Concentrated Flow

Segment ID		BC			
7. Surface description (paved or unpaved)……		UNPAVED			
8. Flow Length, L……..	ft	218			
9. Watercourse slope, s……..	ft/ft	0.032			
10. Average velocity, V (figure 3-1)……	ft/s	2.8			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr	0.02	+	=	0.02

Channel Flow

Segment ID					
12. Cross sectional flow area, a……..	ft^2				
13. Wetted perimeter, P_w ……	ft				
14. Hydraulic radius, r=a/P_w Compute r……	ft				
15. Channel slope, s……	ft/ft				
16. Manning's roughness coefficient, n……					
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V……..	ft/s				
18. Flow length, L……..	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr		+	=	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)……	hr	0.29
	min	**17.4**

East Point Engineering
11 South Main Street
Marlboro, NJ 07746
Tel: 732.577.0180

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
394 Route 79	MSL	19-Aug-20
Location	**Checked**	**Date**
Marlboro Township, Monmouth County	BNP	19-Aug-20

Check one: [ ] Present [x] Developed — Proposed DA-1B

Check one: [x] T_c [ ] T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c only)

Segment ID		AB	BC		
1. Surface description (table 3-1)……..		WOODS	GRASS		
2. Manning's roughness coefficient, n (table 3-1)……		0.400	0.240		
3. Flow length, L (total L ≤ 300 ft.)……	ft	58	92		
4. Two-year 24-hour rainfall, p_2 ……..	in	3.4	3.4		
5. Land slope, s ……	ft/ft	0.069	0.049		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t……..	hr	0.14	+ 0.15	=	0.29

Shallow Concentrated Flow

Segment ID		BC			
7. Surface description (paved or unpaved)……		UNPAVED			
8. Flow Length, L……..	ft	180			
9. Watercourse slope, s……..	ft/ft	0.036			
10. Average velocity, V (figure 3-1)……	ft/s	3.0			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr	0.02	+	=	0.02

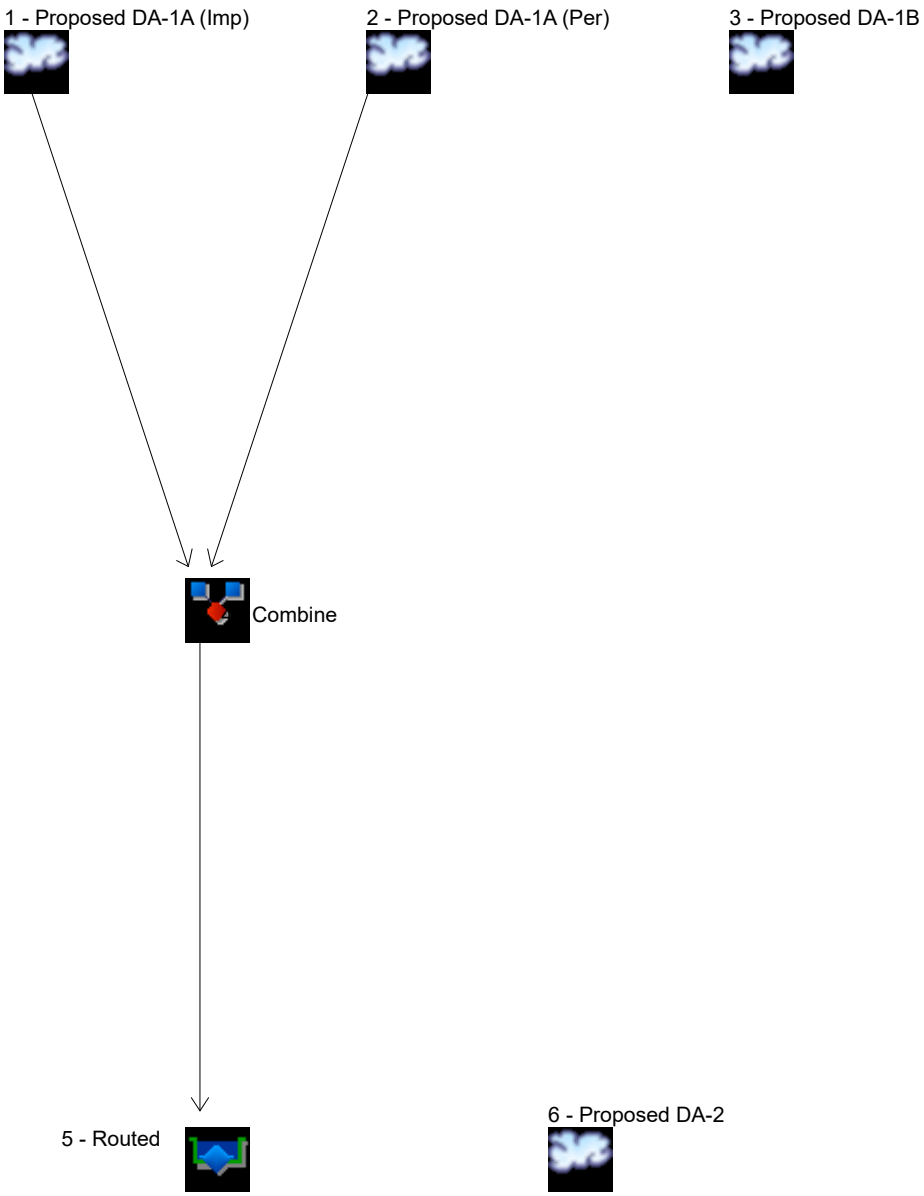
Channel Flow

Segment ID					
12. Cross sectional flow area, a……..	ft^2				
13. Wetted perimeter, P_w ……	ft				
14. Hydraulic radius, r=a/P_w Compute r……	ft				
15. Channel slope, s……	ft/ft				
16. Manning's roughness coefficient, n……					
17. $V = \frac{1.49 r^{2/3} \sqrt{s}}{n}$ Compute V……..	ft/s				
18. Flow length, L……..	ft				
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……..	hr		+	=	0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 0.30

min **18.3**

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Proposed DA-1A (Imp)
2	SCS Runoff	Proposed DA-1A (Per)
3	SCS Runoff	Proposed DA-1B
4	Combine	Combine
5	Reservoir	Routed
6	SCS Runoff	Proposed DA-2

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.23

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	-------	-------	2.303	-------	-------	3.546	-------	-------	6.092	Proposed DA-1A (Imp)
2	SCS Runoff	-------	-------	0.387	-------	-------	0.784	-------	-------	1.651	Proposed DA-1A (Per)
3	SCS Runoff	-------	-------	0.581	-------	-------	1.173	-------	-------	2.470	Proposed DA-1B
4	Combine	1, 2,	-------	2.689	-------	-------	4.331	-------	-------	7.743	Combine
5	Reservoir	4	-------	0.348	-------	-------	0.796	-------	-------	2.420	Routed
6	SCS Runoff	-------	-------	1.013	-------	-------	1.971	-------	-------	4.038	Proposed DA-2

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

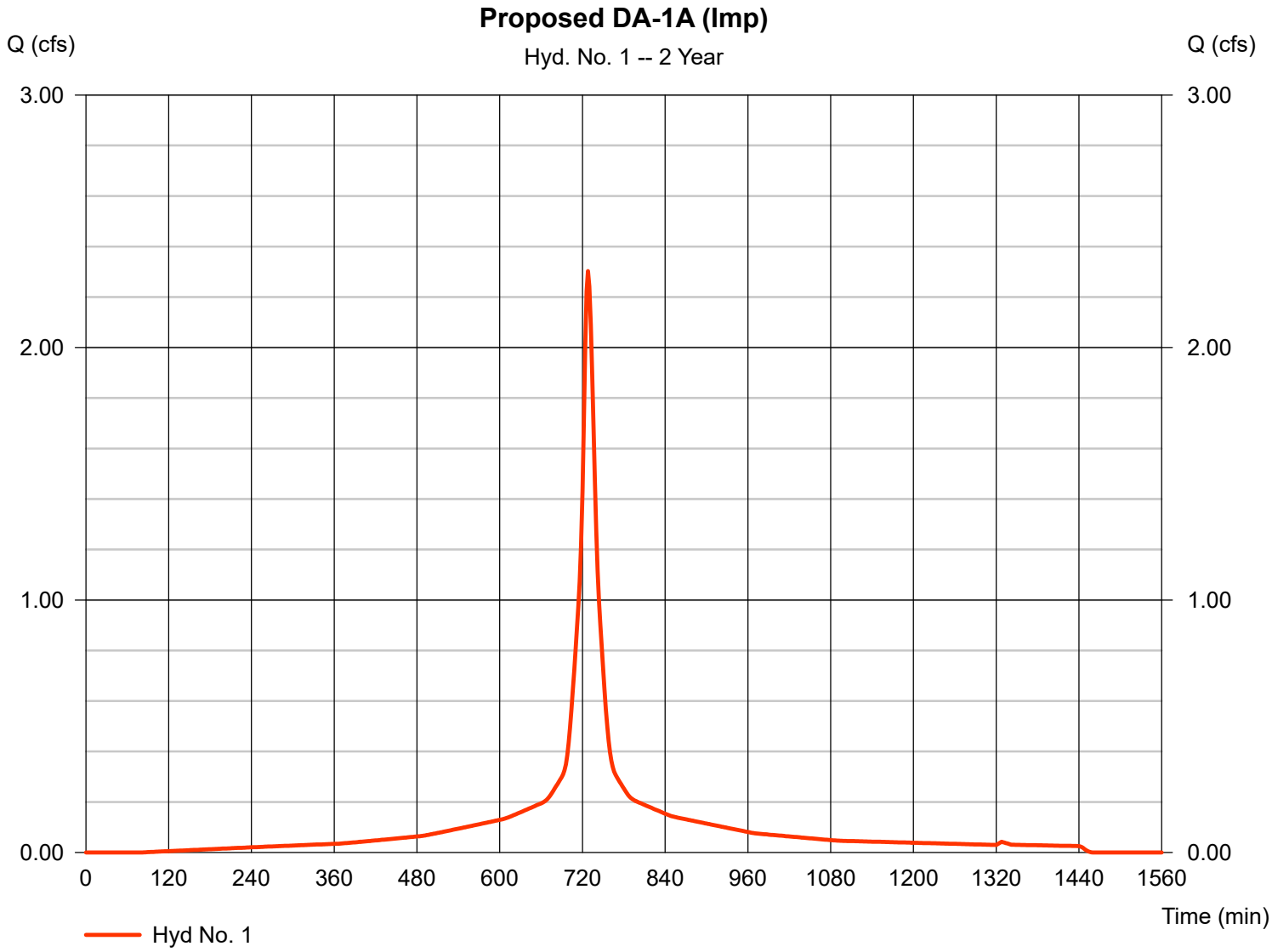
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	2.303	2	728	9,839	----	------	------	Proposed DA-1A (Imp)
2	SCS Runoff	0.387	2	730	1,505	----	------	------	Proposed DA-1A (Per)
3	SCS Runoff	0.581	2	734	2,594	----	------	------	Proposed DA-1B
4	Combine	2.689	2	728	11,344	1, 2,	------	------	Combine
5	Reservoir	0.348	2	772	9,725	4	86.39	6,526	Routed
6	SCS Runoff	1.013	2	734	4,491	----	------	------	Proposed DA-2

Hydrograph Report

Hyd. No. 1

Proposed DA-1A (Imp)

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.303 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	9,839 cuft
Drainage area	=	0.830 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

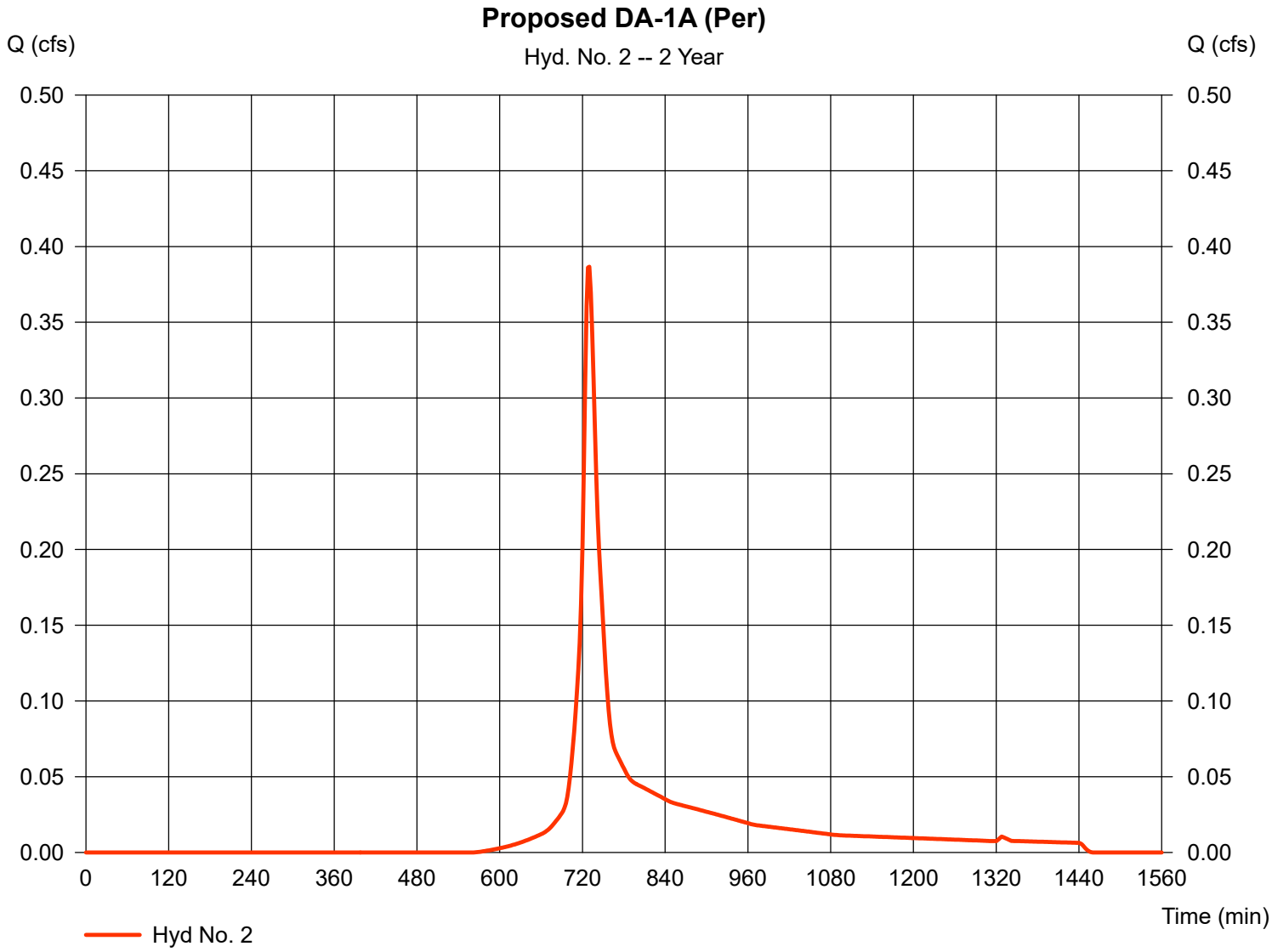


Hydrograph Report

Hyd. No. 2

Proposed DA-1A (Per)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.387 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	1,505 cuft
Drainage area	=	0.270 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

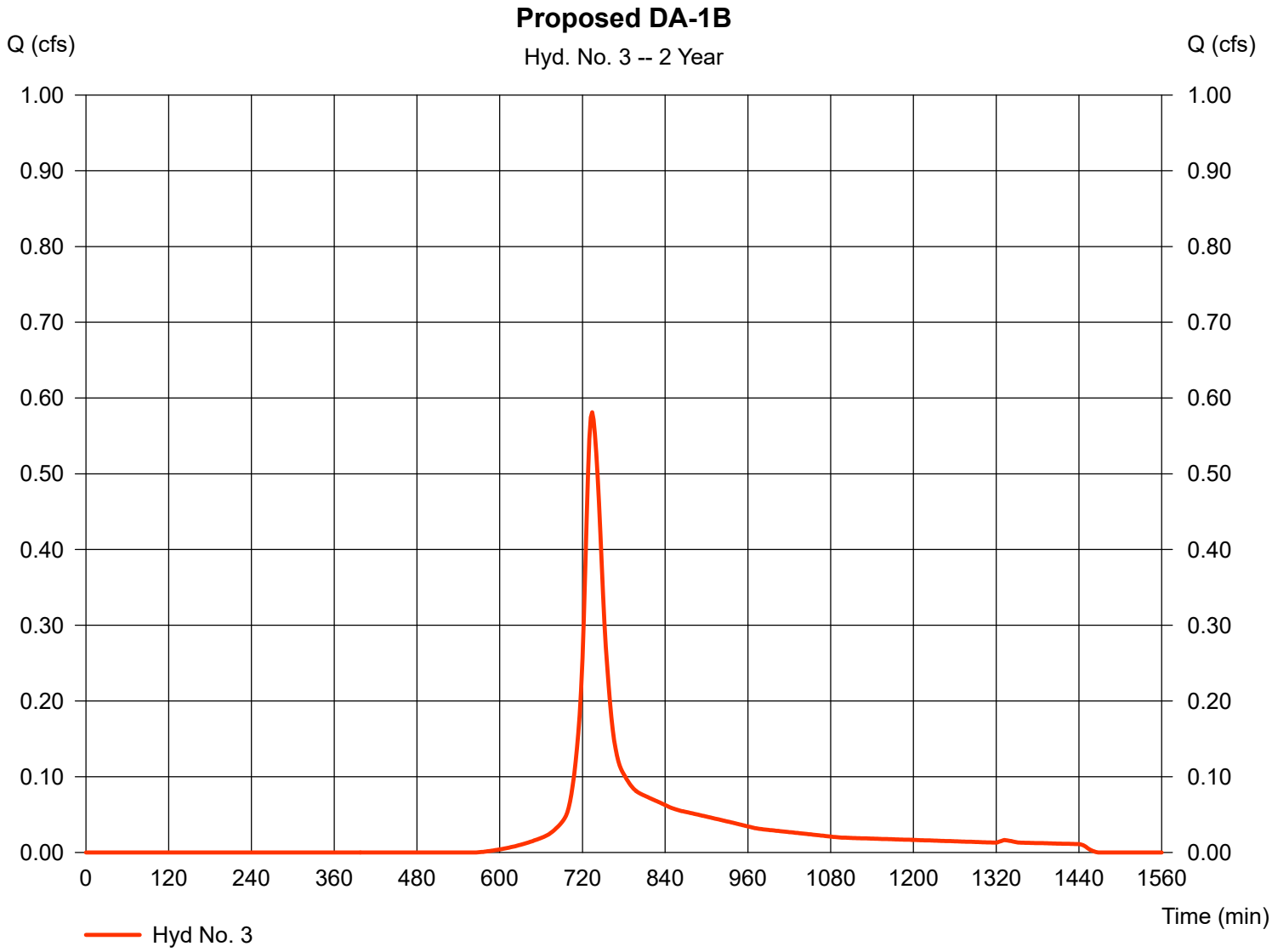


Hydrograph Report

Hyd. No. 3

Proposed DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.581 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	2,594 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	18.00 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

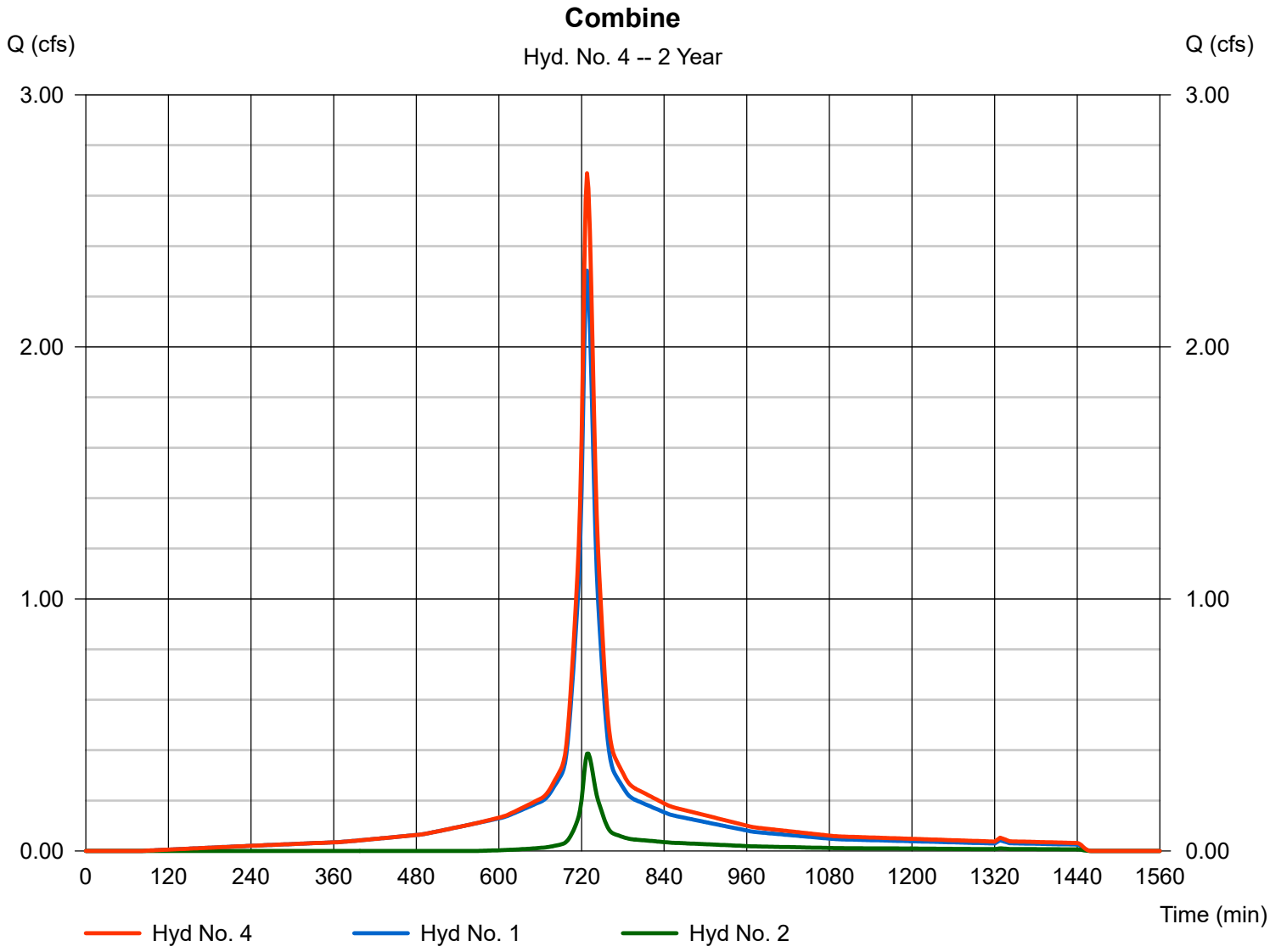


Hydrograph Report

Hyd. No. 4

Combine

Hydrograph type	=	Combine	Peak discharge	=	2.689 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	11,344 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	1.100 ac



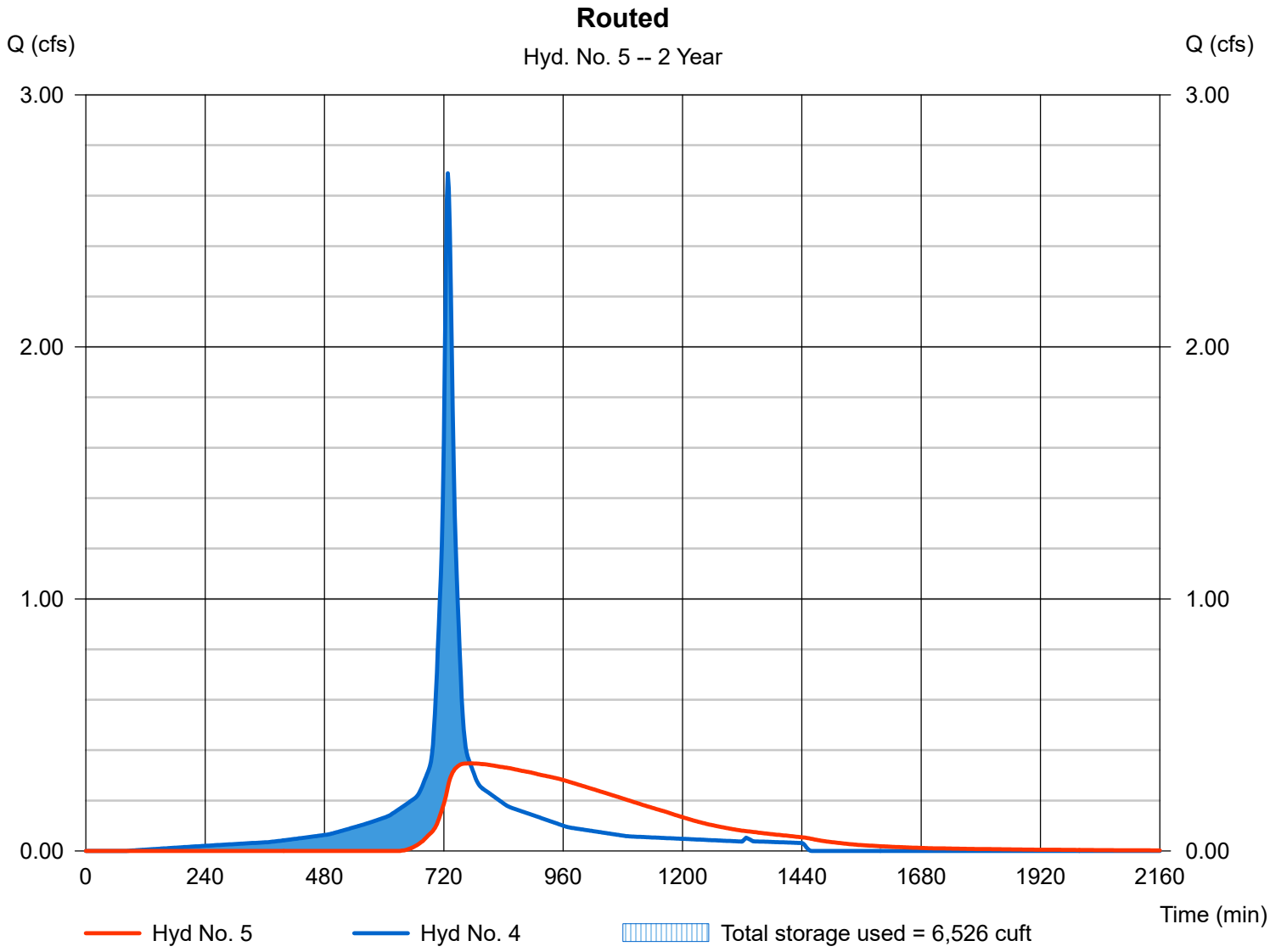
Hydrograph Report

Hyd. No. 5

Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.348 cfs
Storm frequency	=	2 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	9,725 cuft
Inflow hyd. No.	=	4 - Combine	Max. Elevation	=	86.39 ft
Reservoir name	=	<New Pond>	Max. Storage	=	6,526 cuft

Storage Indication method used.



Pond No. 1 - <New Pond>

Pond Data

UG Chambers - Invert elev. = 85.50 ft, Rise x Span = 2.83 x 5.00 ft, Barrel Len = 102.00 ft, No. Barrels = 11, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 85.00 ft, Width = 5.75 ft, Height = 3.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	85.00	n/a	0	0
0.33	85.33	n/a	860	860
0.67	85.67	n/a	1,418	2,278
1.00	86.00	n/a	1,972	4,250
1.33	86.33	n/a	1,948	6,198
1.67	86.67	n/a	1,908	8,106
2.00	87.00	n/a	1,848	9,954
2.33	87.33	n/a	1,765	11,719
2.66	87.66	n/a	1,652	13,371
3.00	88.00	n/a	1,492	14,863
3.33	88.33	n/a	1,216	16,078

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 85.40	85.50	0.00	0.00
Length (ft)	= 15.00	0.50	0.00	0.00
Slope (%)	= 0.50	0.50	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)	= 0.33	0.00	0.00	0.00
Crest El. (ft)	= 86.40	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	85.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.03	86	85.03	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.07	172	85.07	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	258	85.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.13	344	85.13	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.17	430	85.17	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.20	516	85.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.23	602	85.23	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.27	688	85.27	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.30	774	85.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.33	860	85.33	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.37	1,001	85.37	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.40	1,143	85.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.43	1,285	85.43	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.47	1,427	85.47	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.50	1,569	85.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.53	1,710	85.53	0.00 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.003
0.57	1,852	85.57	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.011
0.60	1,994	85.60	0.03 ic	0.02 ic	---	---	0.00	---	---	---	---	---	0.024
0.63	2,136	85.63	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.040
0.67	2,278	85.67	0.06 oc	0.06 ic	---	---	0.00	---	---	---	---	---	0.061
0.70	2,475	85.70	0.09 oc	0.08 ic	---	---	0.00	---	---	---	---	---	0.083
0.73	2,672	85.73	0.11 oc	0.11 ic	---	---	0.00	---	---	---	---	---	0.107
0.77	2,869	85.77	0.14 oc	0.13 ic	---	---	0.00	---	---	---	---	---	0.131
0.80	3,066	85.80	0.16 oc	0.15 ic	---	---	0.00	---	---	---	---	---	0.154
0.83	3,264	85.83	0.18 oc	0.17 ic	---	---	0.00	---	---	---	---	---	0.171
0.87	3,461	85.87	0.20 oc	0.19 ic	---	---	0.00	---	---	---	---	---	0.187
0.90	3,658	85.90	0.21 oc	0.20 ic	---	---	0.00	---	---	---	---	---	0.203
0.93	3,855	85.93	0.22 oc	0.22 ic	---	---	0.00	---	---	---	---	---	0.217
0.97	4,053	85.97	0.23 oc	0.23 ic	---	---	0.00	---	---	---	---	---	0.230
1.00	4,250	86.00	0.25 oc	0.24 ic	---	---	0.00	---	---	---	---	---	0.242
1.03	4,445	86.03	0.26 oc	0.25 ic	---	---	0.00	---	---	---	---	---	0.254
1.07	4,639	86.07	0.27 oc	0.27 ic	---	---	0.00	---	---	---	---	---	0.265

Continues on next page...

<New Pond>

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.10	4,834	86.10	0.29 oc	0.28 ic	---	---	0.00	---	---	---	---	---	0.276
1.13	5,029	86.13	0.29 oc	0.29 ic	---	---	0.00	---	---	---	---	---	0.287
1.17	5,224	86.17	0.30 oc	0.29 ic	---	---	0.00	---	---	---	---	---	0.295
1.20	5,419	86.20	0.32 oc	0.30 ic	---	---	0.00	---	---	---	---	---	0.302
1.23	5,614	86.23	0.32 oc	0.31 ic	---	---	0.00	---	---	---	---	---	0.312
1.27	5,809	86.27	0.33 oc	0.32 ic	---	---	0.00	---	---	---	---	---	0.319
1.30	6,003	86.30	0.33 oc	0.33 ic	---	---	0.00	---	---	---	---	---	0.328
1.33	6,198	86.33	0.35 oc	0.33 ic	---	---	0.00	---	---	---	---	---	0.334
1.37	6,389	86.37	0.35 oc	0.34 ic	---	---	0.00	---	---	---	---	---	0.343
1.40	6,580	86.40	0.36 oc	0.35 ic	---	---	0.00	---	---	---	---	---	0.349
1.43	6,771	86.43	0.38 oc	0.36 ic	---	---	0.00	---	---	---	---	---	0.361
1.47	6,961	86.47	0.38 oc	0.36 ic	---	---	0.01	---	---	---	---	---	0.376
1.50	7,152	86.50	0.41 oc	0.37 ic	---	---	0.03	---	---	---	---	---	0.394
1.53	7,343	86.53	0.42 oc	0.37 ic	---	---	0.04	---	---	---	---	---	0.415
1.57	7,534	86.57	0.44 oc	0.38 ic	---	---	0.06	---	---	---	---	---	0.437
1.60	7,724	86.60	0.46 oc	0.38 ic	---	---	0.08	---	---	---	---	---	0.459
1.63	7,915	86.63	0.49 oc	0.39 ic	---	---	0.10	---	---	---	---	---	0.484
1.67	8,106	86.67	0.51 oc	0.39 ic	---	---	0.12	---	---	---	---	---	0.511
1.70	8,291	86.70	0.55 oc	0.40 ic	---	---	0.14	---	---	---	---	---	0.537
1.73	8,476	86.73	0.57 oc	0.40 ic	---	---	0.16	---	---	---	---	---	0.566
1.76	8,660	86.76	0.60 oc	0.41 ic	---	---	0.19	---	---	---	---	---	0.595
1.80	8,845	86.80	0.64 oc	0.41 ic	---	---	0.22	---	---	---	---	---	0.625
1.83	9,030	86.83	0.66 oc	0.41 ic	---	---	0.24	---	---	---	---	---	0.657
1.86	9,215	86.86	0.70 oc	0.42 ic	---	---	0.27	---	---	---	---	---	0.689
1.90	9,399	86.90	0.72 oc	0.42 ic	---	---	0.30	---	---	---	---	---	0.723
1.93	9,584	86.93	0.76 oc	0.43 ic	---	---	0.33	---	---	---	---	---	0.757
1.96	9,769	86.96	0.80 oc	0.43 ic	---	---	0.36	---	---	---	---	---	0.792
2.00	9,954	87.00	0.85 oc	0.43 ic	---	---	0.40	---	---	---	---	---	0.828
2.03	10,130	87.03	0.87 oc	0.44 ic	---	---	0.43	---	---	---	---	---	0.866
2.06	10,307	87.06	0.91 oc	0.44 ic	---	---	0.46	---	---	---	---	---	0.903
2.10	10,483	87.10	0.95 oc	0.44 ic	---	---	0.50	---	---	---	---	---	0.941
2.13	10,660	87.13	0.99 oc	0.44 ic	---	---	0.54	---	---	---	---	---	0.980
2.16	10,836	87.16	1.03 oc	0.45 ic	---	---	0.57	---	---	---	---	---	1.020
2.20	11,013	87.20	1.08 oc	0.45 ic	---	---	0.61	---	---	---	---	---	1.061
2.23	11,189	87.23	1.12 oc	0.45 ic	---	---	0.65	---	---	---	---	---	1.102
2.26	11,366	87.26	1.16 oc	0.45 ic	---	---	0.69	---	---	---	---	---	1.144
2.30	11,542	87.30	1.20 oc	0.46 ic	---	---	0.73	---	---	---	---	---	1.187
2.33	11,719	87.33	1.24 oc	0.46 ic	---	---	0.77	---	---	---	---	---	1.231
2.36	11,884	87.36	1.28 oc	0.46 ic	---	---	0.81	---	---	---	---	---	1.275
2.40	12,049	87.40	1.32 oc	0.47 ic	---	---	0.85	---	---	---	---	---	1.320
2.43	12,214	87.43	1.38 oc	0.47 ic	---	---	0.90	---	---	---	---	---	1.364
2.46	12,380	87.46	1.42 oc	0.47 ic	---	---	0.94	---	---	---	---	---	1.411
2.50	12,545	87.50	1.47 oc	0.47 ic	---	---	0.99	---	---	---	---	---	1.457
2.53	12,710	87.53	1.51 oc	0.47 ic	---	---	1.03	---	---	---	---	---	1.505
2.56	12,875	87.56	1.56 oc	0.47 ic	---	---	1.08	---	---	---	---	---	1.552
2.60	13,040	87.60	1.61 oc	0.48 ic	---	---	1.12	---	---	---	---	---	1.600
2.63	13,205	87.63	1.66 oc	0.48 ic	---	---	1.17	---	---	---	---	---	1.648
2.66	13,371	87.66	1.70 oc	0.48 ic	---	---	1.22	---	---	---	---	---	1.698
2.70	13,520	87.70	1.75 oc	0.48 ic	---	---	1.27 s	---	---	---	---	---	1.746
2.73	13,669	87.73	1.80 oc	0.48 ic	---	---	1.32 s	---	---	---	---	---	1.794
2.76	13,818	87.76	1.84 oc	0.48 ic	---	---	1.36 s	---	---	---	---	---	1.842
2.80	13,967	87.80	1.89 oc	0.48 ic	---	---	1.41 s	---	---	---	---	---	1.887
2.83	14,117	87.83	1.93 oc	0.48 ic	---	---	1.45 s	---	---	---	---	---	1.931
2.86	14,266	87.86	1.97 oc	0.48 ic	---	---	1.49 s	---	---	---	---	---	1.972
2.90	14,415	87.90	2.00 oc	0.47 ic	---	---	1.53 s	---	---	---	---	---	1.998
2.93	14,564	87.93	2.06 oc	0.47 ic	---	---	1.58 s	---	---	---	---	---	2.055
2.96	14,713	87.96	2.11 oc	0.48 ic	---	---	1.63 s	---	---	---	---	---	2.113
3.00	14,863	88.00	2.17 oc	0.48 ic	---	---	1.69 s	---	---	---	---	---	2.171
3.03	14,984	88.03	2.23 oc	0.49 ic	---	---	1.74 s	---	---	---	---	---	2.229
3.06	15,106	88.06	2.29 oc	0.50 ic	---	---	1.79 s	---	---	---	---	---	2.288
3.10	15,227	88.10	2.35 oc	0.50 ic	---	---	1.85 s	---	---	---	---	---	2.347
3.13	15,349	88.13	2.41 oc	0.51 ic	---	---	1.90 s	---	---	---	---	---	2.406
3.16	15,470	88.16	2.47 oc	0.51 ic	---	---	1.96 s	---	---	---	---	---	2.466
3.20	15,592	88.20	2.53 oc	0.51 ic	---	---	2.01 s	---	---	---	---	---	2.527
3.23	15,713	88.23	2.59 oc	0.52 ic	---	---	2.07 s	---	---	---	---	---	2.587
3.26	15,835	88.26	2.65 oc	0.52 ic	---	---	2.12 s	---	---	---	---	---	2.649
3.30	15,957	88.30	2.71 oc	0.53 ic	---	---	2.18 s	---	---	---	---	---	2.710
3.33	16,078	88.33	2.77 oc	0.53 ic	---	---	2.24 s	---	---	---	---	---	2.772

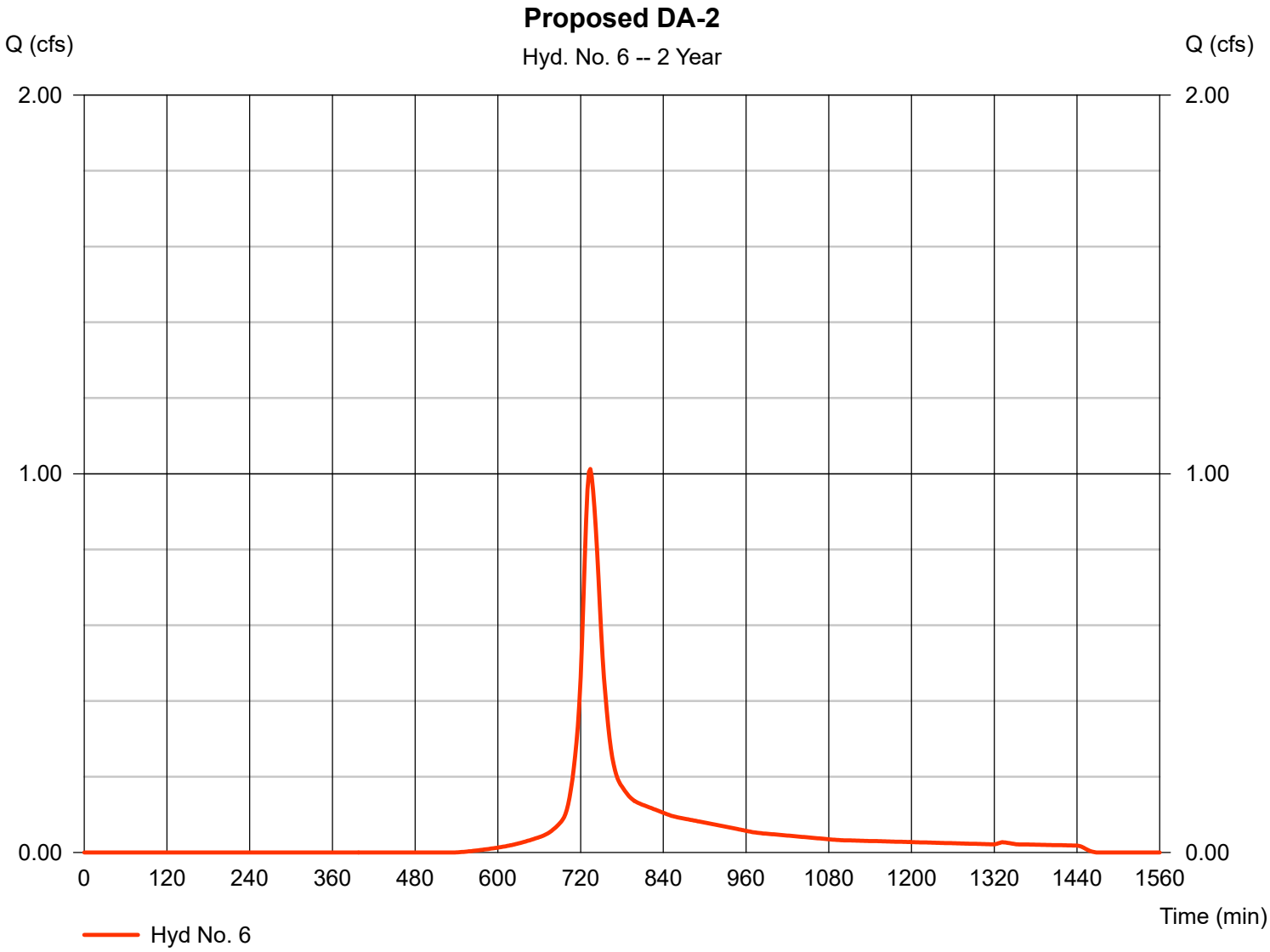
...End

Hydrograph Report

Hyd. No. 6

Proposed DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.013 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	4,491 cuft
Drainage area	=	0.760 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	17.40 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

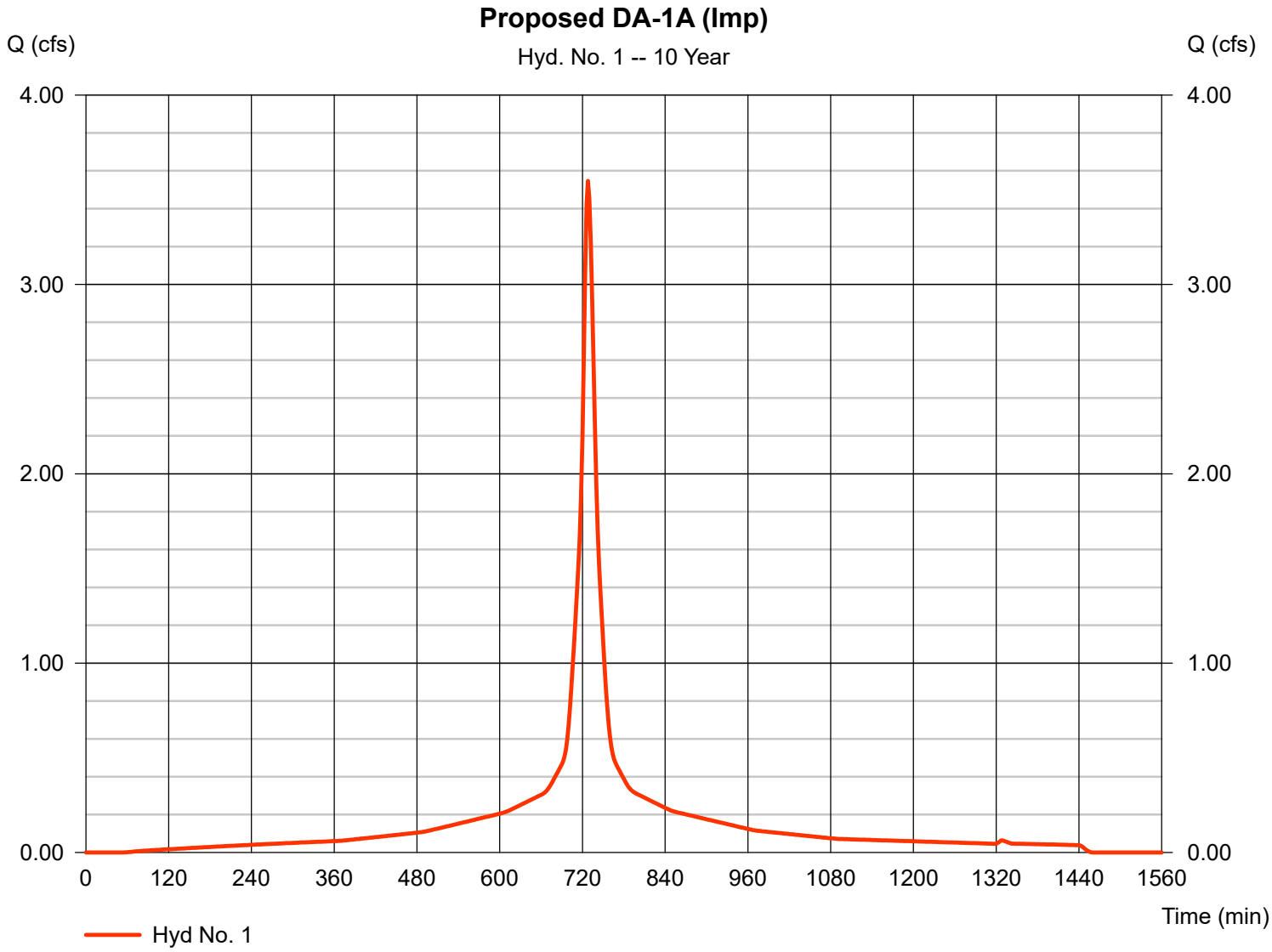
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	3.546	2	728	15,420	----	------	------	Proposed DA-1A (Imp)
2	SCS Runoff	0.784	2	728	3,006	----	------	------	Proposed DA-1A (Per)
3	SCS Runoff	1.173	2	734	5,183	----	------	------	Proposed DA-1B
4	Combine	4.331	2	728	18,426	1, 2,	------	------	Combine
5	Reservoir	0.796	2	760	16,807	4	86.97	9,792	Routed
6	SCS Runoff	1.971	2	732	8,725	----	------	------	Proposed DA-2

Hydrograph Report

Hyd. No. 1

Proposed DA-1A (Imp)

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.546 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	15,420 cuft
Drainage area	=	0.830 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

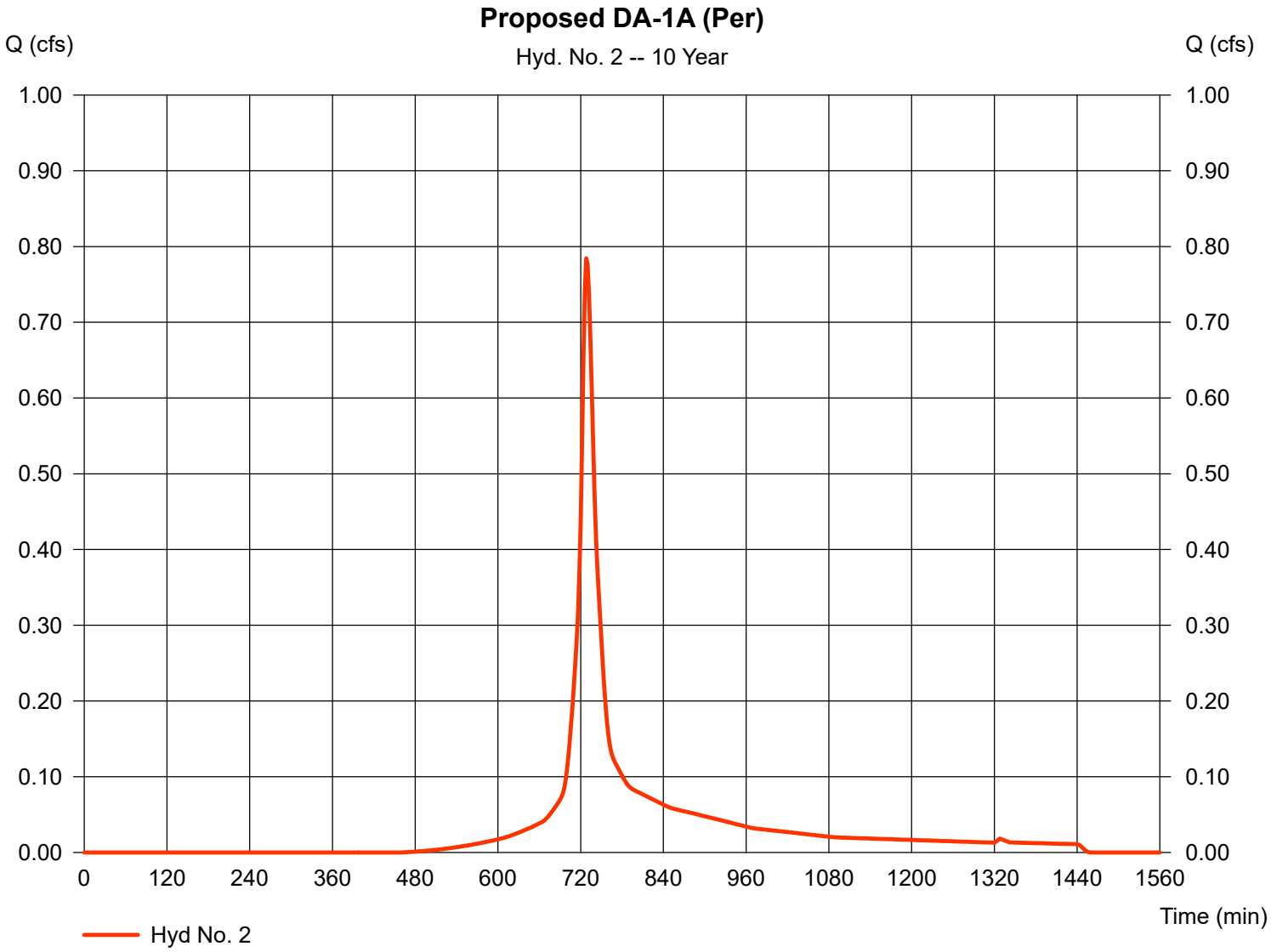


Hydrograph Report

Hyd. No. 2

Proposed DA-1A (Per)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.784 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	3,006 cuft
Drainage area	=	0.270 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

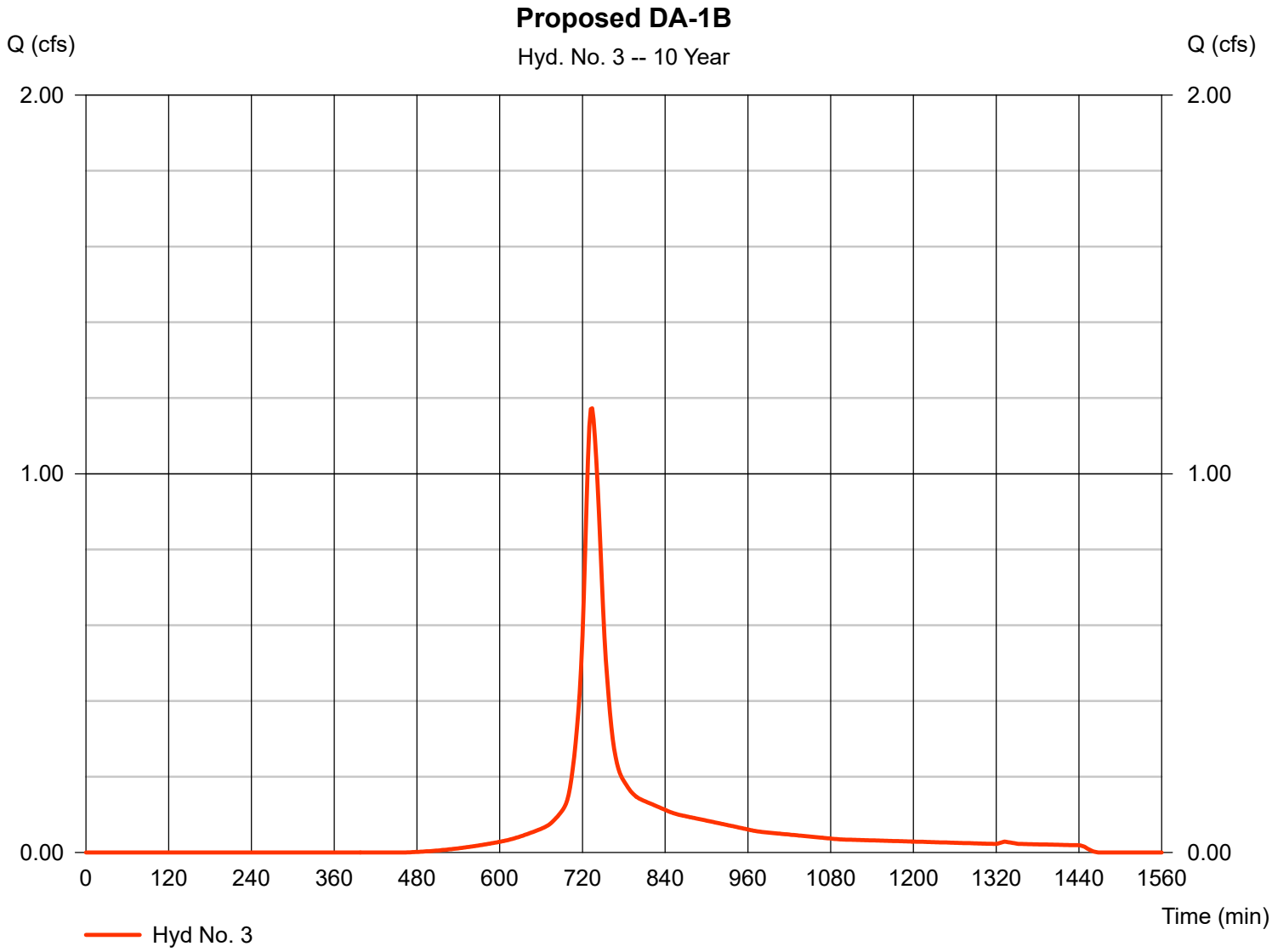


Hydrograph Report

Hyd. No. 3

Proposed DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.173 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	5,183 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	18.00 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

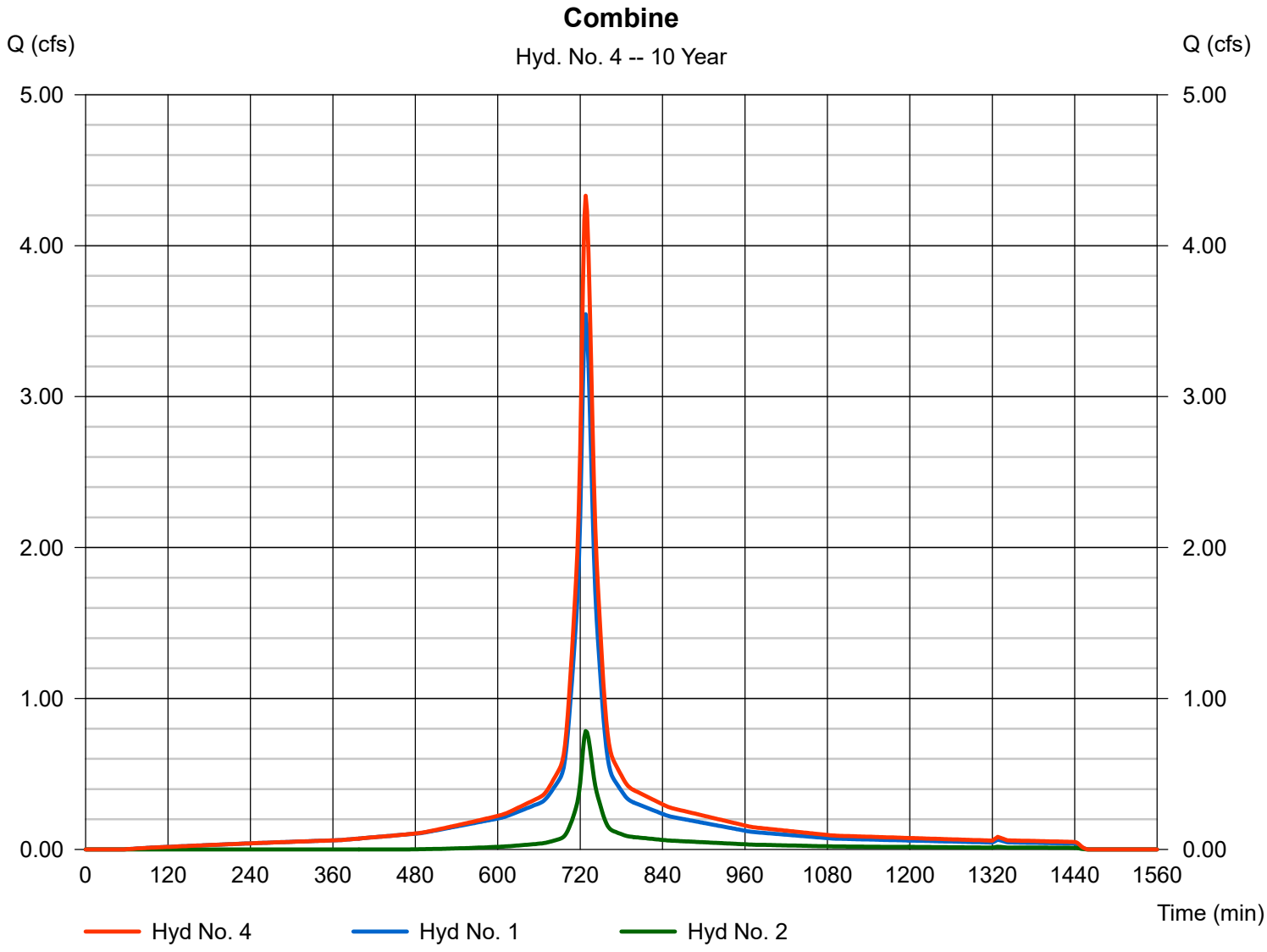


Hydrograph Report

Hyd. No. 4

Combine

Hydrograph type	=	Combine	Peak discharge	=	4.331 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	18,426 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	1.100 ac



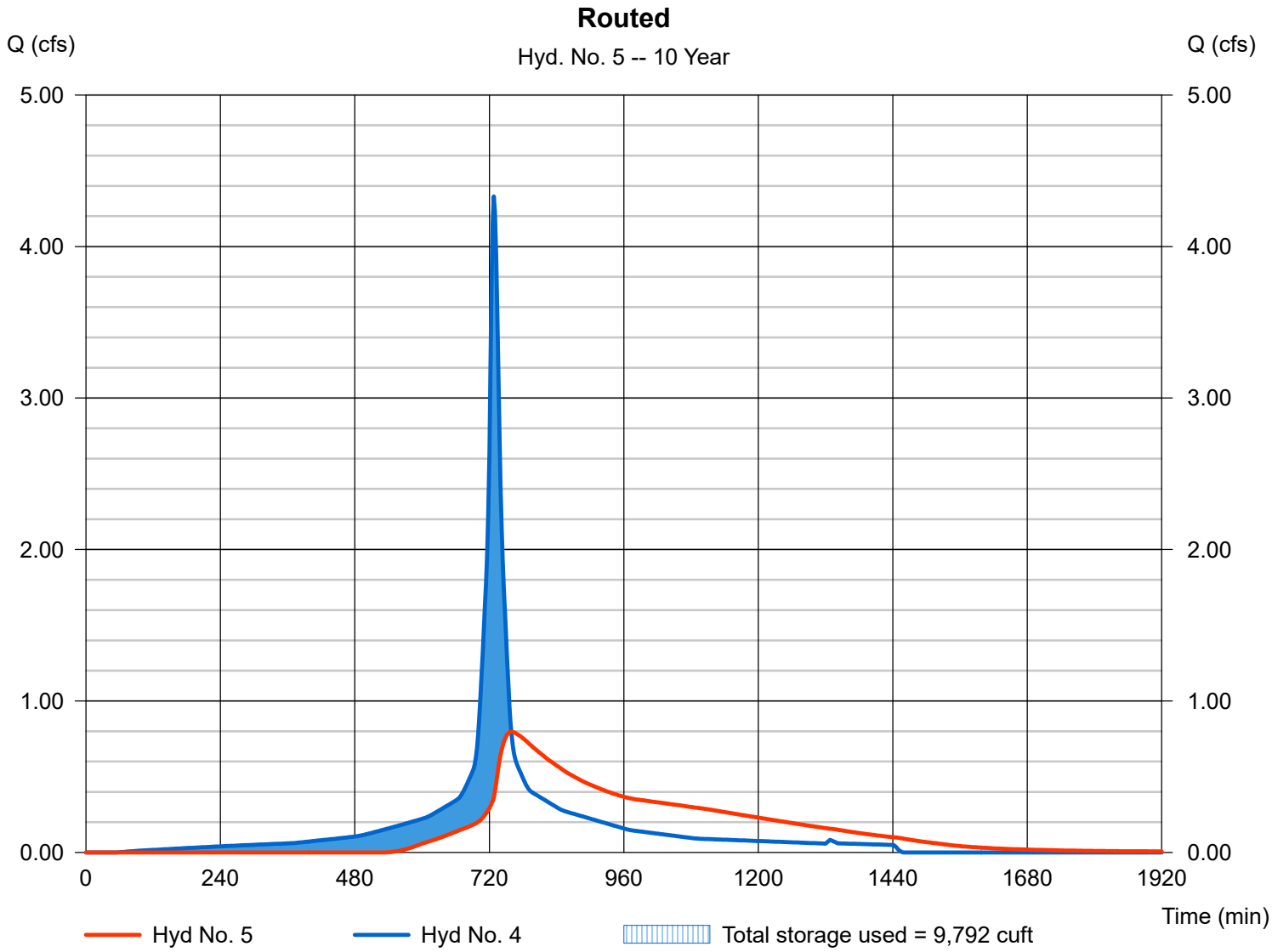
Hydrograph Report

Hyd. No. 5

Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.796 cfs
Storm frequency	=	10 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	16,807 cuft
Inflow hyd. No.	=	4 - Combine	Max. Elevation	=	86.97 ft
Reservoir name	=	<New Pond>	Max. Storage	=	9,792 cuft

Storage Indication method used.

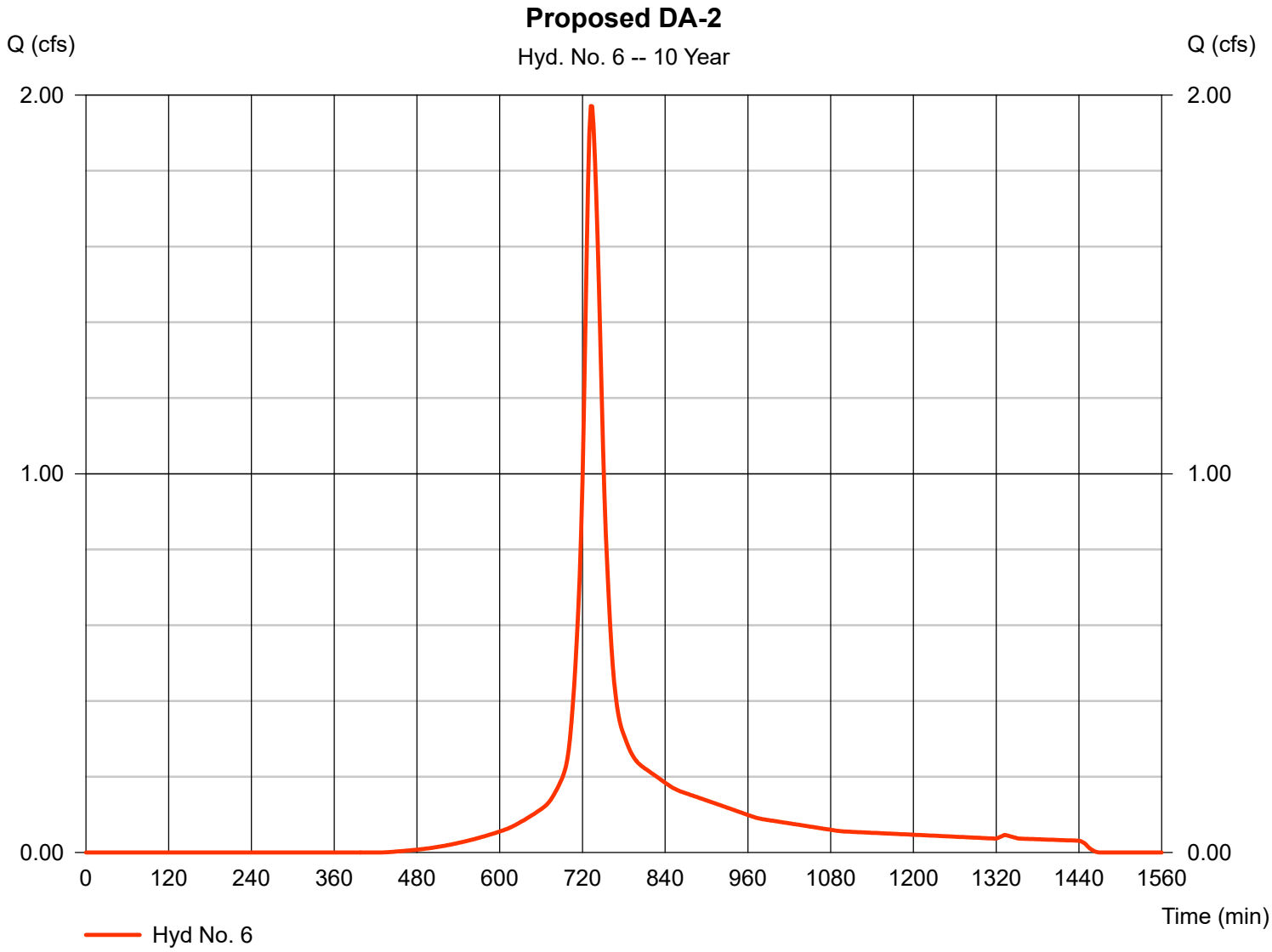


Hydrograph Report

Hyd. No. 6

Proposed DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.971 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	8,725 cuft
Drainage area	=	0.760 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	17.40 min
Total precip.	=	5.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

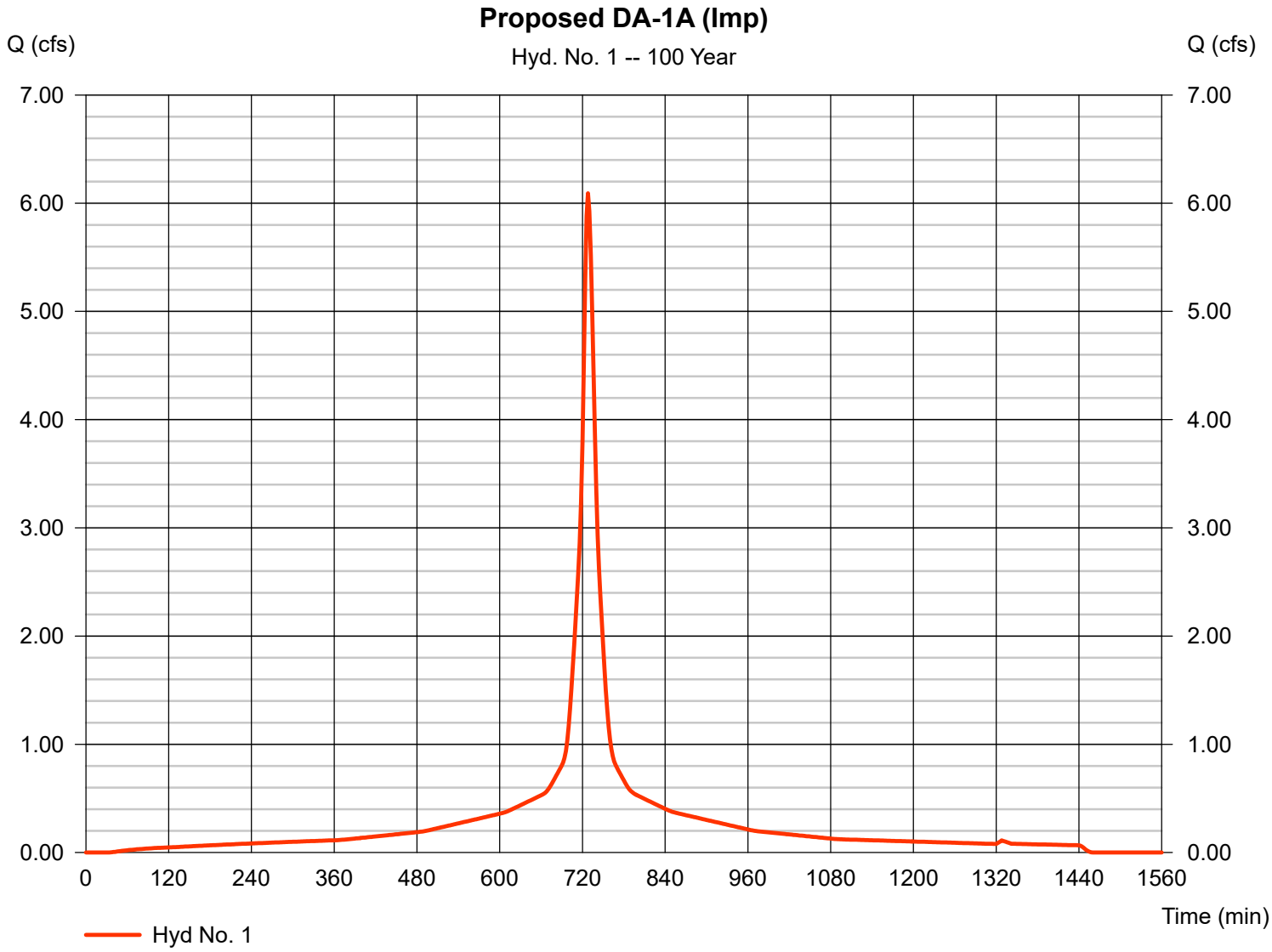
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	6.092	2	728	26,906	----	------	------	Proposed DA-1A (Imp)
2	SCS Runoff	1.651	2	728	6,419	----	------	------	Proposed DA-1A (Per)
3	SCS Runoff	2.470	2	732	11,066	----	------	------	Proposed DA-1B
4	Combine	7.743	2	728	33,325	1, 2,	------	------	Combine
5	Reservoir	2.420	2	750	31,706	4	88.14	15,377	Routed
6	SCS Runoff	4.038	2	732	18,196	----	------	------	Proposed DA-2

Hydrograph Report

Hyd. No. 1

Proposed DA-1A (Imp)

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.092 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	26,906 cuft
Drainage area	=	0.830 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

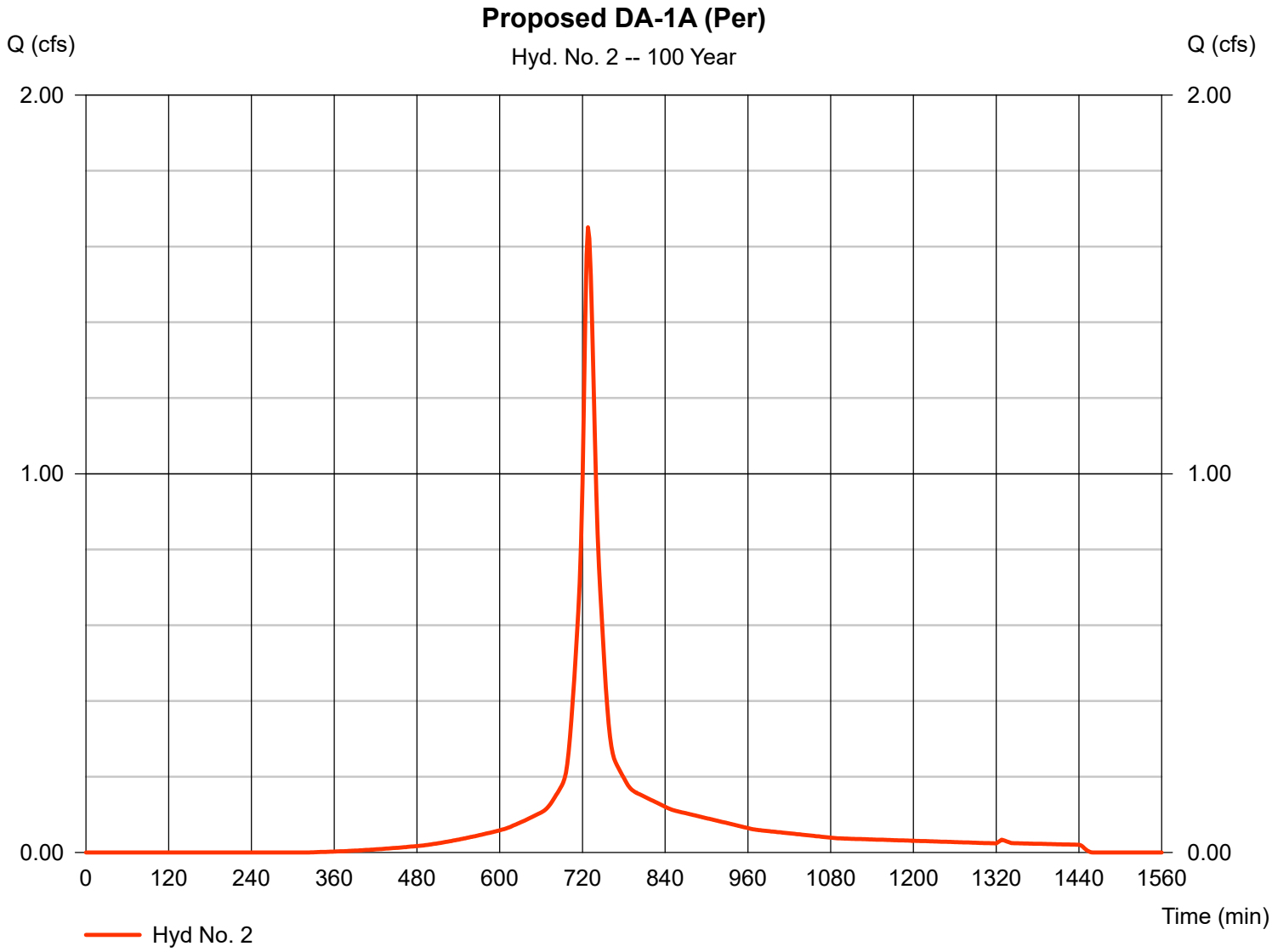


Hydrograph Report

Hyd. No. 2

Proposed DA-1A (Per)

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.651 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	6,419 cuft
Drainage area	=	0.270 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	10.00 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

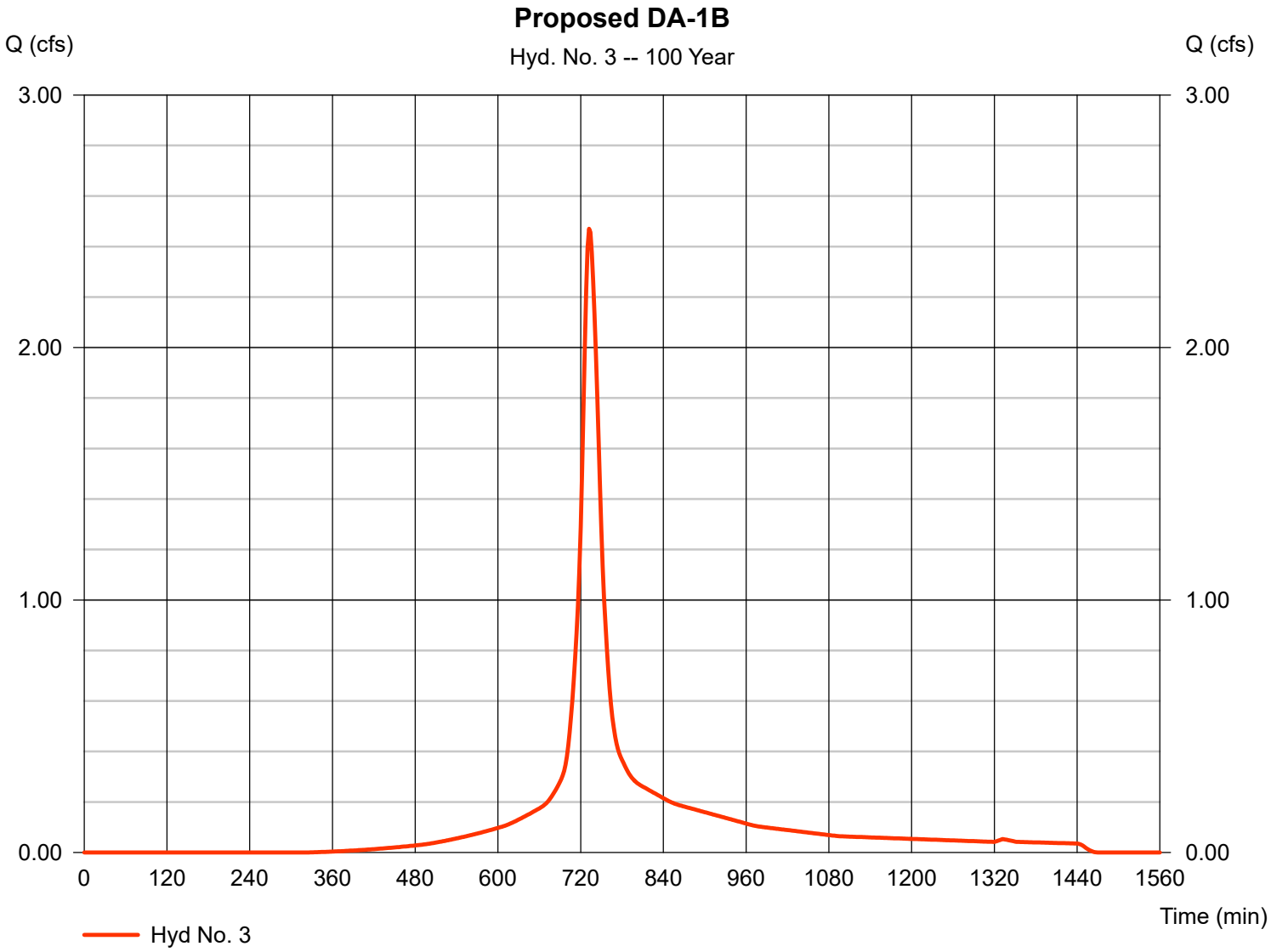


Hydrograph Report

Hyd. No. 3

Proposed DA-1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.470 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	11,066 cuft
Drainage area	=	0.480 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	18.00 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

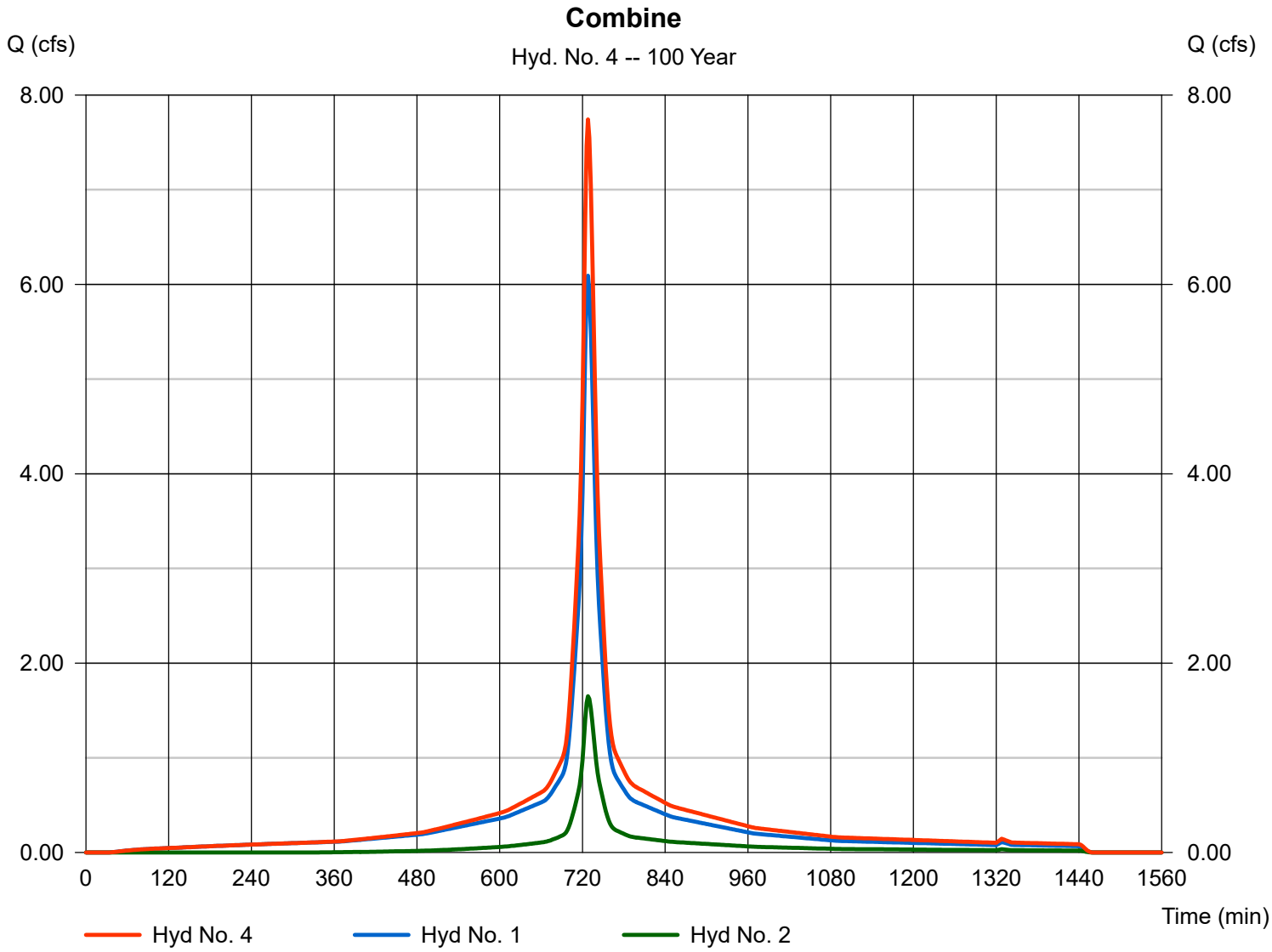


Hydrograph Report

Hyd. No. 4

Combine

Hydrograph type	= Combine	Peak discharge	= 7.743 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 33,325 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.100 ac



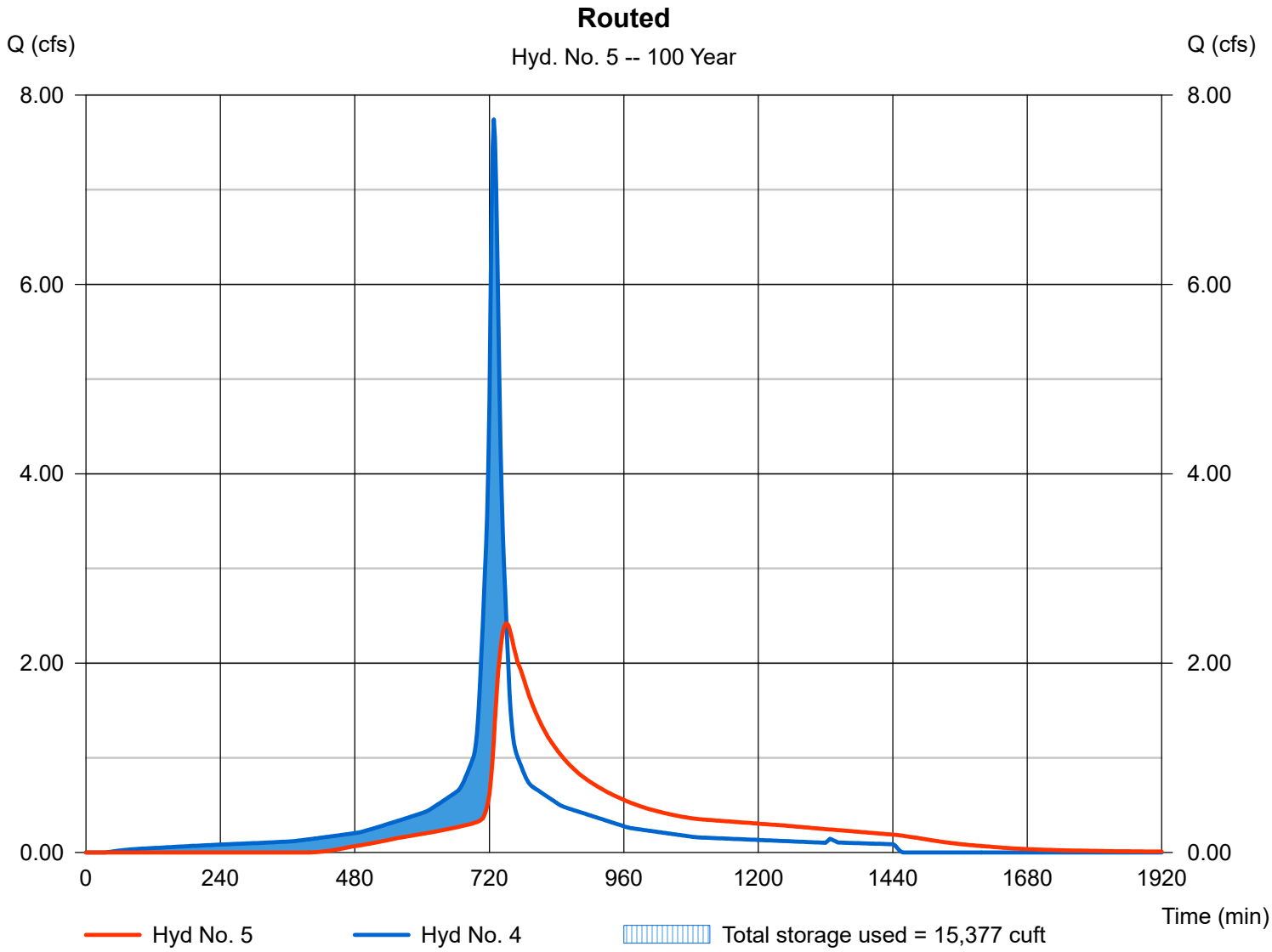
Hydrograph Report

Hyd. No. 5

Routed

Hydrograph type	=	Reservoir	Peak discharge	=	2.420 cfs
Storm frequency	=	100 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	31,706 cuft
Inflow hyd. No.	=	4 - Combine	Max. Elevation	=	88.14 ft
Reservoir name	=	<New Pond>	Max. Storage	=	15,377 cuft

Storage Indication method used.

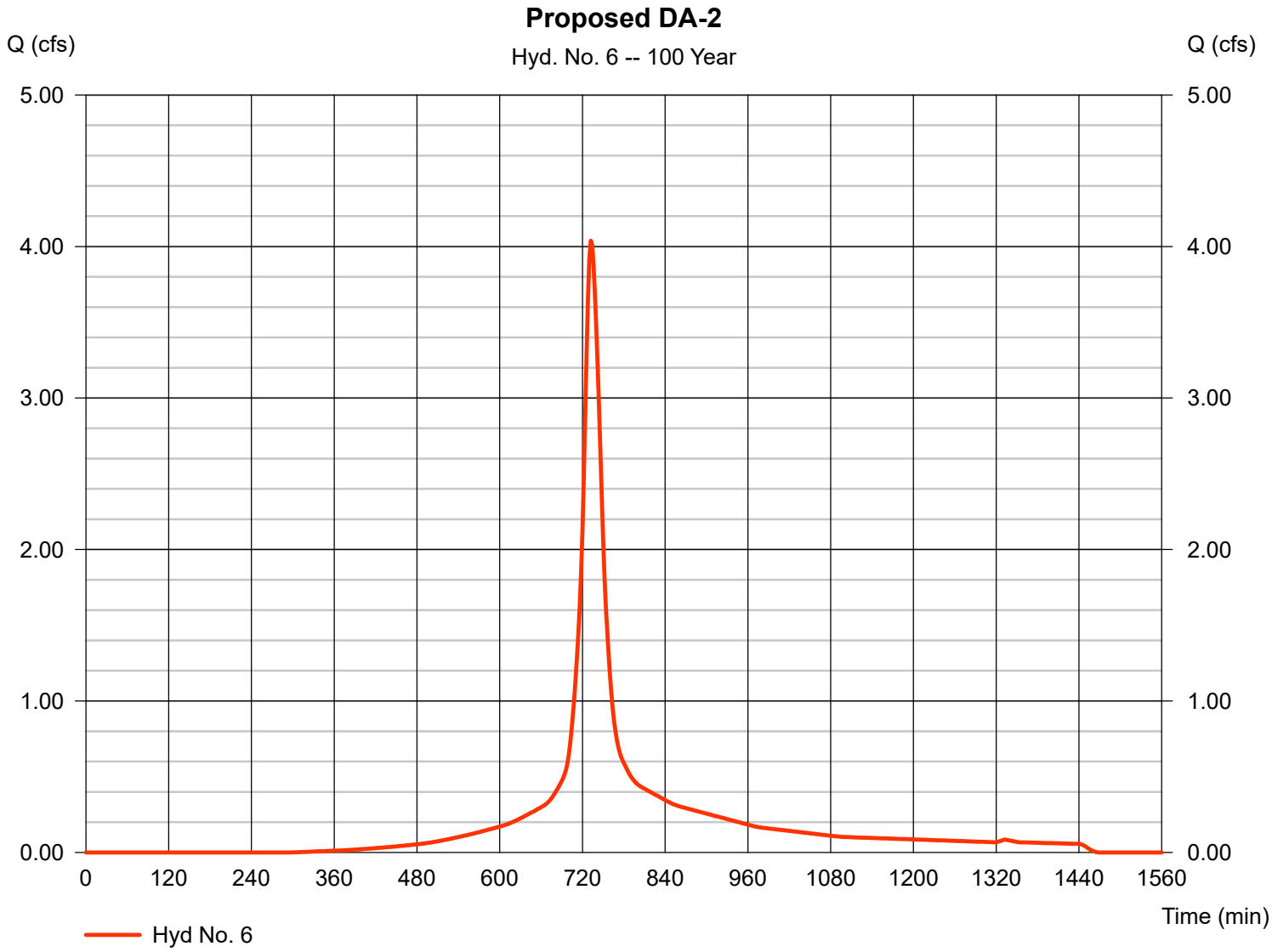


Hydrograph Report

Hyd. No. 6

Proposed DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.038 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	18,196 cuft
Drainage area	=	0.760 ac	Curve number	=	81
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	17.40 min
Total precip.	=	8.90 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



Appendix 3
Soils Map & Soils Report

Map Scale: 1:1,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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

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 1:24,000.

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 14, Jun 1, 2020

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

Date(s) aerial images were photographed: Jun 29, 2019—Jul 16, 2019

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
EveB	Evesboro sand, 0 to 5 percent slopes	A	2.2	79.1%
EveC	Evesboro sand, 5 to 10 percent slopes	A	0.6	20.9%
Totals for Area of Interest			**2.8**	**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.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

R.C. BURDICK, P.E. P.P. P.C.

1023 OCEAN RD. PT. PLEASANT, N.J. 08742
PHONE 732-892-5050
FAX 732-892-5888

SOIL BORING NO. 1

394 Rte. 79
Lot 7, Block 153
Marlboro Township
Monmouth County, New Jersey
Project No. 20-7376

0 – 3”	Dark grayish brown coarse sand, 10 YR 4/2
3” – 6”	Brown coarse sand, 10 YR 5/3
6” – 1’3”	Yellowish brown coarse sand, 10 YR 5/4
1’3” – 1’9”	Yellowish brown coarse sand, 10 YR 5/6
1’9” – 2’8”	Brownish yellow coarse sand, 10 YR 6/6
2’8” – 4’3”	Yellowish brown soft loamy sand, 10 YR 5/8
4’3” – 6’6”	Yellowish brown soft loamy sand, 10 YR 5/8 with gray clay, 10 YR 6/1
6’6” – 12’0”	Grayish brown clay, 10 YR 5/2 with yellowish brown clay, 10 YR 5/2, damp to wet

Boring performed on 9/22/2020
Boring No. 1 location
Permeability sample taken at 5’ depth
Seasonal high water indicated at 8’2”
Standing water encountered at 9’5”
Weather: 73° Sunny
Boring performed by R.C. Burdick P.E.P.P.P.C

_____

Robert C. Burdick P.E. 30929

R.C. BURDICK, P.E. P.P. P.C.

1023 OCEAN RD. PT. PLEASANT, N.J. 08742
PHONE 732-892-5050
FAX 732-892-5888

SOIL BORING NO. 2

394 Rte. 79
Lot 7, Block 153
Marlboro Township
Monmouth County, New Jersey
Project No. 20-7376

0 – 4”	Dark grayish brown coarse sand, 10 YR 4/2
4” – 6”	Very dark grayish brown coarse sand, 10 YR 4/2
6” – 1’6”	Yellowish brown coarse sand, 10 YR 5/6
1’6” – 2’8”	Light yellowish brown coarse sand, 10 YR 6/4
2’8” – 3’5”	Light yellowish brown clay, 10 YR 6/4
3’5” – 8’0”	Brownish yellow clay, 10 YR 6/6 with yellowish brown clay, 10 YR 5/8 and gray clay, 10 YR 6/1
8’0” – 12’0”	Grayish brown soft clay, damp to wet, 10 YR 5/2

Boring performed on 9/22/2020
Boring No. 2 location
Permeability sample taken at 5’ depth
Seasonal high water indicated at 9’0”
Standing water encountered at 10’0”
Weather: 73° Sunny
Boring performed by R.C. Burdick P.E.P.P.P.C

_____

Robert C. Burdick P.E. 30929

R.C. BURDICK, P.E., P.C.
Professional Engineers and Land Surveyors

ROBERT C. BURDICK, P.E.*
JONATHAN T. MILLER, P.E.
STANLEY HANS, P.L.S.
*NJ, PA Licensed

1023 OCEAN ROAD
POINT PLEASANT, N.J. 08742
732-892-5050
Fax: 732-892-5888

Tube Permeameter Test Data For Suitable Fill

Client: Leber
Location: 394 Rt. 79
Test No.: 7376 #1
Date Collected: 9/22/2020

Lot: 7 Block: 153
Township: Marlboro

Date Tested: 9/29/2020

1.	Material Tested:		Fill		Native Soil (indicate Depth):	
2.	Type of Sample:		Undisturbed	X	Disturbed	
3.	Sample Dimesions:					
	Inside Radius of Tube: R, cm:	2				
	Length of Sample, L, in:	3.94				
4.	Bulk Density Determination, (Disturbed Samples only):					
	Sample Weight (Wt. Tube w/ Sample - Wt. Tube w/o Sample):	177.5				
	Sample Volume (L x 2.54 cm/in x 3.14 R²), cc	125.70				
	Bulk Density (Sample Wt. / Sample Volume), grams/cc	1.41				
5.	Standpipe Used:	X	No		Yes	
6.	Height of Water Level Above Rim of Test Basin, in.:					
	At the Beginning of each Test Interval, H1:	6.25				
	At the End of each Test Interval, H2:	6.22				

7. Rate of Water Level Drop:

Time, Start of Test Interval, T1:(min)	Time, End of Test Interval, T2: (min)	Length of Test Interval, T (Min)
0	20.00	20.00
0	20.00	20.00
0	20.00	20.00
	Average Time	20.00

8. Calculation of Permeability:

K, (in./hr) =	60 min/hr x r² / R² x L(in) / T (min) x Ln (H1 / H2) =	0.08
K, (in./hr) =	60 2.400 2.00 3.94 20.00 Ln 6.25 6.22	
	SOIL PERMEABILITY CLASS:	**K0**

9.	Defects in Sample (check appropriate items):	X	None
	Cracks		Large Gravel
	Worm Channels		Large Roots
	Root Channels		Dry Soil
	Soil/Tube Contact		Smearing
	Compaction		Other:

10. I hereby certify that the information furnished on this application 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.

Signature of Site Evaluator:	JANET E. RICH	Date:	1/26/2021
Signature of Professional Engineer:	ROBERT C. BURDICK, P.E.	NJPE#:	30929

Affix Seal

R.C. BURDICK, P.E., P.C.
Professional Engineers and Land Surveyors

ROBERT C. BURDICK, P.E.*
JONATHAN T. MILLER, P.E.
STANLEY HANS, P.L.S.
*NJ, PA Licensed

1023 OCEAN ROAD
POINT PLEASANT, N.J. 08742
732-892-5050
Fax: 732-892-5888

Tube Permeameter Test Data For Suitable Fill

Client: Leber
Location: 394 Rt. 79
Test No.: 7376 #2
Date Collected: 9/22/2020

Lot: 7 Block: 153
Township: Marlboro

Date Tested: 9/29/2020

1.	Material Tested:		Fill		Native Soil (indicate Depth):	
2.	Type of Sample:		Undisturbed	X	Disturbed	
3.	Sample Dimesions:					
	Inside Radius of Tube: R, cm:		2			
	Length of Sample, L, in:		3.15			
4.	Bulk Density Determination, (Disturbed Samples only):					
	Sample Weight (Wt. Tube w/ Sample - Wt. Tube w/o Sample):		177.5			
	Sample Volume (L x 2.54 cm/in x 3.14 R²), cc		100.49			
	Bulk Density (Sample Wt. / Sample Volume), grams/cc		1.77			
5.	Standpipe Used:	X	No		Yes	
6.	Height of Water Level Above Rim of Test Basin, in.:					
	At the Beginning of each Test Interval, H1:		6.25			
	At the End of each Test Interval, H2:		6.20			

7. Rate of Water Level Drop:

Time, Start of Test Interval, T1:(min)	Time, End of Test Interval, T2: (min)	Length of Test Interval, T (Min)
0	15.00	15.00
0	15.00	15.00
0	15.00	15.00
	Average Time	15.00

8. Calculation of Permeability:

K, (in./hr) =	60 min/hr x r² / R² x L(in) / T (min) x Ln (H1 / H2) =	0.15
K, (in./hr) =	60 2.400 2.00 3.15 15.00 Ln 6.25 6.20	
	SOIL PERMEABILITY CLASS:	**K0**

9.	Defects in Sample (check appropriate items):	X	None
	Cracks		Large Gravel
	Worm Channels		Large Roots
	Root Channels		Dry Soil
	Soil/Tube Contact		Smearing
	Compaction		Other:

10. I hereby certify that the information furnished on this application 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.

Signature of Site Evaluator:	JANET E. RICH	Date:	1/26/2021
Signature of Professional Engineer:	ROBERT C. BURDICK, P.E.	NJPE#:	30929

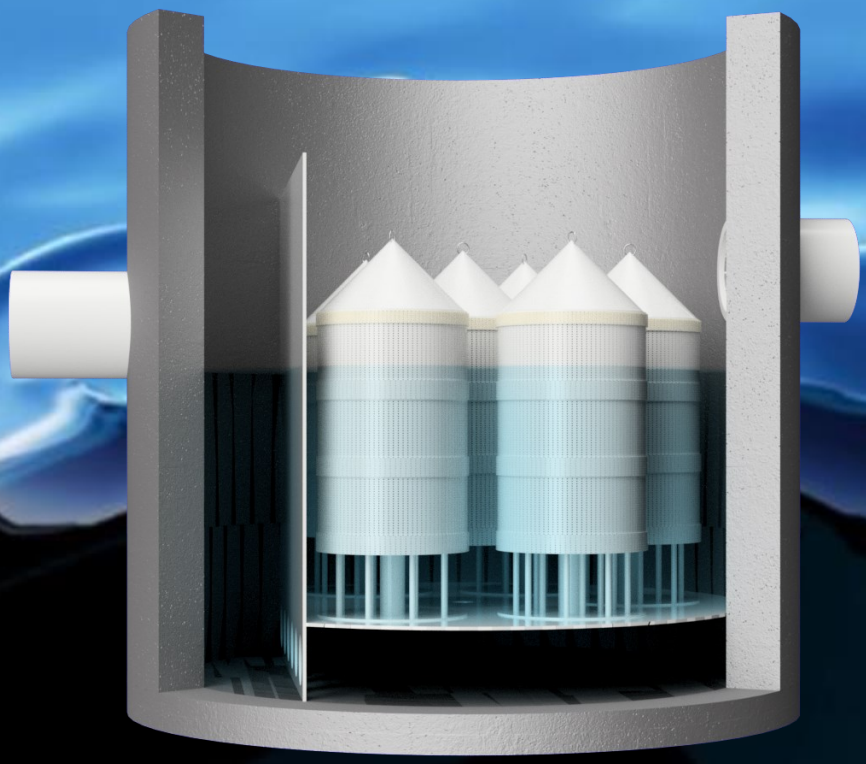
Affix Seal

Appendix 4
Water Quality Filter Information

HydroFilter

Stormwater Filter

Hydroworks LLC
888-290-7900
www.hydroworks.com
info@hydroworks.com



Product Info

HydroFilter efficiently removes oil, trash, and TSS (suspended solids and their associated metals, nutrients, bacteria), from stormwater runoff which is required in NDPES permits and the Clean Water Act.

Features

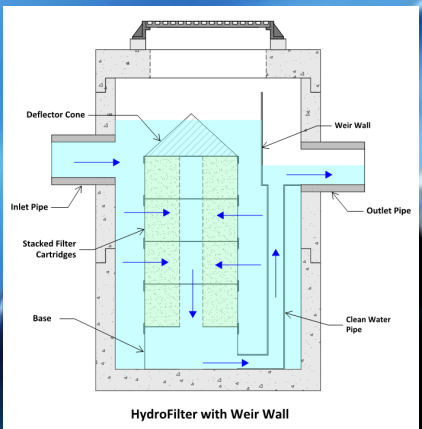
- Provides an overflow bypass to the storm drain for high flows
- NJDEP Certified for Online use
- Can accommodate multiple inlet pipes
- Vertical Modular Design makes it easier to design
- Vertical Design makes it easier to maintain
- Can be made in a round or rectangular structure
- Accommodates shallow installation requirements

Sizing & Design

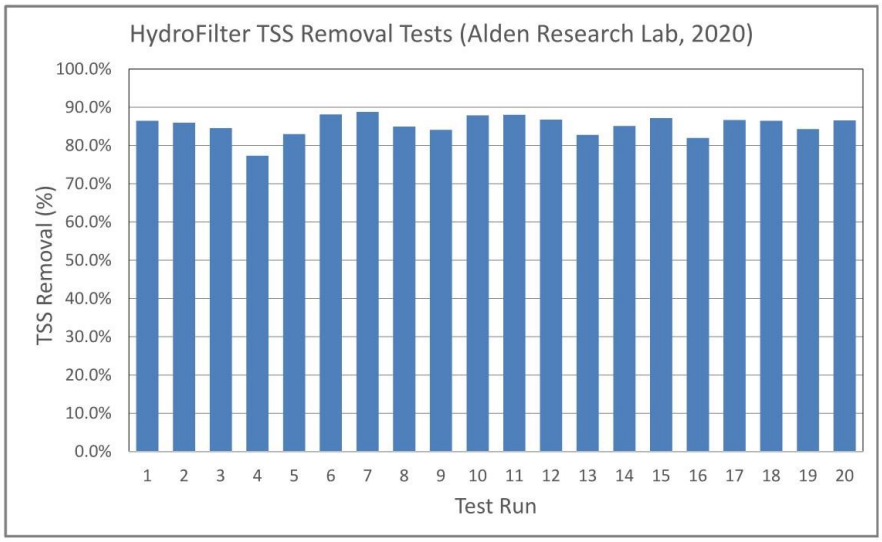
Sized based on independent laboratory testing results and annual TSS removal and/or water quality flow rate.

HydroFilter

Stormwater Filter



HydroFilter with Weir Wall



Hydroworks will design a unit for you or you can download our free design software at www.hydroworks.com

Hydroworks LLC
888-290-7900
www.hydroworks.com
info@hydroworks.com

For more information, call your local Hydroworks representative:

Hydroworks

State of New Jersey

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

Division of Water Quality
Bureau of Nonpoint Pollution Control
401 East State Street
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
Phone: 609-633-7021 / Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CATHERINE R. McCABE
Commissioner

December 17, 2020

Graham Bryant, M.Sc., P.E.
President
Hydroworks, LLC
257 Cox Street
Roselle, NJ 07203

Re: MTD Lab Certification
Hydroworks HydroFilter
On-line Installation Approved

TSS Removal Rate 80%

Dear Mr. Bryant:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydroworks, LLC has requested a Laboratory Certification for the HydroFilter filtration device.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated December 2020) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the HydroFilter stormwater treatment unit by Hydroworks at a TSS removal rate of 80% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.0 gpm/ft^2 of effective filtration treatment area.

2. The HydroFilter stormwater treatment unit shall be installed using the same configuration reviewed by NJCAT, and sized in accordance with the criteria specified in item 7 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the HydroFilter. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://hydroworks.com/hfmaintenance.pdf for any changes to the maintenance requirements.

6. For an MTD to be considered "green infrastructure" (GI) in accordance with the March 2, 2020 amendments to the Stormwater Management rules at N.J.A.C. 7:8, the MTD must meet the GI definition noted at amended N.J.A.C. 7:8-1.2. Specifically, the MTD shall (1) treat by infiltration into subsoil; and/or (2) treat stormwater runoff through filtration by vegetation or soil; or (3) store stormwater for reuse.

   While the HydroFilter can be designed upstream of an infiltration facility, such as a subsurface infiltration basin, the HydroFilter itself does not provide infiltration of the water quality design storm and does not incorporate any vegetation, soil, or storage of stormwater for reuse. As such, it does not meet the definition of green infrastructure at N.J.A.C. 7:8-1.2. However, like any NJDEP certified filtration MTD, if it is utilized as the required 80% TSS removal pre-treatment for a subsurface infiltration basin designed in accordance with Chapter 9.5 of the New Jersey Stormwater BMP Manual, the overall system will meet the definition of GI, since the subsurface infiltration basin does meet the GI definition.

7. Sizing Requirement:

   The example below demonstrates the sizing procedure for the HydroFilter:

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using the HydroFilter. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

The selection of the appropriate model of HydroFilter is based upon both the maximum inflow drainage area and the MTFR. It is necessary to calculate the required model using both methods and to use the largest model determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the HydroFilter in this example is 0.25 acres. Included in Table 1 below, several HydroFilter models are designed with a maximum allowable drainage area greater than 0.25 acres. Specifically, the HydroFilter model HF B8-12-1 with a maximum drainage area allowable of 0.27 acres would be the smallest model able to treat runoff without exceeding the maximum allowable drainage area.

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was based on the following:

time of concentration = 10 minutes
i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c = 0.99 (runoff coefficient for impervious)
$Q = ciA = 0.99 \times 3.2 \times 0.25 = 0.79$ cfs

Given the site runoff is 0.79 cfs and based on the MTFR's listed in Table 1 below, the HydroFilter HF B20-30-1 with an MTFR of 0.84 cfs would be the smallest model that could be used to treat the impervious area without exceeding the MTFR. If using more than one unit for treating runoff, the units should be configured such that the flowrate to each unit does not exceed the design MTFR for each unit and ensuring the entire 0.25 acre area is treated.

The MTFR evaluation results will be used since that method results in the highest minimum configuration determined by the two methods.

The sizing table corresponding to the available system models is noted below:

Table 1. HydroFilter MTFRs and Maximum Allowable Drainage Areas

Model*	Maximum Treatment Flow Rate (MTFR) (cfs)	Drainage Area (acres)
HF-B4-1-2	0.06	0.05
HF-R3-1-2	0.06	0.05
HF B4-2-2	0.11	0.09
HF R4-1-4	0.14	0.09
HF-B8-6-1	0.17	0.14
HF B4.5-2-3	0.17	0.14
HF B8-6-1	0.17	0.14
HF R5-2-3	0.17	0.14
HF B8.5-4-2	0.22	0.18
HF B5.5-2-4	0.22	0.18
HF R6-4-2	0.22	0.18
HF B8-9-1	0.25	0.20
HF R6-3-3	0.25	0.20
HF B8-5-2	0.28	0.23
HF R7-5-2	0.28	0.23
HF B8-12-1	0.33	0.27
HF R7-4-3	0.33	0.27
HF R7-3-4	0.33	0.27
HF B8-6-2	0.39	0.27
HF R8-7-2	0.39	0.32
HF B8-5-3	0.42	0.34
HF R8-5-3	0.42	0.34
HF R10-15-1	0.42	0.34
HF B8-4-4	0.45	0.36
HF B10-15-1	0.45	0.34
HF R8-4-4	0.45	0.36
HF B8-9-2	0.50	0.41
HF B12-18-1	0.50	0.41
HF R12-20-1	0.56	0.45
HF B8-7-3	0.59	0.47
HF B14-21-1	0.59	0.47
HF B10-11-2	0.61	0.50
HF R10-11-2	0.61	0.50
HF B8-5-4	0.67	0.45
HF B16-24-1	0.67	0.54
HF R10-8-3	0.67	0.54
HF B10-9-3	0.75	0.54
HF B18-27-1	0.75	0.61
HF B10-7-4	0.78	0.63
HF B12-13-2	0.78	0.59
HF R10-7-4	0.78	0.63

Table 1. HydroFilter MTFRs and Maximum Allowable Drainage Areas, cont'd

Model*	Maximum Treatment Flow Rate (MTFR) (cfs)	Drainage Area (acres)
HF B20-30-1	0.84	0.68
HF B14-16-2	0.89	0.72
HF R12-16-2	0.89	0.72
HF B12-10-3	0.92	0.68
HF B22-33-1	0.92	0.74
HF B12-8-4	1.00	0.72
HF B14-12-3	1.00	0.81
HF B16-18-2	1.00	0.81
HF B24-36-1	1.00	0.81
HF R12-9-4	1.00	0.81
HF R12-12-3	1.00	0.81
HF B14-10-4	1.12	0.90
HF B16-14-3	1.17	0.95
HF B18-20-2	1.17	0.90
HF B20-22-2	1.28	0.99
HF B16-11-4	1.34	0.99
HF B18-16-3	1.34	1.08
HF B22-25-2	1.39	1.13
HF B20-18-3	1.51	1.15
HF B18-13-4	1.45	1.17
HF B20-14-4	1.56	1.26
HF B24-27-2	1.56	1.22
HF B22-19-3	1.67	1.28
HF B22-16-4	1.78	1.44
HF B24-21-3	1.84	1.42
HF B24-17-4	2.01	1.53

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Brian Salvo of my office at (609) 633-7021.

Sincerely,

Gabriel Mahon, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP – Water & Land Management
Nancy Kempel, NJDEP– BNPC
Brian Salvo, NJDEP – BNPC
Keith Stampfel, NJDEP – DLRP
Dennis Contois, NJDEP – DLRP

Hydroworks® HydroFilter

Operations & Maintenance Manual

Version 1.0

Introduction

The HydroFilter is a stormwater management device designed to both treat and infiltrate stormwater.

Standard filters just treat stormwater contaminants (metals, TSS, oil, nutrients) but do nothing to maintain the hydrologic cycle during urbanization. Maintenance of the hydrologic cycle helps prevent flooding, erosion and promotes water quality by maintaining the stream geomorphology. Maintenance of the hydrologic cycle requires infiltration to reduce the additional stormwater volume and reduction in infiltration that occurs with standard development.

The requirement for infiltration is complicated by the fact that urbanization increases pollution and it would be detrimental to the environment to merely infiltrate this polluted water. Therefore, there is a need to pretreat the water that is to be infiltrated from urbanized areas such as roads and parking lots. HydroFilter provides the pretreatment and infiltration (recharge) in one device.

Many site infiltration practices try to infiltrate all the water and the low point of the site just prior to connection with the municipal storm drain system. This is not the same as predevelopment infiltration which is dispersed all over the site. Centralized infiltration can be problematic since the storm sewer is too deep, requiring an outlet control device to back up water upstream to get the required infiltration volume. Centralized infiltration can cause groundwater mounding and sealing of pores reducing infiltration capacity.

LID practices promote more infiltration at the source. HydroFilter can be considered an LID practice since the intention is to promote dispersed infiltration around the site at each inlet which is a more holistic approach to maintenance of the hydrologic cycle.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. This is especially true of any stormwater treatment practice that includes infiltration such as HydroFilter. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroFilter is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroFilter.

Hydroworks® HydroFilter Operation

The Hydroworks HydroFilter (HF) is a LID device since it promotes the maintenance of the hydrologic cycle. Unlike many infiltration systems however, HydroFilter was designed for dispersed infiltration around the site, such as inlets or catch basins.

Under normal or low flows, water enters the structure through a grate or inlet. Incoming water builds up around the filters and creates head to drive water radially into the filter cartridges from the outside through to the center of the cartridge. There is a 6” (150mm)

diameter open center that runs through the center of each cartridge. Water reaching the center opening falls by gravity into the base plug and is conveyed out of the structure by a pipe(s) into the surrounding ground to be exfiltrated (Figure 1). A solid cone with a check valve is placed on top of the top filter cartridge to prevent incoming water from entering the 6" (150 mm) diameter opening while still allowing air to escape from the center of the cartridges as water enters the filter.

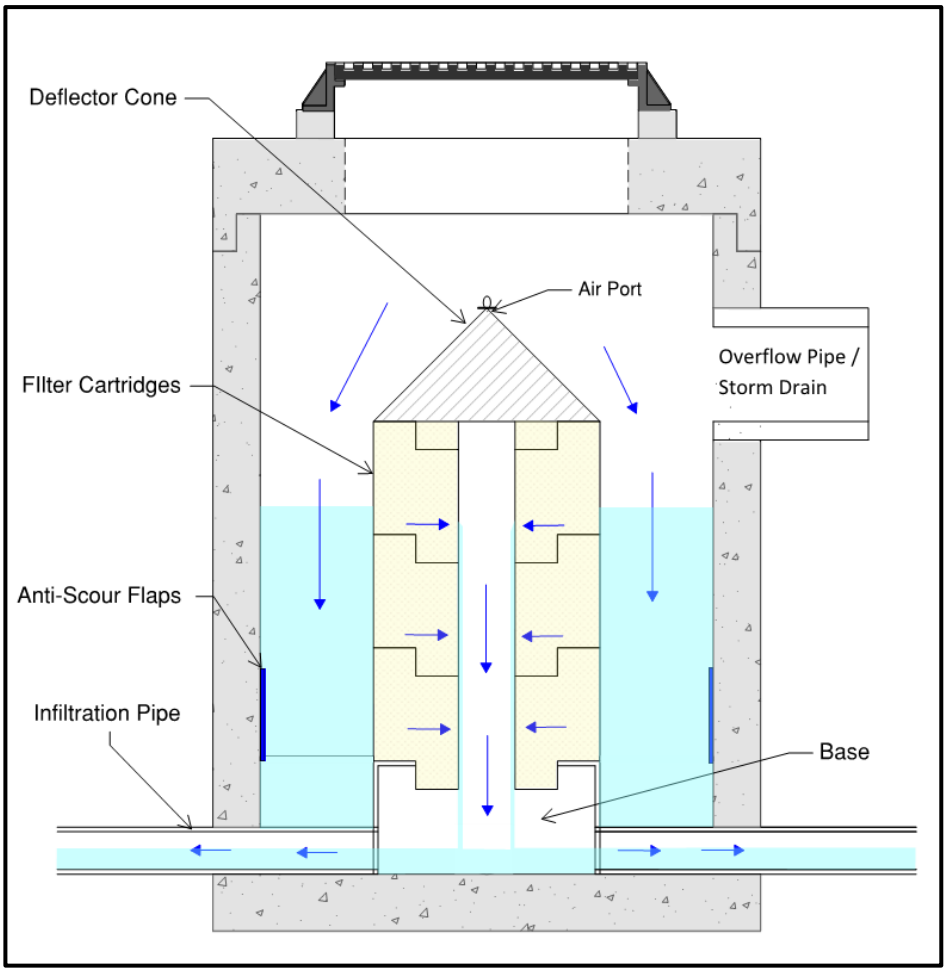


Figure 1. Hydroworks HydroFilter Operation – Low Flow

The exfiltration pipes can be surrounded by crushed stone to increase the volume of water to be exfiltrated back into the ground.

If the flow rate into the structure exceeds the flow capacity of the filter cartridges or infiltration storage capacity around the infiltration pipes water will overflow into the downstream storm drain.

It should be noted that the HydroFilter can come in many configurations (round or square or rectangular structures) with one or two or more cartridges in a stack and

one or more stacks per structure. Therefore, the configuration of the HydroFilter varies depending of the flow rate to be treated and volume of water to be infiltrated.

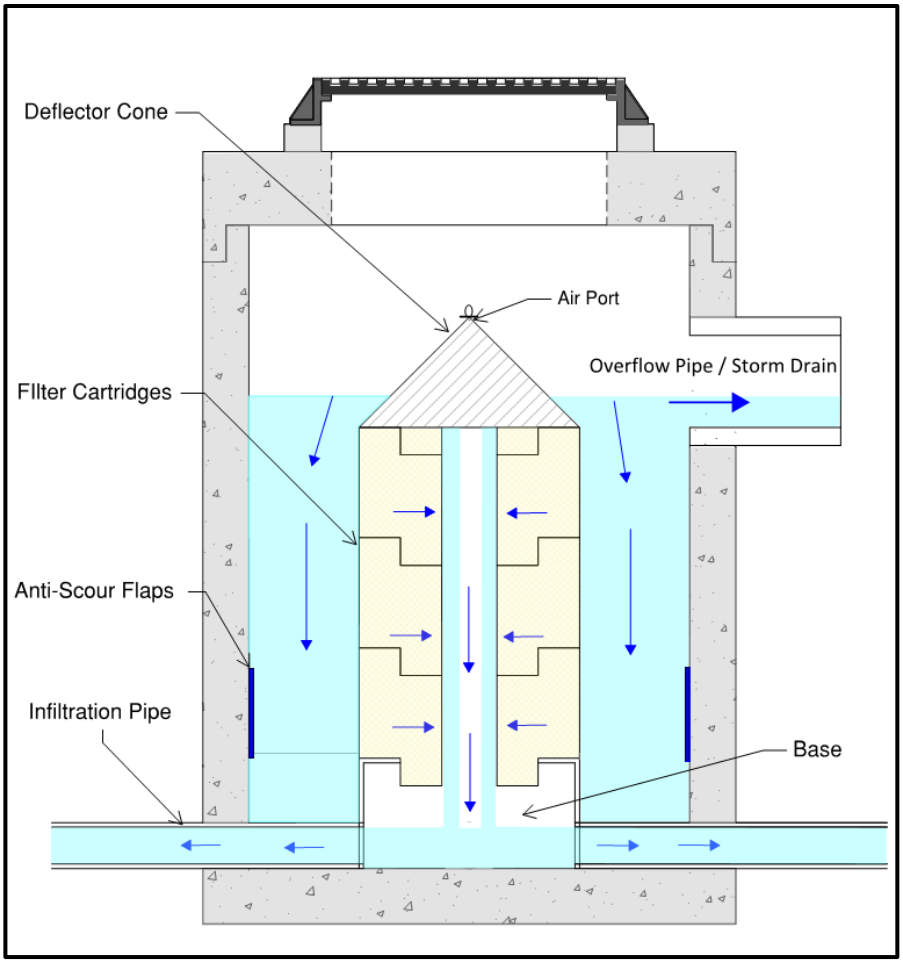


Figure 2. Hydroworks HydroFilter Operation – Bypass

Inspection

Procedure

The HydroFilter should be inspected 24 hours after rainfall. Inspection within 6 hours of rainfall may not provide useful information regarding maintenance since the unit may be draining down.

If the structure has not drained down to the base (bottom of lowest filter cartridge) within 24 hours of the last rainfall, the HydroFilter likely requires maintenance.

In the event of standing water in the structure around the cartridges the cone should be removed from a stack of cartridges. If standing water is visible in the central core of the filter stack consistent with the level of water on the outside of the filter stack this is indicative of a high ground water or slow infiltration and not required filter maintenance.

However, if the water level in the central cartridge is below the bottom of the lowest filter cartridge with standing water around the filter cartridges then filter maintenance is required.

Frequency

Construction Period

The filter cartridges **should not** be installed in the HydroFilter during the construction period since construction sediment will prematurely plug the cartridges requiring excessive maintenance during the construction period. A plate is installed in the base for the construction period to remind the contractor that the cartridges should only be installed for post construction operation. This plate needs to be removed when the cartridges are installed for post development operation.

Post-Construction Period

The Hydroworks HydroFilter should be inspected twice during the first year of operation for normal stabilized sites (no exposed soil or materials storage). The initial inspections will indicate the required future frequency of inspection and maintenance if the unit was maintained and put into service (filters installed) after the construction period.

It is anticipated that the filter cartridges will need to be replaced annually. However, this will depend on pollutant loadings on the site and off-site activities (nearby construction, etc.). Filters are different from separators in that sediment levels at the bottom of a filter do not dictate maintenance frequency.

A filter does not need to be maintained until it's rated treatment rate decreases to the point where it can no longer provide the required annual percentage of pollutant removal. This is a hydraulic requirement that will depend on the hydrology (rainfall intensity distribution) and characteristics of the site (imperviousness, area, pollutant loading) being designed. That is why the frequency of cleaning is based on the presence of water after a storm since the flow rate is reduced indicating maintenance is required.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

1. Water/Sediment Removal

Maintenance involves removing the water and replacing the filter cartridges. In both cases, sediment that has been collected around the filter cartridges in the sump of the device must be removed. This is typically done by vacuum truck.

It is important to remove all sediment and water from the structure before trying to remove and replace the filter cartridges.

2. Filter Cartridge Replacement

Replacement of filter cartridges is made easy due to the modular nature of each cartridge. The cartridges are stacked vertically on top of each other. Each cartridge has a bell and spigot such that the fit together.

A lifting bar is located In the center of the 6” hollow center of each cartridge near the top of the cartridge. The top cone has a lifting ring on the top of it. Vertical stacks of filters should have an access opening in the structure directly above them or close to being directly above them.

A winch with a hook is lowered down to hook on to the cone lifting ring and the cone is winched out of the structure. Similarly, the winch is hooked under the lifting bar of each successive filter cartridge and they are winched out of the structure.

Fresh cartridges are similarly winched in stacking them as required ending each stack with a cone. Call Hydroworks at 888-290-7900 since we offer a cartridge exchange program.

The local municipality should be consulted for the allowable disposal options for both the water and sediments that are removed from the HydroFilter.

Filter Cartridge Replenishment

Small HydroFilter units may be able to be replenished to extend the frequency of replacement. Once the top cone is removed an inflatable pipe plug can be lowered through the central core created by the connected filters to the base and expanded at the bottom to seal the vertical core.

This vertical core or pipe can then be filled with clean water to backflush the filter forcing it to flow from the central core opening back through the filter to the outside of each filter cartridge. This backflush water can then be pumped or vacuumed from the structure with the central core still being full of water.

HYDROFILTER INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____
Depth of rainfall (last 24h) _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroFilter	**Yes**	**No**
Standing water (above 12” base)	☐ *	☐
Missing internal components	☐ **	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the structure (oil, leaves, trash)	☐	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐

* Maintenance required
** Repairs required
*** Further investigation is required

Other Comments: _____

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Hydroworks

Hydroworks® HydroFilter

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroFilter to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the filter has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 257 Cox St., Roselle, NJ 07203 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroFilter are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroFilter, or the cost of other goods or services related to the purchase and installation of the HydroFilter. For this Limited Warranty to apply, the HydroFilter must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroFilter arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroFilter, whether the claim is based upon contract, tort, or other legal basis.

Appendix 5
Drainage Area Maps