January 4, 2023

Revised:
February 28, 2023
May 26, 2023
June 29, 2023
September 13, 2023

222 Church Road

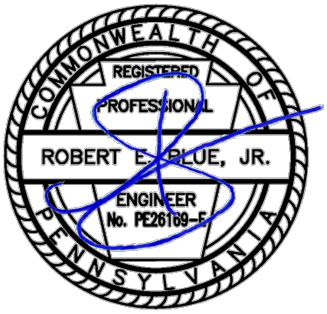
Cheltenham Township, Montgomery Co., PA

POST CONSTRUCTION STORMWATER MANAGEMENT REPORT

REB No.: 2154-10

Prepared for:

222 Church Road, LLC
509 Cedarhill Road
Far Rockaway, NY 11691



Prepared by:

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1.0 INTRODUCTION

This report has been prepared for the 222 Church Road project, a residential subdivision development located in Cheltenham Township, Montgomery County, PA. This report summarizes the stormwater management design and calculations for the approval of the municipal land development application and procurement of the Pennsylvania Department of Environmental Protection's (PADEP) National Pollutant Discharge Elimination System (NPDES) Permit. This report shall accompany the PCSM Plans (Plans) for the project ("PCSM Plan" sheets contained within the "Final Subdivision & Land Development Plan for 222 Church Road". The plans and this report shall be considered the overall stormwater management plan for the project.

The **plans and report were prepared by** the staff of Robert E. Blue Consulting Engineers, P.C. under the direction of Robert E. Blue Jr., P.E. The measures shown have been designed in accordance with the guidelines of PADEP, the County Conservation District, and municipal regulations.

Formal Education

Associates Degree in Architectural Design from Temple University, 1970

Bachelors of Science: Civil Engineering from Temple University, 1972

Pennsylvania Licensed Professional Engineer since 1977 Lic.No.: PE26169-E

Pennsylvania Licensed Land Surveyor since 1982 Lic.No.: SU1323A

Most recently approved plans include:

- The Shoppes at South Abington
  (South Abington Township, Lackawanna County, PA 2020)
- 1950 Skippack Pike – Blue Bell Storage
  (Whitpain Township, Montgomery County, PA 2020)
- Royal Farms #195
  (Marple Township, Delaware County, PA 2019)
- Royal Farms #234
  (Collegeville Borough, Montgomery County, PA 2019)
- Kidz Konnect Daycare
  (Whitpain Township, Montgomery County, PA 2018)
- Royal Farm #132
  (Towamencin Township, Montgomery County, PA 2017)
- Dooley Residence
  (Whitemarsh Township, Montgomery County, PA, 2017)

2.0 PROJECT/SITE BACKGROUND INFORMATION

The site consists of land identified as 222 Church Road located in Cheltenham Township, Montgomery County, PA. The project proposes to subdivide the existing property into ten (10) separate parcels and includes an extension of Harrison Avenue to create a cul-de-sac. Lots 1 thru 4 and 6 thru 8 will be developed into proposed single-family dwellings that front the new extension of Harrison Avenue. Lot 5 will be developed into a proposed single-family dwelling that fronts Church Road (Sr 2023). Lot 9 will remain as an existing dwelling and include a proposed trail extension to connect to the existing Tookany Creek Trail. Lot 10 will remain as open space and be dedicated to Cheltenham Township. Each proposed dwelling includes a driveway for access to the attached garage, a lead walk from the driveway to the front door of the dwelling, and a patio at the rear of the dwelling. An above ground infiltration basin is proposed at the southern end of the development that spans across the rear of Lots 6 thru 8. The NPDES project site boundary and limits of earth disturbance for the project have been defined on the accompanying "PCSM Plan" sheets contained within the "Final Subdivision & Land Development Plan for 222 Church Road".

The development site is within the Tacony Creek-Frankford Creed watershed (A.K.A. Tookany Creek), which is a tributary of the Delaware River. A portion of the development site drains overland directly to Tookany Creek which is located within the adjacent Township-owned property to the south of the subject development. The remainder of the development site drains overland to on-site wetlands which drain overland into the Tookany Creek. The receiving waters have a stream classification, pursuant to PA Chapter 93, of WWF (Warm Water Fishery) and MF (Migratory Fish). FEMA Flood Insurance Rate Maps indicate that the 100-year Floodplain of Tookany Creek extends into the southern portion of the property designated as Lot 10 and is fully outside of the development area with the exception of the proposed trail connection and sanitary sewer replacement.

Natural Resources – A site evaluation has been performed by a wetland scientist and determined that regulated waters, including wetlands, are present within the subject property. These surface waters have been depicted on the accompanying Land Development Plans and are located outside of any development and earth disturbance activities.

A Pennsylvania Natural Diversity Inventory (PNDI) report was prepared on June 27, 2023 and indicates that there are no known impacts.

Drainage Conditions – In general, the site drains in a southerly direction towards the Tookany Creek. The project has been determined to contain two (2) distinct study points, defined as Point of Discharge (POD) #1 and POD #2. POD #1 has been defined as the portion of the site that drains to Tookany Creek upstream of the recently constructed Township trail crossing of Tookany Creek and coincides with the discharge location of the proposed above ground infiltration basin (BMP ID 001) located along the rear of Lots 6 thru 8. POD #2 has been defined as the portion of the site that drains to the on-site wetland (Wetland A) and ultimately Tookany Creek downstream of the recently constructed Township trail crossing of Tookany Creek. In the existing conditions, both POD's receive primarily sheet flow and shallow concentrated flow from the upland residential properties. There are no distinct stormwater facilities or outfalls that drain to these POD's in the existing conditions.

In the proposed conditions, the same general drainage patterns are maintained to the greatest extent possible and the locations of POD #1 and POD #2 remain the same. Some of the area

that was tributary to POD #2 in the existing conditions will be directed towards the BMP ID 001 in the proposed conditions and subsequently POD #1. POD #2 will continue to receive primarily sheet flow and shallow concentrated flow from upland residential properties in the proposed conditions. The proposed stormwater management program provides an overall reduction in peak rate and volume of runoff to the receiving waters.

Infiltration and Geological Studies – Infiltration testing at the site was performed by Penn's Trail Environmental, LLC detailed in a report issued on February 2, 2022 which has been included as an appendix within this report. As part of the investigation, 6 test pits were dug across the site which yielded favorable conditions for infiltration. Test Pits (TP) #5 and #6, specifically, are located within the footprint of the proposed above ground infiltration basin (BMP ID 001) and yielded rates of 0.43 and 4.11 inches per hour, respectively. A factor of safety of 2 was applied to these raw test rates and the geomean was utilized in accordance with the PADEP BMP Manual which resulted in a design infiltration rate of 0.66 inches per hour. The infiltration tests performed in TP#5 and TP#6 were within 1 foot of the proposed infiltration elevation of BMP ID 001.

3.0 DISCUSSION OF BEST MANAGEMENT PRACTICES

The project proposes the use of various BMPs to meet the design requirements both during and post construction. Items of implementation include:

Erosion and Sediment Control BMPs:

- **Rock Construction Entrance:** Two rock construction entrances will be installed to provide a stabilized site access from both Church Road and Harrison Avenue.
- **Pumped Water Filter Bags:** Filter bags will be utilized as needed to pump water out of low areas during construction.
- **Concrete Washout:** All excess concrete products and mixed concrete will be contained within the washout area to prevent pollution during rain events.
- **Compost Filter Socks:** In areas where minimal runoff is expected, compost filter socks are proposed to intercept construction runoff and filter before discharge from the site. The perimeter of the disturbance areas will be installed with Compost Socks which are an ABACT device for use to control siltation concerns of the watersheds TMDL requirements.
- **Erosion Control Blanket:** All slopes at a grade of 3:1 or steeper will be installed with slope protection matting to prevent unnecessary erosion of graded areas. Matting will also be installed within the permanent emergency spillway of Sediment Trap #1/BMP ID 001 to prevent erosion should the spillway be activated.
- **Sediment Trap/Compost Filter Sock Sediment Trap:** A sediment trap is proposed to detain sediment laden runoff prior to discharging from the site. Detaining the runoff allows for sediment and other pollutants to settle out within the trap prior to the stormwater discharging from the site.
- **Riprap Aprons:** Riprap aprons will be installed at all pipe discharge locations to prevent accelerated erosion that would otherwise result from the concentrated runoff.

- **Temporary Topsoil Stockpile:** A topsoil stockpile has been provided on site to provide a location to store topsoil.

Post-Construction Stormwater Management

- **Raingarden/Bioretention Basin (BMP ID 001):** The proposed installation a bioretention basin will provide storage of runoff allowing for evapotranspiration and infiltration of runoff in accordance with volume, peak rate, and water quality requirements. This facility has been designed to infiltrate a specified volume of runoff while still dewatering sooner than 72 hours after the end of the design storm.

Design Methodologies – The project was designed in accordance with the local ordinance regulations for Cheltenham Township including, but not limited to, the Subdivision and Land Development Ordinance, the Zoning Ordinance and the Stormwater Management Ordinance; and the requirements of the Pennsylvania Department of Environmental Protection to procure the NPDES permit.

Erosion & Sediment Pollution Control – The following reference materials and manuals were used in the design of the erosion control measures.

- Erosion and Sediment Pollution Control Program Manual, Department of Environmental Protection, dated March 2012.

Stormwater Management – The following reference materials and manuals were used in the design of the stormwater management system.

- Cheltenham Township Stormwater Management Ordinance and SALDO
- Urban Hydrology for Small Watersheds – TR55, U.S. Sept of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, dated June 1986 (TR55)
- Erosion and Sediment Pollution Control Program Manual, Department of Environmental Protection – Bureau of Watershed Management, dated March 2012 (E&S Manual)
- Pennsylvania Stormwater Best Management Practices, Department of Environmental Protection – Bureau of Watershed Management, dated December 30, 2006 (BMP Manual)

Programs, Applications, and References – To perform the necessary calculations the following programs were utilized to generate the variables and outputs.

- Hydraflow Hydrographs Extension for Autodesk Civil 3D by Autodesk, Inc. v2023
- Stormwater Studio 2022 v3.0.0.29
- AutoCAD Civil3D 2023

Precipitation intensity and depth for the design storms used in the supporting calculations was obtained from NOAA Atlas 14, Volume 2, Version 3 for the area in question.

4.0 POST CONSTRUCTION STORMWATER MANAGEMENT DESIGN

The following shall illustrate that the design of this site meets or exceeds the requirements of the appropriate agencies necessary for the approval of the stormwater management systems and issuance of related permits.

4.1 Pre-Development Runoff Rate Analysis

In general, the site drains in a southerly direction towards the Tookany Creek. The project has been determined to contain two (2) distinct study points, defined as Point of Discharge (POD) #1 and POD #2. POD #1 has been defined as the portion of the site that drains to Tookany Creek upstream of the recently constructed Township trail crossing of Tookany Creek and coincides with the discharge location of the proposed above ground infiltration basin (BMP ID 001) located along the rear of Lots 6 thru 8. POD #2 has been defined as the portion of the site that drains to the on-site wetland (Wetland A) and ultimately Tookany Creek downstream of the recently constructed Township trail crossing of Tookany Creek. In the existing conditions, both POD's receive primarily sheet flow and shallow concentrated flow from the upland residential properties. There are no distinct stormwater facilities or outfalls that drain to these POD's in the existing conditions.

The overall drainage area to each POD was delineated and separated into "On-Site" and "Off-Site" areas, with "On-Site" being the portion of the drainage area within the Limit of Disturbance (LOD) and "Off-Site" being areas outside of the LOD that are tributary to the development site. Time of Concentration (Tc) flow paths were delineated and a Tc was calculated for the drainage area to each POD based on TR-55 methodology.

The pre-development rate of runoff was determined for each drainage area in accordance with the Dekalb Rational Method as defined by Hydraflow Hydrographs 2023. The cover conditions identified for the pre-development conditions are as follows:

- **Meadow/Pervious** - C-Value = 0.25
- **Impervious Areas** - C-Value = 0.95

A weighted 'C' value was determined for each drainage area and used in conjunction with the calculated Tc to determine the pre-development peak rate of runoff to the POD.

4.2 Post-Development Runoff Rate Analysis

The post-development conditions were evaluated utilizing the same procedures defined for the pre-development condition. On-Site and Off-Site drainage areas were delineated for the proposed stormwater BMP as well as bypass areas that drain to each POD. Similar to the pre-development condition, a post-development Tc path was delineated for each drainage area and a Tc was calculated based on TR-55 methodology. The cover conditions identified for the pre-development conditions are as follows:

- **Off-Site/Undisturbed Pervious** - C-Value = 0.25
- **On-Site Lawns/Pervious** - C-Value = 0.35
- **Impervious Areas** - C-Value = 0.95

In the post-development conditions, additional impervious was accounted for on each proposed lot (Lots 1 thru 8) to account for future variations in the amount of impervious cover proposed compared to what is currently shown on the accompanying Land Development Plans. Each lot (Lots 1 thru 8) were allotted an additional 500 square feet beyond what is currently shown on the Land Development Plans, a total of 0.09 Acres of additional impervious. The stormwater management system and all runoff, volume, and water quality calculations were prepared accounting for this additional 0.09 Acres of impervious coverage.

A weighted 'C' value was determined for each drainage area and used in conjunction with the calculated Tc for each area in order to determine the post-development peak rates. The areas draining to the proposed basins were routed using the Hydraflow Hydrographs software, and the resultant flow was added to the Bypass area peak rate in order to determine the total resultant flow to each POD.

Per the Cheltenham Township Stormwater Management Ordinance, Section 290-23, project site is located in Stormwater District 'B' of the Tookany Creek Watershed. Stormwater District 'B' has the following peak rate reduction criteria:

Table 1: Required Peak Rate Reductions per the Cheltenham Township Stormwater Management Ordinance, Section 290-23, for Stormwater District 'B'.

Pre-Development Design Storm	Reduce To	Post-Development Design Storm
1-Year Peak	←	2-Year Peak
2-Year Peak	←	5-Year Peak
5- Year Peak	←	10- Year Peak
10-Year Peak	←	25-Year Peak
25-Year Peak	←	50-Year Peak
100-Year Peak	←	100-Year Peak

The stormwater management system for the site has been designed to reduce the peak rate of runoff from each post-development design storm to be less than the peak rate of runoff from the designated pre-development design storm. A worksheet summarizing the runoff peak rates in the pre-development and post-development conditions and compliance with the criteria listed above are included Appendix A of this report.

4.3 Runoff Volume and Water Quality Analysis

To procure the NPDES permit pursuant to Chapters 93 and 102 of the PA Code, the regulations require that the development manage the difference in runoff volume generated during the 2-yr/24-hr design storm while considering 20% of the pre-development impervious cover as meadow in good condition. To demonstrate compliance, the PADEP PCSM Spreadsheet (included with the supporting calculations) was utilized. Note that 20% of all impervious cover within the limit of disturbance were considered meadow in the pre-development condition. Based on existing and proposed cover conditions and accounting for 20% of the existing impervious as meadow, there is a resultant increase in runoff volume in the 2-yr/24-hr design storm that is managed by the stormwater management system proposed with this development.

To manage the net increase in runoff volume from the 2-yr/24-hr design storm ("Delta-2 Volume") one infiltration BMP is proposed. BMP ID 001 consists of an above ground bioretention basin designed to manage the entire Delta-2 Volume via infiltration and provide water

quality benefits. Compliance with the NPDES volume and water quality criteria are demonstrated via the PADEP PCSM Spreadsheet.

Alternatively, the Cheltenham Township Stormwater Management Ordinance, Sections 290-20 and 290-21, provide separate criteria for Groundwater Recharge and Water Quality Requirements. The ordinance dictates that the Recharge Volume (Rev) and Water Quality Volume (WQv) are both equal to one (1) inch of runoff over all impervious surfaces within the LOD. Based on the provided drainage area tabulation in the post-development conditions, one (1) inch of runoff over all impervious surfaces within the LOD yields a lower volume requirement than the "Delta-2" volume requirement set forth by PA Code described above. Therefore, the proposed stormwater management design for this development meets both the criteria to procure an NPDES Permit as well as the criteria set forth by the Cheltenham Township Stormwater Ordinance.

5.0 CONCLUSION

The report demonstrates target criteria for rate, volume and water quality are met through the protection of resources and the installation of BMPs. As such, the proposed design complies with the regulations of the Municipality and the PADEP NPDES Permit.

APPENDIX

APPENDIX

APPENDIX A

OFF-SITE DISCHARGE ANALYSIS

Existing Conditions

The site drains in a southerly direction towards the Tacony Creek (A.K.A. Tookany Creek). The project has been determined to contain two (2) distinct study points, defined as Point of Discharge (POD) #1 and POD #2. POD #1 has been defined as the portion of the site that drains to Tookany Creek upstream of the recently constructed Township trail crossing of Tookany Creek and coincides with the discharge location of the proposed above ground infiltration basin (BMP ID 001) located along the rear of Lots 6 thru 8. POD #2 has been defined as the portion of the site that converges to the on-site wetland (Wetland A) and ultimately Tookany Creek downstream of the recently constructed Township trail crossing of Tookany Creek. In the existing conditions, both POD's receive primarily sheet flow and shallow concentrated flow from the upland residential properties. There are no distinct stormwater facilities or outfalls that drain to these POD's in the existing conditions and there are no signs of accelerated erosion resulting from drainage within the development area.

From POD #1, runoff converges at a berm just downstream of the recently constructed Township trail. Runoff then flows through an opening in the berm down a slope to low-lying area within the floodplain of Tookany Creek and ultimately into Tookany Creek itself. The flow path from POD#1 to Tookany Creek is fully on Township-owned land and the ground cover consists of the Township gravel trail and dense vegetation downslope of the trail. There are no signs of accelerated erosion in the existing conditions.

At POD #2, water converges within the upper portion of Wetland 'A' which is an area where small pools of surface water are present and bound by a berm that was previously part of a manmade water conveyance structure reported to have been a mill raceway. The mill raceway has since been abandoned and disconnected from the source of surface water. From the upper portion of Wetland 'A', surface water flows through an opening in the existing berm and travels downslope to the lower portion of Wetland 'A' along the Tookany Creek floodplain. There are no signs of accelerated erosion in the existing conditions.

Figure 1 - Photograph of the southern edge of the property facing towards the southwest corner. Looking towards POD #1 near the left portion of the photo.

Figure 2 - Photograph of the southern edge of the property in the vicinity of POD #1 facing towards the southeast corner.

Figure 3 - Photograph from the vicinity of POD #1 looking southeast towards the Township trail. The existing berm can be seen beginning at the bend in the trail. Runoff that crosses the trail gets redirected by the berm and flows to the southwest towards the opening in the berm.

Figure 4 - Photograph along the flow path to receiving waters downstream of POD #1. Standing along the existing berm looking southwest towards the opening in the berm.

Figure 5 - Photograph of the opening in the berm along the flow path from POD #1 to the receiving waters. Beyond this opening, runoff flows across densely vegetated low-lying land until reaching the Tookany Creek.

Figure 6 - Photograph of the abandoned & disconnected old mill race at the southern edge of the subject property, facing southeast towards POD #2 and the upper portion of Wetland 'A'.

Figure 7 - Photograph in the vicinity of POD #2 and the upper portion of Wetland 'A', looking south towards the opening in the berm that allows surface water to drain downslope to the lower portion of Wetland 'A' and ultimately Tookany Creek.

Proposed Conditions

In the proposed conditions, the same general drainage patterns are maintained to the greatest extent possible and the locations of POD #1 and POD #2 remain the same. Some of the area that was tributary to POD #2 in the existing conditions will be directed towards BMP ID 001 in the proposed conditions and subsequently POD #1. The discharge of BMP ID 001 will first drain to a level spreader (LS#1) prior to the outflow reaching POD #1. The level spreader has been designed to distribute the controlled runoff as sheet flow to the existing stabilized vegetated areas downstream of the subject development. POD #2 will continue to receive primarily sheet flow and shallow concentrated flow from upland residential properties in the proposed conditions.

Off-Site Discharge Comparison

The same general drainage patterns and Points of Discharge are maintained between the pre-development and post-development conditions. There is also a net reduction in the peak rate and volume of runoff draining to each POD. Since there are no signs of accelerated erosion as the site exists today (as documented in the photos above) and there is a reduction in peak rate and volume of runoff to each POD, there are no increase in erosion anticipated from this proposed development.

In addition, POD #2 coincides with Wetland ‘A’ as described in the Existing Conditions section of this analysis. Per the DEP Spreadsheet results for DP-002, there is a minor reduction in runoff volume and peak rate to DP-002 that results from the proposed development, and a decrease in pollutant loading that

results from the decrease in runoff volume. Therefore, the proposed development is not anticipated to degrade the quality of Wetland 'A'. Further, a Wetland/Waters Investigation has been prepared by VW Consultants LLC dated April 21, 2023 which has been included as Appendix C.5. of this report. This investigation documents that Wetland 'A' has two main portions, one being the small area of closed grading where surface water is present and the other being the lower portion downslope of the existing berm. For the upper portion that coincides with DP-002, it is believed to be fed by shallow groundwater and transmission of infiltrated water to this low point. The lower portion of the wetland is believed to be fed by regional groundwater discharge. Therefore, the slight reductions to surface runoff that will result from this development will have a de minimis impact on the source hydrology of the receiving wetland.

Permanent Erosion Control Measures

In addition to reducing the peak rate and volume of runoff draining to the receiving waters, the discharge of Sediment Trap #1/BMP ID 001 is proposed to have a level spreader to provide energy dissipation and distribute the basin outflow as sheet flow prior to reaching POD #1.

APPENDIX B

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

PRE-DEV DRAINAGE AREA CALCULATIONS (NRCS)

Reference Formula:
Q = [(P - 0.2S)2 / (P + 0.8S)] * 1/12 * 43,560

S = (1000/CN) - 10
P = **3.30** in. (rainfall depth of 2-year, 24-hour storm)

Drainage Area ID	CN VALUES / Drainage Areas (Ac.)							Total Drainage Area (Ac.)	Weighted CN Value	Runoff Volume (Ft^3)
					Meadow (HSG-B) **58**	Meadow (HSG-C) **71**	Impervious **98**			
DA to POD 001 (On-Site)					0.00	2.15	0.20	**2.35**	**73**	**9,554**
DA to POD 001 (Off-Site)					*0.20*	*1.70*	*0.51*	***2.41***	***76***	***11,745***
DA to POD 002 (On-Site)					0.04	0.89	0.12	**1.05**	**74**	**4,424**
DA to POD 002 (Off-Site)					*0.00*	*1.15*	*0.48*	***1.63***	***79***	***9,263***
Totals	0.00	0.00	0.00	0.00	0.24	5.89	1.31	7.44		**34,986**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

POST-DEV DRAINAGE AREA CALCULATIONS (NRCS)

Reference Formula: S = (1000/CN) - 10

Q = [(P - 0.2S)2 / (P + 0.8S)] * 1/12 * 43,560 P = **3.30** in. (rainfall depth of 2-year, 24-hour storm)

Drainage Area ID	CN VALUES / Drainage Areas (Ac.)							Total Drainage Area (Ac.)	Weighted CN Value	Runoff Volume (Ft^3)
					Open Space/Lawns (HSG-B) **61**	Open Space/Lawns (HSG-C) **74**	Impervious **98**			
To BMP 001 (On-Site)*					0.00	1.34	1.16	**2.50**	**85**	**18,285**
To BMP 001 (Off-Site)					*0.00*	*1.46*	*0.57*	***2.03***	***81***	***12,197***
Bypass to POD #1 (On-Site)					0.00	0.38	0.08	**0.46**	**78**	**2,413**
Bypass to POD #1 (Off-Site)					*0.20*	*0.57*	*0.14*	***0.91***	***75***	***4,195***
Bypass to POD #2 (On-Site)					0.02	0.33	0.09	**0.44**	**78**	**2,360**
Bypass to POD #2 (Off-Site)					*0.00*	*0.82*	*0.28*	***1.10***	***80***	***6,403***
Totals	0.00	0.00	0.00	0.00	0.22	4.90	2.32	7.44		**45,853**

*** On-Site Drainage Area to BMP 001 accounts for an additional 500 SF (0.09 Ac) of impervious on Lots 1 thru 8 beyond what is currently displayed on the plans to allow for minor modifications to building footprint, walkways, patios, or other impervious surfaces.**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

PRE-DEVELOPMENT DRAINAGE AREA CALCULATIONS (Rational Method)

Drainage Area ID	'C'-Value / Drainage Areas (Ac.)				Total Area (Ac.)	Weighted 'C'
	Impervious 0.95		Pervious 0.25	Woods 0.15		
DA to POD 001 (On-Site)	0.20		2.15	0.00	**2.35**	**0.31**
DA to POD 001 (Off-Site)	0.51		1.90	*0.00*	***2.41***	***0.40***
DA to POD 002 (On-Site)	0.12		0.93	0.00	**1.05**	**0.33**
DA to POD 002 (Off-Site)	*0.48*		*1.15*	*0.00*	***1.63***	***0.46***
Totals	1.31	0.00	6.13	0.00	**7.44**	

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

POST-DEVELOPMENT DRAINAGE AREA CALCULATIONS (Rational Method)

Drainage Area ID	'C'-Value / Drainage Areas (Ac.)				Total Area (Ac.)	Weighted 'C'
	Impervious 0.95	Pervious (Off-Site) 0.25	Pervious 0.35	Woods 0.15		
To BMP 001 (On-Site)*	1.16	0.00	1.34	0.00	**2.50**	**0.63**
To BMP 001 (Off-Site)	*0.57*	*1.46*	*0.00*	*0.00*	***2.03***	***0.45***
Bypass to POD #1 (On-Site)	0.08	0.00	0.38	0.00	**0.46**	**0.45**
Bypass to POD #1 (Off-Site)	*0.14*	*0.77*	*0.00*	*0.00*	***0.91***	***0.36***
Bypass to POD #2 (On-Site)	0.09	0.00	0.35	0.00	**0.44**	**0.47**
Bypass to POD #2 (Off-Site)	*0.28*	*0.82*	*0.00*	*0.00*	***1.10***	***0.43***
Totals	2.32	3.05	2.07	0.00	**7.44**	

*** On-Site Drainage Area to BMP 001 accounts for an additional 500 SF (0.09 Ac) of impervious on Lots 1 thru 8 beyond what is currently displayed on the plans to allow for minor modifications to building footprint, walkways, patios, or other impervious surfaces.**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

INLET DRAINAGE AREA CALCULATIONS (Rational Method)

Storm Structure ID	'C'-Value / Drainage Areas (Ac.)				Total Area (Ac.)	Weighted 'C'
	Impervious 0.95		Pervious 0.35			
INL-3	0.18		0.15		**0.33**	**0.68**
INL-4	0.38		0.79		**1.17**	**0.54**
INL-5	0.26		0.49		**0.75**	**0.56**
INL-6	0.72		0.98		**1.70**	**0.60**
Totals	1.54	0.00	2.41	0.00	**3.95**	

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **222 Church Road**

Application Type: **PAG-02 NOI**

County: **Montgomery**

Municipality: **Cheltenham Township**

Project Type: **Single-Family Housing**

(●) New Project ( ) Minor / Major Amendment

Total Project Site Area: **7.44** acres
(In Watershed)

Total Earth Disturbance: **3.40** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **001**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
001	4.53	2.50	0.71	1.73	Discharge to Non-Surface Waters (To Tookany Creek)	WWF, MF	Yes
Undetained Areas	1.37	0.46	0.00	0.22	Discharge to Non-Surface Waters (To Tookany Creek)	WWF, MF	
Totals:	**5.90**	**2.96**	**0.71**	**1.95**			

Volume Management

Project: 222 Church Road

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.3** inches

Alternative 2-Year / 24-Hour Storm Event: inches

Alternative Source:

Pre-Construction Conditions: *No. Rows:* 4 ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	0.00	B	58	1.448	0.38	0
Pervious as Meadow	2.15	C	71	0.817	0.94	7,327
Impervious as Meadow	0.04	C	71	0.817	0.94	136
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.16	N/A	98	0.041	3.07	1,781
TOTAL (ACRES):	**2.35**				**TOTAL (CF):**	**9,245**

Post-Construction Conditions: *No. Rows:* 3

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.00	B	61	1.279	0.49	0
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	1.72	C	74	0.703	1.10	6,893
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	1.24	N/A	98	0.041	3.07	13,806
TOTAL (ACRES):	**2.96**				**TOTAL (CF):**	**20,698**

NET CHANGE IN VOLUME TO MANAGE (CF): **11,454**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **1** *Start BMP Numbering at:* **1**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Rain Garden / Bioretention	-	Off-Site	2.50	18,285	3,971	0.66	43	Yes	4.0	9,273	**8,452**	**3,923**
												Totals:	**8,452**	**3,923**

INFILTRATION & ET CREDITS (CF):	**12,376**
NET CHANGE IN VOLUME TO MANAGE (CF):	**11,454**
TOTAL CREDITS (CF):	**12,376**

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: 222 Church Road

Instructions | General | Volume | *Rate* | Quality

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**3.3**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**4.91**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**6.9**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**7.9**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**7.15**	**4.67**	**-2.48**	***Rate Control Satisfied***
10-Year Storm:	**9.28**	**7.28**	**-2.00**	***Rate Control Satisfied***
50-Year Storm:	**11.01**	**9.90**	**-1.11**	***Rate Control Satisfied***
100-Year Storm:	**11.66**	**10.87**	**-0.79**	***Rate Control Satisfied***

Water Quality

Project: 222 Church Road

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	0.00	B	0	48.8	0.22	2.30	0.00	0.00	0.00
Pervious as Meadow	Grassland/Herbaceous	2.15	C	7,327	48.8	0.22	2.30	22.33	0.10	1.05
Impervious as Meadow	Grassland/Herbaceous	0.04	C	136	48.8	0.22	2.30	0.42	0.00	0.02
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.16	N/A	1,781	65.0	0.29	2.05	7.23	0.03	0.23
	TOTAL (ACRES):	**2.35**					**TOTALS:**	**29.97**	**0.13**	**1.30**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.00	B	0	78.0	0.25	1.25	0.00	0.00	0.00
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	1.72	C	6,893	78.0	0.25	1.25	33.57	0.11	0.54
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	1.24	N/A	13,806	65.0	0.29	2.05	56.03	0.25	1.77
	TOTAL (ACRES):	**2.96**					**TOTALS:**	**89.60**	**0.36**	**2.31**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**59.63**	**0.22**	**1.01**

☑ **Characterize Undetained Areas (for Untreated Stormwater)** *No. Rows:* 3

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0	B	61	1.279	0.49	0
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.38	C	74	0.703	1.10	1,523
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.08	N/A	98	0.041	3.07	891

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Rain Garden / Bioretention	-	2.50	18,285	12,376		5,909	10.00	0.24	0.96	3.69	0.09	0.35

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	3.69	0.09	0.35
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	11.03	0.04	0.23
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	14.72	0.13	0.59
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	29.97	0.13	1.30

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Rober E. Blue, Jr., P.E.	9/12/2023
Spreadsheet User Name	Date

General Information

Instructions | *General* | Volume | Rate | Quality

Project Name: **222 Church Road**

Application Type: **PAG-02 NOI**

County: **Montgomery**

Municipality: **Cheltenham Township**

Project Type: **Single-Family Housing**

(●) New Project ( ) Minor / Major Amendment

Total Project Site Area: **7.44** acres
(In Watershed)

Total Earth Disturbance: **3.40** acres
(In Watershed)

No. of Post-Construction Discharge Points: **1**

Start DP Numbering at: **002**

Discharge Point (DP) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural BMP(s)
002	1.54	0.44	0.60	0.37	Delineated Wetlands Tributary to Tookany Creek	WWF, MF	No
Undetained Areas							
Totals:	**1.54**	**0.44**	**0.6**	**0.37**			

PROJECT SITE MEETS SMALL SITE EXCEPTION - RATE WORKSHEET NOT REQUIRED

Volume Management

Project: 222 Church Road

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.3** inches

Alternative 2-Year / 24-Hour Storm Event: inches

Alternative Source:

Pre-Construction Conditions: *No. Rows:* 4 ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	0.04	B	58	1.448	0.38	55
Pervious as Meadow	0.89	C	71	0.817	0.94	3,033
Impervious as Meadow	0.02	C	71	0.817	0.94	68
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.10	N/A	98	0.041	3.07	1,113
TOTAL (ACRES):	**1.05**				**TOTAL (CF):**	**4,269**

Post-Construction Conditions: *No. Rows:* 3

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.02	B	61	1.279	0.49	35
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.33	C	74	0.703	1.10	1,322
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.09	N/A	98	0.041	3.07	1,002
TOTAL (ACRES):	**0.44**				**TOTAL (CF):**	**2,360**

NET CHANGE IN VOLUME TO MANAGE (CF): **-1,910**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* *Start BMP Numbering at:*

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
												Totals:		

INFILTRATION & ET CREDITS (CF):	
NET CHANGE IN VOLUME TO MANAGE (CF):	**-1,910**
TOTAL CREDITS (CF):	

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: 222 Church Road

Instructions | General | Volume | *Rate* | Quality

SMALL SITE EXCEPTION SATISFIED: RATE CONTROL NOT REQUIRED

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	**3.3**	Alternative 2-Year 24-Hour Storm Event (in):	
NOAA 10-Year 24-Hour Storm Event (in):	**4.91**	Alternative 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	**6.9**	Alternative 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	**7.9**	Alternative 100-Year 24-Hour Storm Event (in):	

☑ **Report Summary of Peak Rates Only**

Attach model input and output data or other calculations to support the rates reported below.

	Peak Discharge Rates (cfs)			
	Pre-Construction	**Post-Construction**	**Net Change**	
2-Year Storm:	**5.06**	**3.14**	**-1.92**	***Rate Control Satisfied***
10-Year Storm:	**6.53**	**4.05**	**-2.48**	***Rate Control Satisfied***
50-Year Storm:	**7.73**	**4.80**	**-2.93**	***Rate Control Satisfied***
100-Year Storm:	**8.19**	**5.08**	**-3.11**	***Rate Control Satisfied***

Water Quality

Project: 222 Church Road

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	0.04	B	55	48.8	0.22	2.30	0.17	0.00	0.01
Pervious as Meadow	Grassland/Herbaceous	0.89	C	3,033	48.8	0.22	2.30	9.24	0.04	0.44
Impervious as Meadow	Grassland/Herbaceous	0.02	C	68	48.8	0.22	2.30	0.21	0.00	0.01
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.10	N/A	1,113	65.0	0.29	2.05	4.52	0.02	0.14
	TOTAL (ACRES):	**1.05**					**TOTALS:**	**14.14**	**0.06**	**0.60**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.02	B	35	78.0	0.25	1.25	0.17	0.00	0.00
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.33	C	1,322	78.0	0.25	1.25	6.44	0.02	0.10
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	0.09	N/A	1,002	65.0	0.29	2.05	4.07	0.02	0.13
	TOTAL (ACRES):	**0.44**					**TOTALS:**	**10.68**	**0.04**	**0.23**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	0.00	0.00	0.00

POD#2

☑ **Characterize Undetained Areas (for Untreated Stormwater)** *No. Rows:* 3

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.02	B	61	1.279	0.49	35
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.33	C	74	0.703	1.10	1,322
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.09	N/A	98	0.041	3.07	1,002

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☑ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	0.00	0.00	0.00
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	10.68	0.04	0.23
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	10.68	0.04	0.23
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	14.14	0.06	0.60

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Rober E. Blue, Jr., P.E.	9/12/2023
Spreadsheet User Name	Date

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

TR-55 Method - Time of Concentration (Tc) Calculations
POINT OF DISCHARGE #1 (PRE-DEVELOPMENT)

Sheet Flow	**Segment ID**	AB						
1. Surface Description *(table 3-1)*….....		Range (natural)						
2. Manning's roughness coefficient., n *(table 3-1)*…..		0.130						
3. Flow length, L ……FT		62						
4. Two-yr 24-hr rainfall, P_2 ……IN		3.30						
5. Land slope, s ……FT/FT		0.0320						
6. $T_c = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ *(Eq. 3-3)* ……HR		**0.0811**	+		+		=	**0.0811**

Shallow Concentrated Flow	**Segment ID**	BC		CD		DE		EF		
7. Surface Description (paved or unpaved) ……		Paved		Unpaved		Paved		Unpaved		
8. Flow length, L ……FT		240		330		11		271		
9. Watercourse slope, s ……FT/FT		0.0630		0.1270		0.0300		0.0616		
10. Average velocity, V (figure 3-1) ……FT/Sec		5.14		5.77		3.55		4.01		
11. T_c = L / 3600V ……HR		**0.0130**	+	**0.0159**	+	**0.0009**	+	**0.0188**	=	**0.0485**

Channel Flow	**Segment ID**							
12. Cross sectional flow area, a ……FT^2								
13. Wetted perimeter, p_W ……FT								
14. Hydraulic radius, r = a/p_W ……FT								
15. Channel Slope, s ……FT/FT								
16. Manning's roughness coefficient …… n								
17. $V = 1.49 r^{2/3} s^{1/2} / n$ ……FT/Sec								
18. Flow length, L ……FT								
19. T_c = L / 3600 V ……HR			+		+		=	
20. Cummulative Tc in Hours (Sum of Steps 6, 11, & 19)……HR								**0.1296**
Tc in MINUTES =								**7.8**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

TR-55 Method - Time of Concentration (Tc) Calculations
POINT OF DISCHARGE #2 (PRE-DEVELOPMENT)

Sheet Flow	**Segment ID**	**AB**	**BC**			
1. Surface Description *(table 3-1)*		Range (natural)	Smooth surfaces			
2. Manning's roughness coefficient., n *(table 3-1)*		0.130	0.01			
3. Flow length, L	FT	44	56			
4. Two-yr 24-hr rainfall, P_2	IN	3.30	3.30			
5. Land slope, s	FT/FT	0.0700	0.1070			
6. $T_c = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ *(Eq. 3-3)*	HR	**0.0451**	+ **0.0064**	+	=	**0.0514**

Shallow Concentrated Flow	**Segment ID**	**CD**	**DE**	**EF**	**FG**	**GH**		
7. Surface Description (paved or unpaved)		Unpaved	Paved	Unpaved	Paved	Unpaved		
8. Flow length, L	FT	221	181	130	13	128		
9. Watercourse slope, s	FT/FT	0.0990	0.0500	0.0540	0.0300	0.0680		
10. Average velocity, V (figure 3-1)	FT/Sec	5.09	4.58	3.75	3.55	4.21		
11. $T_c = L / 3600V$	HR	**0.0121**	+ **0.0110**	+ **0.0096**	+ **0.0010**	+ **0.0084**	=	**0.0421**

Channel Flow	**Segment ID**	**HJ**				
12. Cross sectional flow area, a	FT^2	7.00				
13. Wetted perimeter, p_W	FT	10.32				
14. Hydraulic radius, $r = a/p_W$	FT	0.678				
15. Channel Slope, s	FT/FT	0.0140				
16. Manning's roughness coefficient	n	0.030				
17. $V = 1.49 r^{2/3} s^{1/2} / n$	FT/Sec	4.5354				
18. Flow length, L	FT	125				
19. $T_c = L / 3600 V$	HR	**0.0077**	+	+	=	**0.0077**
20. Cummulative Tc in Hours (Sum of Steps 6, 11, & 19)	HR					**0.1012**
	Tc in MINUTES =					**6.1**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

TR-55 Method - Time of Concentration (Tc) Calculations
TO BMP ID 001 (POST-DEVELOPMENT)

Sheet Flow	**Segment ID**	**AB**						
1. Surface Description *(table 3-1)*.....		Range (natural)						
2. Manning's roughness coefficient., n *(table 3-1)*.....		0.130						
3. Flow length, L .....FT		70						
4. Two-yr 24-hr rainfall, P_2 .....IN		3.30						
5. Land slope, s .....FT/FT		0.0320						
6. $T_c = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ *(Eq. 3-3)* .....HR		**0.0893**	+		+		=	**0.0893**

Shallow Concentrated Flow	**Segment ID**	**BC**		**CD**		**DE**		
7. Surface Description (paved or unpaved)		Paved		Unpaved		Paved		
8. Flow length, L .....FT		240		317		76		
9. Watercourse slope, s .....FT/FT		0.0630		0.1290		0.0530		
10. Average velocity, V (figure 3-1) .....FT/Sec		5.14		5.82		4.71		
11. T_c = L / 3600V .....HR		**0.0130**	+	**0.0151**	+	**0.0045**	=	**0.0326**

Channel Flow	**Segment ID**	**EF**		**FG**				
12. Cross sectional flow area, a .....FT^2		1.77		1.77				
13. Wetted perimeter, p_W .....FT		4.71		4.71				
14. Hydraulic radius, r = a/p_W .....FT		0.375		0.375				
15. Channel Slope, s .....FT/FT		0.0110		0.0075				
16. Manning's roughness coefficient ..... n		0.012		0.012				
17. $V = 1.49 r^{2/3} s^{1/2} / n$ .....FT/Sec		6.7721		5.5919				
18. Flow length, L .....FT		50		141				
19. T_c = L / 3600 V .....HR		**0.0021**	+	**0.0070**	+		=	**0.0091**
20. Cummulative Tc in Hours (Sum of Steps 6, 11, & 19).....HR								**0.1310**
						Tc in MINUTES =		**7.9**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

TR-55 Method - Time of Concentration (Tc) Calculations
POINT OF DISCHARGE #1 (POST-DEVELOPMENT)

Sheet Flow	**Segment ID**	AB				
1. Surface Description *(table 3-1)*.....		Range (natural)				
2. Manning's roughness coefficient., n *(table 3-1)*.....		0.130				
3. Flow length, L .....FT		75				
4. Two-yr 24-hr rainfall, P_2 .....IN		3.30				
5. Land slope, s .....FT/FT		0.1330				
6. $T_c = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ *(Eq. 3-3)* .....HR		**0.0534**	+		+	= **0.0534**

Shallow Concentrated Flow	**Segment ID**	BC	CD	DE		
7. Surface Description (paved or unpaved)		Unpaved	Paved	Unpaved		
8. Flow length, L .....FT		69	119	326		
9. Watercourse slope, s .....FT/FT		0.1300	0.0750	0.0537		
10. Average velocity, V (figure 3-1) .....FT/Sec		5.84	5.60	3.74		
11. T_c = L / 3600V .....HR		**0.0033**	+ **0.0059**	+ **0.0242**	=	**0.0334**

Channel Flow	**Segment ID**					
12. Cross sectional flow area, a .....FT^2						
13. Wetted perimeter, p_W .....FT						
14. Hydraulic radius, r = a/p_W .....FT						
15. Channel Slope, s .....FT/FT						
16. Manning's roughness coefficient ..... n						
17. $V = 1.49 r^{2/3} s^{1/2} / n$ .....FT/Sec						
18. Flow length, L .....FT						
19. T_c = L / 3600 V .....HR			+	+	=	
20. Cummulative Tc in Hours (Sum of Steps 6, 11, & 19).....HR						**0.0868**
Tc in MINUTES =						**5.2**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

TR-55 Method - Time of Concentration (Tc) Calculations
POINT OF DISCHARGE #2 (POST-DEVELOPMENT)

Sheet Flow	**Segment ID**	AB			
1. Surface Description *(table 3-1)*….....		Range (natural)			
2. Manning's roughness coefficient., n *(table 3-1)*…..		0.130			
3. Flow length, L ….....FT		98			
4. Two-yr 24-hr rainfall, P_2 ….....IN		3.30			
5. Land slope, s ….....FT/FT		0.0950			
6. $T_c = 0.007(nL)^{0.8} / P_2^{0.5} s^{0.4}$ *(Eq. 3-3)* ….....HR		**0.0757**	+	+	= **0.0757**

Shallow Concentrated Flow	**Segment ID**	BC	CD	DE	EF	
7. Surface Description (paved or unpaved) ….....		Paved	Unpaved	Paved	Unpaved	
8. Flow length, L ….....FT		12	346	73	107	
9. Watercourse slope, s ….....FT/FT		0.0200	0.0660	0.0220	0.1120	
10. Average velocity, V (figure 3-1) ….....FT/Sec		2.90	4.15	3.04	5.42	
11. T_c = L / 3600V ….....HR		**0.0012**	+ **0.0232**	+ **0.0067**	+ **0.0055**	= **0.0298**

Channel Flow	**Segment ID**				
12. Cross sectional flow area, a ….....FT^2					
13. Wetted perimeter, p_W ….....FT					
14. Hydraulic radius, $r = a/p_W$ ….....FT					
15. Channel Slope, s ….....FT/FT					
16. Manning's roughness coefficient …..... n					
17. $V = 1.49 r^{2/3} s^{1/2} / n$ ….....FT/Sec					
18. Flow length, L ….....FT					
19. T_c = L / 3600 V ….....HR			+	+	=
20. Cummulative Tc in Hours (Sum of Steps 6, 11, & 19)….....**HR**					**0.1055**
				Tc in MINUTES =	**6.3**

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

Runoff Peak Rate Summary

Hydrograph ID	Return Period / Peak Rate (CFS)						
	1 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Pre-Development - POD #1							
PRE-DEV TO POD #1 (ON-SITE)	**2.57**	**3.08**	**3.62**	**4.00**	**4.44**	**4.74**	**5.02**
Post-Development - POD #1							
POST-DEV INFLOW TO BMP001 (ON-SITE)	5.55	6.65	7.82	8.64	9.59	10.25	10.85
BMP001 ROUTING (ON-SITE)	0.00	0.08	0.68	1.11	1.60	1.94	2.27
POST-DEV BYPASS TO POD #1 (ON-SITE)	0.84	1.00	1.17	1.29	1.43	1.53	1.62
Post-Dev to POD #1 - *On-Site Total* **(Subject to Twp Peak Rate Requirements)**	**0.84**	**1.08**	**1.85**	**2.40**	**3.03**	**3.47**	**3.89**
Allowable Peak Rate*	***2.57***	***2.57***	***3.08***	***3.62***	***4.00***	***4.44***	***5.02***
Difference (Prop. - Allow.)	***-1.73***	***-1.49***	***-1.23***	***-1.22***	***-0.97***	***-0.97***	***-1.13***
Pre-Development - POD #2							
PRE-DEV TO POD #2 (ON-SITE)	**1.34**	**1.60**	**1.87**	**2.07**	**2.29**	**2.44**	**2.59**
Post-Development - POD #2							
POST-DEV BYPASS TO POD #2 (ON-SITE) **(Subject to Twp Peak Rate Requirements)**	**0.80**	**0.95**	**1.12**	**1.23**	**1.37**	**1.46**	**1.55**
Allowable Peak Rate*	***1.34***	***1.34***	***1.60***	***1.87***	***2.07***	***2.29***	***2.59***
Difference (Prop. - Allow.)	***-0.54***	***-0.39***	***-0.48***	***-0.64***	***-0.70***	***-0.83***	***-1.04***

Hydrograph ID	Return Period / Peak Rate (CFS)						
	1 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
OVERALL TOTAL TO POD #1							
Overall Pre-Dev POD #1	**5.96**	**7.15**	**8.40**	**9.28**	**10.30**	**11.01**	**11.66**
Overall Post-Dev POD #1	**3.34**	**4.67**	**6.15**	**7.28**	**8.76**	**9.90**	**10.87**
Difference (Post-Dev - Pre-Dev)	**-2.62**	**-2.48**	**-2.25**	**-2.00**	**-1.54**	**-1.11**	**-0.79**
OVERALL TOTAL TO POD #2							
Overall Pre-Dev POD #2	**4.23**	**5.06**	**5.92**	**6.53**	**7.25**	**7.73**	**8.19**
Overall Post-Dev POD #2	**2.62**	**3.14**	**3.67**	**4.05**	**4.49**	**4.80**	**5.08**
Difference (Post-Dev - Pre-Dev)	**-1.61**	**-1.92**	**-2.25**	**-2.48**	**-2.76**	**-2.93**	**-3.11**
Overall Watershed							
Overall Total Pre-Dev Peak Rate	**10.19**	**12.21**	**14.32**	**15.81**	**17.55**	**18.74**	**19.85**
Overall Total Post-Dev Peak Rate	**5.96**	**7.81**	**9.82**	**11.33**	**13.25**	**14.70**	**15.95**
Difference (Post-Dev - Pre-Dev)	**-4.23**	**-4.40**	**-4.50**	**-4.48**	**-4.30**	**-4.04**	**-3.90**

** Per Cheltenham Township Stormwater Management Ordinance Section 290-23, District 'B'.*

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	2.565	1	40	3,682	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	3.394	1	40	4,872	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	5.960	1	40	8,553	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	1.337	1	30	1,439	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	2.893	1	30	3,114	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	4.230	1	30	4,554	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	5.546	1	40	7,959	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	3.217	1	40	4,616	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	8.762	1	40	12,576	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	0.000	1	n/a	0	9	133.71	7,959	BMP001 ROUTE (ON-SITE)
13	Reservoir	1.172	1	70	3,300	11	134.34	11,198	BMP001 ROUTE (OVERALL)
14	Dekalb	0.839	1	25	753	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	1.329	1	25	1,192	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	0.798	1	30	859	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	1.825	1	30	1,965	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	2.623	1	30	2,824	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	3.078	1	40	4,417	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	4.072	1	40	5,845	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	7.150	1	40	10,262	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	1.599	1	30	1,721	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	3.460	1	30	3,724	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	5.059	1	30	5,445	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	6.654	1	40	9,549	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	3.859	1	40	5,539	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	10.51	1	40	15,088	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	0.080	1	79	273	9	134.04	9,519	BMP001 ROUTE (ON-SITE)
13	Reservoir	2.082	1	63	5,812	11	134.50	12,109	BMP001 ROUTE (OVERALL)
14	Dekalb	1.002	1	25	899	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	1.586	1	25	1,422	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	0.954	1	30	1,027	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	2.183	1	30	2,349	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	3.137	1	30	3,377	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	3.615	1	40	5,188	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	4.783	1	40	6,865	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	8.398	1	40	12,053	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	1.872	1	30	2,015	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	4.051	1	30	4,361	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	5.923	1	30	6,376	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	7.815	1	40	11,216	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	4.533	1	40	6,505	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	12.35	1	40	17,721	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	0.678	1	74	1,940	9	134.24	10,602	BMP001 ROUTE (ON-SITE)
13	Reservoir	3.128	1	58	8,445	11	134.66	12,989	BMP001 ROUTE (OVERALL)
14	Dekalb	1.171	1	25	1,051	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	1.853	1	25	1,663	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	1.117	1	30	1,203	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	2.556	1	30	2,751	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	3.673	1	30	3,954	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	3.995	1	40	5,734	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	5.287	1	40	7,588	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	9.283	1	40	13,322	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	2.065	1	30	2,223	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	4.469	1	30	4,810	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	6.534	1	30	7,033	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	8.638	1	40	12,397	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	5.010	1	40	7,191	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	13.65	1	40	19,588	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	1.109	1	71	3,121	9	134.33	11,128	BMP001 ROUTE (ON-SITE)
13	Reservoir	3.949	1	54	10,312	11	134.77	13,617	BMP001 ROUTE (OVERALL)
14	Dekalb	1.291	1	25	1,158	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	2.043	1	25	1,832	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	1.233	1	30	1,327	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	2.819	1	30	3,035	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	4.052	1	30	4,361	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	4.435	1	40	6,365	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	5.869	1	40	8,423	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	10.30	1	40	14,788	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	2.290	1	30	2,465	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	4.955	1	30	5,334	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	7.245	1	30	7,799	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	9.588	1	40	13,761	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	5.561	1	40	7,982	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	15.15	1	40	21,743	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	1.595	1	67	4,485	9	134.42	11,643	BMP001 ROUTE (ON-SITE)
13	Reservoir	5.070	1	49	12,467	11	134.91	14,407	BMP001 ROUTE (OVERALL)
14	Dekalb	1.431	1	25	1,283	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	2.264	1	25	2,031	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	1.367	1	30	1,471	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	3.126	1	30	3,365	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	4.493	1	30	4,836	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	4.739	1	40	6,802	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	6.271	1	40	9,000	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	11.01	1	40	15,802	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	2.444	1	30	2,631	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	5.289	1	30	5,693	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	7.733	1	30	8,324	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	10.25	1	40	14,705	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	5.943	1	40	8,529	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	16.19	1	40	23,234	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	1.941	1	64	5,429	9	134.48	11,976	BMP001 ROUTE (ON-SITE)
13	Reservoir	5.947	1	48	13,957	11	135.01	14,996	BMP001 ROUTE (OVERALL)
14	Dekalb	1.526	1	25	1,369	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	2.416	1	25	2,167	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	1.459	1	30	1,570	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	3.337	1	30	3,591	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	4.795	1	30	5,162	17, 18	------	------	POST-DEV TOTAL TO POD #2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	Dekalb	5.020	1	40	7,205	------	------	------	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	6.643	1	40	9,534	------	------	------	PRE-DEV POD #1 (OFF-SITE)
3	Combine	11.66	1	40	16,739	1, 2	------	------	PRE-DEV TOTAL TO POD #1
5	Dekalb	2.590	1	30	2,788	------	------	------	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	5.604	1	30	6,033	------	------	------	PRE-DEV POD #2 (OFF-SITE)
7	Combine	8.194	1	30	8,820	5, 6	------	------	PRE-DEV TOTAL TO POD #2
9	Dekalb	10.85	1	40	15,577	------	------	------	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	6.295	1	40	9,035	------	------	------	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	17.15	1	40	24,612	9, 10	------	------	POST-DEV TOTAL TO BMP001
12	Reservoir	2.273	1	62	6,301	9	134.53	12,275	BMP001 ROUTE (ON-SITE)
13	Reservoir	6.691	1	47	15,336	11	135.10	15,539	BMP001 ROUTE (OVERALL)
14	Dekalb	1.618	1	25	1,451	------	------	------	POST-DEV BYPASS TO POD #1 (O
15	Dekalb	2.561	1	25	2,297	------	------	------	POST-DEV BYPASS TO POD #1 (O
17	Dekalb	1.546	1	30	1,664	------	------	------	POST-DEV BYPASS TO POD #2 (O
18	Dekalb	3.535	1	30	3,806	------	------	------	POST-DEV BYPASS TO POD #2 (O
19	Combine	5.081	1	30	5,469	17, 18	------	------	POST-DEV TOTAL TO POD #2

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Church Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

BMP Storage Volume Calculations

BMP ID	Surface Storage					Subsurface Storage				Volume Credit				Infiltration Dewatering Time	
						Amended Soil		Stone							
	Stage	Elevation	Contour Area (SF)	Incr. Storage (CF)	Total Storage (CF)	Depth (FT)	Void Ratio	Depth (FT)	Void Ratio	W.Q. Elev.	Surface Storage @ W.Q. Elev. (CF)	Subsurface Storage (CF)	Total Storage Below W.Q. Elev. (CF)	Infiltration Design Rate (IN/HR)	Dewatering Time[1] (HR)
BMP ID 001	0.00	**133.00**	3,971	0	**0**	4.00	30%	0.00	40%	**134.00**	**4,508**	**4,765**	**9,273**	**0.66**	**42.5**
	1.00	**134.00**	5,069	4,508	**4,508**										
	2.00	**135.00**	6,222	5,635	**10,143**										
	2.50	**135.50**	6,878	3,273	**13,416**										
	3.00	**136.00**	7,664	3,633	**17,049**										

NOTES:

[1] **Dewatering Time is calculated as:** $Dewatering\ Time = \frac{Total\ Storage\ Below\ W.Q.Elev.}{(Infiltration\ Design\ Rate/12) * Bottom\ Contour\ Area}$

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Pond No. 1 - BMP 001

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	129.00	n/a	0	0
4.00	133.00	n/a	4,765	4,765
5.00	134.00	n/a	4,508	9,273
6.00	135.00	n/a	5,635	14,908
6.50	135.50	n/a	3,273	18,181
7.00	136.00	n/a	3,633	21,814

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 132.13	0.00	0.00	0.00
Length (ft)	= 26.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

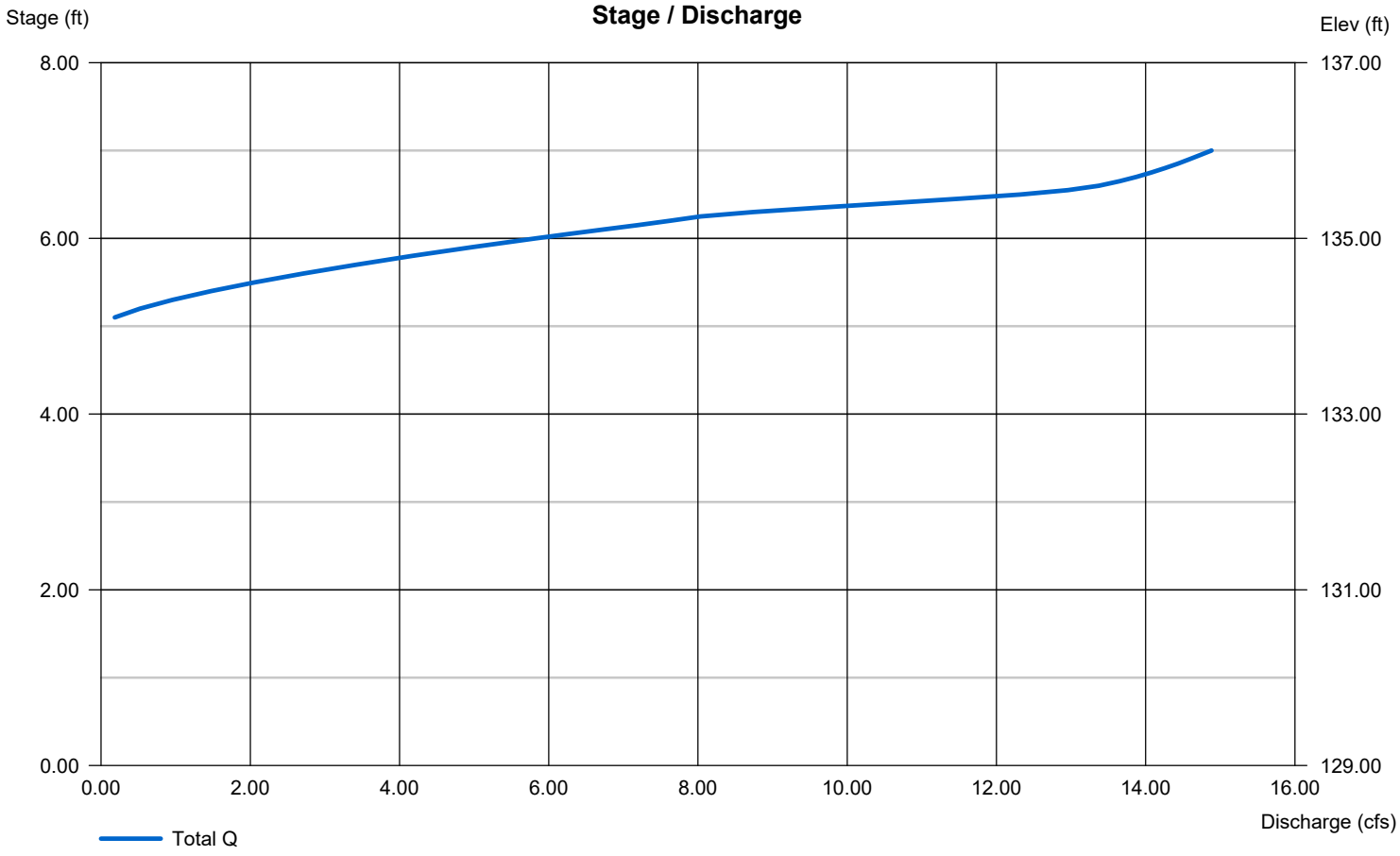
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.44	1.75	0.00	0.00
Crest El. (ft)	= 135.25	134.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

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



ANTI-SEEP COLLAR DESIGN

Sed Trap		**1**			
RISER CREST ELEV.	(feet)	135.25			
INVERT OF OUTFLOW PIPE	(feet)	132.13			
DIAMETER OF PIPE / TYPE	(inches)	18 HDPE	RCP	RCP	RCP
LENGTH OF OUTFALL PIPE	(feet)	26			
PIPE SLOPE	(ft/ft)	**0.0050**			
EMBANKMENT SLOPE (X:1)	(ft/ft)	**3**			
Number of collars	(each)	**2**			
Permanent / Temporary		PERMANENT	PERMANENT	PERMANENT	PERMANENT
"Y"	(feet)	3.12			
SATURATED LENGTH, Ls	(feet)	22			
COLLAR PROJECTION, V	(feet)	1.00			
COLLAR SIZE	(feet)	3.50			
COLLAR SPACING	(feet)	7			
MAXIMUM COLLAR SPACING	(feet)	14			

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT:	**222 Church Road [2154-10]**
LOCATION:	**Cheltenham Township**
COUNTY:	**Montgomery County, PA**

Emergency Spillway Sizing Calculations For:
BMP ID 001

100-Year Storm Inflow (Q): **17.15** CFS (From Post-Development Routing Analysis)

Emergency Spillway Capacity Calculations

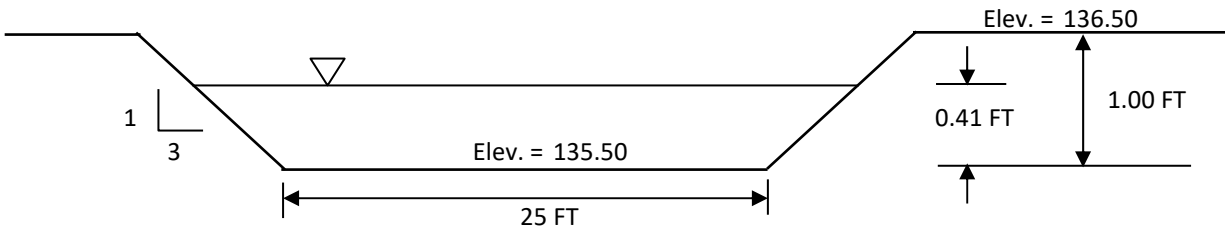
Q = CLH^1.5

Weir Coefficient (C):	**2.63**	
Length (L):	**25**	FT
Flow Depth (H) =	**0.41**	**FT**

Freeboard & Velocity Calculations

Elevation of Spillway:	**135.50**	
Top of Berm Elevation:	**136.50**	
Elevation of Flow (Based on Depth Calculated Above):	**135.91**	
Provided Freeboard =	**0.59**	**FT**

Spillway Opening Side Slope (H:V):	**3 : 1**	
Flow Area (A) =	**10.71**	SF
Flow Velocity (V) = Q / A =	**1.60**	**FT/SEC**



ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT: 222 Curch Road [2154-10]
LOCATION: Cheltenham Township
COUNTY: Montgomery County, PA

PCSM BMP Loading Ratio Calculations

BMP ID No.	Raw Drainage Area to BMP		Pre-Treatment BMP Tabulation			Resultant (Net) Drainage Area		BMP Infiltration Area (SF)	Loading Ratio	
	Overall Drainage Area (SF)	Impervious Drainage Area (SF)	BMP Type	Overall Area Treated (SF)	Impervious Area Treated (SF)	Overall Area (SF)	Impervious Area (SF)		Overall[1]	Impervious[2]
001	197,327	75,359	Sump & Snout	172,062	67,082	25,265	8,276	3,971	**6.4 : 1**	**2.1 : 1**

Notes: [1] Maximum of 8:1 is recommended for the Overall Loading Ratio

[2] Maximum of 5:1 is recommended for the Impervious Loading Ratio; however, in carbonate geology areas, a maximum of 3:1 is recommended

Storm Sewer Tabulation

Project Name: 222 Church Road

Stormwater Studio 2023 v 3.0.0.31

03-01-2023

Line ID	Length	Drng Area		Rational	C x A		Tc		Intensity	Total Q	Capacity	Velocity	Line		Invert Elev		HGL Elev		Surface Elev		Line No
		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
MH2-FES1	67.57	0.000	3.950	0.00	0.00	2.30	5.0	5.57	6.32	14.50	19.72	6.52	24	0.76	133.51	133.00	134.86	134.31	138.11	136.00	1
INL3-MH2	73.04	0.330	3.950	0.68	0.22	2.30	5.0	5.39	6.37	14.62	19.59	4.82	24	0.75	134.26	133.71	136.02	135.78	141.80	138.11	2
INL4-INL3	50.44	1.170	1.920	0.54	0.63	1.05	5.0	5.26	6.40	6.74	11.06	4.18	18	1.11	135.32	134.76	136.49	136.37	144.02	141.80	3
INL6-INL3	70.57	1.700	1.700	0.60	1.02	1.02	5.0	5.00	6.48	6.61	16.15	4.77	24	0.51	135.90	135.54	136.82	136.44	140.37	141.80	4
INL5-INL4	114.99	0.750	0.750	0.56	0.42	0.42	5.0	5.00	6.48	2.72	18.19	2.70	18	3.00	138.97	135.52	139.60	137.12	146.66	144.02	5
OS1-LS#1	26.02	0.000	0.000	0.00	0.00	0.00	0.0	0.00	6.48	4.73	8.77	2.72	18	0.50	132.13	132.00	133.53	133.50	134.75	135.00	6

Notes: IDF File = 2154-10NOAA Intensities.idf, Return Period = 10-yrs.

Project File: 2154-10 SWM Conveyance.sws

Storm Sewer Tabulation

Project Name: 222 Church Road

Stormwater Studio 2023 v 3.0.0.31

03-01-2023

Line ID	Length	Drng Area		Rational	C x A		Tc		Intensity	Total Q	Capacity	Velocity	Line		Invert Elev		HGL Elev		Surface Elev		Line No
		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
MH2-FES1	67.57	0.000	3.950	0.00	0.00	2.30	5.0	5.55	7.08	16.26	19.72	5.80	24	0.76	133.51	133.00	135.05	134.87	138.11	136.00	1
INL3-MH2	73.04	0.330	3.950	0.68	0.22	2.30	5.0	5.38	7.14	16.39	19.59	5.22	24	0.75	134.26	133.71	136.26	135.93	141.80	138.11	2
INL4-INL3	50.44	1.170	1.920	0.54	0.63	1.05	5.0	5.25	7.18	7.55	11.06	4.27	18	1.11	135.32	134.76	136.88	136.62	144.02	141.80	3
INL6-INL3	70.57	1.700	1.700	0.60	1.02	1.02	5.0	5.00	7.26	7.41	16.15	4.94	24	0.51	135.90	135.54	136.87	136.50	140.37	141.80	4
INL5-INL4	114.99	0.750	0.750	0.56	0.42	0.42	5.0	5.00	7.26	3.05	18.19	2.87	18	3.00	138.97	135.52	139.64	137.29	146.66	144.02	5
OS1-LS#1	26.02	0.000	0.000	0.00	0.00	0.00	0.0	0.00	7.26	5.87	8.77	3.36	18	0.50	132.13	132.00	133.55	133.50	134.75	135.00	6

Notes: IDF File = 2154-10NOAA Intensities.idf, Return Period = 25-yrs.

Project File: 2154-10 SWM Conveyance.sws

Storm Sewer Tabulation

Project Name: 222 Church Road

Stormwater Studio 2023 v 3.0.0.31

03-01-2023

Line ID	Length	Drng Area		Rational	C x A		Tc		Intensity	Total Q	Capacity	Velocity	Line		Invert Elev		HGL Elev		Surface Elev		Line No
		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
MH2-FES1	67.57	0.000	3.950	0.00	0.00	2.30	5.0	5.53	8.15	18.72	19.72	5.96	24	0.76	133.51	133.00	135.51	135.06	138.11	136.00	1
INL3-MH2	73.04	0.330	3.950	0.68	0.22	2.30	5.0	5.36	8.22	18.88	19.59	6.01	24	0.75	134.26	133.71	136.47	135.96	141.80	138.11	2
INL4-INL3	50.44	1.170	1.920	0.54	0.63	1.05	5.0	5.24	8.27	8.70	11.06	4.92	18	1.11	135.32	134.76	137.29	136.95	144.02	141.80	3
INL6-INL3	70.57	1.700	1.700	0.60	1.02	1.02	5.0	5.00	8.37	8.53	16.15	3.82	24	0.51	135.90	135.54	137.11	137.05	140.37	141.80	4
INL5-INL4	114.99	0.750	0.750	0.56	0.42	0.42	5.0	5.00	8.37	3.51	18.19	3.11	18	3.00	138.97	135.52	139.69	137.83	146.66	144.02	5
OS1-LS#1	26.02	0.000	0.000	0.00	0.00	0.00	0.0	0.00	8.37	7.25	8.77	4.13	18	0.50	132.13	132.00	133.58	133.50	134.75	135.00	6

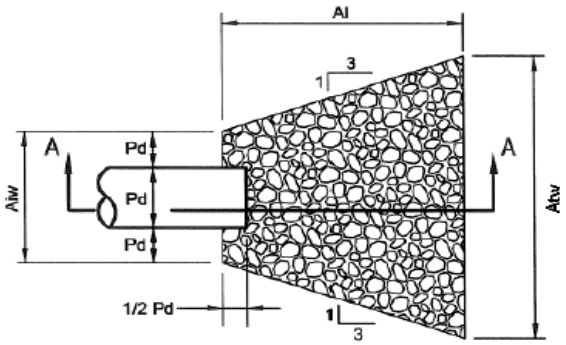
Notes: IDF File = 2154-10NOAA Intensities.idf, Return Period = 100-yrs.

Project File: 2154-10 SWM Conveyance.sws

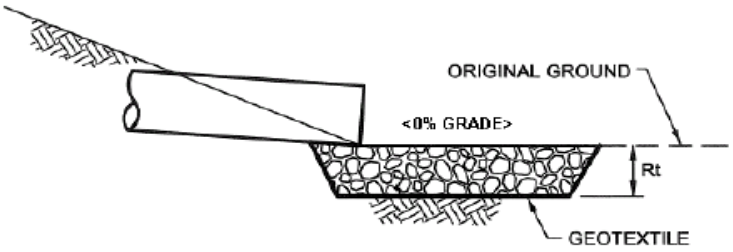
ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT:	**222 Church Road [2154-10]**
LOCATION:	**Cheltenham Township**
COUNTY:	**Montgomery County, PA**

RIPRAP APRON SUMMARY CHART



PLAN VIEW



SECTION A - A

OUTLET NO.	PIPE DIA Pd (IN)	RIPRAP		APRON		
		SIZE (R-__)	THICKNESS Rt (IN)	LENGTH Al (FT)	INITIAL WIDTH Aiw (FT)	TERMINAL WIDTH Atw (FT)
FES#1	24	R-4	18.0	22.0	6.0	14.8

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT:	222 Church Road [2154-10]
LOCATION:	Cheltenham Township
COUNTY:	Montgomery County, PA

RIPRAP APRON SIZING CALCULATIONS

FOR: FES#1

Design Inputs

Pipe Material:	HDPE	
Manning's **n**:	0.012	
Pipe Diameter, **D**:	24	IN
Pipe Slope, **S**:	0.0076	FT/FT
Design Discharge, **Qd**:	14.50	CFS
Design Velocity, **V**:	6.52	FPS
Pipe Inv. Elev. @ Discharge:	133.00	
Tailwater Elevation:	134.79	
Tailwater Condition, **Tw**:	MAX	
Full Flow Area of Pipe, A:	3.14	SF

Full Flow/Equivalency Calcs, Slopes <0.05 FT/FT

$$Q_f = \frac{0.464}{n} * D^{8/3} * S^{1/2}$$

Qf =	**21.40**	**CFS**

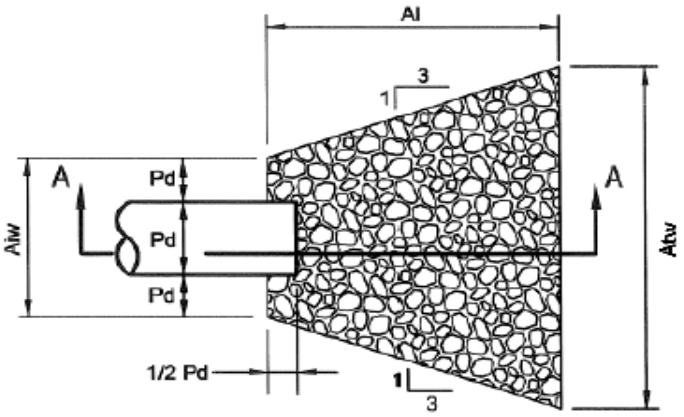
$$Discharge\ Ratio = {}^{d}/_{D} = {}^{Q_d}/_{Q_f}$$

Discharge Ratio =	**0.68**	
% Full =	**0.63**	
Area * Ratio =	**1.98**	**SF**
Equiv. Full-Flow Pipe Size =	**18**	**IN**

RIPRAP APRON SIZE

R-SIZE =	**R-4**		**INITIAL WIDTH, Aiw =**	**6.0**	**FT**
d50 =	**6.0**	**IN**	**TERMINAL WIDTH, Atw =**	**14.8**	**FT**
Rt =	**18.0**	**IN**	**LENGTH, La* =**	**22.0**	**FT**

* PER FIGURE 9.4 OF THE E&S MANUAL



PLAN VIEW

ROBERT E. BLUE CONSULTING ENGINEERS, P.C.

PROJECT:	**222 Church Road [2154-10]**
LOCATION:	**Cheltenham Township**
COUNTY:	**Montgomery County, PA**

Level Spreader Calculations
Level Spreader #1

$V = 1.5 * Cw * H^{1/2}$

$H = (V / 1.5 * Cw)^2$

Down Slope Ground Cover Conditions
Grass/Thicket

V =	1.33 FT/SEC	- Max Allowable Velocity
Cw =	3.0	- Weir Coefficient (Rectangular Weir)
H =	0.09 FT	- Driving Head
H* =	0.70 IN	- Flow Depth over Level Spreader

Weir Equation

$Q_{100} = Cw * L * H^{3/2}$

$L = Q_{100} / Cw * H^{3/2}$

Q100 =	6.69 FT^3/SEC	- 100-yr Storm Flow (From Routing Calculations)
Cw =	3.0	- Weir Coefficient
H =	0.087 FT	- Driving Head (Calculated Above)
L =	86 FT	Minimum Length of Level Spreader

Underdrain Capacity Calculations

$Q = C_d A(2gh)^{1/2}$

$A = \pi r^2$

Cd =	0.6	- Orifice Coefficient

P =	2	- # of Perferations per Linear Foot
r =	0.5 IN	- Radius of Perforation Orifice
A =	0.011 SF	- Area of Orifice (SF)
A =	1.57 IN^2	- Area of Orifice (SQ.IN.)

g =	32.2 FT/SEC^2	Gravitational Constant
h =	0.5 FT	- Head
Q =	0.037 CFS	- Orifice Flow (CFS)
Q =	16.67 GPM	- Orifice Flow (GPM)

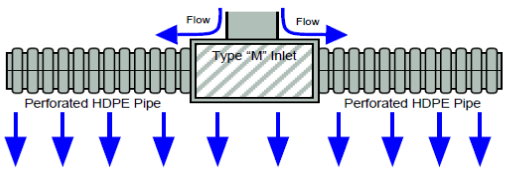
PennDOT Pub 408 Section 610.2(a)1.c Perforations - Area per Linear Foot

1.57 IN^2/LF Provided > 1.4 IN^2/LF Requirement

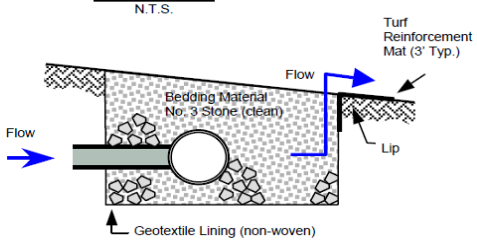
PADEP Design Standard

16.67 GPM/LF Provided > 10 GPM/LF Requirement

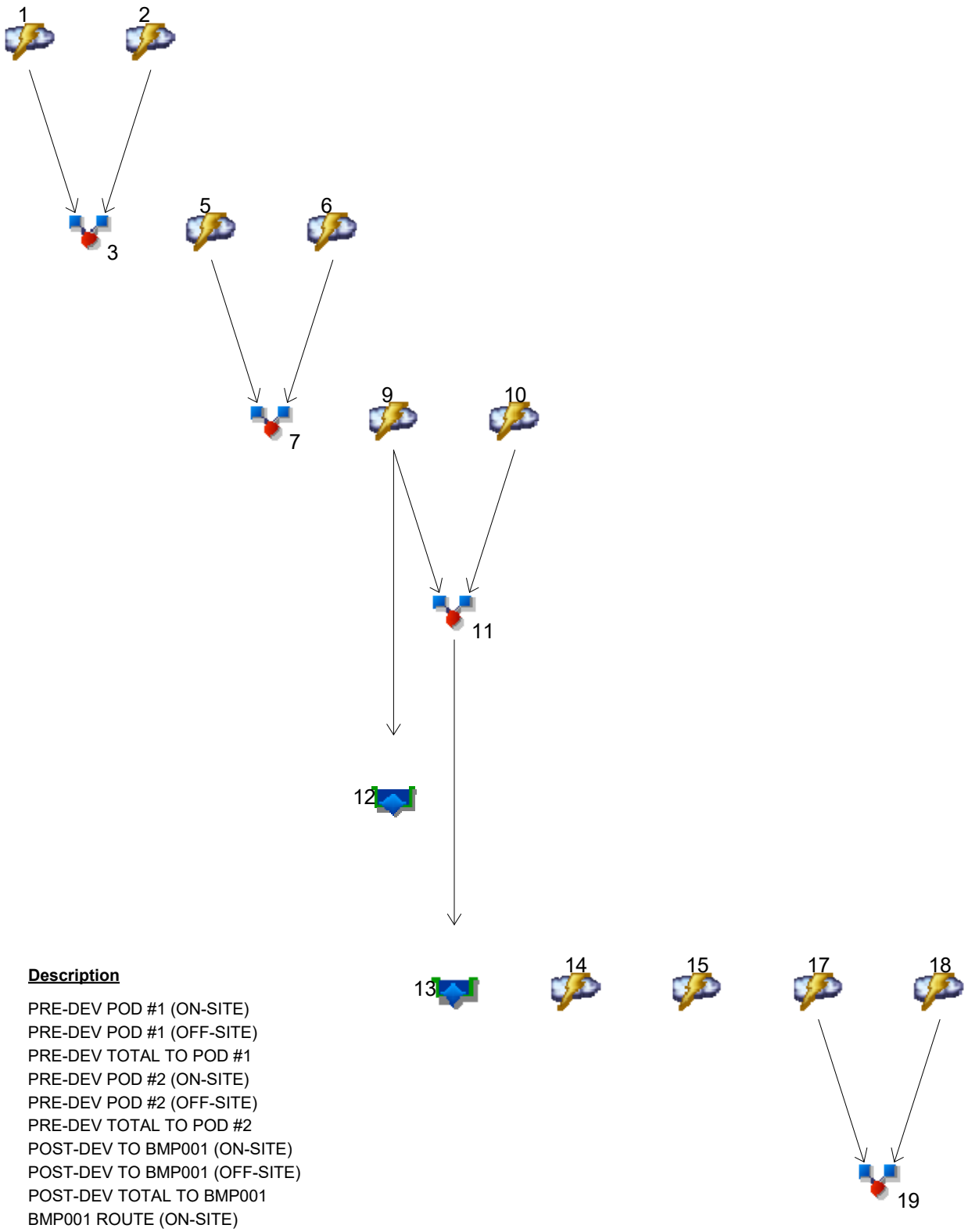
Plan View
N.T.S.



Profile View
N.T.S.



Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Dekalb	PRE-DEV POD #1 (ON-SITE)
2	Dekalb	PRE-DEV POD #1 (OFF-SITE)
3	Combine	PRE-DEV TOTAL TO POD #1
5	Dekalb	PRE-DEV POD #2 (ON-SITE)
6	Dekalb	PRE-DEV POD #2 (OFF-SITE)
7	Combine	PRE-DEV TOTAL TO POD #2
9	Dekalb	POST-DEV TO BMP001 (ON-SITE)
10	Dekalb	POST-DEV TO BMP001 (OFF-SITE)
11	Combine	POST-DEV TOTAL TO BMP001
12	Reservoir	BMP001 ROUTE (ON-SITE)
13	Reservoir	BMP001 ROUTE (OVERALL)
14	Dekalb	POST-DEV BYPASS TO POD #1 (ON-SITE)
15	Dekalb	POST-DEV BYPASS TO POD #1 (OFF-SITE)
17	Dekalb	POST-DEV BYPASS TO POD #2 (ON-SITE)
18	Dekalb	POST-DEV BYPASS TO POD #2 (OFF-SITE)
19	Combine	POST-DEV TOTAL TO POD #2

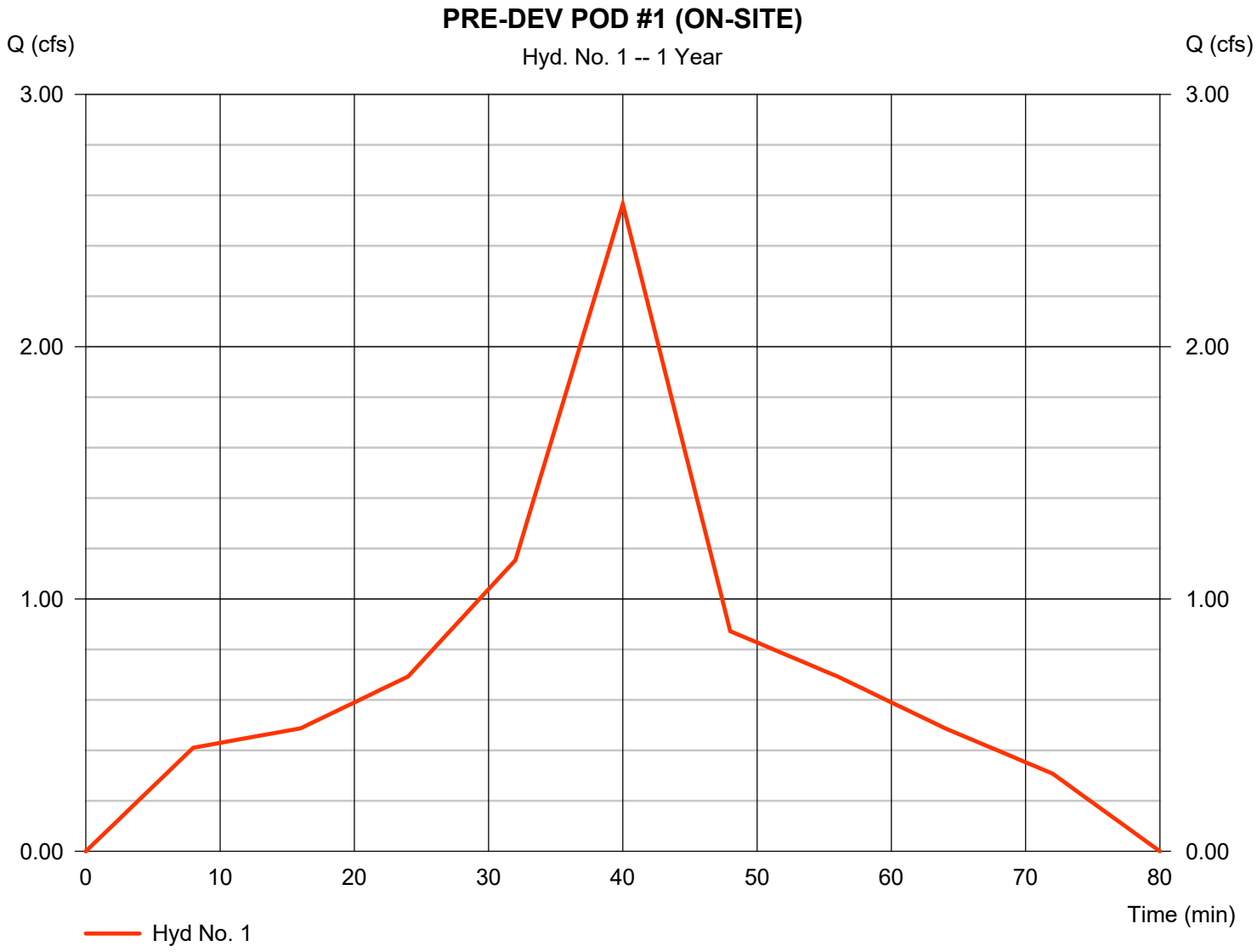
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	2.565 cfs
Storm frequency	=	1 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	3,682 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	3.521 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a



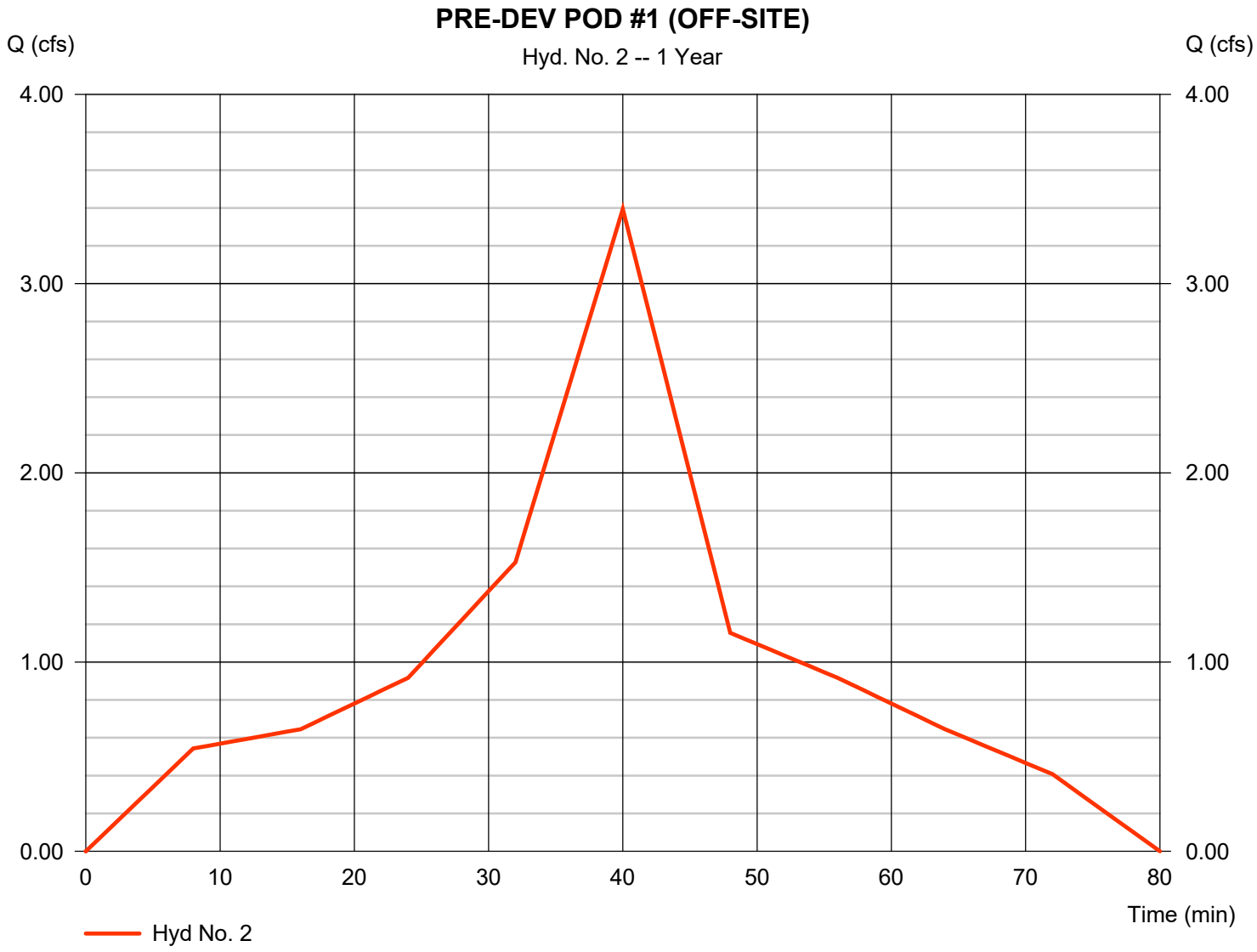
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.394 cfs
Storm frequency	=	1 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	4,872 cuft
Drainage area	=	2.410 ac	Runoff coeff.	=	0.4
Intensity	=	3.521 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

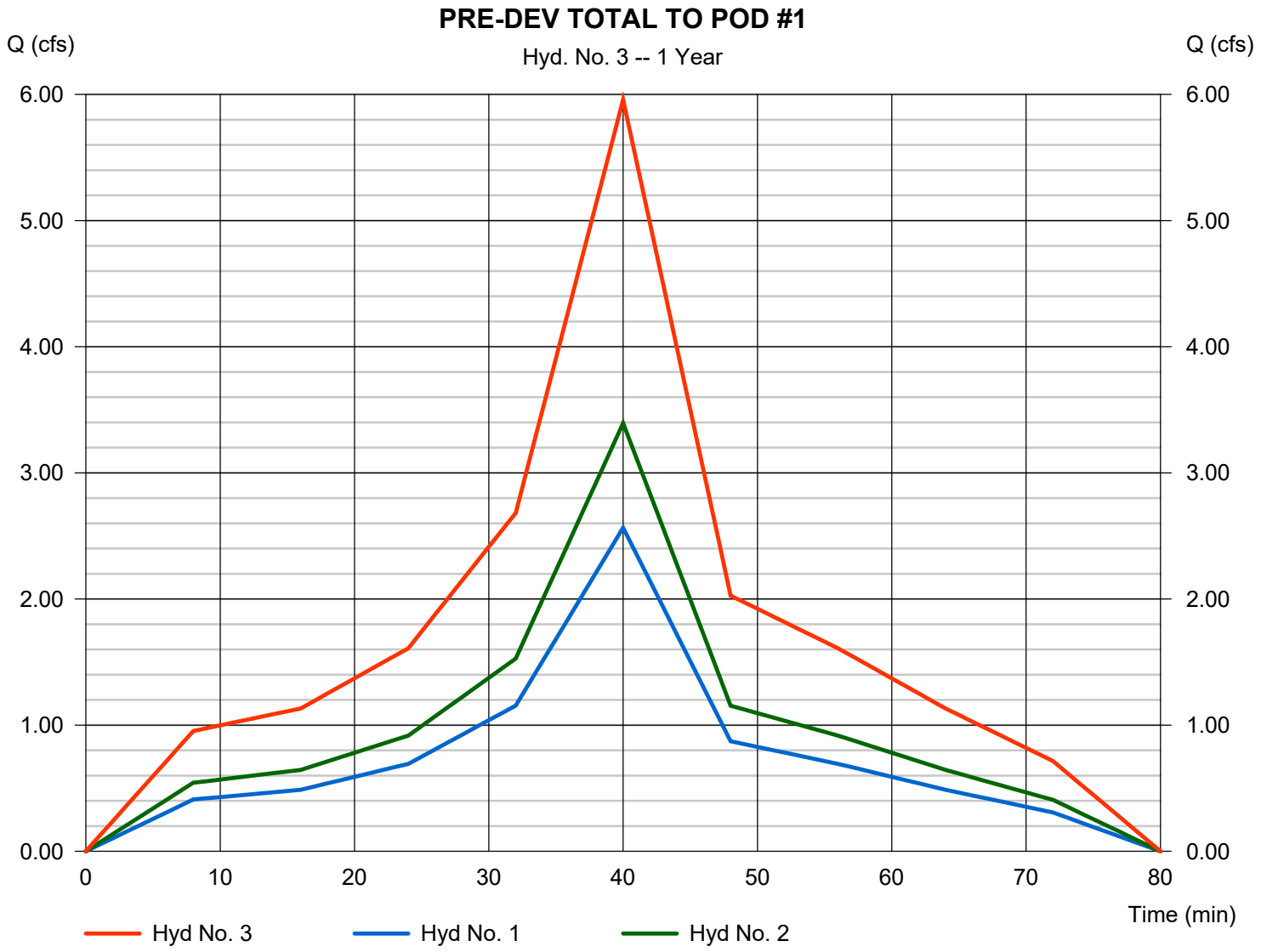


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 5.960 cfs
Storm frequency	= 1 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 8,553 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac



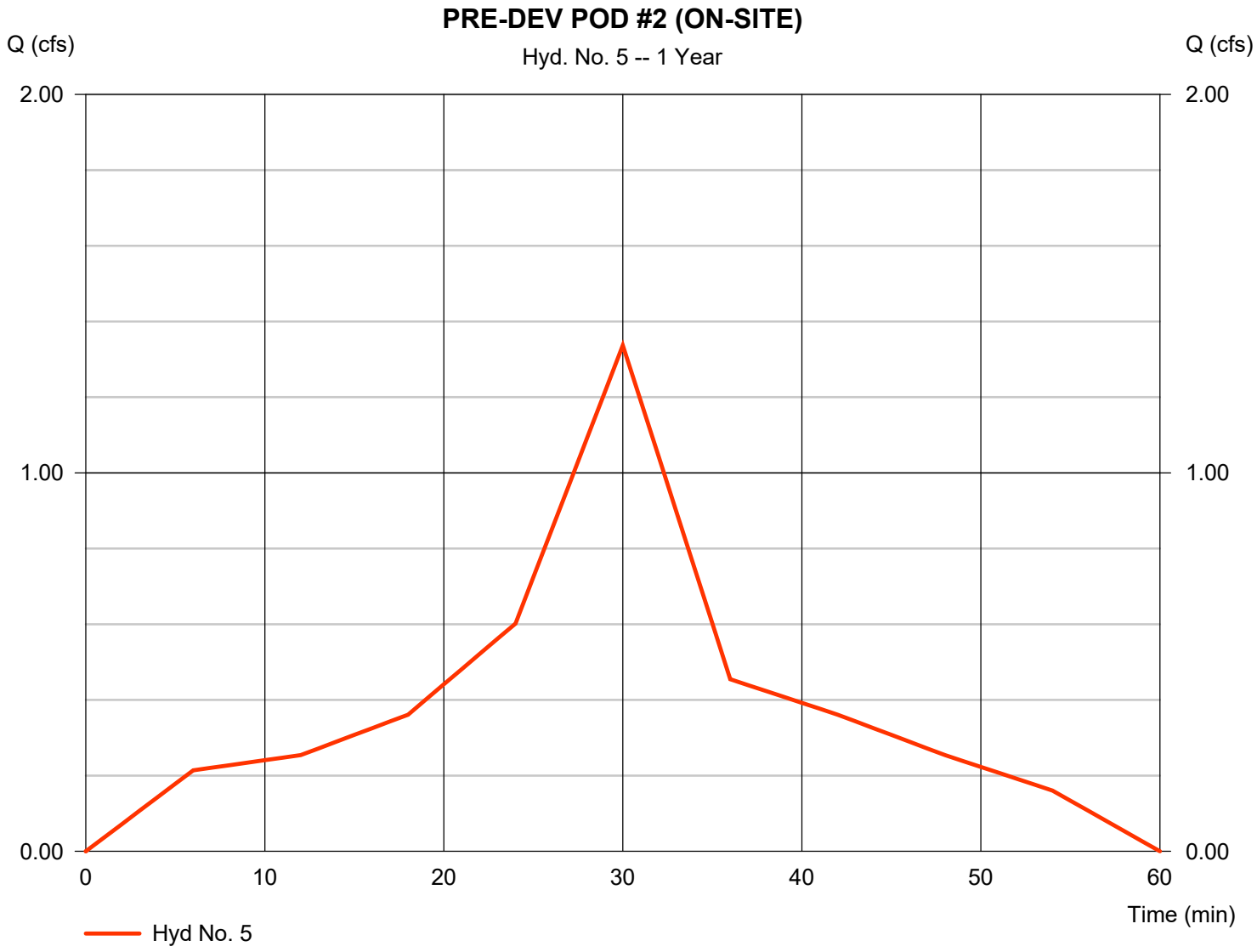
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	1.337 cfs
Storm frequency	=	1 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	1,439 cuft
Drainage area	=	1.050 ac	Runoff coeff.	=	0.33
Intensity	=	3.859 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

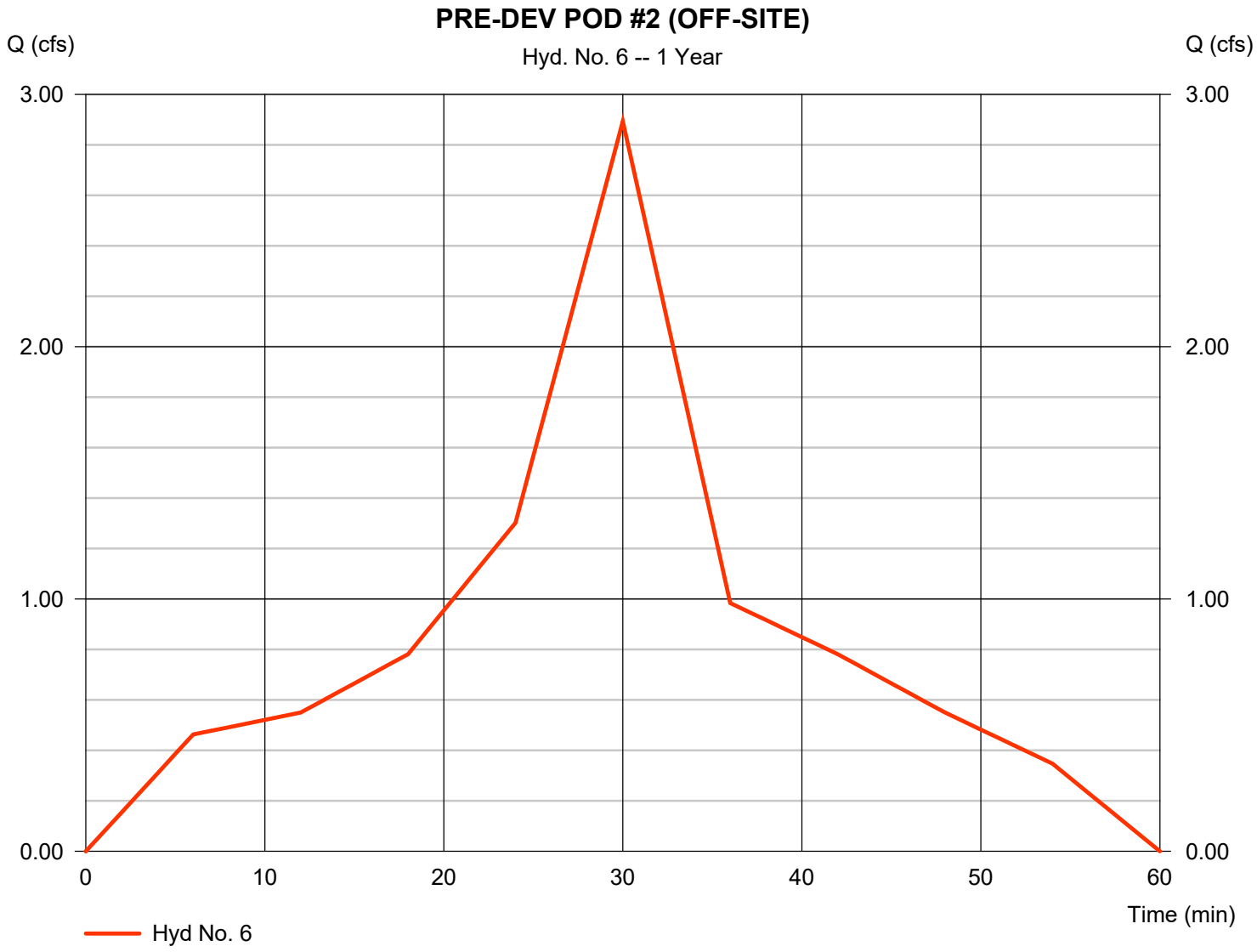


Hydrograph Report

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.893 cfs
Storm frequency	= 1 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 3,114 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.46
Intensity	= 3.859 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

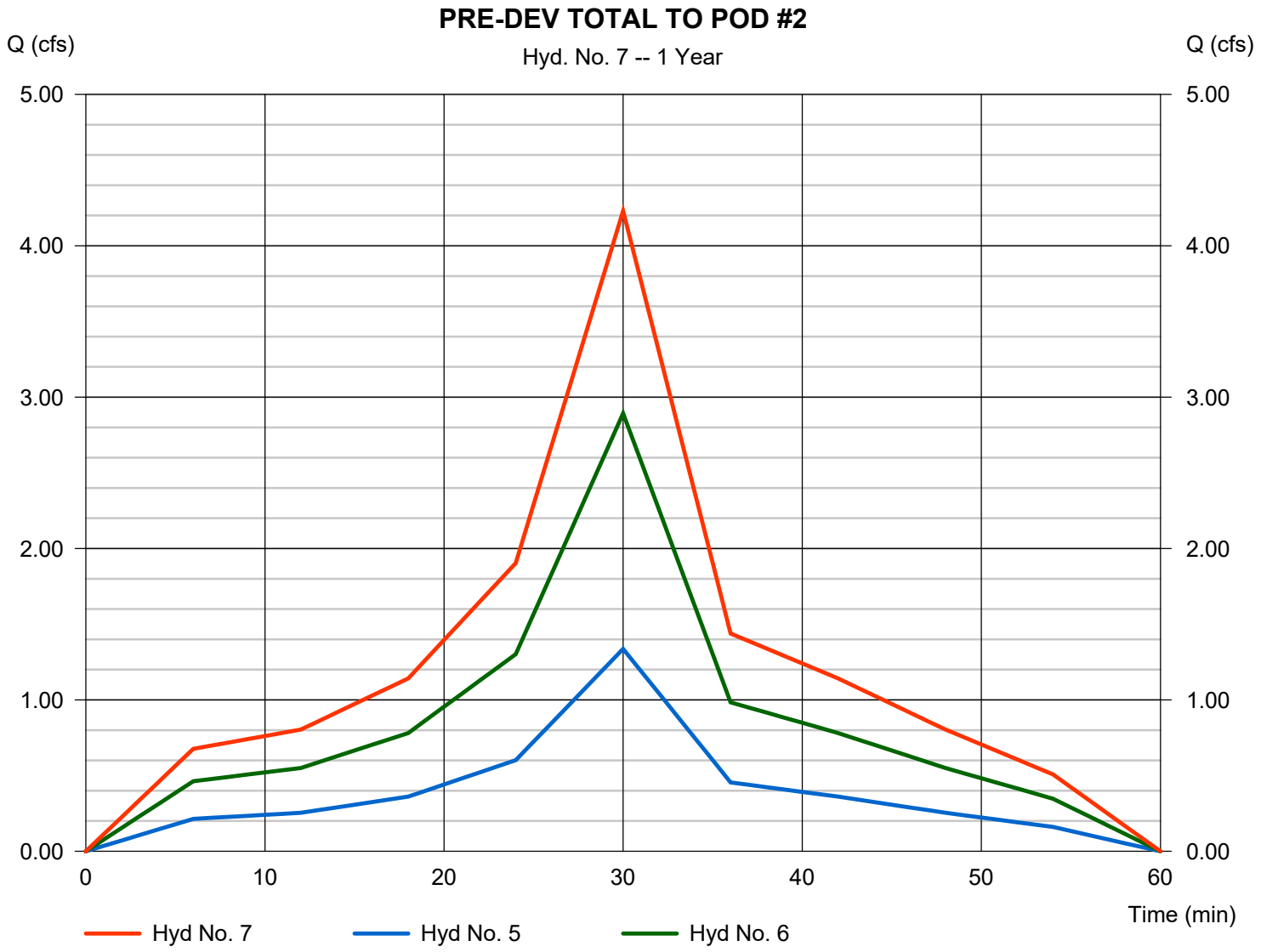


Hydrograph Report

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 4.230 cfs
Storm frequency	= 1 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 4,554 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac

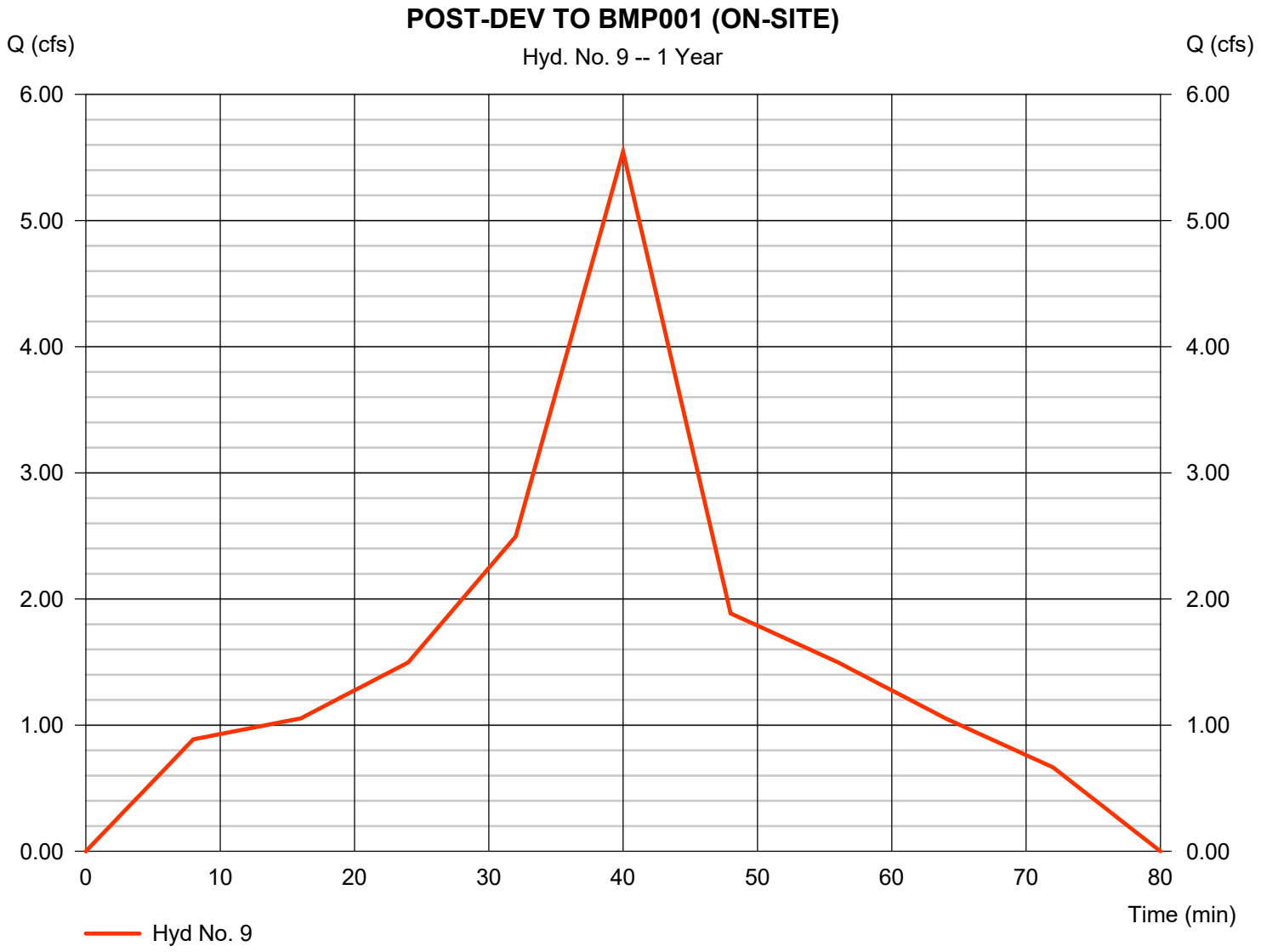


Hydrograph Report

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 5.546 cfs
Storm frequency	= 1 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 7,959 cuft
Drainage area	= 2.500 ac	Runoff coeff.	= 0.63
Intensity	= 3.521 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



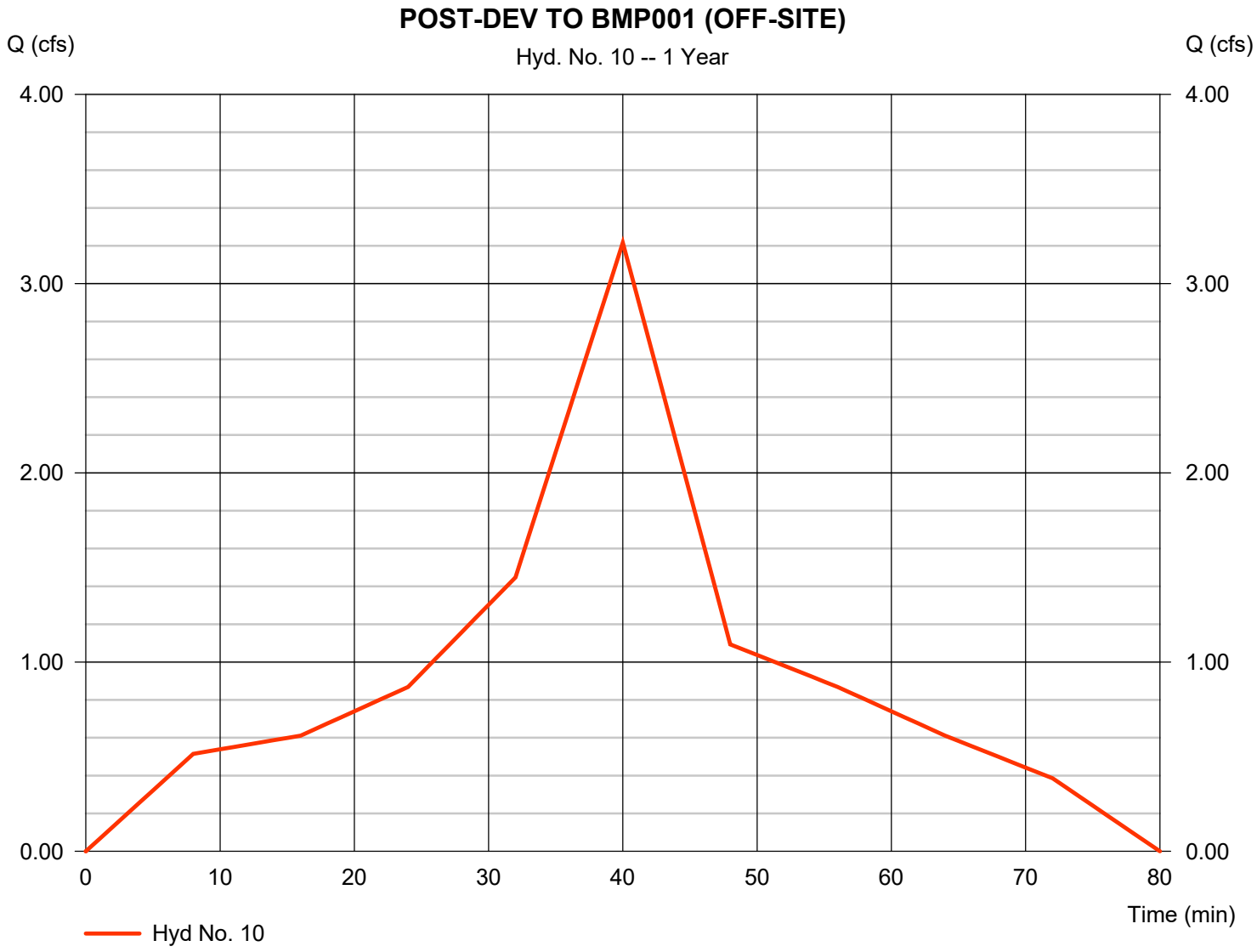
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.217 cfs
Storm frequency	=	1 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	4,616 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	3.521 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a



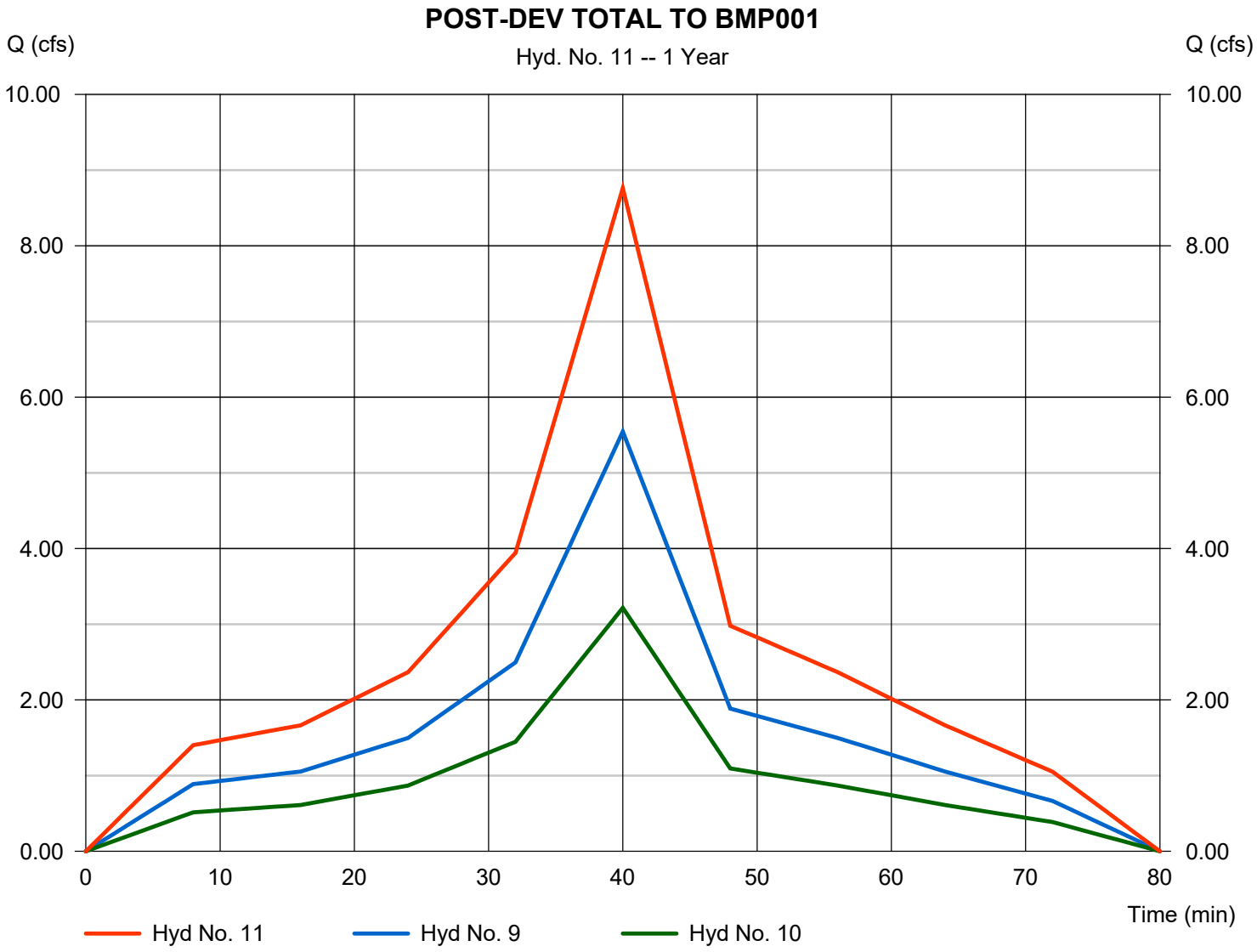
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 8.762 cfs
Storm frequency	= 1 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 12,576 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

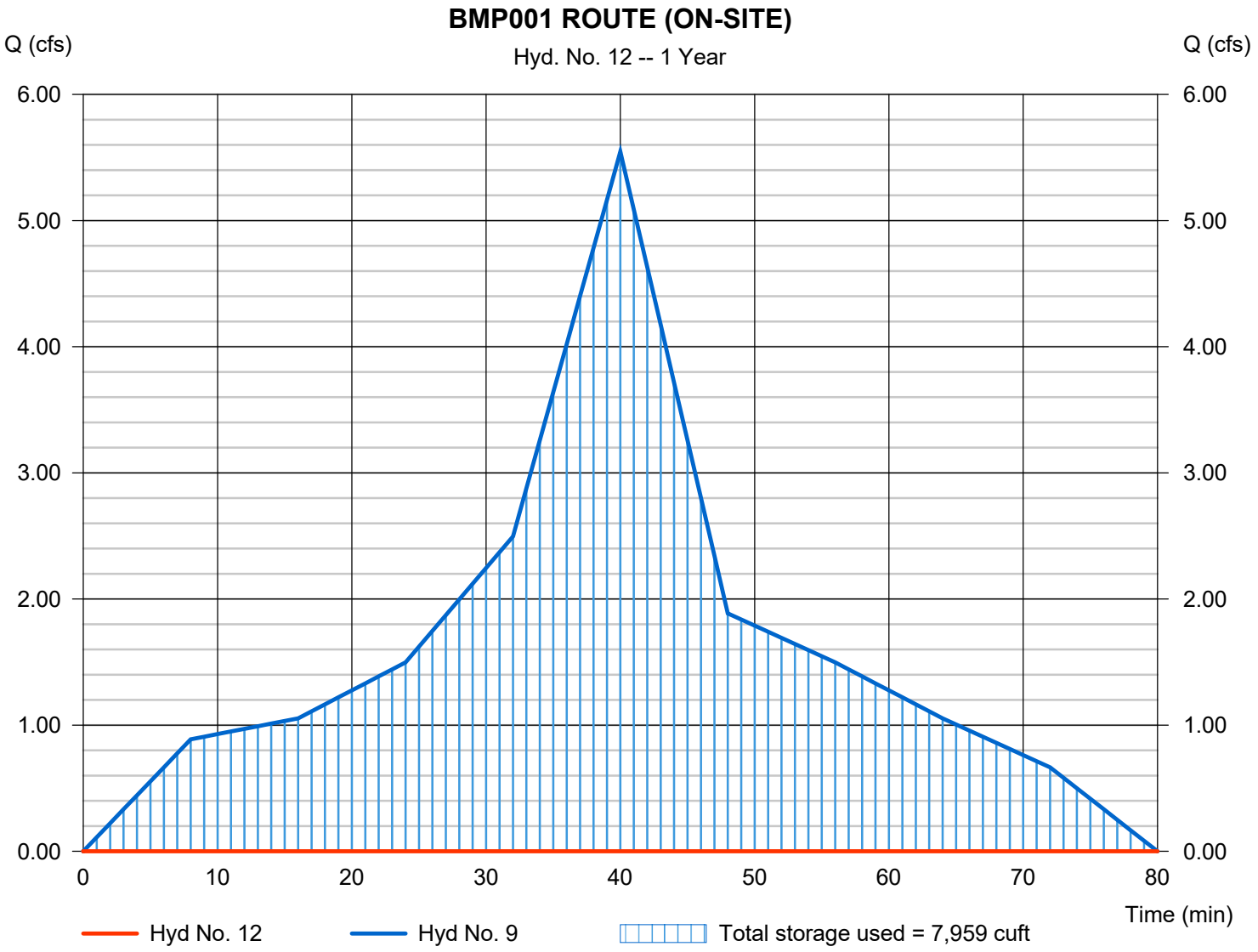
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 133.71 ft
Reservoir name	= BMP 001	Max. Storage	= 7,959 cuft

Storage Indication method used.



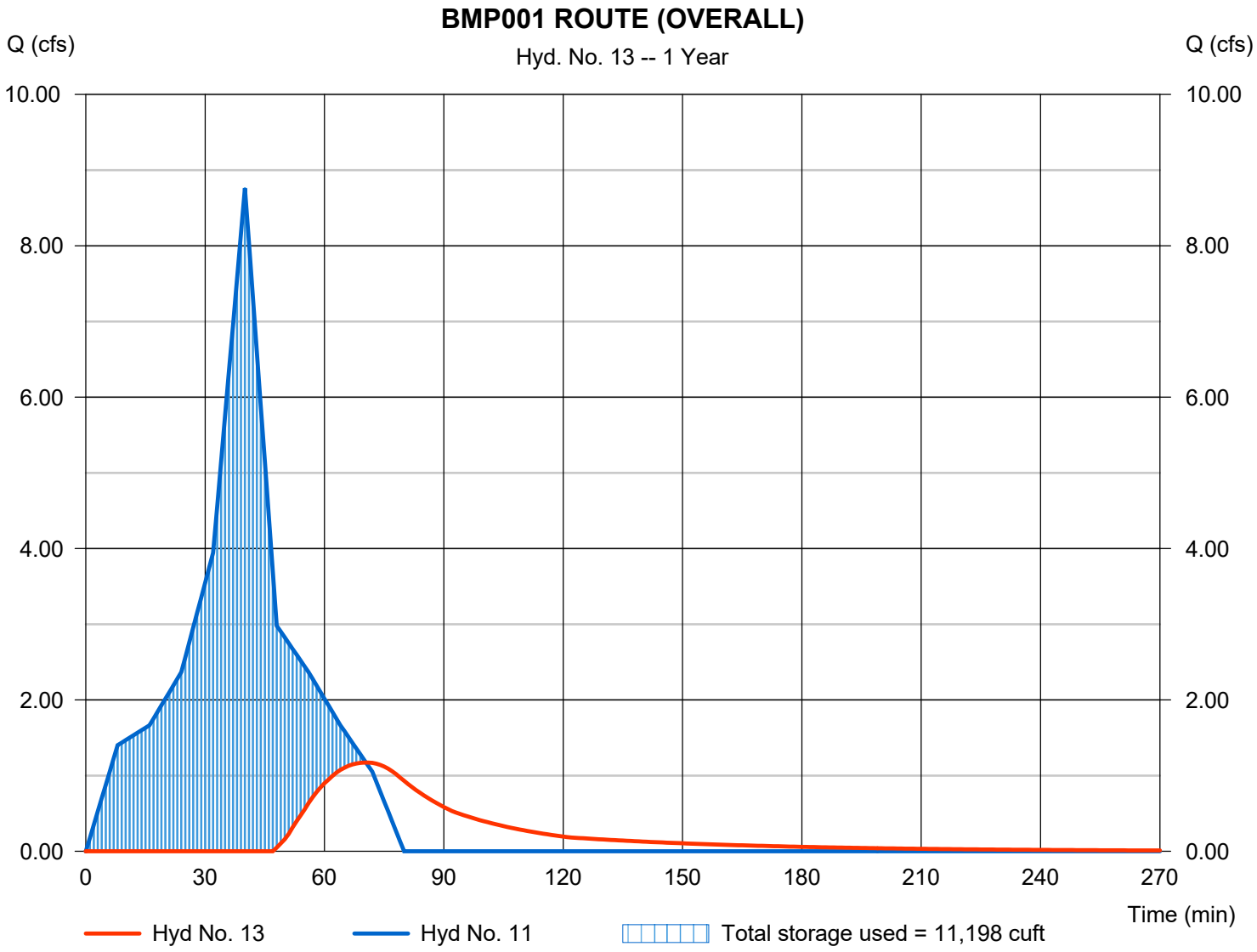
Hydrograph Report

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	1.172 cfs
Storm frequency	=	1 yrs	Time to peak	=	70 min
Time interval	=	1 min	Hyd. volume	=	3,300 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	134.34 ft
Reservoir name	=	BMP 001	Max. Storage	=	11,198 cuft

Storage Indication method used.

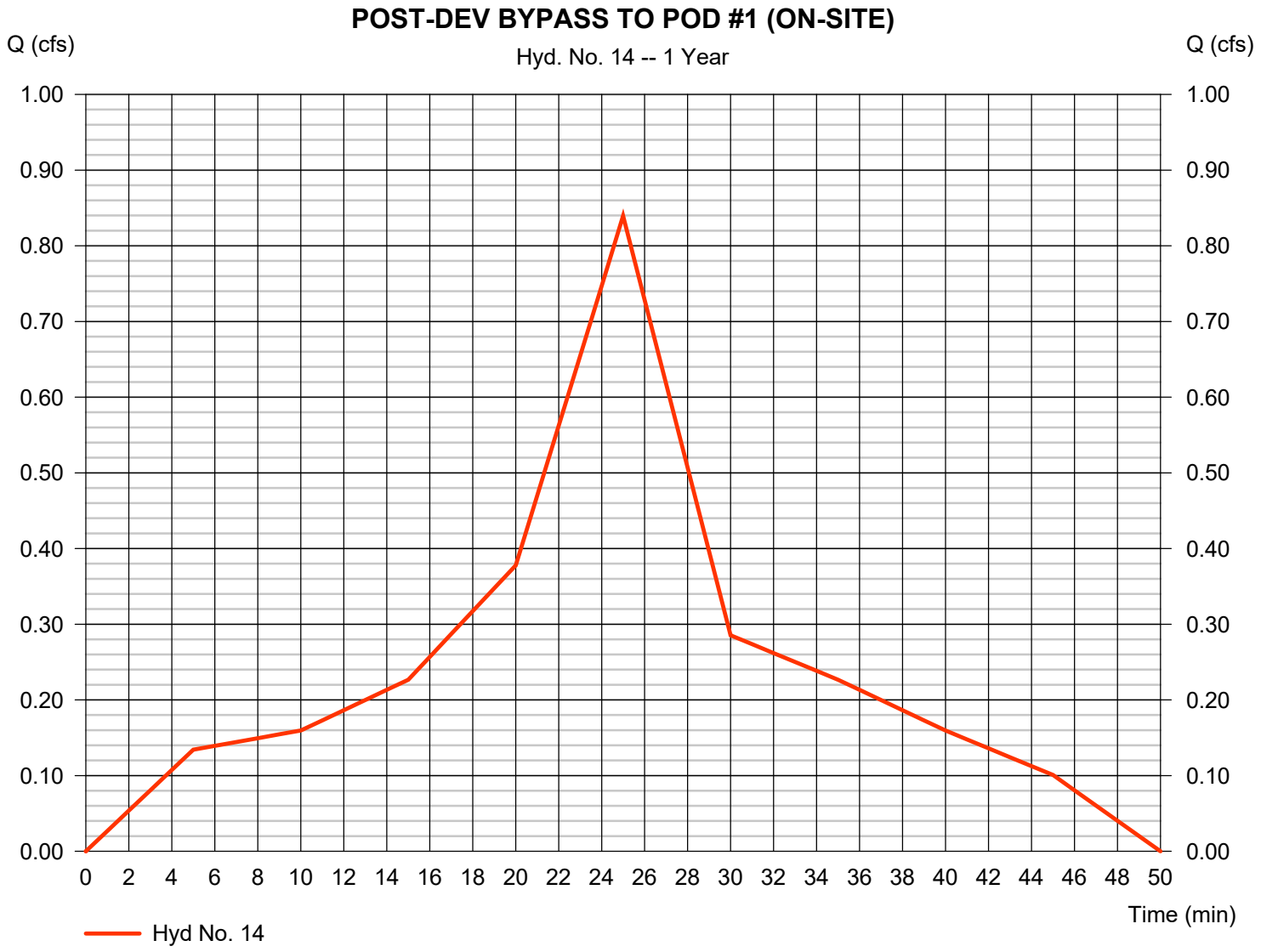


Hydrograph Report

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 0.839 cfs
Storm frequency	= 1 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 753 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 4.055 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

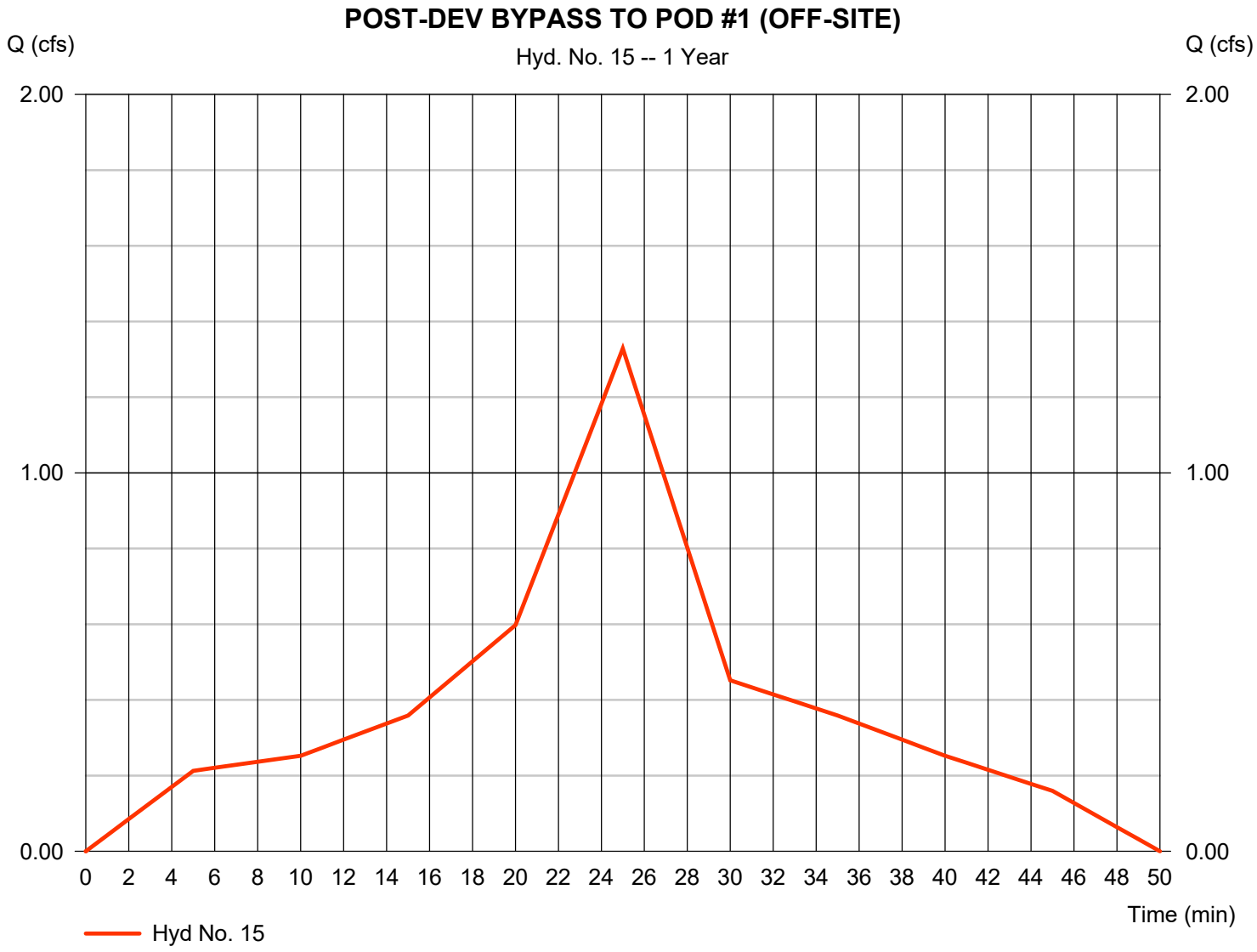


Hydrograph Report

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.329 cfs
Storm frequency	= 1 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,192 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 4.055 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



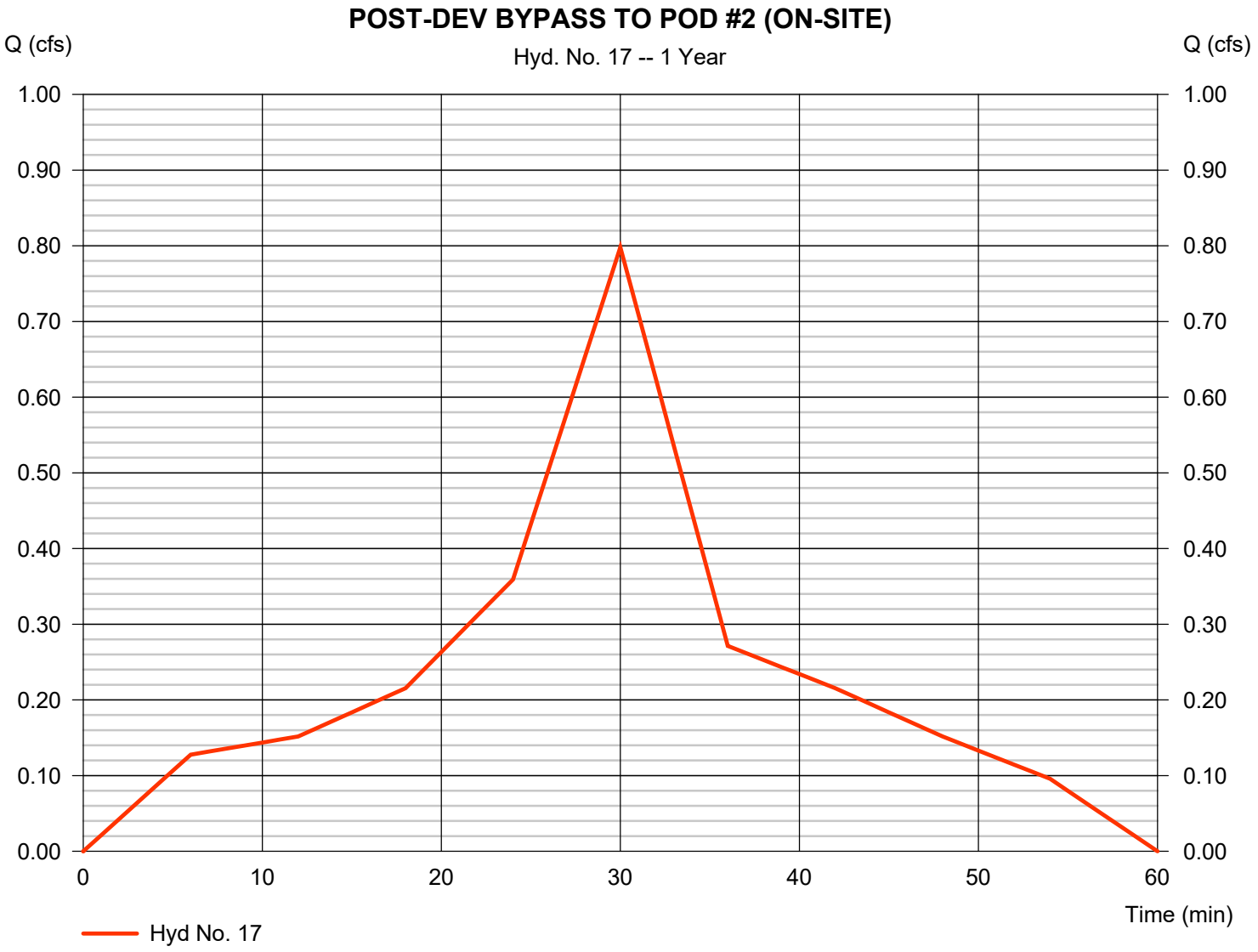
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 0.798 cfs
Storm frequency	= 1 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 859 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 3.859 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

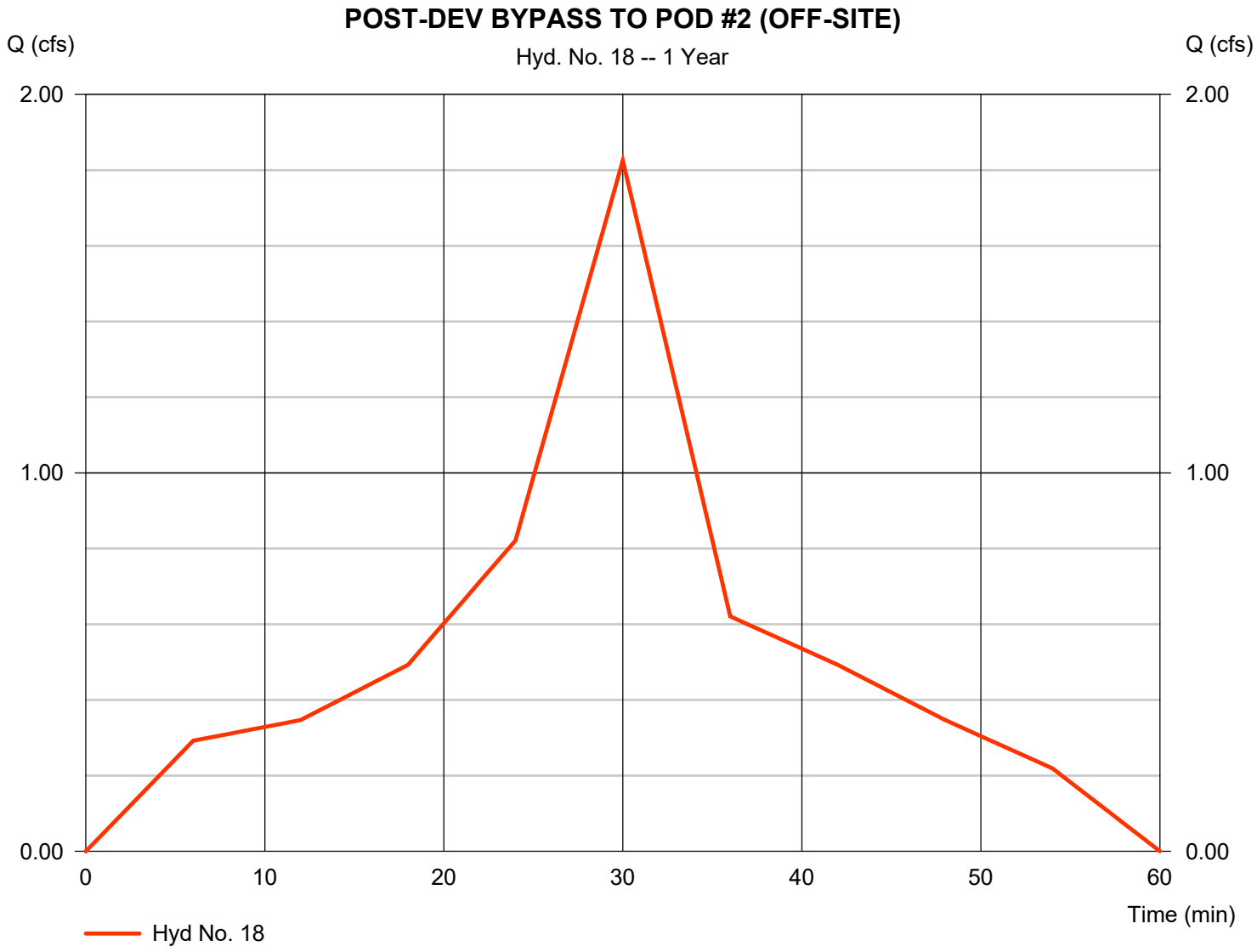


Hydrograph Report

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.825 cfs
Storm frequency	= 1 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,965 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.43
Intensity	= 3.859 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

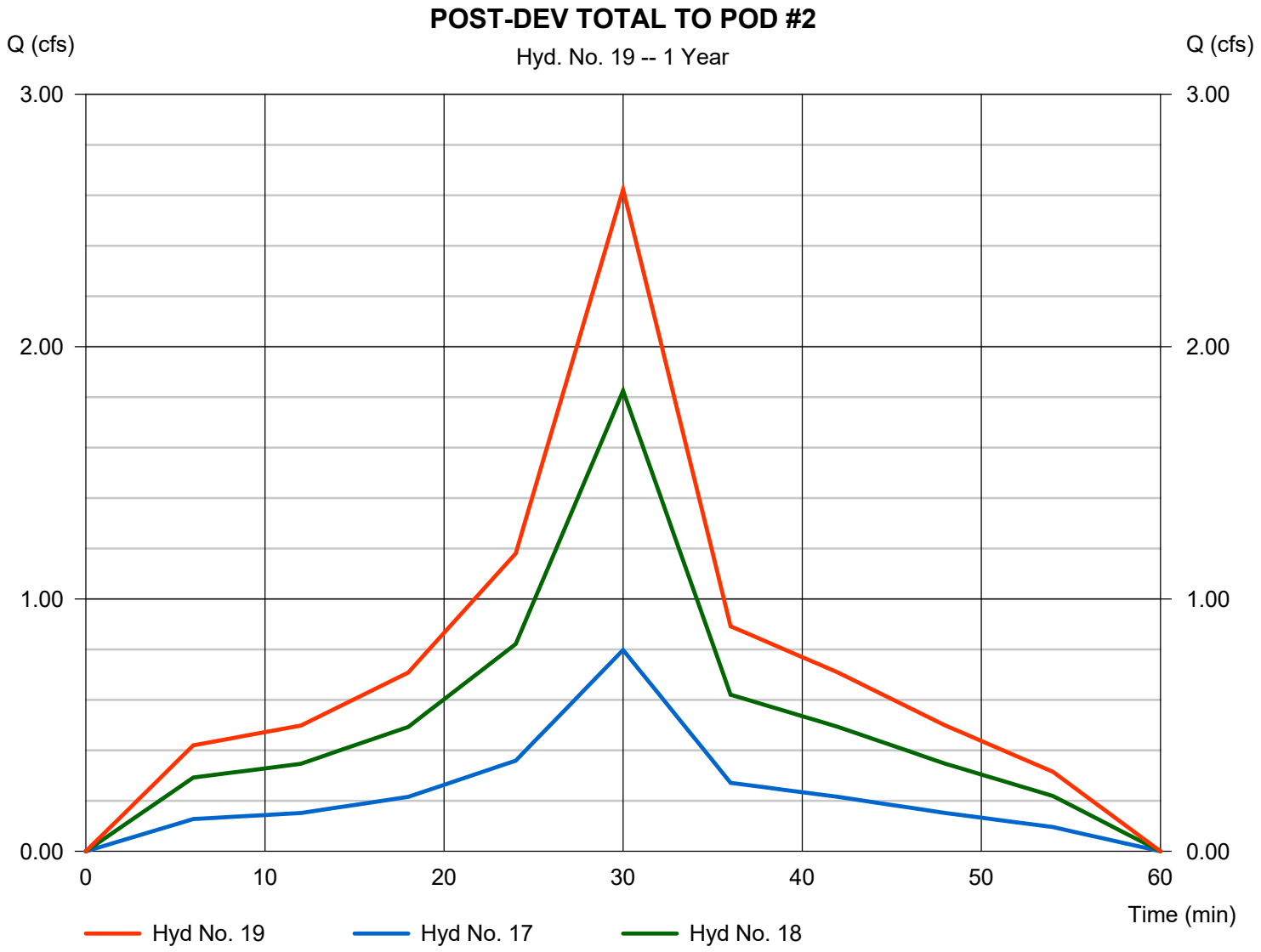


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 2.623 cfs
Storm frequency	= 1 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,824 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



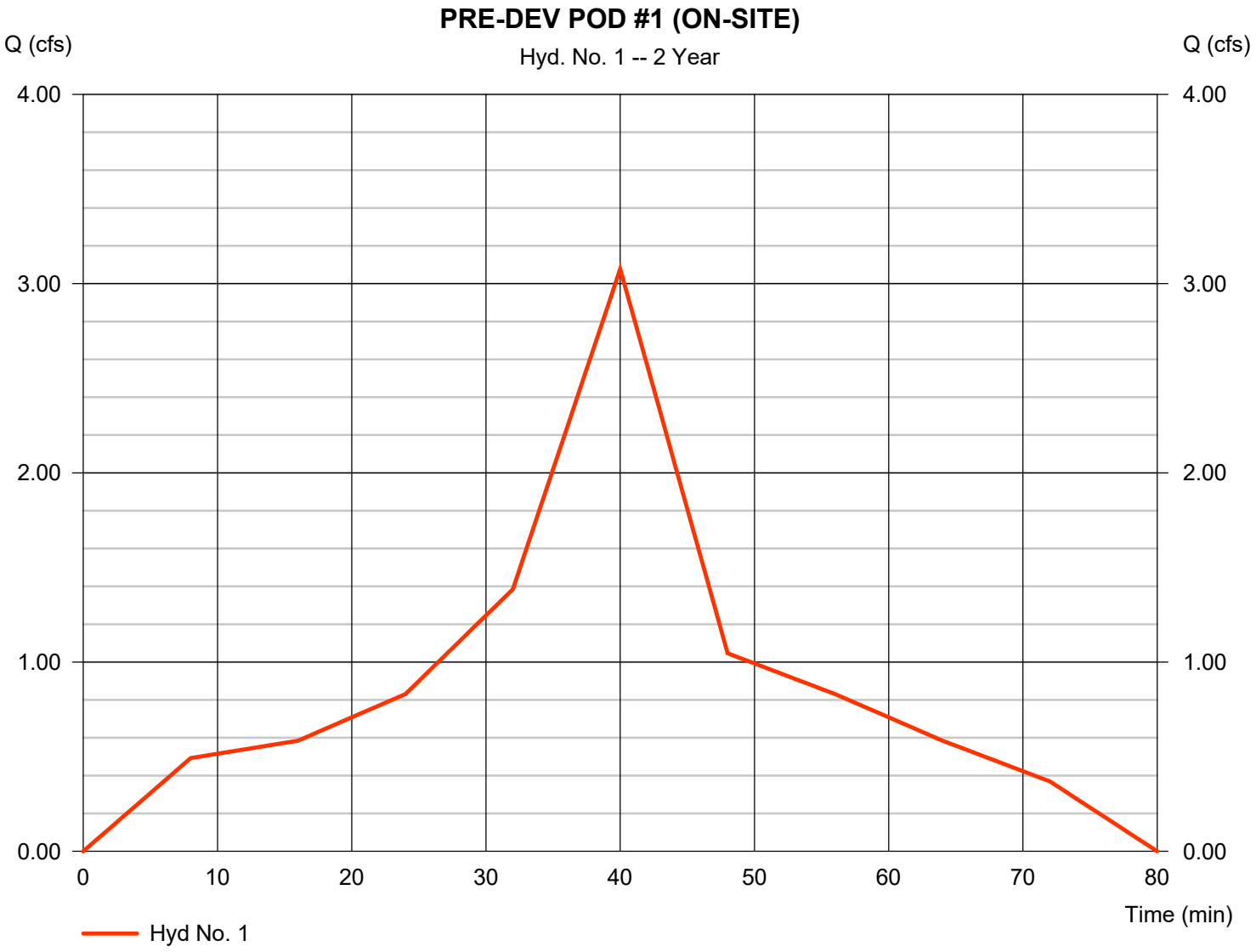
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.078 cfs
Storm frequency	=	2 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	4,417 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	4.224 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

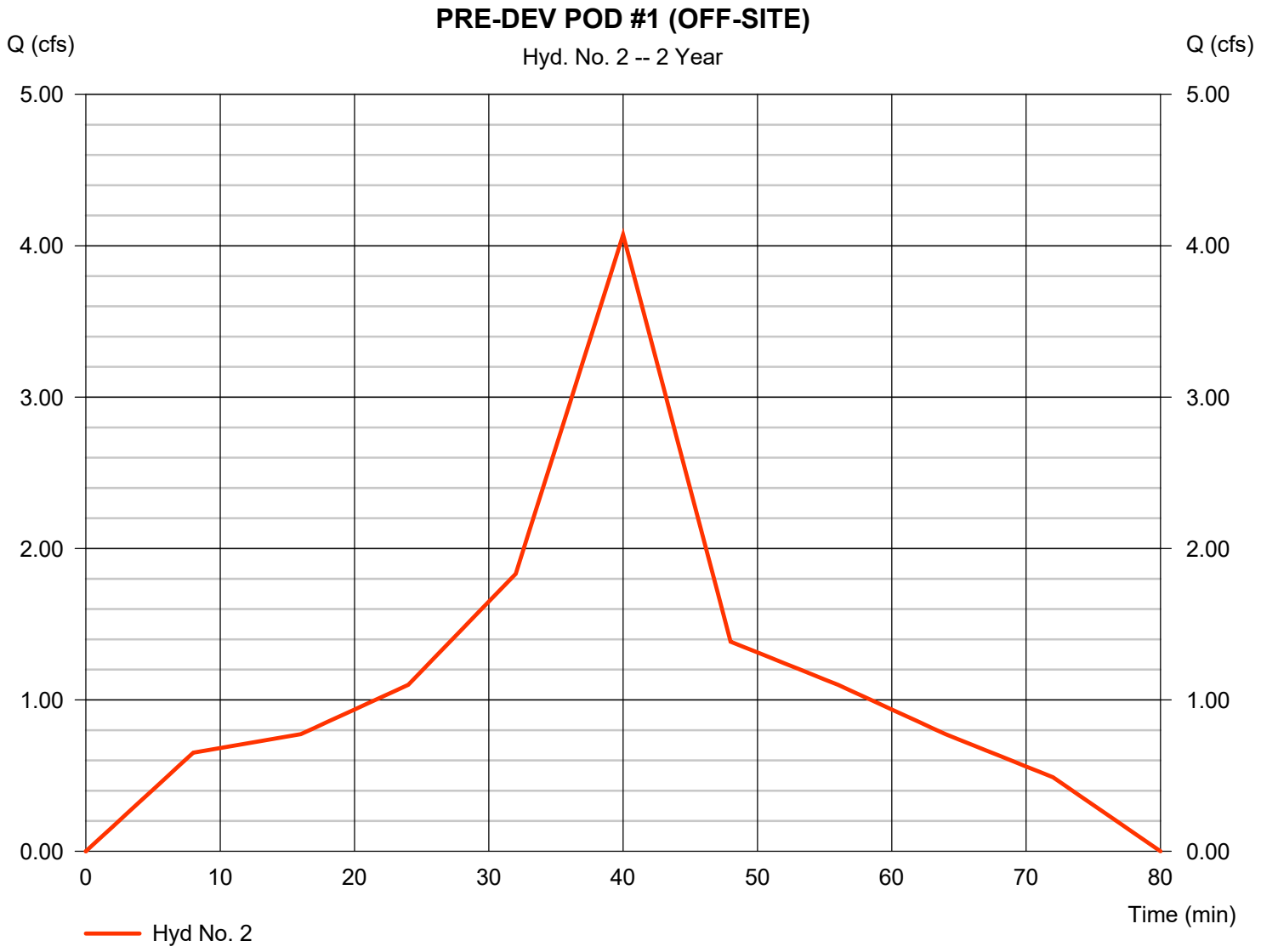


Hydrograph Report

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 4.072 cfs
Storm frequency	= 2 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 5,845 cuft
Drainage area	= 2.410 ac	Runoff coeff.	= 0.4
Intensity	= 4.224 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

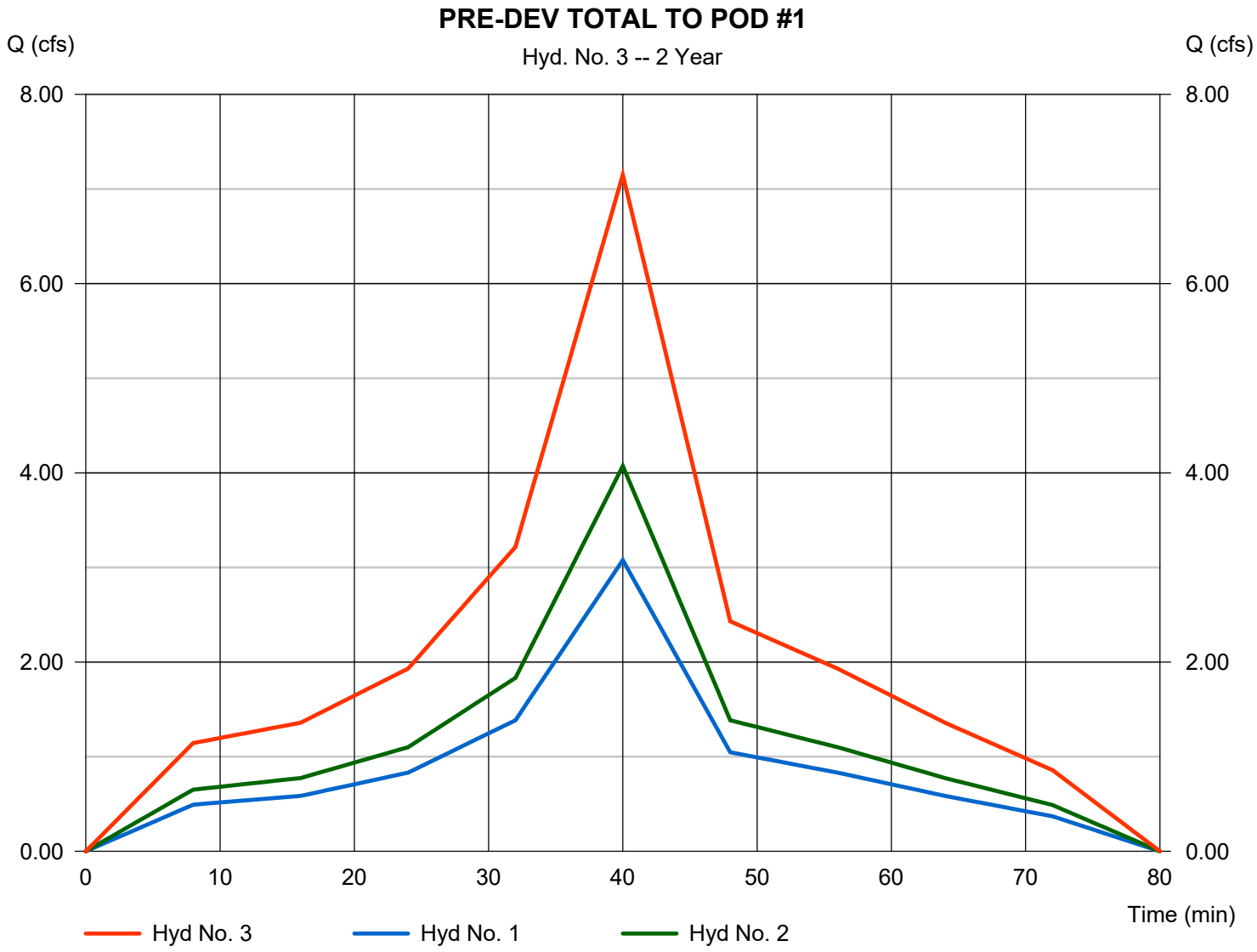


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 7.150 cfs
Storm frequency	= 2 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 10,262 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac

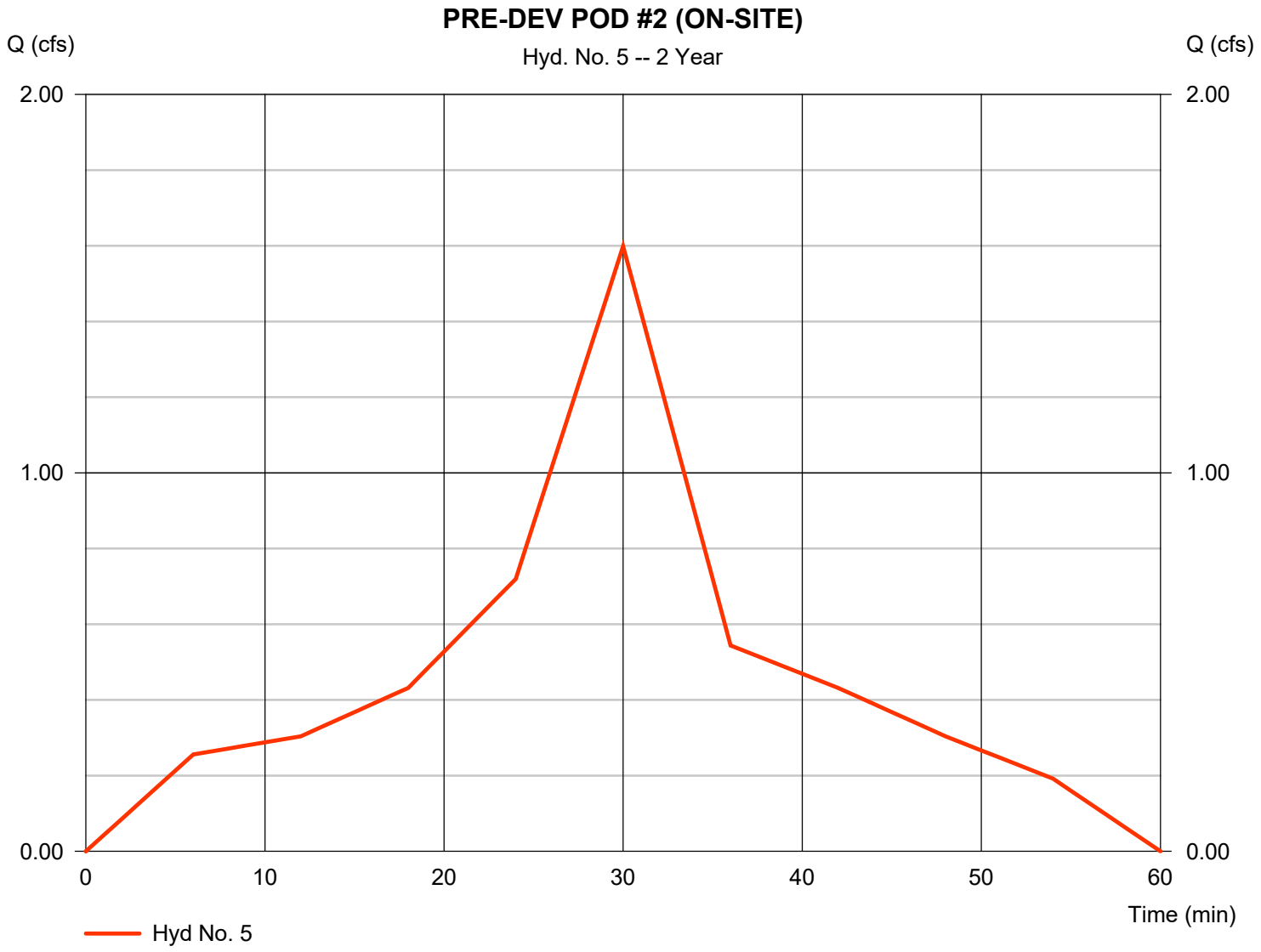


Hydrograph Report

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.599 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,721 cuft
Drainage area	= 1.050 ac	Runoff coeff.	= 0.33
Intensity	= 4.615 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

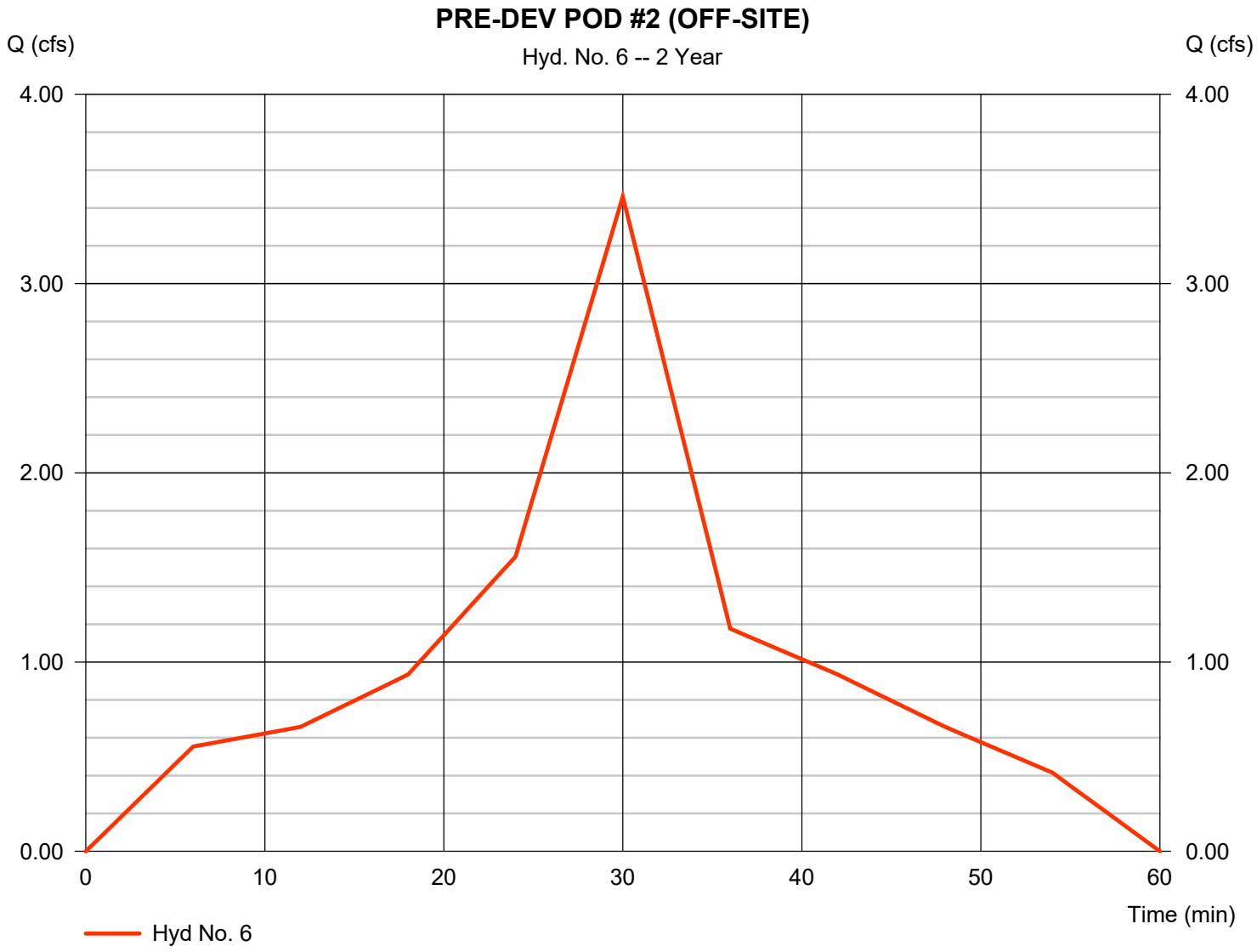


Hydrograph Report

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 3.460 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 3,724 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.46
Intensity	= 4.615 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



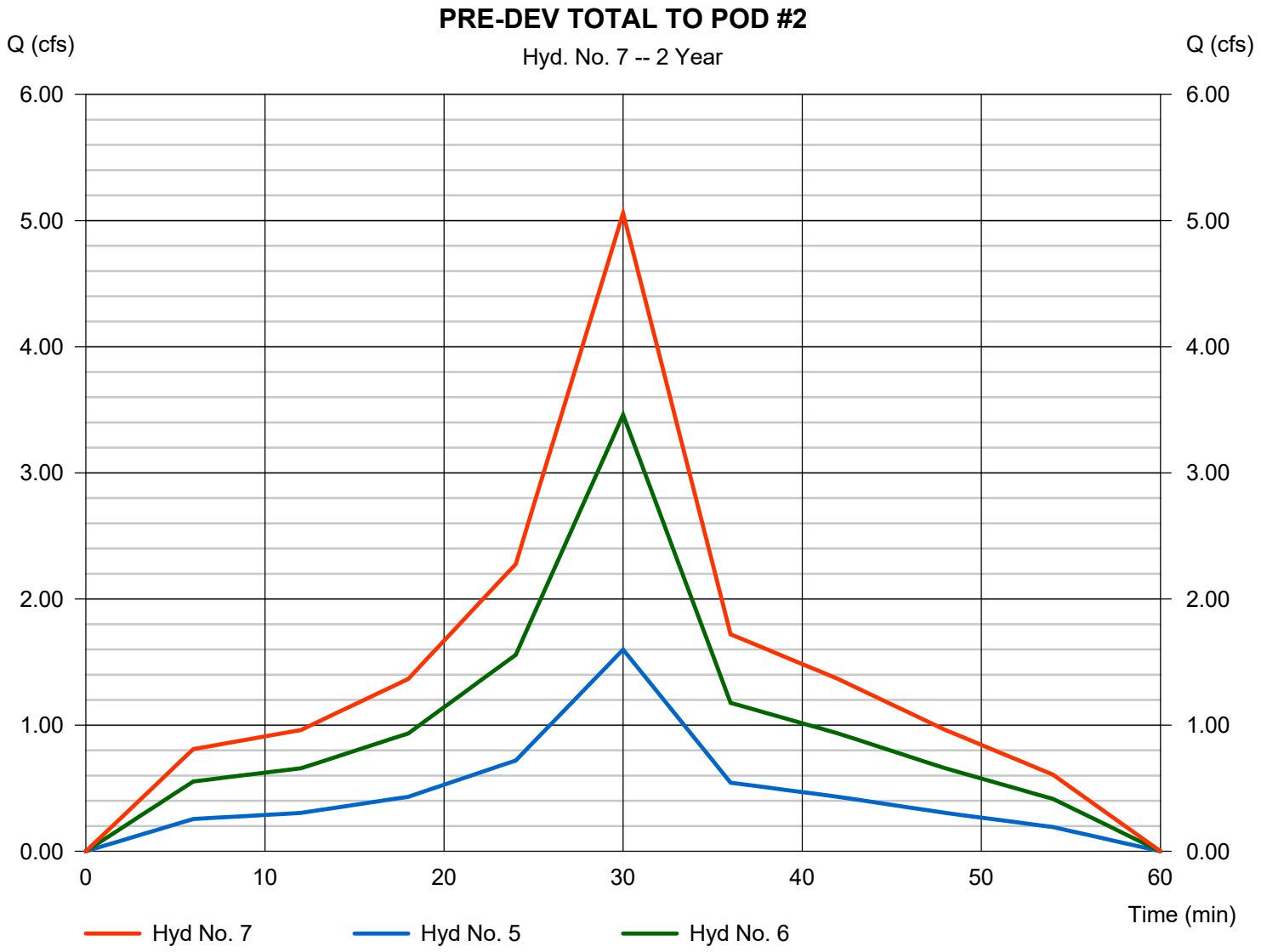
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 5.059 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 5,445 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac

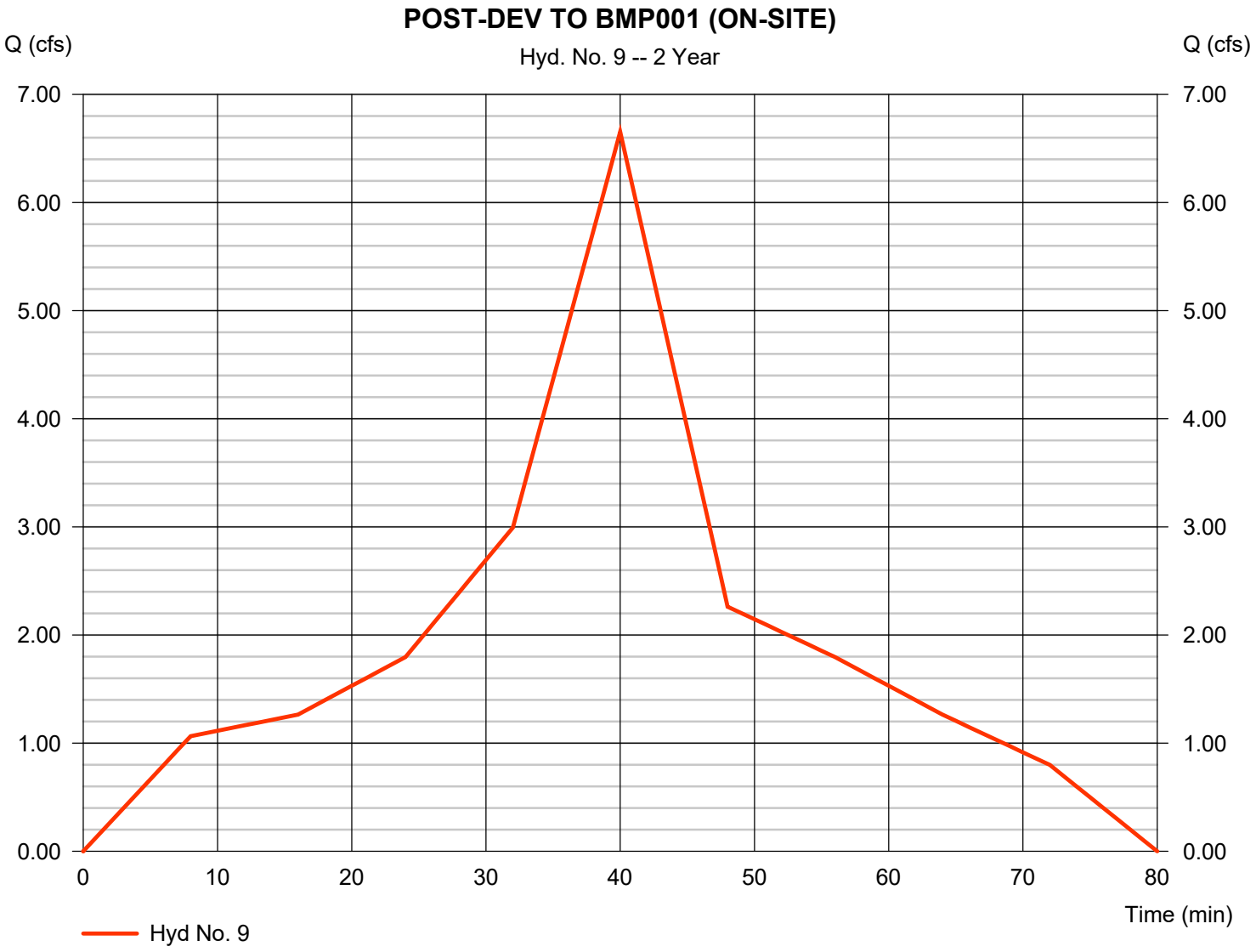


Hydrograph Report

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 6.654 cfs
Storm frequency	= 2 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 9,549 cuft
Drainage area	= 2.500 ac	Runoff coeff.	= 0.63
Intensity	= 4.224 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



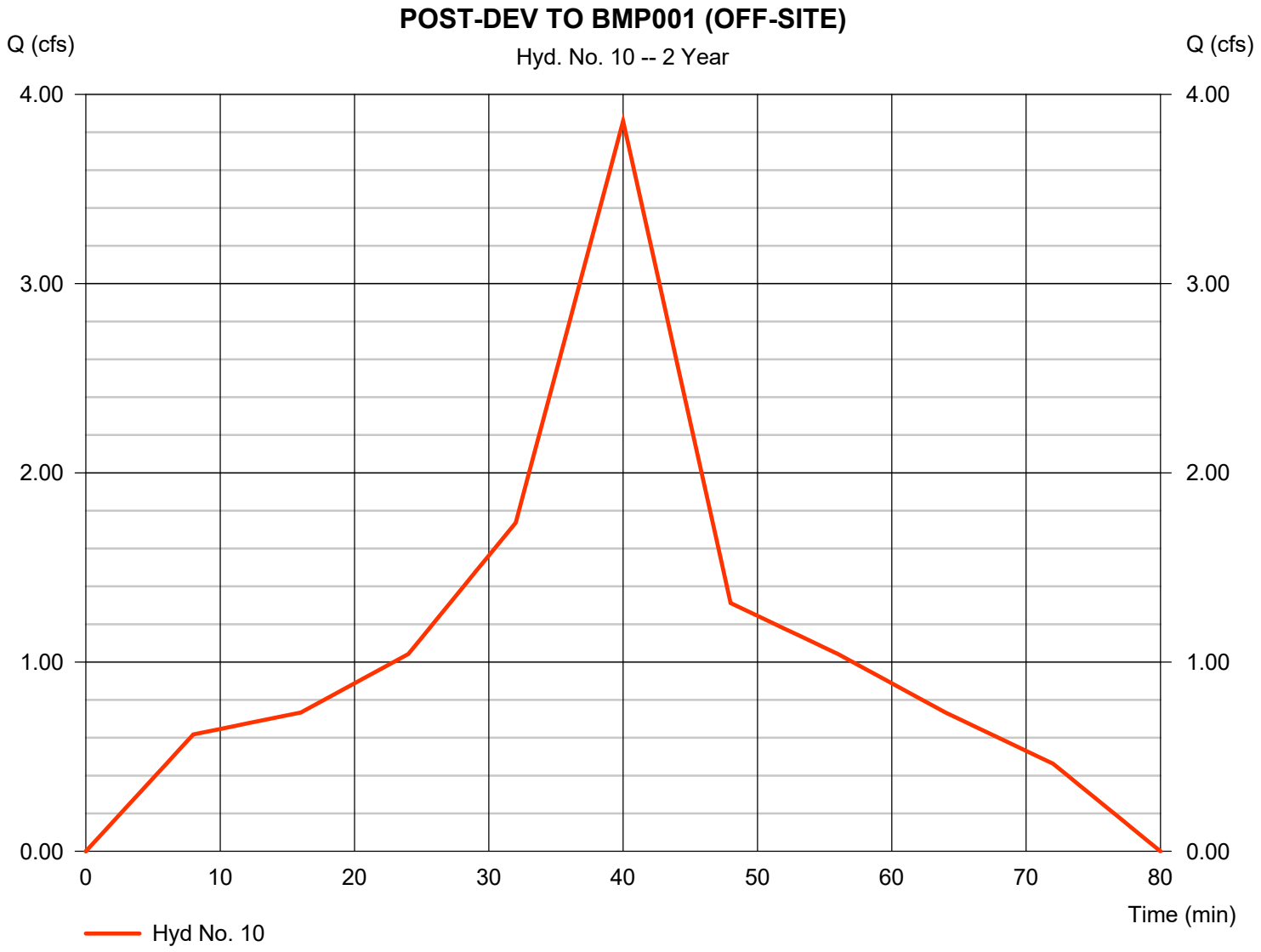
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.859 cfs
Storm frequency	=	2 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	5,539 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	4.224 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

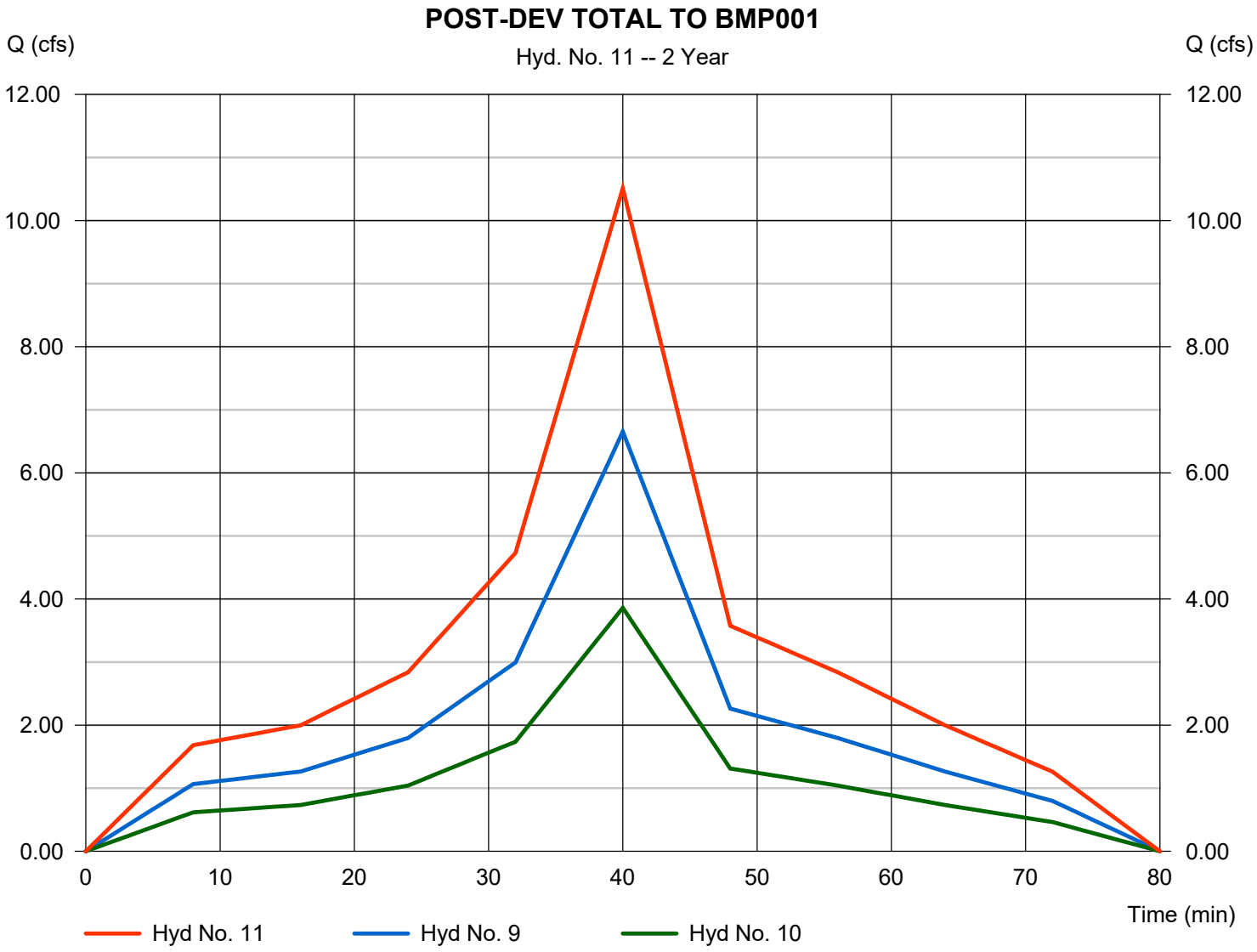


Hydrograph Report

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 10.51 cfs
Storm frequency	= 2 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 15,088 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

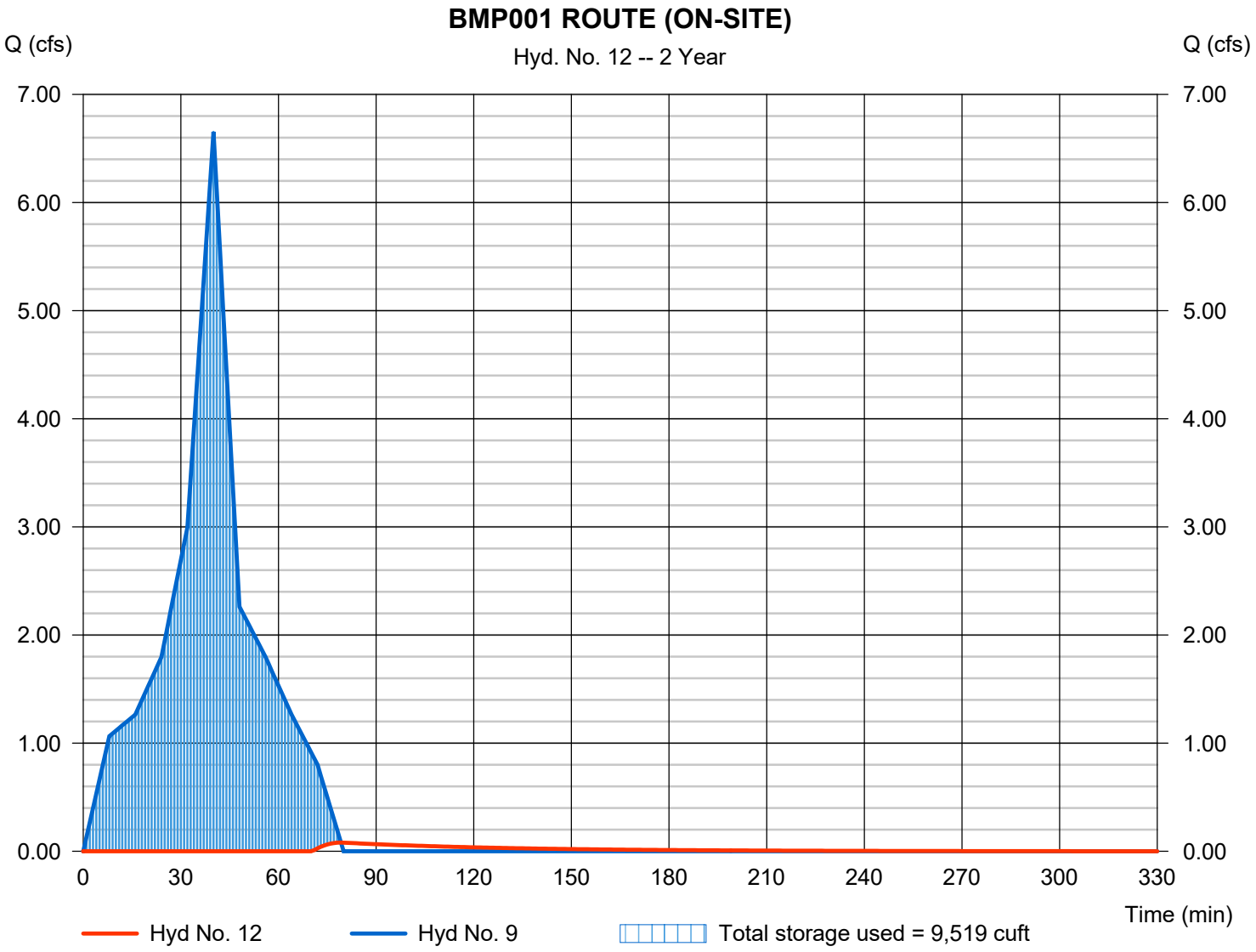
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 0.080 cfs
Storm frequency	= 2 yrs	Time to peak	= 79 min
Time interval	= 1 min	Hyd. volume	= 273 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.04 ft
Reservoir name	= BMP 001	Max. Storage	= 9,519 cuft

Storage Indication method used.



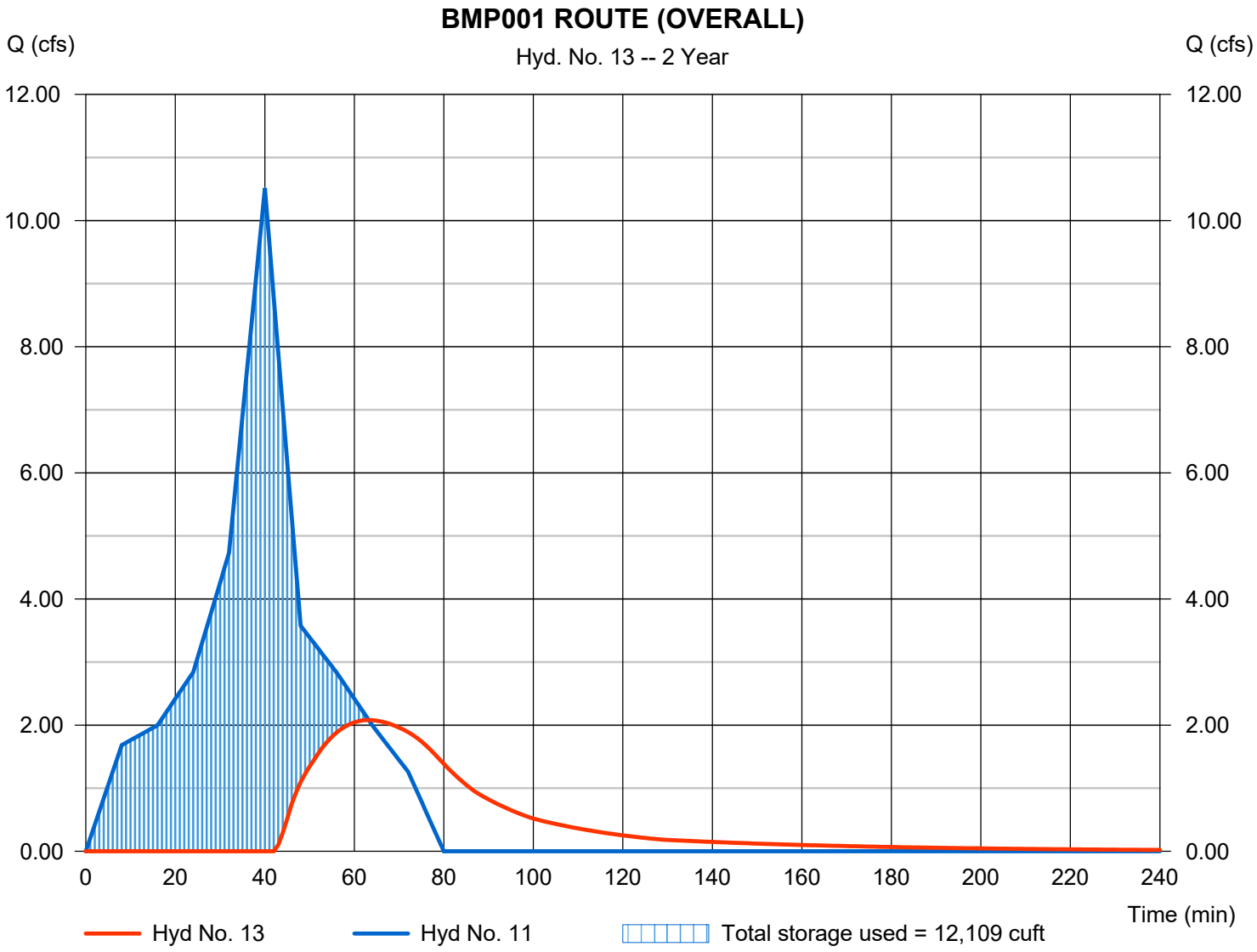
Hydrograph Report

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	2.082 cfs
Storm frequency	=	2 yrs	Time to peak	=	63 min
Time interval	=	1 min	Hyd. volume	=	5,812 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	134.50 ft
Reservoir name	=	BMP 001	Max. Storage	=	12,109 cuft

Storage Indication method used.



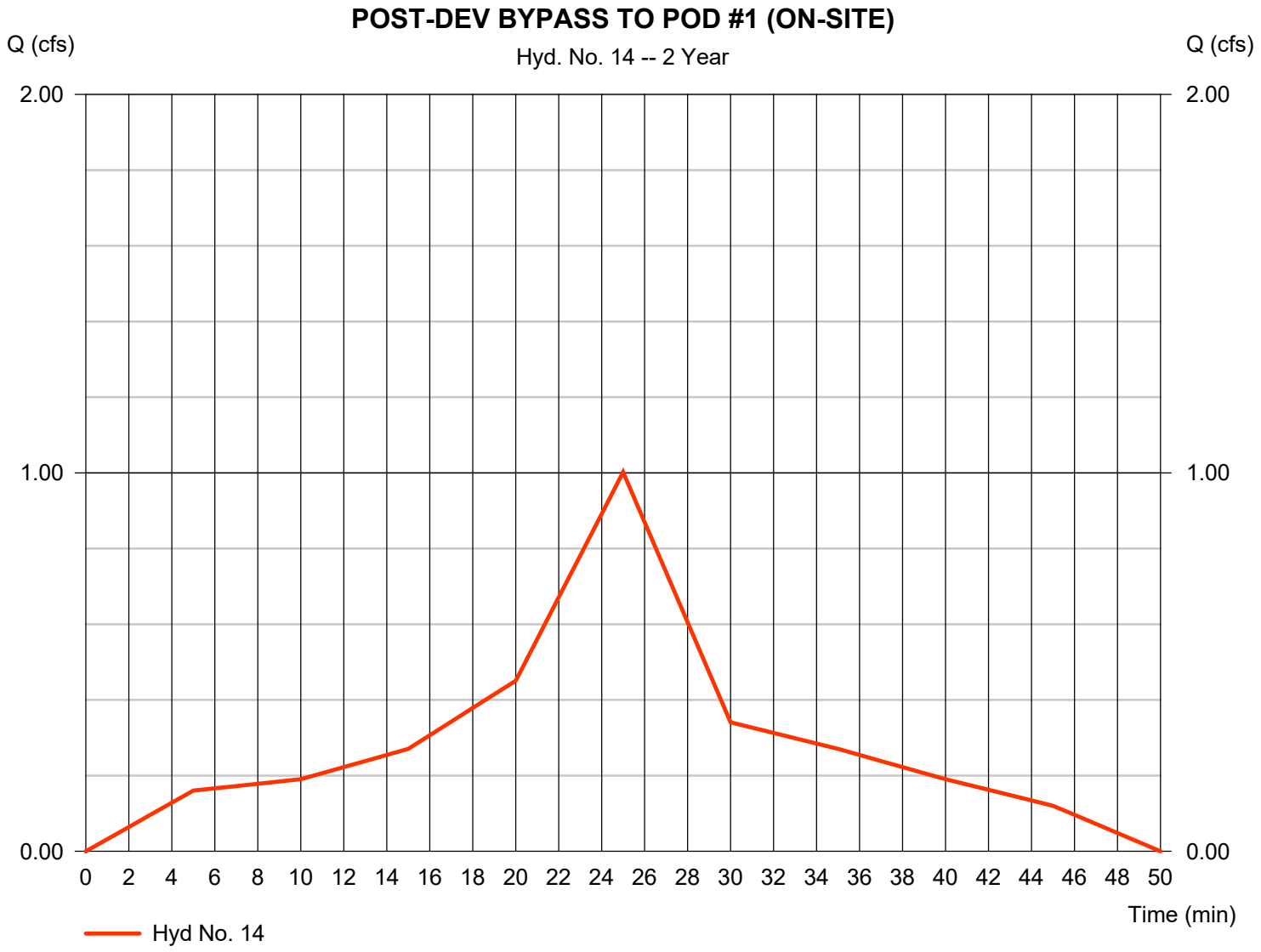
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.002 cfs
Storm frequency	= 2 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 899 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 4.840 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyattsville.IDF	Asc/Rec limb fact	= n/a

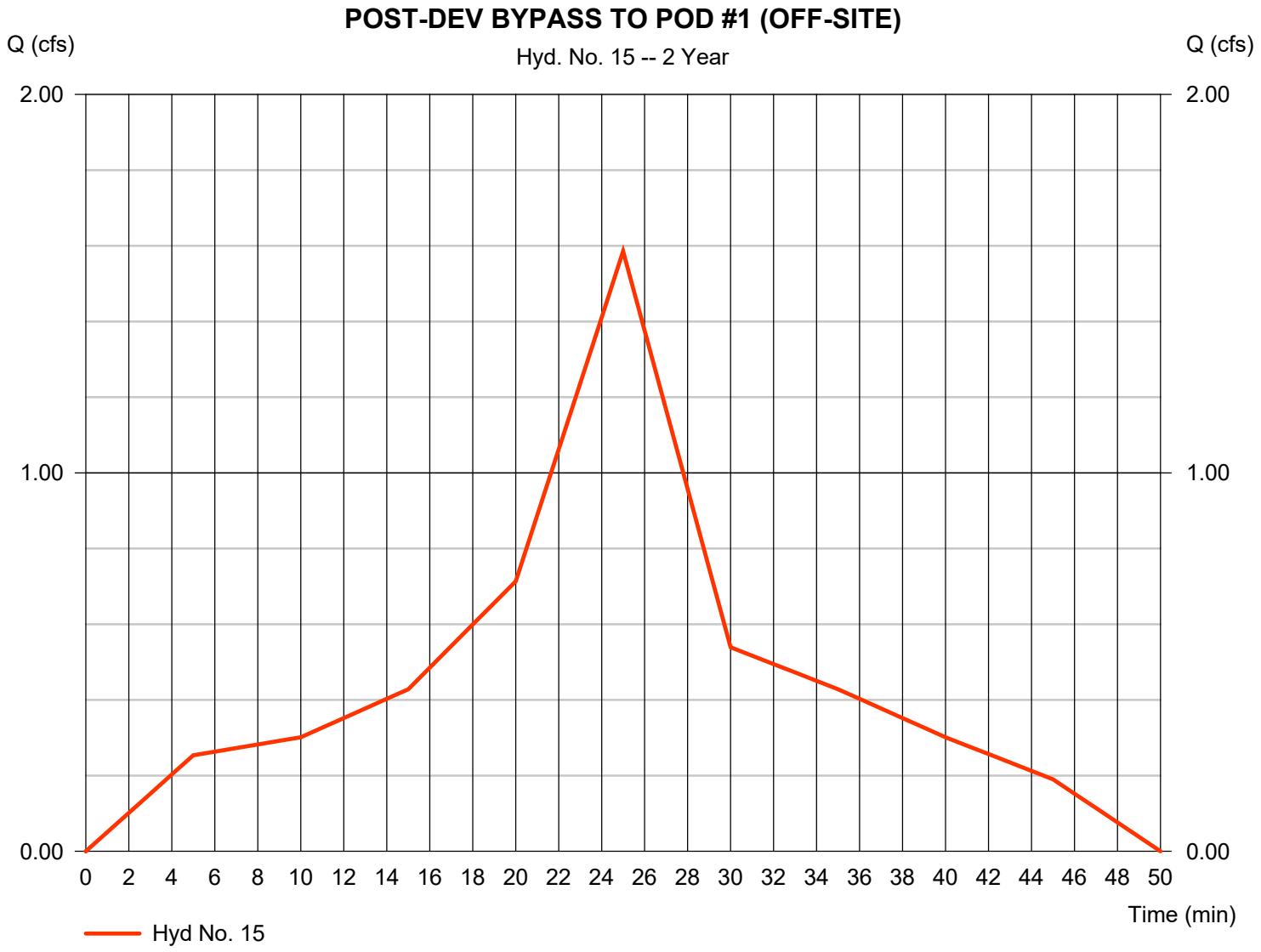


Hydrograph Report

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.586 cfs
Storm frequency	= 2 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,422 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 4.840 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	= n/a

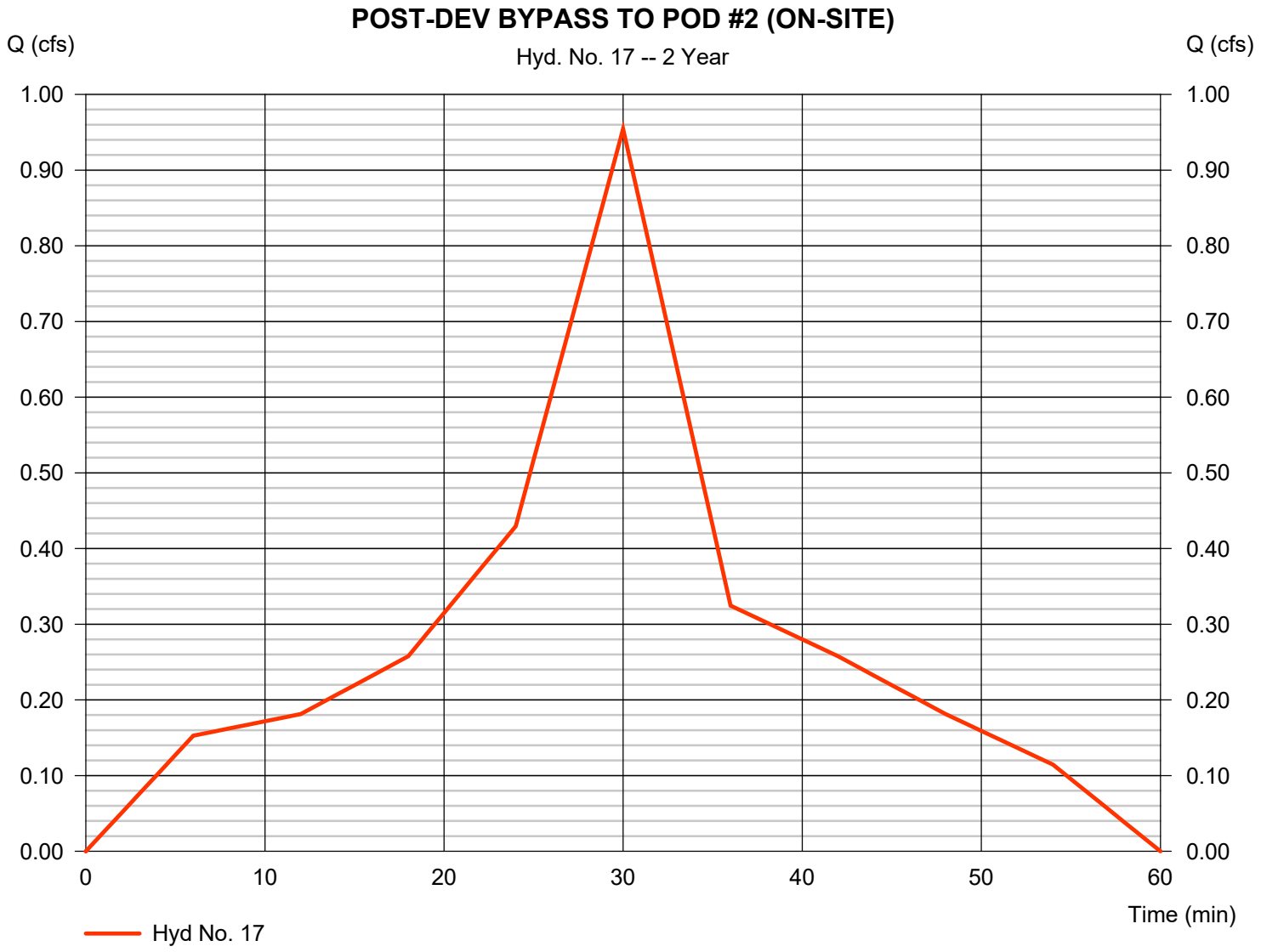


Hydrograph Report

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 0.954 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,027 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 4.615 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

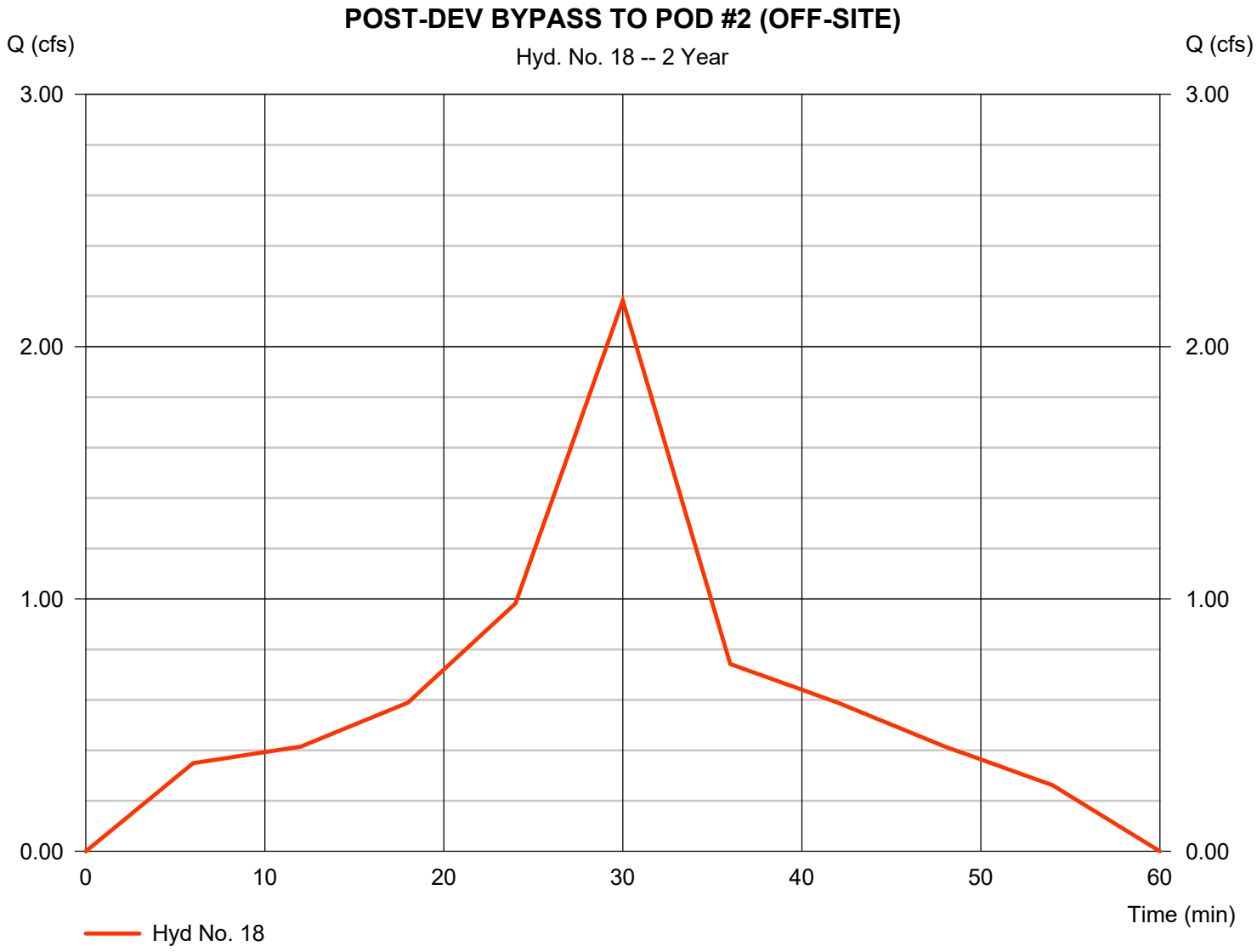


Hydrograph Report

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.183 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,349 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.43
Intensity	= 4.615 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

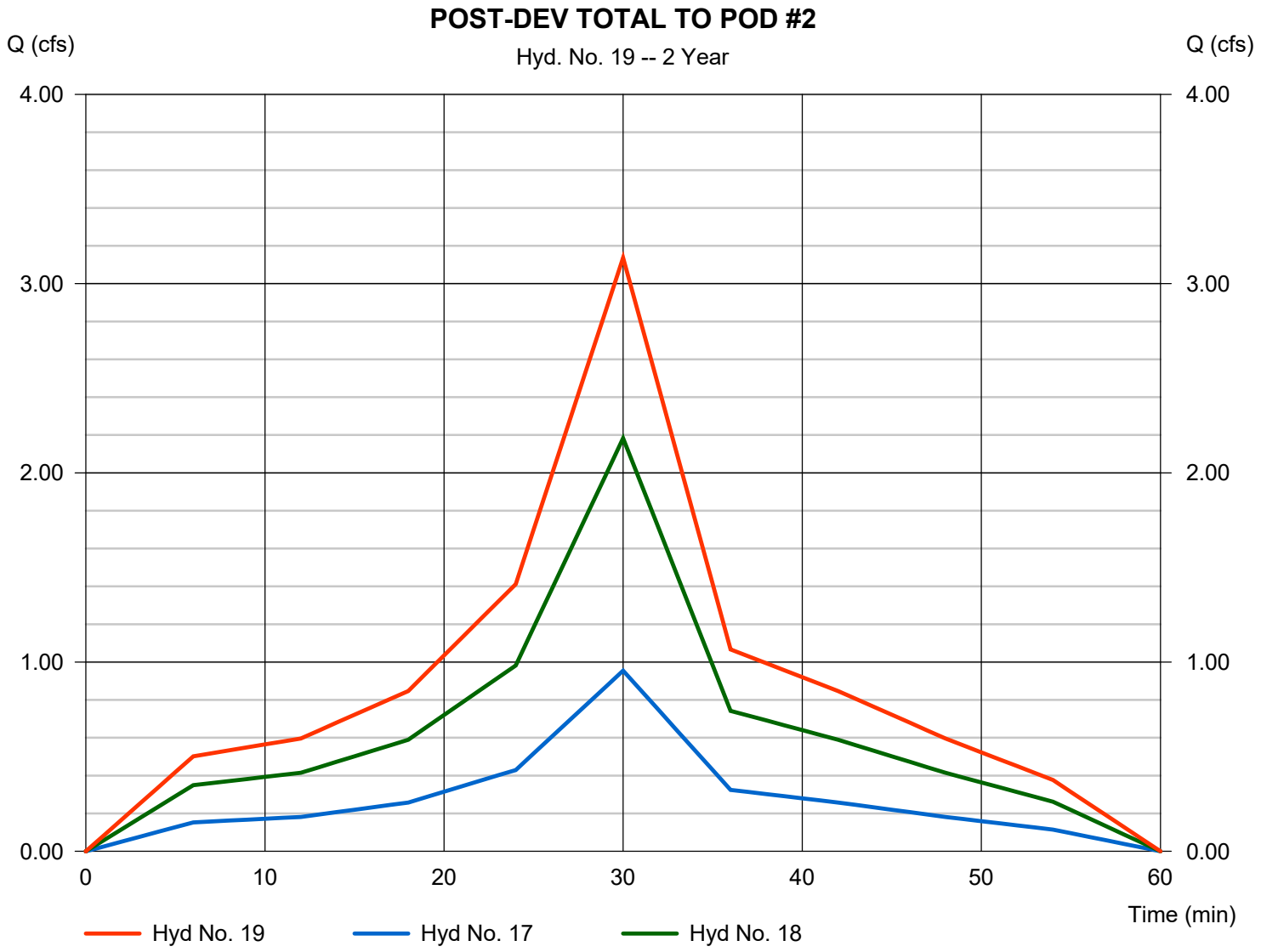


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 3.137 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 3,377 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



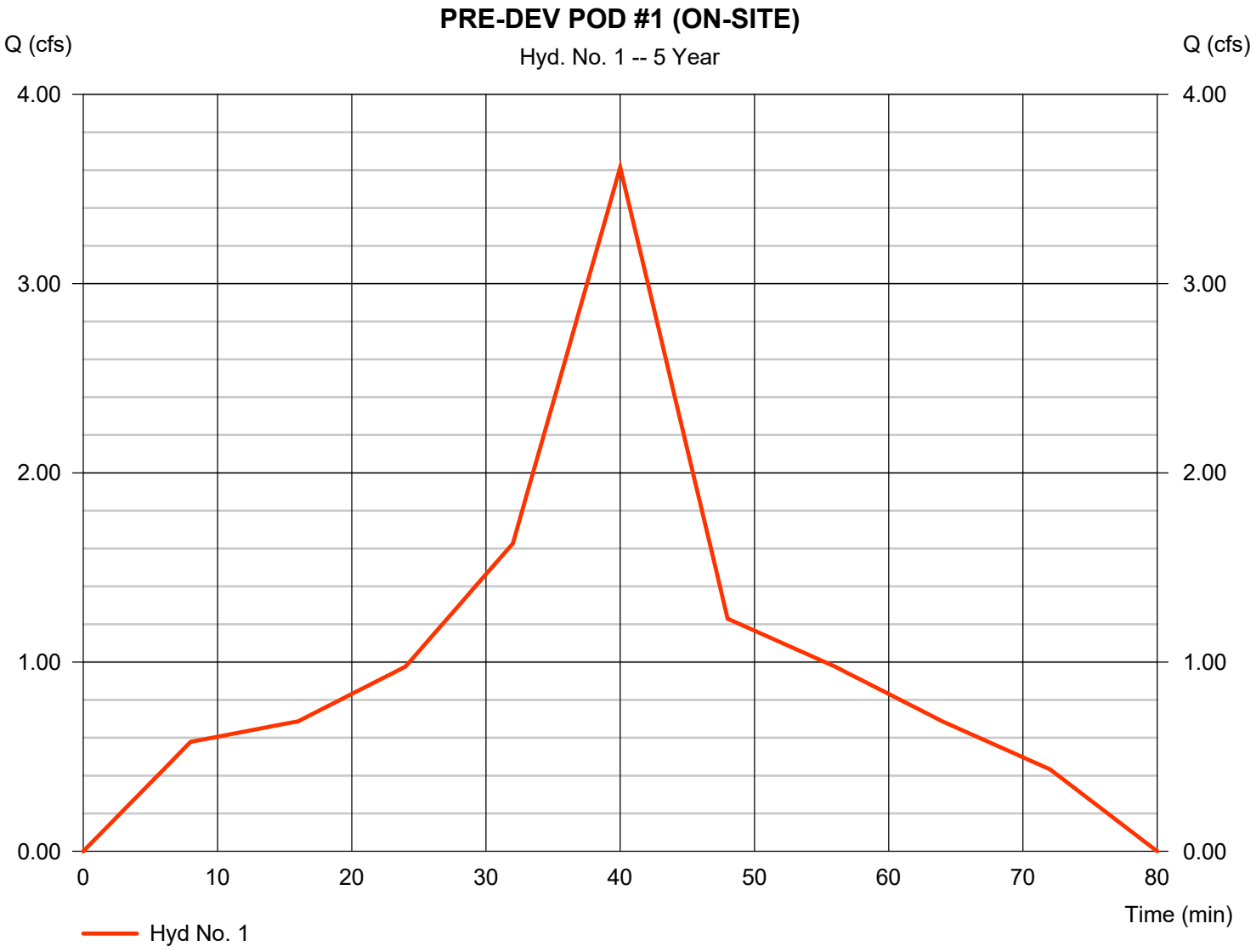
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 3.615 cfs
Storm frequency	= 5 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 5,188 cuft
Drainage area	= 2.350 ac	Runoff coeff.	= 0.31
Intensity	= 4.962 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



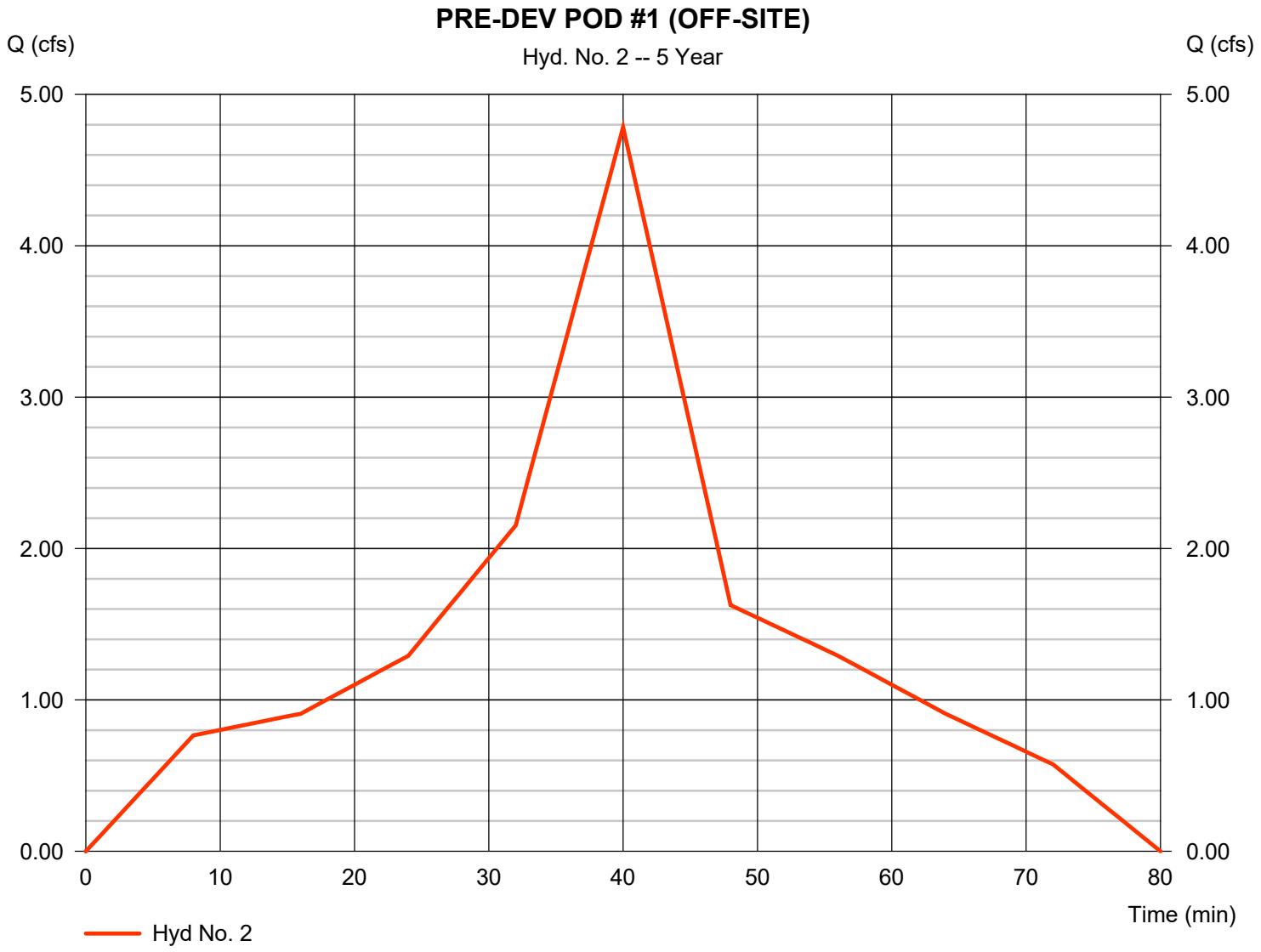
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	4.783 cfs
Storm frequency	=	5 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	6,865 cuft
Drainage area	=	2.410 ac	Runoff coeff.	=	0.4
Intensity	=	4.962 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

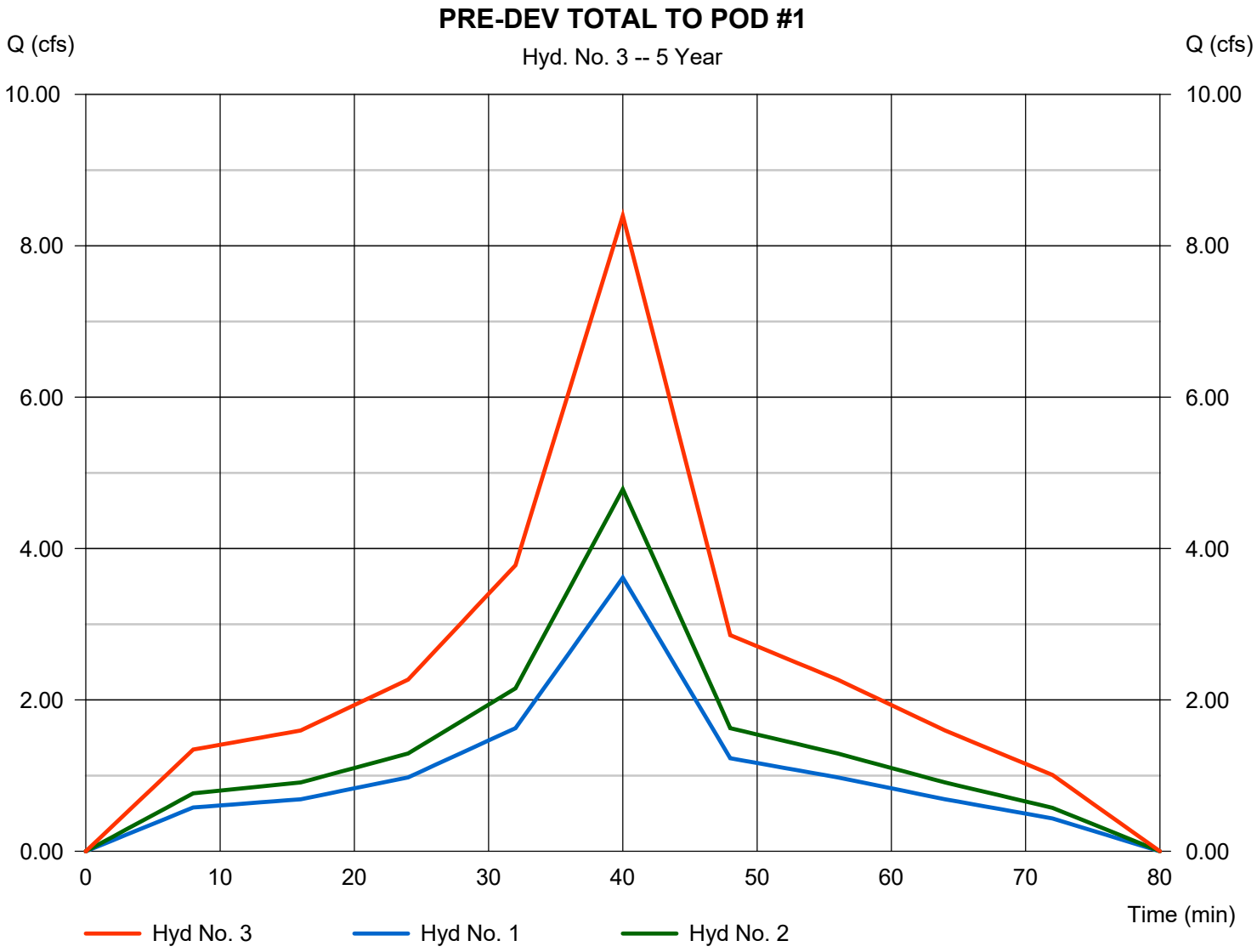


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 8.398 cfs
Storm frequency	= 5 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 12,053 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac



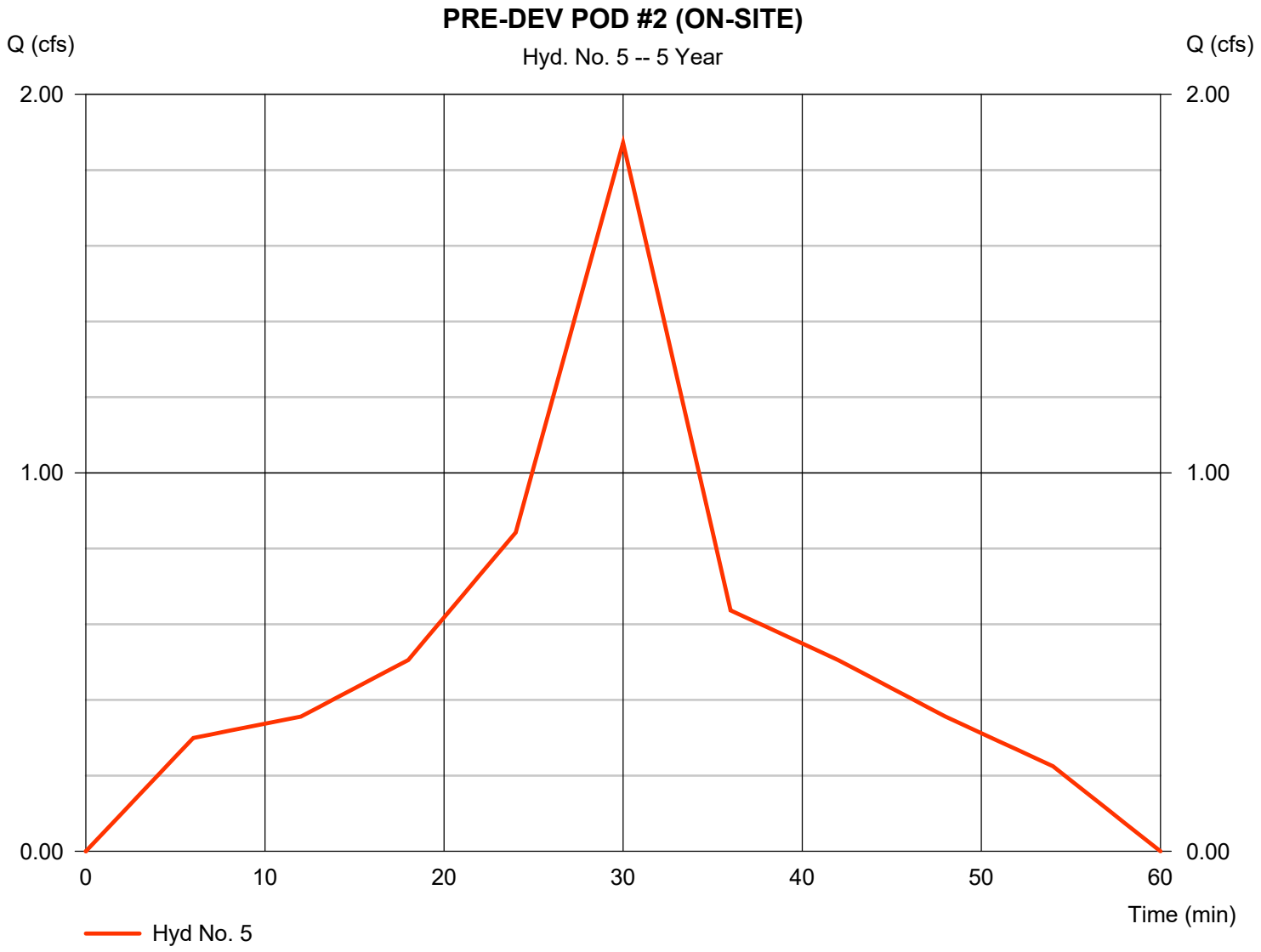
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.872 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,015 cuft
Drainage area	= 1.050 ac	Runoff coeff.	= 0.33
Intensity	= 5.403 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

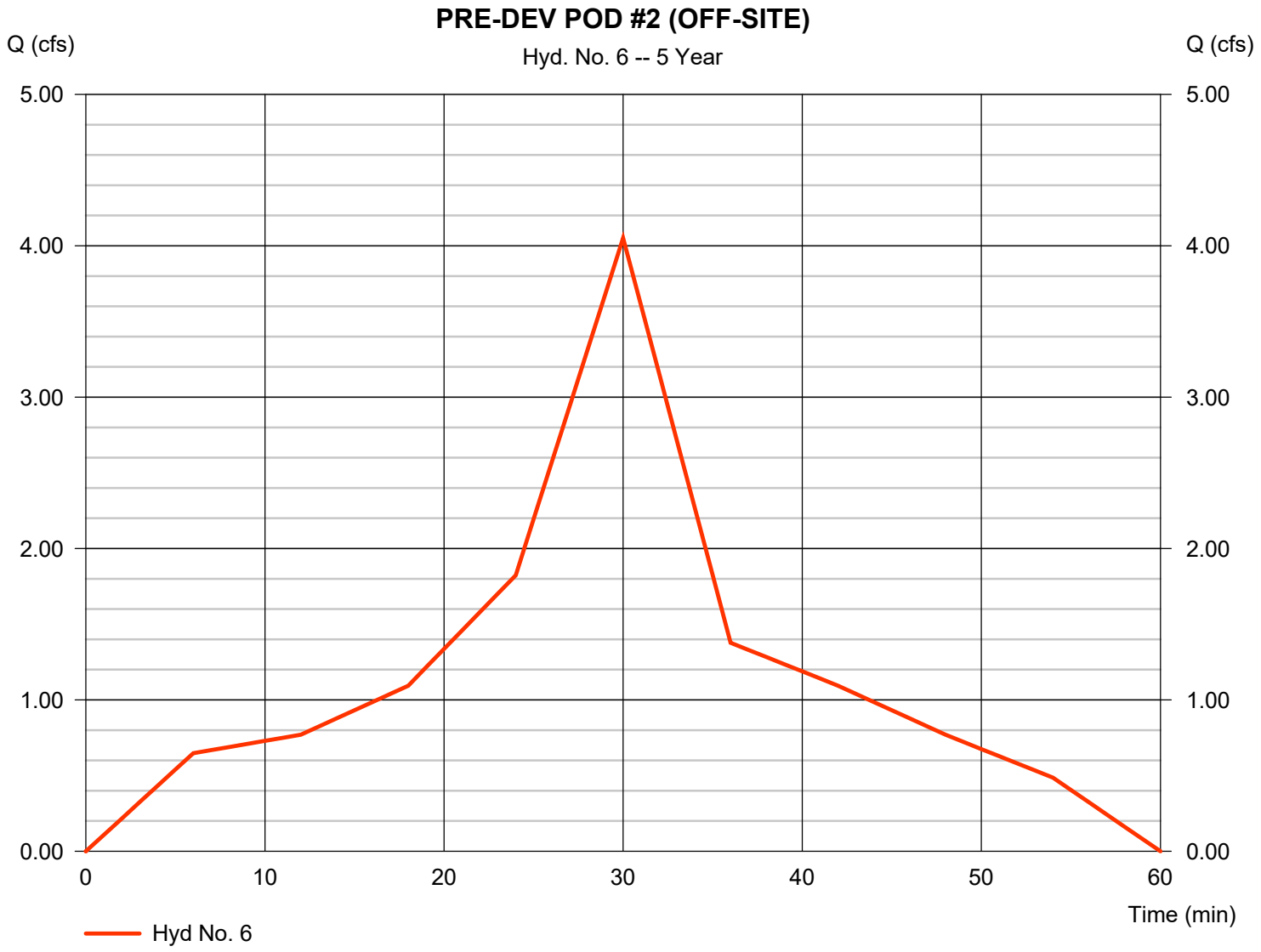


Hydrograph Report

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 4.051 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 4,361 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.46
Intensity	= 5.403 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

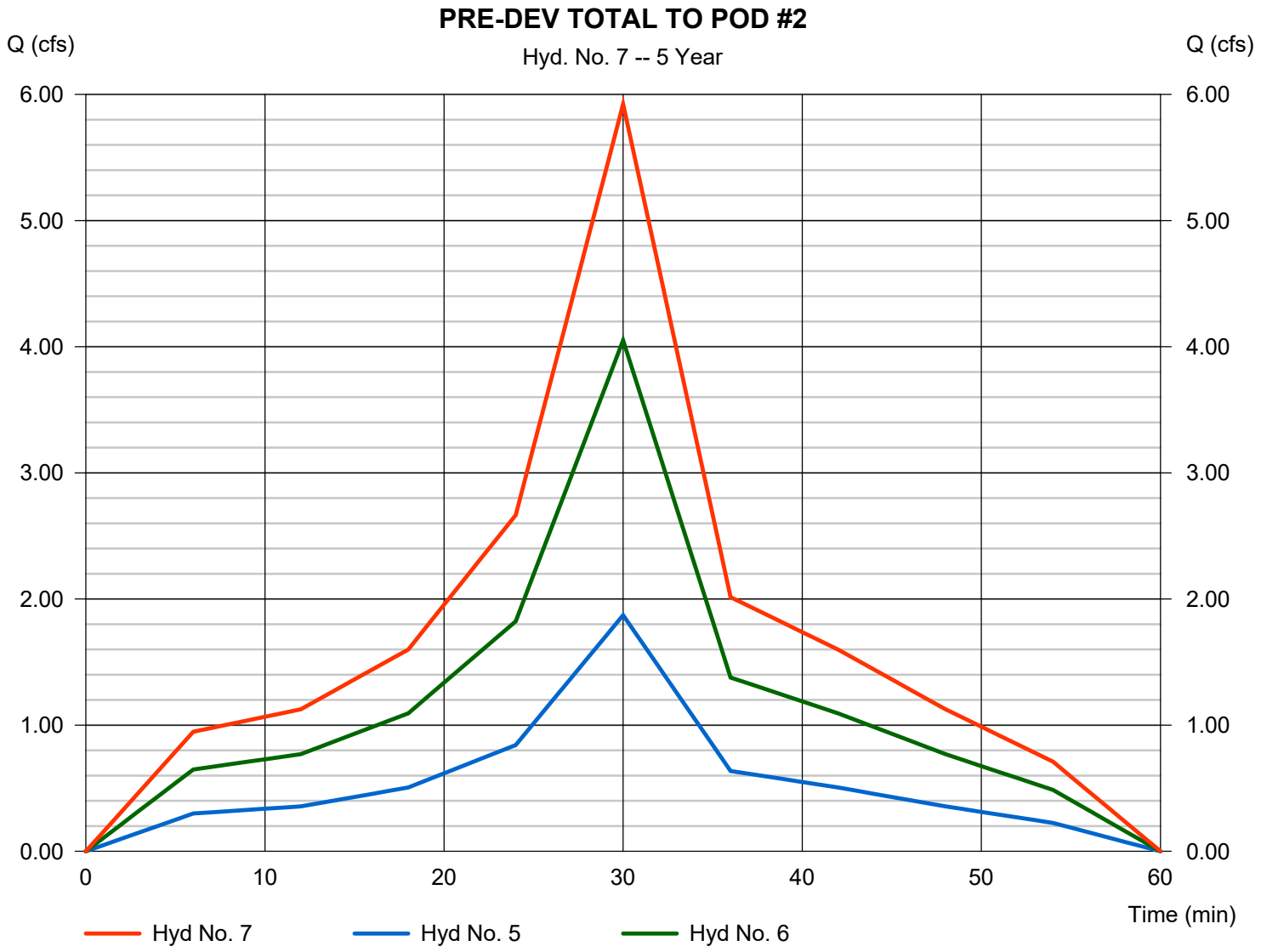


Hydrograph Report

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 5.923 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 6,376 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac



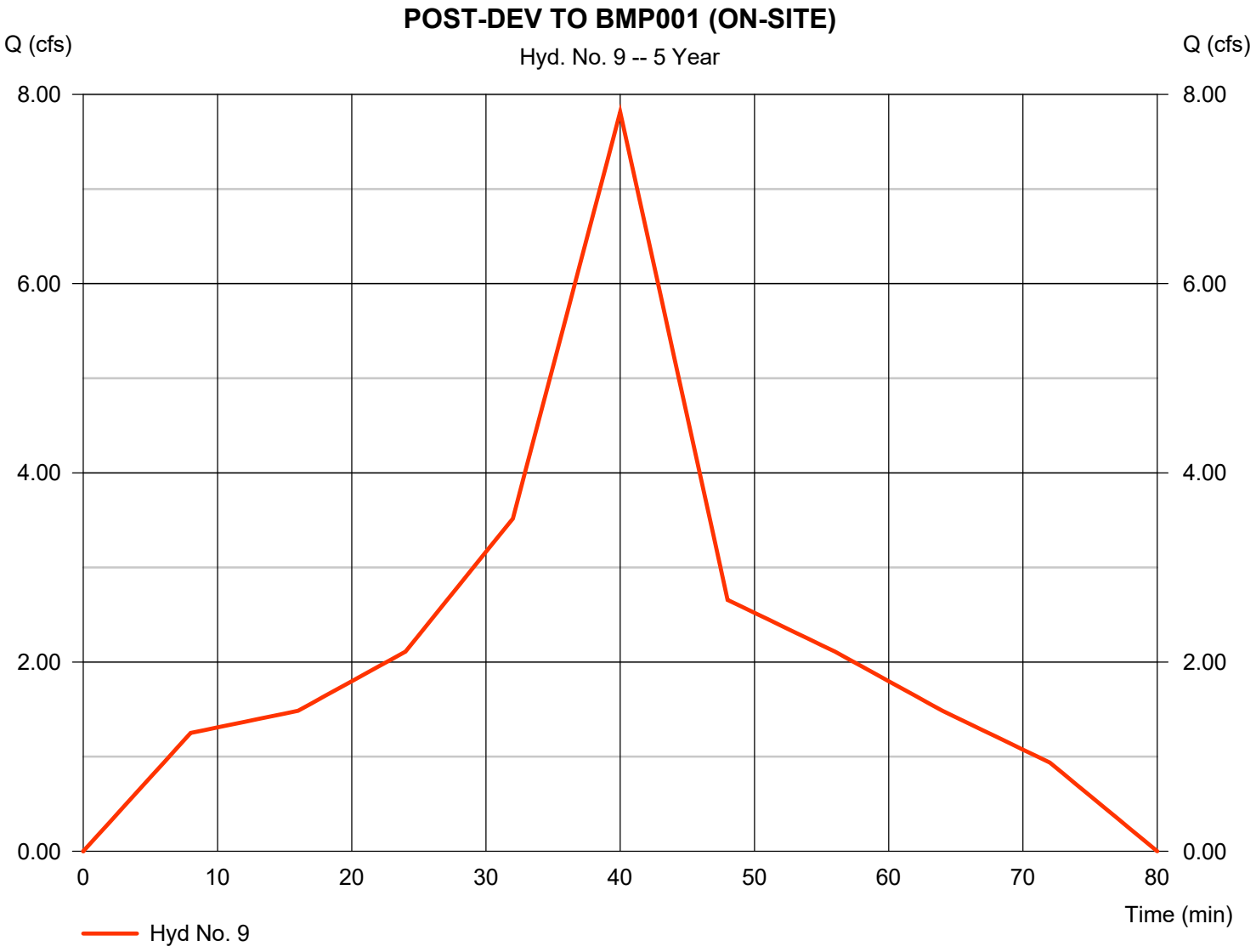
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	7.815 cfs
Storm frequency	=	5 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	11,216 cuft
Drainage area	=	2.500 ac	Runoff coeff.	=	0.63
Intensity	=	4.962 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a



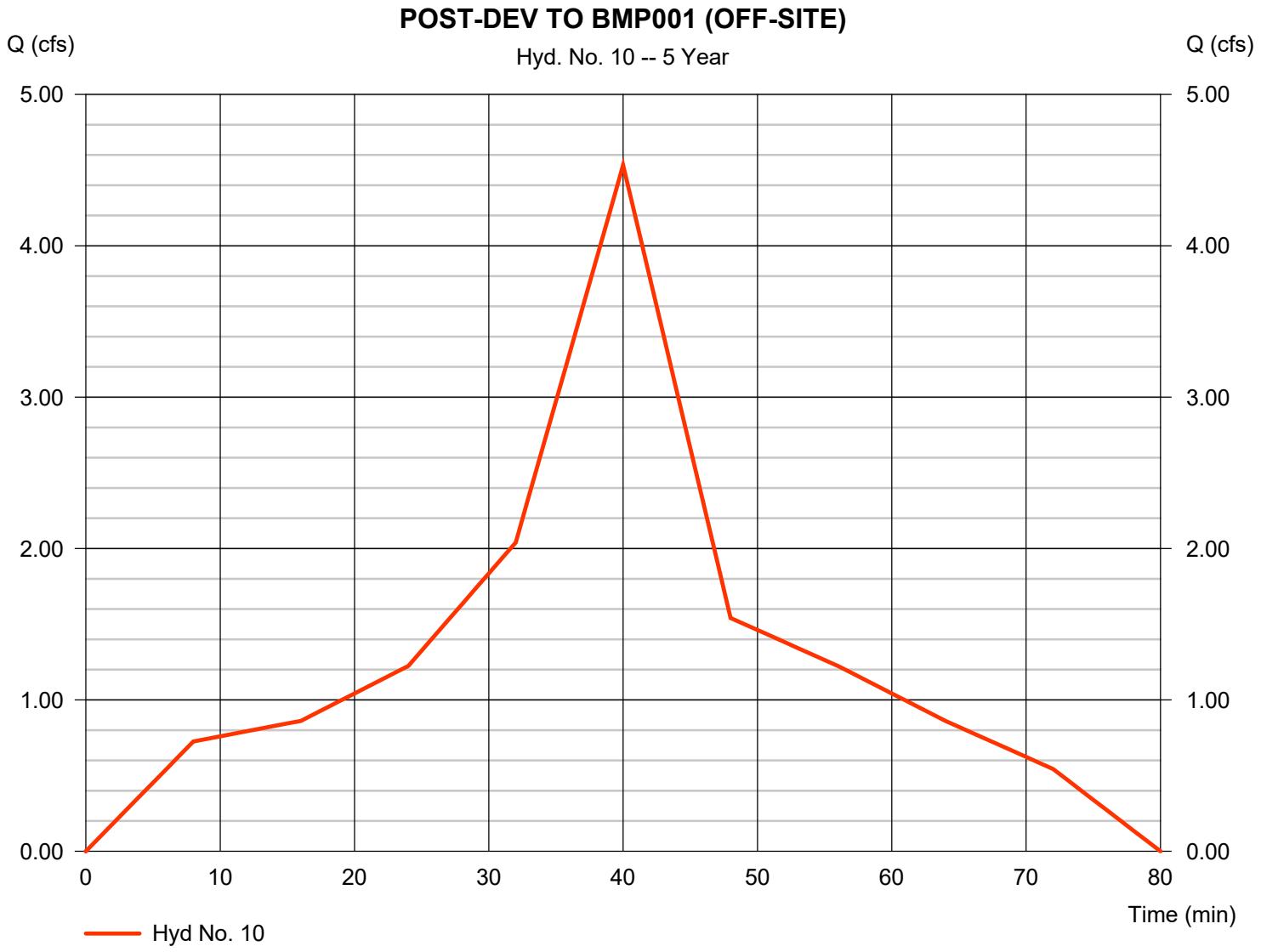
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	4.533 cfs
Storm frequency	=	5 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	6,505 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	4.962 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a



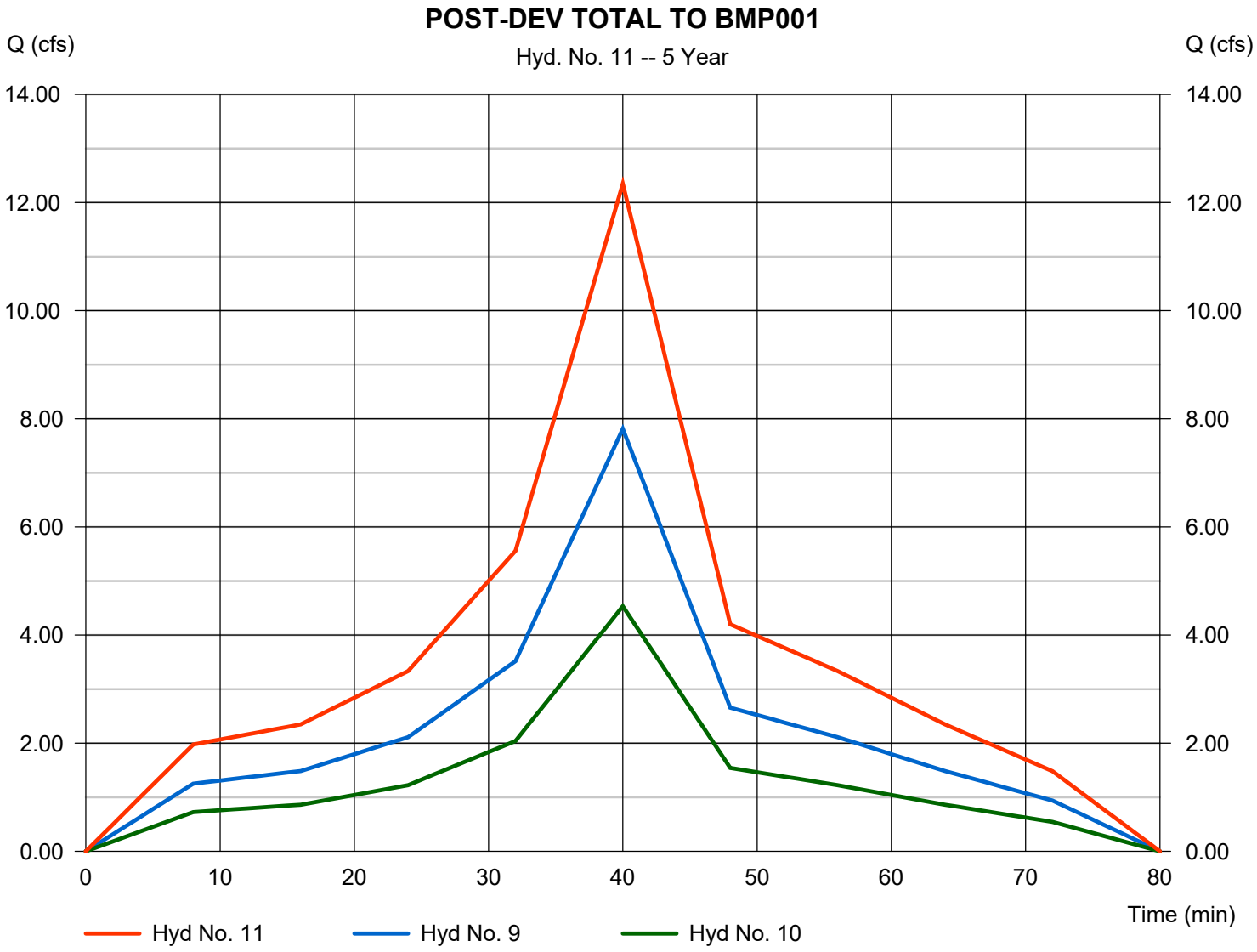
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 12.35 cfs
Storm frequency	= 5 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 17,721 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

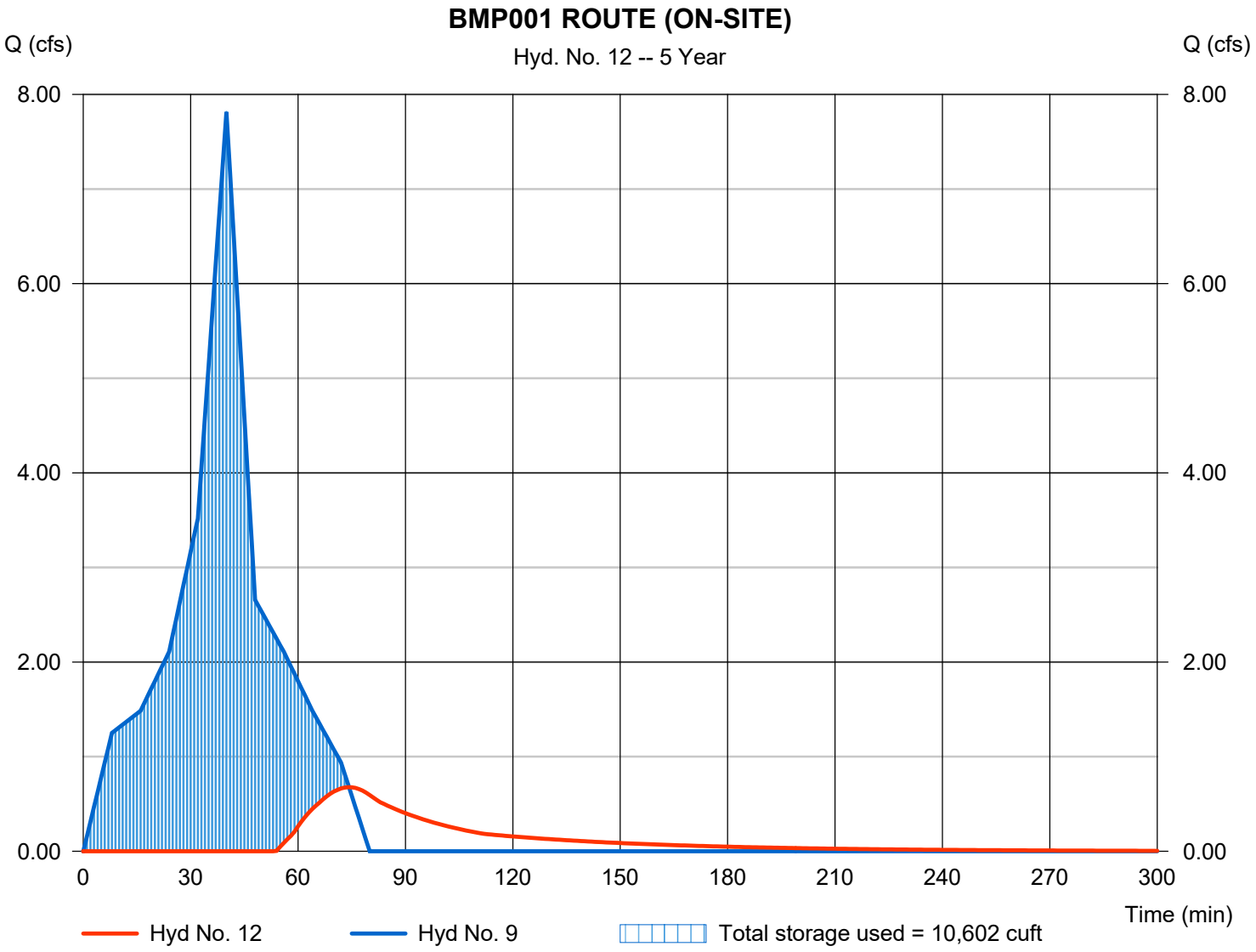
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 0.678 cfs
Storm frequency	= 5 yrs	Time to peak	= 74 min
Time interval	= 1 min	Hyd. volume	= 1,940 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.24 ft
Reservoir name	= BMP 001	Max. Storage	= 10,602 cuft

Storage Indication method used.



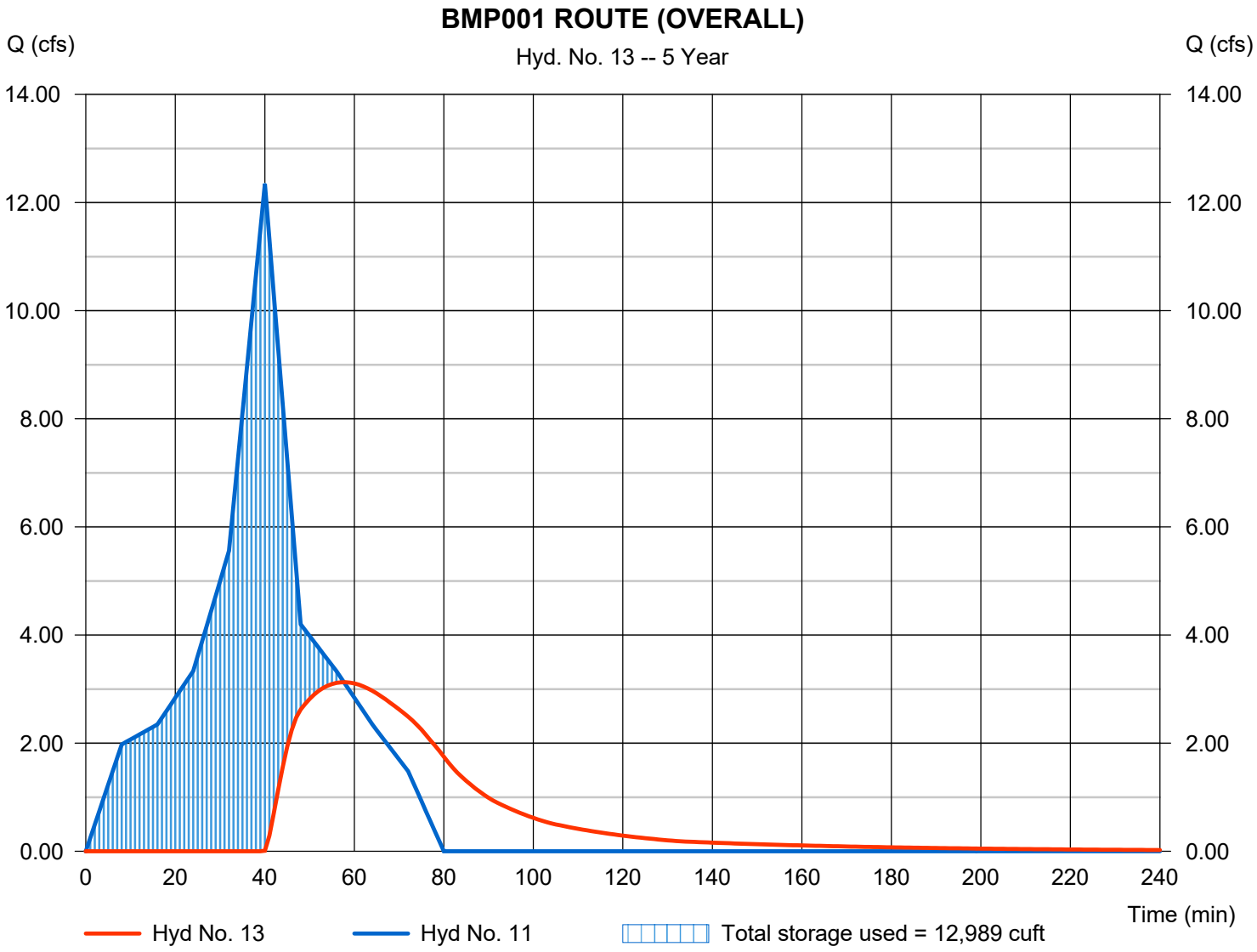
Hydrograph Report

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	3.128 cfs
Storm frequency	=	5 yrs	Time to peak	=	58 min
Time interval	=	1 min	Hyd. volume	=	8,445 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	134.66 ft
Reservoir name	=	BMP 001	Max. Storage	=	12,989 cuft

Storage Indication method used.

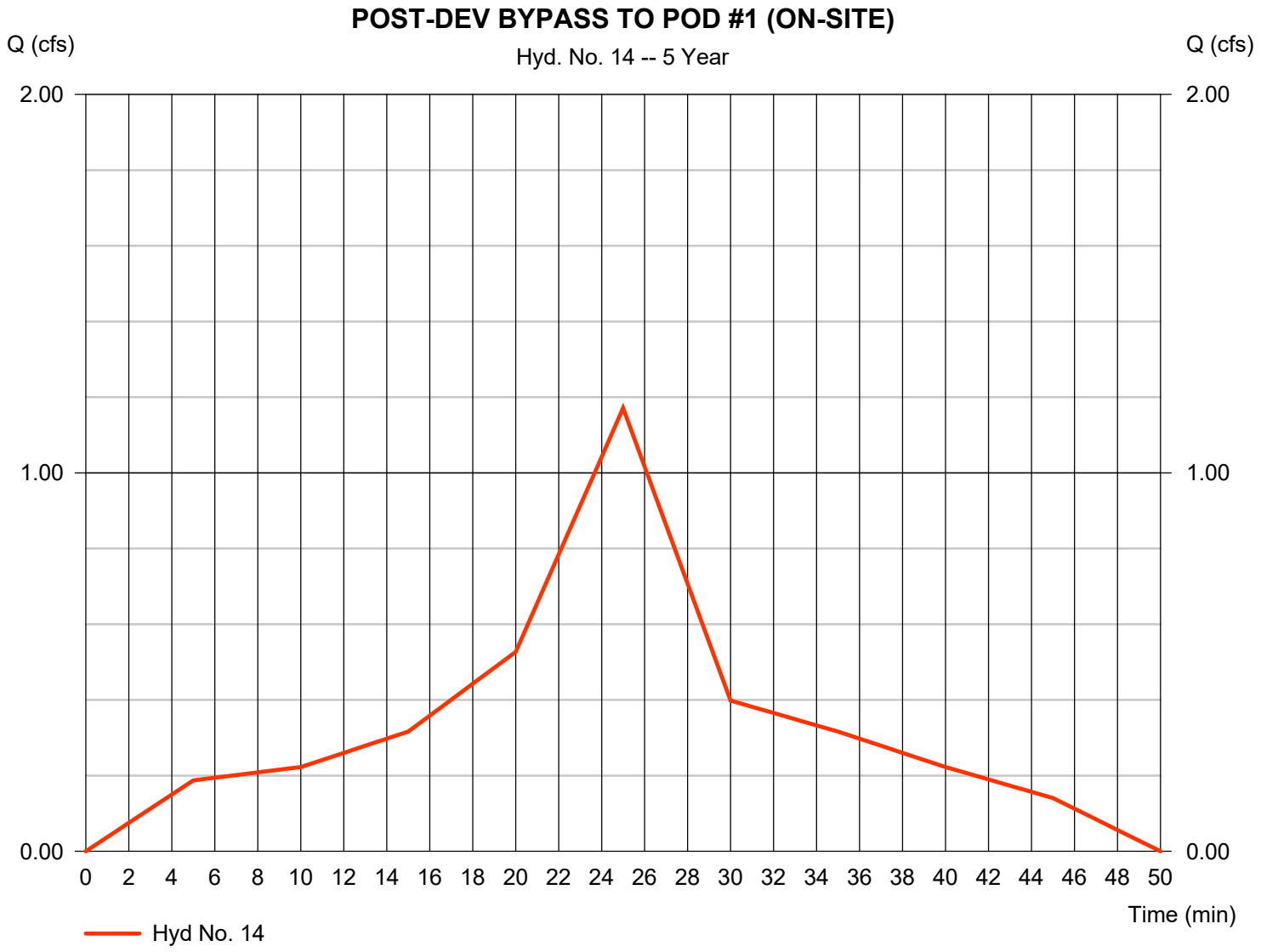


Hydrograph Report

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.171 cfs
Storm frequency	= 5 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,051 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 5.658 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



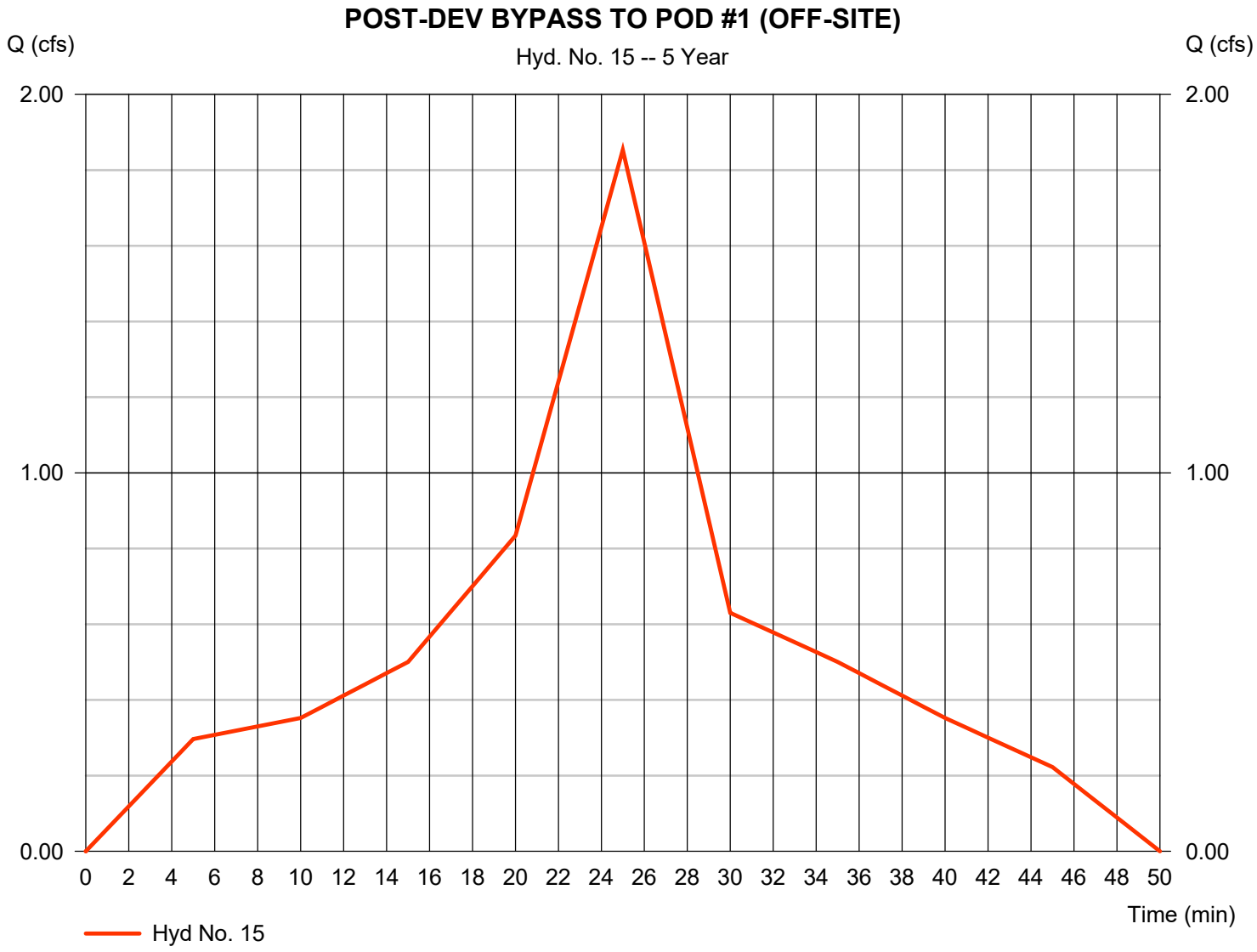
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.853 cfs
Storm frequency	= 5 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,663 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 5.658 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



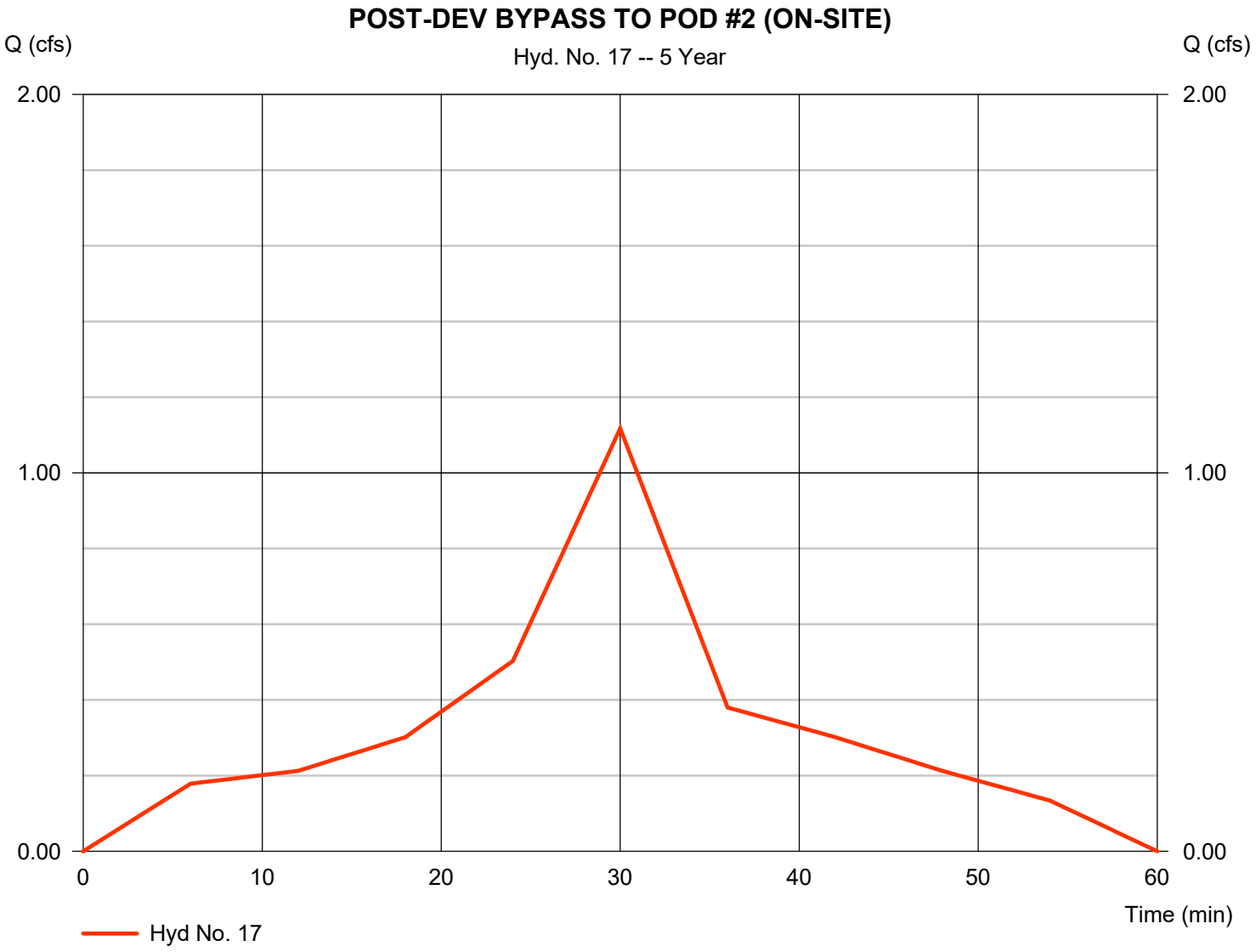
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.117 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,203 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 5.403 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

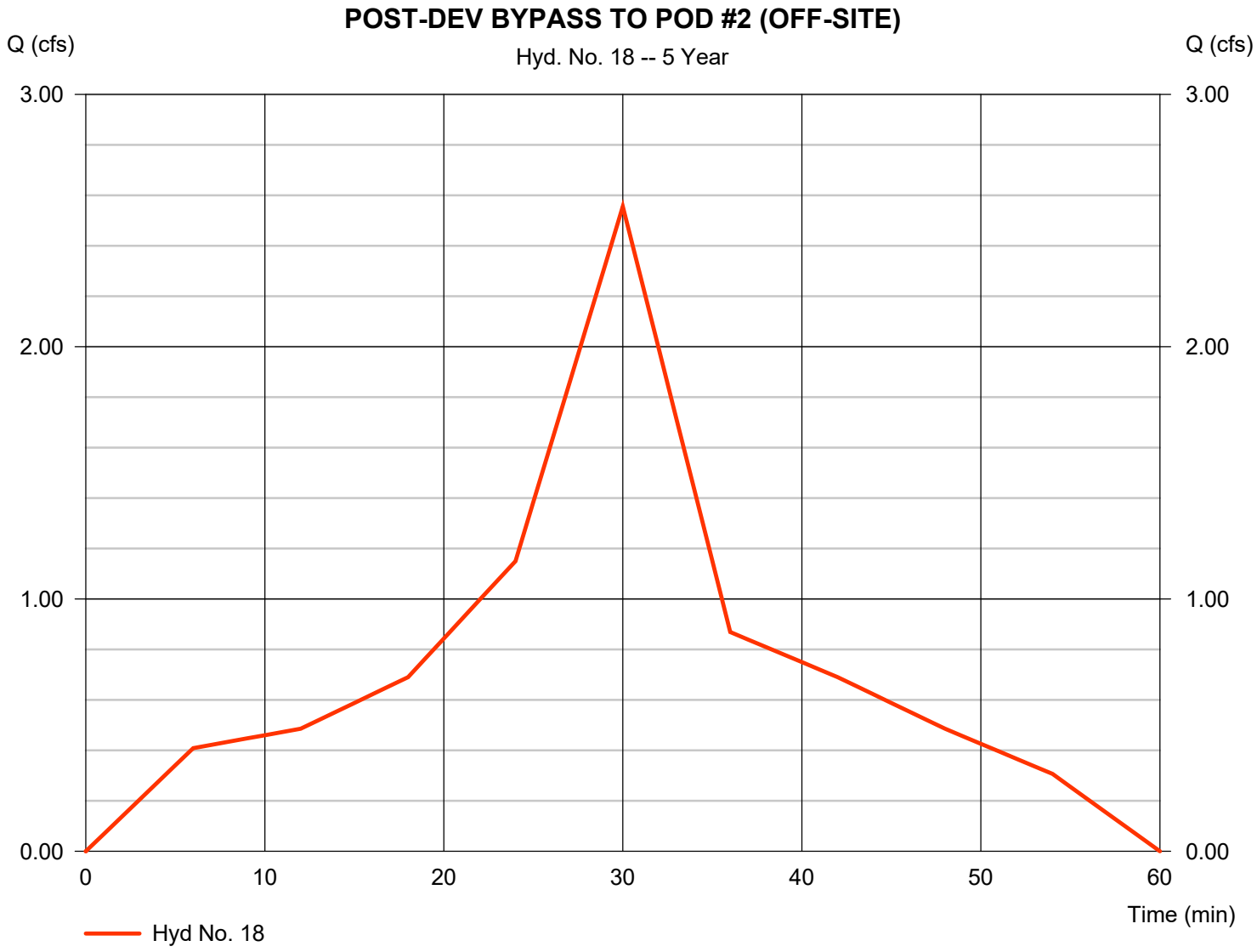


Hydrograph Report

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.556 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,751 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.43
Intensity	= 5.403 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

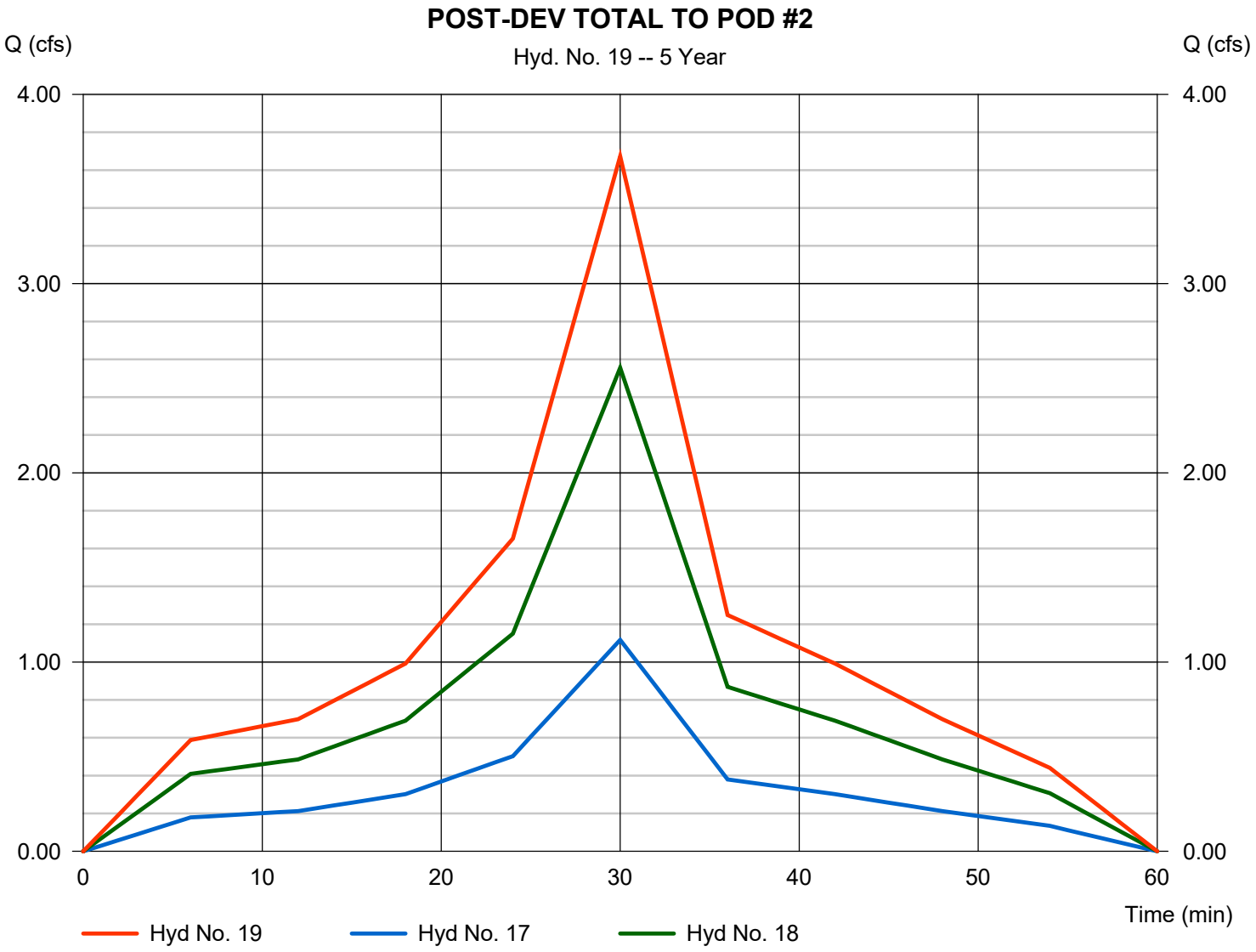


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 3.673 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 3,954 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



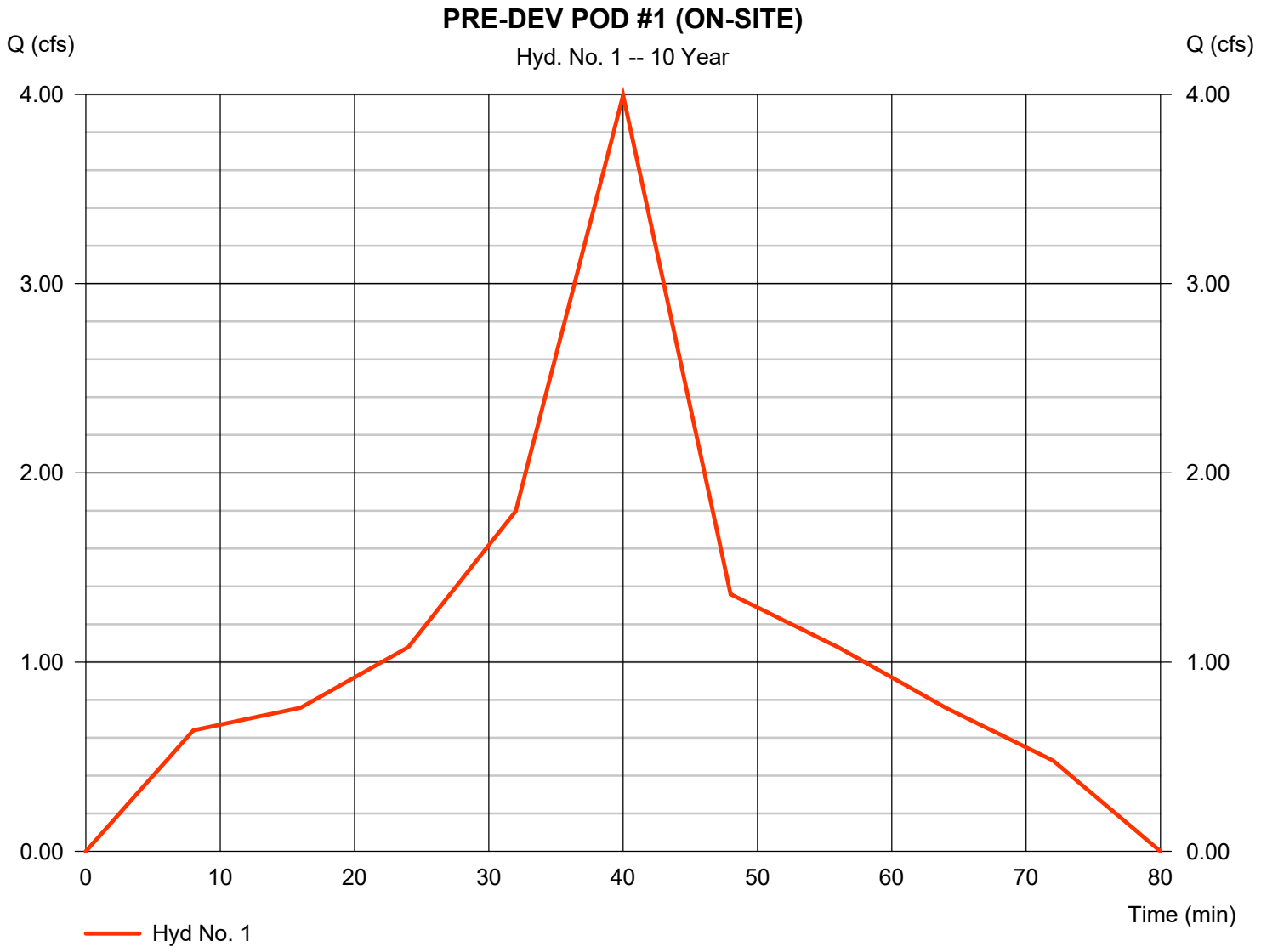
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.995 cfs
Storm frequency	=	10 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	5,734 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	5.485 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

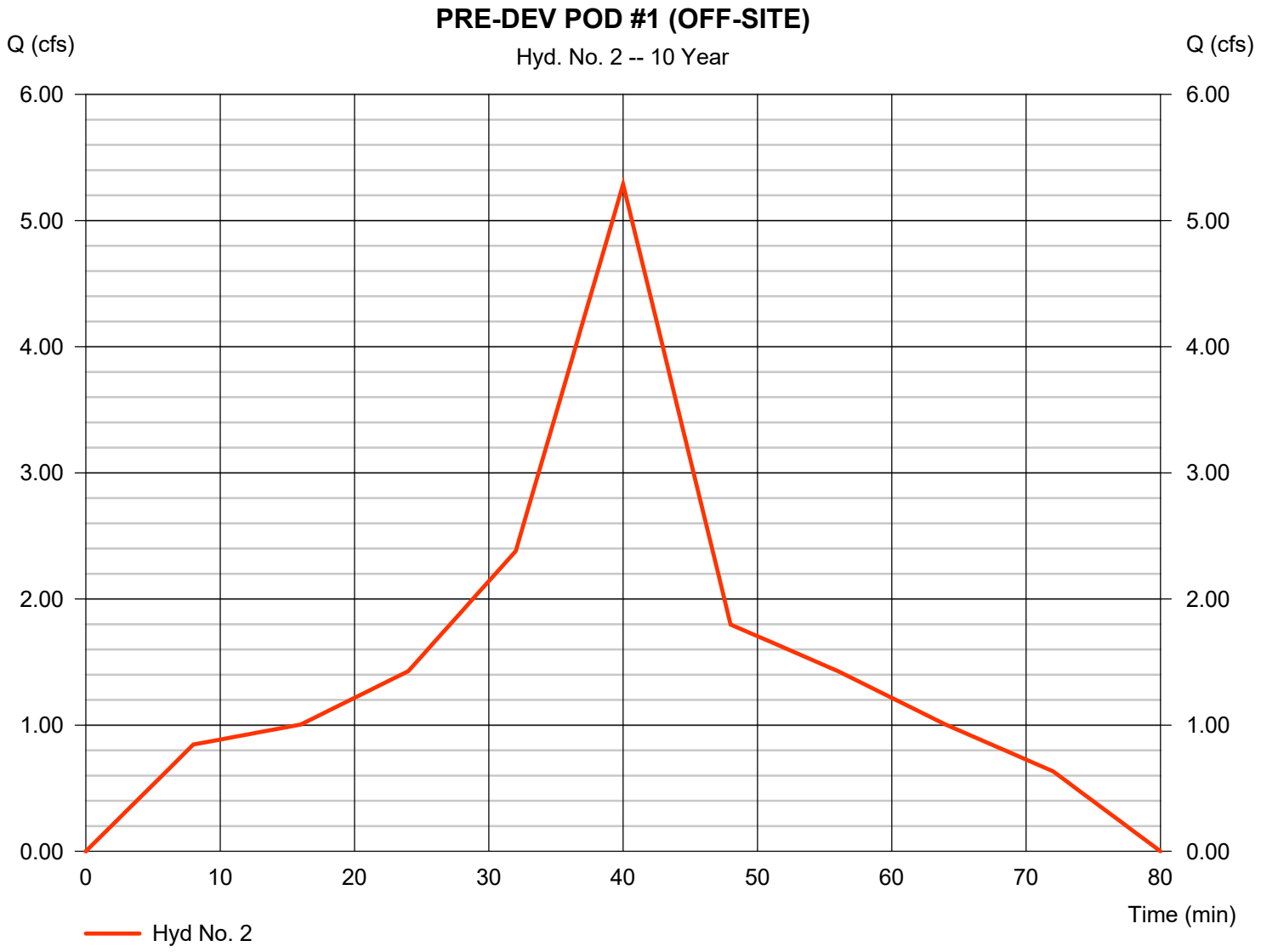


Hydrograph Report

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 5.287 cfs
Storm frequency	= 10 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 7,588 cuft
Drainage area	= 2.410 ac	Runoff coeff.	= 0.4
Intensity	= 5.485 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

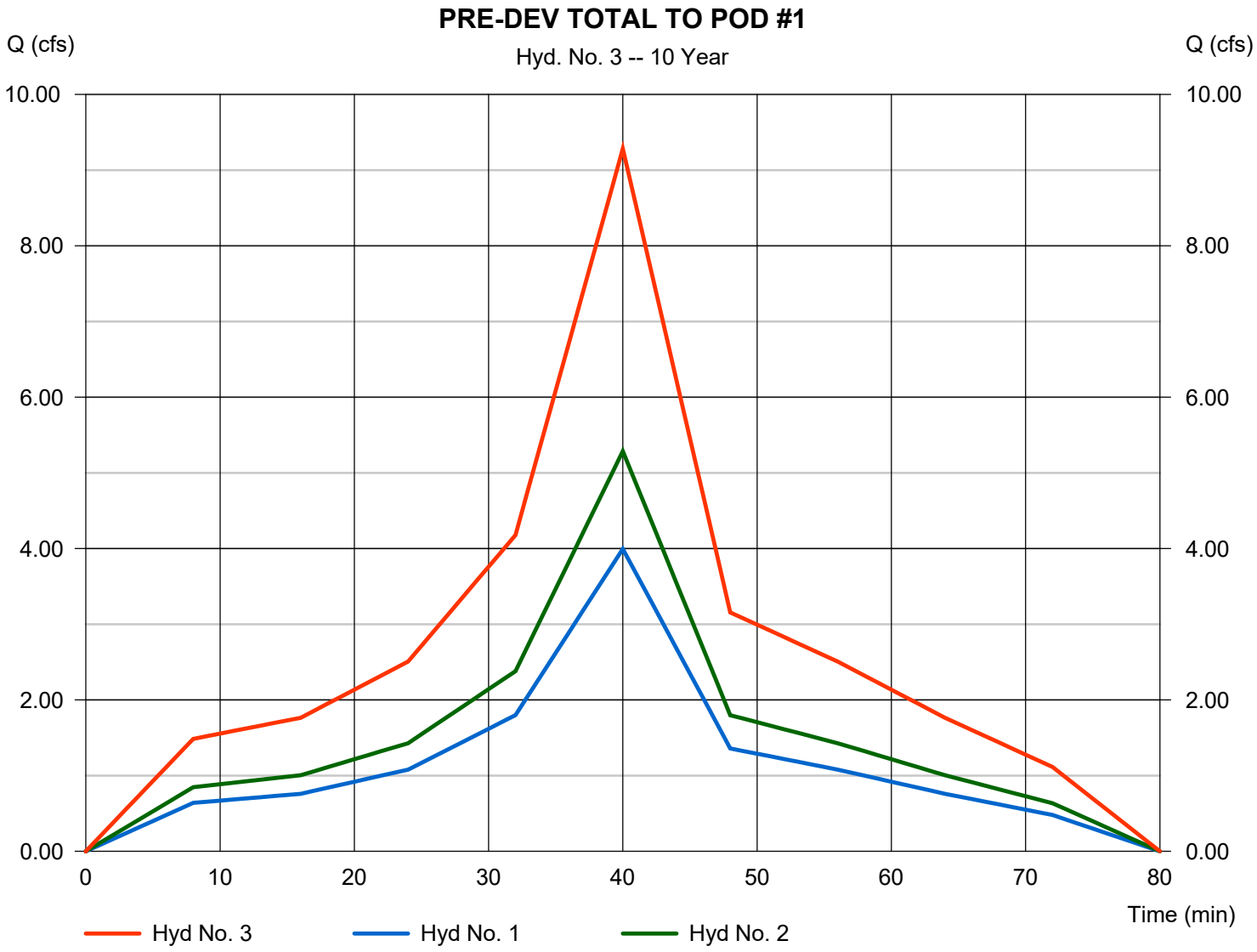


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 9.283 cfs
Storm frequency	= 10 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 13,322 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac



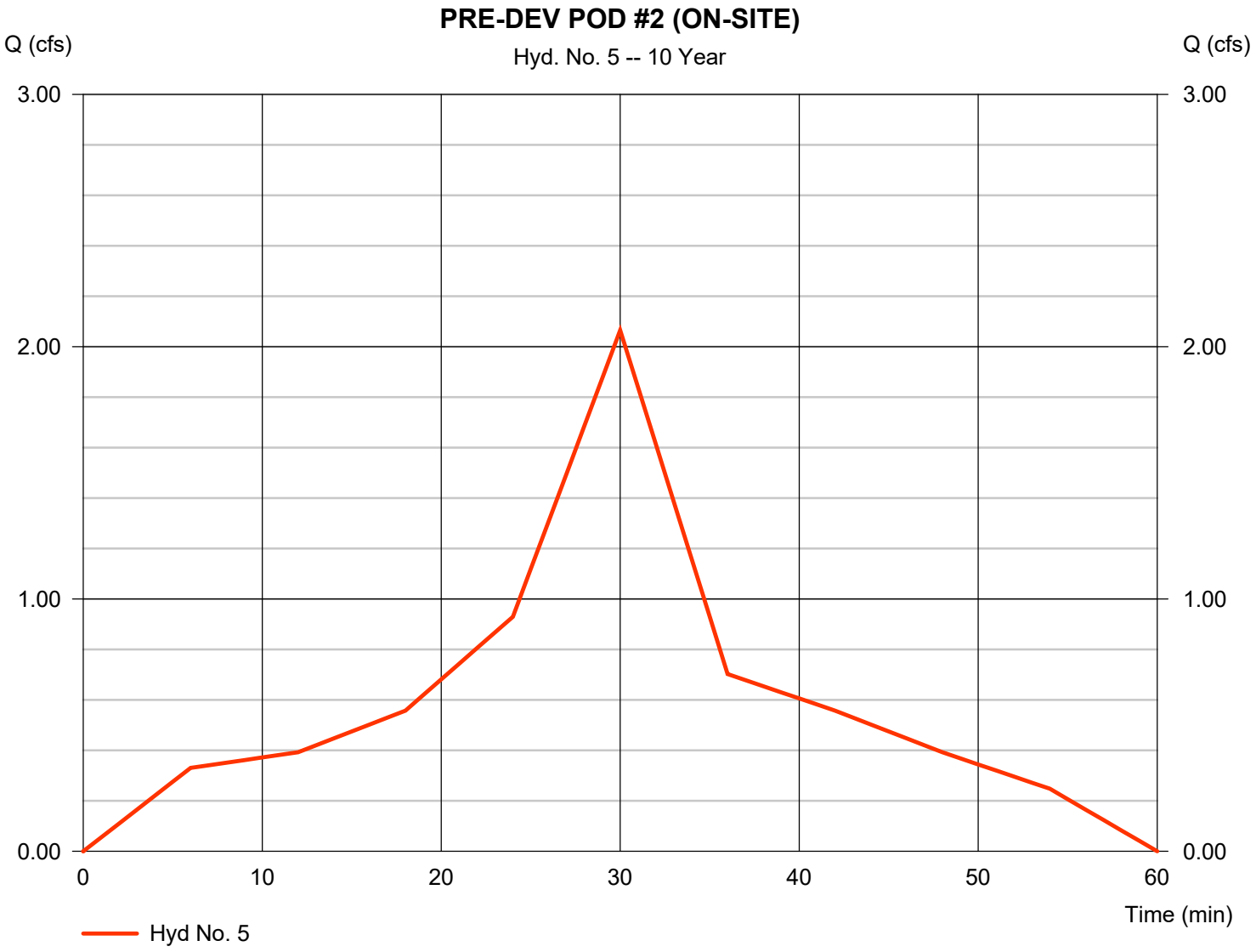
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	2.065 cfs
Storm frequency	=	10 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	2,223 cuft
Drainage area	=	1.050 ac	Runoff coeff.	=	0.33
Intensity	=	5.960 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a



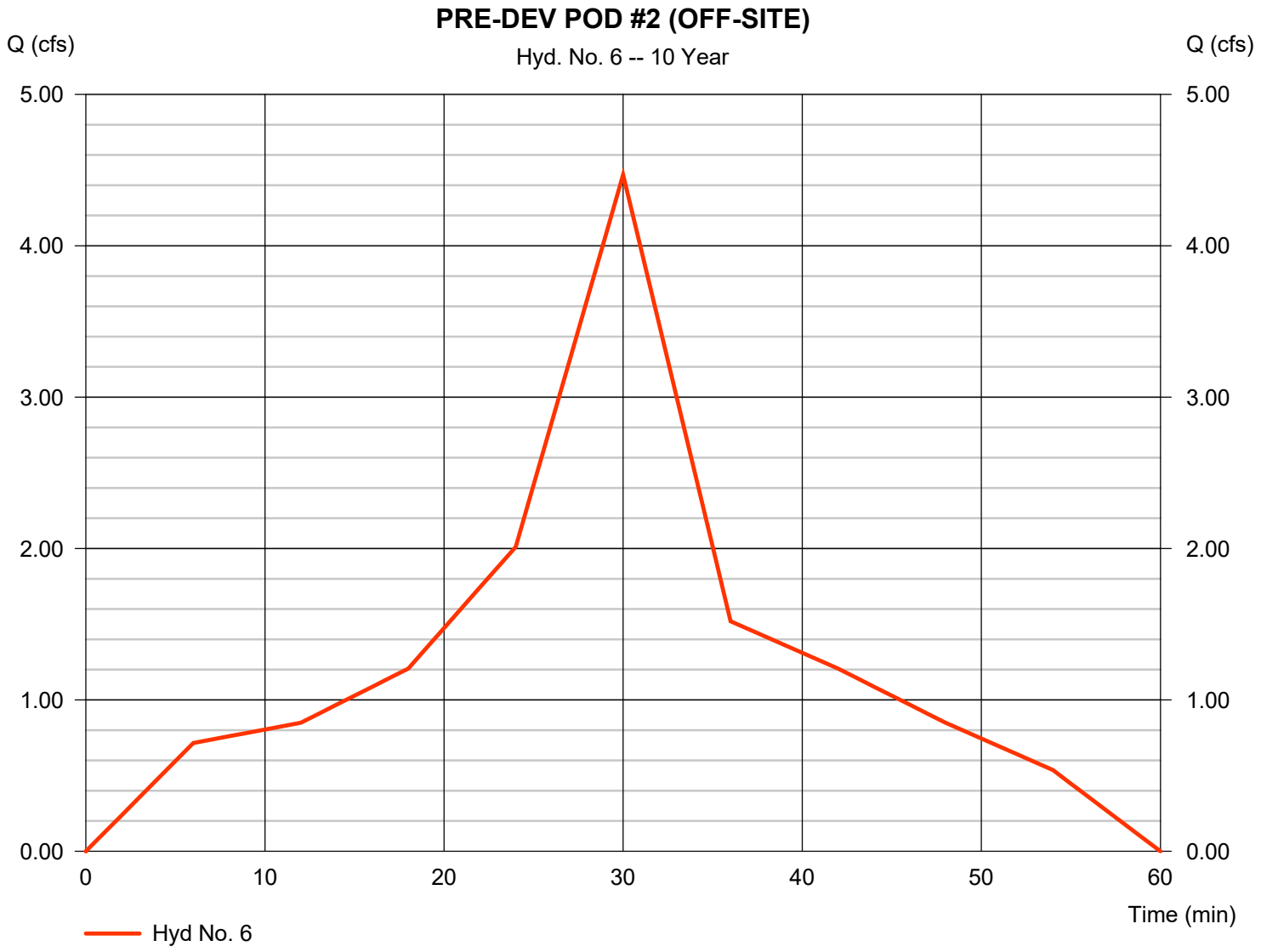
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	4.469 cfs
Storm frequency	=	10 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	4,810 cuft
Drainage area	=	1.630 ac	Runoff coeff.	=	0.46
Intensity	=	5.960 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

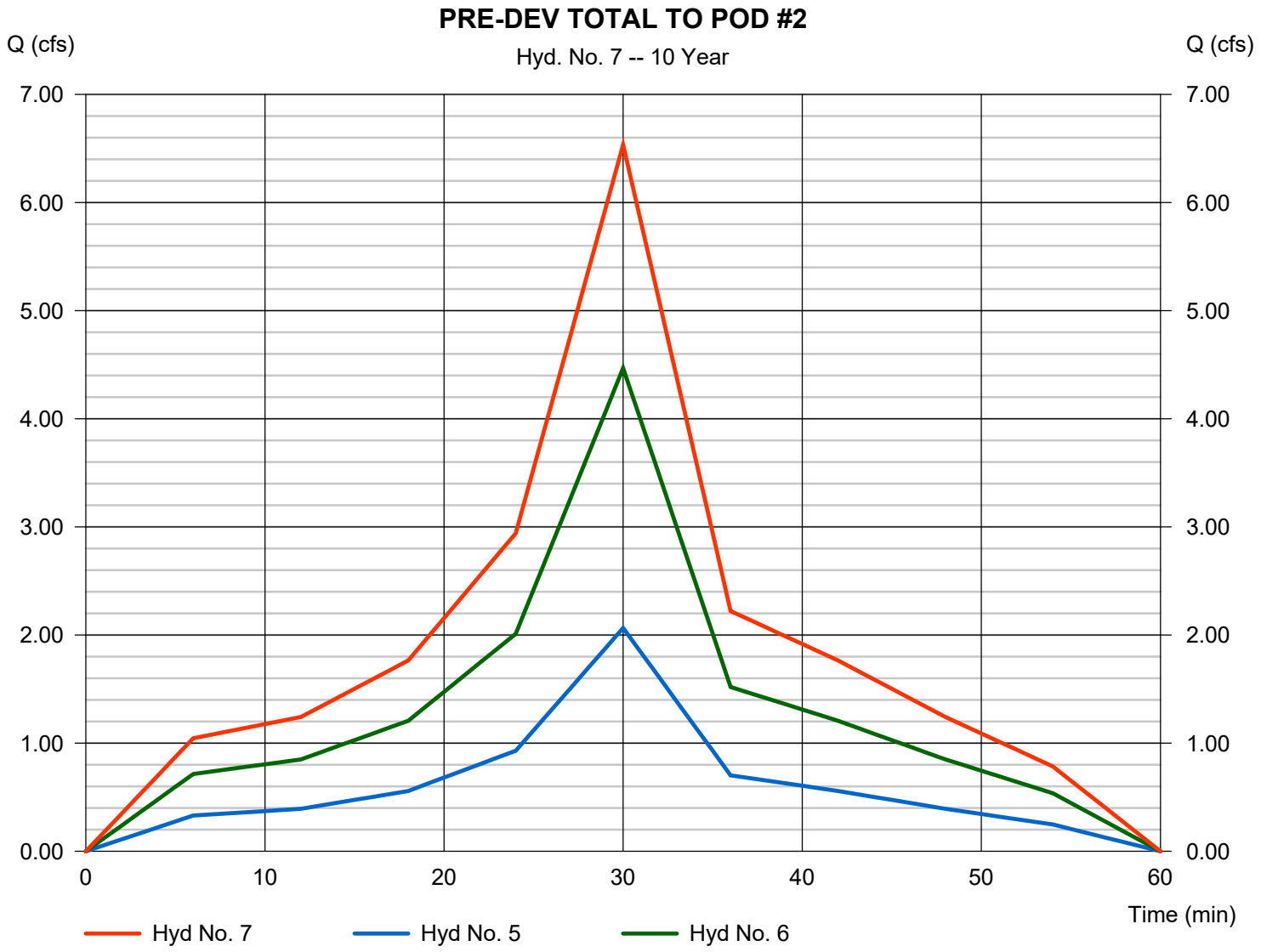


Hydrograph Report

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 6.534 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 7,033 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac

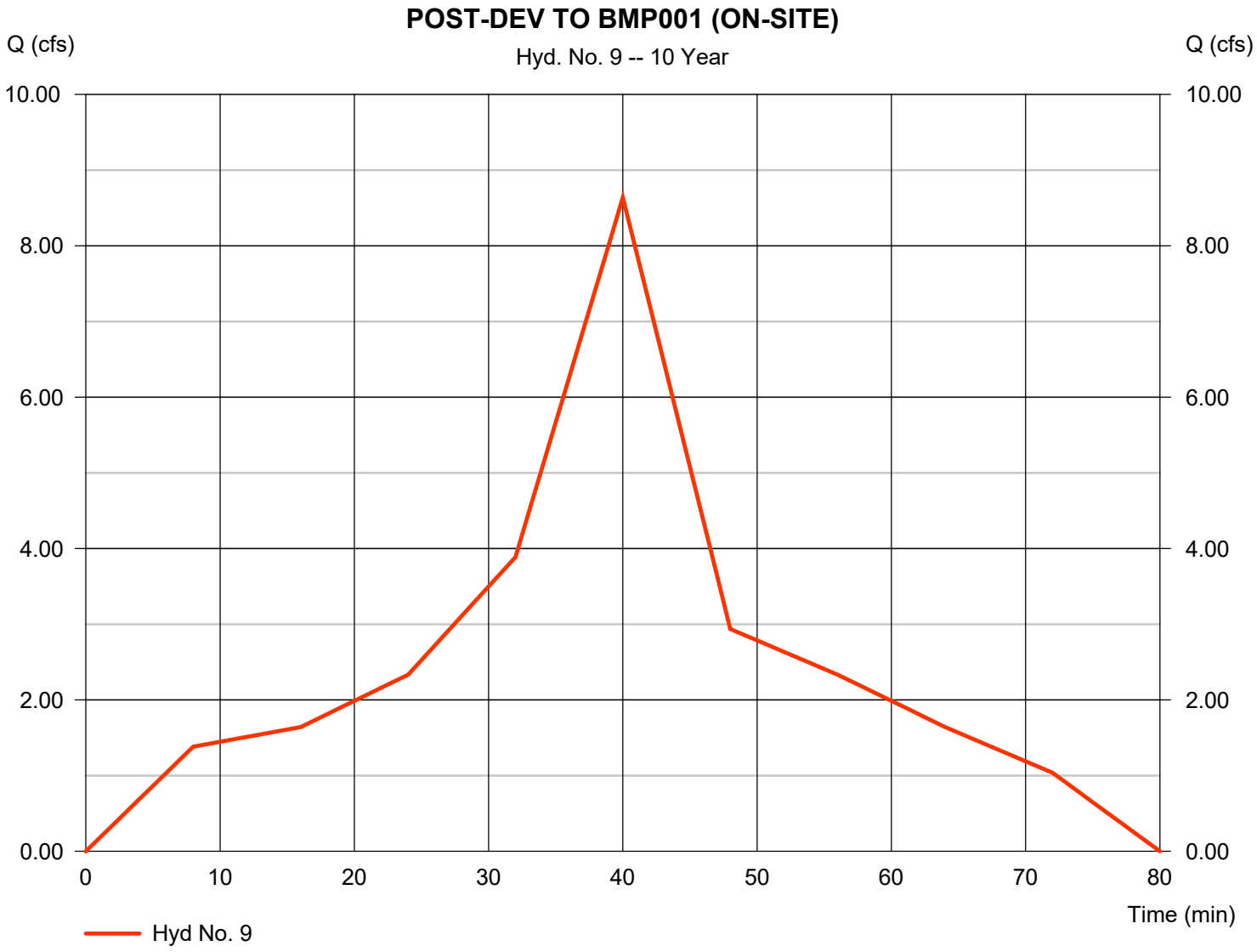


Hydrograph Report

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 8.638 cfs
Storm frequency	= 10 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 12,397 cuft
Drainage area	= 2.500 ac	Runoff coeff.	= 0.63
Intensity	= 5.485 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



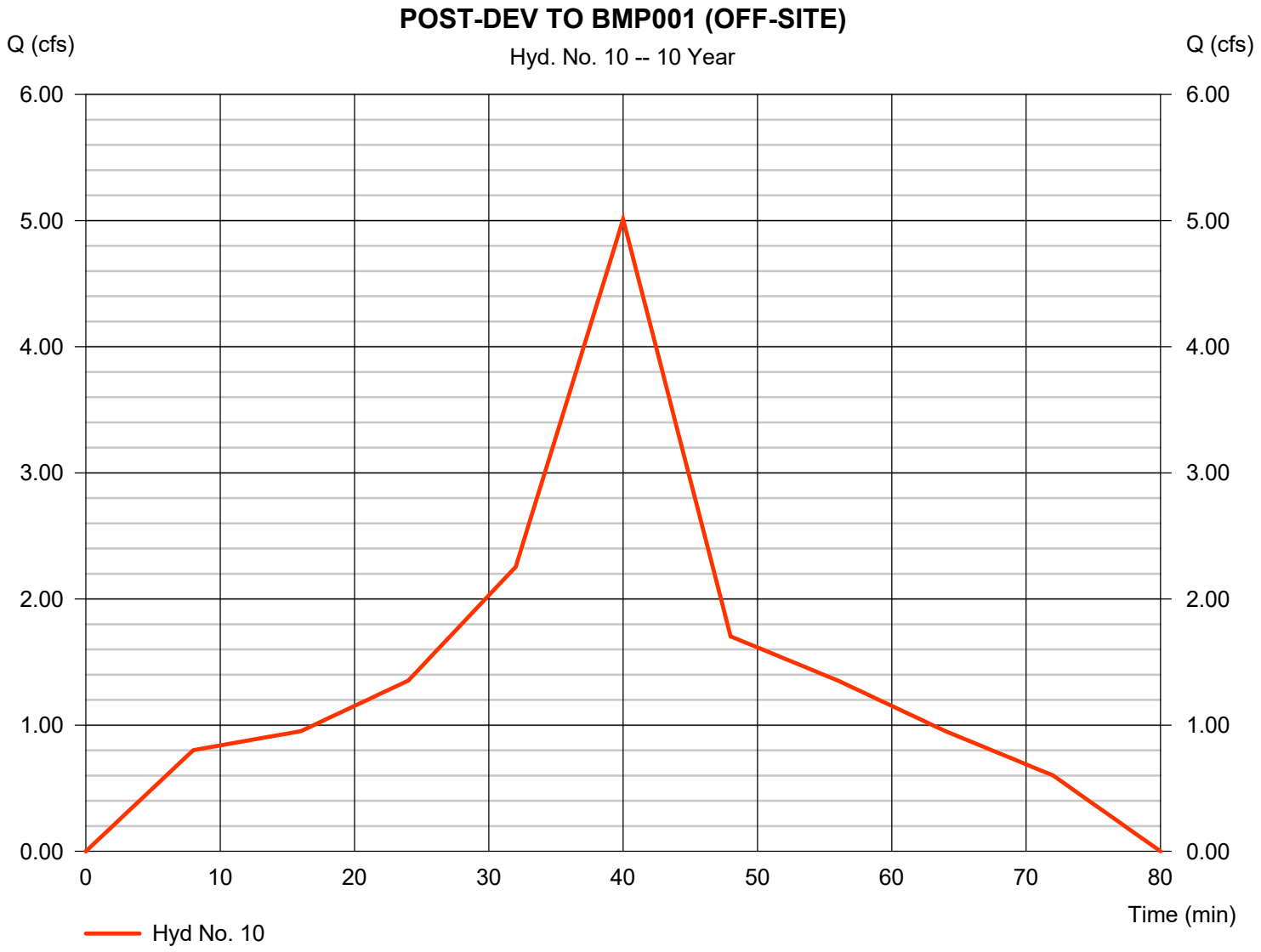
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.010 cfs
Storm frequency	=	10 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	7,191 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	5.485 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a



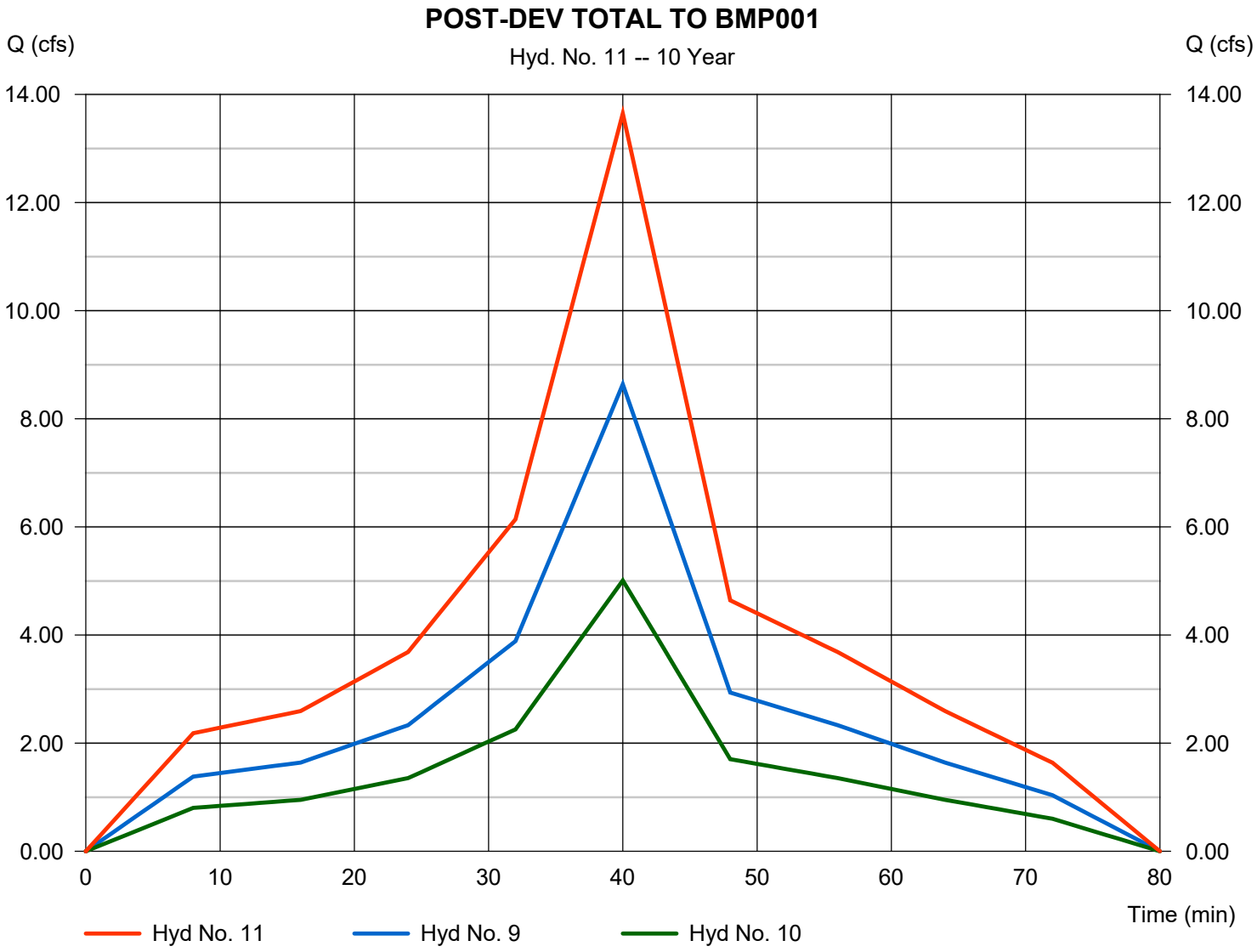
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 13.65 cfs
Storm frequency	= 10 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 19,588 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

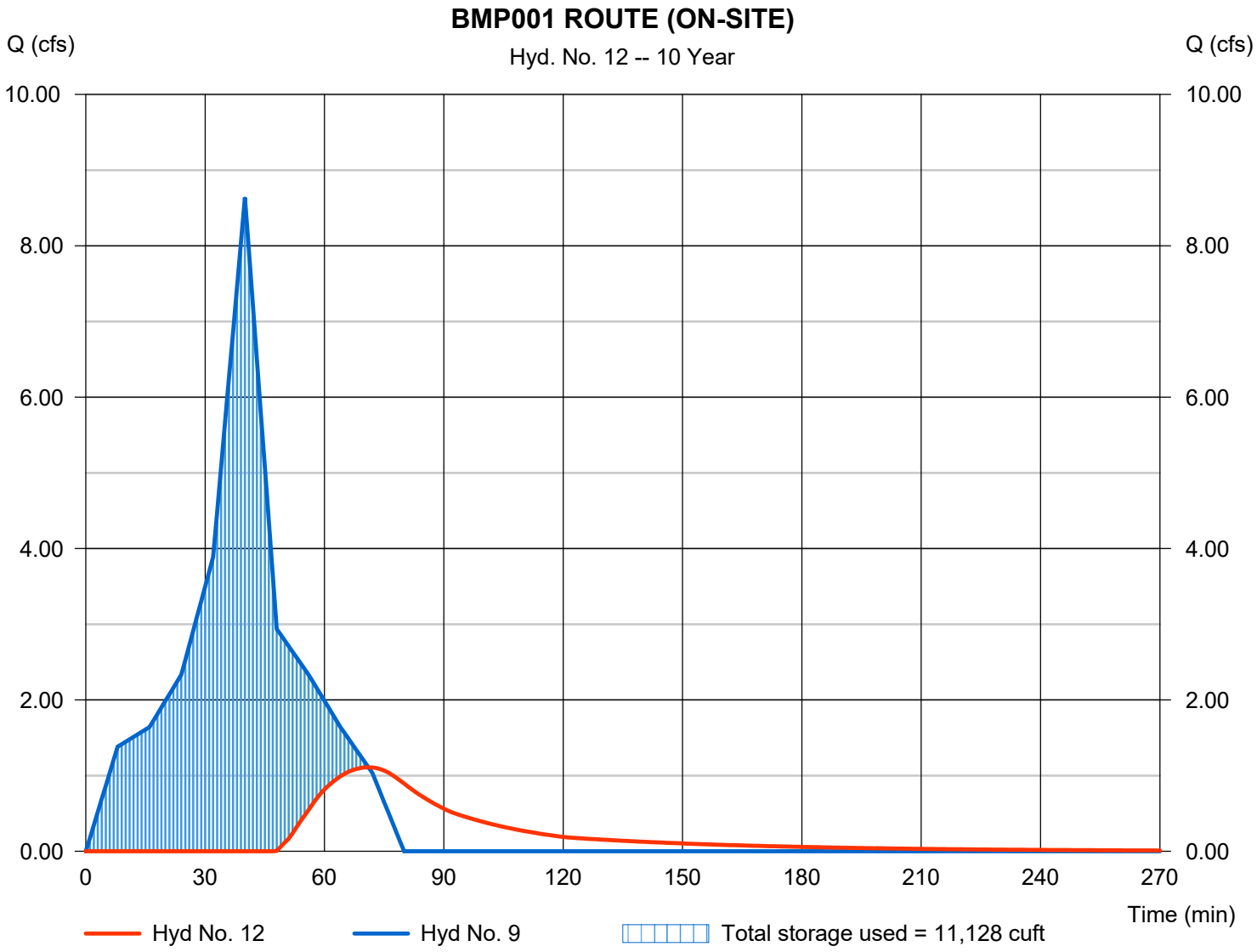
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 1.109 cfs
Storm frequency	= 10 yrs	Time to peak	= 71 min
Time interval	= 1 min	Hyd. volume	= 3,121 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.33 ft
Reservoir name	= BMP 001	Max. Storage	= 11,128 cuft

Storage Indication method used.



Hydrograph Report

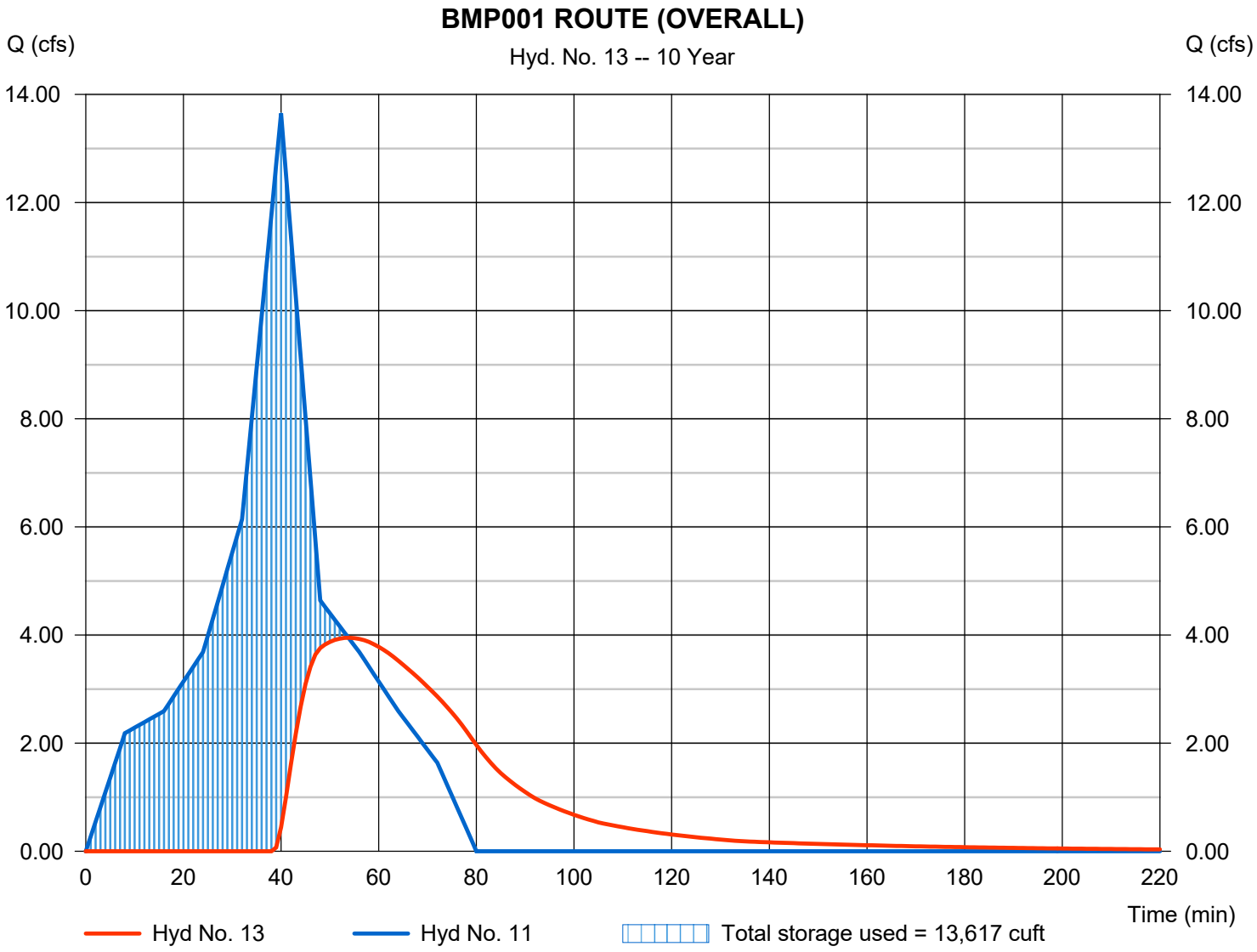
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	3.949 cfs
Storm frequency	=	10 yrs	Time to peak	=	54 min
Time interval	=	1 min	Hyd. volume	=	10,312 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	134.77 ft
Reservoir name	=	BMP 001	Max. Storage	=	13,617 cuft

Storage Indication method used.

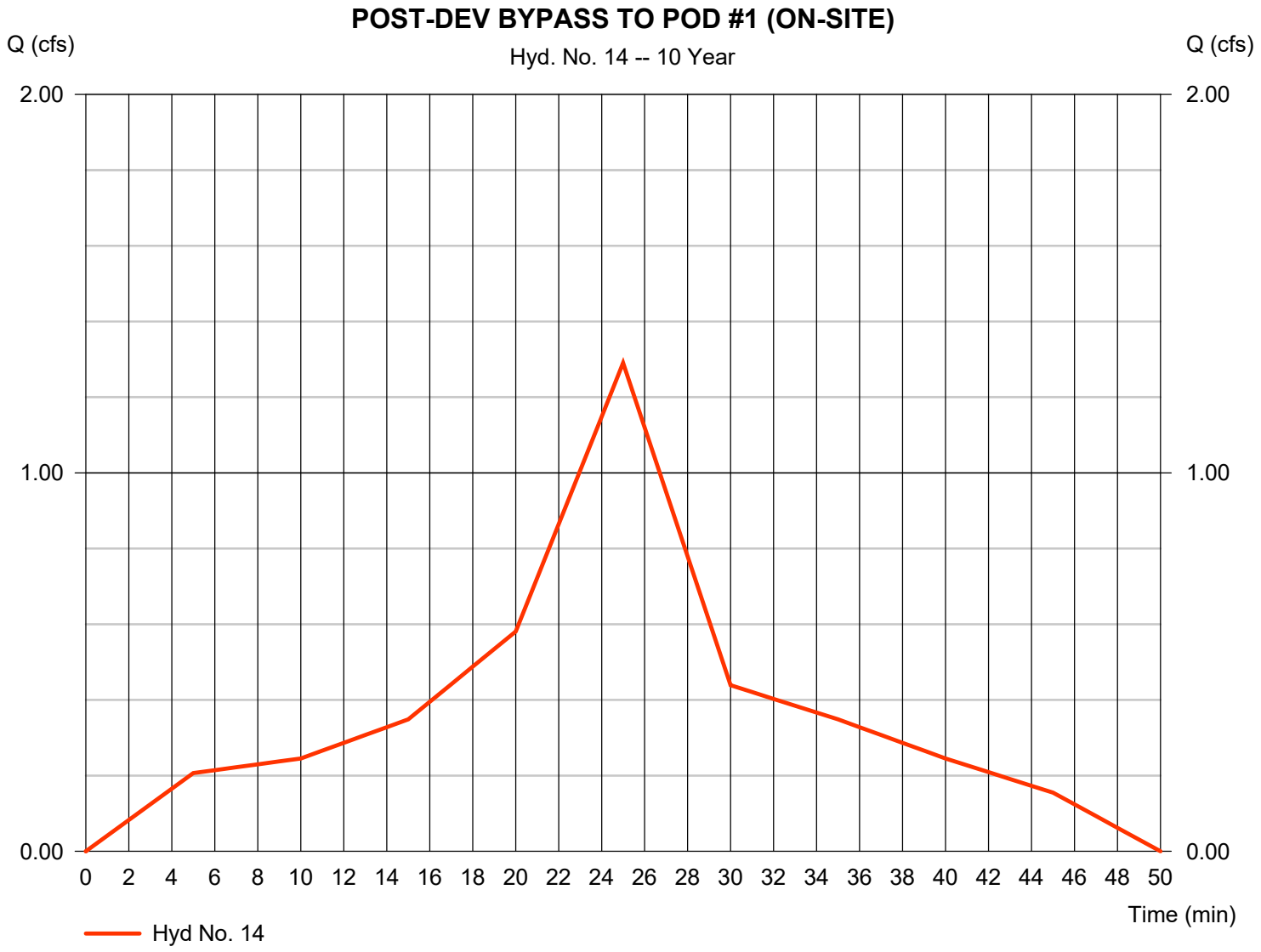


Hydrograph Report

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.291 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,158 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 6.235 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



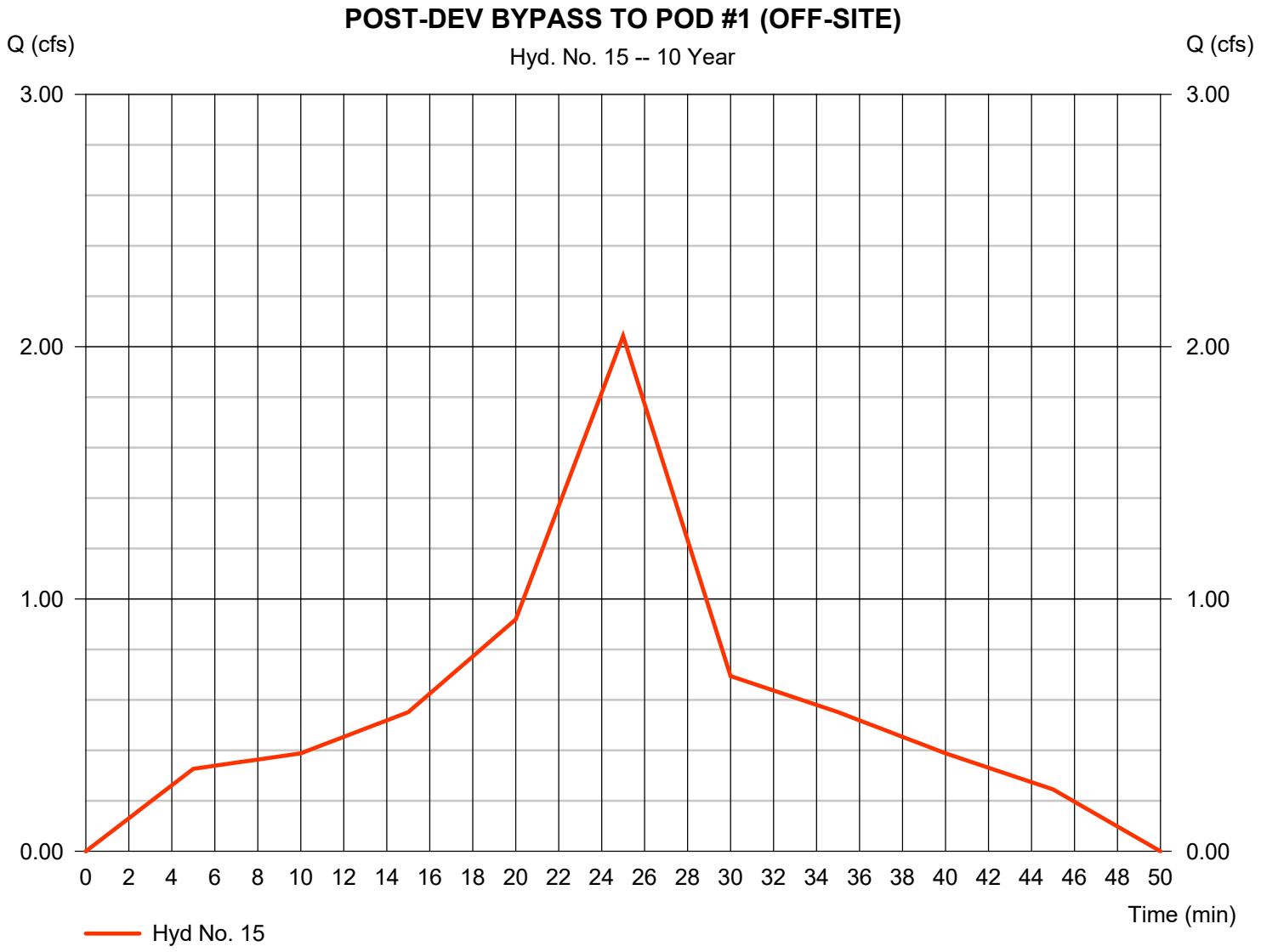
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.043 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,832 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 6.235 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

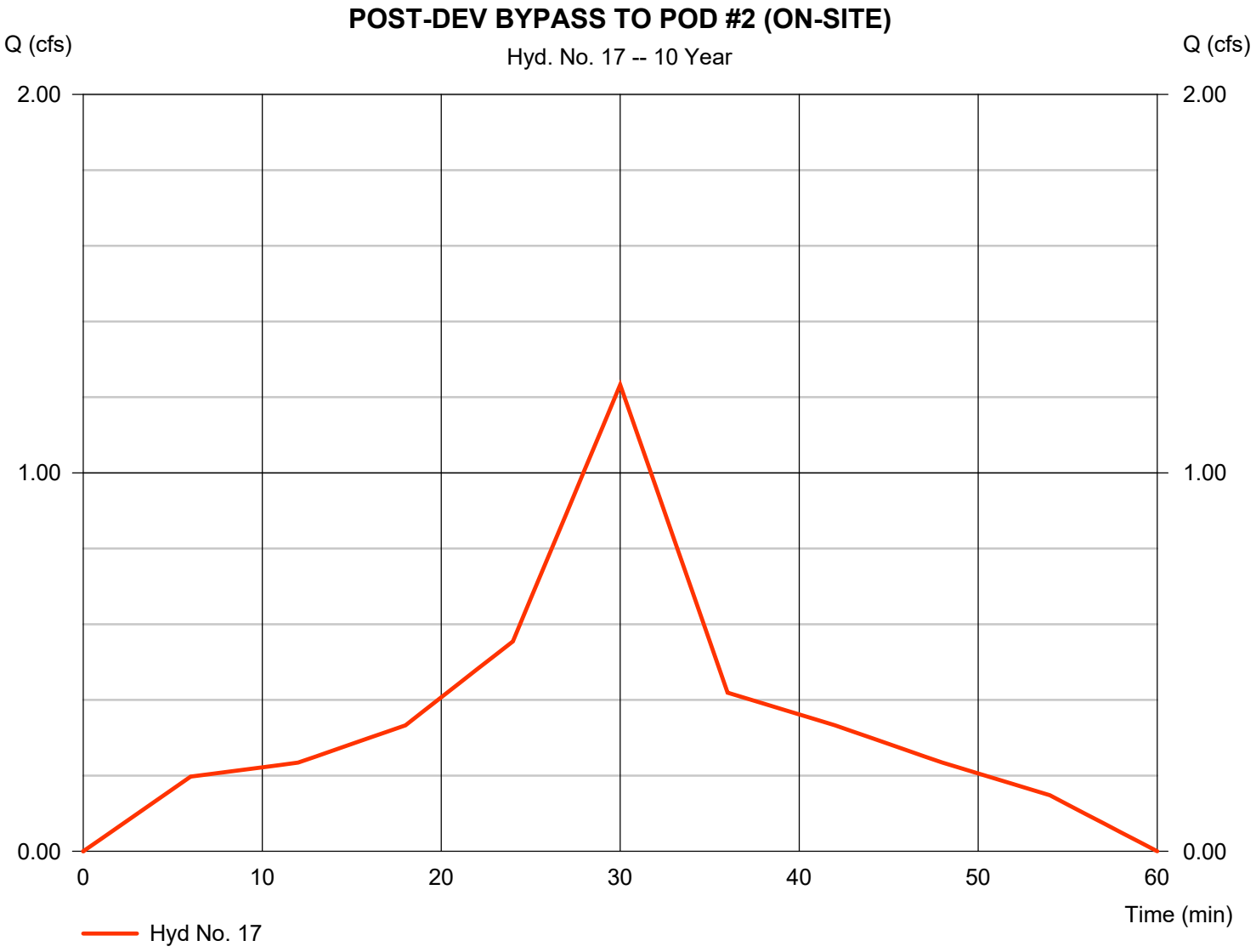


Hydrograph Report

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.233 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,327 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 5.960 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

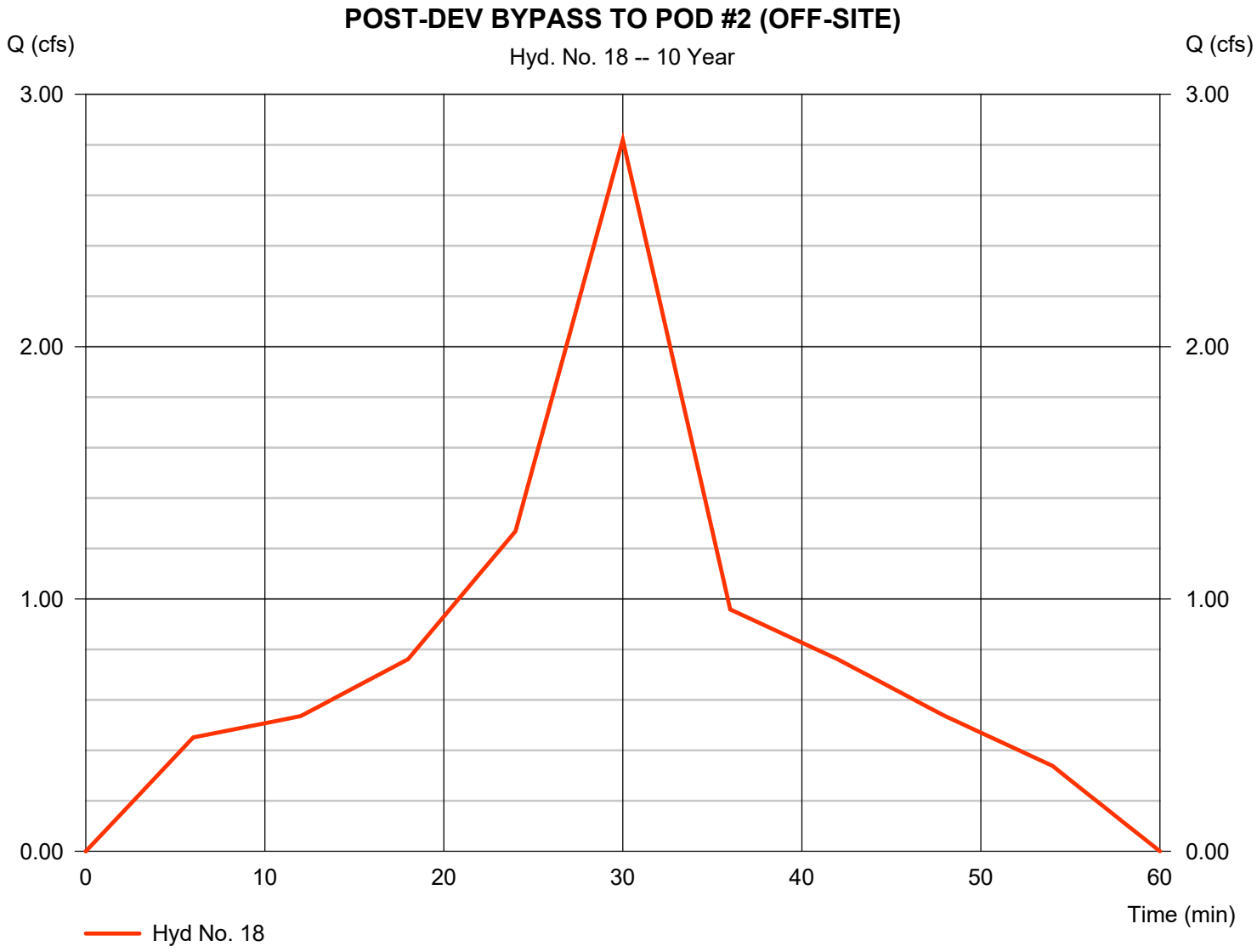


Hydrograph Report

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.819 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 3,035 cuft
Drainage area	= 1.100 ac	Runoff coeff.	= 0.43
Intensity	= 5.960 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



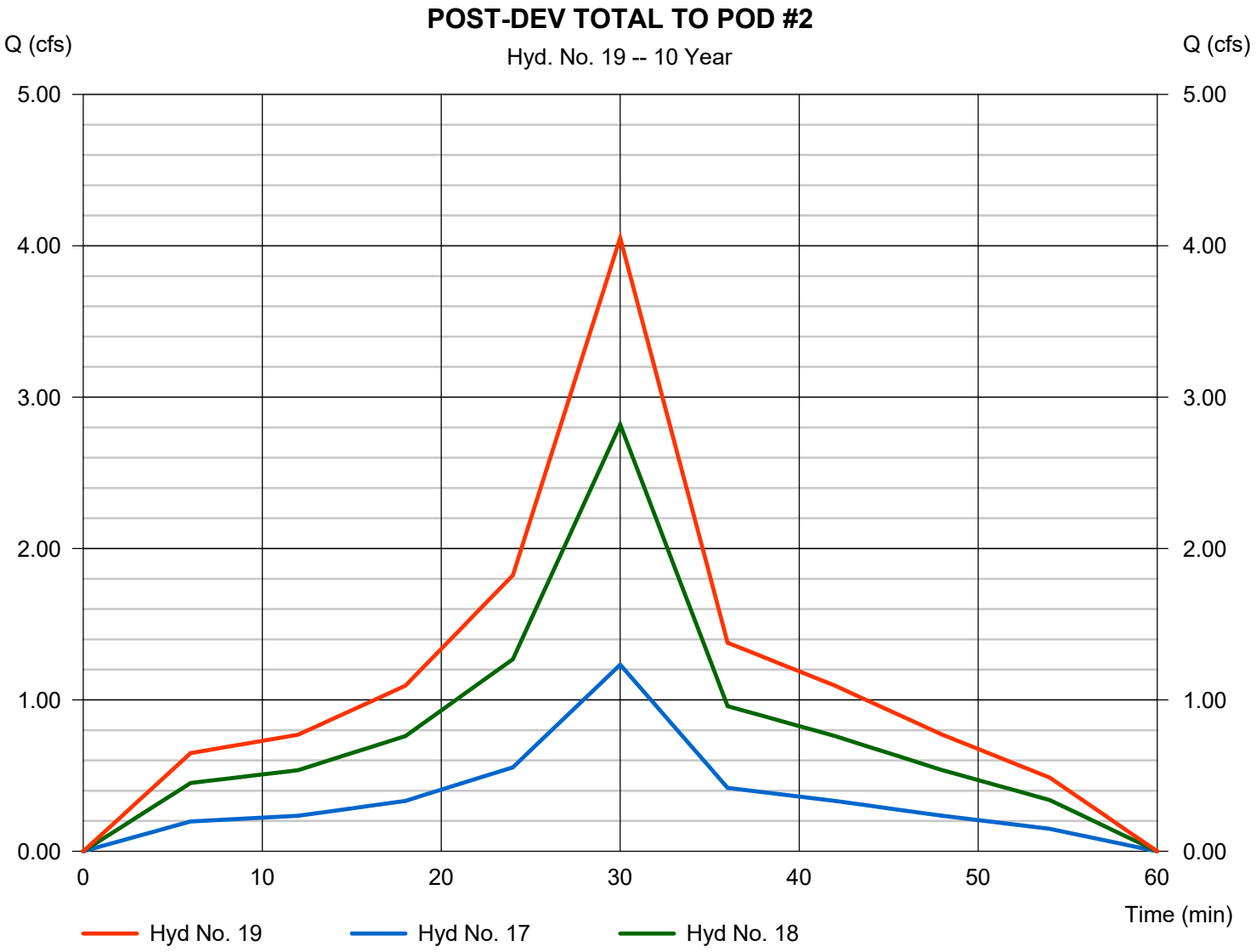
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 4.052 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 4,361 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



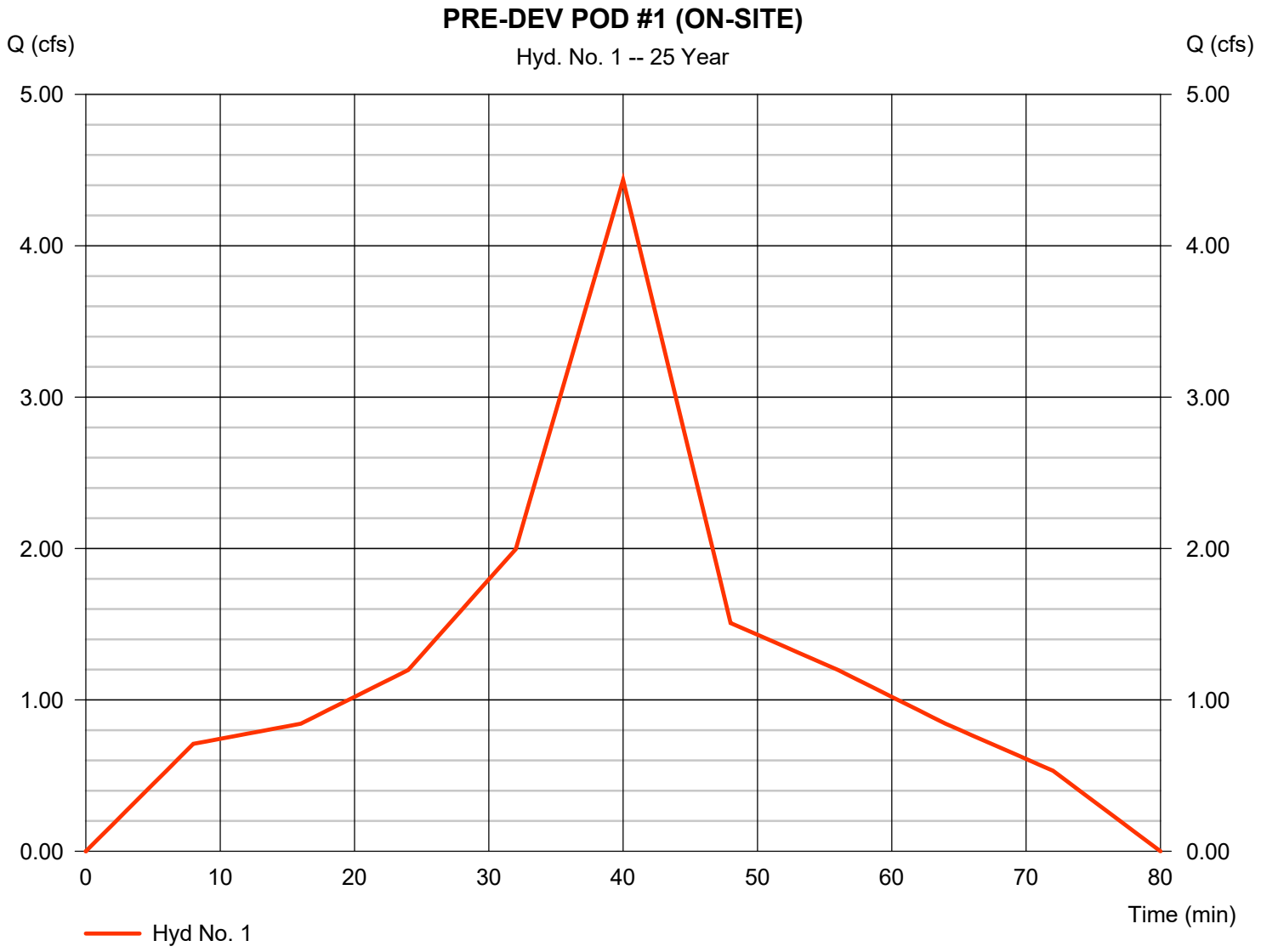
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	4.435 cfs
Storm frequency	=	25 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	6,365 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	6.088 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a



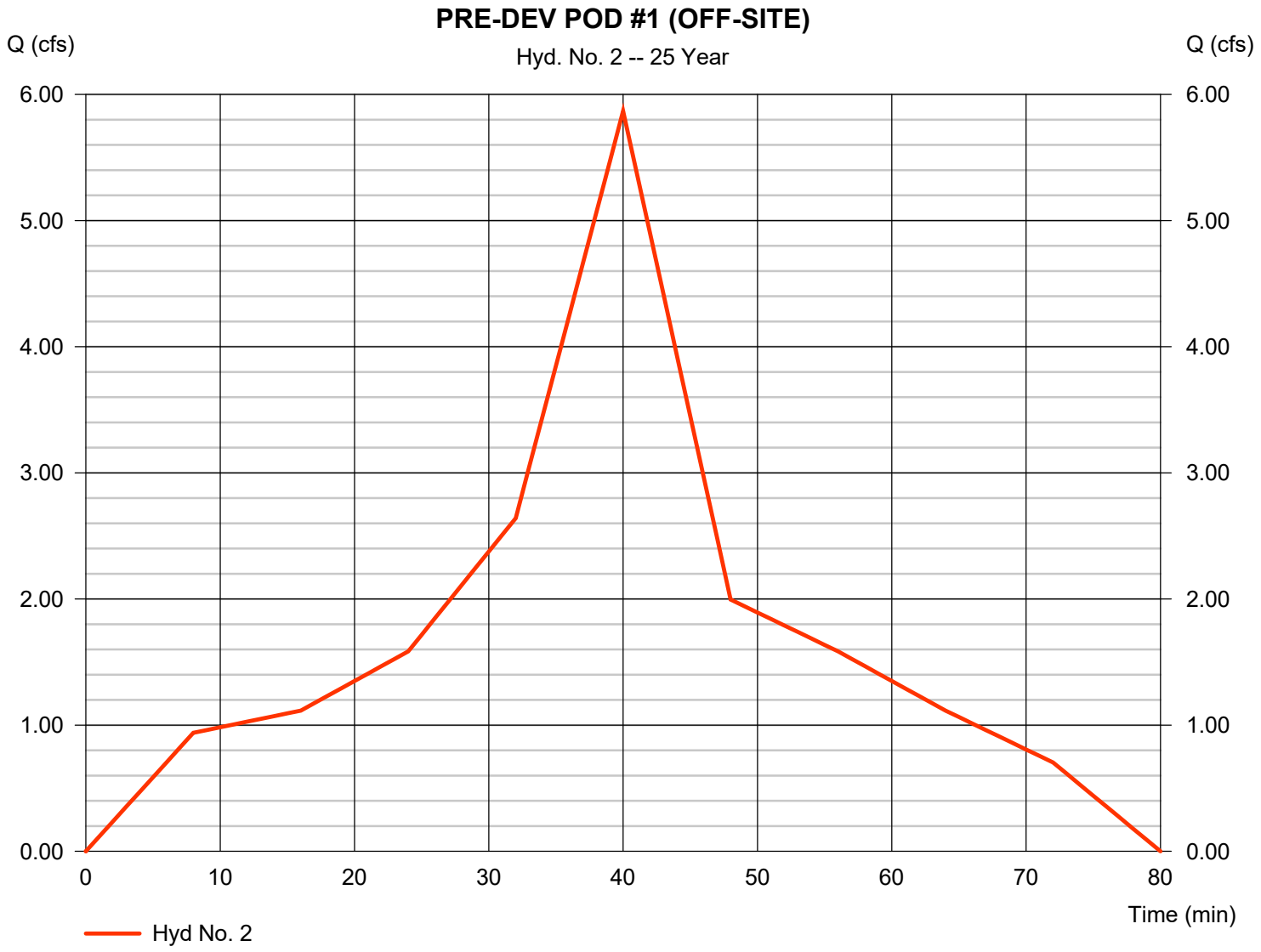
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.869 cfs
Storm frequency	=	25 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	8,423 cuft
Drainage area	=	2.410 ac	Runoff coeff.	=	0.4
Intensity	=	6.088 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

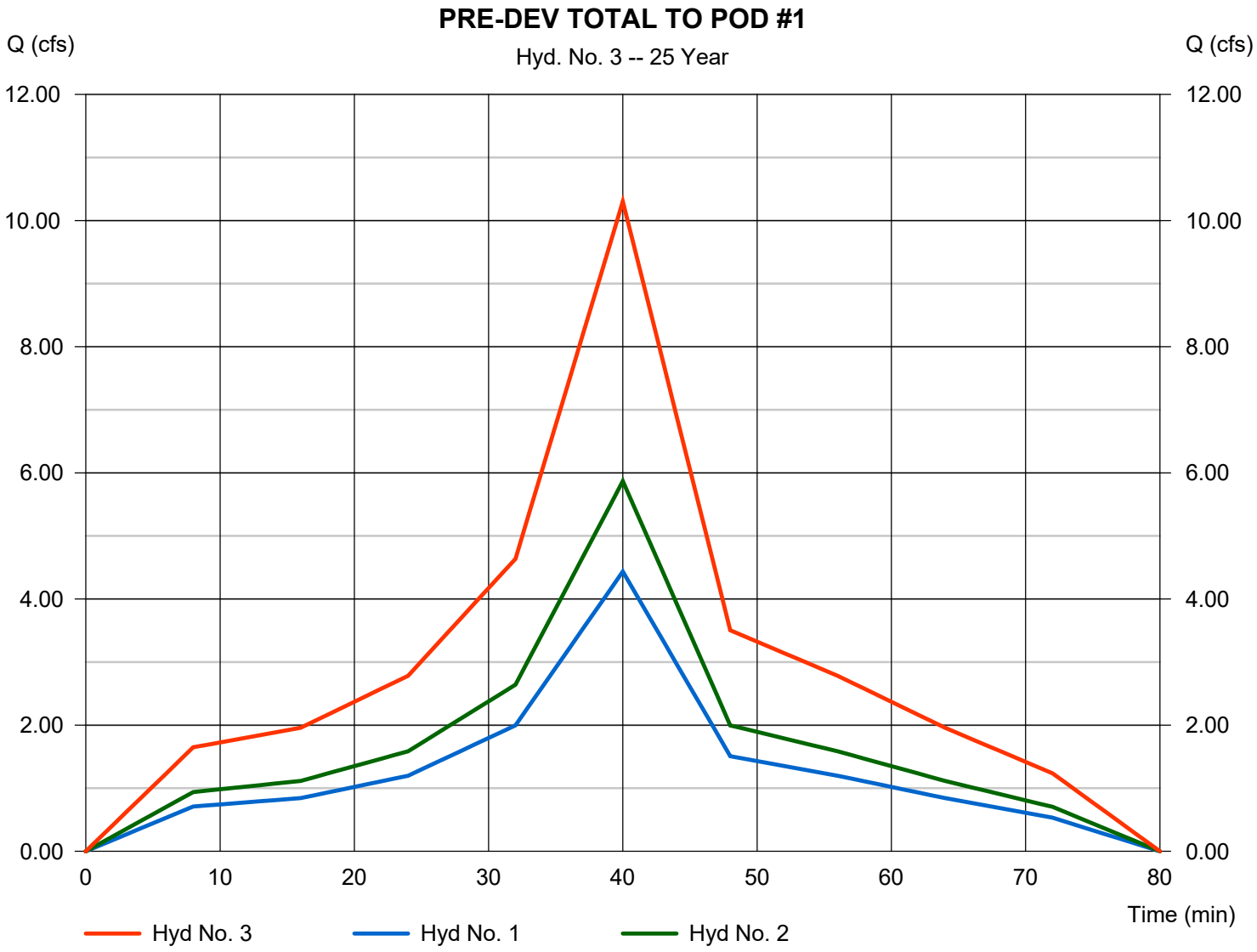


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 10.30 cfs
Storm frequency	= 25 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 14,788 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac

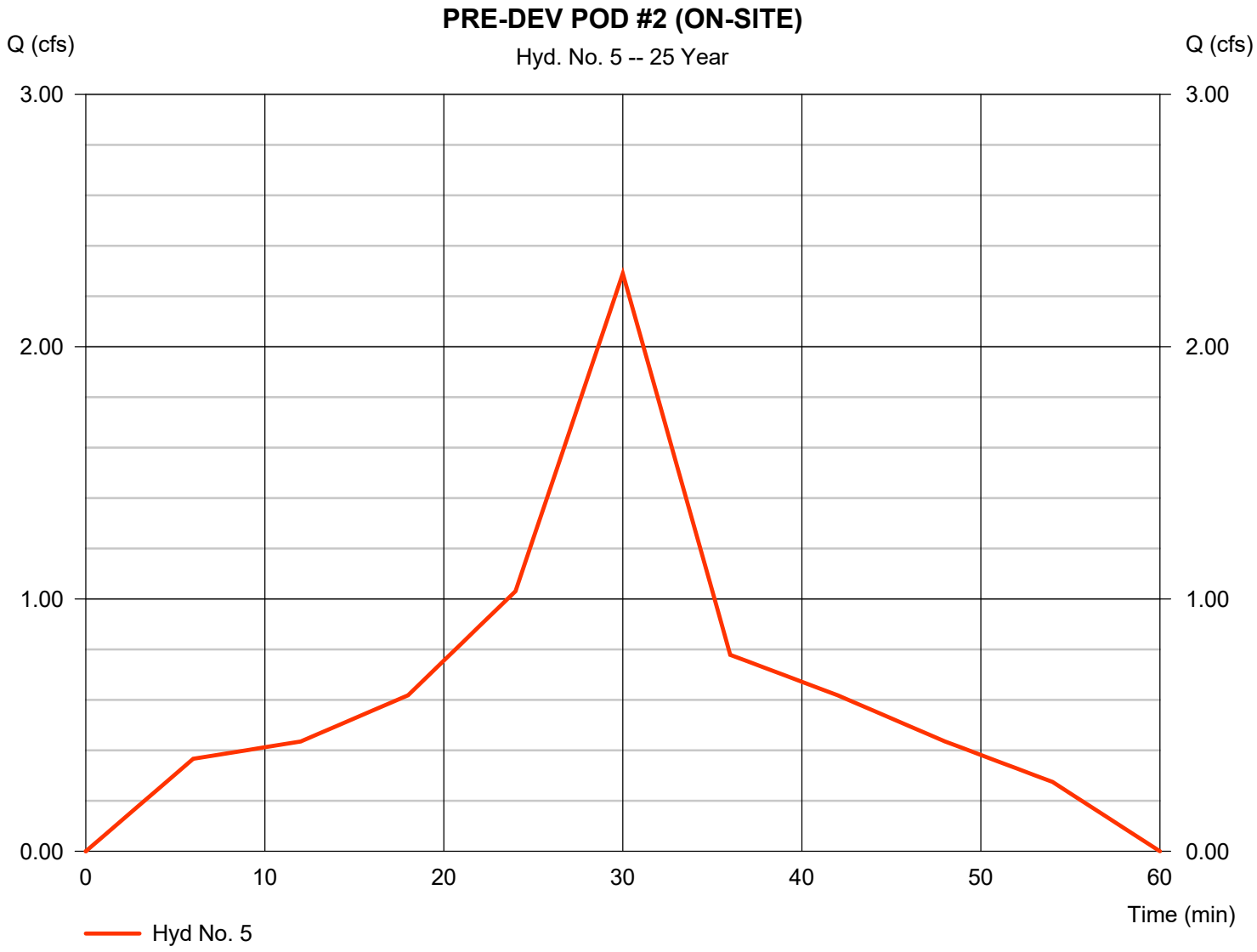


Hydrograph Report

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.290 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,465 cuft
Drainage area	= 1.050 ac	Runoff coeff.	= 0.33
Intensity	= 6.609 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

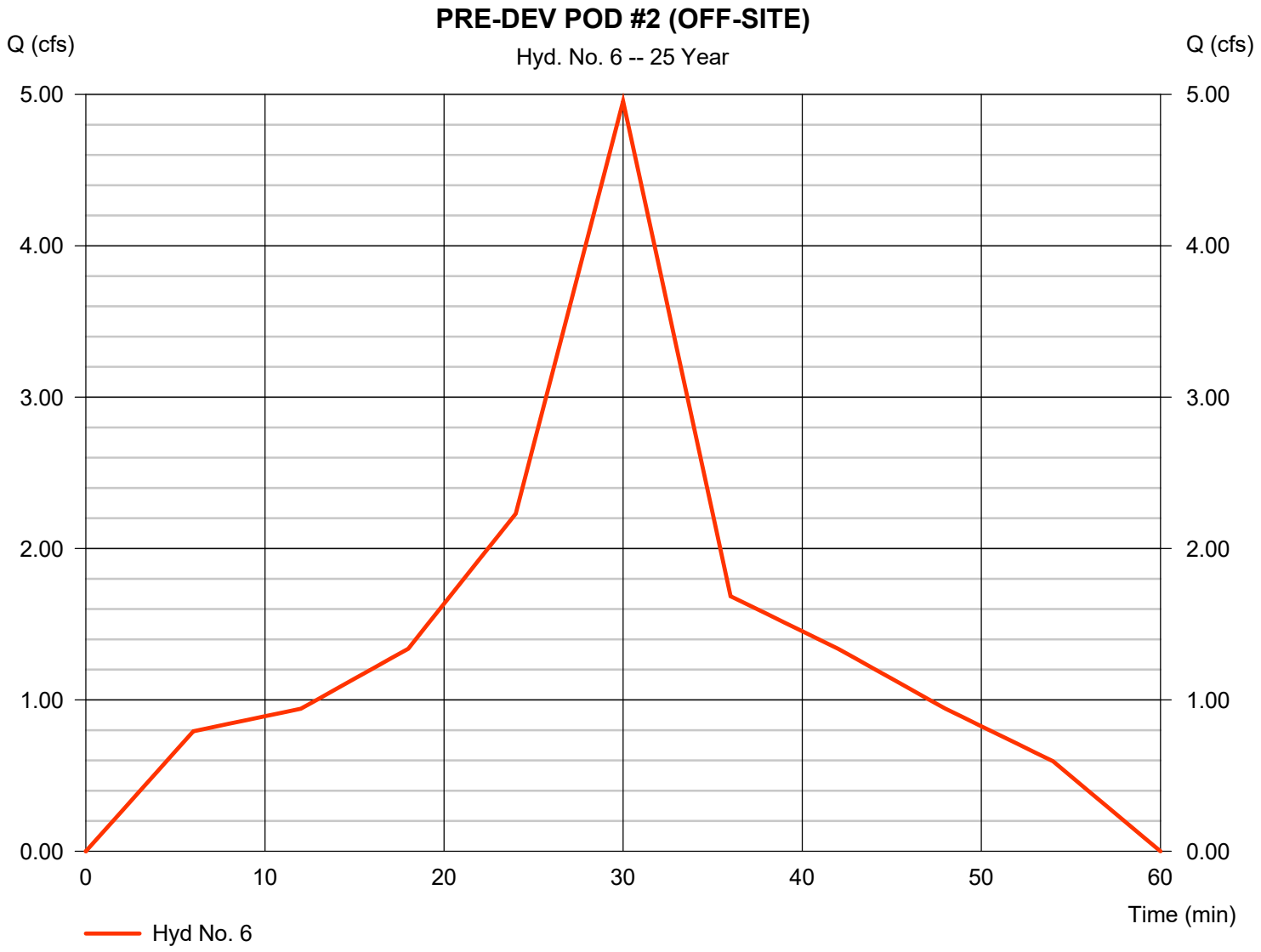


Hydrograph Report

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 4.955 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 5,334 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.46
Intensity	= 6.609 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

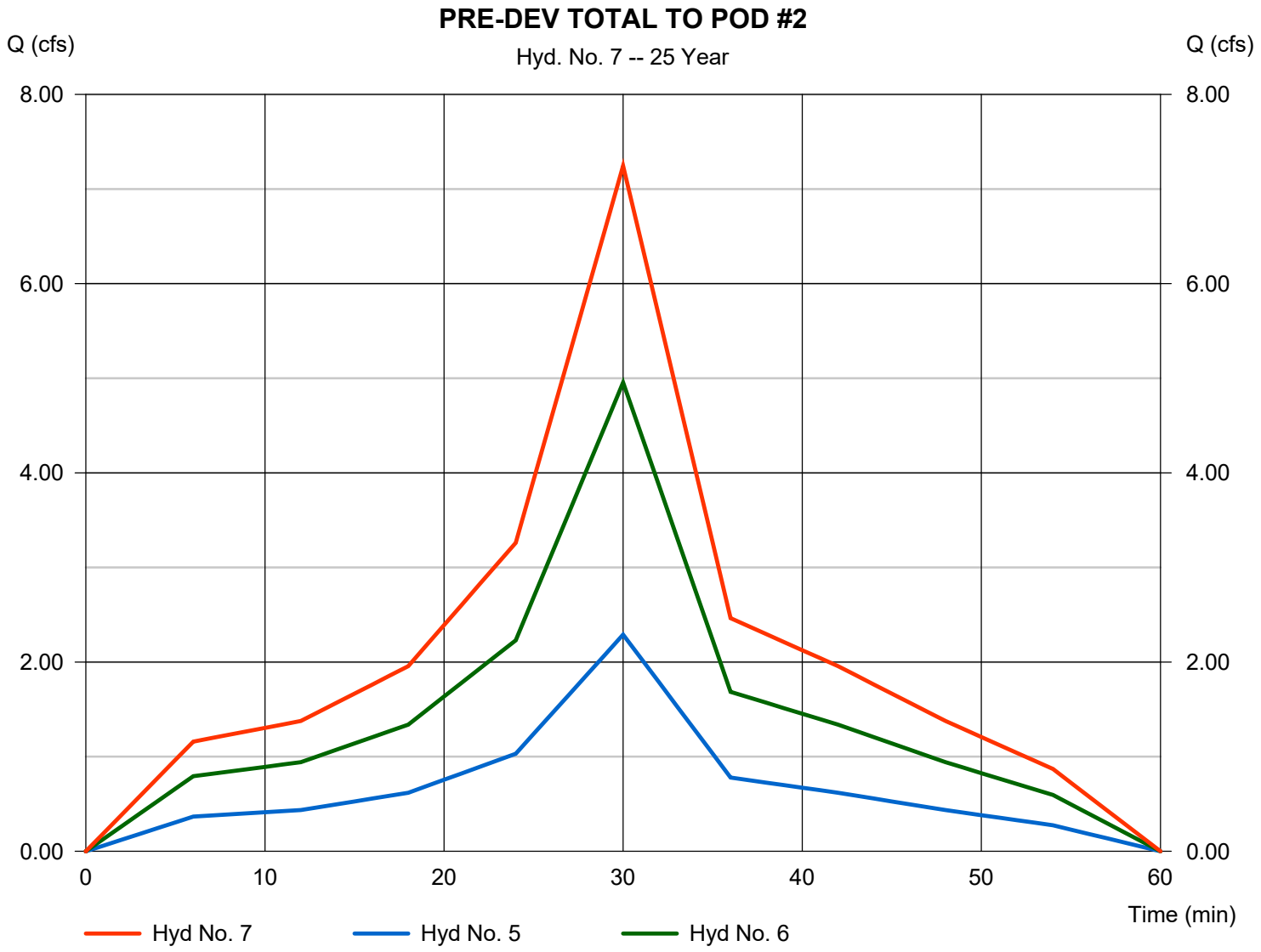


Hydrograph Report

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 7.245 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 7,799 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac



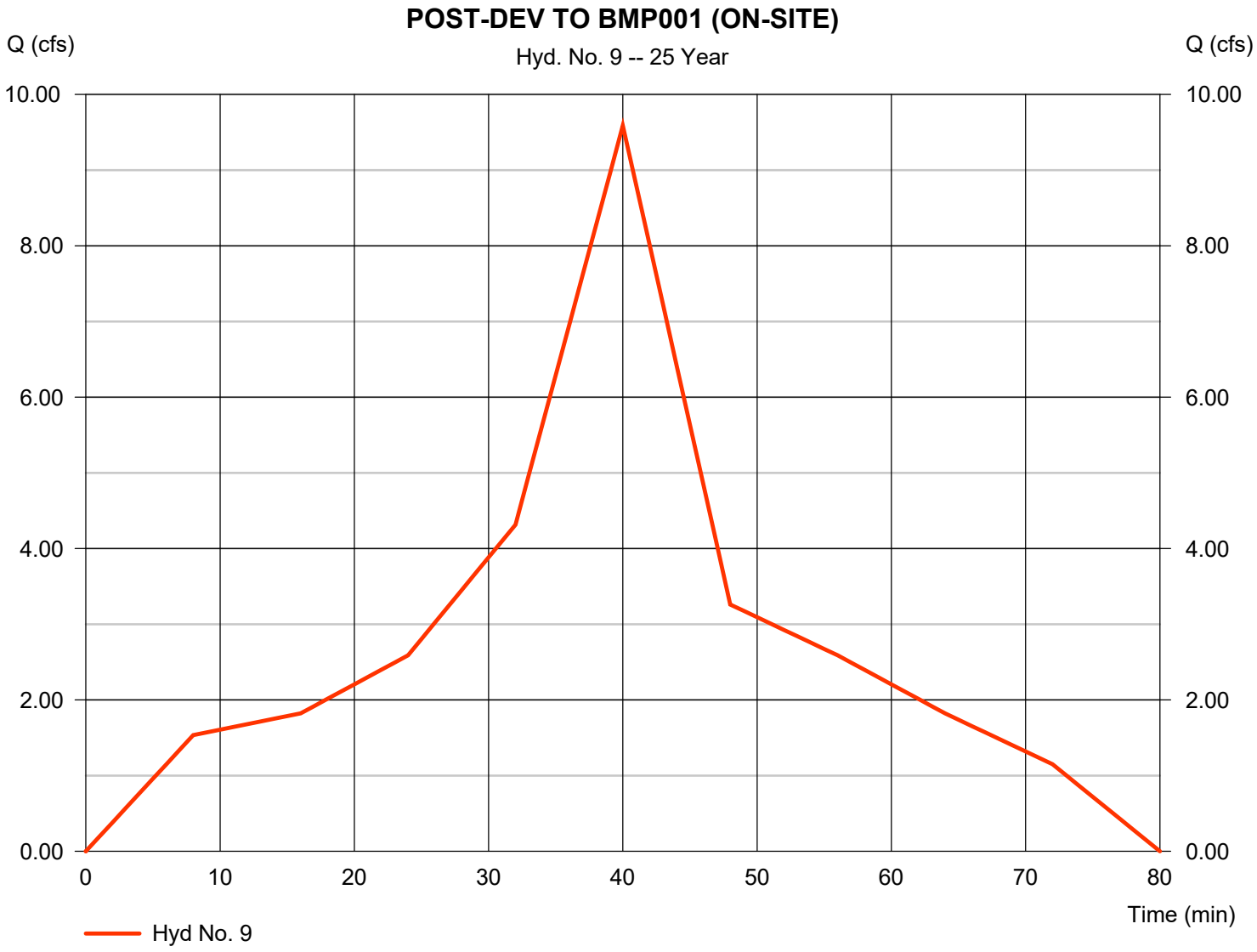
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	9.588 cfs
Storm frequency	=	25 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	13,761 cuft
Drainage area	=	2.500 ac	Runoff coeff.	=	0.63
Intensity	=	6.088 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a



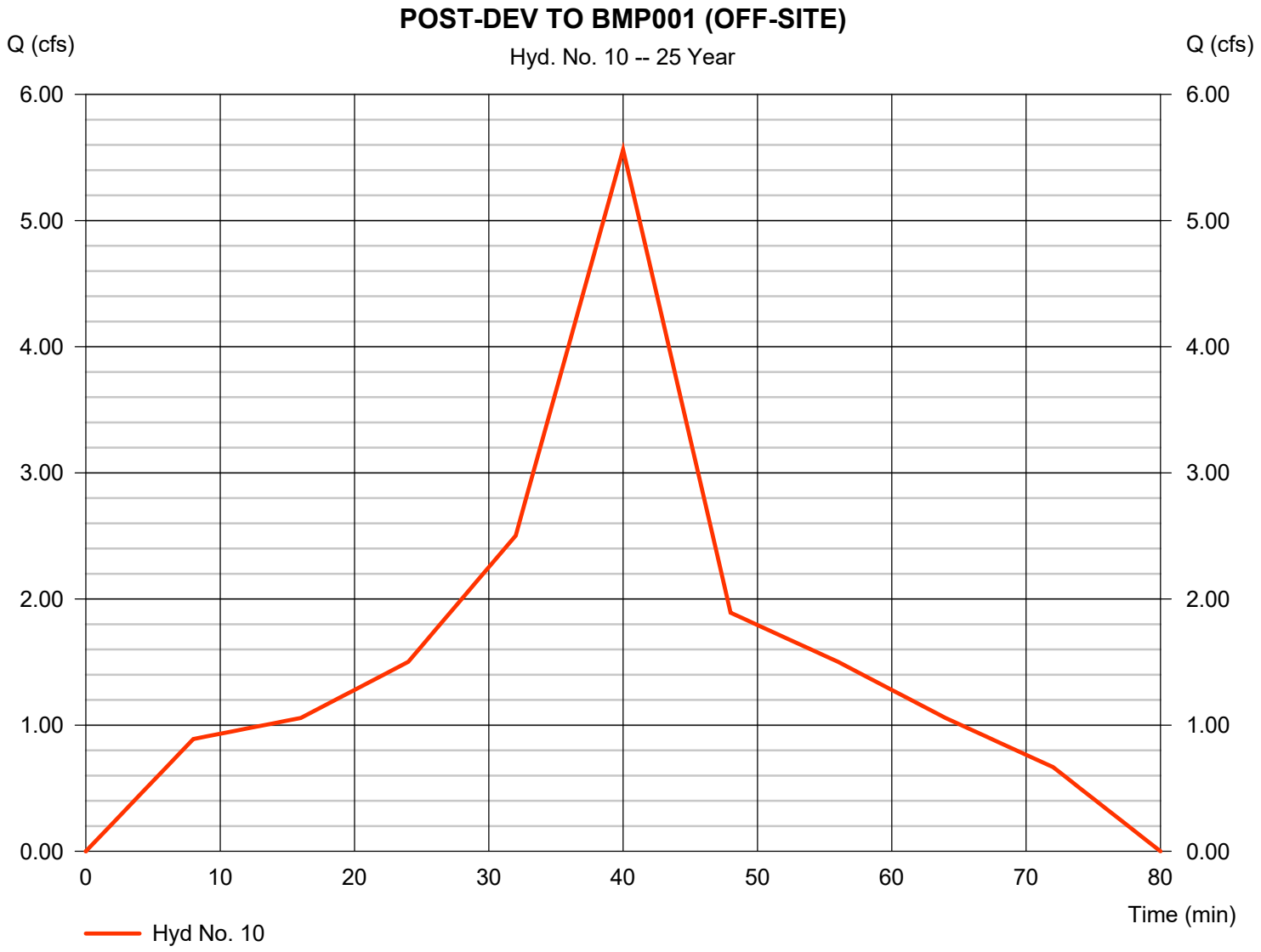
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.561 cfs
Storm frequency	=	25 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	7,982 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	6.088 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a



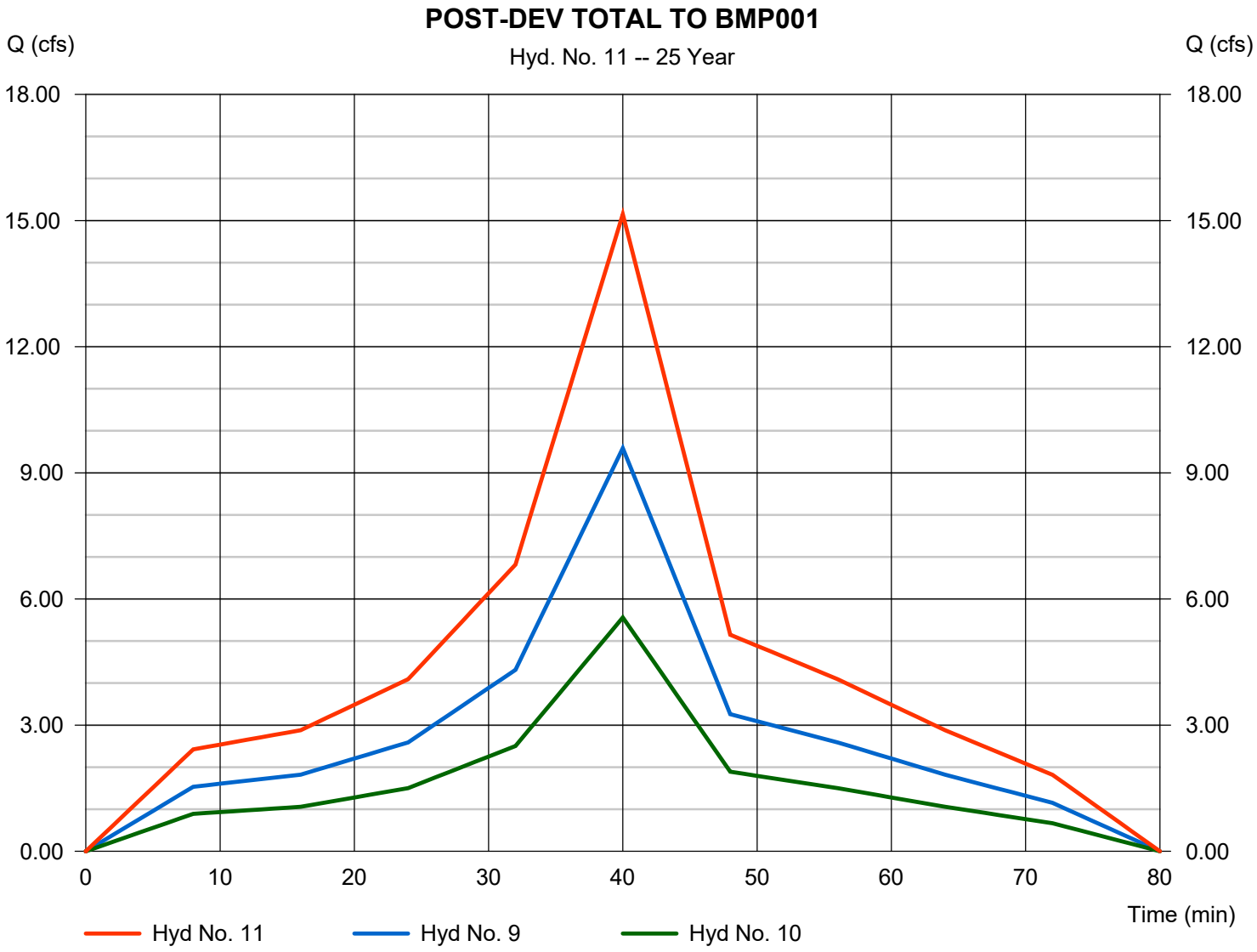
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 15.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 21,743 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

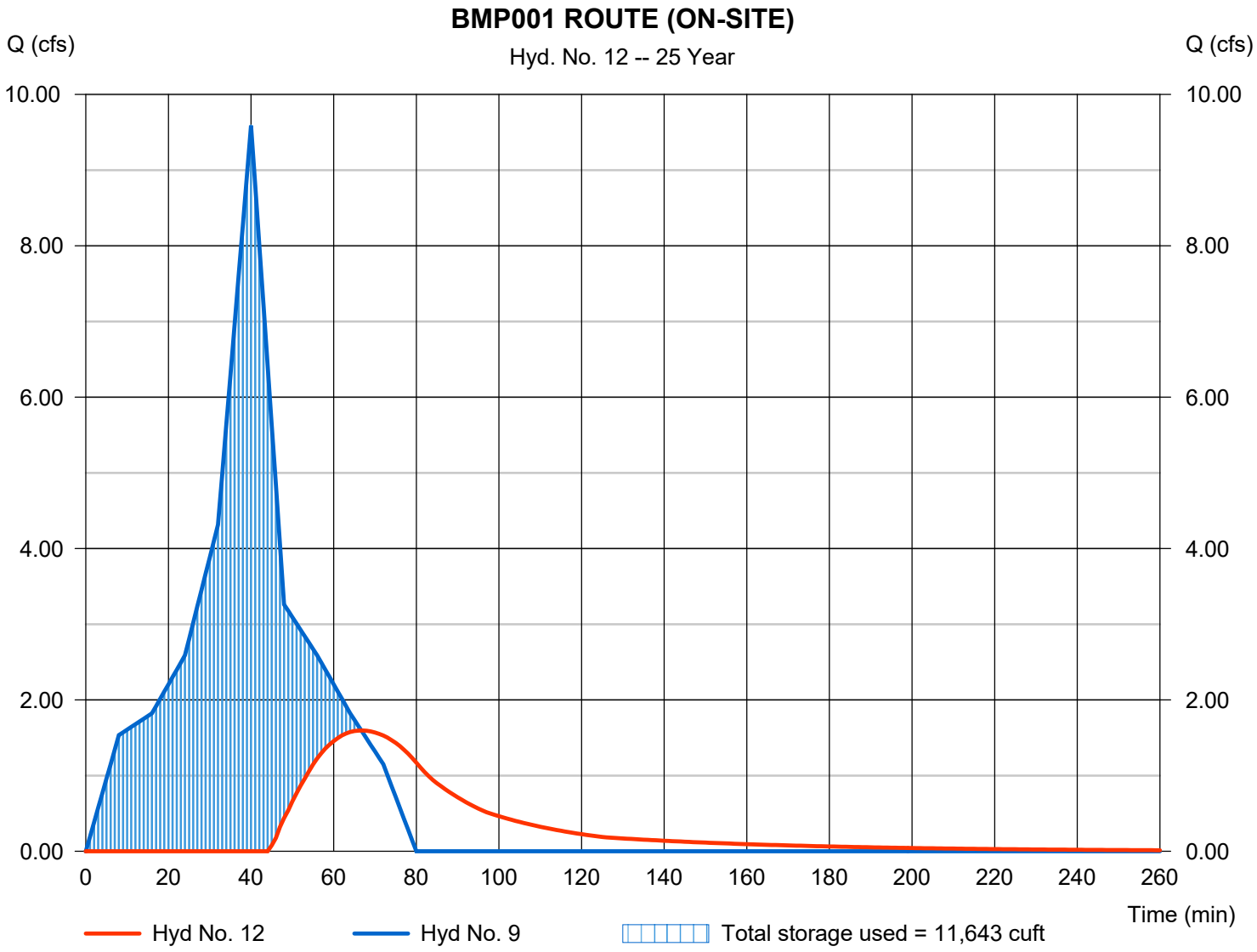
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 1.595 cfs
Storm frequency	= 25 yrs	Time to peak	= 67 min
Time interval	= 1 min	Hyd. volume	= 4,485 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.42 ft
Reservoir name	= BMP 001	Max. Storage	= 11,643 cuft

Storage Indication method used.



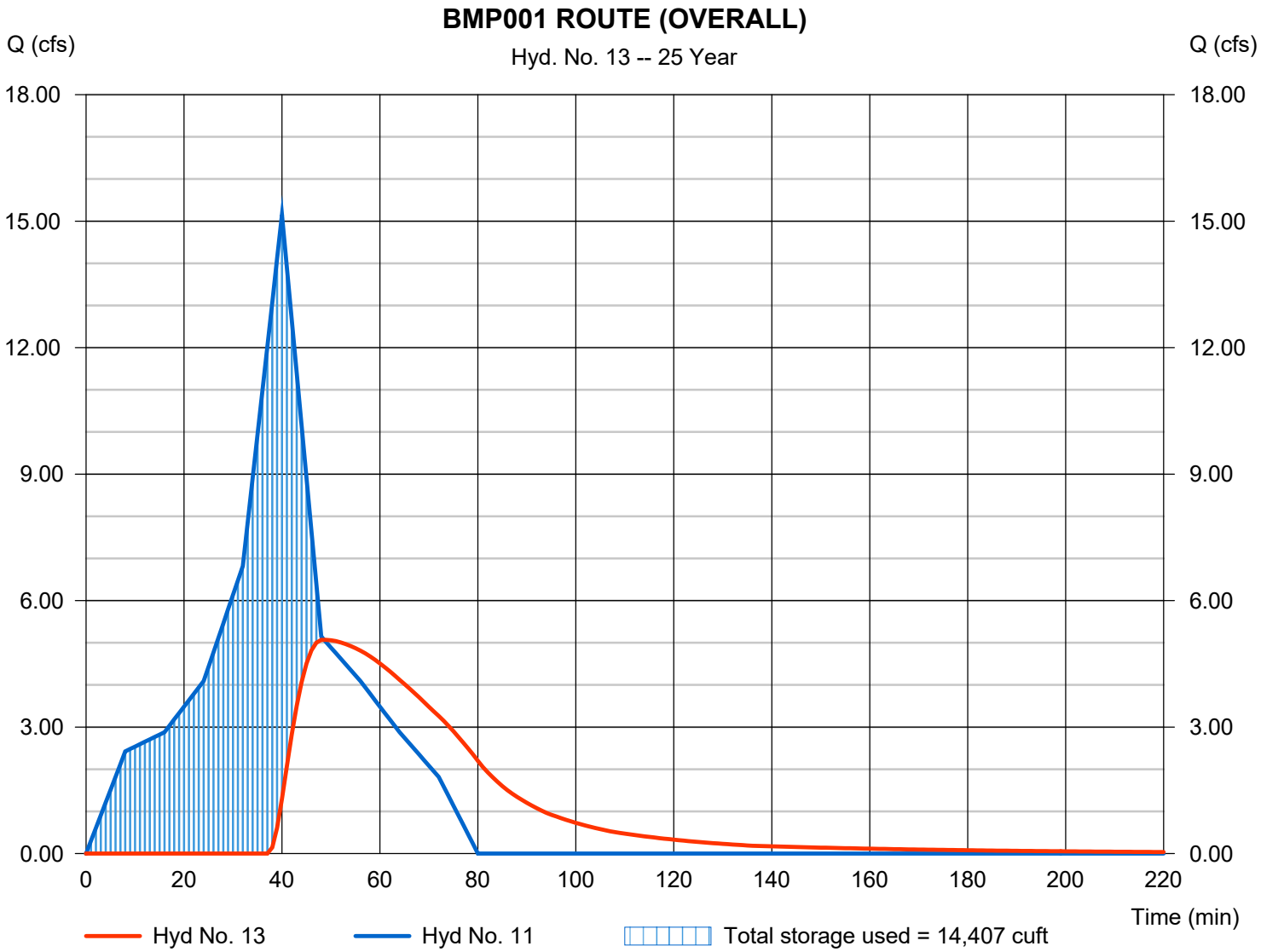
Hydrograph Report

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	= Reservoir	Peak discharge	= 5.070 cfs
Storm frequency	= 25 yrs	Time to peak	= 49 min
Time interval	= 1 min	Hyd. volume	= 12,467 cuft
Inflow hyd. No.	= 11 - POST-DEV TOTAL TO BMP001	Max. Elevation	= 134.91 ft
Reservoir name	= BMP 001	Max. Storage	= 14,407 cuft

Storage Indication method used.

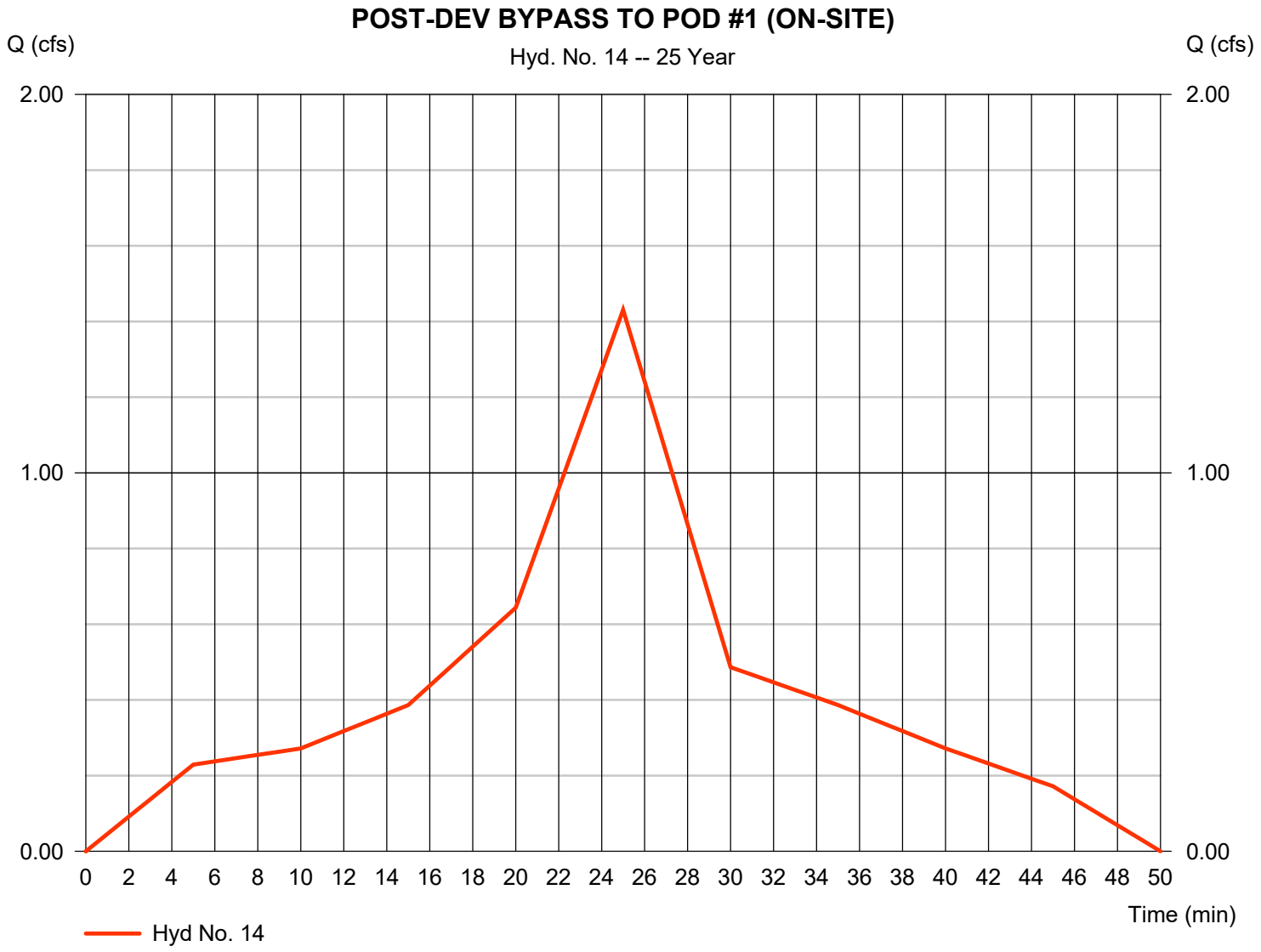


Hydrograph Report

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.431 cfs
Storm frequency	= 25 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,283 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 6.912 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



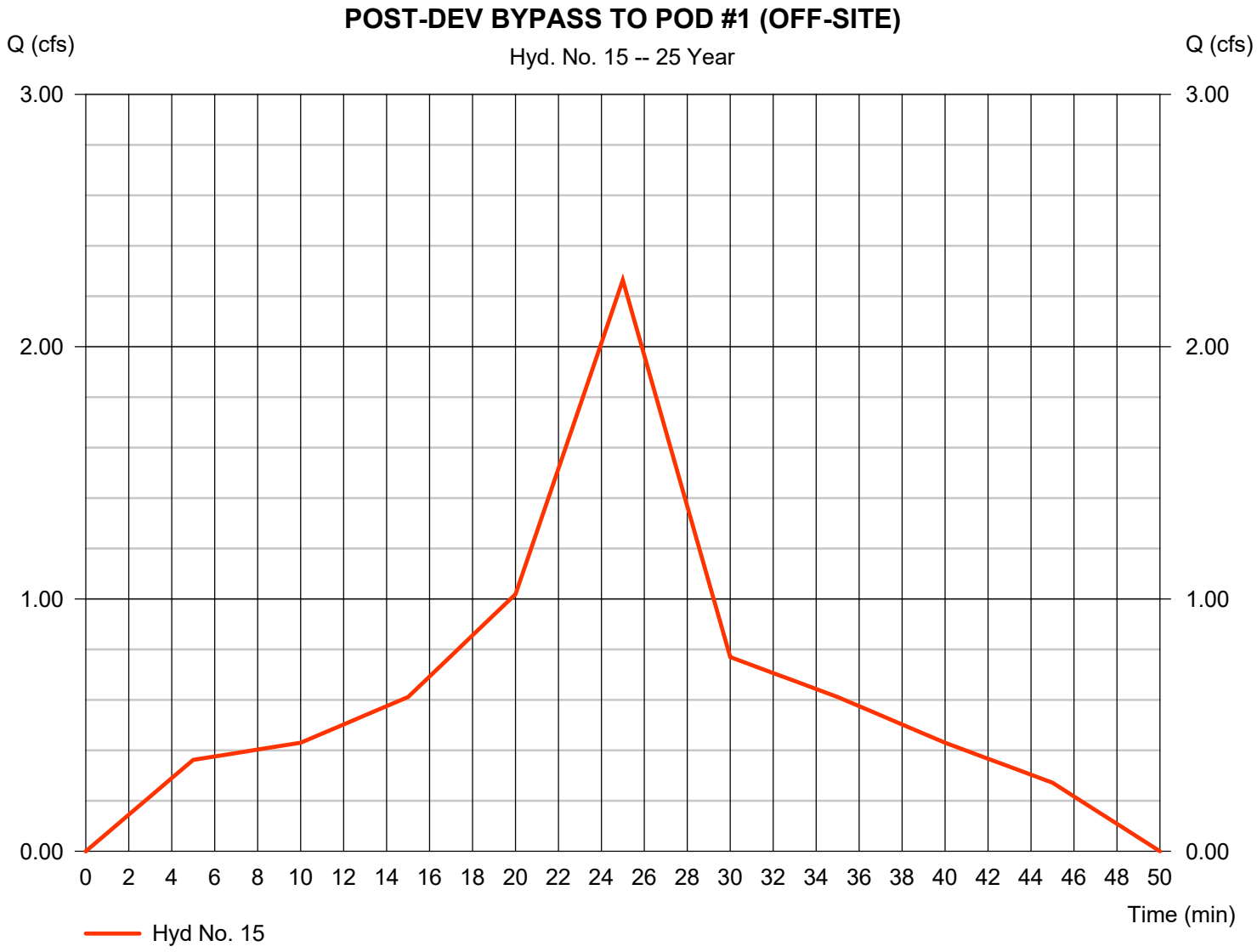
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.264 cfs
Storm frequency	= 25 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 2,031 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 6.912 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

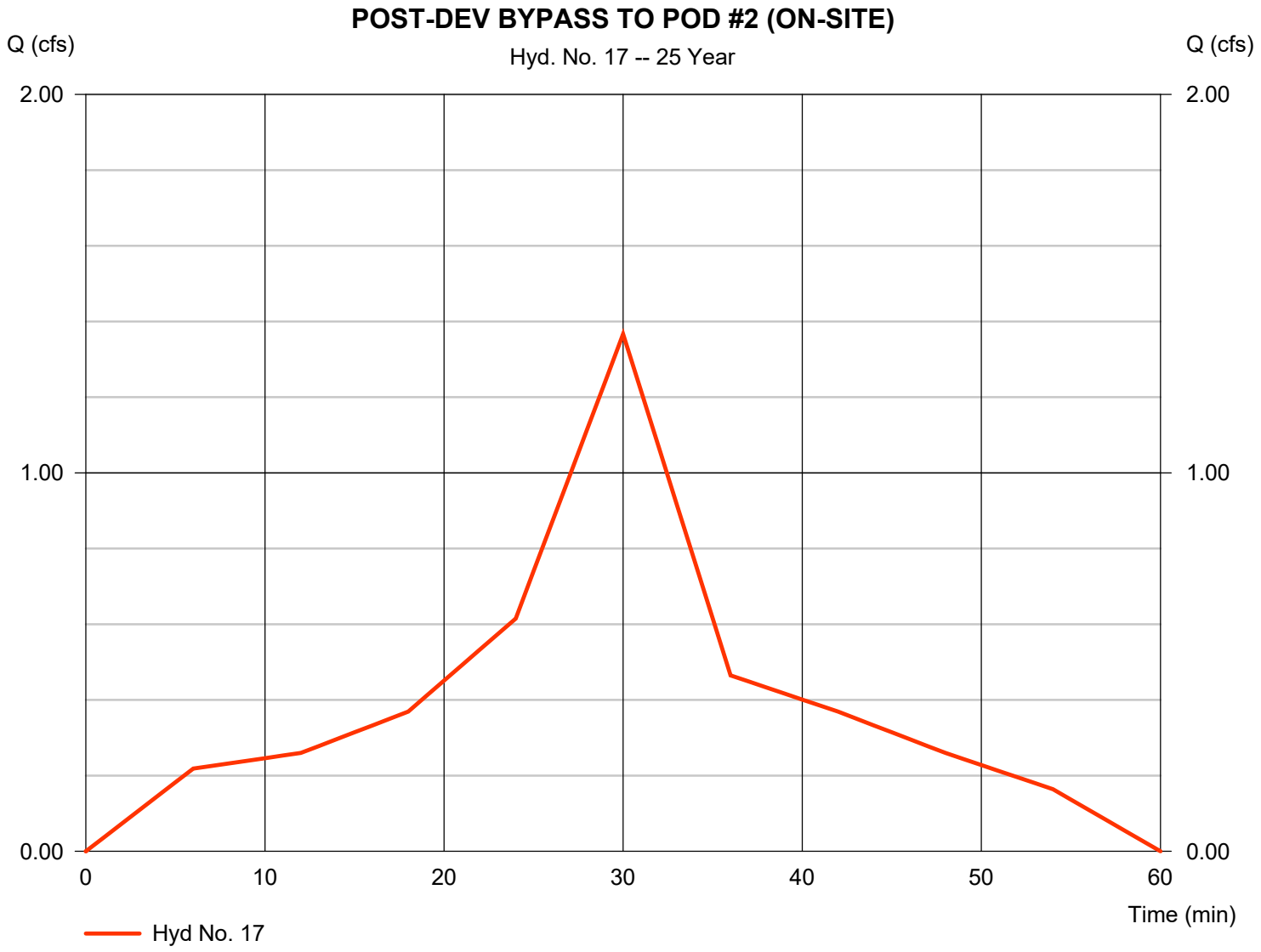


Hydrograph Report

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.367 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,471 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 6.609 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



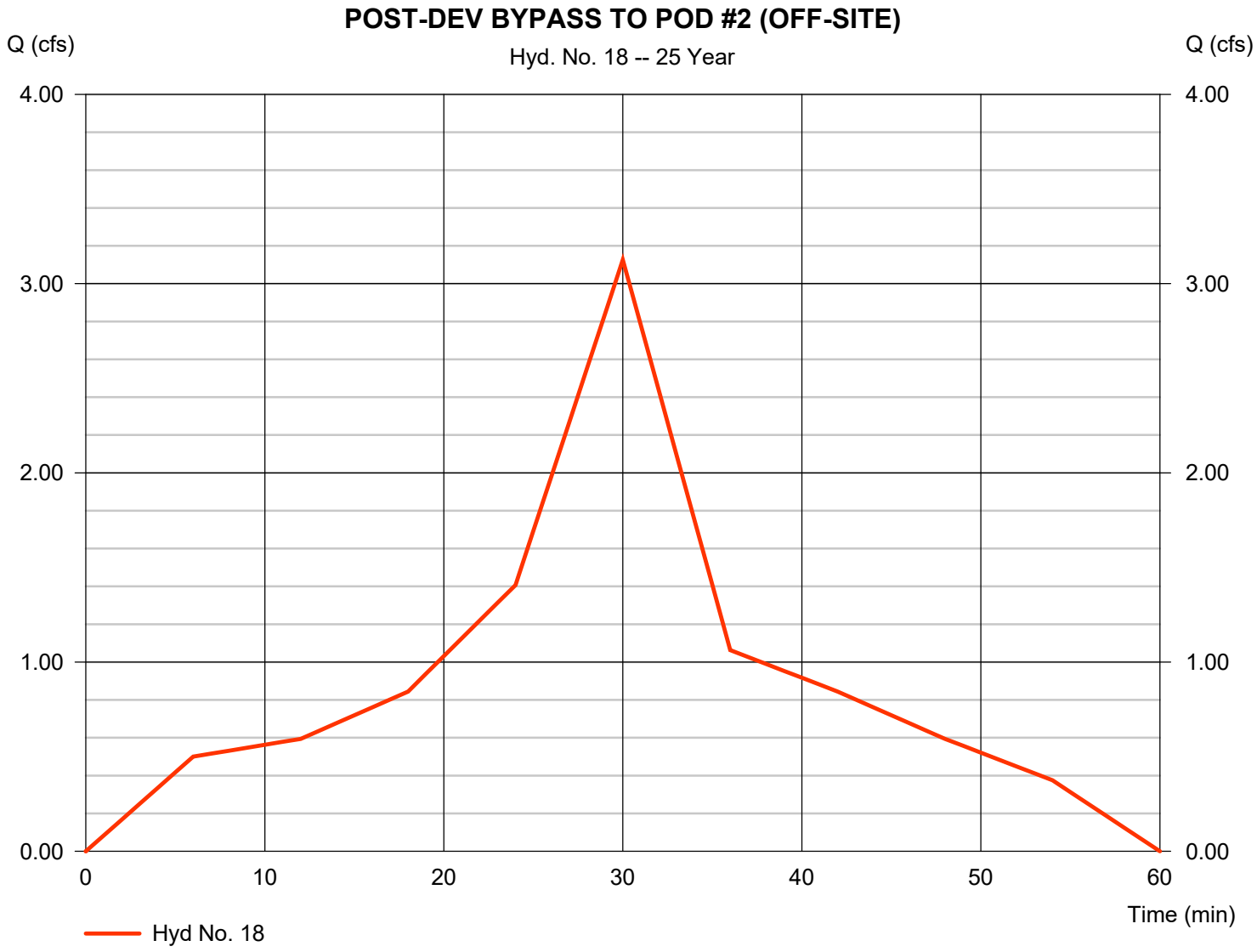
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.126 cfs
Storm frequency	=	25 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	3,365 cuft
Drainage area	=	1.100 ac	Runoff coeff.	=	0.43
Intensity	=	6.609 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

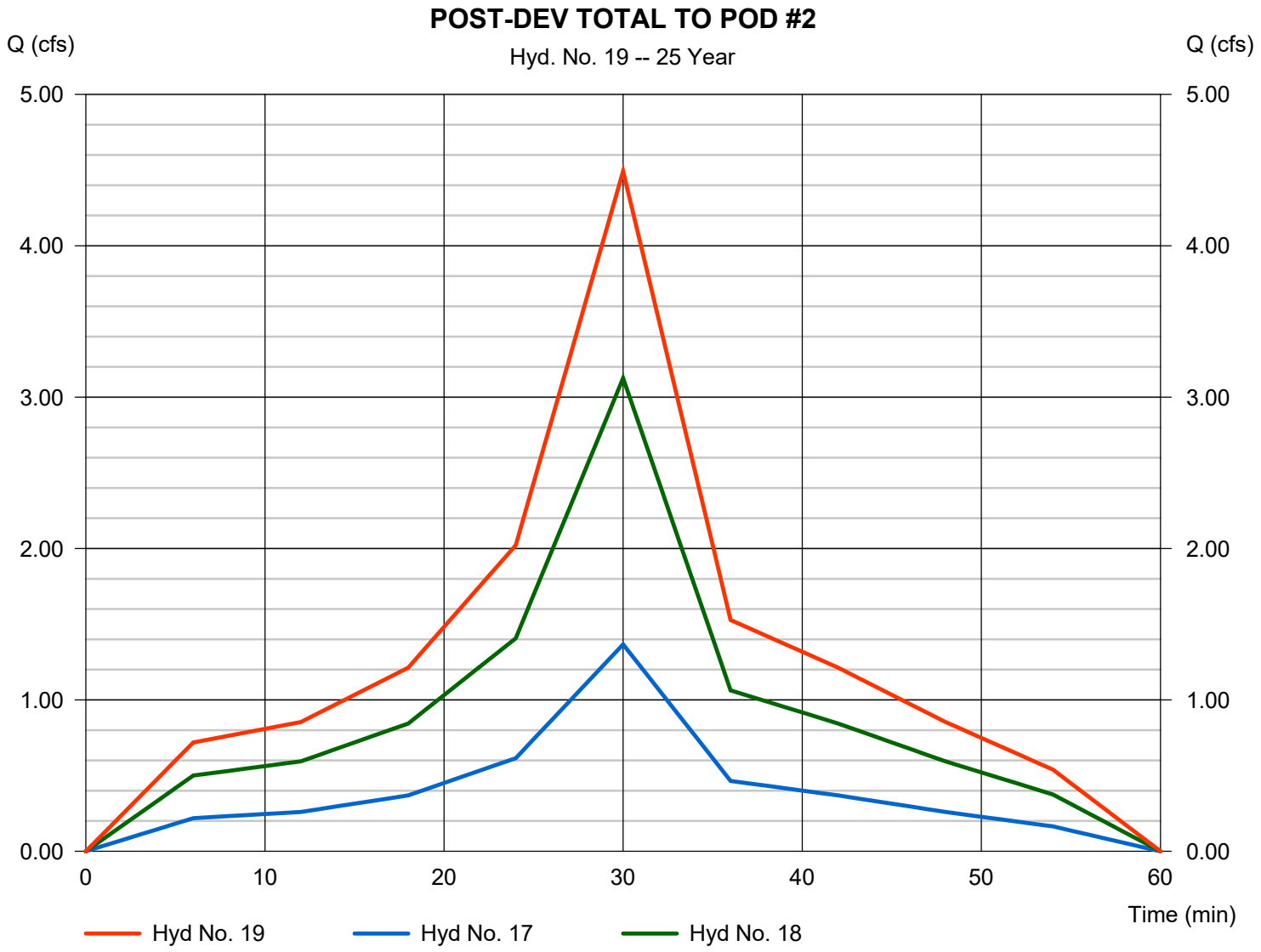


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 4.493 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 4,836 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



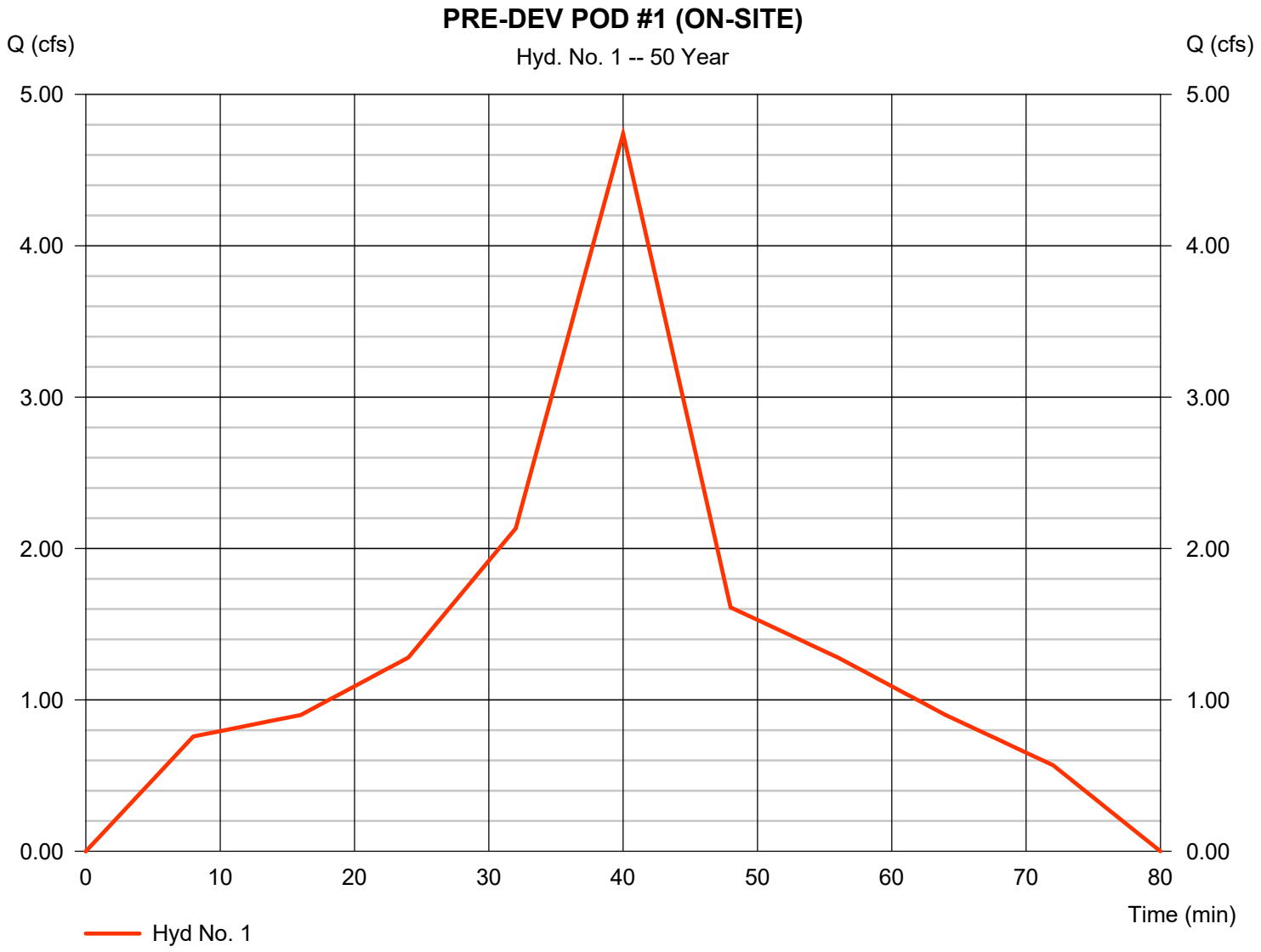
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	4.739 cfs
Storm frequency	=	50 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	6,802 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	6.505 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a



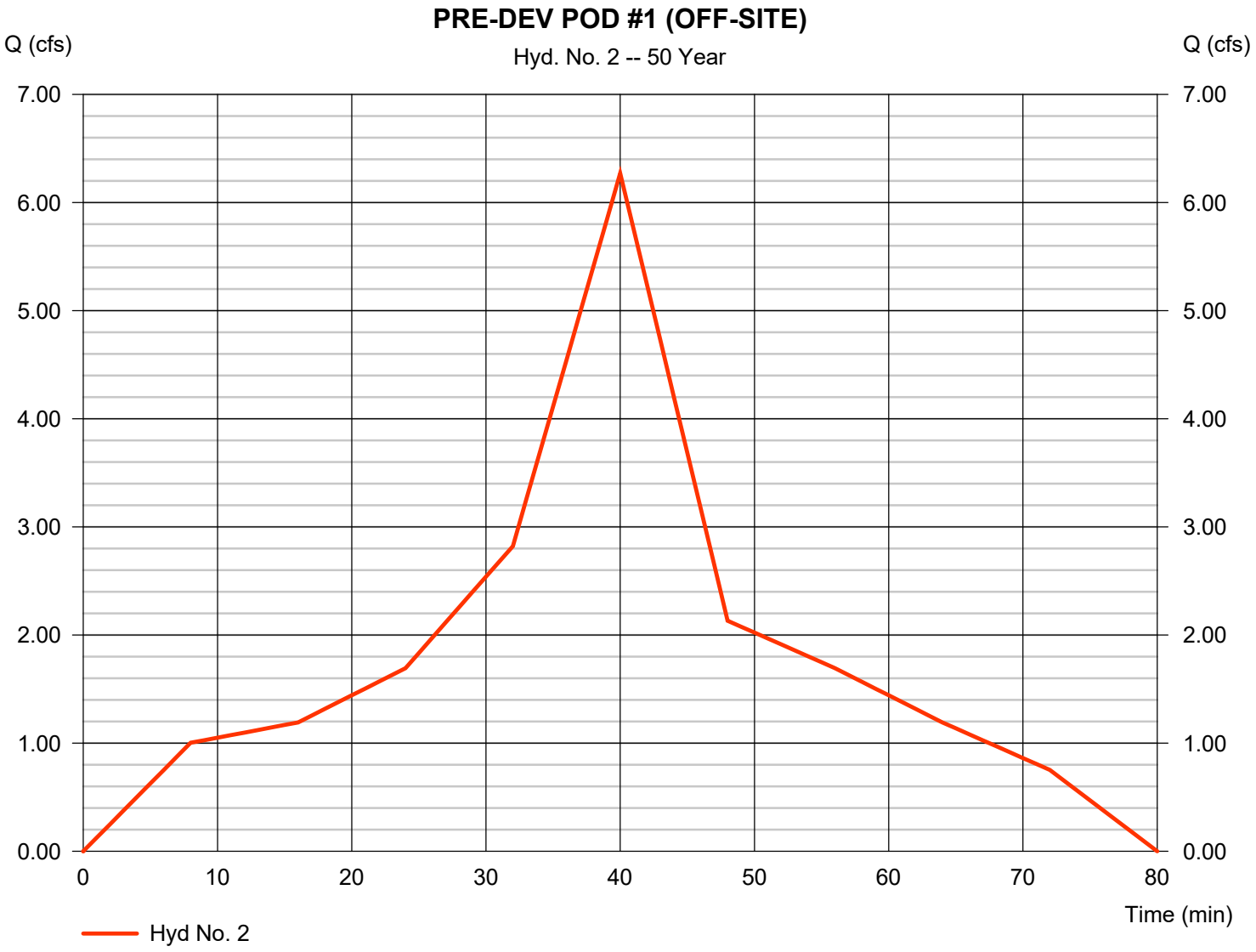
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	6.271 cfs
Storm frequency	=	50 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	9,000 cuft
Drainage area	=	2.410 ac	Runoff coeff.	=	0.4
Intensity	=	6.505 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

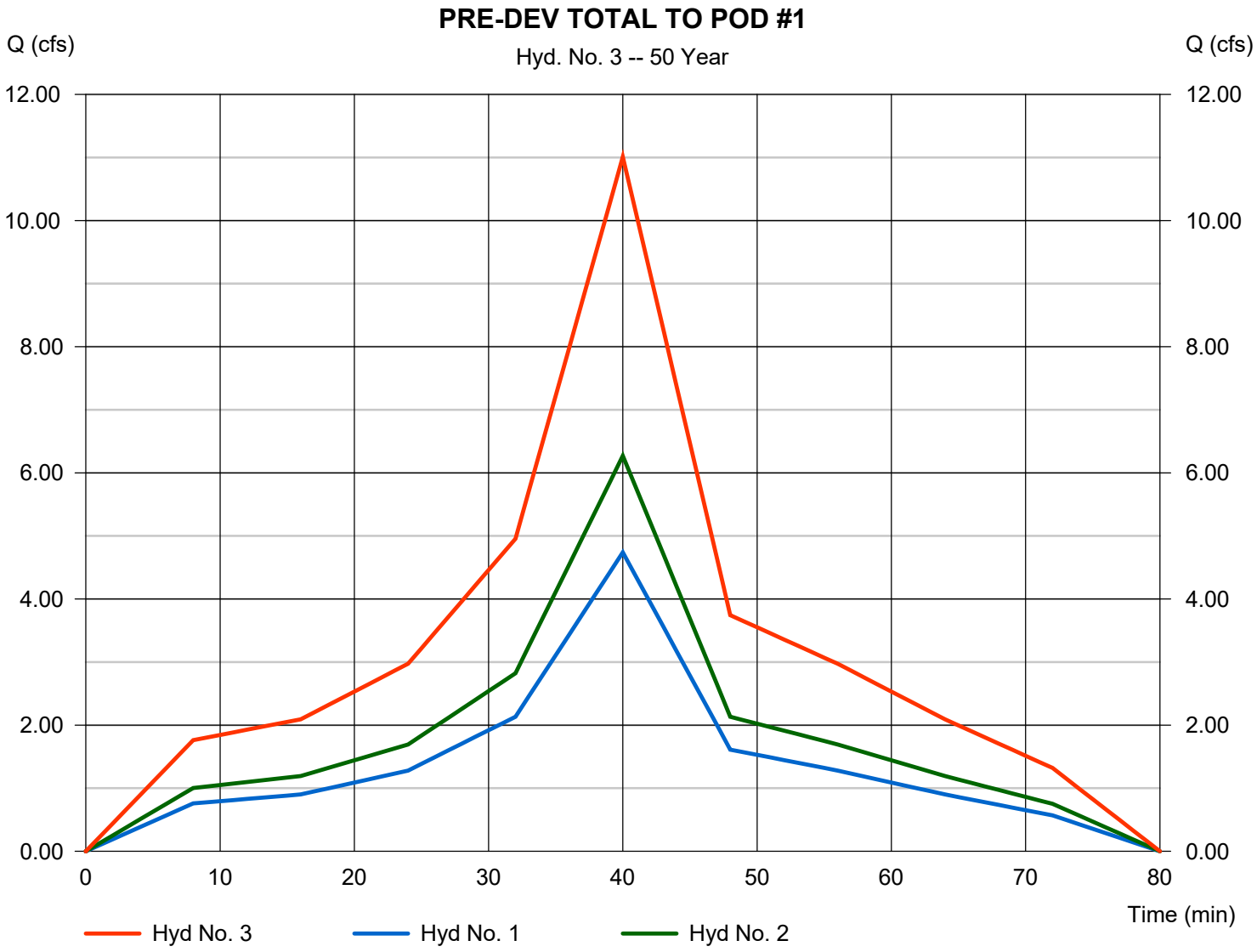


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 11.01 cfs
Storm frequency	= 50 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 15,802 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac

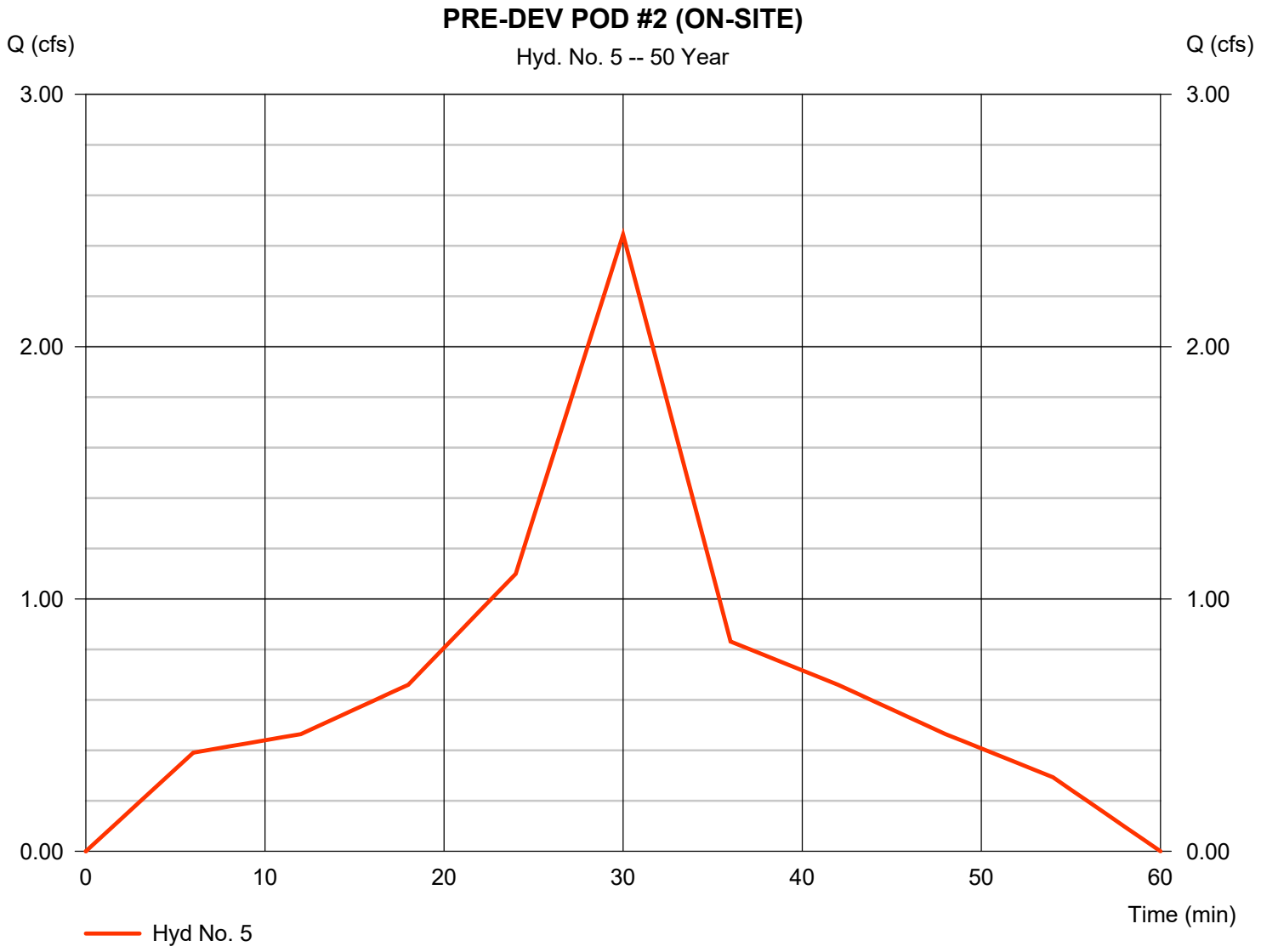


Hydrograph Report

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.444 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 2,631 cuft
Drainage area	= 1.050 ac	Runoff coeff.	= 0.33
Intensity	= 7.054 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

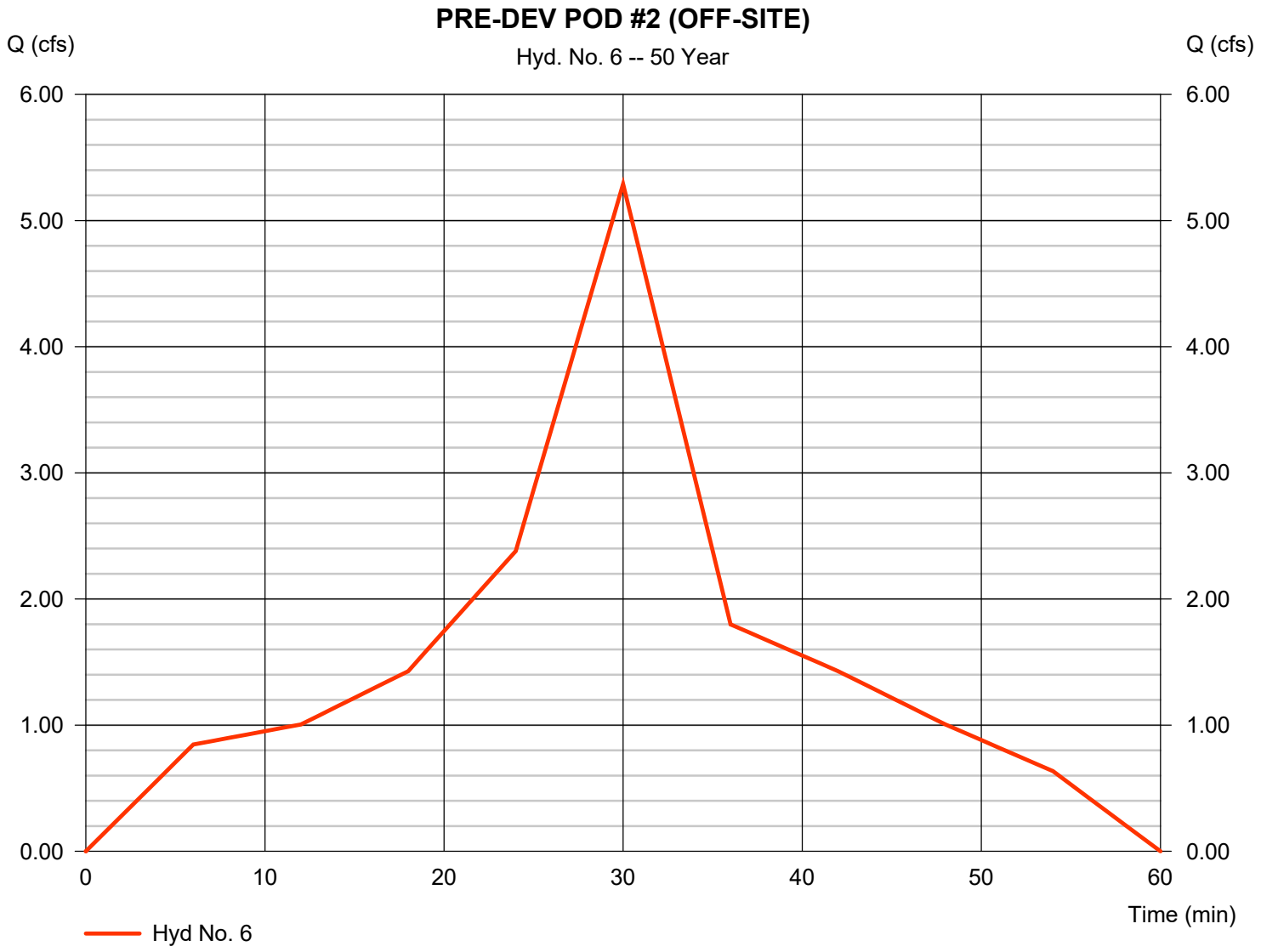


Hydrograph Report

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 5.289 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 5,693 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.46
Intensity	= 7.054 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a



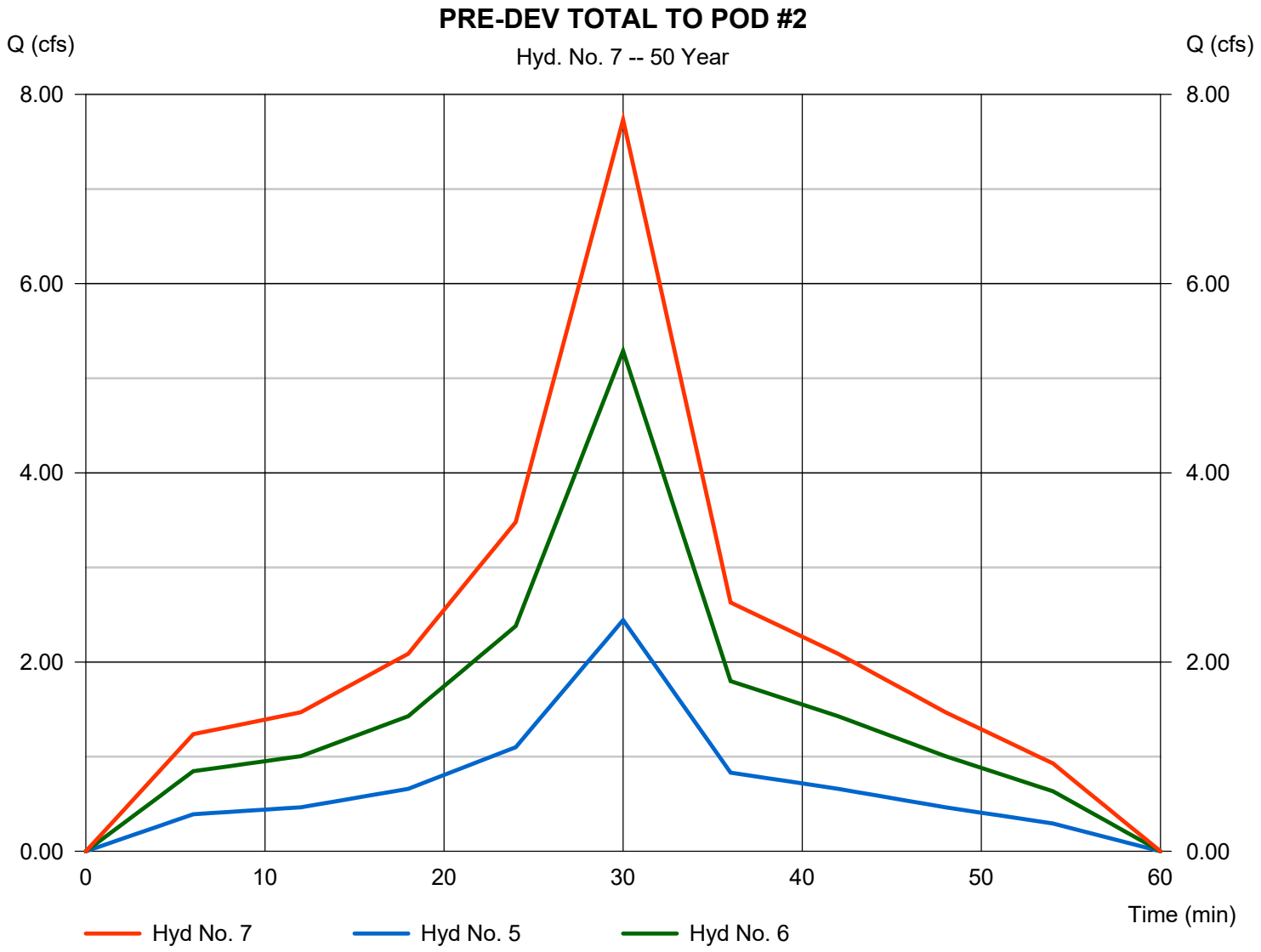
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 7.733 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 8,324 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac

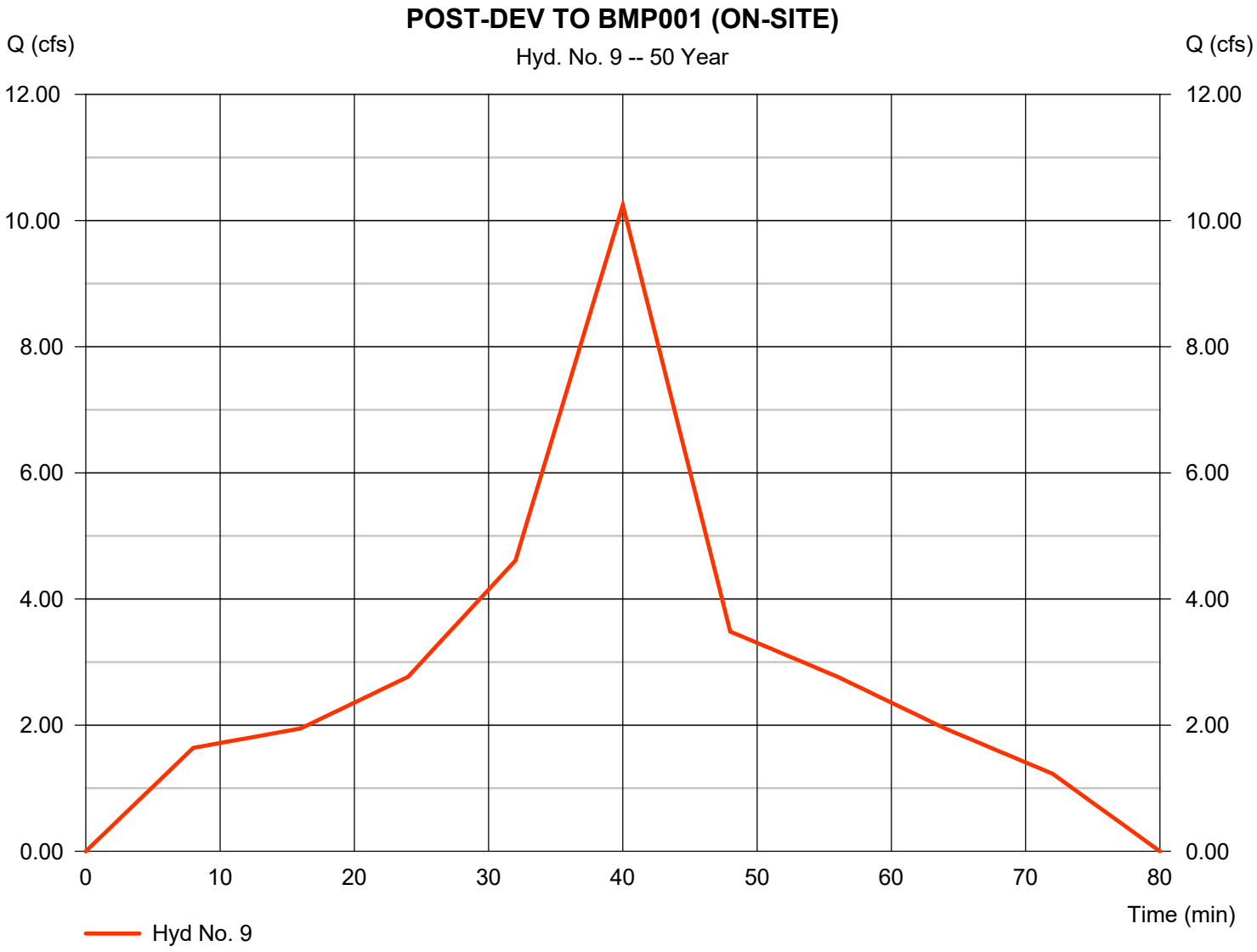


Hydrograph Report

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 10.25 cfs
Storm frequency	= 50 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 14,705 cuft
Drainage area	= 2.500 ac	Runoff coeff.	= 0.63
Intensity	= 6.505 in/hr	Tc by User	= 8.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



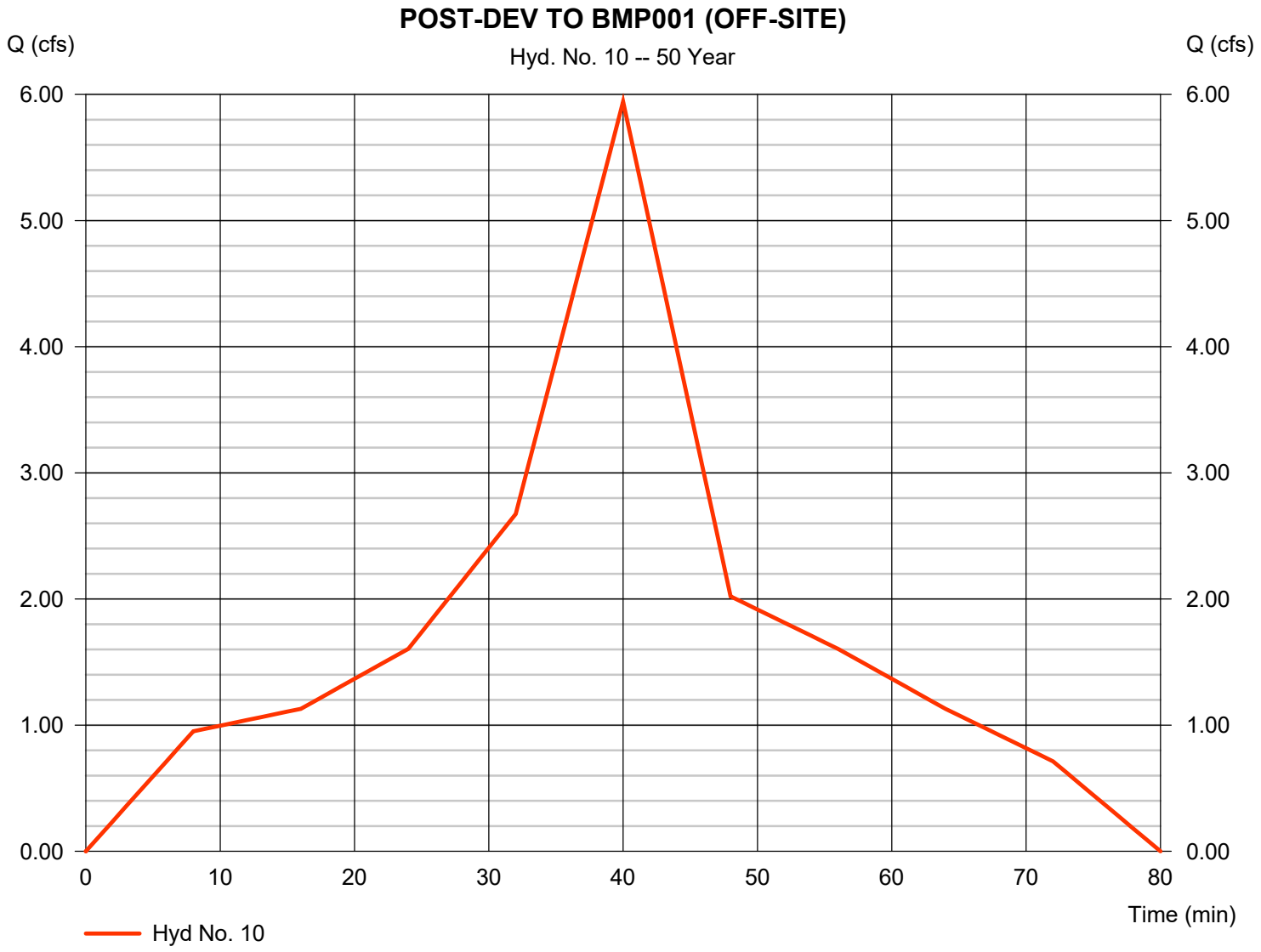
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.943 cfs
Storm frequency	=	50 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	8,529 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	6.505 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a



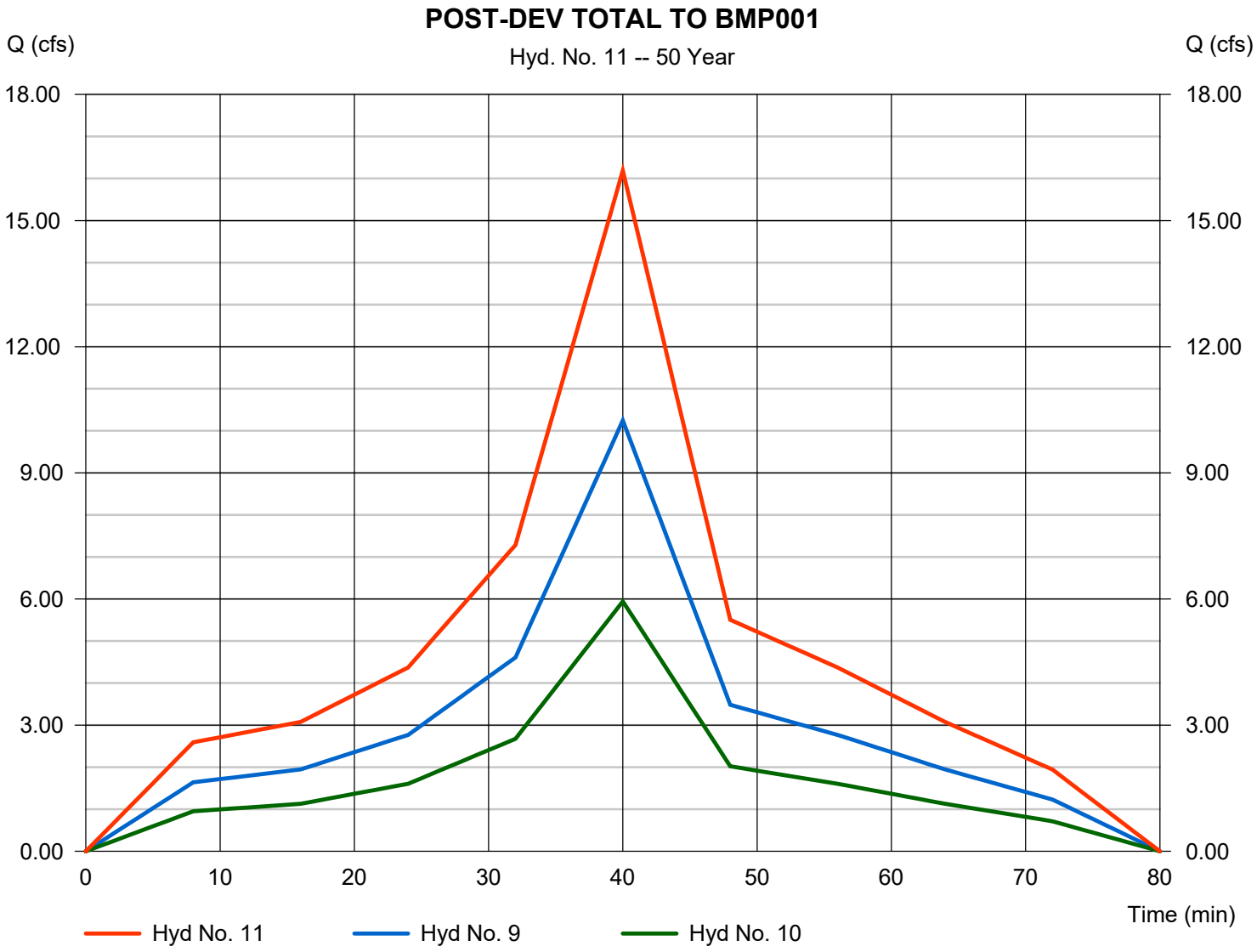
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 16.19 cfs
Storm frequency	= 50 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 23,234 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



Hydrograph Report

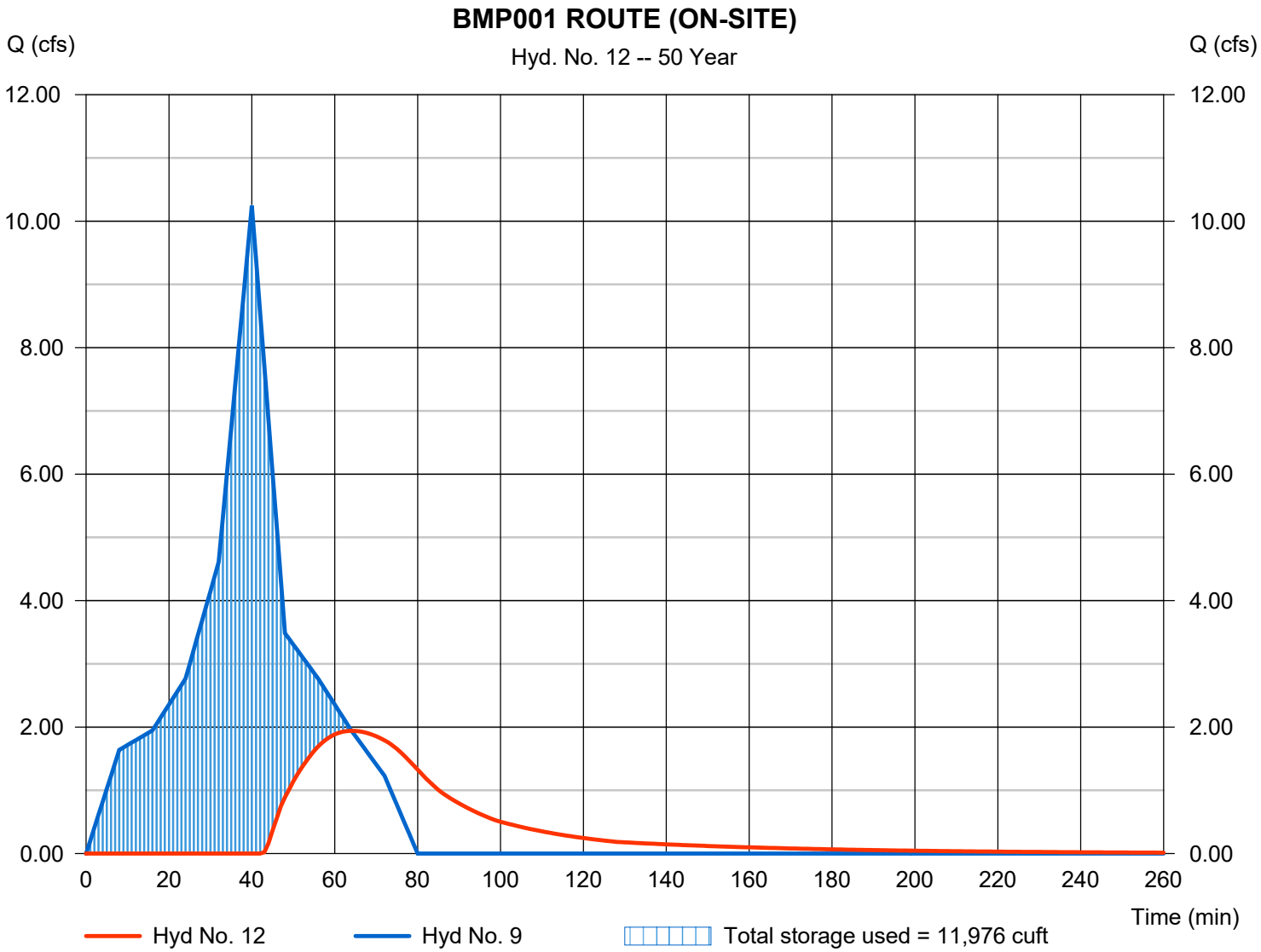
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 1.941 cfs
Storm frequency	= 50 yrs	Time to peak	= 64 min
Time interval	= 1 min	Hyd. volume	= 5,429 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.48 ft
Reservoir name	= BMP 001	Max. Storage	= 11,976 cuft

Storage Indication method used.



Hydrograph Report

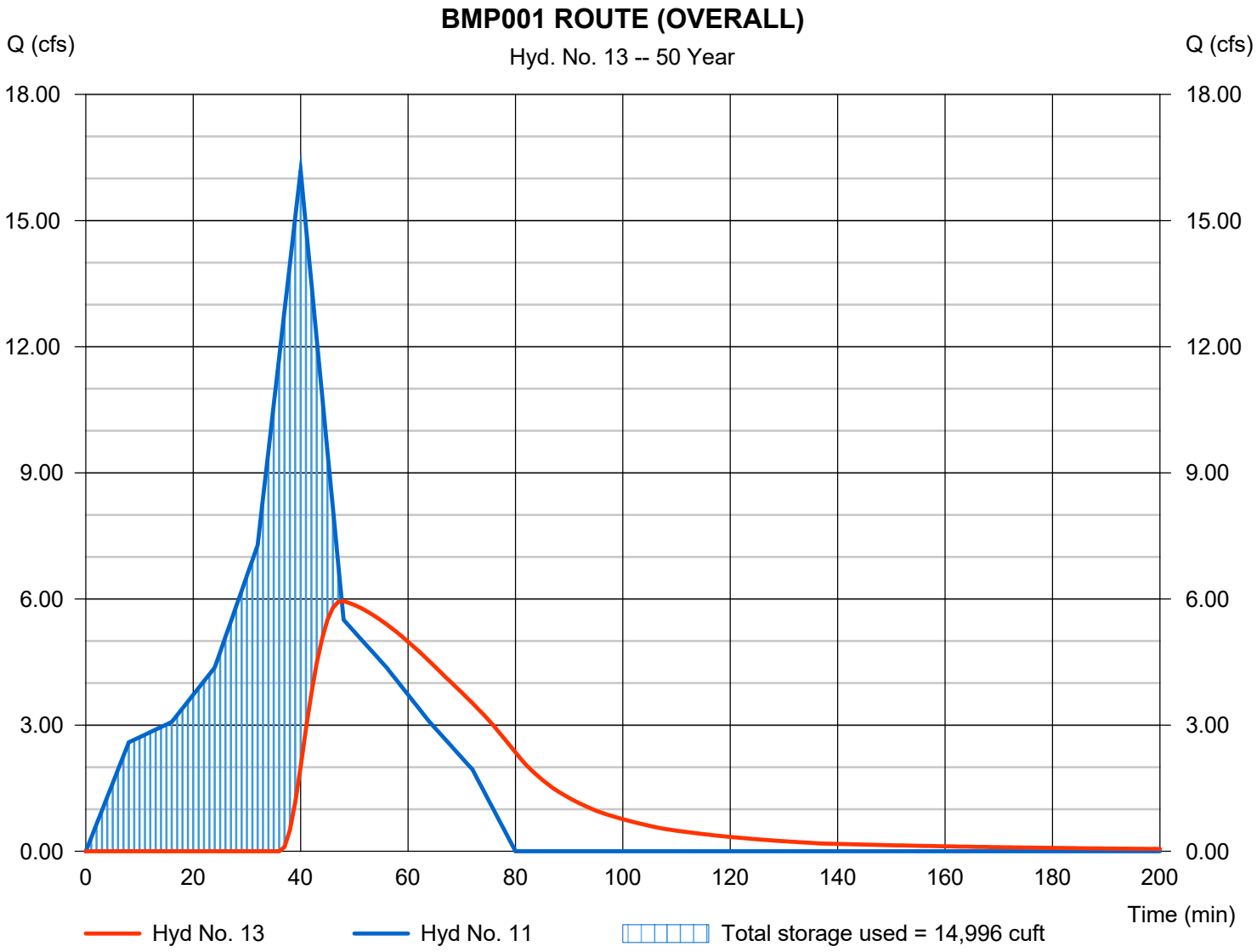
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	5.947 cfs
Storm frequency	=	50 yrs	Time to peak	=	48 min
Time interval	=	1 min	Hyd. volume	=	13,957 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	135.01 ft
Reservoir name	=	BMP 001	Max. Storage	=	14,996 cuft

Storage Indication method used.

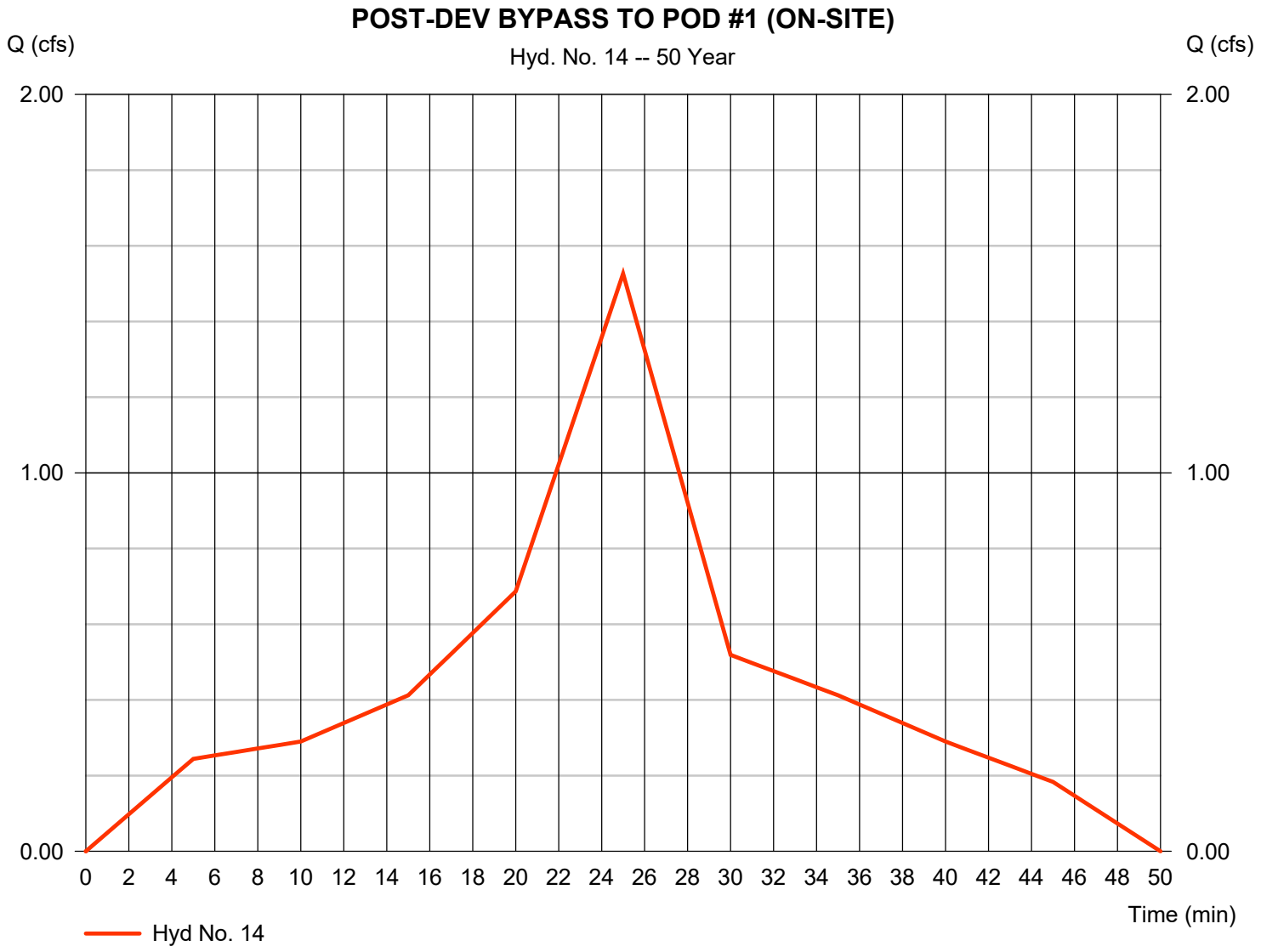


Hydrograph Report

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.526 cfs
Storm frequency	= 50 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,369 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 7.373 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

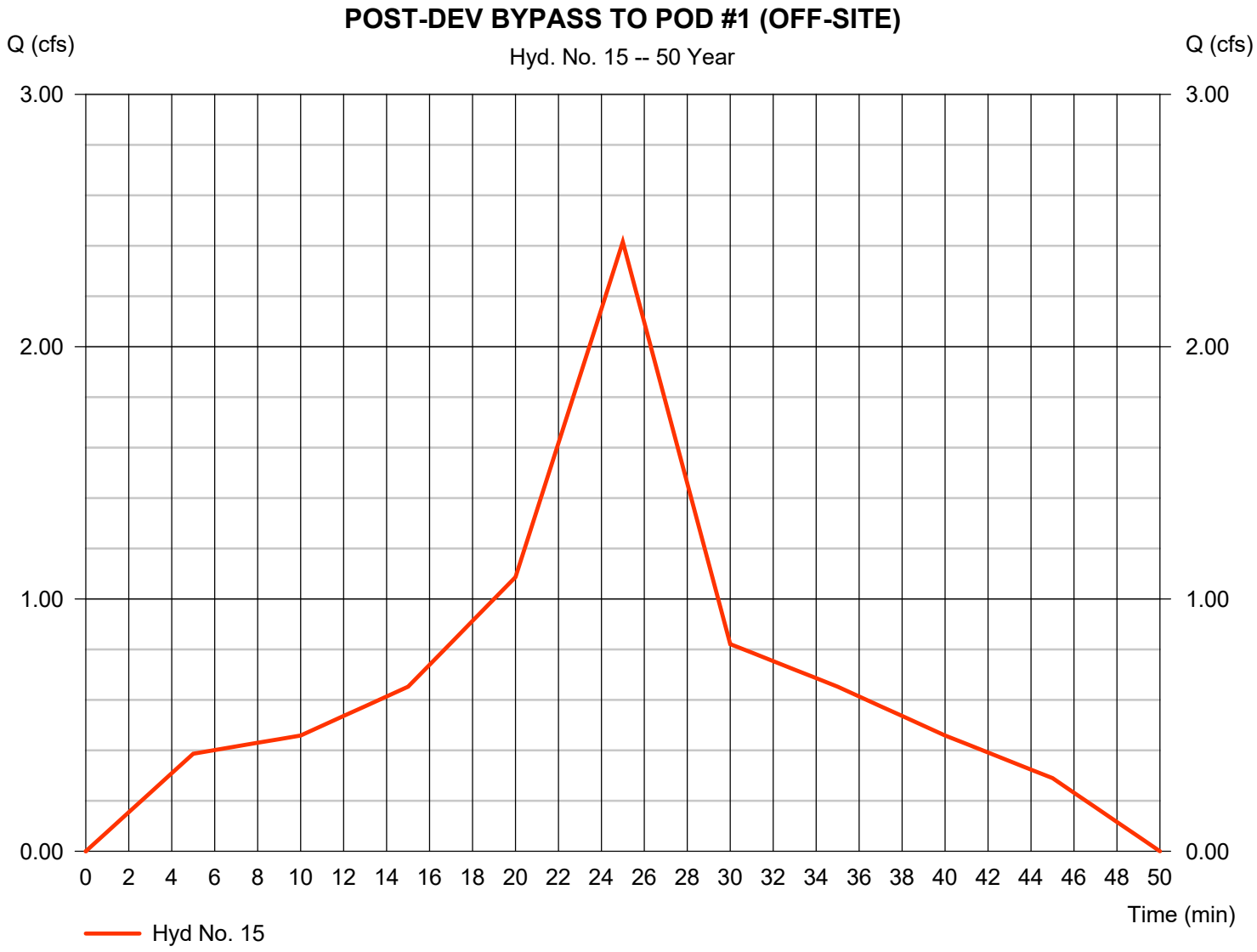


Hydrograph Report

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.416 cfs
Storm frequency	= 50 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 2,167 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 7.373 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	= n/a

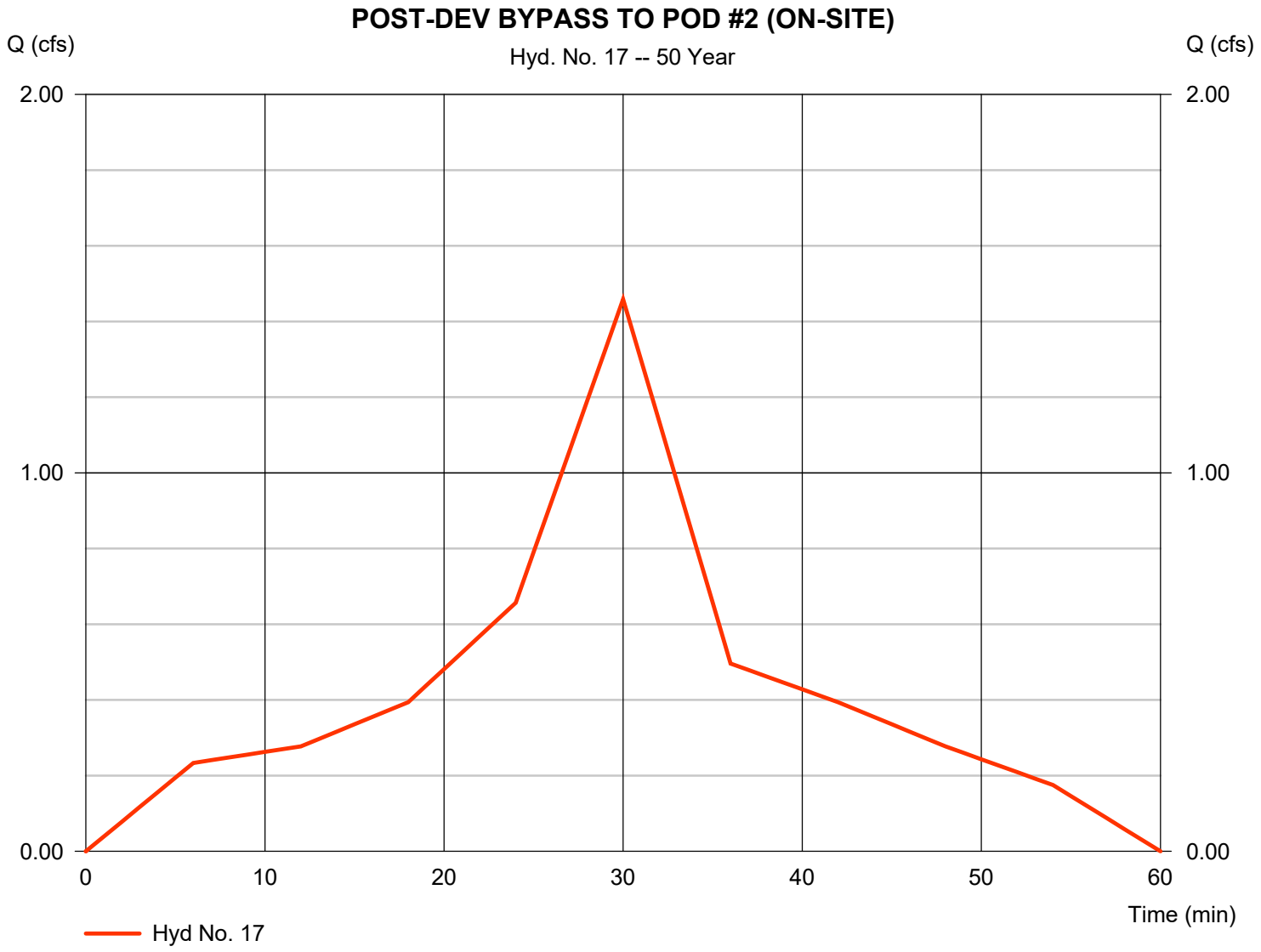


Hydrograph Report

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.459 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,570 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 7.054 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



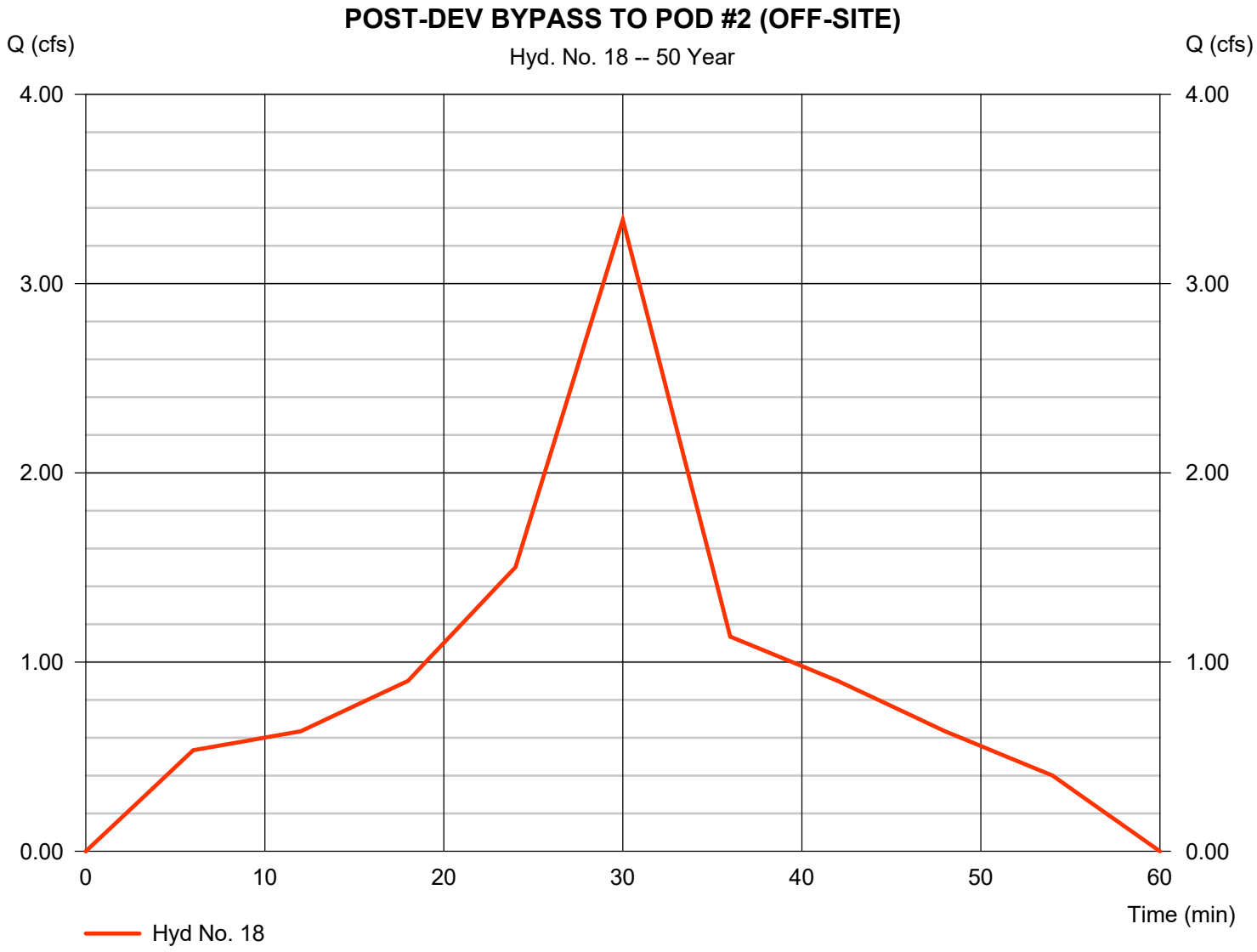
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.337 cfs
Storm frequency	=	50 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	3,591 cuft
Drainage area	=	1.100 ac	Runoff coeff.	=	0.43
Intensity	=	7.054 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

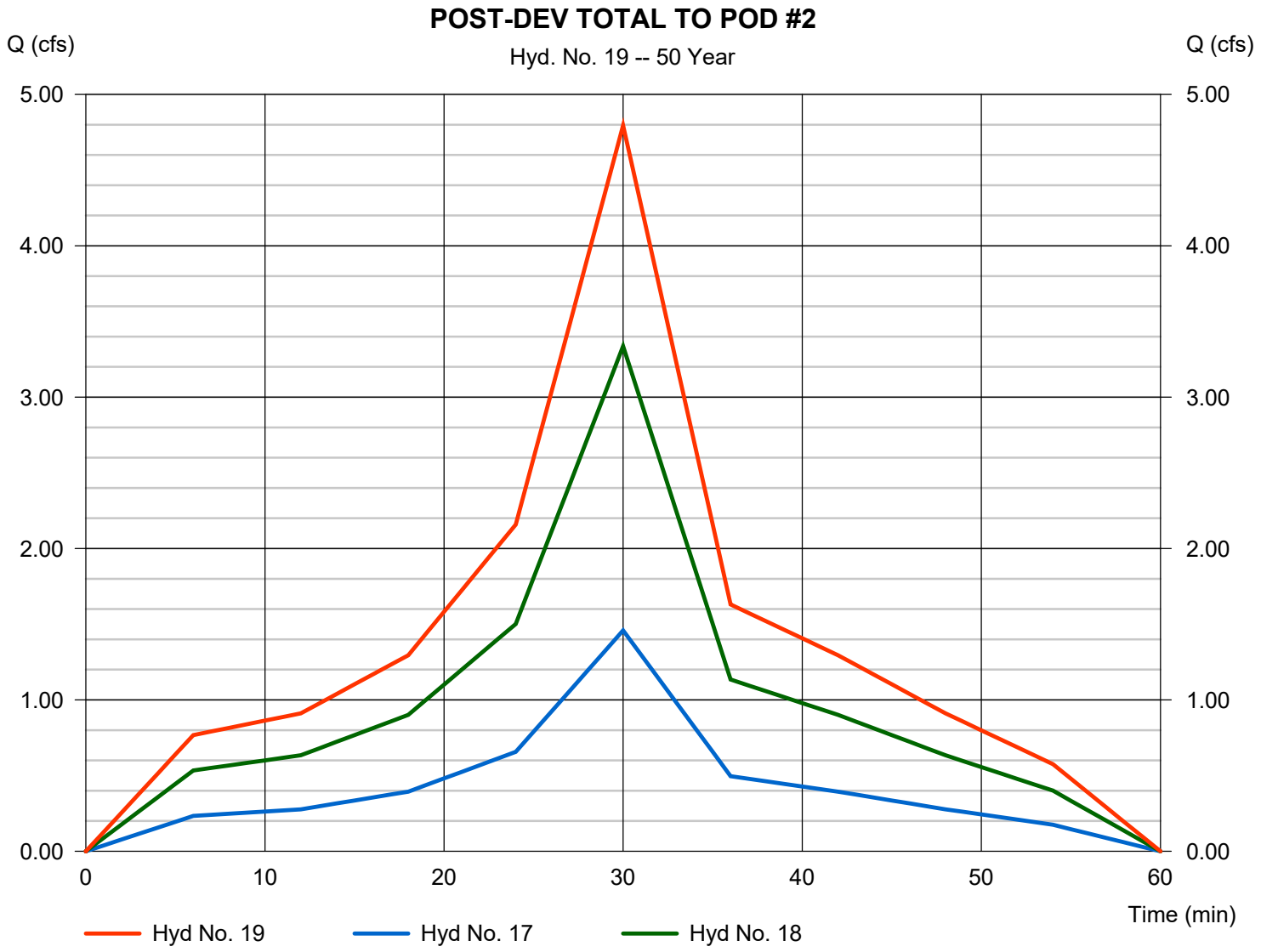


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 4.795 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 5,162 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



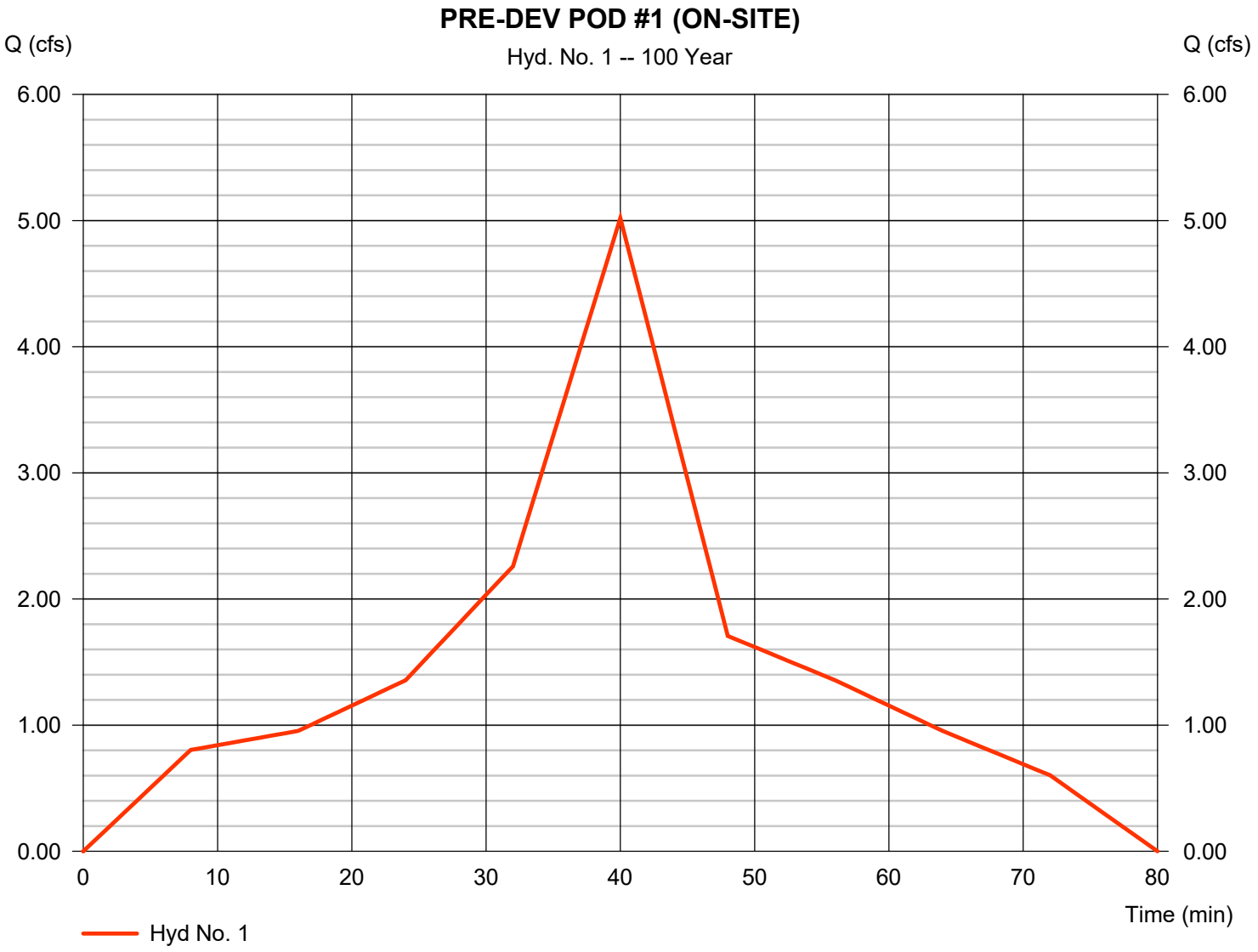
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 1

PRE-DEV POD #1 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.020 cfs
Storm frequency	=	100 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	7,205 cuft
Drainage area	=	2.350 ac	Runoff coeff.	=	0.31
Intensity	=	6.891 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a



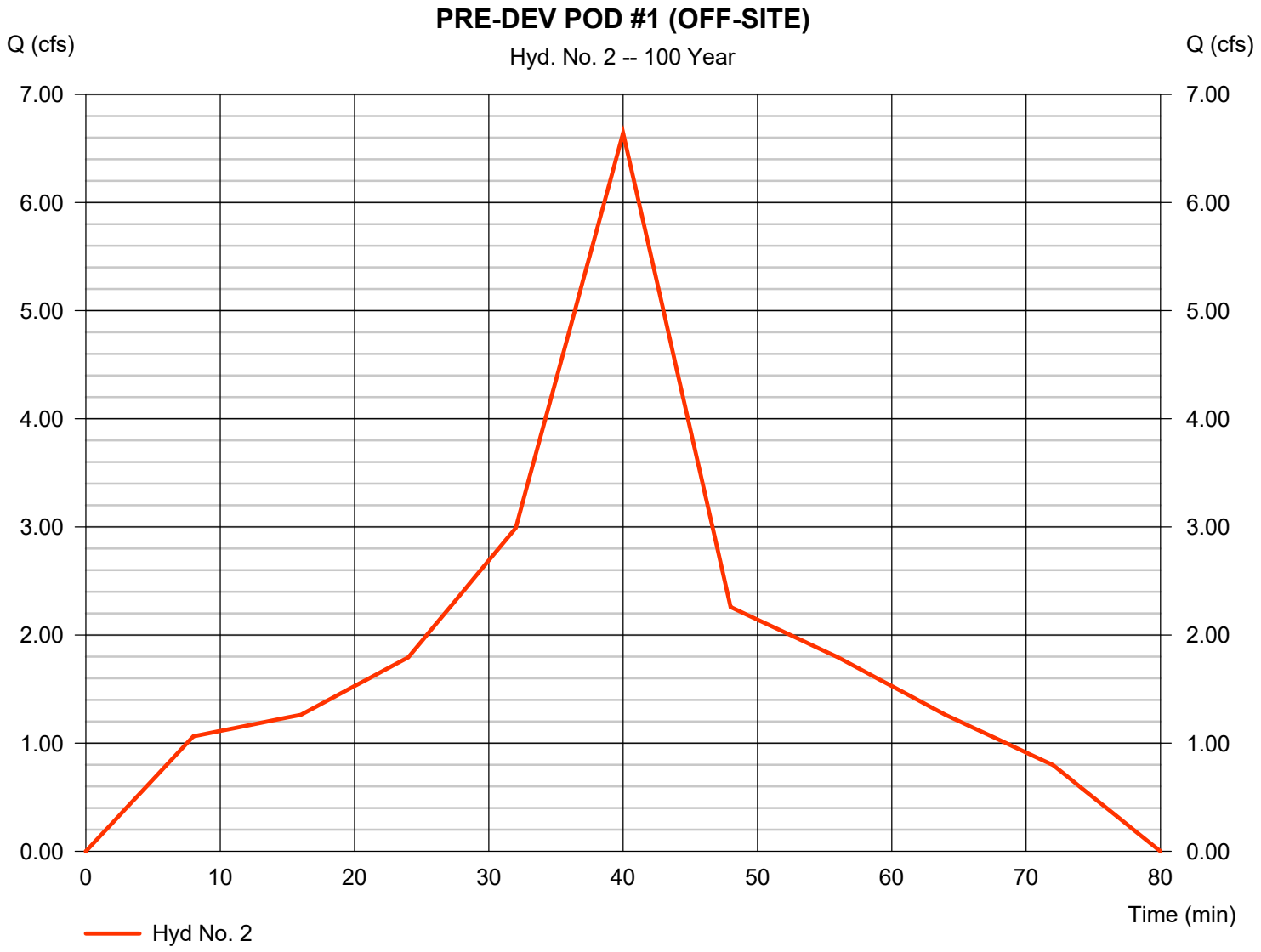
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 2

PRE-DEV POD #1 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	6.643 cfs
Storm frequency	=	100 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	9,534 cuft
Drainage area	=	2.410 ac	Runoff coeff.	=	0.4
Intensity	=	6.891 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a

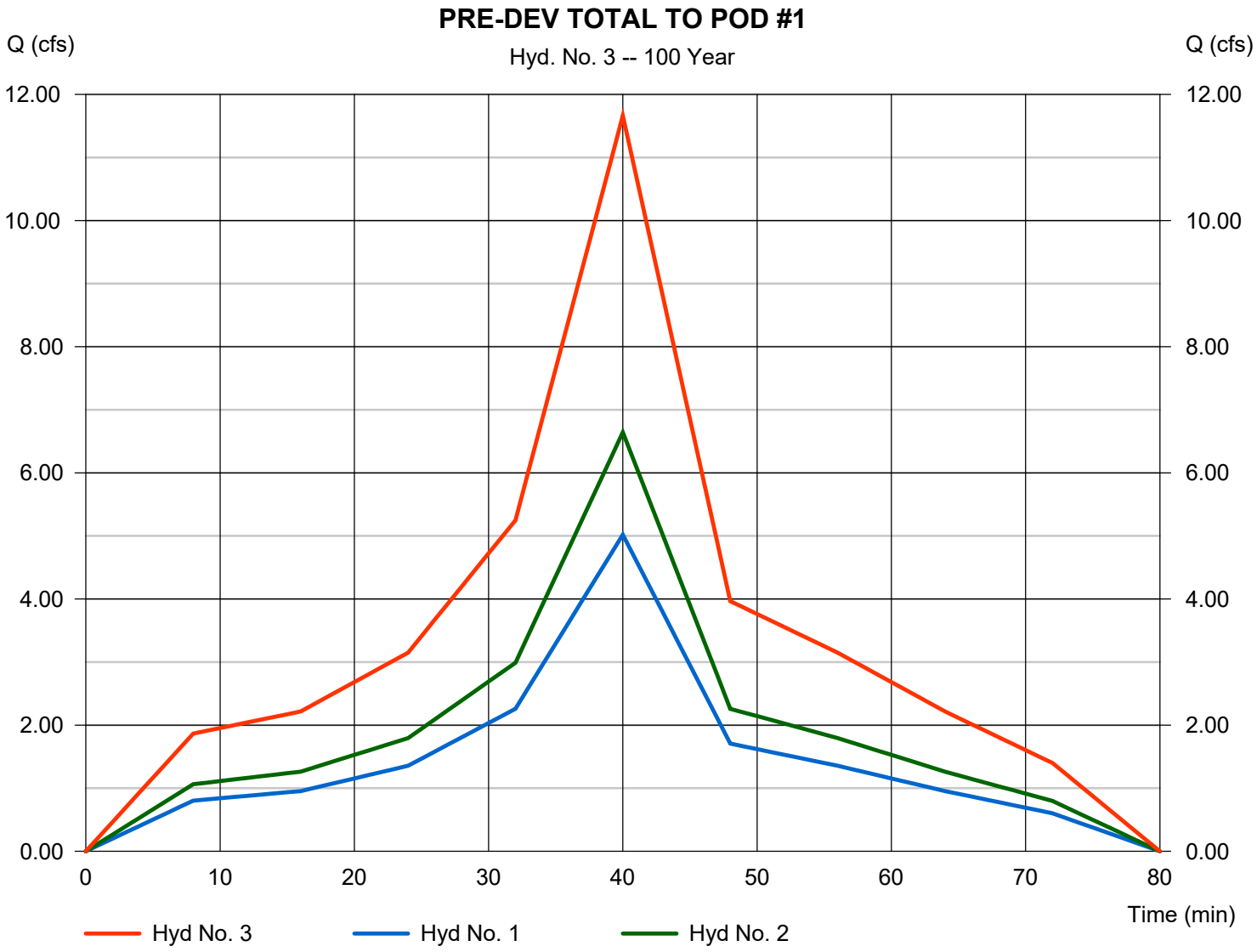


Hydrograph Report

Hyd. No. 3

PRE-DEV TOTAL TO POD #1

Hydrograph type	= Combine	Peak discharge	= 11.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 16,739 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 4.760 ac

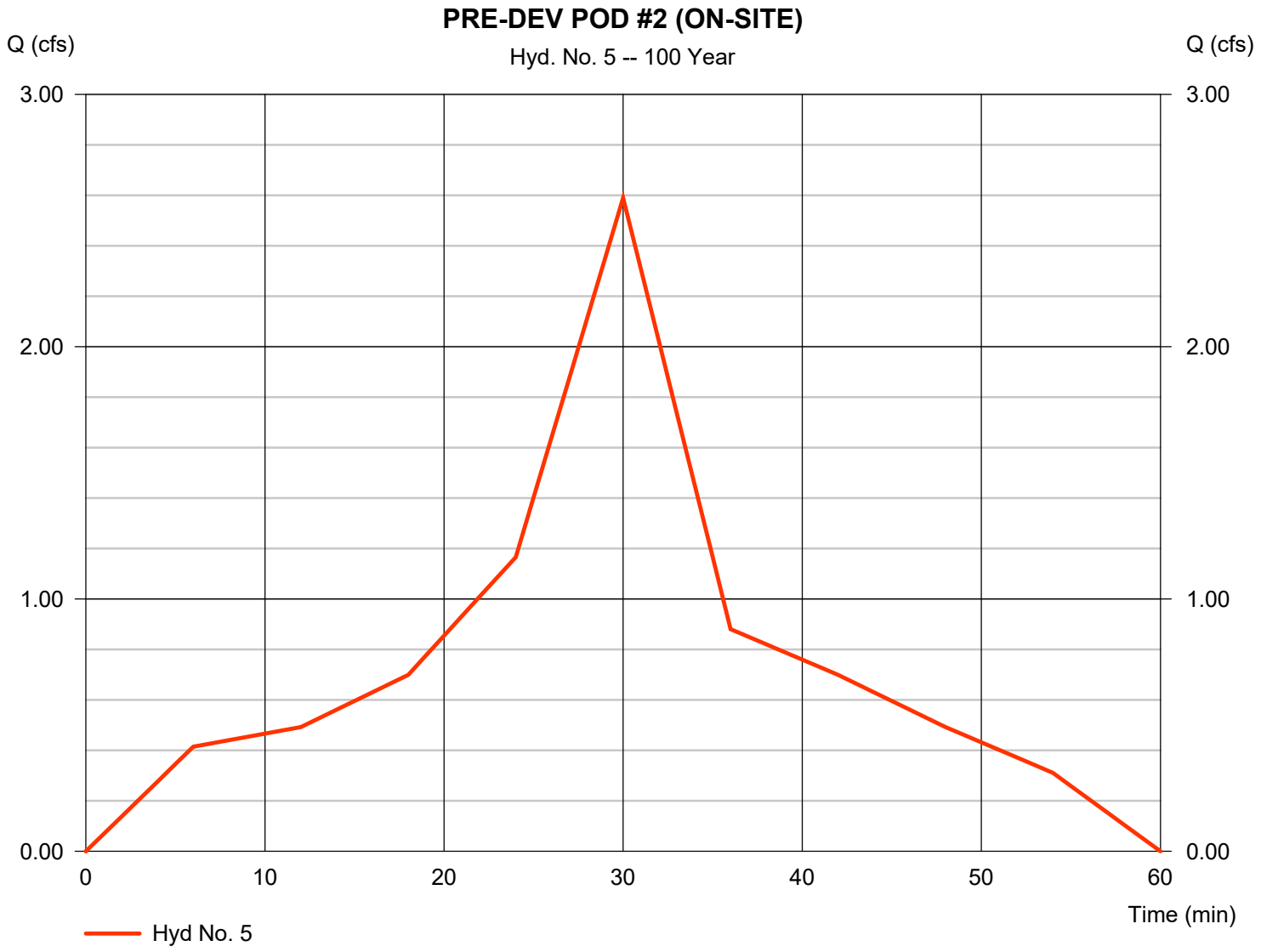


Hydrograph Report

Hyd. No. 5

PRE-DEV POD #2 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	2.590 cfs
Storm frequency	=	100 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	2,788 cuft
Drainage area	=	1.050 ac	Runoff coeff.	=	0.33
Intensity	=	7.475 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a



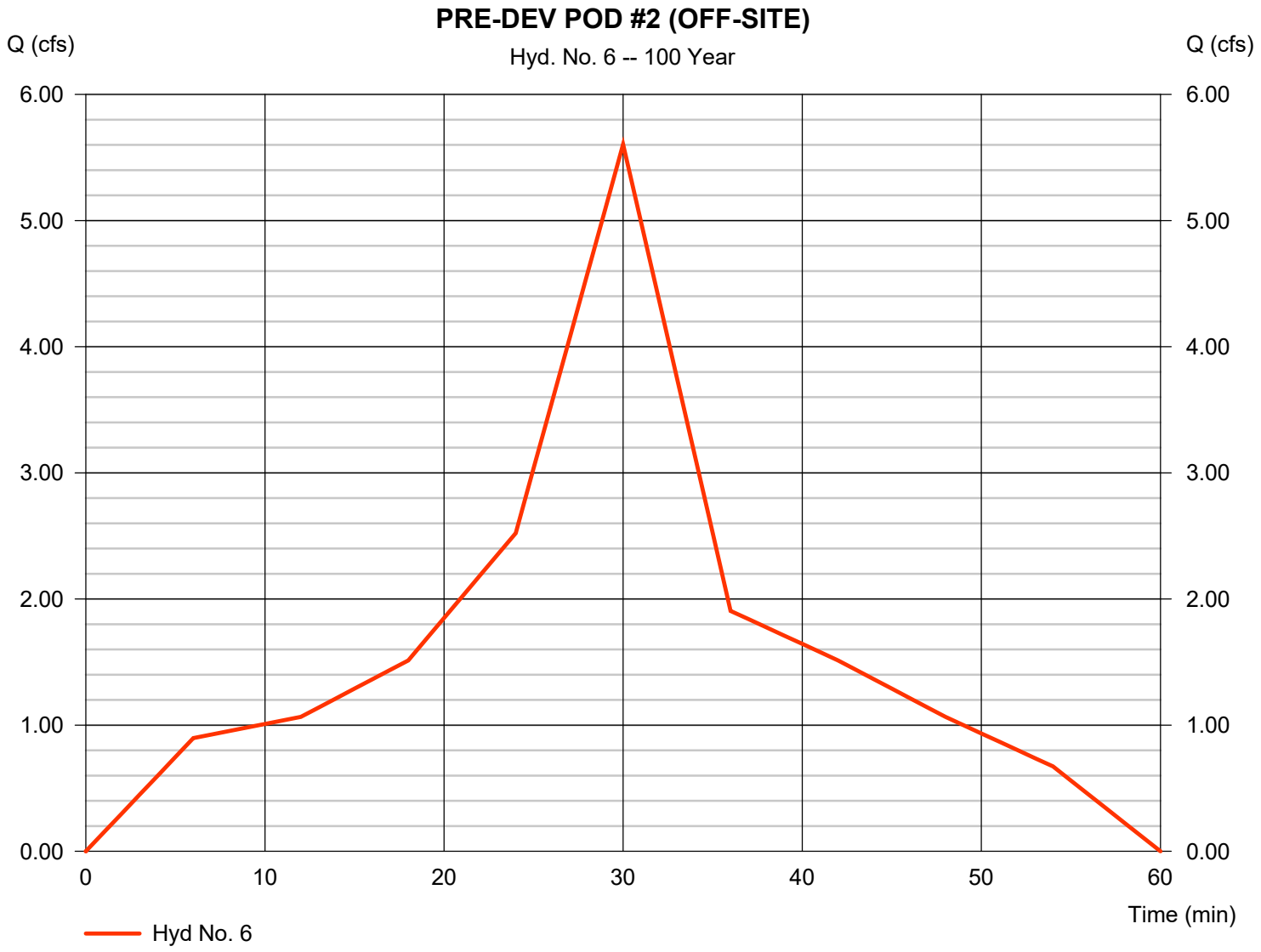
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 6

PRE-DEV POD #2 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	5.604 cfs
Storm frequency	=	100 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	6,033 cuft
Drainage area	=	1.630 ac	Runoff coeff.	=	0.46
Intensity	=	7.475 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

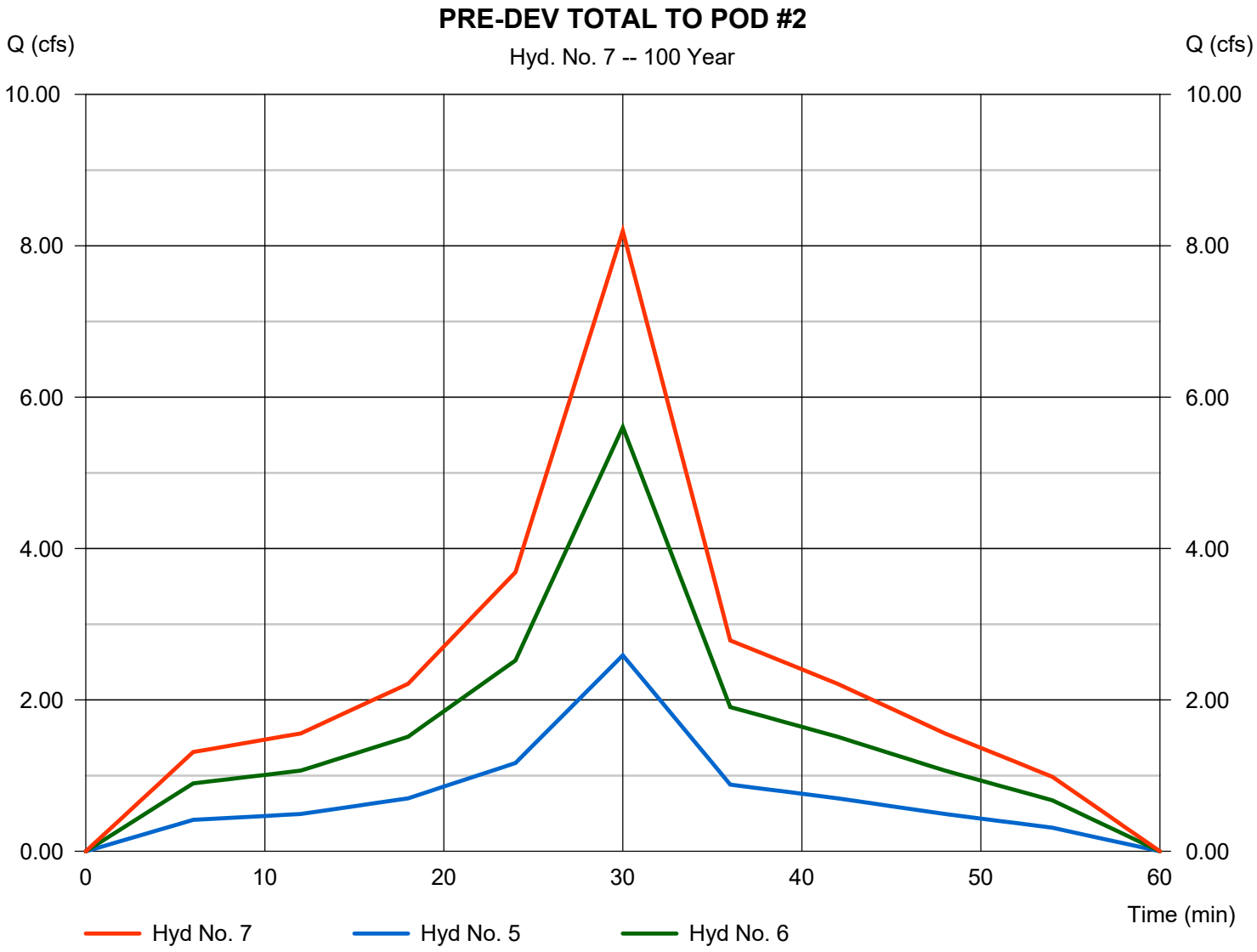


Hydrograph Report

Hyd. No. 7

PRE-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 8.194 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 8,820 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.680 ac



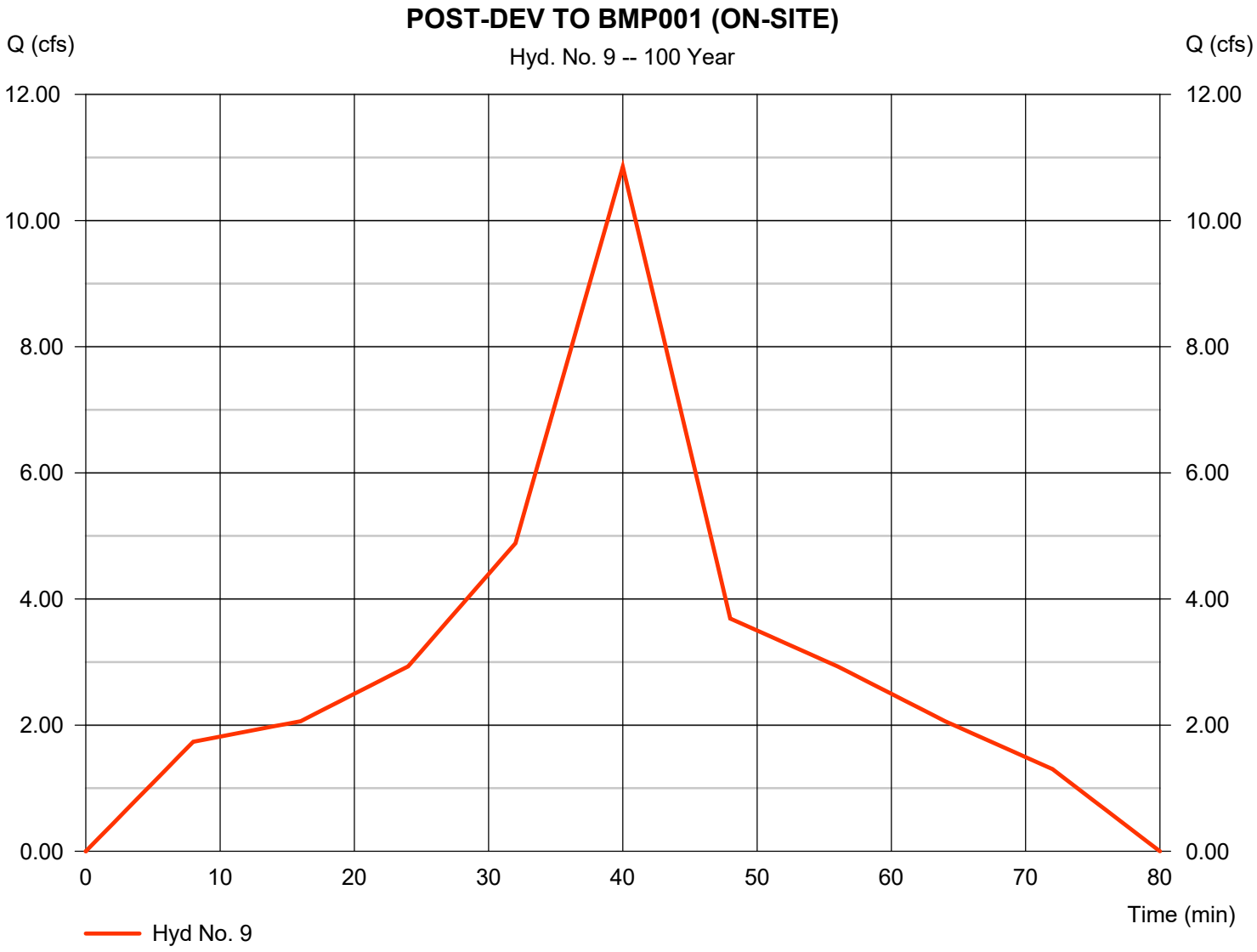
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 9

POST-DEV TO BMP001 (ON-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	10.85 cfs
Storm frequency	=	100 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	15,577 cuft
Drainage area	=	2.500 ac	Runoff coeff.	=	0.63
Intensity	=	6.891 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hydraflow.idf	Asc/Rec limb fact	=	n/a

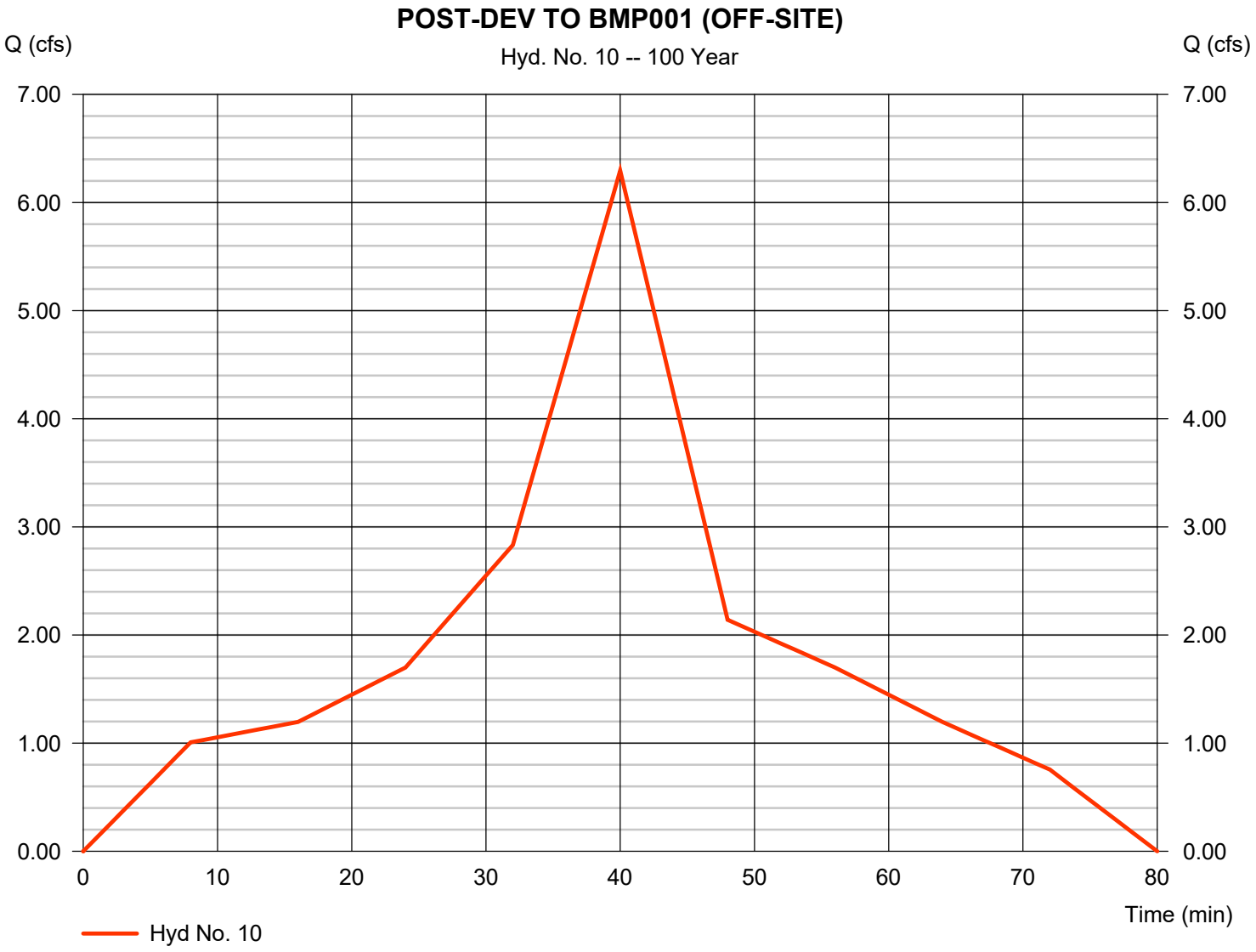


Hydrograph Report

Hyd. No. 10

POST-DEV TO BMP001 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	6.295 cfs
Storm frequency	=	100 yrs	Time to peak	=	40 min
Time interval	=	1 min	Hyd. volume	=	9,035 cuft
Drainage area	=	2.030 ac	Runoff coeff.	=	0.45
Intensity	=	6.891 in/hr	Tc by User	=	8.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	=	n/a



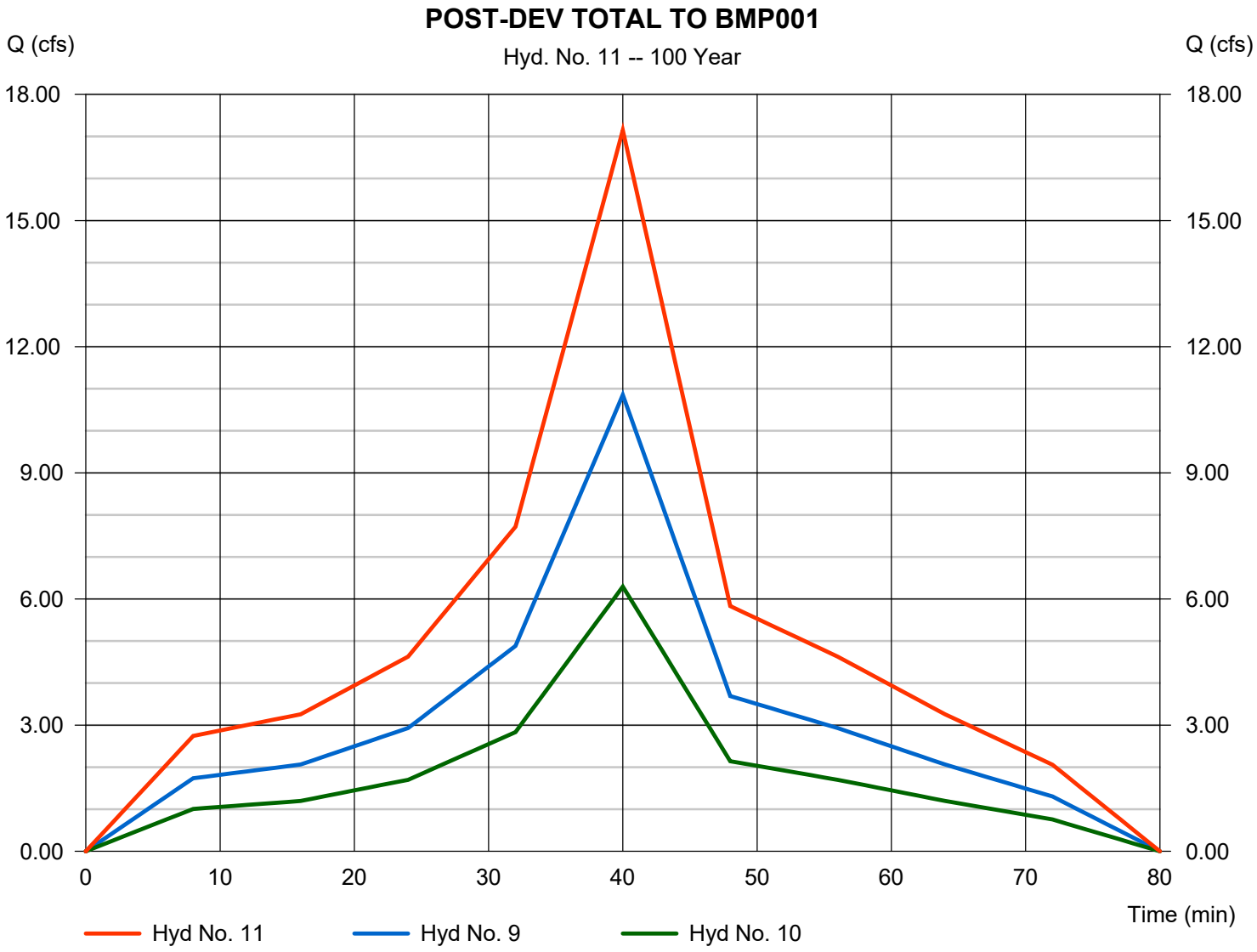
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 11

POST-DEV TOTAL TO BMP001

Hydrograph type	= Combine	Peak discharge	= 17.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 40 min
Time interval	= 1 min	Hyd. volume	= 24,612 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 4.530 ac



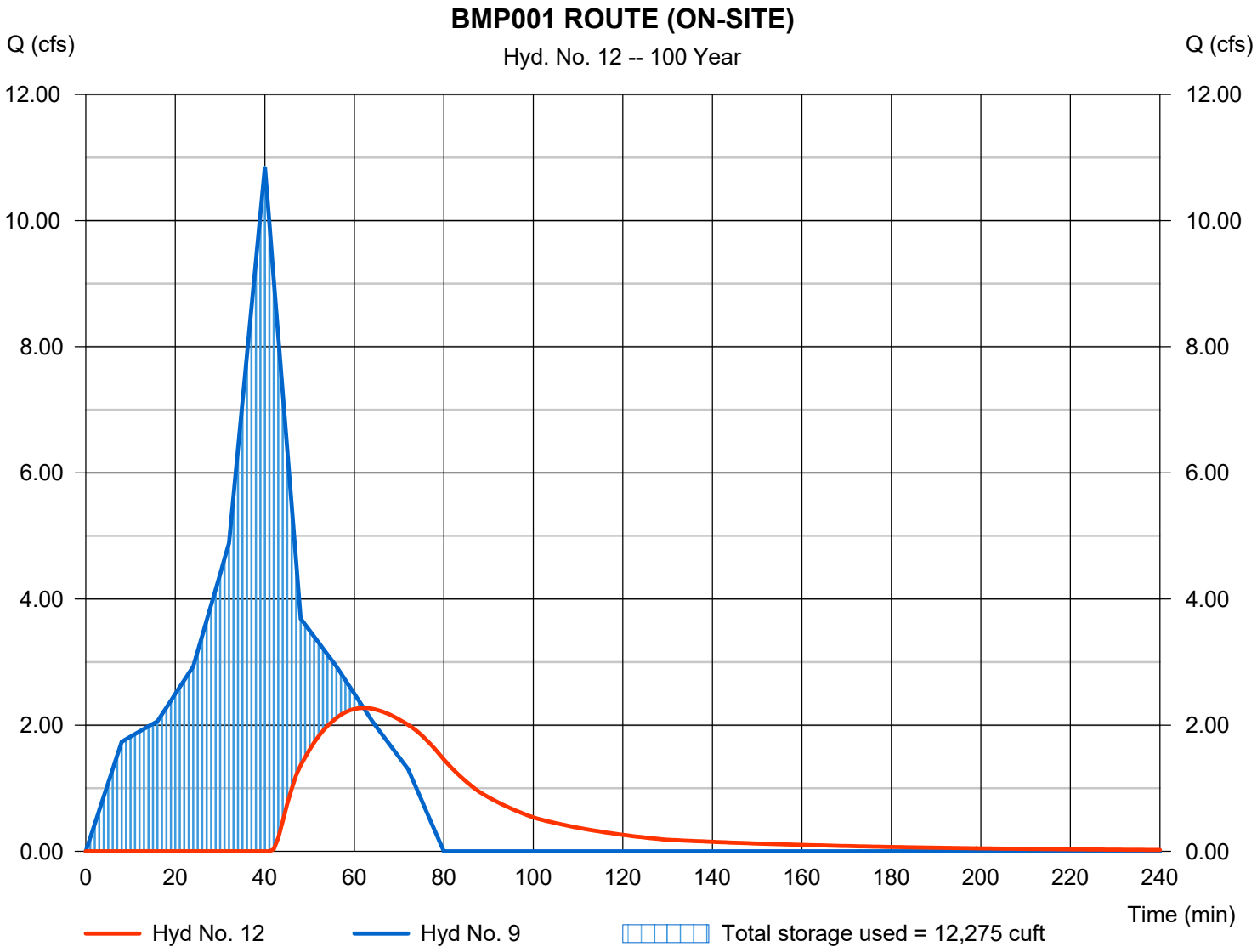
Hydrograph Report

Hyd. No. 12

BMP001 ROUTE (ON-SITE)

Hydrograph type	= Reservoir	Peak discharge	= 2.273 cfs
Storm frequency	= 100 yrs	Time to peak	= 62 min
Time interval	= 1 min	Hyd. volume	= 6,301 cuft
Inflow hyd. No.	= 9 - POST-DEV TO BMP001 (ON-SITE)	Max. Elevation	= 134.53 ft
Reservoir name	= BMP 001	Max. Storage	= 12,275 cuft

Storage Indication method used.



Hydrograph Report

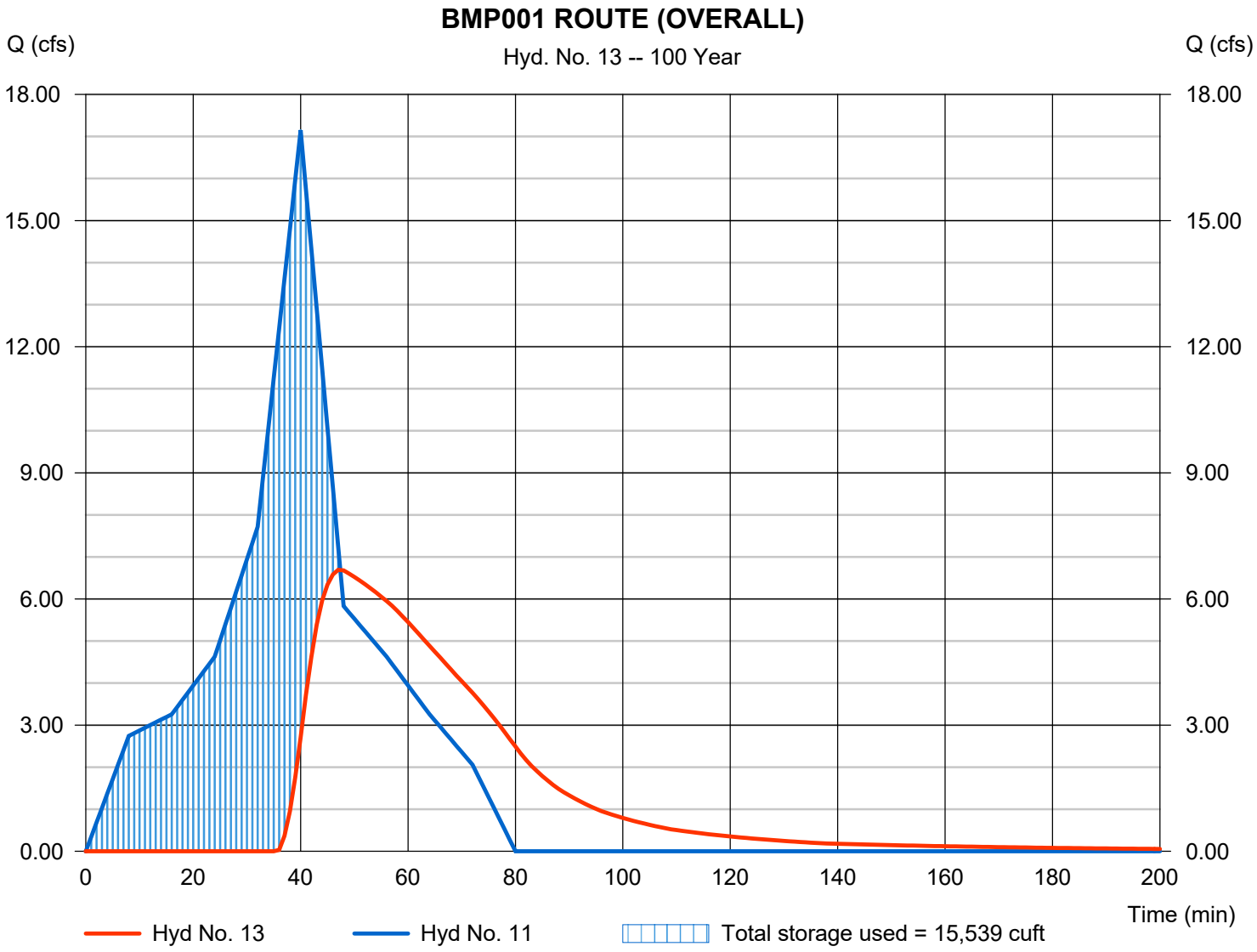
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 13

BMP001 ROUTE (OVERALL)

Hydrograph type	=	Reservoir	Peak discharge	=	6.691 cfs
Storm frequency	=	100 yrs	Time to peak	=	47 min
Time interval	=	1 min	Hyd. volume	=	15,336 cuft
Inflow hyd. No.	=	11 - POST-DEV TOTAL TO BMP001	Max. Elevation	=	135.10 ft
Reservoir name	=	BMP 001	Max. Storage	=	15,539 cuft

Storage Indication method used.



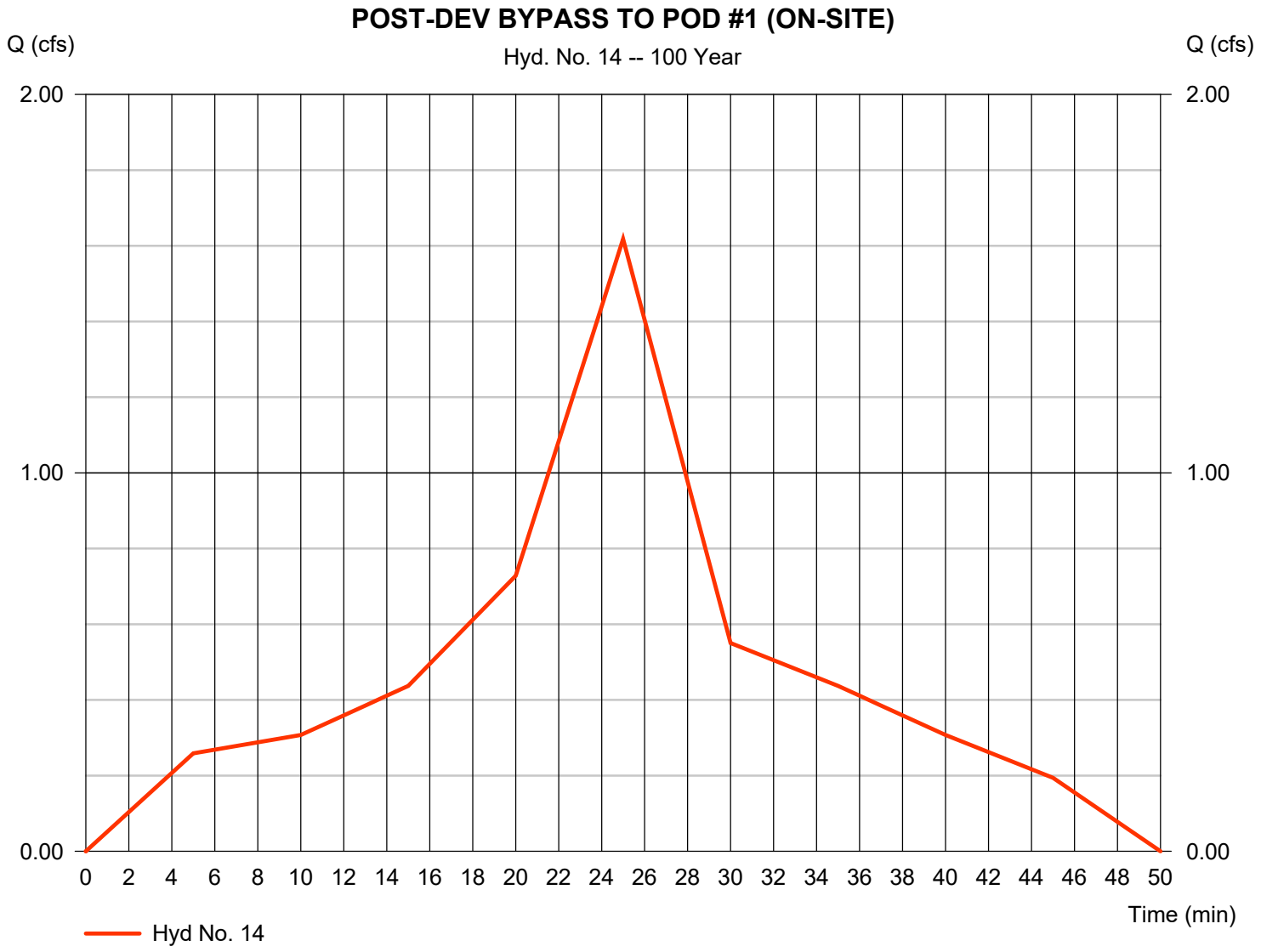
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 14

POST-DEV BYPASS TO POD #1 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.618 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 1,451 cuft
Drainage area	= 0.460 ac	Runoff coeff.	= 0.45
Intensity	= 7.817 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

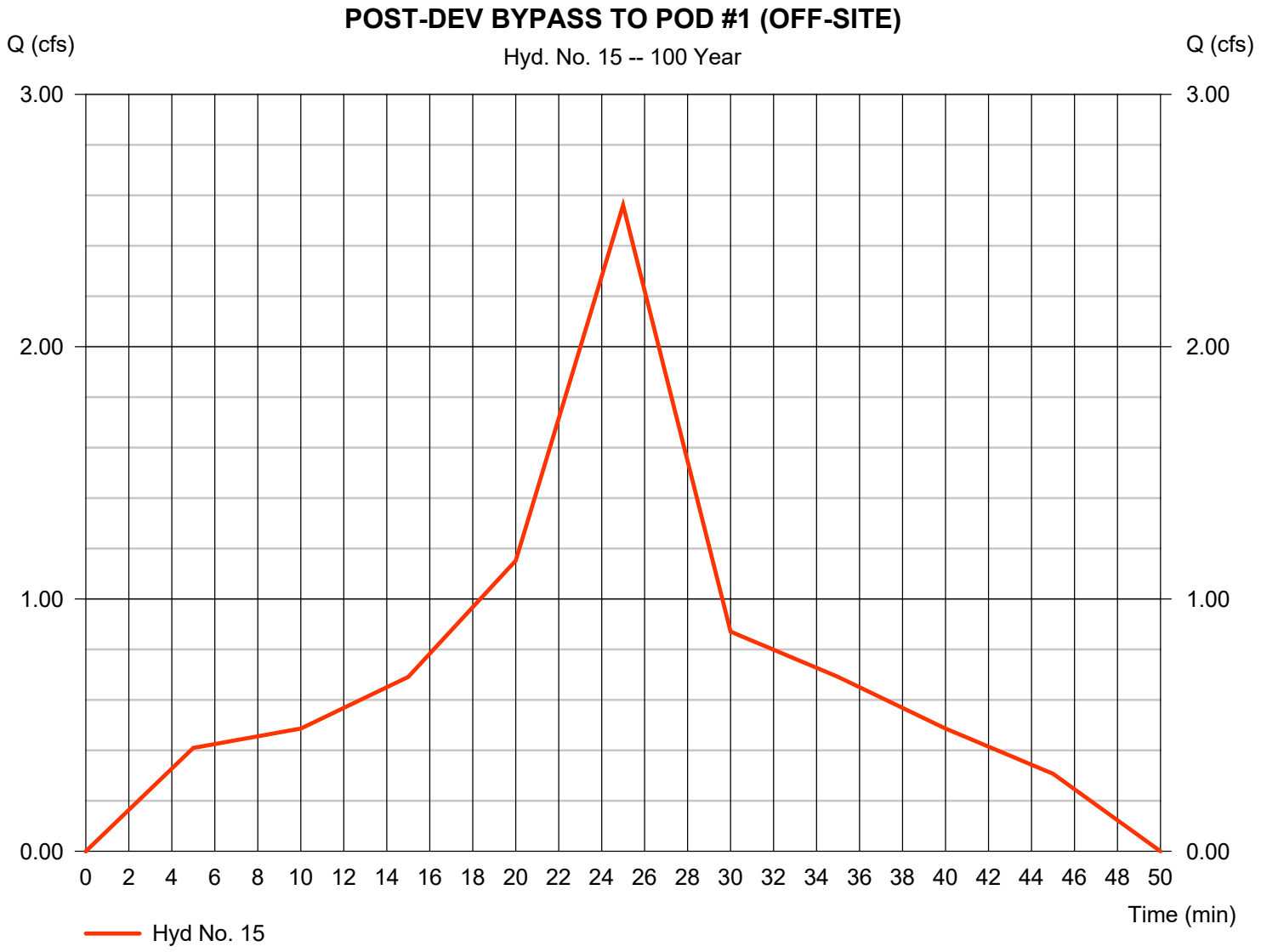


Hydrograph Report

Hyd. No. 15

POST-DEV BYPASS TO POD #1 (OFF-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 2.561 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 2,297 cuft
Drainage area	= 0.910 ac	Runoff coeff.	= 0.36
Intensity	= 7.817 in/hr	Tc by User	= 5.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a



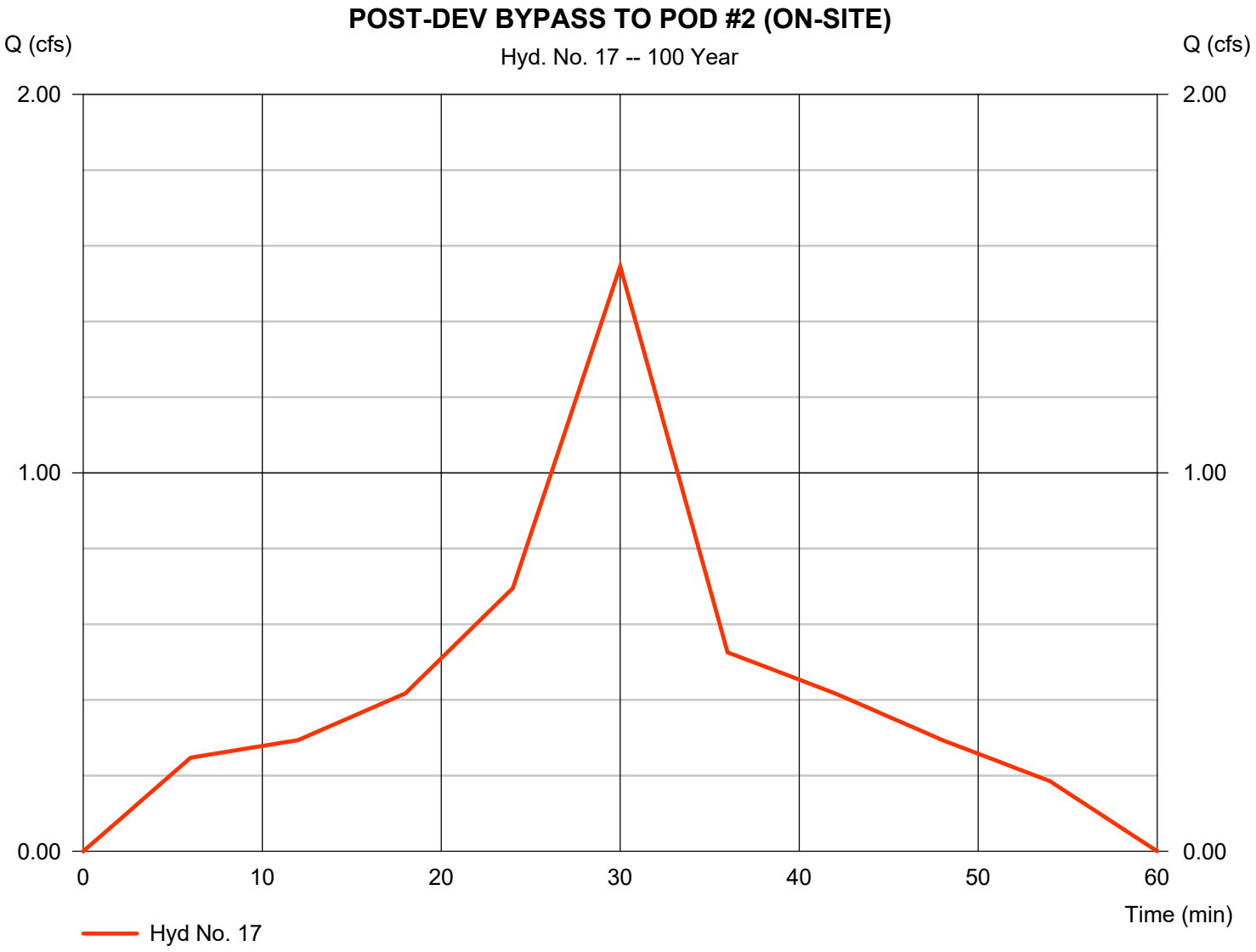
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 09 / 13 / 2023

Hyd. No. 17

POST-DEV BYPASS TO POD #2 (ON-SITE)

Hydrograph type	= Dekalb	Peak discharge	= 1.546 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,664 cuft
Drainage area	= 0.440 ac	Runoff coeff.	= 0.47
Intensity	= 7.475 in/hr	Tc by User	= 6.00 min
IDF Curve	= 2154-10_NOAA Intensities_Hyd.IDF	Asc/Rec limb fact	= n/a

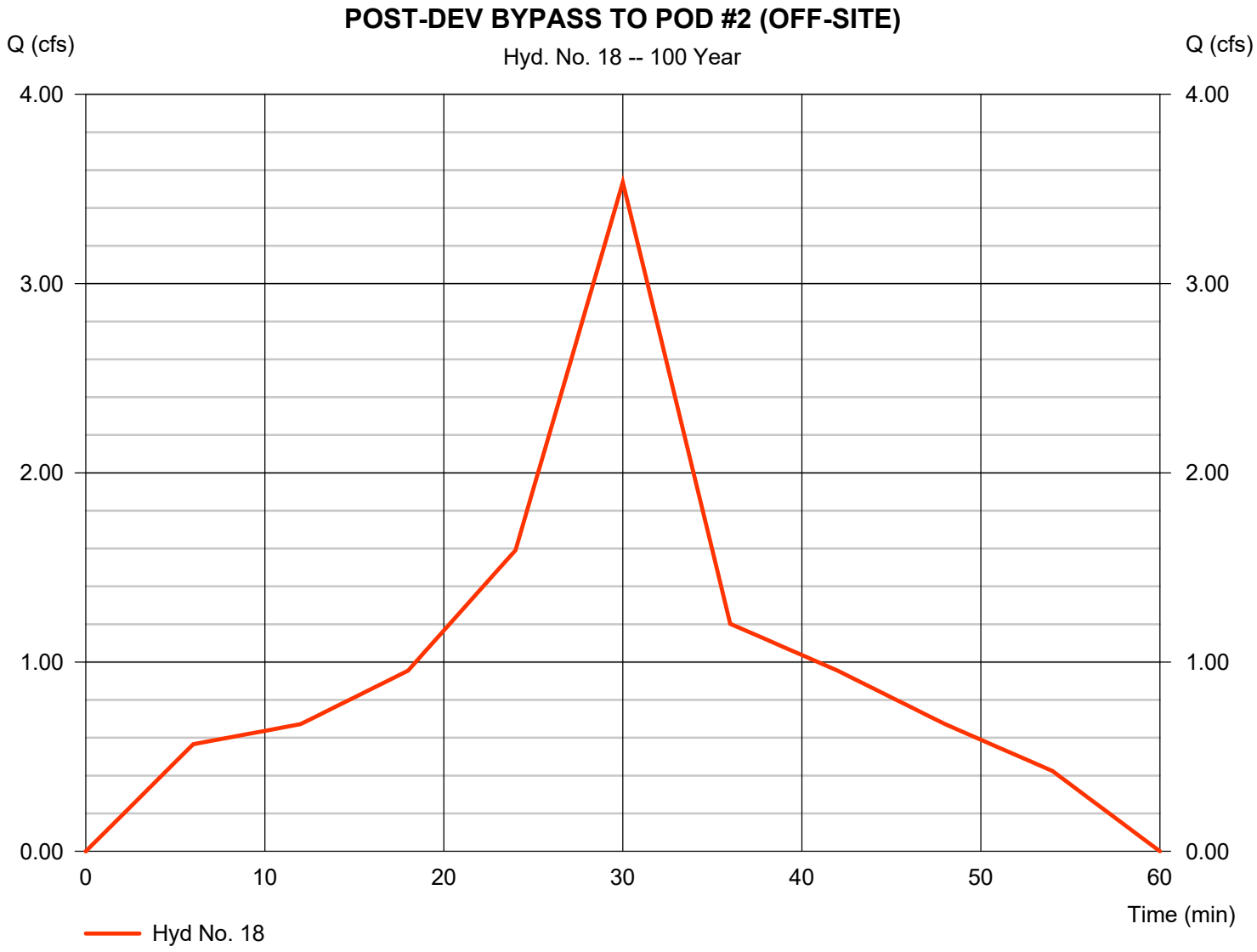


Hydrograph Report

Hyd. No. 18

POST-DEV BYPASS TO POD #2 (OFF-SITE)

Hydrograph type	=	Dekalb	Peak discharge	=	3.535 cfs
Storm frequency	=	100 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	3,806 cuft
Drainage area	=	1.100 ac	Runoff coeff.	=	0.43
Intensity	=	7.475 in/hr	Tc by User	=	6.00 min
IDF Curve	=	2154-10_NOAA Intensities_Hyd.idf	Asc/Rec limb fact	=	n/a

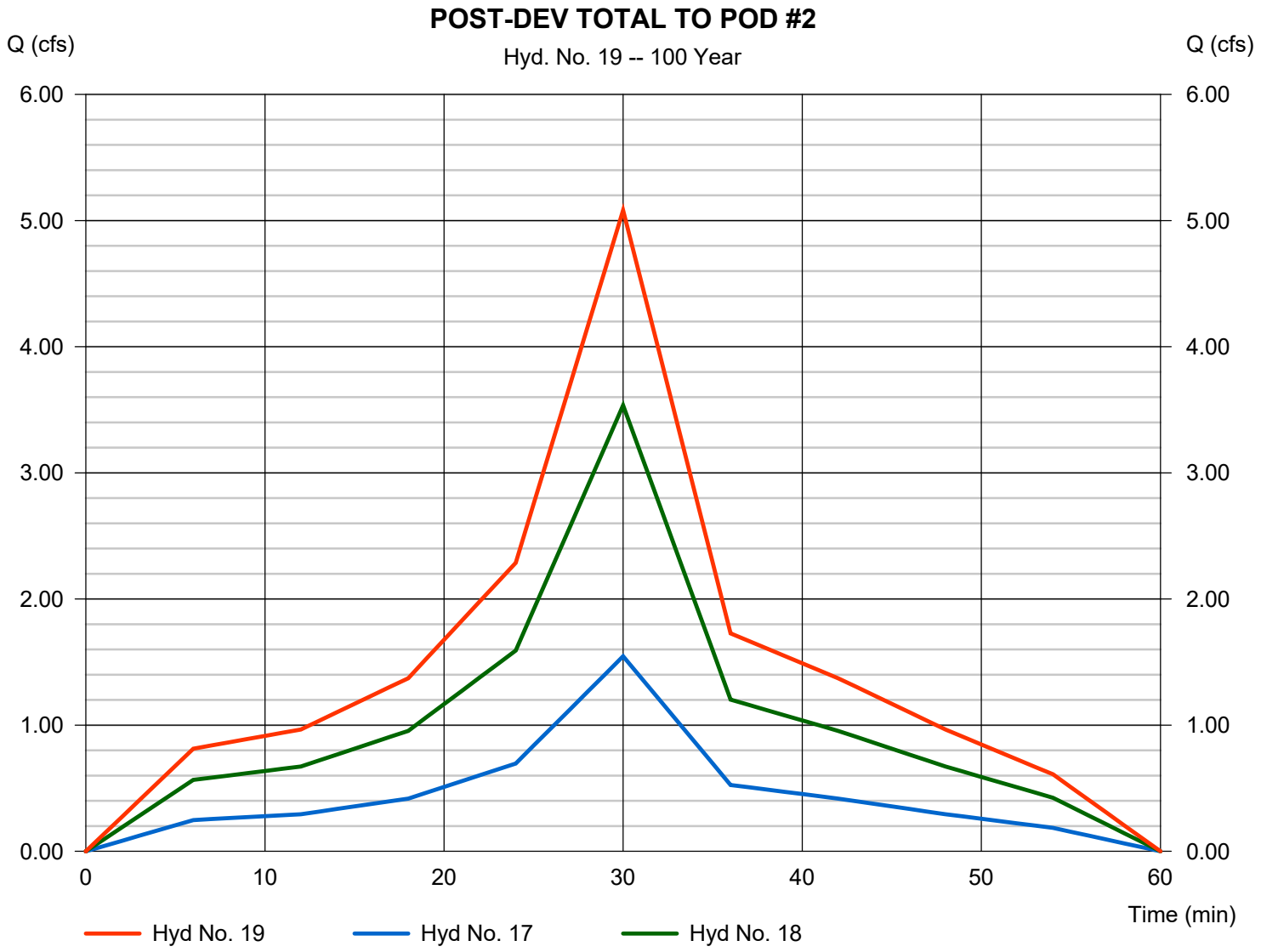


Hydrograph Report

Hyd. No. 19

POST-DEV TOTAL TO POD #2

Hydrograph type	= Combine	Peak discharge	= 5.081 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 5,469 cuft
Inflow hyds.	= 17, 18	Contrib. drain. area	= 1.540 ac



APPENDIX C

NOAA Atlas 14, Volume 2, Version 3
Location name: Elkins Park, Pennsylvania, USA*
Latitude: 40.0697°, Longitude: -75.1172°
Elevation: 147.23 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

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	**0.346** (0.316-0.380)	**0.413** (0.376-0.453)	**0.487** (0.443-0.534)	**0.541** (0.491-0.593)	**0.606** (0.548-0.664)	**0.652** (0.586-0.715)	**0.698** (0.624-0.767)	**0.739** (0.657-0.815)	**0.789** (0.695-0.875)	**0.827** (0.722-0.922)
10-min	**0.553** (0.505-0.607)	**0.660** (0.602-0.724)	**0.780** (0.710-0.855)	**0.865** (0.786-0.948)	**0.966** (0.873-1.06)	**1.04** (0.933-1.14)	**1.11** (0.992-1.22)	**1.17** (1.04-1.29)	**1.25** (1.10-1.38)	**1.30** (1.14-1.45)
15-min	**0.691** (0.631-0.758)	**0.830** (0.756-0.910)	**0.987** (0.898-1.08)	**1.09** (0.994-1.20)	**1.23** (1.11-1.34)	**1.32** (1.18-1.44)	**1.40** (1.25-1.54)	**1.48** (1.31-1.63)	**1.57** (1.38-1.74)	**1.63** (1.43-1.82)
30-min	**0.947** (0.865-1.04)	**1.15** (1.05-1.26)	**1.40** (1.27-1.54)	**1.59** (1.44-1.74)	**1.81** (1.64-1.99)	**1.98** (1.78-2.17)	**2.15** (1.92-2.36)	**2.30** (2.05-2.54)	**2.50** (2.20-2.77)	**2.65** (2.31-2.95)
60-min	**1.18** (1.08-1.30)	**1.44** (1.31-1.58)	**1.80** (1.64-1.97)	**2.07** (1.88-2.26)	**2.42** (2.18-2.65)	**2.68** (2.41-2.94)	**2.96** (2.65-3.25)	**3.23** (2.87-3.56)	**3.59** (3.16-3.98)	**3.86** (3.38-4.31)
2-hr	**1.42** (1.29-1.57)	**1.73** (1.57-1.90)	**2.17** (1.97-2.39)	**2.51** (2.27-2.75)	**2.96** (2.66-3.25)	**3.33** (2.97-3.65)	**3.69** (3.27-4.06)	**4.06** (3.58-4.48)	**4.57** (3.97-5.07)	**4.97** (4.28-5.54)
3-hr	**1.56** (1.41-1.72)	**1.89** (1.72-2.09)	**2.38** (2.15-2.62)	**2.76** (2.49-3.04)	**3.28** (2.94-3.61)	**3.69** (3.29-4.06)	**4.12** (3.65-4.55)	**4.55** (4.00-5.04)	**5.16** (4.46-5.74)	**5.64** (4.82-6.30)
6-hr	**1.95** (1.77-2.16)	**2.36** (2.15-2.61)	**2.96** (2.68-3.27)	**3.44** (3.11-3.79)	**4.13** (3.70-4.56)	**4.70** (4.18-5.18)	**5.30** (4.67-5.86)	**5.95** (5.18-6.58)	**6.86** (5.87-7.65)	**7.61** (6.41-8.53)
12-hr	**2.37** (2.17-2.63)	**2.87** (2.62-3.17)	**3.62** (3.30-4.00)	**4.25** (3.86-4.69)	**5.18** (4.65-5.71)	**5.97** (5.31-6.58)	**6.84** (6.00-7.56)	**7.79** (6.73-8.65)	**9.20** (7.76-10.3)	**10.4** (8.61-11.7)
24-hr	**2.74** (2.53-2.97)	**3.30** (3.05-3.59)	**4.18** (3.86-4.53)	**4.91** (4.52-5.32)	**5.98** (5.48-6.47)	**6.90** (6.27-7.45)	**7.90** (7.13-8.53)	**8.99** (8.04-9.70)	**10.6** (9.35-11.5)	**12.0** (10.4-13.0)
2-day	**3.15** (2.90-3.43)	**3.81** (3.51-4.14)	**4.82** (4.43-5.24)	**5.66** (5.19-6.14)	**6.86** (6.26-7.43)	**7.87** (7.15-8.53)	**8.96** (8.08-9.70)	**10.1** (9.06-11.0)	**11.8** (10.5-12.9)	**13.3** (11.6-14.4)
3-day	**3.33** (3.08-3.62)	**4.02** (3.72-4.37)	**5.07** (4.68-5.50)	**5.92** (5.46-6.42)	**7.15** (6.56-7.73)	**8.18** (7.46-8.84)	**9.27** (8.41-10.0)	**10.4** (9.41-11.3)	**12.1** (10.8-13.2)	**13.6** (12.0-14.7)
4-day	**3.51** (3.26-3.81)	**4.24** (3.93-4.59)	**5.31** (4.92-5.75)	**6.19** (5.73-6.69)	**7.44** (6.85-8.04)	**8.48** (7.78-9.15)	**9.59** (8.74-10.3)	**10.8** (9.76-11.6)	**12.5** (11.2-13.5)	**13.8** (12.3-15.0)
7-day	**4.10** (3.82-4.43)	**4.92** (4.59-5.31)	**6.10** (5.68-6.59)	**7.07** (6.57-7.62)	**8.47** (7.83-9.12)	**9.62** (8.86-10.4)	**10.9** (9.94-11.7)	**12.2** (11.1-13.1)	**14.1** (12.7-15.1)	**15.6** (13.9-16.8)
10-day	**4.67** (4.37-5.00)	**5.58** (5.22-5.98)	**6.82** (6.37-7.31)	**7.82** (7.29-8.38)	**9.22** (8.57-9.87)	**10.3** (9.58-11.1)	**11.5** (10.6-12.3)	**12.8** (11.7-13.7)	**14.5** (13.2-15.5)	**15.9** (14.4-17.1)
20-day	**6.31** (5.96-6.69)	**7.49** (7.08-7.95)	**8.95** (8.46-9.50)	**10.1** (9.53-10.7)	**11.7** (11.0-12.4)	**12.9** (12.1-13.6)	**14.1** (13.2-15.0)	**15.4** (14.3-16.3)	**17.1** (15.8-18.1)	**18.4** (16.9-19.6)
30-day	**7.86** (7.46-8.27)	**9.27** (8.79-9.75)	**10.8** (10.3-11.4)	**12.0** (11.4-12.7)	**13.6** (12.9-14.4)	**14.9** (14.0-15.6)	**16.1** (15.1-16.9)	**17.3** (16.2-18.2)	**18.8** (17.6-19.9)	**20.0** (18.6-21.1)
45-day	**10.0** (9.53-10.5)	**11.8** (11.2-12.3)	**13.5** (12.9-14.2)	**14.9** (14.2-15.6)	**16.6** (15.8-17.4)	**17.9** (17.0-18.7)	**19.1** (18.1-20.0)	**20.2** (19.1-21.2)	**21.7** (20.4-22.8)	**22.7** (21.3-23.9)
60-day	**12.0** (11.4-12.6)	**14.0** (13.4-14.7)	**16.0** (15.3-16.8)	**17.5** (16.7-18.4)	**19.4** (18.5-20.3)	**20.8** (19.8-21.7)	**22.0** (20.9-23.1)	**23.2** (22.0-24.3)	**24.7** (23.4-25.9)	**25.7** (24.3-27.0)

[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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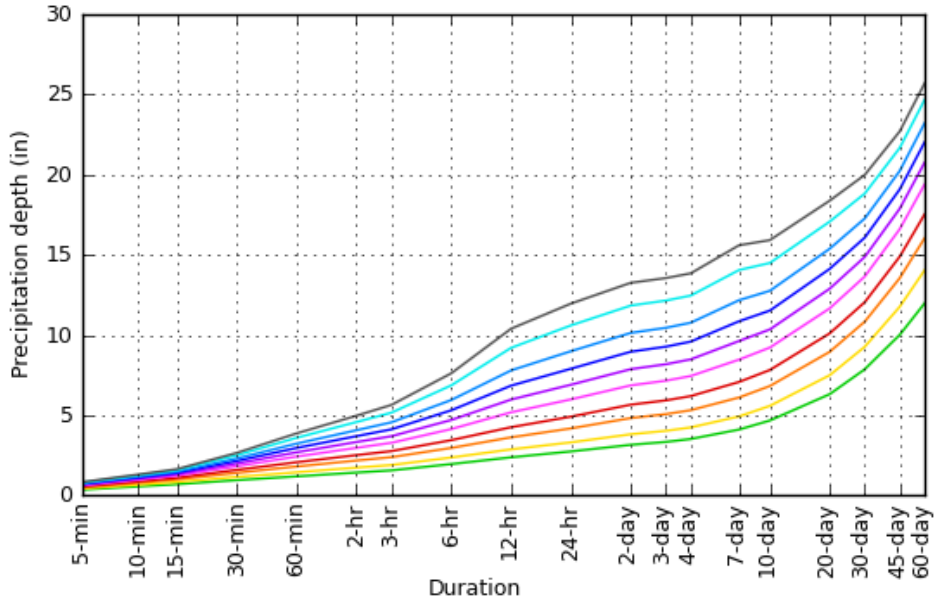
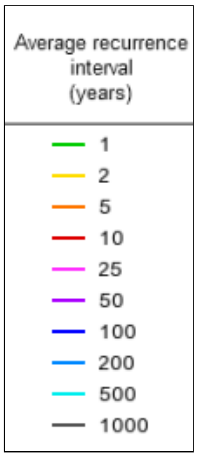
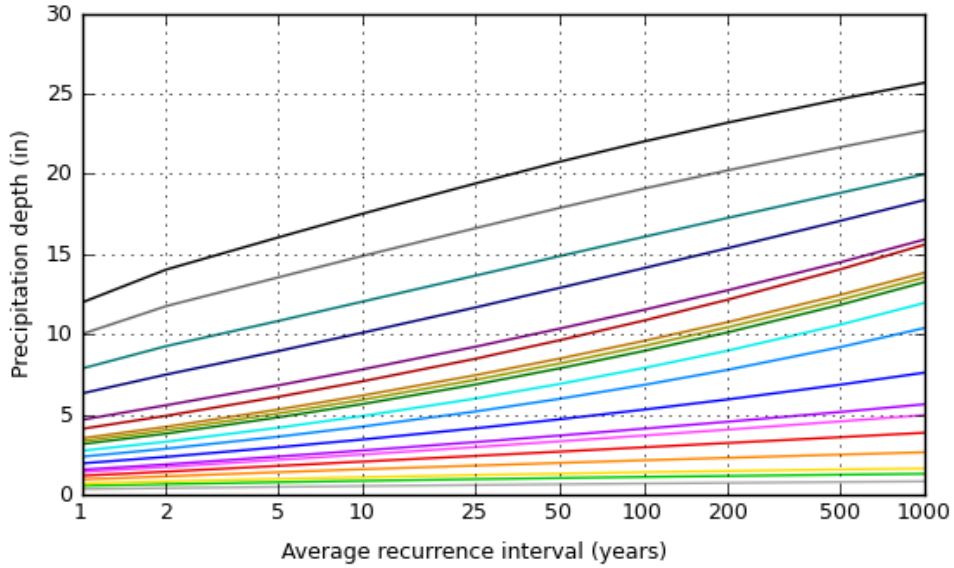
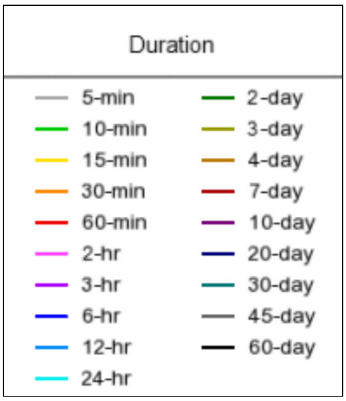
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.0697°, Longitude: -75.1172°









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NOAA Atlas 14, Volume 2, Version 3
Location name: Elkins Park, Pennsylvania, USA*
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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	**4.15** (3.79-4.56)	**4.96** (4.51-5.44)	**5.84** (5.32-6.41)	**6.49** (5.89-7.12)	**7.27** (6.58-7.97)	**7.82** (7.03-8.58)	**8.38** (7.49-9.20)	**8.87** (7.88-9.78)	**9.47** (8.34-10.5)	**9.92** (8.66-11.1)
10-min	**3.32** (3.03-3.64)	**3.96** (3.61-4.34)	**4.68** (4.26-5.13)	**5.19** (4.72-5.69)	**5.80** (5.24-6.35)	**6.23** (5.60-6.83)	**6.65** (5.95-7.31)	**7.03** (6.25-7.75)	**7.49** (6.59-8.30)	**7.81** (6.83-8.71)
15-min	**2.76** (2.52-3.03)	**3.32** (3.02-3.64)	**3.95** (3.59-4.33)	**4.38** (3.98-4.80)	**4.90** (4.42-5.36)	**5.26** (4.73-5.77)	**5.60** (5.02-6.16)	**5.91** (5.26-6.52)	**6.28** (5.54-6.97)	**6.54** (5.71-7.29)
30-min	**1.89** (1.73-2.08)	**2.29** (2.09-2.51)	**2.80** (2.55-3.07)	**3.17** (2.88-3.48)	**3.63** (3.28-3.97)	**3.96** (3.56-4.35)	**4.29** (3.84-4.72)	**4.60** (4.09-5.08)	**5.00** (4.40-5.55)	**5.29** (4.63-5.90)
60-min	**1.18** (1.08-1.30)	**1.44** (1.31-1.58)	**1.80** (1.64-1.97)	**2.07** (1.88-2.26)	**2.42** (2.18-2.65)	**2.68** (2.41-2.94)	**2.96** (2.65-3.25)	**3.23** (2.87-3.56)	**3.59** (3.16-3.98)	**3.86** (3.38-4.31)
2-hr	**0.710** (0.644-0.782)	**0.864** (0.784-0.951)	**1.09** (0.984-1.19)	**1.25** (1.13-1.38)	**1.48** (1.33-1.63)	**1.66** (1.48-1.83)	**1.84** (1.64-2.03)	**2.03** (1.79-2.24)	**2.29** (1.99-2.53)	**2.48** (2.14-2.77)
3-hr	**0.518** (0.470-0.572)	**0.629** (0.571-0.695)	**0.793** (0.717-0.874)	**0.918** (0.829-1.01)	**1.09** (0.979-1.20)	**1.23** (1.10-1.35)	**1.37** (1.22-1.51)	**1.52** (1.33-1.68)	**1.72** (1.49-1.91)	**1.88** (1.61-2.10)
6-hr	**0.326** (0.296-0.360)	**0.394** (0.359-0.436)	**0.494** (0.448-0.545)	**0.575** (0.519-0.634)	**0.690** (0.618-0.761)	**0.785** (0.698-0.865)	**0.886** (0.780-0.978)	**0.993** (0.865-1.10)	**1.15** (0.979-1.28)	**1.27** (1.07-1.43)
12-hr	**0.197** (0.180-0.218)	**0.238** (0.217-0.263)	**0.300** (0.274-0.332)	**0.353** (0.320-0.389)	**0.430** (0.386-0.474)	**0.496** (0.441-0.546)	**0.568** (0.498-0.627)	**0.647** (0.559-0.718)	**0.764** (0.644-0.853)	**0.863** (0.715-0.970)
24-hr	**0.114** (0.105-0.124)	**0.138** (0.127-0.150)	**0.174** (0.161-0.189)	**0.205** (0.188-0.222)	**0.249** (0.228-0.270)	**0.288** (0.261-0.311)	**0.329** (0.297-0.355)	**0.375** (0.335-0.404)	**0.442** (0.390-0.477)	**0.498** (0.434-0.540)
2-day	**0.066** (0.060-0.071)	**0.079** (0.073-0.086)	**0.100** (0.092-0.109)	**0.118** (0.108-0.128)	**0.143** (0.130-0.155)	**0.164** (0.149-0.178)	**0.187** (0.168-0.202)	**0.211** (0.189-0.229)	**0.247** (0.218-0.268)	**0.276** (0.242-0.301)
3-day	**0.046** (0.043-0.050)	**0.056** (0.052-0.061)	**0.070** (0.065-0.076)	**0.082** (0.076-0.089)	**0.099** (0.091-0.107)	**0.114** (0.104-0.123)	**0.129** (0.117-0.139)	**0.145** (0.131-0.157)	**0.169** (0.150-0.183)	**0.188** (0.166-0.204)
4-day	**0.037** (0.034-0.040)	**0.044** (0.041-0.048)	**0.055** (0.051-0.060)	**0.064** (0.060-0.070)	**0.078** (0.071-0.084)	**0.088** (0.081-0.095)	**0.100** (0.091-0.108)	**0.112** (0.102-0.121)	**0.130** (0.116-0.140)	**0.144** (0.128-0.156)
7-day	**0.024** (0.023-0.026)	**0.029** (0.027-0.032)	**0.036** (0.034-0.039)	**0.042** (0.039-0.045)	**0.050** (0.047-0.054)	**0.057** (0.053-0.062)	**0.065** (0.059-0.069)	**0.072** (0.066-0.078)	**0.084** (0.075-0.090)	**0.093** (0.083-0.100)
10-day	**0.019** (0.018-0.021)	**0.023** (0.022-0.025)	**0.028** (0.027-0.030)	**0.033** (0.030-0.035)	**0.038** (0.036-0.041)	**0.043** (0.040-0.046)	**0.048** (0.044-0.051)	**0.053** (0.049-0.057)	**0.060** (0.055-0.065)	**0.066** (0.060-0.071)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.024** (0.023-0.026)	**0.027** (0.025-0.028)	**0.029** (0.028-0.031)	**0.032** (0.030-0.034)	**0.036** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.011)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.023)	**0.024** (0.022-0.025)	**0.026** (0.024-0.028)	**0.028** (0.026-0.029)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.011)	**0.013** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.015-0.016)	**0.017** (0.016-0.017)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.020** (0.019-0.021)	**0.021** (0.020-0.022)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.013** (0.013-0.014)	**0.014** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

[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.

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PF graphical

PDS-based intensity-duration-frequency (IDF) curves
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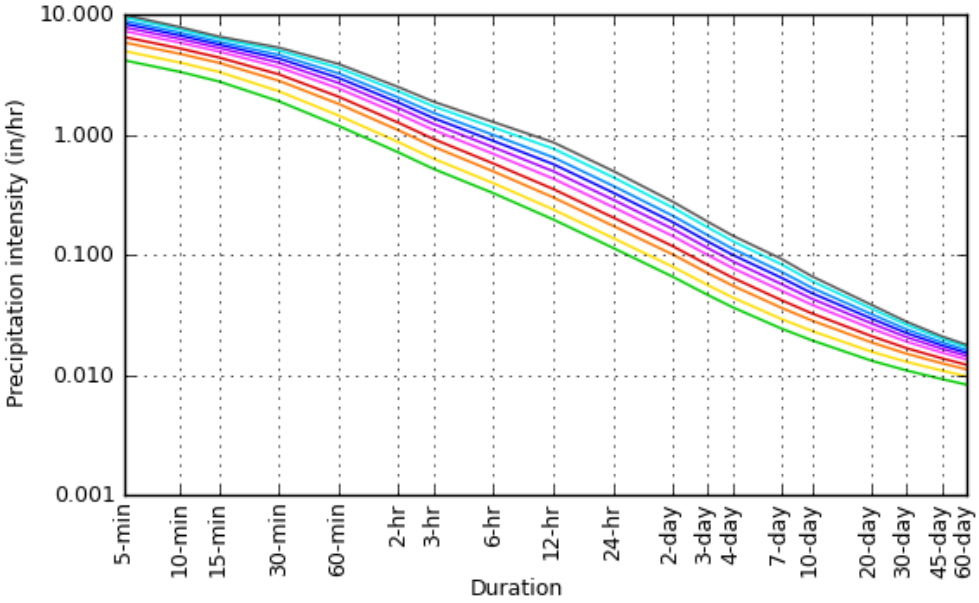

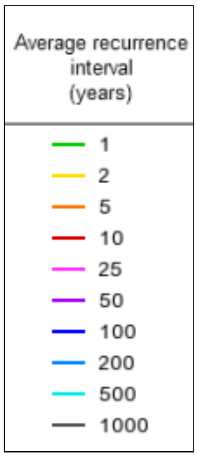

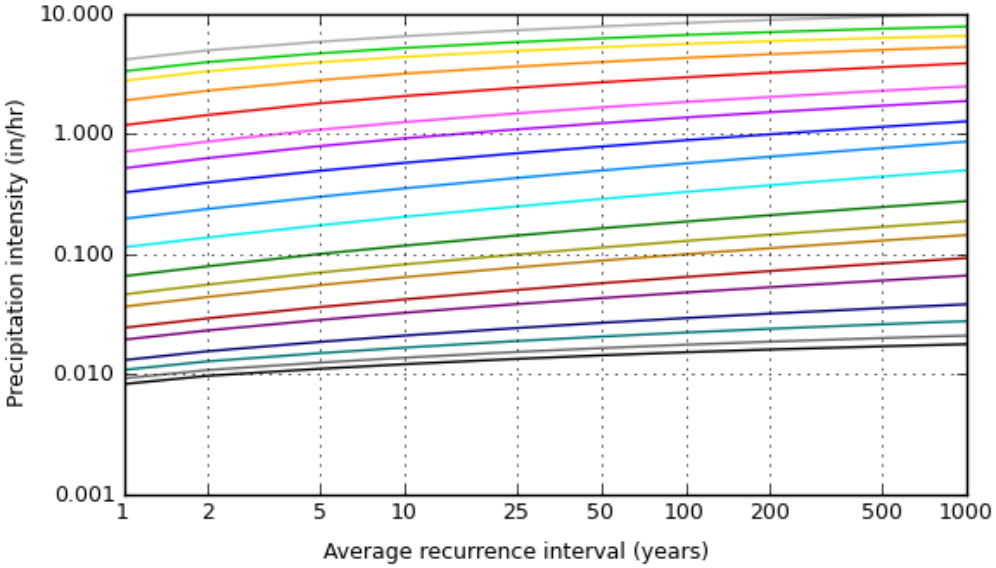

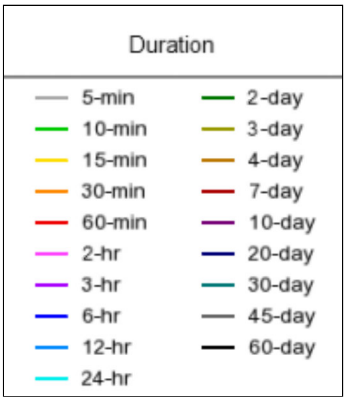

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National Weather Service
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Silver Spring, MD 20910
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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Montgomery County, Pennsylvania

222 Church Road

June 3, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

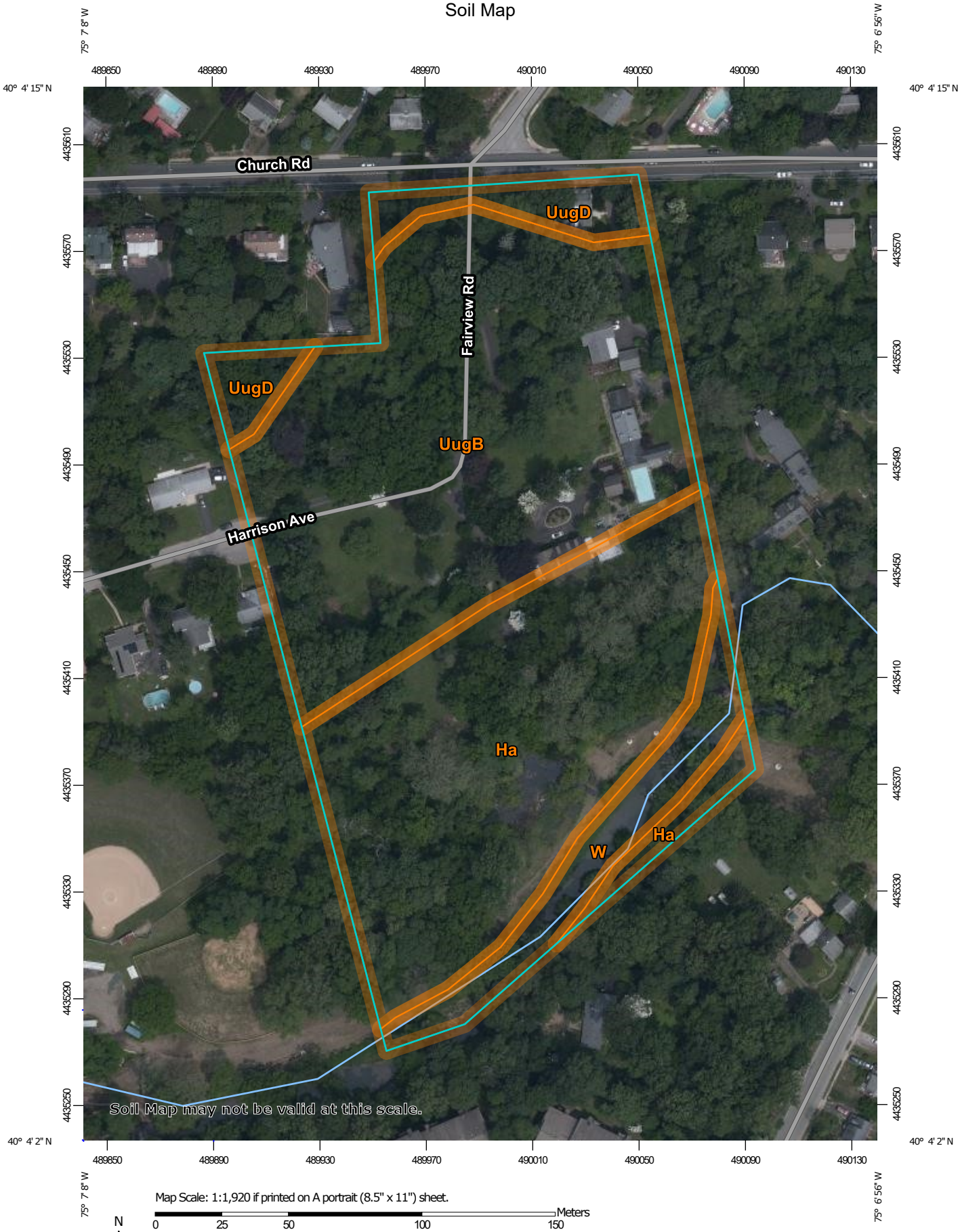
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,920 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Montgomery County, Pennsylvania
Survey Area Data: Version 15, Jun 5, 2020

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

Date(s) aerial images were photographed: Jun 1, 2019—Aug 4, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ha	Hatboro silt loam	4.1	38.6%
UugB	Urban land-Udorthents, schist and gneiss complex, 0 to 8 percent slopes	5.1	47.9%
UugD	Urban land-Udorthents, schist and gneiss complex, 8 to 25 percent slopes	0.6	5.8%
W	Water	0.8	7.8%
Totals for Area of Interest		**10.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Montgomery County, Pennsylvania

Ha—Hatboro silt loam

Map Unit Setting

National map unit symbol: l54h
Elevation: 200 to 800 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Hatboro and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Alluvium derived from metamorphic and sedimentary rock

Typical profile

Ap - 0 to 9 inches: silt loam
Bg - 9 to 44 inches: silt loam
Cg - 44 to 56 inches: sandy clay loam
C - 56 to 70 inches: stratified gravelly sand to clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 5 percent
Landform: Hillslopes

Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

UugB—Urban land-Udorthents, schist and gneiss complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2dtz7
Elevation: 200 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Udorthents, schist and gneiss, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Udorthents, Schist And Gneiss

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Graded areas of schist and/or gneiss

Typical profile

Ap - 0 to 6 inches: loam
C - 6 to 40 inches: silty clay loam
R - 40 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 70 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenelg

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Edgemont

Percent of map unit: 1 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Glenville

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Baile

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Gladstone

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

UugD—Urban land-Udorthents, schist and gneiss complex, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2dtz8
Elevation: 200 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Udorthents, schist and gneiss, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Udorthents, Schist And Gneiss

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Graded areas of schist and/or gneiss

Typical profile

Ap - 0 to 6 inches: loam
C - 6 to 40 inches: silty clay loam
R - 40 to 60 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 20 to 70 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Glenville

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Baile

Percent of map unit: 1 percent
Landform: Depressions

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Edgemont

Percent of map unit: 1 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Gladstone

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Glenelg

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 1nnv3
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Parent material: Rivers streams ponds

Properties and qualities

Runoff class: Negligible
Frequency of ponding: Frequent

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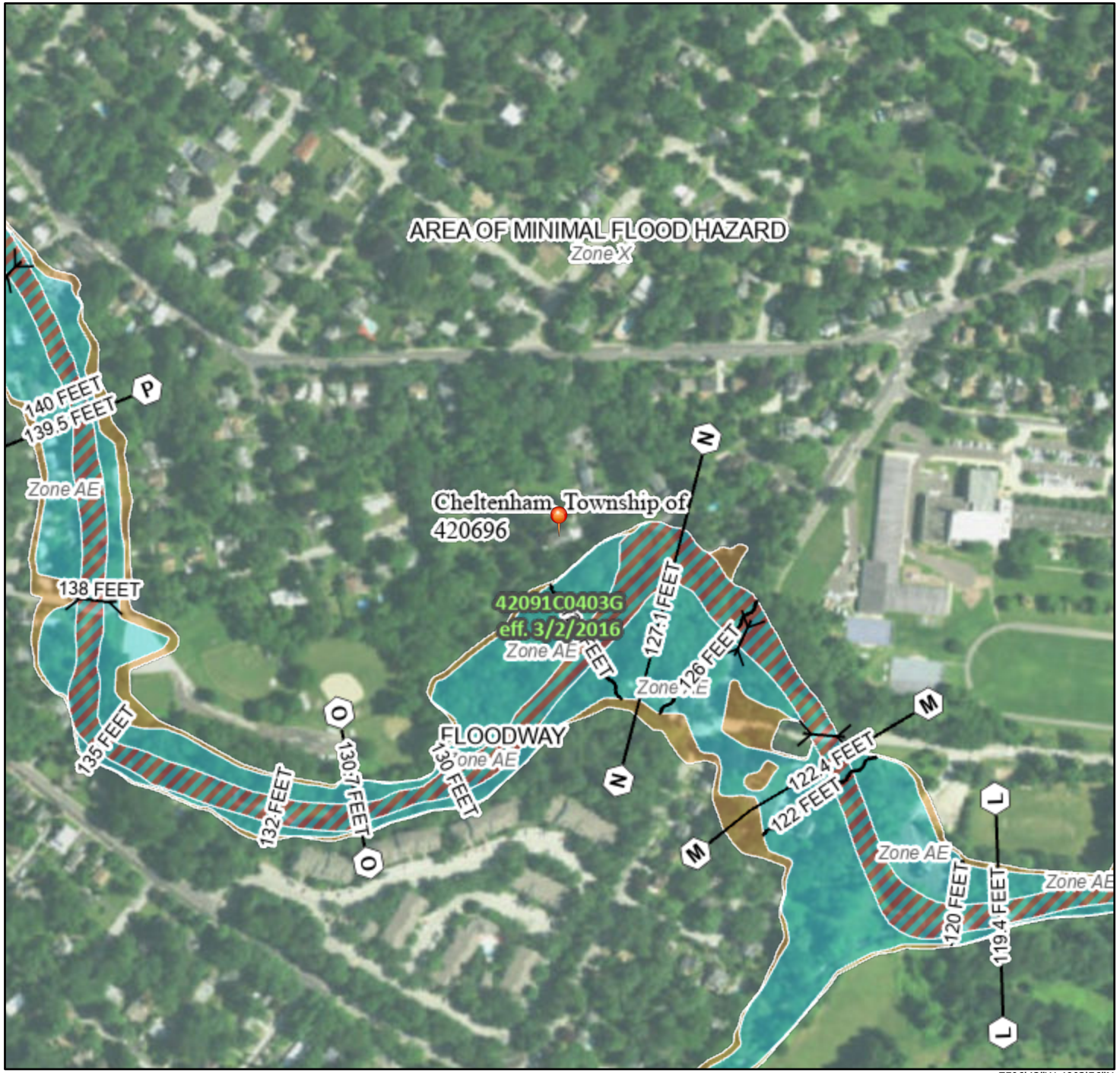
National Flood Hazard Layer FIRMette

FEMA

75°7'20"W 40°4'23"N



75°6'42"W 40°3'56"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/3/2021 at 11:13 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Penn's Trail Environmental, LLC
21 E. Lincoln Ave – Suite 160
Hatfield, PA 19440
Phone: (215) 362-4610
e-mail: staff@pennstrail.com

Robert E. Blue Consulting Engineers, P.C.
1149 Skippack Pike
Blue Bell, PA 19422

February 2, 2022

RE: Stormwater Infiltration Study & Report
222 Church Road Tract
Cheltenham Twp., Montgomery Co., PA
PTE #5303

Dear Mr. Pawlowski;

Penn's Trail Environmental, LLC has performed a subsurface soil and permeability investigation on the referenced parcel. The intent of this investigation was to evaluate the subsurface soil profile and determine the permeability characteristics of the areas indicated for proposed stormwater disposal via infiltration. Test excavations were developed with a backhoe and described in accordance with United States Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS) methodology. In-situ permeability testing was conducted using the Double Ring Infiltrometer (DRI) method as described by ASTM-D3385-09 standards.

Current regulation requires that stormwater control be designed for this proposed new land development project. Permeability testing is required to determine if infiltrative capacity of the subsoil is present. Test locations were positioned throughout this site at the direction of the project engineer. Depth of testing was determined by final constructed grade of the stormwater facilities or adjusted for shallow bedrock or groundwater encountered in test excavations. A backhoe was required for excavation of the test probes and establishment of the double rings.

Soil profile descriptions were developed at each test point and include information such as texture, structure, soil depth, and indication (or lack thereof) of a seasonal high-water table or restricted drainage as would be indicated by redoximorphic features.

Redox features often occur when infiltrating water encounters a slowly permeable layer as it moves downward through the soil profile. These features do not indicate a true water table or zone that is saturated for prolonged periods by regional groundwater at this site. Regional groundwater was not encountered at this site, and redox features observed are an indicator of infiltration issues which are addressed by permeability testing and should not be considered a limiting design factor unless permeability rates reveal that to be the case.

Pre-development USDA-NRCS soil mapping at this site, or more specifically the test locations, was the Hatboro and Urban Land – Udorthents, schist and gneiss soil series. The Hatboro series consists of very deep and poorly drained soils formed in alluvium derived from metamorphic and crystalline rock. They are on flood plains. Saturated hydraulic conductivity is moderately high to high. Solum thickness ranges from 20 to 60 inches. Depth to bedrock ranges from 5 to 10 feet or more. Diagnostic horizons and features recognized in this pedon are an ochric epipedon from 0 to 9 inches (Ap horizon) and a cambic horizon from 9 to 44 inches (Bg1 and Bg2 horizons).

Udorthents are a complex collection of soils that consist of moderately well drained to excessively drained soils that have been disturbed by cutting or filling, and areas that are covered by buildings and pavement. Udorthents consist of gently sloping to moderately

sloping areas where the original soil has been cut away or covered with a loamy fill material. Permeability is moderate to slow throughout. Depth to bedrock is typically more than 60 inches. Seasonal high-water table depth is variable. Layers that restrict permeability, and buried objects may hinder deep excavations. The soil characteristics are variable, requiring on-site investigation before suitability for specific land uses can be evaluated.

The soils at the testing locations were found to be derived primarily from schist as mapped. This investigation was not conducted for the purpose of disputing current mapping or as a re-mapping effort. Loess material was found to overtop schist derived soils at certain test locations. Soil series designations are provided on the attached soil profile data sheets.

Soil profiles of backhoe excavated test pits were developed to depths at or near final constructed grade of proposed stormwater control facilities. The most restrictive barriers from the point of infiltration to contacting the base flow groundwater table were determined. The most common of these barriers in our region include restrictive soil horizons, varying lithology, fracturing of the bedrock or insufficient fracturing of the bedrock, and encountering groundwater among other factors. Our field observations, as reported on the attached soil profile data sheets, indicate that slowly diggable conditions were not encountered in the test pits. Redoximorphic features were noted in test pits 3, 4 and 6 throughout the lower argillic horizon (Bt2). Subsequent detailed testing more accurately predicts the ability of the soil to efficiently infiltrate stormwater and has been attached.

Testing sought to identify zones that would potentially allow the infiltration of stormwater. The testing protocol used considers regional construction practices, the likelihood of "silting in" during and following construction and the subsurface characteristics of the soil and geology. The determination at this site was that no restrictive condition was encountered to the established installation depth for infiltration of stormwater. The double rings were established at a level with sufficient residual subsoil above groundwater and bedrock to seat and seal the rings permitting unsaturated flow through the soil to the water table.

The recommended acceptable range for subsurface disposal of stormwater is 0.10 inches per hour to 10.0 inches per hour according to current BMP guidance. Surface basins where additional storage is economical can have much slower rates and still provide some infiltration. Our office recommends that the design engineer assume zero infiltration for any stormwater area which achieves less than 0.10 inches per hour.

There are various means to arrive at an infiltrative rate for the substratum following testing. Our method is to average the last four stabilized readings as established in the PA BMP Manual. Another is to use the "last" reading as is common for percolation testing for wastewater disposal. Averaging more accurately reflects what would likely occur during a rain (soil saturation) event.

Testing was conducted at discreet locations selected by the project engineer using double ring infiltrometers. Data sheets containing the information recorded for the soil profile descriptions and double ring infiltrometers have been included as attachments to this report. A table summarizing the field data can be found below:

Stormwater Testing Summary

Test Location	Depth of Test Pit Inches	Depth to Water Inches	Depth to Rock Inches	Depth of Testing Inches	Infiltration Rate Inches per hour
1	100	---	---	72	2.59
2	101	---	---	72	0.12

3	99	---	---	72	0.00
4	99	---	---	72	0.15
5	101	---	---	70*	0.43
6	101	---	---	77*	4.11

*Infiltration testing was conducted deeper than proposed due to the sandy texture of a deeper horizon that would promote better infiltration.

The soil encountered demonstrated varied infiltration rates. Subsurface conditions may change following construction and resultant redirection of surface water following development. Results suggest that the average infiltration rates at tested locations 1, 5 and 6 are within the recommended guidelines even after a safety factor of two is applied. Results suggest that the average infiltration rates tested locations 2, 3, and 4 are below the recommended guidelines of 0.10 inches per hour either before or after a safety factor of two is applied.

At test locations 1, 5, and 6, stormwater control devices can include surface and subsurface facilities that allow the design engineer flexibility in reducing velocity containing and disposing of stormwater on this site in select areas due to the channery composition of the soil at this site. Surface features such as vegetated swales and berms can be employed to reduce overland flow and retain water in-situ thus extending contact time and providing for additional infiltration.

At test locations, 2, 3, and 4, stormwater control devices that allow the design engineer flexibility in reducing velocity containing and disposing of stormwater on this site should be limited to surface facilities due to the clayey composition and slow drainage of the soil at this location. Surface features such as vegetated swales and berms can be employed to reduce overland flow and retain water in-situ thus extending contact time and providing for additional infiltration.

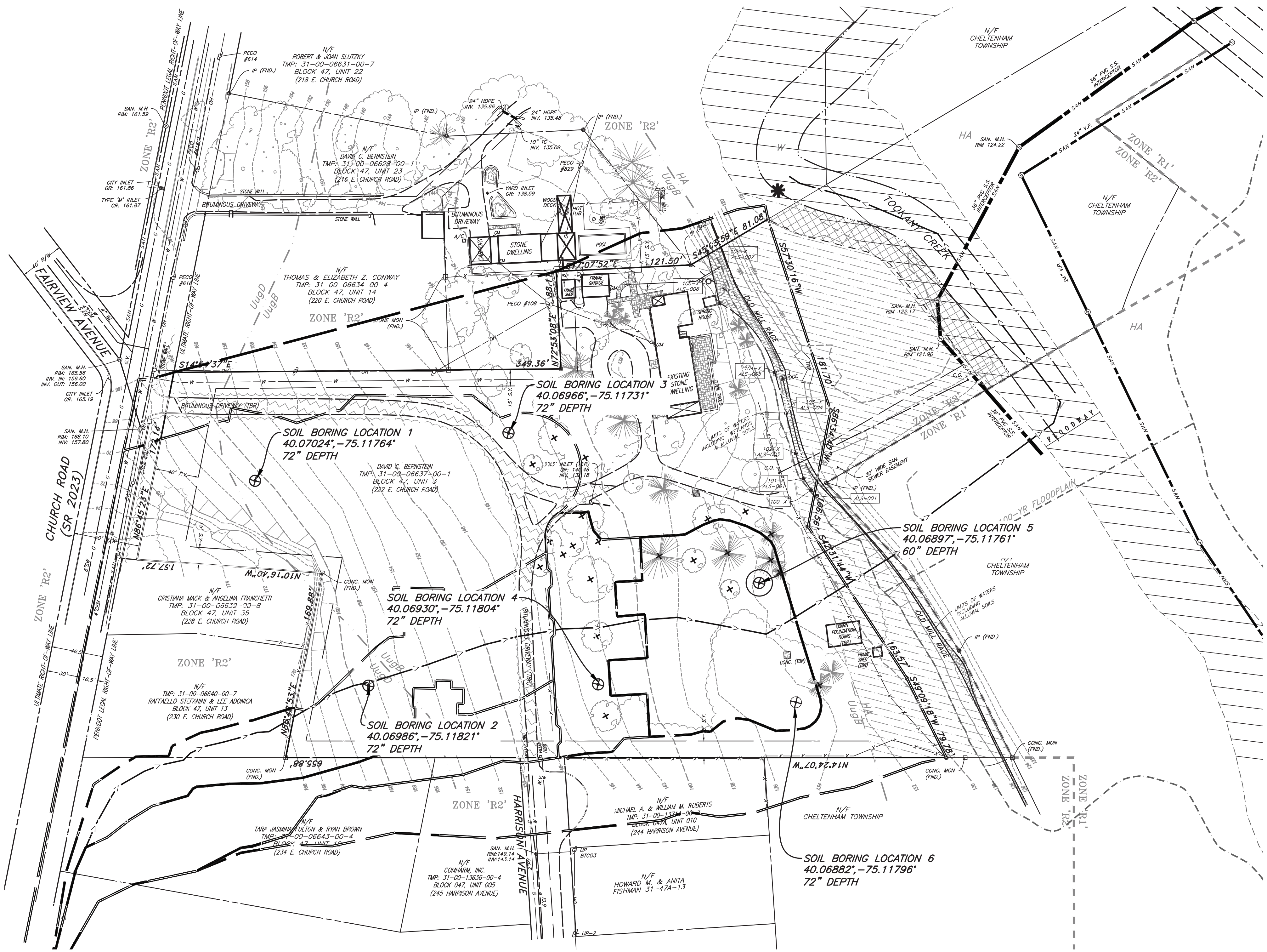
Our findings are a result of testing conducted in specific locations and conditions. Should evidence contrary to the findings in this report be discovered prior to, during, or after construction of the stormwater control devices, our office must be notified immediately so our recommendations can be reviewed and revised if necessary.

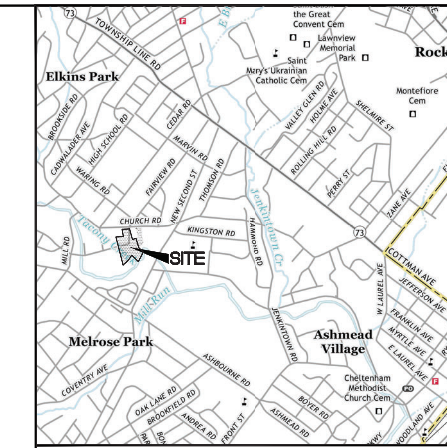
Penn's Trail Environmental, LLC expresses no guarantee that the soil conditions following excavation will be identical to those encountered during this investigation. We recommend that caution is exercised during construction to minimize compaction, or other disturbance in those areas intended for use as infiltration areas.

Please review the enclosed information and if any questions arise do not hesitate to contact our office.

Sincerely,
Penn's Trail Environmental, LLC

Paul A. Golrick/JH
Soil Scientist





LOCATION MAP
SCALE: 1"=2,000'

THE NATIONAL MAP BY U.S.G.S.
FRANKFORD PA 2019 QUADRANGLE

ZONING: R2 – RESIDENTIAL DISTRICT	REQUIREMENTS	EXISTING (222 E. CHURCH)
§295–602.A MINIMUM LOT AREA:	10,000 S.F.	6.2497 ACRES (272,238 S.F.)
§295–602.A MINIMUM LOT WIDTH:	70 FT.	172.14 FT.
§295–602.A SETBACKS:	FRONT YARD = 40 FT. SIDE YARD (AGG.) = 30 FT. SIDE YARD (MIN.) = 10 FT. REAR YARD = 25 FT.	FRONT YARD = 40 FT. SIDE YARD (AGG.) = 30 FT. SIDE YARD (MIN.) = 15 FT. REAR YARD = 25 FT.
§295–602.A MAX. BUILDING COVERAGE:	20%	1.4% (3,788 S.F.)
§295–602.A MAX. IMPERVIOUS COVERAGE:	40%	8.0% (21,590 S.F.)
§295–602.A MAX. BUILDING HEIGHT:	<40 FT.	<40 FT.
§295–602.A GARAGE SETBACK*	10 FT. FROM FRONT FACADE	N/A
* ADDITIONAL REGULATIONS UNDER §295–603		
[1] EXISTING NON–CONFORMITY		

SURVEY NOTES:

1. THIS PLAN REPRESENTS AN ACTUAL FIELD SURVEY PERFORMED BY CHARLES E. SHOEMAKER, INC. COMPLETED IN FEBRUARY, 2021.

2. SITE DATA:

   CURRENT OWNER: DAVID C. BERNSTEIN
   222 E. CHURCH ROAD
   ELKINS PARK, PA 19027

   SITE ADDRESS: 222 E. CHURCH ROAD
   ELKINS PARK, PA 19027
   TAX MAP: BLOCK 47 – UNIT 3
   TAX NUMBER: PARCEL 31–00–06637–001
   DB 6206 PG 272

   RECORDED DATA: CHELTENHAM TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

3. THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CONFIRM THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE.

4. A PORTION OF THE PROJECT SITE SHOWN LIES WITHIN A SPECIAL FLOOD HAZARD AREA ("SFHA") – ZONE AE, AS DOCUMENTED ON THE FLOOD INSURANCE RATE MAP IDENTIFIED AS PANEL 403 OF 451, COMMUNITY NUMBER 420696, MAP NUMBER 42091C0403G; EFFECTIVE DATE: MARCH 2, 2016. THE DATUM FOR THIS MAP IS NAVD88.

5. THE VERTICAL DATUM FOR THIS SITE IS NAVD 1988 BASED ON GPS OBSERVATIONS.

6. PA ONE CALL SERIAL NUMBER: SERIAL #20212303507, DATED AUGUST 21, 2021

7. THE GROSS AND NET AREA OF 222 E. CHURCH ROAD IS 272,238 S.F. OR 6.2497 ACRES.

8. THIS PROPERTY HAS DIRECT ACCESS TO CHURCH ROAD (SR 2023), A PUBLIC STREET, THROUGH TWO (2) TWO–WAY MACADAM DRIVEWAYS. ADDITIONAL THIS PROPERTY HAS DIRECT ACCESS TO HARRISON AVENUE, A PUBLIC STREET.

9. AS OF THE DATE OF SURVEY (APRIL 10, 2020), THERE WAS NO EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS, EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS.

10. PLAN REFERENCES:

    10.1. SUBDIVISION PLA FOR 216 & 222 E. CHURCH ROAD, PREPARED BY CHARLES E. SHOEMAKER, INC., DATED MARCH 1, 2021, LAST REVISED MARCH 31, 2021.

LEGEND

- STORM INLET TYPE 'C'
- STORM INLET TYPE 'M'
- STORM MANHOLE
- SANITARY MANHOLE
- U.P. UTILITY POLE
- L.P. LAMP POST
- F.H. FIRE HYDRANT
- W.V. WATER VALVE
- STEEP SLOPES (15%–25%)
- VERY STEEP SLOPES (>25%)
- STREAM
- FLOODPLAIN
- FENCE
- WALL
- MACADAM EDGE
- CONC. CURB
- DEPRESSED CURB
- CONCRETE
- SLATE
- TREELINE
- PROPERTY CORNER
- IRON PIN FOUND
- RIPARIAN CORRIDOR – ZONE 1
- RIPARIAN CORRIDOR – ZONE 2
- TO BE DEMOLISHED

SOILS TABLE PER USDA NRCS						
MAP SYMBOL	SOIL NAME	SLOPES	HYDROLOGIC GROUP	DEPTH TO WATER TABLE	DRAINAGE CHARACTERISTICS	HYDRIC SOIL
Ha	HATBORO SILT LOAM	0 – 3	B / D	0" – 6"	POORLY DRAINED	YES
UugB	URBAN LAND – URDORTHENTS	0 – 8	C	> 60"	WELL DRAINED	NO
UugD	URBAN LAND – UDORTHENTS	8 – 25	C	> 60"	WELL DRAINED	NO
W	WATER	–	–	–	–	–

REVISIONS
1) 2021–10–13; REV. PER ALLUVIAL SOIL SURVEY

robert e. blue
consulting engineers, p.c.
1149 Skippack Pike, Blue Bell, PA 19422
tel: (610)–277–9441 fax: (610)–277–9897
www.robertblue.com email: rblue@robertblue.com

GRAPHIC SCALE 0 50 100 150 200

EXISTING FEATURES

222 CHURCH ROAD
CHELTENHAM TOWNSHIP
MONTGOMERY COUNTY
PENNSYLVANIA

PREPARED FOR
REGAN KLINE CROSS, LLC
7670 QUEEN ST., SUITE 200
WYNDMOOR PA, 19038

PROFESSIONAL LAND SURVEYOR
ROBERT E. BLUE JR.
LICENSE NO. SU1323A
10/25/2021 (DATE)

DRAWN BY: DJG	CHECKED BY: REB	SCALE: 1"=50'
DATE: 2021–07–23	JOB NUMBER: 2154–10E	SHEET NUMBER: X of #

Penn's Trail Environmental, LLC

21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 1 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Glenelg

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
A	0-6	10YR 3/4		silt loam	strong coarse gr	very friable	clear wavy
Bt	6-42	10YR 5/6		channery sandy loam	weak fine sbk	friable	clear wavy
C	42-100	10YR 5/4		very channery loamy sand	weak very fine sbk	very friable	

Soil Scientist: Terry Harris

Notes

EPIPEDON
Ochric

SUBSURFACE HORIZON(S)
Argillic

SOIL ORDER
Ultisol

DRAINAGE CLASS
Well Drained

LANDFORM
Upland

POSITION
Backslope

PARENT MATERIAL
Colluvium
Residuum

BEDROCK LITHOLOGY
Schist

REDOX FEATURES

Abundance

Few ..... <2%
Common .. 2-20%
Many .....>20%

Contrast

faint
hue & chroma of matrix and redox are closely related.

distinct
matrix & redox features vary 1-2 units of hue and several units of chroma & value.

prominent
Matrix & redox features vary several units in hue, value & chroma.

STRUCTURE

Grade

S*tructureless* - No observable aggregation or arrangement of lines of weakness.
Weak - Poorly formed, indistinct peds barely observable in place.
Moderate - Well-formed, distinct peds moderately durable & evident in place.
Strong - Durable peds evident in undisturbed soil & become separated when disturbed.

COURSE FRAGMENTS (% of profile)

15-35%	35-65%	>65%
gravelly	very gravelly	extremely gravelly
channery	very channery	extremely channery
cobbly	very cobbly	extremely cobbly
flaggy	very flaggy	extremely flaggy
stony	very stony	extremely stony

BOUNDARY

Distinctness

abrupt. ..<1" (thick)
clear. ....1-2.5"
gradual ...2.5-5"
diffuse... ....>5"

Topography

smooth - boundary is nearly level
wavy - pockets with width greater than depth
irregular - pockets with depth greater than width
broken - boundary is discontinuous and interrupted

Type

pl - platy
pr - prismatic
cpr - columnar
gr - granular
abk - angular blocky
sbk - subangular blocky

Penn's Trail Environmental, LLC

21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 2 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Glenelg

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
A1	0-4	10YR 3/4		silt loam	strong coarse gr	very friable	clear wavy
A2	4-10	10YR 5/3		silt loam	moderate medium gr	friable	clear wavy
Bt	10-90	10YR 5/6		channery sandy loam	weak fine sbk	friable	clear wavy
C	90-101	10YR 5/4		very channery loamy sand	weak very fine sbk	very friable	

Soil Scientist: Terry Harris

Notes

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21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 3 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Duncannon

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
Ap	0-14	10YR 4/4		silt loam	moderate medium gr	very friable	clear wavy
Bt1	14-67	10YR 7/6		silt loam	moderate medium sbk	friable	clear wavy
Bt2	67-99	10YR 7/6	common distinct	silt loam	moderate medium sbk	friable	

Soil Scientist: Terry Harris

Notes

EPIPEDON
Ochric

SUBSURFACE HORIZON(S)
Argillic

SOIL ORDER
Alfisol

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Penn's Trail Environmental, LLC

21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 4 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Duncannon

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
Ap	0-10	10YR 4/4		silt loam	moderate medium gr	very friable	clear wavy
Bt1	10-55	10YR 7/6		silt loam	moderate medium sbk	friable	clear wavy
Bt2	55-99	10YR 7/6	common distinct	silt loam	moderate medium sbk	friable	

Soil Scientist: Terry Harris

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EPIPEDON
Ochric

SUBSURFACE HORIZON(S)
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Penn's Trail Environmental, LLC

21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 5 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Duncannon taxadjunct

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
Ap	0-15	10YR 4/4		silt loam	strong medium gr	very friable	gradual wavy
Bt/2C	15-65	10YR 7/6 10YR 5/3		silt loam loamy sand	moderate medium sbk	friable	clear wavy
2C	65-101	10YR 5/3		channery loamy sand	weak very fine sbk	very friable	

Soil Scientist: Terry Harris

Notes

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Ochric

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Weak - Poorly formed, indistinct peds barely observable in place.
Moderate - Well-formed, distinct peds moderately durable & evident in place.
Strong - Durable peds evident in undisturbed soil & become separated when disturbed.

COURSE FRAGMENTS (% of profile)

15-35%	35-65%	>65%
gravelly	very gravelly	extremely gravelly
channery	very channery	extremely channery
cobbly	very cobbly	extremely cobbly
flaggy	very flaggy	extremely flaggy
stony	very stony	extremely stony

BOUNDARY

Distinctness

abrupt. ..<1" (thick)
clear. ....1-2.5"
gradual ...2.5-5"
diffuse... ....>5"

Topography

smooth - boundary is nearly level
wavy - pockets with width greater than depth
irregular - pockets with depth greater than width
broken - boundary is discontinuous and interrupted

Type

pl - platy
pr - prismatic
cpr - columnar
gr - granular
abk - angular blocky
sbk - subangular blocky

Penn's Trail Environmental, LLC

21 East Lincoln Ave - Suite 160
Hatfield, PA 19440
ph. (215) 362-4610

Date: 2/2/22 Pit # 6 PTE # 5303
Project: 222 Church Road
Location: 222 Church Road
Cheltenham Twp., Montgomery Co., PA
Soil Series Lawrenceville taxadjunct

Horizon	Depth (in.)	Color	Redox Features	Texture	Structure	Consistence	Boundary
Ap	0-13	10YR 4/4		silt loam	strong medium gr	very friable	gradual wavy
Bt1	13-31	10YR 7/6		silt loam	moderate medium sbk	friable	clear wavy
Bt2	31-62	10YR 7/6	common distinct	silt loam	moderate medium sbk	friable	gradual wavy
2C	62-101	10YR 5/3		channery loamy sand	weak very fine sbk	very friable	

Soil Scientist: Terry Harris

Notes

EPIPEDON
Ochric

SUBSURFACE HORIZON(S)
Argillic

SOIL ORDER
Alfisol

DRAINAGE CLASS
Moderately Well Drained

LANDFORM
Upland

POSITION
Backslope

PARENT MATERIAL
Loess
Residuum

BEDROCK LITHOLOGY
Schist

REDOX FEATURES

Abundance

Few ..... <2%
Common .. 2-20%
Many .....>20%

Contrast

faint
hue & chroma of matrix and redox are closely related.

distinct
matrix & redox features vary 1-2 units of hue and several units of chroma & value.

prominent
Matrix & redox features vary several units in hue, value & chroma.

STRUCTURE

Grade

S*tructureless* - No observable aggregation or arrangement of lines of weakness.
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Type

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cpr - columnar
gr - granular
abk - angular blocky
sbk - subangular blocky

Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	1
County:	*Montgomery*	Technician:	Cody Kline
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	72 inches	pH:	6.9

Time (hr:min)	**Interval** (min.)	**Inner Ring Drop** (in.)	**Inner Ring Volume change** (ml)	**Outer Ring Drop** (in.)	**Outer Ring Volume Change** (ml)	**Rate** (ml/min)	**Infiltration rate** (in/hr)
8:35 AM			fill		fill		
9:05 AM	30	2 1/8	1,000	2 1/8	1,750	33.33	4.32
9:35 AM	30	2	900	1	800	30.00	3.88
9:45 AM	10	3/8	200	2/8	250	20.00	2.59
9:55 AM	10	4/8	210	2/8	250	21.00	2.72
10:05 AM	10	3/8	190	2/8	240	19.00	2.46
10:15 AM	10	3/8	200	2/8	250	20.00	2.59
Average			200.00		247.50	20.00	2.59

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Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	2
County:	*Montgomery*	Technician:	Cody Kline
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	72 inches	pH:	6.9

Time (hr:min)	**Interval** (min.)	**Inner Ring Drop** (in.)	**Inner Ring Volume change** (ml)	**Outer Ring Drop** (in.)	**Outer Ring Volume Change** (ml)	**Rate** (ml/min)	**Infiltration rate** (in/hr)
9:00 AM			fill		fill		
9:30 AM	30	2 1/8	1,000	1 2/8	1,000	33.33	4.32
10:00 AM	30	2/8	90	1/8	100	3.00	0.39
10:30 AM	30	< 1/8	20	< 1/8	30	0.67	0.09
11:00 AM	30	1/8	30	< 1/8	30	1.00	0.13
11:30 AM	30	1/8	30	< 1/8	30	1.00	0.13
12:00 PM	30	1/8	30	< 1/8	30	1.00	0.13
Average			27.50		30.00	0.92	0.12

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Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	3
County:	*Montgomery*	Technician:	Cody Kline
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	72 inches	pH:	6.9

Time (hr:min)	**Interval** (min.)	**Inner Ring Drop** (in.)	**Inner Ring Volume change** (ml)	**Outer Ring Drop** (in.)	**Outer Ring Volume Change** (ml)	**Rate** (ml/min)	**Infiltration rate** (in/hr)
8:45 AM			fill		fill		
9:15 AM	30	1/8	70	1/8	75	2.33	0.30
9:45 AM	30	< 1/8	20	< 1/8	50	0.67	0.09
10:15 AM	30	0	0	< 1/8	10	0.00	0.00
10:45 AM	30	0	0	0	0	0.00	0.00
11:15 AM	30	0	0	0	0	0.00	0.00
11:45 AM	30	0	0	0	0	0.00	0.00
Average			0.00		2.50	0.00	0.00

Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	4
County:	*Montgomery*	Technician:	Terry Harris
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	72 inches	pH:	6.9

Time (hr:min)	**Interval (min.)**	**Inner Ring Drop (in.)**	**Inner Ring Volume change (ml)**	**Outer Ring Drop (in.)**	**Outer Ring Volume Change (ml)**	**Rate (ml/min)**	**Infiltration rate (in/hr)**
9:16 AM			fill		fill		
9:46 AM	30	1/8	70	4/8	400	2.33	0.30
10:16 AM	30	1/8	30	< 1/8	30	1.00	0.13
10:46 AM	30	1/8	50	1/8	60	1.67	0.22
11:16 AM	30	< 1/8	20	< 1/8	30	0.67	0.09
11:46 AM	30	1/8	40	< 1/8	30	1.33	0.17
12:16 PM	30	1/8	30	< 1/8	30	1.00	0.13
Average			35.00		37.50	1.17	0.15

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Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	5
County:	*Montgomery*	Technician:	Terry Harris
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	70 inches	pH:	6.9

Time (hr:min)	**Interval (min.)**	**Inner Ring Drop (in.)**	**Inner Ring Volume change (ml)**	**Outer Ring Drop (in.)**	**Outer Ring Volume Change (ml)**	**Rate (ml/min)**	**Infiltration rate (in/hr)**
9:49 AM			fill		fill		
10:19 AM	30	1/8	70	3/8	330	2.33	0.30
10:49 AM	30	2/8	100	3/8	340	3.33	0.43
11:19 AM	30	2/8	100	2/8	210	3.33	0.43
11:49 AM	30	2/8	110	3/8	310	3.67	0.47
12:19 PM	30	2/8	100	3/8	270	3.33	0.43
12:49 PM	30	2/8	90	2/8	250	3.00	0.39
Average			100.00		260.00	3.33	0.43

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Double Ring Infiltrometer Data Reporting Sheet

Job Name:	***222 Church Road***	Job #	**5303**
Location:	222 Church Road	Date:	2/2/2022
Township:	*Cheltenham*	Ring #:	6
County:	*Montgomery*	Technician:	Terry Harris
Witness:	-----	Tax Parcel:	31-00-06637-00-1
Water Temp:	50's °F	Weather:	cloudy 30's °F
Test Depth:	77 inches	pH:	6.9

Time (hr:min)	**Interval (min.)**	**Inner Ring Drop (in.)**	**Inner Ring Volume change (ml)**	**Outer Ring Drop (in.)**	**Outer Ring Volume Change (ml)**	**Rate (ml/min)**	**Infiltration rate (in/hr)**
9:31 AM			fill		fill		
10:01 AM	30	2 4/8	1,160	2 6/8	2,260	38.67	5.01
10:31 AM	30	2 2/8	1,040	2 1/8	1,750	34.67	4.49
10:41 AM	10	6/8	360	1 1/8	890	36.00	4.66
10:51 AM	10	5/8	300	3/8	350	30.00	3.88
11:01 AM	10	5/8	290	3/8	320	29.00	3.75
11:11 AM	10	6/8	320	4/8	410	32.00	4.14
Average			317.50		492.50	31.75	4.11

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21 E. Lincoln Ave.-Suite 160
Hatfield, PA 19440

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1590 Canary Road, Quakertown, PA 18951 | 215-536-7006 | Fax: 215-538-6136

VW Consultants LLC

April 21, 2023

Steven N. Kline, AIA
Regan/Kline/Cross
7670 Queen Street, Suite 200
Wyndmoor, PA 19038
via email: s_kline@reganklinecrossllc.com

Re: Wetland/Waters Investigation
222 Church Road
Elkins Park, PA 19027
Cheltenham Township, Montgomery County
TM# 31-00-06637-001

Dear Mr. Kline,

VW Consultants, LLC (VW) is pleased to present this letter summarizing findings of a wetland evaluation completed on March 22, 2023 at the above referenced property. The purpose of the routine investigation was to identify and delineate wetlands and waters of the US and Commonwealth for a proposed residential land development project. This evaluation area was completed throughout the ±5.05 acres property. The property has frontage Church Road and Harrison Ave with paved driveways from each. The property currently contains a stone dwelling and associated outbuildings. The majority of the property is well maintained lawn with scattered mature trees. Site surface drainage is generally toward the south in the direction of Tookany Creek which traverses neighboring lots.

Methodology

The site was evaluated per routine procedures established by *Corps of Engineers Wetland Delineation Manual (1987)* and *Regional Supplement to the Corps of Engineers Wetland Manual: Eastern Mountains and Piedmont Region, (Version 2.0) (2012)*. To qualify as a wetland the manuals require the area to exhibit hydric soils, dominance of hydrophytic vegetation, and wetland hydrology.

VW traversed the project site to identify plant communities and wetland hydrology indicators. Samples points were located in and along low-lying sections of the site most likely to contain wetlands. The project site and delineated wetlands are depicted on the attached *Existing Features* plan, dated July 23, 2021, last revised April 10, 2023, prepared by Robert E. Blue Consulting Engineers, p.c. Locations of the sample points documented on the attached forms are also indicated on the site plan.

Desktop Resource Review and Setting

A review the U.S. Fish and Wildlife Services National Wetlands Inventory (NWI) Map revealed presence of riverine habitat associated with Tookany Creek and a forested wetland within the creeks floodway. Both mapped features are off site and down gradient of the project area.

The current Soil Survey of Montgomery County, Version 6, Sept. 17, 2019, published by the National Resource Conservation Service and accessed via Web Soil Survey indicates soils on the subject site are expected to be Hatboro silt loam (Ha) and Urban land-Udorthents of schist and gneiss (UugB & UugD). The Hatboro soil series is recognized as very deep and poorly drained Inceptisols formed in alluvium from metamorphic and crystalline rock. The Urban land-Udorthents mapping units indicate a combination of manmade impervious coverages and cut/fill lands. Given the site bedrock formation of Wissahickon schist and hillslope position the author would

expect to encountered well drained Glenelg type soil and moderately well Glenville type soil, with an urban component based on the developed condition. Evidence of significant and filling activity was not readily apparent in the upland portion of the project site based on our above grade observations.

Findings

The project site contains a manmade water conveyance structure reported to have been a mill raceway. This raceway is disconnected from the source of surface water as control structures have deteriorated and berms eroded allowing the outlet of water to Tookany Creek upgradient of the project site. A small on-site masonry structure is labelled as Spring House on the Existing Features Plan. During our site visit in late March following a warm wet winter no spring was present at the Spring House. Function of the spring house is likely impacted by changes to the local hydrologic regime as the result of extensive land development or it may have originally functioned as a root cellar.

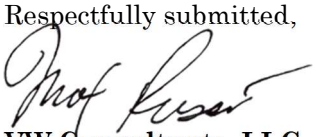
The raceway currently contains a small area of closed grading where surface water is present in small pools at the lowest points. This area meets the criteria of a wetland and was field delineated as such. It is unclear how much of the wetland's hydrology is the result of shallow groundwater or if the wetland is supported by transmission of infiltrated water transmitted via sediment deposits to this low point. To the east and west of the wetland feature the raceway plant communities become more neutral in their affinity for saturated soil conditions and hydrology and hydric soils become absent. The wettest portion of the wetland was unvegetated at the time of our site visit. Margin species include Eurasian buttercup (*Ficaria verna)*, boxelder maple (*Acer negundo)*, and Amur honeysuckle (*Lonicera maackii).*

A natural wetland located at the rear of the Tookany Creek floodplain is present along the toe of the raceway berm. This wetland extends off site to the south. A surface connection from the raceway wetland to the flooplain wetland is present in the form of an erosion channel through the berm. The hydrology source of the floodplain wetland is regional groundwater discharge. The connection with the raceway appears to have minimal impacts on the floodplain wetland hydrology and characteristics. Dominant plants include Eurasian butter cup and boxelder maple, along with skunk cabbage (*Symplocarpus foetidus)* in the most lowlying locations.

Conclusion

The project site includes a wetland regulated by the Commonwealth of Pennsylvania and under Federal jurisdiction administered by the Army Corps of Engineers. The wetland exhibits varying characteristic. The upper portion can be characterized as a manmade depressional wetland to vernal pool during wet springs. The remainder is a backswamp floodplain wetland with drainage channel. The abandoned mill raceway does not exhibit fluvial characteristics that support regulation as a water course. Final jurisdictional boundaries are dependent upon Federal and State field determinations. Should you need any assistance with permitting of disturbance of wetlands or waters please feel free to contact me at 267-498-8778 or by email at mrussick@vw-consultants.com.

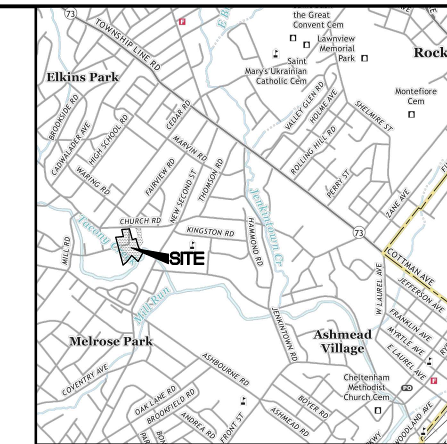
Respectfully submitted,



VW Consultants, *LLC*
Max Russick, CPSS
Soil Scientist

Enclosures: Existing Features Plan (reduced to 11"x17"), NWI Map Figure, Data Forms, NC DWQ Stream Identification Form, Photo Plates

CC: Robert Blue, P.E.- Robert E. Blue Consulting Engineers, P.C.
Michael Baginski, E.I.T.- Robert E. Blue Consulting Engineers, P.C.



LOCATION MAP
SCALE: 1"=2,000'

THE NATIONAL MAP BY U.S.G.S.
FRANKFORD PA 2019 QUADRANGLE

ZONING: R2 – RESIDENTIAL DISTRICT		
	REQUIREMENTS	EXISTING (222 E. CHURCH)
§295–602.A MINIMUM LOT AREA:	10,000 S.F.	5.0503 ACRES (219,992.75 S.F.)
§295–602.A MINIMUM LOT WIDTH:	70 FT.	172.14 FT.
§295–602.A SETBACKS:	FRONT YARD = 40 FT. SIDE YARD (AGG.) = 30 FT. SIDE YARD (MIN.) = 10 FT. REAR YARD = 25 FT.	FRONT YARD = 40 FT. SIDE YARD (AGG.) = 30 FT. SIDE YARD (MIN.) = 15 FT. REAR YARD = 25 FT.
§295–602.A MAX. BUILDING COVERAGE:	20%	1.4% (3,788 S.F.)
§295–602.A MAX. IMPERVIOUS COVERAGE:	40%	8.0% (21,590 S.F.)
§295–602.A MAX. BUILDING HEIGHT:	<40 FT.	<40 FT.
§295–602.A GARAGE SETBACK*	10 FT. BACK FROM FRONT FACADE	<10 FT.[1]
* ADDITIONAL REGULATIONS UNDER §295–603		
[1] EXISTING NON–CONFORMITY		

SURVEY NOTES:

1. THIS PLAN REPRESENTS AN ACTUAL FIELD SURVEY PERFORMED BY CHARLES E. SHOEMAKER, INC. COMPLETED IN FEBRUARY, 2021.

2. SITE DATA:

CURRENT OWNER: 222 CHURCH ROAD LLC (C/O RABBI ZVI BLOOM)
C/O RABBI ZVI BLOOM
509 CEDARHILL ROAD

SITE ADDRESS: 222 E. CHURCH ROAD
ELKINS PARK, PA 19027
TAX MAP: BLOCK 47 – UNIT 3
TAX NUMBER: PARCEL 31–00–06637–001
DB 6206 PG 272

RECORDED DATA: CHELTENHAM TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

3. THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. THE SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED ALTHOUGH HE DOES CONFIRM THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE.

4. A PORTION OF THE PROJECT SITE SHOWN LIES WITHIN A SPECIAL FLOOD HAZARD AREA ("SFHA") – ZONE AE, AS DOCUMENTED ON THE FLOOD INSURANCE RATE MAP IDENTIFIED AS PANEL 403 OF 451, COMMUNITY NUMBER 420696, MAP NUMBER 42091C0403G; EFFECTIVE DATE: MARCH 2, 2016. THE DATUM FOR THIS MAP IS NAVD88.

5. THE VERTICAL DATUM FOR THIS SITE IS NAVD 1988 BASED ON GPS OBSERVATIONS.

6. PA ONE CALL SERIAL NUMBER: SERIAL #20212303507, DATED AUGUST 21, 2021

7. THE GROSS AND NET AREA OF 222 E. CHURCH ROAD IS 272,238 S.F. OR 6.2497 ACRES.

8. THIS PROPERTY HAS DIRECT ACCESS TO CHURCH ROAD (SR 2023), A PUBLIC STREET, THROUGH TWO (2) TWO–WAY MACADAM DRIVEWAYS. ADDITIONAL THIS PROPERTY HAS DIRECT ACCESS TO HARRISON AVENUE, A PUBLIC STREET.

9. AS OF THE DATE OF SURVEY (APRIL 10, 2020), THERE WAS NO EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS, EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS.

10. PLAN REFERENCES:

10.1. SUBDIVISION PLAN FOR 216 & 222 E. CHURCH ROAD, PREPARED BY CHARLES E. SHOEMAKER, INC., DATED MARCH 1, 2021, LAST REVISED MARCH 31, 2021.

SOILS TABLE PER USDA NRCS						
MAP SYMBOL	SOIL NAME	SLOPES	HYDROLOGIC GROUP	DEPTH TO WATER TABLE	DRAINAGE CHARACTERISTICS	HYDRIC SOIL
Ha	HATBORO SILT LOAM	0 – 3	B / D	0" – 6"	POORLY DRAINED	YES
UugB	URBAN LAND – URDORTHENTS	0 – 8	C	> 60"	WELL DRAINED	NO
UugD	URBAN LAND – UDORTHENTS	8 – 25	C	> 60"	WELL DRAINED	NO
W	WATER	–	–	–	–	–

LEGEND

STORM INLET TYPE 'C'
STORM INLET TYPE 'M'
STORM MANHOLE
SANITARY MANHOLE
U.P. UTILITY POLE
L.P. LAMP POST
F.H. FIRE HYDRANT
W.V. WATER VALVE
STEEP SLOPES (15%–25%)
VERY STEEP SLOPES (>25%)
STREAM
FLOODPLAIN
Wetland Sample Point (added by VW)
FENCE
WALL
MACADAM EDGE
CONC. CURB
DEPRESSED CURB
CONCRETE
SLATE
TREELINE
PROPERTY CORNER
IRON PIN FOUND
RIPARIAN CORRIDOR – ZONE 1
RIPARIAN CORRIDOR – ZONE 2
TO BE DEMOLISHED
WETLANDS 'A'
WL–A11 WETLANDS FLAG DESIGNATION

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. BLUE JR. 4/11/2023 (DATE)
LICENSE NO. 26169–E

PROFESSIONAL LAND SURVEYOR
ROBERT E. BLUE JR. 4/11/2023 (DATE)
LICENSE NO. SU1323A

robert e. blue
consulting engineers, p.c.
1149 Skippack Pike, Blue Bell, PA 19422
tel: (610)-277-9897 fax: (610)-277-9441
www.robertblue.com email: rblue@robertblue.com

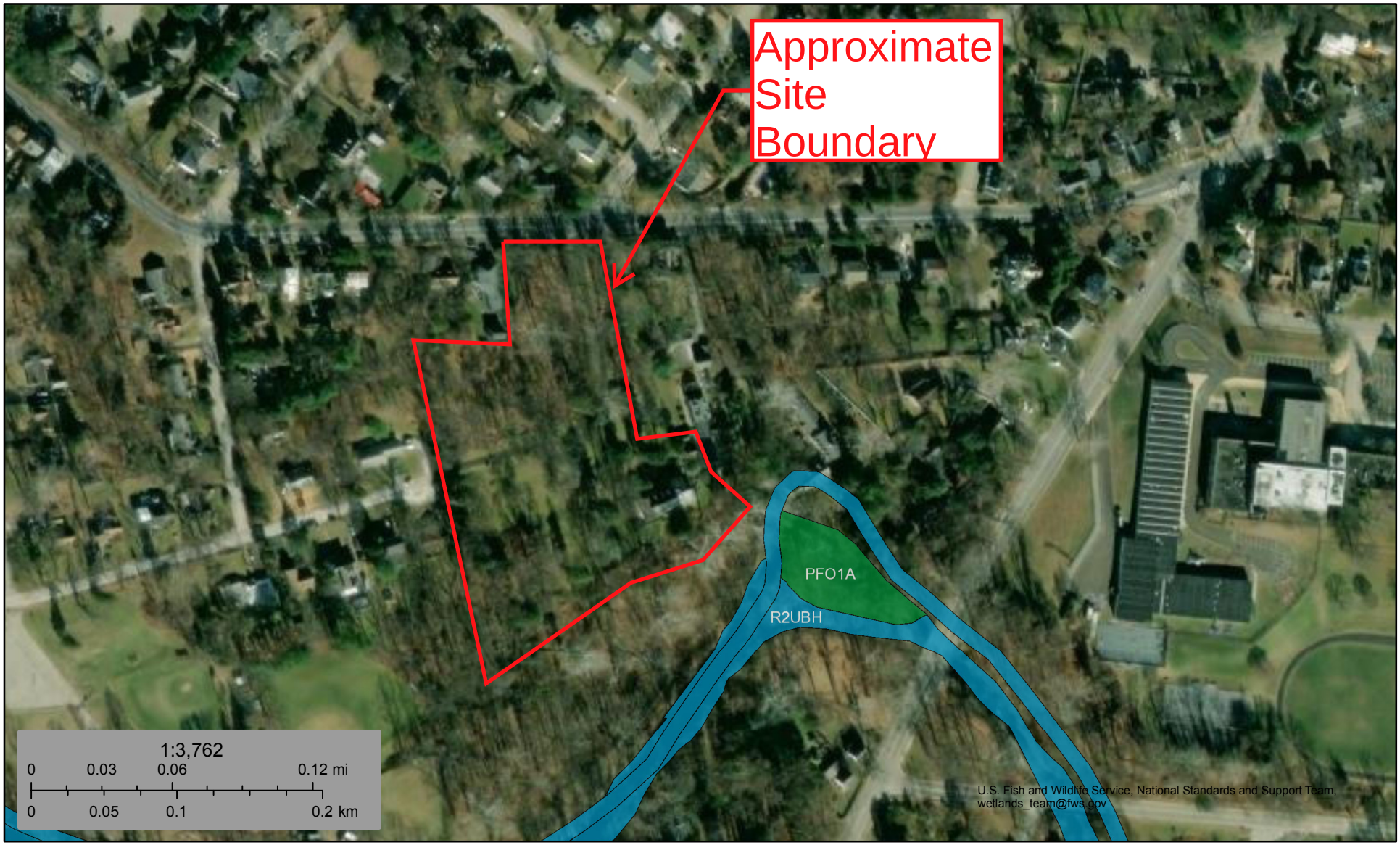
FINAL PLAN
EXISTING FEATURES
222 CHURCH ROAD
CHELTENHAM TOWNSHIP
MONTGOMERY COUNTY
PENNSYLVANIA

PREPARED FOR
222 CHURCH ROAD LLC
C/O RABBI ZVI BLOOM
509 CEDARHILL ROAD
FAR ROCKAWAY, NY 11691

DRAWN BY: DJG	CHECKED BY: REB	SCALE: 1"=50'
DATE: 2021–07–23	JOB NUMBER: 2154–10E	SHEET NUMBER: 4 of 31

U.S. Fish and Wildlife Service
National Wetlands Inventory

222 Church Road



April 20, 2023

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-12-9; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: 222 Church Road City/County: Montgomery Co. Sampling Date: 3/22/23

Applicant/Owner: 222 Church Road LLC State: PA Sampling Point: 1

Investigator(s): Max Russick Section, Township, Range: Cheltanham Twp.

Landform (hillside, terrace, etc.): Artificial Terrace Local relief (concave, convex, none): Concave Slope (%): 1-2

Subregion (LRR or MLRA): LRR S, MLRA 148 Lat: 40.06911 Long: -75.11680 Datum: WGS 84

Soil Map Unit Name: Hatboro NWI classification: Vernal Pool/PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 8
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Site Evaluated during seasonally wet conditions at beginning of growing season.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: 1

Tree Stratum (Plot size: 30' Radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer negundo*	5	Yes	FAC
2. *Fraxinus americana*	1	No	FACU
3.			
4.			
5.			
6.			
7.			
	6	=Total Cover	
50% of total cover: 3		20% of total cover:	2
Sapling/Shrub Stratum (Plot size: 15' Radius)			
1. *Lonicera maackii*	15	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	15	=Total Cover	
50% of total cover: 8		20% of total cover:	3
Herb Stratum (Plot size: 5' Radius)			
1. *Ficaria verna*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10	=Total Cover	
50% of total cover: 5		20% of total cover:	2
Woody Vine Stratum (Plot size: 30' Radius)			
1. *Vitis sp.*	2	No	
2. *Celastrus sp.*	2	No	
3.			
4.			
5.			
	4	=Total Cover	
50% of total cover: 2		20% of total cover:	1

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	1	x 4 =	4
UPL species	15	x 5 =	75
Column Totals:	31 (A)		124 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 2.5/1	100					Loamy/Clayey	
3-16	2.5Y 3/1	92	7.5YR 4/6	5	C	PL/M	Loamy/Clayey	Prominent redox concentrations
			2.5Y 4/2	2	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None Observed

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-12-9; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: 222 Church Road City/County: Montgomery Co. Sampling Date: 3/22/23

Applicant/Owner: 222 Church Road LLC State: PA Sampling Point: 2

Investigator(s): Max Russick Section, Township, Range: Cheltanham Twp.

Landform (hillside, terrace, etc.): Artificial Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR S, MLRA 148 Lat: 40.06898 Long: -75.11710 Datum: WGS 84

Soil Map Unit Name: Hatboro NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes ____	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes X	No ____	Depth (inches): 14
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 13

Wetland Hydrology Present? **Yes** ____ **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Site Evaluated during seasonally wet conditions at beginning of growing season. Stream assessment data also collected at this location.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: 2

Tree Stratum (Plot size: 30' Radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer negundo*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	10 =Total Cover		
50% of total cover: 5	20% of total cover: 2		
Sapling/Shrub Stratum (Plot size: 15' Radius)			
1. *Lonicera maackii*	5	Yes	UPL
2. *Ligustrum sp.*	5	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10 =Total Cover		
50% of total cover: 5	20% of total cover: 2		
Herb Stratum (Plot size: 5' Radius)			
1. *Ficaria verna*	90	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 =Total Cover		
50% of total cover: 45	20% of total cover: 18		
Woody Vine Stratum (Plot size: 30' Radius)			
1. *Vitis sp.*	2	No	
2.			
3.			
4.			
5.			
	2 =Total Cover		
50% of total cover: 1	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	110 (A)		350 (B)

Prevalence Index = B/A = 3.18

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	
14-20	2.5Y 3/2	90	7.5YR 5/6	5	C	PL/M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
___ Loamy Mucky Mineral (F1) **(MLRA 136)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 122, 136)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None Observed
Depth (inches): ____

Hydric Soil Present? **Yes** ____ **No** ____

Remarks:
Soil derived from deposition in mill raceway. No oxidized rhizospheres could be located along living roots.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-12-9; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: 222 Church Road City/County: Montgomery Co. Sampling Date: 3/22/23

Applicant/Owner: 222 Church Road LLC State: PA Sampling Point: 3

Investigator(s): Max Russick Section, Township, Range: Cheltanham Twp.

Landform (hillside, terrace, etc.): Floodplain Terrace Local relief (concave, convex, none): Linear Slope (%): 0-2

Subregion (LRR or MLRA): LRR S, MLRA 148 Lat: 40.069035 Long: -75.1167 Datum: WGS 84

Soil Map Unit Name: Hatboro NWI classification: PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes X	No ____	Depth (inches): 14
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 6

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Site Evaluated during seasonally wet conditions at beginning of growing season. Surface water only present in chanel traversing the wetland.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: 3

Tree Stratum (Plot size: 30' Radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer negundo*	20	Yes	FAC
2. *Acer platanoides*	5	Yes	UPL
3.			
4.			
5.			
6.			
7.			
	25	=Total Cover	
50% of total cover: 13		20% of total cover:	5

Sapling/Shrub Stratum (Plot size: 15' Radius)			
1. *Acer negundo*	5	Yes	FAC
2. *Viburnum dentatum*	2	No	FAC
3. *Euonymus alatus*	10	Yes	UPL
4.			
5.			
6.			
7.			
8.			
9.			
	17	=Total Cover	
50% of total cover: 9		20% of total cover:	4

Herb Stratum (Plot size: 5' Radius)			
1. *Ficaria verna*	90	Yes	FAC
2. *Symplocarpus foetidus*	5	No	OBL
3. *Reynoutria japonica*	1	No	FACU
4. *Ligustrum sp.*	1	No	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	97	=Total Cover	
50% of total cover: 49		20% of total cover:	20

Woody Vine Stratum (Plot size: 30' Radius)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	1	x 4 =	4
UPL species	15	x 5 =	75
Column Totals:	138 (A)		435 (B)

Prevalence Index = B/A = 3.15

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	100					Loamy/Clayey	
8-14	2.5Y 4/1	80	7.5YR 5/6	5	C	PL	Loamy/Clayey	Prominent redox concentrations
			10YR 4/2	5	D	M		
14-20	10YR 4/2	90	7.5YR 5/6	5	C	PL	Loamy/Clayey	Prominent redox concentrations
			10YR 4/2	5	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None Observed

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

NC DWQ Stream Identification Form Version 4.11

Date: 3-22-2023	**Project/Site:** 222 Church Rd	**Latitude:**
Evaluator: Max Russick	**County:** Montgomery	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 4.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

Abandoned / Disconnected Mill Raceway – not a water course

A. Geomorphology (Subtotal = 1)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	(0)	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	(0)	1	2	3
4. Particle size of stream substrate	(0)	1	2	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	(0)	0.5	1	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
12. Presence of Baseflow	(0)	1	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 0)				
18. Fibrous roots in streambed	3	2	1	(0)
19. Rooted upland plants in streambed	3	2	1	(0)
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Sample reach is centered around wetland Sample Point - 2. Raceway floor is blanketed by Eurasian buttercup, a terrestial facultative species.

Sketch:

See Existing Features plan by Robert E. Blue Consulting Engineers, P.C.

<u>222 Church Road</u>

Cheltenham Twp., Montgomery County

March 22, 2023

Photo 1: View of Raceway From Lawn; Facing South

Photo 2: View of Raceway at SP-2,Facing North-northeast

Photo 3: Typical Upland Lawn Condition

Photo 4: Wetland within Floodplain; Facing West