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REPORT

April 2019

STATE OF CONNECTICUT
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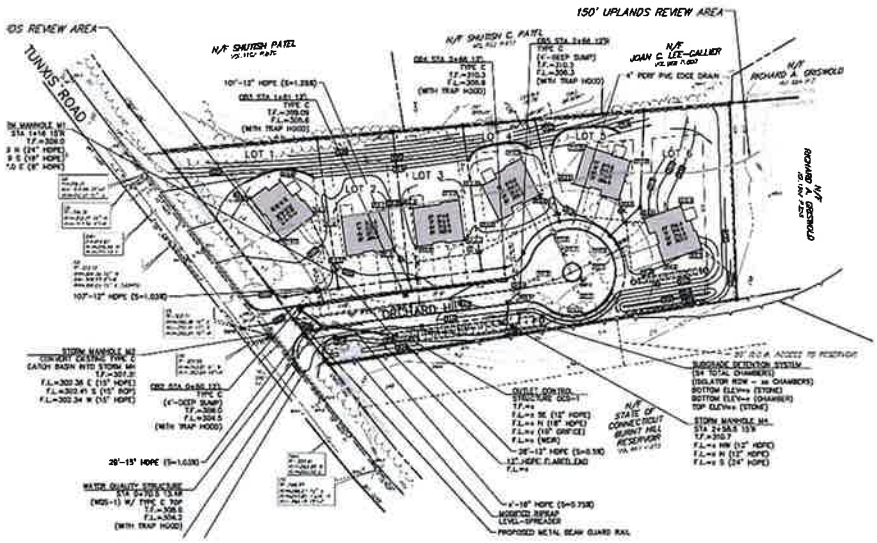
LICENSED
PROFESSIONAL ENGINEER

Stormwater Management Report

Prepared for:
The Bongiovanni Group

Site Location:
380 Tunxis Road
West Hartford, Connecticut



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1.0 INTRODUCTION

Weston & Sampson is pleased to submit this Stormwater Management Report on behalf of the applicant. A six (6) lot residential subdivision is proposed at 380 Tunxis Road in West Hartford, CT. The 2.6 Acre property is located on the north side of Tunxis Road and is bordered by the Farmington Town line/residential properties to the west, a residential property to the north, and a State-owned property associated with the Burnt Hill Reservoir to the east. Refer to the Location Plan in Appendix A.

A 400 linear foot public road and cul-de-sac is proposed to provide direct access from Tunxis Road to the residential properties. The site development will also include curbing, bituminous concrete driveways, landscaping, utilities, retaining walls, and a stormwater management system.

2.0 DESIGN METHODOLOGIES

All storm drainage has been designed in accordance with the State of Connecticut, Department of Transportation, Drainage Manual. The Rational Method was used for the development of peak flows for the storm sewer design while SCS Runoff (TR-55) was used for the detention design. Minimum times of concentration were 5 minutes for paved areas and 10 minutes for grassed areas. All other times of concentration were calculated using the TR-55 method. Precipitation records for each design storm are taken from NOAA Atlas 14, Volume 10, Version 2, Precipitation Frequency Data Server for West Hartford, CT. Refer to Appendix F for this information. Runoff coefficients of 0.3 (Lawns), and 0.9 (Pavement and Roofs) were used for the storm drainage design

The Hydraflow Storm Sewers program was used for the analysis of storm sewer pipe flow, gutter-flow, and hydraulic grade line. The roadway storm sewer system has been designed with the capacity necessary to convey the 10-year frequency design storm. The storm sewer system design can be found in Appendix C.

The Hydraflow Hydrographs program was used for pre-development and post-development analysis of the various drainage areas including the routing of hydrographs through the proposed subgrade detention system. This system has been designed with the capacity necessary to convey and control the 100-year frequency design storm. The Pre and Post-Development Hydrograph Analysis as well as the design of the proposed subgrade detention system pond can be found in Appendix B.

3.0 PRE-DEVELOPMENT SITE CONDITIONS

The existing property is mostly lawn with some wooded areas to the north and has an existing home with paved driveway.

The existing site is divided into three (3) pre-development drainage areas as follows (See Figures 1 and 2 in Appendix A):

Pre-Development A:	Runoff from the southern portion of site generally flows in a southeasterly direction to a Discharge Point located at an existing catch basin located on Tunxis Road.
Pre-Development B:	Runoff from the majority of the project site generally flows in an easterly direction to a Discharge Point located along the eastern property boundary. It is important to note that offsite runoff enters the 380 Tunxis Road property from the west and contributes to pre-development area "B".
Pre-Development C:	Runoff from the northern portion of the property generally flows in a northeasterly direction to a Discharge Point located along the northern property boundary. It is important to note that offsite runoff enters the 380 Tunxis Road property from the west and contributes to pre-development area "C".

A summary of the pre-development peak runoff rates can be seen in Table 1.

4.0 POST-DEVELOPMENT SITE CONDITIONS

The post-development watersheds have been divided into three (3) drainage areas for the purposed of comparing peak rates of runoff with that of pre-development, and can be seen in Figure 3 in Appendix A.

Roadway and front-yard site runoff will be controlled by a roadway storm drainage system consisting of Town Standard (Type C Top) catch basins and shall discharge to a plunge-pool level spreader prior to leaving the site. A second storm drainage system will capture the majority of remaining on-site and offsite runoff and shall discharge to a subgrade detention system. Prior to leaving the site, this runoff will discharge to a plunge-pool level spreader. The majority of roof runoff will be captured by the proposed storm drainage systems while the remaining will be allowed to sheet flow overland. All proposed piping within the development is high density polyethylene (HDPE) and has been sized to control the 10-year design storm. The layout of the system along with pipe sizes and lengths, inverts, top of frames, etc. can be seen on the "Drainage Schematic" or Figure 5 in Appendix A. The storm sewer calculations, which includes pipe hydraulics, gutter-flow analysis, and hydraulic grade line analysis can be seen in the Hydraflow results presented in Appendix C.

The roadway drainage system shall have coarse sediment removal through the use of 2' and 4'-deep sumps catch basins. The primary means for stormwater treatment will be provided by water quality structure (WQS-1). This structure is designed to treat the majority of site runoff and is specified to be a hydrodynamic separator from the CTDOT list of approved products. The structure is capable of removing 80% of total suspended solids (TSS) as well as preventing migration of oils and other floatables. Refer to Appendix D for water quality flow (WQF) and bypass sizing calculations for the proposed water quality structure. A modified riprap splashpad will provide outlet protection while a modified riprap level-spreader will further reduce discharge velocities and convert concentrated runoff to sheet-flow prior to discharging runoff to the adjacent wetlands to the east. These measures are consistent with procedures indicated in the Connecticut Stormwater Quality Manual. It is anticipated

that the combination of these structural BMP's will be most effective in controlling and eliminating sediment, oil and grease, leaves and grass clippings, and seasonally elevated runoff temperatures.

Prior to entering the subgrade detention system, pre-treatment shall occur from the combined use of 2' and 4'-deep sumps catch basins. The first-flush of site runoff shall also be directed through the detention system "isolator row". The isolator chamber row is wrapped in a non-woven geotextile, which is designed to capture any additional sediment that has not been captured in the upstream measures. The subgrade detention system is a chamber-type system surrounded by crushed stone and wrapped in filter fabric (See Figure 6 in Appendix A). The system has not been designed for infiltration as an added factor of safety, but it is likely that some infiltration will occur based on test pit information and permeability testing conducted by Clarence Welti Associates (See report in Appendix G). A proposed outlet control structure will release the detention system discharge at a reduce peak rate of runoff (See Figure 7 in Appendix A). A modified riprap splashpad will provide outlet protection while a modified riprap level-spreader will further reduce discharge velocities and convert concentrated runoff to sheet-flow prior to discharging runoff to the adjacent wetlands to the east. These measures are consistent with procedures indicated in the Connecticut Stormwater Quality Manual.

5.0 EROSION & SEDIMENTATION CONTROL MEASURES

In order to protect the adjacent properties and resource areas from construction related activities, a Soil Erosion and Sediment Control Plan has been developed in accordance with the latest Connecticut Guidelines for Soil Erosion and Sediment Control. This plan will be implemented prior to the start of any site disturbance and will involve the combined use of perimeter silt fencing, hay bale barriers, an anti-tracking pad, and vegetative stabilization. Refer to design plans for soil erosion and sediment control notes, construction sequence, and details.

Once a contractor has been selected and a construction schedule has been established a person shall be named and will be responsible for implementation of sediment and erosion control measures. This responsibility includes the acquisition of materials, installation, and maintenance of erosion and sediment structures, the communication and detailed explanation to all people involved in the site work of the requirements and objective of the erosion and sediment control measures.

Weston and Sampson (860) 513-1473 located at 273 Dividend Road, Rocky Hill, Connecticut, 06067 shall be notified of any proposed alteration to the erosion and sediment control plan, prior to altering, in order to ensure the feasibility of the addition, subtraction, or change in the plan.

An Operation and Maintenance Plan has been prepared for the proposed erosion and sediment control measures during the construction of the stormwater system. This plan shall be implemented at the onset and throughout construction activities until the project is complete. This plan provides guidelines for when the stormwater system should be cleaned, and associated record keeping and can be found in Appendix E.

6.0 SUMMARY

A Pre & Post Development analysis (Appendix B) has been performed to show that the total peak flow rate for the 2 thru 100-year design storms has not increased over that of pre-development. A summary of the pre and post-development peak flow rates for each Subarea is shown below in Table 1:

Table 1
Pre and Post-Development Peak Flows

	2-year, 24-hour storm		10-year, 24-hour storm		25-year, 24-hour storm		50-year, 24-hour storm		100-year, 24-hour storm	
Drainage Subareas	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**	**Peak Flow (cfs) (Pre)**	**Peak Flow (cfs) (Post)**
A	0.69	0.55	1.72	1.30	2.42	1.81	2.97	2.20	3.54	2.60
B	2.14	2.16*	5.12	5.45*	7.13	7.42*	8.70	8.90*	10.31	10.89*
C	0.82	0.54	1.90	1.25	2.63	1.73	3.19	2.10	3.77	2.48
Total (Site)	**3.66**	**3.13**	**8.74**	**7.64**	**12.18**	**10.51**	**14.87**	**12.72**	**17.61**	**15.08**

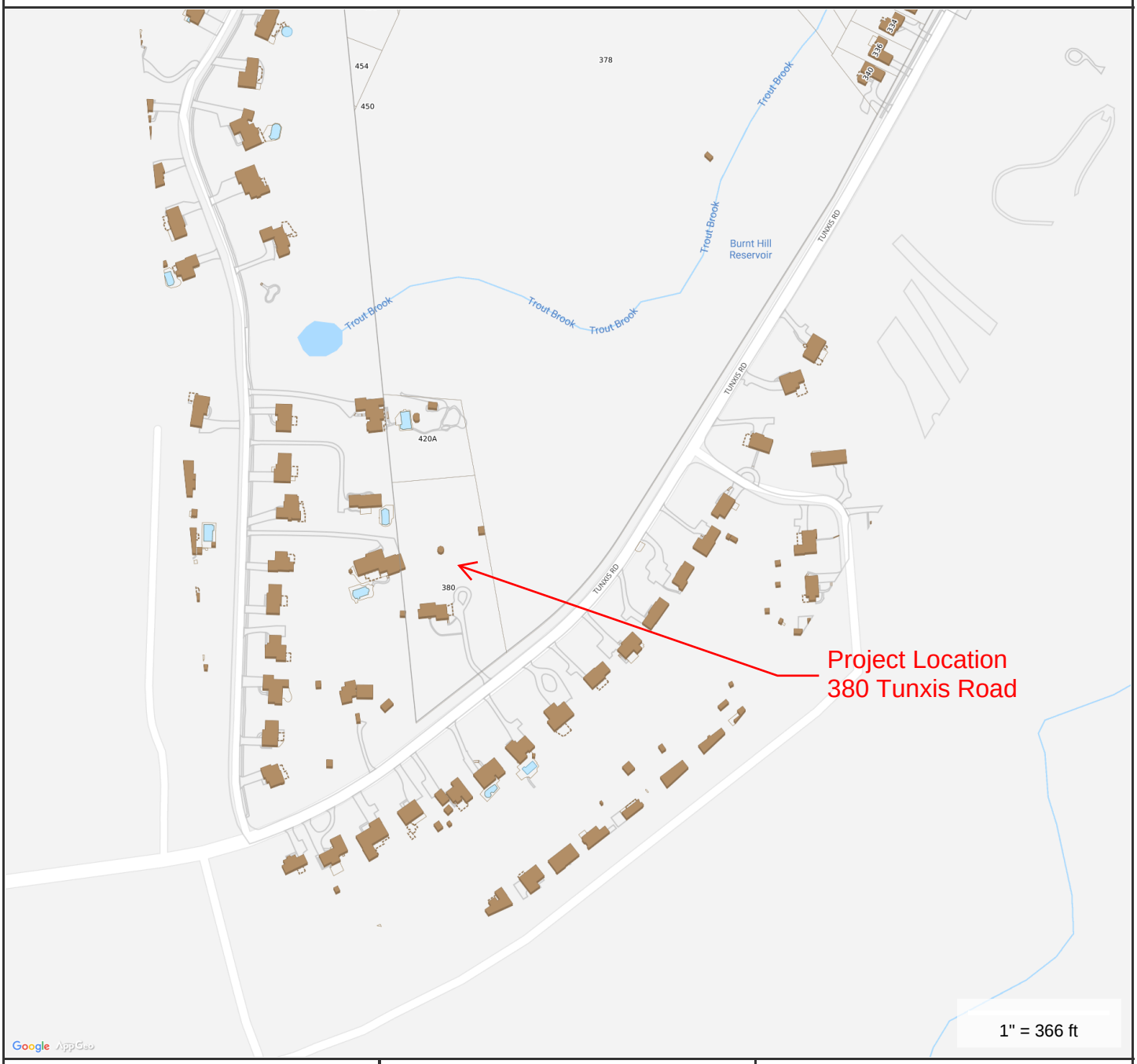
∗ Peak flow represents that which is reduced/mitigated as a result of subgrade detention (Post-Development Subarea B3)

It can be seen from the results in Table 1, that the proposed Stormwater Management System will effectively serve to mitigate the effects of the proposed site improvements. The total post-development peak flow for the various design storms is below that of pre-development. We would consider these results to be conservative since infiltration within the subgrade detention system has not been accounted for in the design and that the post-development peak flows may likely be lower than those indicated in this report.

APPENDIX A

Figures

Location Map



TOWN OF WEST HARTFORD

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

Town of West Hartford, CT makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 8/1/2018
Data updated Daily

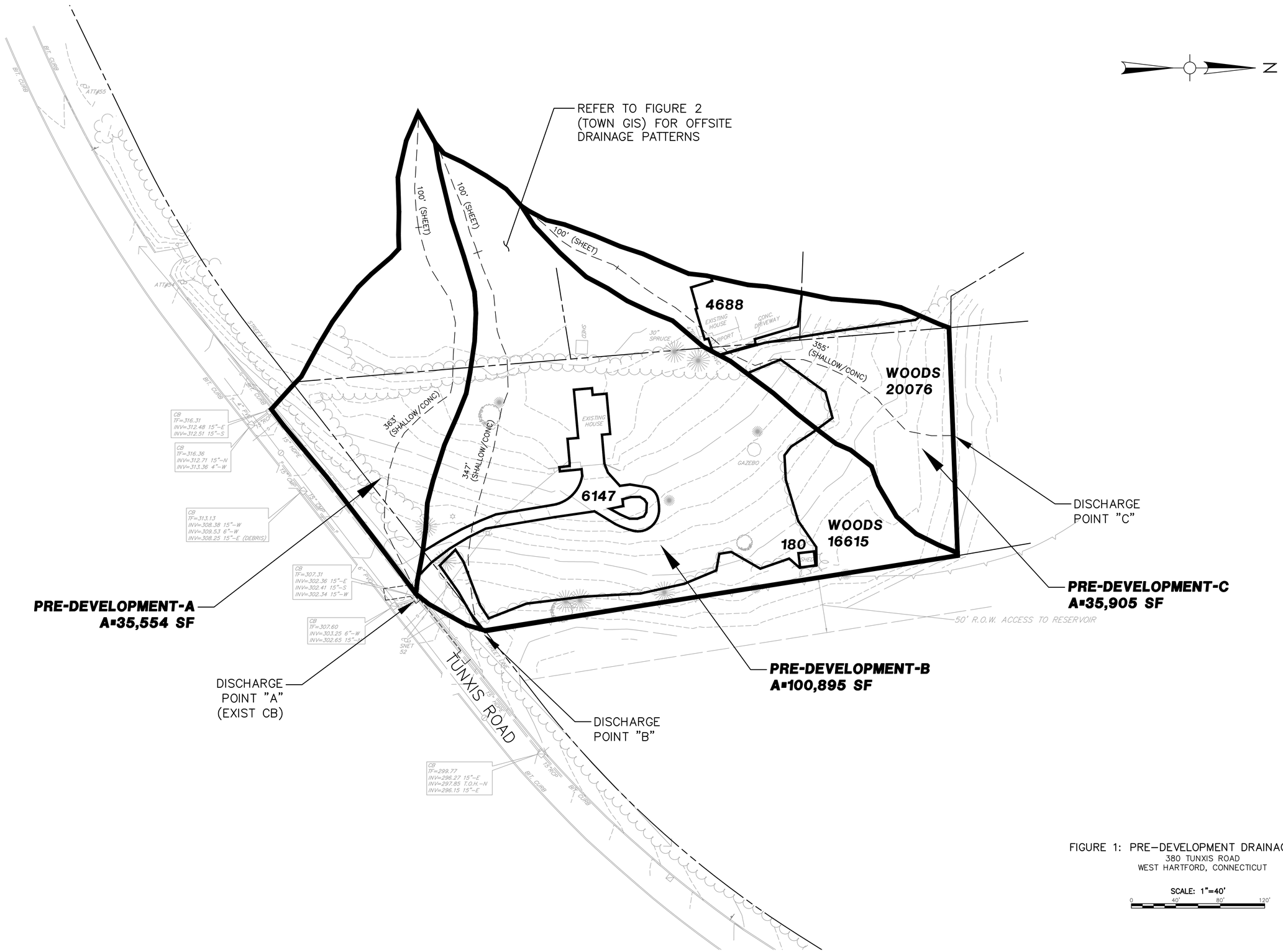
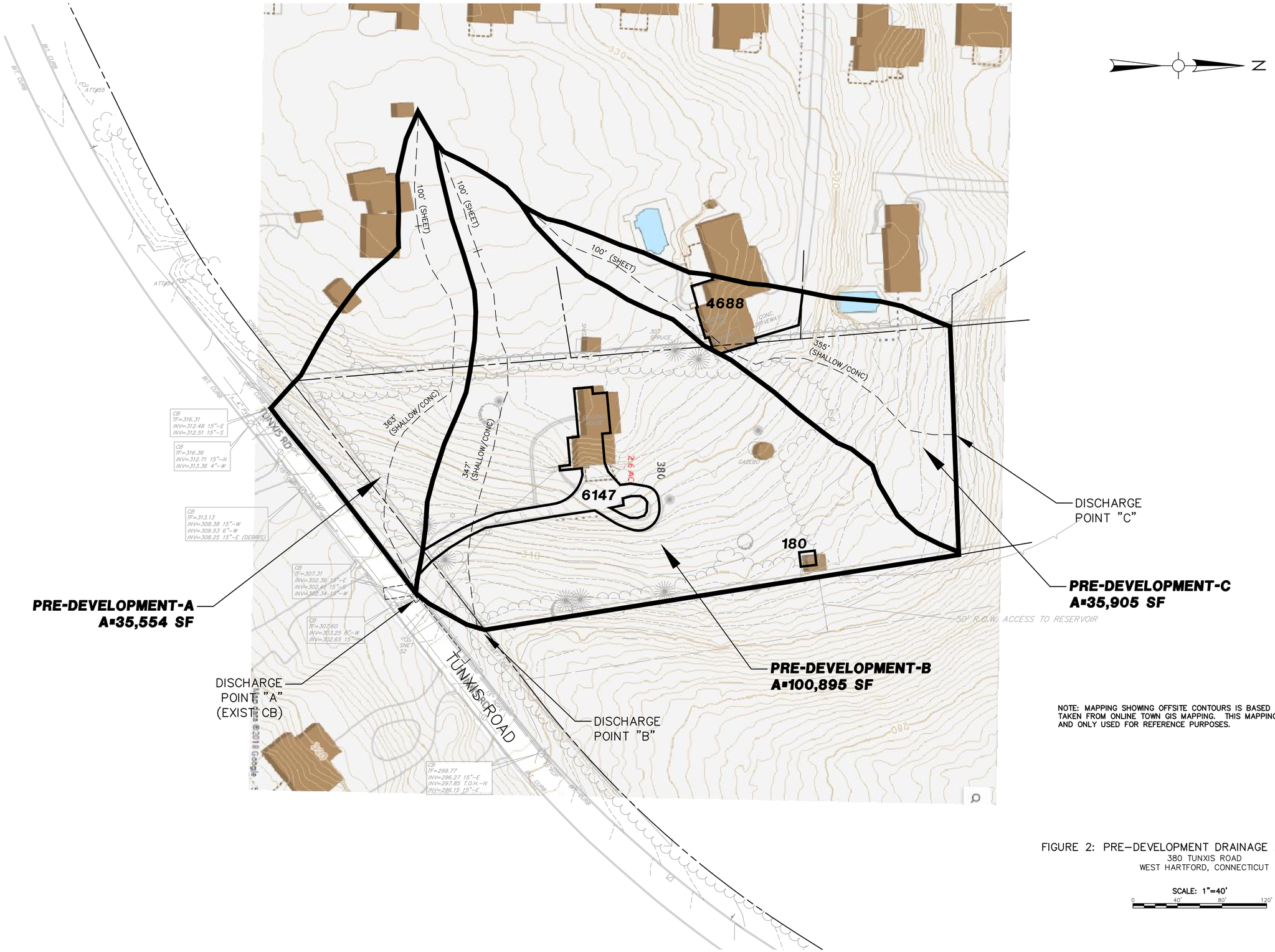


FIGURE 1: PRE-DEVELOPMENT DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'



NOTE: MAPPING SHOWING OFFSITE CONTOURS IS BASED ON TOPOGRAPHY TAKEN FROM ONLINE TOWN GIS MAPPING. THIS MAPPING IS APPROXIMATE AND ONLY USED FOR REFERENCE PURPOSES.

FIGURE 2: PRE–DEVELOPMENT DRAINAGE AREAS (OFFSITE)
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'

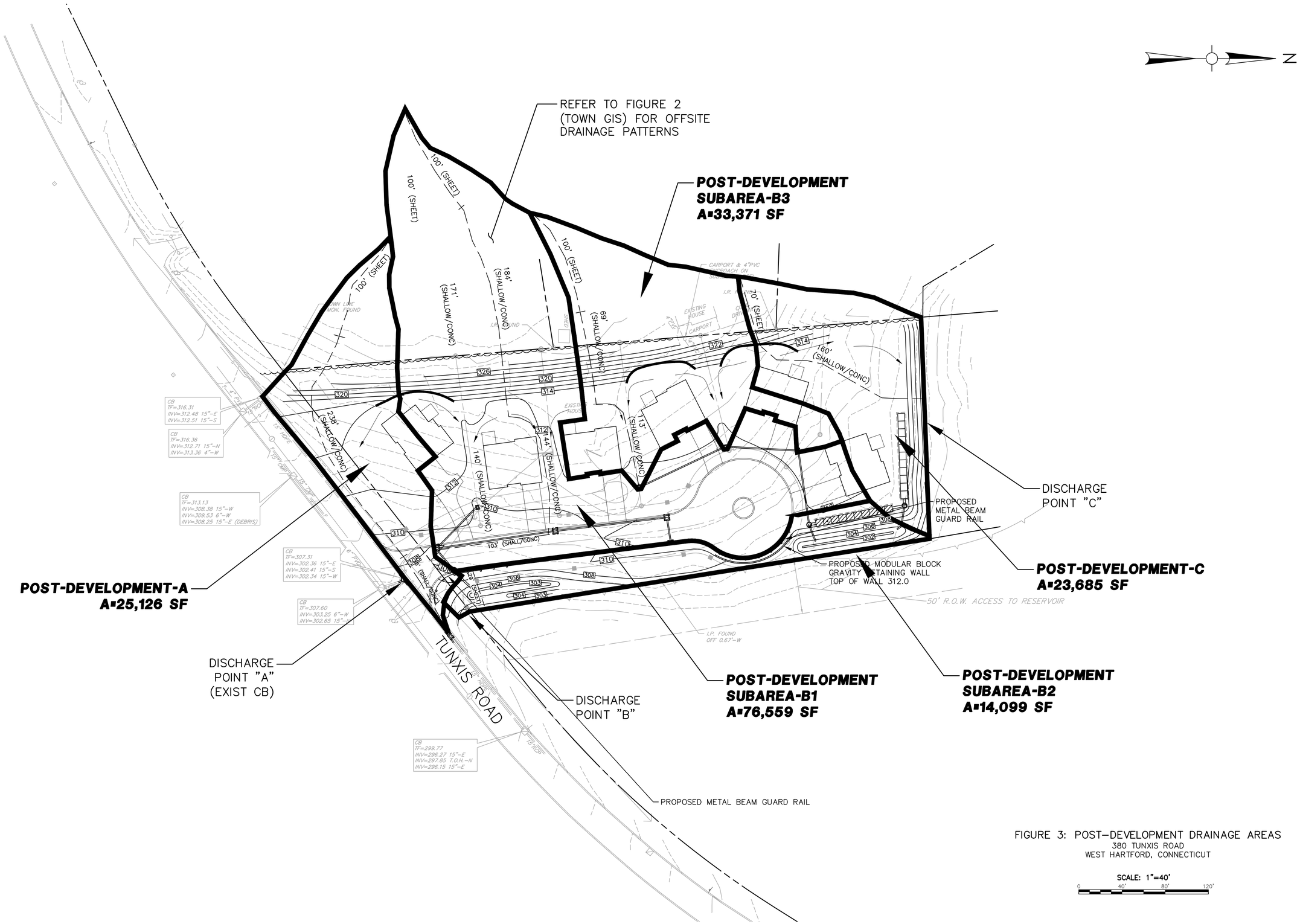


FIGURE 3: POST–DEVELOPMENT DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'

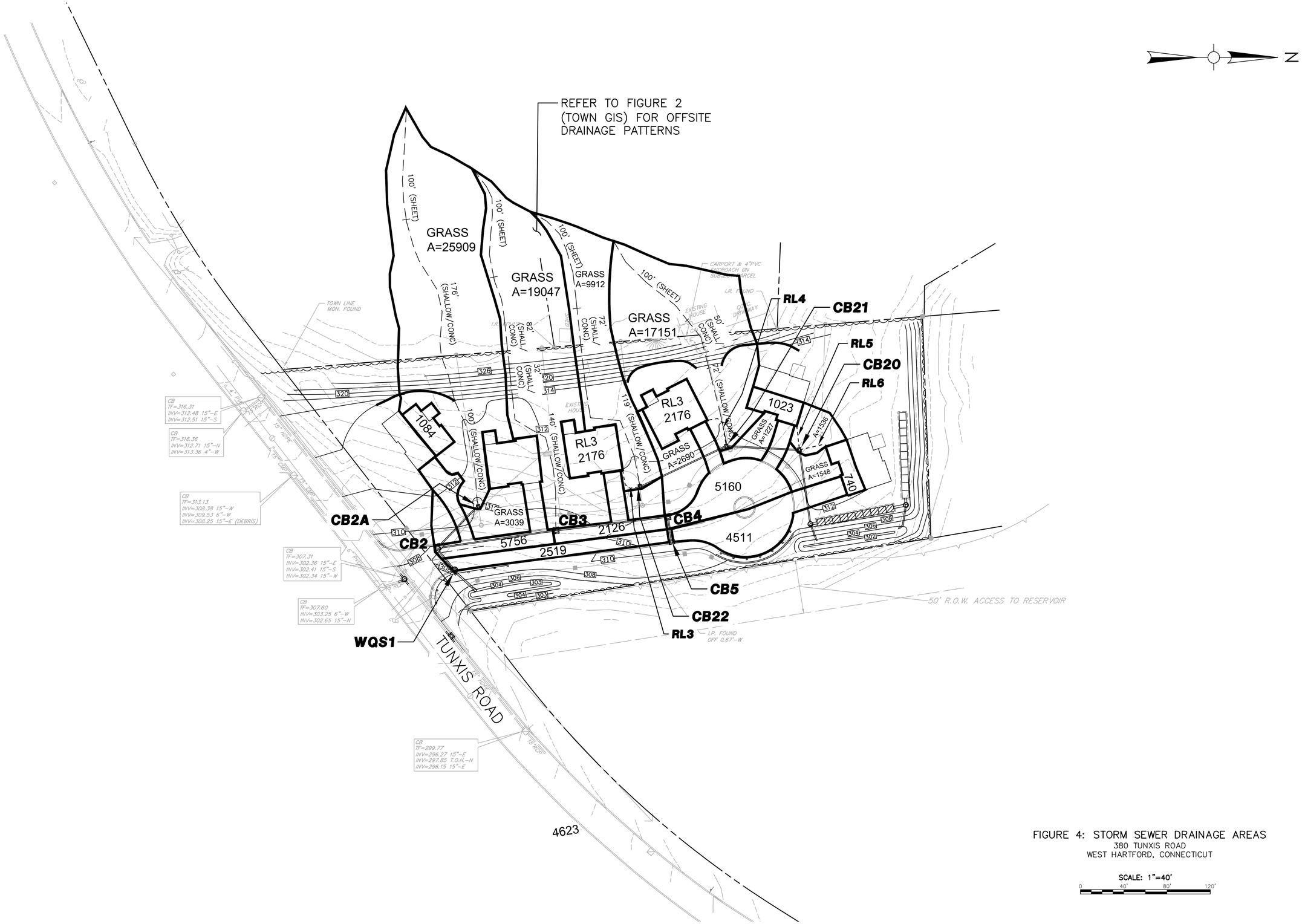
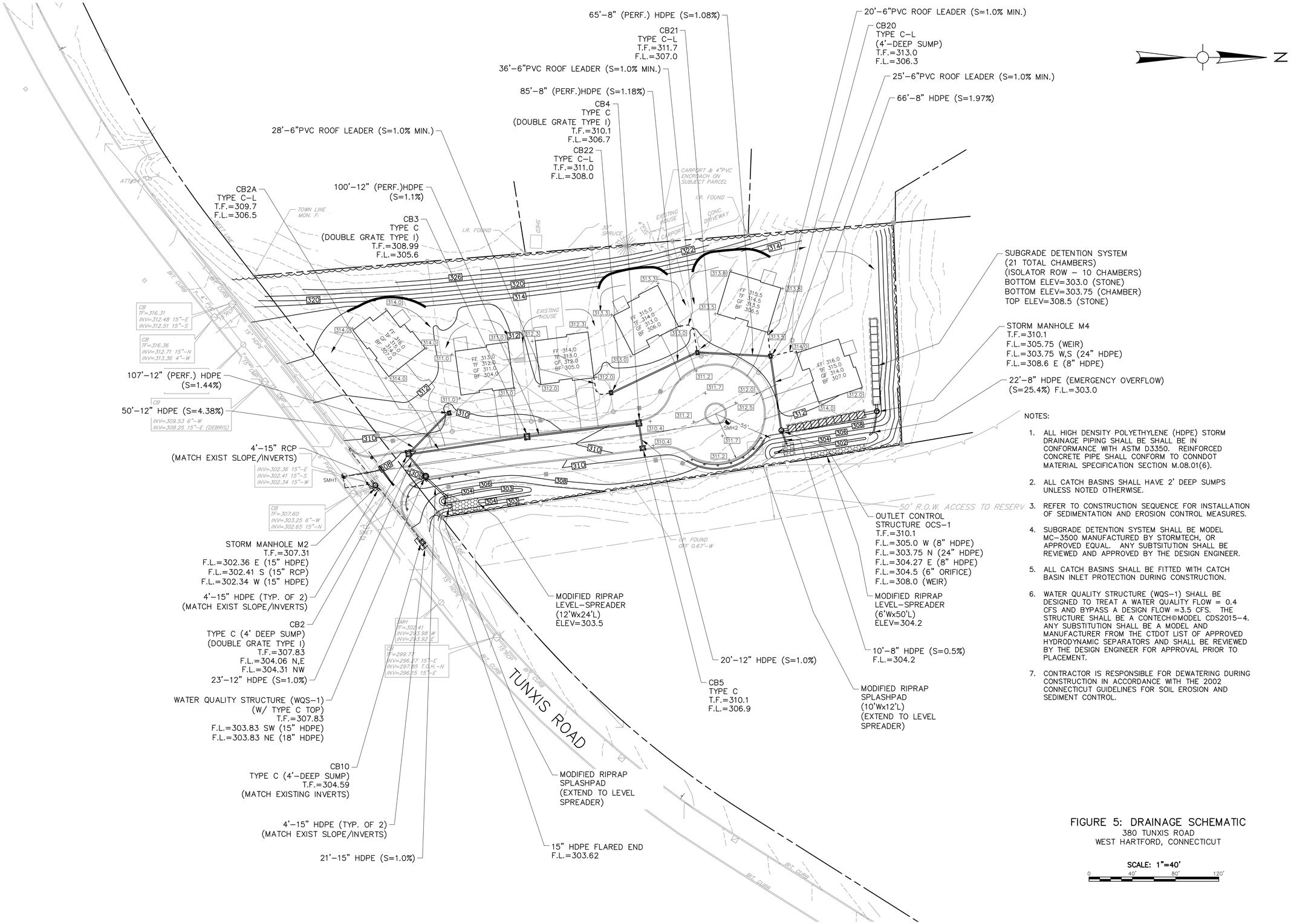


FIGURE 4: STORM SEWER DRAINAGE AREAS
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'



NOTES:

1. ALL HIGH DENSITY POLYETHYLENE (HDPE) STORM DRAINAGE PIPING SHALL BE SHALL BE IN CONFORMANCE WITH ASTM D3350. REINFORCED CONCRETE PIPE SHALL CONFORM TO CONNDOT MATERIAL SPECIFICATION SECTION M.08.01(6).
2. ALL CATCH BASINS SHALL HAVE 2' DEEP SUMPS UNLESS NOTED OTHERWISE.
3. REFER TO CONSTRUCTION SEQUENCE FOR INSTALLATION OF SEDIMENTATION AND EROSION CONTROL MEASURES.
4. SUBGRADE DETENTION SYSTEM SHALL BE MODEL MC-3500 MANUFACTURED BY STORMTECH, OR APPROVED EQUAL. ANY SUBTSITUTION SHALL BE REVIEWED AND APPROVED BY THE DESIGN ENGINEER.
5. ALL CATCH BASINS SHALL BE FITTED WITH CATCH BASIN INLET PROTECTION DURING CONSTRUCTION.
6. WATER QUALITY STRUCTURE (WQS-1) SHALL BE DESIGNED TO TREAT A WATER QUALITY FLOW = 0.4 CFS AND BYPASS A DESIGN FLOW =3.5 CFS. THE STRUCTURE SHALL BE A CONTECH©MODEL CDS2015-4. ANY SUBSTITUTION SHALL BE A MODEL AND MANUFACTURER FROM THE CTDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS AND SHALL BE REVIEWED BY THE DESIGN ENGINEER FOR APPROVAL PRIOR TO PLACEMENT.
7. CONTRACTOR IS RESPONSIBLE FOR DEWATERING DURING CONSTRUCTION IN ACCORDANCE WITH THE 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL.

FIGURE 5: DRAINAGE SCHEMATIC
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

SCALE: 1"=40'
0 40' 80' 120'

STORMTECH
CHAMBER SCHEDULE

ROW #	NUMBER OF CHAMBERS PER ROW
1	10
2	11
TOTAL=	21

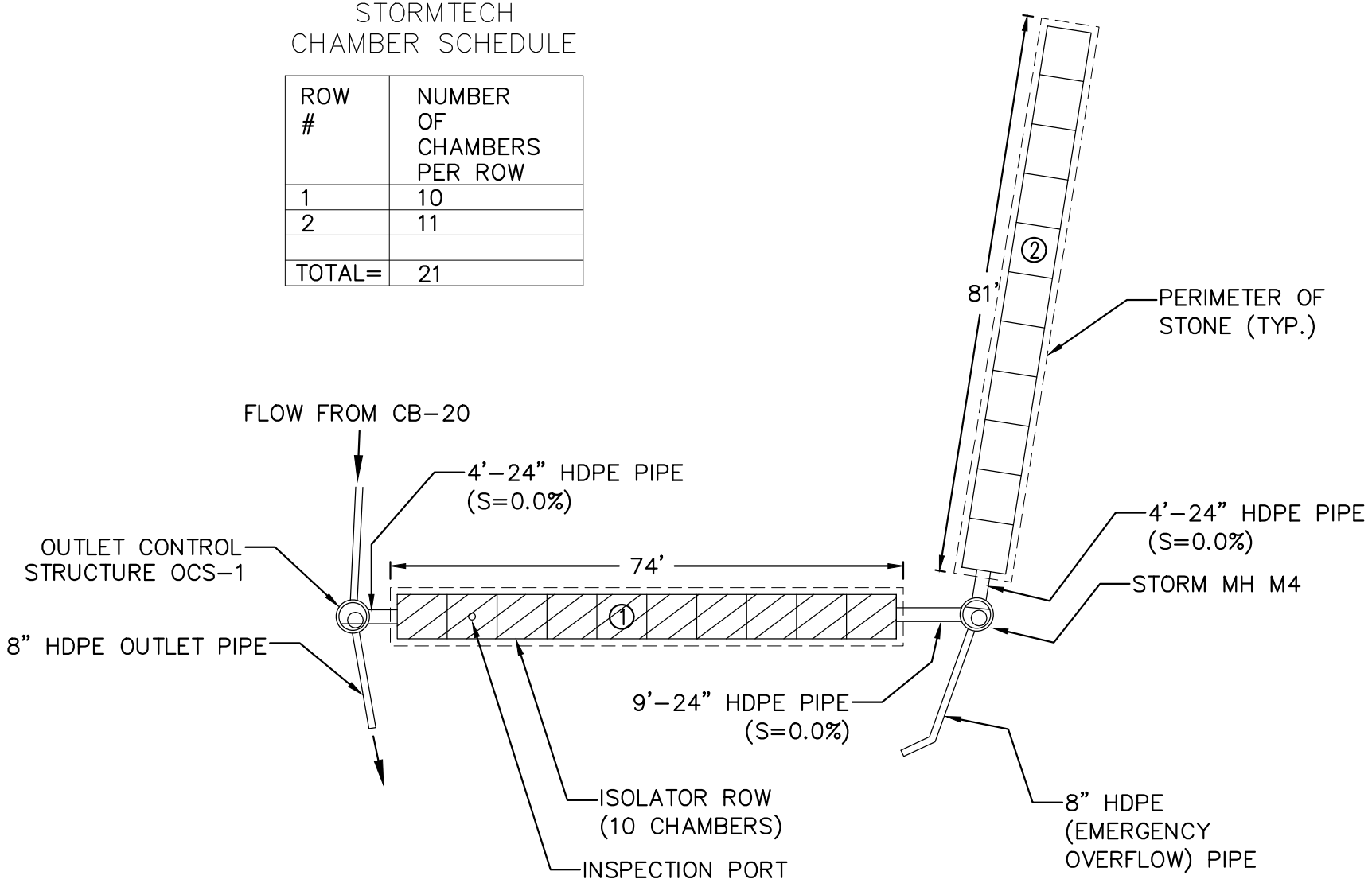


FIGURE 6: SUBGRADE DETENTION SYSTEM SCHEMATIC

N.T.S.

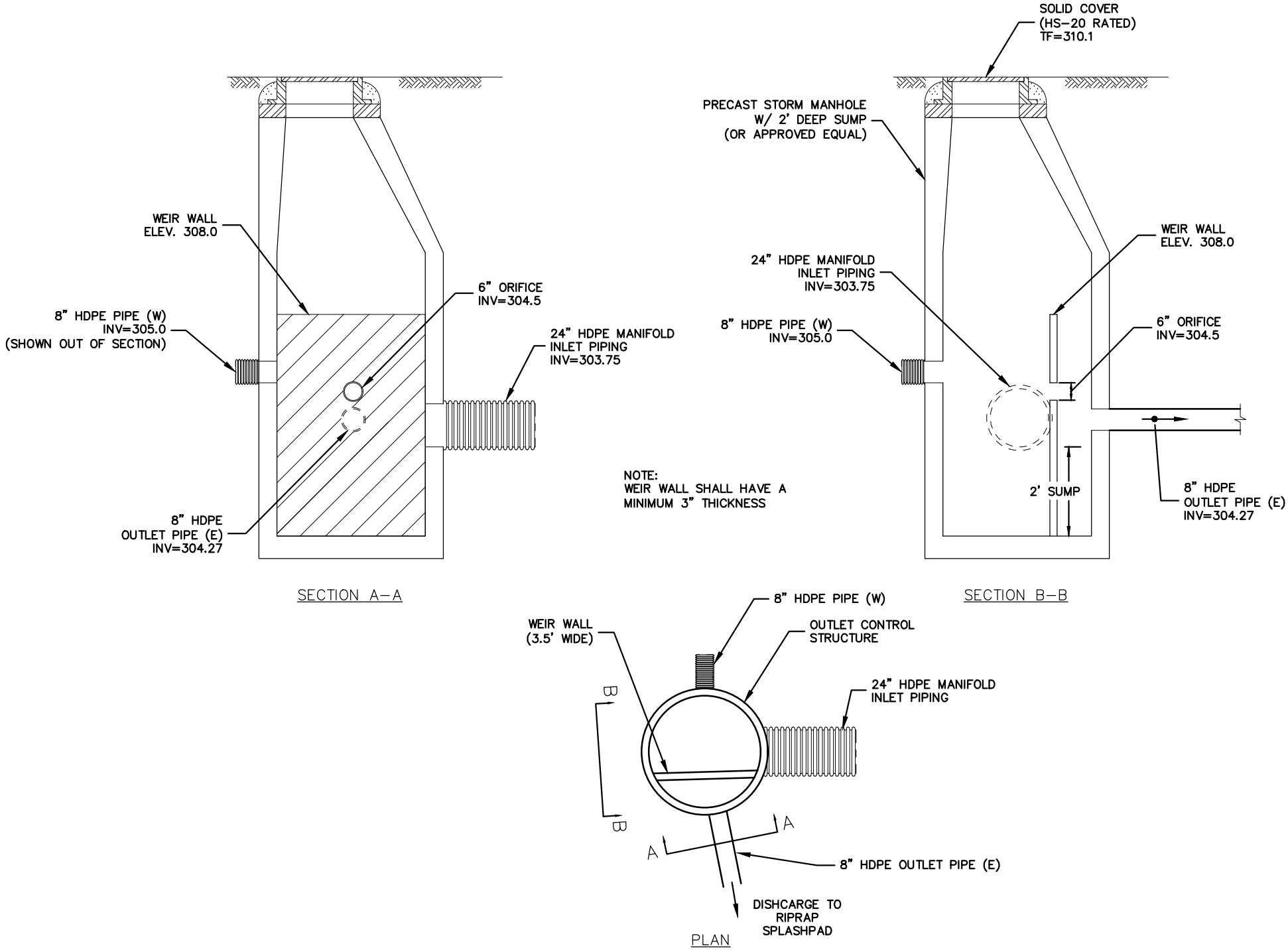


FIGURE 7: OUTLET CONTROL STRUCTURE (OCS-1) AND PIPING DETAIL

N.T.S

APPENDIX B

Pre and Post-Development Analysis (Detention System Design)

SUBJECT	380 Tunxis Rd	SHEET NO.	1	OF	1
	Pre and Post Development	COMPUTED BY	BH	DATE	12/10/2018
JOB NO.	2180652	CHECKED BY	JSP	DATE	3/22/2019

DATA SHEET FOR TR-55 METHOD STORM DRAINAGE DESIGN

NODE		AREA	RUNOFF CURVE NUMBER			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	CN VALUE	TOTAL	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
PRE-	35554	0.816	GRASS	74	60.40	1.5	100	2	Grass	14.25	Sheet
DEVELOP	0	0.000	IMPERVIOUS	98	0.00	39	363	11	Grass	1.13	Shallow
A	0	0.000	WOODS	73	0.00						
						(Tc Calulation from Hydraflow)				15.38	(Total)
	TOTAL	0.816		74.0							
PRE-	77953	1.790	GRASS	74	132.43	2.5	100	3	Grass	12.11	Sheet
DEVELOP	6327	0.145	IMPERVIOUS	98	14.23	32	347	9	Grass	1.19	Shallow
B	16615	0.381	WOODS	73	27.84						
						(Tc Calulation from Hydraflow)				13.3	(Total)
	TOTAL	2.316		75.3							
PRE-	11141	0.256	GRASS	74	18.93	4	100	4	Grass	10.8	Sheet
DEVELOP	4688	0.108	IMPERVIOUS	98	10.55	31	355	9	Grass	0.66	Shallow
C	20076	0.461	WOODS	73	33.64						
						(Tc Calulation from Hydraflow)				11.46	(Total)
	TOTAL	0.824		76.6							

SUBJECT	380 Tunxis Rd	SHEET NO.	1	OF	1
	Post Development	COMPUTED BY	JSP	DATE	4/16/2019
JOB NO.	2180652	CHECKED BY	JSP	DATE	4/16/2019

DATA SHEET FOR TR-55 METHOD STORM DRAINAGE DESIGN

NODE		AREA	RUNOFF CURVE NUMBER			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	CN VALUE	TOTAL	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
POST	23156	0.532	GRASS	74	39.34	6	100	6.0	Grass	9.18	Sheet
DEVELOP	1970	0.045	IMPERVIOUS	98	4.43	23	238	9.7	Grass	0.78	Shallow
A						3	76	3.9	Impv	0.31	Shallow
						(Tc Calulation from Hydraflow)				10.3	(Total)
TOTAL	25126	0.577		75.9							
POST	55294	1.269	GRASS	74	93.93	1.5	100	1.5	Grass	16	Sheet
DEVELOP	21265	0.488	IMPERVIOUS	98	47.84	24	184	13.0	Grass	0.53	Shallow
B1						4	144	2.8	Grass	0.89	Shallow
						1.2	103	1.2	Impv	0.77	Shallow
TOTAL	76559	1.758		80.7		(Tc Calulation from Hydraflow)				18.2	(Total)
POST	14099	0.324	GRASS	74	23.95	Use minimum for grass)=				10	
DEVELOP	0	0.000	IMPERVIOUS	98	0.00						
B2											
TOTAL	14099	0.324		74.0							
POST	27256	0.626	GRASS	74	46.30	4	100	4.0	Grass	10.8	Sheet
DEVELOP	6115	0.140	IMPERVIOUS	98	13.76	22	69	31.9	Grass	0.13	Shallow
B3						2.5	113	2.2	Grass	0.83	Shallow
TOTAL	33371	0.766		78.4		(Tc Calulation from Hydraflow)				11.8	(Total)
POST	21093	0.484	GRASS	74	35.83	Use minimum for grass)=				10	
DEVELOP	2592	0.060	IMPERVIOUS	98	5.83						
C											
TOTAL	23685	0.544		76.6							

Hydraflow Table of Contents

Pre_Post_Tunxis Rd_R2.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Thursday, 04 / 25 / 2019

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25 - Year
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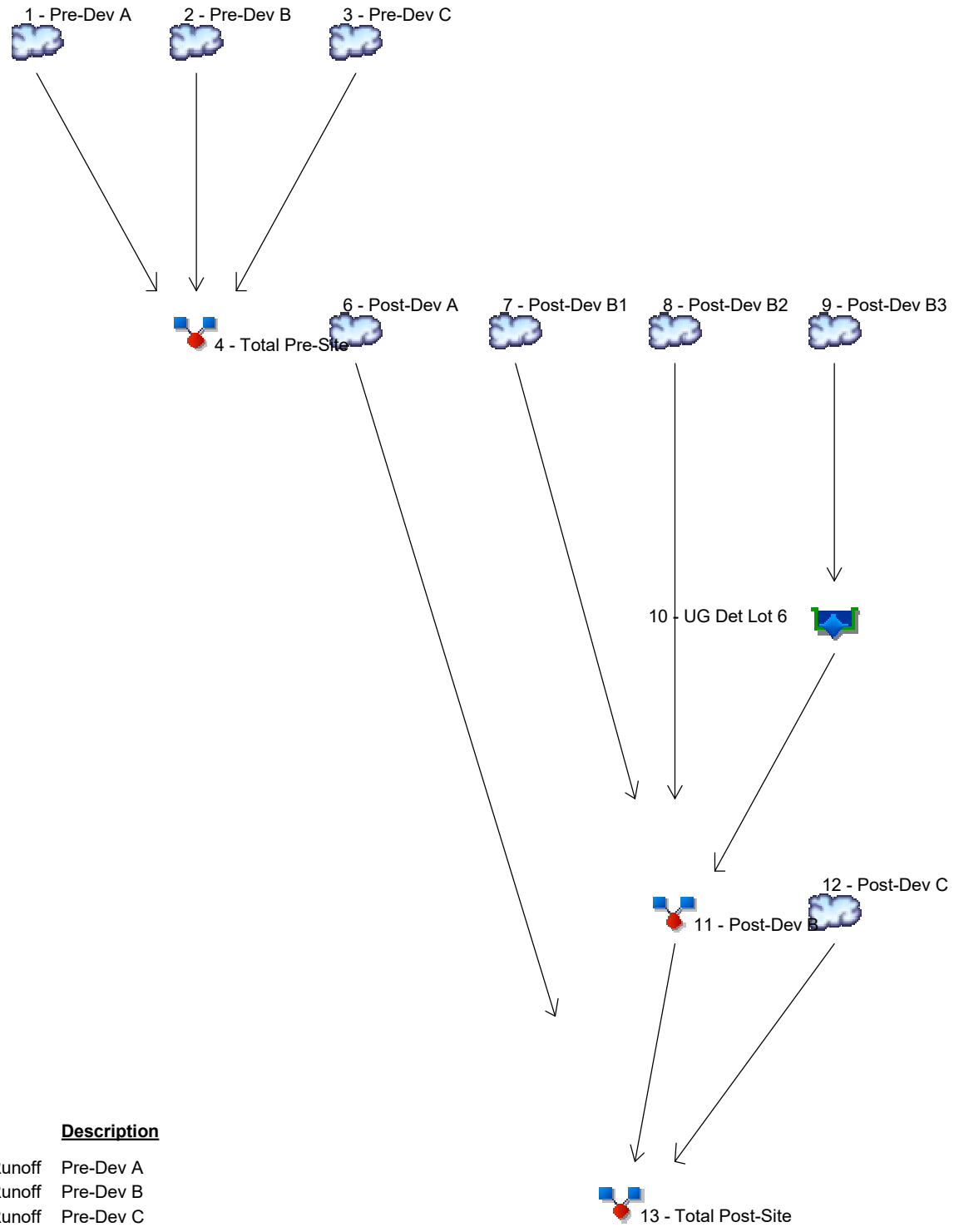
50 - Year
- **Summary Report** 6

100 - Year
- **Summary Report** 7

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Dev A
2	SCS Runoff	Pre-Dev B
3	SCS Runoff	Pre-Dev C
4	Combine	Total Pre-Site
6	SCS Runoff	Post-Dev A
7	SCS Runoff	Post-Dev B1
8	SCS Runoff	Post-Dev B2
9	SCS Runoff	Post-Dev B3
10	Reservoir	UG Det Lot 6
11	Combine	Post-Dev B
12	SCS Runoff	Post-Dev C
13	Combine	Total Post-Site

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	------	-------	0.696	-------	-------	1.722	2.422	2.973	3.537	Pre-Dev A
2	SCS Runoff	------	-------	2.141	-------	-------	5.119	7.129	8.704	10.31	Pre-Dev B
3	SCS Runoff	------	-------	0.822	-------	-------	1.904	2.626	3.190	3.765	Pre-Dev C
4	Combine	1, 2, 3	-------	3.659	-------	-------	8.744	12.18	14.87	17.61	Total Pre-Site
6	SCS Runoff	------	-------	0.553	-------	-------	1.302	1.805	2.199	2.600	Post-Dev A
7	SCS Runoff	------	-------	1.916	-------	-------	4.086	5.498	6.589	7.695	Post-Dev B1
8	SCS Runoff	------	-------	0.276	-------	-------	0.684	0.962	1.180	1.404	Post-Dev B2
9	SCS Runoff	------	-------	0.845	-------	-------	1.876	2.555	3.083	3.619	Post-Dev B3
10	Reservoir	9	-------	0.230	-------	-------	0.879	1.204	1.466	2.812	UG Det Lot 6
11	Combine	7, 8, 10	-------	2.165	-------	-------	5.447	7.416	8.902	10.89	Post-Dev B
12	SCS Runoff	------	-------	0.537	-------	-------	1.248	1.725	2.097	2.476	Post-Dev C
13	Combine	6, 11, 12	-------	3.134	-------	-------	7.641	10.51	12.72	15.08	Total Post-Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	0.696	5	730	2,899	------	------	------	Pre-Dev A
2	SCS Runoff	2.141	5	730	8,812	------	------	------	Pre-Dev B
3	SCS Runoff	0.822	5	730	3,350	------	------	------	Pre-Dev C
4	Combine	3.659	5	730	15,061	1, 2, 3	------	------	Total Pre-Site
6	SCS Runoff	0.553	5	730	2,264	------	------	------	Post-Dev A
7	SCS Runoff	1.916	5	735	9,295	------	------	------	Post-Dev B1
8	SCS Runoff	0.276	5	730	1,151	------	------	------	Post-Dev B2
9	SCS Runoff	0.845	5	730	3,404	------	------	------	Post-Dev B3
10	Reservoir	0.230	5	760	2,232	9	304.80	1,492	UG Det Lot 6
11	Combine	2.165	5	735	12,678	7, 8, 10	------	------	Post-Dev B
12	SCS Runoff	0.537	5	730	2,190	------	------	------	Post-Dev C
13	Combine	3.134	5	735	17,132	6, 11, 12	------	------	Total Post-Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	1.722	5	730	6,855	------	------	------	Pre-Dev A
2	SCS Runoff	5.119	5	730	20,345	------	------	------	Pre-Dev B
3	SCS Runoff	1.904	5	730	7,561	------	------	------	Pre-Dev C
4	Combine	8.744	5	730	34,761	1, 2, 3	------	------	Total Pre-Site
6	SCS Runoff	1.302	5	730	5,172	------	------	------	Post-Dev A
7	SCS Runoff	4.086	5	735	19,605	------	------	------	Post-Dev B1
8	SCS Runoff	0.684	5	730	2,722	------	------	------	Post-Dev B2
9	SCS Runoff	1.876	5	730	7,452	------	------	------	Post-Dev B3
10	Reservoir	0.879	5	745	6,281	9	305.96	2,657	UG Det Lot 6
11	Combine	5.447	5	735	28,607	7, 8, 10	------	------	Post-Dev B
12	SCS Runoff	1.248	5	730	4,959	------	------	------	Post-Dev C
13	Combine	7.641	5	735	38,739	6, 11, 12	------	------	Total Post-Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	2.422	5	730	9,620	------	------	------	Pre-Dev A
2	SCS Runoff	7.129	5	730	28,338	------	------	------	Pre-Dev B
3	SCS Runoff	2.626	5	730	10,453	------	------	------	Pre-Dev C
4	Combine	12.18	5	730	48,411	1, 2, 3	------	------	Total Pre-Site
6	SCS Runoff	1.805	5	730	7,180	------	------	------	Post-Dev A
7	SCS Runoff	5.498	5	735	26,509	------	------	------	Post-Dev B1
8	SCS Runoff	0.962	5	730	3,820	------	------	------	Post-Dev B2
9	SCS Runoff	2.555	5	730	10,201	------	------	------	Post-Dev B3
10	Reservoir	1.204	5	745	9,029	9	306.89	3,498	UG Det Lot 6
11	Combine	7.416	5	735	39,358	7, 8, 10	------	------	Post-Dev B
12	SCS Runoff	1.725	5	730	6,863	------	------	------	Post-Dev C
13	Combine	10.51	5	730	53,401	6, 11, 12	------	------	Total Post-Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	2.973	5	730	11,832	------	------	------	Pre-Dev A
2	SCS Runoff	8.704	5	730	34,706	------	------	------	Pre-Dev B
3	SCS Runoff	3.190	5	730	12,750	------	------	------	Pre-Dev C
4	Combine	14.87	5	730	59,289	1, 2, 3	------	------	Total Pre-Site
6	SCS Runoff	2.199	5	730	8,776	------	------	------	Post-Dev A
7	SCS Runoff	6.589	5	735	31,935	------	------	------	Post-Dev B1
8	SCS Runoff	1.180	5	730	4,698	------	------	------	Post-Dev B2
9	SCS Runoff	3.083	5	730	12,374	------	------	------	Post-Dev B3
10	Reservoir	1.466	5	745	11,202	9	307.86	4,112	UG Det Lot 6
11	Combine	8.902	5	735	47,835	7, 8, 10	------	------	Post-Dev B
12	SCS Runoff	2.097	5	730	8,377	------	------	------	Post-Dev C
13	Combine	12.72	5	730	64,988	6, 11, 12	------	------	Total Post-Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

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	3.537	5	730	14,126	------	------	------	Pre-Dev A
2	SCS Runoff	10.31	5	730	41,297	------	------	------	Pre-Dev B
3	SCS Runoff	3.765	5	730	15,122	------	------	------	Pre-Dev C
4	Combine	17.61	5	730	70,545	1, 2, 3	------	------	Total Pre-Site
6	SCS Runoff	2.600	5	730	10,427	------	------	------	Post-Dev A
7	SCS Runoff	7.695	5	735	37,503	------	------	------	Post-Dev B1
8	SCS Runoff	1.404	5	730	5,609	------	------	------	Post-Dev B2
9	SCS Runoff	3.619	5	730	14,611	------	------	------	Post-Dev B3
10	Reservoir	2.812	5	740	13,439	9	308.46	4,340	UG Det Lot 6
11	Combine	10.89	5	740	56,551	7, 8, 10	------	------	Post-Dev B
12	SCS Runoff	2.476	5	730	9,940	------	------	------	Post-Dev C
13	Combine	15.08	5	735	76,918	6, 11, 12	------	------	Total Post-Site

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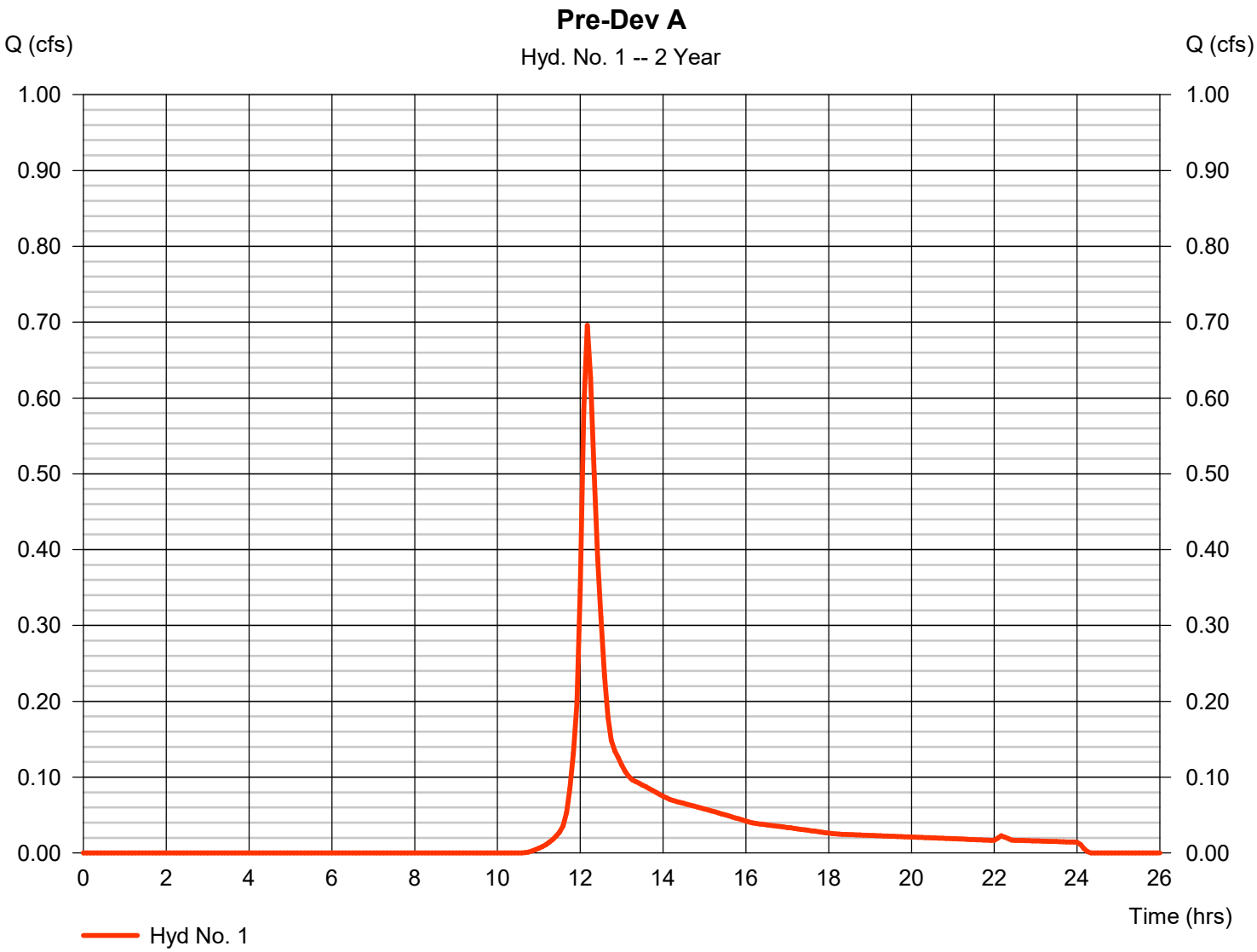
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.696 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,899 cuft
Drainage area	= 0.816 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.40 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No. 1

Pre-Dev A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 14.25**	**+**	**0.00**	**+**	**0.00**	**=**	**14.25**
Shallow Concentrated Flow							
Flow length (ft)	= 363.00		0.00		0.00		
Watercourse slope (%)	= 11.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.35		0.00		0.00		
Travel Time (min)	**= 1.13**	**+**	**0.00**	**+**	**0.00**	**=**	**1.13**
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 ..... 15.40 min

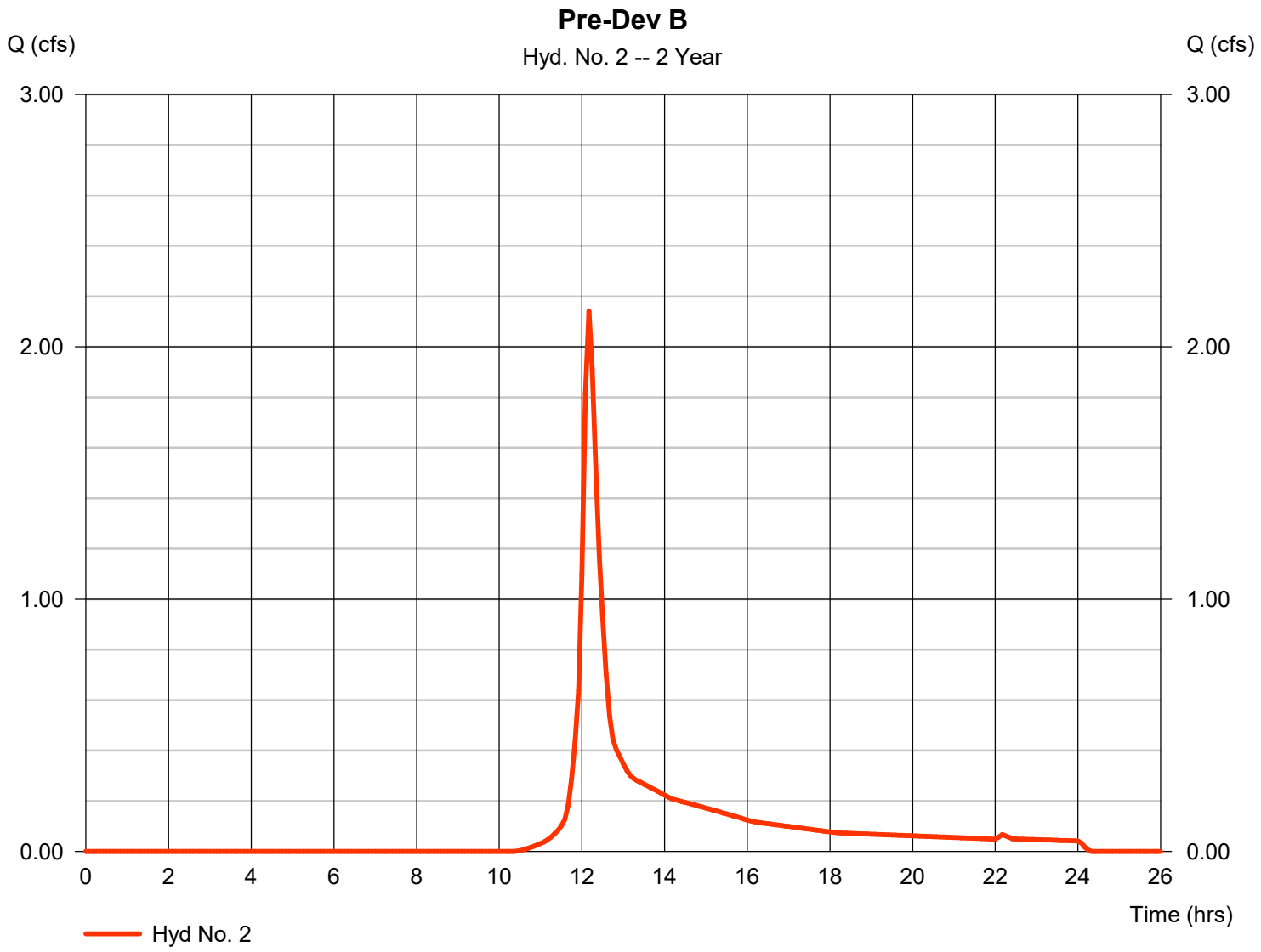
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 2

Pre-Dev B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.141 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 8,812 cuft
Drainage area	= 2.316 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019

Hyd. No. 2

Pre-Dev B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 12.11**	**+**	**0.00**	**+**	**0.00**	**=**	**12.11**
Shallow Concentrated Flow							
Flow length (ft)	= 347.00		0.00		0.00		
Watercourse slope (%)	= 9.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.84		0.00		0.00		
Travel Time (min)	**= 1.19**	**+**	**0.00**	**+**	**0.00**	**=**	**1.19**
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 ..... 13.30 min

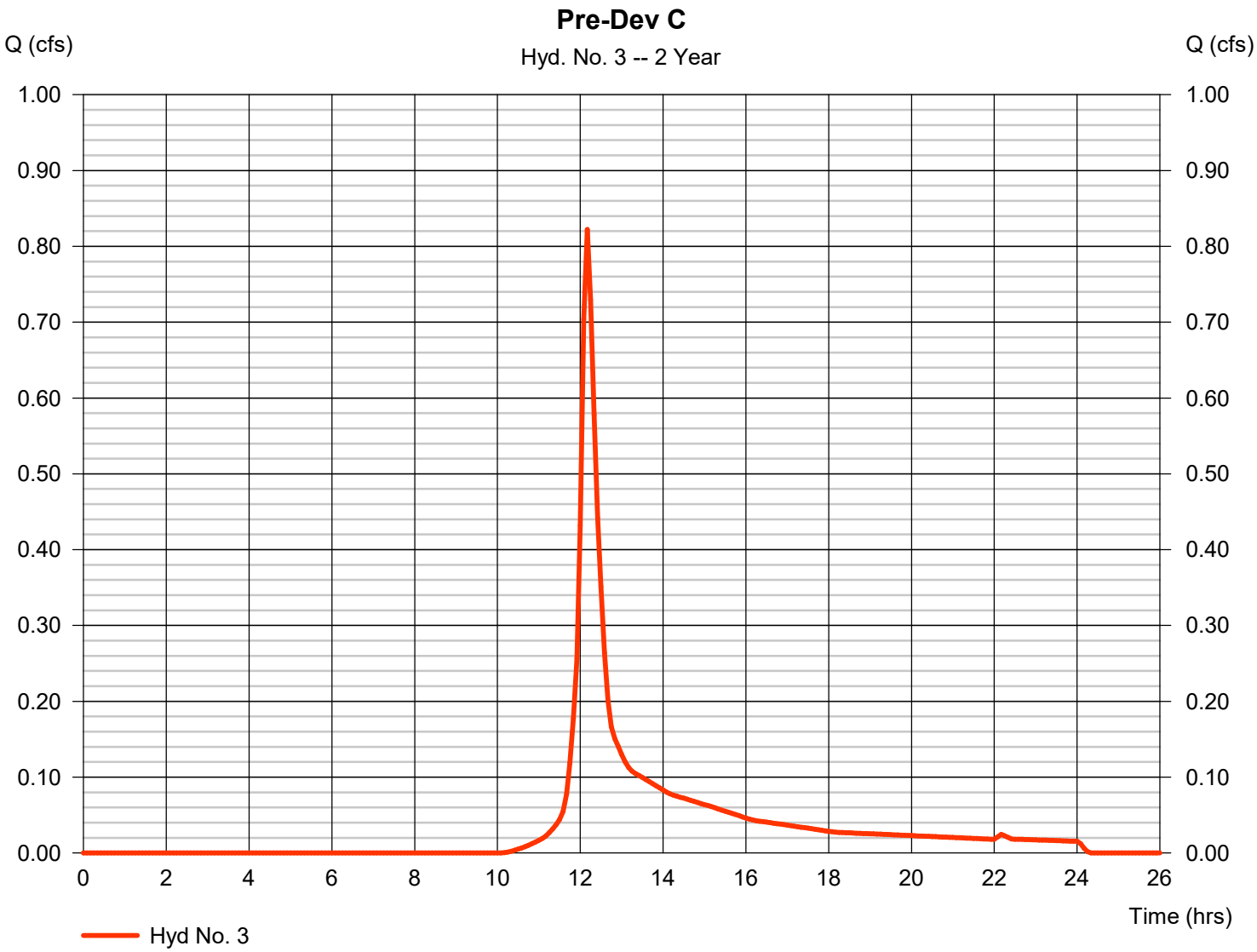
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 3

Pre-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.822 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 3,350 cuft
Drainage area	= 0.824 ac	Curve number	= 76.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.50 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Pre-Dev C

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 10.80**	**+**	**0.00**	**+**	**0.00**	**=**	**10.80**
Shallow Concentrated Flow							
Flow length (ft)	= 355.00		0.00		0.00		
Watercourse slope (%)	= 31.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=8.98		0.00		0.00		
Travel Time (min)	**= 0.66**	**+**	**0.00**	**+**	**0.00**	**=**	**0.66**
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 ..... 11.50 min

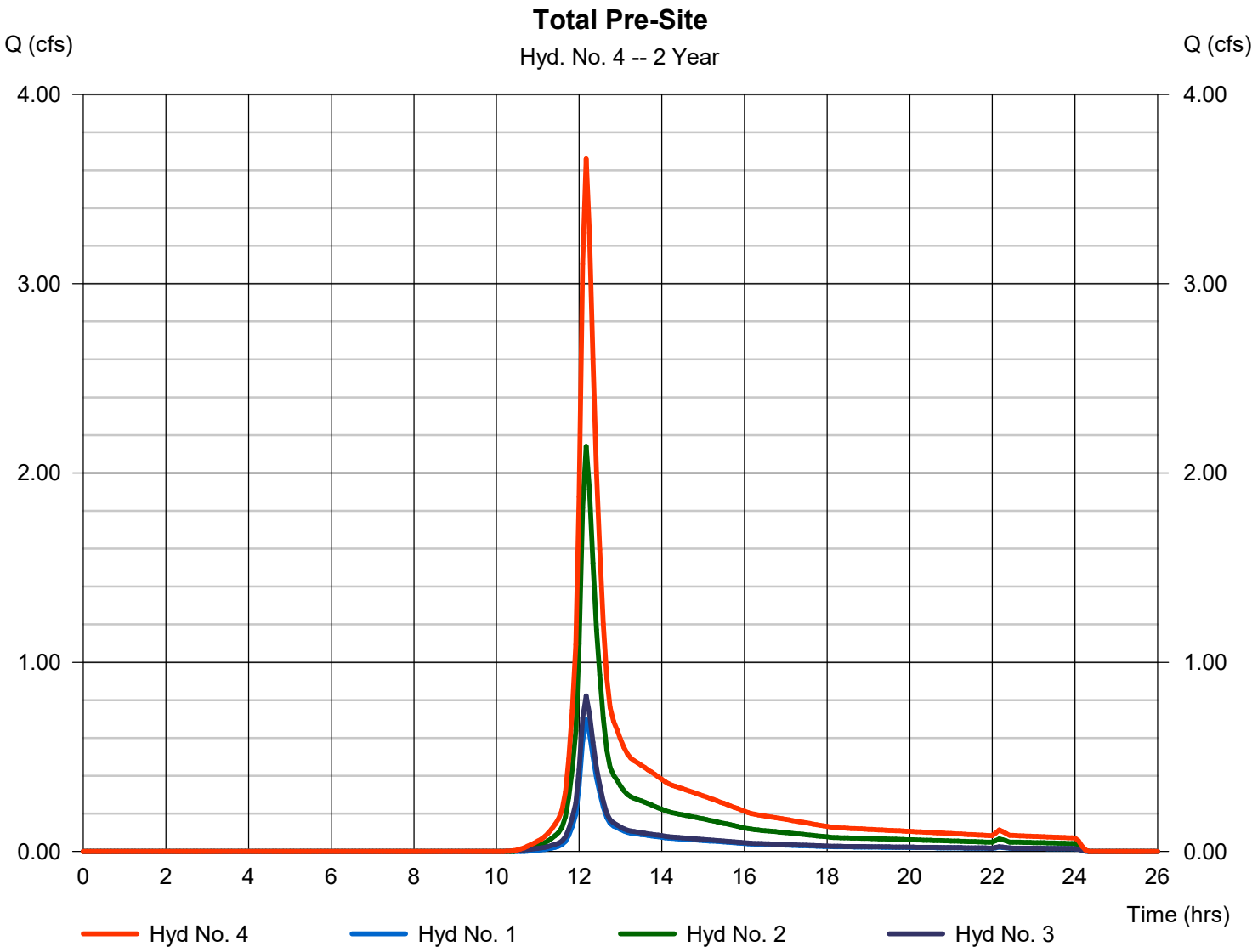
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 4

Total Pre-Site

Hydrograph type	= Combine	Peak discharge	= 3.659 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 15,061 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 3.956 ac



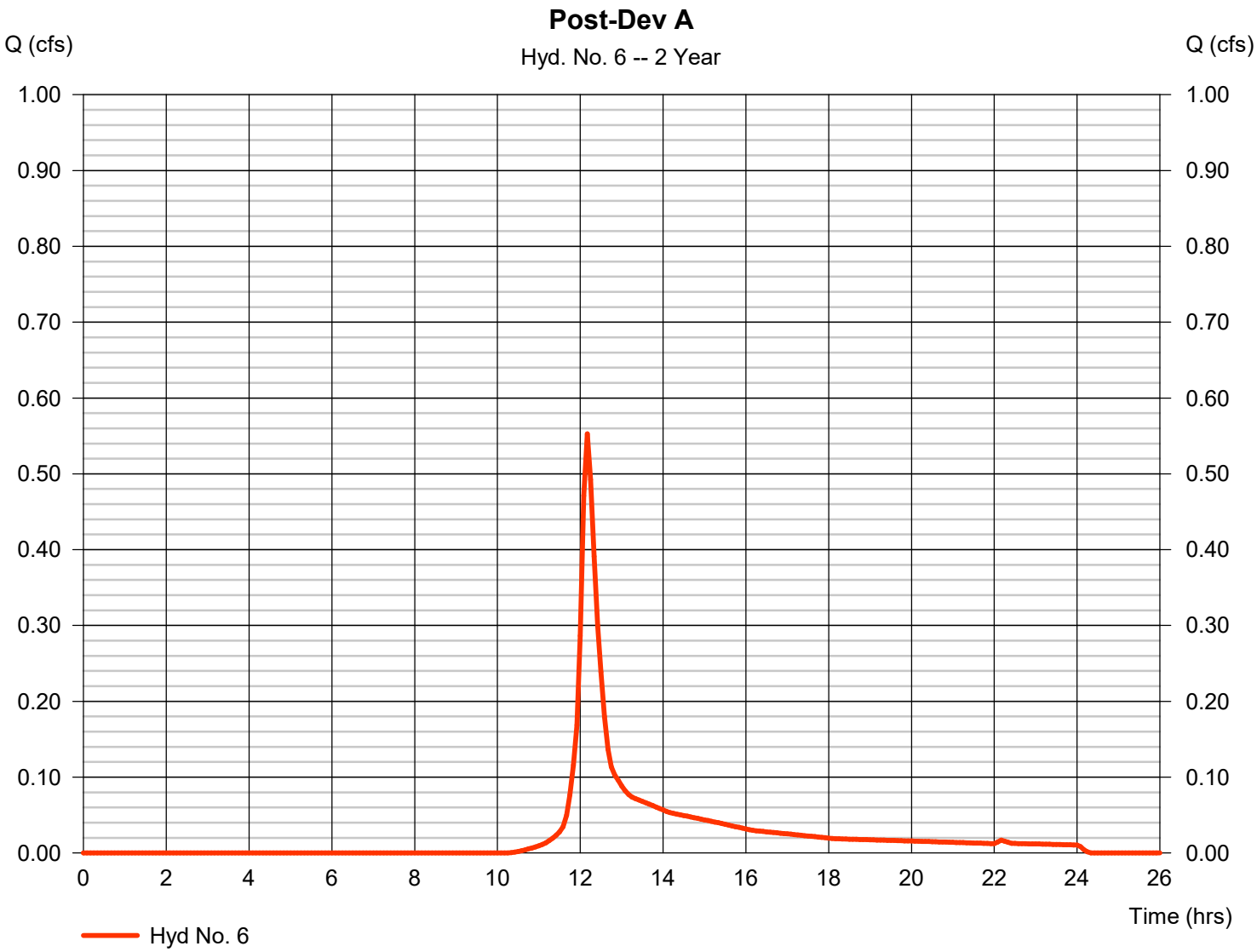
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 6

Post-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.553 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,264 cuft
Drainage area	= 0.577 ac	Curve number	= 75.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.30 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 6

Post-Dev A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 9.18**	**+**	**0.00**	**+**	**0.00**	**=**	**9.18**
Shallow Concentrated Flow							
Flow length (ft)	= 238.00		76.00		0.00		
Watercourse slope (%)	= 10.00		4.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.10		4.07		0.00		
Travel Time (min)	**= 0.78**	**+**	**0.31**	**+**	**0.00**	**=**	**1.09**
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 ..... 10.30 min

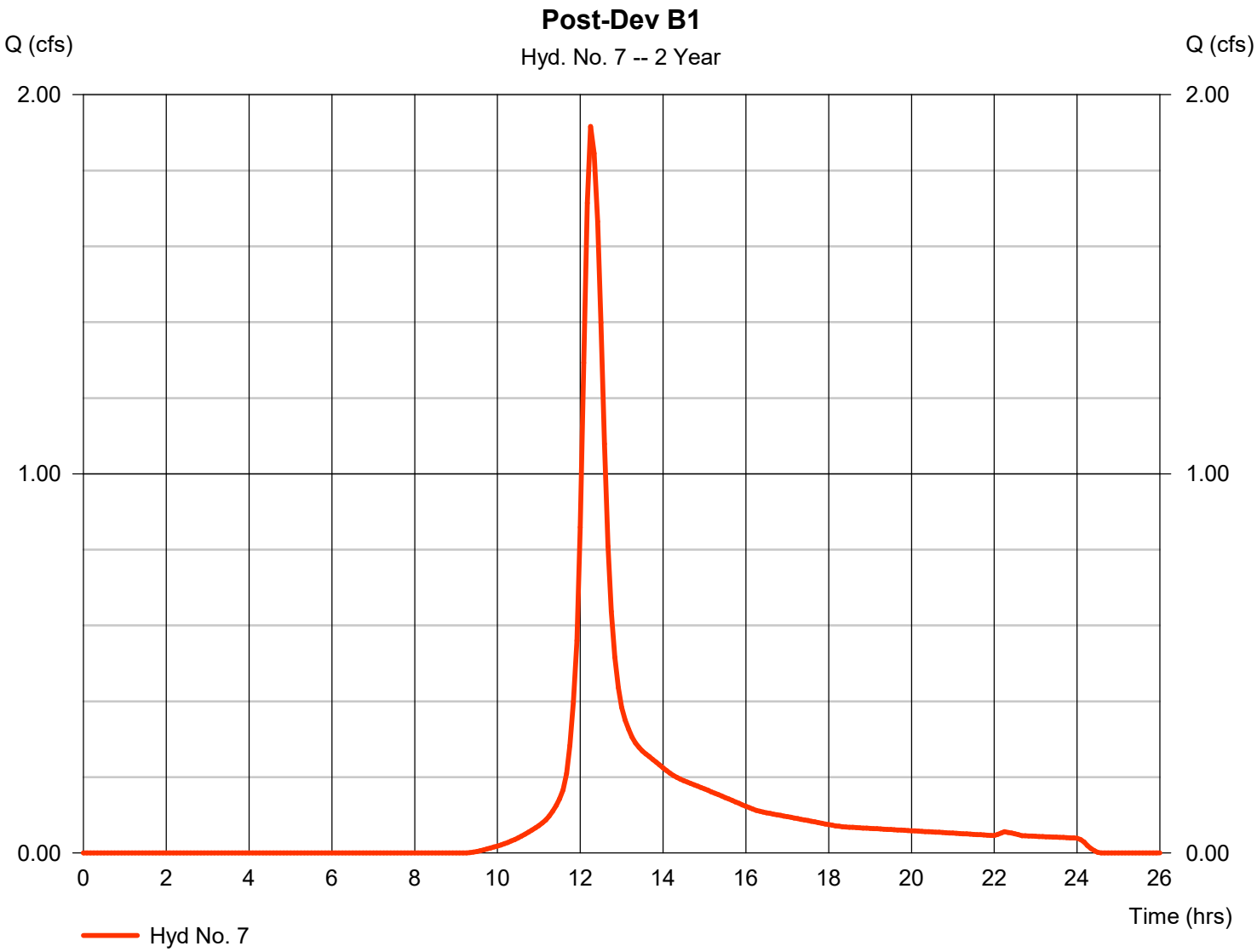
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 7

Post-Dev B1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.916 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 9,295 cuft
Drainage area	= 1.758 ac	Curve number	= 80.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 7

Post-Dev B1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 15.99**	**+**	**0.00**	**+**	**0.00**	**=**	**15.99**
Shallow Concentrated Flow							
Flow length (ft)	= 184.00		144.00		103.00		
Watercourse slope (%)	= 13.00		2.80		1.20		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.82		2.70		2.23		
Travel Time (min)	**= 0.53**	**+**	**0.89**	**+**	**0.77**	**=**	**2.19**
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 ..... 18.20 min

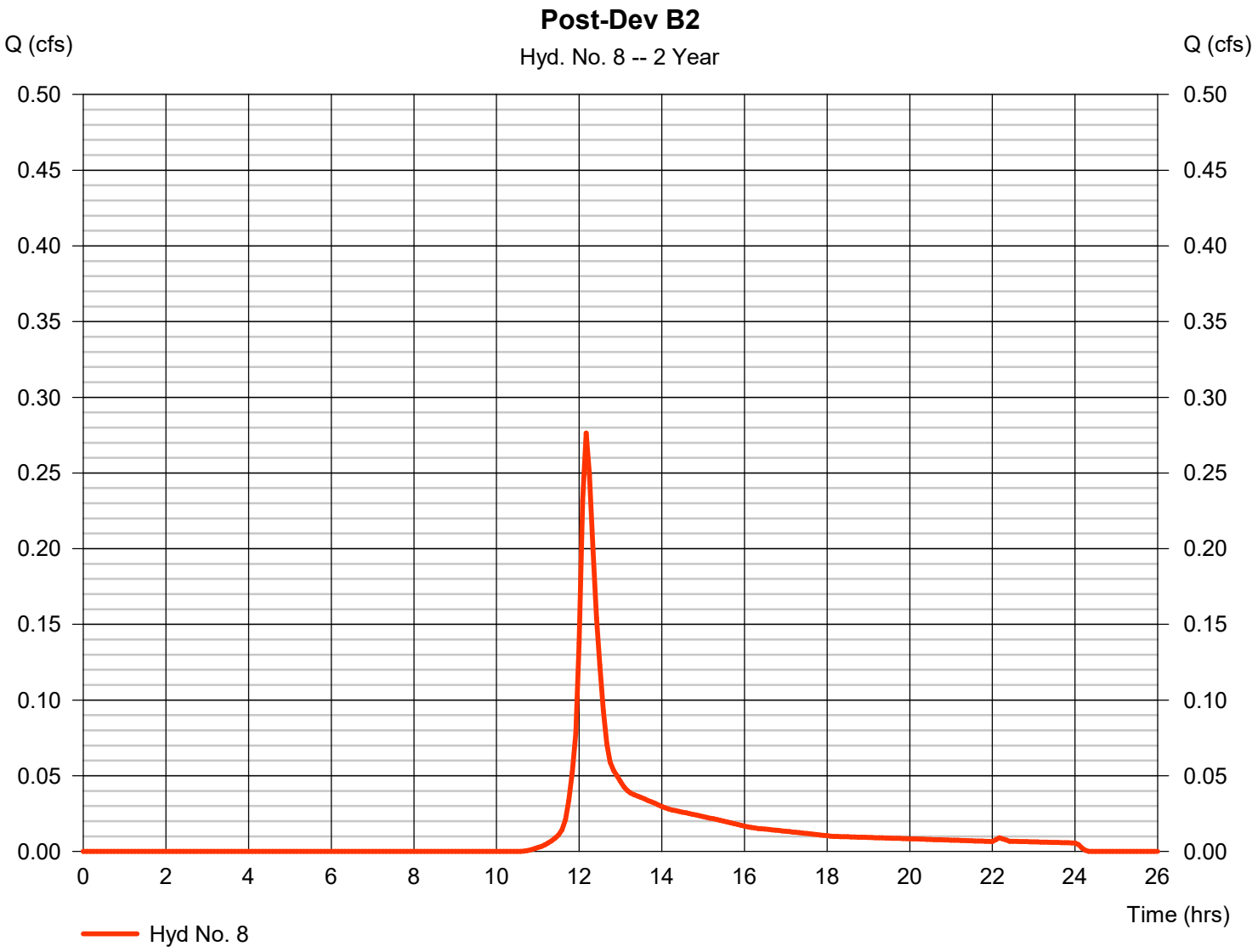
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 8

Post-Dev B2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.276 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 1,151 cuft
Drainage area	= 0.324 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



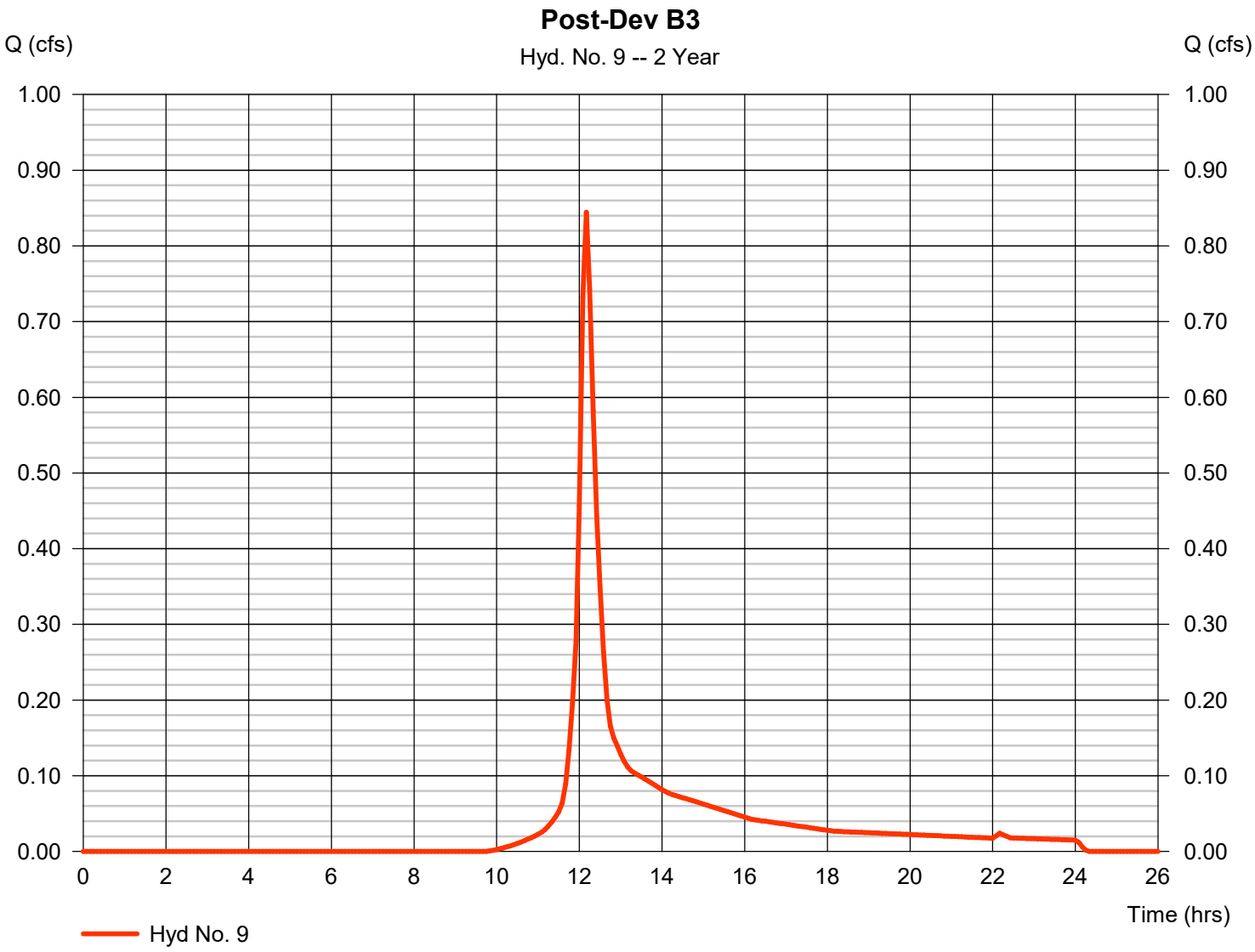
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 9

Post-Dev B3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.845 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 3,404 cuft
Drainage area	= 0.766 ac	Curve number	= 78.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 9

Post-Dev B3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.21		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 10.80**	**+**	**0.00**	**+**	**0.00**	**=**	**10.80**
Shallow Concentrated Flow							
Flow length (ft)	= 69.00		113.00		0.00		
Watercourse slope (%)	= 32.00		2.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=9.13		2.28		0.00		
Travel Time (min)	**= 0.13**	**+**	**0.83**	**+**	**0.00**	**=**	**0.95**
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 ..... 11.70 min

Hydrograph Report

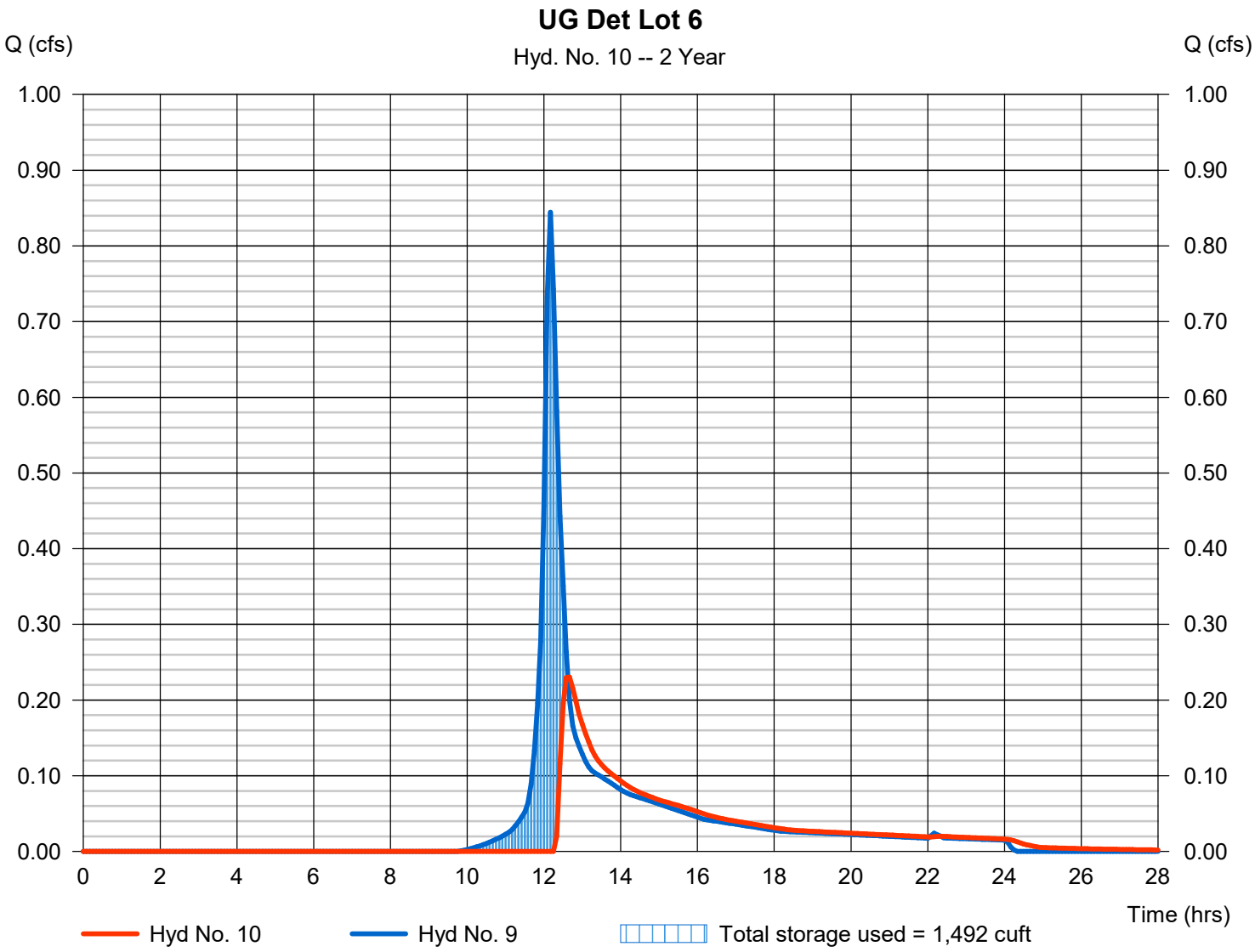
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 10

UG Det Lot 6

Hydrograph type	= Reservoir	Peak discharge	= 0.230 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.67 hrs
Time interval	= 5 min	Hyd. volume	= 2,232 cuft
Inflow hyd. No.	= 9 - Post-Dev B3	Max. Elevation	= 304.80 ft
Reservoir name	= UG Det Lot6	Max. Storage	= 1,492 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Pond No. 2 - UG Det Lot6

Pond Data

UG Chambers -Invert elev. = 303.75 ft, Rise x Span = 3.75 x 6.40 ft, Barrel Len = 149.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 303.00 ft, Width = 8.40 ft, Height = 5.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	303.00	n/a	0	0
0.55	303.55	n/a	275	275
1.10	304.10	n/a	475	751
1.65	304.65	n/a	585	1,336
2.20	305.20	n/a	574	1,910
2.75	305.75	n/a	554	2,465
3.30	306.30	n/a	525	2,990
3.85	306.85	n/a	481	3,471
4.40	307.40	n/a	409	3,880
4.95	307.95	n/a	284	4,164
5.50	308.50	n/a	275	4,440

Culvert / Orifice Structures

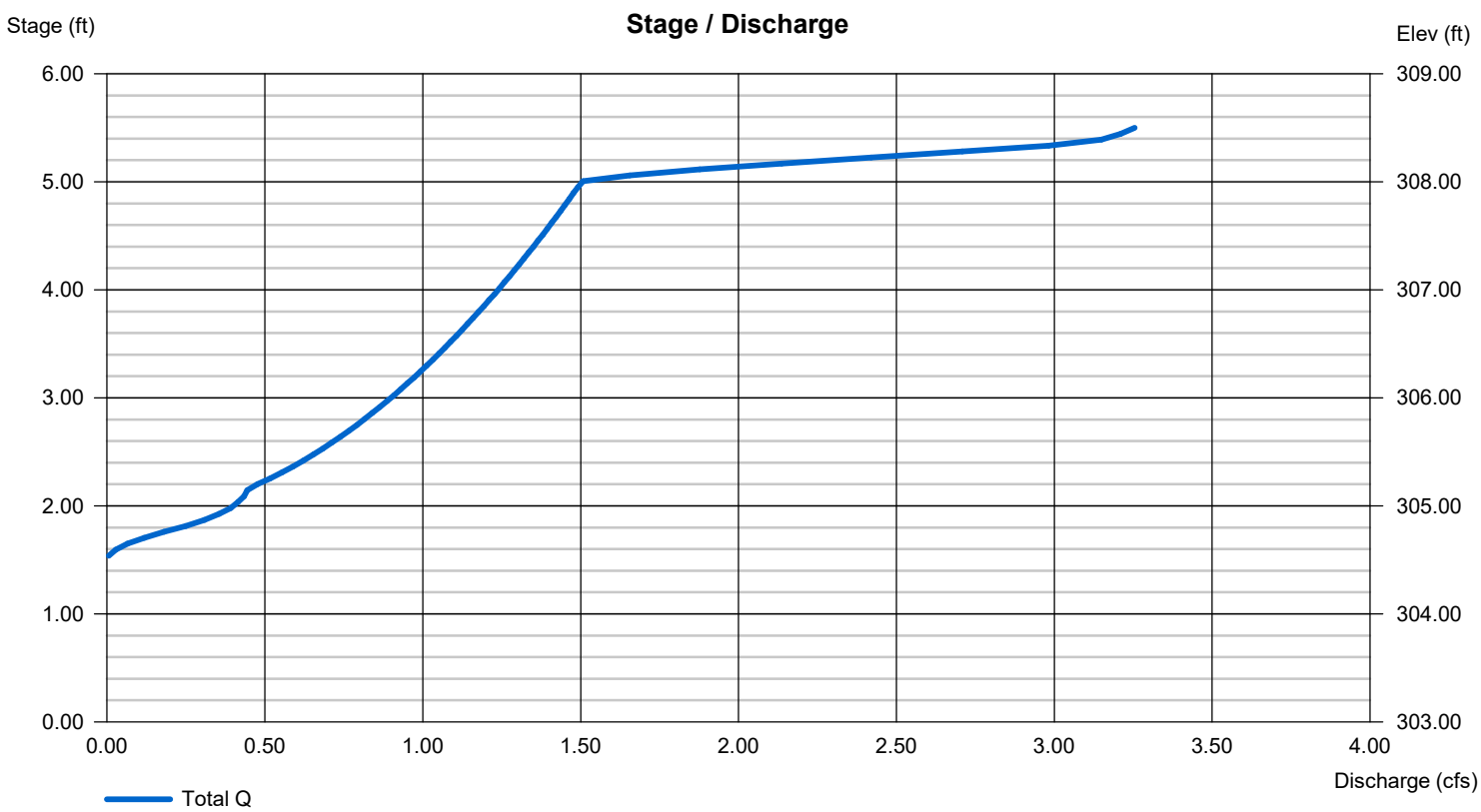
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	6.00	Inactive	0.00
Span (in)	= 8.00	6.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 304.27	304.50	0.00	0.00
Length (ft)	= 10.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.50	0.00	0.00	0.00
Crest El. (ft)	= 308.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).



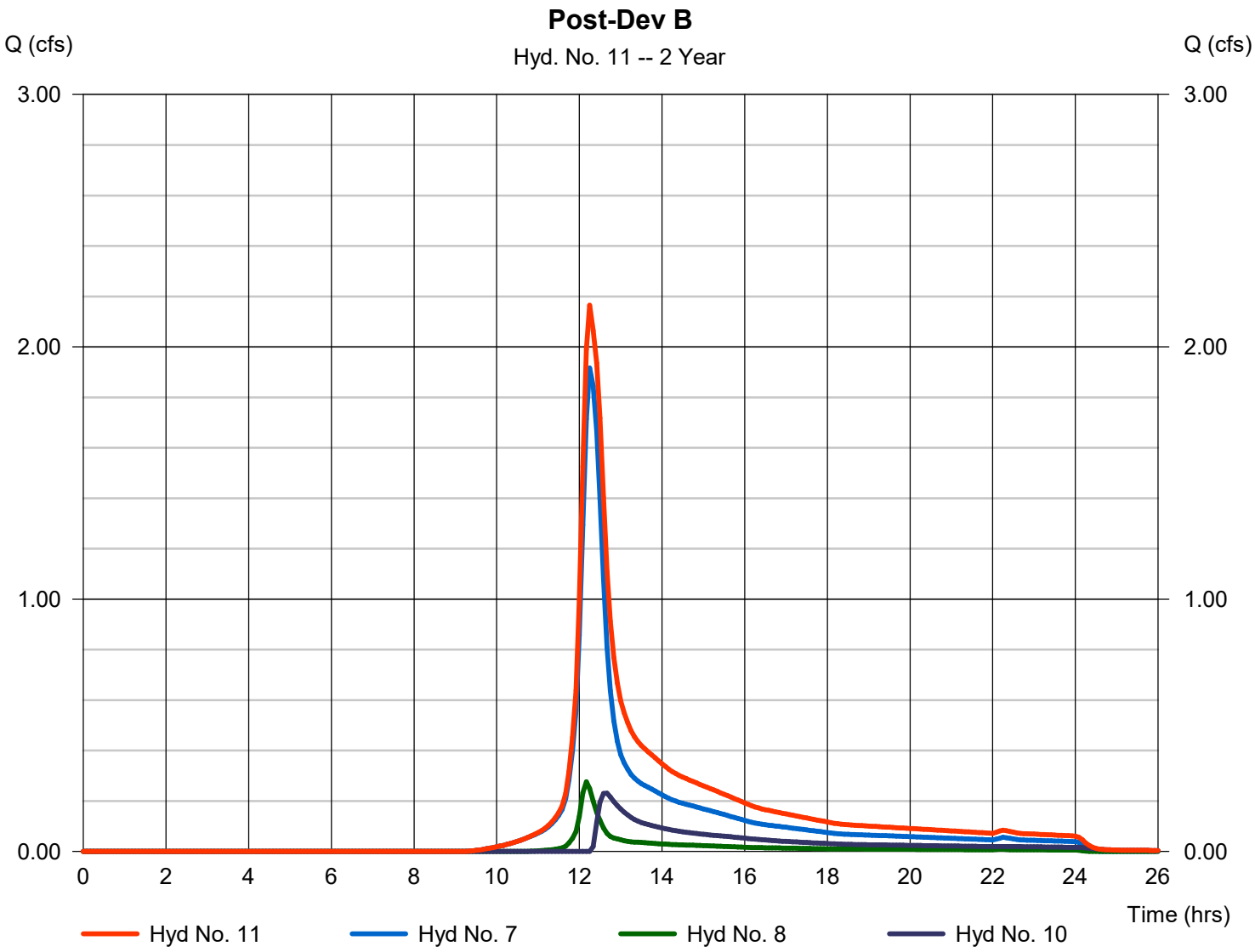
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 11

Post-Dev B

Hydrograph type	= Combine	Peak discharge	= 2.165 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 12,678 cuft
Inflow hyds.	= 7, 8, 10	Contrib. drain. area	= 2.082 ac



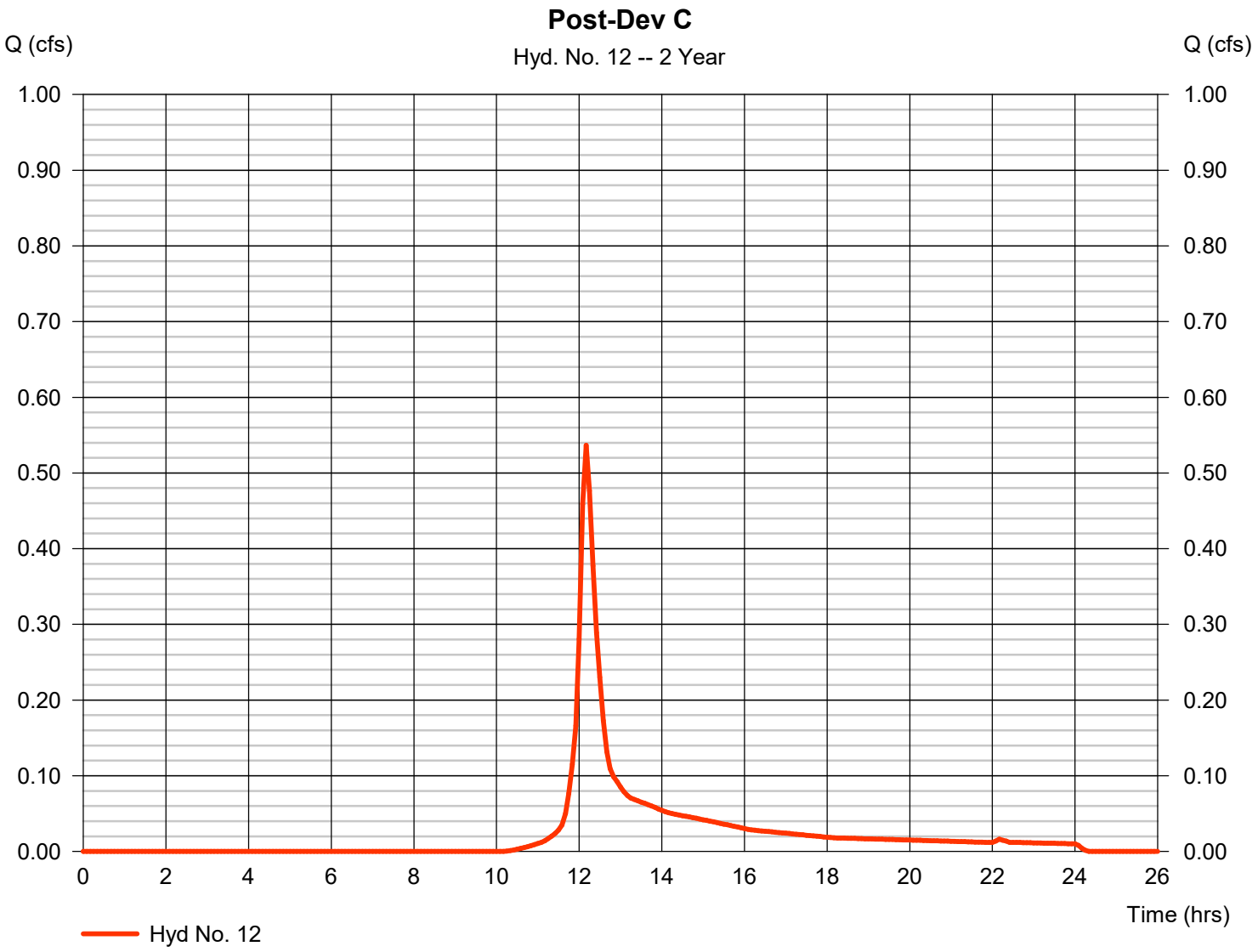
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 12

Post-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.537 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,190 cuft
Drainage area	= 0.544 ac	Curve number	= 76.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.21 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



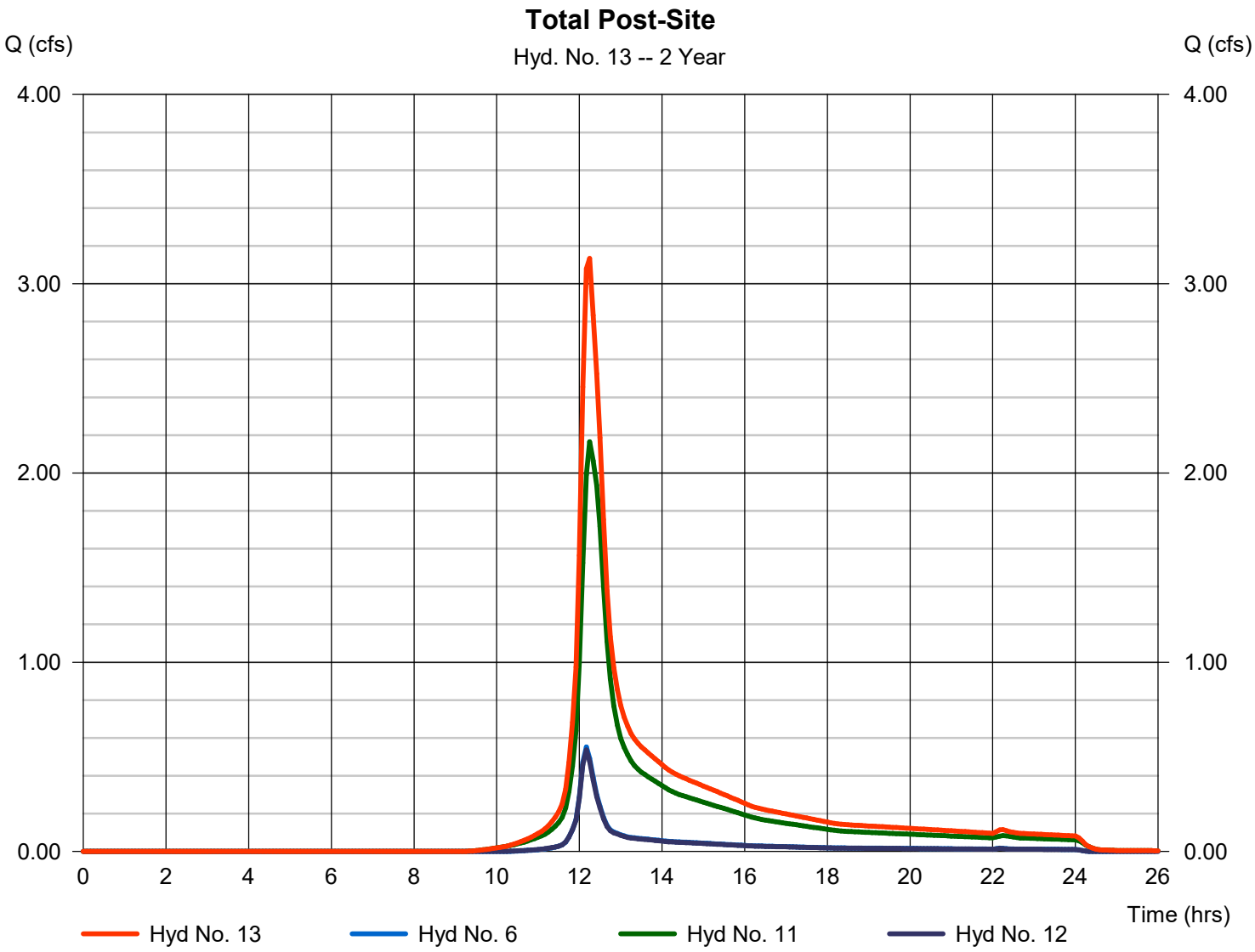
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 13

Total Post-Site

Hydrograph type	= Combine	Peak discharge	= 3.134 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 17,132 cuft
Inflow hyds.	= 6, 11, 12	Contrib. drain. area	= 1.121 ac



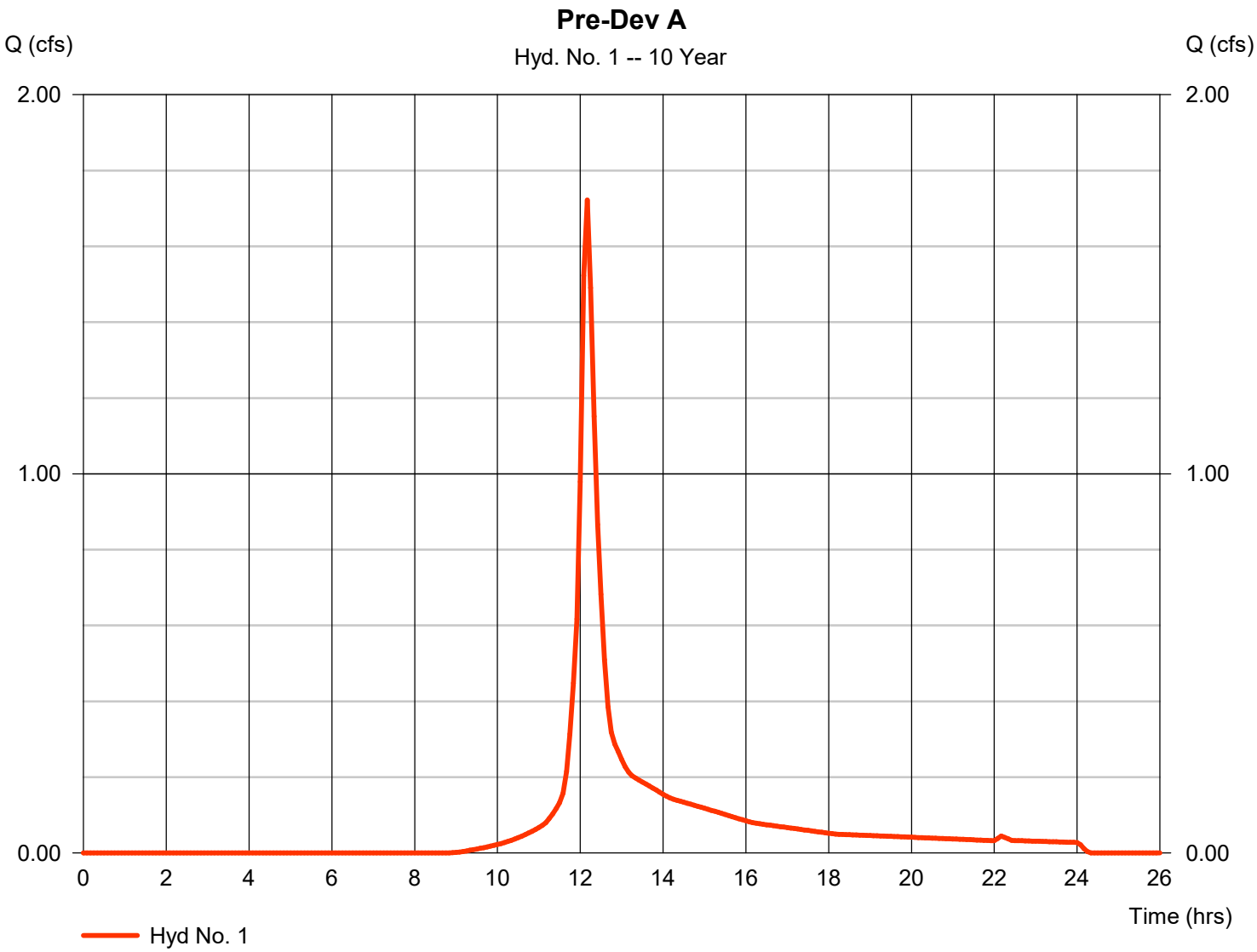
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.722 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 6,855 cuft
Drainage area	= 0.816 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.40 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



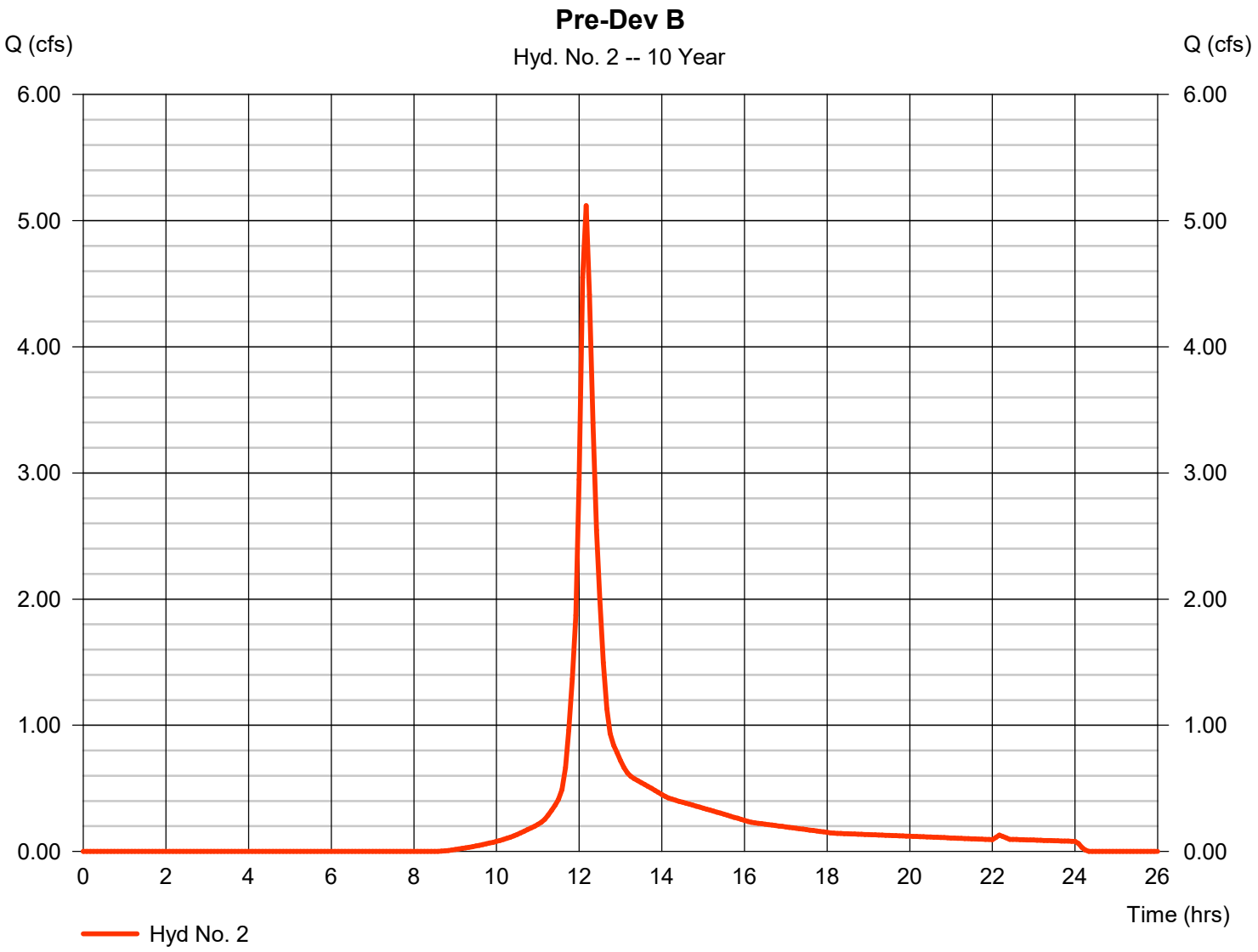
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 2

Pre-Dev B

Hydrograph type	= SCS Runoff	Peak discharge	= 5.119 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 20,345 cuft
Drainage area	= 2.316 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



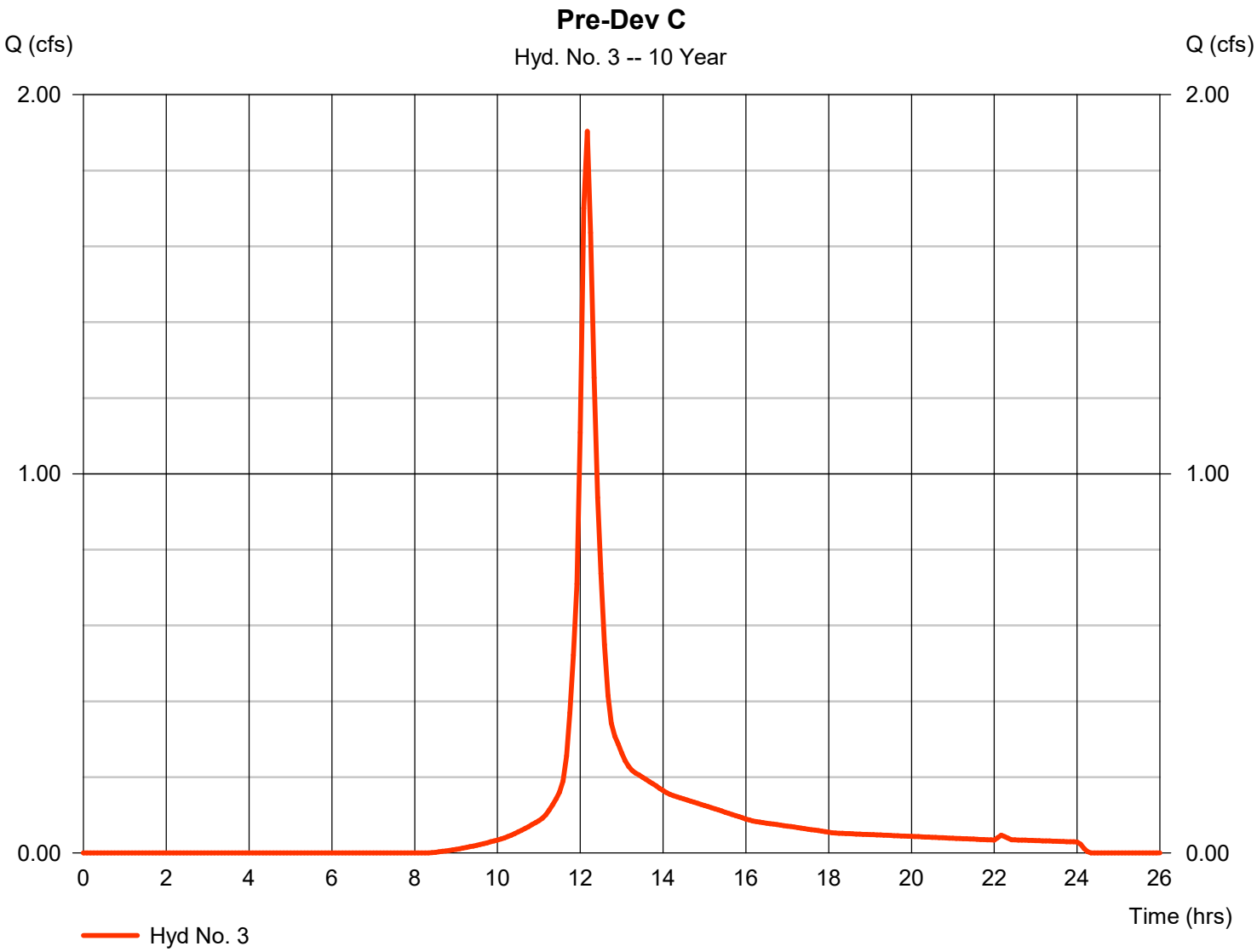
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 3

Pre-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 1.904 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 7,561 cuft
Drainage area	= 0.824 ac	Curve number	= 76.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.50 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



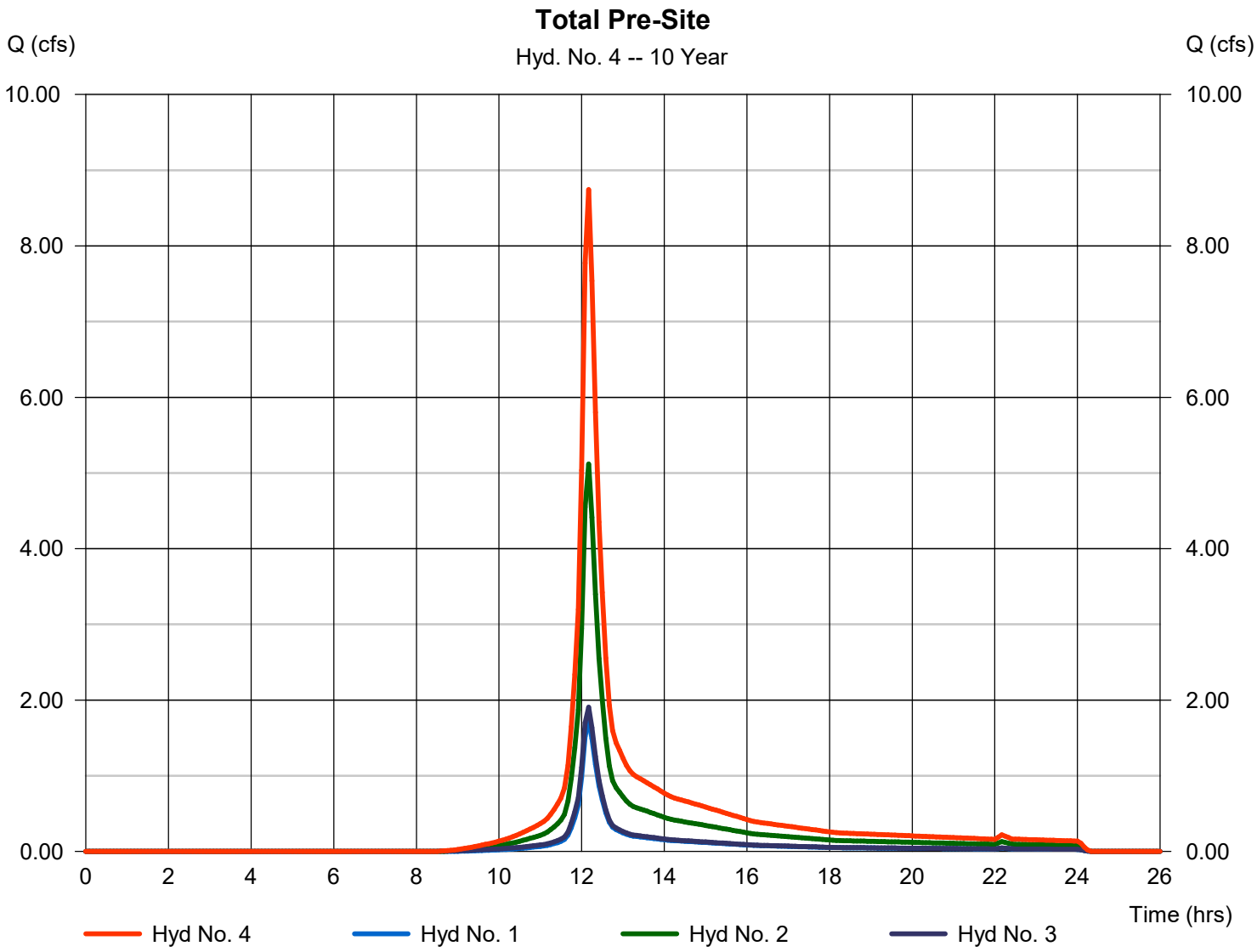
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 4

Total Pre-Site

Hydrograph type	= Combine	Peak discharge	= 8.744 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 34,761 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 3.956 ac



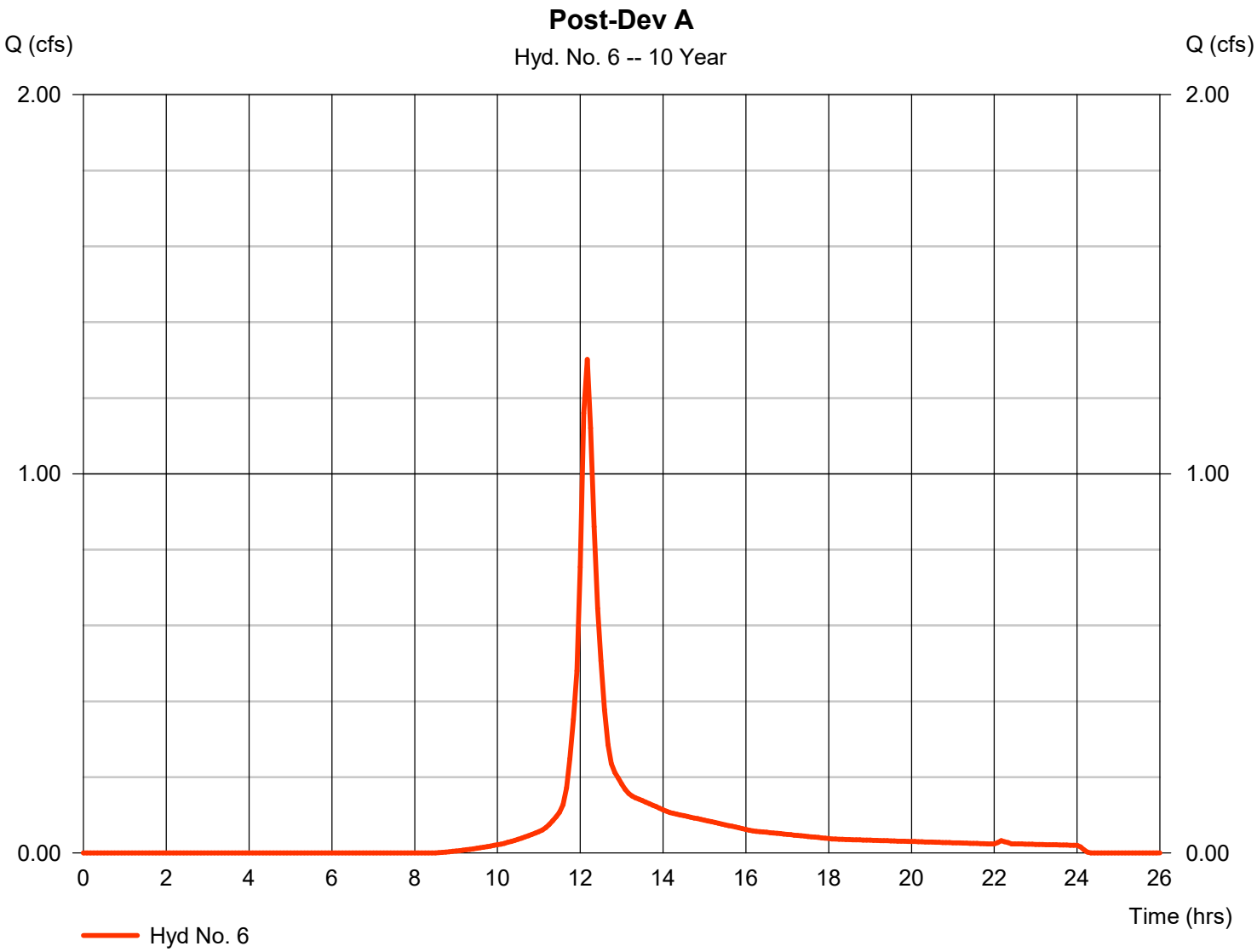
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 6

Post-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.302 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 5,172 cuft
Drainage area	= 0.577 ac	Curve number	= 75.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.30 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



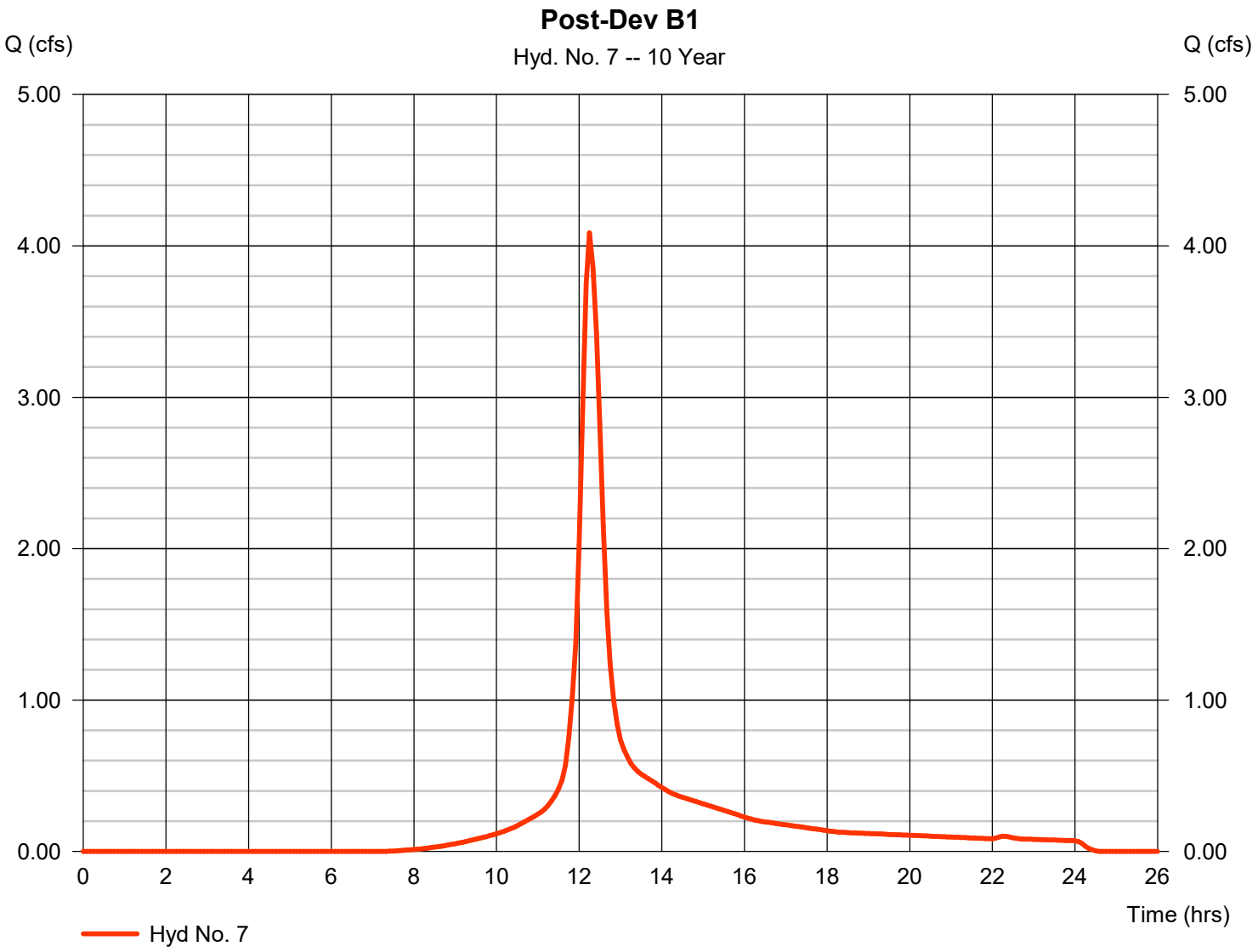
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 7

Post-Dev B1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.086 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 19,605 cuft
Drainage area	= 1.758 ac	Curve number	= 80.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



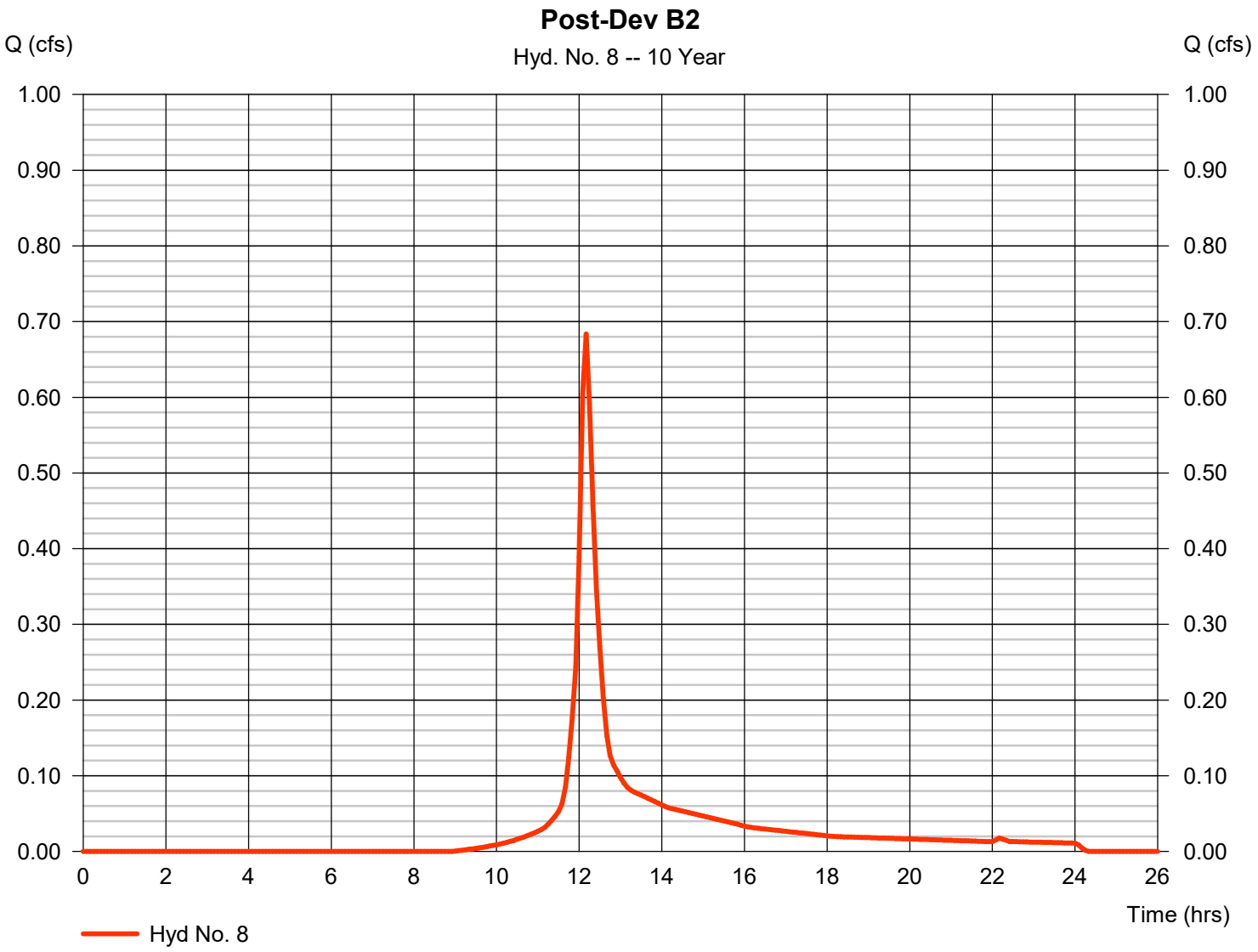
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 8

Post-Dev B2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.684 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 2,722 cuft
Drainage area	= 0.324 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



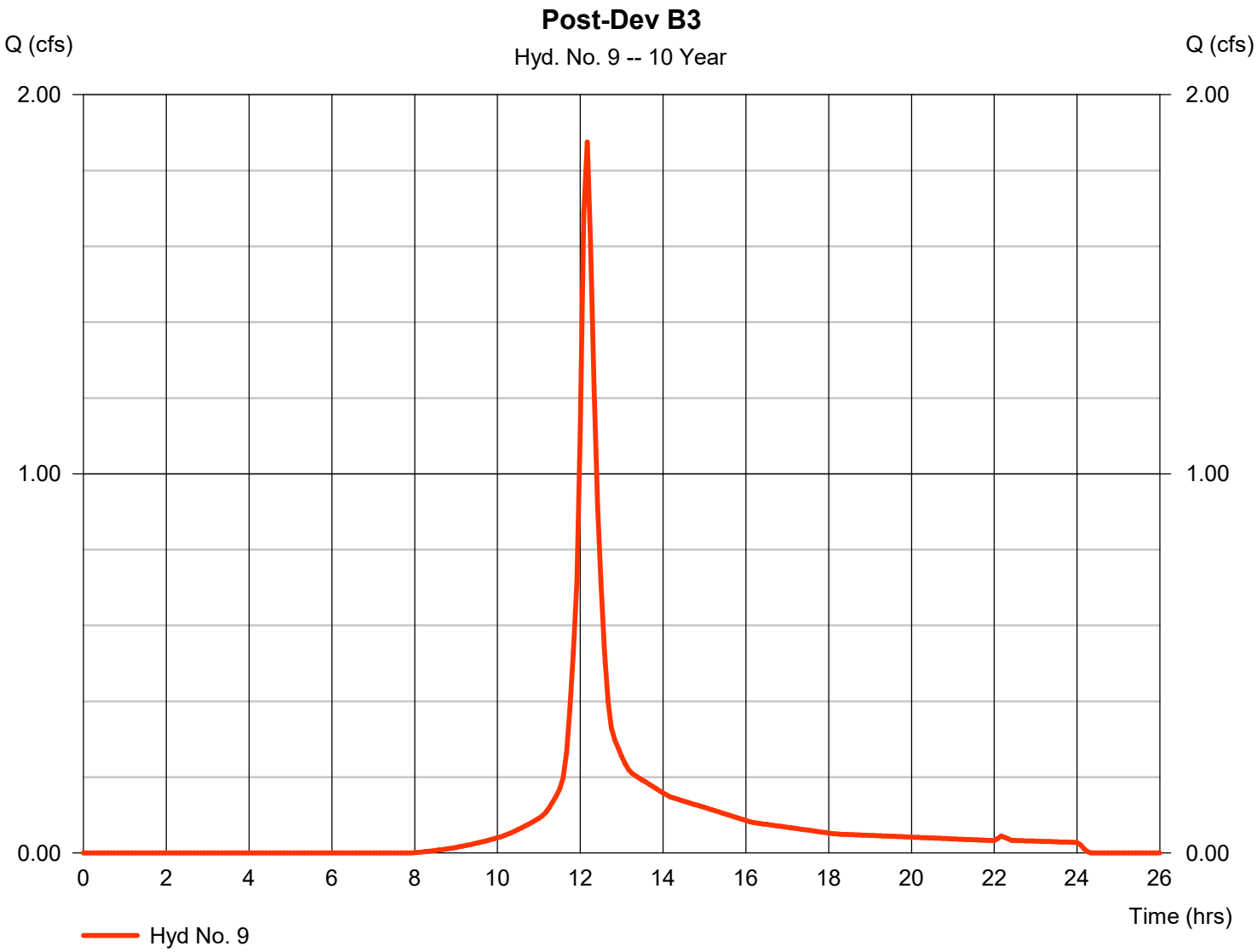
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 9

Post-Dev B3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.876 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 7,452 cuft
Drainage area	= 0.766 ac	Curve number	= 78.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

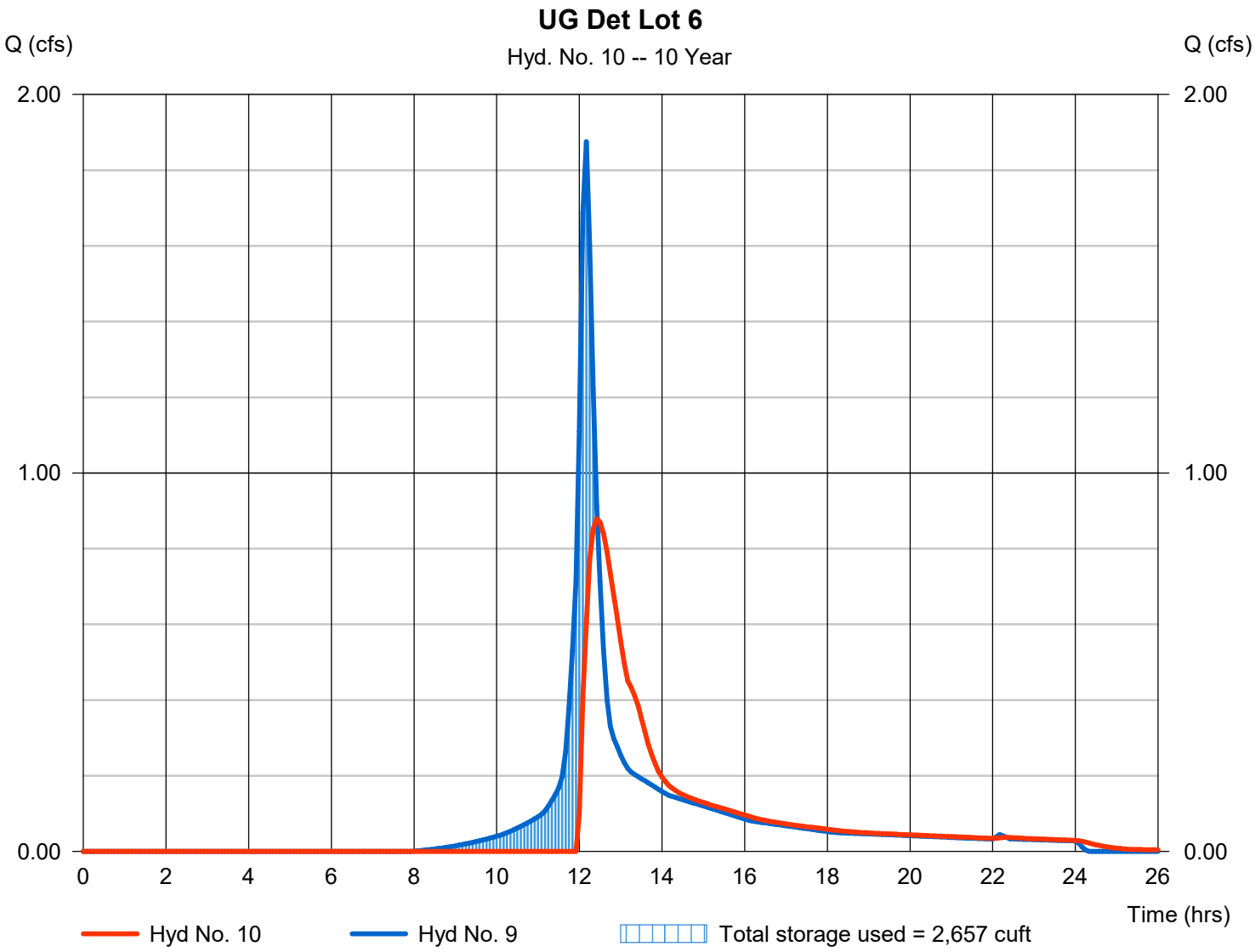
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 10

UG Det Lot 6

Hydrograph type	= Reservoir	Peak discharge	= 0.879 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.42 hrs
Time interval	= 5 min	Hyd. volume	= 6,281 cuft
Inflow hyd. No.	= 9 - Post-Dev B3	Max. Elevation	= 305.96 ft
Reservoir name	= UG Det Lot6	Max. Storage	= 2,657 cuft

Storage Indication method used.



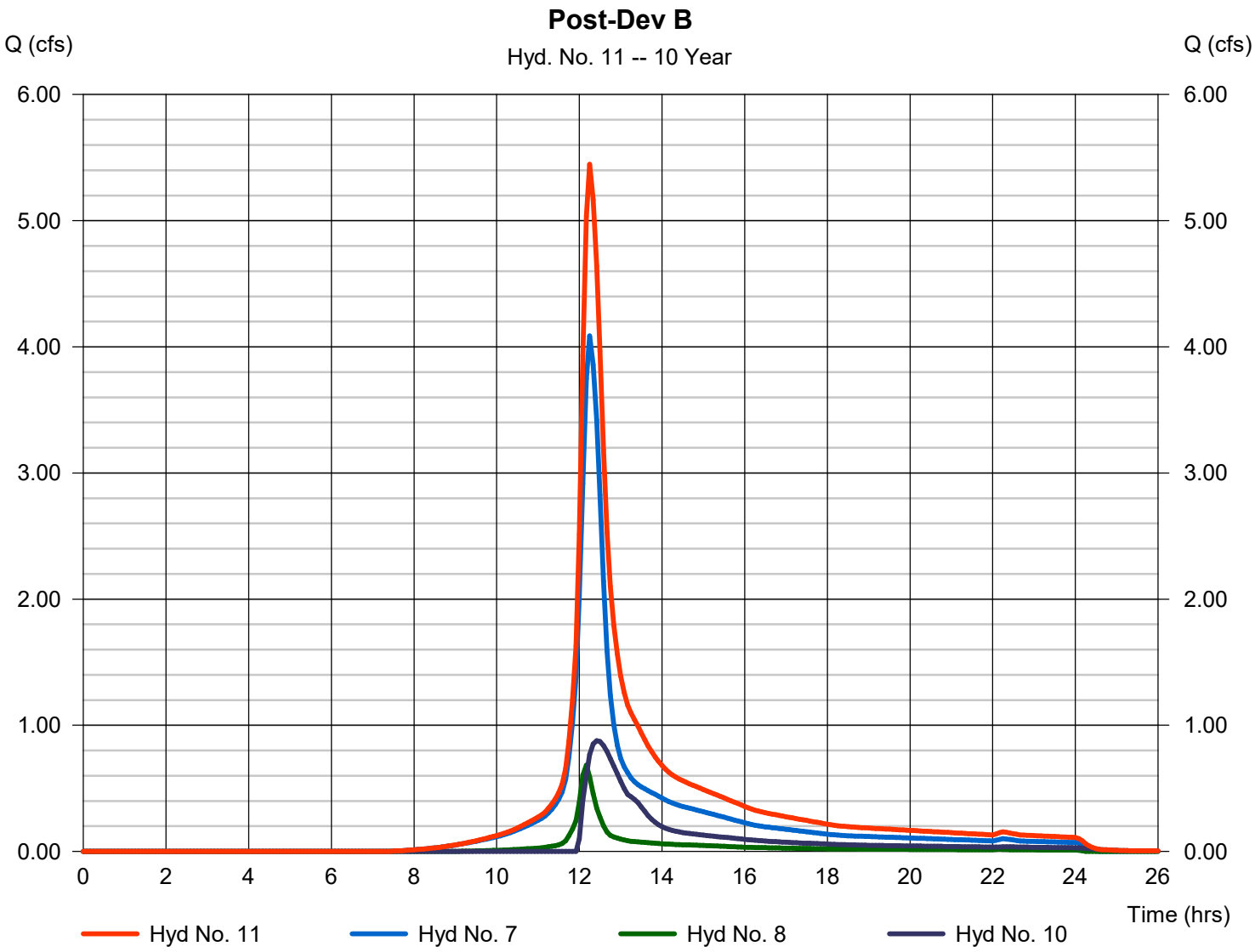
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 11

Post-Dev B

Hydrograph type	= Combine	Peak discharge	= 5.447 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 28,607 cuft
Inflow hyds.	= 7, 8, 10	Contrib. drain. area	= 2.082 ac



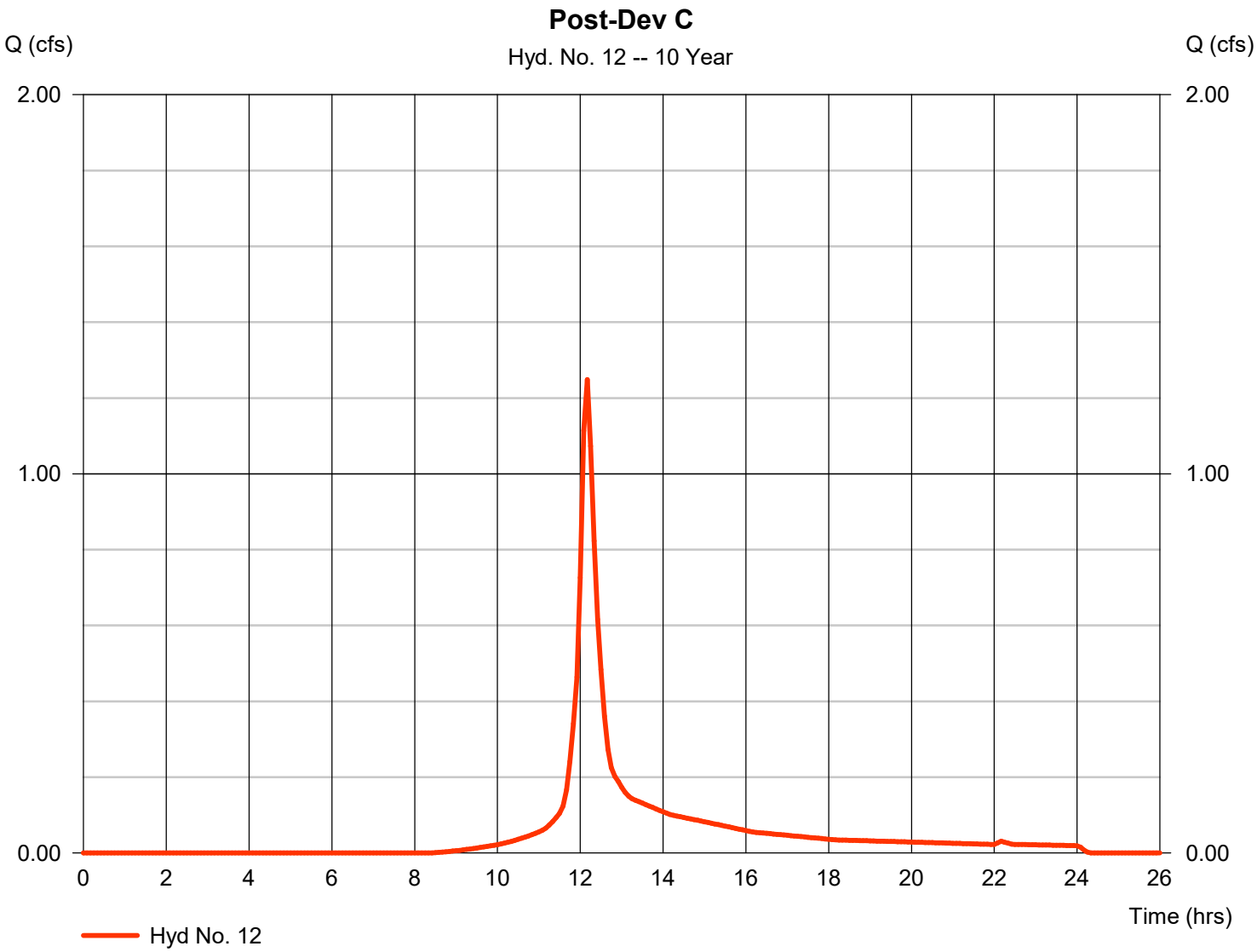
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 12

Post-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 1.248 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 4,959 cuft
Drainage area	= 0.544 ac	Curve number	= 76.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.13 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



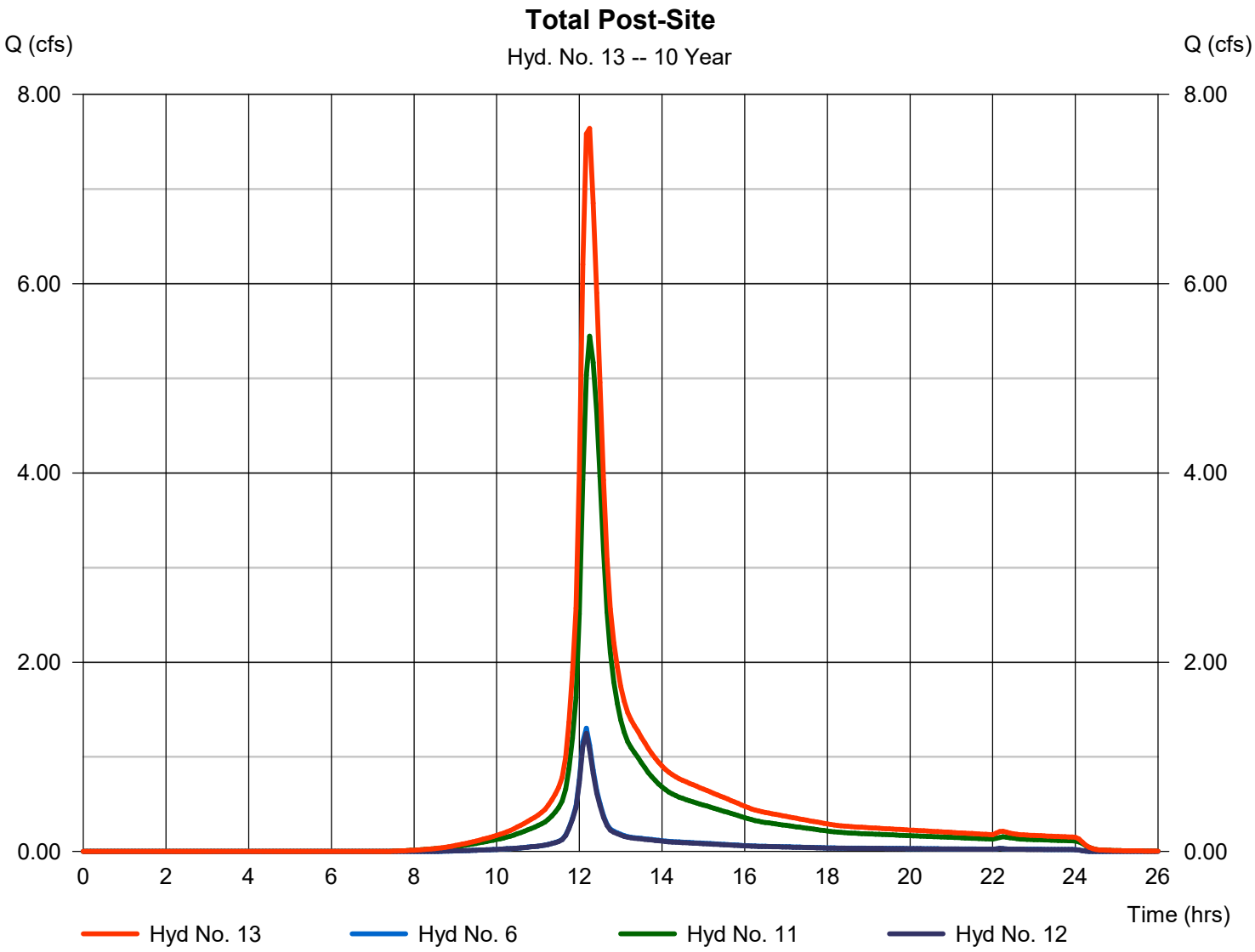
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 13

Total Post-Site

Hydrograph type	= Combine	Peak discharge	= 7.641 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 38,739 cuft
Inflow hyds.	= 6, 11, 12	Contrib. drain. area	= 1.121 ac



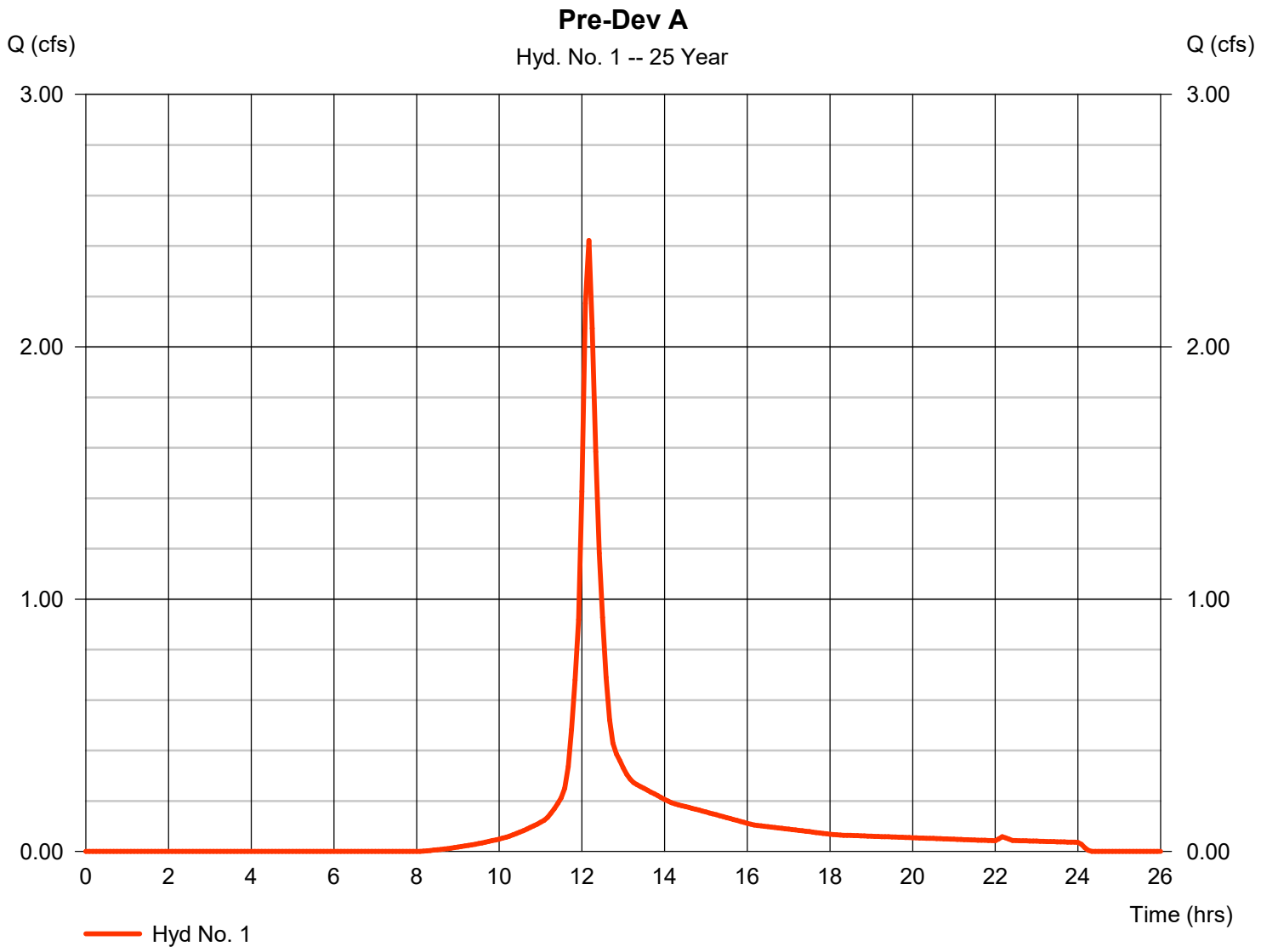
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.422 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 9,620 cuft
Drainage area	= 0.816 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.40 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



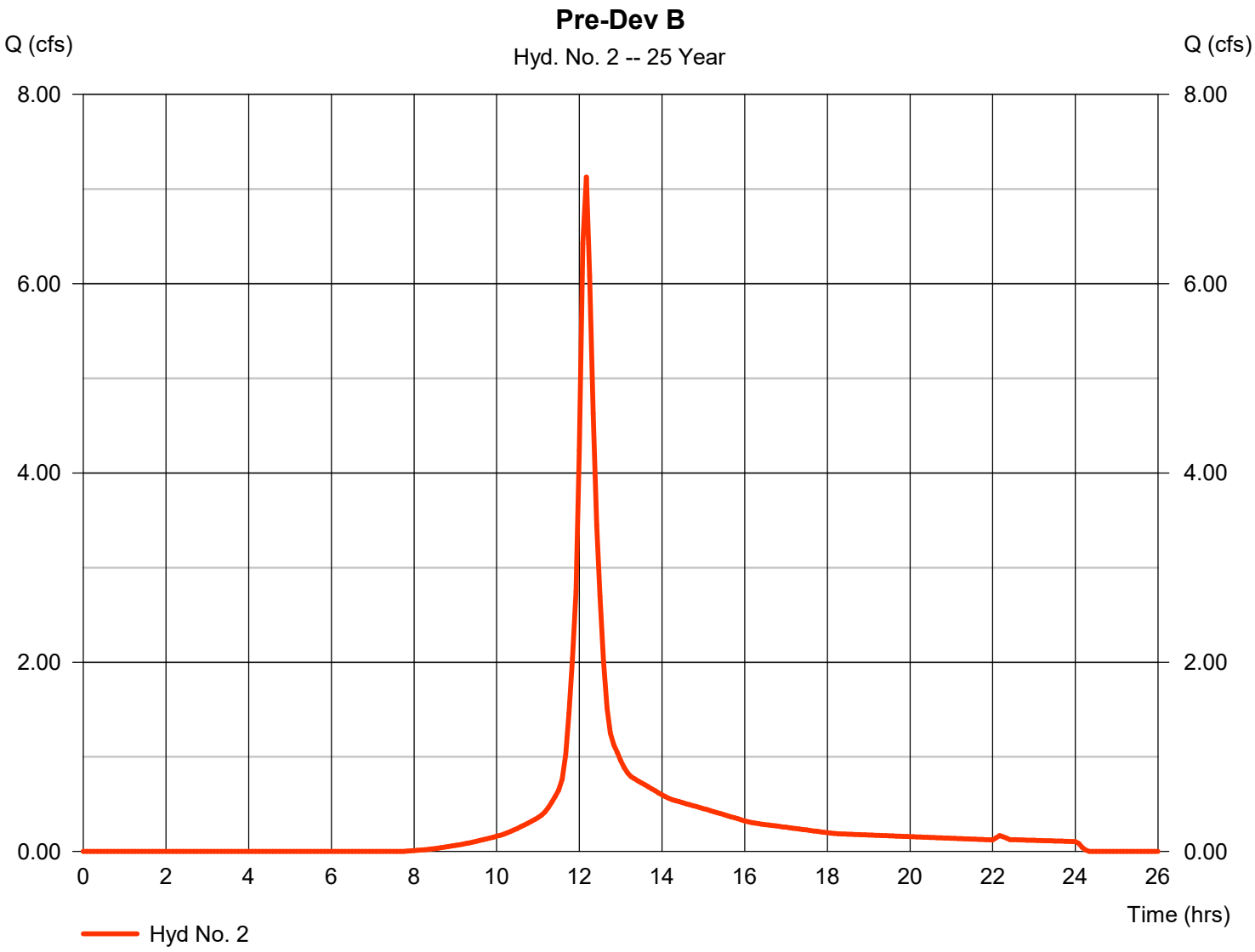
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 2

Pre-Dev B

Hydrograph type	= SCS Runoff	Peak discharge	= 7.129 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 28,338 cuft
Drainage area	= 2.316 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



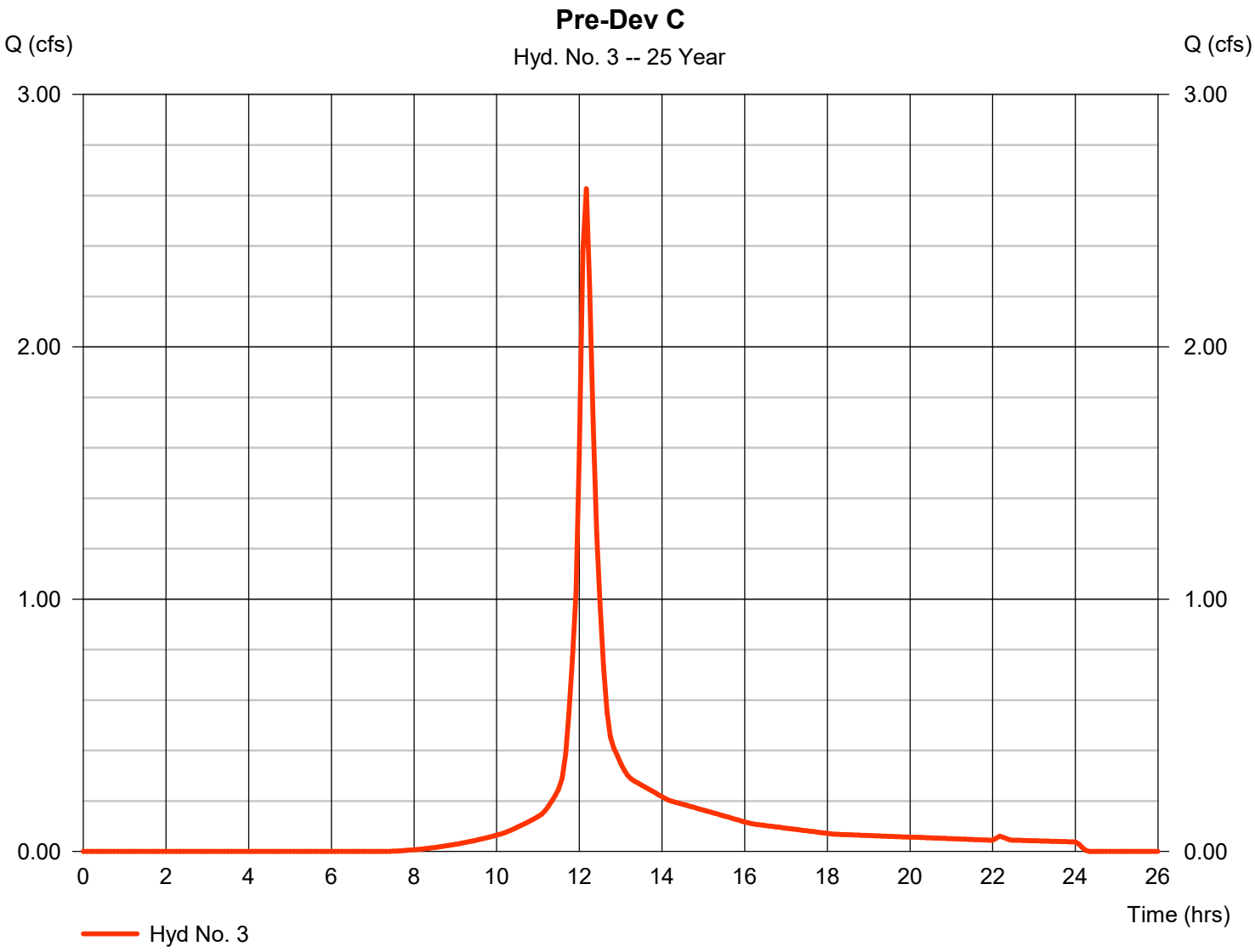
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 3

Pre-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 2.626 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 10,453 cuft
Drainage area	= 0.824 ac	Curve number	= 76.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.50 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



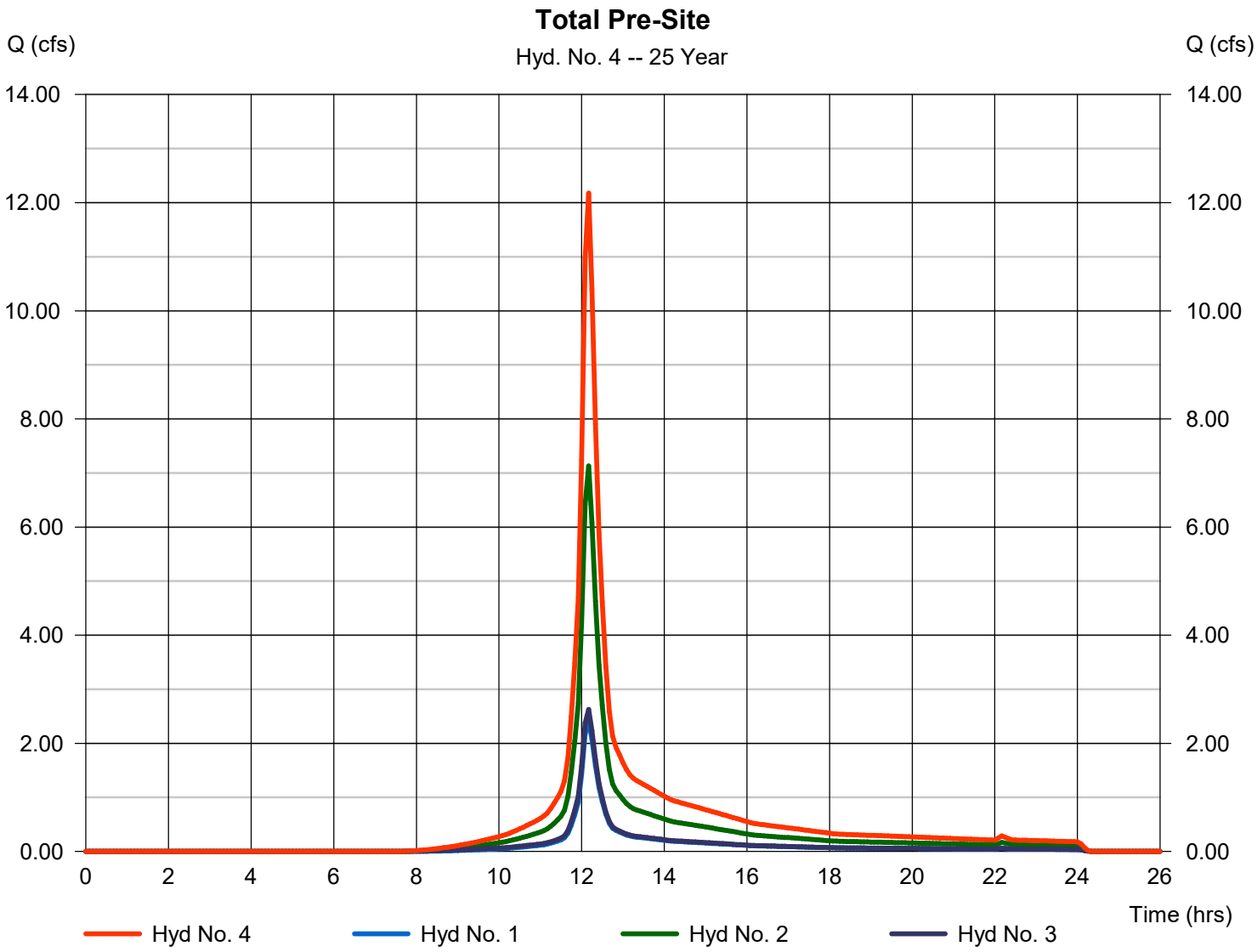
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 4

Total Pre-Site

Hydrograph type	= Combine	Peak discharge	= 12.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 48,411 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 3.956 ac



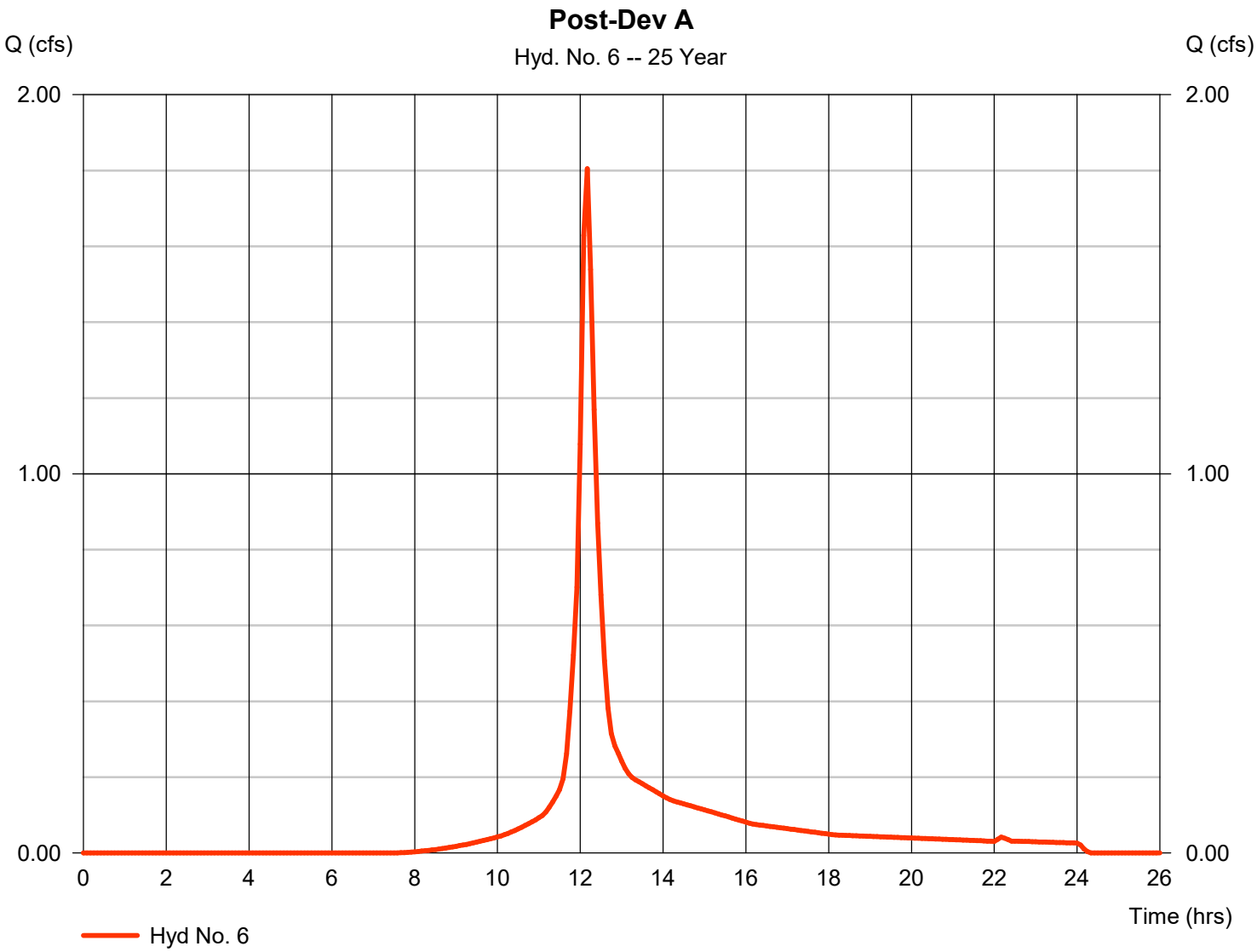
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 6

Post-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.805 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 7,180 cuft
Drainage area	= 0.577 ac	Curve number	= 75.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.30 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



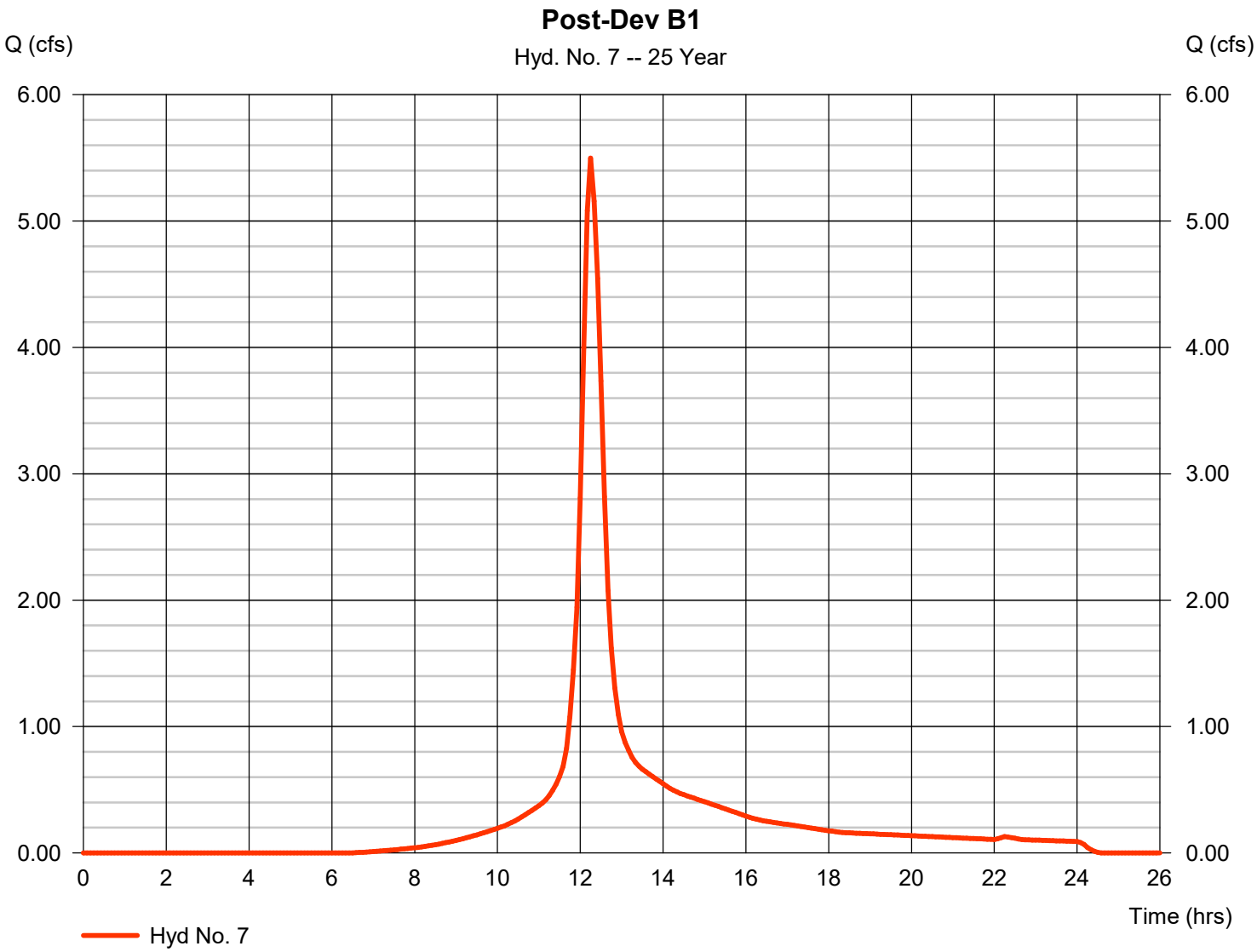
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 7

Post-Dev B1

Hydrograph type	= SCS Runoff	Peak discharge	= 5.498 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 26,509 cuft
Drainage area	= 1.758 ac	Curve number	= 80.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



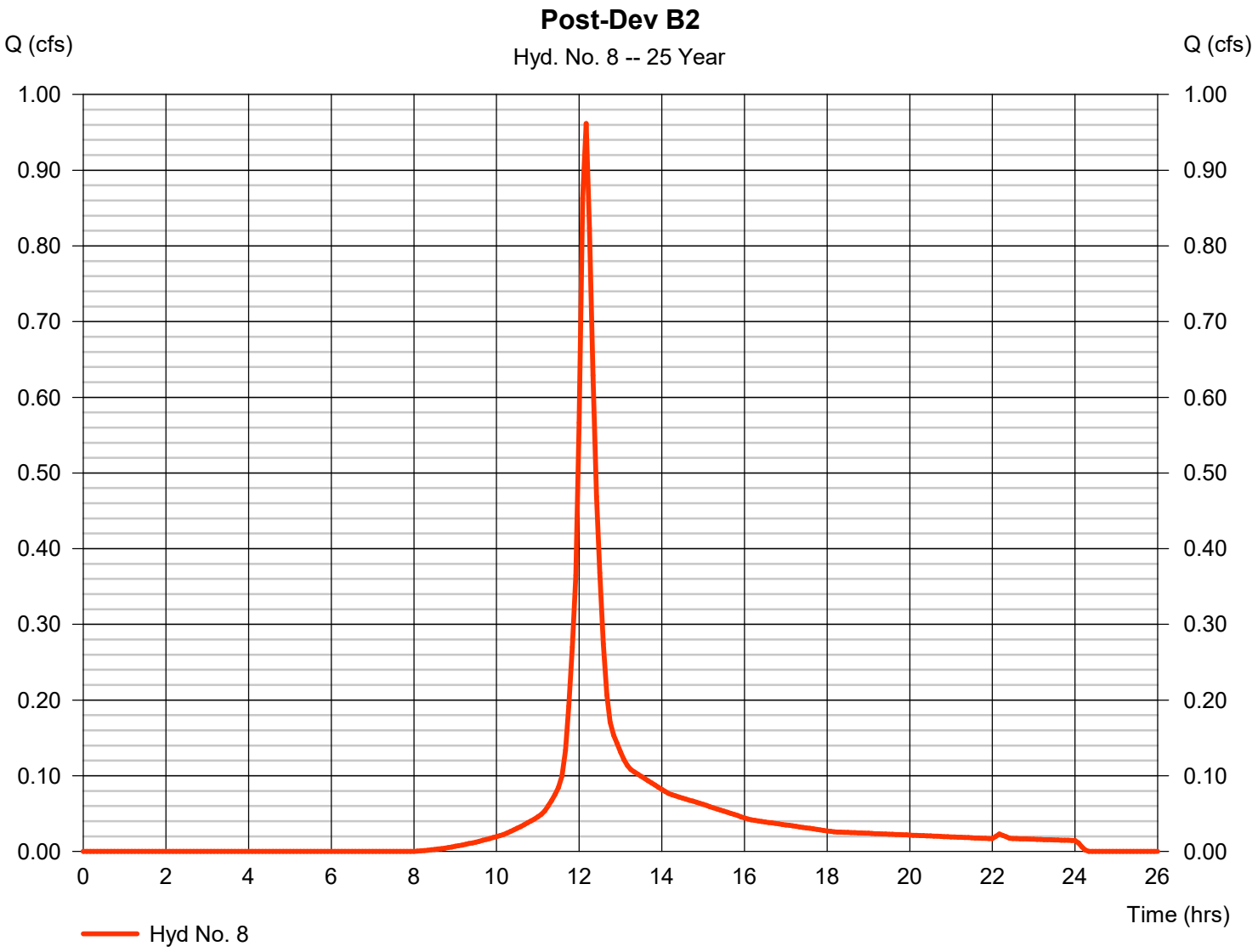
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 8

Post-Dev B2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.962 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 3,820 cuft
Drainage area	= 0.324 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



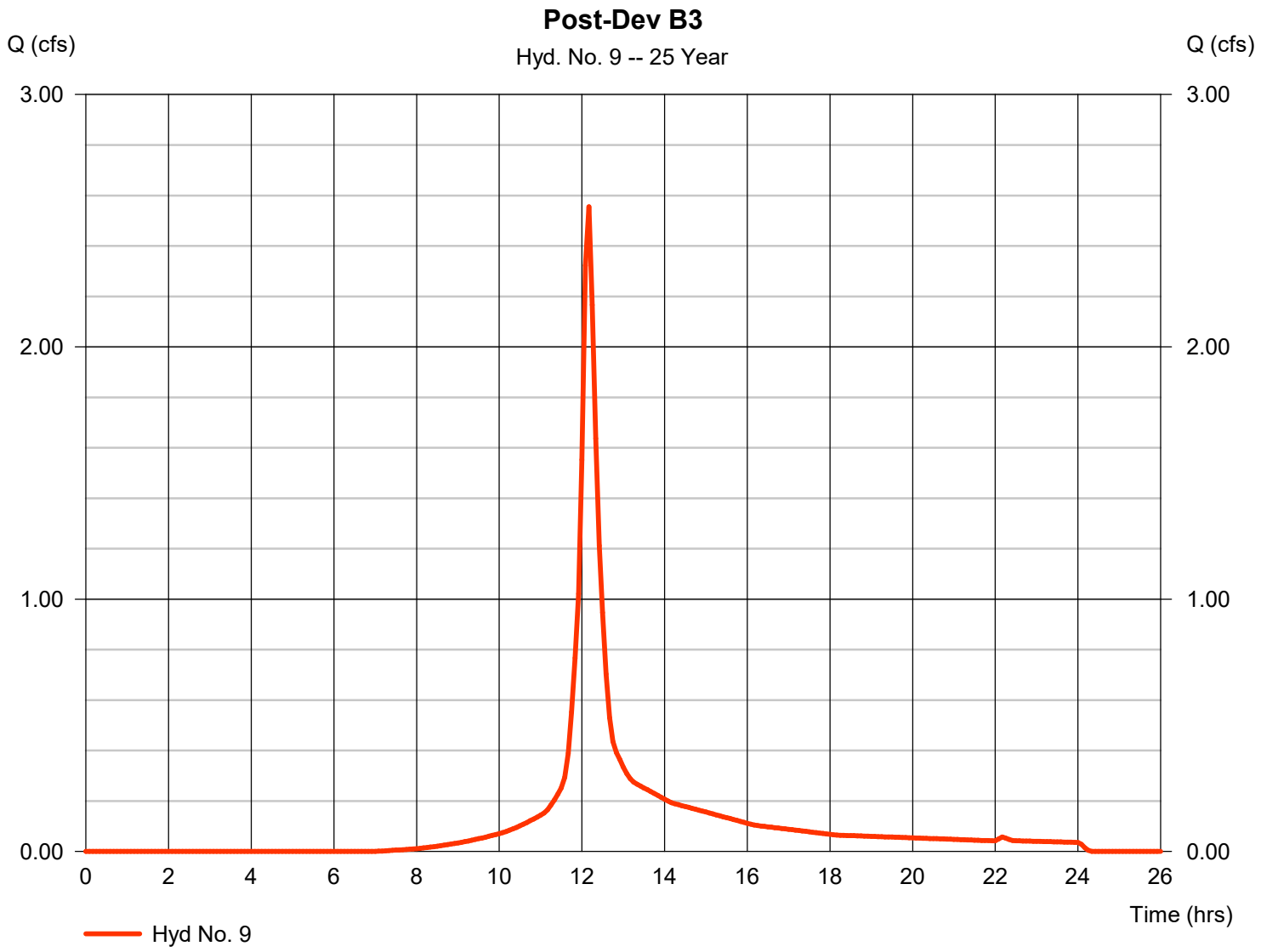
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 9

Post-Dev B3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.555 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 10,201 cuft
Drainage area	= 0.766 ac	Curve number	= 78.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

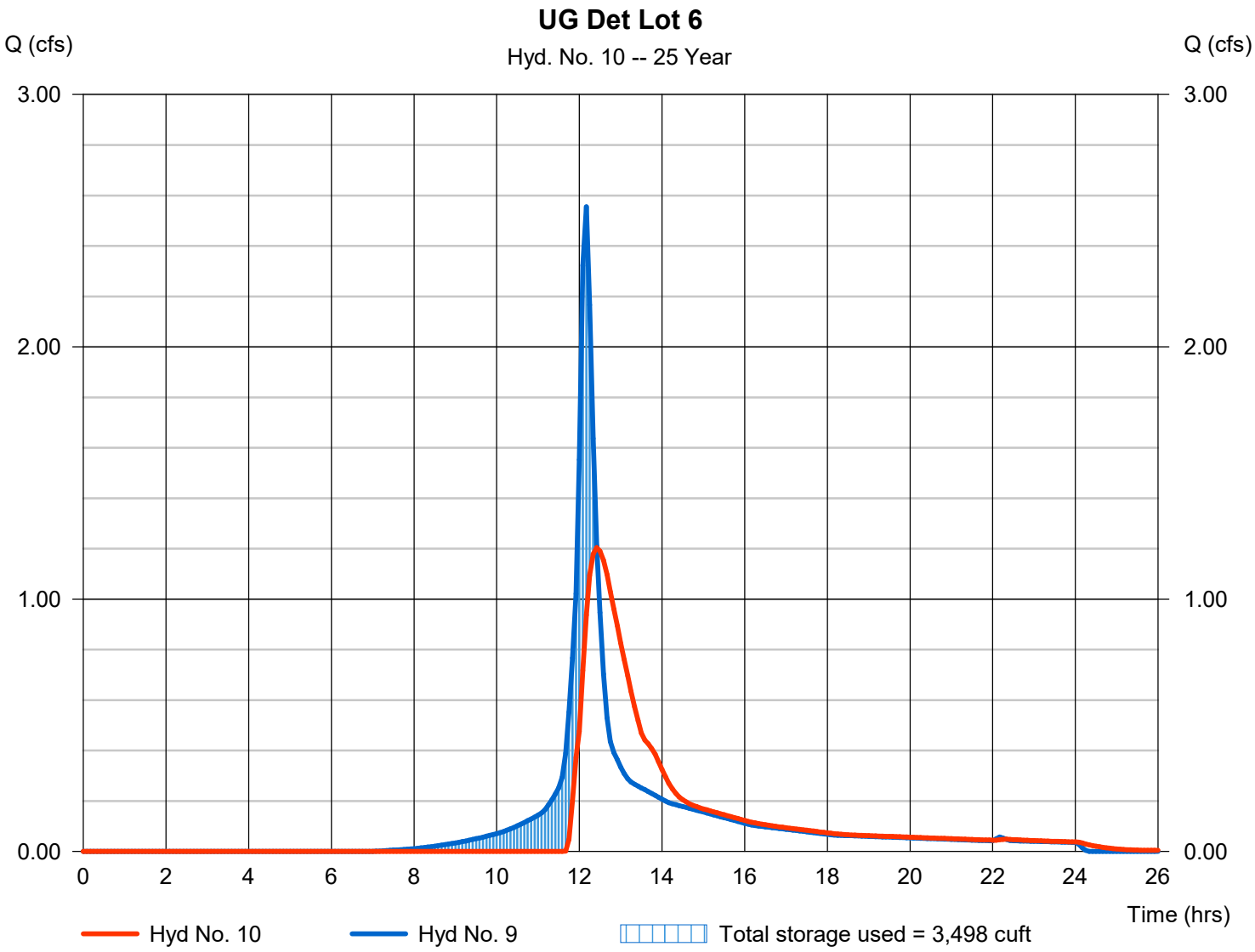
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 10

UG Det Lot 6

Hydrograph type	= Reservoir	Peak discharge	= 1.204 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.42 hrs
Time interval	= 5 min	Hyd. volume	= 9,029 cuft
Inflow hyd. No.	= 9 - Post-Dev B3	Max. Elevation	= 306.89 ft
Reservoir name	= UG Det Lot6	Max. Storage	= 3,498 cuft

Storage Indication method used.



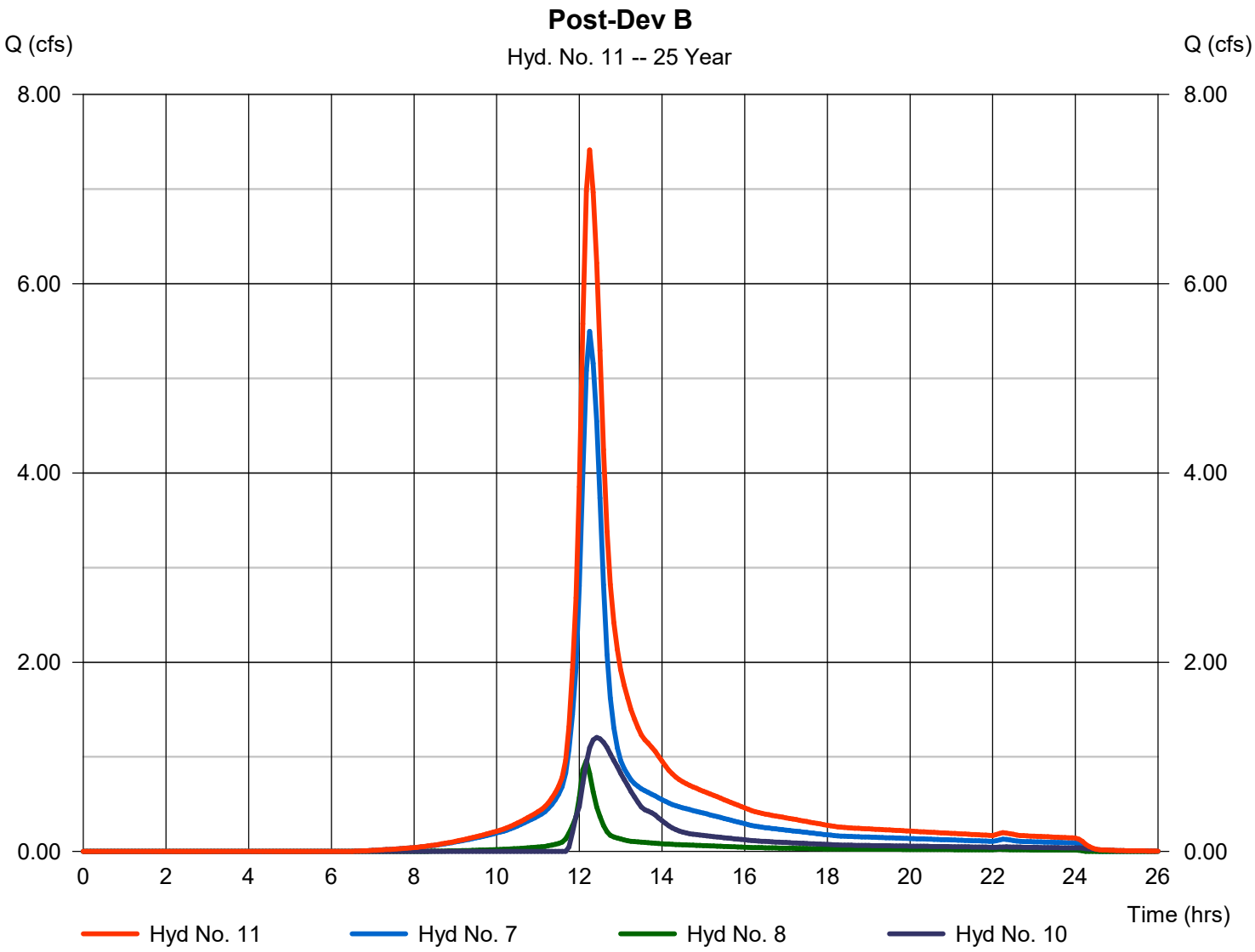
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 11

Post-Dev B

Hydrograph type	= Combine	Peak discharge	= 7.416 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 39,358 cuft
Inflow hyds.	= 7, 8, 10	Contrib. drain. area	= 2.082 ac



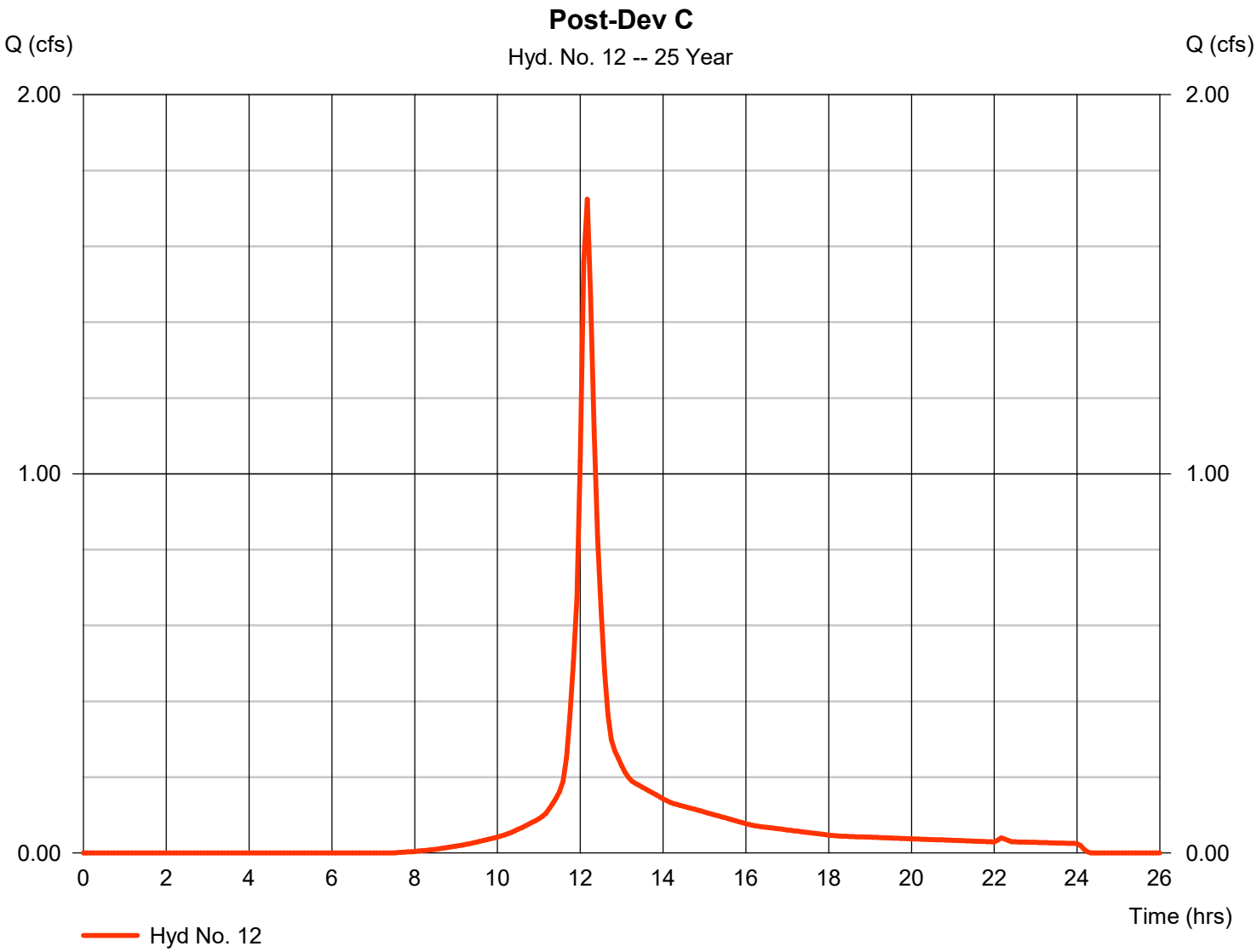
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 12

Post-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 1.725 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 6,863 cuft
Drainage area	= 0.544 ac	Curve number	= 76.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.33 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



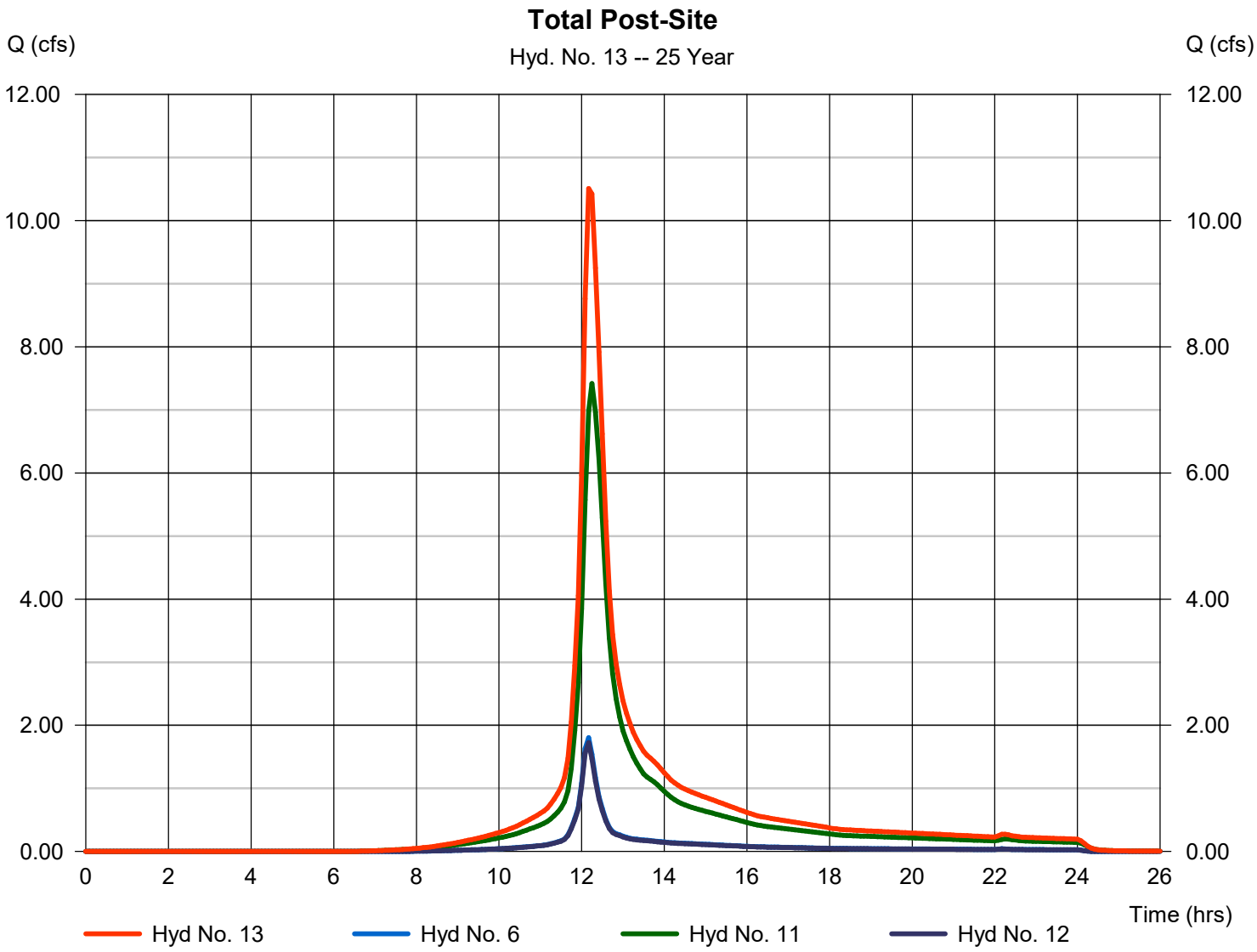
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 13

Total Post-Site

Hydrograph type	= Combine	Peak discharge	= 10.51 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 53,401 cuft
Inflow hyds.	= 6, 11, 12	Contrib. drain. area	= 1.121 ac



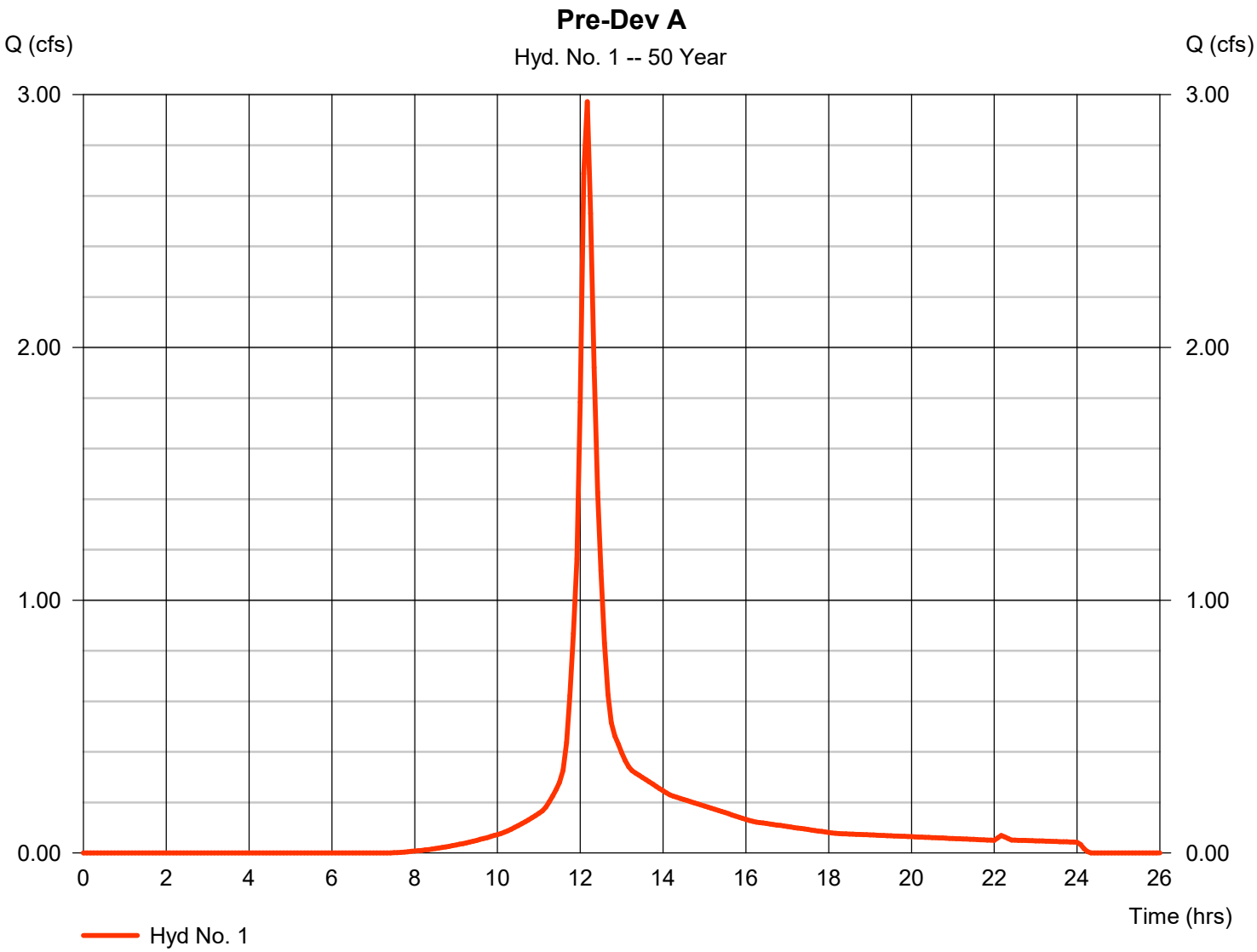
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.973 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 11,832 cuft
Drainage area	= 0.816 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.40 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



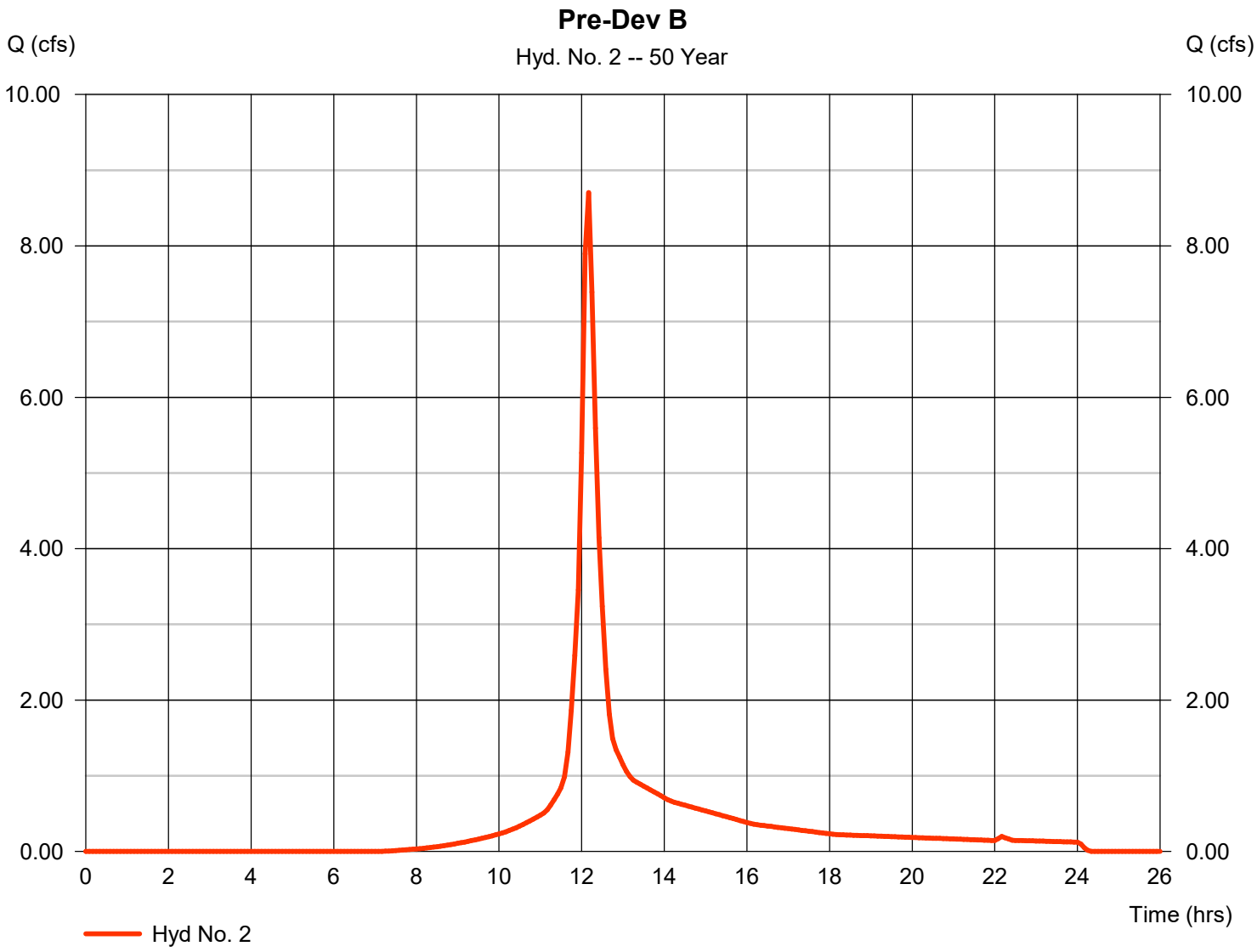
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 2

Pre-Dev B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.704 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 34,706 cuft
Drainage area	= 2.316 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



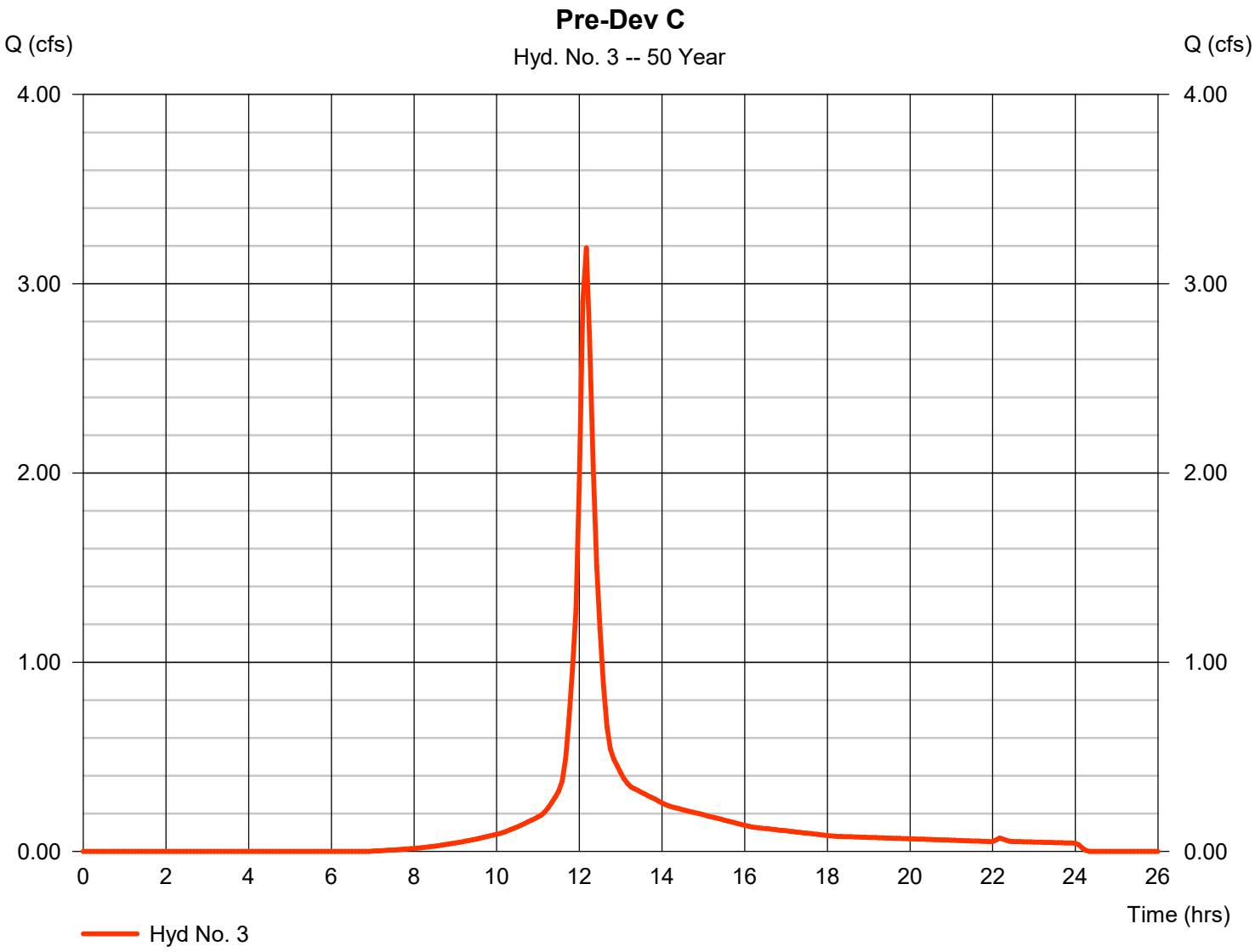
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 3

Pre-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 3.190 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 12,750 cuft
Drainage area	= 0.824 ac	Curve number	= 76.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.50 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



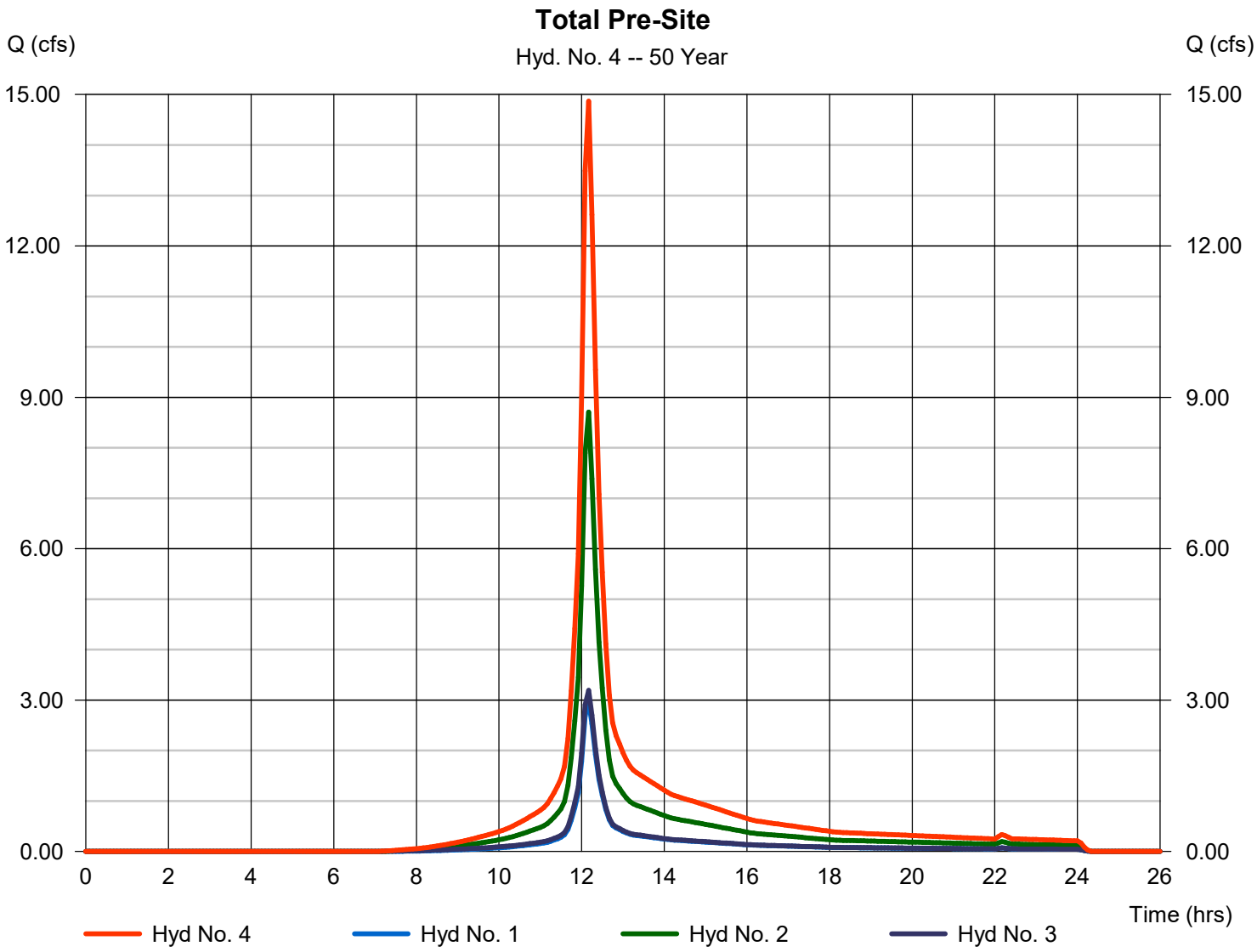
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 4

Total Pre-Site

Hydrograph type	= Combine	Peak discharge	= 14.87 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 59,289 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 3.956 ac



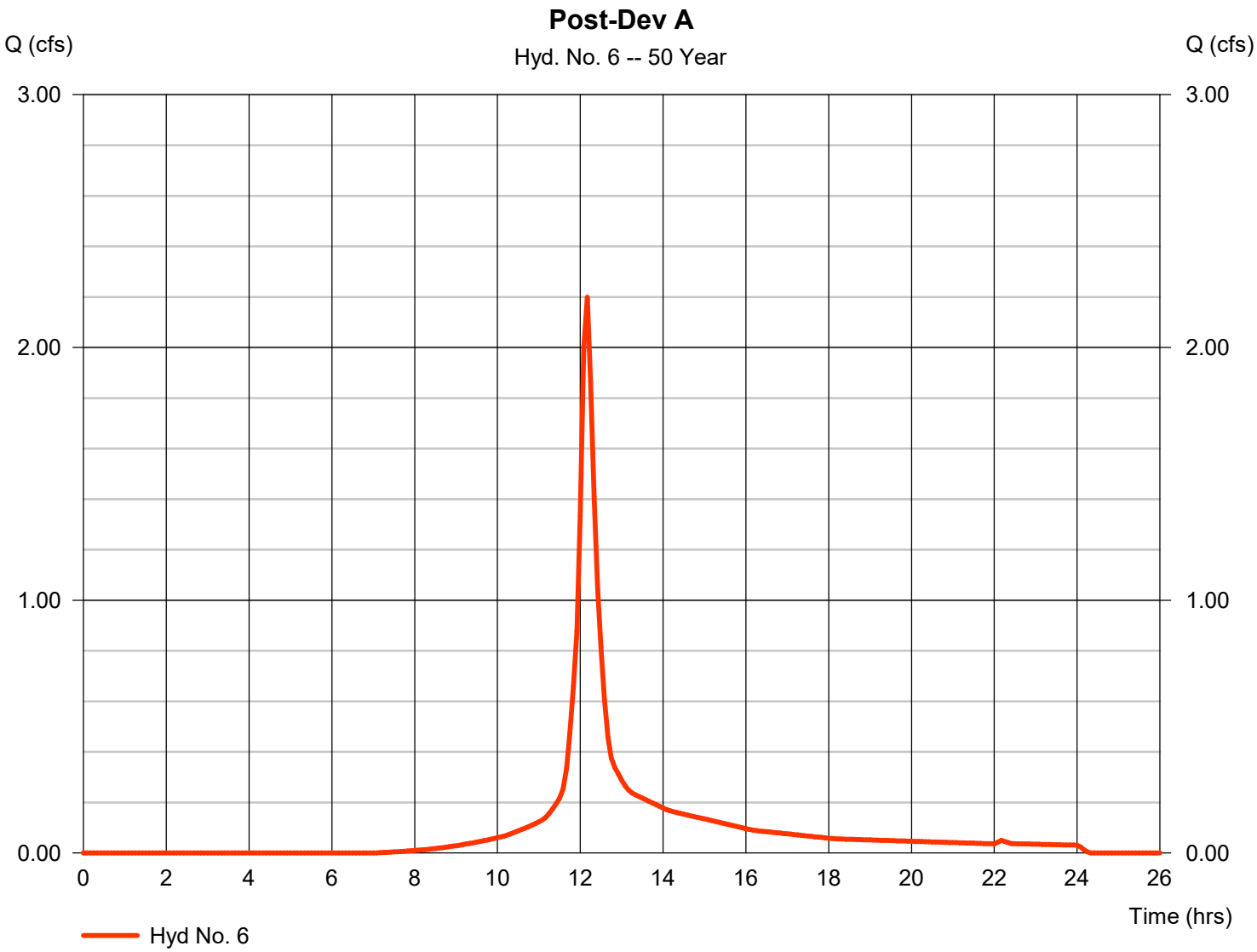
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 6

Post-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.199 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 8,776 cuft
Drainage area	= 0.577 ac	Curve number	= 75.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.30 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



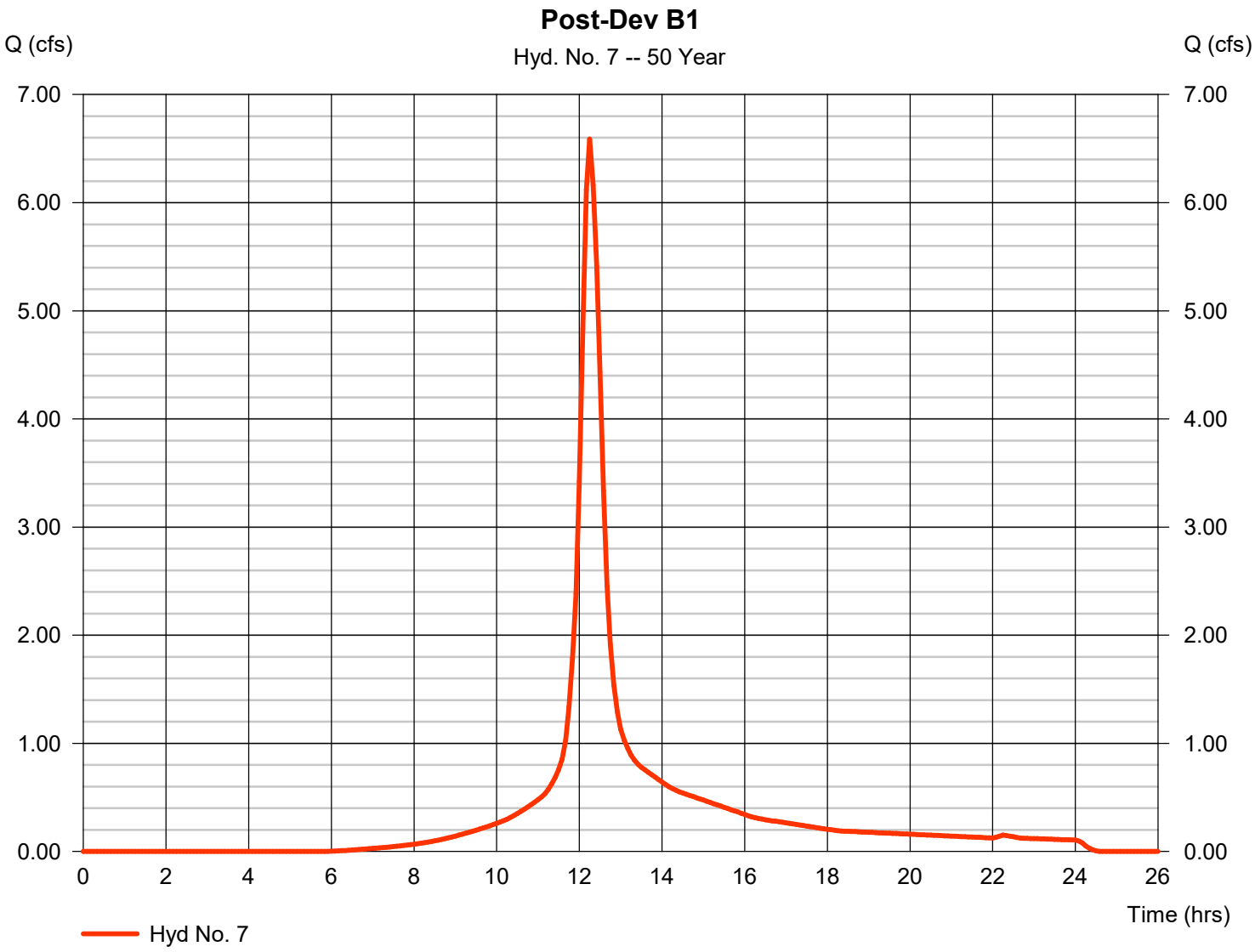
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 7

Post-Dev B1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.589 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 31,935 cuft
Drainage area	= 1.758 ac	Curve number	= 80.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



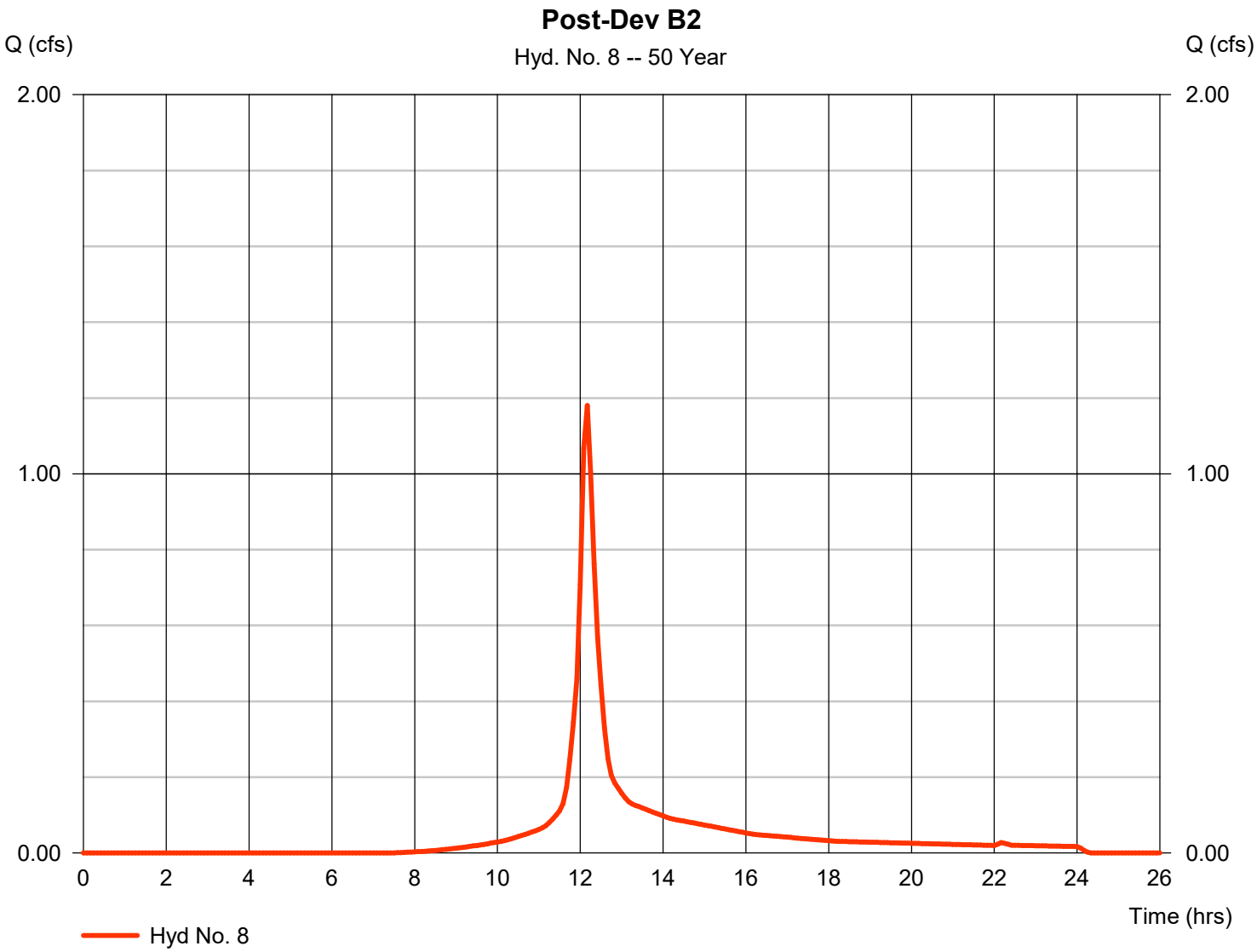
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 8

Post-Dev B2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.180 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 4,698 cuft
Drainage area	= 0.324 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



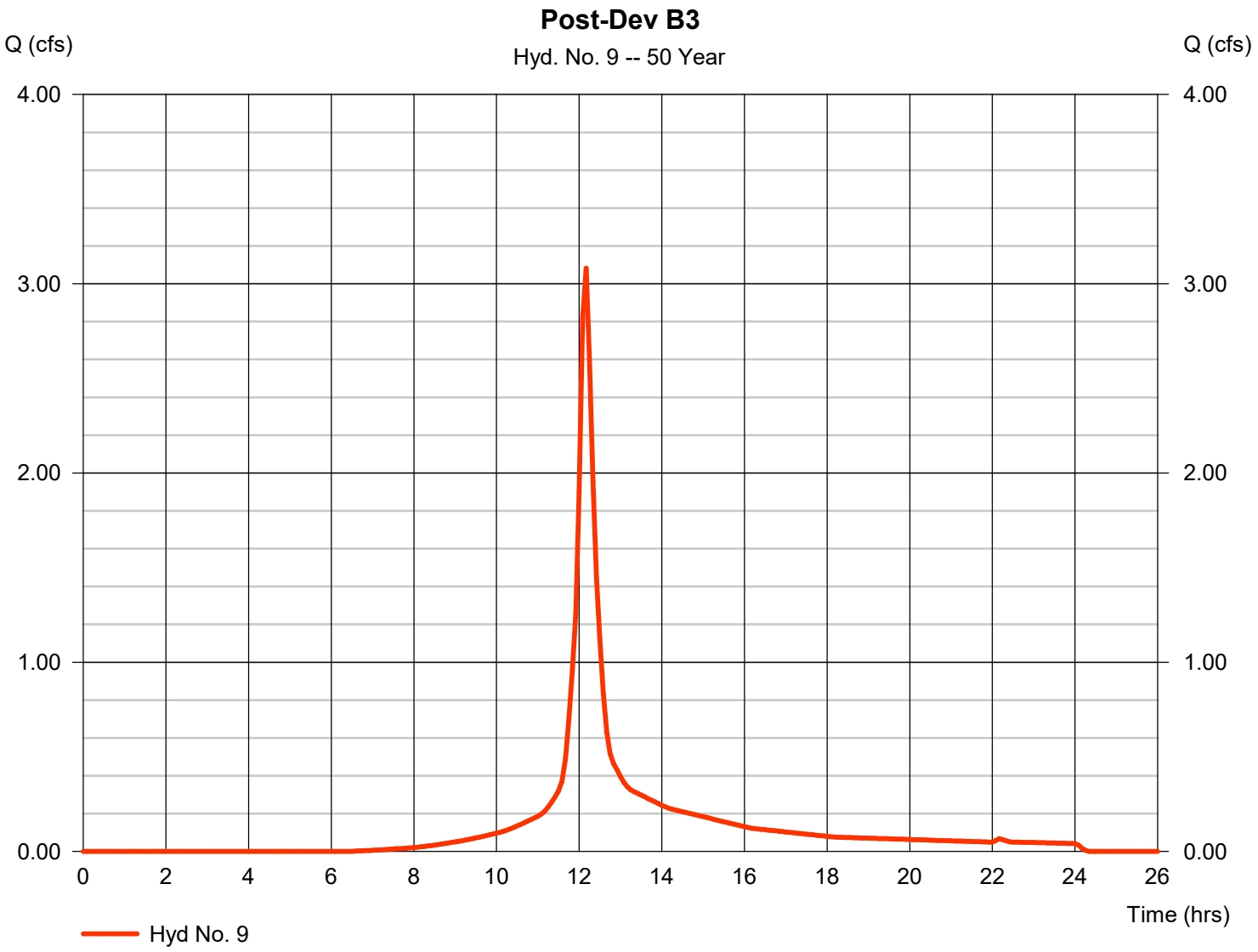
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 9

Post-Dev B3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.083 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 12,374 cuft
Drainage area	= 0.766 ac	Curve number	= 78.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

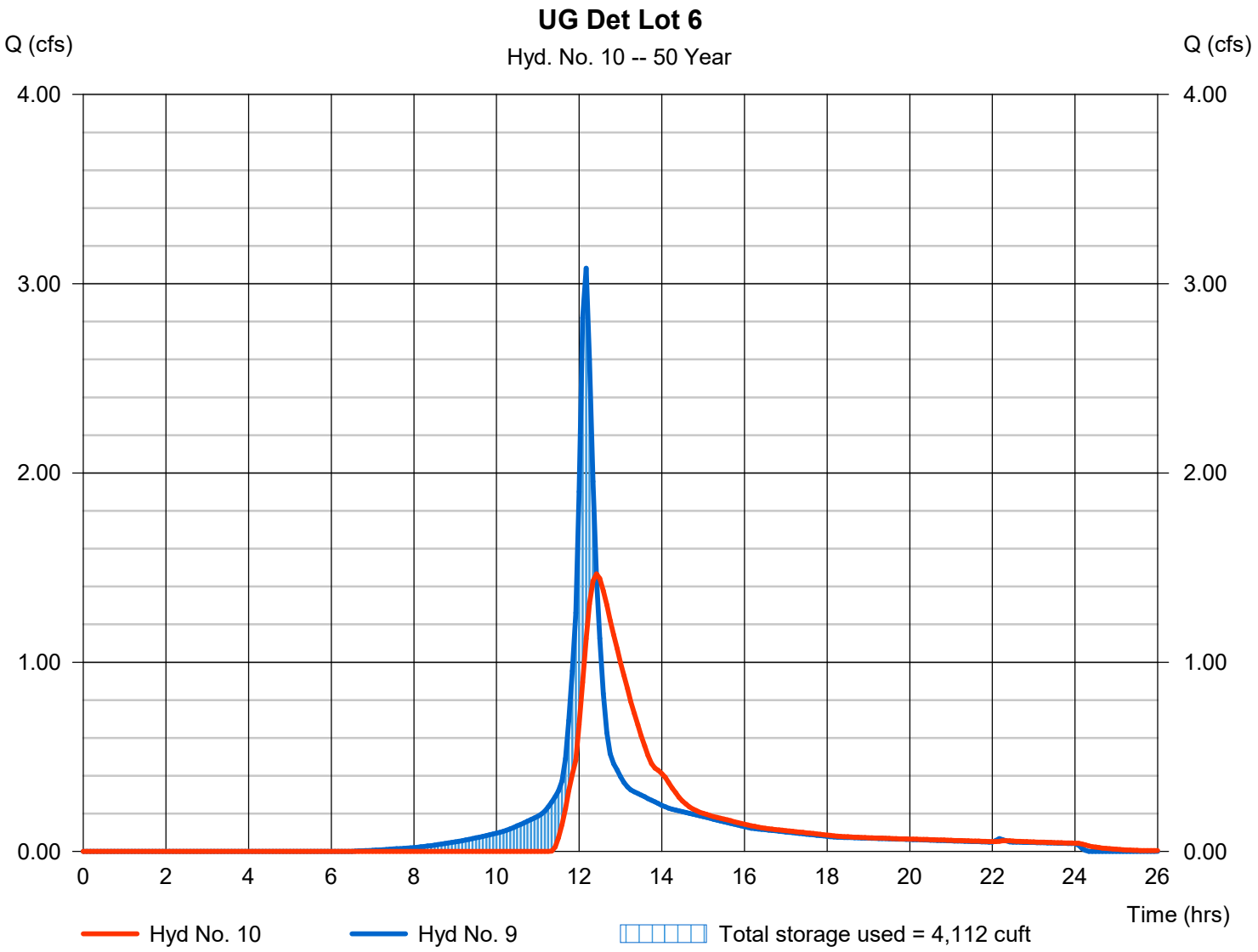
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 10

UG Det Lot 6

Hydrograph type	= Reservoir	Peak discharge	= 1.466 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.42 hrs
Time interval	= 5 min	Hyd. volume	= 11,202 cuft
Inflow hyd. No.	= 9 - Post-Dev B3	Max. Elevation	= 307.86 ft
Reservoir name	= UG Det Lot6	Max. Storage	= 4,112 cuft

Storage Indication method used.



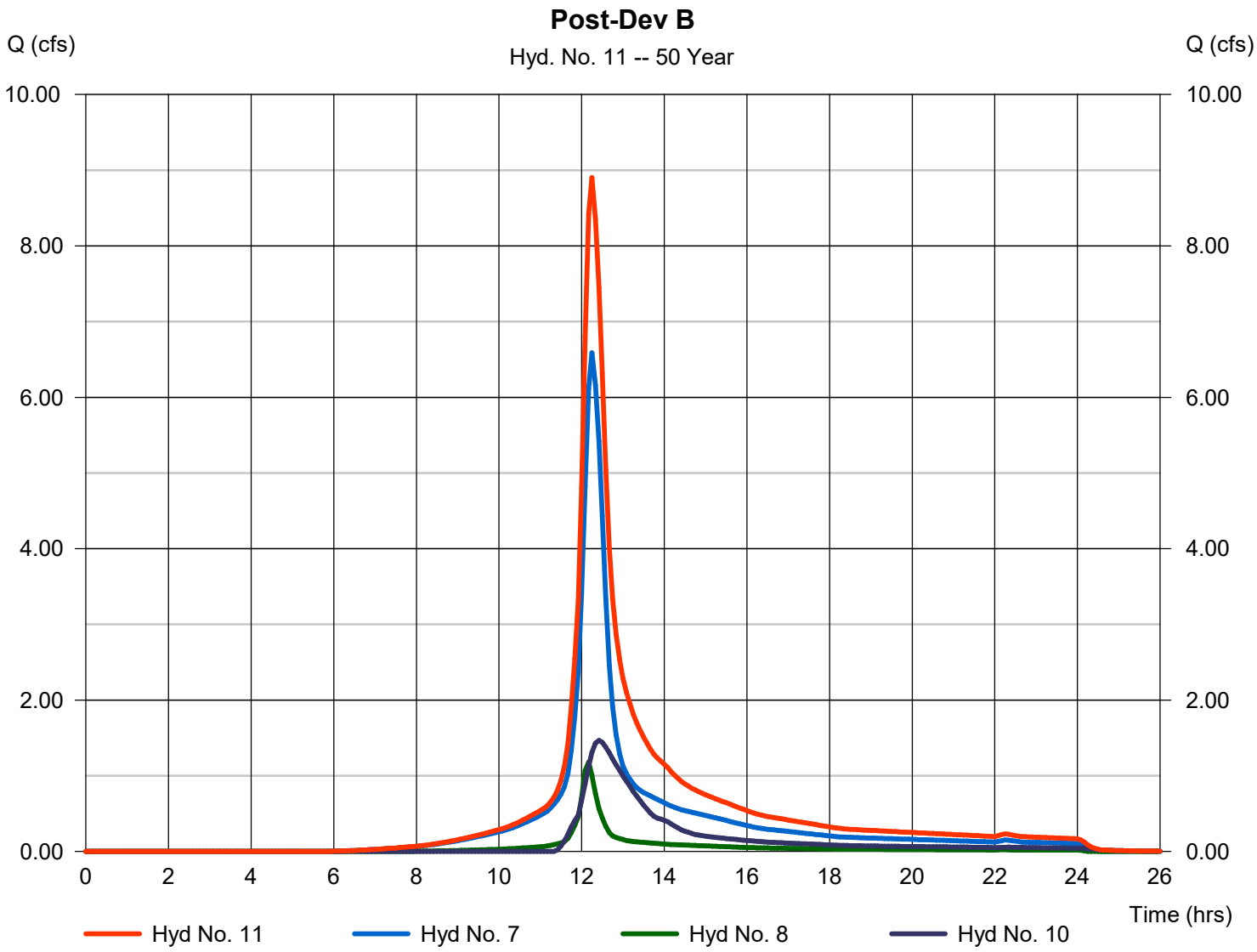
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 11

Post-Dev B

Hydrograph type	= Combine	Peak discharge	= 8.902 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 47,835 cuft
Inflow hyds.	= 7, 8, 10	Contrib. drain. area	= 2.082 ac



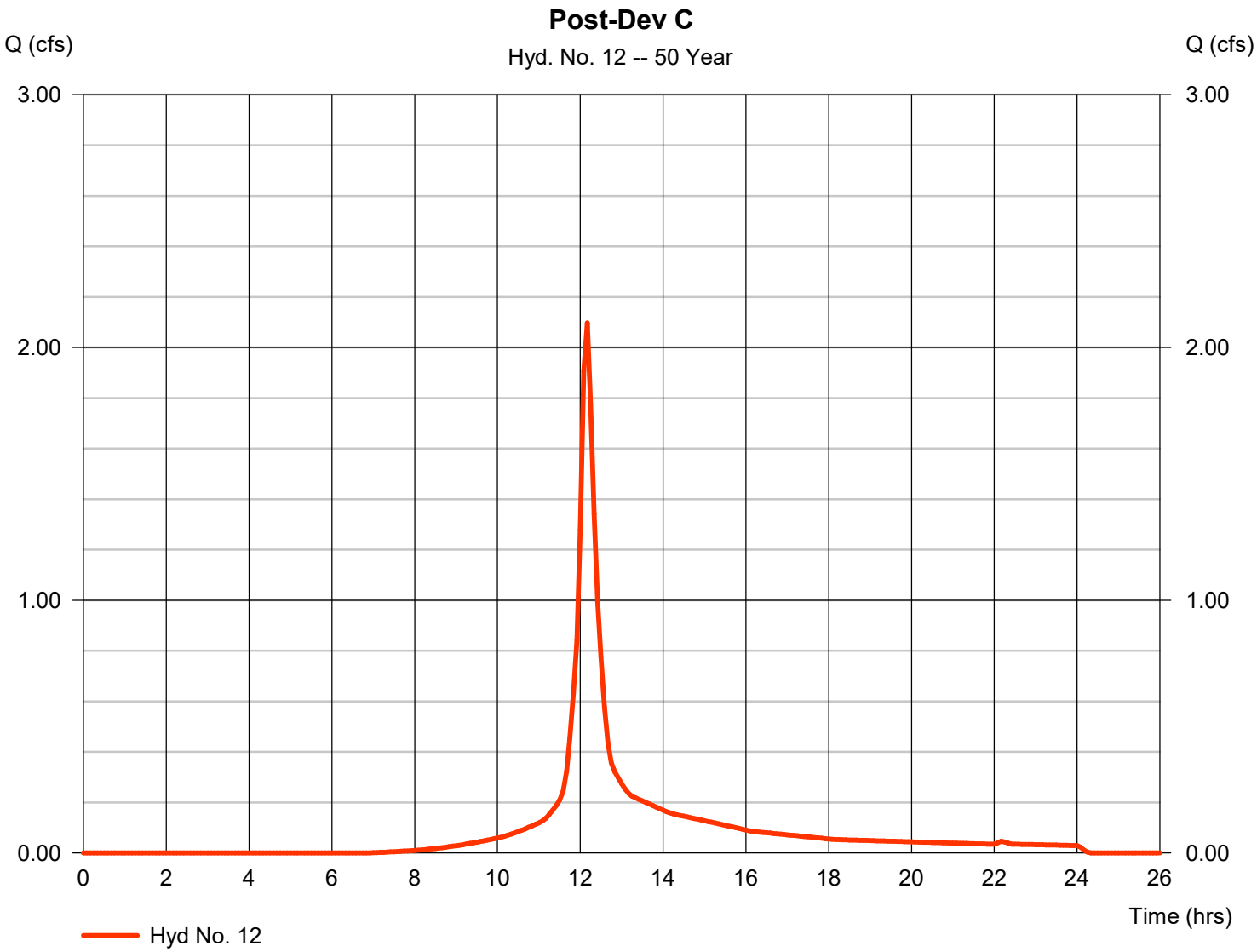
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 12

Post-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 2.097 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 8,377 cuft
Drainage area	= 0.544 ac	Curve number	= 76.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 7.25 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



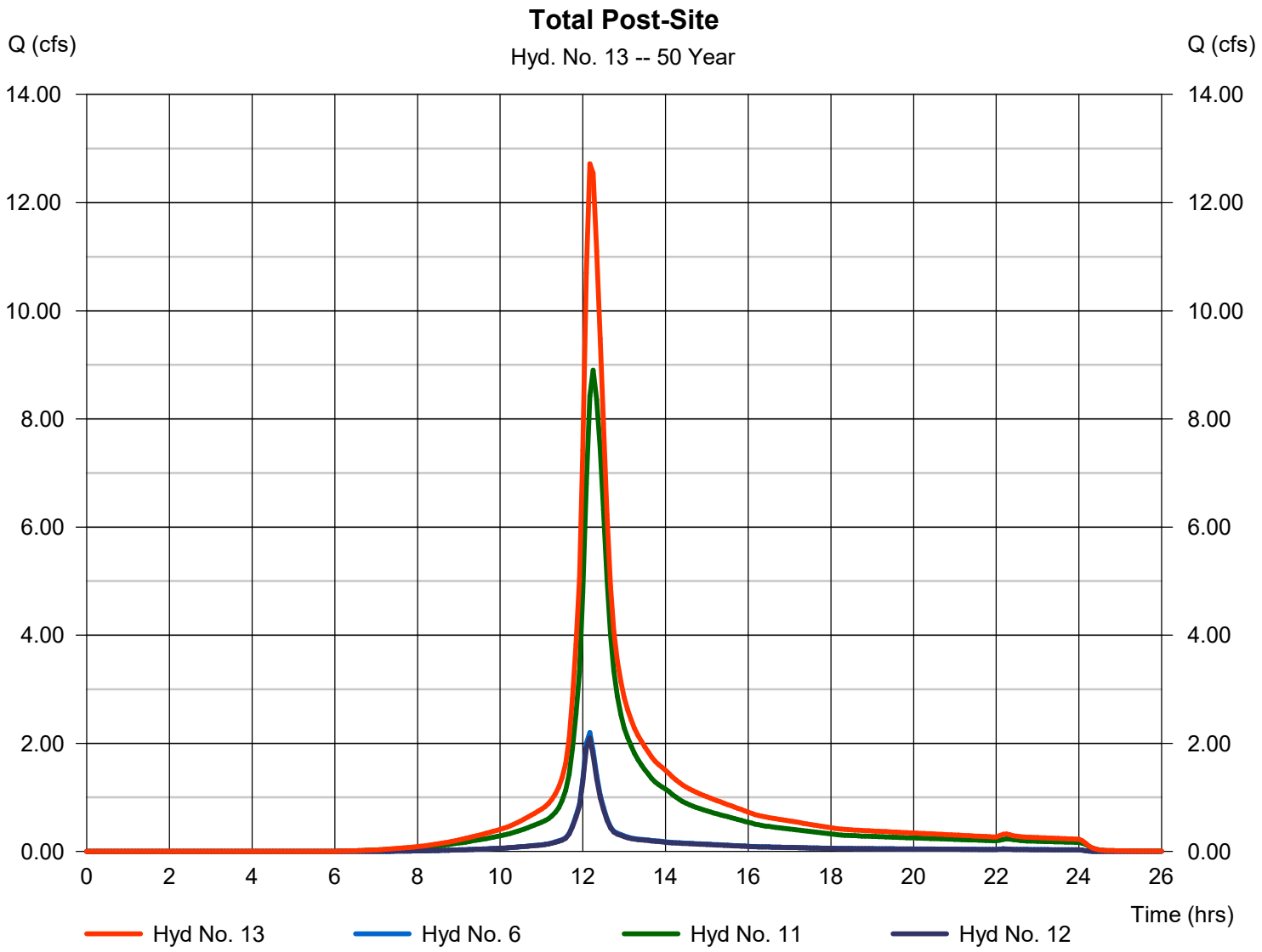
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 13

Total Post-Site

Hydrograph type	= Combine	Peak discharge	= 12.72 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 64,988 cuft
Inflow hyds.	= 6, 11, 12	Contrib. drain. area	= 1.121 ac



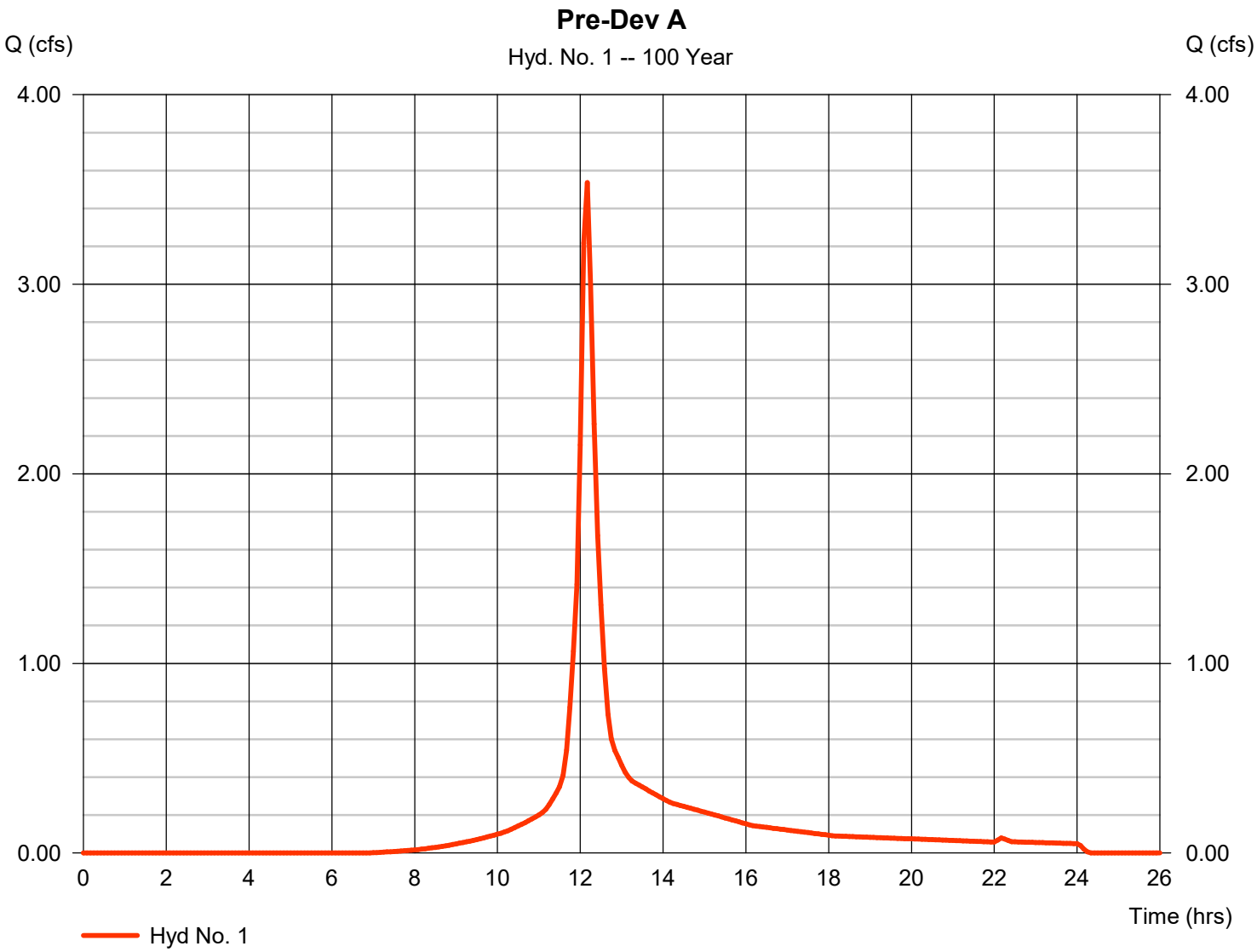
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 1

Pre-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.537 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 14,126 cuft
Drainage area	= 0.816 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.40 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



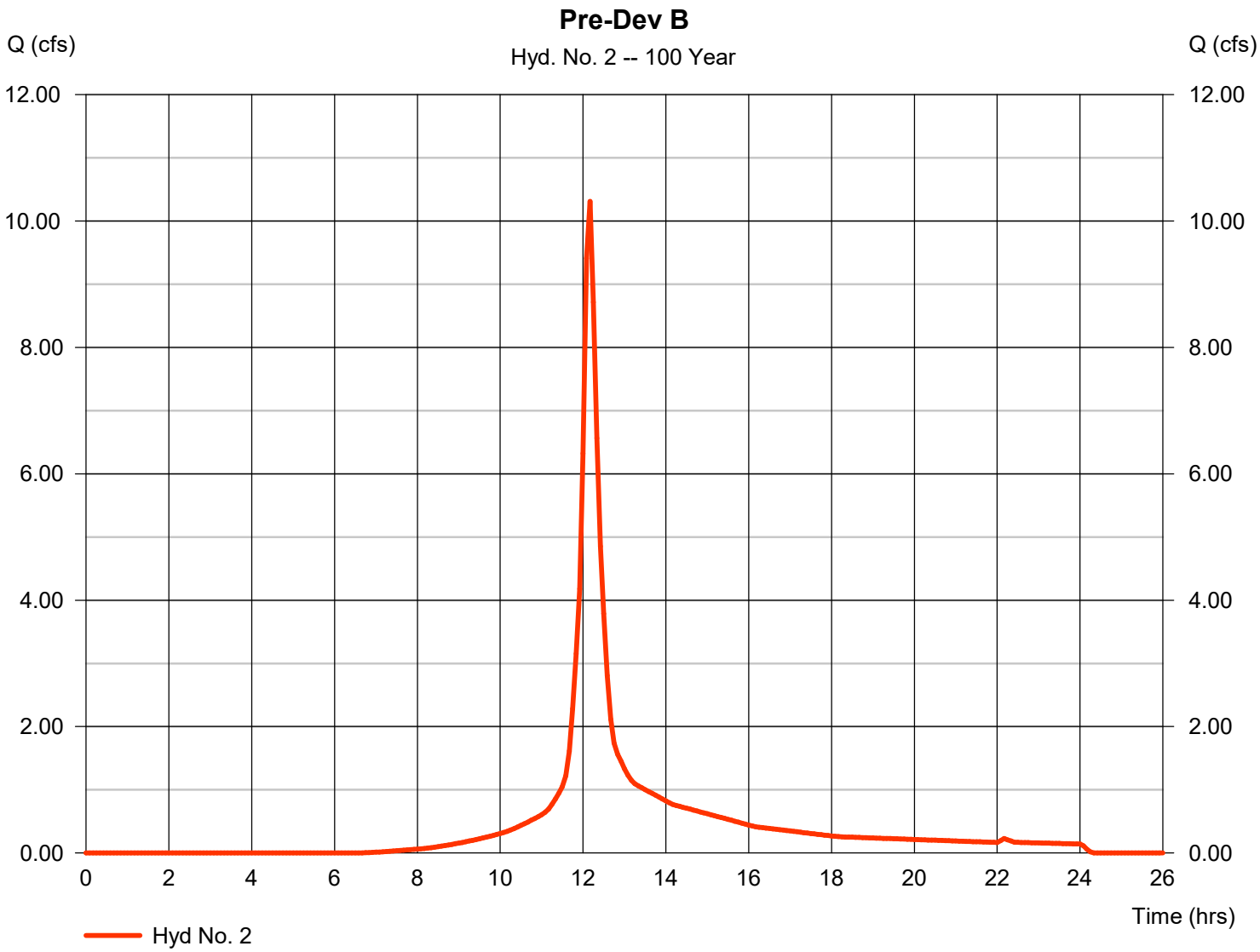
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 2

Pre-Dev B

Hydrograph type	= SCS Runoff	Peak discharge	= 10.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 41,297 cuft
Drainage area	= 2.316 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.30 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



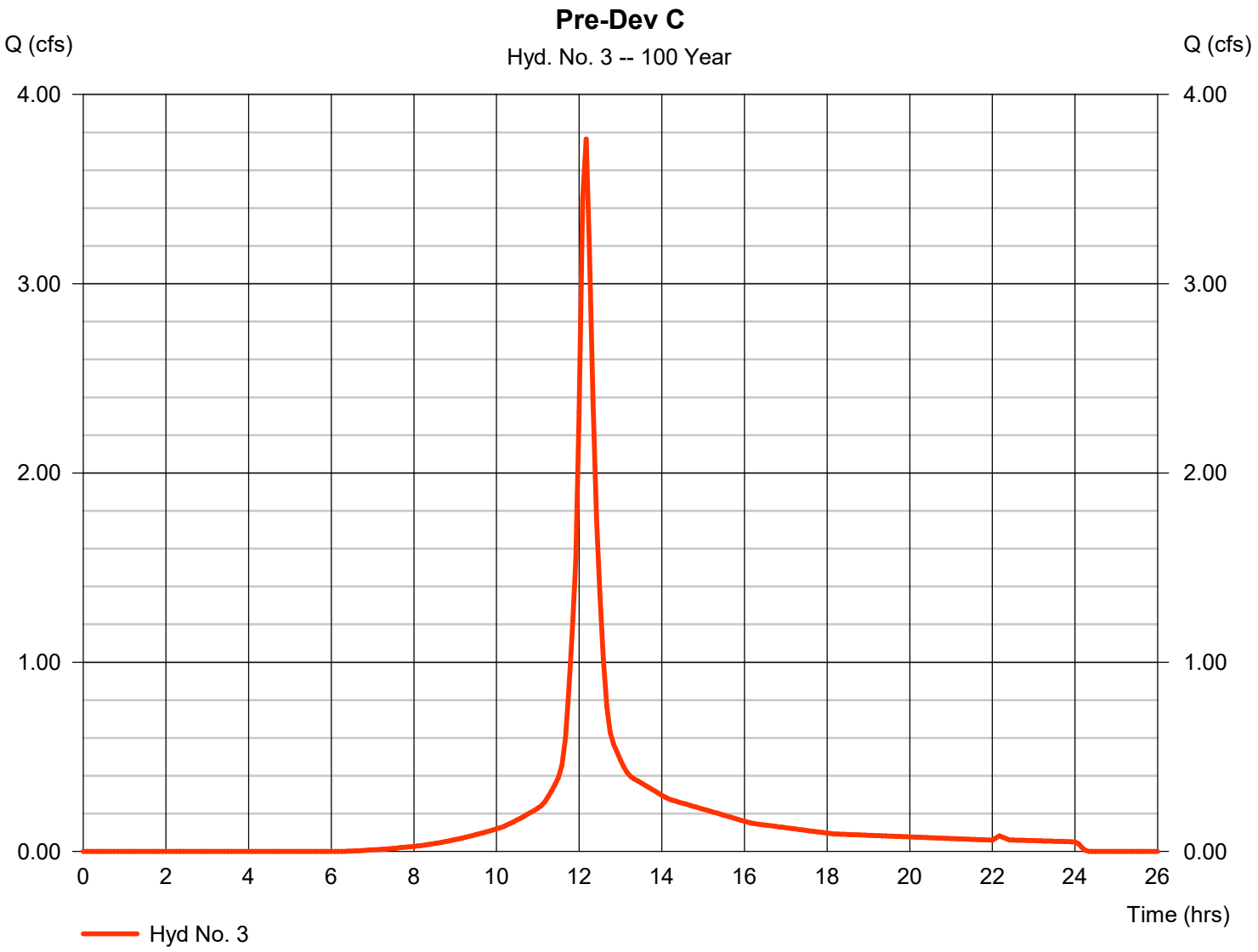
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 3

Pre-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 3.765 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 15,122 cuft
Drainage area	= 0.824 ac	Curve number	= 76.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.50 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



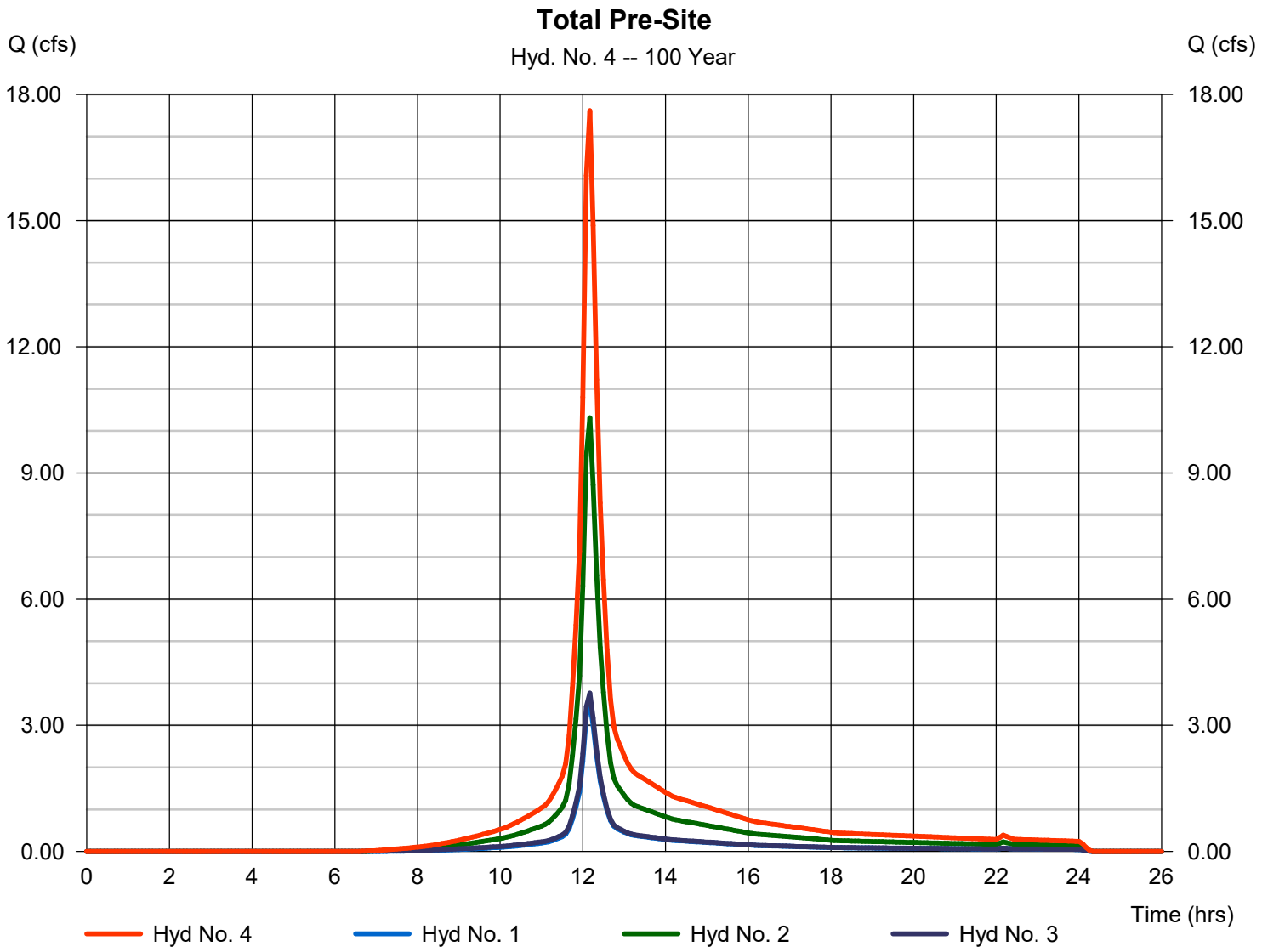
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 4

Total Pre-Site

Hydrograph type	= Combine	Peak discharge	= 17.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 70,545 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 3.956 ac



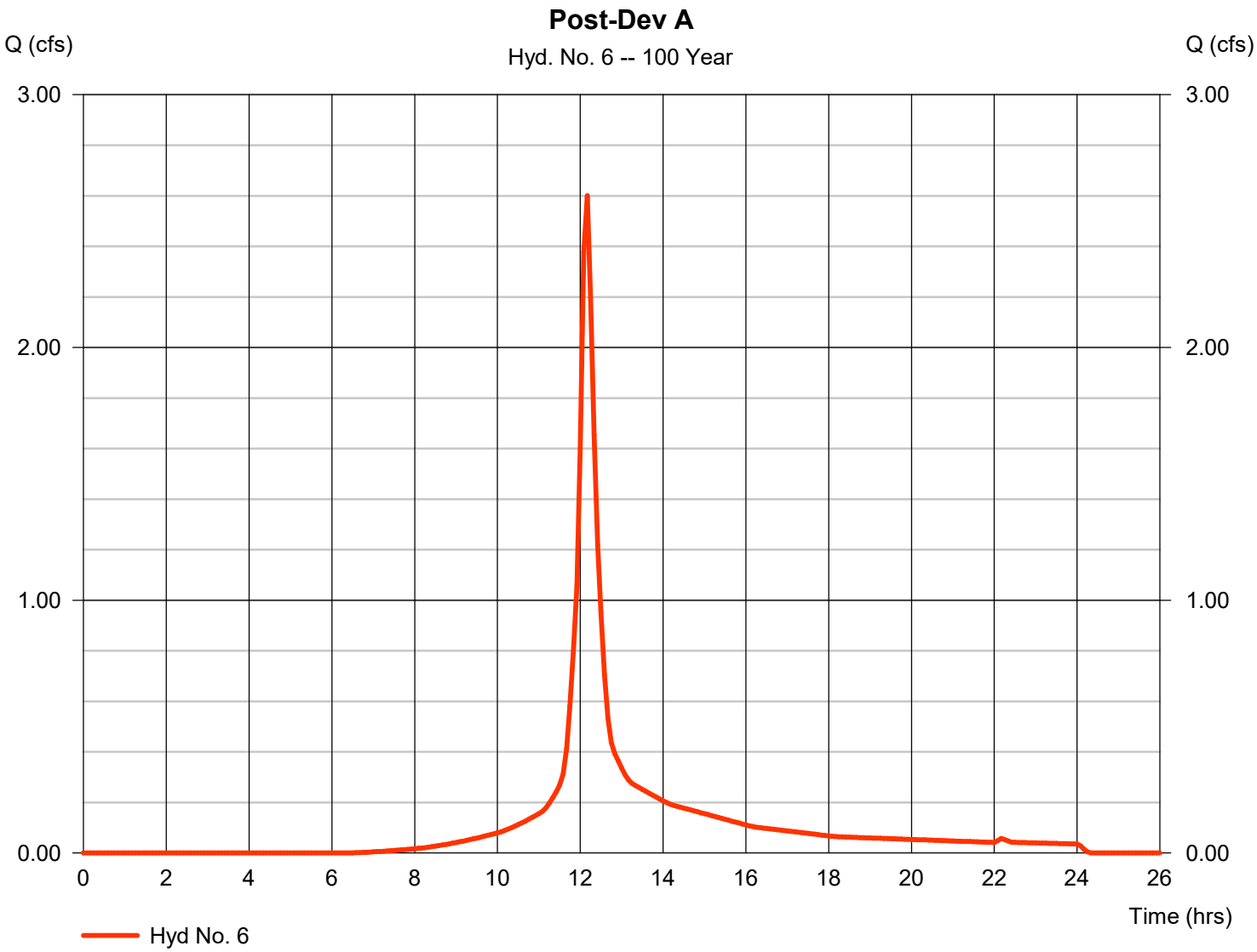
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 6

Post-Dev A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.600 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 10,427 cuft
Drainage area	= 0.577 ac	Curve number	= 75.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.30 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



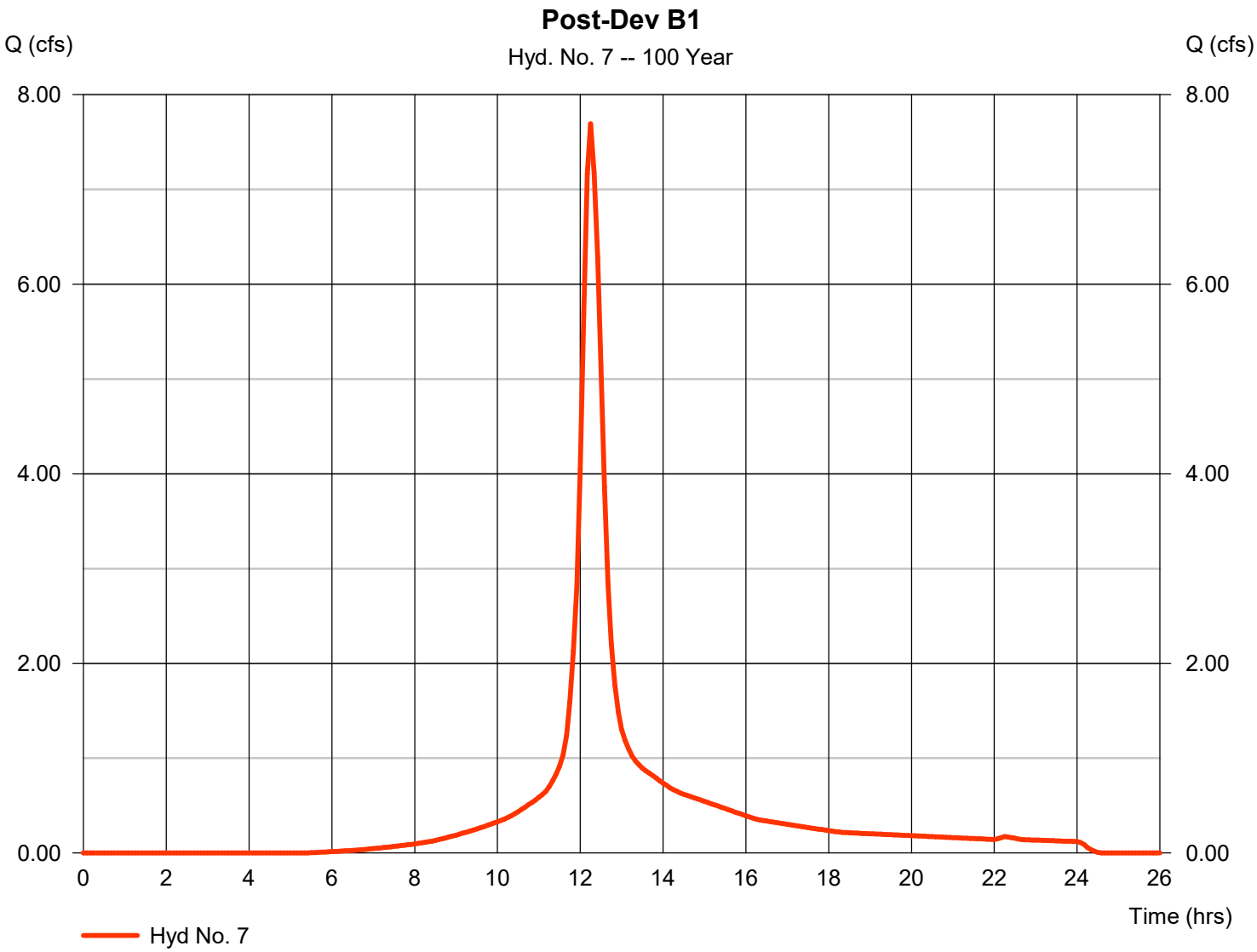
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 7

Post-Dev B1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.695 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 37,503 cuft
Drainage area	= 1.758 ac	Curve number	= 80.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.20 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



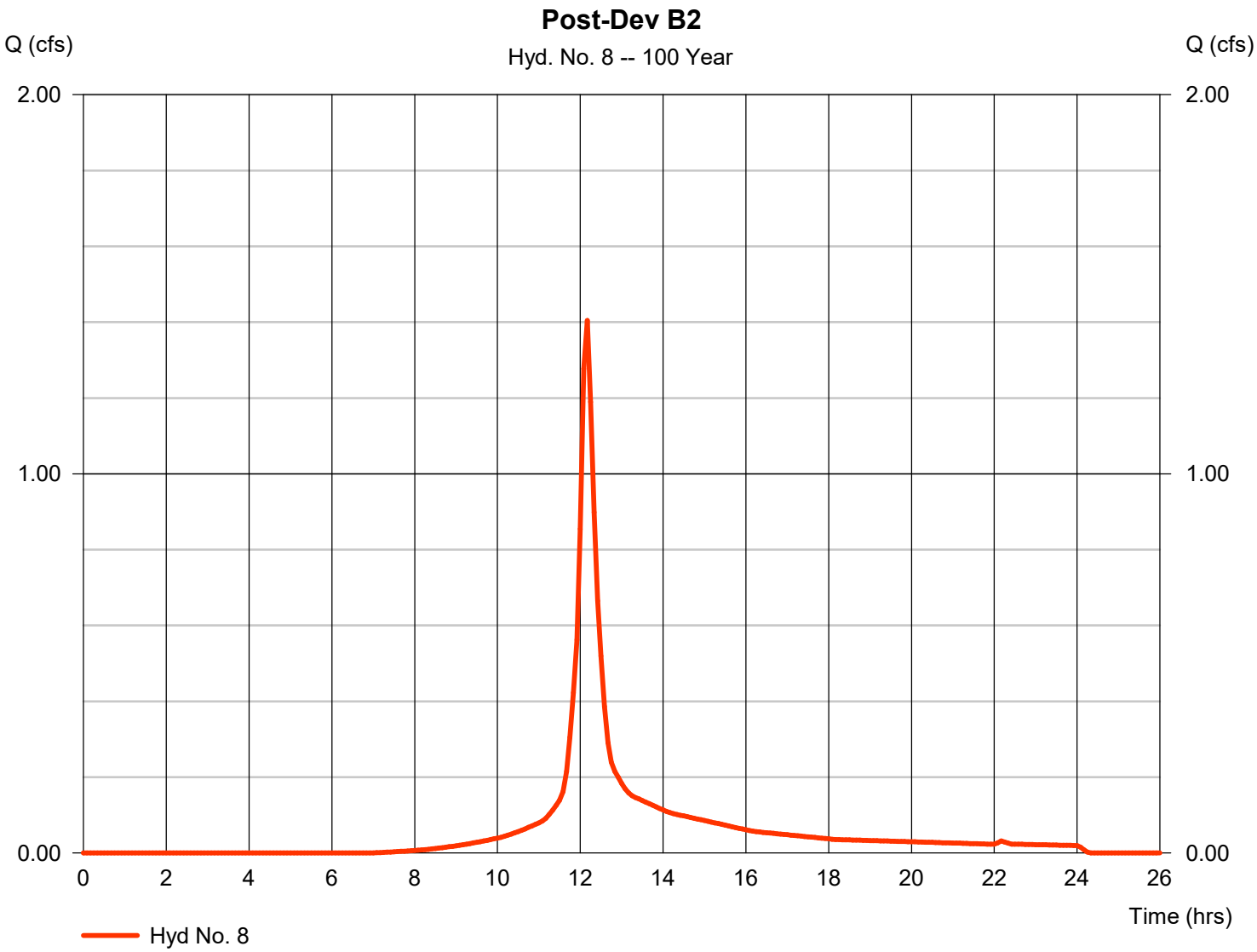
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 8

Post-Dev B2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.404 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 5,609 cuft
Drainage area	= 0.324 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



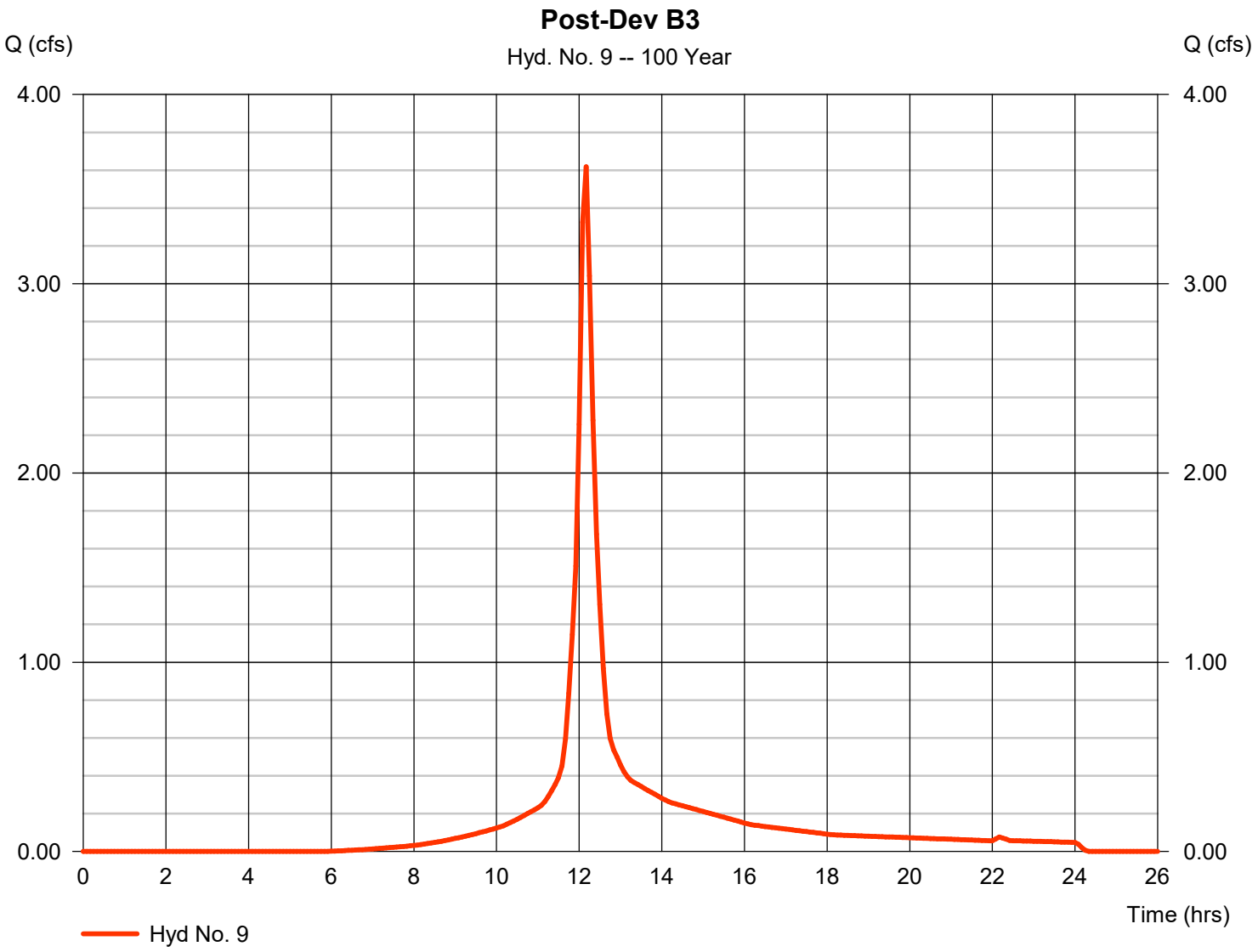
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 9

Post-Dev B3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.619 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 14,611 cuft
Drainage area	= 0.766 ac	Curve number	= 78.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

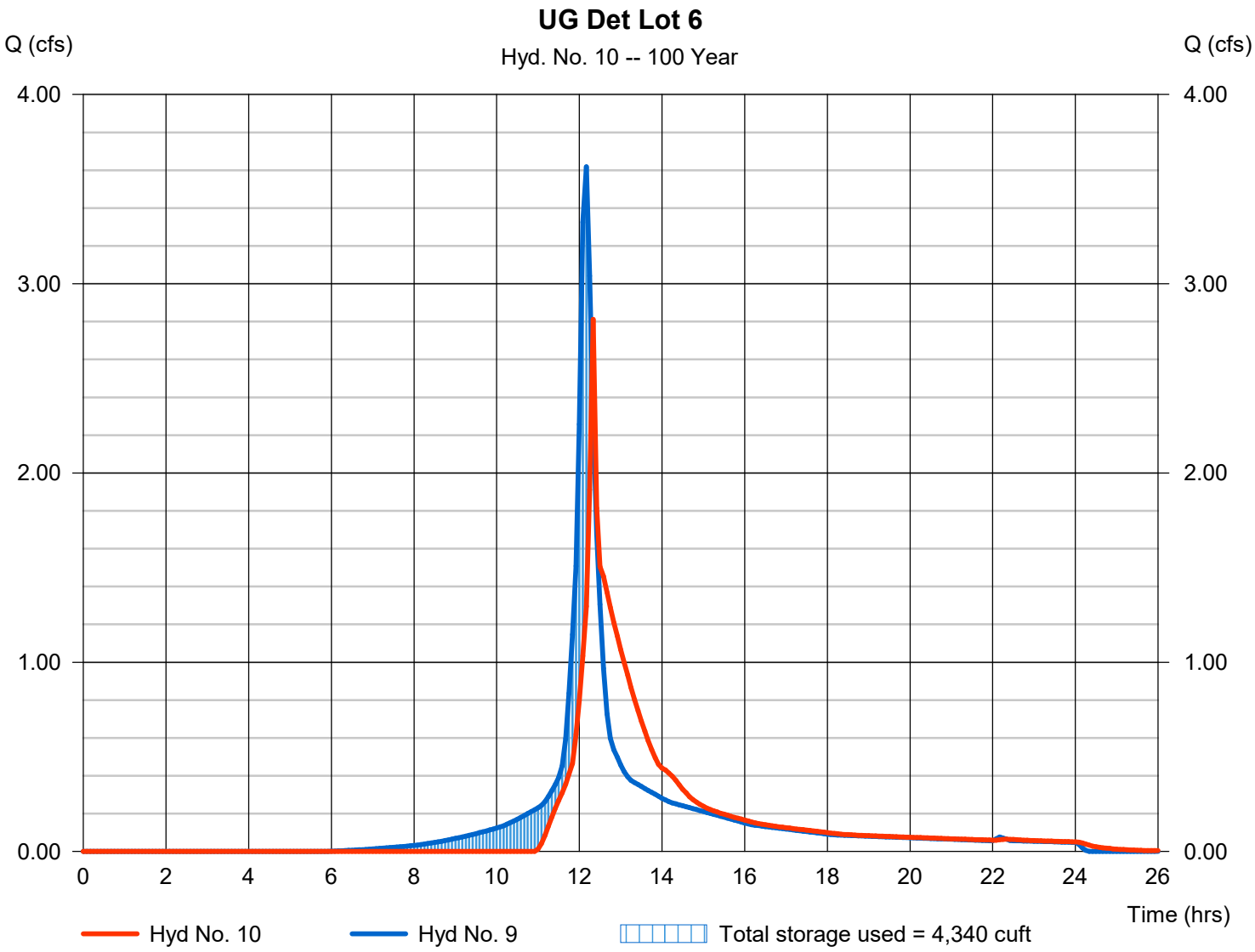
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 10

UG Det Lot 6

Hydrograph type	= Reservoir	Peak discharge	= 2.812 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 5 min	Hyd. volume	= 13,439 cuft
Inflow hyd. No.	= 9 - Post-Dev B3	Max. Elevation	= 308.46 ft
Reservoir name	= UG Det Lot6	Max. Storage	= 4,340 cuft

Storage Indication method used.



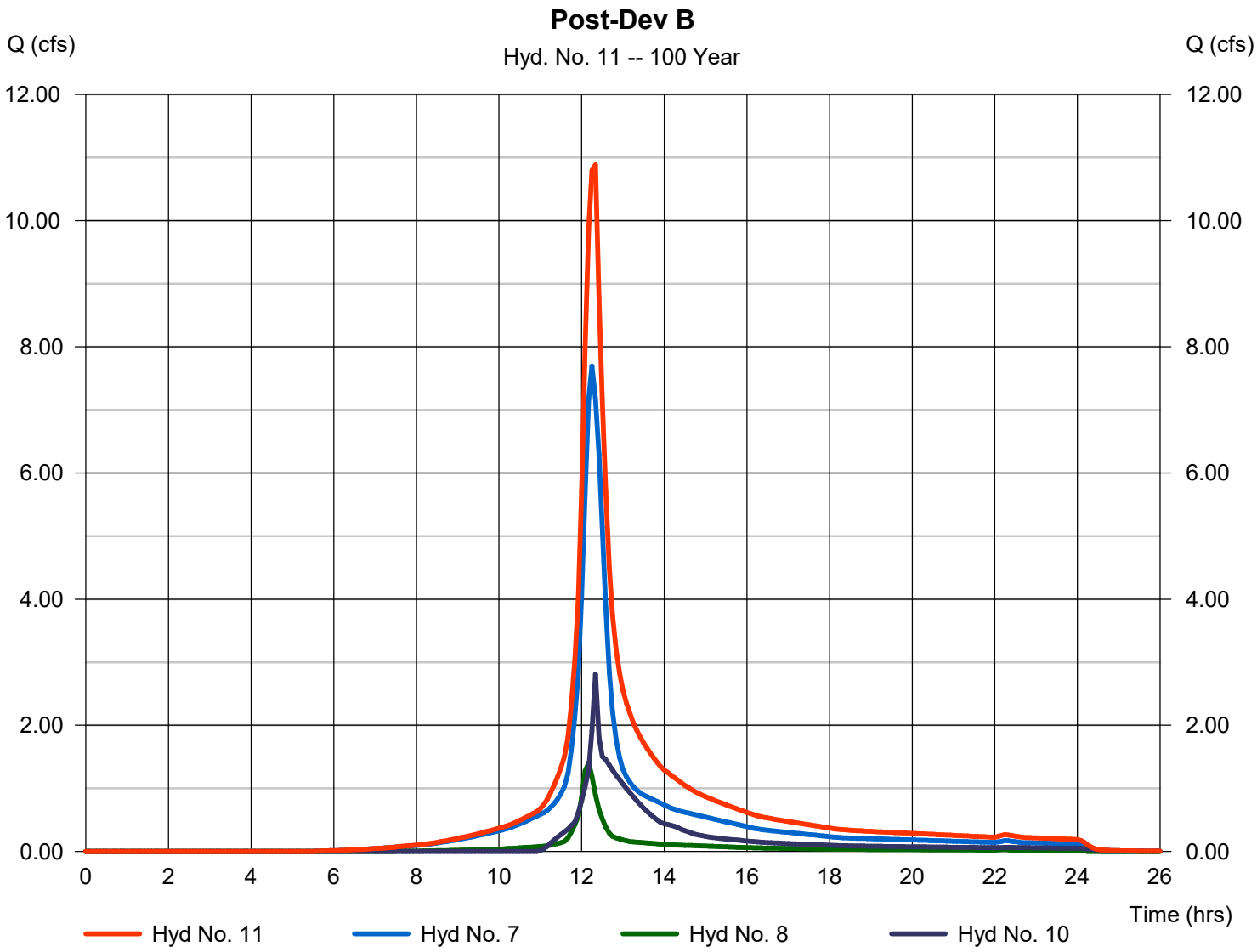
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 11

Post-Dev B

Hydrograph type	= Combine	Peak discharge	= 10.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 5 min	Hyd. volume	= 56,551 cuft
Inflow hyds.	= 7, 8, 10	Contrib. drain. area	= 2.082 ac



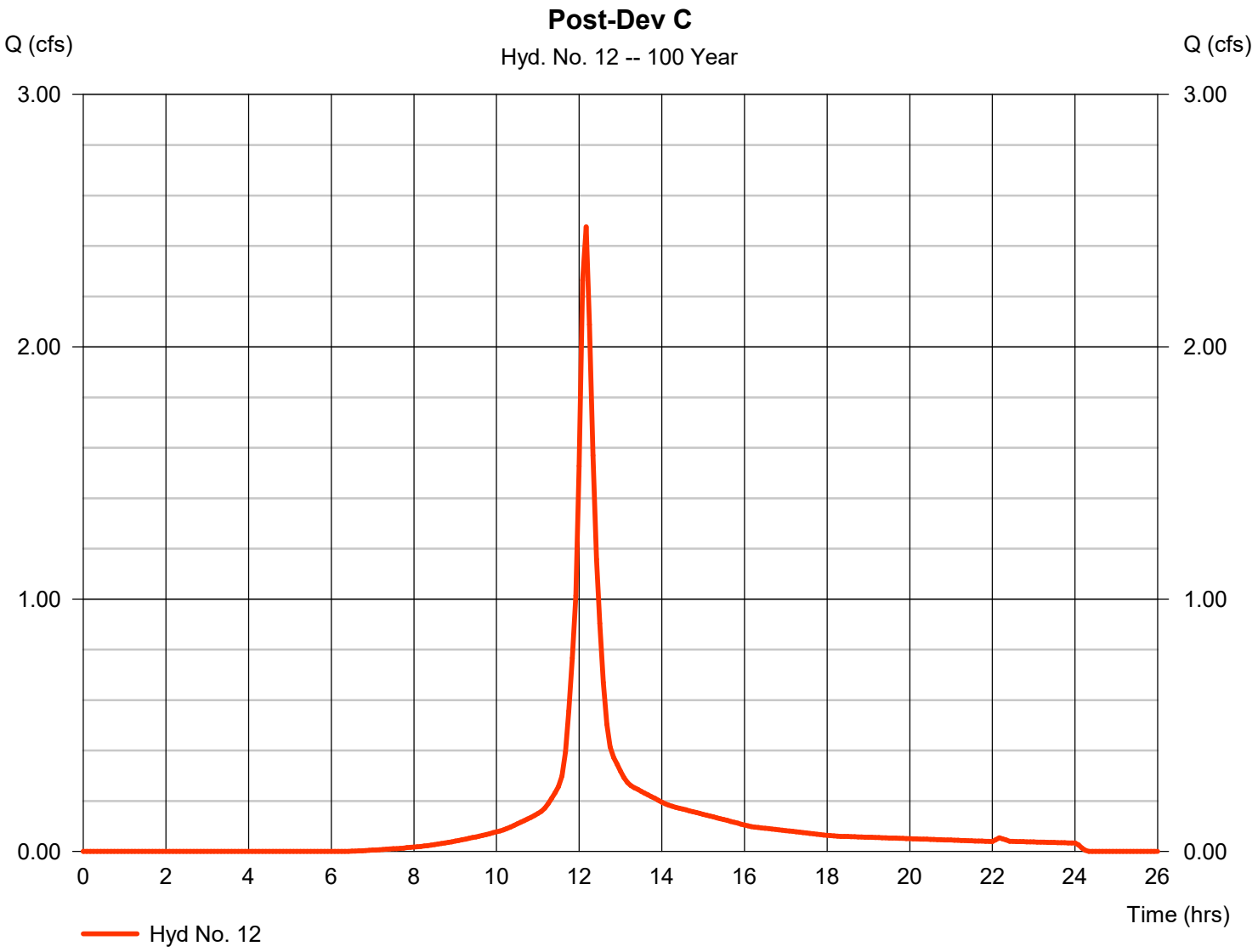
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 12

Post-Dev C

Hydrograph type	= SCS Runoff	Peak discharge	= 2.476 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 5 min	Hyd. volume	= 9,940 cuft
Drainage area	= 0.544 ac	Curve number	= 76.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.18 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



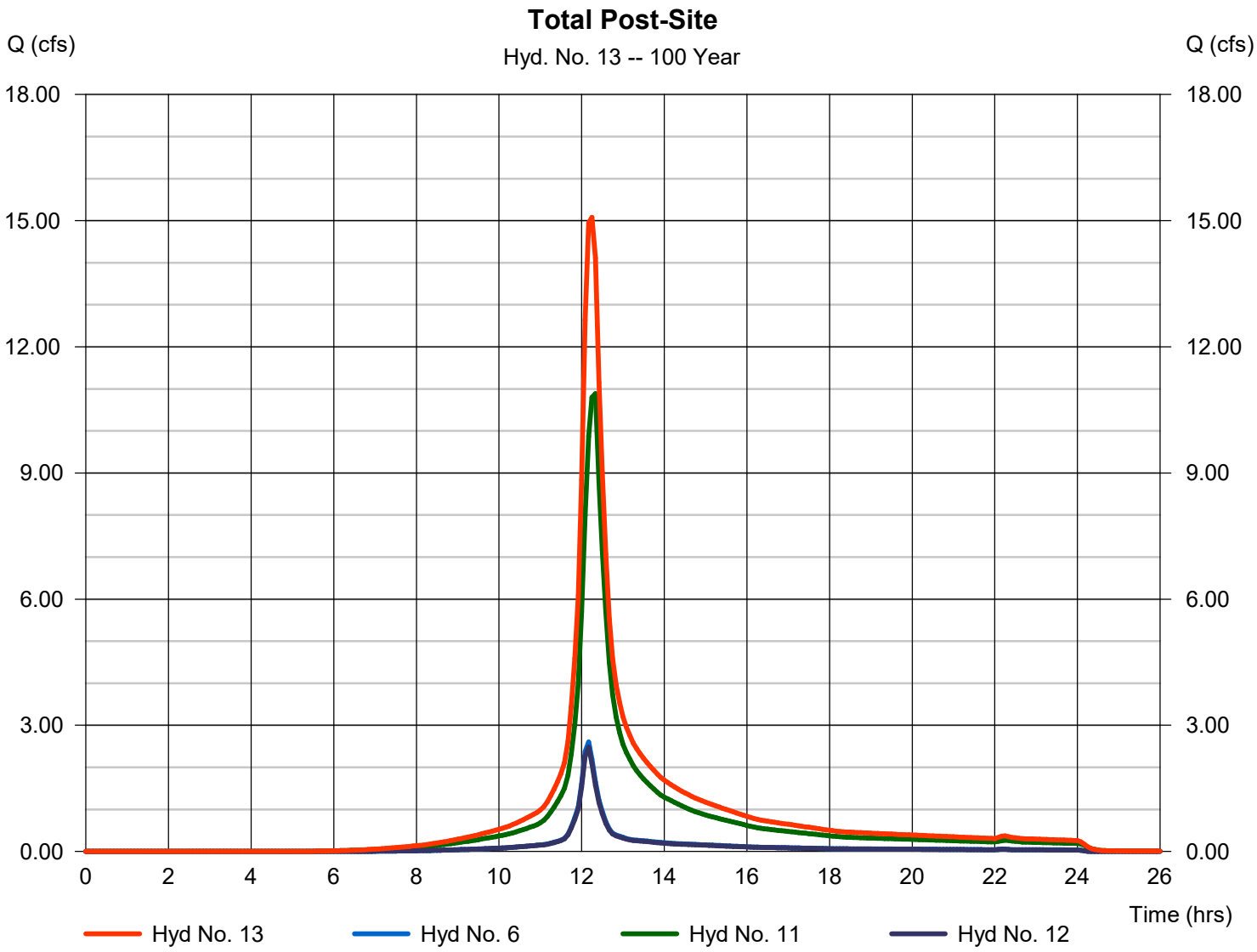
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019 Thursday, 04 / 25 / 2019

Hyd. No. 13

Total Post-Site

Hydrograph type	= Combine	Peak discharge	= 15.08 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.25 hrs
Time interval	= 5 min	Hyd. volume	= 76,918 cuft
Inflow hyds.	= 6, 11, 12	Contrib. drain. area	= 1.121 ac



APPENDIX C

Storm Sewer System Design

SUBJECT	380 Tunxis Rd, West Hartford	SHEET NO.	1	OF	1
	Storm Sewer	COMPUTED BY	BH	DATE	4/16/2019
JOB NO.	2180652	CHECKED BY	JSP	DATE	4/16/2019

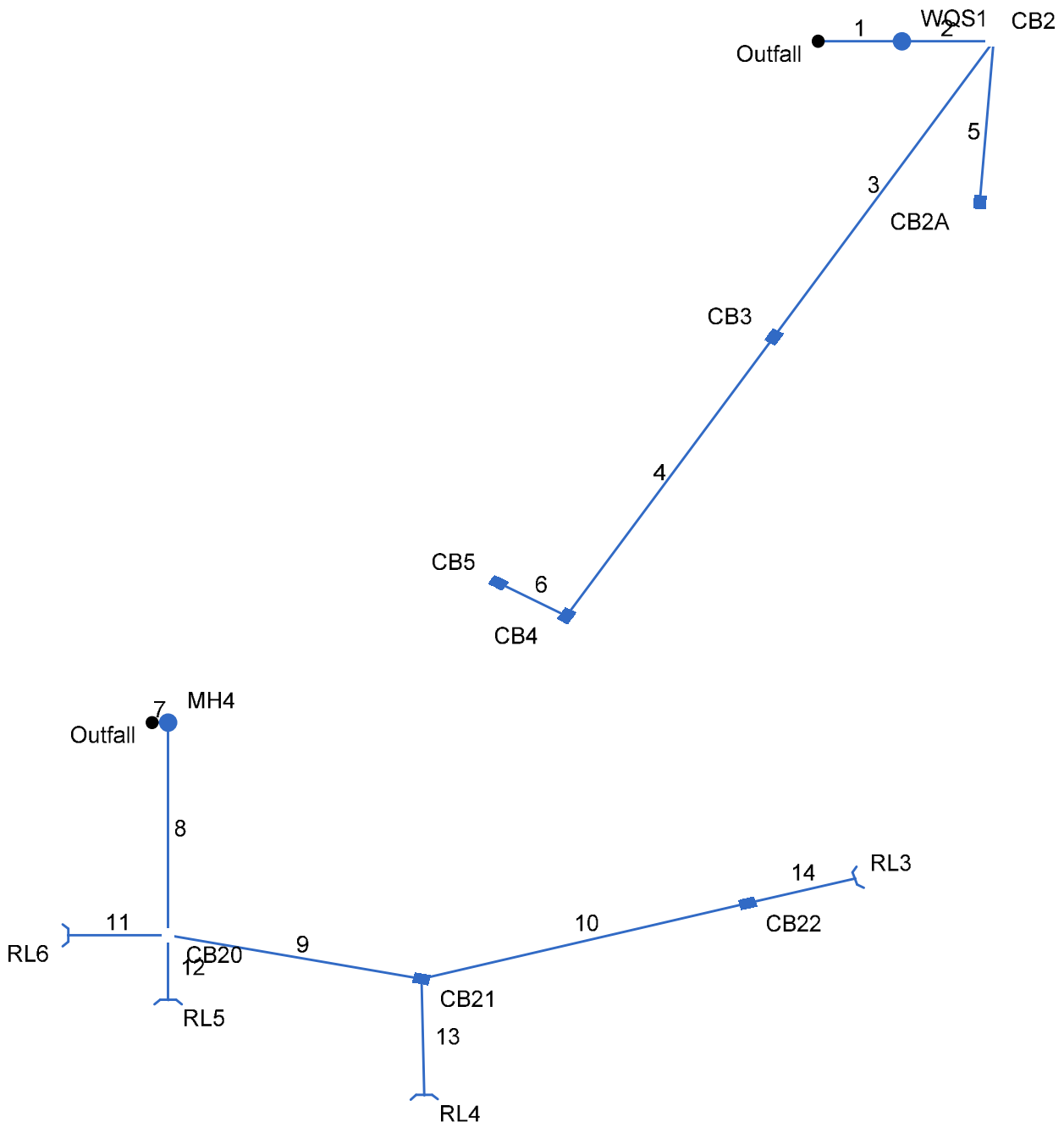
DATA SHEET FOR RATIONAL METHOD STORM DRAINAGE DESIGN

Q = CiA

NODE		AREA	RUNOFF COEFFICIENT C			TIME OF CONCENTRATION (TR-55)					
AREA I.D.	AREA (S.F.)	ACRES	DESCRIPTION	C VALUE	TOTAL AC	ELEV. DIFF. FT	LENGTH FT	SLOPE %	COVER	TIME MIN.	Flow Type
Roadway Storm Drainage System											
WQS-1	2519	0.058	PAVEMENT	0.9	0.052	(Minimum Tc for pavement)				5	
(Type C Top)	0	0.000	GRASS	0.3	0.000						
TOTAL	2519	0.058		0.9	0.052						
CB-2	5756	0.132	PAVEMENT	0.9	0.119	(Minimum Tc for grass)				10	
(Type C)	3039	0.070	GRASS	0.3	0.021						
TOTAL	8795	0.202		0.69	0.140						
CB-2A	1084	0.025	ROOF	0.9	0.022	3	100	3	Grass	12.8	Sheet
(Type C-L)	25909	0.595	GRASS	0.3	0.178	23	176	13	Grass	0.51	Shallow
						4	100	4	Grass	0.52	Shallow
TOTAL	26993	0.620		0.32	0.201	(Tc Calulation from Hydraflow)				13.8	(Total)
CB-3	2126	0.049	PAVEMENT	0.9	0.044	10	100	10	Grass	7.9	Sheet
(Type C)	19047	0.437	GRASS	0.3	0.131	7	82	9	Grass	0.28	Shallow
						16	32	50	Grass	0.05	Shallow
						2.5	140	2	Grass	1.02	Shallow
TOTAL	21173	0.486		0.36	0.175					9.25	(Total)
CB-4	5160	0.118	PAVEMENT	0.9	0.107	(Minimum Tc for grass)				10	
(Type C)	5465	0.125	GRASS	0.3	0.038						
TOTAL	10625	0.244		0.59	0.144						
CB-5	4511	0.104	PAVEMENT	0.9	0.093	(Minimum Tc for pavement)				5	
(Type C)	0	0.000	GRASS	0.3	0.000						
TOTAL	4511	0.104		0.9	0.093						
TOTAL		**1.713**	**(Roadway Storm System)**								

Subdivision Storm Drainage System											
CB-20	1536	0.035	GRASS	0.3	0.011	(Minimum Tc for grass)				10	
(Type C-L)											
CB-21	17151	0.394	GRASS	0.3	0.118	5	100	5	Grass	10.4	Sheet
(Type C-L)						12	50	24	Grass	0.11	Shallow
						2.5	72	3	Grass	0.43	Shallow
						(Tc Calulation from Hydraflow)				10.9	(Total)
CB-22	9912	0.228	GRASS	0.3	0.068	3.5	100	4	Grass	11.4	Sheet
(Type C-L)						16	72	22	Grass	0.16	Shallow
						3	119	3	Grass	0.71	Shallow
										12.2	(Total)
RL6 to	740	0.017	ROOF	0.9	0.015	(Minimum Tc for roof)				5	
CB20											
RL5 to	1023	0.023	ROOF	0.9	0.021	(Minimum Tc for roof)				5	
CB20											
RL4 to	2176	0.050	ROOF	0.9	0.045	(Minimum Tc for roof)				5	
CB21											
RL3 to	2176	0.050	ROOF	0.9	0.045	(Minimum Tc for roof)				5	
CB22											
TOTAL		**0.797**	**(Subdivision Storm System)**								

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



Project File: Storm Sewer_R2.stm	Number of lines: 14	Date: 4/25/2019

Storm Sewers v2019.00

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)	
1	End	21.000	0.000	Comb	0.00	0.06	0.90	5.0	303.62	1.00	303.83	15	Cir	0.013	1.58	307.83	Outlet to WQS1
2	1	23.000	0.000	Comb	0.00	0.08	0.30	10.0	303.83	1.00	304.06	12	Cir	0.013	1.50	307.83	WQS1 to CB2
3	2	107.000	121.000	Comb	0.00	0.77	0.38	9.2	304.06	1.44	305.60	12	Cir	0.013	0.50	308.99	CB2 to CB3
4	3	101.000	0.000	Comb	0.00	0.24	0.59	10.0	305.60	1.09	306.70	12	Cir	0.013	1.00	310.10	CB3 to CB4
5	2	50.000	94.000	Grate	0.00	0.62	0.32	13.8	304.31	4.38	306.50	12	Cir	0.013	0.00	309.70	CB2 to CB2A
6	4	20.000	90.000	Comb	0.00	0.10	0.90	5.0	306.70	1.00	306.90	12	Cir	0.013	0.00	310.10	CB4 to CB5
7	End	4.000	0.000	MH	0.00	0.00	0.00	0.0	303.75	0.00	303.75	24	Cir	0.013	0.67	310.10	UG Det to OCS1
8	7	66.000	90.000	Grate	0.00	0.04	0.30	10.0	305.00	1.97	306.30	8	Cir	0.013	1.00	313.00	OCS1 to CB20
9	8	65.000	-78.000	Grate	0.00	0.39	0.00	10.9	306.30	1.08	307.00	8	Cir	0.013	0.00	311.70	CB20 to CB21
10	9	85.000	-28.000	Grate	0.00	0.23	0.30	12.2	307.00	1.18	308.00	8	Cir	0.013	0.00	311.00	CB21 to CB22
11	8	25.000	90.000	Hdwl	0.00	0.02	0.90	5.0	306.30	1.00	306.55	6	Cir	0.013	0.00	314.00	RL6 to CB20
12	8	20.000	0.000	Hdwl	0.00	0.02	0.90	5.0	306.30	1.00	306.50	6	Cir	0.013	0.00	313.50	RL5 to CB20
13	9	36.000	77.000	Hdwl	0.00	0.05	0.90	5.0	307.00	1.00	307.36	6	Cir	0.013	0.00	313.00	RL4 to CB21
14	10	28.000	0.000	Hdwl	0.00	0.05	0.90	5.0	308.00	1.00	308.28	6	Cir	0.013	0.00	312.00	RL3 to CB22

Project File: Storm Sewer_R2.stm | Number of lines: 14 | Date: 4/25/2019

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Outlet to WQS1	3.48	15	Cir	21.000	303.62	303.83	1.000	304.42	304.58	n/a	304.58 j	End	Combination
2	WQS1 to CB2	3.25	12	Cir	23.000	303.83	304.06	1.000	304.58	304.83	n/a	304.83	1	Combination
3	CB2 to CB3	2.66	12	Cir	107.000	304.06	305.60	1.439	304.83	306.30	n/a	306.30 j	2	Combination
4	CB3 to CB4	1.24	12	Cir	101.000	305.60	306.70	1.089	306.30	307.17	n/a	307.17 j	3	Combination
5	CB2 to CB2A	0.89	12	Cir	50.000	304.31	306.50	4.380	304.83	306.90	n/a	306.90 j	2	Grate
6	CB4 to CB5	0.67	12	Cir	20.000	306.70	306.90	1.000	307.17	307.24	n/a	307.24 j	4	Combination
7	UG Det to OCS1	0.92	24	Cir	4.000	303.75	303.75	0.000	305.80*	305.80*	0.00	305.80	End	Manhole
8	OCS1 to CB20	0.94	8	Cir	66.000	305.00	306.30	1.970	305.80	306.76	n/a	306.76 j	7	Grate
9	CB20 to CB21	0.74	8	Cir	65.000	306.30	307.00	1.077	306.76	307.40	n/a	307.40 j	8	Grate
10	CB21 to CB22	0.55	8	Cir	85.000	307.00	308.00	1.176	307.40	308.35	n/a	308.35 j	9	Grate
11	RL6 to CB20	0.13	6	Cir	25.000	306.30	306.55	1.000	306.76	306.73	n/a	306.73	8	OpenHeadwall
12	RL5 to CB20	0.13	6	Cir	20.000	306.30	306.50	1.000	306.76	306.68	n/a	306.68	8	OpenHeadwall
13	RL4 to CB21	0.33	6	Cir	36.000	307.00	307.36	1.000	307.40	307.65	n/a	307.65 j	9	OpenHeadwall
14	RL3 to CB22	0.33	6	Cir	28.000	308.00	308.28	1.000	308.35	308.57	n/a	308.57 j	10	OpenHeadwall

Project File: Storm Sewer_R2.stm | Number of lines: 14 | Run Date: 4/25/2019

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	21.000	0.06	1.87	0.90	0.05	0.80	5.0	14.6	4.3	3.48	6.46	4.35	15	1.00	303.62	303.83	304.42	304.58	305.12	307.83	Outlet to WQS1
2	1	23.000	0.08	1.81	0.30	0.02	0.75	10.0	14.5	4.4	3.25	3.56	5.07	12	1.00	303.83	304.06	304.58	304.83	307.83	307.83	WQS1 to CB2
3	2	107.000	0.77	1.11	0.38	0.29	0.52	9.2	11.1	5.1	2.66	4.27	4.31	12	1.44	304.06	305.60	304.83	306.30	307.83	308.99	CB2 to CB3
4	3	101.000	0.24	0.34	0.59	0.14	0.23	10.0	10.0	5.4	1.24	3.72	2.77	12	1.09	305.60	306.70	306.30	307.17	308.99	310.10	CB3 to CB4
5	2	50.000	0.62	0.62	0.32	0.20	0.20	13.8	13.8	4.5	0.89	7.45	2.62	12	4.38	304.31	306.50	304.83	306.90	307.83	309.70	CB2 to CB2A
6	4	20.000	0.10	0.10	0.90	0.09	0.09	5.0	5.0	7.4	0.67	3.56	2.34	12	1.00	306.70	306.90	307.17	307.24	310.10	310.10	CB4 to CB5
7	End	4.000	0.00	0.80	0.00	0.00	0.21	0.0	14.0	4.5	0.92	0.00	0.29	24	0.00	303.75	303.75	305.80	305.80	310.10	310.10	UG Det to OCS1
8	7	66.000	0.04	0.80	0.30	0.01	0.21	10.0	13.6	4.5	0.94	1.69	3.17	8	1.97	305.00	306.30	305.80	306.76	310.10	313.00	OCS1 to CB20
9	8	65.000	0.39	0.72	0.00	0.00	0.16	10.9	13.1	4.6	0.74	1.25	3.09	8	1.08	306.30	307.00	306.76	307.40	313.00	311.70	CB20 to CB21
10	9	85.000	0.23	0.28	0.30	0.07	0.11	12.2	12.2	4.8	0.55	1.31	2.73	8	1.18	307.00	308.00	307.40	308.35	311.70	311.00	CB21 to CB22
11	8	25.000	0.02	0.02	0.90	0.02	0.02	5.0	5.0	7.4	0.13	0.56	1.39	6	1.00	306.30	306.55	306.76	306.73	313.00	314.00	RL6 to CB20
12	8	20.000	0.02	0.02	0.90	0.02	0.02	5.0	5.0	7.4	0.13	0.56	1.39	6	1.00	306.30	306.50	306.76	306.68	313.00	313.50	RL5 to CB20
13	9	36.000	0.05	0.05	0.90	0.05	0.05	5.0	5.0	7.4	0.33	0.56	2.38	6	1.00	307.00	307.36	307.40	307.65	311.70	313.00	RL4 to CB21
14	10	28.000	0.05	0.05	0.90	0.05	0.05	5.0	5.0	7.4	0.33	0.56	2.55	6	1.00	308.00	308.28	308.35	308.57	311.00	312.00	RL3 to CB22

Project File: Storm Sewer_R2.stm | Number of lines: 14 | Run Date: 4/25/2019

NOTES:Intensity = 35.29 / (Inlet time + 3.70) ^ 0.72; Return period =Yrs. 10 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	WQS1	0.40	0.17	0.44	0.14	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.12	4.06	0.24	2.37	2.0	Off
2	CB2	0.13	0.28	0.41	0.00	Comb	3.0	3.00	0.00	3.00	3.20	0.012	10.00	0.030	0.030	0.013	0.11	3.58	0.17	0.09	2.0	Off
3	CB3	1.64	0.04	1.40	0.28	Comb	3.0	3.00	0.00	3.00	3.20	0.012	10.00	0.030	0.030	0.013	0.18	6.08	0.26	3.10	2.0	2
4	CB4	0.76	0.00	0.72	0.04	Comb	3.0	3.00	0.00	3.00	3.20	0.012	10.00	0.030	0.030	0.013	0.14	4.51	0.21	1.53	2.0	3
5	CB2A	0.89	0.00	0.89	0.00	Grate	0.0	0.00	1.64	3.00	1.60	Sag	10.00	0.050	0.050	0.013	0.17	3.43	0.17	3.43	0.0	Off
6	CB5	0.67	0.00	0.49	0.17	Comb	3.0	3.00	0.00	3.00	1.60	0.012	10.00	0.030	0.030	0.013	0.13	4.30	0.24	2.60	2.0	1
7	MH4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
8	CB20	0.06	0.00	0.06	0.00	Grate	0.0	0.00	1.64	3.00	1.60	Sag	10.00	0.050	0.050	0.000	0.05	0.91	0.21	0.91	2.0	Off
9	CB21	0.00	0.00	0.00	0.00	Grate	0.0	0.00	1.64	3.00	1.60	Sag	10.00	0.050	0.050	0.013	0.00	0.00	0.17	0.00	2.0	Off
10	CB22	0.33	0.00	0.33	0.00	Grate	0.0	0.00	1.64	3.00	1.60	Sag	10.00	0.050	0.050	0.013	0.11	2.16	0.27	2.16	2.0	Off
11	RL6	0.13	0.00	0.13	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
12	RL5	0.13	0.00	0.13	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
13	RL4	0.33	0.00	0.33	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
14	RL3	0.33	0.00	0.33	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off

Project File: Storm Sewer_R2.stm | Number of lines: 14 | Run Date: 4/25/2019

NOTES: Inlet N-Values = 0.016; Intensity = 35.29 / (Inlet time + 3.70) ^ 0.72; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

APPENDIX D

Stormwater Quality Calculations

Water Quality Flow Calculations (Water Quality Structure WQS-1)

Residential Development

380 Tunxis Rd, West Hartford

WSE Project No. 2180652

Date: 4/22/2019

Refer to C.D.O.T. Drainage Manual Section 11.C-1

Compute Water Quality Volume:

$$WQV = \frac{(1") \times (R) \times (A)}{12}$$

WQV = Acre-Feet

R = 0.05 + 0.009 (I)

I = % Impervious

A= Acres

$$I = \frac{\text{Impervious Area}}{\text{Total Area}} = \frac{0.49}{1.71} = 28.7\ \%$$

$$R = 0.05 + (0.009 \times I) = 28.7 = 0.31$$

A = 1.71 Acres

WQV = 0.044 Acre-Feet

Compute Water Quality Flow:

1. Compute NRCS Runoff Curve Number (CN)

$$CN = \frac{1000}{[\ 10 + 5P + 10Q - 10\ (Q^2 + 1.25QP)^{1/2}]}$$

P = Design Precipitation = 1"

$$Q = \frac{0.044 \text{ acre-feet} \times 12 \text{ in/ft}}{1.71 \text{ acres}} = 0.31 \text{ Watershed inches}$$

CN = 89.7

Water Quality Flow Calculations (Water Quality Structure WQS-1)
Residential Development
380 Tunxis Rd, West Hartford
WSE Project No. 2180652

2. Compute (T_c)

From Hydraflow Storm Sewer Computations, (Tc) = 14.6 minutes
(Based on TR-55 Method) 0.24 hours

3. From Table 4-1 (TR-55)

For CN = 89.7 Ia = 0.229

From Exhibit 4-III (TR-55):

For Tc = 0.24 hours

Ia / P = 0.229

$q_{u =}$ 465 csm/in or (cfs/m^2/in)

Compute Water Quality Flow:

WQF = (q_u) x (A) x (Q)

$q_{u =}$ 465
A = 1.71 acres
0.00267 square miles
Q = 0.31 inches

WQF = 0.38 c.f.s. (see note)

Note: The Water Quality Structure shall be required to treat a water quality flow = **0.38 (c.f.s.)**

The Water Quality Structure shall be required to bypass the design flow = **3.50 * (c.f.s.)**

* From Hydraflow Design

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

380 Tunxis Road
West Harford , CT

Area	**1.17 ac**	Unit Site Designation	**WQU**
Weighted C	**0.43**	Rainfall Station #	**36**
t_c	**15 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.08	34.3%	34.3%	0.04	0.04	32.6
0.16	21.4%	55.7%	0.08	0.08	20.0
0.24	13.3%	69.0%	0.12	0.12	12.2
0.32	8.7%	77.7%	0.16	0.16	7.8
0.40	5.1%	82.8%	0.20	0.20	4.5
0.48	2.8%	85.7%	0.24	0.24	2.4
0.56	2.6%	88.3%	0.28	0.28	2.2
0.64	1.8%	90.1%	0.32	0.32	1.5
0.72	1.2%	91.3%	0.36	0.36	1.0
0.80	1.3%	92.7%	0.40	0.40	1.0
1.00	1.7%	94.4%	0.50	0.50	1.3
2.00	3.8%	98.2%	1.01	1.01	1.8
3.00	1.1%	99.3%	1.51	1.40	0.3
4.00	0.7%	100.0%	2.01	1.40	0.1
					88.7
				Removal Efficiency Adjustment[2] =	0.0%
				Predicted % Annual Rainfall Treated =	99.7%
				Predicted Net Annual Load Removal Efficiency =	**88.7%**

1 - Based on 14 years of 15-minute data from NCDC station 4488, Mansfield Hollow Lake, Tolland County, CT
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

APPENDIX E

Operation & Maintenance Plan

OPERATION AND MAINTENANCE PLAN
380 TUNXIS ROAD, WEST HARTFORD

GENERAL

This section of the plan presents the operation and maintenance plan for the erosion and sediment control measures during construction and for the proposed stormwater management system. It also provides guidelines for when the stormwater system should be cleaned and associated recordkeeping.

EROSION AND SEDIMENT CONTROL MEASURES

The erosion control measures include the following items:

- Straw bales, and Silt Fence
- Permanent Erosion Control Matting
- Temporary Sediment Basin
- Temporary Swales /Berms
- Anti-Tracking Pad
- Vegetative Stabilization
- Temporary Soil Stockpiles
- Dust Control

During construction, the Contractor will be responsible for the operation and maintenance of the erosion and control measures. During this time all erosion and sediment structures shall be maintained in proper working order. Disturbed areas shall be kept to a minimum and shall only take place where immediately required to further construction. It is desirable from an erosion prevention concern to minimize the total disturbed area at any one time. Final grading and seeding shall take place as soon as practical.

A rain gauge shall be placed at the project in a workable location and monitored during rainfall periods until all disturbed areas are stabilized. In the event there is a rainfall greater than 1/2" in a 12-hour period, all erosion control measures shall be checked and repaired as required. If no rain gauge is used, all erosion control measures shall be checked after all rainfall events. A checklist will be filled out by the contractor each week.

All soil erosion and sediment control measures shall be installed as shown on the proposed site plans. It is the intent of this plan that soil erosion measures are the first to be installed and the last to be removed. Surface waters on and adjacent to the site and abutting properties are to be protected from degradation and sedimentation. If abutting properties or street right-of way are jeopardized by construction, it shall be the owner's or contractor's responsibility to protect those properties.

Soil erosion measures shall be inspected weekly and after significant storm events. Make all necessary repairs to facilities as soon as possible. Silt fences and straw bale barriers, temporary sediment trap, and construction swales which accumulate sediment and debris shall be cleaned and re-set.

STORMWATER SYSTEMS

The proposed site plan includes the following stormwater structures:

- Catch Basins with sumps, and Drainage Manholes
- Drainage Piping
- Subgrade Detention Chamber System
- Modified Riprap Splashpad & Level Spreader

The residential homeowner's association of the Tunxis Road development will be responsible for the operation and maintenance of the stormwater structures located outside of the road right -of way. Checklists will be utilized during the inspection and cleaning process and kept on file in the maintenance office.

1. Catch Basins with sumps, Drainage Manholes (Includes Outlet Control Structure):

    a. Catch basins and manholes shall be completely cleaned of accumulated debris and sediments at the completion of construction.
    b. For the first year, catch basins, and manholes shall be inspected on a quarterly basis.
    c. Any accumulated debris within the catch basins/ manholes shall be removed and any repairs as required.
    d. From the second year onward, visual inspections shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
    e. Accumulated debris within the catch basins/ manholes shall be removed and repairs made as required.
    f. Accumulated sediments shall be removed at which time they are within 12 inches of the invert of the outlet pipe.
    g. Any additional maintenance required per the manufacturer's specifications shall also be completed.

2. Drainage Piping

    a. All storm drainage piping shall be completely flushed of debris and accumulated sediment at the completion of construction.
    b. Unless system performance indicates degradation of piping, comprehensive video inspection of storm drainage piping shall occur once every ten years.
    c. Any additional maintenance required per the manufacturer's specifications shall also be completed.

3. Subgrade Detention Chamber System

    The Subgrade Detention Systems will have an Isolator Row which is wrapped in a specified filter fabric to trap sediment and will be inspected every three months and shall be cleaned once a year at a minimum. If during inspection, it

is found that the sediment has accumulated within the Isolator Row, it shall be cleaned immediately with a jet-vac. The System's Isolator Row should be cleaned after the snow and ice removal seasons and before spring rainfall events.

5. Modified Riprap Splashpad & Level-Spreader

The Modified Riprap Splashpad & Level-Spreader will be inspected every three months and shall be cleaned once a year at a minimum. If during inspection, it is found that the sediment has accumulated within the splashpad and/or level-spreader, it shall be cleaned immediately. The splashpad and level-spreader should be cleaned after the snow and ice removal seasons and before spring rainfall events.

Disposal of Debris and Sediment:

All debris and sediment removed from the stormwater structures shall be disposed of legally. There shall be no dumping of silt or debris into or in proximity to any inland wetlands.

Maintenance Records:

The Owners(s) must maintain all records (logs, invoices, reports, data, etc.) and have them readily available for inspection at all times.

STORMWATER SYSTEM INSPECTION CHECKLIST

DATE/TIME:_____

INSPECTOR:_____

STRUCTURE	SATISFACTORY (YES OR NO)	COMMENTS	ACTION	DATE COMPLETED
CATCH BASINS/MANHOLES/OUTLET CONTROL STRUCTURE				
OCS-1				
STORM MH4				
CB20				
CB21				
CB22				

SUBGRADE DETENTION SYSTEM				
ISOLATOR ROW				
24” HDPE MANIFOLD PIPING				
MODIFIED RIPRAP SPLASHPAD				
OUTFALL (NORTH)				
MODIFIED RIPRAP LEVEL-SPREADER				
OUTFALL (NORTH)				

APPENDIX F

Precipitation Data Frequency

NOAA Atlas 14, Volume 10, Version 2
Location name: West Hartford, Connecticut, USA*
Latitude: 41.7588°, Longitude: -72.7444°
Elevation: 125.3 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.07 (3.16-5.22)	4.91 (3.82-6.32)	6.30 (4.88-8.14)	7.45 (5.74-9.68)	9.05 (6.74-12.3)	10.3 (7.50-14.3)	11.5 (8.16-16.6)	13.0 (8.76-19.3)	15.0 (9.73-23.1)	16.5 (10.5-26.0)
10-min	2.88 (2.24-3.70)	3.48 (2.70-4.48)	4.46 (3.46-5.77)	5.28 (4.06-6.86)	6.41 (4.78-8.72)	7.27 (5.32-10.1)	8.14 (5.78-11.8)	9.22 (6.20-13.7)	10.6 (6.89-16.4)	11.7 (7.42-18.4)
15-min	2.26 (1.76-2.90)	2.73 (2.12-3.51)	3.50 (2.71-4.52)	4.14 (3.19-5.38)	5.02 (3.74-6.84)	5.70 (4.17-7.94)	6.38 (4.53-9.24)	7.23 (4.86-10.7)	8.35 (5.41-12.8)	9.20 (5.82-14.5)
30-min	1.52 (1.18-1.96)	1.84 (1.43-2.37)	2.37 (1.83-3.06)	2.80 (2.16-3.64)	3.40 (2.54-4.63)	3.86 (2.82-5.38)	4.33 (3.07-6.26)	4.90 (3.30-7.27)	5.66 (3.67-8.71)	6.24 (3.95-9.80)
60-min	0.958 (0.745-1.23)	1.16 (0.901-1.49)	1.49 (1.16-1.93)	1.77 (1.36-2.30)	2.15 (1.60-2.92)	2.44 (1.78-3.39)	2.73 (1.94-3.95)	3.09 (2.08-4.59)	3.58 (2.32-5.50)	3.94 (2.49-6.19)
2-hr	0.619 (0.484-0.790)	0.748 (0.584-0.956)	0.958 (0.746-1.23)	1.13 (0.878-1.46)	1.37 (1.03-1.86)	1.56 (1.15-2.17)	1.74 (1.25-2.53)	2.00 (1.35-2.95)	2.34 (1.52-3.58)	2.59 (1.65-4.06)
3-hr	0.476 (0.373-0.604)	0.574 (0.451-0.731)	0.737 (0.576-0.941)	0.871 (0.677-1.12)	1.06 (0.797-1.43)	1.20 (0.887-1.66)	1.34 (0.968-1.95)	1.55 (1.05-2.28)	1.82 (1.18-2.78)	2.02 (1.29-3.16)
6-hr	0.300 (0.237-0.378)	0.364 (0.287-0.460)	0.469 (0.369-0.595)	0.556 (0.435-0.710)	0.676 (0.514-0.911)	0.769 (0.573-1.06)	0.861 (0.627-1.25)	1.00 (0.679-1.47)	1.18 (0.773-1.80)	1.32 (0.844-2.06)
12-hr	0.182 (0.145-0.229)	0.224 (0.178-0.281)	0.292 (0.231-0.368)	0.348 (0.274-0.442)	0.426 (0.326-0.572)	0.486 (0.365-0.669)	0.546 (0.400-0.788)	0.637 (0.434-0.930)	0.758 (0.497-1.15)	0.850 (0.544-1.32)
24-hr	0.107 (0.086-0.133)	0.134 (0.107-0.167)	0.177 (0.141-0.222)	0.214 (0.169-0.269)	0.264 (0.203-0.353)	0.302 (0.229-0.416)	0.341 (0.252-0.493)	0.404 (0.276-0.587)	0.487 (0.320-0.736)	0.550 (0.353-0.848)
2-day	0.060 (0.048-0.074)	0.076 (0.062-0.095)	0.104 (0.083-0.129)	0.126 (0.101-0.158)	0.157 (0.122-0.210)	0.181 (0.138-0.249)	0.205 (0.154-0.299)	0.248 (0.170-0.359)	0.305 (0.201-0.459)	0.348 (0.224-0.534)
3-day	0.043 (0.035-0.053)	0.056 (0.045-0.069)	0.075 (0.061-0.094)	0.092 (0.074-0.115)	0.115 (0.090-0.153)	0.132 (0.102-0.182)	0.150 (0.113-0.218)	0.182 (0.125-0.264)	0.225 (0.149-0.338)	0.258 (0.166-0.395)
4-day	0.035 (0.028-0.043)	0.045 (0.036-0.055)	0.060 (0.049-0.075)	0.074 (0.059-0.092)	0.092 (0.072-0.122)	0.106 (0.081-0.145)	0.120 (0.091-0.174)	0.146 (0.100-0.210)	0.180 (0.119-0.270)	0.206 (0.133-0.315)
7-day	0.024 (0.019-0.029)	0.030 (0.024-0.037)	0.040 (0.032-0.049)	0.048 (0.039-0.060)	0.060 (0.047-0.079)	0.069 (0.053-0.094)	0.078 (0.059-0.112)	0.094 (0.065-0.135)	0.115 (0.076-0.172)	0.131 (0.085-0.199)
10-day	0.019 (0.016-0.023)	0.024 (0.019-0.029)	0.031 (0.025-0.038)	0.037 (0.030-0.046)	0.046 (0.036-0.060)	0.053 (0.041-0.071)	0.059 (0.045-0.084)	0.070 (0.049-0.101)	0.085 (0.057-0.127)	0.097 (0.063-0.147)
20-day	0.014 (0.011-0.017)	0.016 (0.013-0.020)	0.020 (0.017-0.025)	0.023 (0.019-0.029)	0.028 (0.022-0.036)	0.031 (0.024-0.042)	0.035 (0.026-0.049)	0.040 (0.028-0.057)	0.047 (0.031-0.070)	0.052 (0.034-0.079)
30-day	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.016 (0.013-0.019)	0.018 (0.015-0.022)	0.021 (0.017-0.027)	0.024 (0.018-0.031)	0.026 (0.019-0.036)	0.029 (0.020-0.041)	0.033 (0.022-0.049)	0.037 (0.024-0.055)
45-day	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.017)	0.016 (0.013-0.021)	0.018 (0.014-0.023)	0.020 (0.015-0.027)	0.021 (0.015-0.030)	0.024 (0.016-0.035)	0.026 (0.017-0.039)
60-day	0.009 (0.007-0.010)	0.009 (0.008-0.011)	0.011 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.011-0.017)	0.015 (0.012-0.019)	0.016 (0.012-0.022)	0.018 (0.012-0.025)	0.019 (0.013-0.028)	0.020 (0.013-0.031)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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NOAA Atlas 14, Volume 10, Version 2
Location name: West Hartford, Connecticut, USA*
Latitude: 41.7588°, Longitude: -72.7444°
Elevation: 125.3 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.339 (0.263-0.435)	0.409 (0.318-0.527)	0.525 (0.407-0.678)	0.621 (0.478-0.807)	0.754 (0.562-1.02)	0.855 (0.625-1.19)	0.957 (0.680-1.39)	1.08 (0.730-1.61)	1.25 (0.811-1.93)	1.38 (0.873-2.17)
10-min	0.480 (0.373-0.616)	0.580 (0.450-0.746)	0.744 (0.576-0.961)	0.880 (0.677-1.14)	1.07 (0.796-1.45)	1.21 (0.886-1.69)	1.36 (0.963-1.96)	1.54 (1.03-2.28)	1.77 (1.15-2.73)	1.95 (1.24-3.07)
15-min	0.564 (0.439-0.725)	0.682 (0.530-0.878)	0.875 (0.678-1.13)	1.03 (0.797-1.35)	1.26 (0.936-1.71)	1.43 (1.04-1.99)	1.60 (1.13-2.31)	1.81 (1.22-2.68)	2.09 (1.35-3.21)	2.30 (1.46-3.61)
30-min	0.761 (0.592-0.978)	0.921 (0.716-1.19)	1.18 (0.916-1.53)	1.40 (1.08-1.82)	1.70 (1.27-2.32)	1.93 (1.41-2.69)	2.16 (1.54-3.13)	2.45 (1.65-3.63)	2.83 (1.83-4.36)	3.12 (1.97-4.90)
60-min	0.958 (0.745-1.23)	1.16 (0.901-1.49)	1.49 (1.16-1.93)	1.77 (1.36-2.30)	2.15 (1.60-2.92)	2.44 (1.78-3.39)	2.73 (1.94-3.95)	3.09 (2.08-4.59)	3.58 (2.32-5.50)	3.94 (2.49-6.19)
2-hr	1.24 (0.969-1.58)	1.50 (1.17-1.91)	1.92 (1.49-2.46)	2.27 (1.76-2.92)	2.75 (2.06-3.73)	3.12 (2.30-4.33)	3.49 (2.50-5.06)	4.00 (2.70-5.91)	4.68 (3.04-7.17)	5.19 (3.29-8.12)
3-hr	1.43 (1.12-1.82)	1.73 (1.35-2.20)	2.21 (1.73-2.83)	2.62 (2.03-3.36)	3.17 (2.39-4.29)	3.60 (2.67-5.00)	4.03 (2.91-5.84)	4.64 (3.14-6.84)	5.46 (3.56-8.35)	6.08 (3.87-9.49)
6-hr	1.79 (1.42-2.27)	2.18 (1.72-2.76)	2.81 (2.21-3.56)	3.33 (2.61-4.25)	4.05 (3.08-5.46)	4.60 (3.43-6.37)	5.16 (3.75-7.47)	5.99 (4.07-8.79)	7.09 (4.63-10.8)	7.92 (5.05-12.3)
12-hr	2.20 (1.75-2.76)	2.70 (2.15-3.39)	3.52 (2.79-4.43)	4.20 (3.30-5.33)	5.13 (3.92-6.89)	5.85 (4.39-8.07)	6.57 (4.81-9.50)	7.68 (5.23-11.2)	9.14 (5.98-13.9)	10.2 (6.55-15.9)
24-hr	2.56 (2.05-3.19)	3.21 (2.56-4.00)	4.26 (3.39-5.33)	5.13 (4.06-6.46)	6.33 (4.87-8.47)	7.25 (5.49-9.98)	8.18 (6.05-11.8)	9.69 (6.63-14.1)	11.7 (7.68-17.7)	13.2 (8.47-20.4)
2-day	2.87 (2.32-3.55)	3.67 (2.95-4.55)	4.97 (3.99-6.18)	6.05 (4.83-7.58)	7.54 (5.86-10.1)	8.69 (6.64-12.0)	9.83 (7.38-14.3)	11.9 (8.16-17.2)	14.6 (9.64-22.0)	16.7 (10.8-25.6)
3-day	3.12 (2.52-3.84)	4.00 (3.23-4.93)	5.43 (4.38-6.73)	6.62 (5.30-8.26)	8.26 (6.45-11.0)	9.53 (7.32-13.1)	10.8 (8.14-15.7)	13.1 (9.02-19.0)	16.2 (10.7-24.4)	18.6 (12.0-28.4)
4-day	3.34 (2.71-4.11)	4.28 (3.47-5.27)	5.81 (4.69-7.18)	7.07 (5.68-8.80)	8.82 (6.90-11.7)	10.2 (7.82-14.0)	11.5 (8.70-16.7)	14.0 (9.63-20.2)	17.3 (11.4-25.9)	19.8 (12.8-30.2)
7-day	3.97 (3.24-4.86)	5.02 (4.09-6.14)	6.72 (5.46-8.26)	8.13 (6.56-10.1)	10.1 (7.91-13.3)	11.6 (8.93-15.8)	13.1 (9.89-18.8)	15.8 (10.9-22.6)	19.3 (12.8-28.8)	22.0 (14.2-33.5)
10-day	4.62 (3.78-5.62)	5.71 (4.67-6.97)	7.50 (6.11-9.19)	8.99 (7.28-11.1)	11.0 (8.68-14.5)	12.6 (9.74-17.1)	14.2 (10.7-20.3)	16.9 (11.7-24.2)	20.5 (13.6-30.5)	23.2 (15.1-35.3)
20-day	6.66 (5.49-8.06)	7.81 (6.43-9.46)	9.70 (7.95-11.8)	11.3 (9.18-13.8)	13.4 (10.6-17.4)	15.1 (11.6-20.1)	16.7 (12.5-23.4)	19.3 (13.4-27.4)	22.6 (15.1-33.4)	25.1 (16.4-38.0)
30-day	8.40 (6.95-10.1)	9.58 (7.92-11.6)	11.5 (9.47-13.9)	13.1 (10.7-16.0)	15.3 (12.1-19.6)	17.0 (13.1-22.4)	18.7 (13.9-25.8)	21.0 (14.7-29.7)	24.0 (16.1-35.4)	26.3 (17.2-39.7)
45-day	10.6 (8.78-12.7)	11.8 (9.78-14.2)	13.8 (11.4-16.6)	15.4 (12.7-18.7)	17.7 (14.0-22.5)	19.5 (15.0-25.4)	21.2 (15.7-28.8)	23.2 (16.3-32.7)	25.8 (17.4-37.9)	27.8 (18.2-41.9)
60-day	12.4 (10.3-14.8)	13.6 (11.3-16.3)	15.7 (13.0-18.9)	17.4 (14.4-21.1)	19.8 (15.7-25.0)	21.6 (16.7-28.0)	23.5 (17.3-31.5)	25.2 (17.8-35.4)	27.5 (18.5-40.3)	29.2 (19.1-44.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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APPENDIX G

Test Pit Data

WELTI GEOTECHNICAL, P.C.

GEOTECHNICAL ENGINEERING

227 Williams Street · P.O. Box 397
Glastonbury, CT 06033-0397

(860) 633-4623 / FAX (860) 657-2514

April 10, 2019

Mr. Alan Bongiovanni, L. S.
The Bongiovanni Group, Inc.
170 Pane Road
Newington, CT 06111

Re: Proposed Residential Subdivision, 380 Middle Road, West Hartford, CT

Dear Alan:

Pursuant to your request a visit was made to the above site on April 4, 2019 to observe six test pits. The logs and a location plan for the test pits are attached herewith.

The natural inorganic soils on the site are from glacial moraine deposits. These deposits consist generally of medium compact to dense fine to coarse sand and silt with little gravel. The groundwater, where evident in the test pits was at 4 to 5 feet below the existing grades.

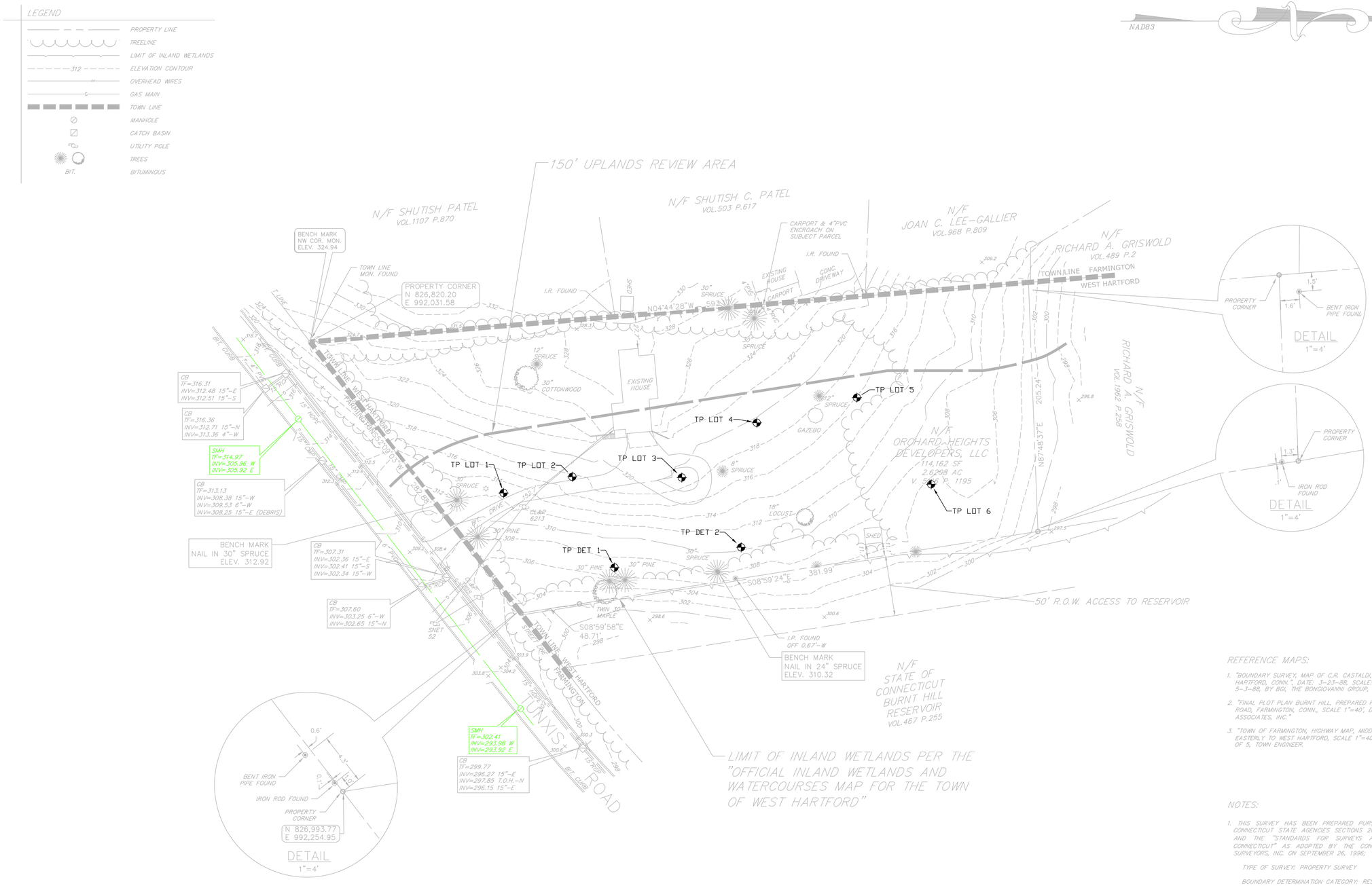
Grain size gradation tests and laboratory permeability tests were performed on 2 soil samples taken from test pits TP#1 and TP#2. These two test pits were located in the area of a proposed storm water detention/infiltration system. The results of the grain size gradation are attached herewith. The results of the laboratory falling head permeability tests performed on the soil samples are as follows.

Sample #	Permeability (feet/day)
TP#1 @ 5'	1.7
TP#2 @ 5'	2.9

If you have any questions, please call me.

Very truly yours,

Max Welti, P. E.



THIS DRAWING HAS BEEN PREPARED BASED, IN PART, ON INFORMATION PROVIDED BY OTHERS RELATING TO THE LOCATION OF UNDERGROUND SERVICES. WE CAN NOT VERIFY THE ACCURACY OF THIS INFORMATION AND SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED HEREIN AS A RESULT.
INDICATED UNDERGROUND UTILITIES ARE BASED ON AVAILABLE DATA. THE LOCATIONS ARE APPROXIMATE AND ALL UTILITIES MAY NOT BE SHOWN.
CALL "CALL B-4-U DIG" AT 1-800-922-4455 PRIOR TO ANY EXCAVATION.

REFERENCE MAPS:

1. "BOUNDARY SURVEY, MAP OF C.R. CASTALDI, 414 TUNXIS ROAD, WEST HARTFORD, CONN.", DATE: 3-23-88, SCALE: 1"=40', REVISED THROUGH 5-3-88, BY BGI, THE BONGIOVANNI GROUP, INC.
2. "FINAL PLOT PLAN BURNT HILL, PREPARED FOR NEWELL STAMM, BURNT HILL ROAD, FARMINGTON, CONN., SCALE 1"=40', DATE JUNE 30, 1983, ALFORD ASSOCIATES, INC."
3. "TOWN OF FARMINGTON, HIGHWAY MAP, MIDDLE ROAD, FROM OLD SOUTH ROAD EASTERLY TO WEST HARTFORD, SCALE 1"=40', DATE JAN. 1940, SHEETS 3 & 4 OF 5, TOWN ENGINEER.

NOTES:

1. THIS SURVEY HAS BEEN PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTIONS 20-300b-1 THROUGH 20-300b-20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF LAND SURVEYORS, INC. ON SEPTEMBER 26, 1996;

   TYPE OF SURVEY: PROPERTY SURVEY

   BOUNDARY DETERMINATION CATEGORY: RESURVEY

   CLASS OF HORIZONTAL ACCURACY: A-2
   CLASS OF VERTICAL ACCURACY: V-2
   CLASS OF BOUNDARY ACCURACY: A-2
   CLASS OF TOPOGRAPHIC ACCURACY: T-2
   SURFACE UTILITY ACCURACY: T-2
   UNDERGROUND UTILITY ACCURACY: D (COMPILED)

   INTENDED USE: EXISTING CONDITIONS

2. HORIZONTAL DATUM IS BASED ON NAD'83.
3. ELEVATIONS ARE BASED ON NAVD'88
4. THIS MAP IS VALID ONLY IF IT BEARS THE ORIGINAL SIGNATURE AND EMBOSSED SEAL OF THE UNDERSIGNED LAND SURVEYOR.

TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON.

SURVEYOR'S SIGNATURE DATE 14649 LICENSE NUMBER

87306

THE BONGIOVANNI GROUP, INC.
LAND SURVEYORS
170 Pane Road
Newington, Conn. 06111
TEL. (860) 666-0134
FAX. (860) 666-3830

Scale: 1"=40'
Checked: AB
Date: 10-08-18
Drawn: D.J.D
Date
Revision

RESURVEY
PREPARED FOR
ORCHARD HEIGHTS DEVELOPERS LLC
380 TUNXIS ROAD
WEST HARTFORD, CONNECTICUT

PROPERTY SURVEY

Sheet 2 of 12

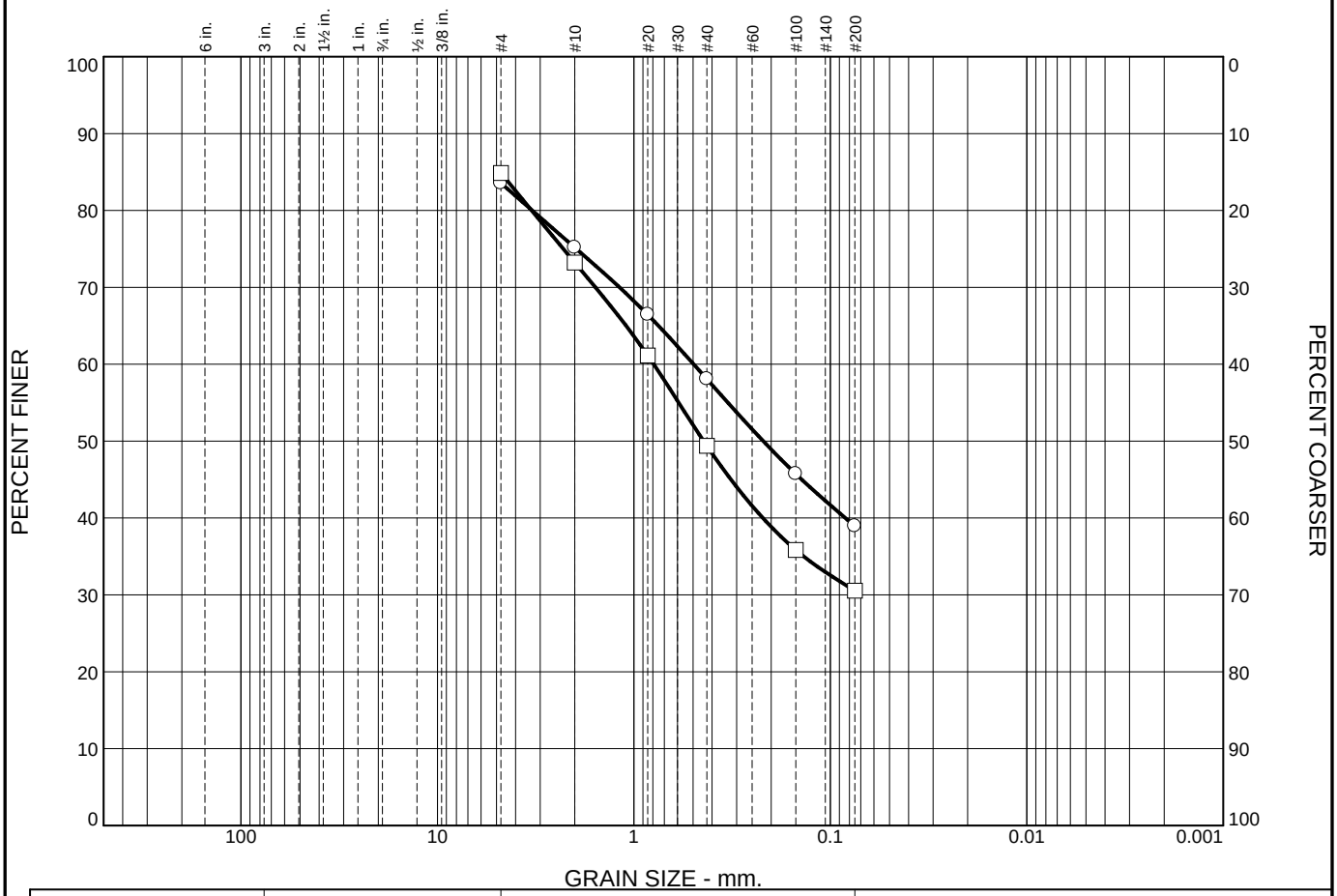
S:\SDSKPROJ\1987_jobs\87306\DWG\87306-SUB.dwg

Proposed Residential Development
380 Middle Road
West Hartford, CT

Test Pits taken 4/4/19
M. Welti

Test Pit #	topsoil & subsoils	moraine	groundwater depth below grade
TP#1	24"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	none
TP#2	18"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 7'	none soils saturated @ 5.0'
Lot#1	12"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	none
Lot#2	18"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	groundwater seepage @ 5.0'
Lot#3	12"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	none
Lot#4	12"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	groundwater seepage @ 4.0'
Lot#5	18"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	groundwater seepage @ 5.0'
Lot#6	18"	fine to medium SAND, some Silt, little Gravel bottom of test pit @ 6'	none

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				8.4	17.1	19.1	39.0	
□				11.7	23.8	18.9	30.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.4962	0.2196					
□				0.7929	0.4413					

	Material Description	USCS	AASHTO
○			
□			

Project No. **Client:** BGI

Project: 380 Middle Road, West Hartford, CT

○ **Depth:** 5 feet **Sample Number:** TP#1

□ **Depth:** 5 feet **Sample Number:** TP#2

Remarks:

○water content = 15.8%

□water content = 17.4%

CLARENCE WELTI ASSOCIATES, INC.

Figure