APPENDIX 5.9-1

Preliminary Hydrology Study

Memorandum

To: Tony Locacciato, AICP Partner-Meridian Consultants
From: Jim Barber, Project Engineer-CHA Consulting, Inc.
Date: JANUARY 31, 2022 (UPDATED DECEMBER 23, 2022)
Re: South Airport Cargo Center at Ontario International Airport (SACC) – Preliminary Hydrology Study for CEQA Submission

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Part of the California Environmental Quality Act (CEQA) is intended to inform government officials and the public about potential environmental effects of proposed development activities and to prevent significant, avoidable environmental damage. One major aspect of environmental concern are the potential hydrological effects any proposed development would have on the surrounding area and downstream watersheds. This memorandum summarizes preliminary results obtained from hydrological calculations and modeling for the proposed South Airport Cargo Center development at Ontario International Airport in Ontario, California.

The governing document for this stormwater analysis is *the San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP*). According to this document, the project site will be, as necessary, divided into distinct Drainage Areas (DA). A Drainage Area is the area of the project site that drains to a specific outlet. For example, if the project site has two outlets, then by definition the site will have two DAs. The sum of the area(s) of the DA(s) will total the project site area.

Each project must be evaluated for Low-Impact-Design (LID) Performance criteria and Hydraulic Condition of Concern (HCOC) criteria. These must be evaluated independently and compliance with each is required. The SACC project site contains multiple DAs so each must be analyzed separately. In order to perform these evaluations, the stormwater characteristics of the sites must be analyzed in both the pre-development condition and post-development condition. Below summarizes and analyzes the SACC project site as it relates to these characteristics.

Pre-Development Conditions:

Based on the survey data, record topographic data and underground stormwater utility information available at the time of this analysis, a large majority of the Airport discharges stormwater into the Cucamonga Channel at various discharge points (outlets). This includes the area where the proposed South Airport Cargo Center (SACC) project site will be located. The pre-development area within the proposed project site location contains four (4) separate DAs. These separate drainage areas convey stormwater to four (4) different outlet points. As stated above, each of these DAs must be analyzed separately. Ultimately though, each of these DA's discharge into the Cucamonga Channel. Below summarizes the hydrological data for each. **Figure 1**, attached hereto, graphically shows the pre-development drainage areas in the form of a drainage plat.

Pre-Development Drainage Area #1:

Drainage Area #1 (DA-1) is the largest drainage area of the three individual areas. Based on the existing topography, this area generally conveys stormwater in a northwest to southeast direction. Stormwater from airport property collects in a small roadside swale adjacent to East Avion Street. As water flows southeast, it eventually flows across East Avion Street to a small swale adjacent to the Cucamonga Channel. This swale eventually overtops the western wall of Cucamonga Channel near the abandoned buildings south of E. Avion Street. Below is a summary of the various hydrological characteristics of DA-1:

DA-1

Total Drainage Area	69.2 Acres
Existing Site Impervious Area	61.2 Acres
Hydrological Soil Group	A
Flowpath Total Length	3,880 L.F.
Time of Concentration	59.5 Minutes
Existing Land Cover Type	Commercial
Existing Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	95

Pre-Development Drainage Area #2:

Drainage Area #2 (DA-2) is the smallest drainage area of the three individual areas. Based on existing topography, this area generally conveys stormwater via a small swale in a north to south direction adjacent to the Cucamonga Channel from Taxiway 'S' to East Avion Street. During normal rainfall events, stormwater is contained in this swale and flows to a collection area near the East Avion Street bridge that crosses over Cucamonga Channel. At this location, stormwater overtops the western wall of Cucamonga Channel and discharges into the channel. Below is a summary of various hydrological characteristics of DA-2:

DA-2

Total Drainage Area	1.8 Acres
Existing Site Impervious Area	1.8 Acres
Hydrological Soil Group	A
Flowpath Total Length	1,610 L.F.
Time of Concentration	17.9 Minutes
Existing Land Cover Type	Commercial
Existing Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	98

Pre-Development Drainage Area #3:

Drainage Area #3 (DA-3) is between DA-1 and DA-2 and consists mostly of the existing airfield apron area. Based on existing topography, this area generally conveys stormwater on airfield apron pavement from Taxiway 'S' to four different stormwater catch basins located on the east side of the apron. Based on underground survey data, catch basins are connected with 12-inch pipes. A 12-inch outlet pipe from the southern-most catch basin discharges stormwater through

a window in the western wall of the Cucamonga Channel. Below is a summary of various hydrological characteristics of DA-3:

DA-3

Total Drainage Area	22.5 Acres
Existing Site Impervious Area	19.2 Acres
Hydrological Soil Group	A
Flowpath Total Length	1,955 L.F.
Time of Concentration	13.3 Minutes
Existing Land Cover Type	Commercial
Existing Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	94

Pre-Development Drainage Area #4:

Drainage Area #4 (DA-4) is located south of E. Avion Street adjacent to Avion Place. Stormwater sheet flows to a collection area and is conveyed westward to the Cucamonga Channel through a series of culverts and. Below is a summary of various hydrological characteristics of DA-4:

DA-4

Total Drainage Area	3.5 Acres
Existing Site Impervious Area	2.7 Acres
Hydrological Soil Group	A
Flowpath Total Length	1,145 L.F.
Time of Concentration	5.1 Minutes
Existing Land Cover Type	Commercial
Existing Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	92

Pre-Development Analysis Summary:

As previously discussed, four drainage areas listed above ultimately all discharge into Cucamonga Channel. Based on the proposed project limits, DA-1, DA-2, and DA-3 encompass the main site of the SACC development. DA-4 encompasses the parking garage site of the proposed SACC development. The main site and parking garage site will have two separate stormwater conveyance systems. These systems will discharge from the respective sites at two separate locations. Thus, DA-1, DA-2, and DA-3 will be combined to determine an overall peak flow rate (Q_{Peak}) and total runoff volume (Q_V). DA-4 will be analyzed separately for the same parameters. This is done to accurately compare the pre-development versus post-development conditions of the two sites in a like-to-like scenario.

Autodesk Hydraflow Hydrographs modeling software was used to determine these values based on hydrological characteristics listed above for the respective drainage areas. Precipitation data was obtained for the Airport from the National Oceanic and Atmospheric Administration (NOAA) website for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storms. Precipitation data is shown below:

Precipitation Depth per NOAA (as of January 2022)

Duration	Average recurrence interval (years)						
	1	2	5	10	25	50	100
5-min	**0.117** (0.098-0.142)	**0.155** (0.129-0.188)	**0.201** (0.167-0.244)	**0.237** (0.195-0.290)	**0.283** (0.225-0.359)	**0.317** (0.247-0.411)	**0.349** (0.265-0.465)
10-min	**0.168** (0.140-0.204)	**0.222** (0.185-0.269)	**0.288** (0.239-0.350)	**0.339** (0.280-0.416)	**0.406** (0.323-0.515)	**0.454** (0.353-0.589)	**0.501** (0.380-0.667)
15-min	**0.204** (0.170-0.246)	**0.268** (0.223-0.325)	**0.348** (0.289-0.423)	**0.411** (0.338-0.503)	**0.491** (0.390-0.623)	**0.549** (0.427-0.712)	**0.606** (0.460-0.806)
30-min	**0.310** (0.259-0.376)	**0.409** (0.341-0.496)	**0.531** (0.441-0.645)	**0.626** (0.516-0.767)	**0.748** (0.595-0.950)	**0.837** (0.652-1.09)	**0.924** (0.701-1.23)
60-min	**0.459** (0.383-0.556)	**0.605** (0.504-0.733)	**0.785** (0.653-0.954)	**0.926** (0.763-1.14)	**1.11** (0.880-1.40)	**1.24** (0.964-1.61)	**1.37** (1.04-1.82)
2-hr	**0.680** (0.567-0.823)	**0.896** (0.747-1.09)	**1.16** (0.966-1.41)	**1.37** (1.13-1.68)	**1.63** (1.30-2.07)	**1.83** (1.42-2.37)	**2.01** (1.53-2.68)
3-hr	**0.846** (0.706-1.02)	**1.12** (0.929-1.35)	**1.45** (1.20-1.76)	**1.70** (1.40-2.09)	**2.03** (1.61-2.58)	**2.27** (1.76-2.94)	**2.49** (1.89-3.32)
6-hr	**1.19** (0.989-1.43)	**1.56** (1.30-1.89)	**2.02** (1.68-2.46)	**2.38** (1.96-2.92)	**2.84** (2.26-3.60)	**3.17** (2.47-4.11)	**3.49** (2.65-4.65)
12-hr	**1.53** (1.28-1.85)	**2.01** (1.68-2.44)	**2.61** (2.17-3.17)	**3.08** (2.54-3.77)	**3.68** (2.93-4.67)	**4.11** (3.20-5.34)	**4.54** (3.45-6.04)
24-hr	**2.01** (1.78-2.31)	**2.65** (2.34-3.06)	**3.46** (3.05-4.01)	**4.10** (3.58-4.78)	**4.93** (4.17-5.94)	**5.54** (4.59-6.81)	**6.14** (4.97-7.73)

Hydraflow Hydrograph Modeling software was used to calculate the combined peak runoff rate and combined total runoff volume for the storm frequency events shown below:

Main Site PreDevelopment-DA-1, DA-2, & DA-3 Combined Discharge

Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	105.1	715,034
5-Year	143.5	985,054
10-Year	173.6	1,200,157
25-Year	212.5	1,480,449
50-Year	241.0	1,687,071
100-Year	268.9	1,890,661

**Note-Per San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP), only the 2-year storm is used to conduct analysis for comparing pre-development versus post-development.*

Parking Garage Site PreDevelopment-DA-4 Discharge

Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	10.5	21,827
5-Year	14.6	30,950
10-Year	17.8	38,284
25-Year	21.9	47,893
50-Year	25.0	55,002
100-Year	27.9	62,022

**Note-Per San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP), only the 2-year storm is used to conduct analysis for comparing pre-development versus post-development.*

Results for the pre-development calculations from the modeling software can be referenced in **Appendix 'A'.**

Post-Development Conditions:

The post-development condition of the main site of the SACC project will serve as an aircraft apron and a new sort building. In addition, landside truck and vehicle parking will also be developed. Opposite the main site, across E. Avion Street, a multi-level parking garage will be constructed. A grading and drainage plan has been developed for both sites and the main goal is to capture, contain/treat, and convey all stormwater each of the respective sites. A series of storm catch basins and pipes will convey stormwater generally from a west to east direction and ultimately discharge this runoff into Cucamonga Channel. Post-development conditions will contain three (3) separate DAs. Below summarizes hydrological data for each of these areas. **Figure 2**, attached hereto, graphically shows the respective post-development drainage areas in the form of a drainage plat.

Post-Development Drainage Area A:

Drainage Area A (DA-A) collects stormwater from the western and middle portion of the main site. Stormwater runoff is conveyed using catch basins and pipes eastward toward the southeastern portion of the site and will enter the main site's underground infiltration system. Below is a summary of various hydrological characteristics of DA-A:

DA-A

Total Drainage Area	66.0 Acres
Proposed Site Impervious Area	60.3 Acres
Hydrological Soil Group	A
Flowpath Total Length	3,556 L.F.
Time of Concentration	14.2 Minutes
Proposed Land Cover Type	Commercial
Proposed Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	96

Post-Development Drainage Area B:

Drainage Area A (DA-B) collects stormwater from the eastern portion of the main site. Stormwater runoff is conveyed using catch basins and pipes toward the southeastern portion of the site and will enter the main site's underground infiltration system. The underground infiltration system will collect stormwater from both DA-A and DA-B and discharge stormwater to a future storm system installed under E. Avion Street (by others). This system will ultimately discharge into the Cucamonga Channel. Below is a summary of various hydrological characteristics of DA-B:

DA-B

Total Drainage Area	27.5 Acres
Proposed Site Impervious Area	26.3 Acres
Hydrological Soil Group	A
Flowpath Total Length	1,647 L.F.
Time of Concentration	2.9 Minutes
Proposed Land Cover Type	Commercial
Proposed Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	97

Post-Development Drainage Area C:

Drainage Area A (DA-C) collects stormwater from the parking garage site. The stormwater will be conveyed across the site via pipe and/or sheet flow to a separate underground infiltration system. This system will discharge to a future storm system installed under E. Avion Street (by others). This system will ultimately discharge into the Cucamonga Channel. Below is a summary of various hydrological characteristics of DA-C:

DA-C

Total Drainage Area	3.5 Acres
Proposed Site Impervious Area	3.3 Acres
Hydrological Soil Group	A
Flowpath Total Length	780 L.F.
Time of Concentration	3.6 Minutes
Proposed Land Cover Type	Commercial
Proposed Pervious Area Condition	Poor (<50%)
Composite Curve Number (CN)	94

Post-Development Analysis Summary:

Post-development drainage areas were analyzed in the same manner as pre-development conditions for peak flow rate (Q_{Peak}) and total runoff volume (Q_V). DA-A, and DA-B are combined, and DA-C is analyzed separately.

Autodesk Hydraflow Hydrographs modeling software was used to determine these values based on hydrological characteristics listed above for respective drainage areas. Same precipitation data was used as listed above for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storms. Results of the analysis are shown below:

Main Site PostDevelopment-DA-A & DA-B Combined Discharge (without Underground Infiltration System)

Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	248.8	745,398
5-Year	332.2	1,011,611
10-Year	397.6	1,222,899
25-Year	482.1	1,497,617
50-Year	544.0	1,699,844
100-Year	604.8	1,898,942

**Note-Per San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP), only the 2-year storm is used to conduct analysis for comparing pre-development versus post-development.*

Parking Garage Site PostDevelopment-DA-C Discharge (without Underground Infiltration System)

Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	11.3	23,976
5-Year	15.3	33,311
10-Year	18.5	40,764
25-Year	22.6	50,490
50-Year	25.7	57,665
100-Year	28.5	64,740

**Note-Per San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP), only the 2-year storm is used to conduct analysis for comparing pre-development versus post-development.*

Results of the post-development calculations and Time of Concentration (TOC) calculations from the modeling software can be referenced in **Appendix 'B'.**

Hydraulic Condition of Concern (HCOC) Performance Criteria :

Section 4.2 of the *San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP)* states a performance criterion for HCOC must be met. This criterion is evaluated by comparing pre-development site hydrology with post-development site hydrology. The criteria states the post-development runoff volume, time of concentration, and peak flow for the 2-year 24-hour storm event shall not exceed that of the pre-development for these conditions by more than five percent.

Pre-development hydrology conditions must be compared to post-development hydrology conditions for total runoff, time of concentration, and peak flow. The table below summarizes the results for the comparison of the main project site:

Main Site PreDevelopment vs. PostDevelopment Comparison (2-year Storm only)

Pre. Runoff Volume (cu.ft)	Post. Runoff Volume (cu.ft)	Pre. Peak Flow (cfs)	Post. Peak Flow (cfs)
715,034	745,398	105.1	*248.8

**The post-development peak flow rate is greater than a 5% increase from the pre-development peak flow-HCOC not met.*

Given the results above for the main site, total runoff volume required to be mitigated based on the HCOC criteria is the difference between pre-development and post-development runoff, which equals 30,364 cubic-feet. Furthermore, the maximum post-development peak flow rate is 1.05 times (105.) which equals 111 cfs.

Additionally, the table below summarizes the results for the comparison of the parking garage site:

Parking Garage Site PreDevelopment vs. PostDevelopment Comparison (2-year Storm only)

Pre. Runoff Volume (cu.ft)	Post. Runoff Volume (cu.ft)	Pre. Peak Flow (cfs)	Post. Peak Flow (cfs)
21,827	*23,976	10.5	**11.3

**The post-development peak volume is greater than a 5% increase from the pre-development peak volume-HCOC not met.*
***The post-development peak flow rate is greater than a 5% increase from the pre-development peak flow-HCOC not met.*

Given the results above for the parking garage, total runoff volume required to be mitigated based on the HCOC criteria is the difference between pre-development and post-development runoff, which equals 2,149 cubic-feet. Furthermore, the maximum post-development peak flow rate is 1.05 times (10.5) which equals 11 cfs.

Low Impact Design (LID) Performance Criteria:

Section 4.1 of the *San Bernadino County Technical Guidance Document for Water Quality Management Plans (WQMP)* states a performance criterion for LID must be met in addition to HCOC. This is a volume-based criteria and is used to measure the overall effectiveness of a LID Best-Management-Practice (BMP).

For LID performance criteria, and empirical formula is given to calculate the maximized water quality capture volume. This capture volume is referred to as the "Design Capture Volume (DCV." Computation of the DCV for the main site is the result of solving for the equation below:

- $C = 0.858 * i^3 - 0.78 * i^2 + 0.774 * i + 0.04$ (C is the drainage area runoff coefficient)
- i = Percent imperviousness for DA = 93% for DA-A and DA-B combined
- $P_6 = P_{2yr,1hr} * a_{1,}$ (P_6 is the mean storm rainfall depth in inches)
- $P_{2yr,1hr}$ = the 2-year, 1-hour rainfall depth = 0.605 inches (from NOAA)
- a_1= 1.4807 (a_1 is the San Bernadino Climatic Region coefficient for the Valley region)
- a2= 1.963 (a_2 is the 48-hour drawdown time coefficient)
- $P_6 = (0.605)(1.4807) = 0.90$
- $C = 0.858(93\%)^3 - 0.78(93\%)^2 + 0.774(93\%) + 0.04 = 0.78$
- $DCV_{(Main)} = DA_{Combined} * C * a2 * P6 / 12$ (DA is the combined drainage area (93.5-Ac) in square-feet)
- **$DCV_{(Main)*}$ = 4,072,860 * 0.78 * 1.963 * 0.90/12 = 467,708 cubic-feet (use 467,800 cubic-feet)**

Per the formula above, it was determined that 467,800 cubic-feet of stormwater runoff from the main site must be mitigated to meet the LID Performance Criteria.

Based on results from analysis using the respective HCOC and LID Performance Criteria listed above, the more stringent (higher) value is required water quality volume. Thus, the total runoff volume that needs to be mitigated from the main site using a BMP before being discharged into Cucamonga Channel is **467,800 cubic-feet**. In addition, the maximum allowable peak flow rate discharged into the Cucamonga Channel is **111 cfs**.

Computation of the DCV for the parking garage site is the result of solving for the equation below:

- $C = 0.858 * i^3 - 0.78 * i^2 + 0.774 * i + 0.04$ (C is the drainage area runoff coefficient)
- i = Percent imperviousness for DA = 93% for DA-C
- $P_6 = P_{2yr,1hr} * a_1$, (P_6 is the mean storm rainfall depth in inches)
- $P_{2yr,1hr}$ = the 2-year, 1-hour rainfall depth = 0.605 inches (from NOAA)
- a_1= 1.4807 (a_1 is the San Bernadino Climatic Region coefficient for the Valley region)
- a2= 1.963 (a_2 is the 48-hour drawdown time coefficient)
- $P_6 = (0.605)(1.4807) = 0.90$
- $C = 0.858(93\%)^3 - 0.78(93\%)^2 + 0.774(93\%) + 0.04 = 0.78$
- $DCV_{(Garage)} = DA_{Combined} * C * a2 * P6 / 12$ (DA is the combined drainage area (3.5-Ac) in square-feet)
- **$DCV_{(Garage)*}$ = 152,460 * 0.78 * 1.963 * 0.90/12 = 17,507 cubic-feet (use 17,600 cubic-feet)**

Per the formula above, it was determined that 17,600 cubic-feet of stormwater runoff from the proposed parking garage site must be mitigated to meet the LID Performance Criteria.

Based on results from analysis using the respective HCOC and LID Performance Criteria listed above, the more stringent (higher) value is required water quality volume. Thus, the total runoff volume that needs to be mitigated from the parking garage site using a BMP before being discharged into Cucamonga Channel is **17,600 cubic-feet**. In addition, the maximum allowable peak flow rate discharged into the Cucamonga Channel is **11 cfs**.

Proposed Stormwater BMP:

Implementation and type of BMP is determined based on hierarchy as set forth in Figure 5-1 of the Technical Guidance Document. Based on that figure, the type of BMP that is allowable and will be implemented as part of this project is an underground infiltration system. Both the main site and parking garage site of the SACC development will utilize separate underground infiltration systems.

These systems will consist of a series of connected underground pipes to store water. The pipes will have an open bottom and will be surrounded by a stone and filter media that will allow for runoff to infiltrate into the subsurface soils to promote groundwater recharge. Sediment/settling chambers and an oil-water separator will be installed immediately upstream of underground infiltration system for the main site only to pre-treat runoff from DA-A and DA-B.

For the main site, to store the required runoff volume of 467,800 cubic-feet, footprint of the underground system is approximately 80' wide by 265' long and will be located in the southeastern

portion of the site. Based on design of the underground infiltration system, a 24-inch outlet pipe on the downstream side of the system will discharge the stormwater at a controlled rate not greater than 24 cfs (for the 100-year storm) into Cucamonga Channel. The results for peak flow rate and volumes are shown below:

Main Site PostDevelopment-DA-A & DA-B Combined Discharge (with Underground Infiltration System)

Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	0.0	0.0
5-Year	0.0	0.0
10-Year	0.0	0.0
25-Year	20.3	102,249
50-Year	22.3	190,820
100-Year	24.0	277,735

For the parking garage site, to store the required runoff volume of 17,600 cubic-feet, footprint of the underground system is approximately 20' wide by 65' long and will be located under the parking garage entrance drive. Based on design of the underground infiltration system, a 24-inch outlet pipe on the downstream side of the system will discharge the stormwater at a controlled rate not greater than 9-cfs (for the 100-year storm) into Cucamonga Channel. The results for peak flow rate and volumes are shown below:

Parking Garage Site PostDevelopment-DA-C Discharge (with Underground Infiltration System)

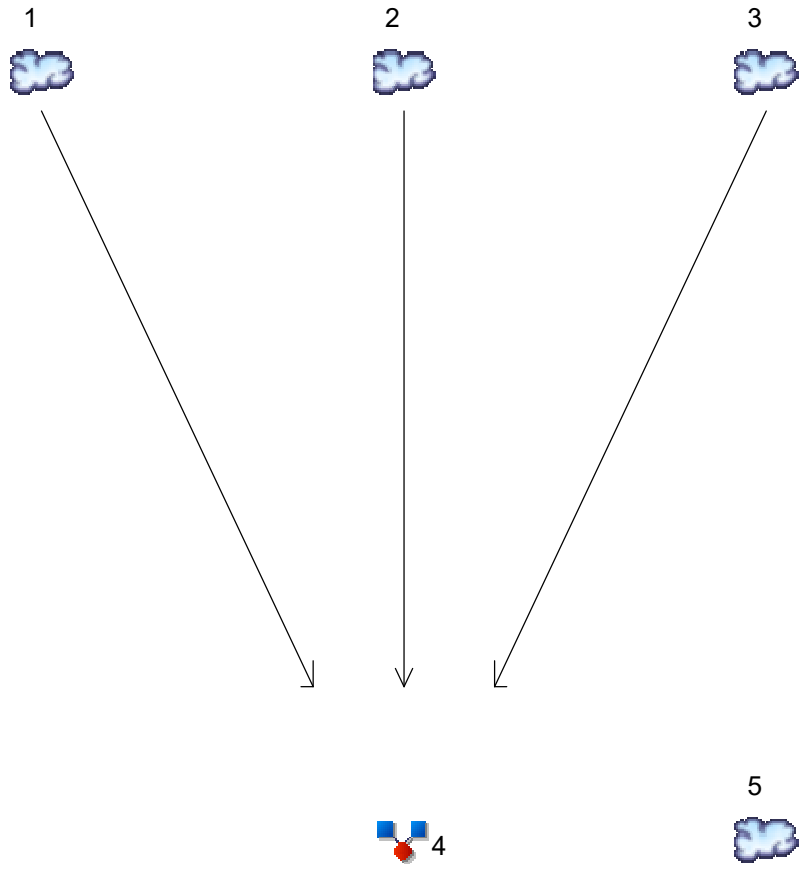
Storm Event Frequency	Total Peak Flow Rate (cfs)	Total Runoff Volume (cu.ft)
*2-Year	0.0	0.0
5-Year	0.0	0.0
10-Year	0.0	0.0
25-Year	1.4	2,327
50-Year	6.7	6,198
100-Year	8.4	10,155

Results for the post-development calculations, including the infiltration system modeling results, can be found in **Appendices 'B' and 'C'** for the main site and parking garage site, respectively.

Based on the results and the high infiltration rate of the native soil (sand), it is clear the underground infiltration system allows for a substantial amount of groundwater recharge. Underground stormwater infiltration is consistent with area-wide Low Impact Design (LID) practices that manage stormwater quality and quantity of the proposed site runoff. This will reduce negative impacts to downstream receiving waterbodies and meet the MS4 permit requirements and WQMP requirements as set forth by San Bernadino County.

APPENDIX ‘A’

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	PreDevelopment Area DA-1
2	SCS Runoff	PreDevelopment Area DA-2
3	SCS Runoff	PreDevelopment Area DA-3
4	Combine	PreDevelopment-Combined Discharge
5	SCS Runoff	PreDevelopment Area DA-4

Hydrograph Return Period Recap

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	------	-------	80.43	-------	109.14	131.67	160.71	181.95	202.78	PreDevelopment Area DA-1
2	SCS Runoff	------	-------	4.590	-------	6.040	7.181	8.658	9.742	10.81	PreDevelopment Area DA-2
3	SCS Runoff	------	-------	63.09	-------	86.08	104.11	127.35	144.34	160.98	PreDevelopment Area DA-3
4	Combine	1, 2, 3	-------	105.07	-------	143.49	173.64	212.52	240.95	268.81	PreDevelopment-Combined Discharg
5	SCS Runoff	------	-------	10.47	-------	14.56	17.78	21.92	24.95	27.92	PreDevelopment Area DA-4

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	80.43	2	748	529,677	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	4.590	2	724	15,812	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	63.09	2	720	169,545	------	------	------	PreDevelopment Area DA-3
4	Combine	105.07	2	722	715,034	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	10.47	2	716	21,827	------	------	------	PreDevelopment Area DA-4

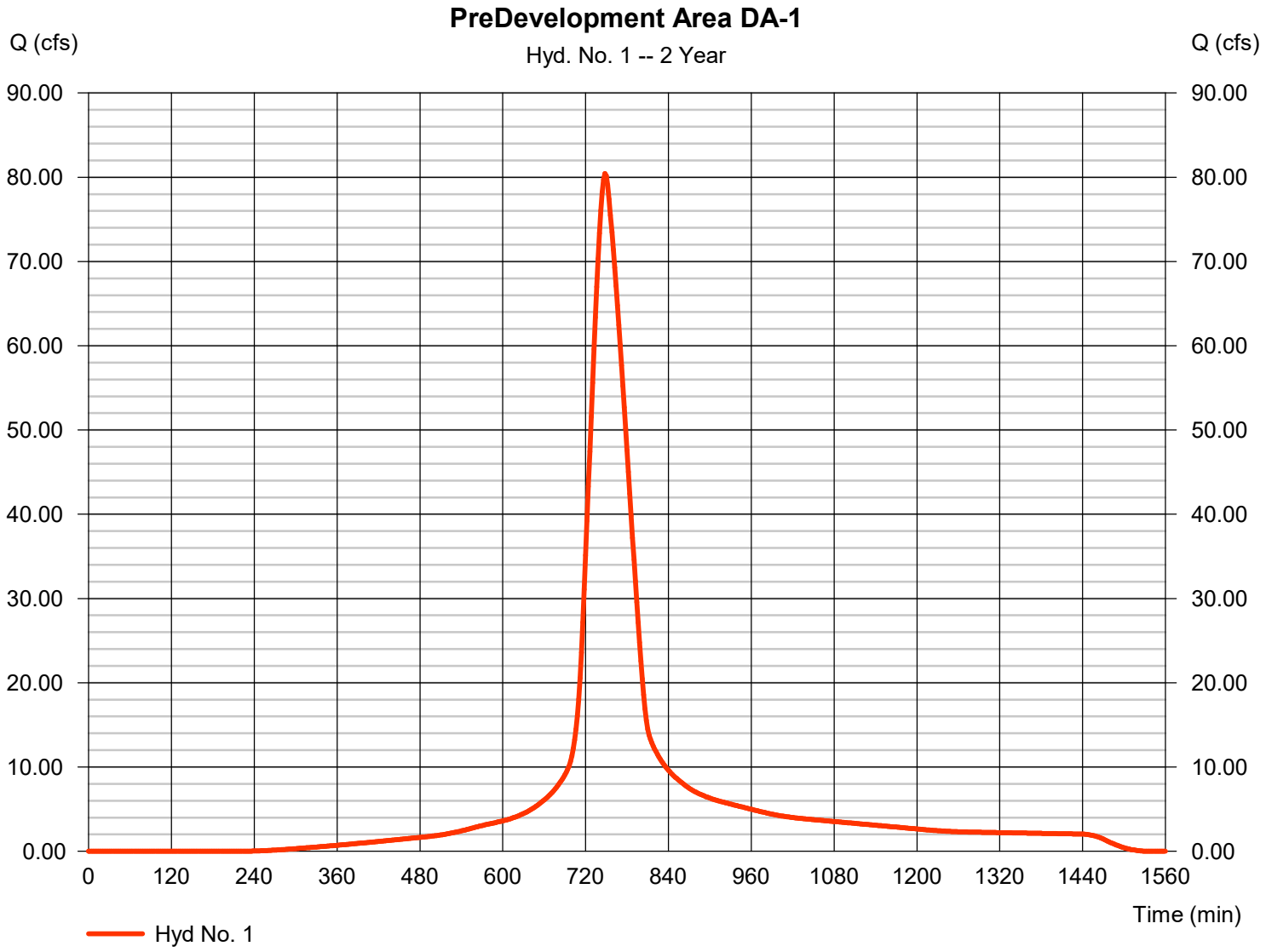
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 80.43 cfs
Storm frequency	= 2 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 529,677 cuft
Drainage area	= 69.200 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 59.50 min
Total precip.	= 2.65 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 1

PreDevelopment Area DA-1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 1.44		0.00		0.00		
Travel Time (min)	**= 4.01**	**+**	**0.00**	**+**	**0.00**	**=**	**4.01**
Shallow Concentrated Flow							
Flow length (ft)	= 964.00		1966.00		650.00		
Watercourse slope (%)	= 1.34		0.21		1.52		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=2.35		0.74		2.51		
Travel Time (min)	**= 6.83**	**+**	**44.32**	**+**	**4.32**	**=**	**55.47**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 59.50 min

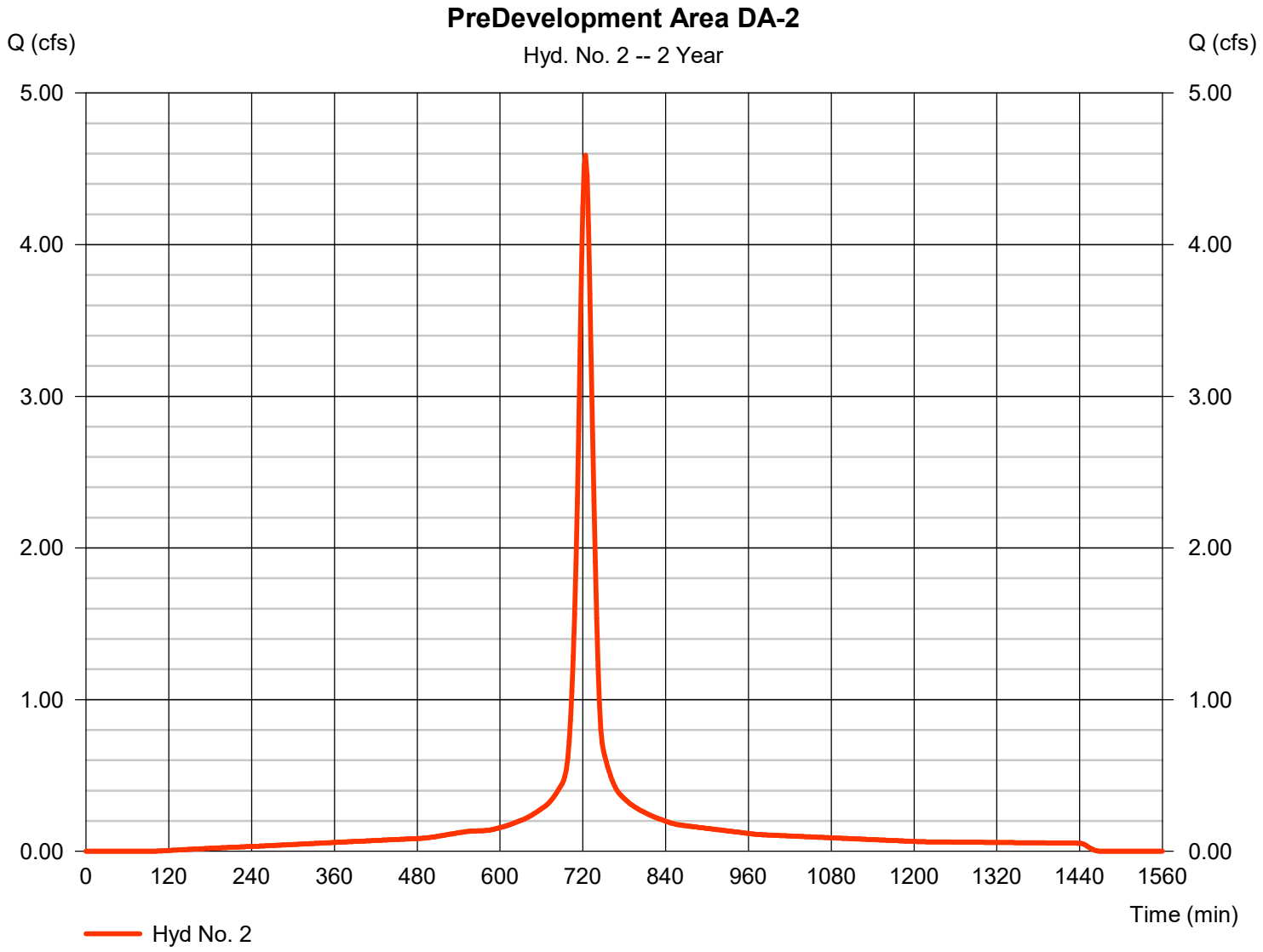
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 4.590 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 15,812 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 2.65 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 2

PreDevelopment Area DA-2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 2.76		0.00		0.00		
Travel Time (min)	**= 3.09**	**+**	**0.00**	**+**	**0.00**	**=**	**3.09**
Shallow Concentrated Flow							
Flow length (ft)	= 805.00		505.21		0.00		
Watercourse slope (%)	= 1.09		0.58		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=1.68		1.23		0.00		
Travel Time (min)	**= 7.96**	**+**	**6.85**	**+**	**0.00**	**=**	**14.82**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.90 min

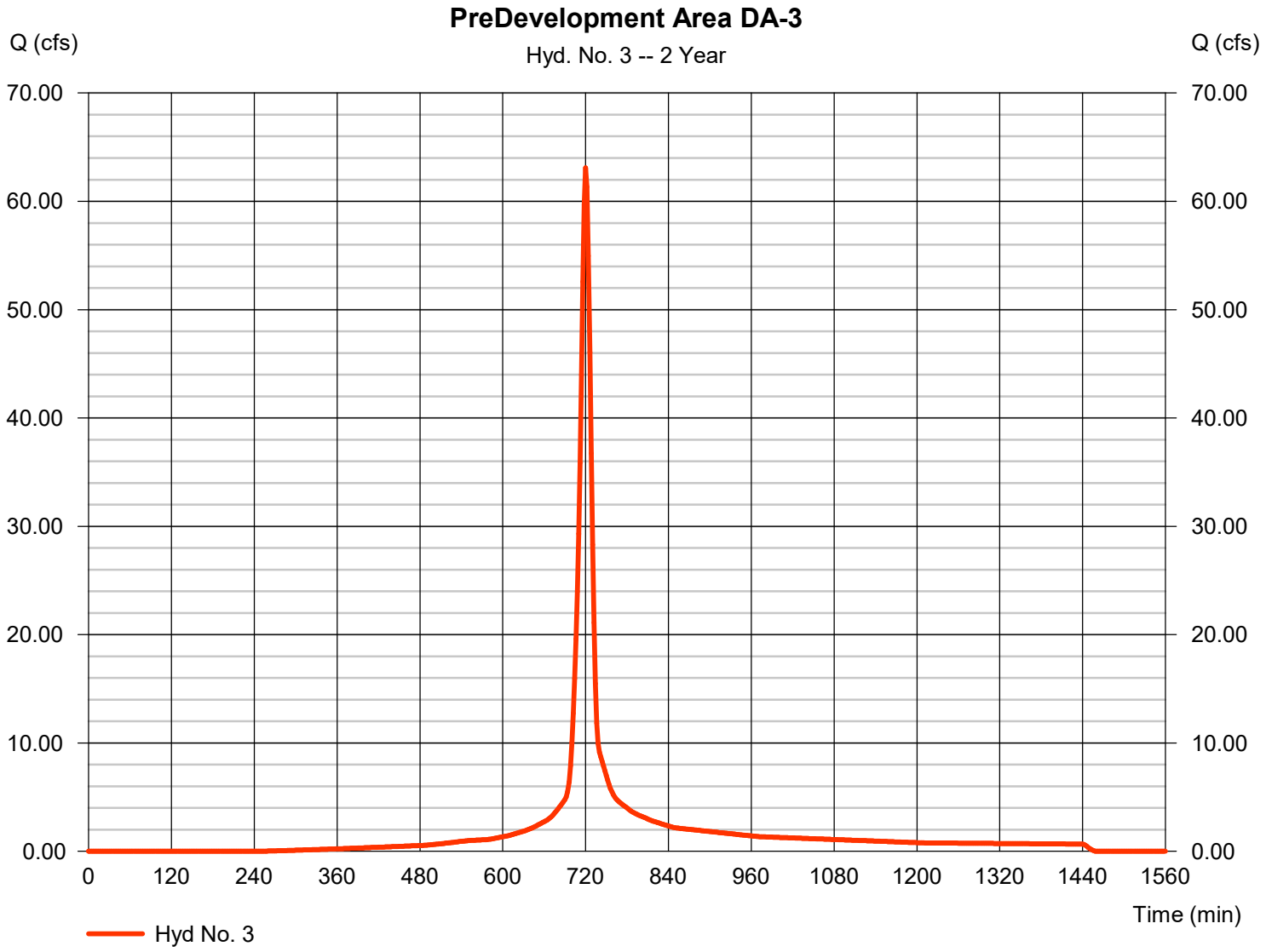
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 63.09 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 169,545 cuft
Drainage area	= 22.500 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 2.65 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 3

PreDevelopment Area DA-3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 4.64**	**+**	**0.00**	**+**	**0.00**	**=**	**4.64**
Shallow Concentrated Flow							
Flow length (ft)	= 685.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=2.49		0.00		0.00		
Travel Time (min)	**= 4.59**	**+**	**0.00**	**+**	**0.00**	**=**	**4.59**
Channel Flow							
X sectional flow area (sqft)	= 0.79		0.00		0.00		
Wetted perimeter (ft)	= 3.14		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=3.92						
			0.00				
					0.00		
Flow length (ft)	({0})970.0		0.0		0.0		
Travel Time (min)	**= 4.12**	**+**	**0.00**	**+**	**0.00**	**=**	**4.12**

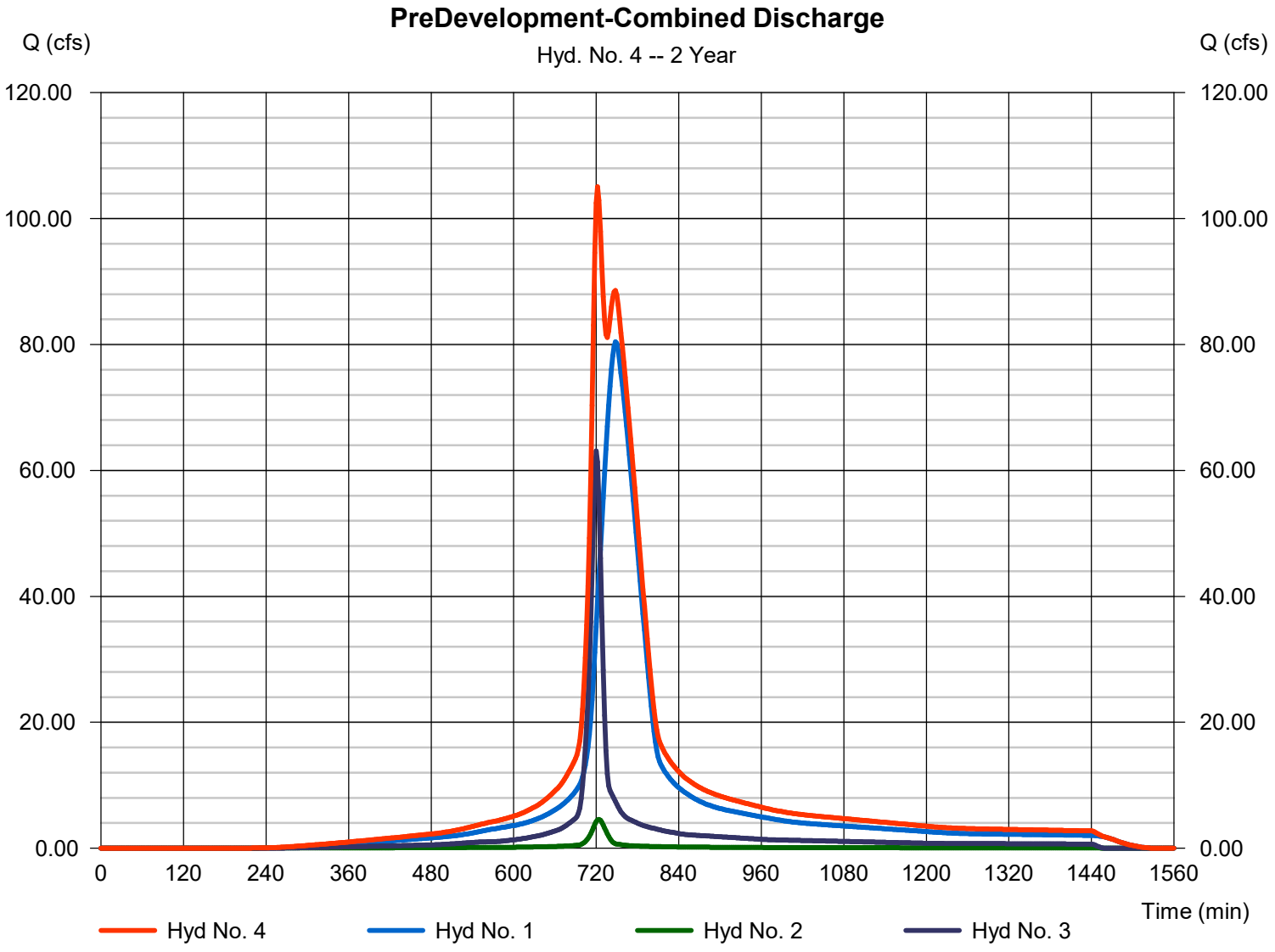
Total Travel Time, Tc ..... 13.30 min

Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	=	Combine	Peak discharge	=	105.07 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	715,034 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	93.500 ac



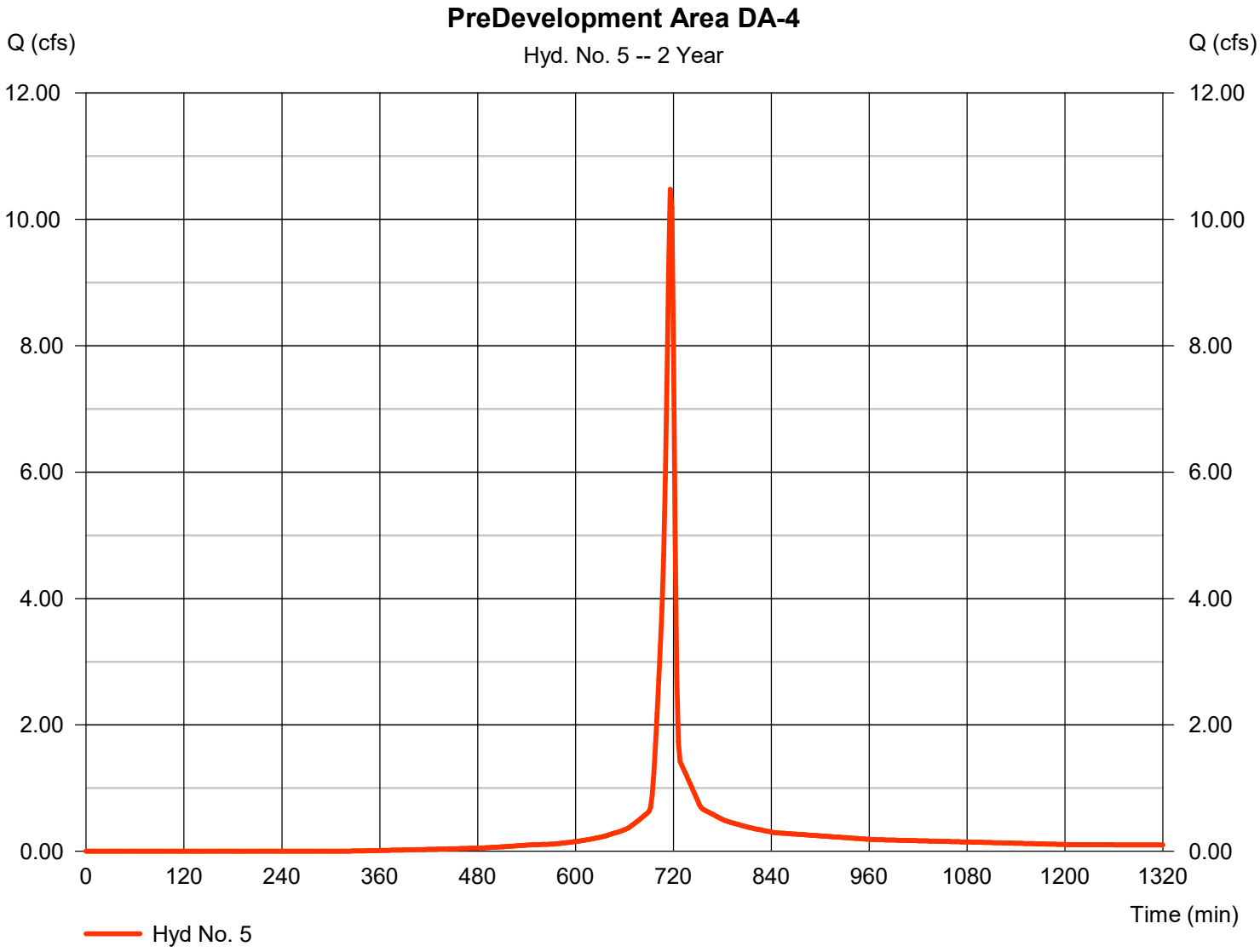
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.47 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	21,827 cuft
Drainage area	=	3.500 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.10 min
Total precip.	=	2.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



TR55 Tc Worksheet

Hyd. No. 5

PreDevelopment Area DA-4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.65		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 4.23**	**+**	**0.00**	**+**	**0.00**	**=**	**4.23**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 7.10		75.00		0.00		
Wetted perimeter (ft)	= 9.40		27.00		0.00		
Channel slope (%)	= 1.00		0.75		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.23						
			17.06				
					0.00		
Flow length (ft)	({0})80.0		765.0		0.0		
Travel Time (min)	**= 0.16**	**+**	**0.75**	**+**	**0.00**	**=**	**0.91**

Total Travel Time, Tc ..... 5.10 min

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	109.14	2	748	728,417	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	6.040	2	724	21,083	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	86.08	2	720	235,555	------	------	------	PreDevelopment Area DA-3
4	Combine	143.49	2	722	985,054	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	14.56	2	716	30,950	------	------	------	PreDevelopment Area DA-4

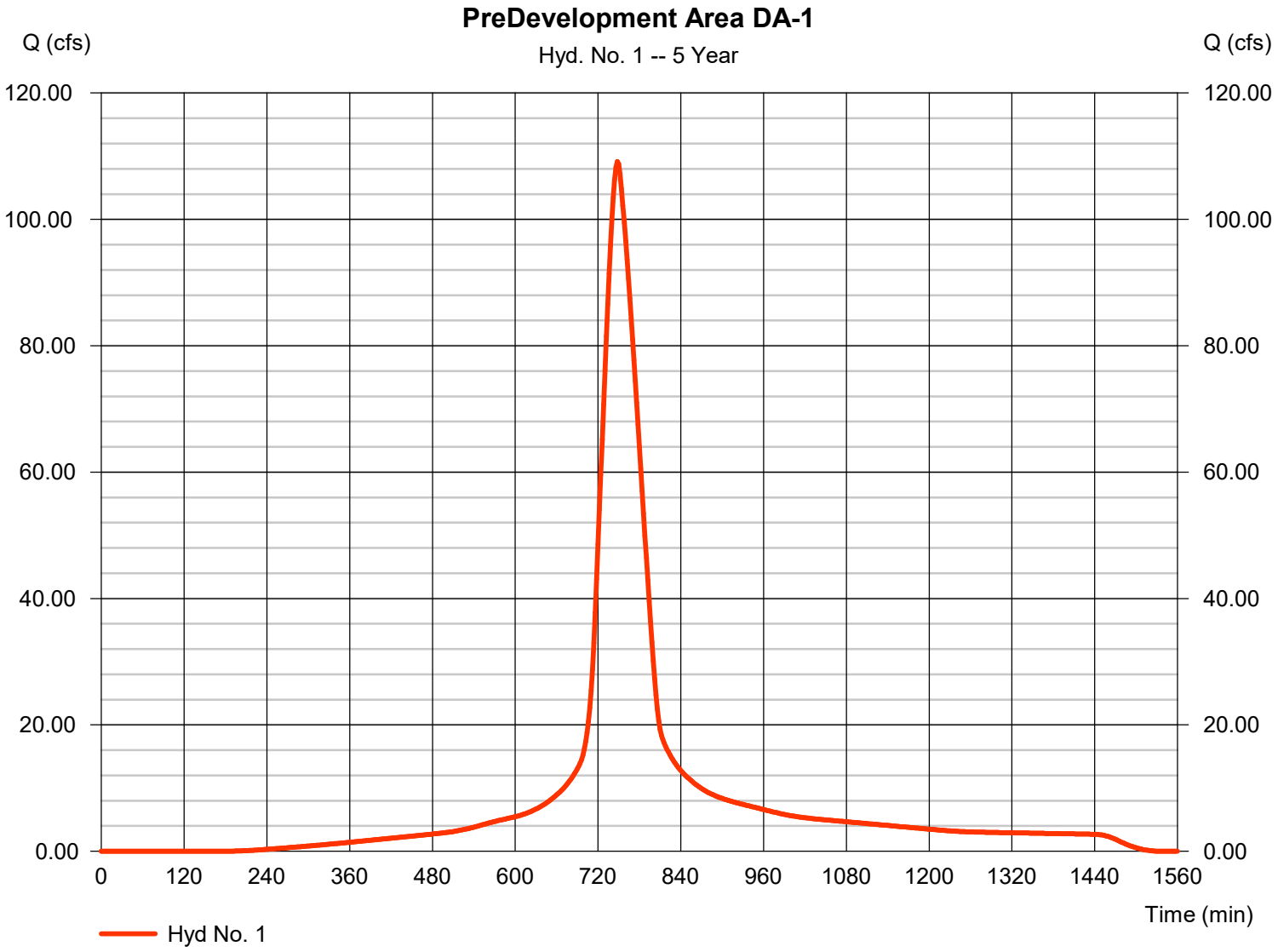
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 109.14 cfs
Storm frequency	= 5 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 728,417 cuft
Drainage area	= 69.200 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 59.50 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



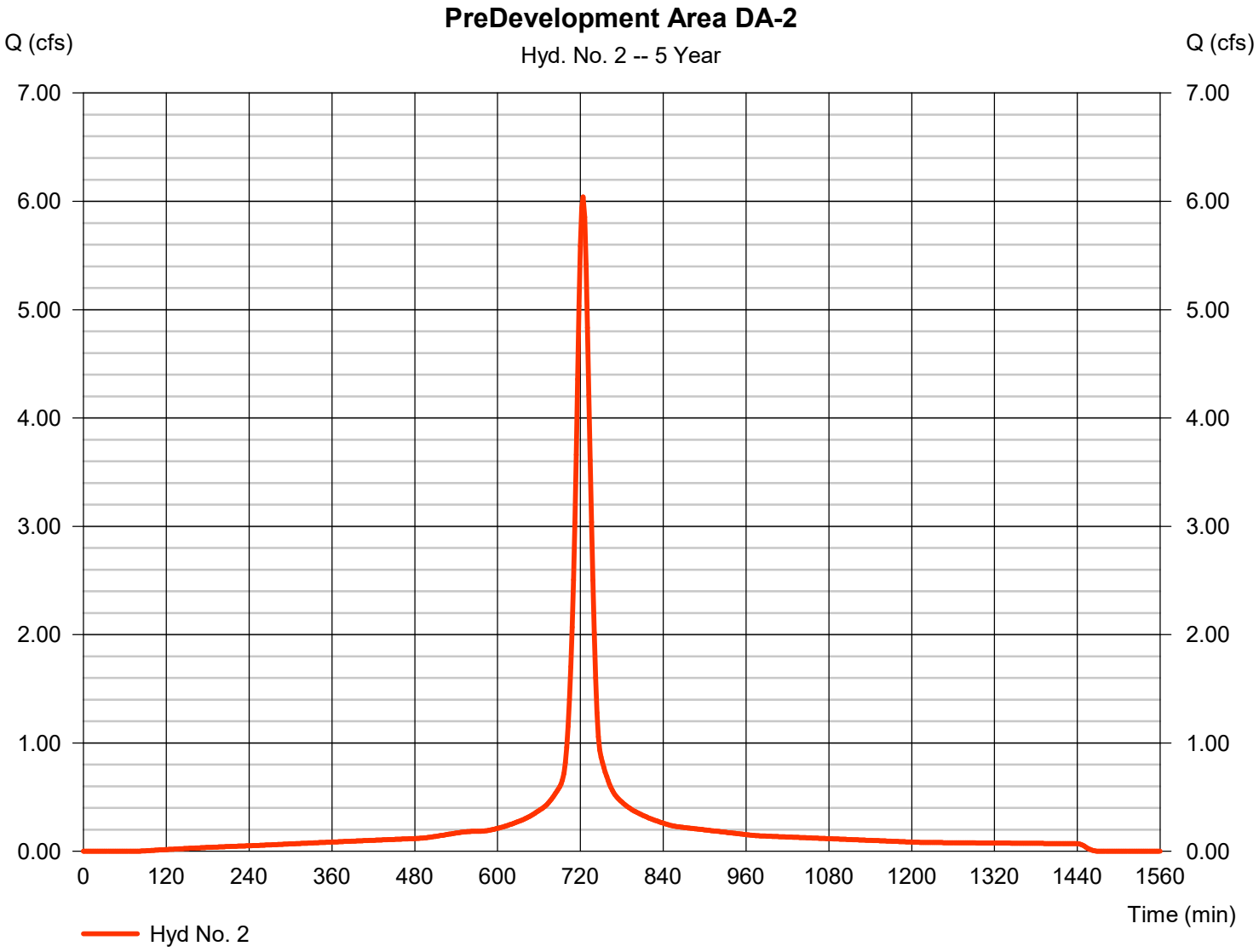
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.040 cfs
Storm frequency	= 5 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 21,083 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



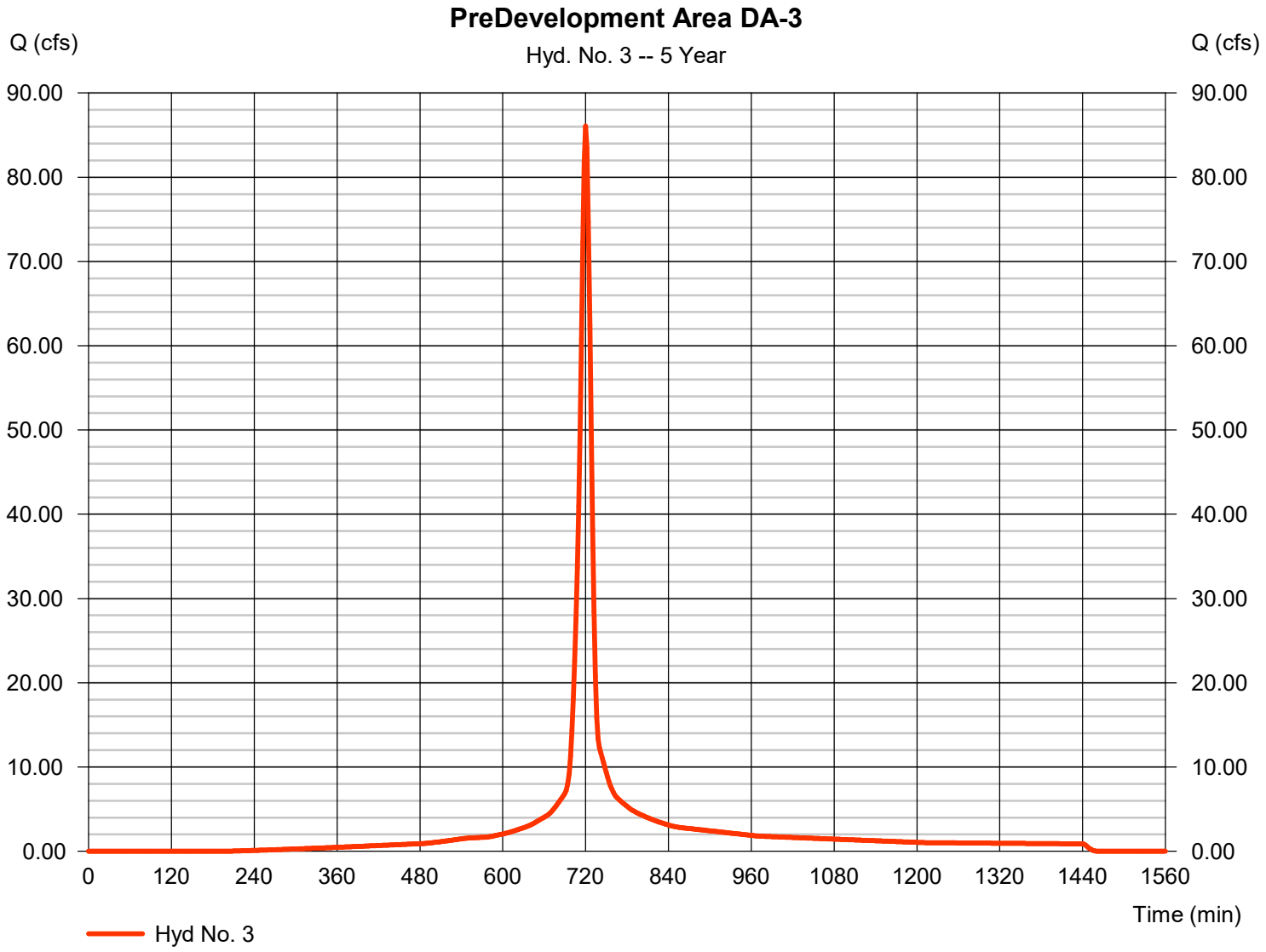
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 86.08 cfs
Storm frequency	= 5 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 235,555 cuft
Drainage area	= 22.500 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500

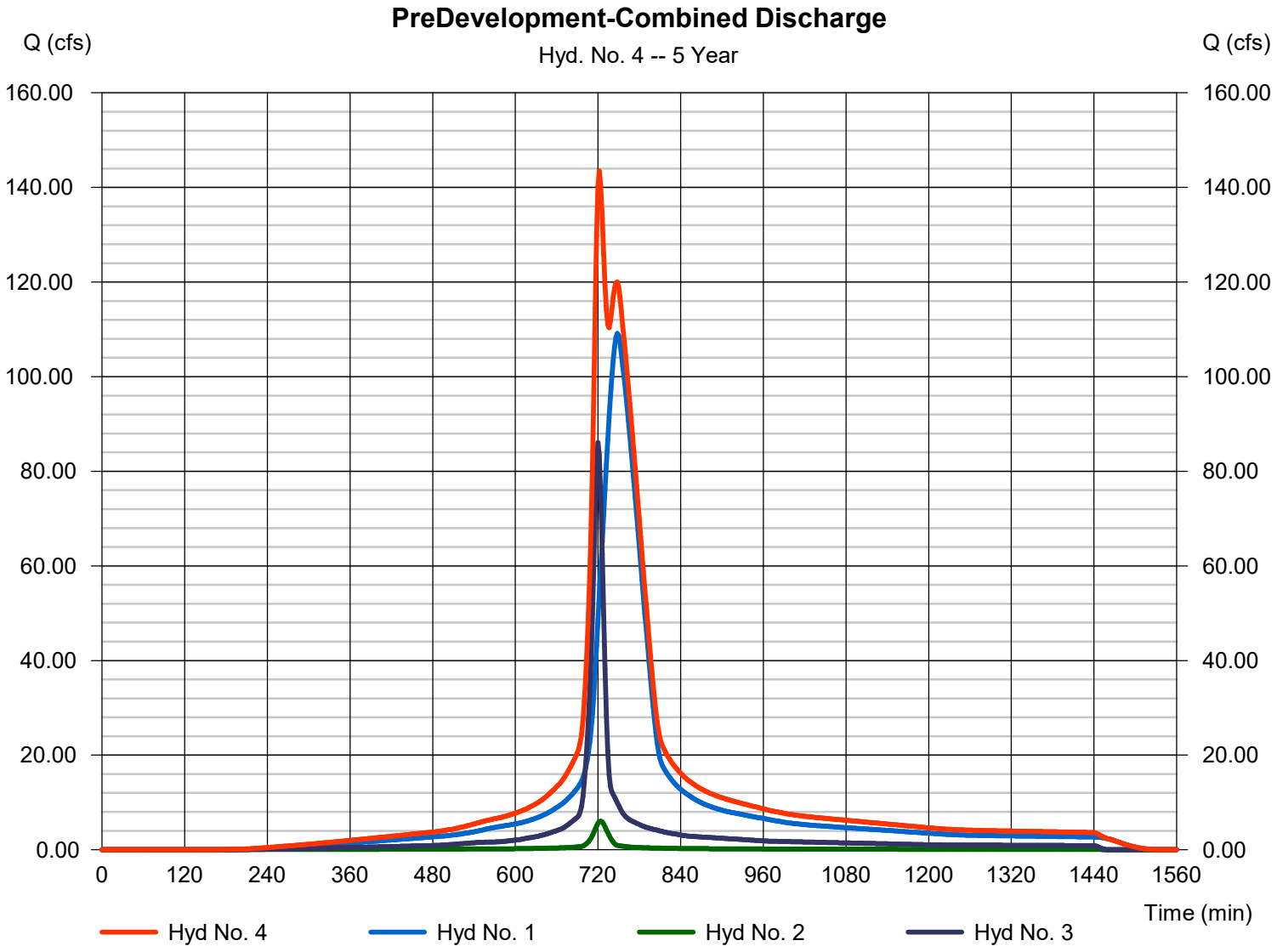


Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	= Combine	Peak discharge	= 143.49 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 985,054 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 93.500 ac



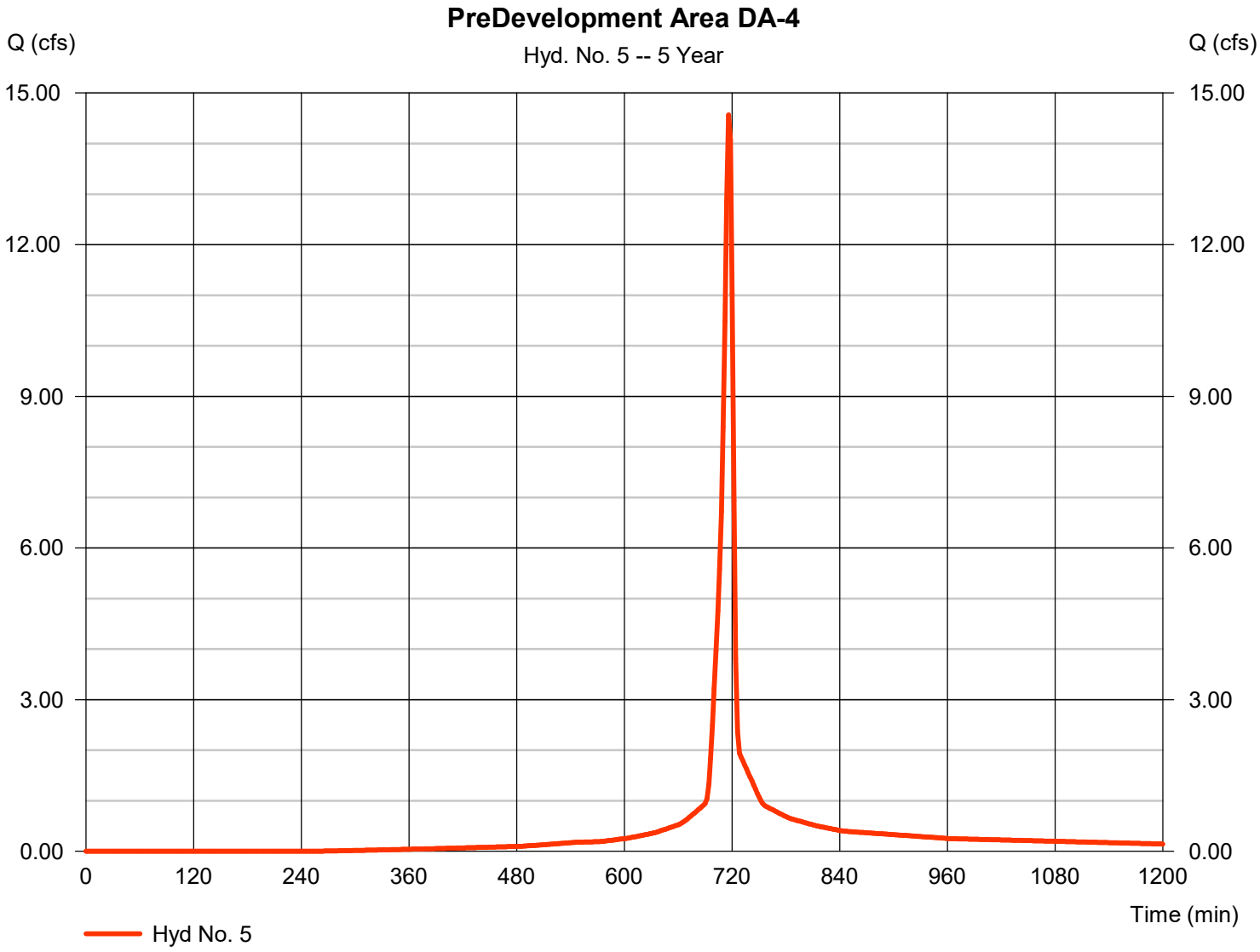
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 14.56 cfs
Storm frequency	= 5 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 30,950 cuft
Drainage area	= 3.500 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.10 min
Total precip.	= 3.46 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	131.67	2	748	886,644	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	7.181	2	724	25,253	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	104.11	2	720	288,260	------	------	------	PreDevelopment Area DA-3
4	Combine	173.64	2	722	1,200,157	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	17.78	2	716	38,284	------	------	------	PreDevelopment Area DA-4

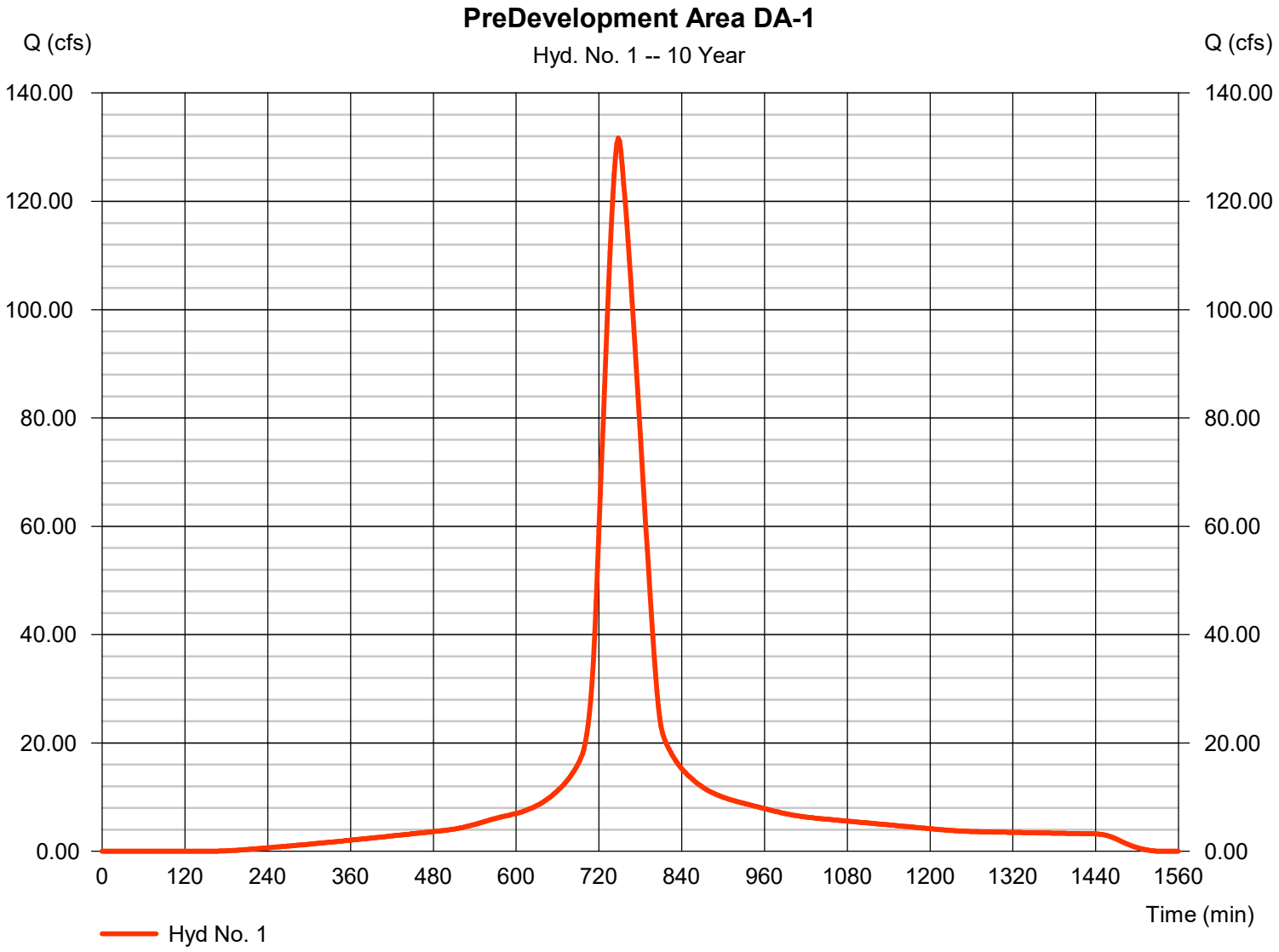
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 131.67 cfs
Storm frequency	= 10 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 886,644 cuft
Drainage area	= 69.200 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 59.50 min
Total precip.	= 4.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



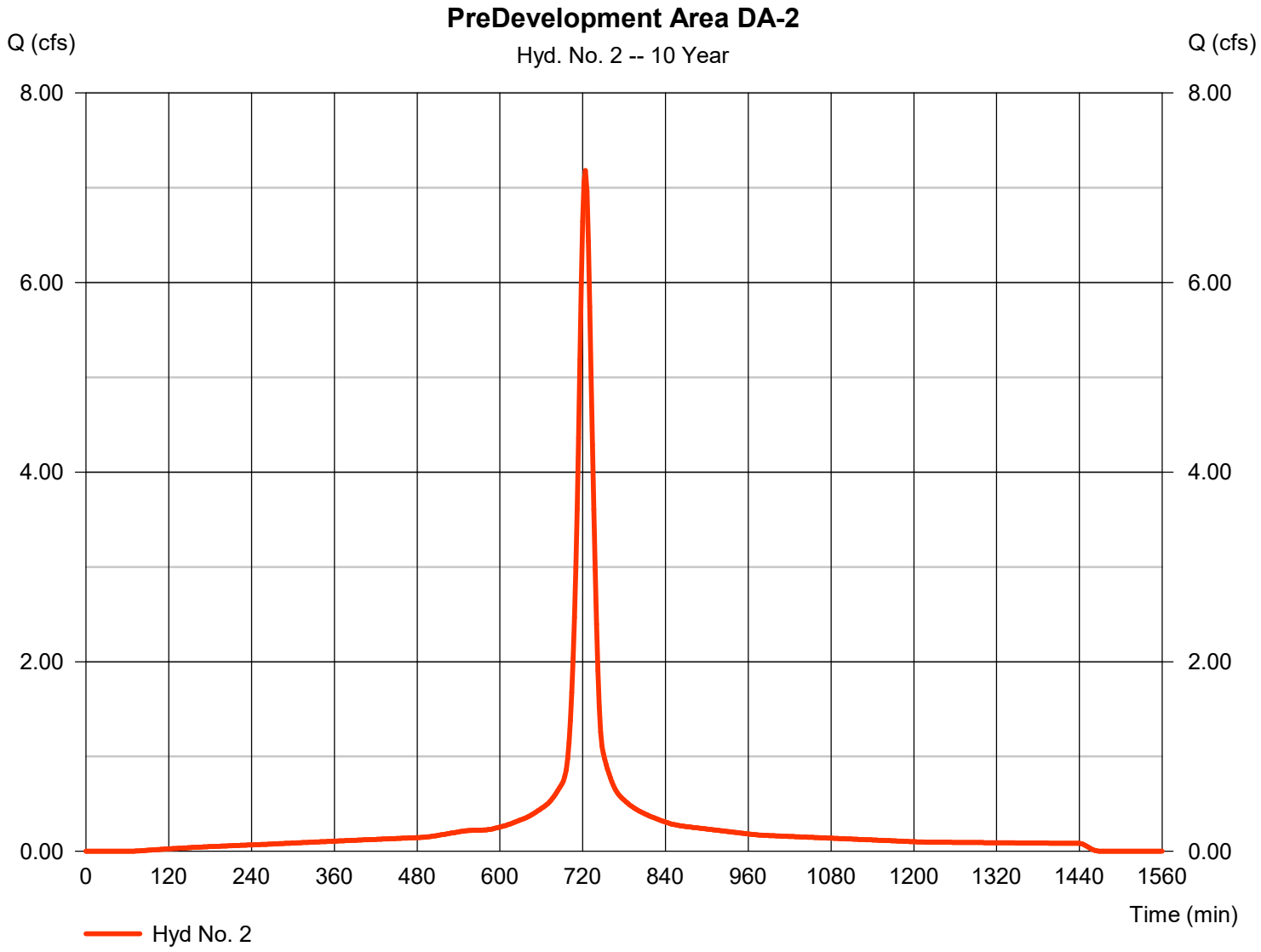
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.181 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 25,253 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 4.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



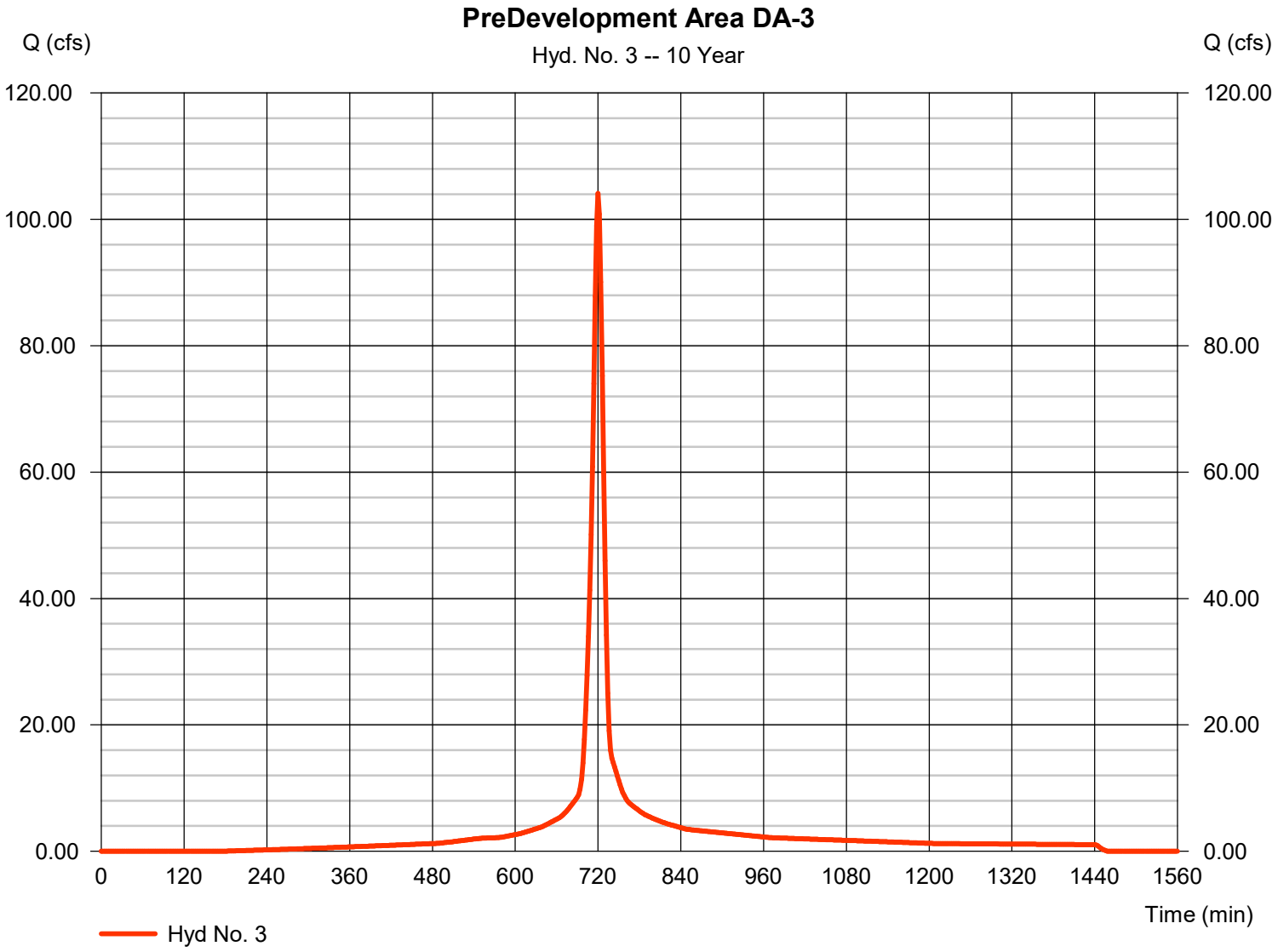
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 104.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 288,260 cuft
Drainage area	= 22.500 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 4.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500

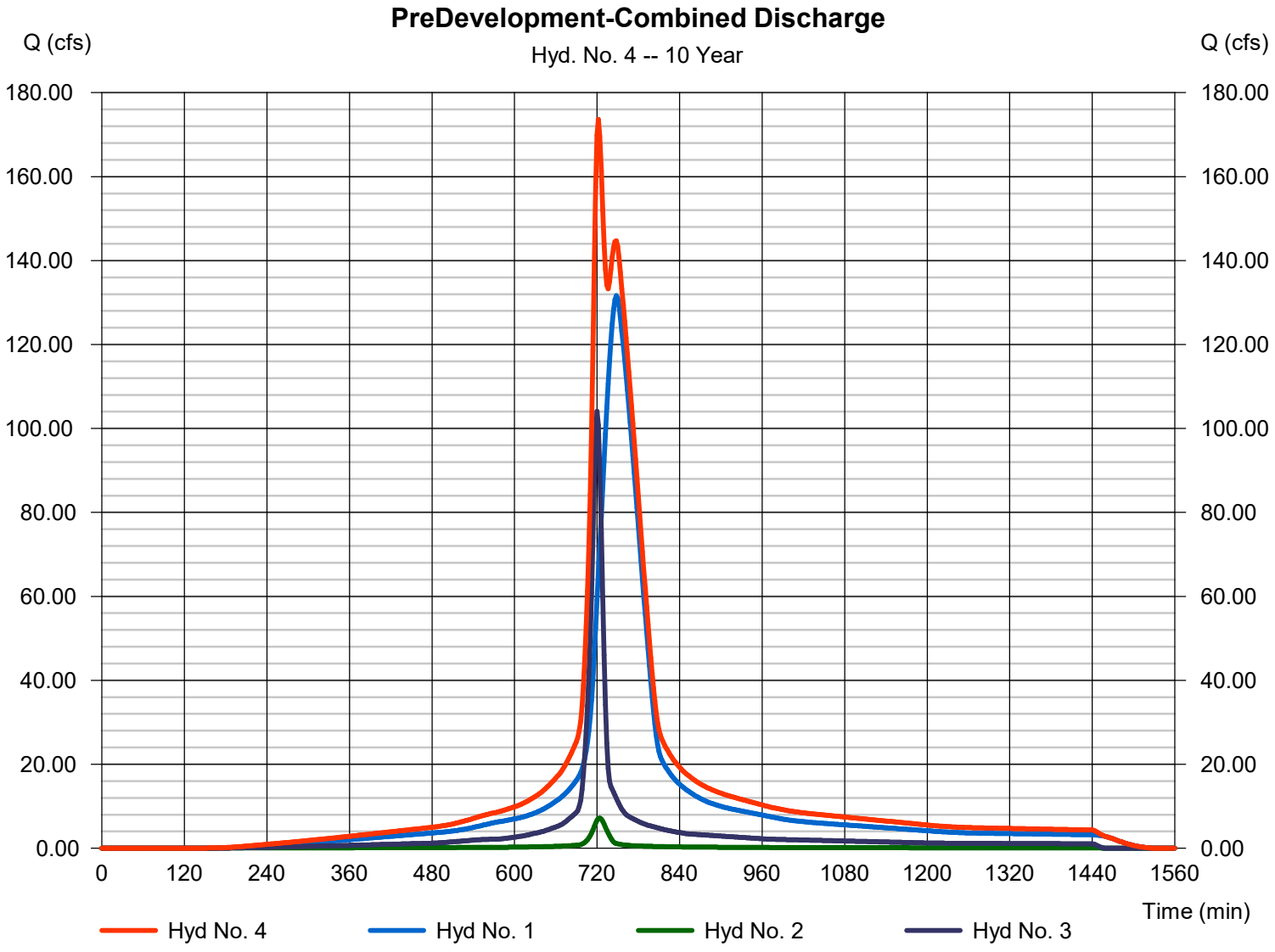


Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	=	Combine	Peak discharge	=	173.64 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,200,157 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	93.500 ac



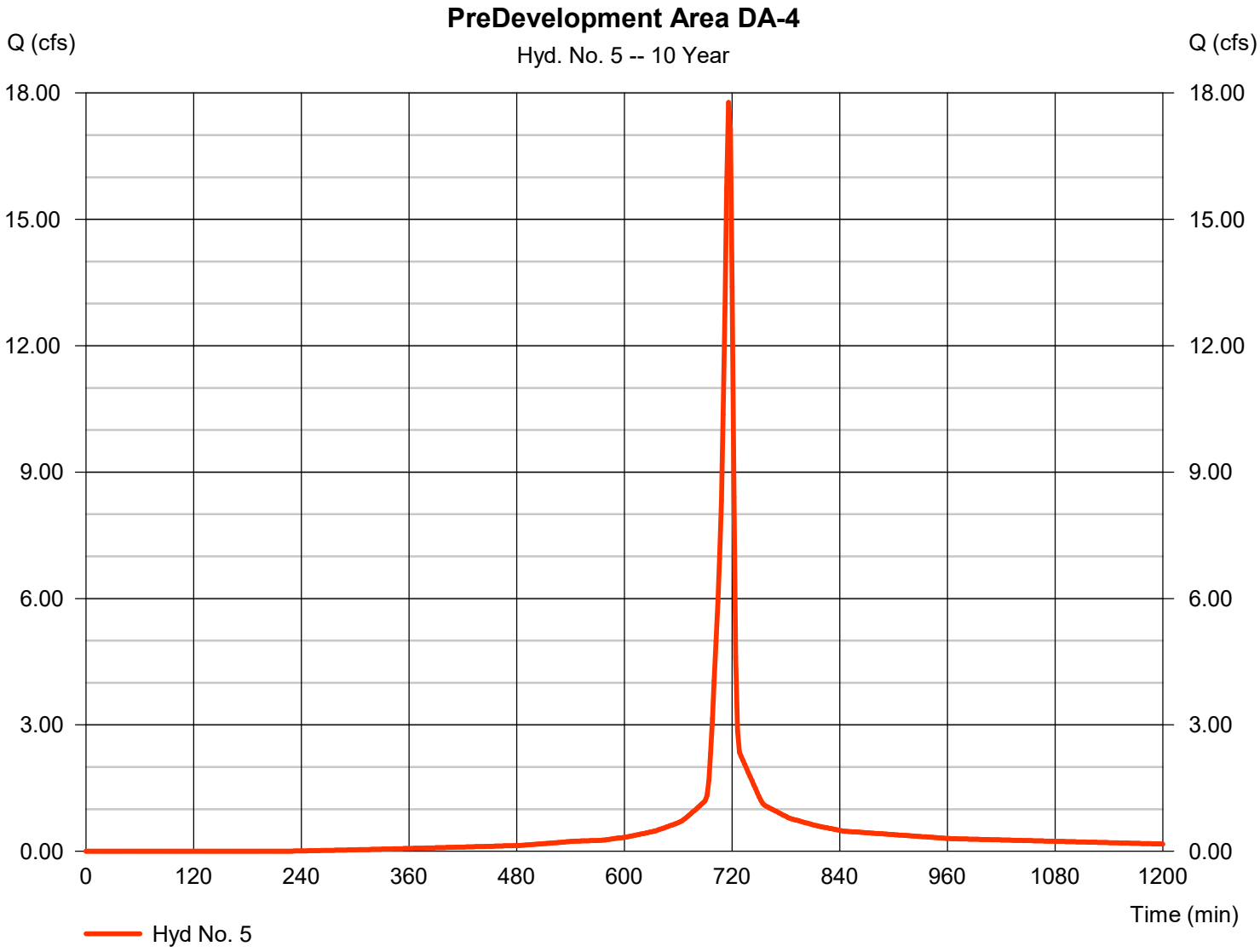
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 17.78 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 38,284 cuft
Drainage area	= 3.500 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.10 min
Total precip.	= 4.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	160.71	2	748	1,092,749	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	8.658	2	724	30,666	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	127.35	2	720	357,034	------	------	------	PreDevelopment Area DA-3
4	Combine	212.52	2	722	1,480,449	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	21.92	2	716	47,893	------	------	------	PreDevelopment Area DA-4

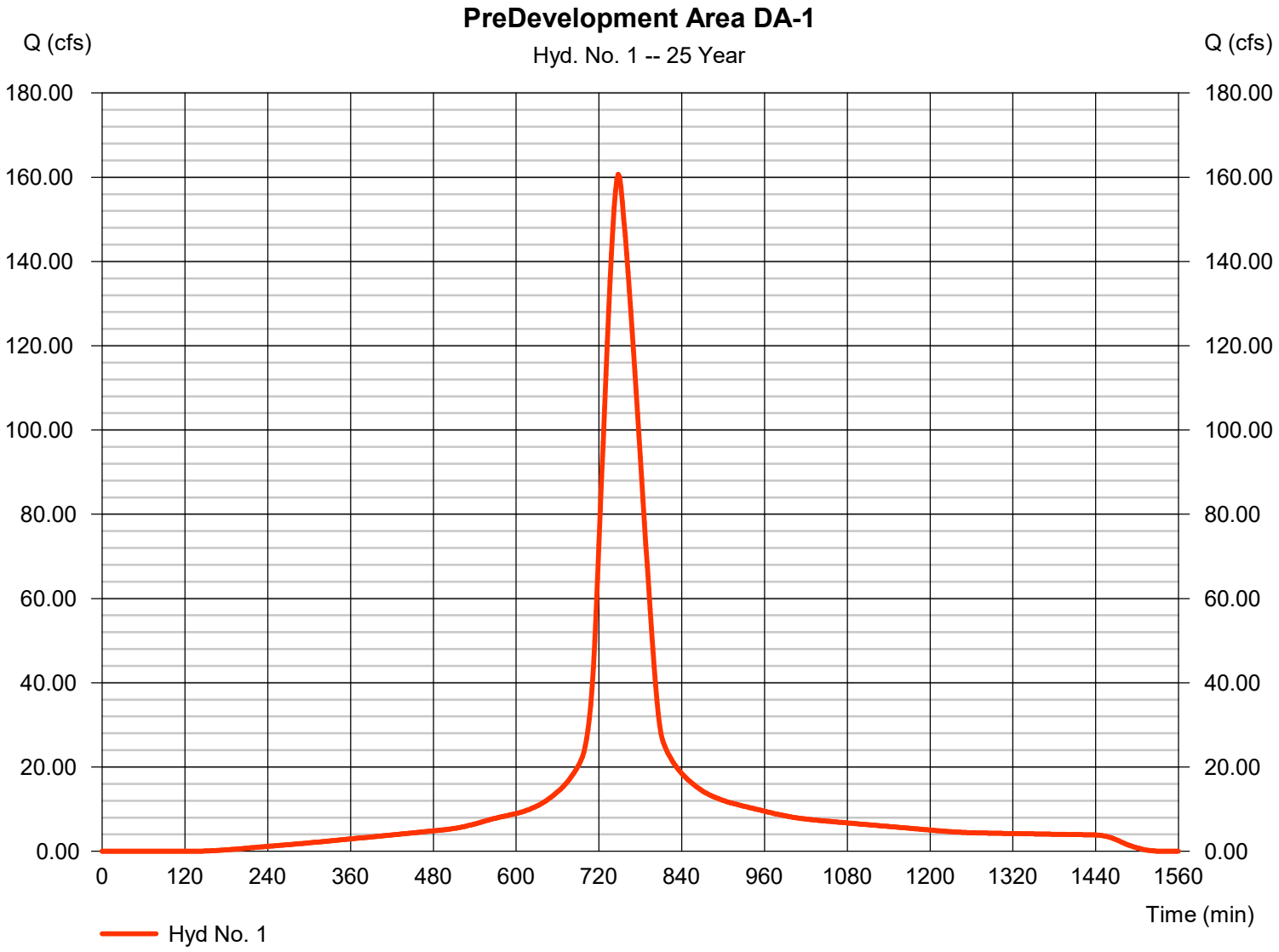
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	160.71 cfs
Storm frequency	=	25 yrs	Time to peak	=	748 min
Time interval	=	2 min	Hyd. volume	=	1,092,749 cuft
Drainage area	=	69.200 ac	Curve number	=	95*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	59.50 min
Total precip.	=	4.93 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



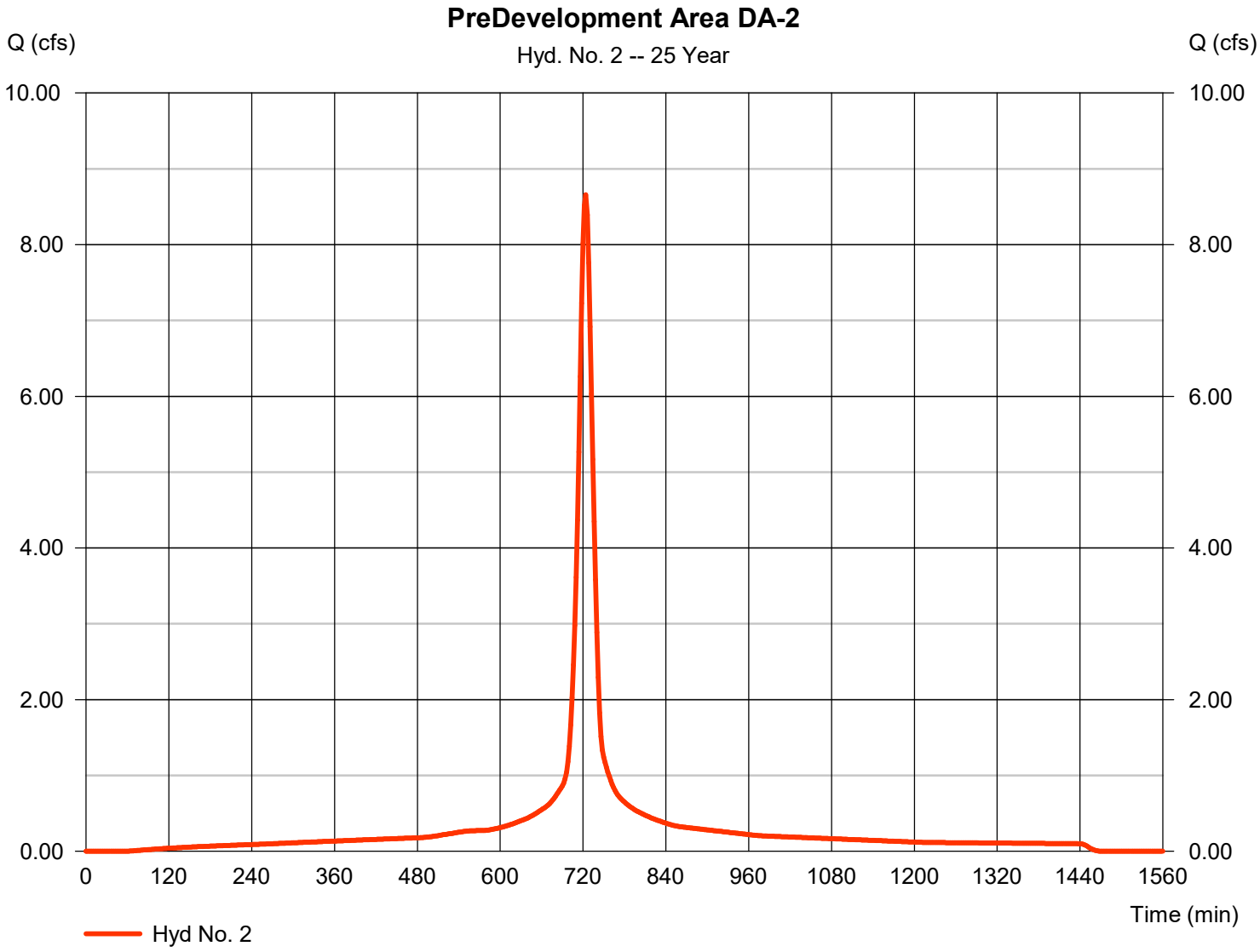
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 8.658 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 30,666 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 4.93 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



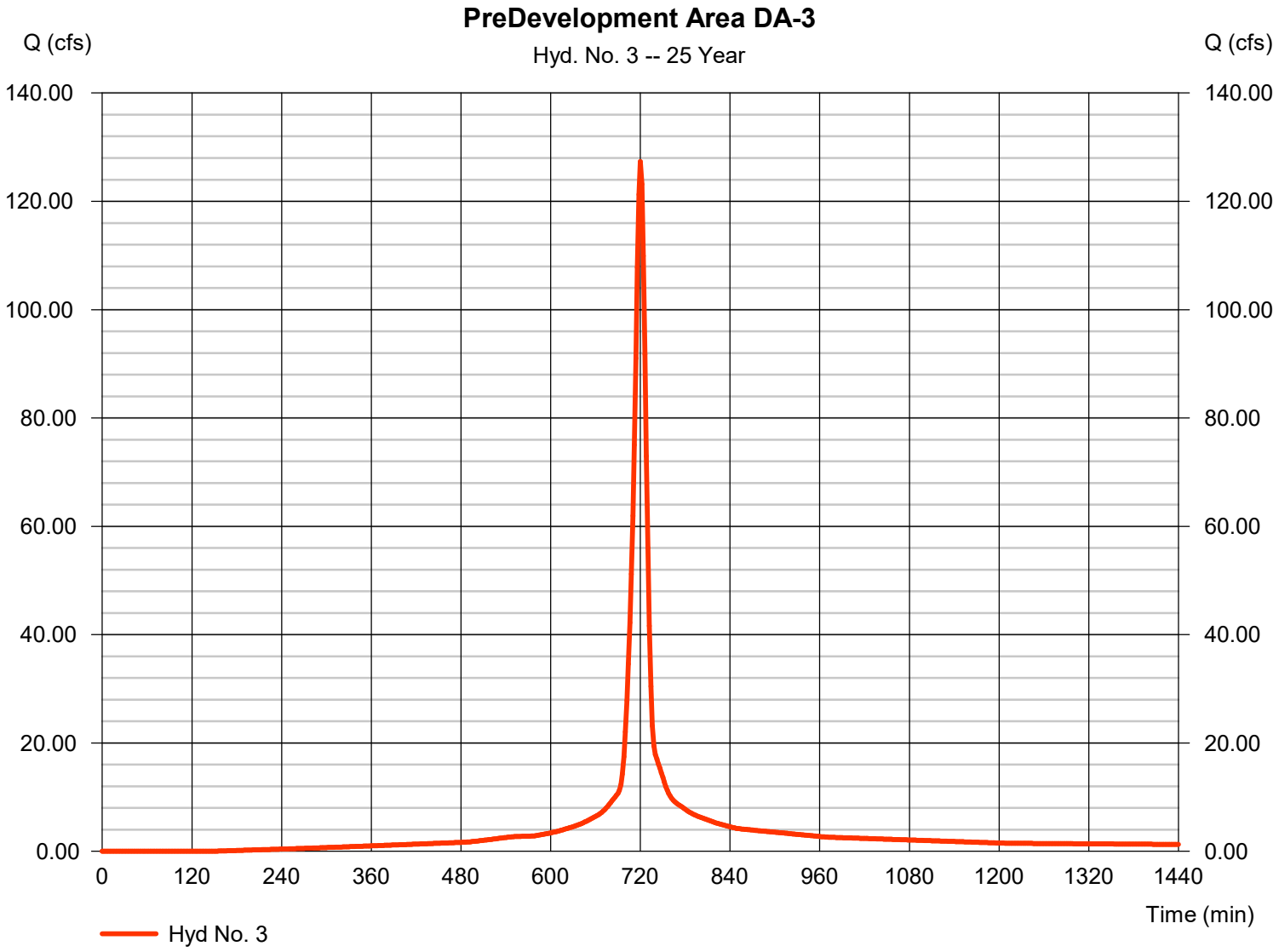
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	127.35 cfs
Storm frequency	=	25 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	357,034 cuft
Drainage area	=	22.500 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.30 min
Total precip.	=	4.93 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500

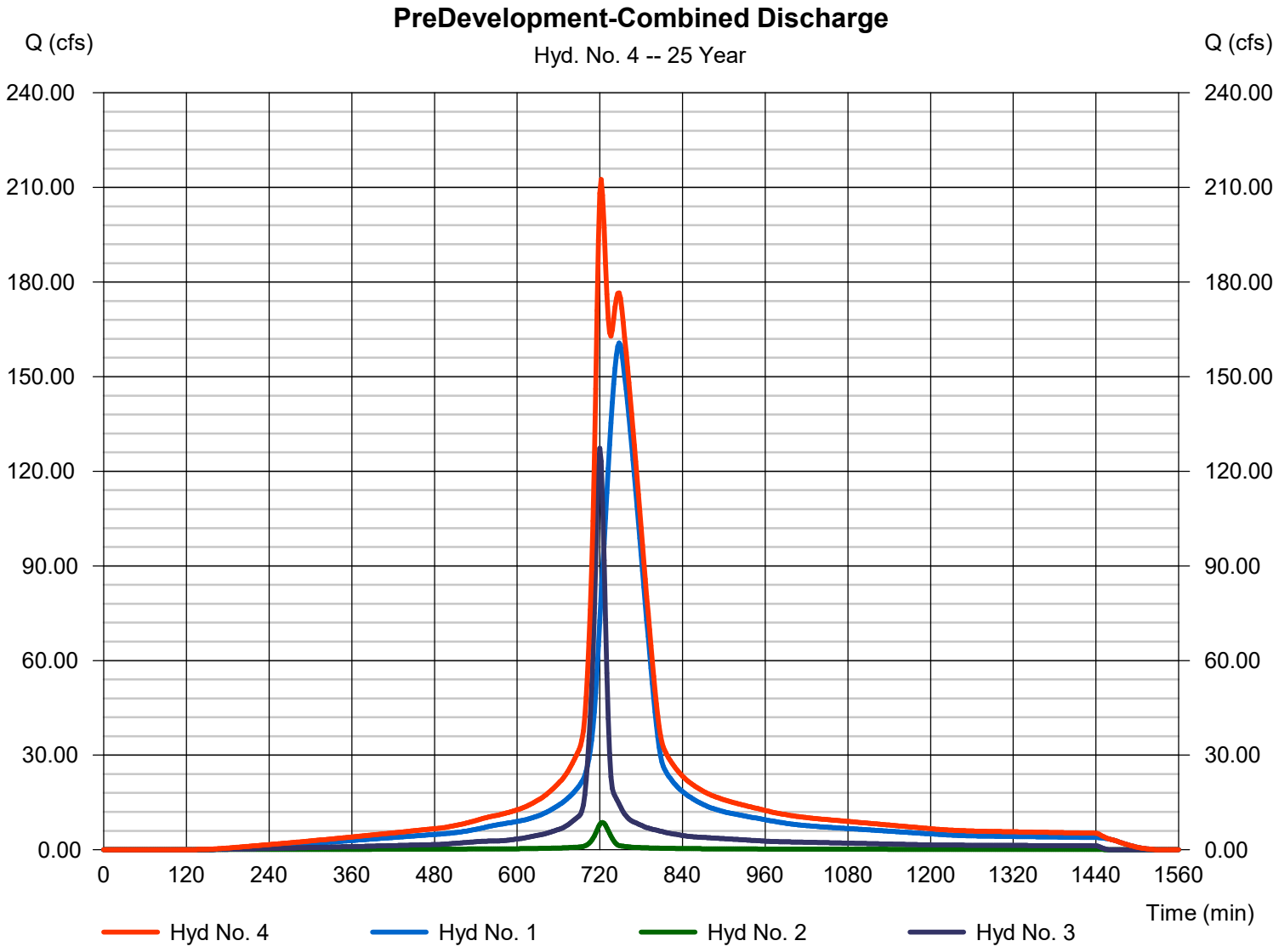


Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	=	Combine	Peak discharge	=	212.52 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,480,449 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	93.500 ac



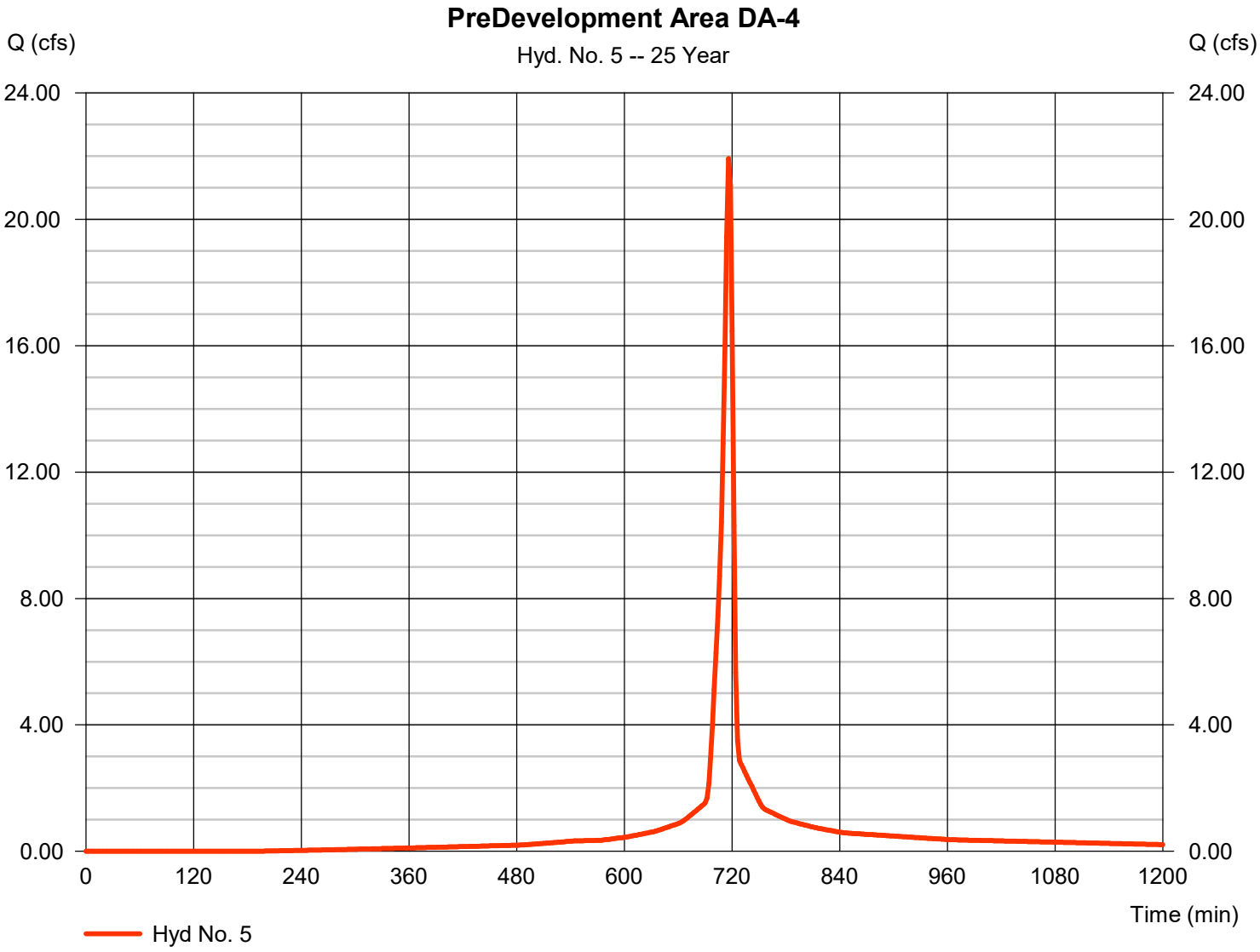
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 21.92 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 47,893 cuft
Drainage area	= 3.500 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.10 min
Total precip.	= 4.93 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	181.95	2	748	1,244,648	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	9.742	2	724	34,646	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	144.34	2	720	407,776	------	------	------	PreDevelopment Area DA-3
4	Combine	240.95	2	722	1,687,071	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	24.95	2	716	55,002	------	------	------	PreDevelopment Area DA-4

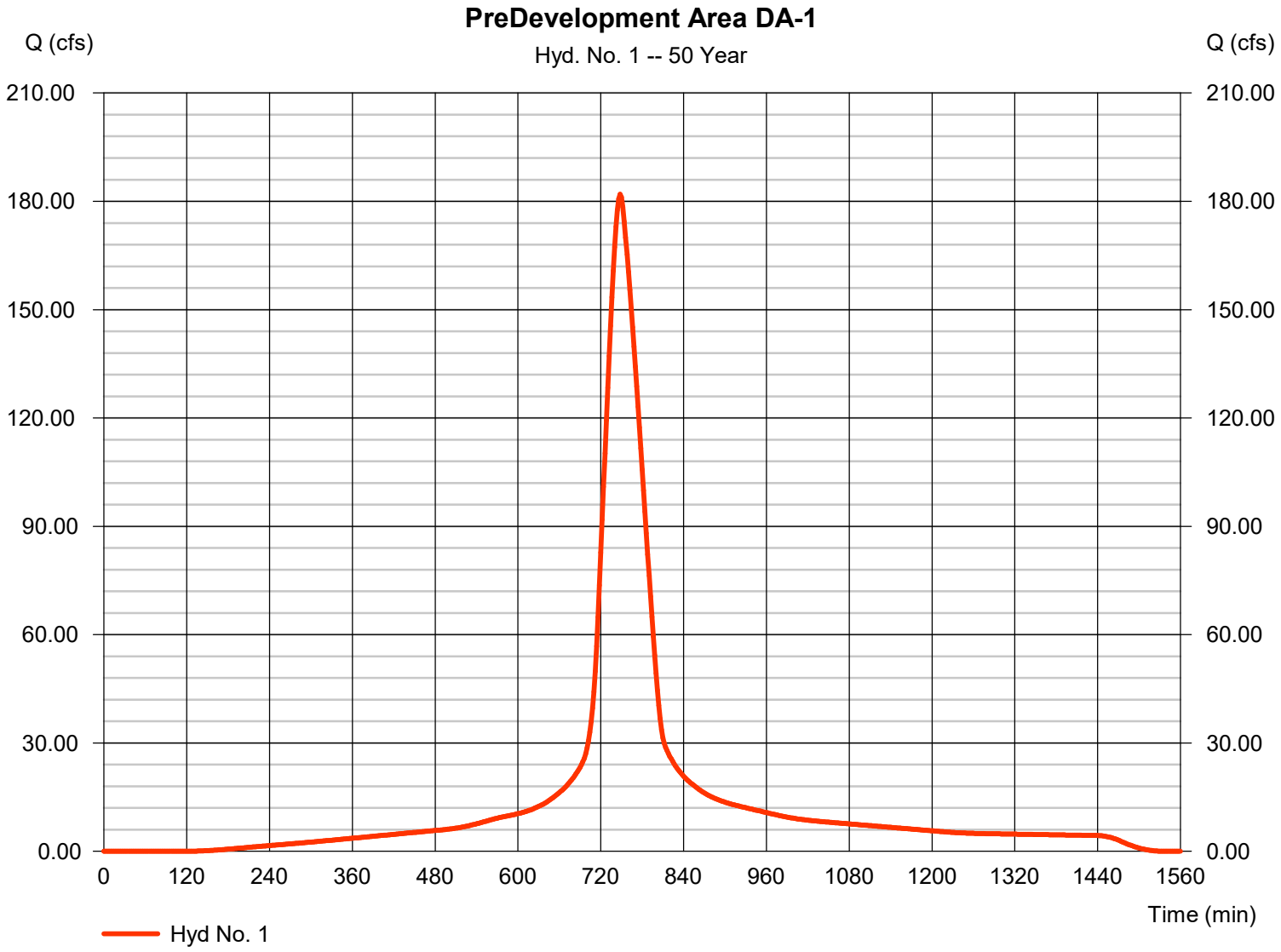
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	= SCS Runoff	Peak discharge	= 181.95 cfs
Storm frequency	= 50 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 1,244,648 cuft
Drainage area	= 69.200 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 59.50 min
Total precip.	= 5.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



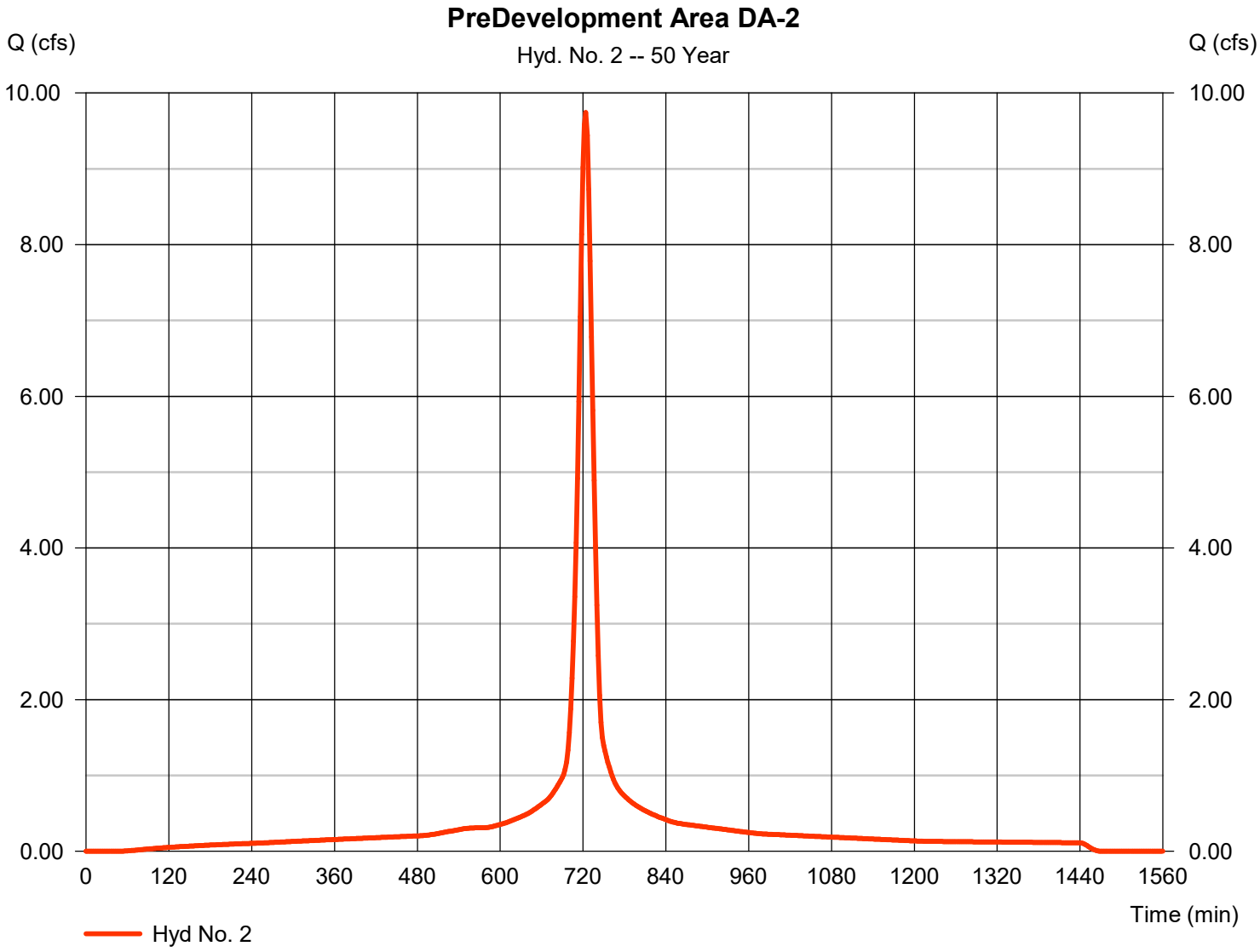
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 9.742 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 34,646 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 5.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



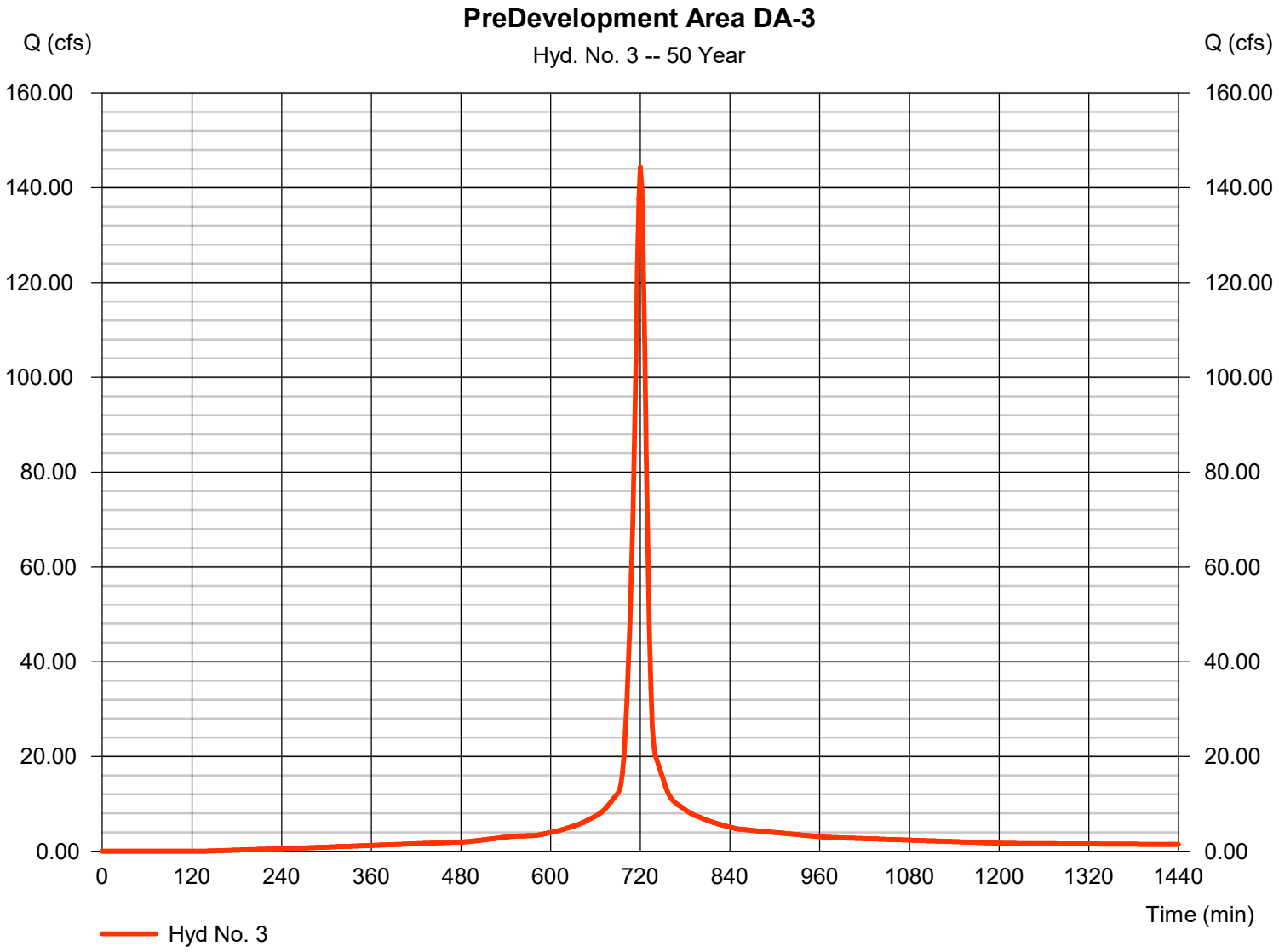
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.34 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	407,776 cuft
Drainage area	=	22.500 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.30 min
Total precip.	=	5.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500

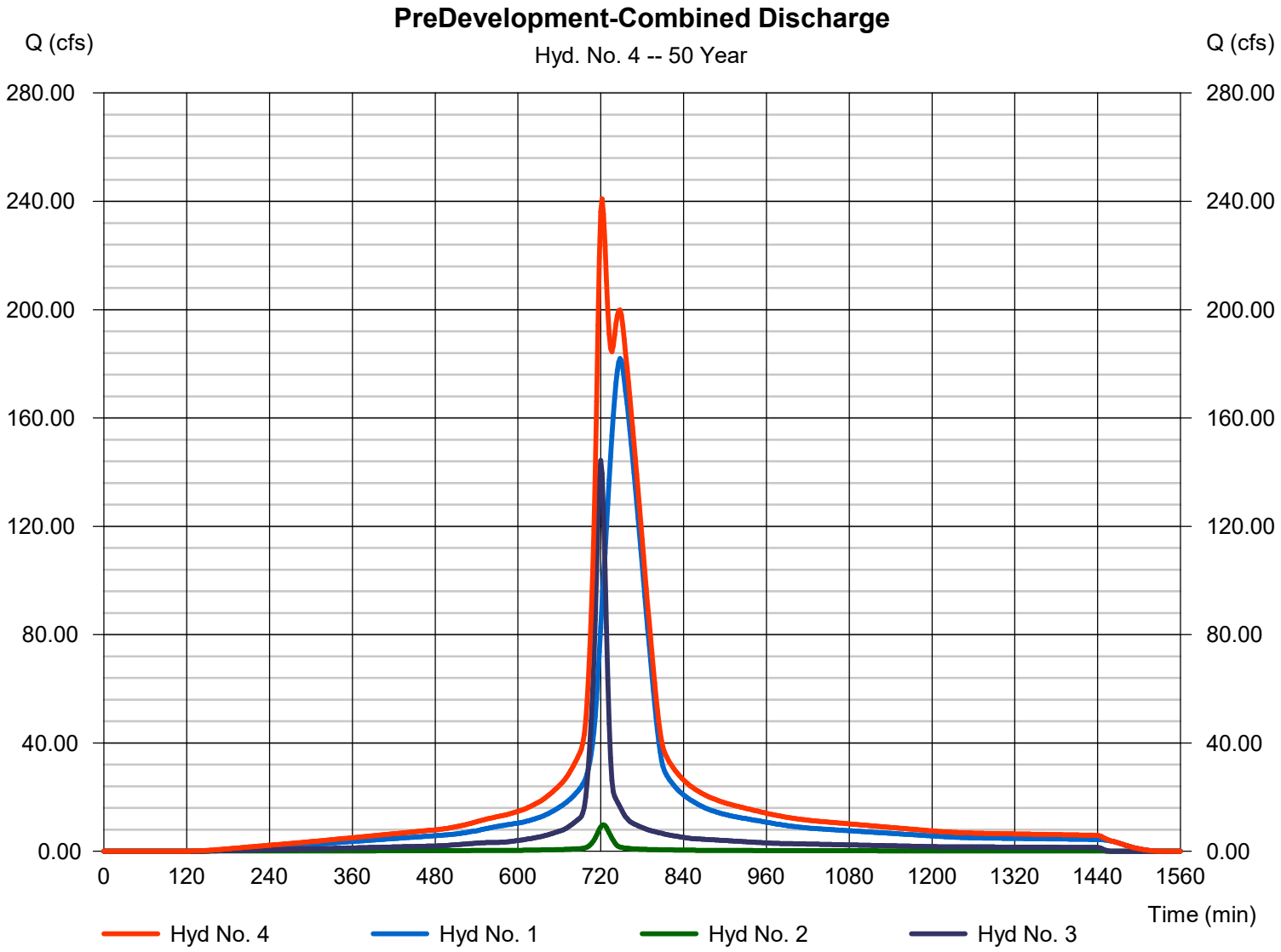


Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	=	Combine	Peak discharge	=	240.95 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,687,071 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	93.500 ac



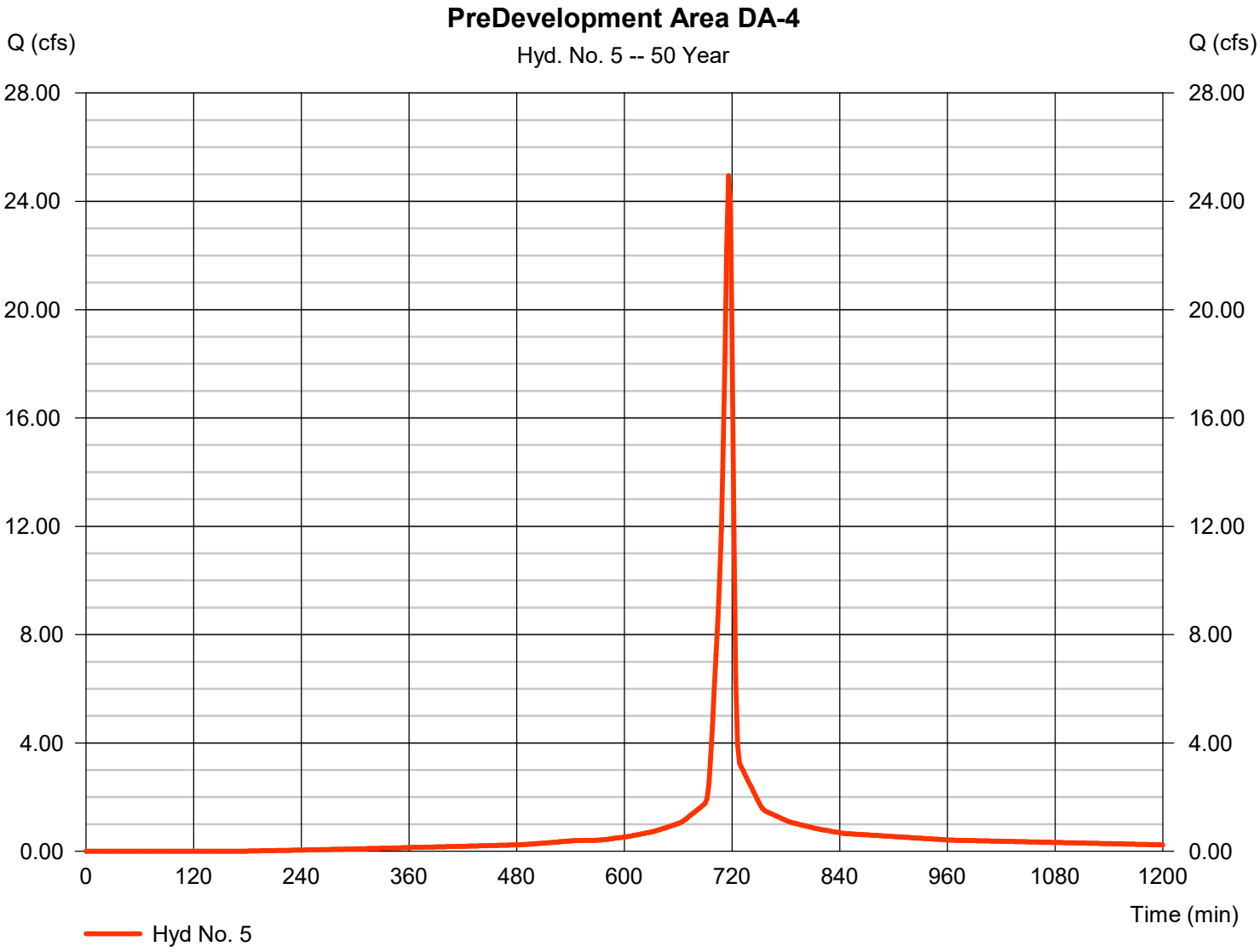
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

Hydrograph type	= SCS Runoff	Peak discharge	= 24.95 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 55,002 cuft
Drainage area	= 3.500 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.10 min
Total precip.	= 5.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	202.78	2	748	1,394,299	------	------	------	PreDevelopment Area DA-1
2	SCS Runoff	10.81	2	724	38,562	------	------	------	PreDevelopment Area DA-2
3	SCS Runoff	160.98	2	720	457,801	------	------	------	PreDevelopment Area DA-3
4	Combine	268.81	2	722	1,890,661	1, 2, 3	------	------	PreDevelopment-Combined Discharg
5	SCS Runoff	27.92	2	716	62,022	------	------	------	PreDevelopment Area DA-4

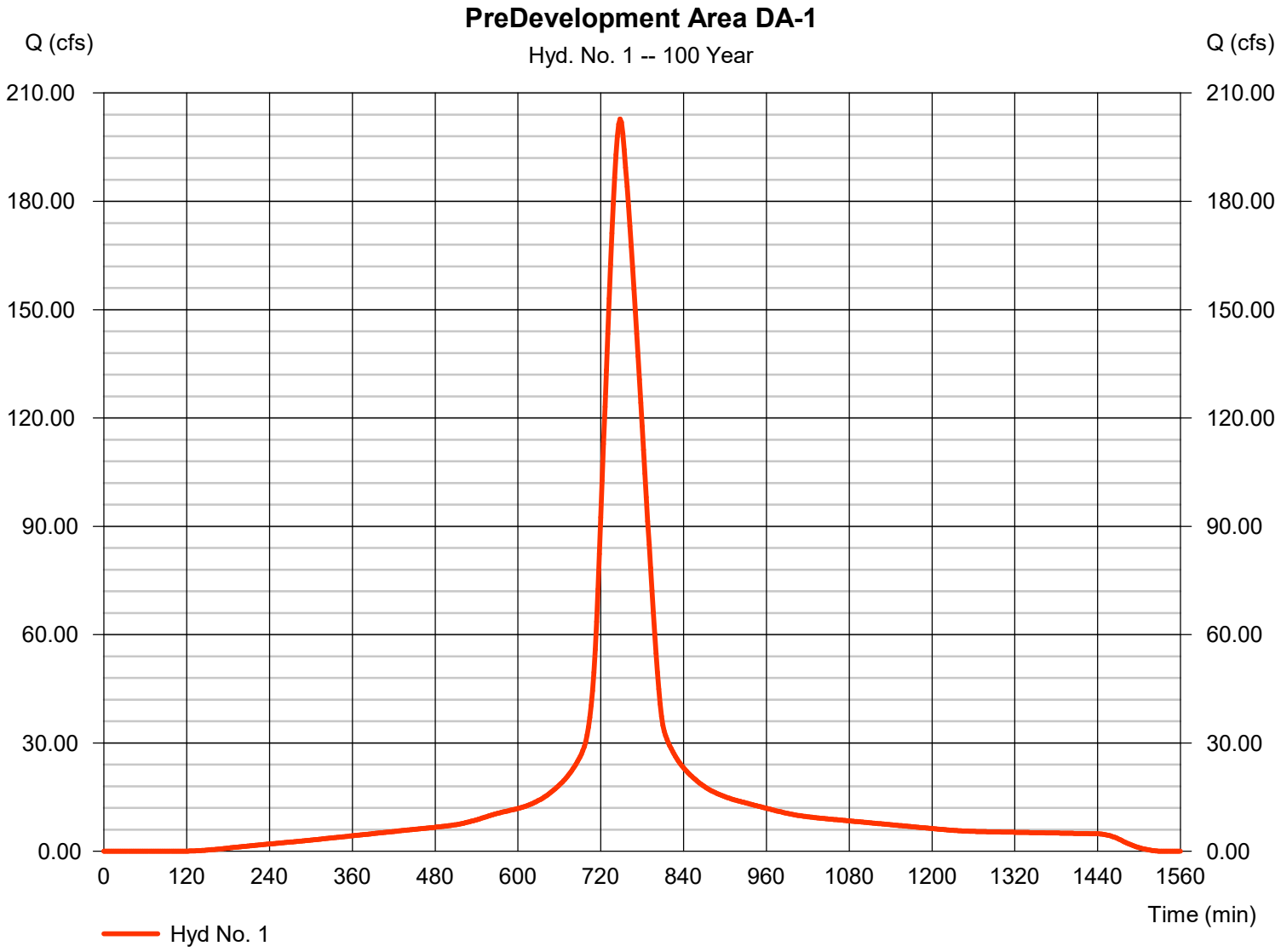
Hydrograph Report

Hyd. No. 1

PreDevelopment Area DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	202.78 cfs
Storm frequency	=	100 yrs	Time to peak	=	748 min
Time interval	=	2 min	Hyd. volume	=	1,394,299 cuft
Drainage area	=	69.200 ac	Curve number	=	95*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	59.50 min
Total precip.	=	6.14 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.000 x 70) + (61.200 x 98)] / 69.200



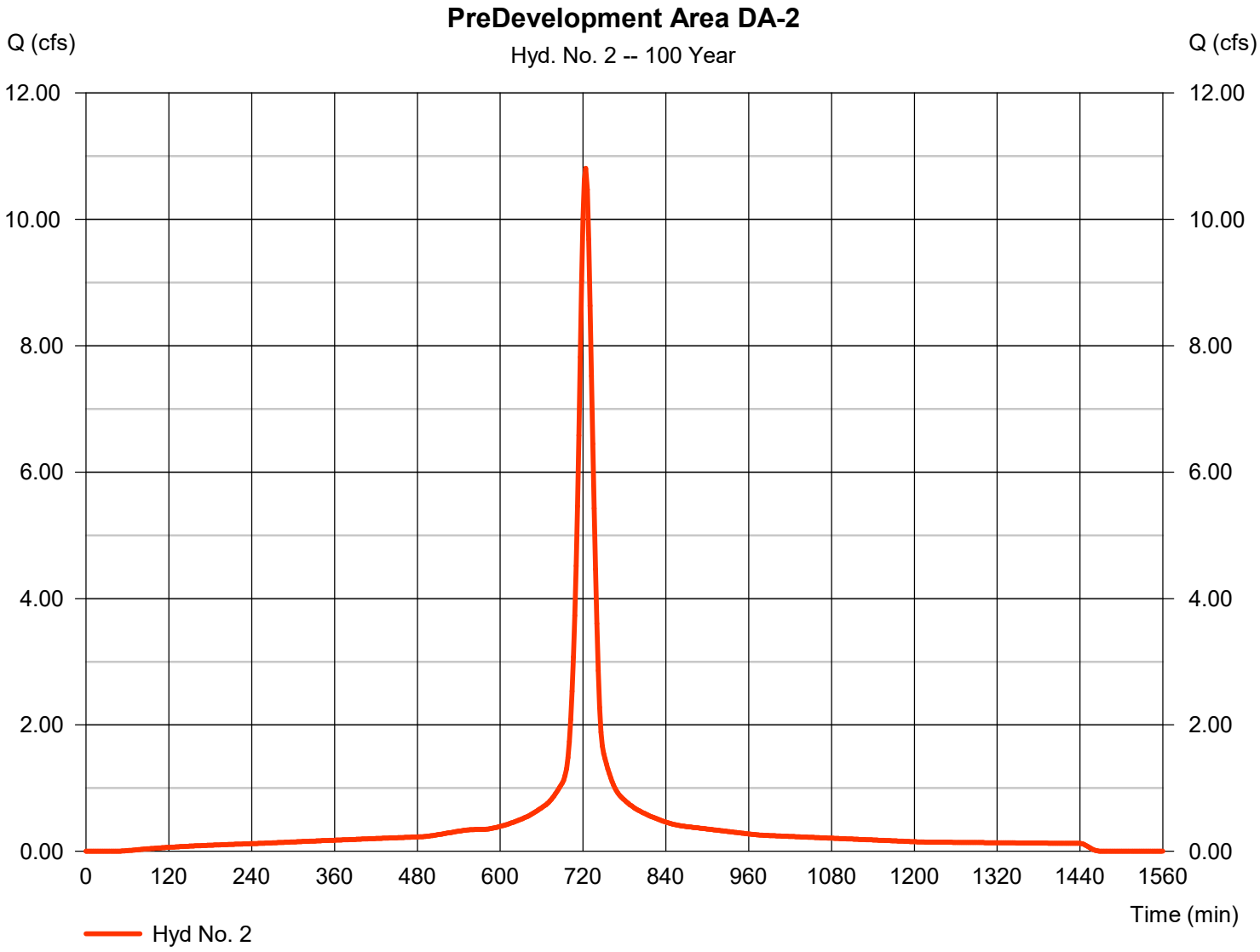
Hydrograph Report

Hyd. No. 2

PreDevelopment Area DA-2

Hydrograph type	= SCS Runoff	Peak discharge	= 10.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 38,562 cuft
Drainage area	= 1.800 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.90 min
Total precip.	= 6.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (1.800 x 98)] / 1.800



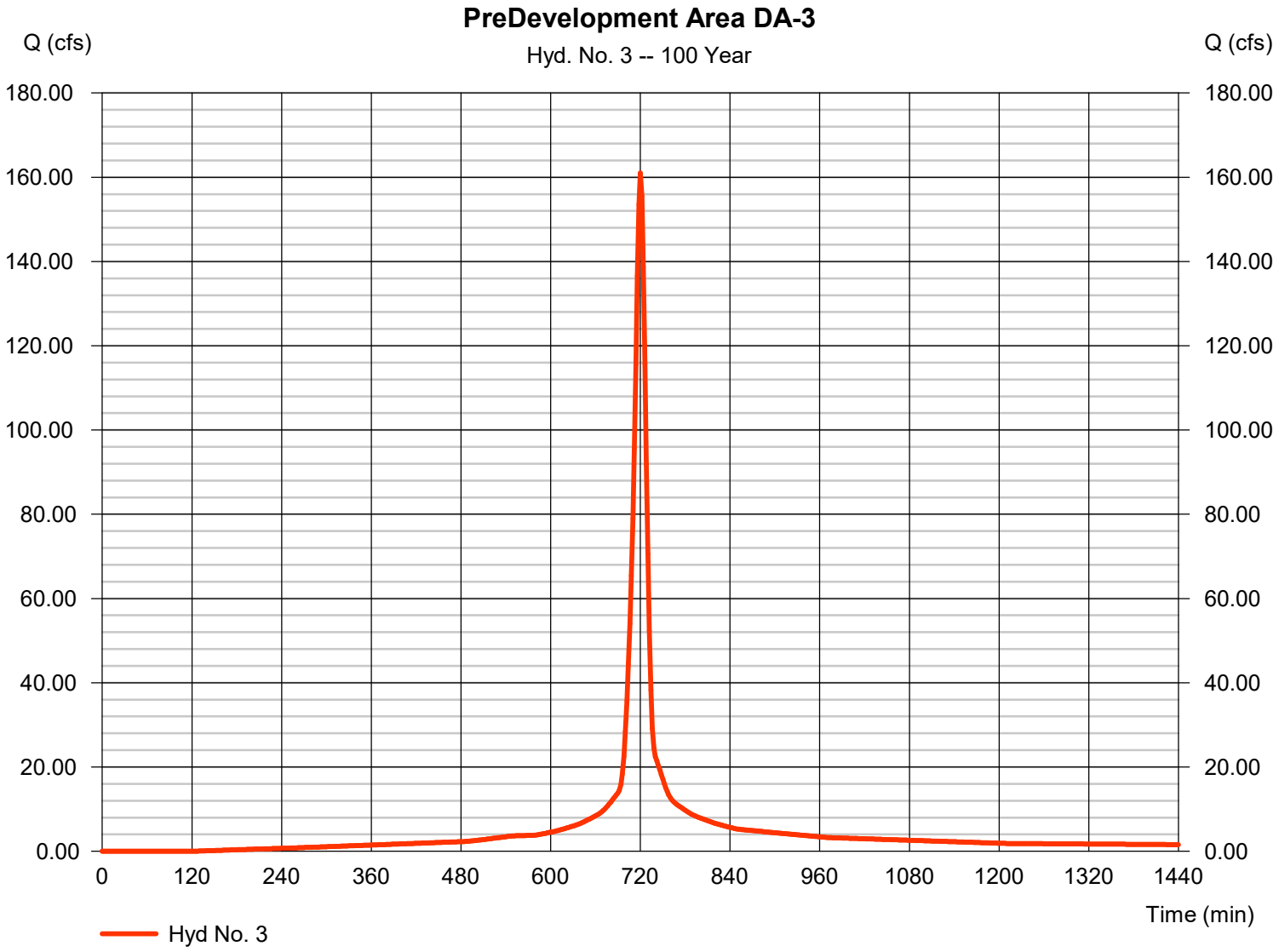
Hydrograph Report

Hyd. No. 3

PreDevelopment Area DA-3

Hydrograph type	= SCS Runoff	Peak discharge	= 160.98 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 457,801 cuft
Drainage area	= 22.500 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 6.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.300 x 70) + (19.200 x 98)] / 22.500

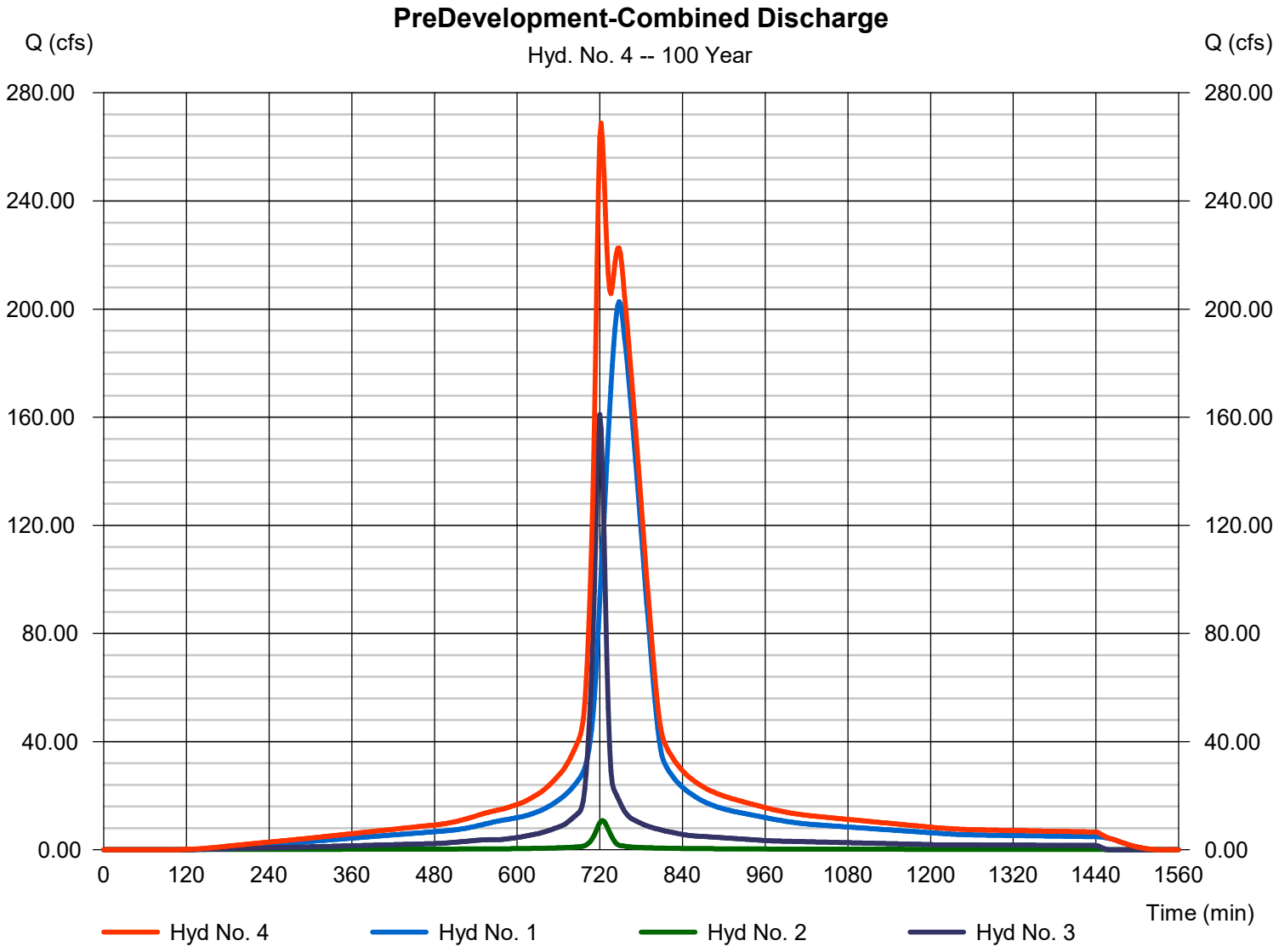


Hydrograph Report

Hyd. No. 4

PreDevelopment-Combined Discharge

Hydrograph type	=	Combine	Peak discharge	=	268.81 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,890,661 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	93.500 ac



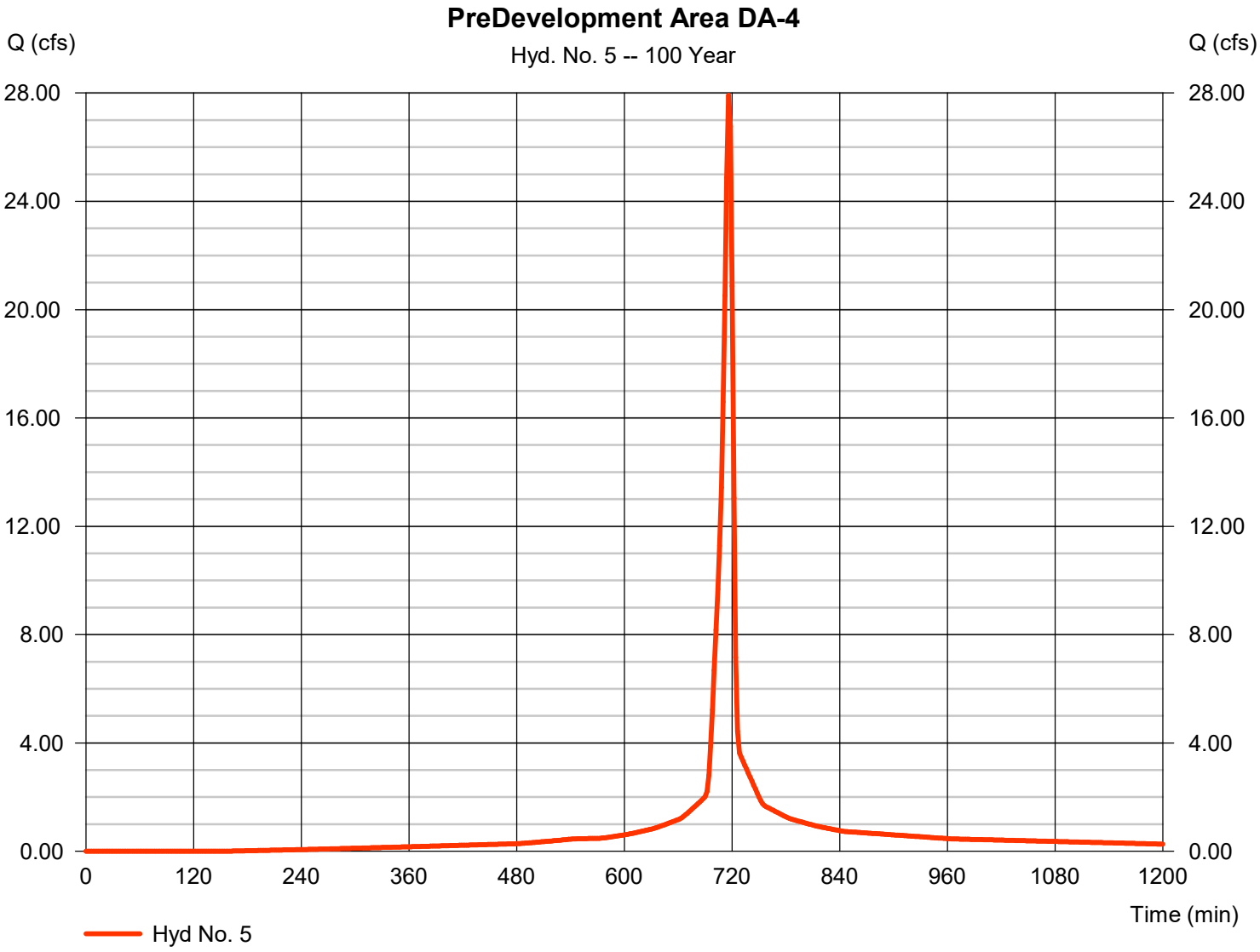
Hydrograph Report

Hyd. No. 5

PreDevelopment Area DA-4

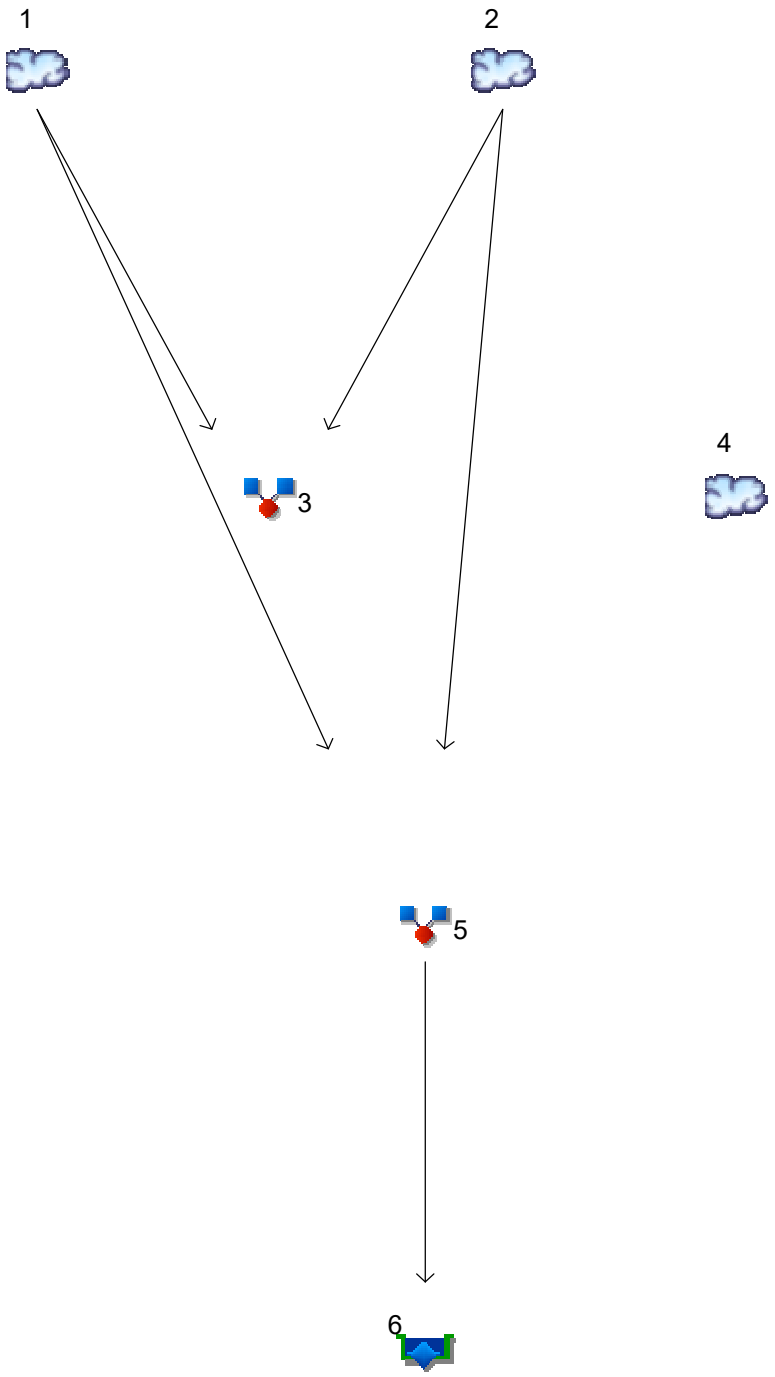
Hydrograph type	= SCS Runoff	Peak discharge	= 27.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 62,022 cuft
Drainage area	= 3.500 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.10 min
Total precip.	= 6.14 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.700 x 98) + (0.800 x 70)] / 3.500



APPENDIX ‘B’

Watershed Model Schematic



Legend

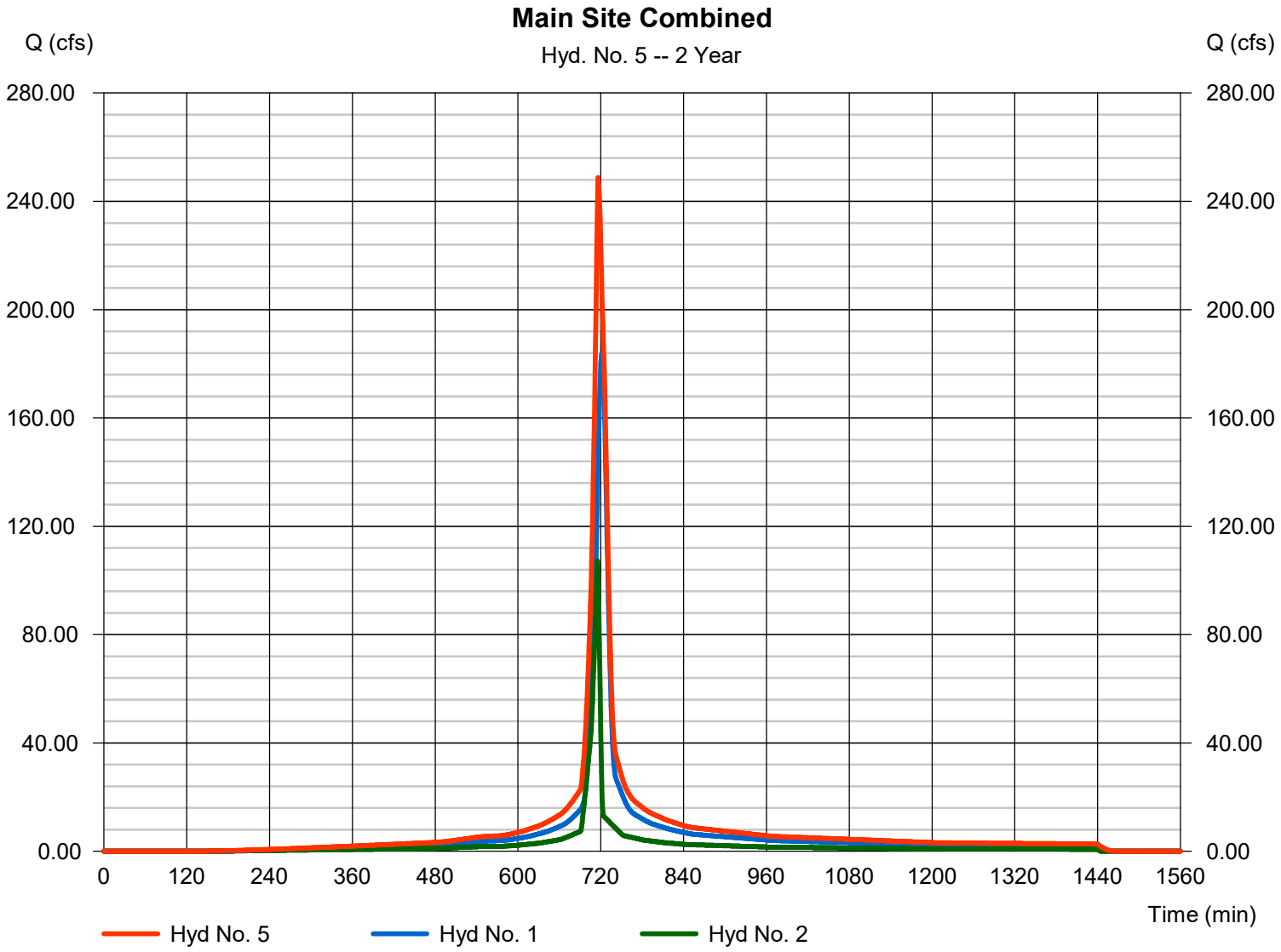
Hyd.	Origin	Description
1	SCS Runoff	PostDevelopment DA-A
2	SCS Runoff	PostDevelopment DA-B
3	Combine	PostDevelopment-at Underground Infiltration BMP
4	SCS Runoff	PostDevelopment DA-C
5	Combine	Main Site Combined
6	Reservoir	UG

Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	= Combine	Peak discharge	= 248.77 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 745,398 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 93.500 ac



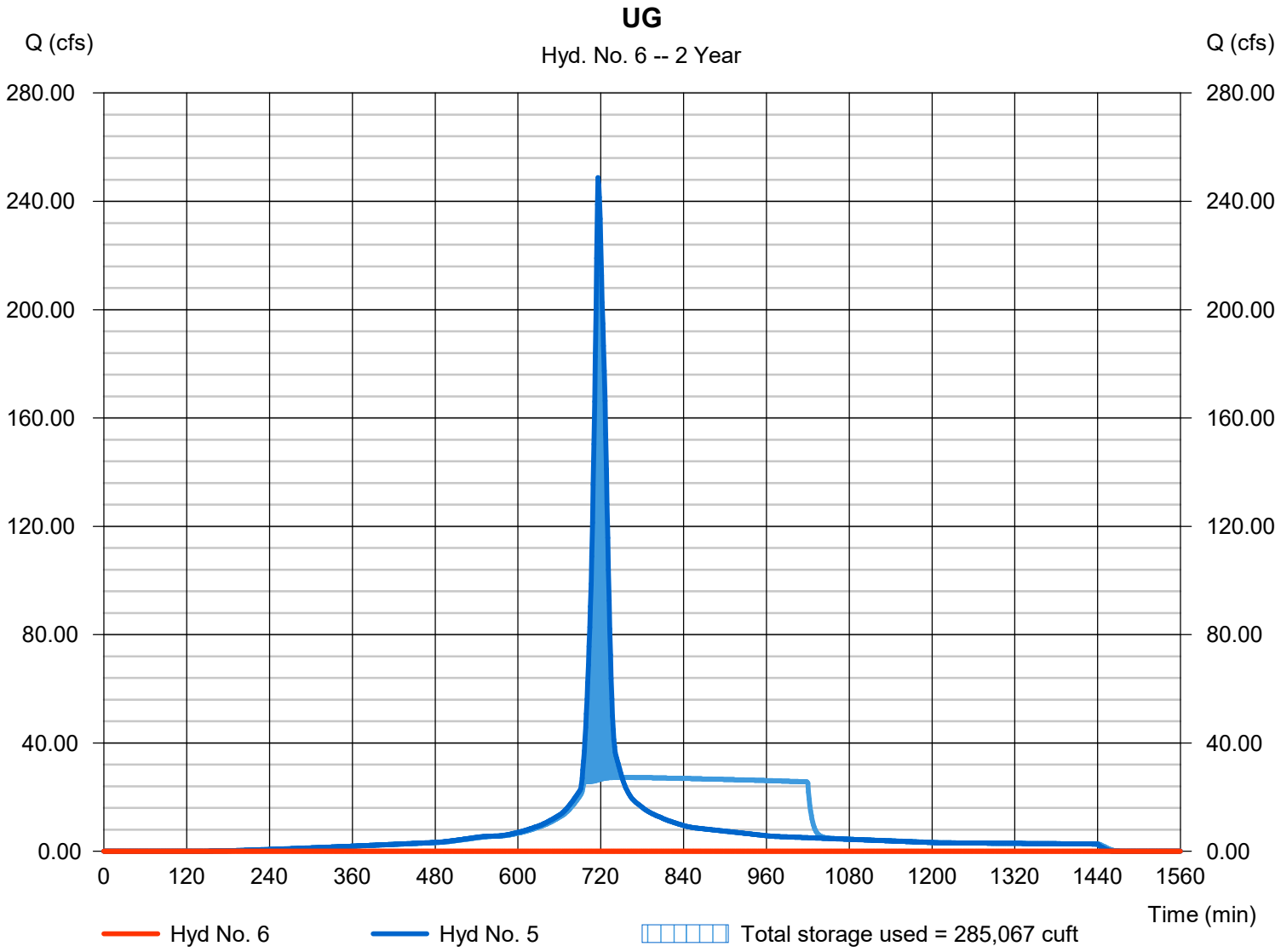
Hydrograph Report

Hyd. No. 6

UG

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	681 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	888.68 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	285,067 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - U.G. Storage

Pond Data

UG Chambers -Invert elev. = 887.00 ft, Rise x Span = 5.00 x 8.33 ft, Barrel Len = 265.00 ft, No. Barrels = 8, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 886.00 ft, Width = 80.00 ft, Height = 9.00 ft, Voids = 35.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	886.00	n/a	0	0
0.90	886.90	n/a	85,691	85,691
1.80	887.80	n/a	100,357	186,047
2.70	888.70	n/a	101,711	287,758
3.60	889.60	n/a	100,620	388,378
4.50	890.50	n/a	98,776	487,154
5.40	891.40	n/a	95,750	582,904
6.30	892.30	n/a	89,233	672,137
7.20	893.20	n/a	85,691	757,828
8.10	894.10	n/a	85,691	843,518
9.00	895.00	n/a	85,691	929,209

Culvert / Orifice Structures

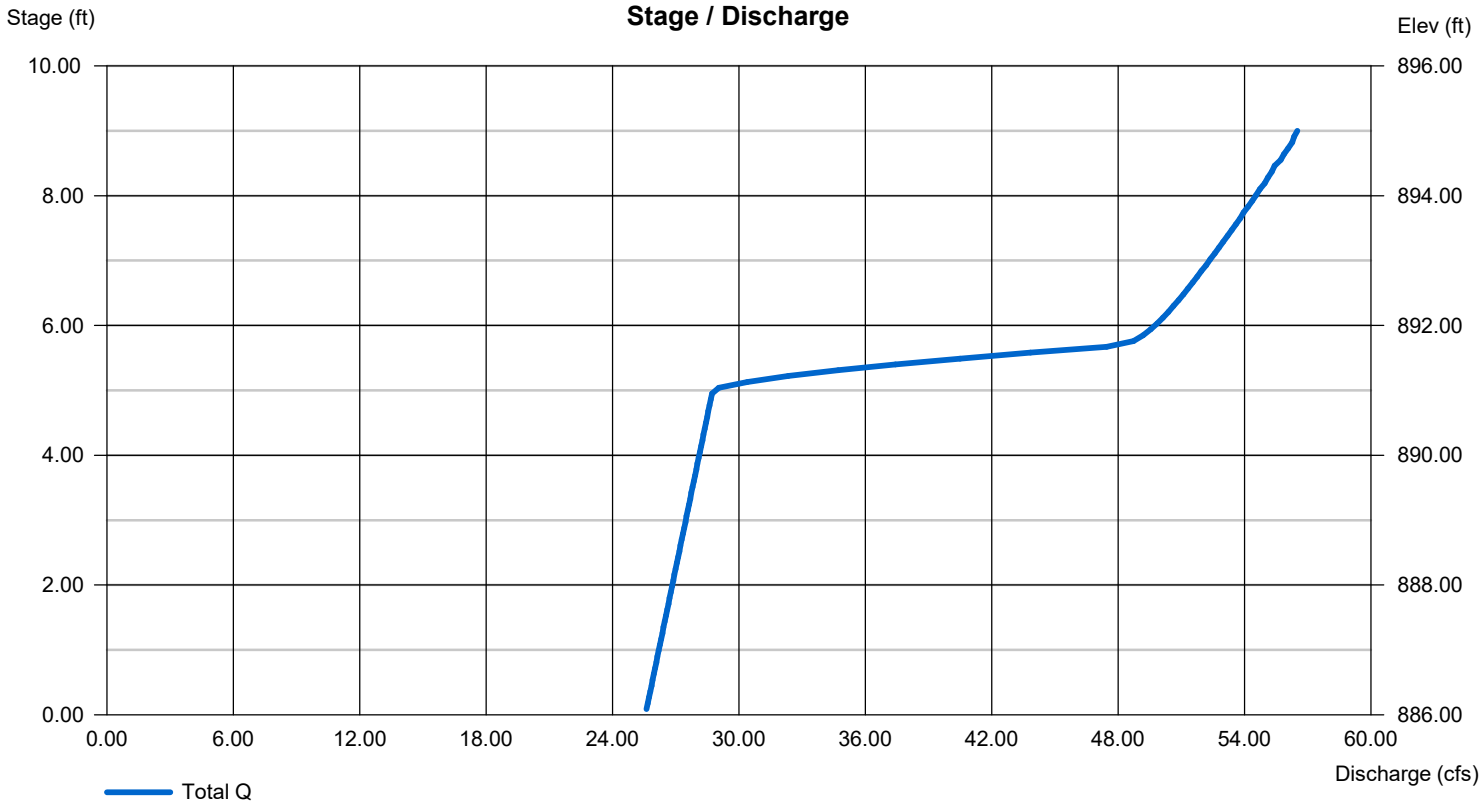
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 887.00	0.00	0.00	0.00
Length (ft)	= 600.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 891.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 5.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

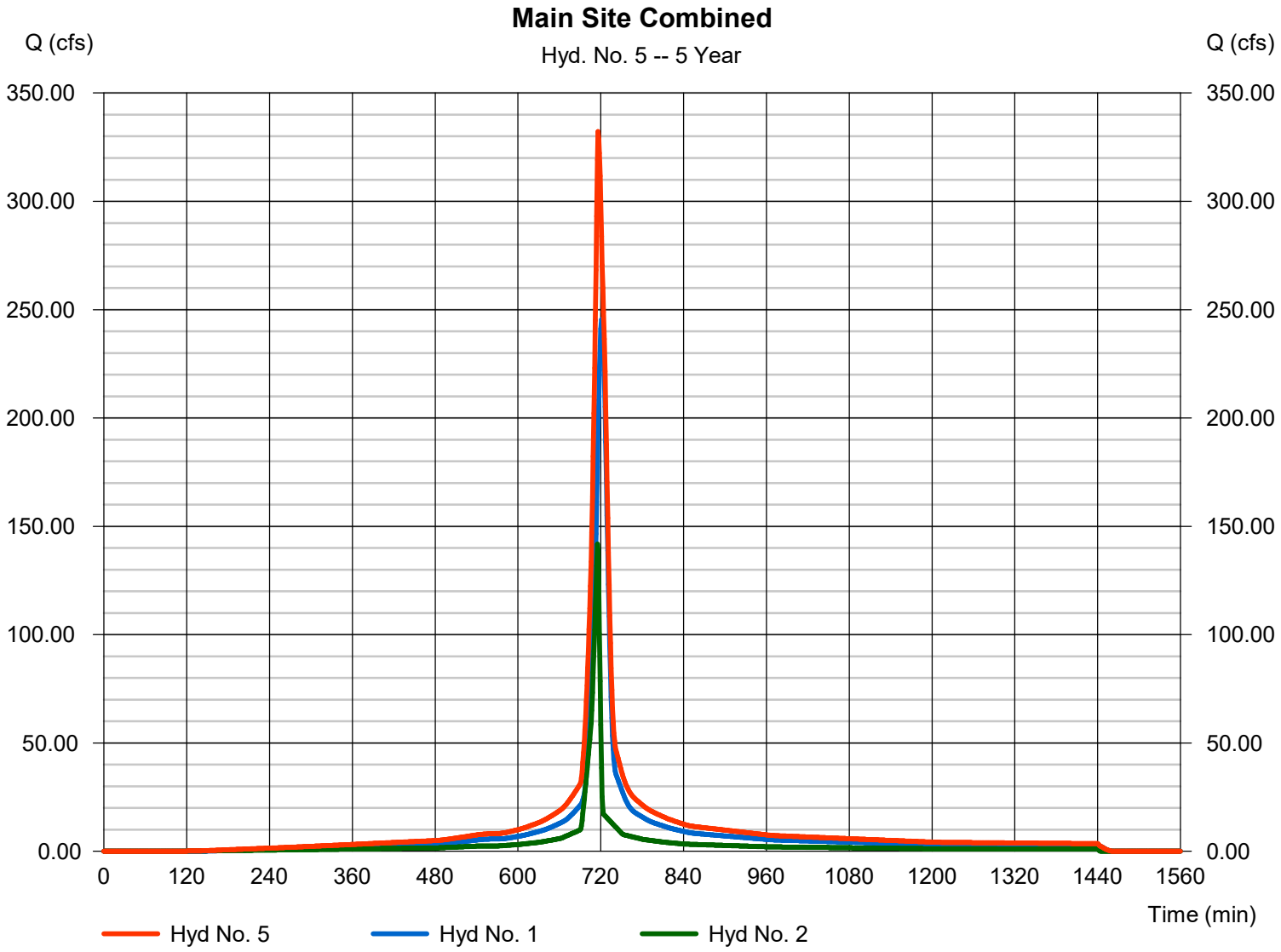


Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	= Combine	Peak discharge	= 332.18 cfs
Storm frequency	= 5 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 1,011,611 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 93.500 ac



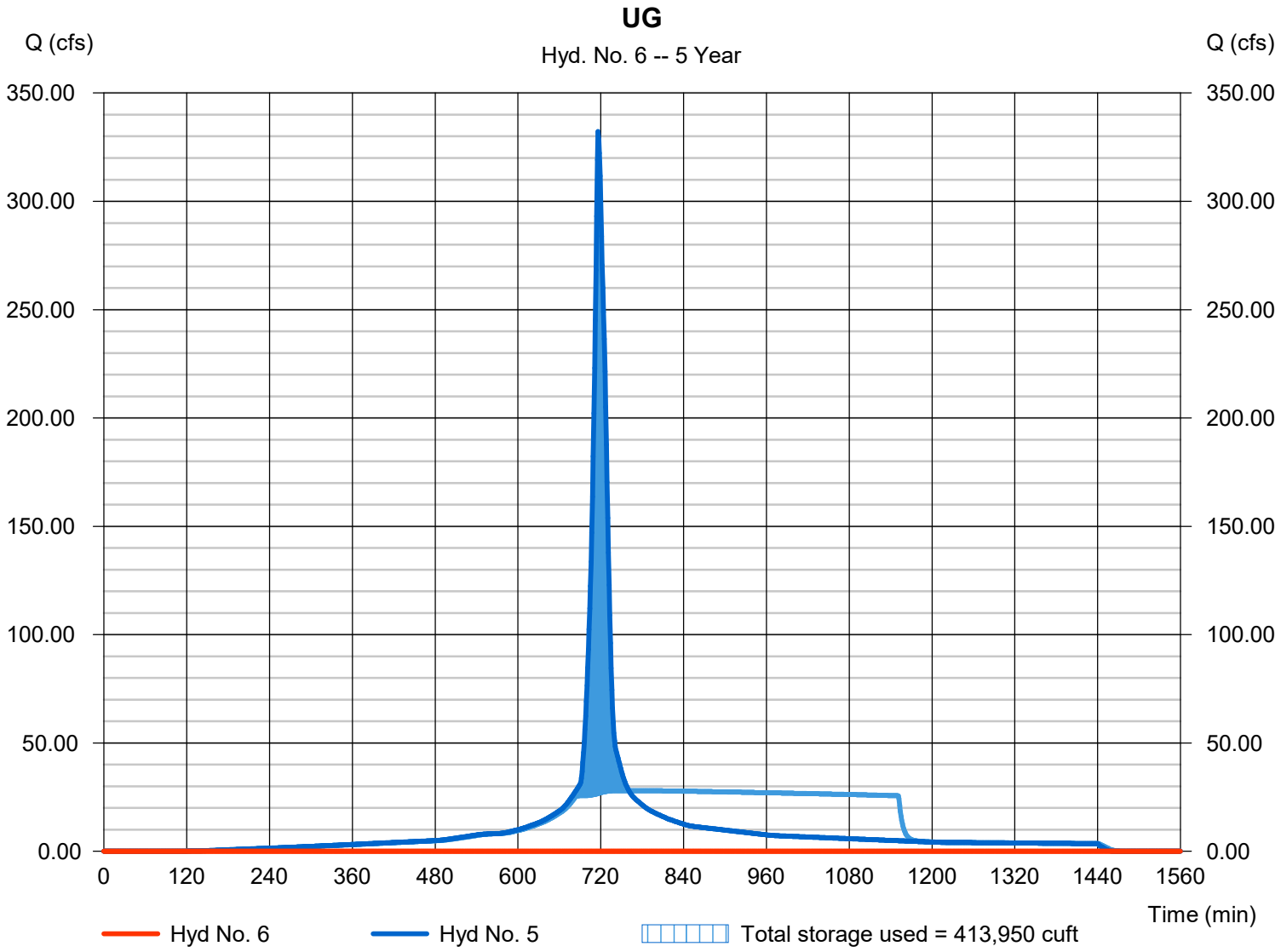
Hydrograph Report

Hyd. No. 6

UG

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	5 yrs	Time to peak	=	654 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	889.83 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	413,950 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

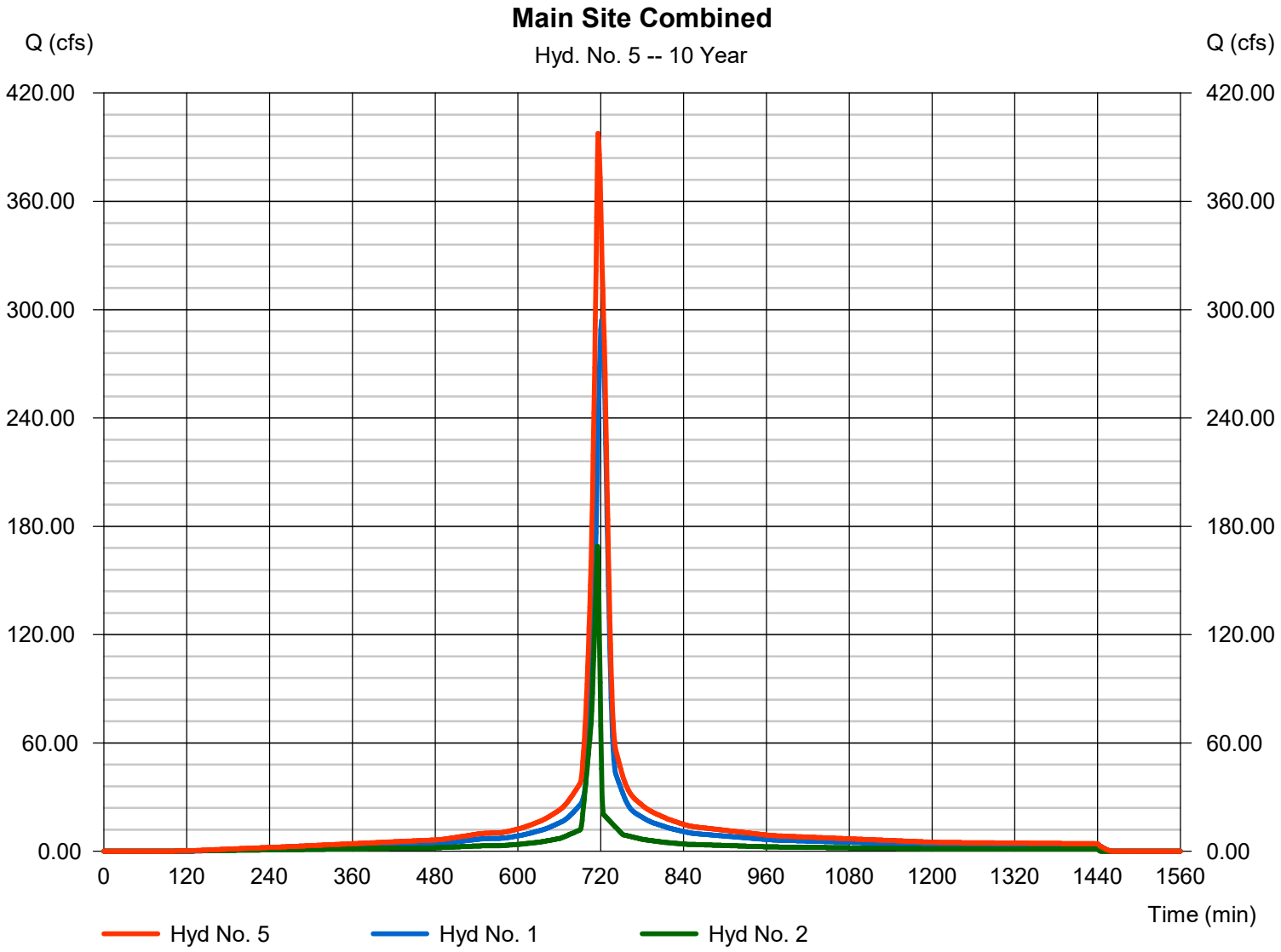


Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	= Combine	Peak discharge	= 397.64 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 1,222,899 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 93.500 ac



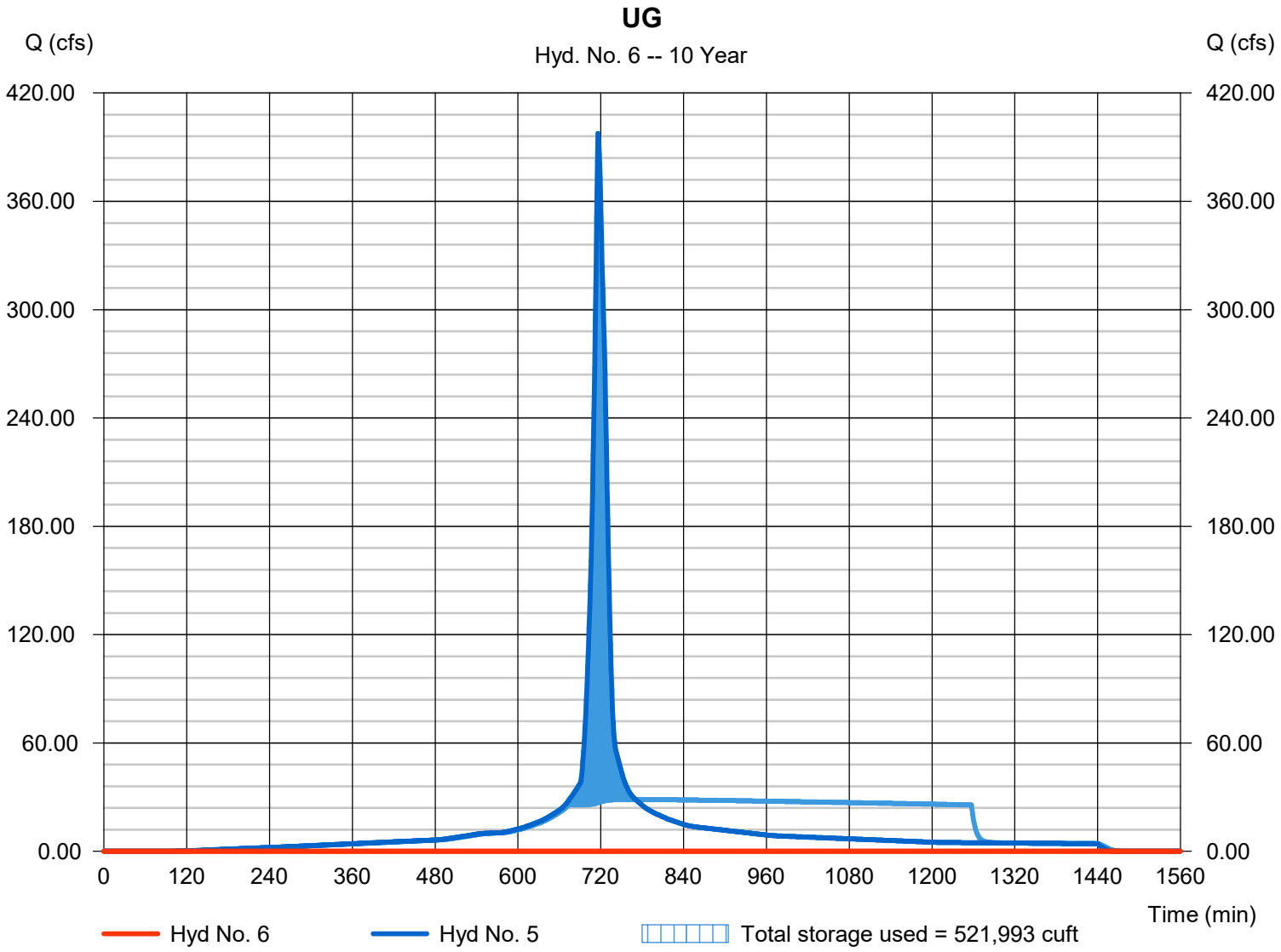
Hydrograph Report

Hyd. No. 6

UG

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	641 min
Time interval	=	1 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	890.83 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	521,993 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

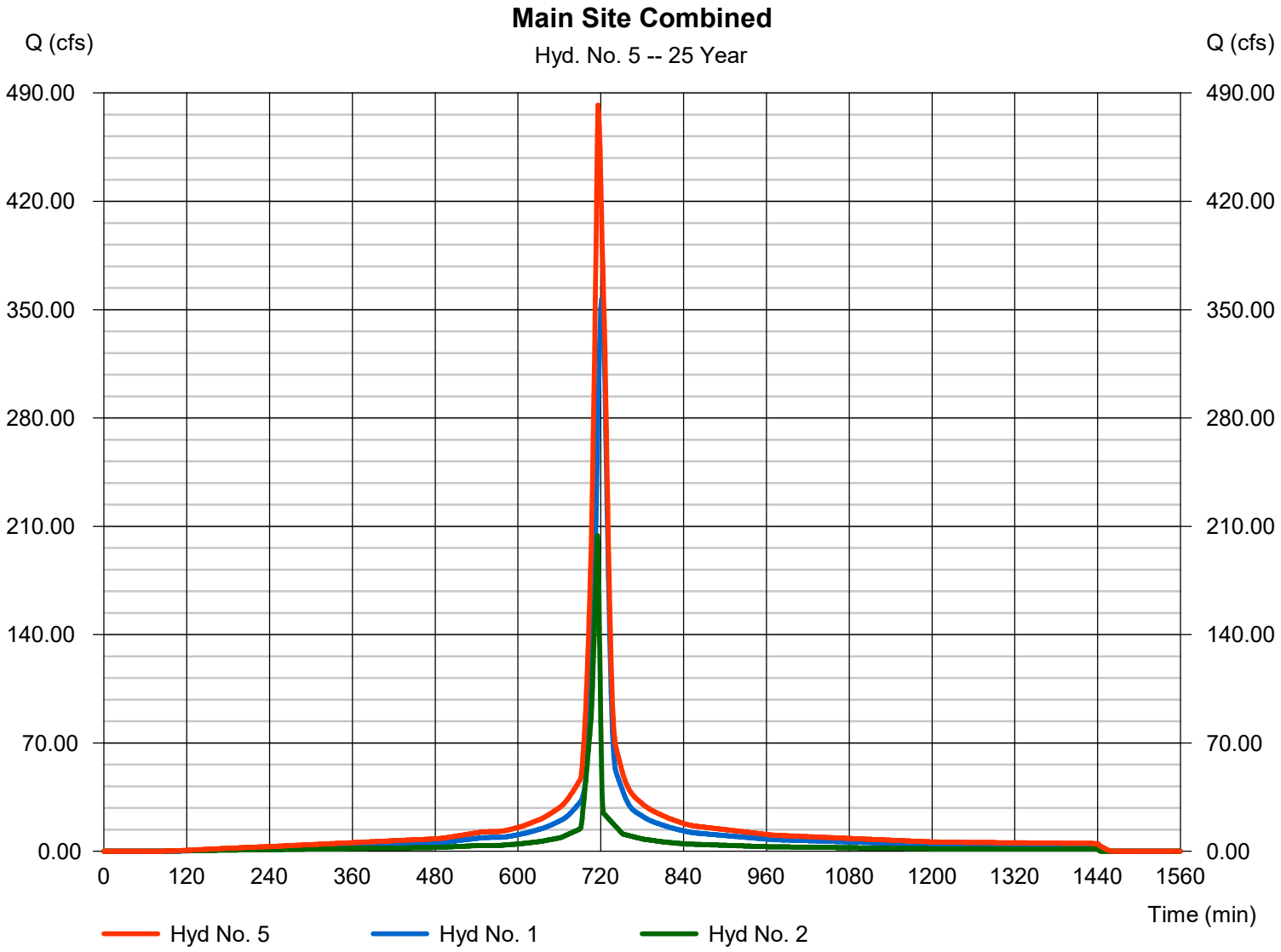


Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	= Combine	Peak discharge	= 482.14 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 1,497,617 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 93.500 ac



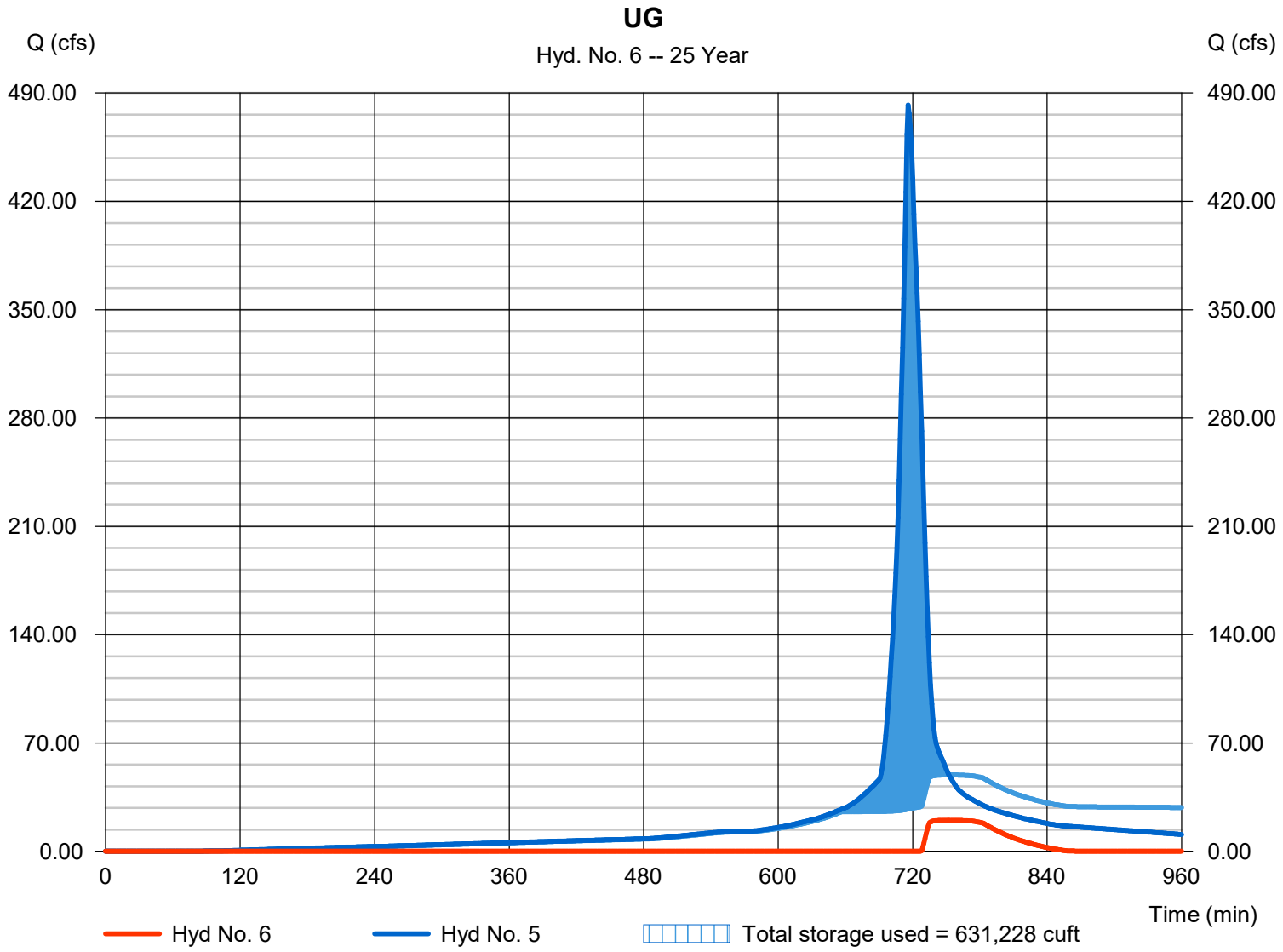
Hydrograph Report

Hyd. No. 6

UG

Hydrograph type	=	Reservoir	Peak discharge	=	20.02 cfs
Storm frequency	=	25 yrs	Time to peak	=	752 min
Time interval	=	1 min	Hyd. volume	=	92,449 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	891.89 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	631,228 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

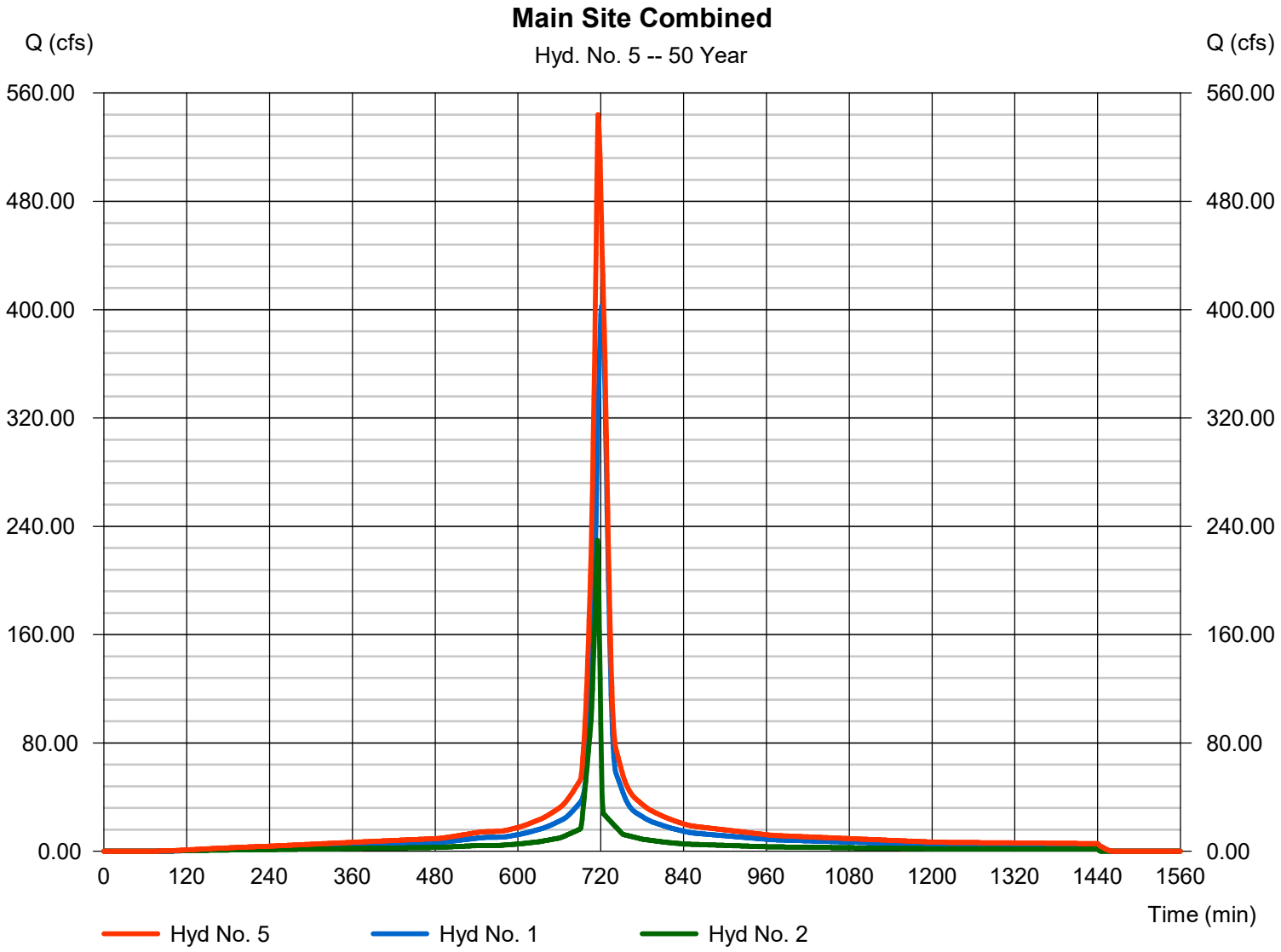


Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	=	Combine	Peak discharge	=	544.02 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	1 min	Hyd. volume	=	1,699,844 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	93.500 ac



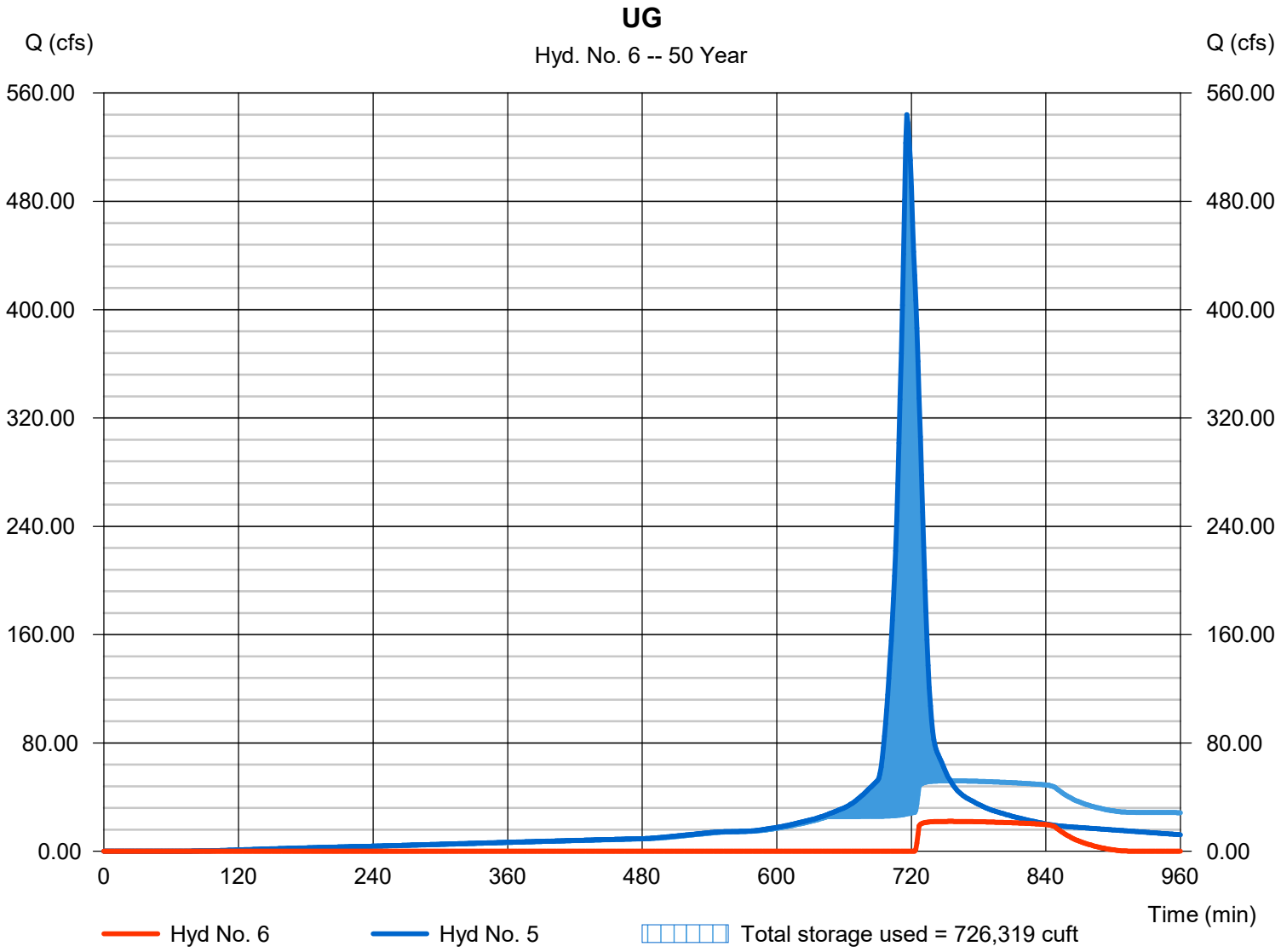
Hydrograph Report

Hyd. No. 6

UG

Hydrograph type	=	Reservoir	Peak discharge	=	22.08 cfs
Storm frequency	=	50 yrs	Time to peak	=	755 min
Time interval	=	1 min	Hyd. volume	=	178,677 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	892.87 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	726,319 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

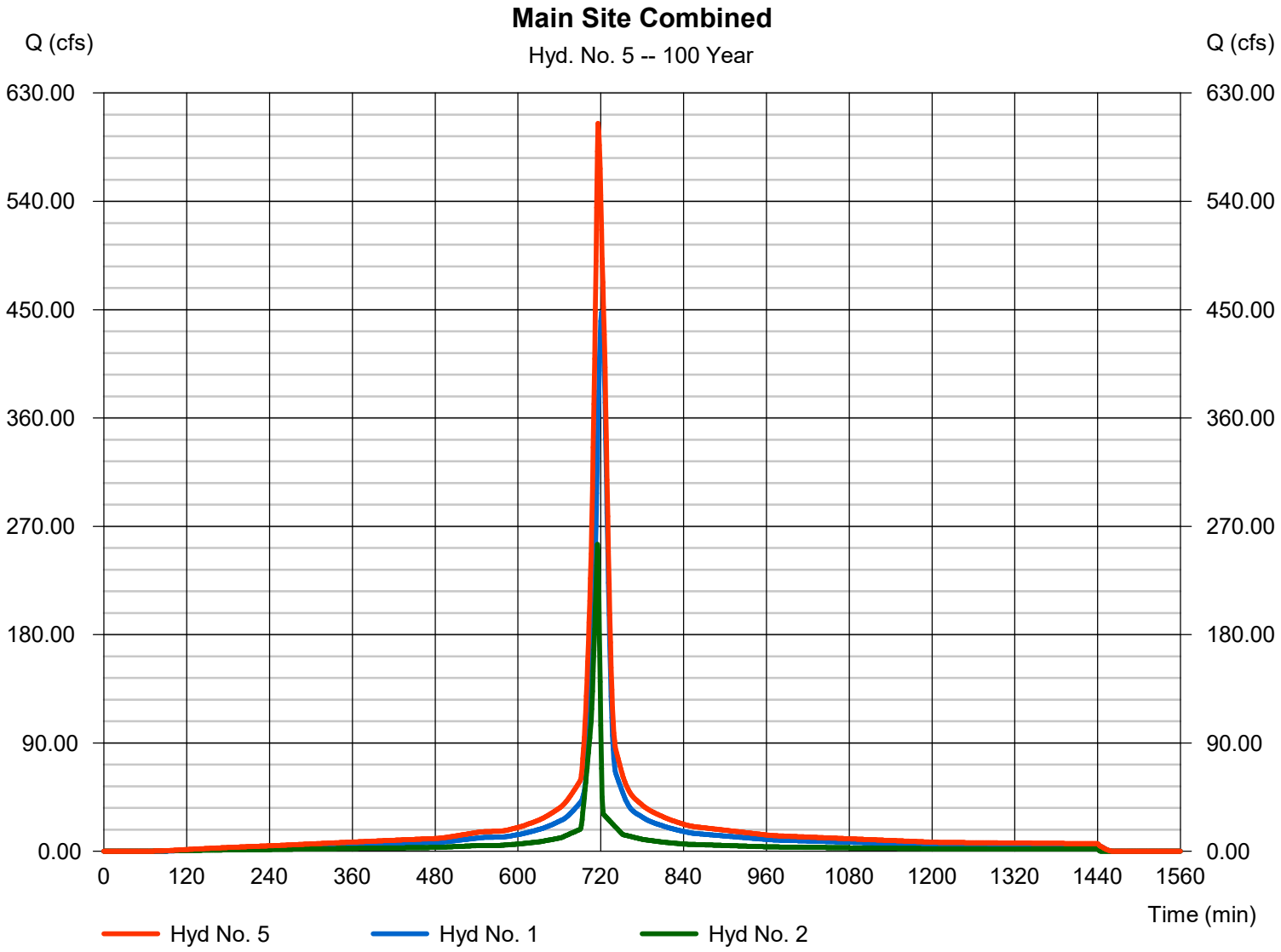


Hydrograph Report

Hyd. No. 5

Main Site Combined

Hydrograph type	= Combine	Peak discharge	= 604.76 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 1,898,942 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 93.500 ac



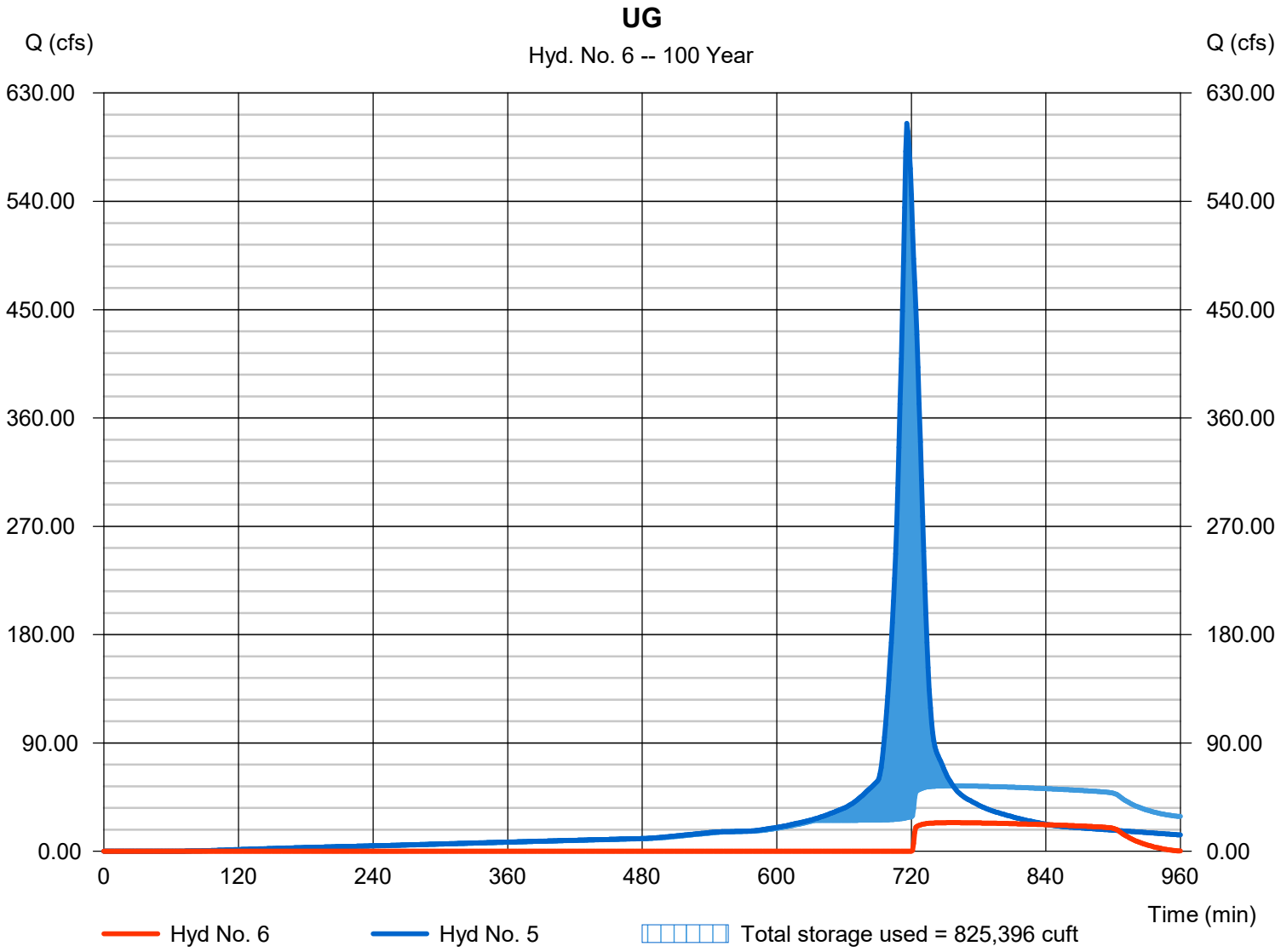
Hydrograph Report

Hyd. No. 6

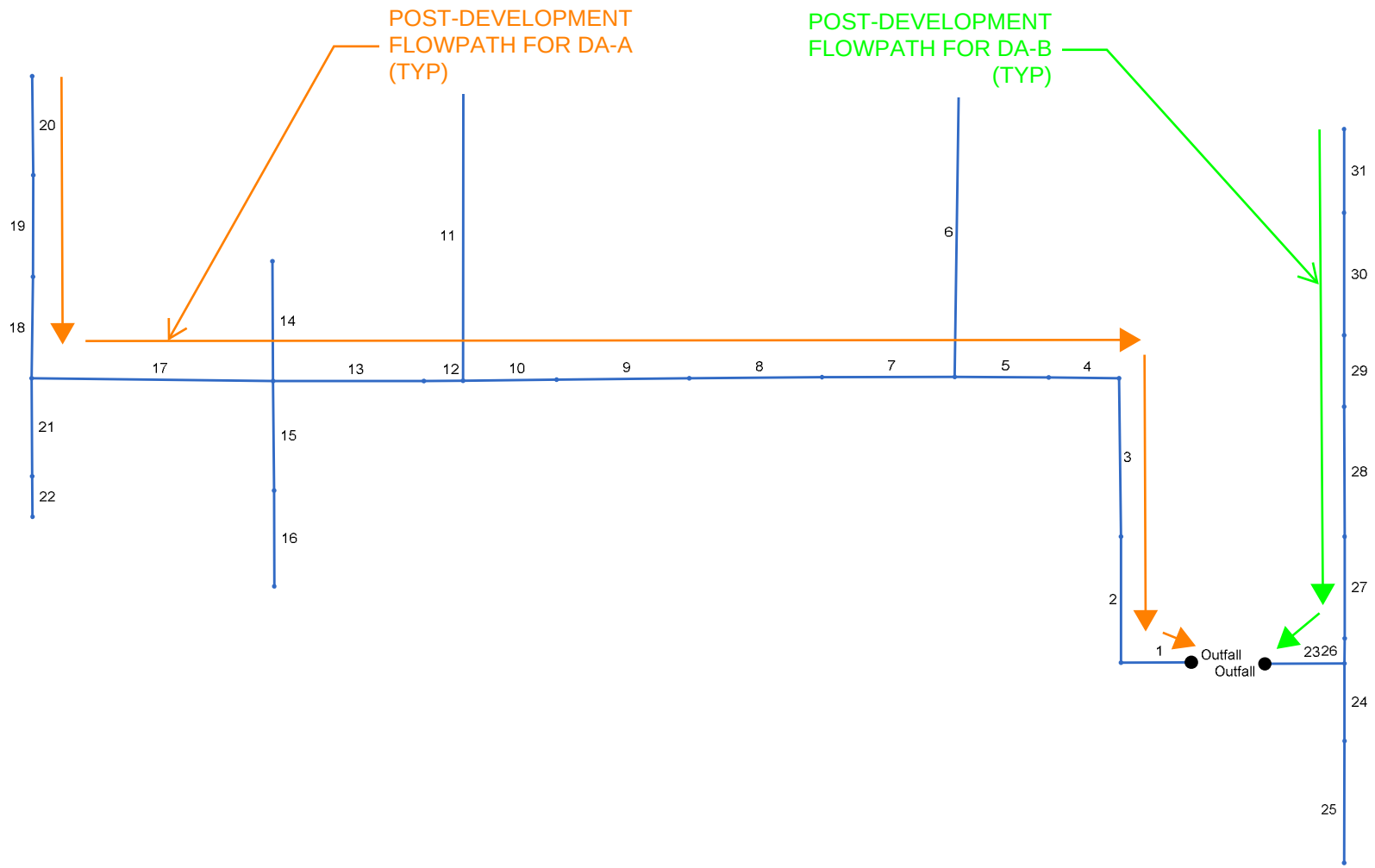
UG

Hydrograph type	=	Reservoir	Peak discharge	=	23.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	757 min
Time interval	=	1 min	Hyd. volume	=	262,733 cuft
Inflow hyd. No.	=	5 - Main Site Combined	Max. Elevation	=	893.91 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	825,396 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Drainage Pipe Network.stm	Number of lines: 31	Date: 1/28/2022

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
31	30	158.000	0.004	MH	0.00	3.82	0.87	0.7	902.56	0.75	903.75	18	Cir	0.013	1.00	0.00	
30	29	231.650	0.052	MH	0.00	1.86	0.90	0.8	900.82	0.75	902.56	24	Cir	0.013	0.15	0.00	
29	28	135.020	0.146	MH	0.00	1.47	0.90	0.4	899.81	0.75	900.82	30	Cir	0.013	0.15	0.00	
28	27	245.670	-0.095	MH	0.00	1.40	0.90	0.5	897.97	0.75	899.81	33	Cir	0.012	0.15	0.00	
27	26	192.510	-0.696	MH	0.00	1.40	0.90	0.4	896.53	0.75	897.97	36	Cir	0.012	0.15	0.00	
26	23	47.280	-89.153	MH	0.00	0.88	0.90	0.1	897.69	0.59	897.97	36	Cir	0.012	0.15	0.00	
25	24	230.570	0.242	MH	0.00	2.11	0.90	0.4	893.89	2.00	898.50	12	Cir	0.012	1.00	0.00	
24	23	146.540	90.242	MH	0.00	0.88	0.90	0.2	890.96	2.00	893.89	15	Cir	0.012	0.15	0.00	
23	End	150.000	-0.259	MH	0.00	0.88	0.90	0.1	880.44	7.01	890.96	36	Cir	0.013	1.00	0.00	
22	21	76.550	-0.350	MH	0.00	2.90	0.88	0.2	902.61	0.74	903.18	12	Cir	0.012	1.00	0.00	
21	17	185.340	-90.937	MH	0.00	1.24	0.90	0.5	901.22	0.75	902.61	18	Cir	0.012	0.15	0.00	
20	19	187.000	-0.668	MH	0.00	2.95	0.84	8.3	910.21	0.75	911.62	15	Cir	0.013	1.00	0.00	
19	18	192.000	-0.722	MH	0.00	1.73	0.90	0.7	908.77	0.75	910.21	18	Cir	0.013	0.15	0.00	
18	17	191.920	90.118	MH	0.00	1.83	0.90	0.6	907.33	0.75	908.77	24	Cir	0.013	0.15	0.00	
17	13	454.530	0.721	MH	0.00	1.81	0.90	1.2	897.81	0.75	901.22	30	Cir	0.013	1.00	0.00	
16	15	181.300	0.495	MH	0.00	17.14	0.87	0.8	899.76	0.75	901.12	42	Cir	0.012	1.00	0.00	
15	13	206.740	-90.509	MH	0.00	1.96	0.90	0.8	898.21	0.75	899.76	48	Cir	0.012	0.15	0.00	
14	13	226.600	89.761	MH	0.00	1.32	0.90	0.7	905.56	0.75	907.26	12	Cir	0.013	1.00	0.00	
13	12	283.890	0.192	MH	0.00	21.28	0.88	0.6	895.68	0.75	897.81	60	Cir	0.013	1.00	0.00	
12	10	73.790	0.440	MH	0.00	2.00	0.90	0.2	895.13	0.75	895.68	60	Cir	0.013	0.15	0.00	
11	10	548.200	90.715	MH	0.00	10.02	0.86	1.1	903.89	0.75	908.00	33	Cir	0.013	1.00	0.00	
10	9	176.050	-0.045	MH	0.00	0.40	0.90	0.3	893.81	0.75	895.13	66	Cir	0.013	1.00	0.00	
9	8	249.840	-0.143	MH	0.00	2.29	0.90	0.4	891.94	0.75	893.81	66	Cir	0.013	0.15	0.00	

Project File: Drainage Pipe Network.stm | Number of lines: 31 | Date: 1/28/2022

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
8	7	249.840	-0.443	MH	0.00	2.70	0.90	0.4	890.07	0.75	891.94	66	Cir	0.013	0.15	0.00	
7	5	249.840	-0.303	MH	0.00	2.80	0.90	0.3	888.20	0.75	890.07	66	Cir	0.013	0.15	0.00	
6	5	548.410	90.557	MH	0.00	8.96	0.86	1.1	903.89	0.75	908.00	33	Cir	0.013	1.00	0.00	
5	4	176.760	-0.529	MH	0.00	2.82	0.90	0.2	886.87	0.75	888.20	72	Cir	0.012	1.00	0.00	
4	3	132.410	-88.519	MH	0.00	1.35	0.90	0.2	885.88	0.75	886.87	72	Cir	0.013	0.15	0.00	
3	2	299.320	-0.703	MH	0.00	4.29	0.90	0.4	883.64	0.75	885.88	72	Cir	0.013	1.00	0.00	
2	1	238.280	90.387	MH	0.00	2.98	0.90	0.2	878.87	2.00	883.64	72	Cir	0.013	0.15	0.00	
1	End	132.590	179.618	MH	0.00	3.40	0.90	0.1	876.22	2.00	878.87	72	Cir	0.013	1.00	0.00	

Project File: Drainage Pipe Network.stm | Number of lines: 31 | Date: 1/28/2022

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
31		Manhole	0.00	Cir	4.00	4.00	18	Cir	903.75			
30		Manhole	0.00	Cir	4.00	4.00	24	Cir	902.56	18	Cir	902.56
29		Manhole	0.00	Cir	4.00	4.00	30	Cir	900.82	24	Cir	900.82
28		Manhole	0.00	Cir	4.00	4.00	33	Cir	899.81	30	Cir	899.81
27		Manhole	0.00	Cir	4.00	4.00	36	Cir	897.97	33	Cir	897.97
26		Manhole	0.00	Cir	4.00	4.00	36	Cir	897.97	36	Cir	896.53
25		Manhole	0.00	Cir	4.00	4.00	12	Cir	898.50			
24		Manhole	0.00	Cir	4.00	4.00	15	Cir	893.89	12	Cir	893.89
23		Manhole	0.00	Cir	4.00	4.00	36	Cir	890.96	15 36	Cir Cir	890.96 897.69
22		Manhole	0.00	Cir	4.00	4.00	12	Cir	903.18			
21		Manhole	0.00	Cir	4.00	4.00	18	Cir	902.61	12	Cir	902.61
20		Manhole	0.00	Cir	4.00	4.00	15	Cir	911.62			
19		Manhole	0.00	Cir	4.00	4.00	18	Cir	910.21	15	Cir	910.21
18		Manhole	0.00	Cir	4.00	4.00	24	Cir	908.77	18	Cir	908.77
17		Manhole	0.00	Cir	4.00	4.00	30	Cir	901.22	24 18	Cir Cir	907.33 901.22
16		Manhole	0.00	Cir	4.00	4.00	42	Cir	901.12			
15		Manhole	0.00	Cir	4.00	4.00	48	Cir	899.76	42	Cir	899.76
14		Manhole	0.00	Cir	4.00	4.00	12	Cir	907.26			
13		Manhole	0.00	Cir	4.00	4.00	60	Cir	897.81	12 48 30	Cir Cir Cir	905.56 898.21 897.81
12		Manhole	0.00	Cir	4.00	4.00	60	Cir	895.68	60	Cir	895.68
11		Manhole	0.00	Cir	4.00	4.00	33	Cir	908.00			

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
10		Manhole	0.00	Cir	4.00	4.00	66	Cir	895.13	33 60	Cir Cir	903.89 895.13
9		Manhole	0.00	Cir	4.00	4.00	66	Cir	893.81	66	Cir	893.81
8		Manhole	0.00	Cir	4.00	4.00	66	Cir	891.94	66	Cir	891.94
7		Manhole	0.00	Cir	4.00	4.00	66	Cir	890.07	66	Cir	890.07
6		Manhole	0.00	Cir	4.00	4.00	33	Cir	908.00			
5		Manhole	0.00	Cir	4.00	4.00	72	Cir	888.20	33 66	Cir Cir	903.89 888.20
4		Manhole	0.00	Cir	4.00	4.00	72	Cir	886.87	72	Cir	886.87
3		Manhole	0.00	Cir	4.00	4.00	72	Cir	885.88	72	Cir	885.88
2		Manhole	0.00	Cir	4.00	4.00	72	Cir	883.64	72	Cir	883.64
1		Manhole	0.00	Cir	4.00	4.00	72	Cir	878.87	72	Cir	878.87

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
31		TR55											0.79	3.14	0.75	0.013	3.94	158	0.00	0.67
30		TR55											1.77	4.71	0.75	0.013	5.15	232	0.00	0.75
29		TR55											1.77	4.71	0.75	0.013	5.15	135	0.00	0.44
28		TR55											7.07	9.42	0.75	0.013	8.19	246	0.00	0.50
27		TR55											7.07	9.42	0.75	0.013	8.19	193	0.00	0.39
26		TR55											7.07	9.42	0.60	0.013	7.33	47	0.00	0.11
25		TR55											3.14	6.28	2.00	0.013	10.19	231	0.00	0.38
24		TR55											7.07	9.42	2.00	0.013	13.37	147	0.00	0.18
23		TR55											28.27	18.85	7.00	0.013	39.79	150	0.00	0.06
22		TR55											3.14	6.28	0.75	0.013	6.24	77	0.00	0.20
21		TR55											3.14	6.28	0.75	0.013	6.24	185	0.00	0.50
20		TR55	0.013 0.013 0.013	95.00 95.00 95.00	3.07 3.07 3.07	0.70 0.70 0.70	2.07 2.39 2.00	109.00	0.70	Paved	1.70	1.07	0.79	3.14	0.75	0.013	3.94	187	0.00	8.31
19		TR55											1.13	3.77	0.75	0.013	4.43	192	0.00	0.72
18		TR55											1.77	4.71	0.75	0.013	5.15	192	0.00	0.62
17		TR55											3.14	6.28	0.75	0.013	6.24	455	0.00	1.21
16		TR55											0.79	3.14	0.75	0.013	3.94	181	0.00	0.77
15		TR55											1.25	3.96	0.75	0.013	4.58	207	0.00	0.75
14		TR55											1.77	4.71	0.75	0.013	5.15	227	0.00	0.73
13		TR55											7.07	9.42	0.75	0.013	8.19	284	0.00	0.58
12		TR55											1.77	4.71	0.75	0.013	5.15	74	0.00	0.24
11		TR55											7.07	9.42	0.75	0.013	8.19	548	0.00	1.12
10		TR55											12.57	12.57	0.75	0.013	9.93	176	0.00	0.30
9		TR55											15.90	14.14	0.75	0.013	10.74	250	0.00	0.39

Project File: Drainage Pipe Network.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 31 | Date: 1/28/2022

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
8		TR55											19.64	15.71	0.75	0.013	11.53	250	0.00	0.36
7		TR55											23.76	17.28	0.75	0.013	12.29	250	0.00	0.34
6		TR55											7.07	9.42	0.75	0.013	8.19	548	0.00	1.12
5		TR55											23.76	17.28	0.75	0.013	12.29	177	0.00	0.24
4		TR55											23.76	17.28	0.75	0.013	12.29	132	0.00	0.18
3		TR55											23.76	17.28	0.75	0.013	12.29	299	0.00	0.41
2		TR55											23.76	17.28	2.00	0.013	20.06	238	0.00	0.20
1		TR55											23.76	17.28	2.00	0.013	20.06	133	0.00	0.11

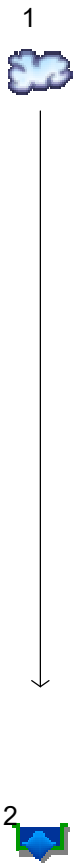
Drainage Area A (DA-A): The Line Numbers boxed in orange are the conveyance flowpaths to the outlet of DA-A. The sum of these Travel Time values equal the total Time of Concentration for DA-A which equals 14.2 minutes

Drainage Area B (DA-B): The Line Numbers boxed in green are the conveyance flowpaths to the outlet of DA-B. The sum of these Travel Time values equal the total Time of Concentration for DA-B which equals 2.9 minutes

Project File: Drainage Pipe Network.stm	Min. Tc used for intensity calculations = 5 min	Number of lines: 31	Date: 1/28/2022

APPENDIX ‘C’

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Parking Garage
2	Reservoir	Parking Garage-U.G.

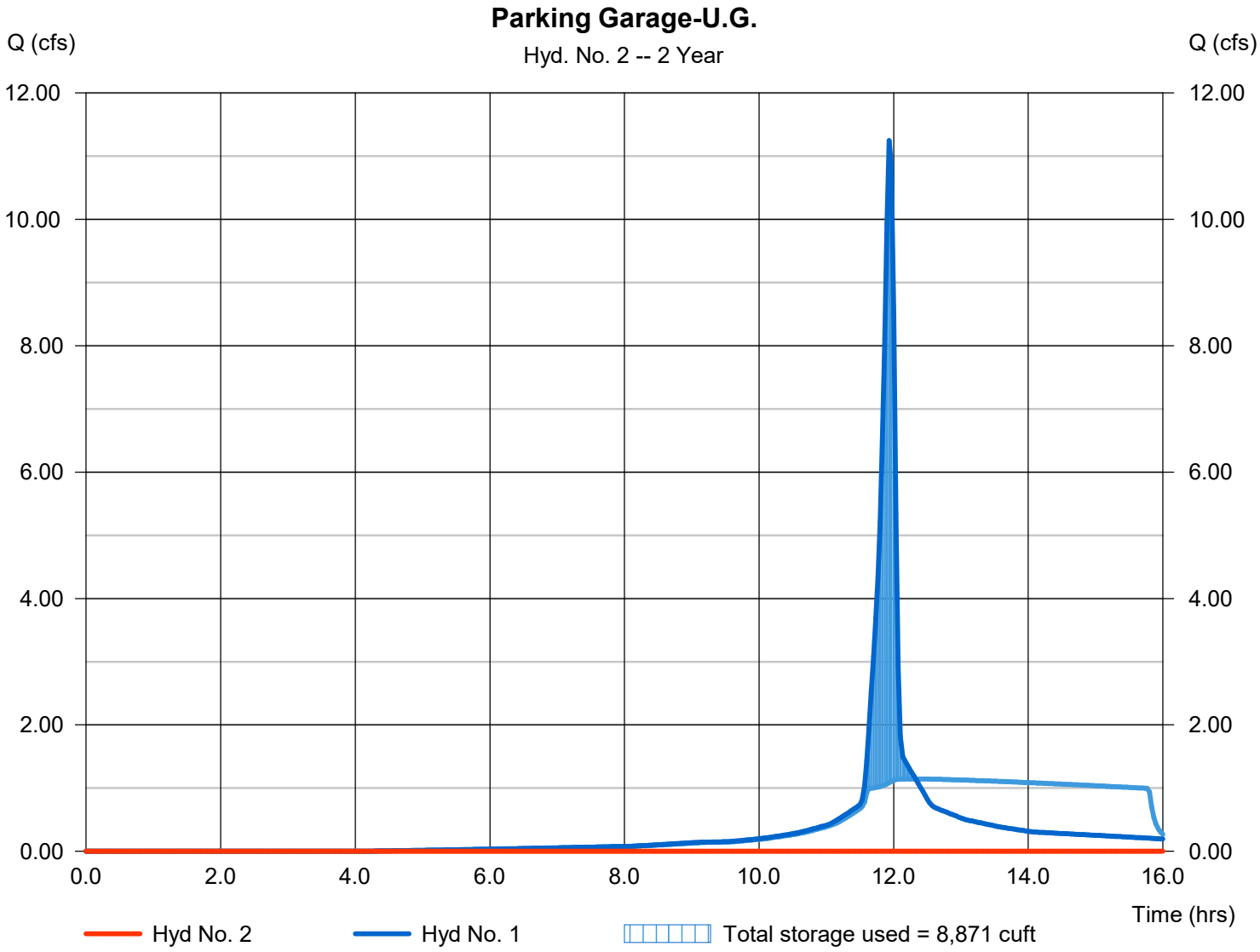
Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	14.70 hrs
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	894.88 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	8,871 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - U.G. Storage

Pond Data

UG Chambers -Invert elev. = 894.00 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 65.00 ft, No. Barrels = 4, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 893.00 ft, Width = 24.00 ft, Height = 7.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	893.00	n/a	0	0
0.70	893.70	n/a	3,038	3,038
1.40	894.40	n/a	3,362	6,400
2.10	895.10	n/a	3,588	9,988
2.80	895.80	n/a	3,534	13,522
3.50	896.50	n/a	3,431	16,954
4.20	897.20	n/a	3,190	20,144
4.90	897.90	n/a	3,038	23,182
5.60	898.60	n/a	3,038	26,220
6.30	899.30	n/a	3,038	29,257
7.00	900.00	n/a	3,038	32,295

Culvert / Orifice Structures

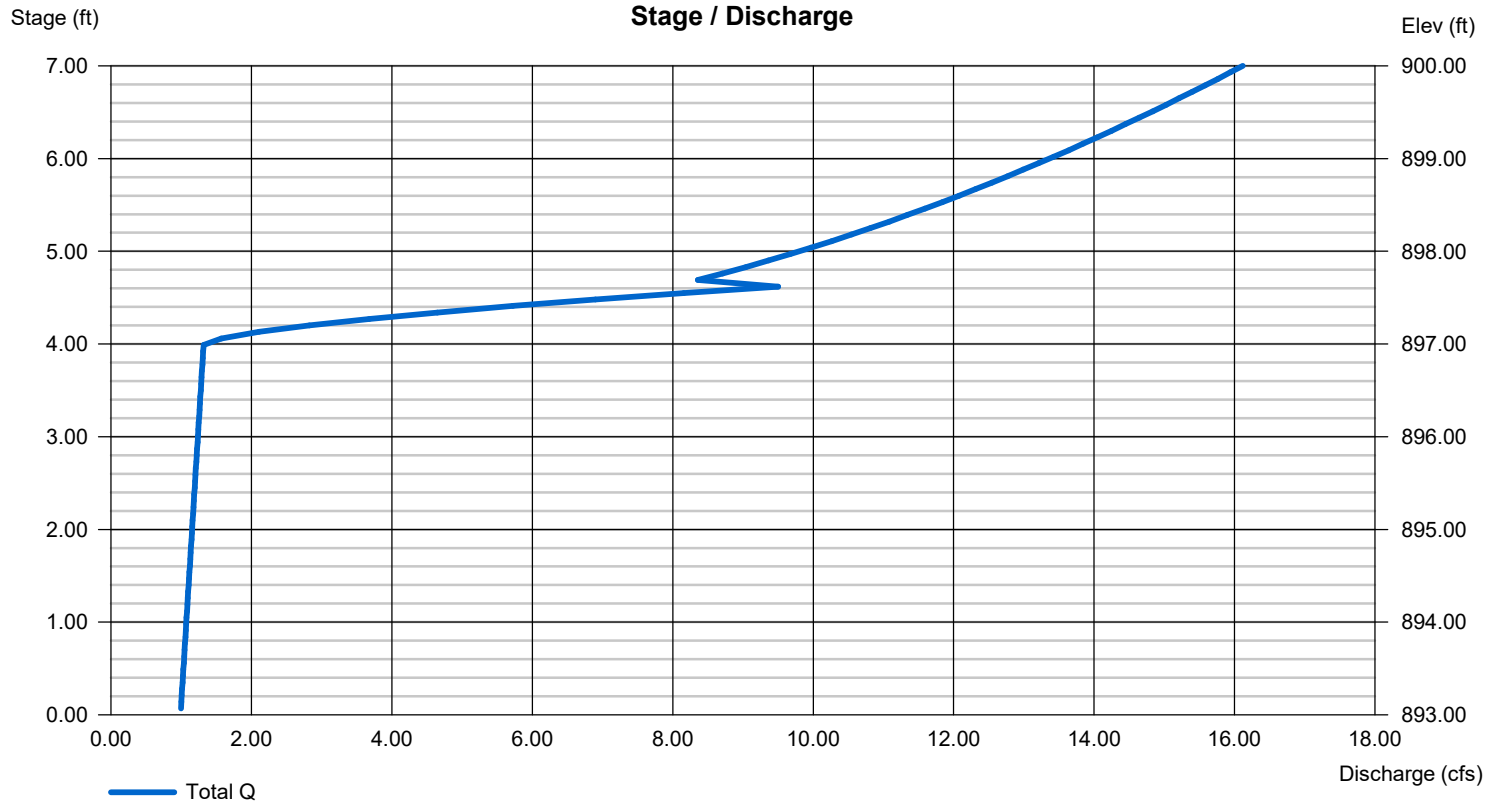
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 893.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.75	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 897.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 5.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



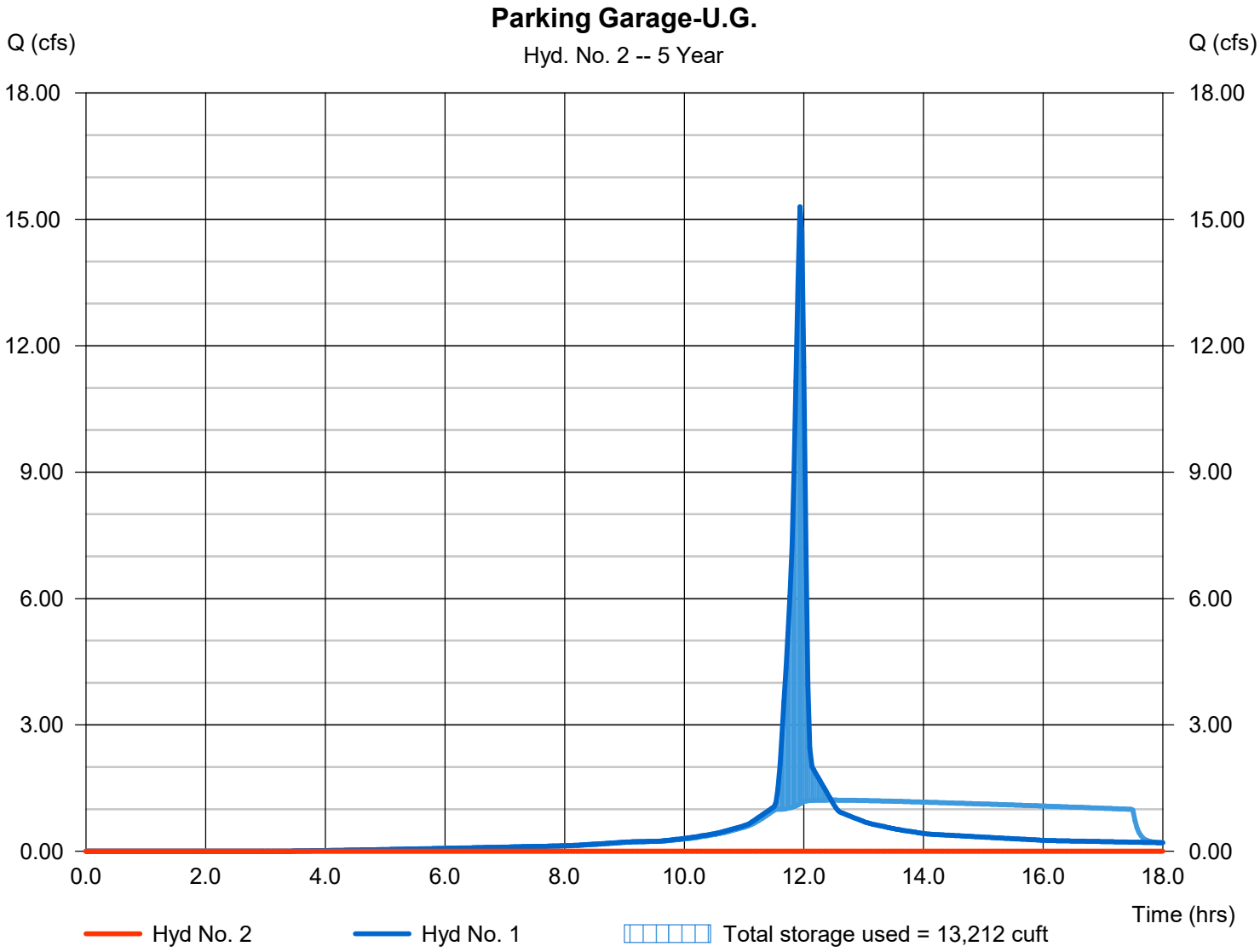
Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	5 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	895.74 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	13,212 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



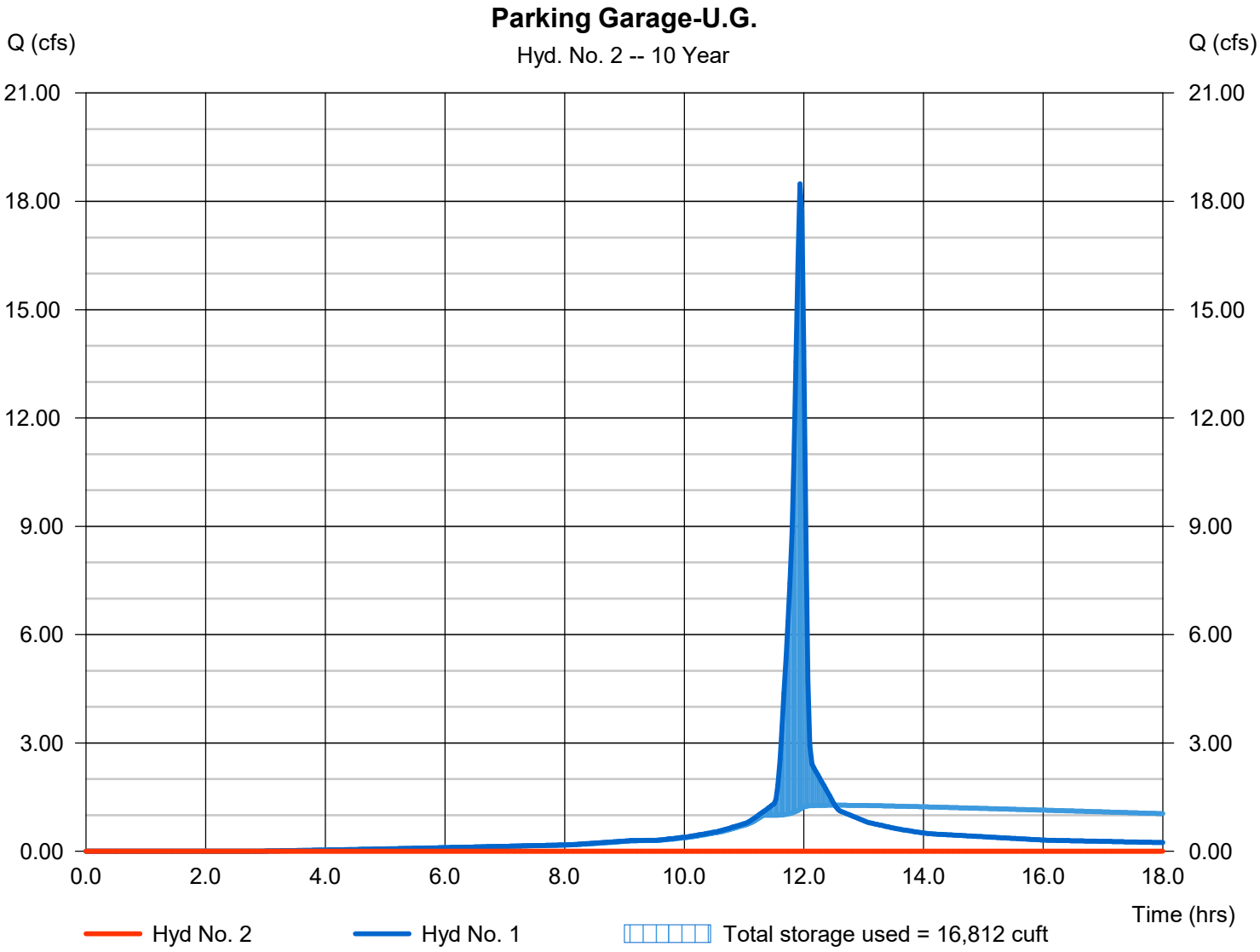
Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	13.87 hrs
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	896.47 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	16,812 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



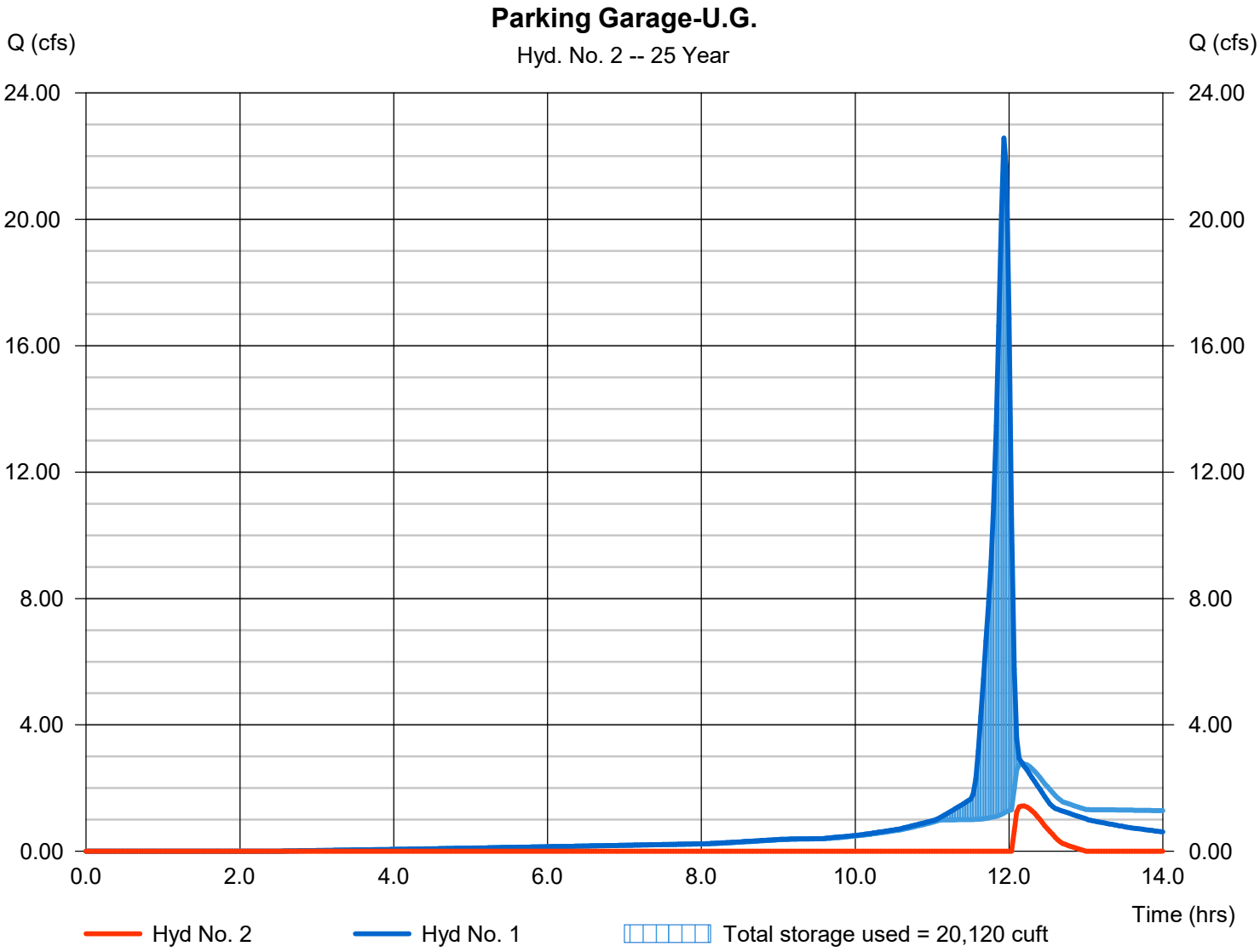
Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	1.436 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	2,327 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	897.19 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	20,120 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



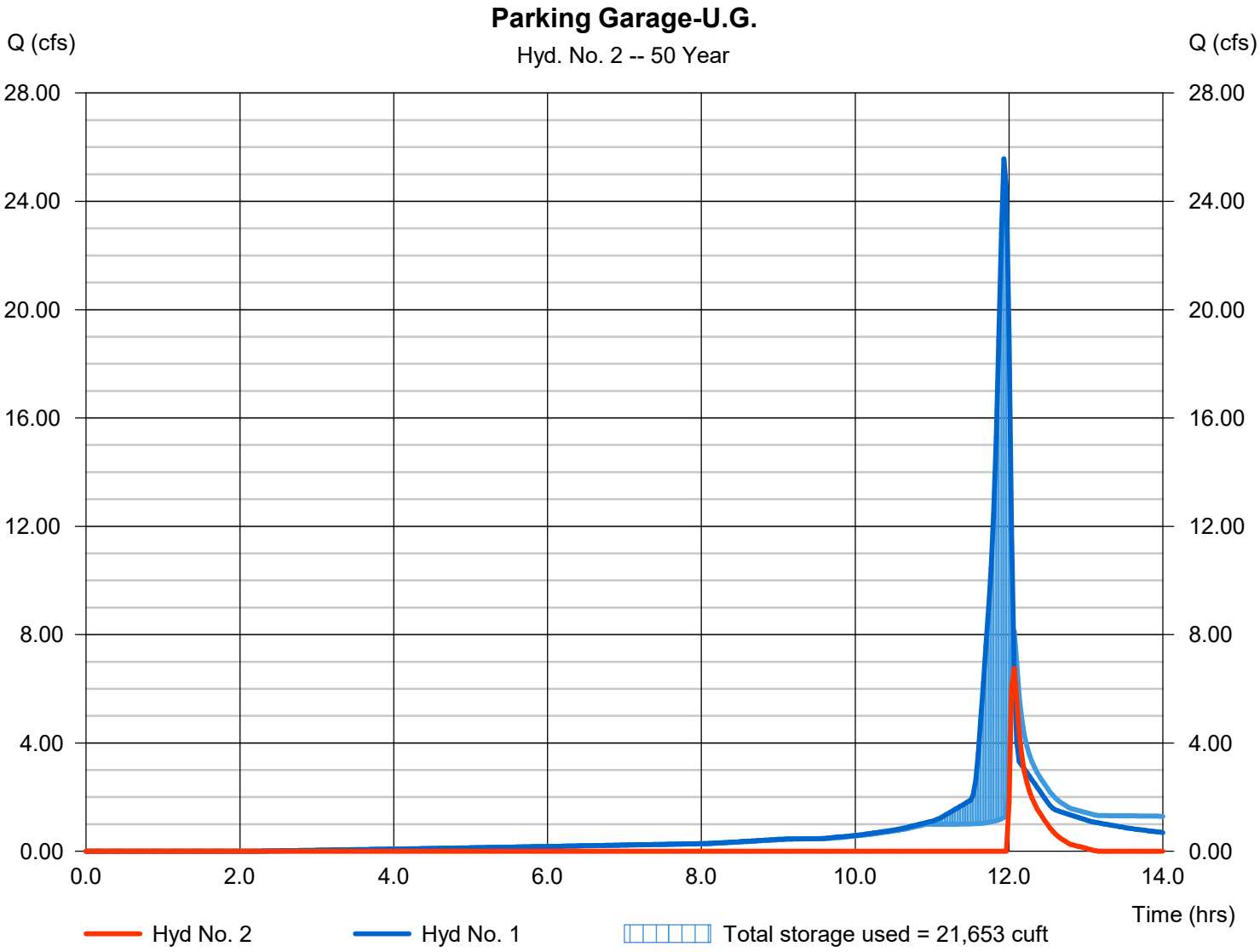
Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	6.750 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	6,198 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	897.55 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	21,653 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

Hyd. No. 2

Parking Garage-U.G.

Hydrograph type	=	Reservoir	Peak discharge	=	8.373 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	10,155 cuft
Inflow hyd. No.	=	1 - Parking Garage	Max. Elevation	=	897.99 ft
Reservoir name	=	U.G. Storage	Max. Storage	=	23,587 cuft

Storage Indication method used. Exfiltration extracted from Outflow.