Stormwater Management Report

For

The Cottages at Wandering Pond
Athens Street
Stow, MA 01775

June 29, 2022

Applicant:	The Cottages at Wandering Pond Realty Trust 148 Park Street North Reading, MA 01864
Owner:	EFMC Associates Limited Partnership 35 Parmenter Road Hudson, MA 01749
	Goshen Lane Realty Trust 148 Park Street North Reading, MA 01864
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STORMWATER MANAGEMENT

The project site is located off Hudson Road and consists of seven (7) parcels totaling approximately 110 acres. Two parcels contain several existing buildings and the other parcels are vacant. Vegetation varies across the site and consists of open space, wooded area, and wetland vegetation. A series of gravel roads and gravel cart paths are located within the site to provide means of access to portions of the site. There is Bordering Vegetated Wetland (BVW) located in the central portion of the site that is associated with the Mean Annual High Water Line (MAHWL) of an unnamed river that runs through the site. There are additional pockets of BVW throughout the site to the south, east, west, and north. The Natural Resource Conservation Service (N.R.C.S) soil survey report for Middlesex County indicates the presence of Scarboro Mucky Fine Sandy Loam, Swansea Muck, Freetown Muck, all of hydrologic soil group D; Paxton Fine Sandy Loam, Woodbridge Fine Sandy Loam, both of hydrologic soil group C; and Hinckley Loamy Sand, Merrimac Fine Sandy Loam, Windsor Loamy Sand, all of hydrologic soil group A.

Pre-Development

The existing site is comprised of twelve subcatchments. Subcatchment E-1 contains wooded area and drains to a BVW located in the northern corner of the site.

Subcatchment E-2 is the largest subcatchment and contains wooded area, open space, the majority of the existing buildings, gravel road/parking areas, BVW and some offsite runoff from the adjacent property. This subcatchment drains to the BVW and stream located centrally on site.

Subcatchment E-3 contains mostly wooded area and a portion of the existing gravel cart path, this subcatchment drains to the northeastern property line and eventually to a BVW offsite.

Subcatchment E-4 contains mainly wooded area and a portion of the existing gravel cart path, all of which drain to the BVW located onsite to the east.

Subcatchment E-5 contains wooded area, open space, gravel road/cart paths, and BVW. Runoff from this subcatchment drains to the BVW located on the southeastern portion of the site.

Subcatchment E-6 contains wooded area and gravel road, all of which drain to the BVW located onsite to the south.

Subcatchment E-7 contains mainly wooded area and a portion of gravel road/parking area. Runoff from this subcatchment drains to a low spot on site.

Subcatchment E-8 contains wooded area and drains to a low spot centrally located on site.

Subcatchment E-9 contains runoff from the adjacent property, wooded area, open space, impervious roof surface, and gravel parking area. This subcatchment drains to a low spot centrally located on site.

Subcatchment E-10 contains mainly wooded area and a portion of a gravel cart path offsite as well as a portion of offsite runoff, all of which drain to the BVW located on the central southern portion of the site.

Subcatchment E-11 contains wooded area and drains to the BVW located offsite to the west.

Subcatchment E-12 contains wooded area and drains to a BVW located offsite to the northwest.

Post-Development

The purpose of the proposed project is to develop an Active Adult Neighborhood (AAN). A series of ten (10) roadways are proposed to serve 142 units spread across the majority of the site. The main road comes in off Hudson Road which travels through the site to the north east and branches off mid-site to the second main road which travels west through the site. There are a series of dead end and looped roadways which branch off the two main roadways. The post-developed site it broken up into the 23 subcatchments shown on the Post-Development Drainage Map and described below.

Subcatchment P-1 compares to subcatchment E-1 and drains to a BVW located in the northern corner of the site. This subcatchment remains unchanged.

Subcatchments P-2A, P-2B, and P-5D compare to subcatchment E-1. Subcatchment P-2A contains the entirety of Stepping Stone Lane and the dwellings proposed along said road, as well as open space and untouched wooded area. Roadway runoff from this subcatchment is captured through a series of catch basins and discharges to IB-2A to be infiltrated and recharged. Similarly, roof runoff is captured through gutters and downspouts which discharge to daylight and ultimately into IB-2A to be infiltrated and recharged. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to discharging into IB-2A. Subcatchment P-5D contains Daffodil Drive, a portion of Wandering Pond Way, and adjacent dwellings. Runoff from this subcatchment discharges to IB-5D which overflows through a rectangular weir and piped into IB-2A. Subcatchment P-2B remains mostly untouched from existing conditions and drains to the BVW and stream located centrally on site.

Subcatchments P-3A and P-3B compare to Subcatchment E-3. Subcatchment P-3A contains a portion of Wandering Pond Circle and several adjacent dwellings. Roadway runoff from this subcatchment is captured through a series of catch basins and discharges to IB-3A to be infiltrated and recharged. Similarly, roof runoff is captured through gutters and downspouts which discharge to daylight or through an underground pipe network and ultimately into IB-3A to be infiltrated and recharged. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to discharging into IB-3A. SMA-3A contains an overflow structure which discharges into Subcatchment P-3B. Subcatchment P-3B contains mostly wooded area, a portion of the existing gravel cart path, and a portion of open space surrounding the proposed dwellings, this subcatchment drains to the northeastern property line and eventually to a BVW offsite.

Subcatchment P-4 contains mostly wooded area, a portion of the existing gravel cart path, and a portion of open space surrounding the proposed dwellings, this subcatchment drains to the BVW located onsite to the east.

Subcatchments P-5A, P-5B, P-5C, and P-5E compare to Subcatchment E-5. Subcatchment P-5A contains a portion of Wandering Pond Circle and several adjacent dwellings, associated open space, and some wooded area. Road runoff is captured, treated, and discharged into IB-5A and roof runoff is captured and discharged to IB-5A to be treated, infiltrated and recharged. IB-5A overflows into IB-5B. Subcatchment P-5B contains the remaining portion of Wandering Pond Circle, adjacent dwellings and associated open space and some remaining wooded area. Road and roof runoff within this subcatchment is captured, treated, and discharged into IB-5B to be infiltrated and recharged. Subcatchment P-5C contains a portion of Wandering Pond Way and adjacent dwellings. Runoff from this subcatchment discharges to IB-5C which overflows through a rectangular weir and piped into Subcatchment P-5E. Subcatchment P-5E contains the majority of Wandering Pond Way, some open space and wooded area, all of which drains to the BVW located on the southeastern portion of the site. Road runoff from this subcatchment is treated via Contech units within the catch basins within the roadway.

Subcatchment P-6A and P-6B compare to subcatchment E-6. Subcatchment P-6A contains mainly wooded area, some open space, and the Wastewater Treatment Facility building. Runoff from this subcatchment drains to the BVW located onsite to the south. Subcatchment P-6B contains the parking for the Wastewater Treatment

Facility Building, some open space and wooded area. Runoff from this subcatchment drains to IB-6B to be treated, infiltrated, and recharged.

Subcatchment P-7A and P-7B compare to Subcatchment E-7. Subcatchment P-7A contains the entirety of Buttercup Lane and Daisy Lane, adjacent dwellings, and associated open space. Runoff from this subcatchment discharges to IB-7A to be treated, infiltrated, and recharged. Subcatchment P-7B contains a portion of Wildflower Lane, the entirety of Cottagehouse Lane, the Cottagehouse, associated parking, pool and associated patio/pool coping, and tennis courts. Runoff from this subcatchment drains to IB-7B to be treated, infiltrated, and recharged.

Subcatchment P-8 compares to Subcatchment E-8. Subcatchment P-8 contains a portion of Wildflower Lane, the entirety of Lily Pad Lane, adjacent dwellings, and open space. Runoff from this subcatchment discharges to IB-P8 to be treated, infiltrated, and recharged.

Subcatchment P-9 compares to subcatchment E-9. Subcatchment P-9 contains runoff from the adjacent property, a portion of Sweet Pea Path, open space, and wooded area. This subcatchment drains to a low spot within the subcatchment. Runoff from Sweet Pea Path is treated via a treatment trench adjacent to the roadway.

Subcatchments P-10A – P-10D compare to subcatchment E-10. Subcatchment P-10A contains mainly wooded area and some open space. Runoff from this subcatchment drains to the BVW located on the central southern portion of the site. Subcatchment P-10B contains a portion of Wildflower Way, adjacent dwellings, and open space. This subcatchment drains to IB-10B where it is treated, infiltrated and recharged. IB-10B overflows to subcatchment 10A. Subcatchment P-10C contains a portion of Wildflower Way, adjacent dwellings and open space. This subcatchment drains to IB-10C where it is treated, infiltrated and recharged. IB-10C overflows into IB-10D. Subcatchment P-10D contains a portion of Wildflower Way and adjacent dwellings. This subcatchment drains to IB-10D to be infiltrated, treated, and recharged and overflows through a broad crested weir and ultimately to the BVW located on the central southern portion of the site.

Subcatchment P-11 compares to subcatchment E-11. Subcatchment P-11 remains mostly unchanged from E-11 with the exception of a small portion due to the proposed grading associated with the proposed dwellings. Runoff from this subcatchment drains to the offsite BVW to the west.

Subcatchment P-12 compares to subcatchment E-12 and remains unchanged draining a BVW located offsite to the northwest.

Road runoff that is directed into any infiltration structure is being treated through a combination of deep sump hooded catch basins and sediment forebay to provide sufficient pre-treatment.

Compliance with MA DEP Stormwater Management Standards

Compliance with the Stormwater Management Standards is as follows:

Standard #1 No Untreated Discharges:

No new untreated discharges are proposed. Any additional runoff will be treated and infiltrated.

Standard #2 Peak Rate Attenuation:

The Post-Development peak flow rates must not be increased from pre-development rates for the 2-year, 10-year, and 25-year, and 100-year storm events. Also, offsite flood impact from the 100-year storm must not be increased. With a combination of infiltration and detention, the peak runoff rate has been decreased. The peak runoff rates have been summarized in the following tables.

Discharge Summary Tables

E-1 Compared to P-1

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0	0	0	0	0.002	0.002	0.015	0.015
Total Volume (cf)	0	0	3.52	3.52	52.4	52.4	228	228

E-2 Compared to P-2

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	5.423	3.443	30.74	21.57	52.98	37.97	92.93	72.51
Total Volume (cf)	46,214	31,781	162,799	116,876	257,433	192,484	426,335	339,453

E-3 Compared to P-3

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	6.809	6.481	17.08	16.21	24.26	22.96	35.91	34.06
Total Volume (cf)	35,200	28,734	82,096	67,014	115,182	94,782	169,813	146,891

E-4 Compared to P-4

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	6.776	6.5	17.00	16.24	24.14	23.05	35.73	34.18
Total Volume (cf)	35,030	27,152	81,699	63,326	114,625	88,848	168,993	130,989

E-5 Compared to P-5

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	7.884	6.876	20.38	17.73	29.19	25.34	43.57	37.90
Total Volume (cf)	41,393	29,184	98,397	69,374	138,911	98,421	206,084	174,152

E-6 Compared to P-6

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0	0	0.056	.011	0.315	.048	1.157	0.369
Total Volume (cf)	0.024	0	1,451	324	3,584	1,169	8,335	3,333

E-7 Compared to P-7

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0	0	0.023	0	0.135	0	1.078	0
Total Volume (cf)	0	0	669	0	3,648	0	12,259	0

E-8 Compared to P-8

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0	0	0.001	0	0.008	0	0.056	0
Total Volume (cf)	0	0	14.5	0	216	0	938	0

E-9 Compared to P-9

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	4.370	3.645	12.48	10.83	18.40	16.12	28.20	24.96
Total Volume (cf)	24,266	20,738	61,359	53,625	88,343	77,748	133,675	118,462

E-10 Compared to P-10

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	11.15	7.438	31.78	19.48	46.70	30.94	71.67	57.08
Total Volume (cf)	68,155	34,825	172,339	102,137	248,131	166,662	375,456	275,201

E-11 Compared to P-11

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	4.684	4.637	13.35	13.21	19.61	19.41	30.10	28.90
Total Volume (cf)	28,624	28,334	72,378	71,647	104,209	103,157	157,683	156,090

E-12 Compared to P-12

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0	0	0	0	0.002	0.002	0.021	0.021
Total Volume (cf)	0	0	4.70	4.7	69.9	69.9	303	303

Standard #3 Stormwater Recharge:

This standard prescribes the stormwater volume that must be recharged to groundwater based on the existing site soil conditions. The Natural Resources Conservation Service (N.R.C.S.) Middlesex Soil Survey map indicates that the site contains soil in Hydrologic Group A, C, and D. The Stormwater Management Policy requires 0.6 inches of runoff over the total impervious area to be recharged in areas with Hydrologic Group A soils, 0.25 inches in areas with hydrologic group C, and 0.10 inches in areas with hydrologic group D. Detailed "Recharge Volume Calculations" showing compliance with this standard are attached.

Standard #4 Water Quality:

According to the guidelines provided in the Stormwater Management Standards 80% Total Suspended Solids (TSS) removal is required for the total increase in impervious area associated with the project. This standard requires 1 inch of water over the impervious area in areas of rapid infiltration and 0.5 inches in all other areas. Calculations are provided. The combination of deep sump hooded catch basins and a sediment forebay will be utilized to achieve the required treatment levels.

Standard #5 Land Uses with Higher Potential Pollutant Loads:

The site will not contain "land uses with higher potential pollutant loads."

Standard #6 Critical Areas:

This site does not discharge runoff to critical areas.

Standard #7 Redevelopment:

This project is not for redevelopment. This standard would require that the Stormwater Management Standards be met to the extent practicable. The project has been designed to meet all of the standards.

Standard #8 Erosion/Sediment Control:

Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed and disturbed soils during construction. Temporary erosion and sedimentation controls during construction include minimizing areas of exposed soil, directing and controlling runoff, and rapidly stabilizing exposed areas. Soils left exposed for extended periods will be mulched and seeded for temporary vegetative cover. Following construction, exposed areas will be permanently vegetated with appropriate ground cover. Erosion and sedimentation control measures will be maintained throughout all phases of construction. Inspections will be made regularly and after rainfalls exceeding 0.5 inches in a 24-hour period during construction. The contractor will be required to inspect erosion and sedimentation control measures at the end of each workday, when precipitation is forecasted, and after each rainfall. All measures will be inspected prior to each weekend. The contractor will replace and repair any malfunctioning or damaged control measures including vegetative stabilization. Long term erosion and sedimentation control will be realized using the Best Management Practices described previously. Areas where soils have been disturbed will be loamed and vegetated.

Standard #9 Operation and Maintenance Plan:

An Operation and Maintenance Plan has been prepared and is included in this report as well as shown on the plan set.

Standard #10 Illicit Discharges to Drainage System:

No known illicit discharges exist nor are any proposed.

Design Basis

1. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
2. The twenty-four hour rainfall, taken from the NOAA Atlas, is 7.84 inches for the 100-year storm, 6.14 inches for the 25-year storm, 5.04 inches for the 10-year storm, and 3.27 inches for the 2-year storm event.
3. The hydrologic calculations were performed using the computer program: “Hydrology Studio” by Hydrology Studio.
4. The soil types of the site were taken from the N.R.C.S. Soil Survey Map for Middlesex County.
5. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
6. The Natural Resource Conservation Service (N.R.C.S) soil survey report for Middlesex County indicates the presence of Scarboro Mucky Fine Sandy Loam, Swansea Muck, Freetown Muck, all of hydrologic soil group D; Paxton Fine Sandy Loam, Woodbridge Fine Sandy Loam, both of hydrologic soil group C; and Hinckley Loamy Sand, Merrimac Fine Sandy Loam, Windsor Loamy Sand, all of hydrologic soil group A.
7. The rational method (Q=CIA) was used as a basis for sizing pipes. Runoff Coefficients: C=0.15 for woods, 0.20 for grass/landscaped areas, and 0.90 for impervious surfaces.
8. The Hantush Method was used for Mounding analysis.

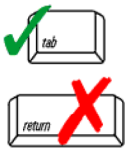
Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ■ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ■ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ■ Other (describe): Infiltration Basin, Treatment Trench, Contech Units

Standard 1: No New Untreated Discharges

- ■ No new untreated discharges
- ■ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ■ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

■ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

■ Soil Analysis provided.

■ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

■ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ■ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

■ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

■ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

■ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

■ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

■ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

■ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ■ Name of the stormwater management system owners;
- ■ Party responsible for operation and maintenance;
- ■ Schedule for implementation of routine and non-routine maintenance tasks;
- ■ Plan showing the location of all stormwater BMPs maintenance access areas;
- ■ Description and delineation of public safety features;
- ■ Estimated operation and maintenance budget; and
- ■ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

■ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Pre-Development Hydrology

Hydrograph 2-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.000	0.00	0.000	----		
2	NRCS Runoff	E-2	5.423	12.47	46,214	----		
3	NRCS Runoff	E-3	6.809	12.30	35,200	----		
4	NRCS Runoff	E-4	6.776	12.30	35,030	----		
5	NRCS Runoff	E-5	7.884	12.30	41,393	----		
6	NRCS Runoff	E-6	0.000	24.17	0.024	----		
7	NRCS Runoff	E-7	0.000	0.00	0.000	----		
8	NRCS Runoff	E-8	0.000	0.00	0.000	----		
9	NRCS Runoff	E-9	4.370	12.33	24,266	----		
10	NRCS Runoff	E-10	11.15	12.43	68,155	----		
11	NRCS Runoff	E-11	4.684	12.43	28,624	----		
12	NRCS Runoff	E-12	0.000	0.00	0.000	----		
14	NRCS Runoff	P-1	0.000	0.00	0.000	----		
16	NRCS Runoff	P-3A	3.053	12.10	10,424	----		
17	Pond Route	IB-3A	0.000	22.87	-0.002	16	288.30	5,524
18	NRCS Runoff	P-3B	6.481	12.20	28,734	----		
19	Junction	P-3 TOTAL	6.481	12.20	28,734	17, 18		
21	NRCS Runoff	P-4	6.500	12.17	27,152	----		
23	NRCS Runoff	P-5A	5.857	12.13	22,525	----		
24	Pond Route	IB-5A	0.000	12.47	0.000	23	305.99	10,729
25	NRCS Runoff	P-5B	4.505	12.17	18,454	----		
26	Junction	INFLOW TO IB-5B	4.505	12.17	18,454	24, 25		
27	Pond Route	IB-5B	0.000	22.93	-0.006	26	279.86	9,349
28	NRCS Runoff	P-5C	2.072	12.13	7,952	----		
29	Pond Route	IB-5C	0.000	12.87	0.002	28	259.12	3,568
30	NRCS Runoff	P-5E	6.876	12.17	29,184	----		
31	Junction	P-5 TOTAL	6.876	12.17	29,184	27, 29, 30		
33	NRCS Runoff	P-5D	3.361	12.10	11,564	----		
34	Pond Route	IB-5D	0.000	15.87	0.005	33	231.81	7,379
35	NRCS Runoff	P-2A	3.280	12.17	14,854	----		
36	Junction	INFLOW TO IB-2A	3.280	12.17	14,854	34, 35		

Hydrograph 2-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	0.000	12.93	0.000	36	229.10	1,461
38	NRCS Runoff	P-2B	3.443	12.47	31,781	----		
39	Junction	TOTAL P-2	3.443	12.47	31,781	37, 38		
41	NRCS Runoff	P-6A	0.000	0.00	0.000	----		
42	NRCS Runoff	P-6B	0.002	22.10	45.1	----		
43	Pond Route	IB-6B	0.000	18.63	0.000	42	217.40	0.735
44	Junction	P-6 TOTAL	0.000	18.63	0.000	41, 43		
46	NRCS Runoff	P-7A	0.563	12.33	4,481	----		
47	Pond Route	IB-7A	0.000	13.23	0.000	46	219.17	355
48	NRCS Runoff	P-7B	0.361	12.50	2,775	----		
49	Pond Route	IB-7B	0.000	13.47	0.000	48	224.09	190
50	Junction	P-7 TOTAL	0.000	13.23	0.000	47, 49		
52	NRCS Runoff	P-8	2.829	12.17	12,496	----		
53	Pond Route	IB-8	0.000	13.40	0.000	52	223.17	1,552
55	NRCS Runoff	P-9	3.645	12.33	20,738	----		
57	NRCS Runoff	P-10A	5.130	12.40	29,688	----		
58	NRCS Runoff	P-10B	4.245	12.13	16,434	----		
59	Pond Route	IB-10B	2.382	12.33	5,138	58	256.73	4,994
60	NRCS Runoff	P-10C	9.376	12.27	44,541	----		
61	Pond Route	IB-10C	4.990	12.53	8,909	60	228.49	12,332
62	NRCS Runoff	P-10D	8.386	12.10	28,634	----		
63	Junction	INFLOW TO IB-10D	8.386	12.10	37,542	61, 62		
64	Pond Route	IB-10D	0.000	11.63	0.000	63	226.74	16,894
65	Junction	P-10 TOTAL	7.438	12.37	34,825	57, 59, 64		
67	NRCS Runoff	P-11	4.637	12.43	28,334	----		
69	NRCS Runoff	P-12	0.000	0.00	0.000	----		

Hydrograph 10-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.000	23.73	3.52	----		
2	NRCS Runoff	E-2	30.74	12.27	162,799	----		
3	NRCS Runoff	E-3	17.08	12.27	82,096	----		
4	NRCS Runoff	E-4	17.00	12.27	81,699	----		
5	NRCS Runoff	E-5	20.38	12.27	98,397	----		
6	NRCS Runoff	E-6	0.056	13.83	1,451	----		
7	NRCS Runoff	E-7	0.023	21.03	669	----		
8	NRCS Runoff	E-8	0.001	23.80	14.5	----		
9	NRCS Runoff	E-9	12.48	12.27	61,359	----		
10	NRCS Runoff	E-10	31.78	12.37	172,339	----		
11	NRCS Runoff	E-11	13.35	12.37	72,378	----		
12	NRCS Runoff	E-12	0.000	23.70	4.70	----		
14	NRCS Runoff	P-1	0.000	23.73	3.52	----		
16	NRCS Runoff	P-3A	5.663	12.10	19,529	----		
17	Pond Route	IB-3A	0.000	21.47	-0.001	16	289.96	11,808
18	NRCS Runoff	P-3B	16.21	12.20	67,014	----		
19	Junction	P-3 TOTAL	16.21	12.20	67,014	17, 18		
21	NRCS Runoff	P-4	16.24	12.17	63,326	----		
23	NRCS Runoff	P-5A	11.29	12.13	43,384	----		
24	Pond Route	IB-5A	0.000	28.47	-0.002	23	307.49	24,675
25	NRCS Runoff	P-5B	8.845	12.17	36,049	----		
26	Junction	INFLOW TO IB-5B	8.845	12.17	36,049	24, 25		
27	Pond Route	IB-5B	0.000	23.37	0.000	26	281.47	21,234
28	NRCS Runoff	P-5C	3.921	12.13	15,103	----		
29	Pond Route	IB-5C	0.000	12.13	0.001	28	260.17	7,907
30	NRCS Runoff	P-5E	17.73	12.17	69,374	----		
31	Junction	P-5 TOTAL	17.73	12.17	69,374	27, 29, 30		
33	NRCS Runoff	P-5D	6.704	12.10	22,917	----		
34	Pond Route	IB-5D	2.074	12.43	8,715	33	232.29	9,947
35	NRCS Runoff	P-2A	9.459	12.17	37,560	----		
36	Junction	INFLOW TO IB-2A	9.459	12.17	46,275	34, 35		

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	0.000	15.00	-0.001	36	229.77	11,554
38	NRCS Runoff	P-2B	21.57	12.30	116,876	----		
39	Junction	TOTAL P-2	21.57	12.30	116,876	37, 38		
41	NRCS Runoff	P-6A	0.011	15.57	324	----		
42	NRCS Runoff	P-6B	0.099	12.47	1,226	----		
43	Pond Route	IB-6B	0.000	13.27	0.000	42	217.46	33.8
44	Junction	P-6 TOTAL	0.011	15.57	324	41, 43		
46	NRCS Runoff	P-7A	3.410	12.17	15,787	----		
47	Pond Route	IB-7A	0.000	19.37	0.000	46	220.90	4,726
48	NRCS Runoff	P-7B	1.569	12.37	8,714	----		
49	Pond Route	IB-7B	0.000	15.97	0.000	48	224.99	2,202
50	Junction	P-7 TOTAL	0.000	15.97	0.000	47, 49		
52	NRCS Runoff	P-8	7.833	12.17	30,929	----		
53	Pond Route	IB-8	0.000	24.43	0.000	52	223.94	8,657
55	NRCS Runoff	P-9	10.83	12.30	53,625	----		
57	NRCS Runoff	P-10A	13.22	12.37	70,572	----		
58	NRCS Runoff	P-10B	8.494	12.13	32,566	----		
59	Pond Route	IB-10B	7.380	12.20	18,051	58	257.01	6,225
60	NRCS Runoff	P-10C	18.35	12.27	87,007	----		
61	Pond Route	IB-10C	9.716	12.53	36,809	60	229.47	20,221
62	NRCS Runoff	P-10D	15.56	12.10	53,644	----		
63	Junction	INFLOW TO IB-10D	20.96	12.17	90,453	61, 62		
64	Pond Route	IB-10D	7.799	12.93	13,514	63	229.36	42,634
65	Junction	P-10 TOTAL	19.48	12.30	102,137	57, 59, 64		
67	NRCS Runoff	P-11	13.21	12.37	71,647	----		
69	NRCS Runoff	P-12	0.000	23.70	4.70	----		

Hydrograph 25-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.002	15.37	52.4	----		
2	NRCS Runoff	E-2	52.98	12.27	257,433	----		
3	NRCS Runoff	E-3	24.26	12.27	115,182	----		
4	NRCS Runoff	E-4	24.14	12.27	114,625	----		
5	NRCS Runoff	E-5	29.19	12.27	138,911	----		
6	NRCS Runoff	E-6	0.315	12.57	3,584	----		
7	NRCS Runoff	E-7	0.135	14.83	3,648	----		
8	NRCS Runoff	E-8	0.008	15.47	216	----		
9	NRCS Runoff	E-9	18.40	12.27	88,343	----		
10	NRCS Runoff	E-10	46.70	12.37	248,131	----		
11	NRCS Runoff	E-11	19.61	12.37	104,209	----		
12	NRCS Runoff	E-12	0.002	15.33	69.9	----		
14	NRCS Runoff	P-1	0.002	15.37	52.4	----		
16	NRCS Runoff	P-3A	7.305	12.10	25,435	----		
17	Pond Route	IB-3A	0.164	14.13	760	16	290.73	15,437
18	NRCS Runoff	P-3B	22.96	12.17	94,022	----		
19	Junction	P-3 TOTAL	22.96	12.17	94,782	17, 18		
21	NRCS Runoff	P-4	23.05	12.13	88,848	----		
23	NRCS Runoff	P-5A	14.74	12.13	57,048	----		
24	Pond Route	IB-5A	0.000	12.70	0.003	23	308.40	34,518
25	NRCS Runoff	P-5B	11.63	12.17	47,637	----		
26	Junction	INFLOW TO IB-5B	11.63	12.17	47,637	24, 25		
27	Pond Route	IB-5B	0.000	28.43	-0.003	26	282.38	29,508
28	NRCS Runoff	P-5C	5.092	12.13	19,765	----		
29	Pond Route	IB-5C	0.135	13.73	483	28	260.72	10,635
30	NRCS Runoff	P-5E	25.34	12.13	97,939	----		
31	Junction	P-5 TOTAL	25.34	12.13	98,421	27, 29, 30		
33	NRCS Runoff	P-5D	8.856	12.10	30,434	----		
34	Pond Route	IB-5D	4.739	12.27	15,690	33	232.51	11,171
35	NRCS Runoff	P-2A	13.88	12.17	54,078	----		
36	Junction	INFLOW TO IB-2A	17.53	12.20	69,768	34, 35		

Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	2.287	12.63	5,595	36	230.31	20,754
38	NRCS Runoff	P-2B	37.97	12.27	186,889	----		
39	Junction	TOTAL P-2	37.97	12.27	192,484	37, 38		
41	NRCS Runoff	P-6A	0.048	12.77	1,169	----		
42	NRCS Runoff	P-6B	0.344	12.33	2,617	----		
43	Pond Route	IB-6B	0.000	16.17	0.000	42	218.00	344
44	Junction	P-6 TOTAL	0.048	12.77	1,169	41, 43		
46	NRCS Runoff	P-7A	5.930	12.17	24,963	----		
47	Pond Route	IB-7A	0.000	22.60	0.000	46	222.09	9,219
48	NRCS Runoff	P-7B	2.550	12.33	13,370	----		
49	Pond Route	IB-7B	0.000	18.50	0.000	48	225.68	4,275
50	Junction	P-7 TOTAL	0.000	22.60	0.000	47, 49		
52	NRCS Runoff	P-8	11.38	12.17	44,231	----		
53	Pond Route	IB-8	0.000	22.13	0.000	52	224.50	14,615
55	NRCS Runoff	P-9	16.12	12.27	77,748	----		
57	NRCS Runoff	P-10A	18.93	12.33	99,629	----		
58	NRCS Runoff	P-10B	11.23	12.13	43,249	----		
59	Pond Route	IB-10B	8.391	12.27	27,095	58	257.16	7,449
60	NRCS Runoff	P-10C	24.10	12.27	114,974	----		
61	Pond Route	IB-10C	10.63	12.57	56,437	60	230.32	28,731
62	NRCS Runoff	P-10D	20.06	12.10	69,866	----		
63	Junction	INFLOW TO IB-10D	28.94	12.10	126,303	61, 62		
64	Pond Route	IB-10D	11.38	12.63	39,938	63	229.46	43,807
65	Junction	P-10 TOTAL	30.94	12.50	166,662	57, 59, 64		
67	NRCS Runoff	P-11	19.41	12.37	103,157	----		
69	NRCS Runoff	P-12	0.002	15.33	69.9	----		

Hydrograph 100-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.015	12.50	228	----		
2	NRCS Runoff	E-2	92.93	12.23	426,335	----		
3	NRCS Runoff	E-3	35.91	12.27	169,813	----		
4	NRCS Runoff	E-4	35.73	12.27	168,993	----		
5	NRCS Runoff	E-5	43.57	12.27	206,084	----		
6	NRCS Runoff	E-6	1.157	12.43	8,335	----		
7	NRCS Runoff	E-7	1.078	12.53	12,259	----		
8	NRCS Runoff	E-8	0.056	12.60	938	----		
9	NRCS Runoff	E-9	28.20	12.27	133,675	----		
10	NRCS Runoff	E-10	71.67	12.33	375,456	----		
11	NRCS Runoff	E-11	30.10	12.33	157,683	----		
12	NRCS Runoff	E-12	0.021	12.43	303	----		
14	NRCS Runoff	P-1	0.015	12.50	228	----		
16	NRCS Runoff	P-3A	9.836	12.10	34,751	----		
17	Pond Route	IB-3A	2.935	12.43	8,274	16	290.97	16,606
18	NRCS Runoff	P-3B	34.06	12.17	138,617	----		
19	Junction	P-3 TOTAL	34.06	12.17	146,891	17, 18		
21	NRCS Runoff	P-4	34.18	12.13	130,989	----		
23	NRCS Runoff	P-5A	20.10	12.13	78,715	----		
24	Pond Route	IB-5A	1.960	12.90	12,066	23	309.01	41,527
25	NRCS Runoff	P-5B	15.95	12.17	66,061	----		
26	Junction	INFLOW TO IB-5B	15.95	12.17	78,127	24, 25		
27	Pond Route	IB-5B	3.194	13.07	22,800	26	283.09	36,688
28	NRCS Runoff	P-5C	6.902	12.13	27,136	----		
29	Pond Route	IB-5C	2.414	12.43	6,054	28	260.94	11,696
30	NRCS Runoff	P-5E	37.90	12.13	145,298	----		
31	Junction	P-5 TOTAL	37.90	12.13	174,151	27, 29, 30		
33	NRCS Runoff	P-5D	12.21	12.10	42,421	----		
34	Pond Route	IB-5D	8.009	12.23	27,189	33	232.87	13,186
35	NRCS Runoff	P-2A	21.27	12.13	81,828	----		
36	Junction	INFLOW TO IB-2A	29.06	12.17	109,017	34, 35		

Hydrograph 100-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	6.729	12.57	26,751	36	230.94	32,449
38	NRCS Runoff	P-2B	67.68	12.23	312,703	----		
39	Junction	TOTAL P-2	72.51	12.27	339,453	37, 38		
41	NRCS Runoff	P-6A	0.369	12.47	3,333	----		
42	NRCS Runoff	P-6B	1.043	12.20	5,524	----		
43	Pond Route	IB-6B	0.000	19.87	0.000	42	219.15	1,446
44	Junction	P-6 TOTAL	0.369	12.47	3,333	41, 43		
46	NRCS Runoff	P-7A	10.38	12.17	41,342	----		
47	Pond Route	IB-7A	0.000	16.50	0.000	46	223.89	18,061
48	NRCS Runoff	P-7B	4.262	12.30	21,524	----		
49	Pond Route	IB-7B	0.000	20.83	0.000	48	226.79	8,198
50	Junction	P-7 TOTAL	0.000	16.50	0.000	47, 49		
52	NRCS Runoff	P-8	17.31	12.13	66,477	----		
53	Pond Route	IB-8	0.000	8.97	0.000	52	225.43	25,332
55	NRCS Runoff	P-9	24.96	12.27	118,462	----		
57	NRCS Runoff	P-10A	28.30	12.33	147,807	----		
58	NRCS Runoff	P-10B	15.50	12.13	60,282	----		
59	Pond Route	IB-10B	8.891	12.33	42,154	58	257.60	10,845
60	NRCS Runoff	P-10C	33.06	12.23	159,440	----		
61	Pond Route	IB-10C	11.70	12.63	88,306	60	231.41	43,013
62	NRCS Runoff	P-10D	27.02	12.10	95,454	----		
63	Junction	INFLOW TO IB-10D	36.44	12.10	183,760	61, 62		
64	Pond Route	IB-10D	19.89	12.33	85,240	63	229.65	46,089
65	Junction	P-10 TOTAL	57.08	12.33	275,201	57, 59, 64		
67	NRCS Runoff	P-11	29.80	12.33	156,090	----		
69	NRCS Runoff	P-12	0.021	12.43	303	----		

Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.16	4.80
A	Open Space	Good Condition	39			0.00	0.00
A	Brush	Fair	35			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Fair Condition	74			0.00	0.00
C	Gravel		89			0.00	0.00
					Totals =	0.16	4.80

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4.80}{0.16} = 30.00$; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.09	0.09	0.38

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-1
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.082			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.16			0.16
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	32			
9. Watercourse slope, s		ft/ft	0.047			
10. Average Velocity, V (figure 3-1)		ft/s	3.50			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.0

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

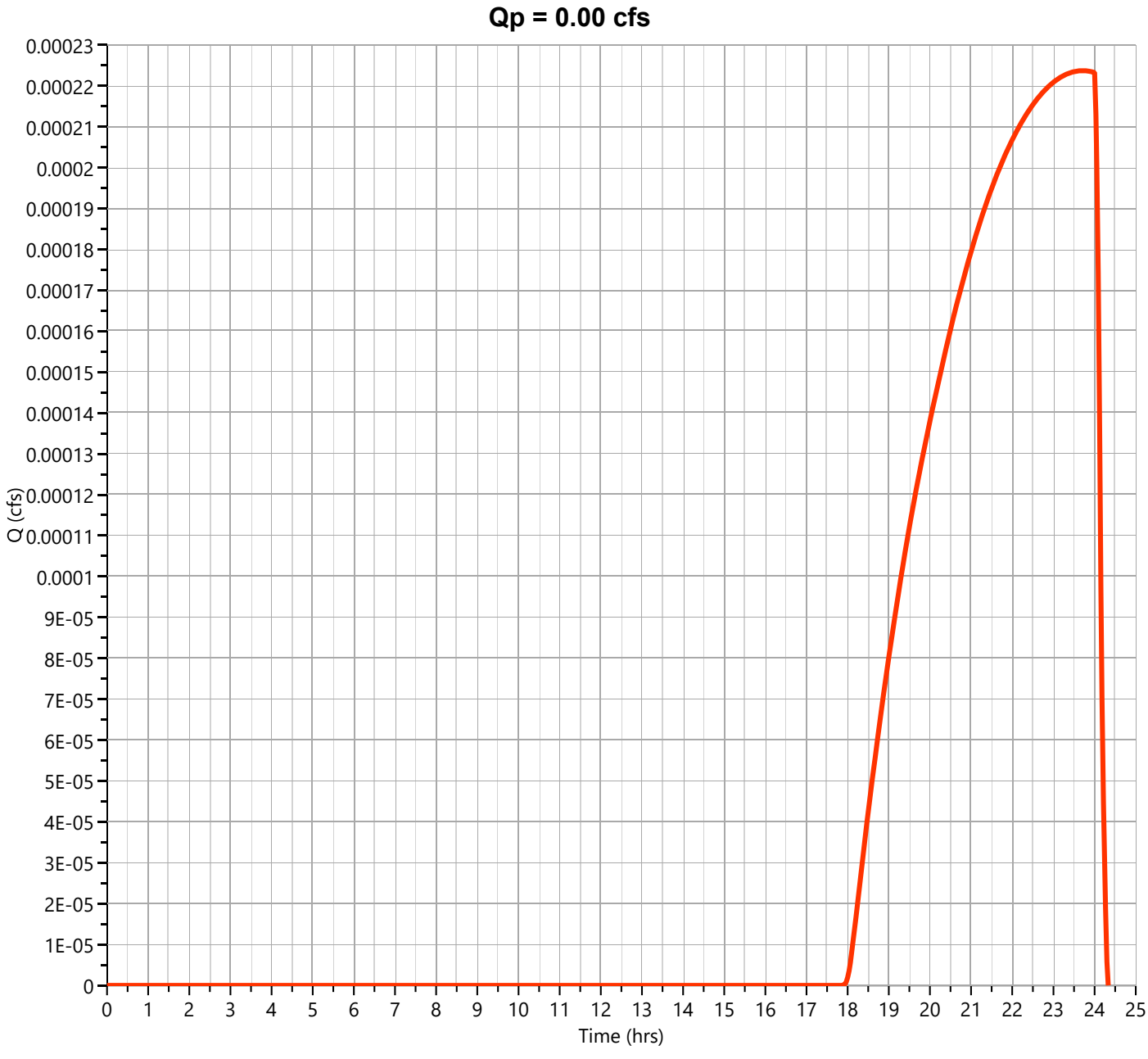
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06-28-2022

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.73 hrs
Time Interval	= 2 min	Runoff Volume	= 3.52 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

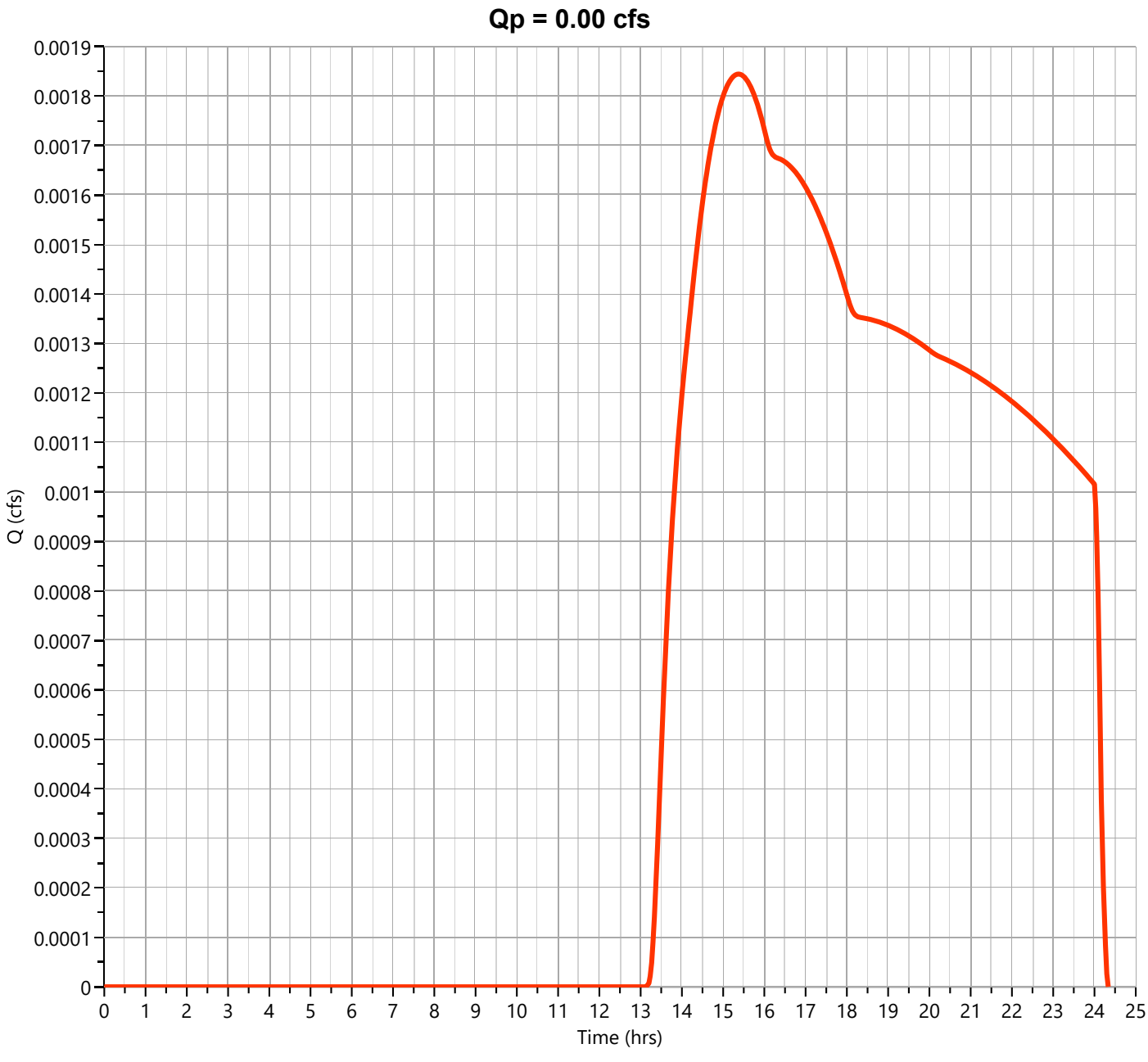
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06-28-2022

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.37 hrs
Time Interval	= 2 min	Runoff Volume	= 52.4 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

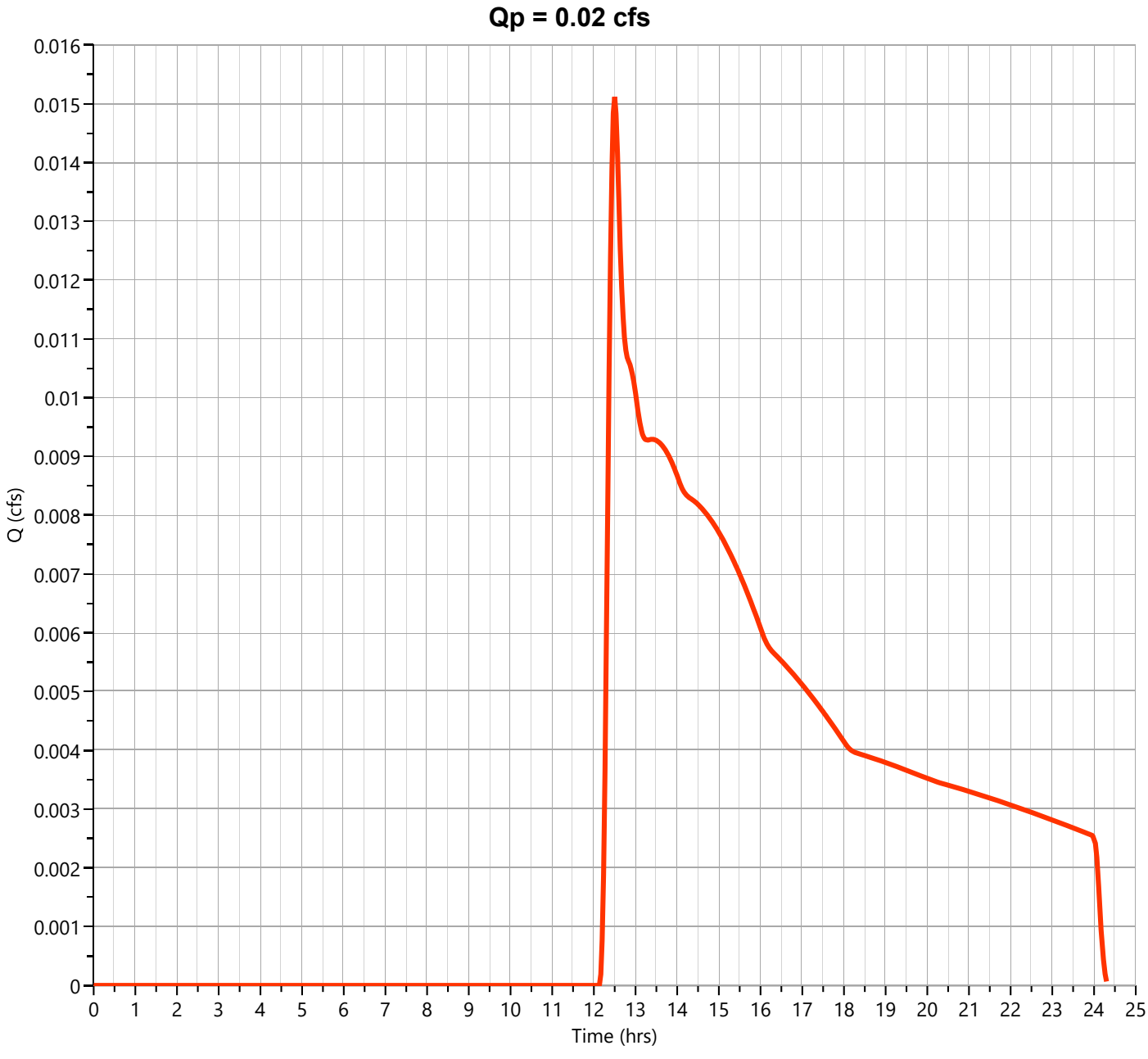
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06-28-2022

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.015 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Runoff Volume	= 228 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: [Present] Developed Subcatchment E-2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.34	33.25
A	Woods Good Condition	30			10.55	316.40
A	Open Space Good Condition	39			3.99	155.49
A	Open Space Fair Condition	49			1.96	96.14
A	Woods-Grass Combination Good Condition	32			2.33	74.66
A	Gravel	76			1.01	76.90
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.06	3.49
B	Gravel	85			0.01	1.11
C	Woods Good Condition	70			11.33	793.12
C	Open Space Fair Condition	79			1.57	123.81
C	Gravel	89			0.17	15.03
D	BVW	77			8.91	685.84
1/ Use only one CN source per line.	1839246			Totals =	42.22	2375.23

CN (weighted) = total product / total area = 2375.23 / 42.22 = 56.25 ; Use CN = 56

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.31	1.70	2.81

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-2
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.028			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.25			0.25
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	694			
9. Watercourse slope, s		ft/ft	0.128			
10. Average Velocity, V (figure 3-1)		ft/s	5.77			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.29
min 17.2

Hydrograph Report

Project Name:

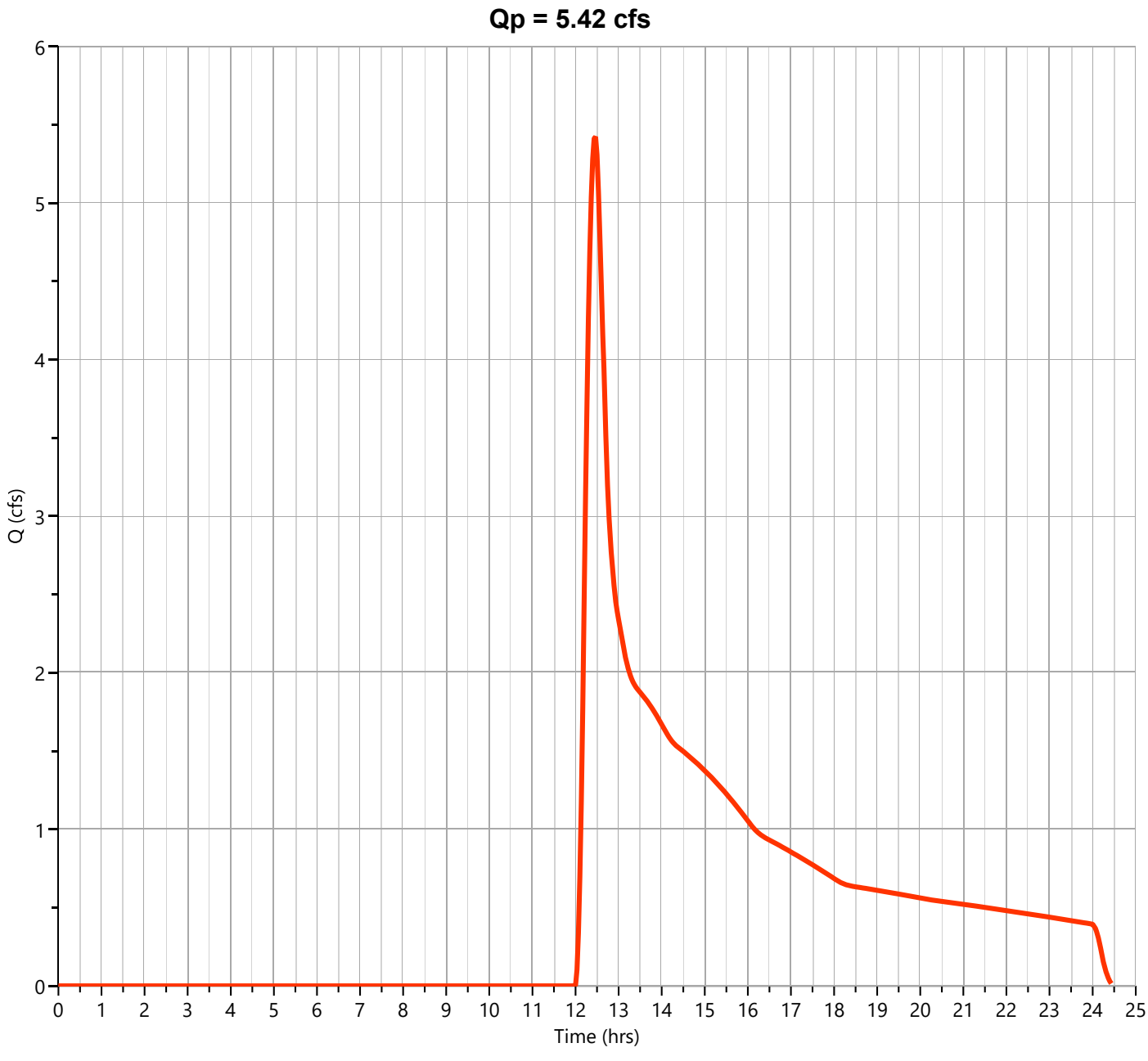
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06-28-2022

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.423 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 46,214 cuft
Drainage Area	= 42.22 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 17.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

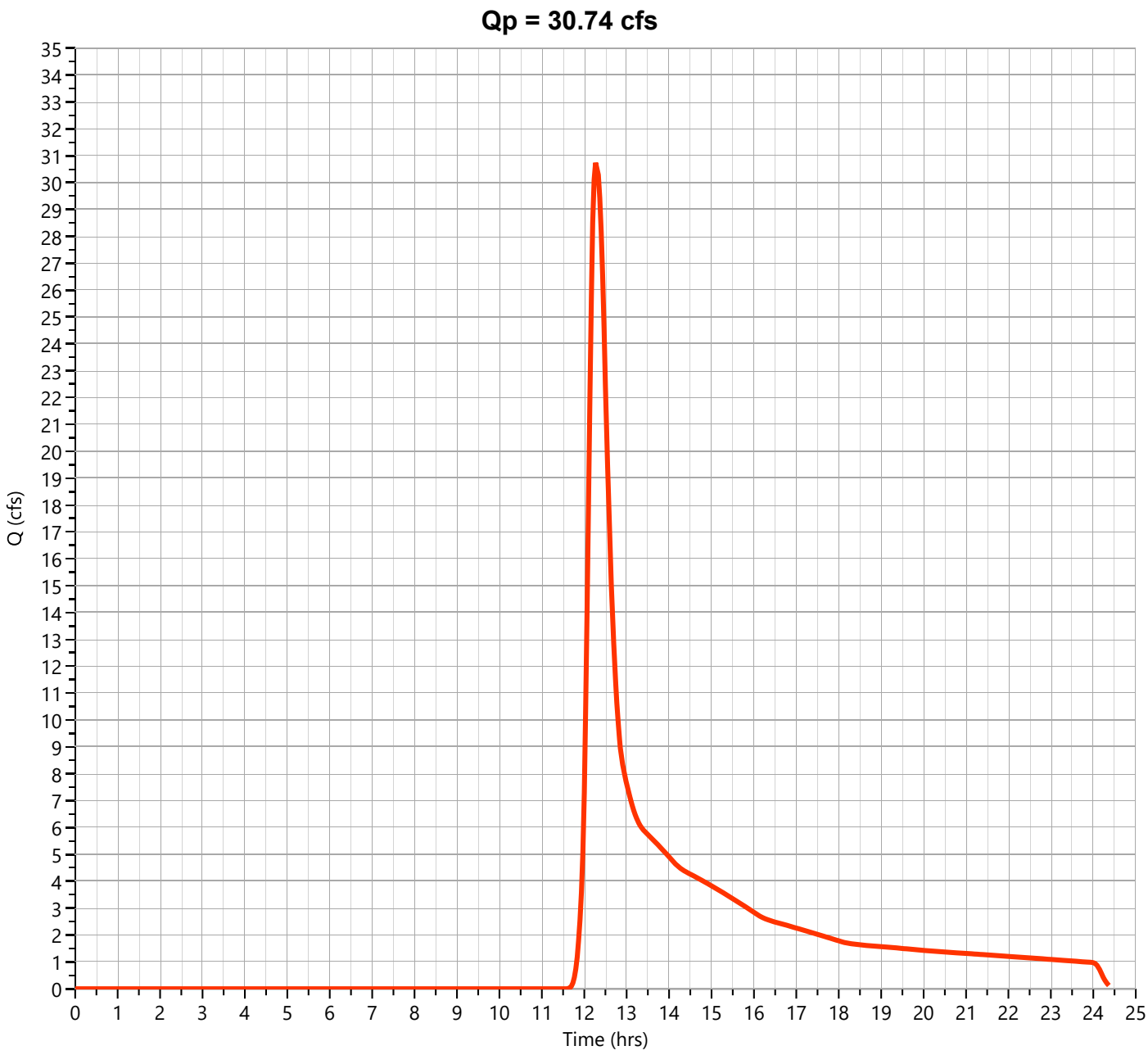
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06-28-2022

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 30.74 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 162,799 cuft
Drainage Area	= 42.22 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 17.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

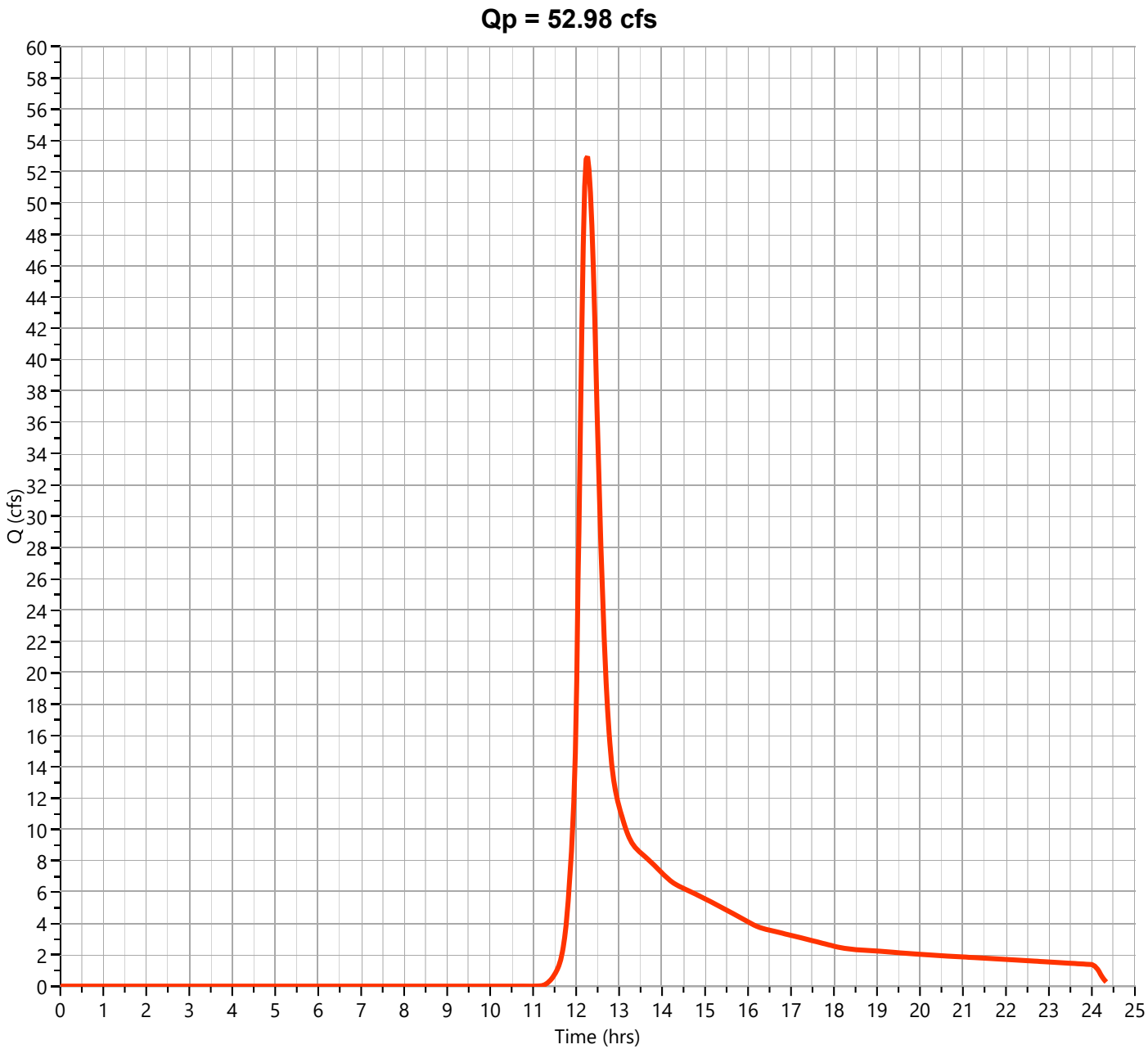
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06-28-2022

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 52.98 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 257,433 cuft
Drainage Area	= 42.22 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 17.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

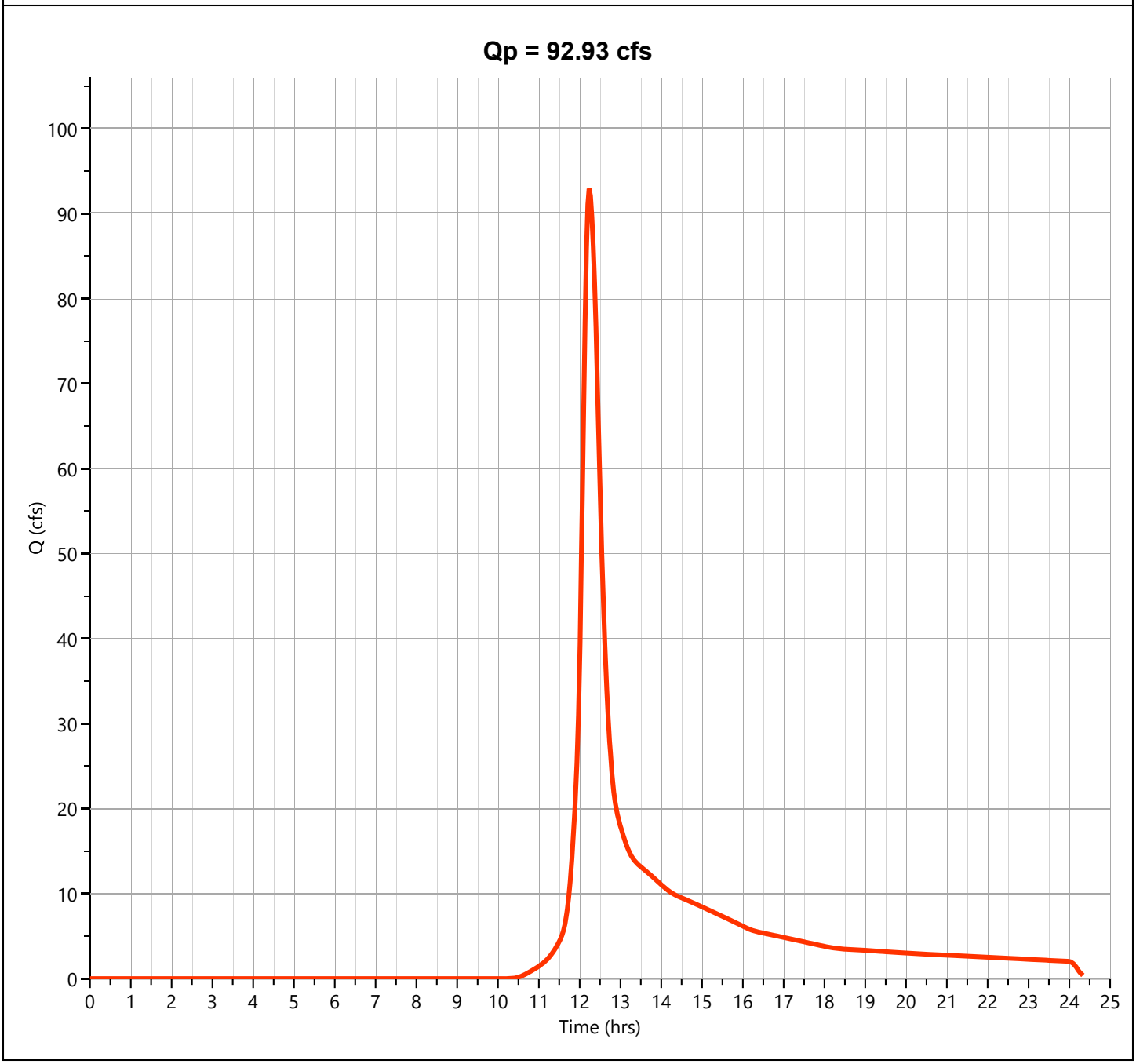
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06-28-2022

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 92.93 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 426,335 cuft
Drainage Area	= 42.22 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 17.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.00	0.00
A	Open Space	Good Condition	39			0.00	0.00
A	Brush	Fair	35			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			10.00	699.99
C	Open Space	Good Condition	74			0.00	0.00
C	Gravel		89			0.35	30.80

1/ Use only one CN source per line. 450669 Totals = 10.35 730.79

CN (weighted) = total product / total area = 730.79 / 10.35 = 70.64 ; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.90	2.98	4.40

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-3
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.012			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.35			0.35
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	457			
9. Watercourse slope, s		ft/ft	0.168			
10. Average Velocity, V (figure 3-1)		ft/s	6.61			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.37
min 22.4

Hydrograph Report

Project Name:

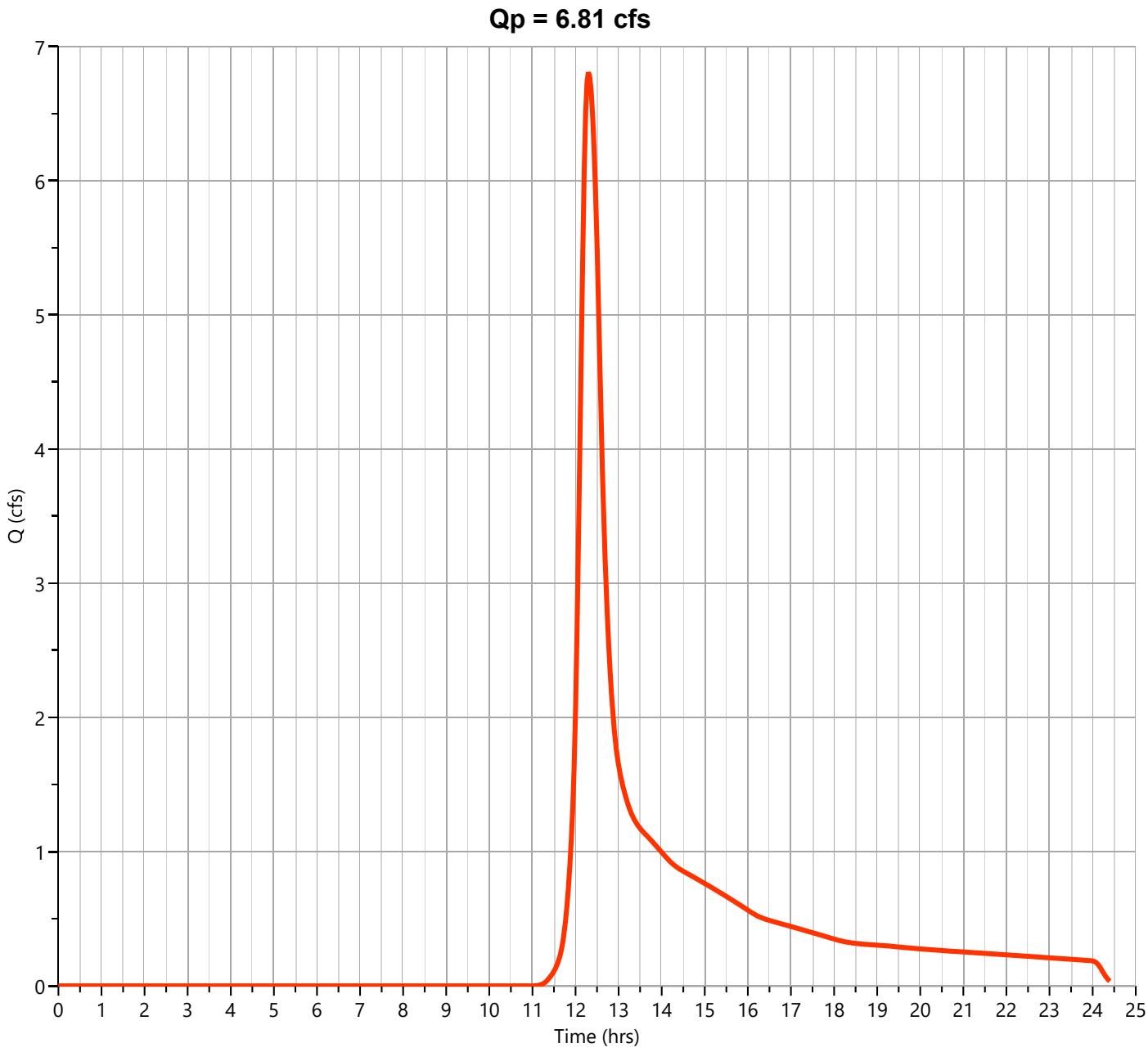
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06-28-2022

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.809 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 35,200 cuft
Drainage Area	= 10.35 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 22.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

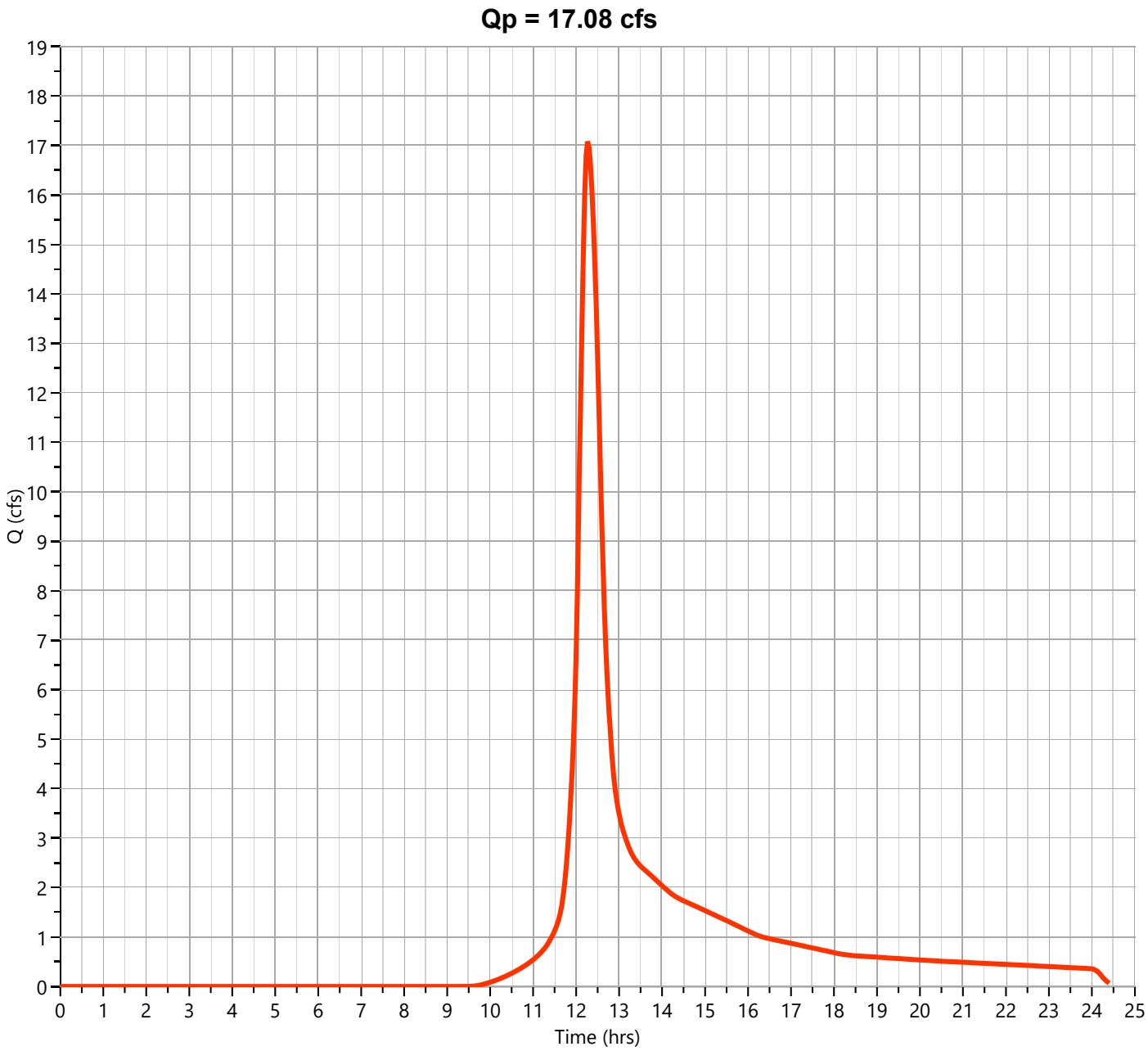
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06-28-2022

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 17.08 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 82,096 cuft
Drainage Area	= 10.35 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 22.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

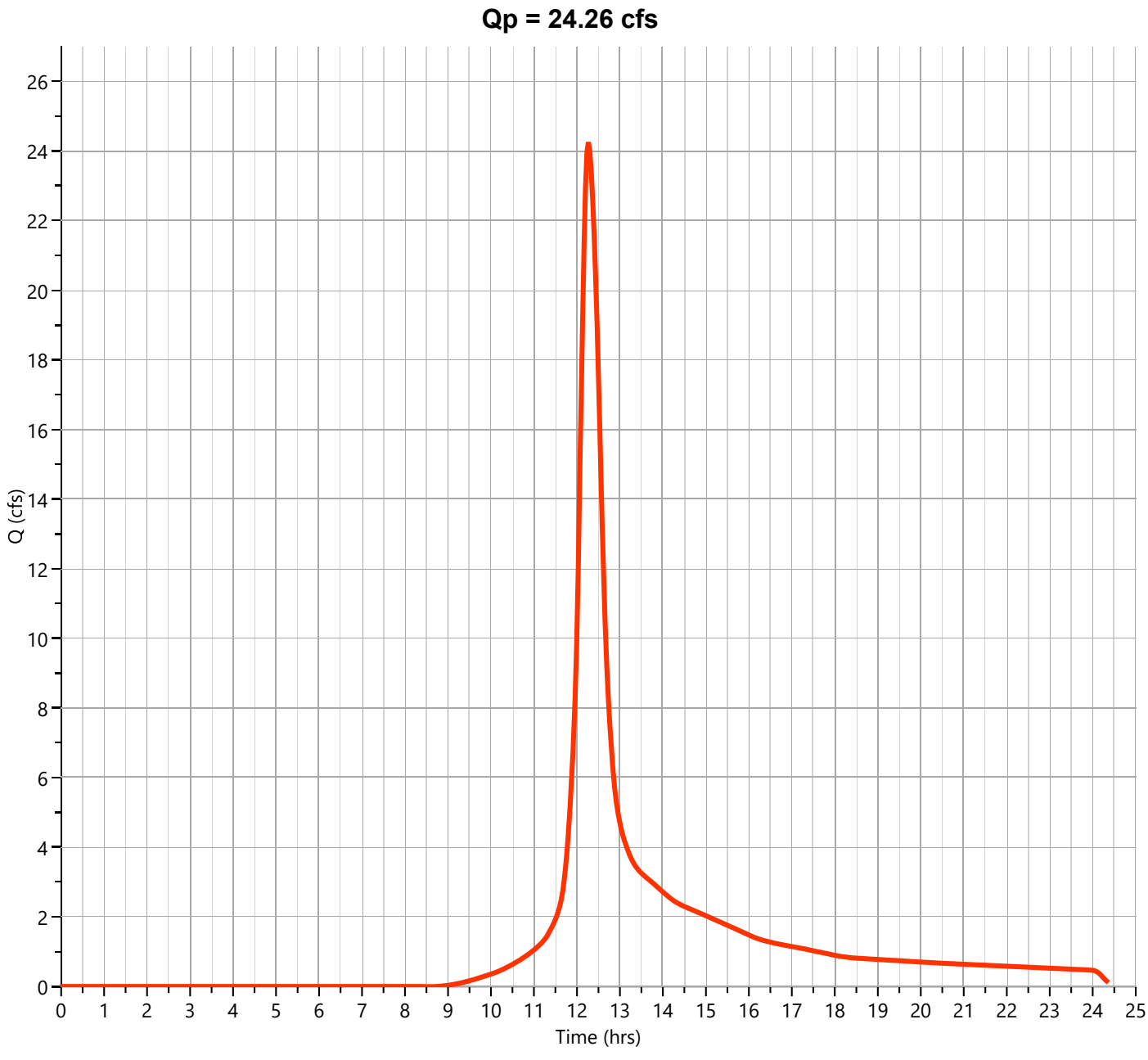
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06-28-2022

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.26 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 115,182 cuft
Drainage Area	= 10.35 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 22.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

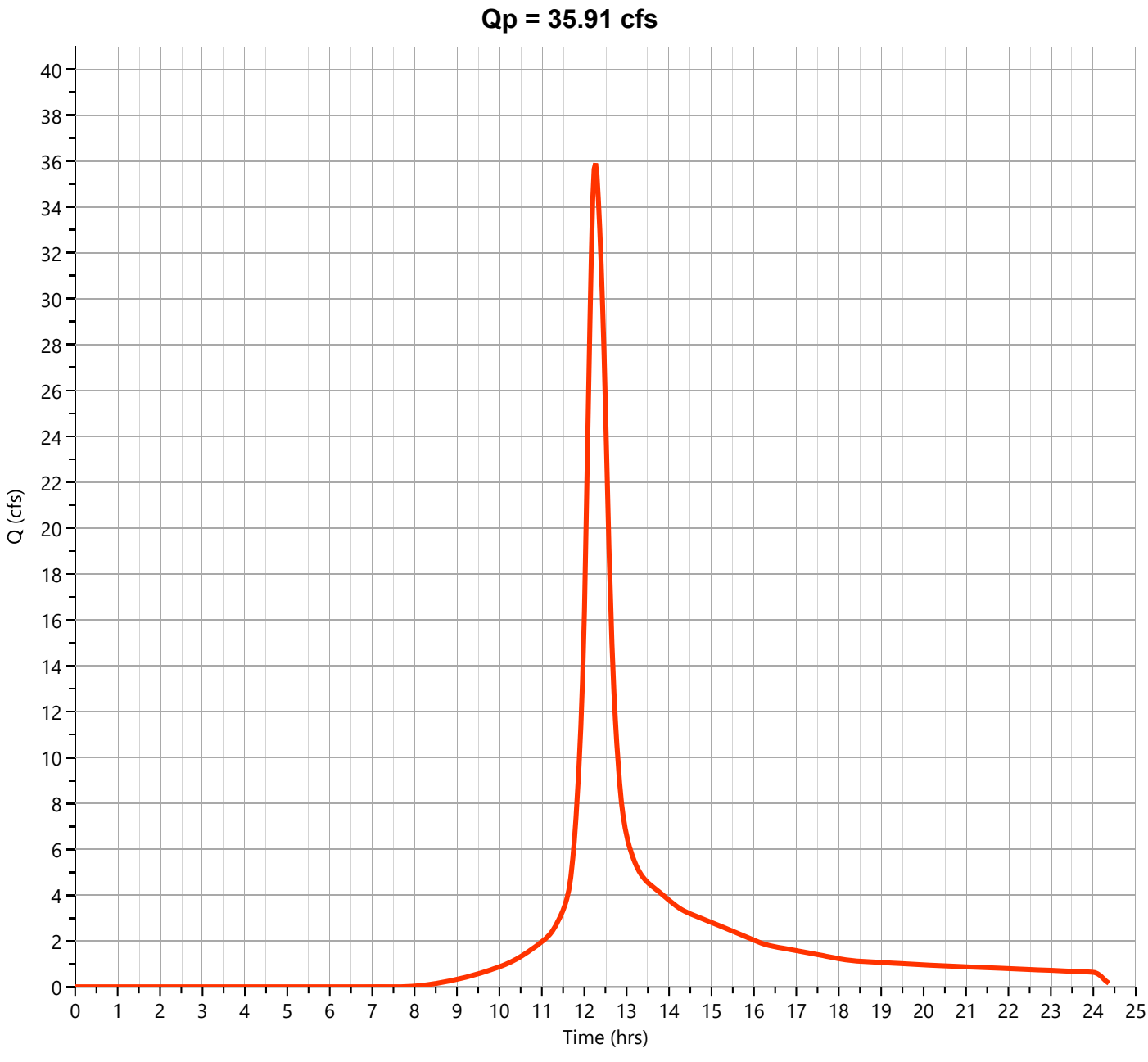
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06-28-2022

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 35.91 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 169,813 cuft
Drainage Area	= 10.35 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 22.4 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.00	0.00
A	Open Space	Good Condition	39			0.00	0.00
A	Brush	Fair	35			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			9.90	693.10
C	Open Space	Good Condition	74			0.00	0.00
C	Gravel		89			0.36	32.29
D	BVW		77			0.03	2.55

1/ Use only one CN source per line. 448550 Totals = 10.30 727.93

CN (weighted) = total product / total area = 727.93 / 10.30 = 70.69 ; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.90	2.98	4.41

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-4
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.016			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.32			0.32
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	735			
9. Watercourse slope, s		ft/ft	0.103			
10. Average Velocity, V (figure 3-1)		ft/s	5.18			
11. Tt = L / 3600V	Compute Tt	hr	0.04			0.04
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.36
min 21.3

Hydrograph Report

Project Name:

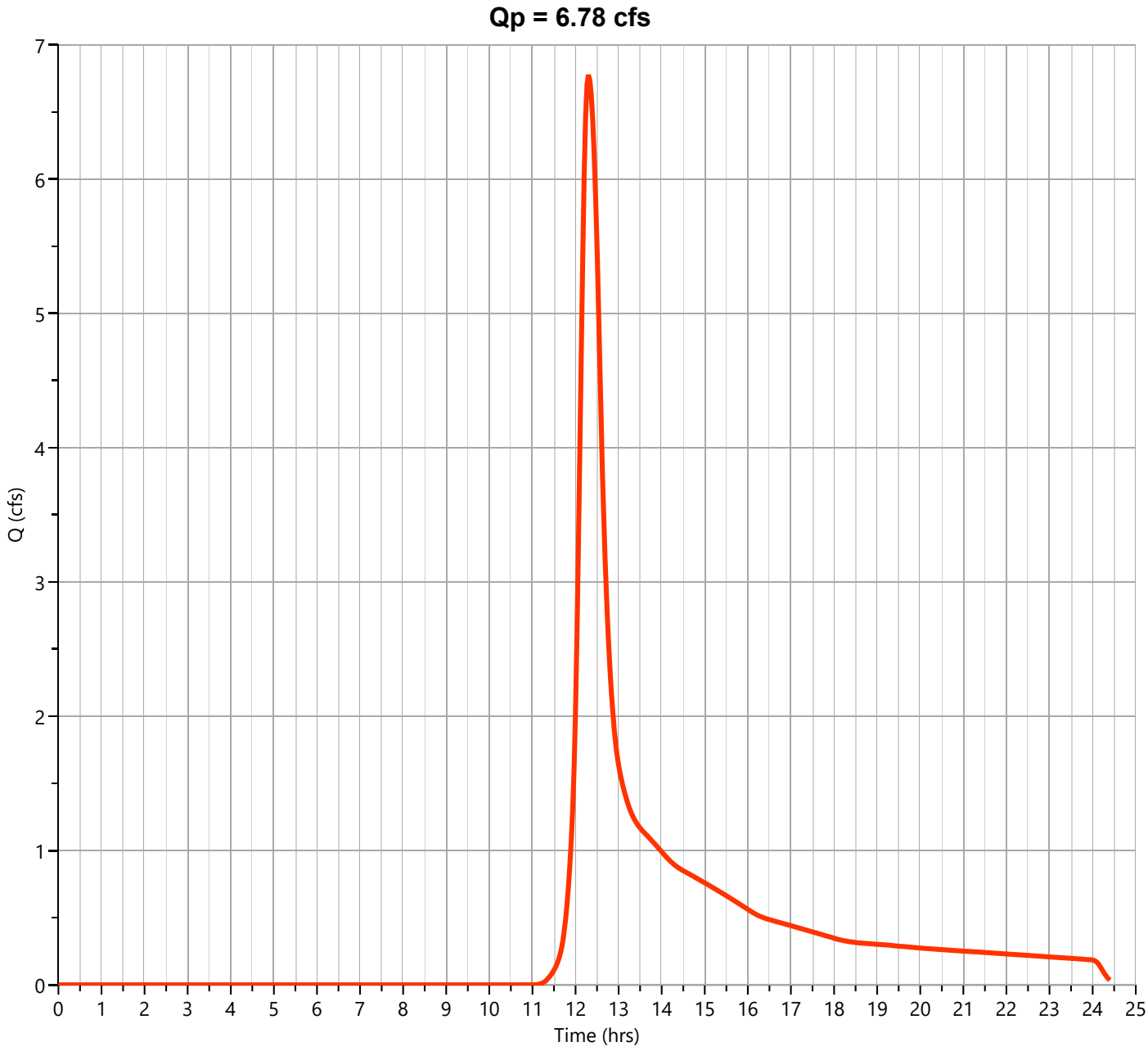
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06-28-2022

E-4

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.776 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 35,030 cuft
Drainage Area	= 10.3 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

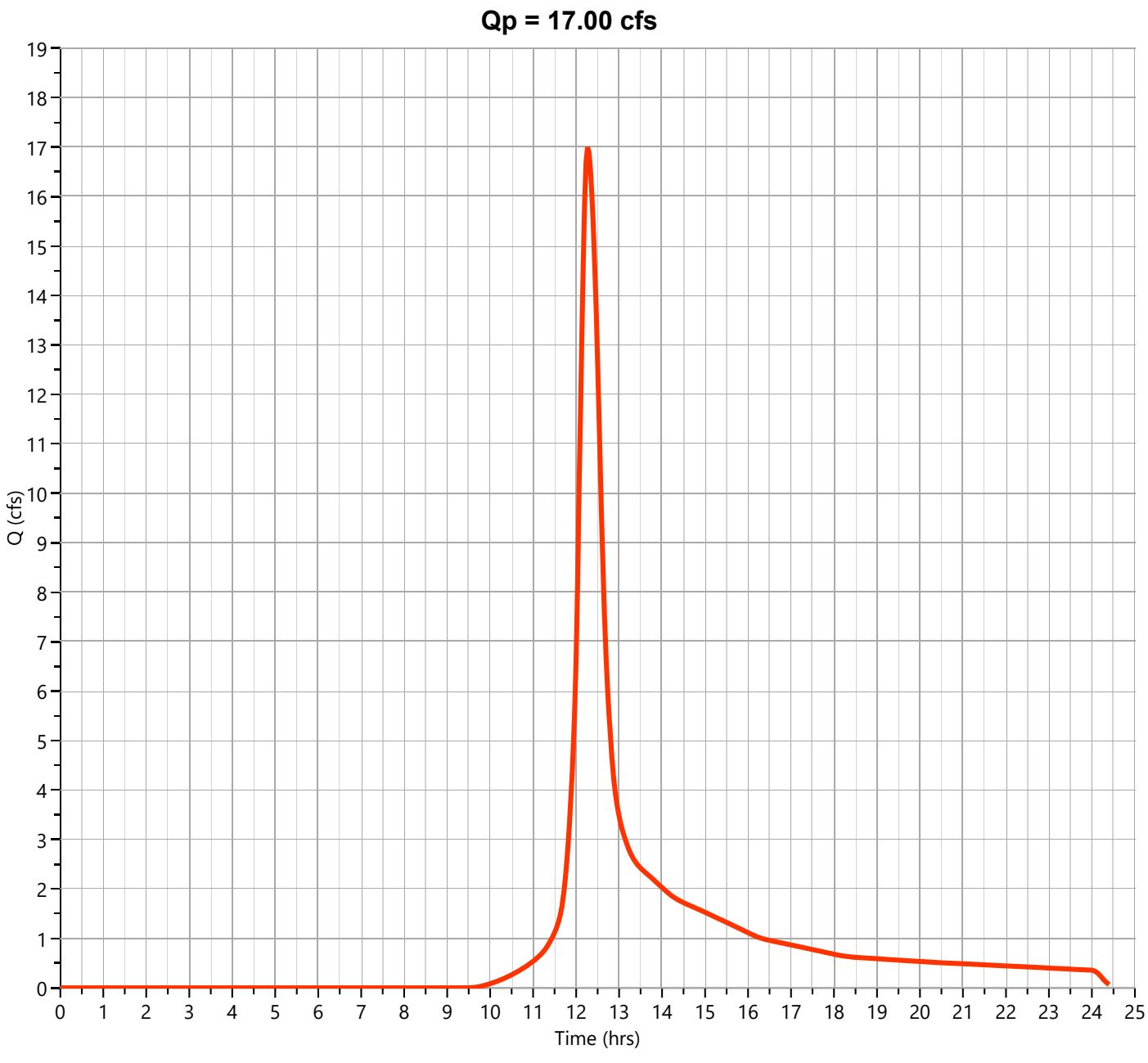
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06-28-2022

E-4

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 17.00 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 81,699 cuft
Drainage Area	= 10.3 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

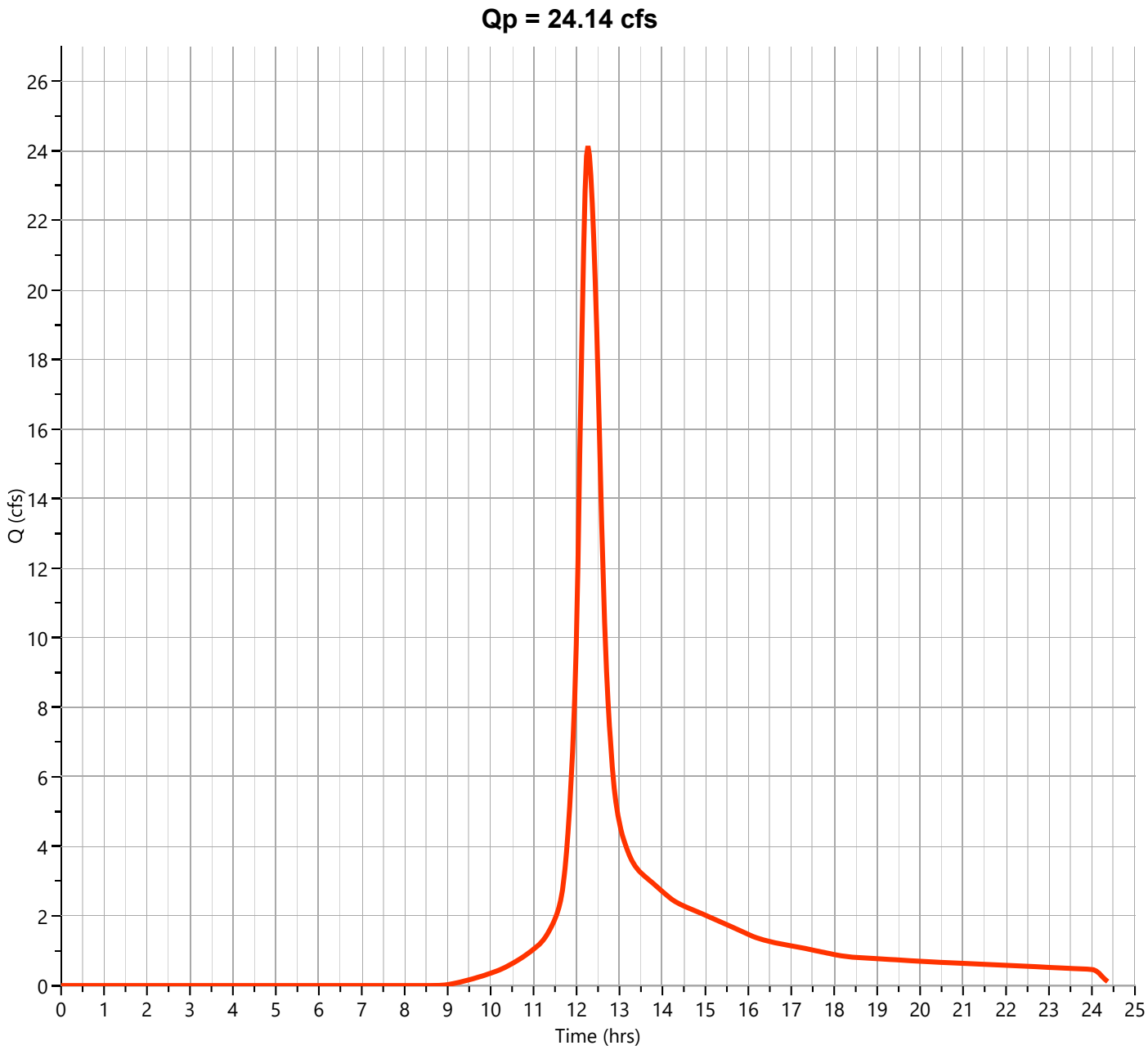
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06-28-2022

E-4

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.14 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 114,625 cuft
Drainage Area	= 10.3 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

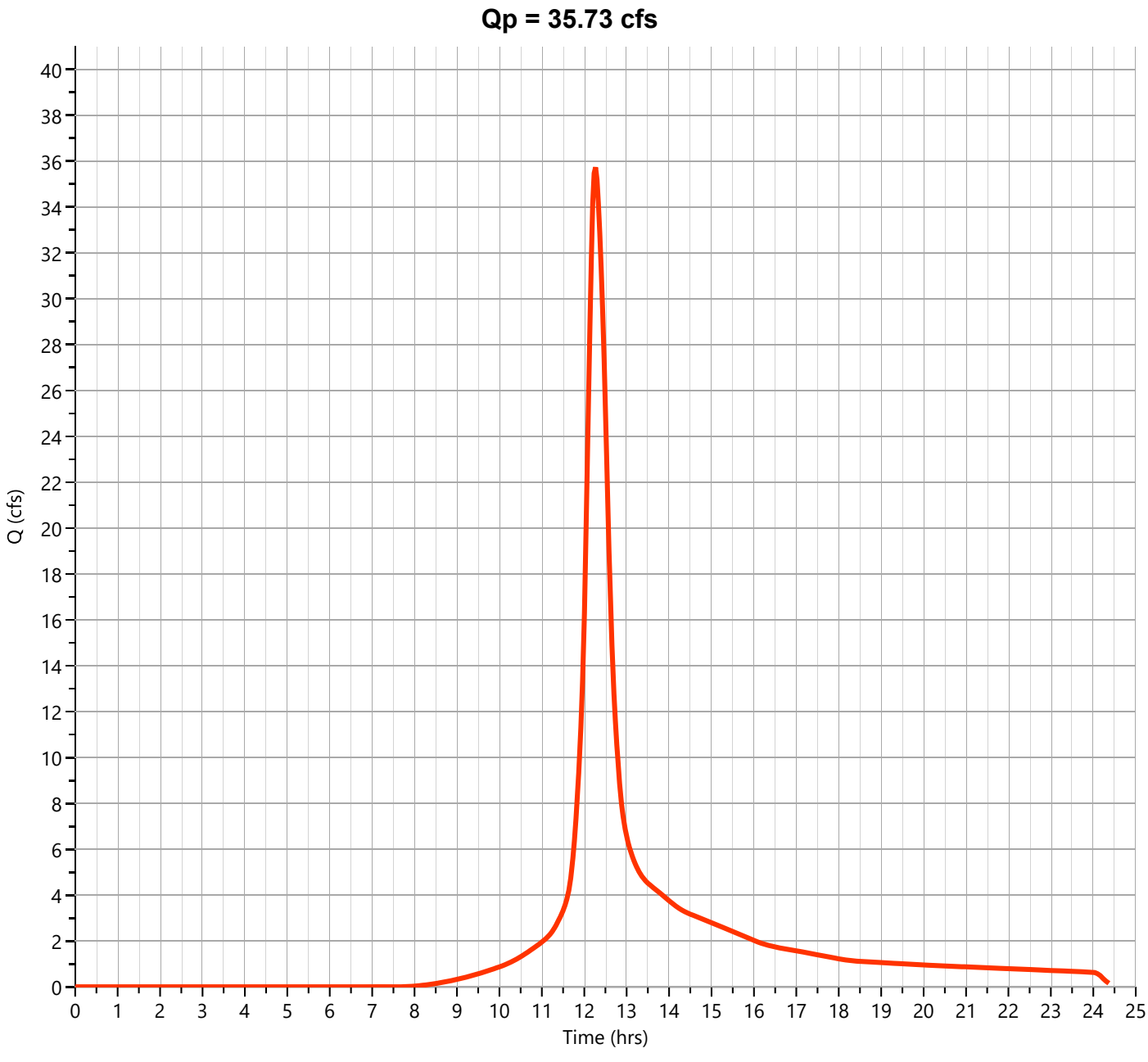
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06-28-2022

E-4

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 35.73 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 168,993 cuft
Drainage Area	= 10.3 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.04	3.50
A	Woods Good Condition	30			0.89	26.68
A	Open Space Good Condition	39			0.30	11.76
A	Open Space Fair Condition	49			1.02	50.11
A	Gravel	76			0.11	8.11
B	Woods Good Condition	55			1.42	77.88
B	Open Space Good Condition	61			0.36	21.90
B	Gravel	85			0.13	10.97
C	Woods Good Condition	70			5.57	390.08
C	Open Space Fair Condition	79			0.81	63.81
C	Gravel	89			0.05	4.08
D	BVW	77			2.21	170.08

1/ Use only one CN source per line. 561699 Totals = 12.89 838.95

CN (weighted) = total product / total area = 838.95 / 12.89 = 65.06 ; Use CN = 65

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.64	2.46	3.77

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-5
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.026			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.26			0.26
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	1260			
9. Watercourse slope, s		ft/ft	0.076			
10. Average Velocity, V (figure 3-1)		ft/s	4.45			
11. Tt = L / 3600V	Compute Tt	hr	0.08			0.08
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.34
	min	20.3

Hydrograph Report

Project Name:

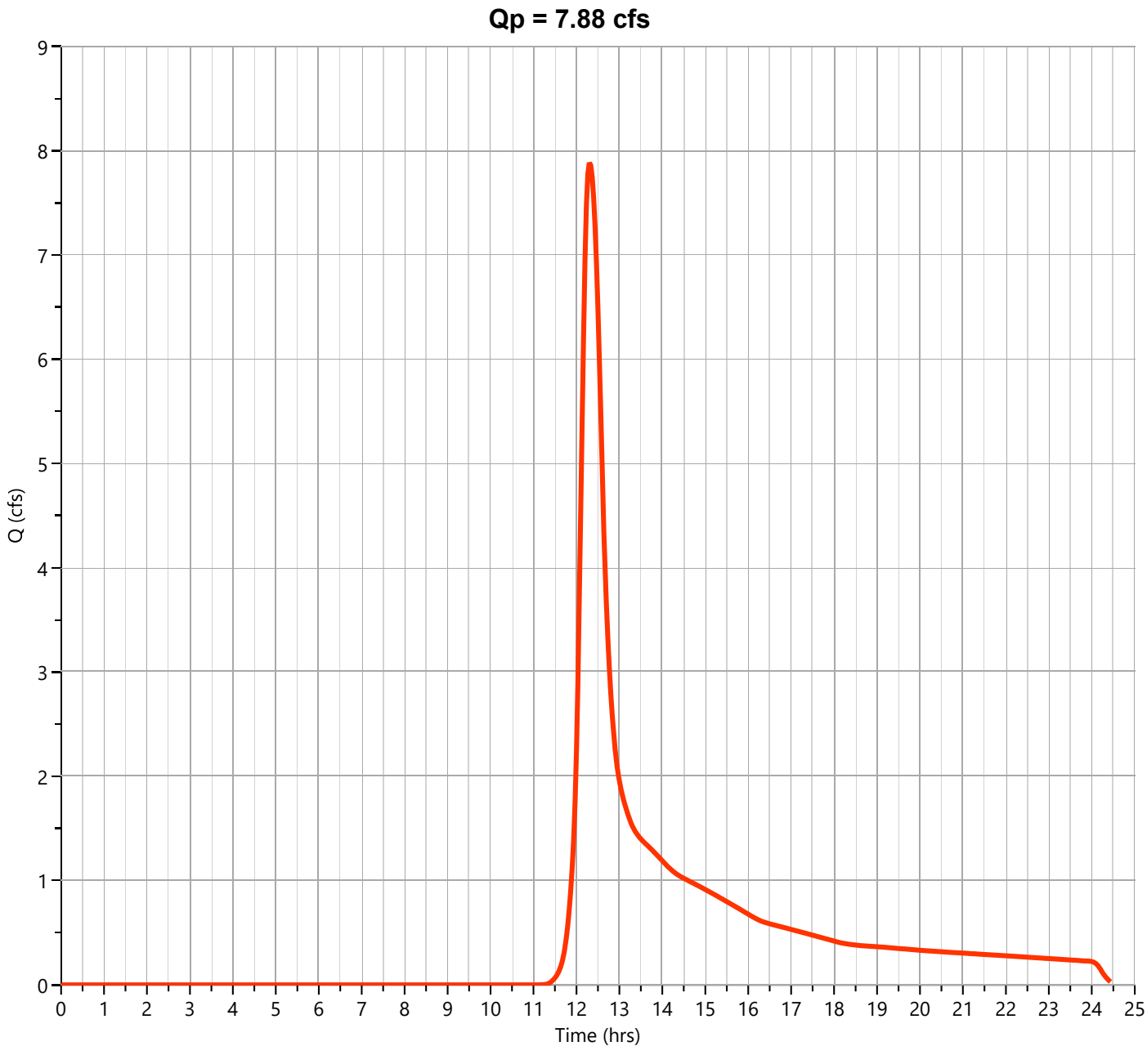
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06-28-2022

E-5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.884 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 41,393 cuft
Drainage Area	= 12.89 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 20.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

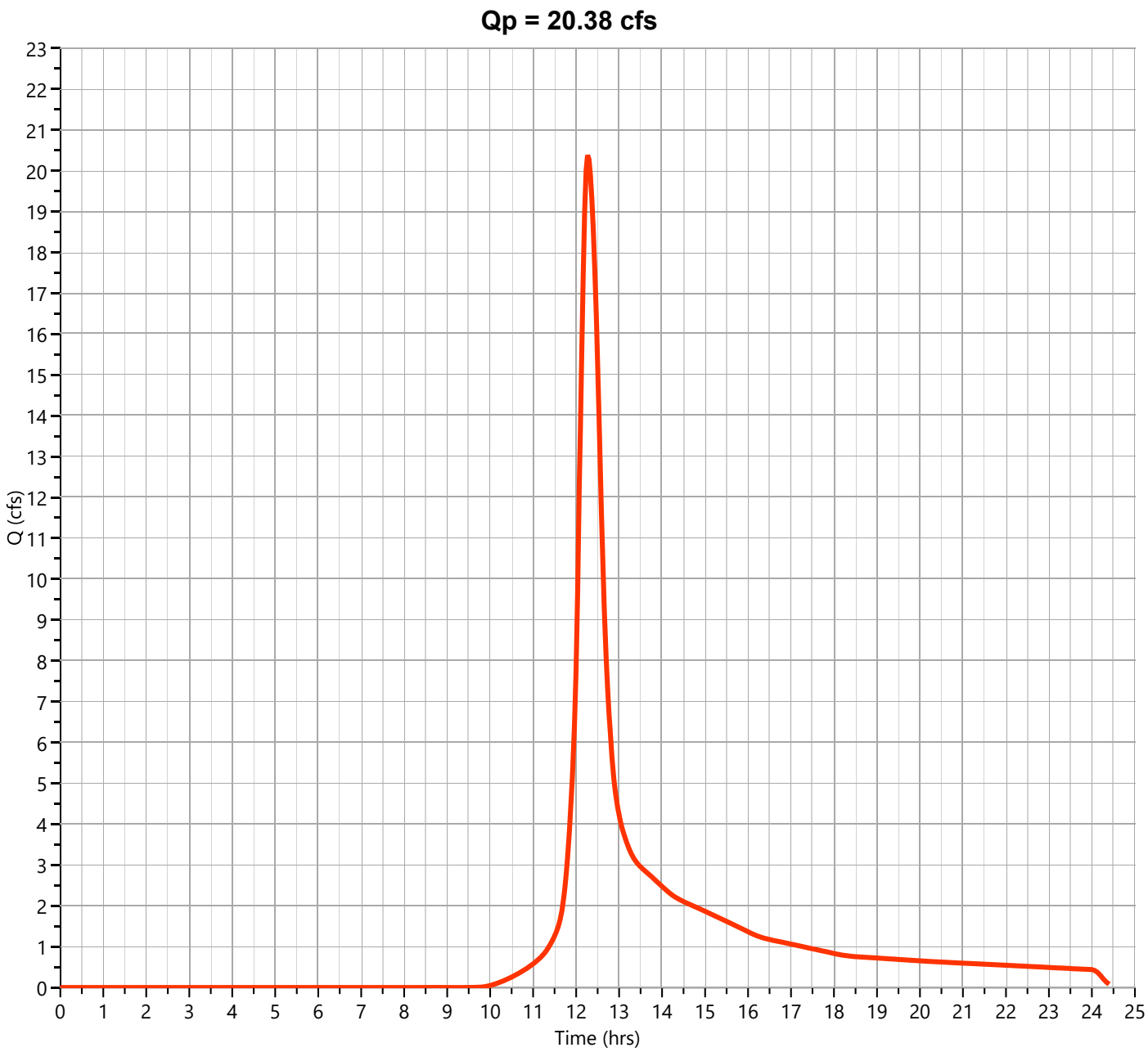
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06-28-2022

E-5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.38 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 98,397 cuft
Drainage Area	= 12.89 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 20.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

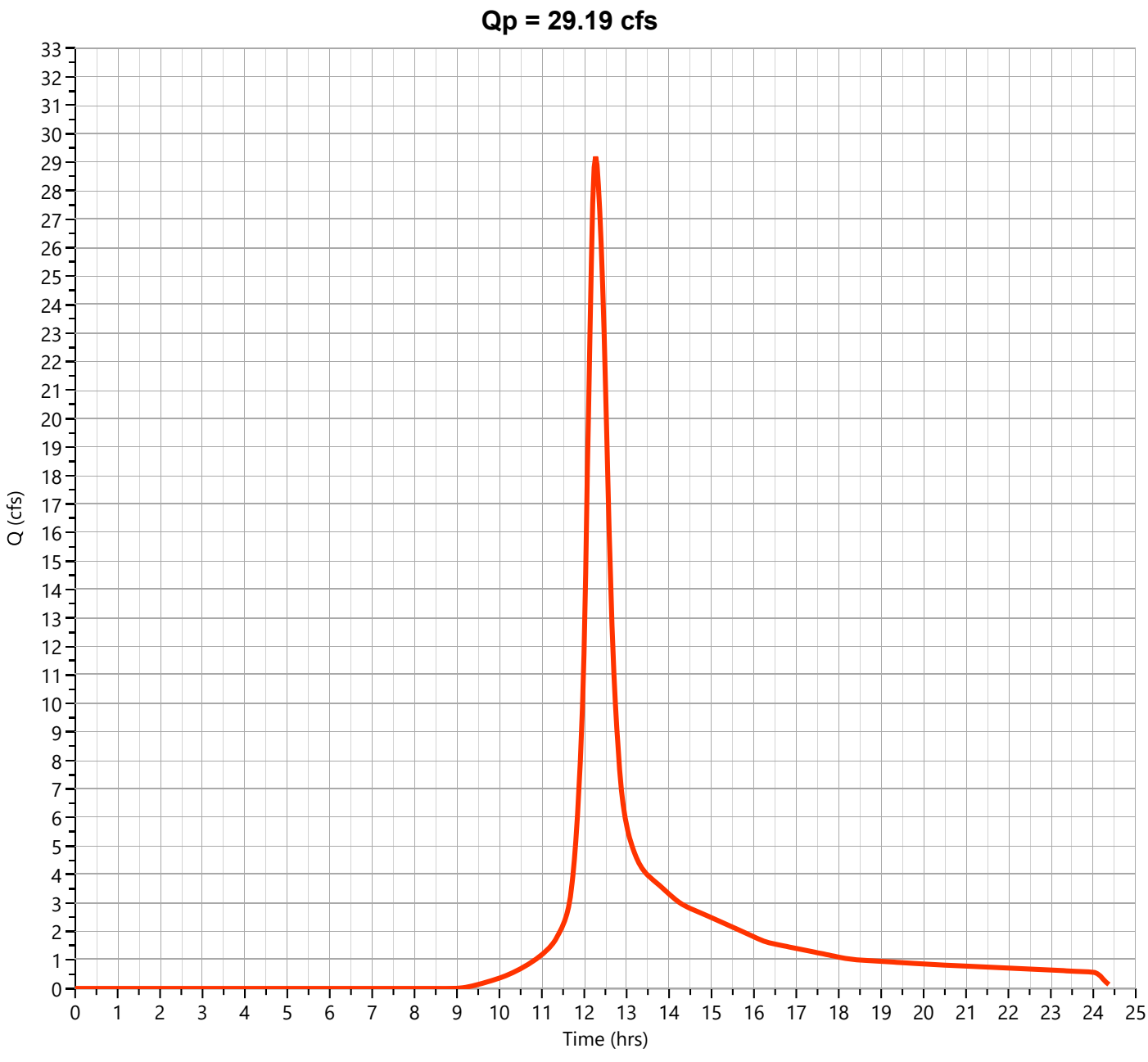
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06-28-2022

E-5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 29.19 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 138,911 cuft
Drainage Area	= 12.89 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 20.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

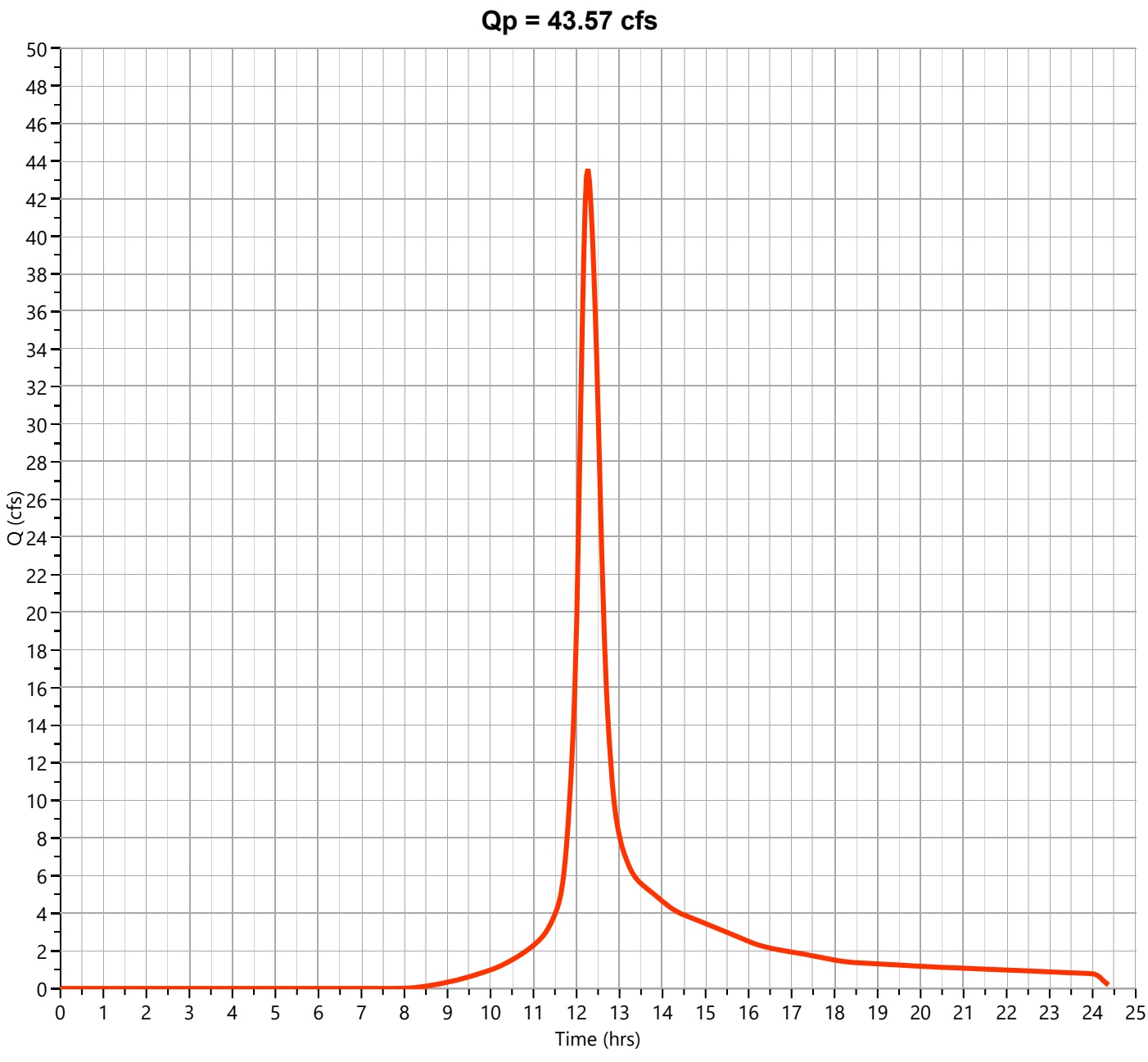
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06-28-2022

E-5

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 43.57 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 206,084 cuft
Drainage Area	= 12.89 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 20.3 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			1.87	56.21
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.30	22.80
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Good Condition	74			0.00	0.00
C	Gravel		89			0.00	0.00
D	BVW		77			0.08	6.03

1/ Use only one CN source per line. 98094 Totals = 2.25 85.04

CN (weighted) = total product / total area = 85.04 / 2.25 = 37.76 ; Use CN = 38

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.00	0.42	0.98

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-6
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.014			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.33			0.33
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	297			
9. Watercourse slope, s		ft/ft	0.050			
10. Average Velocity, V (figure 3-1)		ft/s	3.61			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.36
min 21.4

Hydrograph Report

Project Name:

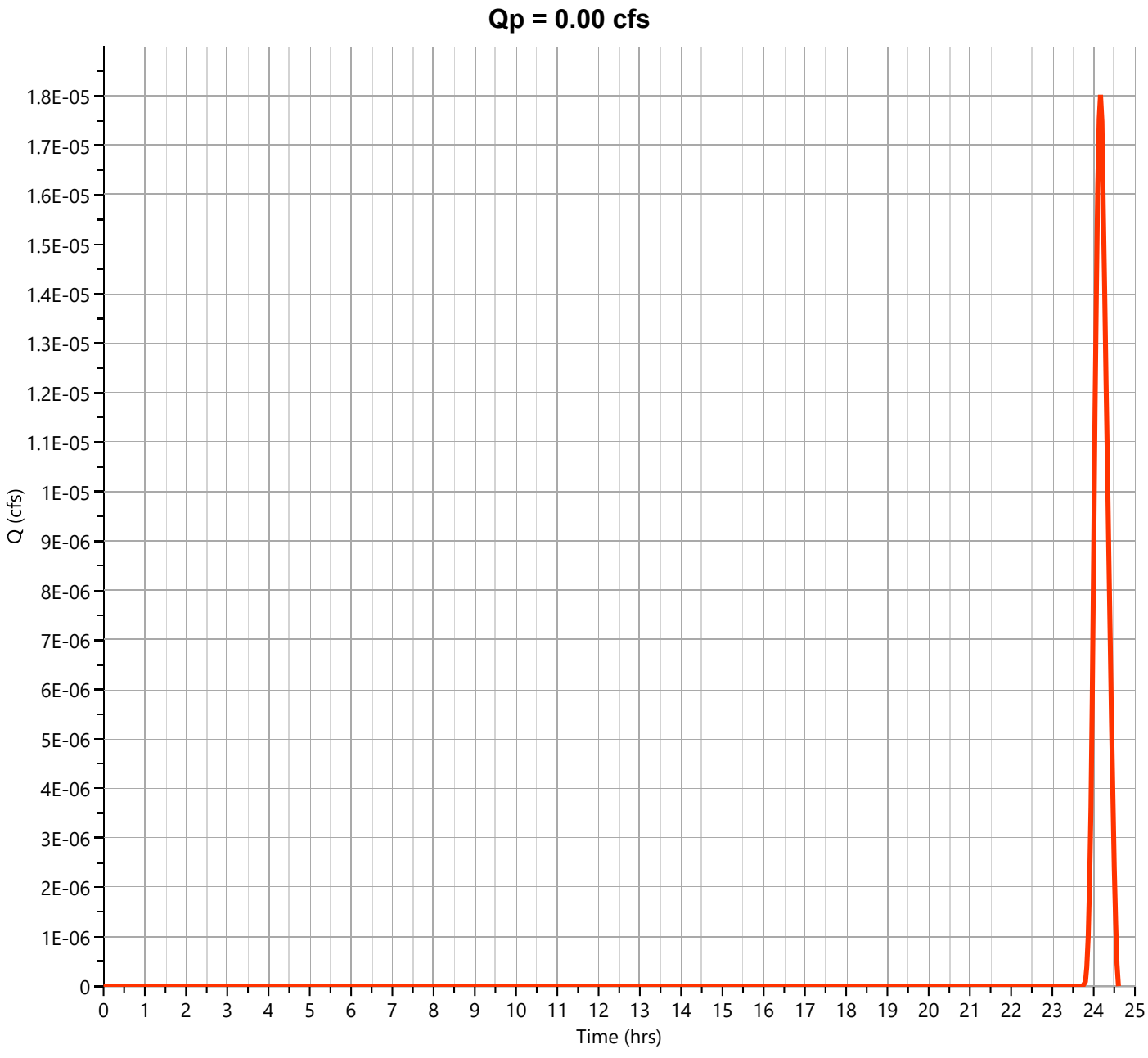
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06-28-2022

E-6

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 24.17 hrs
Time Interval	= 2 min	Runoff Volume	= 0.024 cuft
Drainage Area	= 2.25 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 21.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

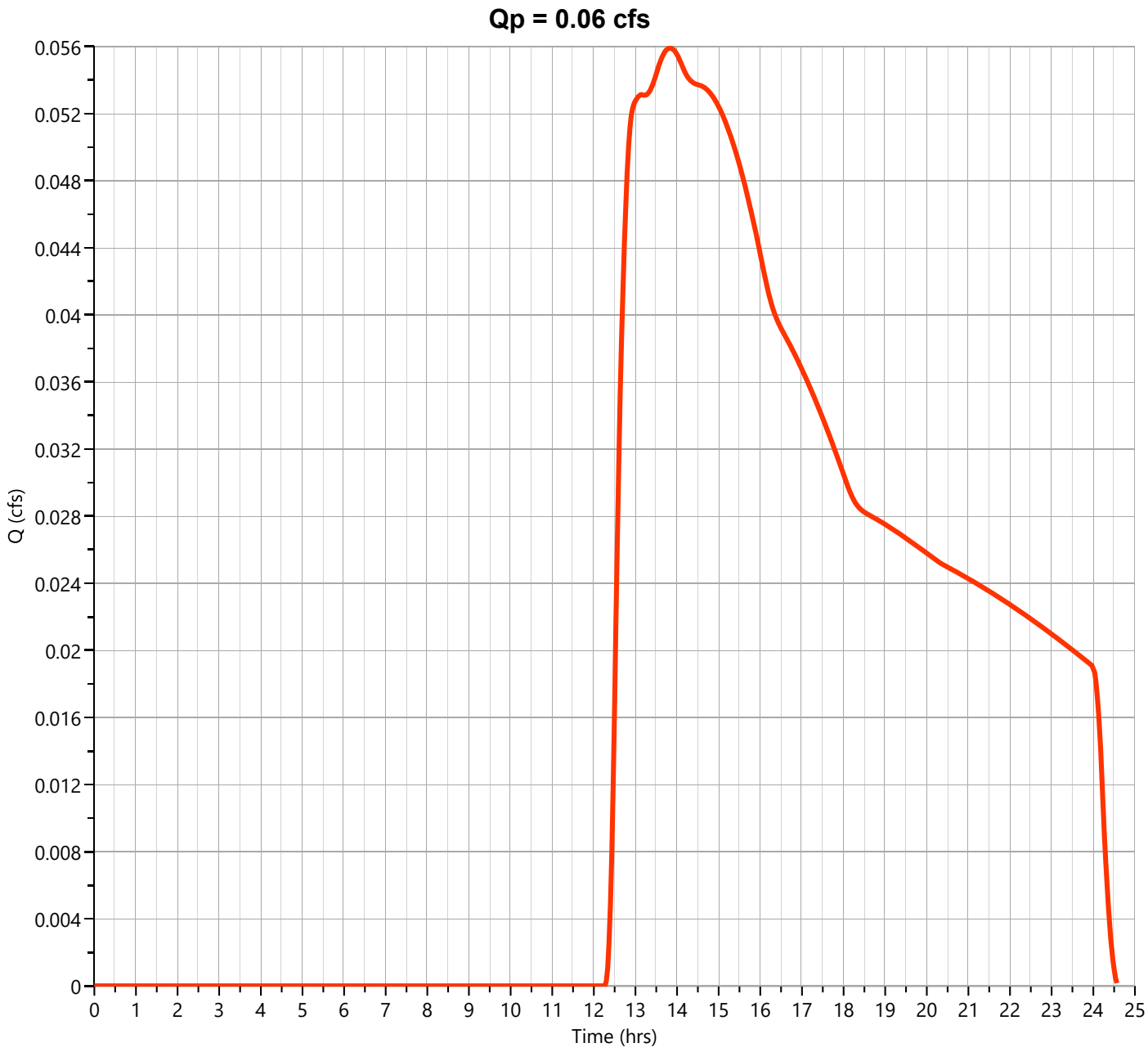
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06-28-2022

E-6

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.056 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.83 hrs
Time Interval	= 2 min	Runoff Volume	= 1,451 cuft
Drainage Area	= 2.25 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 21.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

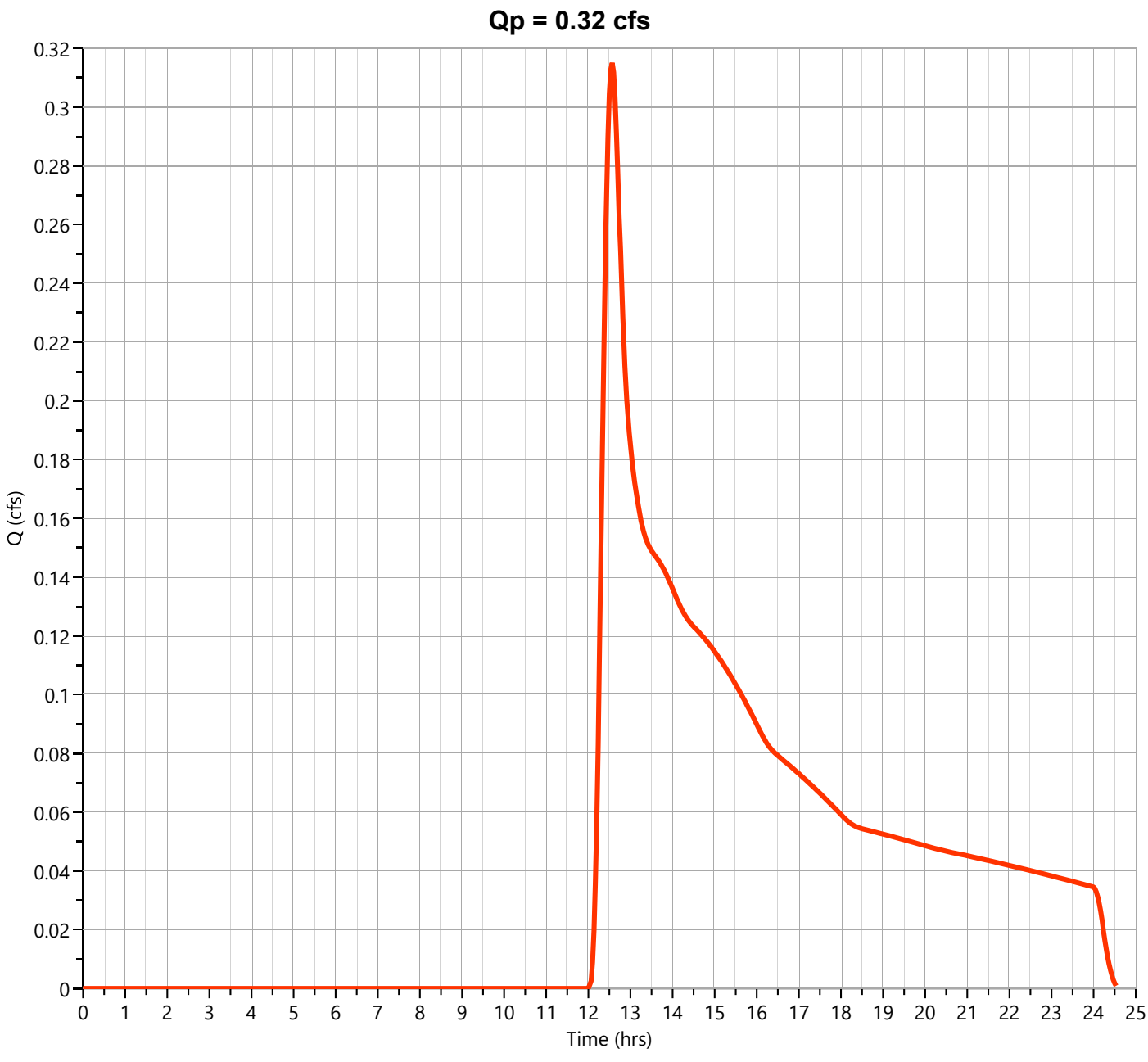
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06-28-2022

E-6

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.315 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Runoff Volume	= 3,584 cuft
Drainage Area	= 2.25 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 21.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

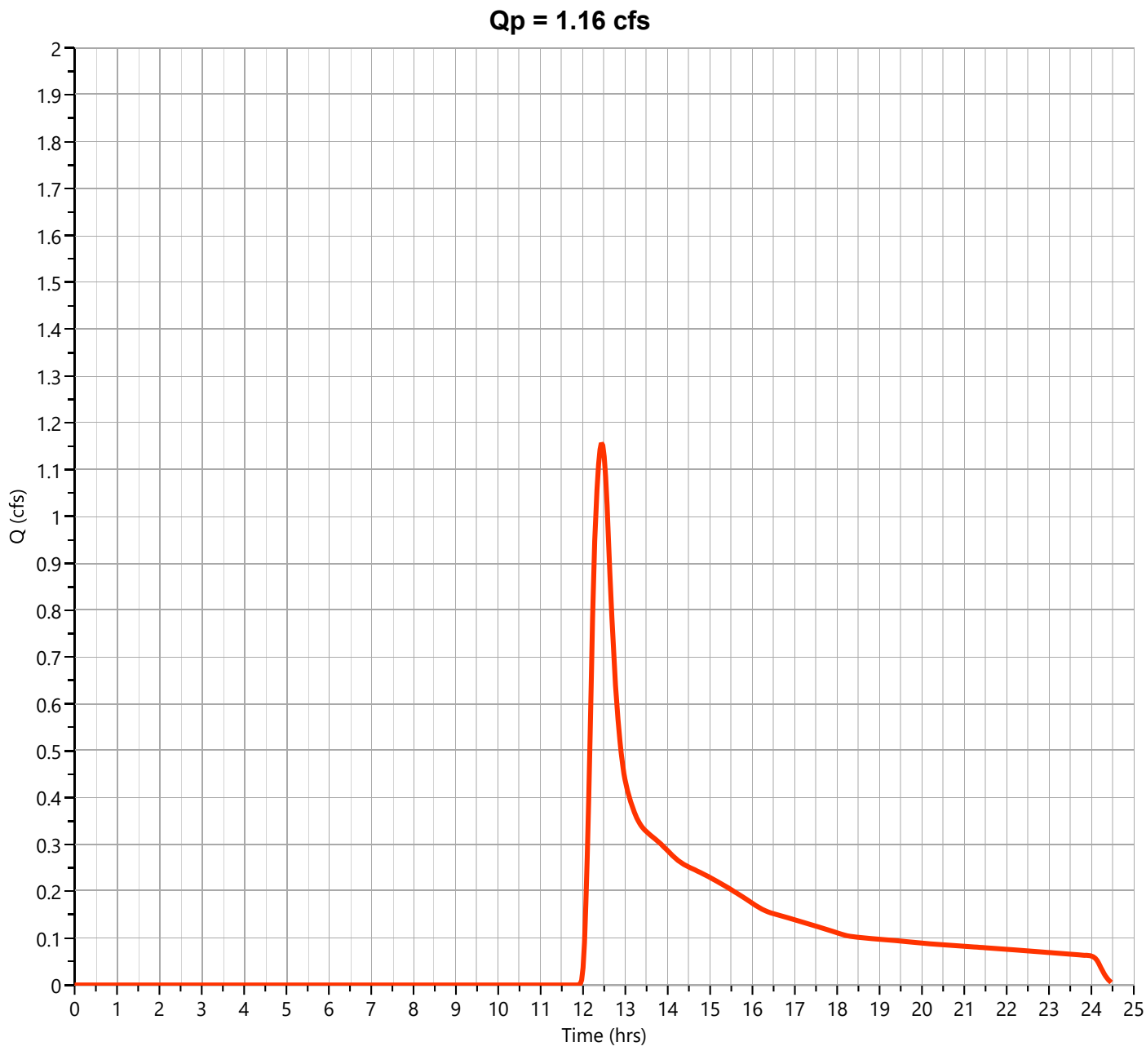
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06-28-2022

E-6

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.157 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 8,335 cuft
Drainage Area	= 2.25 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 21.4 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			6.24	187.15
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.27	20.52
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Good Condition	74			0.00	0.00
C	Gravel		89			0.00	0.00

1/ Use only one CN source per line. 283510 Totals = 6.51 207.68

CN (weighted) = total product / total area = 207.68 / 6.51 = 31.91 ; Use CN = 32

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.05	0.15	0.51

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-7
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.036			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.23			0.23
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	533			
9. Watercourse slope, s		ft/ft	0.011			
10. Average Velocity, V (figure 3-1)		ft/s	1.69			
11. Tt = L / 3600V	Compute Tt	hr	0.09			0.09
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.32
	min	19.0

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

E-7

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 6.51 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

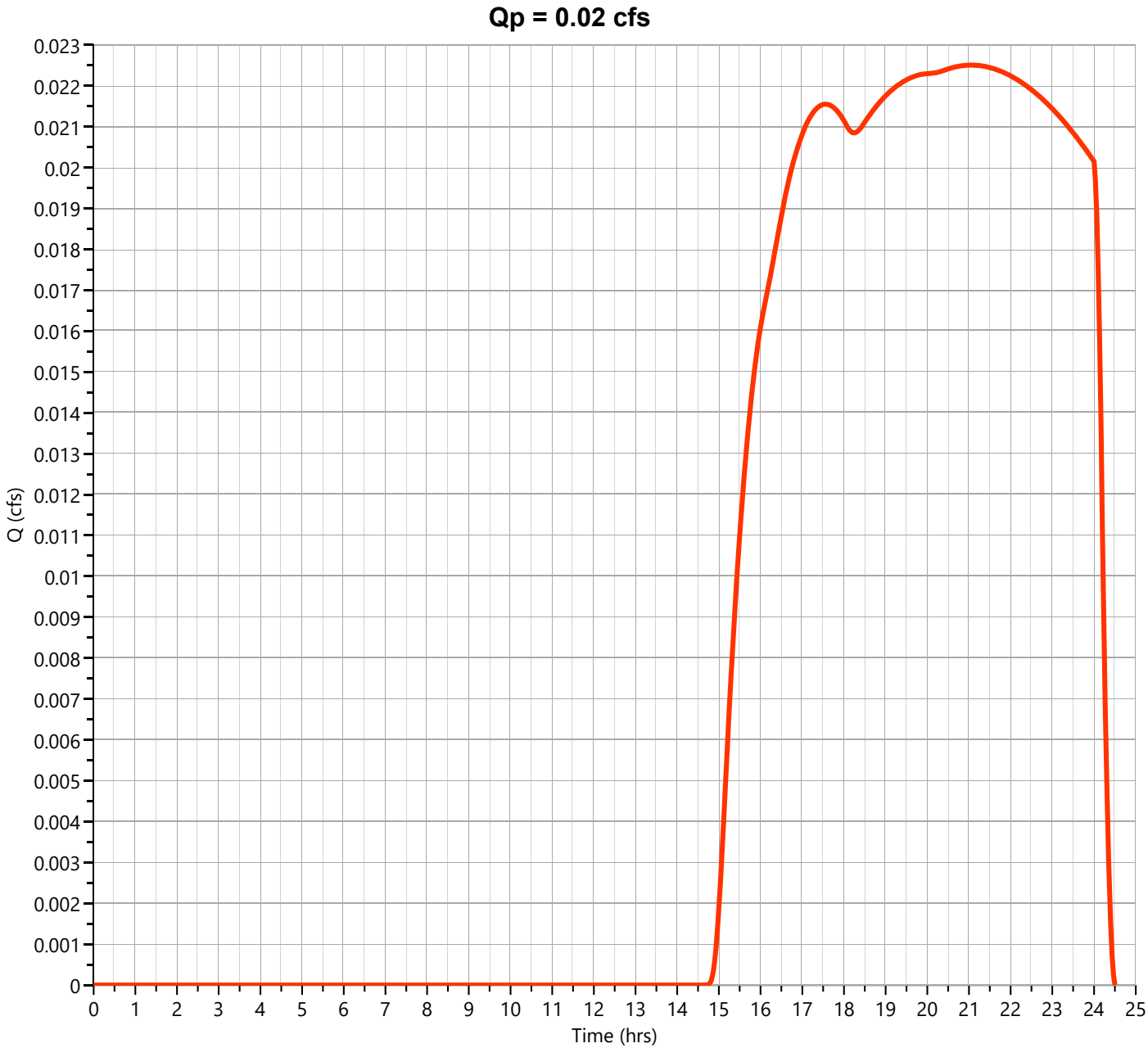
Hydrology Studio v 3.0.0.24

06-28-2022

E-7

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.023 cfs
Storm Frequency	= 10-yr	Time to Peak	= 21.03 hrs
Time Interval	= 2 min	Runoff Volume	= 669 cuft
Drainage Area	= 6.51 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

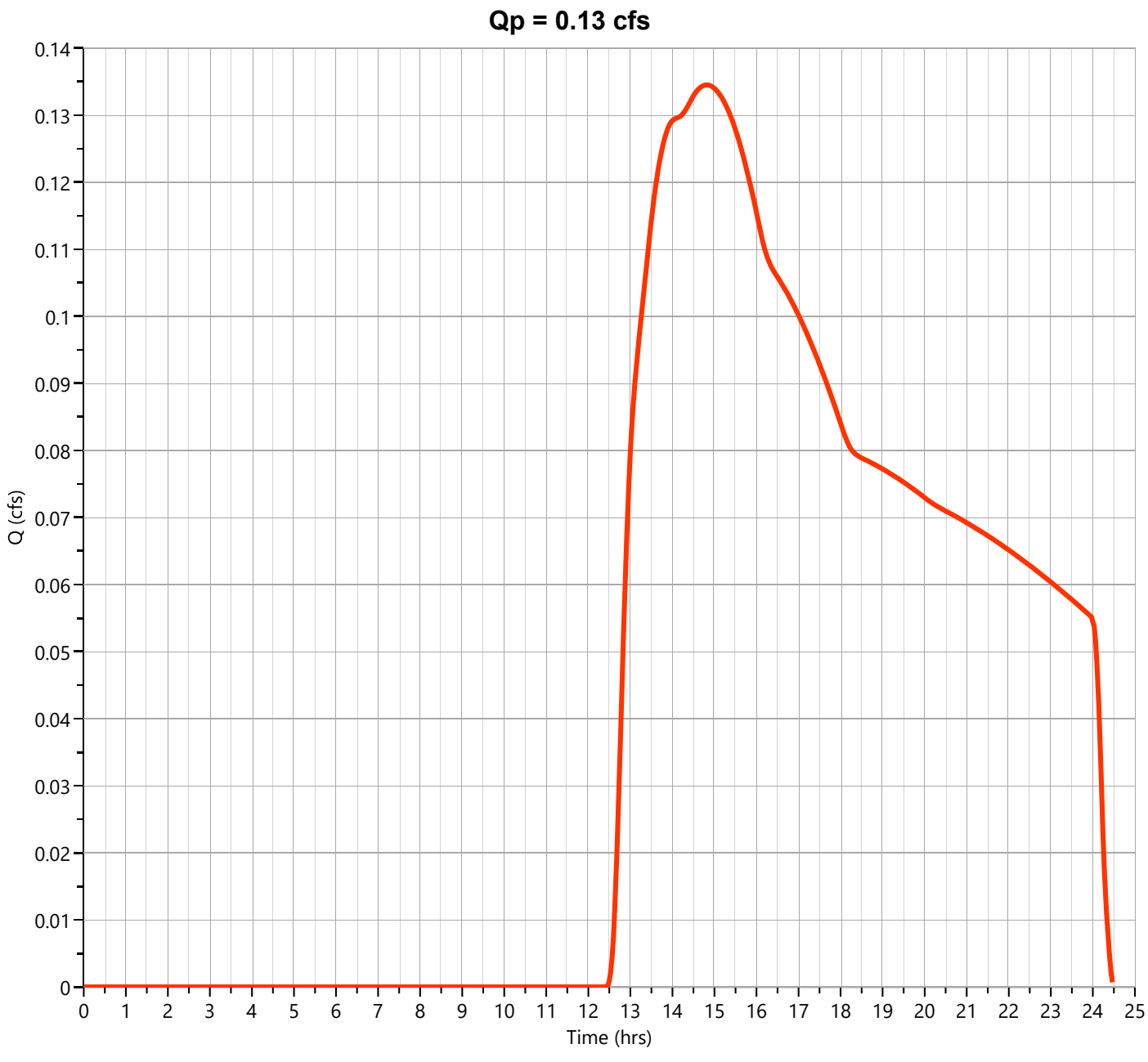
Hydrology Studio v 3.0.0.24

06-28-2022

E-7

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.135 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.83 hrs
Time Interval	= 2 min	Runoff Volume	= 3,648 cuft
Drainage Area	= 6.51 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

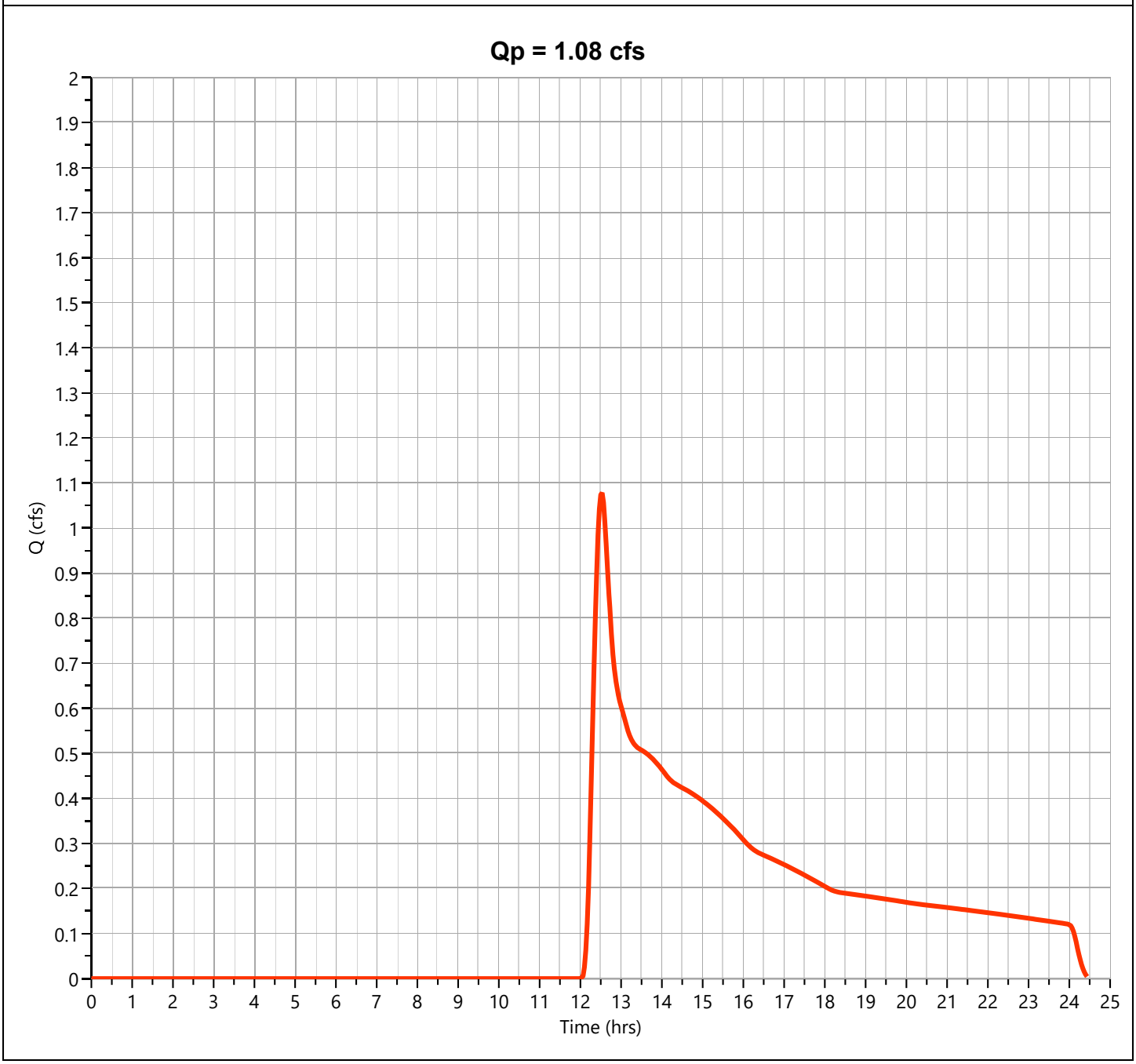
Hydrology Studio v 3.0.0.24

06-28-2022

E-7

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.078 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Runoff Volume	= 12,259 cuft
Drainage Area	= 6.51 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-8

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.68	20.49
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Poor Condition	86			0.00	0.00
C	Gravel		89			0.00	0.00

1/ Use only one CN source per line. 29757 Totals = 0.68 20.49

CN (weighted) = total product / total area = 20.49 / 0.68 = 30.00 ; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.09	0.09	0.38

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-8
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.016			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.32			0.32
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	116			
9. Watercourse slope, s		ft/ft	0.038			
10. Average Velocity, V (figure 3-1)		ft/s	3.15			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.33
min 19.6

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

E-8

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.68 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

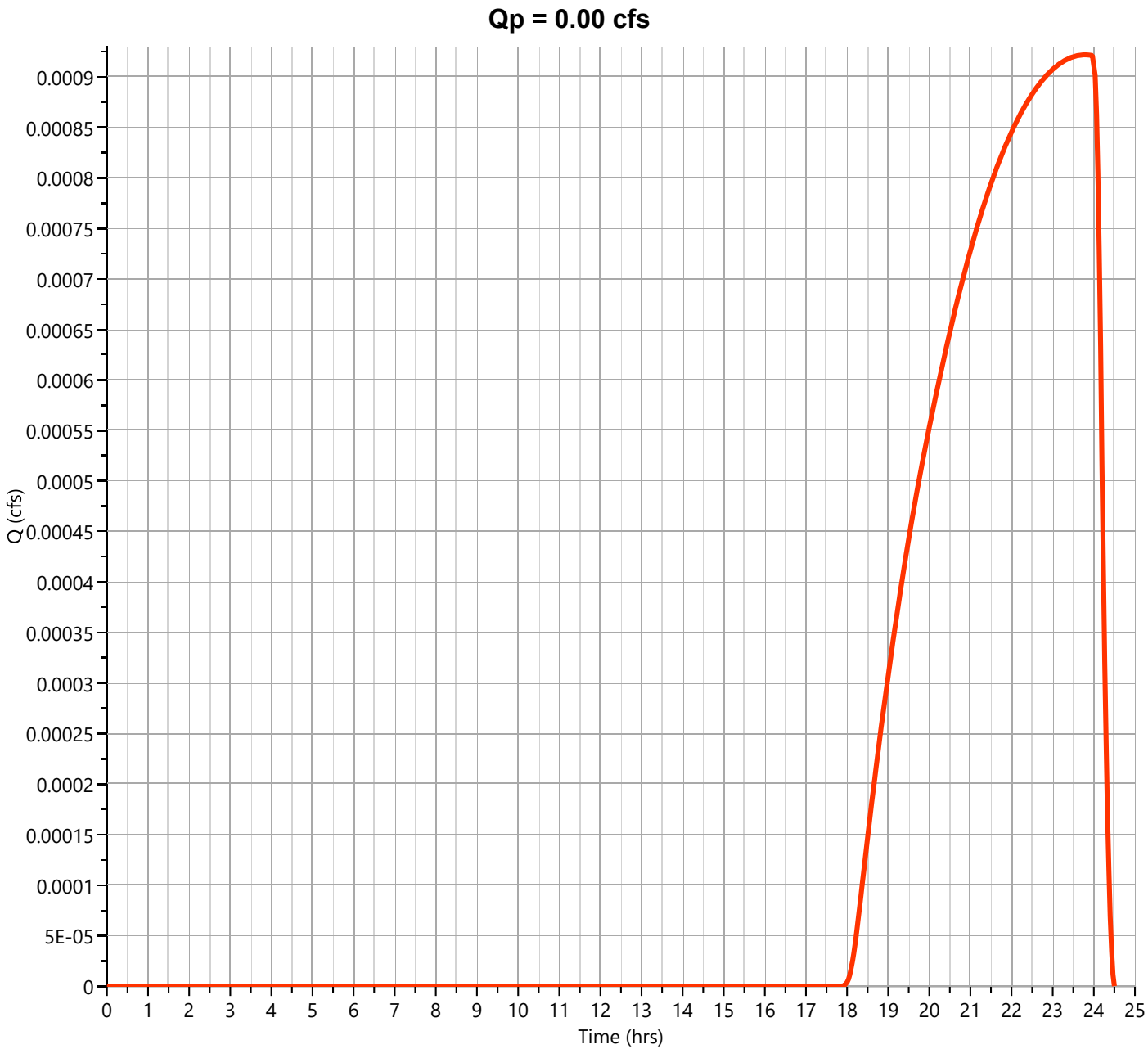
Hydrology Studio v 3.0.0.24

06-28-2022

E-8

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.001 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.80 hrs
Time Interval	= 2 min	Runoff Volume	= 14.5 cuft
Drainage Area	= 0.68 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

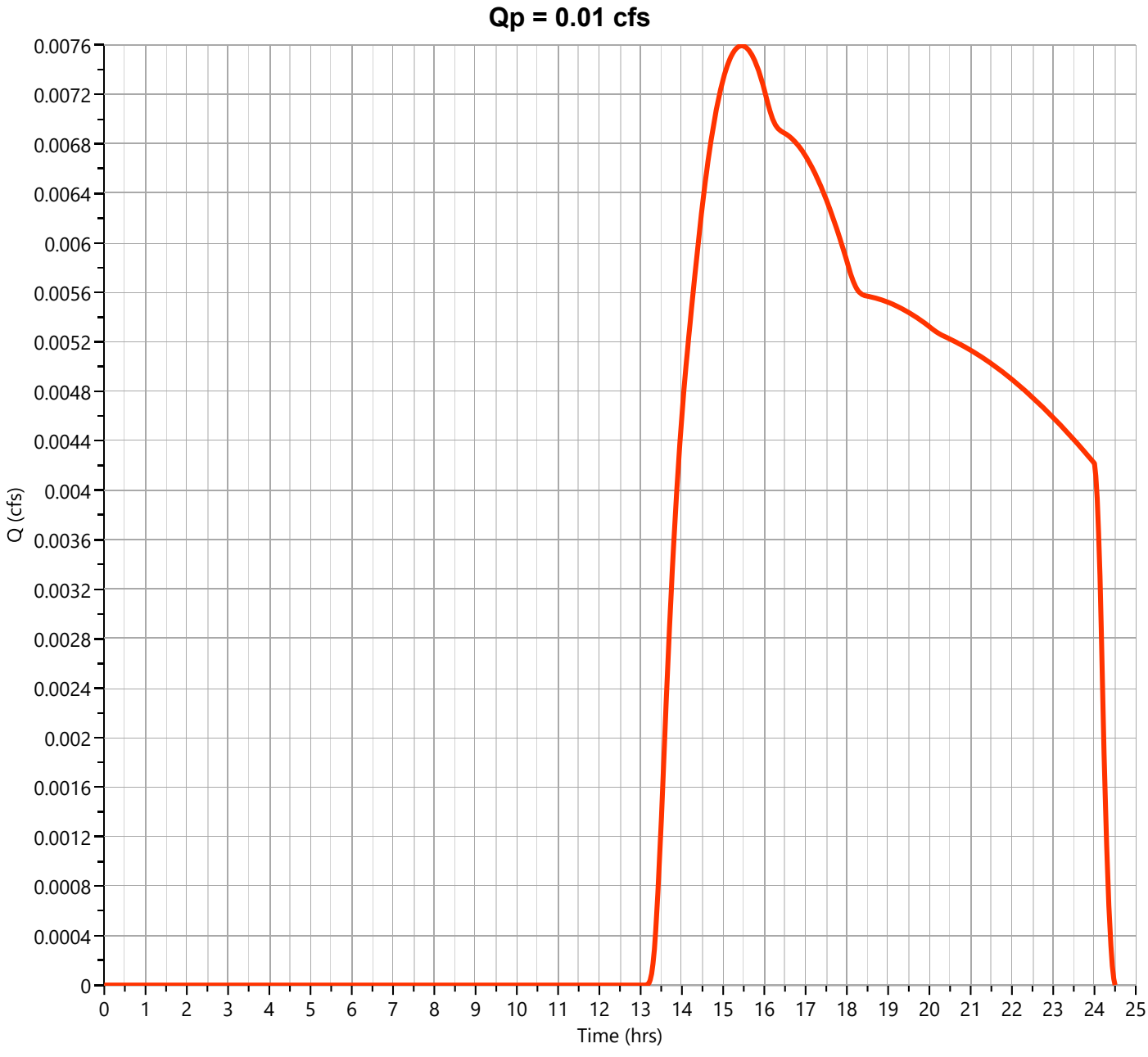
Hydrology Studio v 3.0.0.24

06-28-2022

E-8

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.008 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.47 hrs
Time Interval	= 2 min	Runoff Volume	= 216 cuft
Drainage Area	= 0.68 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

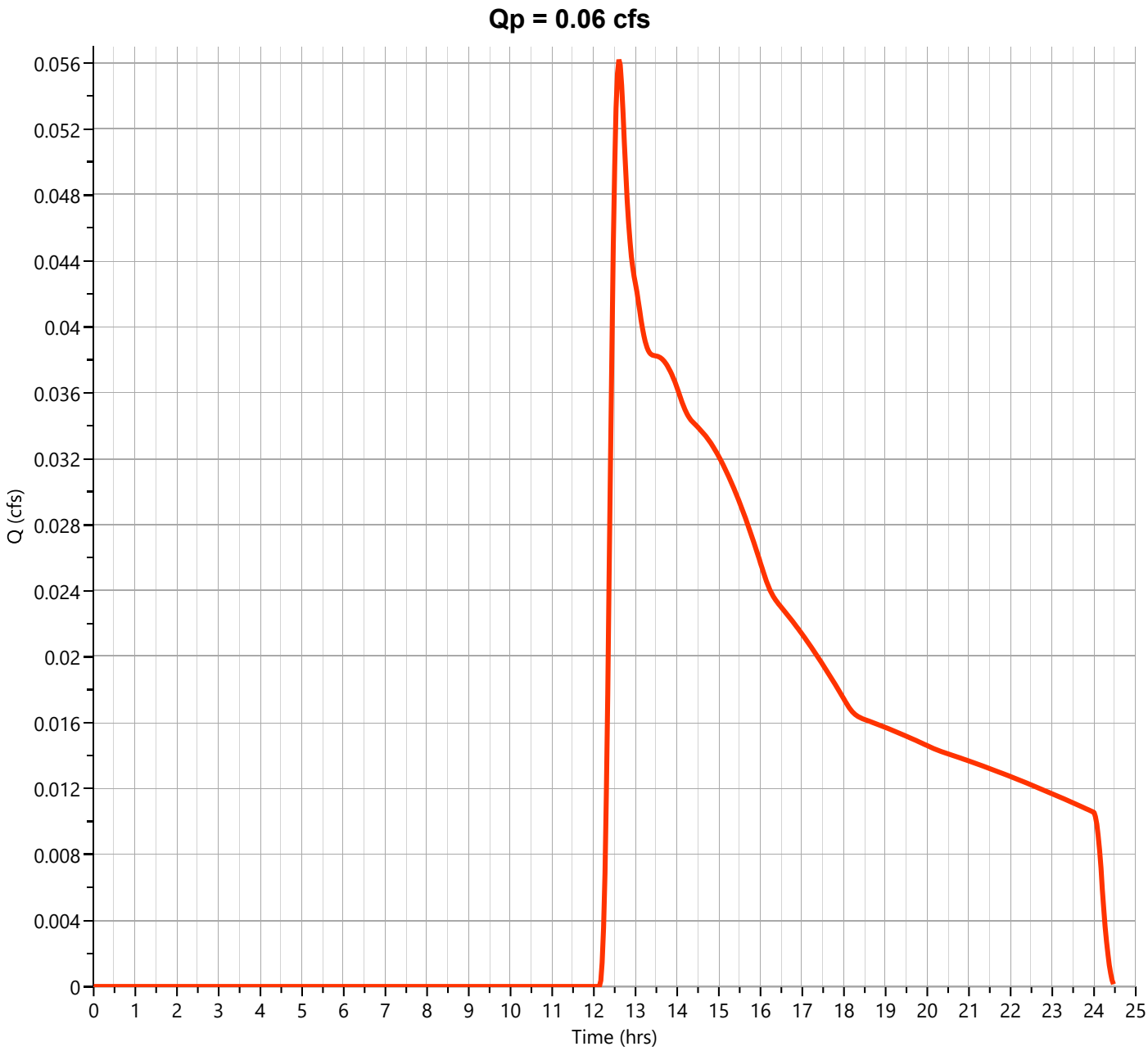
Hydrology Studio v 3.0.0.24

06-28-2022

E-8

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.056 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Runoff Volume	= 938 cuft
Drainage Area	= 0.68 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-9

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.13	13.18
A	Woods Good Condition	30			0.99	29.66
A	Open Space Good Condition	39			0.16	6.13
A	Open Space Fair Condition	49			0.38	18.64
A	Gravel	76			0.50	38.18
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			4.03	282.03
C	Open Space Good Condition	74			0.87	64.64
D	Open Space Good Condition	80			0.08	6.31
D	Open Space Fair Condition	84			0.06	5.32
D	Woods Good Condition	77			1.86	143.36

1/ Use only one CN source per line. 395073 Totals = 9.07 607.45

CN (weighted) = total product / total area = 607.45 / 9.07 = 66.98 ; Use CN = 67

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.72	2.63	3.99

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-9
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.026			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.26			0.26
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	1125			
9. Watercourse slope, s		ft/ft	0.042			
10. Average Velocity, V (figure 3-1)		ft/s	3.31			
11. Tt = L / 3600V	Compute Tt	hr	0.09			0.09
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.35
min 21.3

Hydrograph Report

Project Name:

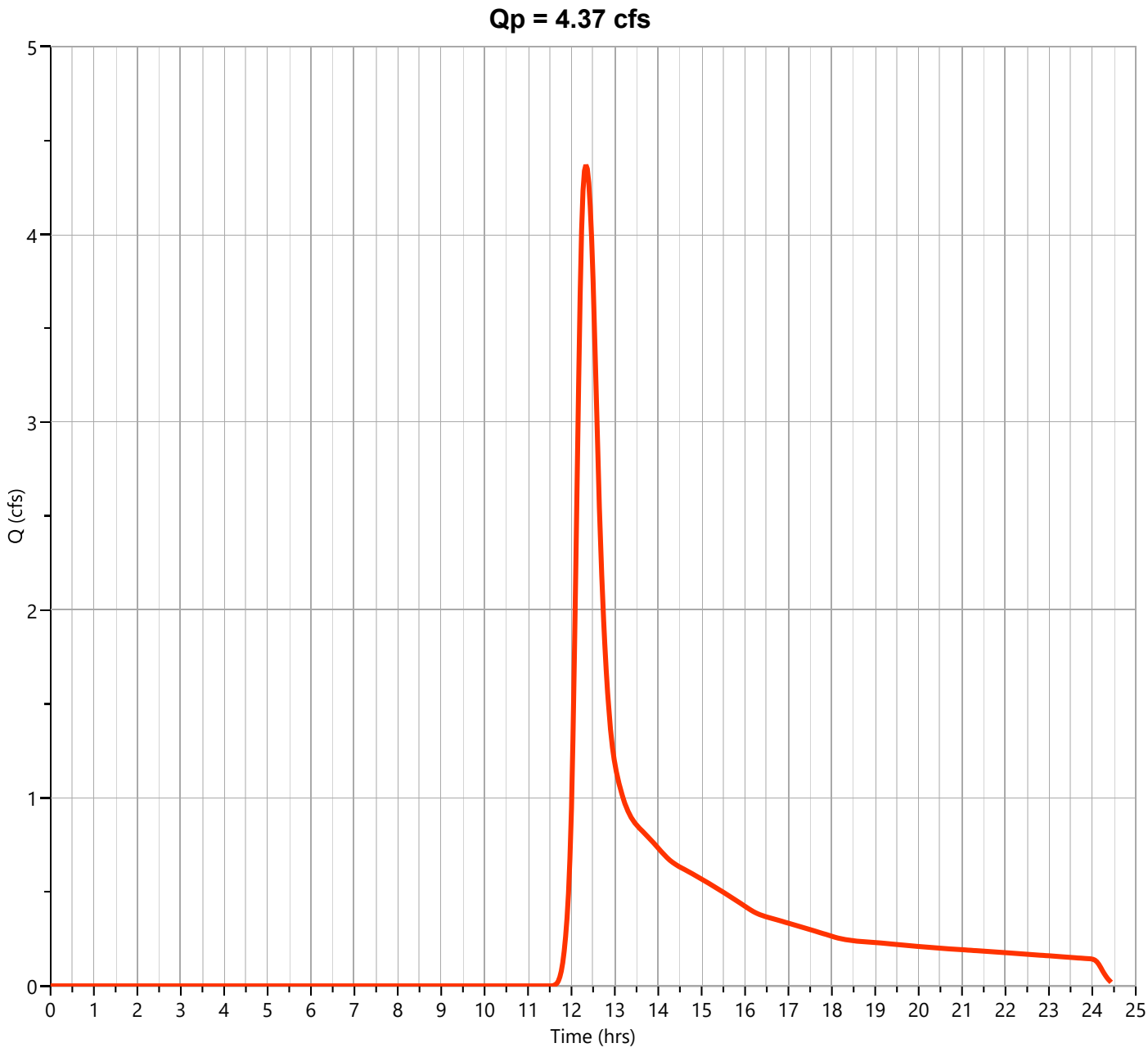
Hydrology Studio v 3.0.0.24

06-28-2022

E-9

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.370 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 24,266 cuft
Drainage Area	= 9.07 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

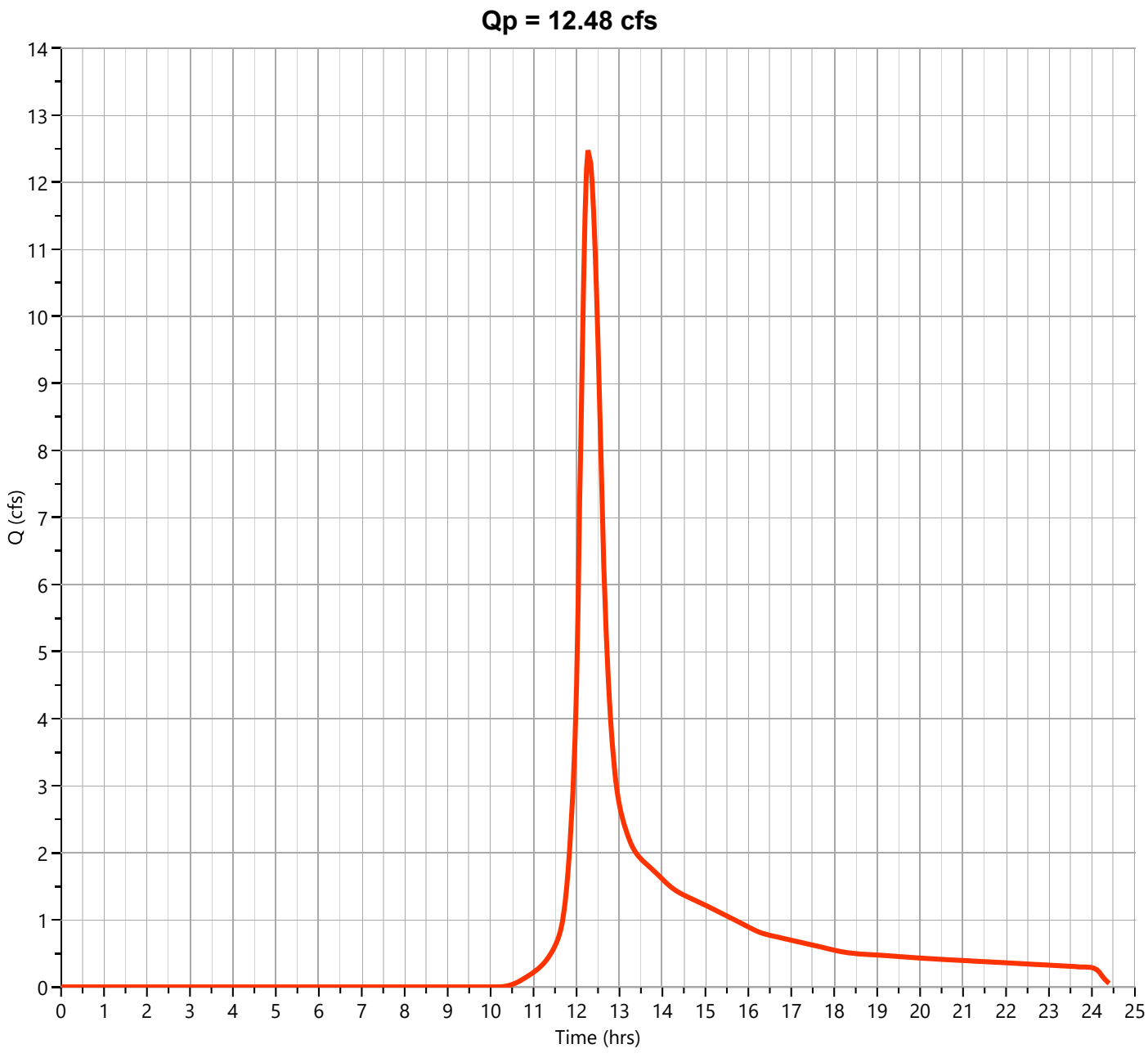
Hydrology Studio v 3.0.0.24

06-28-2022

E-9

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 12.48 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 61,359 cuft
Drainage Area	= 9.07 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

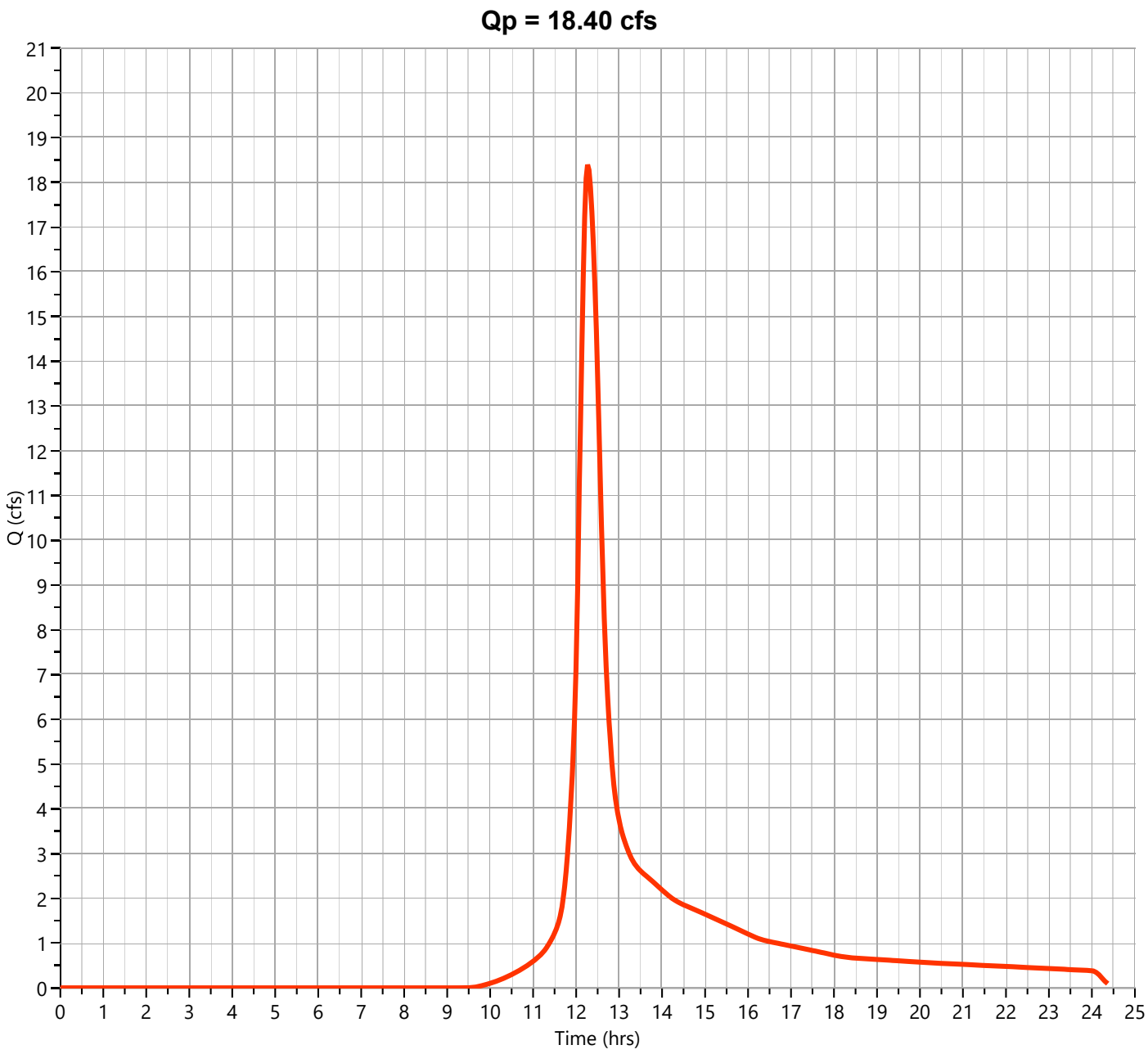
Hydrology Studio v 3.0.0.24

06-28-2022

E-9

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.40 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 88,343 cuft
Drainage Area	= 9.07 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

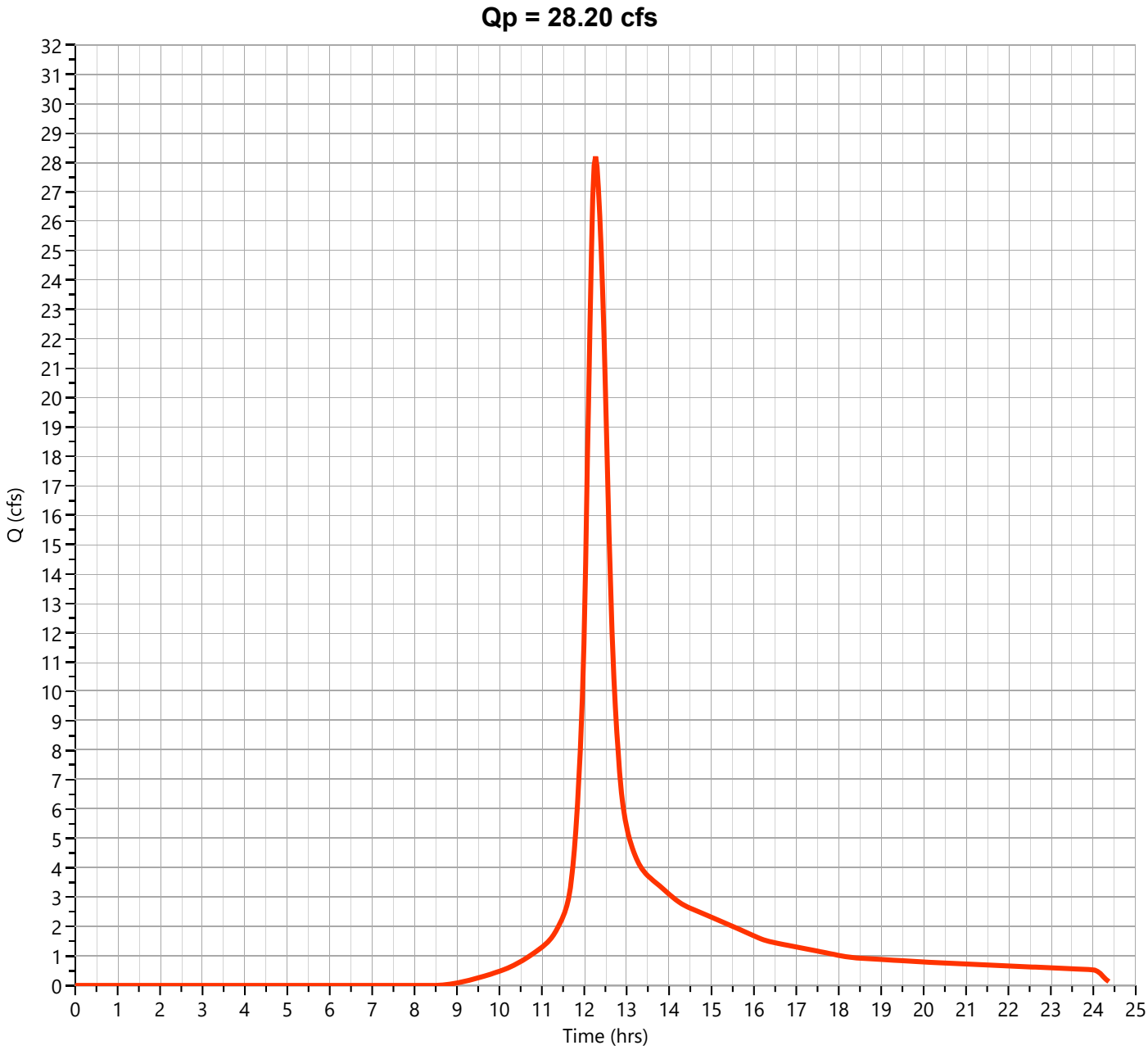
Hydrology Studio v 3.0.0.24

06-28-2022

E-9

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 28.20 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 133,675 cuft
Drainage Area	= 9.07 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 21.3 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-10

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			2.28	68.33
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.05	3.81
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
C	Woods	Good Condition	70			21.06	1474.45
C	Open Space	Fair Condition	79			0.00	0.00
C	Gravel		89			0.18	16.30
D	Woods	Good Condition	77			1.97	151.70
D	Gravel		91			0.03	3.12
D	BVW		77			0.35	26.97

1/ Use only one CN source per line. 1129474 Totals = 25.93 1744.68

CN (weighted) = total product / total area = 1744.68 / 25.93 = 67.29 ; Use CN = 67

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.74	2.66	4.02

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-10
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.008			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.42			0.42
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	1082			
9. Watercourse slope, s		ft/ft	0.055			
10. Average Velocity, V (figure 3-1)		ft/s	3.78			
11. Tt = L / 3600V	Compute Tt	hr	0.08			0.08
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.50
min 29.8

Hydrograph Report

Project Name:

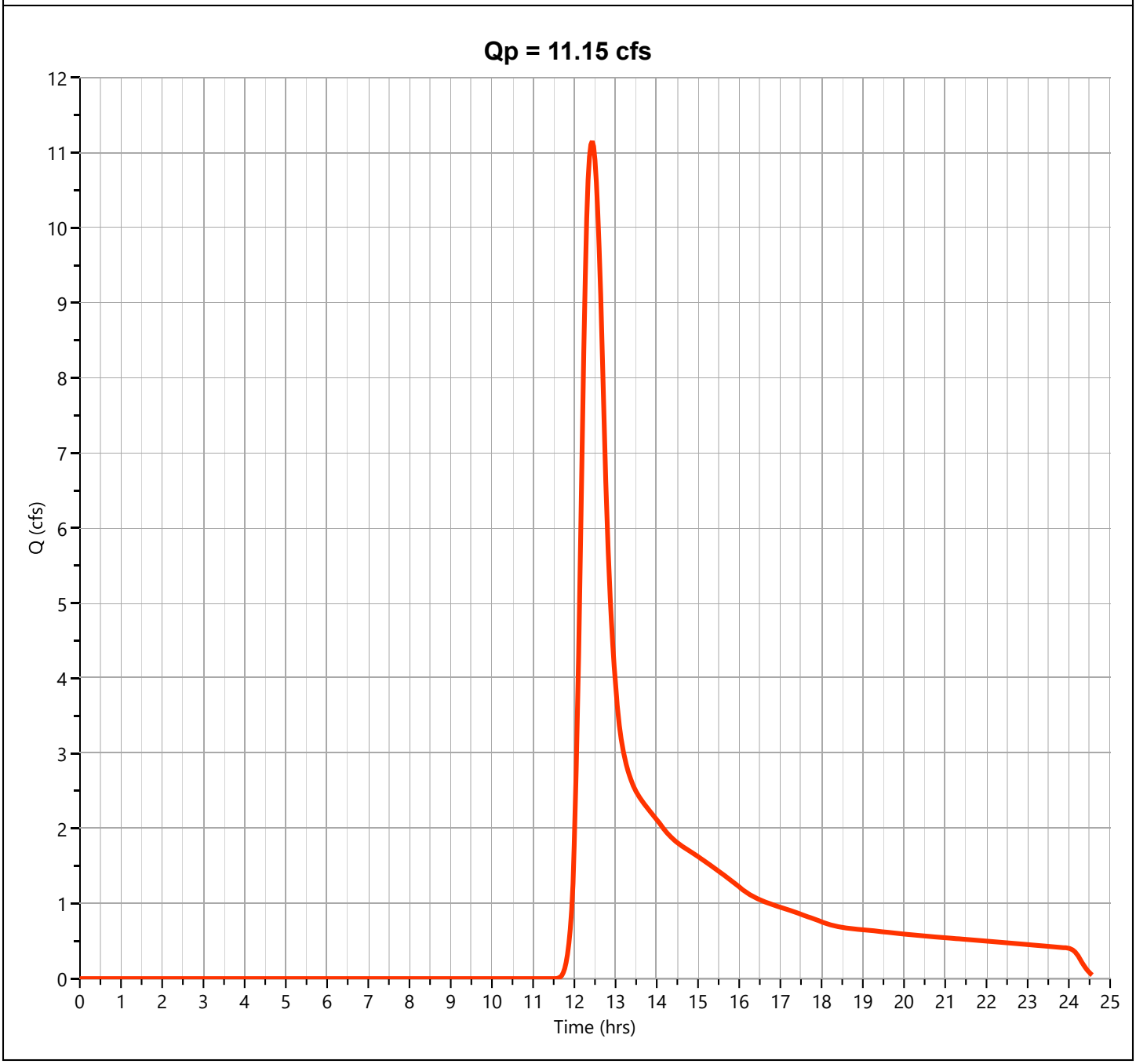
Hydrology Studio v 3.0.0.24

06-28-2022

E-10

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.15 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 68,155 cuft
Drainage Area	= 25.93 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 29.8 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

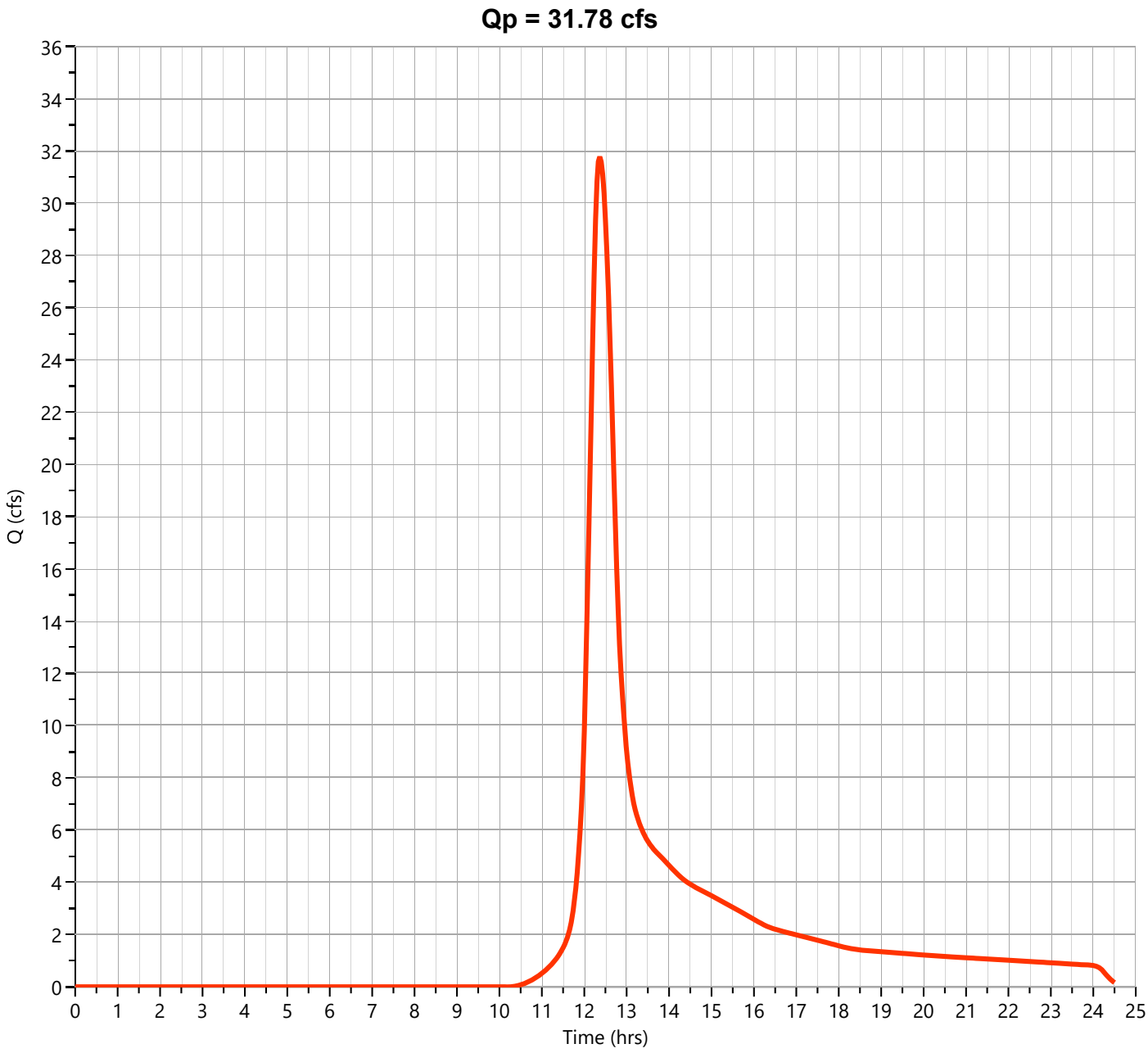
Hydrology Studio v 3.0.0.24

06-28-2022

E-10

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 31.78 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 172,339 cuft
Drainage Area	= 25.93 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 29.8 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

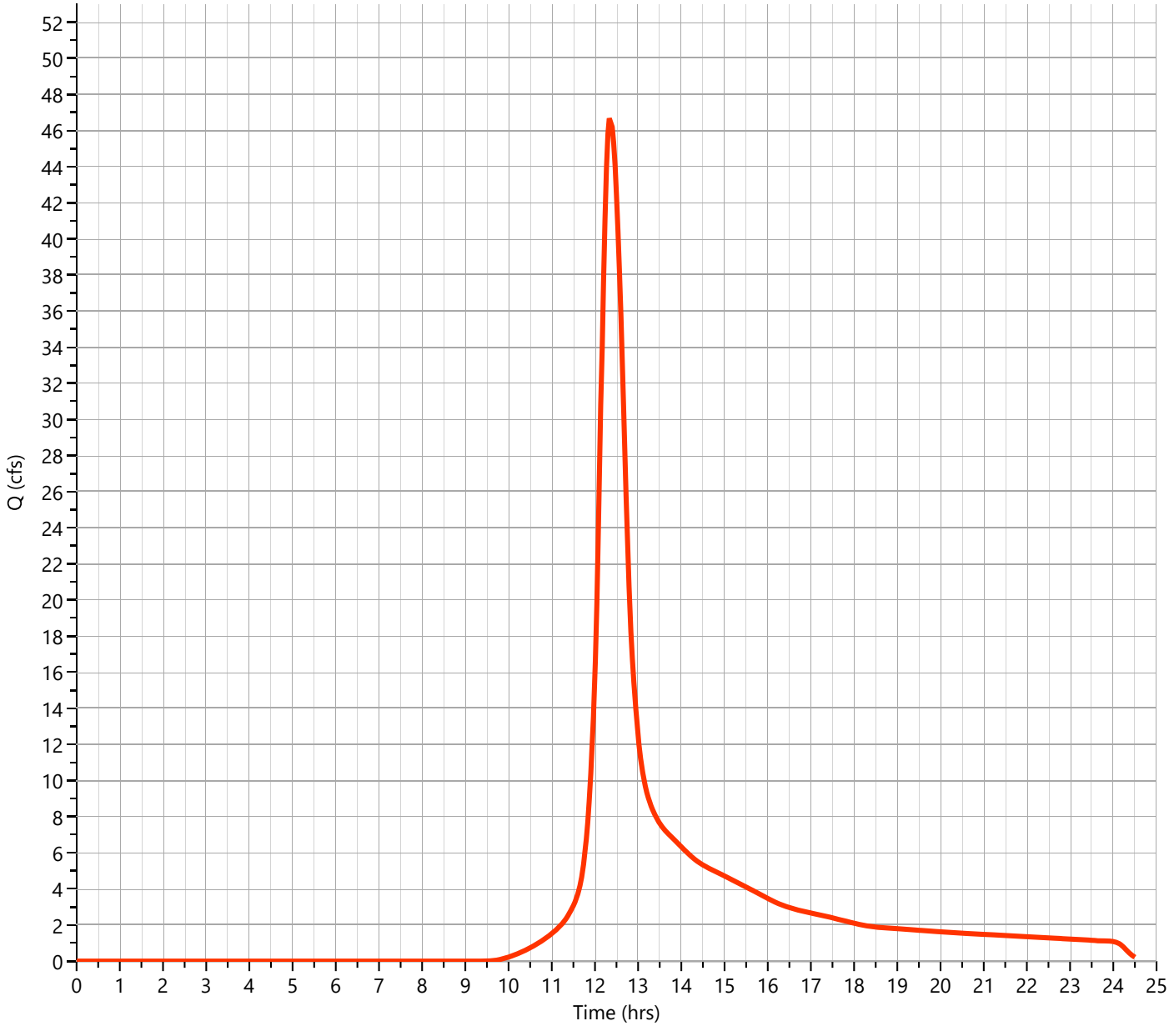
Hydrology Studio v 3.0.0.24

06-28-2022

E-10

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 46.70 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 248,131 cuft
Drainage Area	= 25.93 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 29.8 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

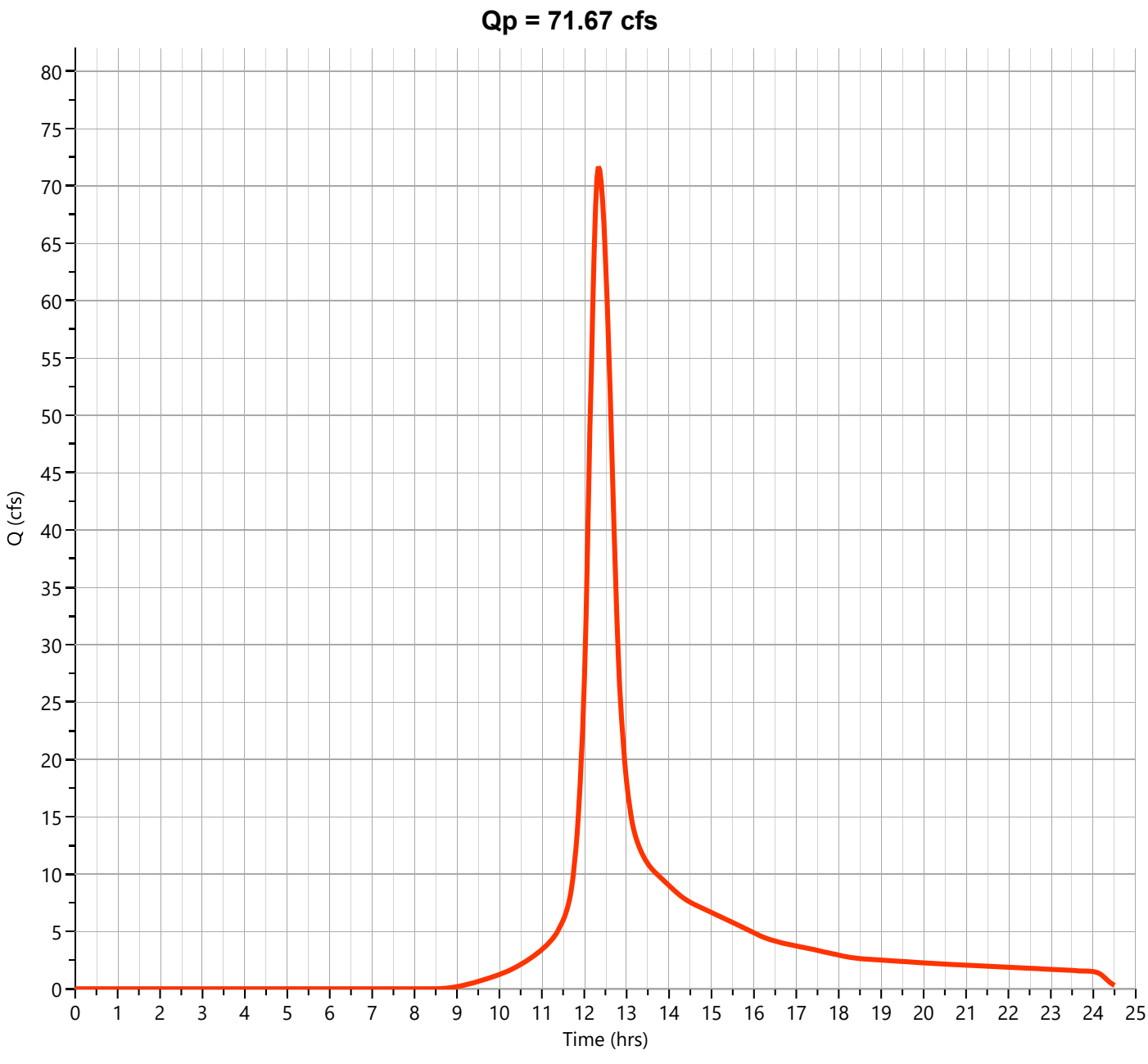
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06-28-2022

E-10

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 71.67 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 375,456 cuft
Drainage Area	= 25.93 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 29.8 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-11

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.80	24.12
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			10.09	706.27
C	Open Space	Poor Condition	86			0.00	0.00
C	Gravel		89			0.00	0.00
D	BVW		77			0.00	0.00

1/ Use only one CN source per line. 474519 Totals = 10.89 730.38

CN (weighted) = total product / total area = 730.38 / 10.89 = 67.05 ; Use CN = 67

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.73	2.64	3.99

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-11
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.006			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.47			0.47
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	411			
9. Watercourse slope, s		ft/ft	0.047			
10. Average Velocity, V (figure 3-1)		ft/s	3.50			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.50
	min	30.0

Hydrograph Report

Project Name:

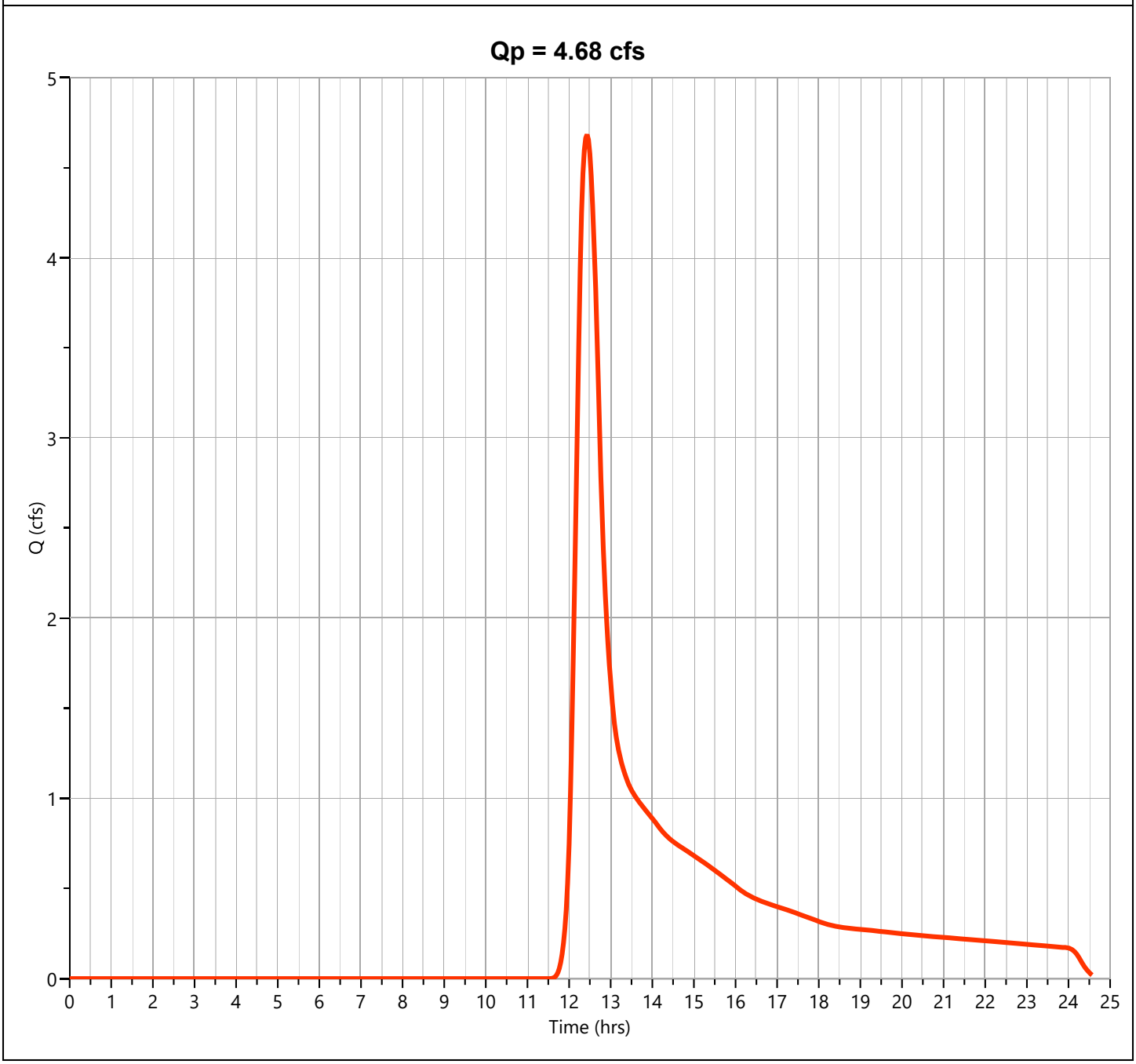
Hydrology Studio v 3.0.0.24

06-28-2022

E-11

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.684 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 28,624 cuft
Drainage Area	= 10.89 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

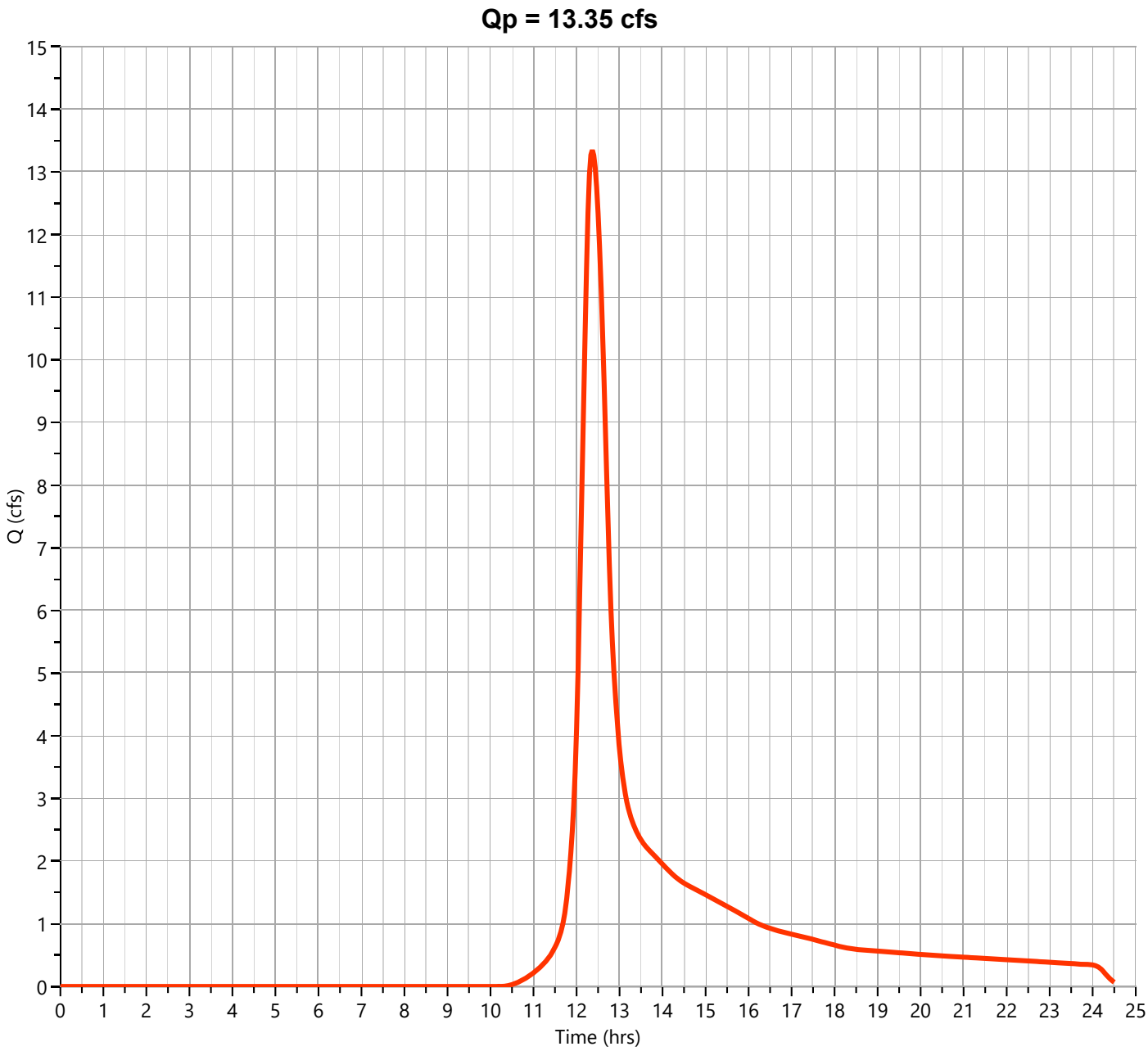
Hydrology Studio v 3.0.0.24

06-28-2022

E-11

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.35 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 72,378 cuft
Drainage Area	= 10.89 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

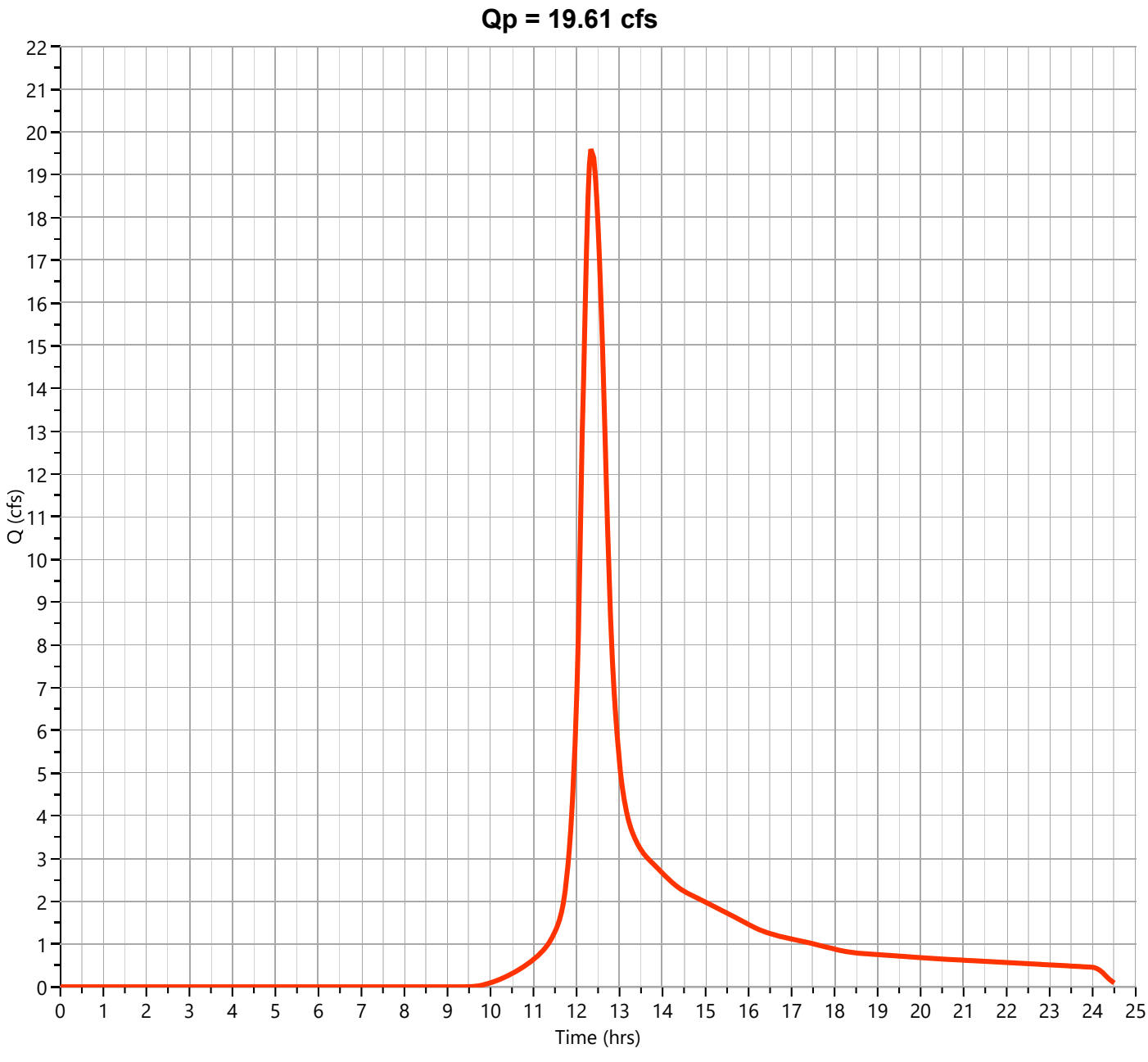
Hydrology Studio v 3.0.0.24

06-28-2022

E-11

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 19.61 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 104,209 cuft
Drainage Area	= 10.89 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

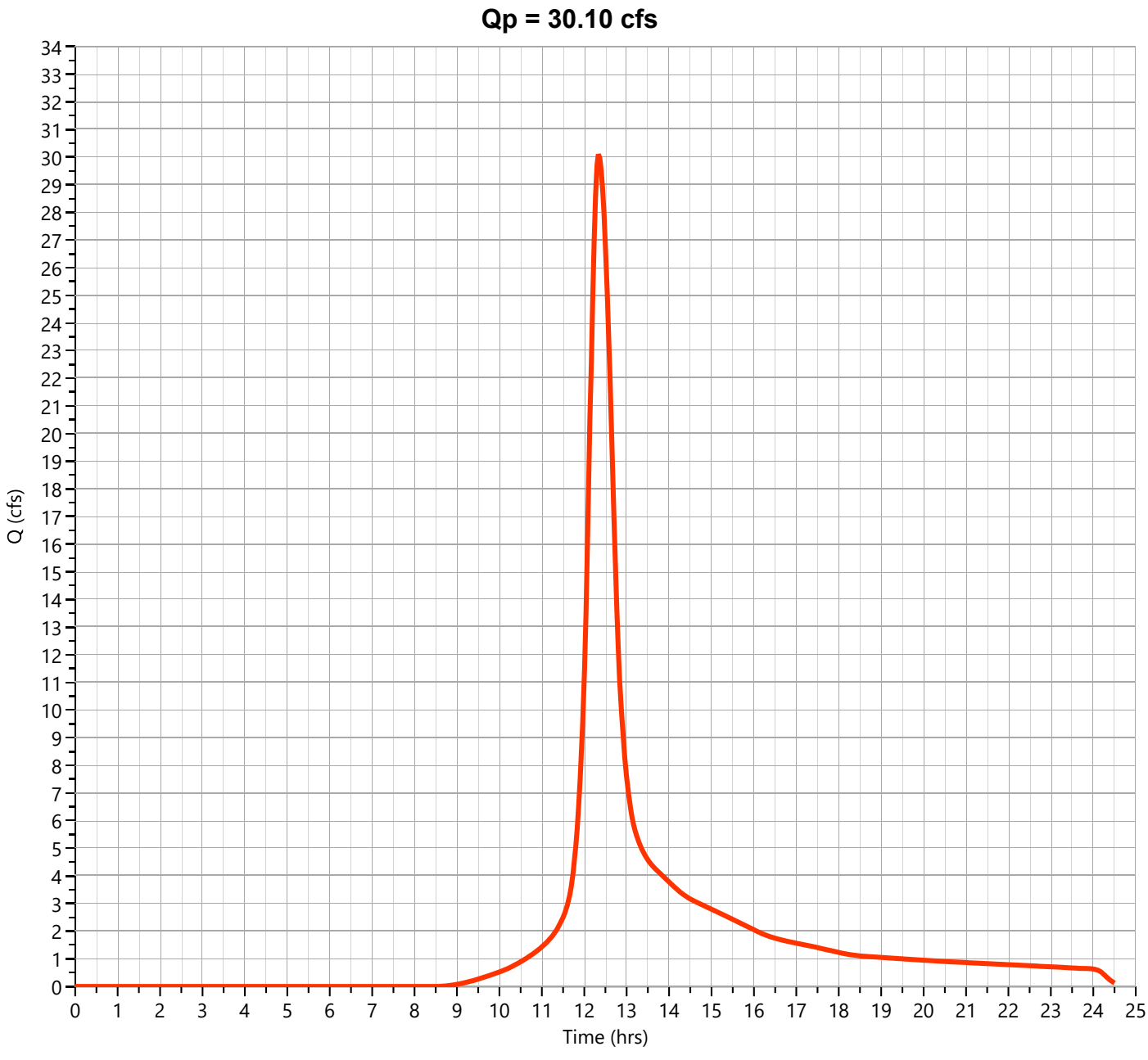
Hydrology Studio v 3.0.0.24

06-28-2022

E-11

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 30.10 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 157,683 cuft
Drainage Area	= 10.89 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/1/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-12

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.22	6.53
A	Open Space	Good Condition	39			0.00	0.00
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Poor Condition	86			0.00	0.00
C	Gravel		89			0.00	0.00
D	BVW		77			0.00	0.00

1/ Use only one CN source per line. 9482 Totals = 0.22 6.53

CN (weighted) = total product / total area = 6.53 / 0.22 = 30.00 ; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.09	0.09	0.38

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/1/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment E-12
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.122			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.14			0.14
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	57			
9. Watercourse slope, s		ft/ft	0.112			
10. Average Velocity, V (figure 3-1)		ft/s	5.40			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.14
min 8.6

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

E-12

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

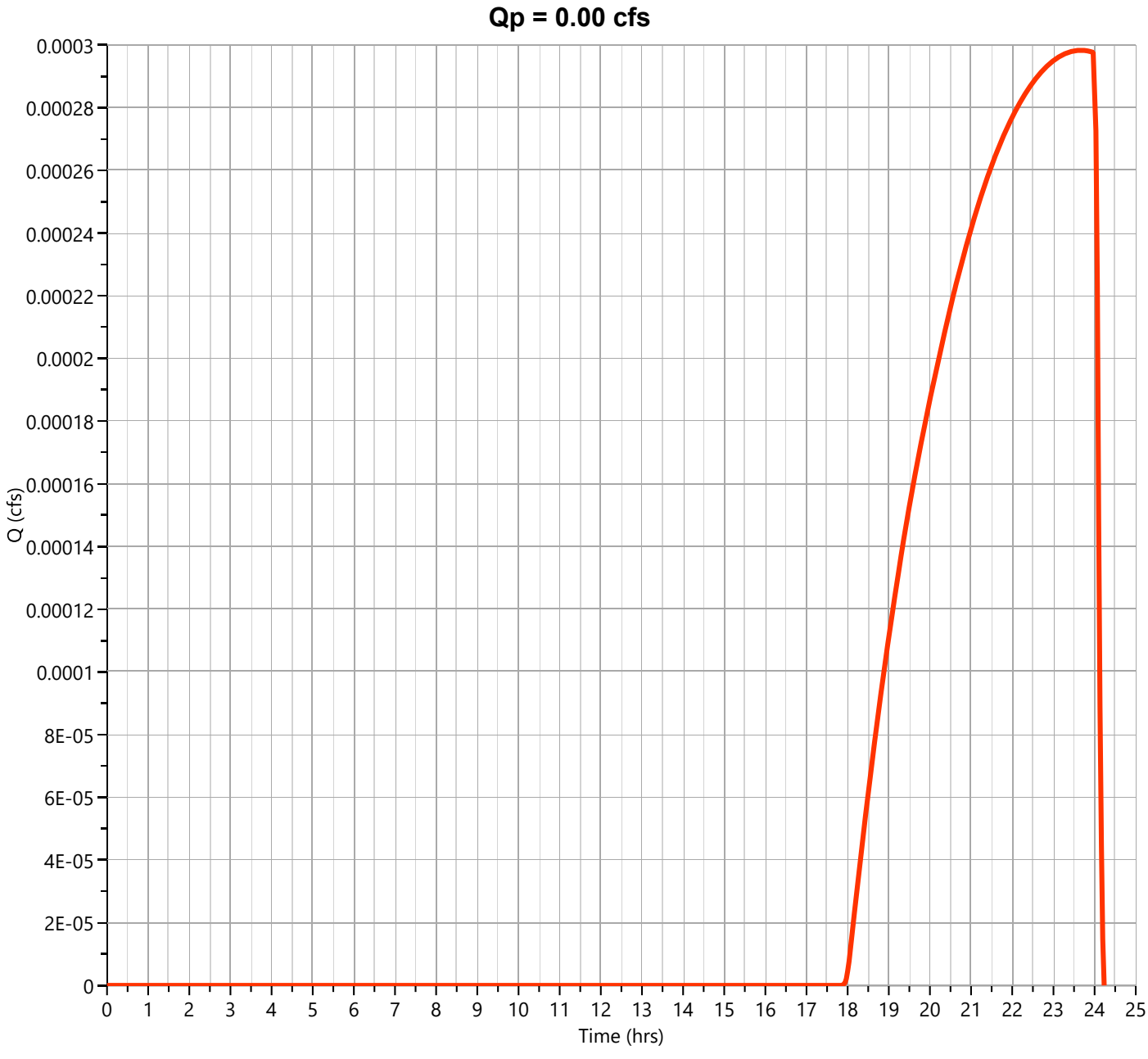
Hydrology Studio v 3.0.0.24

06-28-2022

E-12

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.70 hrs
Time Interval	= 2 min	Runoff Volume	= 4.70 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

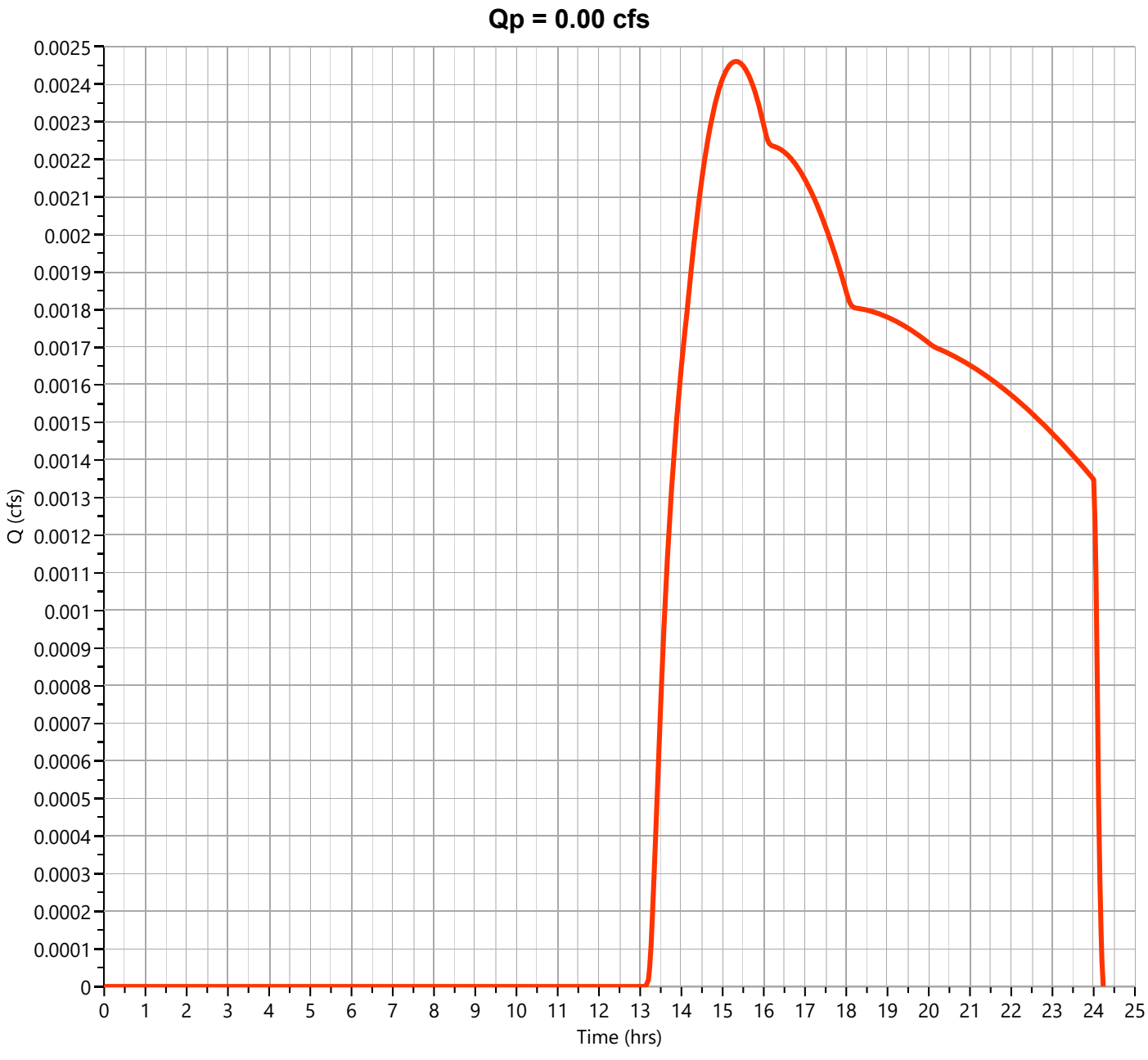
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06-28-2022

E-12

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.33 hrs
Time Interval	= 2 min	Runoff Volume	= 69.9 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

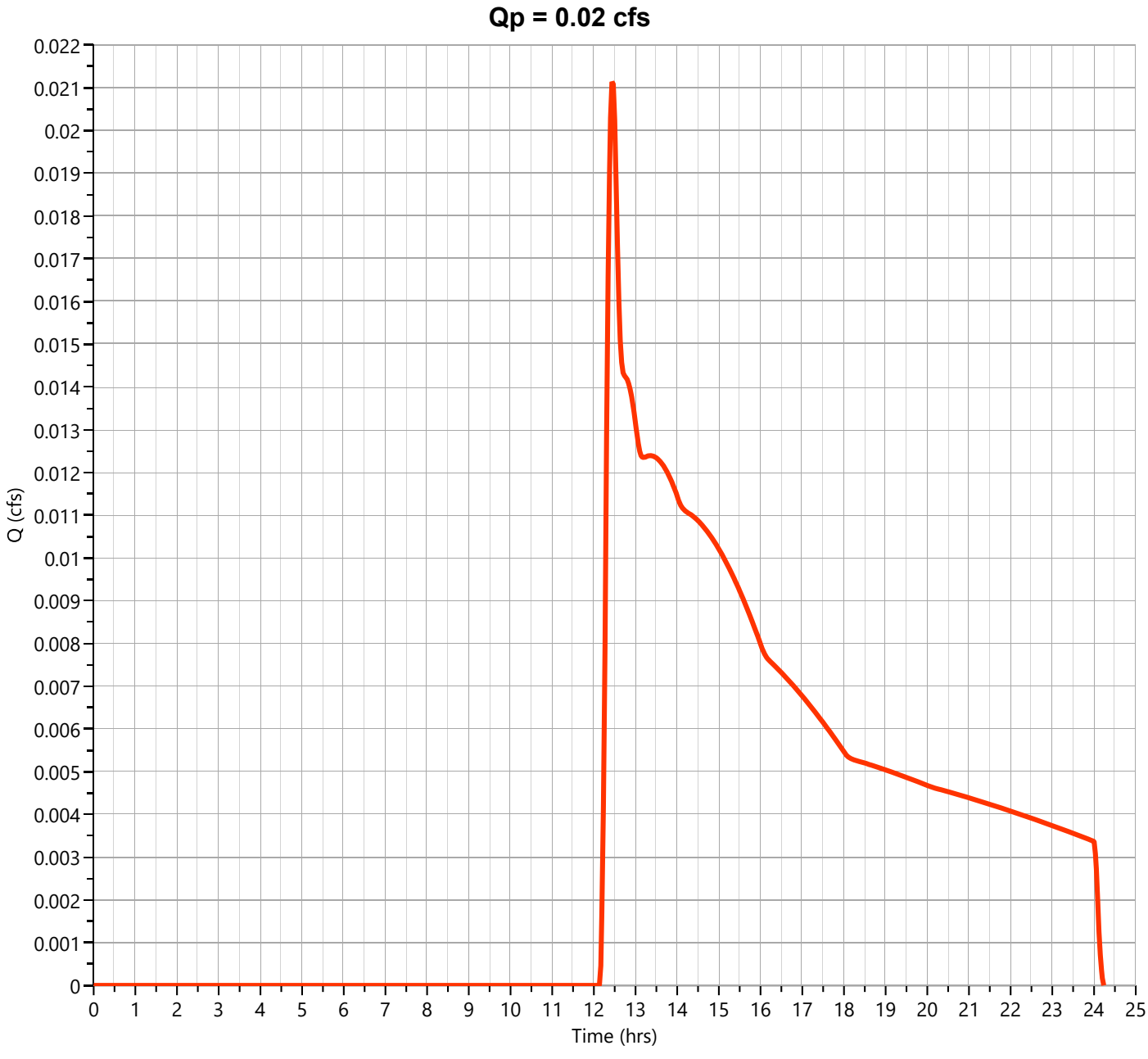
Hydrology Studio v 3.0.0.24

06-28-2022

E-12

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.021 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 303 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Post-Development Hydrology

Hydrograph 2-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.000	0.00	0.000	----		
2	NRCS Runoff	E-2	5.423	12.47	46,214	----		
3	NRCS Runoff	E-3	6.809	12.30	35,200	----		
4	NRCS Runoff	E-4	6.776	12.30	35,030	----		
5	NRCS Runoff	E-5	7.884	12.30	41,393	----		
6	NRCS Runoff	E-6	0.000	24.17	0.024	----		
7	NRCS Runoff	E-7	0.000	0.00	0.000	----		
8	NRCS Runoff	E-8	0.000	0.00	0.000	----		
9	NRCS Runoff	E-9	4.370	12.33	24,266	----		
10	NRCS Runoff	E-10	11.15	12.43	68,155	----		
11	NRCS Runoff	E-11	4.684	12.43	28,624	----		
12	NRCS Runoff	E-12	0.000	0.00	0.000	----		
14	NRCS Runoff	P-1	0.000	0.00	0.000	----		
16	NRCS Runoff	P-3A	3.053	12.10	10,424	----		
17	Pond Route	IB-3A	0.000	22.87	-0.002	16	288.30	5,524
18	NRCS Runoff	P-3B	6.481	12.20	28,734	----		
19	Junction	P-3 TOTAL	6.481	12.20	28,734	17, 18		
21	NRCS Runoff	P-4	6.500	12.17	27,152	----		
23	NRCS Runoff	P-5A	5.857	12.13	22,525	----		
24	Pond Route	IB-5A	0.000	12.47	0.000	23	305.99	10,729
25	NRCS Runoff	P-5B	4.505	12.17	18,454	----		
26	Junction	INFLOW TO IB-5B	4.505	12.17	18,454	24, 25		
27	Pond Route	IB-5B	0.000	22.93	-0.006	26	279.86	9,349
28	NRCS Runoff	P-5C	2.072	12.13	7,952	----		
29	Pond Route	IB-5C	0.000	12.87	0.002	28	259.12	3,568
30	NRCS Runoff	P-5E	6.876	12.17	29,184	----		
31	Junction	P-5 TOTAL	6.876	12.17	29,184	27, 29, 30		
33	NRCS Runoff	P-5D	3.361	12.10	11,564	----		
34	Pond Route	IB-5D	0.000	15.87	0.005	33	231.81	7,379
35	NRCS Runoff	P-2A	3.280	12.17	14,854	----		
36	Junction	INFLOW TO IB-2A	3.280	12.17	14,854	34, 35		

Hydrograph 2-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	0.000	12.93	0.000	36	229.10	1,461
38	NRCS Runoff	P-2B	3.443	12.47	31,781	----		
39	Junction	TOTAL P-2	3.443	12.47	31,781	37, 38		
41	NRCS Runoff	P-6A	0.000	0.00	0.000	----		
42	NRCS Runoff	P-6B	0.002	22.10	45.1	----		
43	Pond Route	IB-6B	0.000	18.63	0.000	42	217.40	0.735
44	Junction	P-6 TOTAL	0.000	18.63	0.000	41, 43		
46	NRCS Runoff	P-7A	0.563	12.33	4,481	----		
47	Pond Route	IB-7A	0.000	13.23	0.000	46	219.17	355
48	NRCS Runoff	P-7B	0.361	12.50	2,775	----		
49	Pond Route	IB-7B	0.000	13.47	0.000	48	224.09	190
50	Junction	P-7 TOTAL	0.000	13.23	0.000	47, 49		
52	NRCS Runoff	P-8	2.829	12.17	12,496	----		
53	Pond Route	IB-8	0.000	13.40	0.000	52	223.17	1,552
55	NRCS Runoff	P-9	3.645	12.33	20,738	----		
57	NRCS Runoff	P-10A	5.130	12.40	29,688	----		
58	NRCS Runoff	P-10B	4.245	12.13	16,434	----		
59	Pond Route	IB-10B	2.382	12.33	5,138	58	256.73	4,994
60	NRCS Runoff	P-10C	9.376	12.27	44,541	----		
61	Pond Route	IB-10C	4.990	12.53	8,909	60	228.49	12,332
62	NRCS Runoff	P-10D	8.386	12.10	28,634	----		
63	Junction	INFLOW TO IB-10D	8.386	12.10	37,542	61, 62		
64	Pond Route	IB-10D	0.000	11.63	0.000	63	226.74	16,894
65	Junction	P-10 TOTAL	7.438	12.37	34,825	57, 59, 64		
67	NRCS Runoff	P-11	4.637	12.43	28,334	----		
69	NRCS Runoff	P-12	0.000	0.00	0.000	----		

Hydrograph 10-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.000	23.73	3.52	----		
2	NRCS Runoff	E-2	30.74	12.27	162,799	----		
3	NRCS Runoff	E-3	17.08	12.27	82,096	----		
4	NRCS Runoff	E-4	17.00	12.27	81,699	----		
5	NRCS Runoff	E-5	20.38	12.27	98,397	----		
6	NRCS Runoff	E-6	0.056	13.83	1,451	----		
7	NRCS Runoff	E-7	0.023	21.03	669	----		
8	NRCS Runoff	E-8	0.001	23.80	14.5	----		
9	NRCS Runoff	E-9	12.48	12.27	61,359	----		
10	NRCS Runoff	E-10	31.78	12.37	172,339	----		
11	NRCS Runoff	E-11	13.35	12.37	72,378	----		
12	NRCS Runoff	E-12	0.000	23.70	4.70	----		
14	NRCS Runoff	P-1	0.000	23.73	3.52	----		
16	NRCS Runoff	P-3A	5.663	12.10	19,529	----		
17	Pond Route	IB-3A	0.000	21.47	-0.001	16	289.96	11,808
18	NRCS Runoff	P-3B	16.21	12.20	67,014	----		
19	Junction	P-3 TOTAL	16.21	12.20	67,014	17, 18		
21	NRCS Runoff	P-4	16.24	12.17	63,326	----		
23	NRCS Runoff	P-5A	11.29	12.13	43,384	----		
24	Pond Route	IB-5A	0.000	28.47	-0.002	23	307.49	24,675
25	NRCS Runoff	P-5B	8.845	12.17	36,049	----		
26	Junction	INFLOW TO IB-5B	8.845	12.17	36,049	24, 25		
27	Pond Route	IB-5B	0.000	23.37	0.000	26	281.47	21,234
28	NRCS Runoff	P-5C	3.921	12.13	15,103	----		
29	Pond Route	IB-5C	0.000	12.13	0.001	28	260.17	7,907
30	NRCS Runoff	P-5E	17.73	12.17	69,374	----		
31	Junction	P-5 TOTAL	17.73	12.17	69,374	27, 29, 30		
33	NRCS Runoff	P-5D	6.704	12.10	22,917	----		
34	Pond Route	IB-5D	2.074	12.43	8,715	33	232.29	9,947
35	NRCS Runoff	P-2A	9.459	12.17	37,560	----		
36	Junction	INFLOW TO IB-2A	9.459	12.17	46,275	34, 35		

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	0.000	15.00	-0.001	36	229.77	11,554
38	NRCS Runoff	P-2B	21.57	12.30	116,876	----		
39	Junction	TOTAL P-2	21.57	12.30	116,876	37, 38		
41	NRCS Runoff	P-6A	0.011	15.57	324	----		
42	NRCS Runoff	P-6B	0.099	12.47	1,226	----		
43	Pond Route	IB-6B	0.000	13.27	0.000	42	217.46	33.8
44	Junction	P-6 TOTAL	0.011	15.57	324	41, 43		
46	NRCS Runoff	P-7A	3.410	12.17	15,787	----		
47	Pond Route	IB-7A	0.000	19.37	0.000	46	220.90	4,726
48	NRCS Runoff	P-7B	1.569	12.37	8,714	----		
49	Pond Route	IB-7B	0.000	15.97	0.000	48	224.99	2,202
50	Junction	P-7 TOTAL	0.000	15.97	0.000	47, 49		
52	NRCS Runoff	P-8	7.833	12.17	30,929	----		
53	Pond Route	IB-8	0.000	24.43	0.000	52	223.94	8,657
55	NRCS Runoff	P-9	10.83	12.30	53,625	----		
57	NRCS Runoff	P-10A	13.22	12.37	70,572	----		
58	NRCS Runoff	P-10B	8.494	12.13	32,566	----		
59	Pond Route	IB-10B	7.380	12.20	18,051	58	257.01	6,225
60	NRCS Runoff	P-10C	18.35	12.27	87,007	----		
61	Pond Route	IB-10C	9.716	12.53	36,809	60	229.47	20,221
62	NRCS Runoff	P-10D	15.56	12.10	53,644	----		
63	Junction	INFLOW TO IB-10D	20.96	12.17	90,453	61, 62		
64	Pond Route	IB-10D	7.799	12.93	13,514	63	229.36	42,634
65	Junction	P-10 TOTAL	19.48	12.30	102,137	57, 59, 64		
67	NRCS Runoff	P-11	13.21	12.37	71,647	----		
69	NRCS Runoff	P-12	0.000	23.70	4.70	----		

Hydrograph 25-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.002	15.37	52.4	----		
2	NRCS Runoff	E-2	52.98	12.27	257,433	----		
3	NRCS Runoff	E-3	24.26	12.27	115,182	----		
4	NRCS Runoff	E-4	24.14	12.27	114,625	----		
5	NRCS Runoff	E-5	29.19	12.27	138,911	----		
6	NRCS Runoff	E-6	0.315	12.57	3,584	----		
7	NRCS Runoff	E-7	0.135	14.83	3,648	----		
8	NRCS Runoff	E-8	0.008	15.47	216	----		
9	NRCS Runoff	E-9	18.40	12.27	88,343	----		
10	NRCS Runoff	E-10	46.70	12.37	248,131	----		
11	NRCS Runoff	E-11	19.61	12.37	104,209	----		
12	NRCS Runoff	E-12	0.002	15.33	69.9	----		
14	NRCS Runoff	P-1	0.002	15.37	52.4	----		
16	NRCS Runoff	P-3A	7.305	12.10	25,435	----		
17	Pond Route	IB-3A	0.164	14.13	760	16	290.73	15,437
18	NRCS Runoff	P-3B	22.96	12.17	94,022	----		
19	Junction	P-3 TOTAL	22.96	12.17	94,782	17, 18		
21	NRCS Runoff	P-4	23.05	12.13	88,848	----		
23	NRCS Runoff	P-5A	14.74	12.13	57,048	----		
24	Pond Route	IB-5A	0.000	12.70	0.003	23	308.40	34,518
25	NRCS Runoff	P-5B	11.63	12.17	47,637	----		
26	Junction	INFLOW TO IB-5B	11.63	12.17	47,637	24, 25		
27	Pond Route	IB-5B	0.000	28.43	-0.003	26	282.38	29,508
28	NRCS Runoff	P-5C	5.092	12.13	19,765	----		
29	Pond Route	IB-5C	0.135	13.73	483	28	260.72	10,635
30	NRCS Runoff	P-5E	25.34	12.13	97,939	----		
31	Junction	P-5 TOTAL	25.34	12.13	98,421	27, 29, 30		
33	NRCS Runoff	P-5D	8.856	12.10	30,434	----		
34	Pond Route	IB-5D	4.739	12.27	15,690	33	232.51	11,171
35	NRCS Runoff	P-2A	13.88	12.17	54,078	----		
36	Junction	INFLOW TO IB-2A	17.53	12.20	69,768	34, 35		

Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	2.287	12.63	5,595	36	230.31	20,754
38	NRCS Runoff	P-2B	37.97	12.27	186,889	----		
39	Junction	TOTAL P-2	37.97	12.27	192,484	37, 38		
41	NRCS Runoff	P-6A	0.048	12.77	1,169	----		
42	NRCS Runoff	P-6B	0.344	12.33	2,617	----		
43	Pond Route	IB-6B	0.000	16.17	0.000	42	218.00	344
44	Junction	P-6 TOTAL	0.048	12.77	1,169	41, 43		
46	NRCS Runoff	P-7A	5.930	12.17	24,963	----		
47	Pond Route	IB-7A	0.000	22.60	0.000	46	222.09	9,219
48	NRCS Runoff	P-7B	2.550	12.33	13,370	----		
49	Pond Route	IB-7B	0.000	18.50	0.000	48	225.68	4,275
50	Junction	P-7 TOTAL	0.000	22.60	0.000	47, 49		
52	NRCS Runoff	P-8	11.38	12.17	44,231	----		
53	Pond Route	IB-8	0.000	22.13	0.000	52	224.50	14,615
55	NRCS Runoff	P-9	16.12	12.27	77,748	----		
57	NRCS Runoff	P-10A	18.93	12.33	99,629	----		
58	NRCS Runoff	P-10B	11.23	12.13	43,249	----		
59	Pond Route	IB-10B	8.391	12.27	27,095	58	257.16	7,449
60	NRCS Runoff	P-10C	24.10	12.27	114,974	----		
61	Pond Route	IB-10C	10.63	12.57	56,437	60	230.32	28,731
62	NRCS Runoff	P-10D	20.06	12.10	69,866	----		
63	Junction	INFLOW TO IB-10D	28.94	12.10	126,303	61, 62		
64	Pond Route	IB-10D	11.38	12.63	39,938	63	229.46	43,807
65	Junction	P-10 TOTAL	30.94	12.50	166,662	57, 59, 64		
67	NRCS Runoff	P-11	19.41	12.37	103,157	----		
69	NRCS Runoff	P-12	0.002	15.33	69.9	----		

Hydrograph 100-yr Summary

Project Name:

06-29-2022

Hydrology Studio v 3.0.0.24

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	E-1	0.015	12.50	228	----		
2	NRCS Runoff	E-2	92.93	12.23	426,335	----		
3	NRCS Runoff	E-3	35.91	12.27	169,813	----		
4	NRCS Runoff	E-4	35.73	12.27	168,993	----		
5	NRCS Runoff	E-5	43.57	12.27	206,084	----		
6	NRCS Runoff	E-6	1.157	12.43	8,335	----		
7	NRCS Runoff	E-7	1.078	12.53	12,259	----		
8	NRCS Runoff	E-8	0.056	12.60	938	----		
9	NRCS Runoff	E-9	28.20	12.27	133,675	----		
10	NRCS Runoff	E-10	71.67	12.33	375,456	----		
11	NRCS Runoff	E-11	30.10	12.33	157,683	----		
12	NRCS Runoff	E-12	0.021	12.43	303	----		
14	NRCS Runoff	P-1	0.015	12.50	228	----		
16	NRCS Runoff	P-3A	9.836	12.10	34,751	----		
17	Pond Route	IB-3A	2.935	12.43	8,274	16	290.97	16,606
18	NRCS Runoff	P-3B	34.06	12.17	138,617	----		
19	Junction	P-3 TOTAL	34.06	12.17	146,891	17, 18		
21	NRCS Runoff	P-4	34.18	12.13	130,989	----		
23	NRCS Runoff	P-5A	20.10	12.13	78,715	----		
24	Pond Route	IB-5A	1.960	12.90	12,066	23	309.01	41,527
25	NRCS Runoff	P-5B	15.95	12.17	66,061	----		
26	Junction	INFLOW TO IB-5B	15.95	12.17	78,127	24, 25		
27	Pond Route	IB-5B	3.194	13.07	22,800	26	283.09	36,688
28	NRCS Runoff	P-5C	6.902	12.13	27,136	----		
29	Pond Route	IB-5C	2.414	12.43	6,054	28	260.94	11,696
30	NRCS Runoff	P-5E	37.90	12.13	145,298	----		
31	Junction	P-5 TOTAL	37.90	12.13	174,151	27, 29, 30		
33	NRCS Runoff	P-5D	12.21	12.10	42,421	----		
34	Pond Route	IB-5D	8.009	12.23	27,189	33	232.87	13,186
35	NRCS Runoff	P-2A	21.27	12.13	81,828	----		
36	Junction	INFLOW TO IB-2A	29.06	12.17	109,017	34, 35		

Hydrograph 100-yr Summary

Project Name:

06-29-2022

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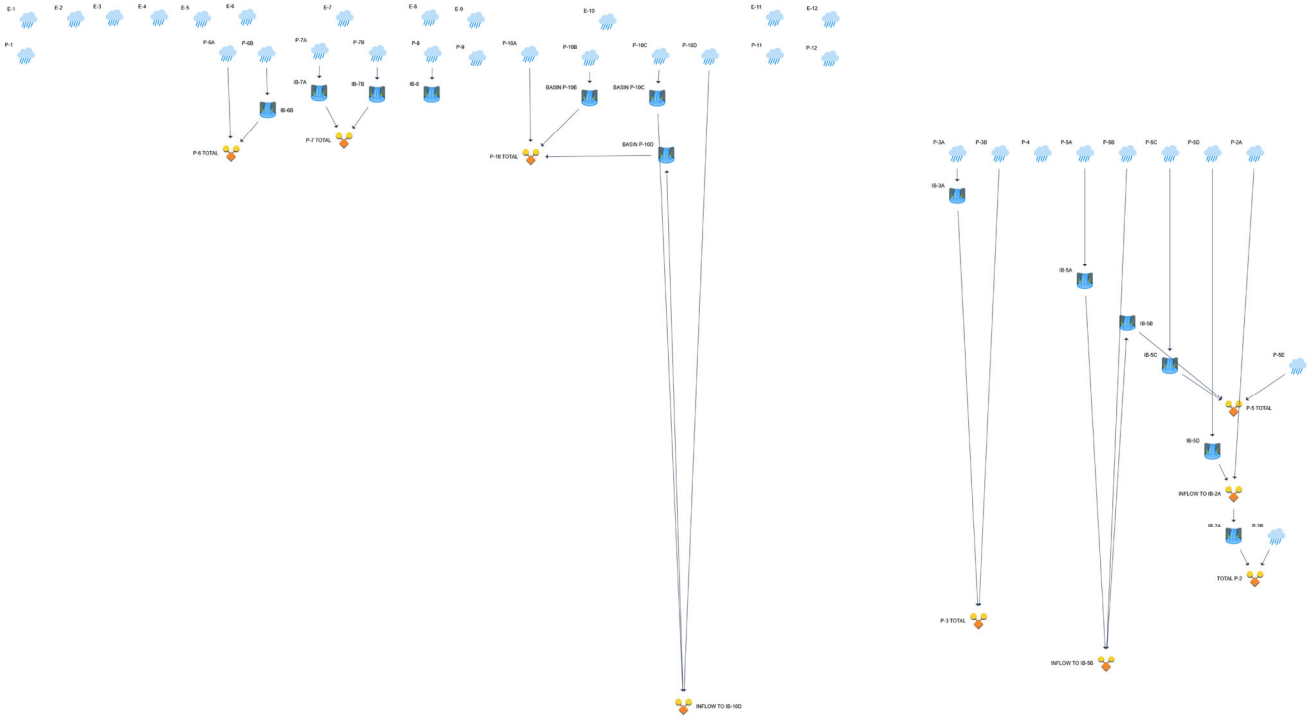
Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
37	Pond Route	IB-2A	6.729	12.57	26,751	36	230.94	32,449
38	NRCS Runoff	P-2B	67.68	12.23	312,703	----		
39	Junction	TOTAL P-2	72.51	12.27	339,453	37, 38		
41	NRCS Runoff	P-6A	0.369	12.47	3,333	----		
42	NRCS Runoff	P-6B	1.043	12.20	5,524	----		
43	Pond Route	IB-6B	0.000	19.87	0.000	42	219.15	1,446
44	Junction	P-6 TOTAL	0.369	12.47	3,333	41, 43		
46	NRCS Runoff	P-7A	10.38	12.17	41,342	----		
47	Pond Route	IB-7A	0.000	16.50	0.000	46	223.89	18,061
48	NRCS Runoff	P-7B	4.262	12.30	21,524	----		
49	Pond Route	IB-7B	0.000	20.83	0.000	48	226.79	8,198
50	Junction	P-7 TOTAL	0.000	16.50	0.000	47, 49		
52	NRCS Runoff	P-8	17.31	12.13	66,477	----		
53	Pond Route	IB-8	0.000	8.97	0.000	52	225.43	25,332
55	NRCS Runoff	P-9	24.96	12.27	118,462	----		
57	NRCS Runoff	P-10A	28.30	12.33	147,807	----		
58	NRCS Runoff	P-10B	15.50	12.13	60,282	----		
59	Pond Route	IB-10B	8.891	12.33	42,154	58	257.60	10,845
60	NRCS Runoff	P-10C	33.06	12.23	159,440	----		
61	Pond Route	IB-10C	11.70	12.63	88,306	60	231.41	43,013
62	NRCS Runoff	P-10D	27.02	12.10	95,454	----		
63	Junction	INFLOW TO IB-10D	36.44	12.10	183,760	61, 62		
64	Pond Route	IB-10D	19.89	12.33	85,240	63	229.65	46,089
65	Junction	P-10 TOTAL	57.08	12.33	275,201	57, 59, 64		
67	NRCS Runoff	P-11	29.80	12.33	156,090	----		
69	NRCS Runoff	P-12	0.021	12.43	303	----		

Basin Model

Hydrology Studio v 3.0.0.24

Project Name:

06-28-2022



SUMMARY TABLE **SM-3719C**

Project: Athens Street By PFK Date 6/26/22
Rev Date

Location: Stow, MA Checked Date

EXISTING	AREA	CN	TIME OF CONCENTRATION
E-1	0.16	30	10.0
E-2	42.22	56	17.2
E-3	10.35	71	22.4
E-4	10.30	71	21.3
E-5	12.89	65	20.3
E-6	2.25	38	21.4
E-7	6.51	32	19.0
E-8	0.68	30	19.6
E-9	9.07	67	21.3
E-10	25.93	67	20.4
E-11	10.89	67	30.0
E-12	0.22	30	8.6
Total	**131.47**		

PROPOSED	AREA	CN	TIME OF CONCENTRATION
P-1	0.16	30	10.0
P-2A	5.48	67	11.7
P-2B	32.20	55	17.0
P-3A	1.58	85	8.1
P-3B	8.82	71	13.4
P-4	7.88	71	10.2
P-5A	3.61	83	12.8
P-5B	3.27	82	14.2
P-5C	1.22	84	10.9
P-5D	2.09	81	6.7
P-5E	8.97	70	12.8
P-6A	1.37	34	19.6
P-6B	1.16	41	10.7
P-7A	3.97	56	10.2
P-7B	1.94	59	24.9
P-8	4.33	68	10.5
P-9	8.27	66	20.7
P-10A	9.41	70	28.6
P-10B	2.88	81	10.0
P-10C	7.56	82	20.4
P-10D	4.34	85	9.4
P-11	10.78	67	30.0
P-12	0.22	30	8.6
Total	**131.48**		

Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)		CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			0.16	4.80
A	Open Space	Good Condition	39			0.00	0.00
A	Brush	Fair	35			0.00	0.00
A	Gravel		76			0.00	0.00
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
B	Gravel		85			0.00	0.00
C	Woods	Good Condition	70			0.00	0.00
C	Open Space	Fair Condition	74			0.00	0.00
C	Gravel		89			0.00	0.00
1/ Use only one CN source per line.					Totals =	0.16	4.80

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4.80}{0.16} = 30.00$; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.09	0.09	0.38

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-1

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.082			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.16			0.16
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	32			
9. Watercourse slope, s		ft/ft	0.047			
10. Average Velocity, V (figure 3-1)		ft/s	3.50			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.0

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

P-1

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

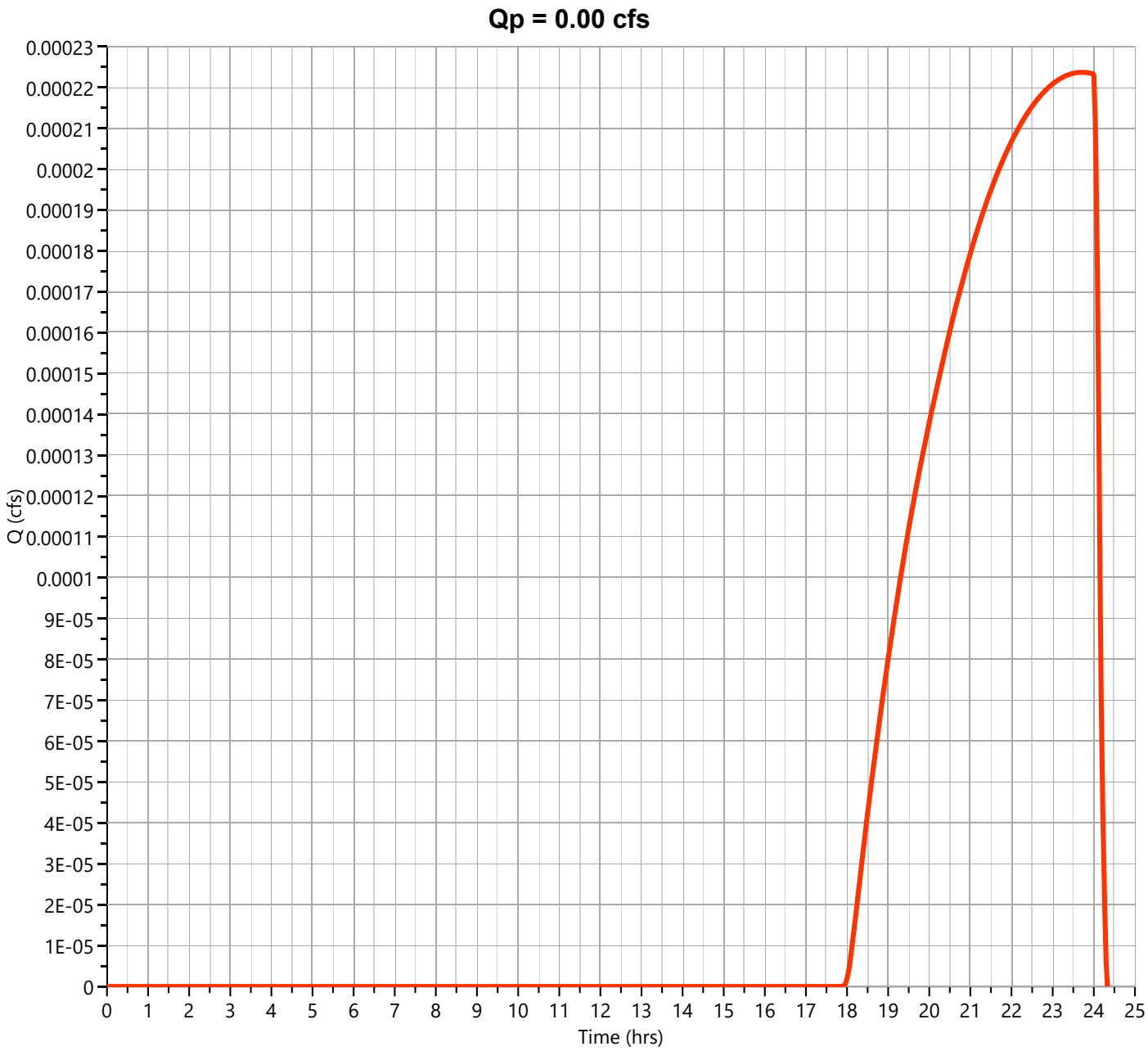
Hydrology Studio v 3.0.0.24

06-28-2022

P-1

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.73 hrs
Time Interval	= 2 min	Runoff Volume	= 3.52 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

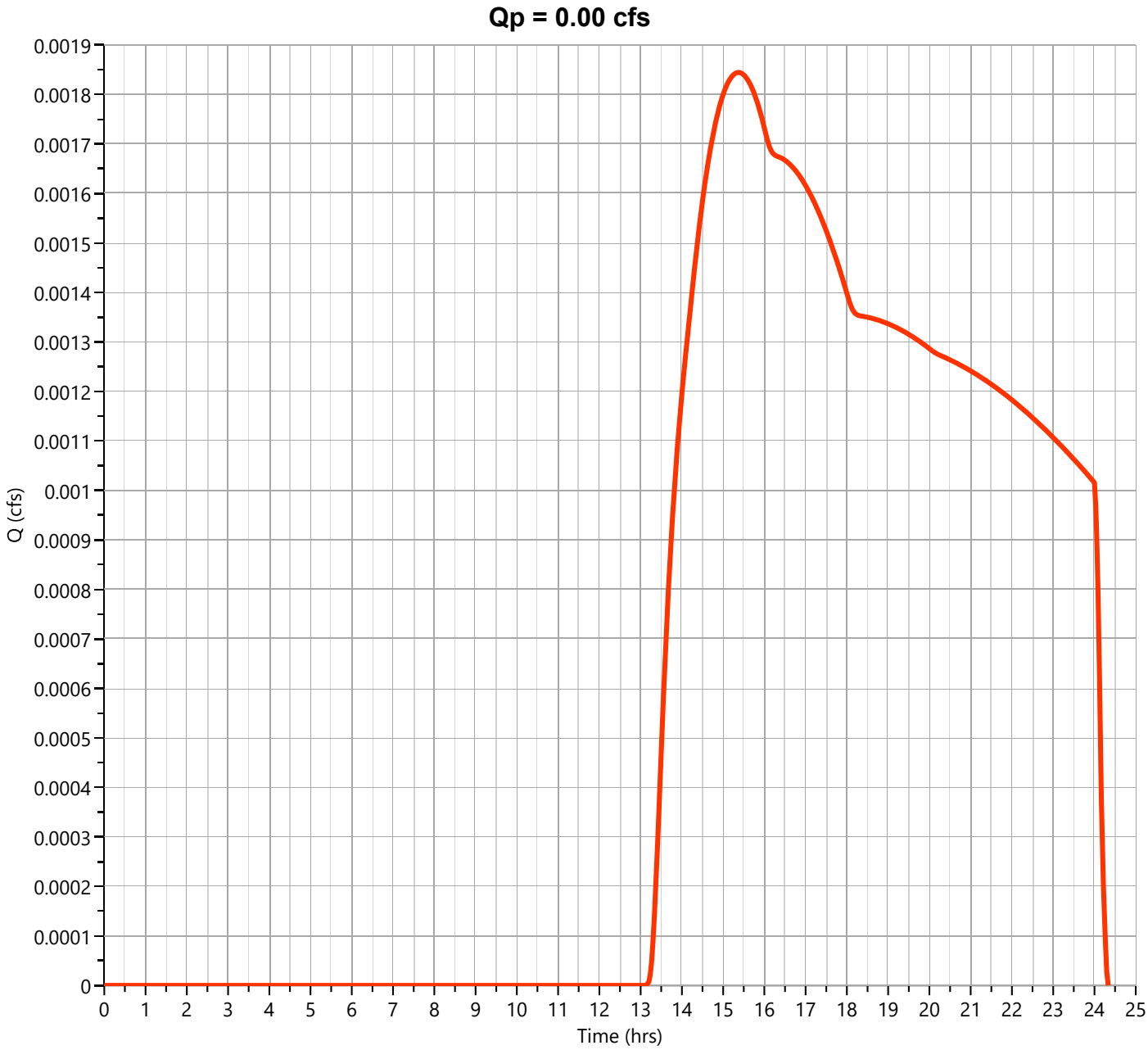
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06-28-2022

P-1

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.37 hrs
Time Interval	= 2 min	Runoff Volume	= 52.4 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

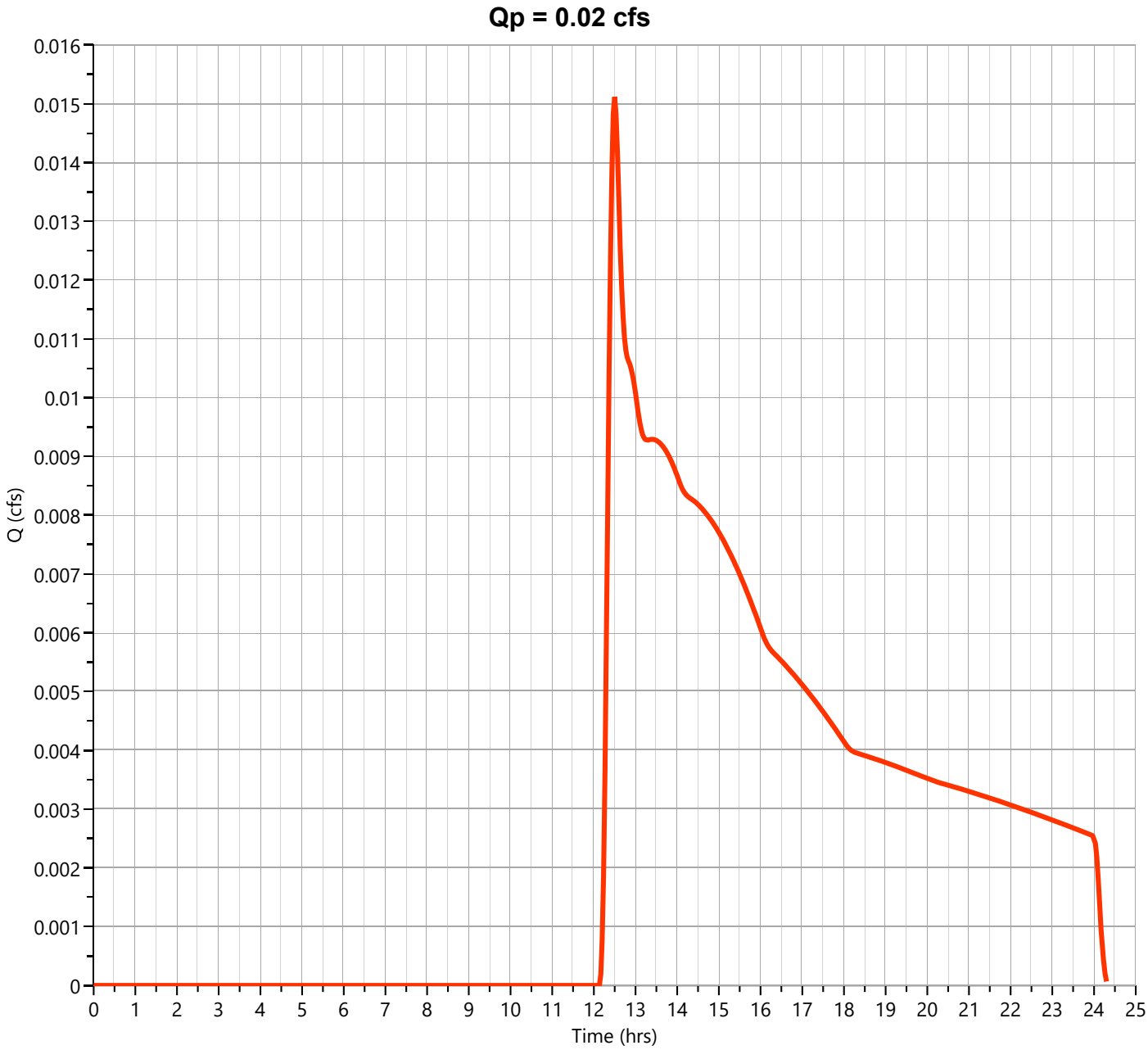
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06-28-2022

P-1

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.015 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Runoff Volume	= 228 cuft
Drainage Area	= 0.16 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By PFK Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-5D

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.03	100.68
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.18	7.06
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.10	6.71
C	Open Space Poor Condition	86			0.00	0.00
C	Open Space Good Condition	70			0.78	54.83
D	Open Space Good Condition	80			0.00	0.00
1/ Use only one CN source per line.		90928		Totals =	2.09	169.27

CN (weighted) = total product / total area = 169.27 / 2.09 = 81.09 ; Use CN = 81

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.53	4.02	5.60

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By PFK Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-5D

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	20			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.070			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.08			0.08
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	47	489		
9. Watercourse slope, s		ft/ft	0.150	0.07		
10. Average Velocity, V (figure 3-1)		ft/s	6.25	5.38		
11. Tt = L / 3600V	Compute Tt	hr	0.00	0.03		0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.11
min 6.7

Hydrograph Report

Project Name:

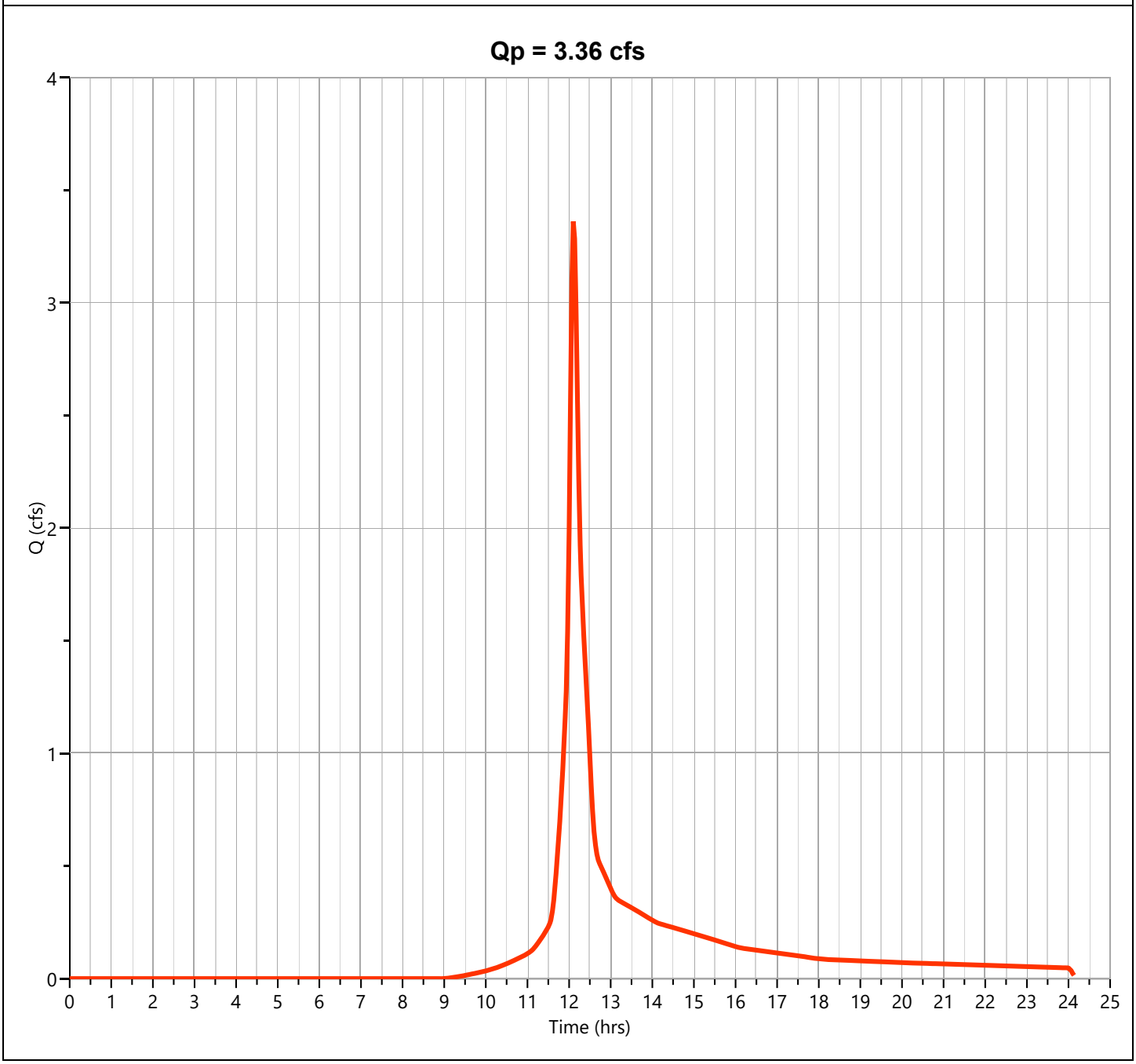
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06-28-2022

P-5D

Hyd. No. 33

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.361 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 11,564 cuft
Drainage Area	= 2.09 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 6.7 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

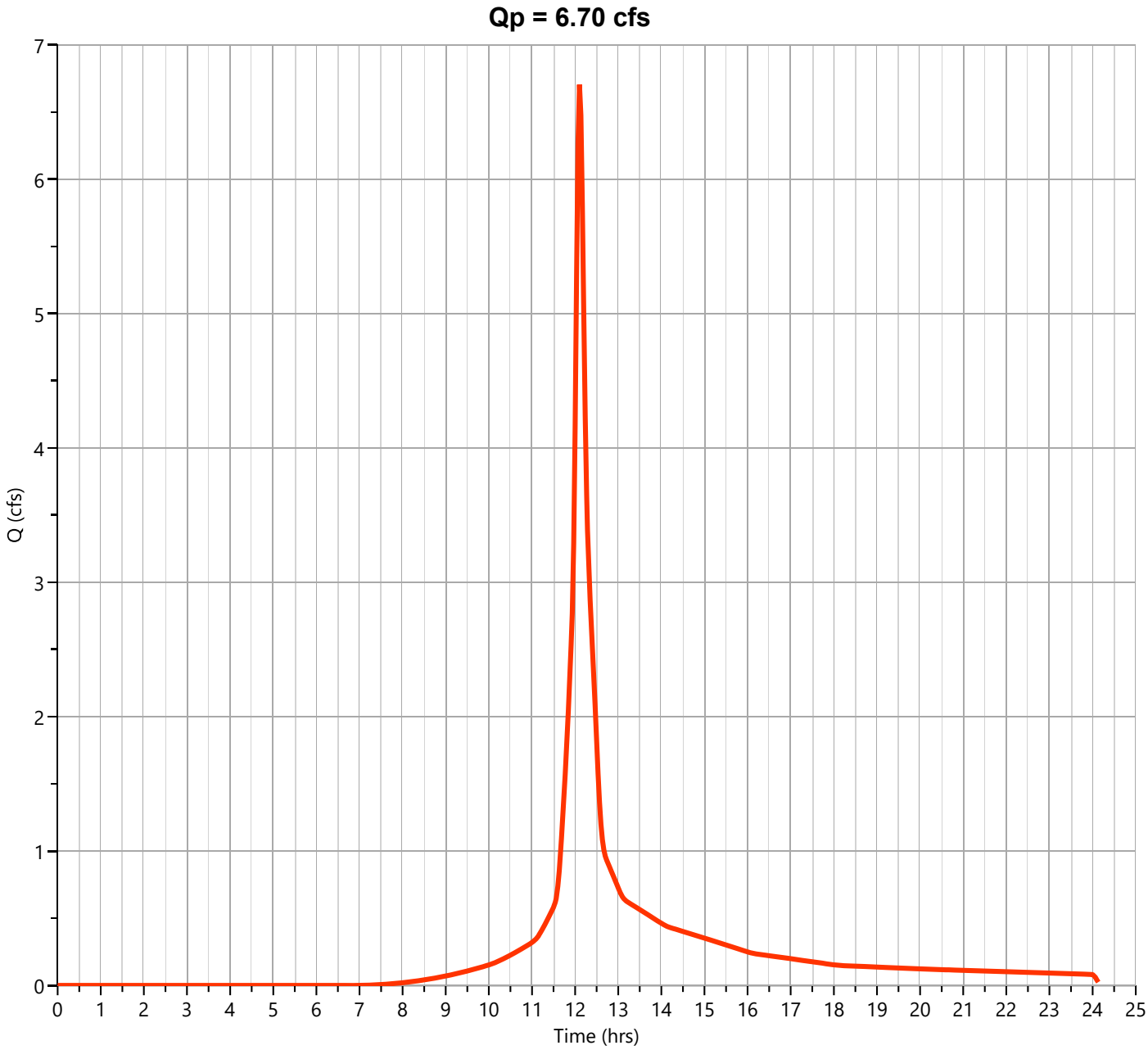
Hydrology Studio v 3.0.0.24

06-28-2022

P-5D

Hyd. No. 33

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.704 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 22,917 cuft
Drainage Area	= 2.09 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 6.7 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

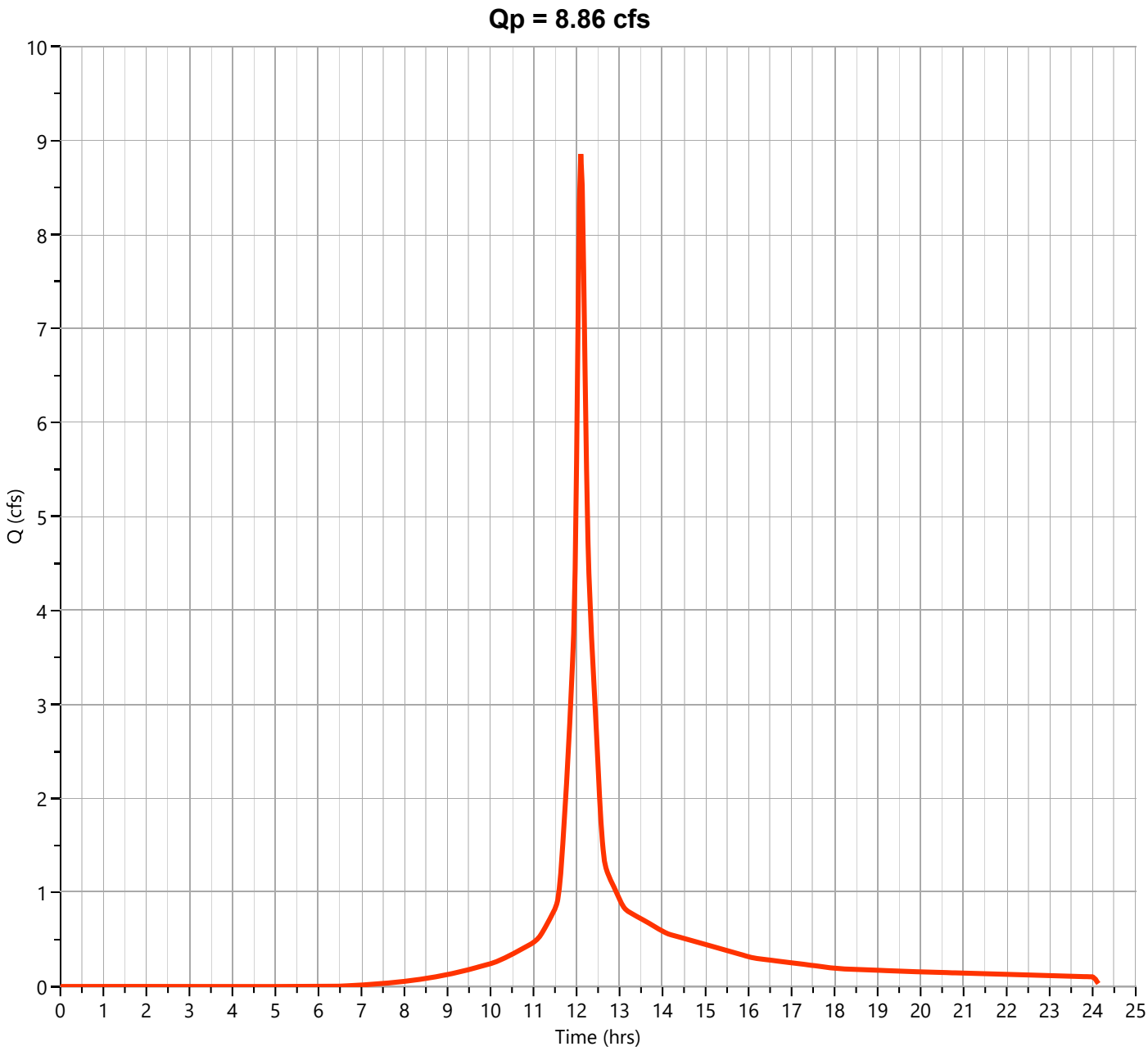
Hydrology Studio v 3.0.0.24

06-28-2022

P-5D

Hyd. No. 33

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.856 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 30,434 cuft
Drainage Area	= 2.09 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 6.7 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

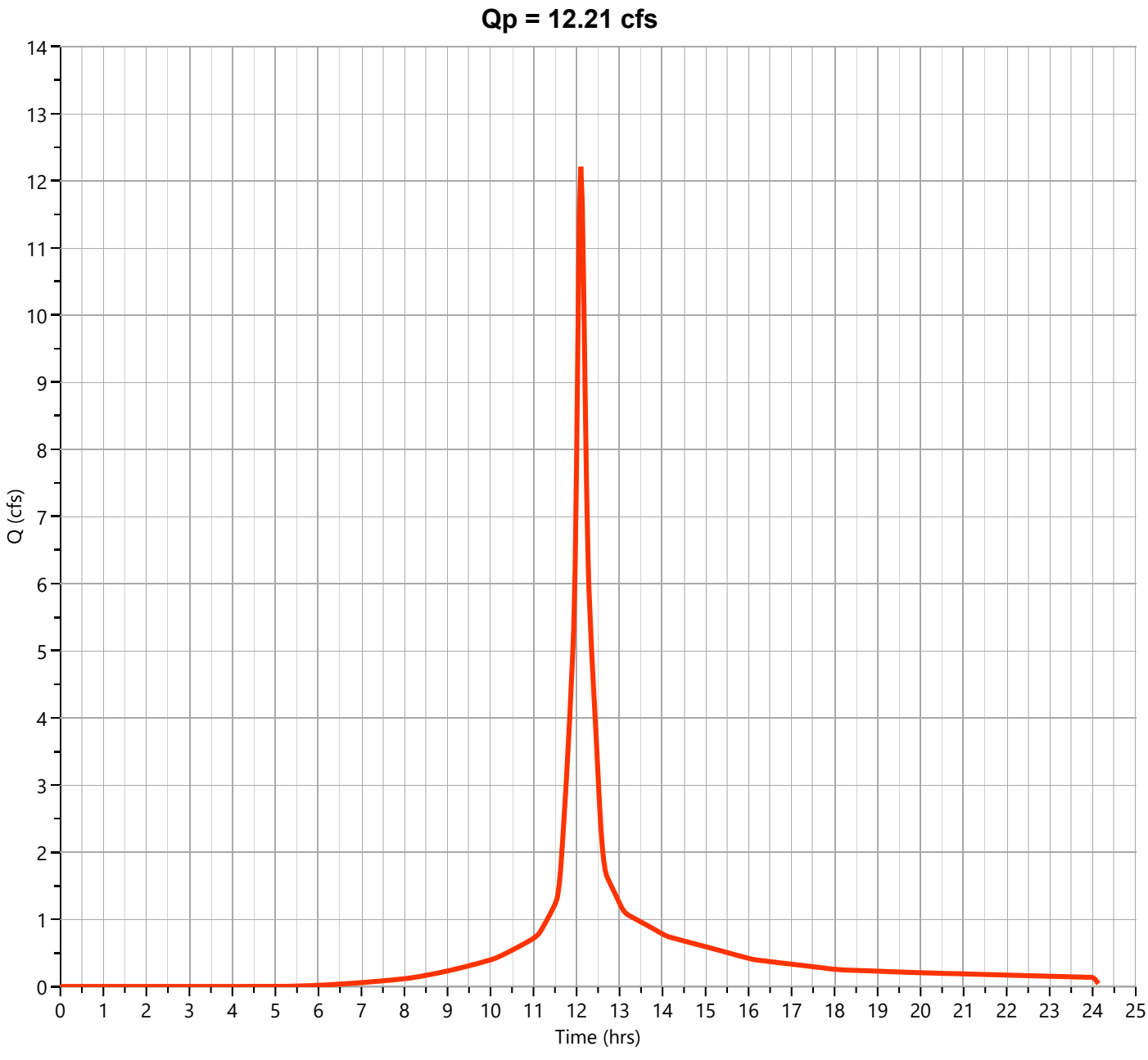
Hydrology Studio v 3.0.0.24

06-28-2022

P-5D

Hyd. No. 33

Hydrograph Type	= NRCS Runoff	Peak Flow	= 12.21 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 42,421 cuft
Drainage Area	= 2.09 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 6.7 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

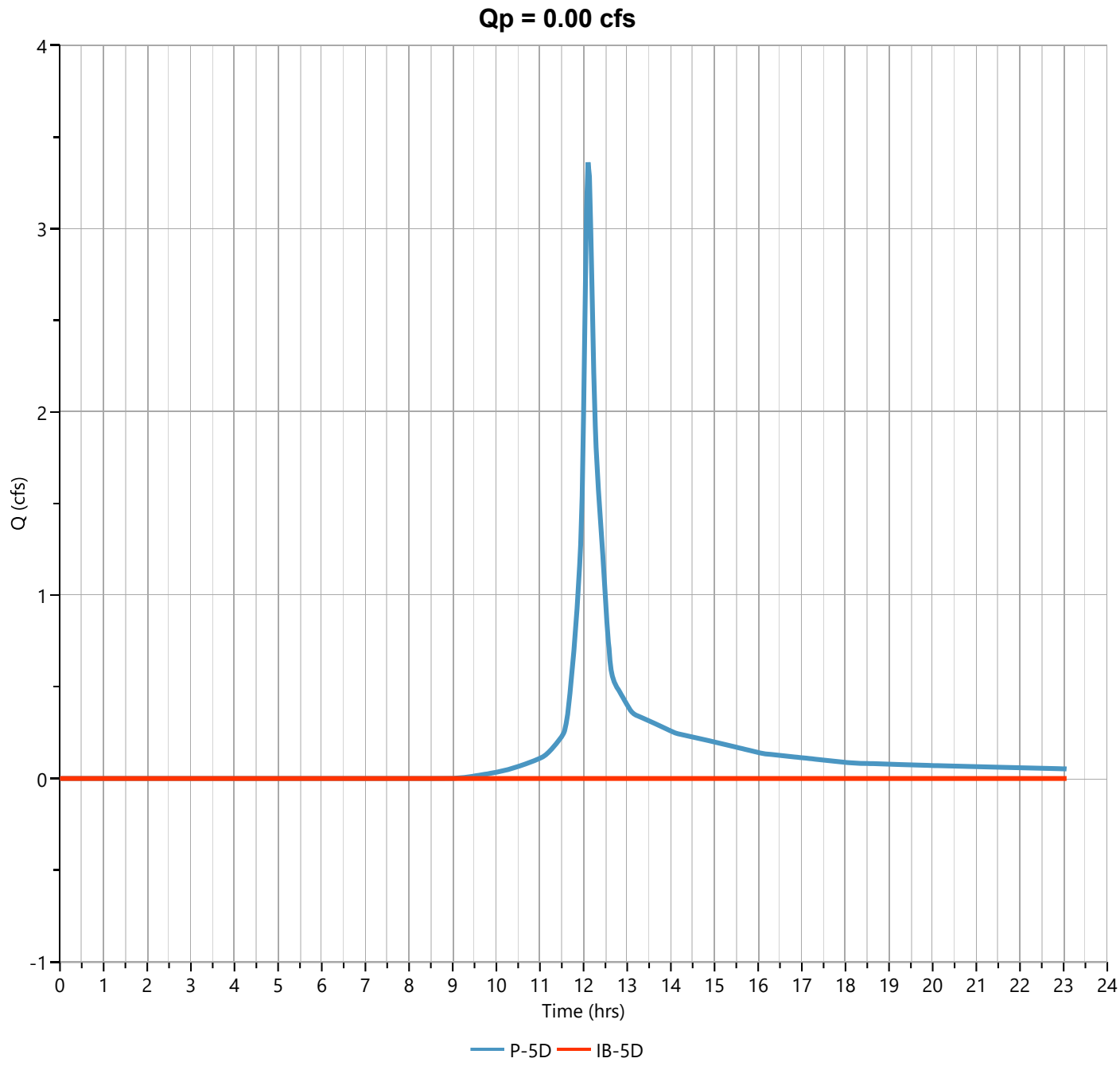
IB-5D

Hyd. No. 34

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 15.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.005 cuft
Inflow Hydrograph	= 33 - P-5D	Max. Elevation	= 231.81 ft
Pond Name	= IB-5D	Max. Storage	= 7,379 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.00 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

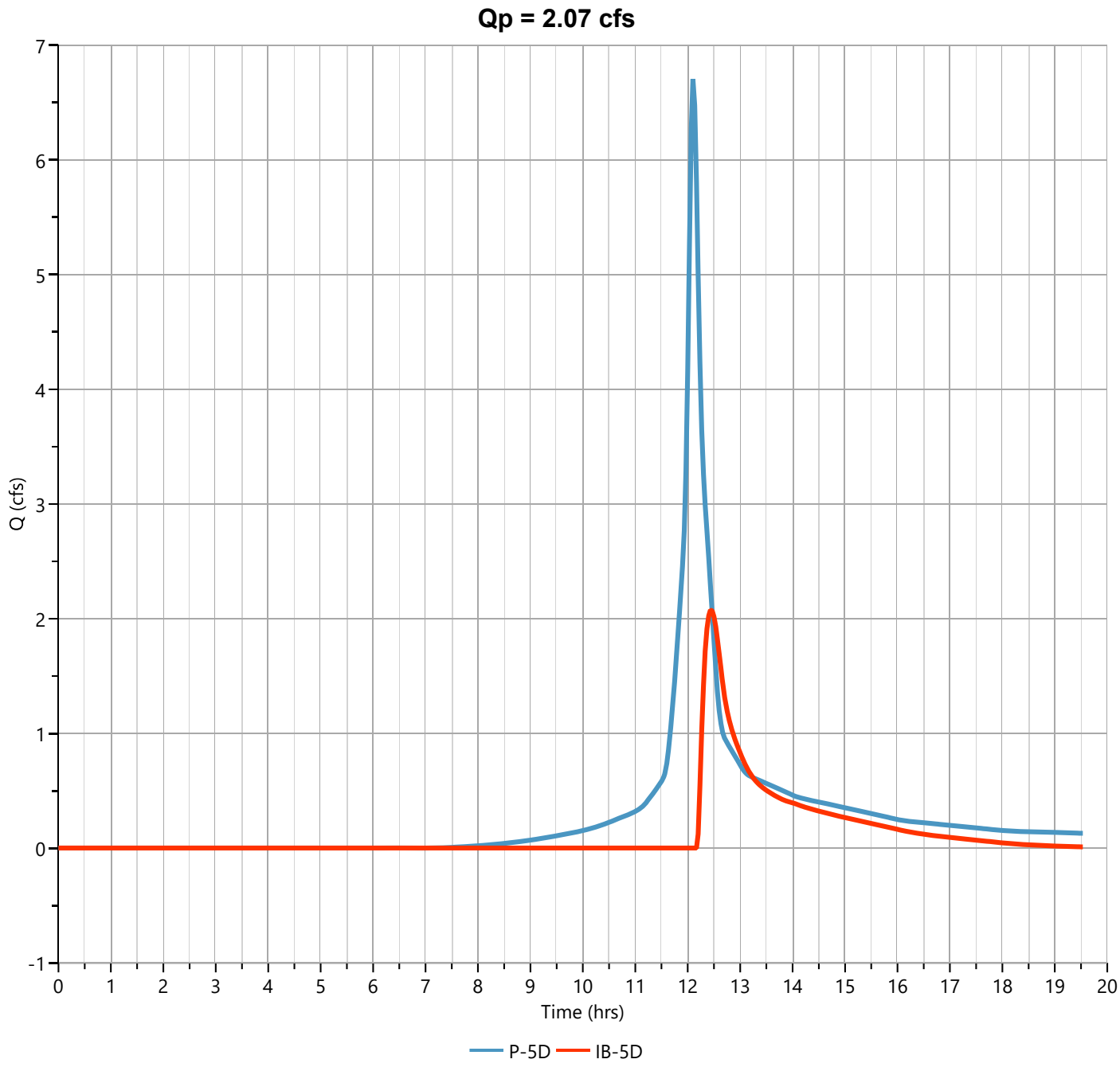
IB-5D

Hyd. No. 34

Hydrograph Type	= Pond Route	Peak Flow	= 2.074 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 8,715 cuft
Inflow Hydrograph	= 33 - P-5D	Max. Elevation	= 232.29 ft
Pond Name	= IB-5D	Max. Storage	= 9,947 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

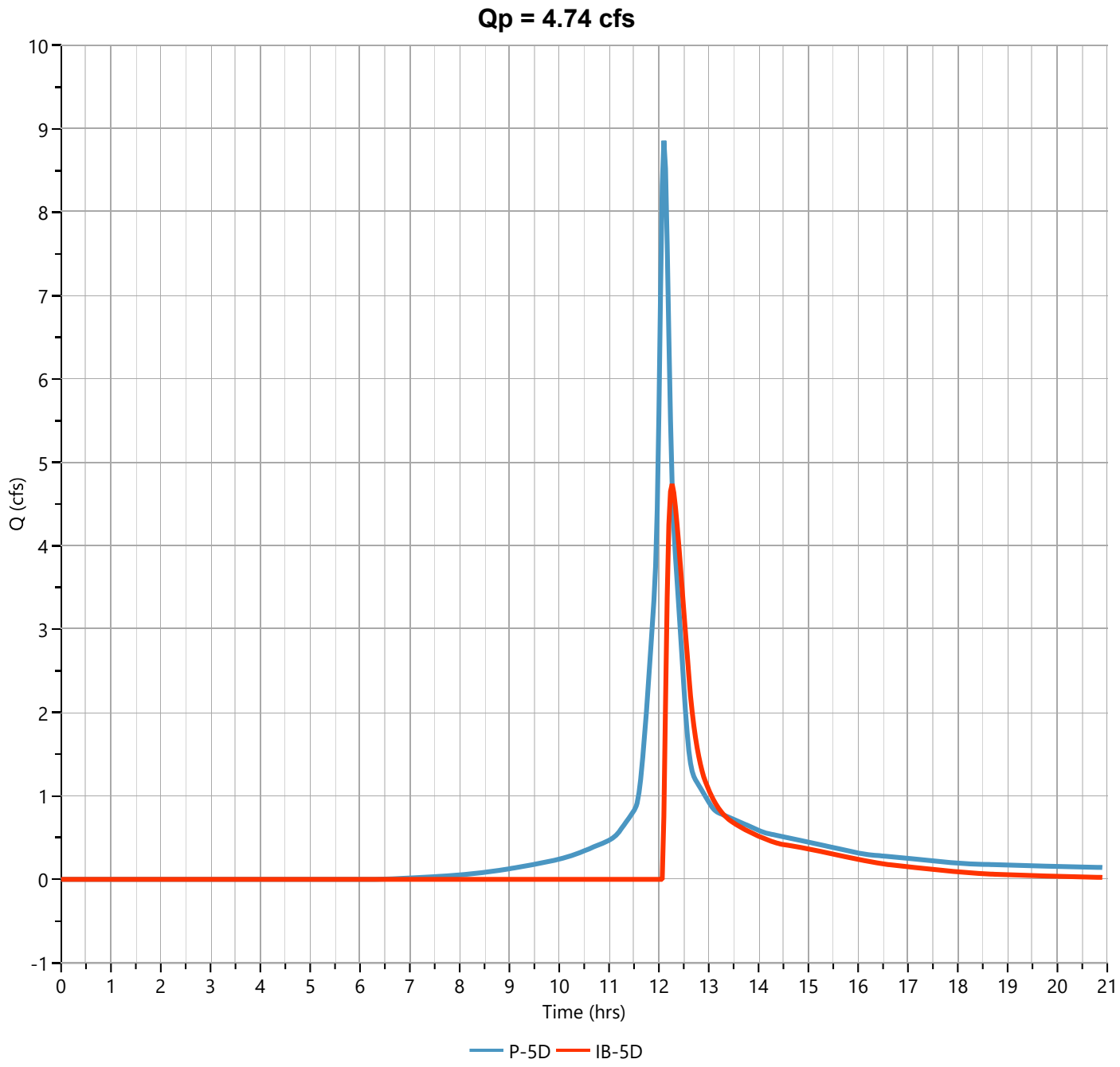
06-28-2022

IB-5D

Hyd. No. 34

Hydrograph Type	= Pond Route	Peak Flow	= 4.739 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,690 cuft
Inflow Hydrograph	= 33 - P-5D	Max. Elevation	= 232.51 ft
Pond Name	= IB-5D	Max. Storage	= 11,171 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

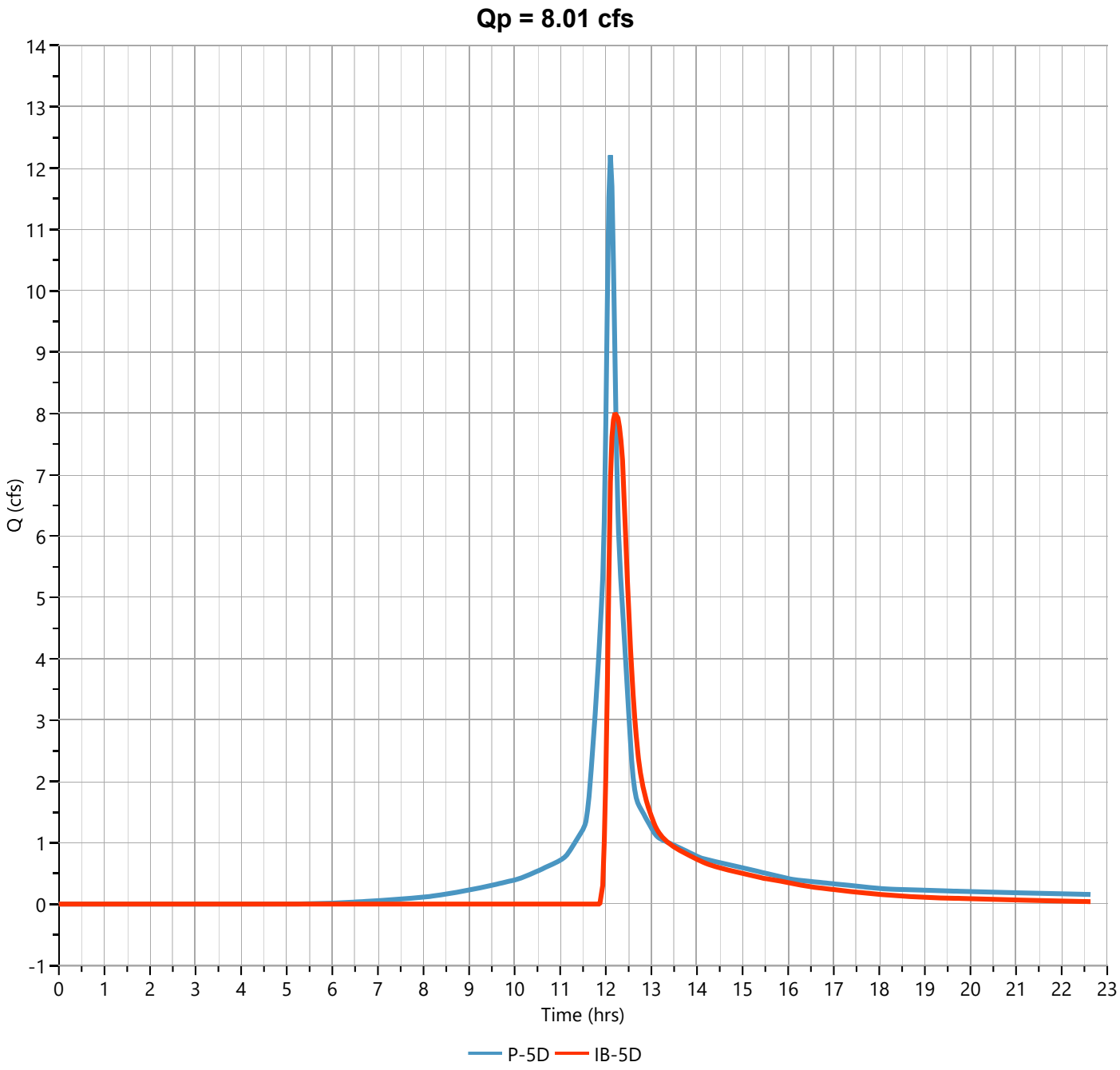
IB-5D

Hyd. No. 34

Hydrograph Type	= Pond Route	Peak Flow	= 8.009 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 27,189 cuft
Inflow Hydrograph	= 33 - P-5D	Max. Elevation	= 232.87 ft
Pond Name	= IB-5D	Max. Storage	= 13,186 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

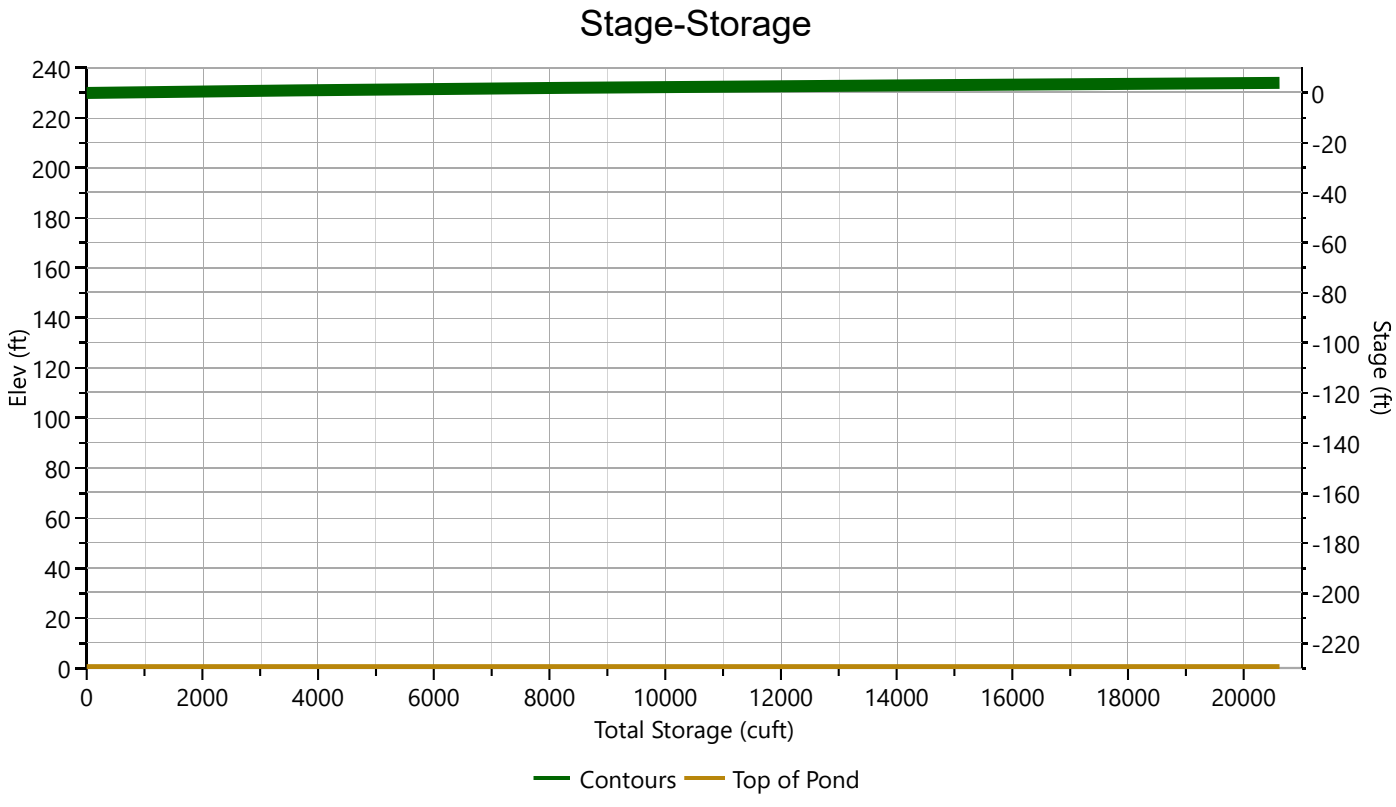
IB-5D

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	230.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	230.00	3,129	0.000	0.000
1.00	231.00	4,097	3,613	3,613
2.00	232.00	5,259	4,678	8,291
3.00	233.00	6,149	5,704	13,995
4.00	234.00	7,097	6,623	20,618



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

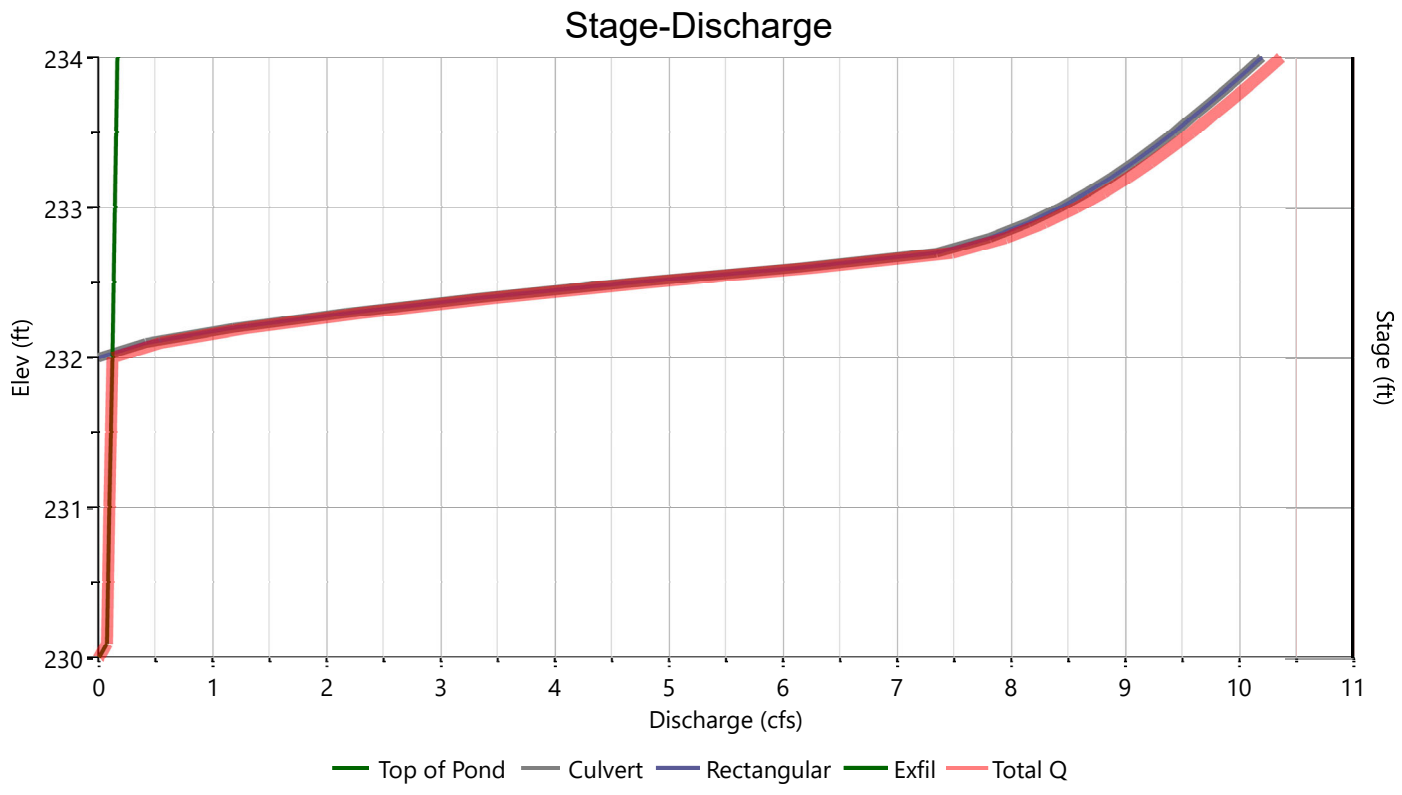
06-28-2022

IB-5D

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	15				Hole Diameter, in	
Span, in	15				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	230.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	99					
Barrel Slope, %	1					
N-Value, n	0.012					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1*	2	3		
Shape / Type	Circular	Rectangular			Exfiltration, in/hr	1.02**
Crest Elevation, ft		232				
Crest Length, ft		4				
Angle, deg						
Weir Coefficient, Cw		3.3				

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5D

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	230.00	0.000	0.000					0.000				0.000		0.000
1.00	231.00	3,613	0.000					0.000				0.097		0.097
2.00	232.00	8,291	0.000					0.000				0.124		0.124
3.00	233.00	13,995	8.425 oc					8.425 s				0.145		8.570
4.00	234.00	20,618	10.20 oc					10.20 s				0.168		10.36

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

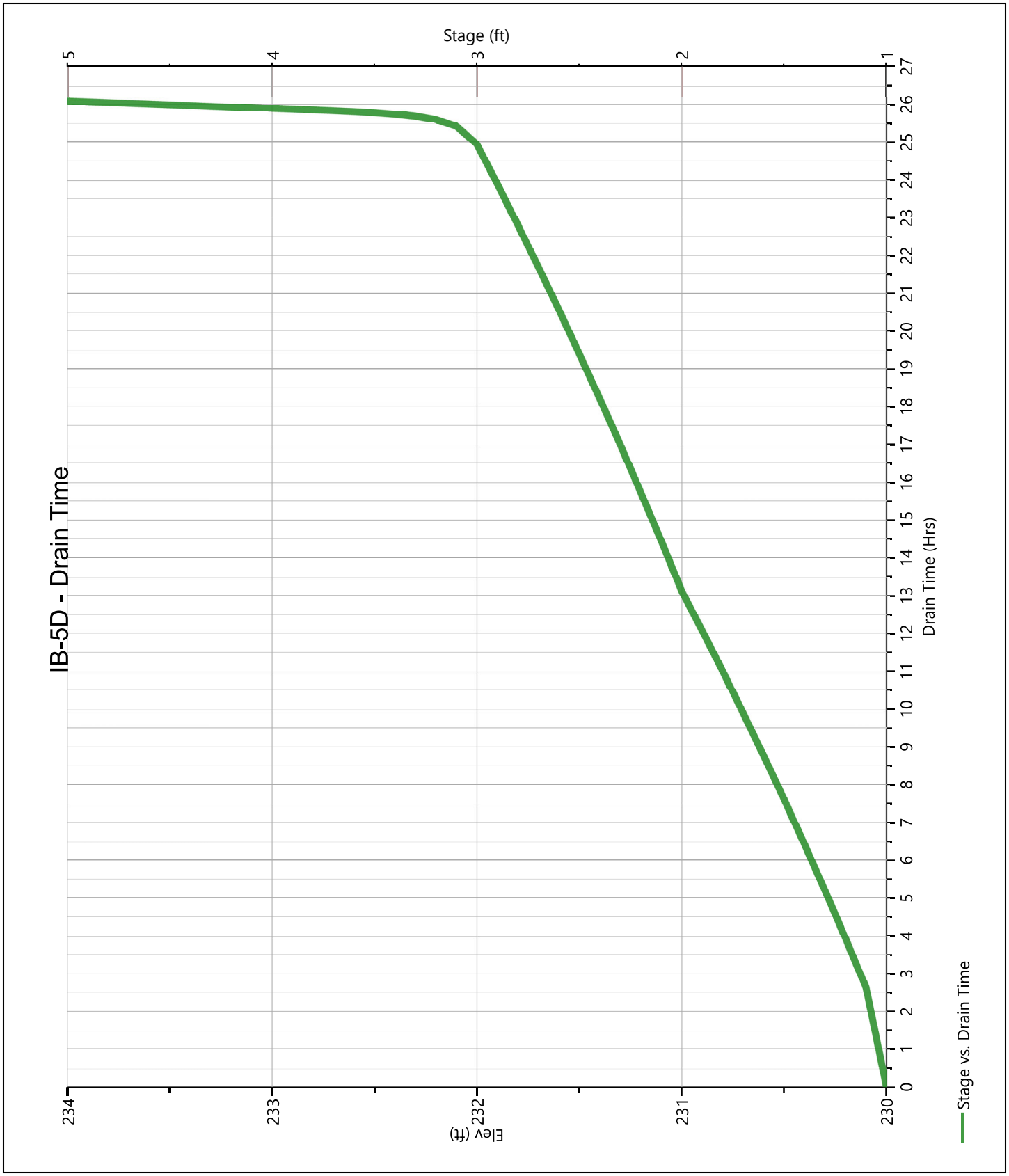
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5D

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By PFK Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-2A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.13	110.64
A	Woods Good Condition	30			0.15	4.61
A	Open Space Good Condition	39			2.19	85.27
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.71	49.70
C	Open Space Poor Condition	86			0.00	0.00
C	Open Space Good Condition	89			1.30	115.49
1/ Use only one CN source per line.		238557		Totals =	5.48	365.70

CN (weighted) = total product / total area = 365.70 / 5.48 = 66.78 ; Use CN = 67

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.71	2.62	3.96

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By PFK Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed Subcatchment P-2A
Circle one: Tc | Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.010			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.18			0.18
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	124			
9. Watercourse slope, s		ft/ft	0.032	0.013		
10. Average Velocity, V (figure 3-1)		ft/s	2.89	2.32		
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.00		0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.20
min 11.7

Hydrograph Report

Project Name:

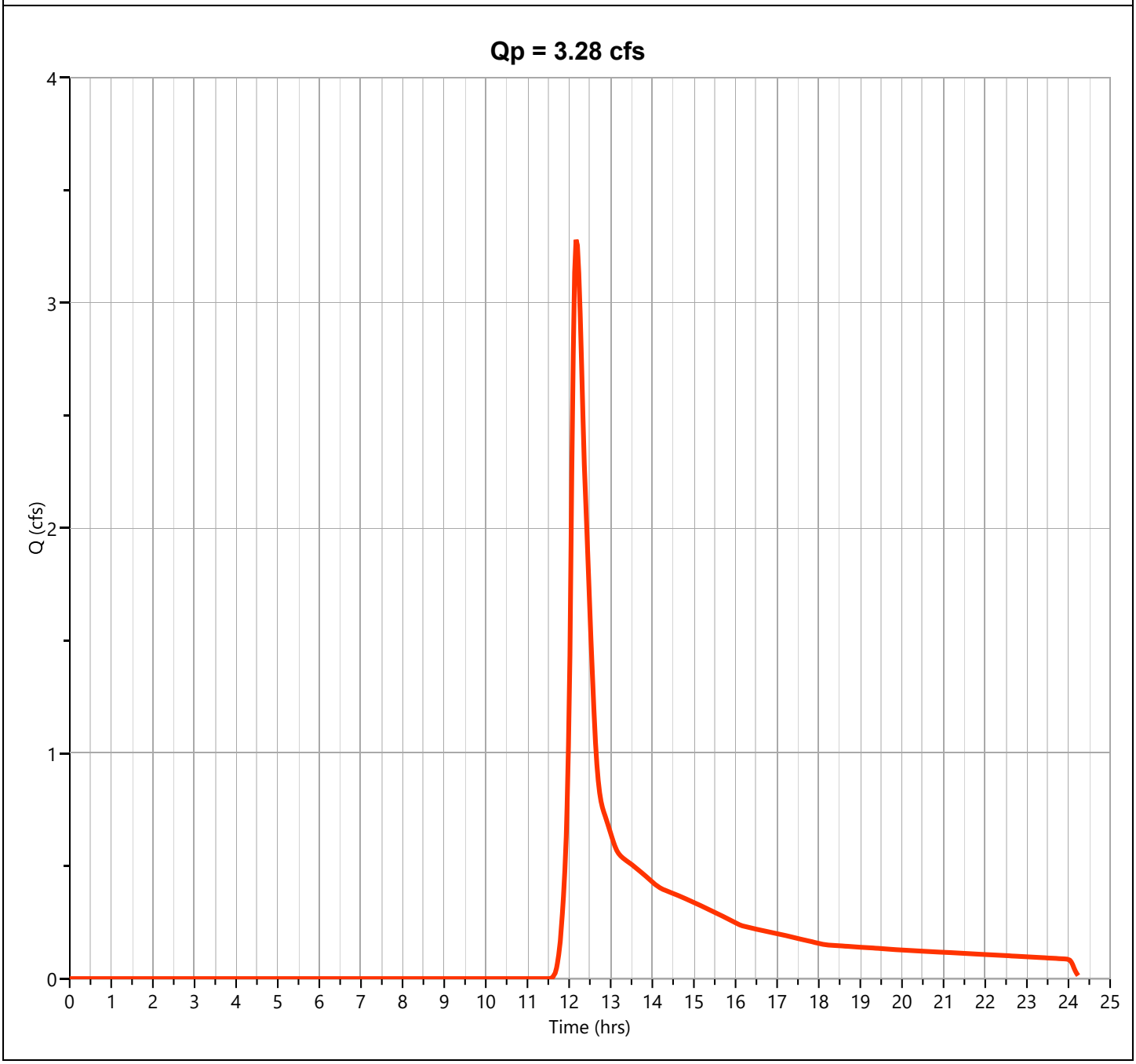
Hydrology Studio v 3.0.0.24

06-28-2022

P-2A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.280 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 14,854 cuft
Drainage Area	= 5.48 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 11.7 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

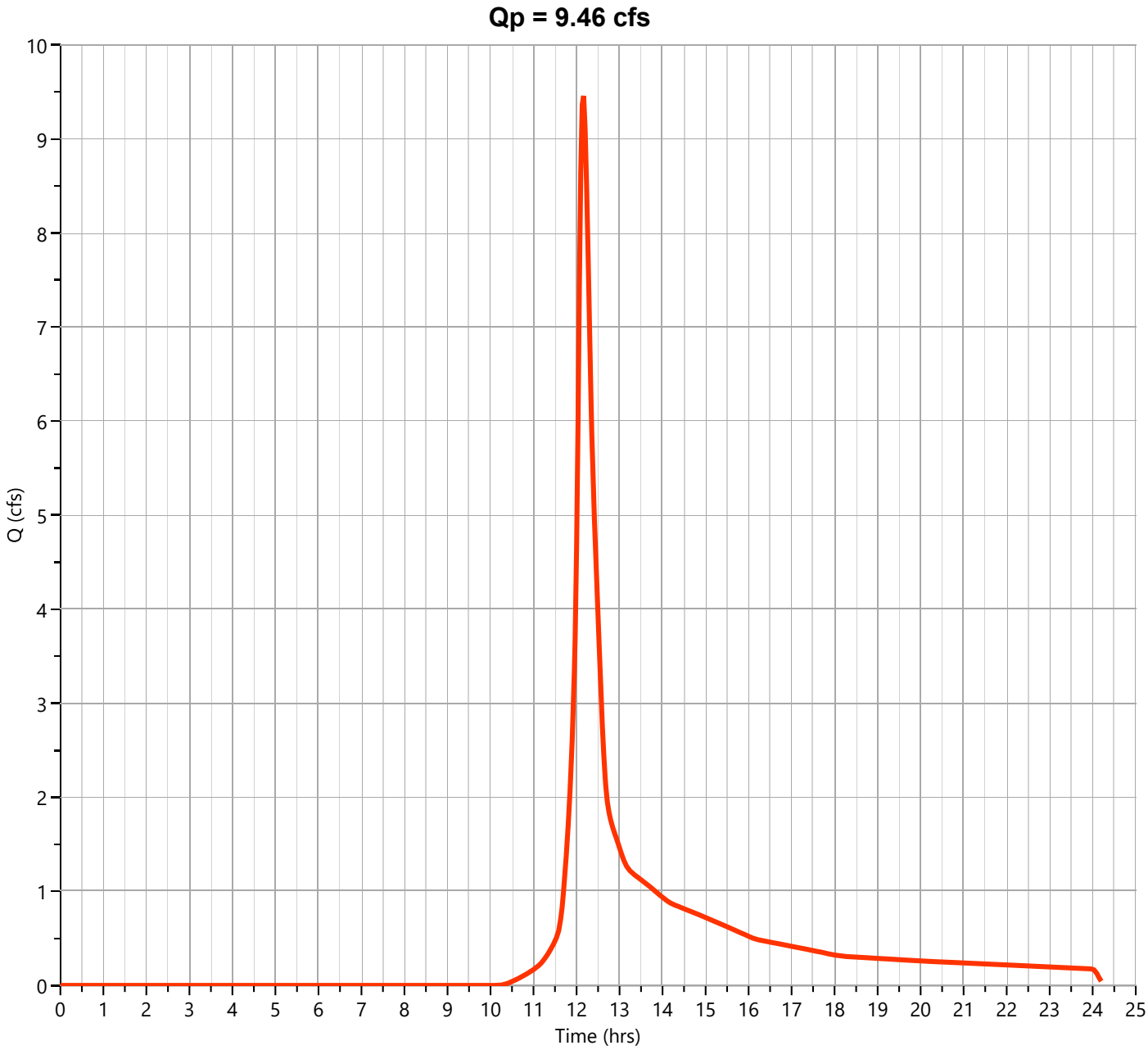
Hydrology Studio v 3.0.0.24

06-28-2022

P-2A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.459 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 37,560 cuft
Drainage Area	= 5.48 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 11.7 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

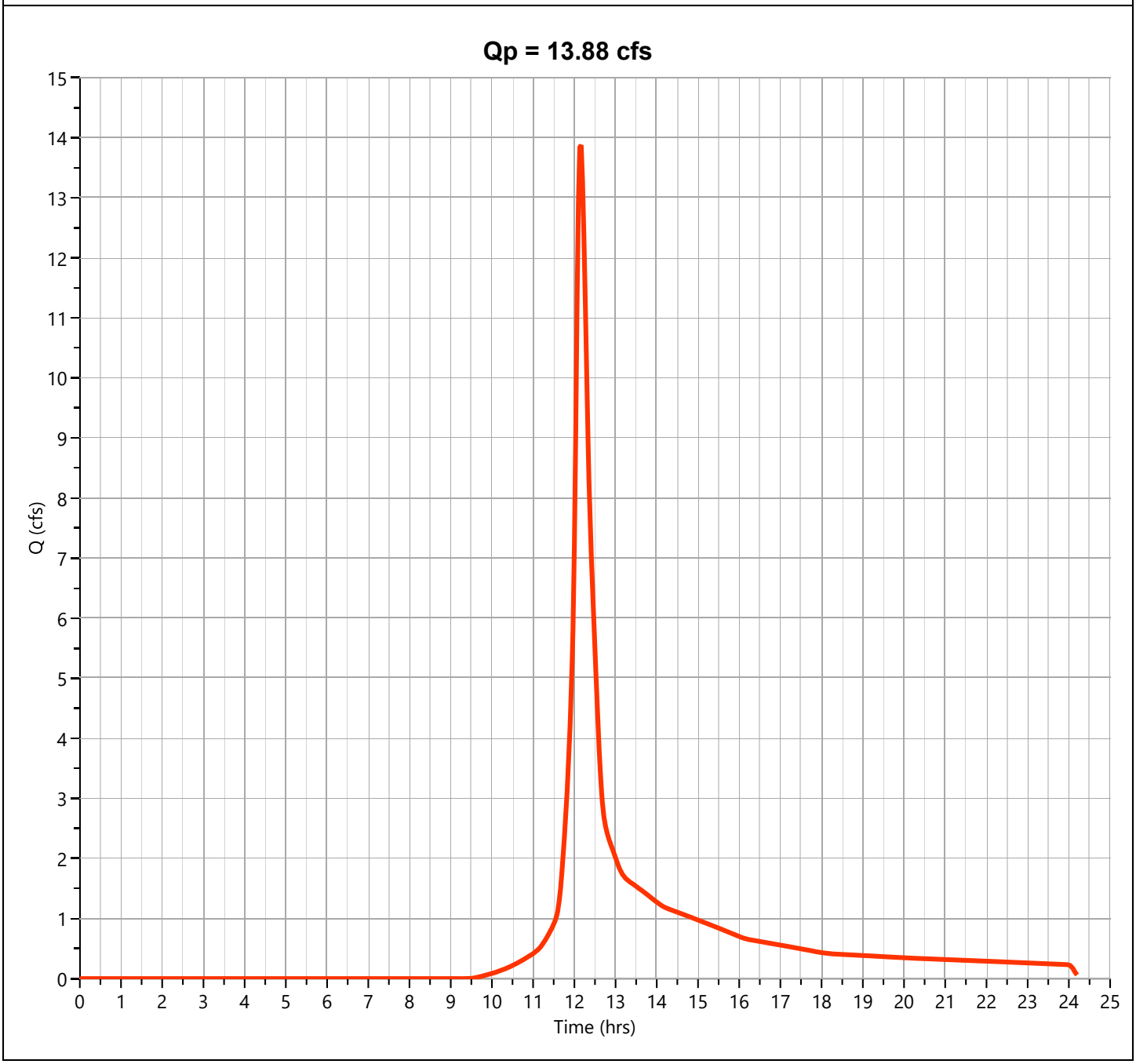
Hydrology Studio v 3.0.0.24

06-28-2022

P-2A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.88 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 54,078 cuft
Drainage Area	= 5.48 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 11.7 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

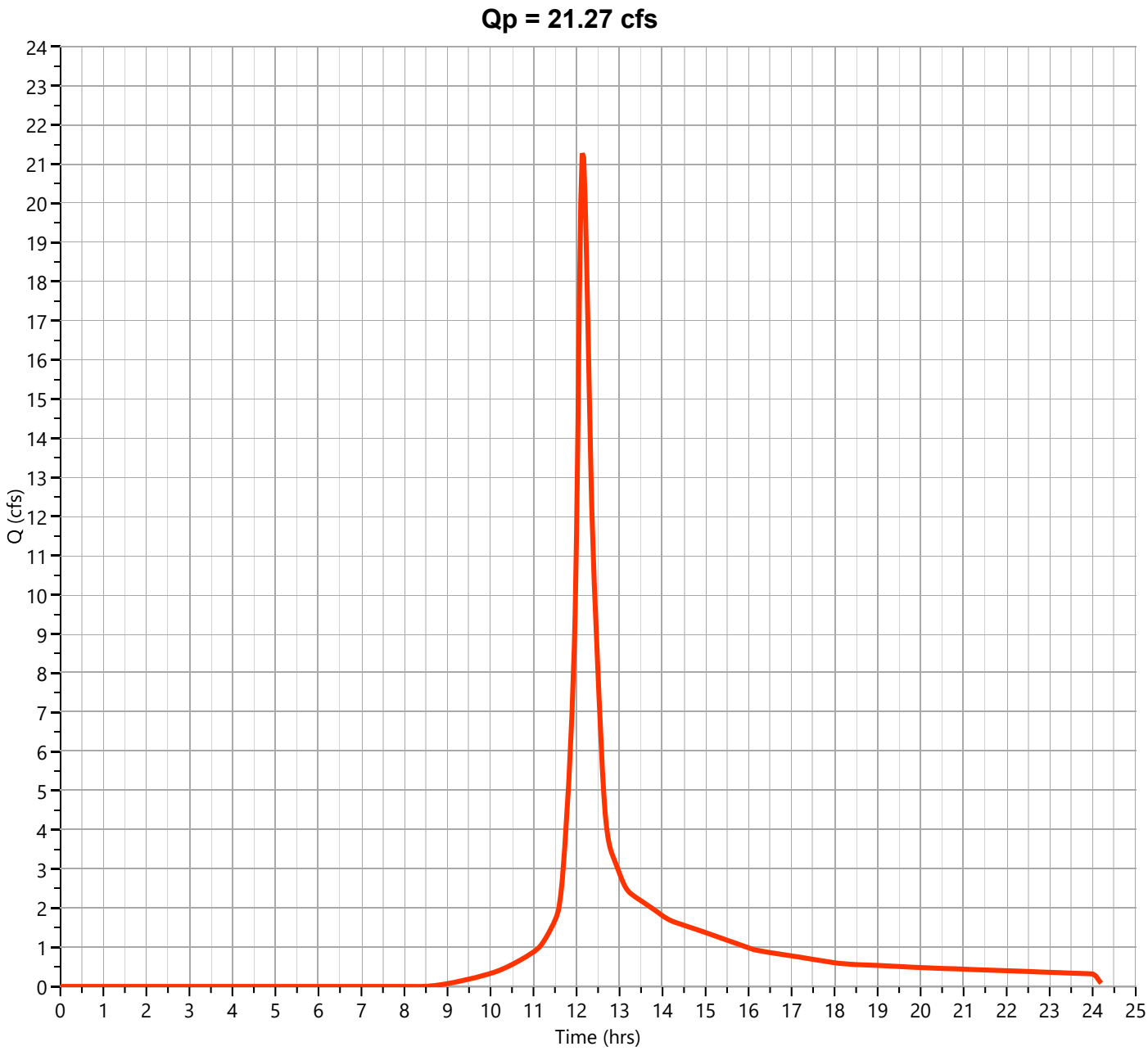
Hydrology Studio v 3.0.0.24

06-28-2022

P-2A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 21.27 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 81,828 cuft
Drainage Area	= 5.48 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 11.7 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

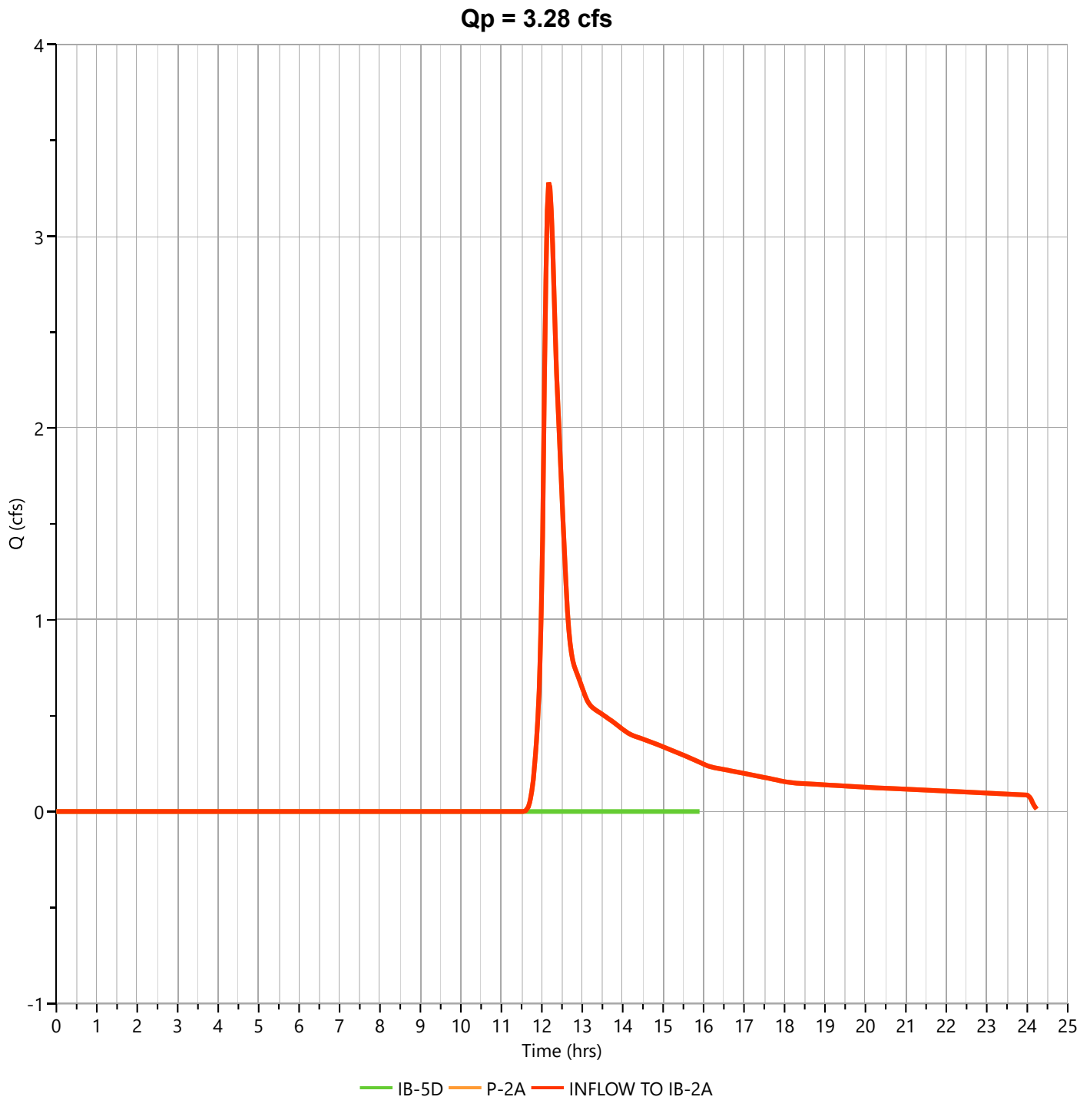
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06-28-2022

INFLOW TO IB-2A

Hyd. No. 36

Hydrograph Type	= Junction	Peak Flow	= 3.280 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 14,854 cuft
Inflow Hydrographs	= 34, 35	Total Contrib. Area	= 5.48 ac



Hydrograph Report

Project Name:

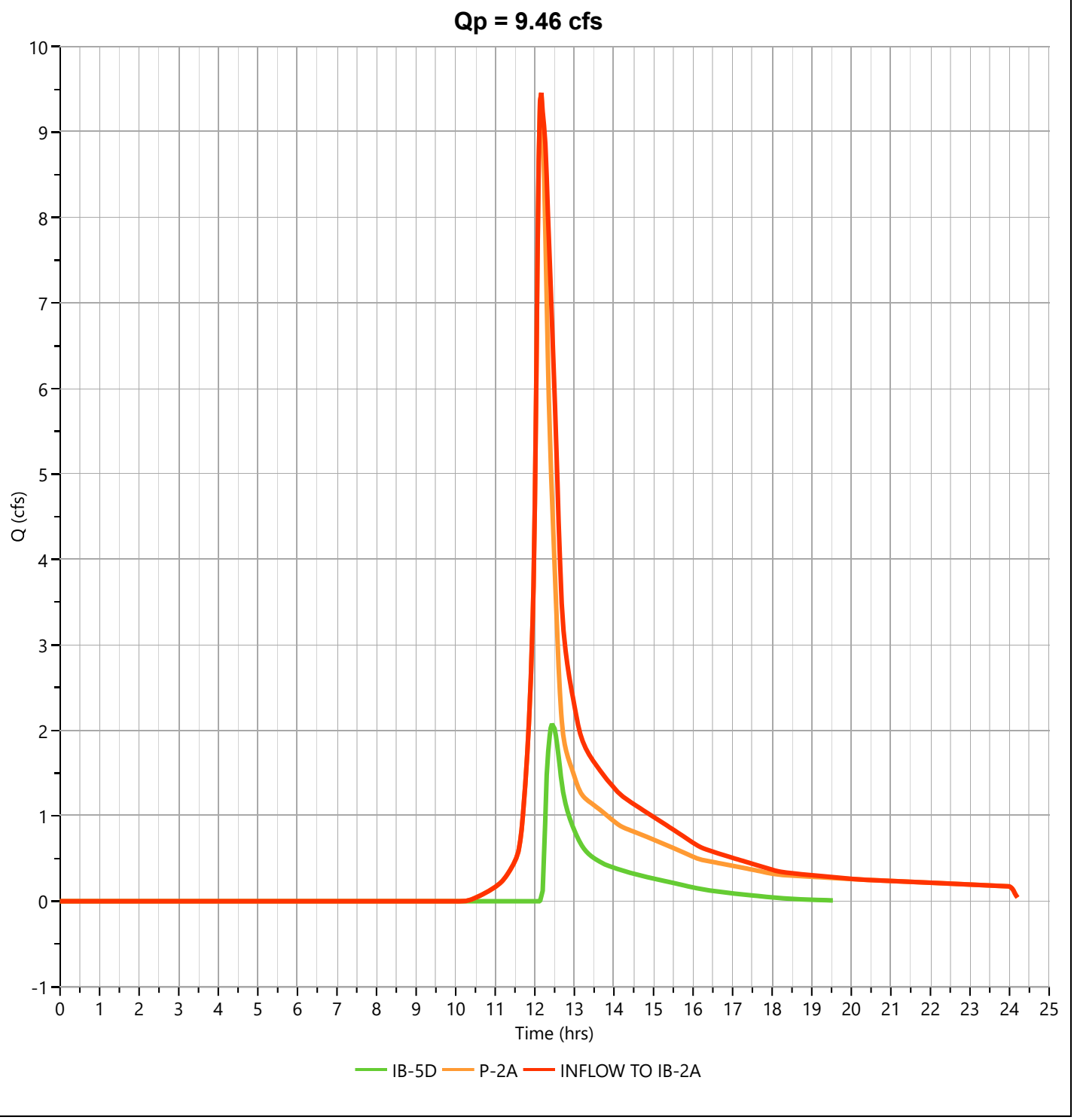
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-2A

Hyd. No. 36

Hydrograph Type	= Junction	Peak Flow	= 9.459 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 46,275 cuft
Inflow Hydrographs	= 34, 35	Total Contrib. Area	= 5.48 ac



Hydrograph Report

Project Name:

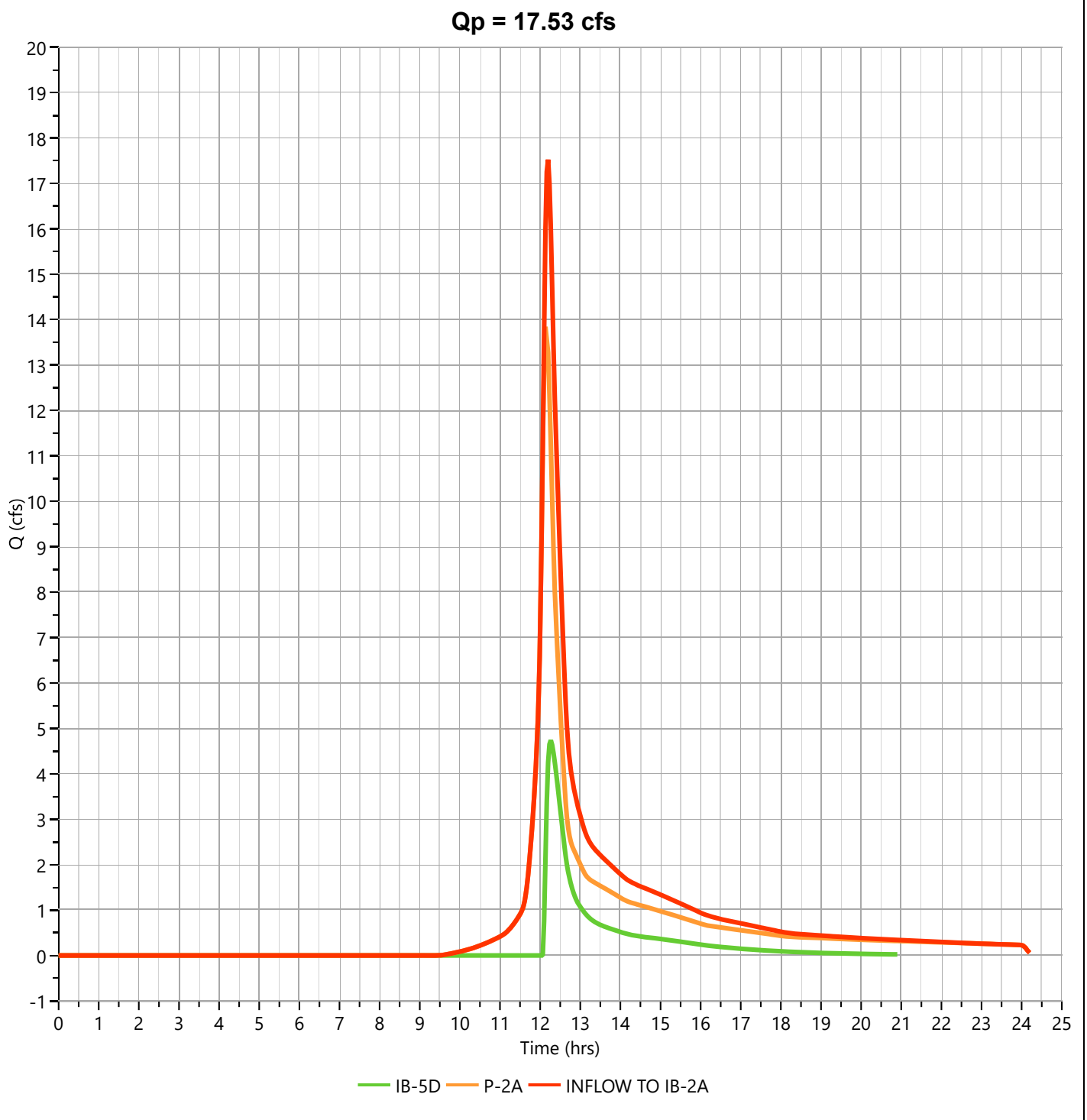
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-2A

Hyd. No. 36

Hydrograph Type	= Junction	Peak Flow	= 17.53 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 69,768 cuft
Inflow Hydrographs	= 34, 35	Total Contrib. Area	= 5.48 ac



Hydrograph Report

Project Name:

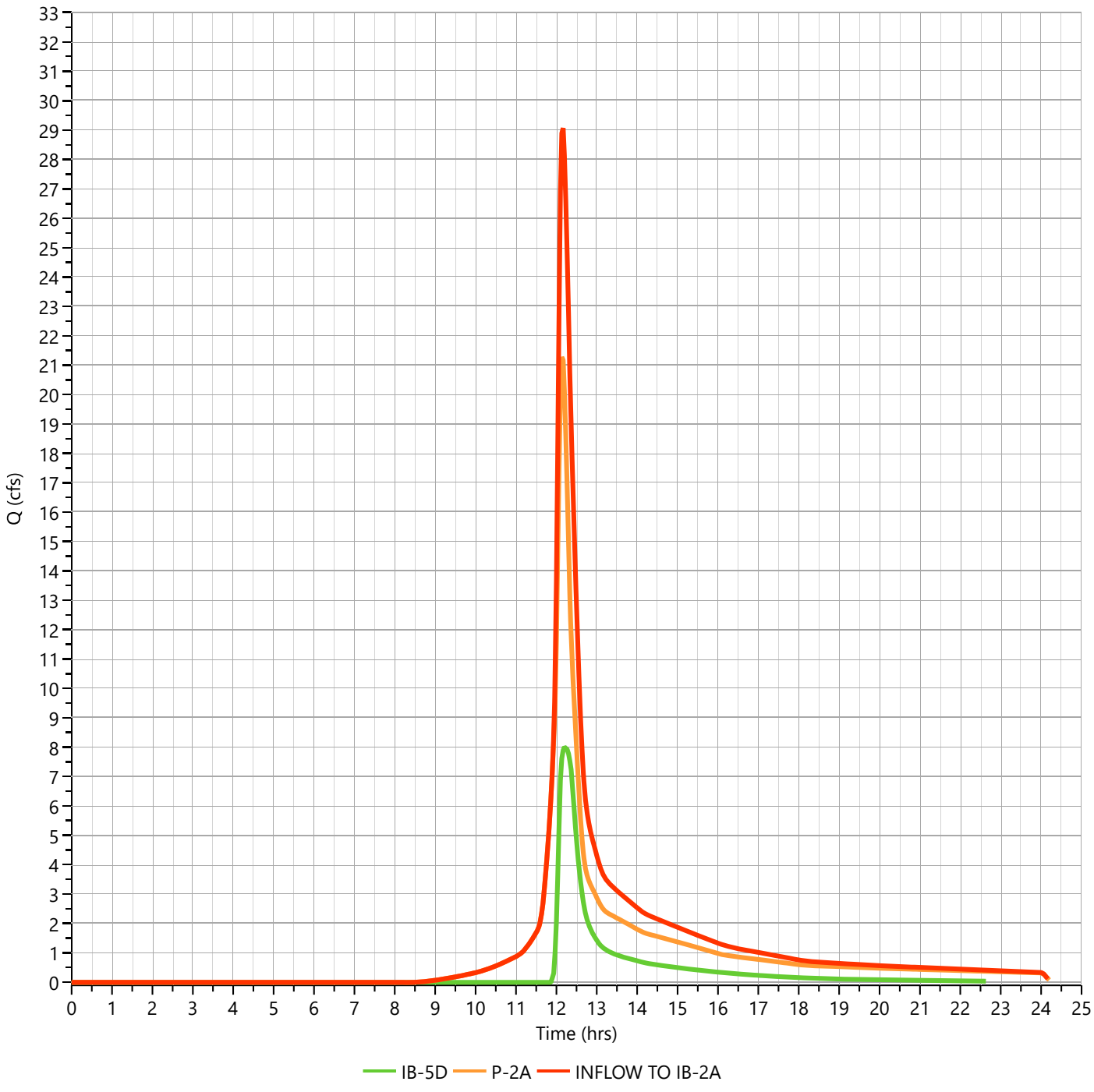
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-2A

Hyd. No. 36

Hydrograph Type	= Junction	Peak Flow	= 29.06 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 109,017 cuft
Inflow Hydrographs	= 34, 35	Total Contrib. Area	= 5.48 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

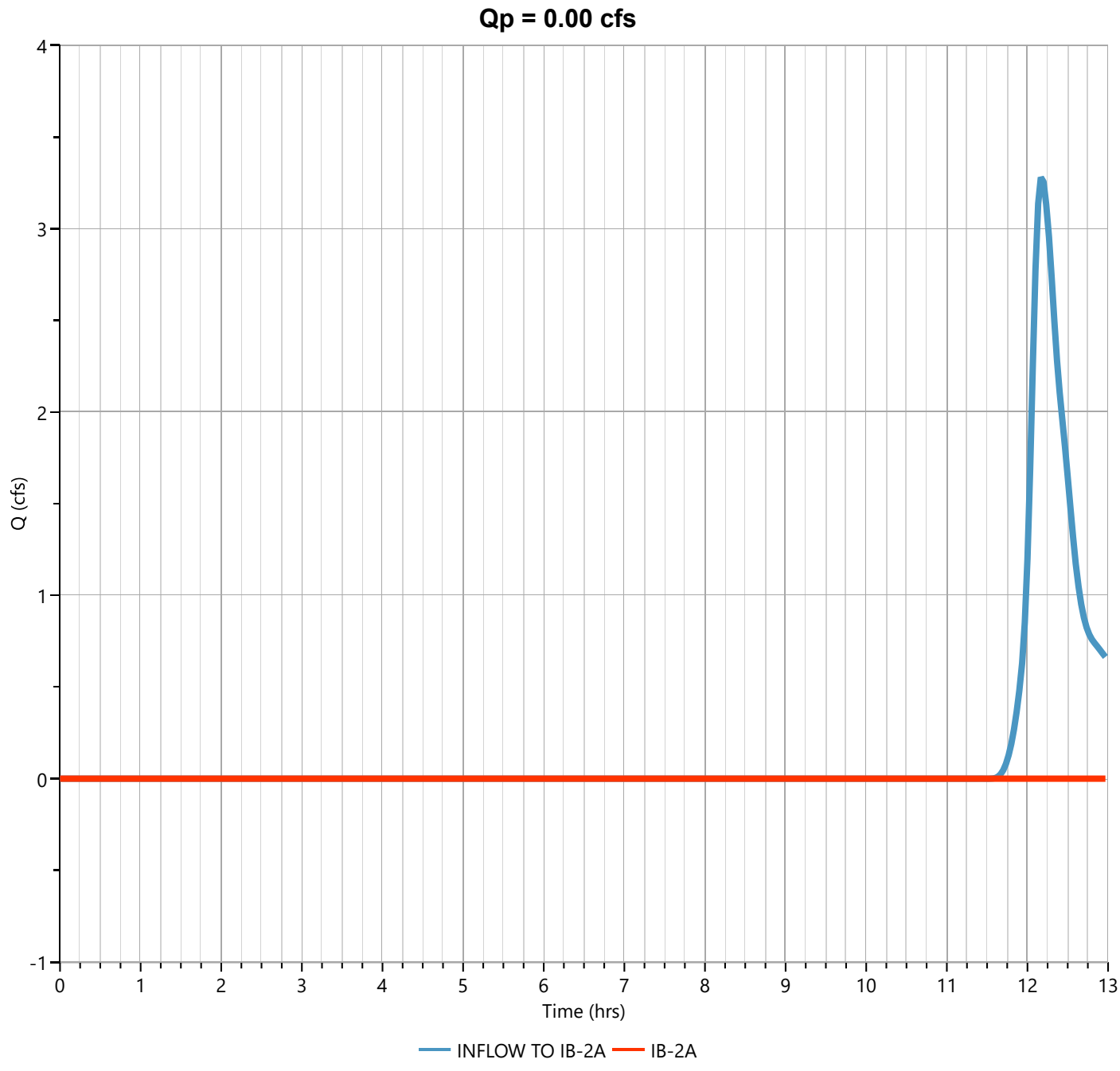
06-28-2022

IB-2A

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - INFLOW TO IB-2A	Max. Elevation	= 229.10 ft
Pond Name	= IB-2A	Max. Storage	= 1,461 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

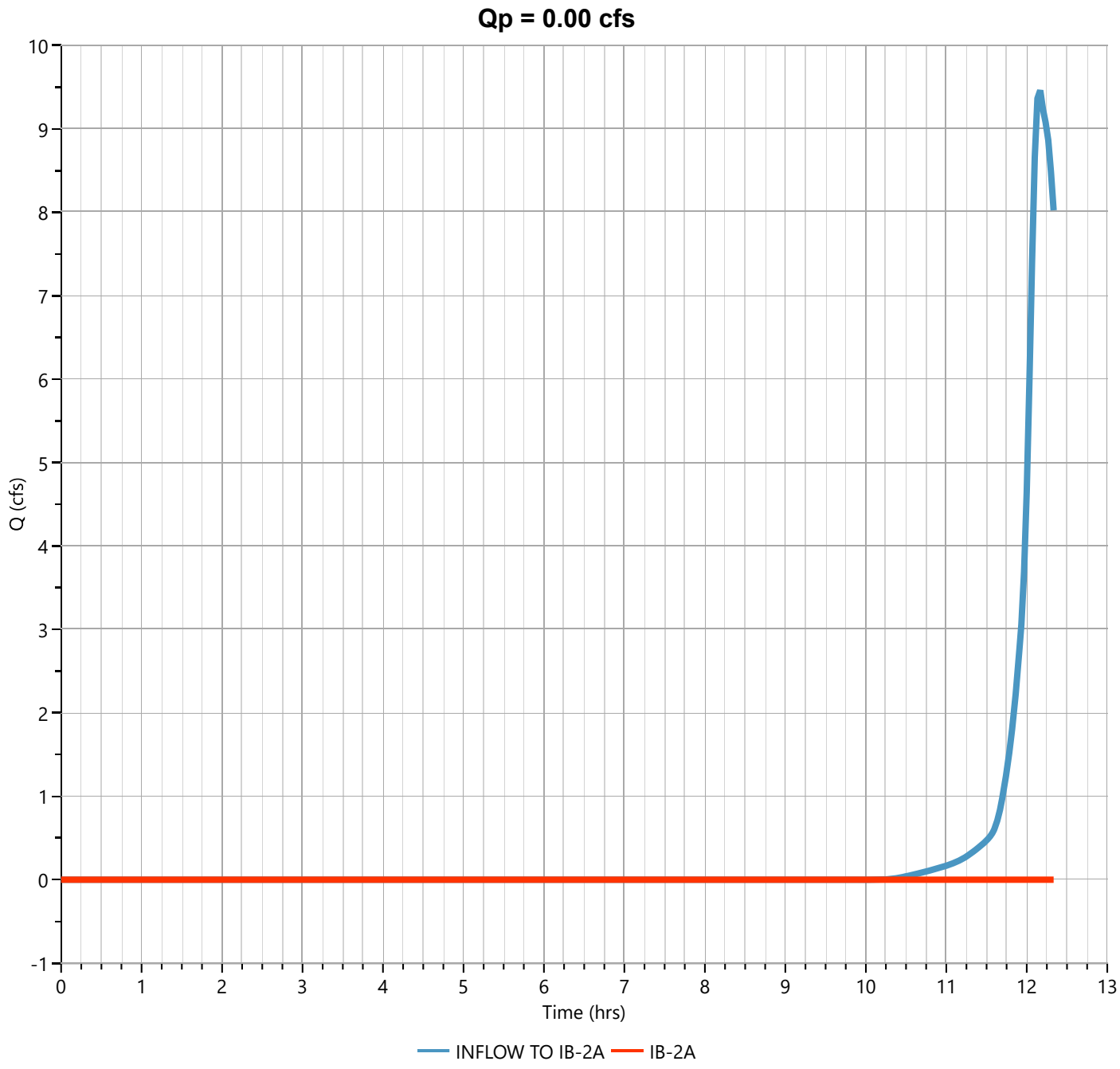
06-28-2022

IB-2A

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - INFLOW TO IB-2A	Max. Elevation	= 229.77 ft
Pond Name	= IB-2A	Max. Storage	= 11,554 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

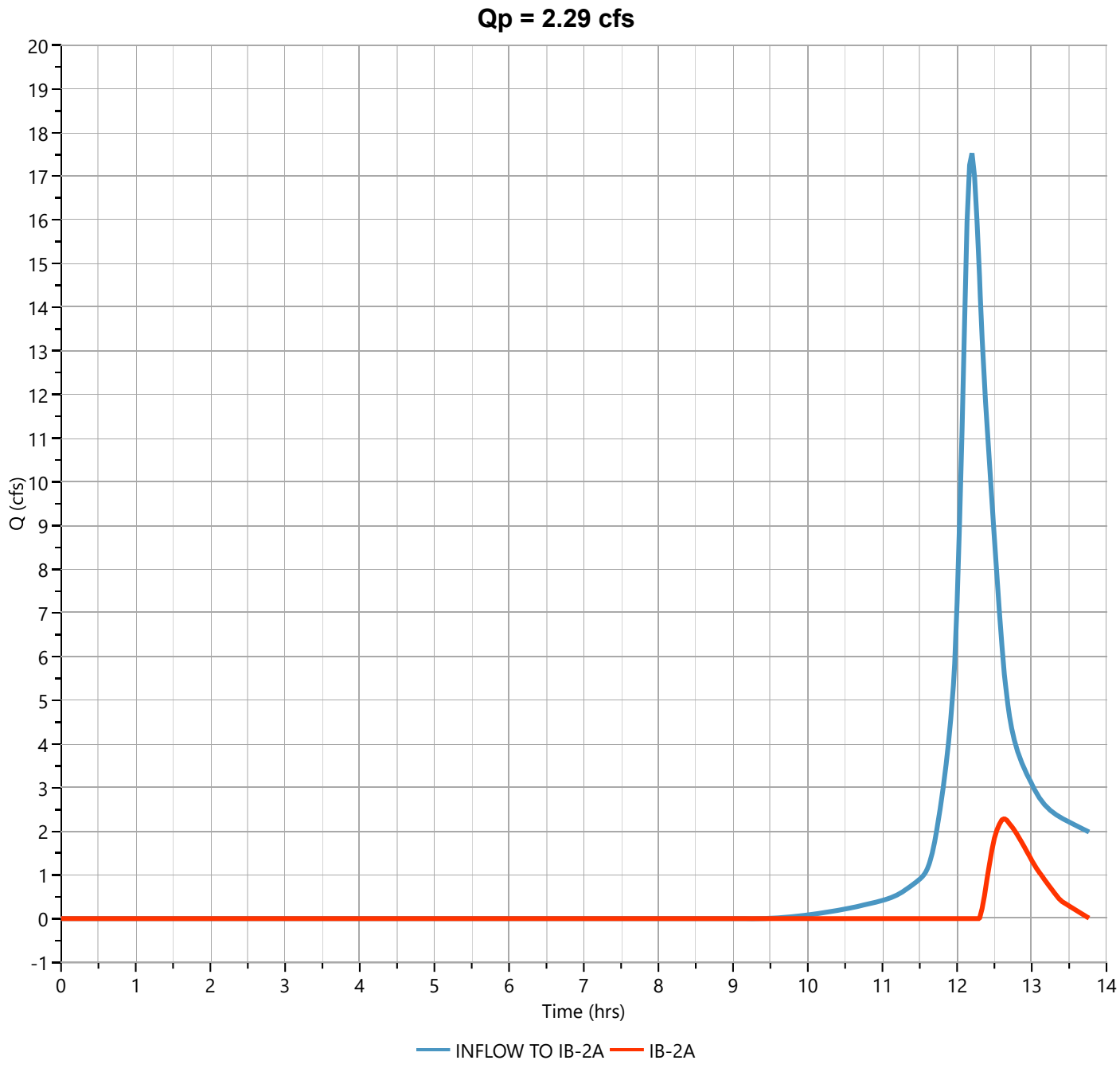
06-28-2022

IB-2A

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 2.287 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,595 cuft
Inflow Hydrograph	= 36 - INFLOW TO IB-2A	Max. Elevation	= 230.31 ft
Pond Name	= IB-2A	Max. Storage	= 20,754 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

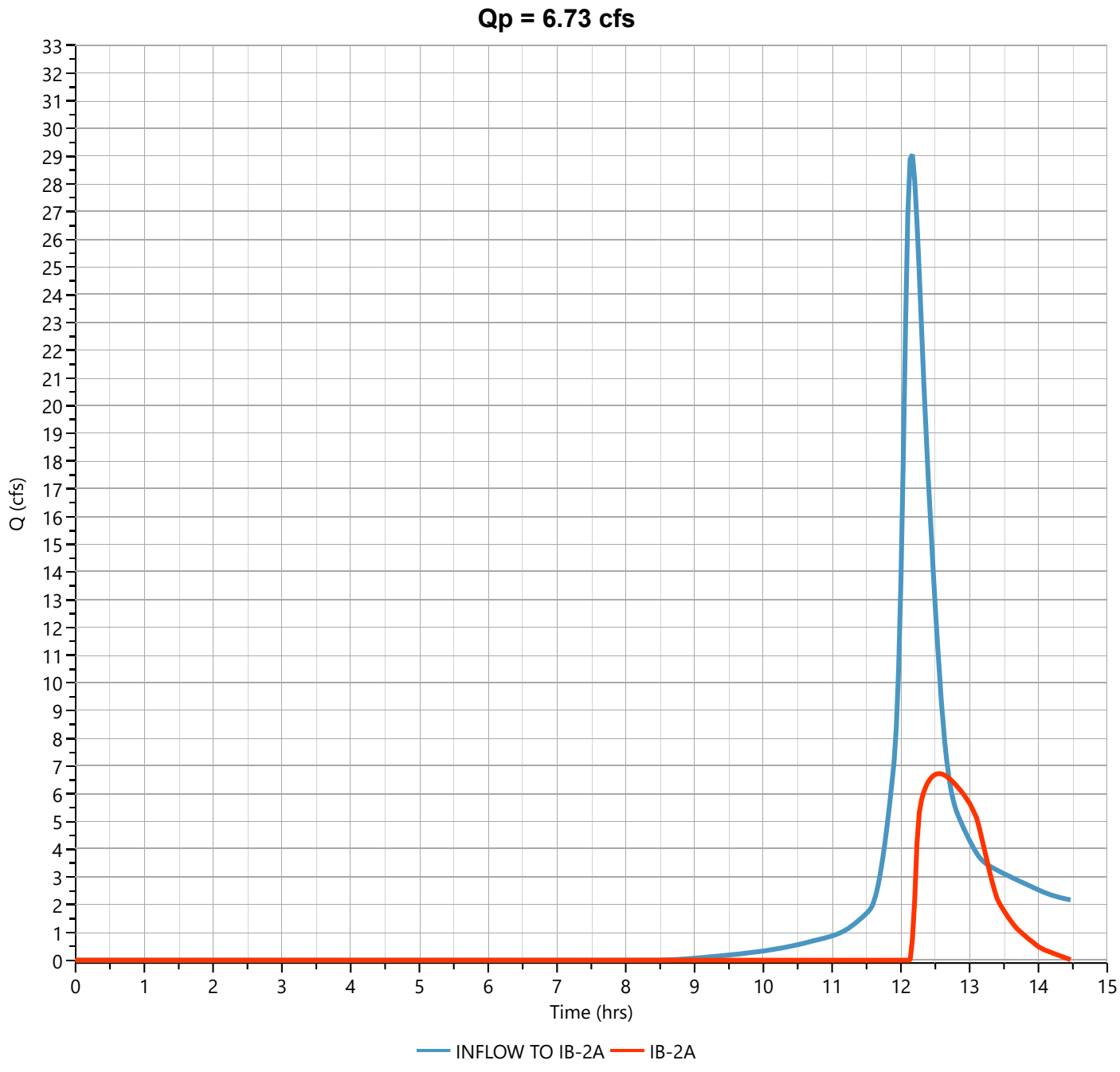
06-28-2022

IB-2A

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 6.726 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 26,751 cuft
Inflow Hydrograph	= 36 - INFLOW TO IB-2A	Max. Elevation	= 230.94 ft
Pond Name	= IB-2A	Max. Storage	= 32,450 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

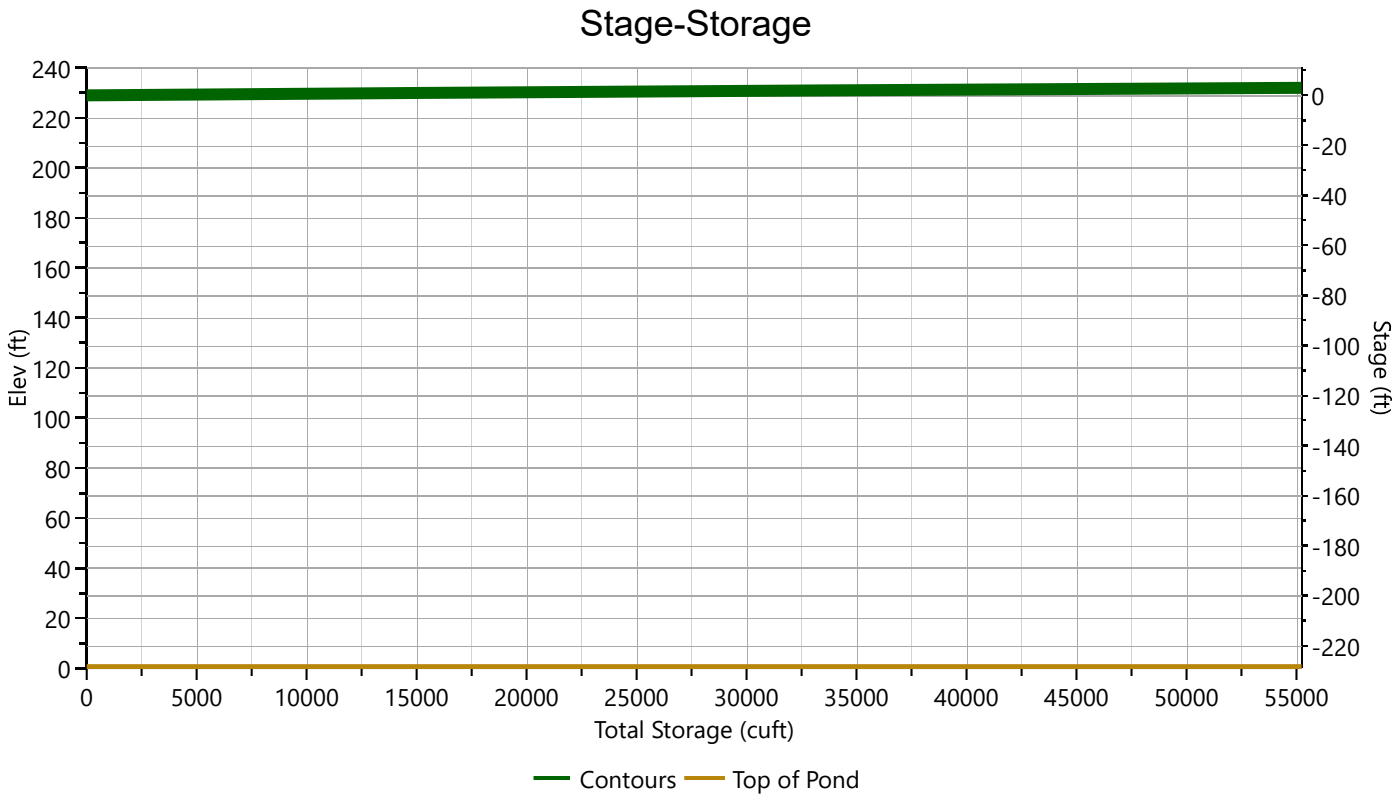
IB-2A

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	229.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	229.00	13,450	0.000	0.000
1.00	230.00	16,755	15,103	15,103
2.00	231.00	20,029	18,392	33,495
3.00	232.00	23,446	21,738	55,232



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

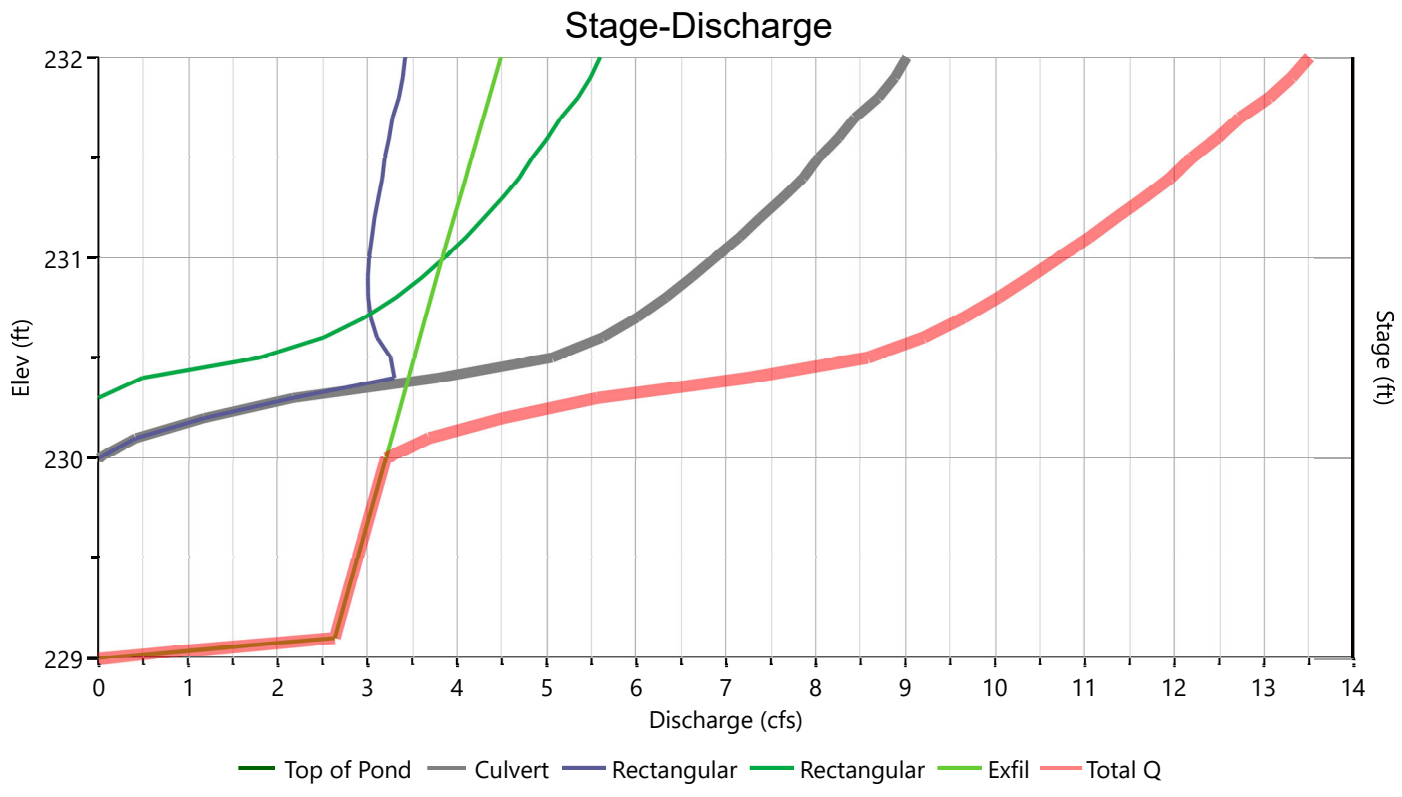
06-28-2022

IB-2A

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	15				Hole Diameter, in	
Span, in	15				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	229.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	50					
Barrel Slope, %	2					
N-Value, n	0.012					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1*	2*	3		
Shape / Type	Circular	Rectangular	Rectangular		Exfiltration, in/hr	8.27**
Crest Elevation, ft		230	230.33			
Crest Length, ft		4	8			
Angle, deg						
Weir Coefficient, Cw		3.3	3.3			

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-2A

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	229.00	0.000	0.000					0.000	0.000			0.000		0.000
1.00	230.00	15,103	0.000					0.000	0.000			3.207		3.207
2.00	231.00	33,495	6.877 ic					3.018 s	3.859 s			3.834		10.71
3.00	232.00	55,232	9.014 ic					3.420 s	5.594 s			4.488		13.50

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

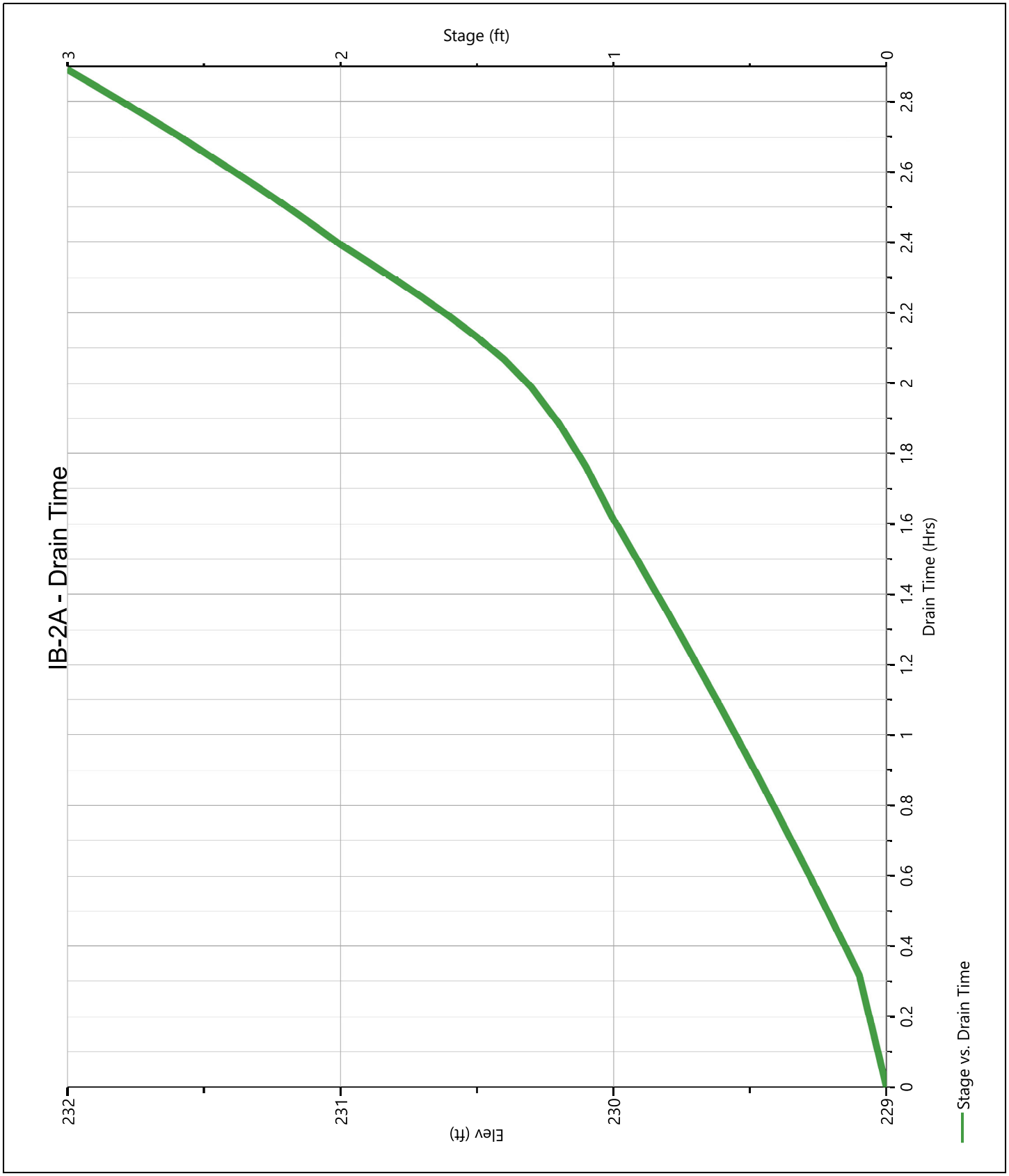
Project Name:

Hydrology Studio v 3.0.0.24

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IB-2A

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By PFK Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-2B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			8.87	266.12
A	Open Space Good Condition	39			4.25	165.88
A	Open Space Fair Condition	49			0.00	0.00
A	Woods-Grass Combination Good Condition	32			2.04	65.21
A	Gravel	76			0.20	14.98
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.05	2.96
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			7.67	536.95
C	Open Space Fair Condition	79			0.05	3.61
C	Gravel	89			0.17	15.03
D	BVW	77			8.91	685.73
1/ Use only one CN source per line.				Totals =	32.20	1756.46

CN (weighted) = total product / total area = 1756.46 / 32.20 = 54.55 ; Use CN = 55

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.26	1.56	2.63

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By PFK Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed Subcatchment P-2B
Circle one: Tc | Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.024			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.27			0.27
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	404			
9. Watercourse slope, s		ft/ft	0.200			
10. Average Velocity, V (figure 3-1)		ft/s	7.22			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.28
min 17.0

Hydrograph Report

Project Name:

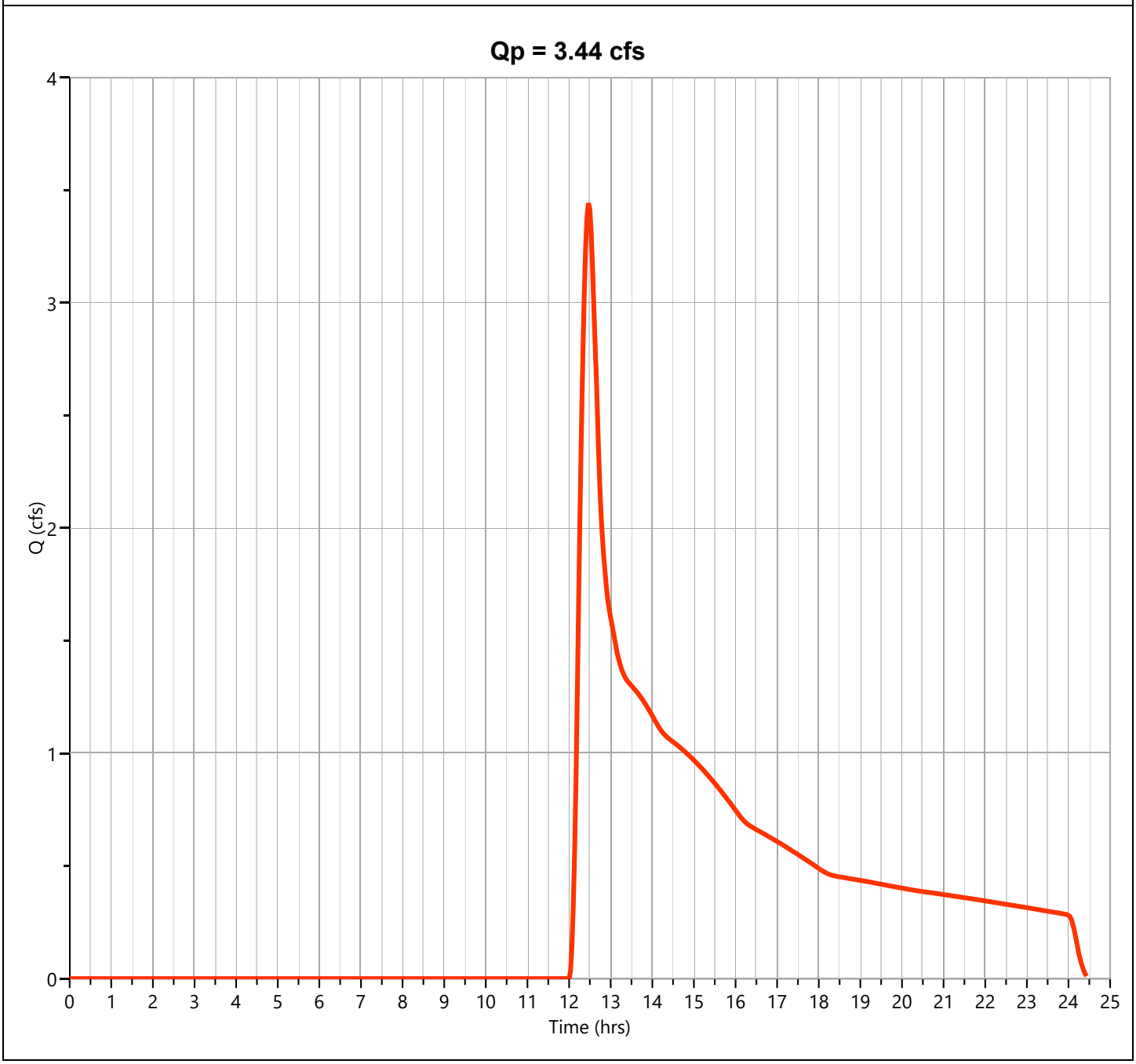
Hydrology Studio v 3.0.0.24

06-28-2022

P-2B

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.443 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 31,781 cuft
Drainage Area	= 32.2 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

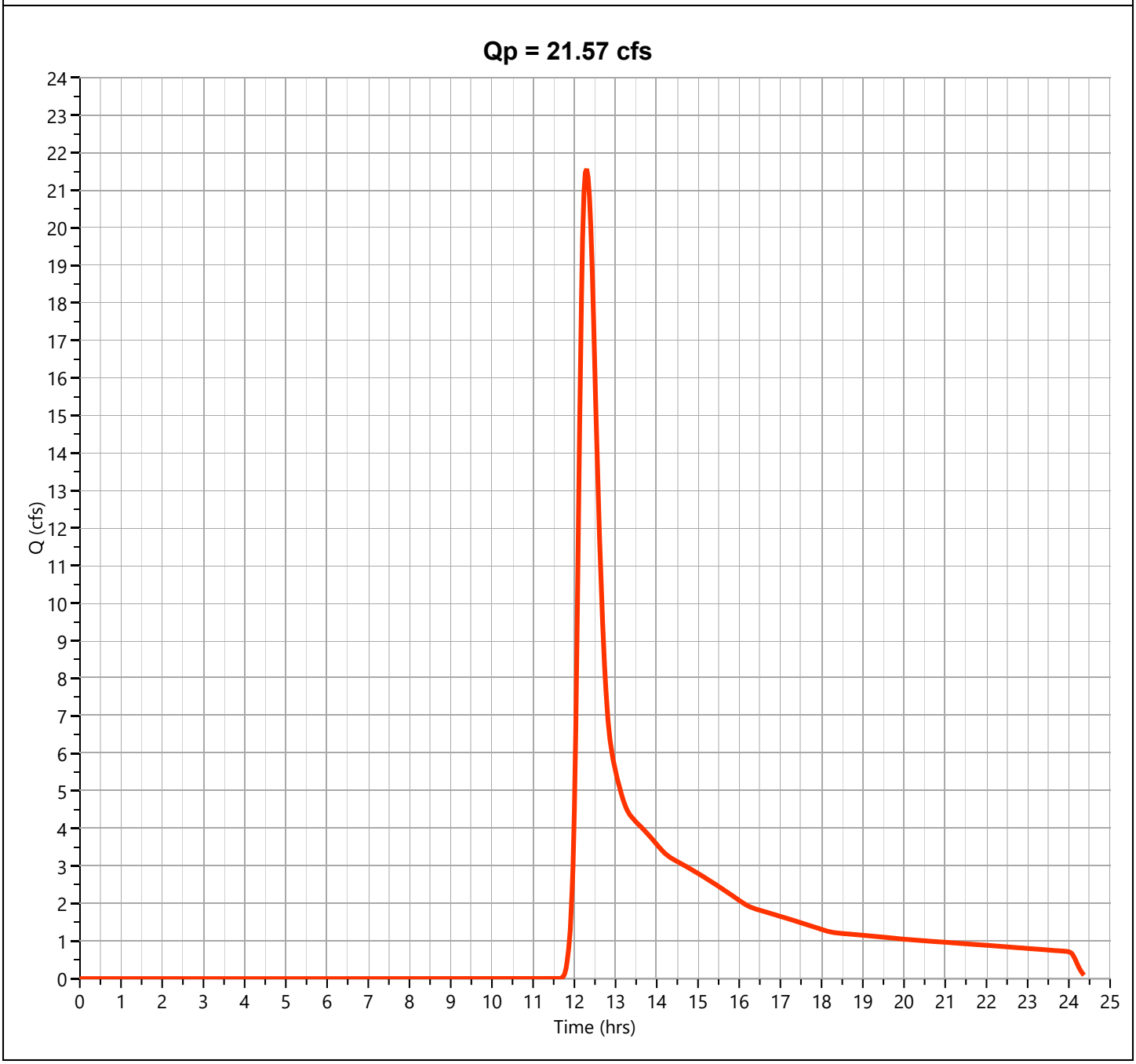
Hydrology Studio v 3.0.0.24

06-28-2022

P-2B

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 21.57 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 116,876 cuft
Drainage Area	= 32.2 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

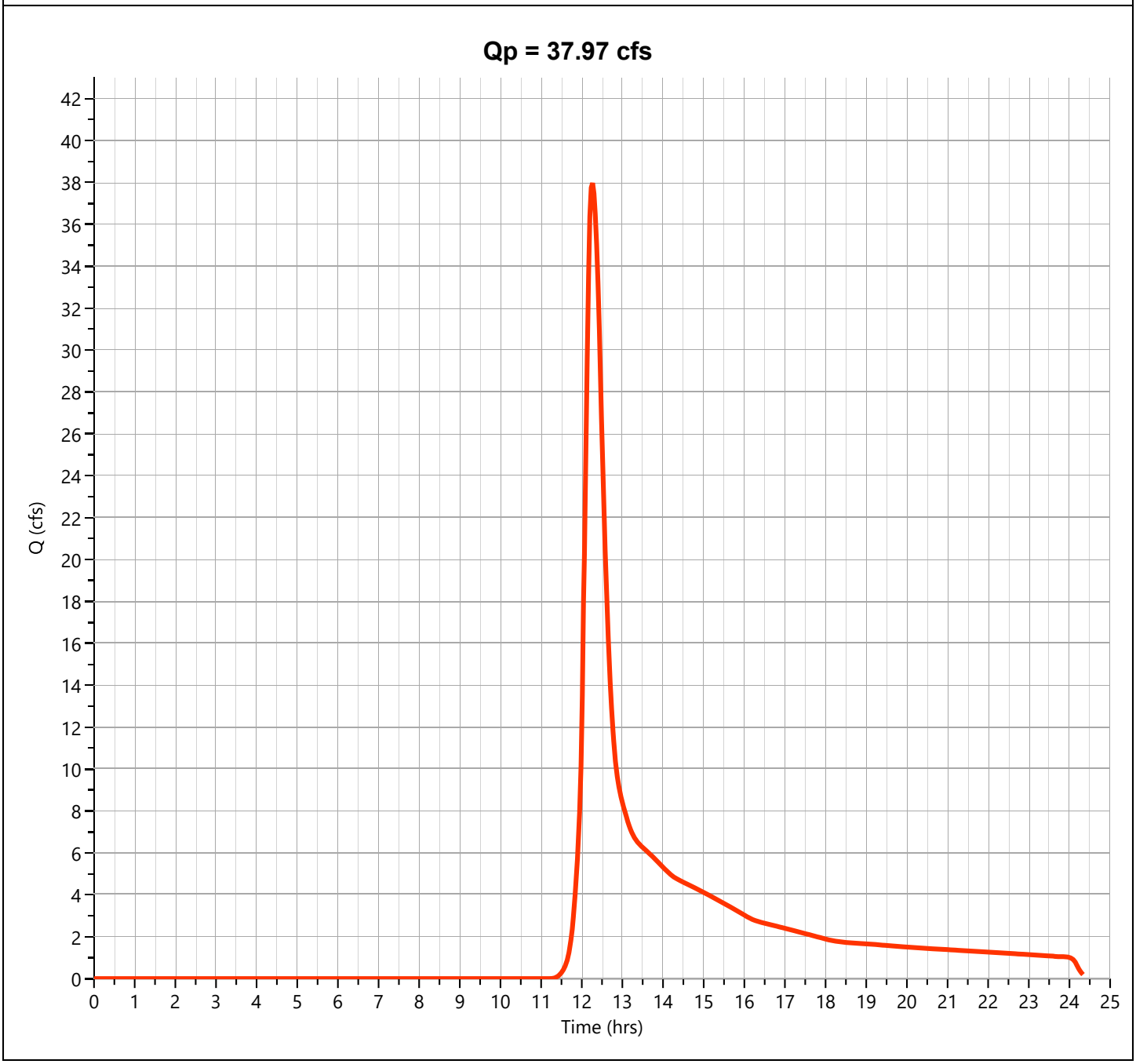
Hydrology Studio v 3.0.0.24

06-28-2022

P-2B

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 37.97 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 186,889 cuft
Drainage Area	= 32.2 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

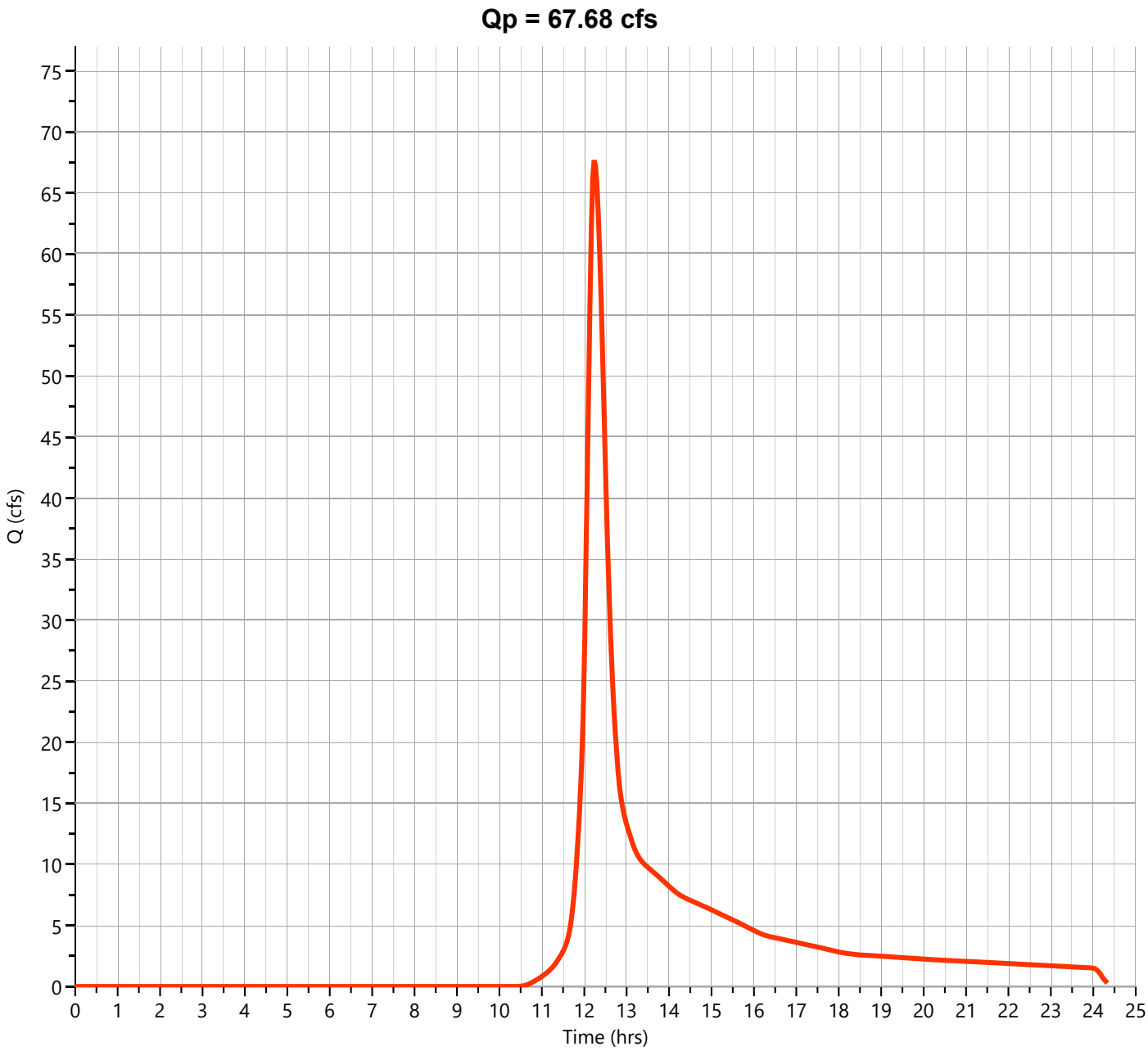
Hydrology Studio v 3.0.0.24

06-28-2022

P-2B

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 67.68 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 312,703 cuft
Drainage Area	= 32.2 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

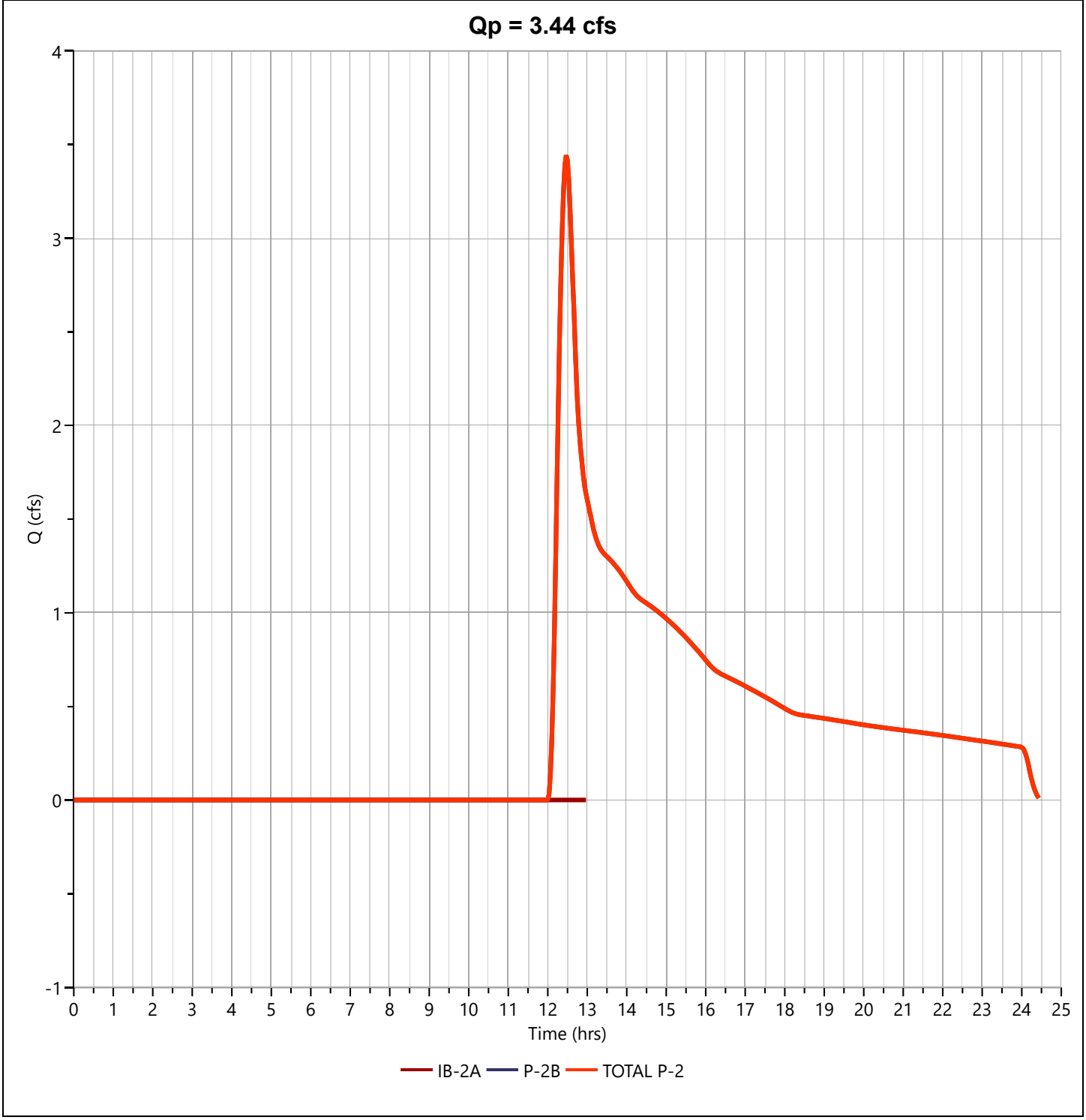
Hydrology Studio v 3.0.0.24

06-28-2022

TOTAL P-2

Hyd. No. 39

Hydrograph Type	= Junction	Peak Flow	= 3.443 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 31,781 cuft
Inflow Hydrographs	= 37, 38	Total Contrib. Area	= 32.2 ac



Hydrograph Report

Project Name:

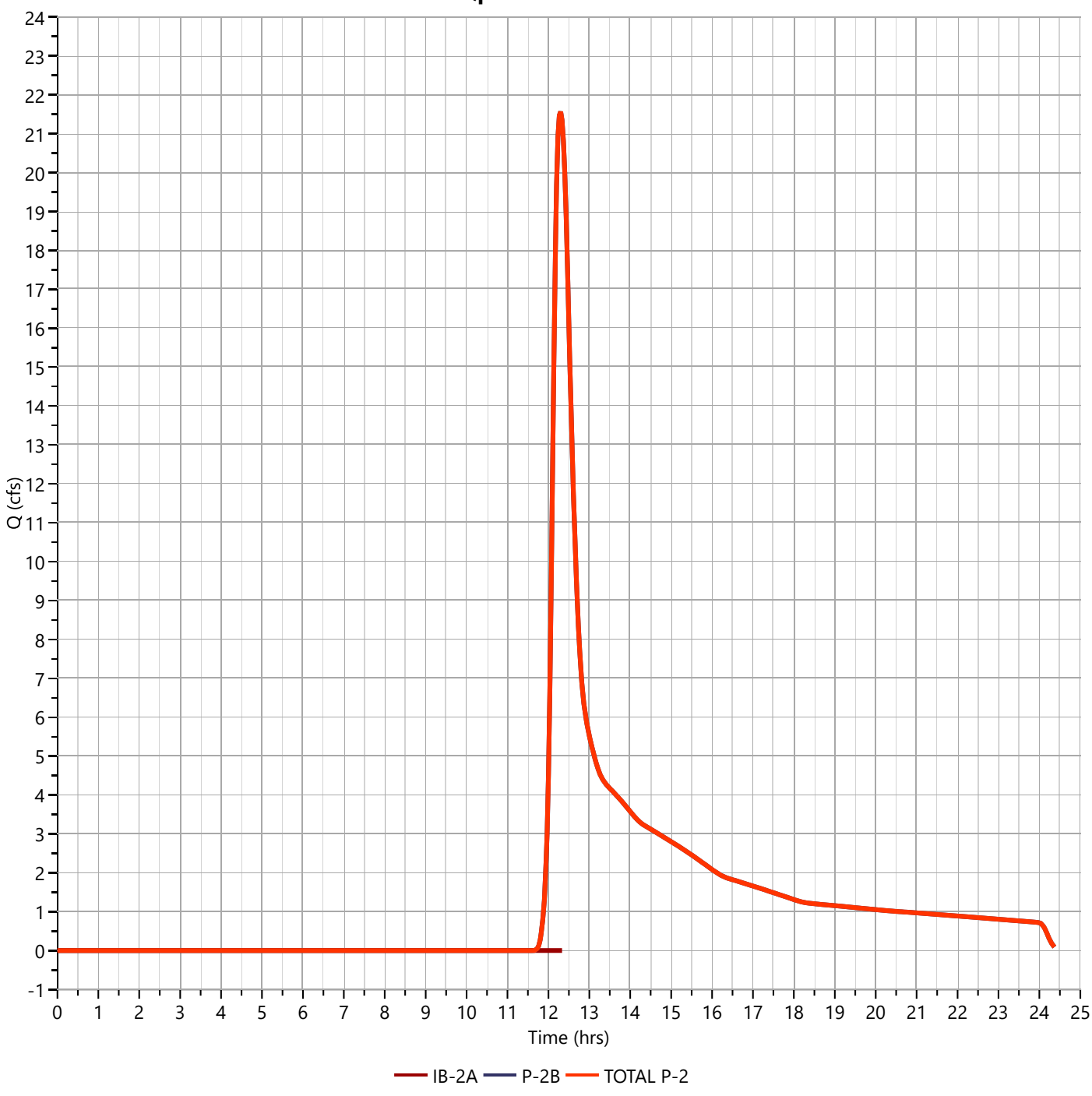
Hydrology Studio v 3.0.0.24

06-28-2022

TOTAL P-2

Hyd. No. 39

Hydrograph Type	= Junction	Peak Flow	= 21.57 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 116,876 cuft
Inflow Hydrographs	= 37, 38	Total Contrib. Area	= 32.2 ac



Hydrograph Report

Project Name:

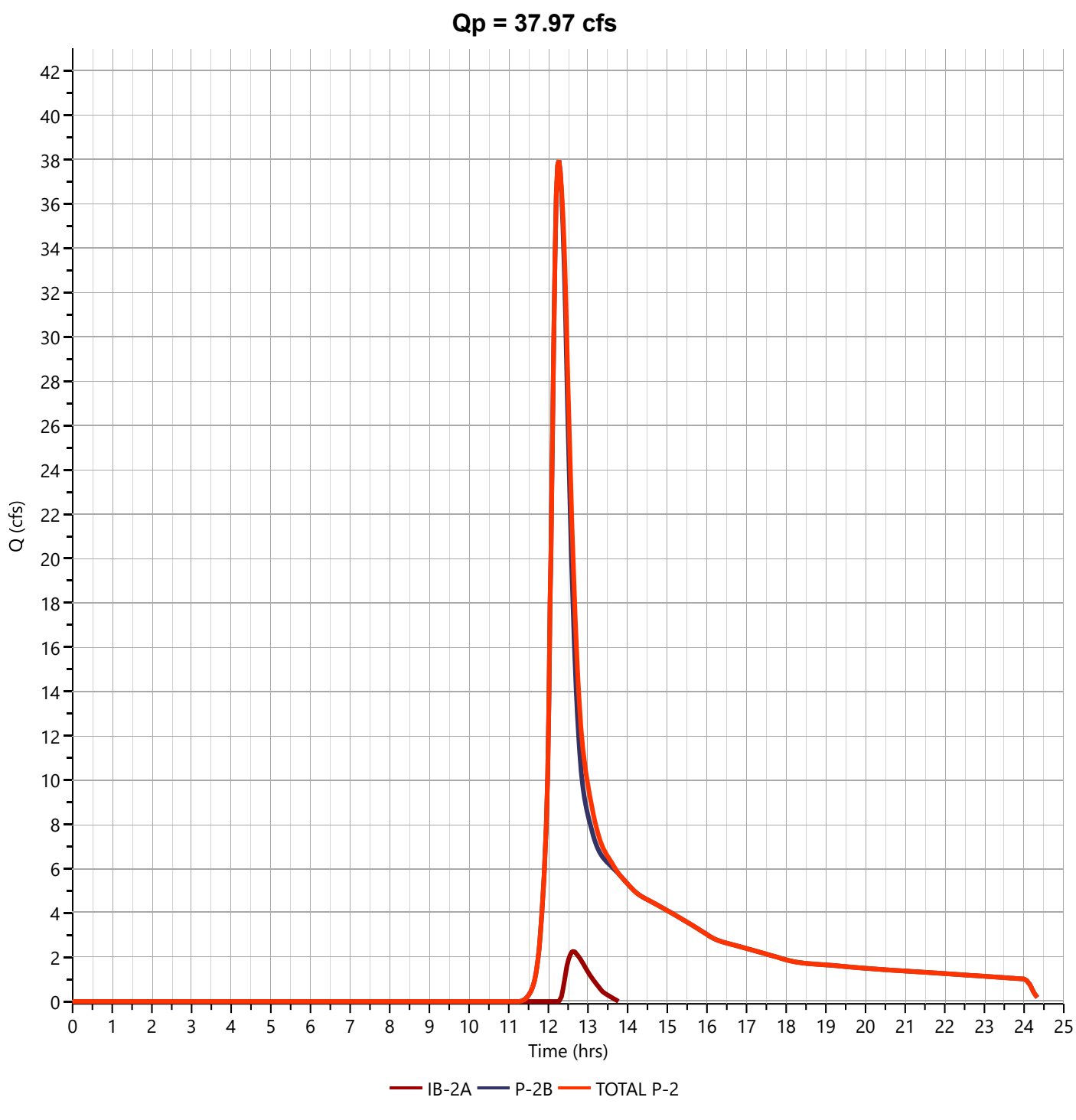
Hydrology Studio v 3.0.0.24

06-28-2022

TOTAL P-2

Hyd. No. 39

Hydrograph Type	= Junction	Peak Flow	= 37.97 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 192,484 cuft
Inflow Hydrographs	= 37, 38	Total Contrib. Area	= 32.2 ac



Hydrograph Report

Project Name:

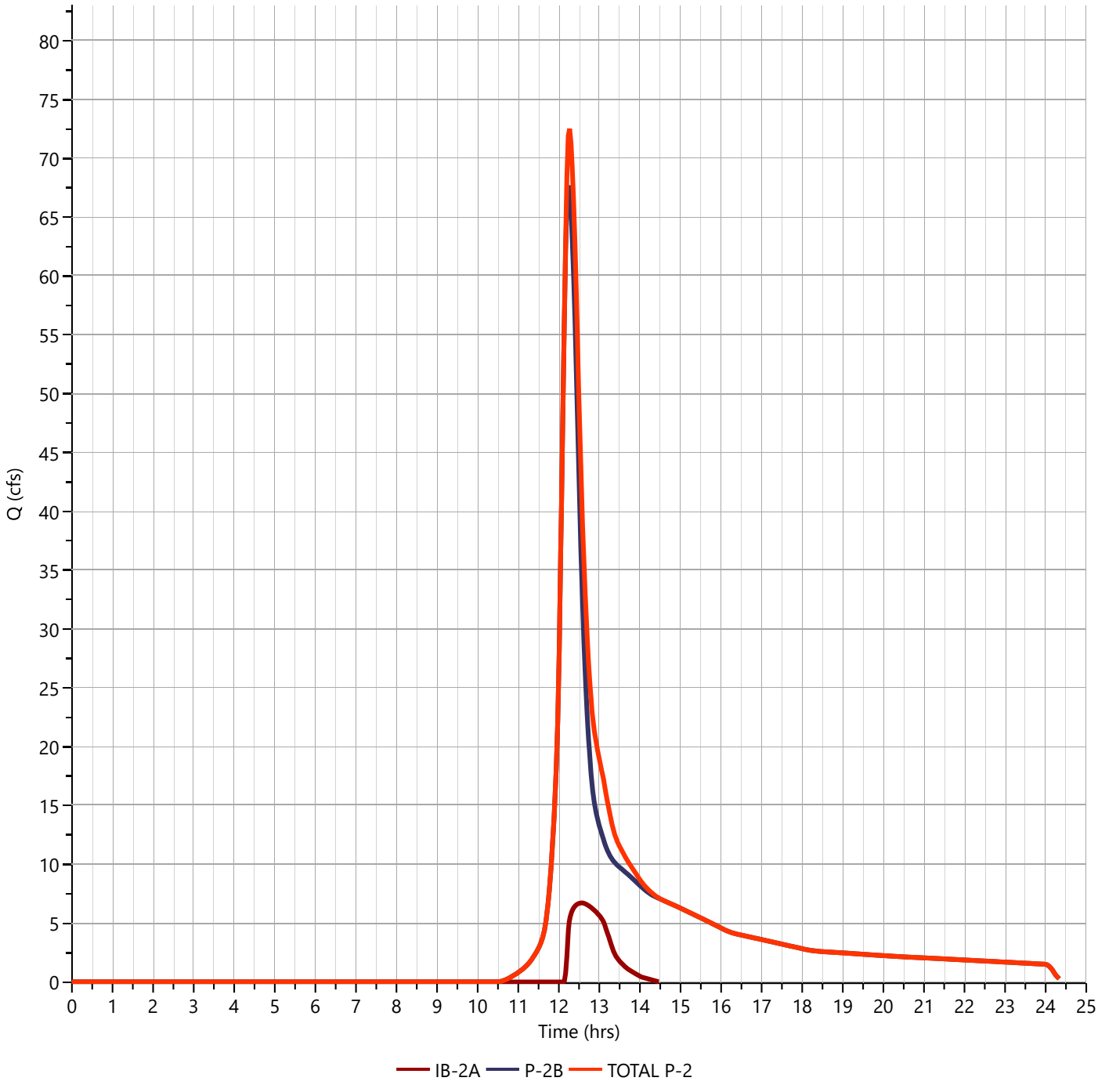
Hydrology Studio v 3.0.0.24

06-28-2022

TOTAL P-2

Hyd. No. 39

Hydrograph Type	= Junction	Peak Flow	= 72.51 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 339,453 cuft
Inflow Hydrographs	= 37, 38	Total Contrib. Area	= 32.2 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/21/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-3A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.71	69.93
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Brush Fair	35			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.03	1.86
C	Open Space Good Condition	74			0.84	61.88
C	Gravel	89			0.00	0.00
1/ Use only one CN source per line.		68669		Totals =	1.58	133.67

CN (weighted) = total product / total area = 133.67 / 1.58 = 84.80 ; Use CN = 85

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.80	4.41	6.04

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/21/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-3A

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.050			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.10			0.10
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	315	157		
9. Watercourse slope, s		ft/ft	0.070	0.013		
10. Average Velocity, V (figure 3-1)		ft/s	4.27	2.32		
11. Tt = L / 3600V	Compute Tt	hr	0.02	0.02		0.04
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.14
min 8.1

Hydrograph Report

Project Name:

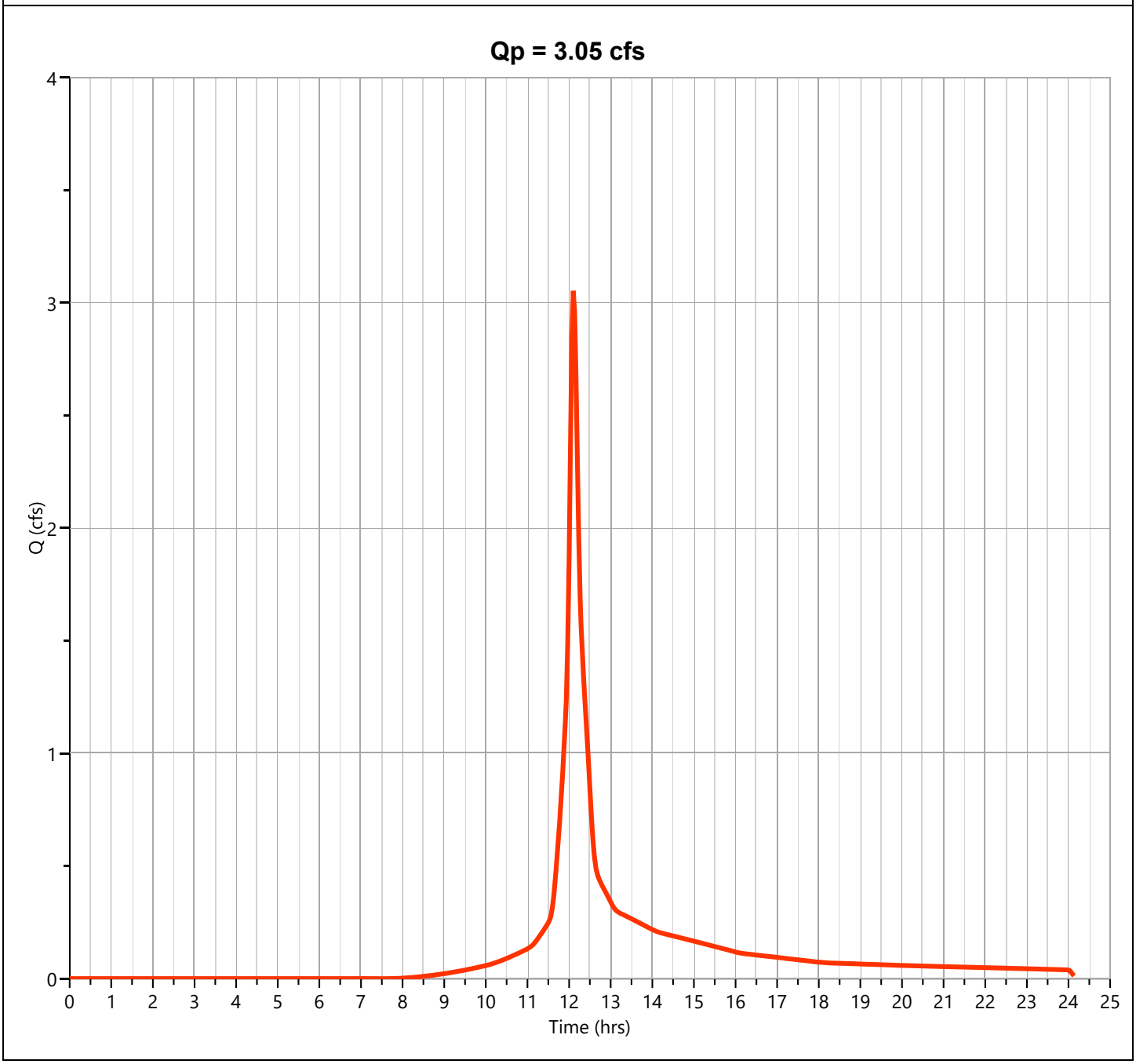
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06-28-2022

P-3A

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.053 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 10,424 cuft
Drainage Area	= 1.58 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 8.1 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

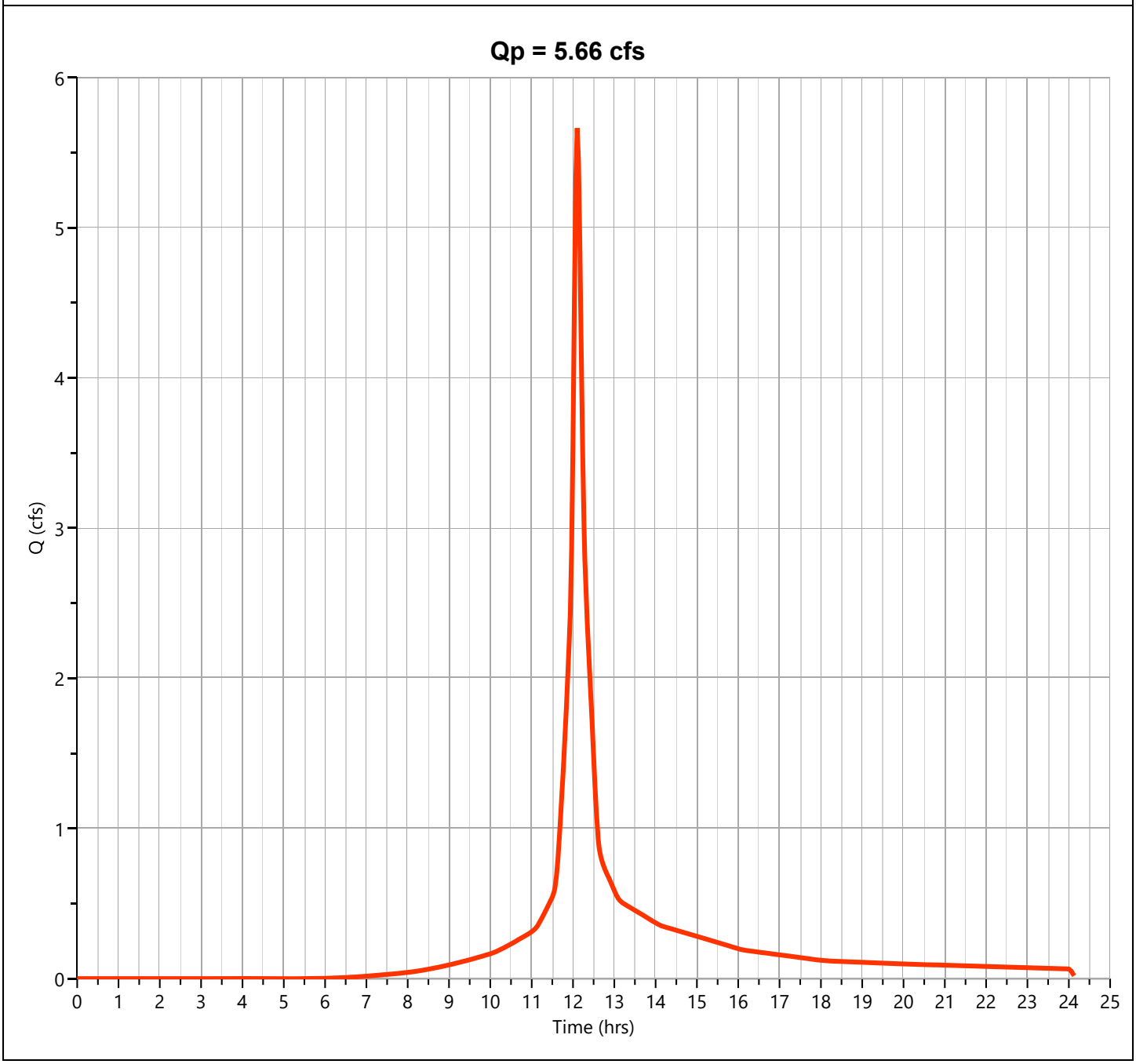
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06-28-2022

P-3A

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.663 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 19,529 cuft
Drainage Area	= 1.58 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 8.1 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

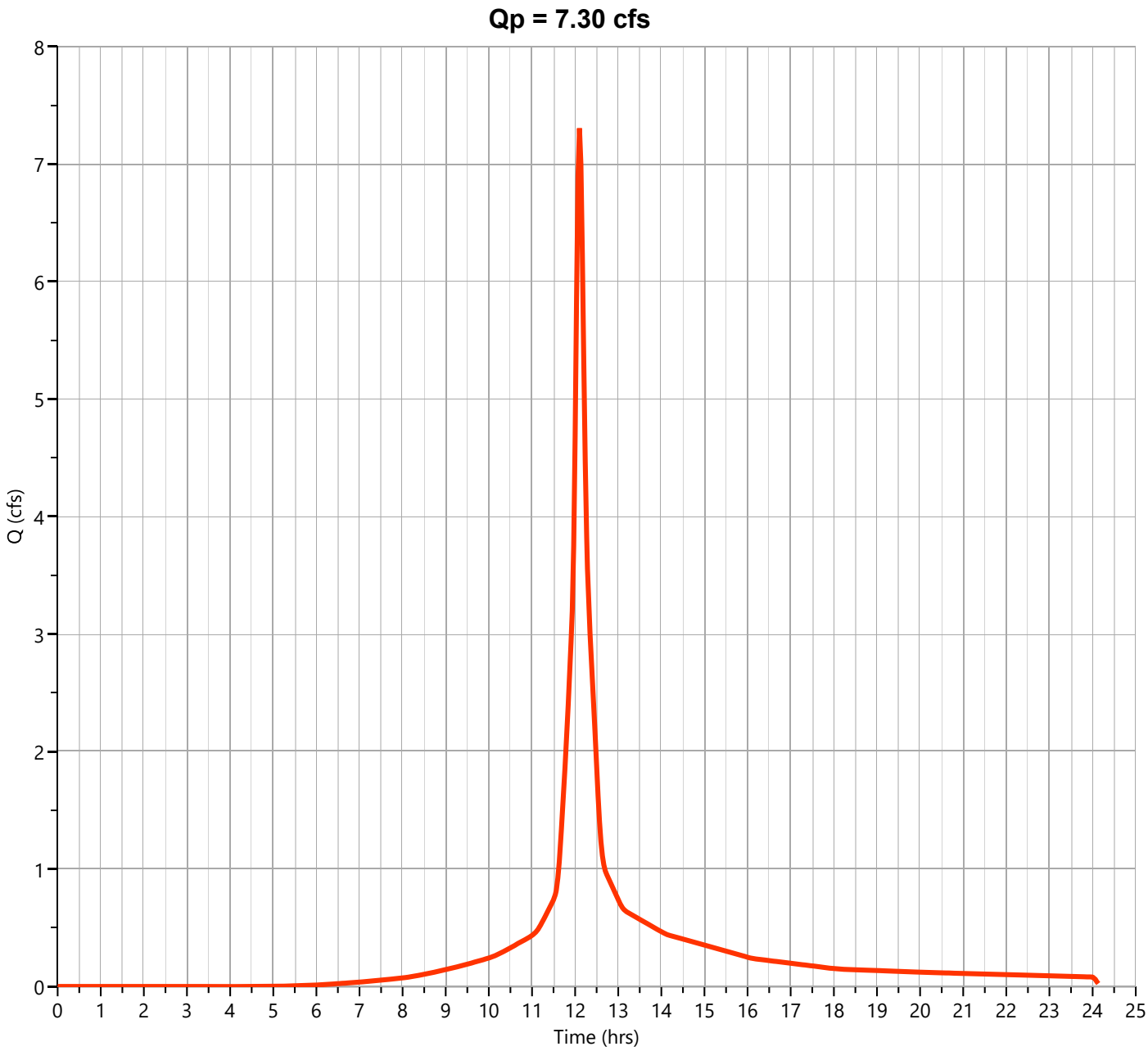
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06-28-2022

P-3A

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.305 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 25,435 cuft
Drainage Area	= 1.58 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 8.1 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

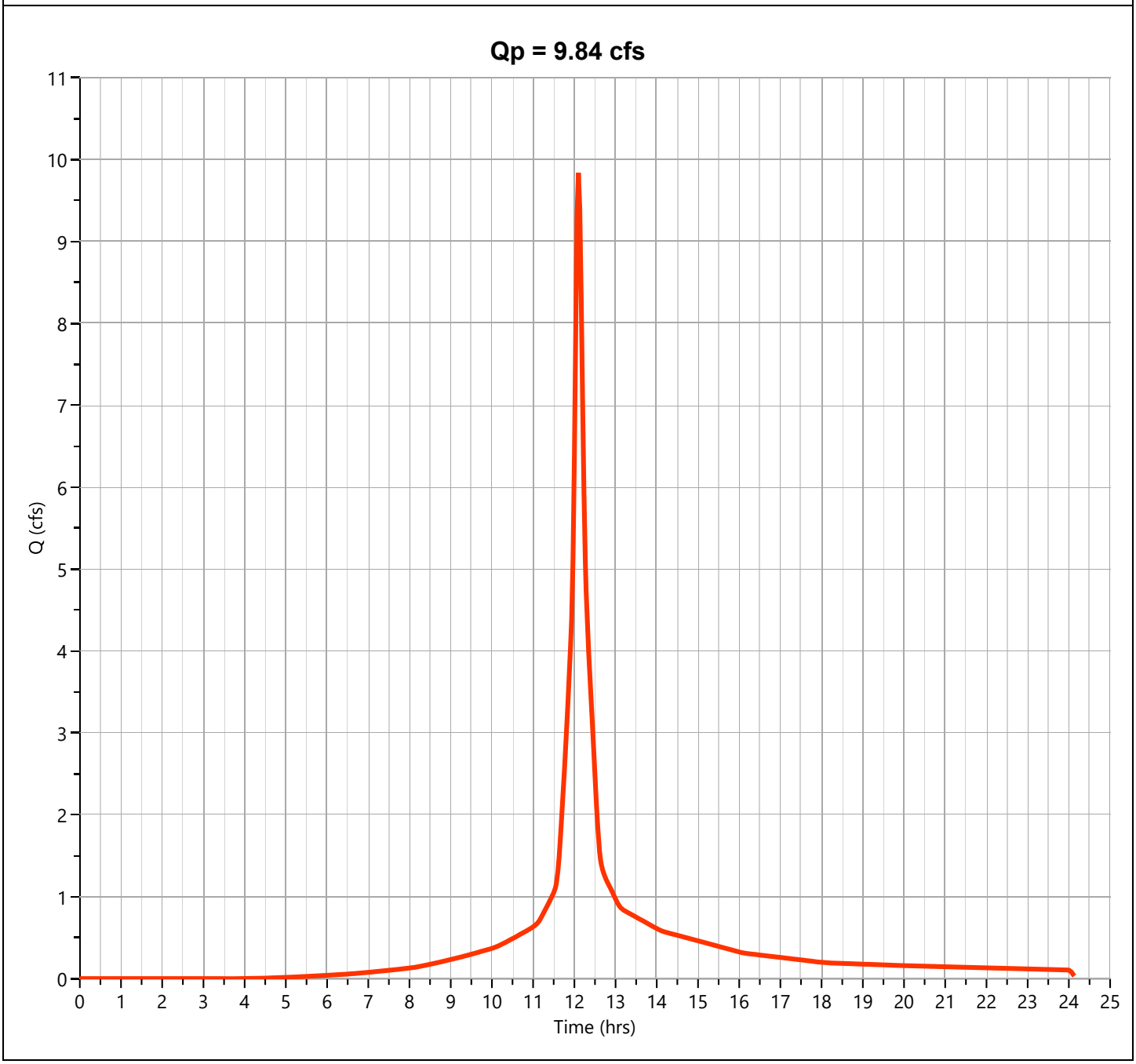
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06-28-2022

P-3A

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.836 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 34,751 cuft
Drainage Area	= 1.58 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 8.1 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

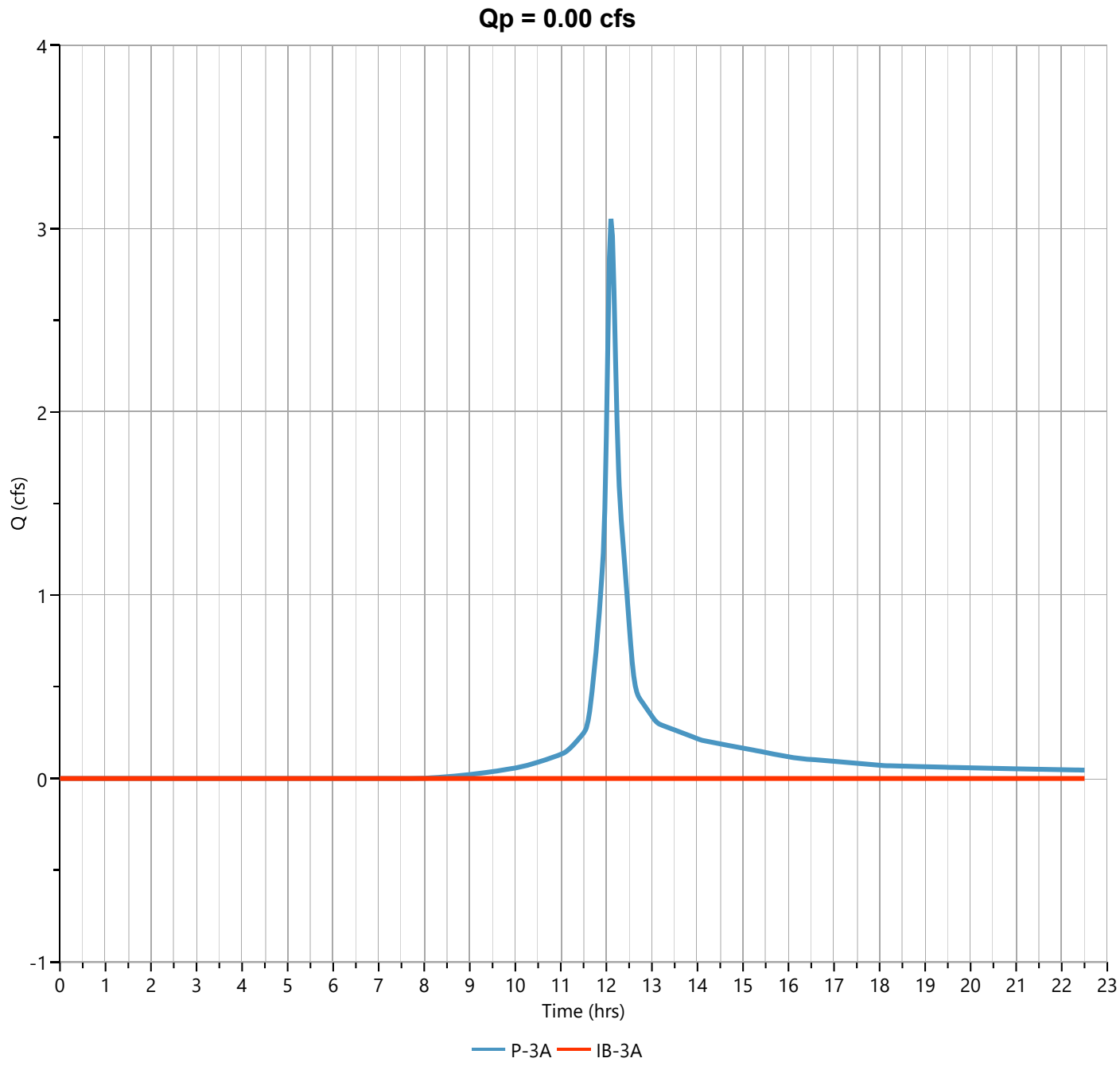
06-28-2022

IB-3A

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= -0.003 cuft
Inflow Hydrograph	= 16 - P-3A	Max. Elevation	= 288.30 ft
Pond Name	= IB-3A	Max. Storage	= 5,524 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

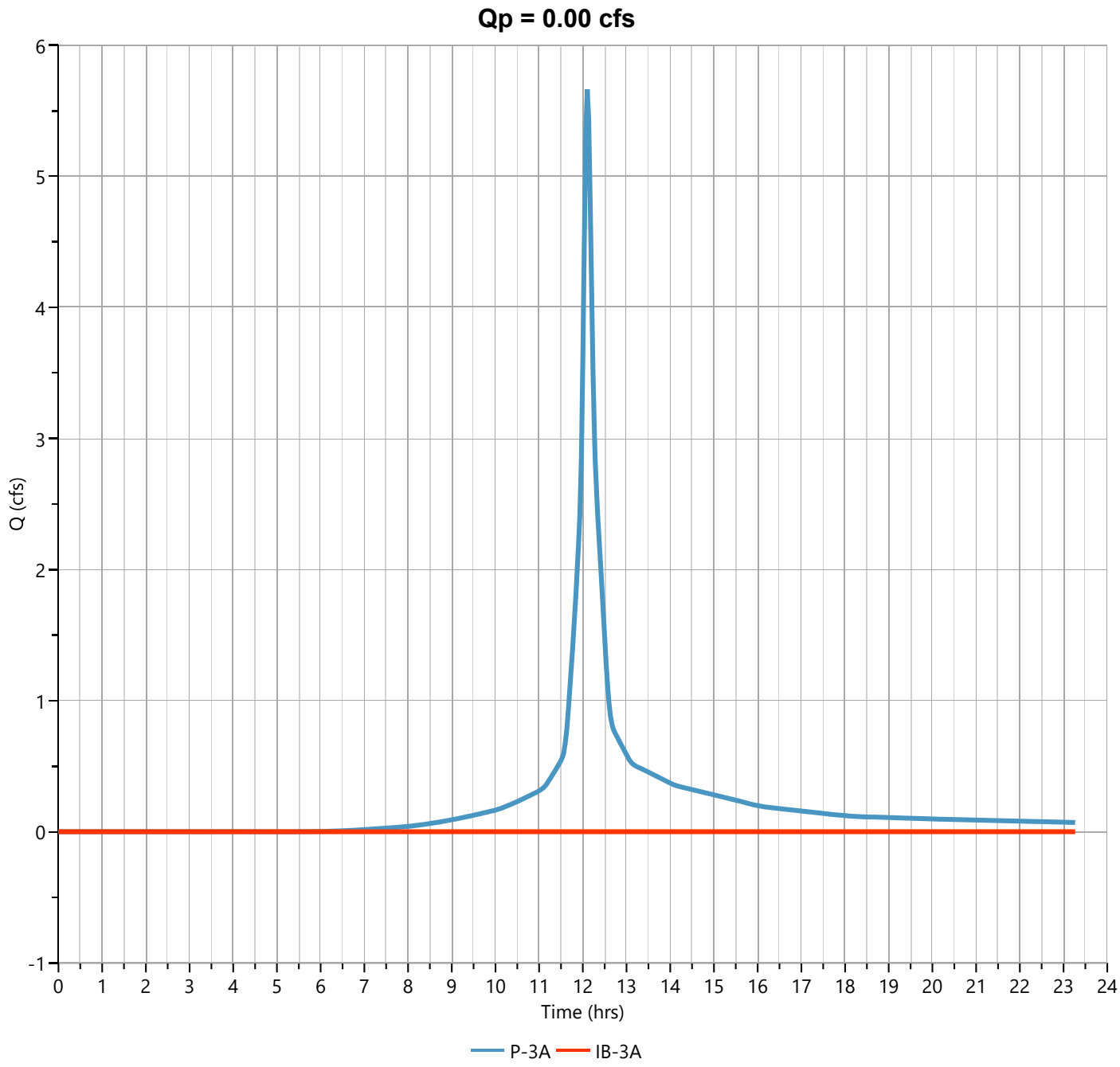
06-28-2022

IB-3A

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 21.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= -0.001 cuft
Inflow Hydrograph	= 16 - P-3A	Max. Elevation	= 289.96 ft
Pond Name	= IB-3A	Max. Storage	= 11,808 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

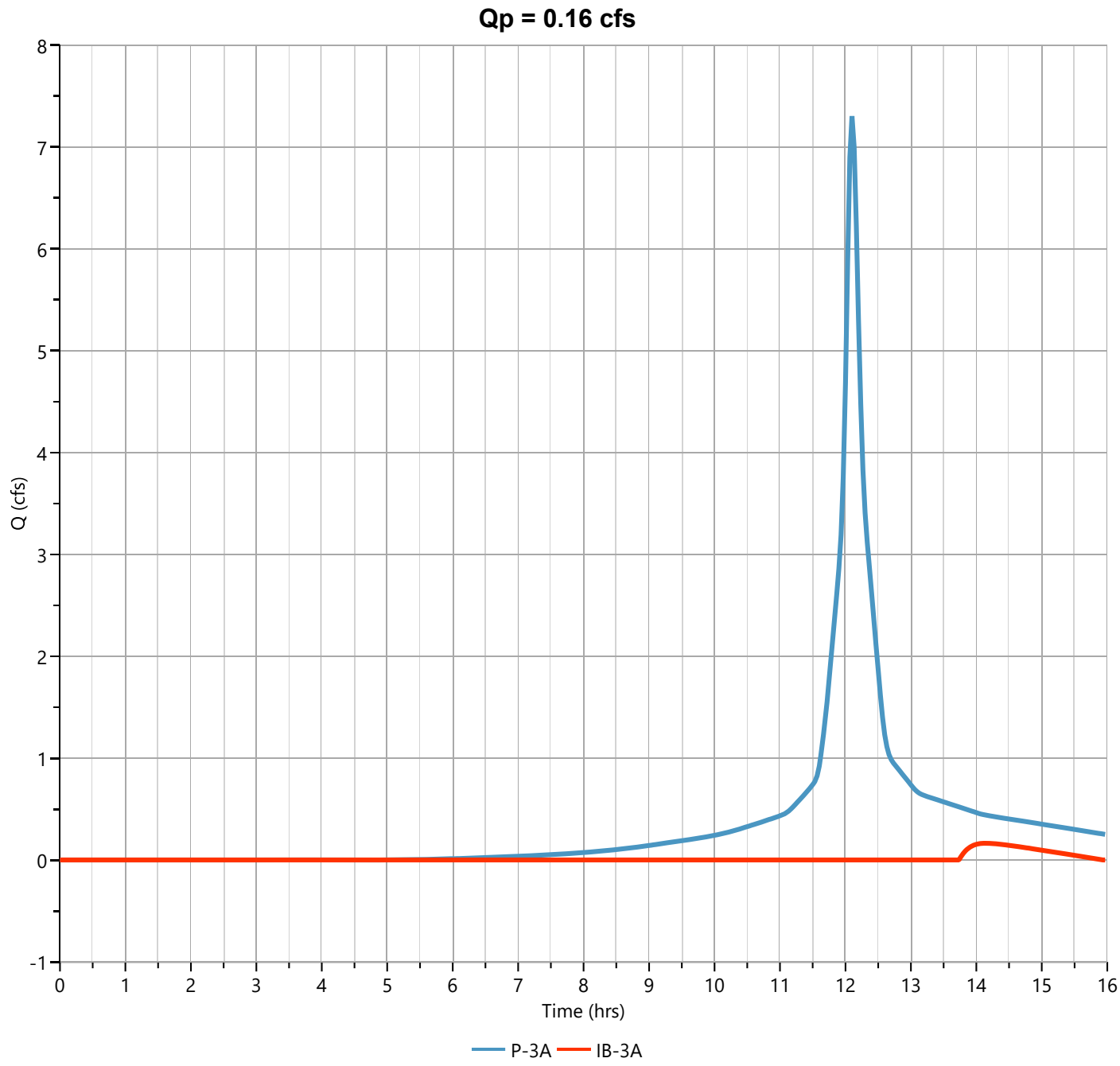
IB-3A

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 0.164 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 760 cuft
Inflow Hydrograph	= 16 - P-3A	Max. Elevation	= 290.73 ft
Pond Name	= IB-3A	Max. Storage	= 15,437 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.24 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

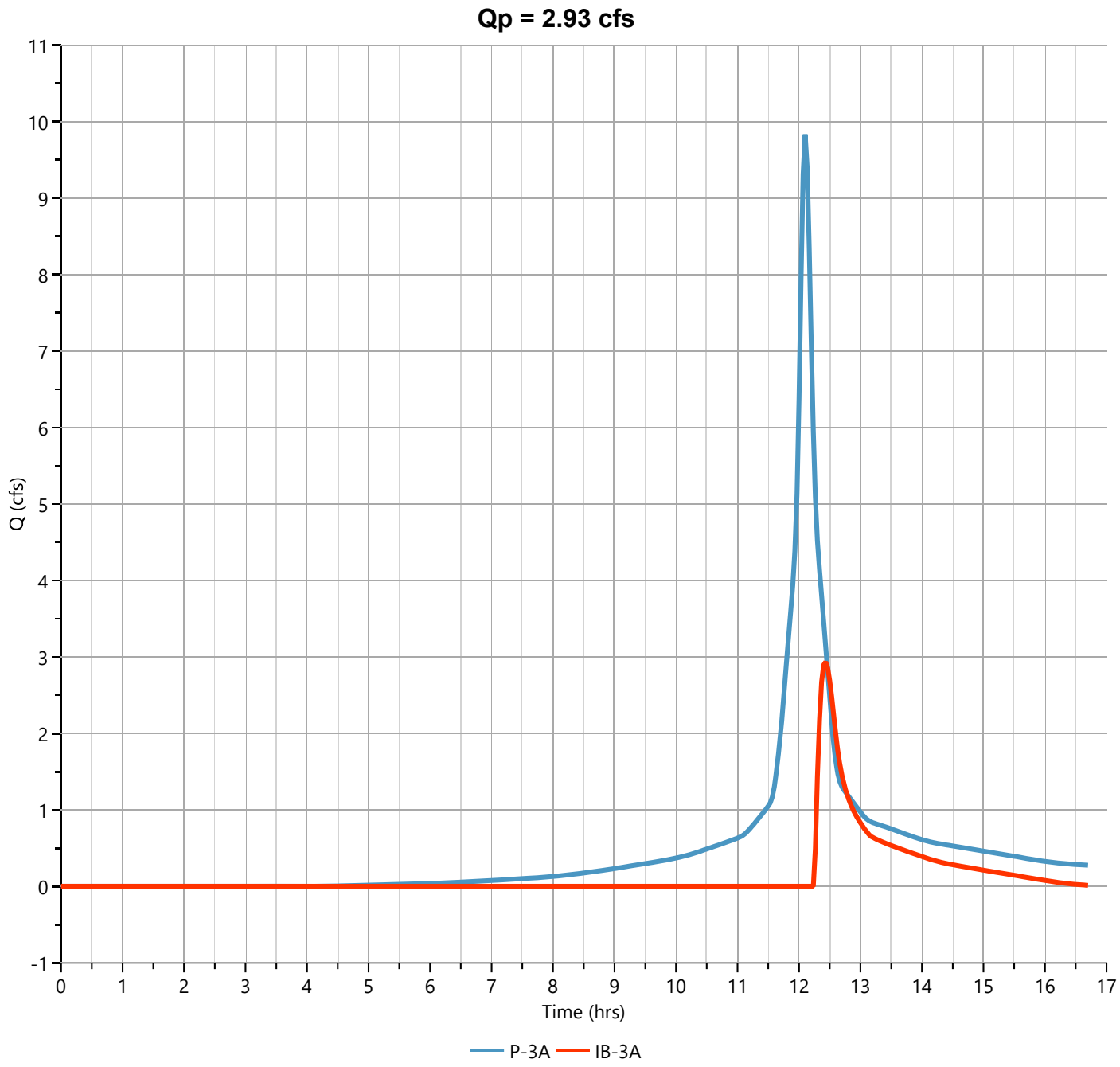
IB-3A

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 2.935 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 8,274 cuft
Inflow Hydrograph	= 16 - P-3A	Max. Elevation	= 290.97 ft
Pond Name	= IB-3A	Max. Storage	= 16,606 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

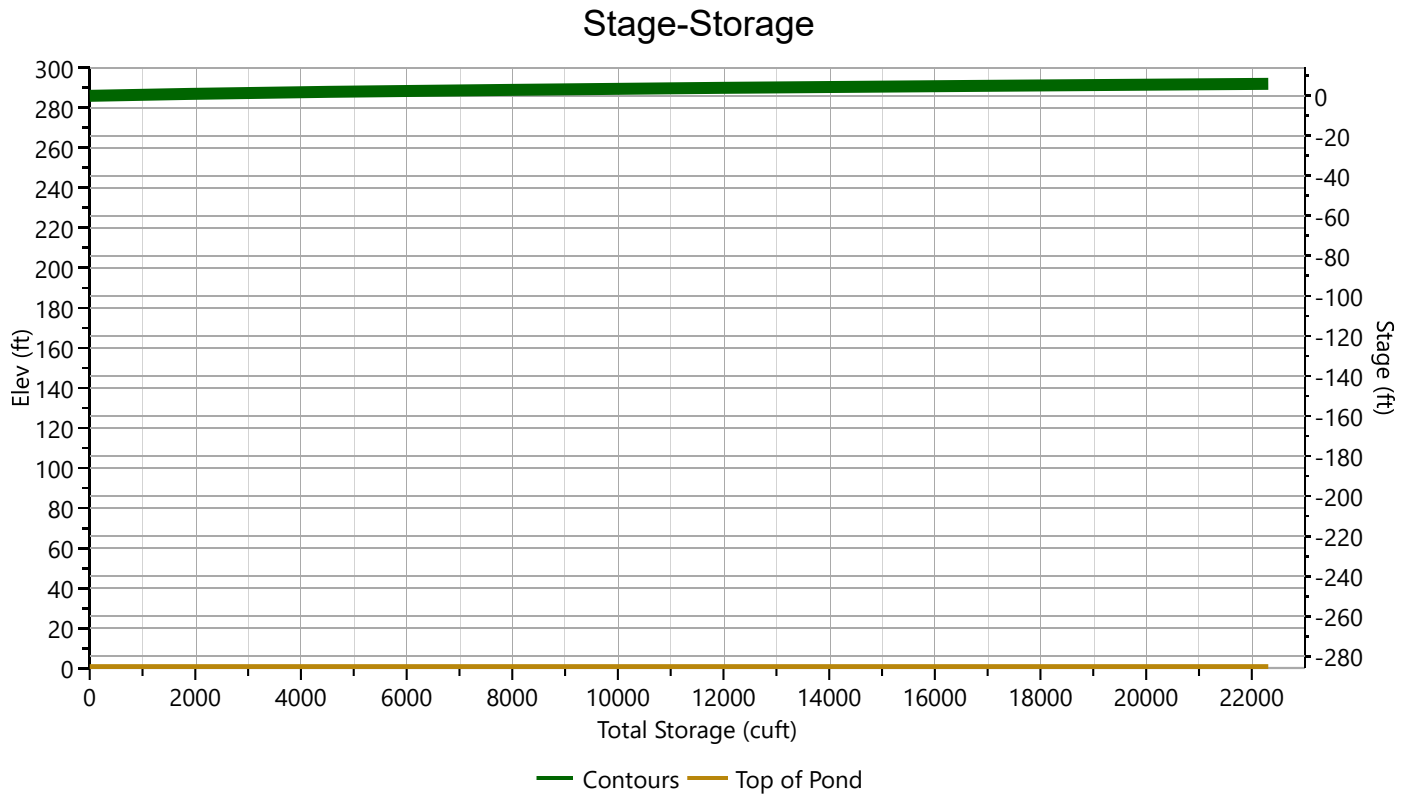
IB-3A

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	286.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	286.00	1,513	0.000	0.000
1.00	287.00	2,232	1,873	1,873
2.00	288.00	3,070	2,651	4,524
3.00	289.00	3,709	3,390	7,913
4.00	290.00	4,405	4,057	11,970
5.00	291.00	5,158	4,782	16,752
6.00	292.00	5,967	5,563	22,314



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

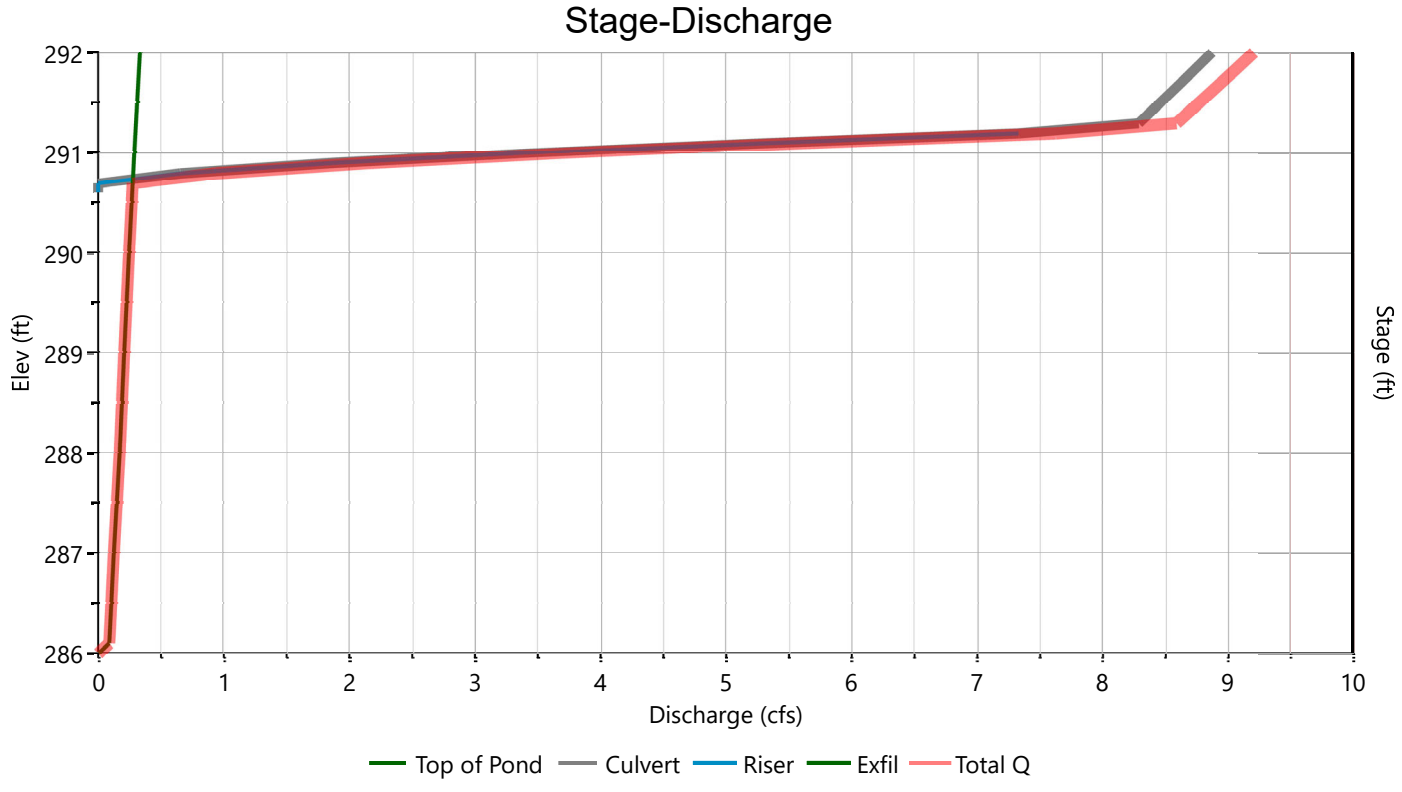
06-28-2022

IB-3A

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate	
		1	2	3		
Rise, in	12				Orifice Dia, in	
Span, in	12				No. Orifices	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	286.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	50					
Barrel Slope, %	2					
N-Value, n	0.012					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular				Exfiltration, in/hr	2.41**
Crest Elevation, ft	290.7					
Crest Length, ft	6.28					
Angle, deg						
Weir Coefficient, Cw	3.3					

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-3A

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	286.00	0.000	0.000				0.000					0.000		0.000
1.00	287.00	1,873	0.000				0.000					0.125		0.125
2.00	288.00	4,524	0.000				0.000					0.171		0.171
3.00	289.00	7,913	0.000				0.000					0.207		0.207
4.00	290.00	11,970	0.000				0.000					0.246		0.246
5.00	291.00	16,752	3.405 ic				3.405					0.288		3.693
6.00	292.00	22,314	8.868 ic				0.000					0.333		9.201

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

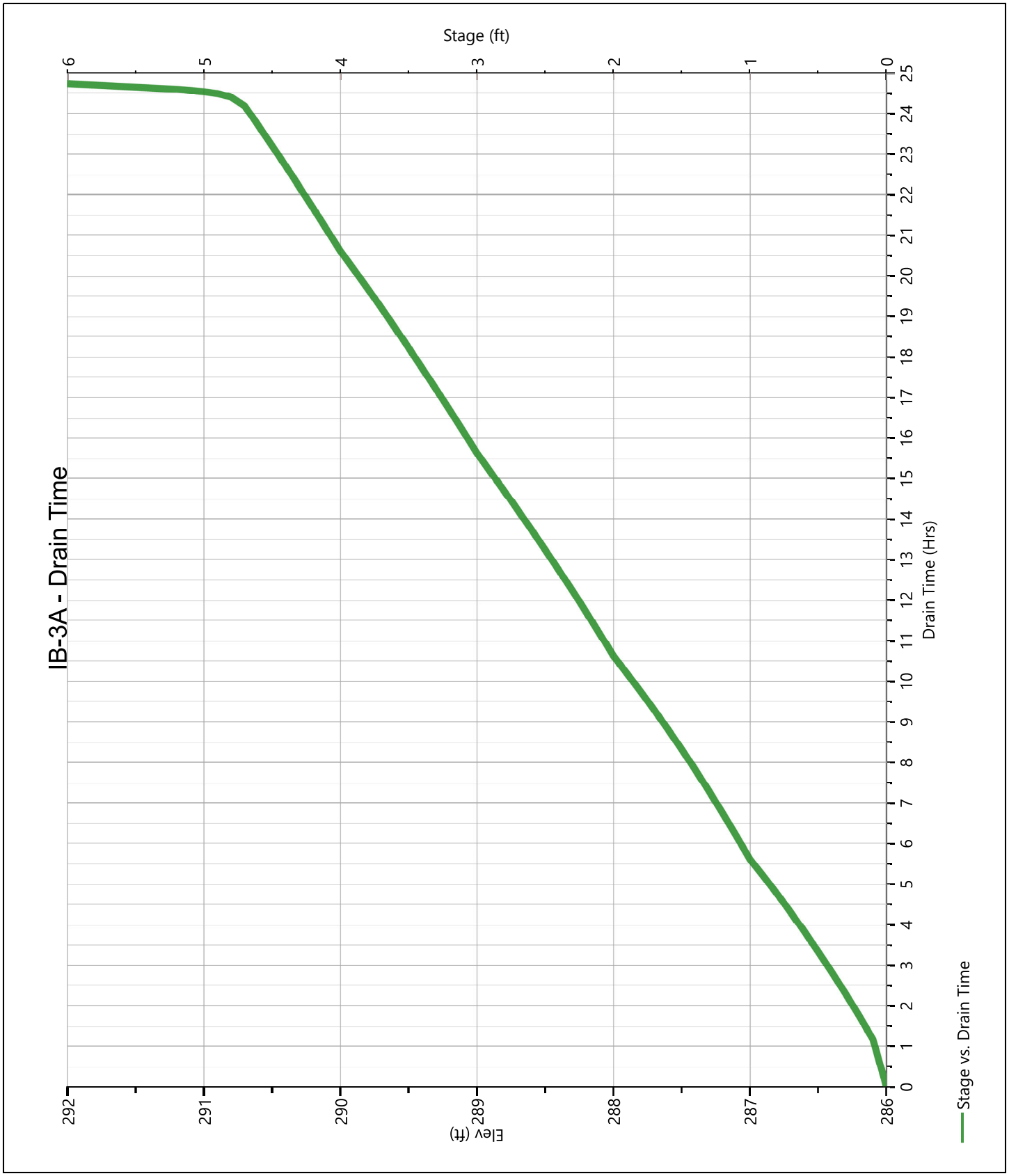
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-3A

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/21/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-3B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Brush Fair	35			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			7.57	529.63
C	Open Space Good Condition	74			0.90	66.82
C	Gravel	89			0.35	30.80
1/ Use only one CN source per line.		383994		Totals =	8.82	627.26

CN (weighted) = total product / total area = 627.26 / 8.82 = 71.16 ; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.93	3.03	4.46

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/21/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed Subcatchment P-3B
Circle one: Tc | Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.049			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.20			0.20
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	469			
9. Watercourse slope, s		ft/ft	0.140			
10. Average Velocity, V (figure 3-1)		ft/s	6.04			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.22
min 13.4

Hydrograph Report

Project Name:

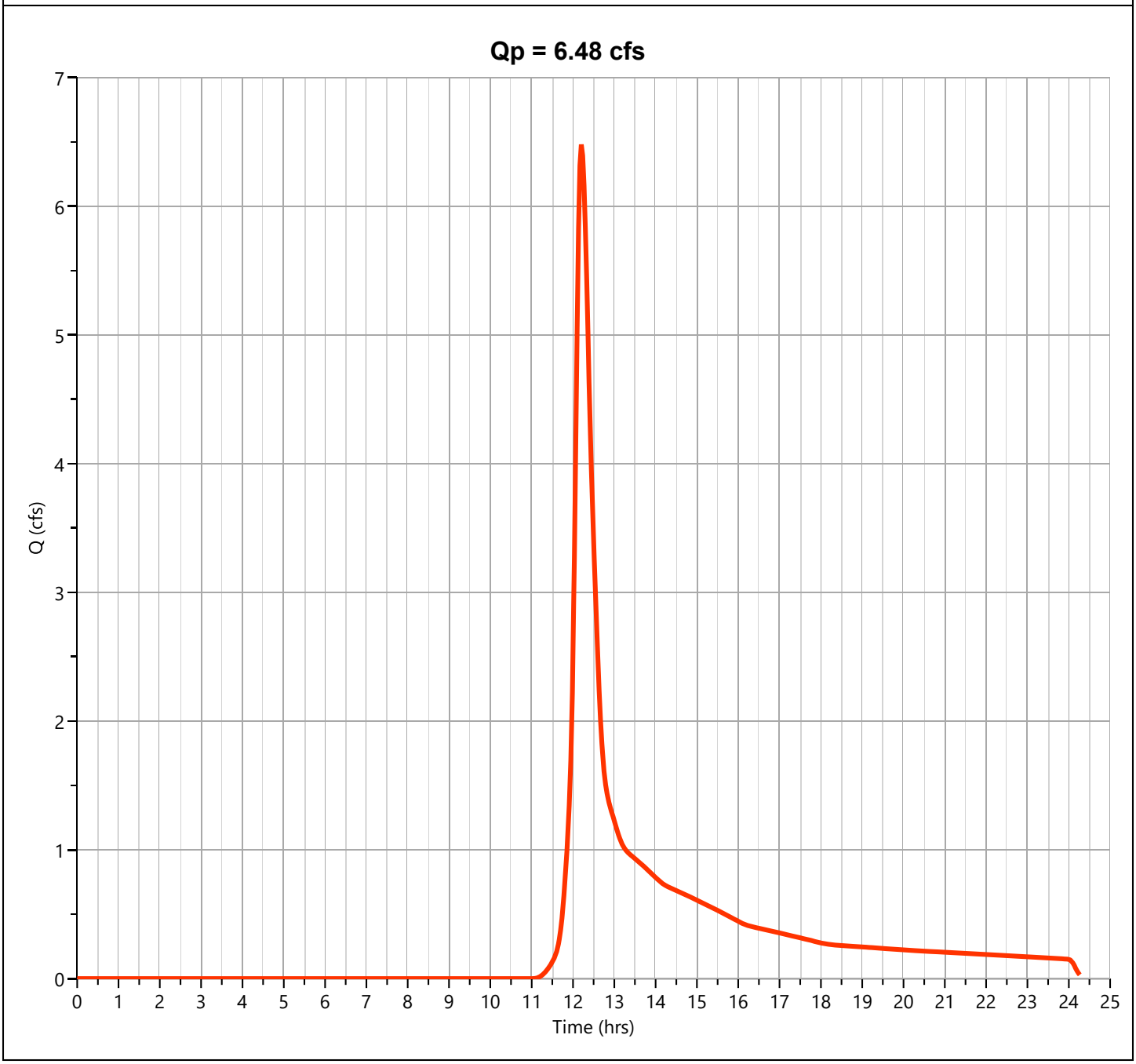
Hydrology Studio v 3.0.0.24

06-28-2022

P-3B

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.481 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 28,734 cuft
Drainage Area	= 8.82 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 13.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

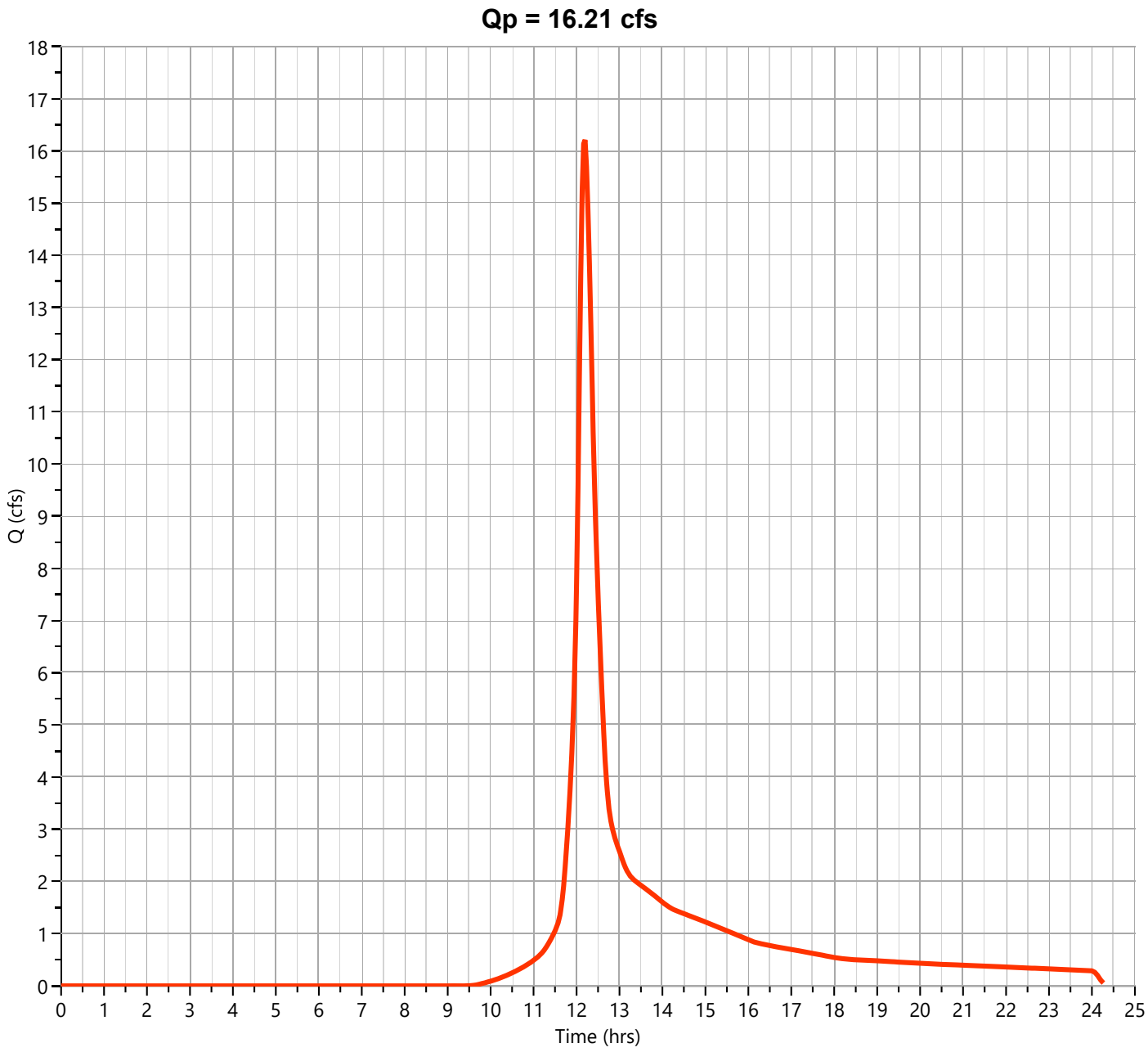
Hydrology Studio v 3.0.0.24

06-28-2022

P-3B

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.21 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 67,014 cuft
Drainage Area	= 8.82 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 13.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

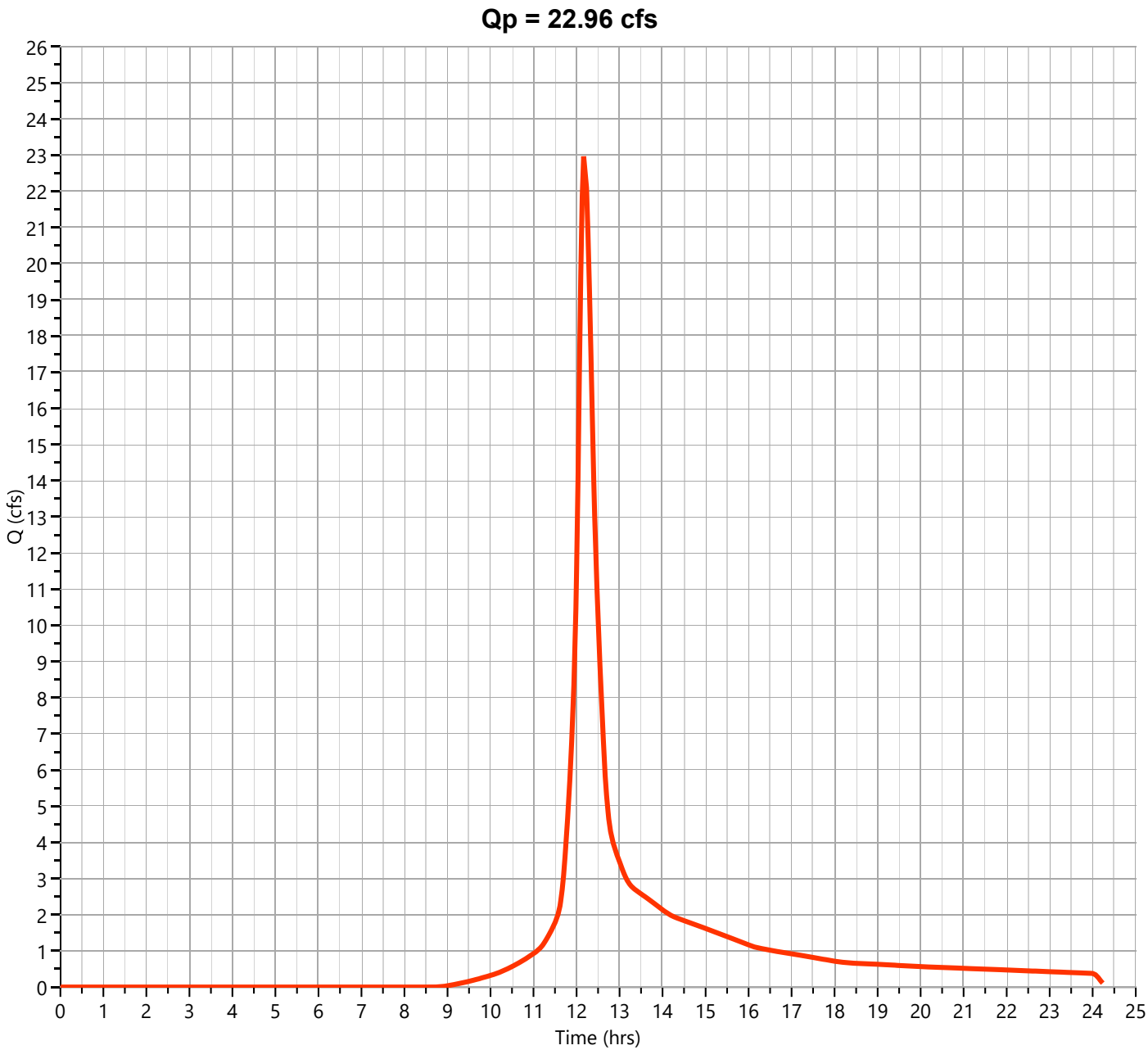
Hydrology Studio v 3.0.0.24

06-28-2022

P-3B

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 22.96 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 94,022 cuft
Drainage Area	= 8.82 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 13.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

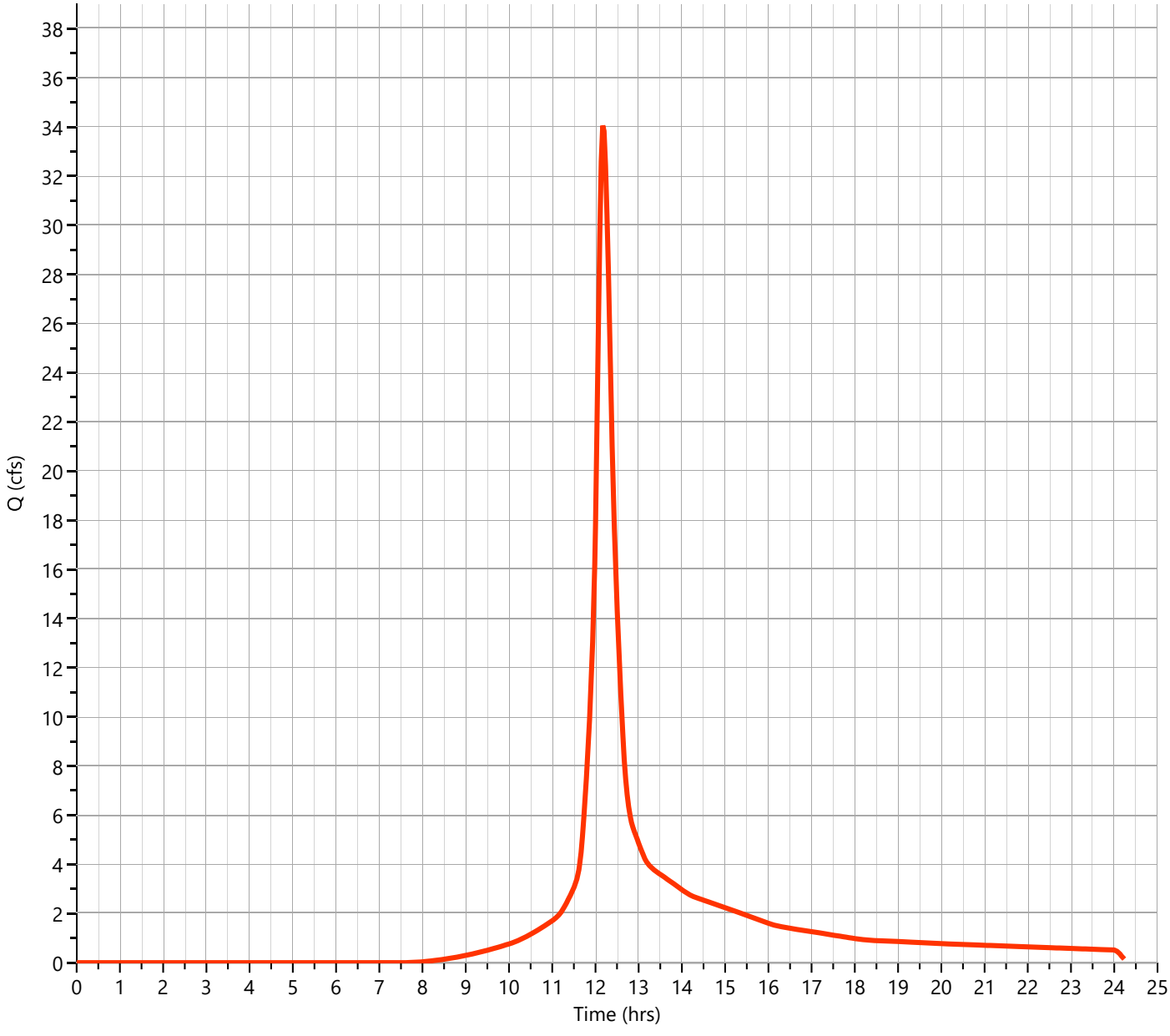
Hydrology Studio v 3.0.0.24

06-28-2022

P-3B

Hyd. No. 18

Hydrograph Type	= NRCS Runoff	Peak Flow	= 34.06 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 138,617 cuft
Drainage Area	= 8.82 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 13.4 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

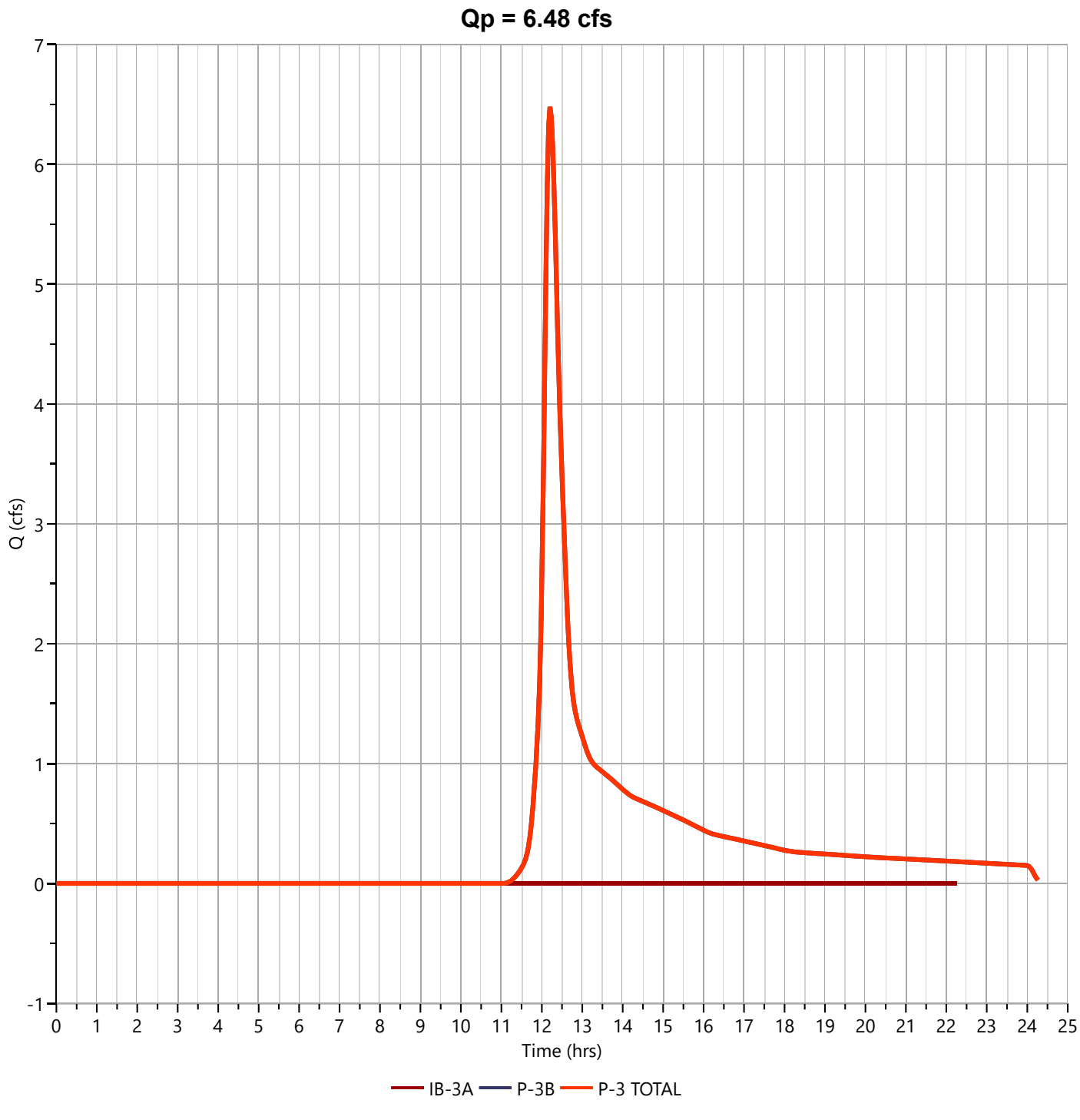
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06-28-2022

P-3 TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 6.481 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 28,734 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 8.82 ac



Hydrograph Report

Project Name:

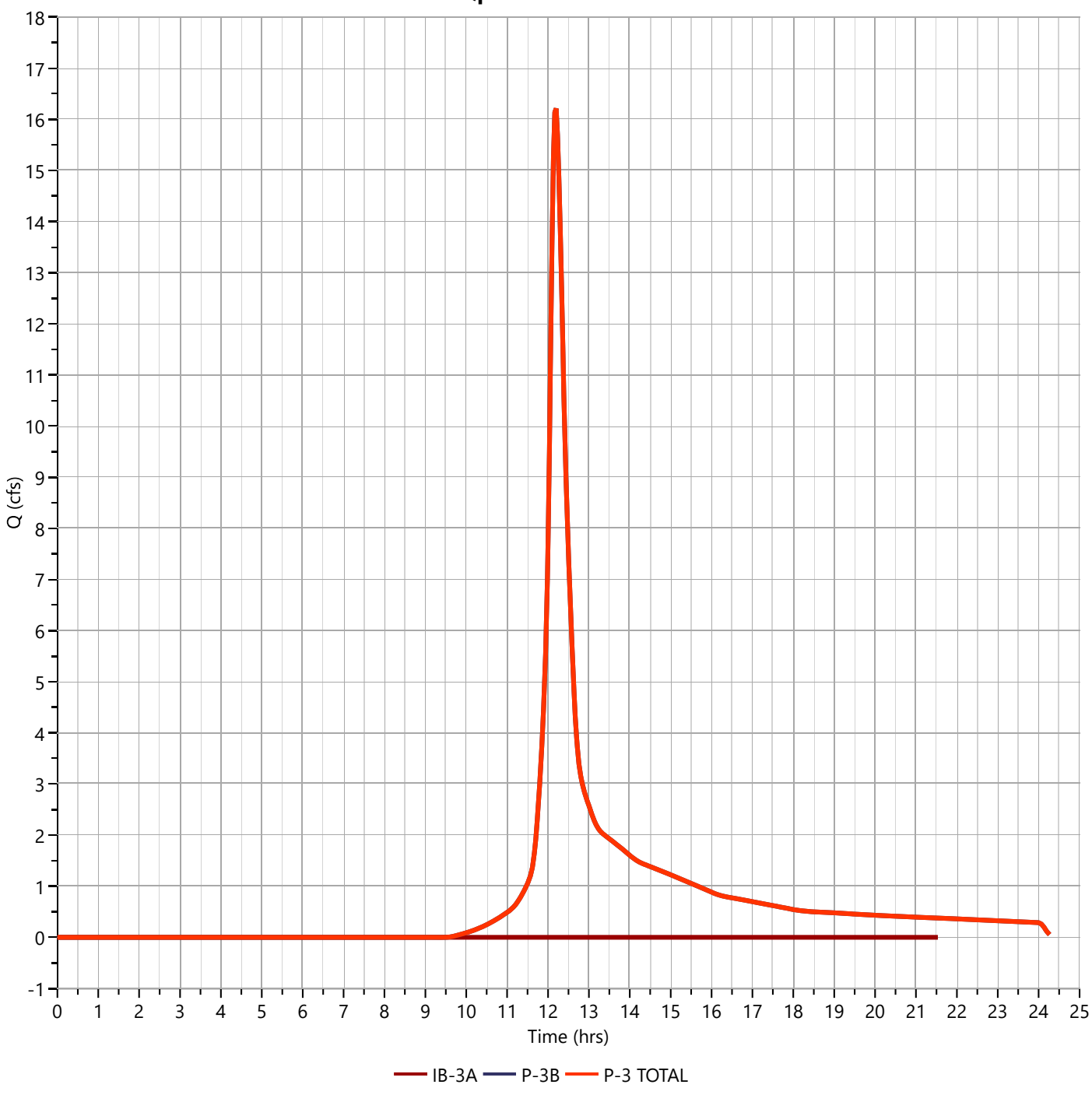
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06-28-2022

P-3 TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 16.21 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 67,014 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 8.82 ac



Hydrograph Report

Project Name:

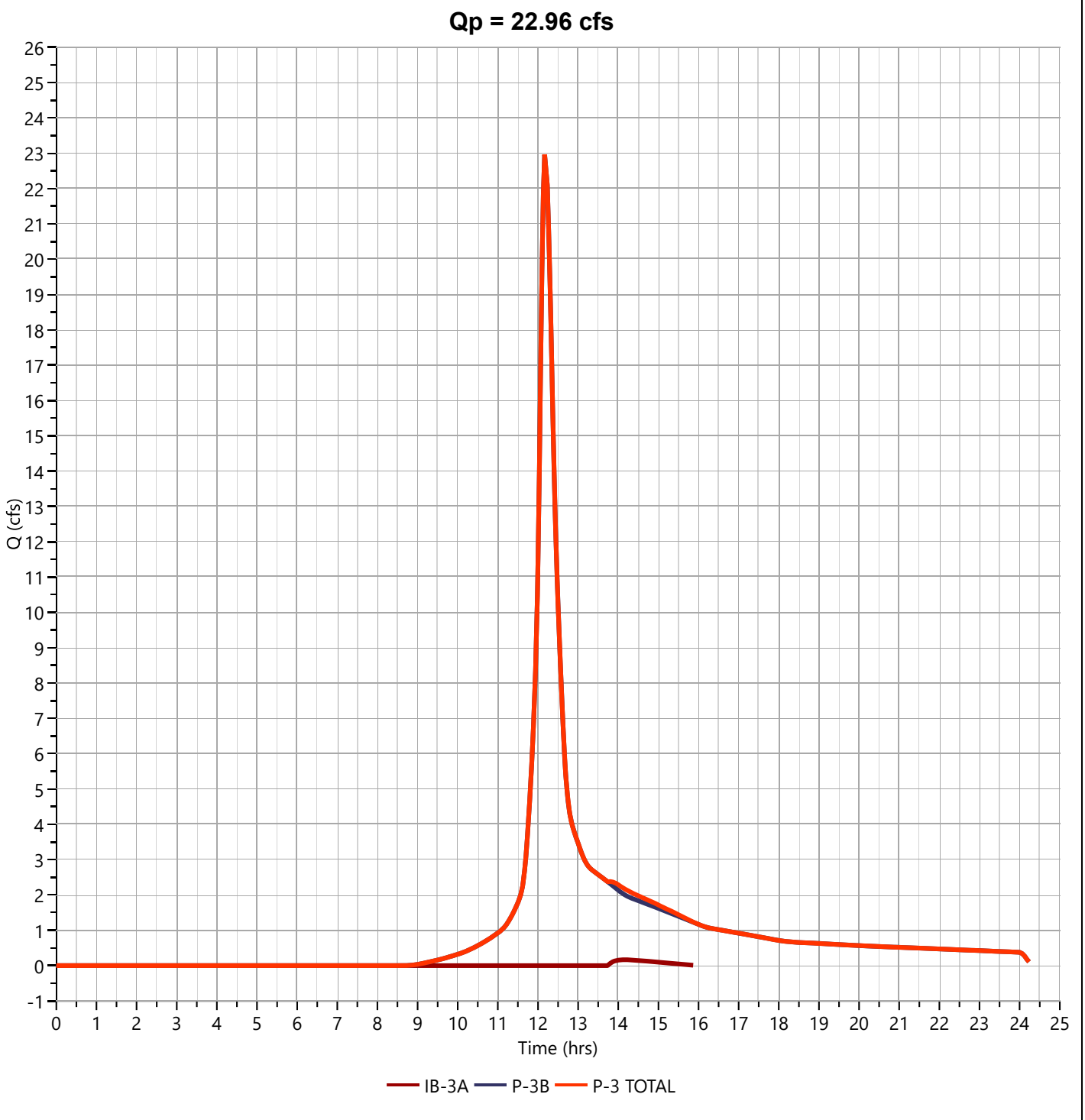
Hydrology Studio v 3.0.0.24

06-28-2022

P-3 TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 22.96 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 94,782 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 8.82 ac



Hydrograph Report

Project Name:

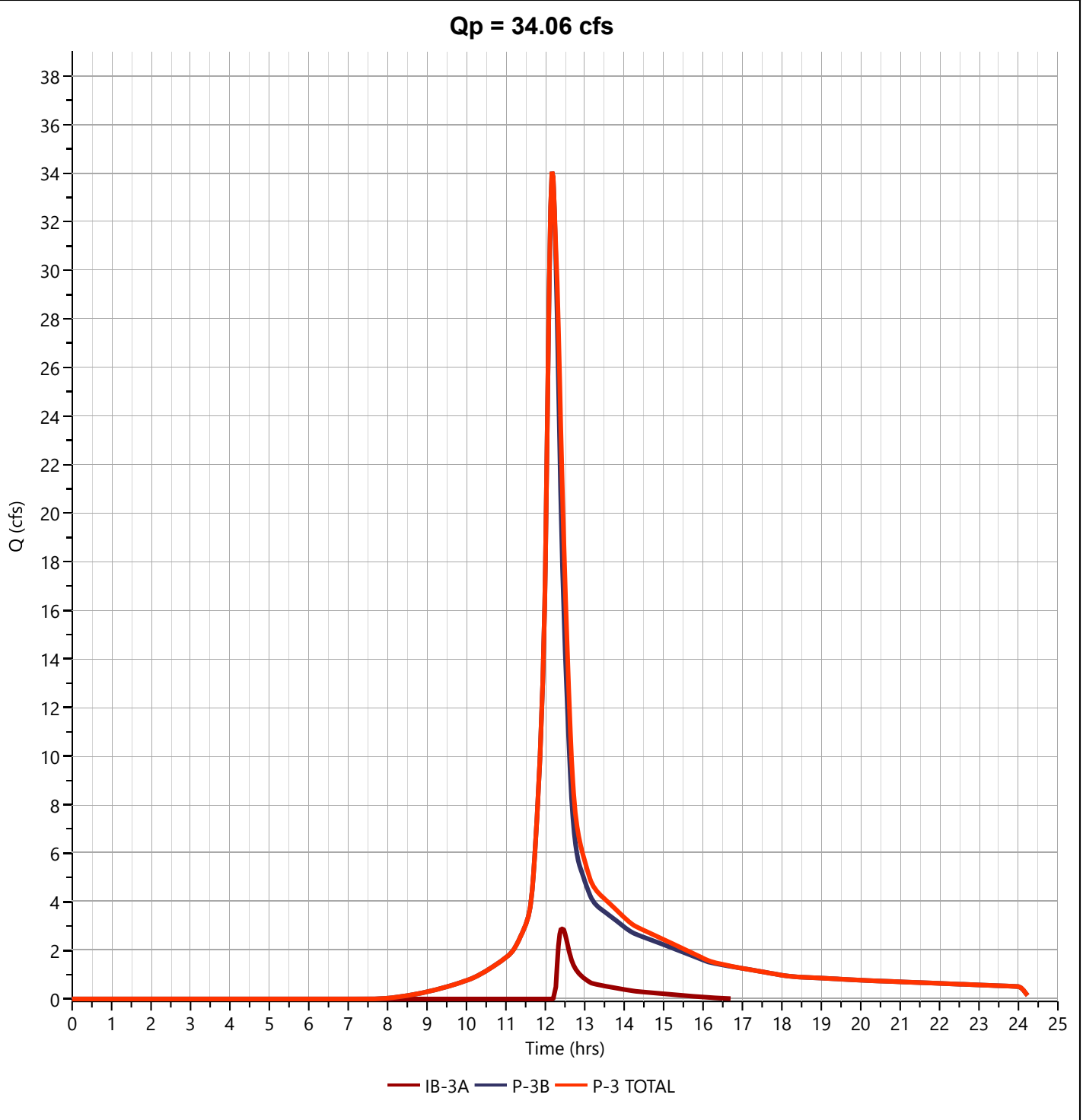
Hydrology Studio v 3.0.0.24

06-28-2022

P-3 TOTAL

Hyd. No. 19

Hydrograph Type	= Junction	Peak Flow	= 34.06 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 146,891 cuft
Inflow Hydrographs	= 17, 18	Total Contrib. Area	= 8.82 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/21/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			6.42	449.48
C	Open Space Good Condition	74			1.06	78.51
C	Gravel	89			0.36	32.29
D	BVW	77			0.03	2.55
1/ Use only one CN source per line.	343165			Totals =	7.88	562.83

CN (weighted) = total product / total area = 562.83 / 7.88 = 71.44 ; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.94	3.05	4.49

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/21/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-4
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B	B-C		
1. Surface Description (table 3-1)			GRASS	WOODS		
2. Mannings roughness coeff., n (table 3-1)			0.24	0.6		
3. Flow length, L (total L <= 300 ft)		ft	22	28		
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1		
5. Land Slope, s		ft/ft	0.100	0.057		
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.04	0.12		0.16
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	275			
9. Watercourse slope, s		ft/ft	0.150			
10. Average Velocity, V (figure 3-1)		ft/s	6.25			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.2

Hydrograph Report

Project Name:

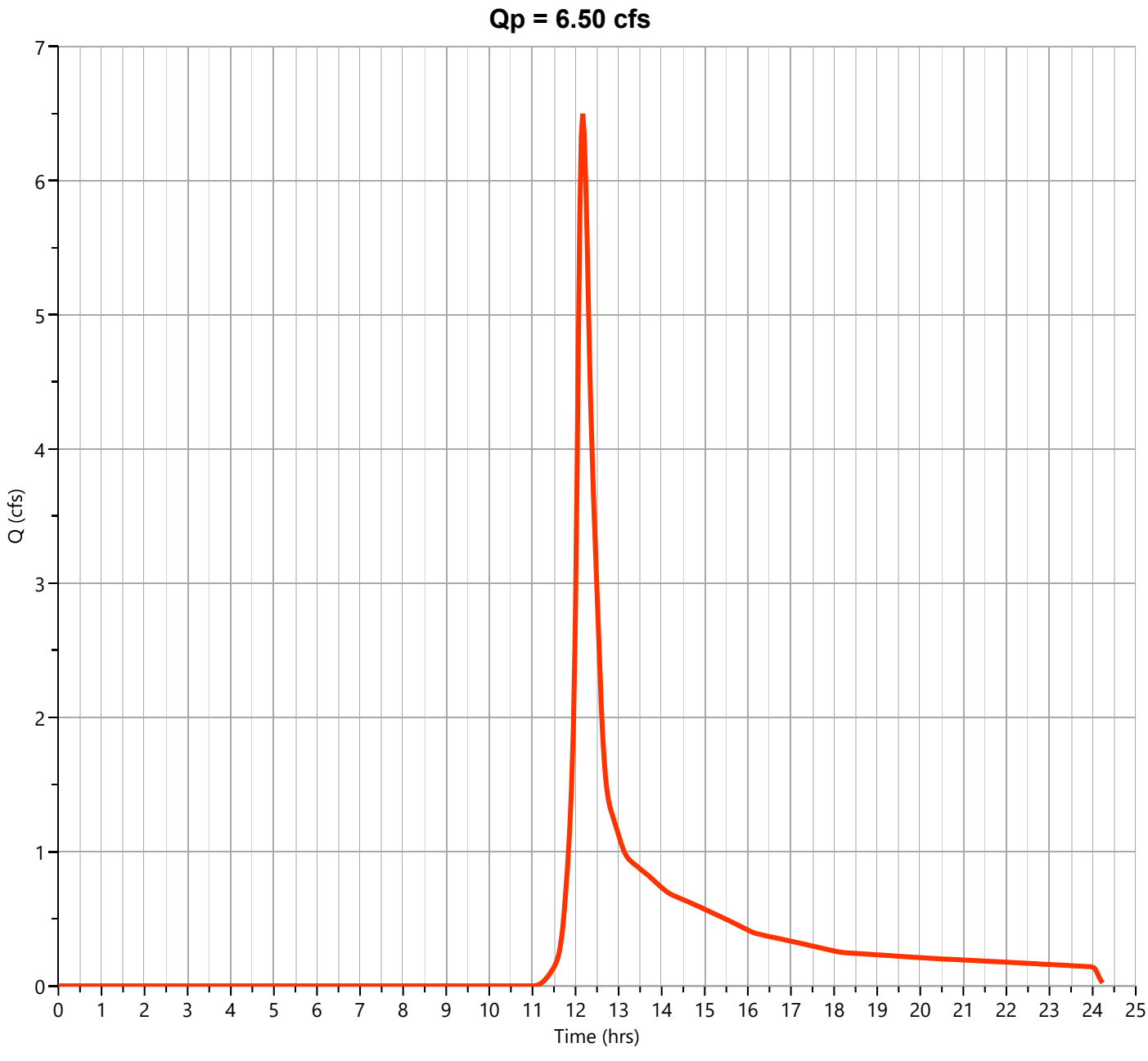
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06-28-2022

P-4

Hyd. No. 21

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.500 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 27,152 cuft
Drainage Area	= 7.88 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

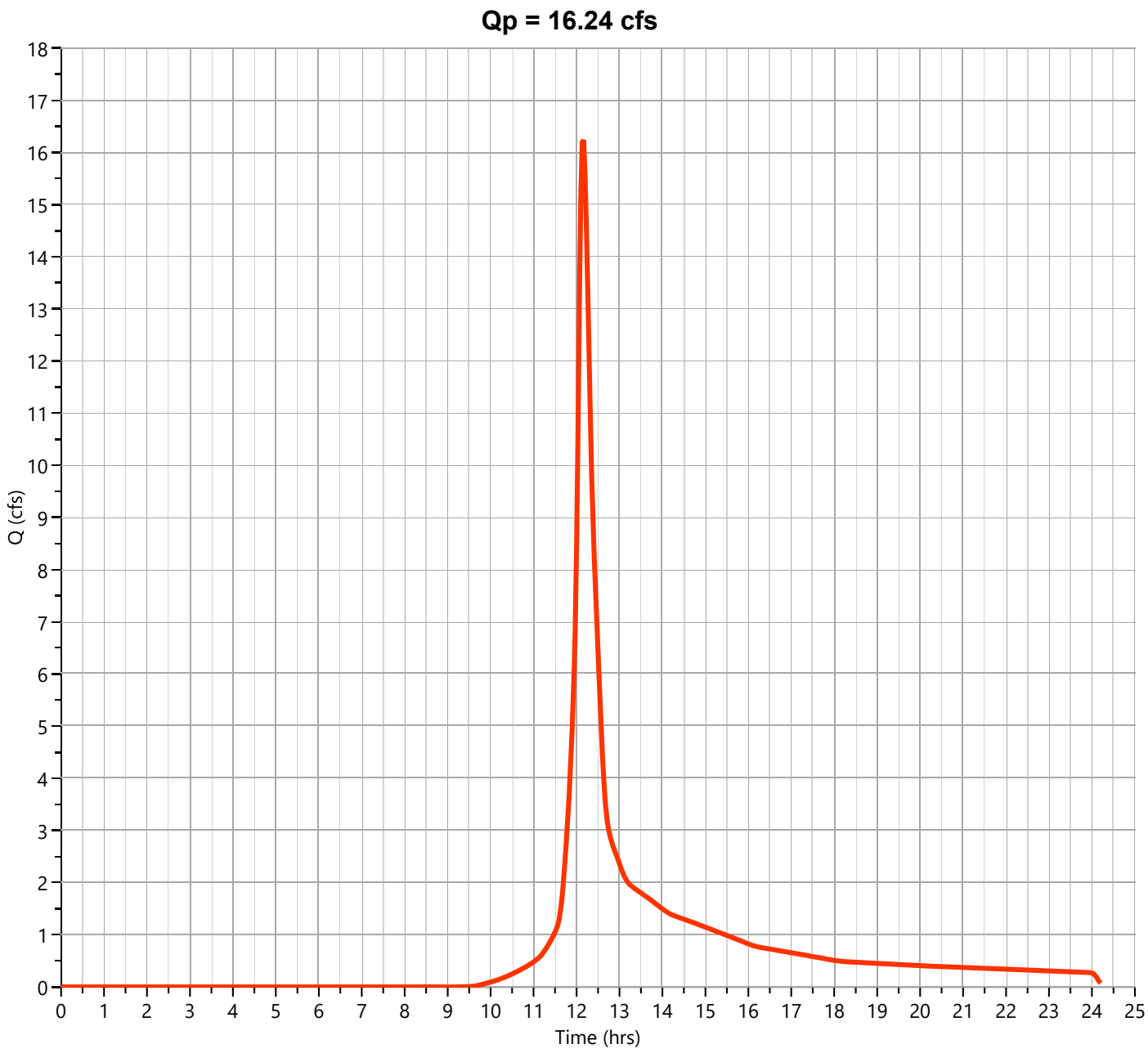
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06-28-2022

P-4

Hyd. No. 21

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.24 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 63,326 cuft
Drainage Area	= 7.88 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

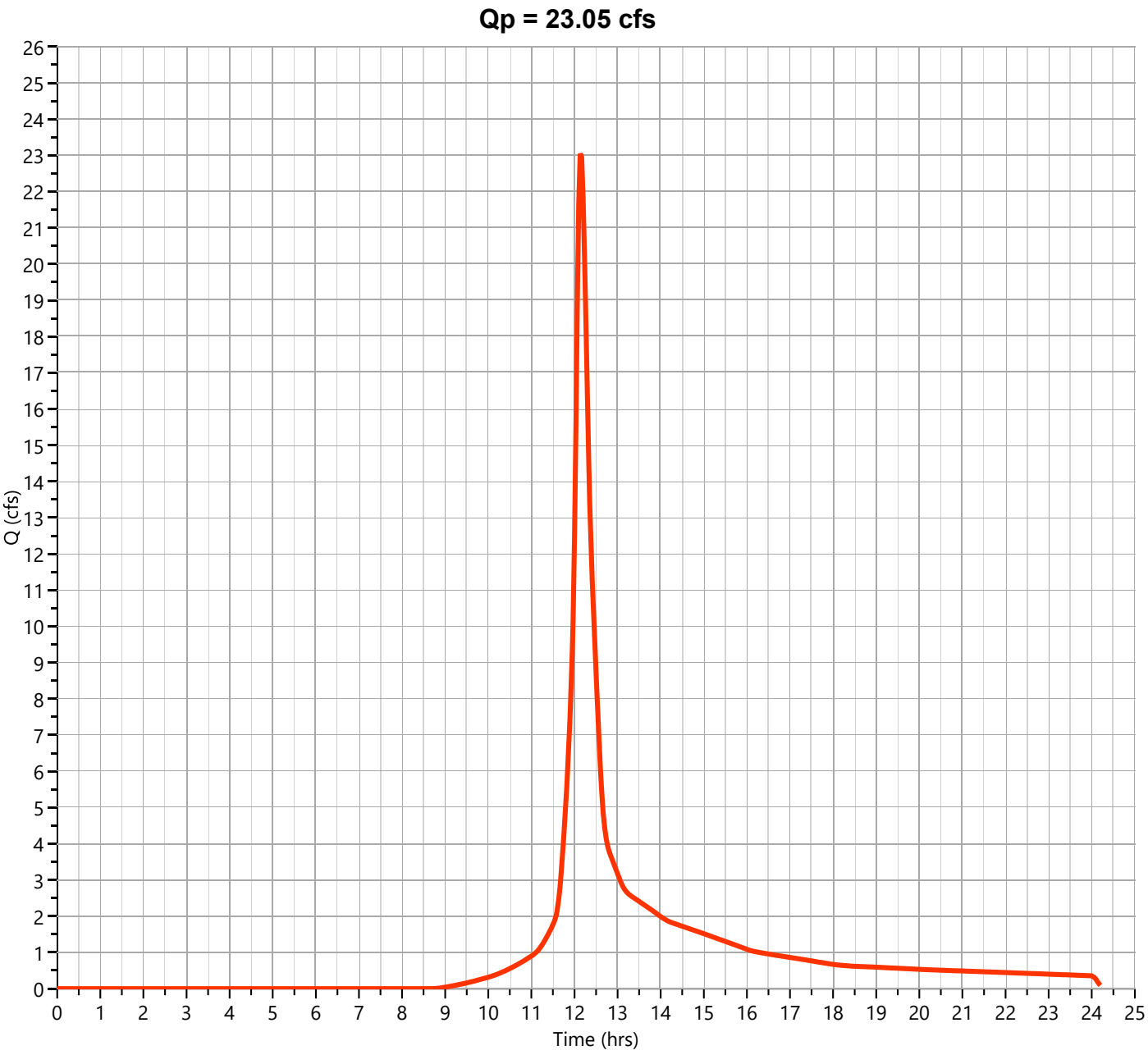
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P-4

Hyd. No. 21

Hydrograph Type	= NRCS Runoff	Peak Flow	= 23.05 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 88,848 cuft
Drainage Area	= 7.88 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

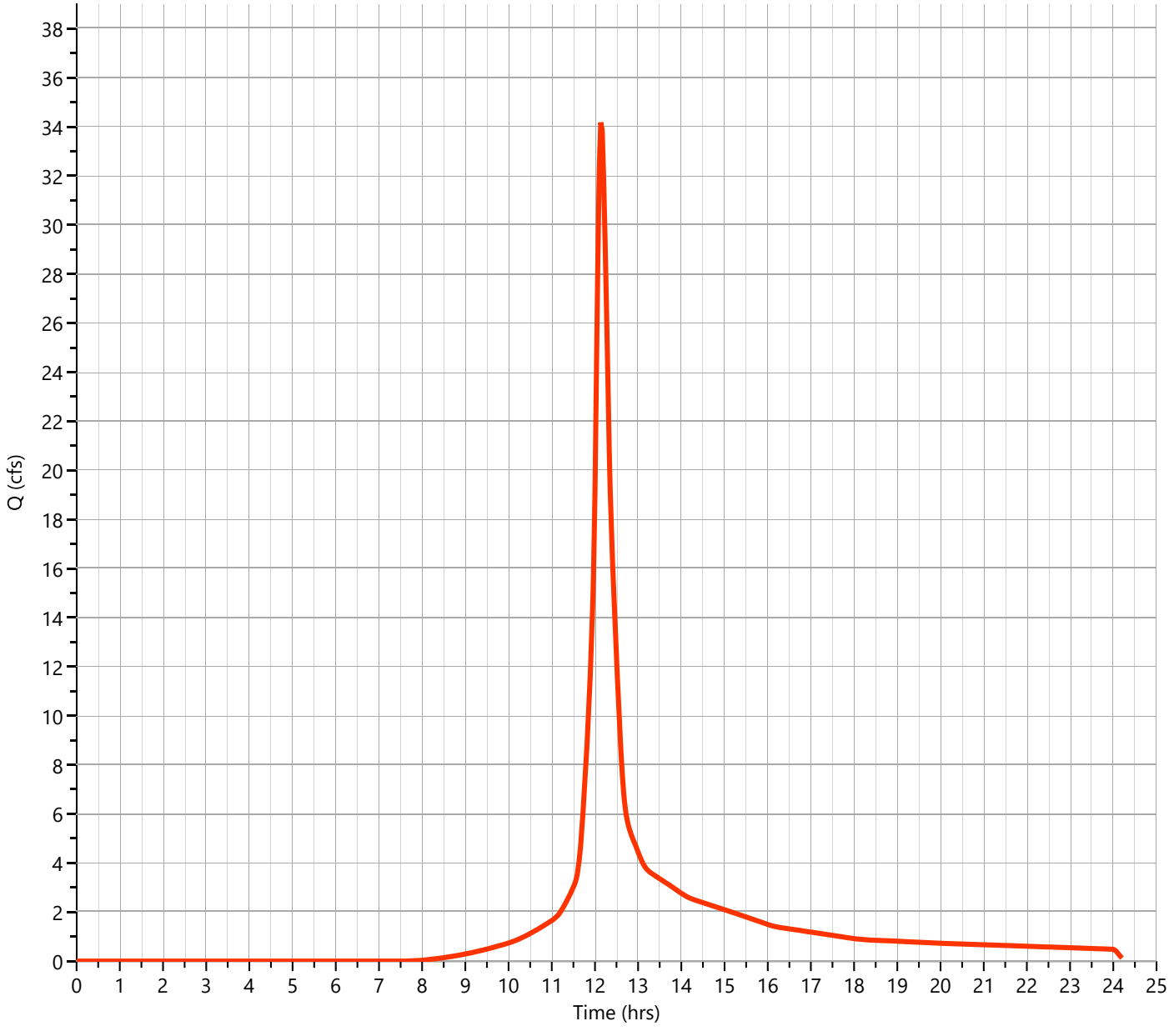
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06-28-2022

P-4

Hyd. No. 21

Hydrograph Type	= NRCS Runoff	Peak Flow	= 34.18 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 130,989 cuft
Drainage Area	= 7.88 ac	Curve Number	= 71
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/21/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-5A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.51	147.57
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.58	40.87
C	Open Space Good Condition	74			1.52	112.67
C	Gravel	89			0.00	0.00
1/ Use only one CN source per line.		157350		Totals =	3.61	301.11

CN (weighted) = total product / total area = 301.11 / 3.61 = 83.36 ; Use CN = 83

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.69	4.26	5.87

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/21/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-5A

			A-B	B-C		
Sheet flow (Applicable to Tc only)		Segment ID				
1. Surface Description (table 3-1)			GRASS	WOODS		
2. Mannings roughness coeff., n (table 3-1)			0.24	0.6		
3. Flow length, L (total L <= 300 ft)		ft	20	30		
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1		
5. Land Slope, s		ft/ft	0.050	0.030		
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.05	0.16		0.21
Shallow concentrated Flow		Segment ID	C-D			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	88			
9. Watercourse slope, s		ft/ft	0.120			
10. Average Velocity, V (figure 3-1)		ft/s	5.59			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.21
min 12.8

Hydrograph Report

Project Name:

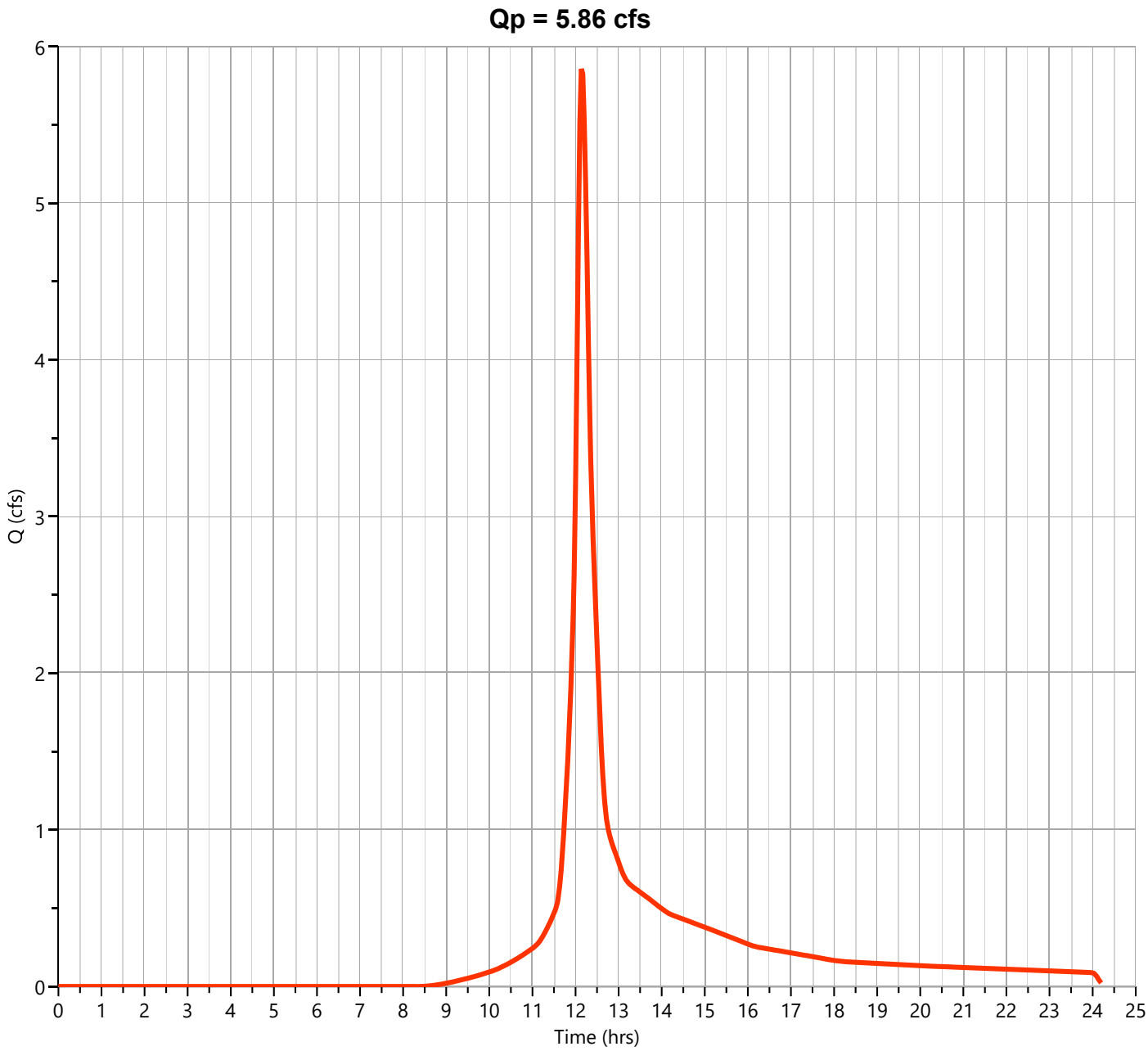
Hydrology Studio v 3.0.0.24

06-28-2022

P-5A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.857 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 22,525 cuft
Drainage Area	= 3.61 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

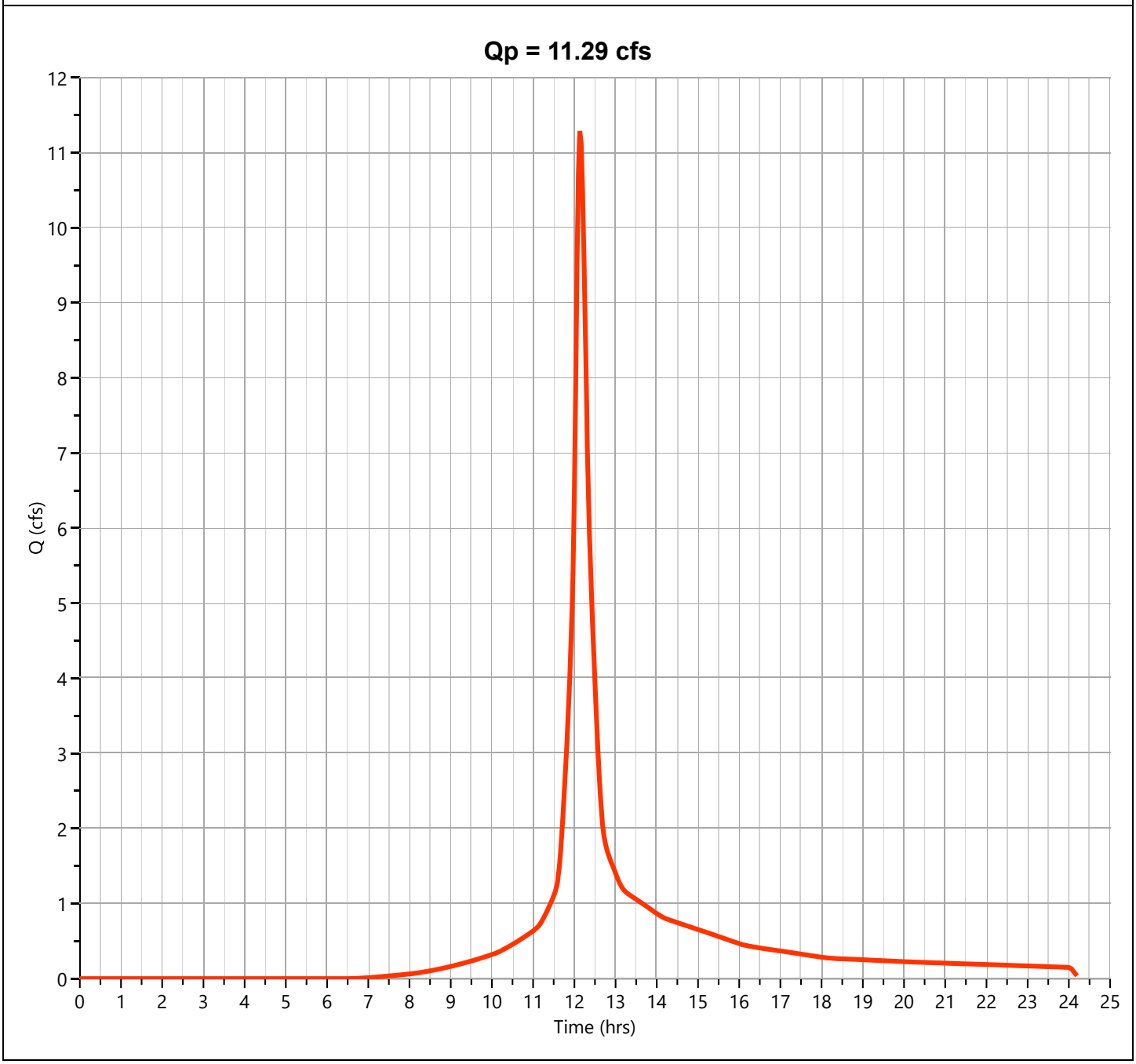
Hydrology Studio v 3.0.0.24

06-28-2022

P-5A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.29 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 43,384 cuft
Drainage Area	= 3.61 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

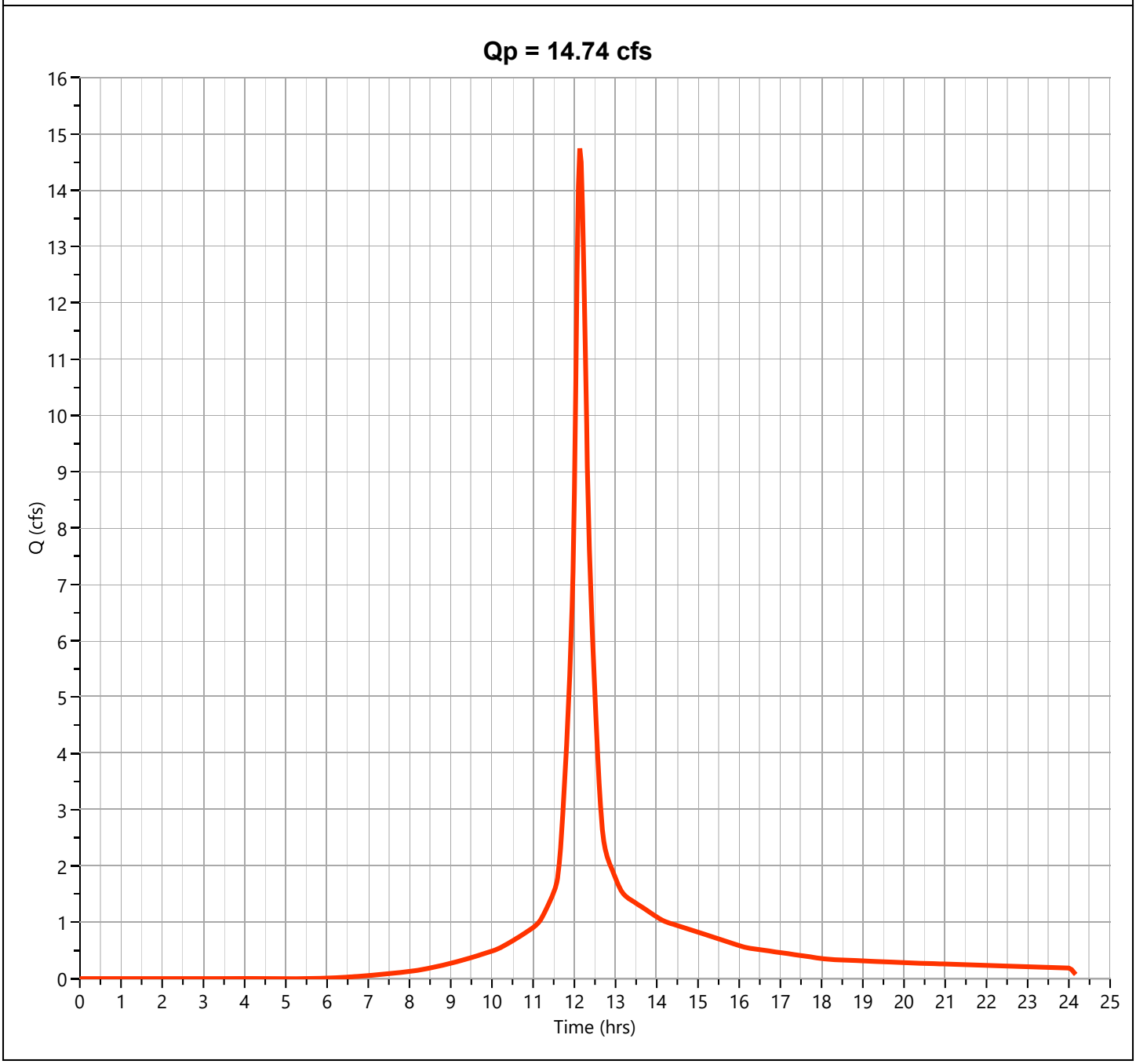
Hydrology Studio v 3.0.0.24

06-28-2022

P-5A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 14.74 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 57,048 cuft
Drainage Area	= 3.61 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

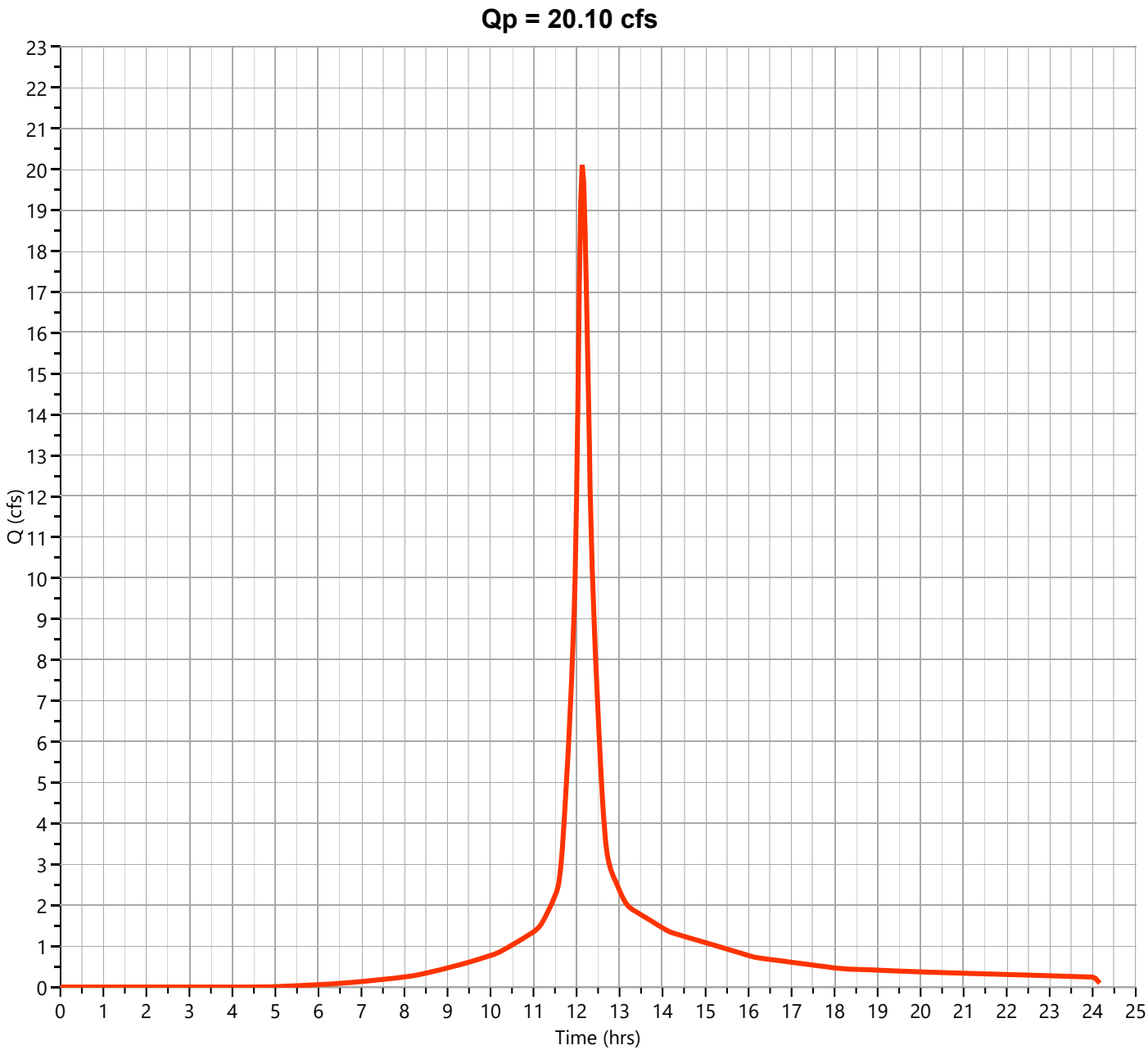
Hydrology Studio v 3.0.0.24

06-28-2022

P-5A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.10 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 78,715 cuft
Drainage Area	= 3.61 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

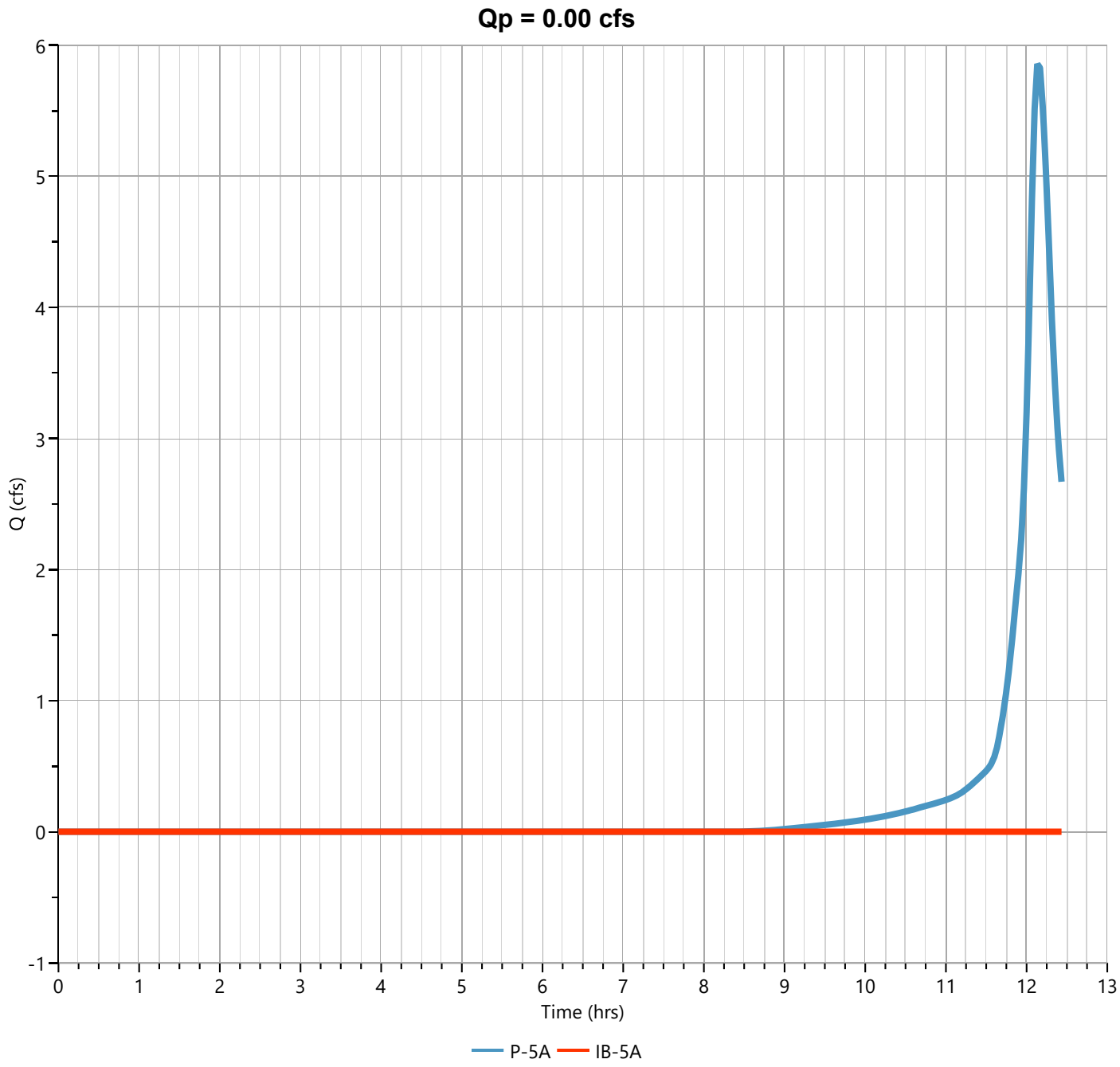
06-28-2022

IB-5A

Hyd. No. 24

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 23 - P-5A	Max. Elevation	= 305.99 ft
Pond Name	= IB-5A	Max. Storage	= 10,729 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

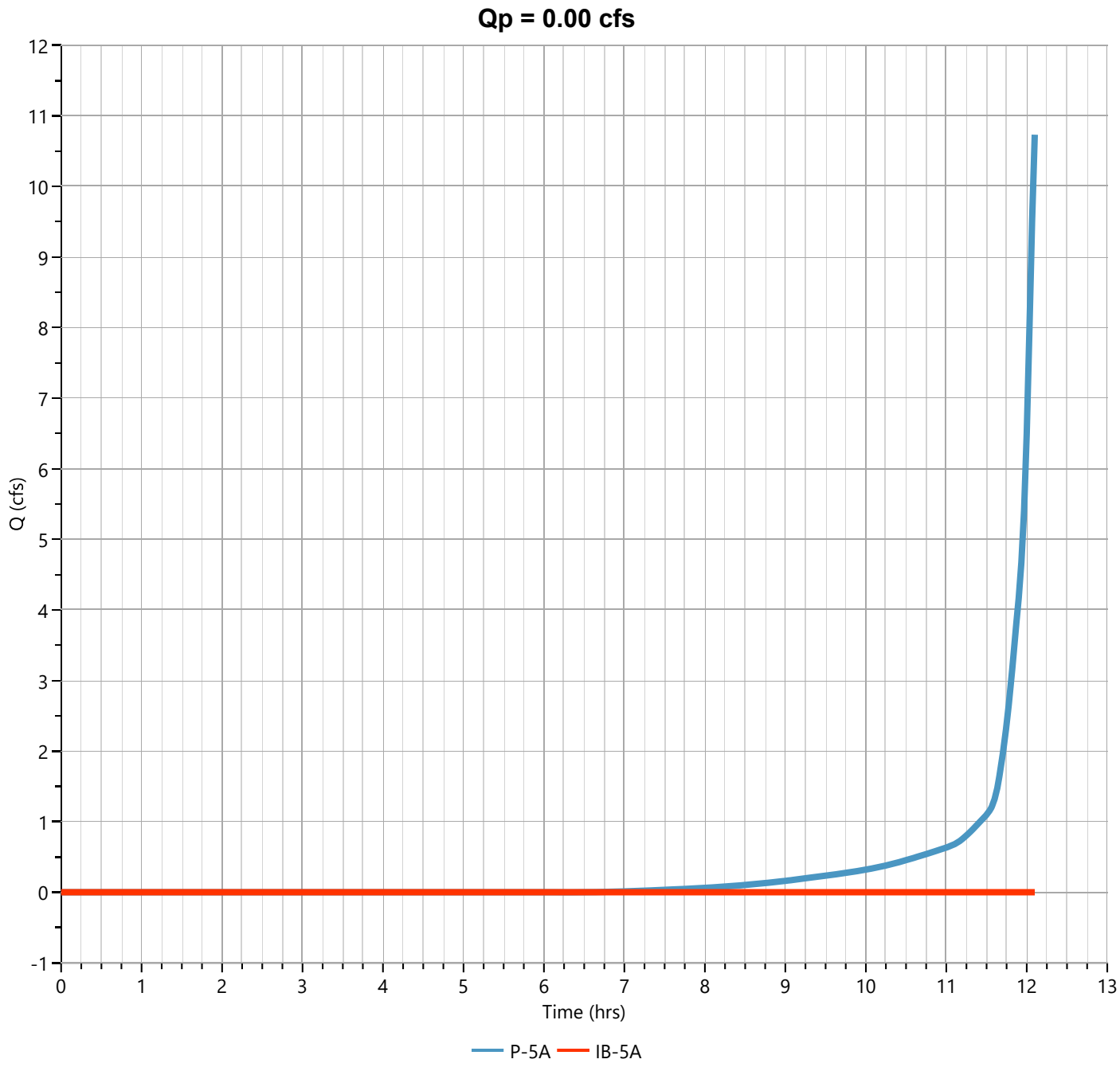
06-28-2022

IB-5A

Hyd. No. 24

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 23 - P-5A	Max. Elevation	= 307.49 ft
Pond Name	= IB-5A	Max. Storage	= 24,675 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

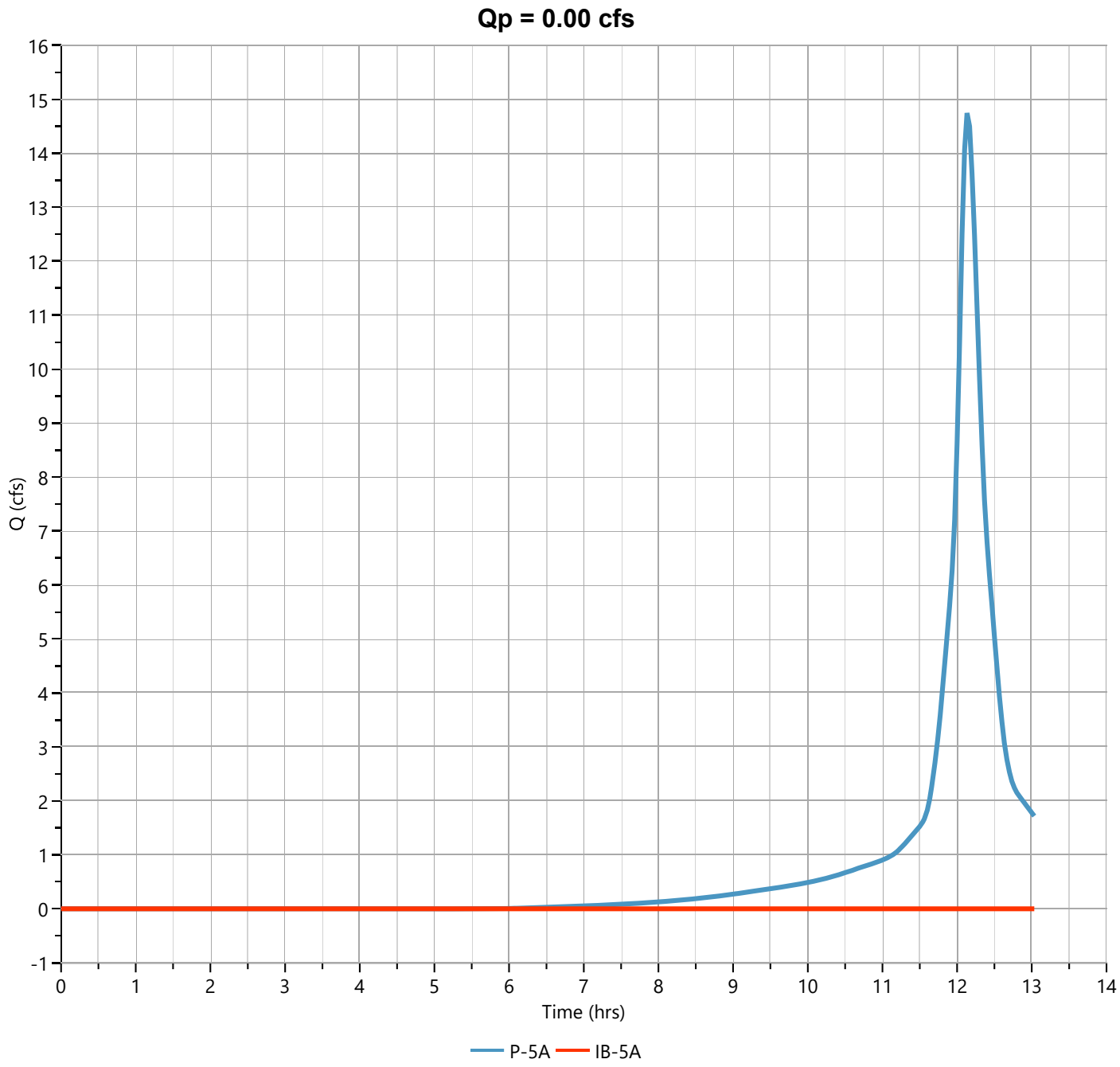
06-28-2022

IB-5A

Hyd. No. 24

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.002 cuft
Inflow Hydrograph	= 23 - P-5A	Max. Elevation	= 308.40 ft
Pond Name	= IB-5A	Max. Storage	= 34,518 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

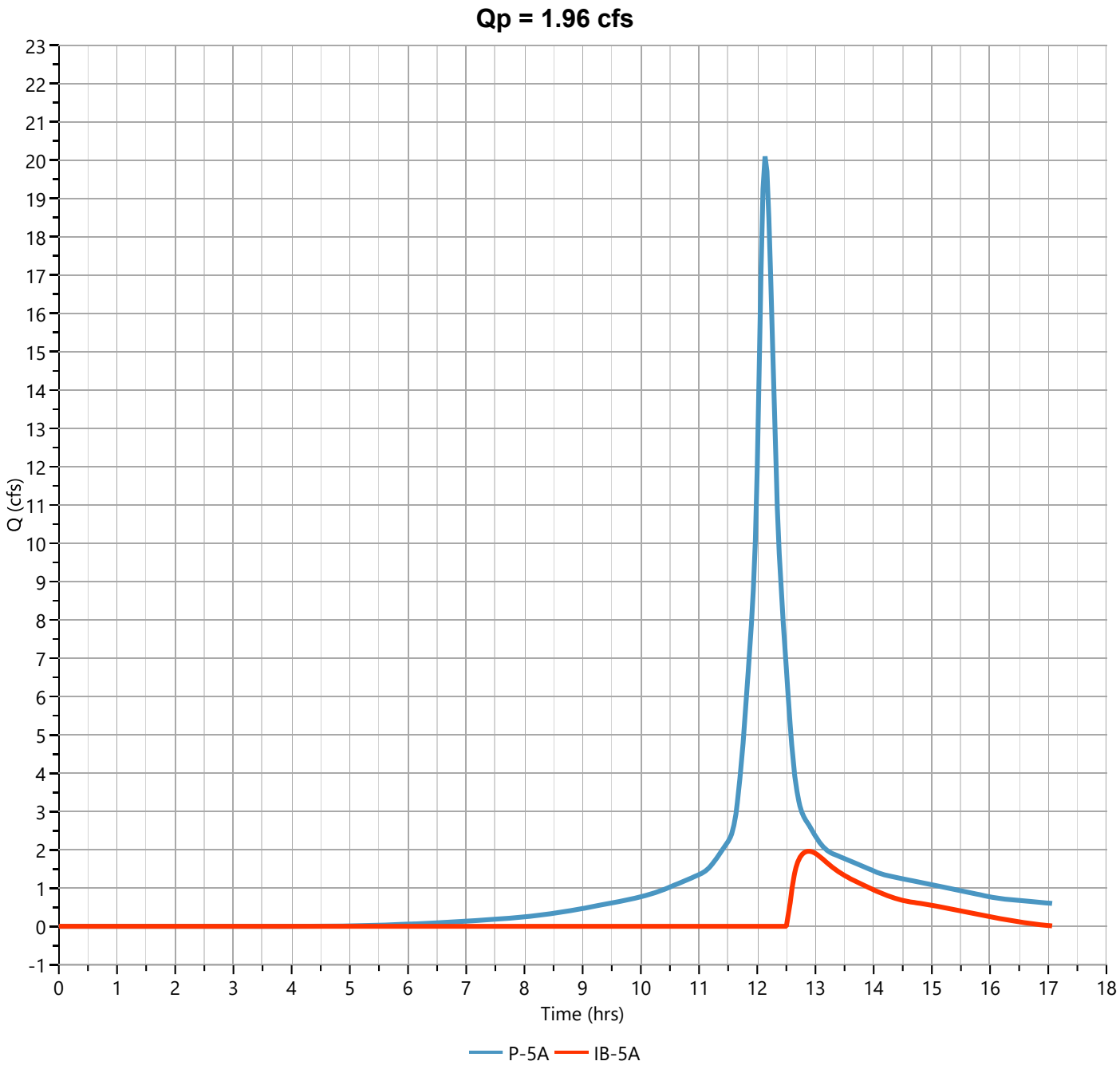
IB-5A

Hyd. No. 24

Hydrograph Type	= Pond Route	Peak Flow	= 1.960 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.90 hrs
Time Interval	= 2 min	Hydrograph Volume	= 12,066 cuft
Inflow Hydrograph	= 23 - P-5A	Max. Elevation	= 309.01 ft
Pond Name	= IB-5A	Max. Storage	= 41,527 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 32 min



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

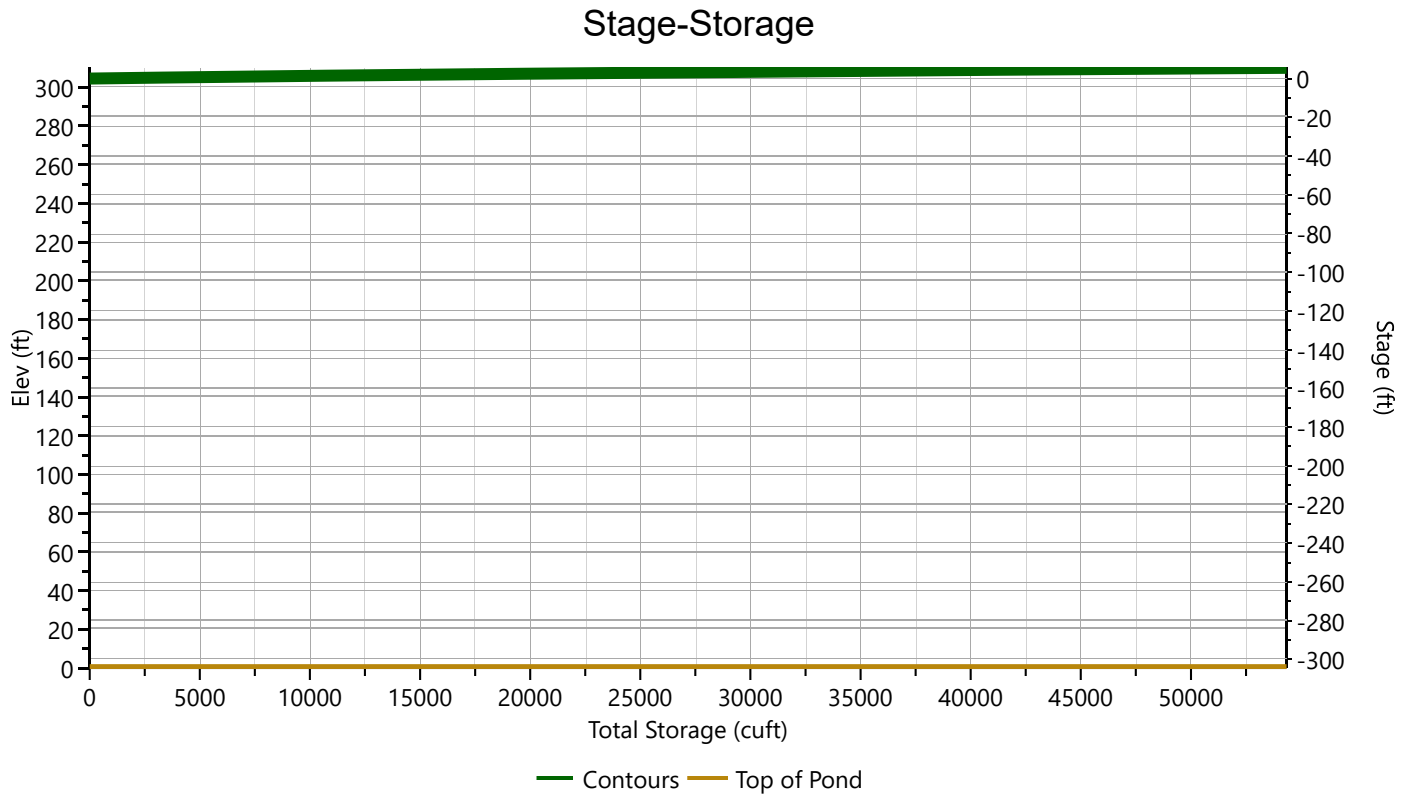
IB-5A

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	304.50
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	304.50	6,225	0.000	0.000
0.50	305.00	6,846	3,268	3,268
1.50	306.00	8,166	7,506	10,774
2.50	307.00	9,604	8,885	19,659
3.50	308.00	10,876	10,240	29,899
4.50	309.00	12,205	11,541	41,439
5.50	310.00	13,590	12,898	54,337



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

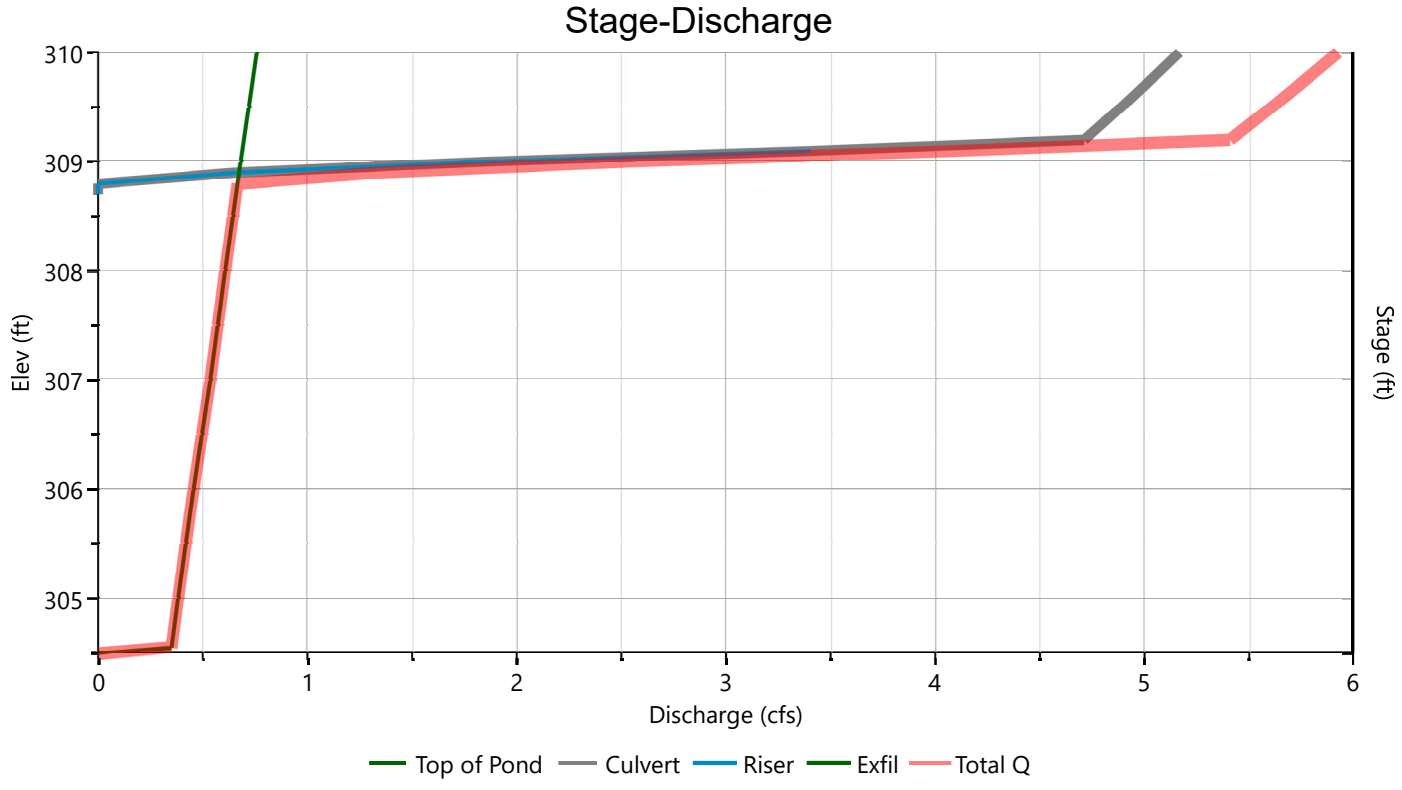
06-28-2022

IB-5A

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate	
		1	2	3		
Rise, in	12				Orifice Dia, in	
Span, in	12				No. Orifices	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	304.50				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	180					
Barrel Slope, %	.14					
N-Value, n	0.013					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular				Exfiltration, in/hr	2.41**
Crest Elevation, ft	308.8					
Crest Length, ft	6.28					
Angle, deg						
Weir Coefficient, Cw	3.3					

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5A

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	304.50	0.000	0.000				0.000					0.000		0.000
0.50	305.00	3,268	0.000				0.000					0.382		0.382
1.50	306.00	10,774	0.000				0.000					0.456		0.456
2.50	307.00	19,659	0.000				0.000					0.536		0.536
3.50	308.00	29,899	0.000				0.000					0.607		0.607
4.50	309.00	41,439	1.854 oc				1.854					0.681		2.535
5.50	310.00	54,337	5.166 oc				0.000					0.758		5.924

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

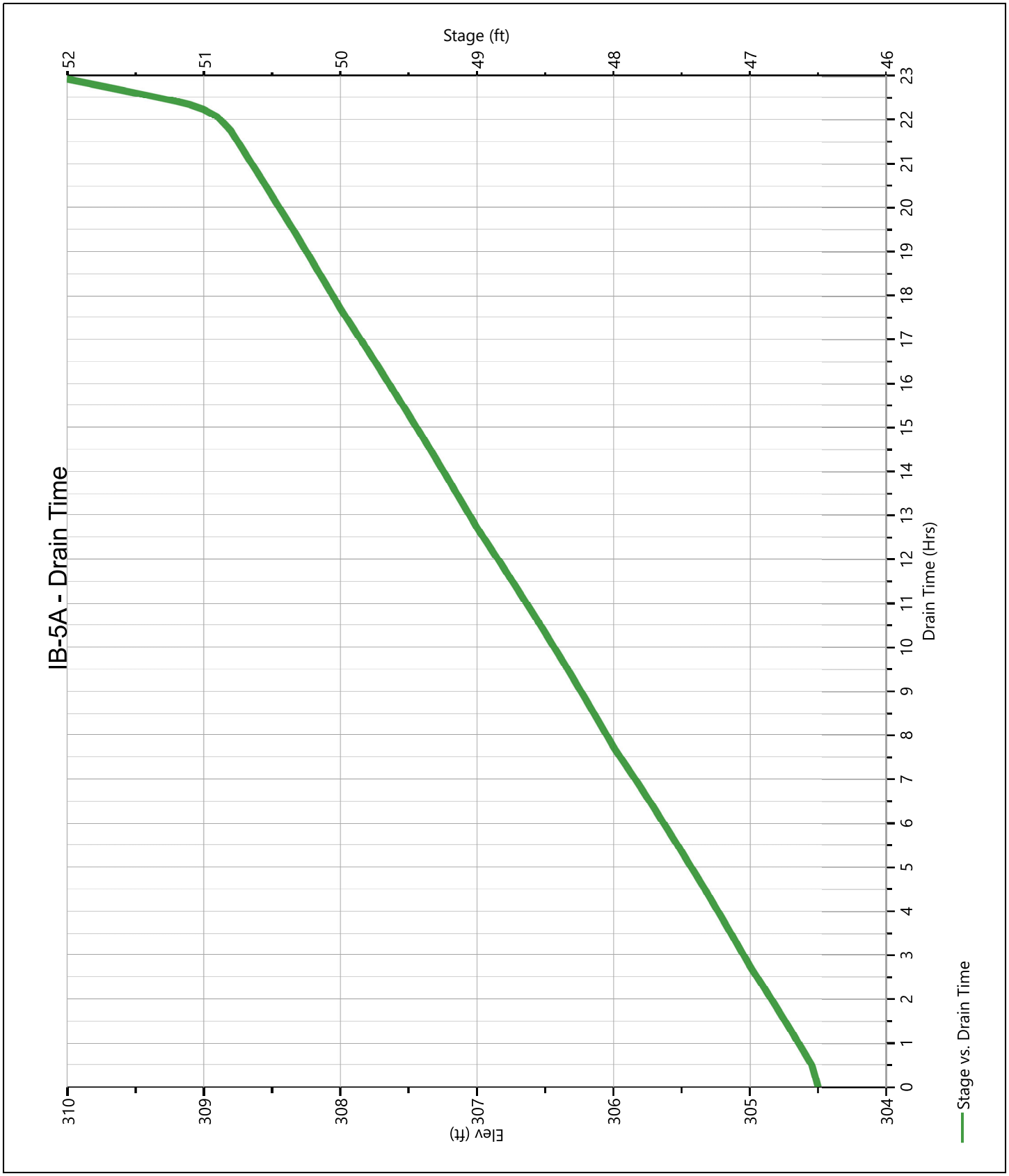
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5A

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By MKO Date 6/21/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-5B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.09	107.27
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.36	25.36
C	Open Space Good Condition	74			1.82	134.53
C	Gravel	89			0.00	0.00
1/ Use only one CN source per line.		142652		Totals =	3.27	267.16

CN (weighted) = total product / total area = 267.16 / 3.27 = 81.58 ; Use CN = 82

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.56	4.07	5.66

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By MKO Date 6/21/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-5B

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.050			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.20			0.20
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	251	157		
9. Watercourse slope, s		ft/ft	0.090	0.010		
10. Average Velocity, V (figure 3-1)		ft/s	4.84	2.03		
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.02		0.04
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.24
min 14.2

Hydrograph Report

Project Name:

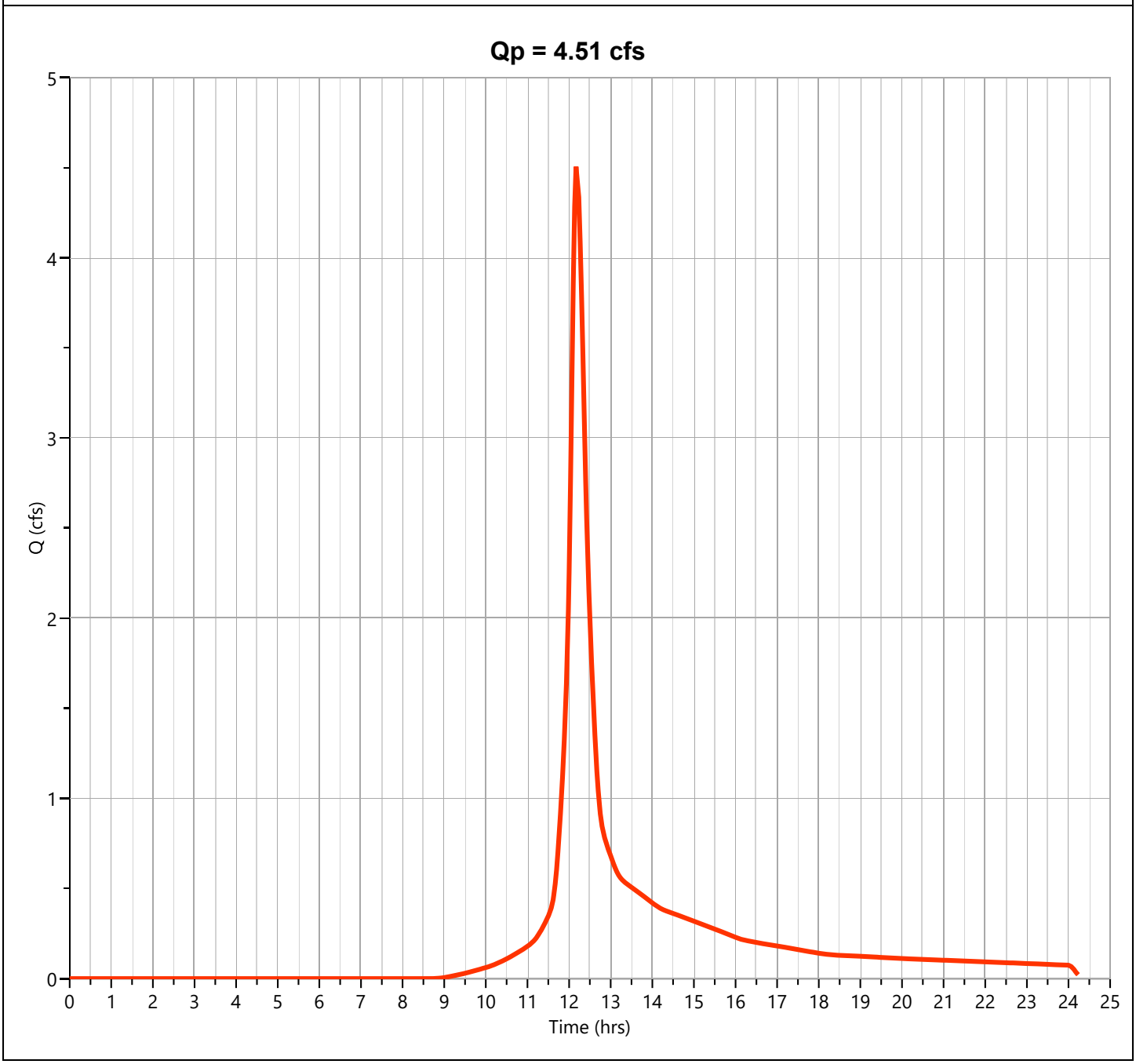
Hydrology Studio v 3.0.0.24

06-28-2022

P-5B

Hyd. No. 25

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.505 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 18,454 cuft
Drainage Area	= 3.27 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 14.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

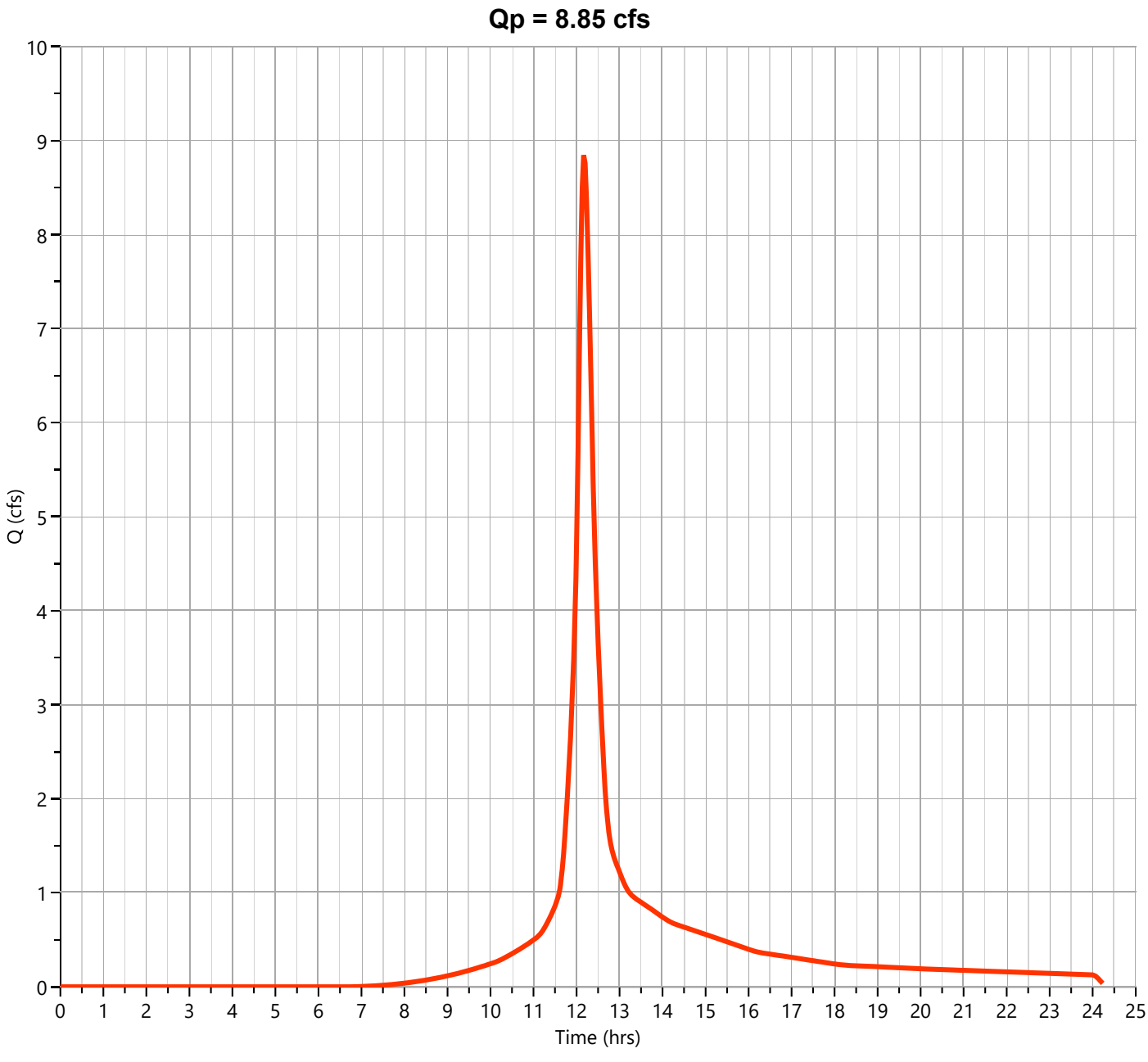
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06-28-2022

P-5B

Hyd. No. 25

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.845 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 36,049 cuft
Drainage Area	= 3.27 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 14.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

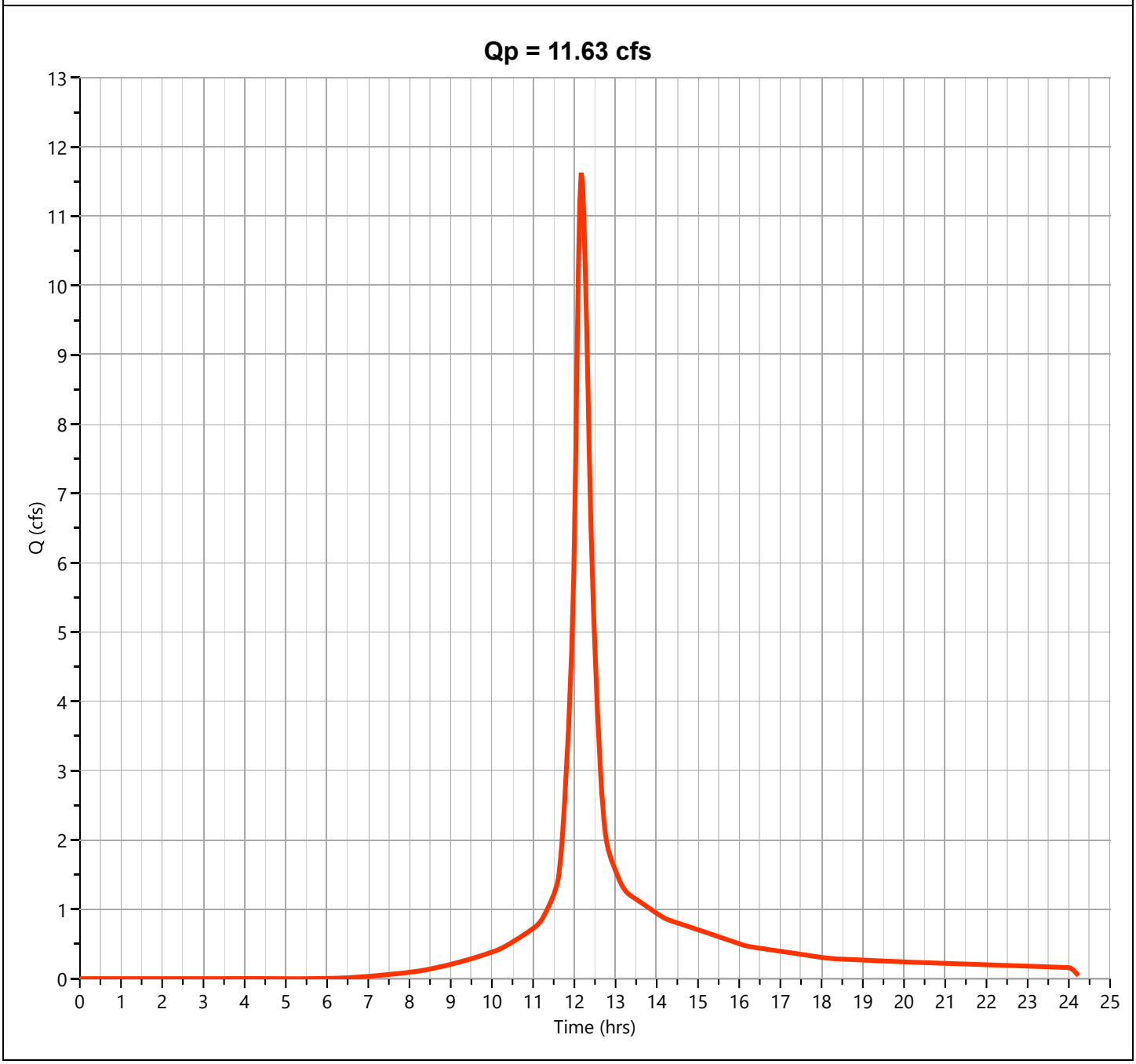
Hydrology Studio v 3.0.0.24

06-28-2022

P-5B

Hyd. No. 25

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.63 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 47,637 cuft
Drainage Area	= 3.27 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 14.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

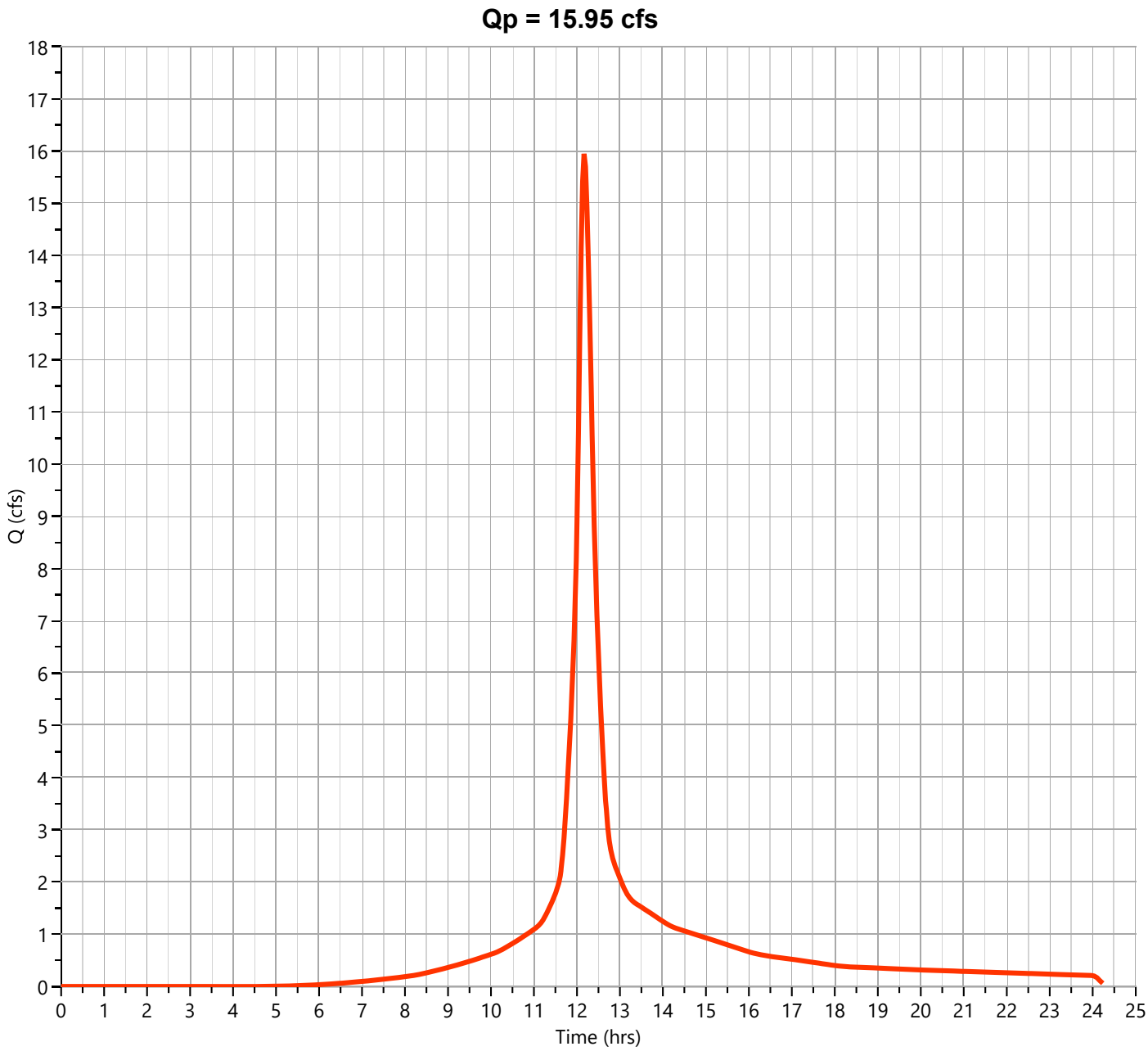
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06-28-2022

P-5B

Hyd. No. 25

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.95 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 66,061 cuft
Drainage Area	= 3.27 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 14.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

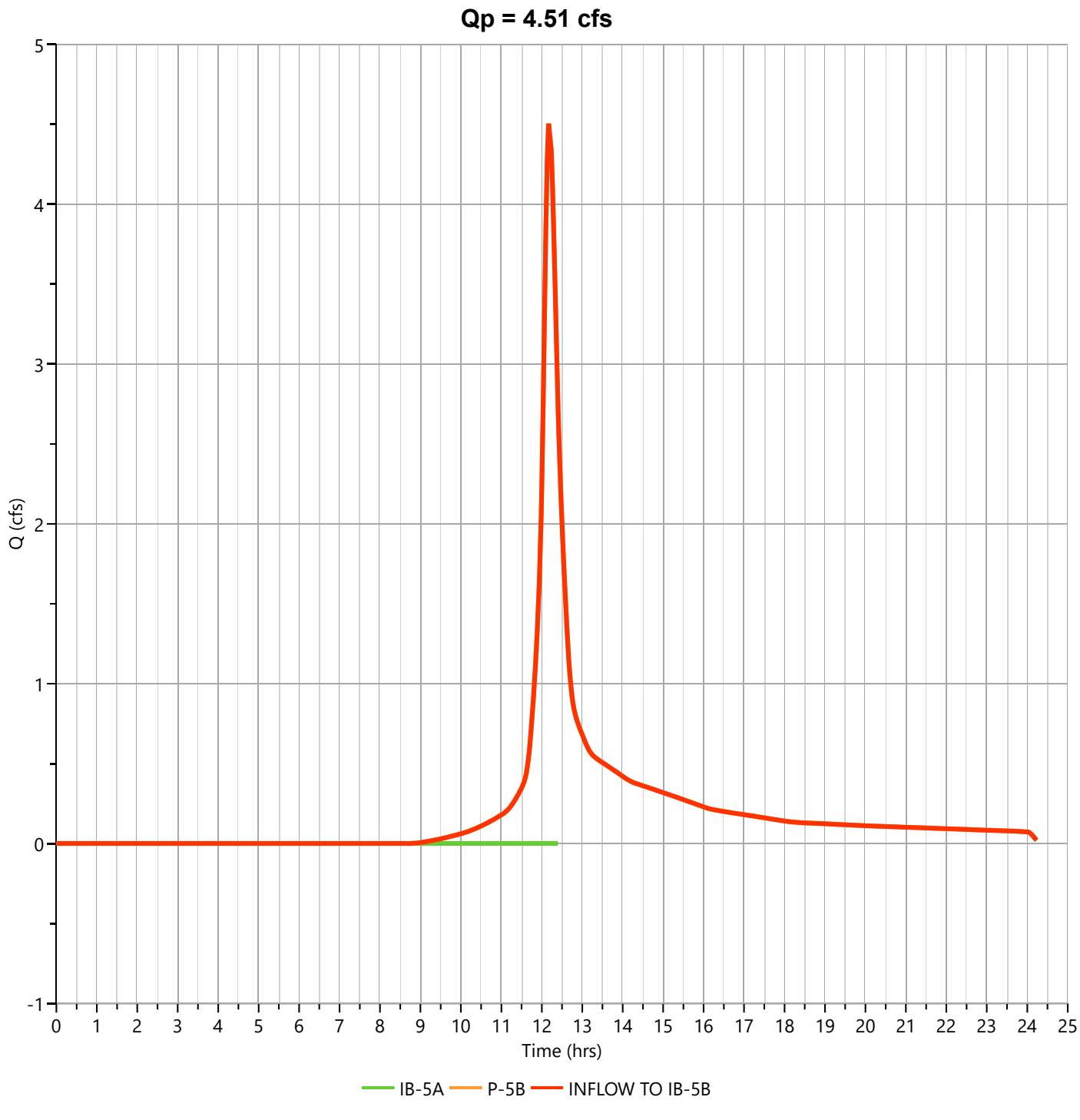
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06-28-2022

INFLOW TO IB-5B

Hyd. No. 26

Hydrograph Type	= Junction	Peak Flow	= 4.505 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 18,454 cuft
Inflow Hydrographs	= 24, 25	Total Contrib. Area	= 3.27 ac



Hydrograph Report

Project Name:

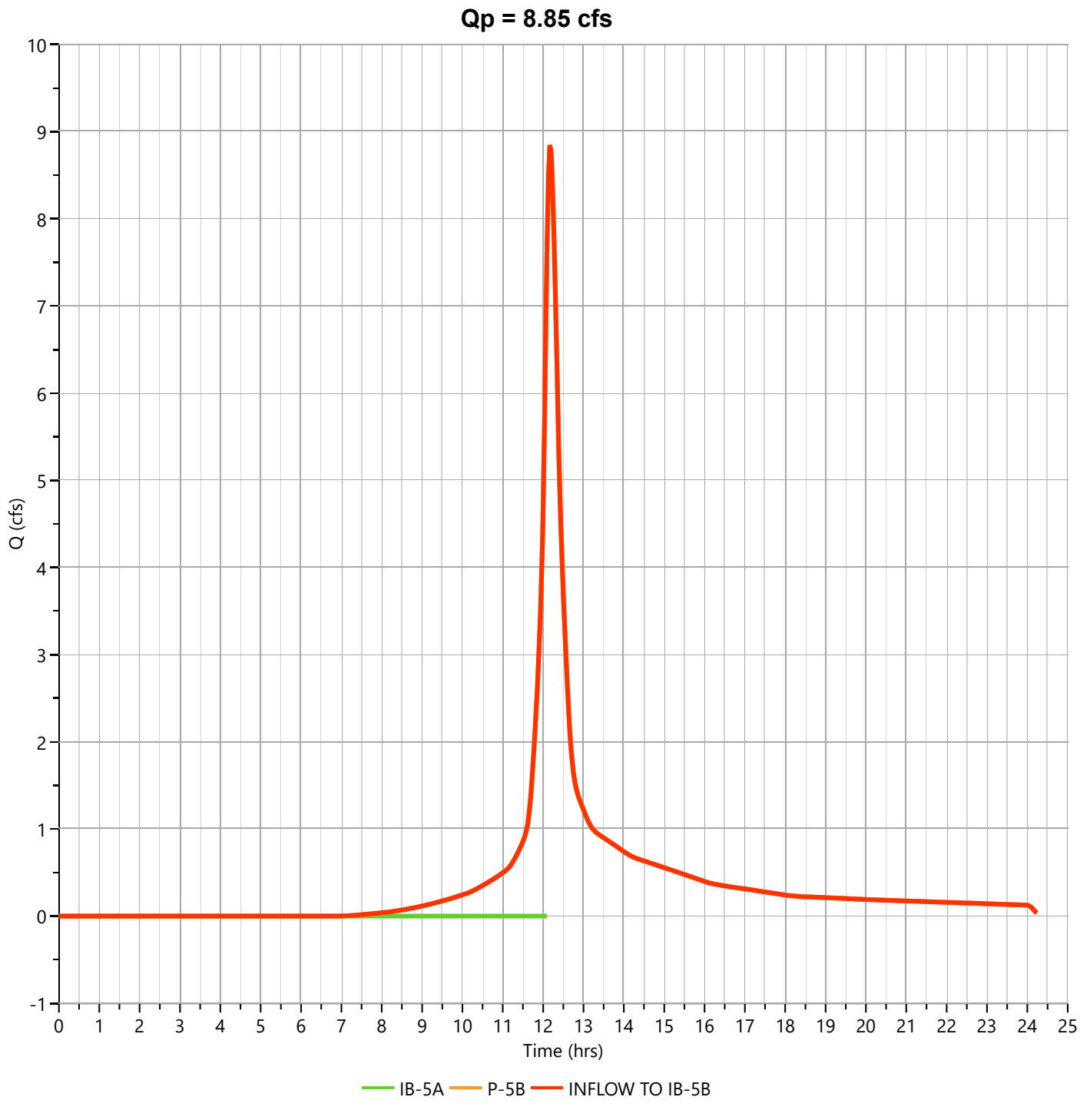
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-5B

Hyd. No. 26

Hydrograph Type	= Junction	Peak Flow	= 8.845 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 36,049 cuft
Inflow Hydrographs	= 24, 25	Total Contrib. Area	= 3.27 ac



Hydrograph Report

Project Name:

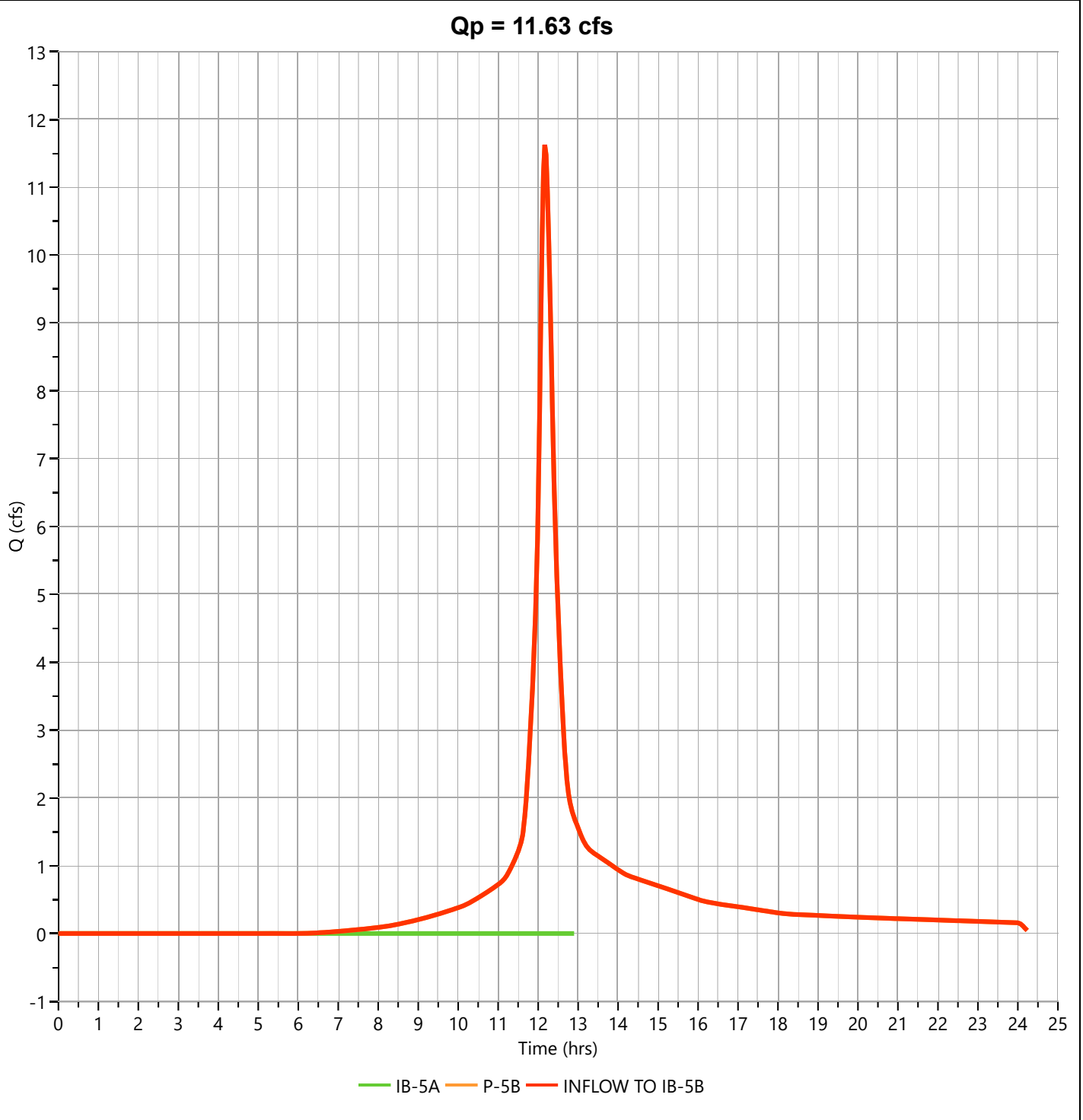
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-5B

Hyd. No. 26

Hydrograph Type	= Junction	Peak Flow	= 11.63 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 47,637 cuft
Inflow Hydrographs	= 24, 25	Total Contrib. Area	= 3.27 ac



Hydrograph Report

Project Name:

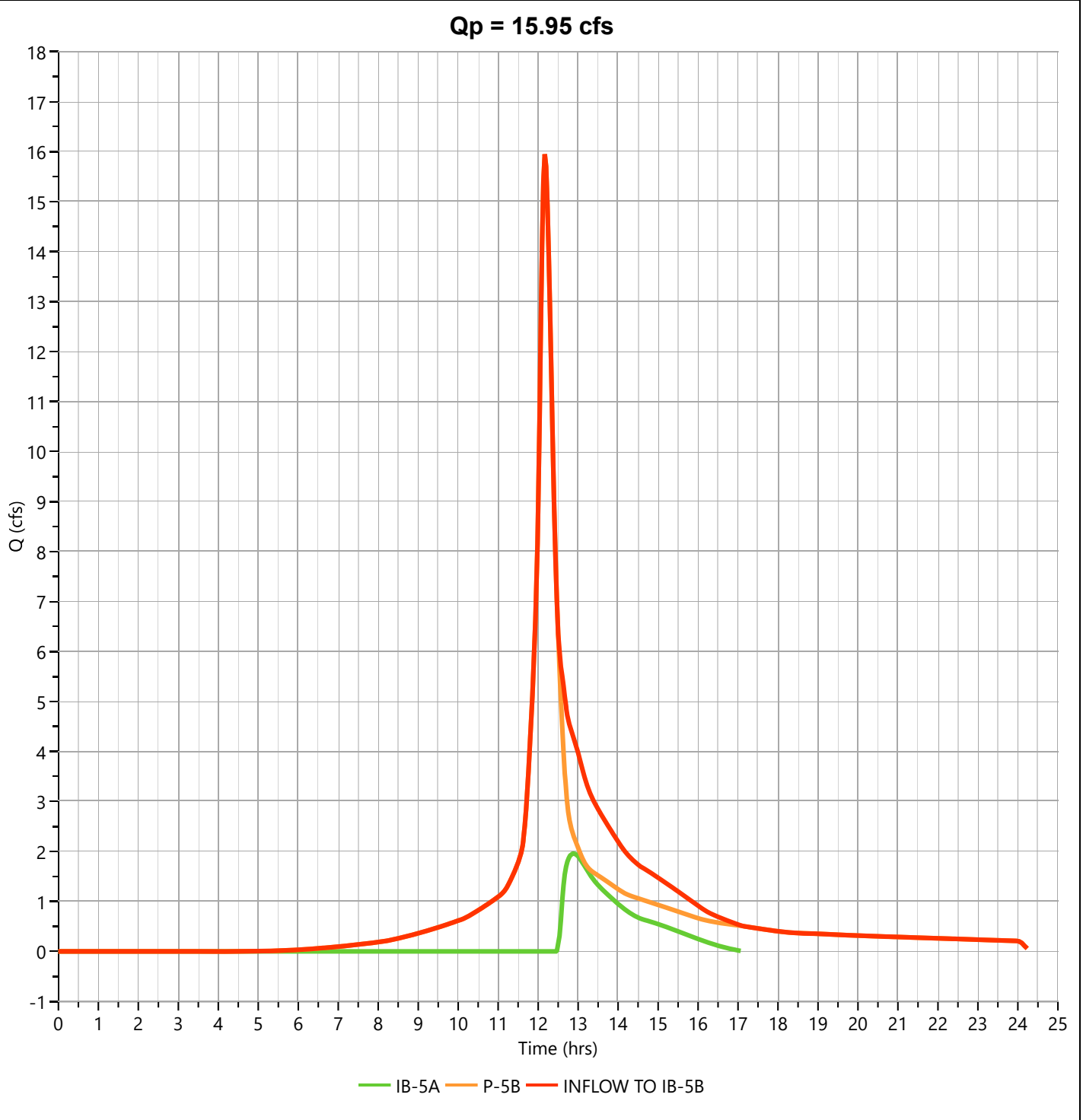
Hydrology Studio v 3.0.0.24

06-28-2022

INFLOW TO IB-5B

Hyd. No. 26

Hydrograph Type	= Junction	Peak Flow	= 15.95 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 78,127 cuft
Inflow Hydrographs	= 24, 25	Total Contrib. Area	= 3.27 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

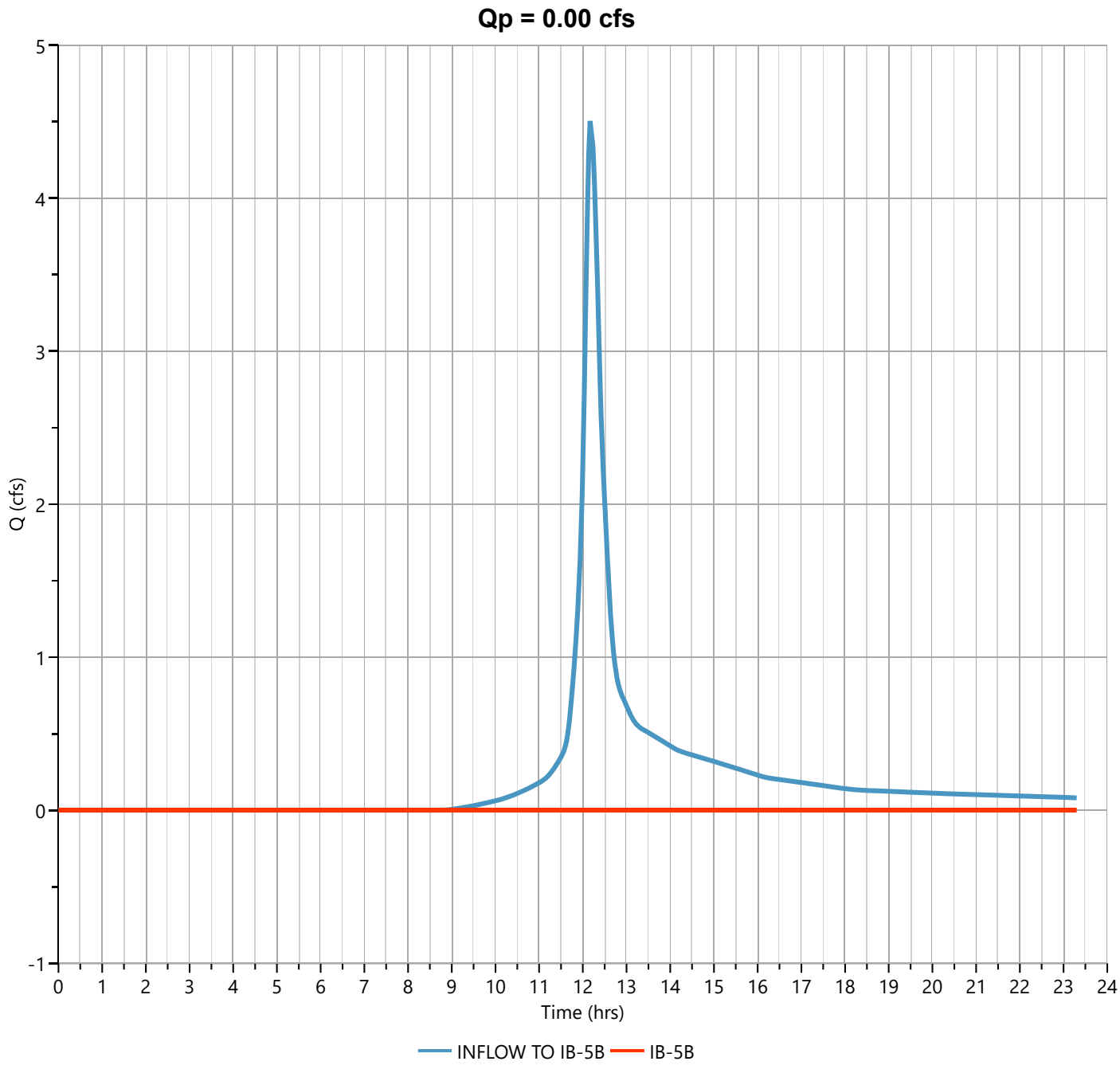
06-28-2022

IB-5B

Hyd. No. 27

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= -0.006 cuft
Inflow Hydrograph	= 26 - INFLOW TO IB-5B	Max. Elevation	= 279.86 ft
Pond Name	= IB-5B	Max. Storage	= 9,349 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

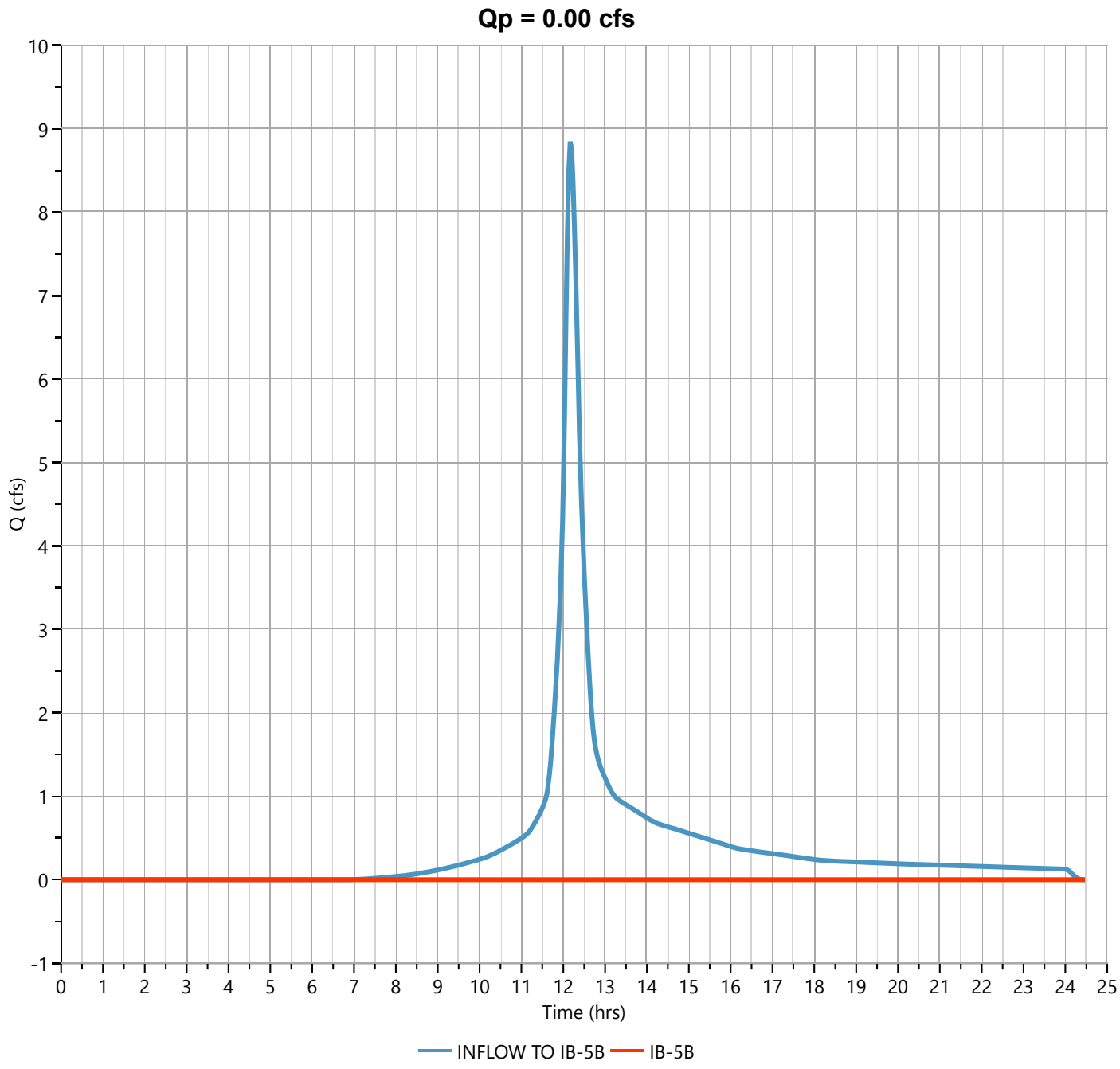
IB-5B

Hyd. No. 27

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 26 - INFLOW TO IB-5B	Max. Elevation	= 281.47 ft
Pond Name	= IB-5B	Max. Storage	= 21,234 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 7.21 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

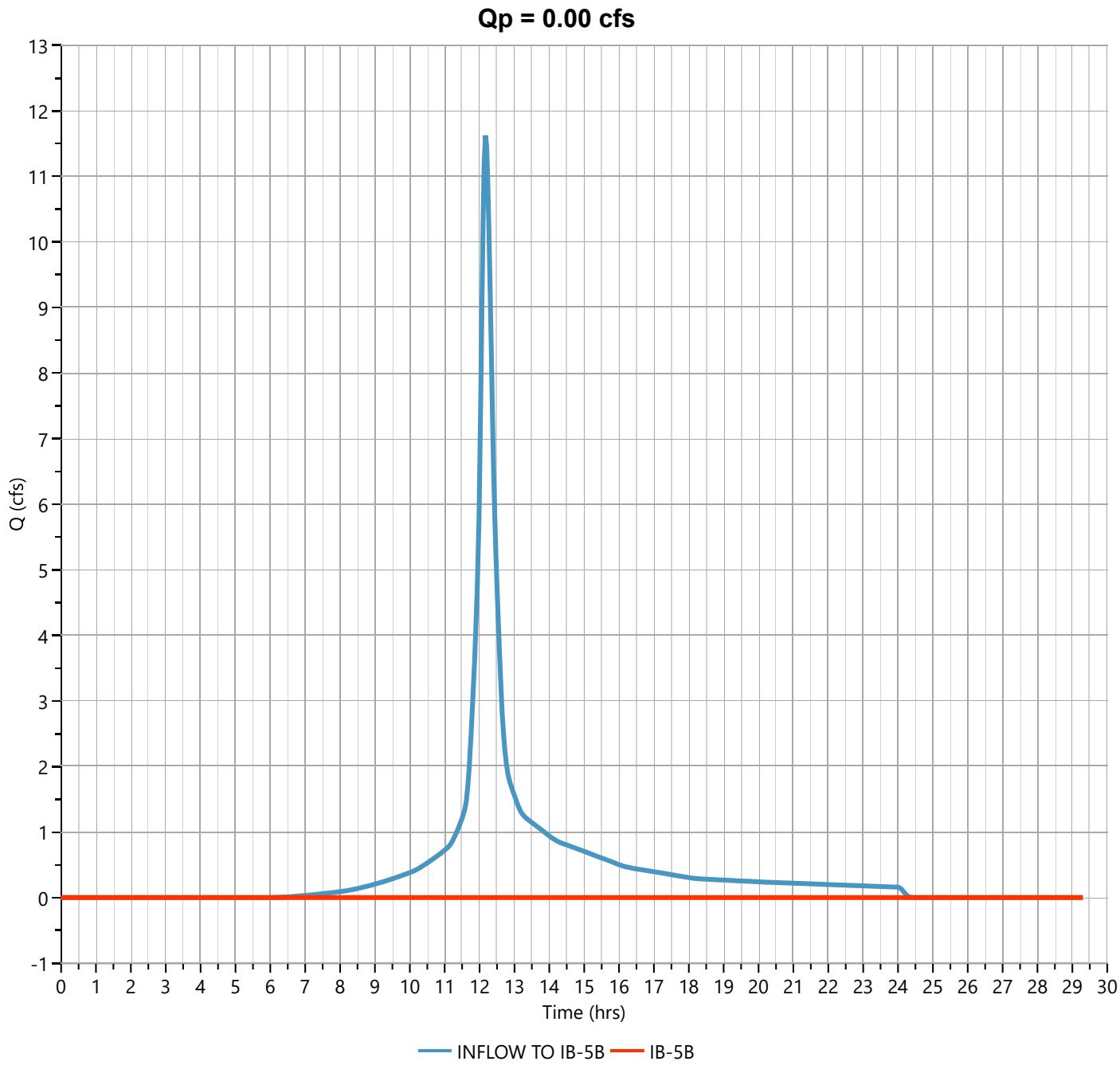
06-28-2022

IB-5B

Hyd. No. 27

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 28.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= -0.003 cuft
Inflow Hydrograph	= 26 - INFLOW TO IB-5B	Max. Elevation	= 282.38 ft
Pond Name	= IB-5B	Max. Storage	= 29,508 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

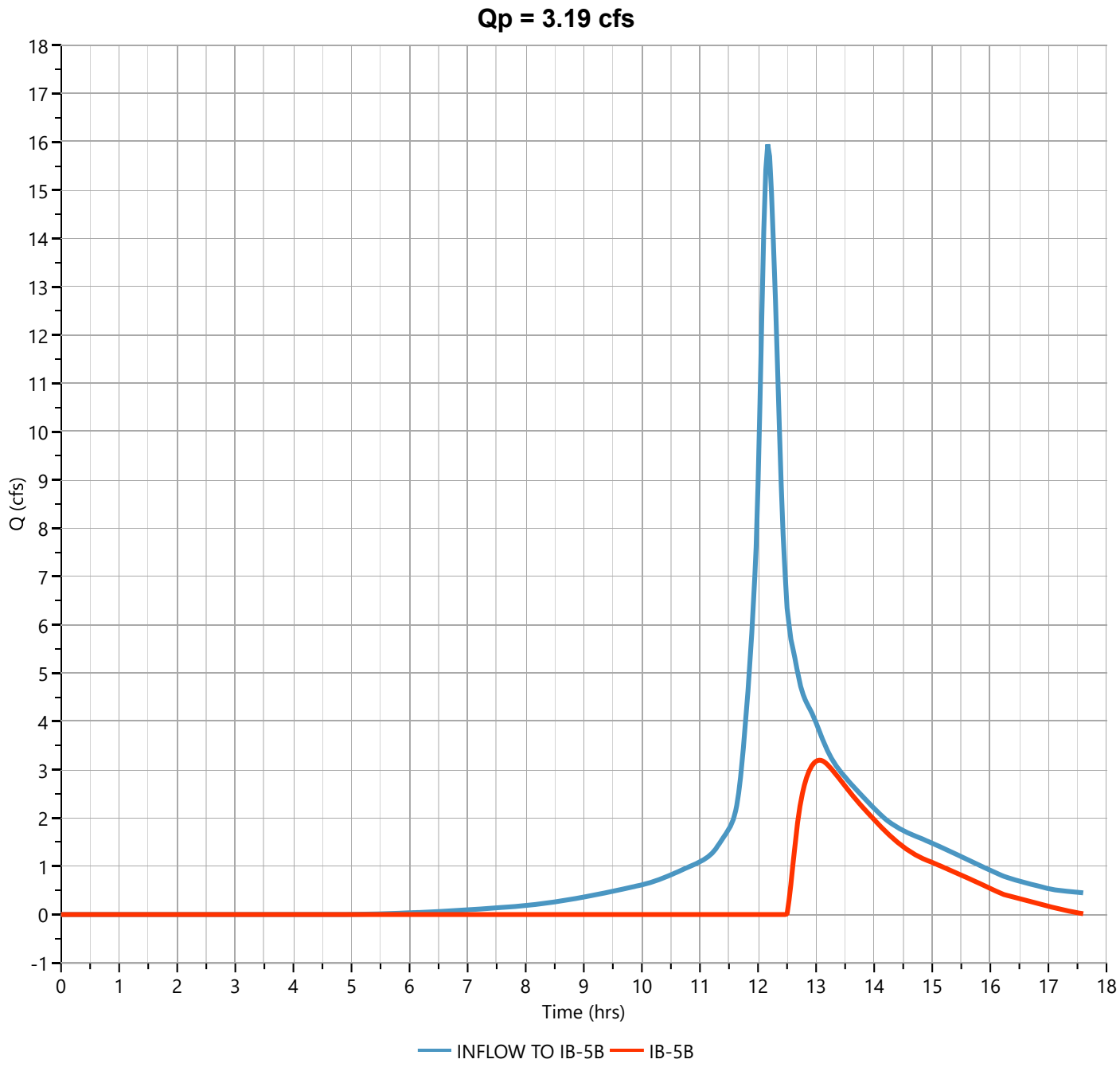
IB-5B

Hyd. No. 27

Hydrograph Type	= Pond Route	Peak Flow	= 3.194 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 22,800 cuft
Inflow Hydrograph	= 26 - INFLOW TO IB-5B	Max. Elevation	= 283.09 ft
Pond Name	= IB-5B	Max. Storage	= 36,688 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 33 min



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

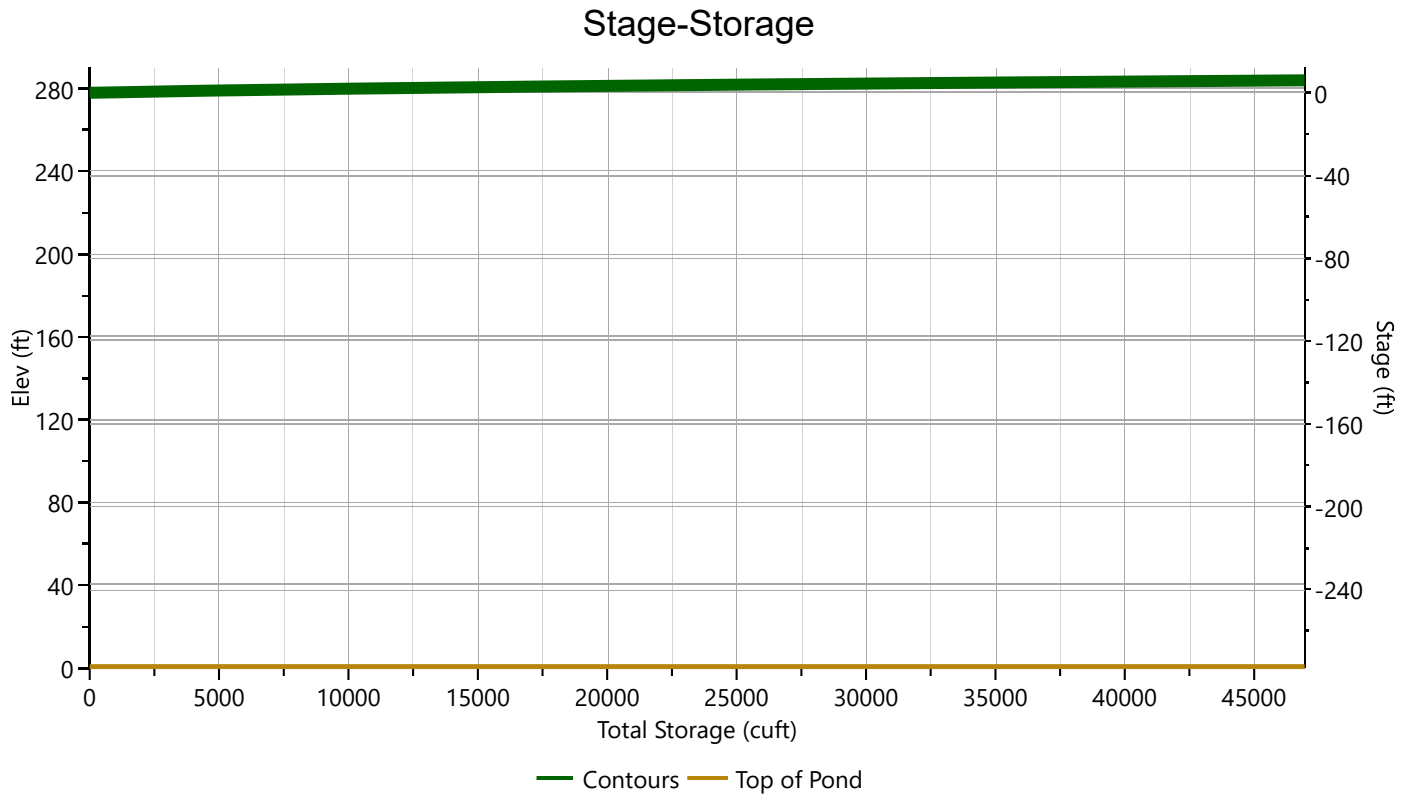
IB-5B

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	278.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	278.00	3,758	0.000	0.000
1.00	279.00	5,033	4,396	4,396
2.00	280.00	6,460	5,747	10,142
3.00	281.00	7,779	7,120	17,262
4.00	282.00	9,269	8,524	25,786
5.00	283.00	10,567	9,918	35,704
6.00	284.00	11,921	11,244	46,948



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

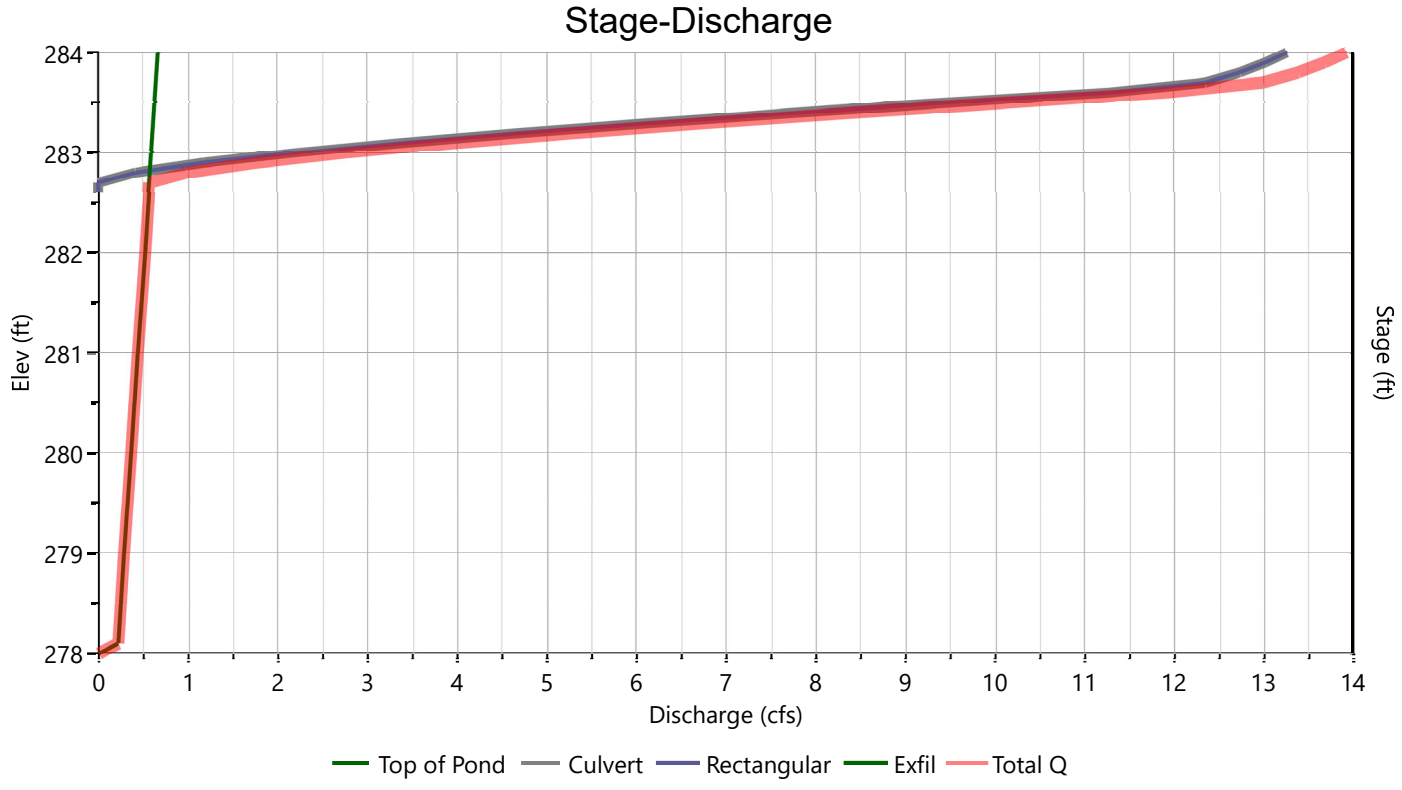
06-28-2022

IB-5B

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	15				Hole Diameter, in	
Span, in	15				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	278.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	50					
Barrel Slope, %	2					
N-Value, n	0.012					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1*	2	3		
Shape / Type	Circular	Rectangular			Exfiltration, in/hr	2.41**
Crest Elevation, ft		282.7				
Crest Length, ft		4				
Angle, deg						
Weir Coefficient, Cw		3.3				

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5B

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	278.00	0.000	0.000					0.000				0.000		0.000
1.00	279.00	4,396	0.000					0.000				0.281		0.281
2.00	280.00	10,142	0.000					0.000				0.360		0.360
3.00	281.00	17,262	0.000					0.000				0.434		0.434
4.00	282.00	25,786	0.000					0.000				0.517		0.517
5.00	283.00	35,704	2.169 ic					2.169				0.590		2.758
6.00	284.00	46,948	13.26 ic					13.26 s				0.665		13.92

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

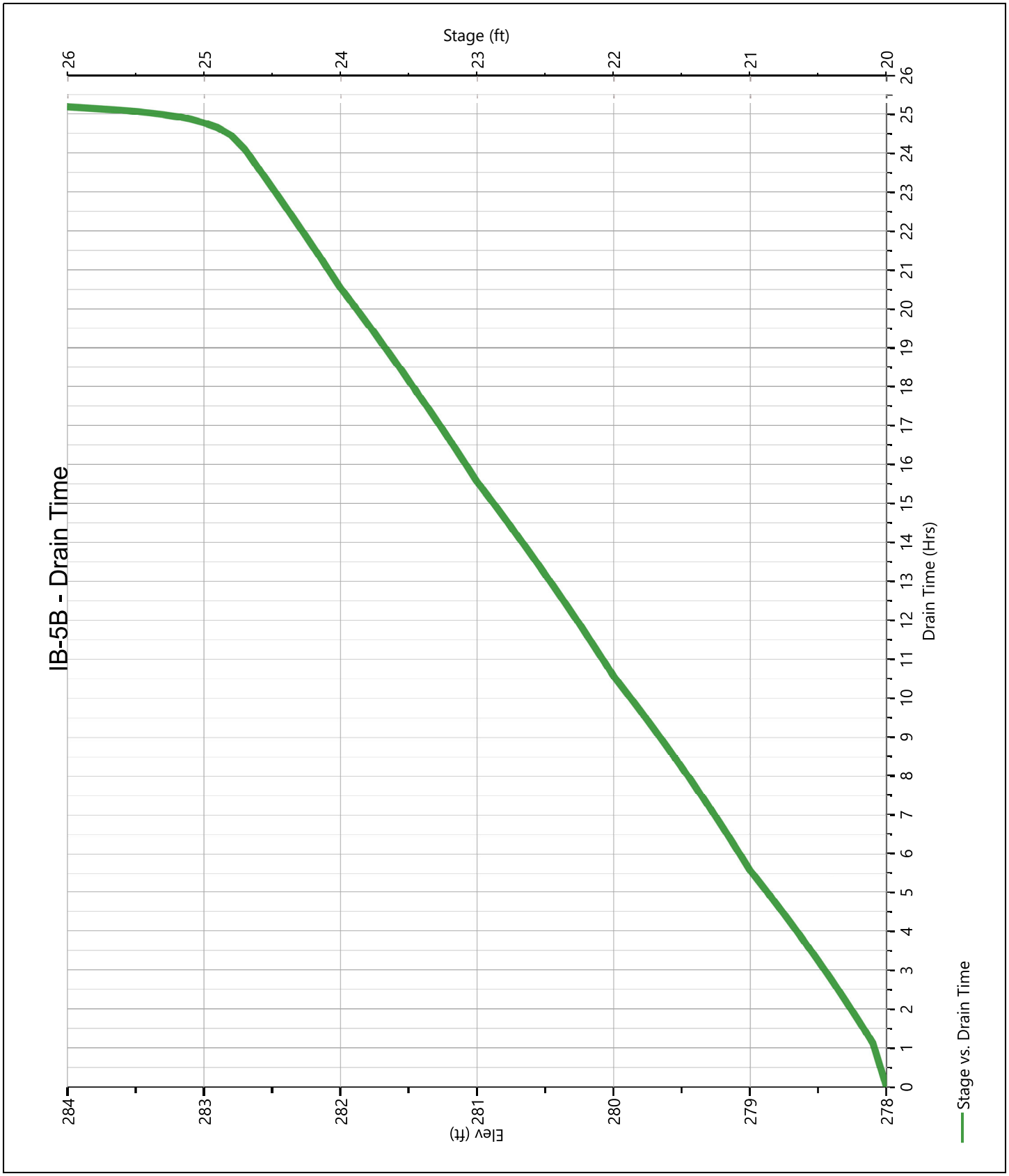
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5B

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By PFK Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-5C

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.60	58.73
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Open Space Good Condition	70			0.62	43.13
D	Open Space Good Condition	80			0.00	0.00
1/ Use only one CN source per line.		52946		Totals =	1.22	101.86

CN (weighted) = total product / total area = 101.86 / 1.22 = 83.80 ; Use CN = 84

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.73	4.31	5.92

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By PFK Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-5C

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.065			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.18			0.18
Shallow concentrated Flow		Segment ID	C-D			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	35			
9. Watercourse slope, s		ft/ft	0.200			
10. Average Velocity, V (figure 3-1)		ft/s	7.22			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.18
min 10.9

Hydrograph Report

Project Name:

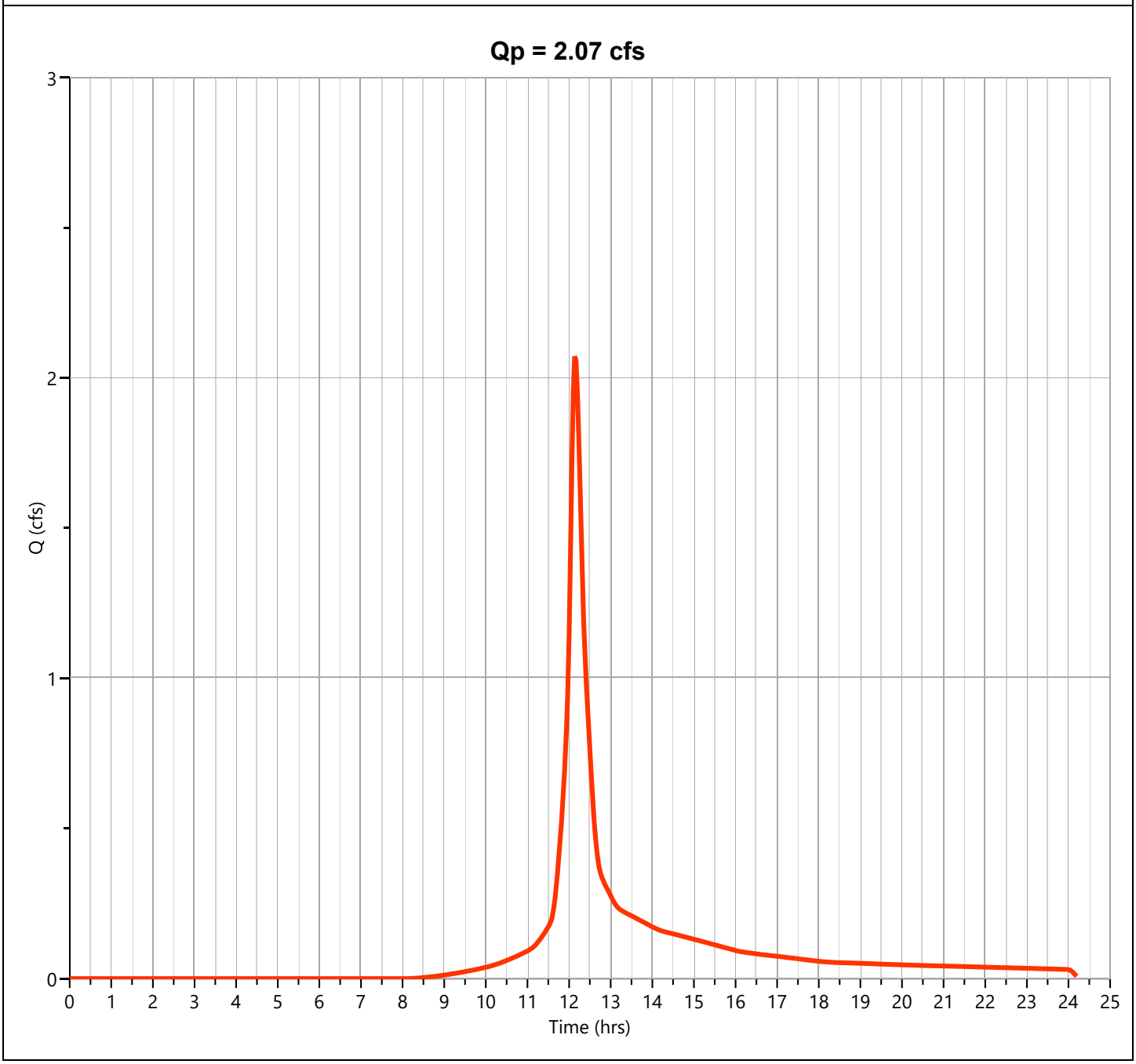
Hydrology Studio v 3.0.0.24

06-28-2022

P-5C

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.072 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 7,952 cuft
Drainage Area	= 1.22 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 10.9 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

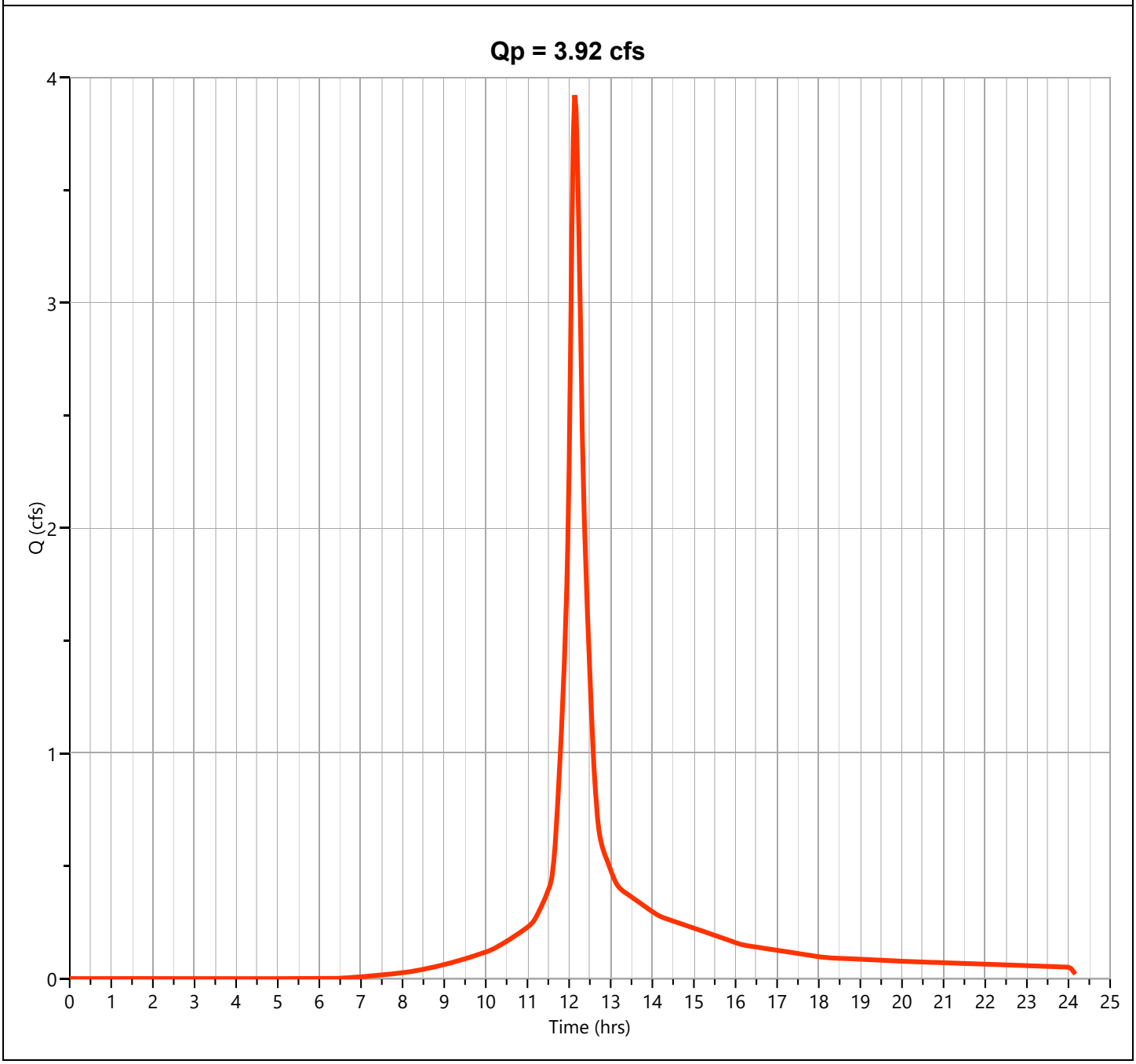
Hydrology Studio v 3.0.0.24

06-28-2022

P-5C

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.921 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 15,103 cuft
Drainage Area	= 1.22 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 10.9 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

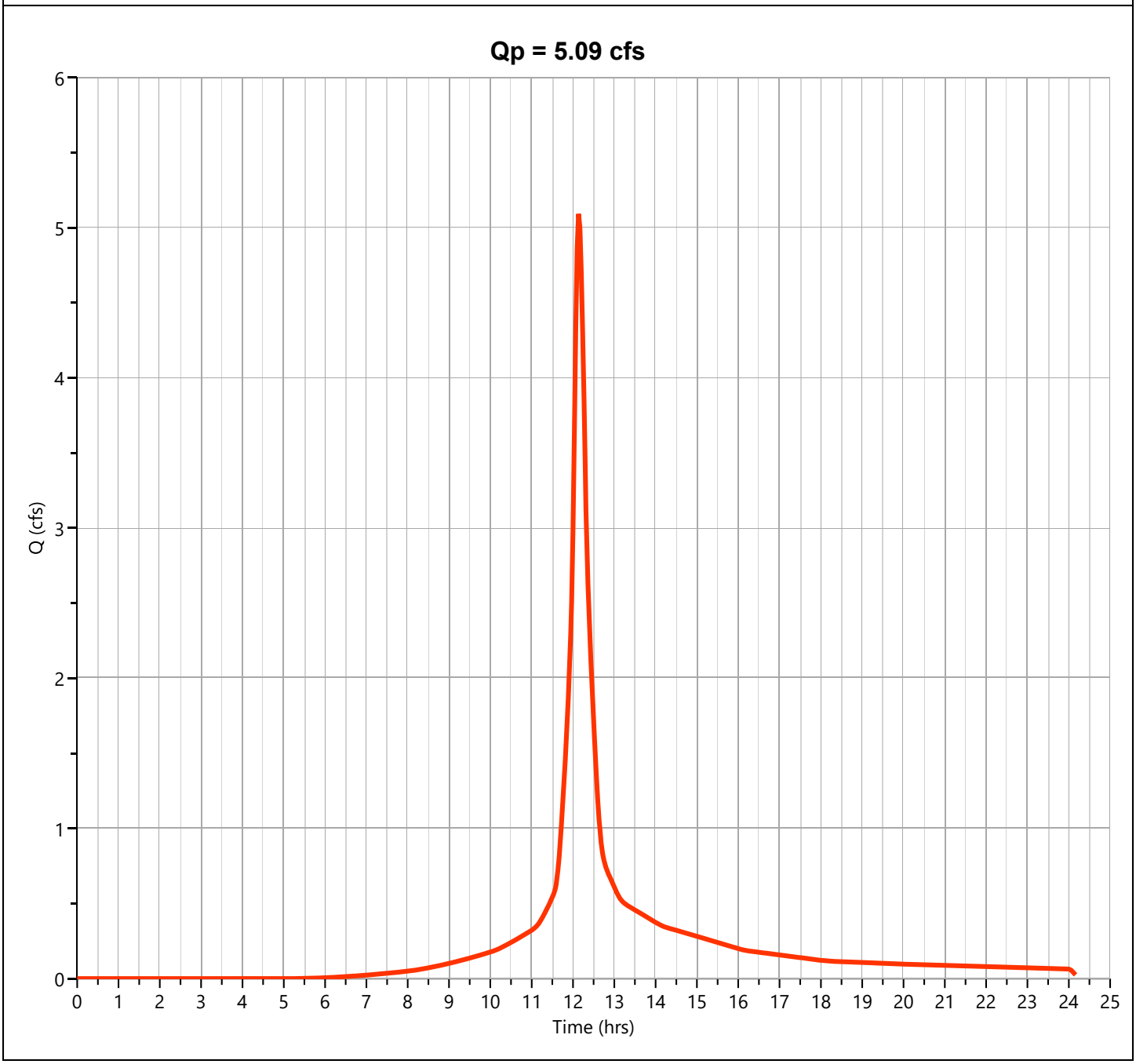
Hydrology Studio v 3.0.0.24

06-28-2022

P-5C

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.092 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 19,765 cuft
Drainage Area	= 1.22 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 10.9 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

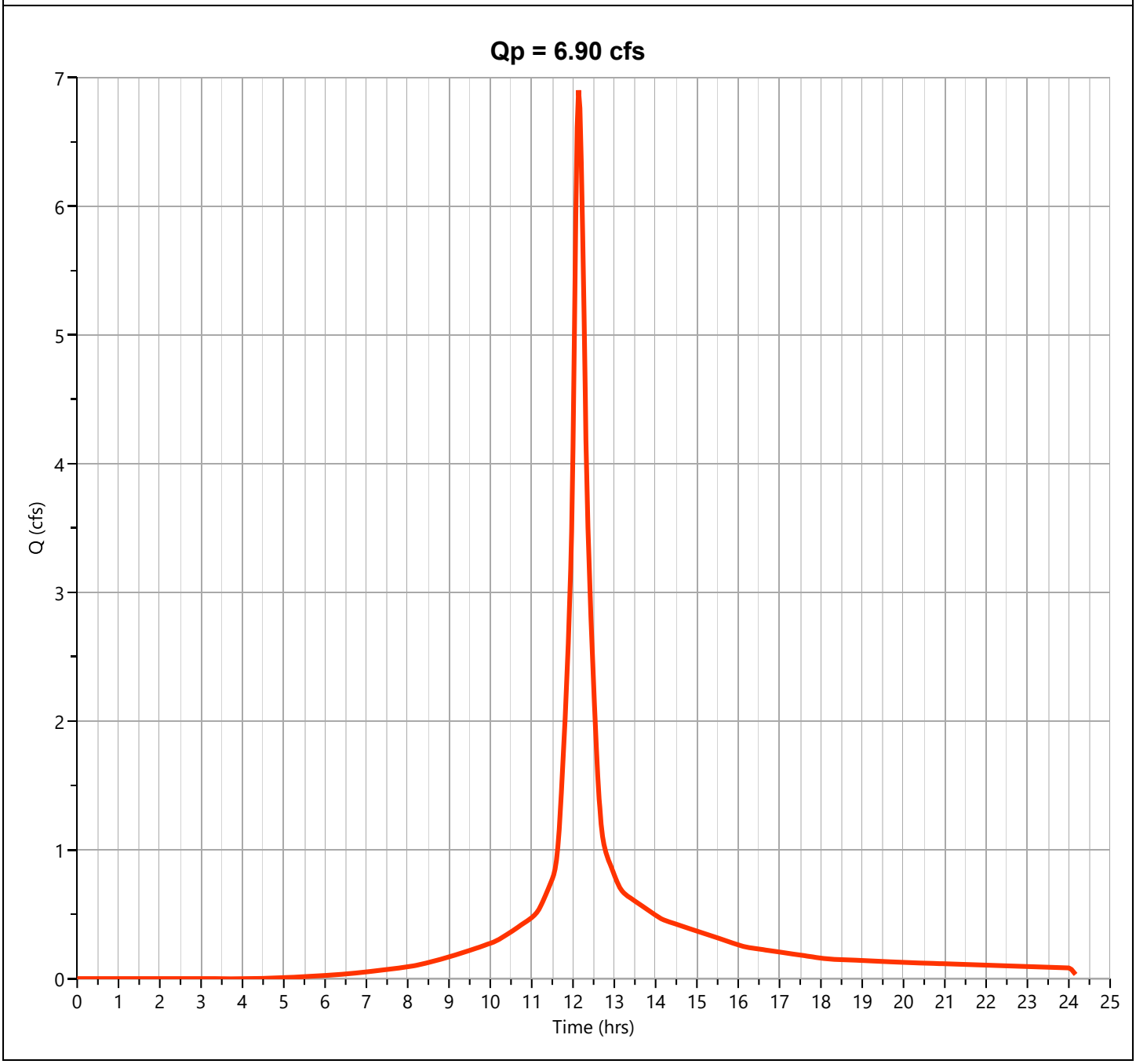
Hydrology Studio v 3.0.0.24

06-28-2022

P-5C

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.902 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 27,136 cuft
Drainage Area	= 1.22 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 10.9 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

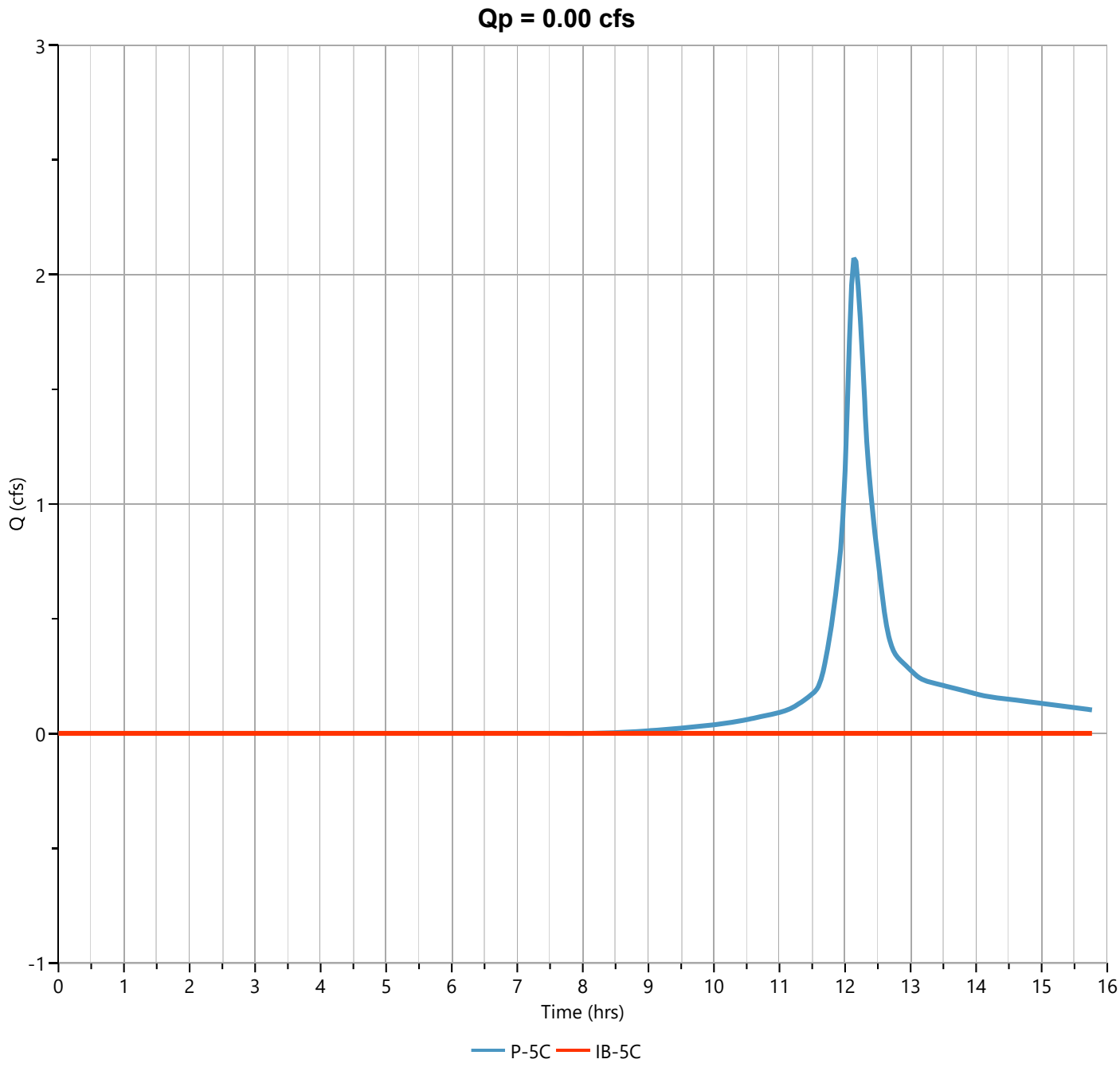
IB-5C

Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.002 cuft
Inflow Hydrograph	= 28 - P-5C	Max. Elevation	= 259.12 ft
Pond Name	= IB-5C	Max. Storage	= 3,568 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 6 min



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

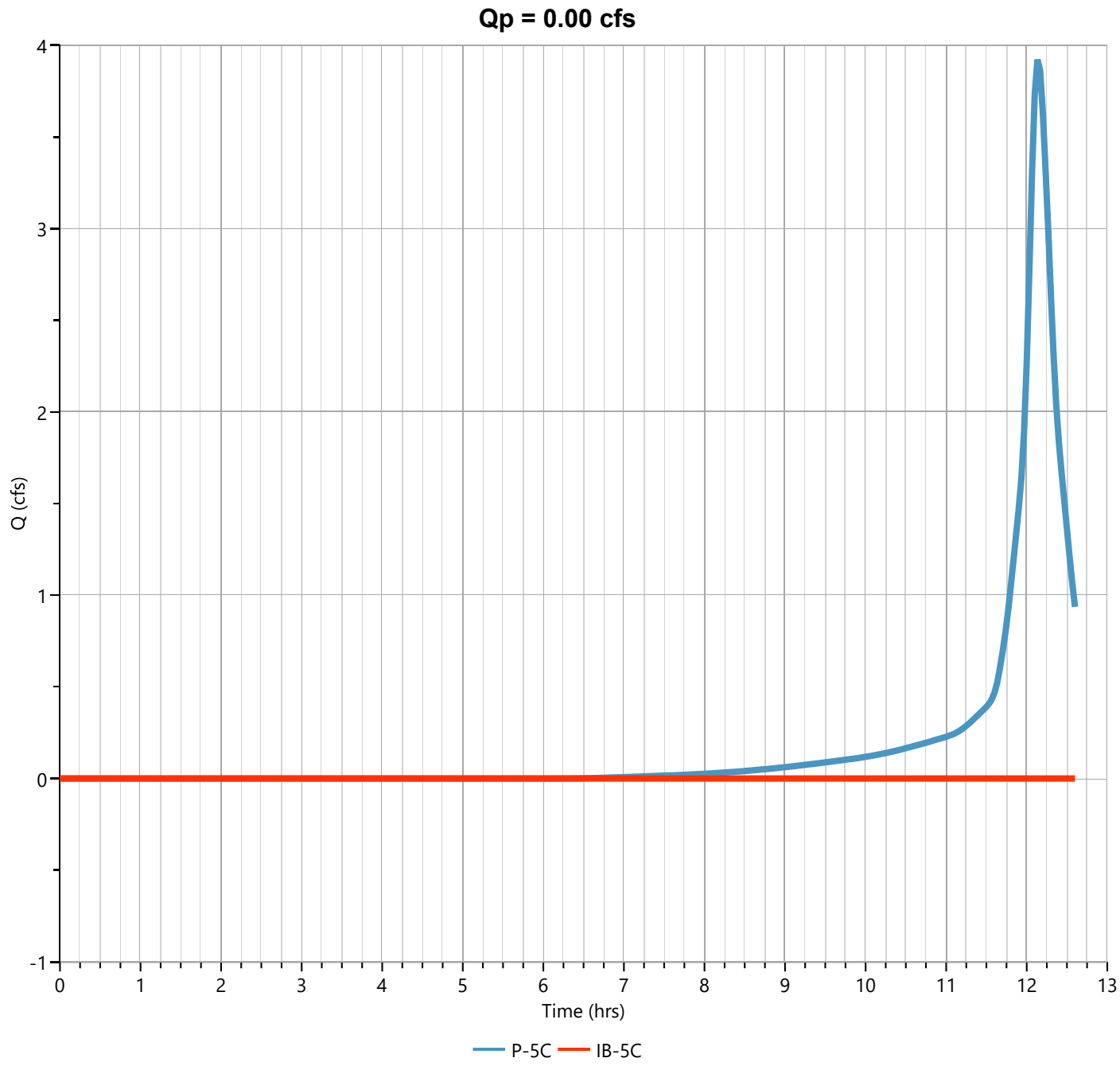
06-28-2022

IB-5C

Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.001 cuft
Inflow Hydrograph	= 28 - P-5C	Max. Elevation	= 260.17 ft
Pond Name	= IB-5C	Max. Storage	= 7,907 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

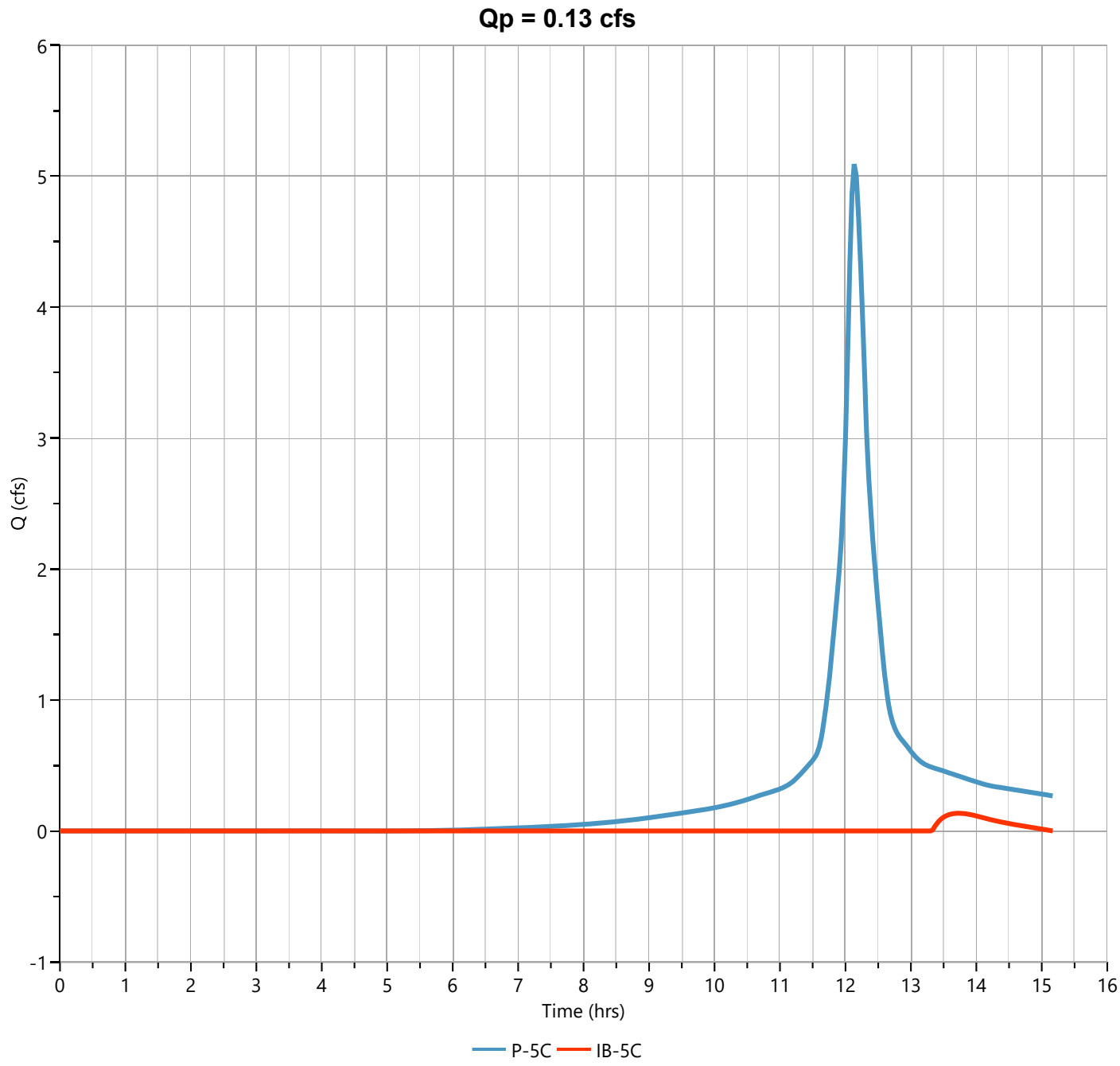
IB-5C

Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 0.135 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.73 hrs
Time Interval	= 2 min	Hydrograph Volume	= 483 cuft
Inflow Hydrograph	= 28 - P-5C	Max. Elevation	= 260.72 ft
Pond Name	= IB-5C	Max. Storage	= 10,635 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 35 min



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

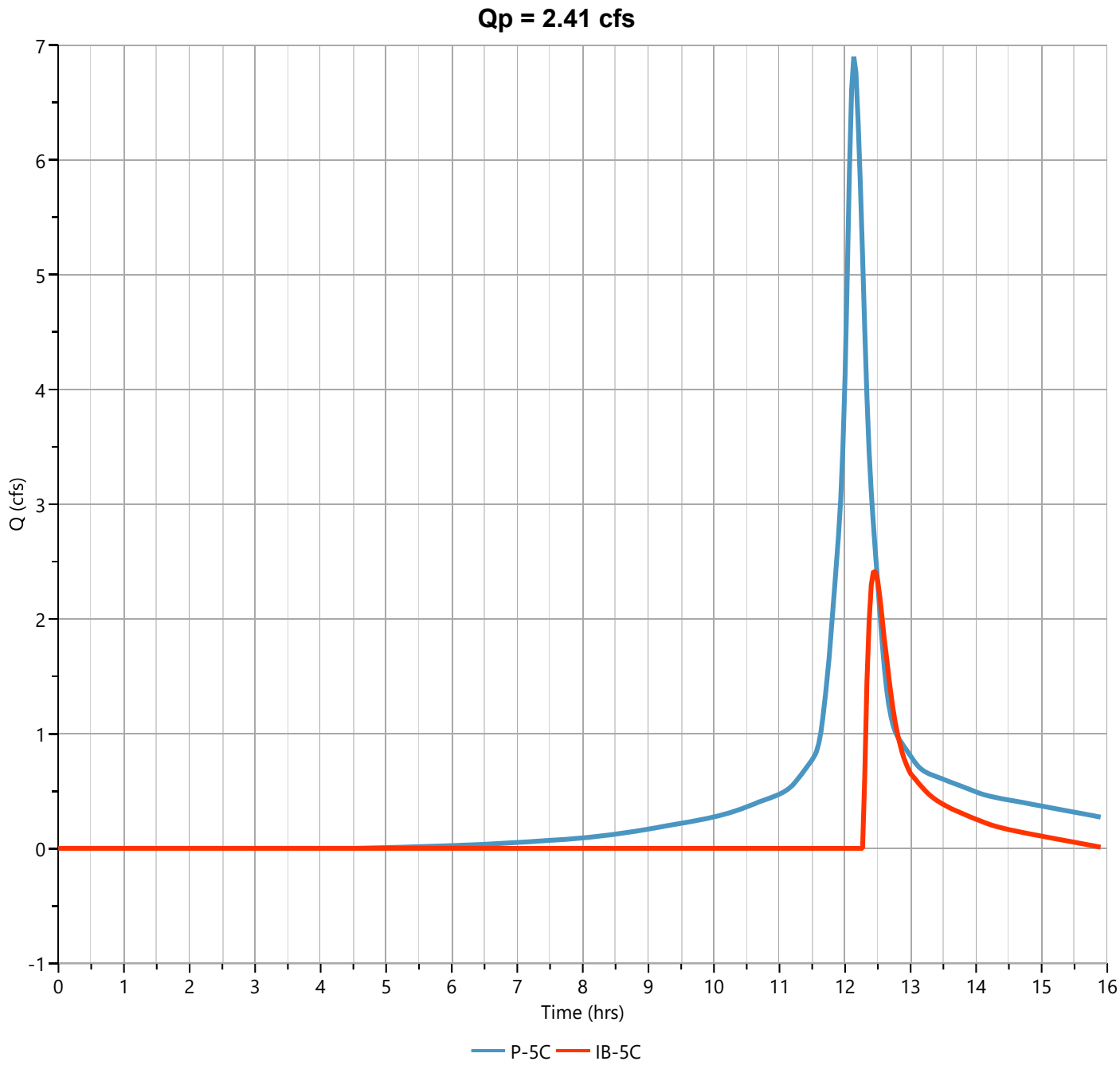
06-28-2022

IB-5C

Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 2.414 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 6,054 cuft
Inflow Hydrograph	= 28 - P-5C	Max. Elevation	= 260.94 ft
Pond Name	= IB-5C	Max. Storage	= 11,696 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

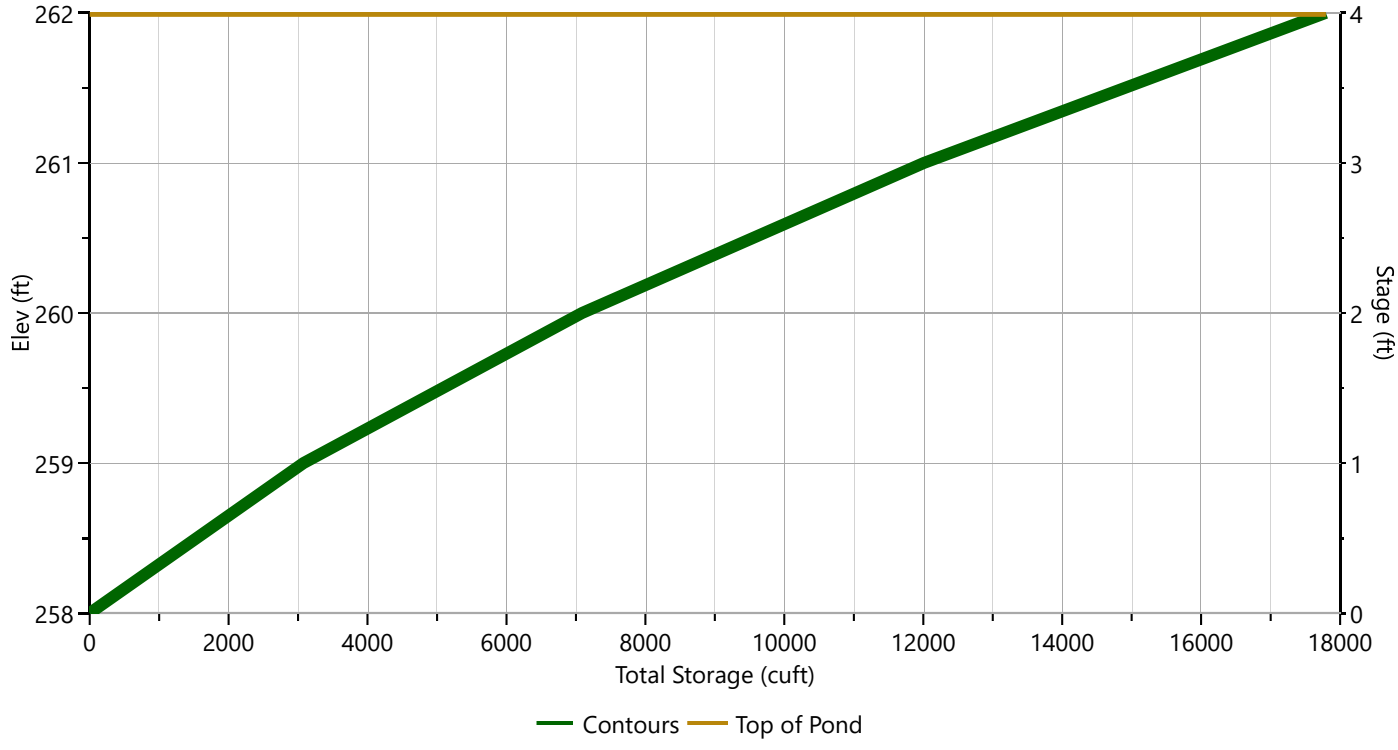
IB-5C

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	258.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	258.00	2,638	0.000	0.000
1.00	259.00	3,517	3,078	3,078
2.00	260.00	4,505	4,011	7,089
3.00	261.00	5,340	4,923	12,011
4.00	262.00	6,231	5,786	17,797



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

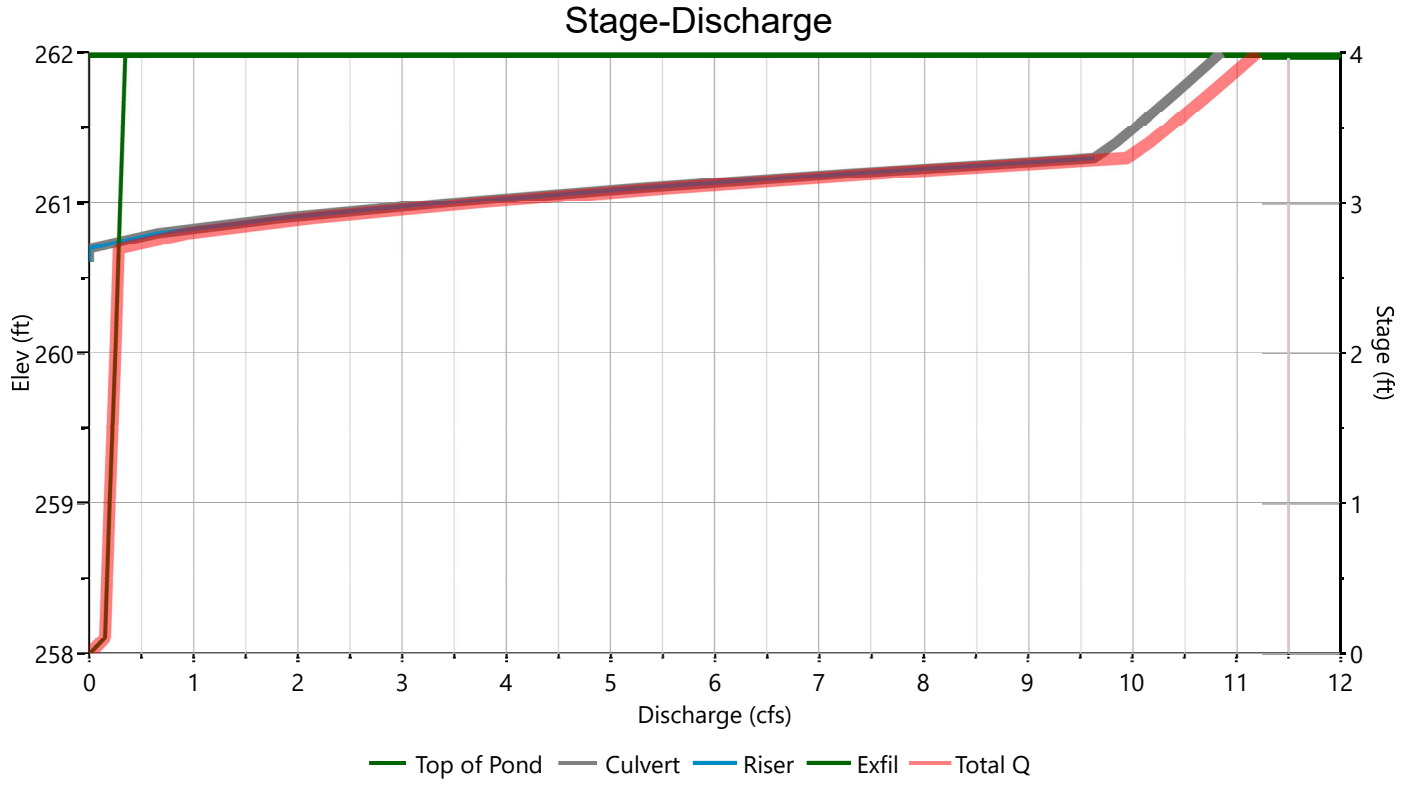
06-28-2022

IB-5C

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate	
		1	2	3		
Rise, in	15				Orifice Dia, in	
Span, in	15				No. Orifices	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	258.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	50					
Barrel Slope, %	2					
N-Value, n	0.012					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular				Exfiltration, in/hr	2.41**
Crest Elevation, ft	260.7					
Crest Length, ft	6.28					
Angle, deg						
Weir Coefficient, Cw	3.3					

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5C

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	258.00	0.000	0.000				0.000					0.000		0.000
1.00	259.00	3,078	0.000				0.000					0.196		0.196
2.00	260.00	7,089	0.000				0.000					0.251		0.251
3.00	261.00	12,011	3.405 ic				3.405					0.298		3.703
4.00	262.00	17,797	10.85 ic				0.000					0.348		11.20

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

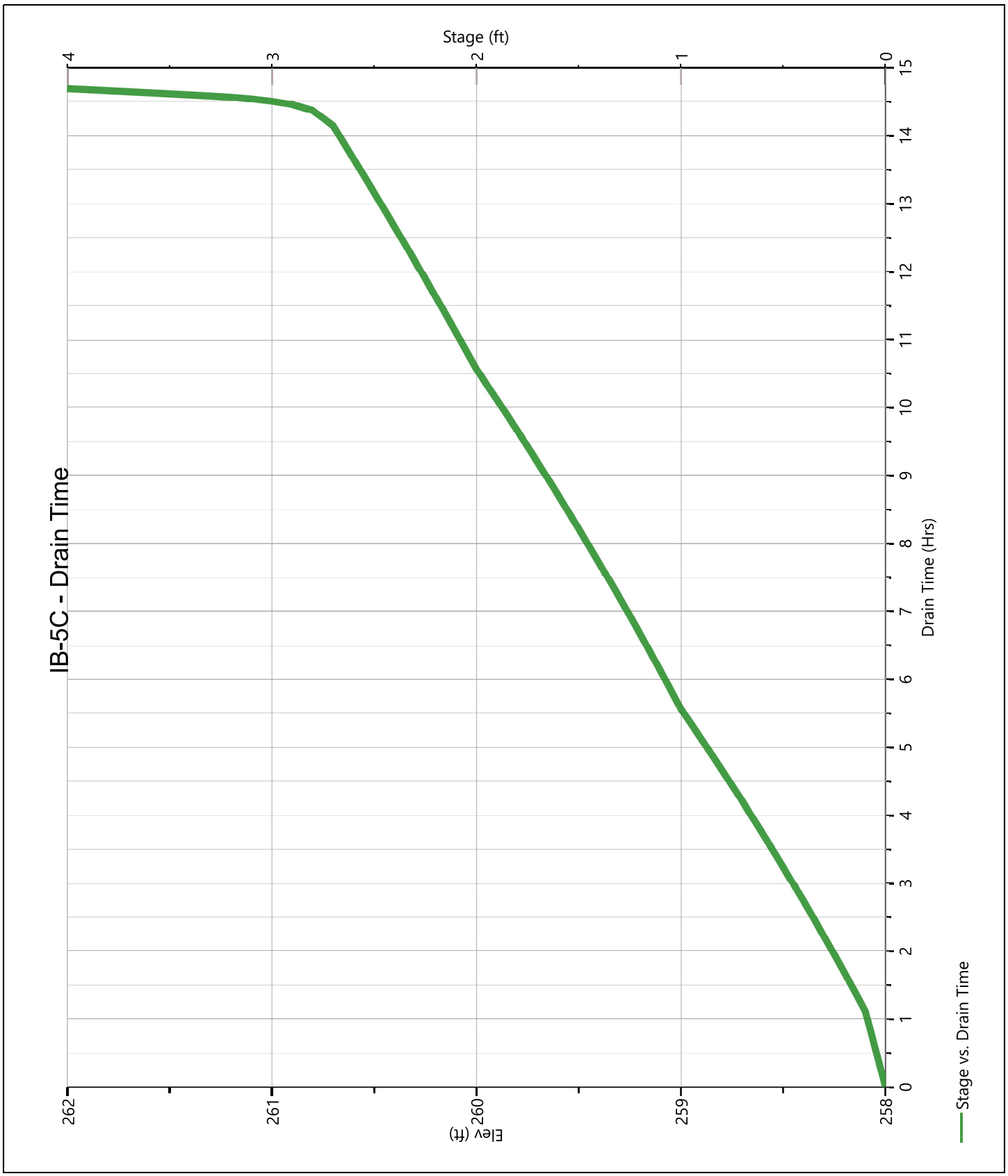
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-5C

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By PFK Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-5E

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.07	105.19
A	Woods Good Condition	30			1.18	35.32
A	Open Space Good Condition	39			0.97	37.86
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			1.42	99.60
C	Open Space Fair Condition	79			0.47	36.84
C	Gravel	89			0.00	0.00
D	Woods Good Condition	91			1.09	99.49
D	Open Space Good Condition	80			0.55	44.18
D	Gravel	91			0.00	0.00
D	BVW	77			2.21	170.08

1/ Use only one CN source per line. 390519 Totals = 8.97 628.56

CN (weighted) = total product / total area = 628.56 / 8.97 = 70.11 ; Use CN = 70

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.87	2.93	4.34

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By PFK Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-5E
Circle one: Tc Tt through
subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.060			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.19			0.19
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	459			
9. Watercourse slope, s		ft/ft	0.080			
10. Average Velocity, V (figure 3-1)		ft/s	4.56			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.21
min 12.8

Hydrograph Report

Project Name:

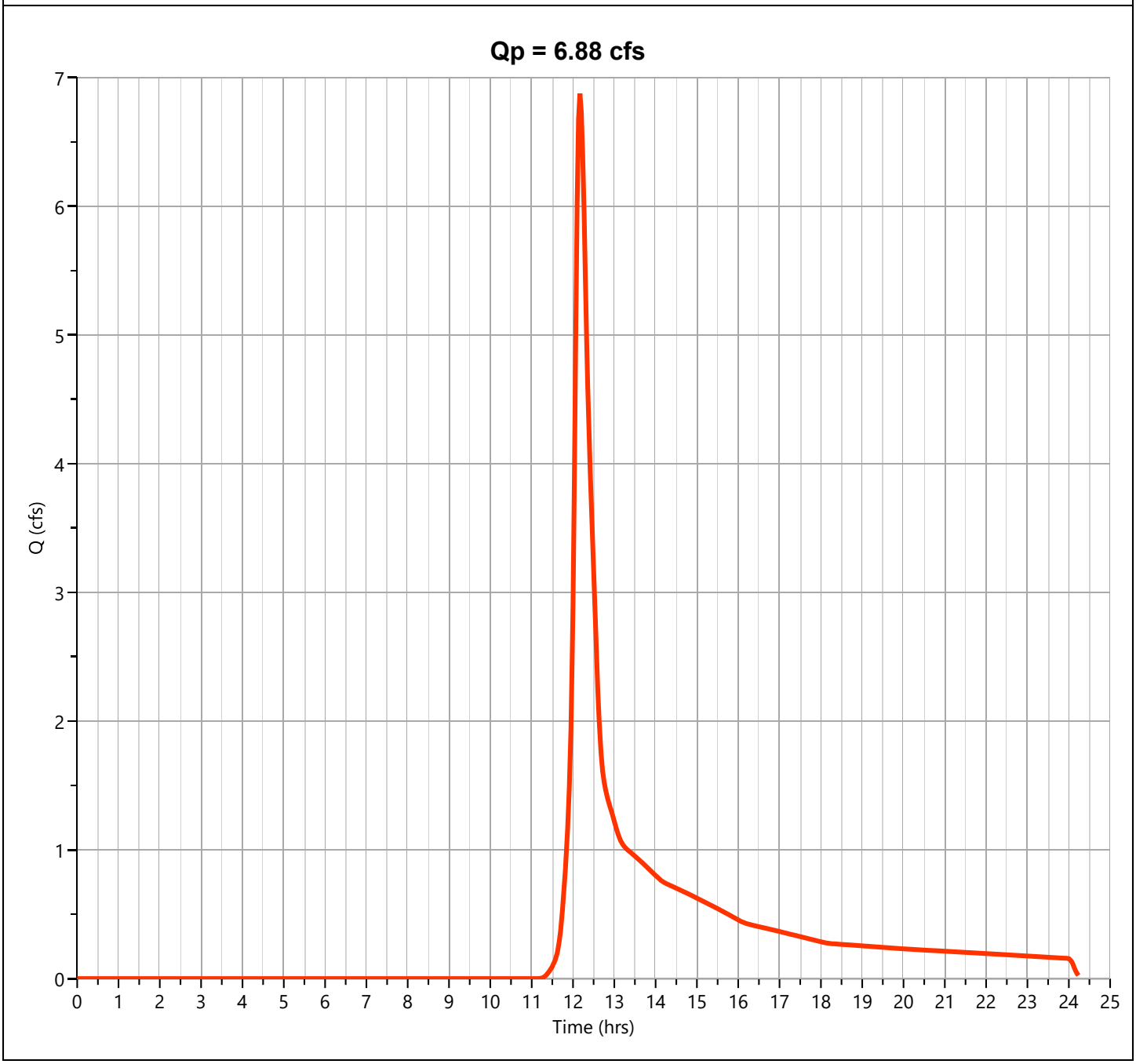
Hydrology Studio v 3.0.0.24

06-28-2022

P-5E

Hyd. No. 30

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.876 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 29,184 cuft
Drainage Area	= 8.97 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

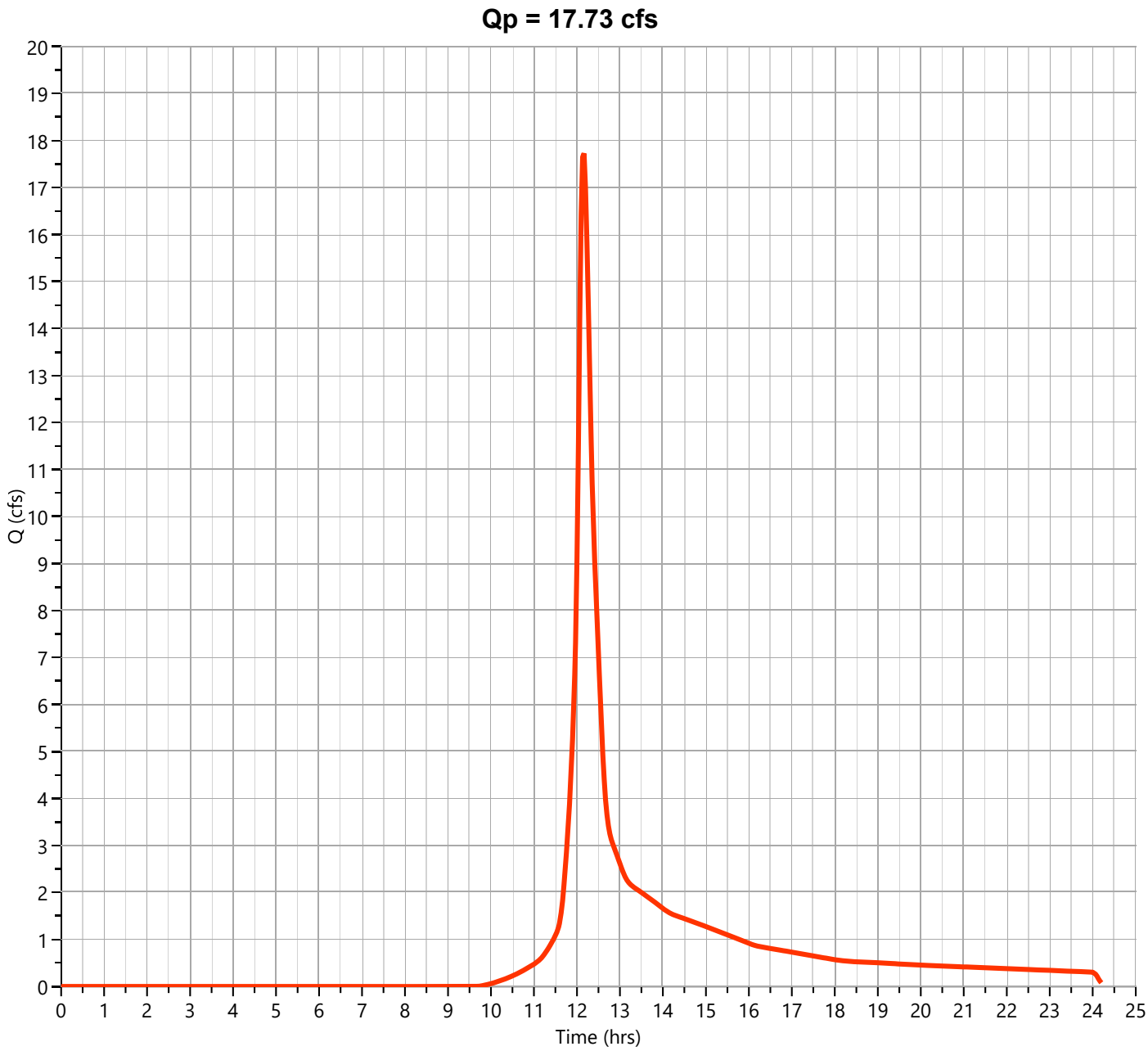
Hydrology Studio v 3.0.0.24

06-28-2022

P-5E

Hyd. No. 30

Hydrograph Type	= NRCS Runoff	Peak Flow	= 17.73 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 69,374 cuft
Drainage Area	= 8.97 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

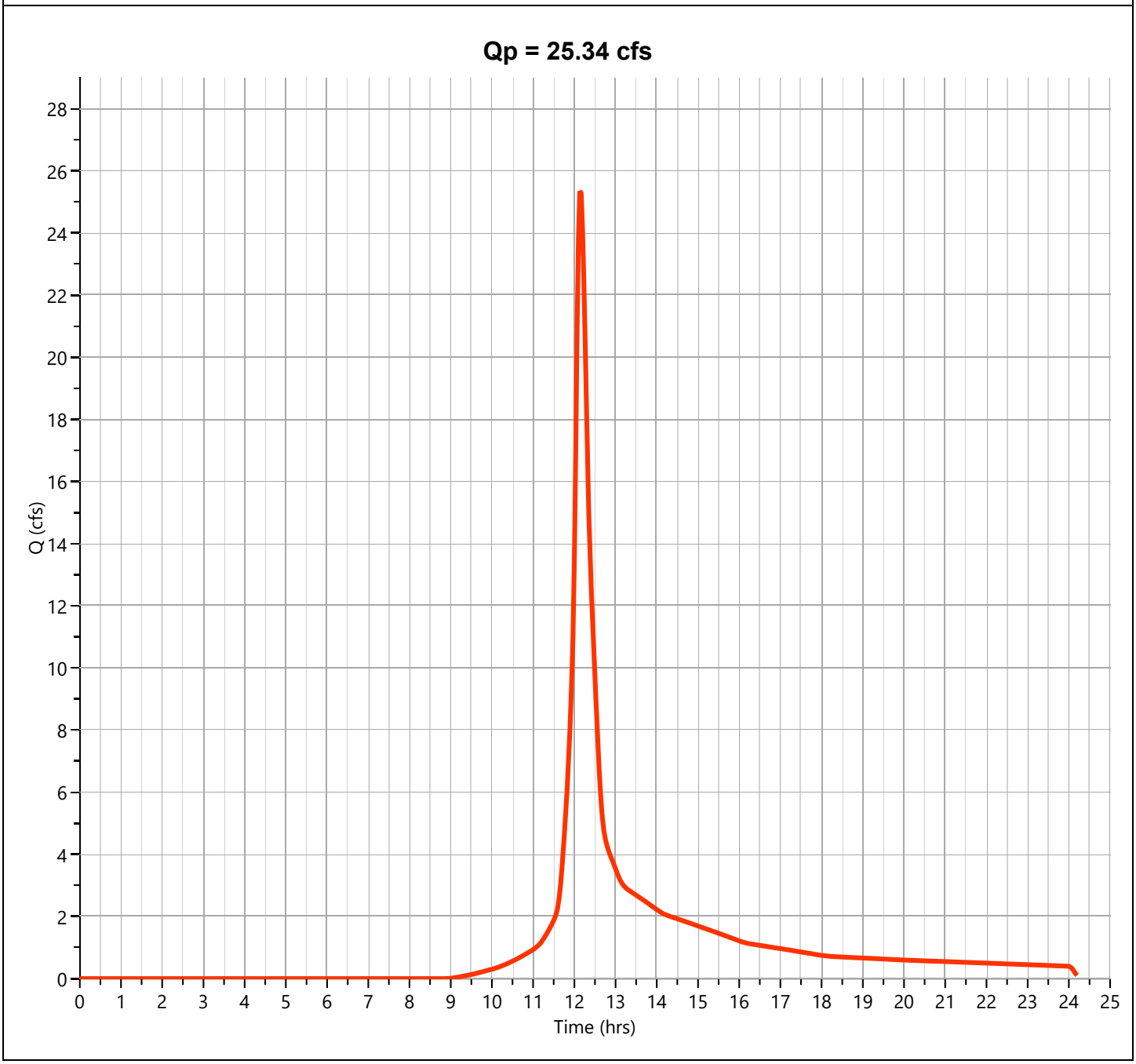
Hydrology Studio v 3.0.0.24

06-28-2022

P-5E

Hyd. No. 30

Hydrograph Type	= NRCS Runoff	Peak Flow	= 25.34 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 97,939 cuft
Drainage Area	= 8.97 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

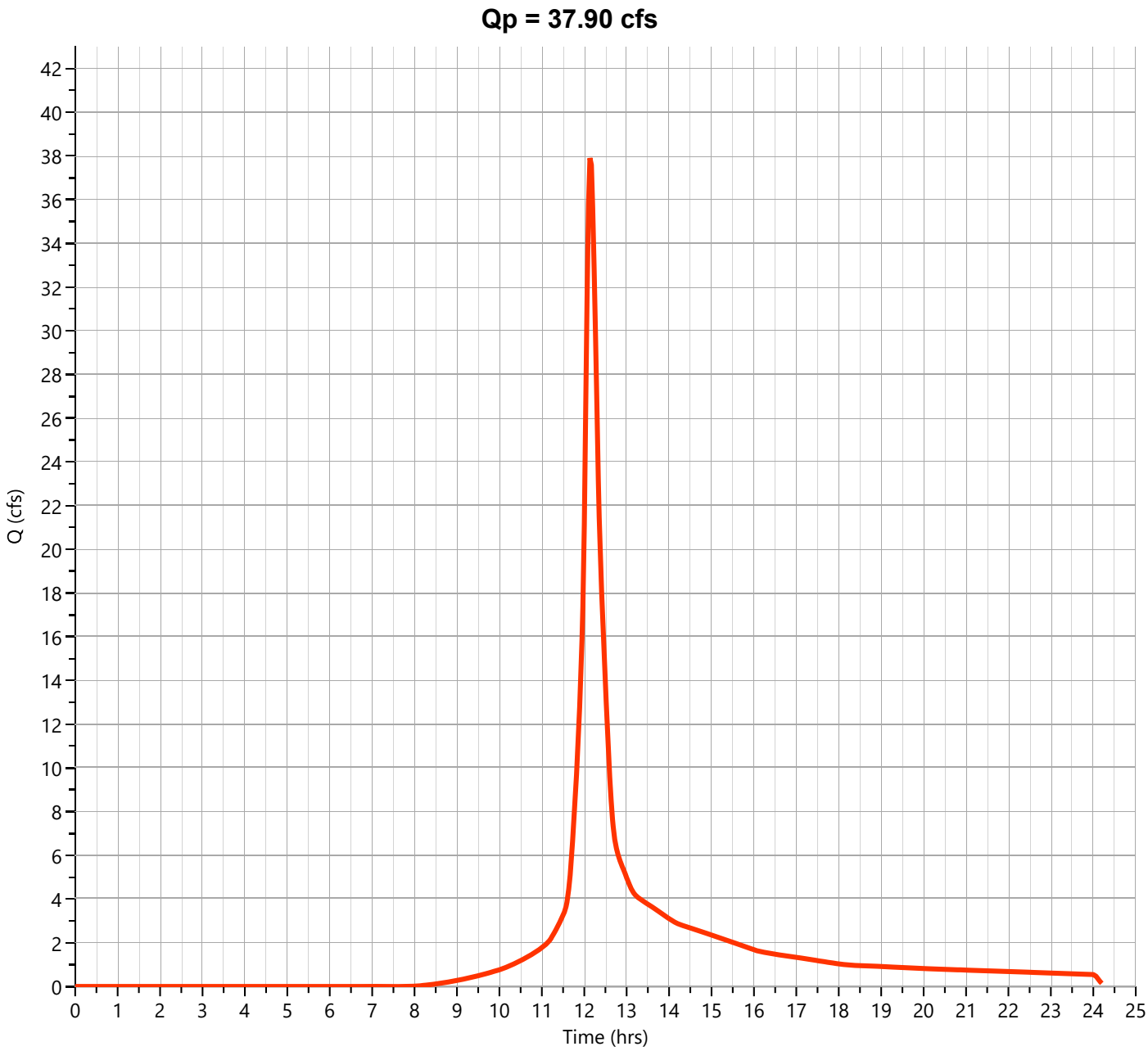
Hydrology Studio v 3.0.0.24

06-28-2022

P-5E

Hyd. No. 30

Hydrograph Type	= NRCS Runoff	Peak Flow	= 37.90 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 145,298 cuft
Drainage Area	= 8.97 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 12.8 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

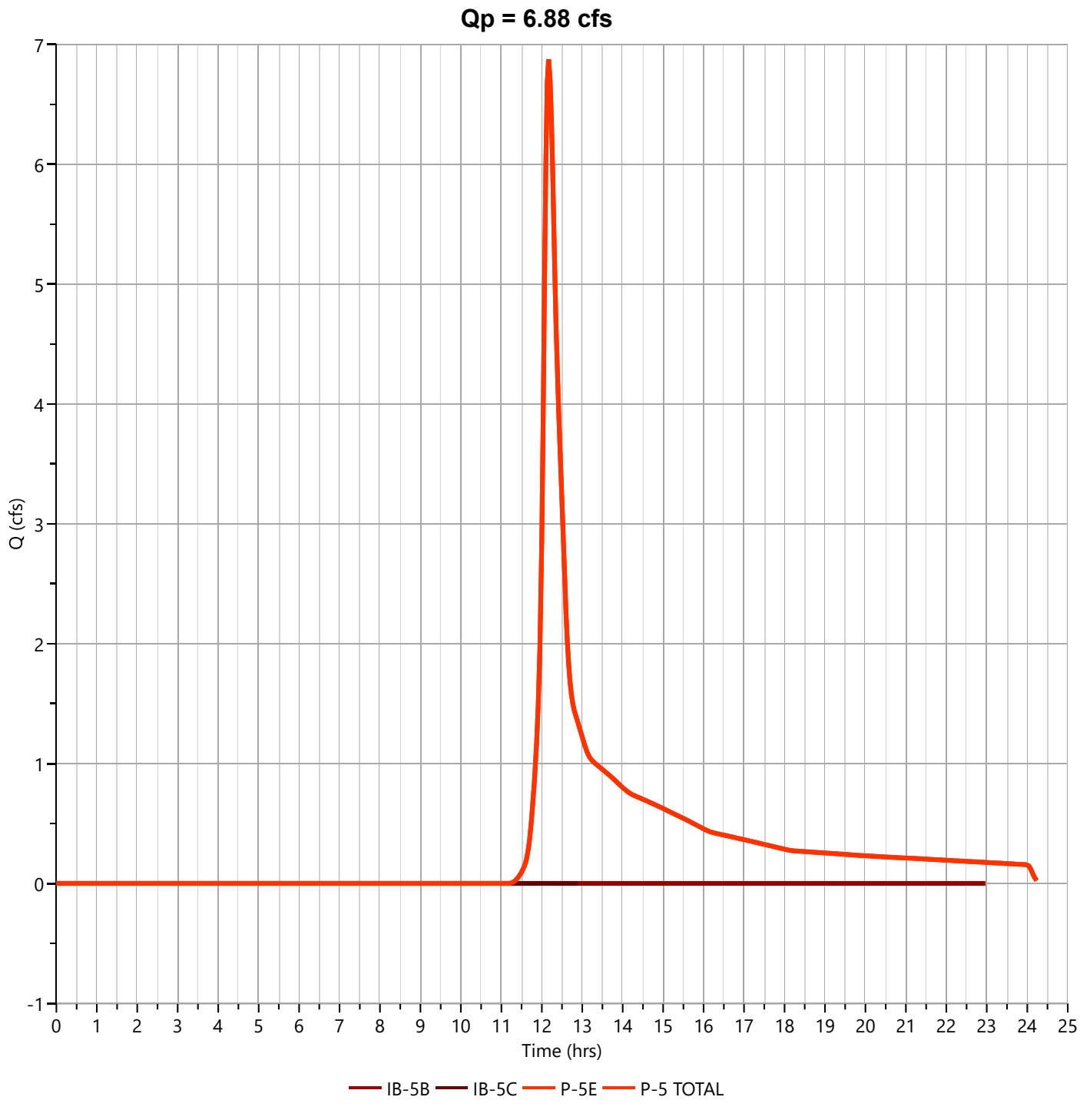
Hydrology Studio v 3.0.0.24

06-28-2022

P-5 TOTAL

Hyd. No. 31

Hydrograph Type	= Junction	Peak Flow	= 6.876 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 29,184 cuft
Inflow Hydrographs	= 27, 29, 30	Total Contrib. Area	= 8.97 ac



Hydrograph Report

Project Name:

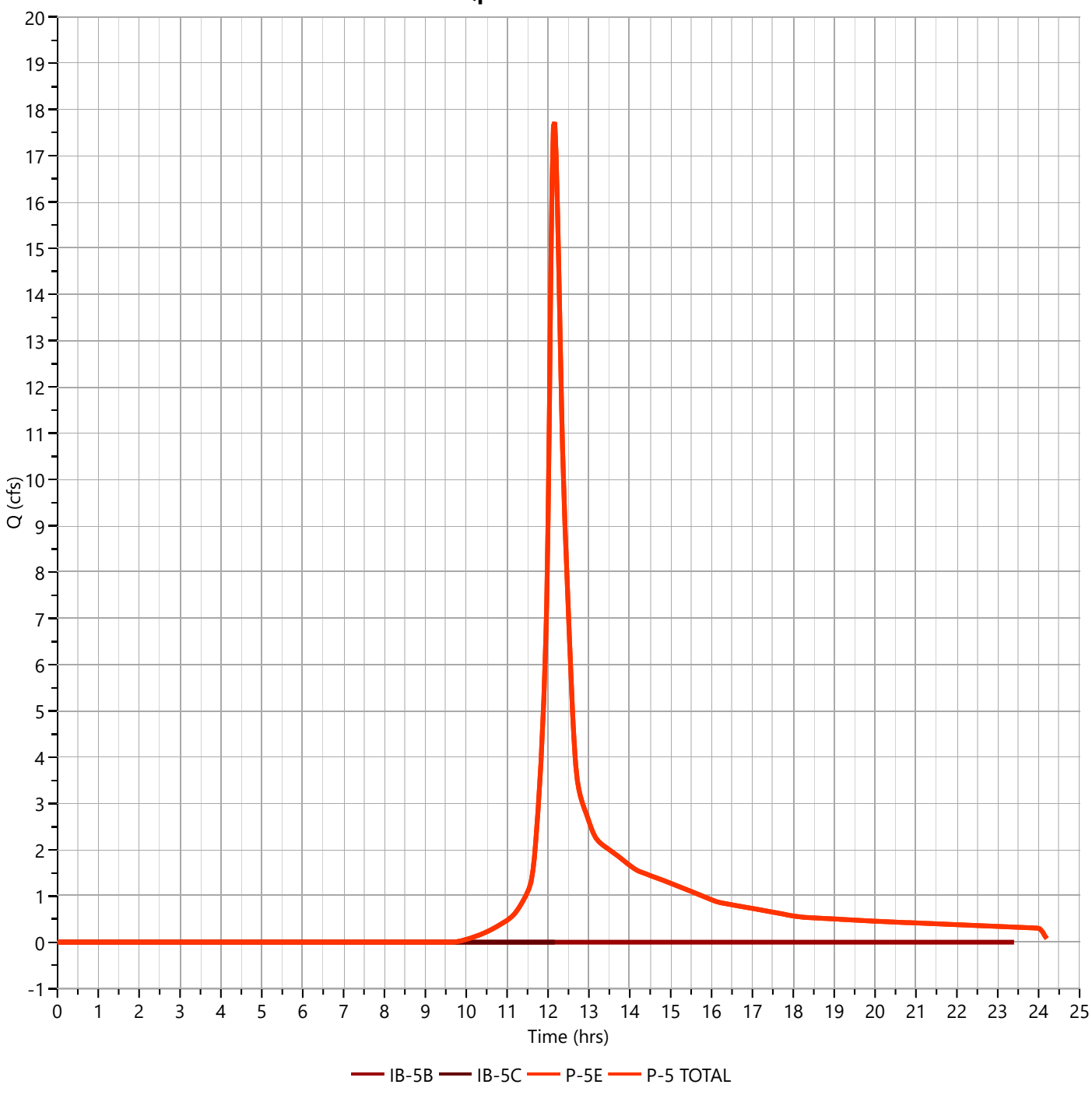
Hydrology Studio v 3.0.0.24

06-28-2022

P-5 TOTAL

Hyd. No. 31

Hydrograph Type	= Junction	Peak Flow	= 17.73 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 69,374 cuft
Inflow Hydrographs	= 27, 29, 30	Total Contrib. Area	= 8.97 ac



Hydrograph Report

Project Name:

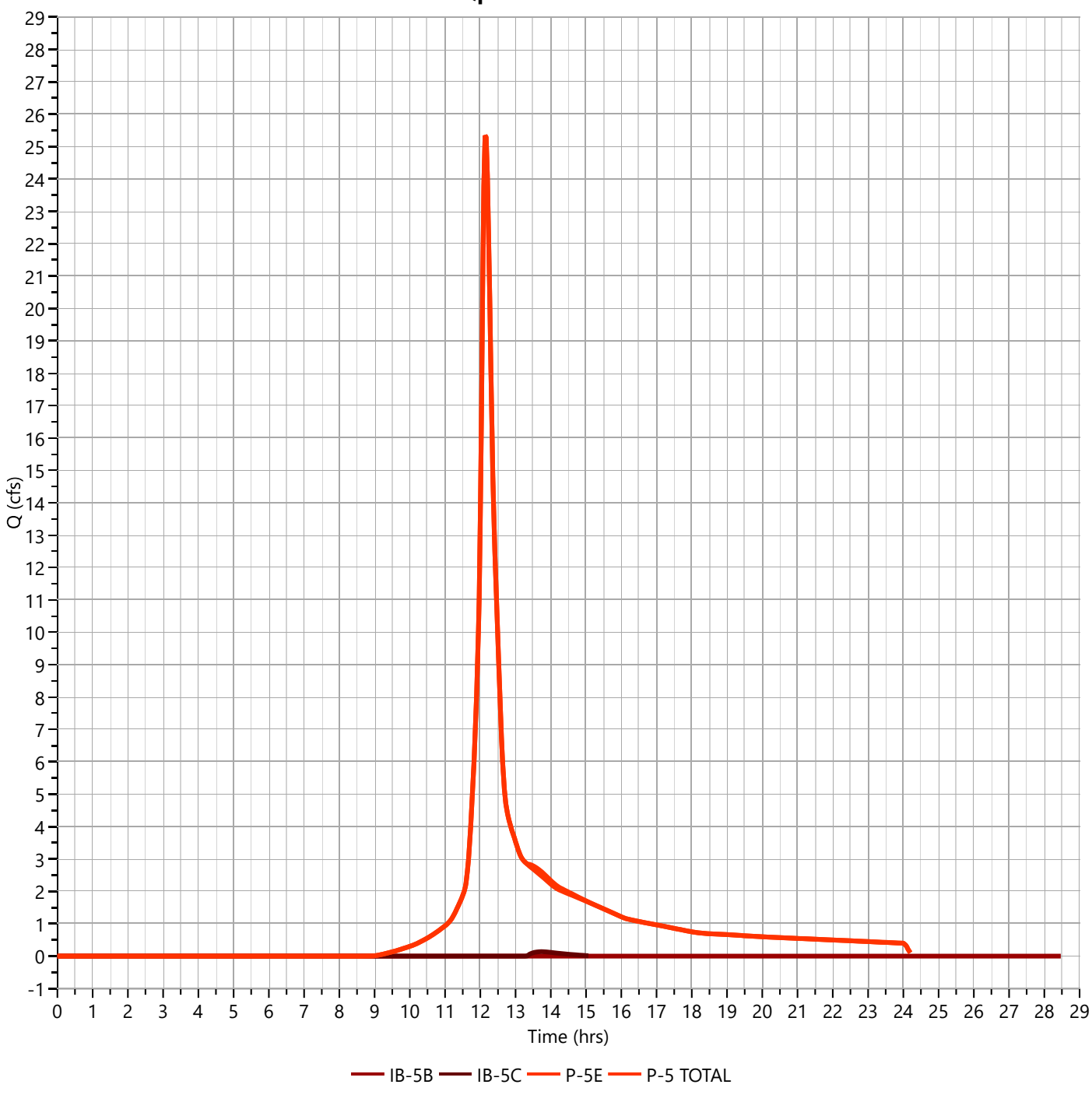
Hydrology Studio v 3.0.0.24

06-28-2022

P-5 TOTAL

Hyd. No. 31

Hydrograph Type	= Junction	Peak Flow	= 25.34 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 98,421 cuft
Inflow Hydrographs	= 27, 29, 30	Total Contrib. Area	= 8.97 ac



Hydrograph Report

Project Name:

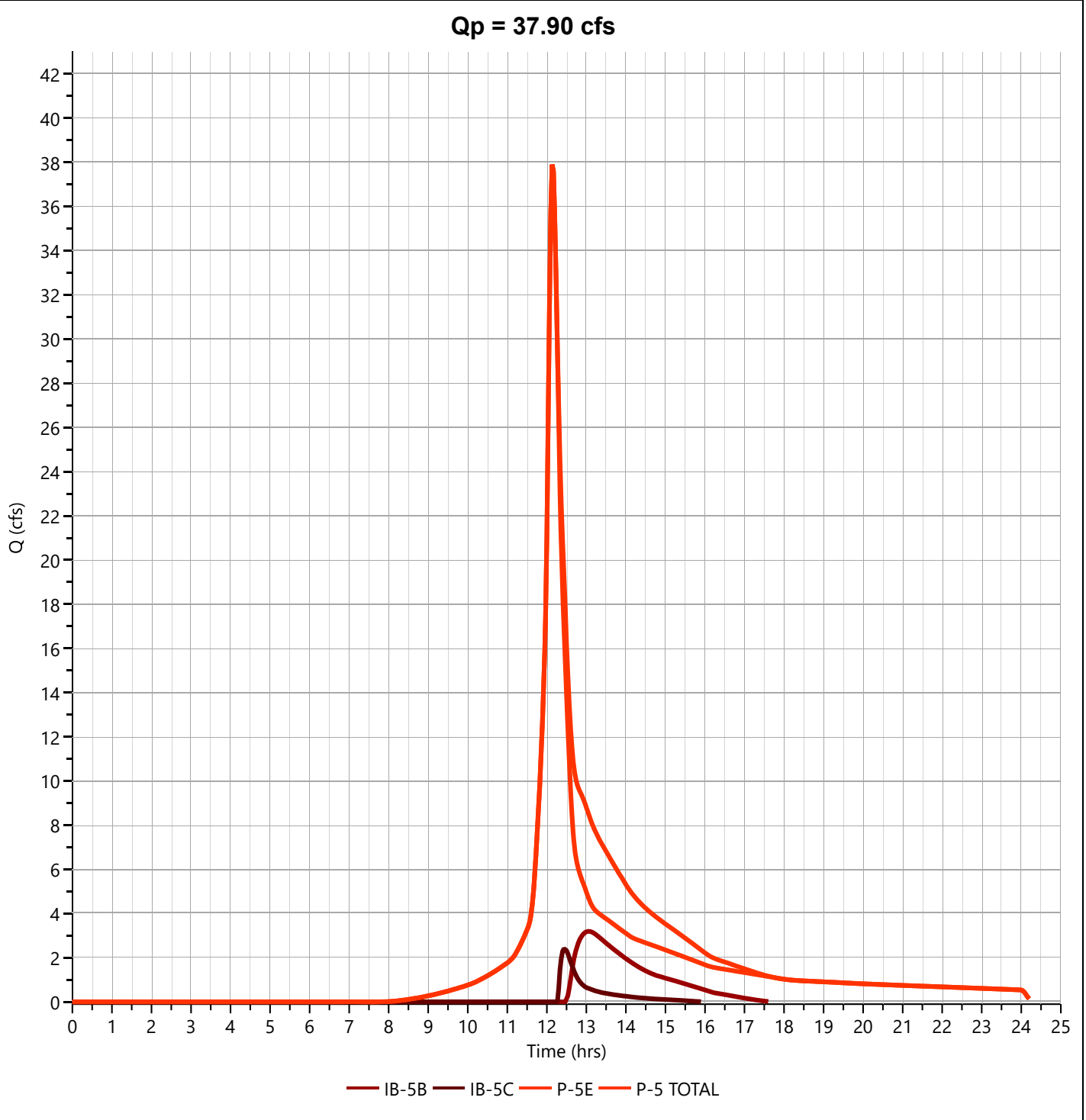
Hydrology Studio v 3.0.0.24

06-28-2022

P-5 TOTAL

Hyd. No. 31

Hydrograph Type	= Junction	Peak Flow	= 37.90 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 174,152 cuft
Inflow Hydrographs	= 27, 29, 30	Total Contrib. Area	= 8.97 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-6A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			1.15	34.35
A	Open Space Good Condition	39			0.15	5.82
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.08	6.03
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.00	0.00
1/ Use only one CN source per line.		59790		Totals =	1.37	46.20

CN (weighted) = total product / total area = 46.20 / 1.37 = 33.66 ; Use CN = 34

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.02	0.22	0.64

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed
Circle one: Tc Tt through subarea Subcatchment P-6A

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.020			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	381			
9. Watercourse slope, s		ft/ft	0.030			
10. Average Velocity, V (figure 3-1)		ft/s	2.79			
11. Tt = L / 3600V	Compute Tt	hr	0.04			0.04
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.33
min 19.6

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

P-6A

Hyd. No. 41

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.37 ac	Curve Number	= 34
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

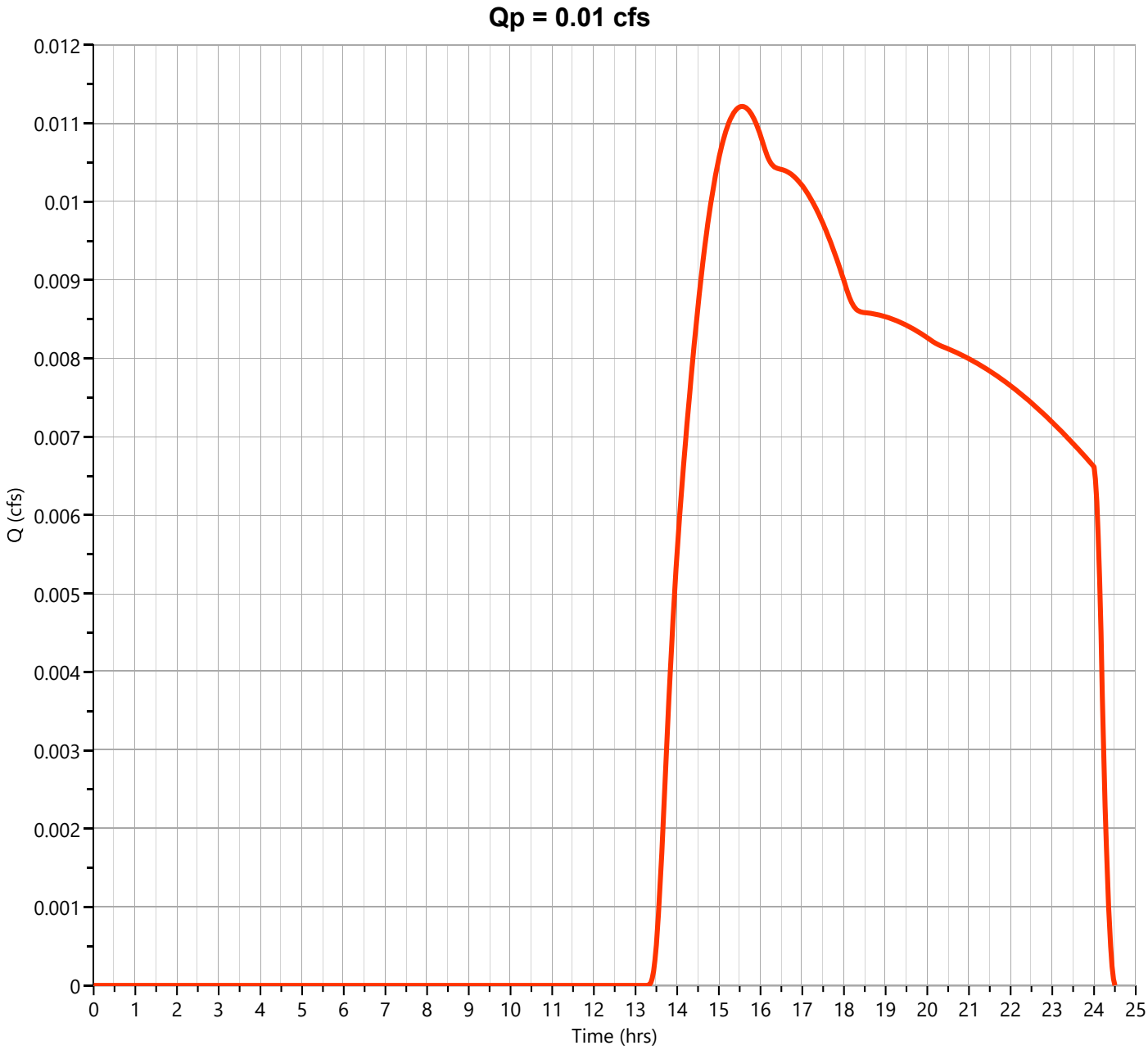
Hydrology Studio v 3.0.0.24

06-28-2022

P-6A

Hyd. No. 41

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.011 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.57 hrs
Time Interval	= 2 min	Runoff Volume	= 324 cuft
Drainage Area	= 1.37 ac	Curve Number	= 34
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

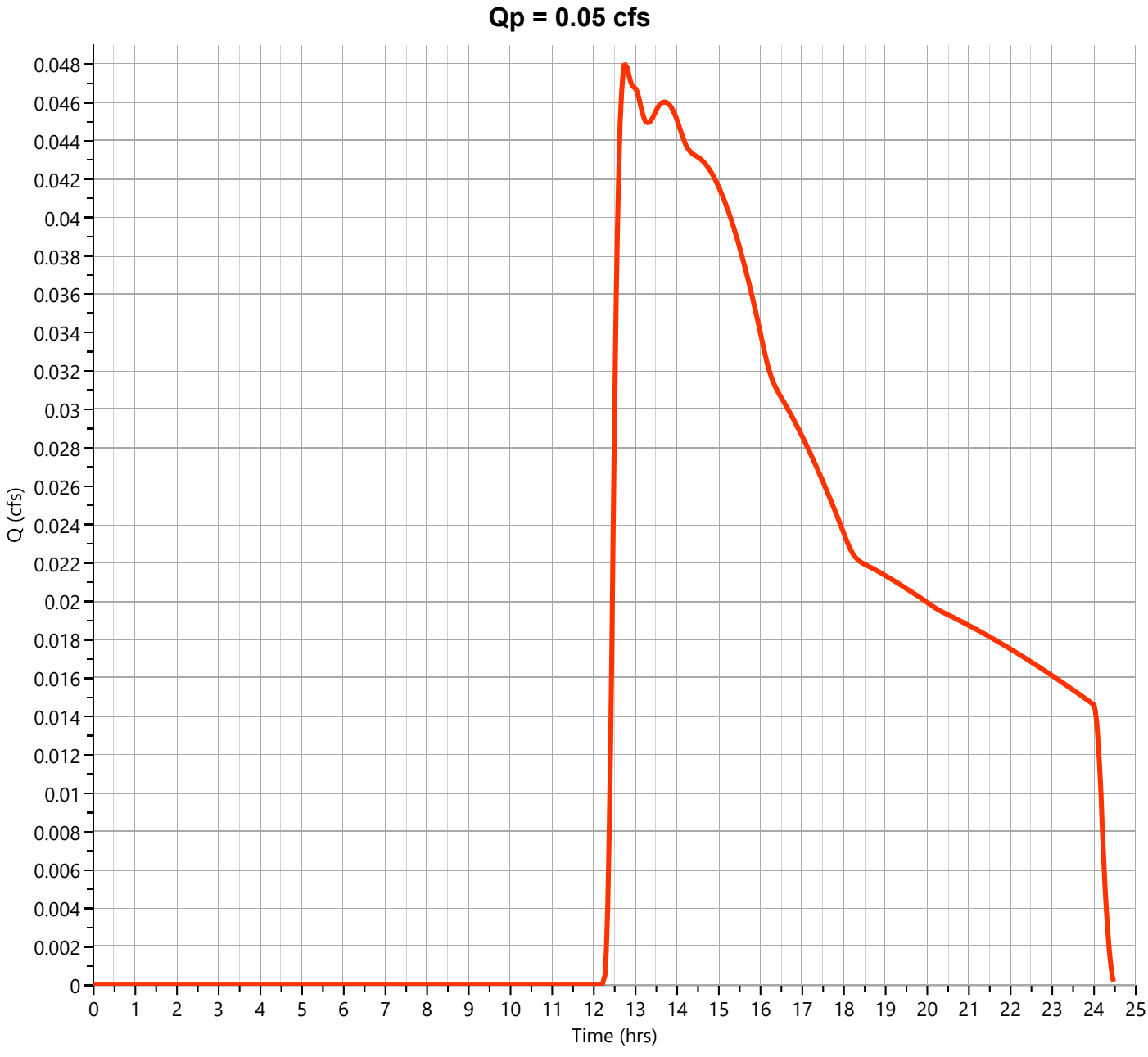
Hydrology Studio v 3.0.0.24

06-28-2022

P-6A

Hyd. No. 41

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.048 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.77 hrs
Time Interval	= 2 min	Runoff Volume	= 1,169 cuft
Drainage Area	= 1.37 ac	Curve Number	= 34
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

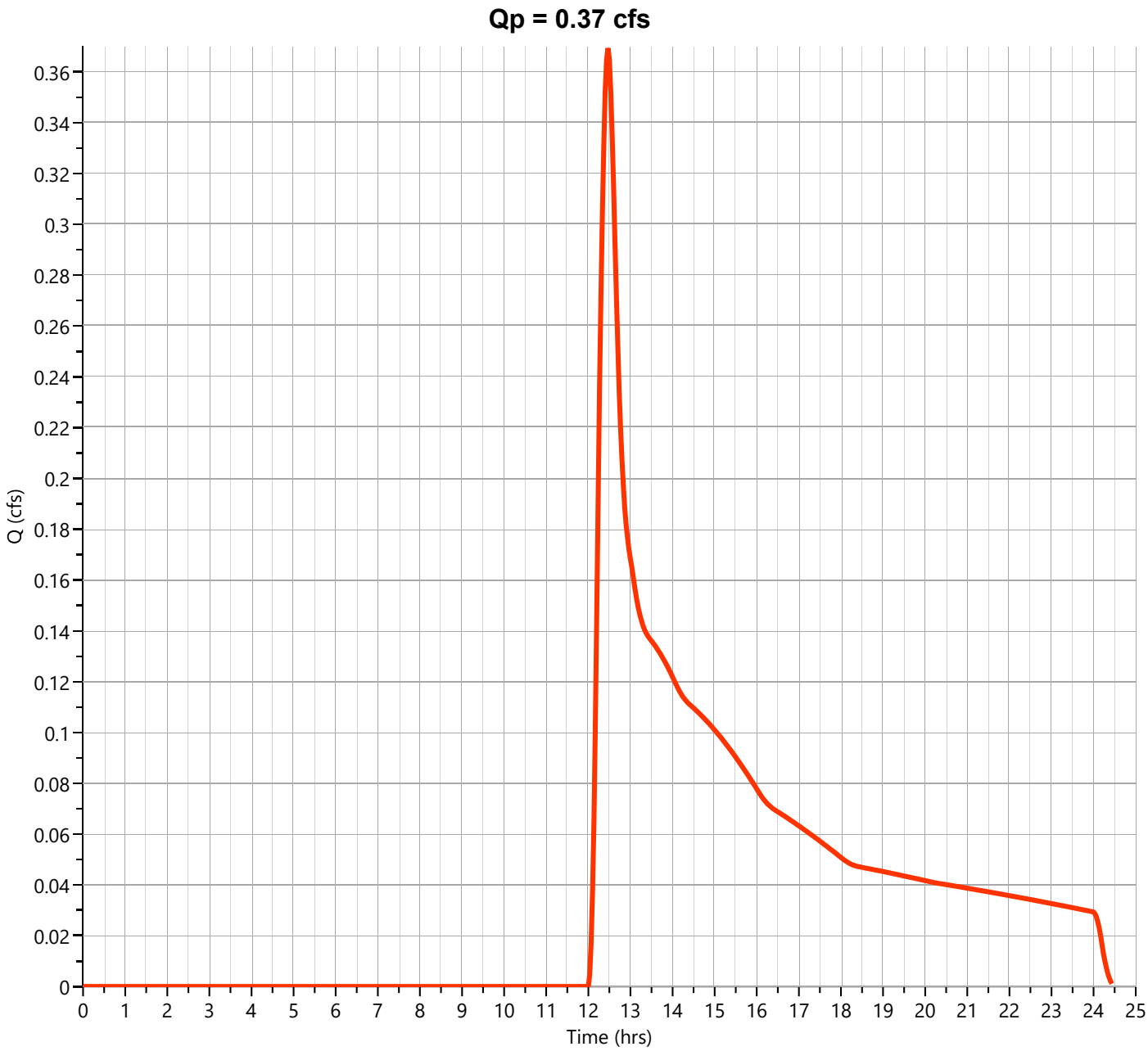
Hydrology Studio v 3.0.0.24

06-28-2022

P-6A

Hyd. No. 41

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.369 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 3,333 cuft
Drainage Area	= 1.37 ac	Curve Number	= 34
Tc Method	= User	Time of Conc. (Tc)	= 19.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-6B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.13	13.15
A	Woods Good Condition	30			0.58	17.47
A	Open Space Good Condition	39			0.45	17.36
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.00	0.00
1/ Use only one CN source per line.		50607		Totals =	1.16	47.99

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{47.99}{1.16} = 41.30$; Use CN = 41

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.01	0.62	1.30

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-6B

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.015			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.16			0.16
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	224			
9. Watercourse slope, s		ft/ft	0.030			
10. Average Velocity, V (figure 3-1)		ft/s	2.79			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.18
min 10.7

Hydrograph Report

Project Name:

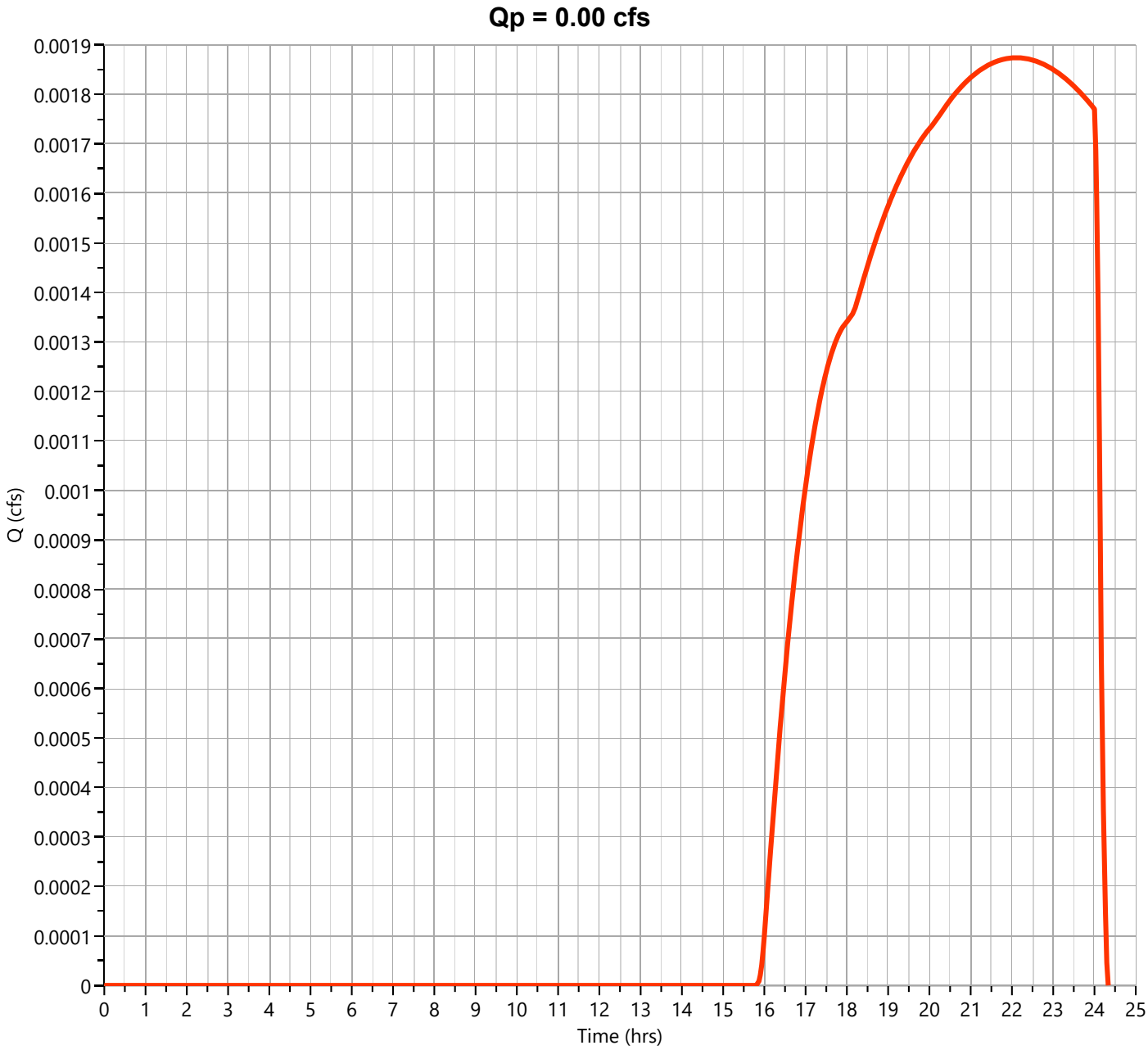
Hydrology Studio v 3.0.0.24

06-28-2022

P-6B

Hyd. No. 42

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.10 hrs
Time Interval	= 2 min	Runoff Volume	= 45.1 cuft
Drainage Area	= 1.16 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.7 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

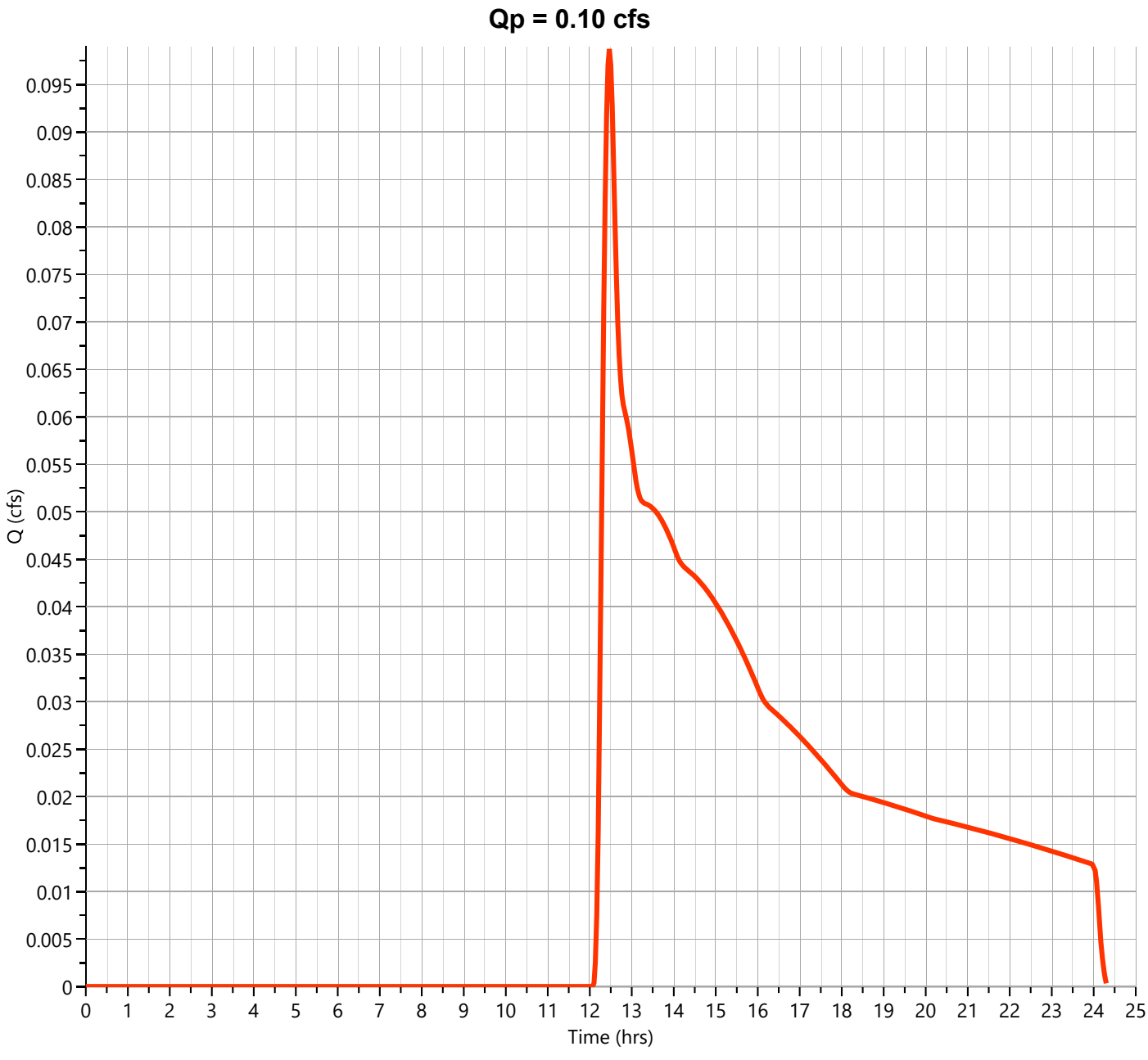
Hydrology Studio v 3.0.0.24

06-28-2022

P-6B

Hyd. No. 42

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.099 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 1,226 cuft
Drainage Area	= 1.16 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.7 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

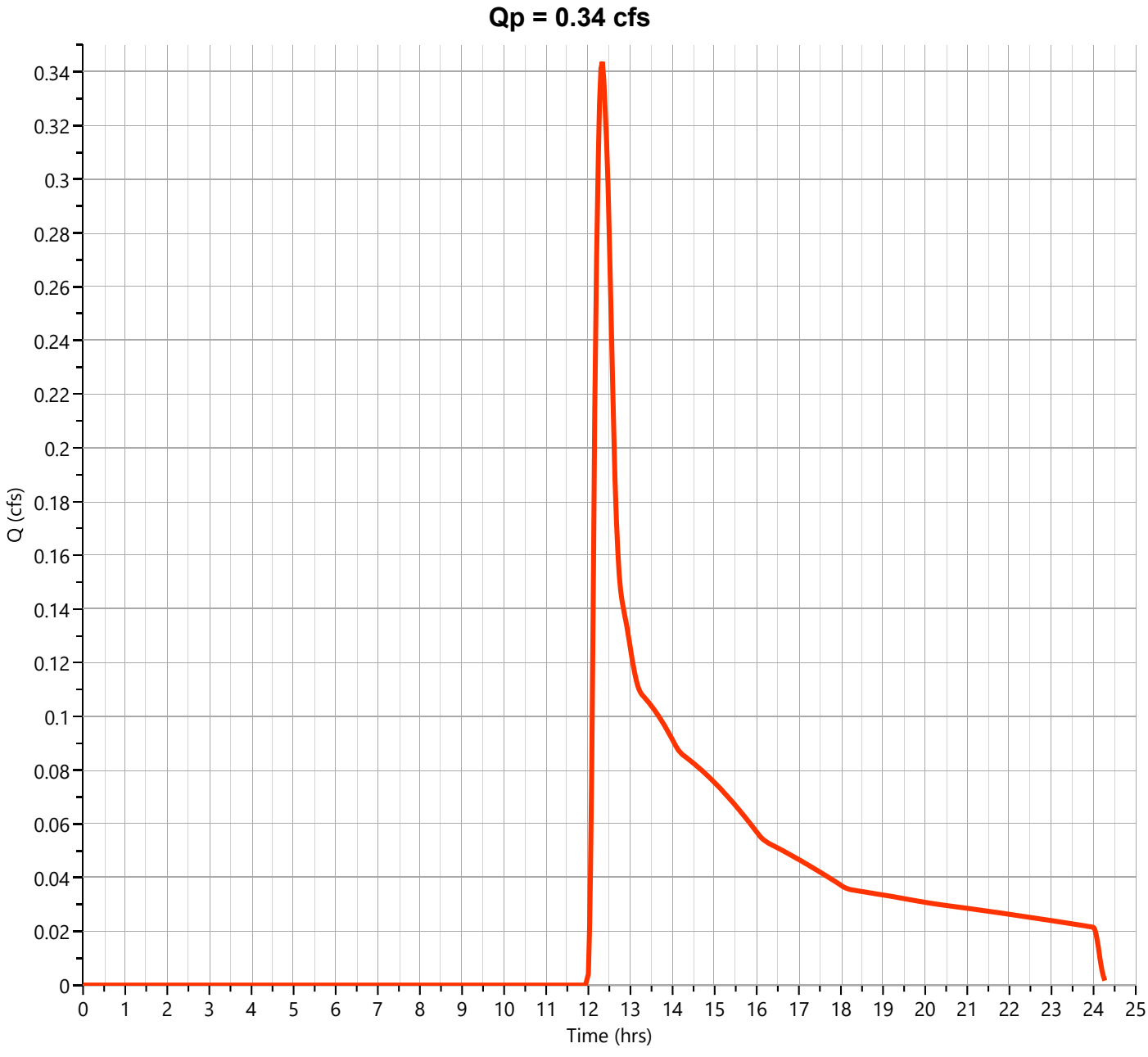
Hydrology Studio v 3.0.0.24

06-28-2022

P-6B

Hyd. No. 42

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.344 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 2,617 cuft
Drainage Area	= 1.16 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.7 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

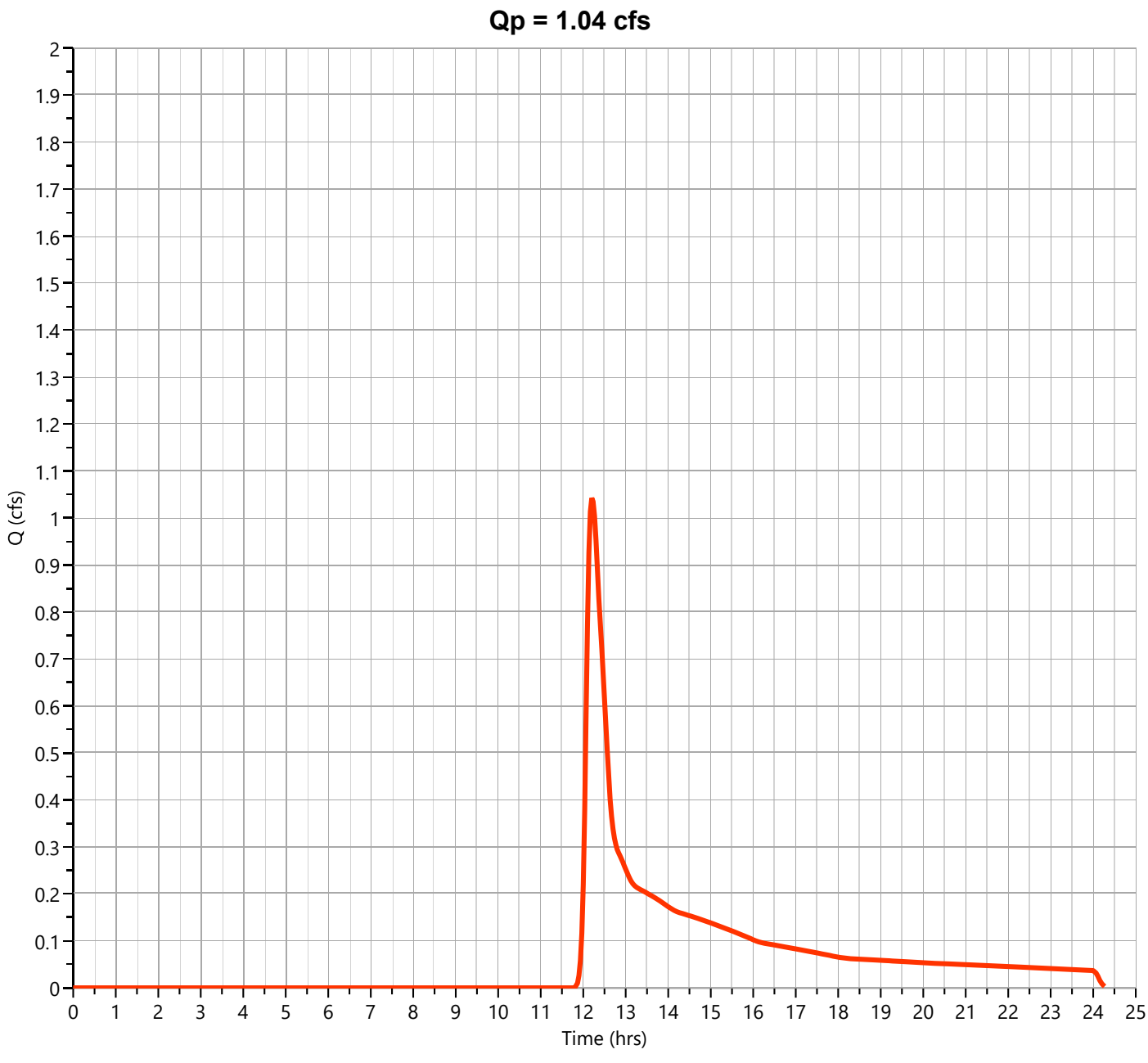
Hydrology Studio v 3.0.0.24

06-28-2022

P-6B

Hyd. No. 42

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.043 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 5,524 cuft
Drainage Area	= 1.16 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.7 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

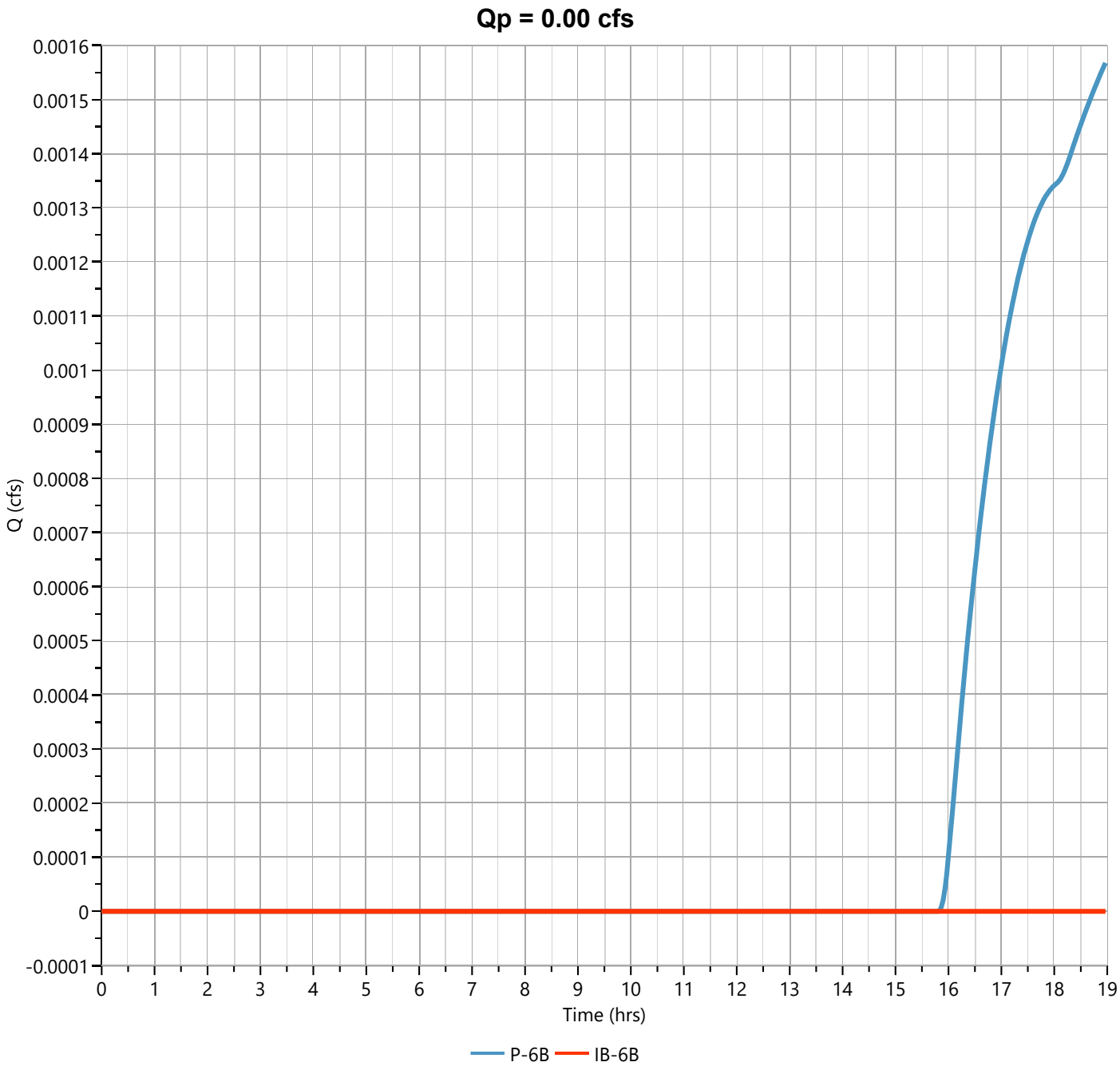
06-28-2022

IB-6B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 18.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-6B	Max. Elevation	= 217.40 ft
Pond Name	= IB-6B	Max. Storage	= 0.735 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

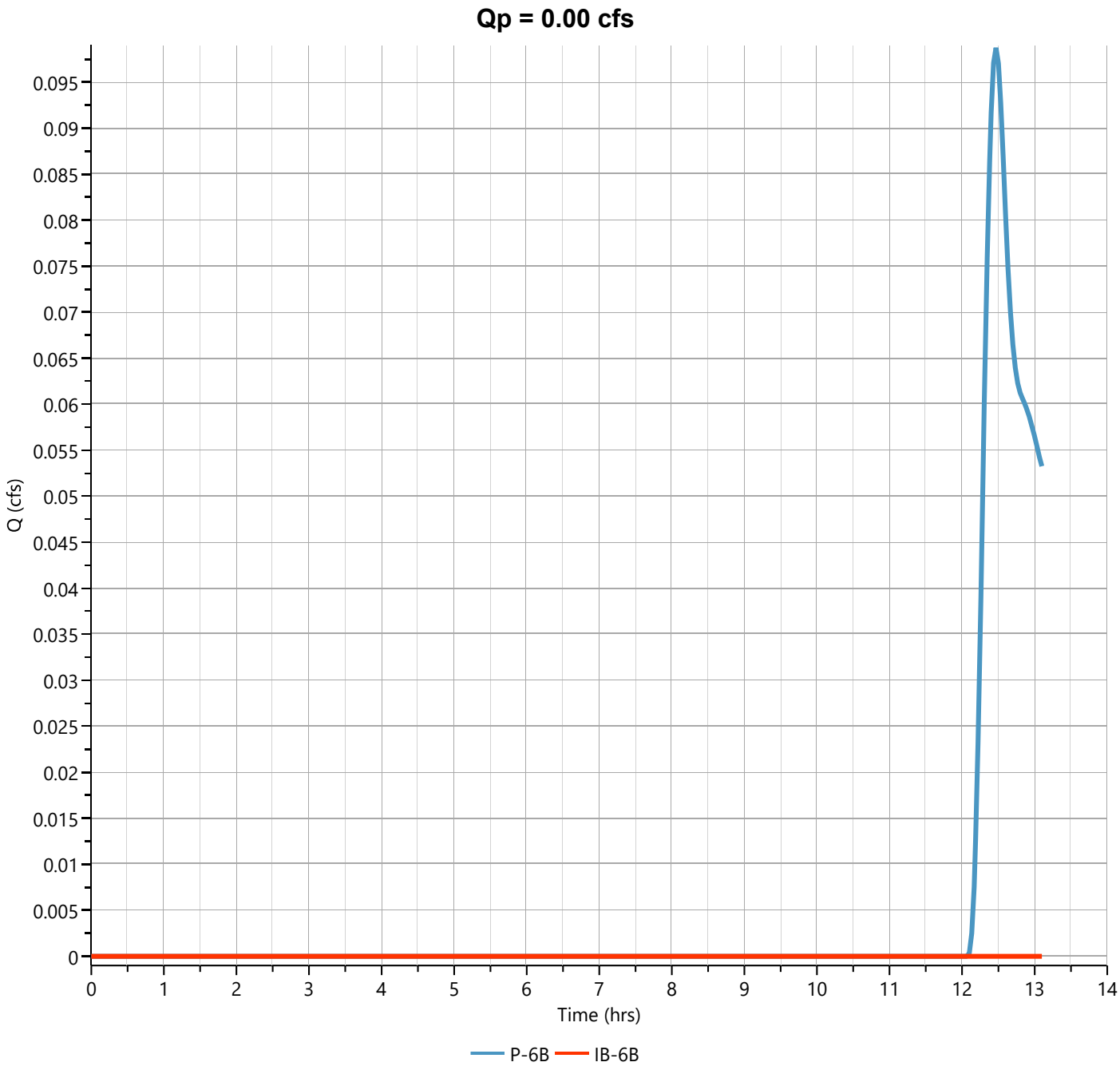
06-28-2022

IB-6B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-6B	Max. Elevation	= 217.46 ft
Pond Name	= IB-6B	Max. Storage	= 33.8 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

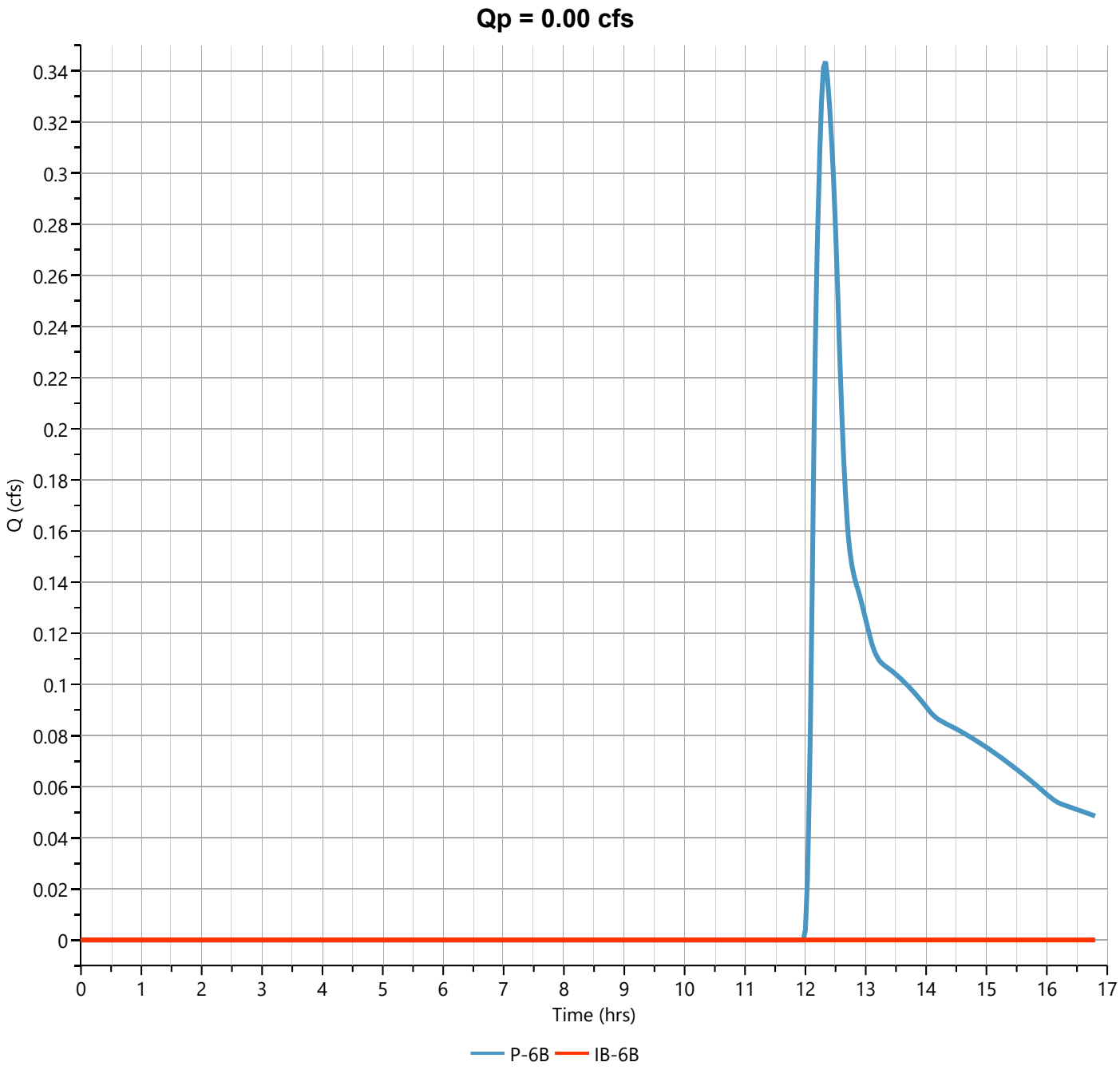
IB-6B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 16.73 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-6B	Max. Elevation	= 218.00 ft
Pond Name	= IB-6B	Max. Storage	= 344 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.37 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

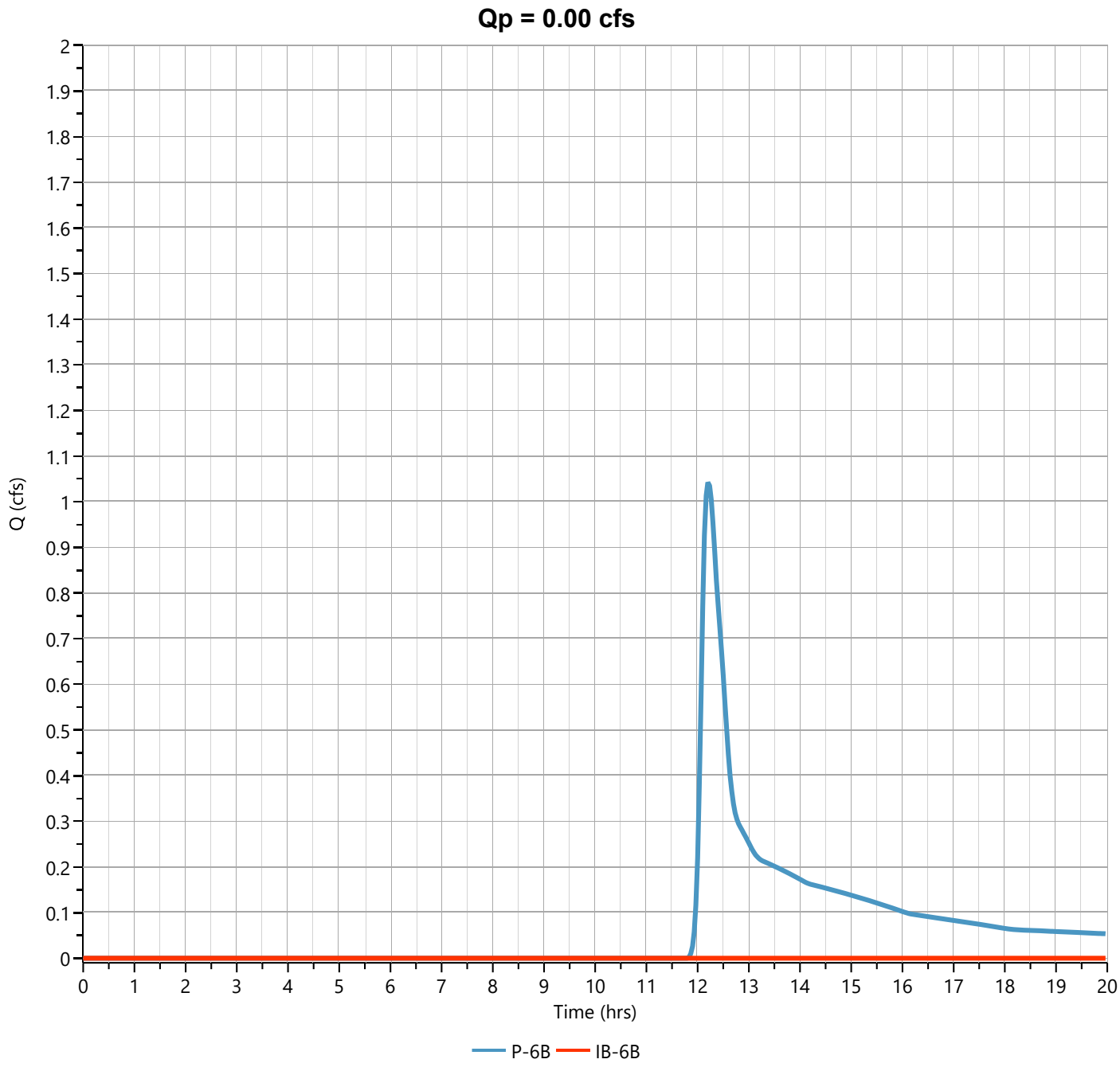
06-28-2022

IB-6B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 19.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-6B	Max. Elevation	= 219.15 ft
Pond Name	= IB-6B	Max. Storage	= 1,446 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

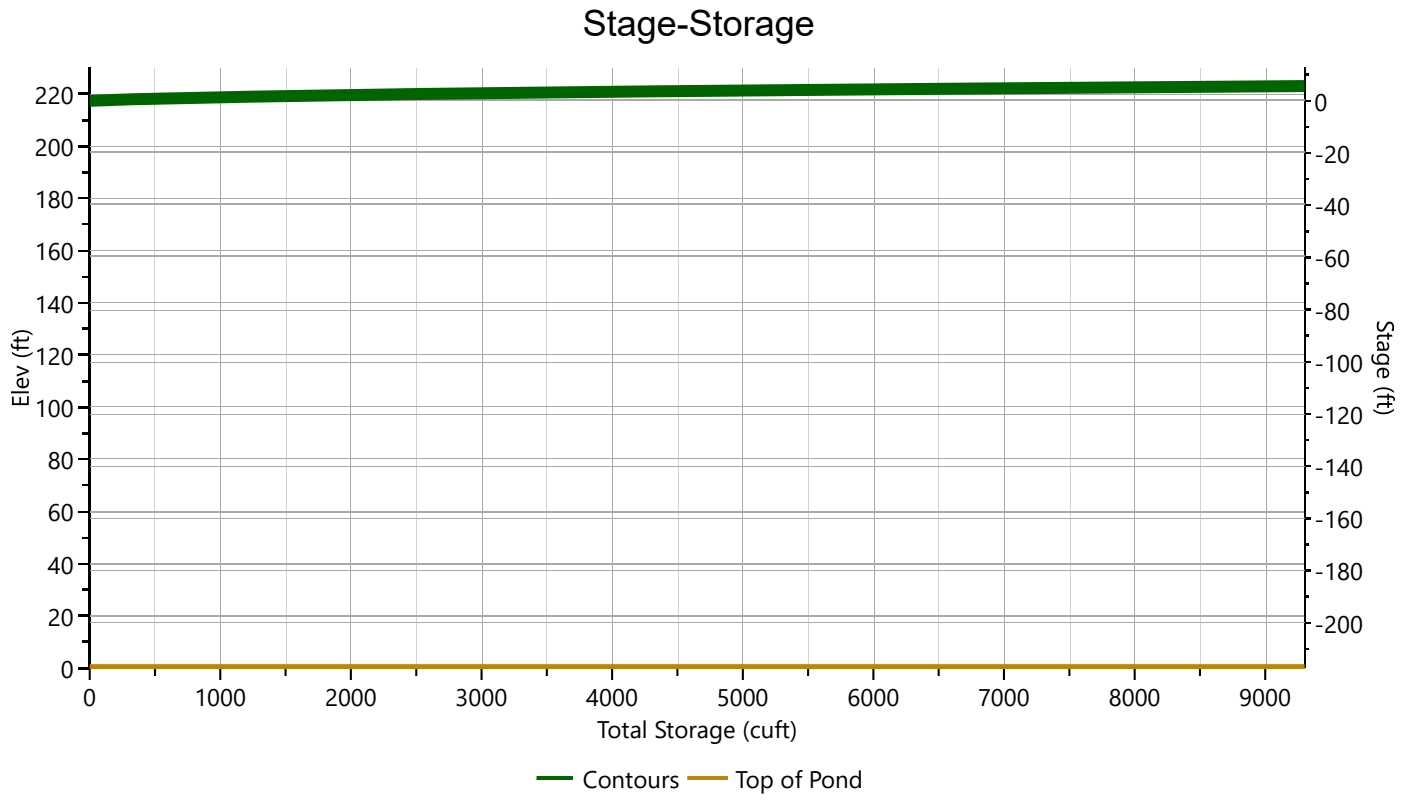
IB-6B

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	217.40
Voids (%)	100.00
Volume Calc	Conic

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	217.40	426	0.000	0.000
0.60	218.00	729	342	342
1.60	219.00	1,106	911	1,253
2.60	220.00	1,512	1,304	2,557
3.60	221.00	1,975	1,738	4,295
4.60	222.00	2,494	2,229	6,524
5.60	223.00	3,070	2,777	9,301



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

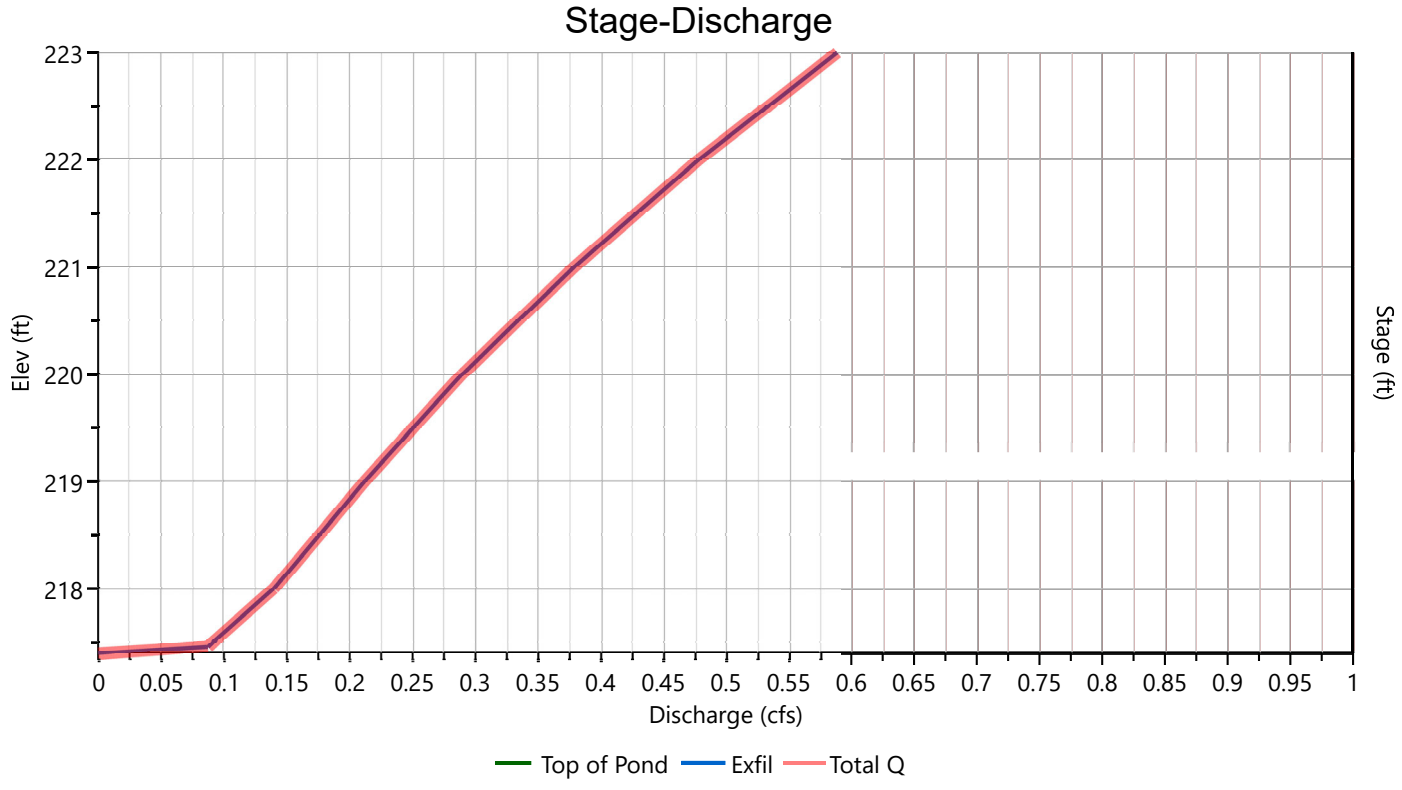
06-28-2022

IB-6B

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	8.27**
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-6B

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	217.40	0.000										0.000		0.000
0.60	218.00	342										0.140		0.140
1.60	219.00	1,253										0.212		0.212
2.60	220.00	2,557										0.289		0.289
3.60	221.00	4,295										0.378		0.378
4.60	222.00	6,524										0.477		0.477
5.60	223.00	9,301										0.588		0.588

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

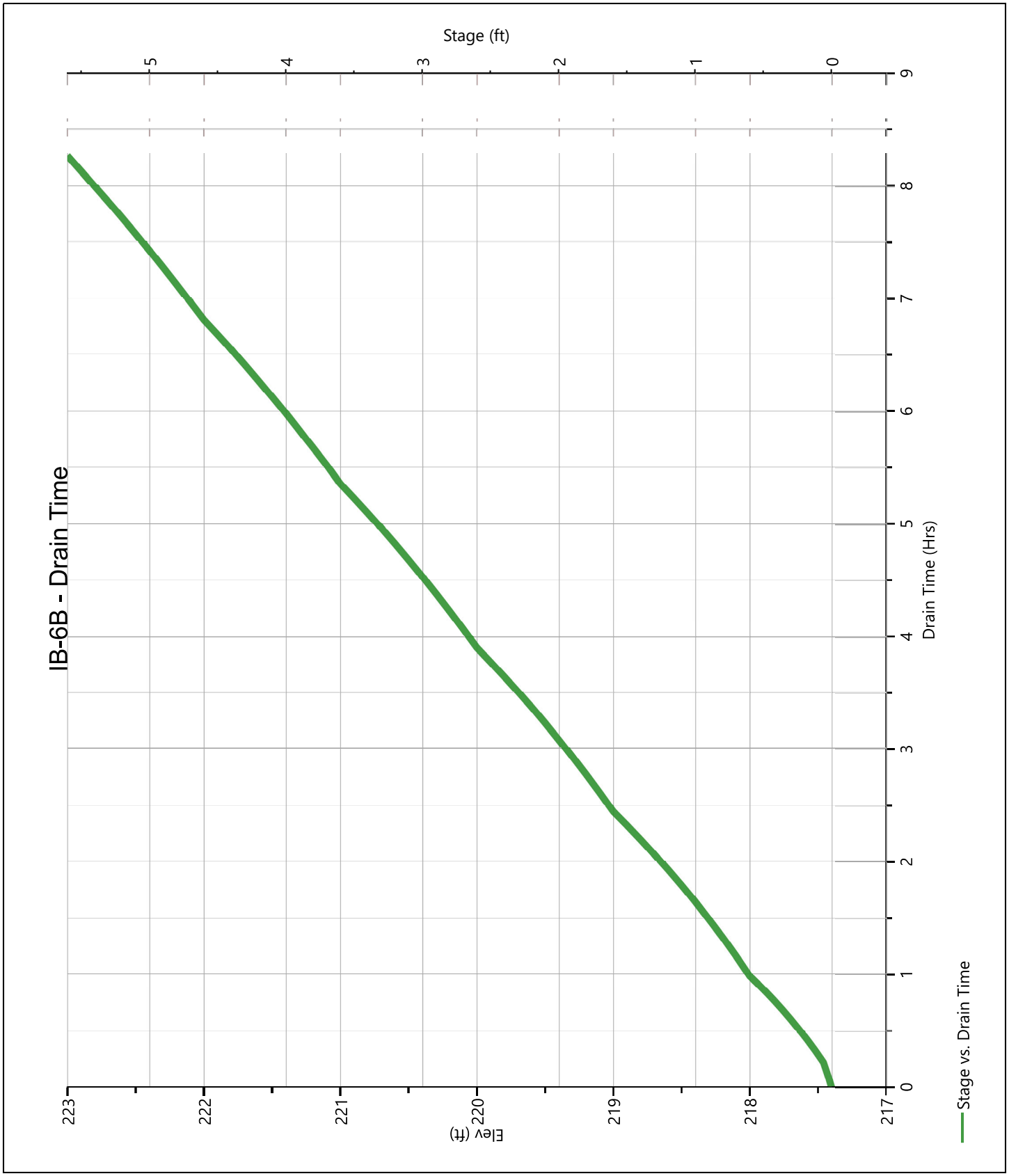
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-6B

Pond Drawdown



Hydrograph Report

Project Name:

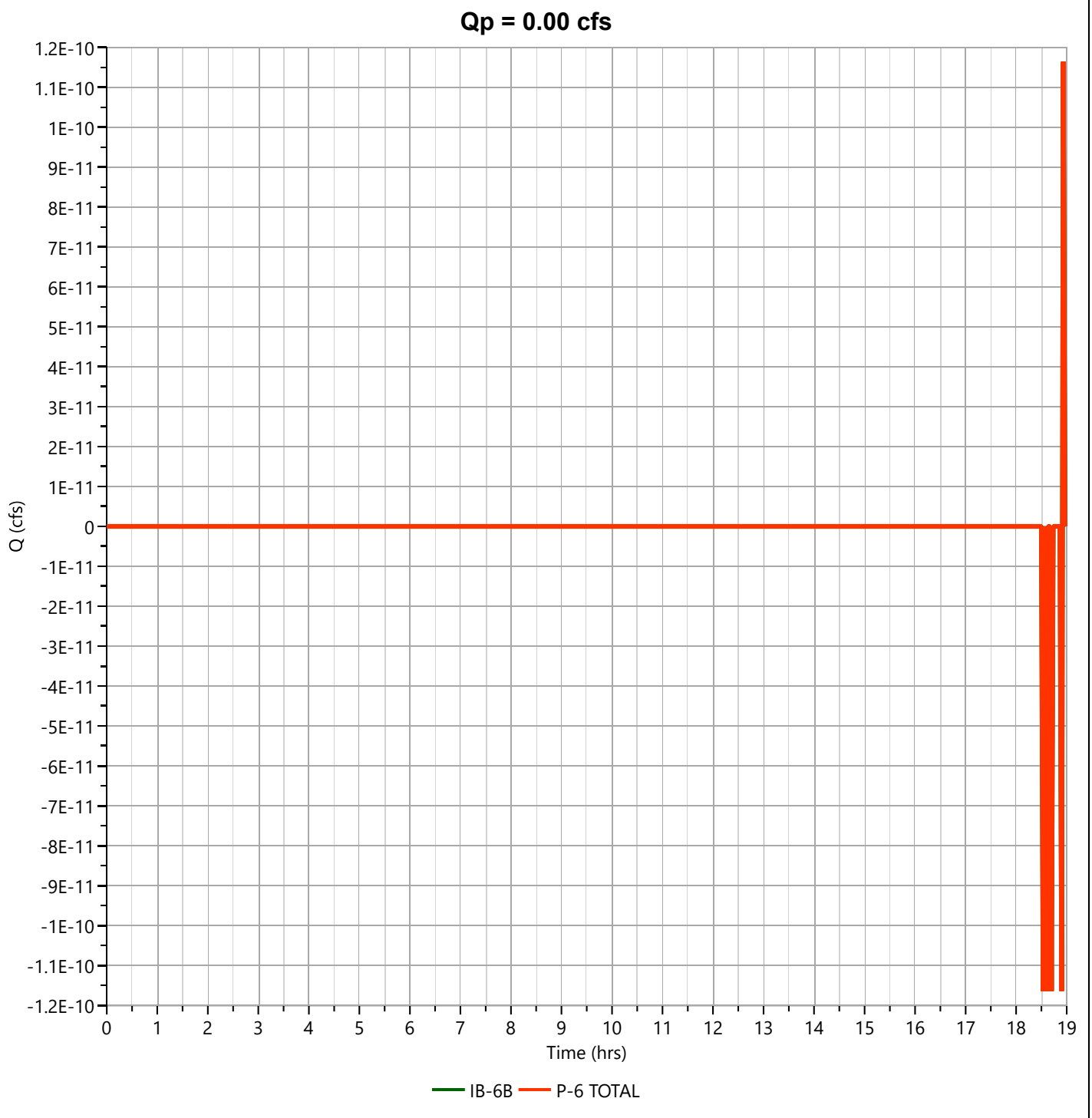
Hydrology Studio v 3.0.0.24

06-28-2022

P-6 TOTAL

Hyd. No. 44

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 18.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 41, 43	Total Contrib. Area	= 1.37 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

P-6 TOTAL

Hyd. No. 44

Hydrograph Type	= Junction	Peak Flow	= 0.011 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 324 cuft
Inflow Hydrographs	= 41, 43	Total Contrib. Area	= 1.37 ac



Hydrograph Report

Project Name:

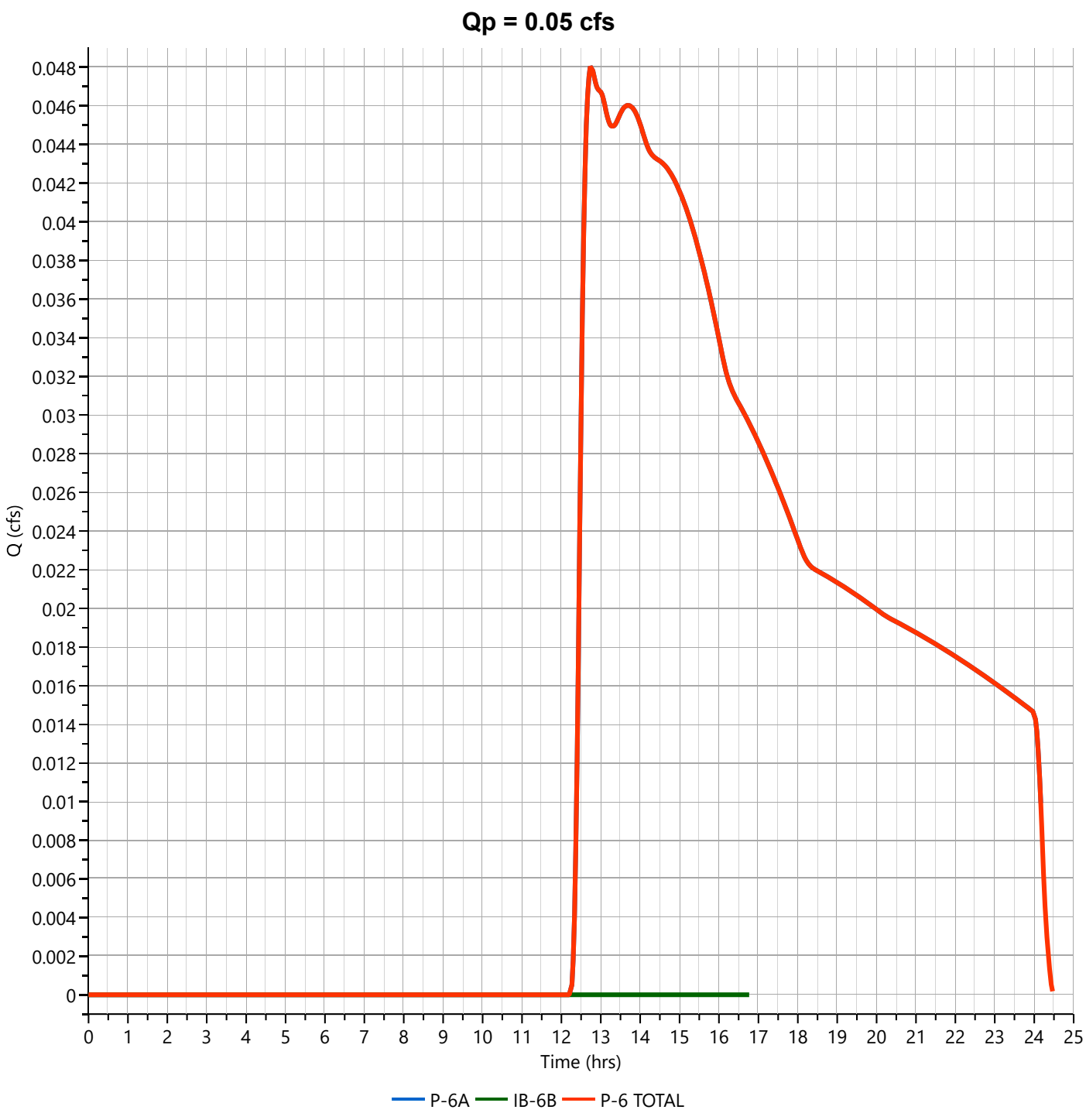
Hydrology Studio v 3.0.0.24

06-28-2022

P-6 TOTAL

Hyd. No. 44

Hydrograph Type	= Junction	Peak Flow	= 0.048 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.77 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,169 cuft
Inflow Hydrographs	= 41, 43	Total Contrib. Area	= 1.37 ac



Hydrograph Report

Project Name:

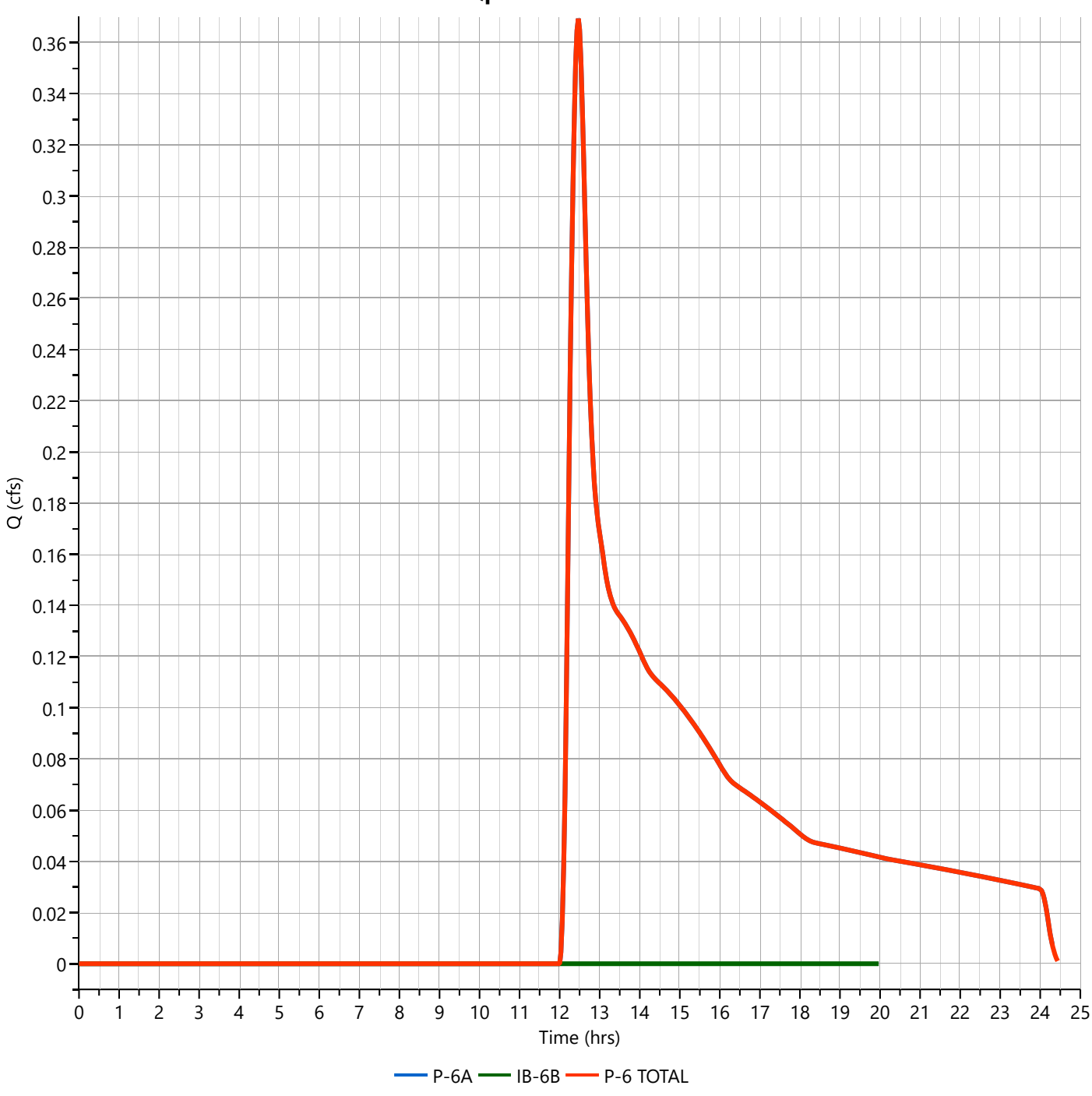
Hydrology Studio v 3.0.0.24

06-28-2022

P-6 TOTAL

Hyd. No. 44

Hydrograph Type	= Junction	Peak Flow	= 0.369 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 3,333 cuft
Inflow Hydrographs	= 41, 43	Total Contrib. Area	= 1.37 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-7A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.25	122.74
A	Woods Good Condition	30			0.67	20.13
A	Open Space Good Condition	39			2.02	78.71
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.02	1.86
1/ Use only one CN source per line.		171705		Totals =	3.97	223.44

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{223.44}{3.97} = 56.35$; Use CN = 56

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.31	1.71	2.82

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-7A

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.020			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.14			0.14
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	251			
9. Watercourse slope, s		ft/ft	0.020			
10. Average Velocity, V (figure 3-1)		ft/s	2.28			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.2

Hydrograph Report

Project Name:

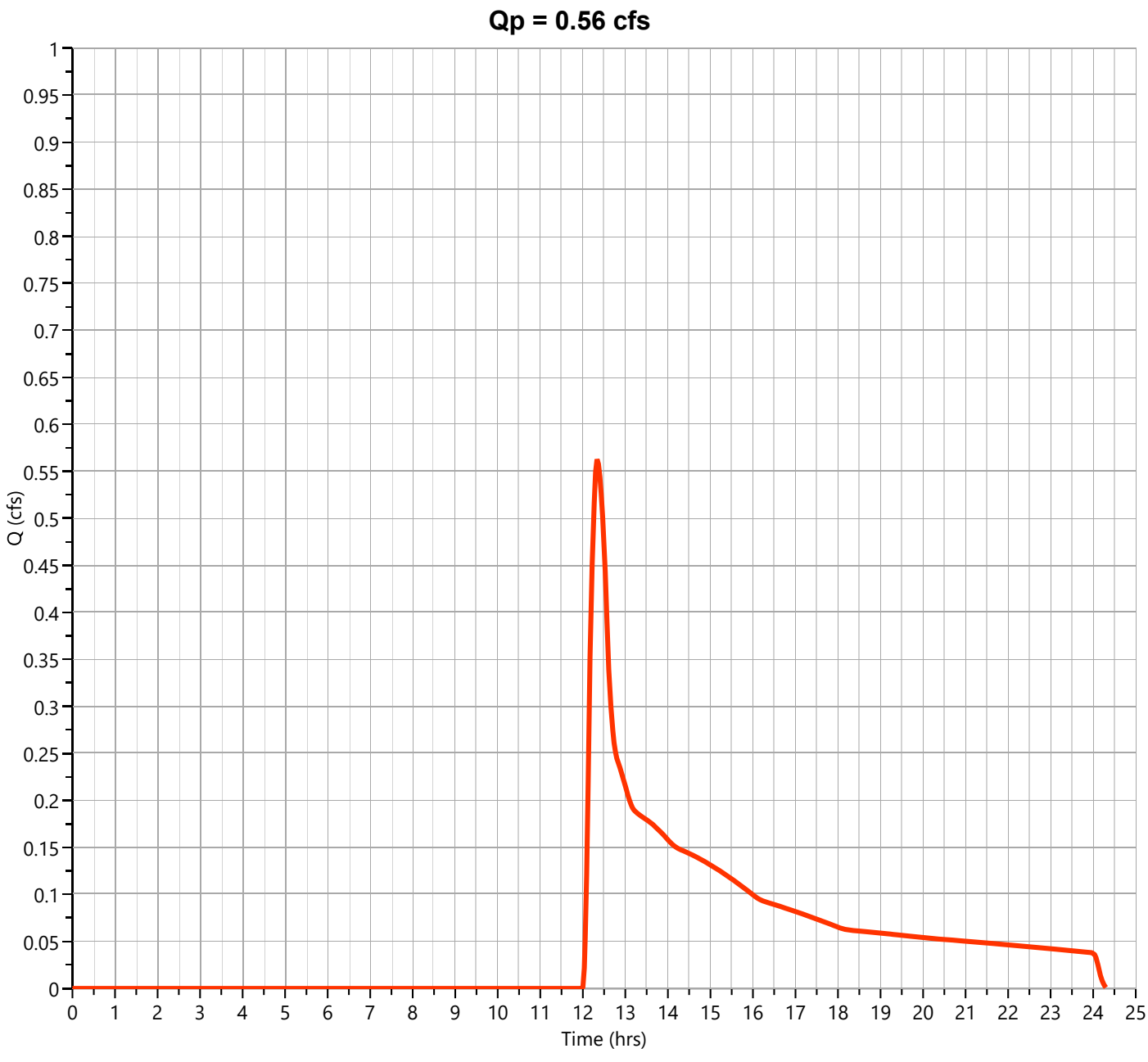
Hydrology Studio v 3.0.0.24

06-28-2022

P-7A

Hyd. No. 46

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.563 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 4,481 cuft
Drainage Area	= 3.97 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

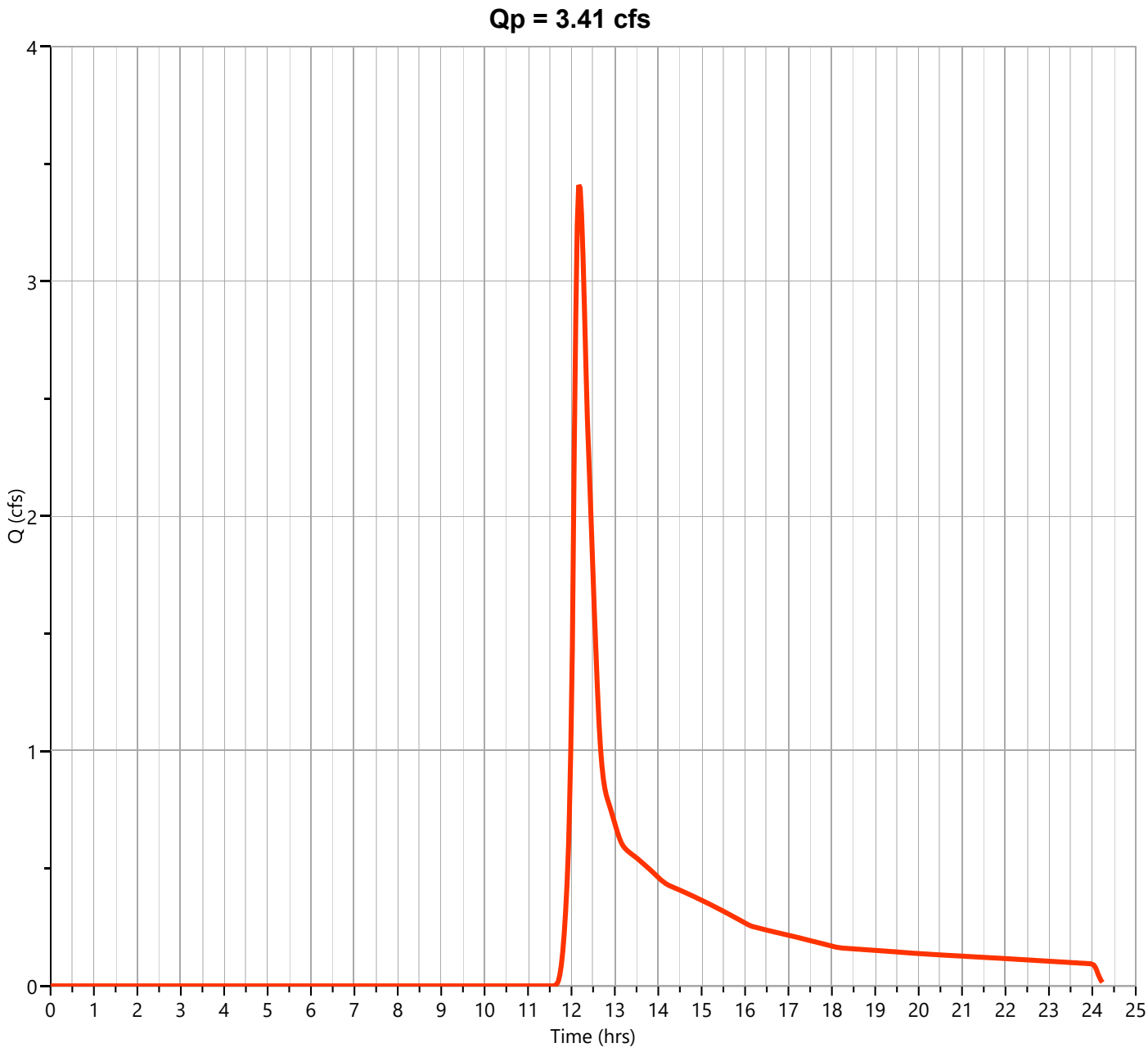
Hydrology Studio v 3.0.0.24

06-28-2022

P-7A

Hyd. No. 46

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.410 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 15,787 cuft
Drainage Area	= 3.97 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

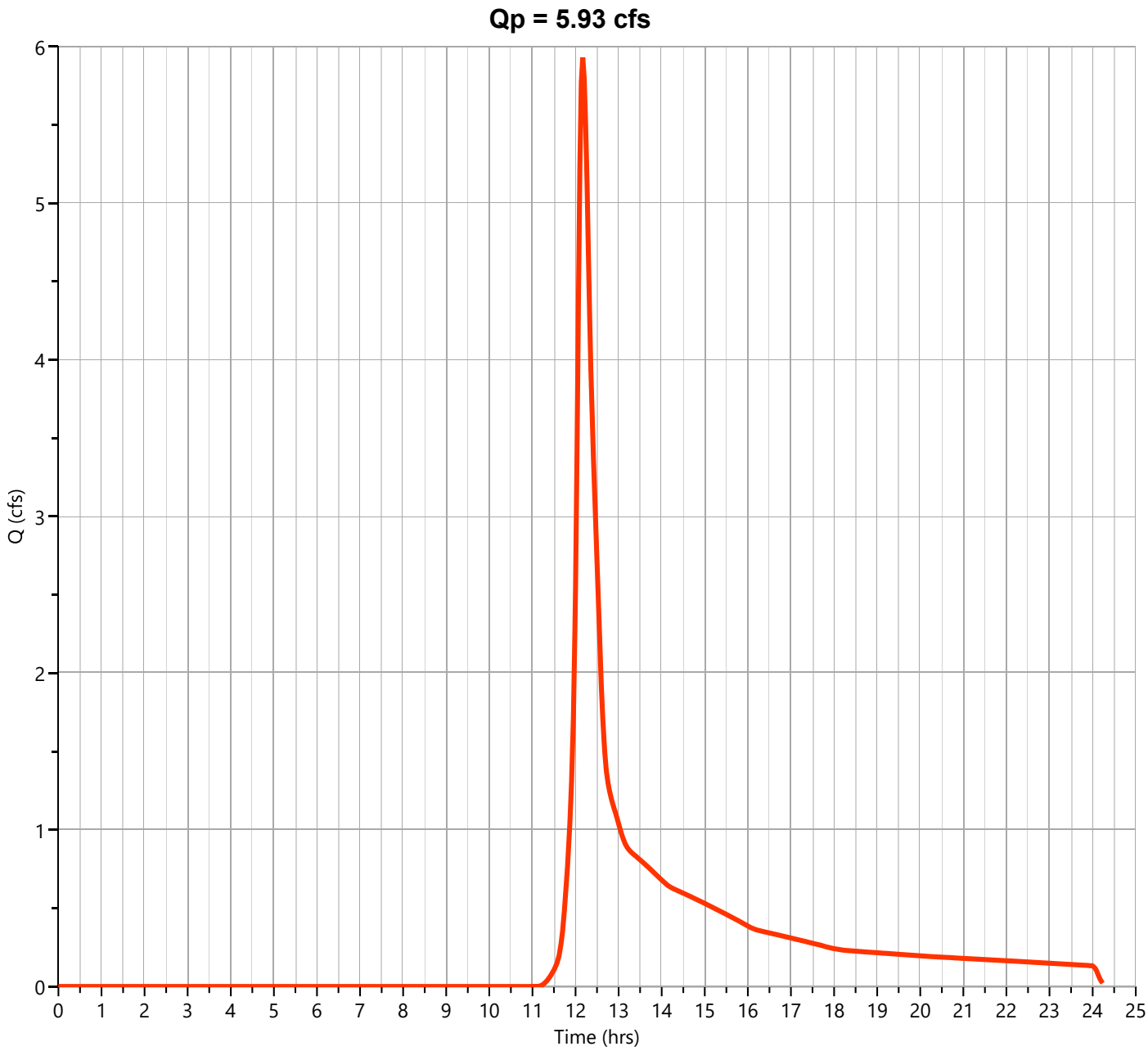
Hydrology Studio v 3.0.0.24

06-28-2022

P-7A

Hyd. No. 46

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.930 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 24,963 cuft
Drainage Area	= 3.97 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

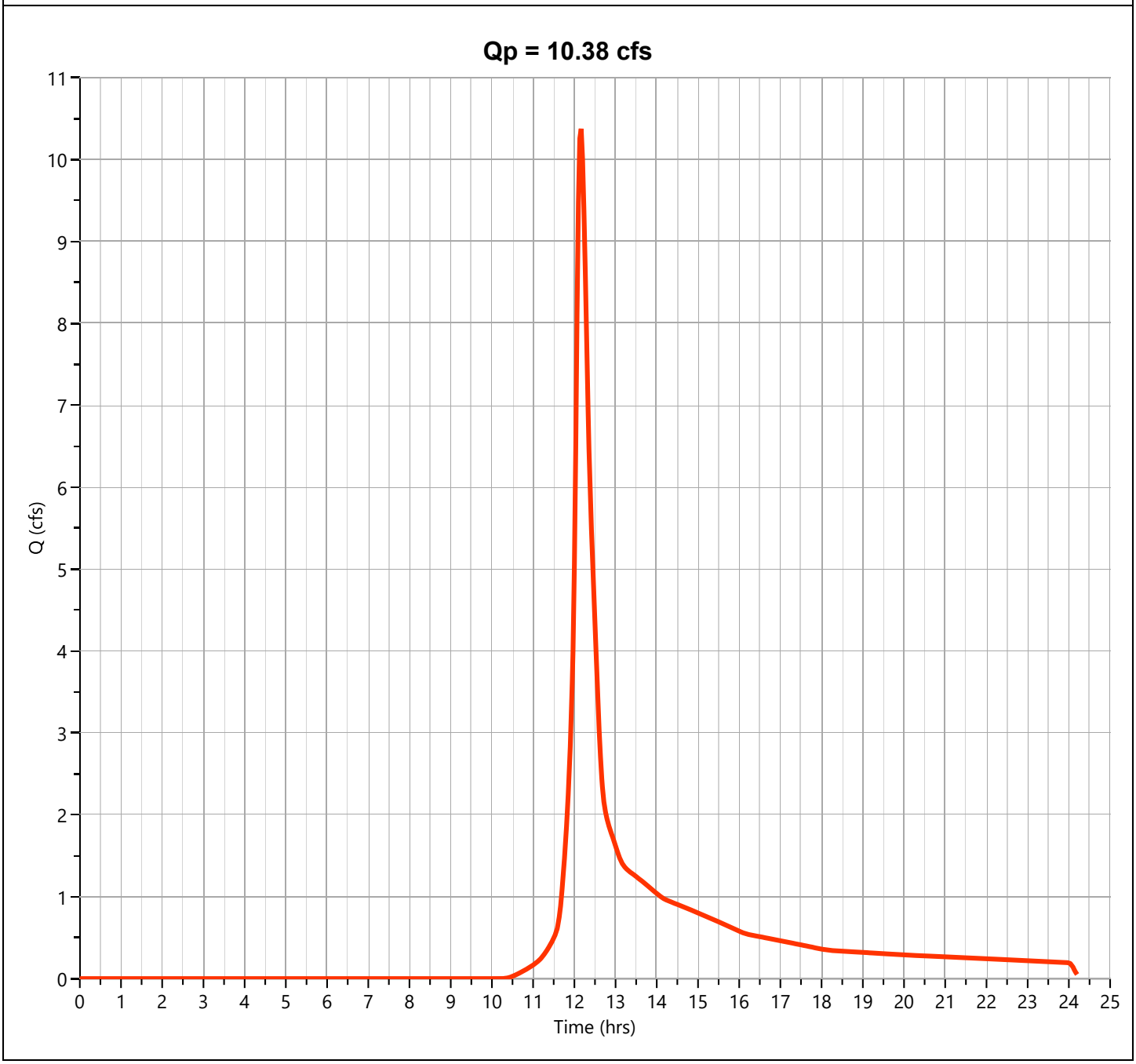
Hydrology Studio v 3.0.0.24

06-28-2022

P-7A

Hyd. No. 46

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.38 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 41,342 cuft
Drainage Area	= 3.97 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 10.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

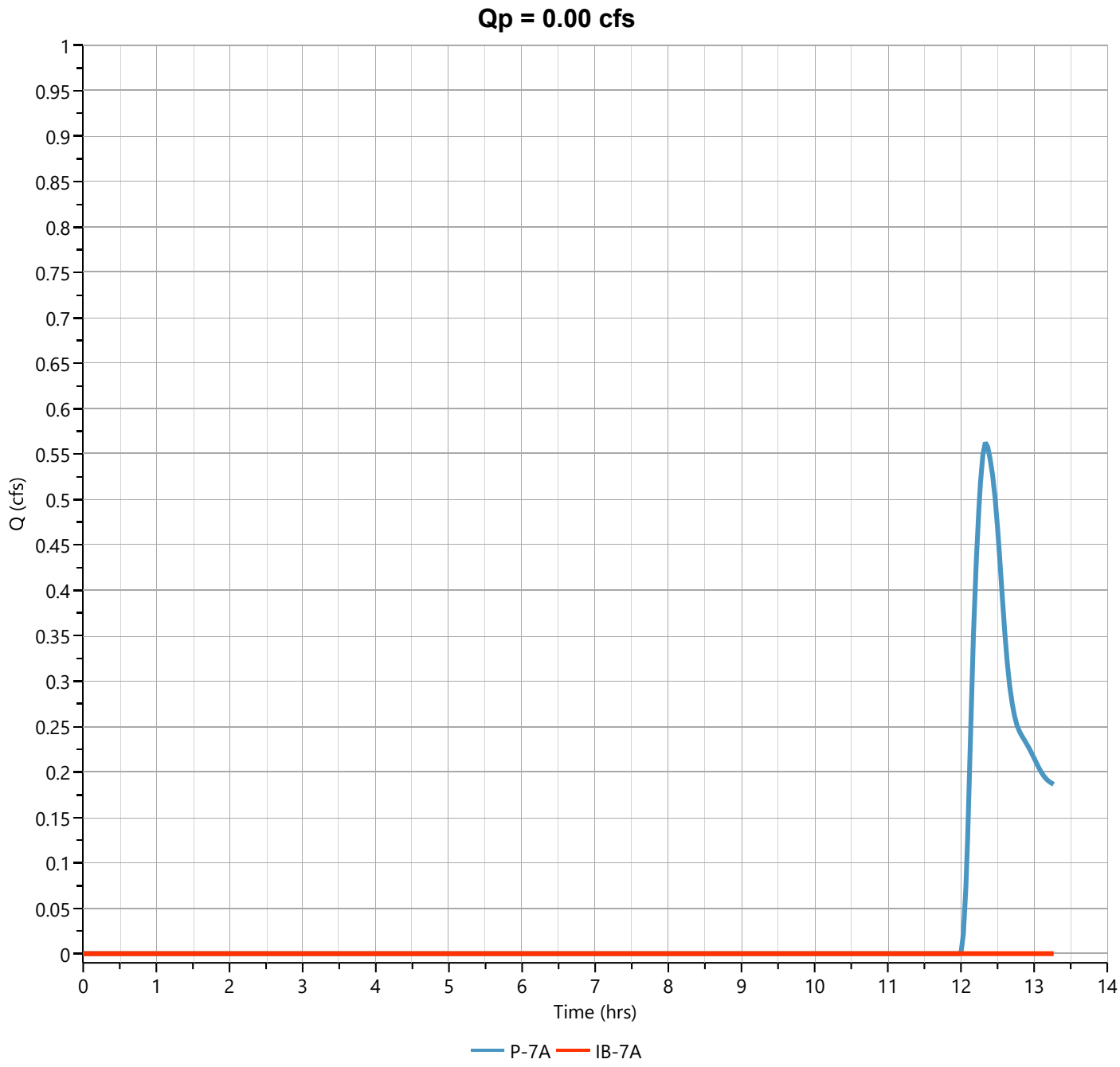
06-28-2022

IB-7A

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-7A	Max. Elevation	= 219.17 ft
Pond Name	= IB-7A	Max. Storage	= 355 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

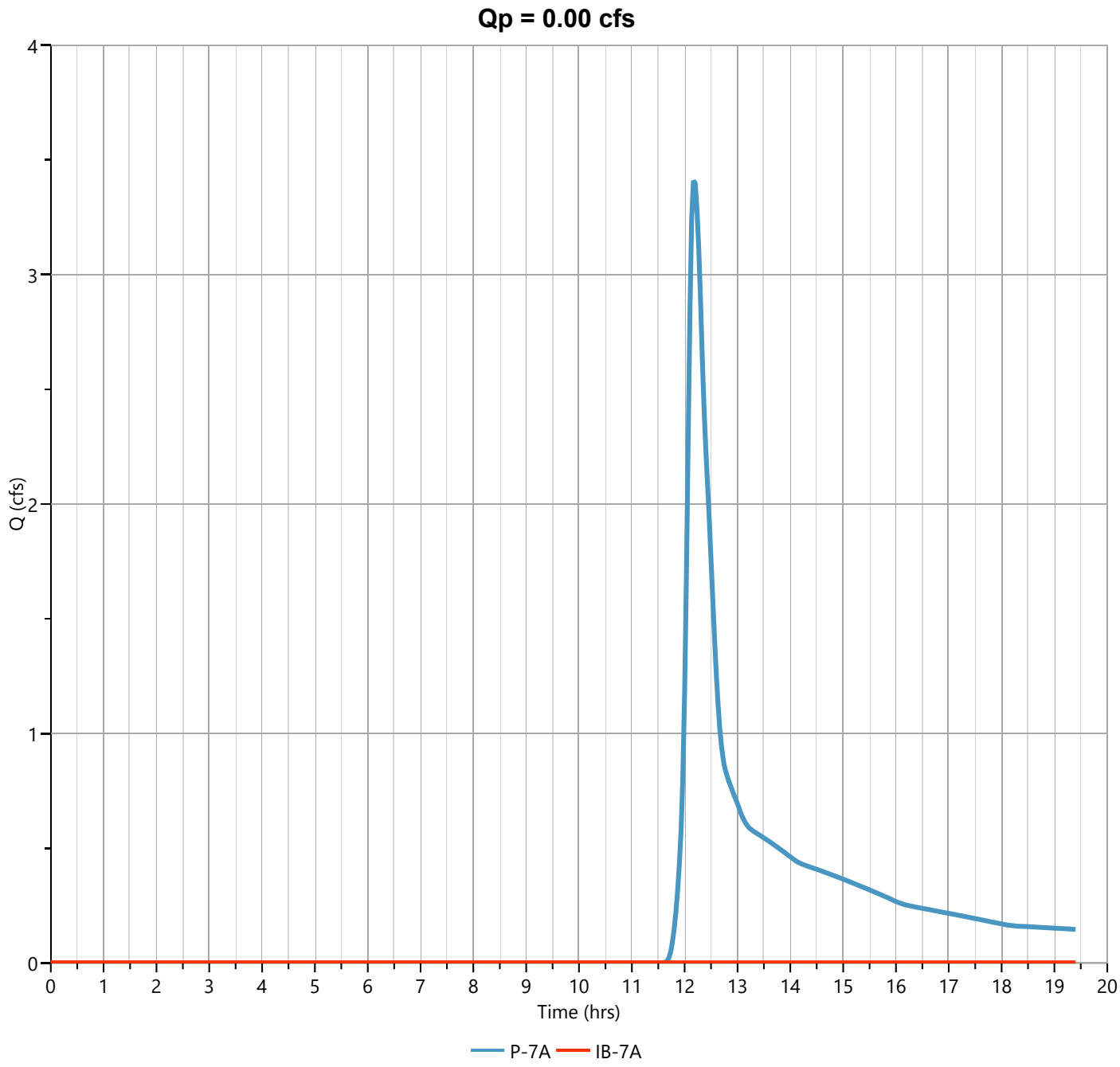
IB-7A

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 19.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-7A	Max. Elevation	= 220.90 ft
Pond Name	= IB-7A	Max. Storage	= 4,726 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3.00 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

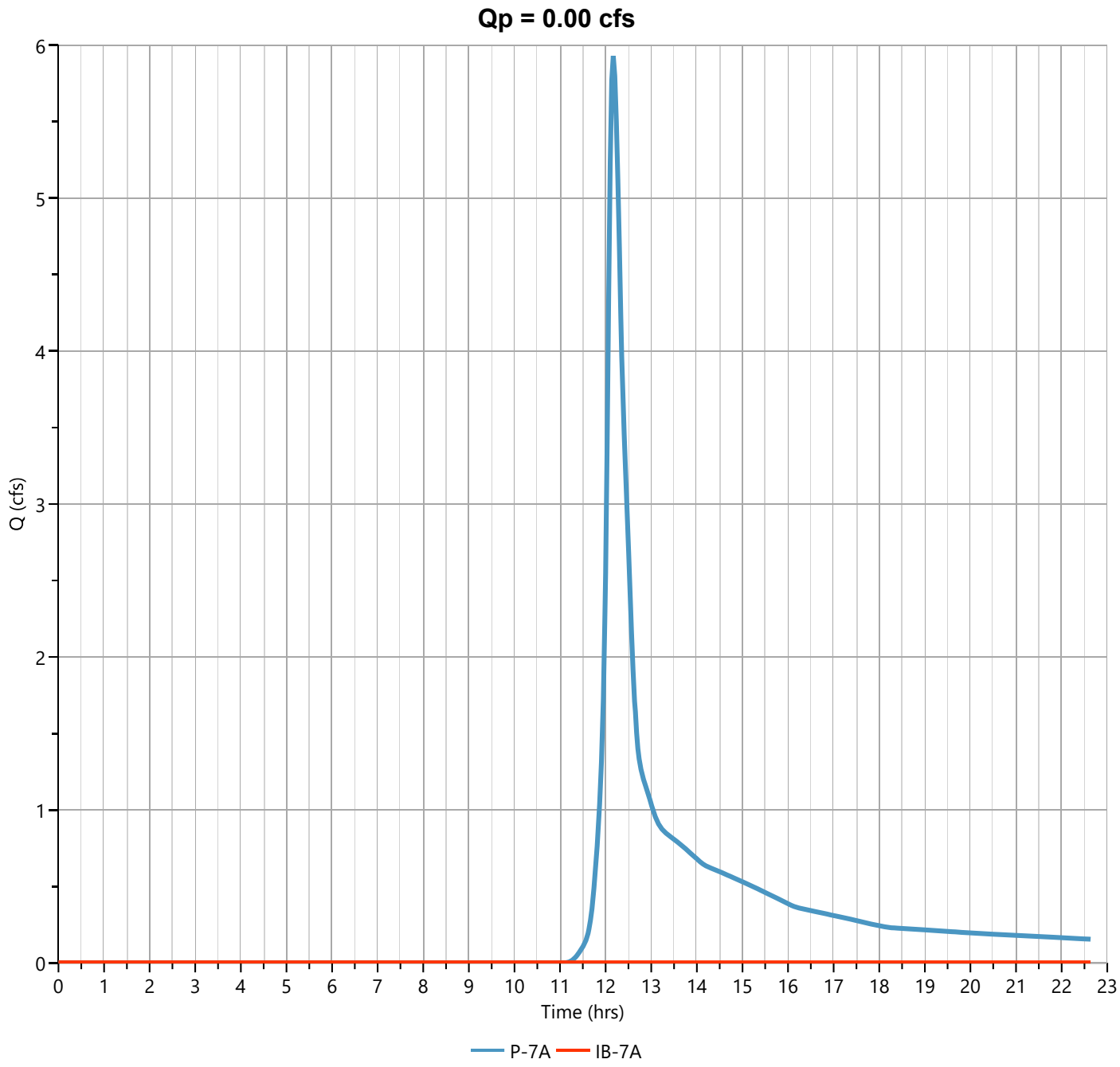
IB-7A

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 22.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-7A	Max. Elevation	= 222.09 ft
Pond Name	= IB-7A	Max. Storage	= 9,219 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3.78 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

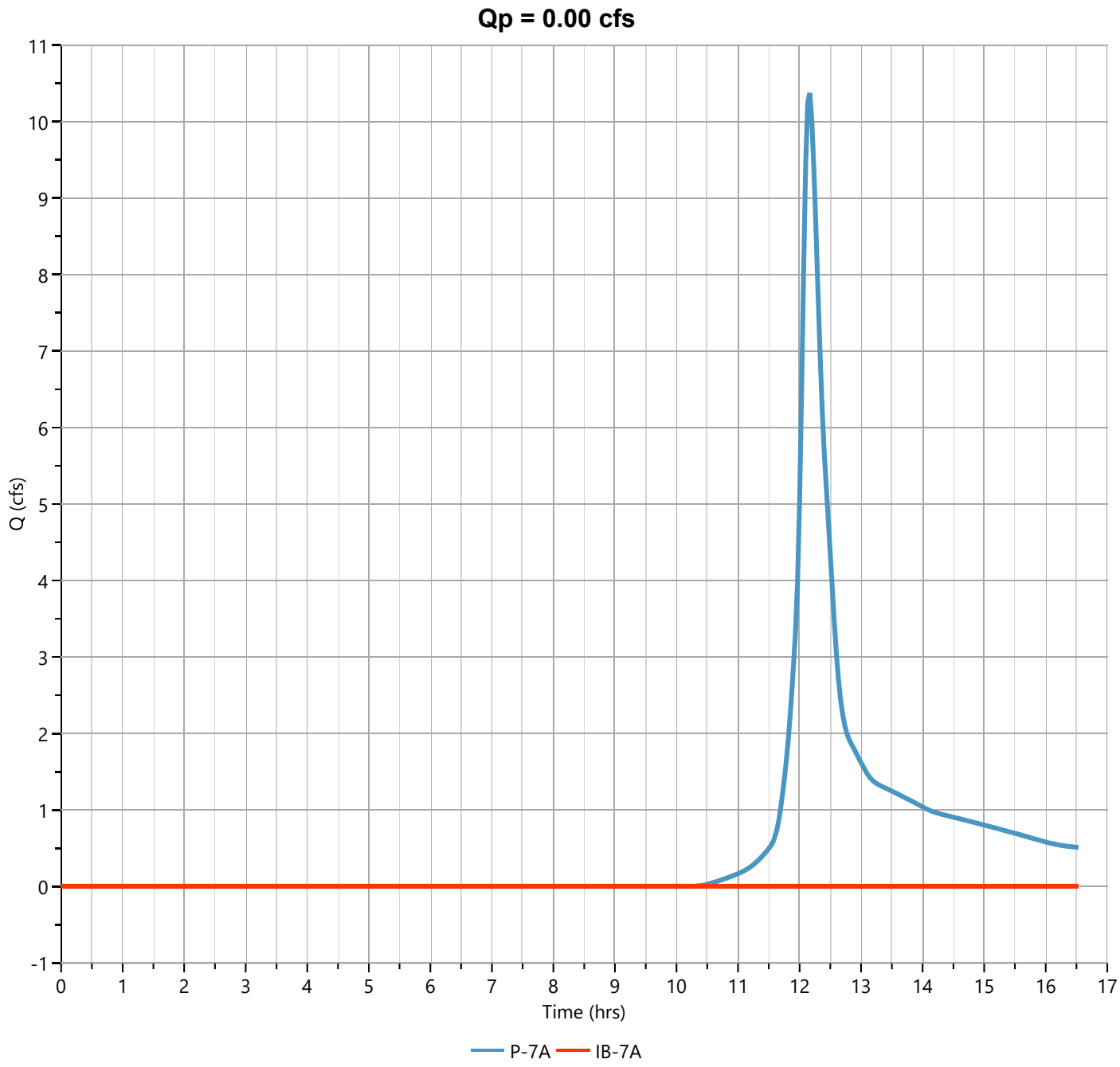
IB-7A

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 16.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-7A	Max. Elevation	= 223.89 ft
Pond Name	= IB-7A	Max. Storage	= 18,061 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3.74 hrs



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

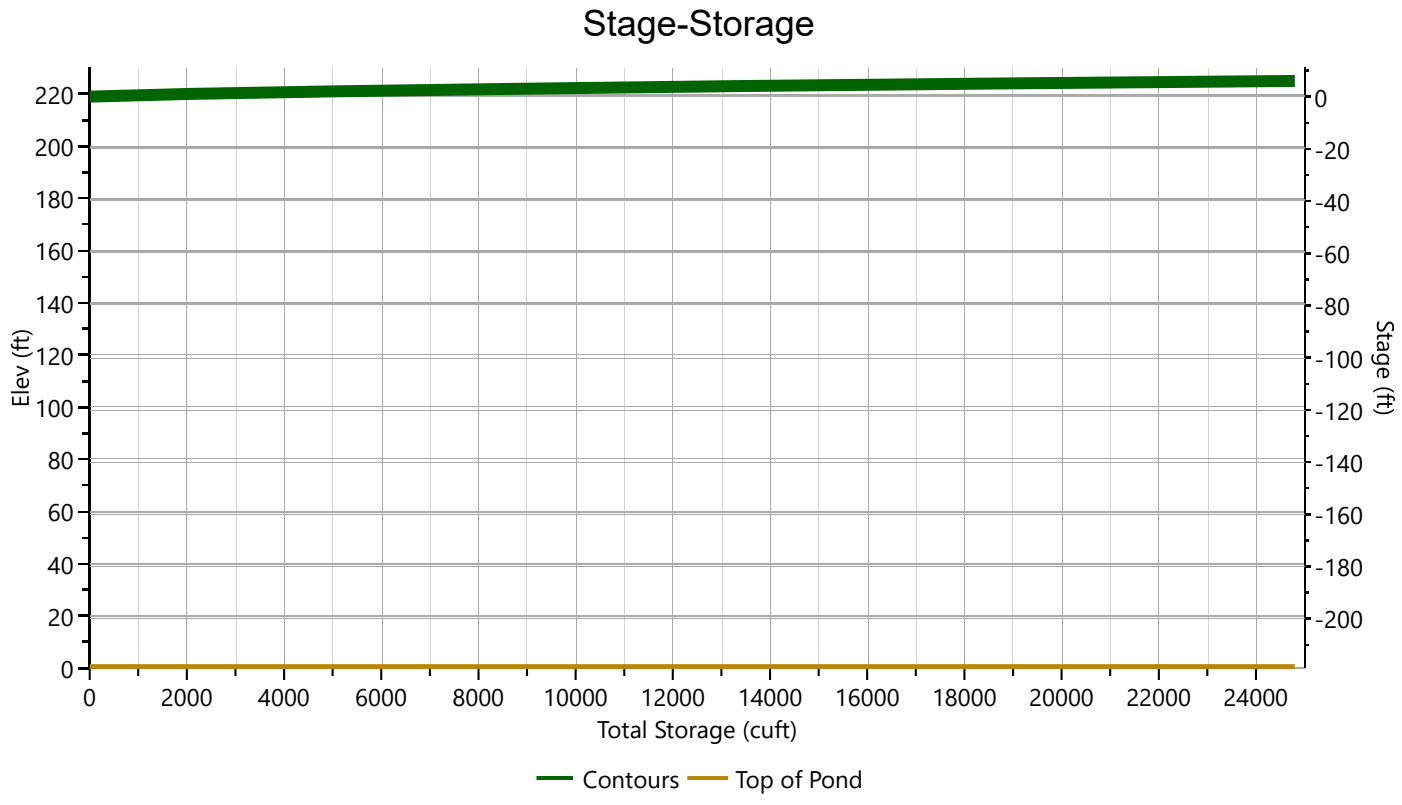
IB-7A

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	219.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	219.00	1,657	0.000	0.000
1.00	220.00	2,460	2,059	2,059
2.00	221.00	3,465	2,963	5,021
3.00	222.00	4,155	3,810	8,831
4.00	223.00	4,902	4,529	13,360
5.00	224.00	5,705	5,304	18,663
6.00	225.00	6,565	6,135	24,798



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

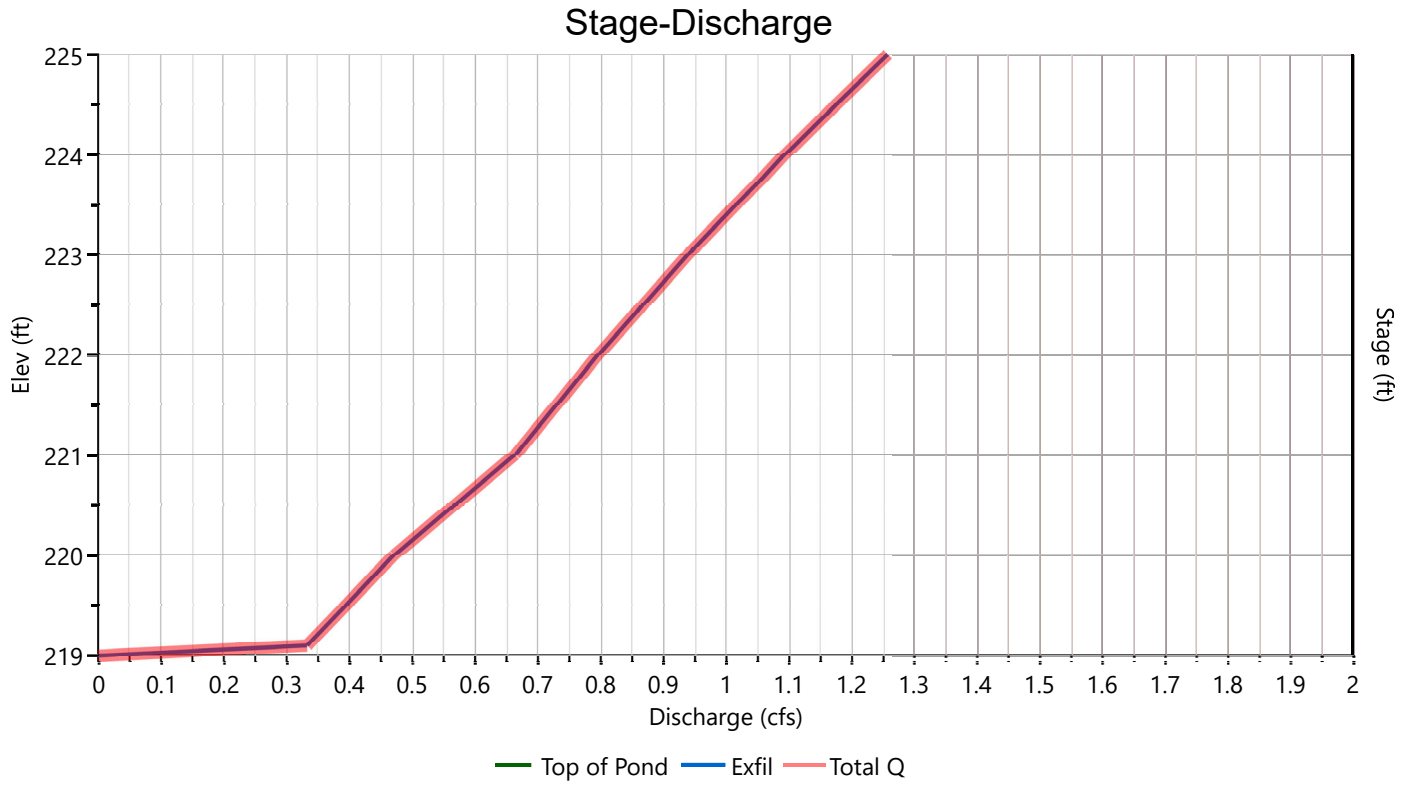
06-28-2022

IB-7A

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	8.27**
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-7A

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	219.00	0.000										0.000		0.000
1.00	220.00	2,059										0.471		0.471
2.00	221.00	5,021										0.663		0.663
3.00	222.00	8,831										0.795		0.795
4.00	223.00	13,360										0.938		0.938
5.00	224.00	18,663										1.092		1.092
6.00	225.00	24,798										1.257		1.257

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

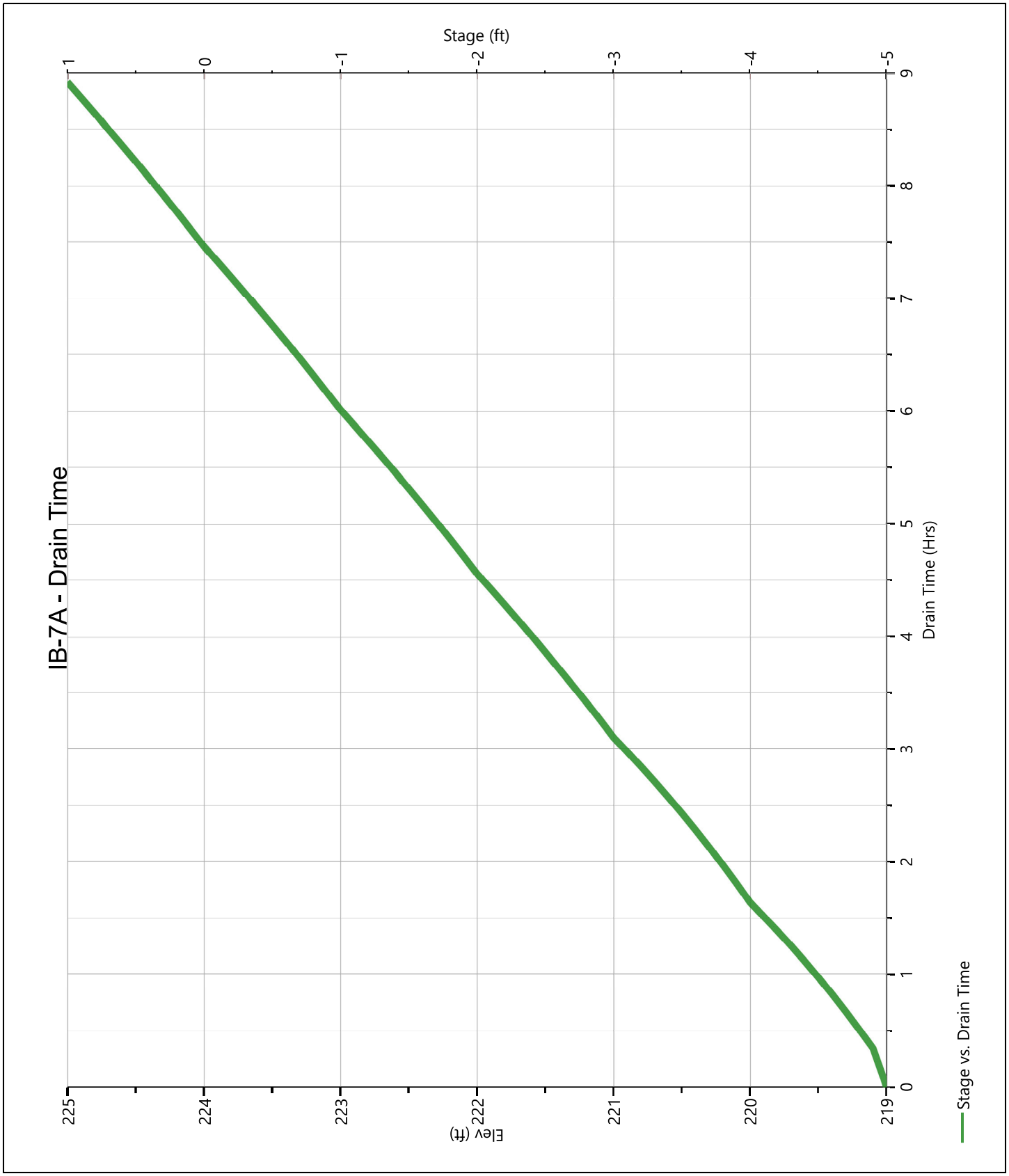
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-7A

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-7B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.72	70.11
A	Woods Good Condition	30			0.48	14.32
A	Open Space Good Condition	39			0.75	29.27
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.00	0.00
1/ Use only one CN source per line.		84650		Totals =	1.94	113.70

CN (weighted) = total product / total area = 113.70 / 1.94 = 58.51 ; Use CN = 59

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.38	1.89	3.05

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-7B
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.010			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.38			0.38
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	200			
9. Watercourse slope, s		ft/ft	0.010			
10. Average Velocity, V (figure 3-1)		ft/s	1.61			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.42
min 24.9

Hydrograph Report

Project Name:

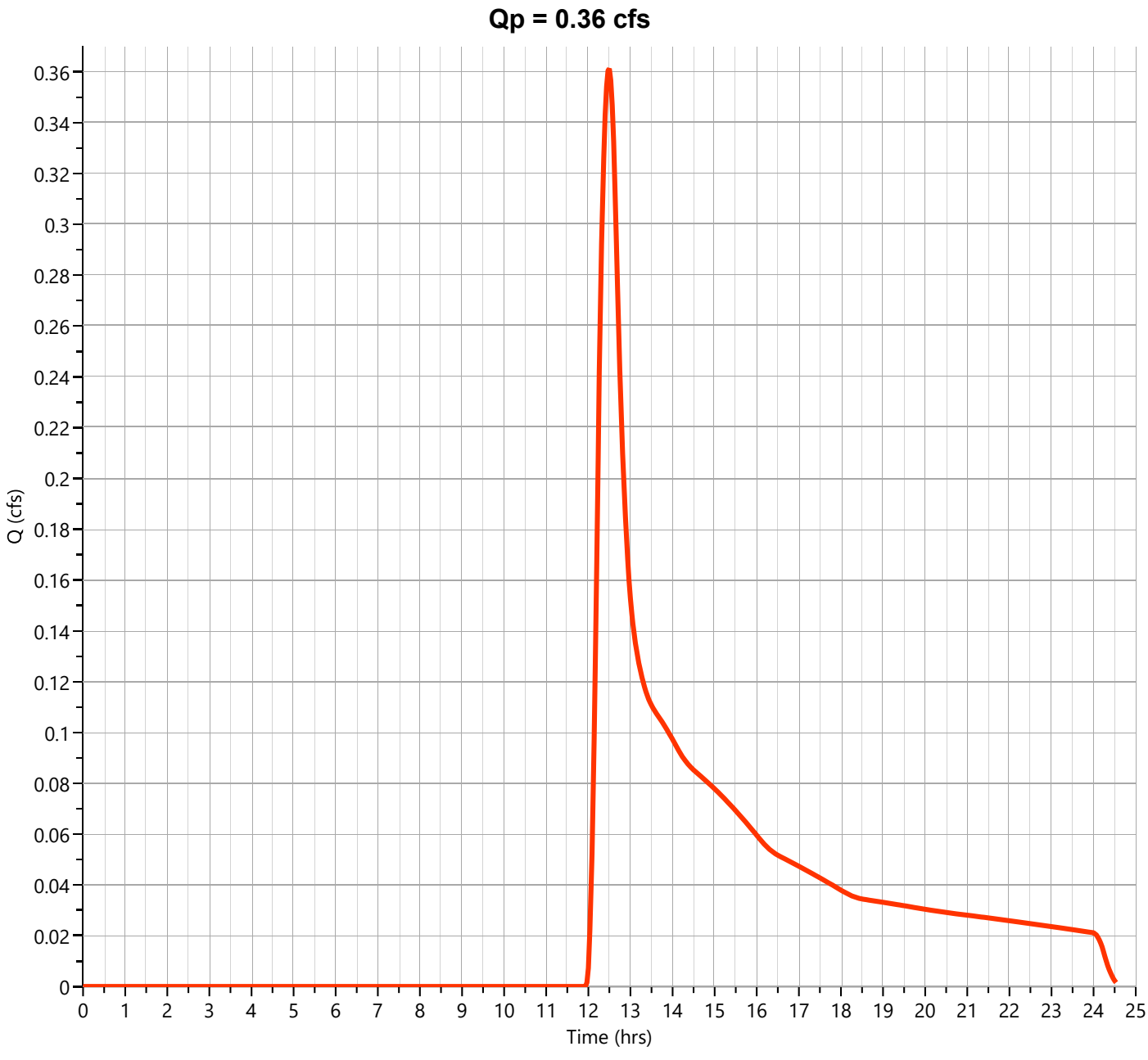
Hydrology Studio v 3.0.0.24

06-28-2022

P-7B

Hyd. No. 48

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.361 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Runoff Volume	= 2,775 cuft
Drainage Area	= 1.94 ac	Curve Number	= 59
Tc Method	= User	Time of Conc. (Tc)	= 24.9 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

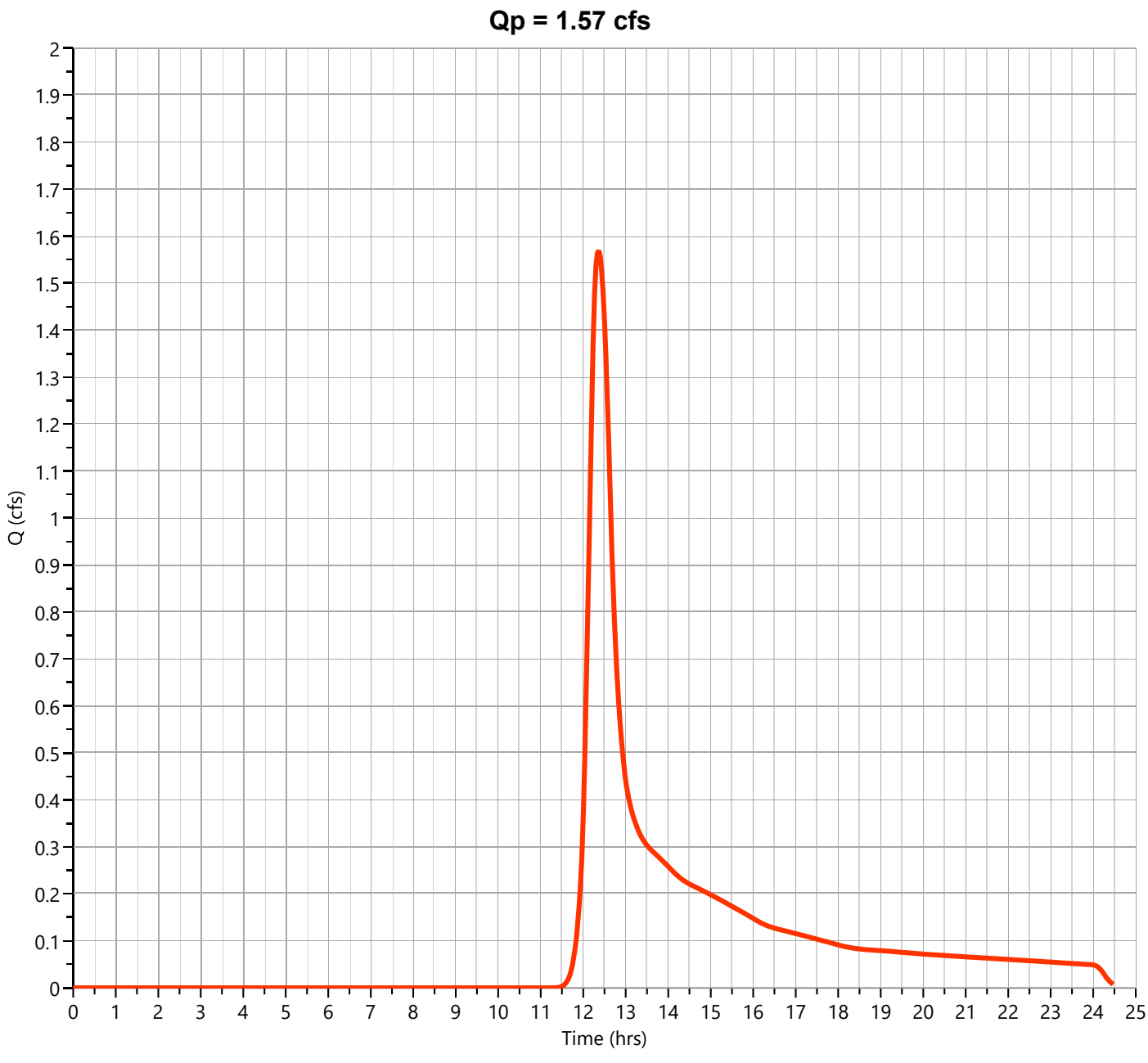
Hydrology Studio v 3.0.0.24

06-28-2022

P-7B

Hyd. No. 48

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.569 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 8,714 cuft
Drainage Area	= 1.94 ac	Curve Number	= 59
Tc Method	= User	Time of Conc. (Tc)	= 24.9 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

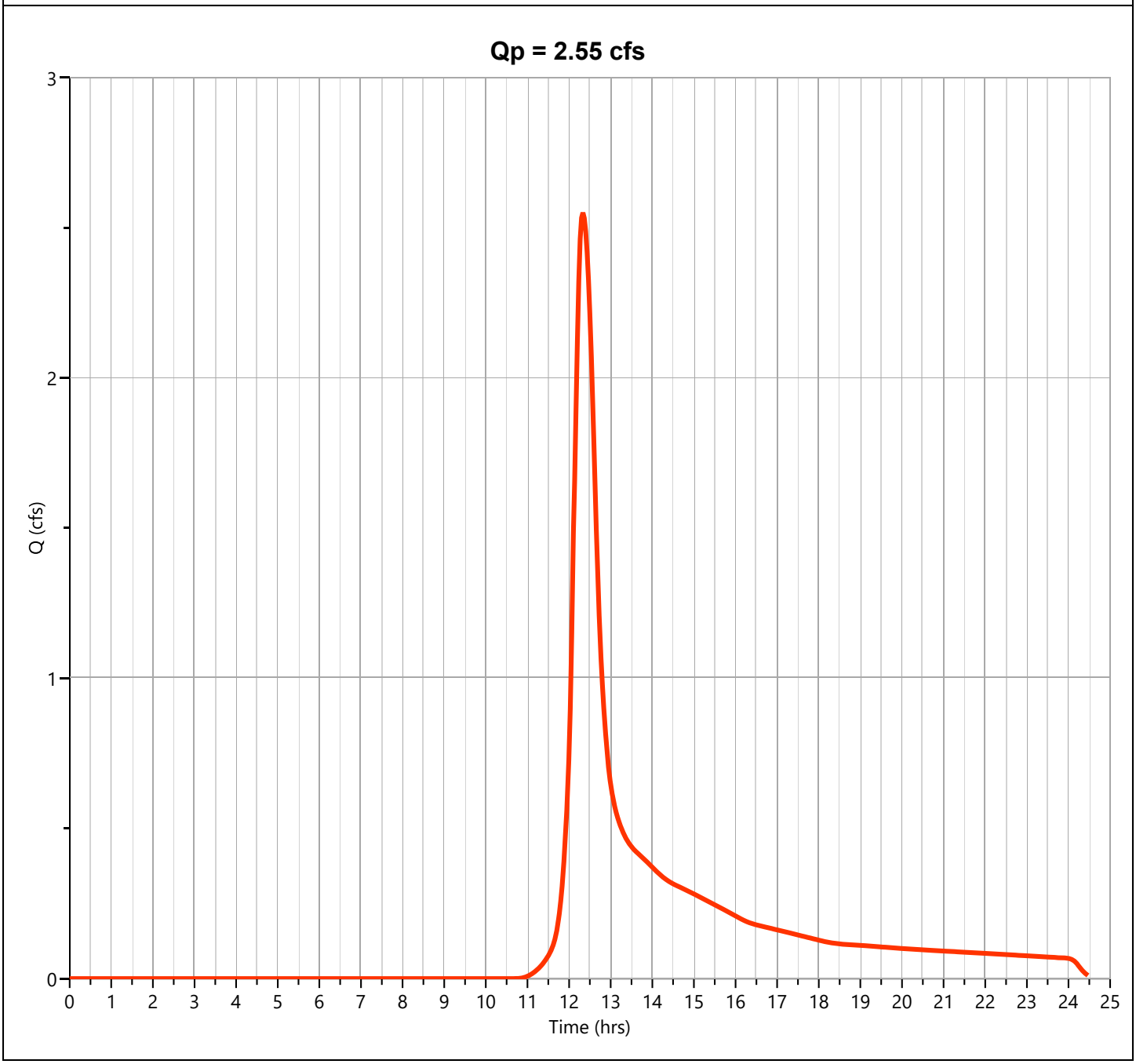
Hydrology Studio v 3.0.0.24

06-28-2022

P-7B

Hyd. No. 48

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.550 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 13,370 cuft
Drainage Area	= 1.94 ac	Curve Number	= 59
Tc Method	= User	Time of Conc. (Tc)	= 24.9 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

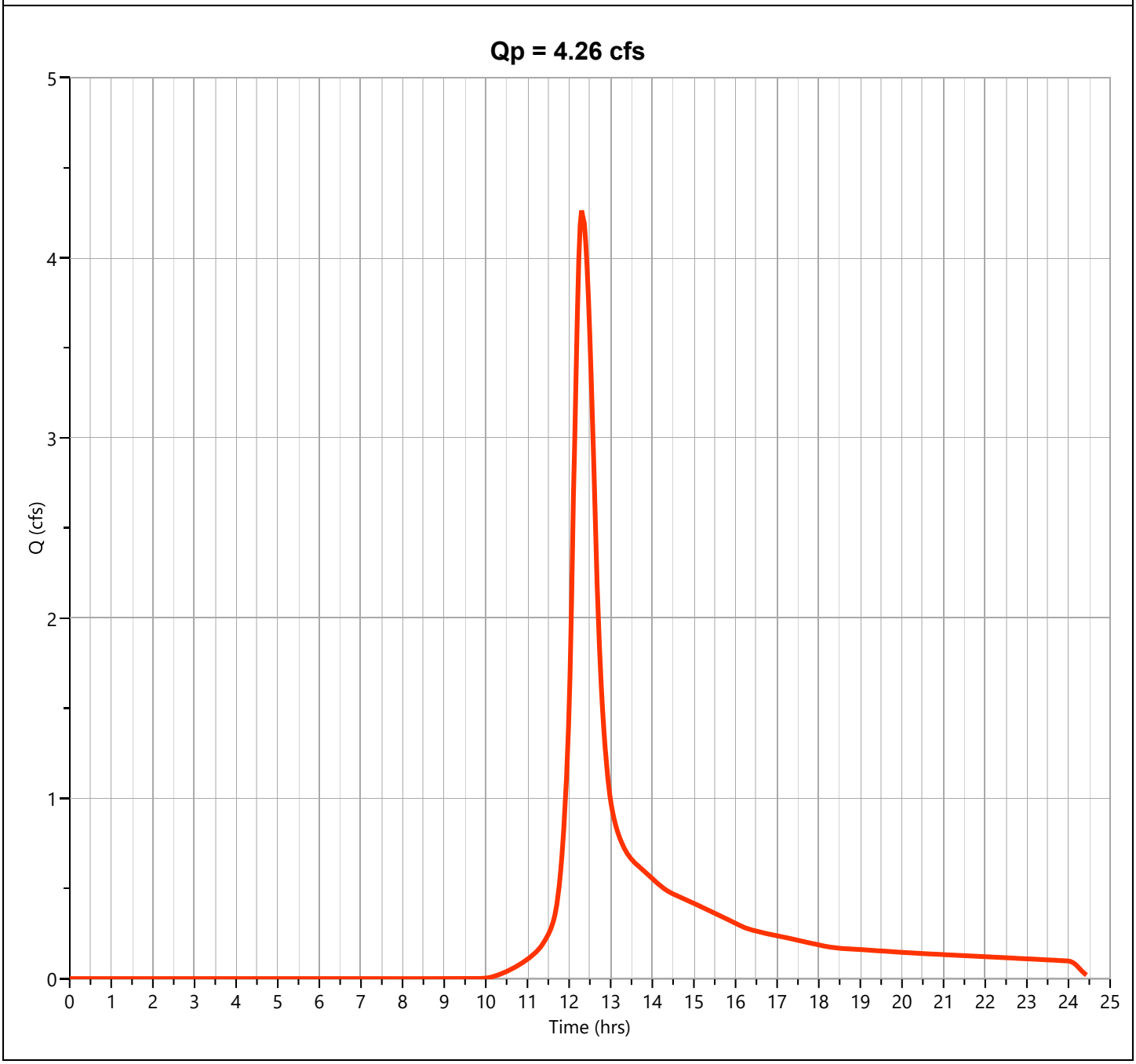
Hydrology Studio v 3.0.0.24

06-28-2022

P-7B

Hyd. No. 48

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.262 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 21,524 cuft
Drainage Area	= 1.94 ac	Curve Number	= 59
Tc Method	= User	Time of Conc. (Tc)	= 24.9 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

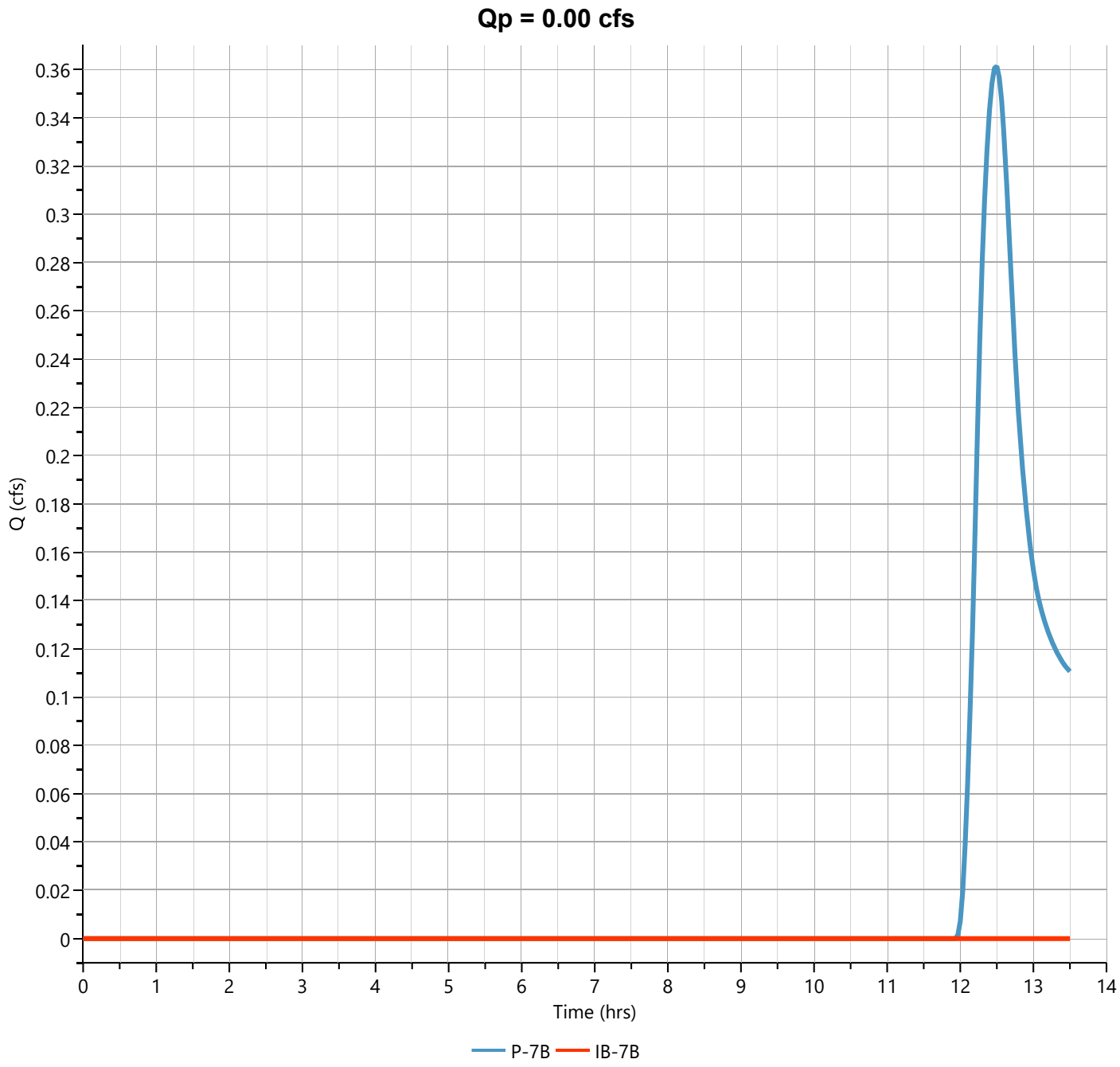
06-28-2022

IB-7B

Hyd. No. 49

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 48 - P-7B	Max. Elevation	= 224.09 ft
Pond Name	= IB-7B	Max. Storage	= 190 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

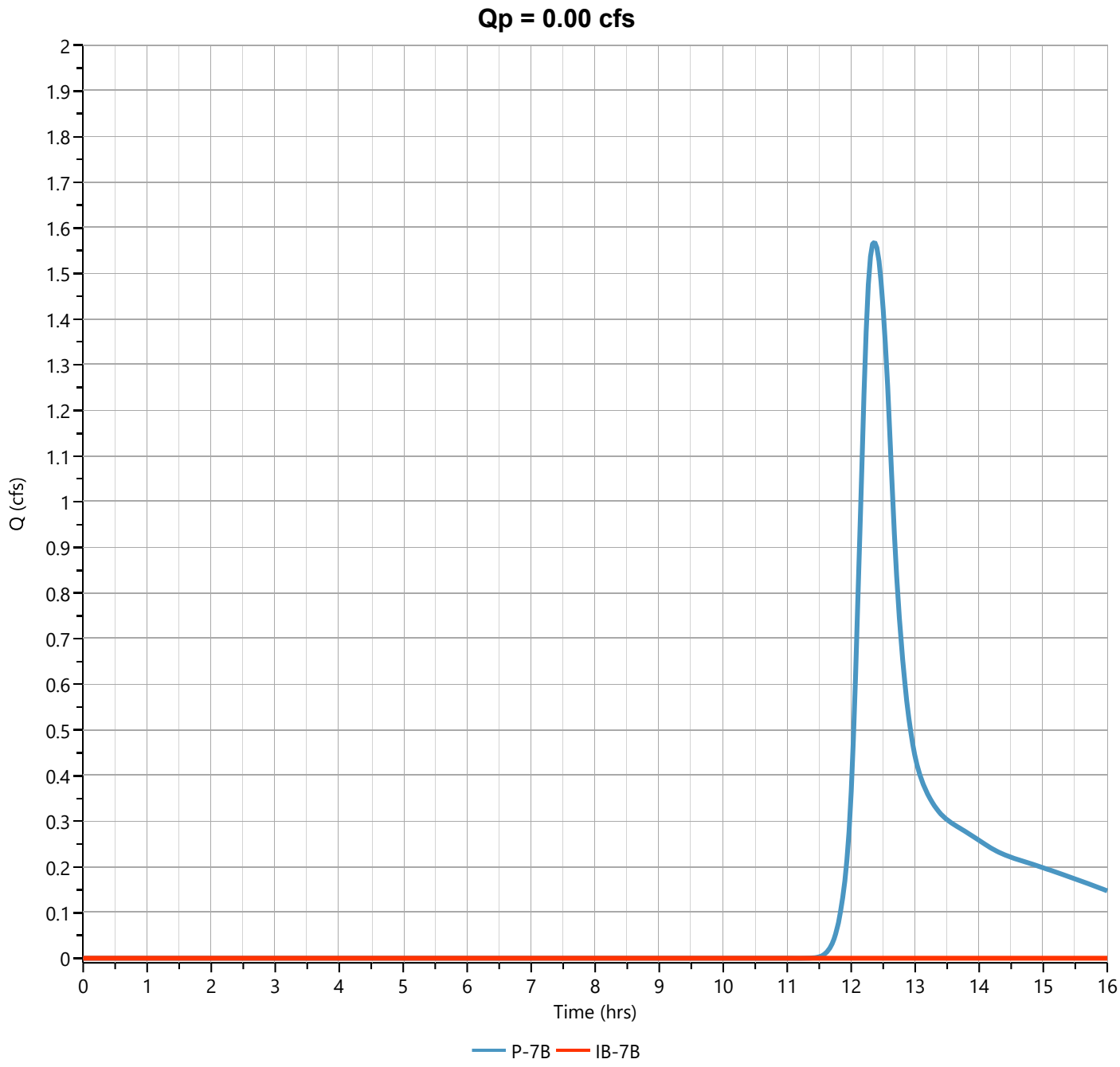
IB-7B

Hyd. No. 49

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 48 - P-7B	Max. Elevation	= 224.99 ft
Pond Name	= IB-7B	Max. Storage	= 2,202 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.63 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

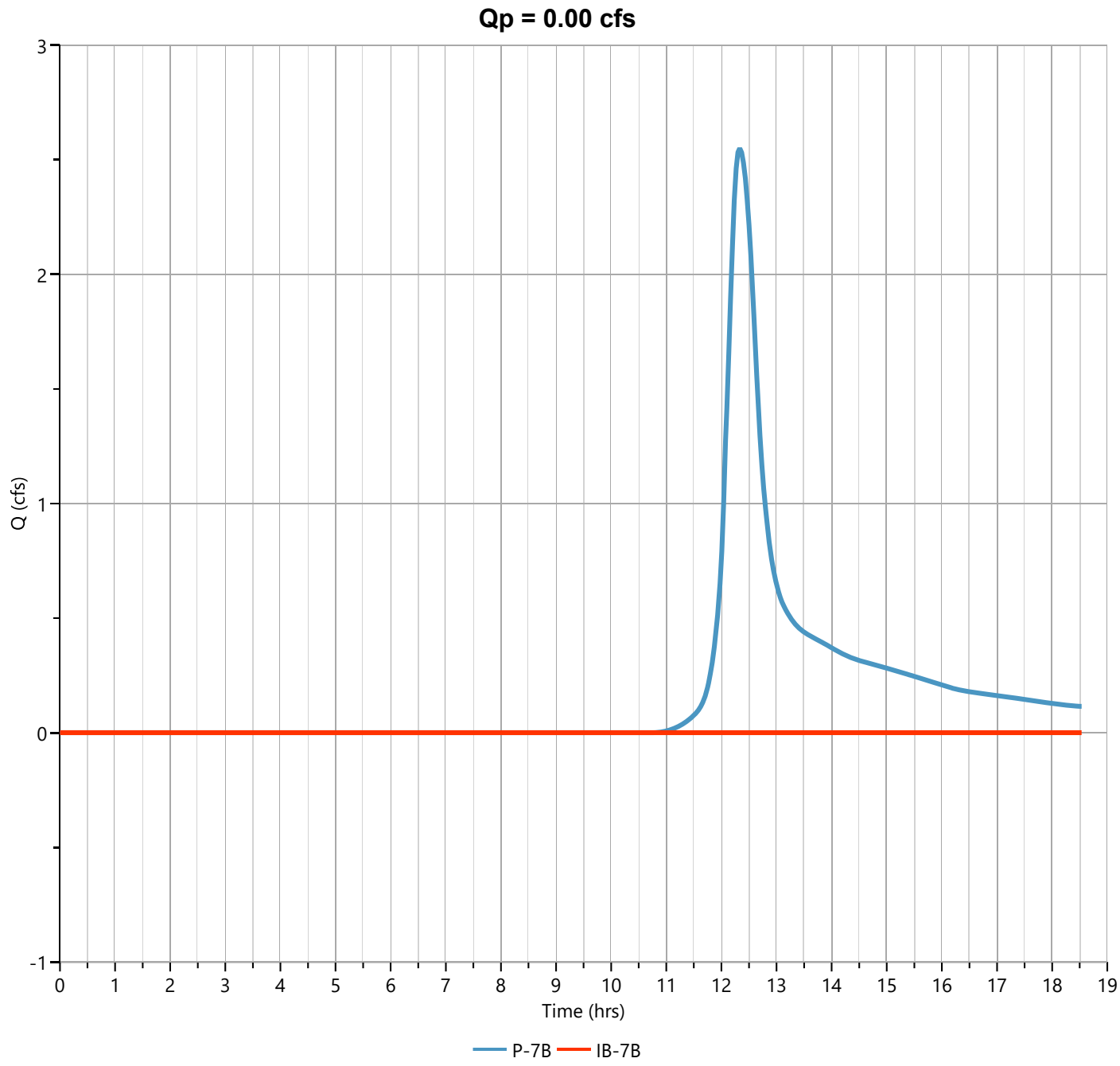
06-28-2022

IB-7B

Hyd. No. 49

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 18.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 48 - P-7B	Max. Elevation	= 225.68 ft
Pond Name	= IB-7B	Max. Storage	= 4,275 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

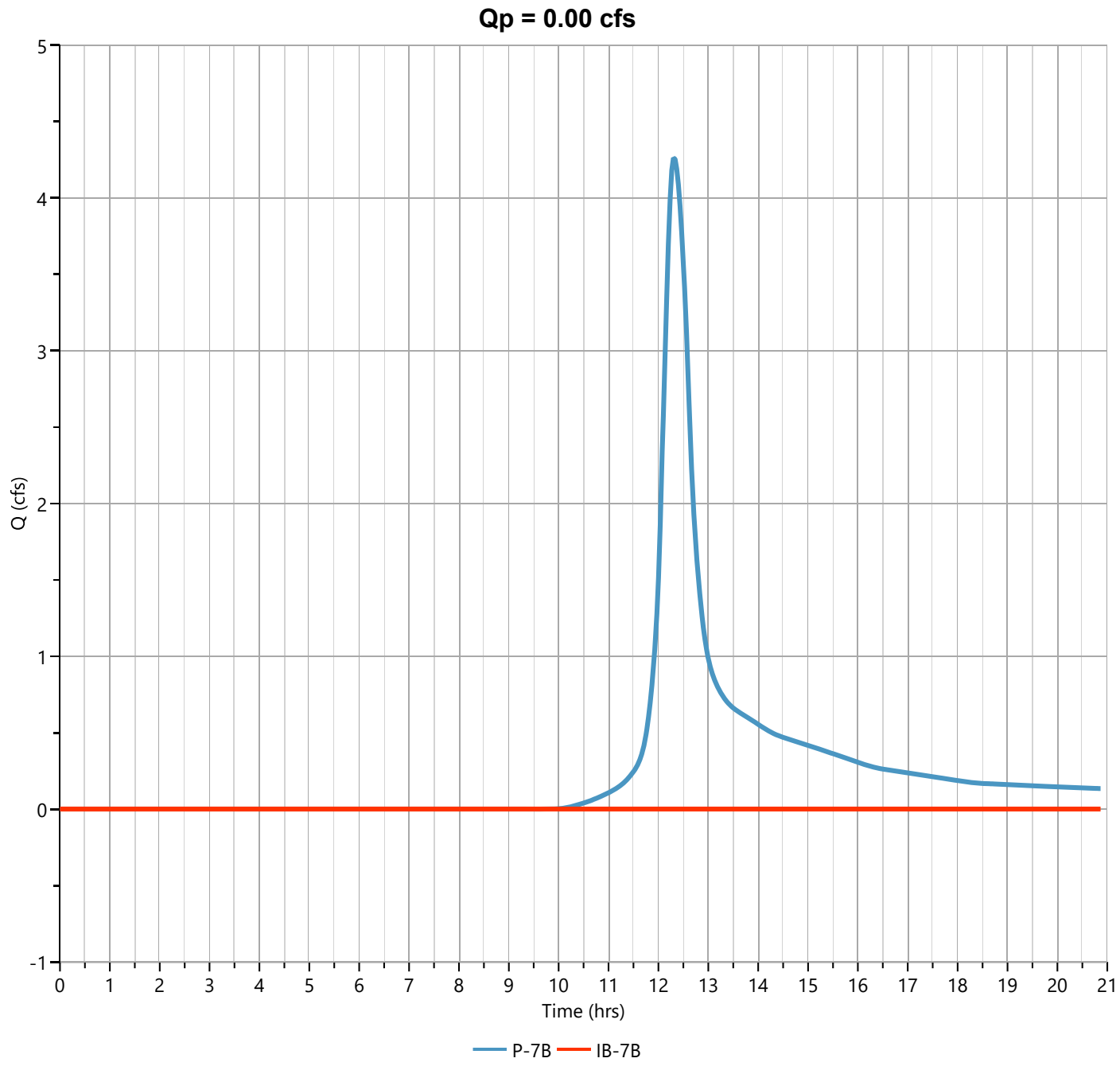
IB-7B

Hyd. No. 49

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 20.83 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 48 - P-7B	Max. Elevation	= 226.79 ft
Pond Name	= IB-7B	Max. Storage	= 8,198 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 34.07 hrs



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

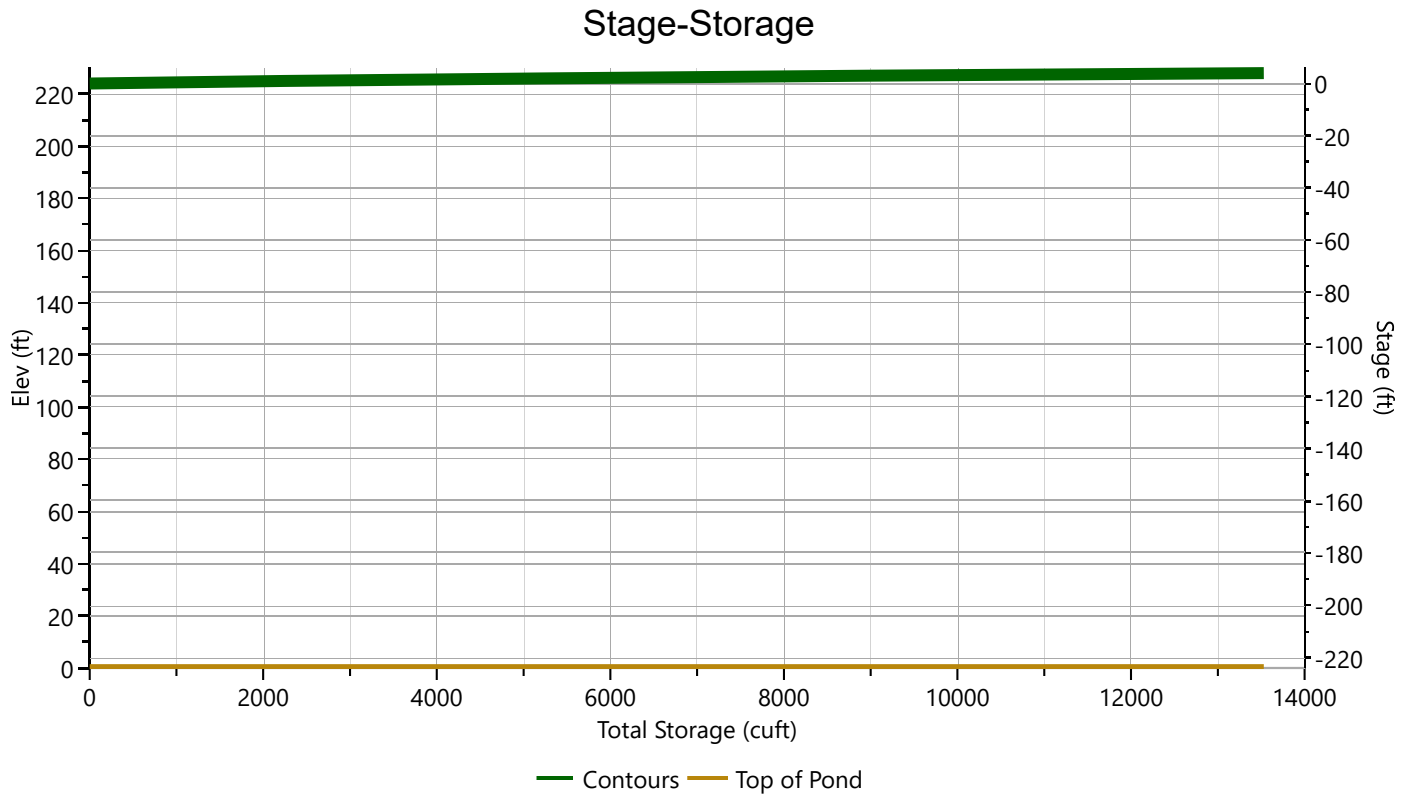
IB-7B

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	224.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	224.00	1,843	0.000	0.000
1.00	225.00	2,627	2,235	2,235
2.00	226.00	3,381	3,004	5,239
3.00	227.00	4,131	3,756	8,995
4.00	228.00	4,939	4,535	13,530



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

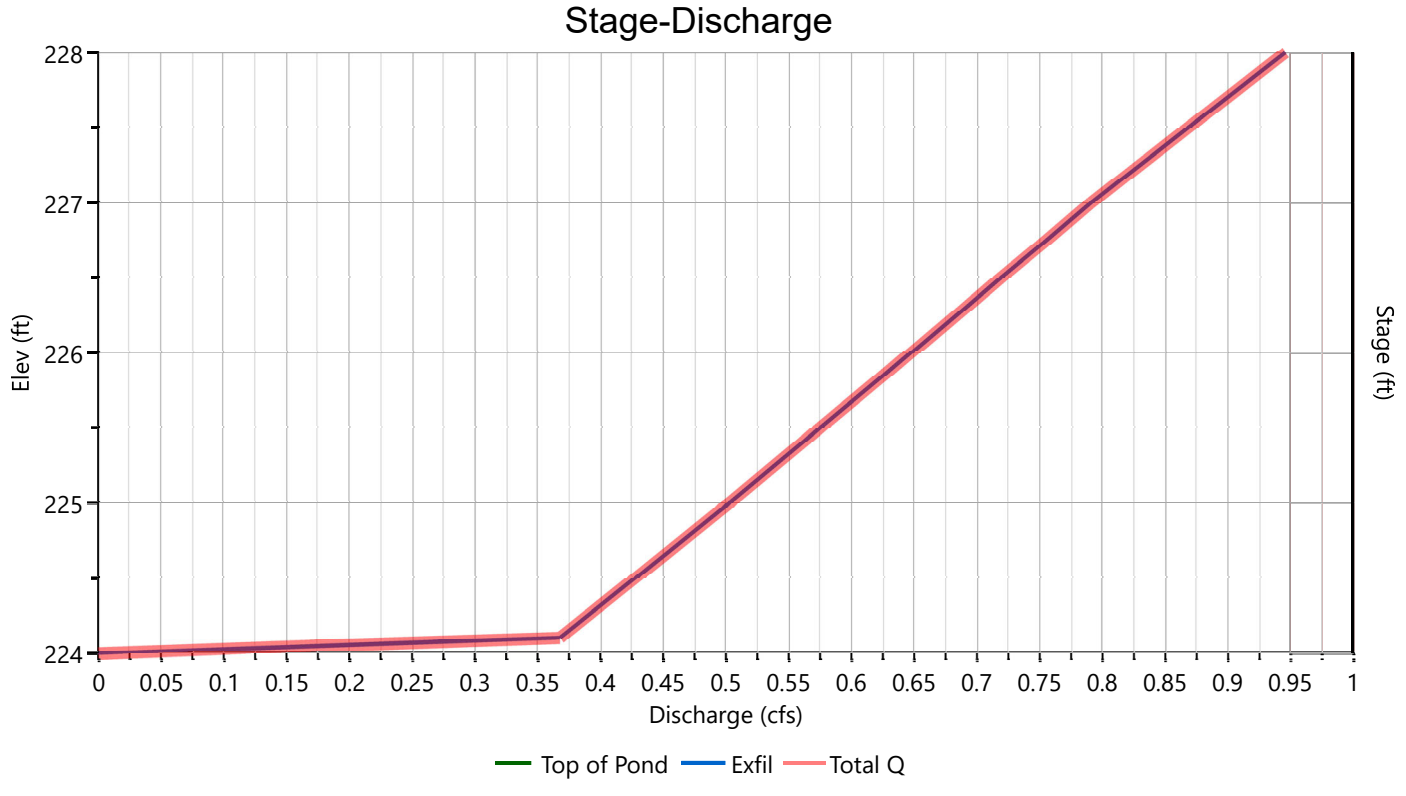
06-28-2022

IB-7B

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	8.27**
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-7B

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	224.00	0.000										0.000		0.000
1.00	225.00	2,235										0.503		0.503
2.00	226.00	5,239										0.647		0.647
3.00	227.00	8,995										0.791		0.791
4.00	228.00	13,530										0.945		0.945

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

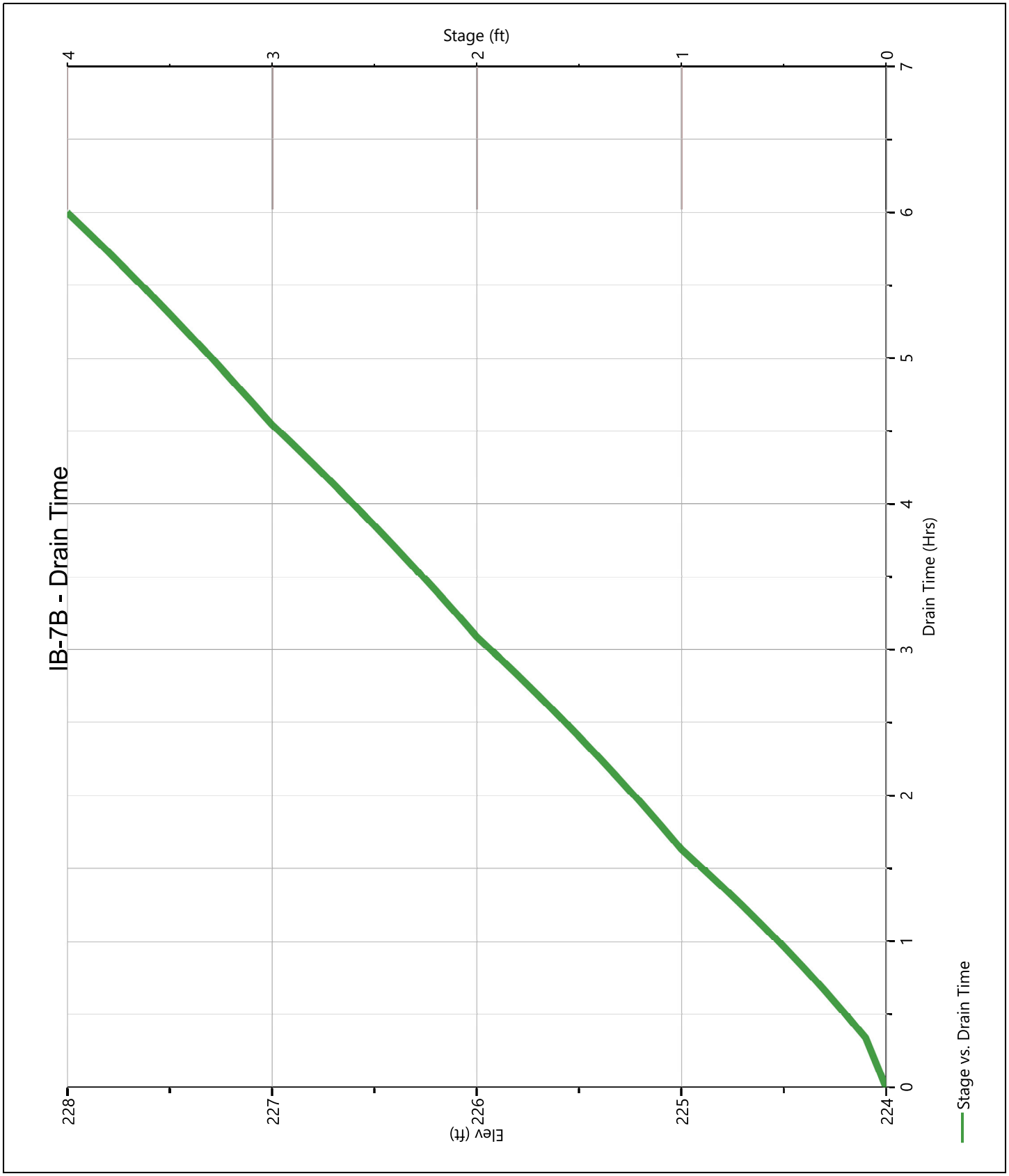
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-7B

Pond Drawdown



Hydrograph Report

Project Name:

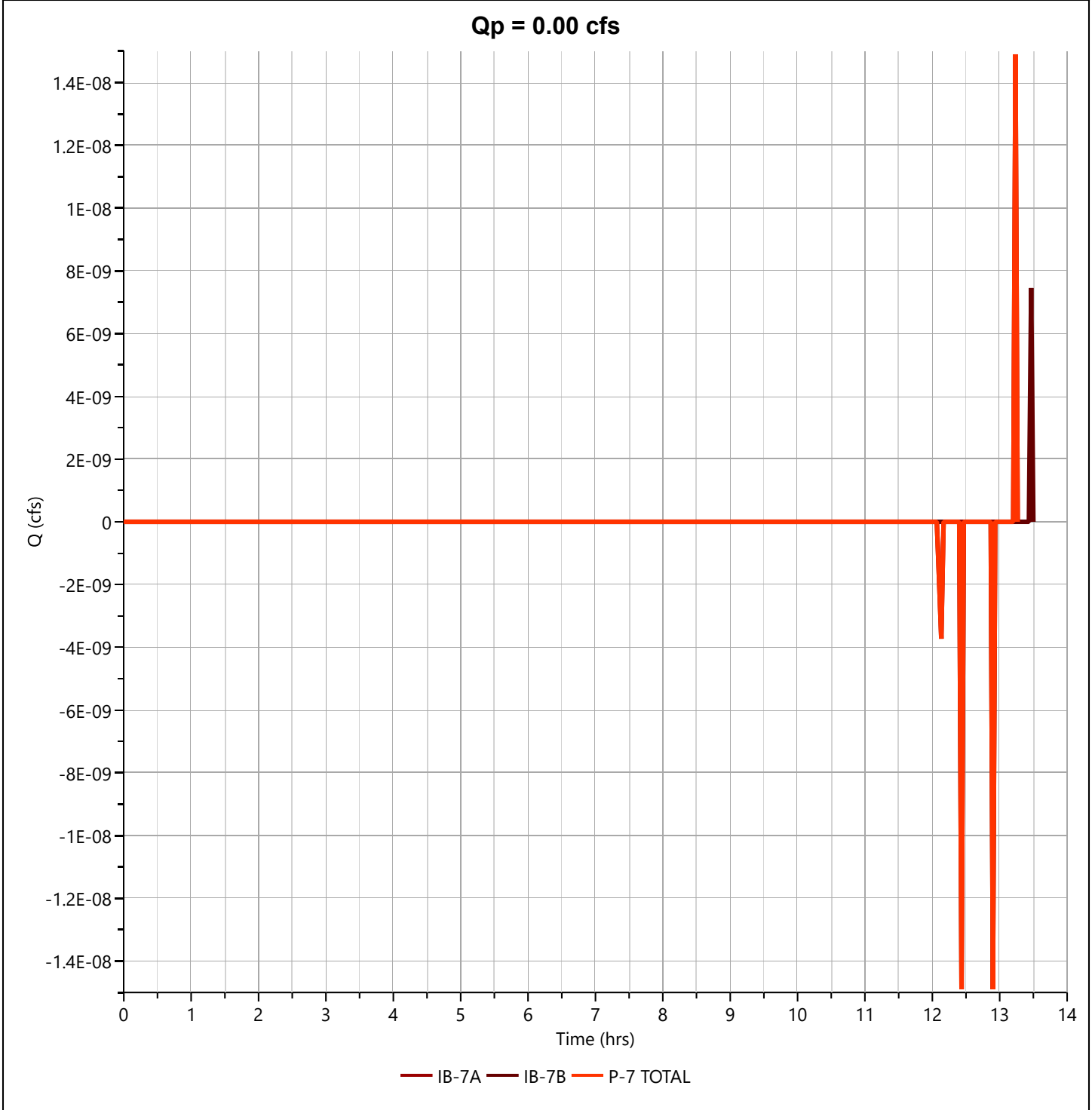
Hydrology Studio v 3.0.0.24

06-28-2022

P-7 TOTAL

Hyd. No. 50

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 47, 49	Total Contrib. Area	= 0.0 ac



Hydrograph Report

Project Name:

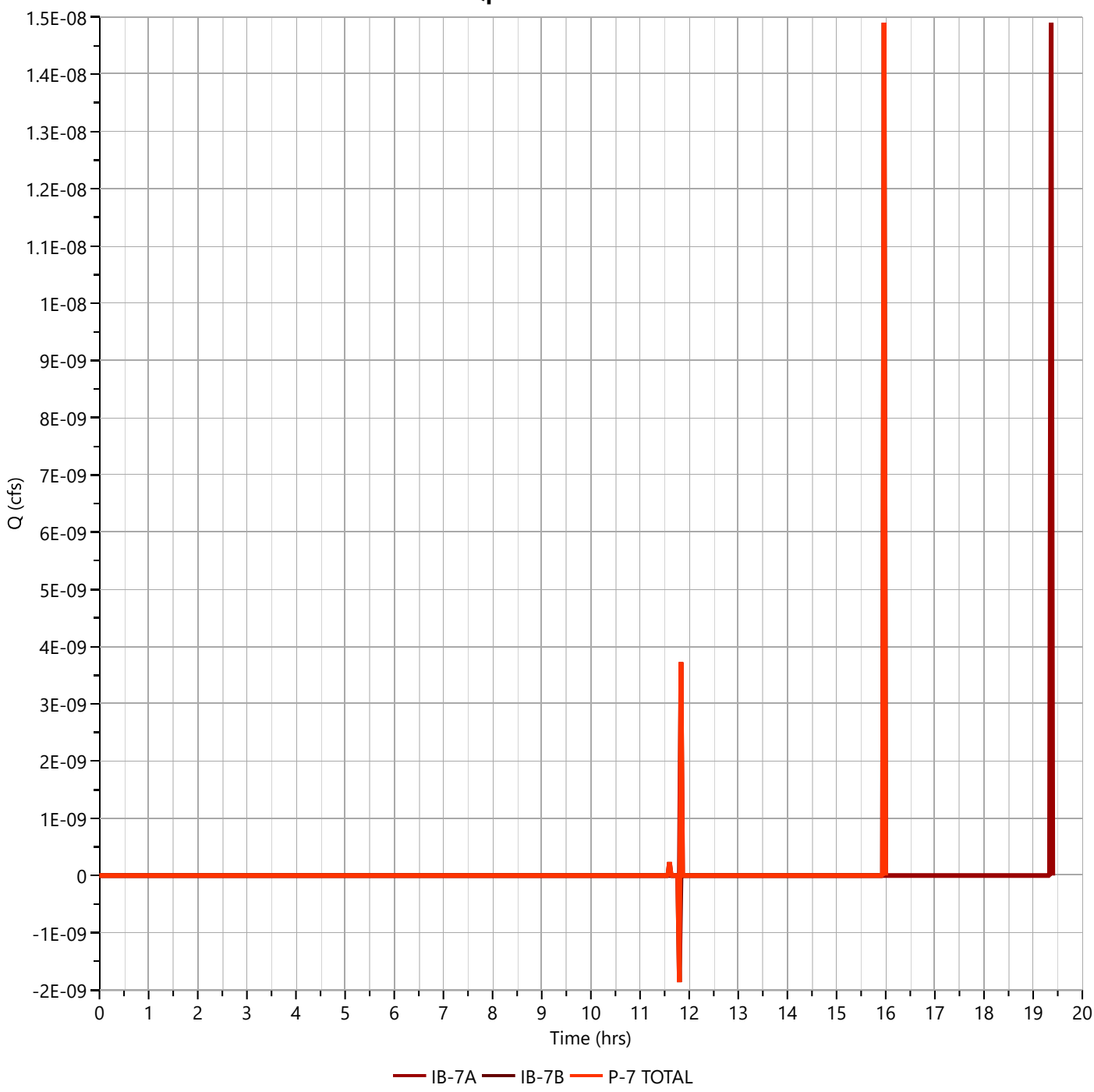
Hydrology Studio v 3.0.0.24

06-28-2022

P-7 TOTAL

Hyd. No. 50

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 47, 49	Total Contrib. Area	= 0.0 ac



Hydrograph Report

Project Name:

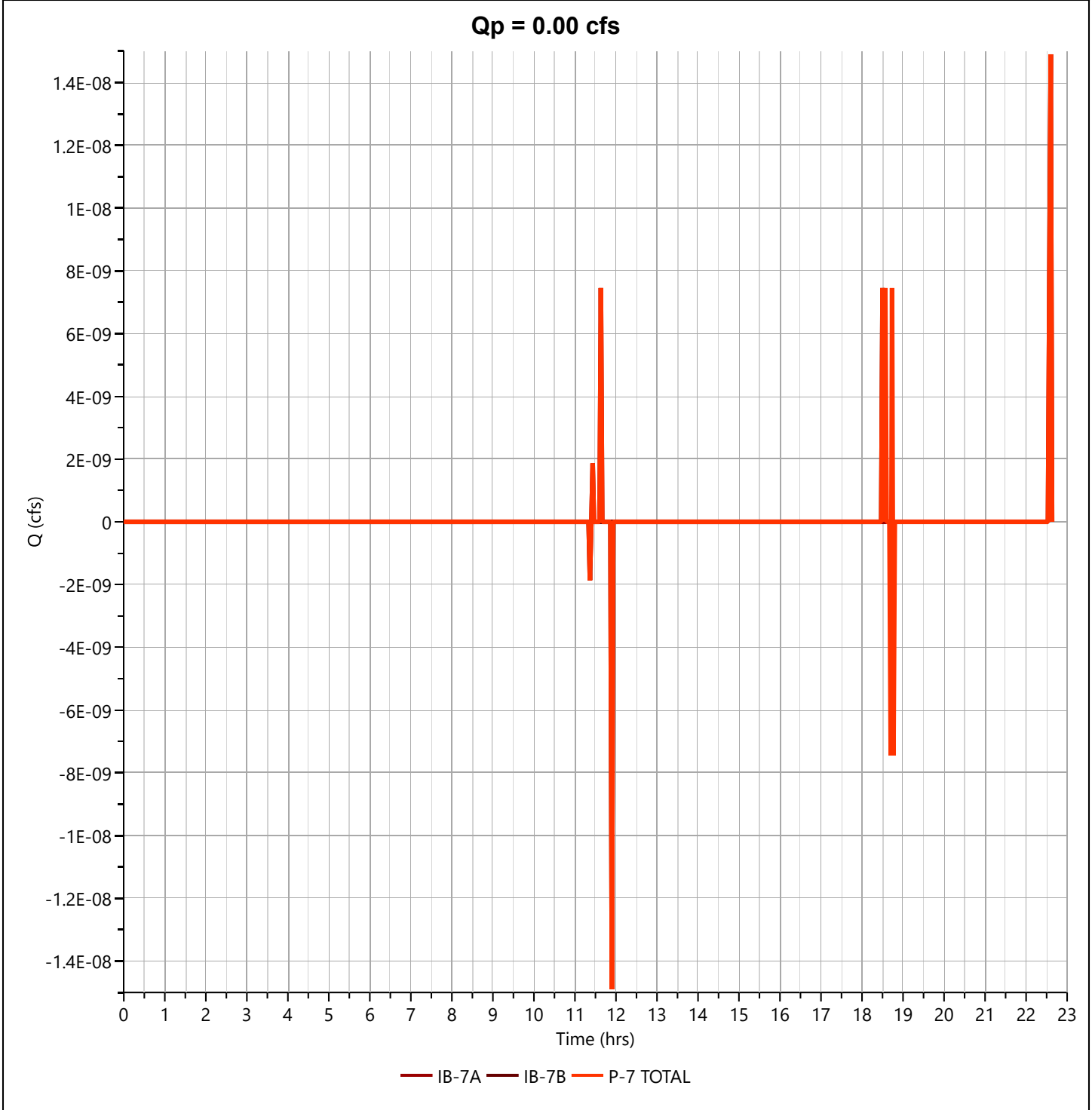
Hydrology Studio v 3.0.0.24

06-28-2022

P-7 TOTAL

Hyd. No. 50

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 22.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 47, 49	Total Contrib. Area	= 0.0 ac



Hydrograph Report

Project Name:

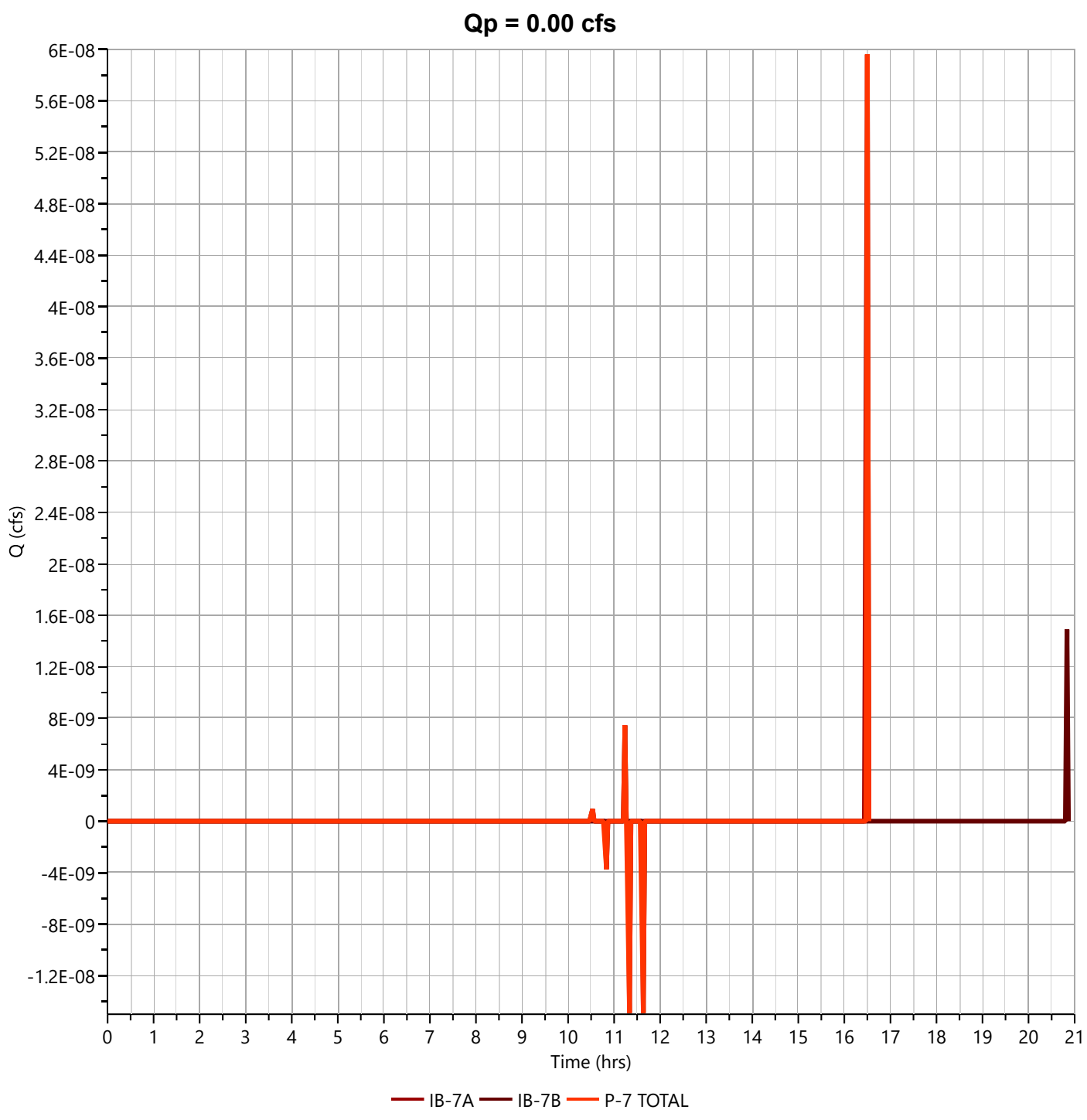
Hydrology Studio v 3.0.0.24

06-28-2022

P-7 TOTAL

Hyd. No. 50

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 16.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 47, 49	Total Contrib. Area	= 0.0 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-8

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.90	186.30
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			2.10	81.95
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.33	26.09

1/ Use only one CN source per line. 174342 Totals = 4.33 294.34

CN (weighted) = total product / total area = 294.34 / 4.33 = 68.00 ; Use CN = 68

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.77	2.73	4.10

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-8

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.015			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.16			0.16
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	142			
9. Watercourse slope, s		ft/ft	0.015			
10. Average Velocity, V (figure 3-1)		ft/s	1.98			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.18
min 10.5

Hydrograph Report

Project Name:

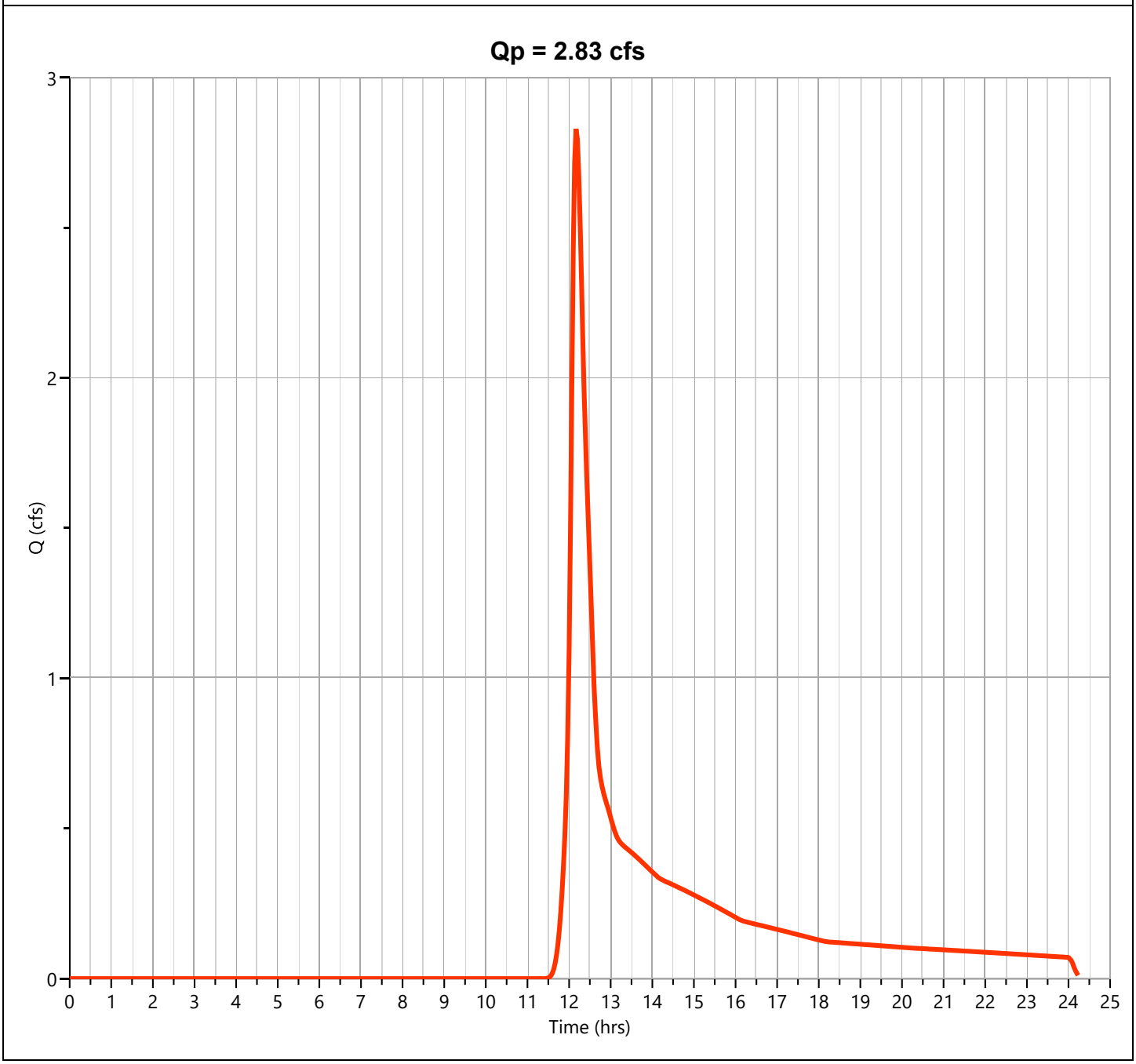
Hydrology Studio v 3.0.0.24

06-28-2022

P-8

Hyd. No. 52

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.829 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 12,496 cuft
Drainage Area	= 4.33 ac	Curve Number	= 68
Tc Method	= User	Time of Conc. (Tc)	= 10.5 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

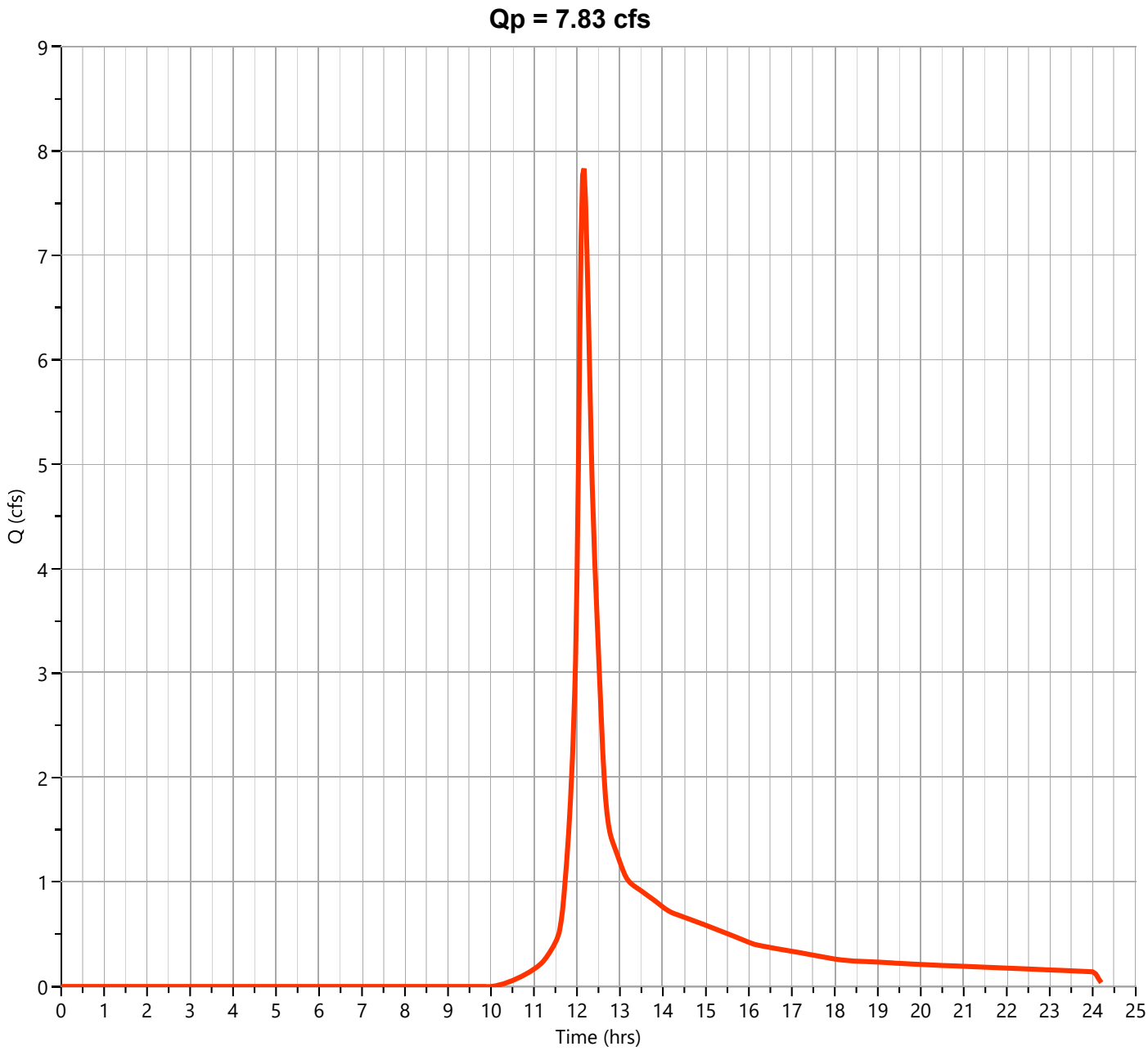
Hydrology Studio v 3.0.0.24

06-28-2022

P-8

Hyd. No. 52

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.833 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 30,929 cuft
Drainage Area	= 4.33 ac	Curve Number	= 68
Tc Method	= User	Time of Conc. (Tc)	= 10.5 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

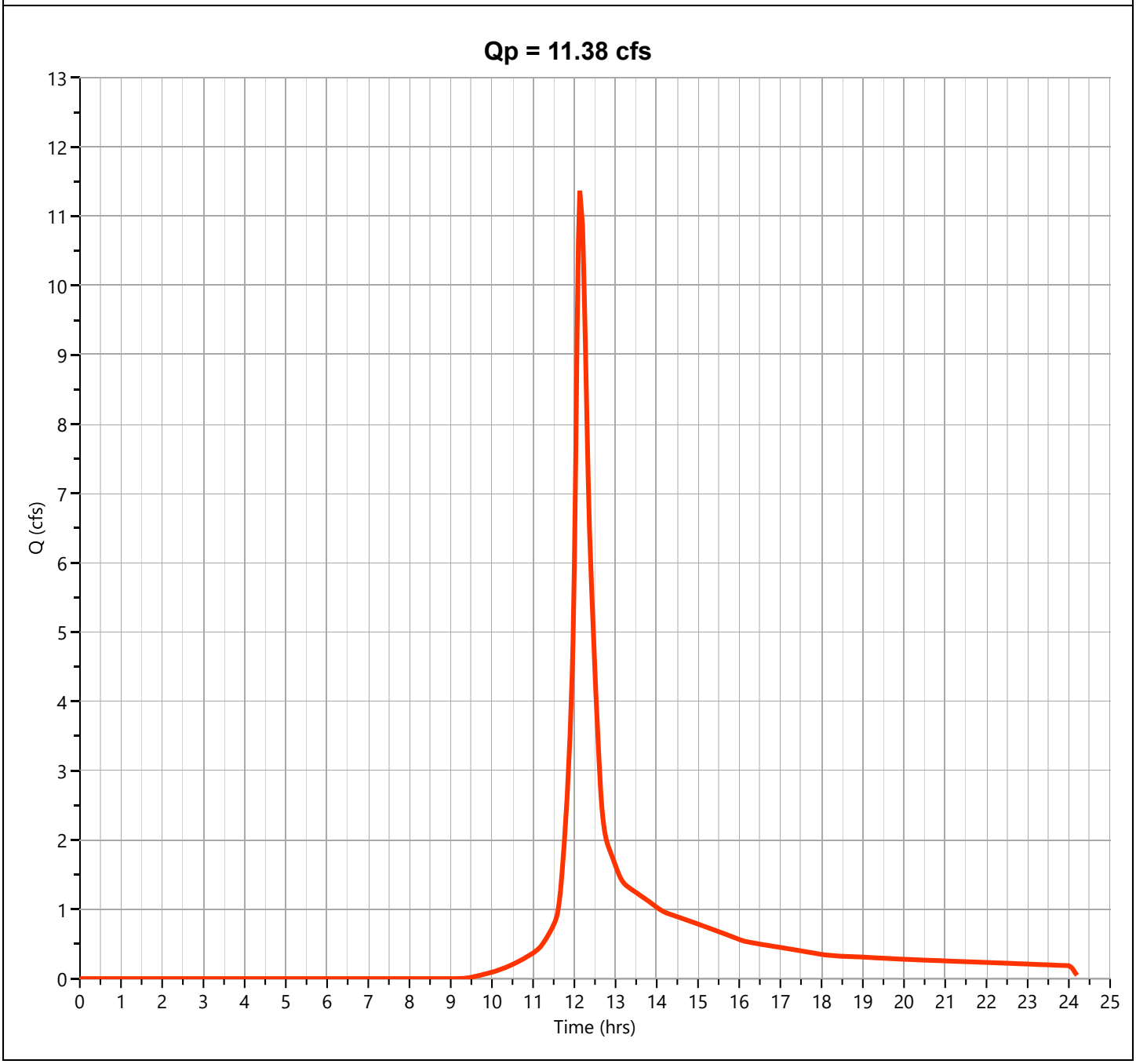
Hydrology Studio v 3.0.0.24

06-28-2022

P-8

Hyd. No. 52

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.38 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 44,231 cuft
Drainage Area	= 4.33 ac	Curve Number	= 68
Tc Method	= User	Time of Conc. (Tc)	= 10.5 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

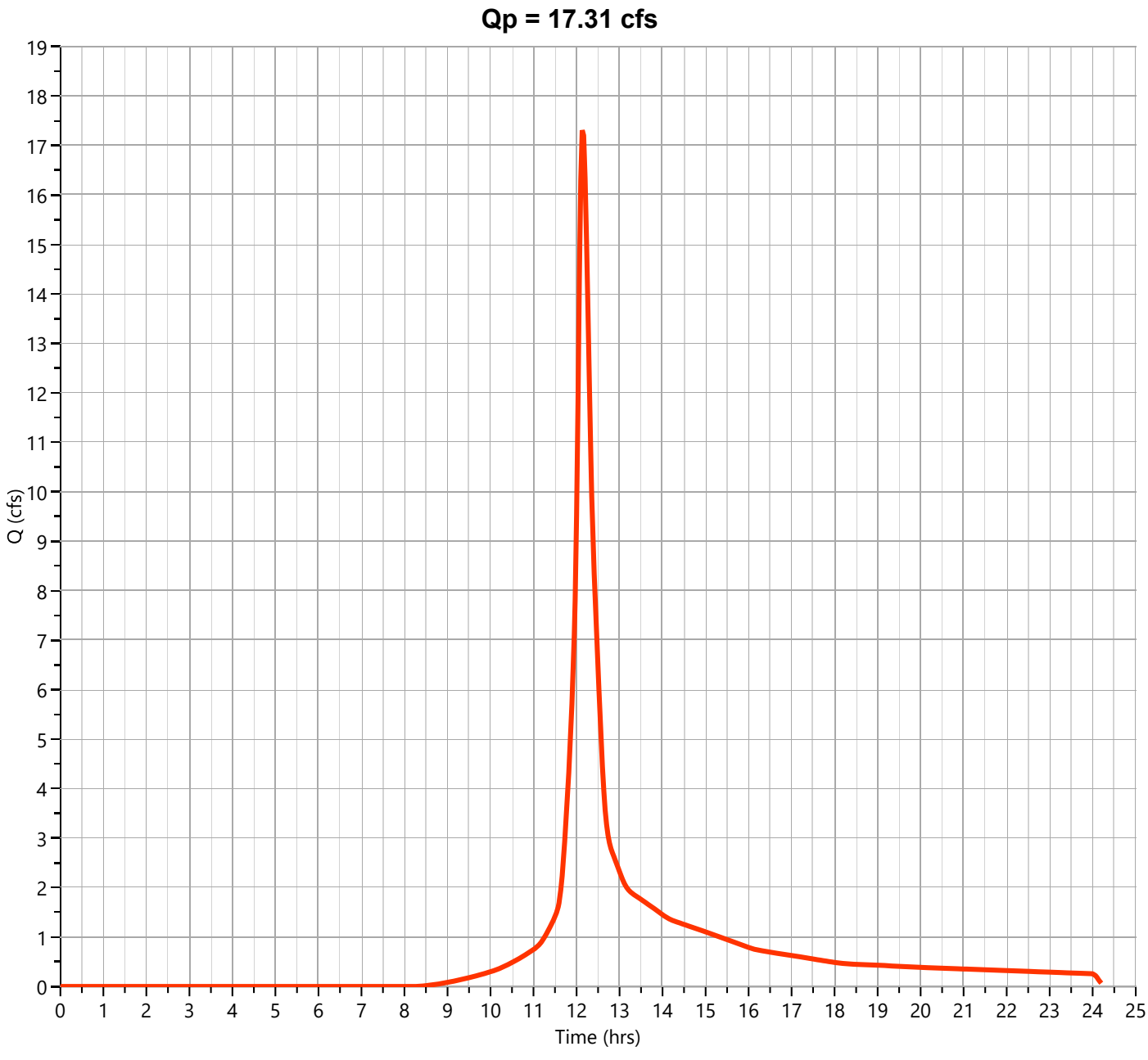
Hydrology Studio v 3.0.0.24

06-28-2022

P-8

Hyd. No. 52

Hydrograph Type	= NRCS Runoff	Peak Flow	= 17.31 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 66,477 cuft
Drainage Area	= 4.33 ac	Curve Number	= 68
Tc Method	= User	Time of Conc. (Tc)	= 10.5 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

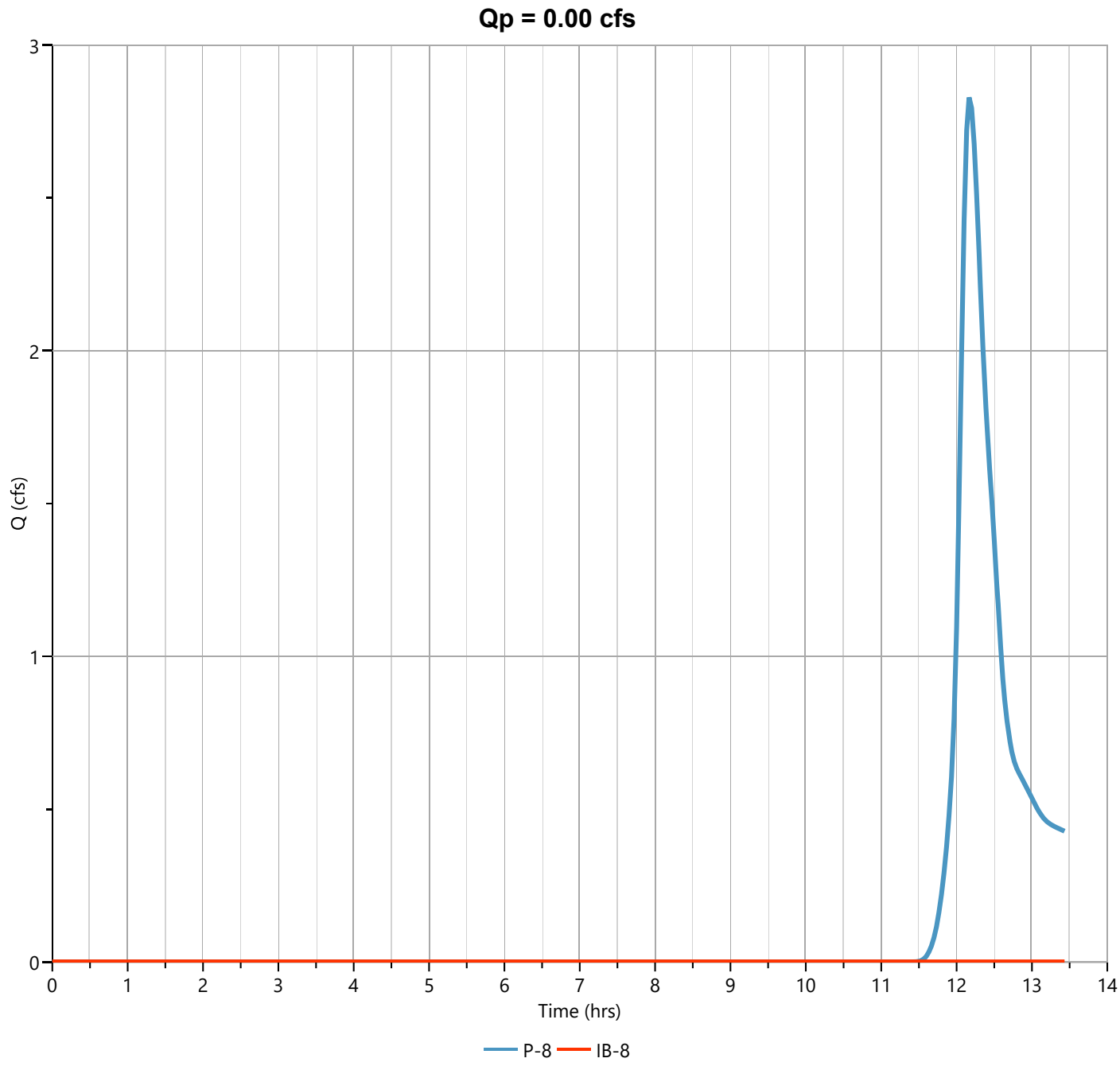
06-28-2022

IB-8

Hyd. No. 53

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.40 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 52 - P-8	Max. Elevation	= 223.17 ft
Pond Name	= IB-8	Max. Storage	= 1,552 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

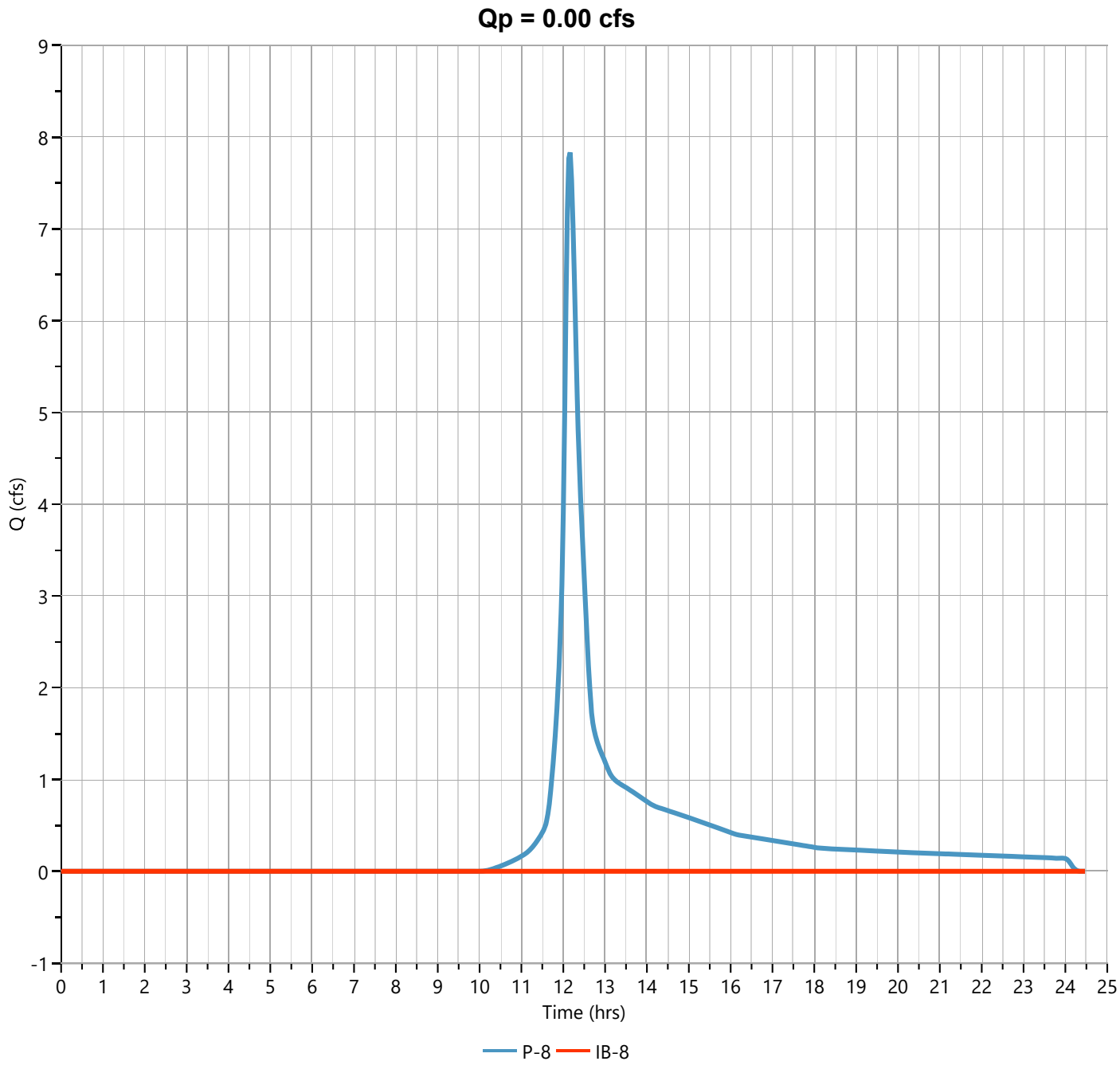
06-28-2022

IB-8

Hyd. No. 53

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 24.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 52 - P-8	Max. Elevation	= 223.94 ft
Pond Name	= IB-8	Max. Storage	= 8,657 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

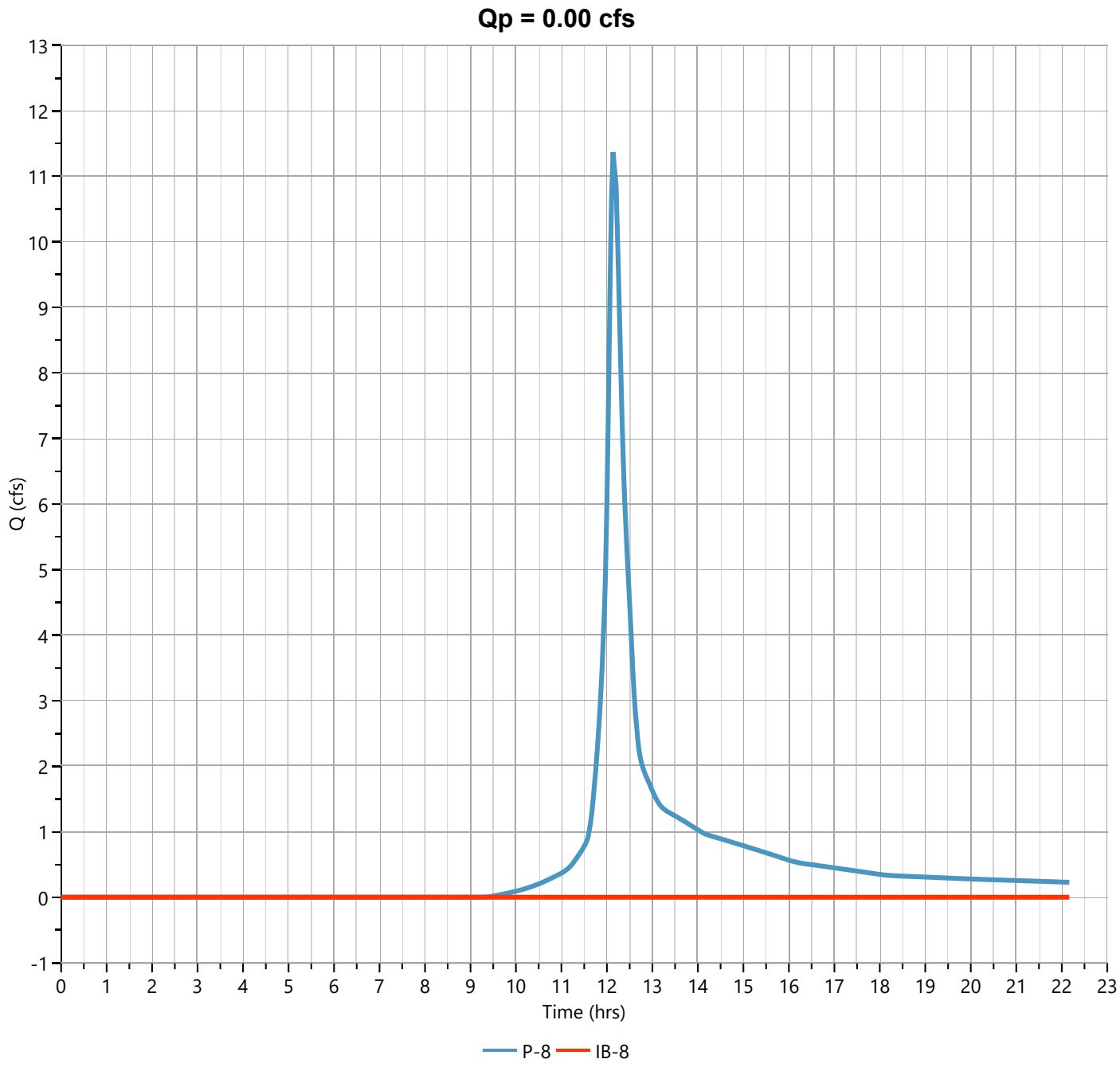
06-28-2022

IB-8

Hyd. No. 53

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 22.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 52 - P-8	Max. Elevation	= 224.50 ft
Pond Name	= IB-8	Max. Storage	= 14,615 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

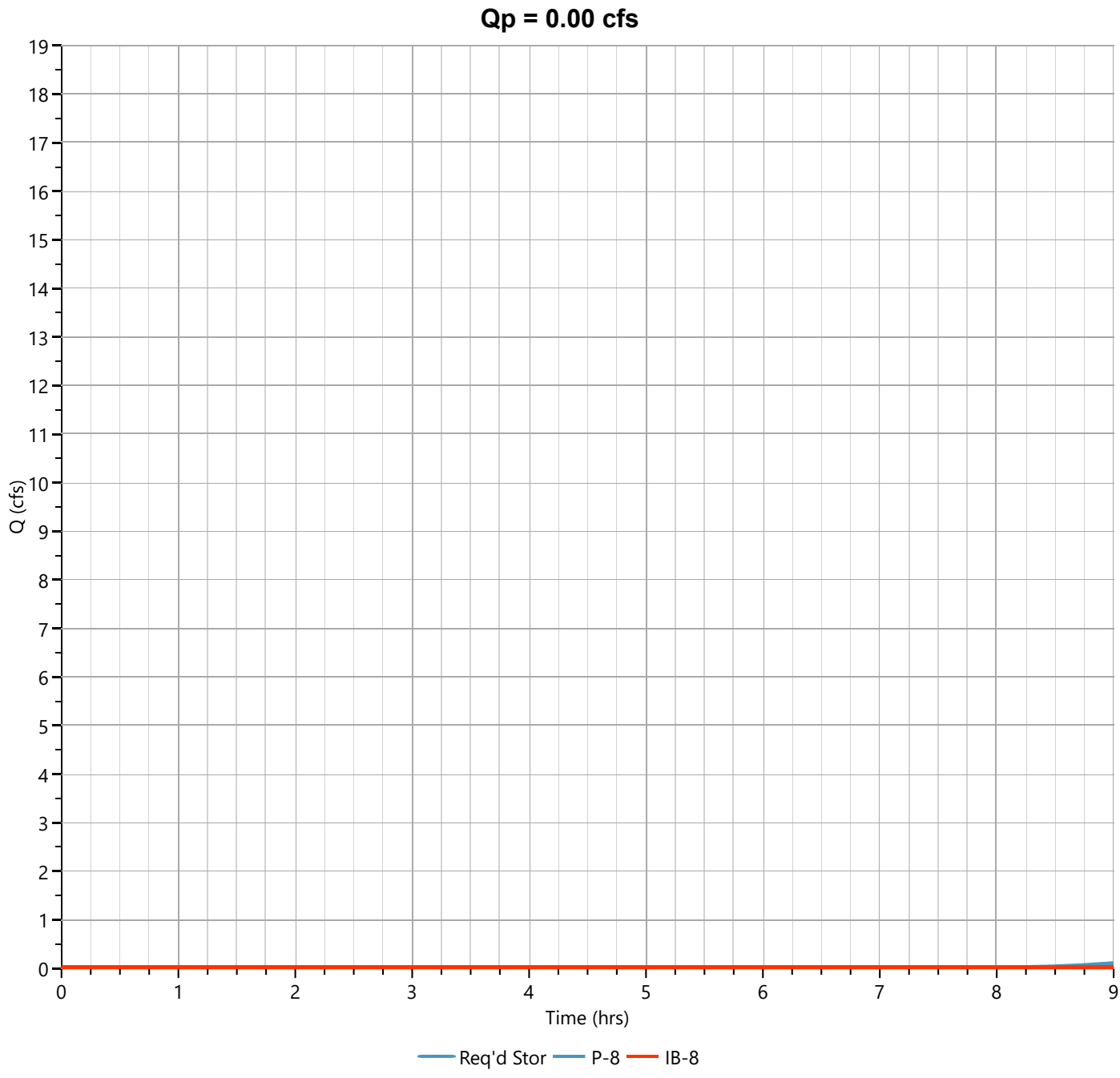
06-28-2022

IB-8

Hyd. No. 53

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 8.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 52 - P-8	Max. Elevation	= 225.43 ft
Pond Name	= IB-8	Max. Storage	= 25,332 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

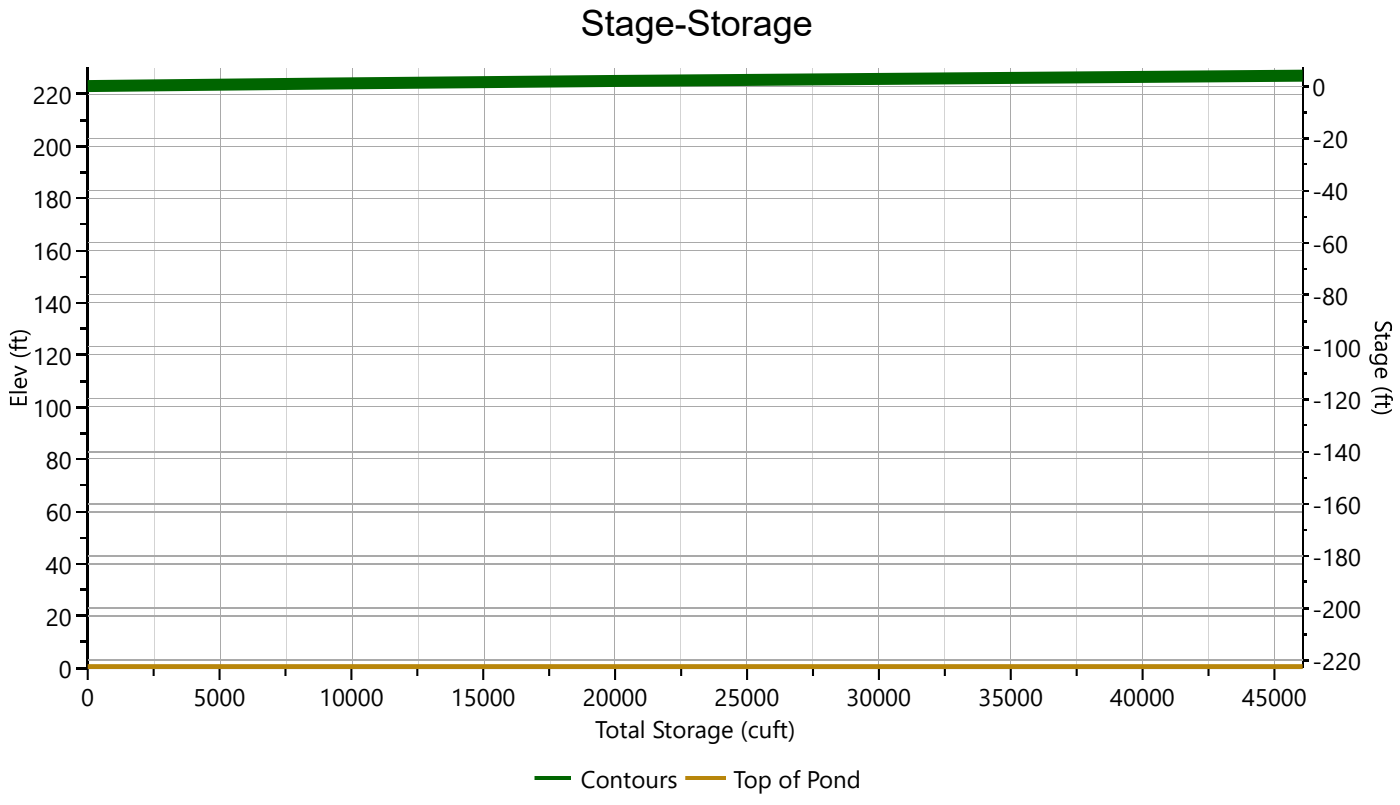
IB-8

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	223.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	223.00	8,372	0.000	0.000
1.00	224.00	9,985	9,179	9,179
2.00	225.00	11,652	10,819	19,997
3.00	226.00	13,110	12,381	32,378
4.00	227.00	14,264	13,687	46,065



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

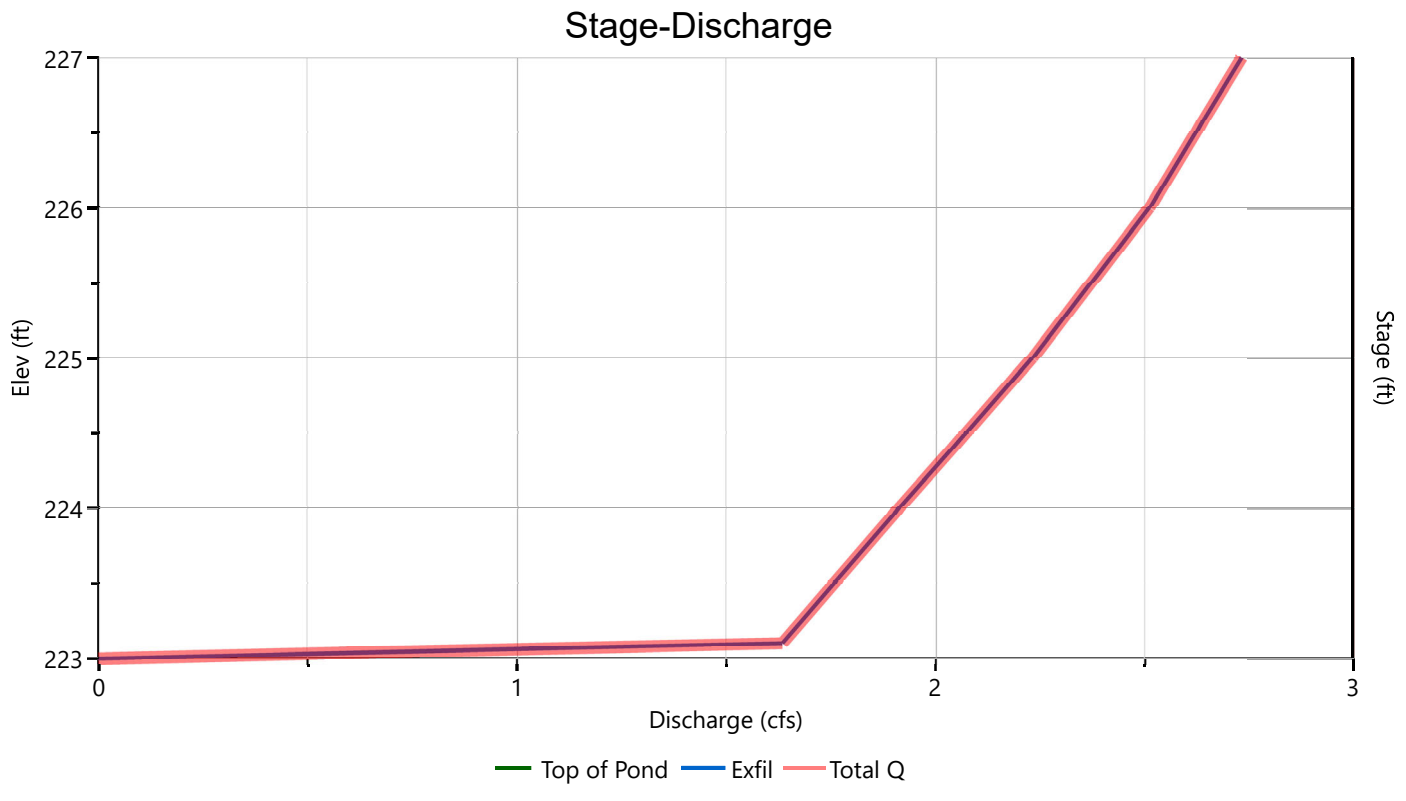
06-28-2022

IB-8

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	8.27**
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-8

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	223.00	0.000										0.000		0.000
1.00	224.00	9,179										1.911		1.911
2.00	225.00	19,997										2.231		2.231
3.00	226.00	32,378										2.510		2.510
4.00	227.00	46,065										2.731		2.731

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

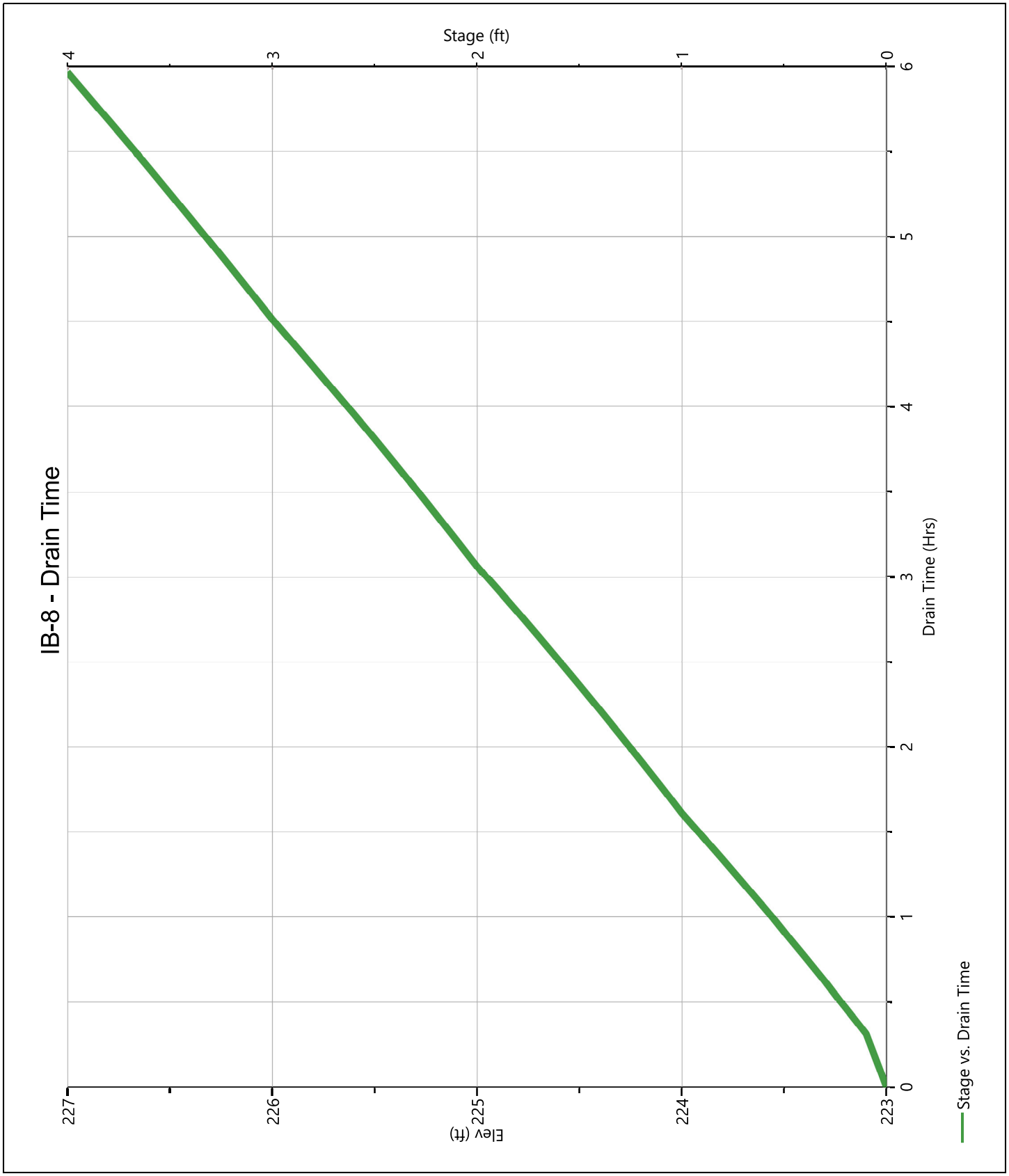
Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

IB-8

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-9

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.15	14.93
A	Woods Good Condition	30			1.07	32.24
A	Open Space Good Condition	39			0.38	14.88
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			4.03	282.03
C	Open Space Good Condition	74			0.87	64.64
D	Open Space Good Condition	80			0.16	13.09
D	Open Space Fair Condition	84			0.00	0.00
D	Woods Good Condition	77			1.60	122.98
1/ Use only one CN source per line.		360316		Totals =	8.27	544.79

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{544.79}{8.27} =$ 65.86 ; Use CN = 66

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.67	2.53	3.86

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-9

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.026			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.26			0.26
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	1018			
9. Watercourse slope, s		ft/ft	0.042			
10. Average Velocity, V (figure 3-1)		ft/s	3.31			
11. Tt = L / 3600V	Compute Tt	hr	0.09			0.09
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.35
min 20.7

Hydrograph Report

Project Name:

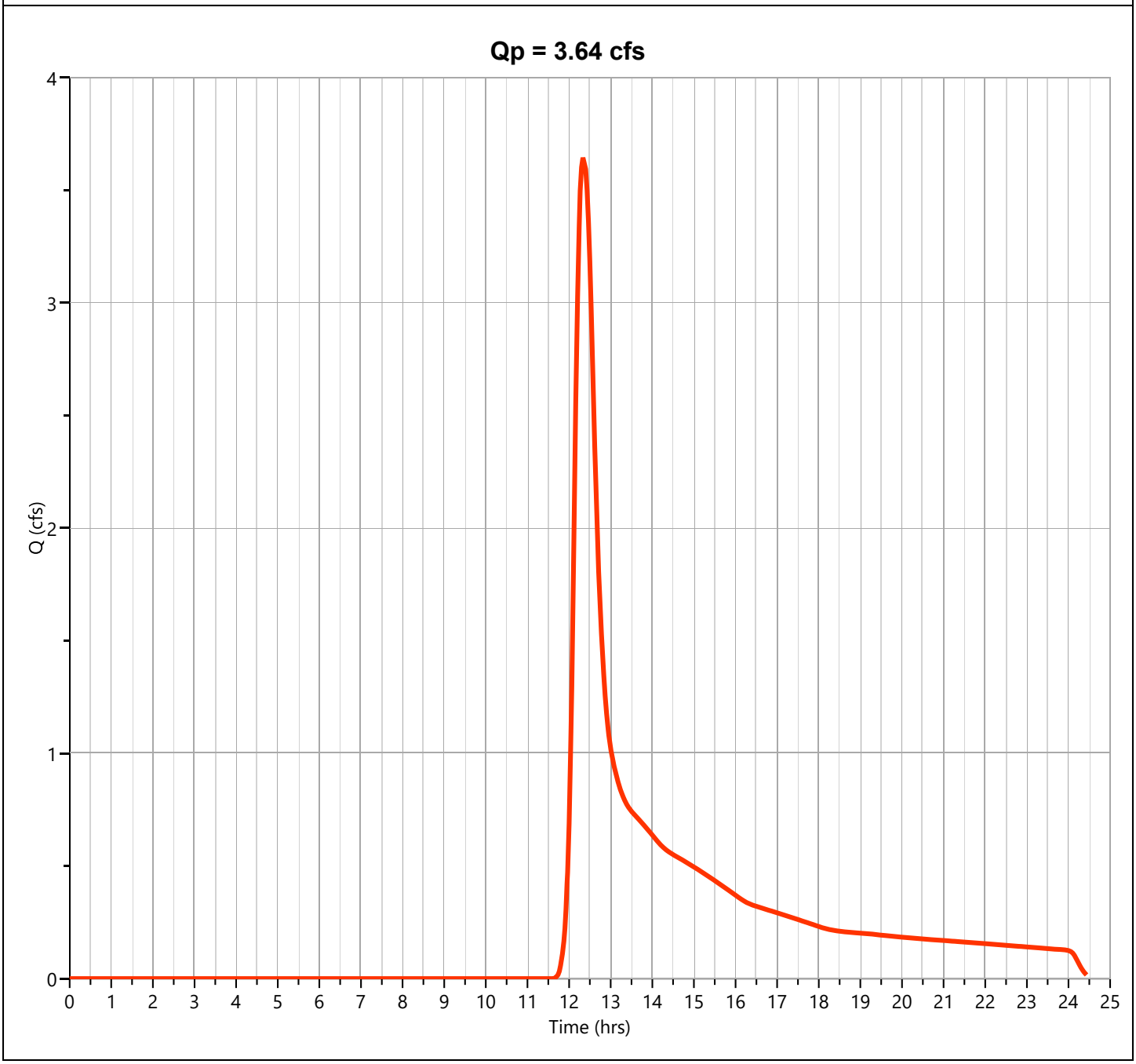
Hydrology Studio v 3.0.0.24

06-28-2022

P-9

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.645 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 20,738 cuft
Drainage Area	= 8.27 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 20.7 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

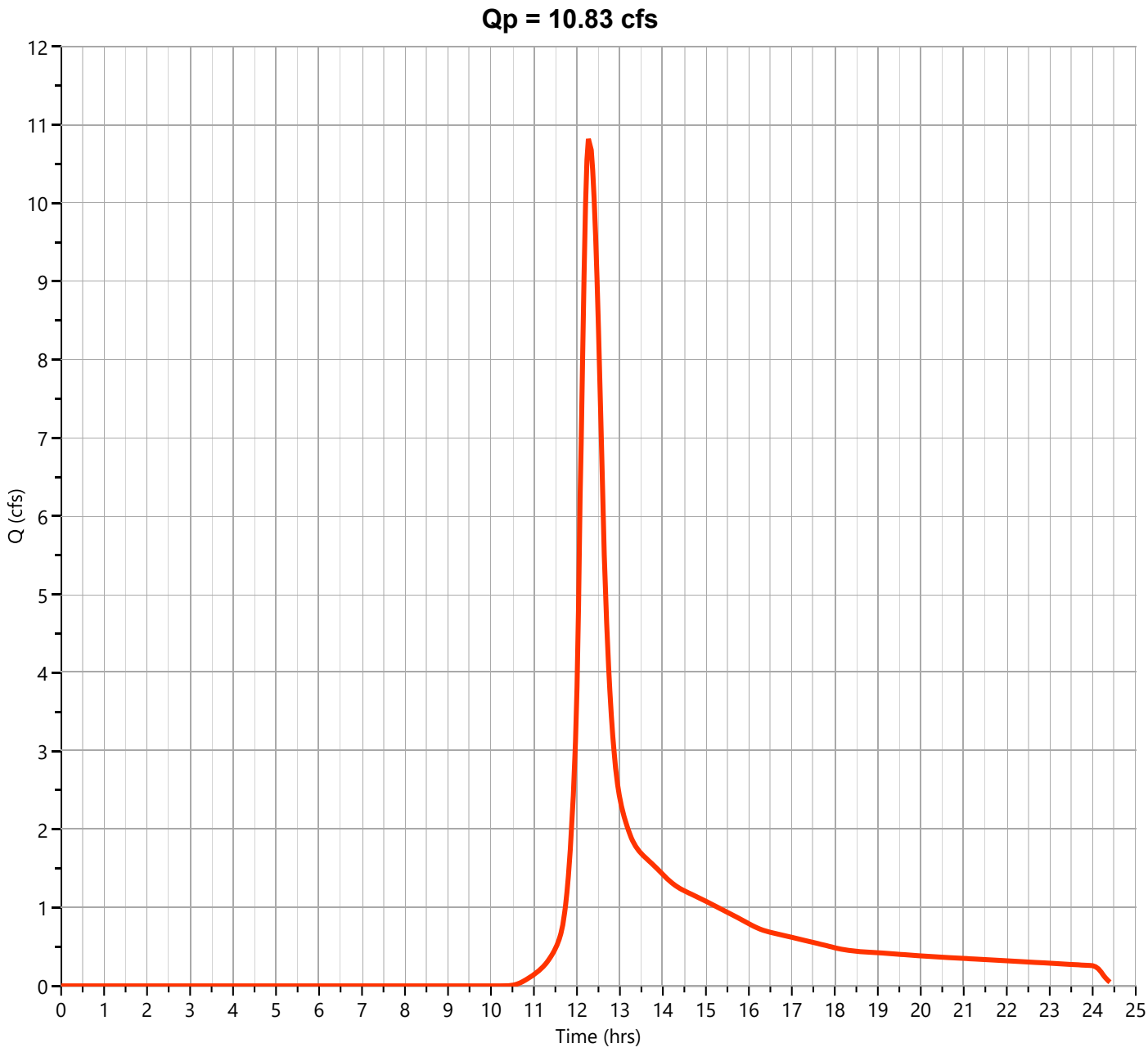
Hydrology Studio v 3.0.0.24

06-28-2022

P-9

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.83 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 53,625 cuft
Drainage Area	= 8.27 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 20.7 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

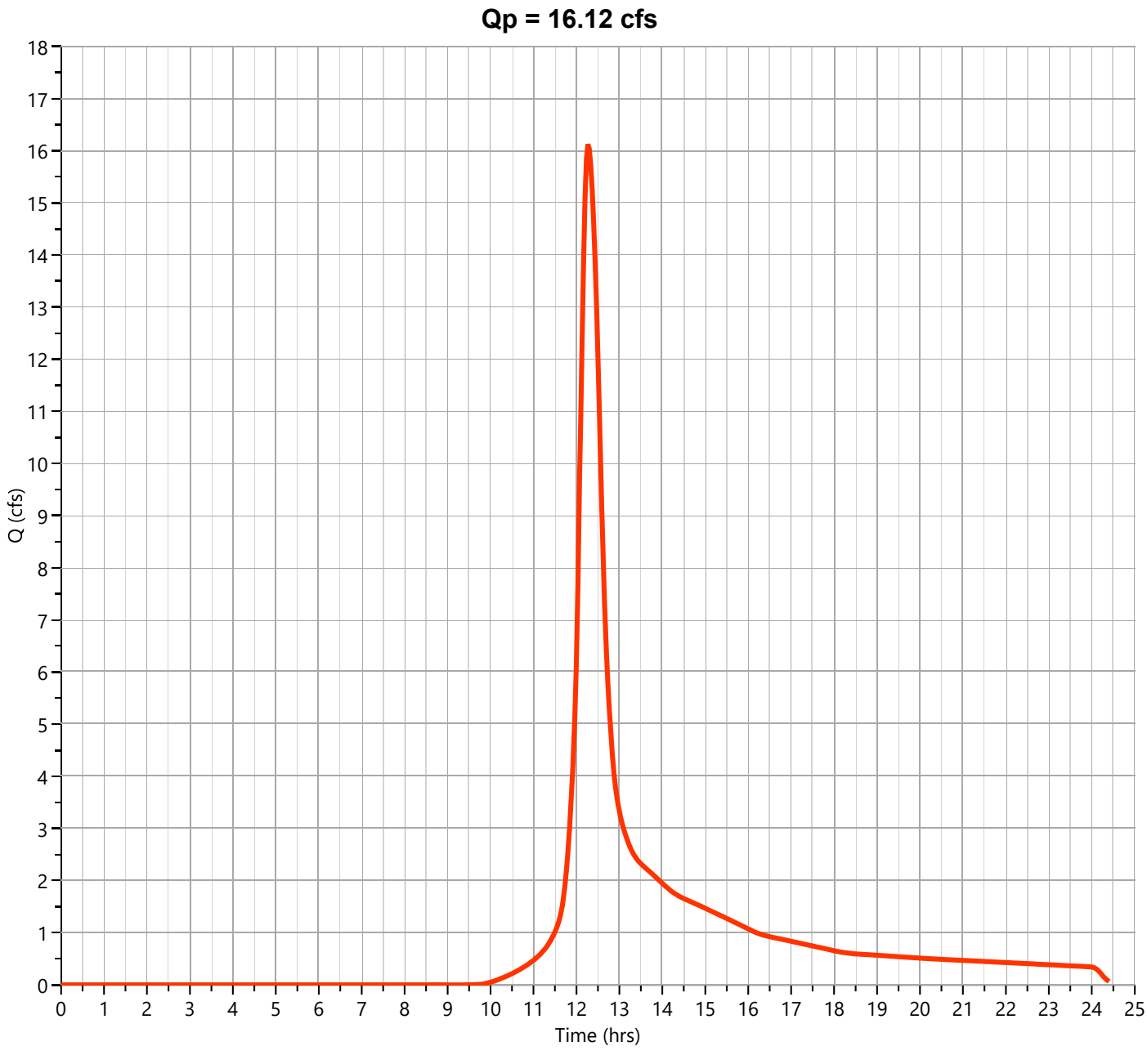
Hydrology Studio v 3.0.0.24

06-28-2022

P-9

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.12 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 77,748 cuft
Drainage Area	= 8.27 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 20.7 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

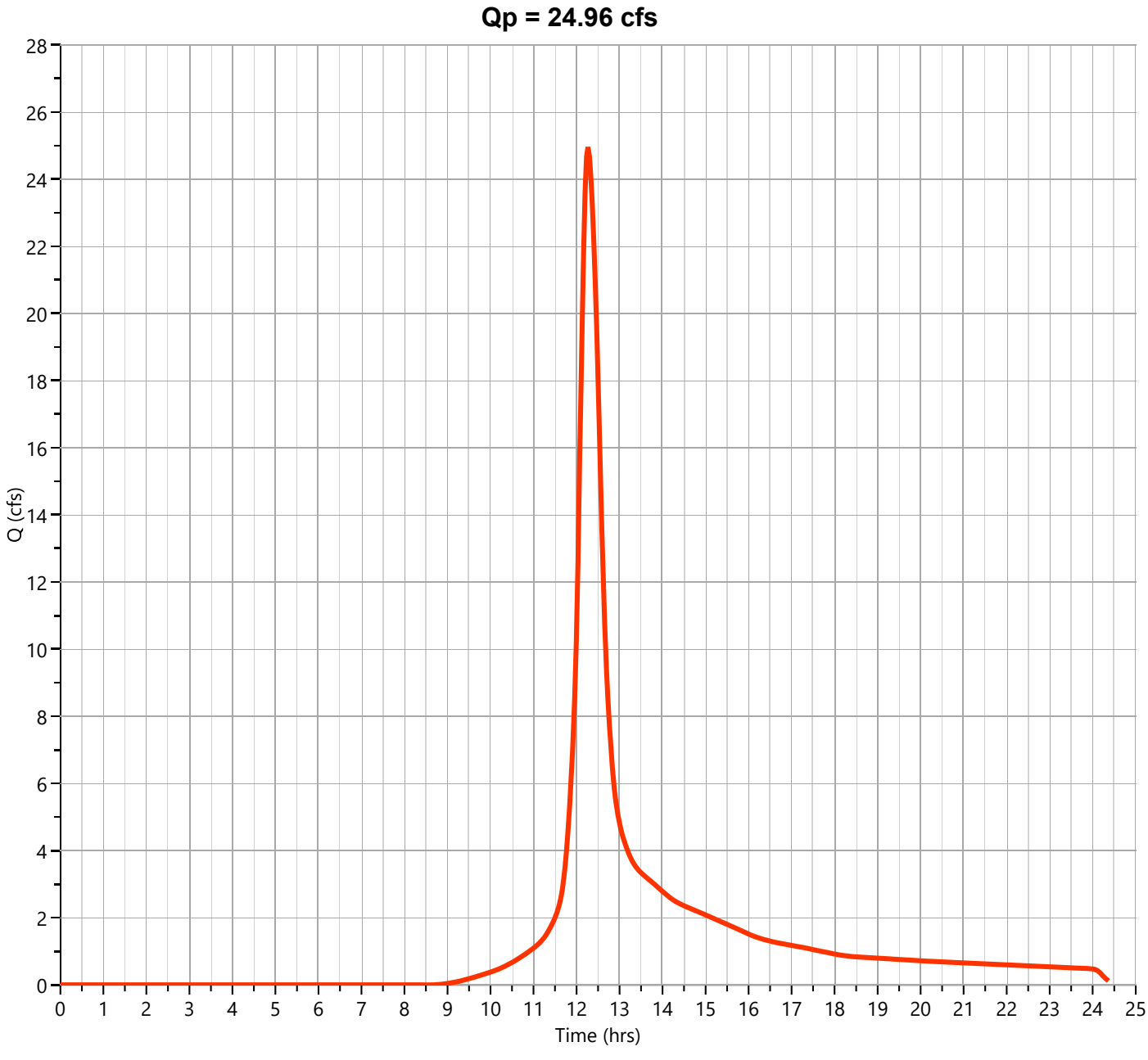
Hydrology Studio v 3.0.0.24

06-28-2022

P-9

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.96 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 118,462 cuft
Drainage Area	= 8.27 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 20.7 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-10A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.20	19.13
A	Woods Good Condition	30			0.41	12.42
A	Open Space Good Condition	39			0.10	3.81
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			6.29	439.97
C	Open Space Good Condition	74			1.13	83.71
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.35	26.97
D	Woods Good Condition	77			0.65	49.73
D	Open Space Good Condition	80			0.29	23.51
1/ Use only one CN source per line.		369101		Totals =	9.41	659.24

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{659.24}{9.41} = 70.03$; Use CN = 70

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.87	2.92	4.33

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-10A
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.010			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.38			0.38
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	963			
9. Watercourse slope, s		ft/ft	0.030			
10. Average Velocity, V (figure 3-1)		ft/s	2.79			
11. Tt = L / 3600V	Compute Tt	hr	0.10			0.10
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.48
min 28.6

Hydrograph Report

Project Name:

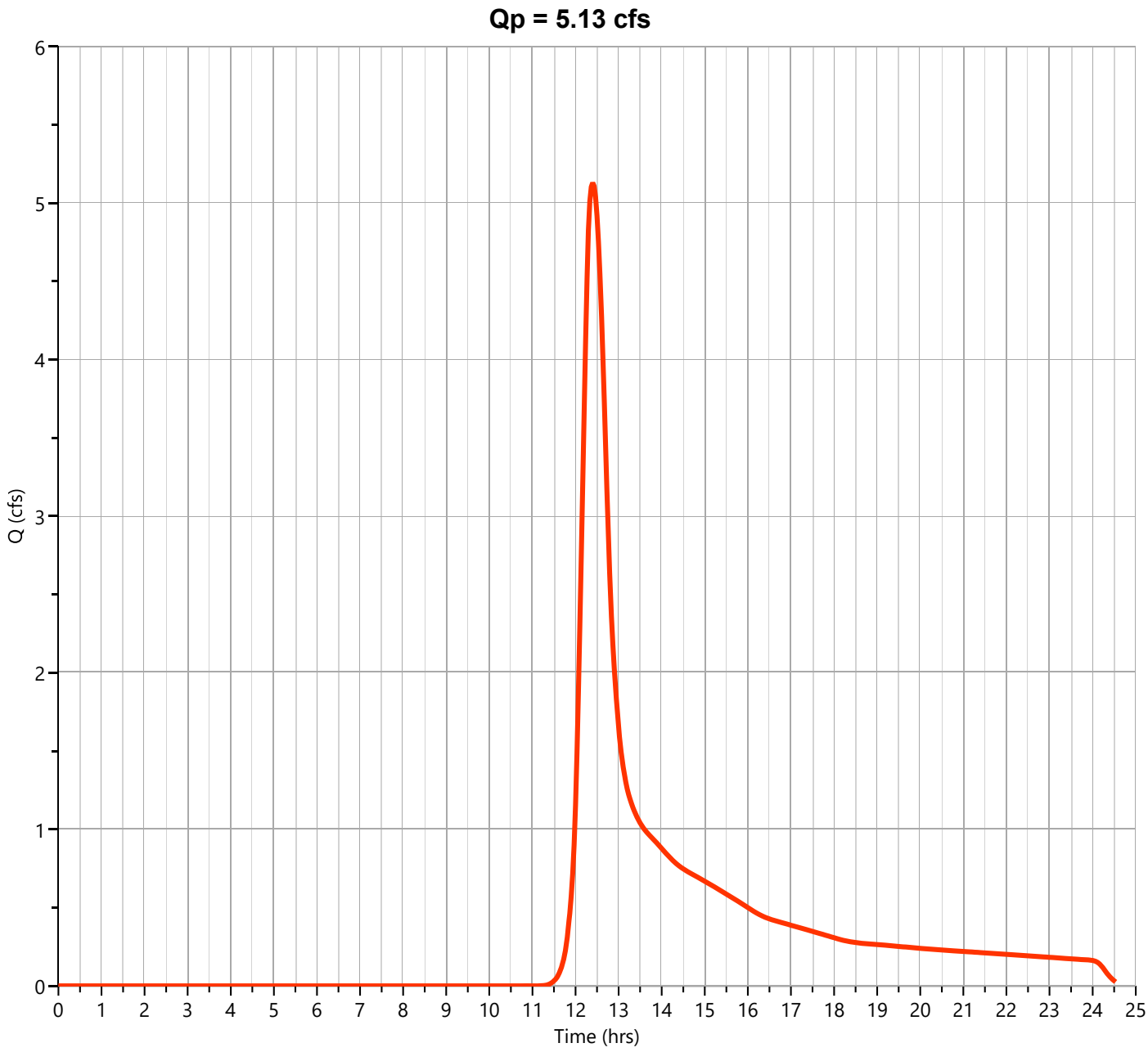
Hydrology Studio v 3.0.0.24

06-29-2022

P-10A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.130 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 29,688 cuft
Drainage Area	= 9.41 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 28.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

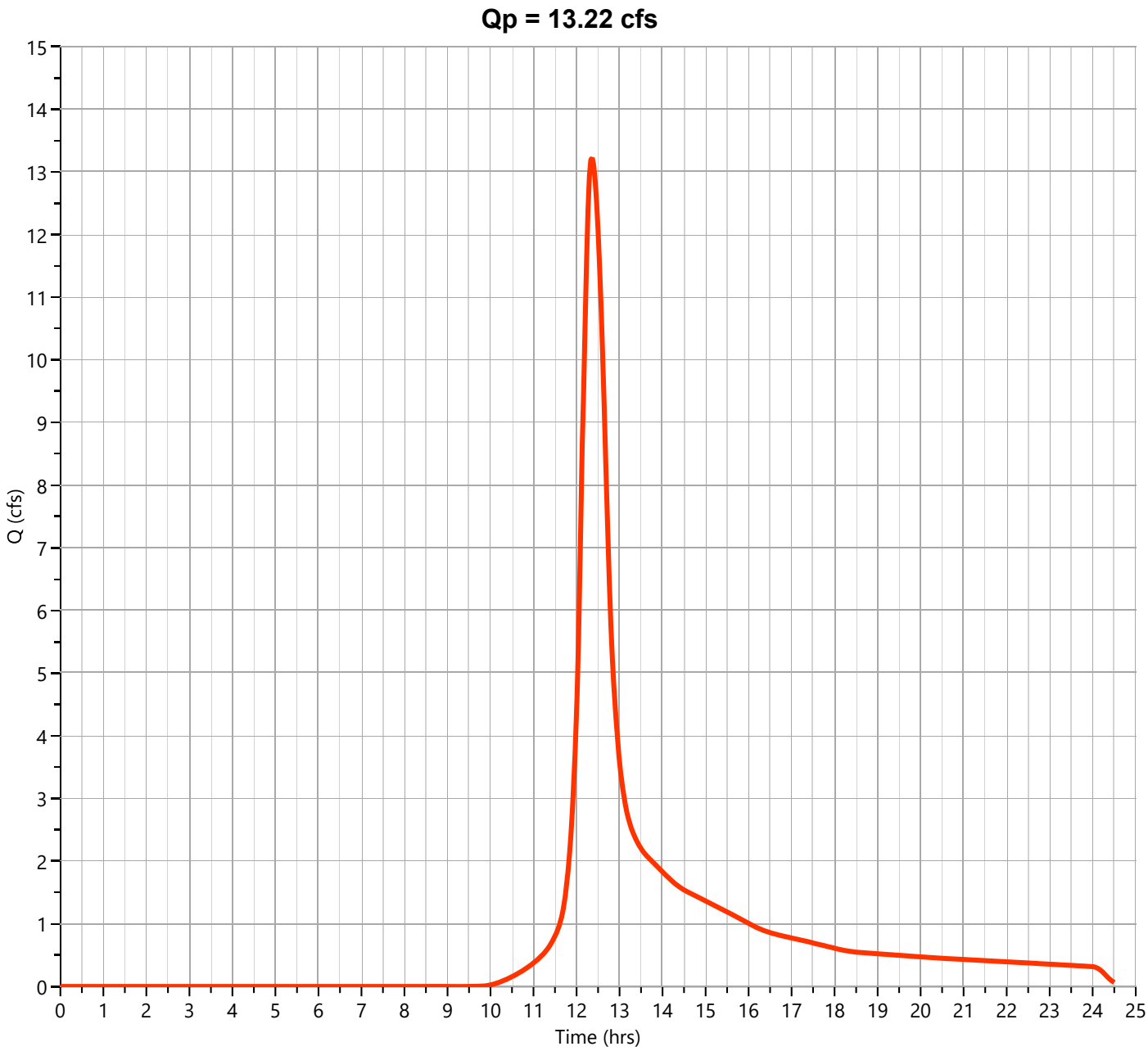
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06-29-2022

P-10A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.22 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 70,572 cuft
Drainage Area	= 9.41 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 28.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

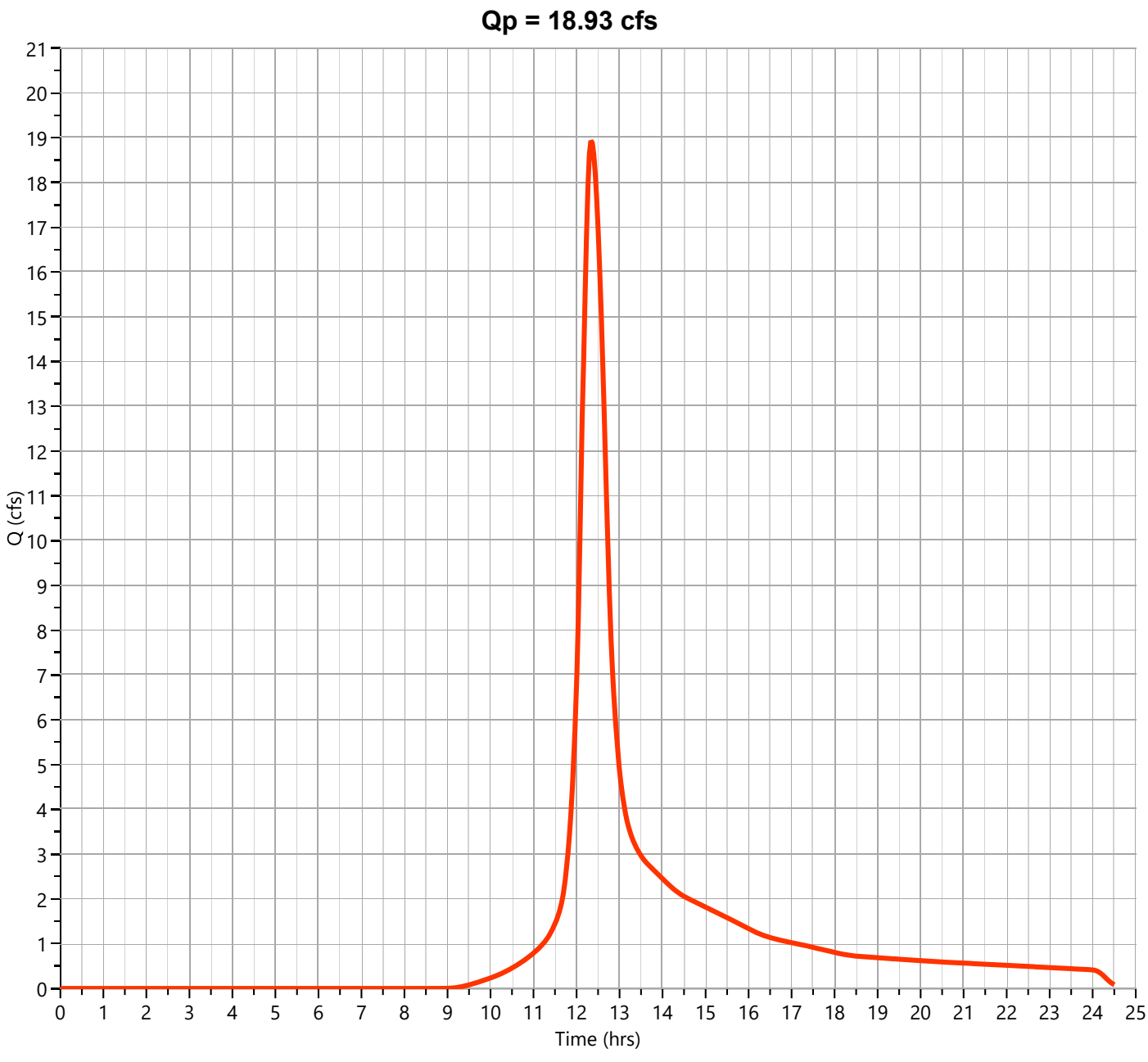
Hydrology Studio v 3.0.0.24

06-29-2022

P-10A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.93 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 99,629 cuft
Drainage Area	= 9.41 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 28.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

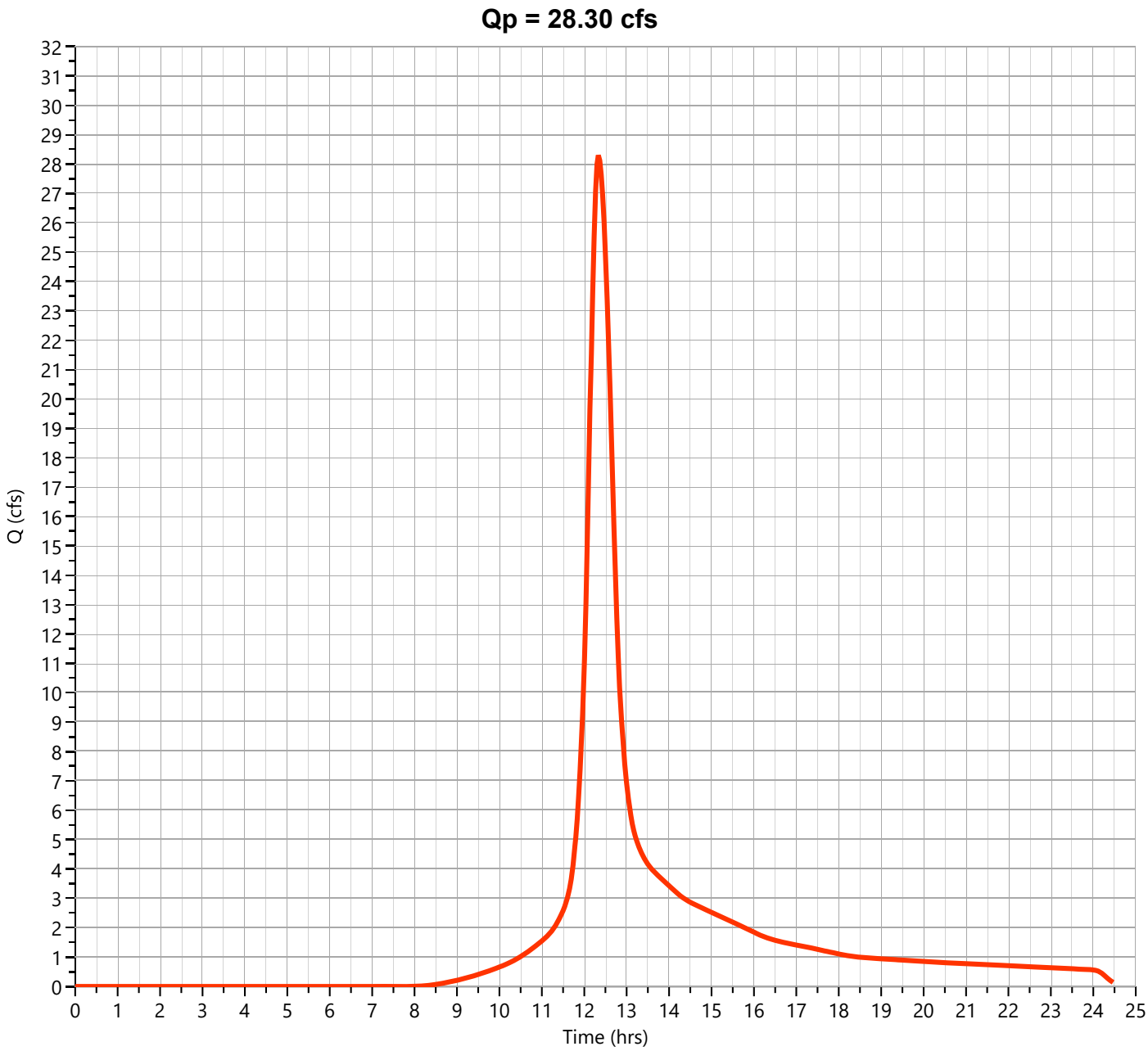
Hydrology Studio v 3.0.0.24

06-29-2022

P-10A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 28.30 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 147,807 cuft
Drainage Area	= 9.41 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 28.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-10B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.84	82.54
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Good Condition	74			2.03	150.58
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
1/ Use only one CN source per line.		125326		Totals =	2.88	233.12

CN (weighted) = total product / total area = 233.12 / 2.88 = 81.03 ; Use CN = 81

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.53	4.01	5.59

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-10B
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.020			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.14			0.14
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	231			
9. Watercourse slope, s		ft/ft	0.020			
10. Average Velocity, V (figure 3-1)		ft/s	2.28			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.0

Hydrograph Report

Project Name:

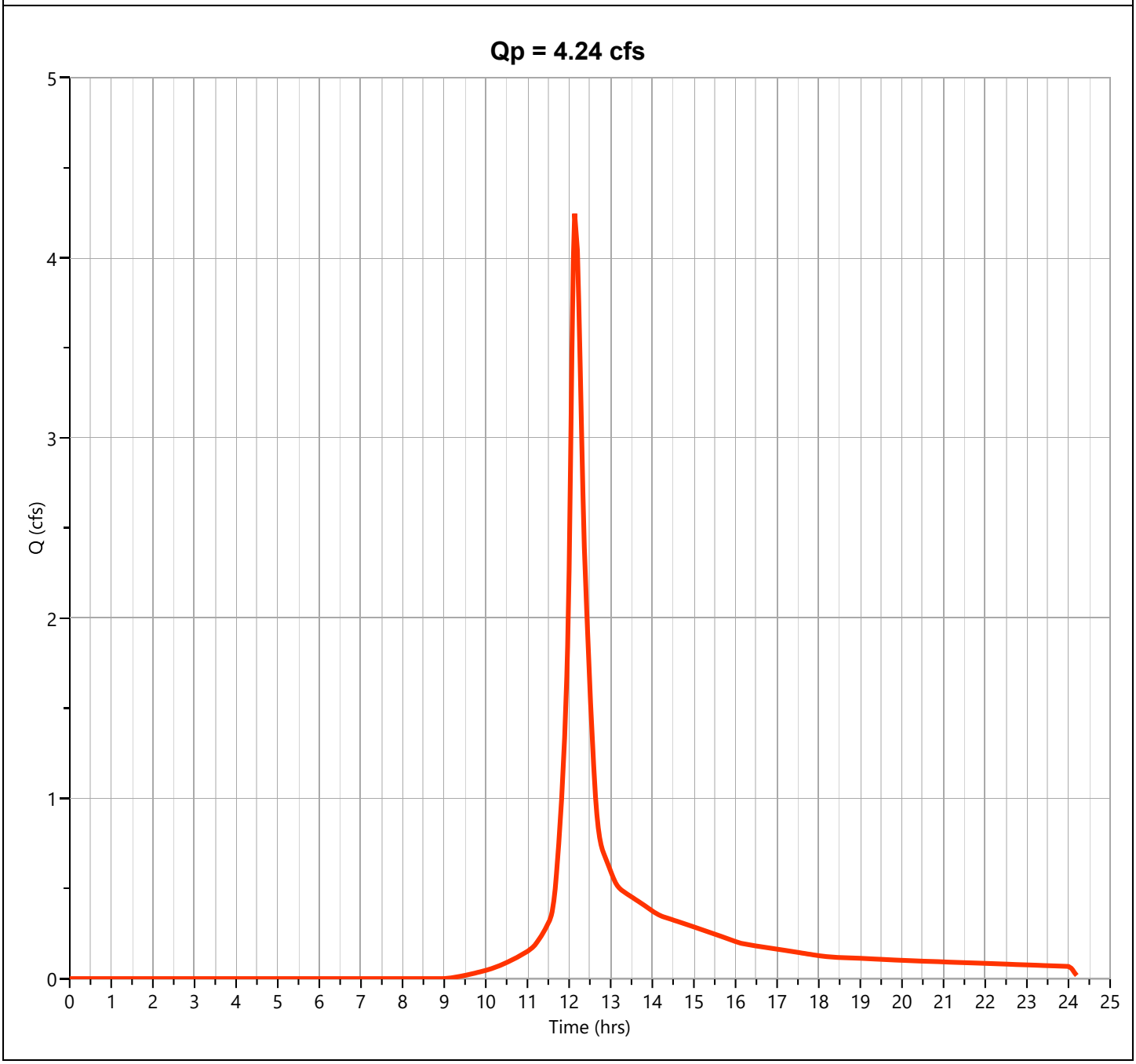
Hydrology Studio v 3.0.0.24

06-29-2022

P-10B

Hyd. No. 58

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.245 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 16,434 cuft
Drainage Area	= 2.88 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

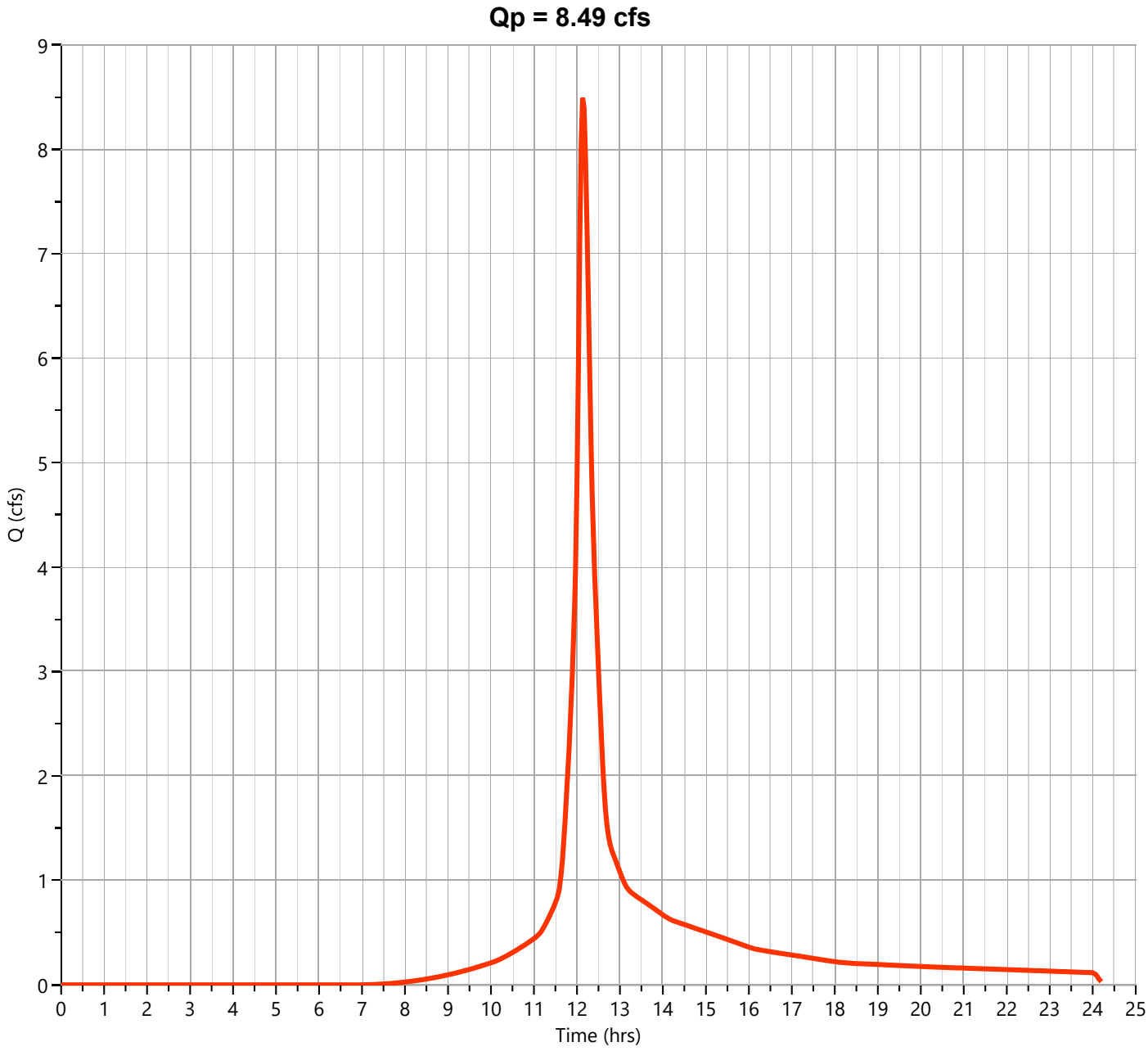
Hydrology Studio v 3.0.0.24

06-29-2022

P-10B

Hyd. No. 58

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.494 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 32,566 cuft
Drainage Area	= 2.88 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

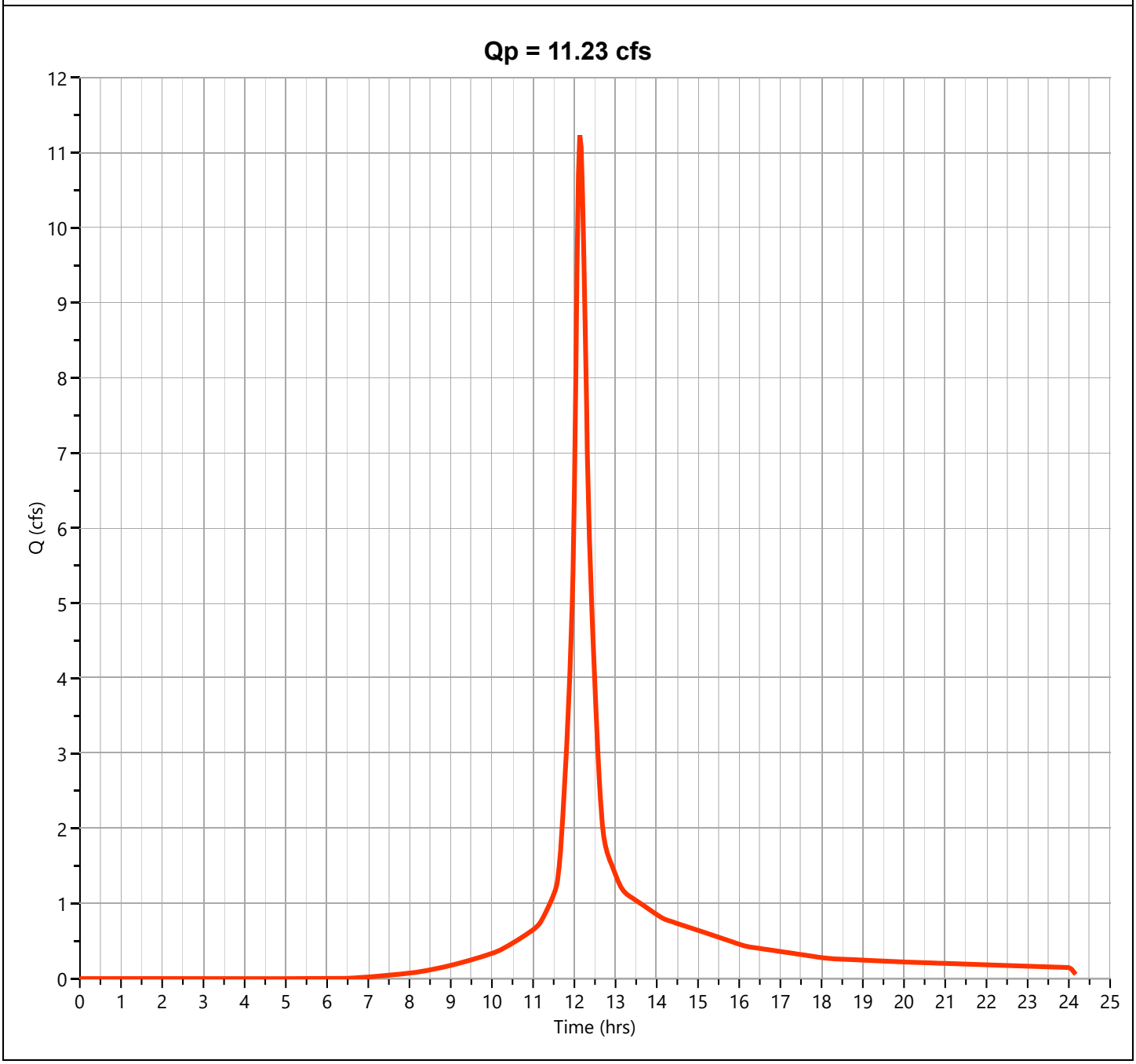
Hydrology Studio v 3.0.0.24

06-29-2022

P-10B

Hyd. No. 58

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.23 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 43,249 cuft
Drainage Area	= 2.88 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

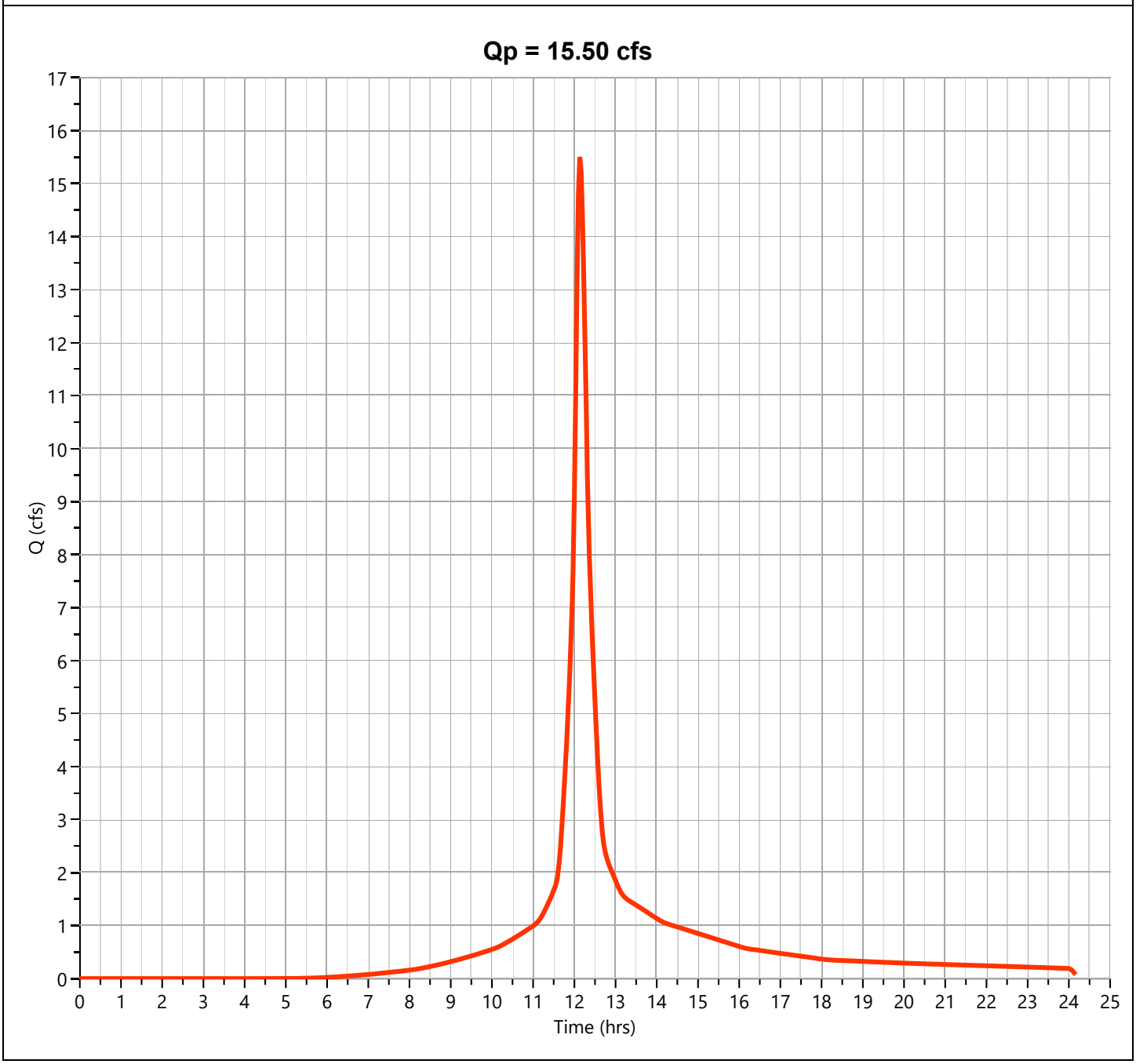
Hydrology Studio v 3.0.0.24

06-29-2022

P-10B

Hyd. No. 58

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.50 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 60,282 cuft
Drainage Area	= 2.88 ac	Curve Number	= 81
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

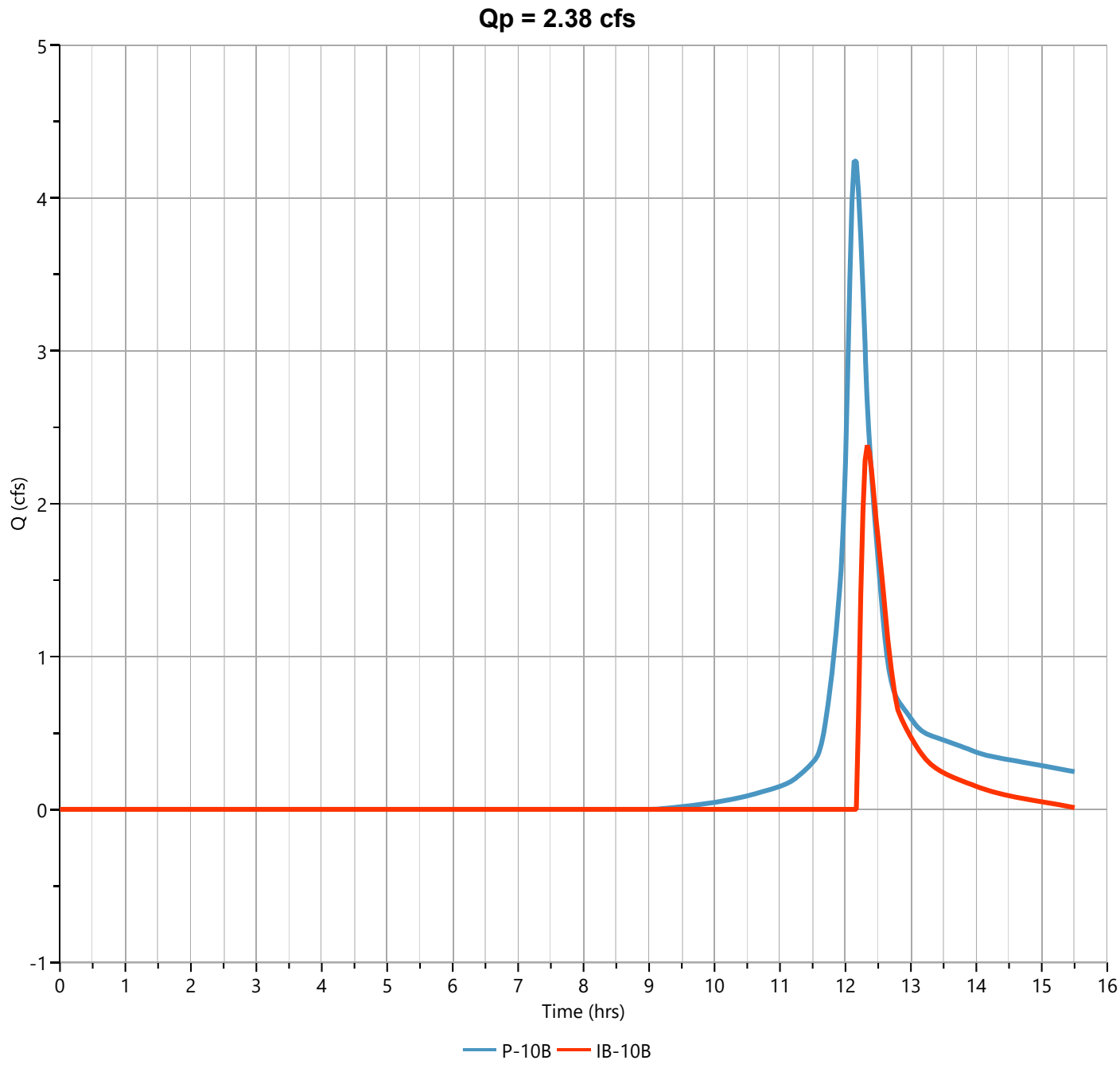
06-29-2022

IB-10B

Hyd. No. 59

Hydrograph Type	= Pond Route	Peak Flow	= 2.382 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,138 cuft
Inflow Hydrograph	= 58 - P-10B	Max. Elevation	= 256.73 ft
Pond Name	= IB-10B	Max. Storage	= 4,994 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

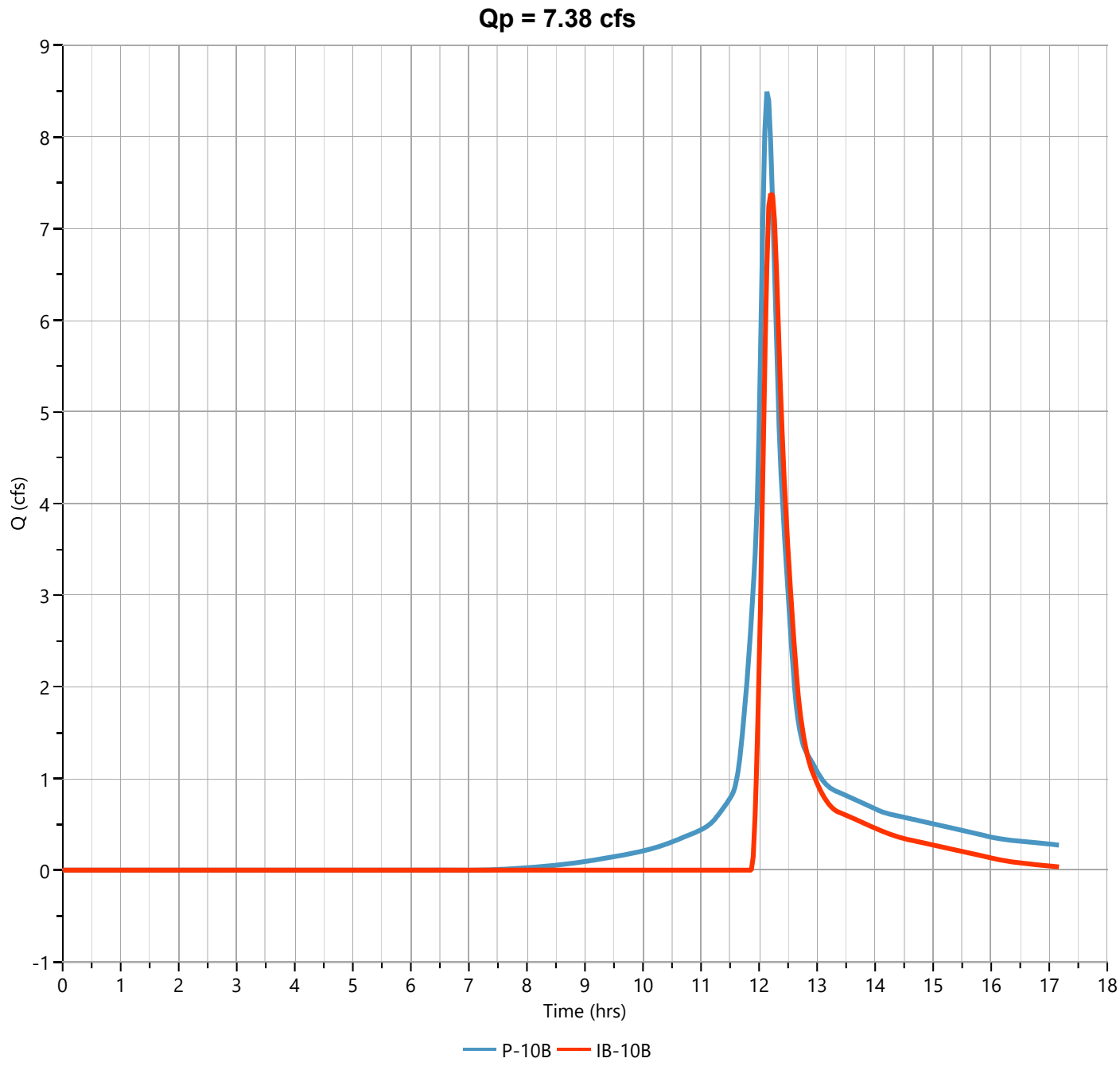
06-29-2022

IB-10B

Hyd. No. 59

Hydrograph Type	= Pond Route	Peak Flow	= 7.380 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 18,051 cuft
Inflow Hydrograph	= 58 - P-10B	Max. Elevation	= 257.01 ft
Pond Name	= IB-10B	Max. Storage	= 6,225 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

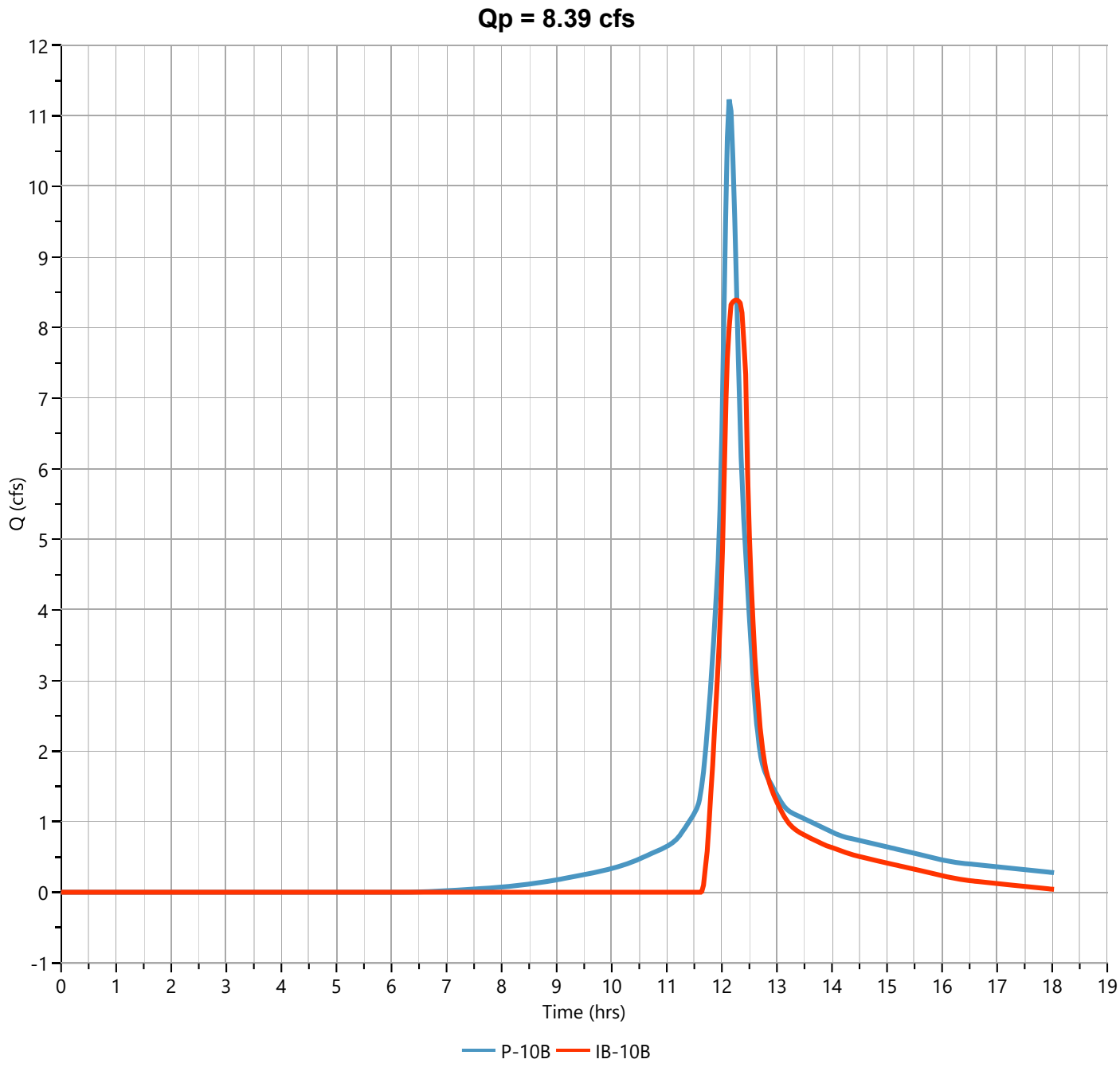
06-29-2022

IB-10B

Hyd. No. 59

Hydrograph Type	= Pond Route	Peak Flow	= 8.391 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 27,095 cuft
Inflow Hydrograph	= 58 - P-10B	Max. Elevation	= 257.16 ft
Pond Name	= IB-10B	Max. Storage	= 7,449 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

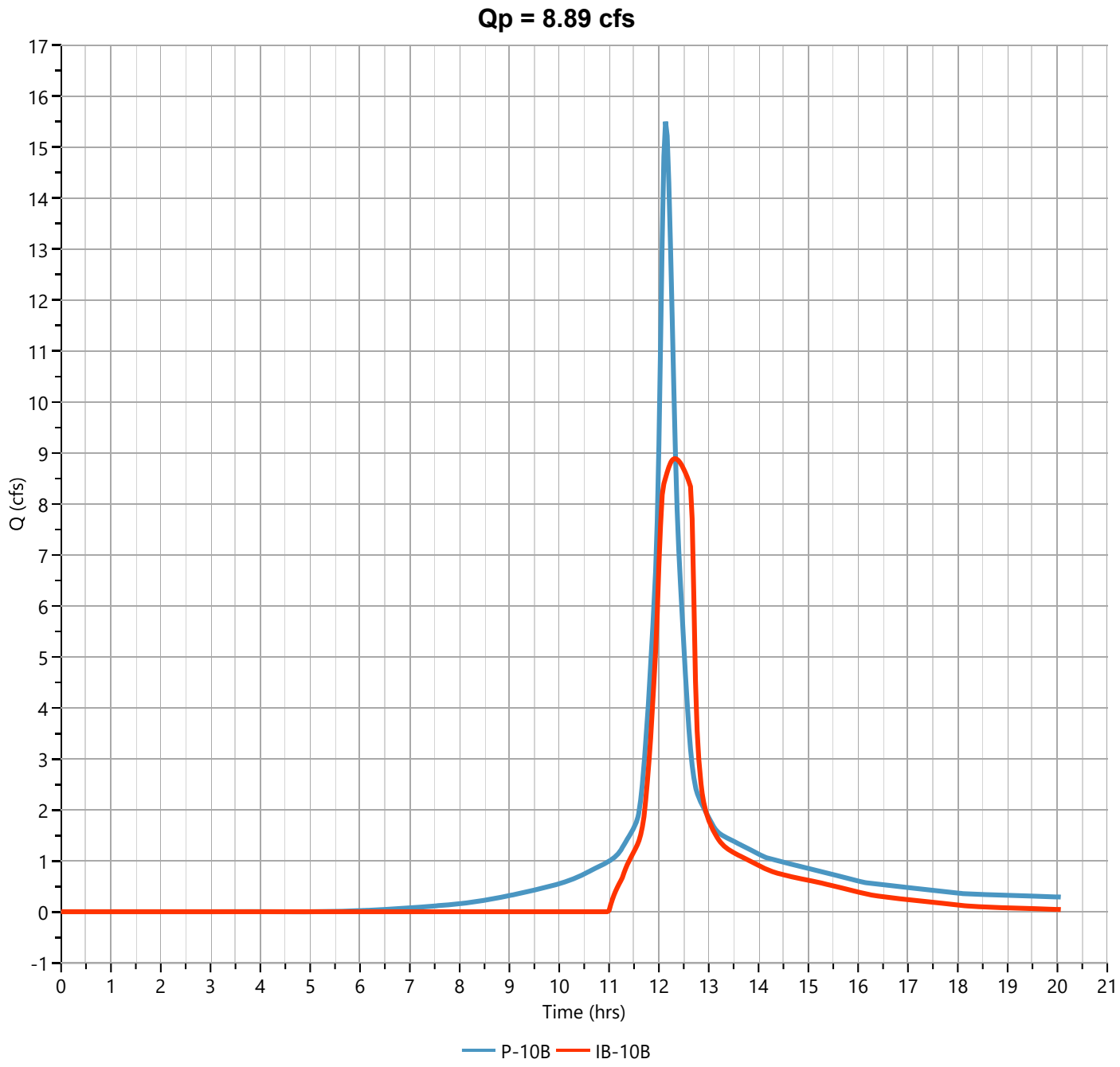
06-29-2022

IB-10B

Hyd. No. 59

Hydrograph Type	= Pond Route	Peak Flow	= 8.891 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 42,154 cuft
Inflow Hydrograph	= 58 - P-10B	Max. Elevation	= 257.60 ft
Pond Name	= IB-10B	Max. Storage	= 10,845 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

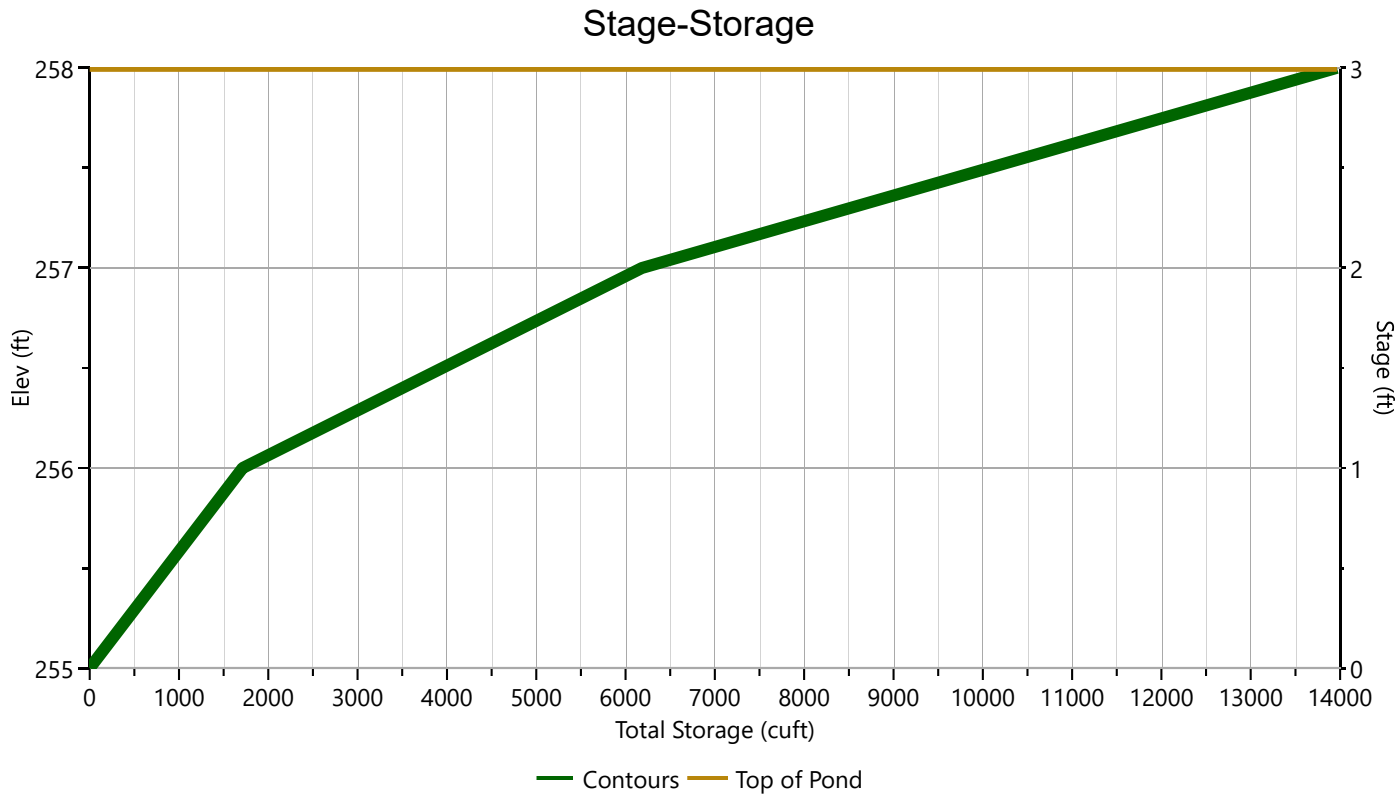
IB-10B

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	255.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	255.00	828	0.000	0.000
1.00	256.00	2,597	1,713	1,713
2.00	257.00	6,344	4,471	6,183
3.00	258.00	9,218	7,781	13,964



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

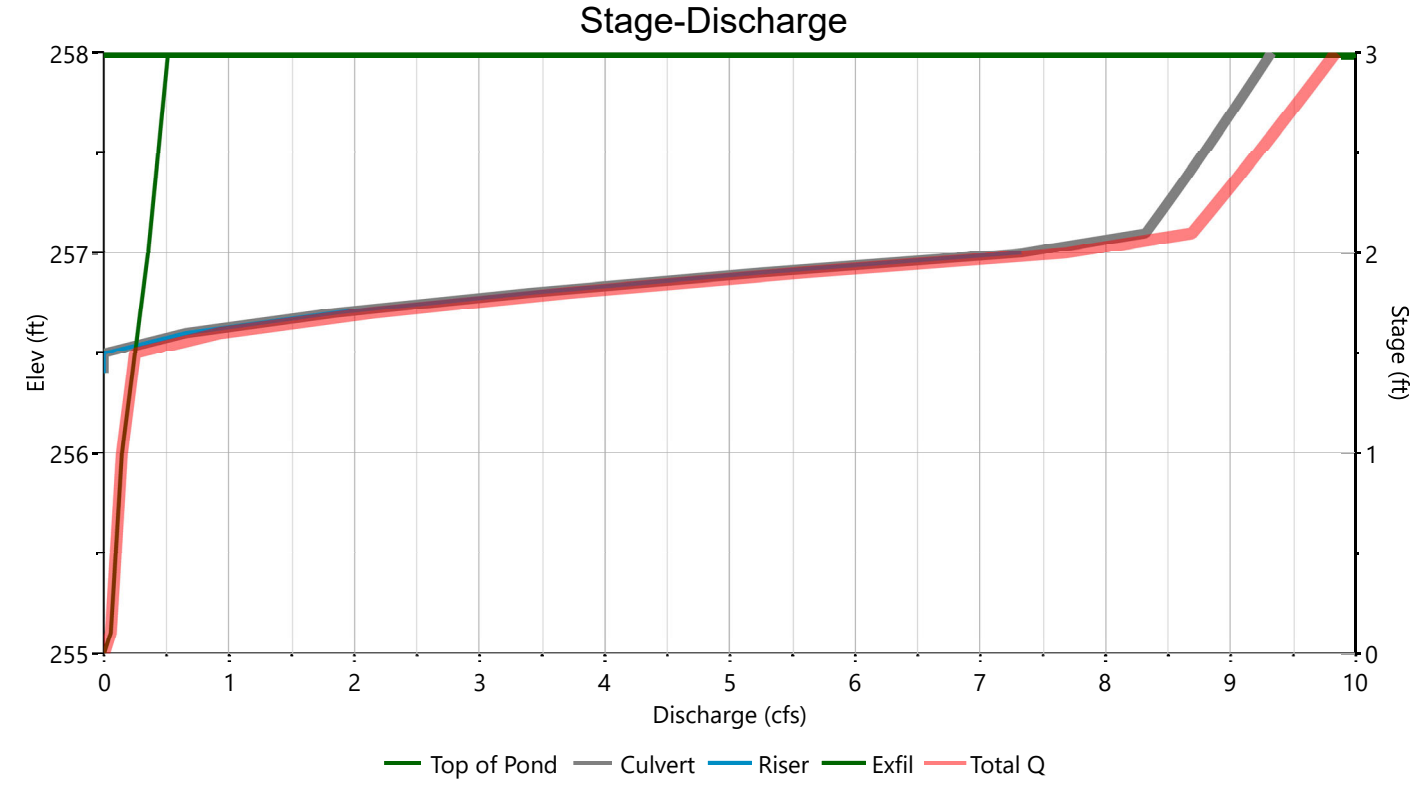
06-29-2022

IB-10B

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate	
		1	2	3		
Rise, in	18				Orifice Dia, in	
Span, in	18				No. Orifices	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	254.50				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	480					
Barrel Slope, %	.5					
N-Value, n	0.013					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular				Exfiltration, in/hr	2.41**
Crest Elevation, ft	256.5					
Crest Length, ft	6.28					
Angle, deg						
Weir Coefficient, Cw	3.3					

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10B

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	255.00	0.000	0.000				0.000					0.000		0.000
1.00	256.00	1,713	0.000 ic				0.000					0.145		0.145
2.00	257.00	6,183	7.327 oc				7.327					0.354		7.681
3.00	258.00	13,964	9.326 oc				0.000					0.514		9.840

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

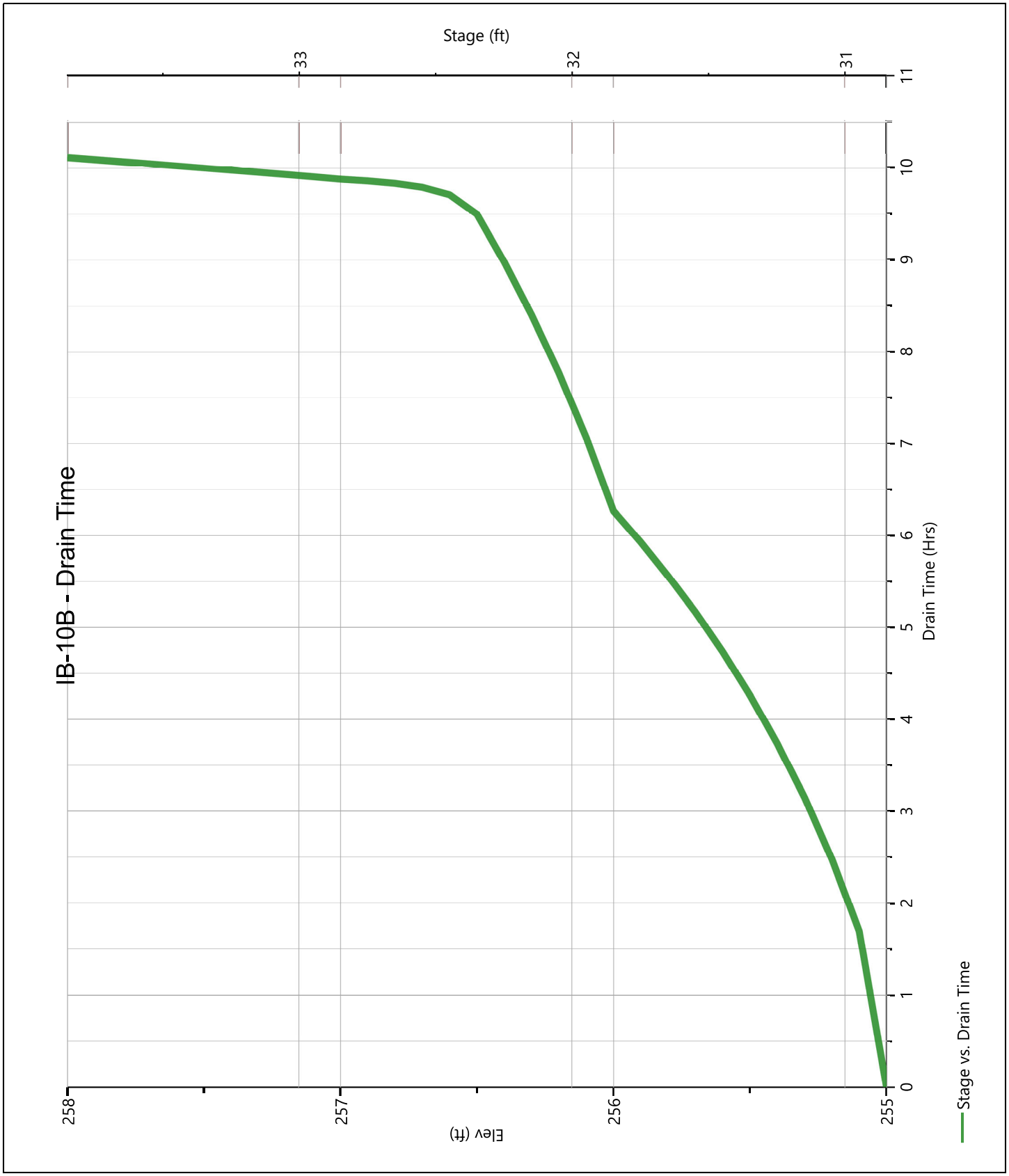
Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10B

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-10C

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			2.47	242.02
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			1.13	78.82
C	Open Space Good Condition	74			3.51	259.64
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.22	16.67
D	Open Space Good Condition	80			0.24	19.17

1/ Use only one CN source per line. 309457 Totals = 7.56 616.31

CN (weighted) = total product / total area = 616.31 / 7.56 = 81.52 ; Use CN = 82

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.56	4.07	5.65

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-10C

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.025			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.26			0.26
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	885			
9. Watercourse slope, s		ft/ft	0.040			
10. Average Velocity, V (figure 3-1)		ft/s	3.23			
11. Tt = L / 3600V	Compute Tt	hr	0.08			0.08
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.34
min 20.4

Hydrograph Report

Project Name:

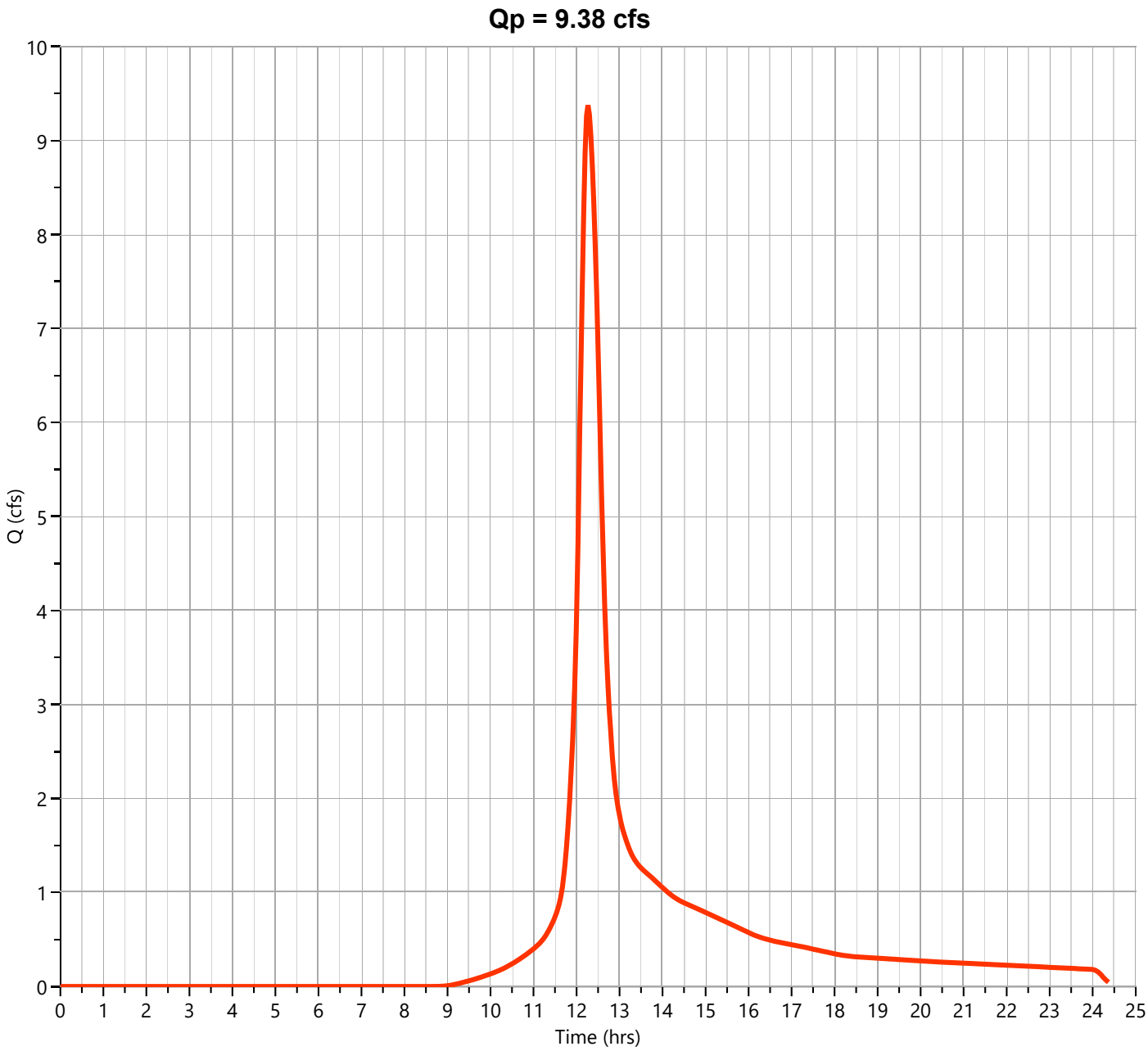
Hydrology Studio v 3.0.0.24

06-29-2022

P-10C

Hyd. No. 60

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.376 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 44,541 cuft
Drainage Area	= 7.56 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 20.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

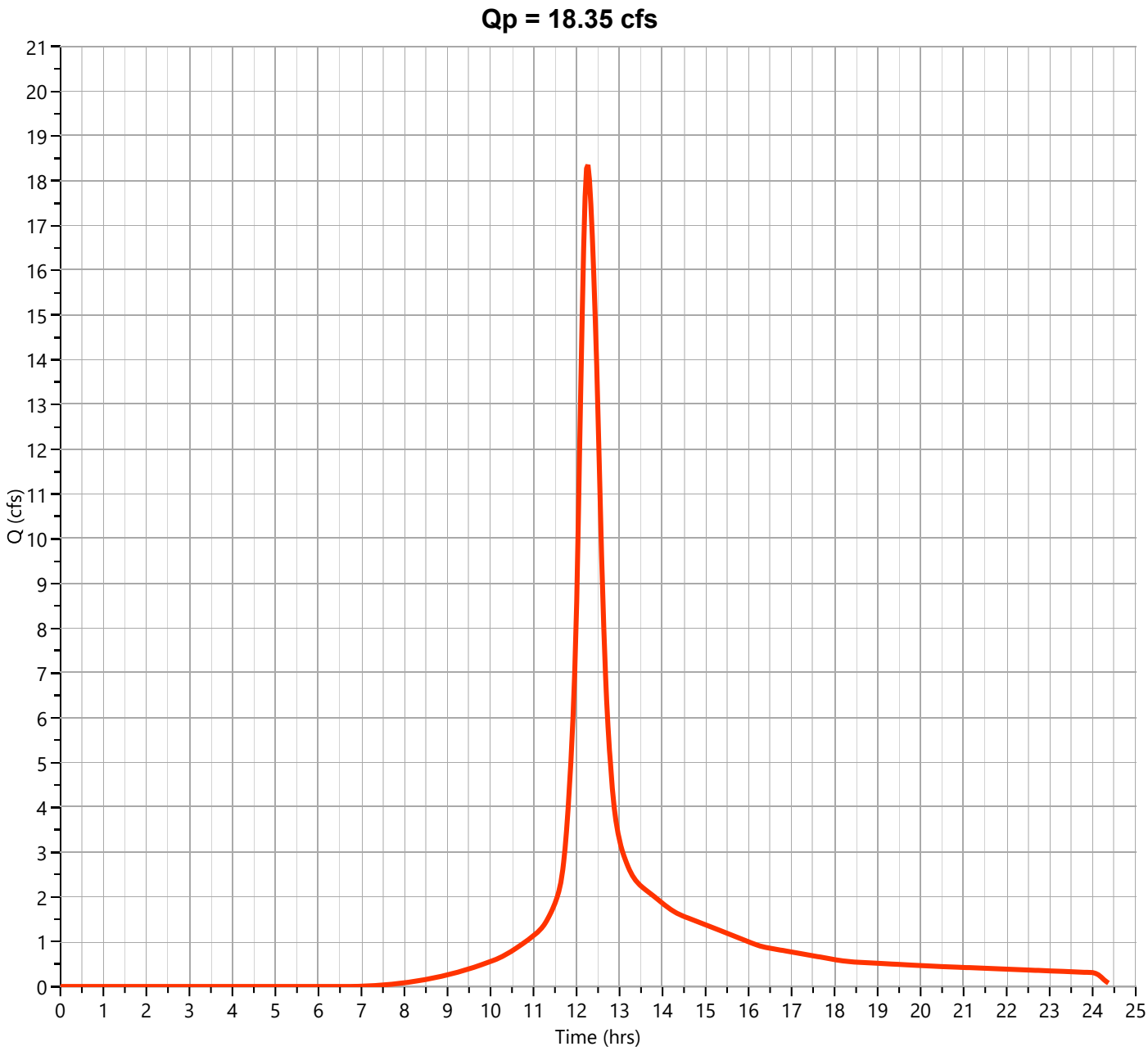
Hydrology Studio v 3.0.0.24

06-29-2022

P-10C

Hyd. No. 60

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.35 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 87,007 cuft
Drainage Area	= 7.56 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 20.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

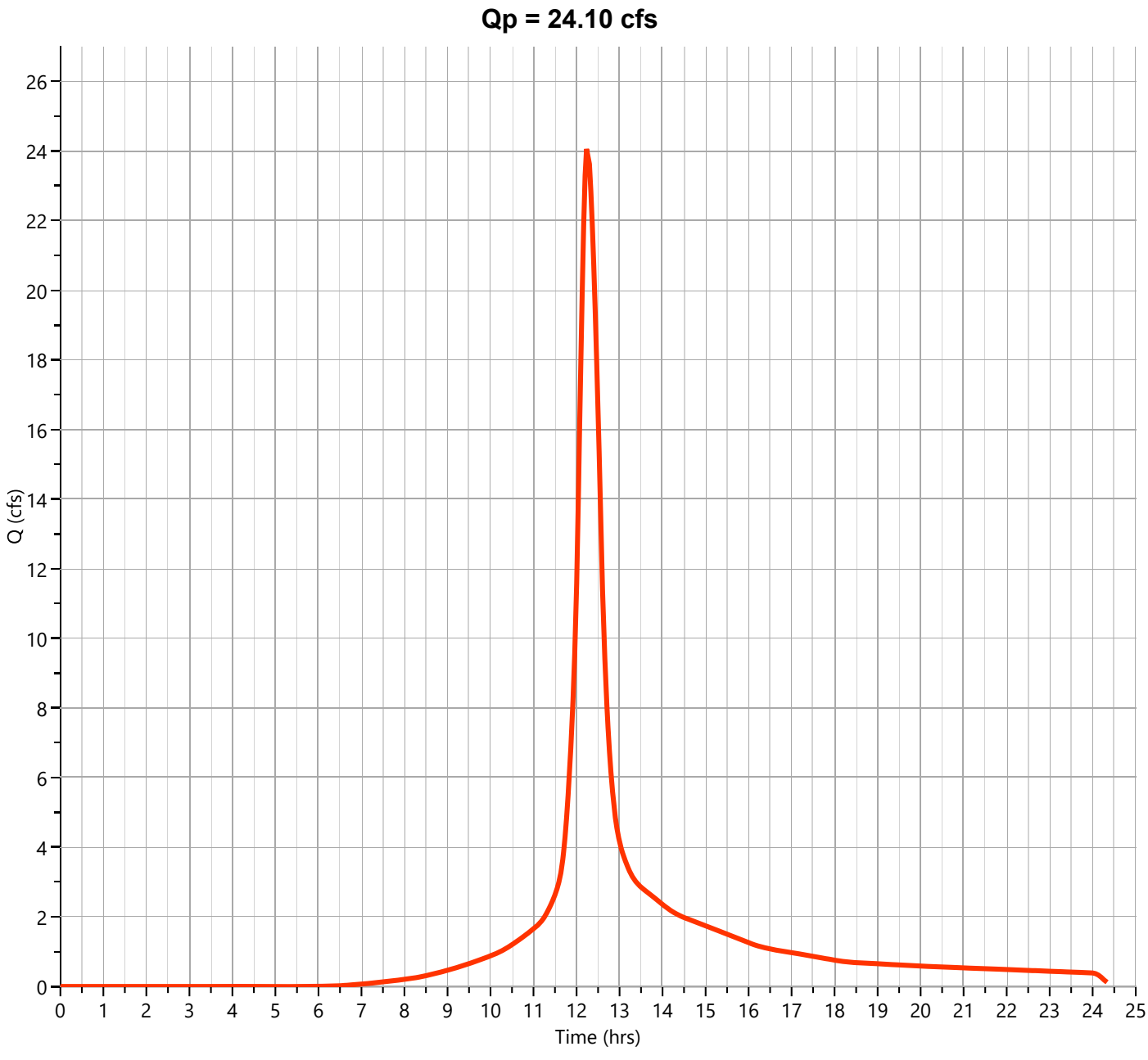
Hydrology Studio v 3.0.0.24

06-29-2022

P-10C

Hyd. No. 60

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.10 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 114,974 cuft
Drainage Area	= 7.56 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 20.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

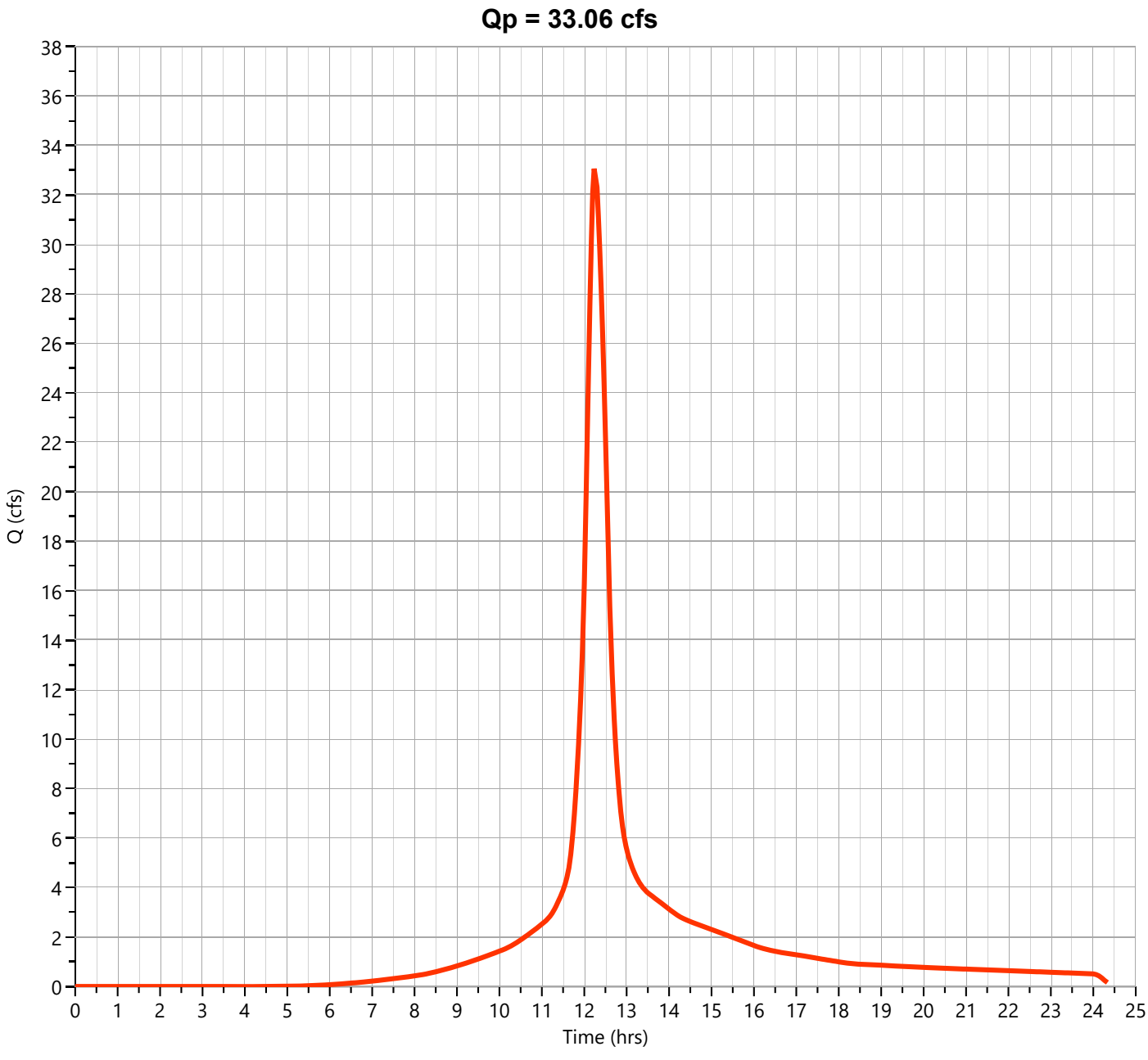
Hydrology Studio v 3.0.0.24

06-29-2022

P-10C

Hyd. No. 60

Hydrograph Type	= NRCS Runoff	Peak Flow	= 33.06 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 159,440 cuft
Drainage Area	= 7.56 ac	Curve Number	= 82
Tc Method	= User	Time of Conc. (Tc)	= 20.4 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

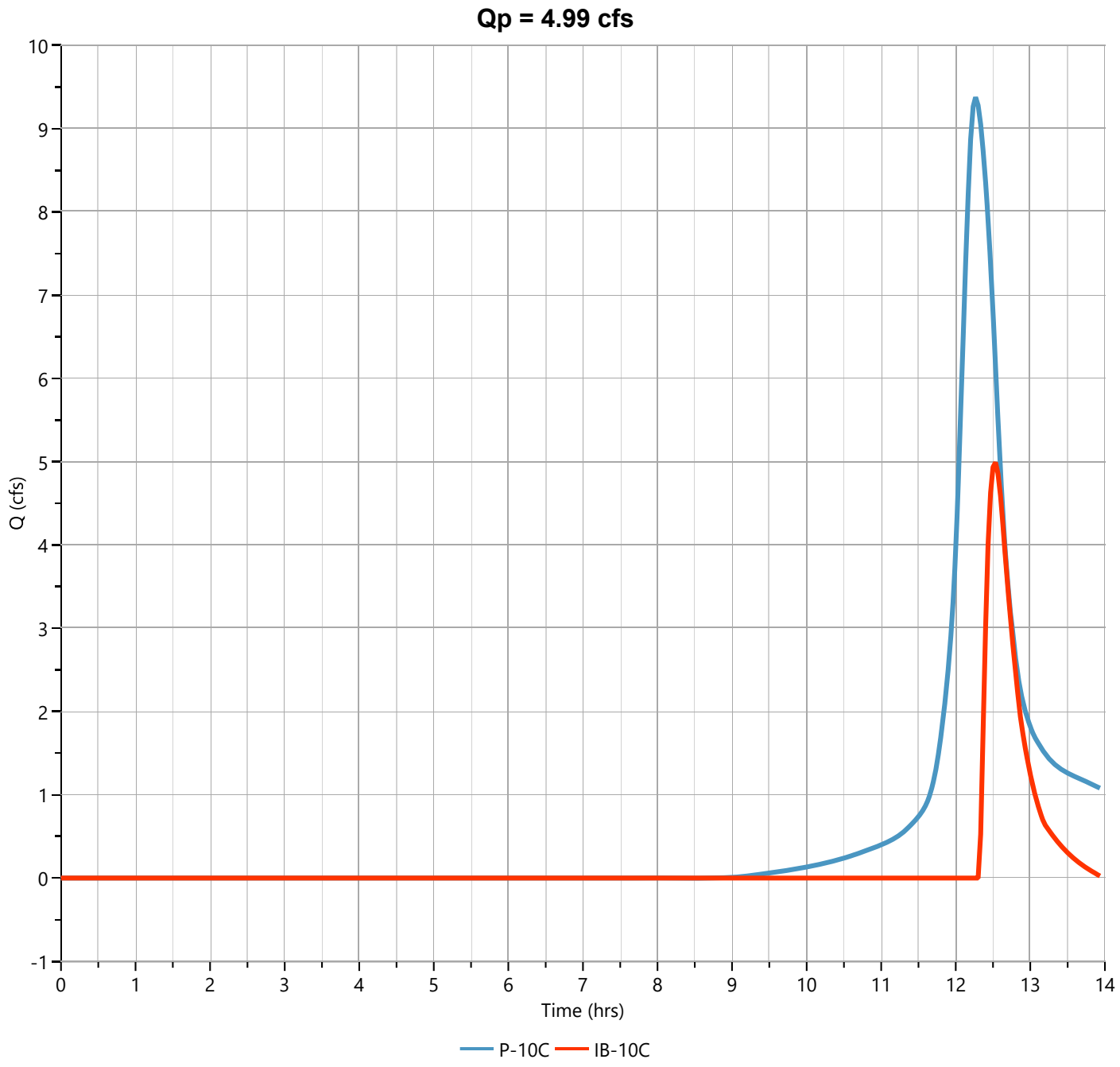
06-29-2022

IB-10C

Hyd. No. 61

Hydrograph Type	= Pond Route	Peak Flow	= 4.990 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Hydrograph Volume	= 8,909 cuft
Inflow Hydrograph	= 60 - P-10C	Max. Elevation	= 228.49 ft
Pond Name	= IB-10C	Max. Storage	= 12,332 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

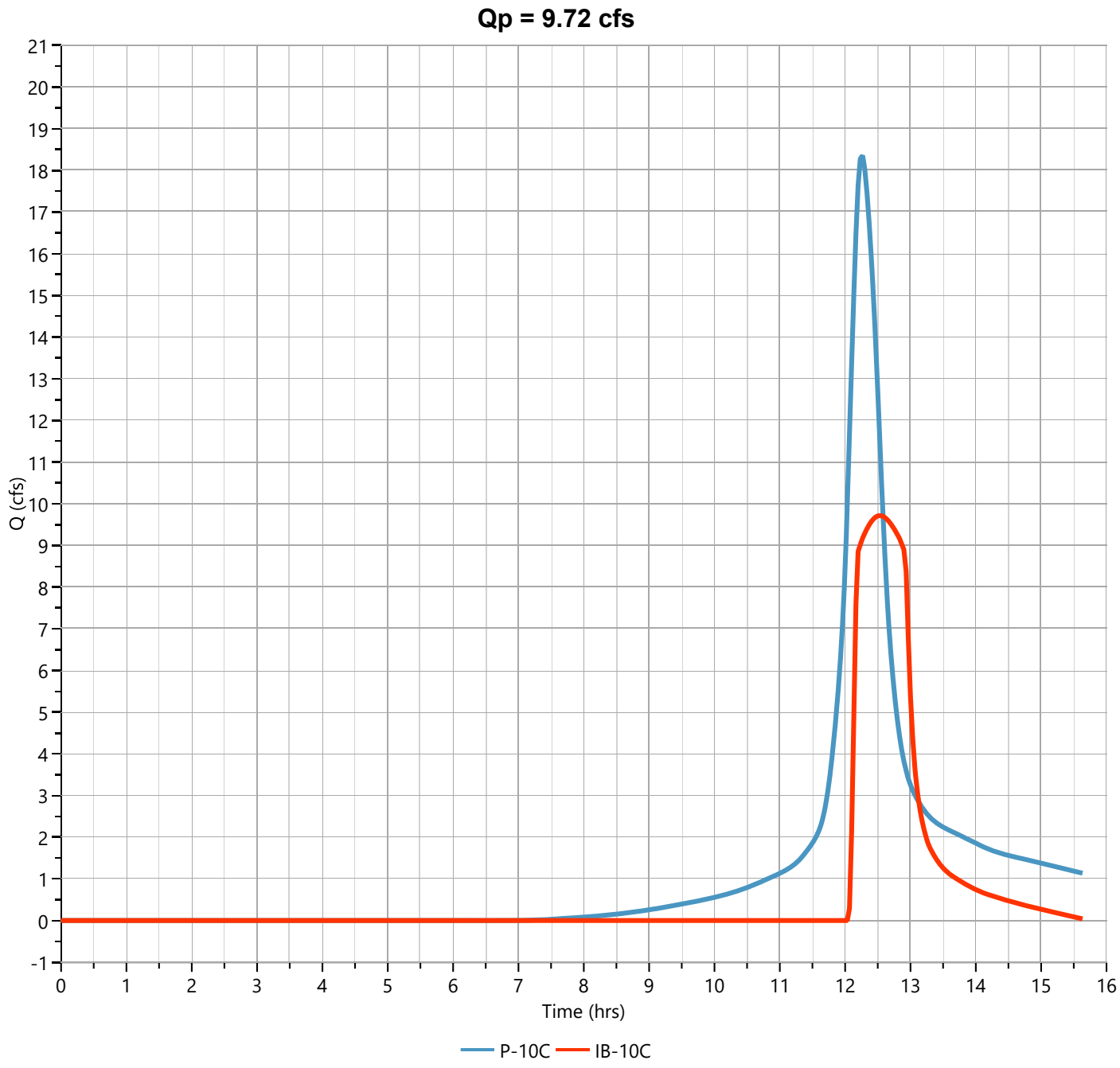
06-29-2022

IB-10C

Hyd. No. 61

Hydrograph Type	= Pond Route	Peak Flow	= 9.716 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Hydrograph Volume	= 36,809 cuft
Inflow Hydrograph	= 60 - P-10C	Max. Elevation	= 229.47 ft
Pond Name	= IB-10C	Max. Storage	= 20,221 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

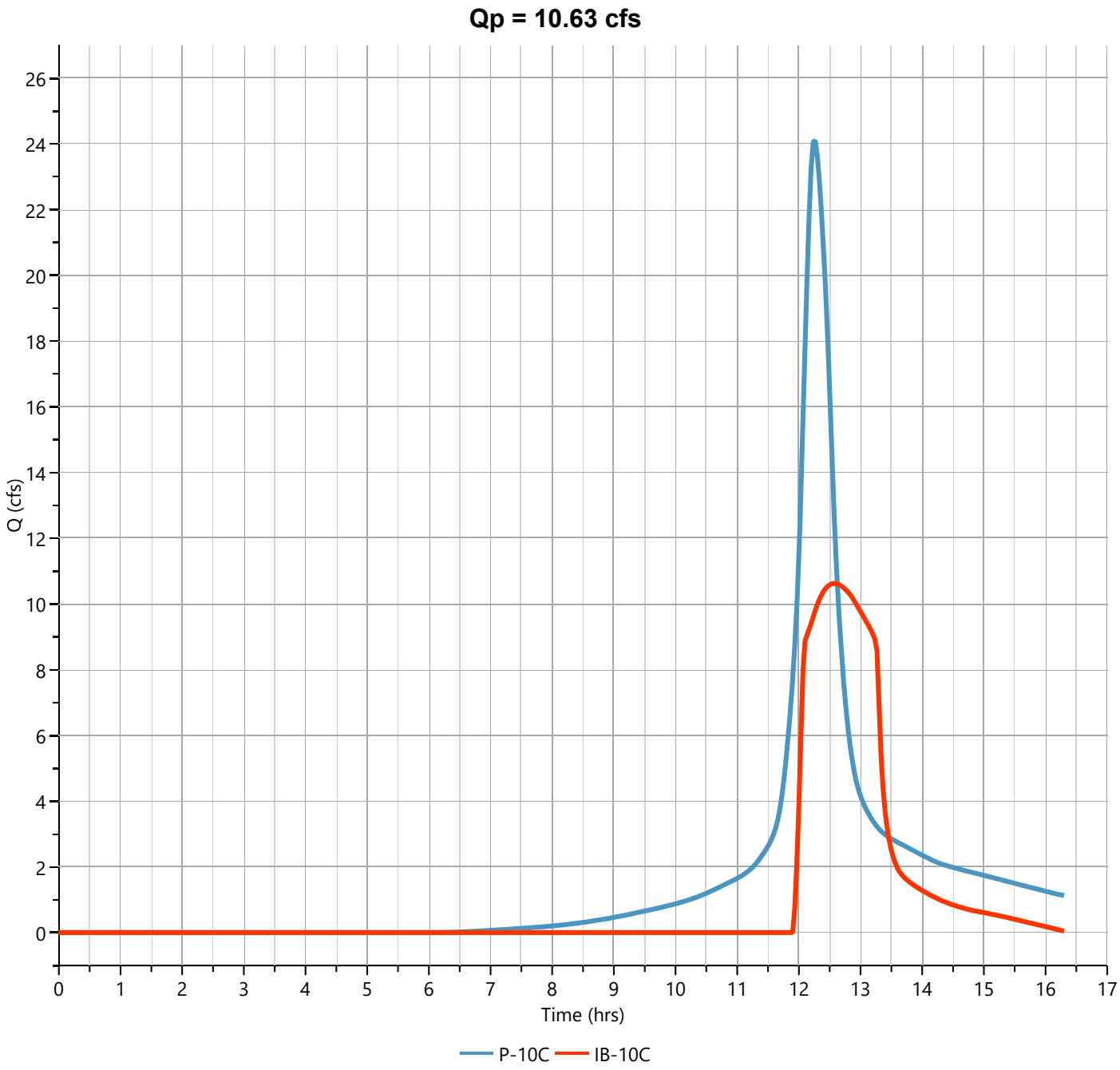
06-29-2022

IB-10C

Hyd. No. 61

Hydrograph Type	= Pond Route	Peak Flow	= 10.63 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 56,437 cuft
Inflow Hydrograph	= 60 - P-10C	Max. Elevation	= 230.32 ft
Pond Name	= IB-10C	Max. Storage	= 28,731 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

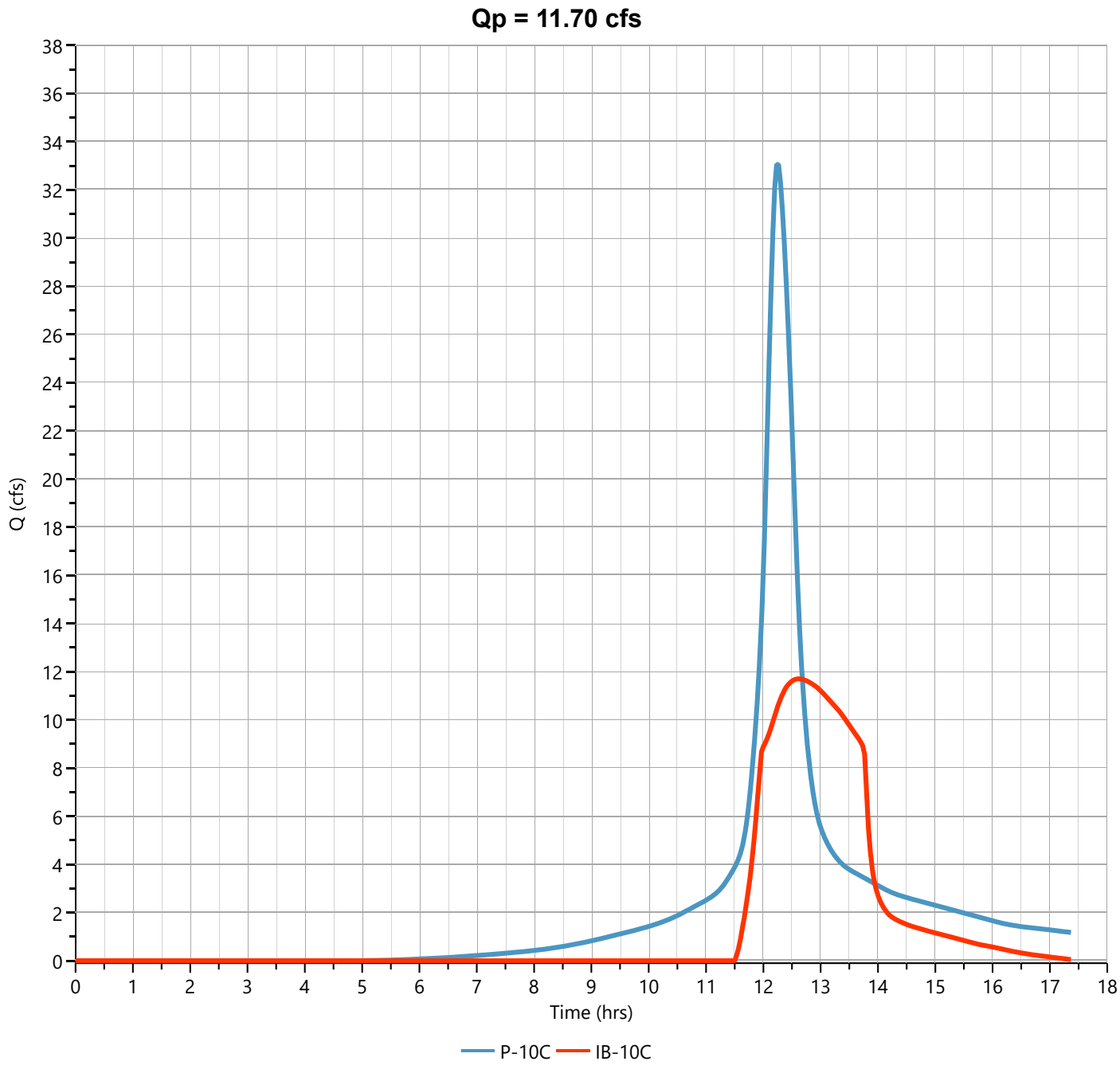
06-29-2022

IB-10C

Hyd. No. 61

Hydrograph Type	= Pond Route	Peak Flow	= 11.70 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 88,306 cuft
Inflow Hydrograph	= 60 - P-10C	Max. Elevation	= 231.41 ft
Pond Name	= IB-10C	Max. Storage	= 43,013 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

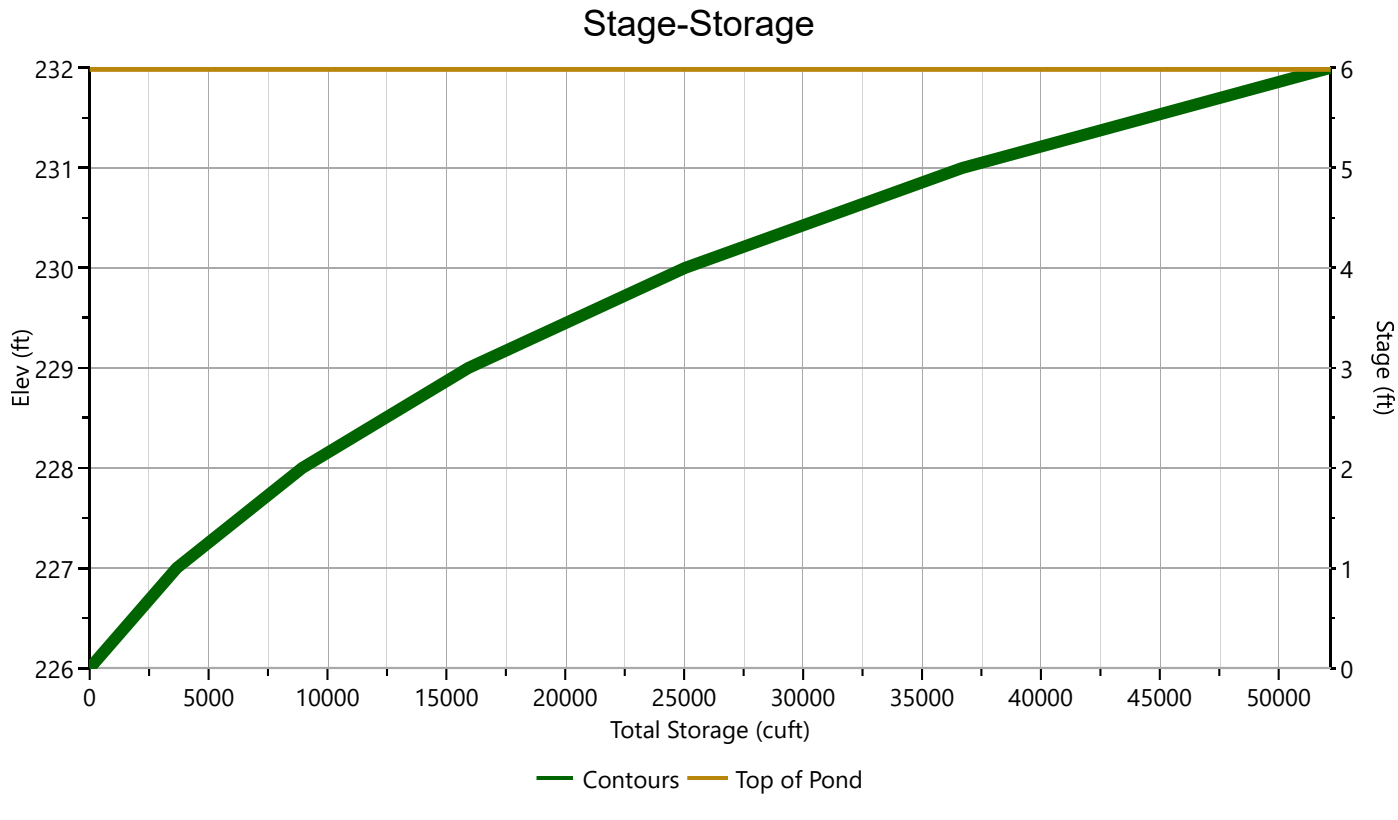
IB-10C

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	226.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	226.00	2,885	0.000	0.000
1.00	227.00	4,440	3,663	3,663
2.00	228.00	6,103	5,272	8,934
3.00	229.00	7,873	6,988	15,922
4.00	230.00	10,325	9,099	25,021
5.00	231.00	13,012	11,669	36,690
6.00	232.00	17,961	15,487	52,176



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

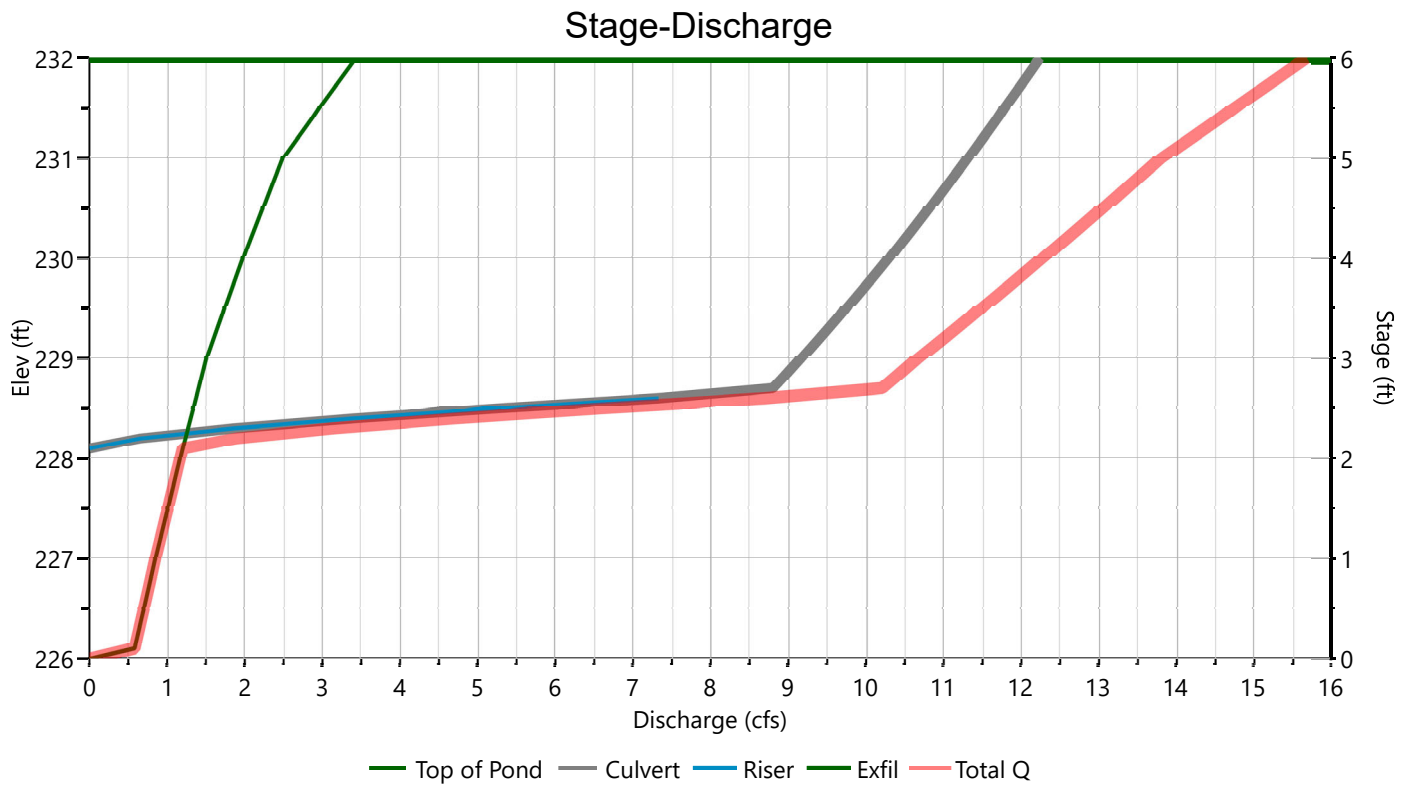
06-29-2022

IB-10C

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Orifice Plate	
		1	2	3		
Rise, in	12				Orifice Dia, in	
Span, in	12				No. Orifices	
No. Barrels	2				Invert Elevation, ft	
Invert Elevation, ft	225.10				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	185					
Barrel Slope, %	.5					
N-Value, n	0.013					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular	Rectangular			Exfiltration, in/hr	8.27**
Crest Elevation, ft	228.1					
Crest Length, ft	6.28					
Angle, deg						
Weir Coefficient, Cw	3.3					

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10C

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	226.00	0.000	0.000				0.000					0.000		0.000
1.00	227.00	3,663	0.000 oc				0.000					0.850		0.850
2.00	228.00	8,934	0.000 oc				0.000					1.168		1.168
3.00	229.00	15,922	9.167 oc				0.000					1.507		10.67
4.00	230.00	25,021	10.30 oc				0.000					1.977		12.27
5.00	231.00	36,690	11.31 oc				0.000					2.491		13.80
6.00	232.00	52,176	12.24 oc				0.000					3.438		15.68

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

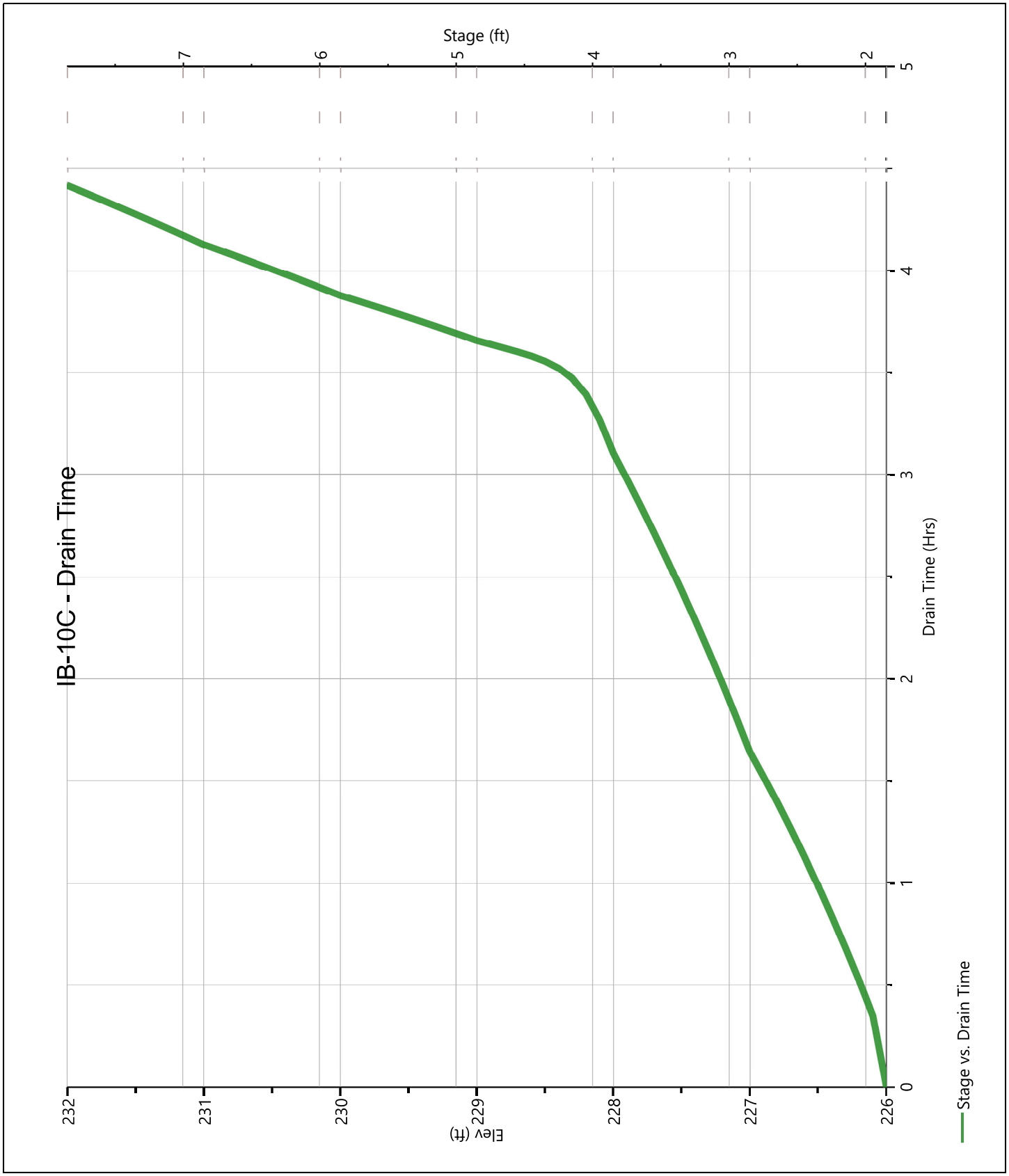
Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10C

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-10D

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			1.92	188.48
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.04	2.88
C	Open Space Good Condition	74			2.36	174.50
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
D	Open Space Good Condition	80			0.02	1.25

1/ Use only one CN source per line. 188293 Totals = 4.34 367.12

CN (weighted) = total product / total area = 367.12 / 4.34 = 84.62 ; Use CN = 85

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	1.79	4.39	6.01

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-10D
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.040			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.11			0.11
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	607			
9. Watercourse slope, s		ft/ft	0.040			
10. Average Velocity, V (figure 3-1)		ft/s	3.23			
11. Tt = L / 3600V	Compute Tt	hr	0.05			0.05
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.16
min 9.4

Hydrograph Report

Project Name:

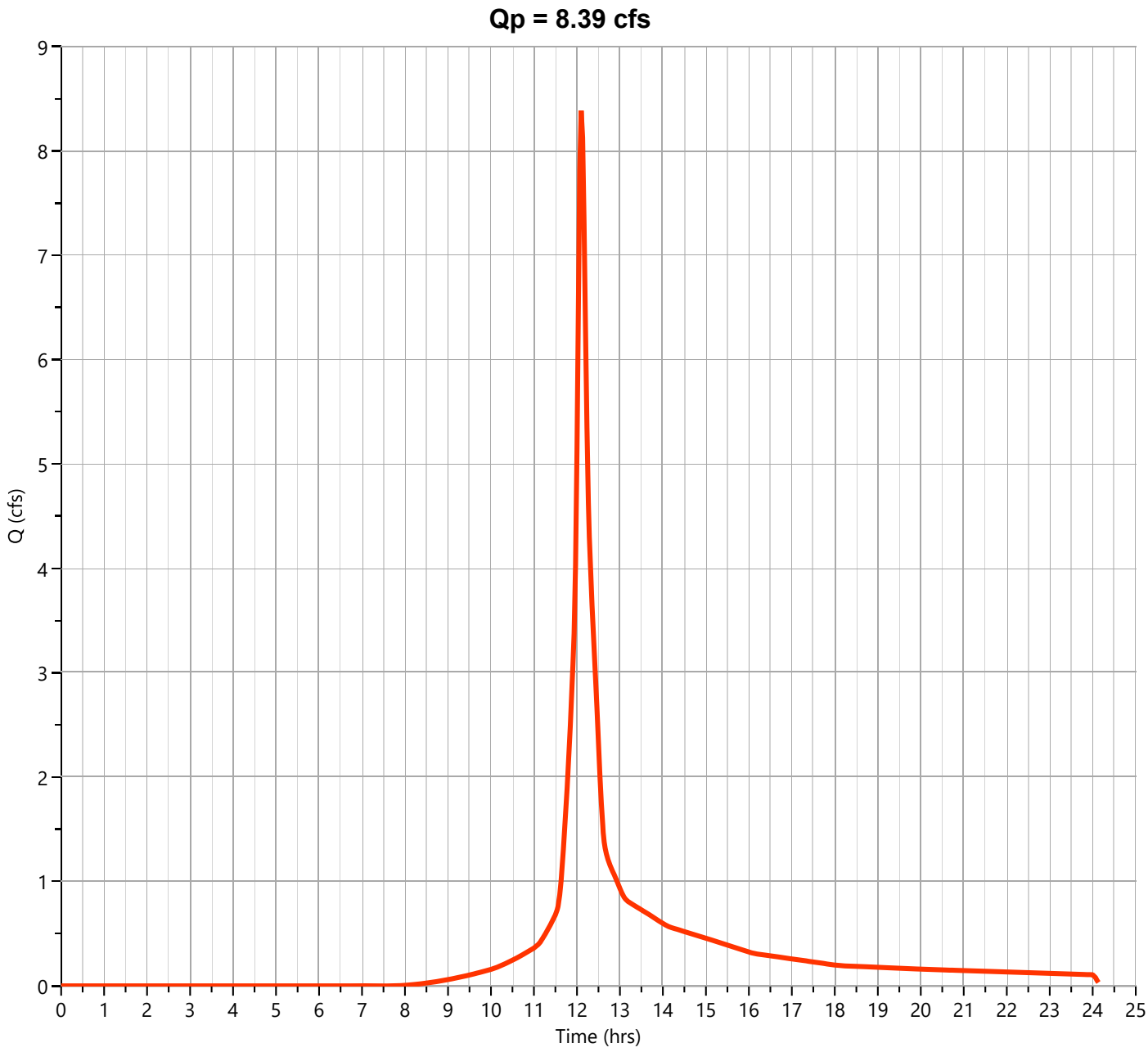
Hydrology Studio v 3.0.0.24

06-29-2022

P-10D

Hyd. No. 62

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.386 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 28,634 cuft
Drainage Area	= 4.34 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 9.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

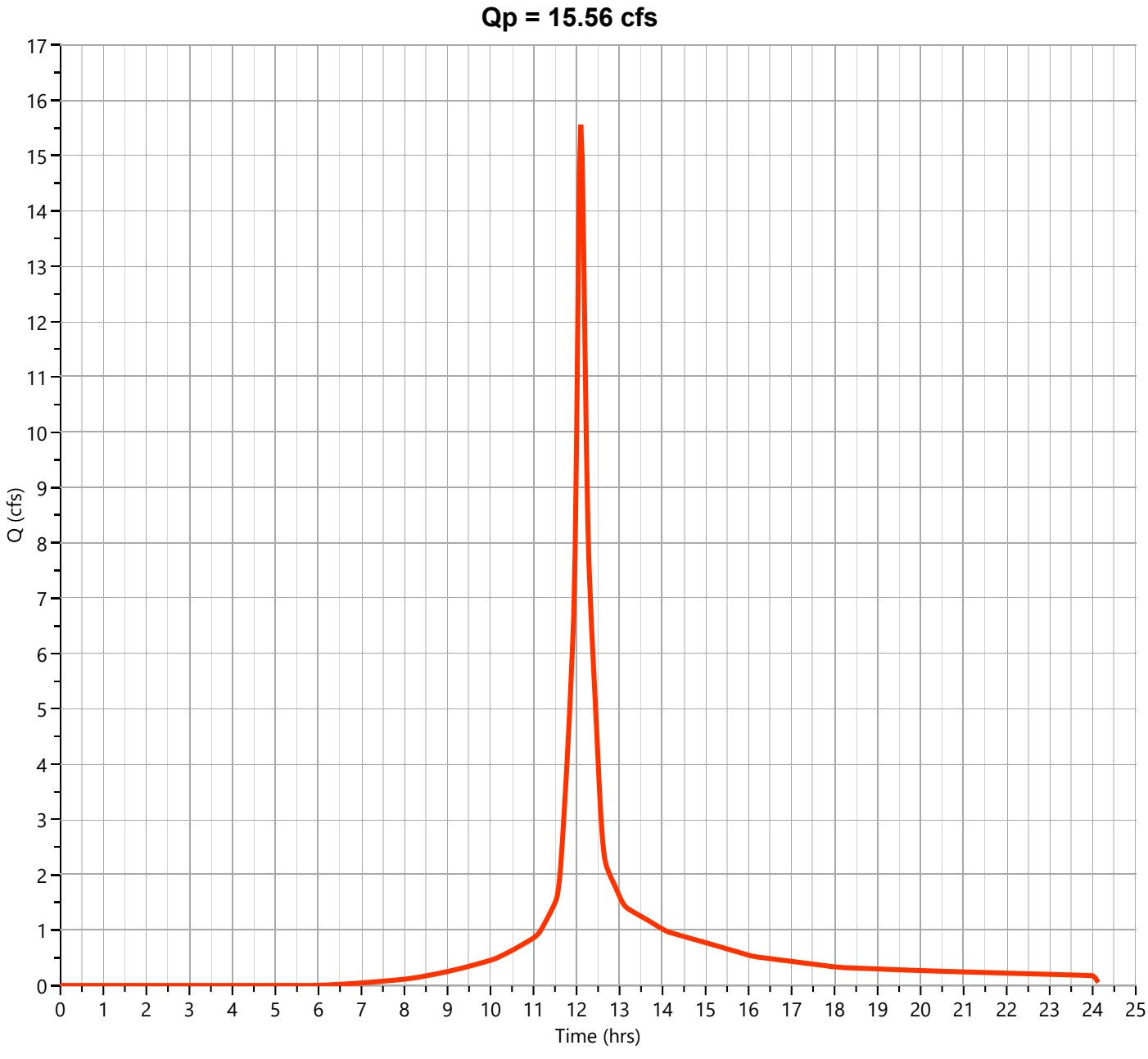
Hydrology Studio v 3.0.0.24

06-29-2022

P-10D

Hyd. No. 62

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.56 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 53,644 cuft
Drainage Area	= 4.34 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 9.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

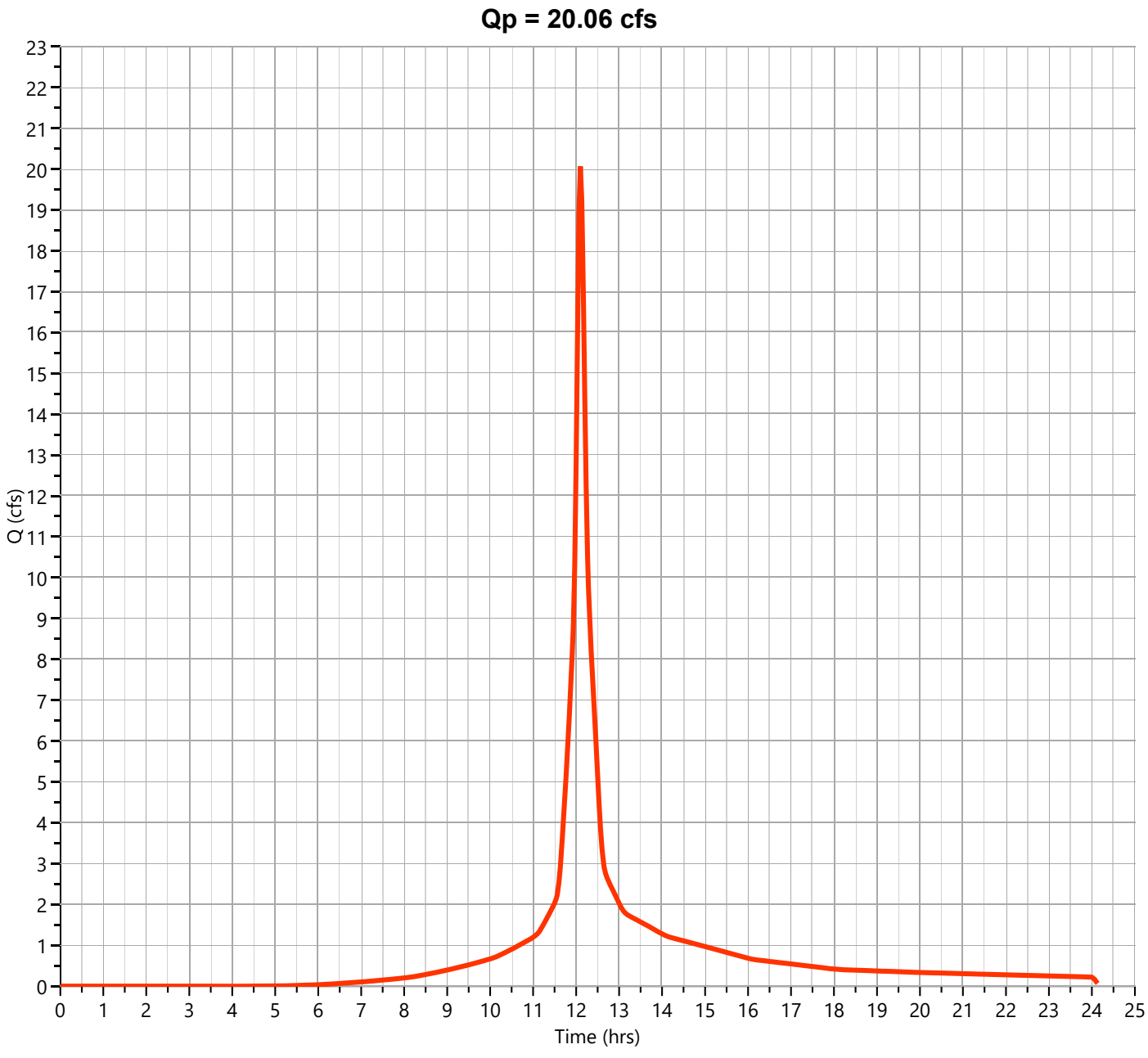
Hydrology Studio v 3.0.0.24

06-29-2022

P-10D

Hyd. No. 62

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.06 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 69,866 cuft
Drainage Area	= 4.34 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 9.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

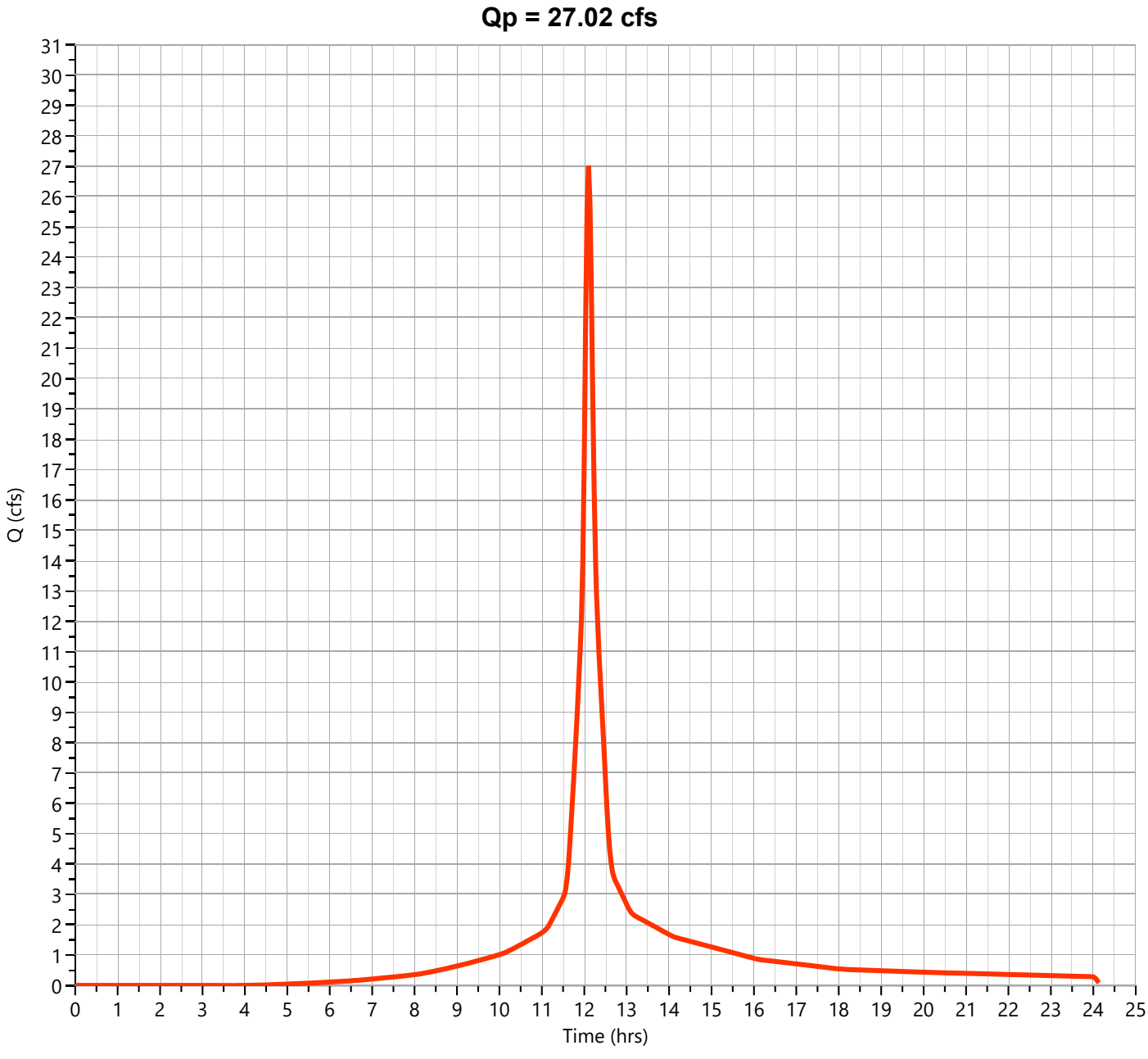
Hydrology Studio v 3.0.0.24

06-29-2022

P-10D

Hyd. No. 62

Hydrograph Type	= NRCS Runoff	Peak Flow	= 27.02 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 95,454 cuft
Drainage Area	= 4.34 ac	Curve Number	= 85
Tc Method	= User	Time of Conc. (Tc)	= 9.4 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

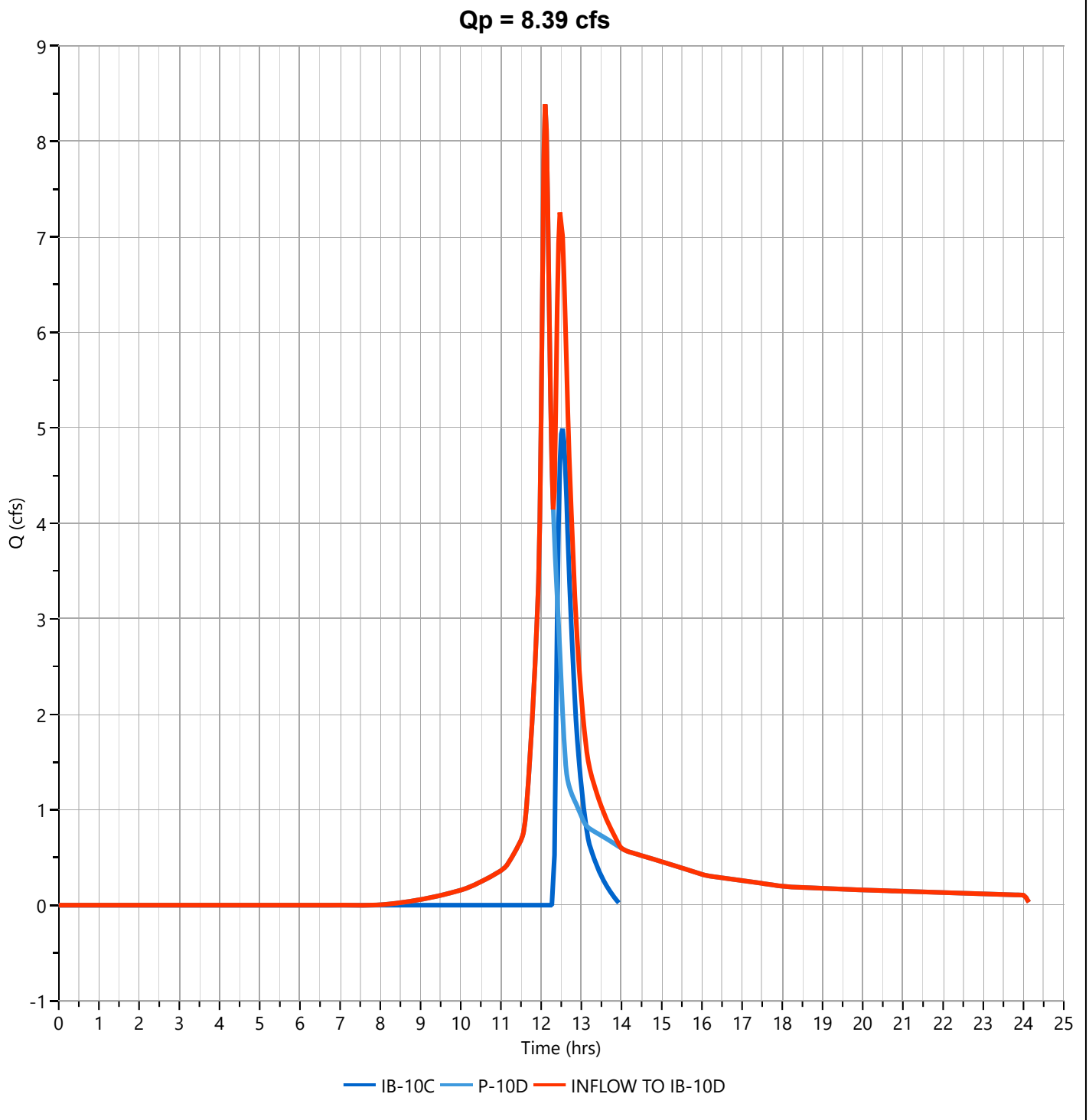
Hydrology Studio v 3.0.0.24

06-29-2022

INFLOW TO IB-10D

Hyd. No. 63

Hydrograph Type	= Junction	Peak Flow	= 8.386 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 37,542 cuft
Inflow Hydrographs	= 61, 62	Total Contrib. Area	= 4.34 ac



Hydrograph Report

Project Name:

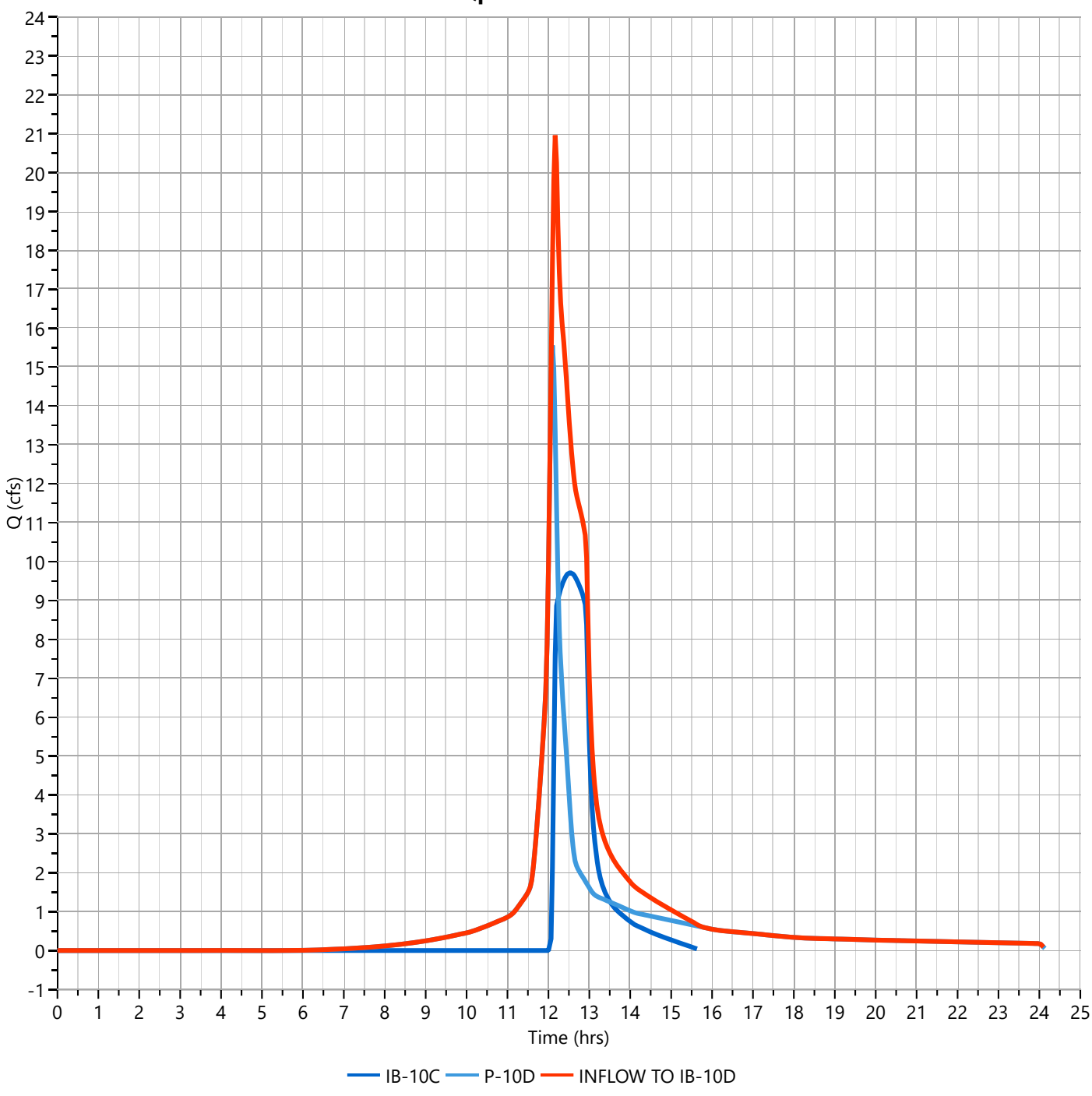
Hydrology Studio v 3.0.0.24

06-29-2022

INFLOW TO IB-10D

Hyd. No. 63

Hydrograph Type	= Junction	Peak Flow	= 20.96 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 90,453 cuft
Inflow Hydrographs	= 61, 62	Total Contrib. Area	= 4.34 ac



Hydrograph Report

Project Name:

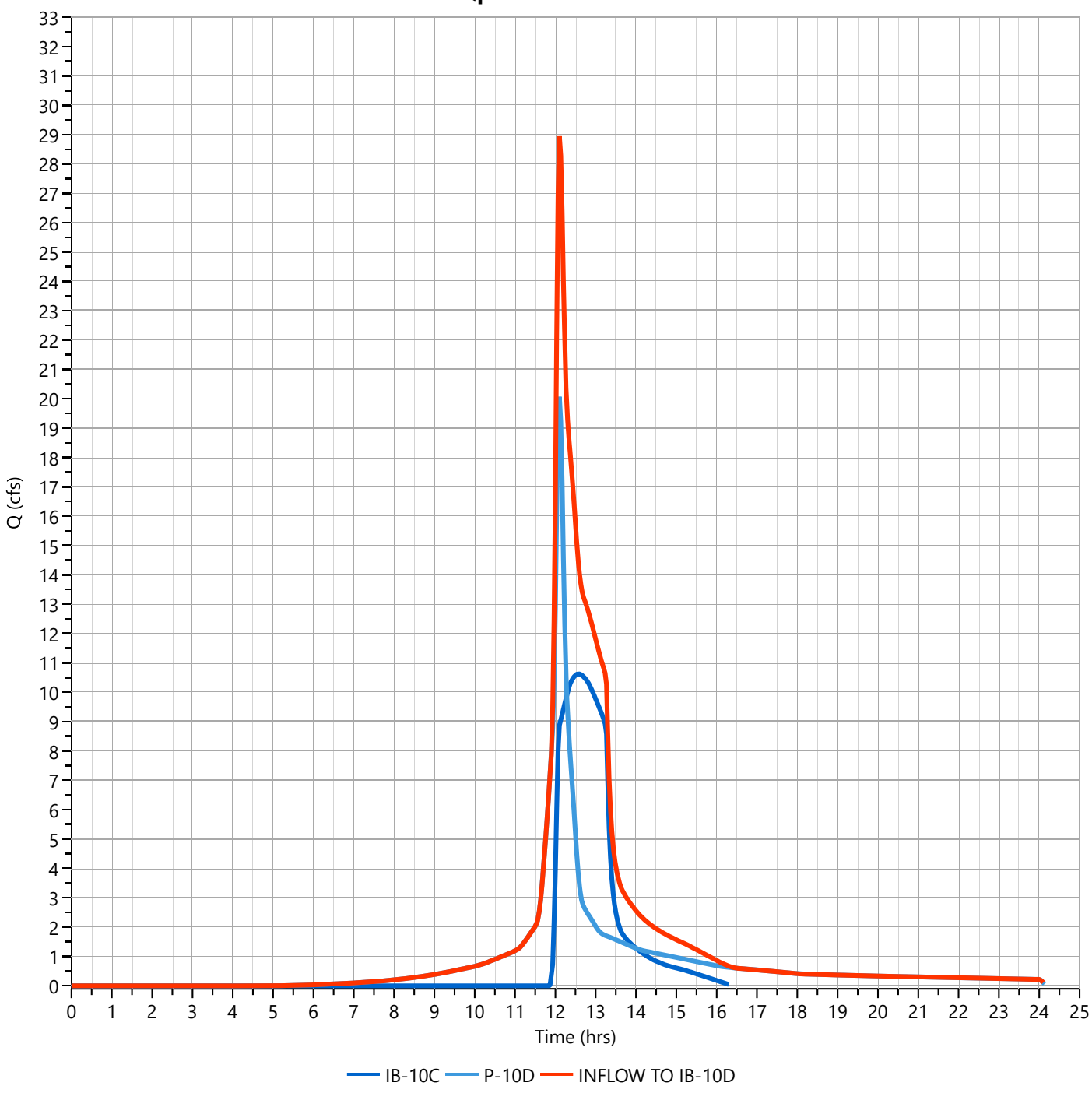
Hydrology Studio v 3.0.0.24

06-29-2022

INFLOW TO IB-10D

Hyd. No. 63

Hydrograph Type	= Junction	Peak Flow	= 28.94 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 126,303 cuft
Inflow Hydrographs	= 61, 62	Total Contrib. Area	= 4.34 ac



Hydrograph Report

Project Name:

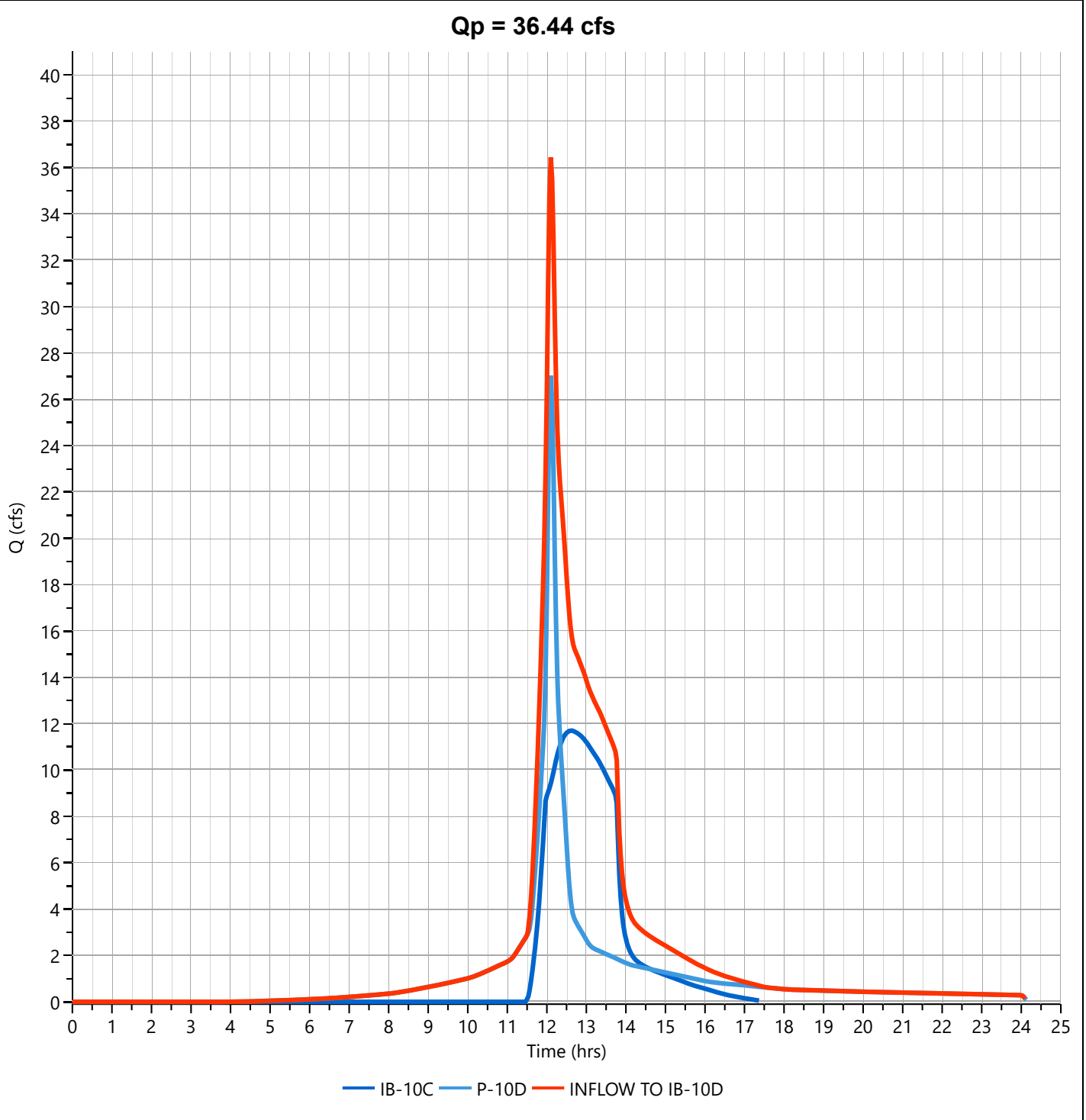
Hydrology Studio v 3.0.0.24

06-29-2022

INFLOW TO IB-10D

Hyd. No. 63

Hydrograph Type	= Junction	Peak Flow	= 36.44 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 183,760 cuft
Inflow Hydrographs	= 61, 62	Total Contrib. Area	= 4.34 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

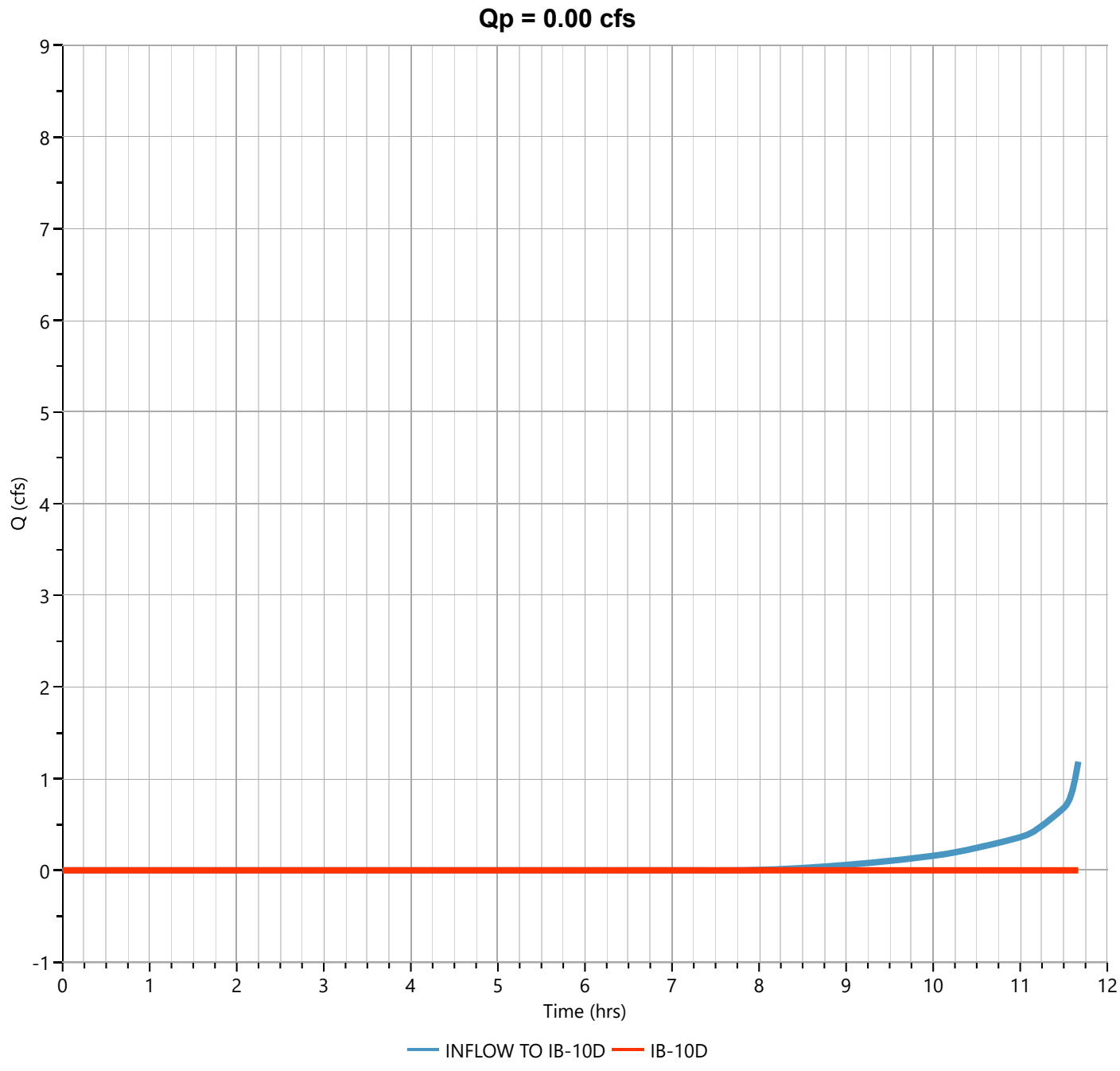
06-29-2022

IB-10D

Hyd. No. 64

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 11.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 63 - INFLOW TO IB-10D	Max. Elevation	= 226.74 ft
Pond Name	= IB-10D	Max. Storage	= 16,894 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

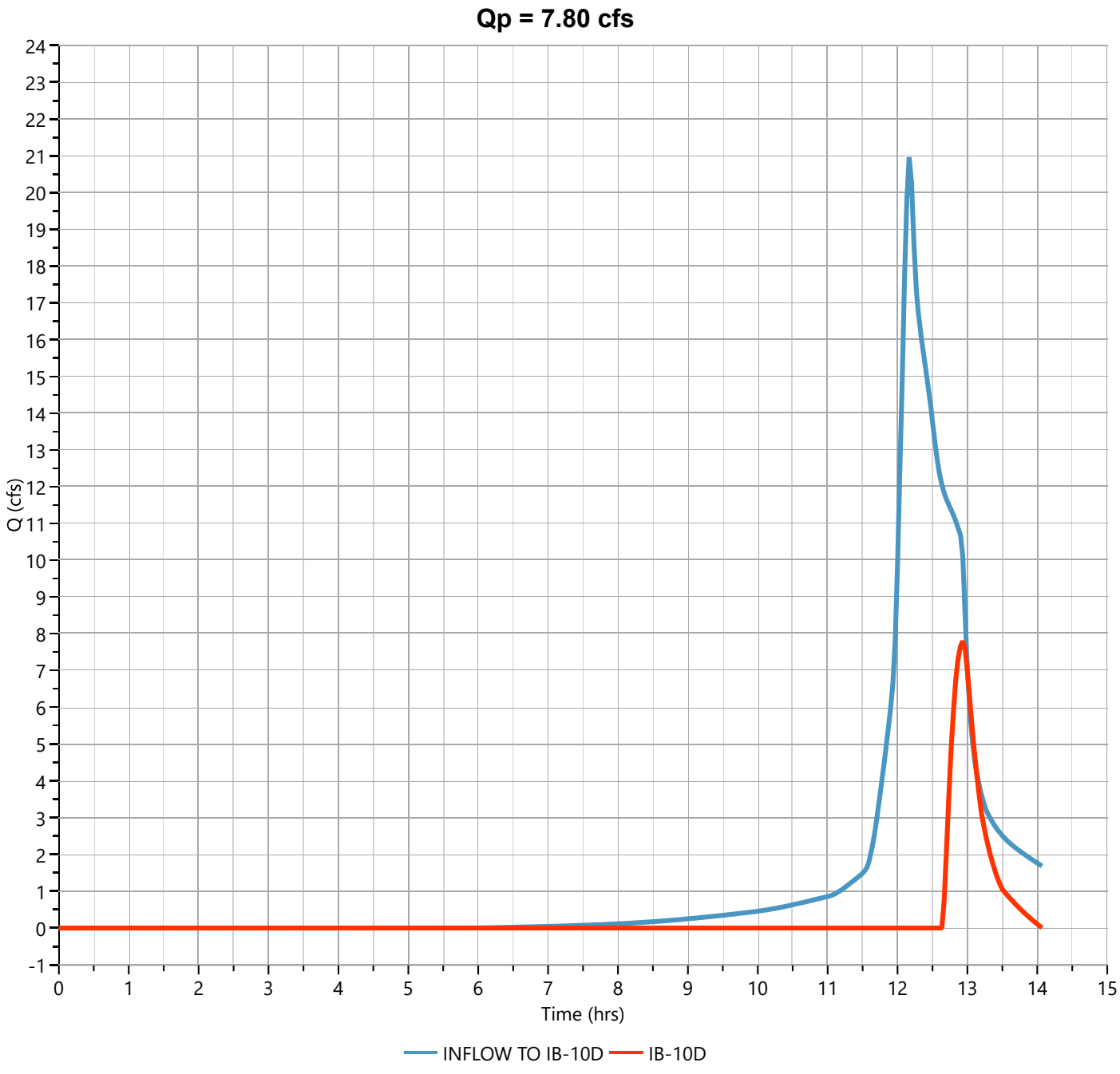
06-29-2022

IB-10D

Hyd. No. 64

Hydrograph Type	= Pond Route	Peak Flow	= 7.799 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 13,514 cuft
Inflow Hydrograph	= 63 - INFLOW TO IB-10D	Max. Elevation	= 229.36 ft
Pond Name	= IB-10D	Max. Storage	= 42,634 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

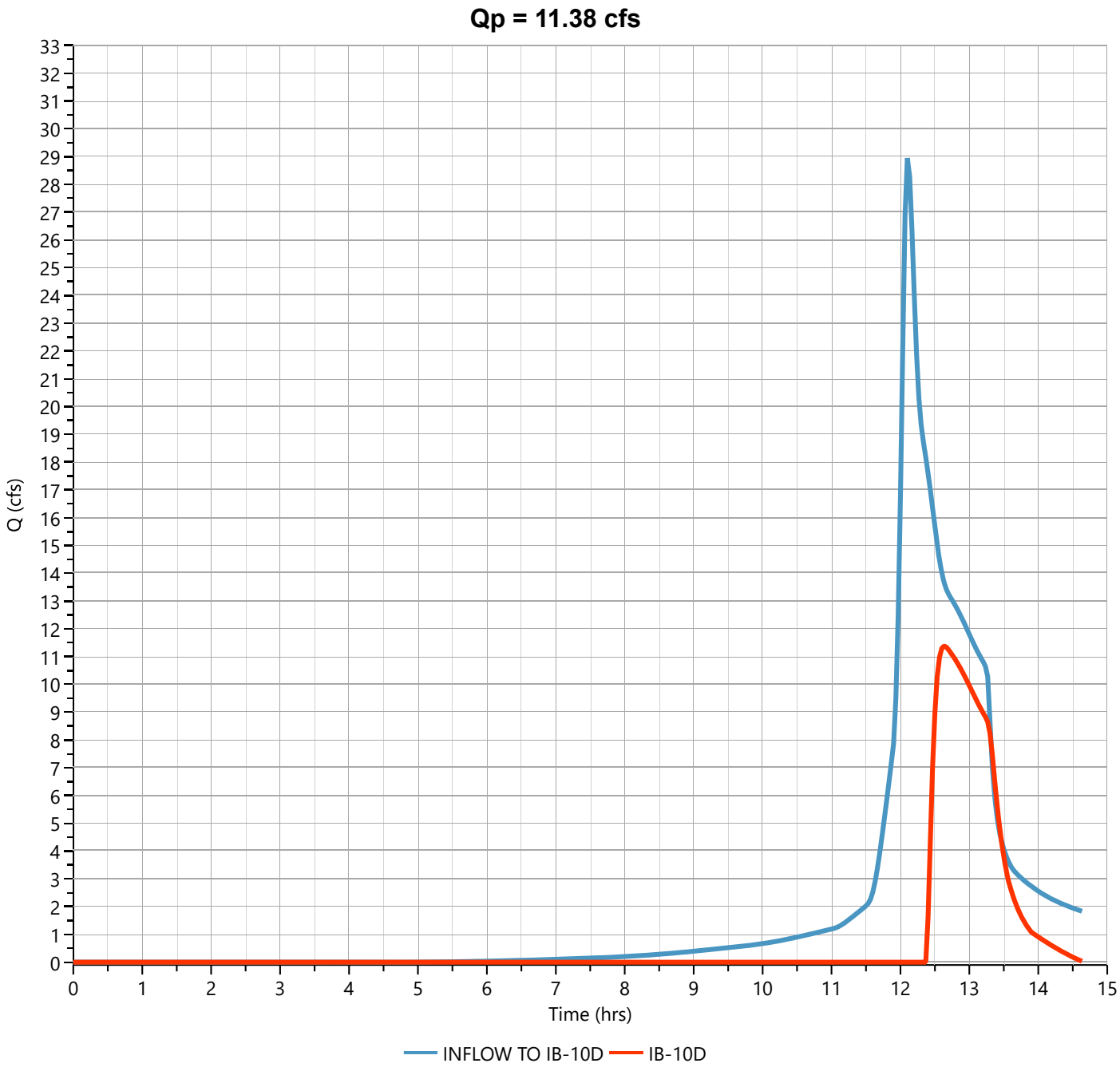
IB-10D

Hyd. No. 64

Hydrograph Type	= Pond Route	Peak Flow	= 11.38 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 39,938 cuft
Inflow Hydrograph	= 63 - INFLOW TO IB-10D	Max. Elevation	= 229.46 ft
Pond Name	= IB-10D	Max. Storage	= 43,807 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

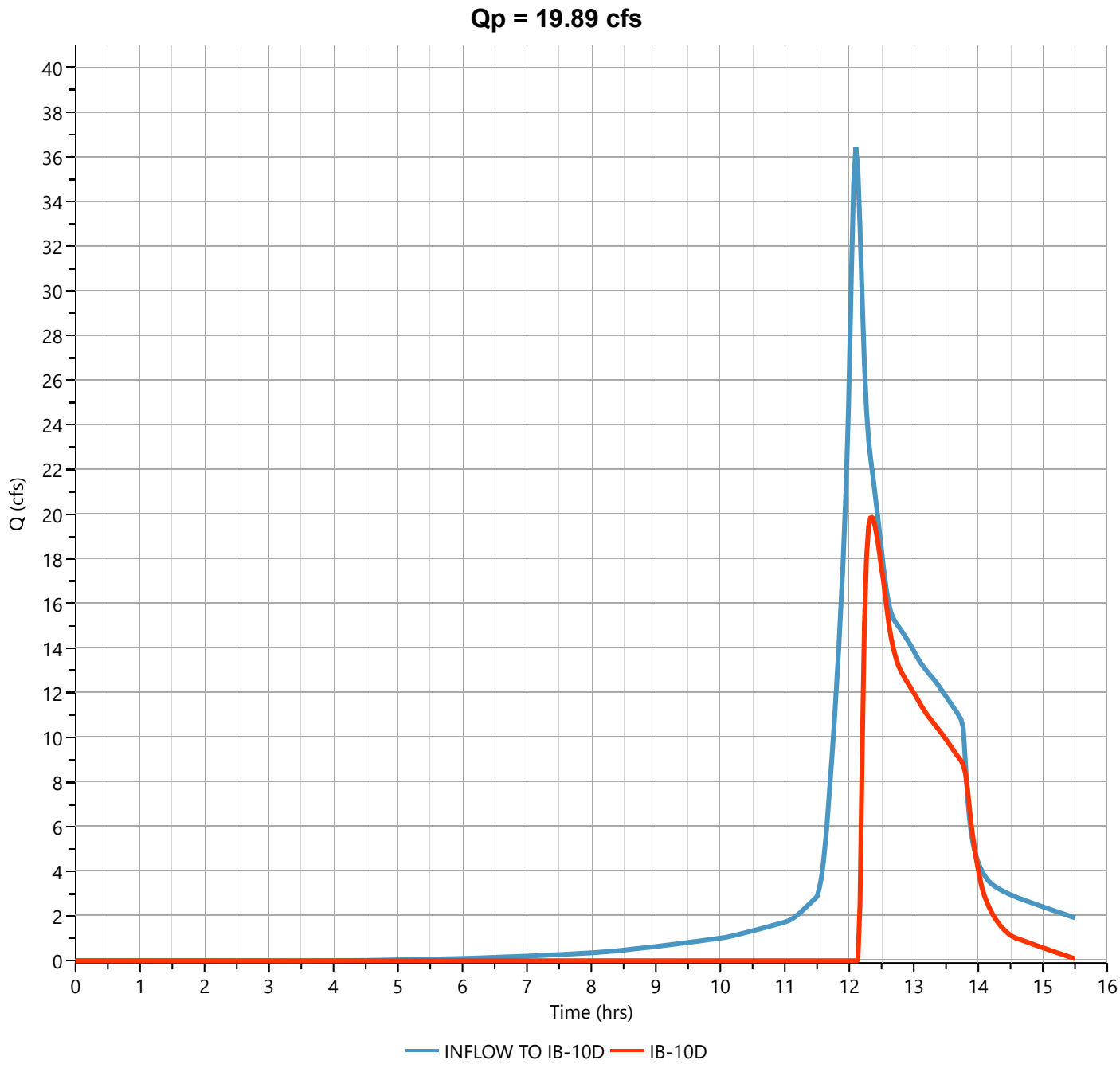
IB-10D

Hyd. No. 64

Hydrograph Type	= Pond Route	Peak Flow	= 19.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 85,240 cuft
Inflow Hydrograph	= 63 - INFLOW TO IB-10D	Max. Elevation	= 229.65 ft
Pond Name	= IB-10D	Max. Storage	= 46,089 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

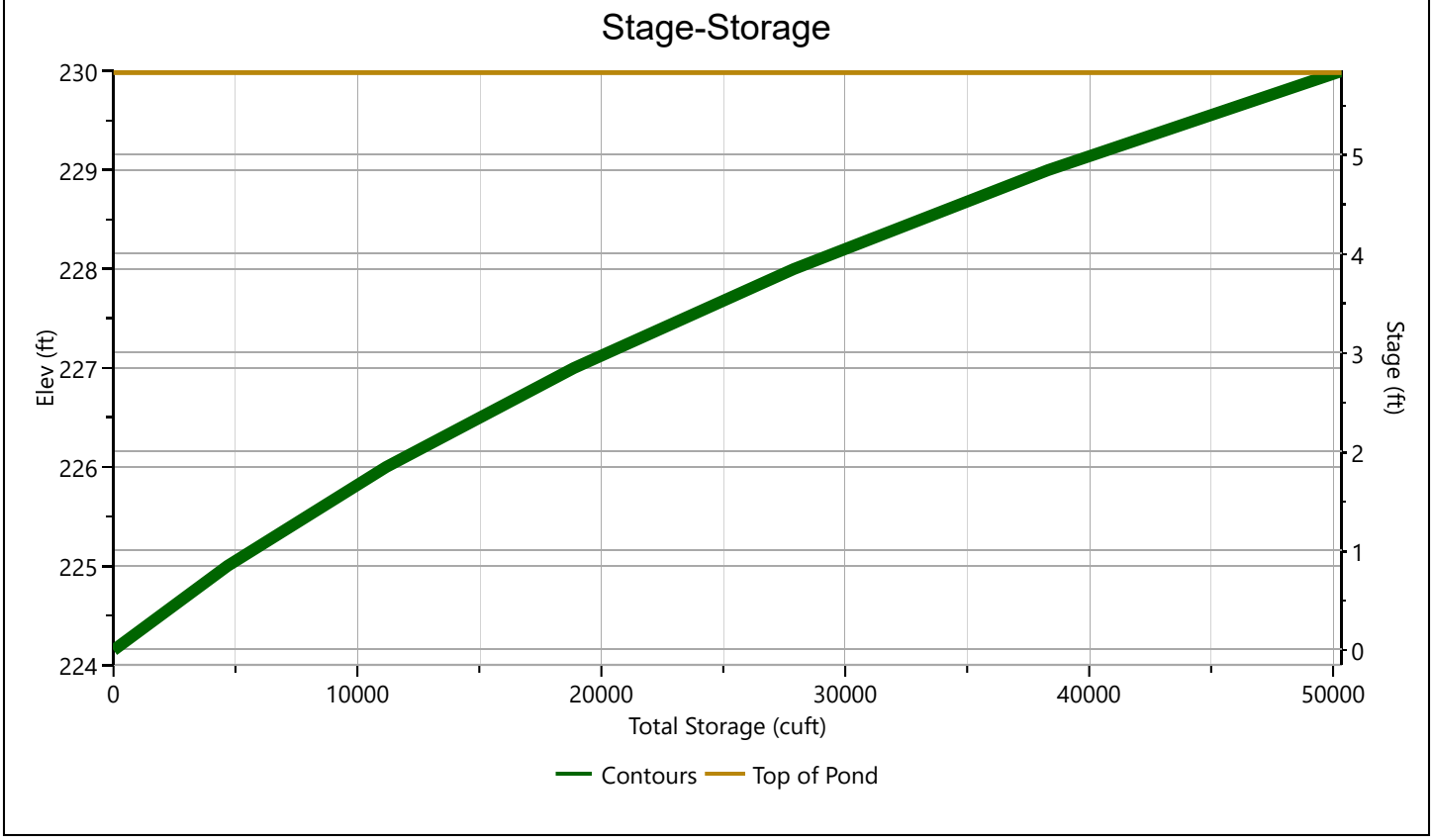
IB-10D

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	224.15
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	224.15	5,049	0.000	0.000
0.85	225.00	5,946	4,673	4,673
1.85	226.00	7,069	6,508	11,180
2.85	227.00	8,320	7,695	18,875
3.85	228.00	9,698	9,009	27,884
4.85	229.00	11,148	10,423	38,307
5.85	230.00	12,922	12,035	50,342



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

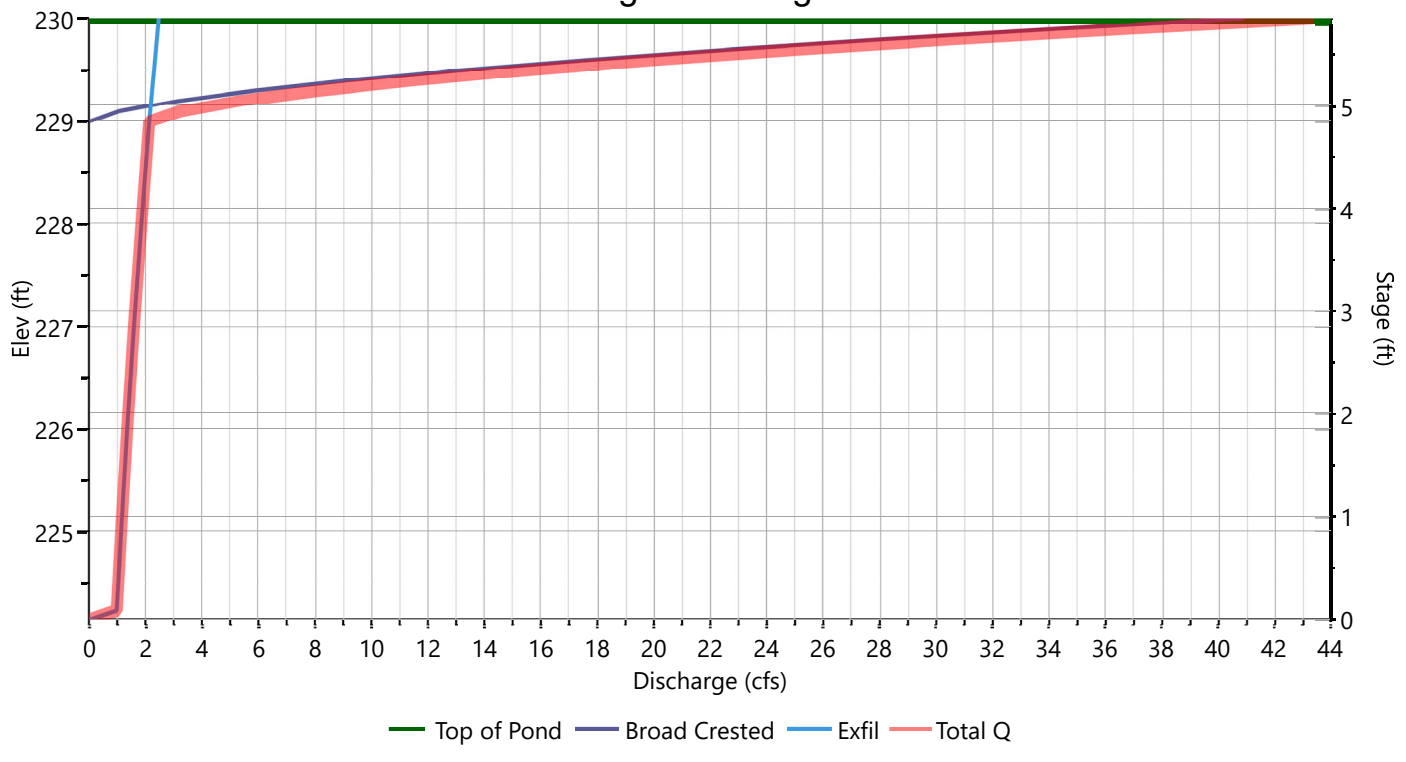
06-29-2022

IB-10D

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular	Broad Crested			Exfiltration, in/hr	8.27**
Crest Elevation, ft		229				
Crest Length, ft		10				
Angle, deg		18.4 (3:1)				
Weir Coefficient, Cw		3.3				

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10D

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	224.15	0.000						0.000				0.000		0.000
0.85	225.00	4,673						0.000				1.138		1.138
1.85	226.00	11,180						0.000				1.353		1.353
2.85	227.00	18,875						0.000				1.593		1.593
3.85	228.00	27,884						0.000				1.857		1.857
4.85	229.00	38,307						0.000				2.134		2.134
5.85	230.00	50,342						40.92				2.474		43.39

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

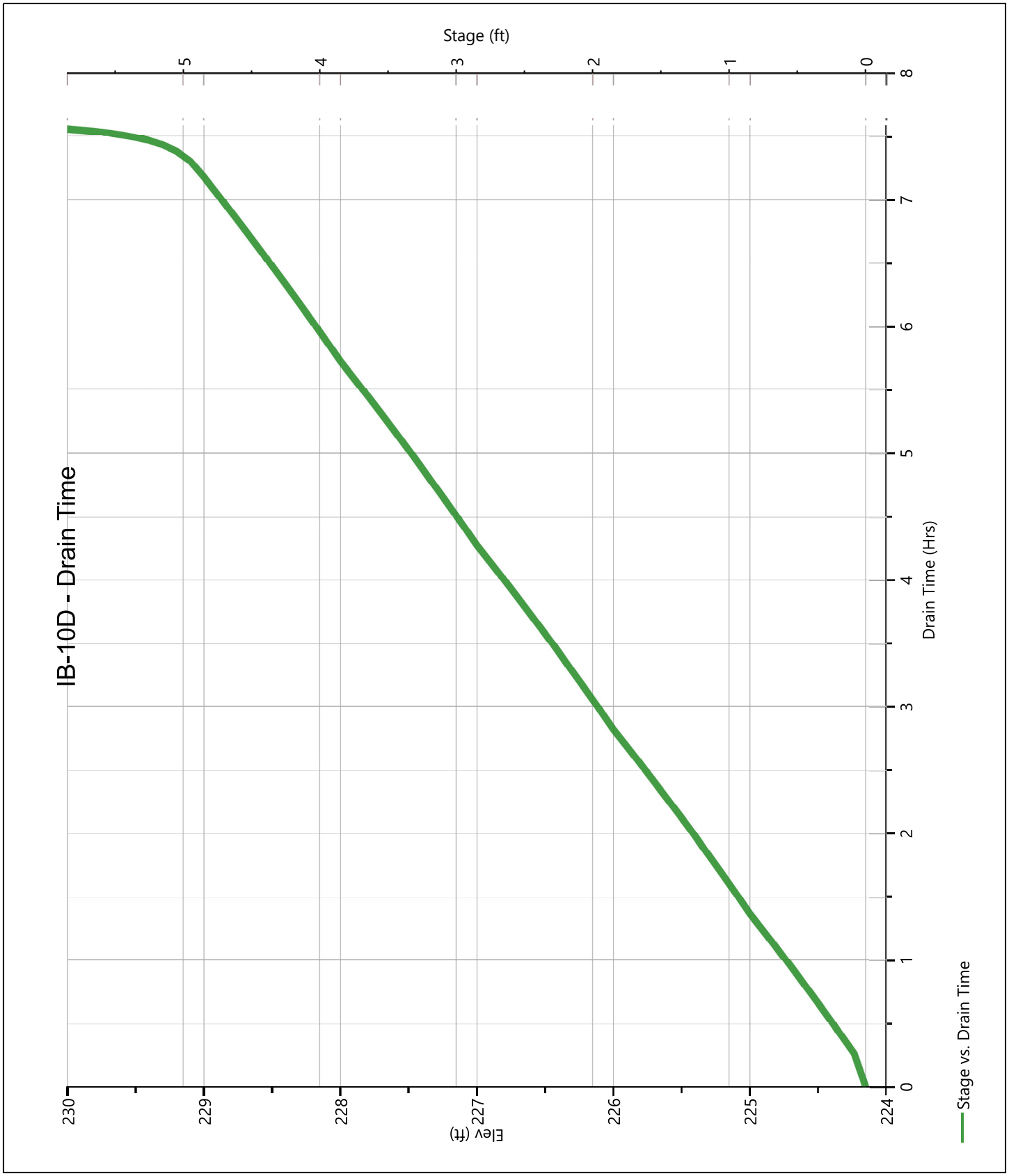
Project Name:

Hydrology Studio v 3.0.0.24

06-29-2022

IB-10D

Pond Drawdown



Hydrograph Report

Project Name:

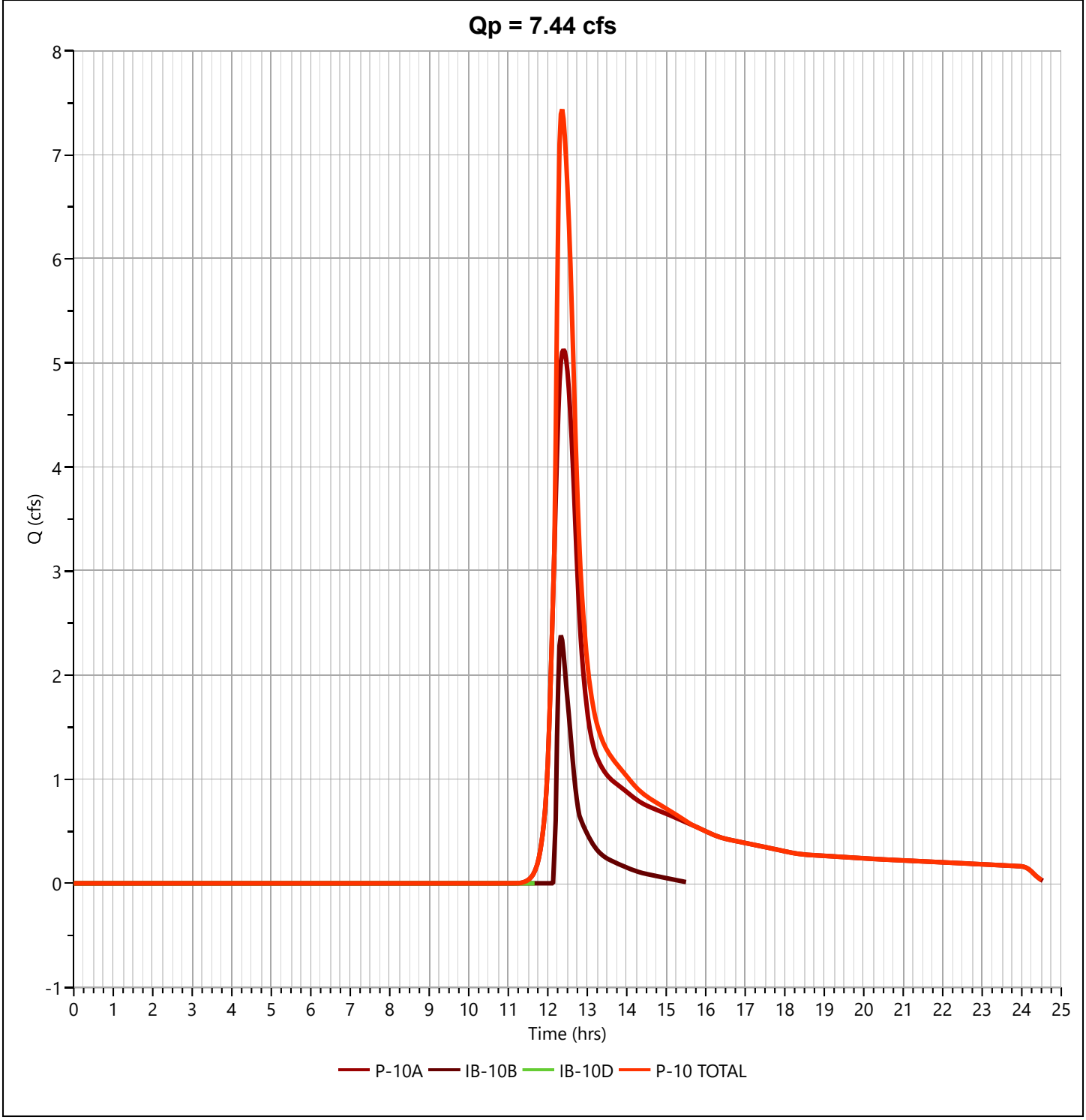
Hydrology Studio v 3.0.0.24

06-29-2022

P-10 TOTAL

Hyd. No. 65

Hydrograph Type	= Junction	Peak Flow	= 7.438 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 34,825 cuft
Inflow Hydrographs	= 57, 59, 64	Total Contrib. Area	= 9.41 ac



Hydrograph Report

Project Name:

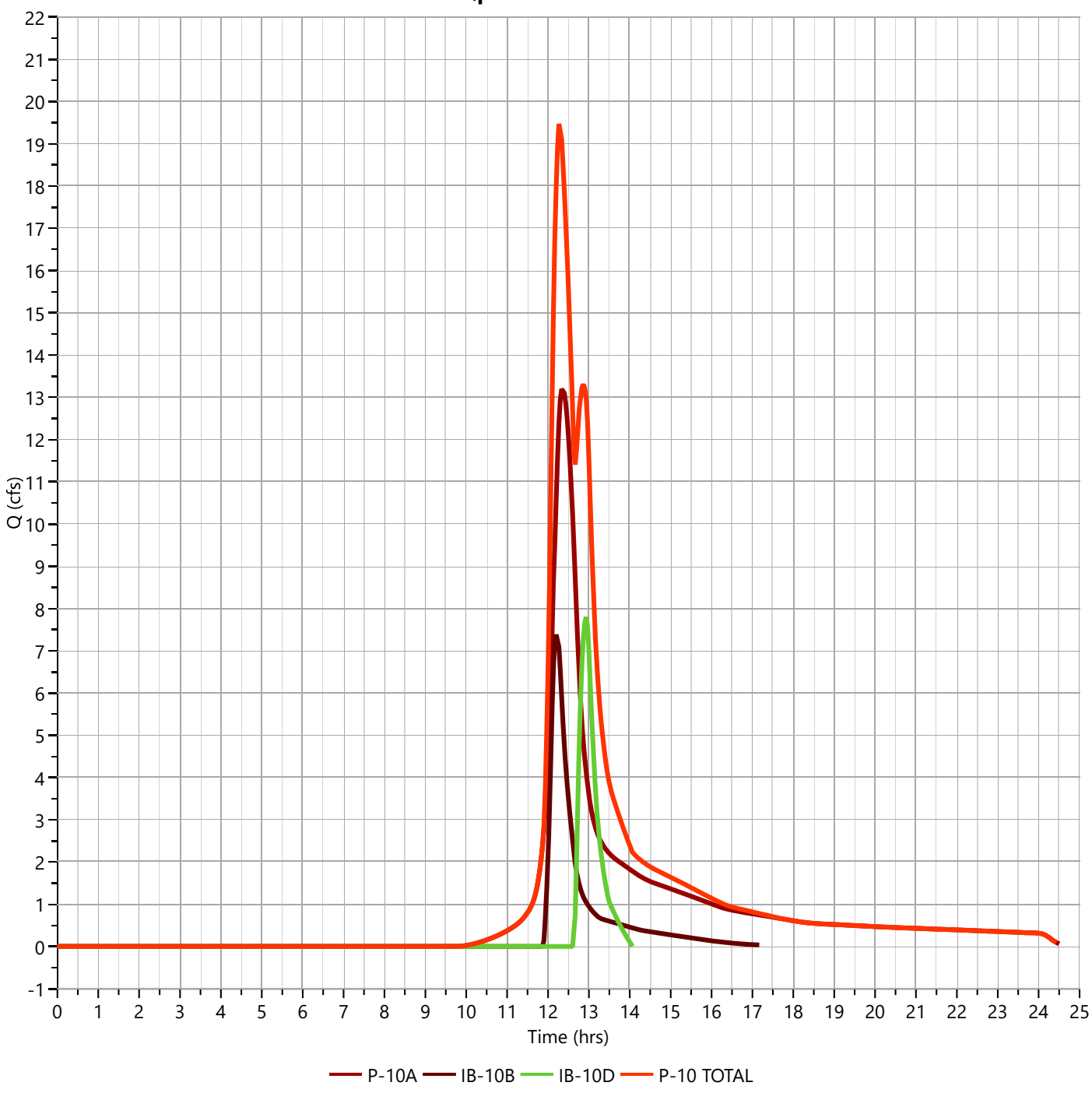
Hydrology Studio v 3.0.0.24

06-29-2022

P-10 TOTAL

Hyd. No. 65

Hydrograph Type	= Junction	Peak Flow	= 19.48 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 102,137 cuft
Inflow Hydrographs	= 57, 59, 64	Total Contrib. Area	= 9.41 ac



Hydrograph Report

Project Name:

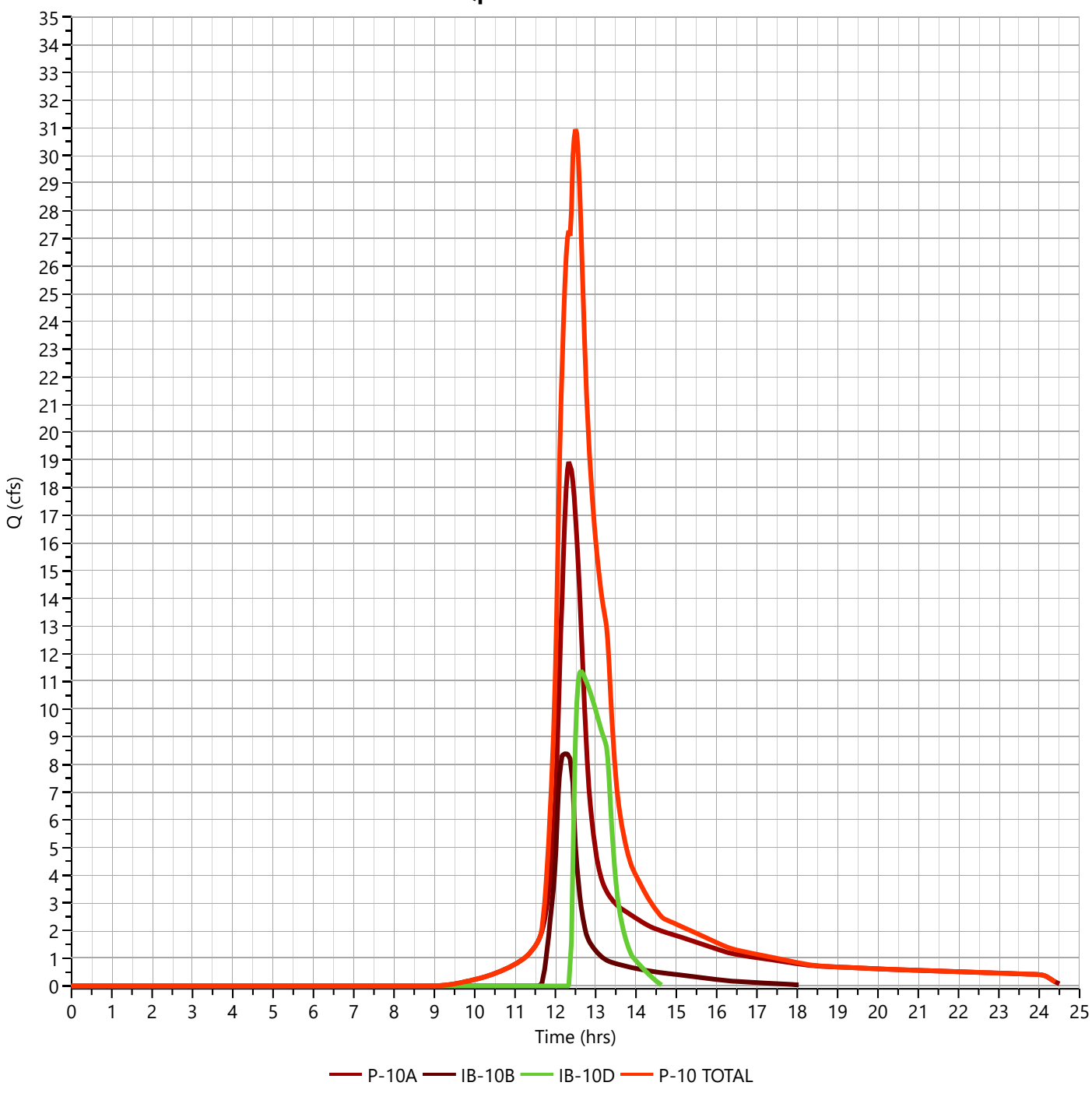
Hydrology Studio v 3.0.0.24

06-29-2022

P-10 TOTAL

Hyd. No. 65

Hydrograph Type	= Junction	Peak Flow	= 30.94 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 166,662 cuft
Inflow Hydrographs	= 57, 59, 64	Total Contrib. Area	= 9.41 ac



Hydrograph Report

Project Name:

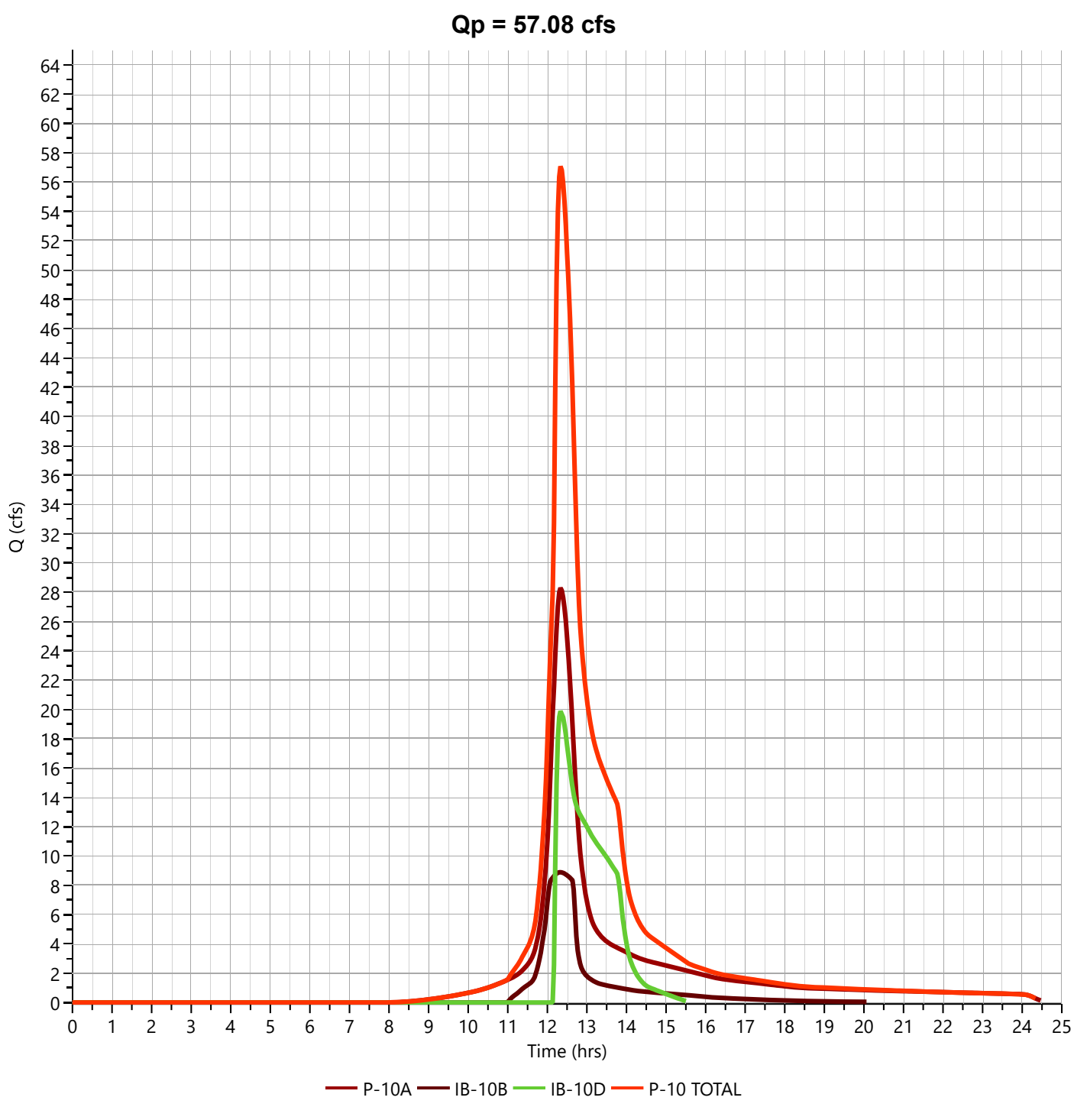
Hydrology Studio v 3.0.0.24

06-29-2022

P-10 TOTAL

Hyd. No. 65

Hydrograph Type	= Junction	Peak Flow	= 57.08 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 275,201 cuft
Inflow Hydrographs	= 57, 59, 64	Total Contrib. Area	= 9.41 ac



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-11

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.80	24.12
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			9.97	698.05
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00

1/ Use only one CN source per line. 469406 Totals = 10.78 722.17

CN (weighted) = total product / total area = 722.17 / 10.78 = 67.02 ; Use CN = 67

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.72	2.64	3.99

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present Developed Subcatchment P-11
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.006			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.47			0.47
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	411			
9. Watercourse slope, s		ft/ft	0.047			
10. Average Velocity, V (figure 3-1)		ft/s	3.50			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.50
	min	30.0

Hydrograph Report

Project Name:

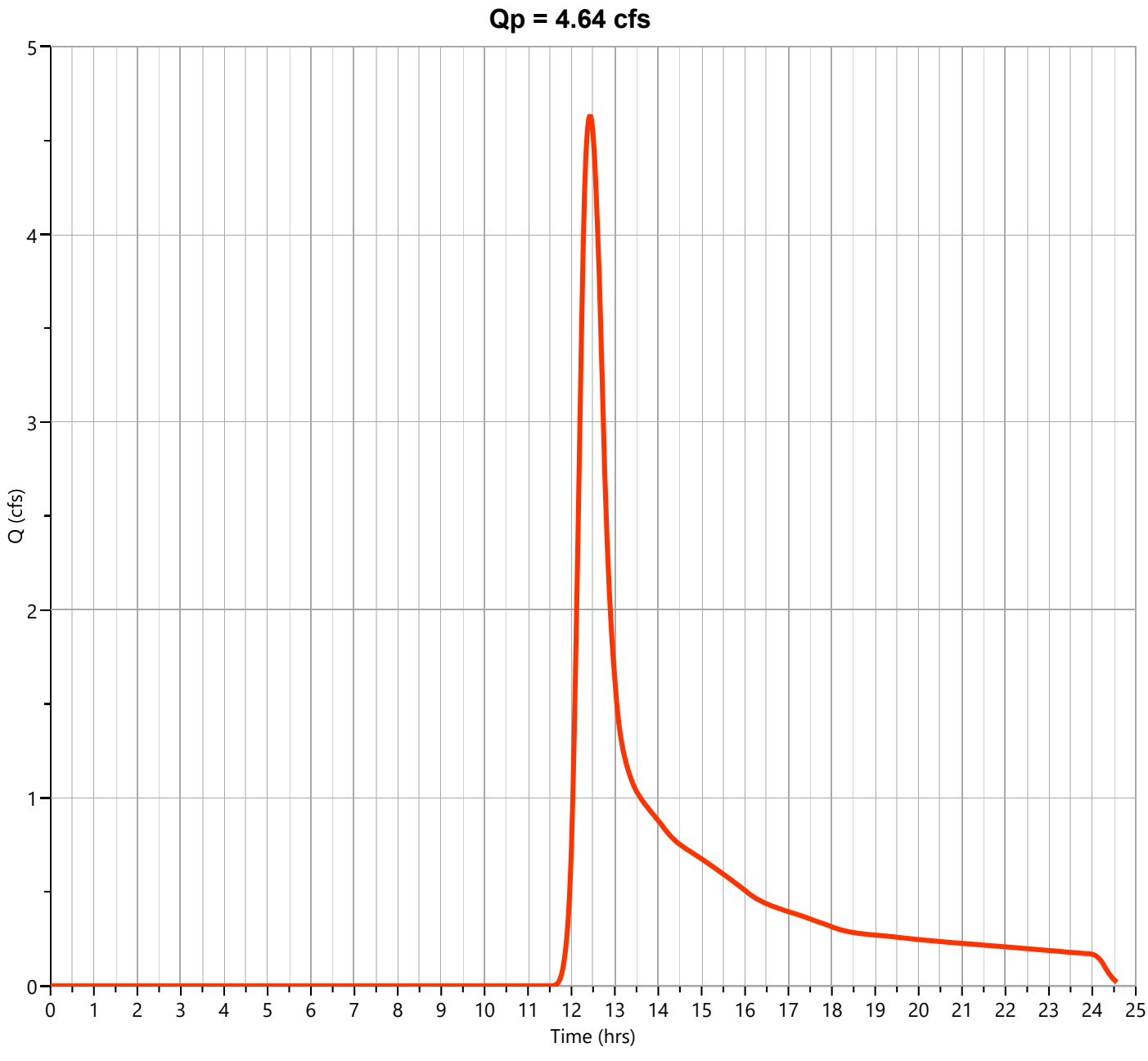
Hydrology Studio v 3.0.0.24

06-28-2022

P-11

Hyd. No. 67

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.637 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 28,334 cuft
Drainage Area	= 10.78 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

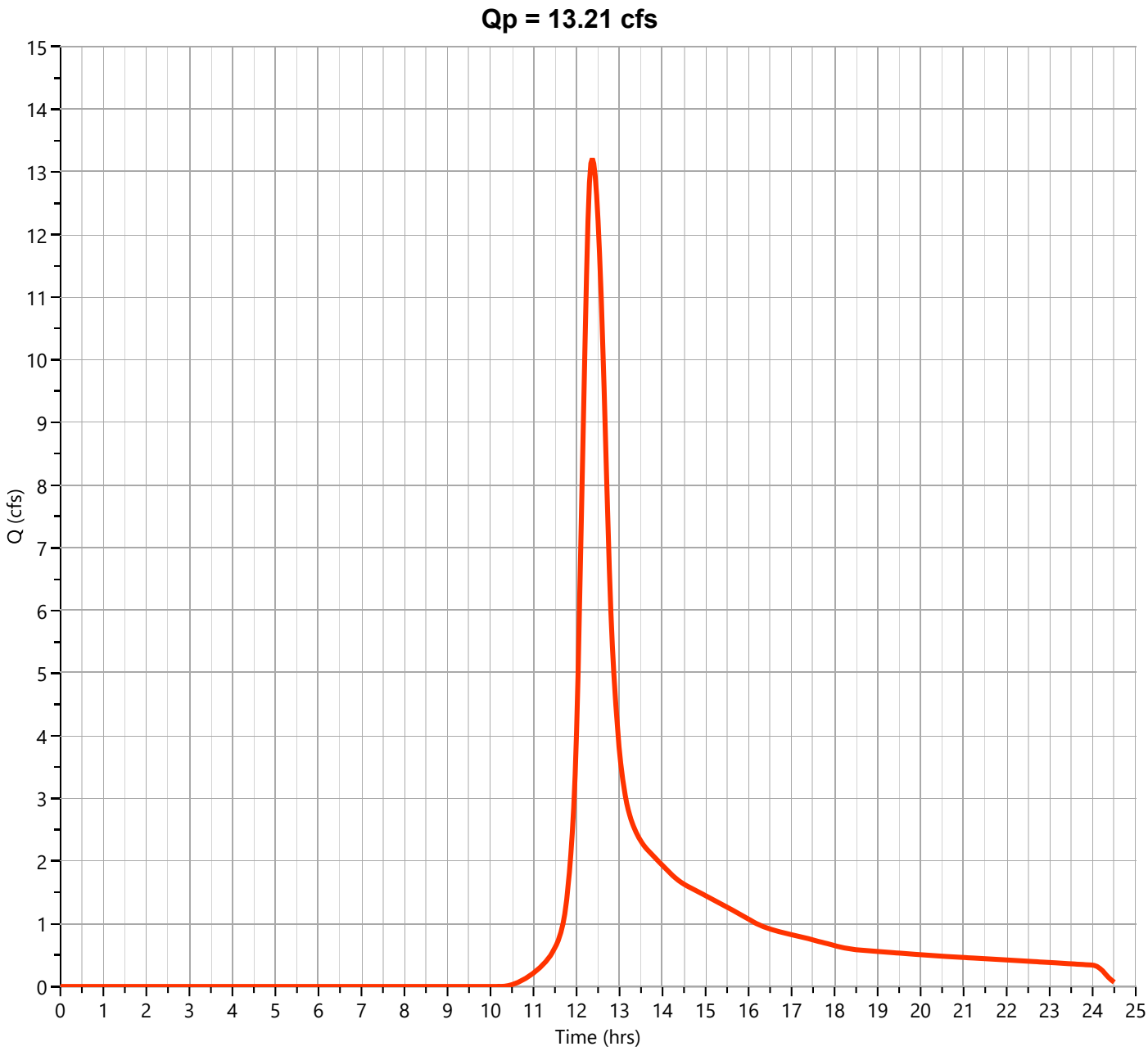
Hydrology Studio v 3.0.0.24

06-28-2022

P-11

Hyd. No. 67

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.21 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 71,647 cuft
Drainage Area	= 10.78 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

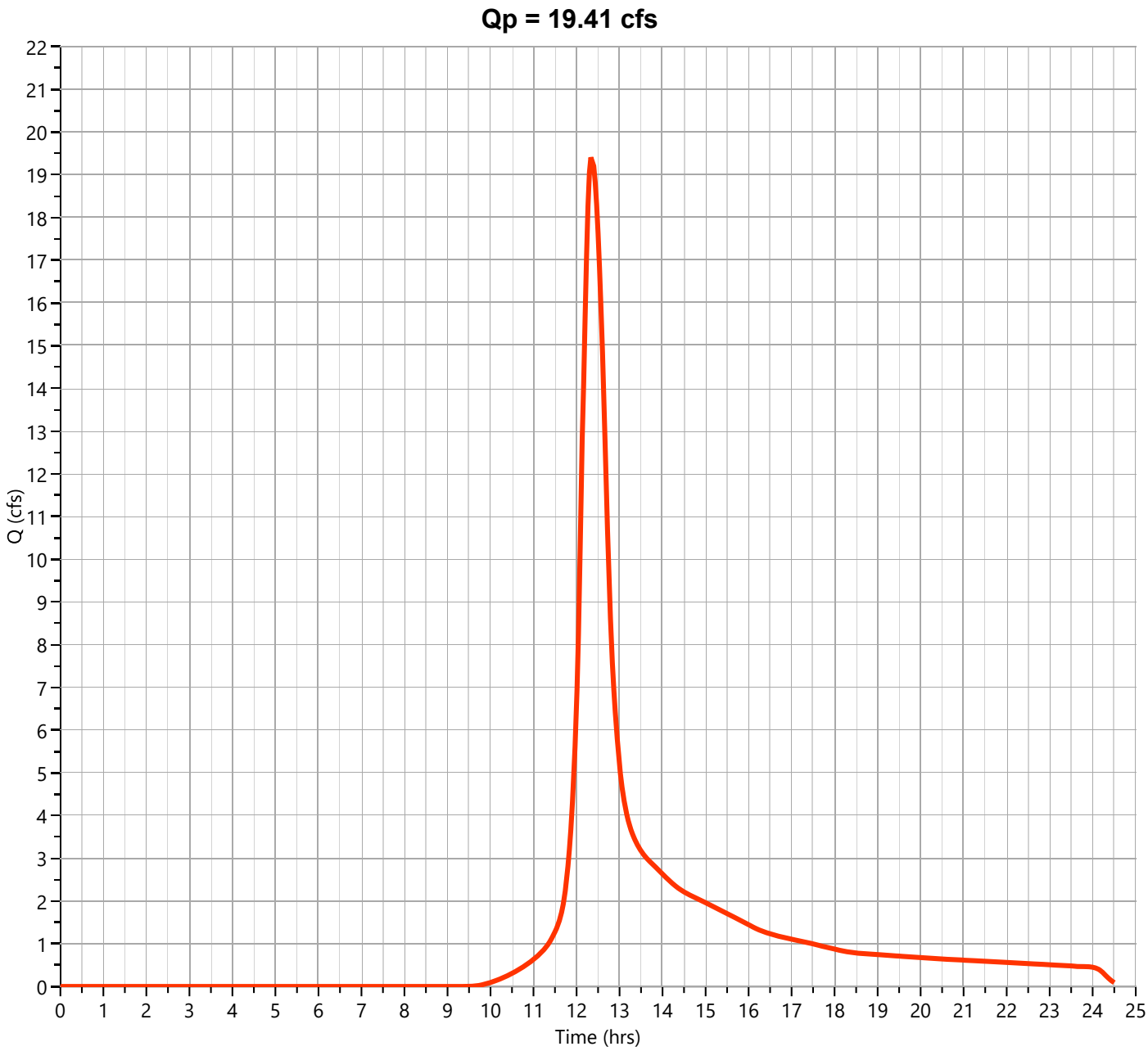
Hydrology Studio v 3.0.0.24

06-28-2022

P-11

Hyd. No. 67

Hydrograph Type	= NRCS Runoff	Peak Flow	= 19.41 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 103,157 cuft
Drainage Area	= 10.78 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

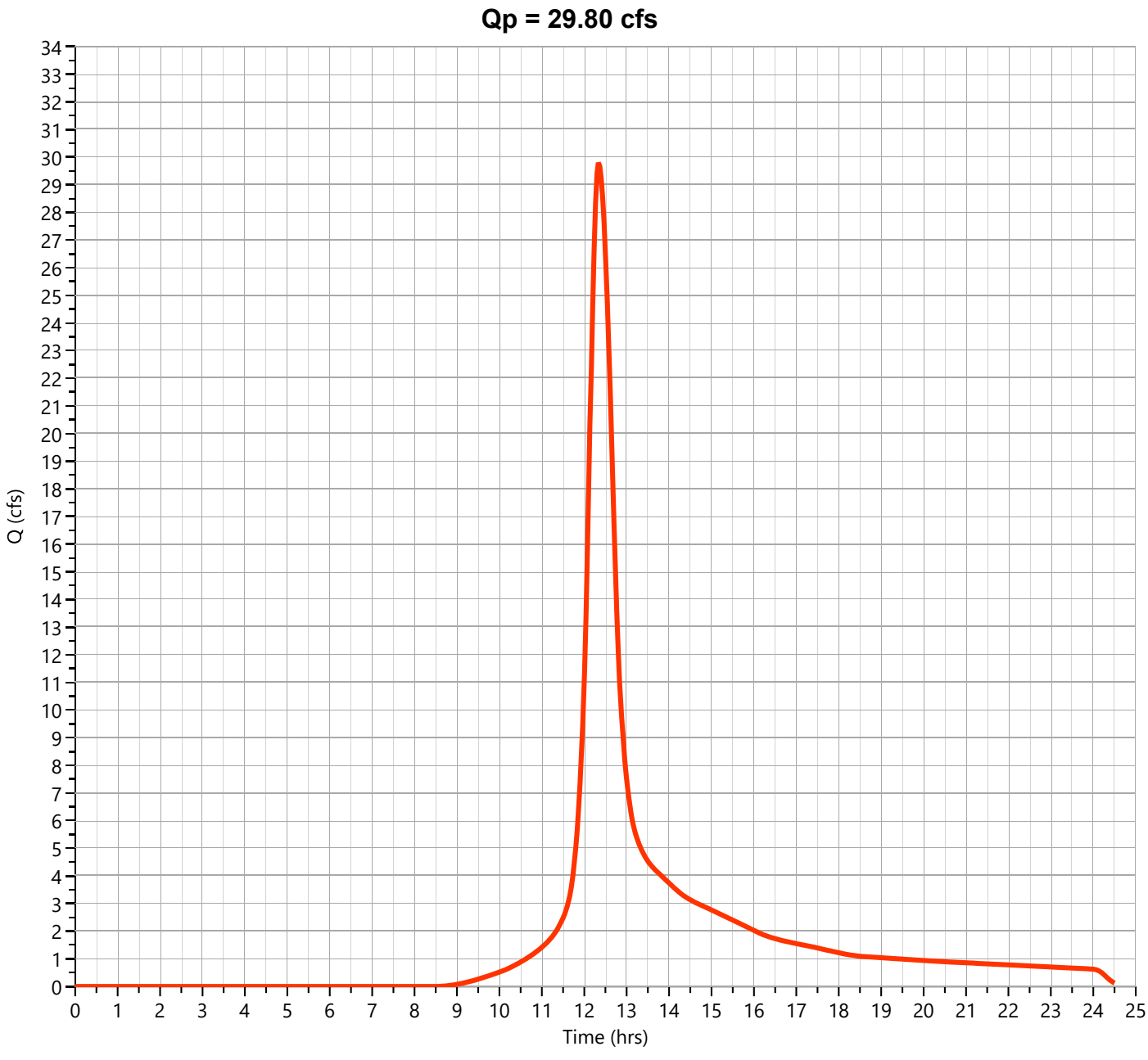
Hydrology Studio v 3.0.0.24

06-28-2022

P-11

Hyd. No. 67

Hydrograph Type	= NRCS Runoff	Peak Flow	= 29.80 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 156,090 cuft
Drainage Area	= 10.78 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 30.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-3719C**

Project: Athens Street By NC Date 6/24/22
Rev Date
Location: Stow, MA Checked Date

Circle one: Present [Developed] Subcatchment P-12

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area Acres	Product of CN x Area
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.22	6.53
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
B	Gravel	85			0.00	0.00
C	Woods Good Condition	70			0.00	0.00
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00

1/ Use only one CN source per line. 9482 Totals = 0.22 6.53

CN (weighted) = total product / total area = 6.53 / 0.22 = 30.00 ; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	25	100
Rainfall, P (24-hour).....	in	3.27	6.14	7.84
Runoff, Q.....	in	0.09	0.09	0.38

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-3719C

Project: Athens Street By NC Date 6/24/2022
Rev Date
Location: Stow, MA Checked Date

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-12

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.122			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.14			0.14
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	57			
9. Watercourse slope, s		ft/ft	0.112			
10. Average Velocity, V (figure 3-1)		ft/s	5.40			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.14
min 8.6

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.24

06-28-2022

P-12

Hyd. No. 69

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

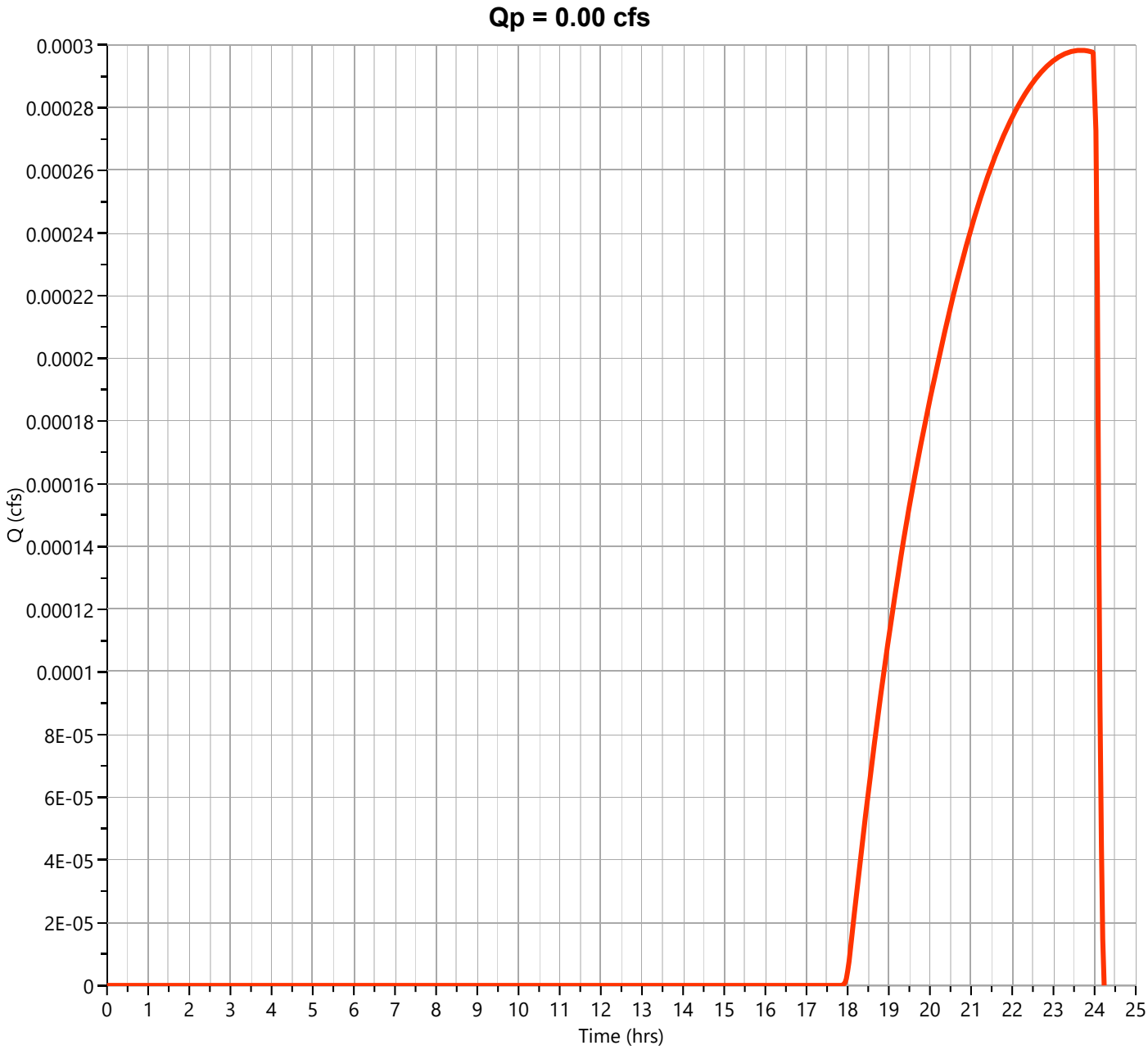
Hydrology Studio v 3.0.0.24

06-28-2022

P-12

Hyd. No. 69

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 23.70 hrs
Time Interval	= 2 min	Runoff Volume	= 4.70 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

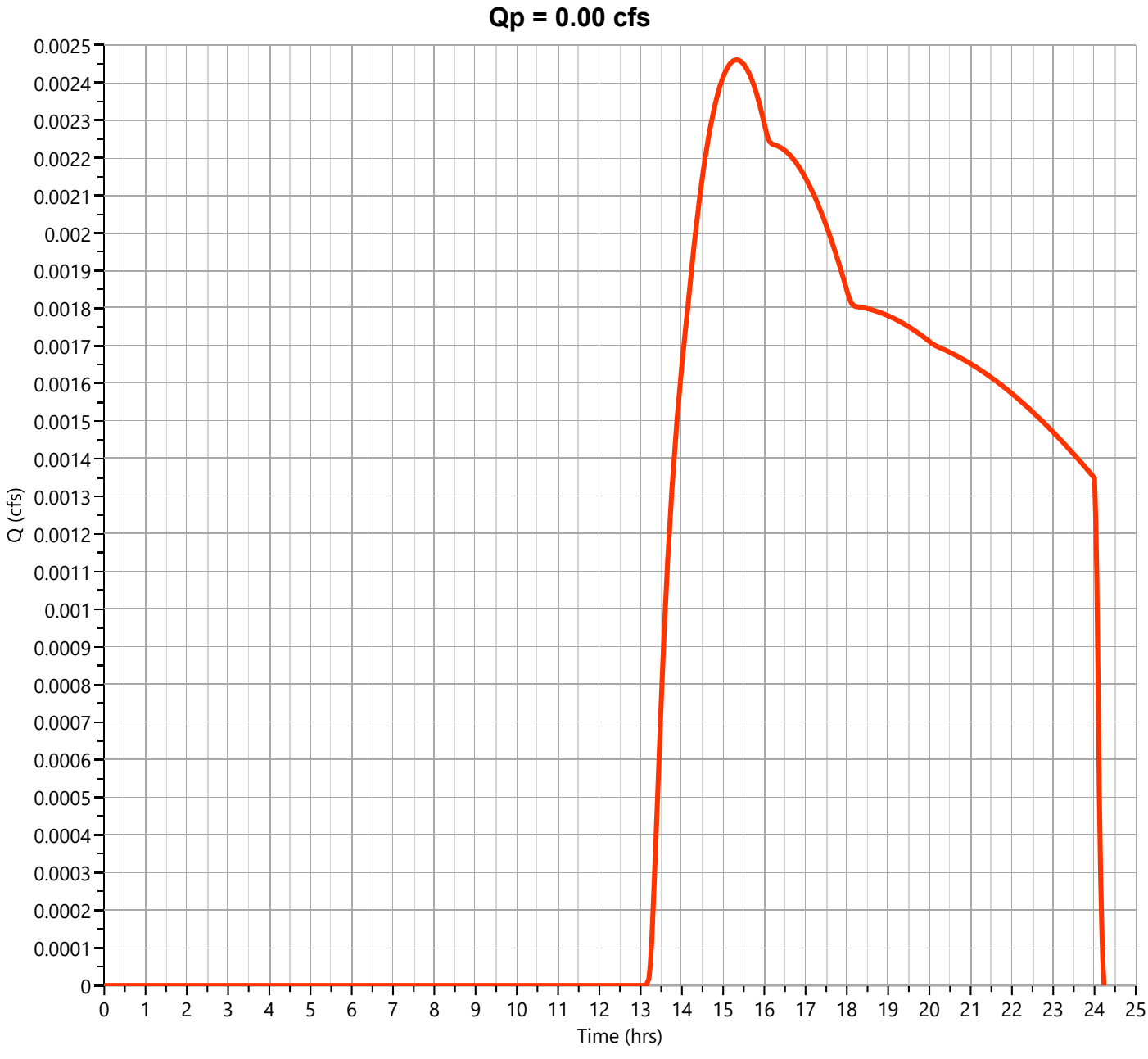
Hydrology Studio v 3.0.0.24

06-28-2022

P-12

Hyd. No. 69

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.33 hrs
Time Interval	= 2 min	Runoff Volume	= 69.9 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

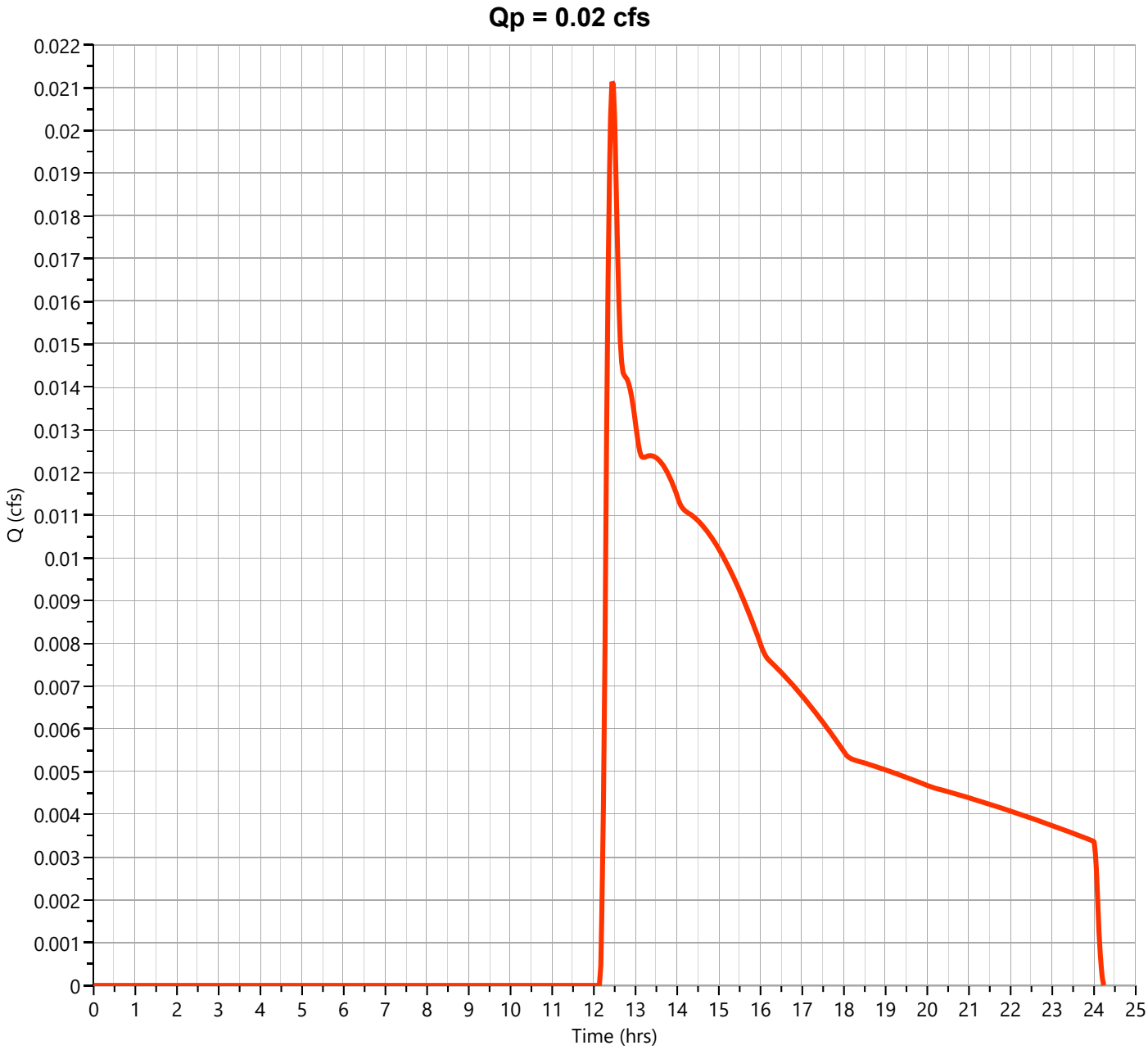
Hydrology Studio v 3.0.0.24

06-28-2022

P-12

Hyd. No. 69

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.021 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 303 cuft
Drainage Area	= 0.22 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 8.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Recharge Volume Calculations

Recharge Volume Calculations

Job: 3719C

Calculated PFK
Date: 6/27/2022

IB-2A

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 1.13 acres
49,179 s.f.

Required Recharge Volume (Rv)

$$Rv = 49{,}179 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{2{,}459 \text{ c.f.}}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1	ft			
K (saturated hydraulic conductivity):	8.27	inches/hour			
	0.69	feet/hour			
T (time):	2	hours			
A=	13,450	s.f.			
Voids=	1.00				
Rv=	31,989	c.f.		>	2,459 c.f.
Basin Volume:	15,103	c.f.	(Below Outlet)		

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.69 Hours

0.69 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-3A

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.71 acres
31,083 s.f.

Required Recharge Volume (Rv)

$$Rv = 31{,}083 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{648} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	4.7	ft			
K (saturated hydraulic conductivity):	2.41	inches/hour			
	0.20	feet/hour			
T (time):	2	hours			
A=	1,513	s.f.			
Voids=	1.00				
Rv=	7,719	c.f.		>	648 c.f.
Basin Volume:	15,317	c.f.	(Below Outlet)		

72 Hour Drawdown
Rv/(K x Bottom Area)= 9.88 Hours
9.88 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-5A

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 1.51 acres
65,595 s.f.

Required Recharge Volume (Rv)

$$Rv = 65{,}595 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{1{,}367 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	4.3	ft		
K (saturated hydraulic conductivity):	2.41	inches/hour		
	0.20	feet/hour		
T (time):	2	hours		
A=	6,225	s.f.		
Voids=	1.00			
Rv=	29,268	c.f.	>	1,367 c.f.
Basin Volume:	39,131	c.f.	(Below Outlet)	

72 Hour Drawdown
Rv/(K x Bottom Area)= 6.66 Hours
6.66 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-5B

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 1.09 acres
47,682 s.f.

Required Recharge Volume (Rv)

$$Rv = 47{,}682 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{993} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	4.7	ft			
K (saturated hydraulic conductivity):	2.41	inches/hour			
	0.20	feet/hour			
T (time):	2	hours			
A=	3,758	s.f.			
Voids=	1.00				
Rv=	19,172	c.f.		>	993 c.f.
Basin Volume:	32,728	c.f.	(Below Outlet)		

72 Hour Drawdown
Rv/(K x Bottom Area)= 8.50 Hours
8.50 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated PFK
Date: 6/27/2022

IB-5C

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.60 acres
26,104 s.f.

Required Recharge Volume (Rv)

$$Rv = 26{,}104 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{544} \text{ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	2.7	ft			
K (saturated hydraulic conductivity):	2.41	inches/hour			
	0.20	feet/hour			
T (time):	2	hours			
A=	2,638	s.f.			
Voids=	1.00				
Rv=	8,182	c.f.	>	544	c.f.
Basin Volume:	10,534	c.f.	(Below Outlet)		

72 Hour Drawdown

Rv/(K x Bottom Area)= 6.41 Hours

6.41 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated PFK
Date: 6/27/2022

IB-5D

Soils: Windsor Loamy Sand
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 1.03 acres
44,751 s.f.

Required Recharge Volume (Rv)

$$Rv = 44{,}751 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{932} \text{ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	2	ft
K (saturated hydraulic conductivity):	1.02	inches/hour
	0.09	feet/hour
T (time):	2	hours
A=	3,129	s.f.
Voids=	1.00	
Rv=	6,790	c.f. > 932 c.f.
Basin Volume:	8,291	c.f. (Below Outlet)

72 Hour Drawdown

Rv/(K x Bottom Area)= 14.37 Hours

14.37 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-6B

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.13 acres
5,846 s.f.

Required Recharge Volume (Rv)

$$Rv = 5{,}846 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{292} \text{ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	4.6	ft			
K (saturated hydraulic conductivity):	8.27	inches/hour			
	0.69	feet/hour			
T (time):	2	hours			
A=	426	s.f.			
Voids=	1.00				
Rv=	2,547	c.f.		>	292 c.f.
Basin Volume:	6,524	c.f.	(Below Outlet)		

72 Hour Drawdown

Rv/(K x Bottom Area)= 3.72 Hours

3.72 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-7A

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 1.25 acres
54,555 s.f.

Required Recharge Volume (Rv)

$$Rv = 54{,}555 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{2{,}728} \text{ c.f.}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	5	ft			
K (saturated hydraulic conductivity):	8.27	inches/hour			
	0.69	feet/hour			
T (time):	2	hours			
A=	1,657	s.f.			
Voids=	1.00				
Rv=	10,569	c.f.	>	2,728	c.f.
Basin Volume:	18,663	c.f.	(Below Outlet)		

72 Hour Drawdown

Rv/(K x Bottom Area)= 2.56 Hours

2.56 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-7B

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.72 acres
31,162 s.f.

Required Recharge Volume (Rv)

$$Rv = 31{,}162 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{1{,}558 \text{ c.f.}}$$

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	3	ft			
K (saturated hydraulic conductivity):	2.41	inches/hour			
	0.20	feet/hour			
T (time):	2	hours			
A=	1,843	s.f.			
Voids=	1.00				
Rv=	6,269	c.f.		>	1,558 c.f.
Basin Volume:	8,995	c.f.	(Below Outlet)		

72 Hour Drawdown

Rv/(K x Bottom Area)= 7.14 Hours

7.14 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-8

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 1.90 acres
82,808 s.f.

Required Recharge Volume (Rv)

$$Rv = 82{,}808 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{4{,}140 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	3	ft			
K (saturated hydraulic conductivity):	8.27	inches/hour			
	0.69	feet/hour			
T (time):	2	hours			
A=	8,372	s.f.			
Voids=	1.00				
Rv=	36,655	c.f.		>	4,140 c.f.
Basin Volume:	32,378	c.f.	(Below Outlet)		

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.28 Hours
1.28 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-10B

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.84 acres
36,688 s.f.

Required Recharge Volume (Rv)

$$Rv = 36{,}688 \text{ s.f.} \times \frac{0.25}{12} = \mathbf{764} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1.5	ft			
K (saturated hydraulic conductivity):	2.41	inches/hour			
	0.20	feet/hour			
T (time):	2	hours			
A=	828	s.f.			
Voids=	1.00				
Rv=	1,575	c.f.		>	764 c.f.
Basin Volume:	3,948	c.f.	(Below Outlet)		

72 Hour Drawdown
Rv/(K x Bottom Area)= 12.48 Hours
12.48 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-10C

Soils: Woodbridge Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 2.47 acres
107,574 s.f.

Required Recharge Volume (Rv)

Rv = 107,574 s.f. x 0.6/12 = **5,379 c.f.**

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility): 2.1 ft
K (saturated hydraulic conductivity): 8.27 inches/hour
0.69 feet/hour
T (time): 2 hours
A= 2,885 s.f.
Voids= 1.00
Rv= 10,035 c.f. > 5,379 c.f.
Basin Volume: 9,633 c.f. (Below Outlet)

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.39 Hours
1.39 < 72 hours O.K.

Recharge Volume Calculations

Job: 3719C

Calculated MKO
Date: 6/27/2022

IB-10D

Soils: Woodbridge Fine Sandy Loam
Hydrologic Group: C
Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 1.92 acres
83,779 s.f.

Required Recharge Volume (Rv)

Rv = 83,779 s.f. x 0.6/12 = **4,189 c.f.**

Simple Dynamic Method

A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility): 4.85 ft
K (saturated hydraulic conductivity): 8.27 inches/hour
0.69 feet/hour
T (time): 2 hours
A= 5,049 s.f.
Voids= 1.00
Rv= 31,447 c.f. > 4,189 c.f.
Basin Volume: 38,307 c.f. (Below Outlet)

72 Hour Drawdown

Rv/(K x Bottom Area)= 1.77 Hours
1.77 < 72 hours O.K.

Required Recharge Volume

Job: **SM-3719C**

Calculated by: PFK

Date: 6/27/2022

Required Recharge Volume

Soils: Sand

Hydrologic Group: A

Required Recharge Volume

1 inches of runoff x impervious area

Total Impervious Area:	16.73	acres					
	728,704	**s.f.**					
1.) Required Recharge Volume (Rv)							
Rv =	728,704	s.f. x	1 / 12		=	**60,725**	**c.f.**
					=	**60,725**	**c.f.**
Impervious Area draining to recharge facilit					=	**666,806**	**s.f.**
	728,704 / 666,806				=	**1.09**	
2.) Adjusted Minimum Required Recharge Volume							
3.)							
Rv=	60,725	s.f. x	1.09		=	**66,362**	**c.f.**
4.)							

Recharge Volume Provided

IB-2A					=	31,989	C.F.
IB-3A					=	7,719	C.F.
IB-5A					=	29,268	c.f.
IB-5B					=	19,172	c.f.
IB-5C					=	8,182	C.F.
IB-5D					=	6,790	
IB-6B					=	2,547	
IB-7A					=	10,569	
IB-7B					=	6,269	
IB-8					=	36,655	
IB-10B					=	1,575	
IB-10C					=	10,035	
IB-10D					=	31,447	
Total Recharge Volume Provided					=	**202,216**	**c.f.**
202,216	**c.f.**	**>**	**66,362**	**c.f.**		**OK**	
	=	666,806 / 728,704		=	92%		
Total Impervious area							
Impervious area being recharged	**92%**	**>**	**65%**			**OK**	

Water Quality Volume Calculations

Water Quality Volume Calculations

Job: 3719C

Calculated by: PFK
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-2A

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 1.13 acres
49,179 s.f.

Required Water Quality Volume

$$V = 49{,}179 \text{ s.f.} \times \frac{1}{12} = \mathbf{4{,}098 \text{ c.f.}}$$

Volume Provided 15,103 c.f. (storage below outlet)

15,103 c.f. > 4,098 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: MKO
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-3A

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

0.5 inch of runoff x impervious area

Impervious area: 0.71 acres
31,083 s.f.

Required Water Quality Volume

$$V = \frac{31{,}083 \text{ s.f.} \times 0.5}{12} = \mathbf{1{,}295 \text{ c.f.}}$$

Volume Provided 15,317 c.f. (storage below outlet)

15,317 c.f. > 1,295 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: MKO
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-5A

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

0.5 inch of runoff x impervious area

Impervious area: 1.51 acres
65,595 s.f.

Required Water Quality Volume

$$V = \frac{65{,}595 \text{ s.f.} \times 0.5}{12} = \mathbf{2{,}733 \text{ c.f.}}$$

Volume Provided 39,131 c.f. (storage below outlet)

39,131 c.f. > 2,733 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: MKO
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-5B

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

0.5 inch of runoff x impervious area

Impervious area: 1.09 acres
47,682 s.f.

Required Water Quality Volume

$$V = \frac{47{,}682 \text{ s.f.} \times 0.5}{12} = \mathbf{1{,}987 \text{ c.f.}}$$

Volume Provided 32,728 c.f. (storage below outlet)

32,728 c.f. > 1,987 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: PFK
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-5C

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

0.5 inch of runoff x impervious area

Impervious area: 0.60 acres
26,104 s.f.

Required Water Quality Volume

$$V = \frac{26{,}104 \text{ s.f.} \times 0.5}{12} = \mathbf{1{,}088 \text{ c.f.}}$$

Volume Provided 10,534 c.f. (storage below outlet)

10,534 c.f. > 1,088 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: PFK
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-5D

Soils: Windsor Loamy Sand
Hydrologic Group: C
Required First Flush Volume

1 inch of runoff x impervious area

Impervious area: 1.03 acres
44,751 s.f.

Required Water Quality Volume

$$V = 44{,}751 \text{ s.f.} \times \frac{1}{12} = \mathbf{3{,}729 \text{ c.f.}}$$

Volume Provided 8,291 c.f. (storage below outlet)

8,291 c.f. > 3,729 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-6B

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 0.13 acres
5,846 s.f.

Required Water Quality Volume

$$V = 5{,}846 \text{ s.f.} \times \frac{1}{12} = \mathbf{487} \text{ c.f.}$$

Volume Provided 6,524 c.f.

6,524 c.f. > 487 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-7A

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 1.25 acres
54,555 s.f.

Required Water Quality Volume

$$V = 54{,}555 \text{ s.f.} \times \frac{1}{12} = \mathbf{4{,}546 \text{ c.f.}}$$

Volume Provided 18,663 c.f.

18,663 c.f. > 4,546 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-7B

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 0.72 acres
31,162 s.f.

Required Water Quality Volume

$$V = 31{,}162 \text{ s.f.} \times \frac{1}{12} = \mathbf{2{,}597 \text{ c.f.}}$$

Volume Provided 8,995 c.f.

8,995 c.f. > 2,597 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-8

Soils: Merrimac Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

1 inch of runoff x impervious area

Impervious area: 1.90 acres
82,808 s.f.

Required Water Quality Volume

$$V = 82{,}808 \text{ s.f.} \times \frac{1}{12} = \mathbf{6{,}901 \text{ c.f.}}$$

Volume Provided 32,378 c.f.

32,378 c.f. > 6,901 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

Treatment Trench P-9

Soils: Hinckley Loamy Sand
Hydrologic Group: A
Required First Flush Volume

1 inch of runoff x impervious area

Impervious area: 0.05 acres
1,964 s.f.

Required Water Quality Volume

$$V = 1{,}964 \text{ s.f.} \times \frac{1}{12} = \mathbf{164} \text{ c.f.}$$

Treatment Trench Volume Provided= L x W x D x 0.4 = **176** c.f.

176 c.f. > 164 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-10B

Soils: Paxton Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume

1 inch of runoff x impervious area

Impervious area: 0.84 acres
36,688 s.f.

Required Water Quality Volume

$$V = 36{,}688 \text{ s.f.} \times \frac{1}{12} = \mathbf{3{,}057 \text{ c.f.}}$$

Volume Provided 3,948 c.f. (storage below outlet)

3,948 c.f. > 3,057 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-10C

Soils: Woodbridge Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 2.47 acres
107,574 s.f.

Required Water Quality Volume

$$V = 107{,}574 \text{ s.f.} \times \frac{1}{12} = \mathbf{8{,}965 \text{ c.f.}}$$

Volume Provided 9,633 c.f. (storage below outlet)

9,633 c.f. > 8,965 c.f. O.K.

Water Quality Volume Calculations

Job: 3719C

Calculated by: NC
Date: 6/27/2022

Location: The Cottages at Wandering Pond

IB-10D

Soils: Woodbridge Fine Sandy Loam
Hydrologic Group: C
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 1.92 acres
83,779 s.f.

Required Water Quality Volume

$$V = \frac{83{,}779 \text{ s.f.} \times 1}{12} = \mathbf{6{,}982 \text{ c.f.}}$$

Volume Provided 38,307 c.f. (storage below outlet)

38,307 c.f. > 6,982 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-2A

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
230	0	318		
231	1	548	433	
			0	
			0	
				433

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.13 acres
49,179 s.f.

Required Sediment Forebay Size

$$V = \frac{49{,}179 \text{ s.f.} \times 0.1}{12} = \mathbf{410 \text{ c.f.}}$$

Provided 433 c.f.

433 c.f. > 410 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-3A

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
286	0	325		
287	1	604	464.5	
			0	
			0	
				465

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.71 acres
31,083 s.f.

Required Sediment Forebay Size

$$V = \frac{31{,}083 \text{ s.f.} \times 0.1}{12} = \mathbf{259 \text{ c.f.}}$$

Provided 465 c.f.

465 c.f. > 259 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-5A

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
204.5	0	427		
205	0.5	555	245.5	
206	1	854	704.5	
			0	
				950

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.51 acres
65,595 s.f.

Required Sediment Forebay Size

$$V = 65{,}595 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{547 \text{ c.f.}}$$

Provided 950 c.f.

950 c.f. > 547 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-5B

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
280	0	395		
281	1	661	528	
			0	
			0	
				528

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.09 acres
47,682 s.f.

Required Sediment Forebay Size

$$V = \frac{47{,}682 \text{ s.f.} \times 0.1}{12} = \mathbf{397 \text{ c.f.}}$$

Provided 528 c.f.

528 c.f. > 397 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-5C

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
258	0	292		
259	1	533	412.5	
			0	
			0	
				413

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.60 acres
26,104 s.f.

Required Sediment Forebay Size

$$V = \frac{26{,}104 \text{ s.f.} \times 0.1}{12} = \mathbf{218 \text{ c.f.}}$$

Provided 413 c.f.

413	**c.f. >**	**218**	**c.f. O.K.**

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-5D

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
230	0	298		
231	1	541	419.5	
			0	
			0	
				420

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.03 acres
44,751 s.f.

Required Sediment Forebay Size

$$V = \frac{44{,}751 \text{ s.f.} \times 0.1}{12} = \mathbf{373 \text{ c.f.}}$$

Provided 420 c.f.

420	**c.f. >**	**373**	**c.f. O.K.**

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: MKO
Date: 6/28/2022

IB-6B

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
217.4	0	117		
218	0.6	215	99.6	
			0	
			0	
				100

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.13 acres
5,846 s.f.

Required Sediment Forebay Size

$$V = 5{,}846 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{49} \text{ c.f.}$$

Provided 100 c.f.

100	**c.f. >**	**49**	**c.f. O.K.**

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

IB-7A

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
219	0	311		
220	1	636	473.5	
				474

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.25 acres

54,555 s.f.

Required Sediment Forebay Size

$$V = \frac{54{,}555 \text{ s.f.} \times 0.1}{12} = \mathbf{455 \text{ c.f.}}$$

Provided 474 c.f.

474	**c.f. >**	**455**	**c.f. O.K.**

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

IB-7B

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
224	0	176		
225	1	354	265	
				265

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.72 acres

31,162 s.f.

Required Sediment Forebay Size

$$V = \frac{31{,}162 \text{ s.f.} \times 0.1}{12} = \mathbf{260 \text{ c.f.}}$$

Provided 265 c.f.

265 c.f. > 260 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

IB-8

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
222	0	546		
223	1	897	721.5	
				722

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.90 acres

82,808 s.f.

Required Sediment Forebay Size

$$V = \frac{82{,}808 \text{ s.f.} \times 0.1}{12} = \mathbf{690 \text{ c.f.}}$$

Provided 722 c.f.

722 c.f. > 690 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

IB-10B (north forebay)

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
256	0	137		
257	1	310	223.5	
			0	
			0	
				224

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.38 acres

16,672 s.f.

Required Sediment Forebay Size

$$V = \frac{16{,}672 \text{ s.f.} \times 0.1}{12} = \mathbf{139 \text{ c.f.}}$$

Provided 224 c.f.

224	**c.f. >**	**139**	**c.f. O.K.**

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

IB-10B (south forebay)

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
256	0	146		
257	1	349	247.5	
			0	
			0	
				248

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 0.46 acres

20,016 s.f.

Required Sediment Forebay Size

$$V = \frac{20{,}016 \text{ s.f.} \times 0.1}{12} = \mathbf{167 \text{ c.f.}}$$

Provided 248 c.f.

248 c.f. > 167 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

Infiltration Basin P-10C

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
230	0	585		
231	1	1337	961	
			0	
			0	
				961

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 2.47 acres

107,574 s.f.

Required Sediment Forebay Size

$$V = 107{,}574 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{896 \text{ c.f.}}$$

Provided 961 c.f.

961 c.f. > 896 c.f. O.K.

Sediment Forebay Sizing Calculations

Job: SM-3719C

Calculated by: NC

Date: 6/21/2022

Infiltration Basin P-10D

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
225	0	154		
226	1	337	245.5	
227	1	576	457	
228	1	873	725	
				1427

Sediment Forebay Sizing

0.1 inches of runoff x impervious area

Impervious area: 1.92 acres

83,779 s.f.

Required Sediment Forebay Size

$V = 83{,}779 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{698 \text{ c.f.}}$

Provided 1,427 c.f.

1,427	**c.f. >**	**698**	**c.f. O.K.**

Groundwater Mounding Calculations

Groundwater Mounding Analysis

SM-3719C

Project: The Cottages at Wandering Pond
Location: Off of Hudson Road, Stow, MA

Date: 6/27/2022
Rev:
By: MKO

	Length of Application (ft)	Width of Application (ft)	Area (s.f.)	Required Recharge Volume (c.f.)	**Application Rate (c.f./day/s.f.)**	**Duration of Application**	**Fillable Porosity**	**Hydraulic Conductivity (ft/day)**	Bottom of Structure Elevation	**E.S.H.G.W.**	**Initial Saturated Thickness Used (ft)**	**Mound Height**
Infiltration Basin 2A	481.0	34.8	16,755	2,459	0.15	1 day	0.28	39	229.00	226.00	8.5	0.24
Infiltration Basin 6B	41	27.0	1,106	292	0.26				217.40	215.37	5	0.29
Infiltration Basin 7A	76	75	5,700	2,728	0.48				219.00	217	13	0.82
Infiltration Basin 10C	192.0	31.8	6,103	5,379	0.88				226.00	222.40	13	1.09
Infiltration Basin 10D	118.0	94.5	11,148	4,189	0.38				224.15	222.14	8.33	1.05
Infiltration Basin 3A	72.0	71.0	5,112	648	0.13	1 day	0.18	8	286.00	282.50	13	0.55
Infiltration Basin 5A	173.5	70.3	12,205	1,367	0.11				304.50	302.50	13	0.52
Infiltration Basin 5B	187.0	56.5	10,567	993	0.09				278.00	276.00	13	0.39
Infiltration Basin 10B	240	26.4	6,344	764	0.12				255.00	253.00	8	0.38
Infiltration Basin 5D	67.0	78.5	5,259	932	0.18	1 day	0.16	6	230.00	226.80	7	1.04

Application Rate = $\frac{\text{Required Recharge Volume}}{\text{Bottom Area}}$

Duration of Application = 1 day for analysis of 24-hour storm events

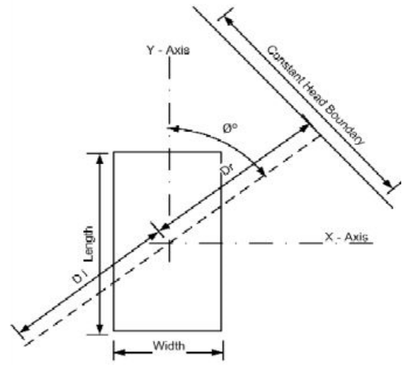
Fillable Porosity = Value based on soil classification from attached table

Hydraulic Conductivity = Value taken from attached table

Initial Saturated Thickness = Depth from bottom of deepest test pit (since depth to ledge is unknown) to estimated seasonal high groundwater (ESHGW)

Distance to Constant Head Boundary (Di & Dr):
Bordering Vegetated Wetland used as constant head boundary

Angle from z-axis (Ø):



SPECIFIC YIELD VALUES (%)

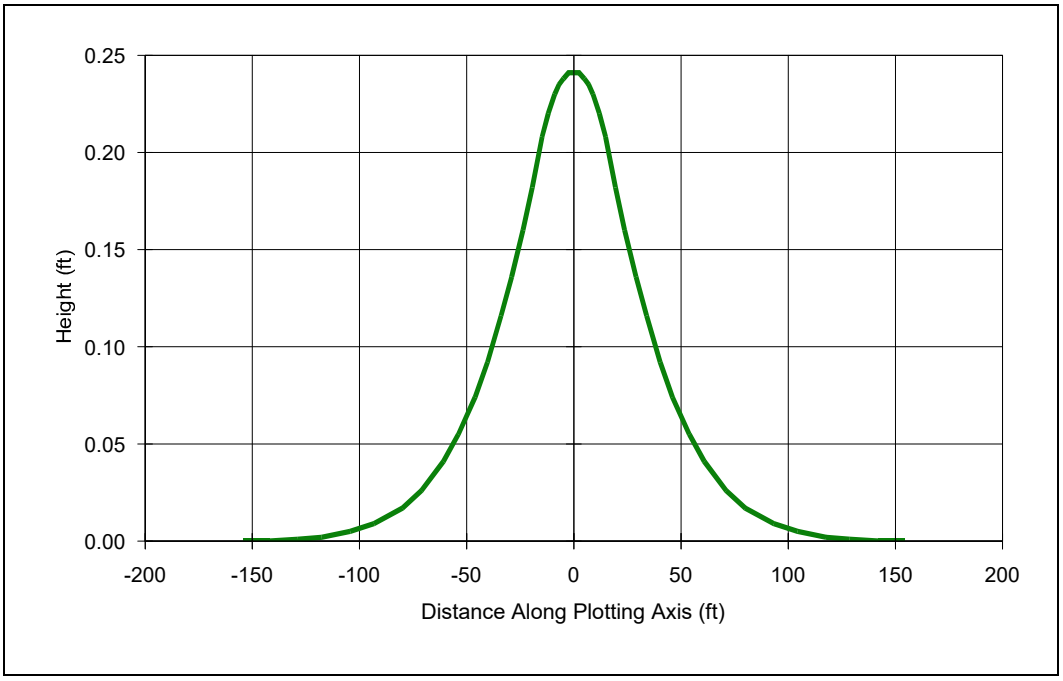
Coarse gravel	0.23
Medium gravel	0.24
Fine gravel	0.25
Coarse sand	0.27
Medium sand	0.28
Fine sand	0.23
Silt	0.08
Clay	0.03

HYDRAULIC CONDUCTIVITY VALUES (FT/DAY)

MATERIAL	AVERAGE	RANGE
Fine gravel	1476	1181 - 3280
Medium gravel	886	689 - 1181
Coarse gravel	492	328 – 689
Coarse sand	148	65 - 328
Medium sand	39	16 - 65
Fine sand	8	3 - 16
Silt	0.3	0.03 – 3
Clay	0.0007	<0.03
S & G mix	172	16 – 328
S & G glacial till		<100
Glacial till		<10

*Mass DEP Groundwater Mounding for Systems Larger than 2,000 GPD Presentation

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 2A

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:32:57 PM

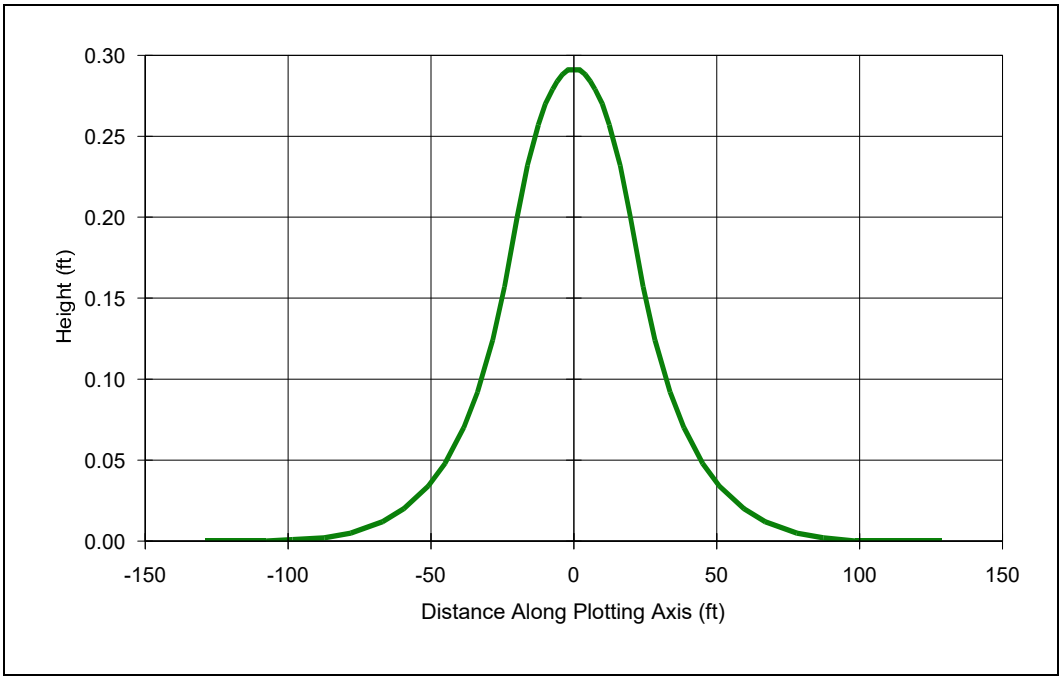
INPUT PARAMETERS

Application rate: 0.15 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 8.5 ft
Length of application area: 481 ft
Width of application area: 34.8 ft
Constant head boundary used at: 153 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 17.4 ft
positive Y: 0 ft
Total volume applied: 2510.82 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-153	0	-153	0
-128.7	0	-129	0
-104.3	0	-104	0
-80	0	-80	0.02
-60.9	0	-61	0.04
-46.1	0	-46	0.07
-33.9	0	-34	0.12
-23.7	0	-24	0.16
-14.8	0	-15	0.21
-8.9	0	-9	0.23
-4.8	0	-5	0.24
0	0	0	0.24
4.8	0	5	0.24
8.9	0	9	0.23
14.8	0	15	0.21
23.7	0	24	0.16
33.9	0	34	0.12
46.1	0	46	0.07
60.9	0	61	0.04
80	0	80	0.02
104.3	0	104	0
128.7	0	129	0
153	0	153	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 6B

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:34:26 PM

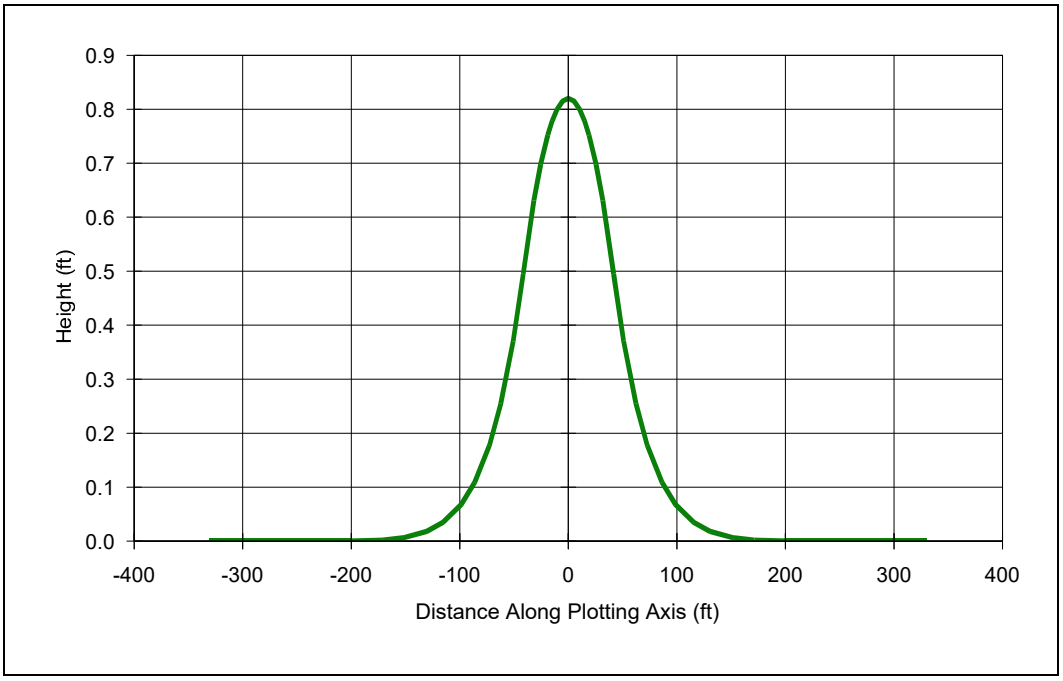
INPUT PARAMETERS

Application rate: 0.26 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 5 ft
Length of application area: 41 ft
Width of application area: 27 ft
Constant head boundary used at: 128 ft
Plotting axis from Y-Axis: 11 degrees
Edge of recharge area:
positive X: 4 ft
positive Y: 20.5 ft
Total volume applied: 287.82 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-24.4	-125.6	-128	0
-20.5	-105.7	-108	0
-16.7	-85.7	-87	0
-12.8	-65.7	-67	0.01
-9.7	-50	-51	0.03
-7.4	-37.8	-39	0.07
-5.4	-27.9	-28	0.12
-3.8	-19.5	-20	0.2
-2.4	-12.2	-12	0.26
-1.4	-7.3	-7	0.28
-0.8	-4	-4	0.29
0	0	0	0.29
0.8	4	4	0.29
1.4	7.3	7	0.28
2.4	12.2	12	0.26
3.8	19.5	20	0.2
5.4	27.9	28	0.12
7.4	37.8	39	0.07
9.7	50	51	0.03
12.8	65.7	67	0.01
16.7	85.7	87	0
20.5	105.7	108	0
24.4	125.6	128	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 7A

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:43:36 PM

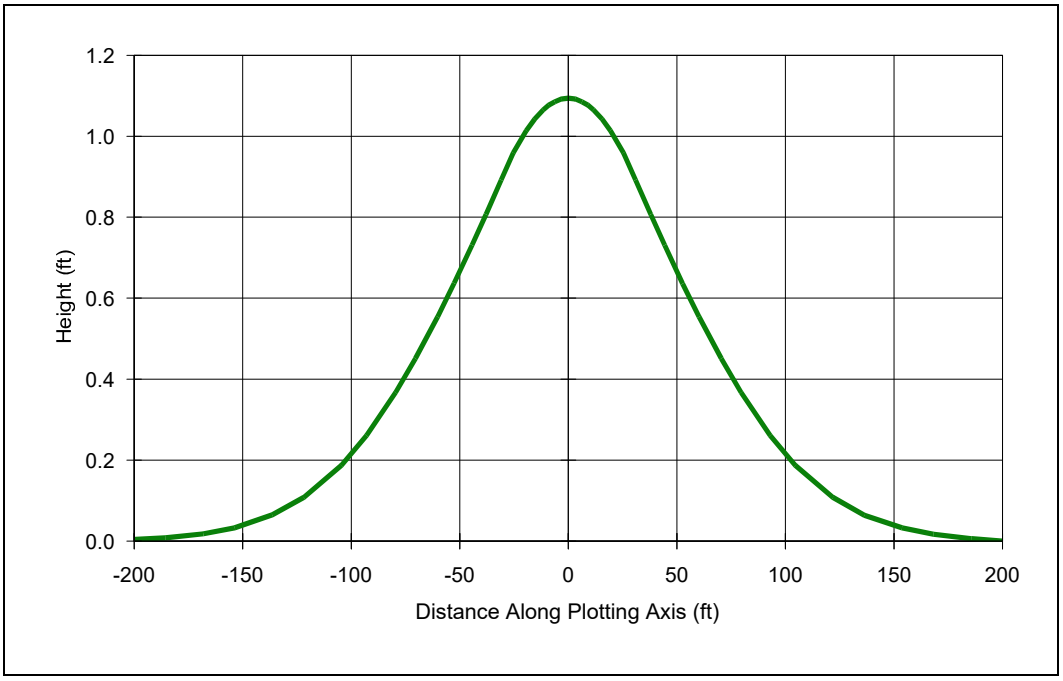
INPUT PARAMETERS

Application rate: 0.48 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 13 ft
Length of application area: 76 ft
Width of application area: 75 ft
Constant head boundary used at: 328 ft
Plotting axis from Y-Axis: 66 degrees
Edge of recharge area:
positive X: 37.5 ft
positive Y: 16.7 ft
Total volume applied: 2736 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-299.6	-133.4	-328	0
-252	-112.2	-276	0
-204.3	-91	-224	0
-156.7	-69.8	-172	0
-119.2	-53.1	-131	0.02
-90.2	-40.2	-99	0.07
-66.5	-29.6	-73	0.18
-46.4	-20.7	-51	0.37
-29	-12.9	-32	0.63
-17.4	-7.7	-19	0.75
-9.4	-4.2	-10	0.8
0	0	0	0.82
9.4	4.2	10	0.8
17.4	7.7	19	0.75
29	12.9	32	0.63
46.4	20.7	51	0.37
66.5	29.6	73	0.18
90.2	40.2	99	0.07
119.2	53.1	131	0.02
156.7	69.8	172	0
204.3	91	224	0
252	112.2	276	0
299.6	133.4	328	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 10C

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:45:23 PM

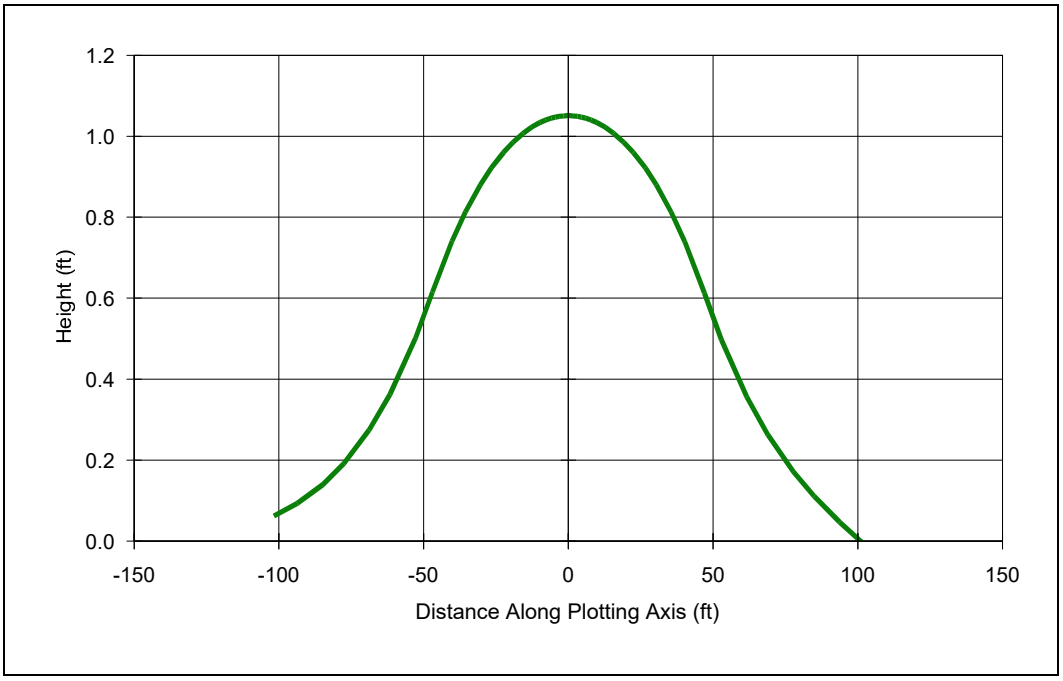
INPUT PARAMETERS

Application rate: 0.88 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 13 ft
Length of application area: 192 ft
Width of application area: 31.8 ft
Constant head boundary used at: 200 ft
Plotting axis from Y-Axis: 32 degrees
Edge of recharge area:
positive X: 15.9 ft
positive Y: 25.4 ft
Total volume applied: 5372.928 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-106	-169.6	-200	0
-89.1	-142.6	-168	0.02
-72.3	-115.7	-136	0.06
-55.4	-88.7	-105	0.19
-42.2	-67.5	-80	0.37
-31.9	-51.1	-60	0.55
-23.5	-37.6	-44	0.73
-16.4	-26.3	-31	0.89
-10.3	-16.4	-19	1.01
-6.1	-9.8	-12	1.06
-3.3	-5.3	-6	1.08
0	0	0	1.09
3.3	5.3	6	1.08
6.1	9.8	12	1.06
10.3	16.4	19	1.01
16.4	26.3	31	0.89
23.5	37.6	44	0.73
31.9	51.1	60	0.55
42.2	67.5	80	0.37
55.4	88.7	105	0.19
72.3	115.7	136	0.06
89.1	142.6	168	0.02
106	169.6	200	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 10D

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:35:44 PM

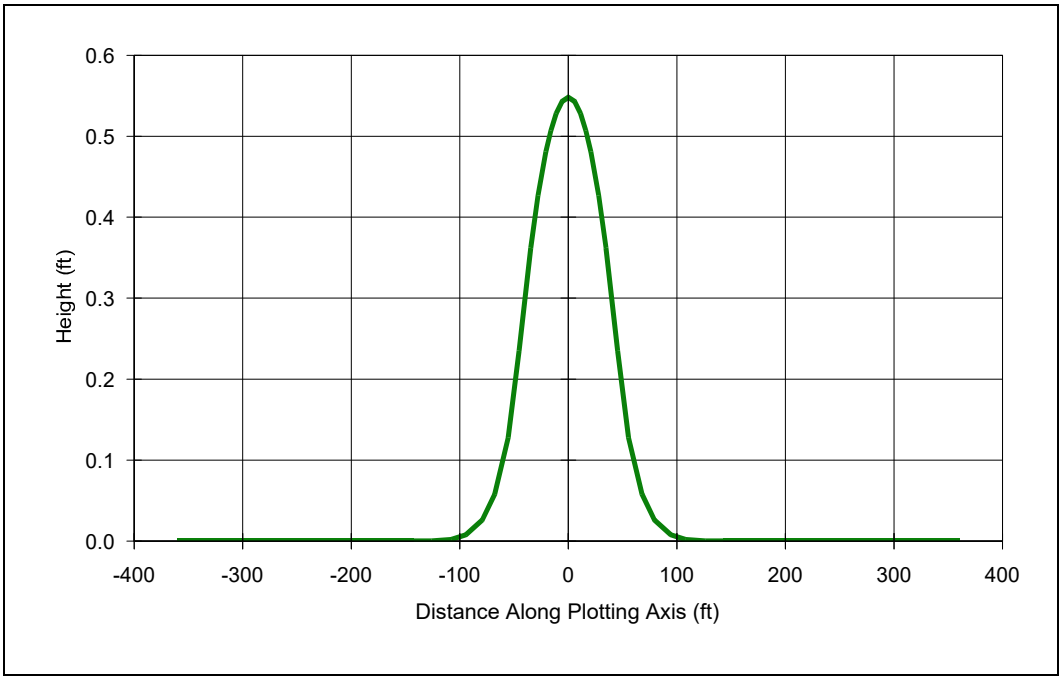
INPUT PARAMETERS

Application rate: 0.38 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 8.33 ft
Length of application area: 118 ft
Width of application area: 94.5 ft
Constant head boundary used at: 101 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 47.2 ft
positive Y: 0 ft
Total volume applied: 4237.38 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-101	0	-101	0.06
-84.9	0	-85	0.14
-68.9	0	-69	0.27
-52.8	0	-53	0.5
-40.2	0	-40	0.74
-30.4	0	-30	0.88
-22.4	0	-22	0.96
-15.6	0	-16	1.01
-9.8	0	-10	1.03
-5.9	0	-6	1.04
-3.2	0	-3	1.05
0	0	0	1.05
3.2	0	3	1.05
5.9	0	6	1.04
9.8	0	10	1.03
15.6	0	16	1.01
22.4	0	22	0.96
30.4	0	30	0.88
40.2	0	40	0.74
52.8	0	53	0.5
68.9	0	69	0.26
84.9	0	85	0.11
101	0	101	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 3A

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:36:37 PM

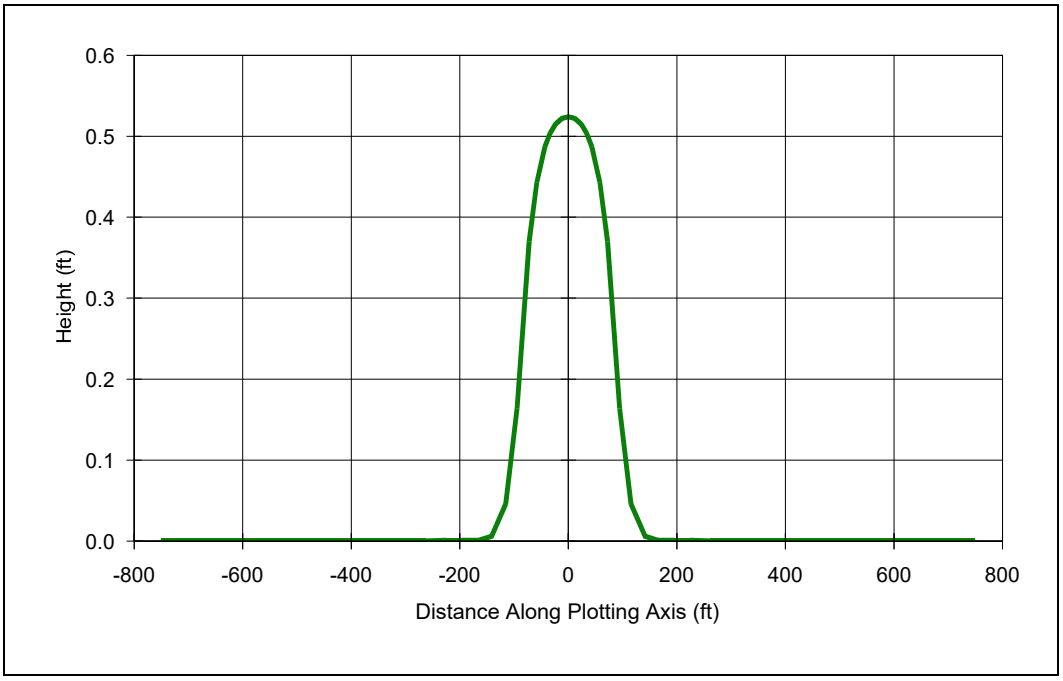
INPUT PARAMETERS

Application rate: 0.13 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.18
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 13 ft
Length of application area: 72 ft
Width of application area: 71 ft
Constant head boundary used at: 358 ft
Plotting axis from Y-Axis: 39 degrees
Edge of recharge area:
positive X: 29.2 ft
positive Y: 36 ft
Total volume applied: 664.56 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-225.3	-278.2	-358	0
-189.5	-234	-301	0
-153.6	-189.7	-244	0
-117.8	-145.5	-187	0
-89.6	-110.7	-142	0
-67.8	-83.7	-108	0
-50	-61.7	-79	0.03
-34.9	-43.1	-55	0.13
-21.8	-27	-35	0.36
-13.1	-16.1	-21	0.48
-7.1	-8.8	-11	0.53
0	0	0	0.55
7.1	8.8	11	0.53
13.1	16.1	21	0.48
21.8	27	35	0.36
34.9	43.1	55	0.13
50	61.7	79	0.03
67.8	83.7	108	0
89.6	110.7	142	0
117.8	145.5	187	0
153.6	189.7	244	0
189.5	234	301	0
225.3	278.2	358	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 5A

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:37:43 PM

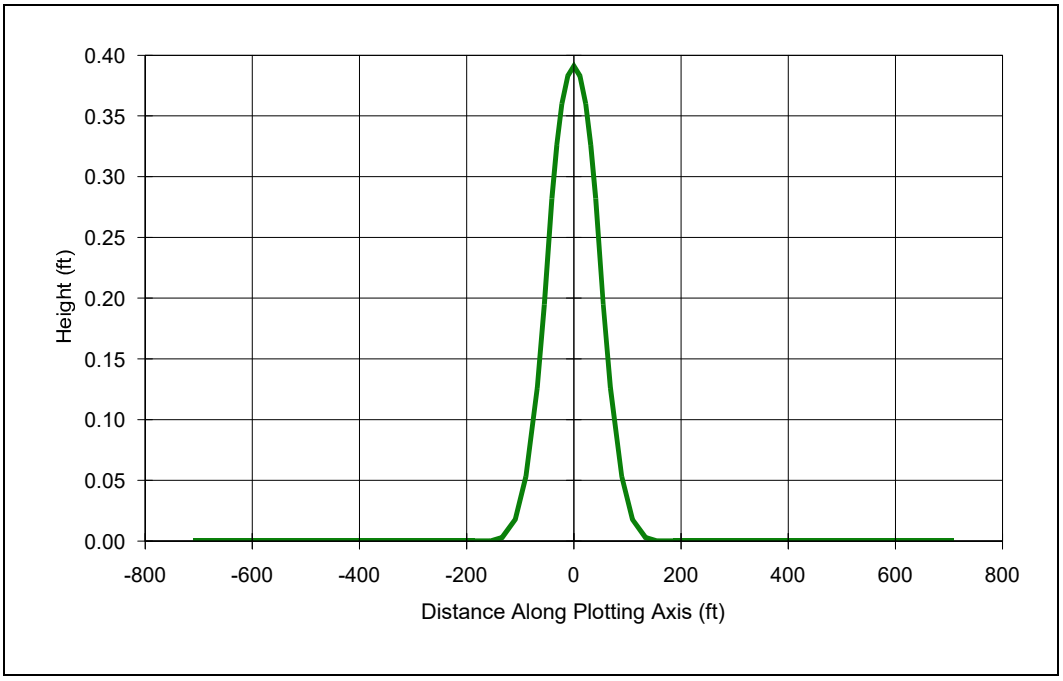
INPUT PARAMETERS

Application rate: 0.11 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.18
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 13 ft
Length of application area: 173.5 ft
Width of application area: 70.3 ft
Constant head boundary used at: 745 ft
Plotting axis from Y-Axis: 16 degrees
Edge of recharge area:
positive X: 24.9 ft
positive Y: 86.8 ft
Total volume applied: 1341.676 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-205.3	-716.1	-745	0
-172.7	-602.3	-627	0
-140	-488.3	-508	0
-107.4	-374.5	-390	0
-81.7	-285	-296	0
-61.8	-215.6	-224	0
-45.5	-158.8	-165	0
-31.8	-110.9	-115	0.05
-19.9	-69.4	-72	0.37
-11.9	-41.5	-43	0.49
-6.5	-22.6	-23	0.52
0	0	0	0.52
6.5	22.6	23	0.52
11.9	41.5	43	0.49
19.9	69.4	72	0.37
31.8	110.9	115	0.05
45.5	158.8	165	0
61.8	215.6	224	0
81.7	285	296	0
107.4	374.5	390	0
140	488.3	508	0
172.7	602.3	627	0
205.3	716.1	745	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 5B

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:38:42 PM

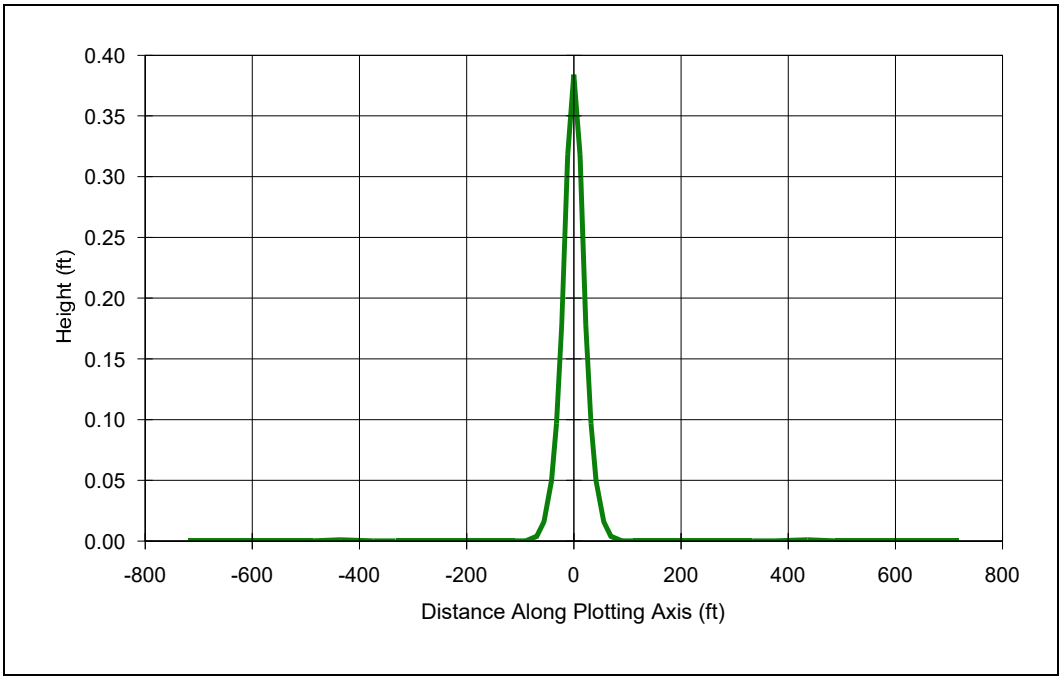
INPUT PARAMETERS

Application rate: 0.09 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.18
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 13 ft
Length of application area: 187 ft
Width of application area: 56.5 ft
Constant head boundary used at: 705 ft
Plotting axis from Y-Axis: 36 degrees
Edge of recharge area:
positive X: 28.2 ft
positive Y: 38.9 ft
Total volume applied: 950.895 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-414.4	-570.4	-705	0
-348.5	-479.7	-593	0
-282.6	-388.9	-481	0
-216.7	-298.2	-369	0
-164.9	-226.9	-281	0
-124.7	-171.7	-212	0
-91.9	-126.5	-156	0
-64.2	-88.3	-109	0.02
-40.2	-55.3	-68	0.13
-24	-33.1	-41	0.28
-13.1	-18	-22	0.36
0	0	0	0.39
13.1	18	22	0.36
24	33.1	41	0.28
40.2	55.3	68	0.13
64.2	88.3	109	0.02
91.9	126.5	156	0
124.7	171.7	212	0
164.9	226.9	281	0
216.7	298.2	369	0
282.6	388.9	481	0
348.5	479.7	593	0
414.4	570.4	705	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 10B

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:39:43 PM

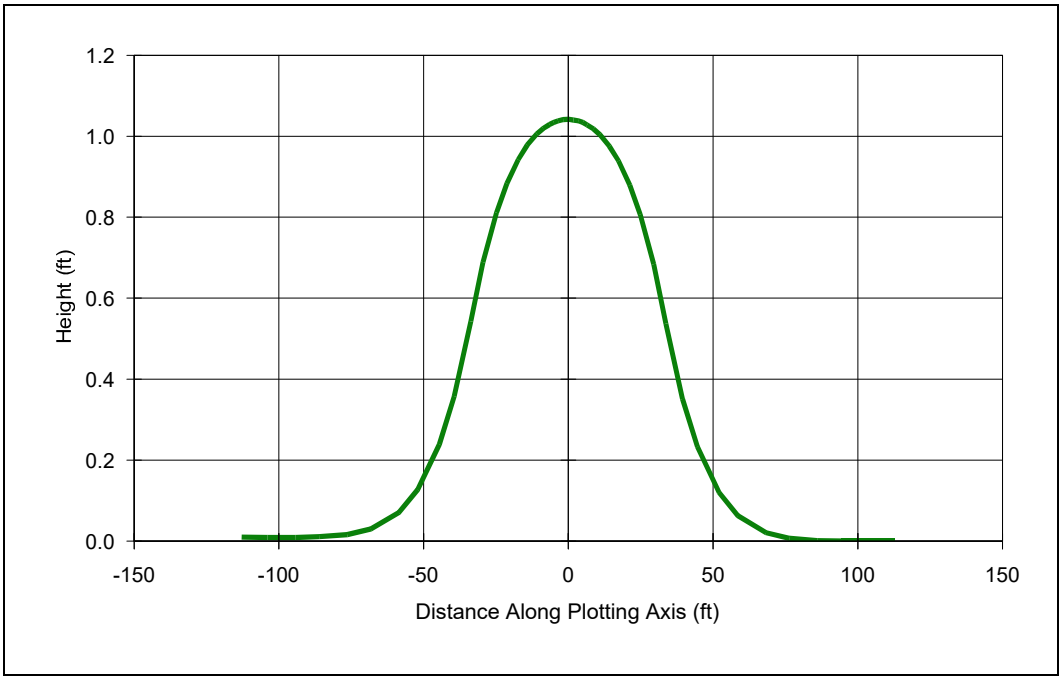
INPUT PARAMETERS

Application rate: 0.12 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.18
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 8 ft
Length of application area: 240 ft
Width of application area: 26.4 ft
Constant head boundary used at: 715 ft
Plotting axis from Y-Axis: 69 degrees
Edge of recharge area:
positive X: 13.2 ft
positive Y: 5.1 ft
Total volume applied: 760.32 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-667.5	-256.2	-715	0
-561.4	-215.5	-601	0
-455.2	-174.7	-488	0
-349	-134	-374	0
-265.6	-102	-284	0
-200.9	-77.1	-215	0
-148.1	-56.8	-159	0
-103.4	-39.7	-111	0
-64.7	-24.8	-69	0
-38.7	-14.9	-41	0.05
-21	-8.1	-23	0.18
0	0	0	0.38
21	8.1	23	0.18
38.7	14.9	41	0.05
64.7	24.8	69	0
103.4	39.7	111	0
148.1	56.8	159	0
200.9	77.1	215	0
265.6	102	284	0
349	134	374	0
455.2	174.7	488	0
561.4	215.5	601	0
667.5	256.2	715	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 5D

ANALYST: MKO

DATE: 6/28/2022 TIME: 4:40:35 PM

INPUT PARAMETERS

Application rate: 0.18 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.16
Hydraulic conductivity: 6 ft/day
Initial saturated thickness: 7 ft
Length of application area: 67 ft
Width of application area: 78.5 ft
Constant head boundary used at: 112 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 33.5 ft
Total volume applied: 946.71 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-112	-112	0.01
0	-94.2	-94	0.01
0	-76.4	-76	0.02
0	-58.6	-59	0.07
0	-44.6	-45	0.24
0	-33.7	-34	0.54
0	-24.8	-25	0.81
0	-17.3	-17	0.94
0	-10.9	-11	1.01
0	-6.5	-6	1.03
0	-3.5	-4	1.04
0	0	0	1.04
0	3.5	4	1.04
0	6.5	6	1.03
0	10.9	11	1
0	17.3	17	0.94
0	24.8	25	0.81
0	33.7	34	0.54
0	44.6	45	0.23
0	58.6	59	0.06
0	76.4	76	0.01
0	94.2	94	0
0	112	112	0

Culvert and Weir Analysis

Stamski And McNary, Inc.
Engineering - Planning – Surveying
1000 Main Street; Acton, MA 01720 (978) 263-8585
www.stamskiandmcnary.com

Culvert and Weir Analysis

For

The Cottages at Wandering Pond
Athens Street
Stow, MA

June 20, 2022

Applicant: The Cottages at Wondering Pond Realty Trust
148 Park Street
North Reading, MA 01864

Owner : EFMC Associates Limited Partnership
35 Parmenter Road
Hudson, MA 01749

Goshen Lane Realty Trust
148 Park Street
North Reading, MA 01864

Athens Street, LLC
148 Park Street
North Reading, MA 01864

Greystone Painting Corp.
21 Wellington Avenue
Hudson, MA 01749

SM-3719C File: 3719C Culvert Report Cover.doc

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Narrative

Culvert and Weir Calculations

The site is located at Athens Street in Stow, Massachusetts and is approximately 114.85 acres with existing barns, buildings, and sheds in various states of disrepair, served by a gravel road. The proposed project is an Active Adult Neighborhood with various unit types.

The site is accessed by an existing gravel road of various widths which crosses a stream in two areas. The first crossing, closer to Hudson Road, crosses the stream with a wooden bridge on stone abutments. This bridge has an opening approximately 63" wide and 42" high.

The second crossing, upstream of the first, consists of two reinforced concrete pipes (RCPs)- 43" and 24" in diameter.

In large storm events, water overtops the gravel road at both existing crossings.

The two stream crossings were modeled in Culvert Studio software program. The flowrates were taken from USGS's StreamStats program. The goal in designing the replacement culverts is to match existing hydrologic conditions while keeping the water from overtopping the road in large storm events, and to prevent the headwater elevation from increasing past FEMA 100-year elevations.

First Stream Crossing

The first stream crossing is proposed to be replaced with a combination of culverts. To keep flows through the crossing like existing, an open bottom box culvert is proposed with the same opening size (63" wide by 42" high) as the existing wooden bridge on stone abutments. To prevent water overtopping the road in large storm events, a weir box is proposed adjacent to the open bottom box culvert, allowing that excess water to flow under the road. The length of the weir was determined such that during a 100-year flood, the headwater does not go above the 100-year flood elevation. In typical hydrologic conditions, the weir box is not overtopped and flow continues through the proposed culvert as it does in existing conditions.

At the first stream crossing, the existing gravel road is not as wide as the proposed road and sidewalk, so a portion of the wetland resource area must be filled. To meet stream crossing standards for the portion of stream that is to be covered, a larger width (140" wide) open bottom box culvert is proposed directly upstream of the narrower (63" wide) open bottom box culvert. This allows stream crossing standards to be met while also preventing more flow through the culvert than currently happens in existing conditions.

Second Stream Crossing

The second stream crossing is proposed to be replaced with a weir box with orifices and 42" culverts. The weir box will encompass the 42" culverts, so the flow rate through

them in typical hydrologic conditions and smaller storm events is controlled by the orifice sizes in the weir box. The orifice sizes were calculated to allow the same flows through them as what occurs in existing conditions through the 43" and 24" RCPs, which resulted in 37.0" and 23.9" orifices.

In larger storm events, the weir box is overtopped, and flow is allowed under the road through the (4) 42" RCPs. The weir length was calculated to keep the headwater elevation from rising above the 100-year flood elevation during a 100-year flood flow rate.

Sizing Spreadsheets

Cottages at Wandering Pond

Athens Street, Stow, MA Date: 20-Jun-22

Existing First Stream Crossing (closer to Hudson Road)

Q (cfs) (50-percent AEP flood)	Q (cfs) (10-percent AEP flood)	Q (cfs) (1-percent AEP flood)	(per Streamstats peak-flow statistics)
52.7	117	230	

Existing wooden bridge on stone abutments

Span=	63	inches
Height=	42	inches
Length=	19.2	feet
Invert In=	210.64	inches
Invert Out=	210.49	inches
Skew Angle=	14	degrees
Embankment		
Top Width=	15	feet
Top Elevation=	215.3	
Crest Length=	18	ft
Existing Overtopping at 100-year (from Culvert Studio)=	61.78	cfs
Tailwater Elevation in 100-year flood=	214.3	(from FEMA profile)

Proposed First Stream Crossing (closer to Hudson Road)

Match existing culvert dimensions/elevations

Span=	63	inches
Height=	42	inches
Length=	39.3	feet
Invert In=	211.1	inches
Invert Out=	210.7	inches
Skew Angle=	28	degrees
Embankment		
Top Width=	35	feet
Top Elevation=	218.5	
Crest Length=	18	ft
Tailwater Elevation in 100-year flood=	214.3	(from FEMA profile)
Second Culvert with weir----		
Top weir=	213.2	
Overtop Flow weir needs to take (from existing, Culvert Studio)=	61.78	cfs

Sharp Crested Weir equation

Q=3.3*L*(H^1.5)

L=Q/(3.3*(H^1.5)

Find length of weir needed to keep upstream headwater at FEMA 100-year

Upstream FEMA 100-year flood elevation	214.3
H=Upstream FEMA 100-year- Top Weir=	1.1
Weir Length (L)=	16.2

Box culvert needed behind weir

Overtop Q=	61.78	cfs	(from Existing First Crossing Culvert Studio)
Span=	66	inches	
Height=	32	inches	
Length=	38	feet	
Invert In=	210.63	inches	
Invert Out=	210.55	inches	
Skew Angle=	28	degrees	
Embankment			
Top Width=	32.8	feet	
Top Elevation=	218.1		
Crest Length=	18	ft	

Culvert Studio confirms headwater stays below top of weir and FEMA 100-year elevation

Cottages at Wandering Pond

Athens Street, Stow, MA Date: 20-Jun-22

Existing Second Stream Crossing

Q (cfs) (50-percent AEP flood)	Q (cfs) (10-percent AEP flood)	Q (cfs) (1-percent AEP flood)	(per Streamstats peak-flow statistics)
51.5	114	225	

Existing (1) 43" RCP & (1) 24" RCP

Existing flow through (2) culverts in 100-year (ignoring flow overtopping road) (from Culvert Studio)= 107.77 cfs

Existing flow through 43" pipe in 100-year (from Culvert Studio)= 74.08 cfs

Existing flow through 24" pipe in 100-year (from Culvert Studio)= 33.69 cfs

Determine orifice sizes to take same flows as existing and keep upstream headwater at 100-year flood elevation

To match 43" culvert

Orifice Equation:

Q=CA x (2gh)^.5

A=Q/C(2gh)^0.5

C=	0.6		g=	32.2
Orifice Diameter=	37.0	in	Inv.=	220.97
Area=	7.48	SF	h=	4.23
Area=	1077.21	square inches		

To match 24" culvert

C=	0.6		g=	32.2
Orifice Diameter=	23.9	in	Inv.=	220.17
Area=	3.12	SF	h=	5.03
Area=	449.25	square inches		

Remaining flow to go over weir= 117.23 cfs

Top Weir= 224.68

Determine length of weir needed so that headwater elevations are 100-year floodplain elevs

100-year floodplain upstream= 225.2

Sharp Crested Weir equation

Q=3.3*L*(H^1.5)

L=Q/(3.3*(H^1.5)

H=100-year floodplain - top weir= 0.52

Weir Length= 94.7

Determine culvert size for pipes past weir box

Culvert Diameter 42 inches

Number of pipes 4

42" invert in= 220.97

42" invert out= 220.4

Culvert Studio confirms (4) 42" pipes are sufficient for taking total flow and keep headwater below top of weir & 100-year flood elevation

Culvert Studio Reports

Existing First Crossing
Culvert Studio Reports

Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Existing First Crossing

Culvert 1

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.49 ft
Length	= 19.20 ft
Slope	= 0.008 ft/ft
Invert Elev. Up	= 210.64 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 215.30 ft
Crest Length	= 18.00 ft

DISCHARGE

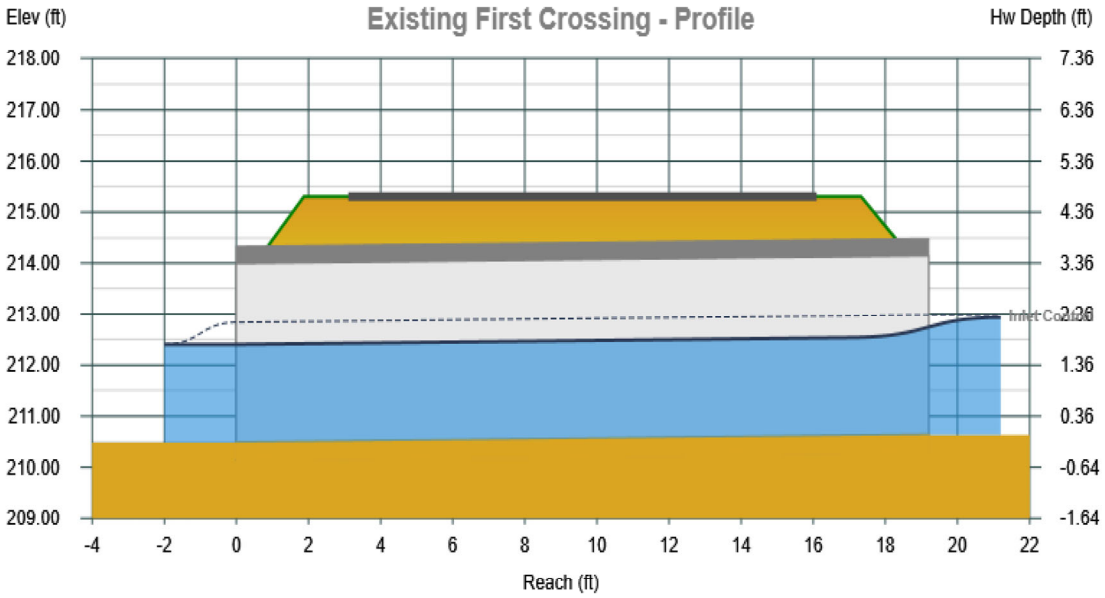
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.65		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
52.70	52.70	0.00	5.26	5.25	22.9	22.9	212.40	212.55	212.93



Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Existing First Crossing

Culvert 1

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.49 ft
Length	= 19.20 ft
Slope	= 0.008 ft/ft
Invert Elev. Up	= 210.64 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 215.30 ft
Crest Length	= 18.00 ft

DISCHARGE

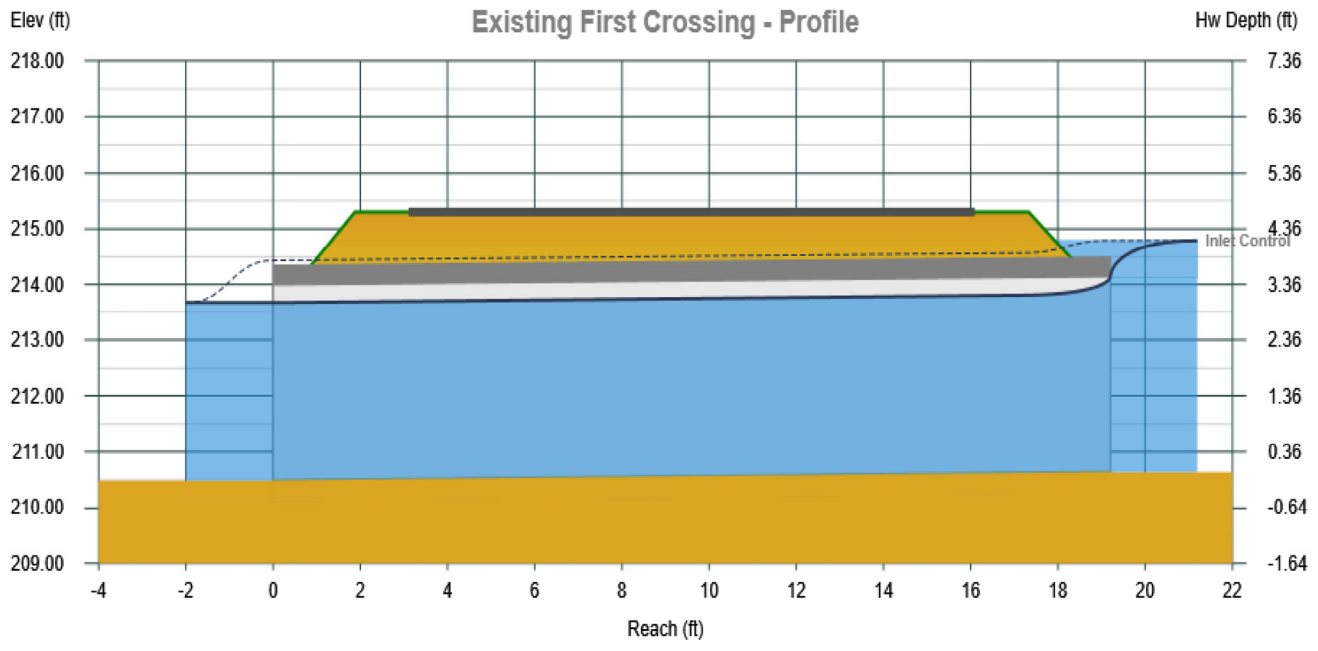
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.19		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
117.00	117.00	0.00	7.01	7.01	38.2	38.2	213.67	213.82	214.79



Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Existing First Crossing

Culvert 1

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.49 ft
Length	= 19.20 ft
Slope	= 0.008 ft/ft
Invert Elev. Up	= 210.64 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 215.30 ft
Crest Length	= 18.00 ft

DISCHARGE

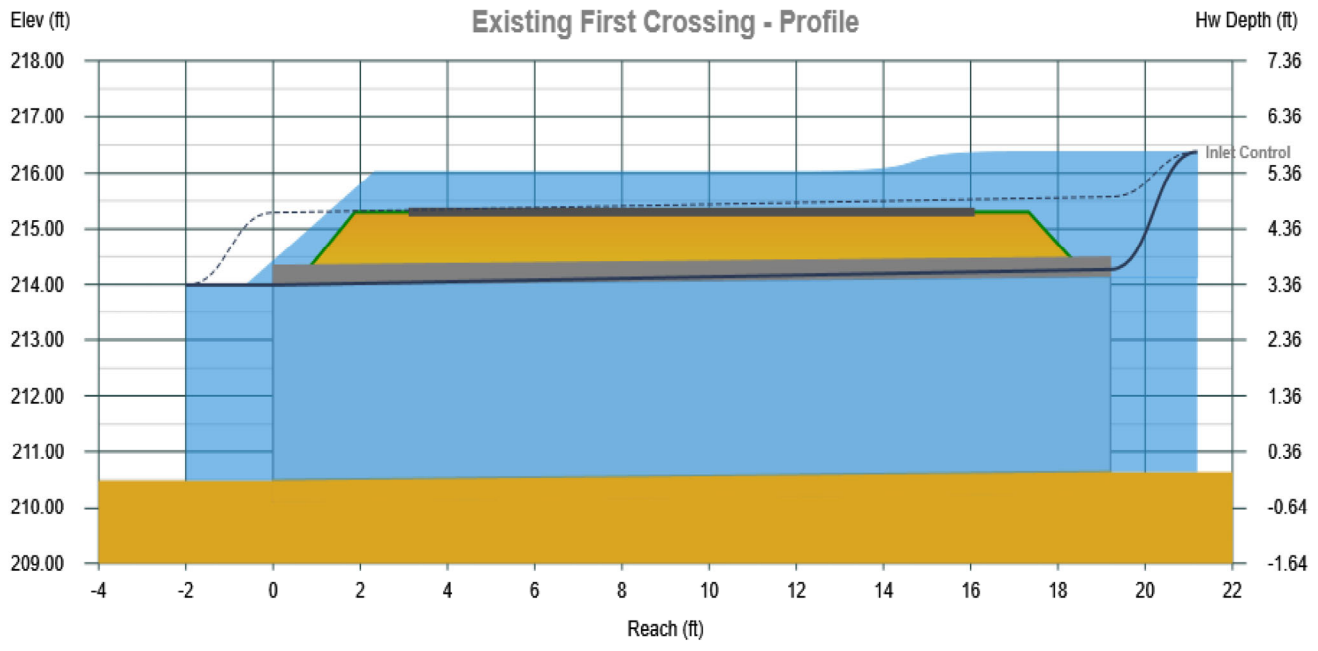
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.64		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
230.00	168.22	61.78	9.15	9.15	42.0	42.0	213.99	214.27	216.38



Proposed First Crossing
Culvert Studio Reports

Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Proposed First Crossing

Culvert 2

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.70 ft
Length	= 39.3 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 211.10 ft
No. Barrels	= 1
Plan Skew Angle	= 28 degrees

EMBANKMENT

Top Width	= 32.80 ft
Top Elevation	= 218.20 ft
Crest Length	= 18.00 ft

DISCHARGE

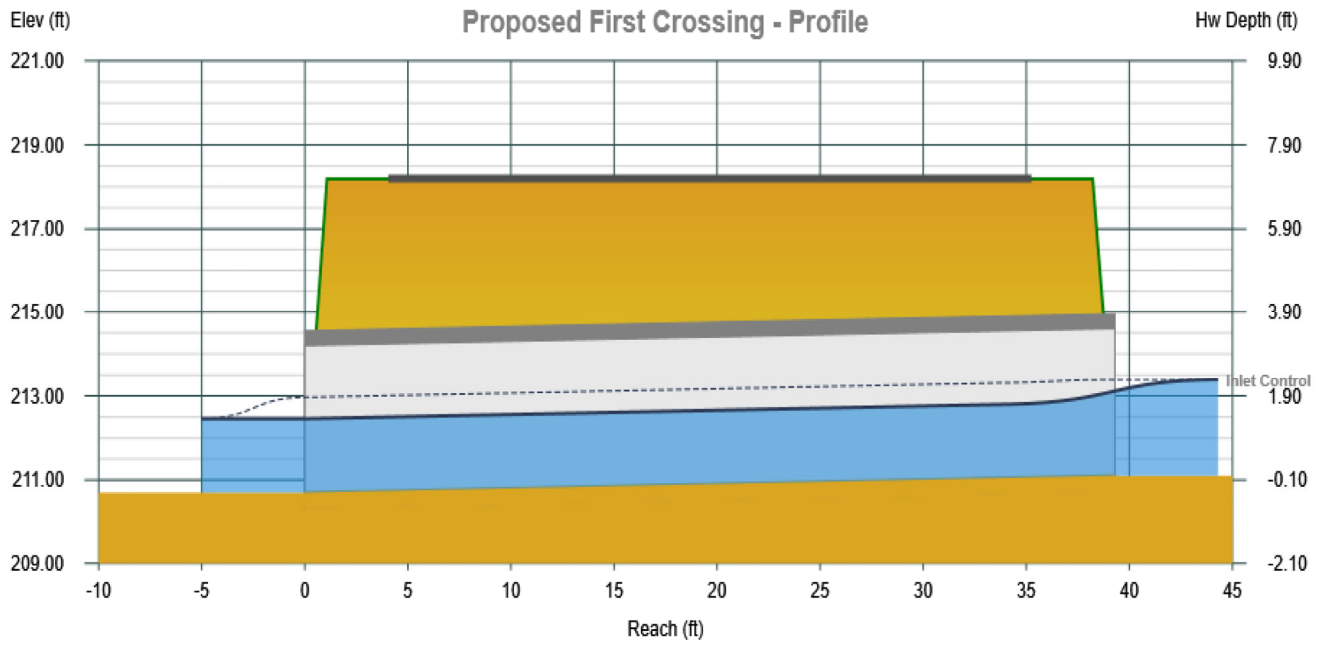
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.65		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
52.70	52.70	0.00	5.70	5.72	21.1	21.0	212.46	212.85	213.38



Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Proposed First Crossing

Culvert 2

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.70 ft
Length	= 39.3 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 211.10 ft
No. Barrels	= 1
Plan Skew Angle	= 28 degrees

EMBANKMENT

Top Width	= 32.80 ft
Top Elevation	= 218.20 ft
Crest Length	= 18.00 ft

DISCHARGE

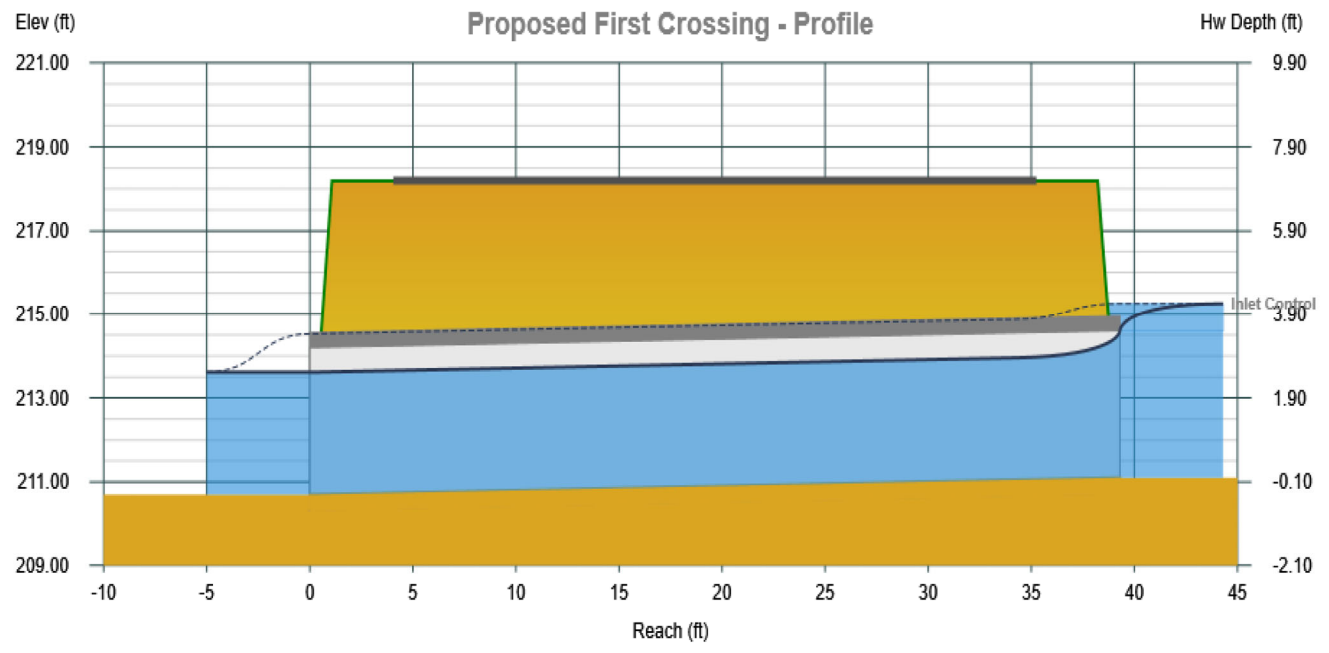
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.19		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
117.00	117.00	0.00	7.63	7.66	35.0	34.9	213.62	214.01	215.25



Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Proposed First Crossing

Culvert 2

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 42 in
Span	= 63 in
Invert Elev. Down	= 210.70 ft
Length	= 39.3 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 211.10 ft
No. Barrels	= 1
Plan Skew Angle	= 28 degrees

EMBANKMENT

Top Width	= 32.80 ft
Top Elevation	= 218.20 ft
Crest Length	= 18.00 ft

DISCHARGE

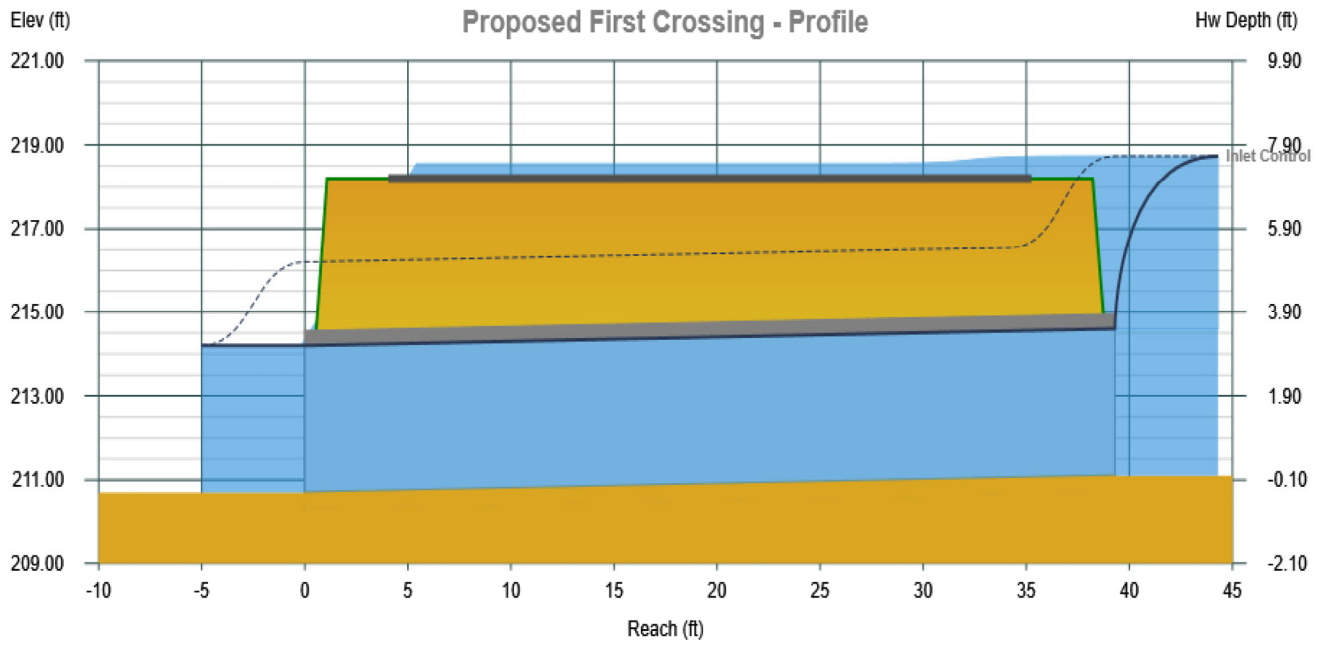
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 2.18		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
230.00	208.80	21.20	11.36	11.36	42.0	42.0	214.20	214.60	218.73



Proposed First Crossing- Box Culvert past Weir Box Culvert Studio Reports

Culvert Report

Project filename: 3719C CULVERT STUDIO FIRST CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Proposed First Crossing after weir

Culvert 3

CULVERT

Shape	= Rectangular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 32 in
Span	= 66 in
Invert Elev. Down	= 210.55 ft
Length	= 39.6 ft
Slope	= 0.002 ft/ft
Invert Elev. Up	= 210.63 ft
No. Barrels	= 1
Plan Skew Angle	= 28 degrees

EMBANKMENT

Top Width	= 32.80 ft
Top Elevation	= 218.10 ft
Crest Length	= 18.00 ft

DISCHARGE

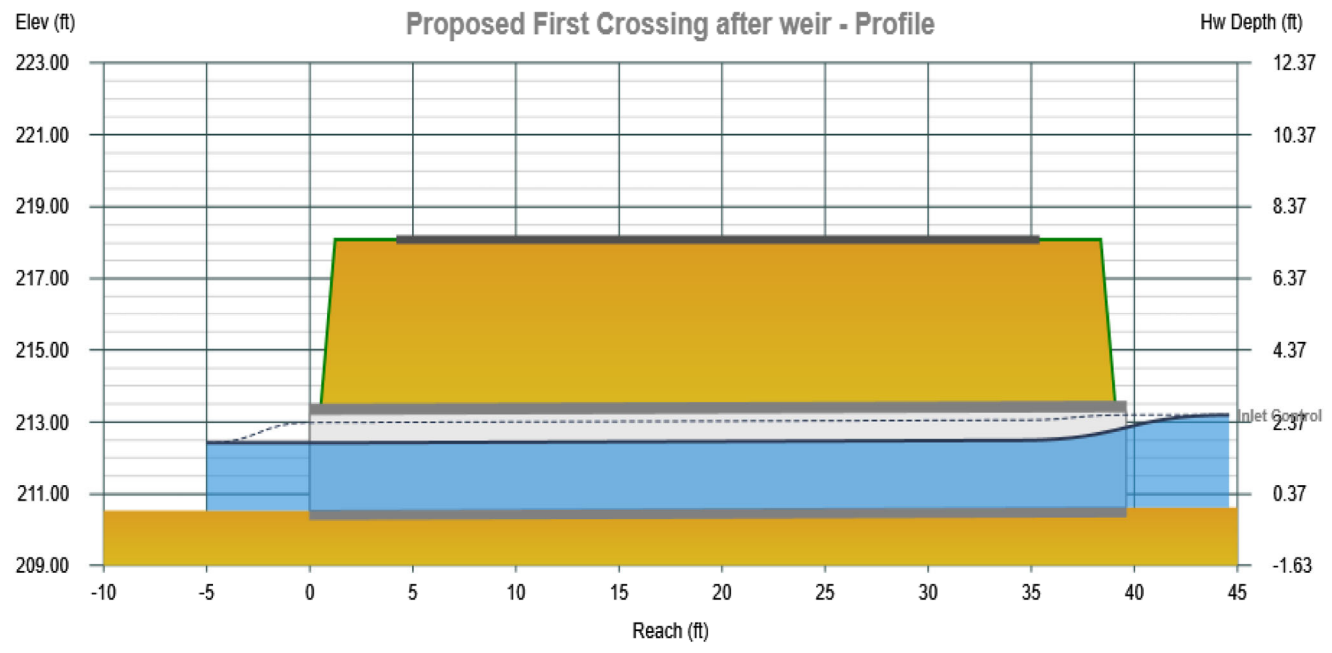
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.96		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
61.78	61.78	0.00	5.97	5.97	22.6	22.6	212.43	212.51	213.20



Existing Second Crossing
Culvert Studio Reports

Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

2-year Existing Second Crossing

Culvert 2

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 24 in
Span	= 24 in
Invert Elev. Down	= 220.64 ft
Length	= 48.7 ft
Slope	= -0.010 ft/ft
Invert Elev. Up	= 220.17 ft
No. Barrels	= 1
Plan Skew Angle	= 34 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

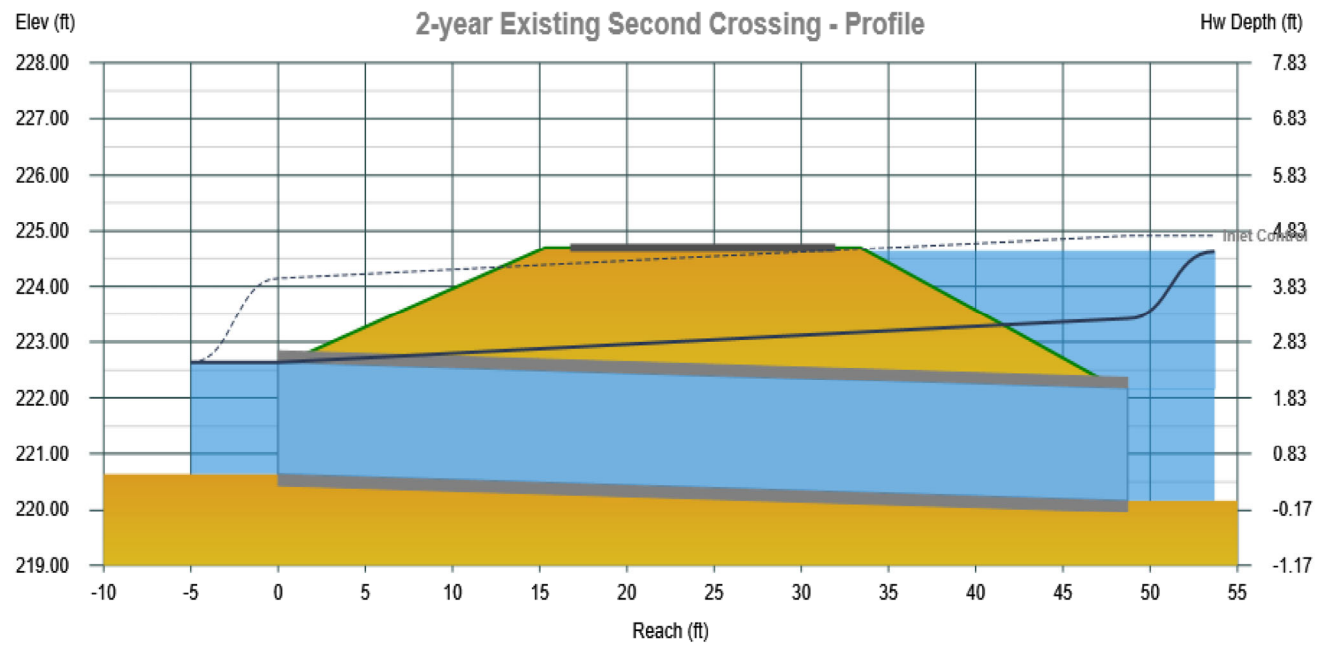
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 2.23		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
30.90	30.90	0.00	9.84	9.84	24.0	24.0	222.64	223.42	224.63



Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

2-year Existing Second Crossing

Culvert 1

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 43 in
Span	= 43 in
Invert Elev. Down	= 220.99 ft
Length	= 41.1 ft
Slope	= 0.000 ft/ft
Invert Elev. Up	= 220.97 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

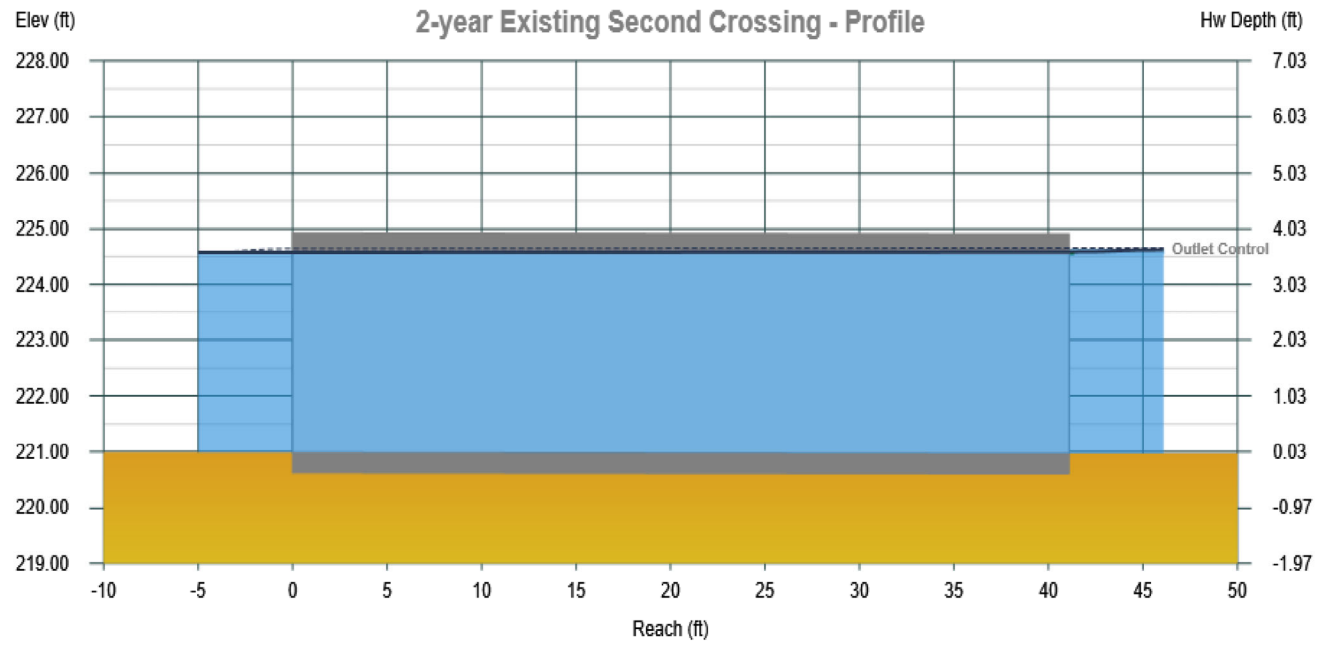
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.02		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
20.60	20.60	0.00	2.04	2.04	43.0	43.0	224.57	224.59	224.62



Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

10-year Existing Second Crossing

Culvert 4

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 24 in
Span	= 24 in
Invert Elev. Down	= 220.64 ft
Length	= 48.7 ft
Slope	= -0.010 ft/ft
Invert Elev. Up	= 220.17 ft
No. Barrels	= 1
Plan Skew Angle	= 34 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

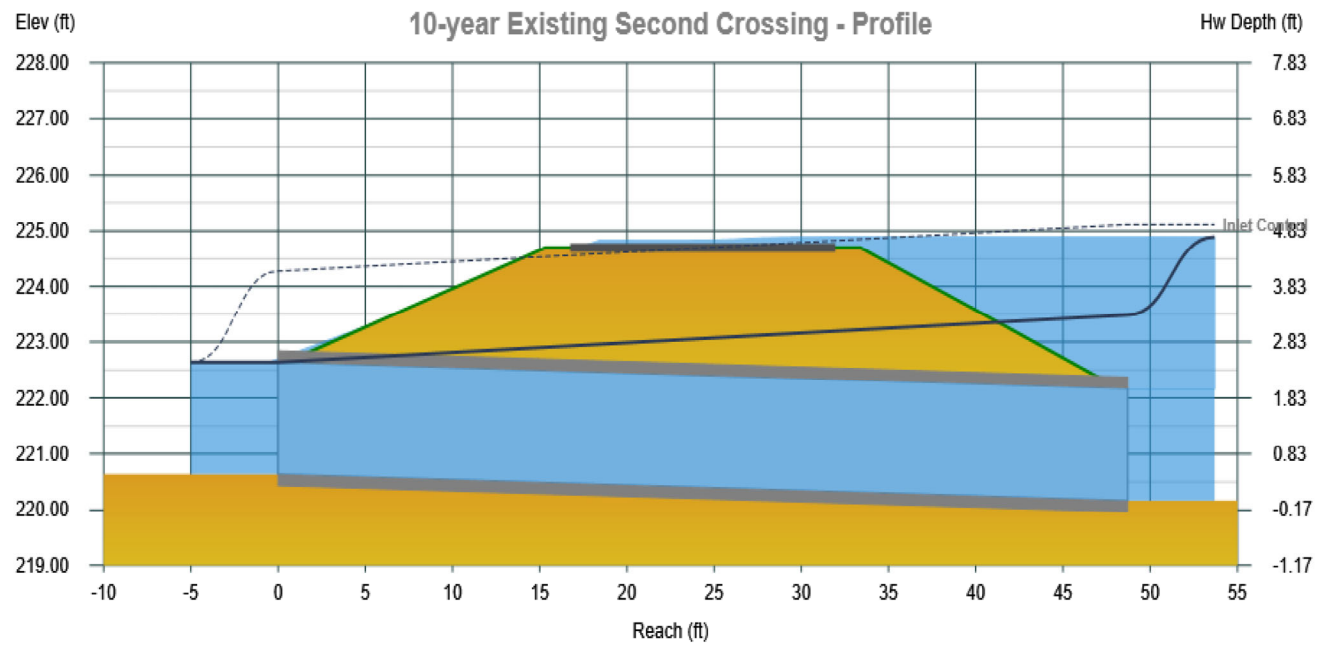
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 2.36		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
45.60	32.22	13.38	10.26	10.25	24.0	24.0	222.64	223.48	224.89



Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

10-year Existing Second Crossing

Culvert 3

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 43 in
Span	= 43 in
Invert Elev. Down	= 220.99 ft
Length	= 41.1 ft
Slope	= 0.000 ft/ft
Invert Elev. Up	= 220.97 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

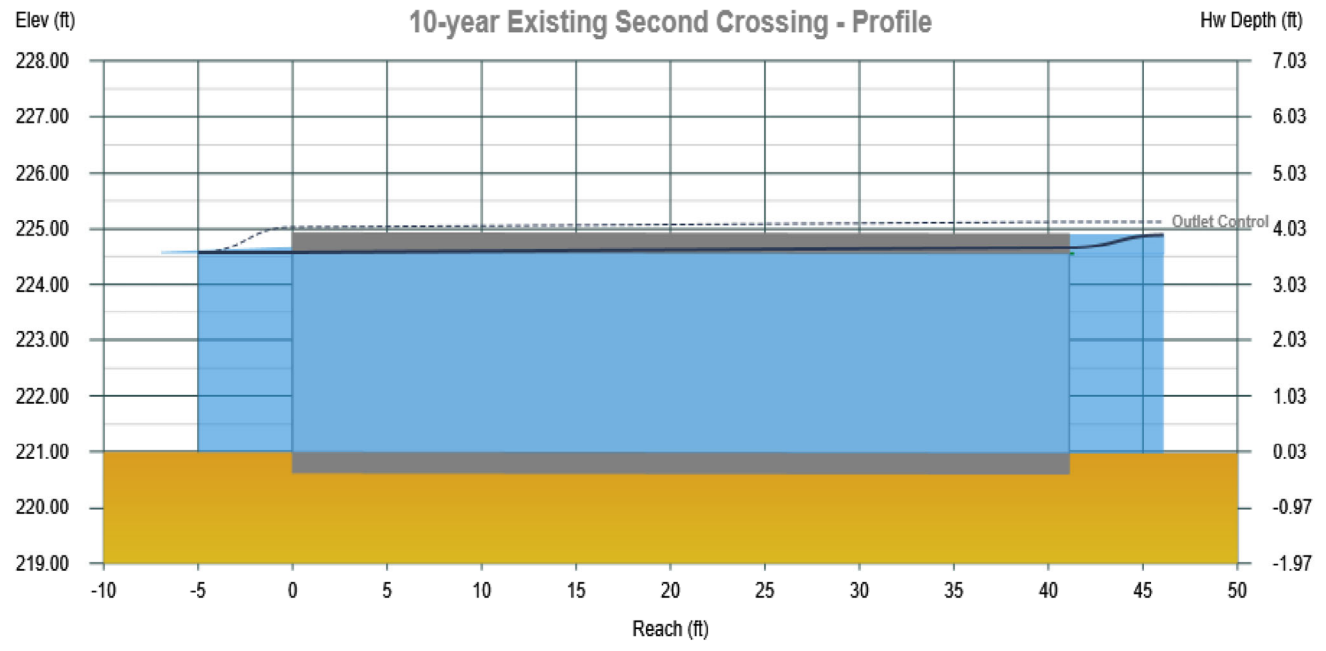
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.10		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
68.40	55.02	13.38	5.46	5.46	43.0	43.0	224.57	224.67	224.90



Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

100-year Existing Second Crossing

Culvert 6

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 24 in
Span	= 24 in
Invert Elev. Down	= 220.64 ft
Length	= 48.7 ft
Slope	= -0.010 ft/ft
Invert Elev. Up	= 220.17 ft
No. Barrels	= 1
Plan Skew Angle	= 34 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

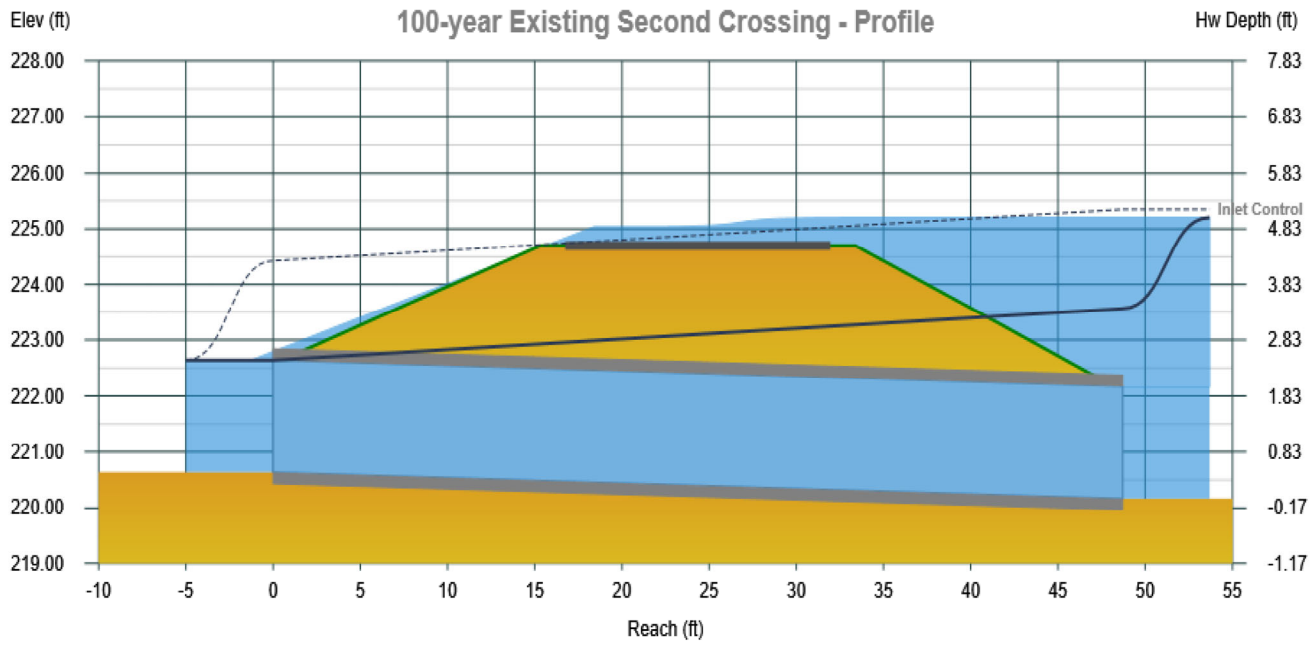
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 2.52		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
94.50	33.69	60.81	10.72	10.72	24.0	24.0	222.64	223.56	225.20



Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

100-year Existing Second Crossing

Culvert 5

CULVERT

Shape	= Circular
Inlet Edge	= Projecting
Material	= Concrete
Manning's n	= 0.012
Rise	= 43 in
Span	= 43 in
Invert Elev. Down	= 220.99 ft
Length	= 41.1 ft
Slope	= 0.000 ft/ft
Invert Elev. Up	= 220.97 ft
No. Barrels	= 1
Plan Skew Angle	= 14 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 224.70 ft
Crest Length	= 53.00 ft

DISCHARGE

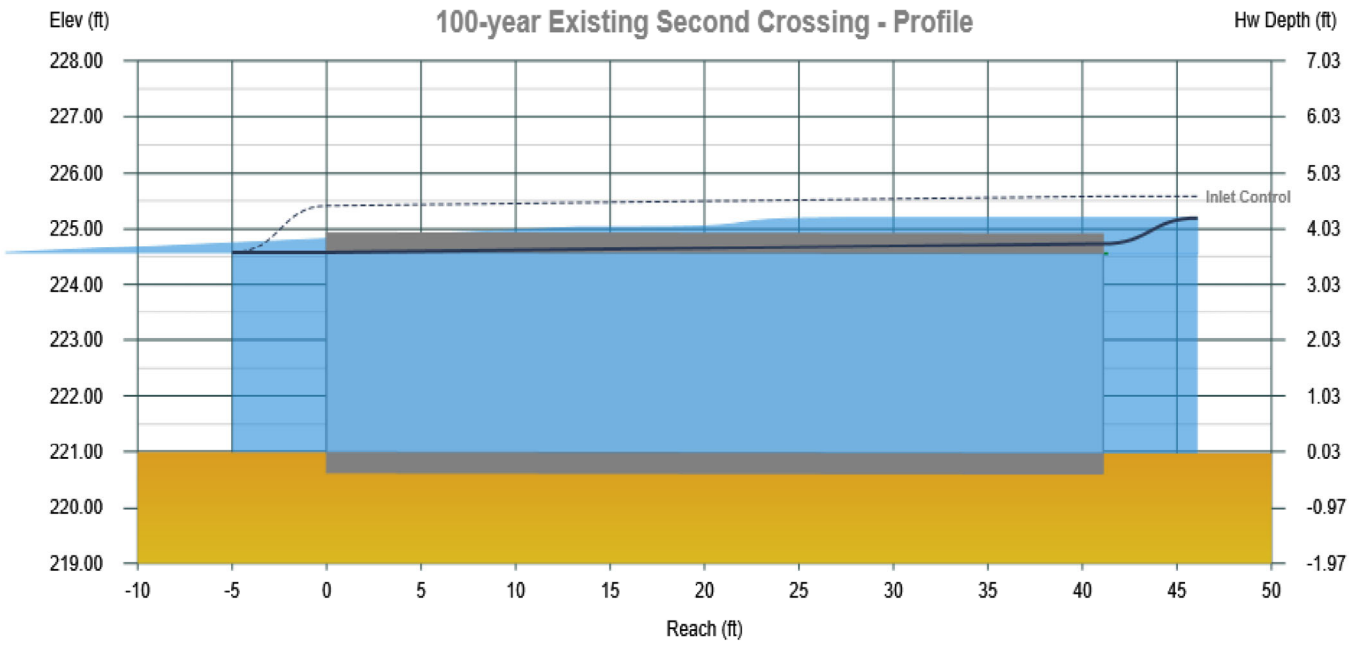
Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.18		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
130.50	74.08	56.42	7.35	7.35	43.0	43.0	224.57	224.74	225.20



Proposed Second Crossing- (4) 42" RCP past Weir Box
Culvert Studio Reports

Culvert Report

Project filename: 3719C CULVERT STUDIO SECOND CROSSING ONLY.cst

Culvert Studio v 2.0.0.27

06-21-2022

Proposed Second Crossing Past Weir Box — Culvert 8

CULVERT

Shape	= Circular
Inlet Edge	= Square Edge/ Hdwall
Material	= Concrete
Manning's n	= 0.012
Rise	= 42 in
Span	= 42 in
Invert Elev. Down	= 220.40 ft
Length	= 39.9 ft
Slope	= 0.014 ft/ft
Invert Elev. Up	= 220.97 ft
No. Barrels	= 4
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 29.00 ft
Top Elevation	= 229.00 ft
Crest Length	= 75.00 ft

DISCHARGE

Method	= User-defined

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.06		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
225.00	225.00	0.00	10.81	8.16	22.3	28.3	222.26	223.33	224.67



Stream Crossing Standards-
Portion of First Crossing

Cottages at Wandering Pond- Athens Street, Stow, MA

Stream Crossing Calculations

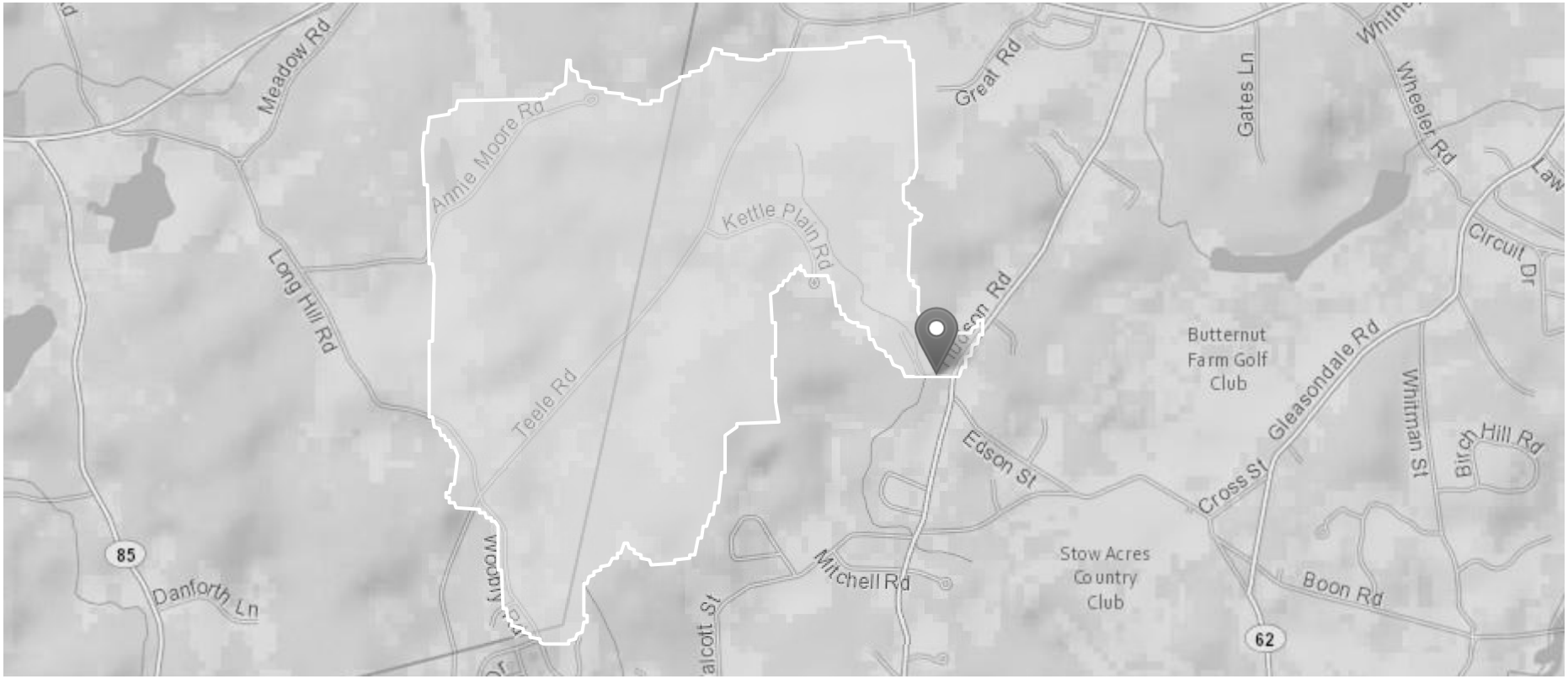
Date: 20-Jun-22

	Feet			
Average Height streambed to bottom of culvert	3.5			
Width of opening, from foundation edges	10			
Length of stream that is crossed	27			
Bankfull width	8			
1.2X Bankfull width	9.6			
	Provided		Minimum	
Openness Ratio	1.30	>	0.82	OK
Crossing Span	10	>	9.6	OK

StreamStats Peak Flow Statistics

StreamStats Report

Region ID: MA
Workspace ID: MA20220603134806639000
Clicked Point (Latitude, Longitude): 42.42130, -71.54009
Time: 2022-06-03 09:48:27 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.33	square miles
ELEV	Mean Basin Elevation	316	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	5.75	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.33	square miles	0.16	512
ELEV	Mean Basin Elevation	316	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	5.75	percent	0	32.3

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	ASEp
50-percent AEP flood	52.7	ft^3/s	26.8	104	42.3
20-percent AEP flood	88.2	ft^3/s	44.2	176	43.4
10-percent AEP flood	117	ft^3/s	57.3	239	44.7
4-percent AEP flood	158	ft^3/s	74.7	334	47.1
2-percent AEP flood	193	ft^3/s	88.3	422	49.4
1-percent AEP flood	230	ft^3/s	102	519	51.8

Statistic	Value	Unit	PII	PIu	ASEp
0.5-percent AEP flood	271	ft^3/s	117	630	54.1
0.2-percent AEP flood	329	ft^3/s	135	802	57.6

Peak-Flow Statistics Citations

Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (https://dx.doi.org/10.3133/sir20165156)

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Application Version: 4.9.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.0

StreamStats Report

Region ID: MA
Workspace ID: MA20220603135810805000
Clicked Point (Latitude, Longitude): 42.42335, -71.54220
Time: 2022-06-03 09:58:30 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.3	square miles
ELEV	Mean Basin Elevation	318	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	5.91	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.3	square miles	0.16	512
ELEV	Mean Basin Elevation	318	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	5.91	percent	0	32.3

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	ASEp
50-percent AEP flood	51.5	ft^3/s	26.2	101	42.3
20-percent AEP flood	86.3	ft^3/s	43.3	172	43.4
10-percent AEP flood	114	ft^3/s	55.8	233	44.7
4-percent AEP flood	155	ft^3/s	73.3	328	47.1
2-percent AEP flood	189	ft^3/s	86.5	413	49.4
1-percent AEP flood	225	ft^3/s	99.8	507	51.8

Statistic	Value	Unit	PII	PIu	ASEp
0.5-percent AEP flood	265	ft^3/s	114	616	54.1
0.2-percent AEP flood	322	ft^3/s	132	785	57.6

Peak-Flow Statistics Citations

Zarriello, P.J.,2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (https://dx.doi.org/10.3133/sir20165156)

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Application Version: 4.9.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.0

FEMA Floodway Data & Profile

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Branch of Assabet River								
A	1,589[1]	65	188	1.8	195.3	195.3	196.1	0.8
B	1,943[1]	69	216	1.6	197.5	197.5	198.5	1.0
C	2,862[1]	22	53	2.5	199.0	199.0	200.0	1.0
D	3,105[1]	76	297	0.4	202.2	202.2	202.2	0.0
E	4,087[1]	15	20	6.7	203.1	203.1	203.1	0.0
F	5,169[1]	14	49	2.8	209.3	209.3	210.3	1.0
G	6,325[1]	43	85	1.3	214.3	214.3	214.3	0.0
H	6,405[1]	32	56	1.9	214.3	214.3	214.4	0.1
I	7,413[1]	15	22	4.4	221.5	221.5	222.0	0.5
J	7,608[1]	45	151	0.6	225.2	225.2	225.2	0.0
K	8,527[1]	47	112	0.9	225.4	225.4	225.4	0.0
L	9,573[1]	56	111	0.9	225.6	225.6	225.8	0.2
Branch of Elizabeth Brook 1								
A	401[2]	12	63	2.0	195.0	195.0	196.0	1.0
B	1,062[2]	86	437	0.3	195.1	195.1	196.1	1.0
C	1,183[2]	40	186	0.7	198.8	198.8	199.8	1.0
D	1,299[2]	176	952	0.1	198.9	198.9	199.8	0.9
E	2,017[2]	225	1,809	0.1	198.9	198.9	199.8	0.9
F	2,756[2]	15	49	2.6	198.9	198.9	199.8	0.9
G	2,872[2]	91	180	0.7	202.9	202.9	202.9	0.0
H	2,973[2]	38	195	0.6	202.9	202.9	202.9	0.0

[1] Feet above confluence with Assabet River

[2] Feet above confluence with Elizabeth Brook 1

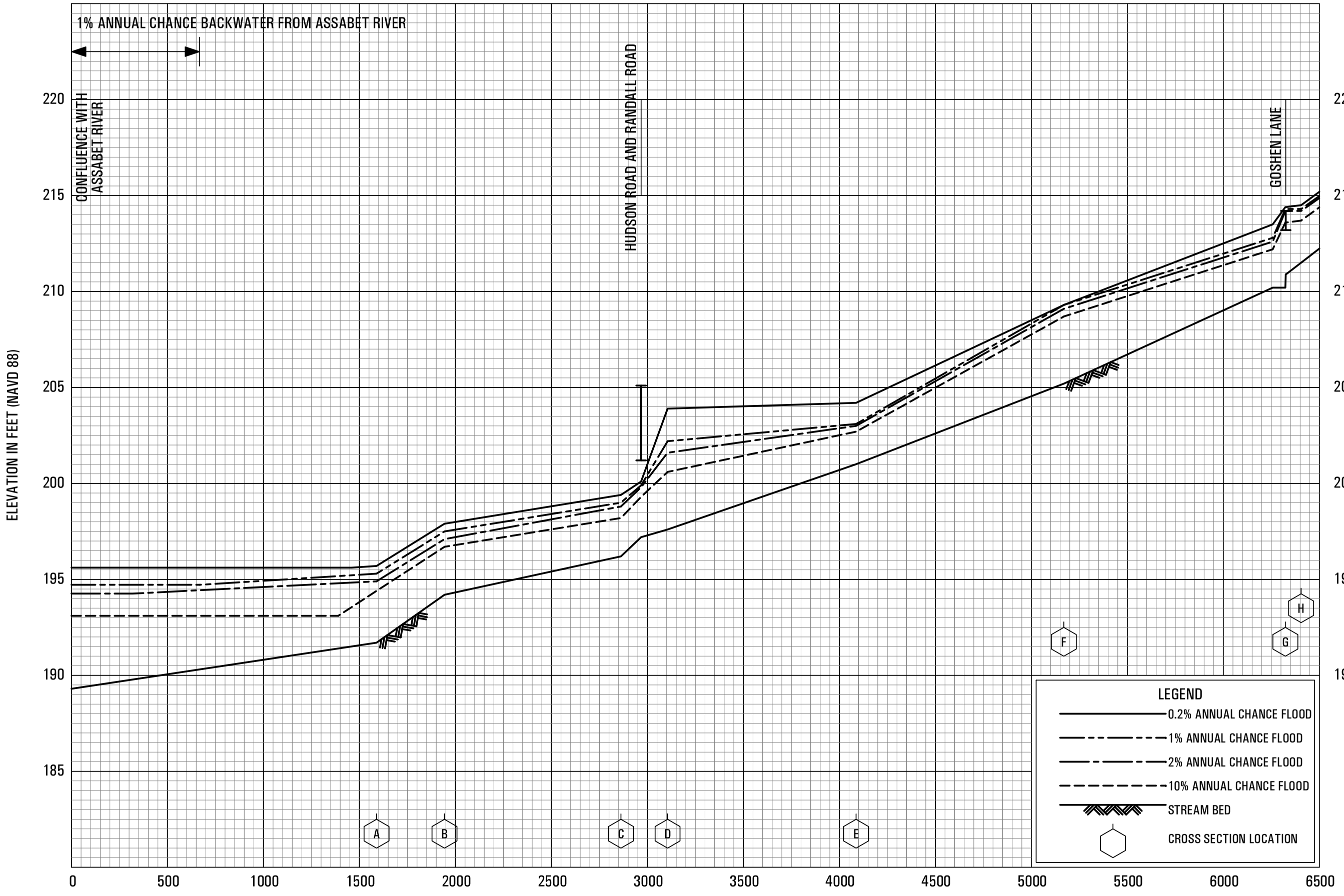
TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BRANCH OF ASSABET RIVER – BRANCH OF ELIZABETH BROOK 1



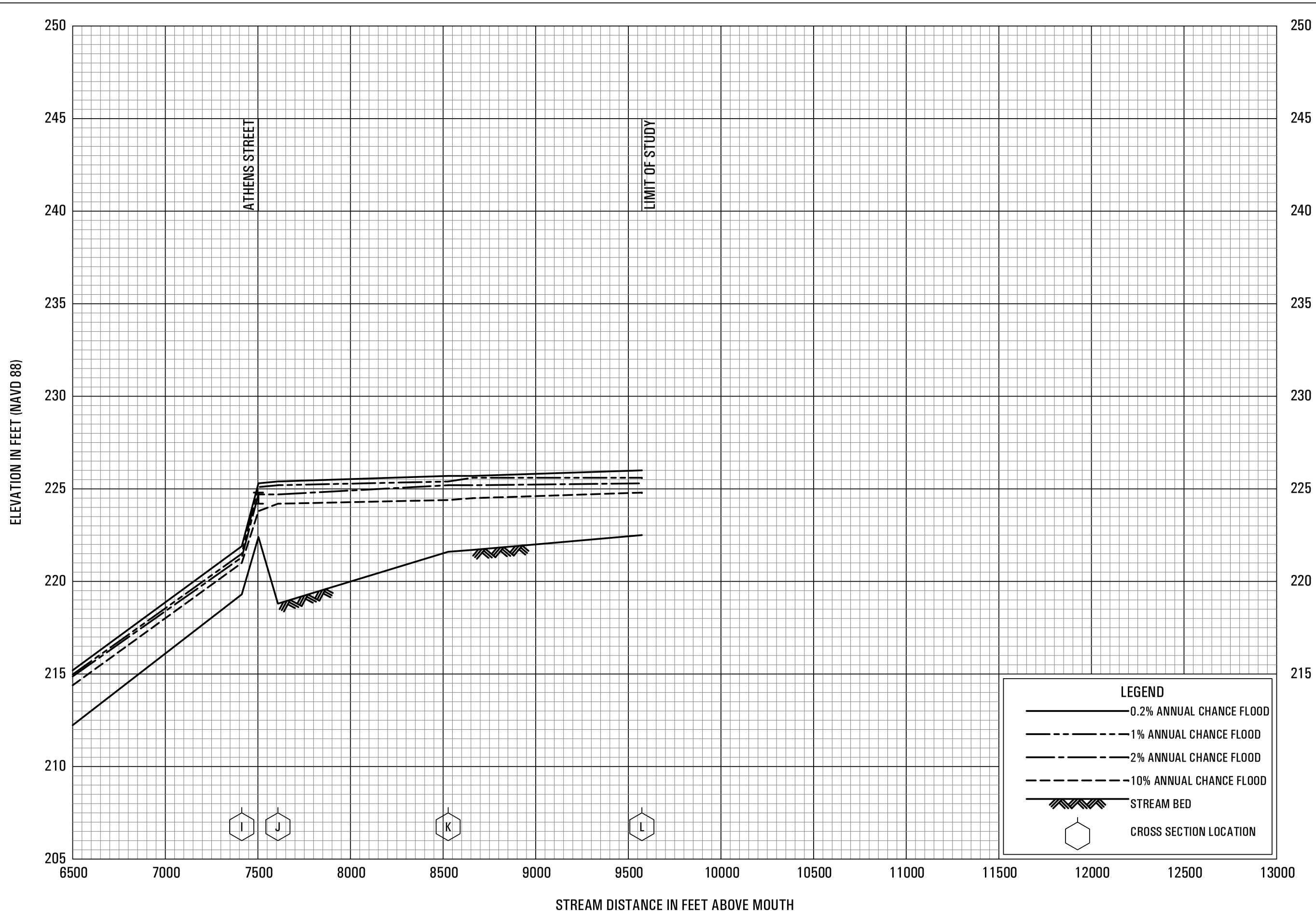
FLOOD PROFILES

BRANCH OF ASSABET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MIDDLESEX COUNTY, MA

(ALL JURISDICTIONS)



FLOOD PROFILES

BRANCH OF ASSABET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MIDDLESEX COUNTY, MA

(ALL JURISDICTIONS)

110P

TSS Removal Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: The Cottages at Wandering Pond

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Area Drain	**0.25**	**1.00**	**0.25**	**0.75**
Sediment Forebay	**0.25**	**0.75**	**0.19**	**0.56**
Infiltration Basin	**0.80**	**0.56**	**0.45**	**0.11**

Total TSS Removal = **89%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: SM-3719C

Prepared By: MKO

Date: 6/28/2022

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Soil Evaluation

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-1 (Hole #) | 10/25/2021 (Date) | 8:00AM (Time) | 45d, rain (Weather) | (Latitude) | (Longitude:)

1. Land Use: AGRICULTURAL FIELD (e.g., woodland, agricultural field, vacant lot, etc.) | MEADOW (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-10 (Slope (%))

Description of Location:

2. Soil Parent Material: OUTWASH | MORAINE (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >>100 feet | Drainage Way _____ feet | Wetlands >>100 feet
Property Line >>10 feet | Drinking Water Well >100 feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
8	A	SL	10YR 3/3	-	-	-	-	-	M	F	
20	B	LS	10YR 5/6	-	-	-	-	-	M	F	
84	C1	SAND	10YR 6/2	50	high/low	2	-	-	SG	L	
164	C2	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-2 (Hole #) 10/25/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use: _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
8	A	SL	10YR 3/3	-	-	-	-	-	M	F	
24	B	LS	10YR 5/6	-	-	-	-	-	M	F	
82	C1	SAND	10YR 6/2	52	high/low	2	-	-	SG	L	
156	C2	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-3 (Hole #) 10/25/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
6	A	SL	10YR 3/3	-	-	-	-	-	M	F	
24	B	LS	10YR 5/6	-	-	-	-	-	M	F	
56	C1	SAND	10YR 6/2	56	high/low	2	-	-	SG	L	
156	C2	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-4 (Hole #) | 10/25/2021 (Date) | (Time) | (Weather) | (Latitude) | (Longitude:)

1. Land Use (e.g., woodland, agricultural field, vacant lot, etc.) | (Vegetation) | R02, PARCEL4 (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | (Slope (%))

Description of Location:

2. Soil Parent Material: | (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands _____ feet | Property Line _____ feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☑ Yes ☐ No If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
22	FILL	-	-	-	-	-	-	-	-	-	
48	C1	LS	10YR 6/2	-	-	-	-	-	M	F	
66	C2	C. SAND	10YR 5/6	48	high/low	2	-	-	SG	L	
162	C3	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-5 (Hole #) 10/25/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use Athens Stre (e.g., woodland, agricultural field, vacant lot, etc.) _____ (Vegetation) _____ (Surface Stones (e.g., cobbles, stones, boulders, etc.)) _____ (Slope (%))

   Description of Location: _____

2. Soil Parent Material: _____ (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS)) _____

3. Distances from: Open Water Body _____ feet; Drainage Way _____ feet; Wetlands _____ feet; Property Line _____ feet; Drinking Water Well _____ feet; Other _____ feet

4. Unsuitable Materials Present: ☑ Yes ☐ No If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
26	FILL	-	-	-	-	-	-	-	-	-	
76	C1	C. SAND	10YR 5/6	48	high/low	2	-	-	SG	L	
156	C2	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-21-6 (Hole #) 10/25/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
8	A	SL	10YR 3/3	-	-	-	-	-	M	F	
20	B	SAND	10YR 5/6	-	-	-	-	-	SG	L	
60	C1	C. SAND	10YR 5/3	60	high/low	2	-	-	SG	L	
150	C2	SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10-25-1 (Hole #) | 10/25/2021 (Date) | 8:30 (Time) | RAINY (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 7200 feet | Drainage Way – feet | Wetlands 7100 feet | Property Line 710 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: – Depth Weeping from Pit | – Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	A	SL	10YR 3/3	-	-	-	-	-	m	f	
10-24	B	LS	10YR 4/6	-	-	-	2	-	m	f	
24-60	C1	S	10YR 3/6	-	-	-	5	10	SG	L	
60-138	C2	S	10YR 5/2	-	-	-	10	5	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10-25-2 (Hole #) 10/25/2021 (Date) 9:30 (Time) RAINY (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED (Vegetation) SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) ~5 (Slope (%))

Description of Location: _____

2. Soil Parent Material: TILL _____ (Landform) FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet; Drainage Way - feet; Wetlands >100 feet; Property Line >10 feet; Drinking Water Well - feet; Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 84" Depth Weeping from Pit 132" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-14	A	10YR 3/3	SL	-	-	-	-	-	M	F	
14-40	B	10YR 5/4	SL	-	-	-	-	-	M	F	
40-66	C1	10YR 5/2	S	60"	HIGH/LOW	>5	5	5	SG	L	
60-72	C2	10YR 5/2	SL	↓	↓	↓	-	-	M	F	
72-138	C3	10YR 4/3	S	↓	↓	↓	10	15	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10-25-3 (Hole #) | 10/25/2021 (Date) | 10:30 (Time) | RAINY (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | Vegetation: WOODED | Surface Stones (e.g., cobbles, stones, boulders, etc.): SOME | Slope (%): ~2

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body 7200 feet | Drainage Way – feet | Wetlands 7100 feet
Property Line 710 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: – Depth Weeping from Pit – Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	SL	10YR 3/3	-	-	-	-	-	M	F	
12-24	B	SL	10YR 3/6	-	-	-	-	-	M	F	
24-160	C	S	10YR 5/2	-	-	-	10	15	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10-25-4 (Hole #) | 10/25/2021 (Date) | 11:00 (Time) | RAINY (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | Vegetation: WOODED | Surface Stones (e.g., cobbles, stones, boulders, etc.): SOME | Slope (%): ~2

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body 7200 feet | Property Line 710 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands 7100 feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	SL	10YR 3/3	-	-	-	-	-	M	F	
12-24	B	SL	10YR 3/6	-	-	-	-	-	M	F	
24-96	C1	S	10YR 5/2	-	-	-	5	5	SG	L	
96-104	C2	FINE S	10YR 4/2	-	-	-	-	-	SG	L	
104-156	C3	S	10YR 5/2	-	-	-	5	5	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10-25-5 (Hole #) 10/25/2021 (Date) 11:30 (Time) RAINY (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED (Vegetation) SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) ~2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL _____ (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body 7200 feet; Drainage Way - feet; Wetlands 7100 feet; Property Line 710 feet; Drinking Water Well - feet; Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-16	A	SL	10YR 3/3	-	-	-	-	-	M	F	
16-36	B	SL	10YR 3/6	-	-	-	-	-	M	F	
36-156	C	S	10YR 5/2	-	-	-	10	15	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8-1 (Hole #) | 4/8/2022 (Date) | 12PM (Time) | 55d, CLOUDY (Weather) | _____ (Latitude) | _____ (Longitude:)

1. Land Use: WOODLAND (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-10 (Slope (%))

Description of Location: _____

2. Soil Parent Material: _____ | _____ (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands _____ feet | Property Line _____ feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
16	A	SL	10YR 3/3	-	-	-	-	-	M	F	
32	B	S	10YR 5/8	-	-	-	-	-	SG	L	
48	C1	S	10YR 5/3	-	-	-	-	-	SG	L	
84	C2	COARSE SAND	10YR 5/3	-	-	-	10	10	SG	L	
136	C3	S	10YR 5/3	84	HIGH/LOW	2	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8-2 (Hole #) 4/8/2022 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use: _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
16	A	SL	10YR 3/3	-	-	-	-	-	M	F	
32	B	S	10YR 5/8	-	-	-	-	-	SG	L	
48	C1	S	10YR 5/3	-	-	-	-	-	SG	L	
86	C2	COARSE SAND	10YR 5/3	-	-	-	10	10	SG	L	
144	C3	S	10YR 5/3	86	HIGH/LOW	2	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8-3 (Hole #) 4/8/2022 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 112 Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
12	A	SL	10YR 3/3	-	-	-	-	-	M	F	
38	B	S	10YR 5/8	-	-	-	-	-	SG	L	
62	C1	S	10YR 5/3	-	-	-	-	-	SG	L	
100	C2	COARSE SAND	10YR 5/3	-	-	-	10	10	SG	L	
136	C3	S	10YR 5/3	100	HIGH/LOW	2	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8-4 (Hole #) 4/8/2022 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use: _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
8	A	SL	10YR 3/3	-	-	-	-	-	M	F	
20	B	COARSE SAND	10YR 5/8	-	-	-	-	-	SG	L	
56	C1	FINE SAND	10YR 5/3	46	HIGH/LOW	2	-	-	SG	L	
96	C2	COARSE SAND	10YR 5/3	-	-	-	-	-	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D1 (Hole #) | 4/7/22 (Date) | 9:05 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body – feet | Drainage Way – feet | Wetlands >200 feet
Property Line >200 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 60" Depth Weeping from Pit | BOTTOM Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4	A	SL	10YR 2/2	-	-	-	-	-	M	F	
4-20	B	SL	10YR 3/6	-	-	-	-	-	M	F	
20-112	C	LS	10YR 5/2	32"	HIGH/LOW	75	10	5	M	F	BOULDER

Additional Notes: _____

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D2 (Hole #) | 4/7/22 (Date) | 9:40 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: ____

2. Soil Parent Material: GLACIOFLUVIAL | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Drainage Way - feet | Wetlands 7200 feet
Property Line 7200 feet | Drinking Water Well - feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 84" Depth Weeping from Pit | BOTTOM Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	A	SL	10YR 3/3	-	-	-	-	-	M	F	
6-24	B	SL	10YR 3/6	-	-	-	-	-	M	F	
24-96	C	LS	10YR 4/2	60"	HIGH/LOW	>5	5	10	M	F	BOULDER

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D3 (Hole #) | 4/7/22 (Date) | 10:30 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~5 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body - feet | Property Line 750 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands 7100 feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 114" Depth Weeping from Pit | 114" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-3	A	SL	10YR 3/2	-	-	-	-	-	M	F	
3-12	B	LS	10YR 3/6	-	-	-	-	-	M	F	
12-56	C1	S	10YR 5/3	56"	HIGH/LOW	75	20	15	SG	L	
56-72	C2	LS	2.5Y 5/3	↓	↓	↓	-	-	M	F	
72-120	C3	S	10YR 5/3	↓	↓	↓	10	10	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: D4 (Hole #) | 4/7/22 (Date) | 11:00 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~10 (Slope (%))

Description of Location: ____

2. Soil Parent Material: GLACIOFLUVIAL | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Property Line 7100 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands 750 feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	A	SL	10YR 3/2	-	-	-	-	-	M	F	
8-24	B	LS	10YR 3/6	-	-	-	-	-	M	F	
24-84	C1	S	10YR 5/3	84"	HIGH/LOW	75	10	15	SG	L	
84-120	C2	FINE SAND	2.5Y 5/3	↓	↓	↓	-	-	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D5 (Hole #) | 4/7/22 (Date) | 11:30 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NO (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body – feet | Drainage Way – feet | Wetlands >150 feet
Property Line >200 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: – Depth Weeping from Pit – Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	A	10 SL	10YR 3/2	-	-	-	-	-	M	F	
10-18	B	SL	10YR 3/6	-	-	-	-	-	M	F	
18-120	C	S	10YR 5/3	-	-	-	10	10	SG	L	

Additional Notes: _____

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D6 (Hole #) | 4/7/22 (Date) | 12:00 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: COMMERCIAL (e.g., woodland, agricultural field, vacant lot, etc.) | Vegetation: GRAVEL | Surface Stones (e.g., cobbles, stones, boulders, etc.): YES | Slope (%): ~0

   Description of Location: NEXT TO OLD LANDSCAPE BUILDING

2. Soil Parent Material: GLACIOFLUVIAL | Landform: ____ | Position on Landscape (SU, SH, BS, FS, TS): ____

3. Distances from: Open Water Body: - feet | Drainage Way: - feet | Wetlands: - feet | Property Line: >10 feet | Drinking Water Well: - feet | Other: - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit | - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 16	FILL	-	-	-	-	-	-	-	-	-	
16 - 36	B	SL	10YR 3/6	-	-	-	2	2	M	F	
36-120	C	S	10YR 5/2	-	-	-	10	10	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D7 (Hole #) | 4/7/22 (Date) | 12:30 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

   Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body – feet | Drainage Way – feet | Wetlands – feet | Property Line 7100 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: – Depth Weeping from Pit – Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	SL	10YR 3/3	-	-	-	-	-	M	F	
12-32	B	LS	10YR 3/6	-	-	-	-	-	M	F	
32-120	C	S	10YR 5/2	-	-	-	15	15	SG	L	CAVE IN

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D8 (Hole #) | 4/7/22 (Date) | 1:00 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform | Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body - feet | Property Line 7100 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands - feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 12	A	SL	10 YR 3/3	-	-	-	-	-	M	F	
12 - 26	B	SL	10 YR 3/6	-	-	-	-	-	M	F	
26 - 96	C1	S	10 YR 5/3	-	-	-	10	5	SG	L	
96 - 132	C2	FINE LS	2.5Y 5/3	-	-	-	-	-	M	F	

Additional Notes: _____

Commonwealth of Massachusetts
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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D9 (Hole #) | 4/7/22 (Date) | 1:30 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | NONE (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Property Line 750 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands - feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 90" Depth Weeping from Pit | BOTTOM Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0 - 32	A	SL	10YR 3/2	-	-	-	-	-	M	F	
32 - 48	B	SL	10YR 3/6	-	-	-	2	5	M	F	
48 - 120	C	S	10YR 5/3	66"	HIGH/LOW	75	10	10	SG	L	

Additional Notes: _____

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Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D10 (Hole #) | 4/7/22 (Date) | 2:20 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude)

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) | WOODED (Vegetation) | YES (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: ____

2. Soil Parent Material: GLACIOFLUVIAL | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Drainage Way - feet | Wetlands - feet | Property Line - feet | Drinking Water Well - feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	A	SL	10 YR 3/2	-	-	-	-	-	M	F	
9-32	B	SL	10 YR 3/6	-	-	-	-	-	M	F	
32-120	C	LS	10 YR 5/3	-	-	-	5	20	M	F	COMPACT ROCKS

Additional Notes: ____

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: D11 (Hole #) | 4/7/22 (Date) | 3:00 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: AGRICULTURAL FIELD (e.g., woodland, agricultural field, vacant lot, etc.) | Vegetation: FIELD/MEADOW | Surface Stones (e.g., cobbles, stones, boulders, etc.): NO | Slope (%): ~0-2

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body - feet | Property Line >100 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands >100 feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	A	SL	10YR 3/2	-	-	-	-	-	M	F	
8-20	B	SL	10YR 3/6	-	-	-	-	-	M	F	
20-72	C1	S	10YR 5/3	-	-	-	-	-	SG	L	
72-132	C2	FINE SAND	2.5Y 5/3	-	-	-	-	-	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D12 (Hole #) | 4/7/22 (Date) | 3:30 (Time) | OVERCAST (Weather) | (Latitude) | (Longitude:)

1. Land Use: AGRICULTURAL FIELD (e.g., woodland, agricultural field, vacant lot, etc.) | FIELD/MEADOW (Vegetation) | NO (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~0-2 (Slope (%))

Description of Location: _____

2. Soil Parent Material: GLACIOFLUVIAL | Landform | Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body – feet | Drainage Way – feet | Wetlands 7100 feet
Property Line 750 feet | Drinking Water Well – feet | Other – feet

4. Unsuitable Materials Present: ☑ Yes ☐ No If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 72" Depth Weeping from Pit 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-54	FILL	–	–	–	–	–	–	–	–	–	
54-72	C1	S	10YR 5/3	54"	HIGH/LOW	75	–	–	SG	L	
72-120	C2	FINE SAND	5YR 3/2	↓	↓	–	–	–	M	F	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D13 (Hole #) | 4/7/22 (Date) | 4:15 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude:)

1. Land Use: AGRICULTURAL FIELD (e.g., woodland, agricultural field, vacant lot, etc.) | BRUSH / MOSS (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | ~2 (Slope (%))

Description of Location: ____

2. Soil Parent Material: GLACIOFLUVIAL | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Property Line >100 feet | Drainage Way - feet | Drinking Water Well - feet | Wetlands >200 feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-6	A	SL	10YR 3/4	-	-	-	-	-	M	F	
6-20	B	SL	10YR 3/6	-	-	-	2	2	M	F	
20-120	C	LS	10YR 5/3	-	-	-	15	25	M	F	

Additional Notes:

Commonwealth of Massachusetts
City/Town of STOW

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: D14 (Hole #) | 4/7/22 (Date) | 4:45 (Time) | OVERCAST (Weather) | ____ (Latitude) | ____ (Longitude:)

1. Land Use: AGRICULTURAL (e.g., woodland, agricultural field, vacant lot, etc.) | BRUSH/MEADOW (Vegetation) | SOME (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | NO-2 (Slope (%))

Description of Location: ____

2. Soil Parent Material: GLACIOFLUVIAL | ____ (Landform) | ____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body - feet | Drainage Way - feet | Wetlands 7100 feet
Property Line 7100 feet | Drinking Water Well - feet | Other - feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☑ No If yes: - Depth Weeping from Pit - Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	A	SL	10YR 3/4	-	-	-	-	-	M	F	
10-120	C	SL	10YR 4/3	72"	HIGH/LOW	75	10	25	M	F	VERY ROCKY

Additional Notes:

Drainage Maps

Stormwater Operation and Maintenance Manual

Schedule for Inspection and Maintenance:

Street Sweeping:
The pavement shall be swept of all sediment twice a year with concentrations in the spring and the fall.

Deep Sump Hooded Catch Basins:
During construction, catch basin grates shall be wrapped with filter fabric. Catch basins shall be cleaned upon the completion of construction. After construction, the deep sumps for all catch basins shall be inspected four times a year and cleaned four times a year. Sediment removed shall be disposed of in accordance with applicable local, state, and federal guidelines and regulations. The depth of the sediment in a basin shall not exceed a depth of 18 inches as determined by probing with a stick. If the stick hits the bottom within 30 inches of the water level, more than 18 inches of sediment has accumulated and must be removed. Licensed persons should remove and dispose of the contents of the sump in accordance with applicable regulations.

Sediment Forebay:
The floor and sidewalls of the sediment forebay must be stabilized before use. Sediment forebay shall be inspected monthly and cleaned a minimum of four times per year when sediment depth is between 3-6 inches. After sediment removal, any damaged vegetation must be replaced. Grass in the forebay shall not exceed 6 inches in length and any scouring and gullying shall be repaired as necessary.

Infiltration Basin:
Preventative maintenance should be performed at least twice a year, and ideally sediment should be removed from the sediment forebay after every major storm event. Sediment shall be disposed of in accordance with applicable local, state, and federal guidelines and regulations. Once online, the basins shall be inspected after every major storm even (1" in 24 hours), for the first 3 months. thereafter, the basin should be inspected at least twice per year. Important items to check for include: differential settlement, cracking, erosion, leakage, or tree growth on the embankments, condition of riprap, sediment accumulation and the health of the turf. At least twice a year, the buffer area and side slopes of the basin should be mowed. Grass clippings and accumulated organic matter should be removed to prevent the formation of an impervious organic mat. Trash and debris should also be removed at this time. Scarify bottom area and add additional sand if necessary. Sediment should be removed from the basin as necessary. Removal procedures should not take place until the floor of the basin is thoroughly dry. Pretreatment devices associated with basins should be inspected and cleaned at least twice a year and ideally every other month.

Treatment Trench:
Trench shall be inspected annually. The filter fabric shall be inspected for excessive sediment build up. If appreciable amounts of sediment are observed the top layer of stone shall be moved aside and the filter fabric cleaned or replaced. The top layer of stone shall then be washed and placed over the filter fabric.

Emergency Contacts:
In the event of a hazardous materials spill on the site the following parties shall be contacted:
Fire Department: ph: 978-897-4537

Records:
The Homeowners Association shall maintain an inspection log of all elements of the storm water management plan. The Homeowners Association shall maintain a maintenance log documenting the inspection and maintenance of the drainage structures. A copy of the erosion control and storm water maintenance plan and inspection logs shall be kept onsite at all times.

Responsible Party:
After construction the Homeowners Association shall be responsible for the inspection and maintenance of the street sweeping, snow removal, and all components of the stormwater management system. Each individual homeowner shall be responsible for their own drywell.

Budget: The estimated annual operation and maintenance budget is $5,000.

Illicit Discharges: There will be no illicit discharges on site. The Site Plan identifies the locations for the proposed stormwater management system on site which shows that these systems do not allow entry of any illicit discharge into the municipal stormwater system. The Site Plan also shows that there are no connections between the stormwater and wastewater system.

Name: _____

Signature: _____

Date: _____

The Cottages at Wandering Pond

Operation and Maintenance Inspection Log

Year: _____

Inspection Items:	**Frequency:**
Street Sweeping	**Two times per year**
Catch Basin	**Four times per year**
Infiltration Basin	**Two times per year**
Sediment Forebay	**Monthly**
Treatment Trench	**Annually**

Street Sweeping:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Catch Basin:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

Infiltration Basin:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Erosion in Basin: _____
Outlet Structure: _____
Comments:

Action Required:

Sediment Forebay:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth is between 3"-6")
Comments:

Action Required:

Treatment Trench:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required: