

# Stormwater Management Report

For

## **The Cottages at Wandering Pond**

**Athens Street**

Stow, MA 01775

**June 29, 2022**

**Rev: October 27, 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

Athens Street, LLC  
148 Park Street  
North Reading, MA 01864

Greystone Painting Corp.  
21 Wellington Avenue  
Hudson, MA 01749

SM-3719C

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## **Narrative**

# 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 thirteen (13) subcatchments. Subcatchment E-1 contains wooded area and drains to a BVW located in the northern corner of the site.

Subcatchment E-2A contains wooded area, open space, gravel roads, and BVW. This subcatchment drains to a BVW located along the northern portion of the site.

Subcatchment E-2B contains wooded area, open space, gravel roads, most of the existing buildings, BVW, and some offsite runoff. Runoff from this subcatchment drains to the BVW and river located centrally onsite.

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, and it drains to the BVW located onsite to the east.

Subcatchment E-5 contains wooded area, open space, gravel road/cart paths, the existing dwelling at 217 Hudson Road, 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 portions of gravel roads, all of which drain to the BVW located onsite to the south.

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

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

Subcatchment E-9A contains wooded area, open space, some runoff from the adjacent property, an existing building, and gravel roads and parking areas. This subcatchment drains to a low spot centrally located on site.

Subcatchment E-9B contains some onsite wooded area, and a residential development located on the abutting property to the north, which consists of wooded area, open space, several dwellings and driveways, and a portion of a road. Runoff from this subcatchment is directed to a detention basin located offsite to the north of the subject property. The basin and its outflows have been modeled in this stormwater analysis.

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 140 units spread across the majority of the site. The main road comes in off Hudson Road which travels through the site to the northeast 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 is broken up into the 26 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-2A1, P-2A2, and P-2A3 compare to subcatchment E-2A. Subcatchment P-2A1 contains a portion of Wandering Pond Circle, some dwellings, and the surrounding open space. Roadway runoff from this subcatchment is captured in a series of catch basins located along the roadway and discharges to IB-2A1 to be infiltrated and recharged. Subcatchment P-2A2 similarly contains a portion of Wandering Pond Circle, some dwellings, and surrounding open space. Runoff from this subcatchment is captured in a series of catch basins located along the roadway and discharges to IB-2A2, where it is infiltrated and recharged. Subcatchment P-2A3 remains mostly unchanged with the exception of a proposed pump house building and holding tank for the proposed water supply system, and it contains the remaining open space, wooded area, gravel road, and BVW to the west of Wandering Pond Circle. This subcatchment, along with the outflows of IB-2A1 and IB-2A2, continues to drain to the BVW located along the northern portion of the site.

Subcatchments P-2B-A, P-2B-B, and P-5D compare to subcatchment E-2B. Subcatchment P-2B-A contains the entirety of Stepping Stone Lane and the dwellings proposed along the road, a proposed portion of a gravel drive to provide access to the pump house and wells, as well as open space and wooded area, some of which remains undisturbed. Runoff from the roadway, dwelling roof areas, and surrounding open space is captured in a series of catch basins located along Stepping Stone Lane before discharging to IB-2B-A, where it is infiltrated and recharged. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to infiltration. Subcatchment P-5D contains a portion of Wandering Pond Way, all of Daffodil Drive, the dwellings located along Daffodil Drive, and surrounding open space. Runoff from this subcatchment is captured in a series of catch basins along the roadway before discharging to IB-5D, where it is infiltrated and recharged. IB-5D is designed to overflow into IB-2B-A. Prior to infiltration, the roadway runoff in this subcatchment is treated through a combination of deep sump hooded catch basins and a sediment forebay. Subcatchment P-2B-B contains a portion of the proposed and existing gravel access road and mainly undisturbed open space and wooded area. Runoff from this subcatchment, along with the outflow of IB-2B-A, continues to flow to the BVW and river located centrally onsite.

Subcatchments P-3A and P-3B compare to Subcatchment E-3. Subcatchment P-3A contains a portion of Wandering Pond Circle and some adjacent dwellings. Runoff from this subcatchment is captured through a series of catch basins located along the roadway and discharges to IB-3A to be infiltrated and recharged. 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, combined with the outflow of IB-3A, drains to the northeastern property line and eventually to a BVW offsite.

Subcatchments P-4A and P-4B compare to Subcatchment E-4. Subcatchment P-4A contains a portion of Wandering Pond Circle and some open space. Runoff is captured through a series of catch basins located along the roadway and discharges to IB-4A. Subcatchment P-4B contains mostly undisturbed wooded area, a portion of the existing gravel cart path, and some open space surrounding the dwellings. Runoff from this subcatchment and the outflow of IB-4A continue to drain to the BVW located onsite to the east.

A total of 19 dwellings located along the outside of Wandering Pond Circle will be provided with an individual roof drywell designed to fully infiltrate roof runoff up to the 100-year design storm.

Subcatchments P-5B, P-5C, and P-5E compare to Subcatchment E-5. Subcatchment P-5B contains a portion of Wandering Pond Circle, some open space surrounding the roadway, and much of the undisturbed area in the center of Wandering Pond Circle. Runoff from this subcatchment is captured in a series of catch basins located along the roadway before discharging to IB-5B, where it is infiltrated and recharged. Subcatchment P-5C contains a portion of Wandering Pond Way, all of the dwellings located along said road, and surrounding open space. Roadway runoff is captured in a series of catch basins before discharging to IB-5C. Roadway runoff is treated with a combination of deep sump hooded catch basins and a sediment forebay prior to infiltration. Roof runoff from the dwellings is captured in gutters and directed via a roof drain to IB-5C. IB-5B and IB-5C are designed to overflow; excess runoff is piped under the road network and daylights directly into Subcatchment P-5E. Subcatchment P-5E contains Athens Street, the majority of Wandering Pond Way, the existing dwelling at 217 Hudson Road, open space, and wooded area, all of which drains to the BVW located on the southeastern portion of the site. Roadway runoff from this subcatchment is treated via Contech units within the catch basins prior to discharge.

Subcatchment P-6A and P-6B compare to subcatchment E-6. Subcatchment P-6A contains mainly wooded area and some open space. Runoff from this subcatchment drains to the BVW located onsite to the south. Subcatchment P-6B contains the driveway and parking area for the Wastewater Treatment Facility Building, the building itself, some open space, and wooded area. Runoff from this subcatchment is captured in a series of catch basins located along the paved area and drains to IB-6B to be infiltrated and recharged. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to infiltration.

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 paved sports court. 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, a portion of Sweet Pea Path, adjacent dwellings, and open space. Runoff from this subcatchment discharges to IB-P8 to be treated, infiltrated, and recharged.

Subcatchments P-9A, P-9B, P-10A, P-10B, and P-10C compare to subcatchment E-10. Subcatchment P-9A contains open space and wooded area along the northern property lines behind the dwellings along Wildflower Way along with a portion of Sweet Pea Path. Runoff from this subcatchment drains directly to IB-10C. Roadway runoff from Sweet Pea Path is treated via a treatment trench adjacent to the roadway prior to infiltration. Subcatchment P-9B contains mostly the abutting development and the runoff from the outflow of its associated detention basin. Runoff from this detention basin drains onto the subject property and eventually discharges to IB-10C. Subcatchment P-10A contains mainly wooded area and some open space around the dwellings. Runoff from this subcatchment continues to flow towards the BVW located on the central southern portion of the site. Subcatchment P-10B contains a portion of Wildflower Way, several dwellings, and surrounding open space. Roadway and open space runoff are captured in a series of catch basins located along

Wildflower Way before discharging to IB-10B. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to infiltration. Roof runoff from the dwellings is captured in gutters and directed via a roof drain to IB-10B. Subcatchment P-10C contains the remainder of Wildflower Way and the adjacent dwellings, surrounding open space, and undisturbed area in the center of the Wildflower Way loop. Runoff from this subcatchment is captured in a series of catch basins located along the roadway and discharged to IB-10C. Roadway runoff is treated through a combination of deep sump hooded catch basins and a sediment forebay prior to infiltration. IB-10B and IB-10C are designed to overflow, with excess runoff being piped to daylight and discharging to the BVW. Post development peak discharge rate and volume is increased from existing conditions during the 100-year design storm only, but it will not result in an increase in offsite flooding during the 100-year 24-hour storm.

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 to 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, 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 rates and volumes have 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-2A Compared to P-2A**

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	6.063	5.436	20.82	20.40	32.08	31.74	51.14	50.99
Total Volume (cf)	35,403	29,551	98,578	84,699	146,158	130,257	227,661	214,146

**E-2B Compared to P-2B**

	2-year Storm		10-year Storm		25-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	1.662	0.228	13.40	5.869	24.82	14.25	45.93	31.04
Total Volume (cf)	18,921	6,036	77,016	40,825	126,186	80,601	215,845	156,142

**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	6.575	17.08	16.89	24.26	24.00	35.91	35.48
Total Volume (cf)	35,200	30,154	82,096	71,767	115,182	101,147	169,813	149,710

**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)	6.300	5.817	16.28	15.63	23.33	22.81	34.82	34.67
Total Volume (cf)	33,076	26,743	78,626	67,232	111,000	96,276	164,675	114,721

**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)	2.571	1.706	11.19	9.312	18.21	16.89	30.49	30.16
Total Volume (cf)	19,062	15,443	59,868	53,006	91,855	83,082	147,879	140,316

**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	0.014	0.315	0.058	1.157	0.445
Total Volume (cf)	0.024	0	1,451	390	3,584	1,408	8,335	4,014

**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-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)	3.993	2.097	18.72	13.86	30.87	26.48	52.40	56.23
Total Volume (cf)	34,460	16,218	112,089	71,688	173,628	147,496	282,066	286,599

### **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	29.80
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	4.70	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. Additionally, runoff from non-metal roofs may be discharged to a drywell without any pretreatment.

### **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**



# 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.<sup>1</sup> 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<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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.



# Checklist for Stormwater Report

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## 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.

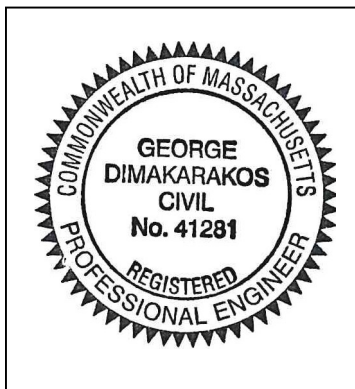
A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

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### 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



10/28/22

Signature and Date

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## 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

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## 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

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## 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<sup>1</sup>
- ☐ 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.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.





# Checklist for Stormwater Report

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## 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

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## 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

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## 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

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## 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**

## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By MKO Date 6/1/22  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	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.

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

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.09	0.09	0.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
---------

 DevelopedCircle one: 

Tc
----

 Tt through subareaSubcatchment E-1Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

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 3.0.0.21

10-27-2022

**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:

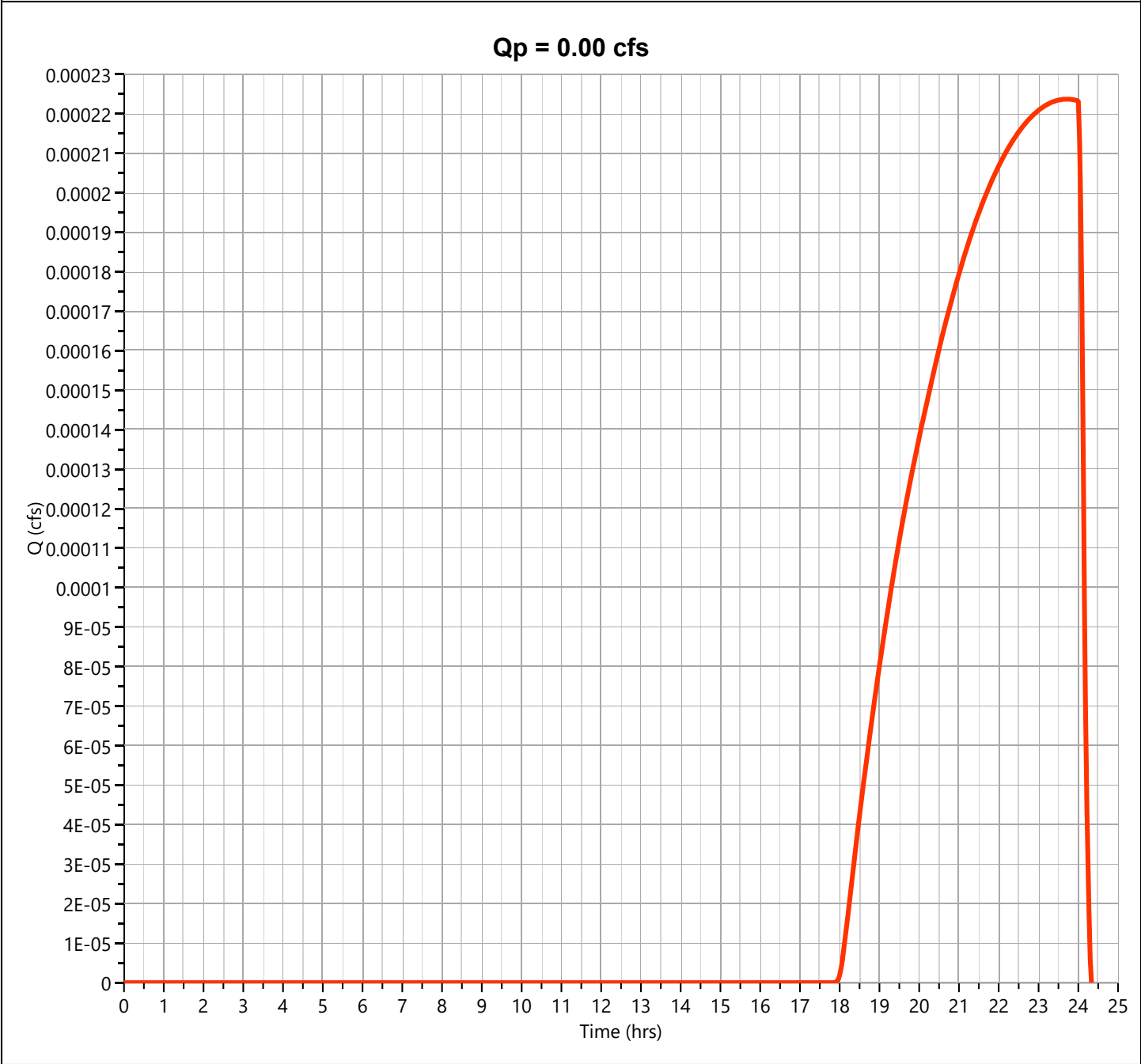
Hydrology Studio v 3.0.0.21

10-27-2022

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:

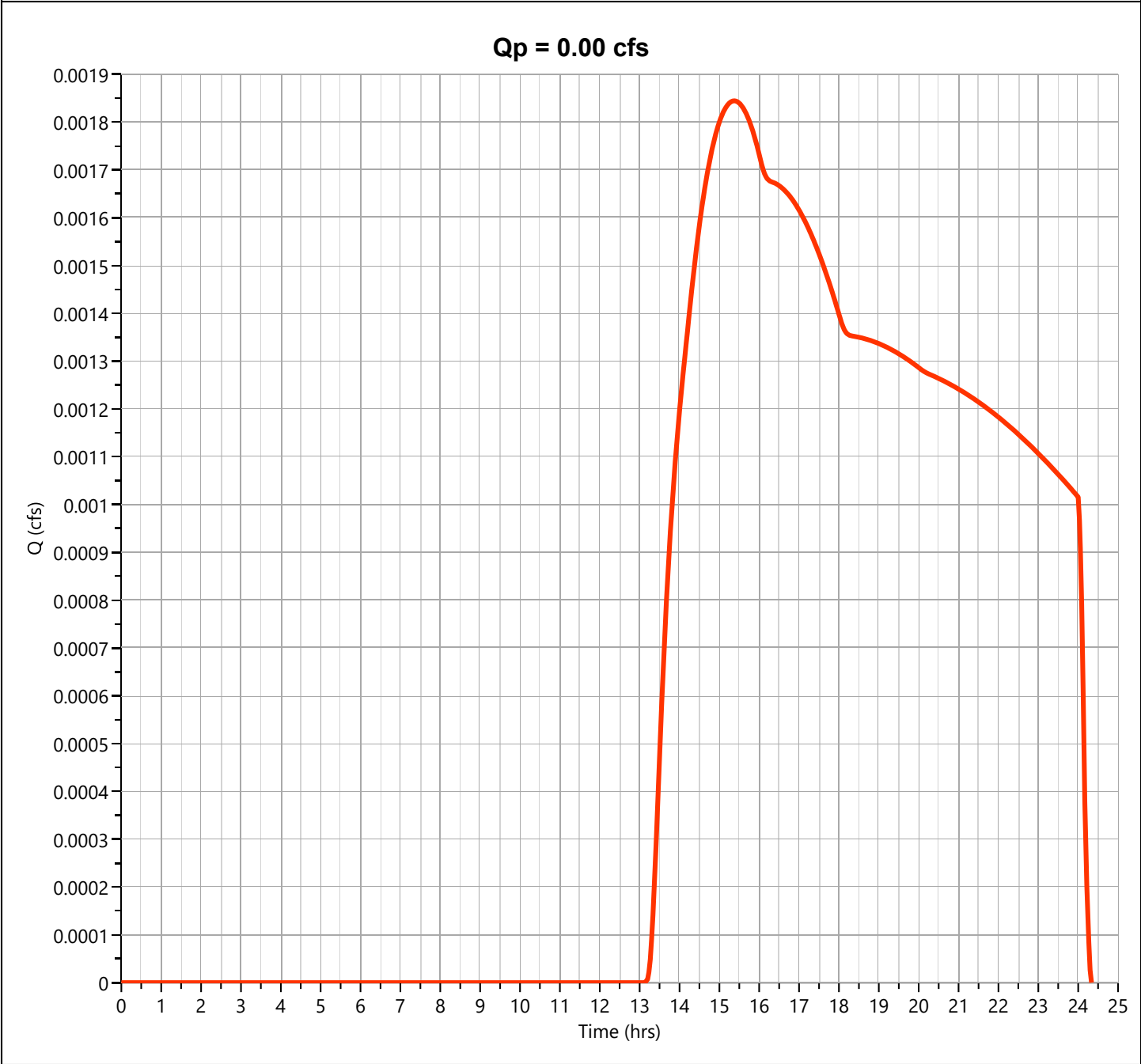
Hydrology Studio v 3.0.0.21

10-27-2022

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:

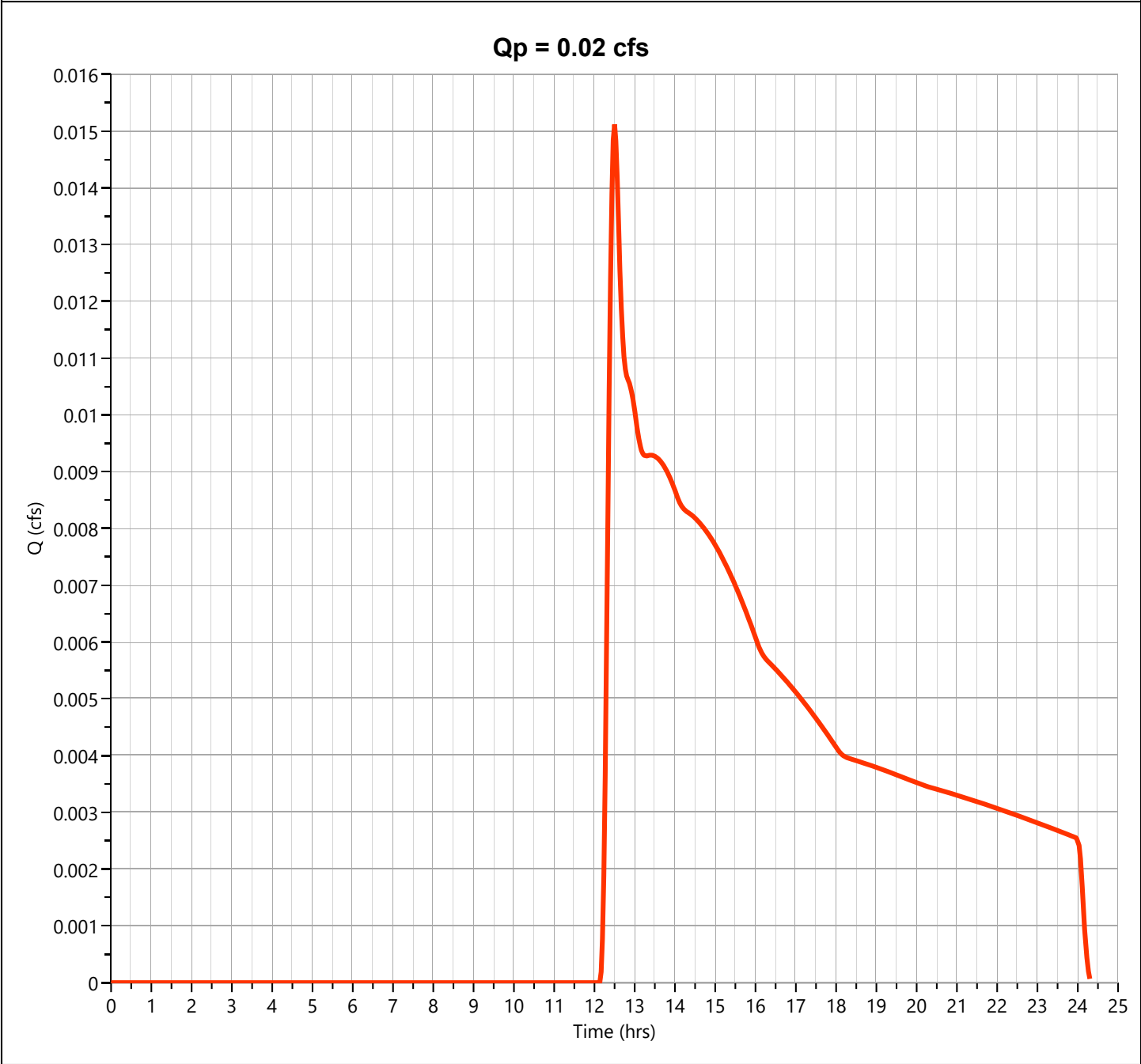
Hydrology Studio v 3.0.0.21

10-27-2022

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  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 9/27/2022  
 Date \_\_\_\_\_  
 Circle one: ☒ Present ☐ Developed Subcatchment E-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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			3.28	98.39
A	Open Space Good Condition	39			1.17	45.45
A	Open Space Fair Condition	49			0.06	3.13
A	Woods-Grass Combination Good Condition	32			0.00	0.00
A	Gravel	76			0.22	16.34
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			8.00	559.75
C	Open Space Fair Condition	79			0.09	7.14
C	Gravel	89			0.11	10.19
D	BVW	77			4.78	367.78
Totals =					17.70	1108.18

1/ Use only one CN source per line.

CN (weighted) =  $\frac{\text{total product}}{\text{total area}} = \frac{1108.18}{17.70} = 62.60$  ; Use CN = **63**

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.54	2.24	3.50

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date 9/27/2022

Date \_\_\_\_\_

Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through subareaSubcatchment E-2ASheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.25

A-B		
WOODS		
0.6		
50		
3.1		
0.028		
0.25		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C		
UNPAVED		
694		
0.128		
5.77		
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.  $T_t = L / 3600V$ 

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:

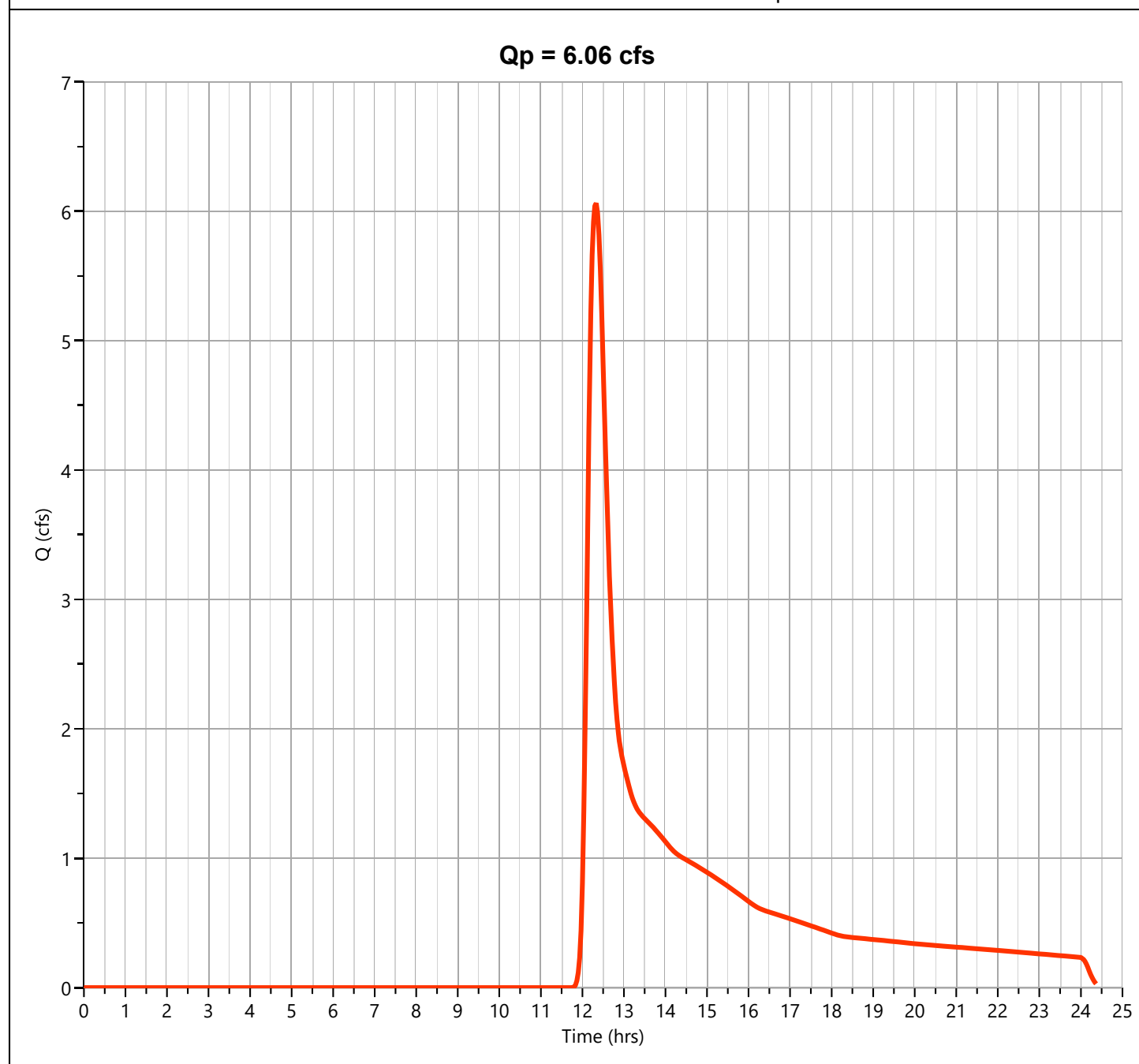
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2A**

**Hyd. No. 2**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.063 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 35,403 cuft
Drainage Area	= 17.7 ac	Curve Number	= 63
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:

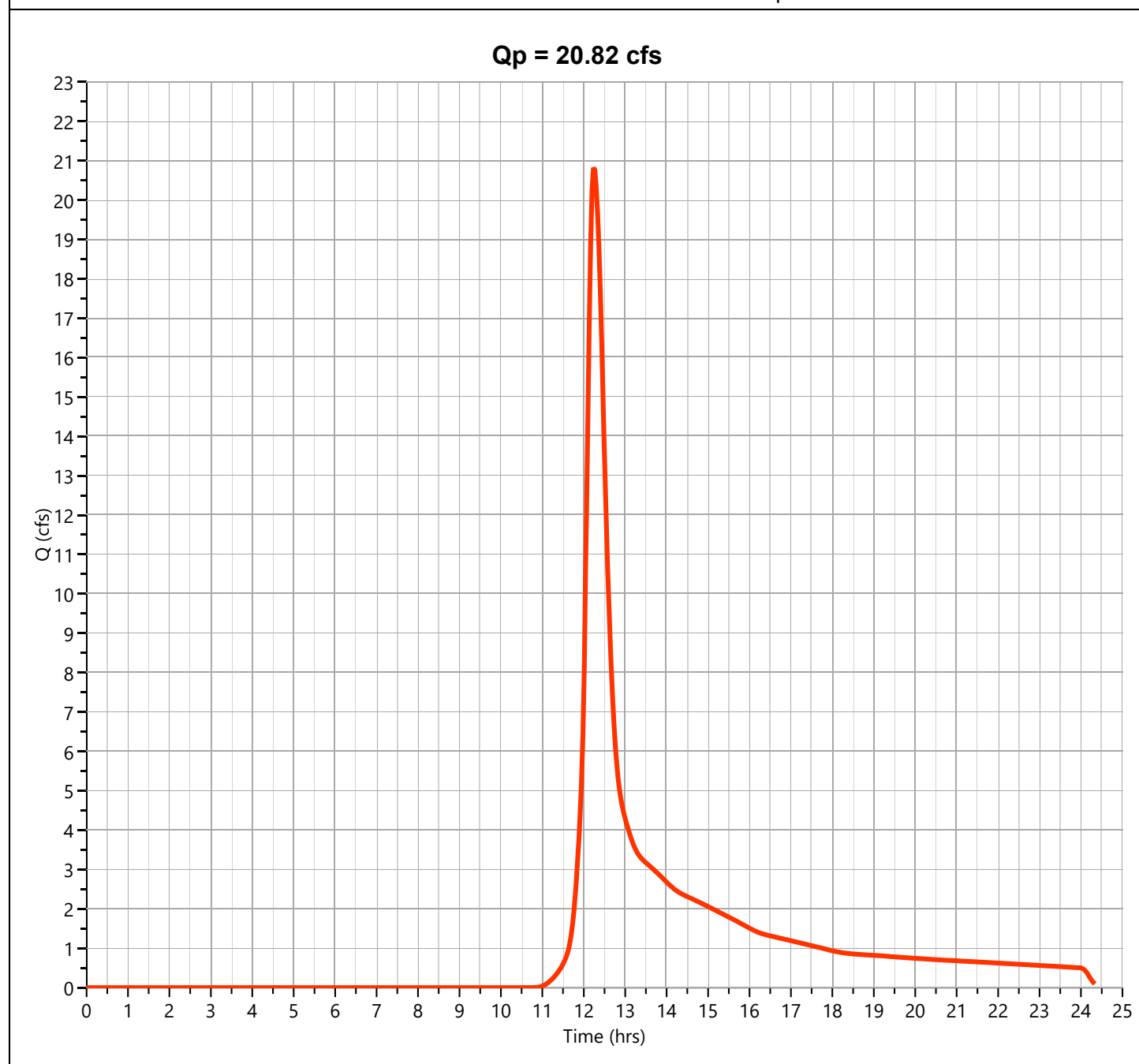
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2A**

**Hyd. No. 2**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.82 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 98,578 cuft
Drainage Area	= 17.7 ac	Curve Number	= 63
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:

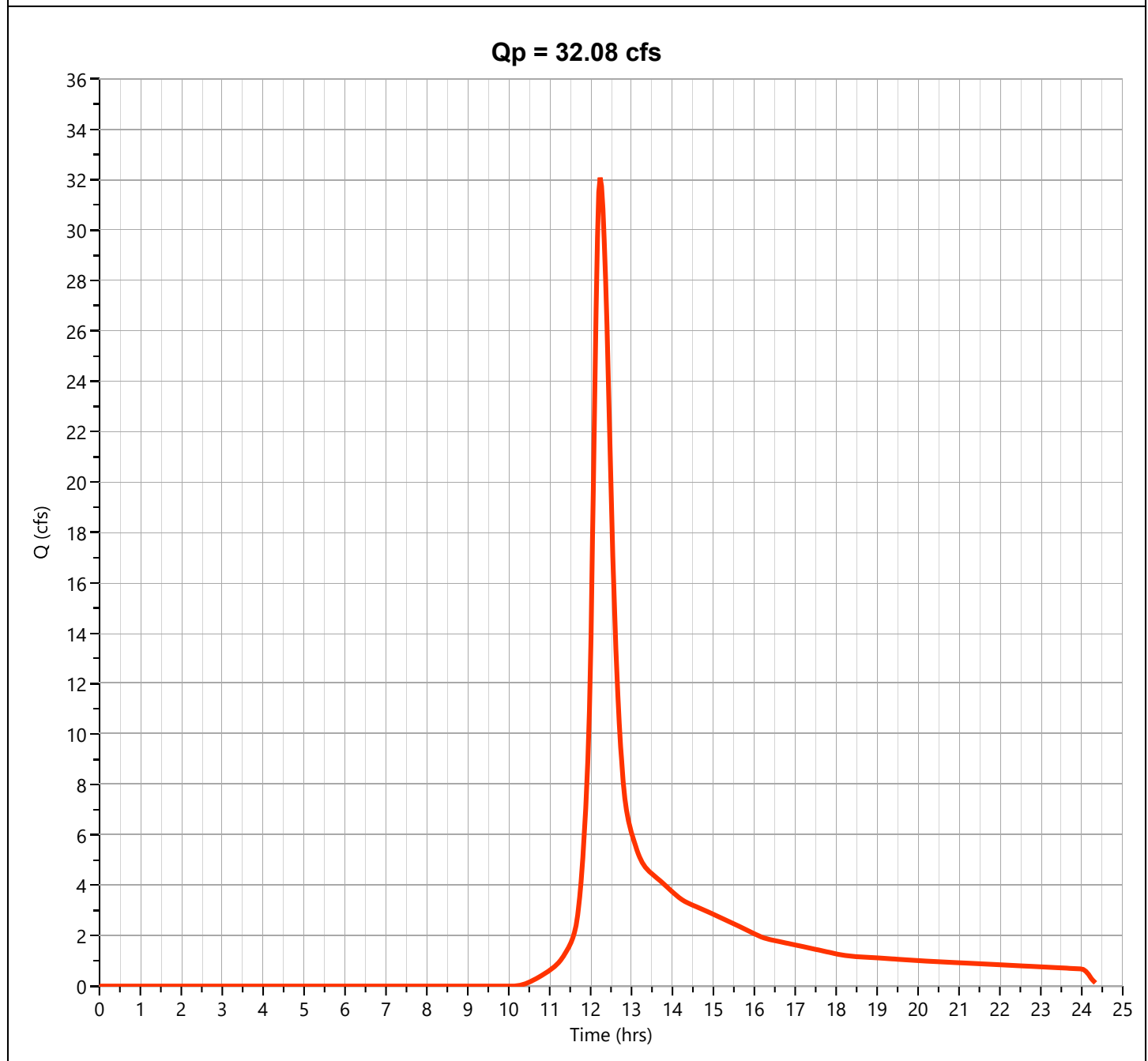
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2A**

**Hyd. No. 2**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 32.08 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 146,158 cuft
Drainage Area	= 17.7 ac	Curve Number	= 63
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:

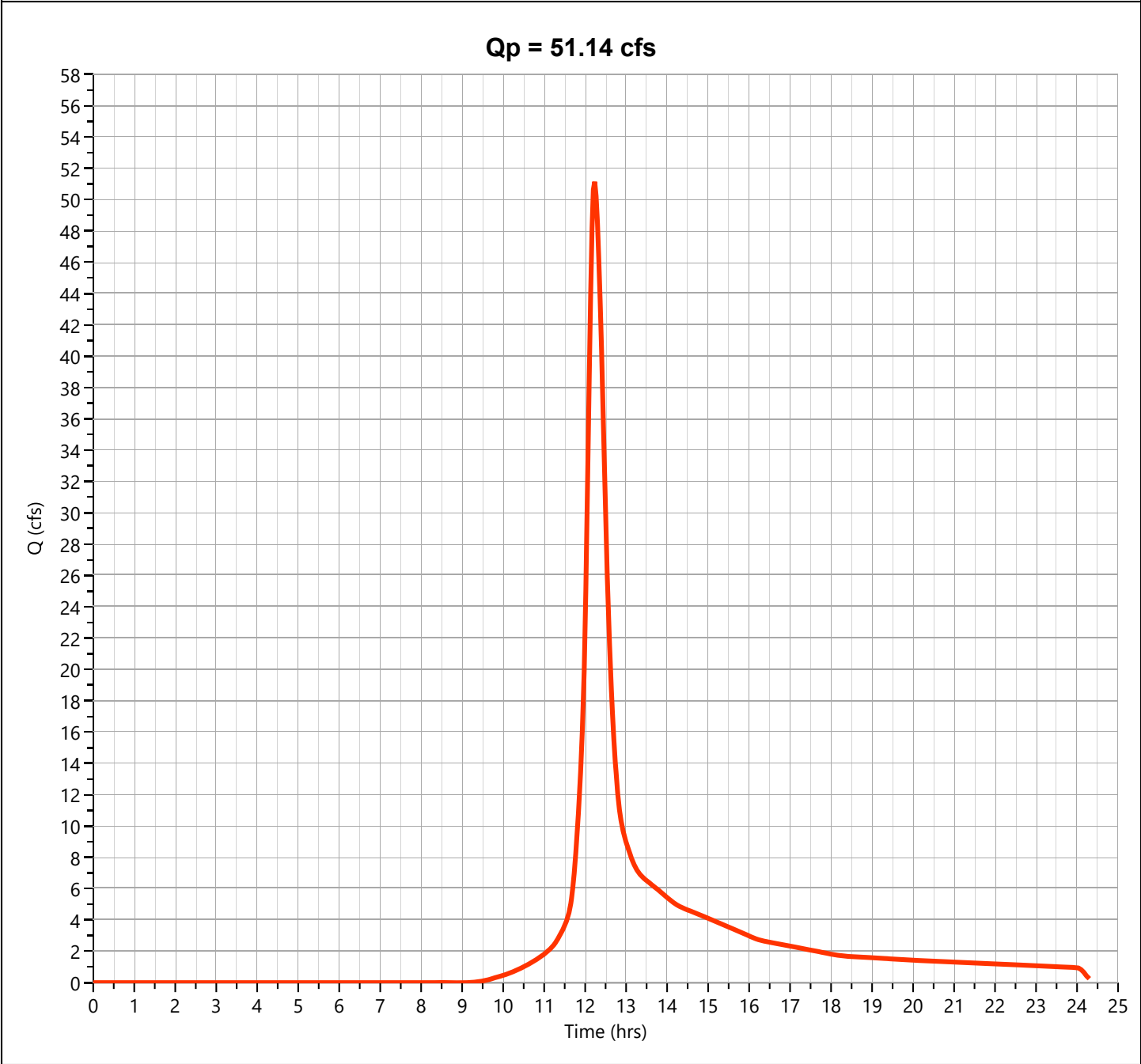
Hydrology Studio v 3.0.0.21

10-27-2022

E-2A

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 51.14 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 227,661 cuft
Drainage Area	= 17.7 ac	Curve Number	= 63
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  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 9/27/2022  
 Date \_\_\_\_\_  
 Circle one: ☒ Present ☐ Developed Subcatchment E-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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious	98			0.34	33.25
A	Woods Good Condition	30			5.85	175.41
A	Open Space Good Condition	39			2.78	108.36
A	Open Space Fair Condition	49			1.89	92.39
A	Woods-Grass Combination Good Condition	32			2.92	93.30
A	Gravel	76			0.84	63.70
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			3.65	255.18
C	Open Space Fair Condition	79			1.74	137.62
C	Gravel	89			0.00	0.00
D	BVW	77			4.14	318.86
Totals =					24.13	1278.07

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1278.07}{24.13} = 52.96 ; \text{ Use CN} = \boxed{53}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.22	1.44	2.46

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through subareaSubcatchment E-2BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.21

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

0.07

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

17.3



# Hydrograph Report

Project Name:

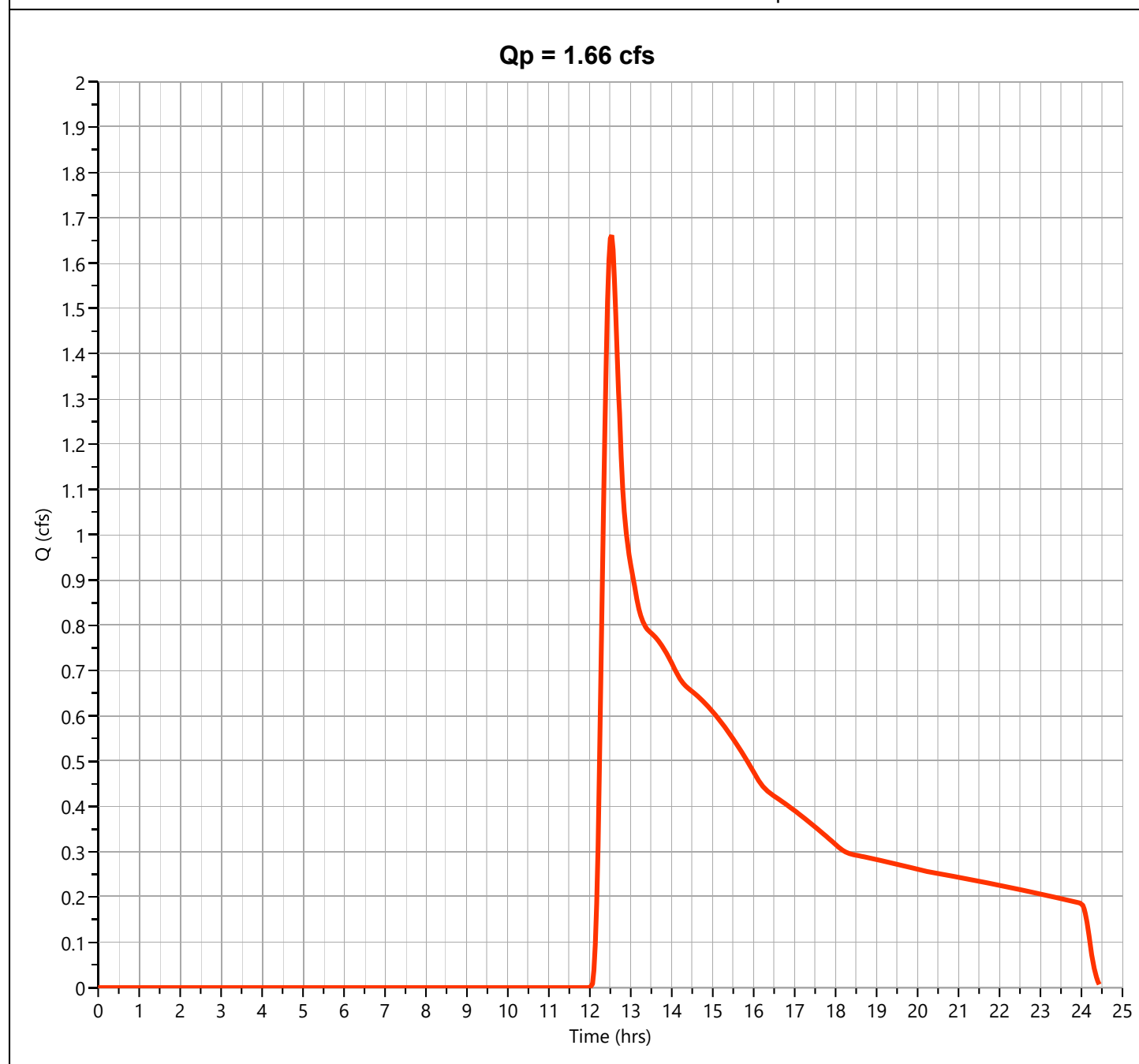
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2B**

**Hyd. No. 3**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.662 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Runoff Volume	= 18,921 cuft
Drainage Area	= 24.13 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

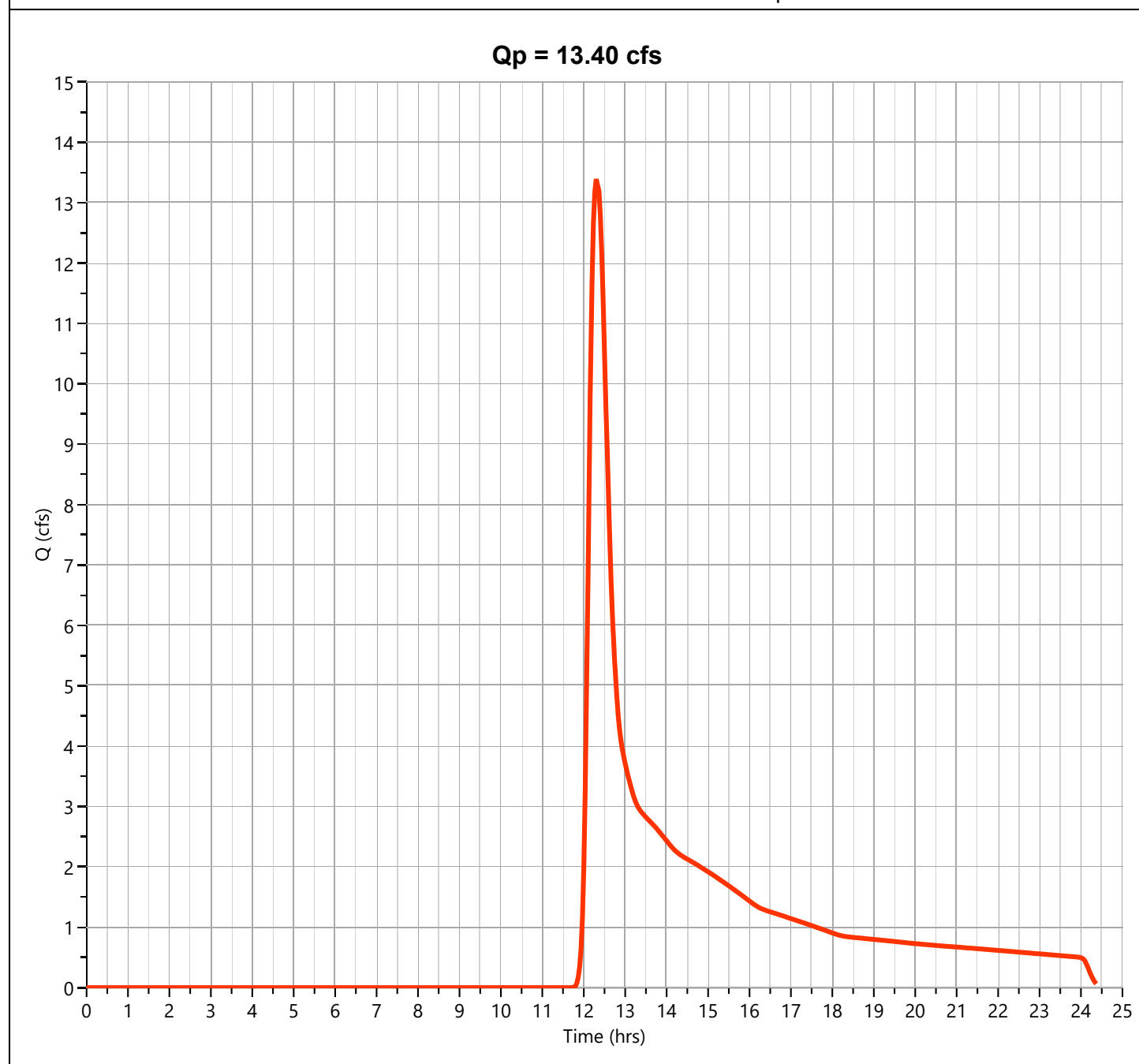
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2B**

**Hyd. No. 3**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.40 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 77,016 cuft
Drainage Area	= 24.13 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

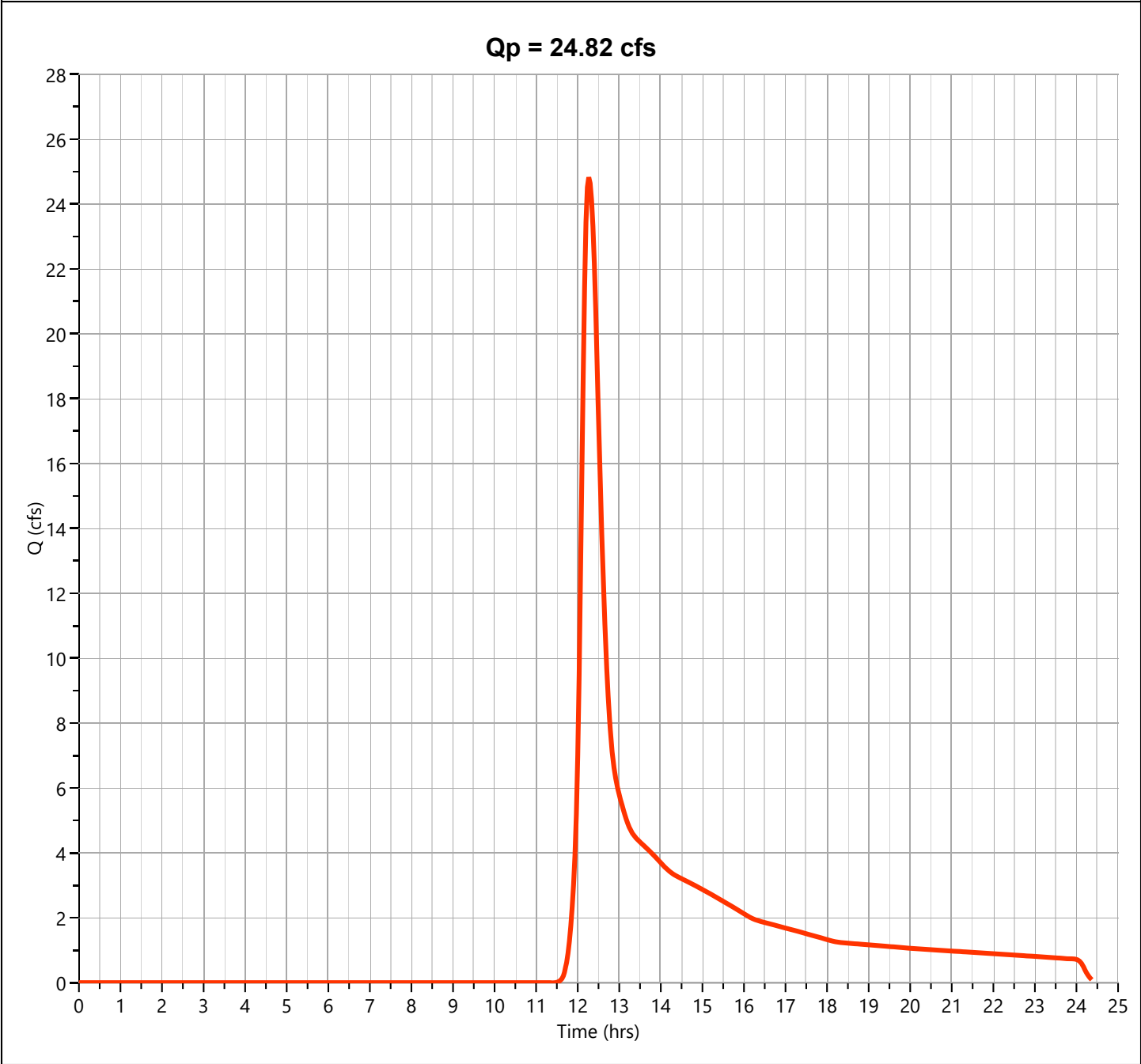
Hydrology Studio v 3.0.0.21

10-27-2022

E-2B

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.82 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 126,186 cuft
Drainage Area	= 24.13 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

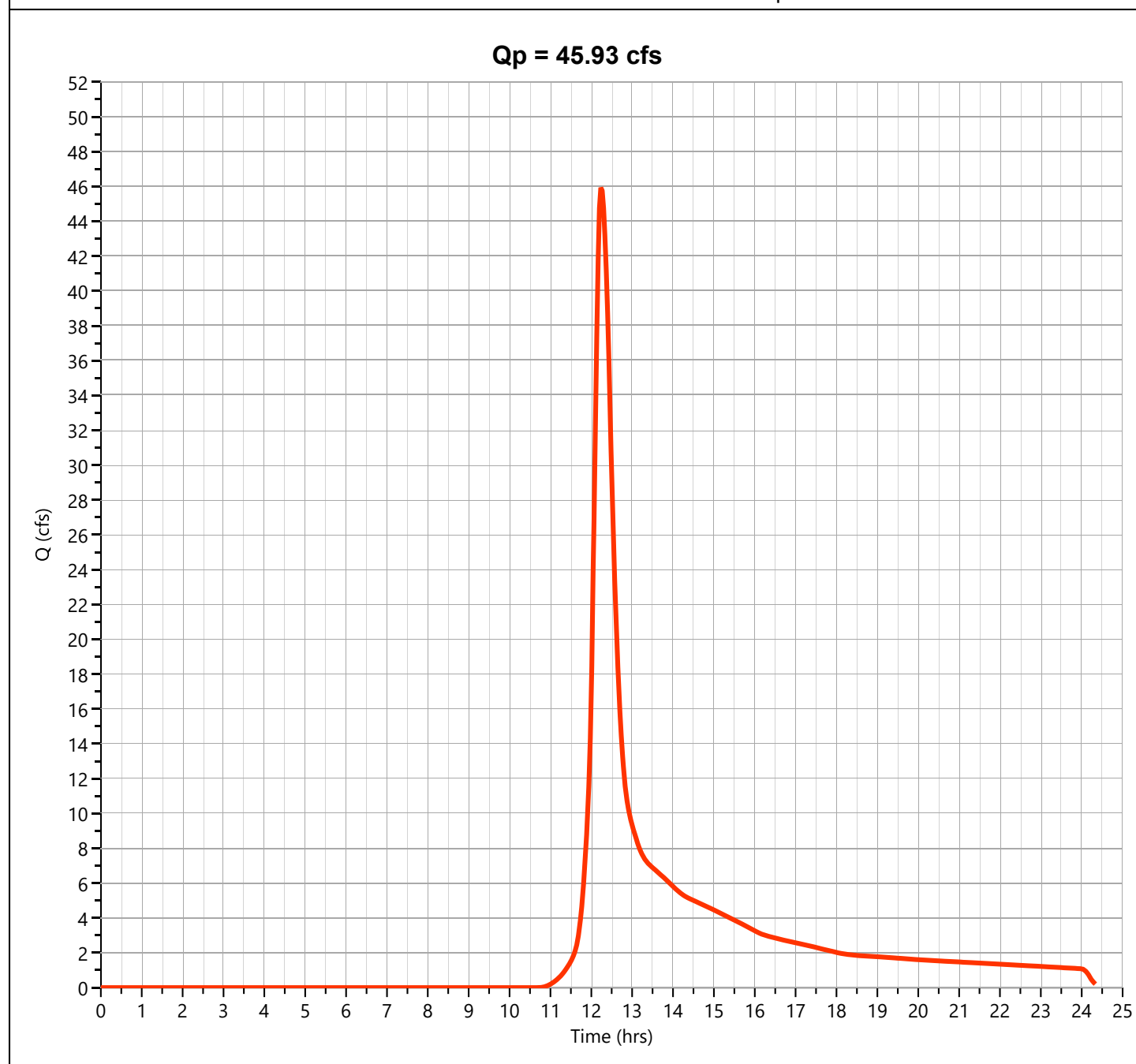
Hydrology Studio v 3.0.0.21

10-27-2022

**E-2B**

**Hyd. No. 3**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 45.93 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 215,845 cuft
Drainage Area	= 24.13 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.3 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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	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
Totals =					10.35	730.79

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{730.79}{10.35} = 70.64 ; \text{ Use CN} = \boxed{71}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,  
 or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.90	2.98	4.40

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through subareaSubcatchment E-3Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.35

A-B		
WOODS		
0.6		
50		
3.1		
0.012		
0.35		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.02

B-C		
UNPAVED		
457		
0.168		
6.61		
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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr  
min0.37  
22.4

# Hydrograph Report

Project Name:

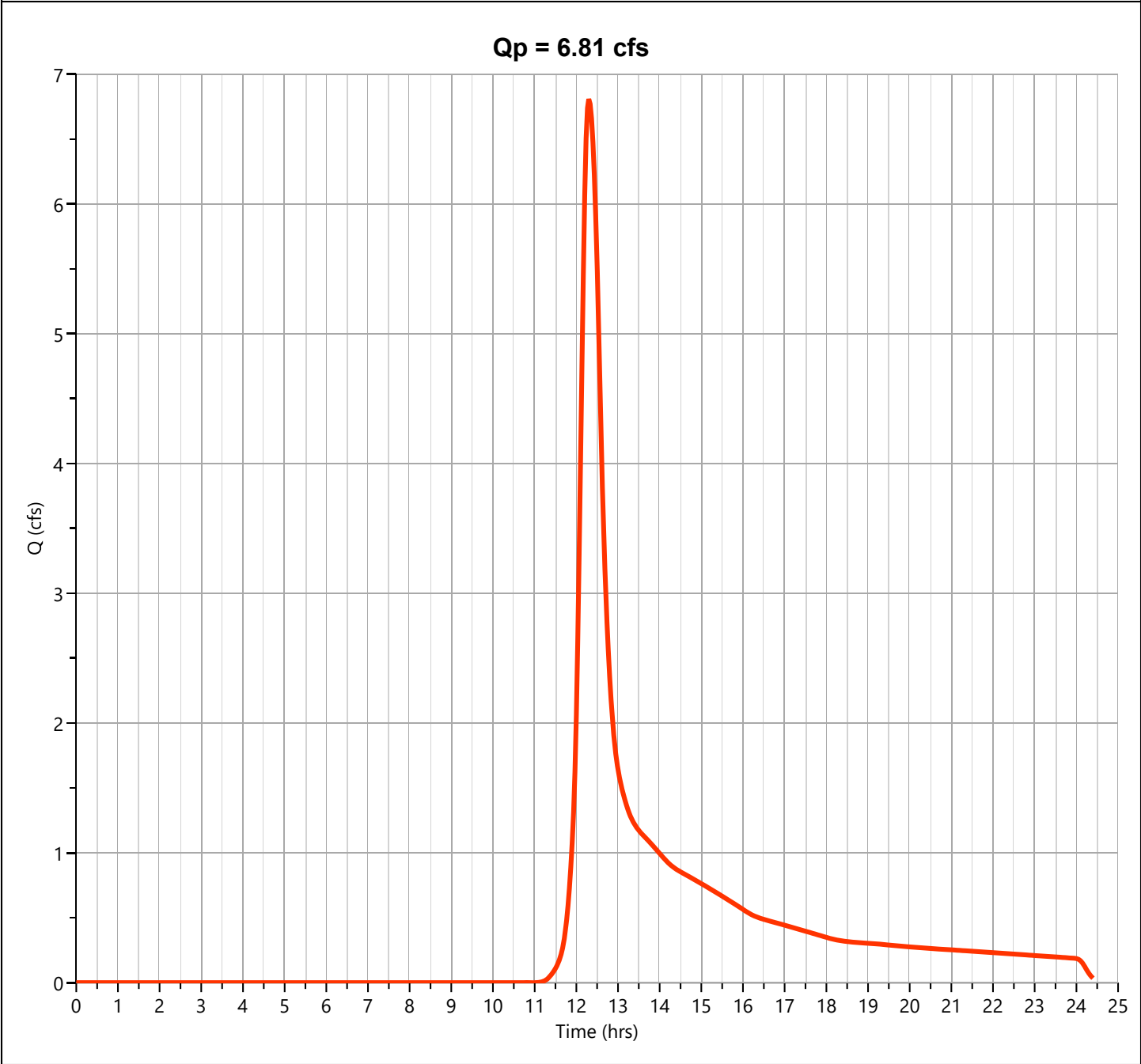
Hydrology Studio v 3.0.0.21

10-27-2022

E-3

Hyd. No. 4

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:

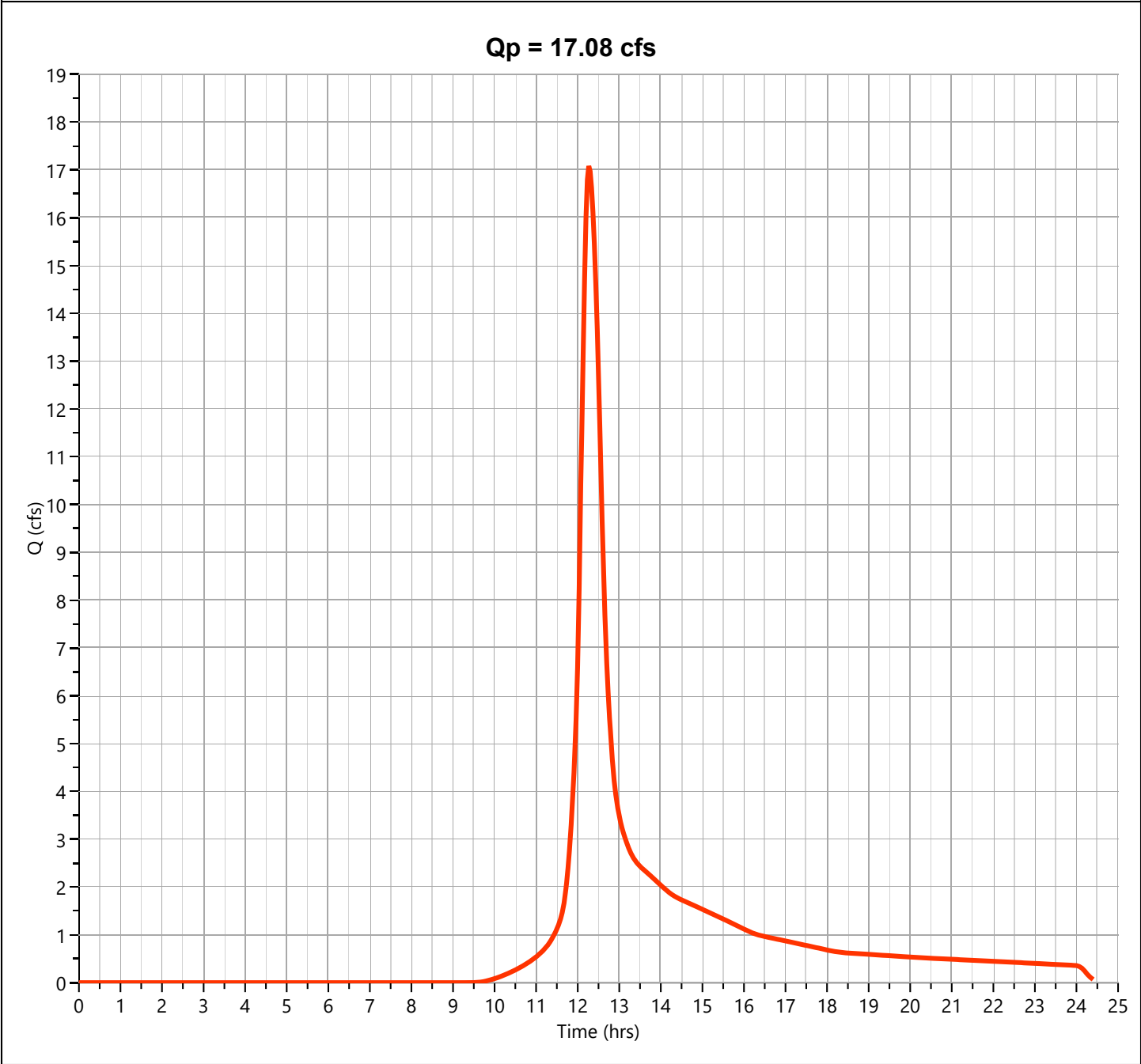
Hydrology Studio v 3.0.0.21

10-27-2022

E-3

Hyd. No. 4

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:

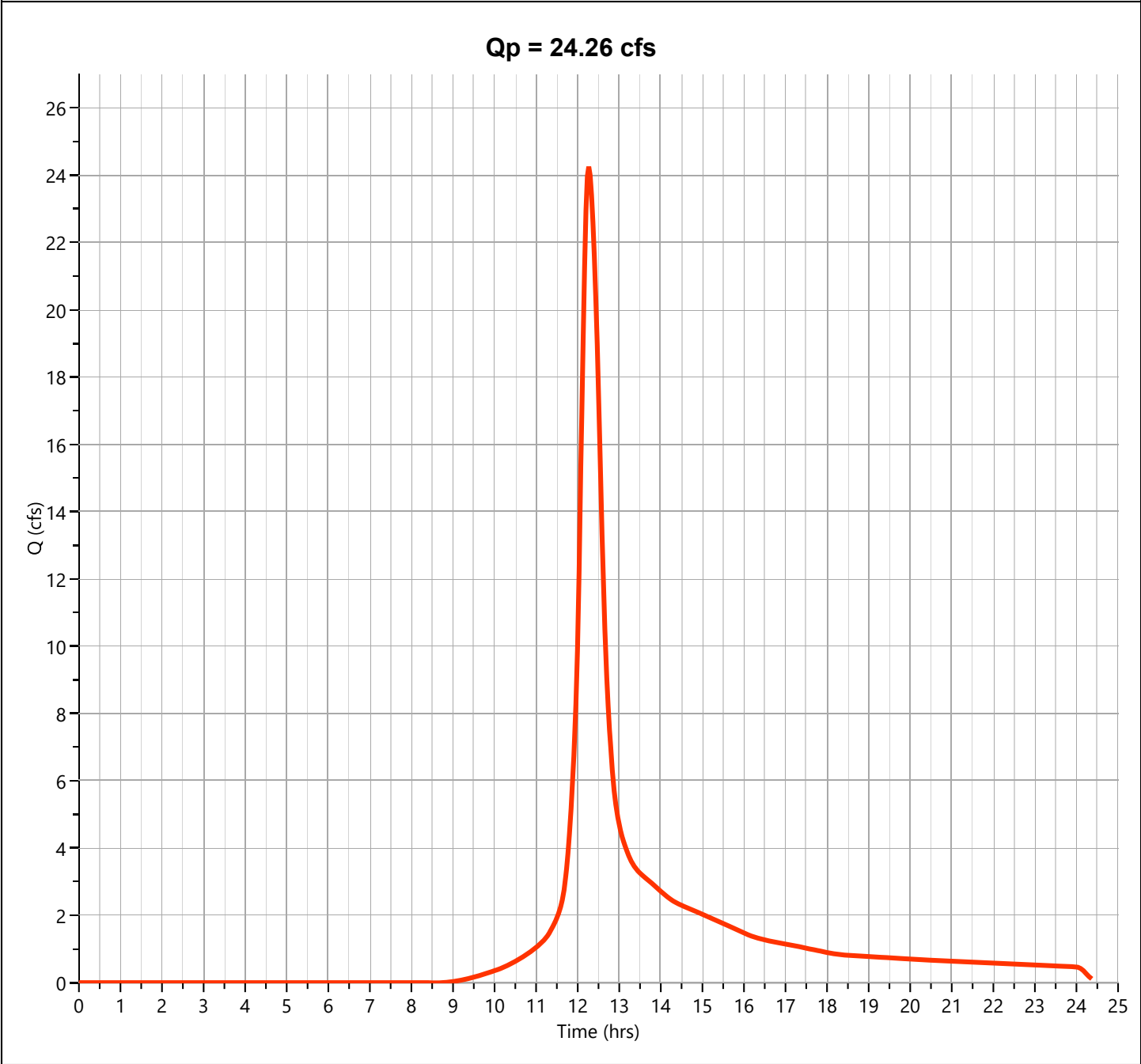
Hydrology Studio v 3.0.0.21

10-27-2022

E-3

Hyd. No. 4

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:

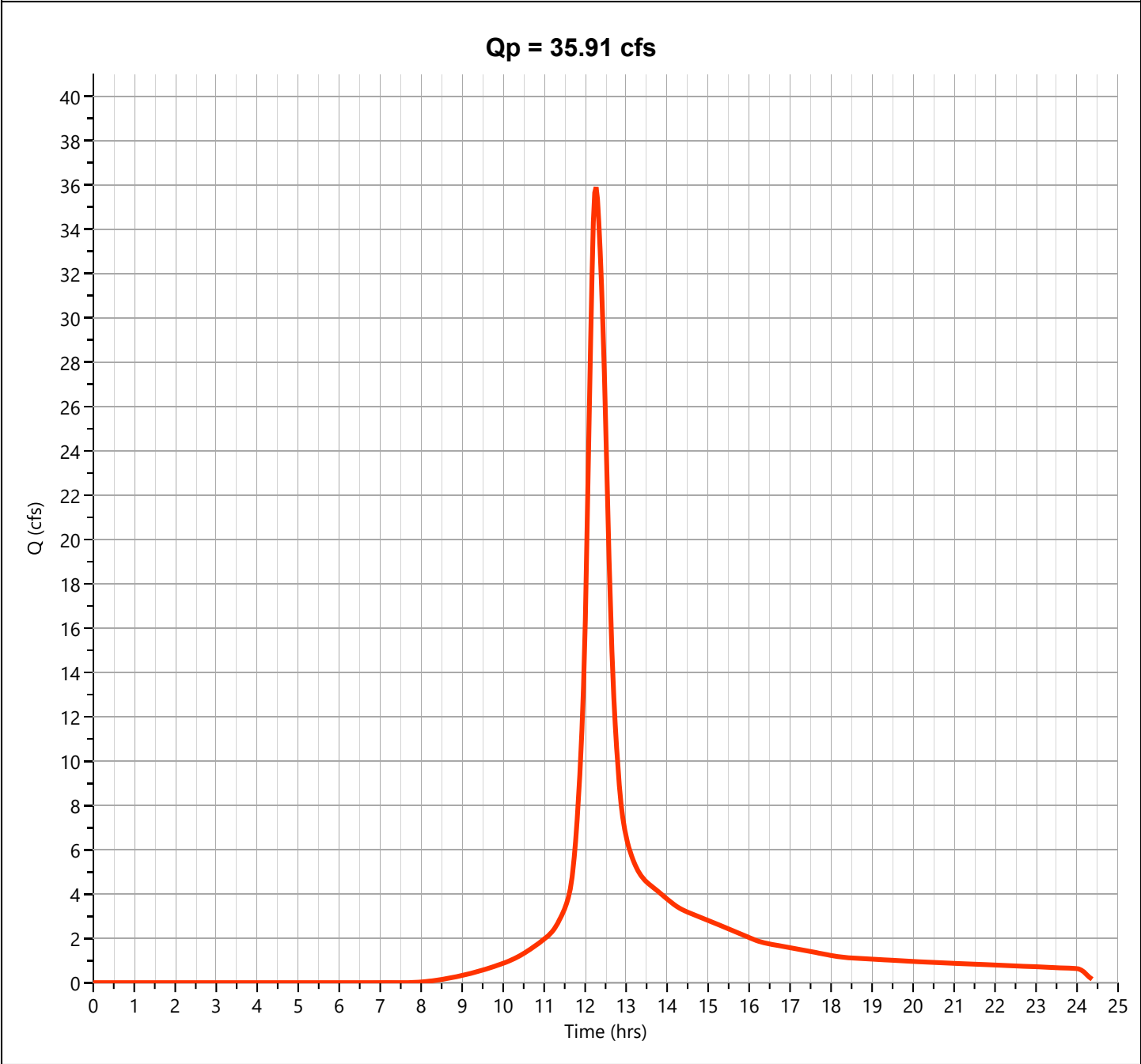
Hydrology Studio v 3.0.0.21

10-27-2022

E-3

Hyd. No. 4

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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.18	5.55
A	Open Space Good Condition	39			0.00	0.00
A	Brush Fair	35			0.00	0.00
A	Gravel	76			0.05	3.63
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			9.72	680.19
C	Open Space Good Condition	74			0.00	0.00
C	Gravel	89			0.31	28.03
D	BVW	77			0.03	2.51
Totals =					10.30	719.91

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{719.91}{10.30} = 69.91 ; \text{ Use CN} = \boxed{70}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,  
 or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.86	2.91	4.32

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked                     Rev Date 9/27/2022Date                     Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through  
subareaSubcatchment E-4Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.32

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

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:

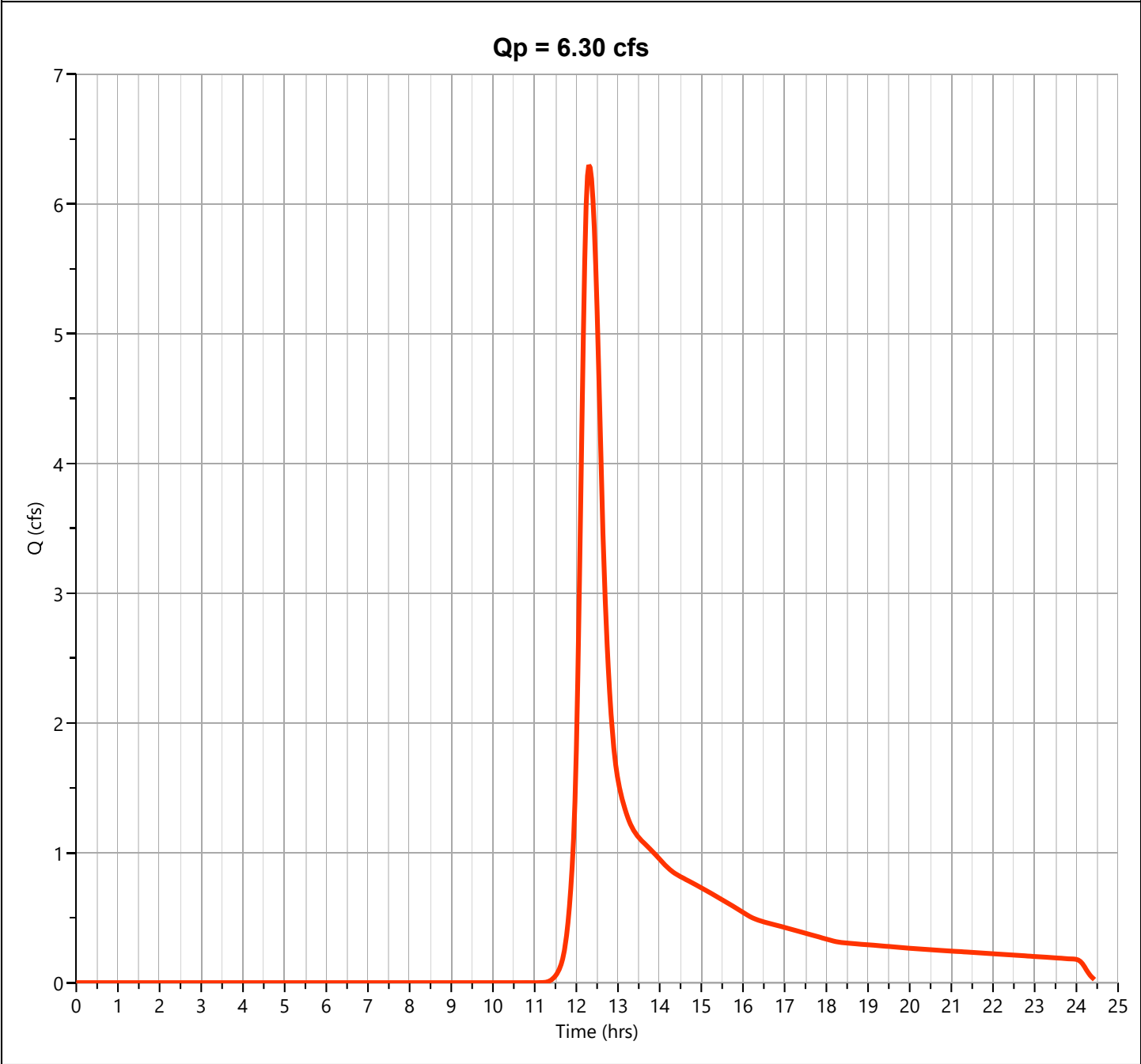
Hydrology Studio v 3.0.0.21

10-27-2022

E-4

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.300 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 33,076 cuft
Drainage Area	= 10.3 ac	Curve Number	= 70
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:

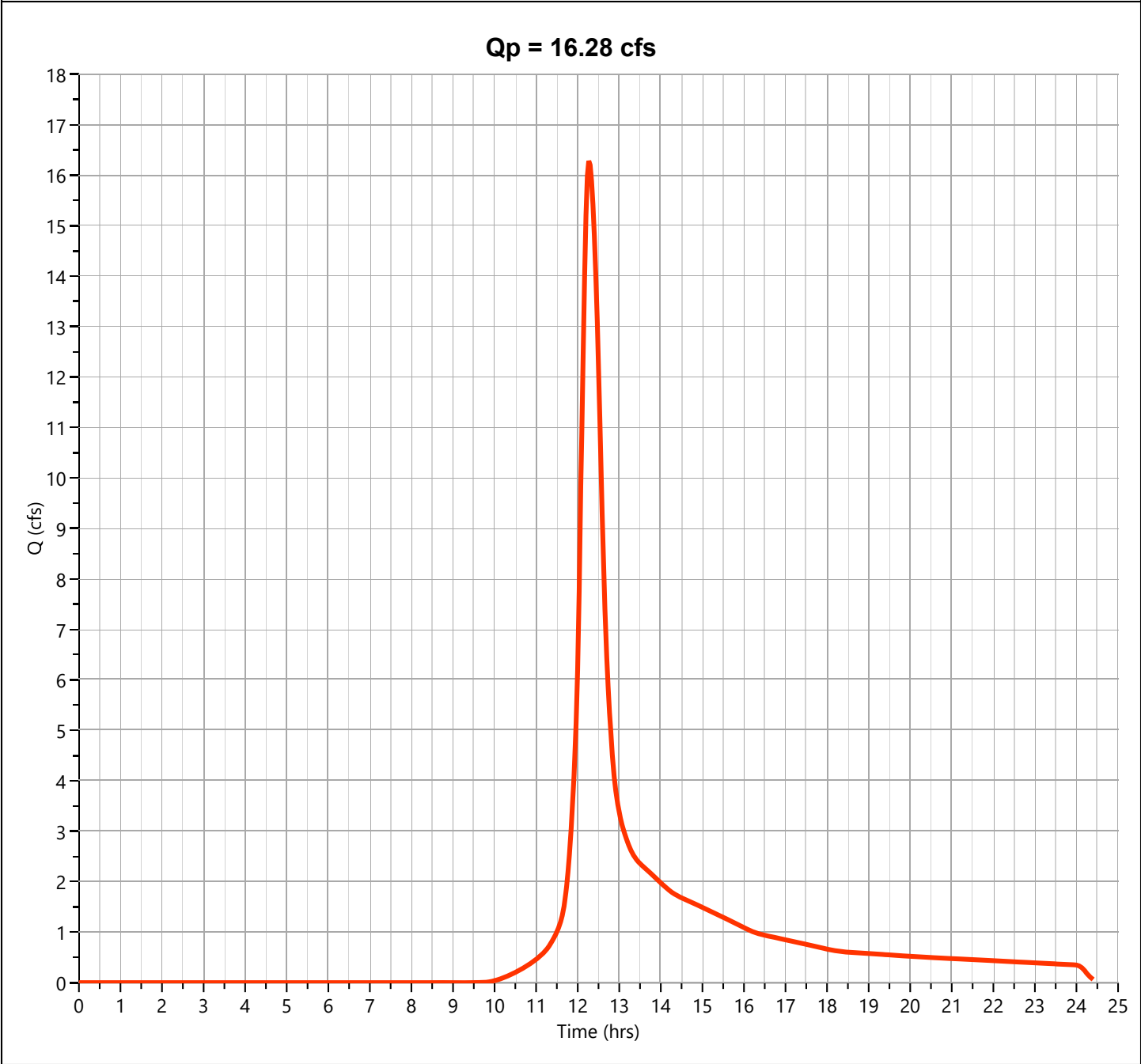
Hydrology Studio v 3.0.0.21

10-27-2022

E-4

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.28 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 78,626 cuft
Drainage Area	= 10.3 ac	Curve Number	= 70
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:

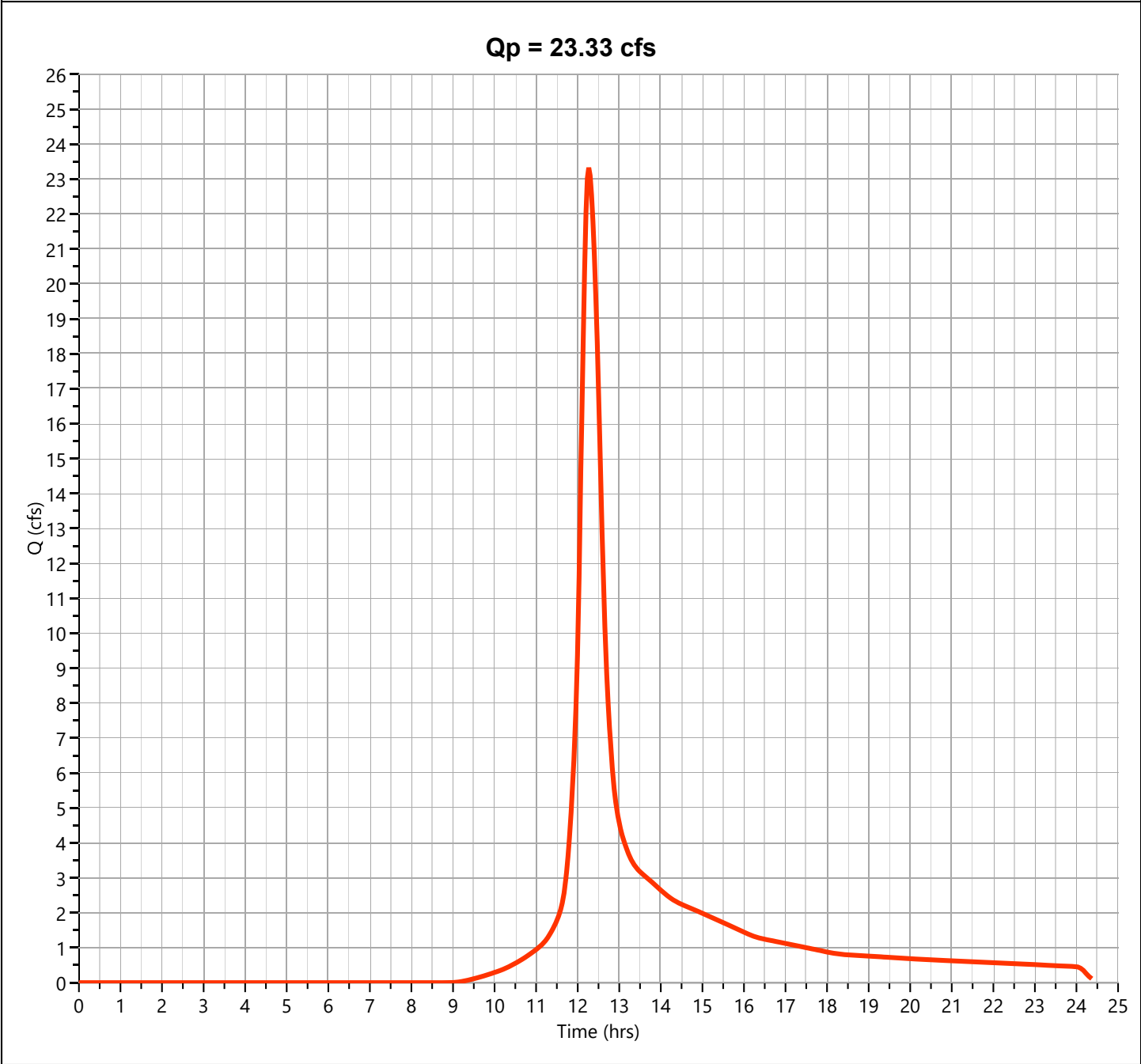
Hydrology Studio v 3.0.0.21

10-27-2022

E-4

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 23.33 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 111,000 cuft
Drainage Area	= 10.3 ac	Curve Number	= 70
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:

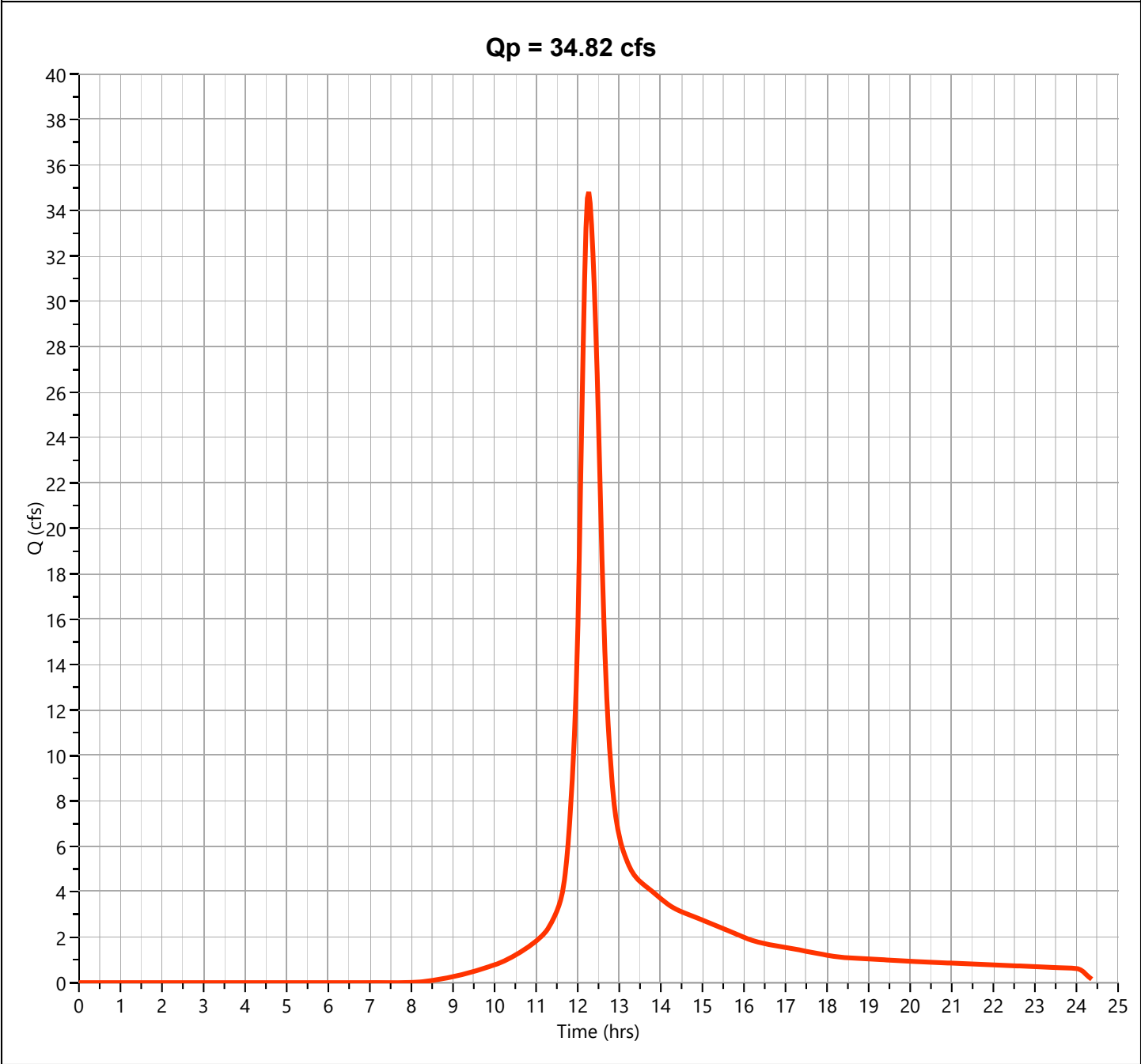
Hydrology Studio v 3.0.0.21

10-27-2022

E-4

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 34.82 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 164,675 cuft
Drainage Area	= 10.3 ac	Curve Number	= 70
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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious	98			0.04	3.50
A	Woods Good Condition	30			3.05	91.50
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			1.97	96.49
A	Gravel	76			0.24	17.90
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			4.91	343.56
C	Open Space Fair Condition	79			0.49	38.52
C	Gravel	89			0.00	0.00
D	BVW	77			2.21	170.08
Totals =					12.89	761.55

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{761.55}{12.89} = 59.06 ; \text{ Use CN} = \boxed{59}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.40	1.93	3.11

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through subarea Subcatchment E-5Sheet flow (Applicable to Tc only)

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

4. Two-yr 24-hr rainfall, P2

5. Land Slope, s

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Segment ID

A-B		
WOODS		
0.6		
50		
3.1		
0.026		
0.26		

0.26

Shallow concentrated Flow

7. Surface Description (paved or unpaved)

8. Flow Length, L

9. Watercourse slope, s

10. Average Velocity, V (figure 3-1)

11.  $Tt = L / 3600V$ 

Compute Tt hr

Segment ID

B-C		
UNPAVED		
1260		
0.076		
4.45		
0.08		

0.08

Channel flow

12. Cross sectional flow area, a

13. Wetted perimeter, pw

14. Hydraulic radius,  $r=a/wp$ 

15. Channel Slope, s

16. Manning's roughness coeff., n

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

19.  $Tt = L / 3600V$ 

Compute r

Compute V

Compute Tt hr

Segment ID


0

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

hr  
min0.34  
20.3

# Hydrograph Report

Project Name:

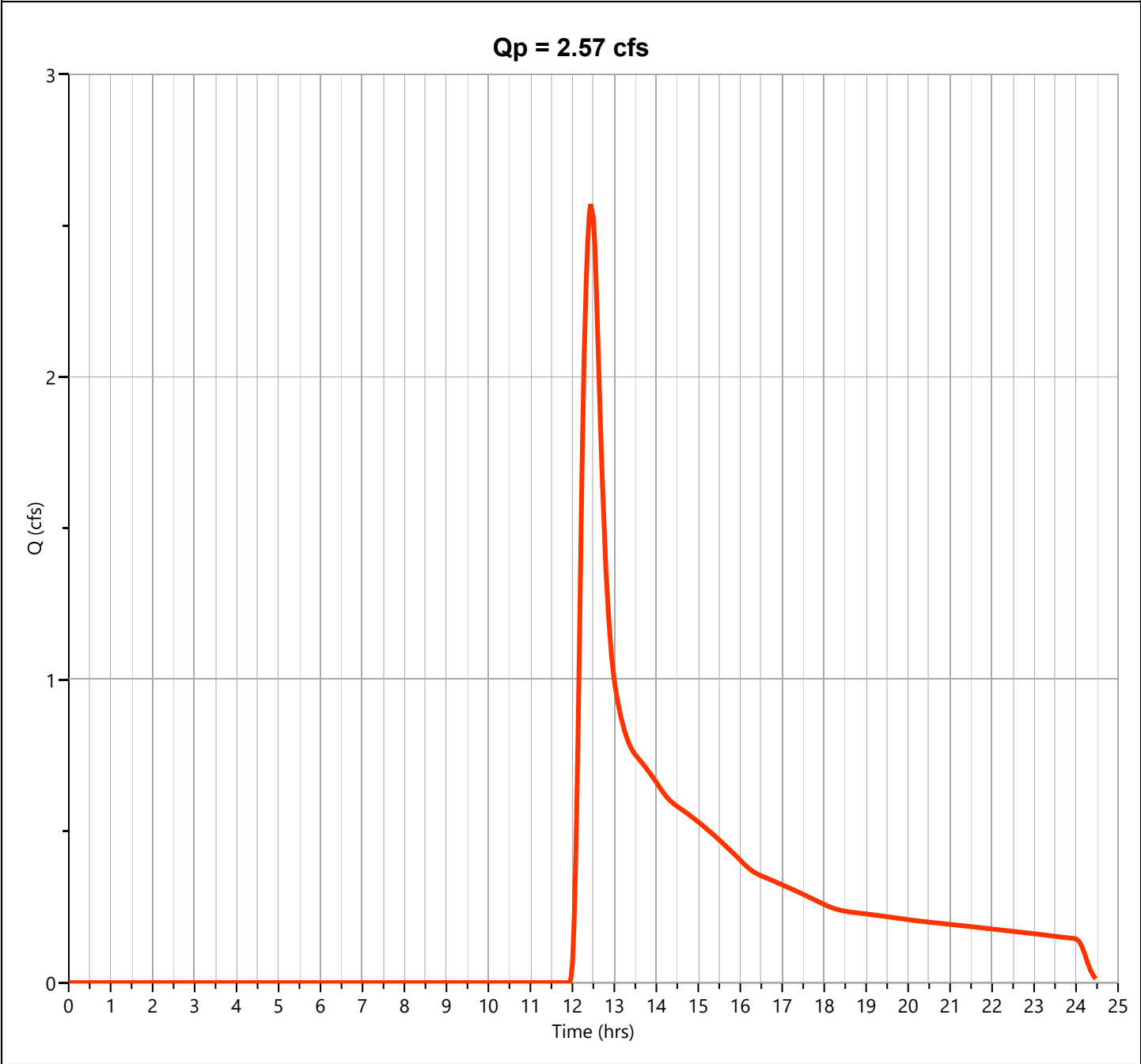
Hydrology Studio v 3.0.0.21

10-27-2022

E-5

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.571 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 19,062 cuft
Drainage Area	= 12.89 ac	Curve Number	= 59
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:

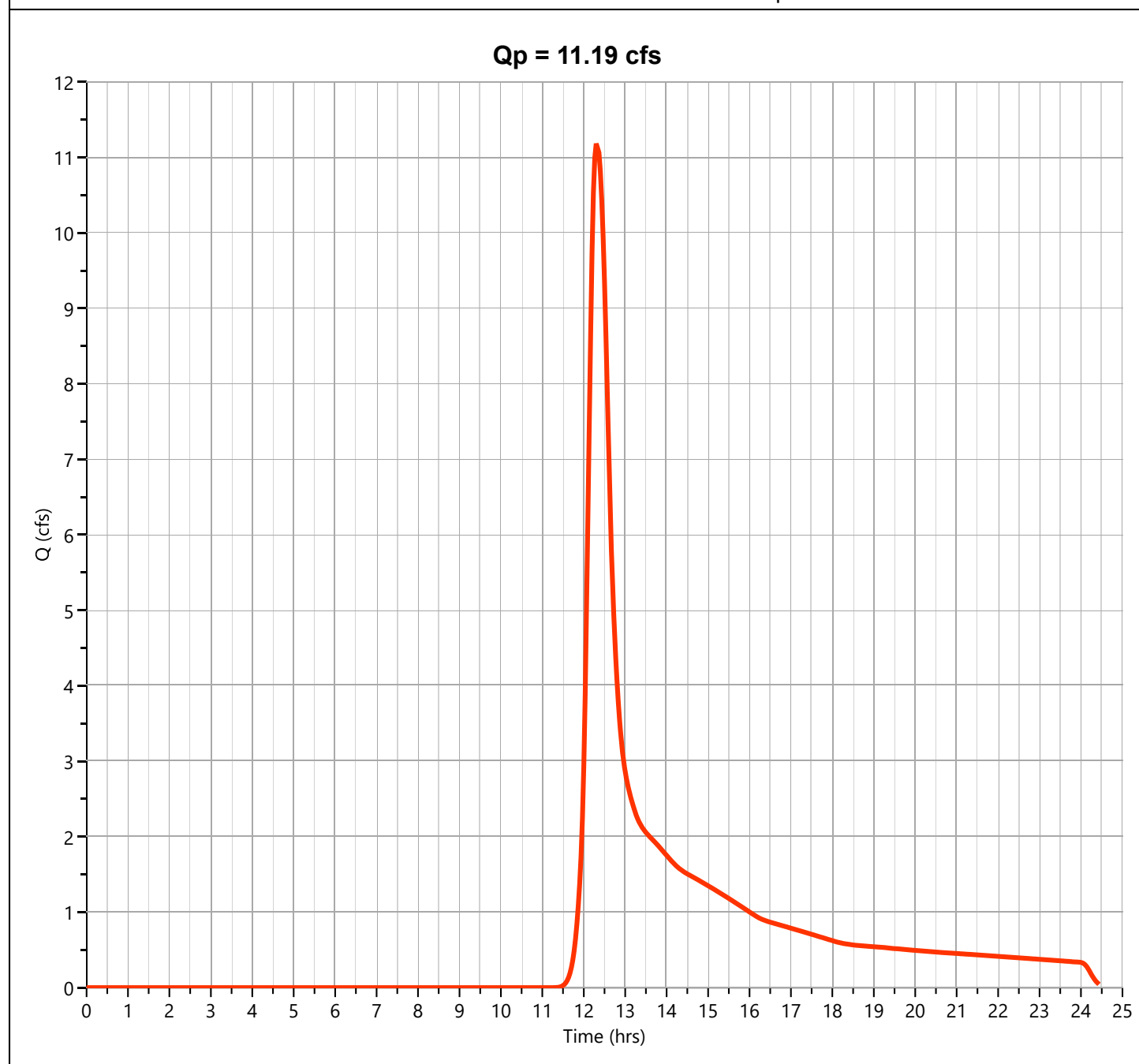
Hydrology Studio v 3.0.0.21

10-27-2022

**E-5**

**Hyd. No. 6**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.19 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 59,868 cuft
Drainage Area	= 12.89 ac	Curve Number	= 59
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:

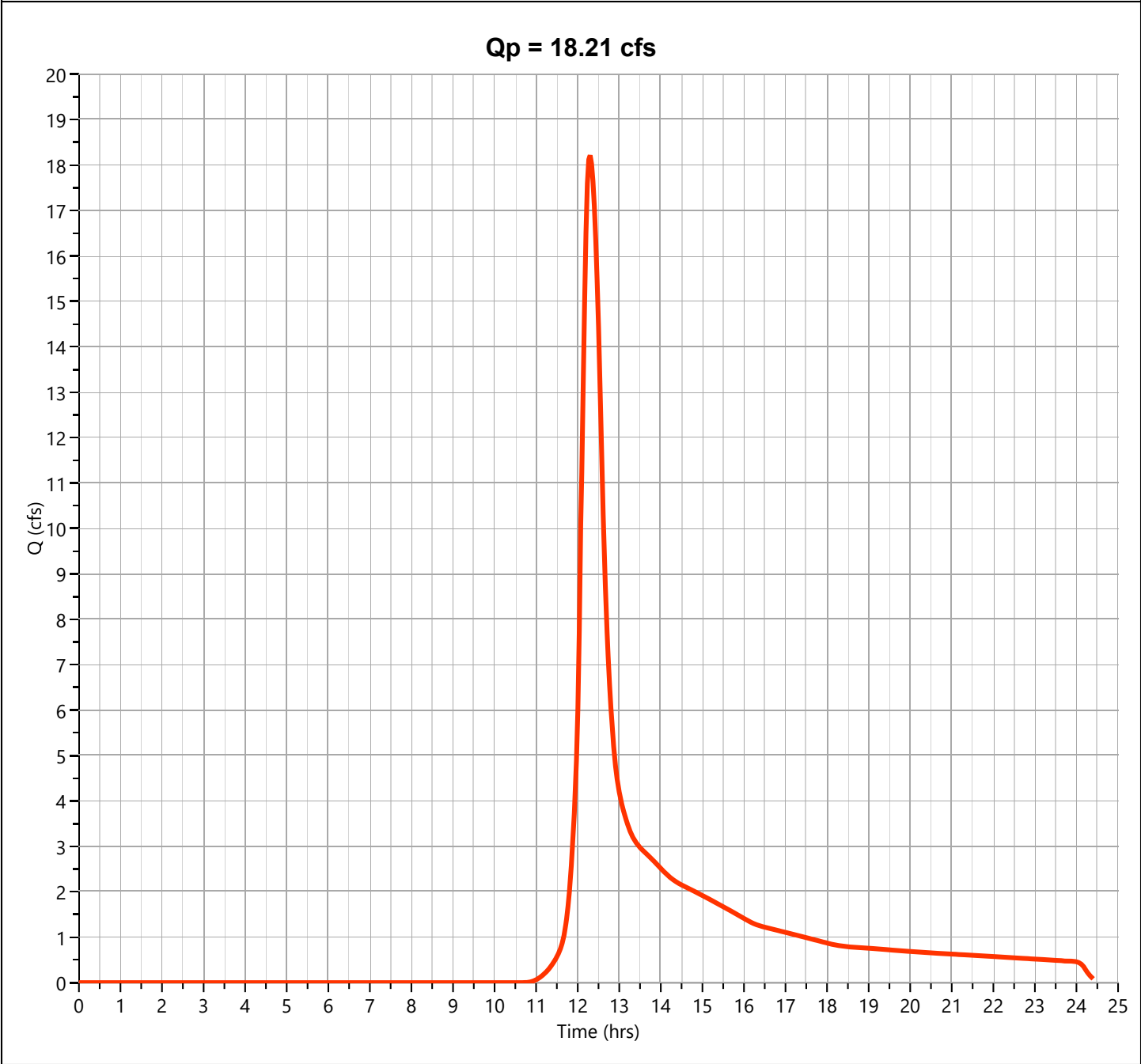
Hydrology Studio v 3.0.0.21

10-27-2022

E-5

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.21 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 91,855 cuft
Drainage Area	= 12.89 ac	Curve Number	= 59
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:

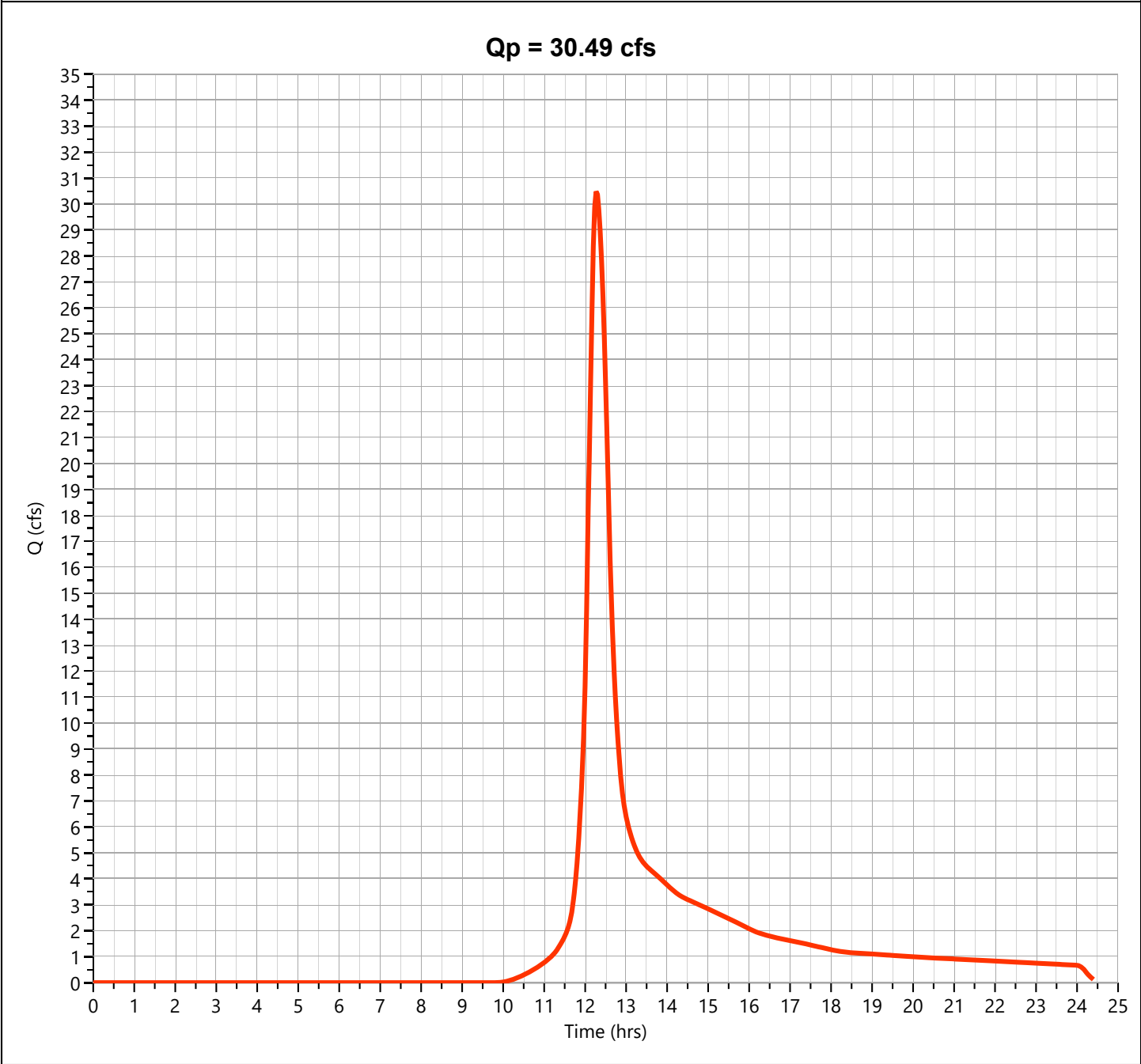
Hydrology Studio v 3.0.0.21

10-27-2022

E-5

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 30.49 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 147,879 cuft
Drainage Area	= 12.89 ac	Curve Number	= 59
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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	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	22.79
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
Totals =					2.25	85.03

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{85.03}{2.25} = 37.76 ; \text{ Use CN} = \boxed{38}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.00	0.42	0.98

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked                     Rev Date 9/27/2022Date                     

Circle one:

Present
Tc

Developed

Circle one:

Tt

through  
subareaSubcatchment E-6Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

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:

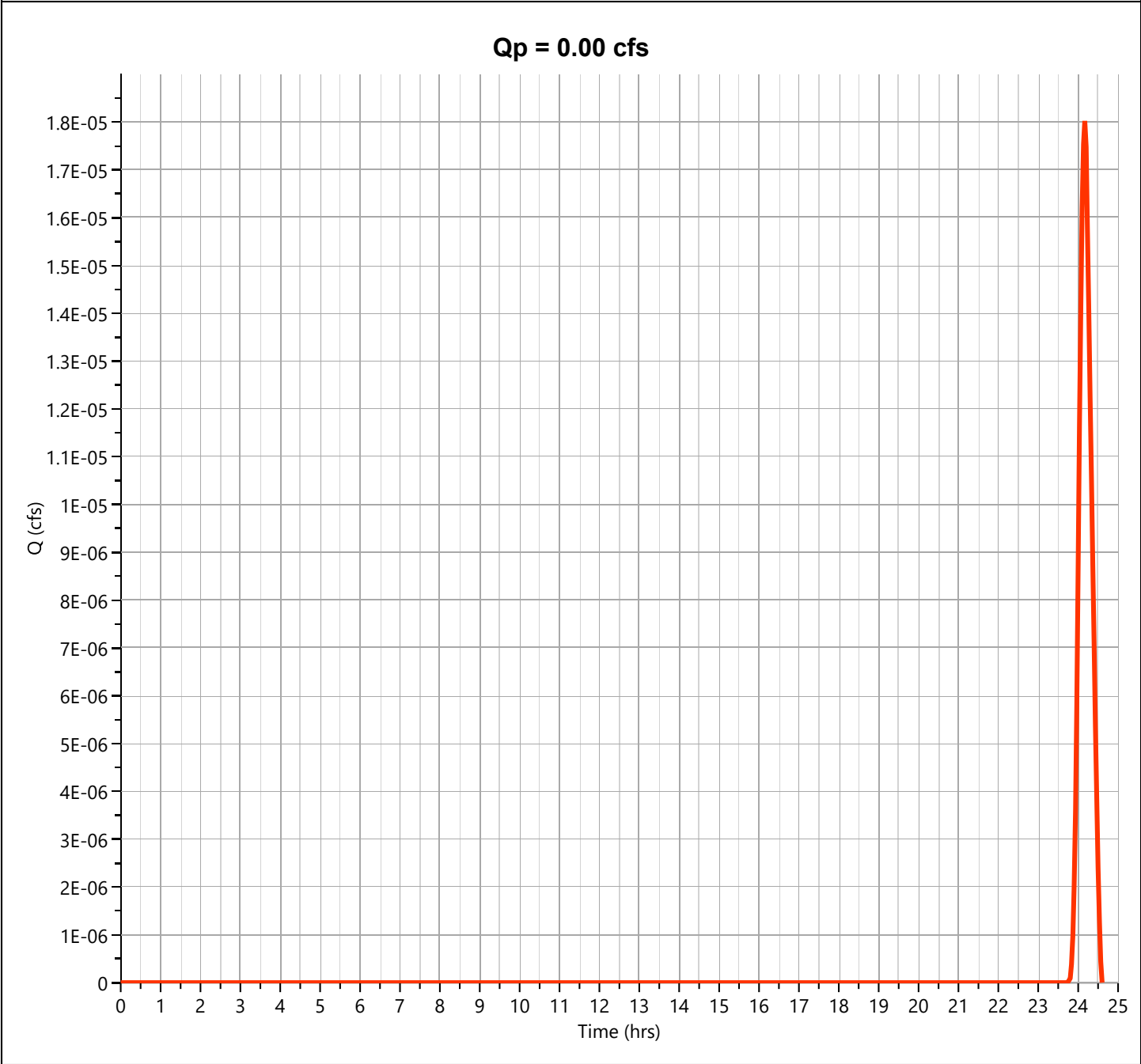
Hydrology Studio v 3.0.0.21

10-27-2022

E-6

Hyd. No. 7

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:

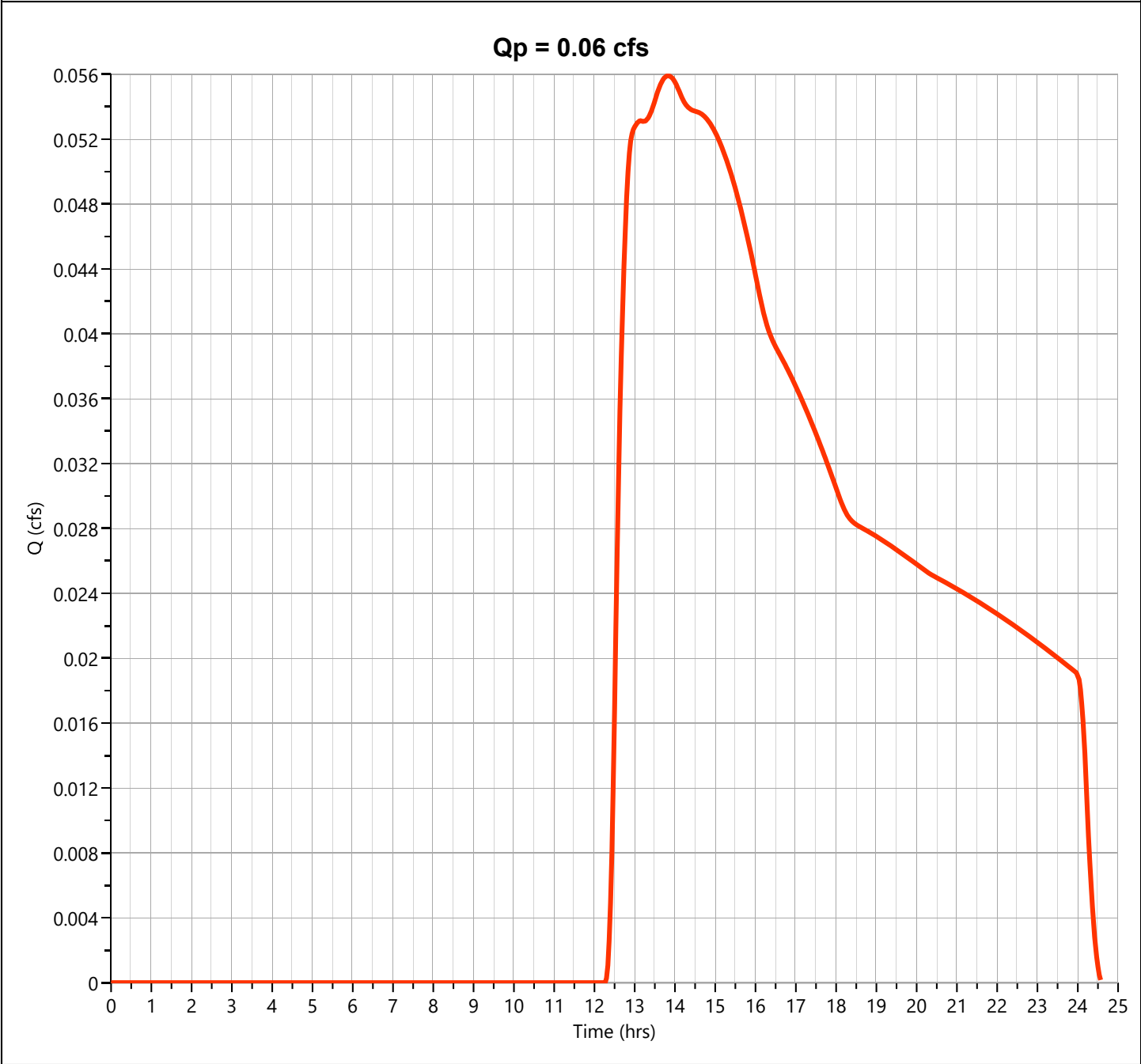
Hydrology Studio v 3.0.0.21

10-27-2022

E-6

Hyd. No. 7

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:

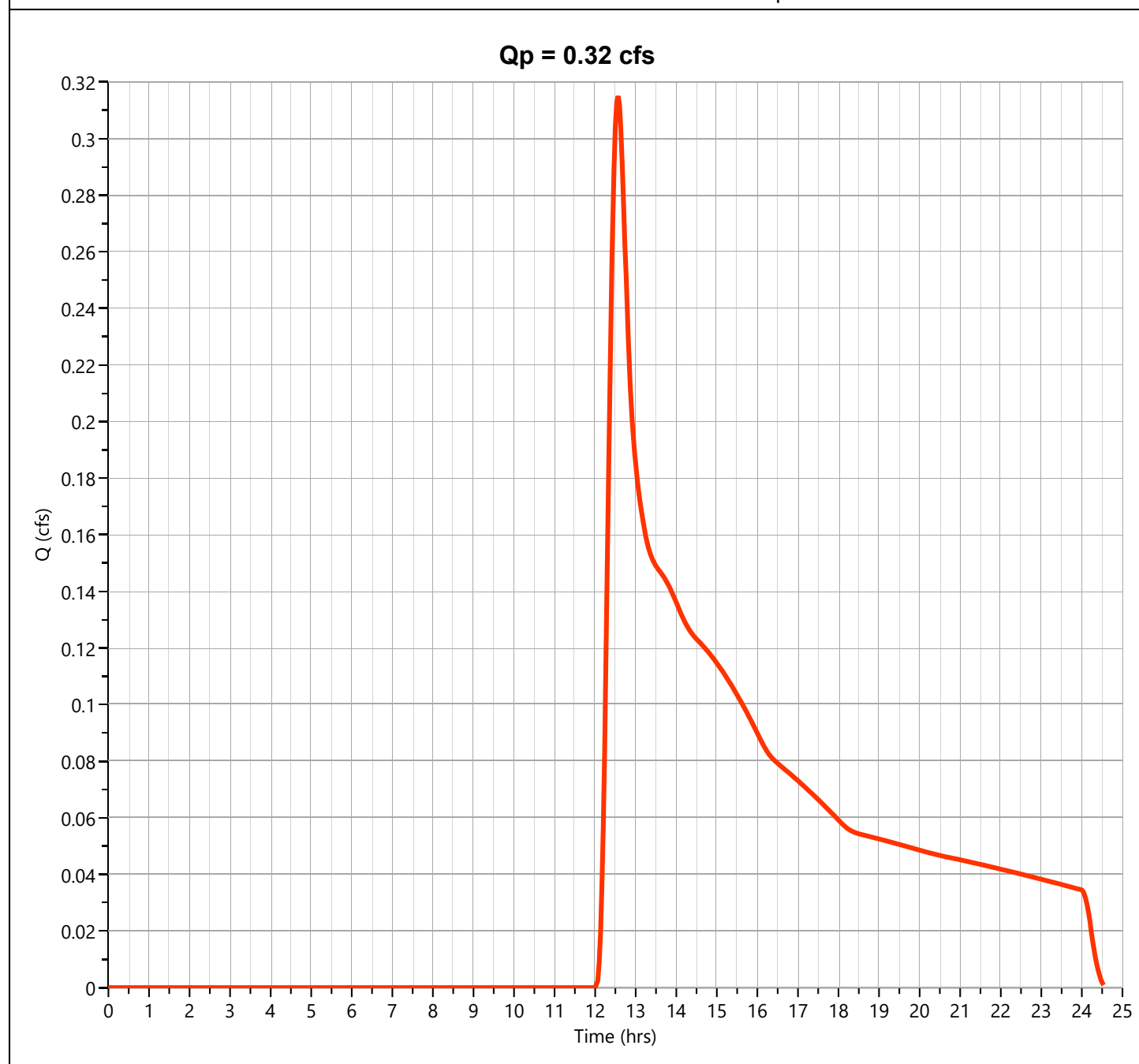
Hydrology Studio v 3.0.0.21

10-27-2022

E-6

Hyd. No. 7

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:

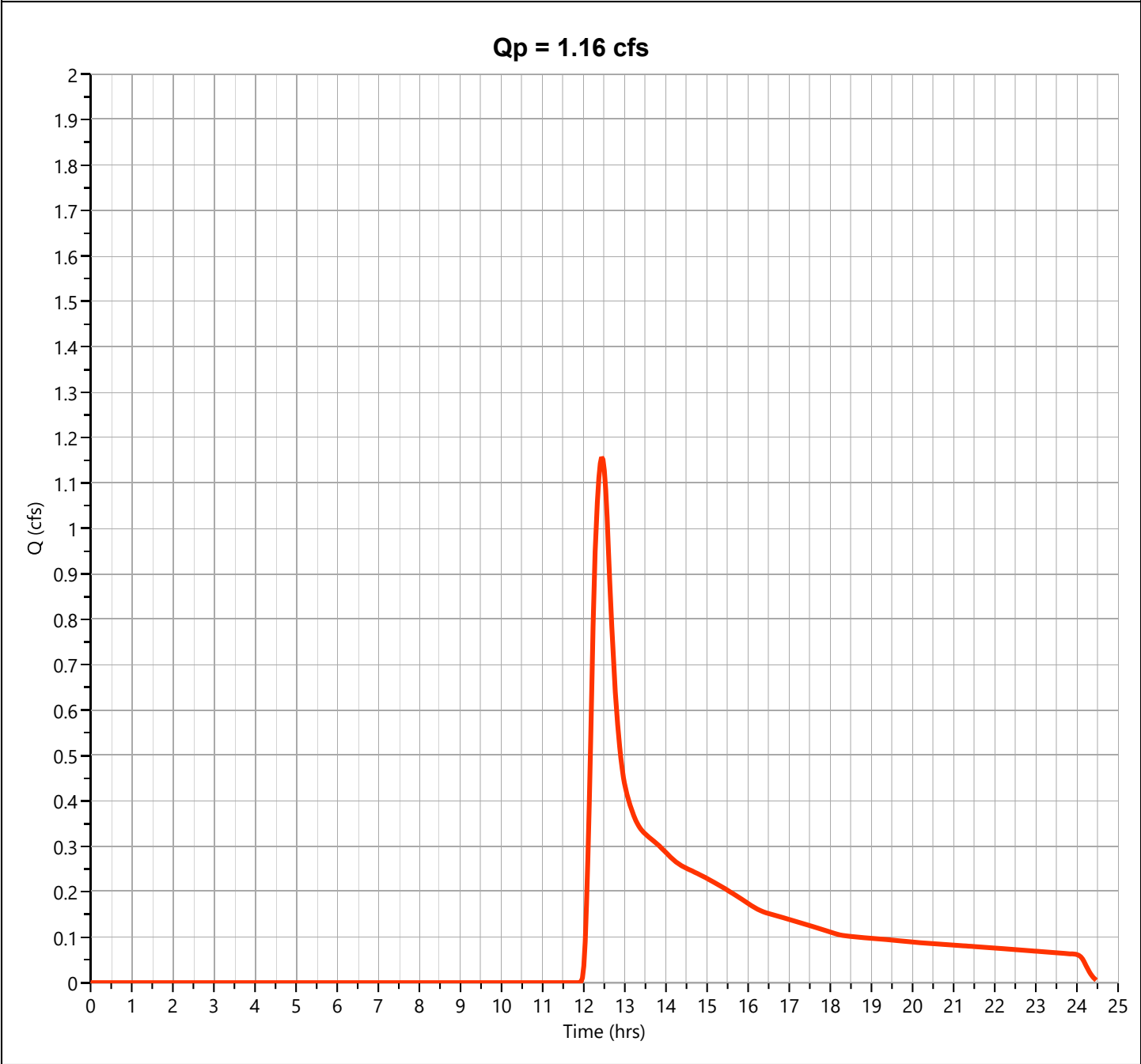
Hydrology Studio v 3.0.0.21

10-27-2022

E-6

Hyd. No. 7

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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	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
Totals =					6.51	207.68

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{207.68}{6.51} = 31.91; \text{ Use CN} = \boxed{32}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.05	0.15	0.51

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through  
subareaSubcatchment E-7Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.32  
19.0

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**E-7**

**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	= 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:

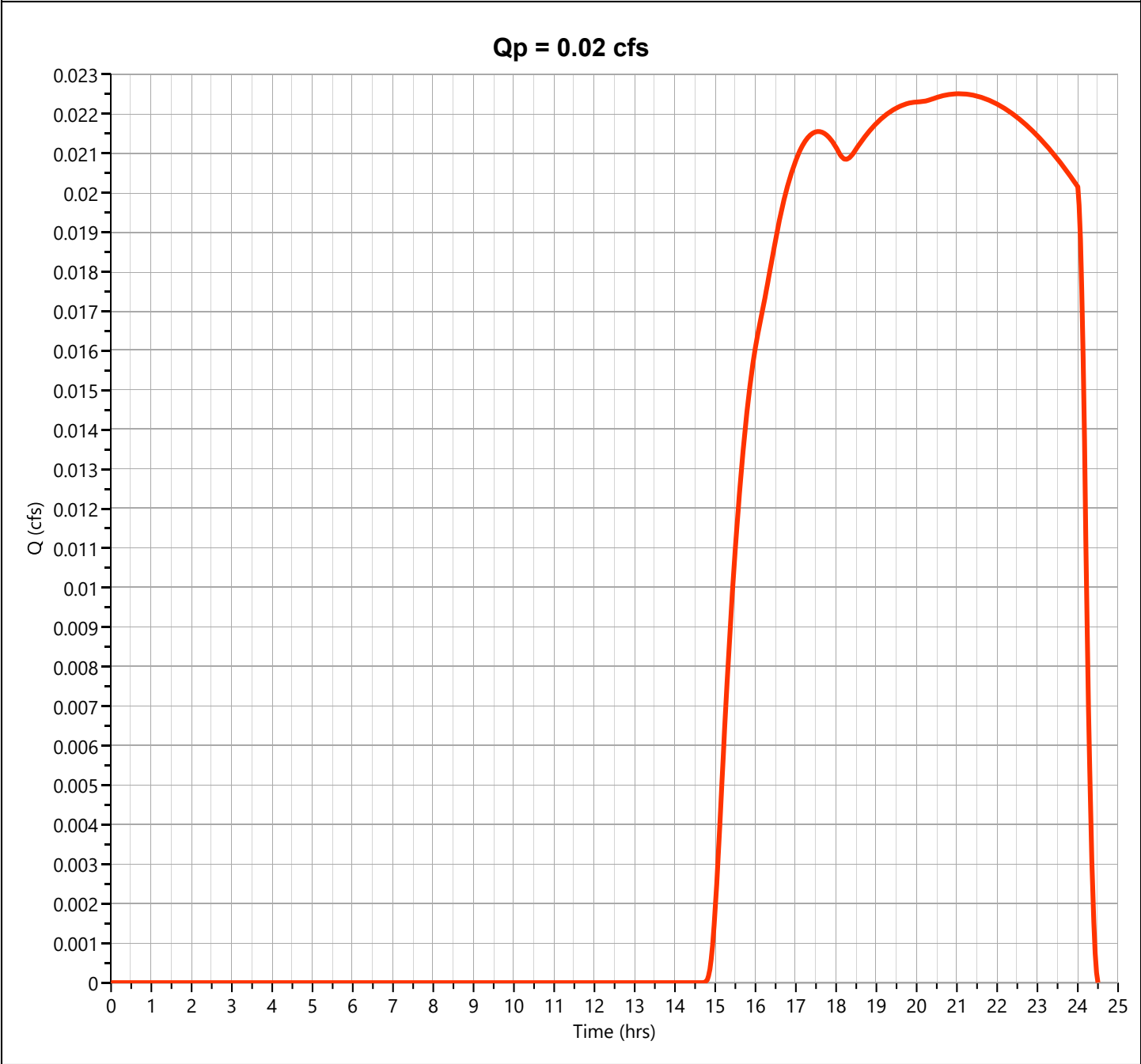
Hydrology Studio v 3.0.0.21

10-27-2022

E-7

Hyd. No. 8

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:

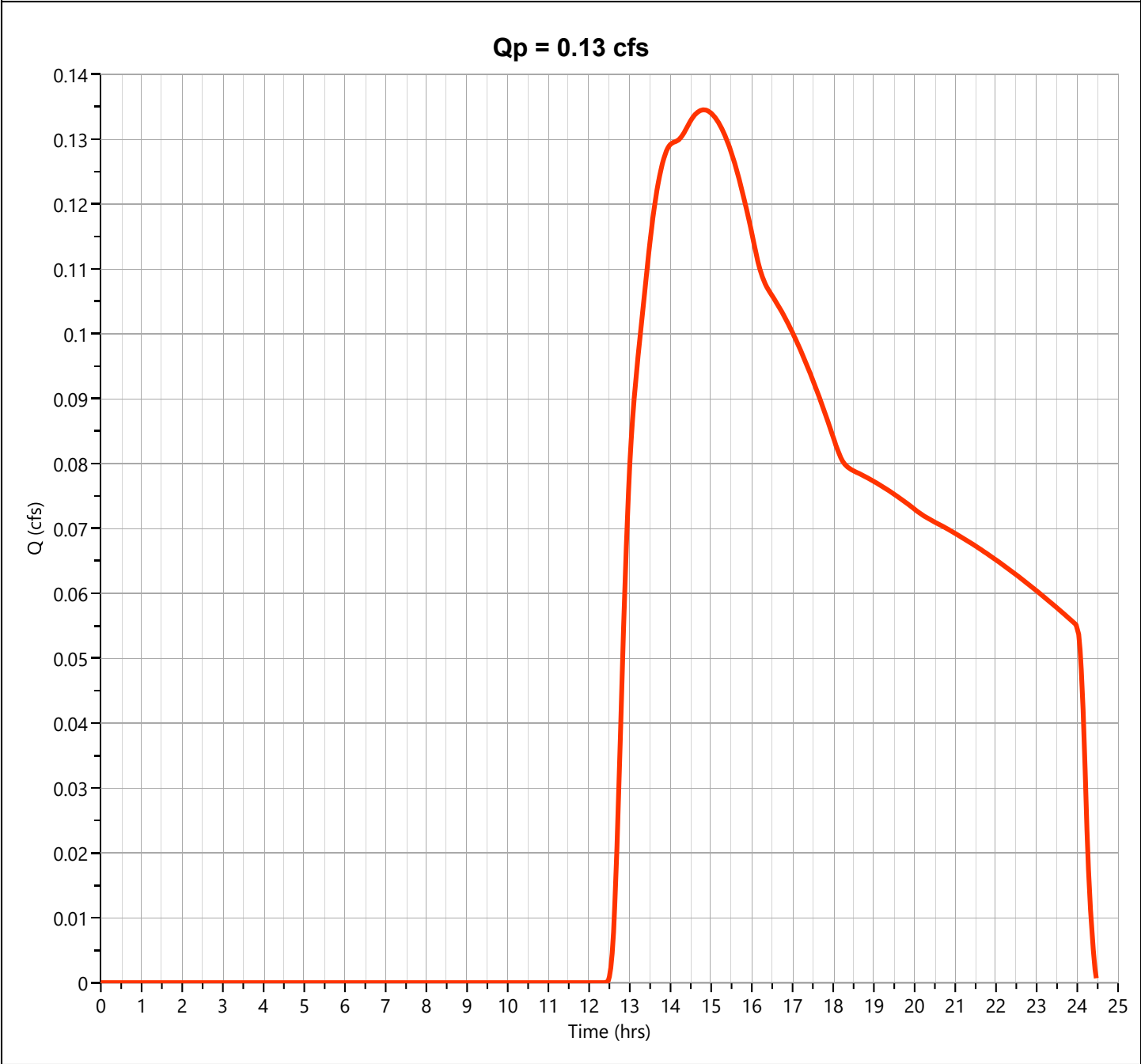
Hydrology Studio v 3.0.0.21

10-27-2022

E-7

Hyd. No. 8

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:

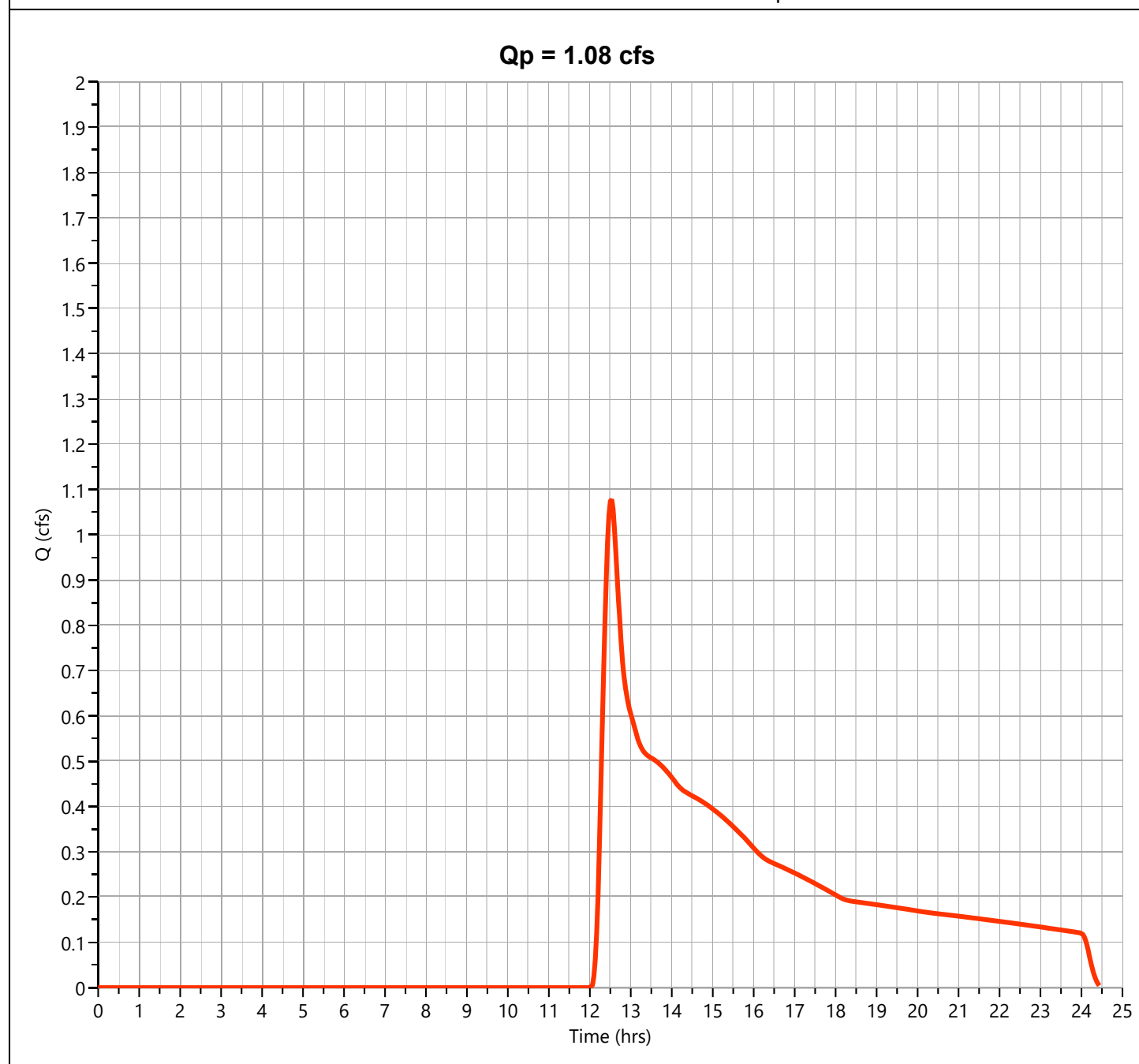
Hydrology Studio v 3.0.0.21

10-27-2022

E-7

Hyd. No. 8

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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	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
Totals =					0.68	20.49

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{20.49}{0.68} = 30.00 ; \text{ Use CN} = \boxed{30}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.09	0.09	0.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked                     Rev Date 9/27/2022Date                     Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through  
subareaSubcatchment E-8Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.32

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

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 3.0.0.21

10-27-2022

**E-8**

**Hyd. No. 9**

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:

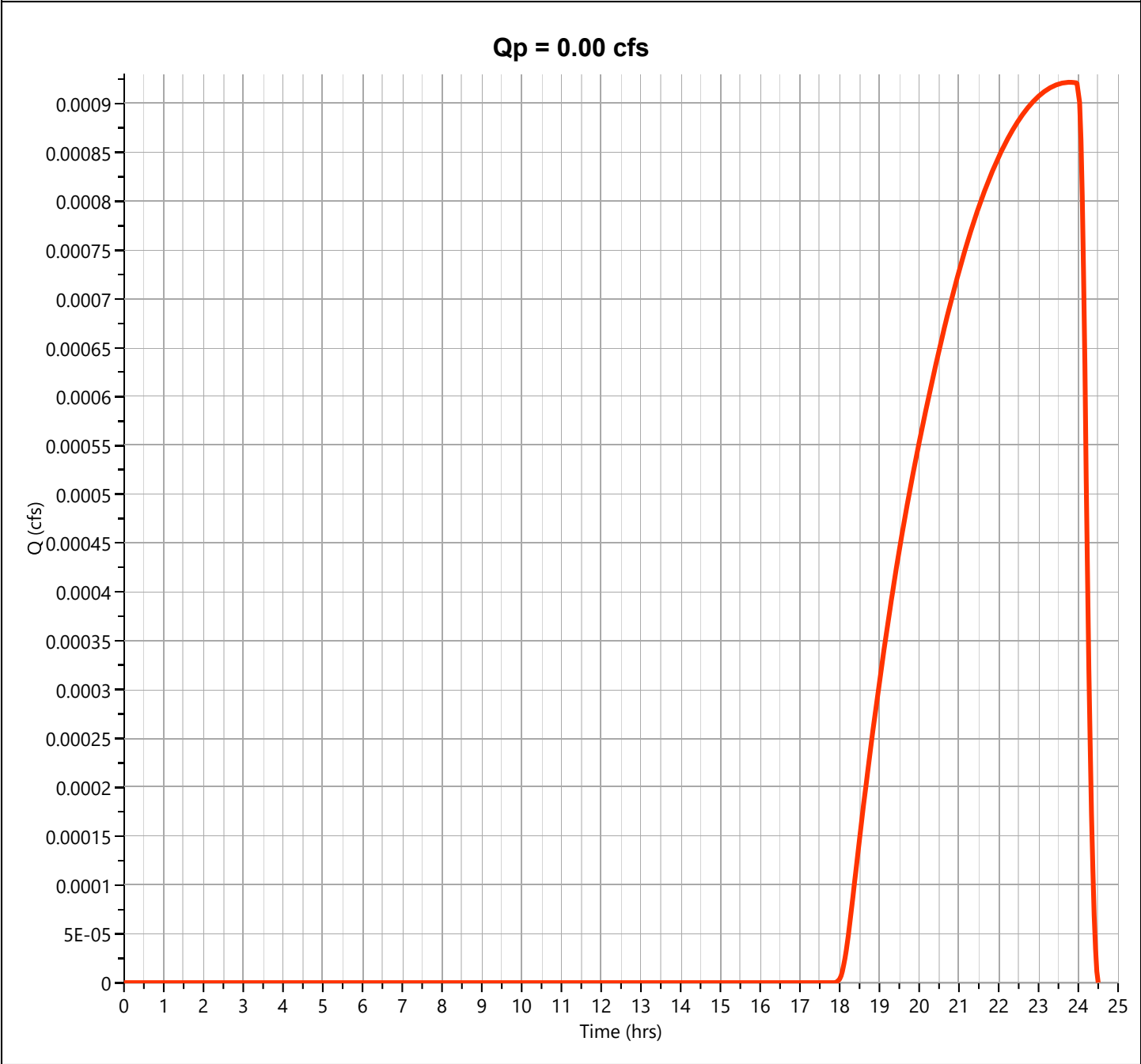
Hydrology Studio v 3.0.0.21

10-27-2022

E-8

Hyd. No. 9

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:

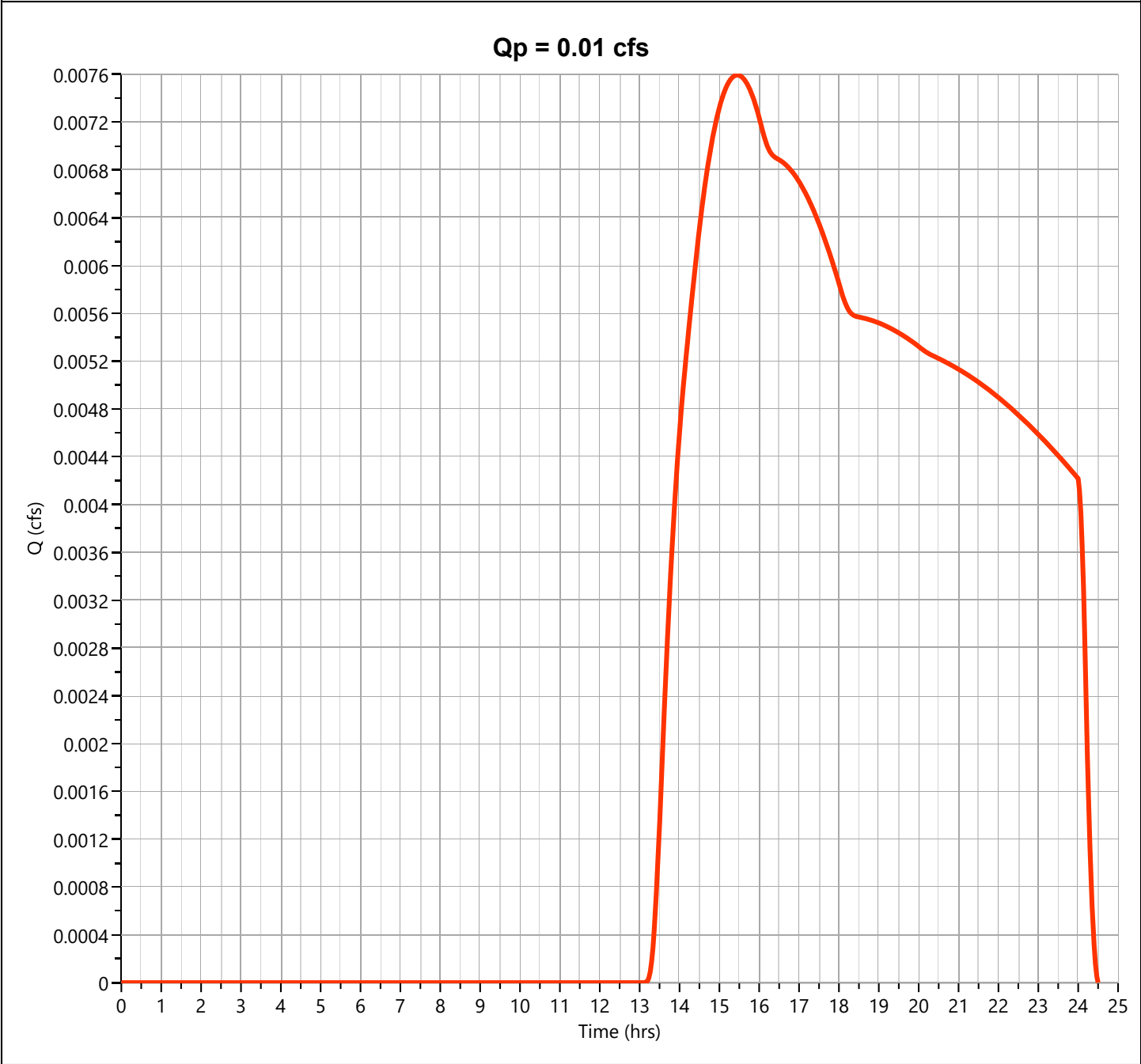
Hydrology Studio v 3.0.0.21

10-27-2022

E-8

Hyd. No. 9

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:

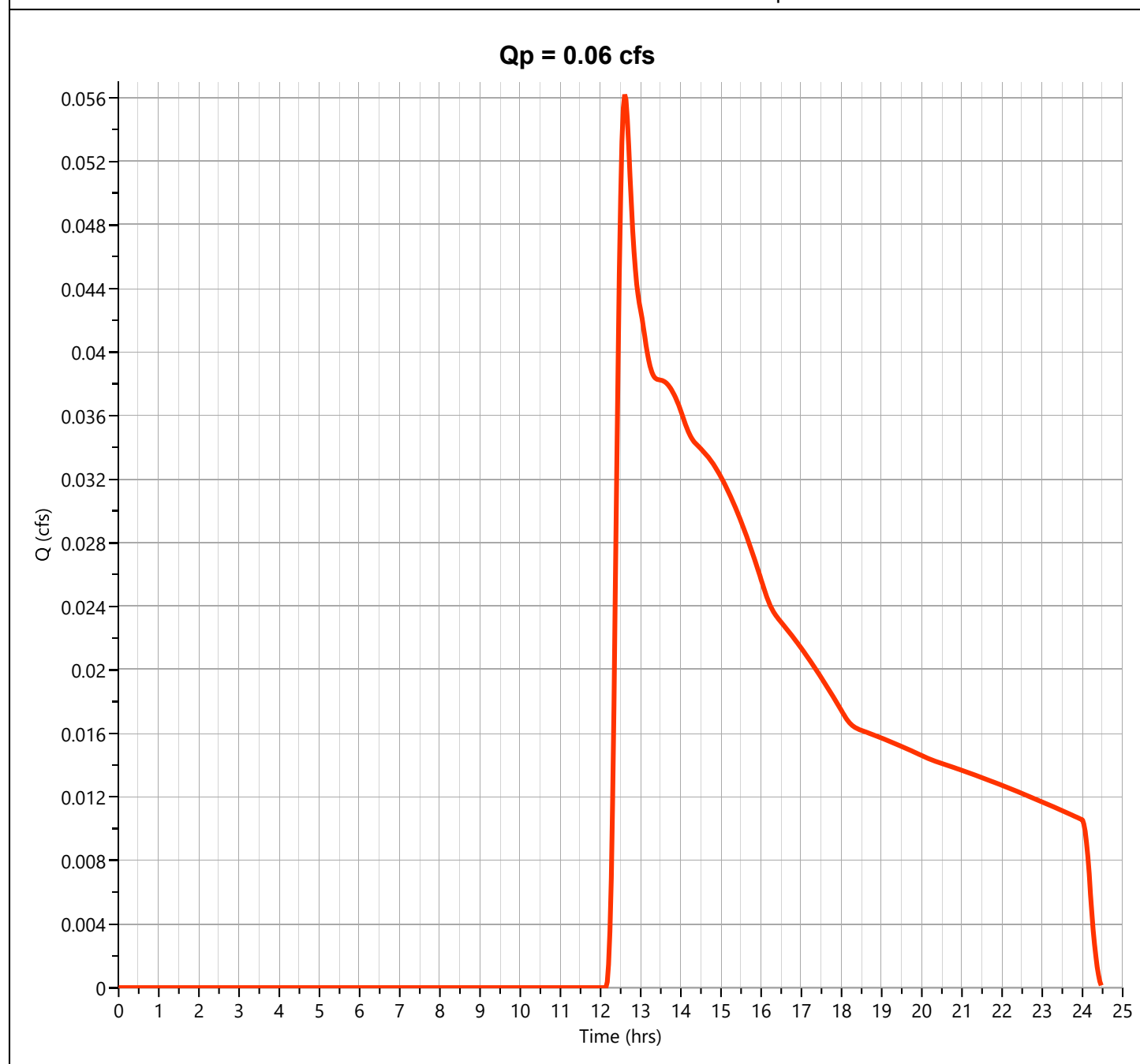
Hydrology Studio v 3.0.0.21

10-27-2022

E-8

Hyd. No. 9

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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 Date             
 Circle one: ☒ Present ☐ Developed Subcatchment E-9A

## 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.03	2.67
A	Woods Good Condition	30			1.57	47.09
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.44	21.74
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			0.05	3.27
C	Open Space Good Condition	74			0.00	0.00
D	Open Space Good Condition	80			0.00	0.00
D	Open Space Fair Condition	84			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
Totals =					2.59	112.94

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{112.94}{2.59} = 43.62 ; \text{ Use CN} = \boxed{44}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,  
 or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.03	0.77	1.52

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through  
subareaSubcatchment E-9ASheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

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

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

hr

0.27

min

16.3

# Hydrograph Report

Project Name:

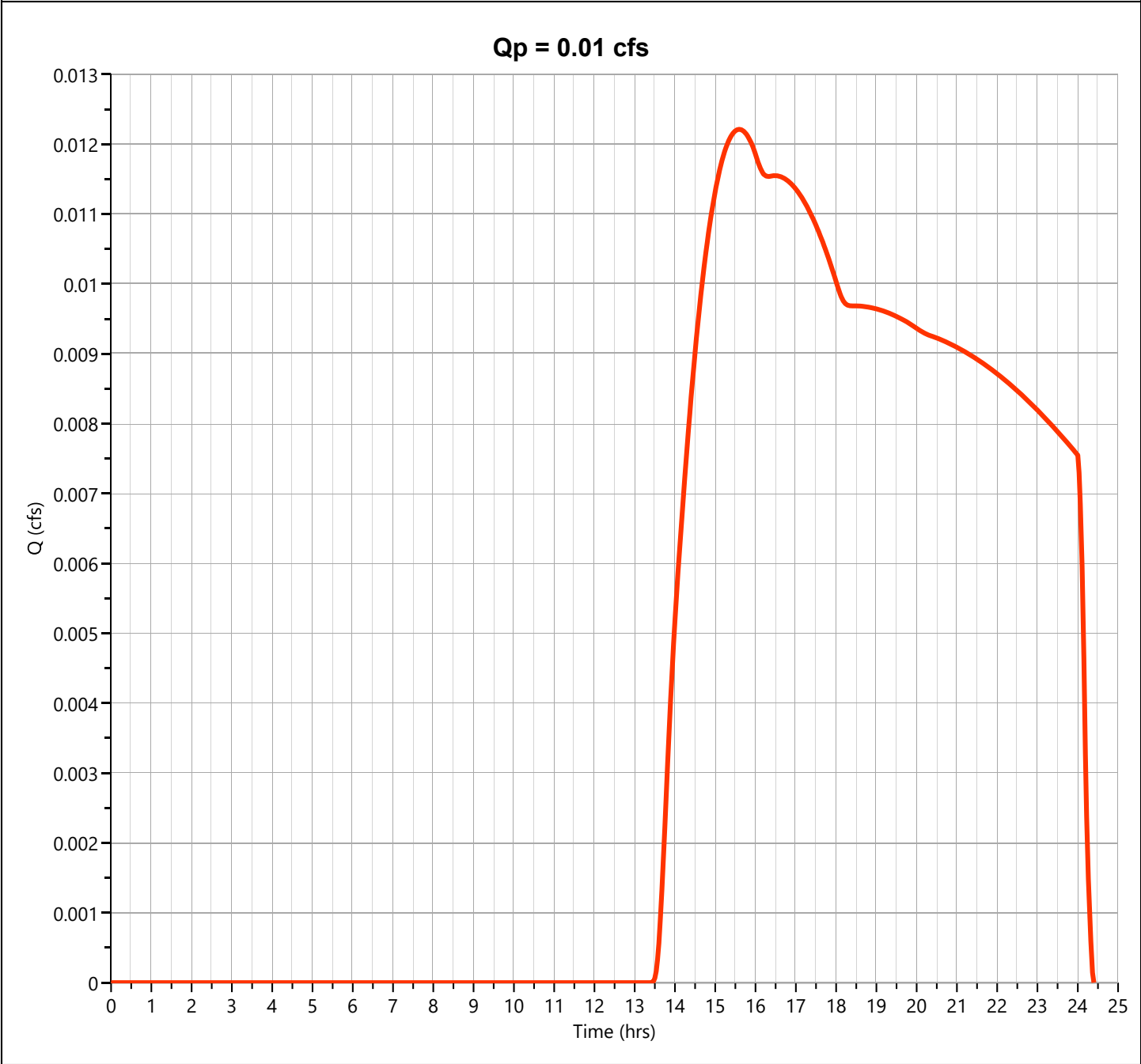
Hydrology Studio v 3.0.0.21

10-27-2022

E-9A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.012 cfs
Storm Frequency	= 2-yr	Time to Peak	= 15.60 hrs
Time Interval	= 2 min	Runoff Volume	= 358 cuft
Drainage Area	= 2.59 ac	Curve Number	= 44
Tc Method	= User	Time of Conc. (Tc)	= 16.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

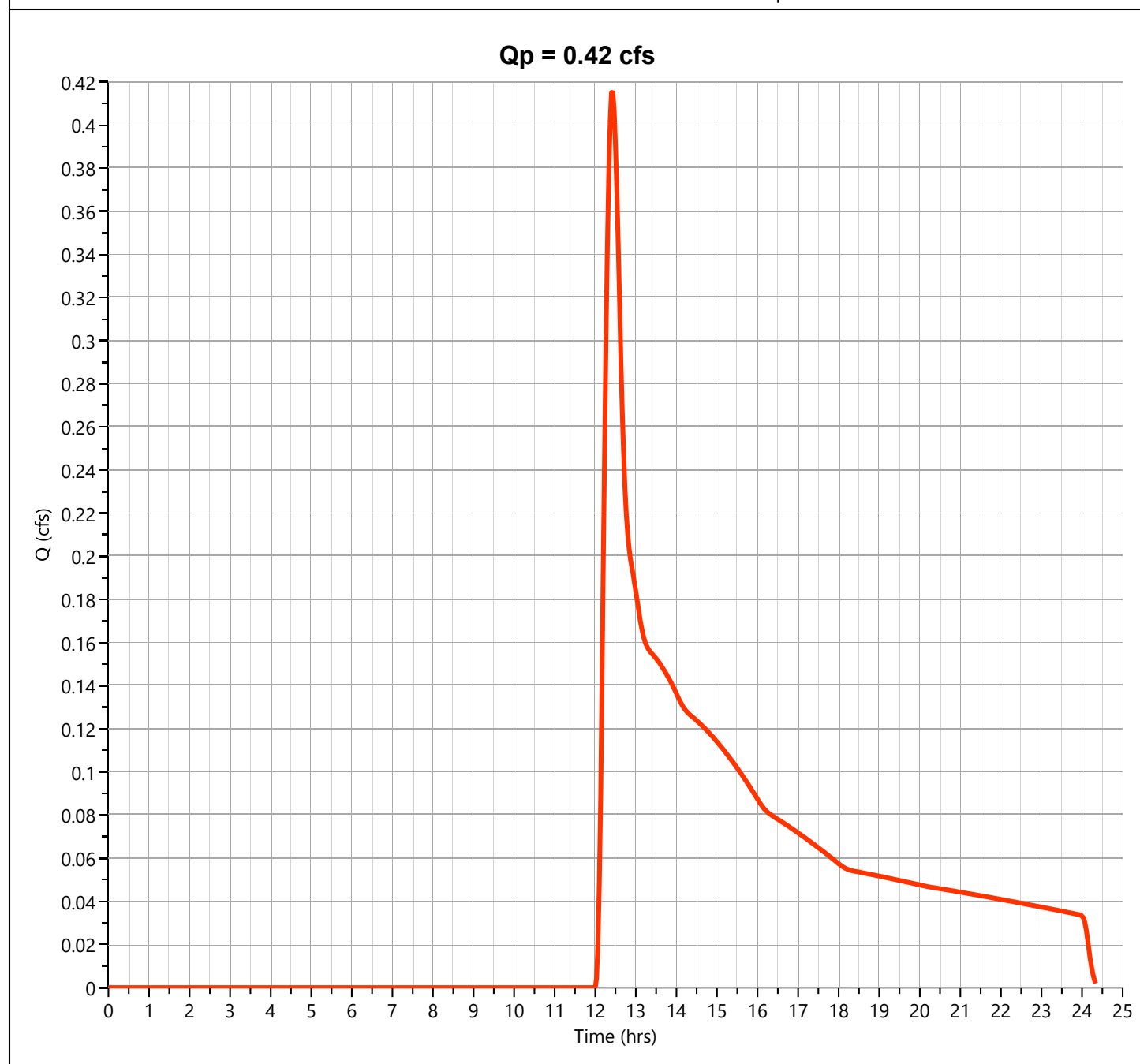
Hydrology Studio v 3.0.0.21

10-27-2022

**E-9A**

**Hyd. No. 10**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.416 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 3,747 cuft
Drainage Area	= 2.59 ac	Curve Number	= 44
Tc Method	= User	Time of Conc. (Tc)	= 16.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

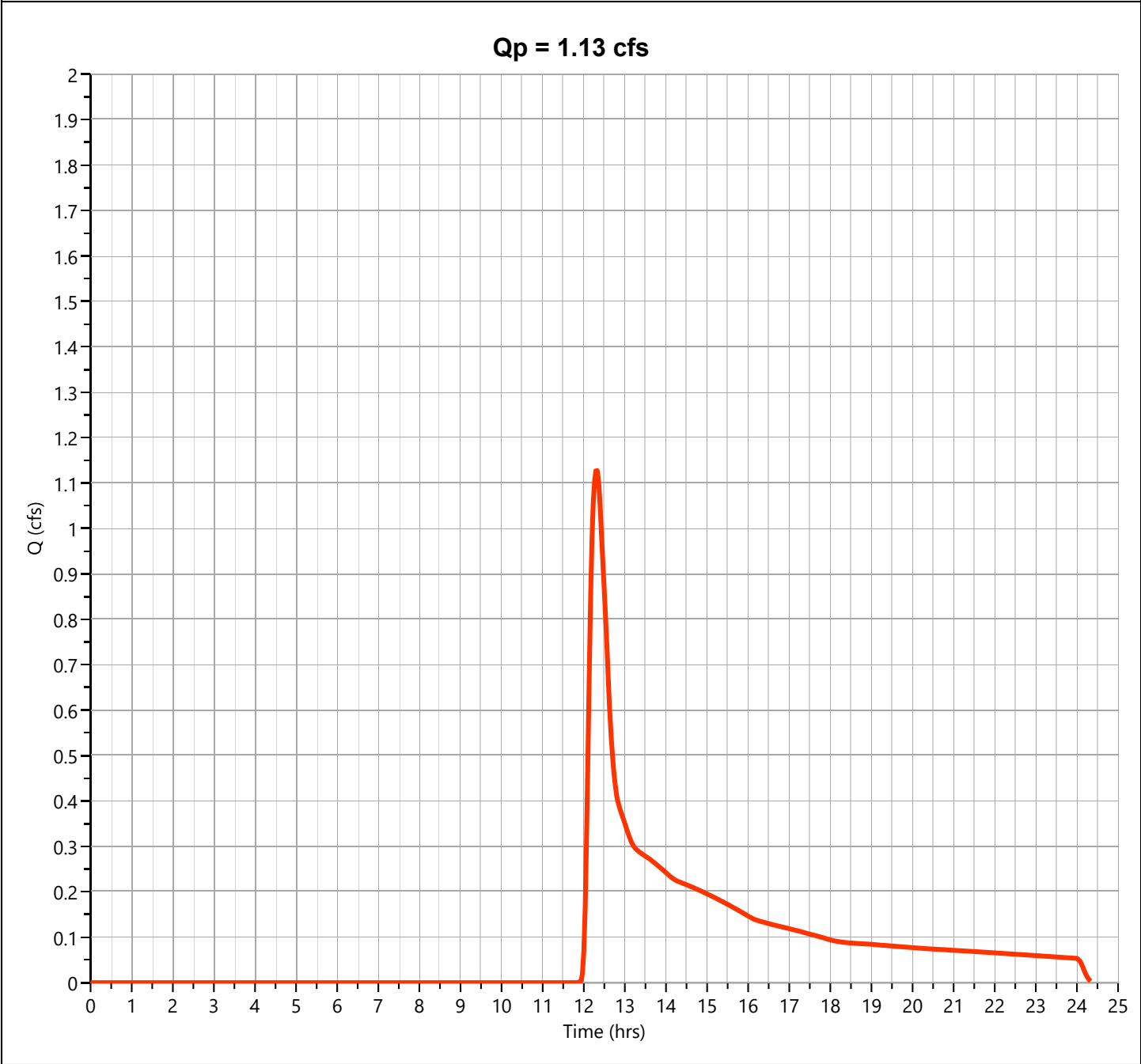
Hydrology Studio v 3.0.0.21

10-27-2022

E-9A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.130 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 7,257 cuft
Drainage Area	= 2.59 ac	Curve Number	= 44
Tc Method	= User	Time of Conc. (Tc)	= 16.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

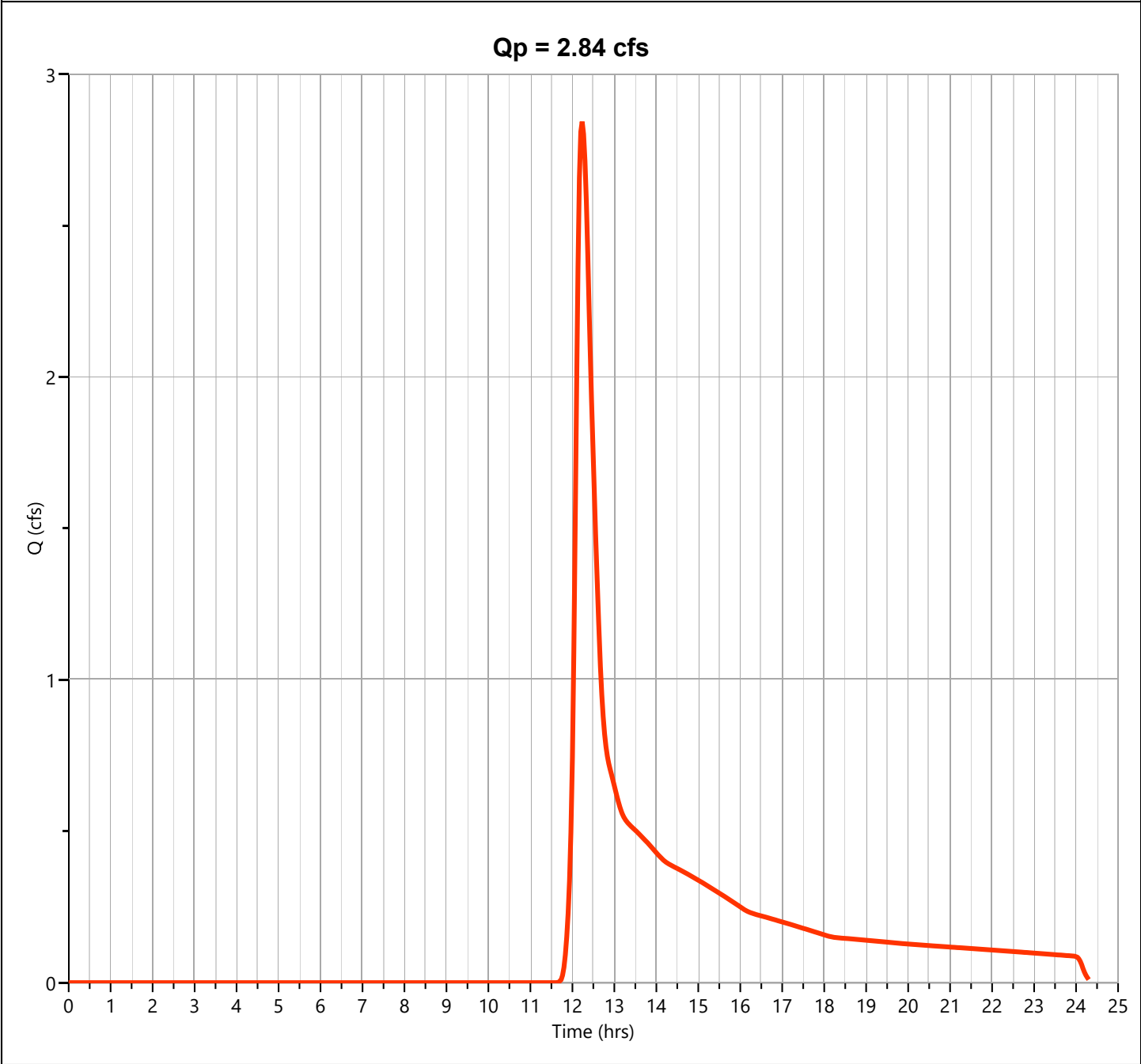
Hydrology Studio v 3.0.0.21

10-27-2022

E-9A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.844 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 14,258 cuft
Drainage Area	= 2.59 ac	Curve Number	= 44
Tc Method	= User	Time of Conc. (Tc)	= 16.3 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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 Date             
 Circle one: ☒ Present ☐ Developed Subcatchment E-9B

## 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			1.01	98.85
A	Woods Good Condition	30			1.54	46.08
A	Open Space Good Condition	39			1.06	41.53
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			4.90	343.20
C	Open Space Good Condition	74			3.41	252.00
D	Open Space Good Condition	80			0.00	0.00
D	Open Space Fair Condition	84			0.00	0.00
D	Woods Good Condition	77			0.00	0.00
Totals =					11.92	781.65

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{781.65}{11.92} = 65.59 ; \text{ Use CN} = \boxed{66}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.66	2.51	3.83

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through  
subareaSubcatchment E-9BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

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

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

hr

0.30

min

17.9



# Hydrograph Report

Project Name:

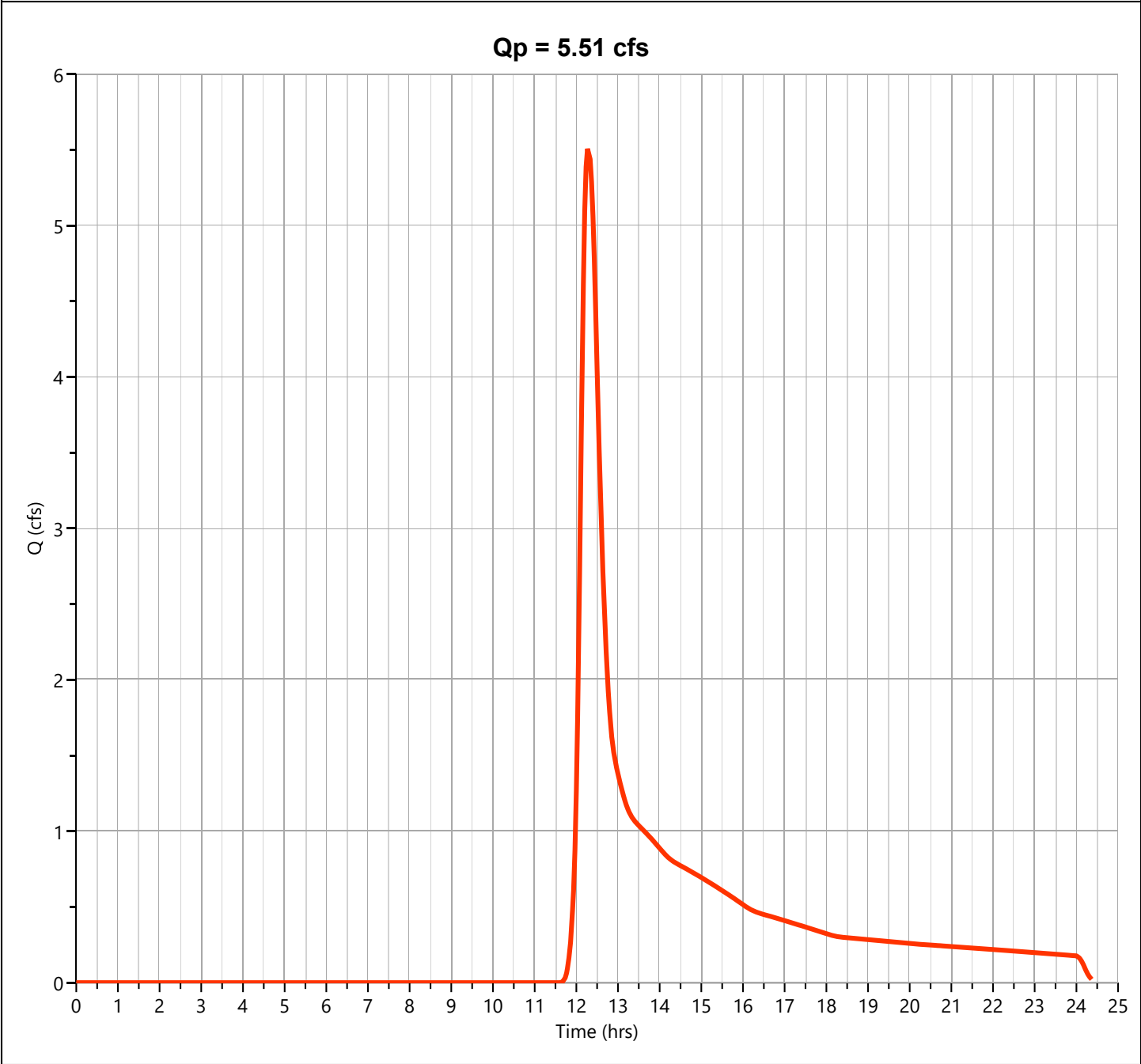
Hydrology Studio v 3.0.0.21

10-27-2022

E-9B

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.513 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 29,366 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

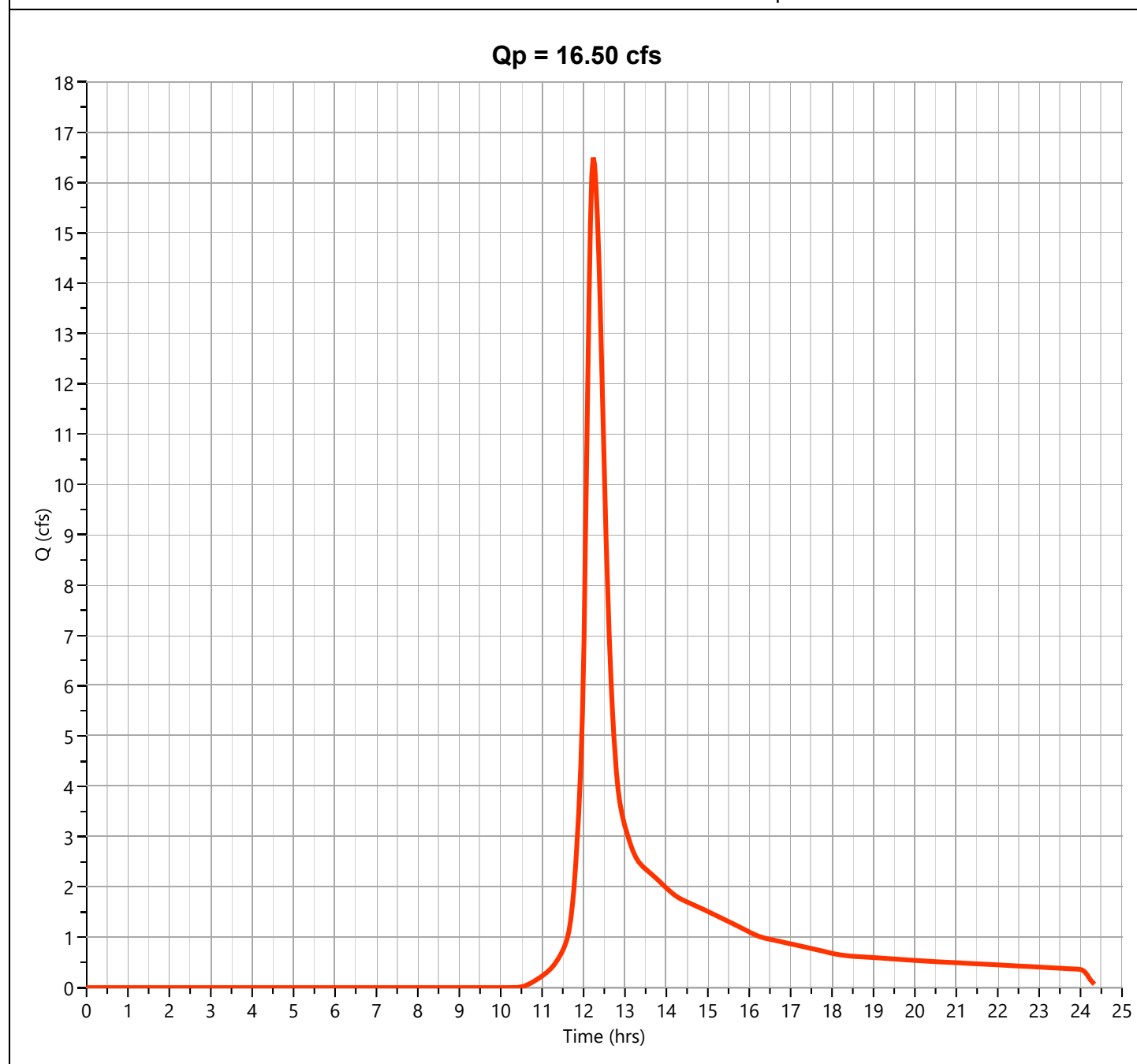
Hydrology Studio v 3.0.0.21

10-27-2022

**E-9B**

**Hyd. No. 11**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.50 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 75,937 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

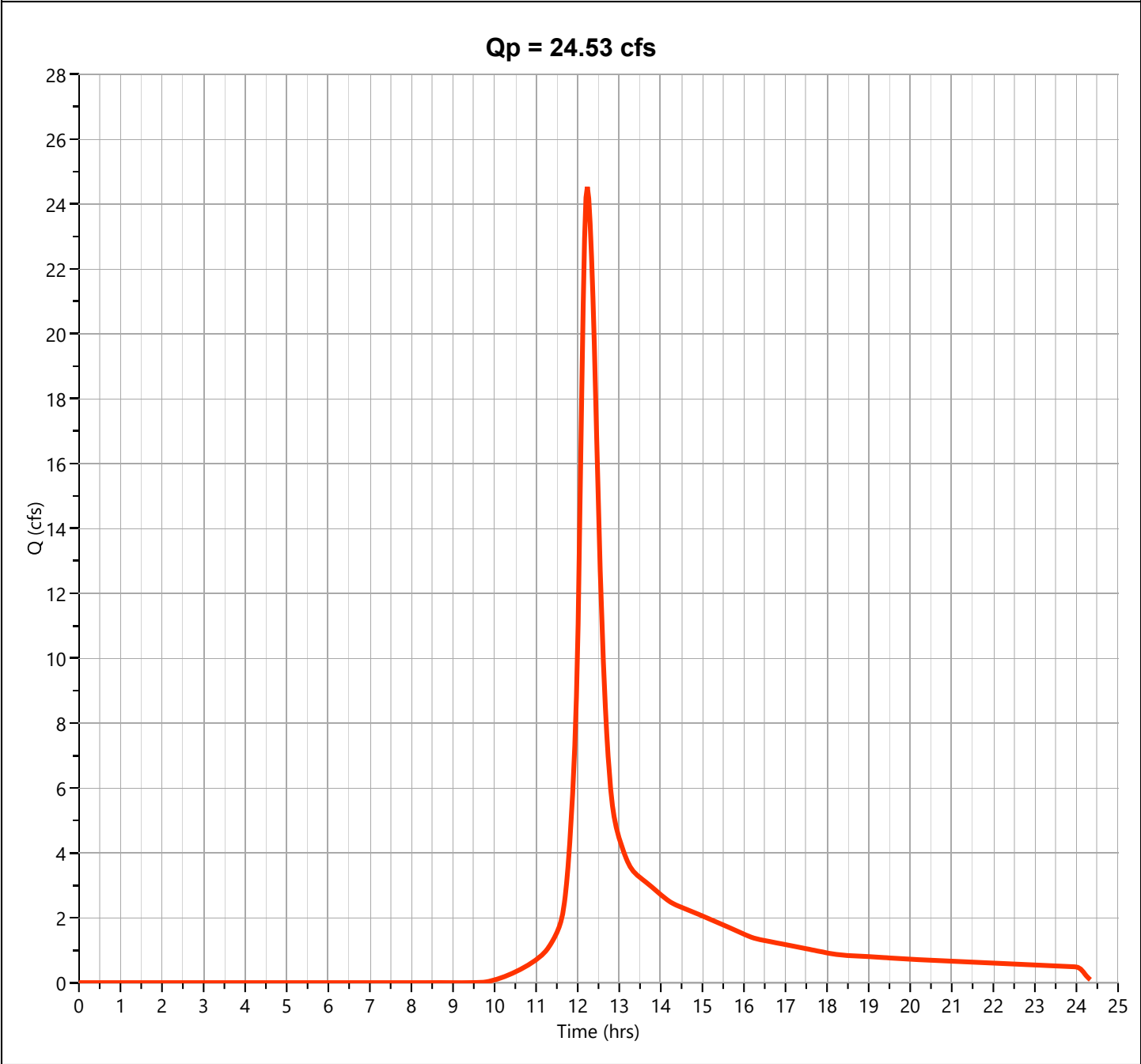
Hydrology Studio v 3.0.0.21

10-27-2022

E-9B

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.53 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 110,097 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

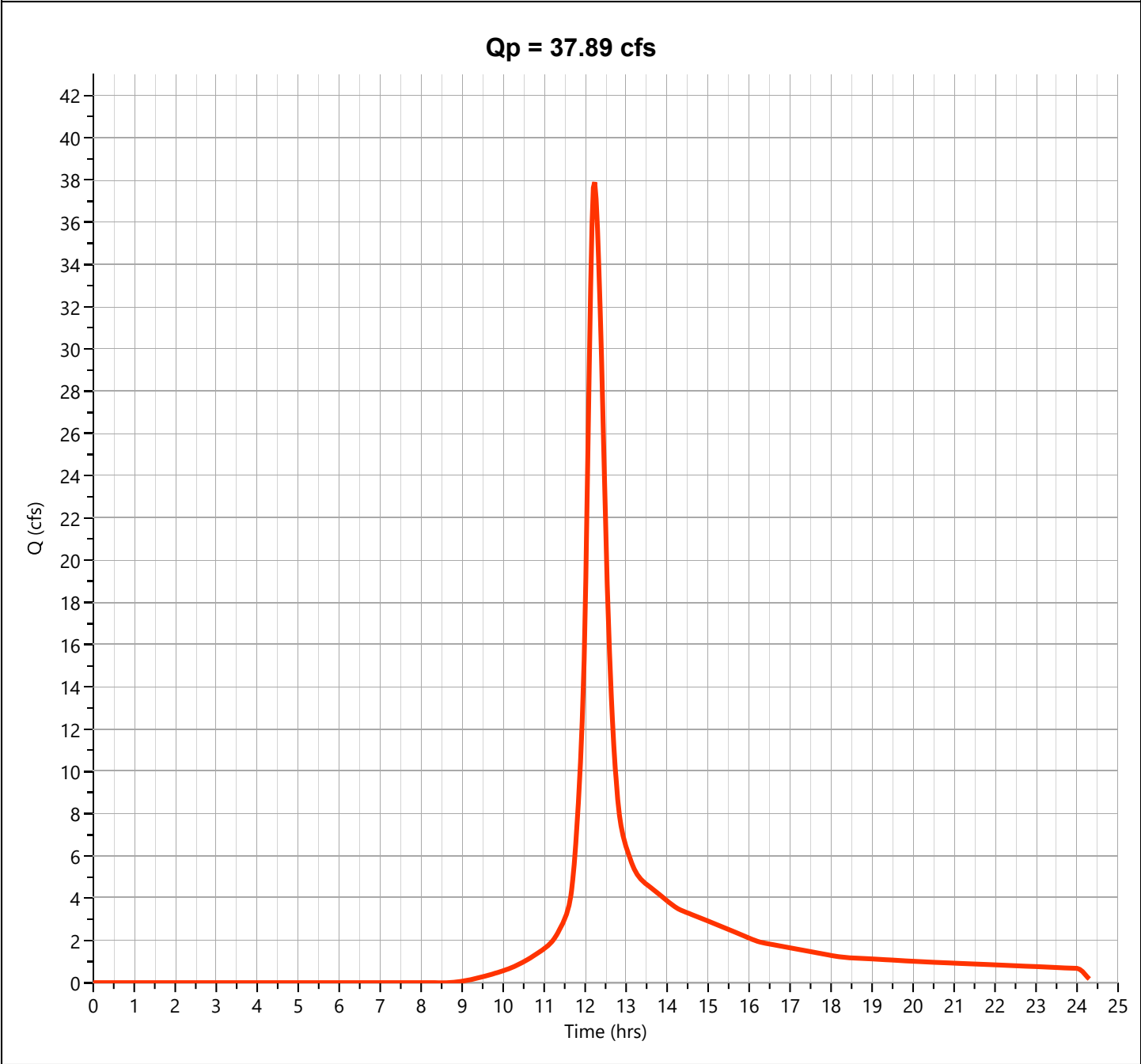
Hydrology Studio v 3.0.0.21

10-27-2022

E-9B

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 37.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 167,750 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DETENTION BASIN

**Hyd. No. 12**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 11 - E-9B	Max. Elevation	= 236.72 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 29,366 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DETENTION BASIN

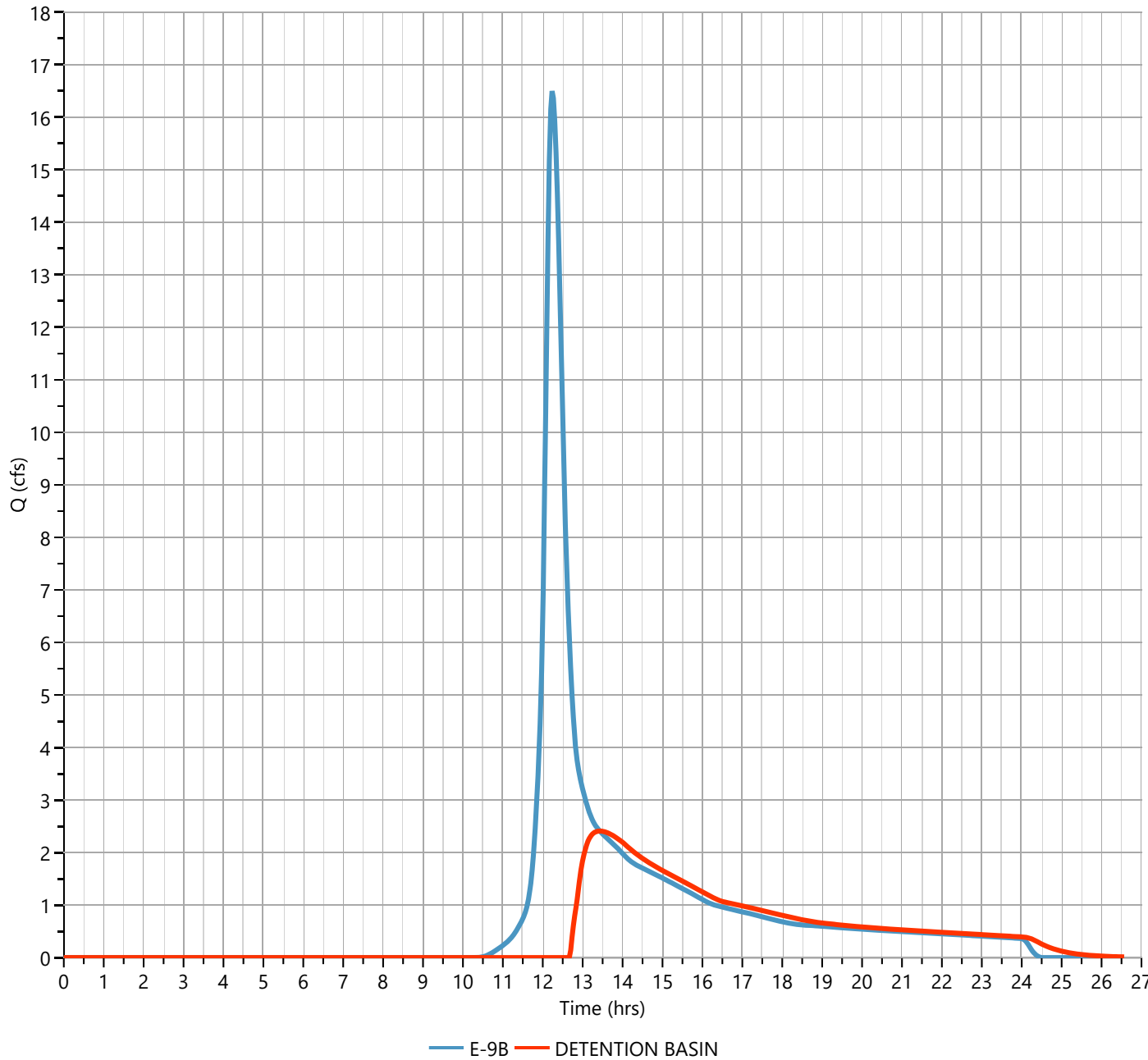
Hyd. No. 12

Hydrograph Type	= Pond Route	Peak Flow	= 2.408 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 41,634 cuft
Inflow Hydrograph	= 11 - E-9B	Max. Elevation	= 237.17 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 38,554 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2.41 hrs

Qp = 2.41 cfs



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DETENTION BASIN

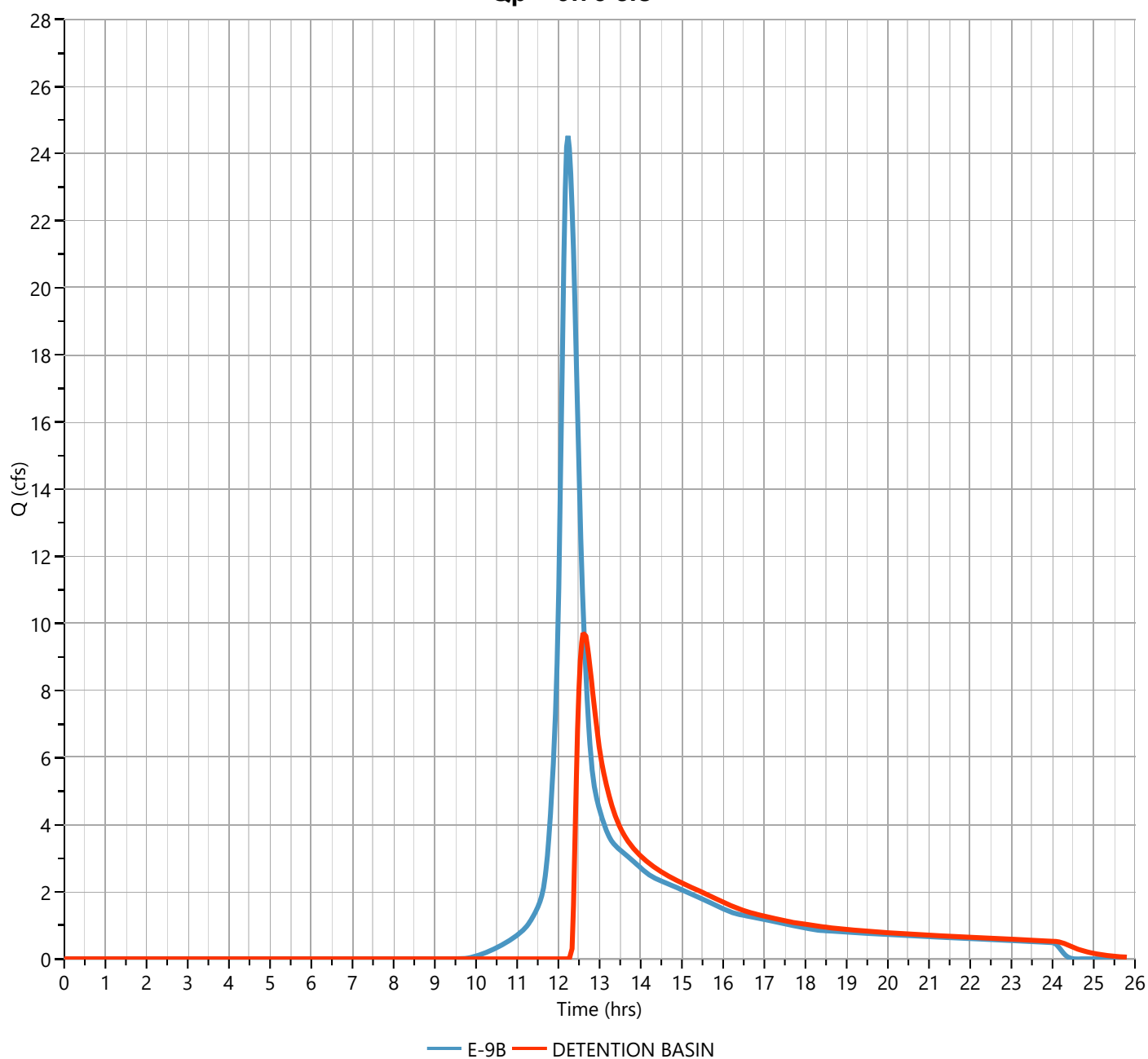
Hyd. No. 12

Hydrograph Type	= Pond Route	Peak Flow	= 9.751 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 75,794 cuft
Inflow Hydrograph	= 11 - E-9B	Max. Elevation	= 237.42 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 44,933 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.49 hrs

**Qp = 9.75 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DETENTION BASIN

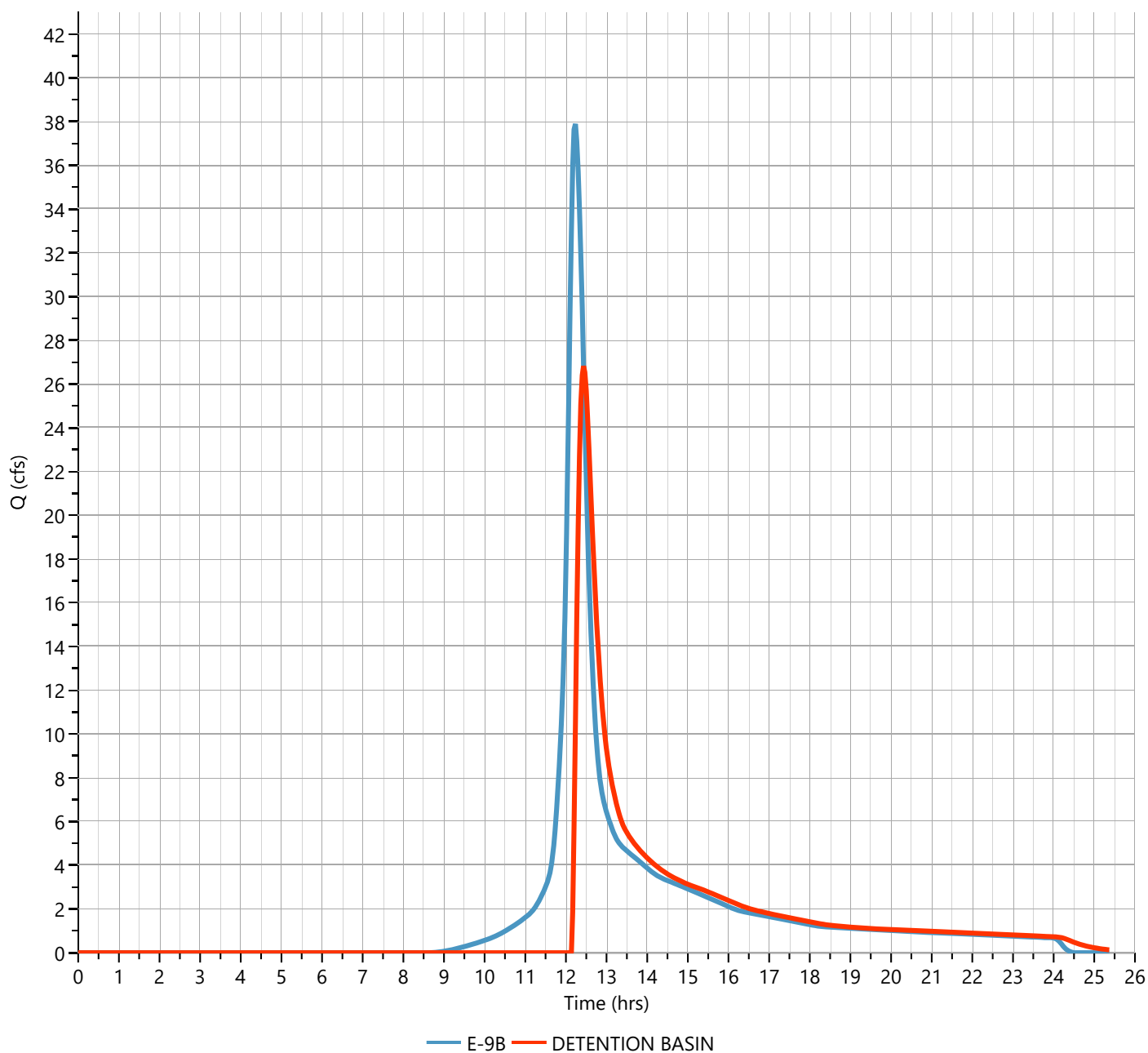
Hyd. No. 12

Hydrograph Type	= Pond Route	Peak Flow	= 26.82 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 133,448 cuft
Inflow Hydrograph	= 11 - E-9B	Max. Elevation	= 237.78 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 54,171 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 58 min

**Qp = 26.82 cfs**





# Pond Report

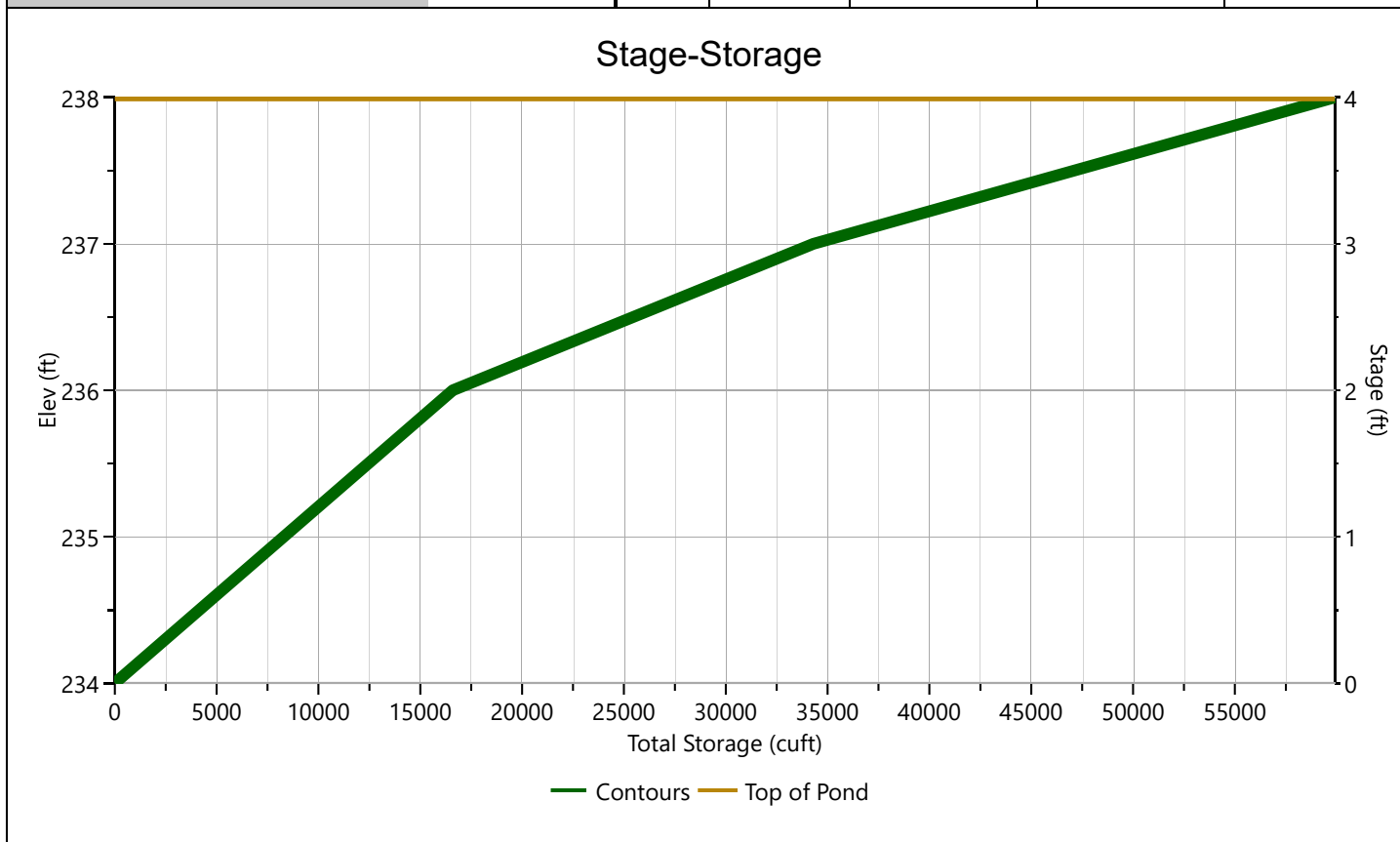
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## EXIST DETENTION

## Stage-Storage

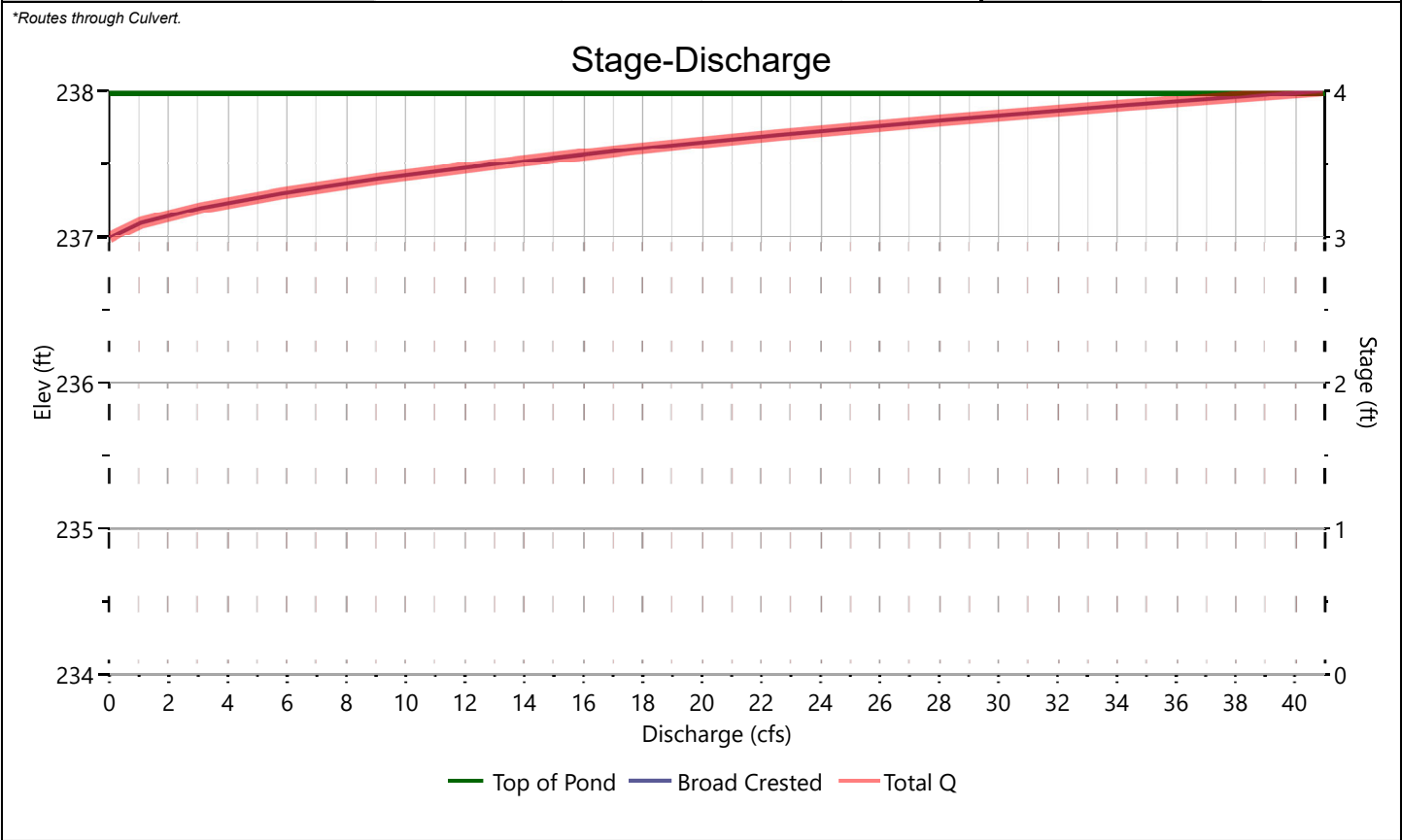
[illegible]

EXIST DETENTION

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					
Weirs	Riser*	Weirs			Ancillary
		1	2	3	
Shape / Type		Broad Crested			Exfiltration, in/hr
Crest Elevation, ft		237			
Crest Length, ft		10			
Angle, deg		18.4 (3:1)			
Weir Coefficient, Cw		3.3			

\*Routes through Culvert.



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## EXIST DETENTION

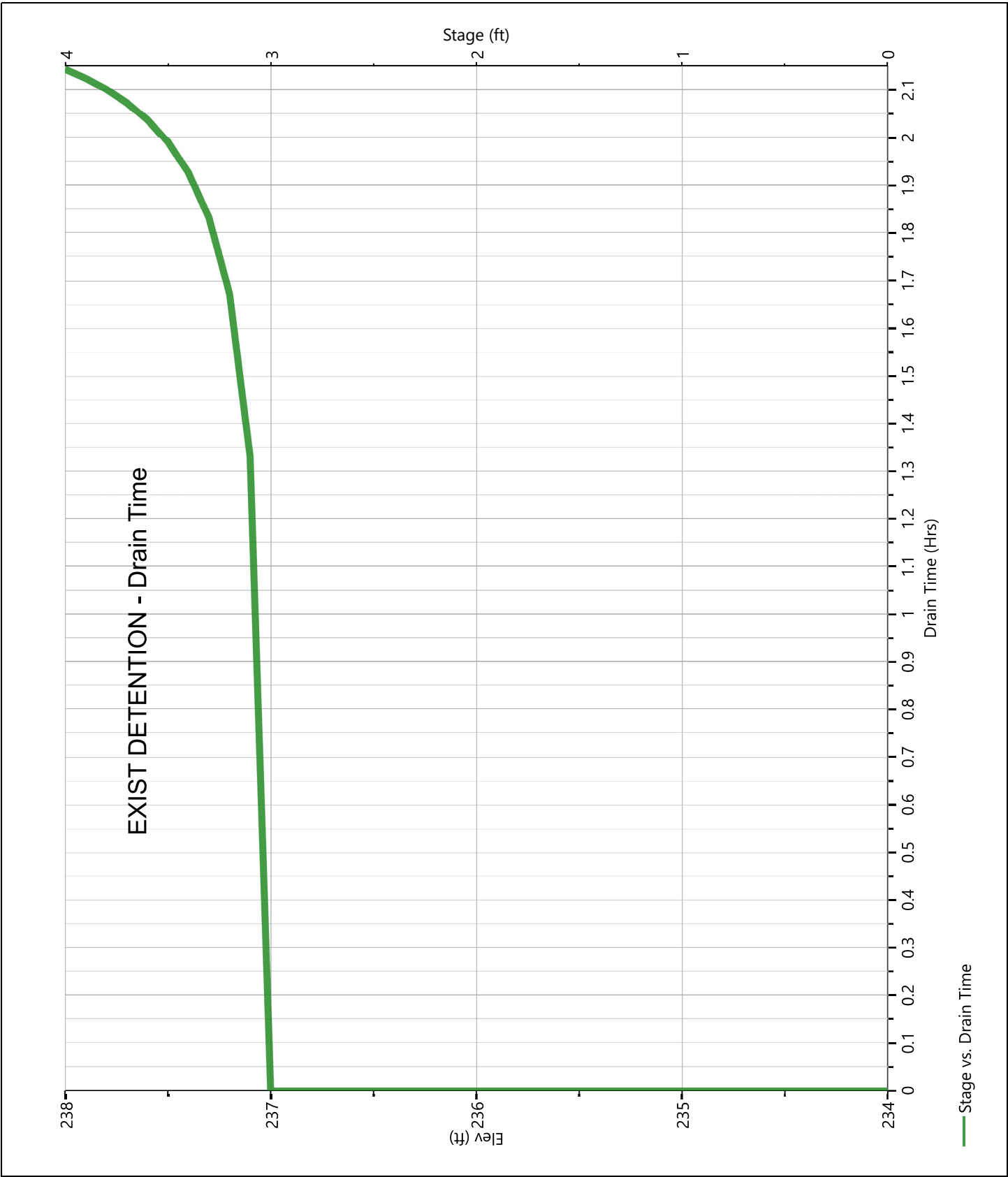
## Stage-Storage-Discharge Summary

[illegible]

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

EXIST DETENTION

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By MKO Date 6/1/22  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			7.61	228.33
A	Open Space Good Condition	39			0.00	0.00
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.14	10.92
B	Woods Good Condition	55			0.00	0.00
B	Open Space Good Condition	61			0.00	0.00
C	Woods Good Condition	70			17.70	1239.05
C	Open Space Fair Condition	79			0.00	0.00
C	Gravel	89			0.12	11.00
D	Woods Good Condition	77			0.00	0.00
D	Gravel	91			0.00	0.00
D	BVW	77			0.35	26.97
Totals =					25.93	1516.27

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1516.27}{25.93} = 58.48 ; \text{ Use CN} = \boxed{58}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.38	1.88	3.05

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date Circle one: 

Present
Tc

 DevelopedCircle one: 

Tt
----

 through subareaSubcatchment E-10Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.42

A-B		
WOODS		
0.6		
50		
3.1		
0.008		
0.42		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

0.08

B-C		
UNPAVED		
1082		
0.055		
3.78		
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:

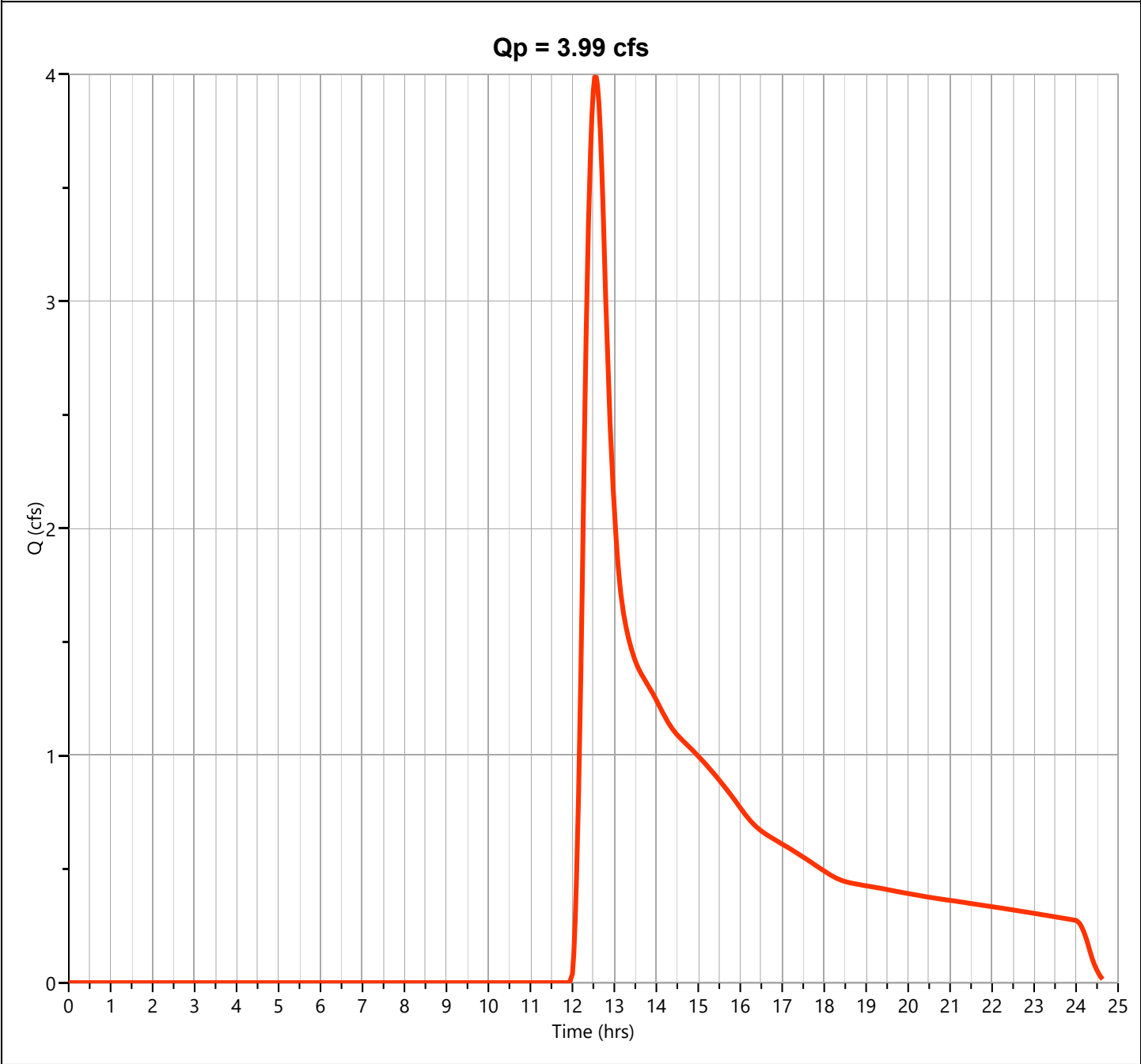
Hydrology Studio v 3.0.0.21

10-27-2022

E-10

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.993 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Runoff Volume	= 34,460 cuft
Drainage Area	= 25.93 ac	Curve Number	= 58
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:

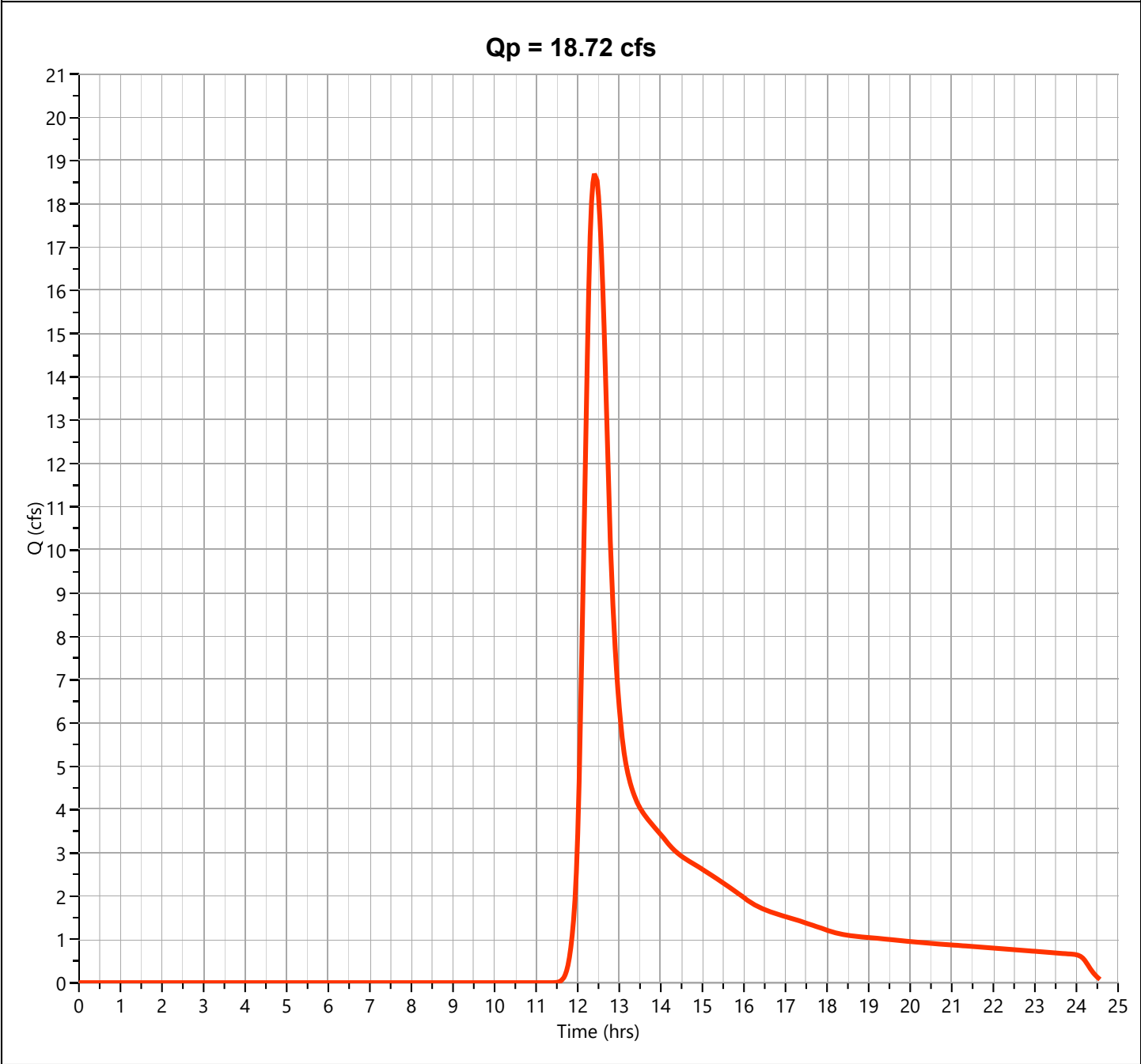
Hydrology Studio v 3.0.0.21

10-27-2022

E-10

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.72 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 112,089 cuft
Drainage Area	= 25.93 ac	Curve Number	= 58
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:

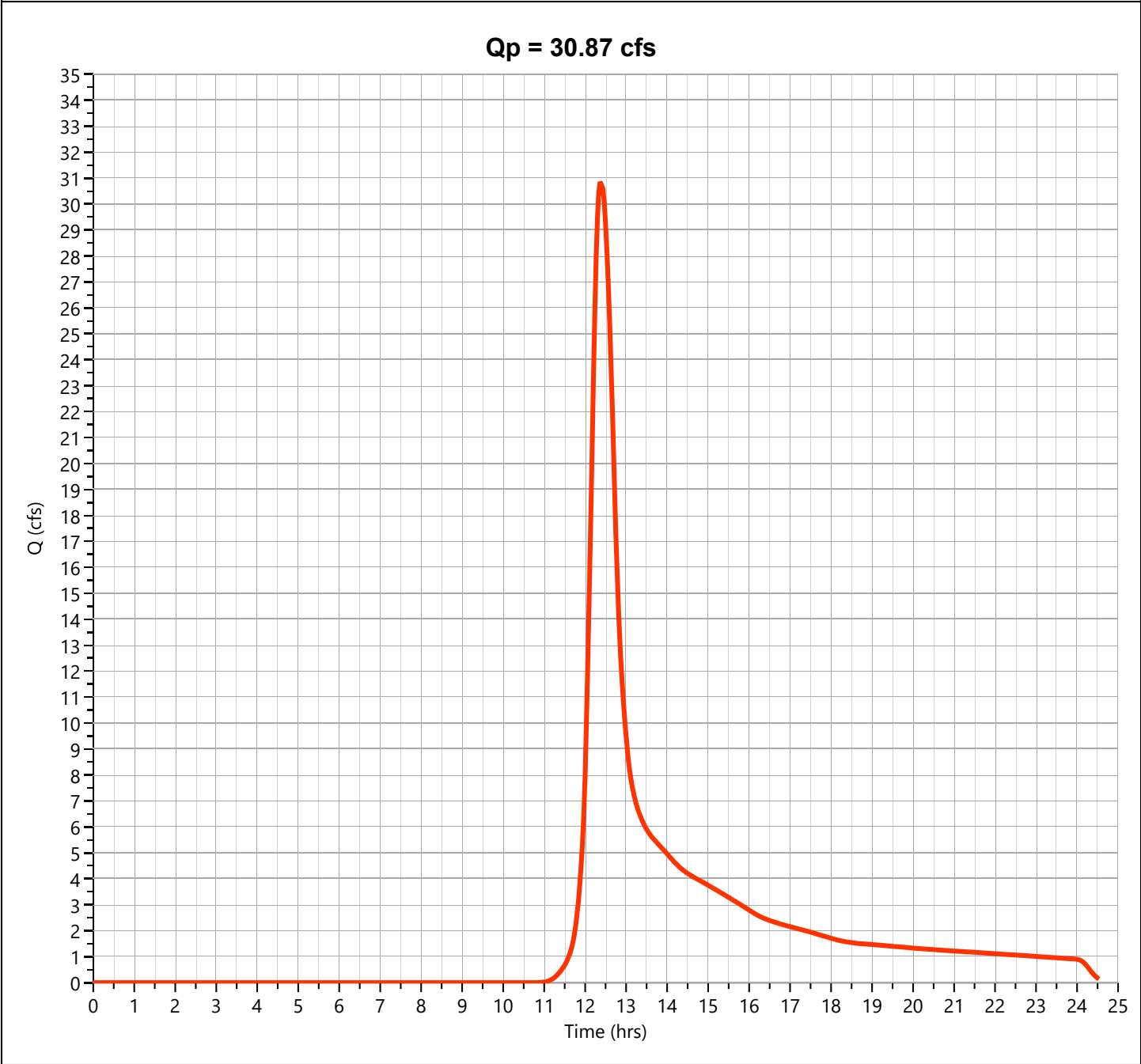
Hydrology Studio v 3.0.0.21

10-27-2022

E-10

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 30.87 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 173,628 cuft
Drainage Area	= 25.93 ac	Curve Number	= 58
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:

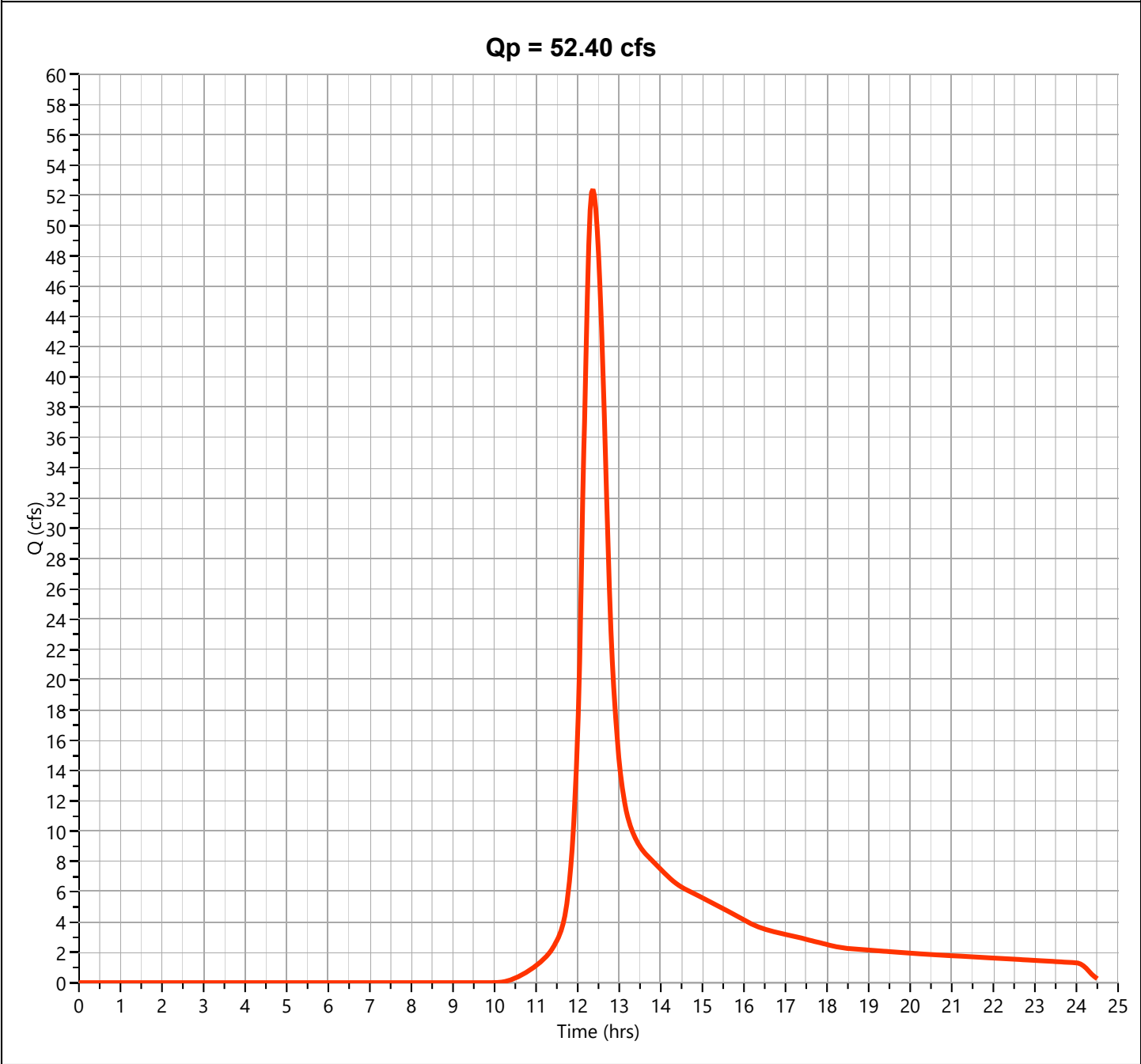
Hydrology Studio v 3.0.0.21

10-27-2022

E-10

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 52.40 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 282,066 cuft
Drainage Area	= 25.93 ac	Curve Number	= 58
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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.80	24.00
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			10.09	706.53
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
Totals =					10.89	730.54

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{730.54}{10.89} = 67.06 ; \text{ Use CN} = \boxed{67}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,  
 or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.73	2.64	4.00

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date 

Circle one:

Present
Tc

Developed

Circle one:

Tt

through  
subareaSubcatchment E-11Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

Channel flow

Segment ID

12. Cross sectional flow area, a

sf

13. Wetted perimeter, pw

ft

14. Hydraulic radius,  $r = a / pw$ 

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.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.50  
30.0

# Hydrograph Report

Project Name:

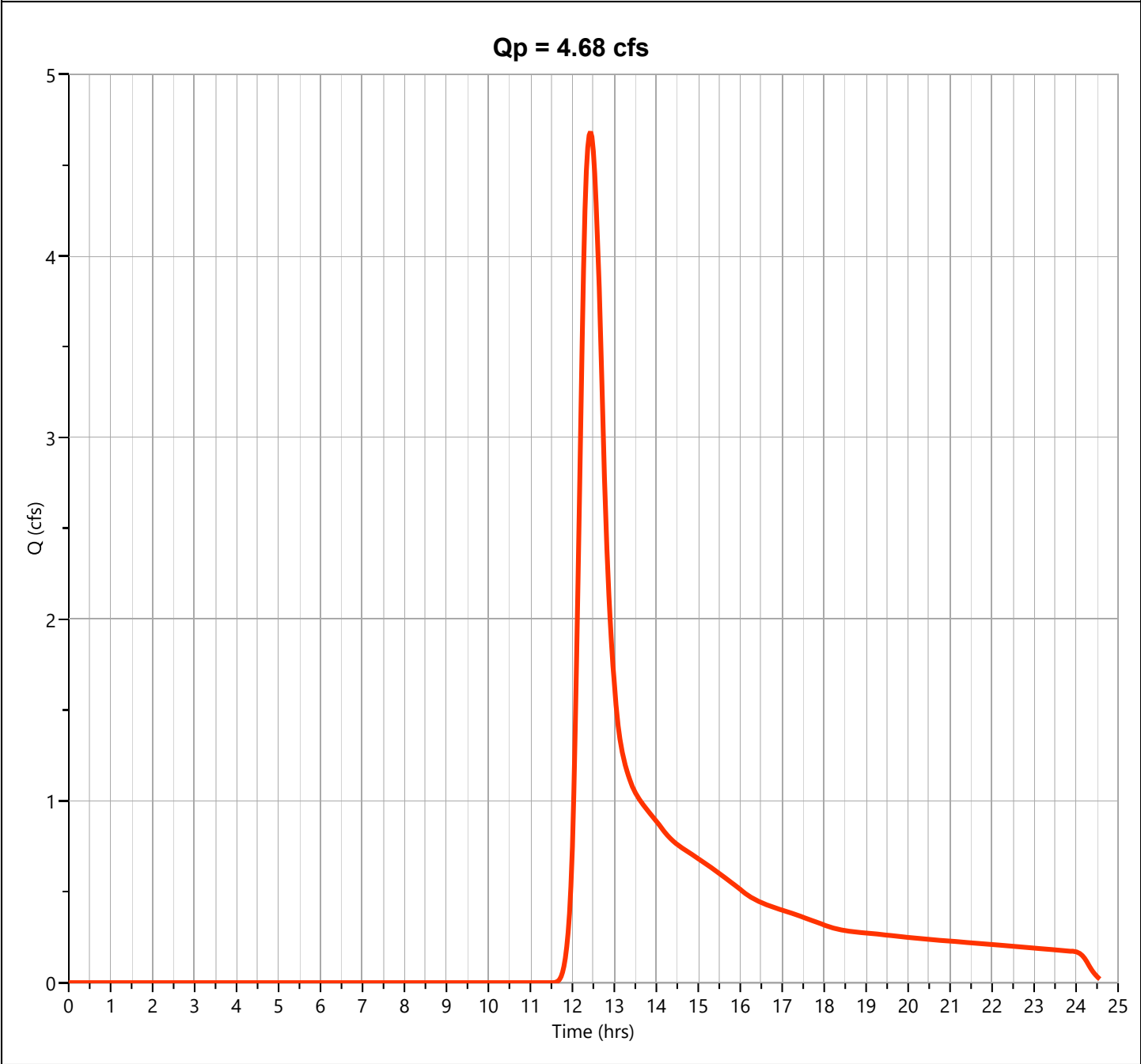
Hydrology Studio v 3.0.0.21

10-27-2022

E-11

Hyd. No. 15

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:

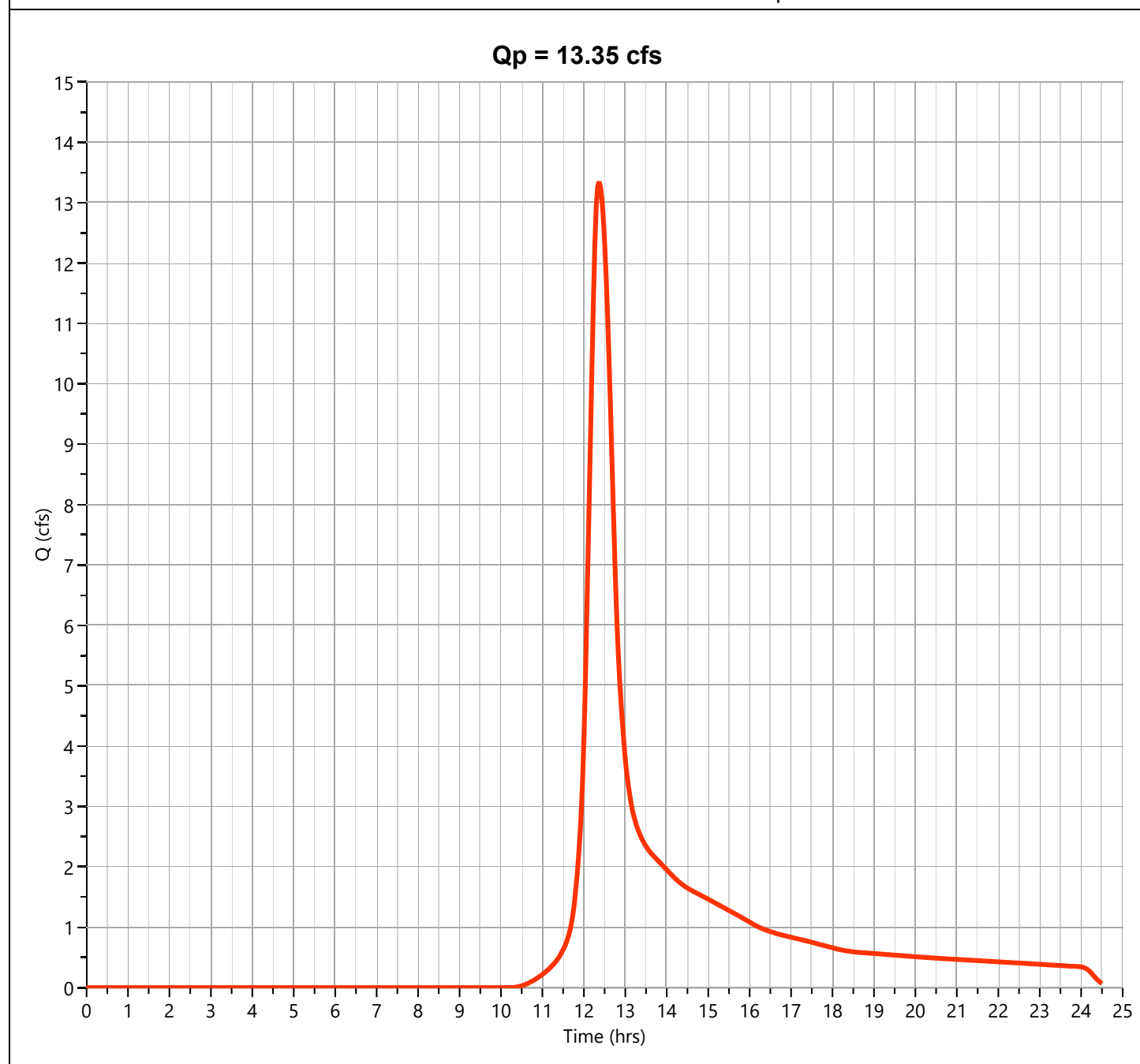
Hydrology Studio v 3.0.0.21

10-27-2022

**E-11**

**Hyd. No. 15**

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:

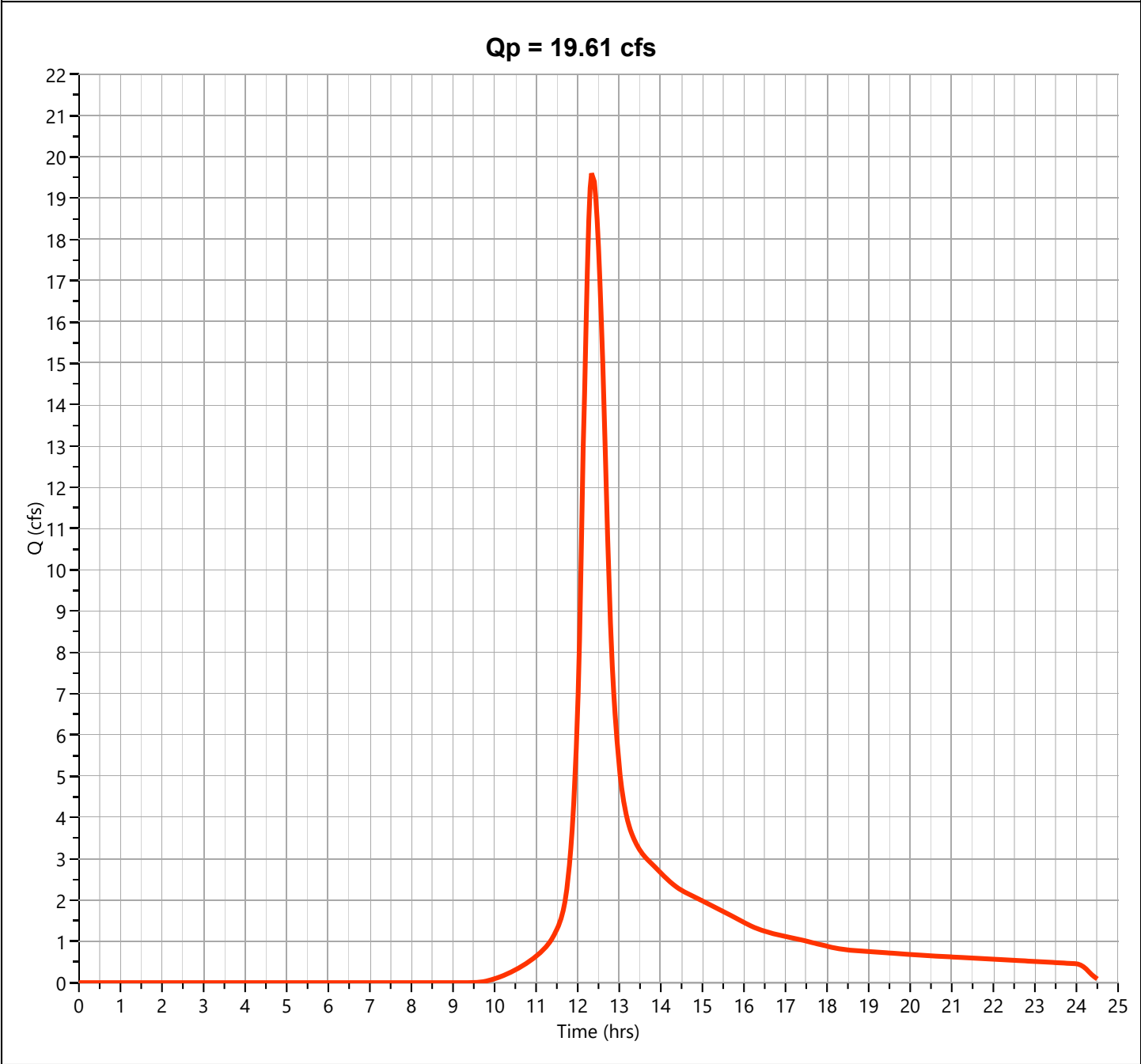
Hydrology Studio v 3.0.0.21

10-27-2022

E-11

Hyd. No. 15

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:

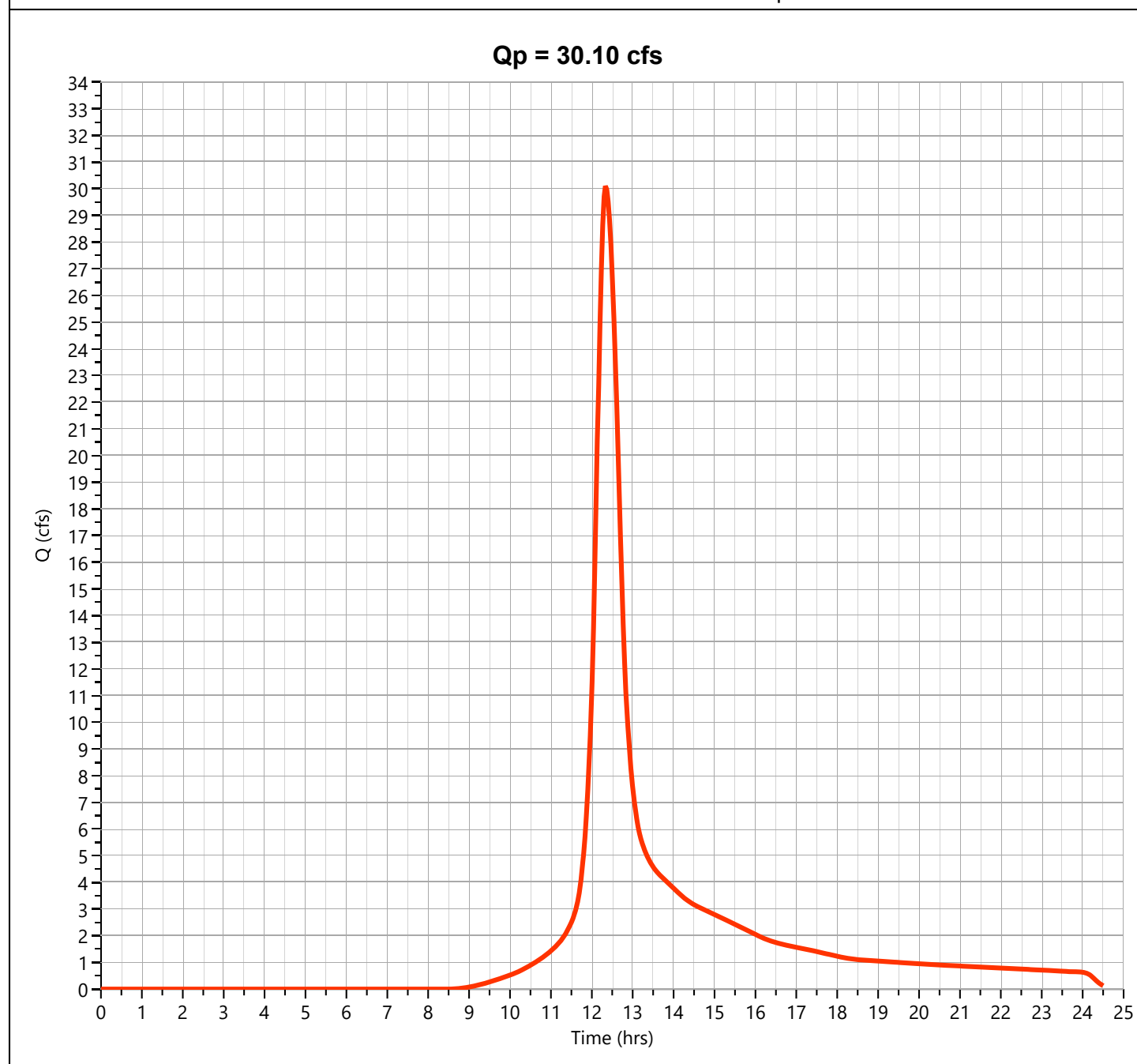
Hydrology Studio v 3.0.0.21

10-27-2022

**E-11**

**Hyd. No. 15**

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  
 Location: Stow, MA Checked            Rev Date 9/27/2022  
 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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	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
Totals =					0.22	6.53

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{6.53}{0.22} = 30.00 ; \text{ Use CN} = \boxed{30}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.09	0.09	0.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy MKODate 6/1/2022Location: Stow, MAChecked Rev Date 9/27/2022Date 

Circle one:

☒ Present

Developed

Subcatchment E-12

Circle one:

☒ Tc

Tt

through  
subareaSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.14

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

0

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

hr  
min0.14  
8.6

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**E-12**

**Hyd. No. 16**

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:

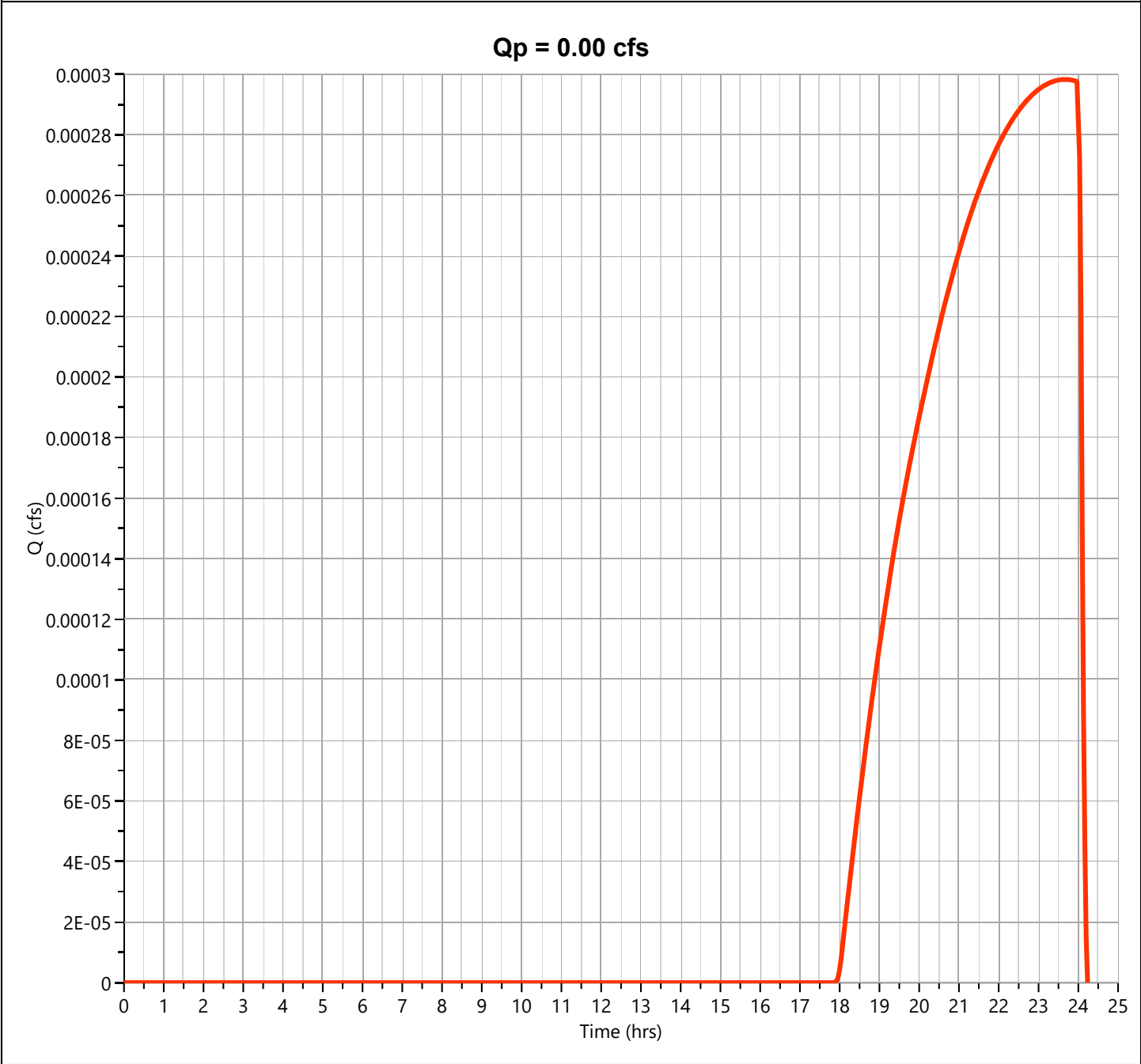
Hydrology Studio v 3.0.0.21

10-27-2022

E-12

Hyd. No. 16

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:

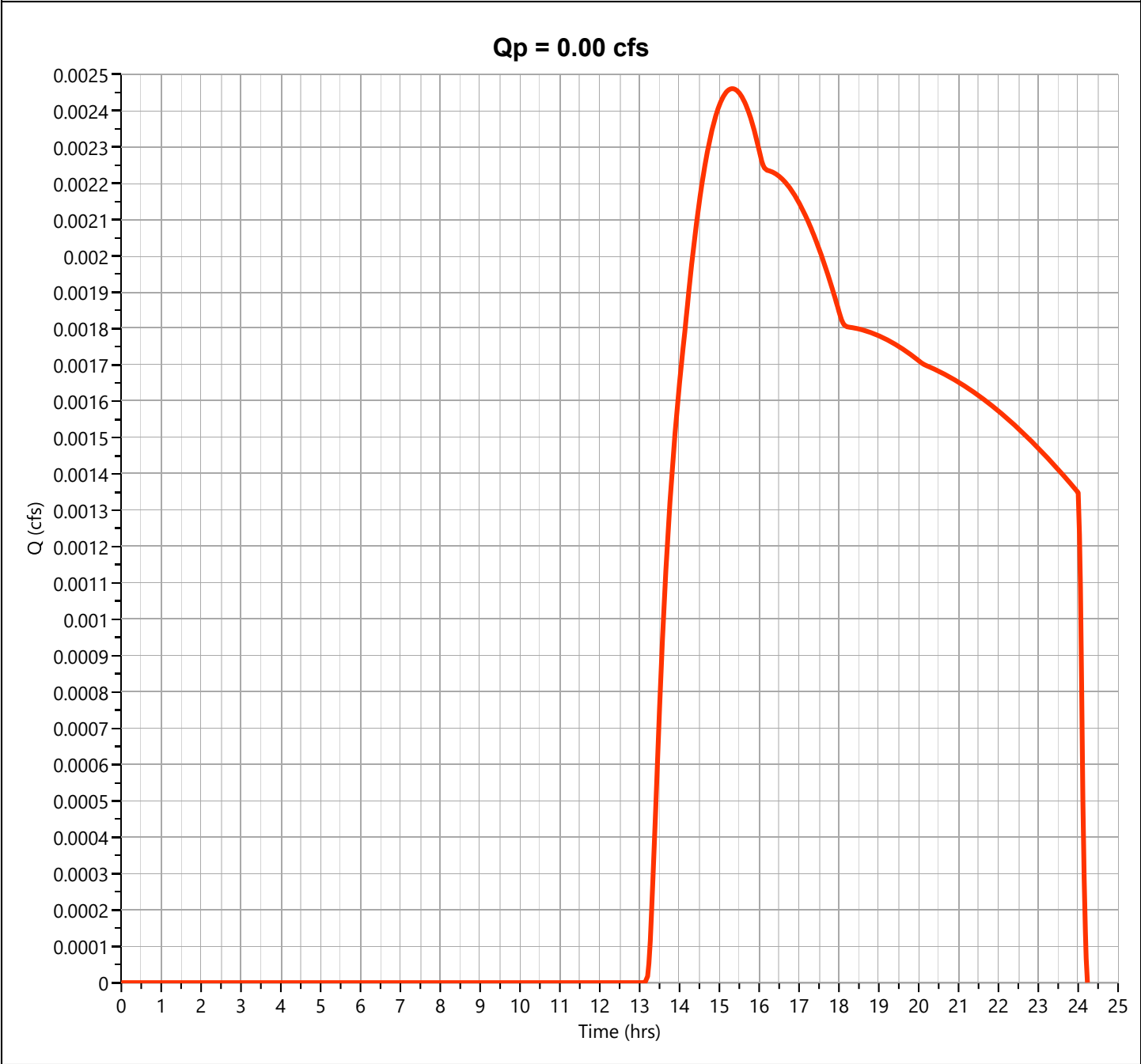
Hydrology Studio v 3.0.0.21

10-27-2022

E-12

Hyd. No. 16

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:

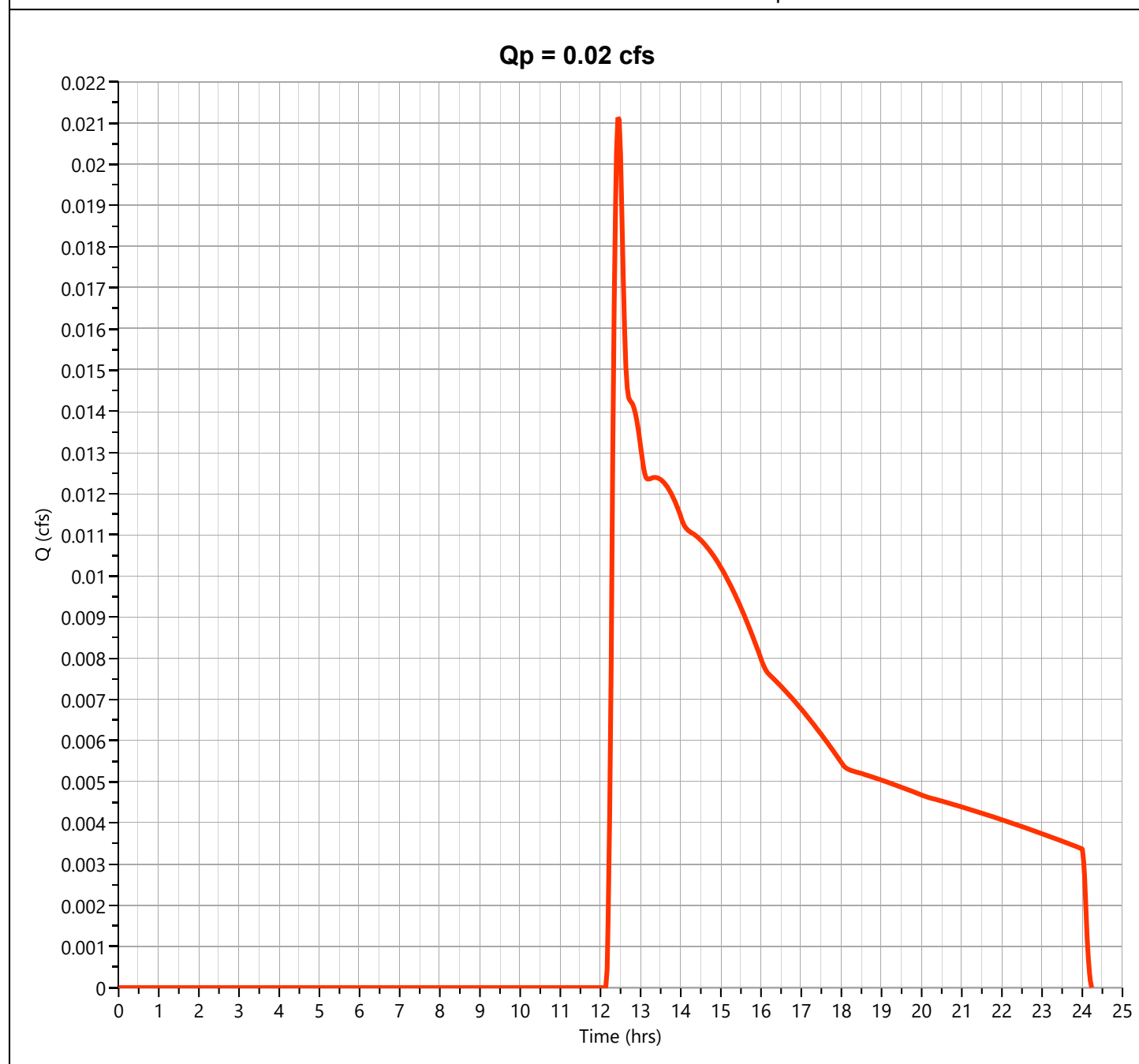
Hydrology Studio v 3.0.0.21

10-27-2022

**E-12**

**Hyd. No. 16**

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**

**SUMMARY TABLE****SM-3719C**Project: Athens StreetBy PFKDate 6/26/22Rev Date 10/13/22Location: Stow, MAChecked Date 

EXISTING	AREA	CN	TIME OF CONCENTRATION
E-1	0.16	30	10.0
E-2A	17.70	63	17.2
E-2B	24.13	53	17.3
E-3	10.35	71	22.4
E-4	10.30	70	21.3
E-5	12.89	59	20.3
E-6	2.25	38	21.4
E-7	6.51	32	19.0
E-8	0.68	30	19.6
E-9A	2.59	44	16.3
E-9B	11.92	66	17.9
E-10	25.93	58	20.4
E-11	10.89	67	30.0
E-12	0.22	30	8.6
<b>Total</b>	<b>136.52</b>		

PROPOSED	AREA	CN	TIME OF CONCENTRATION
P-1	0.16	30	10.0
P-2A1	1.47	84	9.6
P-2A2	1.43	81	14.2
P-2A3	15.44	62	11.5
P-2B-A	5.53	63	12.4
P-2B-B	15.81	48	11.3
P-3A	1.09	83	8.2
P-3B	8.52	71	13.4
P-4A	1.71	76	13.2
P-4B	7.57	70	10.5
P-5B	2.75	76	17.6
P-5C	1.22	84	10.9
P-5D	2.20	79	6.7
P-5E	8.97	57	12.8
P-6A	1.65	34	19.6
P-6B	0.90	47	10.9
P-7A	3.97	61	6.9
P-7B	1.99	53	24.9
P-8	4.67	64	10.5
P-9A	4.77	55	14.0
P-9B	11.92	66	17.9
P-10A	10.25	60	28.6
P-10B	2.90	82	10.0
P-10C	7.67	84	20.4
P-11	10.78	67	30.0
P-12	0.22	30	8.6
<b>Roof Runoff (x19)</b>	<b>0.99</b>	<b>98</b>	<b>6.0</b>
<b>Total</b>	<b>136.52</b>		



# Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	E-1	0.000	0.00	0.000	----		
2	NRCS Runoff	E-2A	6.063	12.33	35,403	----		
3	NRCS Runoff	E-2B	1.662	12.53	18,921	----		
4	NRCS Runoff	E-3	6.809	12.30	35,200	----		
5	NRCS Runoff	E-4	6.300	12.30	33,076	----		
6	NRCS Runoff	E-5	2.571	12.47	19,062	----		
7	NRCS Runoff	E-6	0.000	24.17	0.024	----		
8	NRCS Runoff	E-7	0.000	0.00	0.000	----		
9	NRCS Runoff	E-8	0.000	0.00	0.000	----		
10	NRCS Runoff	E-9A	0.012	15.60	358	----		
11	NRCS Runoff	E-9B	5.513	12.30	29,366	----		
12	Pond Route	DETENTION BASIN	0.000	0.00	0.000	11	236.72	29,366
13	Junction	E-9 TOTAL	0.012	15.60	358	10, 12		
14	NRCS Runoff	E-10	3.993	12.57	34,460	----		
15	NRCS Runoff	E-11	4.684	12.43	28,624	----		
16	NRCS Runoff	E-12	0.000	0.00	0.000	----		

# Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	P-1	0.000	0.00	0.000	----		
3	NRCS Runoff	P-3A	1.928	12.10	6,595	----		
4	Pond Route	IB-3A	0.473	12.47	2,397	3	290.19	2,228
5	NRCS Runoff	P-3B	6.260	12.20	27,756	----		
6	Junction	P-3 TOTAL	6.575	12.20	30,154	4, 5		
8	NRCS Runoff	P-4A	1.939	12.17	7,688	----		
9	Pond Route	IB-4A	0.331	12.63	2,113	8	282.04	2,679
10	NRCS Runoff	P-4B	5.803	12.17	24,629	----		
11	Junction	P-4 TOTAL	5.817	12.17	26,742	9, 10		
13	NRCS Runoff	P-5B	2.628	12.23	11,989	----		
14	Pond Route	IB-5B	0.511	12.77	4,250	13	284.48	4,337
15	NRCS Runoff	P-5C	2.072	12.13	7,952	----		
16	Pond Route	IB-5C	0.000	12.87	0.002	15	259.12	3,568
17	NRCS Runoff	P-5E	1.511	12.30	11,193	----		
18	Junction	P-5 TOTAL	1.706	12.37	15,443	14, 16, 17		
20	NRCS Runoff	P-2A2	1.878	12.20	7,715	----		
21	Pond Route	IB-2A2	0.000	12.43	0.000	20	302.24	3,550
22	NRCS Runoff	P-2A1	2.719	12.10	9,291	----		
23	Pond Route	IB-2A1	0.000	12.33	0.000	22	306.99	4,049
24	NRCS Runoff	P-2A3	5.436	12.20	29,551	----		
25	Junction	TOTAL P-2A	5.436	12.20	29,551	21, 23, 24		
27	NRCS Runoff	P-2B-A	2.204	12.20	11,406	----		
28	NRCS Runoff	P-5D	3.197	12.10	11,097	----		
29	Pond Route	IB-5D	0.000	16.13	0.002	28	231.73	7,020
30	Junction	INFLOW TO IB-2B-A	2.204	12.20	11,406	27, 29		
31	Pond Route	IB-2B-A	0.000	12.50	0.000	30	229.10	1,006
32	NRCS Runoff	P-2B-B	0.228	13.80	6,036	----		
33	Junction	P-2B Total	0.228	13.80	6,036	31, 32		
35	NRCS Runoff	P-6A	0.000	0.00	0.000	----		
36	NRCS Runoff	P-6B	0.010	14.73	282	----		

# Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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-6B	0.000	13.37	0.000	36	219.01	6.91
38	Junction	P-6 TOTAL	0.000	13.37	0.000	35, 37		
40	NRCS Runoff	P-7A	1.309	12.17	6,815	----		
41	Pond Route	IB-7A	0.000	16.33	0.000	40	219.17	704
42	NRCS Runoff	P-7B	0.122	12.63	1,536	----		
43	Pond Route	IB-7B	0.000	13.90	0.000	42	224.03	62.8
44	Junction	P-7 TOTAL	0.000	16.33	0.000	41, 43		
46	NRCS Runoff	P-8	2.083	12.20	10,351	----		
47	Pond Route	IB-8	0.000	12.07	0.000	46	222.17	1,168
49	NRCS Runoff	P-9B	5.513	12.30	29,366	----		
50	Pond Route	DET. BASIN OUTFLOW	0.000	0.00	0.000	49	236.72	29,366
51	Junction	P-9 TOTAL	0.000	0.00	0.000	50		
53	NRCS Runoff	P-10A	2.097	12.53	16,218	----		
54	NRCS Runoff	P-10B	4.488	12.13	17,311	----		
55	Pond Route	IB-10B	0.000	12.10	0.000	54	225.90	4,886
56	NRCS Runoff	P-10C	10.43	12.27	49,342	----		
57	NRCS Runoff	P-9A	0.520	12.40	4,590	----		
58	Junction	TO IB-10C	10.82	12.27	53,932	56, 57		
59	Pond Route	IB-10C	0.000	19.53	0.000	58	225.72	13,187
60	Junction	P-10 TOTAL	2.097	12.53	16,218	53, 55, 59		
62	NRCS Runoff	P-11	4.637	12.43	28,334	----		
64	NRCS Runoff	P-12	0.000	0.00	0.000	----		
66	NRCS Runoff	Roof Runoff	0.153	12.07	517	----		
67	Pond Route	Roof Drywell	0.000	9.83	0.000	66	101.06	161

# Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	E-1	0.000	23.73	3.52	----		
2	NRCS Runoff	E-2A	20.82	12.23	98,578	----		
3	NRCS Runoff	E-2B	13.40	12.33	77,016	----		
4	NRCS Runoff	E-3	17.08	12.27	82,096	----		
5	NRCS Runoff	E-4	16.28	12.27	78,626	----		
6	NRCS Runoff	E-5	11.19	12.33	59,868	----		
7	NRCS Runoff	E-6	0.056	13.83	1,451	----		
8	NRCS Runoff	E-7	0.023	21.03	669	----		
9	NRCS Runoff	E-8	0.001	23.80	14.5	----		
10	NRCS Runoff	E-9A	0.416	12.43	3,747	----		
11	NRCS Runoff	E-9B	16.50	12.23	75,937	----		
12	Pond Route	DETENTION BASIN	2.408	13.43	41,634	11	237.17	38,554
13	Junction	E-9 TOTAL	2.562	13.43	45,381	10, 12		
14	NRCS Runoff	E-10	18.72	12.43	112,089	----		
15	NRCS Runoff	E-11	13.35	12.37	72,378	----		
16	NRCS Runoff	E-12	0.000	23.70	4.70	----		

# Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	P-1	0.000	22.13	3.52	----		
3	NRCS Runoff	P-3A	3.704	12.10	12,702	----		
4	Pond Route	IB-3A	1.404	12.37	7,033	3	290.93	3,938
5	NRCS Runoff	P-3B	15.66	12.20	64,735	----		
6	Junction	P-3 TOTAL	16.89	12.20	71,767	4, 5		
8	NRCS Runoff	P-4A	4.275	12.13	16,442	----		
9	Pond Route	IB-4A	1.501	12.47	8,685	8	282.87	5,370
10	NRCS Runoff	P-4B	14.96	12.17	58,547	----		
11	Junction	P-4 TOTAL	15.63	12.17	67,232	9, 10		
13	NRCS Runoff	P-5B	5.798	12.23	25,640	----		
14	Pond Route	IB-5B	3.299	12.47	15,199	13	285.26	7,582
15	NRCS Runoff	P-5C	3.921	12.13	15,103	----		
16	Pond Route	IB-5C	0.000	12.13	0.001	15	260.17	7,907
17	NRCS Runoff	P-5E	8.379	12.17	37,806	----		
18	Junction	P-5 TOTAL	9.312	12.27	53,006	14, 16, 17		
20	NRCS Runoff	P-2A2	3.755	12.17	15,288	----		
21	Pond Route	IB-2A2	0.043	14.43	133	20	303.51	8,289
22	NRCS Runoff	P-2A1	5.133	12.10	17,647	----		
23	Pond Route	IB-2A1	0.000	13.57	0.001	22	308.02	9,142
24	NRCS Runoff	P-2A3	20.40	12.17	84,566	----		
25	Junction	TOTAL P-2A	20.40	12.17	84,699	21, 23, 24		
27	NRCS Runoff	P-2B-A	7.748	12.17	31,761	----		
28	NRCS Runoff	P-5D	6.634	12.10	22,649	----		
29	Pond Route	IB-5D	1.926	12.47	8,511	28	232.28	9,862
30	Junction	INFLOW TO IB-2B-A	7.748	12.17	40,272	27, 29		
31	Pond Route	IB-2B-A	1.516	12.63	5,181	30	229.90	8,937
32	NRCS Runoff	P-2B-B	5.432	12.27	35,644	----		
33	Junction	P-2B Total	5.869	12.30	40,825	31, 32		
35	NRCS Runoff	P-6A	0.014	15.57	390	----		
36	NRCS Runoff	P-6B	0.265	12.30	1,857	----		

# Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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-6B	0.000	15.80	0.000	36	219.59	283
38	Junction	P-6 TOTAL	0.014	15.57	390	35, 37		
40	NRCS Runoff	P-7A	5.329	12.13	20,077	----		
41	Pond Route	IB-7A	0.000	22.73	0.000	40	220.34	5,971
42	NRCS Runoff	P-7B	0.987	12.43	6,252	----		
43	Pond Route	IB-7B	0.000	16.10	0.000	42	224.61	1,176
44	Junction	P-7 TOTAL	0.000	16.10	0.000	41, 43		
46	NRCS Runoff	P-8	6.918	12.17	28,087	----		
47	Pond Route	IB-8	0.000	11.87	0.000	46	223.18	8,244
49	NRCS Runoff	P-9B	16.50	12.23	75,937	----		
50	Pond Route	DET. BASIN OUTFLOW	2.408	13.43	41,634	49	237.17	38,554
51	Junction	P-9 TOTAL	2.408	13.43	41,634	50		
53	NRCS Runoff	P-10A	8.490	12.40	49,281	----		
54	NRCS Runoff	P-10B	8.811	12.13	33,815	----		
55	Pond Route	IB-10B	0.053	12.67	88.3	54	226.88	11,821
56	NRCS Runoff	P-10C	19.69	12.27	93,719	----		
57	NRCS Runoff	P-9A	3.367	12.23	16,881	----		
58	Junction	TO IB-10C	23.01	12.27	110,600	56, 57		
59	Pond Route	IB-10C	2.959	12.73	10,498	58	226.71	33,938
60	Junction	P-10 TOTAL	10.23	12.53	59,867	53, 55, 59		
62	NRCS Runoff	P-11	13.21	12.37	71,647	----		
64	NRCS Runoff	P-12	0.000	22.10	4.70	----		
66	NRCS Runoff	Roof Runoff	0.238	12.07	817	----		
67	Pond Route	Roof Drywell	0.000	10.43	0.000	66	101.75	291

# Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	E-1	0.002	15.37	52.4	----		
2	NRCS Runoff	E-2A	32.08	12.23	146,158	----		
3	NRCS Runoff	E-2B	24.82	12.27	126,186	----		
4	NRCS Runoff	E-3	24.26	12.27	115,182	----		
5	NRCS Runoff	E-4	23.33	12.27	111,000	----		
6	NRCS Runoff	E-5	18.21	12.30	91,855	----		
7	NRCS Runoff	E-6	0.315	12.57	3,584	----		
8	NRCS Runoff	E-7	0.135	14.83	3,648	----		
9	NRCS Runoff	E-8	0.008	15.47	216	----		
10	NRCS Runoff	E-9A	1.130	12.30	7,257	----		
11	NRCS Runoff	E-9B	24.53	12.23	110,097	----		
12	Pond Route	DETENTION BASIN	9.751	12.63	75,794	11	237.42	44,933
13	Junction	E-9 TOTAL	10.37	12.60	83,051	10, 12		
14	NRCS Runoff	E-10	30.87	12.40	173,628	----		
15	NRCS Runoff	E-11	19.61	12.37	104,209	----		
16	NRCS Runoff	E-12	0.002	15.33	69.9	----		

# Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	P-1	0.002	15.37	52.4	----		
3	NRCS Runoff	P-3A	4.833	12.10	16,703	----		
4	Pond Route	IB-3A	1.995	12.33	10,323	3	291.30	4,993
5	NRCS Runoff	P-3B	22.18	12.17	90,824	----		
6	Junction	P-3 TOTAL	24.00	12.20	101,147	4, 5		
8	NRCS Runoff	P-4A	5.848	12.13	22,412	----		
9	Pond Route	IB-4A	2.490	12.43	13,623	8	283.29	6,941
10	NRCS Runoff	P-4B	21.38	12.13	82,653	----		
11	Junction	P-4 TOTAL	22.81	12.17	96,276	9, 10		
13	NRCS Runoff	P-5B	7.910	12.23	34,951	----		
14	Pond Route	IB-5B	5.521	12.40	23,445	13	285.55	9,065
15	NRCS Runoff	P-5C	5.092	12.13	19,765	----		
16	Pond Route	IB-5C	0.135	13.73	483	15	260.72	10,635
17	NRCS Runoff	P-5E	14.23	12.17	59,154	----		
18	Junction	P-5 TOTAL	16.89	12.20	83,082	14, 16, 17		
20	NRCS Runoff	P-2A2	4.966	12.17	20,303	----		
21	Pond Route	IB-2A2	1.195	12.60	3,863	20	303.70	9,088
22	NRCS Runoff	P-2A1	6.659	12.10	23,093	----		
23	Pond Route	IB-2A1	0.000	13.00	0.001	22	308.65	12,760
24	NRCS Runoff	P-2A3	31.74	12.17	126,394	----		
25	Junction	TOTAL P-2A	31.74	12.17	130,257	21, 23, 24		
27	NRCS Runoff	P-2B-A	11.89	12.17	47,091	----		
28	NRCS Runoff	P-5D	8.876	12.10	30,386	----		
29	Pond Route	IB-5D	4.544	12.27	15,724	28	232.49	11,090
30	Junction	INFLOW TO IB-2B-A	15.32	12.20	62,815	27, 29		
31	Pond Route	IB-2B-A	4.277	12.57	17,500	30	230.44	15,611
32	NRCS Runoff	P-2B-B	12.41	12.20	63,102	----		
33	Junction	P-2B Total	14.25	12.27	80,601	31, 32		
35	NRCS Runoff	P-6A	0.058	12.77	1,408	----		
36	NRCS Runoff	P-6B	0.632	12.20	3,353	----		



# Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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-6B	0.000	18.73	0.000	36	220.48	846
38	Junction	P-6 TOTAL	0.058	12.77	1,408	35, 37		
40	NRCS Runoff	P-7A	8.421	12.10	30,260	----		
41	Pond Route	IB-7A	0.000	19.53	0.000	40	221.14	10,526
42	NRCS Runoff	P-7B	1.811	12.37	10,244	----		
43	Pond Route	IB-7B	0.000	17.40	0.000	42	225.33	2,841
44	Junction	P-7 TOTAL	0.000	17.40	0.000	41, 43		
46	NRCS Runoff	P-8	10.49	12.17	41,323	----		
47	Pond Route	IB-8	0.000	11.73	0.000	46	223.92	14,336
49	NRCS Runoff	P-9B	24.53	12.23	110,097	----		
50	Pond Route	DET. BASIN OUTFLOW	9.751	12.63	75,794	49	237.42	44,933
51	Junction	P-9 TOTAL	9.751	12.63	75,794	50		
53	NRCS Runoff	P-10A	13.57	12.37	74,925	----		
54	NRCS Runoff	P-10B	11.58	12.13	44,684	----		
55	Pond Route	IB-10B	0.563	12.67	2,416	54	227.36	16,025
56	NRCS Runoff	P-10C	25.55	12.27	122,644	----		
57	NRCS Runoff	P-9A	5.954	12.20	26,993	----		
58	Junction	TO IB-10C	31.44	12.23	149,637	56, 57		
59	Pond Route	IB-10C	7.352	12.63	28,854	58	227.18	45,158
60	Junction	P-10 TOTAL	19.74	12.50	106,195	53, 55, 59		
62	NRCS Runoff	P-11	19.41	12.37	103,157	----		
64	NRCS Runoff	P-12	0.002	15.33	69.9	----		
66	NRCS Runoff	Roof Runoff	0.290	12.07	1,004	----		
67	Pond Route	Roof Drywell	0.000	9.77	0.000	66	102.24	379

# Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	E-1	0.015	12.50	228	----		
2	NRCS Runoff	E-2A	51.14	12.23	227,661	----		
3	NRCS Runoff	E-2B	45.93	12.23	215,845	----		
4	NRCS Runoff	E-3	35.91	12.27	169,813	----		
5	NRCS Runoff	E-4	34.82	12.27	164,675	----		
6	NRCS Runoff	E-5	30.49	12.27	147,879	----		
7	NRCS Runoff	E-6	1.157	12.43	8,335	----		
8	NRCS Runoff	E-7	1.078	12.53	12,259	----		
9	NRCS Runoff	E-8	0.056	12.60	938	----		
10	NRCS Runoff	E-9A	2.844	12.23	14,258	----		
11	NRCS Runoff	E-9B	37.89	12.23	167,750	----		
12	Pond Route	DETENTION BASIN	26.82	12.43	133,448	11	237.78	54,171
13	Junction	E-9 TOTAL	28.86	12.43	147,706	10, 12		
14	NRCS Runoff	E-10	52.40	12.37	282,066	----		
15	NRCS Runoff	E-11	30.10	12.33	157,683	----		
16	NRCS Runoff	E-12	0.021	12.43	303	----		

# Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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)
1	NRCS Runoff	P-1	0.015	12.50	228	----		
3	NRCS Runoff	P-3A	6.583	12.10	23,047	----		
4	Pond Route	IB-3A	2.929	12.30	15,808	3	291.83	6,527
5	NRCS Runoff	P-3B	32.90	12.17	133,902	----		
6	Junction	P-3 TOTAL	35.48	12.17	149,710	4, 5		
8	NRCS Runoff	P-4A	8.346	12.13	32,087	----		
9	Pond Route	IB-4A	4.180	12.37	22,100	8	283.87	9,308
10	NRCS Runoff	P-4B	31.98	12.13	122,621	----		
11	Junction	P-4 TOTAL	34.67	12.17	144,721	9, 10		
13	NRCS Runoff	P-5B	11.28	12.20	50,037	----		
14	Pond Route	IB-5B	8.928	12.37	37,255	13	285.92	10,957
15	NRCS Runoff	P-5C	6.902	12.13	27,136	----		
16	Pond Route	IB-5C	2.414	12.43	6,054	15	260.94	11,696
17	NRCS Runoff	P-5E	24.48	12.17	97,007	----		
18	Junction	P-5 TOTAL	30.16	12.20	140,316	14, 16, 17		
20	NRCS Runoff	P-2A2	6.854	12.17	28,299	----		
21	Pond Route	IB-2A2	4.177	12.37	10,252	20	303.96	10,181
22	NRCS Runoff	P-2A1	9.017	12.10	31,706	----		
23	Pond Route	IB-2A1	2.026	12.50	5,471	22	308.99	14,669
24	NRCS Runoff	P-2A3	50.99	12.17	198,423	----		
25	Junction	TOTAL P-2A	50.99	12.17	214,146	21, 23, 24		
27	NRCS Runoff	P-2B-A	18.89	12.17	73,351	----		
28	NRCS Runoff	P-5D	12.39	12.10	42,798	----		
29	Pond Route	IB-5D	7.861	12.23	27,675	28	232.88	13,292
30	Junction	INFLOW TO IB-2B-A	26.60	12.17	101,026	27, 29		
31	Pond Route	IB-2B-A	7.117	12.57	40,738	30	231.38	28,543
32	NRCS Runoff	P-2B-B	26.63	12.17	115,404	----		
33	Junction	P-2B Total	31.04	12.20	156,142	31, 32		
35	NRCS Runoff	P-6A	0.445	12.47	4,014	----		
36	NRCS Runoff	P-6B	1.411	12.17	6,232	----		

# Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

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-6B	0.000	15.13	0.000	36	221.77	2,097
38	Junction	P-6 TOTAL	0.445	12.47	4,014	35, 37		
40	NRCS Runoff	P-7A	13.79	12.10	47,890	----		
41	Pond Route	IB-7A	0.000	11.27	0.000	40	222.39	19,475
42	NRCS Runoff	P-7B	3.343	12.33	17,523	----		
43	Pond Route	IB-7B	0.000	11.83	0.000	42	226.36	6,077
44	Junction	P-7 TOTAL	0.000	11.27	0.000	41, 43		
46	NRCS Runoff	P-8	16.50	12.13	63,880	----		
47	Pond Route	IB-8	0.000	11.37	0.000	46	224.97	25,111
49	NRCS Runoff	P-9B	37.89	12.23	167,750	----		
50	Pond Route	DET. BASIN OUTFLOW	26.82	12.43	133,448	49	237.78	54,171
51	Junction	P-9 TOTAL	26.82	12.43	133,448	50		
53	NRCS Runoff	P-10A	22.40	12.37	119,578	----		
54	NRCS Runoff	P-10B	15.88	12.13	61,966	----		
55	Pond Route	IB-10B	1.003	12.67	7,962	54	228.13	23,335
56	NRCS Runoff	P-10C	34.68	12.23	168,385	----		
57	NRCS Runoff	P-9A	10.62	12.20	45,165	----		
58	Junction	TO IB-10C	45.05	12.23	213,550	56, 57		
59	Pond Route	IB-10C	15.33	12.60	65,152	58	227.84	62,532
60	Junction	P-10 TOTAL	36.23	12.47	192,692	53, 55, 59		
62	NRCS Runoff	P-11	29.80	12.33	156,090	----		
64	NRCS Runoff	P-12	0.021	12.43	303	----		
66	NRCS Runoff	Roof Runoff	0.371	12.07	1,293	----		
67	Pond Route	Roof Drywell	0.000	8.90	0.000	66	103.25	521

## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date #####  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	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.

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

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.09	0.09	0.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/27/2022Date                     Circle one: Present 

Developed
-----------

Circle one: Tc 

Tt
----

Subcatchment P-1through  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $Tt = L / 3600V$ 

Compute Tt hr

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 3.0.0.21

10-27-2022

**P-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:

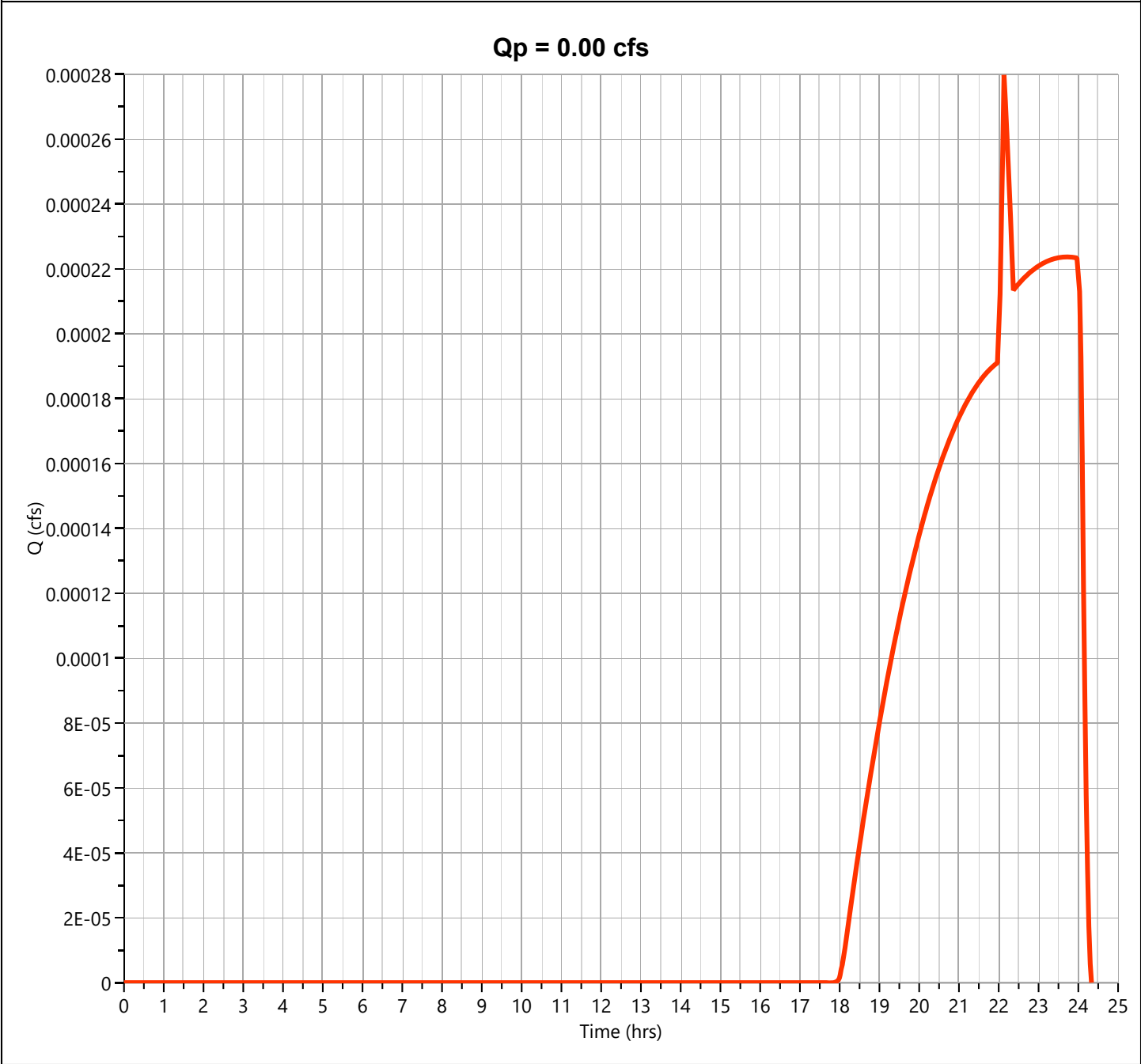
Hydrology Studio v 3.0.0.21

10-27-2022

P-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 22.13 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:

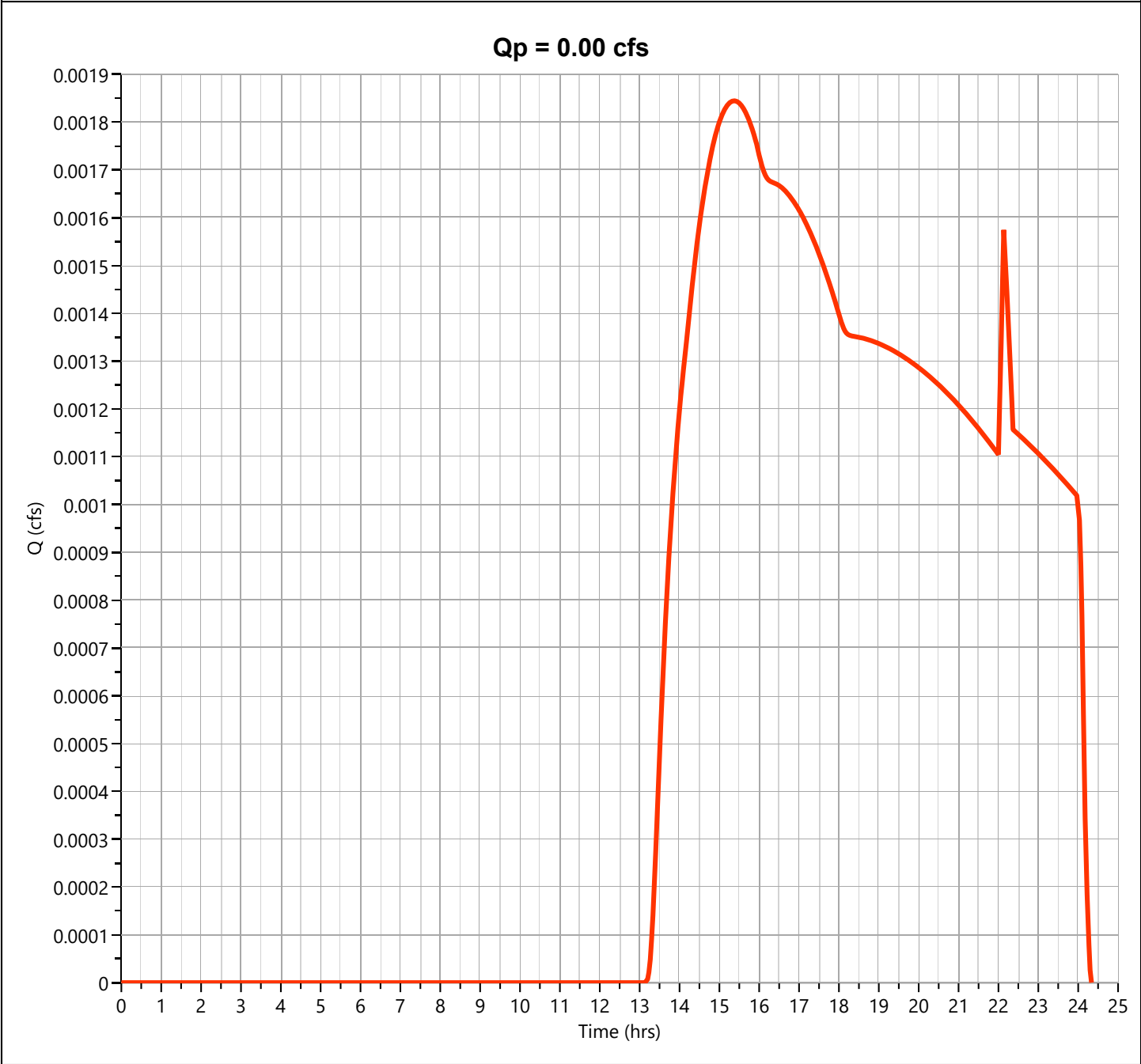
Hydrology Studio v 3.0.0.21

10-27-2022

P-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:

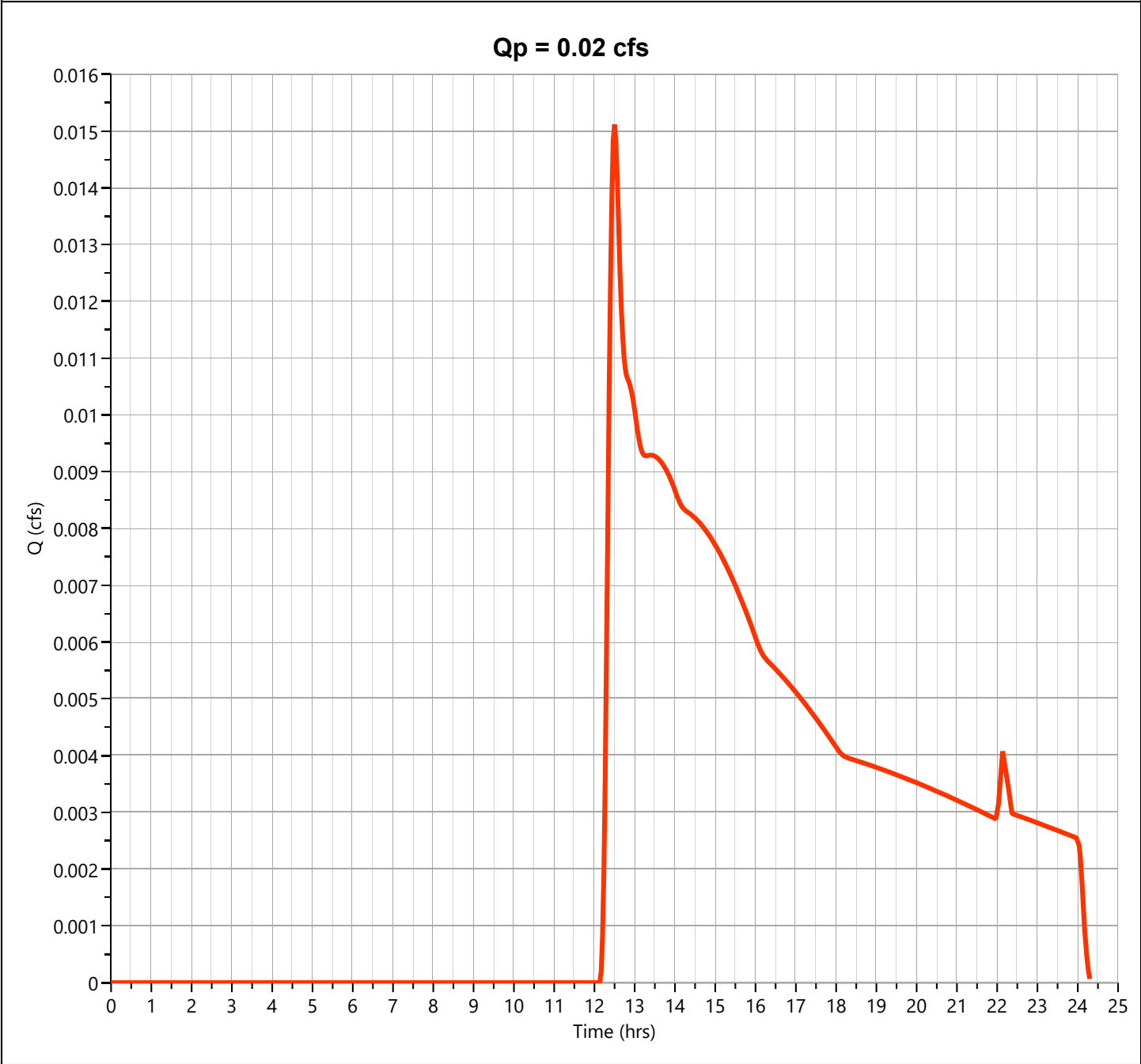
Hydrology Studio v 3.0.0.21

10-27-2022

P-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 PFK Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☐ Developed ☒ Subcatchment P-2A2

**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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.49	47.68
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			0.25	17.38
C	Open Space Good Condition	74			0.69	51.09
C	Gravel	89			0.00	0.00
Totals =					1.43	116.15

1/ Use only one CN source per line.

62083

Totals =

1.43

116.15

CN (weighted) =  $\frac{\text{total product}}{\text{total area}} = \frac{116.15}{1.43} = 81.50$ ; Use CN = **81**

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.56	4.06	5.65

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 10/13/2022Location: Stow, MAChecked                     Rev Date                     Date                     Circle one: 

Present	Developed
---------	-----------

Circle one: 

Tc	Tt
----	----

Subcatchment P-2A2through  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.22

A-B		
WOODS		
0.6		
50		
3.1		
0.040		
0.22		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.02

B-C	C-D	D-E
UNPAVED	UNPAVED	PAVED
102	109	15
0.040	0.065	0.07
3.23	4.11	5.38
0.01	0.01	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.  $T_t = L / 3600V$ 

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:

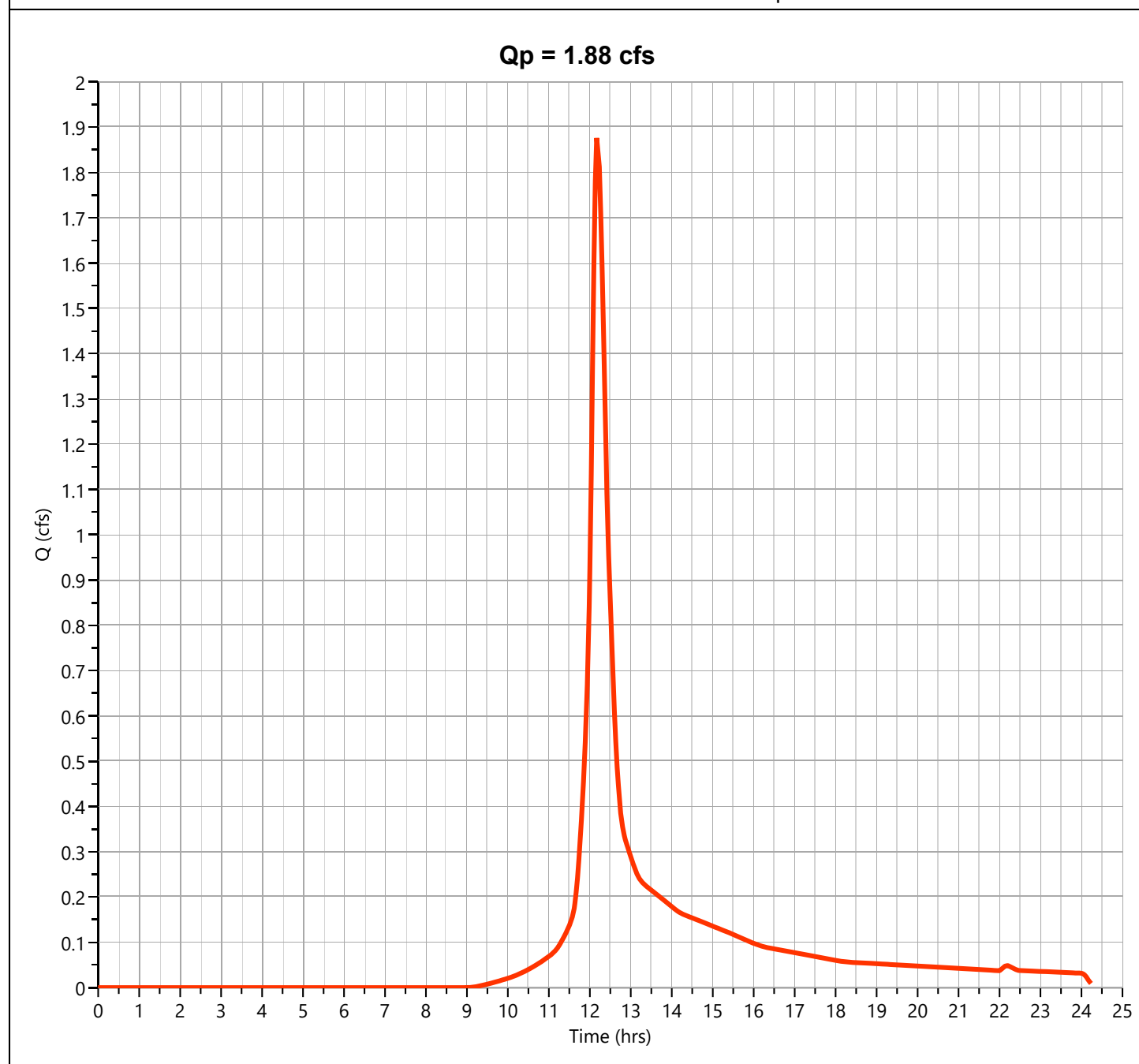
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2A2**

**Hyd. No. 20**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.878 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 7,715 cuft
Drainage Area	= 1.43 ac	Curve Number	= 81
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:

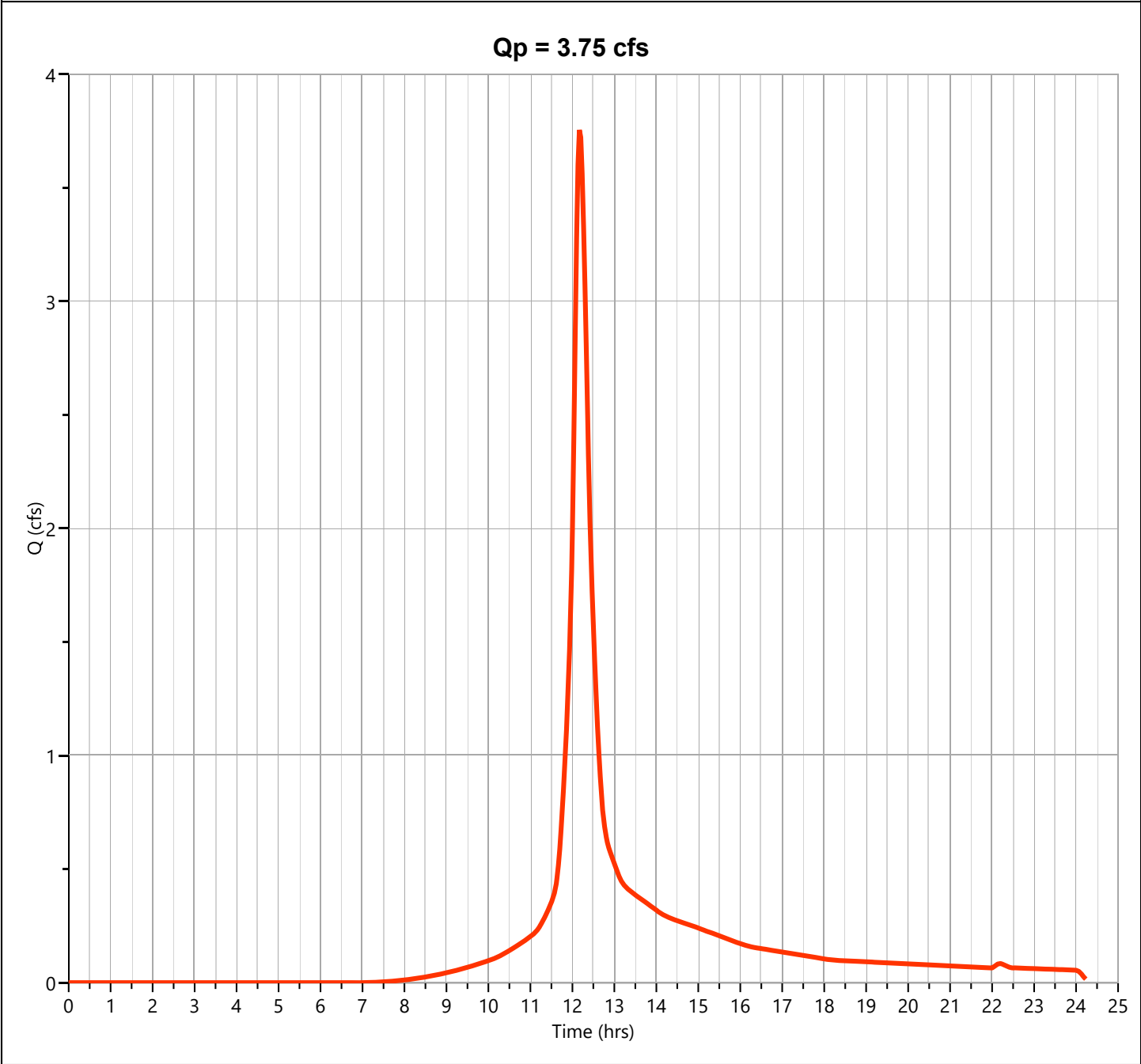
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A2

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.755 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 15,288 cuft
Drainage Area	= 1.43 ac	Curve Number	= 81
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:

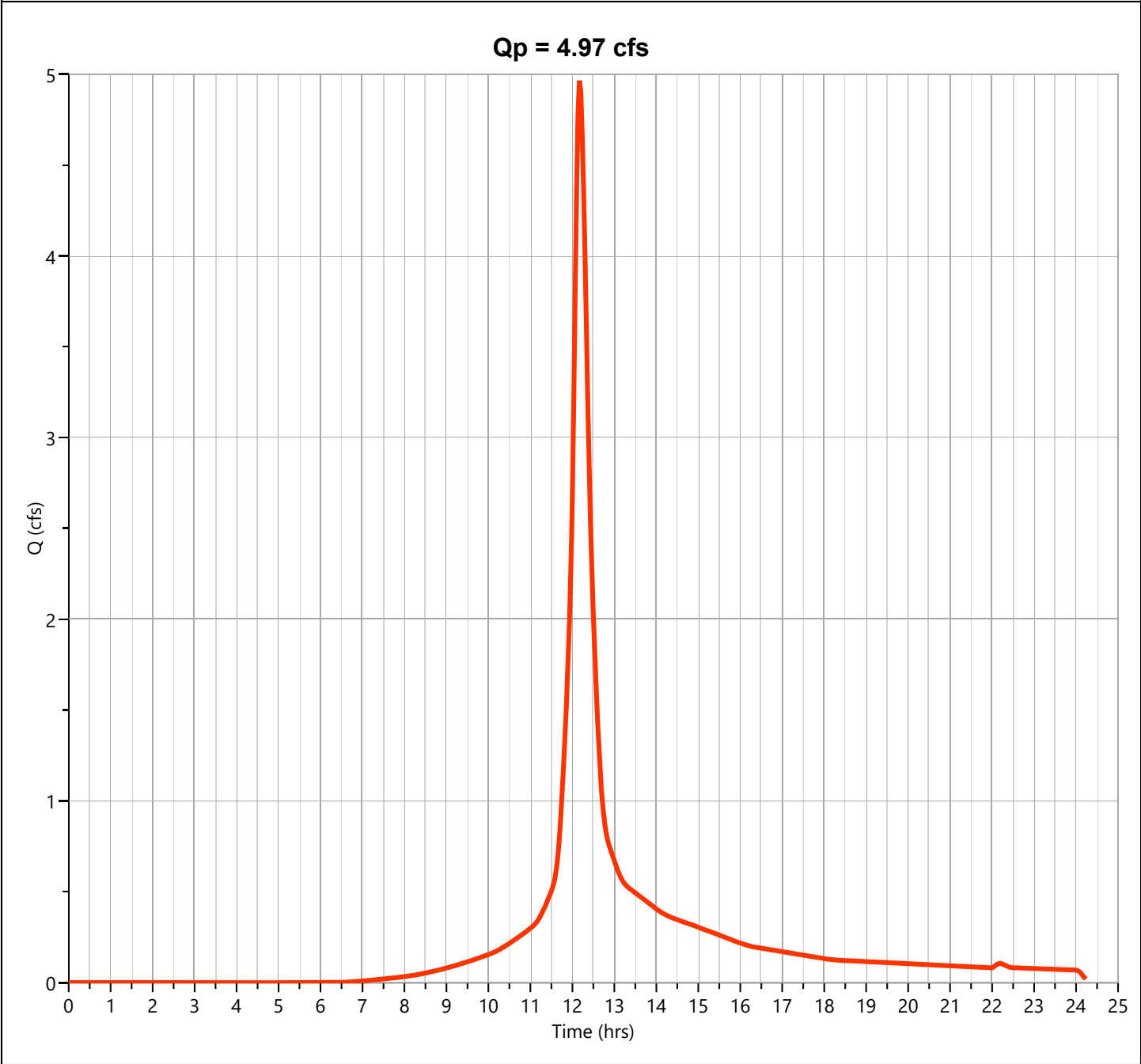
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A2

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.966 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 20,303 cuft
Drainage Area	= 1.43 ac	Curve Number	= 81
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:

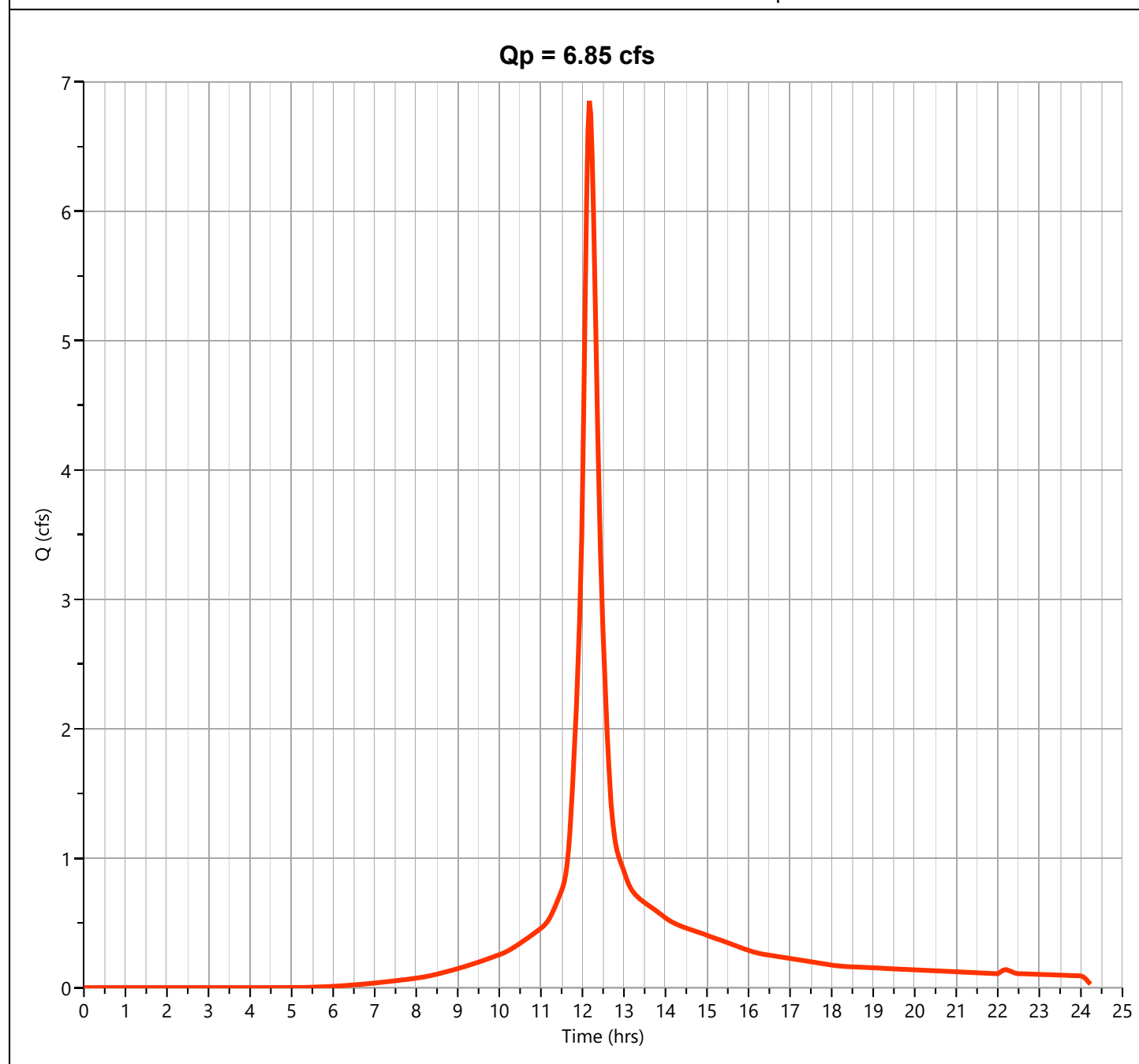
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2A2**

**Hyd. No. 20**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.854 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 28,299 cuft
Drainage Area	= 1.43 ac	Curve Number	= 81
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:

Hydrology Studio v 3.0.0.21

10-27-2022

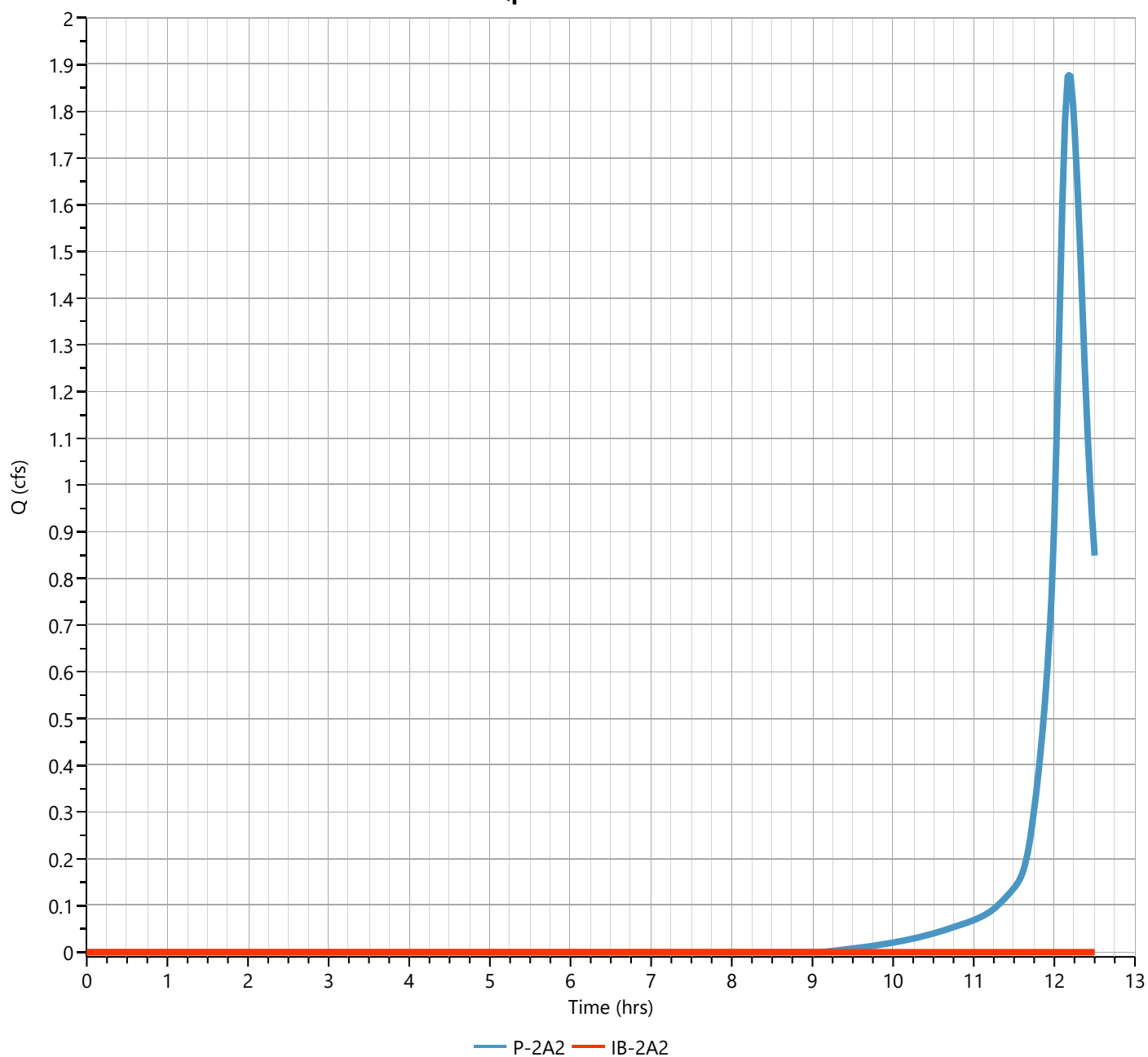
**IB-2A2**

**Hyd. No. 21**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 20 - P-2A2	Max. Elevation	= 302.24 ft
Pond Name	= IB-2A2	Max. Storage	= 3,550 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A2**

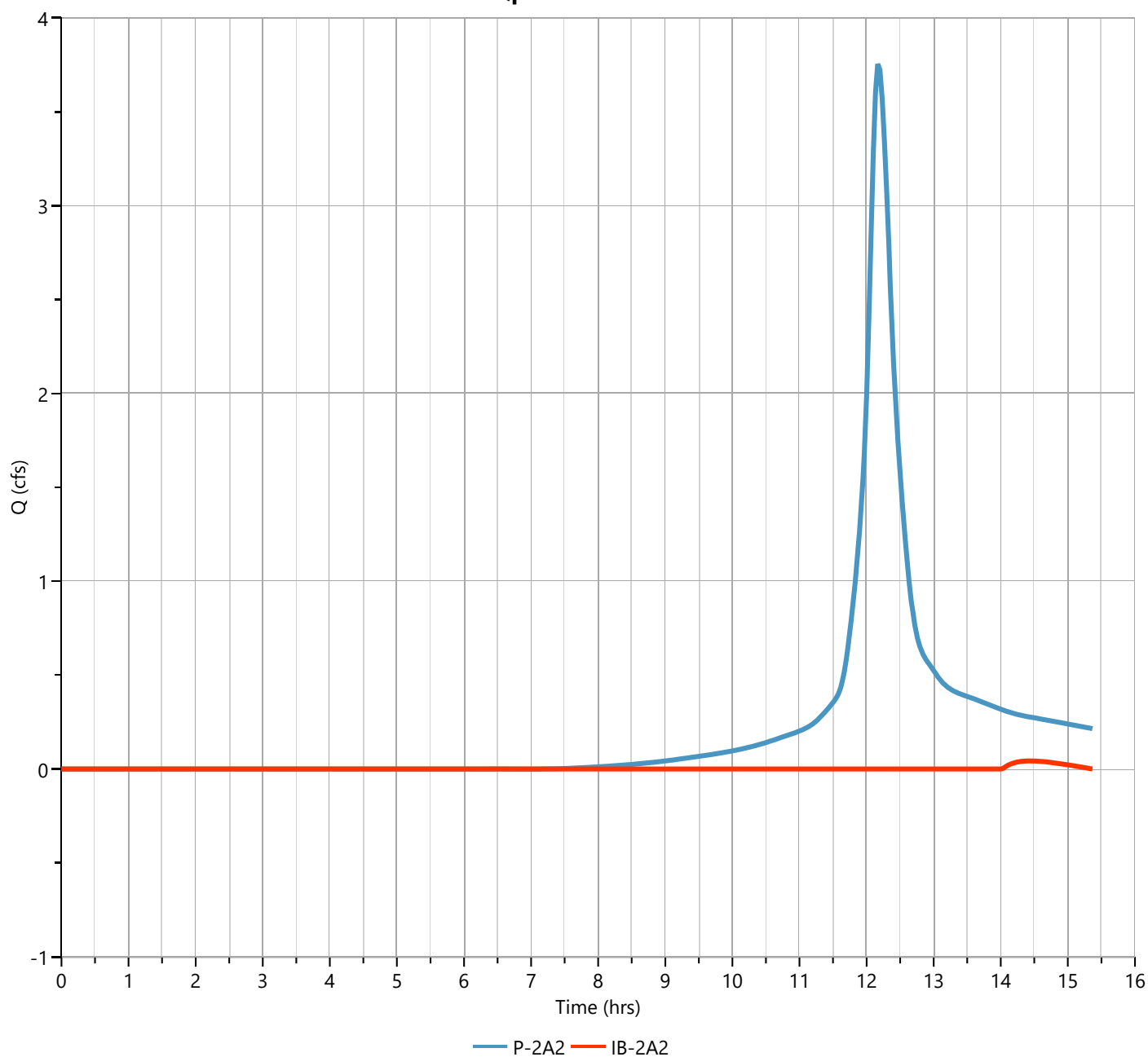
**Hyd. No. 21**

Hydrograph Type	= Pond Route	Peak Flow	= 0.043 cfs
Storm Frequency	= 10-yr	Time to Peak	= 14.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 133 cuft
Inflow Hydrograph	= 20 - P-2A2	Max. Elevation	= 303.51 ft
Pond Name	= IB-2A2	Max. Storage	= 8,289 cuft

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 52 min*

**Qp = 0.04 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

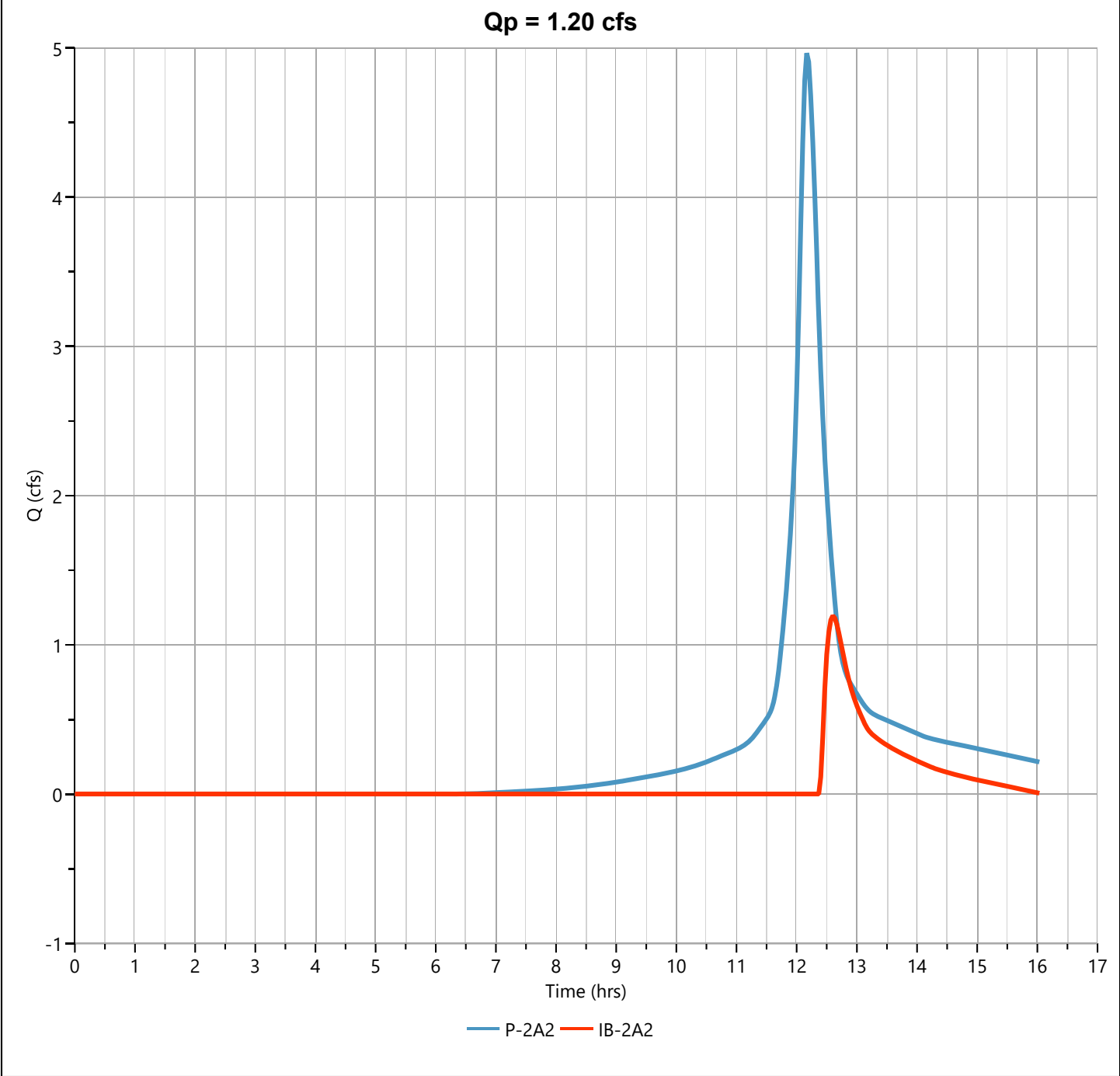
10-27-2022

IB-2A2

Hyd. No. 21

Hydrograph Type	= Pond Route	Peak Flow	= 1.195 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 3,863 cuft
Inflow Hydrograph	= 20 - P-2A2	Max. Elevation	= 303.70 ft
Pond Name	= IB-2A2	Max. Storage	= 9,088 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

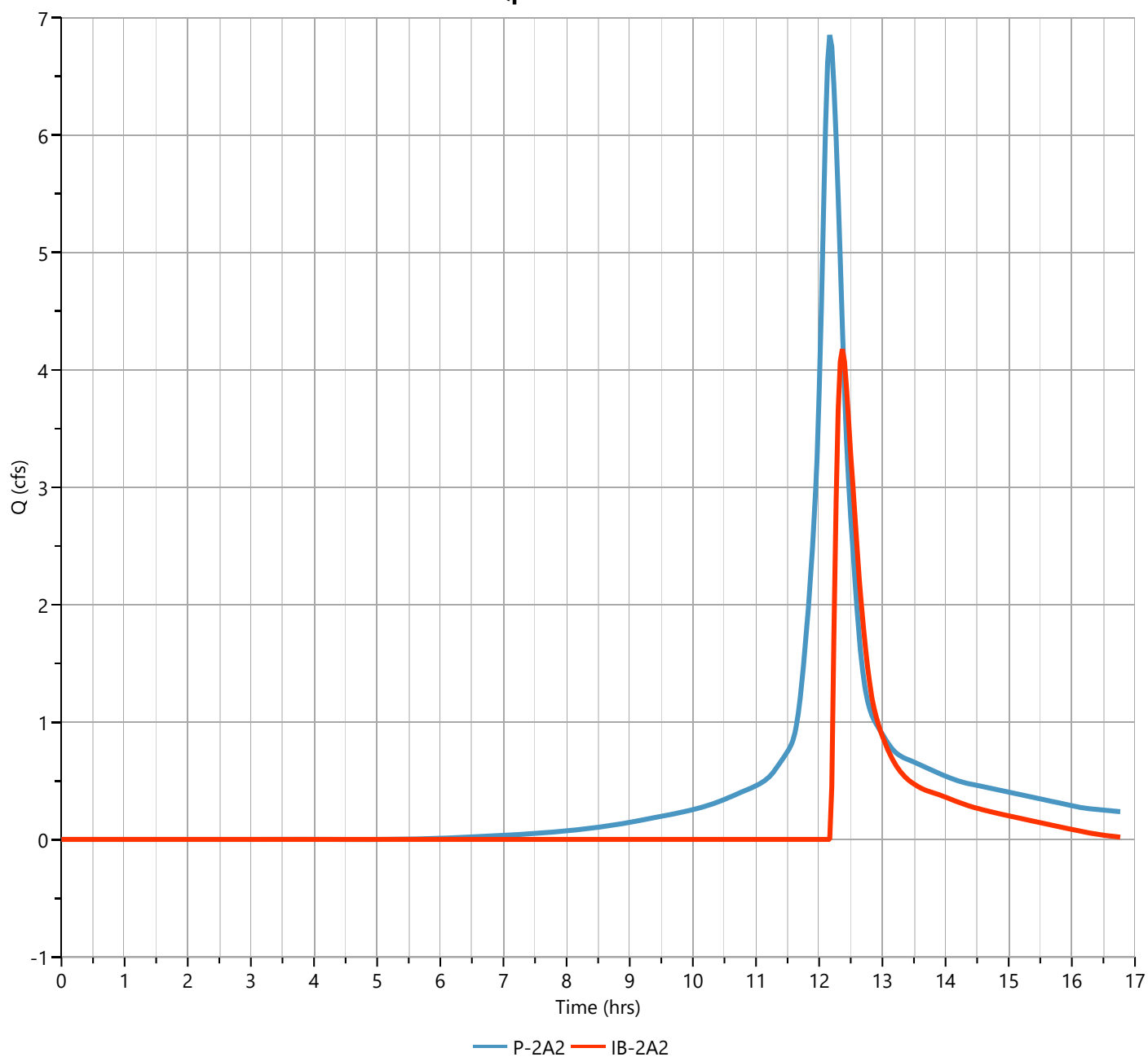
**IB-2A2**

**Hyd. No. 21**

Hydrograph Type	= Pond Route	Peak Flow	= 4.177 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 10,252 cuft
Inflow Hydrograph	= 20 - P-2A2	Max. Elevation	= 303.96 ft
Pond Name	= IB-2A2	Max. Storage	= 10,181 cuft

*Pond Routing by Storage Indication Method*

**Qp = 4.18 cfs**



# Pond Report

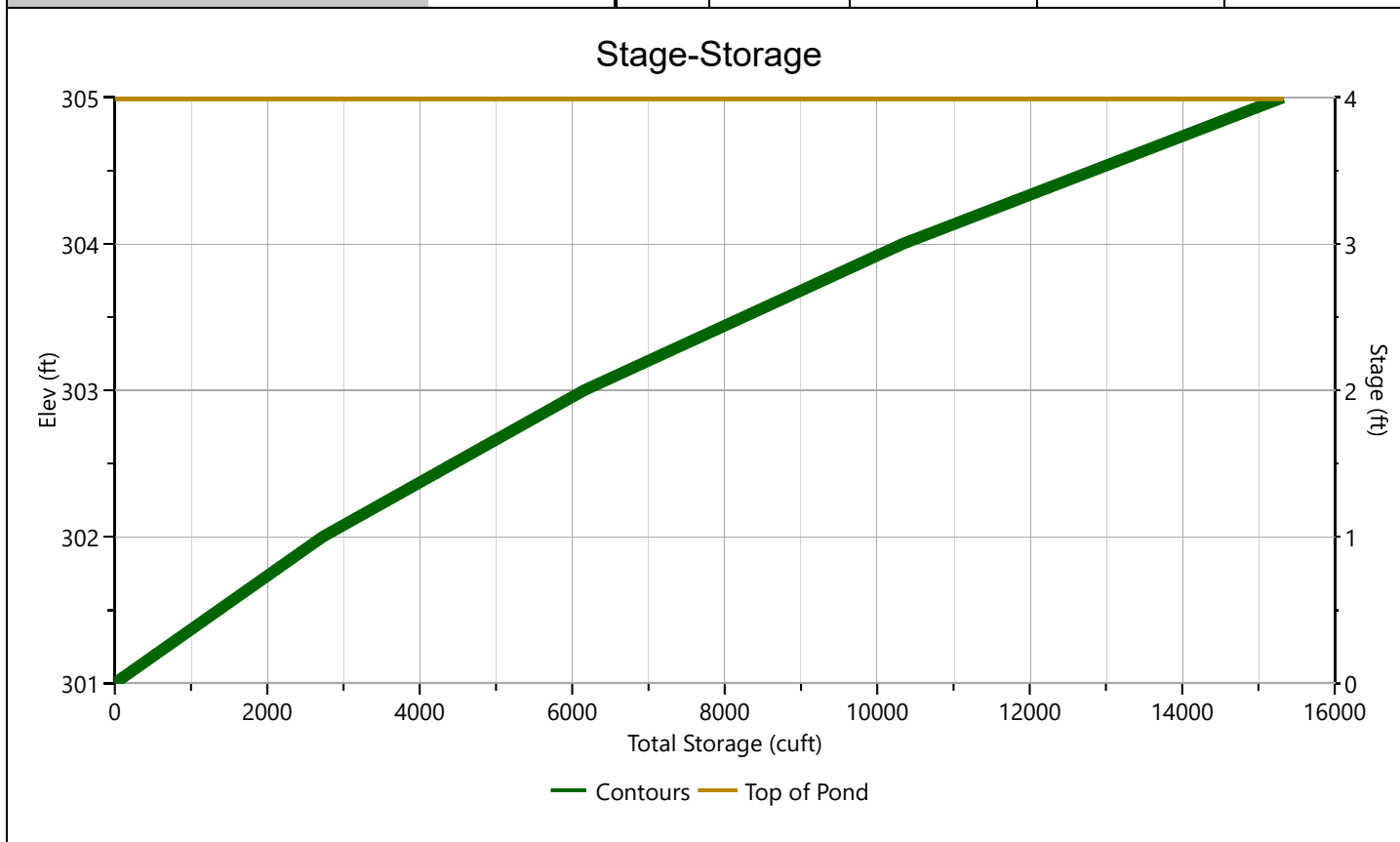
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A2**

## Stage-Storage

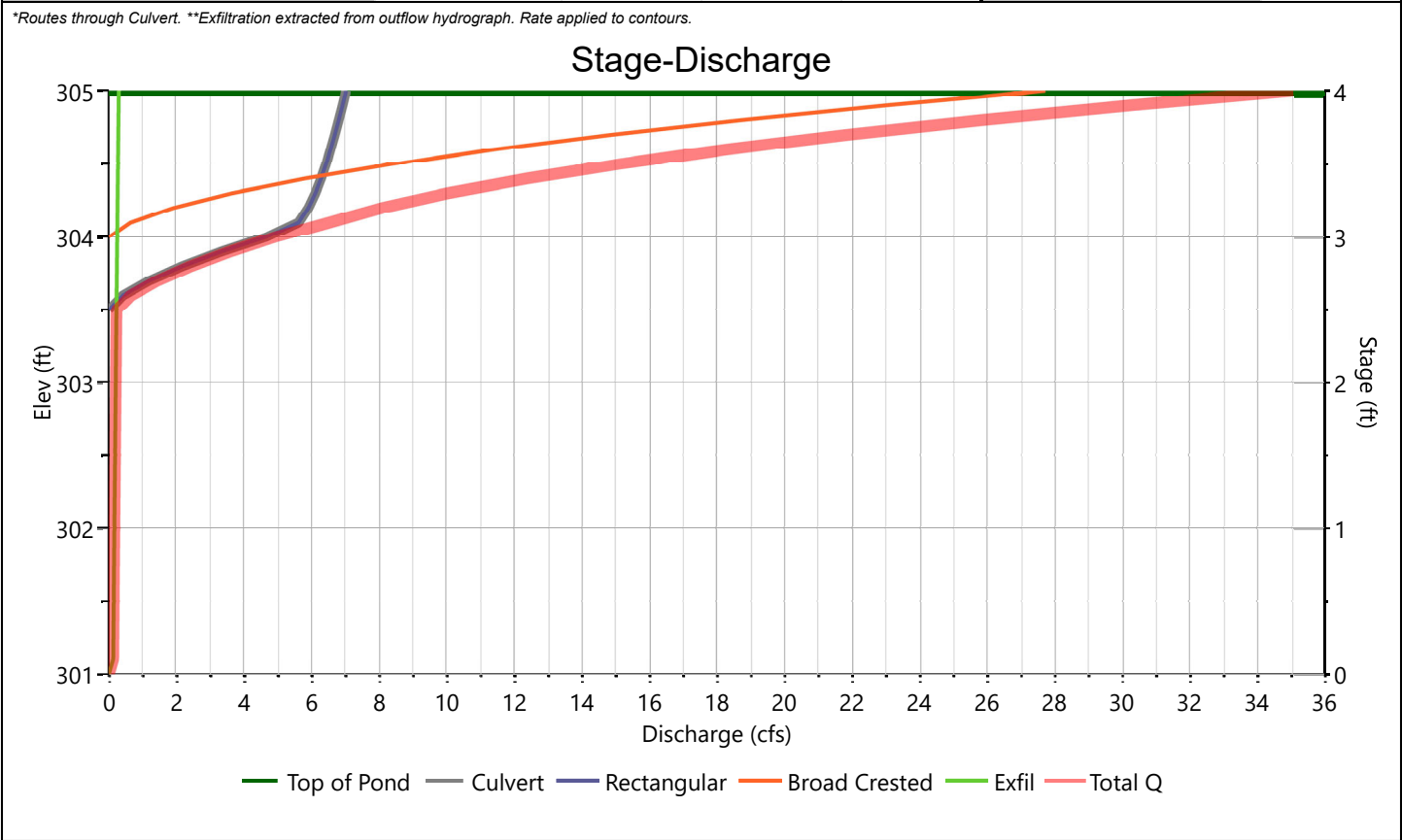
[illegible]

IB-2A2

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	12				Hole Diameter, in	
Span, in	12				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	301.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	34					
Barrel Slope, %	8.8					
N-Value, n	0.013					
Weirs	Riser*	Weirs			Ancillary	
		1*	2	3		
Shape / Type	Circular	Rectangular		Broad Crested	Exfiltration, in/hr	2.41**
Crest Elevation, ft		303.5		304		
Crest Length, ft		4		6		
Angle, deg				18.4 (3:1)		
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 3.0.0.21

10-27-2022

**IB-2A2**

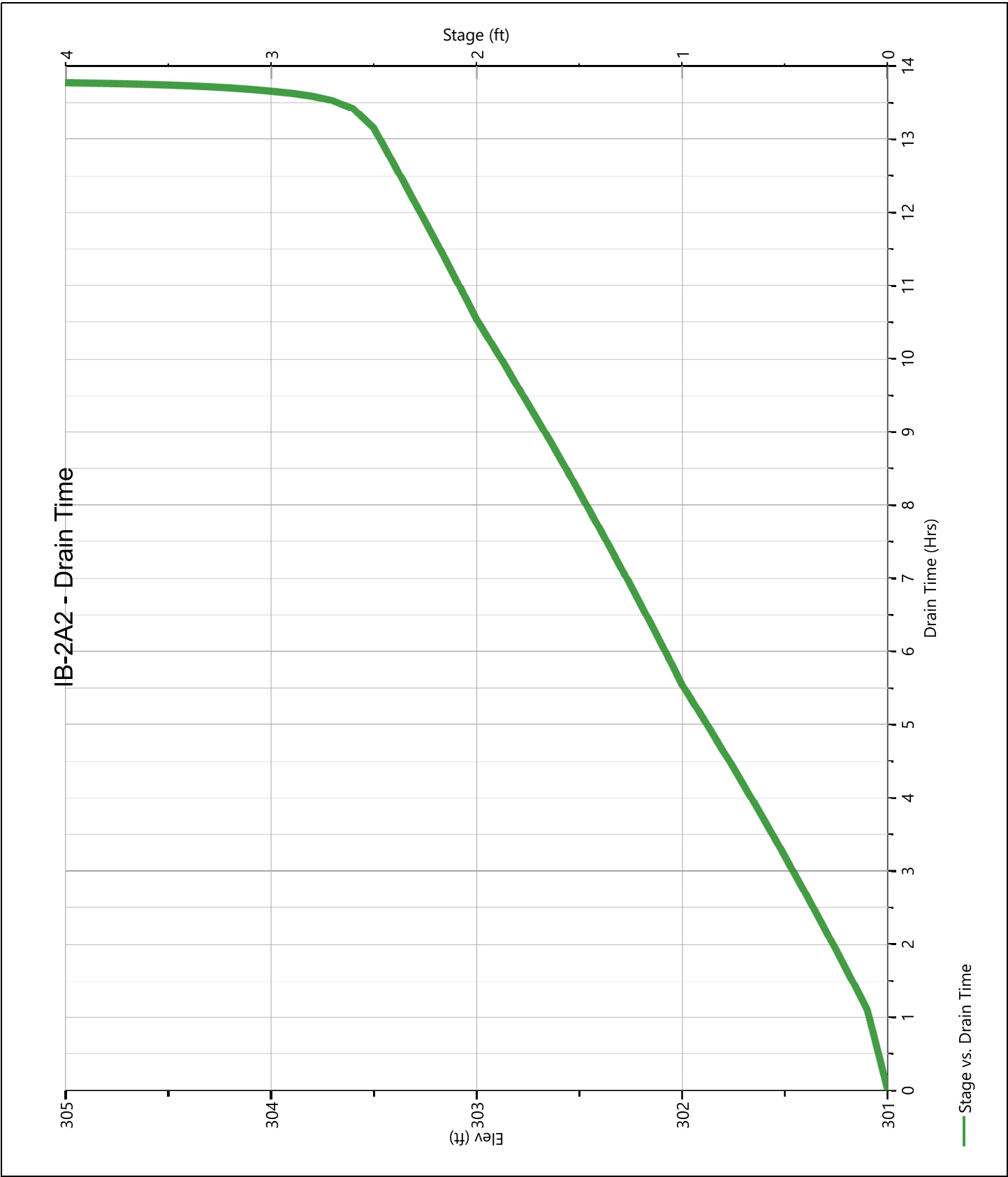
## Stage-Storage-Discharge Summary

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	301.00	0.000	0.000					0.000		0.000		0.000		0.000
1.00	302.00	2,731	0.000					0.000		0.000		0.171		0.171
2.00	303.00	6,157	0.000					0.000		0.000		0.211		0.211
3.00	304.00	10,335	4.667 ic					4.667		0.000		0.255		4.922
4.00	305.00	15,323	7.028 ic					7.028 s		27.72		0.302		35.05

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

IB-2A2

Pond Drawdown





**Worksheet 2: Runoff curve number and runoff**

**SM-3719C**

Project: Athens Street By PFK Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☐ Developed ☒ Subcatchment P-2A1

**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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.59	57.61
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			0.00	0.00
C	Open Space Good Condition	74			0.89	65.57
C	Gravel	89			0.00	0.00
Totals =					1.47	123.18

1/ Use only one CN source per line.

64206

Totals =

1.47

123.18

CN (weighted) =  $\frac{\text{total product}}{\text{total area}} = \frac{123.18}{1.47} = 83.57$ ; Use CN = **84**

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.71	4.28	5.89

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 10/13/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date \_\_\_\_\_

Date \_\_\_\_\_

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-2A1Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.16  
9.6

# Hydrograph Report

Project Name:

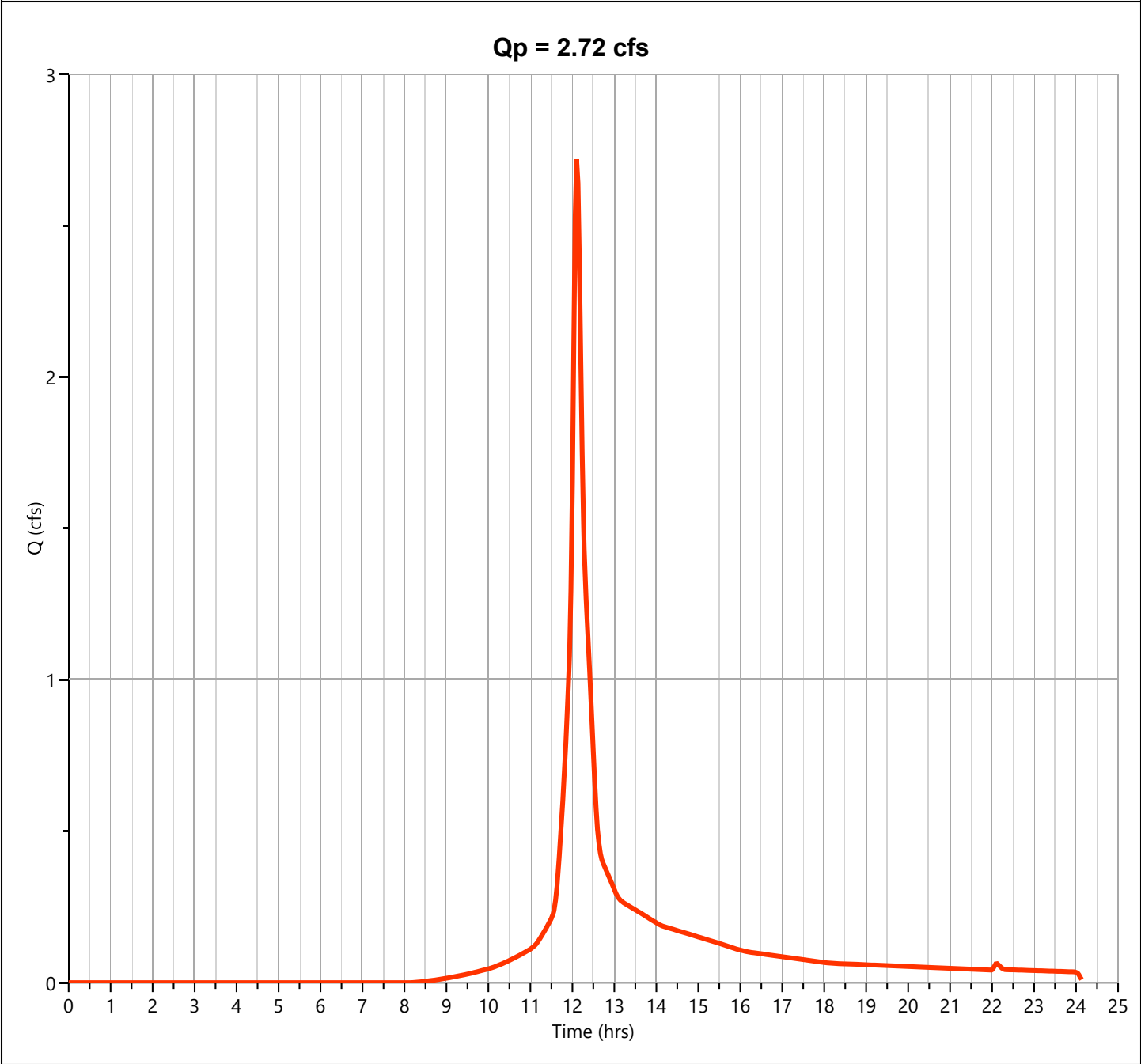
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A1

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.719 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 9,291 cuft
Drainage Area	= 1.47 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 9.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

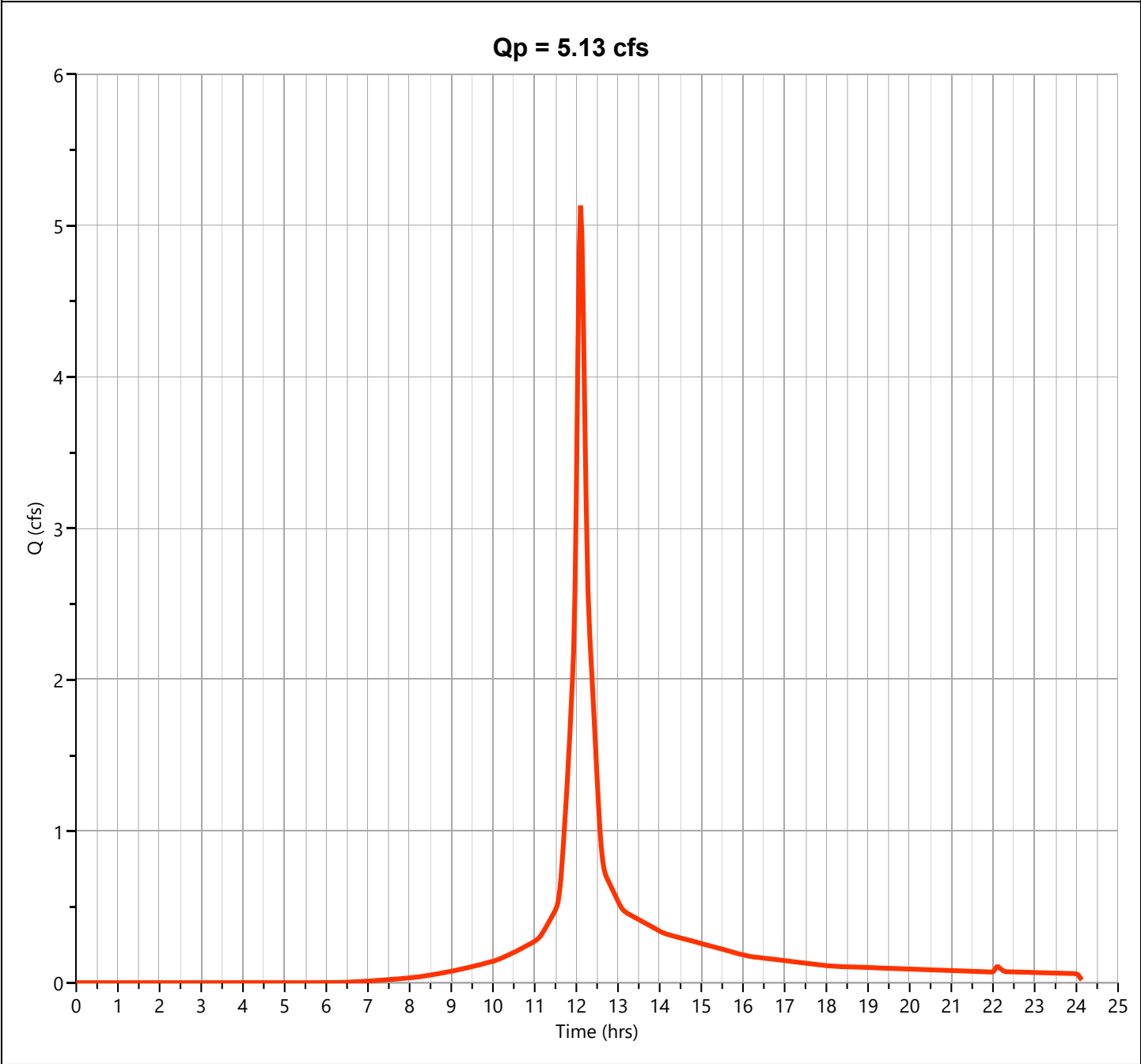
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A1

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.133 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 17,647 cuft
Drainage Area	= 1.47 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 9.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

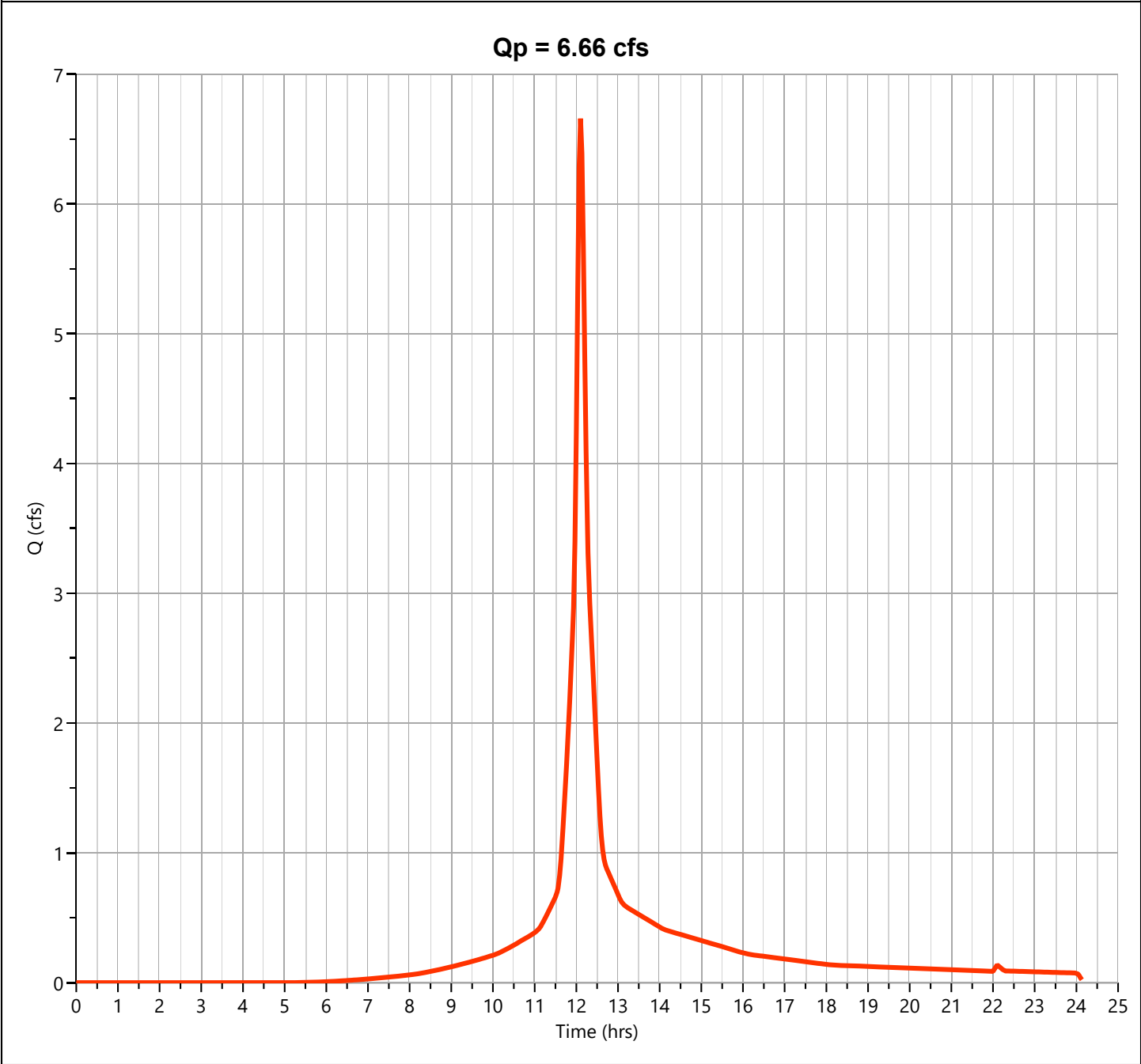
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A1

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.659 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 23,093 cuft
Drainage Area	= 1.47 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 9.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

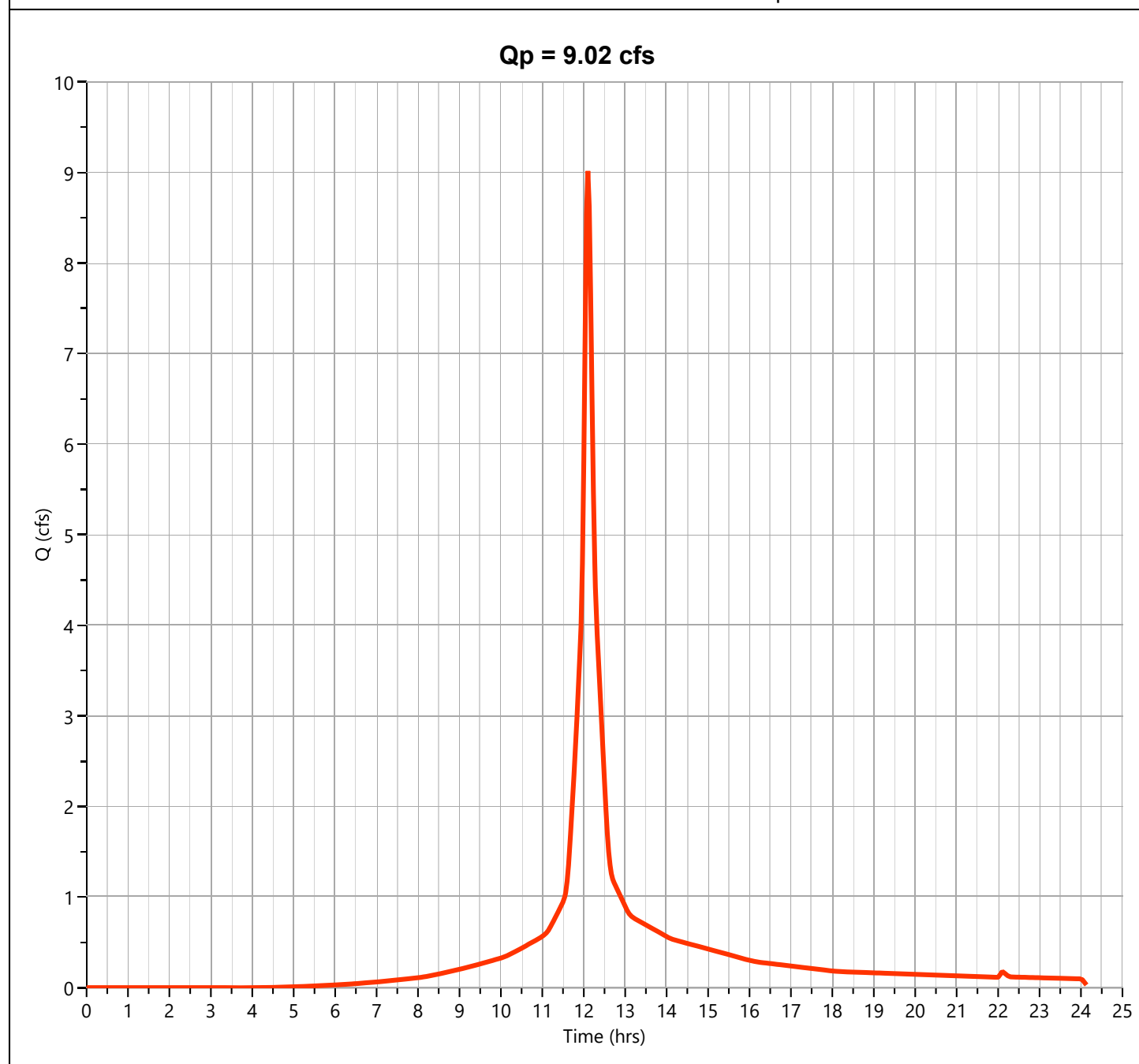
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2A1**

**Hyd. No. 22**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.017 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 31,706 cuft
Drainage Area	= 1.47 ac	Curve Number	= 84
Tc Method	= User	Time of Conc. (Tc)	= 9.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

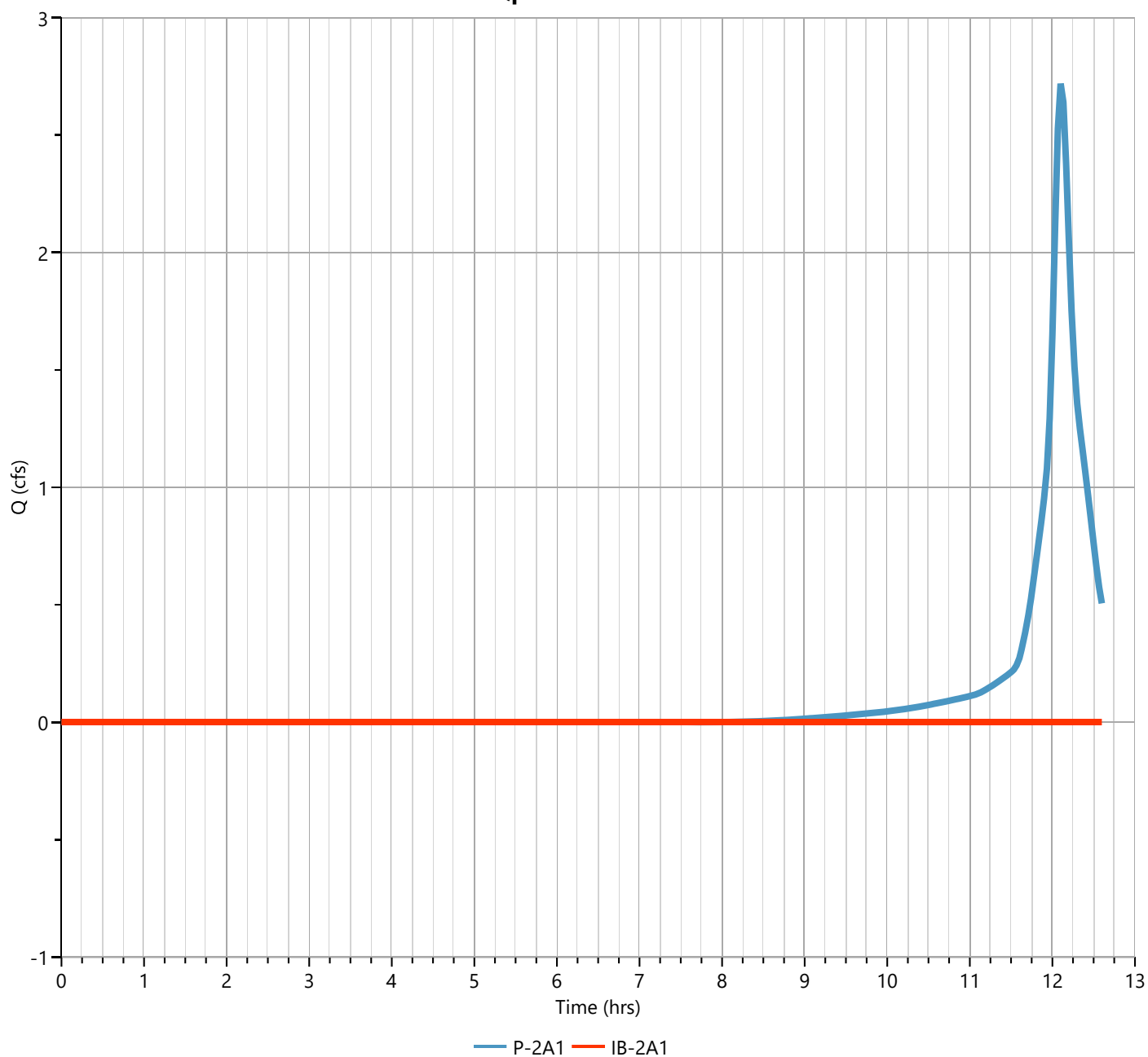
**IB-2A1**

**Hyd. No. 23**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 22 - P-2A1	Max. Elevation	= 306.99 ft
Pond Name	= IB-2A1	Max. Storage	= 4,049 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Pond Report

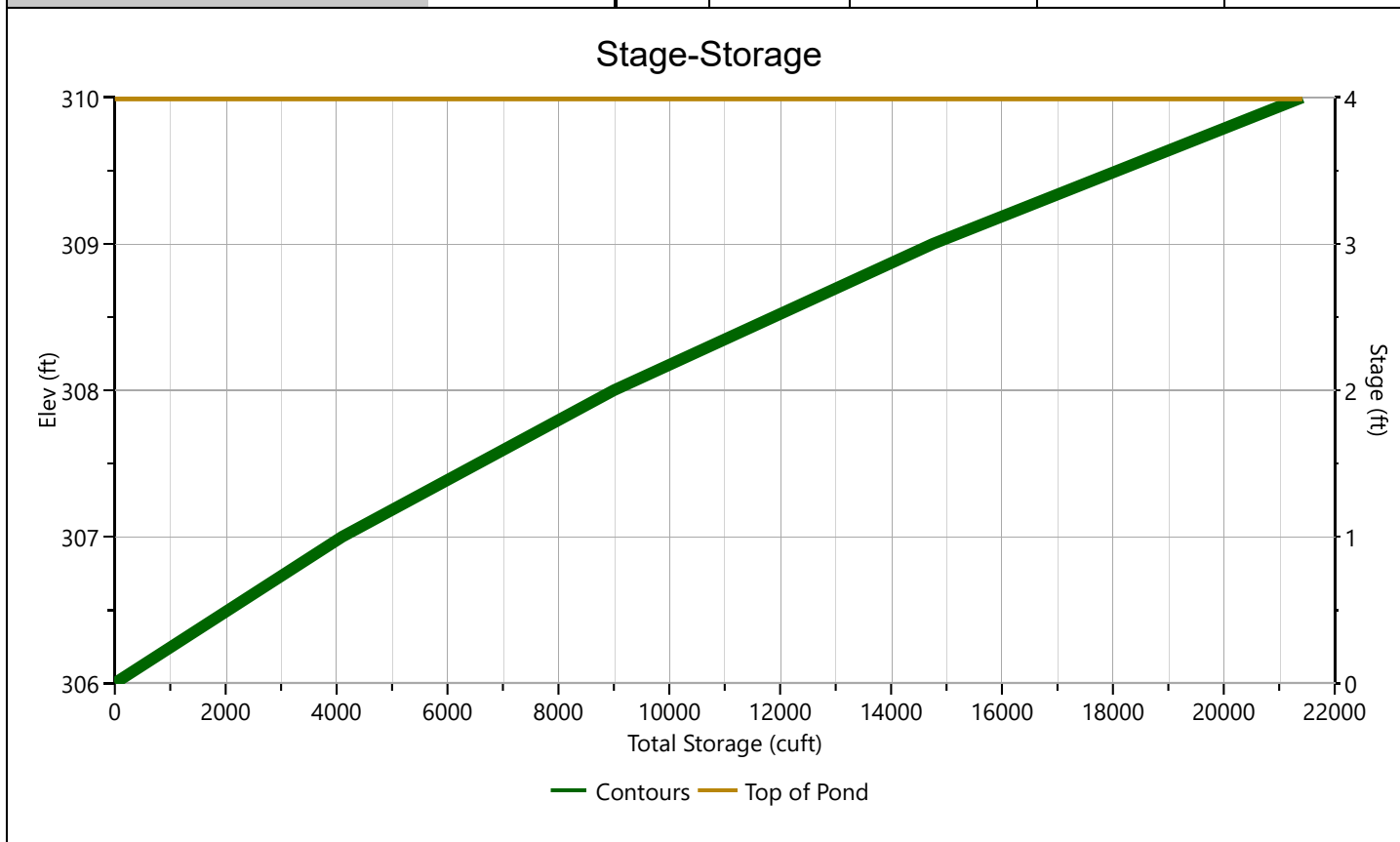
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A1**

## Stage-Storage

[illegible]

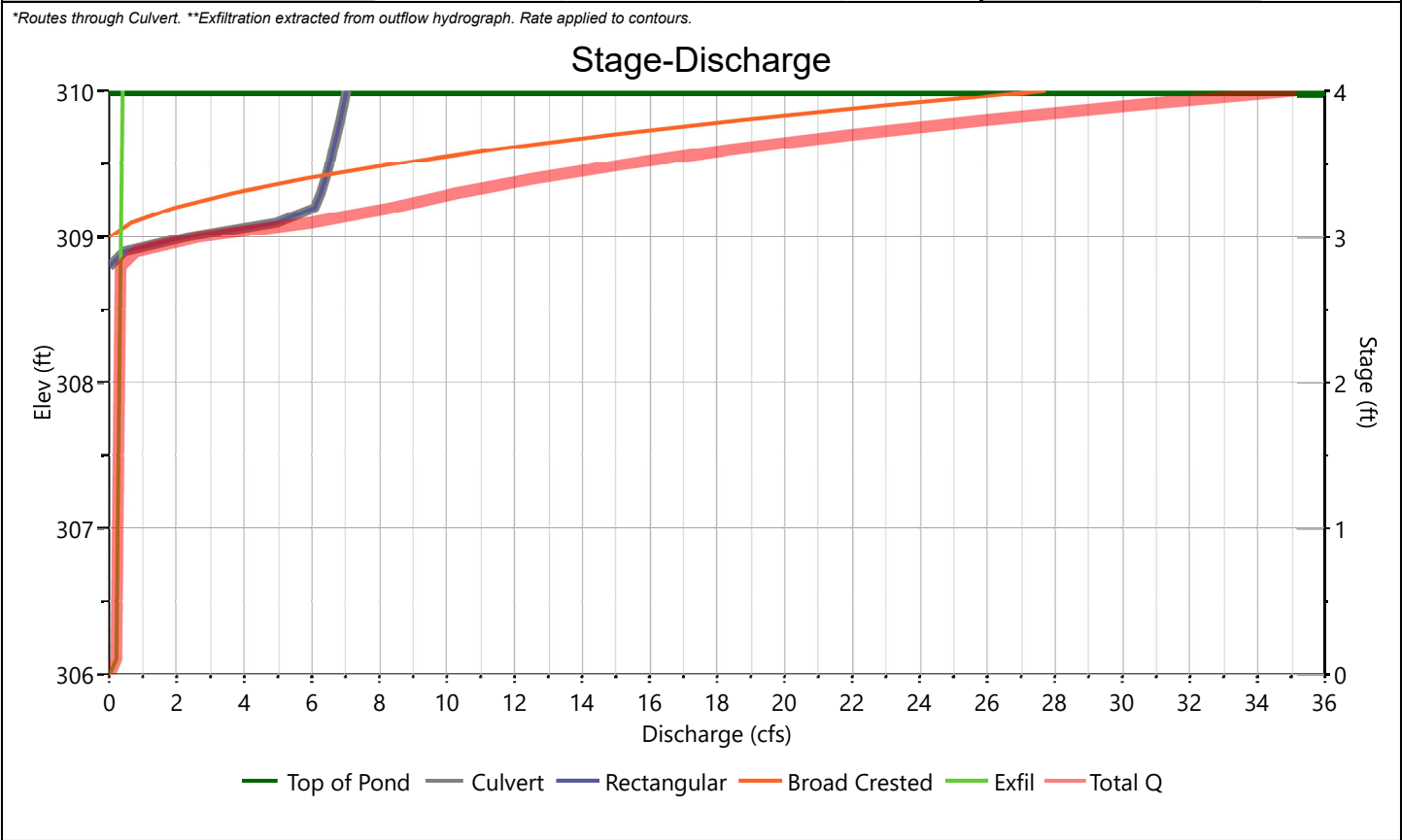


IB-2A1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	12				Hole Diameter, in	
Span, in	12				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	306.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	28					
Barrel Slope, %	3.6					
N-Value, n	0.012					
Weirs	Riser*	Weirs			Ancillary	
		1*	2	3		
Shape / Type	Circular	Rectangular		Broad Crested	Exfiltration, in/hr	2.41**
Crest Elevation, ft		308.85		309		
Crest Length, ft		12		6		
Angle, deg				18.4 (3:1)		
Weir Coefficient, Cw		3.3		3.3		

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



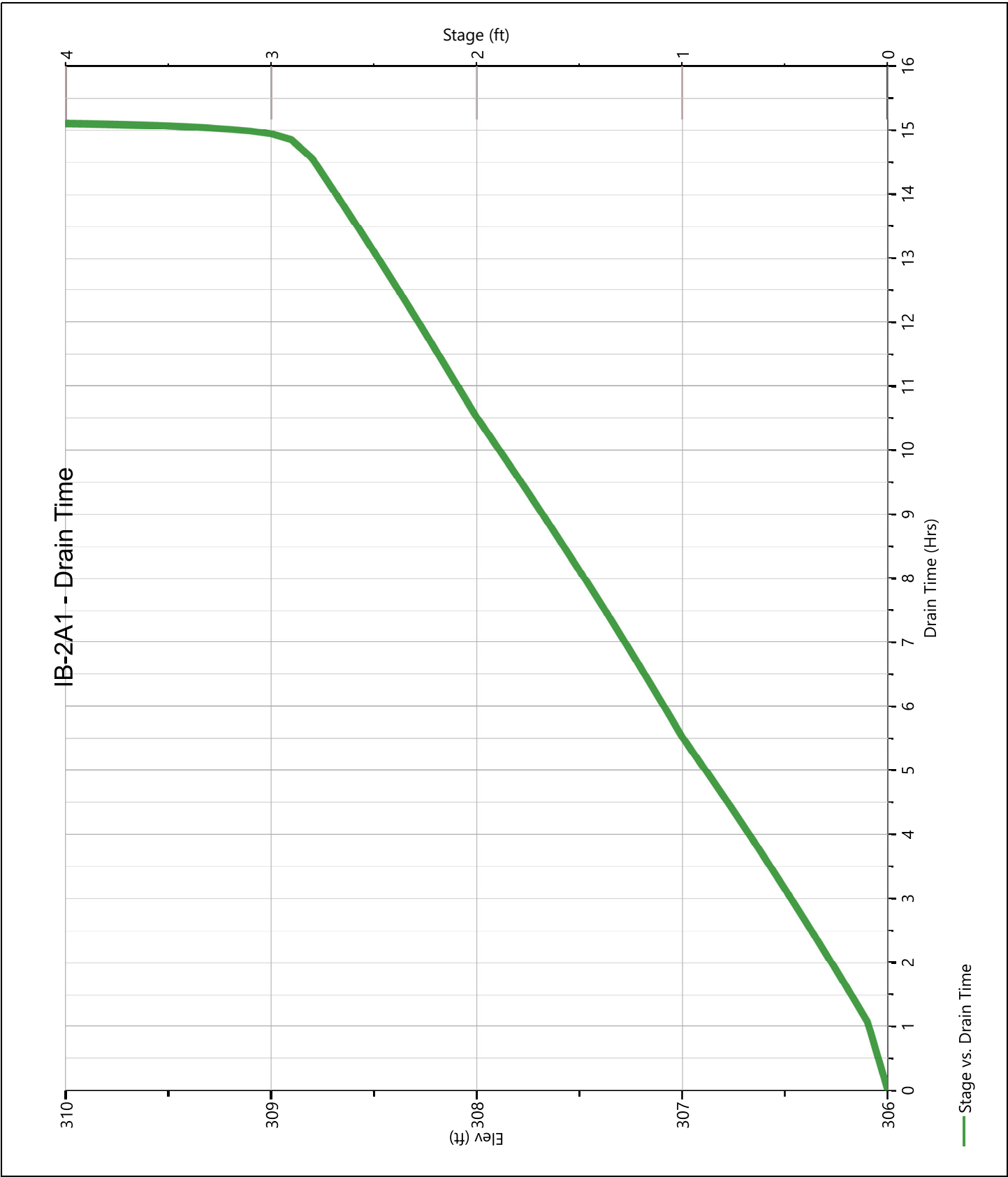
## Project Name:

10-27-2022

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

IB-2A1

Pond Drawdown



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A1**

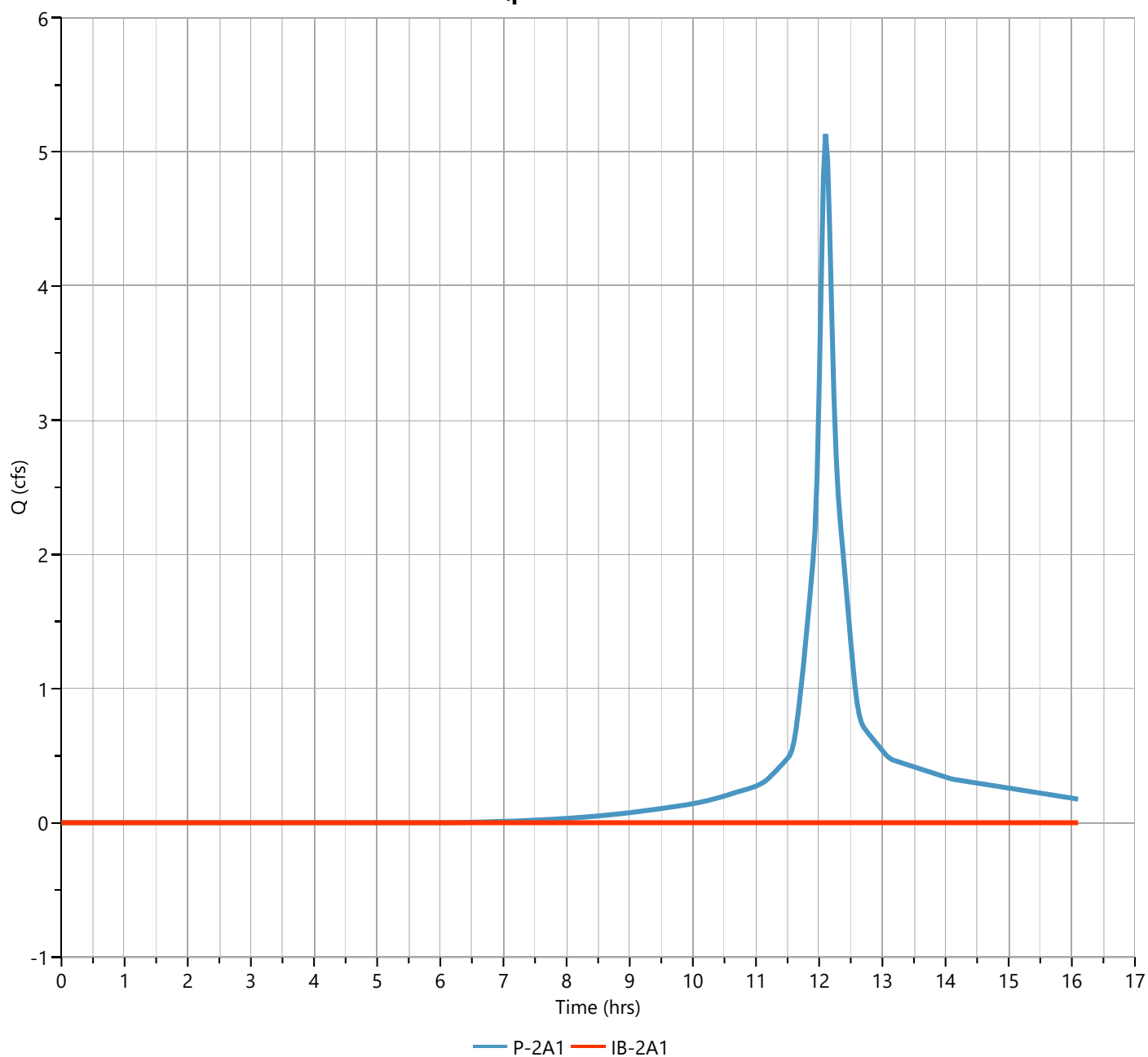
**Hyd. No. 23**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.001 cuft
Inflow Hydrograph	= 22 - P-2A1	Max. Elevation	= 308.02 ft
Pond Name	= IB-2A1	Max. Storage	= 9,142 cuft

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 1.14 hrs*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A1**

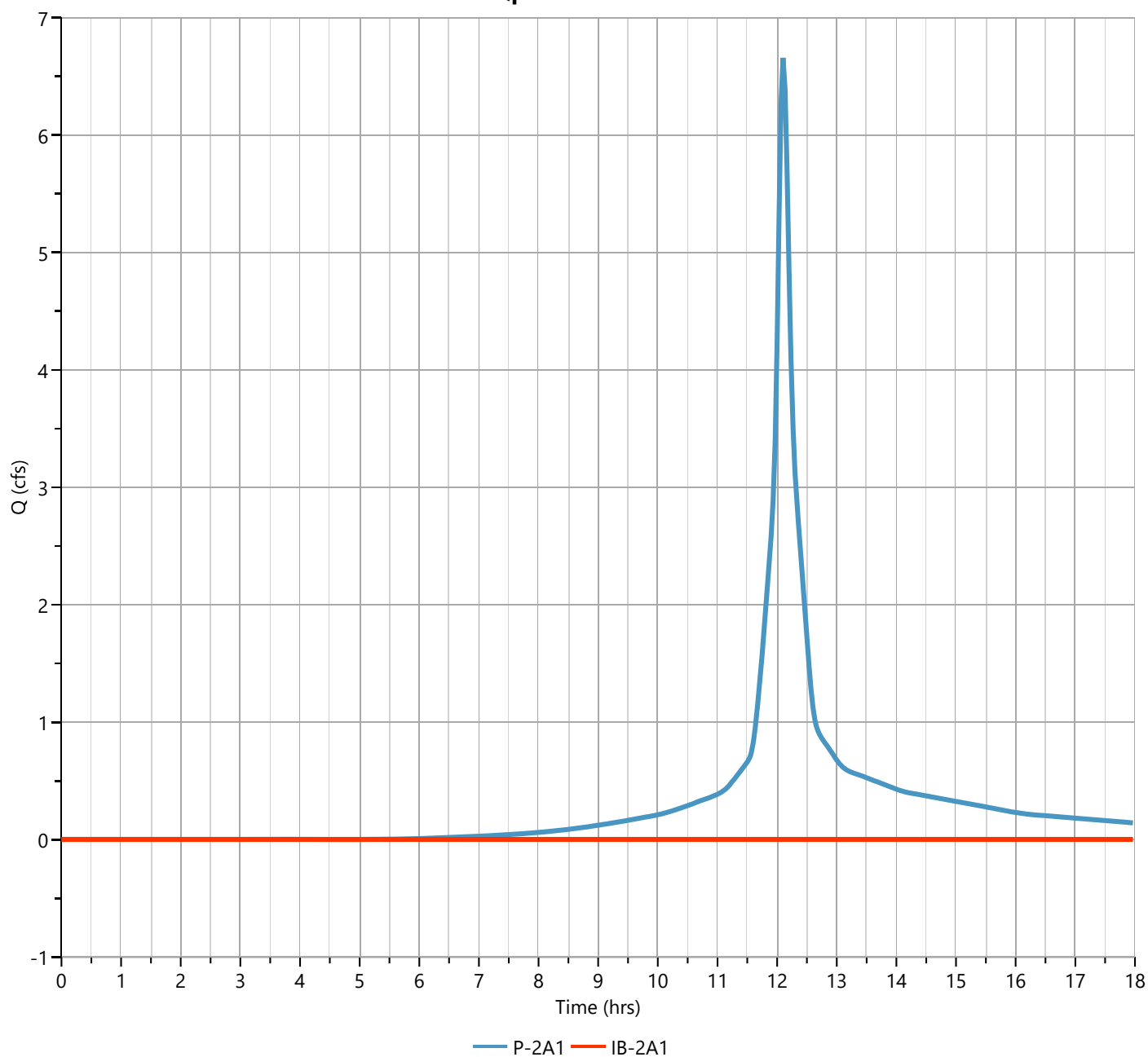
**Hyd. No. 23**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.001 cuft
Inflow Hydrograph	= 22 - P-2A1	Max. Elevation	= 308.65 ft
Pond Name	= IB-2A1	Max. Storage	= 12,760 cuft

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 2.04 hrs*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A1**

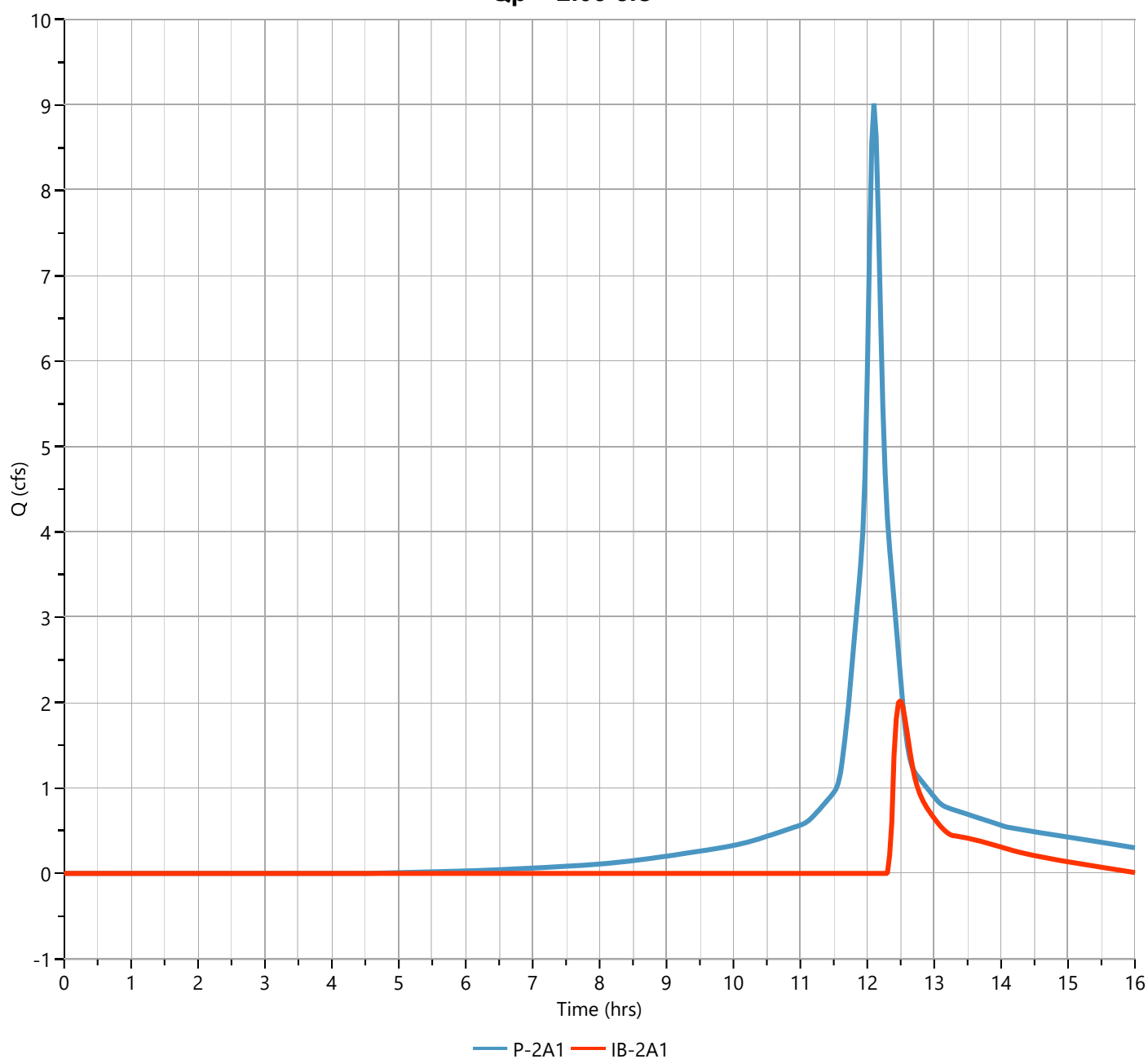
**Hyd. No. 23**

Hydrograph Type	= Pond Route	Peak Flow	= 2.026 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,471 cuft
Inflow Hydrograph	= 22 - P-2A1	Max. Elevation	= 308.99 ft
Pond Name	= IB-2A1	Max. Storage	= 14,669 cuft

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 0 min*

**Qp = 2.03 cfs**



# Pond Report

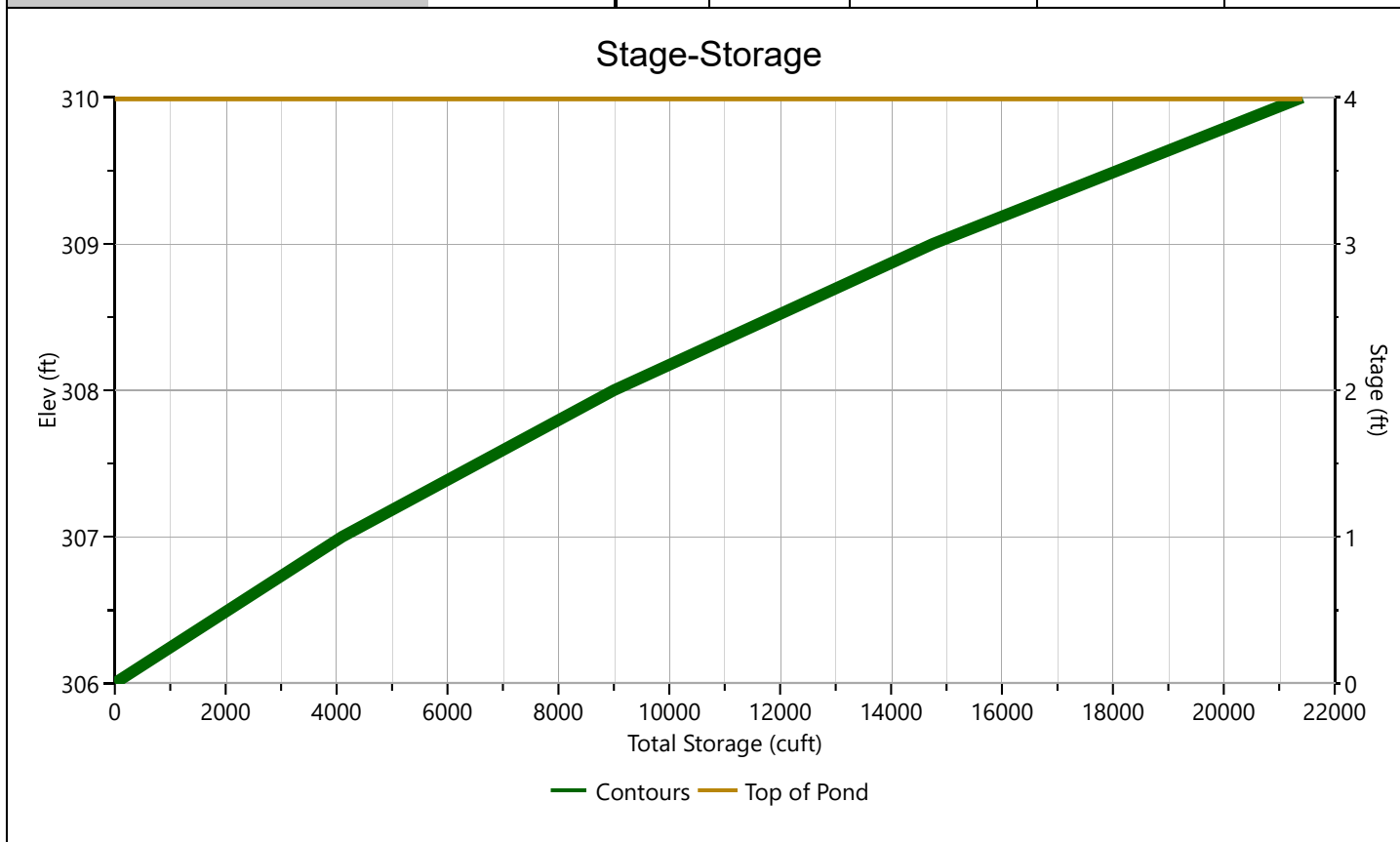
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2A1**

## Stage-Storage

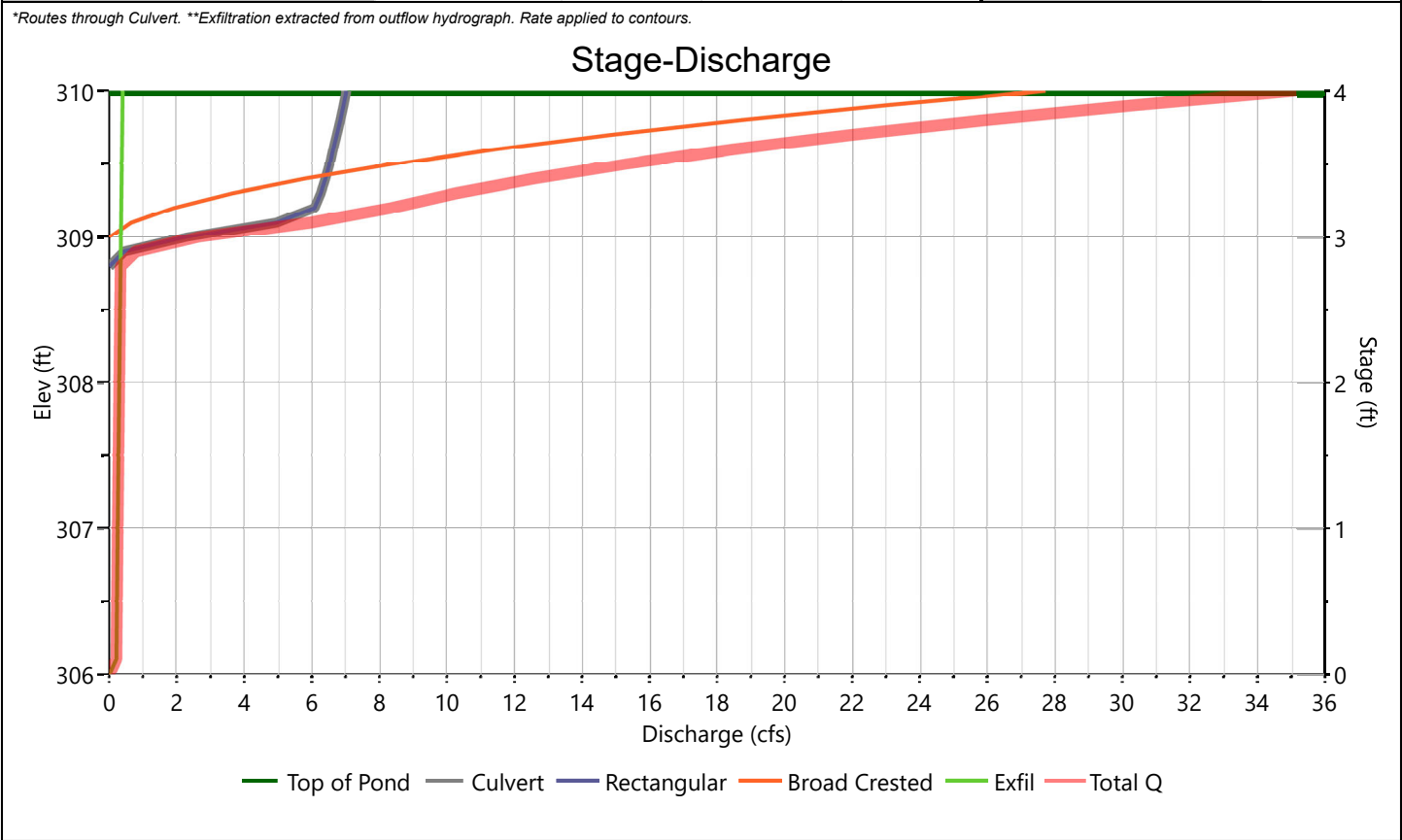
[illegible]

IB-2A1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	12				Hole Diameter, in	
Span, in	12				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	306.00				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	28					
Barrel Slope, %	3.6					
N-Value, n	0.012					
Weirs	Riser*	Weirs			Ancillary	
		1*	2	3		
Shape / Type	Circular	Rectangular		Broad Crested	Exfiltration, in/hr	2.41**
Crest Elevation, ft		308.85		309		
Crest Length, ft		12		6		
Angle, deg				18.4 (3:1)		
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 3.0.0.21

10-27-2022

**IB-2A1**

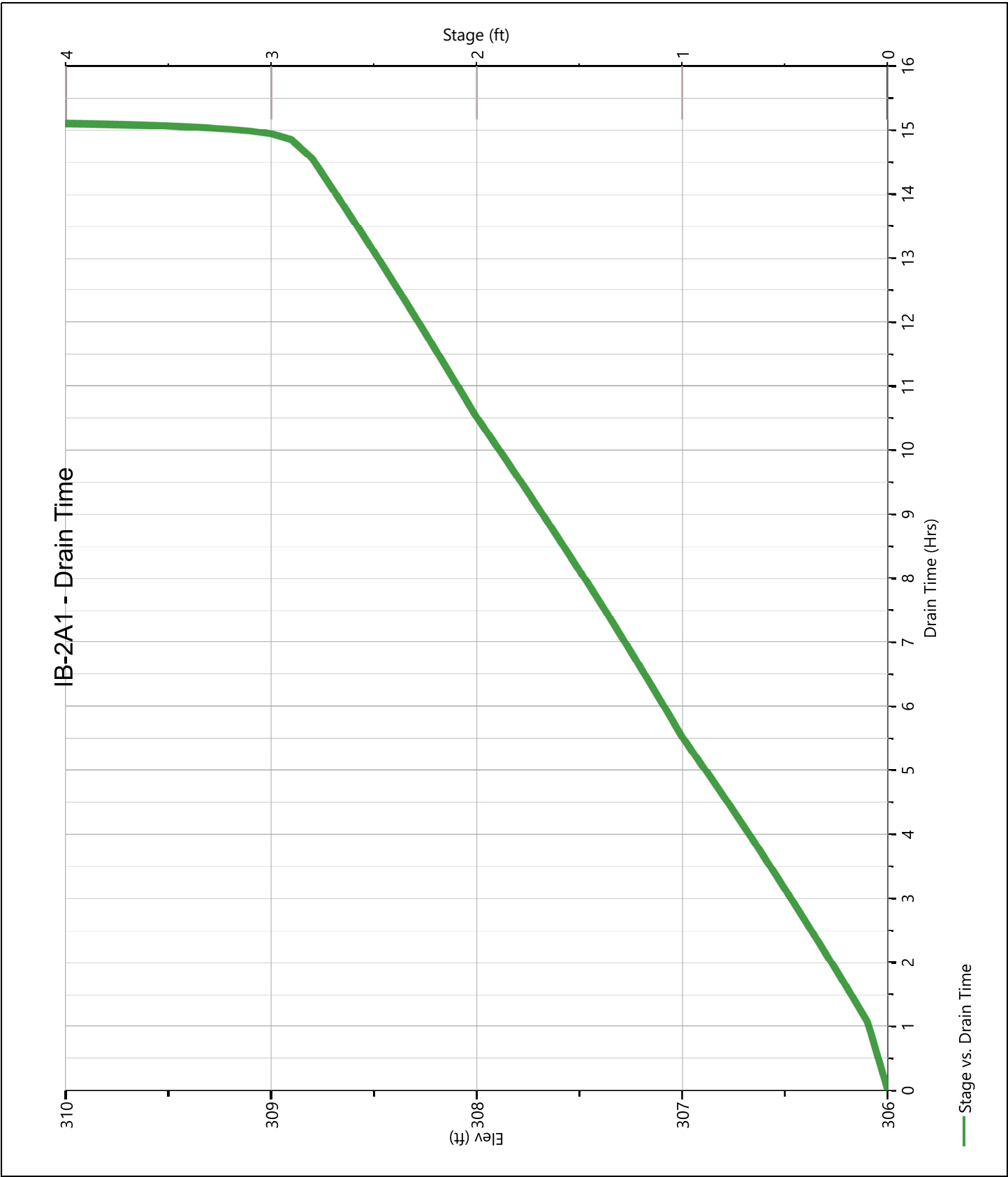
## Stage-Storage-Discharge Summary

[illegible]

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

IB-2A1

Pond Drawdown



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

Project: Athens Street By PFK Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☒ Developed Subcatchment P-2A3

**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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			3.35	100.50
A	Open Space	Good Condition	39			1.16	45.15
A	Open Space	Fair Condition	49			0.00	0.00
A	Woods-Grass Combination	Good Condition	32			0.00	0.00
A	Gravel		76			0.22	16.35
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
C	Open Space	Good Condition	77			0.62	47.74
C	Woods	Good Condition	70			5.20	364.14
C	Open Space	Fair Condition	79			0.00	0.00
C	Gravel		89			0.12	10.26
D	BVW		77			4.78	367.78
1/ Use only one CN source per line. 464358 Totals =						15.44	951.92

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{951.92}{15.44} = 61.67 ; \text{ Use CN} = \boxed{62}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.50	2.16	3.40

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 10/13/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date \_\_\_\_\_

Date \_\_\_\_\_

Circle one: 

Present	Developed
---------	-----------

Circle one: 

Tc	Tt
----	----

through  
subareaSubcatchment P-2A3Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.19  
11.5

# Hydrograph Report

Project Name:

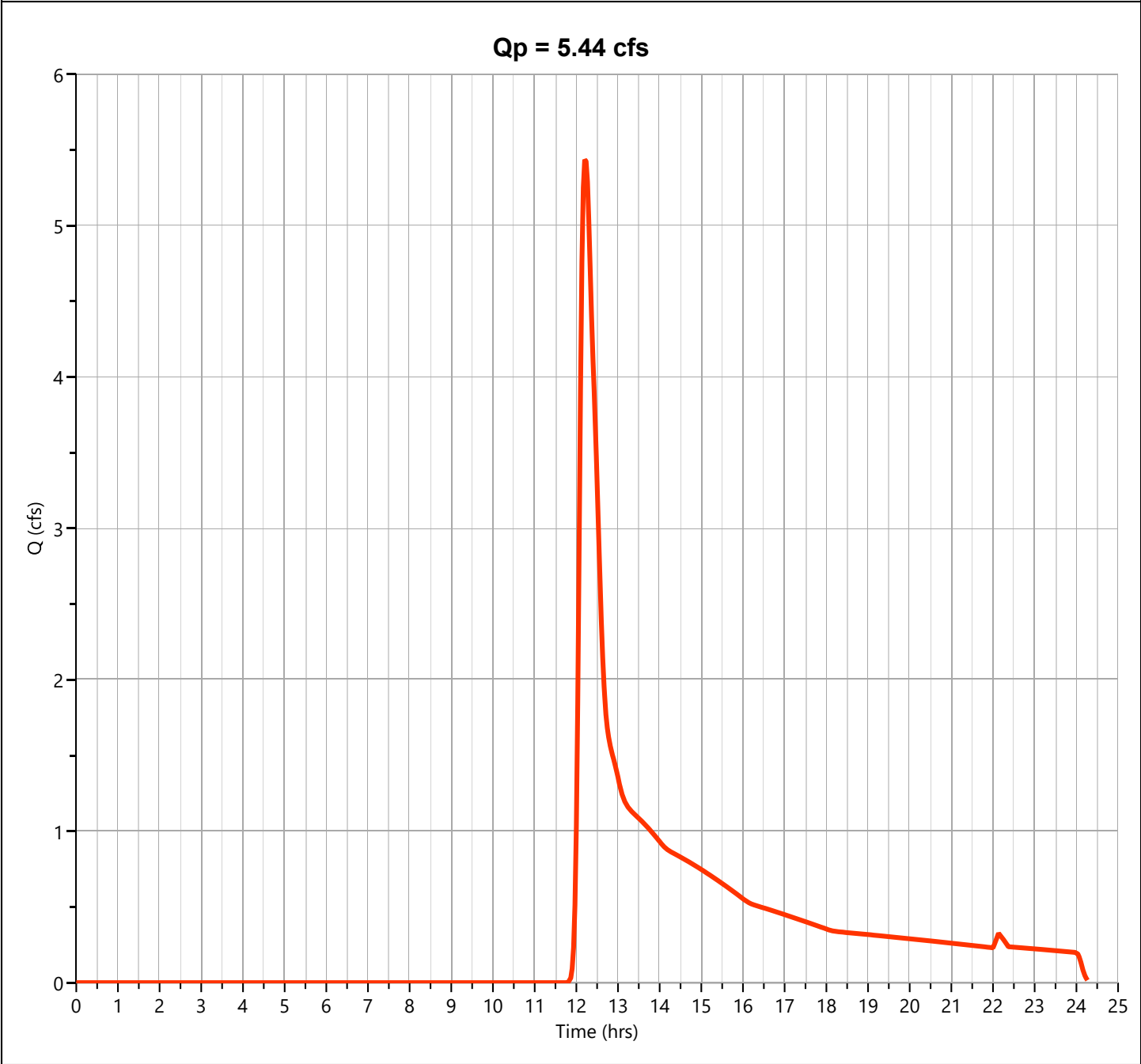
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A3

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.436 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 29,551 cuft
Drainage Area	= 15.44 ac	Curve Number	= 62
Tc Method	= User	Time of Conc. (Tc)	= 11.5 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

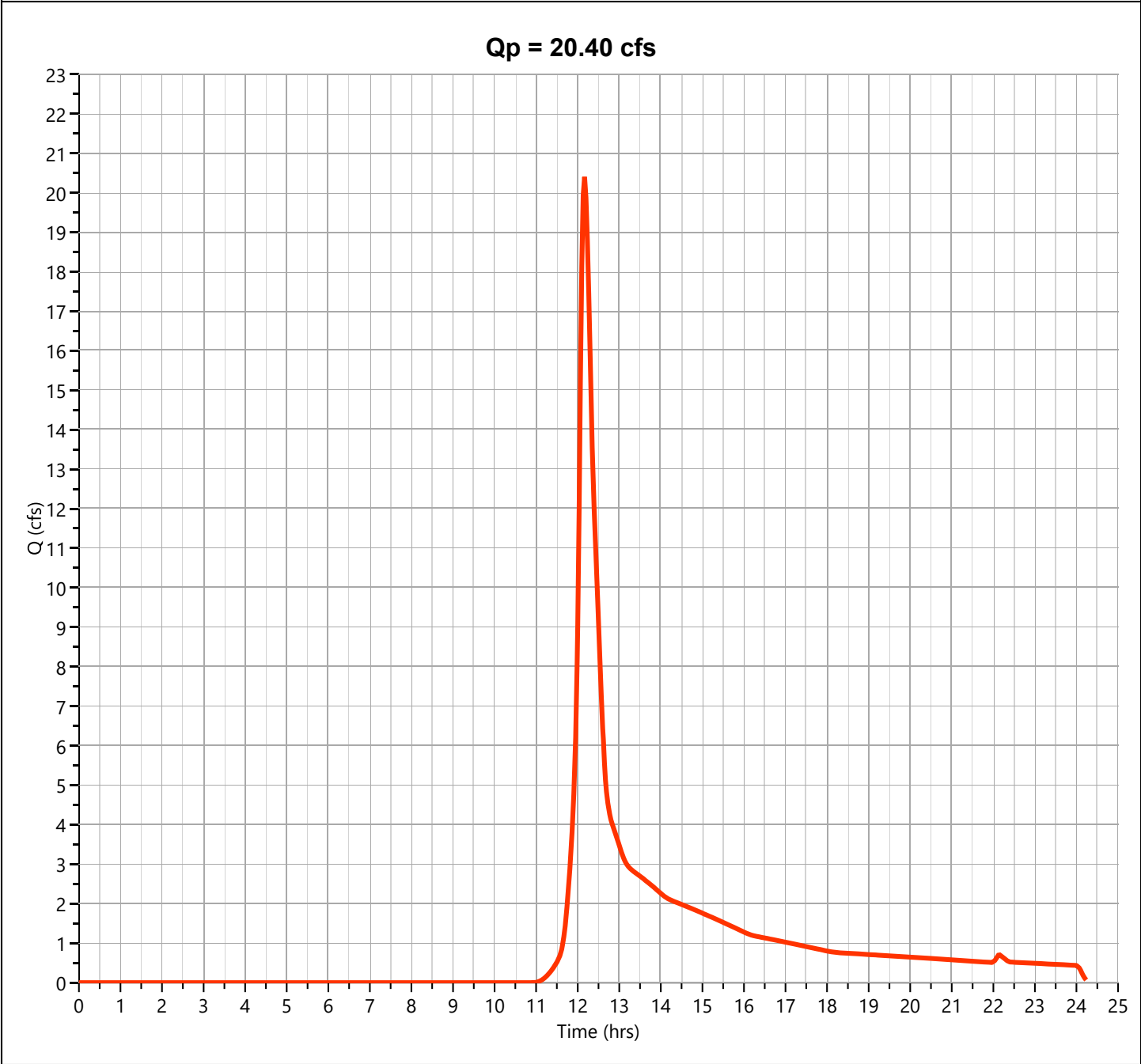
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A3

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.40 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 84,566 cuft
Drainage Area	= 15.44 ac	Curve Number	= 62
Tc Method	= User	Time of Conc. (Tc)	= 11.5 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

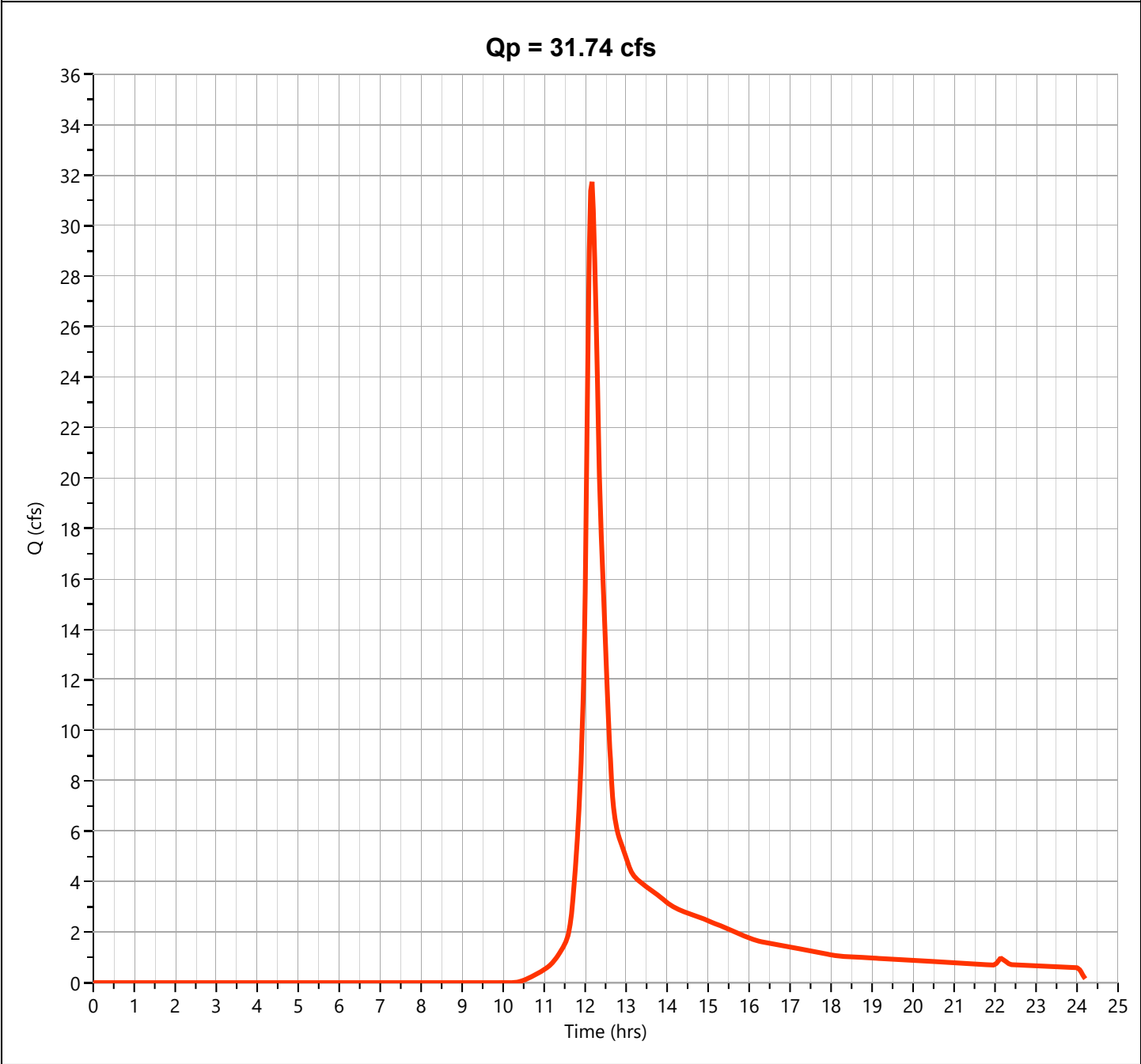
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A3

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 31.74 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 126,394 cuft
Drainage Area	= 15.44 ac	Curve Number	= 62
Tc Method	= User	Time of Conc. (Tc)	= 11.5 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

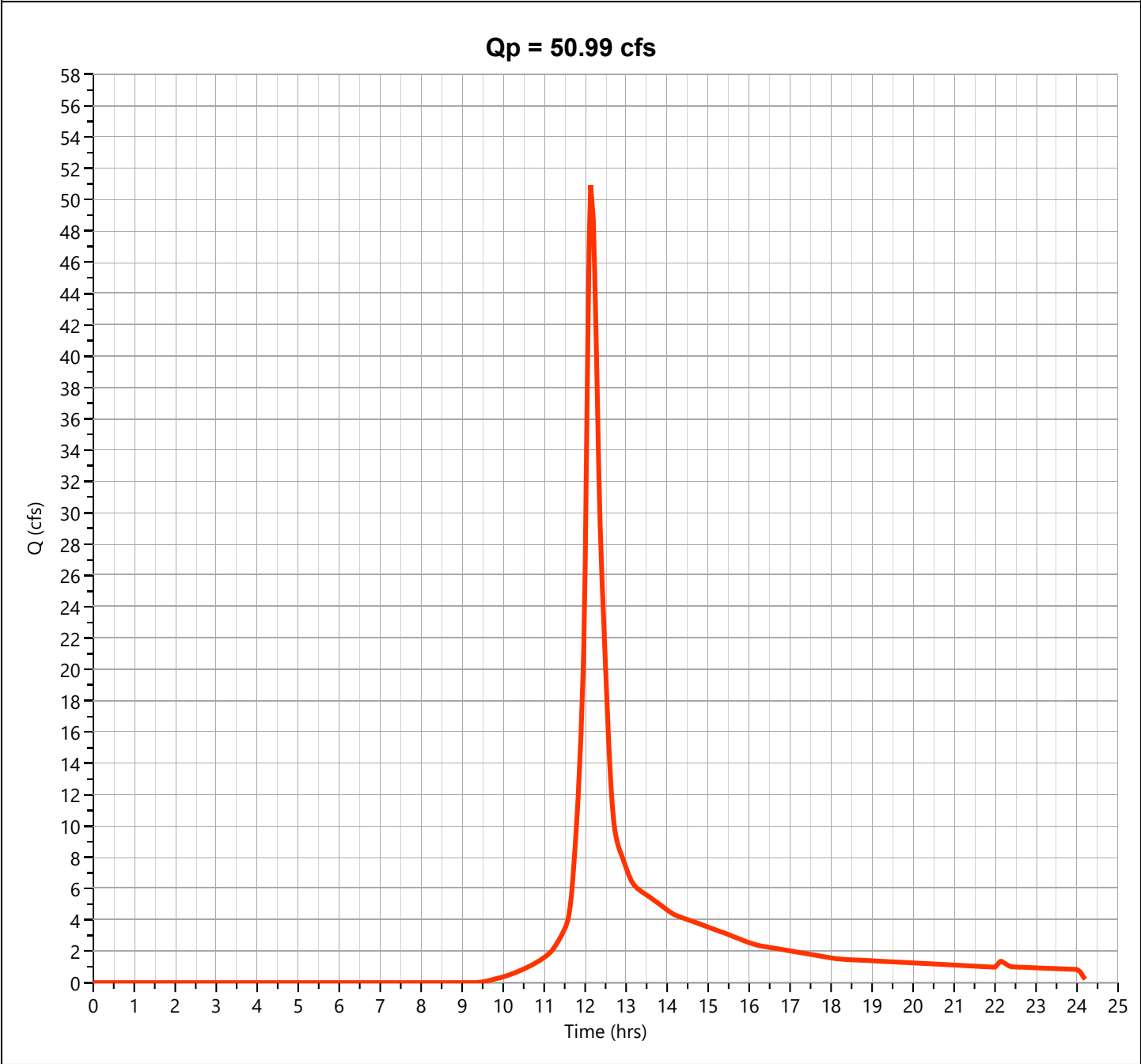
Hydrology Studio v 3.0.0.21

10-27-2022

P-2A3

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 50.99 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 198,423 cuft
Drainage Area	= 15.44 ac	Curve Number	= 62
Tc Method	= User	Time of Conc. (Tc)	= 11.5 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484





# Hydrograph Report

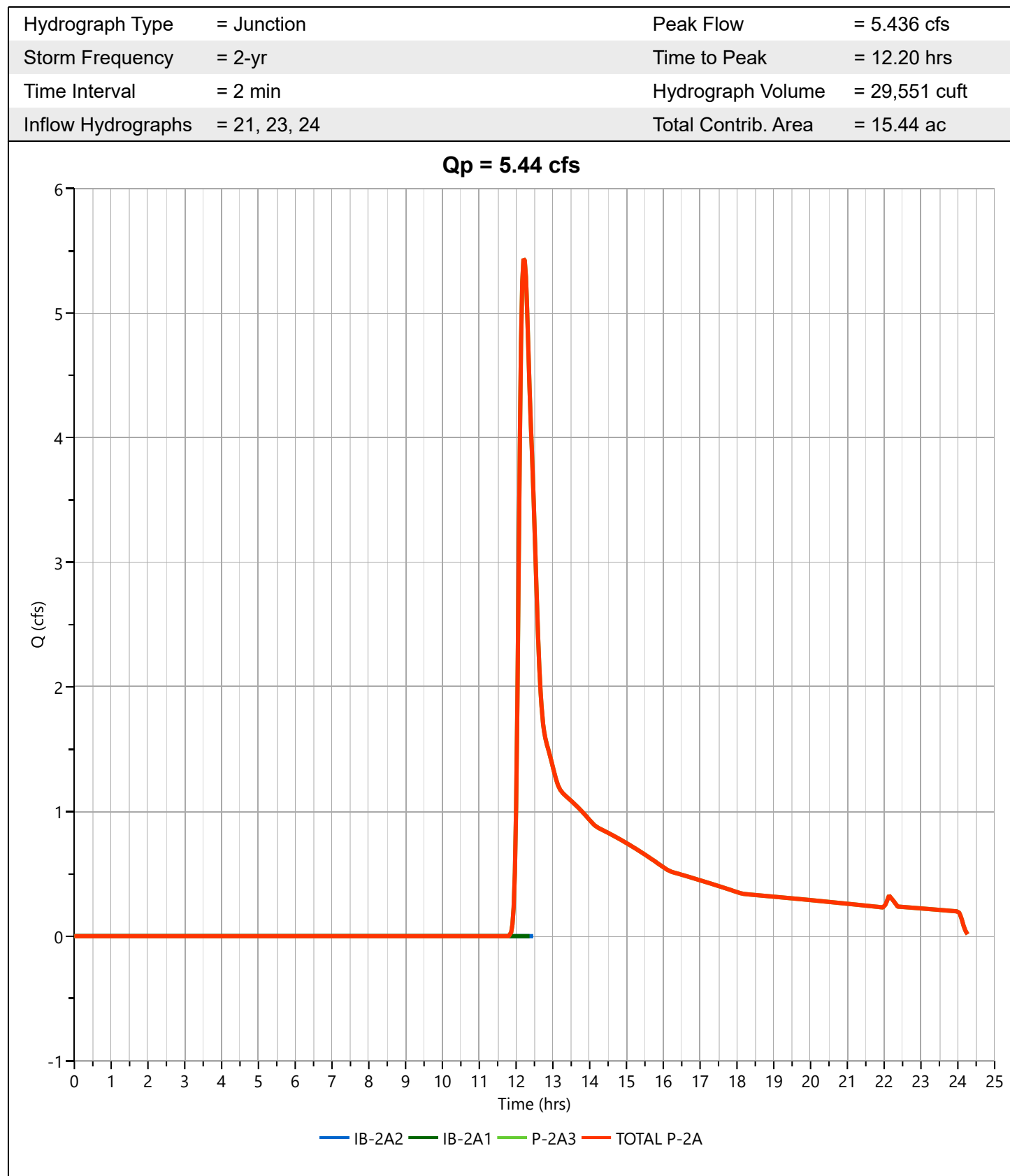
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## TOTAL P-2A

Hyd. No. 25



# Hydrograph Report

Project Name:

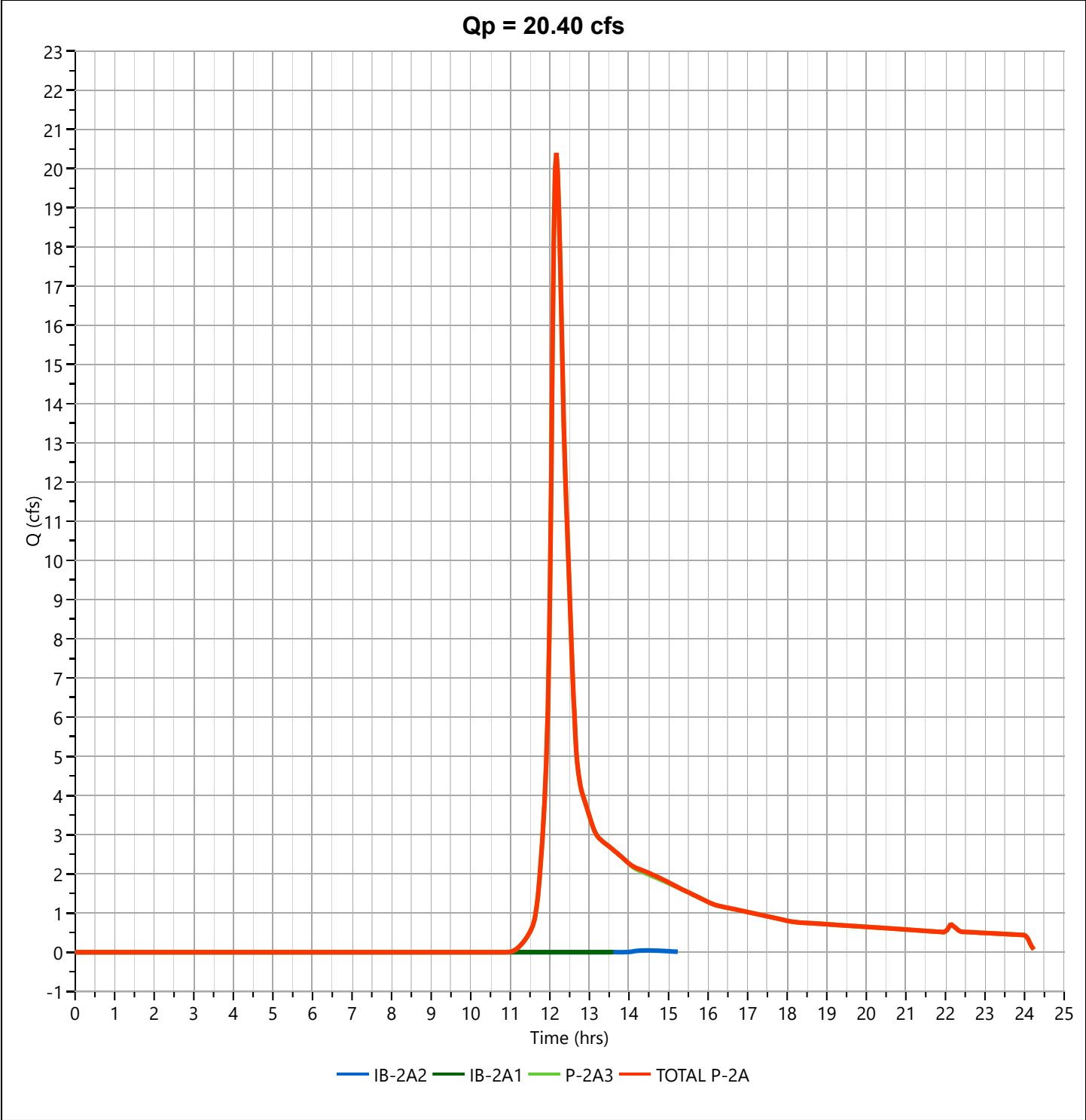
Hydrology Studio v 3.0.0.21

10-27-2022

## TOTAL P-2A

Hyd. No. 25

Hydrograph Type	= Junction	Peak Flow	= 20.40 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 84,699 cuft
Inflow Hydrographs	= 21, 23, 24	Total Contrib. Area	= 15.44 ac



# Hydrograph Report

Project Name:

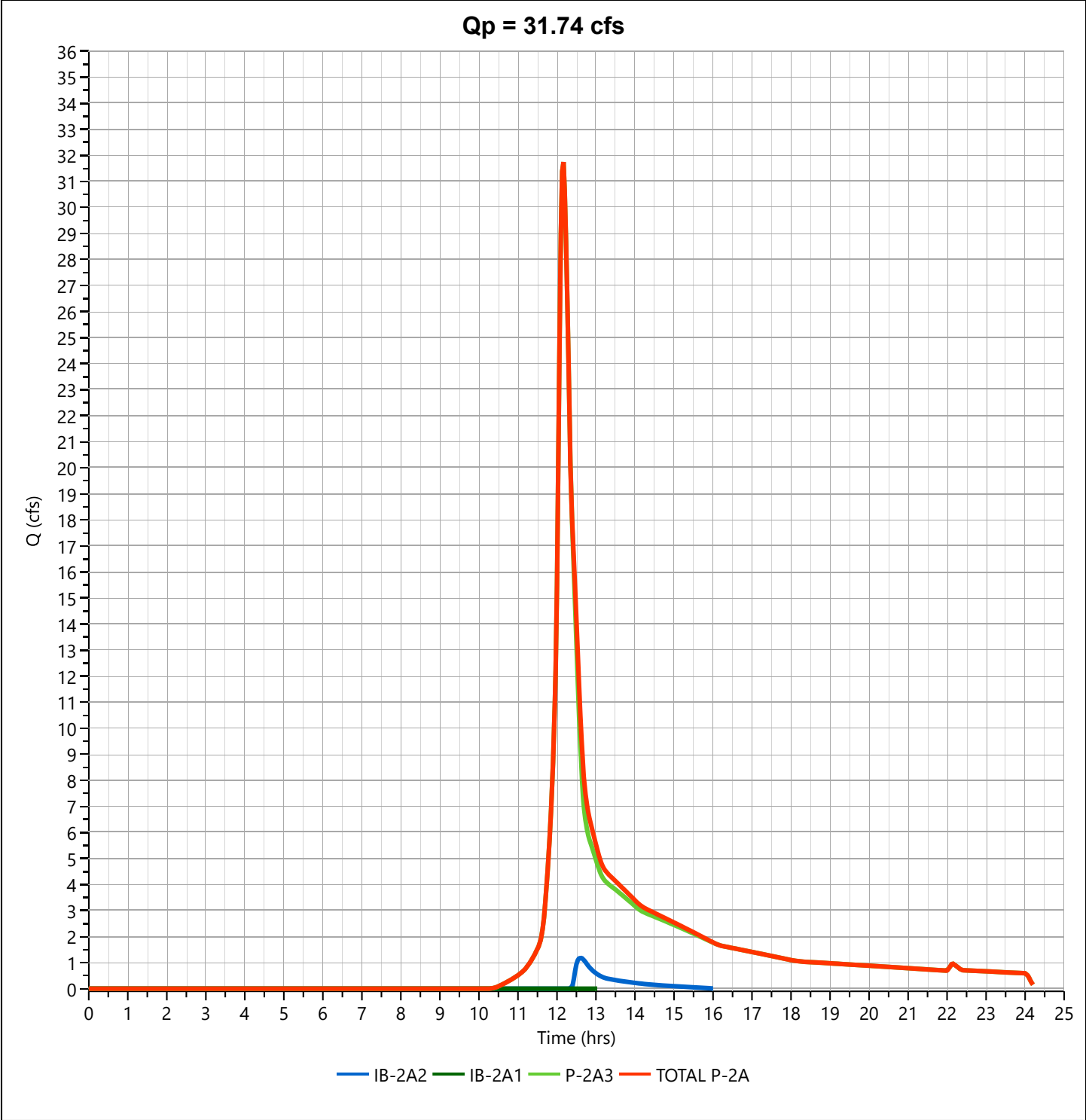
Hydrology Studio v 3.0.0.21

10-27-2022

## TOTAL P-2A

## Hyd. No. 25

Hydrograph Type	= Junction	Peak Flow	= 31.74 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 130,257 cuft
Inflow Hydrographs	= 21, 23, 24	Total Contrib. Area	= 15.44 ac



# Hydrograph Report

Project Name:

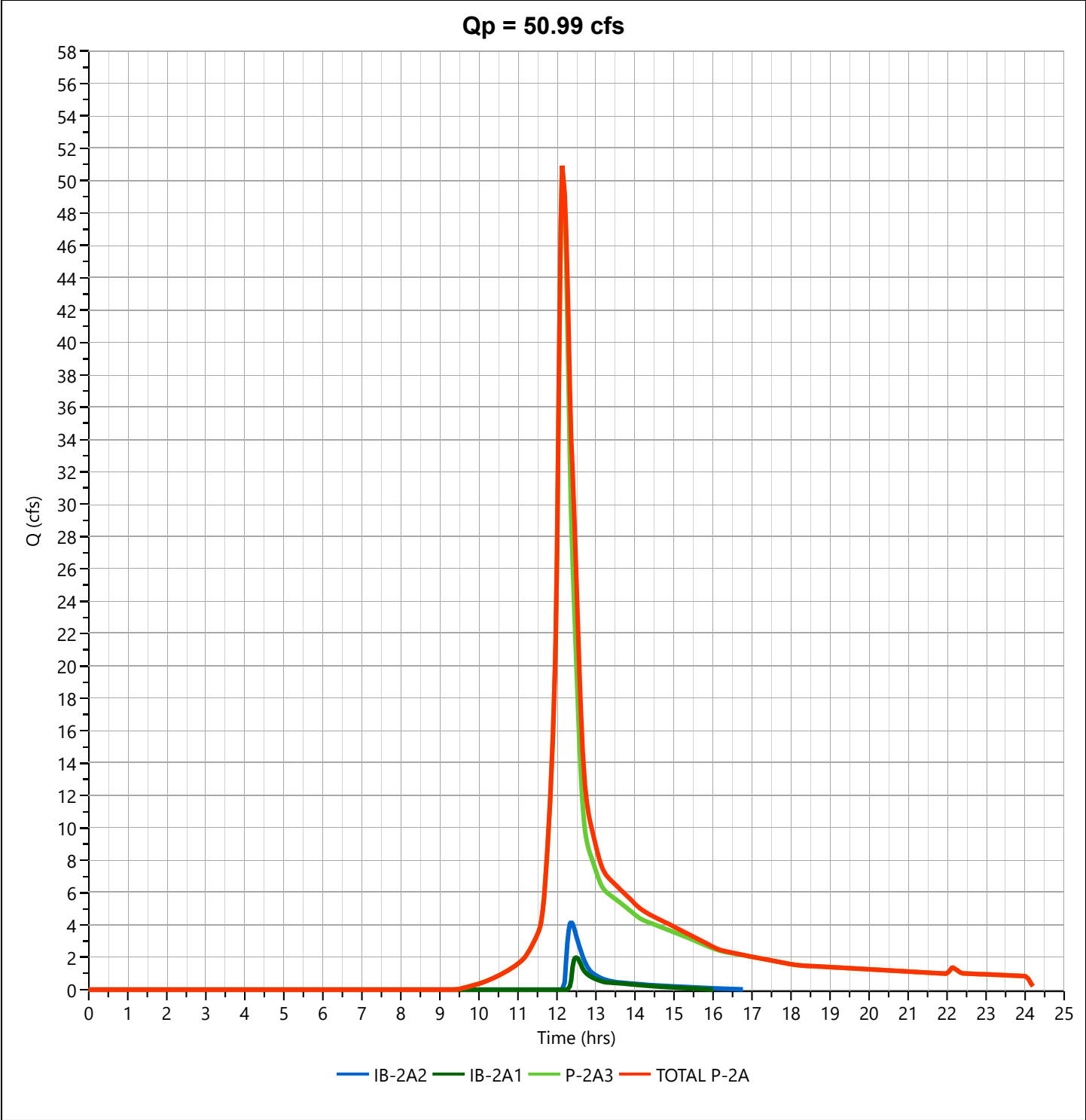
Hydrology Studio v 3.0.0.21

10-27-2022

## TOTAL P-2A

## Hyd. No. 25

Hydrograph Type	= Junction	Peak Flow	= 50.99 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 214,146 cuft
Inflow Hydrographs	= 21, 23, 24	Total Contrib. Area	= 15.44 ac



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

Project: Athens Street By NC Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☒ Developed Subcatchment P-2B-A

**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/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious	98			0.81	79.01
A	Woods Good Condition	30			0.02	0.52
A	Open Space Good Condition	39			2.16	84.26
A	Open Space Fair Condition	49			0.00	0.00
C	Gravel	89			0.07	5.95
C	Woods Good Condition	70			0.79	55.42
C	Open Space Poor Condition	86			0.00	0.00
C	Open Space Good Condition	74			1.68	124.64
Totals =					5.53	349.81

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{349.81}{5.53} = 63.29 ; \text{ Use CN} = \boxed{63}$$

**2. Runoff**

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.56	2.30	3.58

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 10/13/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date \_\_\_\_\_

Date \_\_\_\_\_

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-2B-ASheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr

0.21

min

12.4

# Hydrograph Report

Project Name:

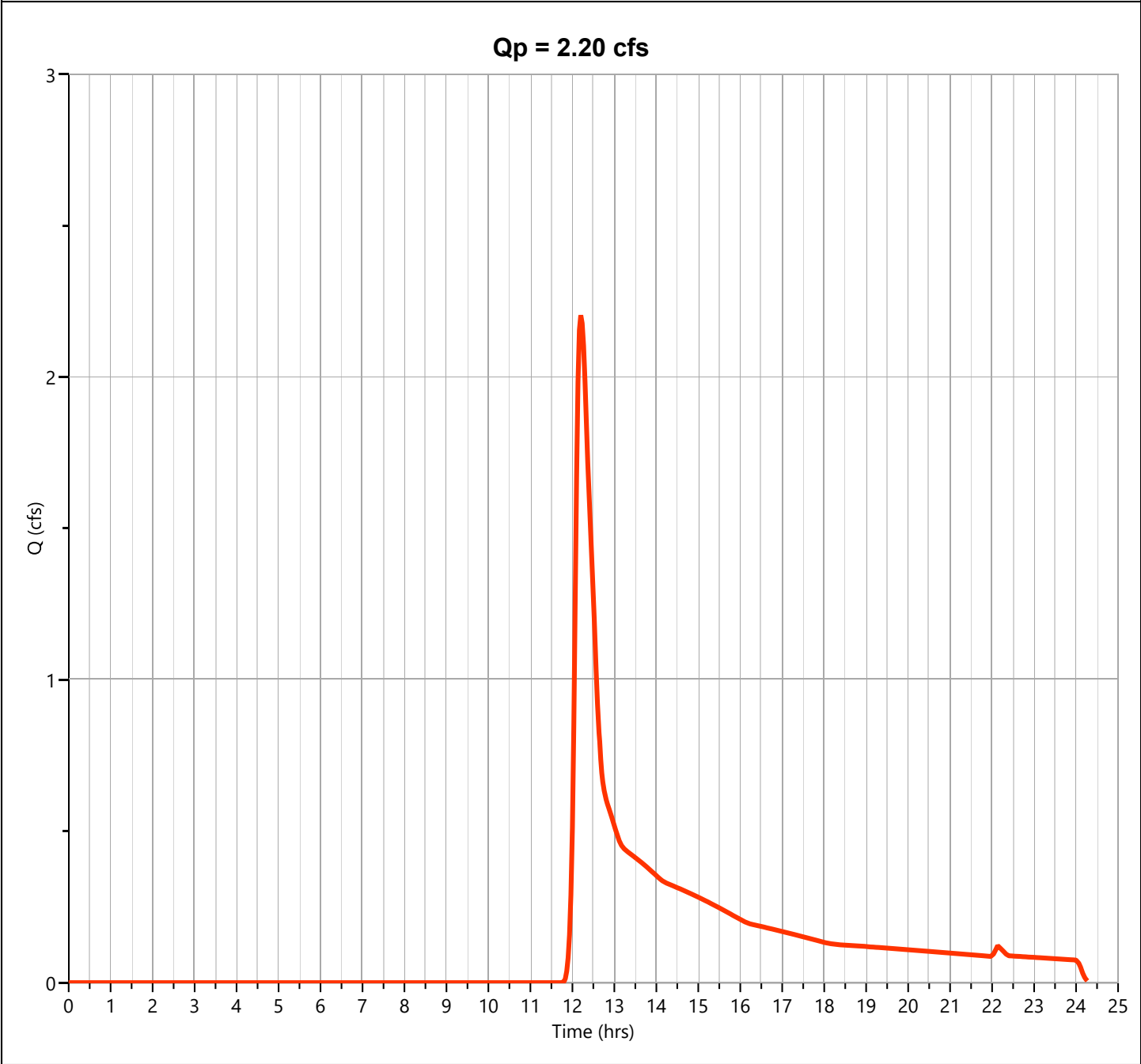
Hydrology Studio v 3.0.0.21

10-27-2022

P-2B-A

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.204 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 11,406 cuft
Drainage Area	= 5.53 ac	Curve Number	= 63
Tc Method	= User	Time of Conc. (Tc)	= 12.4 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

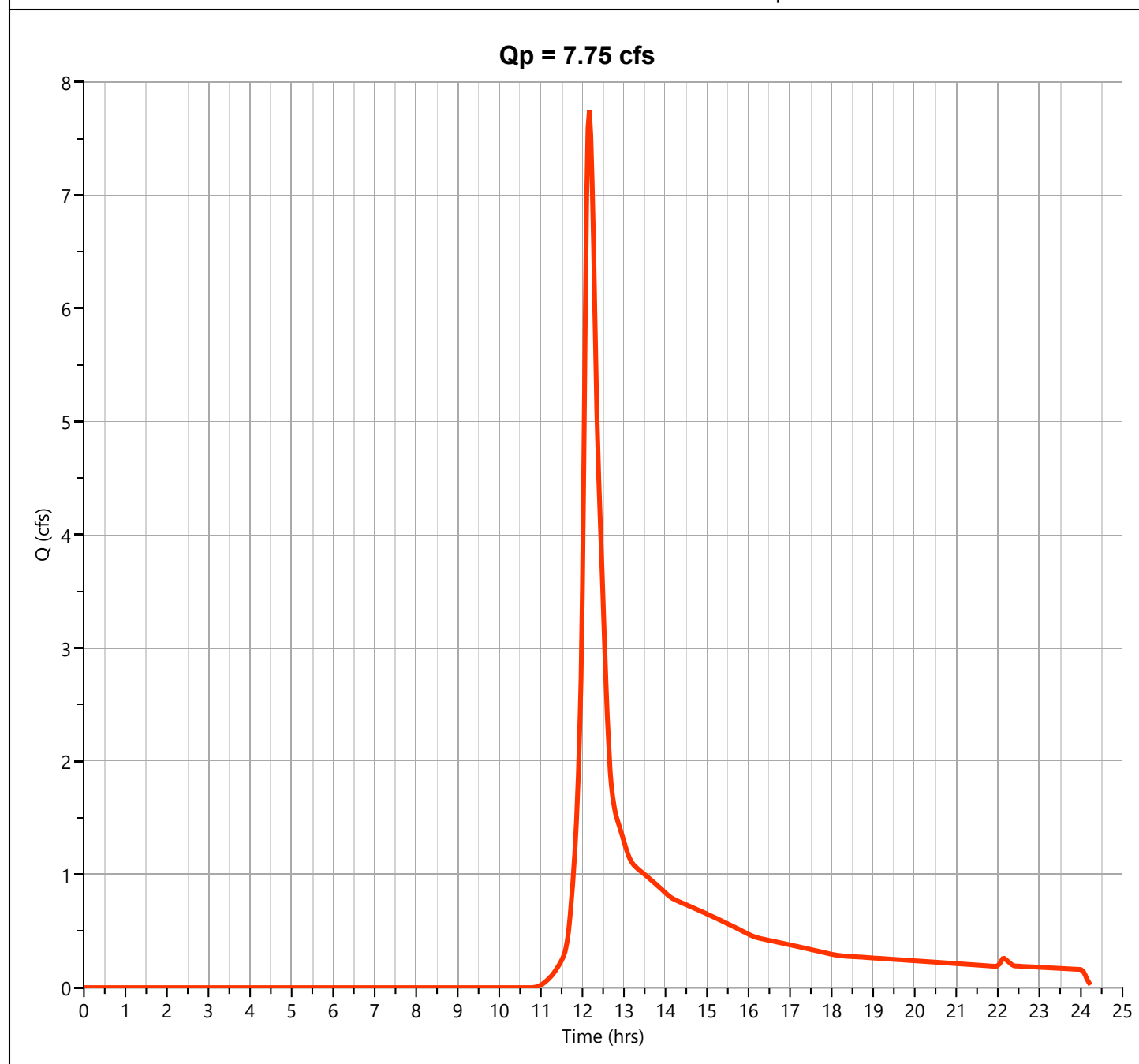
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2B-A**

**Hyd. No. 27**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.748 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 31,761 cuft
Drainage Area	= 5.53 ac	Curve Number	= 63
Tc Method	= User	Time of Conc. (Tc)	= 12.4 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484





# Hydrograph Report

Project Name:

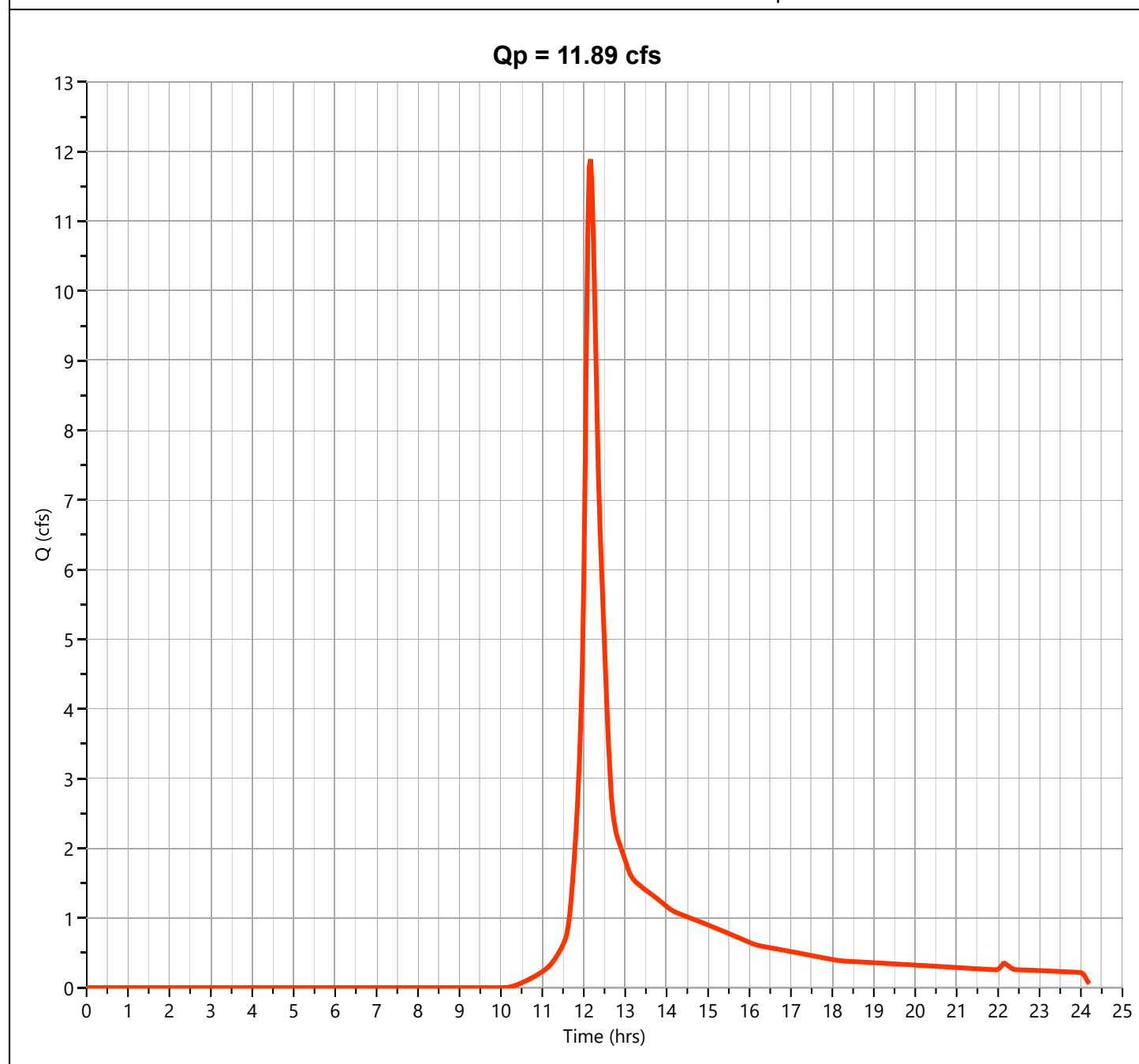
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2B-A**

**Hyd. No. 27**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.89 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 47,091 cuft
Drainage Area	= 5.53 ac	Curve Number	= 63
Tc Method	= User	Time of Conc. (Tc)	= 12.4 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

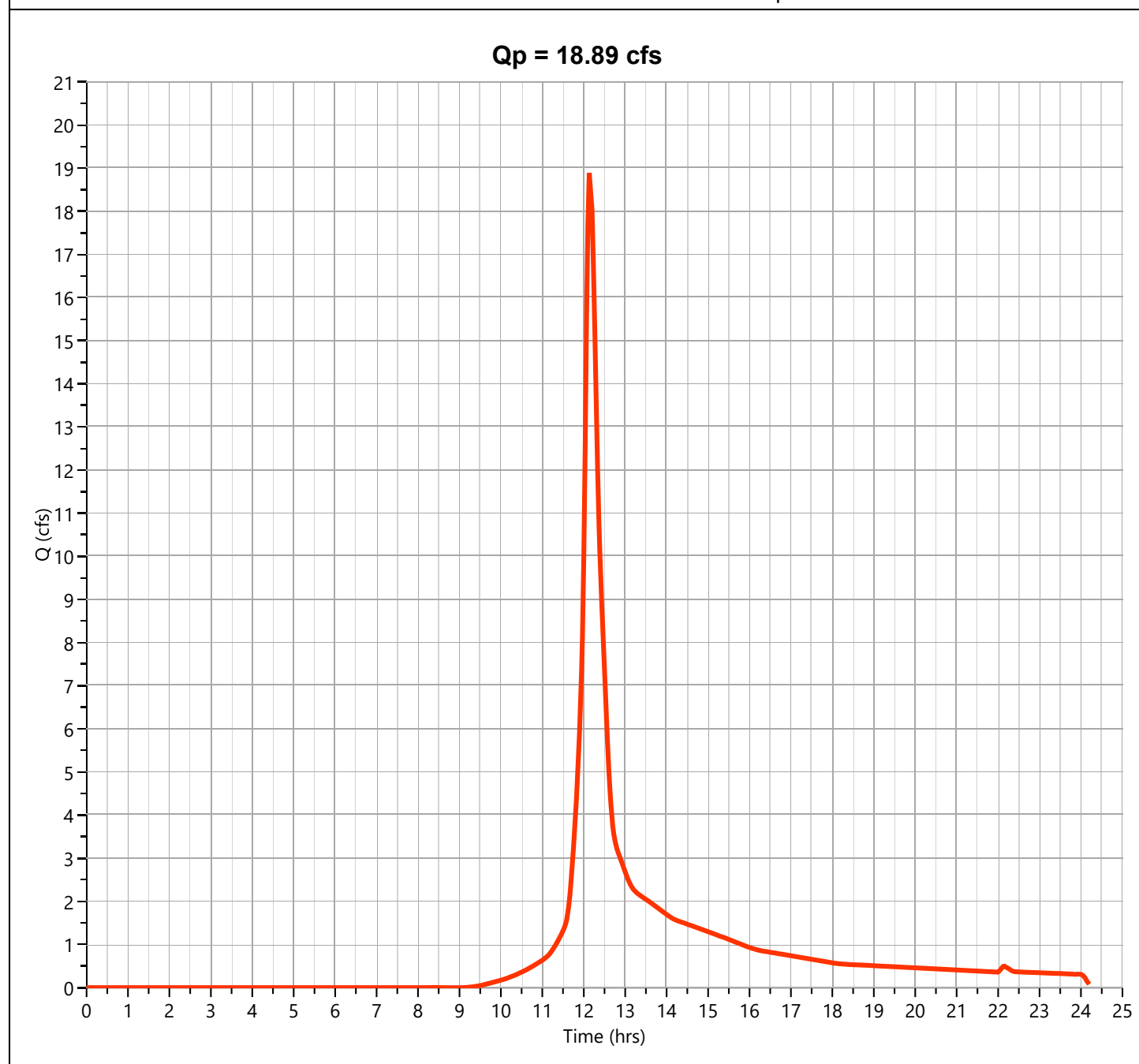
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2B-A**

**Hyd. No. 27**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 73,351 cuft
Drainage Area	= 5.53 ac	Curve Number	= 63
Tc Method	= User	Time of Conc. (Tc)	= 12.4 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 PFK Date 6/21/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			1.03	101.00
A	Woods	Good Condition	30			0.00	0.00
A	Open Space	Good Condition	39			0.28	10.87
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			0.89	62.57
D	Open Space	Good Condition	80			0.00	0.00
1/ Use only one CN source per line. 95975 Totals =						2.20	174.45

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{174.45}{2.20} = 79.18 ; \text{ Use CN} = \boxed{79}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.40	3.82	5.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-5DSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.11  
6.7

# Hydrograph Report

Project Name:

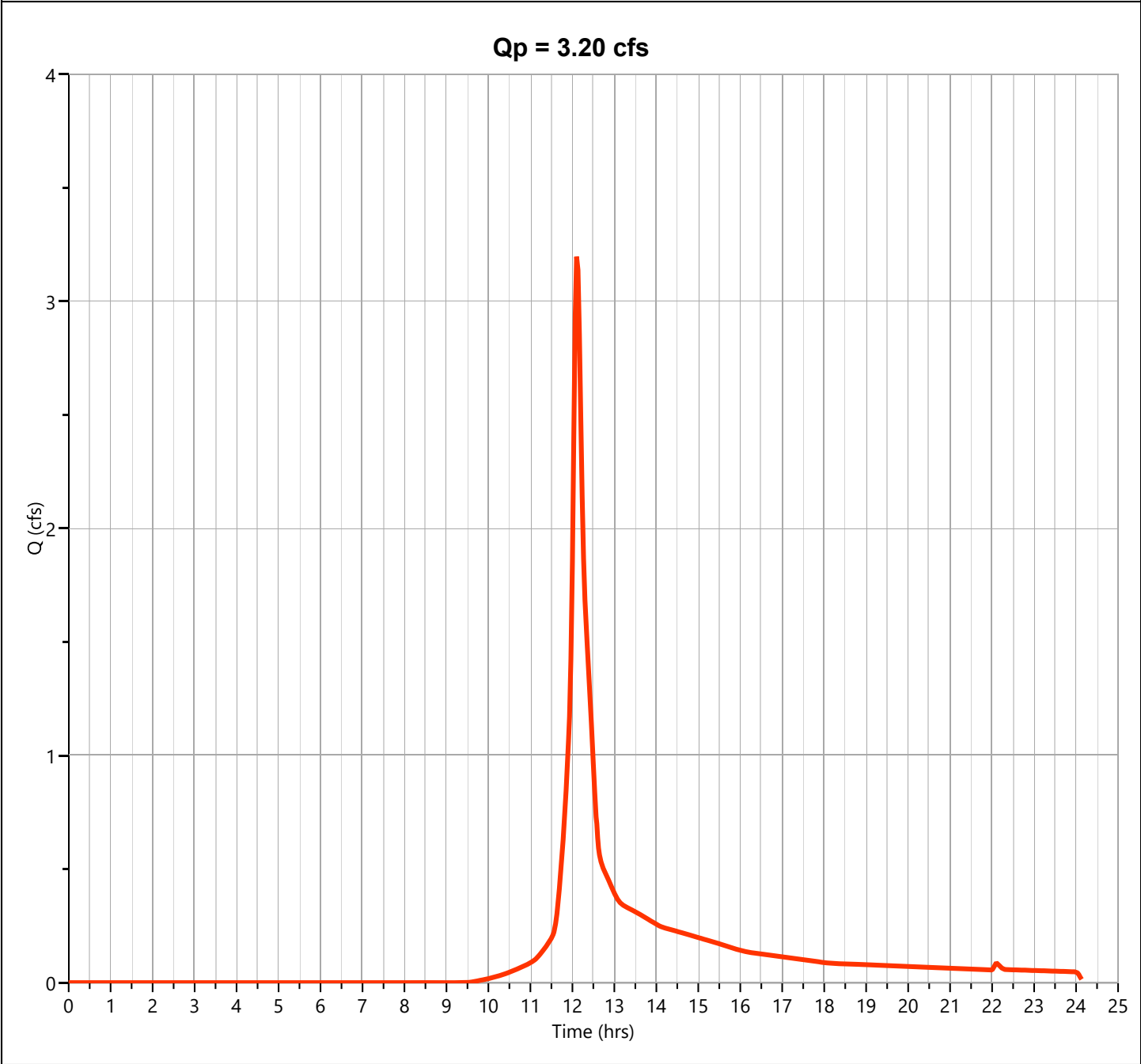
Hydrology Studio v 3.0.0.21

10-27-2022

P-5D

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.197 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 11,097 cuft
Drainage Area	= 2.2 ac	Curve Number	= 79
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:

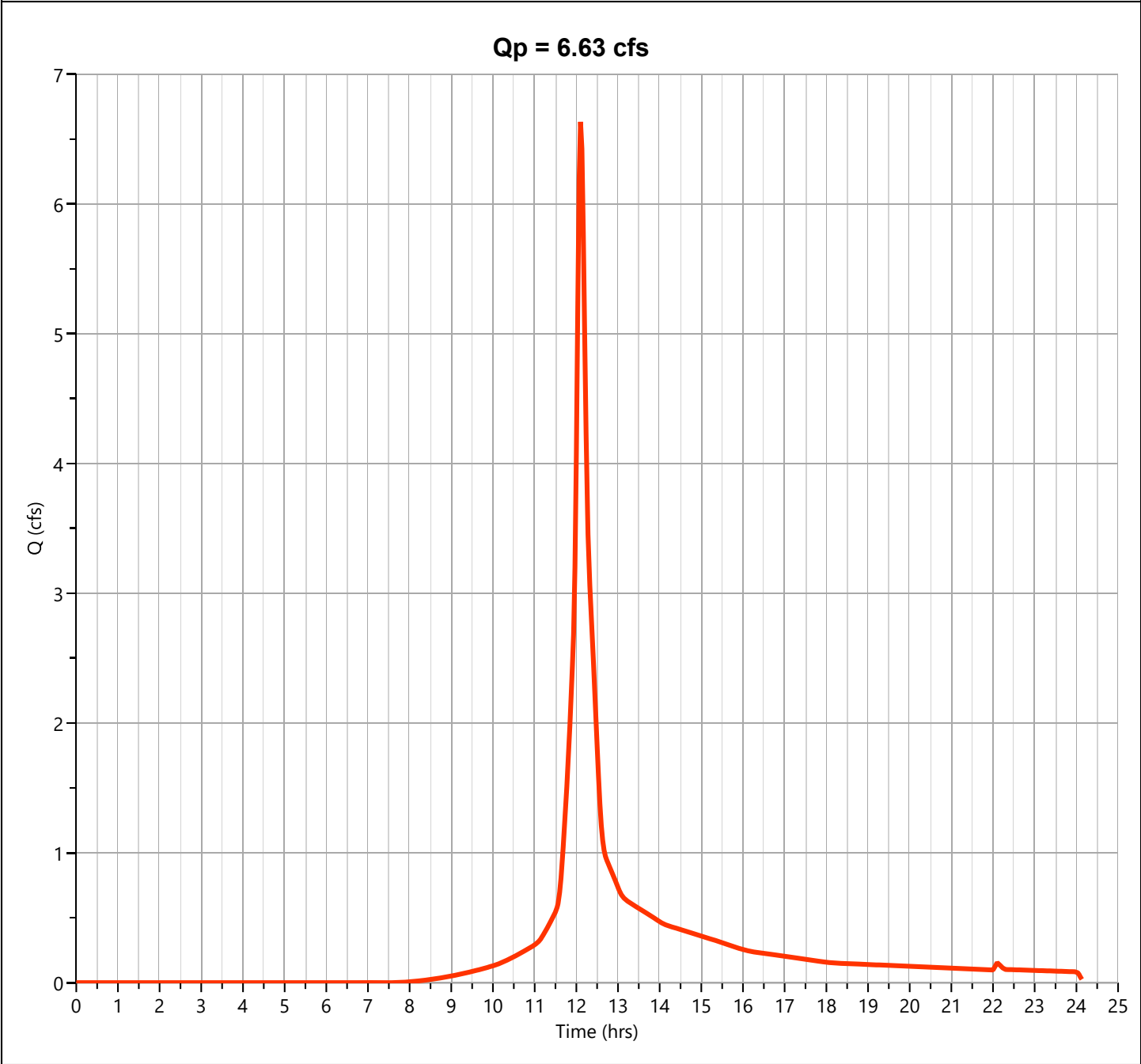
Hydrology Studio v 3.0.0.21

10-27-2022

P-5D

Hyd. No. 28

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.634 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 22,649 cuft
Drainage Area	= 2.2 ac	Curve Number	= 79
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:

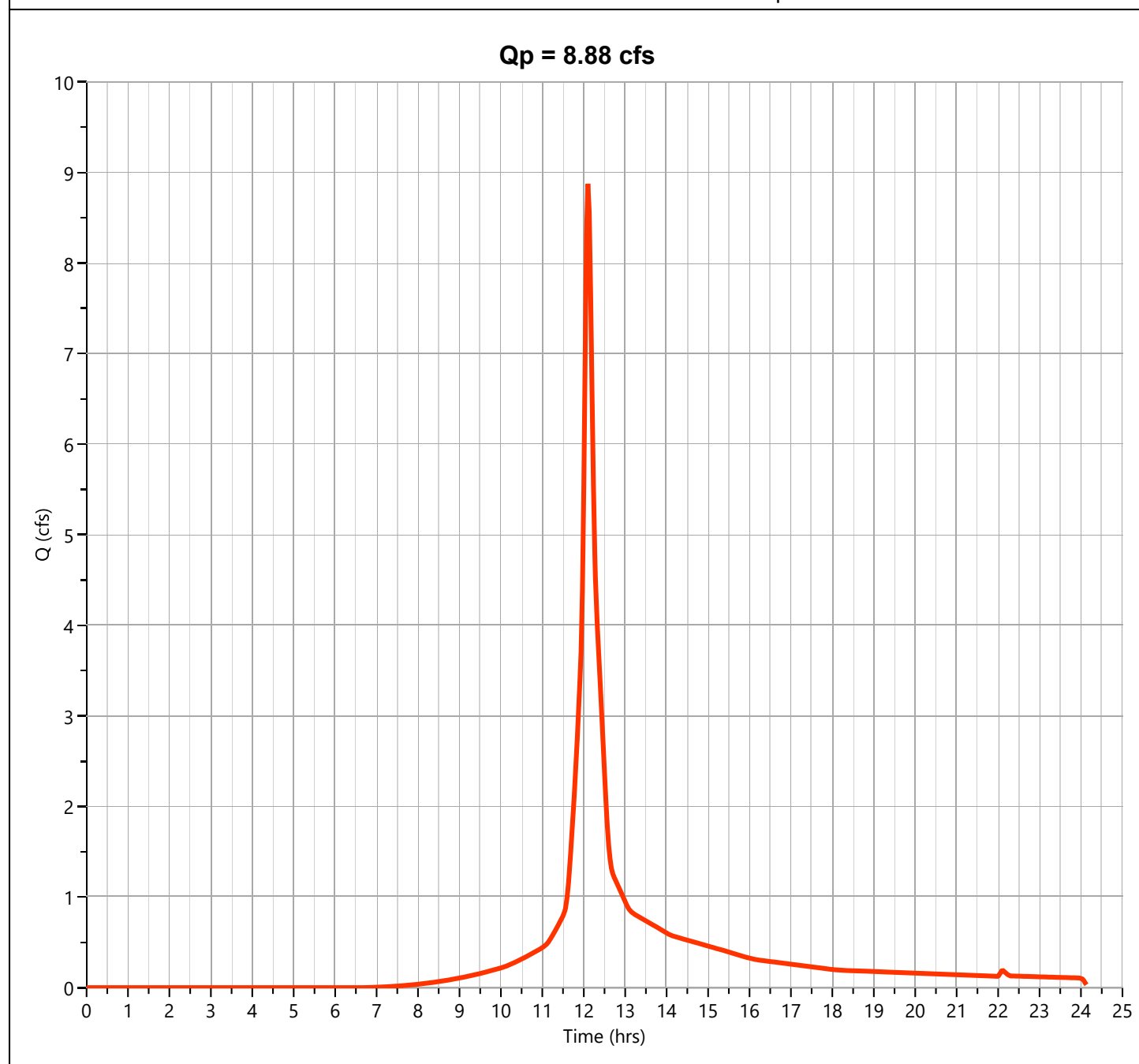
Hydrology Studio v 3.0.0.21

10-27-2022

**P-5D**

**Hyd. No. 28**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.876 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 30,386 cuft
Drainage Area	= 2.2 ac	Curve Number	= 79
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:

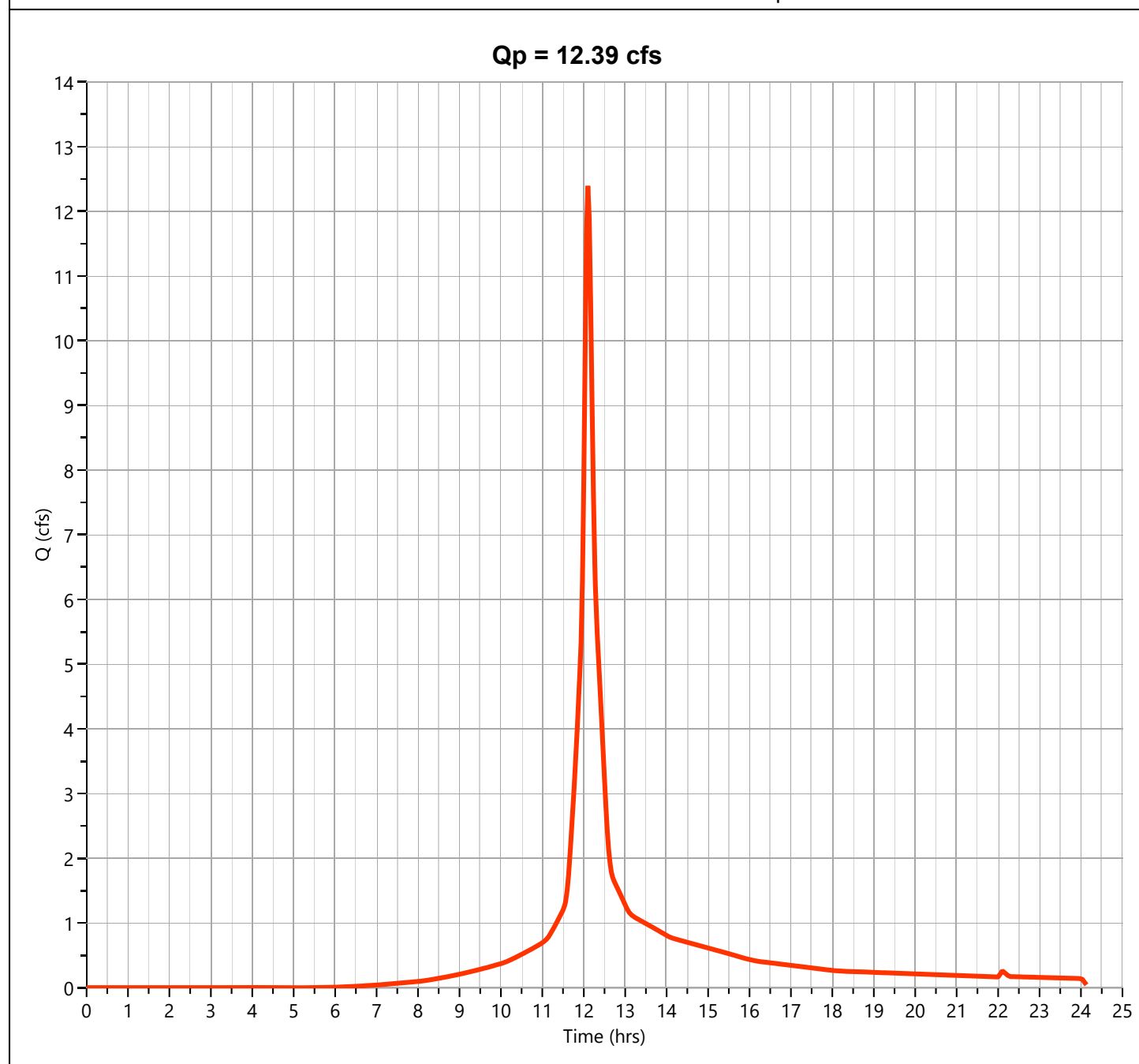
Hydrology Studio v 3.0.0.21

10-27-2022

**P-5D**

**Hyd. No. 28**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 12.39 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 42,798 cuft
Drainage Area	= 2.2 ac	Curve Number	= 79
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 3.0.0.21

10-27-2022

## IB-5D

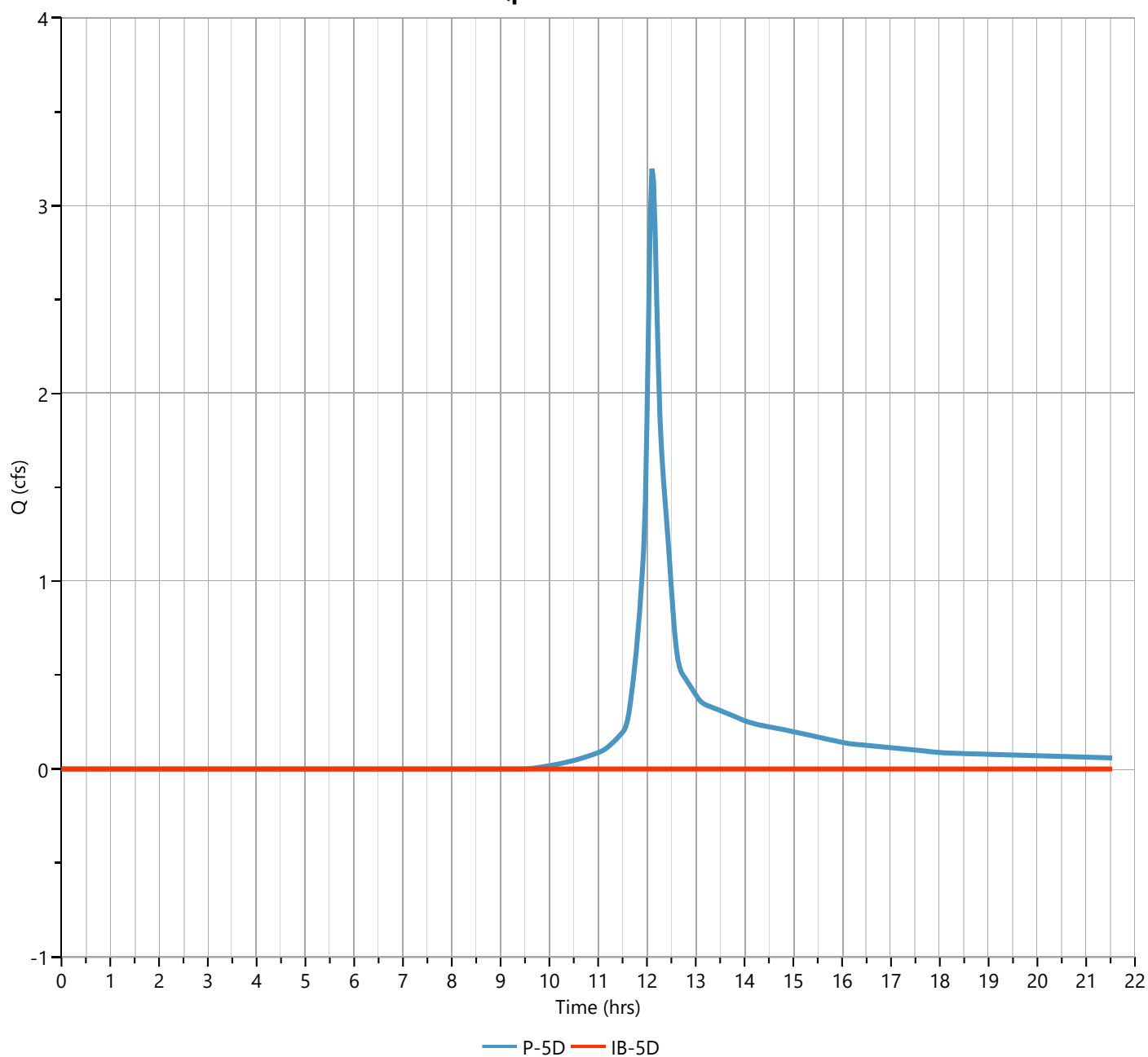
## Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 16.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.002 cuft
Inflow Hydrograph	= 28 - P-5D	Max. Elevation	= 231.73 ft
Pond Name	= IB-5D	Max. Storage	= 7,020 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.15 hrs

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

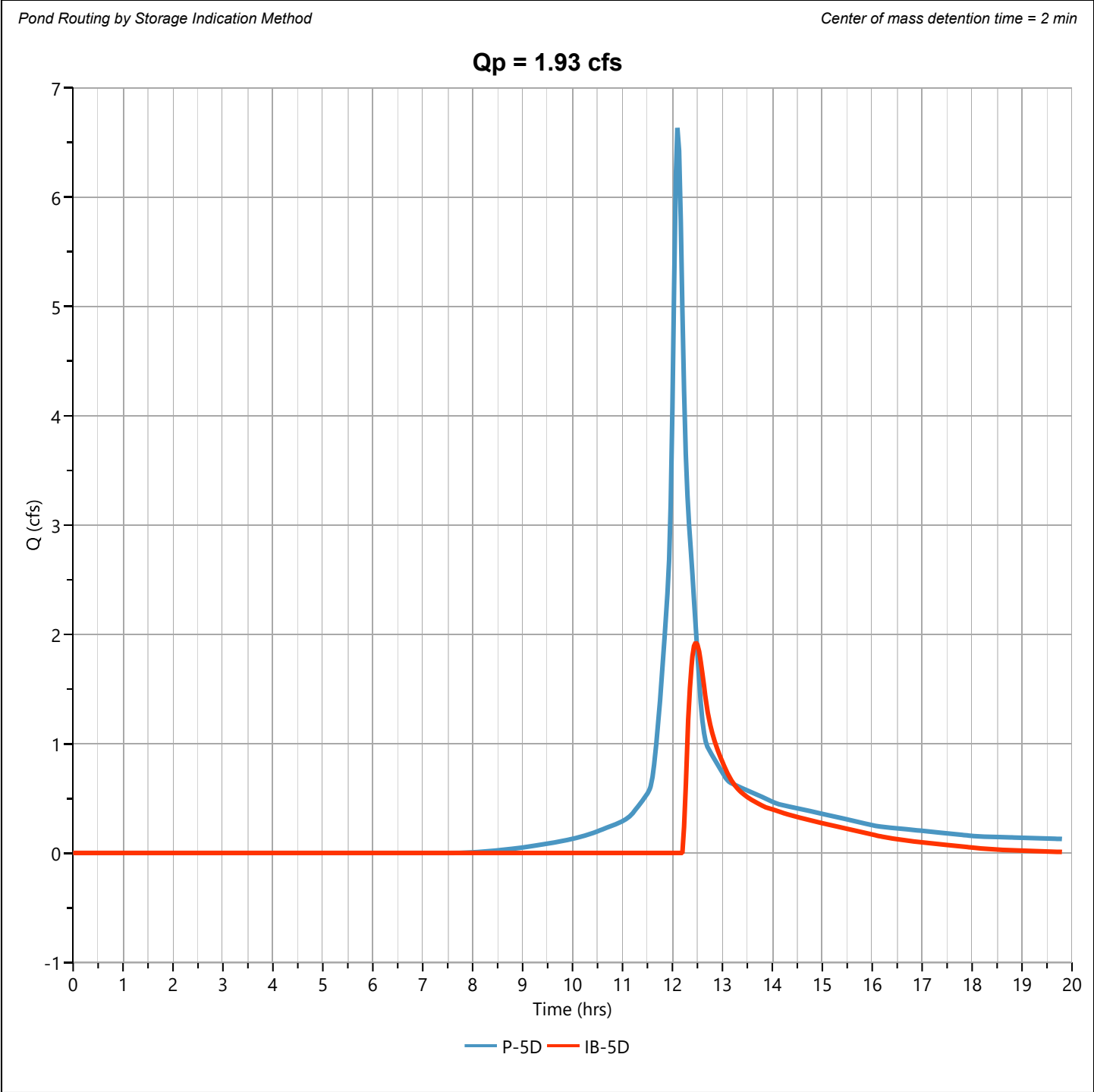
Hydrology Studio v 3.0.0.21

10-27-2022

IB-5D

Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 1.926 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 8,511 cuft
Inflow Hydrograph	= 28 - P-5D	Max. Elevation	= 232.28 ft
Pond Name	= IB-5D	Max. Storage	= 9,862 cuft



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

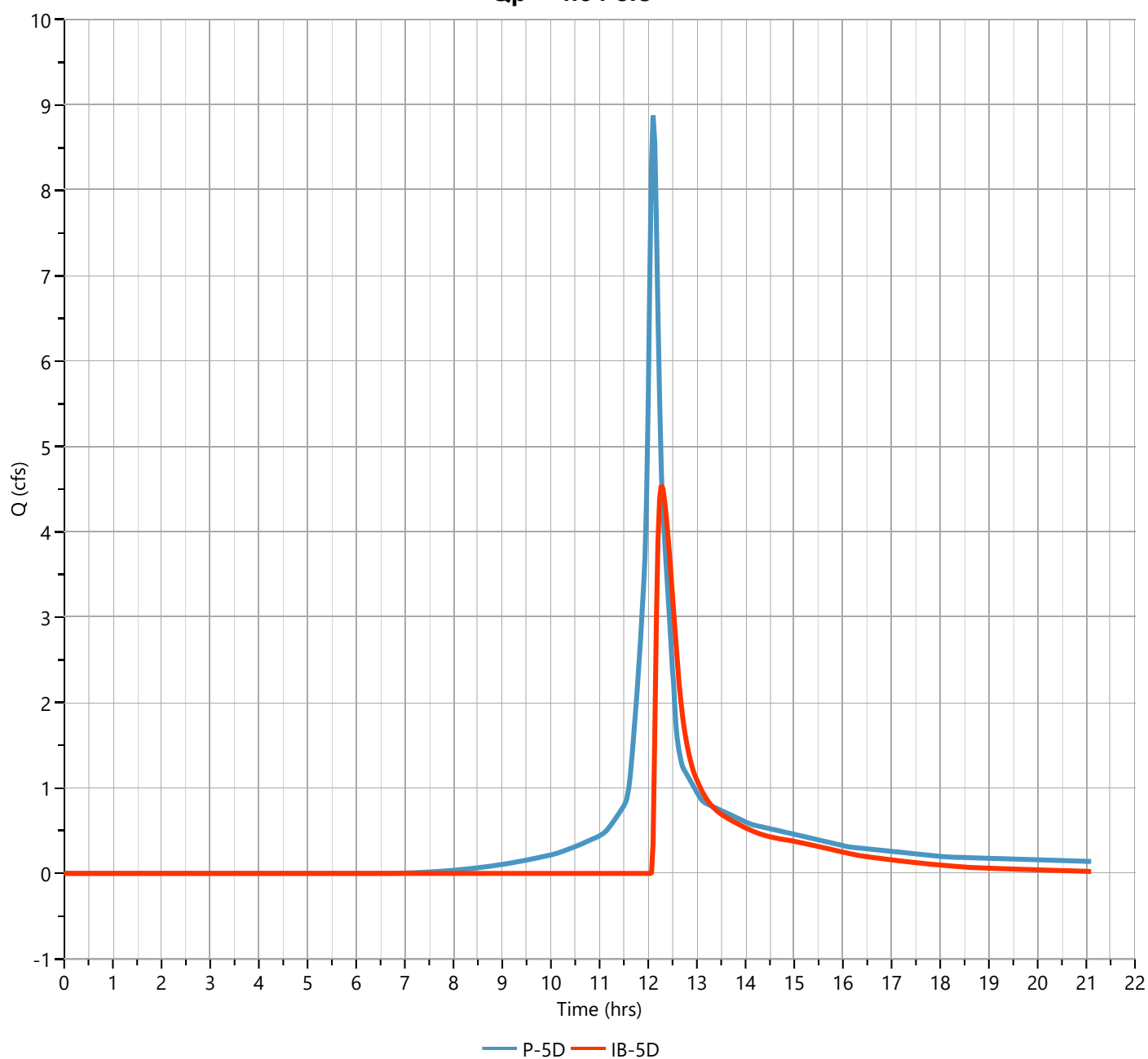
## IB-5D

## Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 4.544 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,724 cuft
Inflow Hydrograph	= 28 - P-5D	Max. Elevation	= 232.49 ft
Pond Name	= IB-5D	Max. Storage	= 11,090 cuft

*Pond Routing by Storage Indication Method*

**Qp = 4.54 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## IB-5D

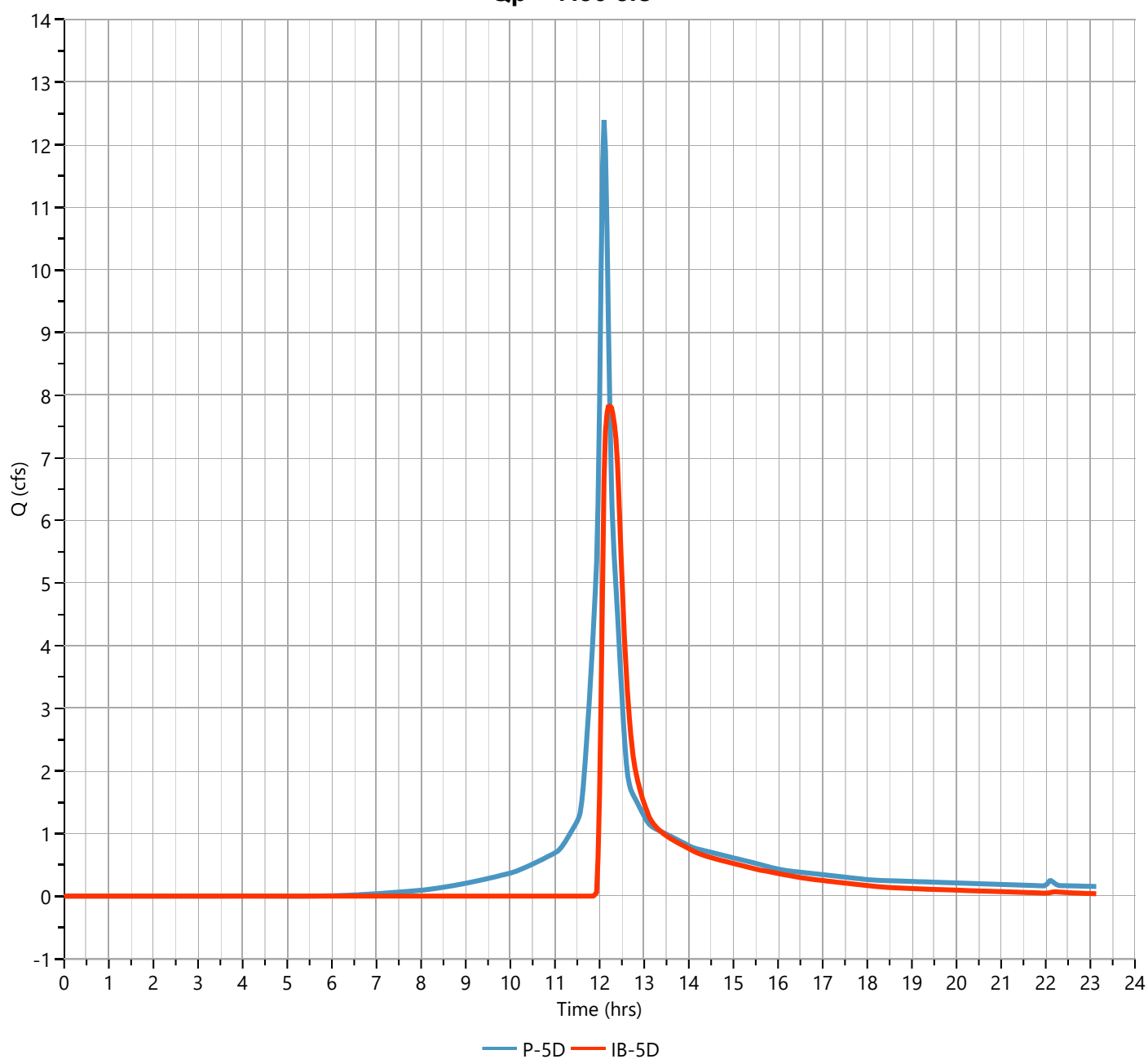
## Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 7.861 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 27,675 cuft
Inflow Hydrograph	= 28 - P-5D	Max. Elevation	= 232.88 ft
Pond Name	= IB-5D	Max. Storage	= 13,292 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2 min

**Qp = 7.86 cfs**



# Pond Report

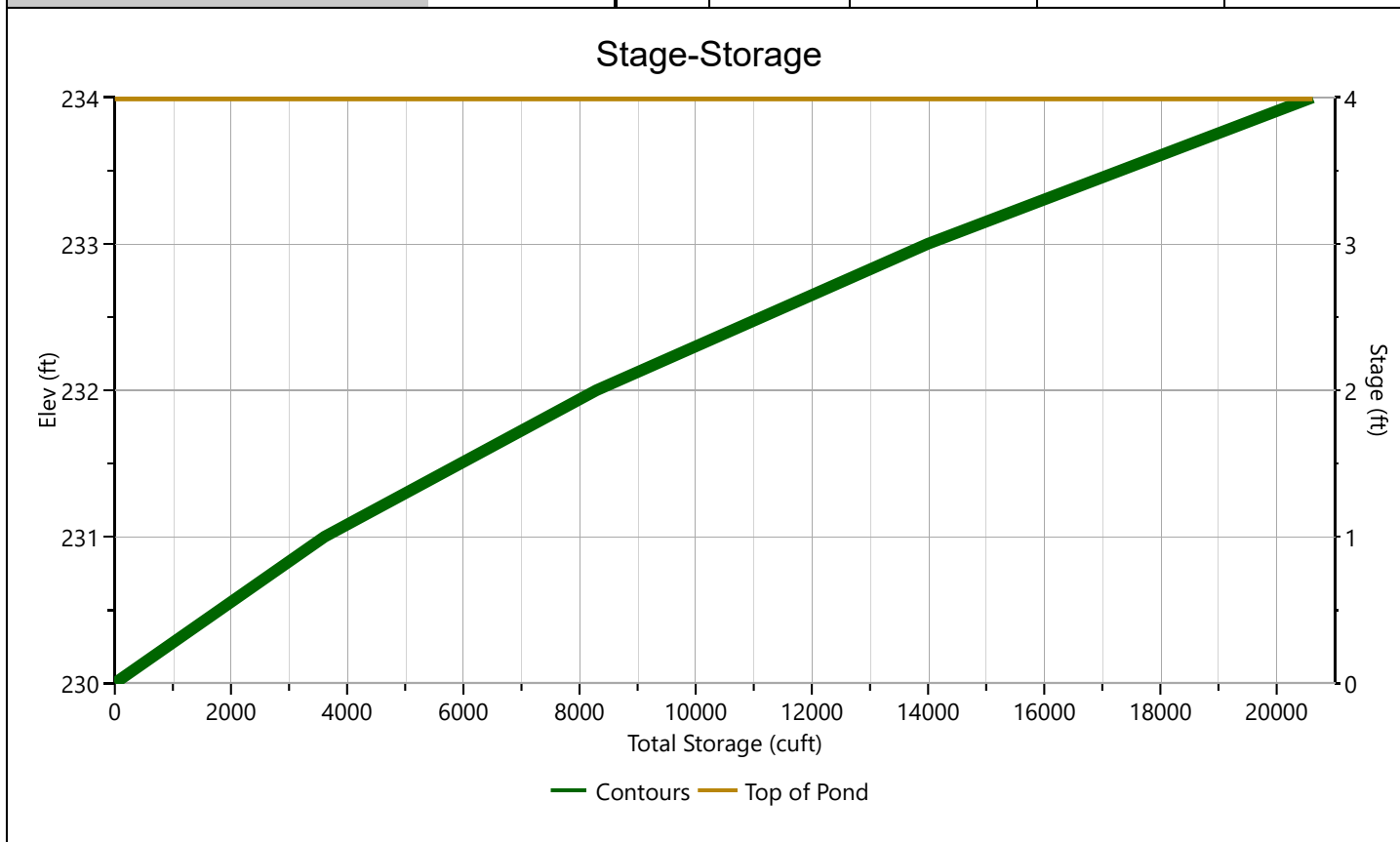
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

# IB-5D

## Stage-Storage

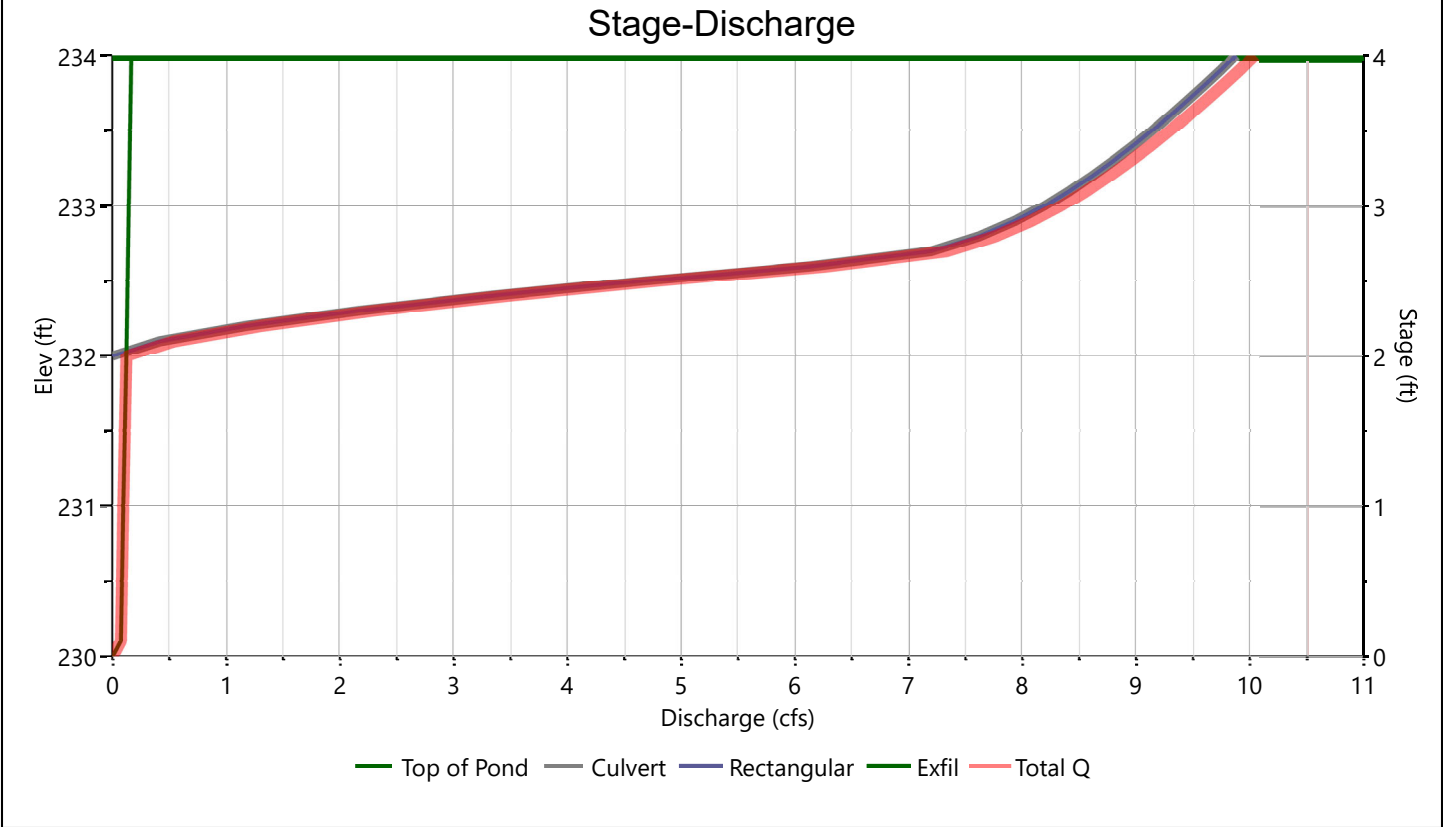
[illegible]

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	111					
Barrel Slope, %	.9					
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 3.0.0.21

10-27-2022

**IB-5D**

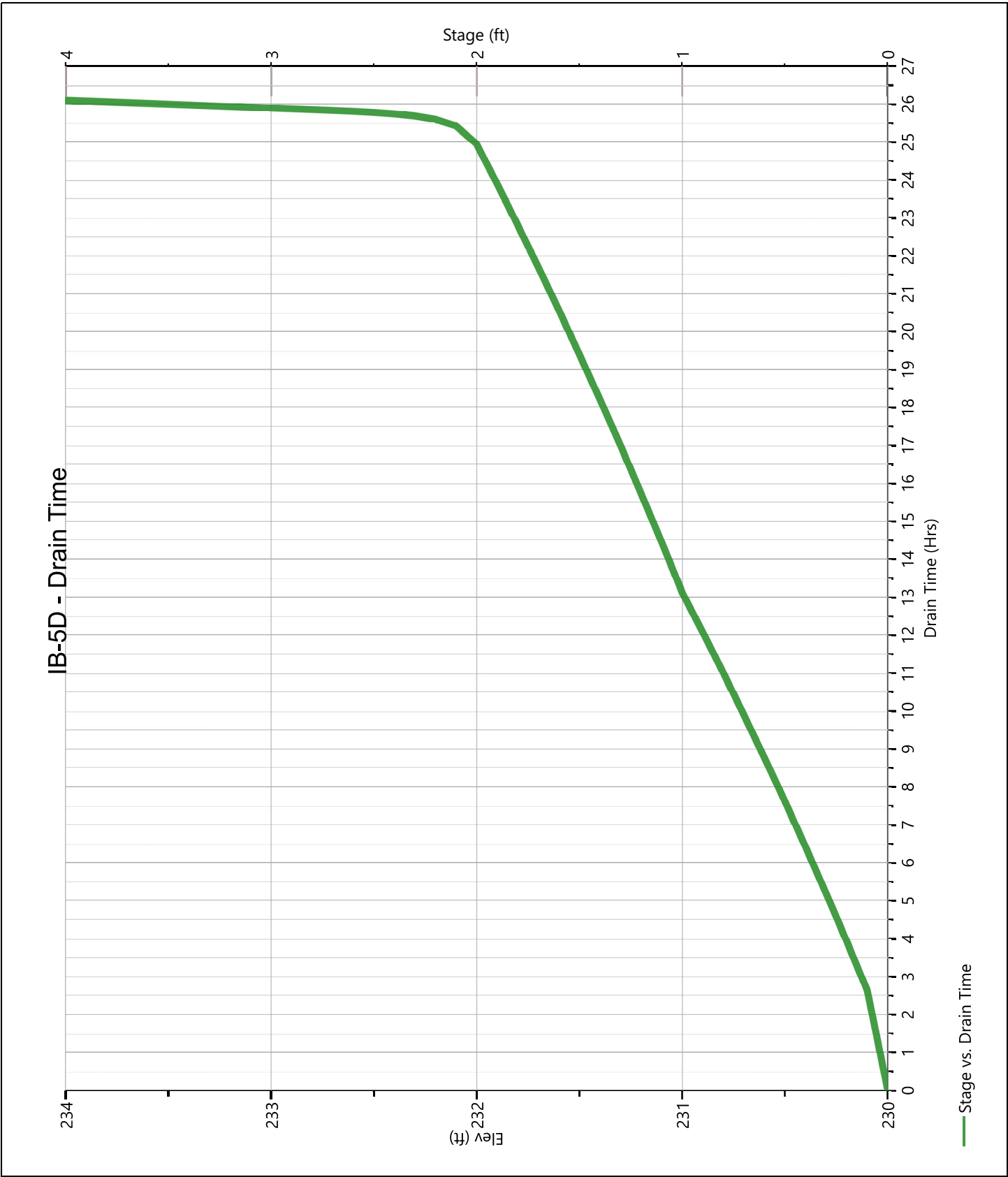
### Stage-Storage-Discharge Summary

[illegible]

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

IB-5D

Pond Drawdown





# Hydrograph Report

Project Name:

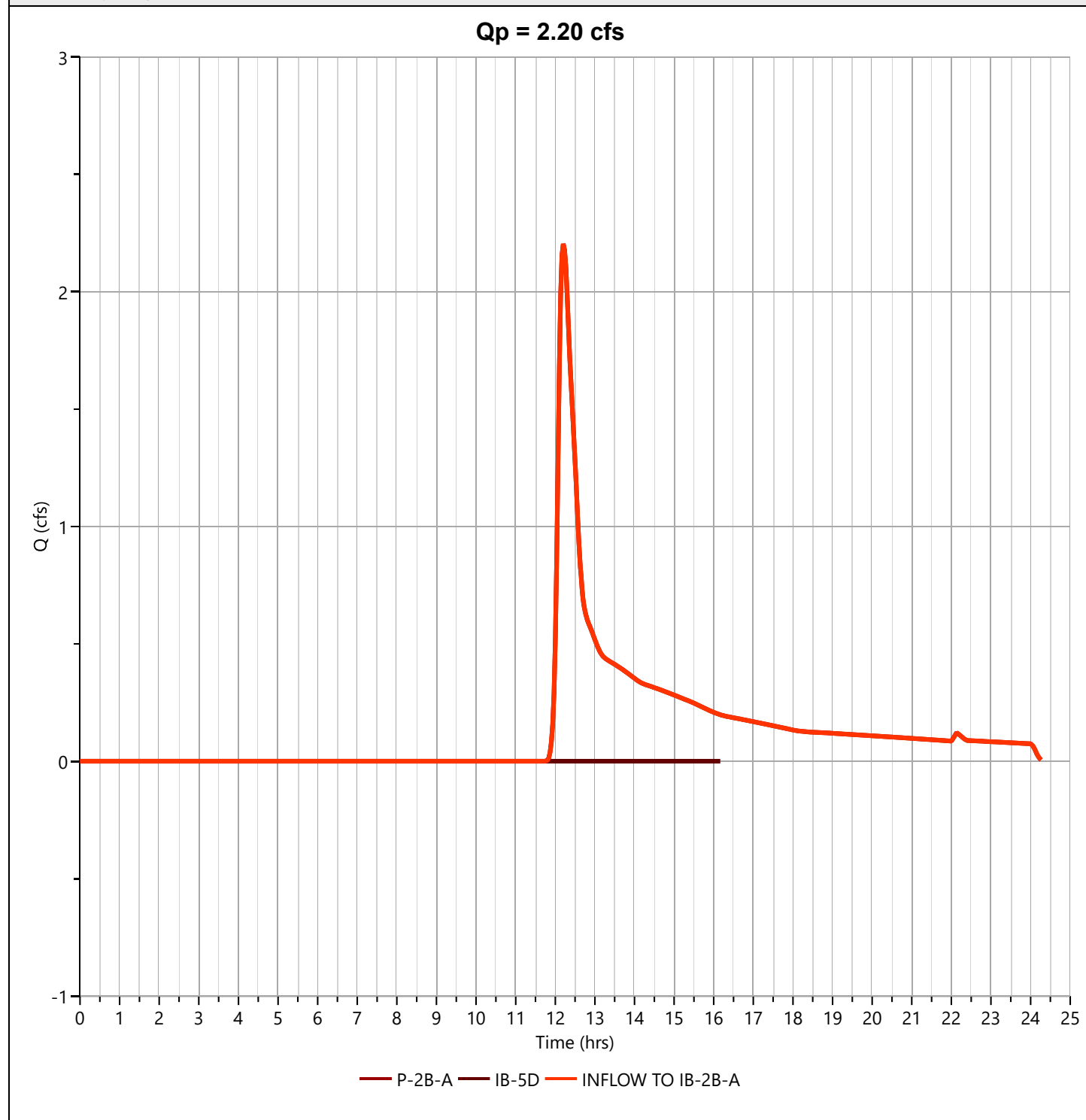
Hydrology Studio v 3.0.0.21

10-27-2022

## INFLOW TO IB-2B-A

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 2.204 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 11,406 cuft
Inflow Hydrographs	= 27, 29	Total Contrib. Area	= 5.53 ac



# Hydrograph Report

Project Name:

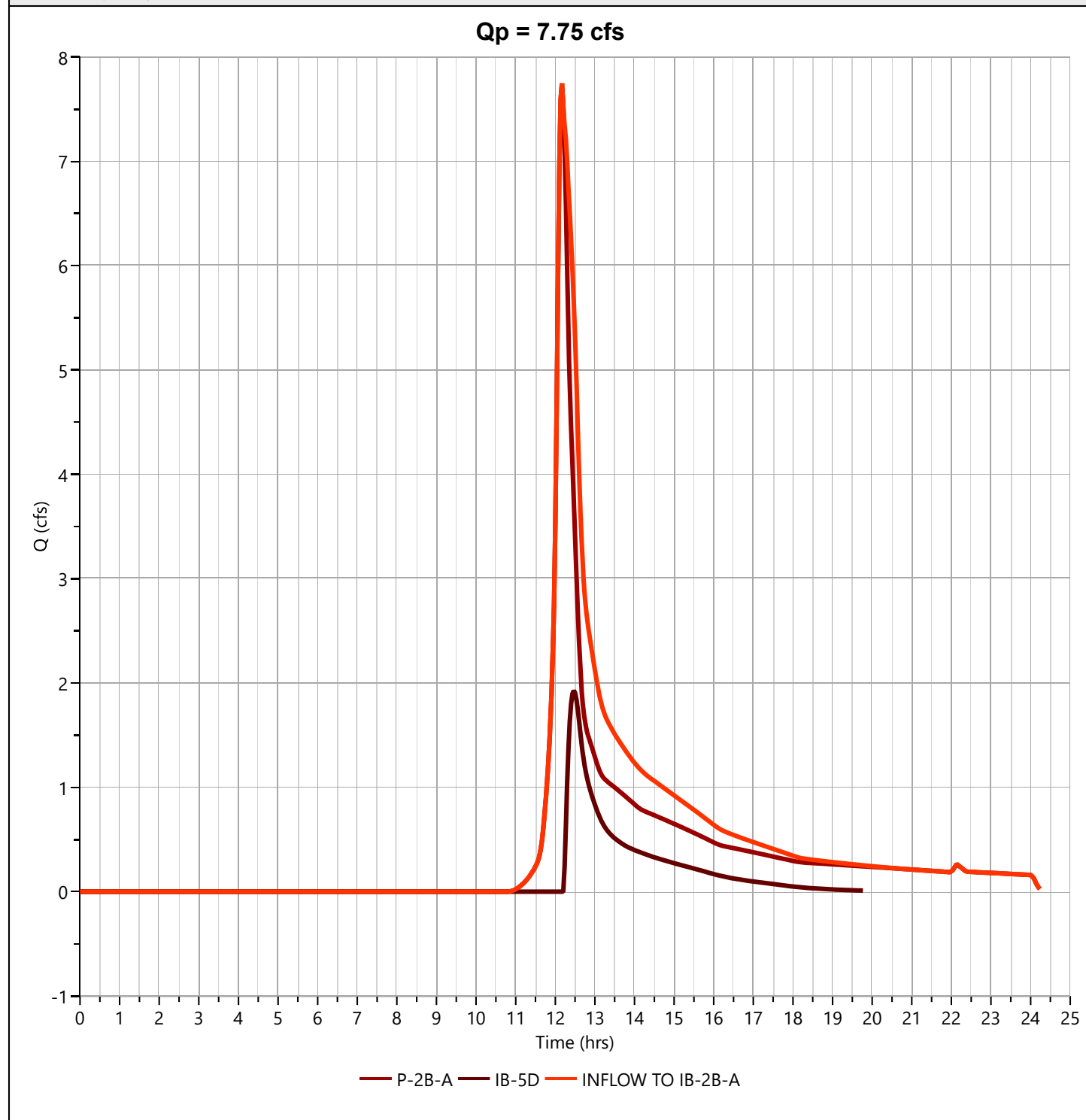
Hydrology Studio v 3.0.0.21

10-27-2022

## INFLOW TO IB-2B-A

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 7.748 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 40,272 cuft
Inflow Hydrographs	= 27, 29	Total Contrib. Area	= 5.53 ac



# Hydrograph Report

Project Name:

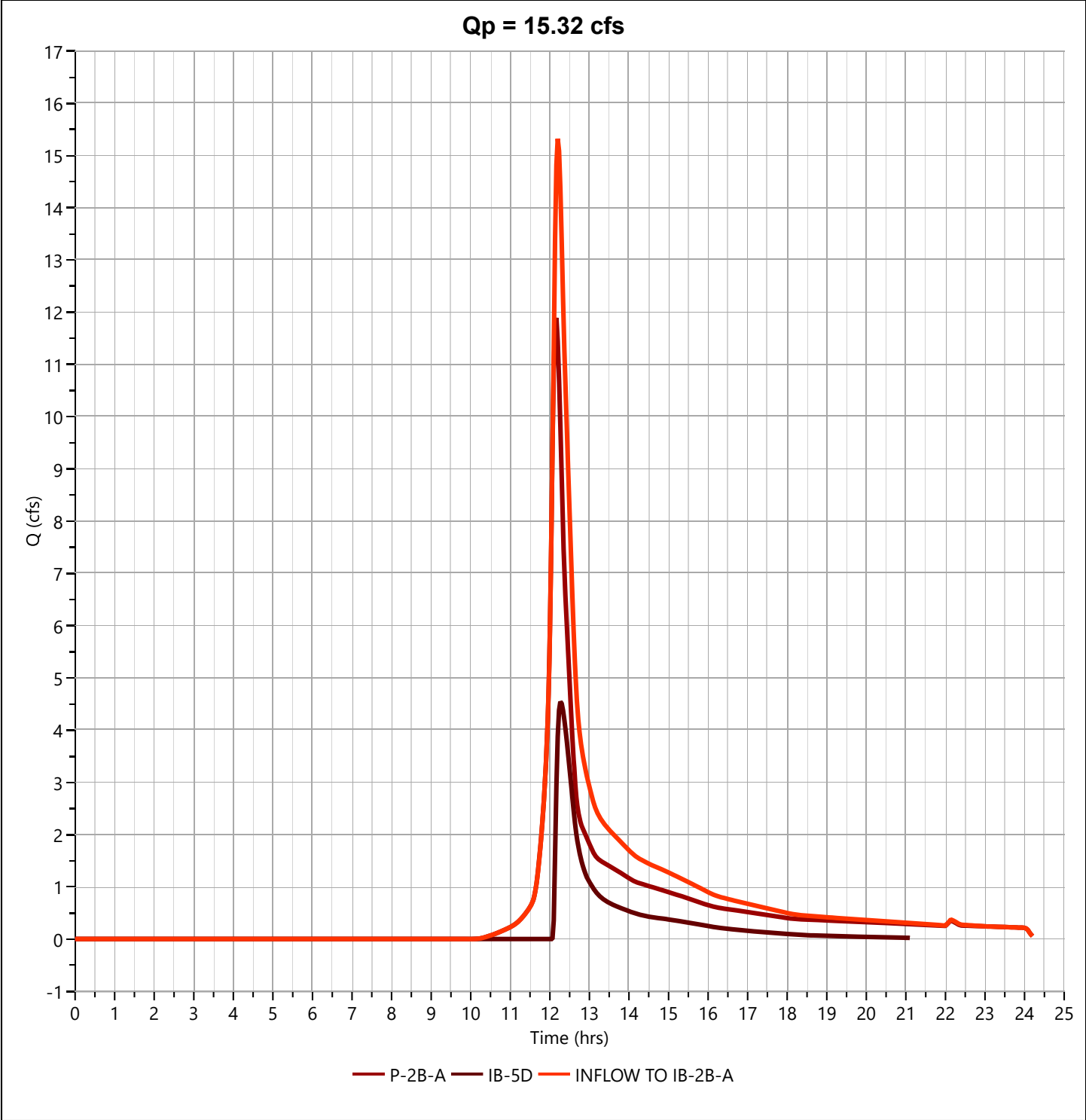
Hydrology Studio v 3.0.0.21

10-27-2022

## INFLOW TO IB-2B-A

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 15.32 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 62,815 cuft
Inflow Hydrographs	= 27, 29	Total Contrib. Area	= 5.53 ac



# Hydrograph Report

Project Name:

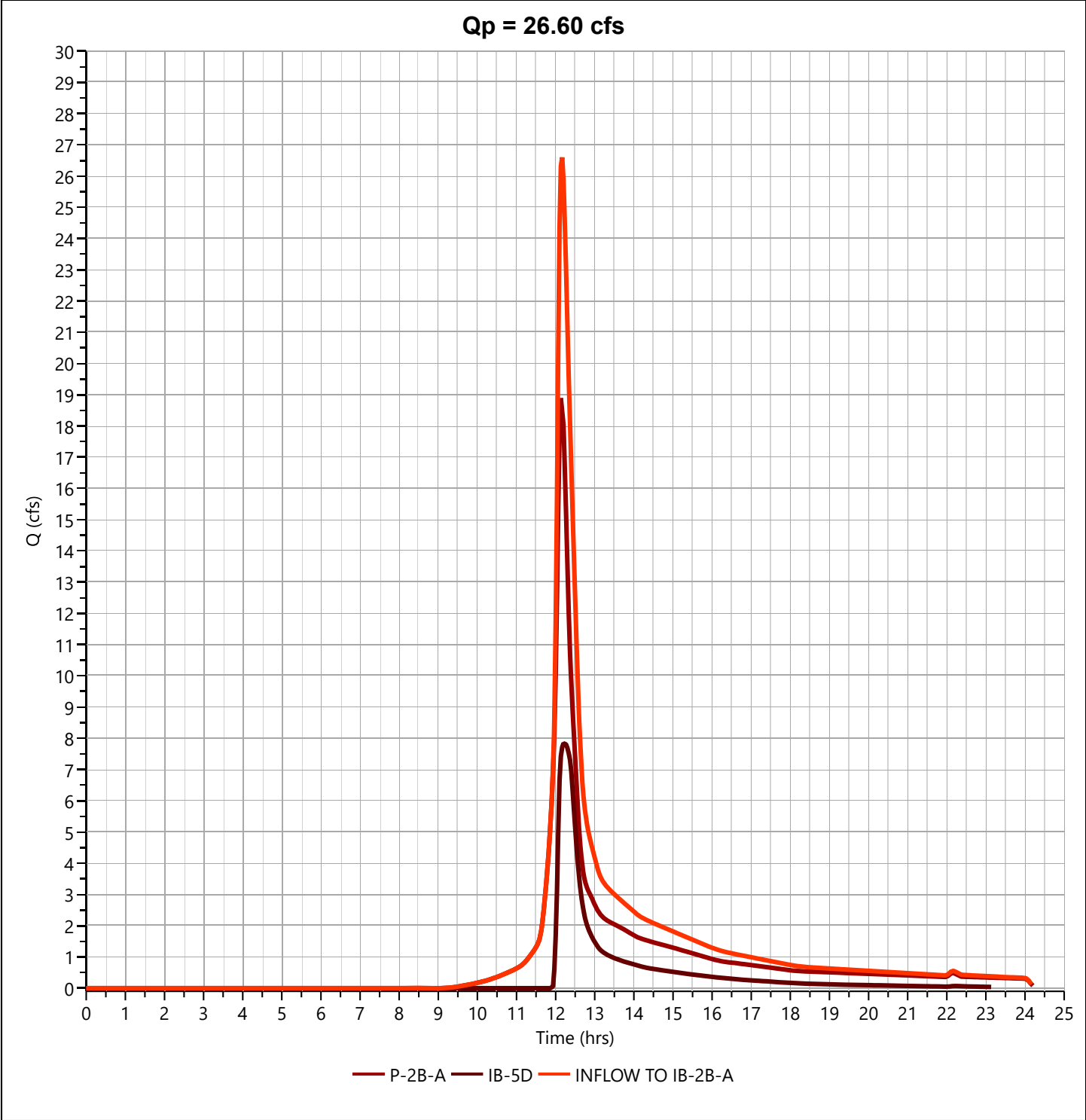
Hydrology Studio v 3.0.0.21

10-27-2022

## INFLOW TO IB-2B-A

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 26.60 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 101,026 cuft
Inflow Hydrographs	= 27, 29	Total Contrib. Area	= 5.53 ac



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

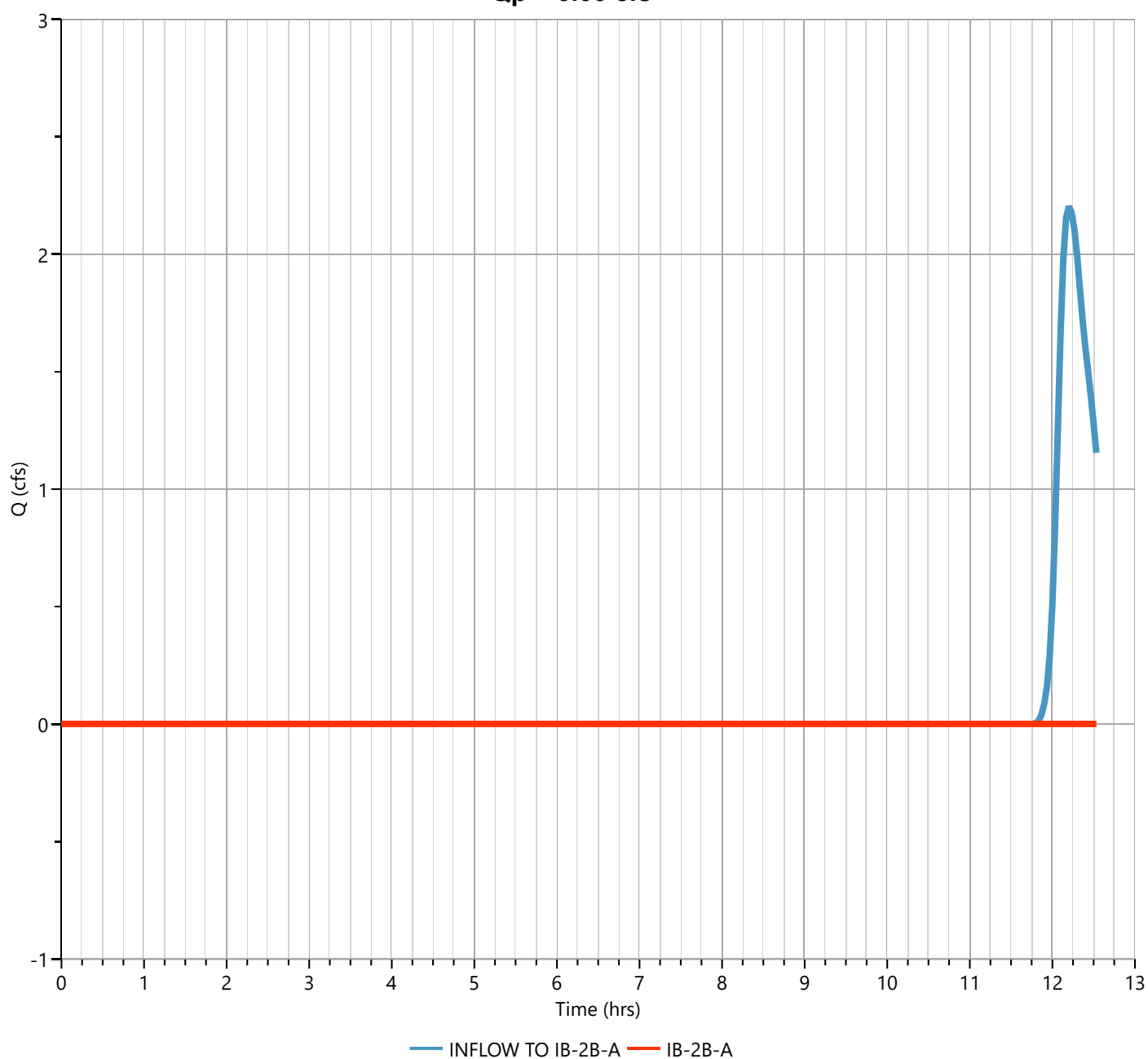
**IB-2B-A**

**Hyd. No. 31**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 30 - INFLOW TO IB-2B-A	Max. Elevation	= 229.10 ft
Pond Name	= IB-2B-A	Max. Storage	= 1,006 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

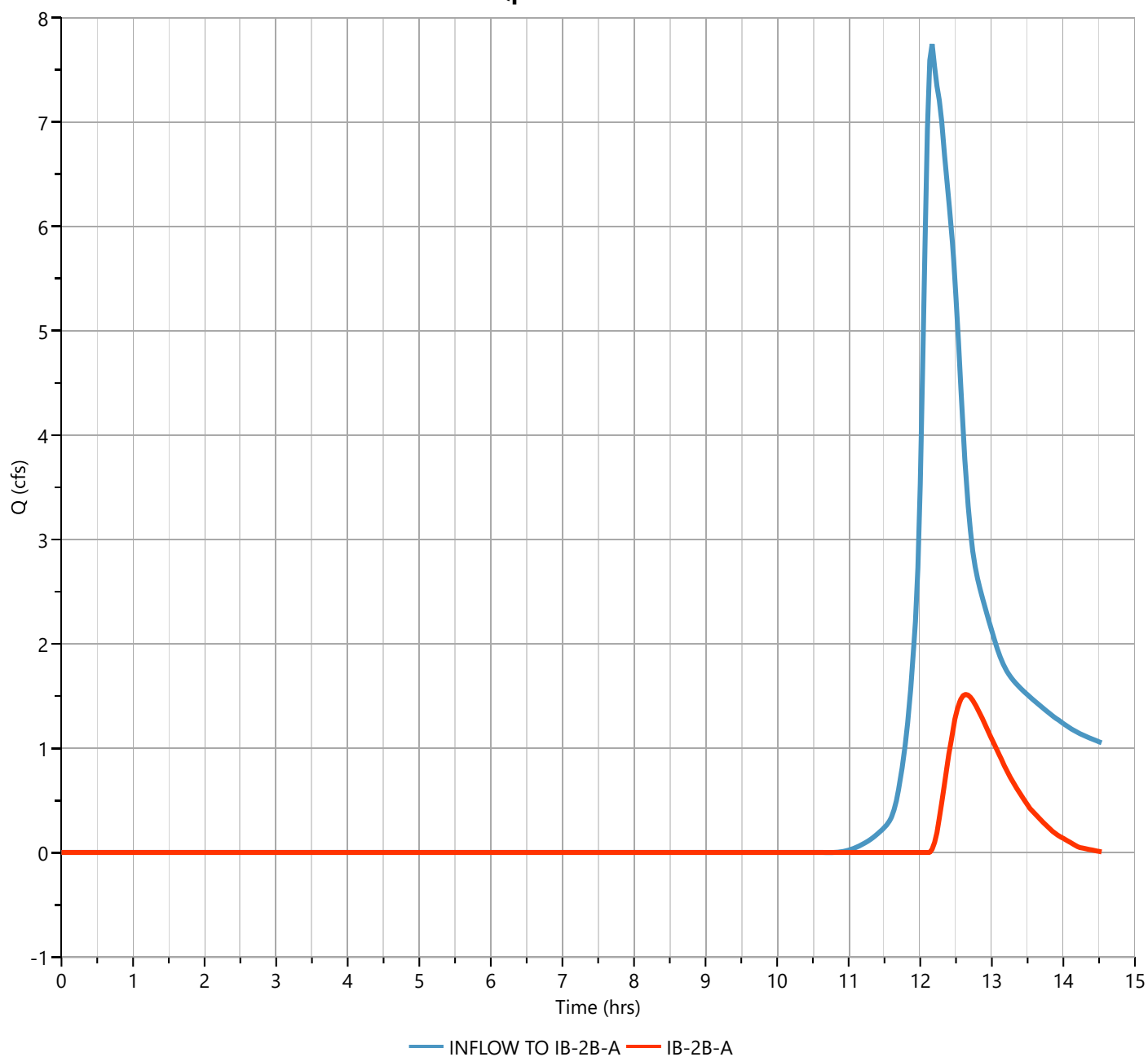
## IB-2B-A

## Hyd. No. 31

Hydrograph Type	= Pond Route	Peak Flow	= 1.516 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,181 cuft
Inflow Hydrograph	= 30 - INFLOW TO IB-2B-A	Max. Elevation	= 229.90 ft
Pond Name	= IB-2B-A	Max. Storage	= 8,937 cuft

*Pond Routing by Storage Indication Method*

**Qp = 1.52 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

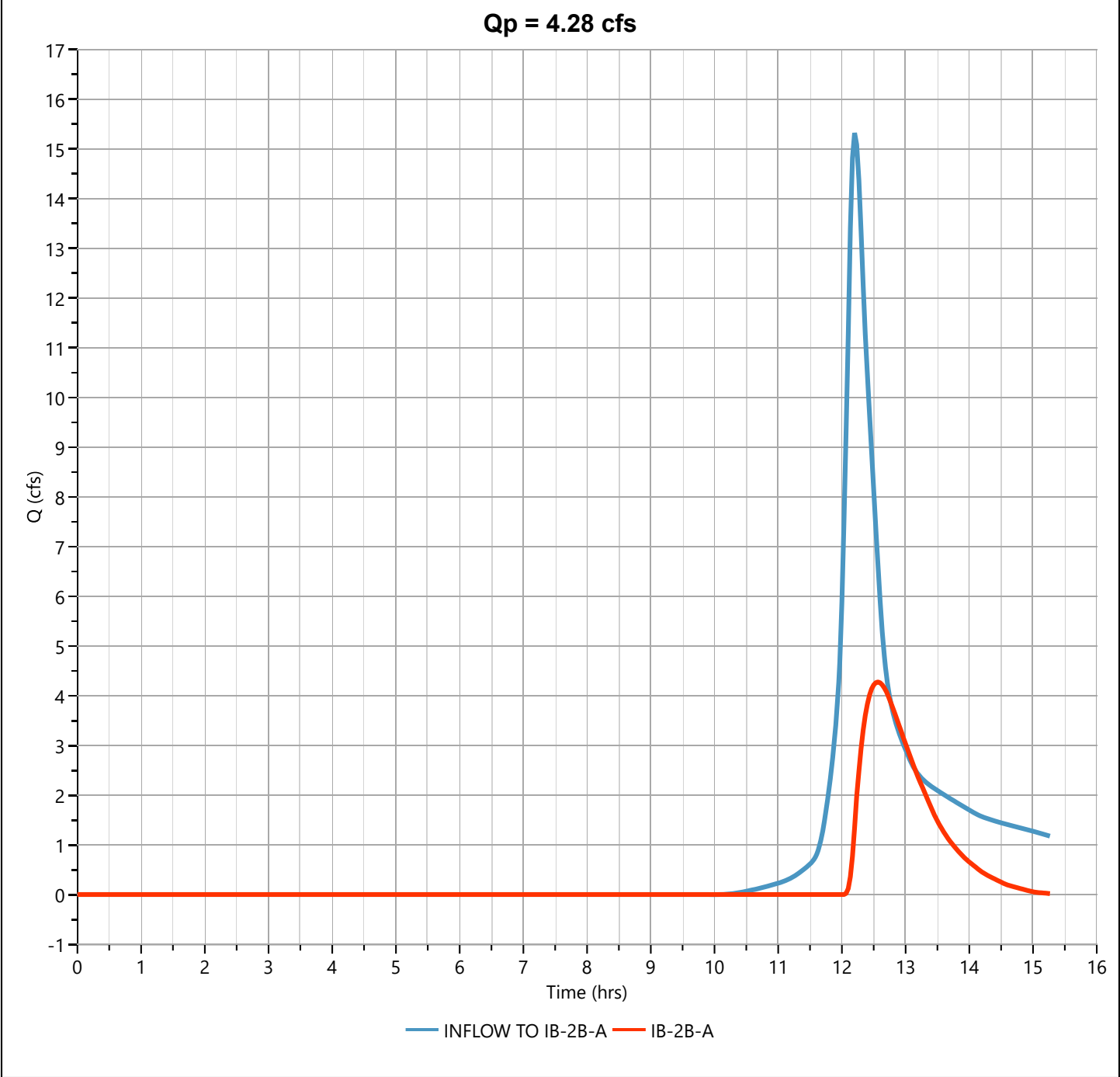
10-27-2022

IB-2B-A

Hyd. No. 31

Hydrograph Type	= Pond Route	Peak Flow	= 4.277 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 17,500 cuft
Inflow Hydrograph	= 30 - INFLOW TO IB-2B-A	Max. Elevation	= 230.44 ft
Pond Name	= IB-2B-A	Max. Storage	= 15,611 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

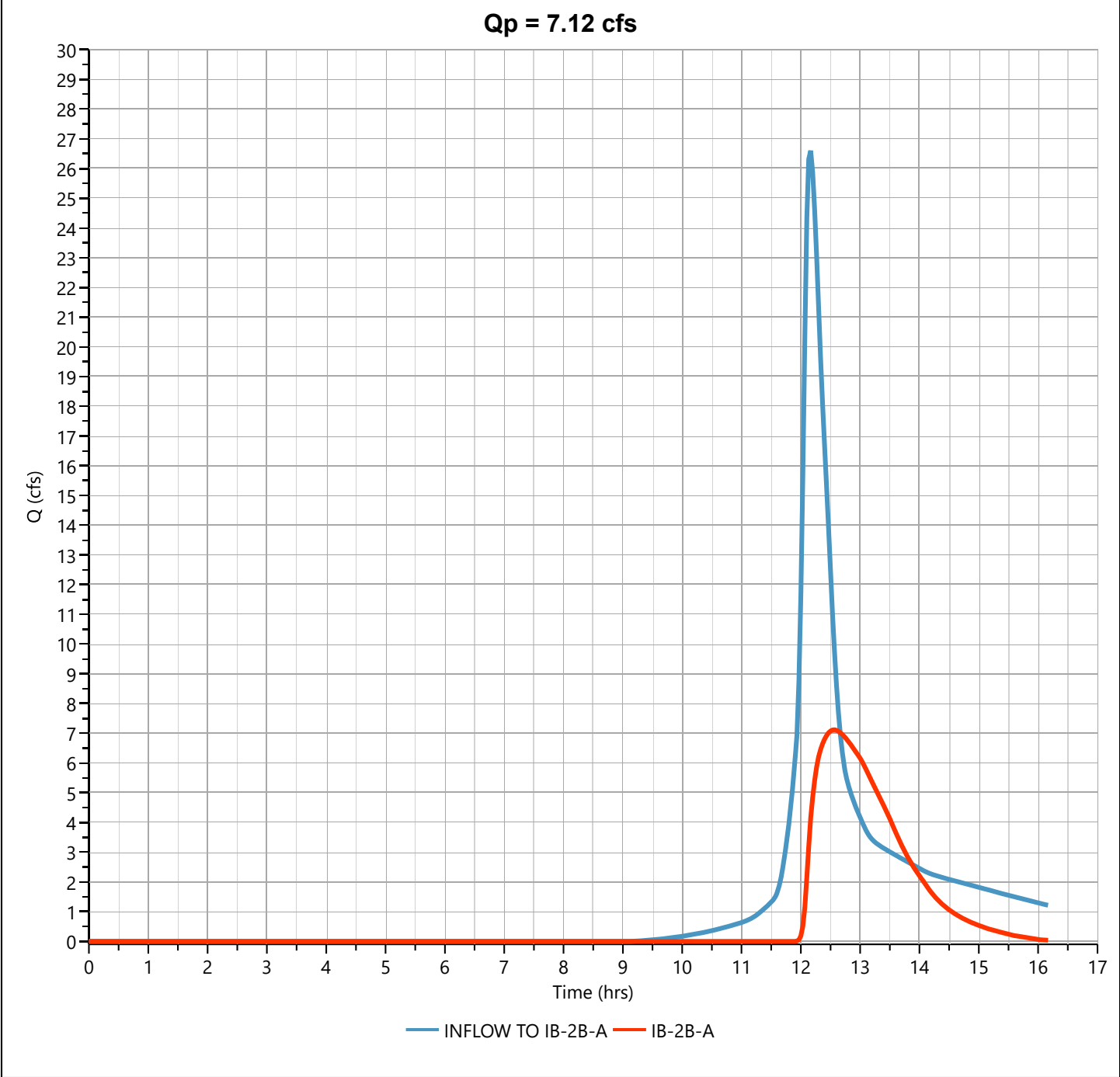
10-27-2022

IB-2B-A

Hyd. No. 31

Hydrograph Type	= Pond Route	Peak Flow	= 7.117 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 40,738 cuft
Inflow Hydrograph	= 30 - INFLOW TO IB-2B-A	Max. Elevation	= 231.38 ft
Pond Name	= IB-2B-A	Max. Storage	= 28,543 cuft

Pond Routing by Storage Indication Method





# Pond Report

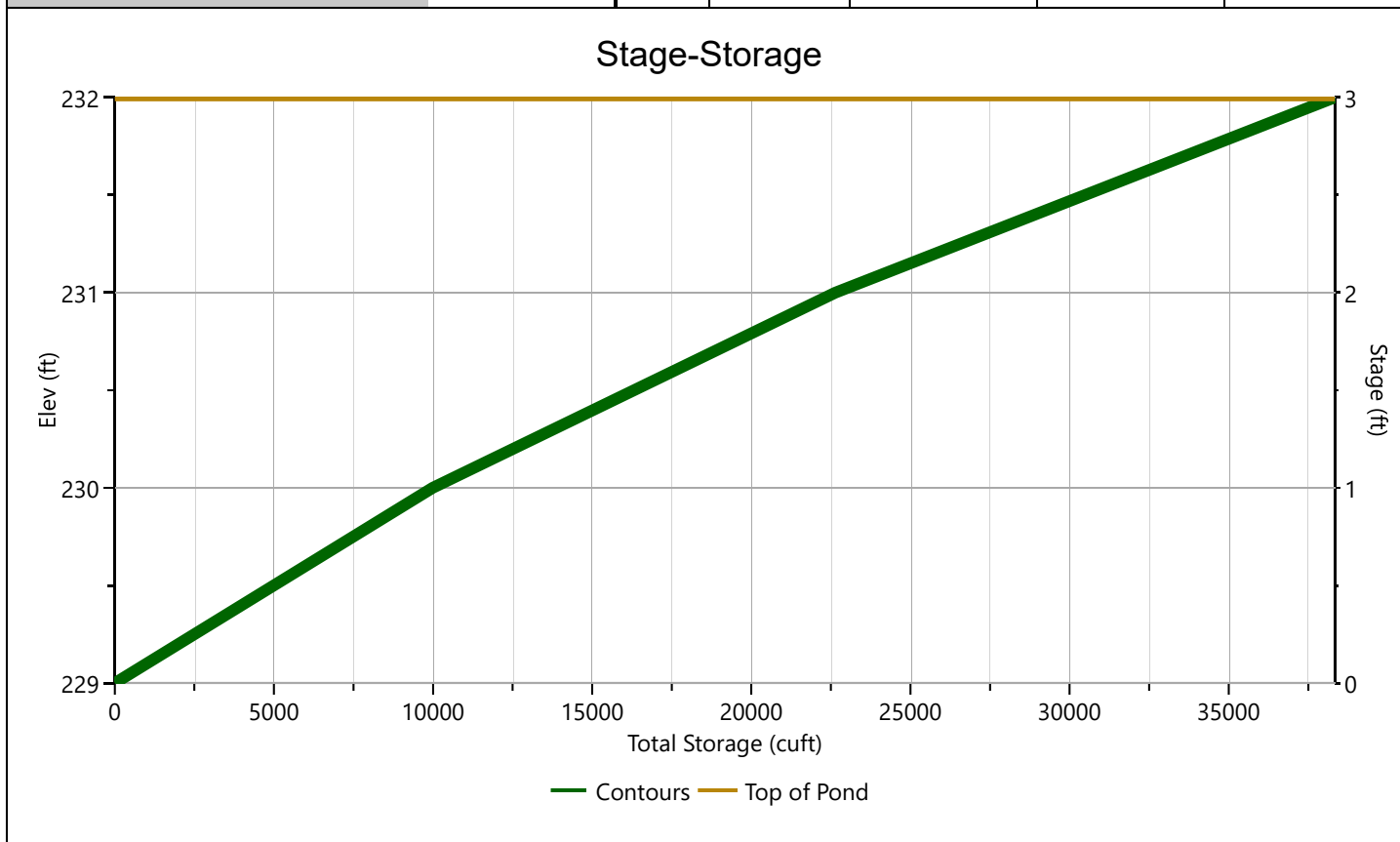
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-2B-A**

## Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

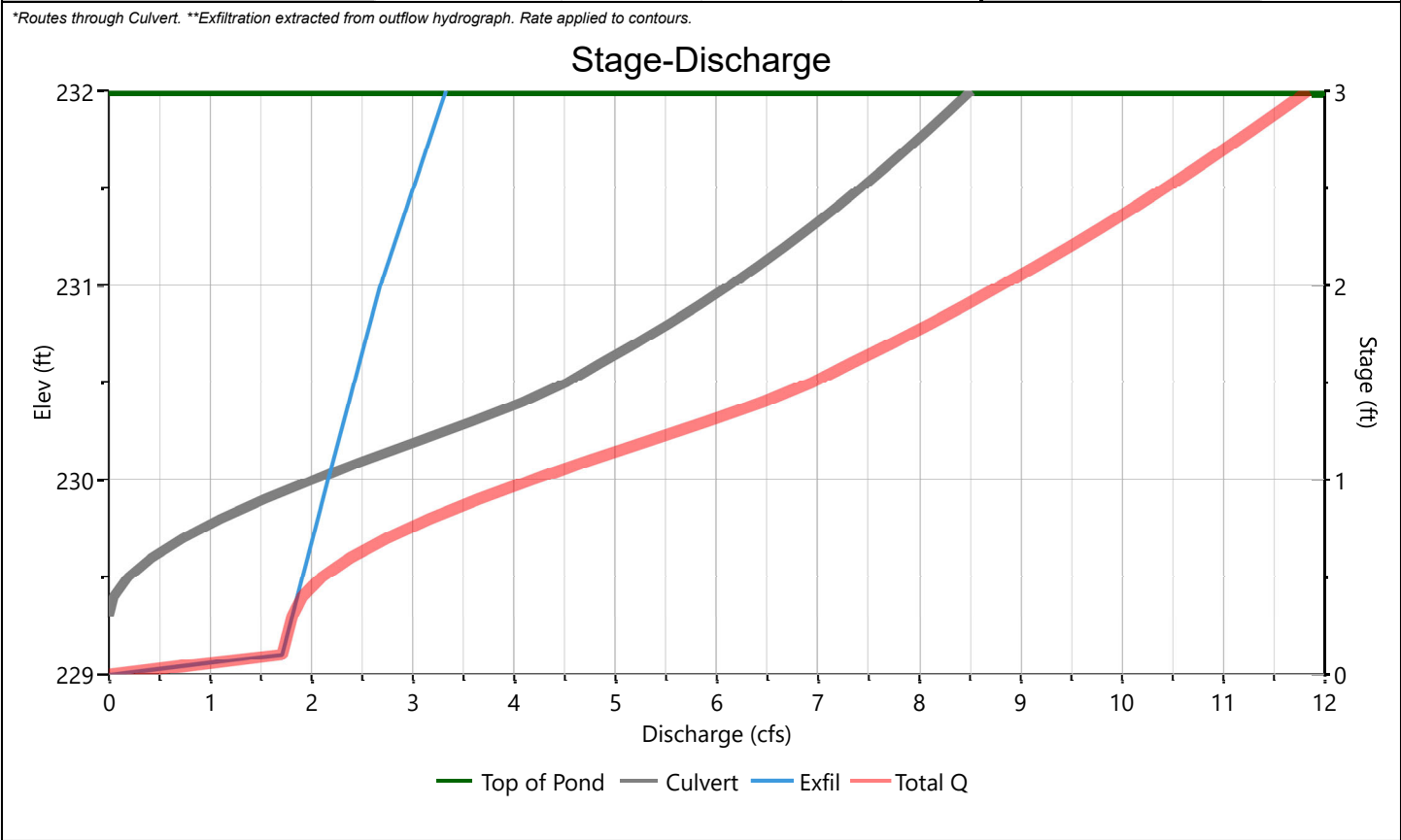
10-27-2022

IB-2B-A

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	229.30				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	60					
Barrel Slope, %	1					
N-Value, n	0.012					
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 3.0.0.21

10-27-2022

**IB-2B-A**

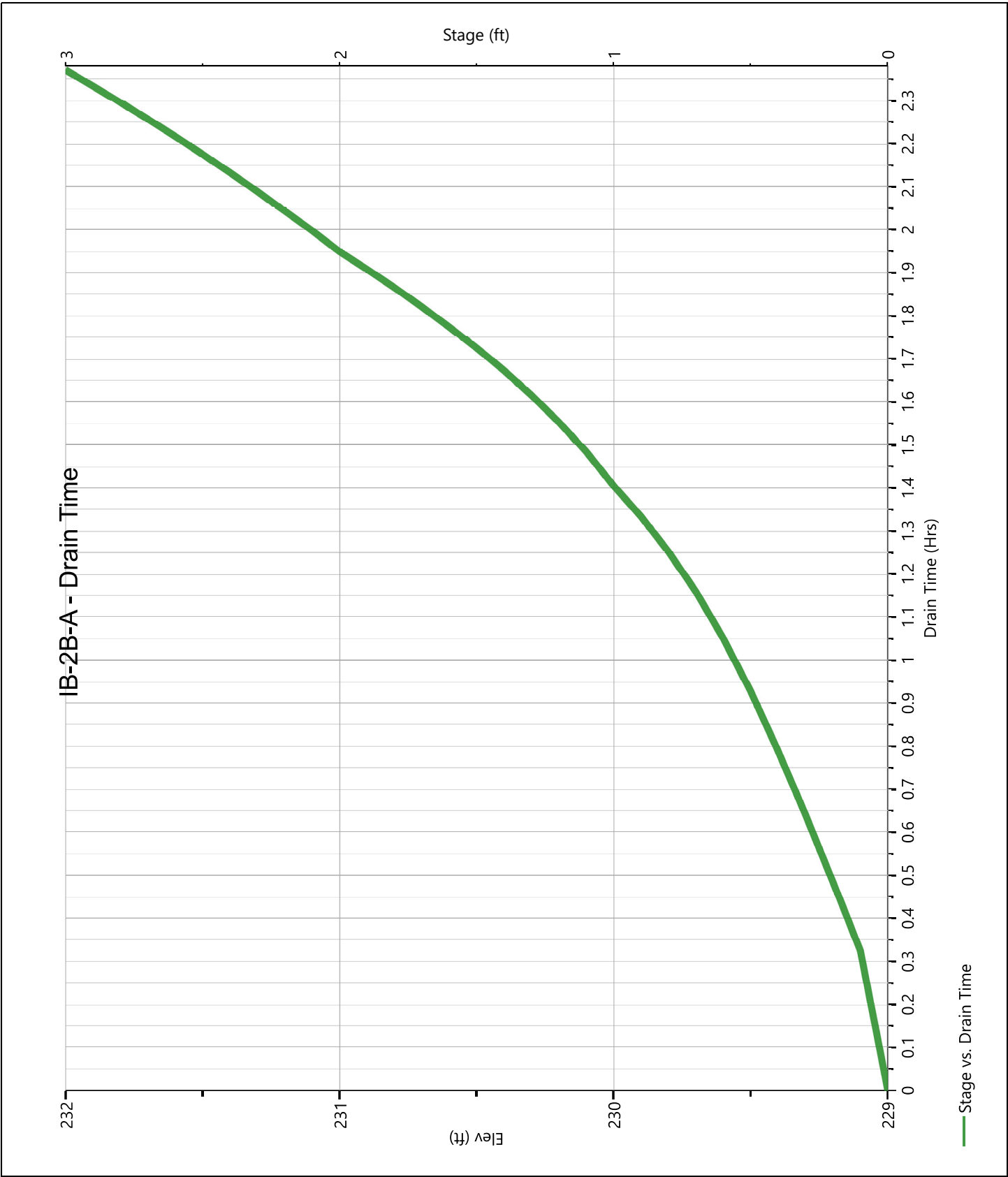
## Stage-Storage-Discharge Summary

[illegible]

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

IB-2B-A

Pond Drawdown



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

Project: Athens Street By NC Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☒ Developed Subcatchment P-2B-B

**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/			Area	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			7.63	228.79
A	Open Space	Good Condition	39			2.63	102.40
A	Open Space	Fair Condition	49			0.00	0.00
A	Woods-Grass Combination	Good Condition	32			0.00	0.00
A	Gravel		76			0.03	2.16
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
C	Gravel		89			0.01	1.32
C	Woods	Good Condition	70			0.85	59.22
C	Open Space	Fair Condition	79			0.00	0.00
C	Open Space	Good Condition	74			0.52	38.84
C	Gravel		89			0.00	0.00
D	BVW		77			4.14	318.78
Totals =						15.81	751.52

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{751.52}{15.81} = 47.55 ; \text{ Use CN} = \boxed{48}$$

**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	1.03	1.90

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 10/13/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date \_\_\_\_\_  
Date \_\_\_\_\_

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-2B-BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.16

A-B		
WOODS		
0.6		
50		
3.1		
0.094		
0.16		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C		
UNPAVED		
644		
0.110		
5.35		
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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr  
min0.19  
11.3

# Hydrograph Report

Project Name:

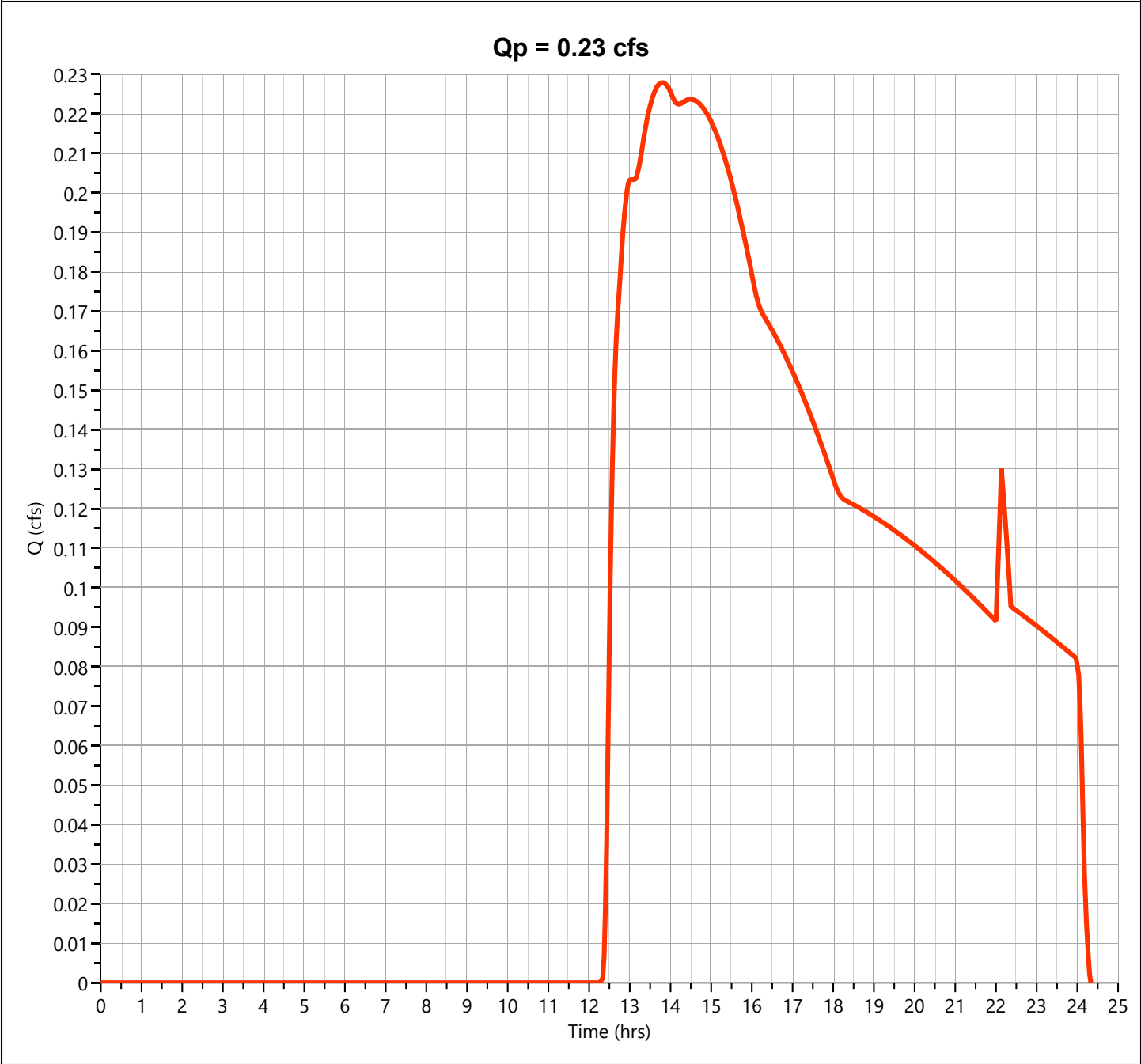
Hydrology Studio v 3.0.0.21

10-27-2022

P-2B-B

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.228 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.80 hrs
Time Interval	= 2 min	Runoff Volume	= 6,036 cuft
Drainage Area	= 15.81 ac	Curve Number	= 48
Tc Method	= User	Time of Conc. (Tc)	= 11.3 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

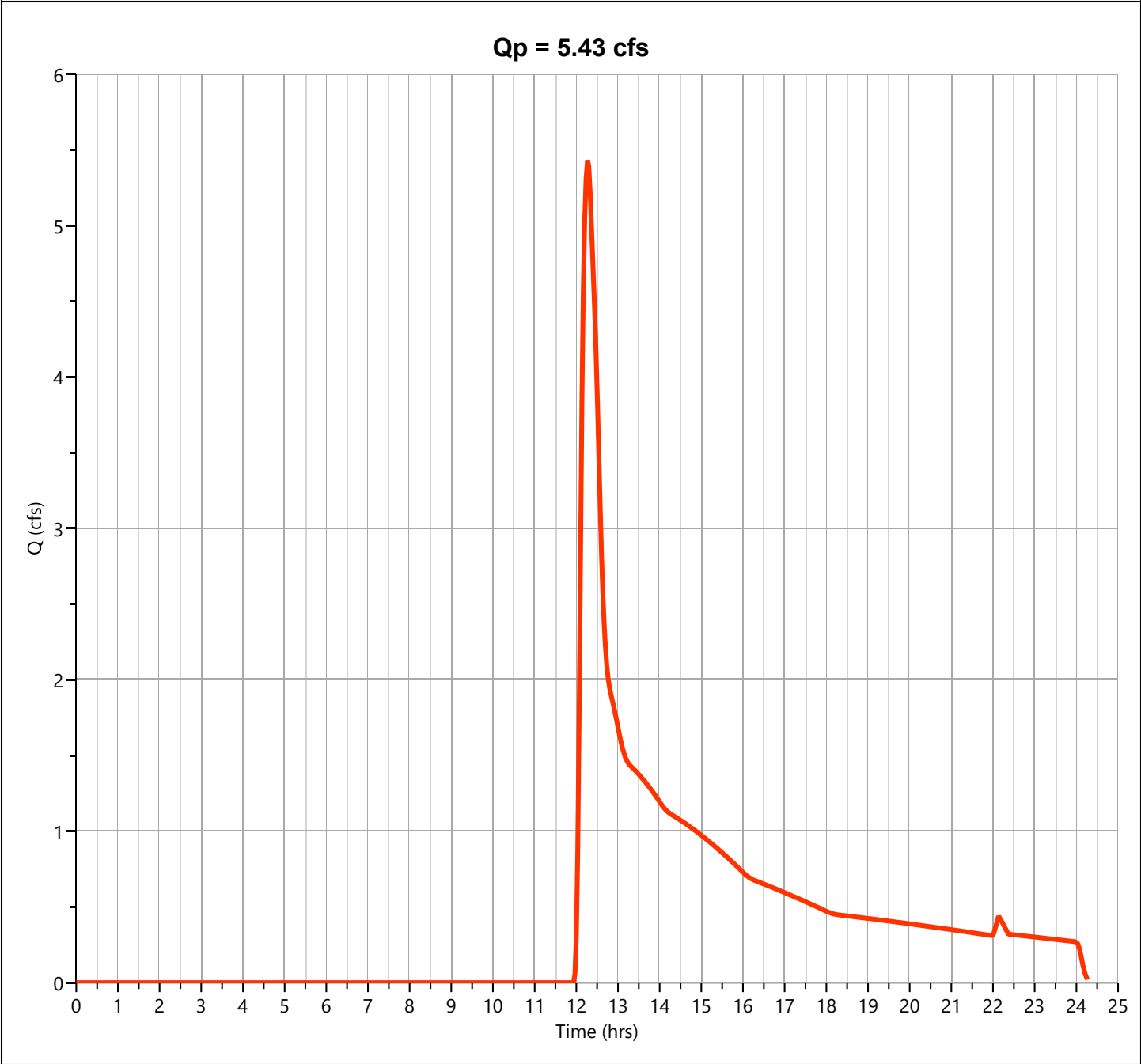
Hydrology Studio v 3.0.0.21

10-27-2022

P-2B-B

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.432 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 35,644 cuft
Drainage Area	= 15.81 ac	Curve Number	= 48
Tc Method	= User	Time of Conc. (Tc)	= 11.3 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484





# Hydrograph Report

Project Name:

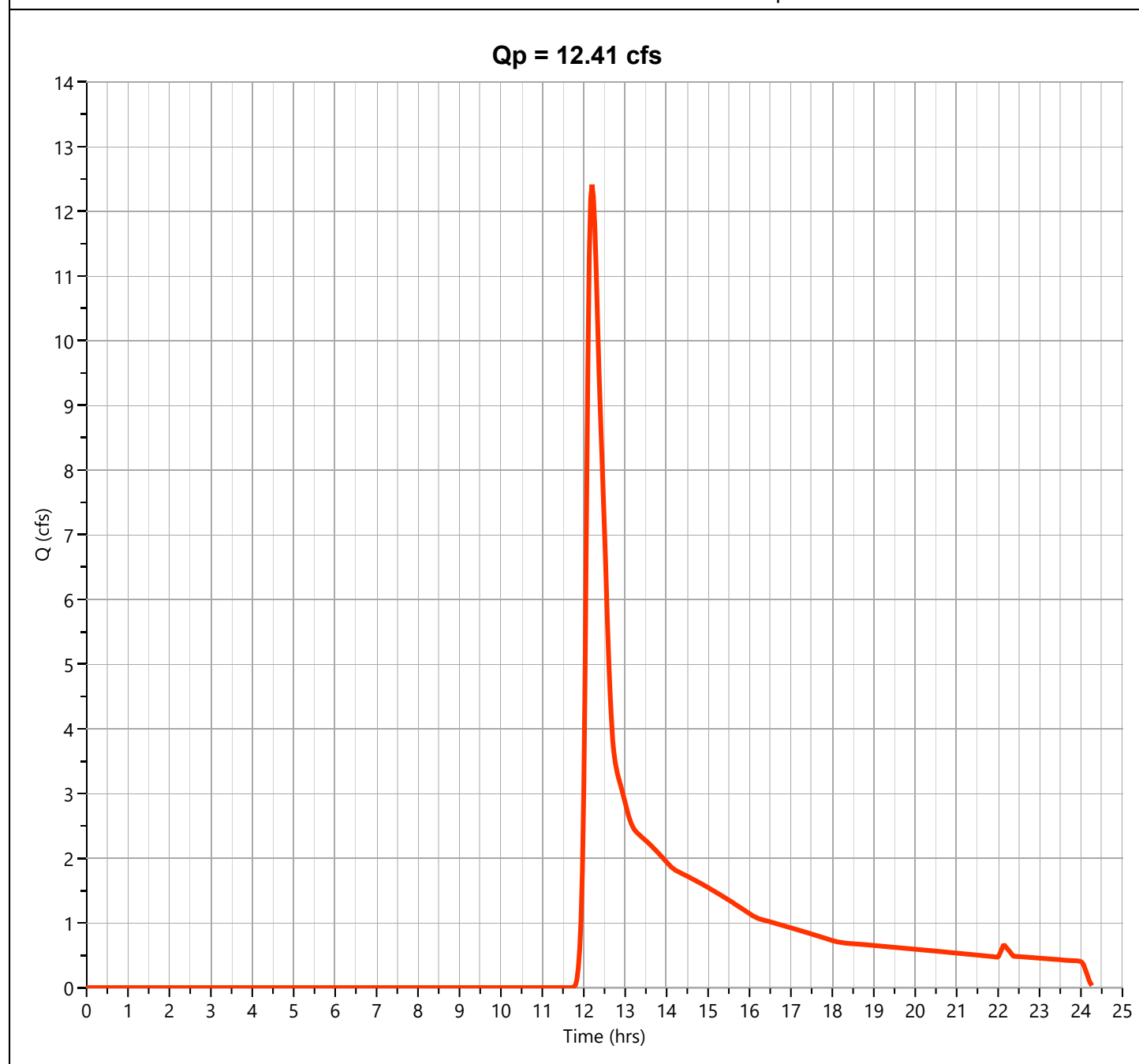
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2B-B**

**Hyd. No. 32**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 12.41 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 63,102 cuft
Drainage Area	= 15.81 ac	Curve Number	= 48
Tc Method	= User	Time of Conc. (Tc)	= 11.3 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

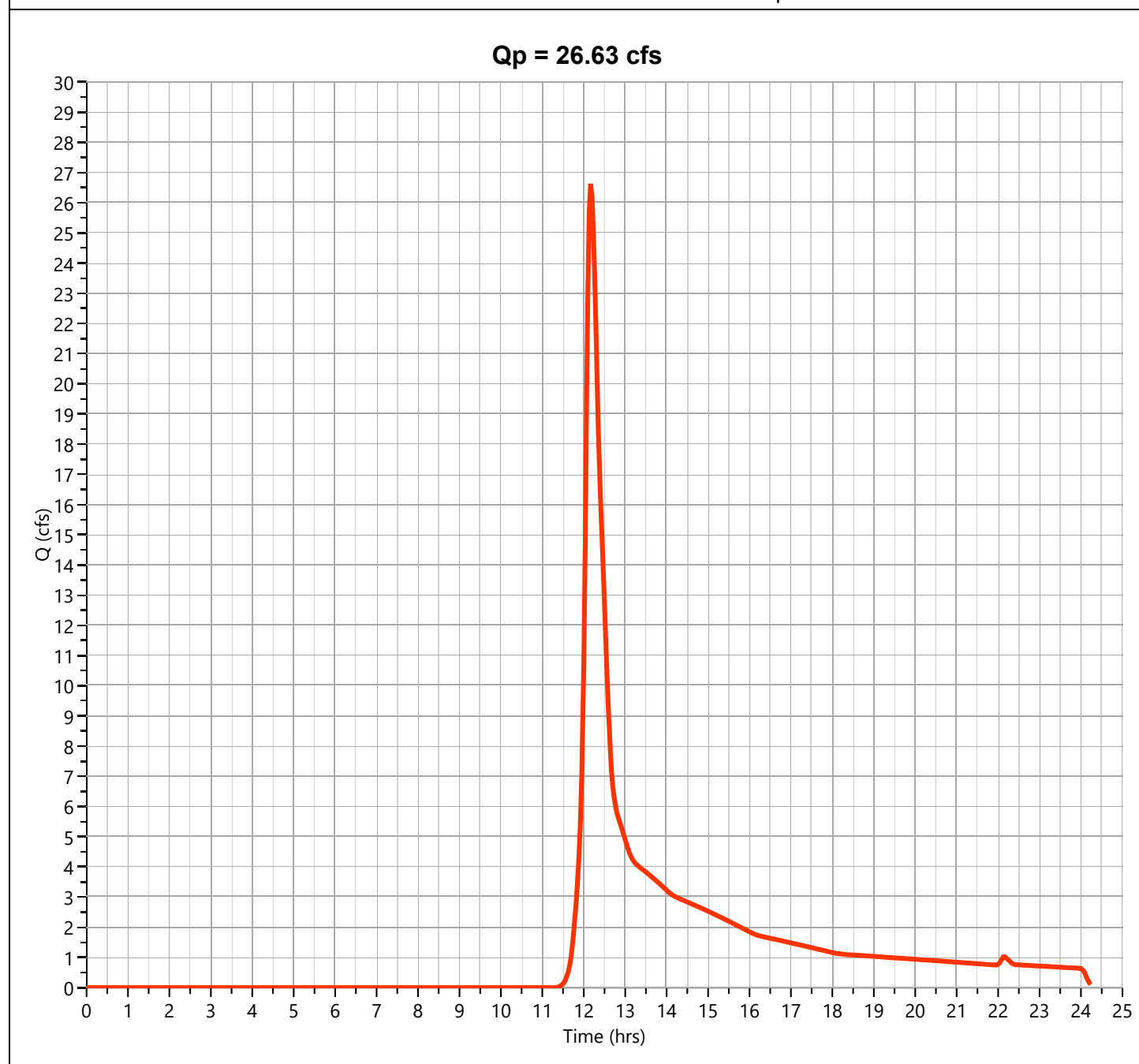
Hydrology Studio v 3.0.0.21

10-27-2022

**P-2B-B**

**Hyd. No. 32**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 26.63 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 115,404 cuft
Drainage Area	= 15.81 ac	Curve Number	= 48
Tc Method	= User	Time of Conc. (Tc)	= 11.3 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

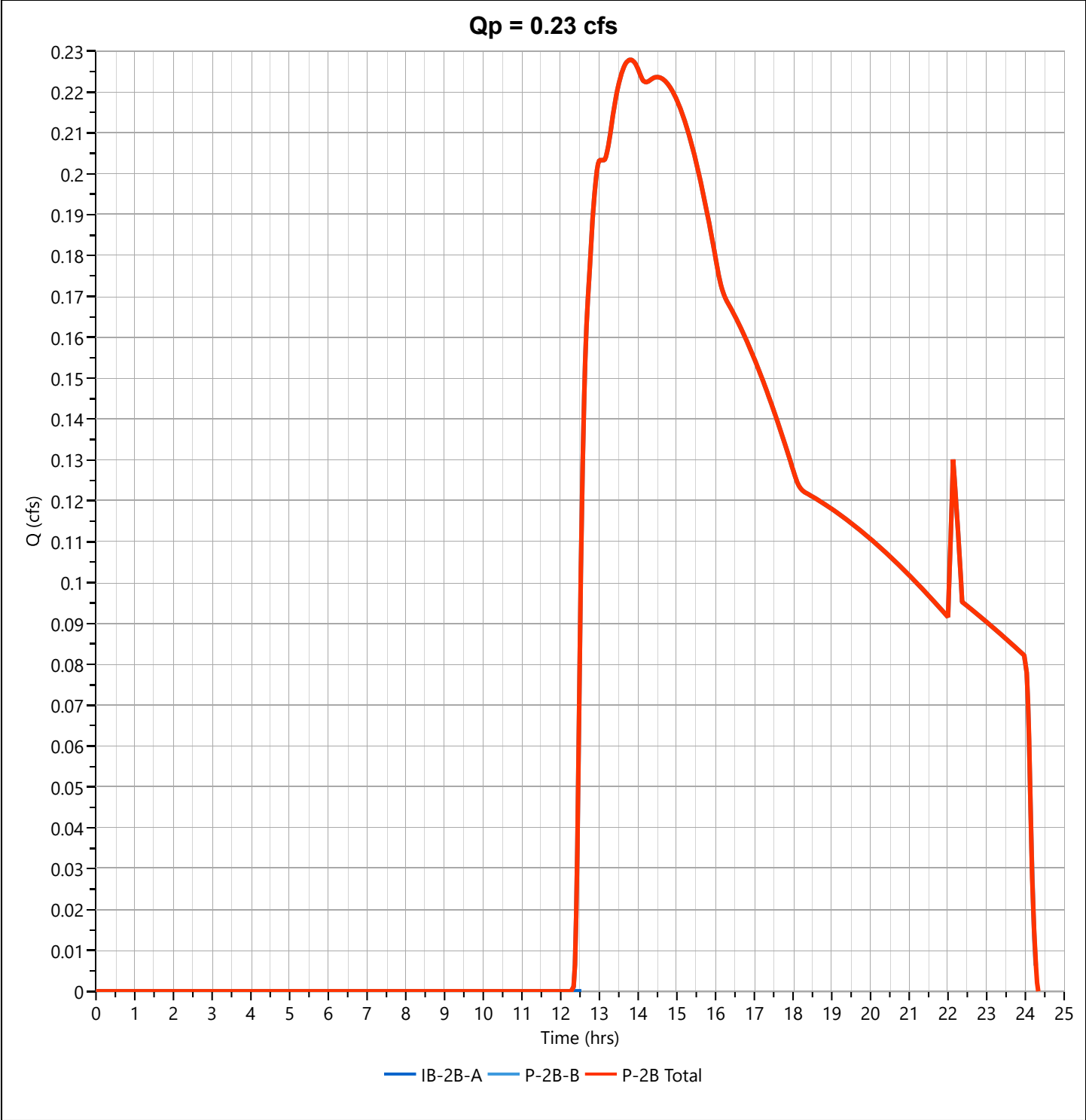
Hydrology Studio v 3.0.0.21

10-27-2022

## P-2B Total

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 0.228 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.80 hrs
Time Interval	= 2 min	Hydrograph Volume	= 6,036 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 15.81 ac



# Hydrograph Report

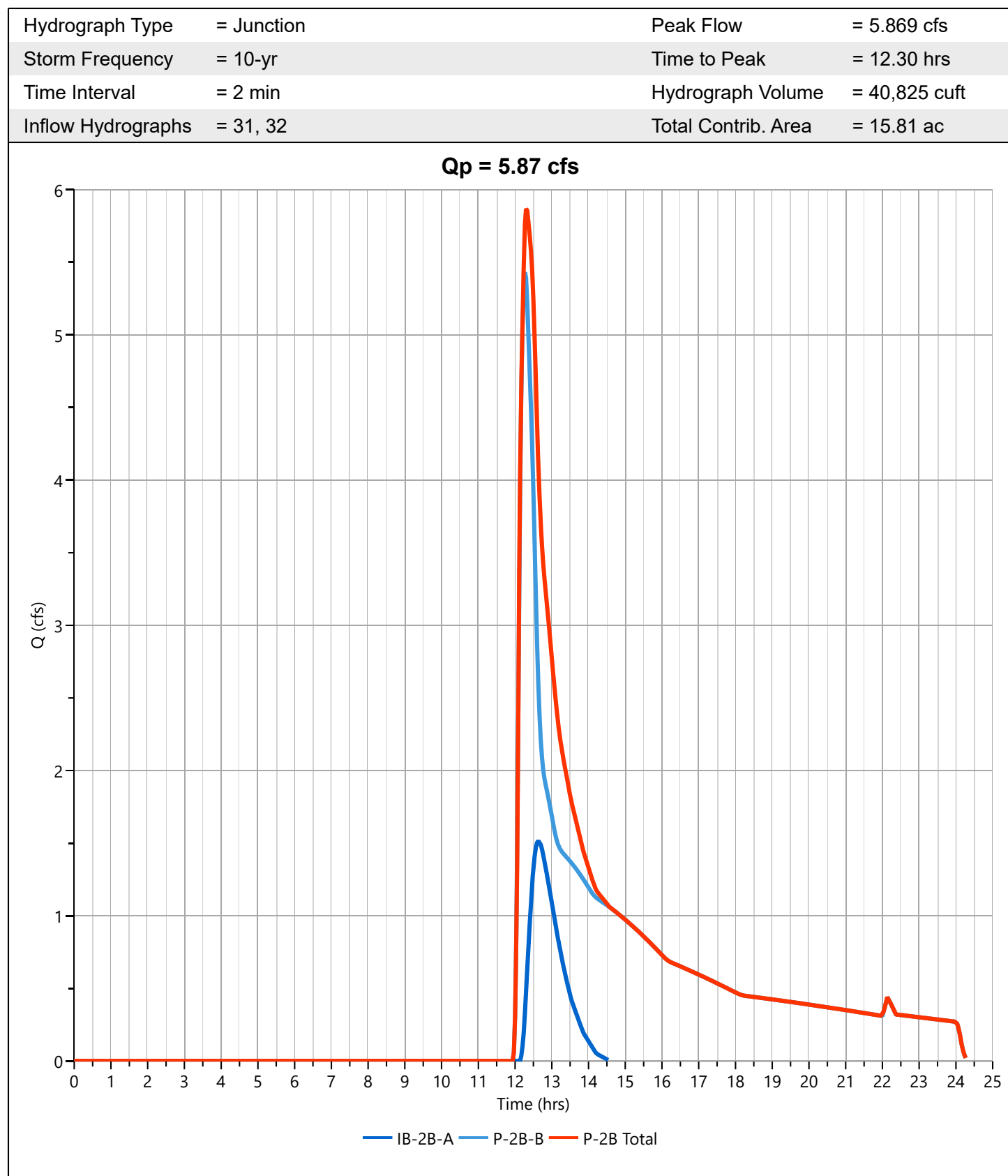
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-2B Total

Hyd. No. 33



# Hydrograph Report

Project Name:

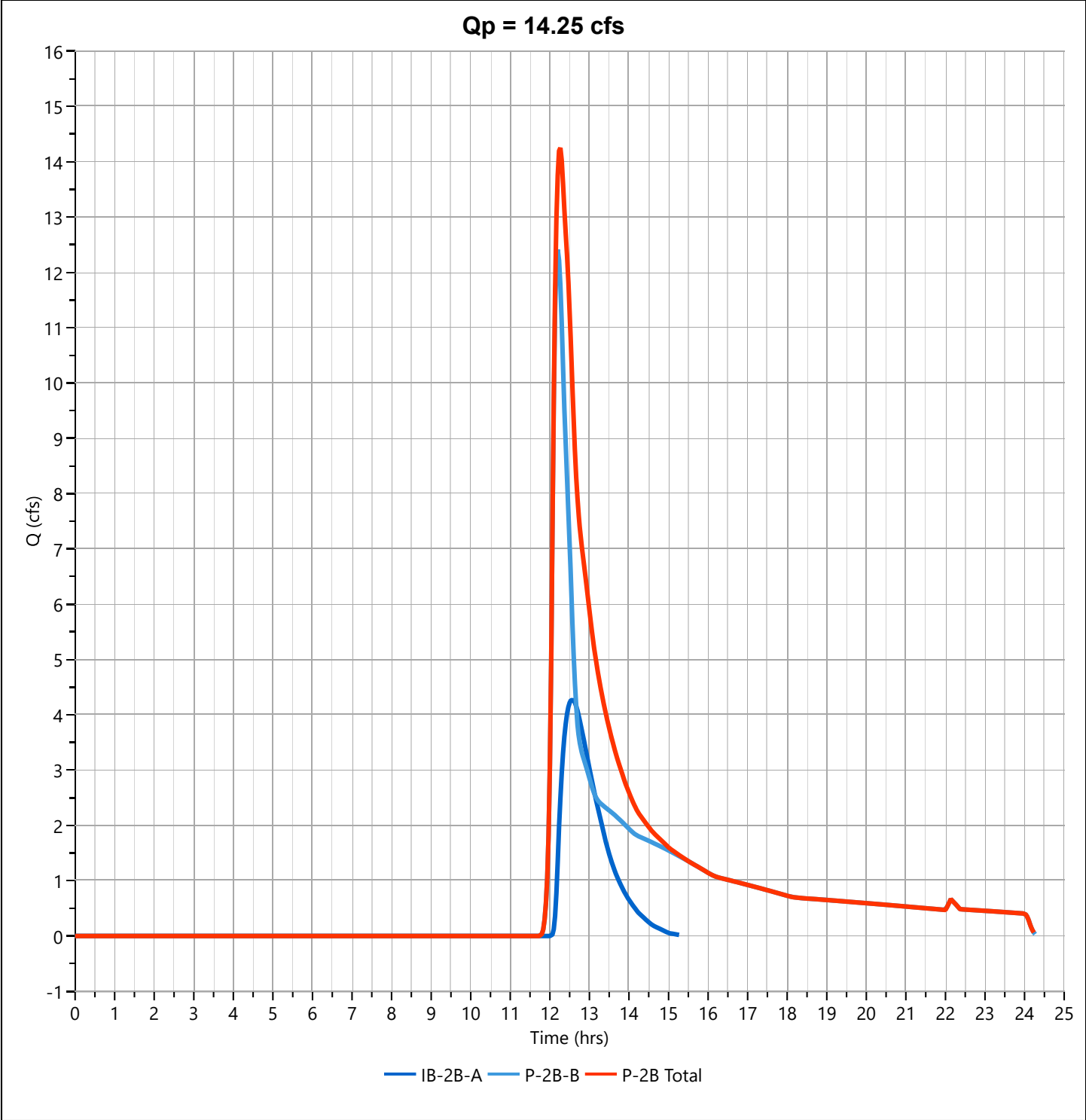
Hydrology Studio v 3.0.0.21

10-27-2022

## P-2B Total

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 14.25 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 80,601 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 15.81 ac



# Hydrograph Report

Project Name:

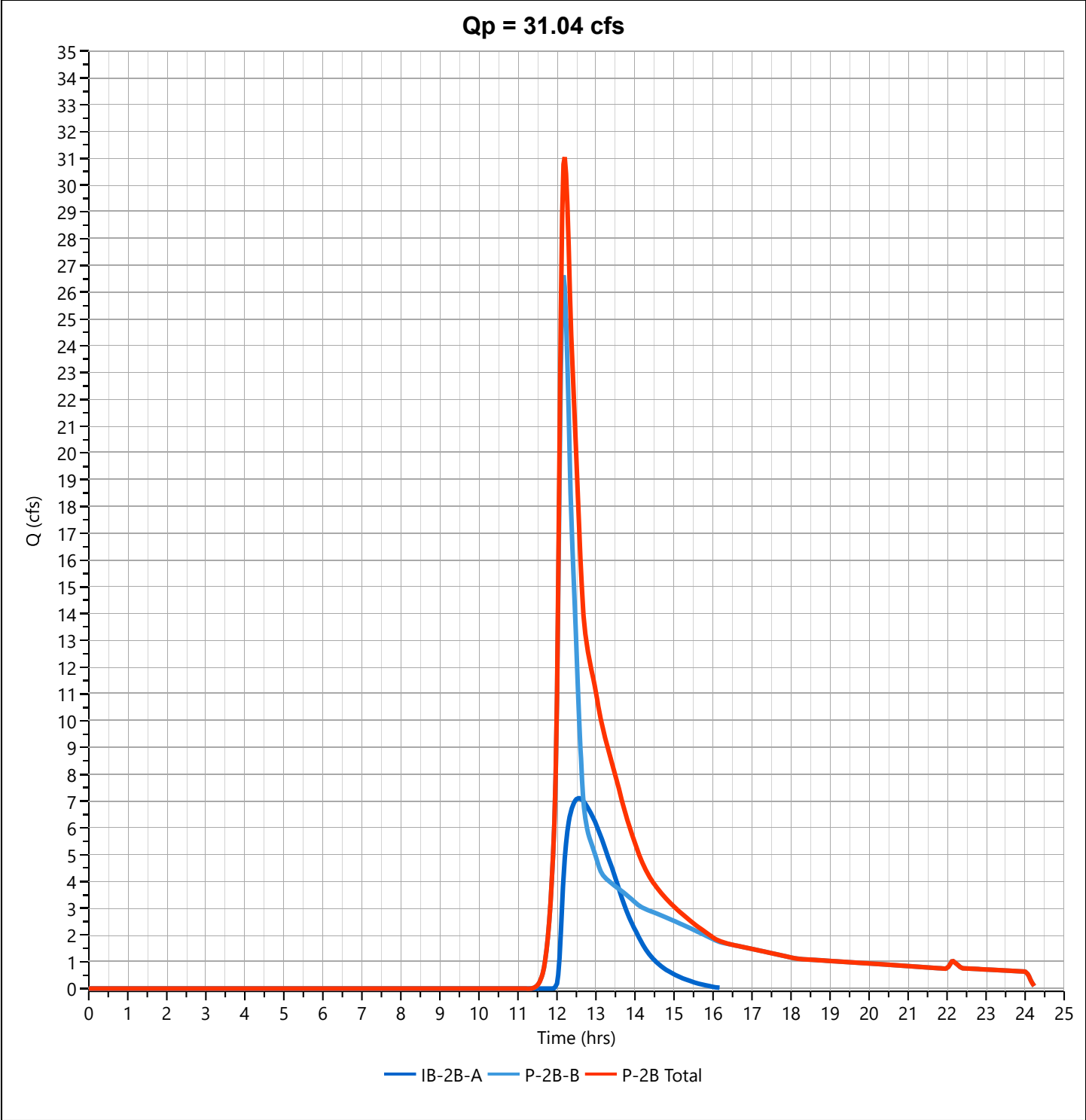
Hydrology Studio v 3.0.0.21

10-27-2022

## P-2B Total

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 31.04 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 156,142 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 15.81 ac



**Worksheet 2: Runoff curve number and runoff**

**SM-3719C**

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.40	39.67
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			0.00	0.00
C	Open Space Good Condition	74			0.68	50.43
C	Gravel	89			0.00	0.00
1/ Use only one CN source per line. 47317 Totals =					1.09	90.10

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{90.10}{1.09} = 82.94 ; \text{ Use CN} = \boxed{83}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.66	4.22	5.82

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date 10/13/2022

Date \_\_\_\_\_

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-3ASheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr

0.14

min

8.2



# Hydrograph Report

Project Name:

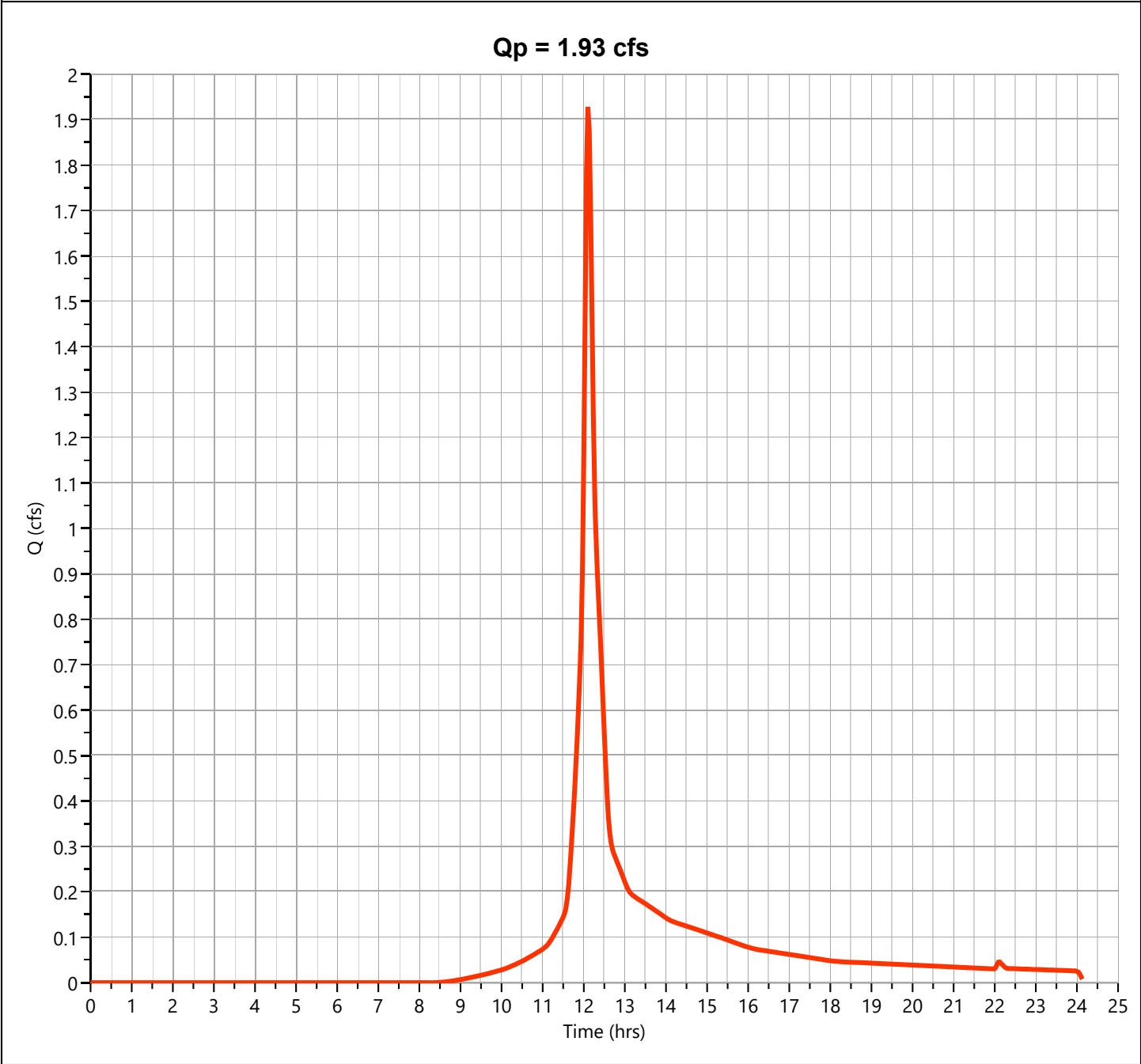
Hydrology Studio v 3.0.0.21

10-27-2022

P-3A

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.928 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 6,595 cuft
Drainage Area	= 1.09 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 8.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

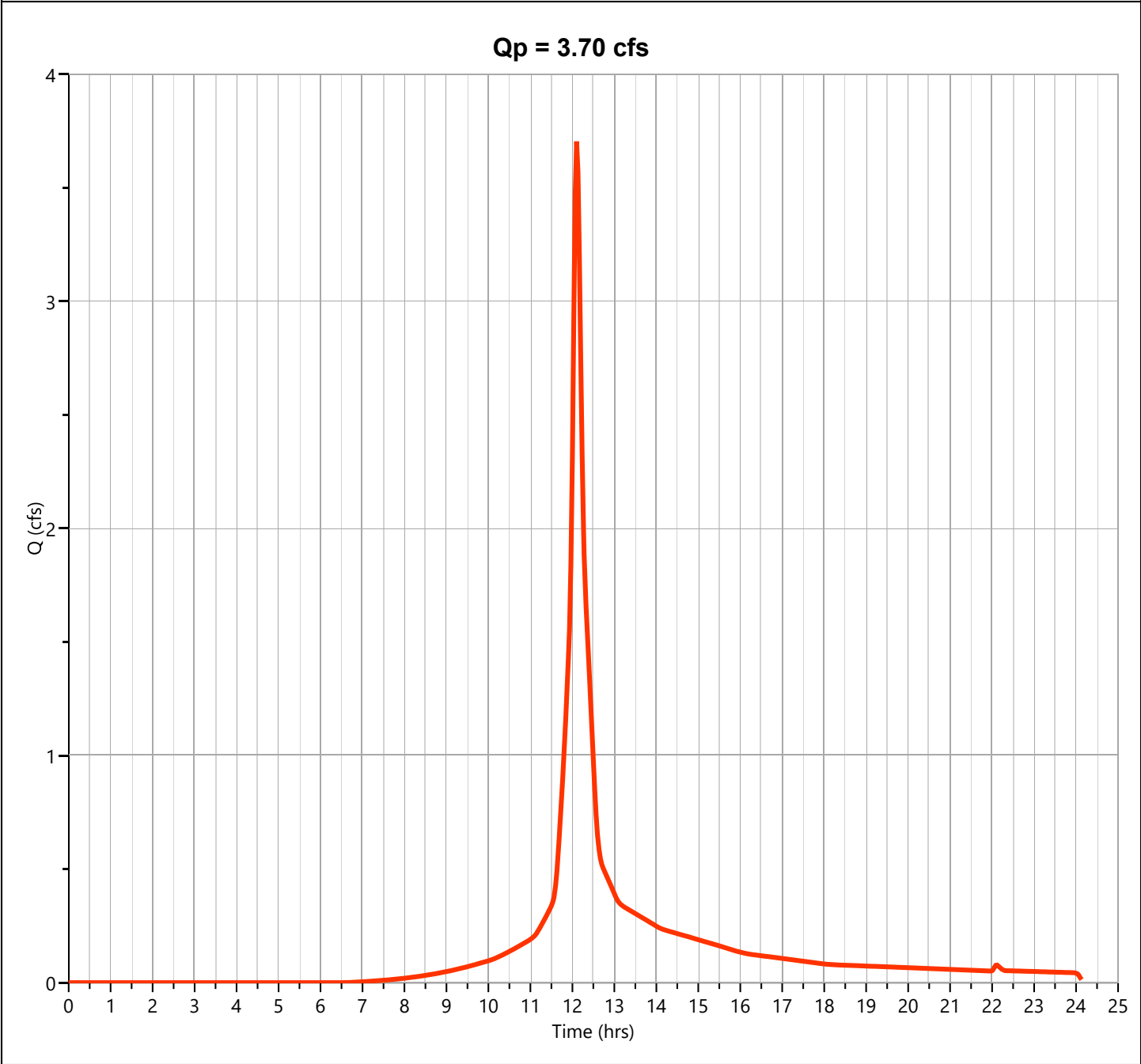
Hydrology Studio v 3.0.0.21

10-27-2022

P-3A

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.704 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 12,702 cuft
Drainage Area	= 1.09 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 8.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

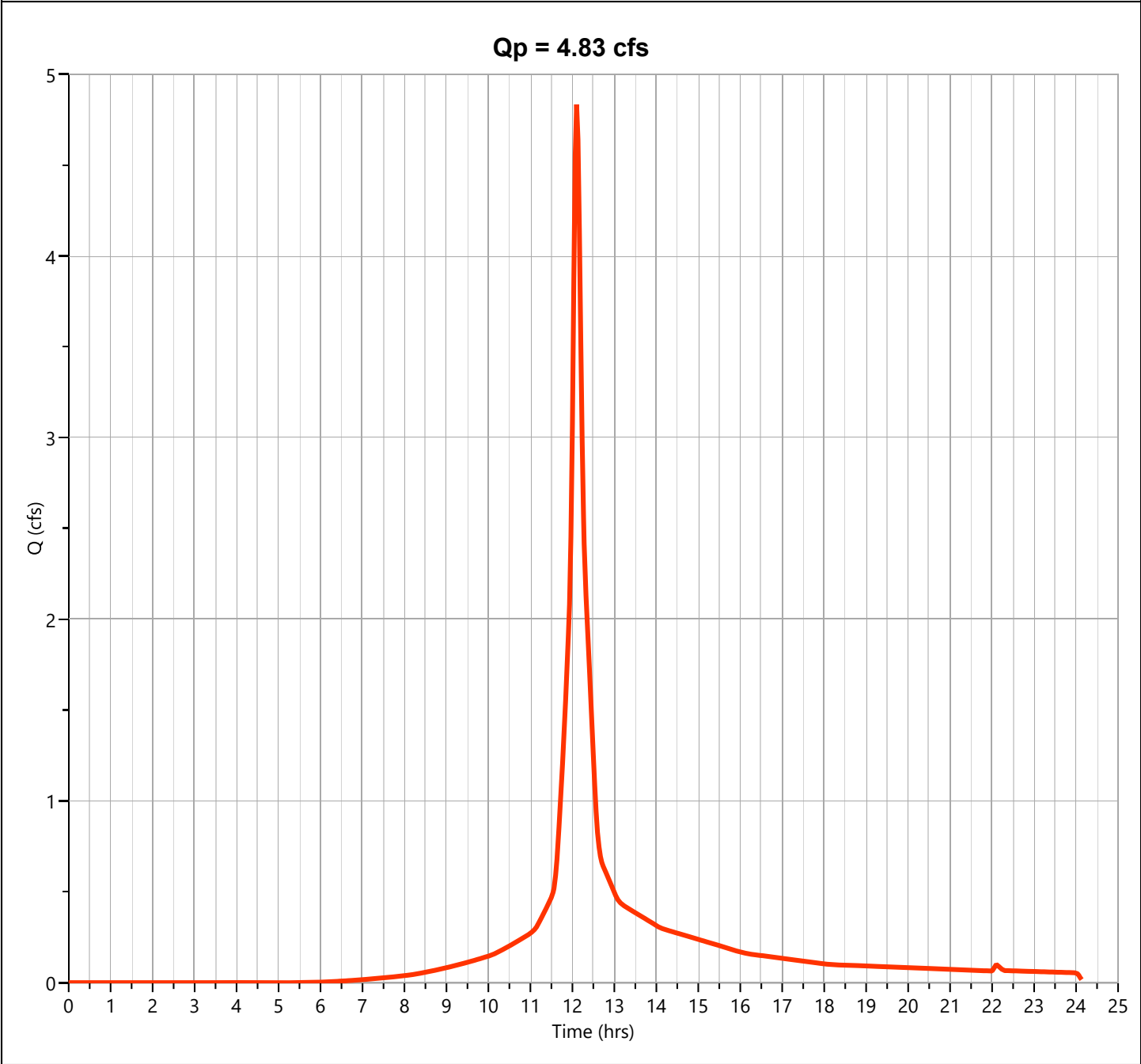
Hydrology Studio v 3.0.0.21

10-27-2022

P-3A

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.833 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 16,703 cuft
Drainage Area	= 1.09 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 8.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

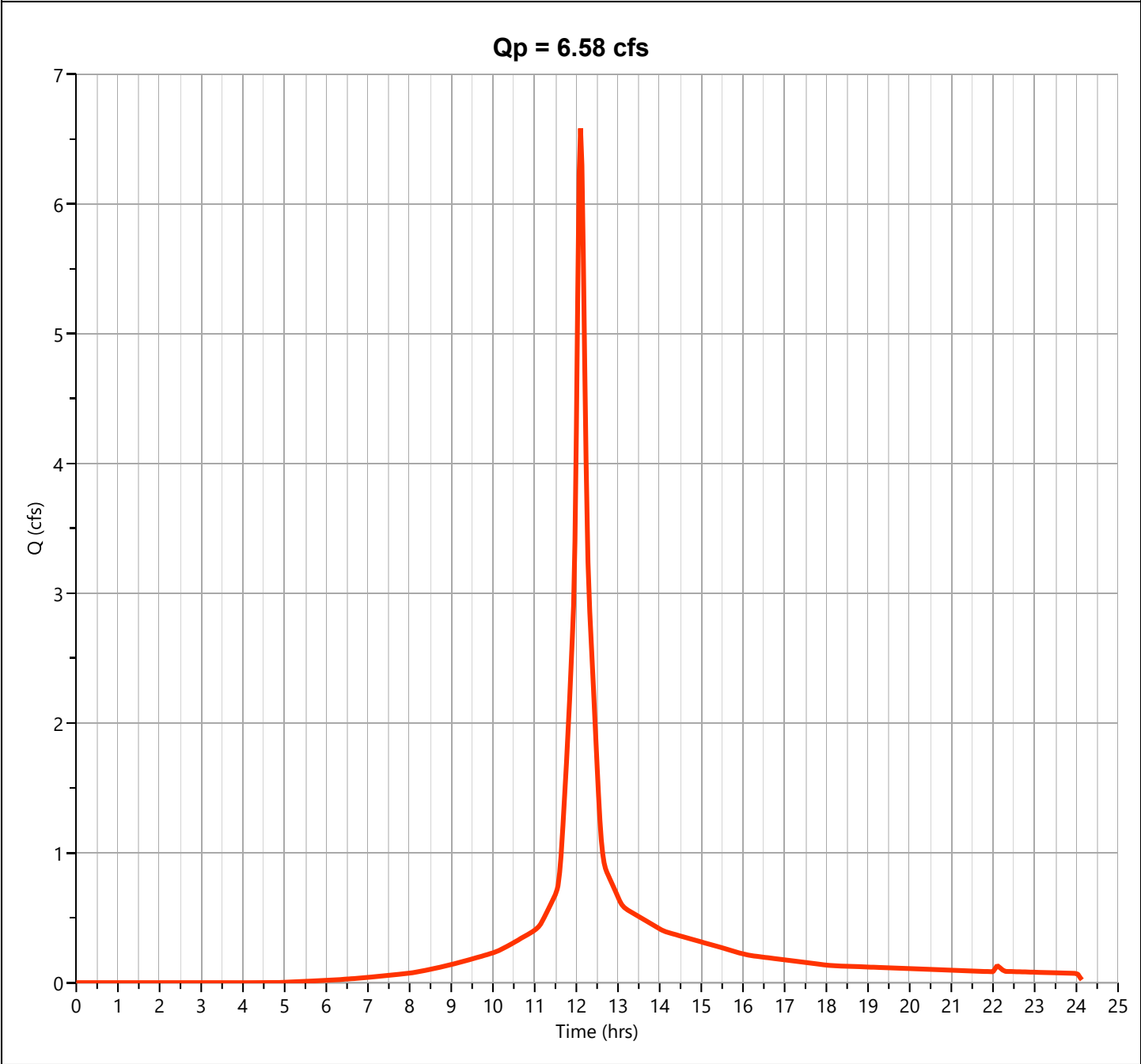
Hydrology Studio v 3.0.0.21

10-27-2022

P-3A

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.583 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 23,047 cuft
Drainage Area	= 1.09 ac	Curve Number	= 83
Tc Method	= User	Time of Conc. (Tc)	= 8.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

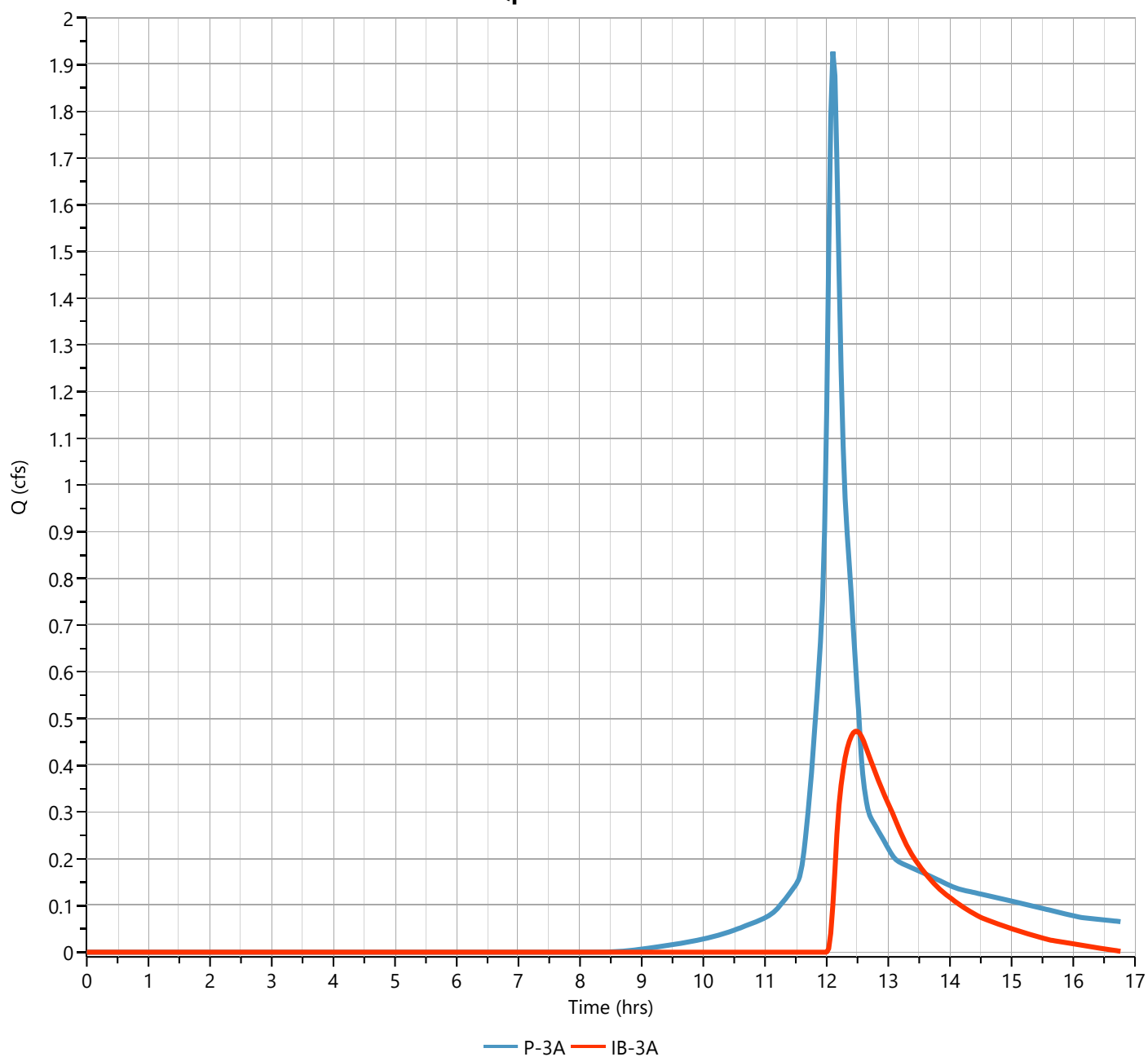
## IB-3A

## Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 0.473 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,397 cuft
Inflow Hydrograph	= 3 - P-3A	Max. Elevation	= 290.19 ft
Pond Name	= IB-3A	Max. Storage	= 2,228 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.47 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

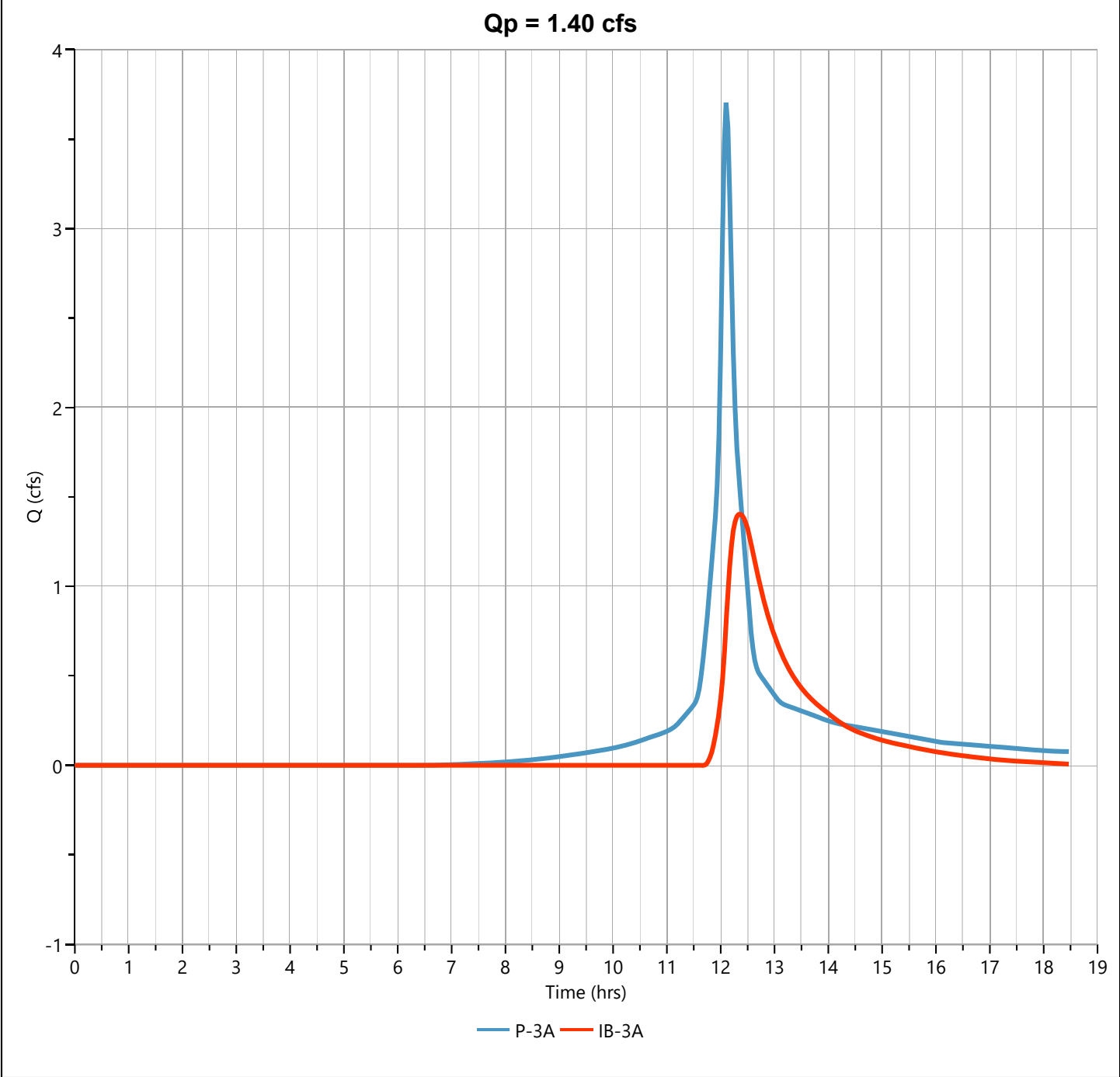
10-27-2022

IB-3A

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 1.404 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 7,033 cuft
Inflow Hydrograph	= 3 - P-3A	Max. Elevation	= 290.93 ft
Pond Name	= IB-3A	Max. Storage	= 3,938 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

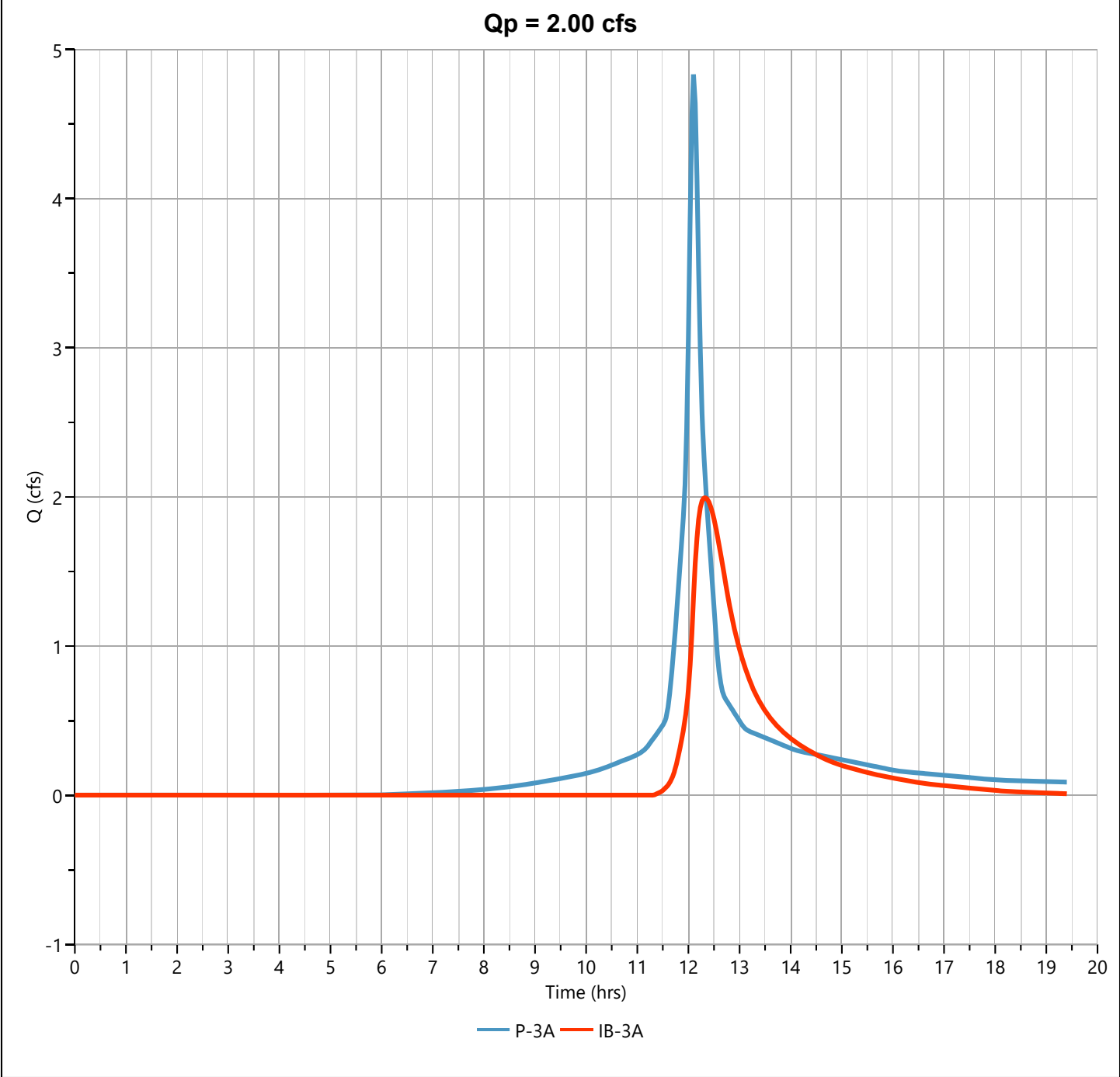
10-27-2022

IB-3A

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 1.995 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 10,323 cuft
Inflow Hydrograph	= 3 - P-3A	Max. Elevation	= 291.30 ft
Pond Name	= IB-3A	Max. Storage	= 4,993 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

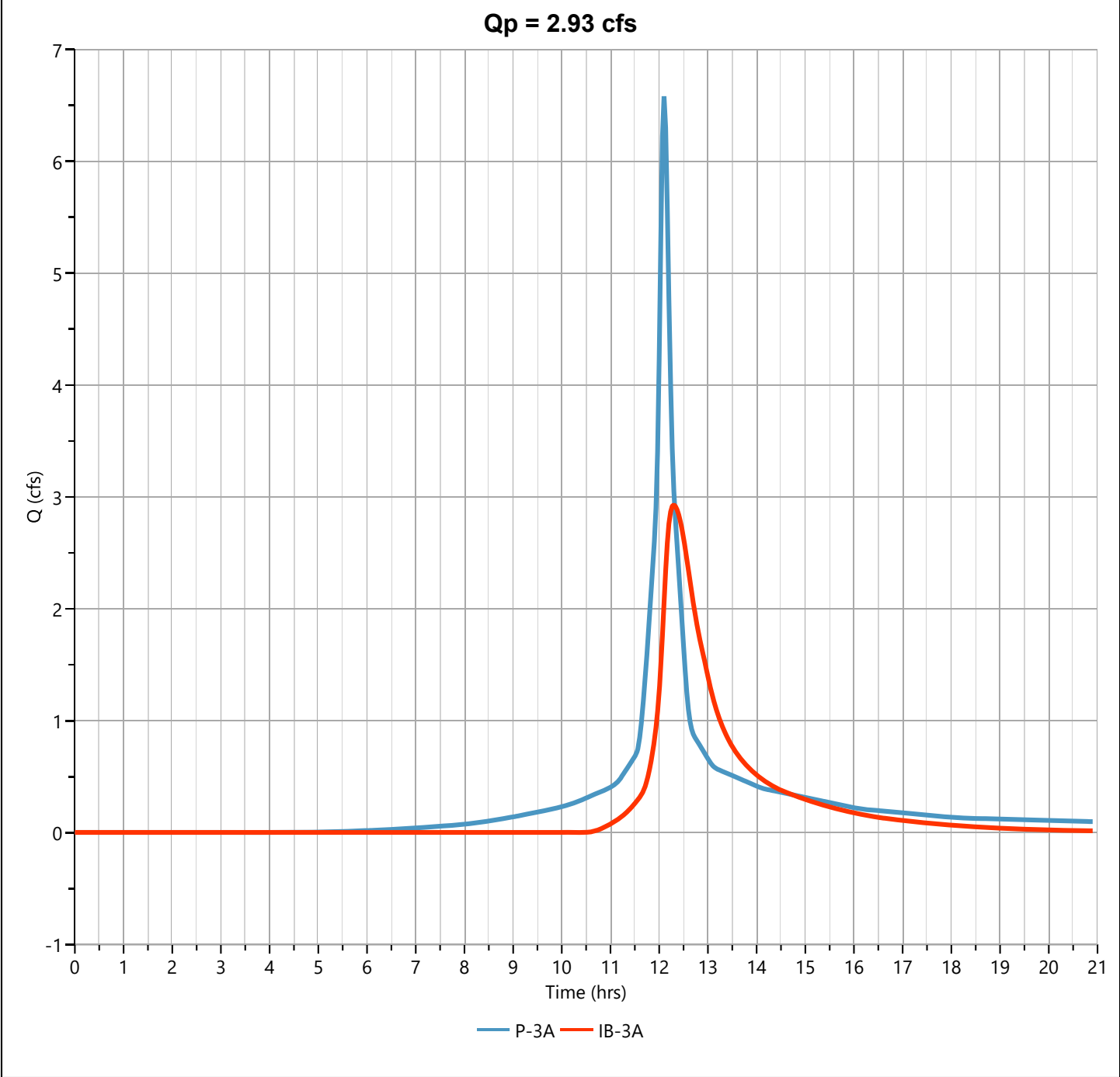
10-27-2022

IB-3A

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 2.929 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,808 cuft
Inflow Hydrograph	= 3 - P-3A	Max. Elevation	= 291.83 ft
Pond Name	= IB-3A	Max. Storage	= 6,527 cuft

Pond Routing by Storage Indication Method





# Pond Report

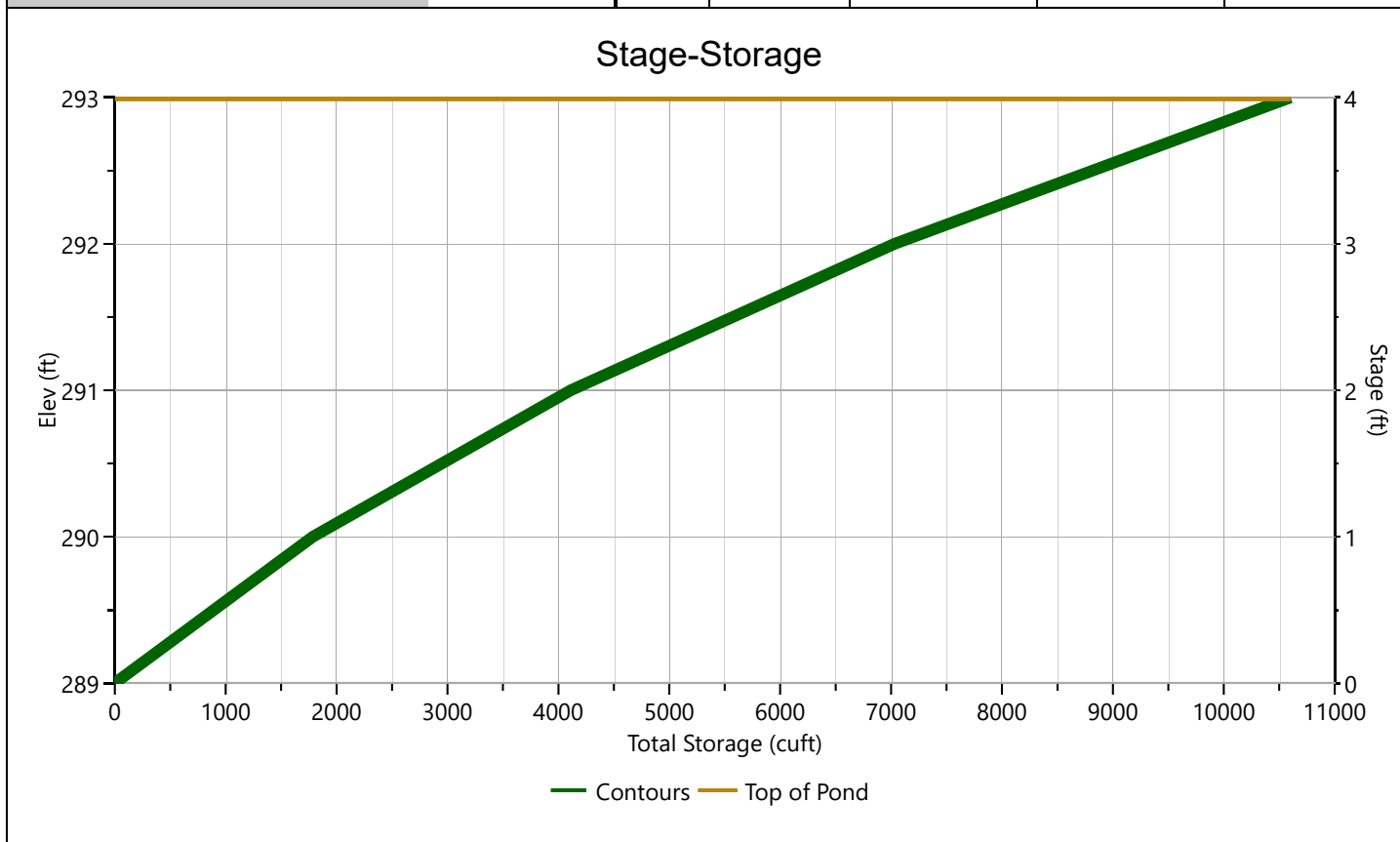
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

# IB-3A

## Stage-Storage

[illegible]

# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

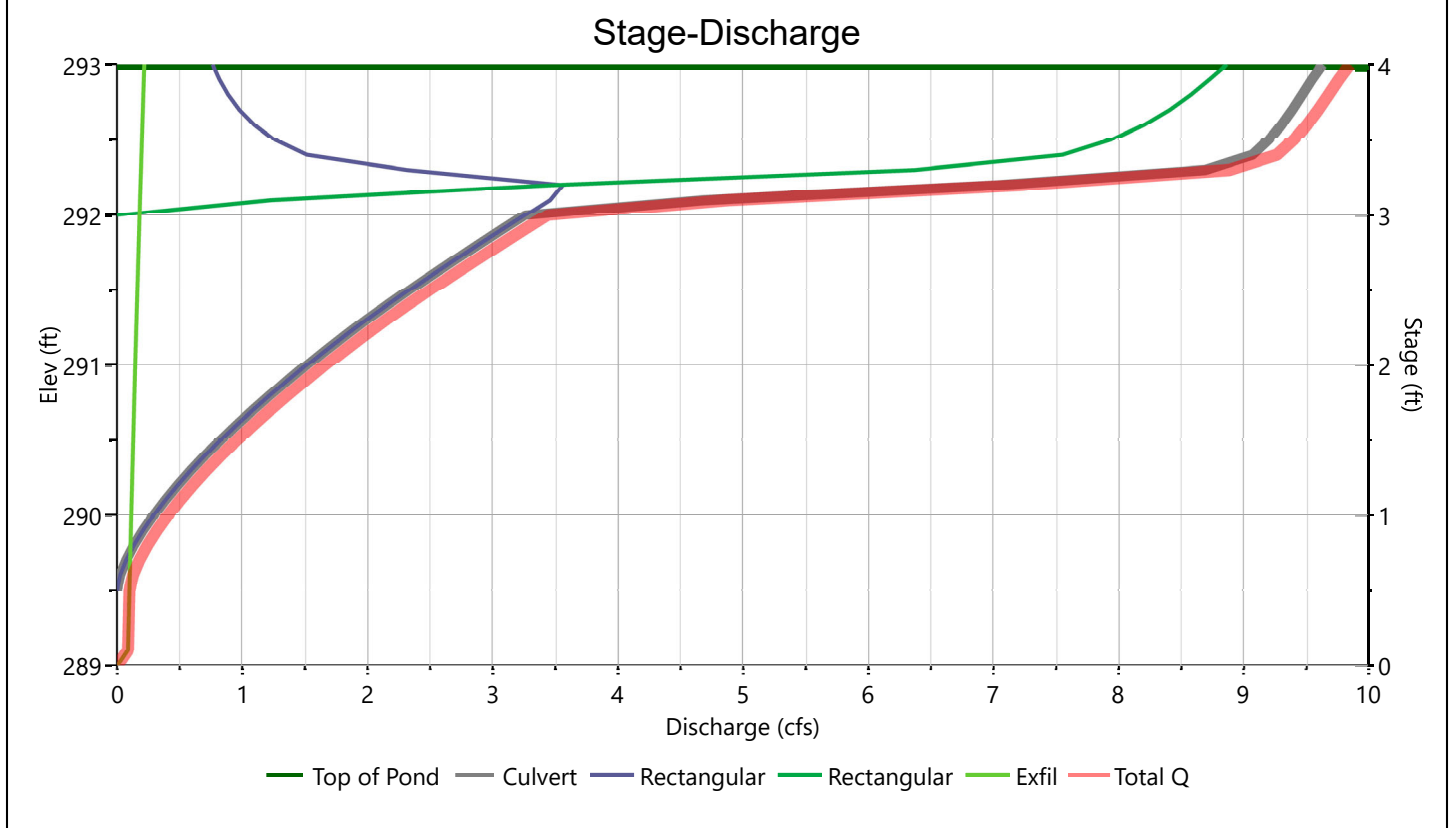
10-27-2022

## IB-3A

## Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1	2	3	
Rise, in	12				Hole Diameter, in
Span, in	12				No. holes
No. Barrels	1				Invert Elevation, ft
Invert Elevation, ft	286.00				Height, ft
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co
Length, ft	37				
Barrel Slope, %	2.7				
N-Value, n	0.012				
Weirs	Riser*	Weirs			Ancillary
		1*	2*	3	
Shape / Type	Circular	Rectangular	Rectangular		Exfiltration, in/hr
Crest Elevation, ft		289.5	292		2.41**
Crest Length, ft		.25	11.75		
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 3.0.0.21

10-27-2022

**IB-3A**

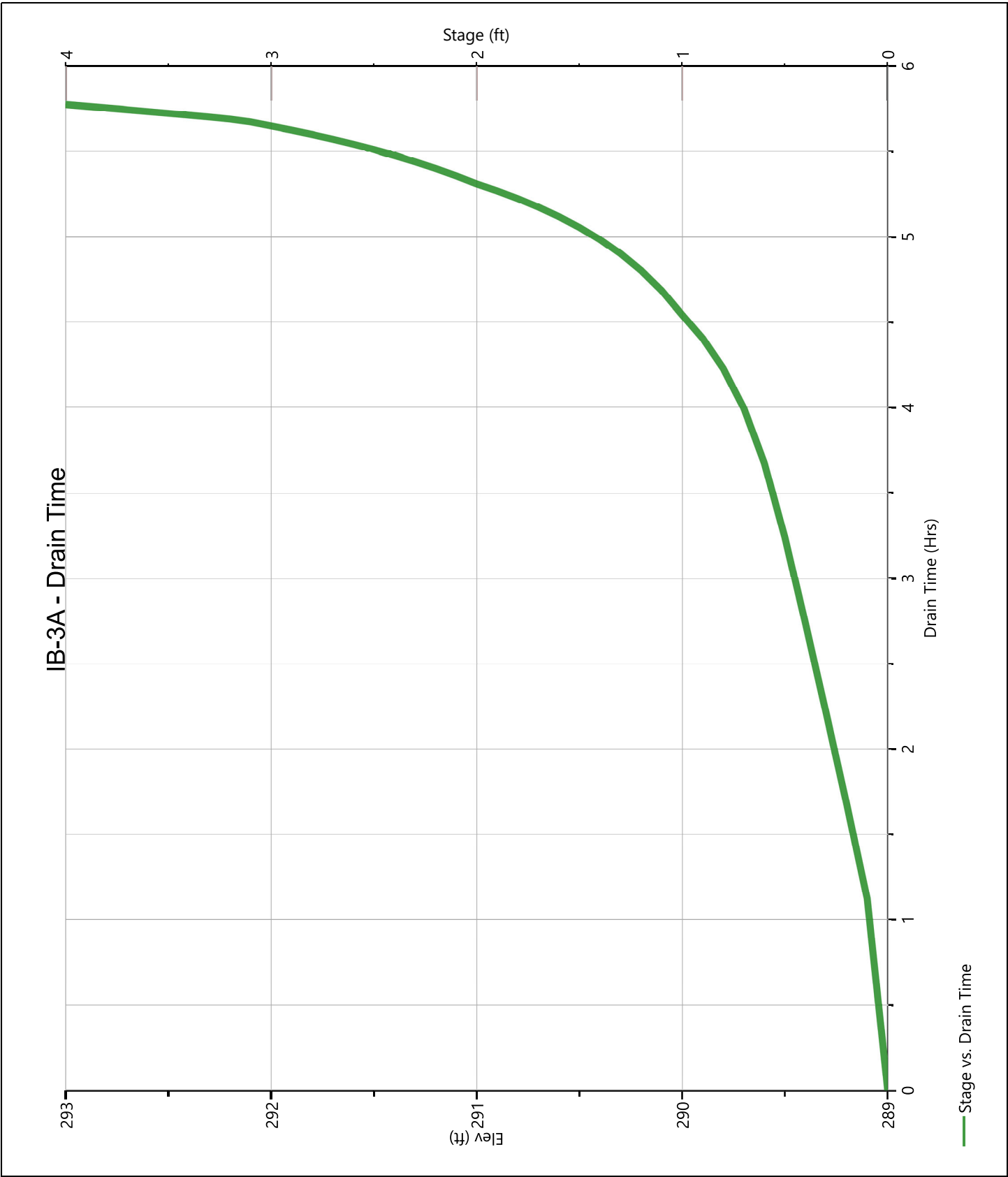
### Stage-Storage-Discharge Summary

[illegible]

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

IB-3A

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	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			7.27	509.21
C	Open Space Good Condition	74			0.90	66.27
C	Gravel	89			0.35	30.80
1/ Use only one CN source per line. 370960 Totals =					8.52	606.28

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{606.28}{8.52} = 71.19 ; \text{ Use CN} = \boxed{71}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.93	3.03	4.46

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: 

Present	Developed
---------	-----------

Circle one: 

Tc	Tt
----	----

Subcatchment P-3Bthrough  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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:

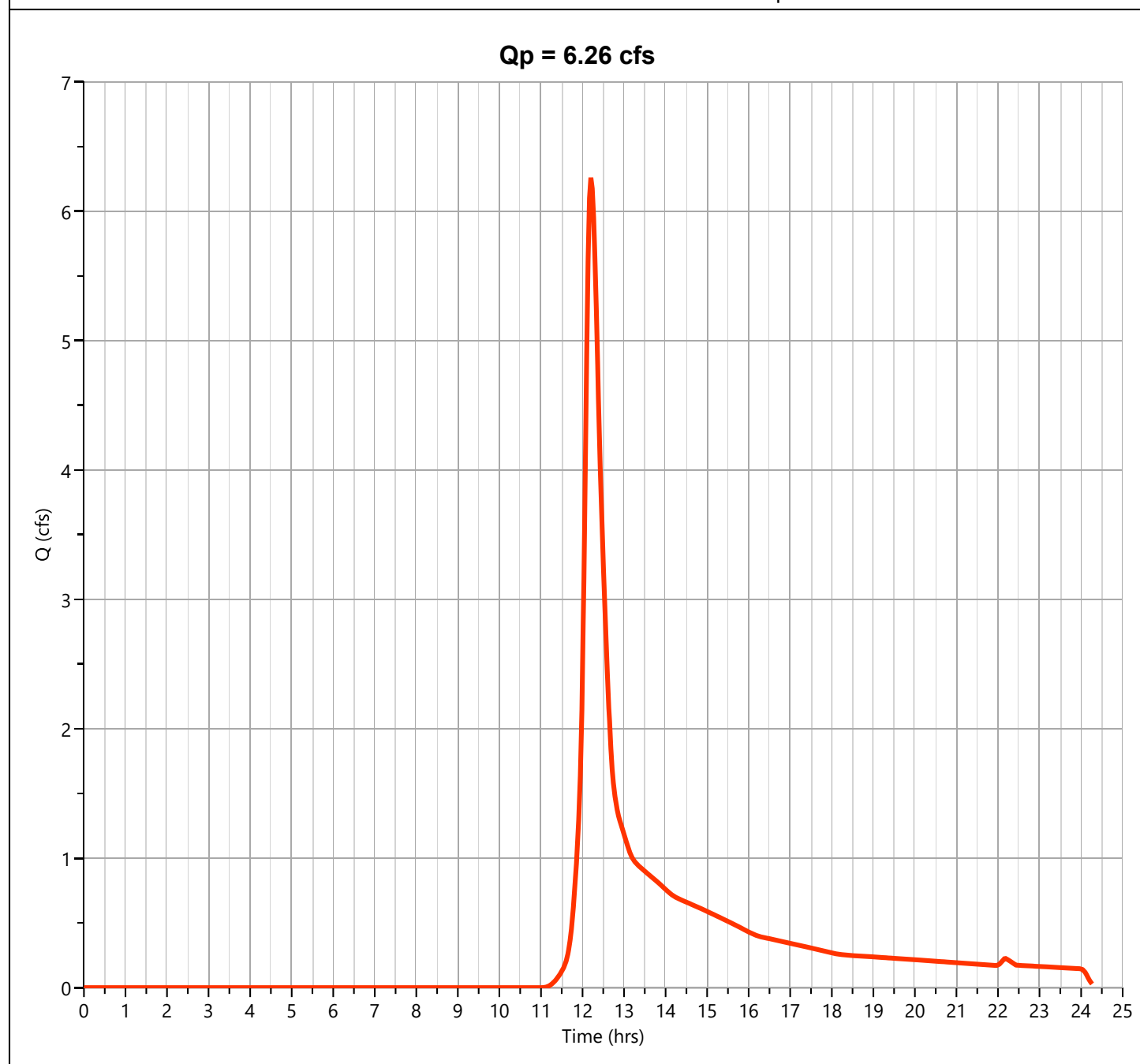
Hydrology Studio v 3.0.0.21

10-27-2022

**P-3B**

**Hyd. No. 5**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.260 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 27,756 cuft
Drainage Area	= 8.52 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:

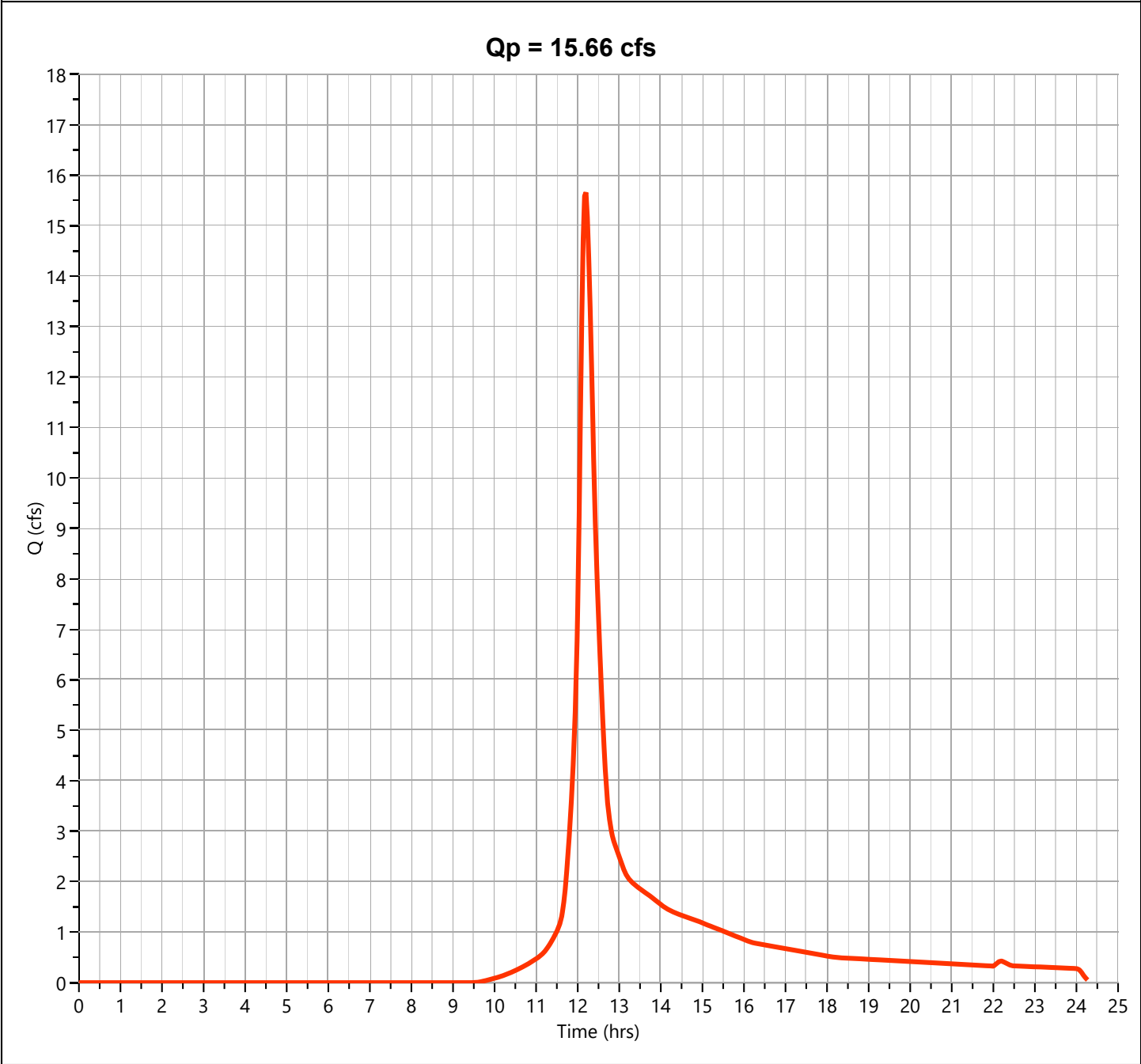
Hydrology Studio v 3.0.0.21

10-27-2022

P-3B

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.66 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 64,735 cuft
Drainage Area	= 8.52 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:

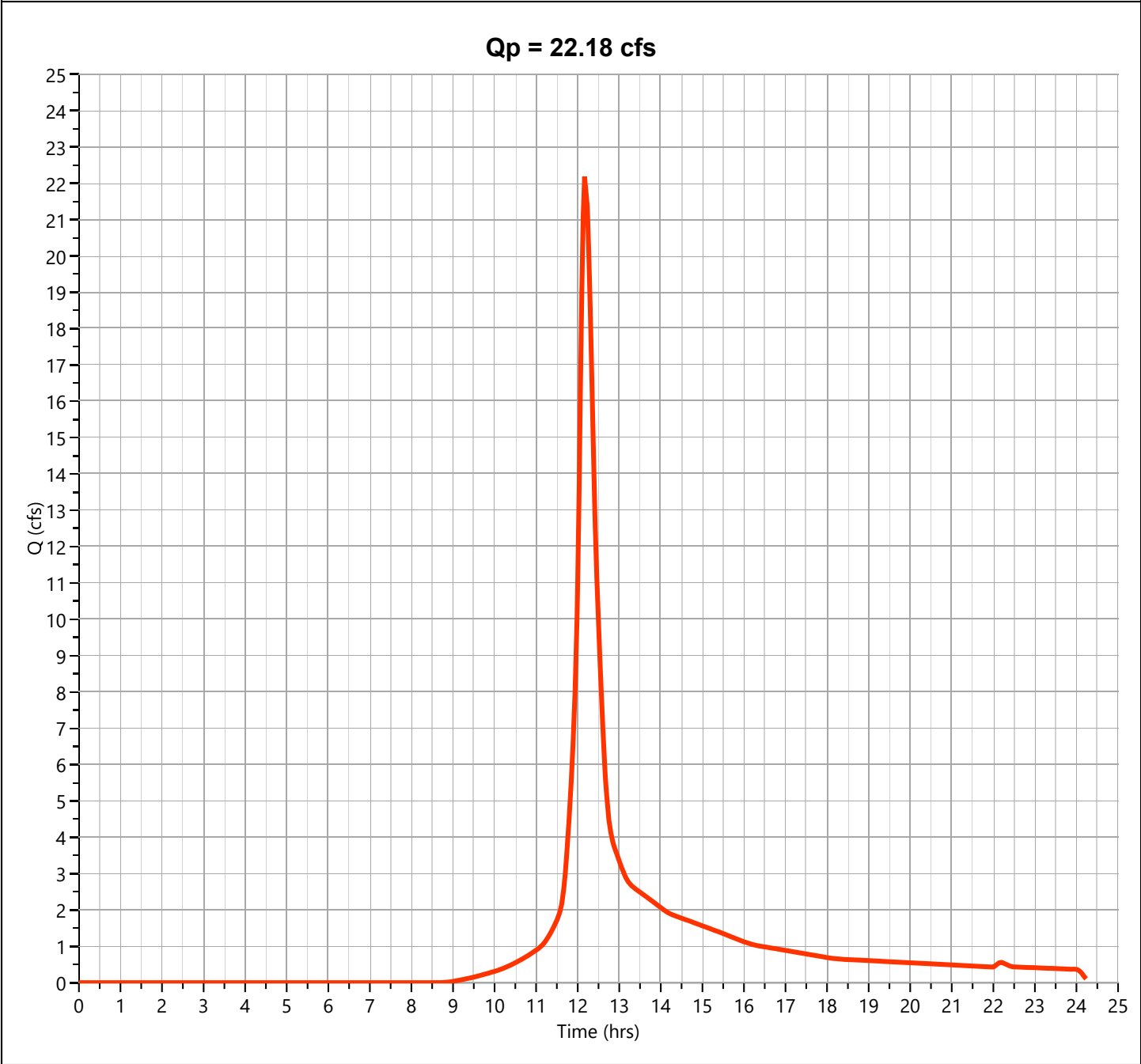
Hydrology Studio v 3.0.0.21

10-27-2022

P-3B

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 22.18 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 90,824 cuft
Drainage Area	= 8.52 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:

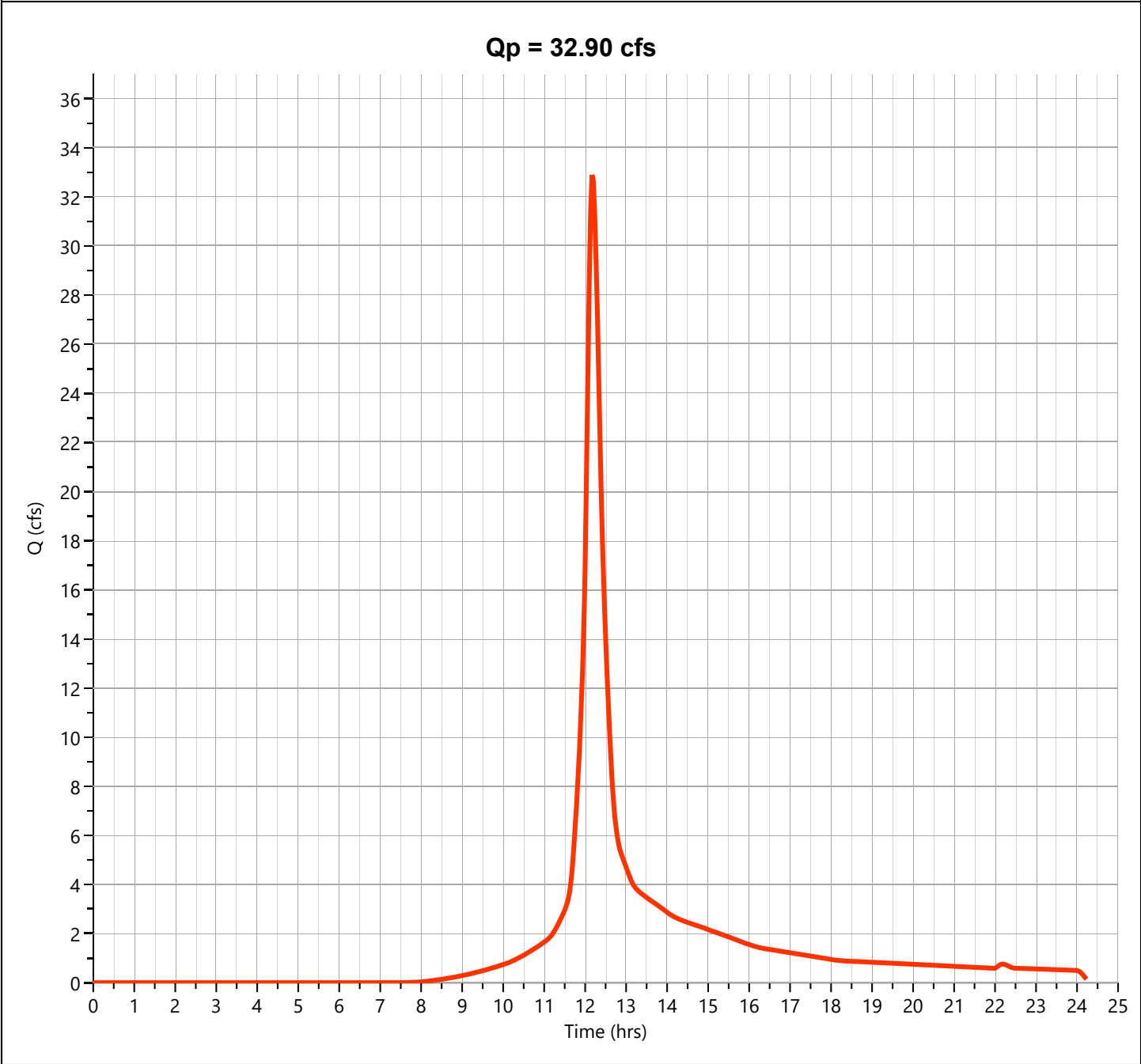
Hydrology Studio v 3.0.0.21

10-27-2022

P-3B

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 32.90 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 133,902 cuft
Drainage Area	= 8.52 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

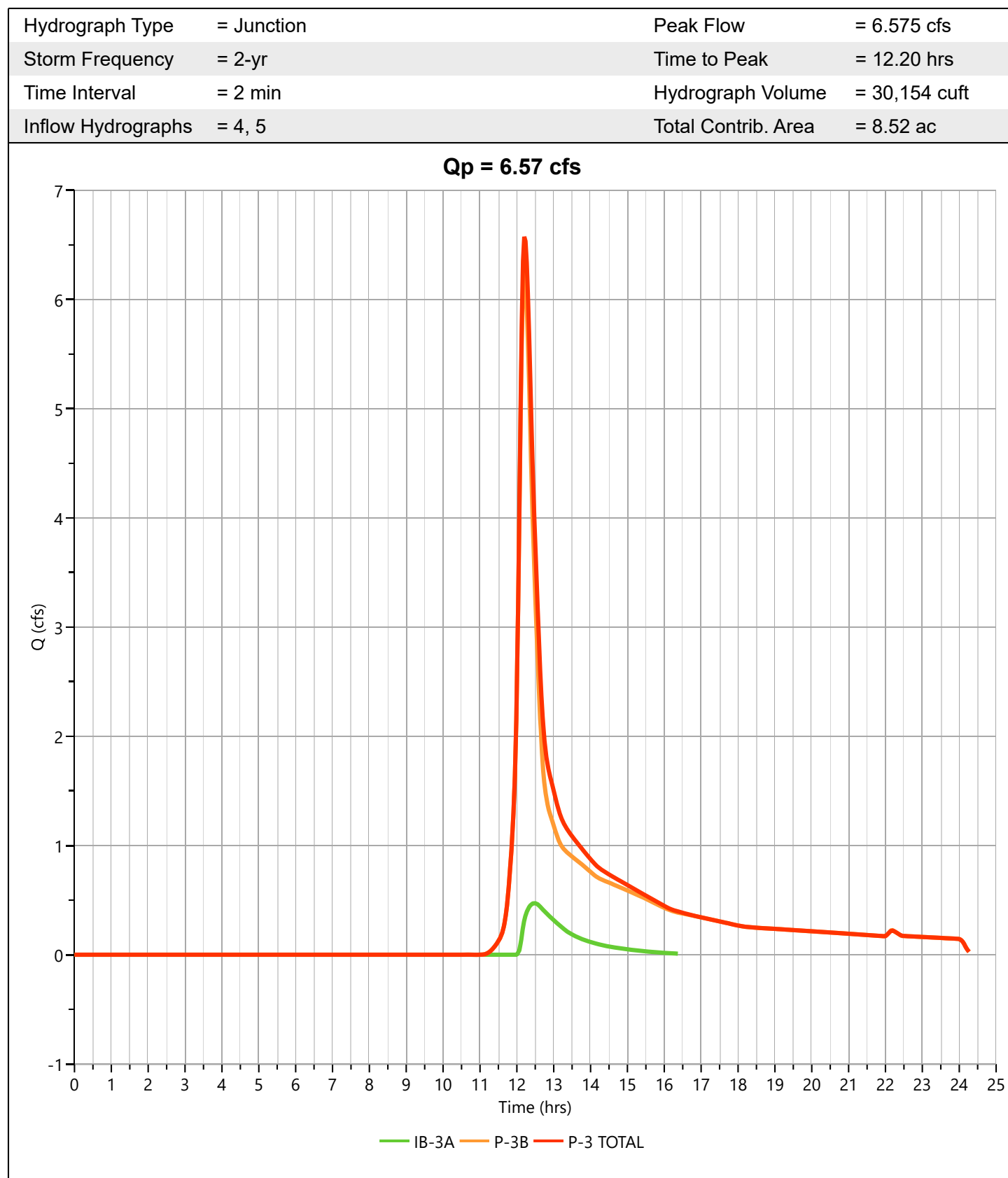
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-3 TOTAL

Hyd. No. 6



# Hydrograph Report

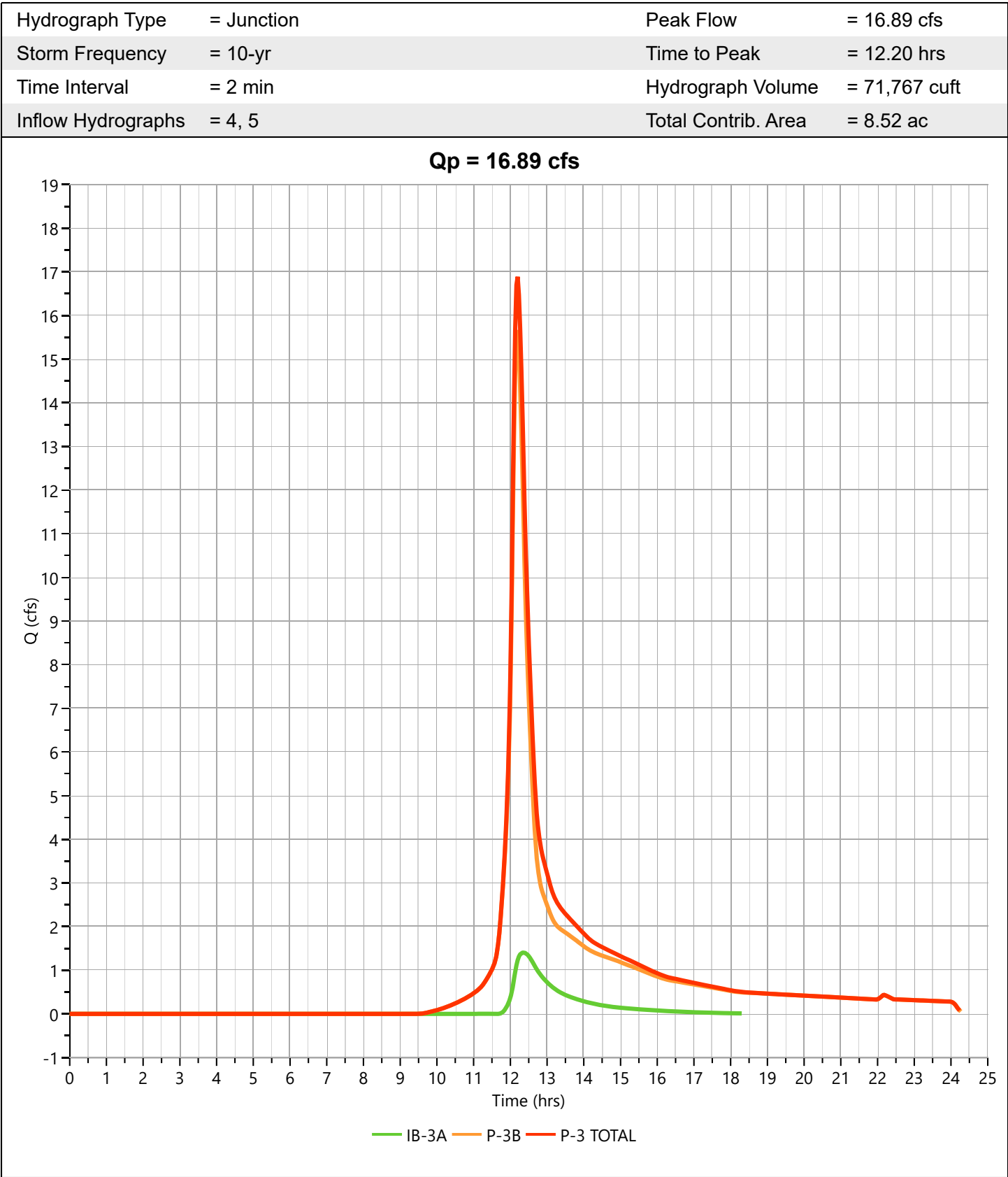
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-3 TOTAL

Hyd. No. 6



# Hydrograph Report

Project Name:

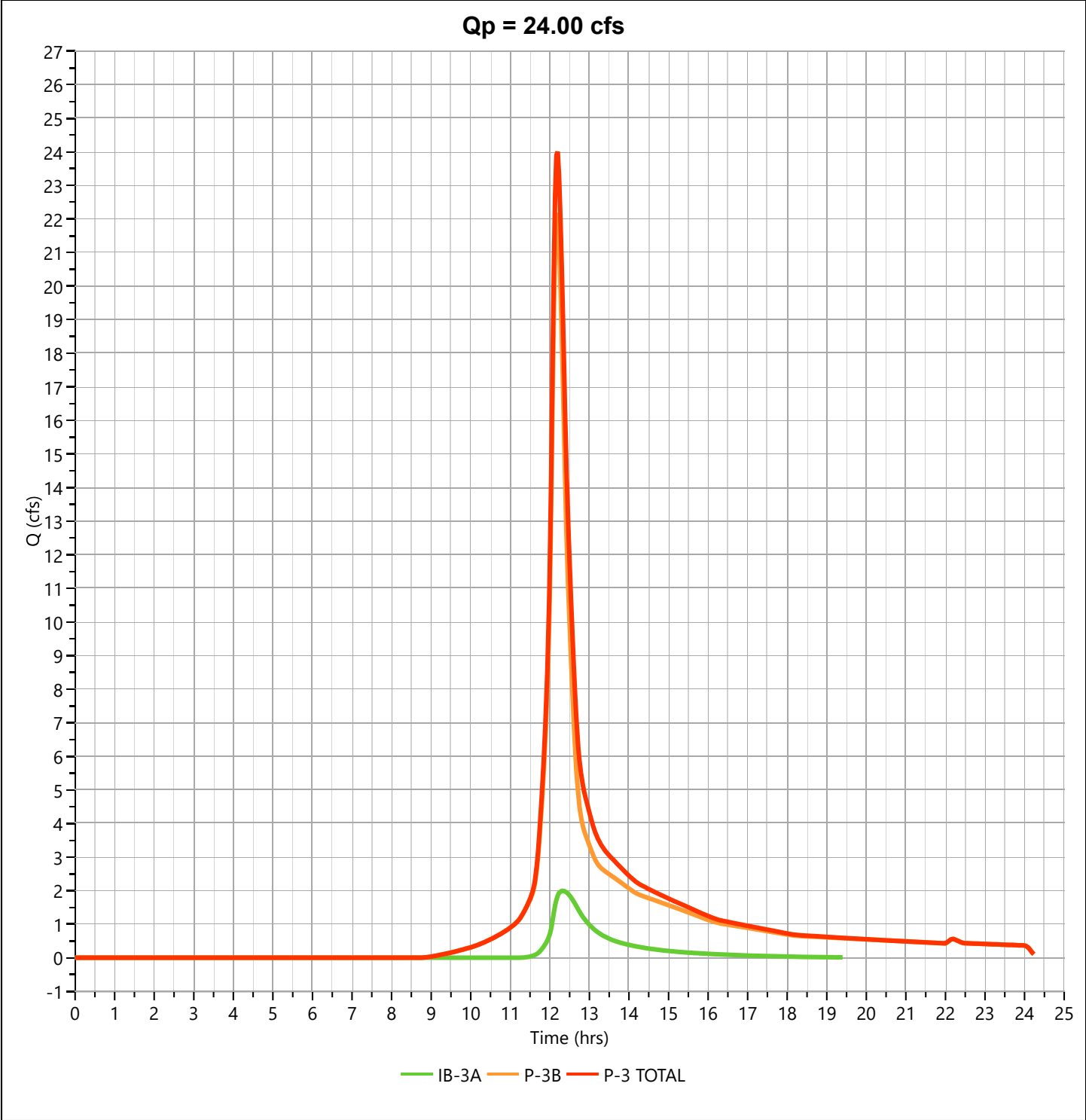
Hydrology Studio v 3.0.0.21

10-27-2022

## P-3 TOTAL

Hyd. No. 6

Hydrograph Type	= Junction	Peak Flow	= 24.00 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 101,147 cuft
Inflow Hydrographs	= 4, 5	Total Contrib. Area	= 8.52 ac



# Hydrograph Report

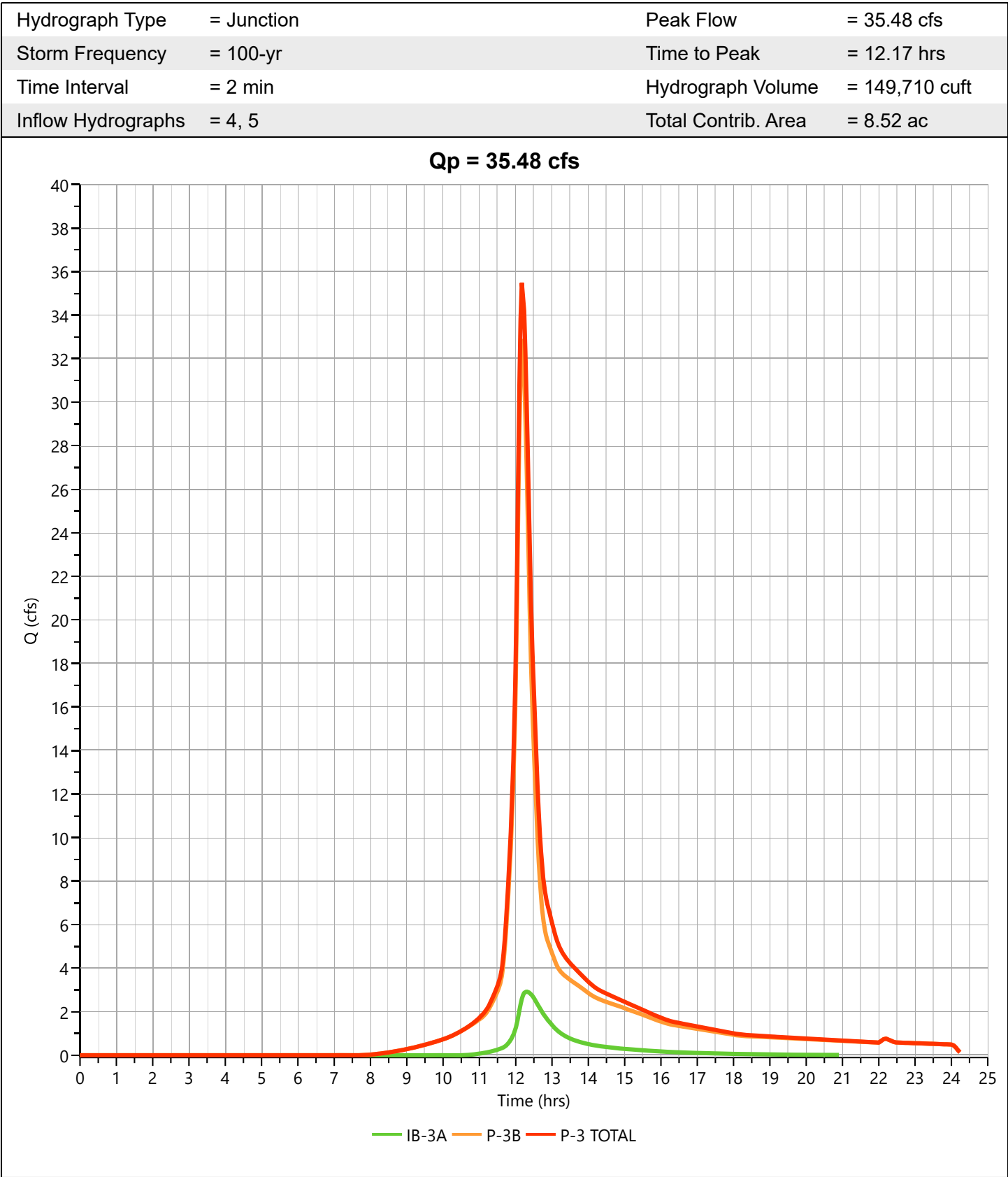
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-3 TOTAL

## Hyd. No. 6



**Worksheet 2: Runoff curve number and runoff**

**SM-3719C**

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 Date \_\_\_\_\_  
 Circle one: Present ☐ Developed ☒ Subcatchment P-4A

**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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.27	26.69
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			0.57	40.17
C	Open Space Good Condition	74			0.86	63.71
C	Gravel	89			0.00	0.00
D	BVW	77			0.00	0.00
Totals =					1.71	130.57

1/ Use only one CN source per line.

74362

Totals =

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{130.57}{1.71} = 76.48 ; \text{ Use CN} = \boxed{76}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.23	3.55	5.07

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date 10/13/2022

Date \_\_\_\_\_

Circle one: 

Present	Developed
---------	-----------

Circle one: 

Tc	Tt
----	----

through  
subareaSubcatchment P-4ASheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.20

A-B		
WOODS		
0.6		
50		
3.1		
0.050		
0.20		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.02

B-C	C-D	D-E
UNPAVED	UNPAVED	PAVED
192	12	69
0.100	0.33	0.01
5.10	9.27	2.03
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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr

0.22

min

13.2



# Hydrograph Report

Project Name:

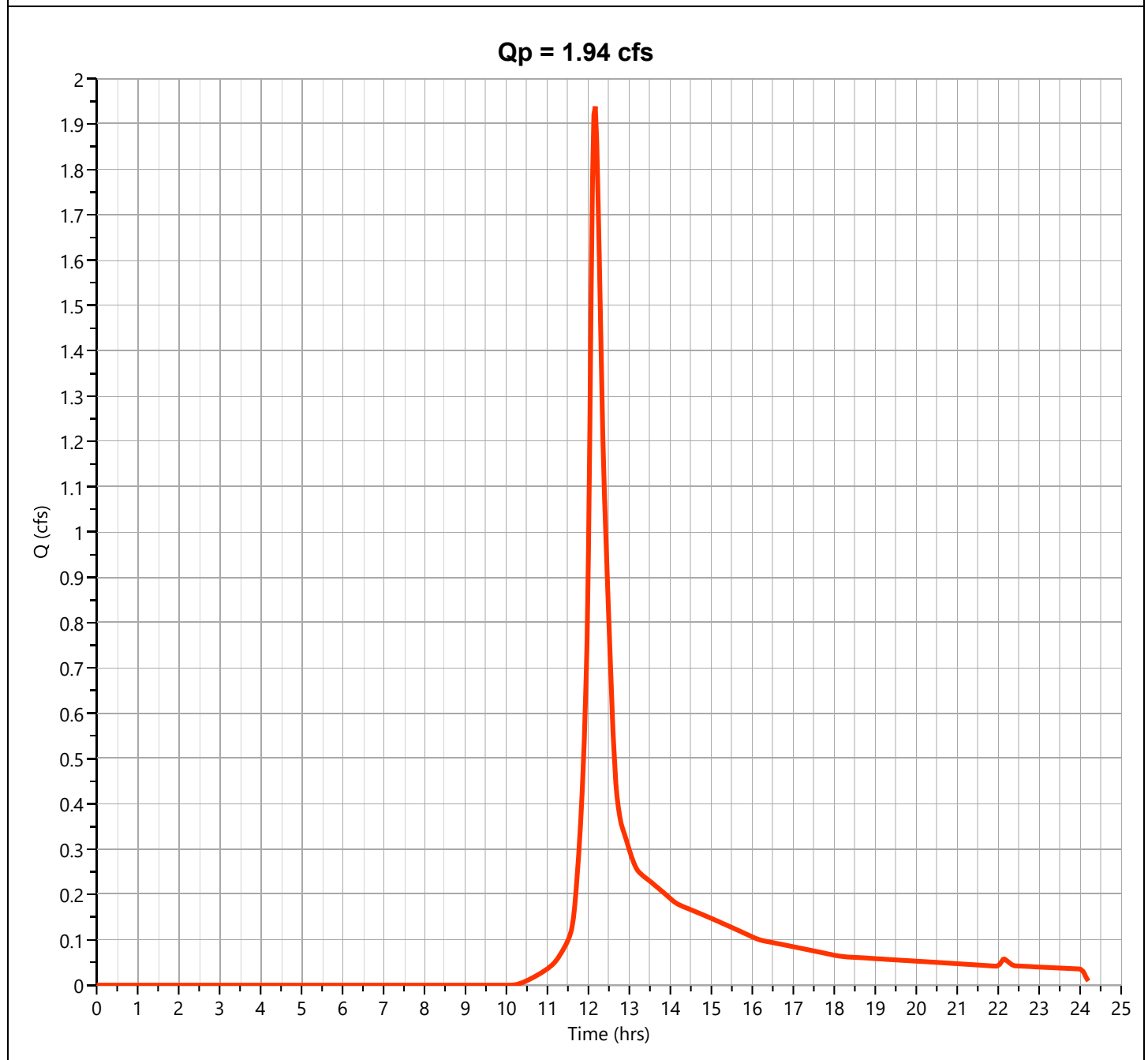
Hydrology Studio v 3.0.0.21

10-27-2022

**P-4A**

**Hyd. No. 8**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.939 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,688 cuft
Drainage Area	= 1.71 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 13.2 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

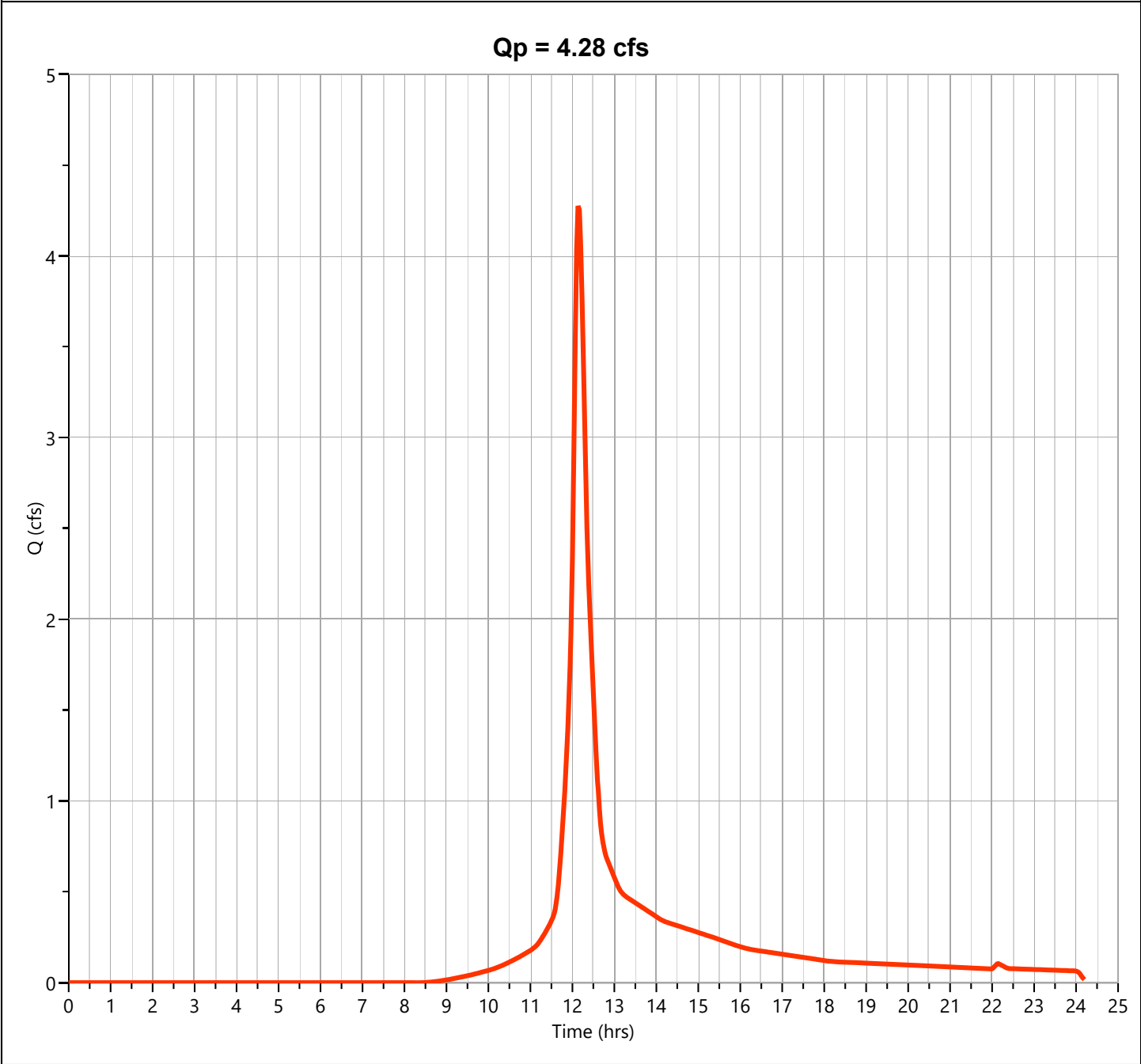
Hydrology Studio v 3.0.0.21

10-27-2022

P-4A

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.275 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 16,442 cuft
Drainage Area	= 1.71 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 13.2 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

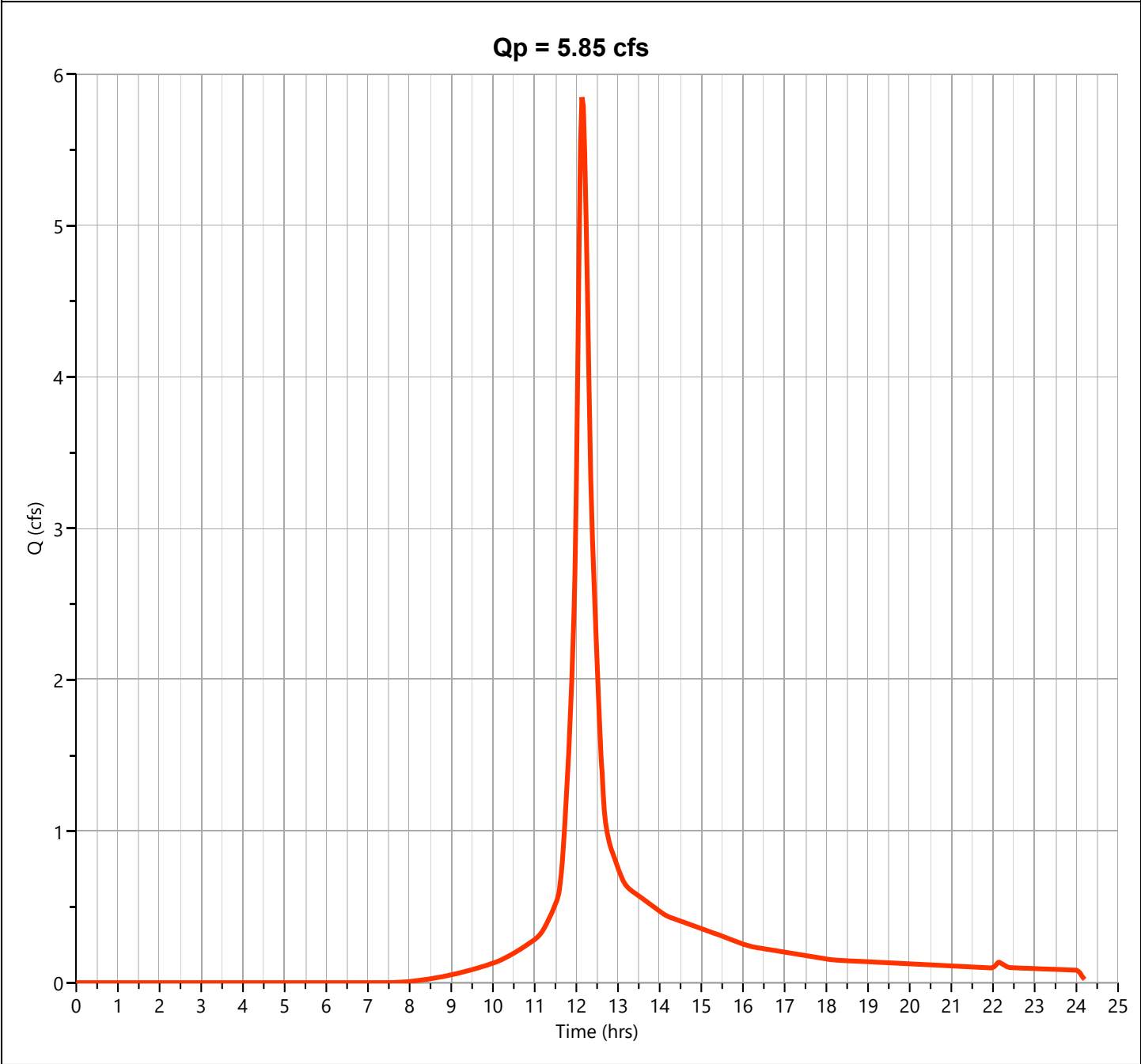
Hydrology Studio v 3.0.0.21

10-27-2022

P-4A

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.848 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 22,412 cuft
Drainage Area	= 1.71 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 13.2 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

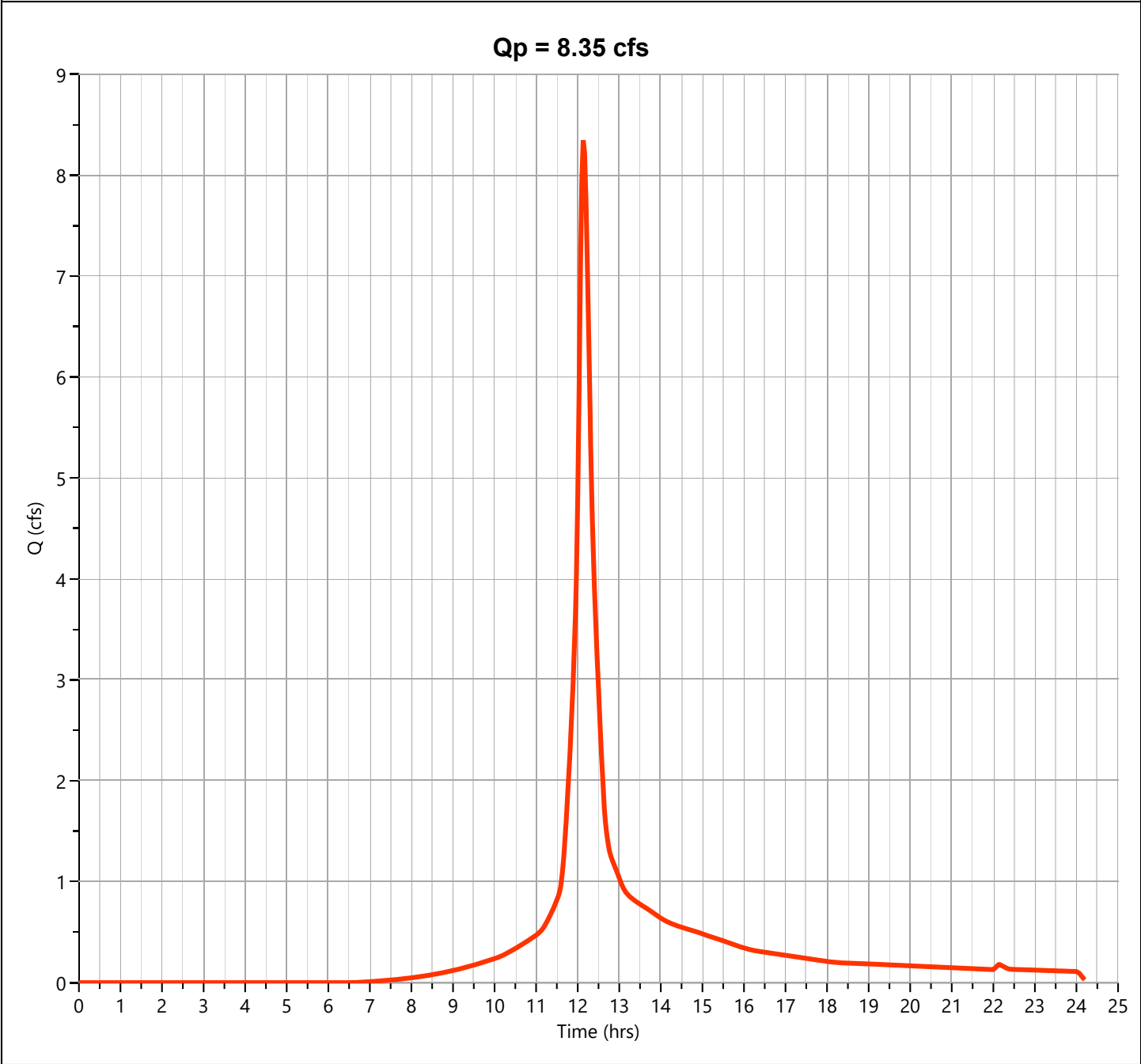
Hydrology Studio v 3.0.0.21

10-27-2022

P-4A

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.346 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 32,087 cuft
Drainage Area	= 1.71 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 13.2 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

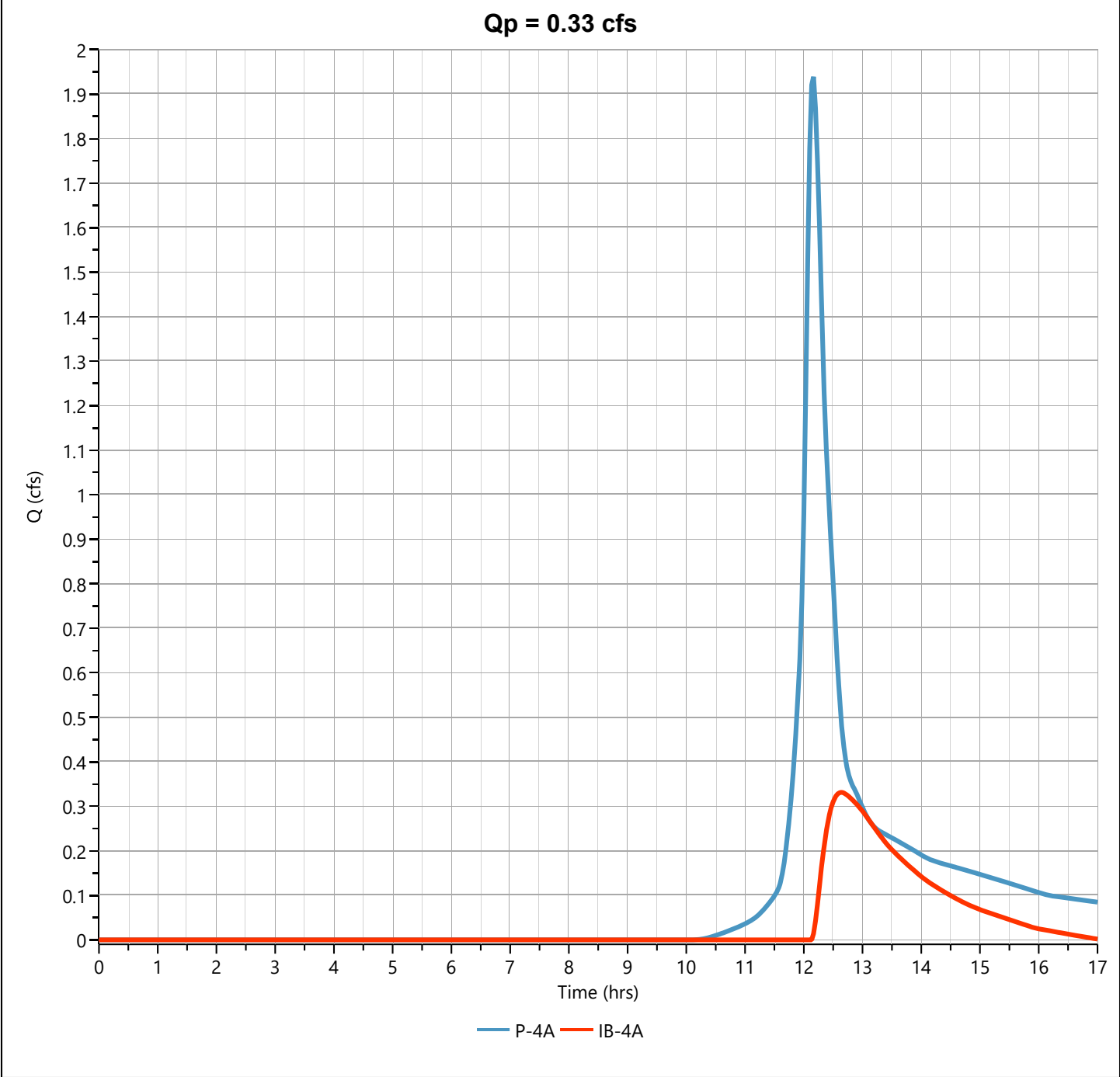
10-27-2022

IB-4A

Hyd. No. 9

Hydrograph Type	= Pond Route	Peak Flow	= 0.331 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,113 cuft
Inflow Hydrograph	= 8 - P-4A	Max. Elevation	= 282.04 ft
Pond Name	= IB-4A	Max. Storage	= 2,679 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

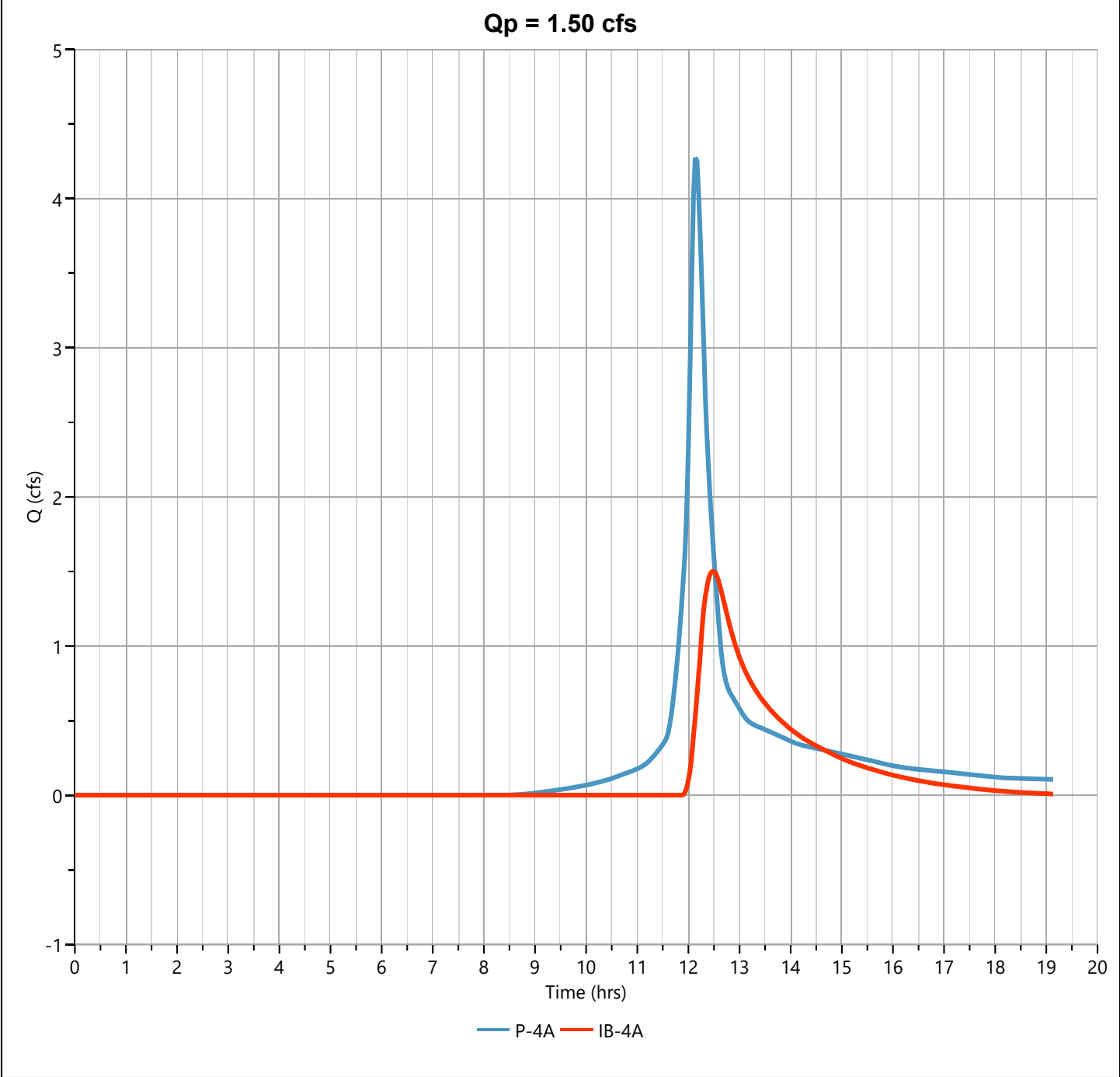
10-27-2022

IB-4A

Hyd. No. 9

Hydrograph Type	= Pond Route	Peak Flow	= 1.501 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 8,685 cuft
Inflow Hydrograph	= 8 - P-4A	Max. Elevation	= 282.87 ft
Pond Name	= IB-4A	Max. Storage	= 5,370 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

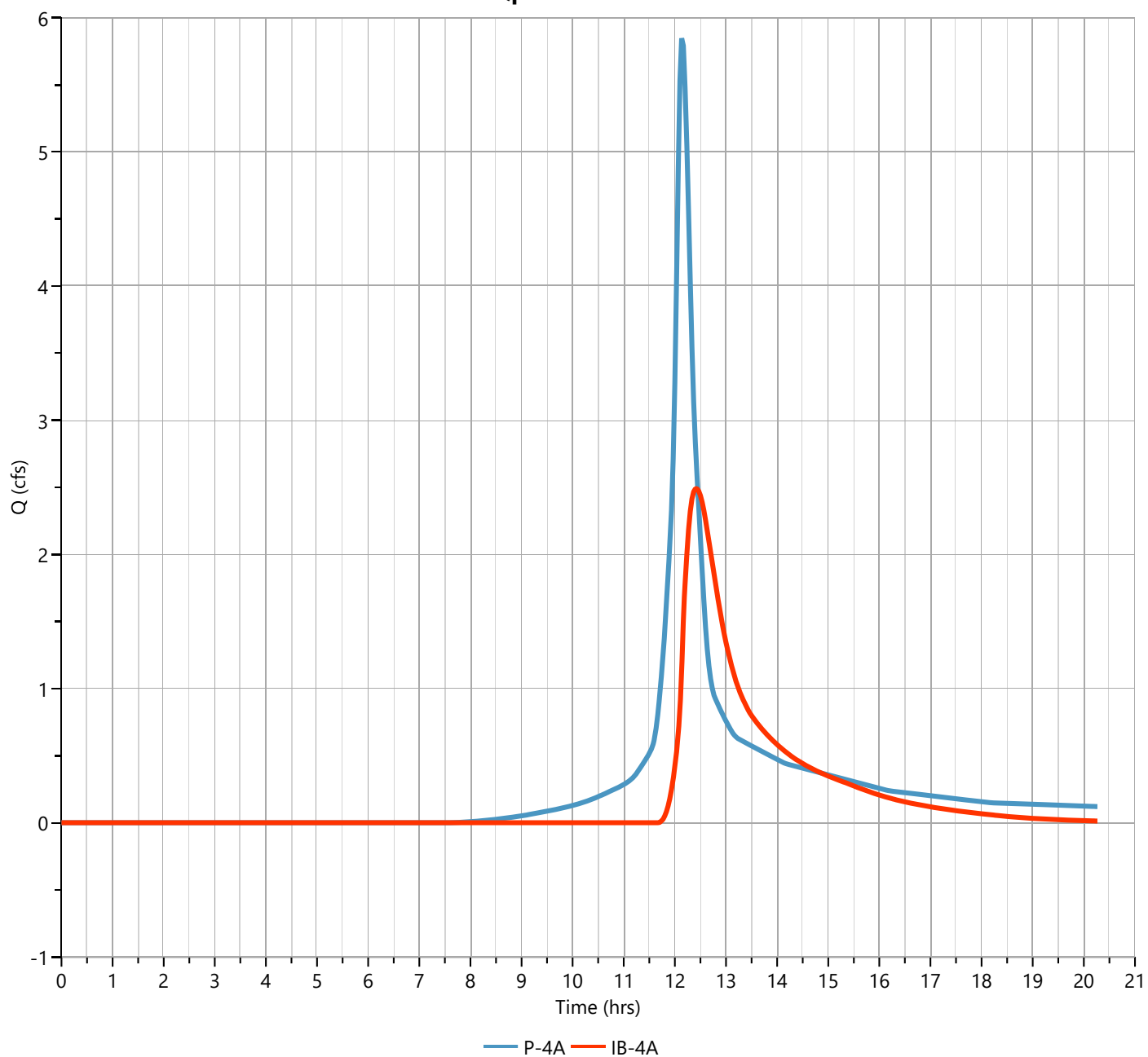
**IB-4A**

**Hyd. No. 9**

Hydrograph Type	= Pond Route	Peak Flow	= 2.490 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 13,623 cuft
Inflow Hydrograph	= 8 - P-4A	Max. Elevation	= 283.29 ft
Pond Name	= IB-4A	Max. Storage	= 6,941 cuft

*Pond Routing by Storage Indication Method*

**Qp = 2.49 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

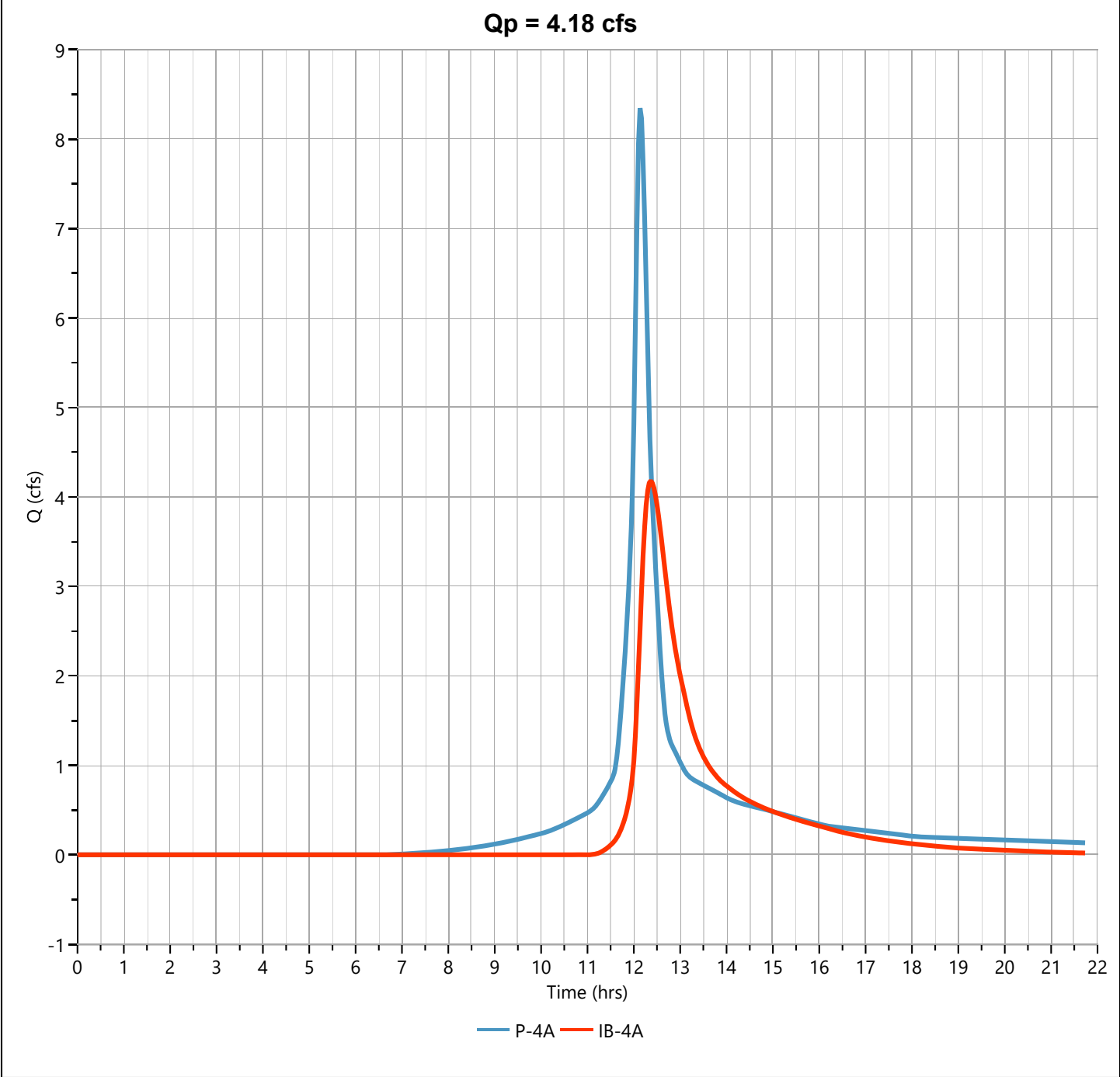
10-27-2022

IB-4A

Hyd. No. 9

Hydrograph Type	= Pond Route	Peak Flow	= 4.180 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 22,100 cuft
Inflow Hydrograph	= 8 - P-4A	Max. Elevation	= 283.87 ft
Pond Name	= IB-4A	Max. Storage	= 9,308 cuft

Pond Routing by Storage Indication Method





# Pond Report

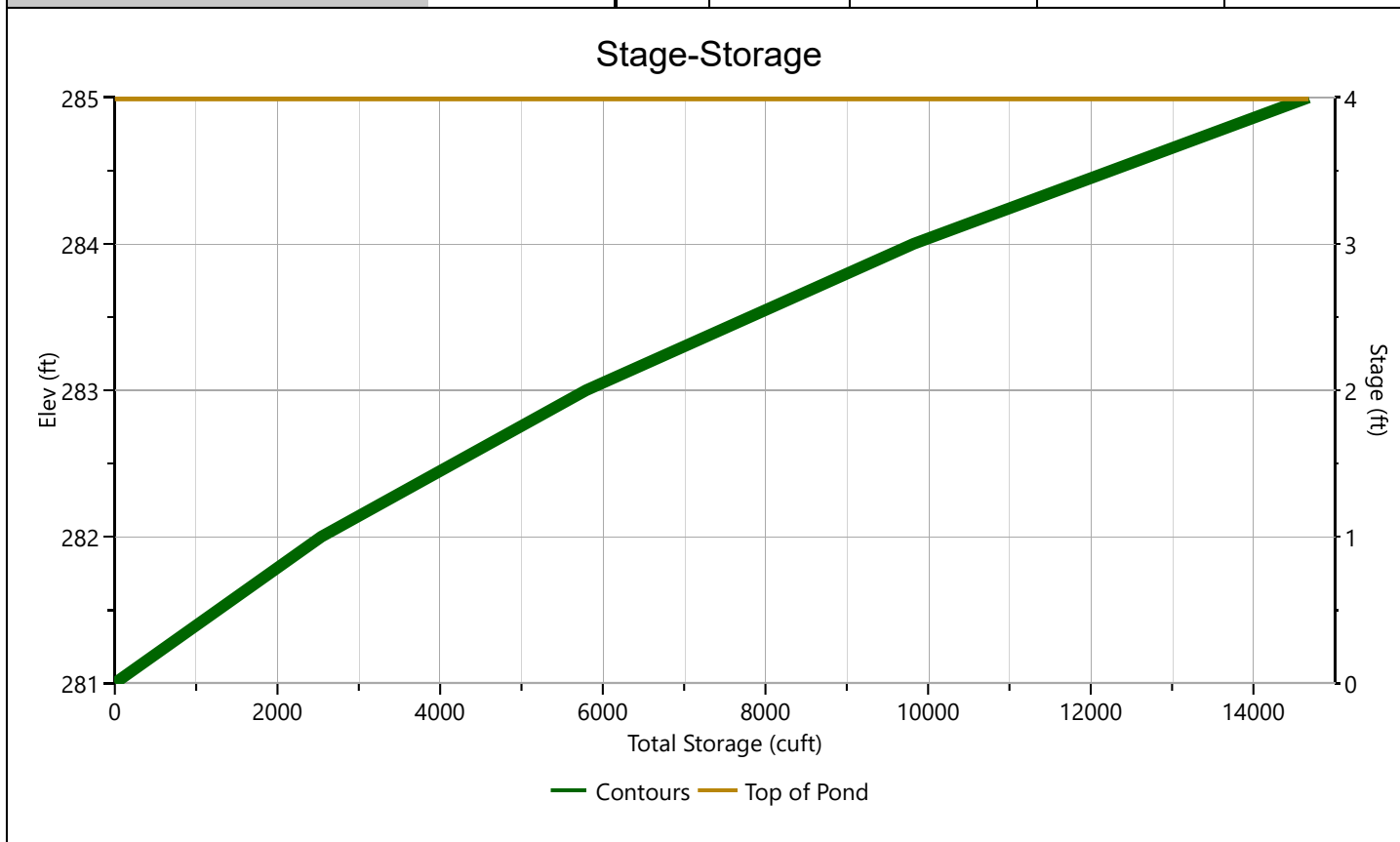
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

# IB-4A

## Stage-Storage

[illegible]

# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

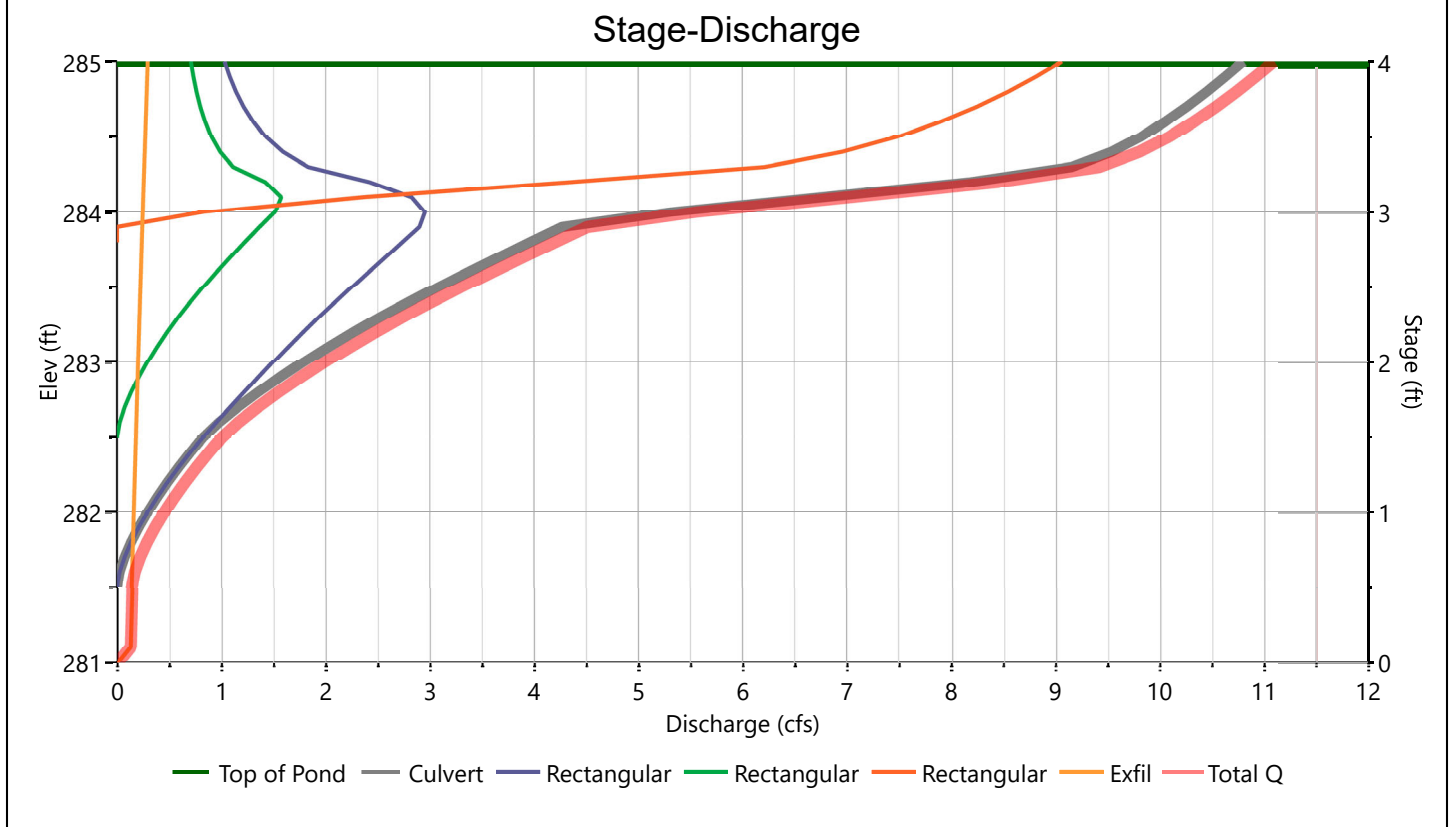
10-27-2022

## IB-4A

## 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	281.00				Height, ft
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co
Length, ft	43				
Barrel Slope, %	14				
N-Value, n	0.012				
Weirs	Riser*	Weirs			Ancillary
		1*	2*	3*	
Shape / Type		Rectangular	Rectangular	Rectangular	Exfiltration, in/hr
Crest Elevation, ft		281.5	282.5	283.9	2.41**
Crest Length, ft		.25	.25	8	
Angle, deg					
Weir Coefficient, Cw		3.3	3.3	3.3	

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



Project Name:

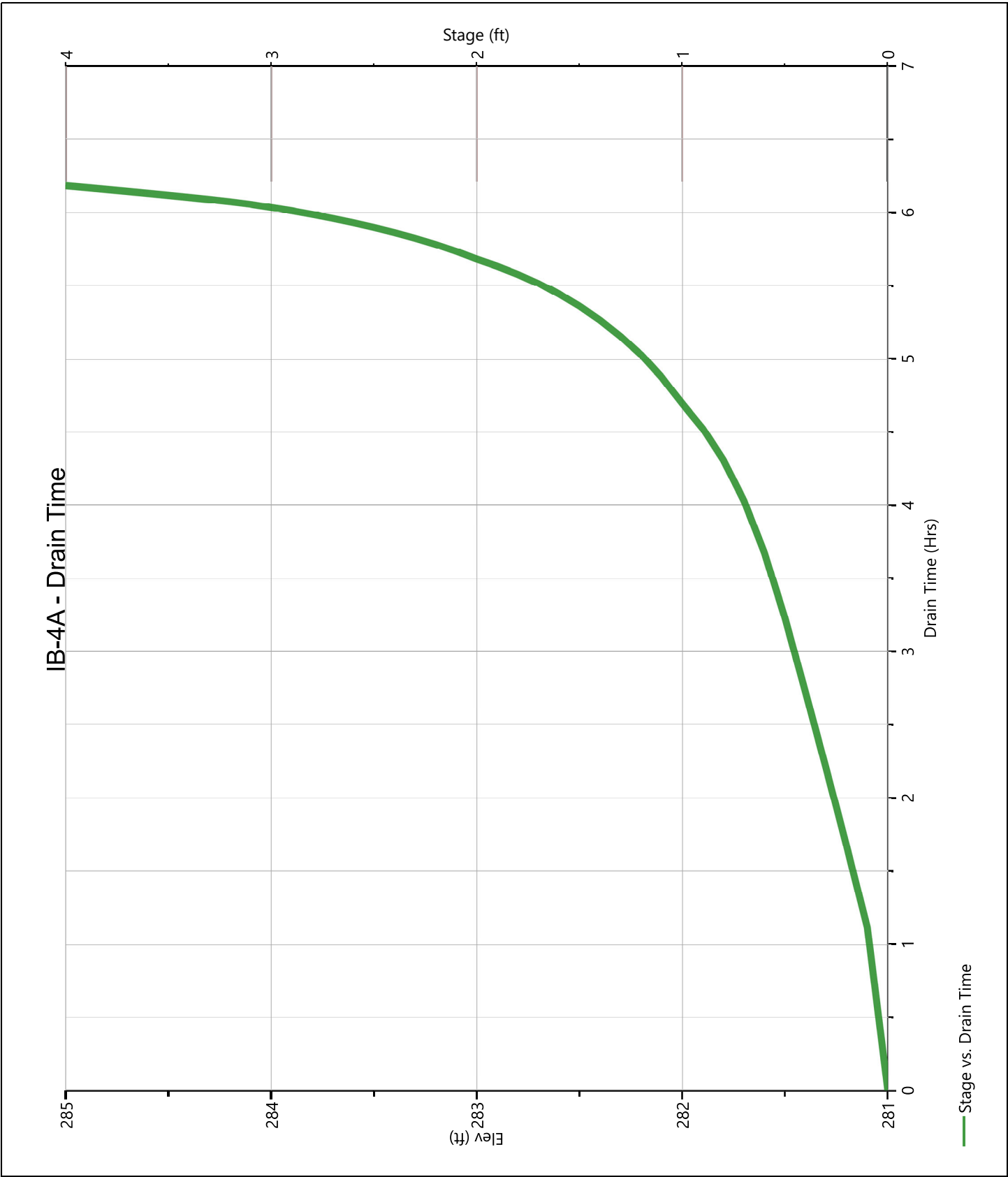
10-27-2022

### Stage-Storage-Discharge Summary

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

IB-4A

Pond Drawdown



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

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 Date \_\_\_\_\_  
 Circle one: Present ☒ Developed Subcatchment P-4B

**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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			0.18	5.55
A	Open Space Good Condition	39			0.00	0.00
A	Gravel	76			0.05	3.63
C	Woods Good Condition	70			5.99	418.99
C	Open Space Good Condition	74			1.00	74.21
C	Gravel	89			0.31	28.03
D	BVW	77			0.03	2.55
Totals =					7.57	532.95

1/ Use only one CN source per line.

329708

Totals =

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{532.95}{7.57} = 70.41 ; \text{ Use CN} = \boxed{70}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.89	2.96	4.37

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: 

Present	Developed
---------	-----------

Circle one: 

Tc	Tt
----	----

Subcatchment P-4Bthrough  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.17

A-B		
WOODS		
0.6		
50		
3.1		
0.080		
0.17		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.01

B-C		
UNPAVED		
189		
0.126		
5.73		
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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

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:

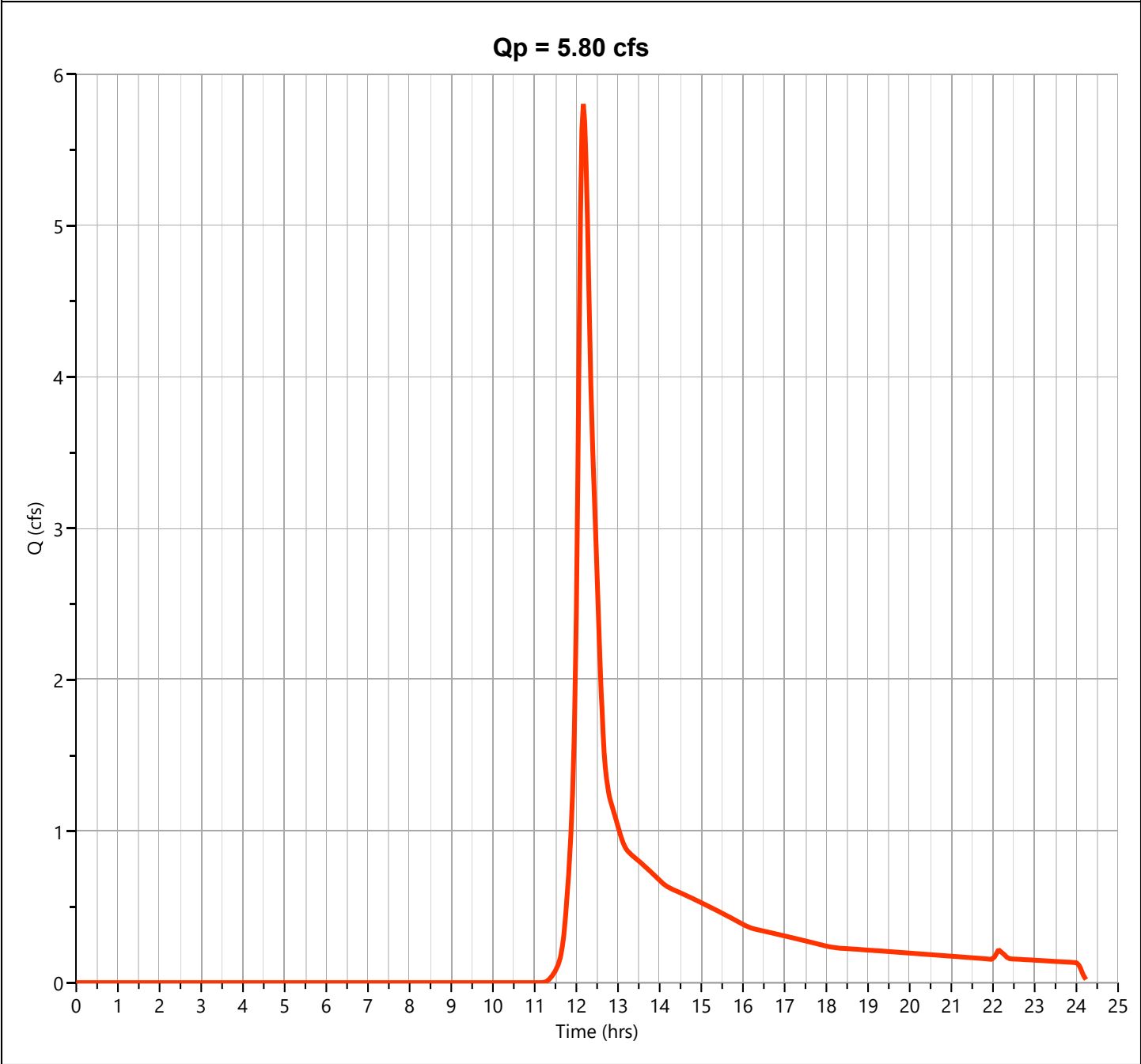
Hydrology Studio v 3.0.0.21

10-27-2022

P-4B

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.803 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 24,629 cuft
Drainage Area	= 7.57 ac	Curve Number	= 70
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:

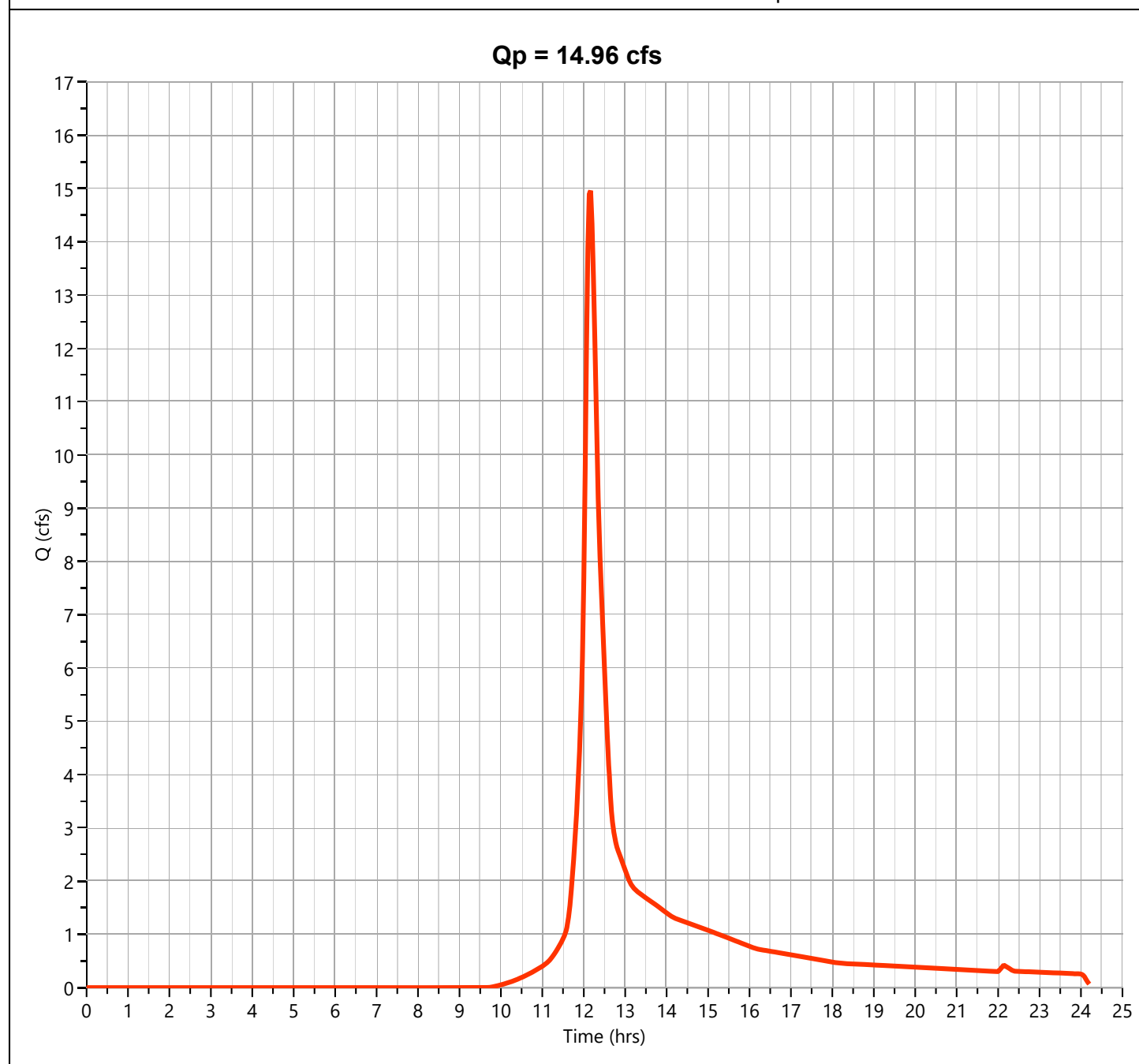
Hydrology Studio v 3.0.0.21

10-27-2022

**P-4B**

**Hyd. No. 10**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 14.96 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 58,547 cuft
Drainage Area	= 7.57 ac	Curve Number	= 70
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:

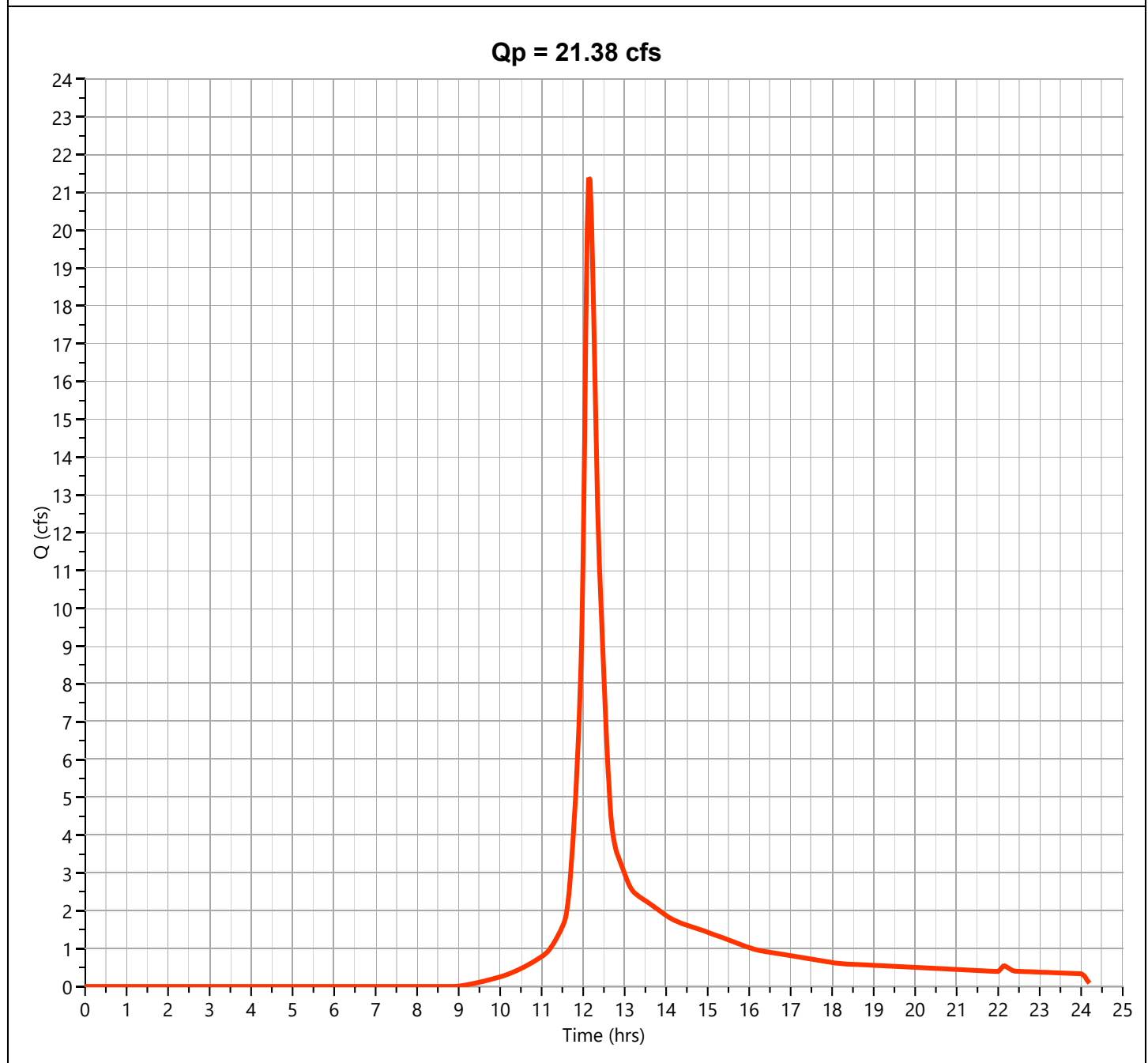
Hydrology Studio v 3.0.0.21

10-27-2022

**P-4B**

**Hyd. No. 10**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 21.38 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 82,653 cuft
Drainage Area	= 7.57 ac	Curve Number	= 70
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:

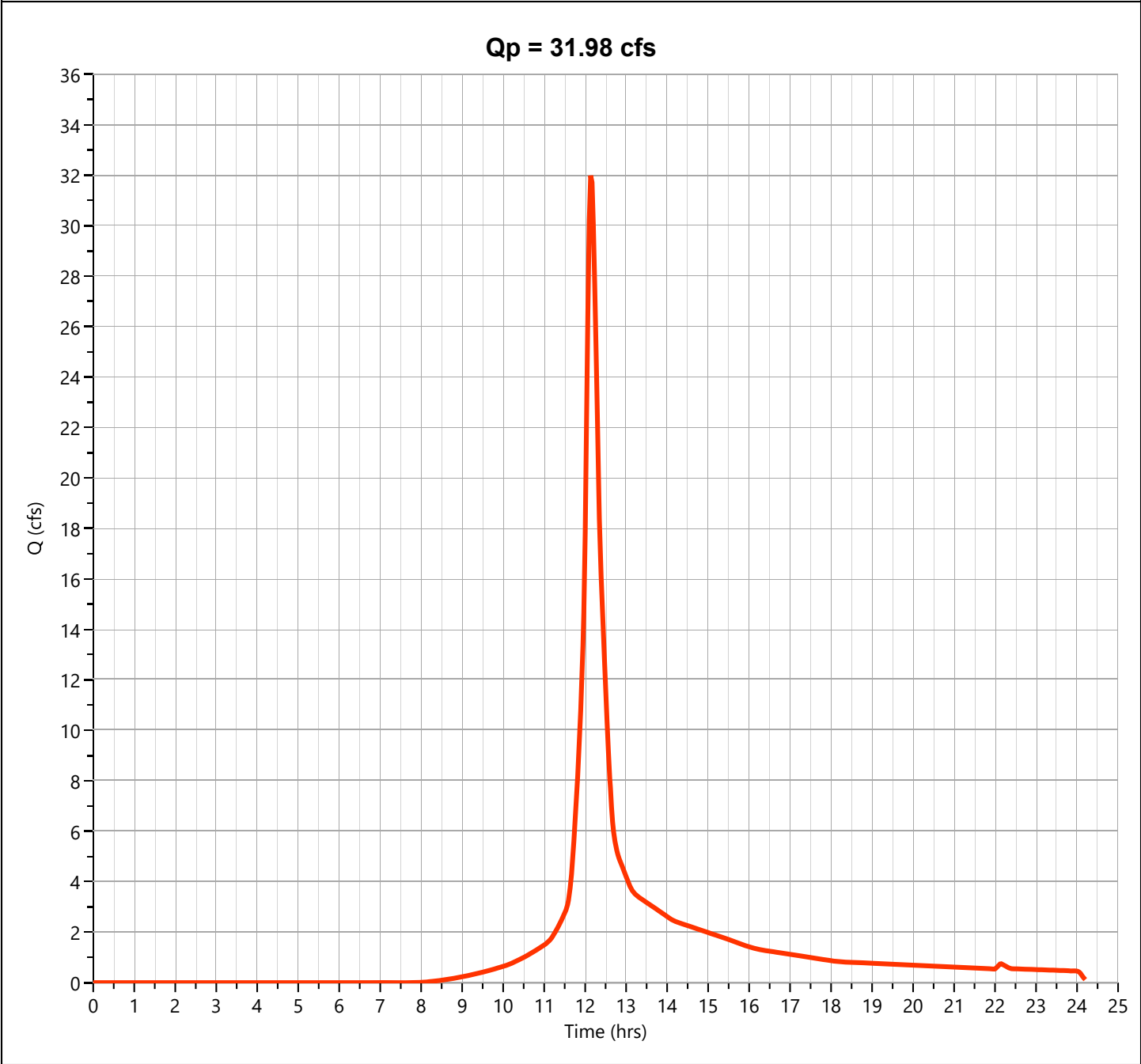
Hydrology Studio v 3.0.0.21

10-27-2022

P-4B

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 31.98 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 122,621 cuft
Drainage Area	= 7.57 ac	Curve Number	= 70
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:

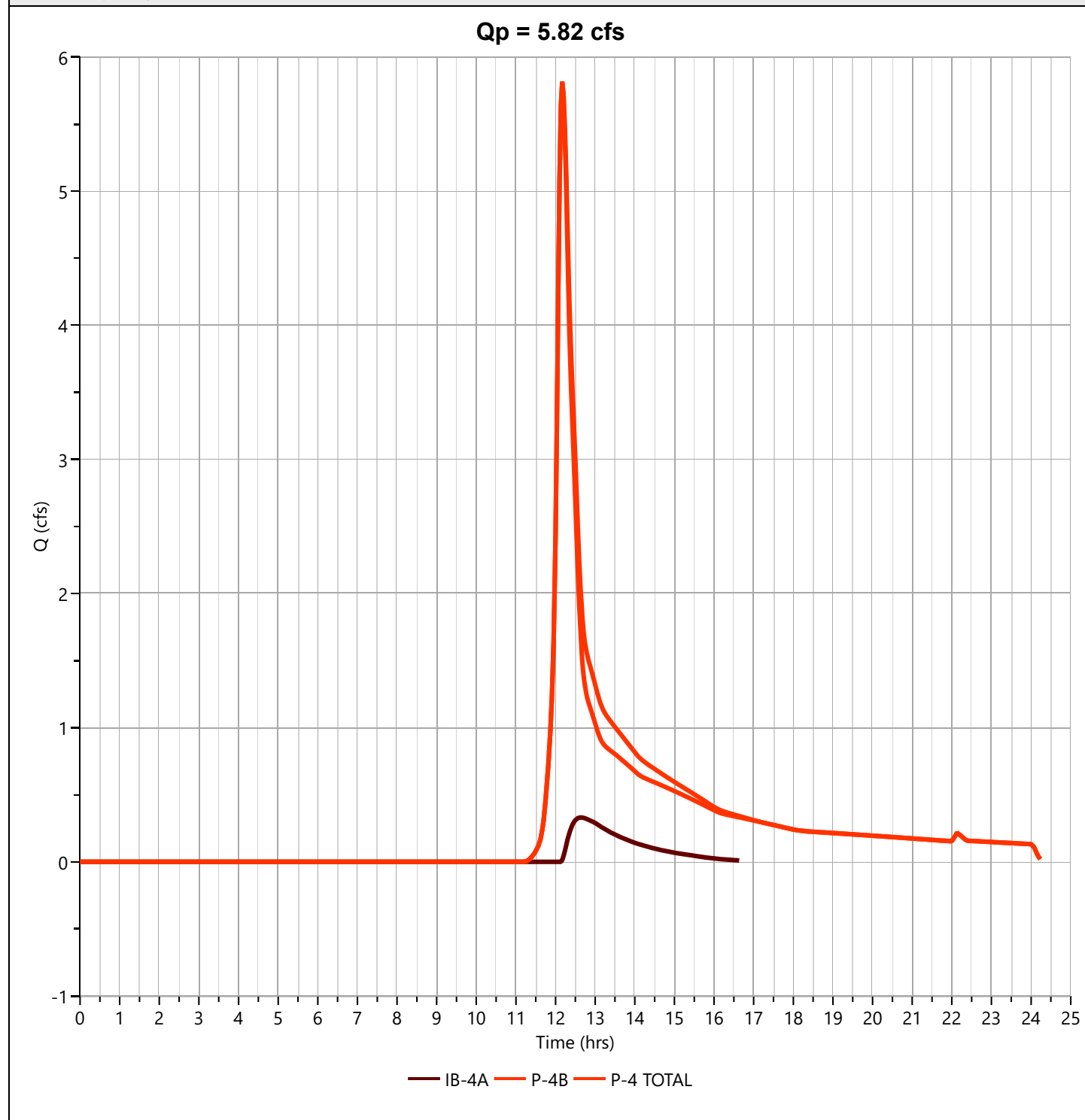
Hydrology Studio v 3.0.0.21

10-27-2022

## P-4 TOTAL

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 5.817 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 26,742 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 7.57 ac



# Hydrograph Report

Project Name:

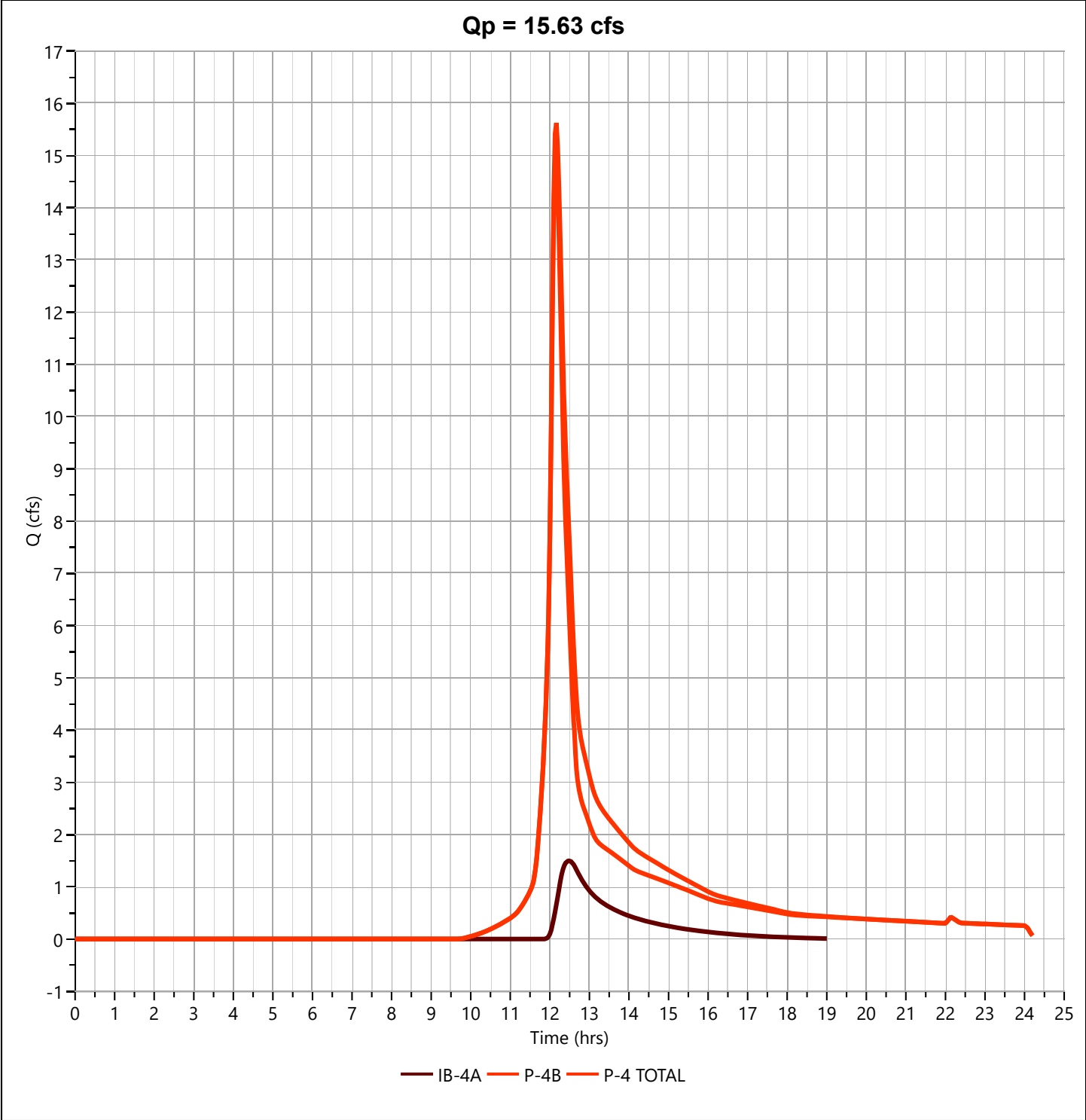
Hydrology Studio v 3.0.0.21

10-27-2022

## P-4 TOTAL

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 15.63 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 67,232 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 7.57 ac



# Hydrograph Report

Project Name:

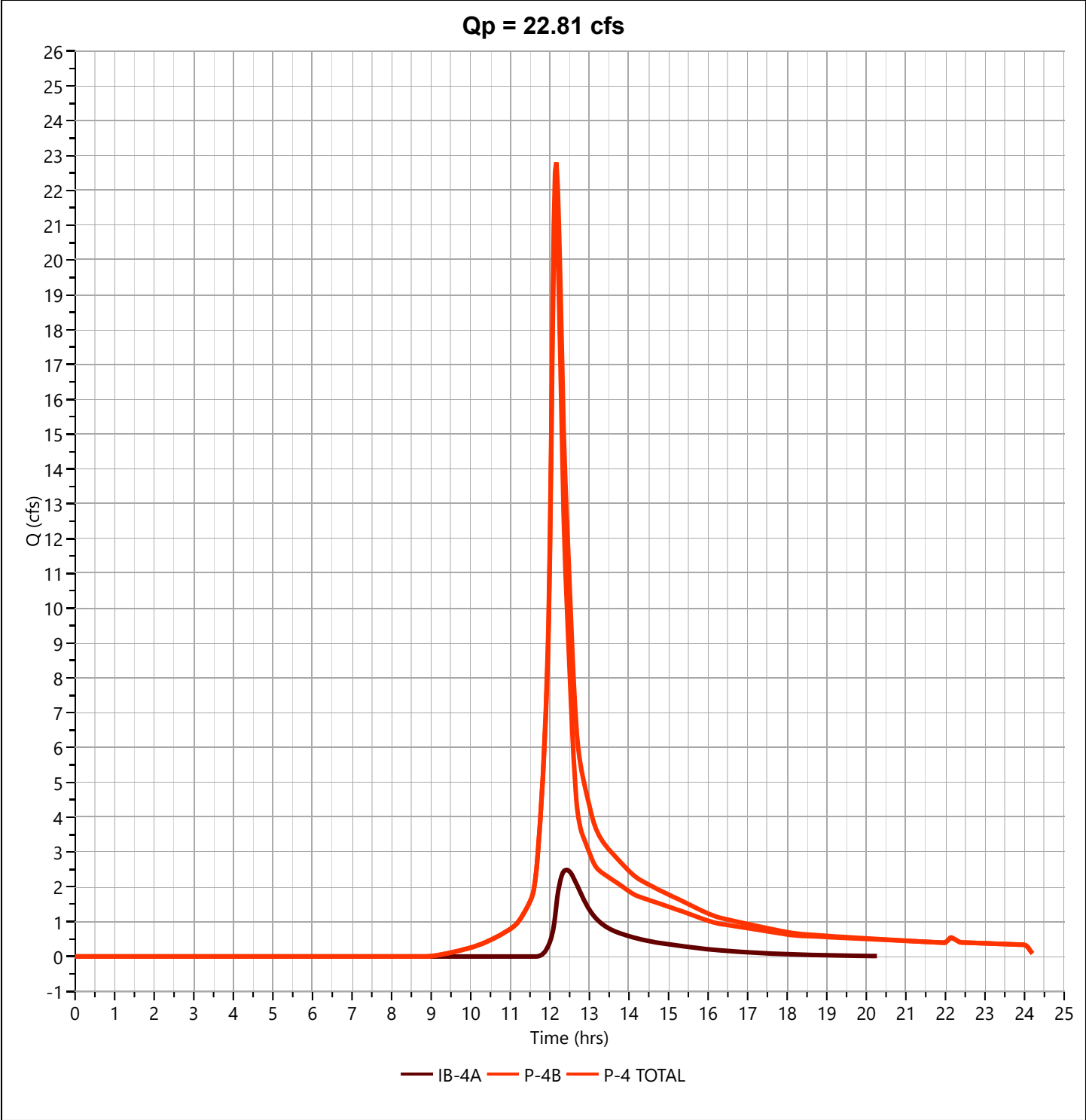
Hydrology Studio v 3.0.0.21

10-27-2022

## P-4 TOTAL

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 22.81 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 96,276 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 7.57 ac



# Hydrograph Report

Project Name:

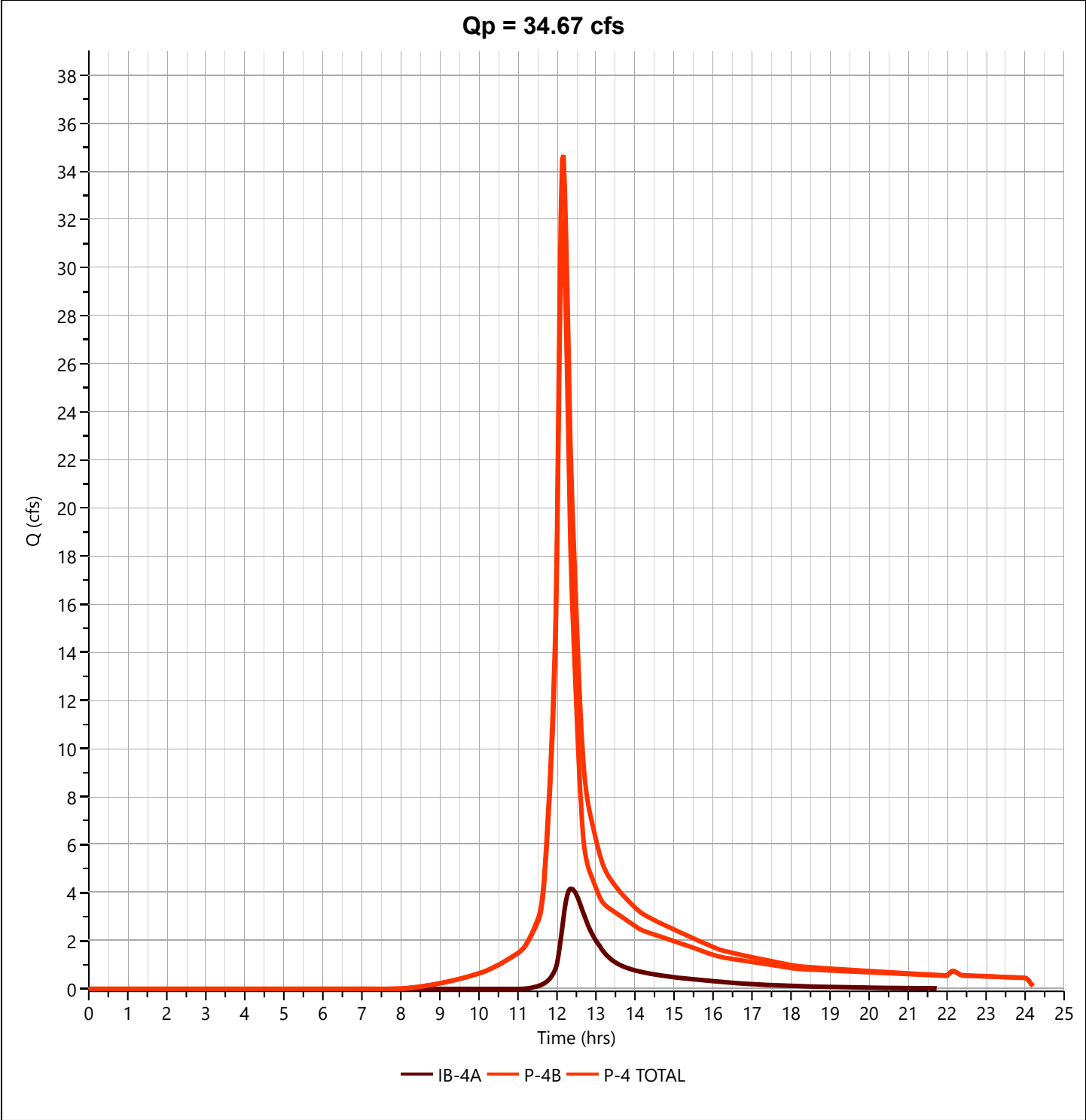
Hydrology Studio v 3.0.0.21

10-27-2022

## P-4 TOTAL

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 34.67 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 144,721 cuft
Inflow Hydrographs	= 9, 10	Total Contrib. Area	= 7.57 ac



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.47	46.53
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			1.37	95.58
C	Open Space Good Condition	74			0.91	67.47
C	Gravel	89			0.00	0.00
1/ Use only one CN source per line. 119879 Totals =					2.75	209.59

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{209.59}{2.75} = 76.16 ; \text{ Use CN} = \boxed{76}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.21	3.52	5.03

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-5BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.26

A-B		
WOODS		
0.6		
50		
3.1		
0.025		
0.26		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C	C-D	D-E
UNPAVED	UNPAVED	PAVED
204	22	120
0.090	0.330	0.01
4.84	9.27	2.03
0.01	0.00	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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr  
min0.29  
17.6



# Hydrograph Report

Project Name:

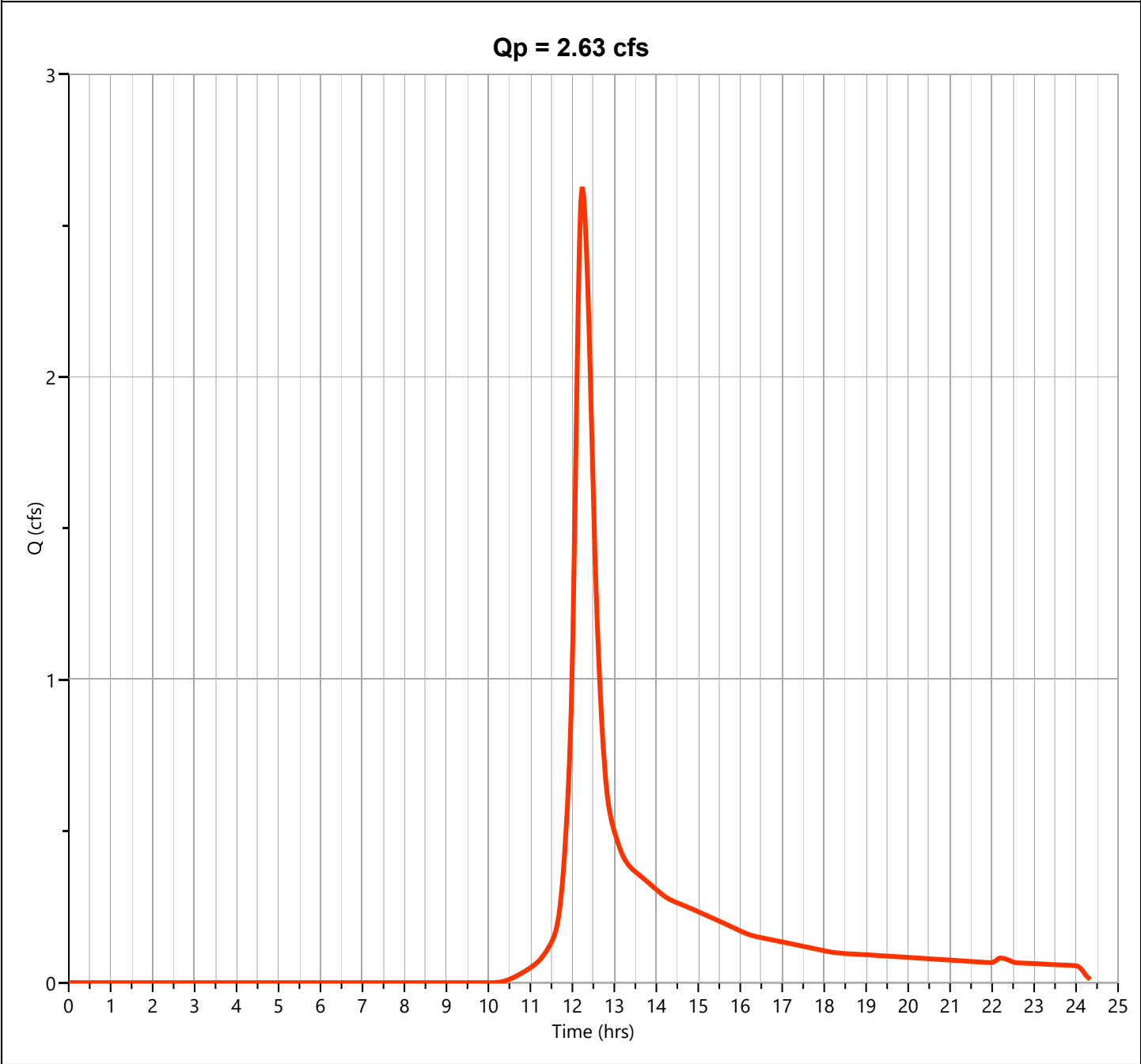
Hydrology Studio v 3.0.0.21

10-27-2022

P-5B

Hyd. No. 13

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.628 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 11,989 cuft
Drainage Area	= 2.75 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 17.6 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

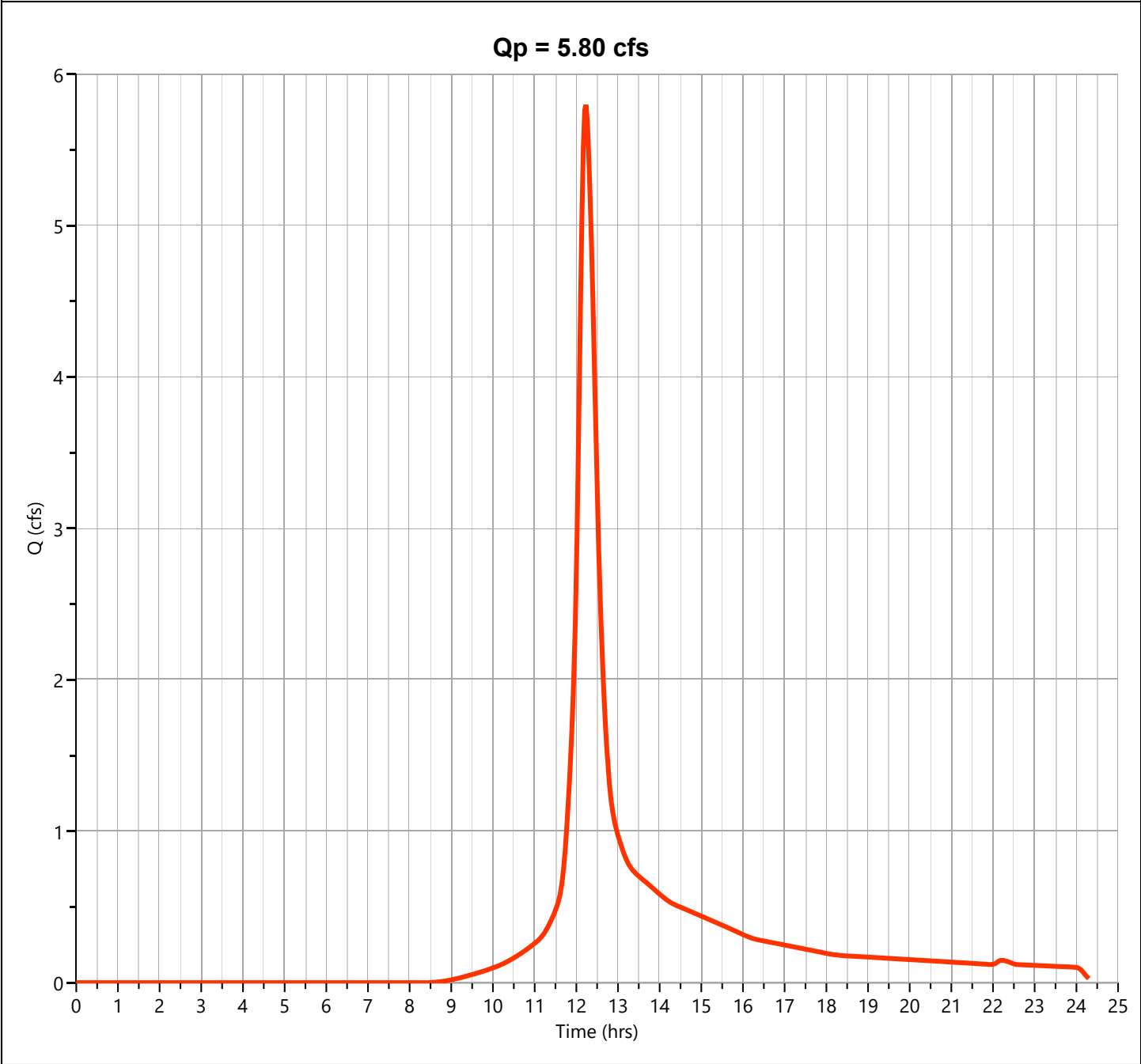
Hydrology Studio v 3.0.0.21

10-27-2022

P-5B

Hyd. No. 13

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.798 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 25,640 cuft
Drainage Area	= 2.75 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 17.6 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

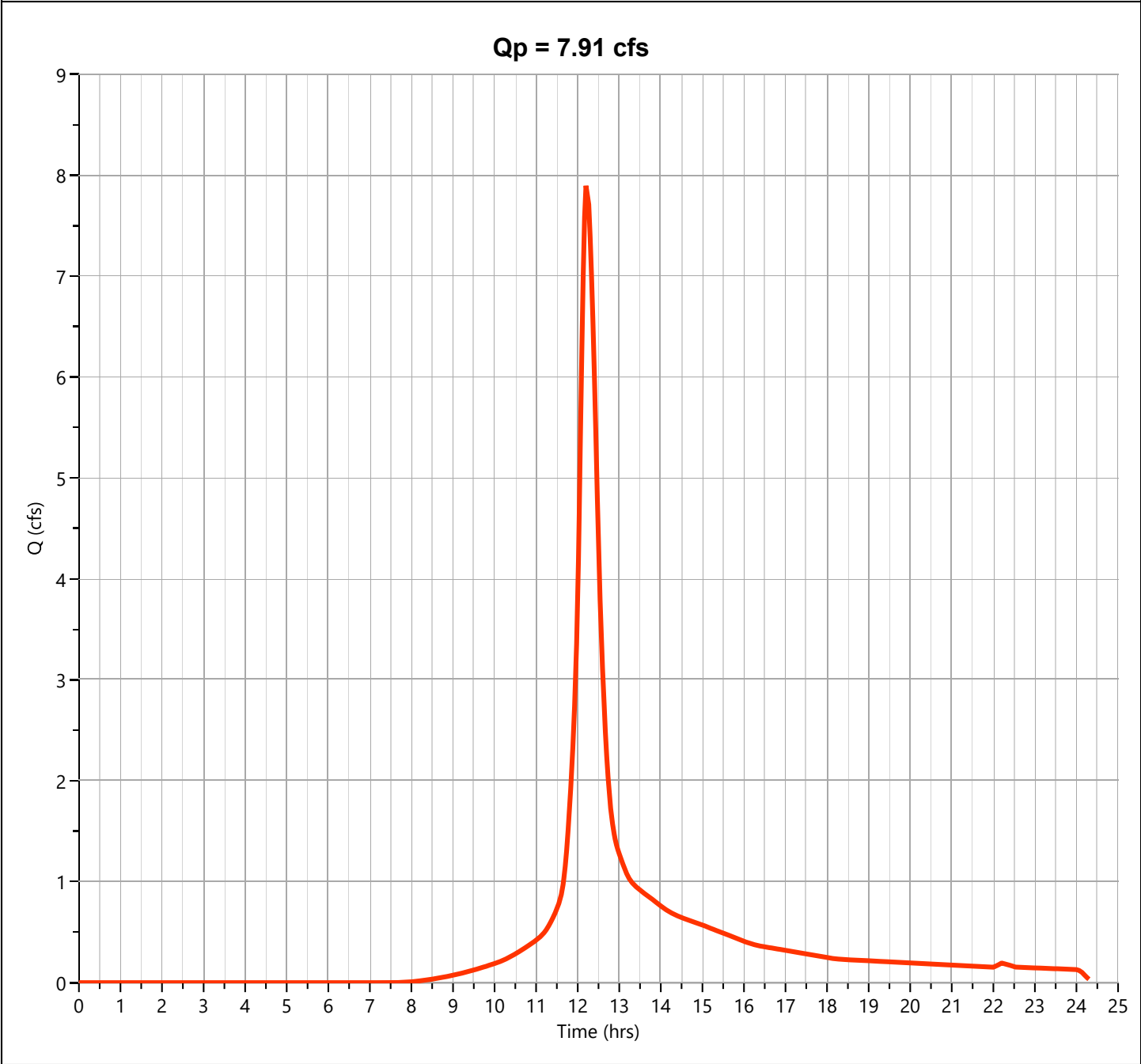
Hydrology Studio v 3.0.0.21

10-27-2022

P-5B

Hyd. No. 13

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.910 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 34,951 cuft
Drainage Area	= 2.75 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 17.6 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

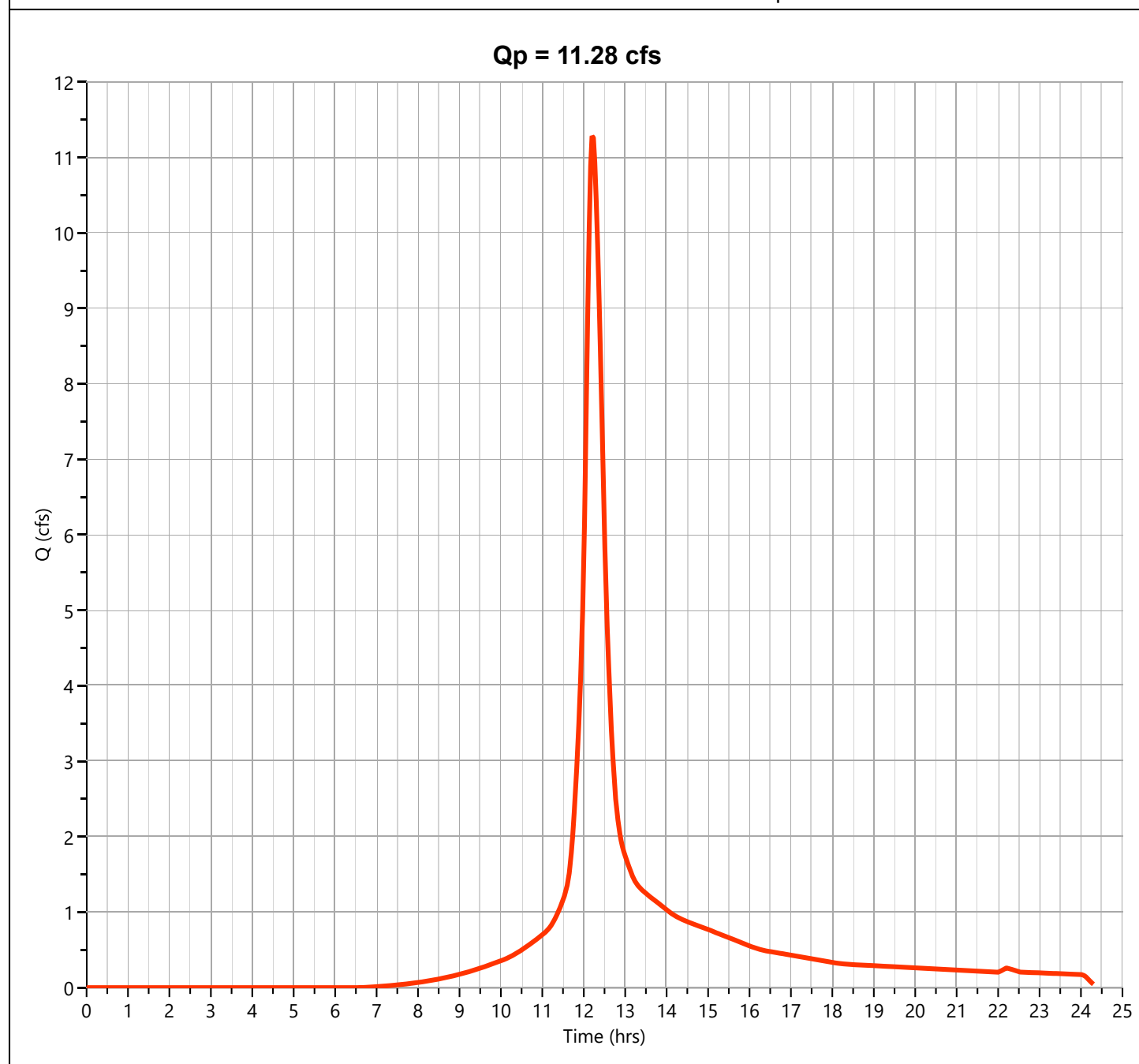
Hydrology Studio v 3.0.0.21

10-27-2022

**P-5B**

**Hyd. No. 13**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.28 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 50,037 cuft
Drainage Area	= 2.75 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 17.6 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

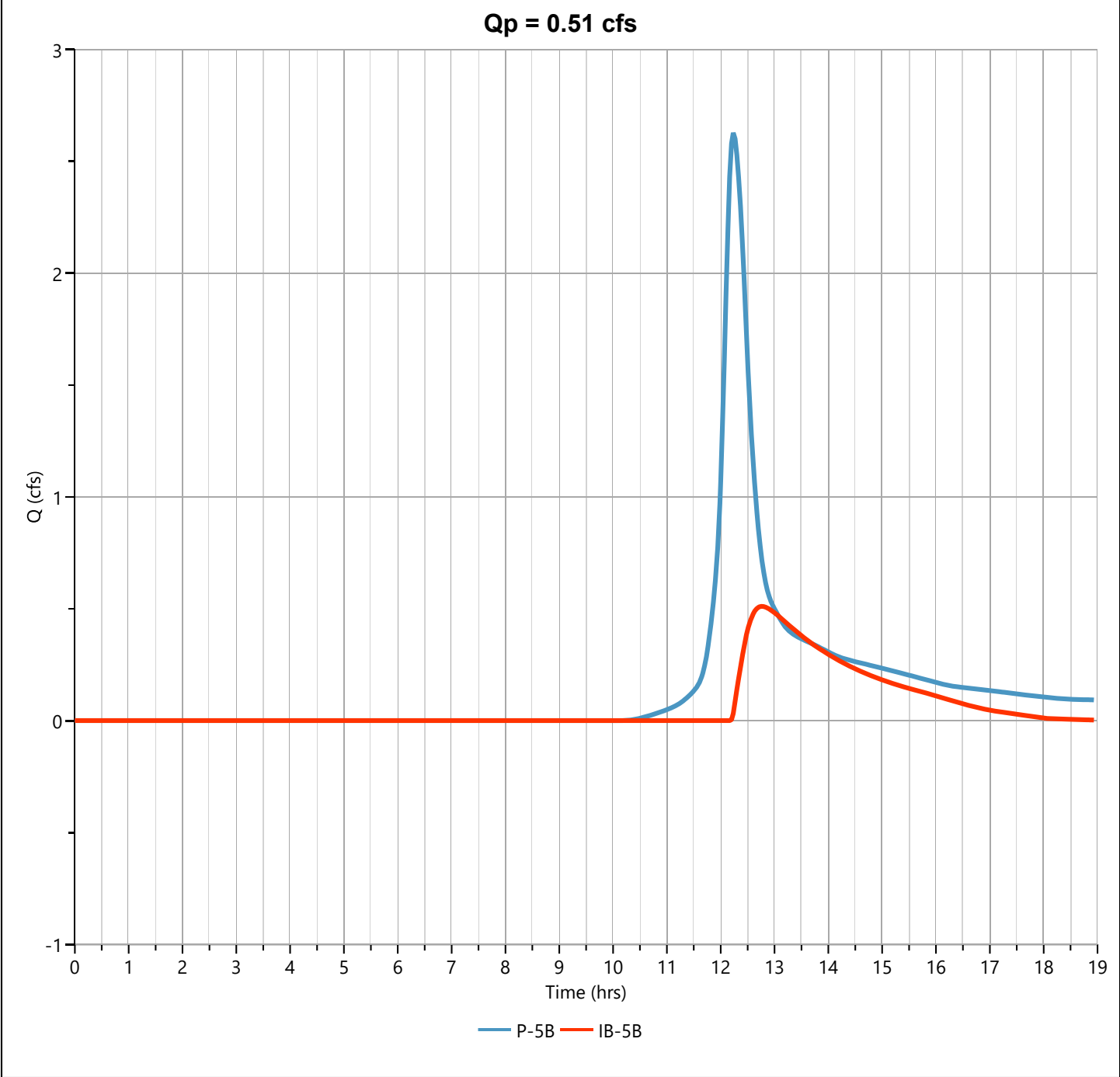
10-27-2022

IB-5B

Hyd. No. 14

Hydrograph Type	= Pond Route	Peak Flow	= 0.511 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.77 hrs
Time Interval	= 2 min	Hydrograph Volume	= 4,250 cuft
Inflow Hydrograph	= 13 - P-5B	Max. Elevation	= 284.48 ft
Pond Name	= IB-5B	Max. Storage	= 4,337 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

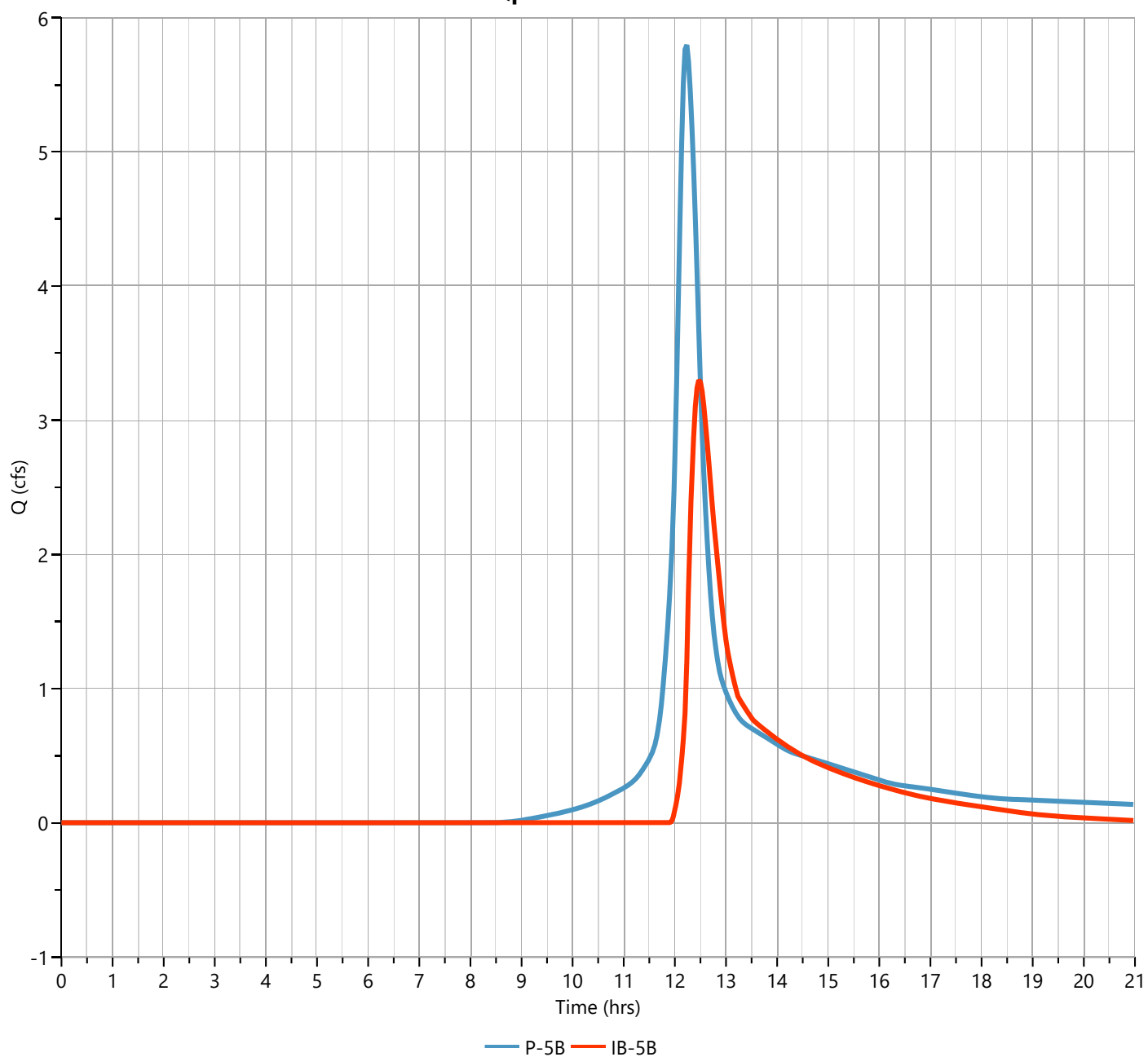
**IB-5B**

**Hyd. No. 14**

Hydrograph Type	= Pond Route	Peak Flow	= 3.299 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,199 cuft
Inflow Hydrograph	= 13 - P-5B	Max. Elevation	= 285.26 ft
Pond Name	= IB-5B	Max. Storage	= 7,582 cuft

*Pond Routing by Storage Indication Method*

**Qp = 3.30 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

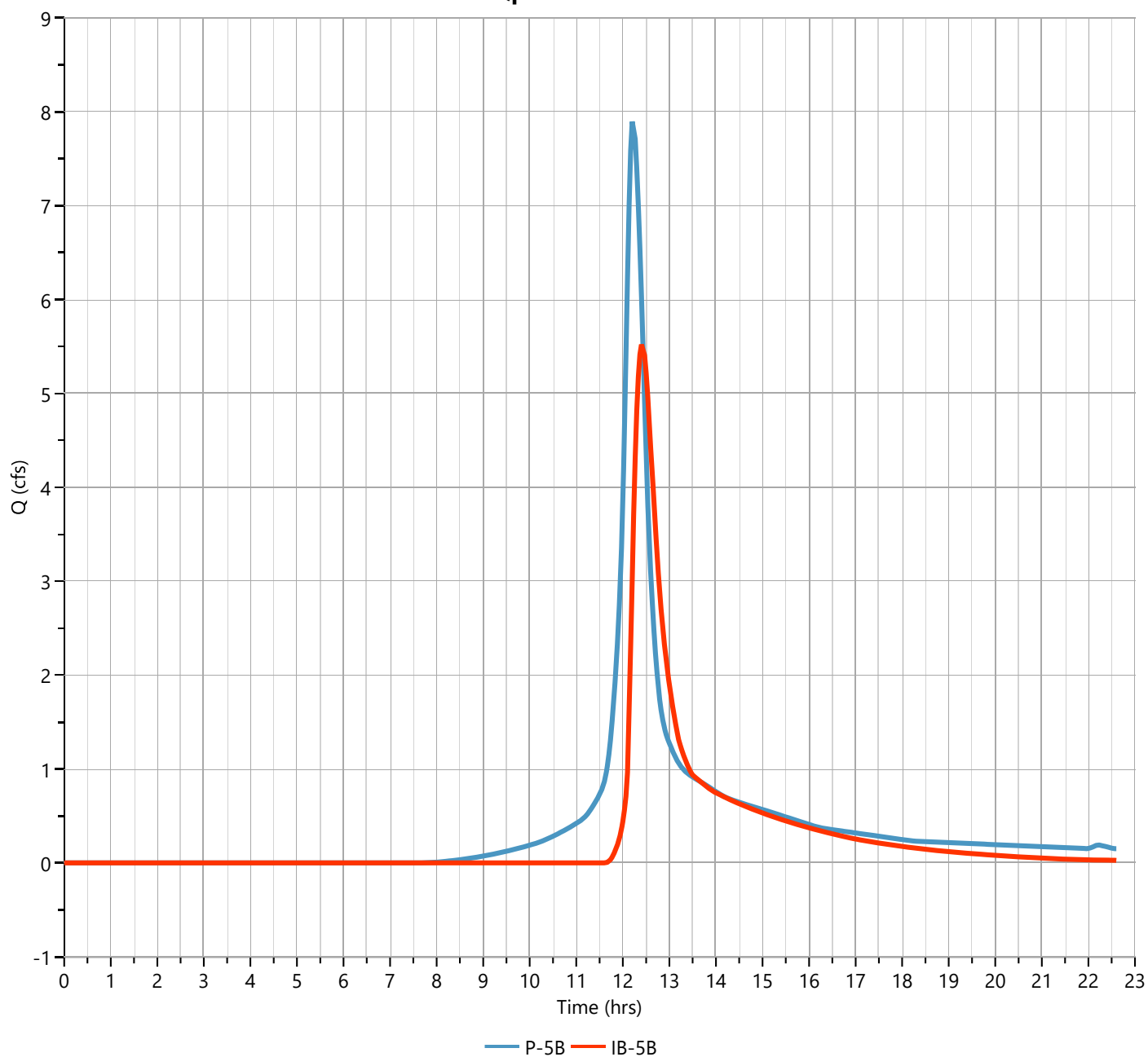
## IB-5B

## Hyd. No. 14

Hydrograph Type	= Pond Route	Peak Flow	= 5.521 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Hydrograph Volume	= 23,445 cuft
Inflow Hydrograph	= 13 - P-5B	Max. Elevation	= 285.55 ft
Pond Name	= IB-5B	Max. Storage	= 9,065 cuft

*Pond Routing by Storage Indication Method*

**Qp = 5.52 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-5B**

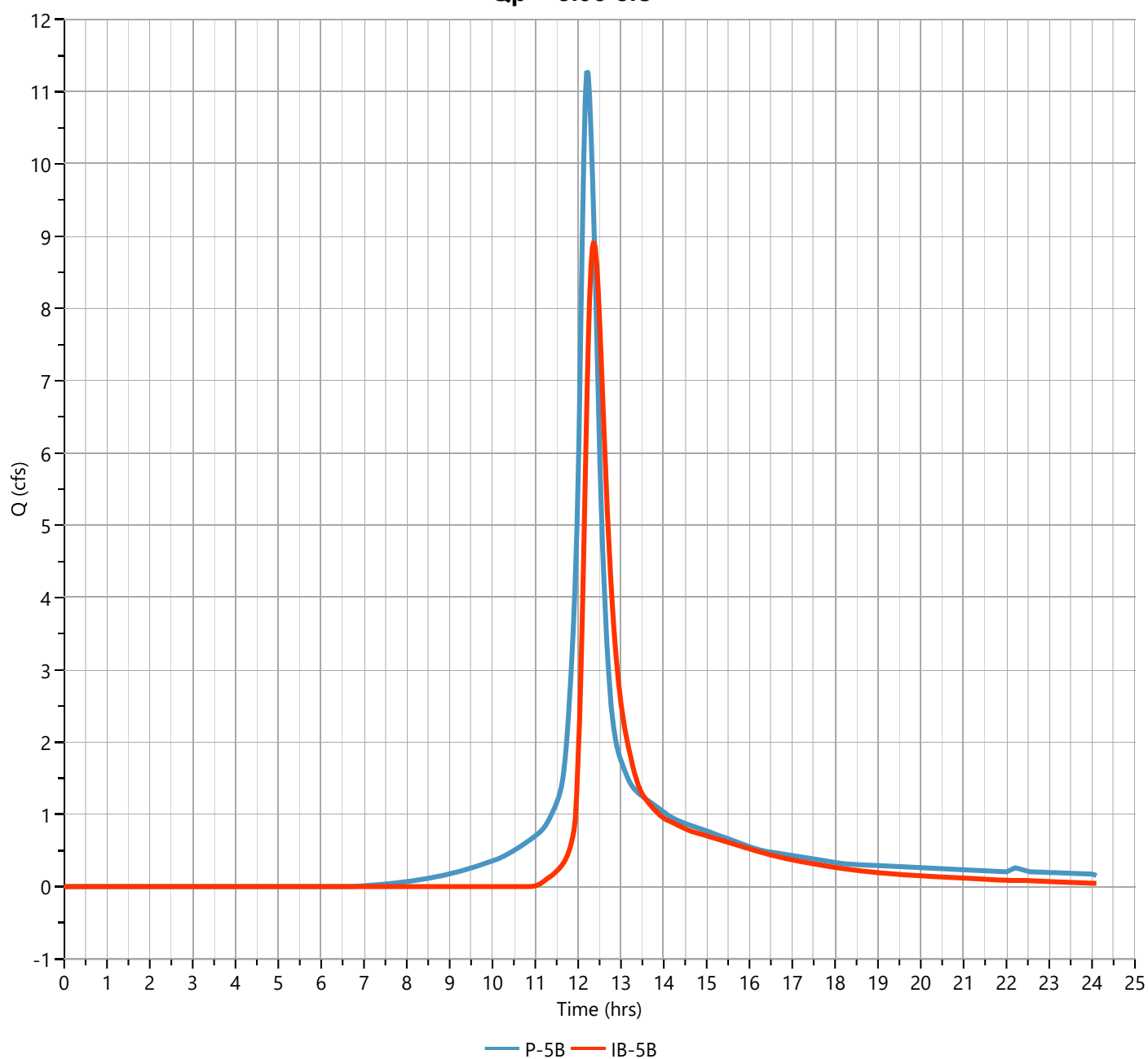
**Hyd. No. 14**

Hydrograph Type	= Pond Route	Peak Flow	= 8.928 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 37,255 cuft
Inflow Hydrograph	= 13 - P-5B	Max. Elevation	= 285.92 ft
Pond Name	= IB-5B	Max. Storage	= 10,957 cuft

*Pond Routing by Storage Indication Method*

*Center of mass detention time = 0 min*

**Qp = 8.93 cfs**





# Pond Report

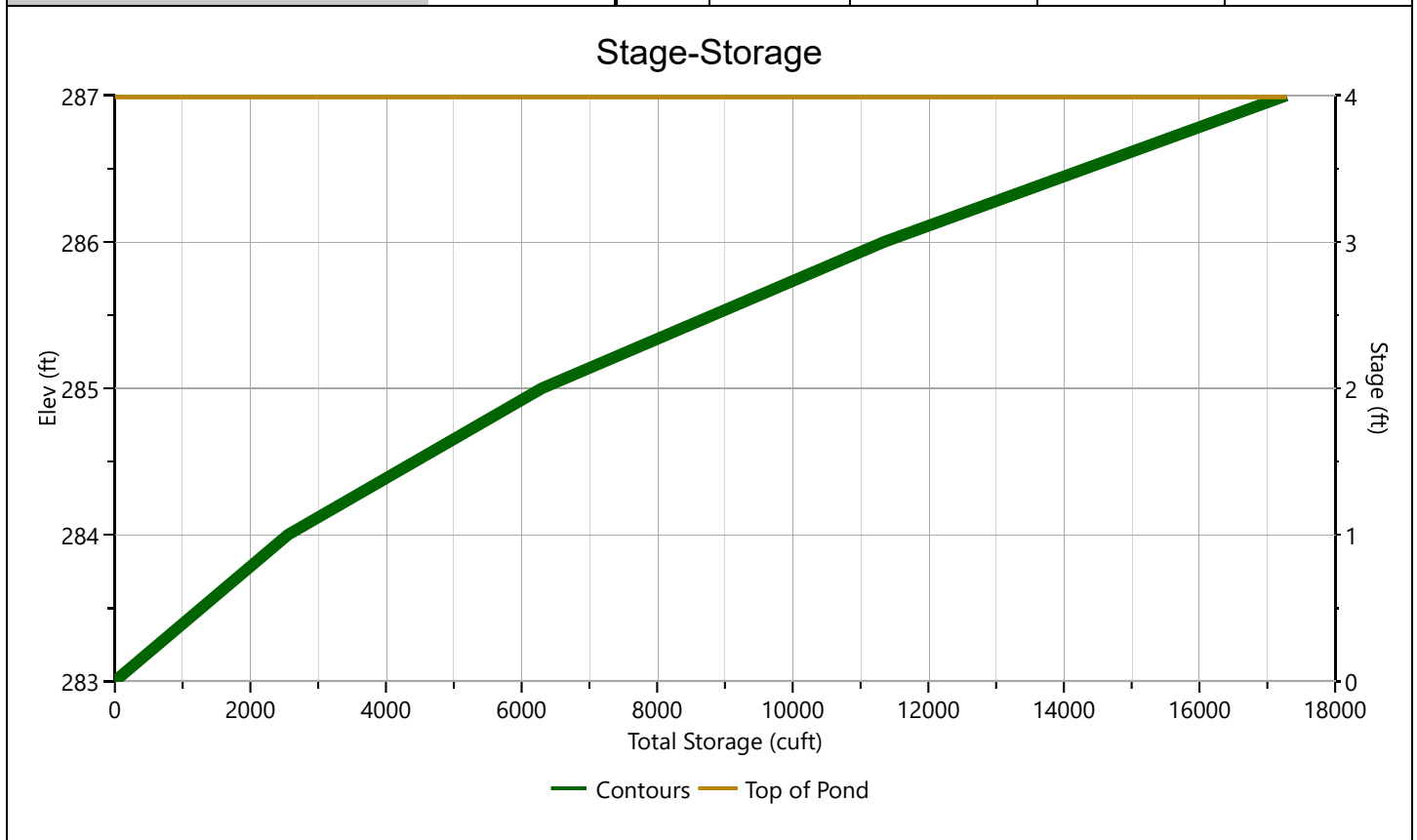
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-5B**

## Stage-Storage

[illegible]

# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

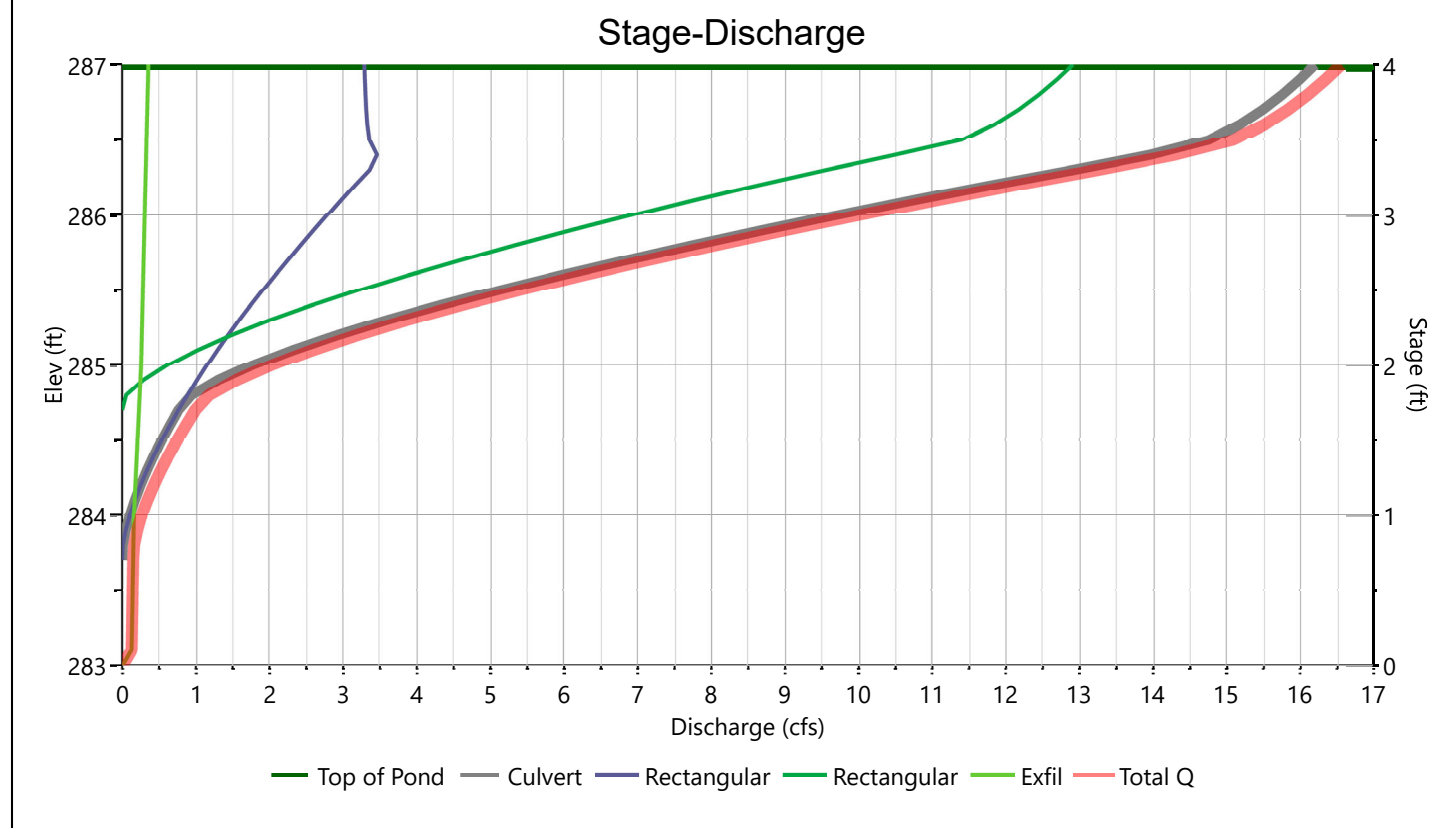
10-27-2022

## 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	52					
Barrel Slope, %	11.5					
N-Value, n	0.012					
Weirs	Riser*	Weirs			Ancillary	
		1*	2*	3*		
Shape / Type	Circular	Rectangular	Rectangular	Rectangular	Exfiltration, in/hr	2.41**
Crest Elevation, ft		283.75	284.75	285.75		
Crest Length, ft		.25	1.5	11.25		
Angle, deg						
Weir Coefficient, Cw		3.3	3.3	3.3		

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



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-5B**

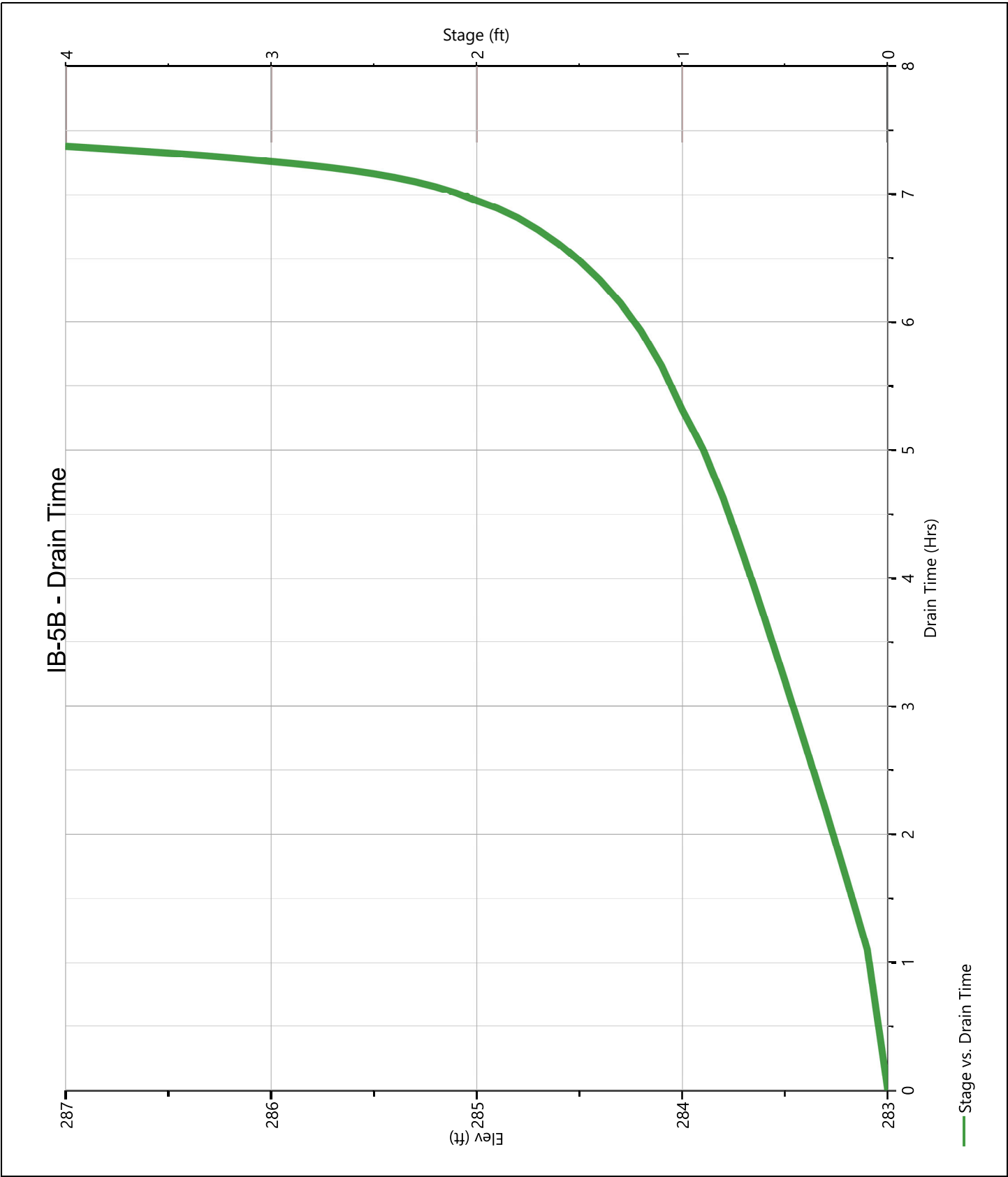
### Stage-Storage-Discharge Summary

[illegible]

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

IB-5B

Pond Drawdown



**Worksheet 2: Runoff curve number and runoff**

**SM-3719C**

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	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
Totals =						1.22	101.86

1/ Use only one CN source per line.

52946

Totals =

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{101.86}{1.22} = 83.80 ; \text{ Use CN} = \boxed{84}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.73	4.31	5.92

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     

Circle one:

Present ☐ Developed ☒

Circle one:

☒ Tc ☐ Ttthrough  
subareaSubcatchment P-5CSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr  
min0.18  
10.9

# Hydrograph Report

Project Name:

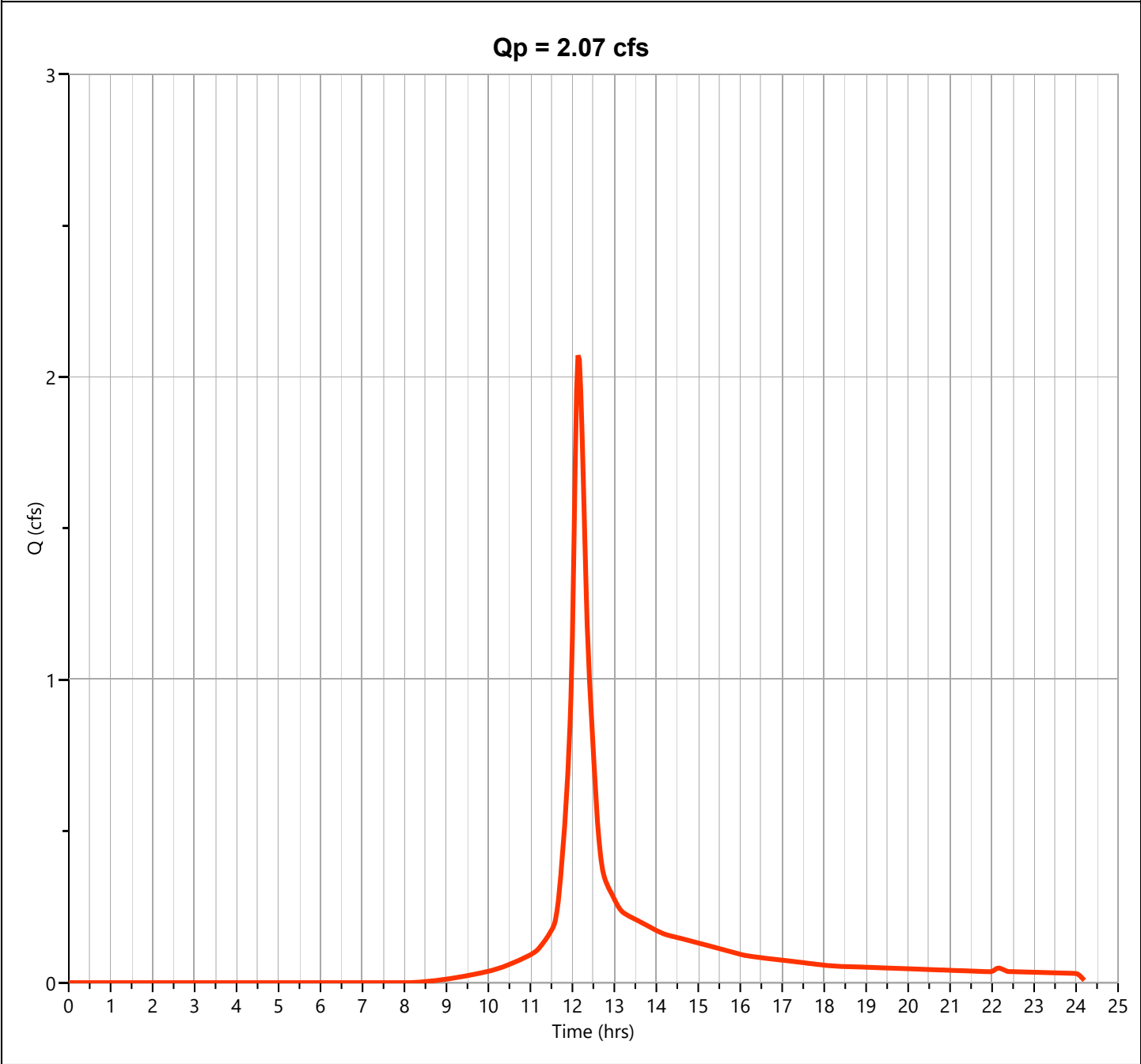
Hydrology Studio v 3.0.0.21

10-27-2022

P-5C

Hyd. No. 15

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:

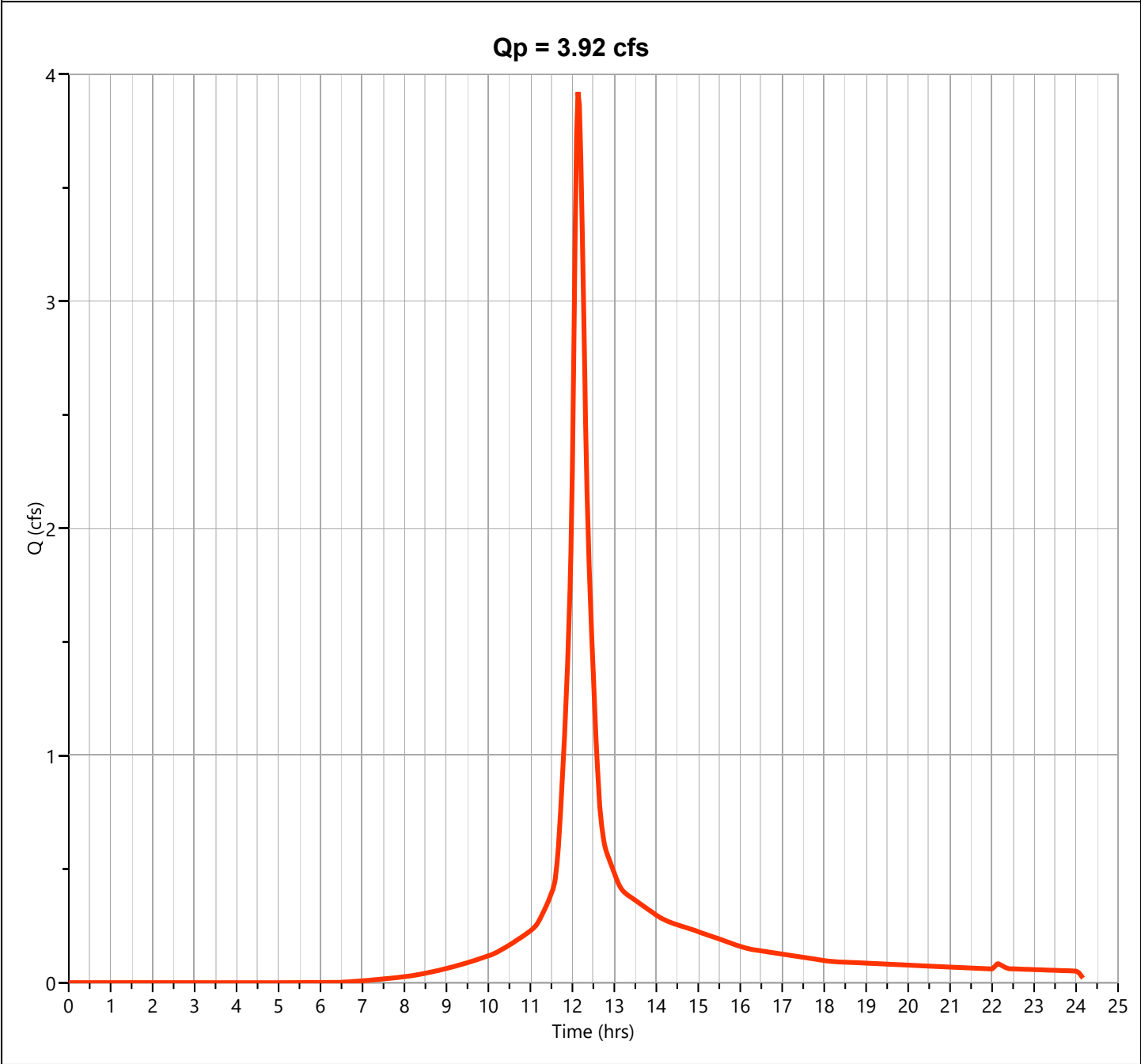
Hydrology Studio v 3.0.0.21

10-27-2022

P-5C

Hyd. No. 15

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:

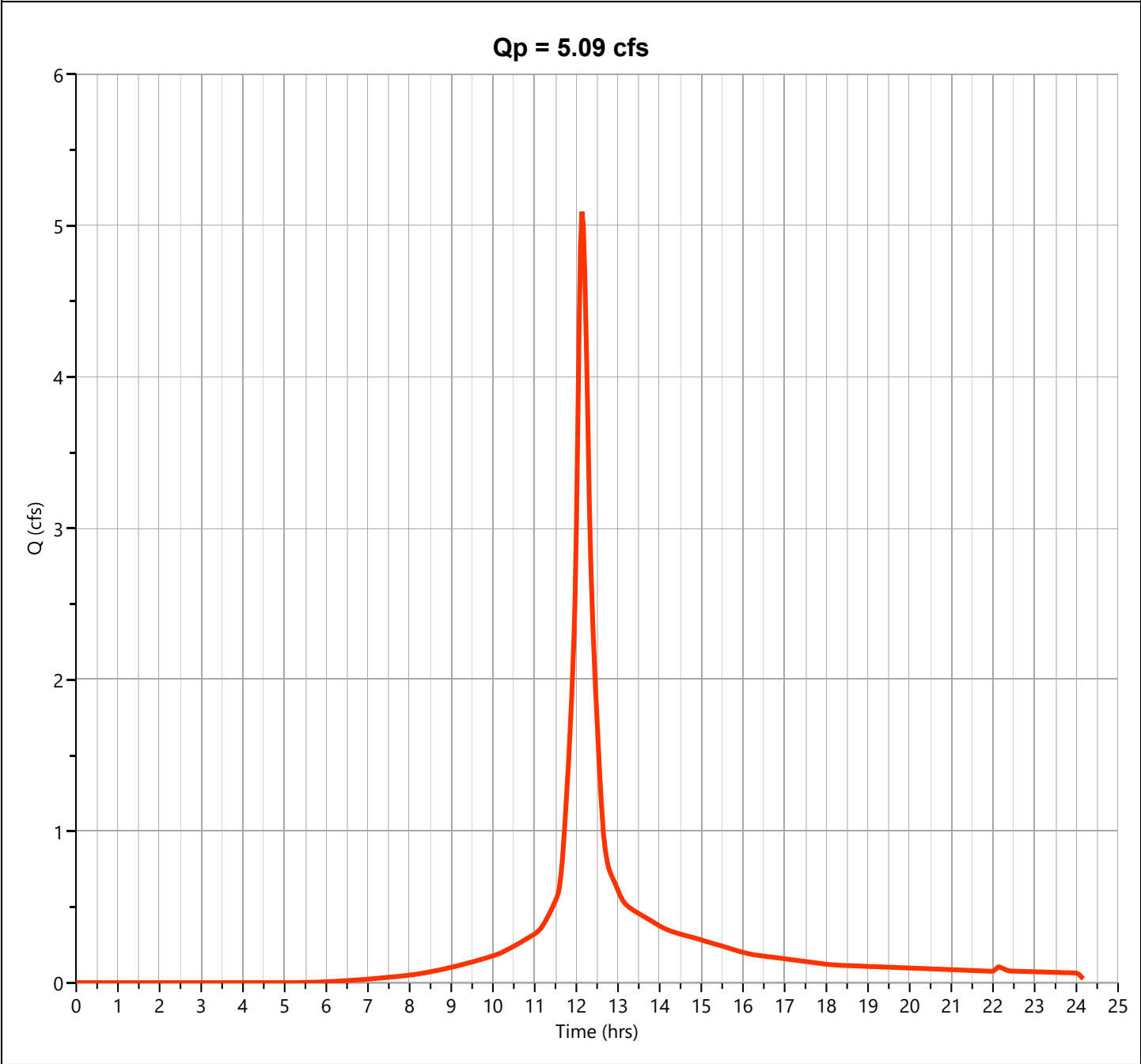
Hydrology Studio v 3.0.0.21

10-27-2022

P-5C

Hyd. No. 15

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:

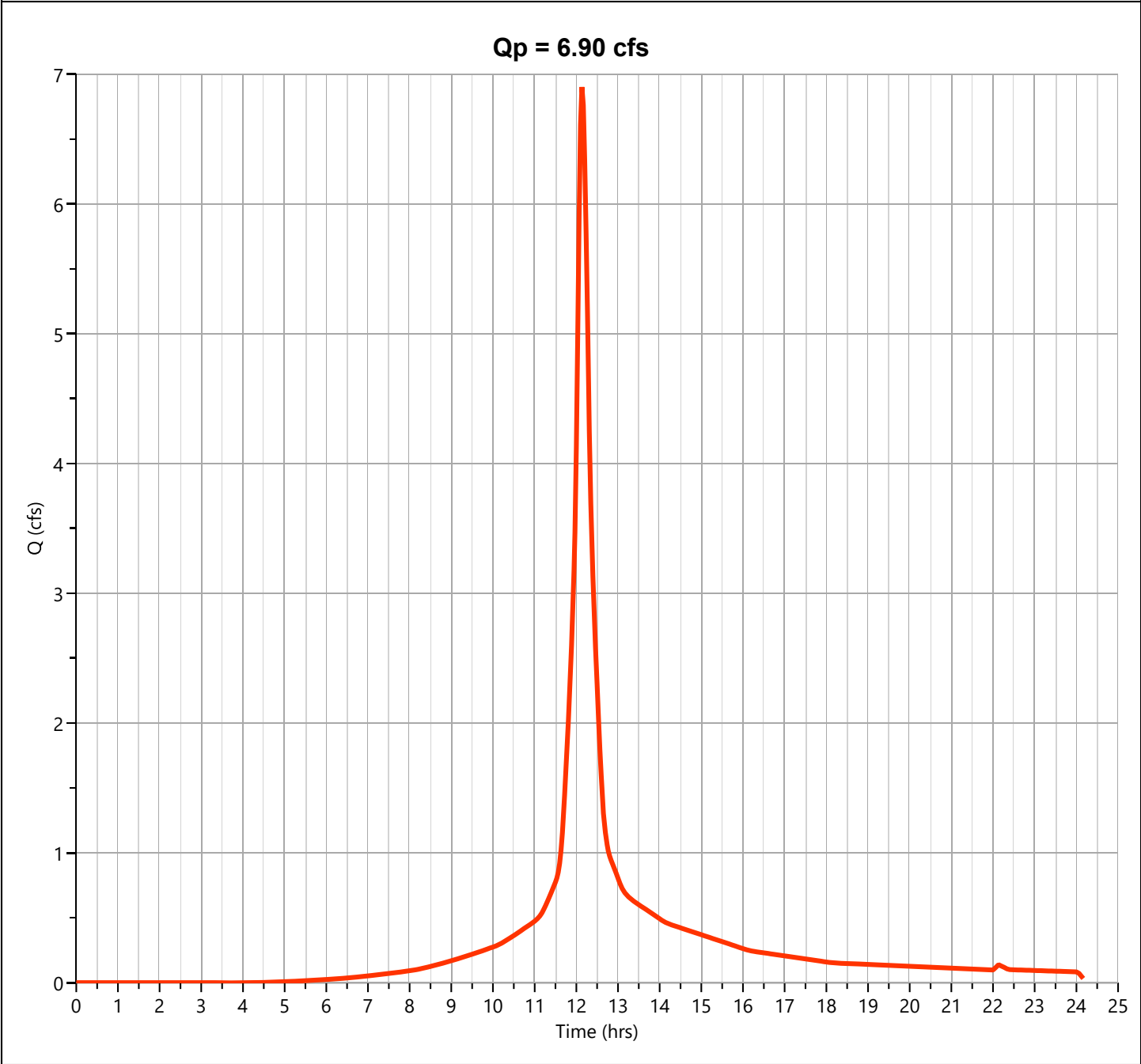
Hydrology Studio v 3.0.0.21

10-27-2022

P-5C

Hyd. No. 15

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 3.0.0.21

10-27-2022

**IB-5C**

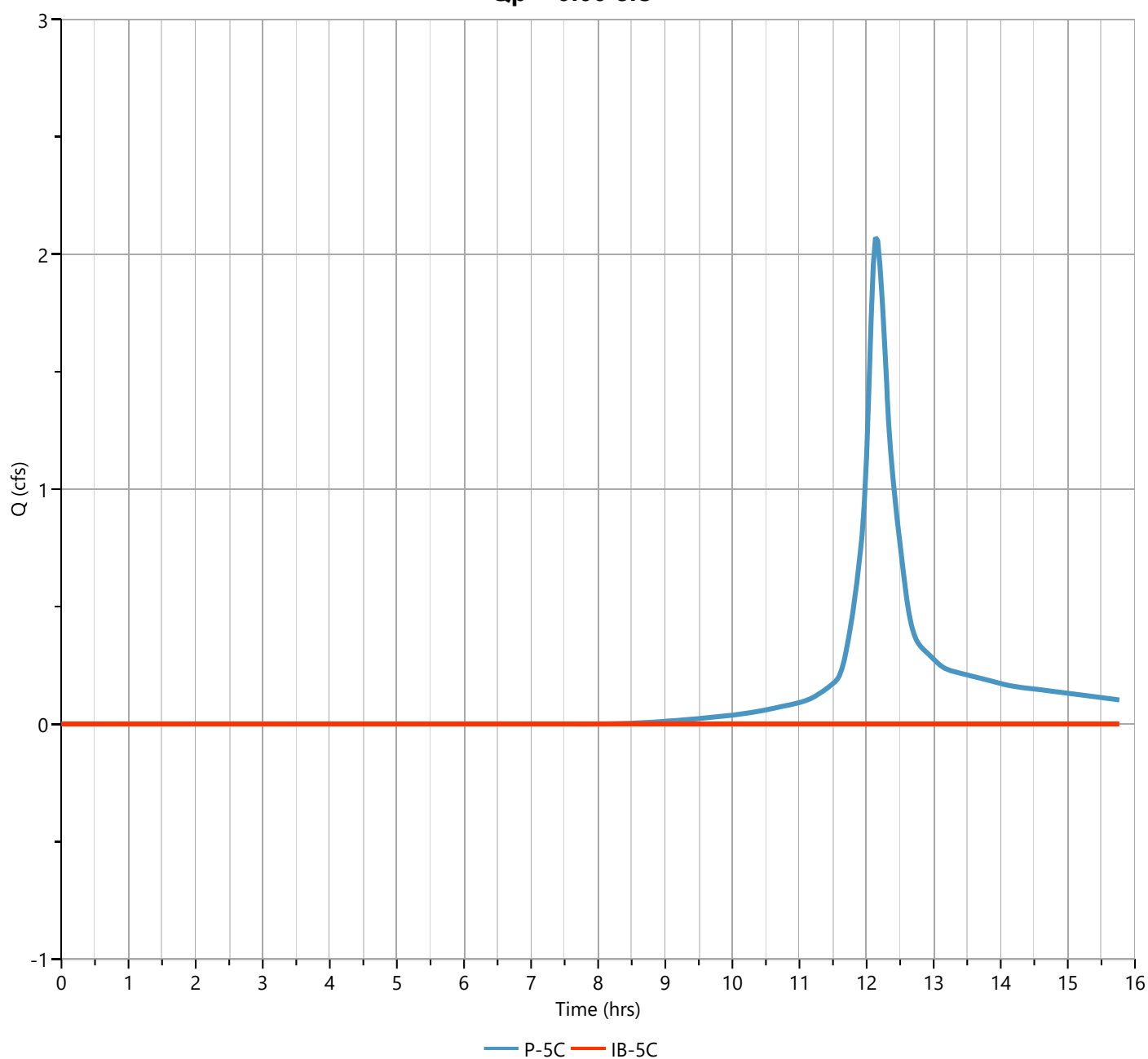
**Hyd. No. 16**

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	= 15 - 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*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

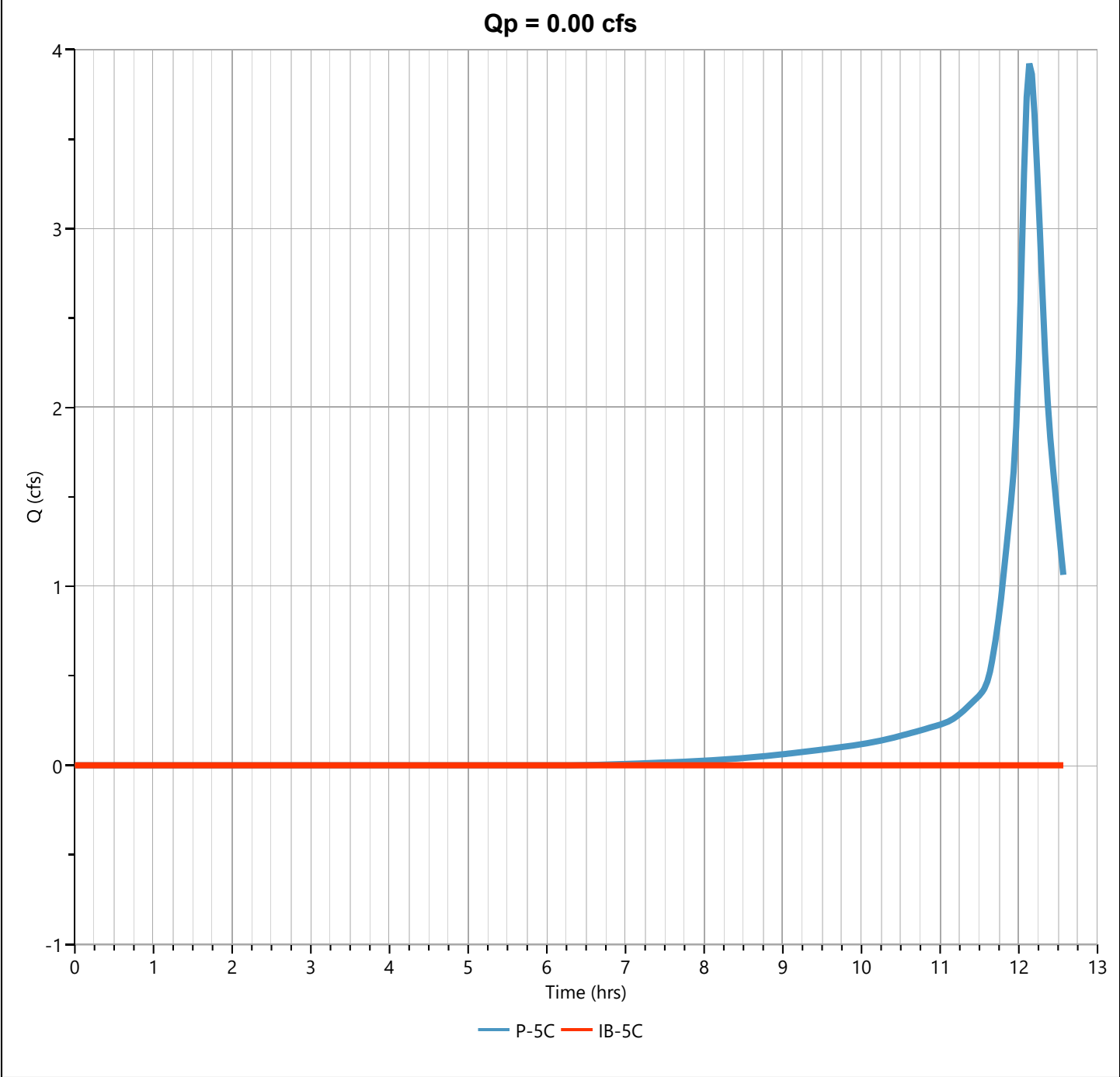
10-27-2022

IB-5C

Hyd. No. 16

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	= 15 - 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 3.0.0.21

10-27-2022

**IB-5C**

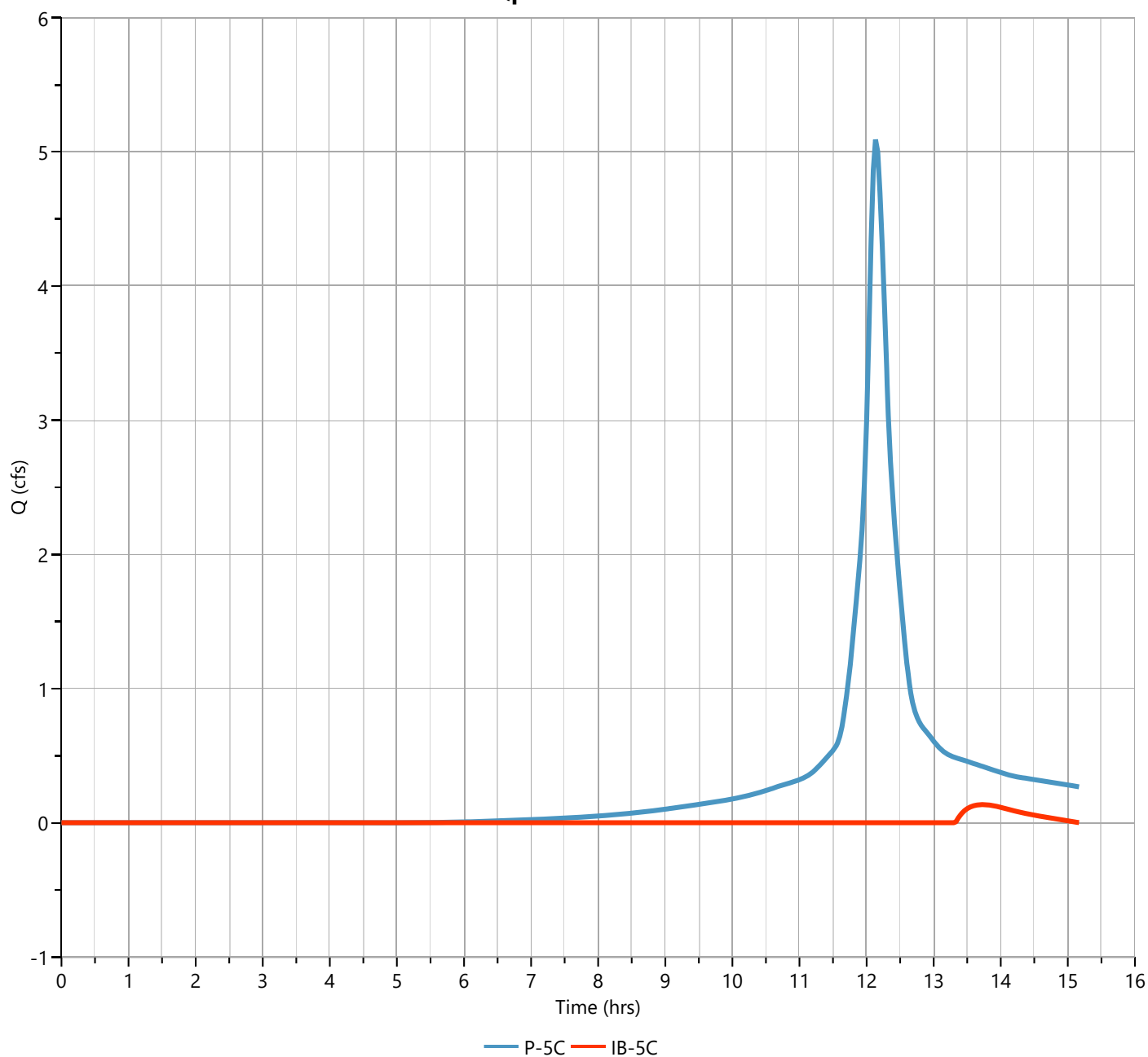
**Hyd. No. 16**

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	= 15 - 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*

**Qp = 0.13 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

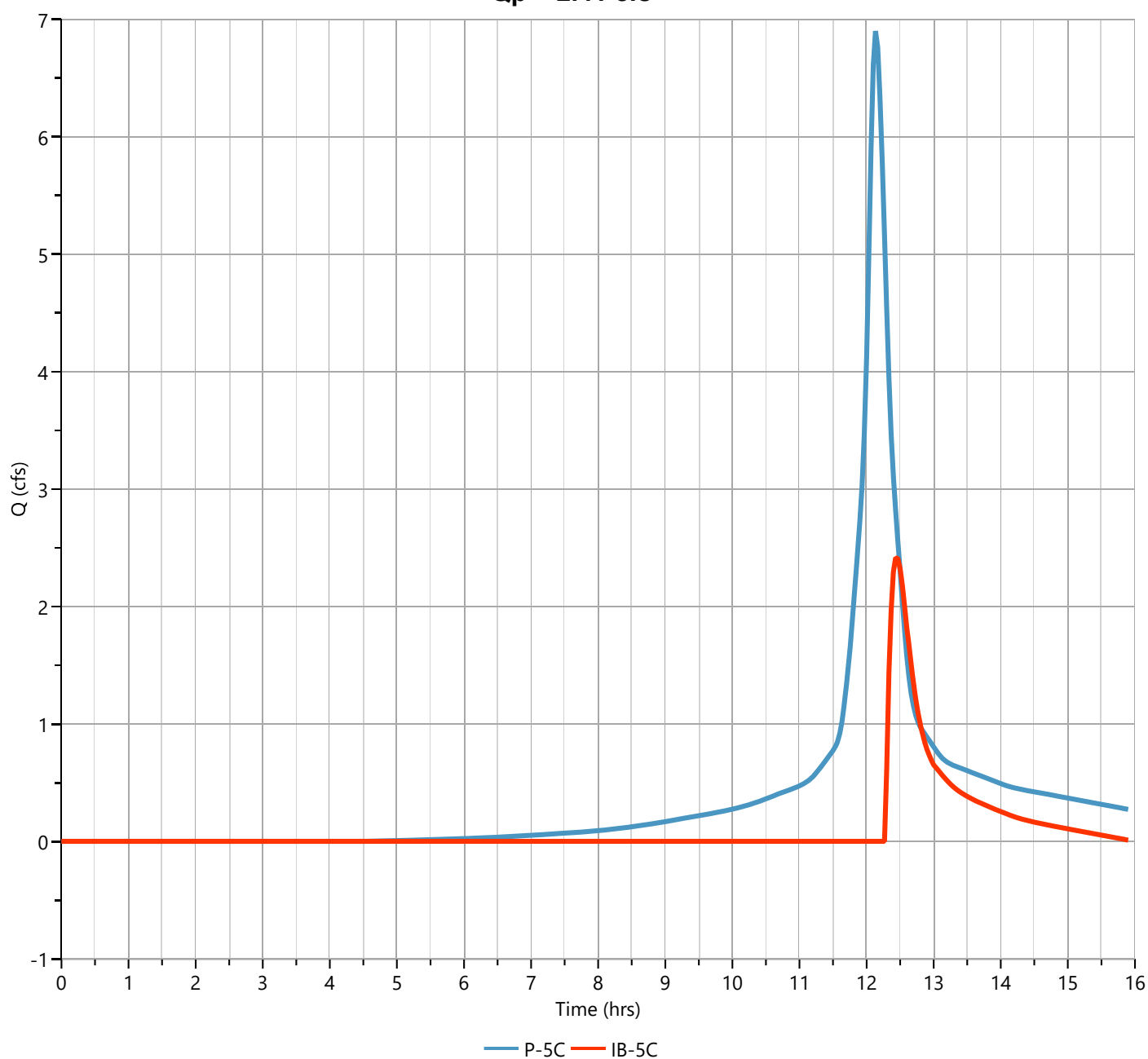
## IB-5C

## Hyd. No. 16

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	= 15 - P-5C	Max. Elevation	= 260.94 ft
Pond Name	= IB-5C	Max. Storage	= 11,696 cuft

*Pond Routing by Storage Indication Method*

**Qp = 2.41 cfs**



# Pond Report

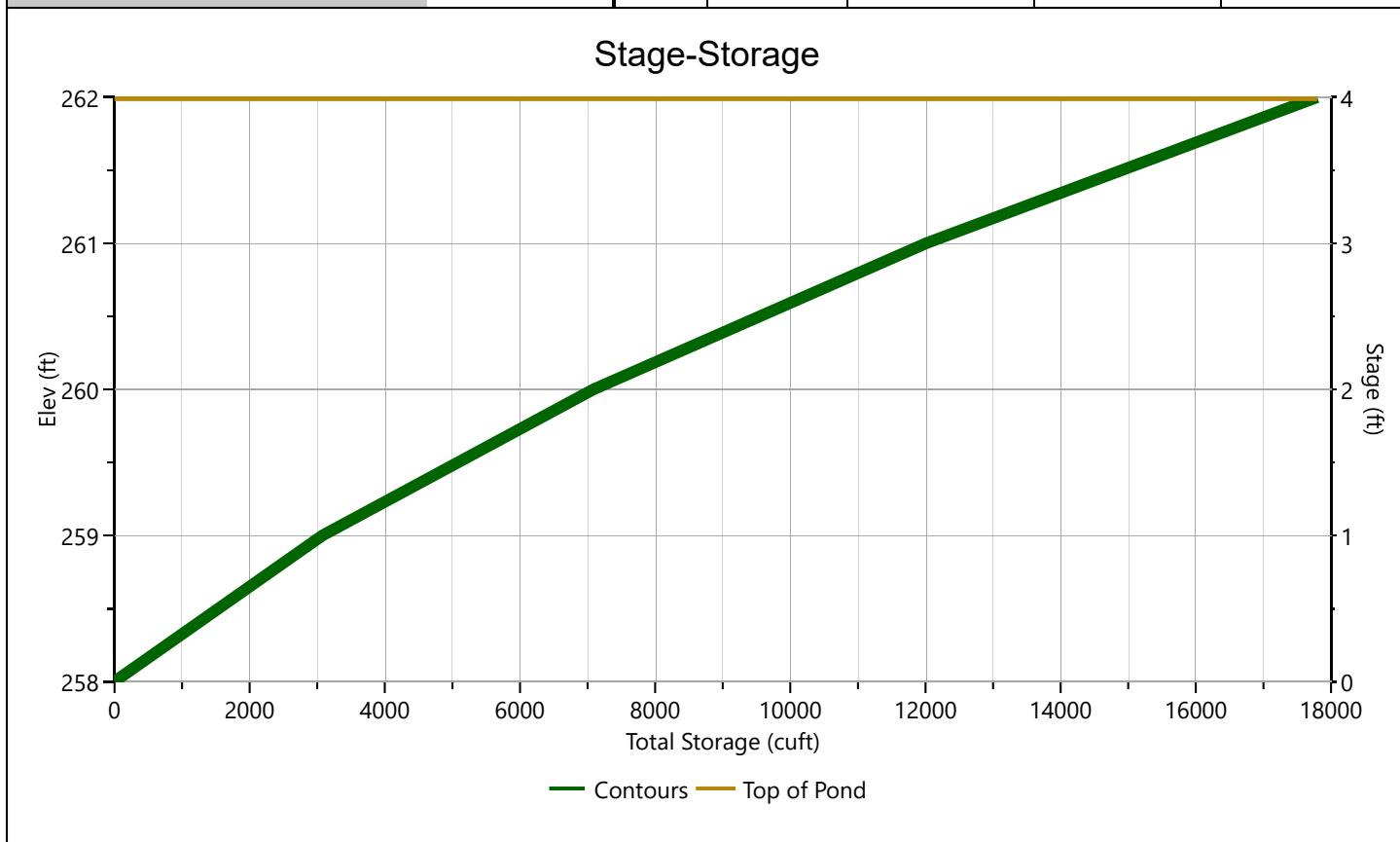
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-5C**

## Stage-Storage

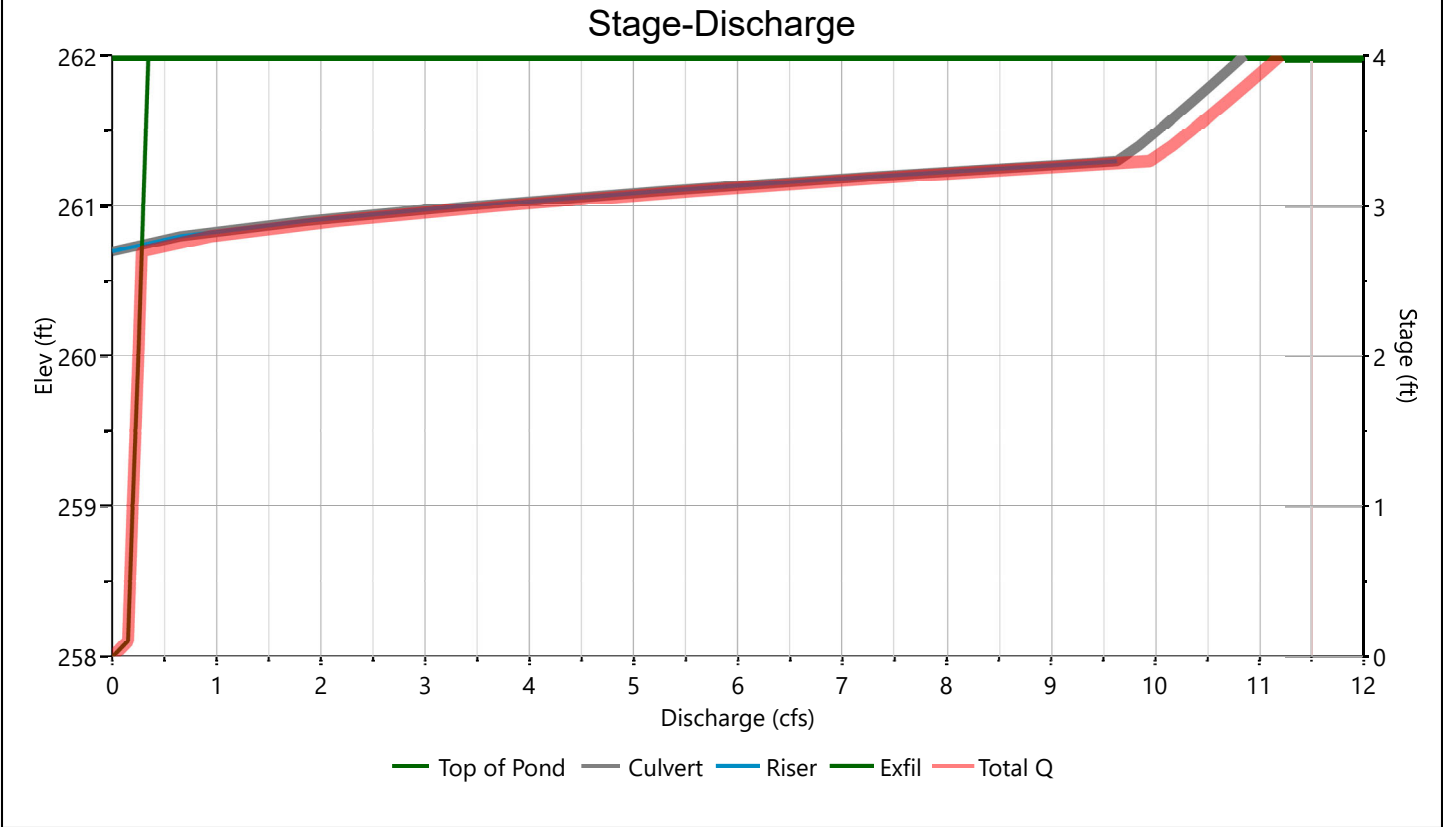
[illegible]

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	88					
Barrel Slope, %	2.12					
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 3.0.0.21

10-27-2022

**IB-5C**

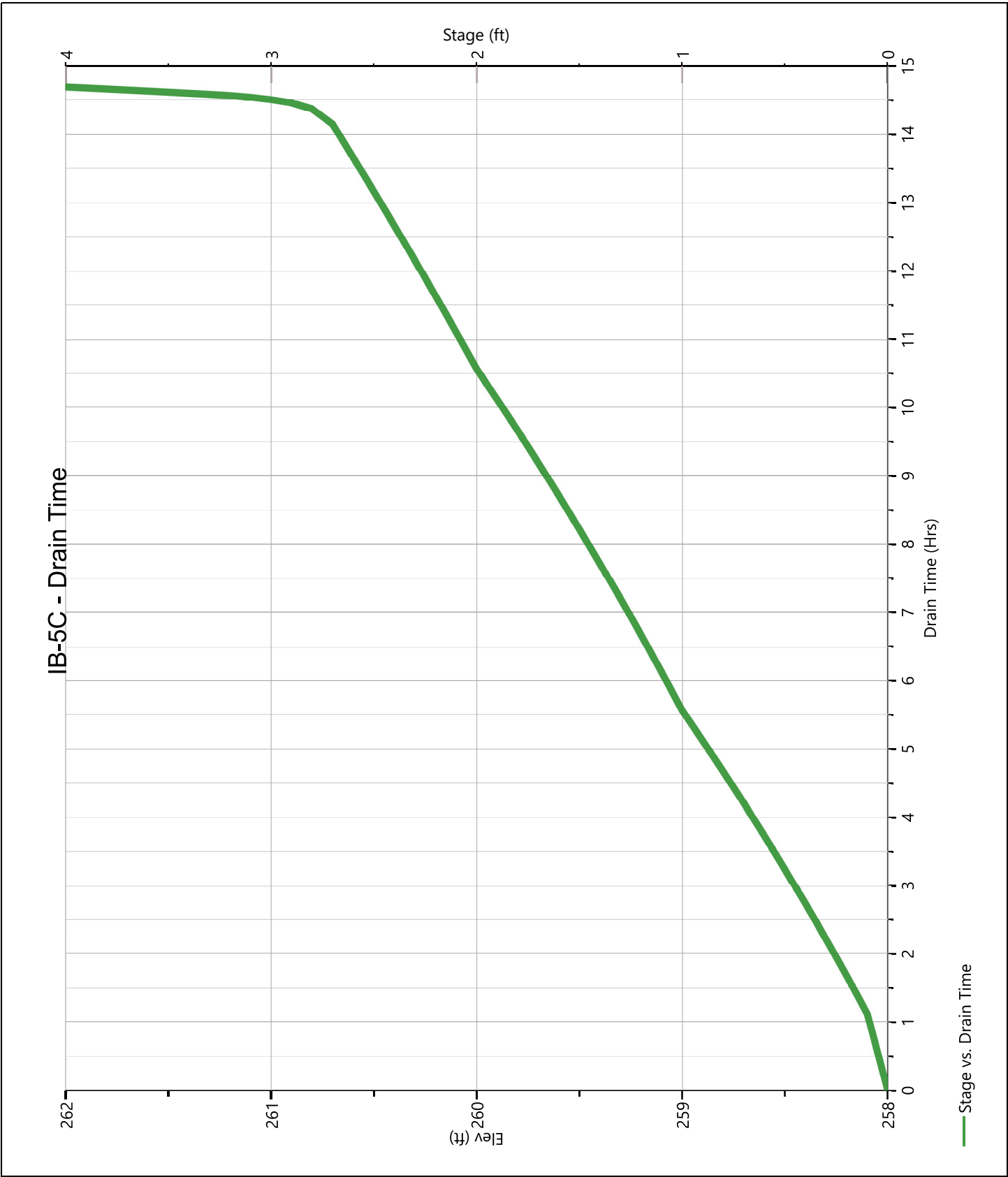
### Stage-Storage-Discharge Summary

[illegible]

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

IB-5C

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By PFK Date 6/21/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			1.09	106.43
A	Woods Good Condition	30			2.63	78.99
A	Open Space Good Condition	39			2.05	80.04
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.00	0.00
C	Woods Good Condition	70			0.54	37.93
C	Open Space Good Condition	77			0.43	33.48
C	Gravel	89			0.00	0.00
D	Woods Good Condition	91			0.00	0.00
D	Open Space Good Condition	80			0.00	0.00
D	Gravel	91			0.00	0.00
D	BVW	77			2.22	170.98
1/ Use only one CN source per line. 390664 Totals =					8.97	507.85

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{507.85}{8.97} = 56.63 ; \text{ Use CN} = \boxed{57}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.32	1.73	2.85

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/21/2022Location: Stow, MA

Checked \_\_\_\_\_

Rev Date 10/13/2022

Date \_\_\_\_\_

Circle one:

Present

Developed

Circle one:

Tc

Tt

through  
subareaSubcatchment P-5ESheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.19

A-B		
WOODS		
0.6		
50		
3.1		
0.060		
0.19		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C		
UNPAVED		
459		
0.080		
4.56		
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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

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:

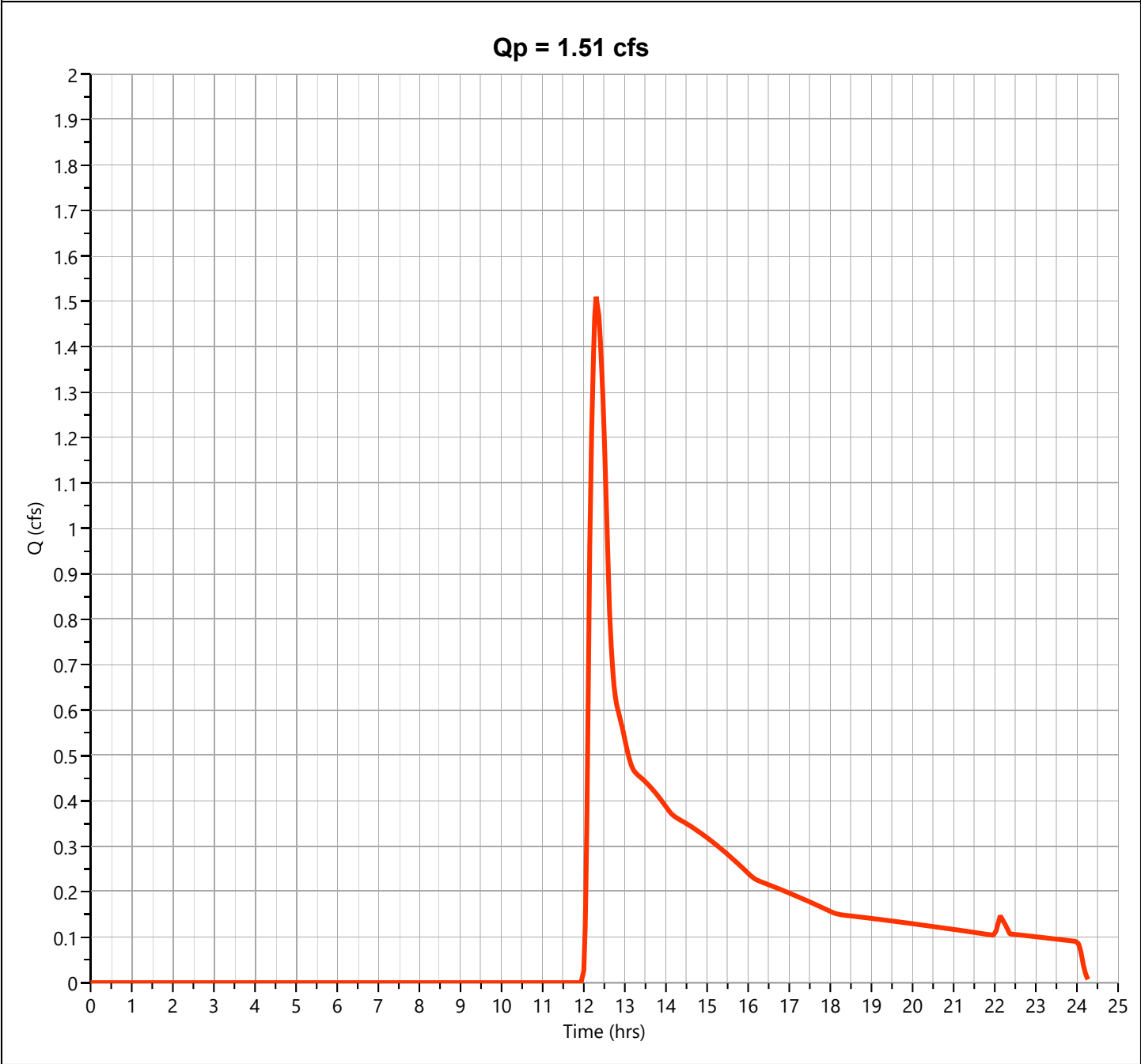
Hydrology Studio v 3.0.0.21

10-27-2022

P-5E

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.511 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 11,193 cuft
Drainage Area	= 8.97 ac	Curve Number	= 57
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:

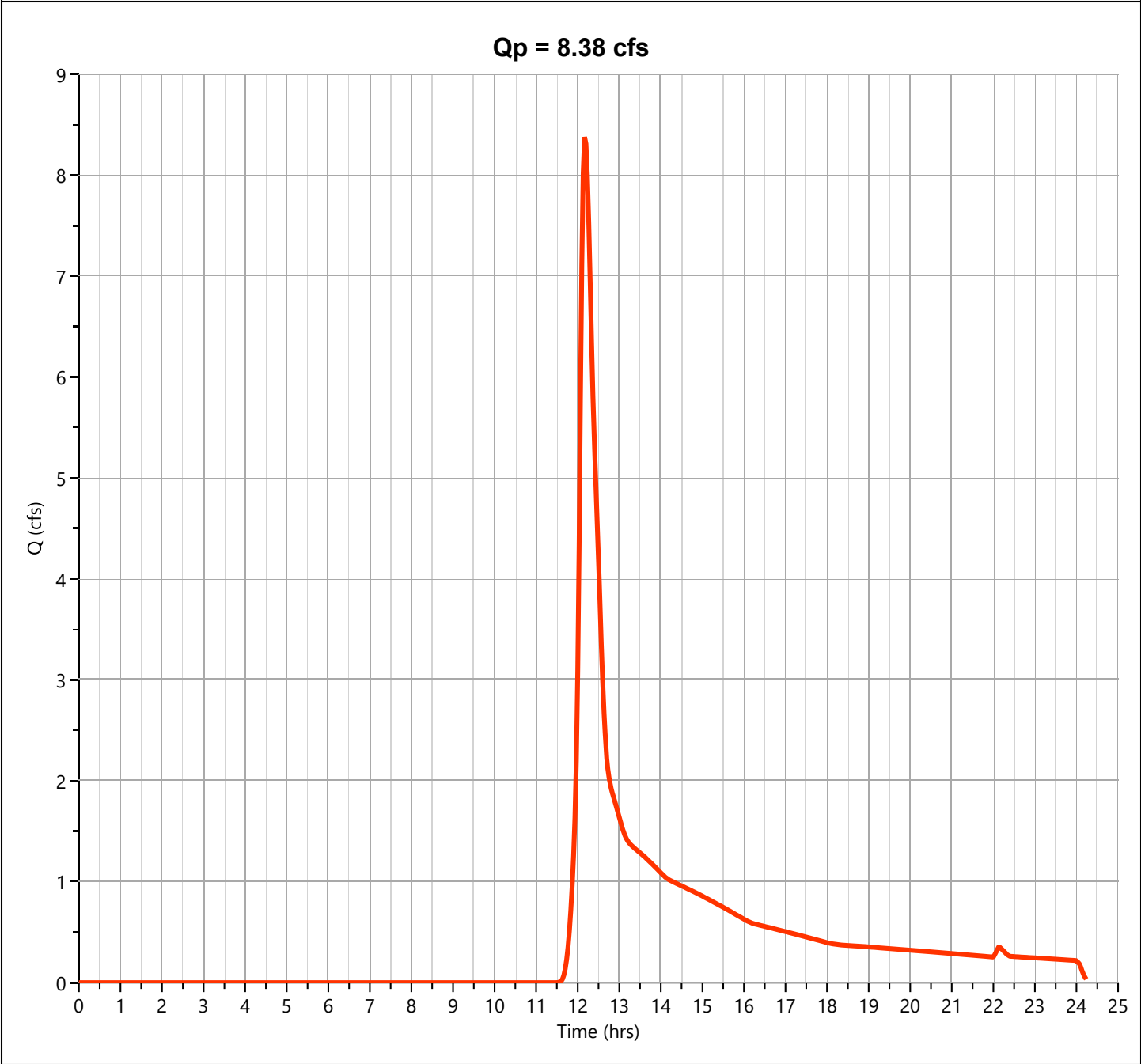
Hydrology Studio v 3.0.0.21

10-27-2022

P-5E

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.379 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 37,806 cuft
Drainage Area	= 8.97 ac	Curve Number	= 57
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:

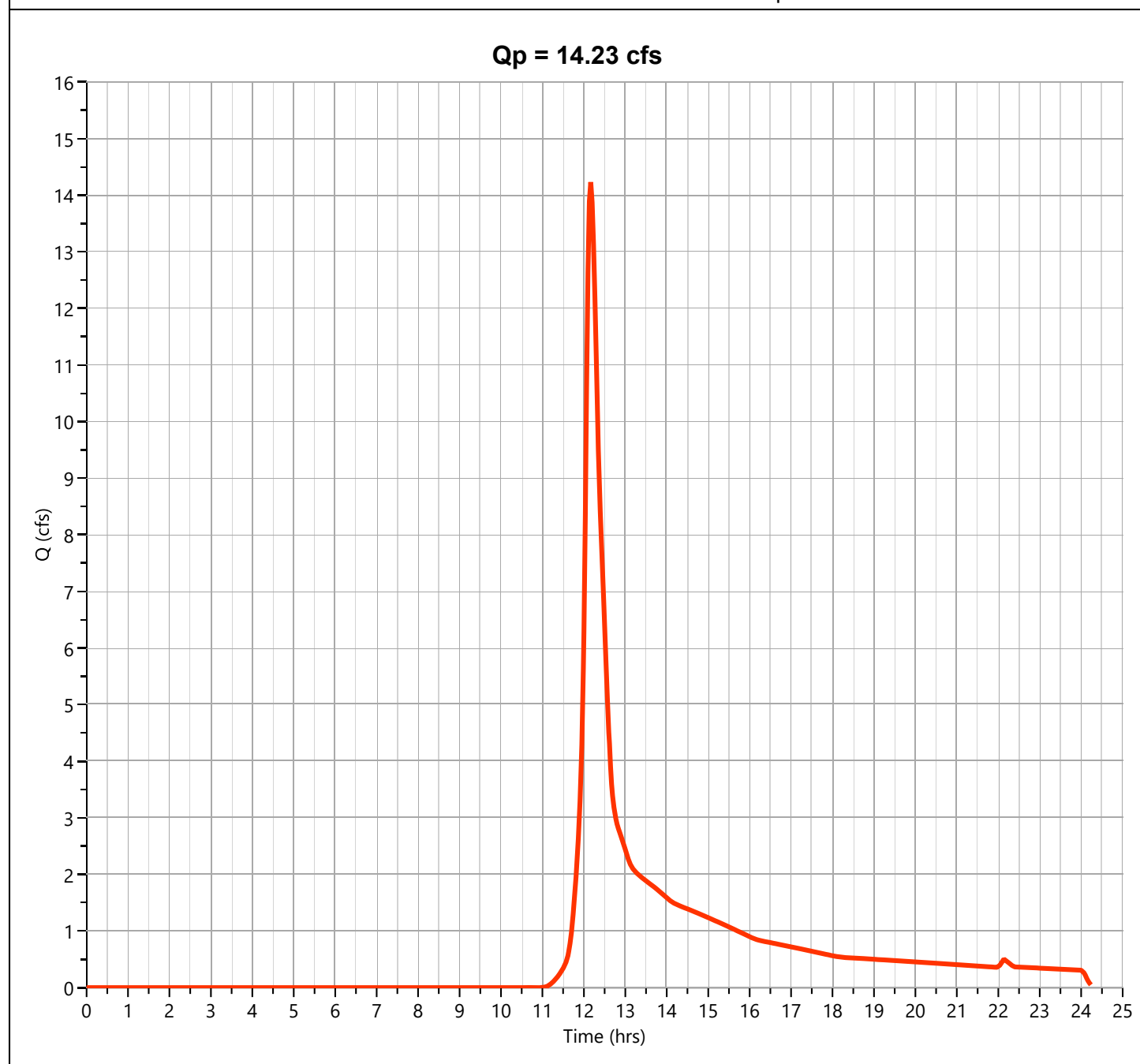
Hydrology Studio v 3.0.0.21

10-27-2022

**P-5E**

**Hyd. No. 17**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 14.23 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 59,154 cuft
Drainage Area	= 8.97 ac	Curve Number	= 57
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:

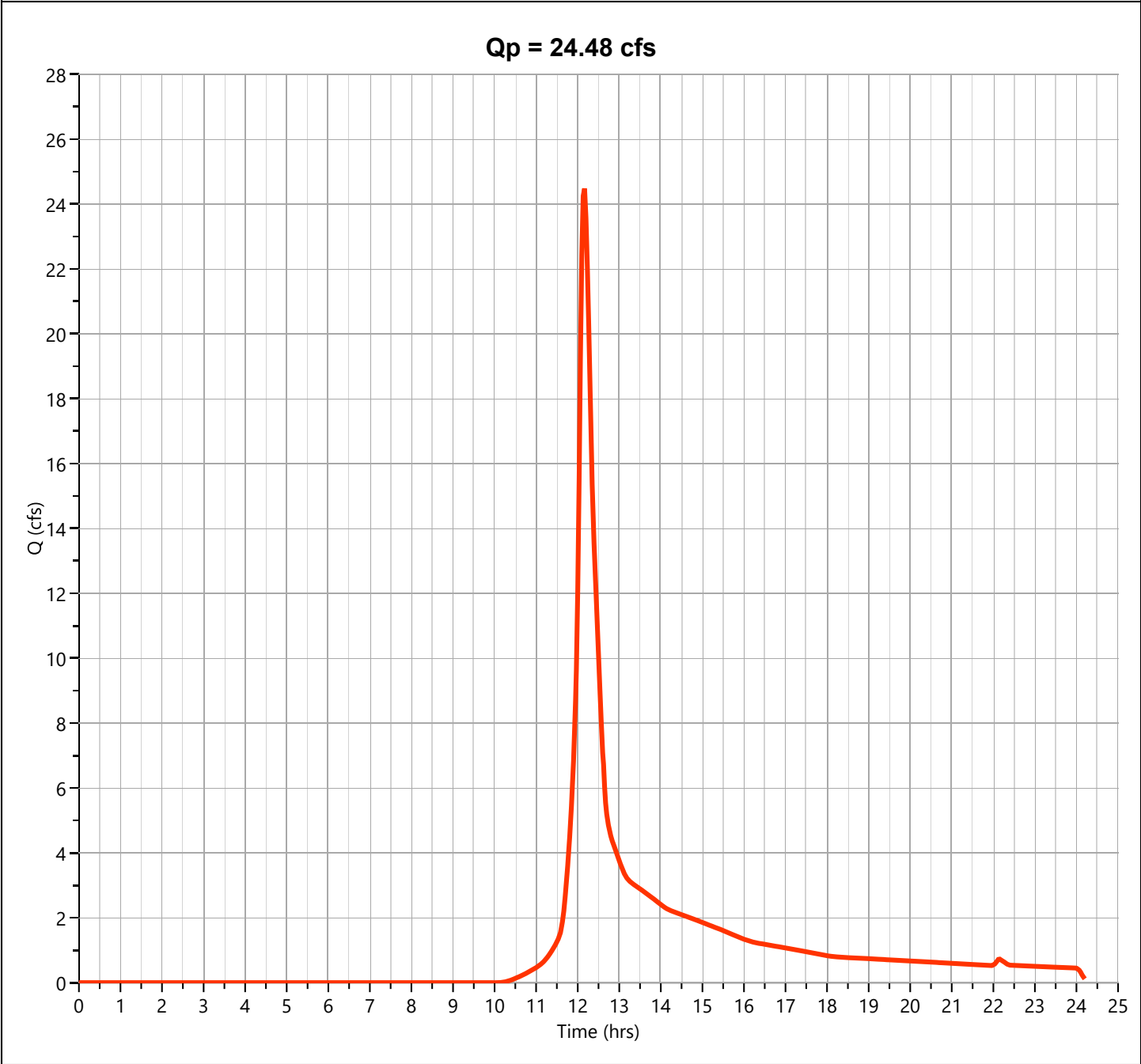
Hydrology Studio v 3.0.0.21

10-27-2022

P-5E

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.48 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 97,007 cuft
Drainage Area	= 8.97 ac	Curve Number	= 57
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:

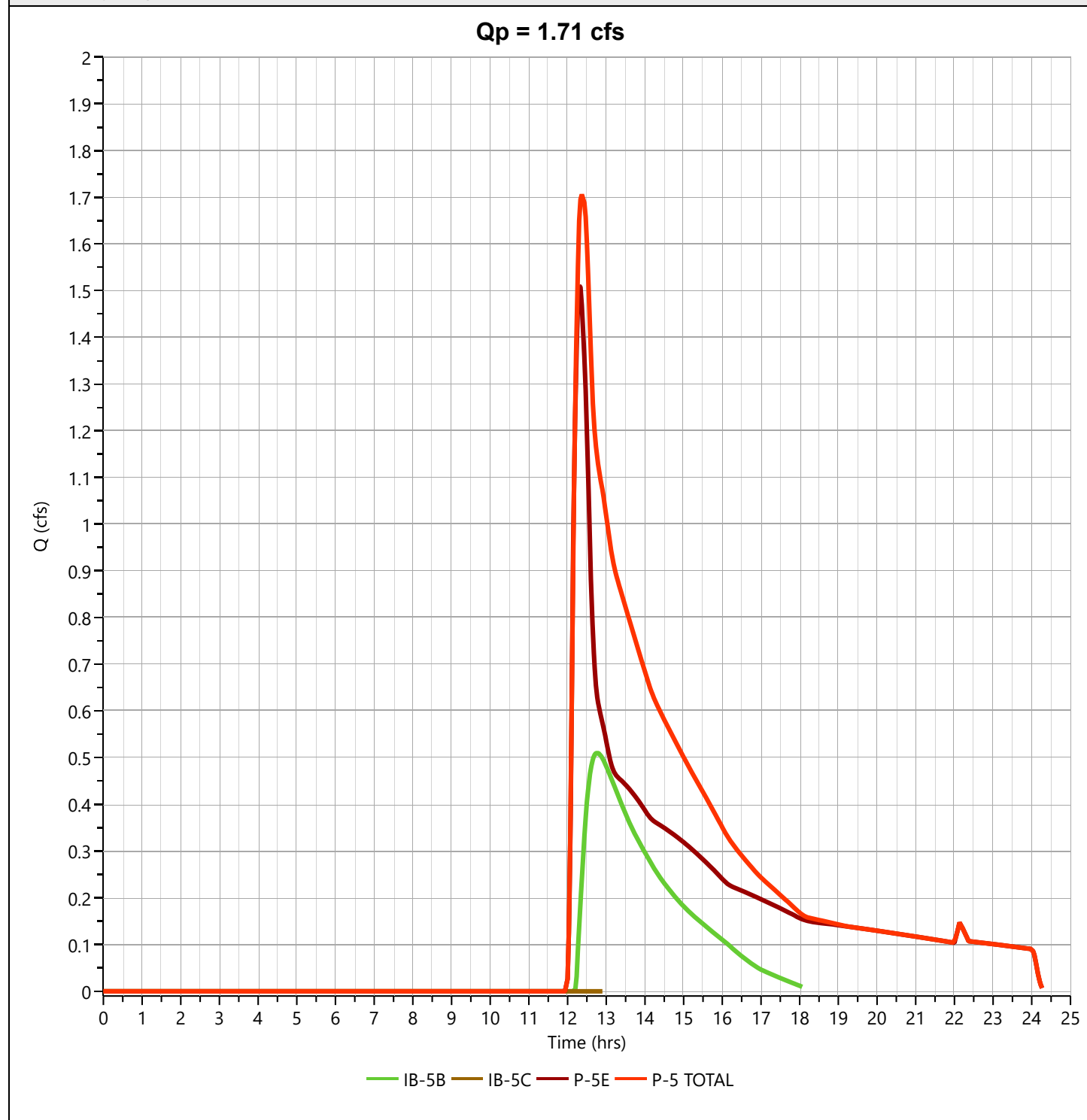
Hydrology Studio v 3.0.0.21

10-27-2022

## P-5 TOTAL

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 1.706 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,443 cuft
Inflow Hydrographs	= 14, 16, 17	Total Contrib. Area	= 8.97 ac



# Hydrograph Report

Project Name:

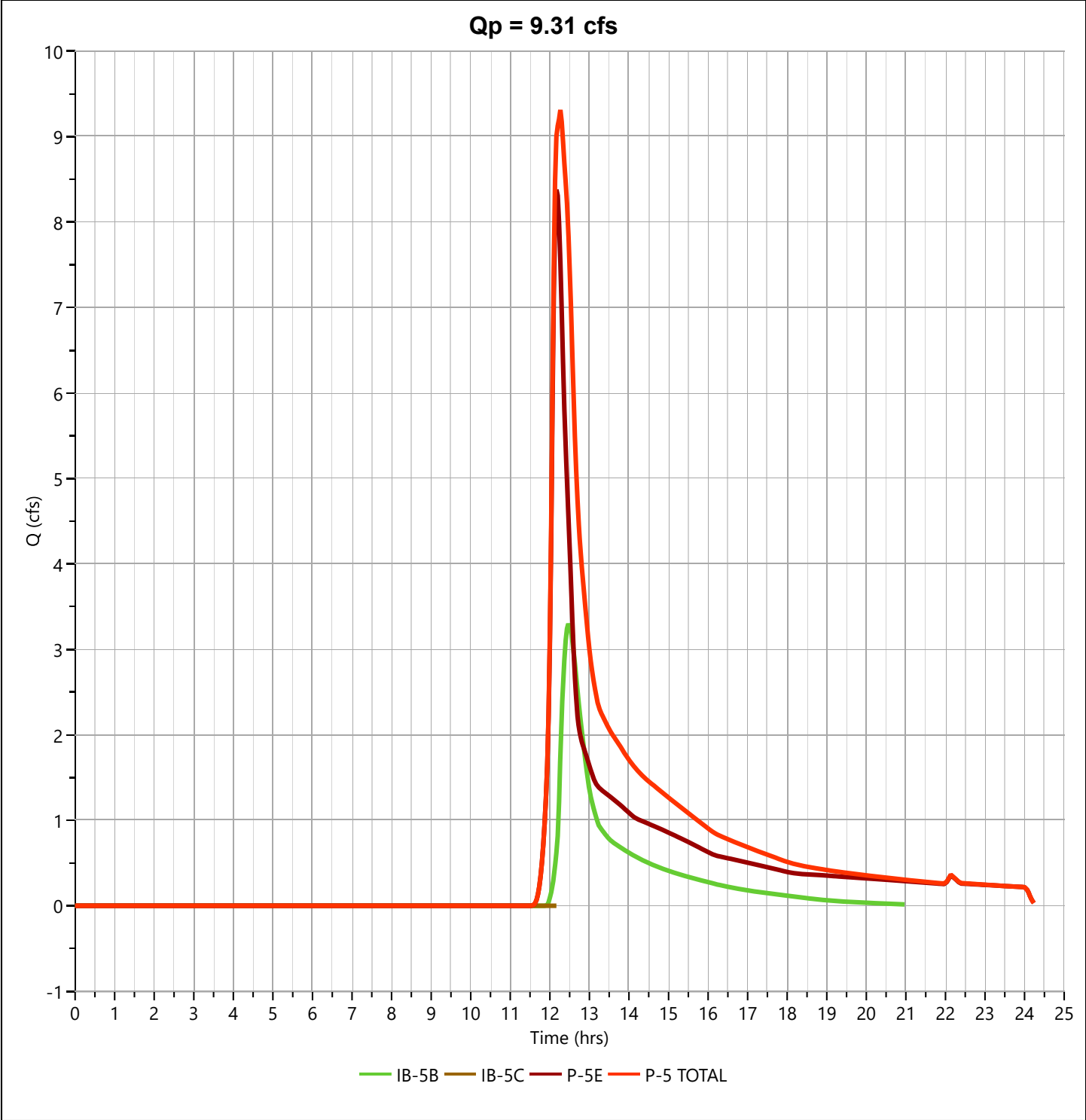
Hydrology Studio v 3.0.0.21

10-27-2022

## P-5 TOTAL

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 9.312 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 53,006 cuft
Inflow Hydrographs	= 14, 16, 17	Total Contrib. Area	= 8.97 ac



# Hydrograph Report

Project Name:

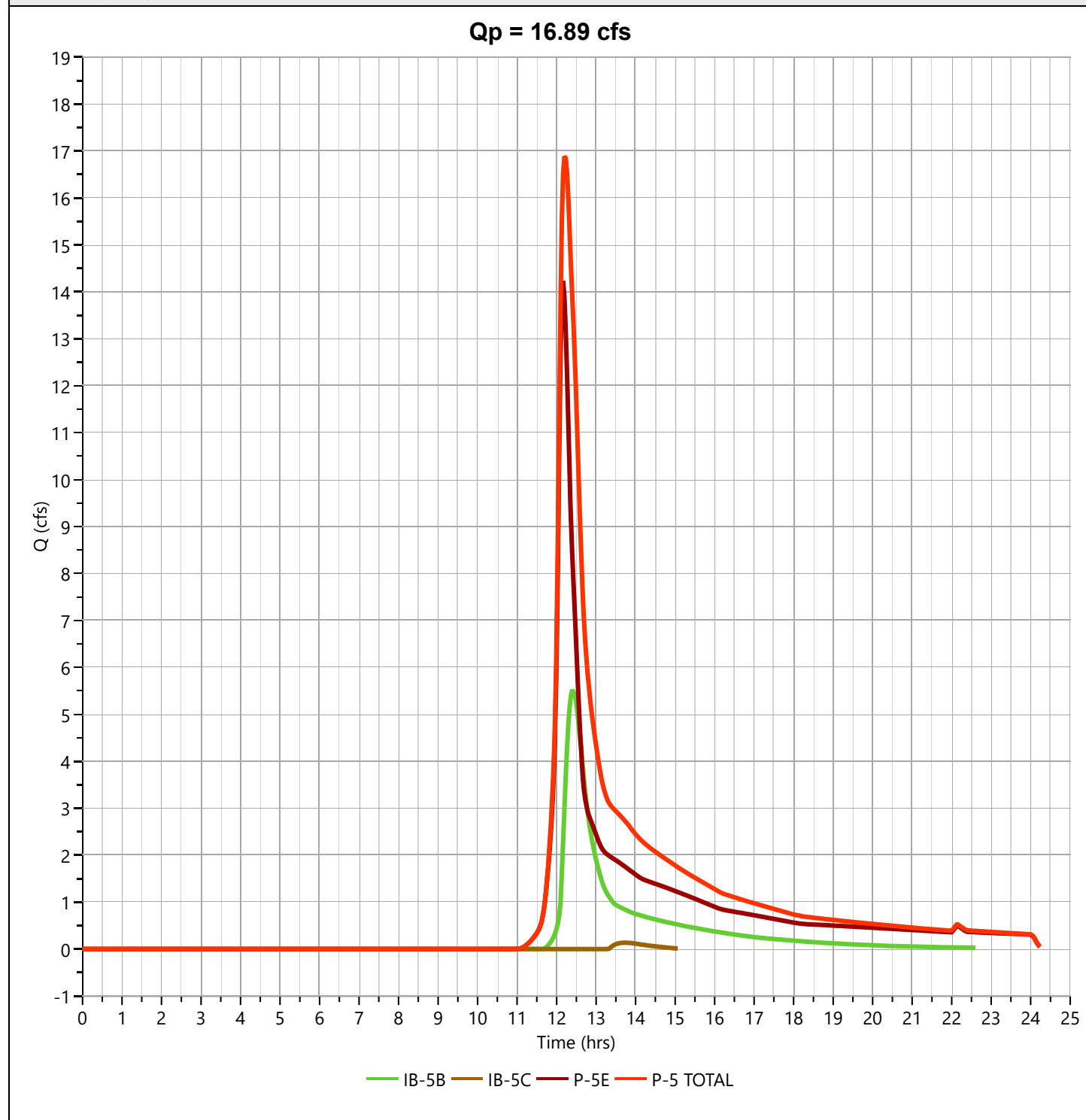
Hydrology Studio v 3.0.0.21

10-27-2022

## P-5 TOTAL

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 16.89 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 83,082 cuft
Inflow Hydrographs	= 14, 16, 17	Total Contrib. Area	= 8.97 ac



# Hydrograph Report

Project Name:

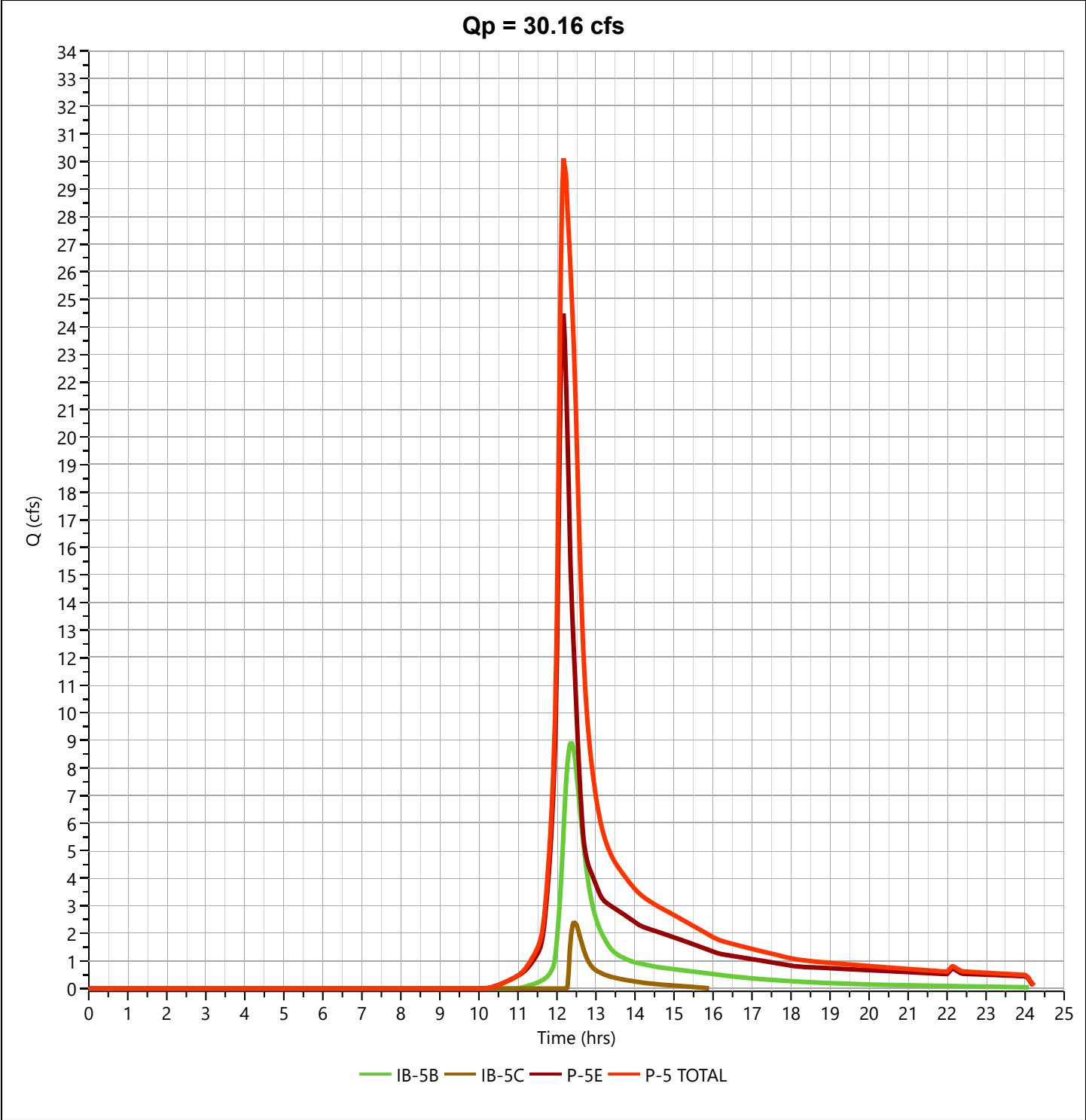
Hydrology Studio v 3.0.0.21

10-27-2022

## P-5 TOTAL

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 30.16 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 140,316 cuft
Inflow Hydrographs	= 14, 16, 17	Total Contrib. Area	= 8.97 ac



Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			0.00	0.00
A	Woods	Good Condition	30			1.27	38.21
A	Open Space	Good Condition	39			0.30	11.73
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.			71992			Totals =	
						1.65	55.97

CN (weighted) =  $\frac{\text{total product}}{\text{total area}} = \frac{55.97}{1.65} = 33.86$ ; Use CN = 34

2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.02	0.23	0.66

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present ☐ ☒ DevelopedCircle one: Tc ☐ ☒ TtSubcatchment P-6Athrough  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.29

A-B		
WOODS		
0.6		
50		
3.1		
0.020		
0.29		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.04

B-C		
UNPAVED		
381		
0.030		
2.79		
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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

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 3.0.0.21

10-27-2022

**P-6A**

**Hyd. No. 35**

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	= 1.65 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:

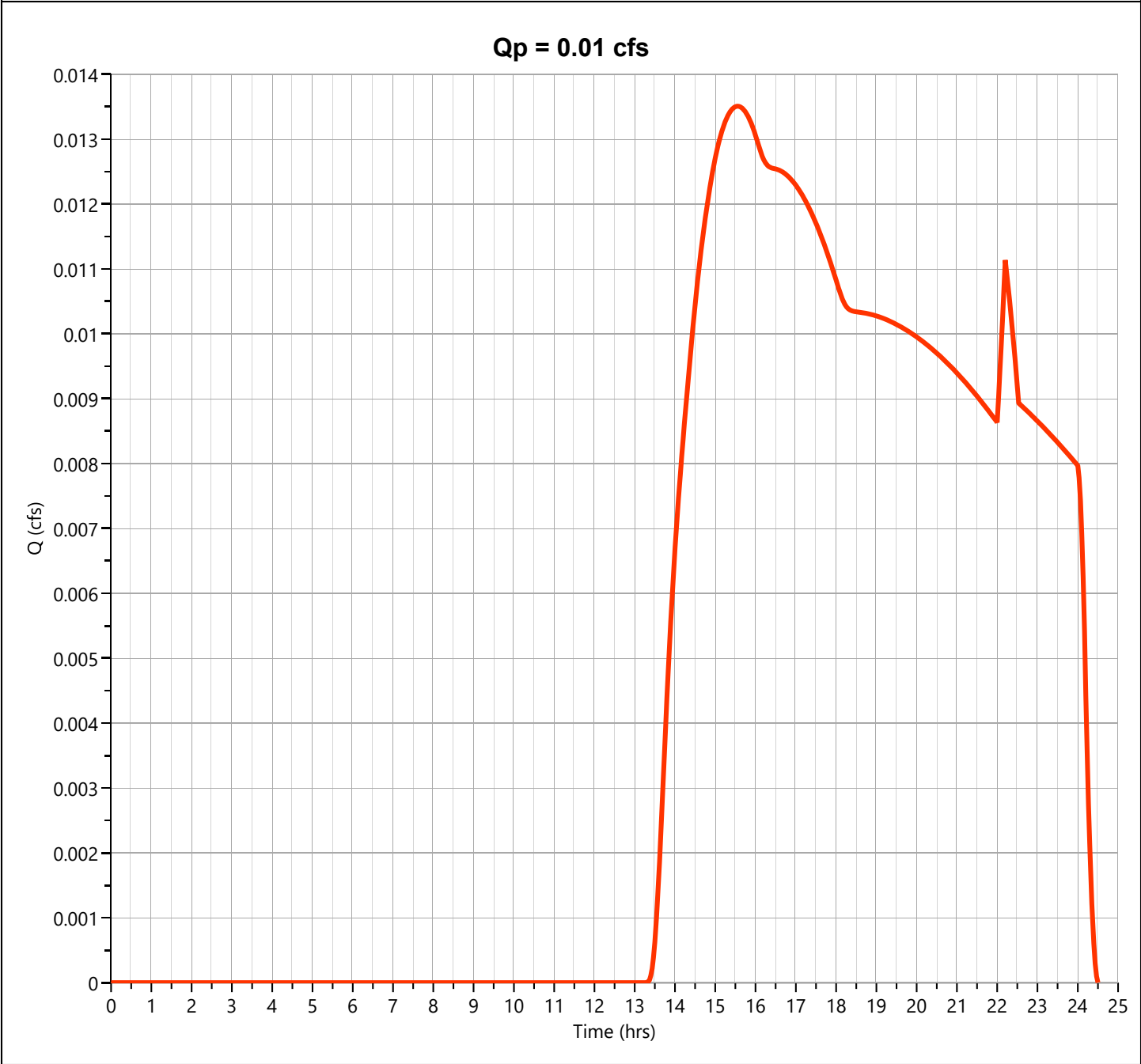
Hydrology Studio v 3.0.0.21

10-27-2022

P-6A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.014 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.57 hrs
Time Interval	= 2 min	Runoff Volume	= 390 cuft
Drainage Area	= 1.65 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:

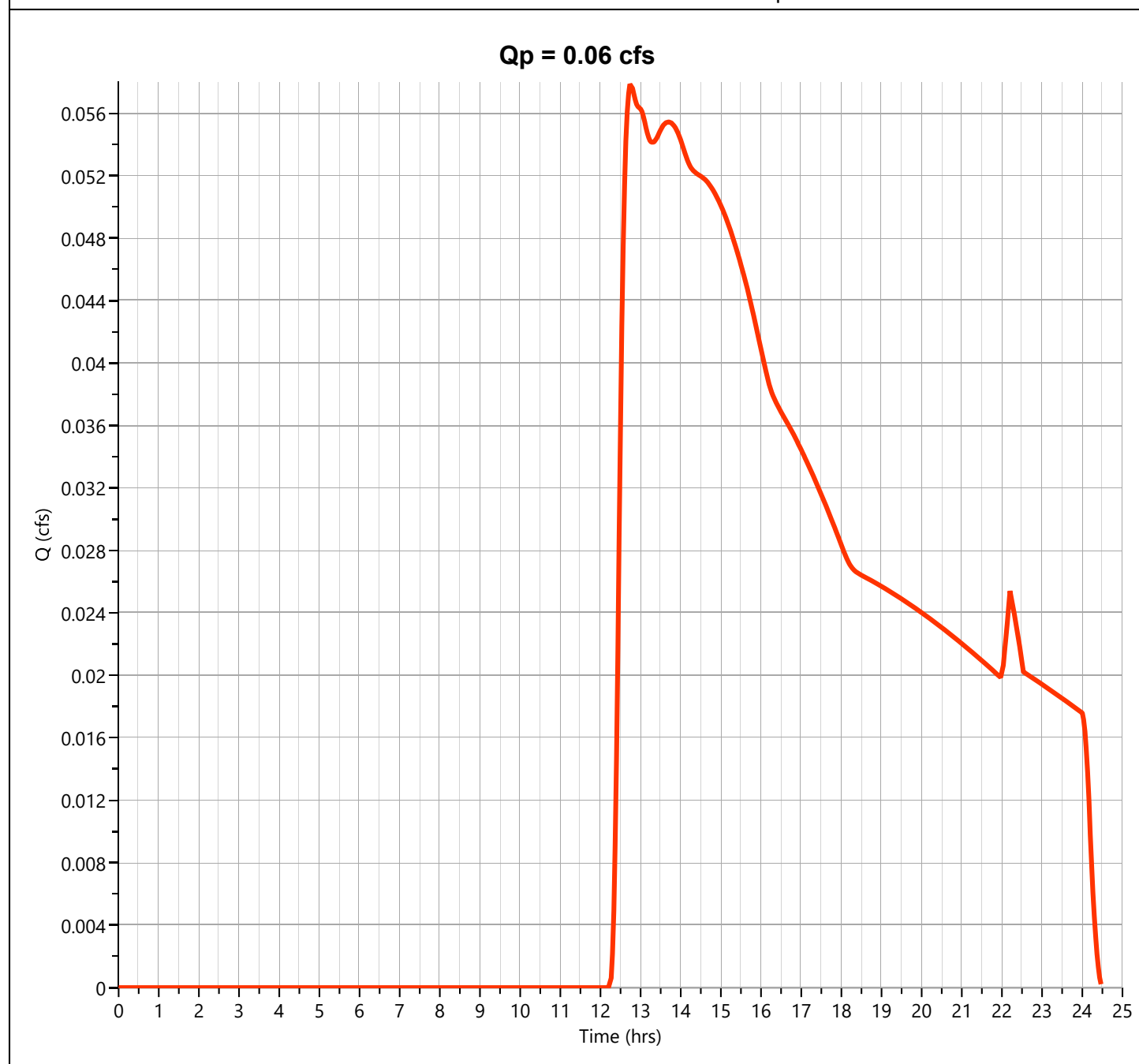
Hydrology Studio v 3.0.0.21

10-27-2022

**P-6A**

**Hyd. No. 35**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.058 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.77 hrs
Time Interval	= 2 min	Runoff Volume	= 1,408 cuft
Drainage Area	= 1.65 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:

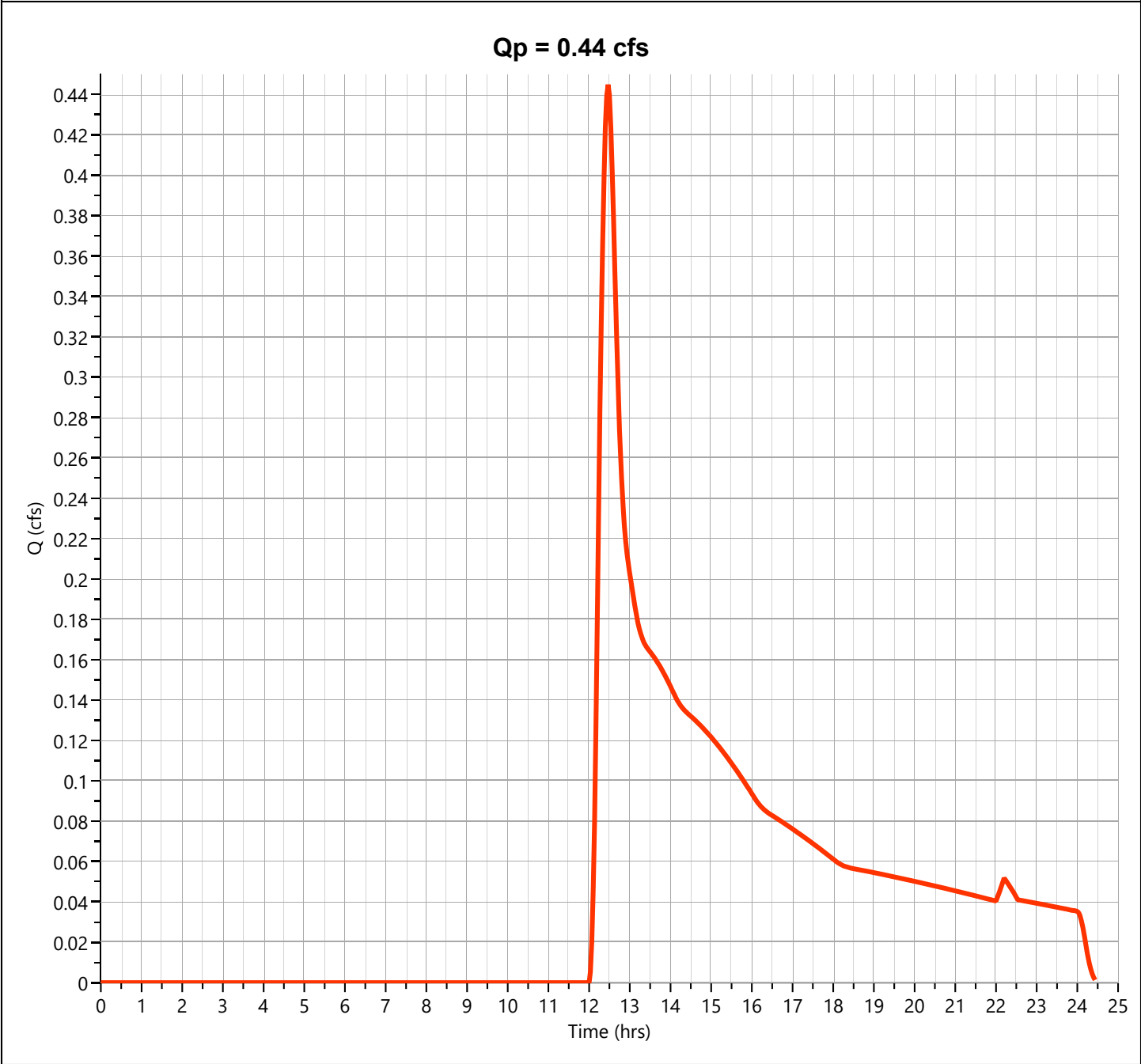
Hydrology Studio v 3.0.0.21

10-27-2022

P-6A

Hyd. No. 35

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.445 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 4,014 cuft
Drainage Area	= 1.65 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  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.17	16.23
A	Woods Good Condition	30			0.32	9.71
A	Open Space Good Condition	39			0.42	16.19
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.		39394	Totals =		0.90	42.13

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{42.13}{0.90} = 46.58 ; \text{ Use CN} = \boxed{47}$$

## 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	0.08	0.97	1.81

(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 StreetBy NCDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present ☐ DevelopedCircle one: Tc ☐ TtSubcatchment P-6Bthrough  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.16

A-B		
LAWN		
0.24		
50		
3.1		
0.015		
0.16		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C		
UNPAVED		
263		
0.030		
2.79		
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.  $T_t = L / 3600V$ 

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:

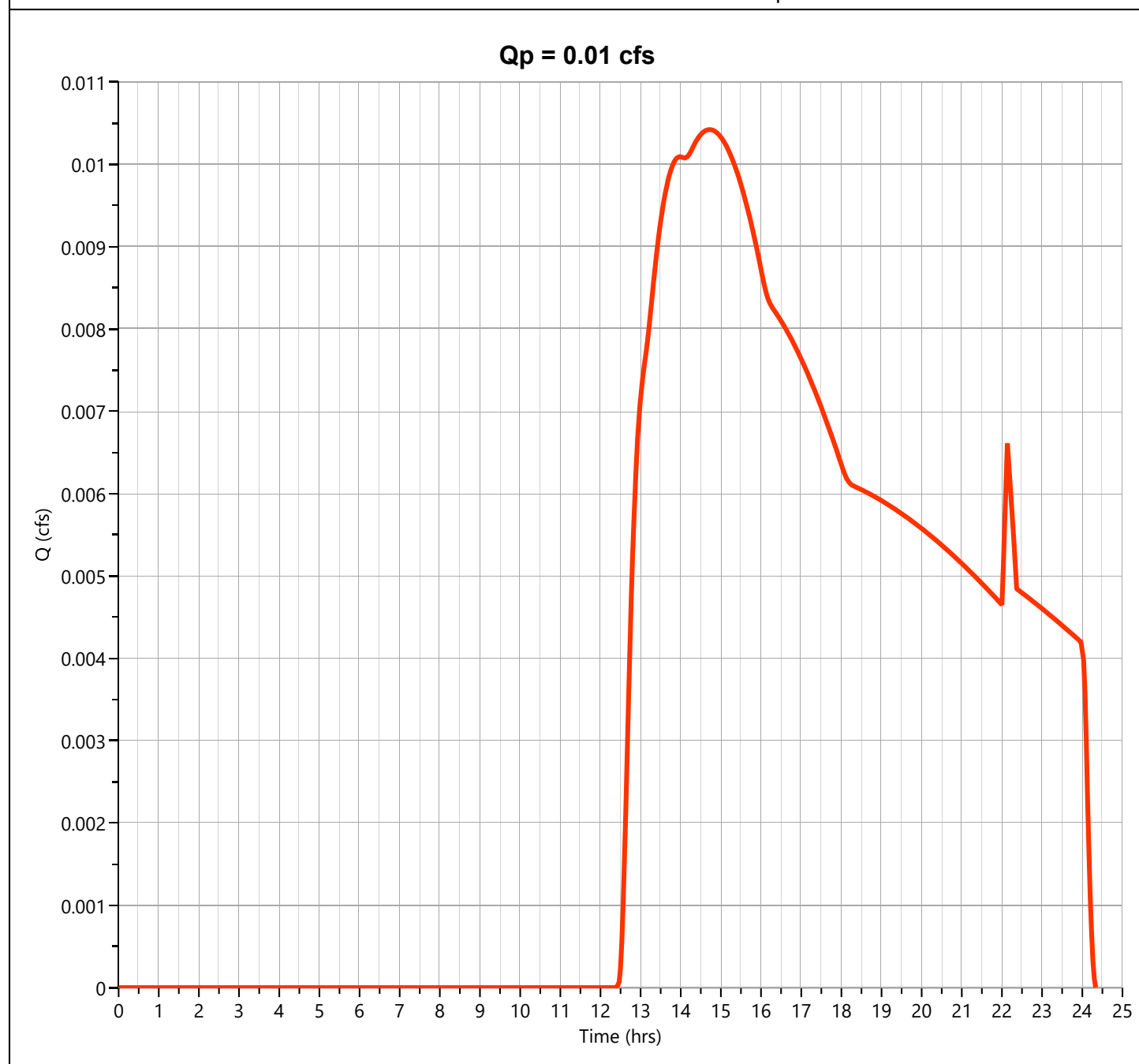
Hydrology Studio v 3.0.0.21

10-27-2022

**P-6B**

**Hyd. No. 36**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.010 cfs
Storm Frequency	= 2-yr	Time to Peak	= 14.73 hrs
Time Interval	= 2 min	Runoff Volume	= 282 cuft
Drainage Area	= 0.9 ac	Curve Number	= 47
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:

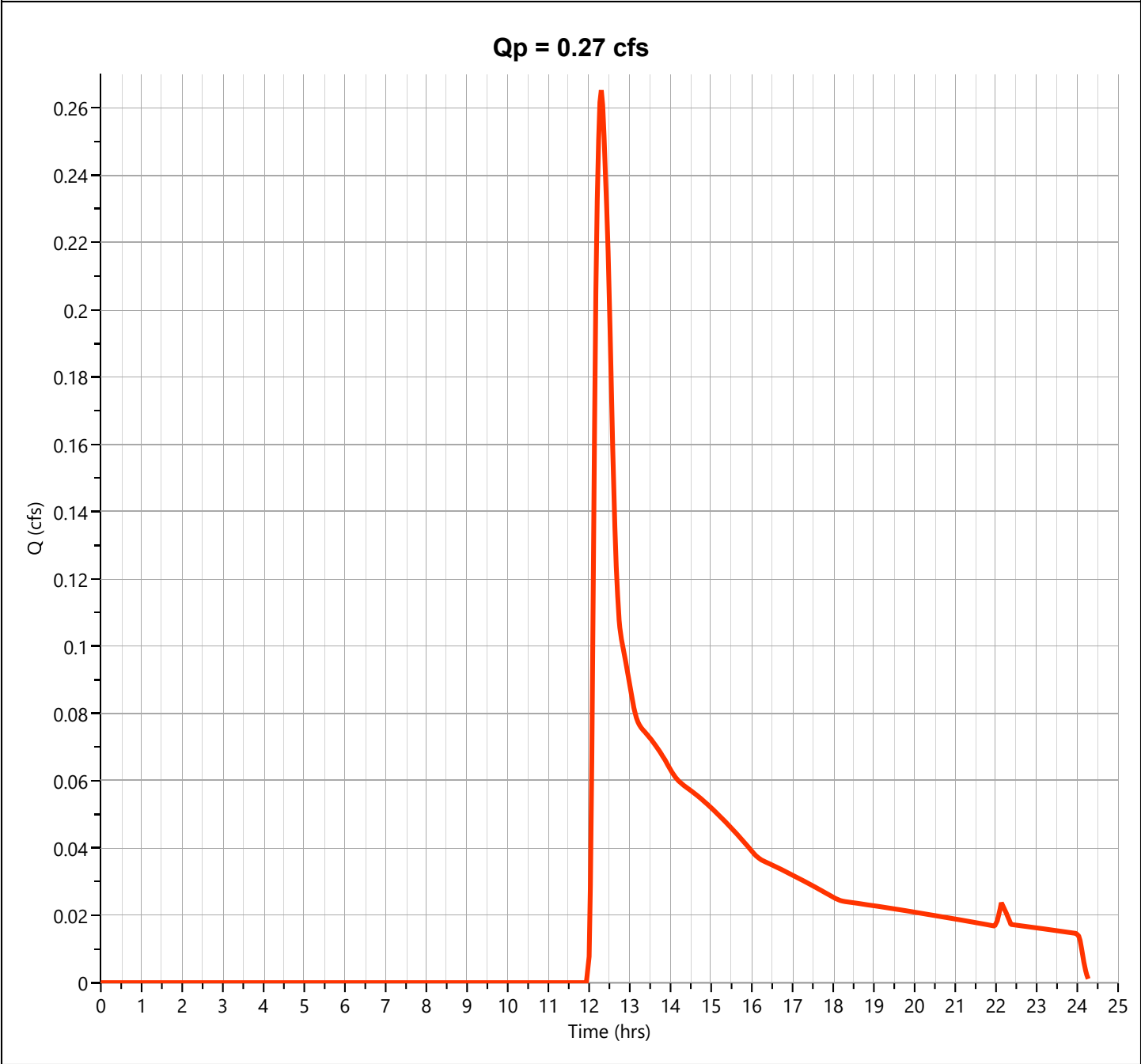
Hydrology Studio v 3.0.0.21

10-27-2022

P-6B

Hyd. No. 36

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.265 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 1,857 cuft
Drainage Area	= 0.9 ac	Curve Number	= 47
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:

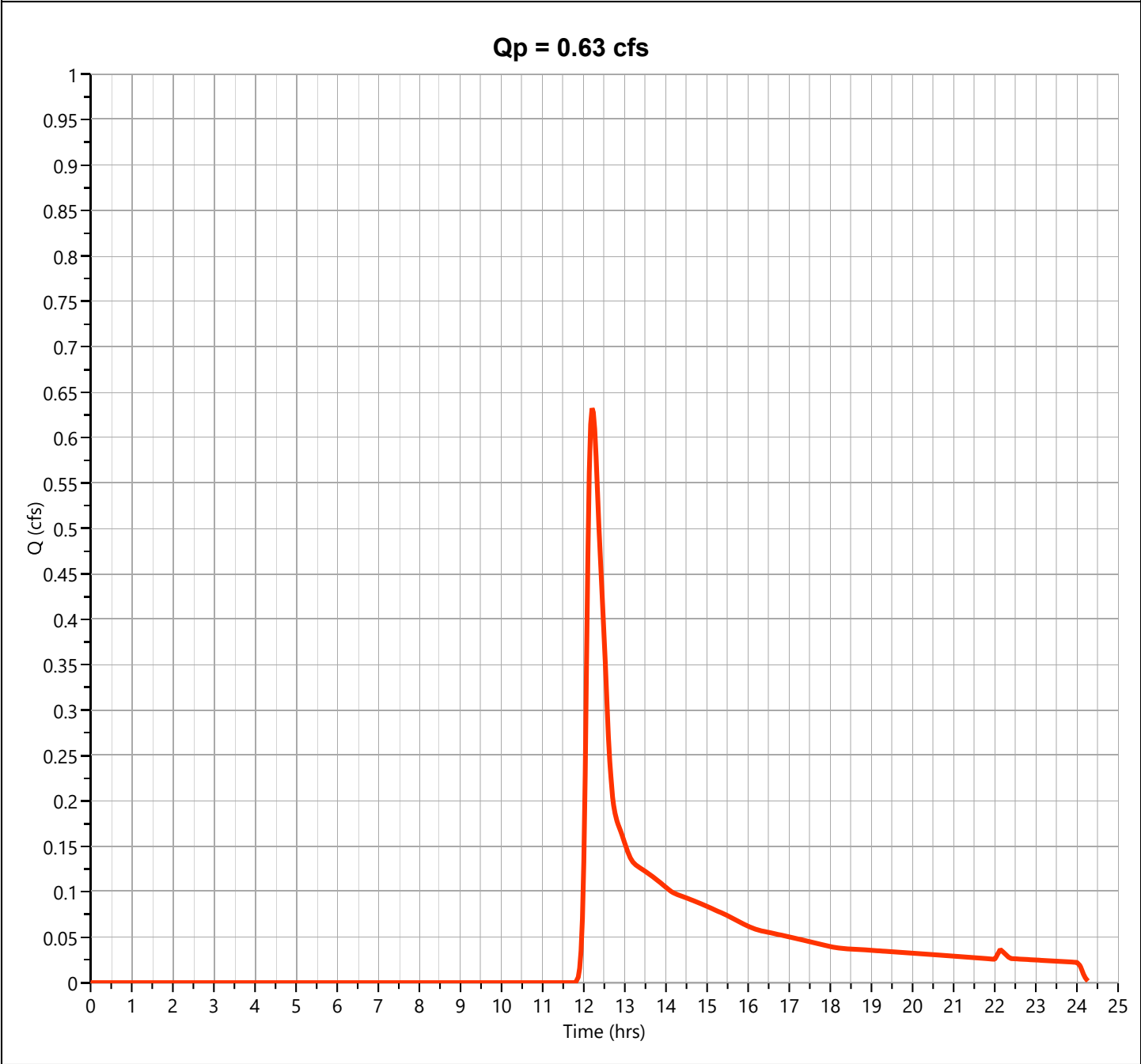
Hydrology Studio v 3.0.0.21

10-27-2022

P-6B

Hyd. No. 36

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.632 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 3,353 cuft
Drainage Area	= 0.9 ac	Curve Number	= 47
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:

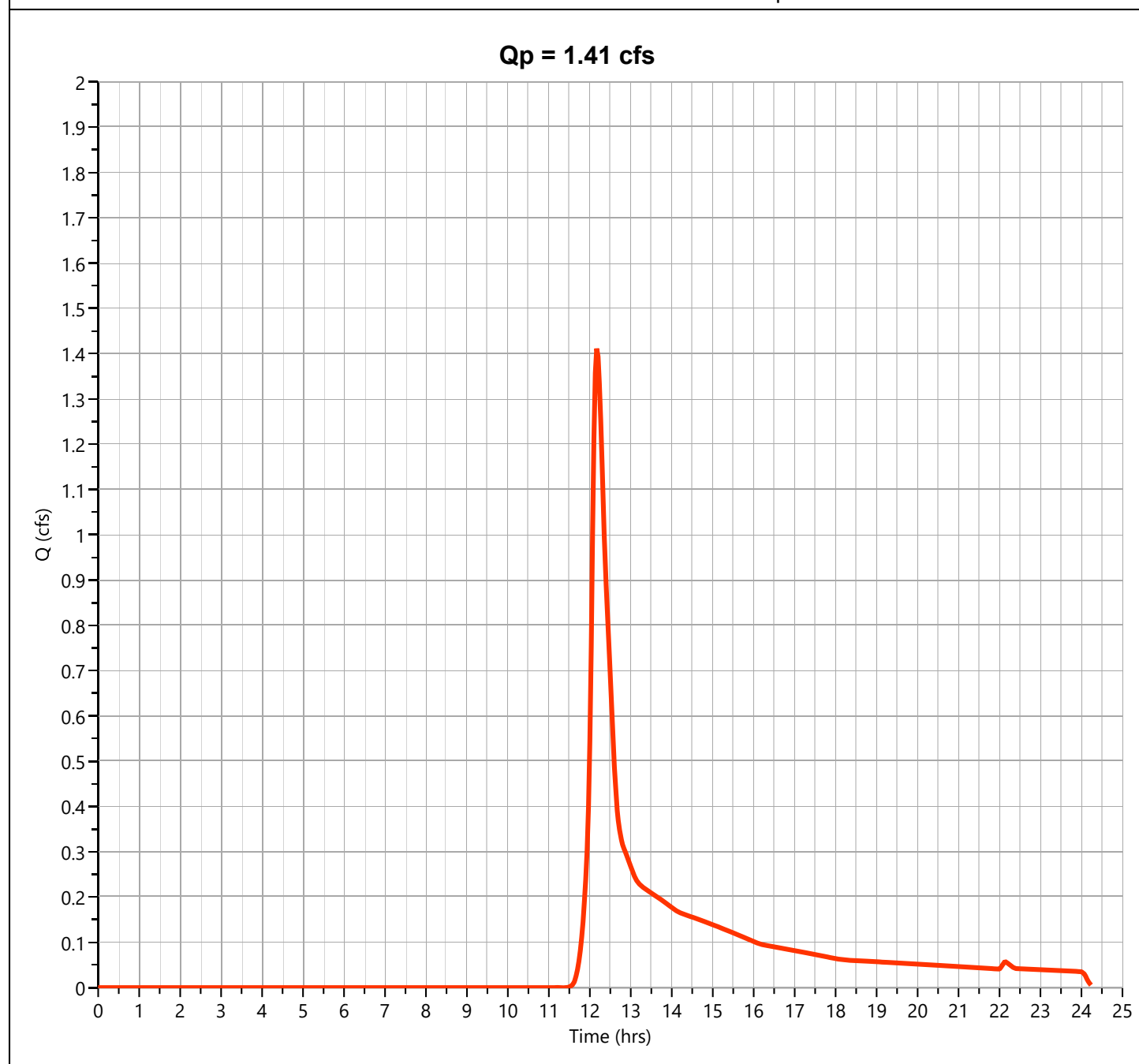
Hydrology Studio v 3.0.0.21

10-27-2022

**P-6B**

**Hyd. No. 36**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.411 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,232 cuft
Drainage Area	= 0.9 ac	Curve Number	= 47
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 3.0.0.21

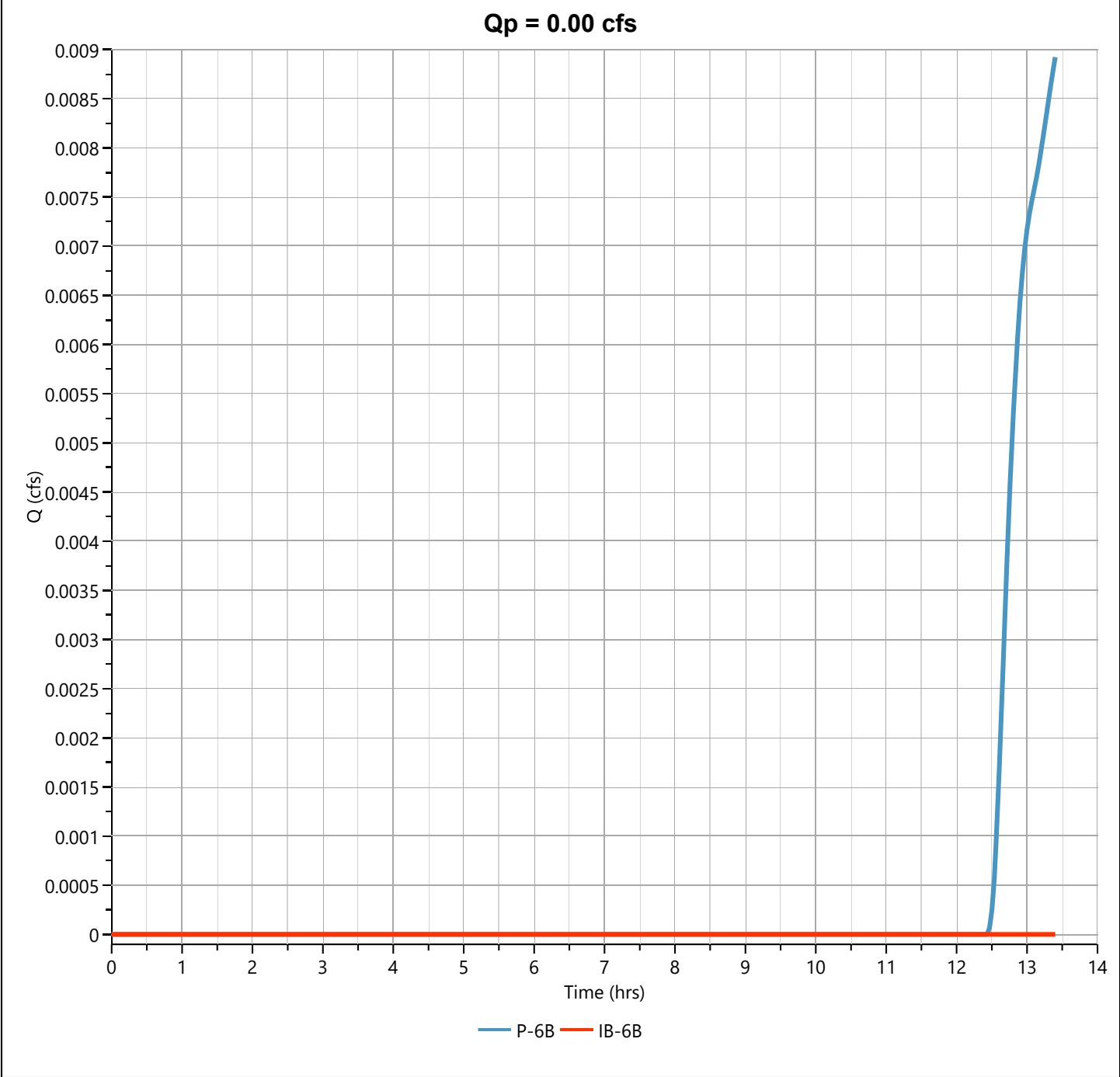
10-27-2022

IB-6B

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - P-6B	Max. Elevation	= 219.01 ft
Pond Name	= IB-6B	Max. Storage	= 6.91 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

IB-6B

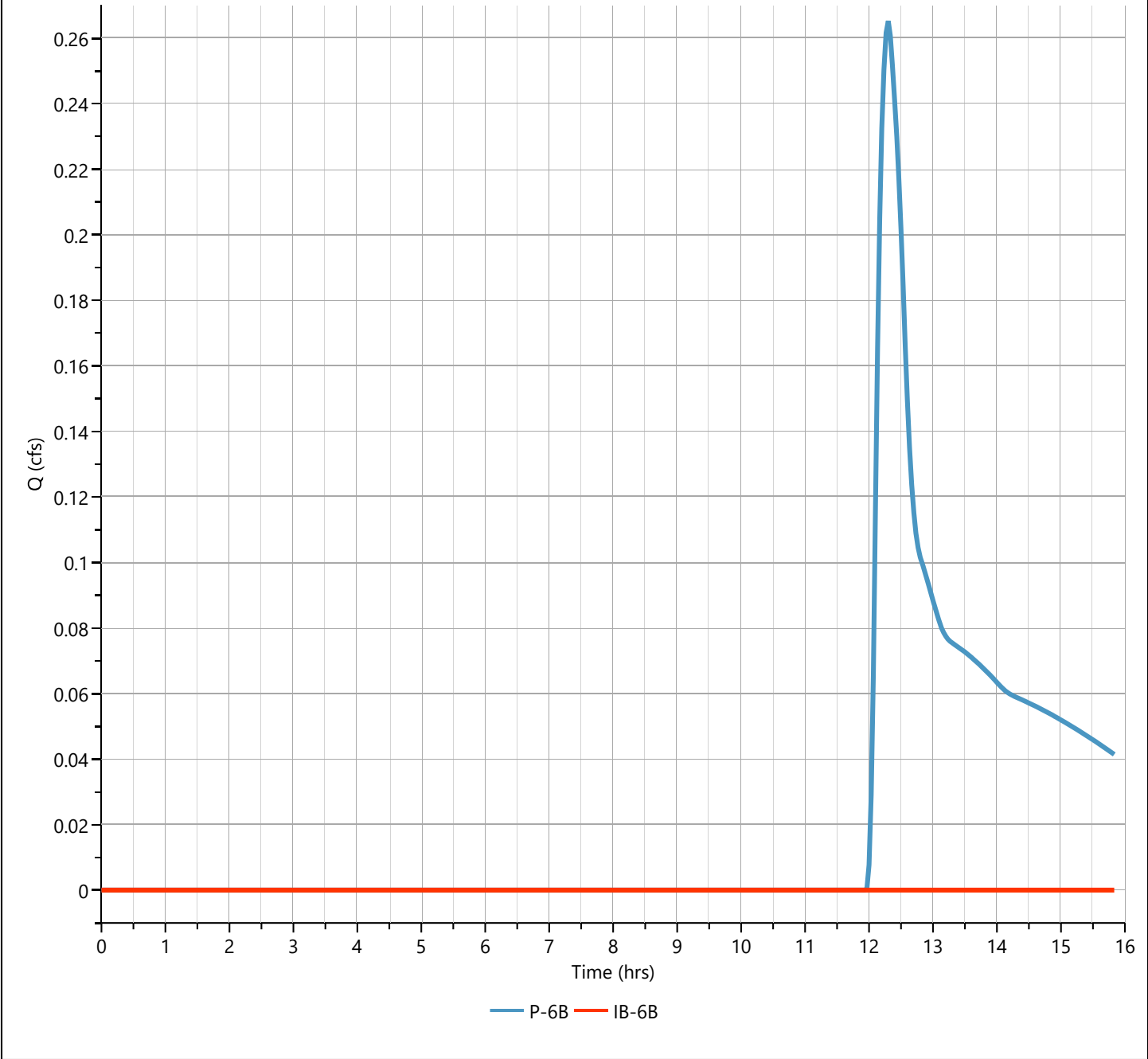
Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 15.80 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - P-6B	Max. Elevation	= 219.59 ft
Pond Name	= IB-6B	Max. Storage	= 283 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 13 min

Qp = 0.00 cfs



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

IB-6B

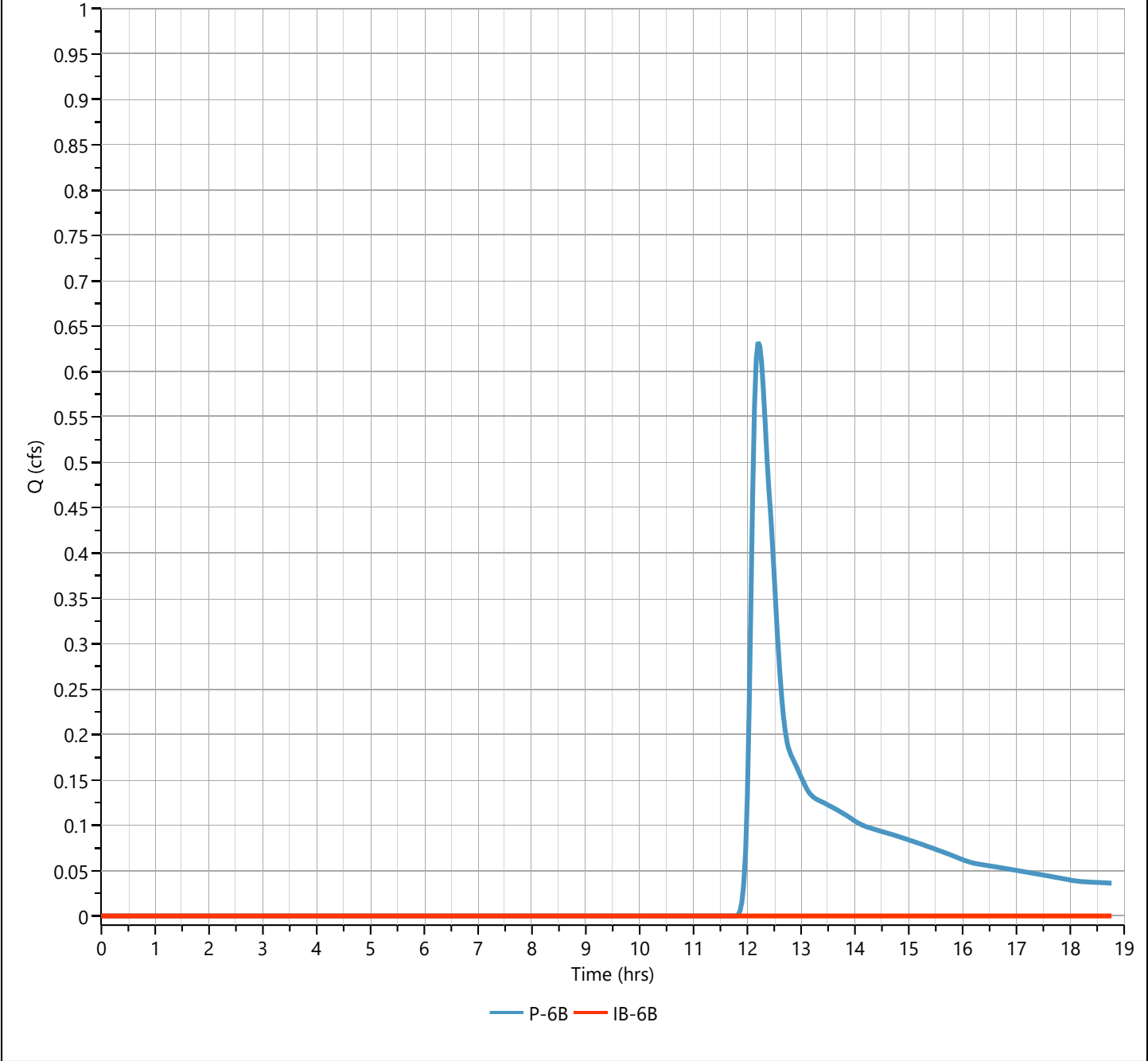
Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 18.73 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - P-6B	Max. Elevation	= 220.48 ft
Pond Name	= IB-6B	Max. Storage	= 846 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2.85 hrs

Qp = 0.00 cfs



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

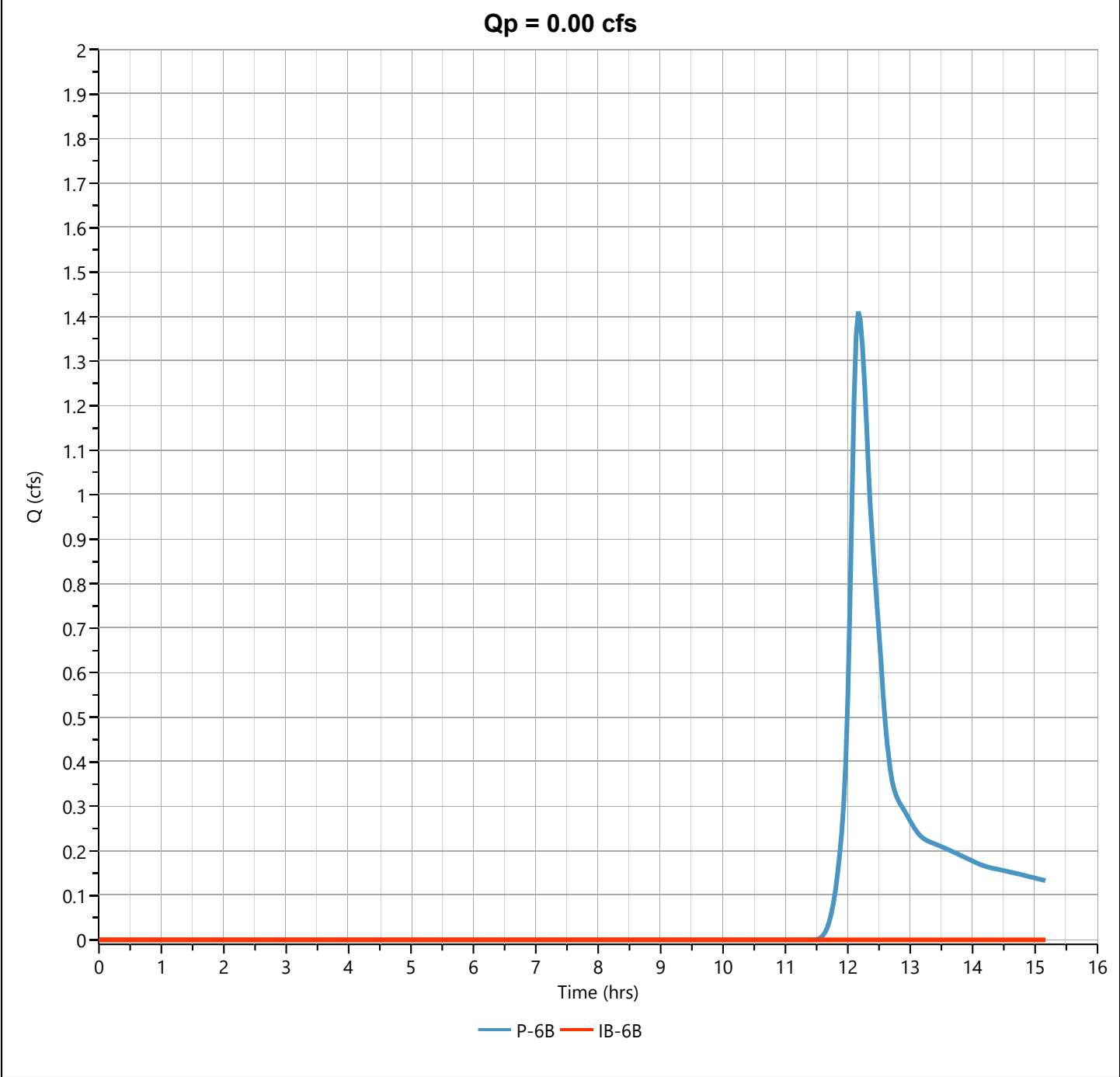
10-27-2022

IB-6B

Hyd. No. 37

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 15.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 36 - P-6B	Max. Elevation	= 221.77 ft
Pond Name	= IB-6B	Max. Storage	= 2,097 cuft

Pond Routing by Storage Indication Method



# Pond Report

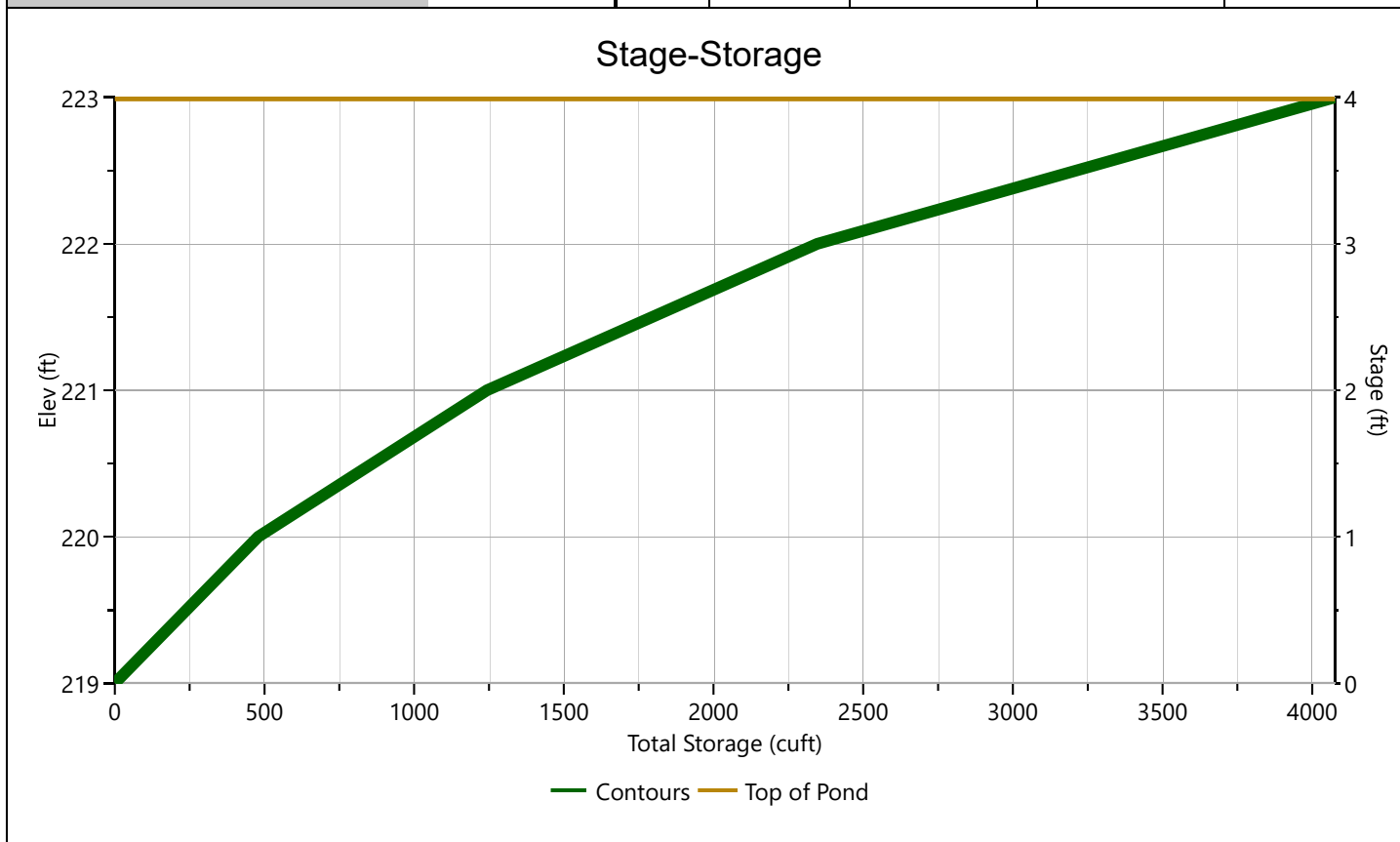
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-6B**

## Stage-Storage

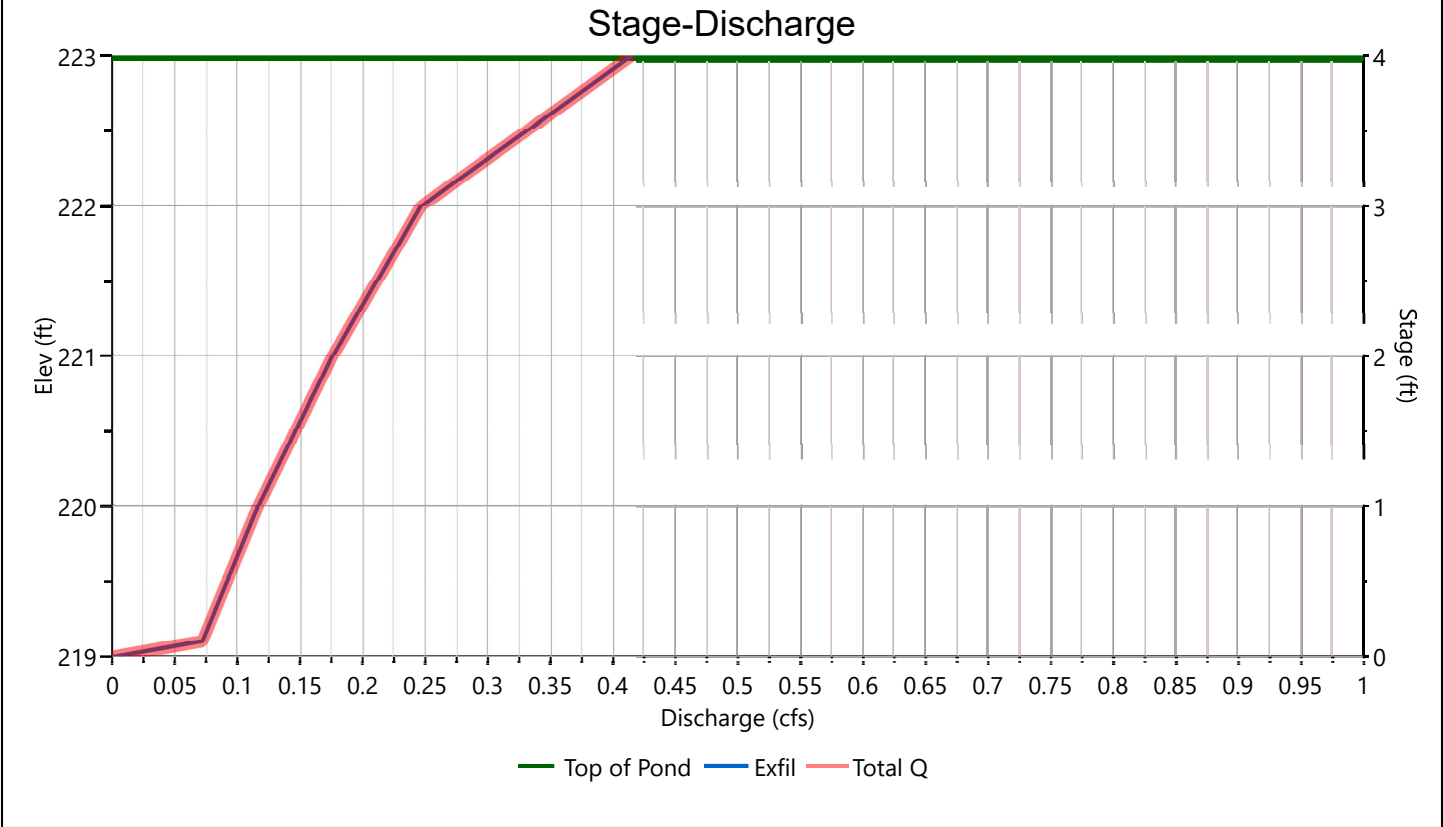
[illegible]

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
Crest Elevation, ft					8.27**
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 3.0.0.21

10-27-2022

**IB-6B**

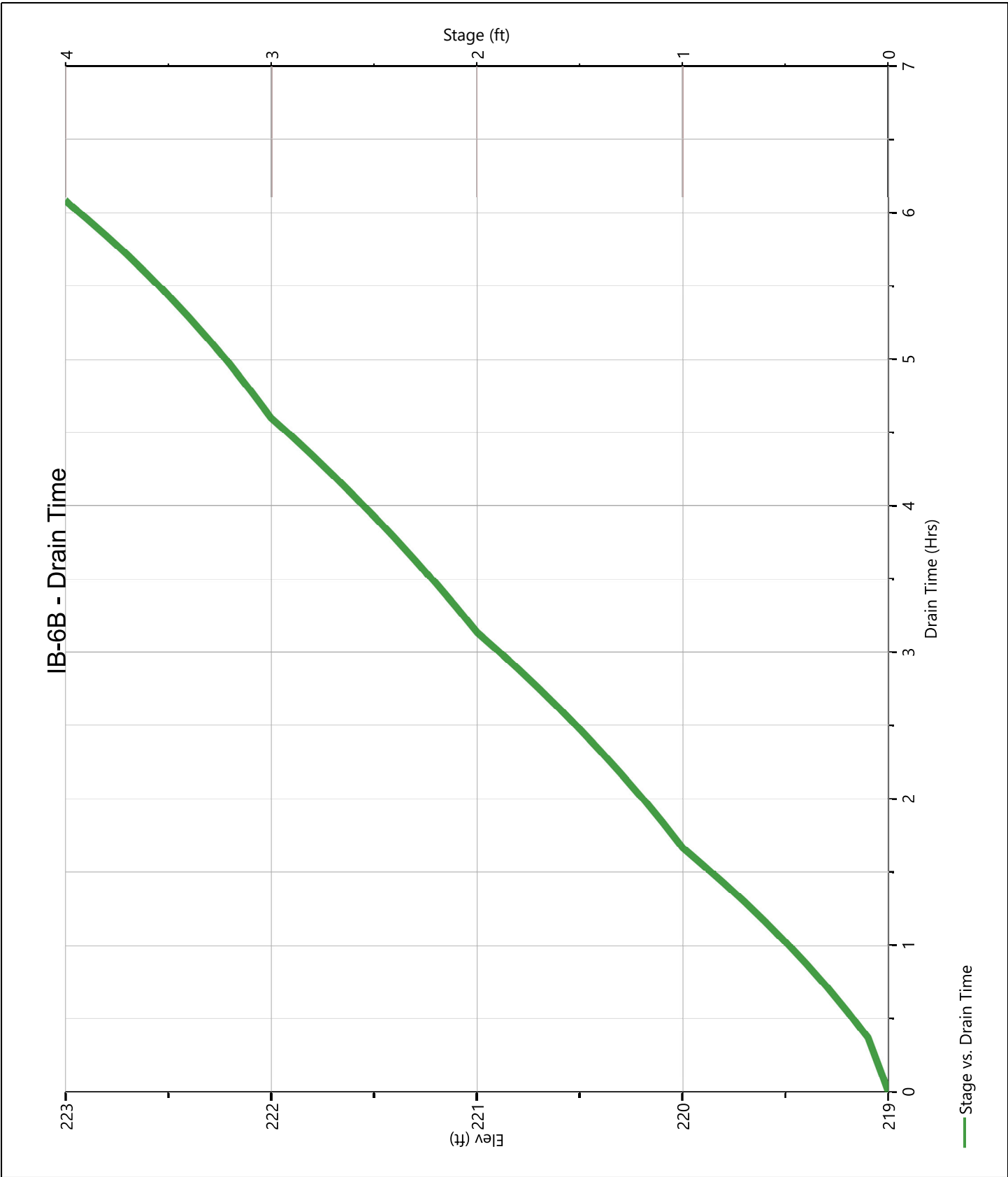
### Stage-Storage-Discharge Summary

[illegible]

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

IB-6B

Pond Drawdown





# Hydrograph Report

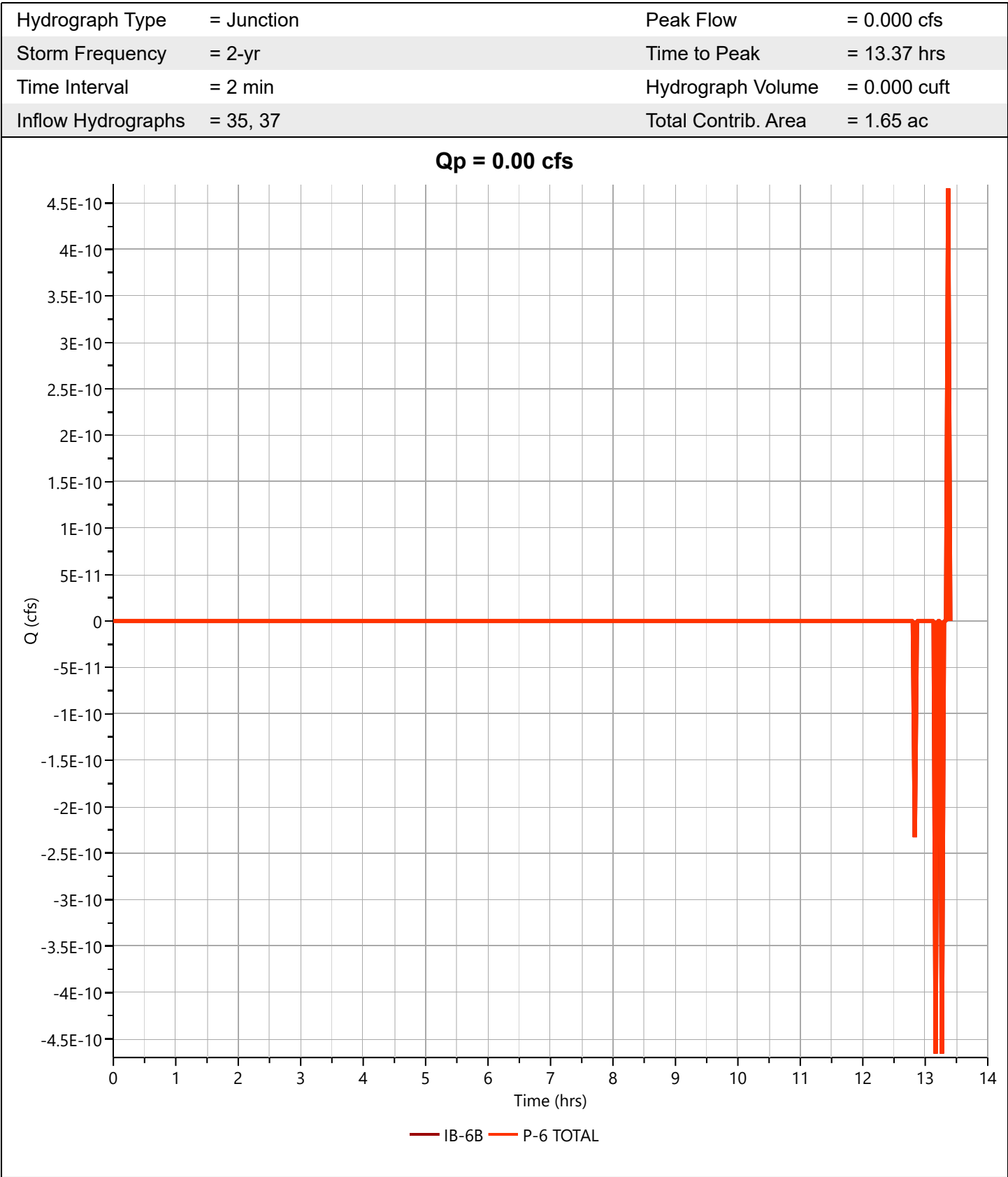
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-6 TOTAL

Hyd. No. 38



# Hydrograph Report

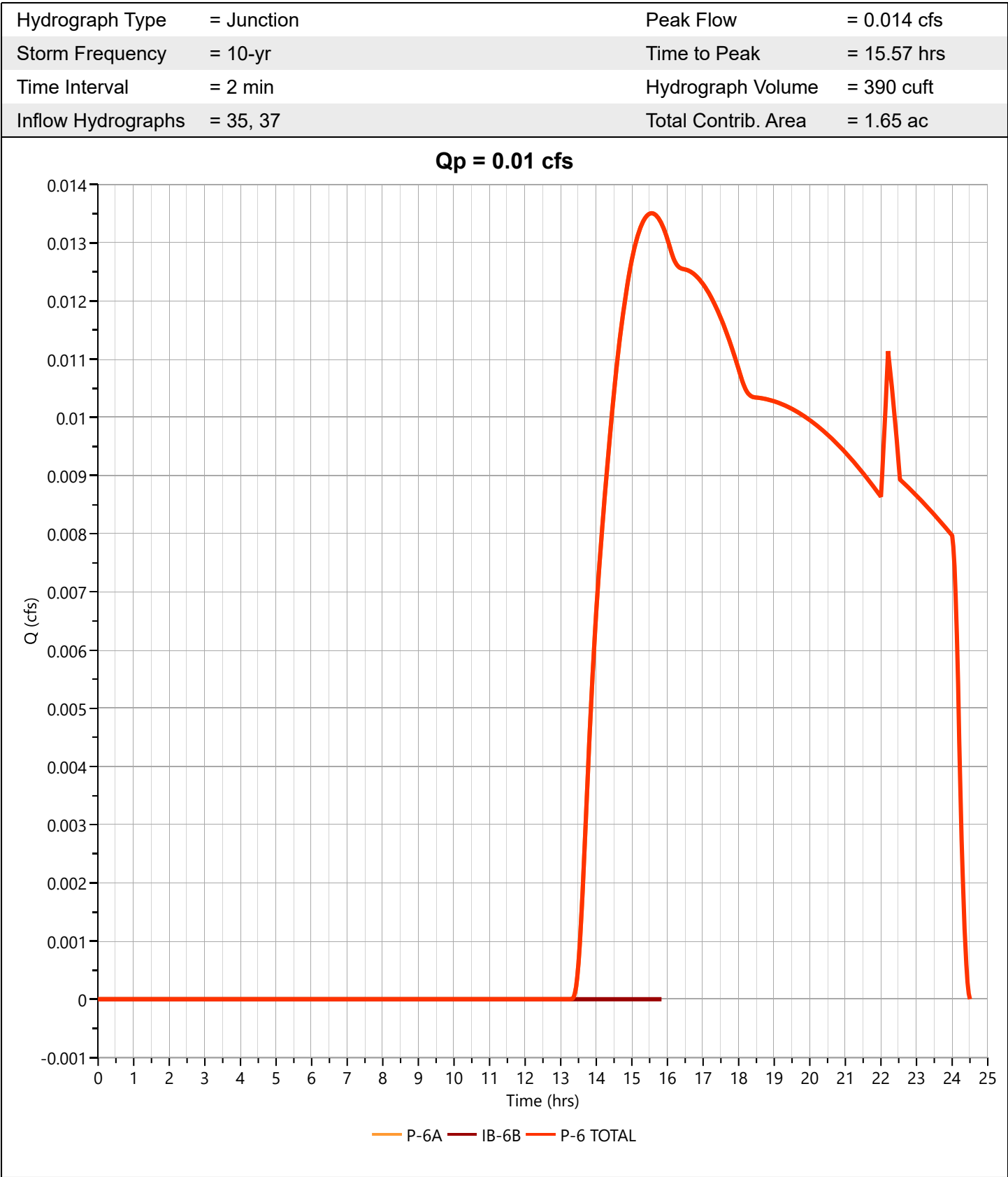
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-6 TOTAL

Hyd. No. 38



# Hydrograph Report

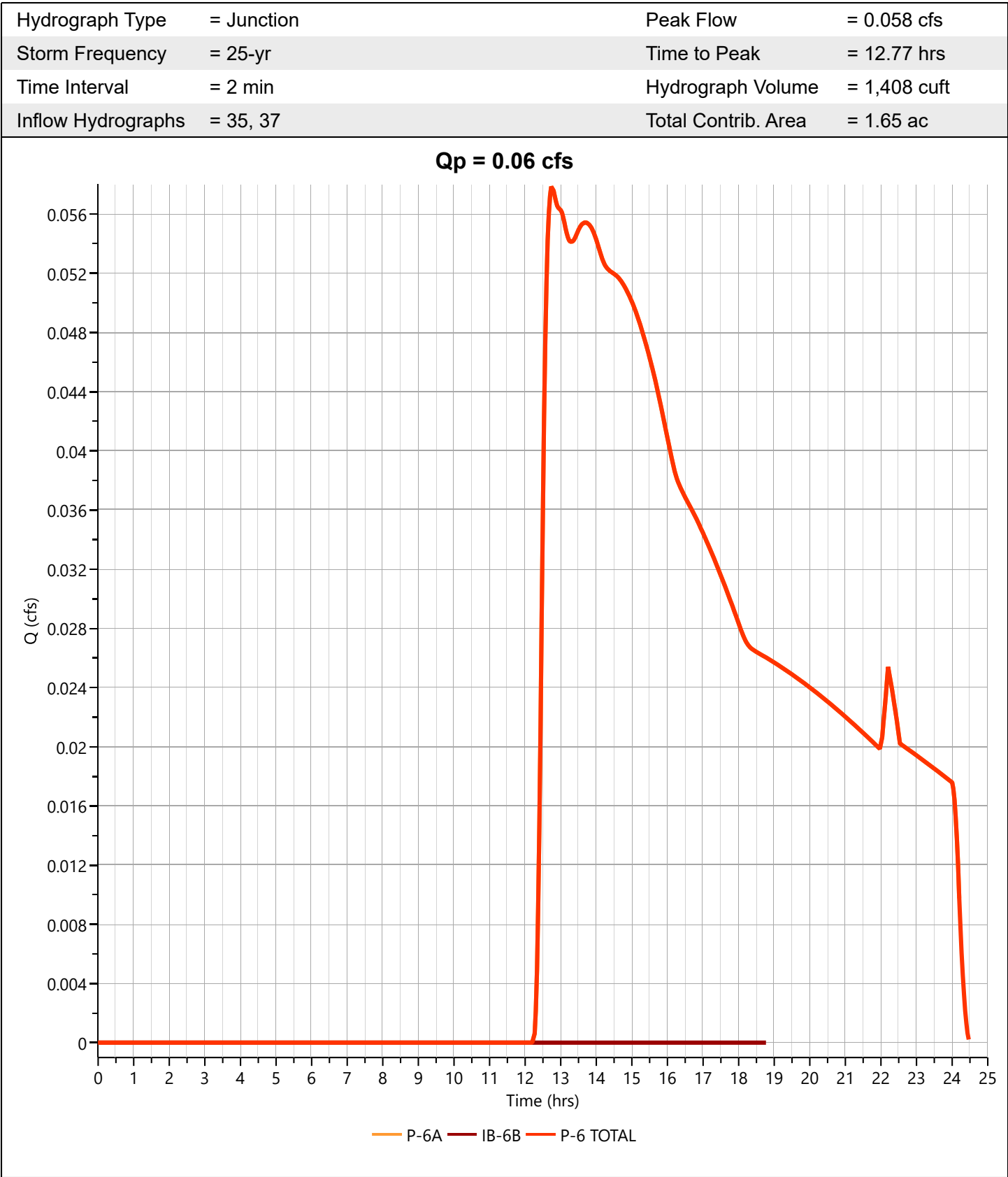
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-6 TOTAL

Hyd. No. 38



# Hydrograph Report

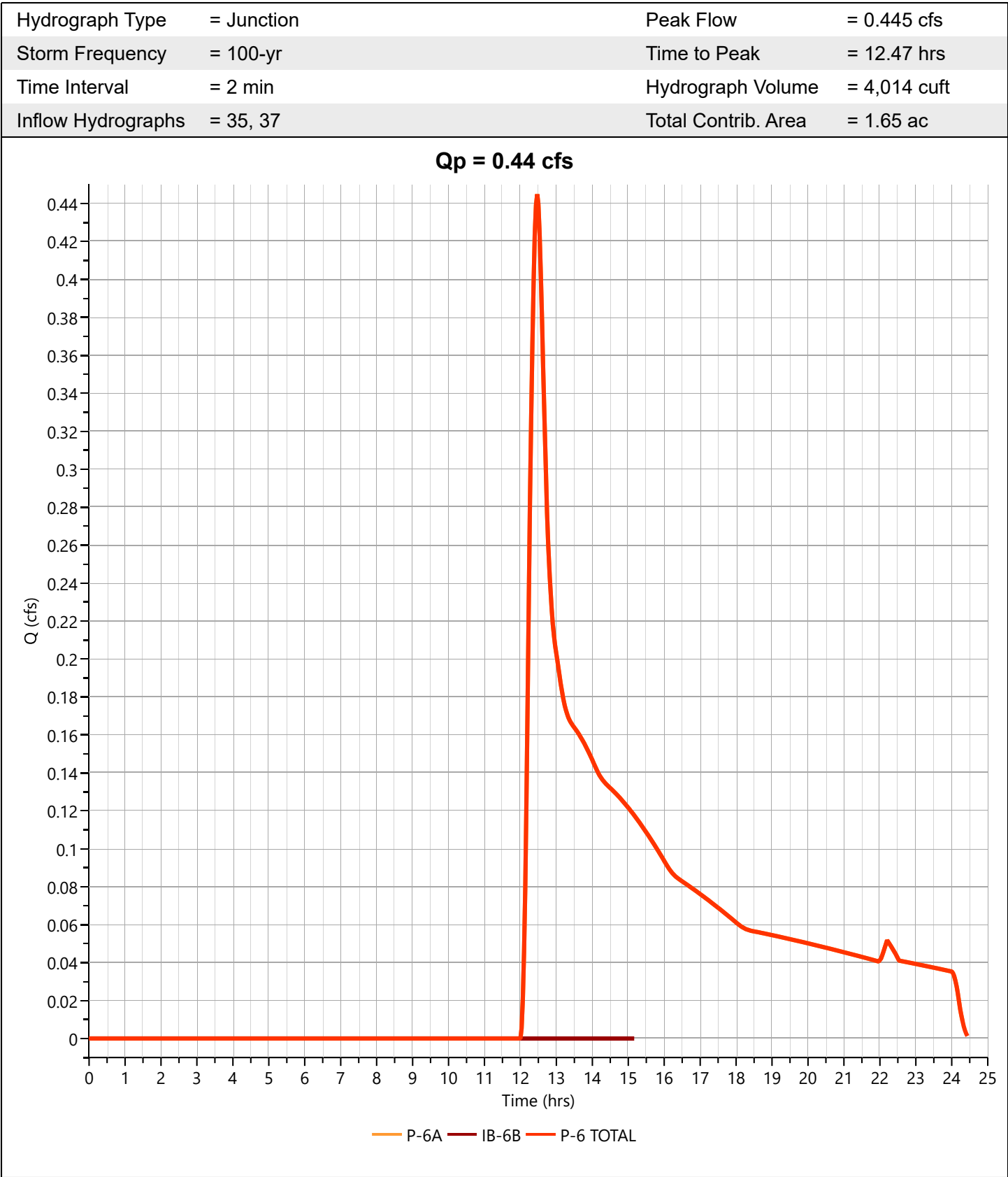
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-6 TOTAL

Hyd. No. 38



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			1.47	144.27
A	Woods Good Condition	30			0.12	3.62
A	Open Space Good Condition	39			2.37	92.58
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.		172790	Totals =		3.97	240.47

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{240.47}{3.97} = 60.62 ; \quad \text{Use CN} = \boxed{61}$$

## 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	0.46	2.07	3.28

(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 StreetBy NCDate 6/24/2022Location: Stow, MAChecked Rev Date 10/13/2022Date Circle one: Present ☐ Developed ☒Circle one: Tc ☐ Tt ☒Subcatchment P-7Athrough  
subarea Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.10

A-B		
LAWN		
0.24		
50		
3.1		
0.045		
0.10		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.01

B-C		
UNPAVED		
140		
0.026		
2.60		
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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr

0.12

min

6.9

# Hydrograph Report

Project Name:

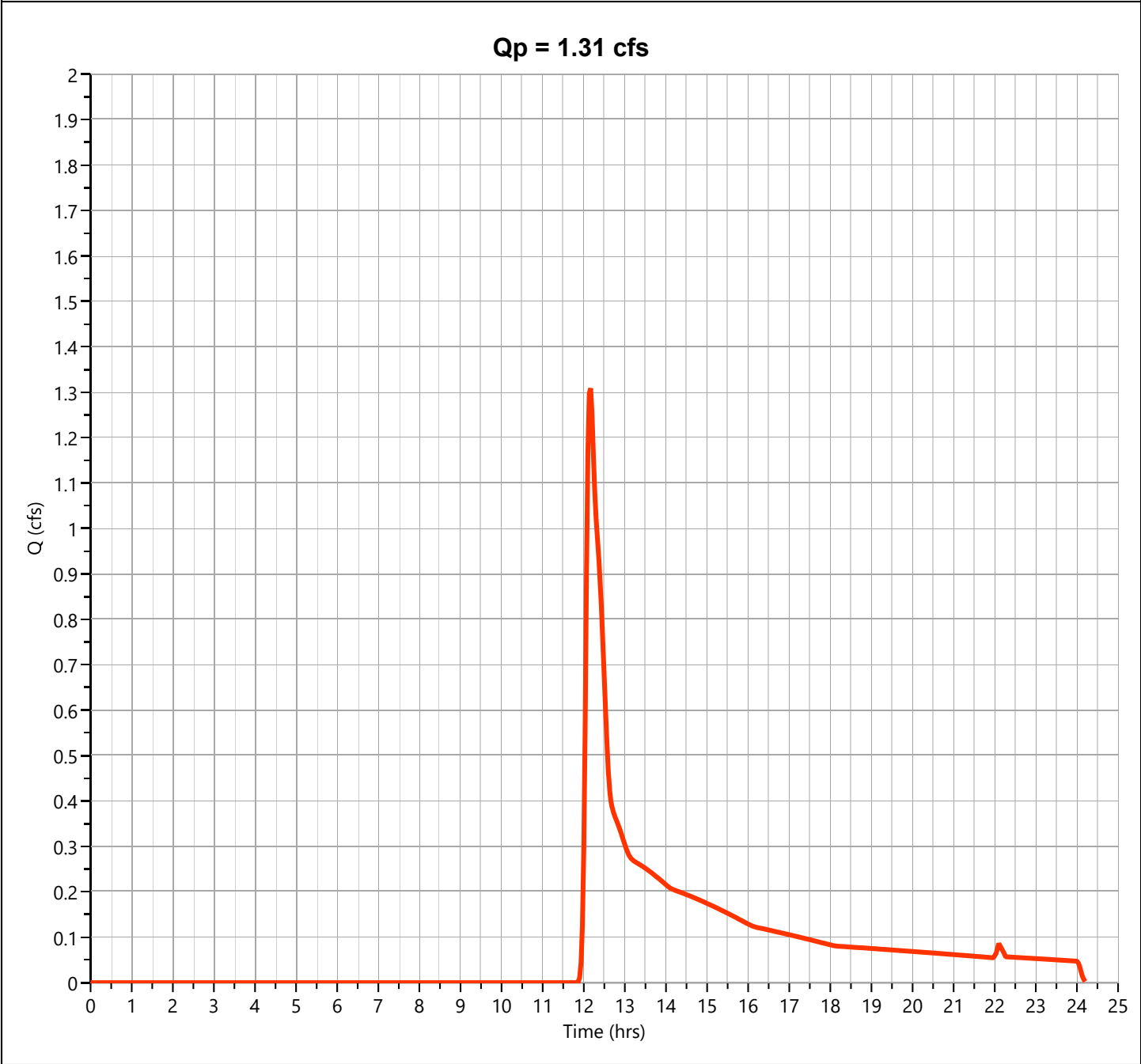
Hydrology Studio v 3.0.0.21

10-27-2022

P-7A

Hyd. No. 40

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.309 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,815 cuft
Drainage Area	= 3.97 ac	Curve Number	= 61
Tc Method	= User	Time of Conc. (Tc)	= 6.9 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

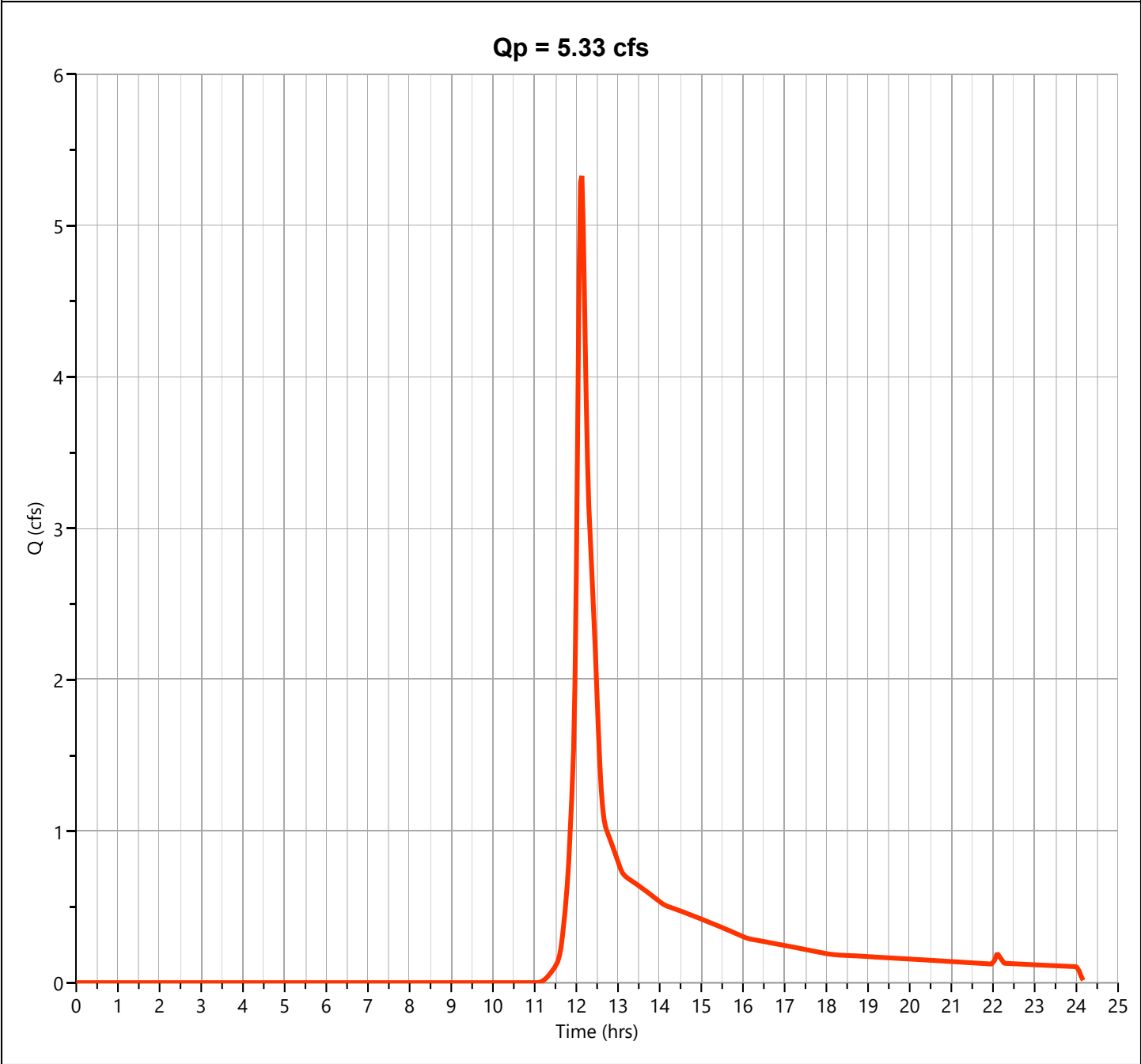
Hydrology Studio v 3.0.0.21

10-27-2022

P-7A

Hyd. No. 40

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.329 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 20,077 cuft
Drainage Area	= 3.97 ac	Curve Number	= 61
Tc Method	= User	Time of Conc. (Tc)	= 6.9 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484





# Hydrograph Report

Project Name:

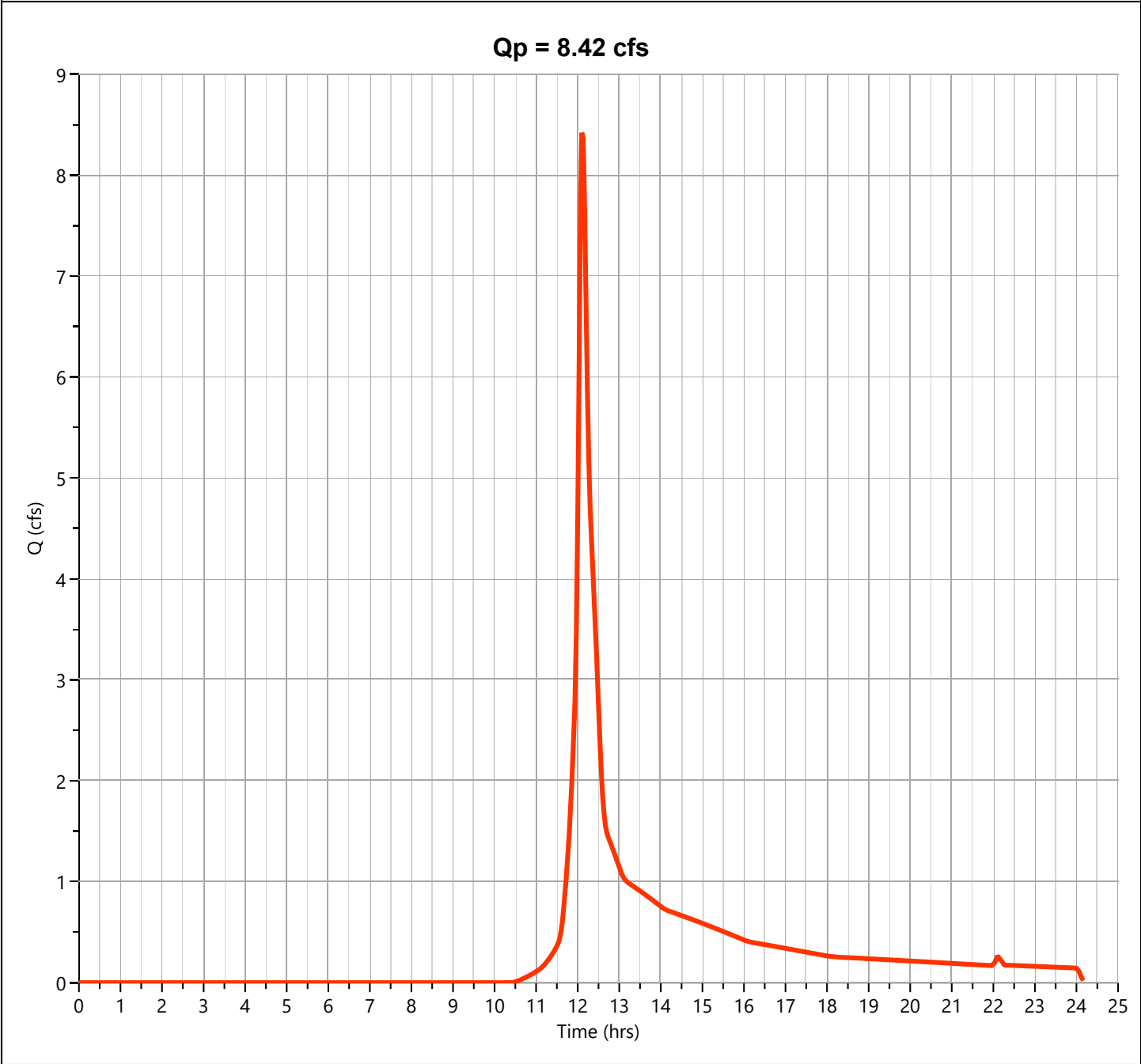
Hydrology Studio v 3.0.0.21

10-27-2022

P-7A

Hyd. No. 40

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.421 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 30,260 cuft
Drainage Area	= 3.97 ac	Curve Number	= 61
Tc Method	= User	Time of Conc. (Tc)	= 6.9 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

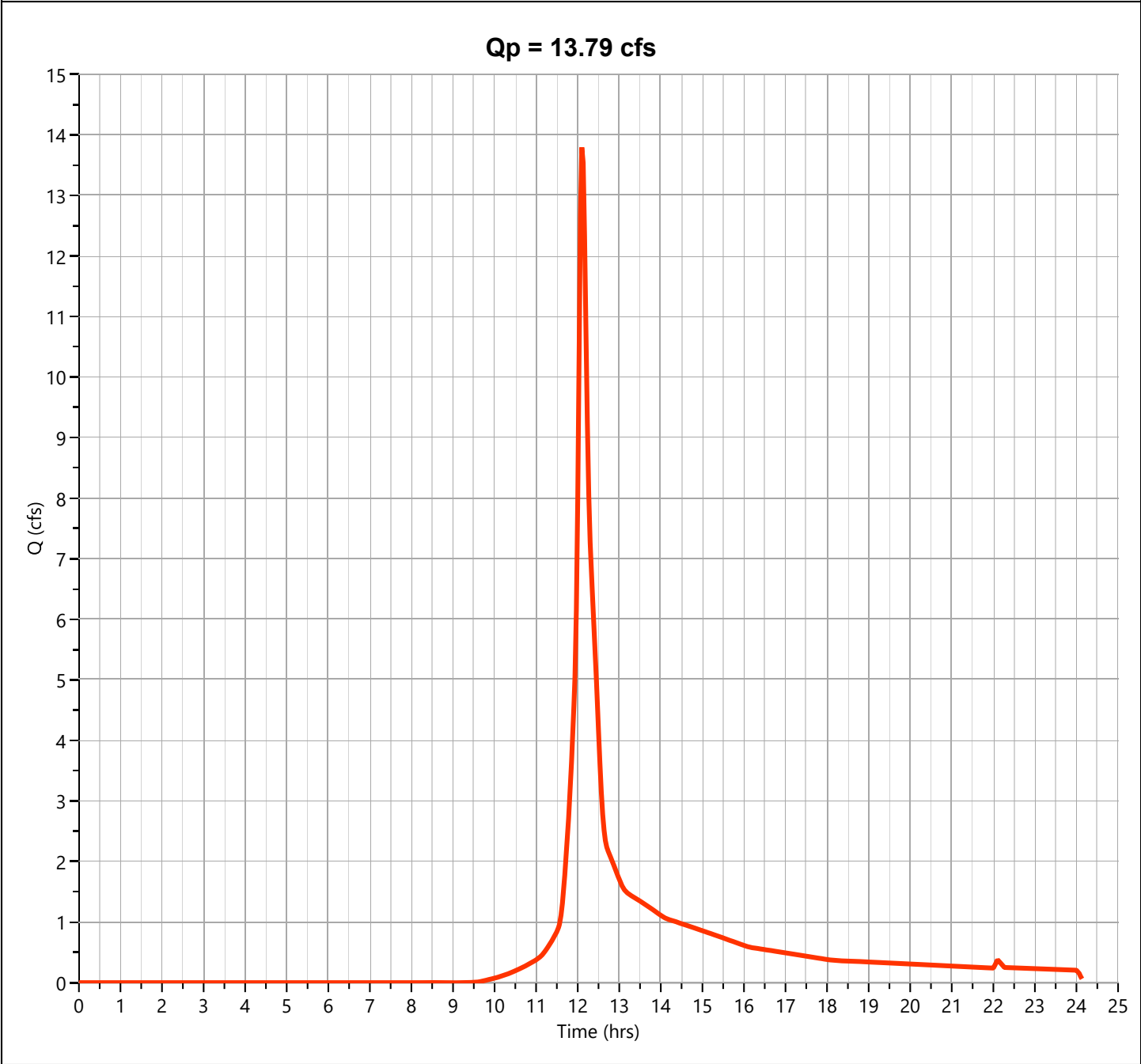
Hydrology Studio v 3.0.0.21

10-27-2022

P-7A

Hyd. No. 40

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.79 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 47,890 cuft
Drainage Area	= 3.97 ac	Curve Number	= 61
Tc Method	= User	Time of Conc. (Tc)	= 6.9 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

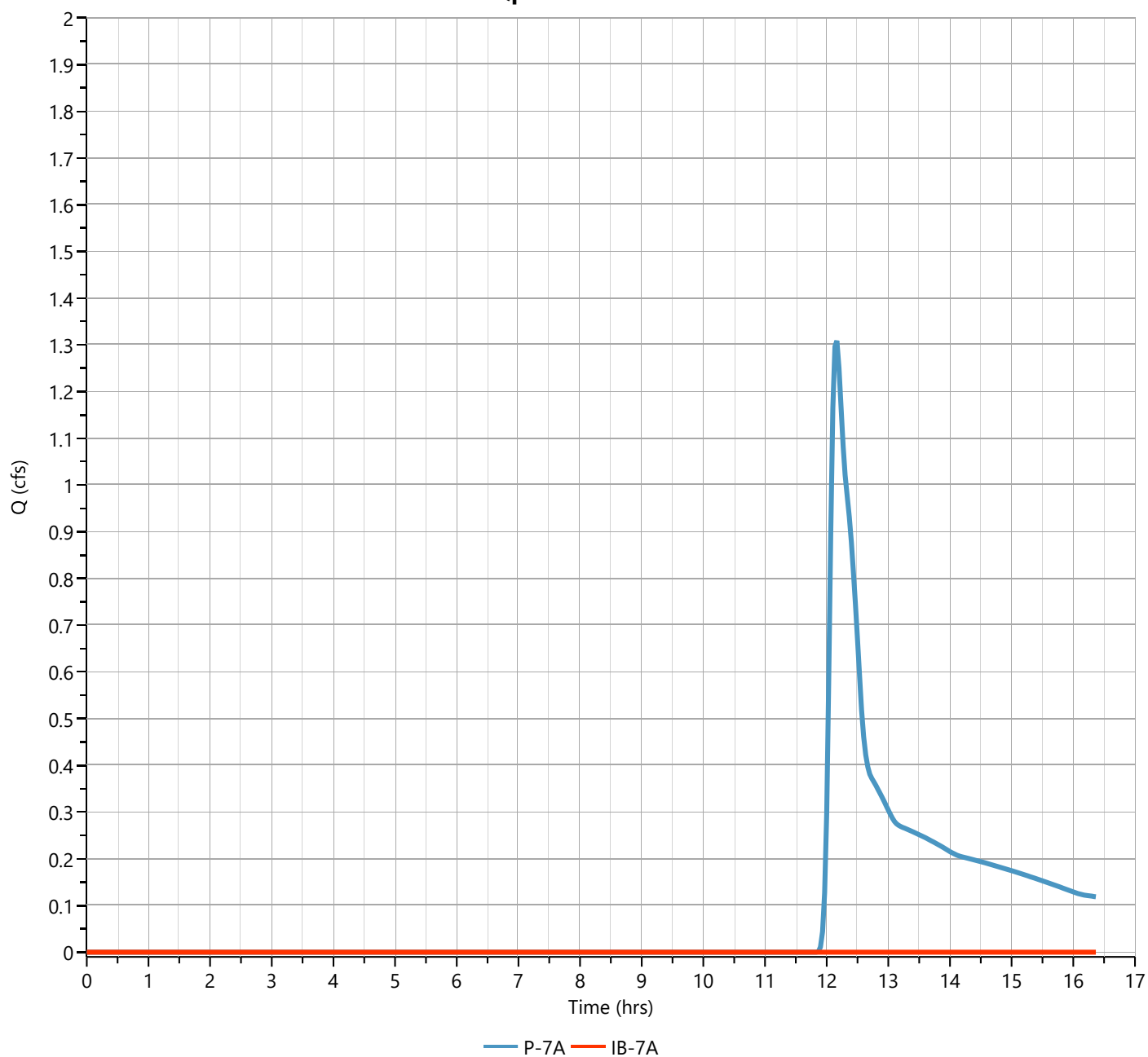
## IB-7A

## Hyd. No. 41

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 16.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 40 - P-7A	Max. Elevation	= 219.17 ft
Pond Name	= IB-7A REVISED	Max. Storage	= 704 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

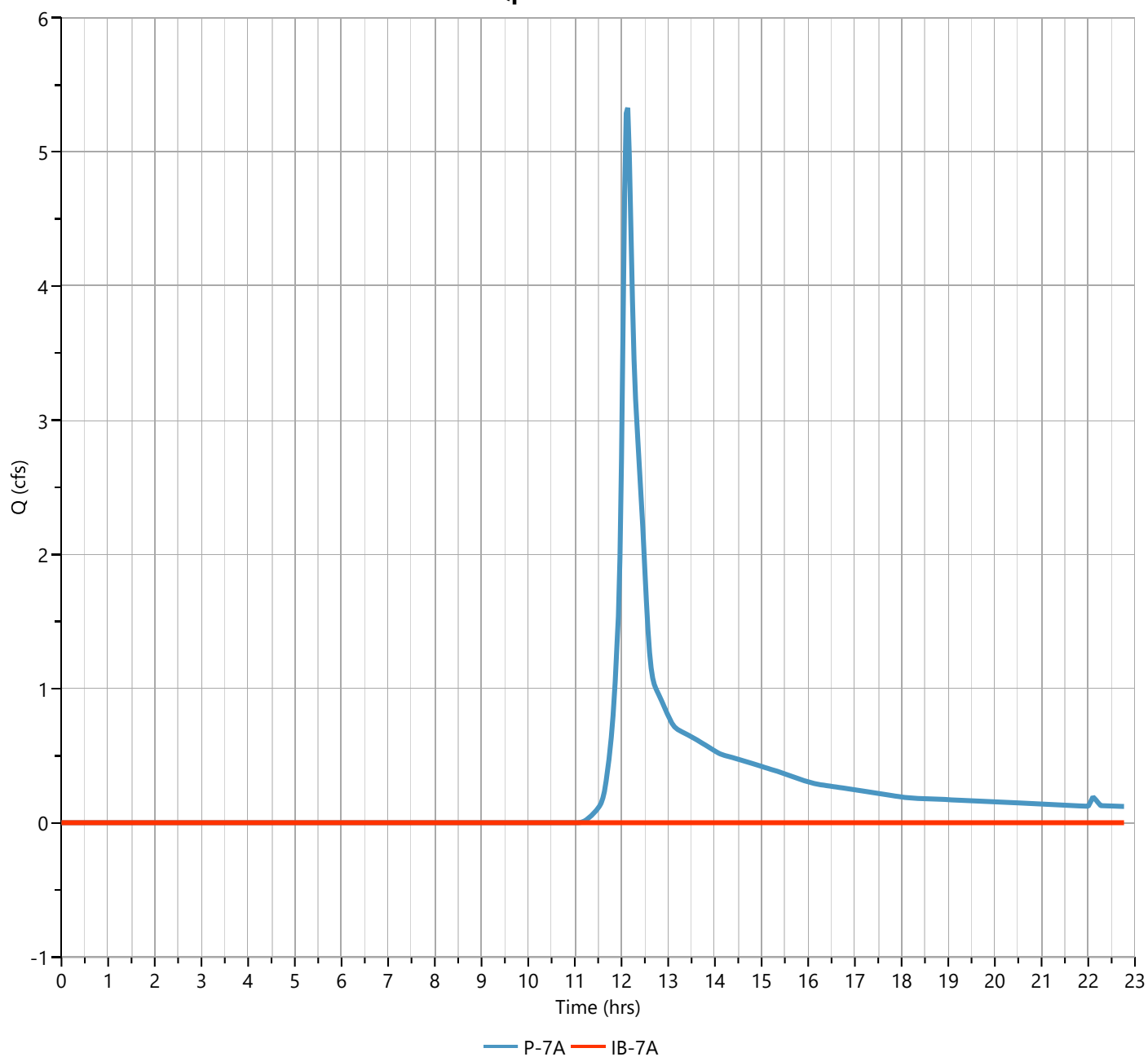
## IB-7A

## Hyd. No. 41

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 22.73 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 40 - P-7A	Max. Elevation	= 220.34 ft
Pond Name	= IB-7A REVISED	Max. Storage	= 5,971 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

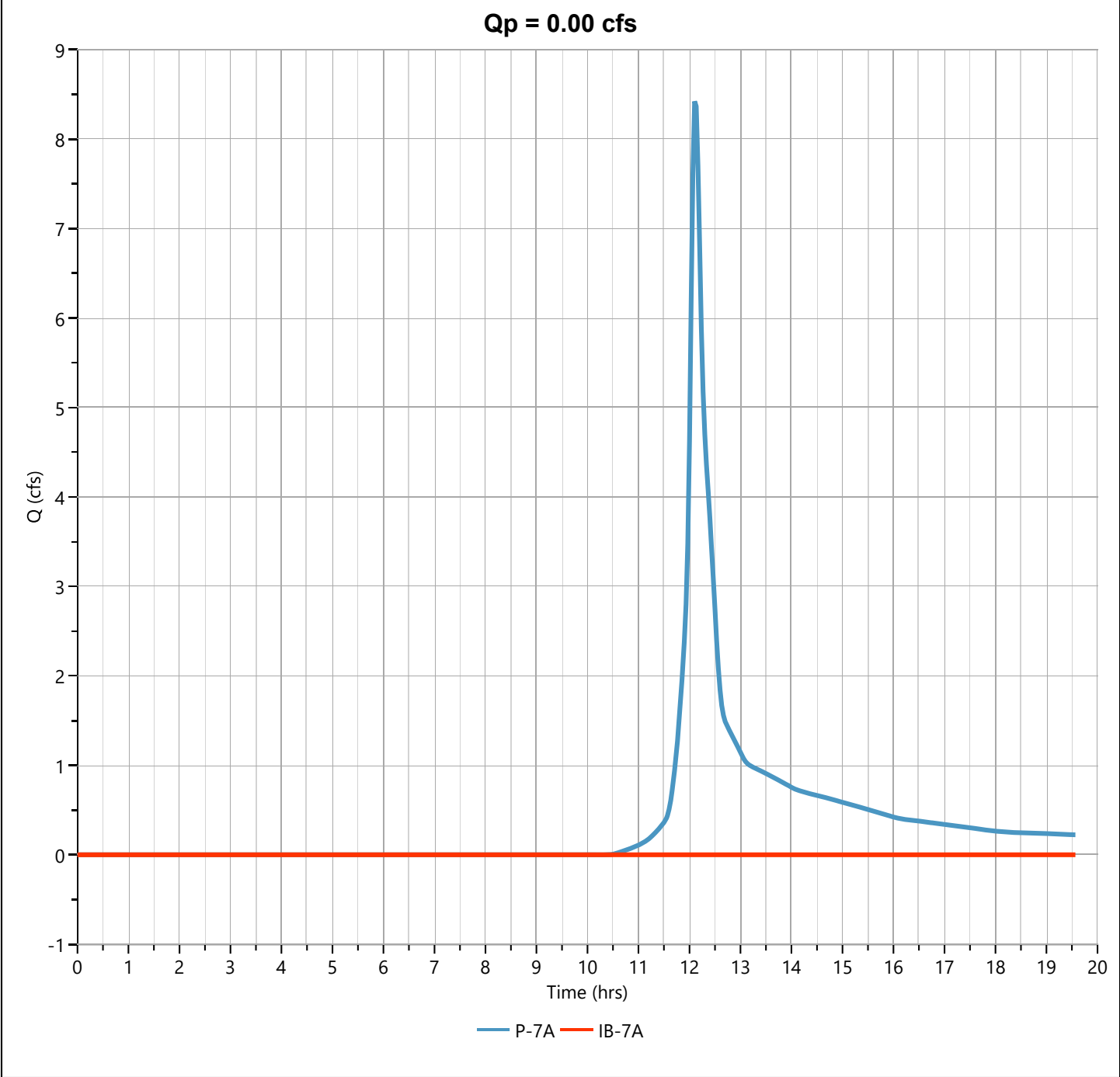
10-27-2022

## IB-7A

## Hyd. No. 41

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 19.53 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 40 - P-7A	Max. Elevation	= 221.14 ft
Pond Name	= IB-7A REVISED	Max. Storage	= 10,526 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

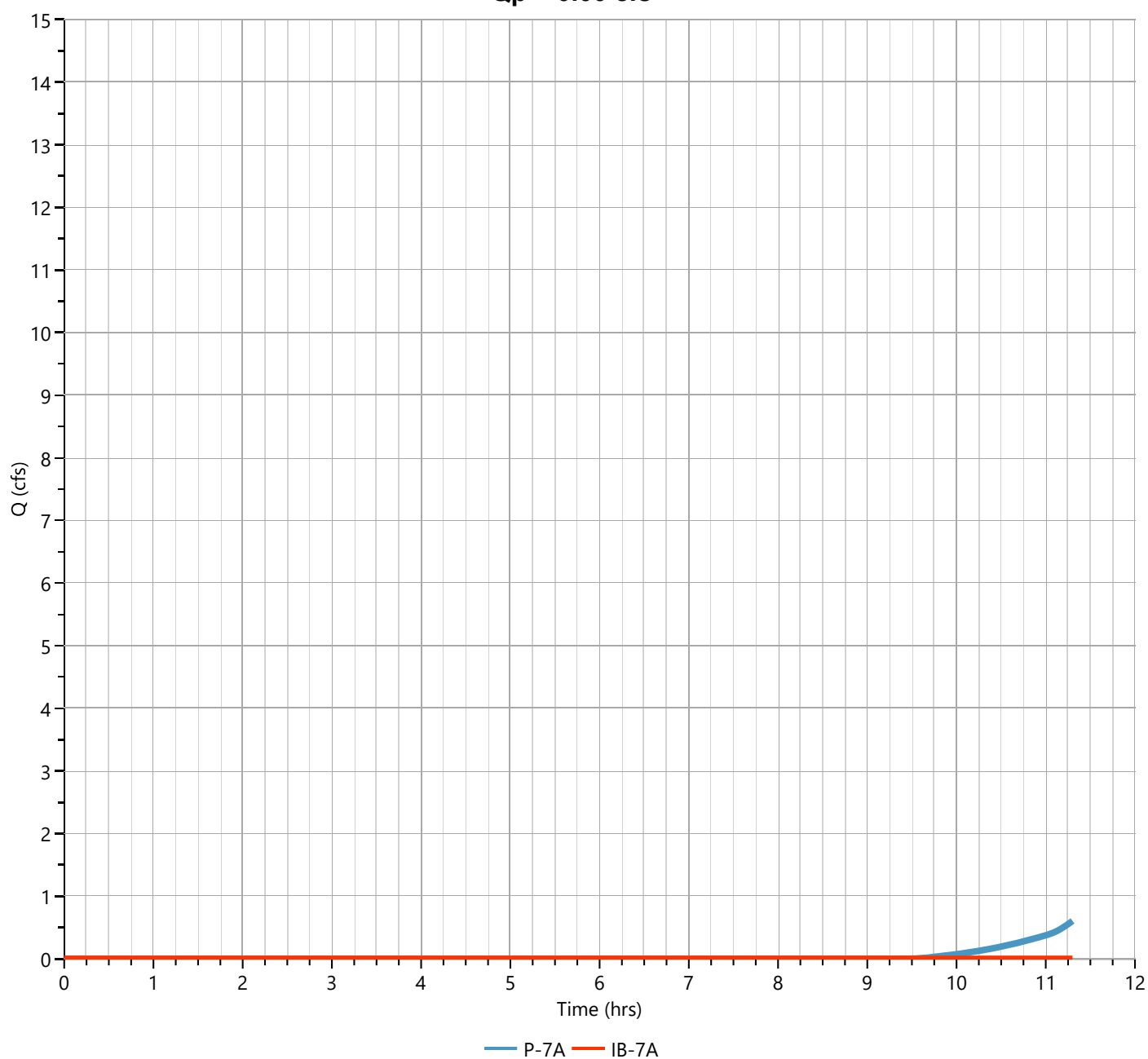
## IB-7A

## Hyd. No. 41

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 11.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 40 - P-7A	Max. Elevation	= 222.39 ft
Pond Name	= IB-7A REVISED	Max. Storage	= 19,475 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Pond Report

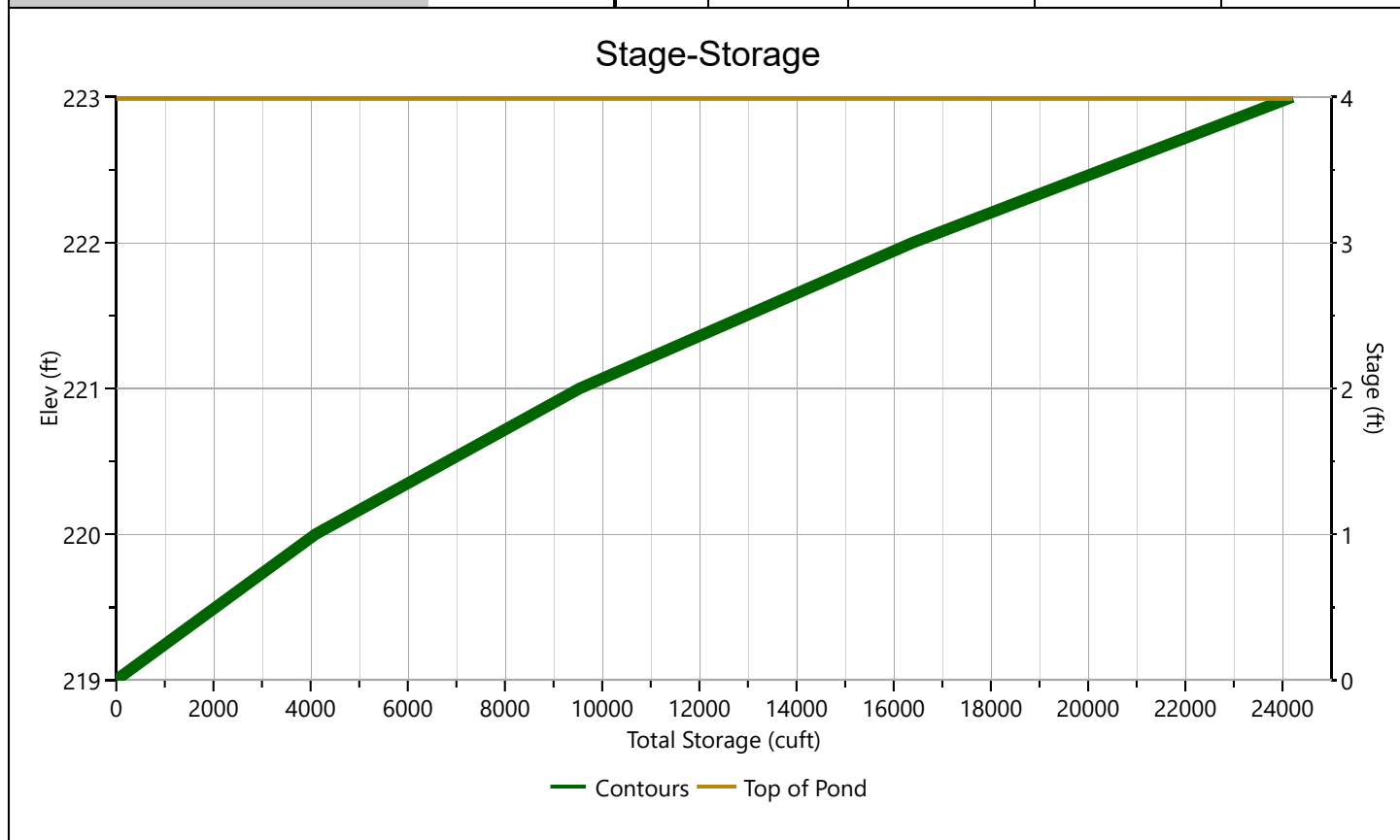
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-7A REVISED**

## Stage-Storage

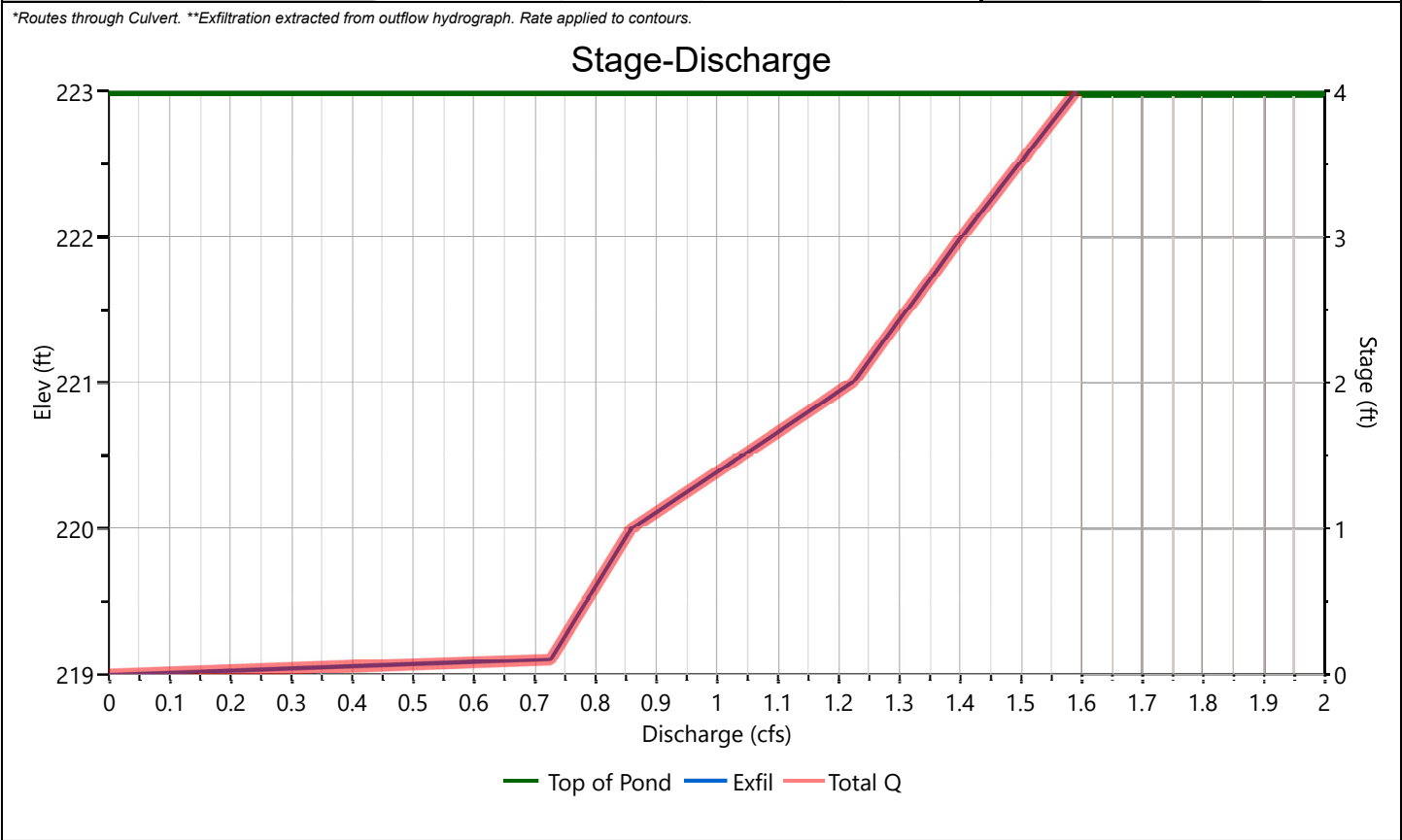
[illegible]

IB-7A REVISED

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1	2	3	
Rise, in					Hole Diameter, in
Span, in					No. holes
No. Barrels	1				Invert Elevation, ft
Invert Elevation, ft	219.00				Height, ft
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co
Length, ft					
Barrel Slope, %					
N-Value, n	0.000				
Weirs	Riser*	Weirs			Ancillary
		1	2	3	
Shape / Type					Exfiltration, in/hr
Crest Elevation, ft					8.27**
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 3.0.0.21

10-27-2022

**IB-7A REVISED**

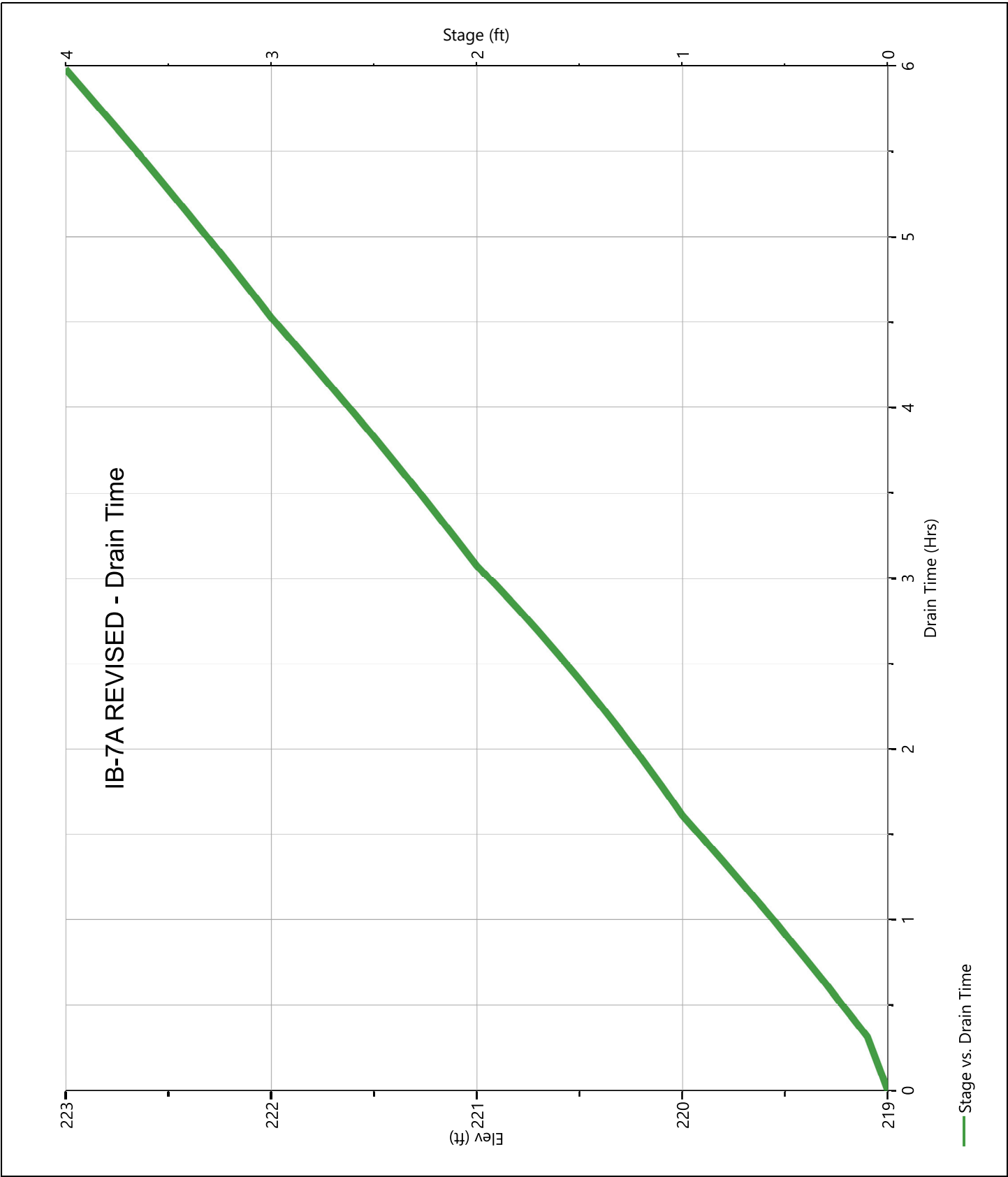
## Stage-Storage-Discharge Summary

[illegible]

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

IB-7A REVISED

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.52	50.59
A	Woods Good Condition	30			0.20	6.13
A	Open Space Good Condition	39			1.27	49.48
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.		86653	Totals =		1.99	106.20

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{106.20}{1.99} = 53.39 ; \quad \text{Use CN} = \boxed{53}$$

## 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	0.23	1.47	2.50

(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 StreetBy NCDate 6/24/2022Location: Stow, MAChecked Rev Date 10/13/2022Date Circle one: Present ☐ Developed ☒Circle one: Tc ☐ Tt ☒

Subcatchment P-7B

through  
subareaSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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

hr

min

0.42

24.9

# Hydrograph Report

Project Name:

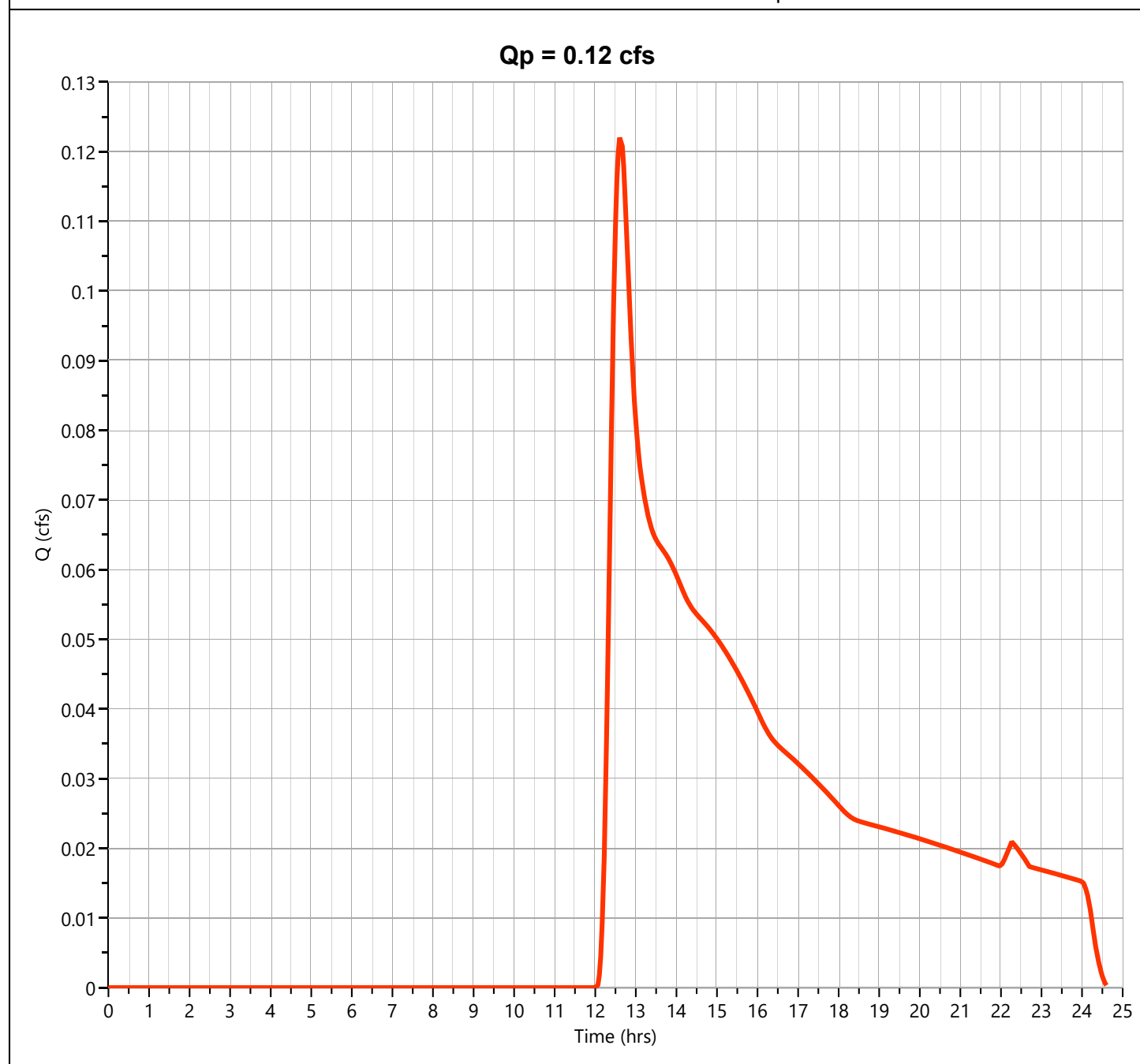
Hydrology Studio v 3.0.0.21

10-27-2022

**P-7B**

**Hyd. No. 42**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.122 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Runoff Volume	= 1,536 cuft
Drainage Area	= 1.99 ac	Curve Number	= 53
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:

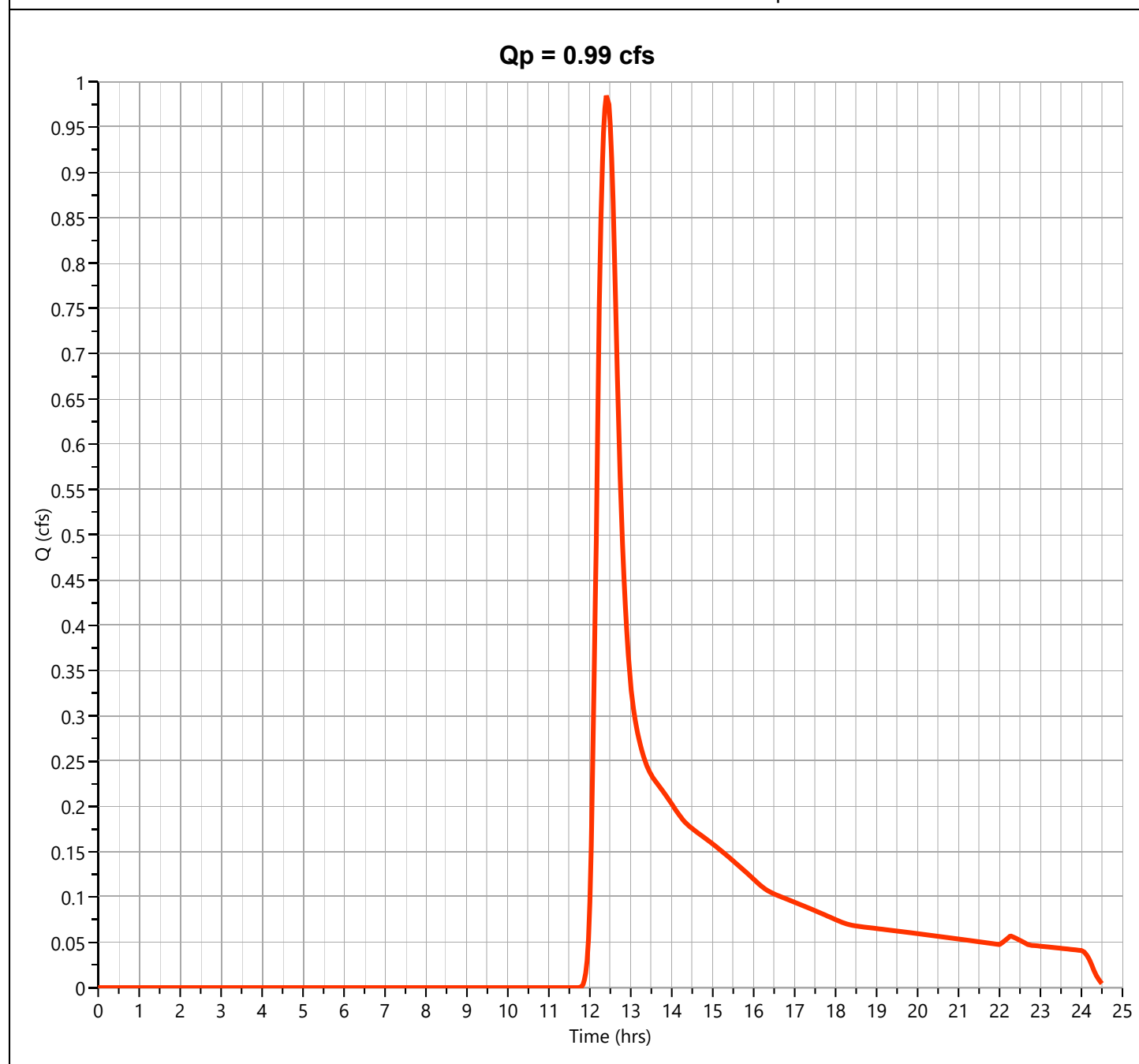
Hydrology Studio v 3.0.0.21

10-27-2022

**P-7B**

**Hyd. No. 42**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.987 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 6,252 cuft
Drainage Area	= 1.99 ac	Curve Number	= 53
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:

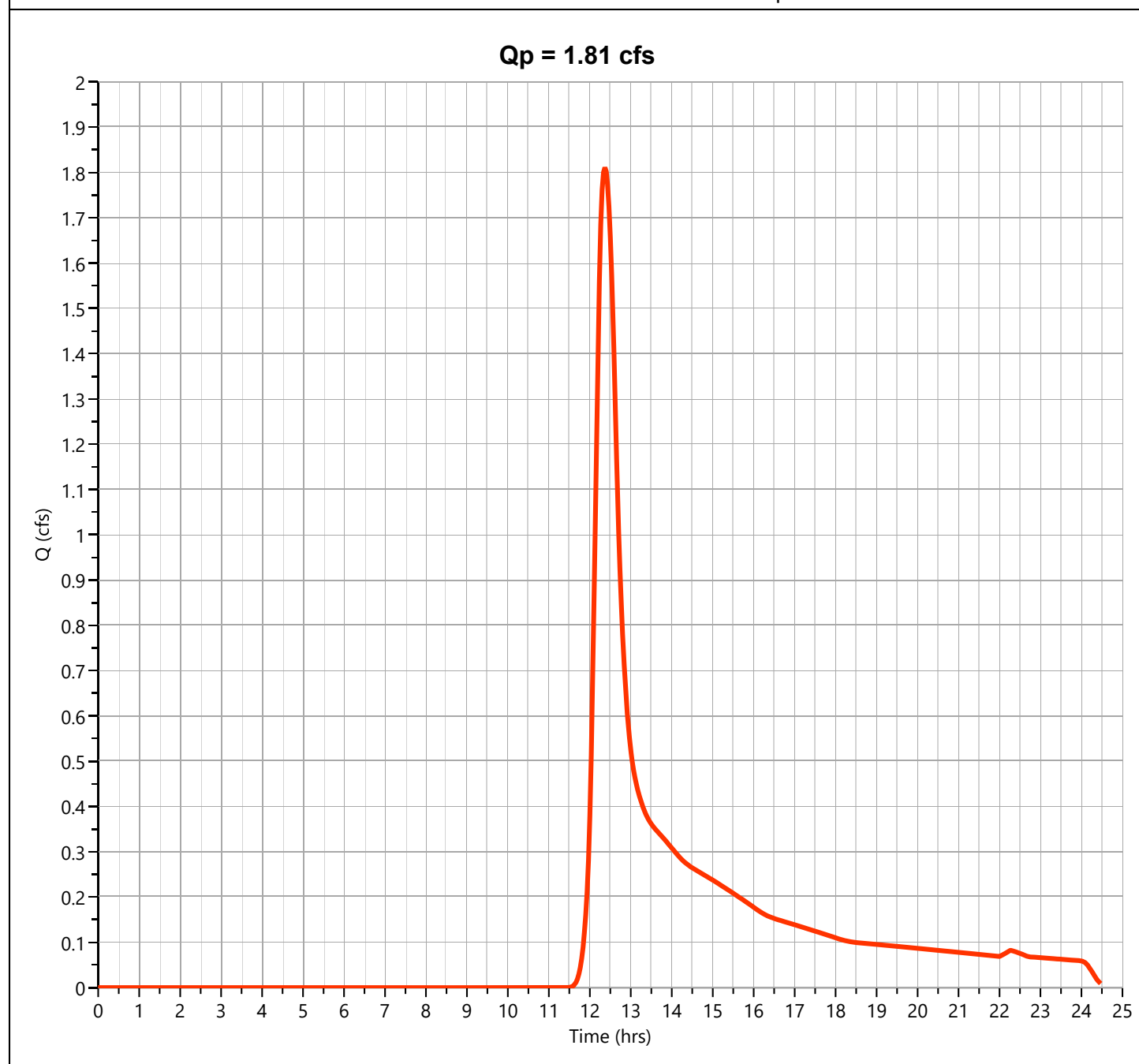
Hydrology Studio v 3.0.0.21

10-27-2022

**P-7B**

**Hyd. No. 42**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.811 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 10,244 cuft
Drainage Area	= 1.99 ac	Curve Number	= 53
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:

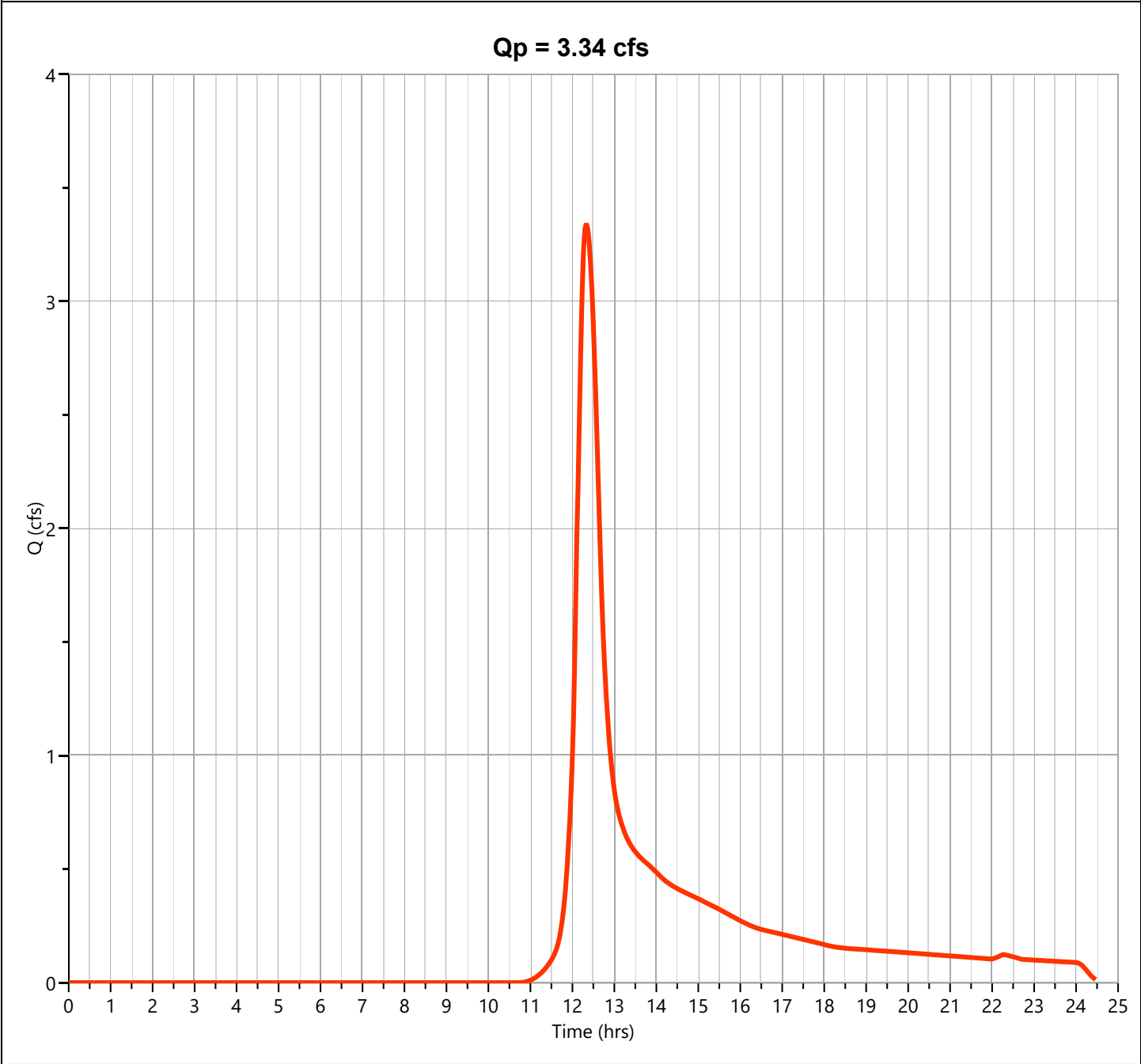
Hydrology Studio v 3.0.0.21

10-27-2022

P-7B

Hyd. No. 42

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.343 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 17,523 cuft
Drainage Area	= 1.99 ac	Curve Number	= 53
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 3.0.0.21

10-27-2022

**IB-7B**

**Hyd. No. 43**

Hydrograph Type = Pond Route

Peak Flow = 0.000 cfs

Storm Frequency = 2-yr

Time to Peak = 13.90 hrs

Time Interval = 2 min

Hydrograph Volume = 0.000 cuft

Inflow Hydrograph = 42 - P-7B

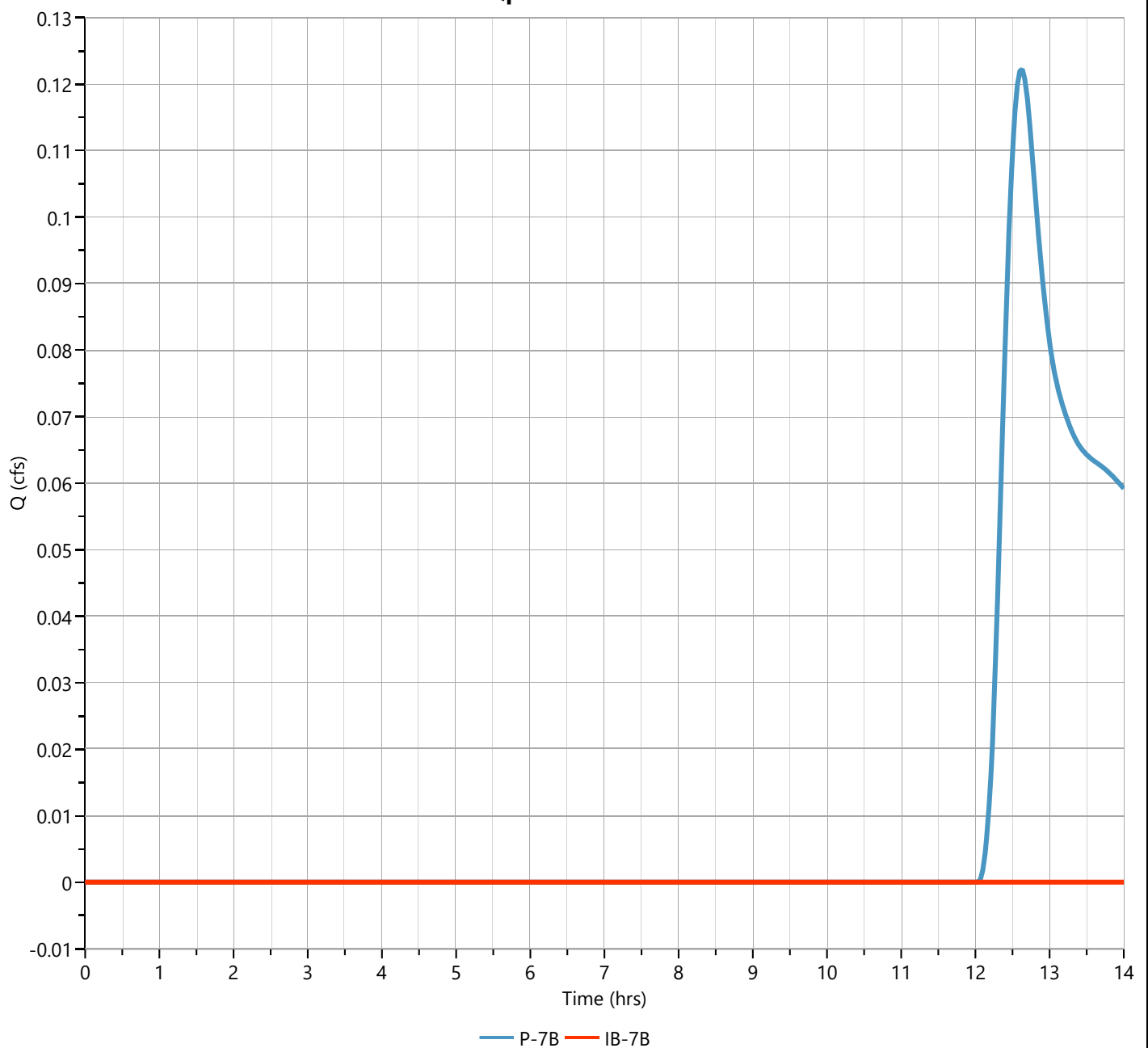
Max. Elevation = 224.03 ft

Pond Name = IB-7B

Max. Storage = 62.8 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

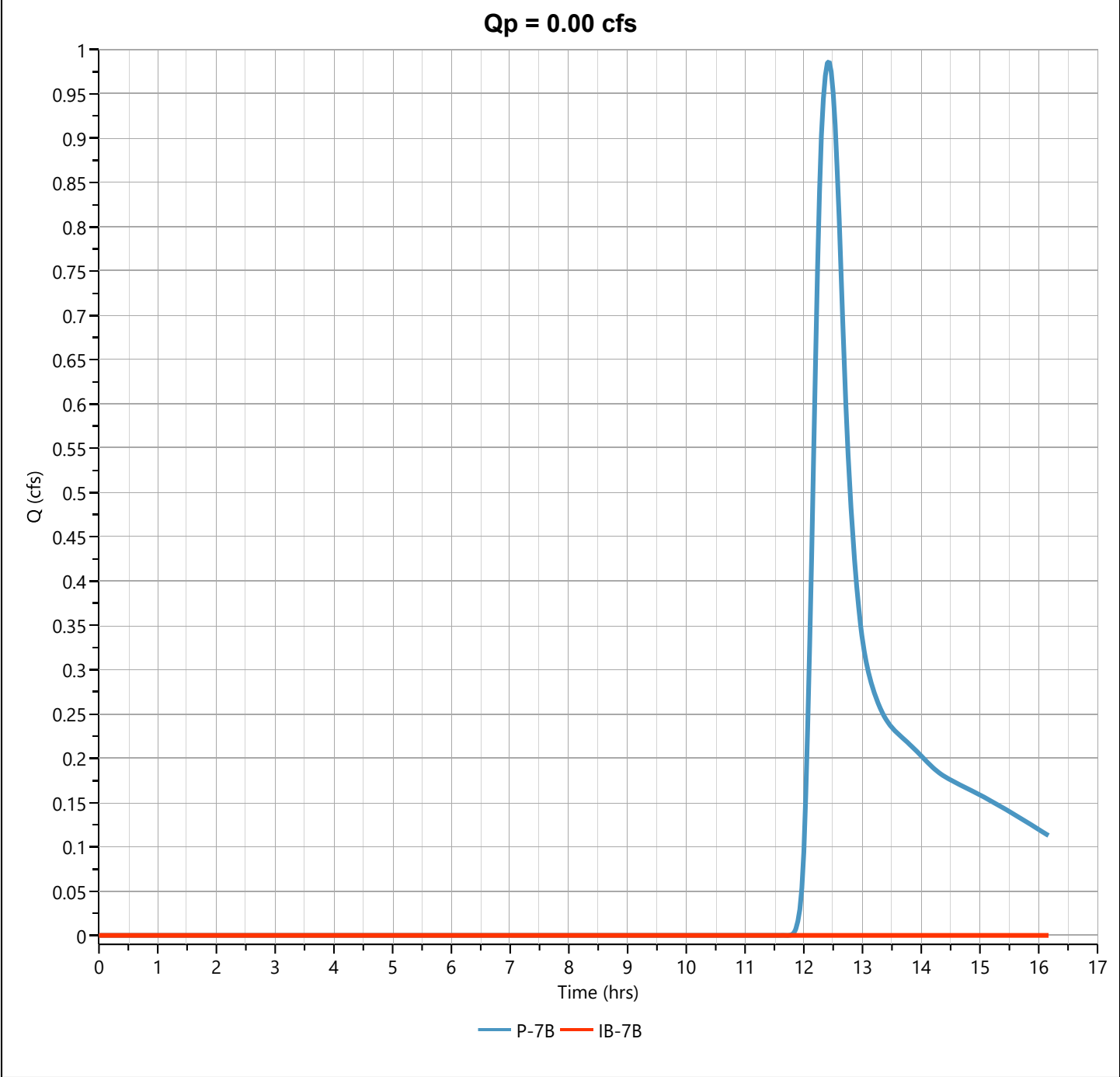
10-27-2022

IB-7B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 16.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-7B	Max. Elevation	= 224.61 ft
Pond Name	= IB-7B	Max. Storage	= 1,176 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

IB-7B

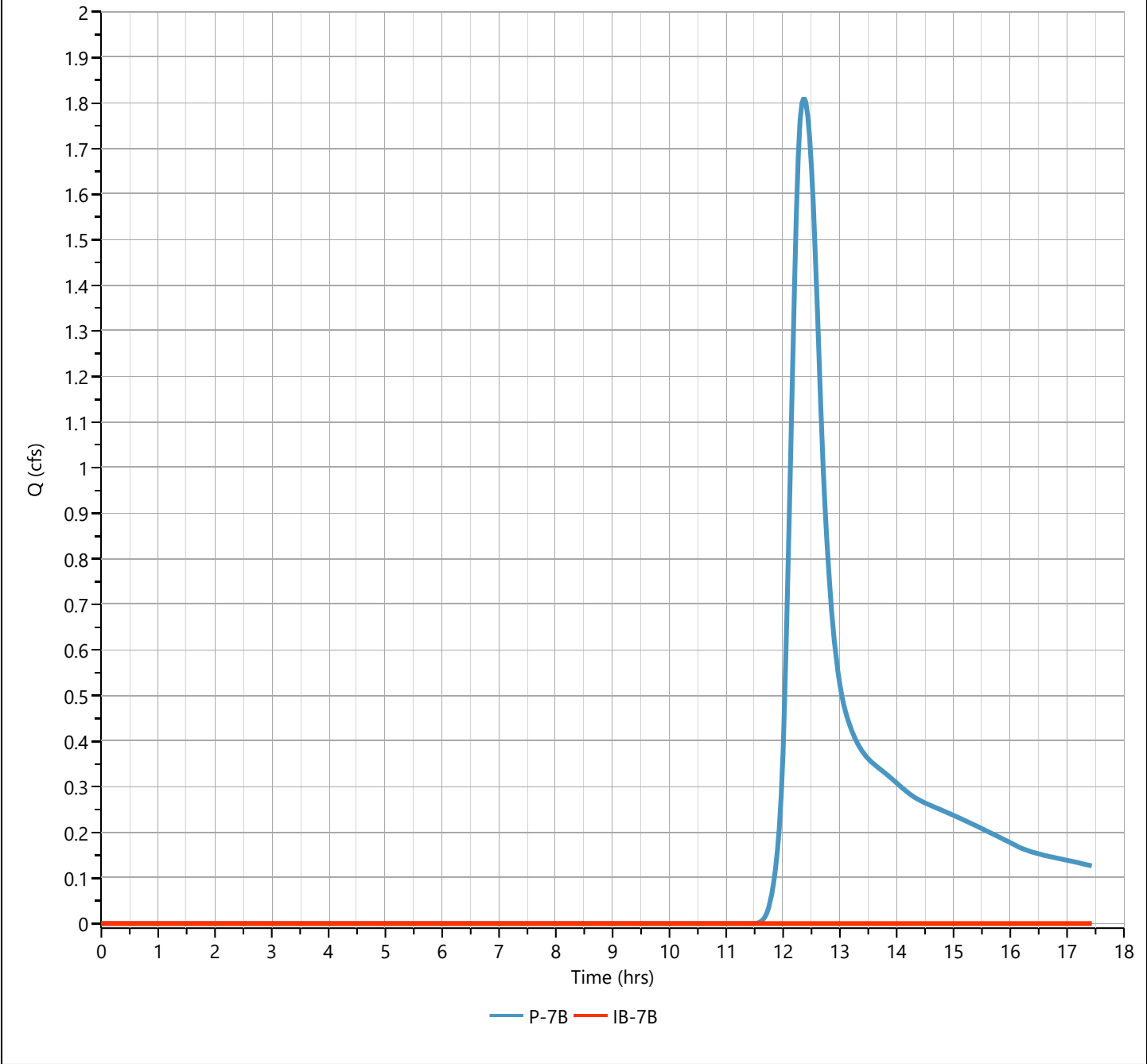
Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 17.40 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-7B	Max. Elevation	= 225.33 ft
Pond Name	= IB-7B	Max. Storage	= 2,841 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 9.07 hrs

Qp = 0.00 cfs



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

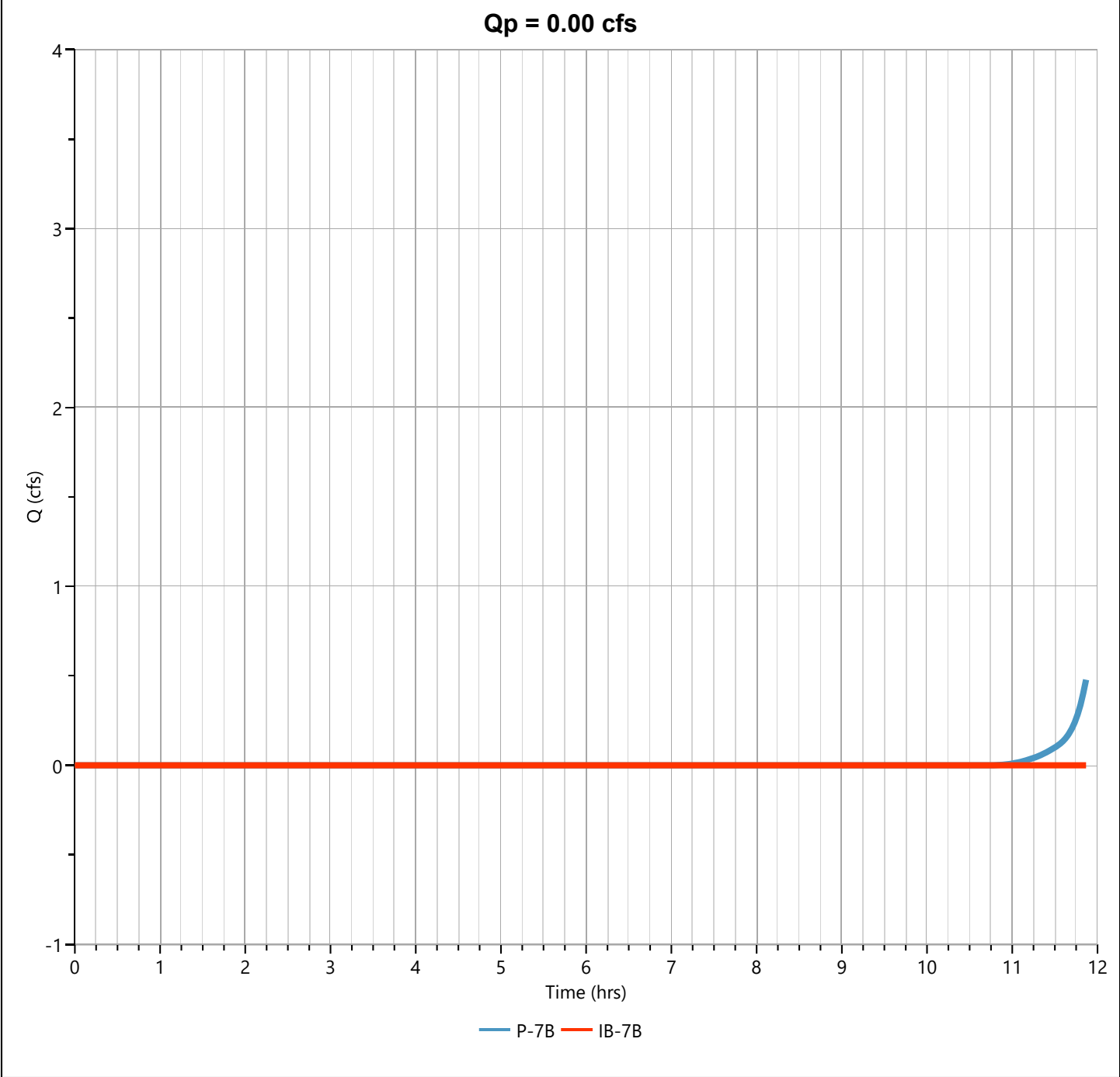
10-27-2022

IB-7B

Hyd. No. 43

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 11.83 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 42 - P-7B	Max. Elevation	= 226.36 ft
Pond Name	= IB-7B	Max. Storage	= 6,077 cuft

Pond Routing by Storage Indication Method



# Pond Report

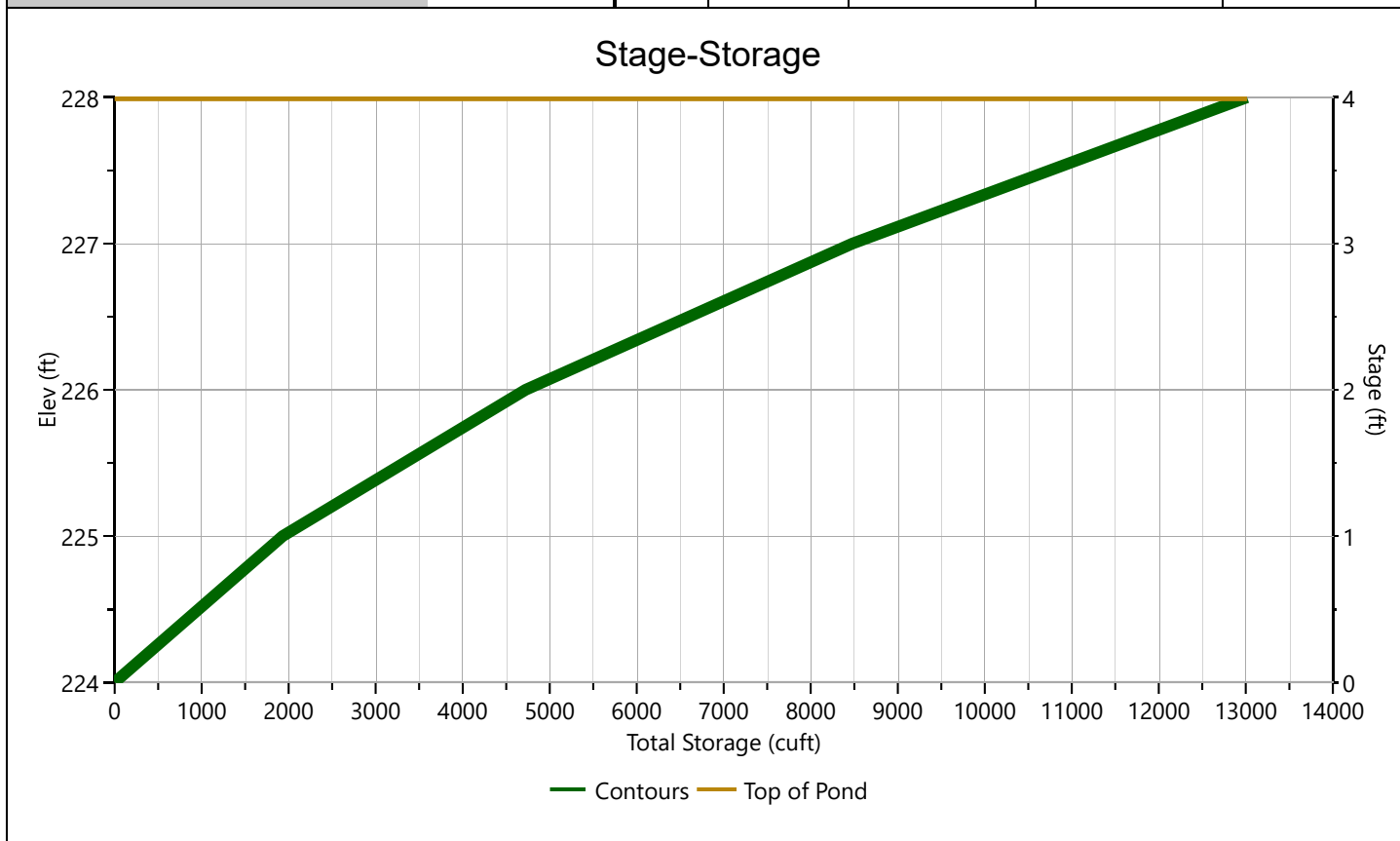
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

# IB-7B

## Stage-Storage

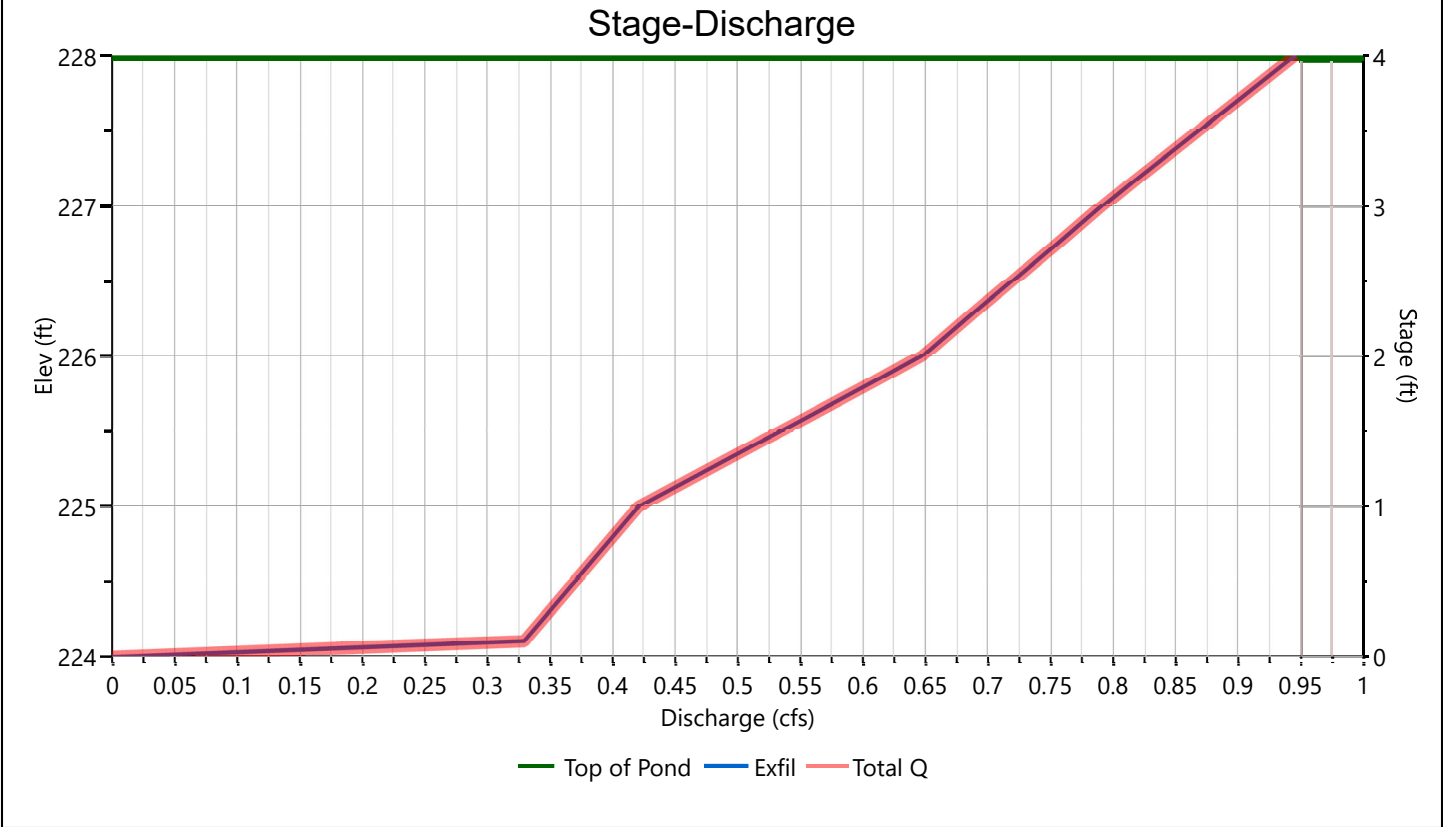
[illegible]

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
Crest Elevation, ft					8.27**
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 3.0.0.21

10-27-2022

**IB-7B**

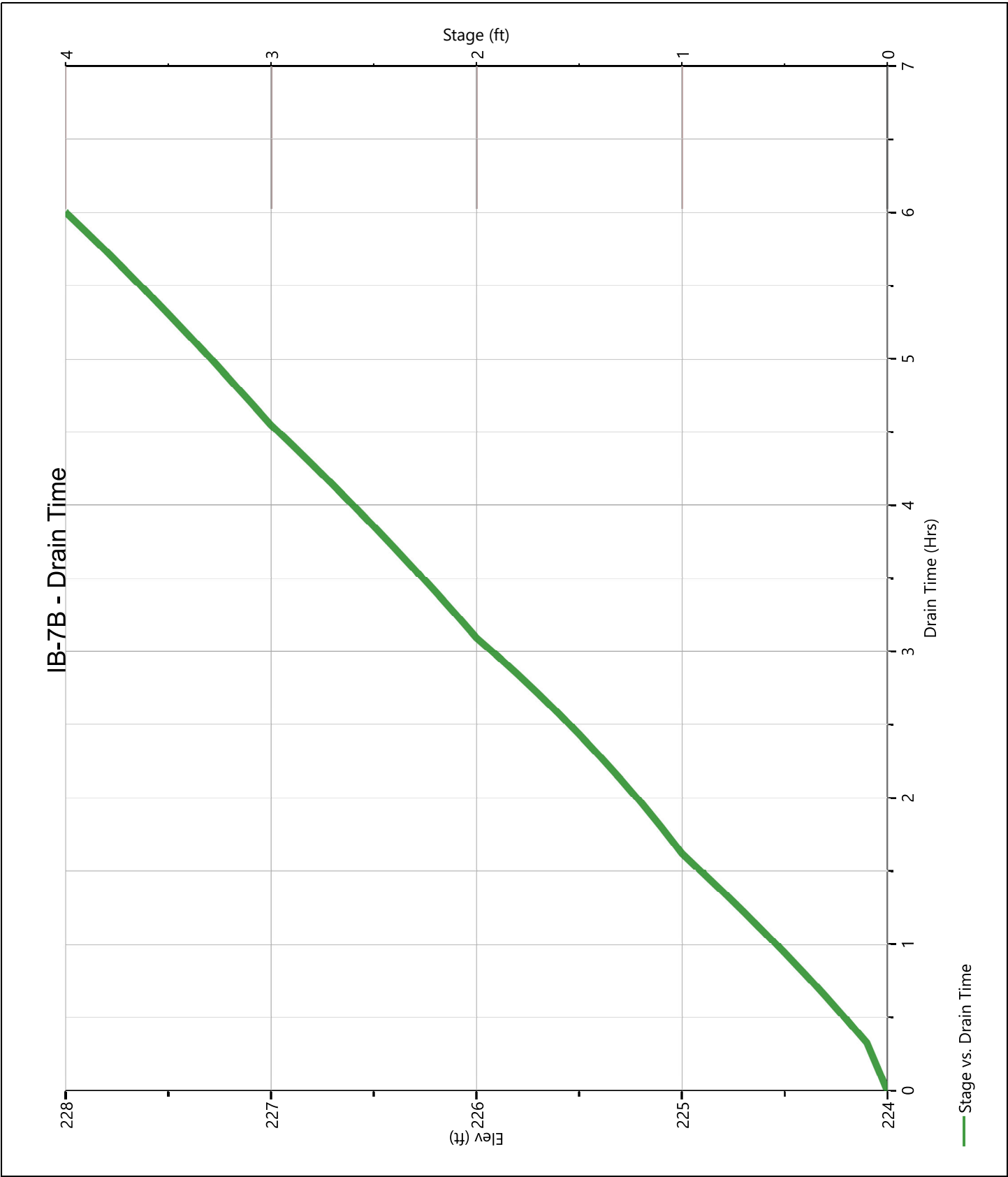
## Stage-Storage-Discharge Summary

[illegible]

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

IB-7B

Pond Drawdown





# Hydrograph Report

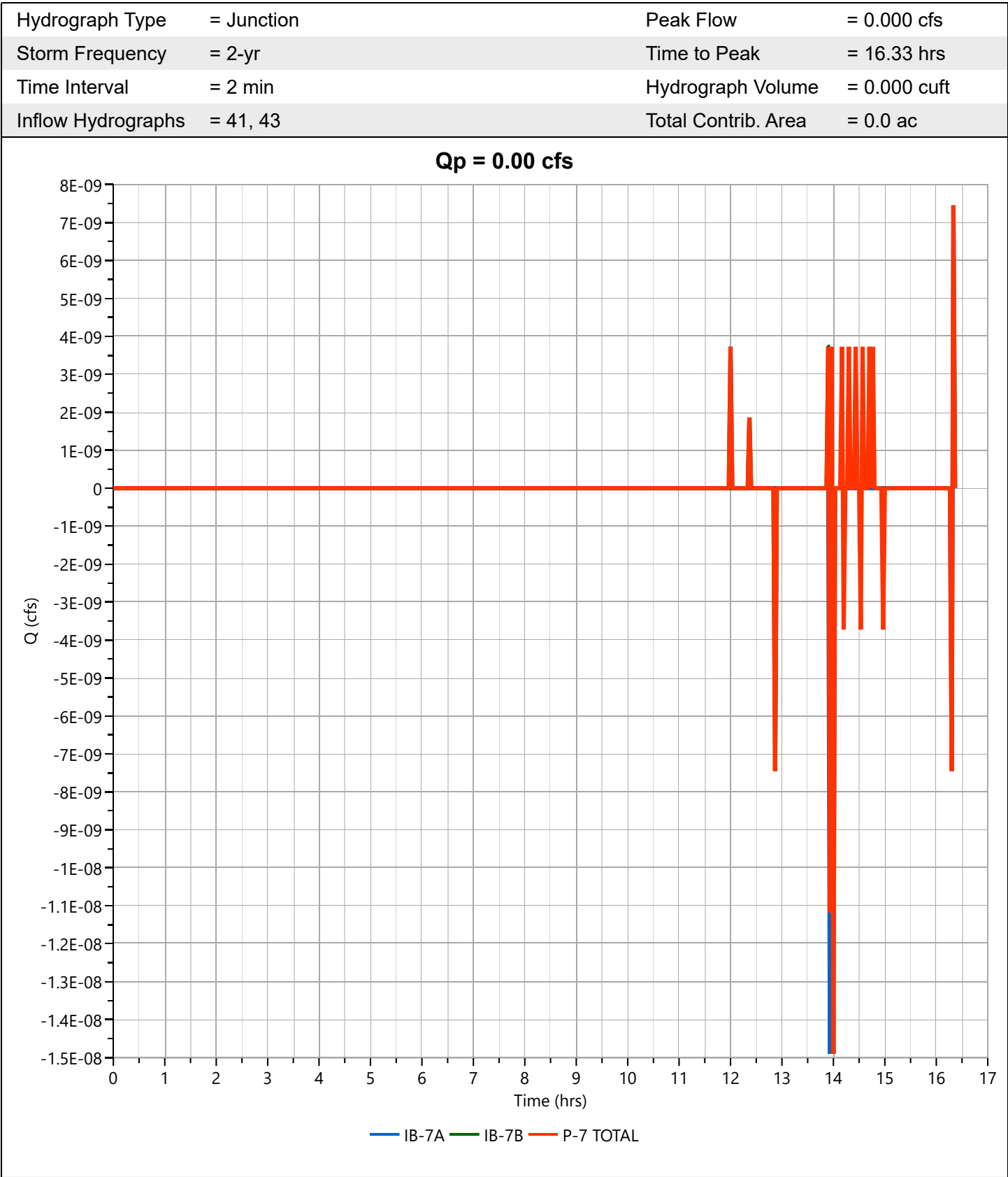
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-7 TOTAL

Hyd. No. 44



# Hydrograph Report

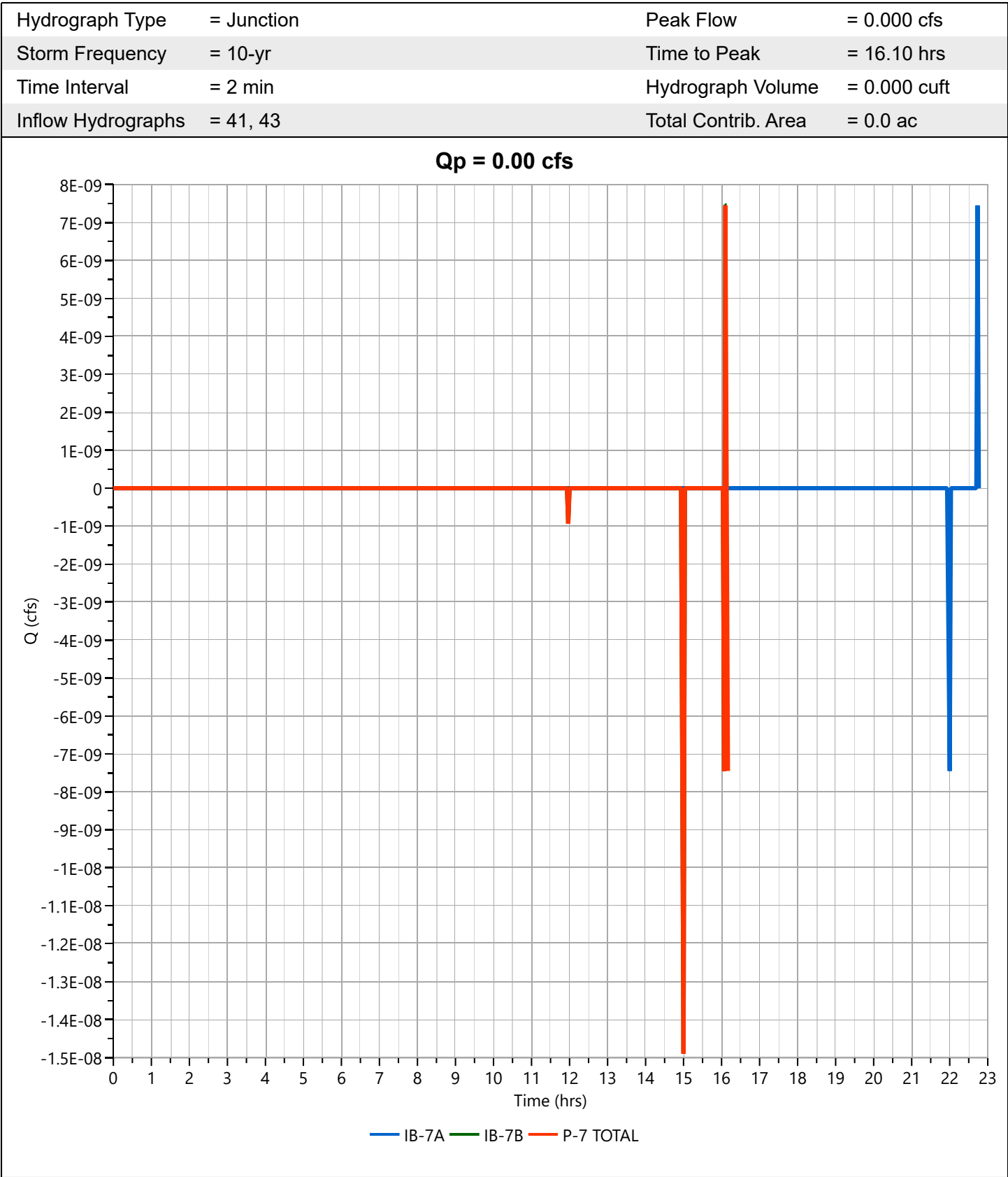
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-7 TOTAL

Hyd. No. 44



# Hydrograph Report

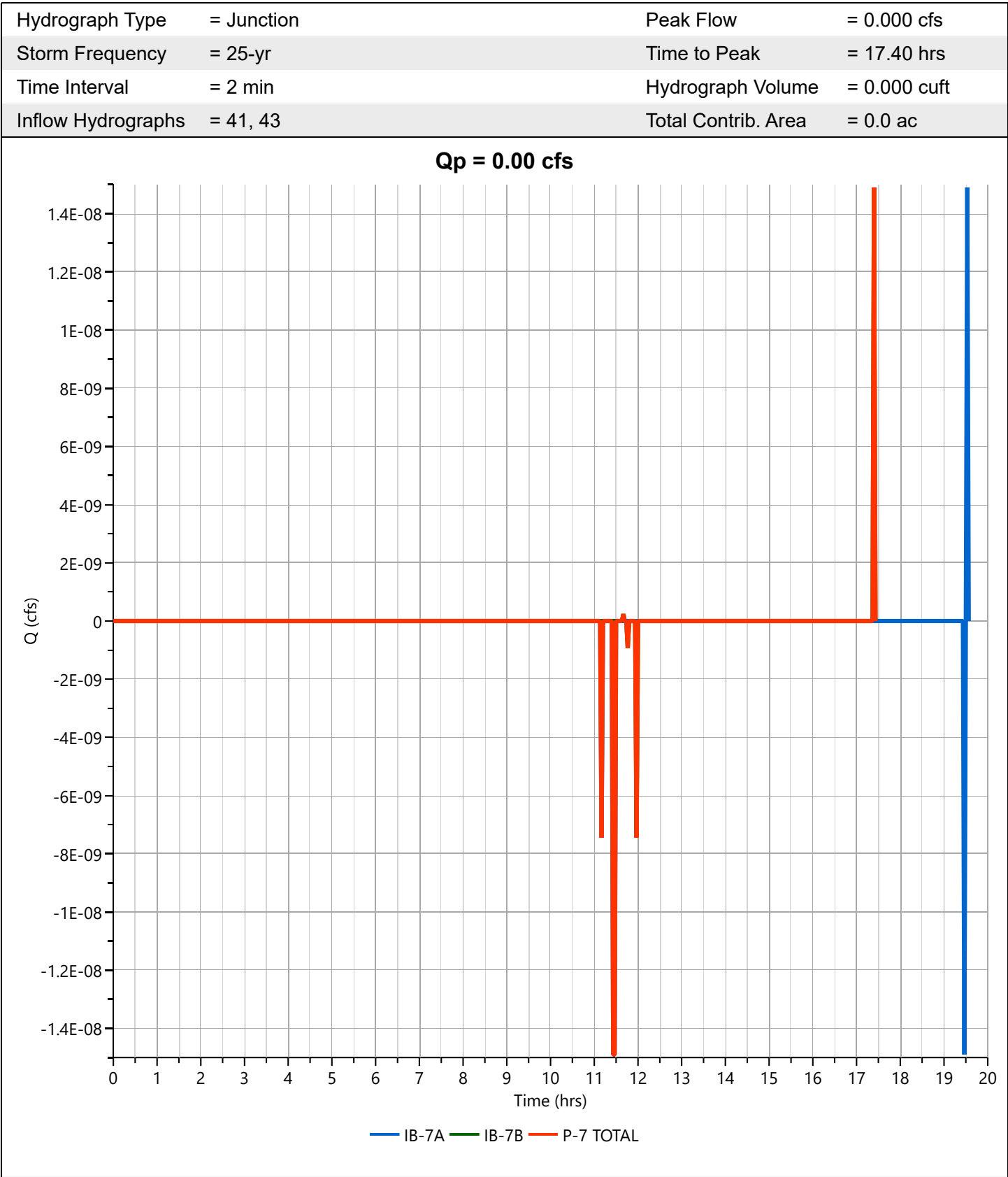
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## P-7 TOTAL

Hyd. No. 44



# Hydrograph Report

Project Name:

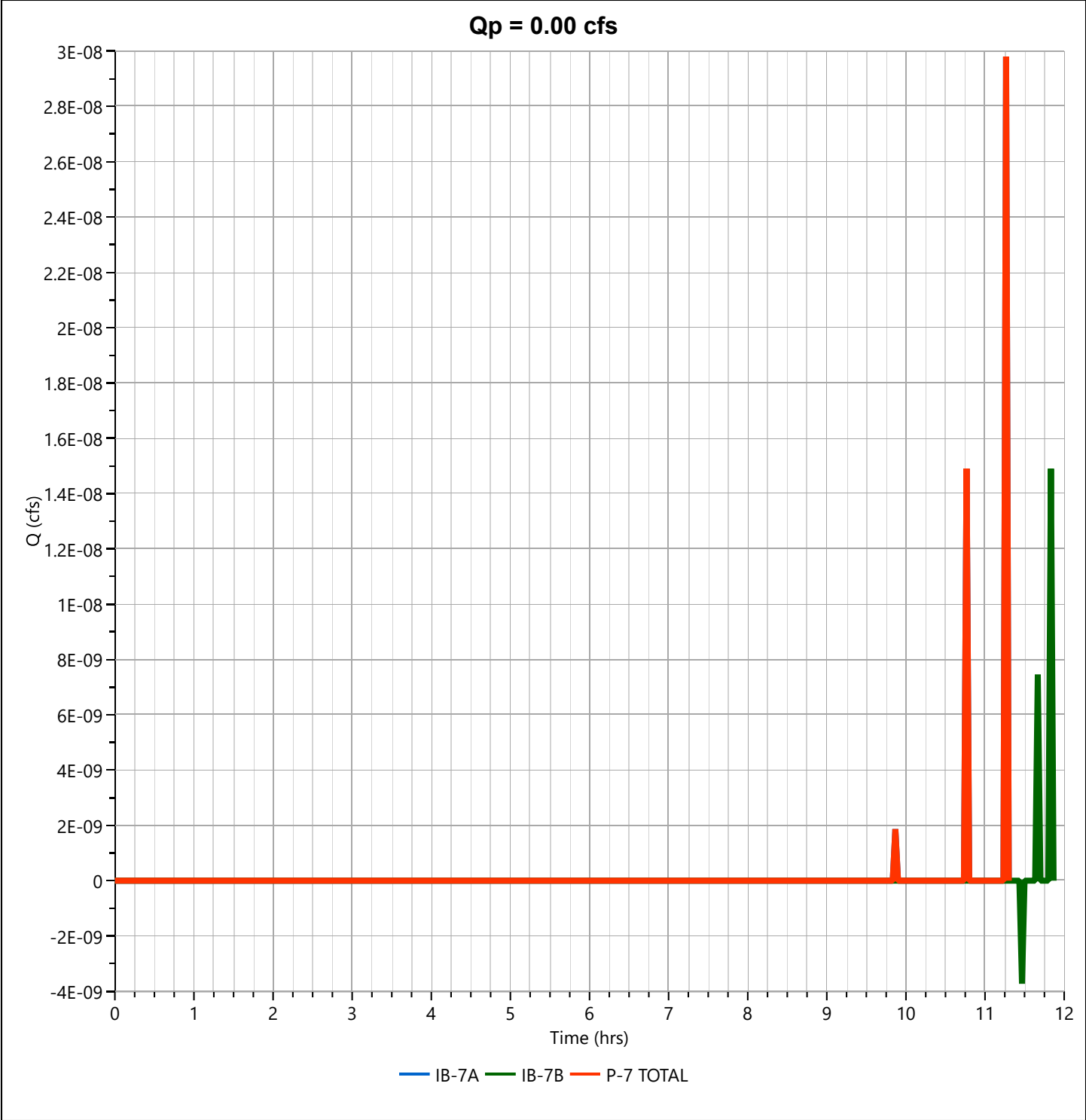
Hydrology Studio v 3.0.0.21

10-27-2022

## P-7 TOTAL

Hyd. No. 44

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 11.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 41, 43	Total Contrib. Area	= 0.0 ac



Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			2.01	197.18
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			2.65	103.50
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.		203242	Totals =		4.67	300.68

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{300.68}{4.67} = 64.44 ; \text{ Use CN} = \boxed{64}$$

2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.61	2.40	3.70

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present ☐ DevelopedCircle one: Tc ☐ TtSubcatchment P-8through  
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.16

A-B		
LAWN		
0.24		
50		
3.1		
0.015		
0.16		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.02

B-C		
UNPAVED		
142		
0.015		
1.98		
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.  $T_t = L / 3600V$ 

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:

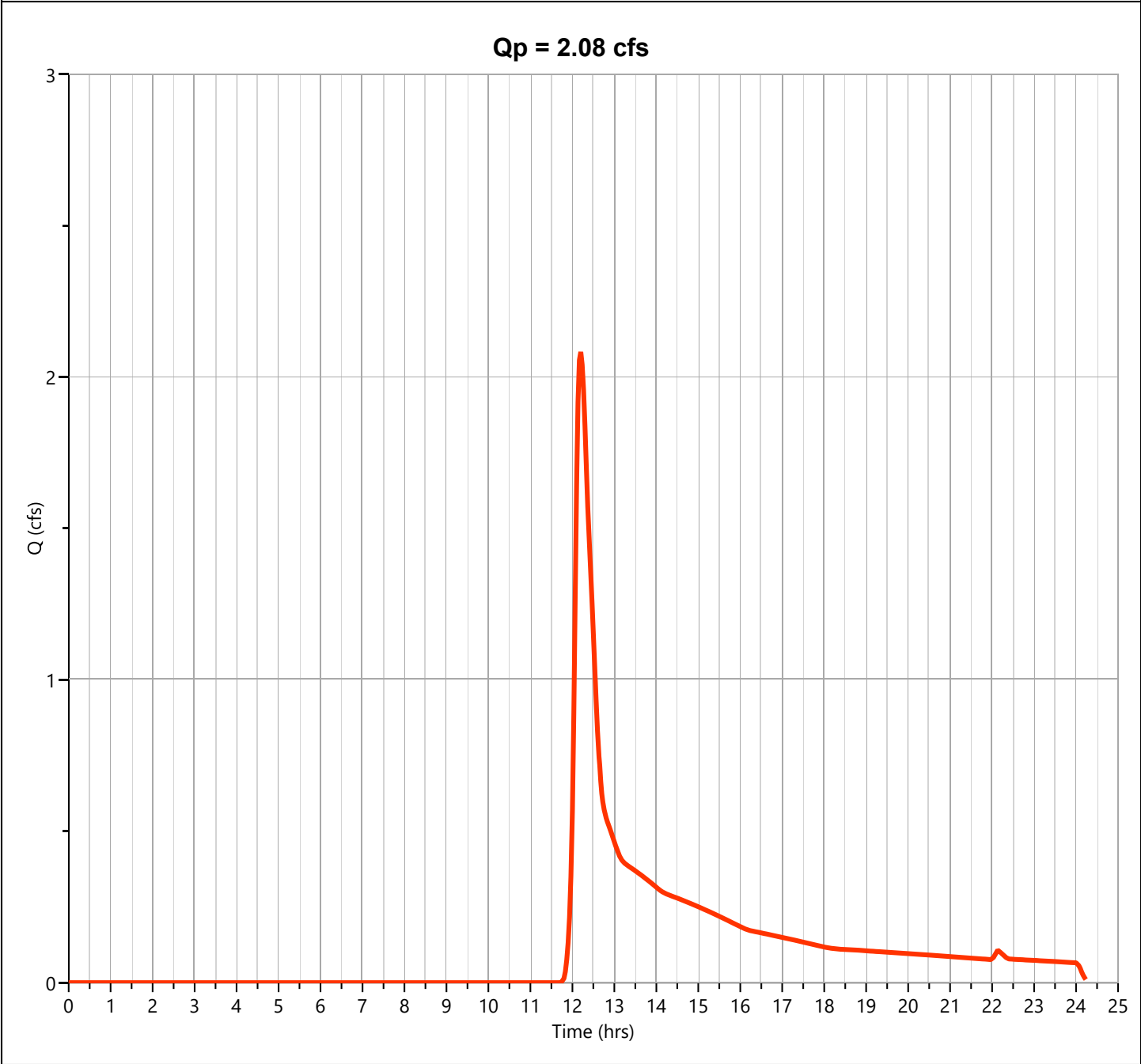
Hydrology Studio v 3.0.0.21

10-27-2022

P-8

Hyd. No. 46

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.083 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 10,351 cuft
Drainage Area	= 4.67 ac	Curve Number	= 64
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:

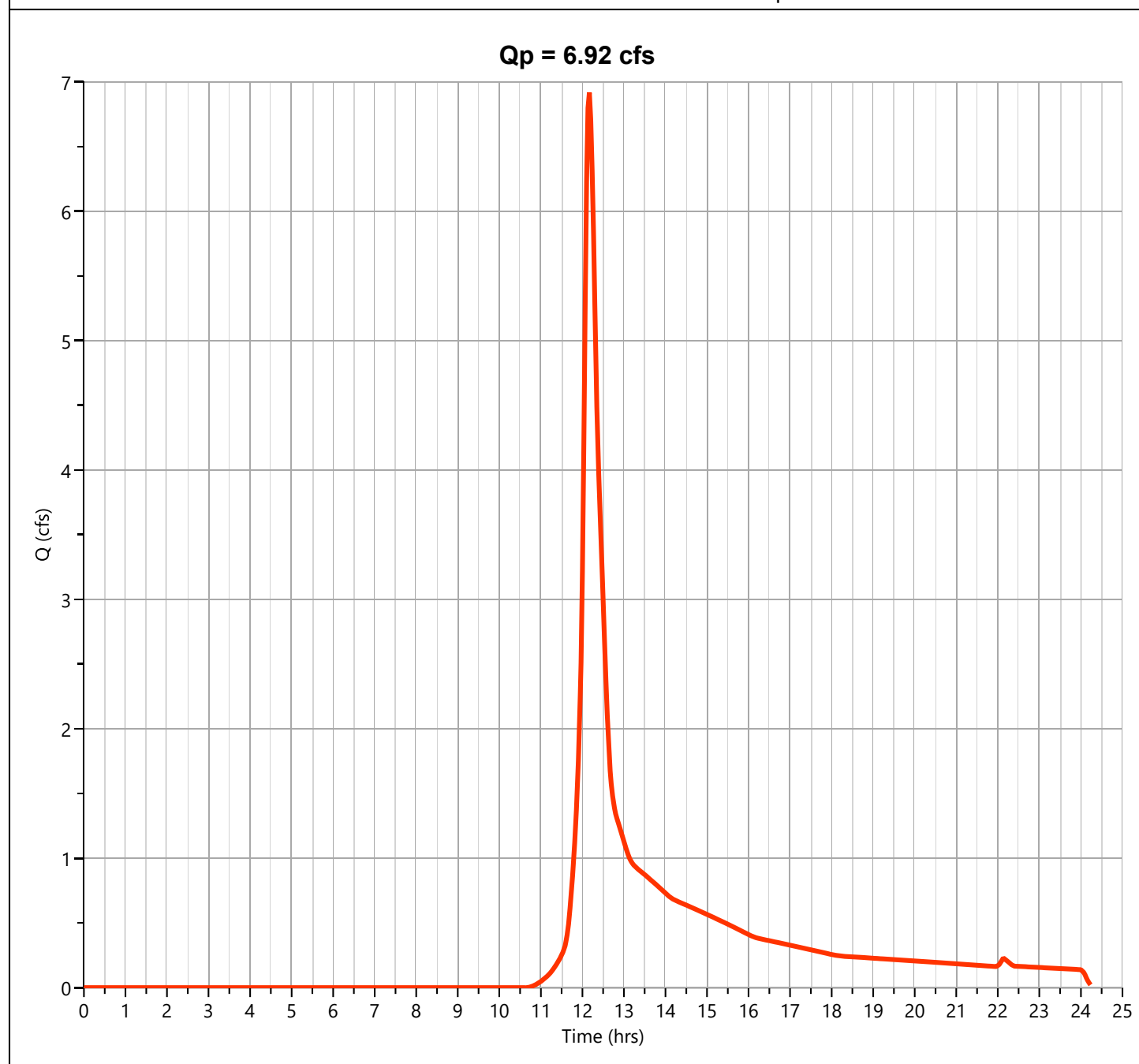
Hydrology Studio v 3.0.0.21

10-27-2022

**P-8**

**Hyd. No. 46**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.918 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 28,087 cuft
Drainage Area	= 4.67 ac	Curve Number	= 64
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:

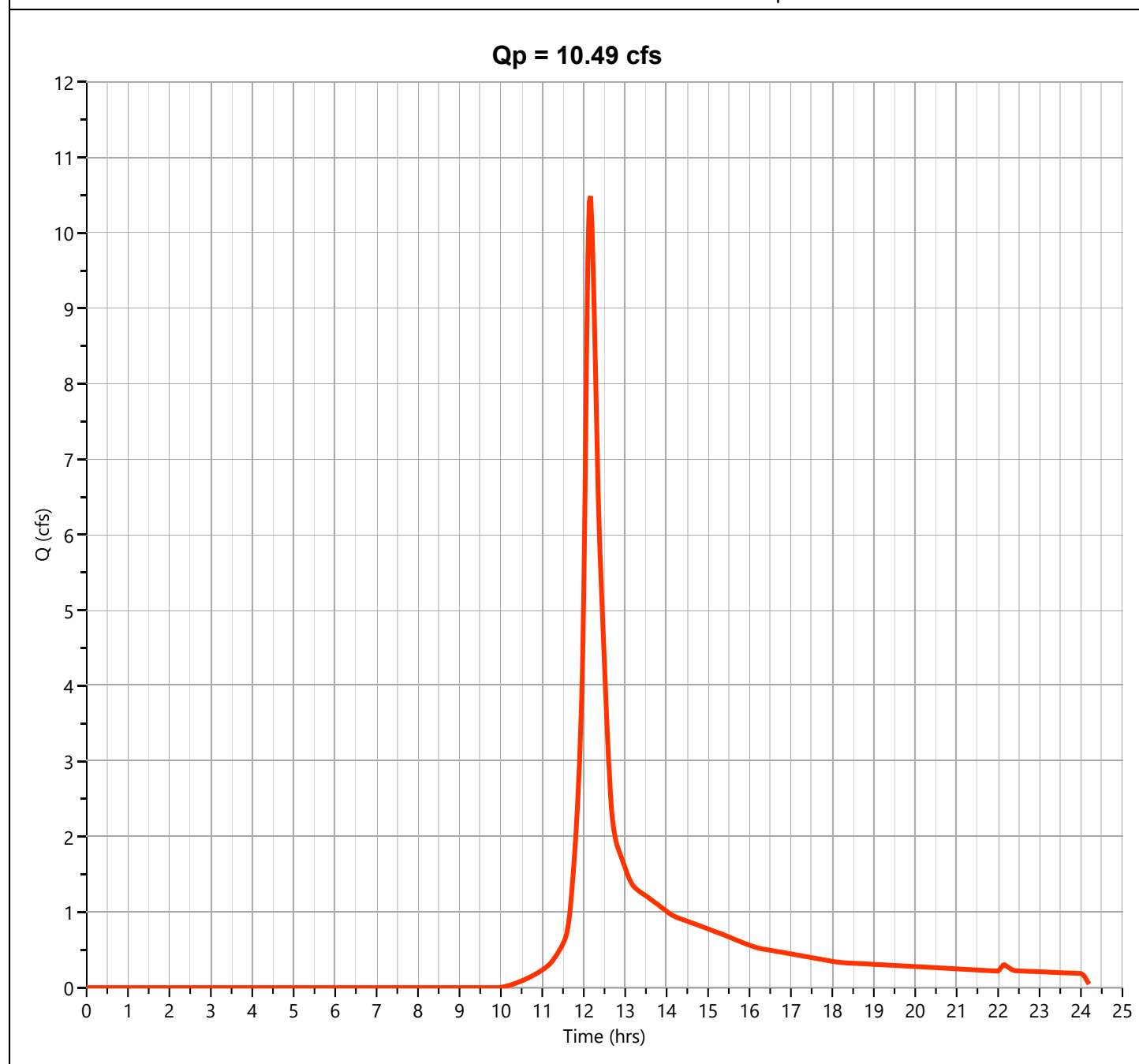
Hydrology Studio v 3.0.0.21

10-27-2022

**P-8**

**Hyd. No. 46**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.49 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 41,323 cuft
Drainage Area	= 4.67 ac	Curve Number	= 64
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:

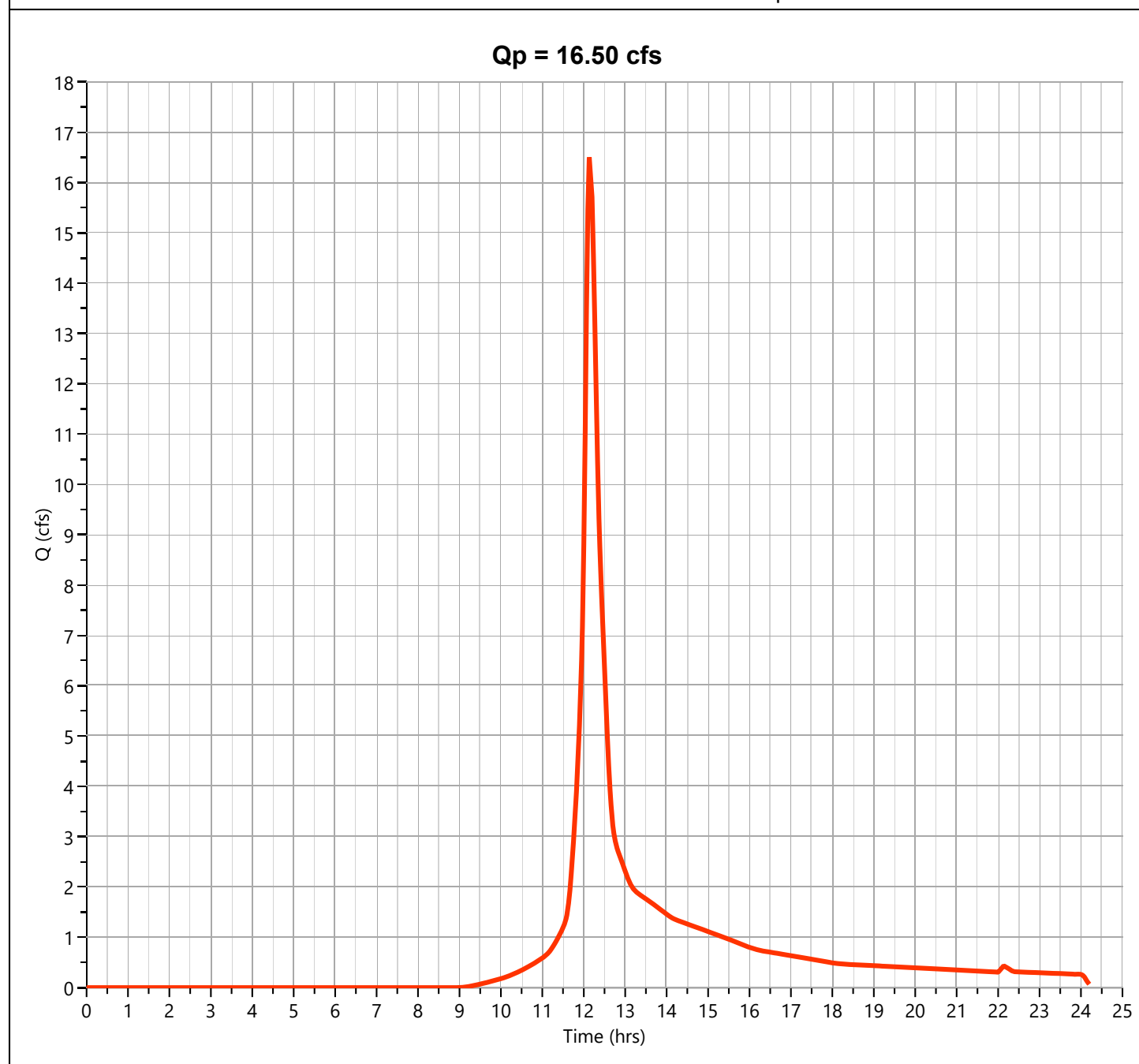
Hydrology Studio v 3.0.0.21

10-27-2022

**P-8**

**Hyd. No. 46**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.50 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 63,880 cuft
Drainage Area	= 4.67 ac	Curve Number	= 64
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 3.0.0.21

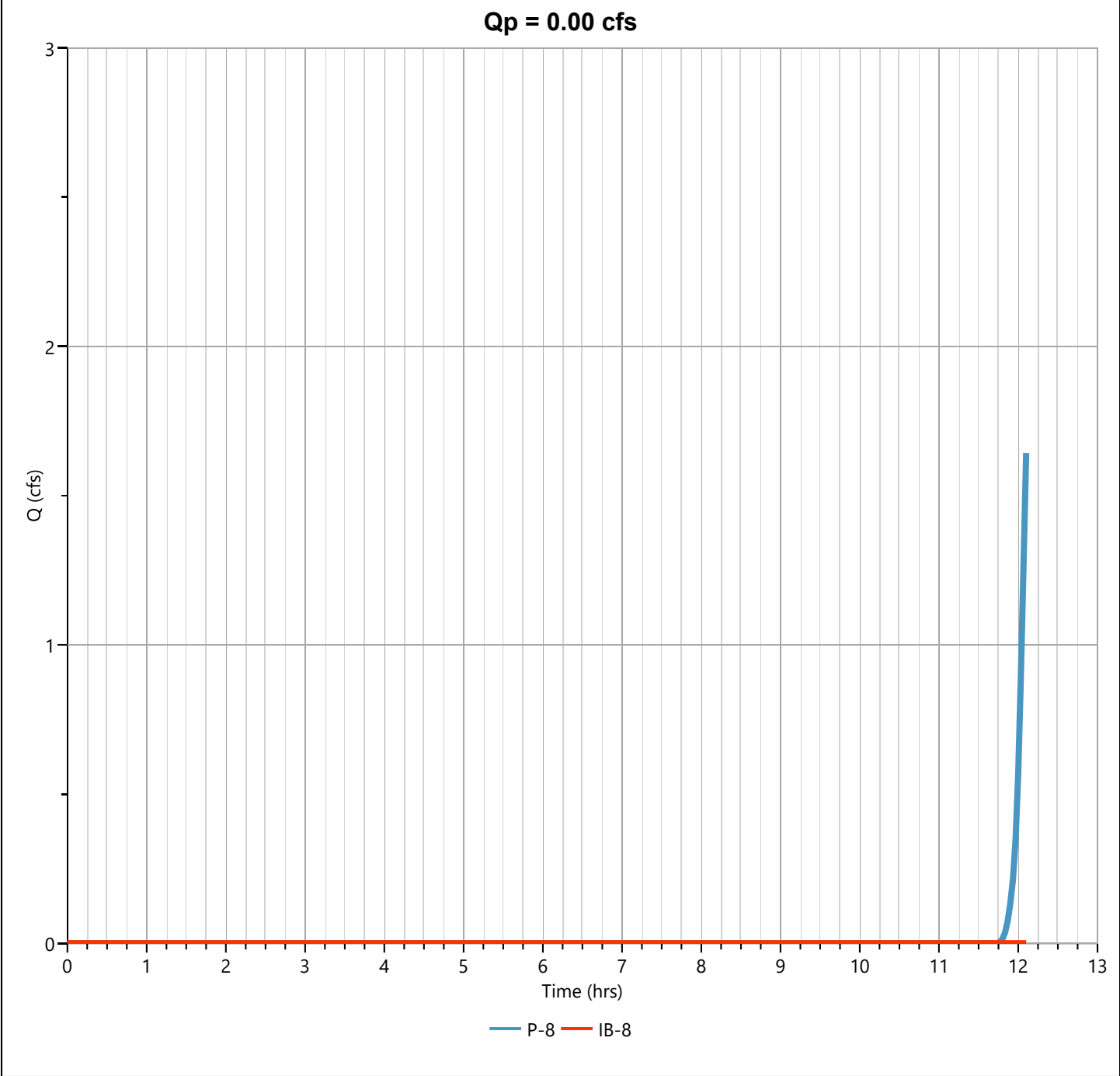
10-27-2022

IB-8

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-8	Max. Elevation	= 222.17 ft
Pond Name	= IB-8	Max. Storage	= 1,168 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

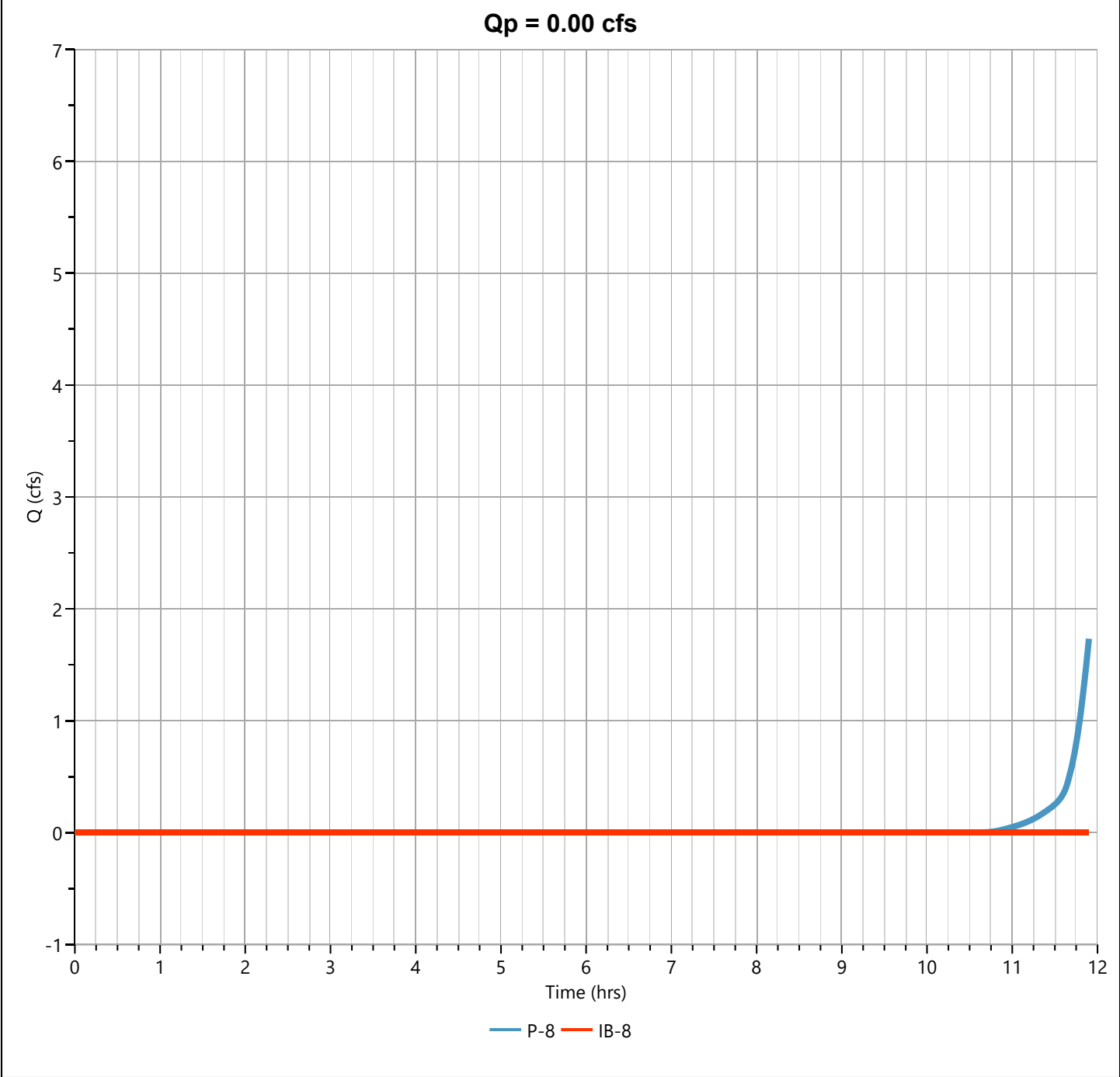
10-27-2022

IB-8

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 11.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-8	Max. Elevation	= 223.18 ft
Pond Name	= IB-8	Max. Storage	= 8,244 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

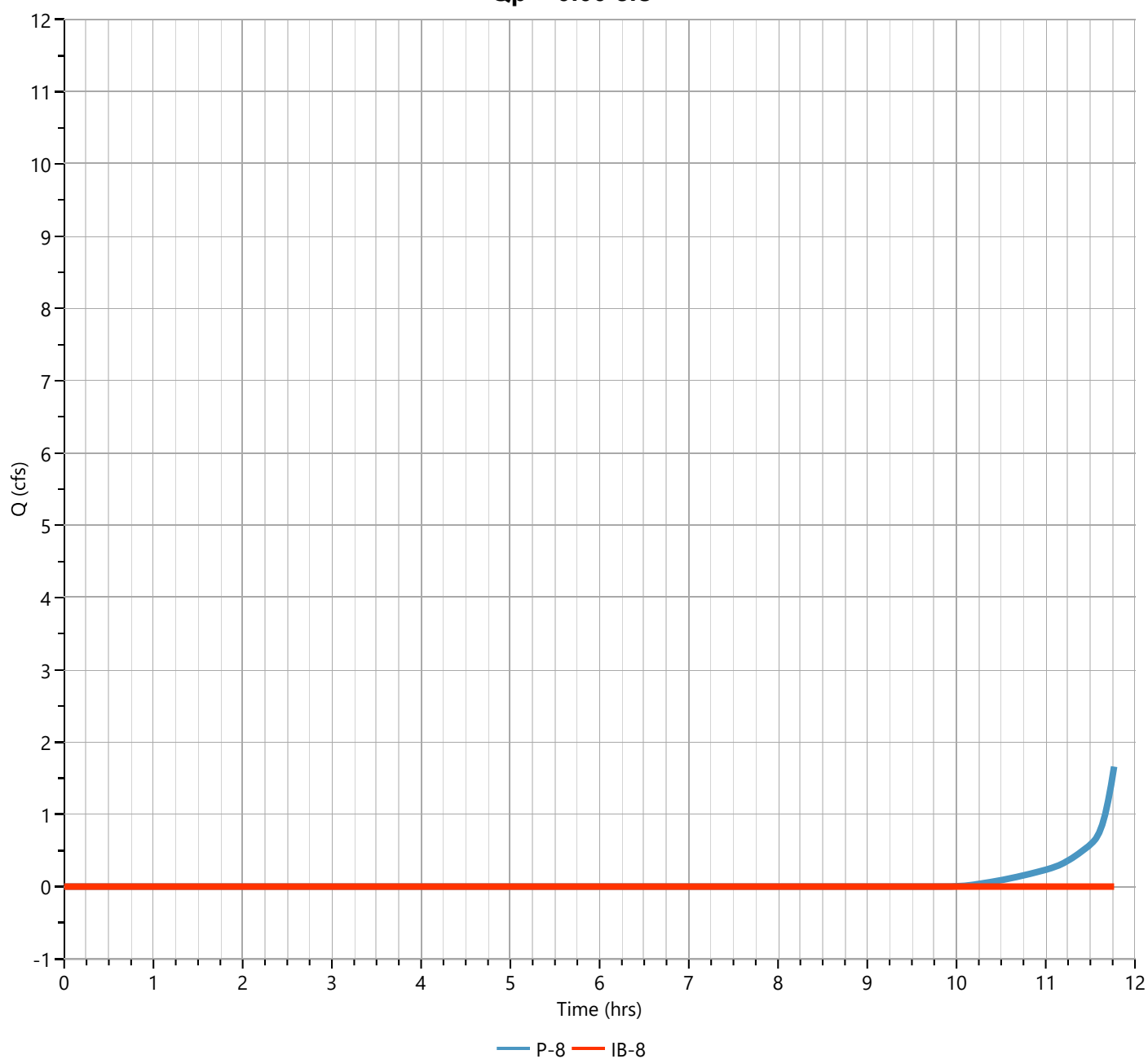
**IB-8**

**Hyd. No. 47**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 11.73 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-8	Max. Elevation	= 223.92 ft
Pond Name	= IB-8	Max. Storage	= 14,336 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

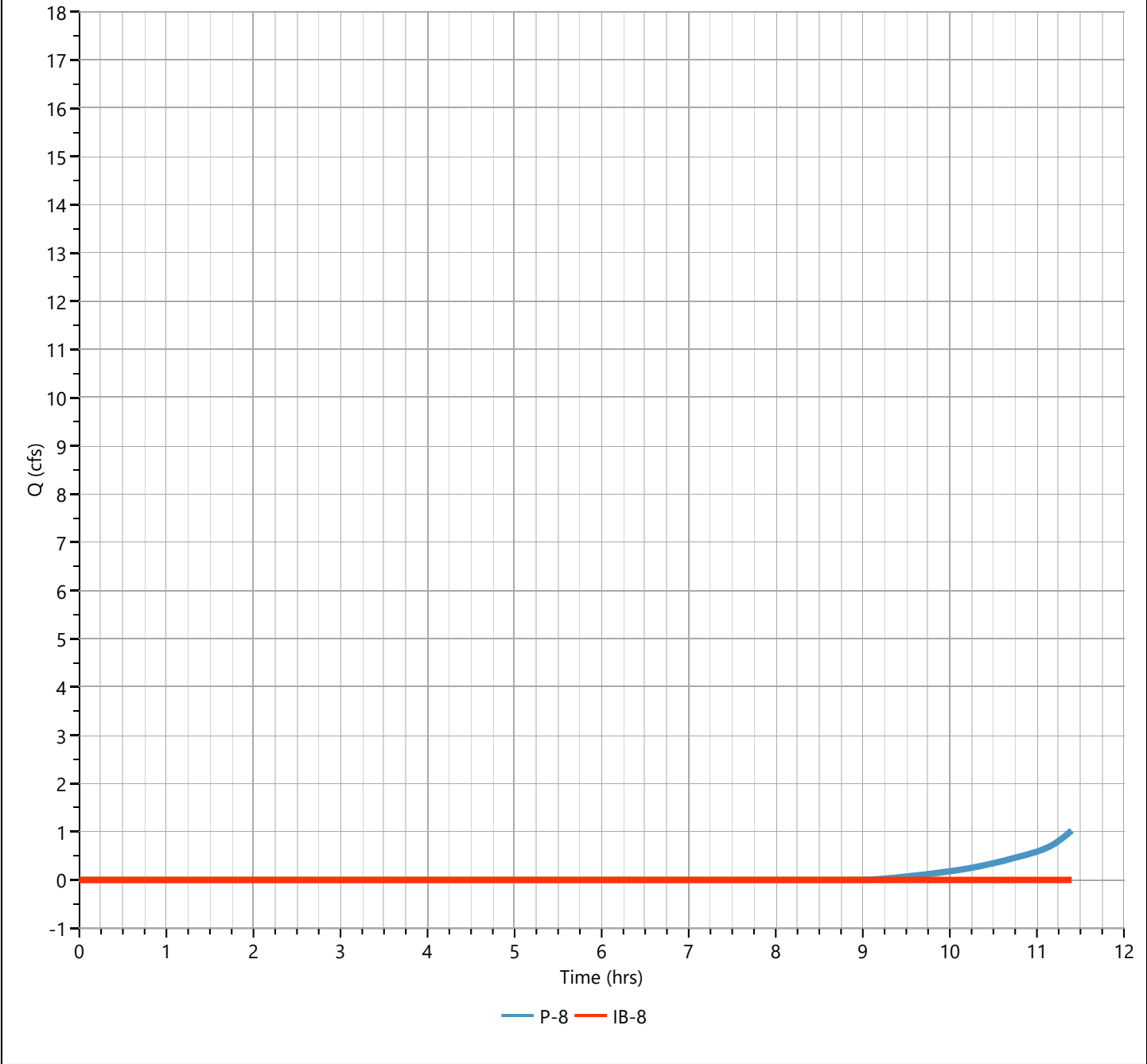
IB-8

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 11.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 46 - P-8	Max. Elevation	= 224.97 ft
Pond Name	= IB-8	Max. Storage	= 25,111 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs



# Pond Report

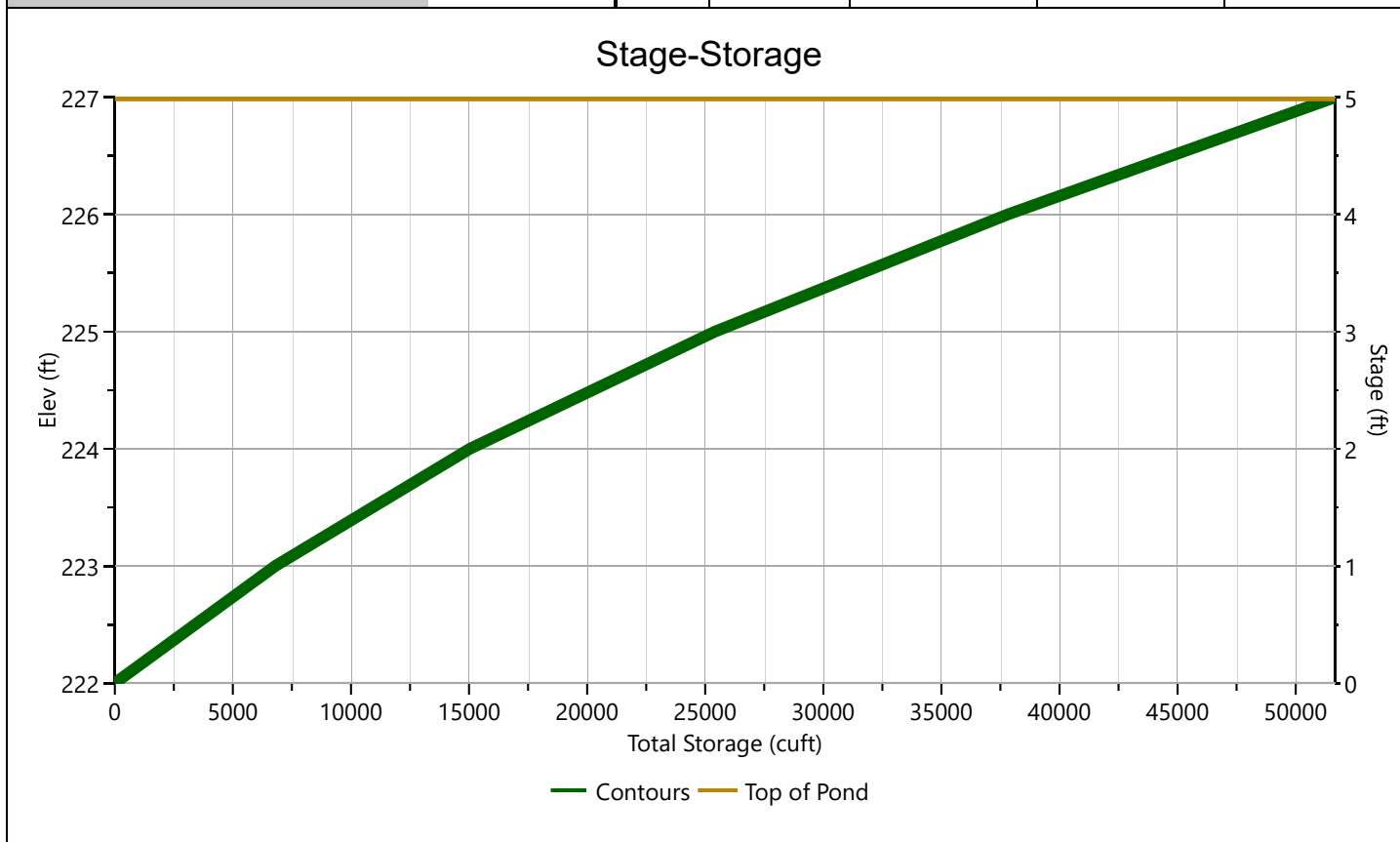
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

**IB-8**

## Stage-Storage

[illegible]

# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

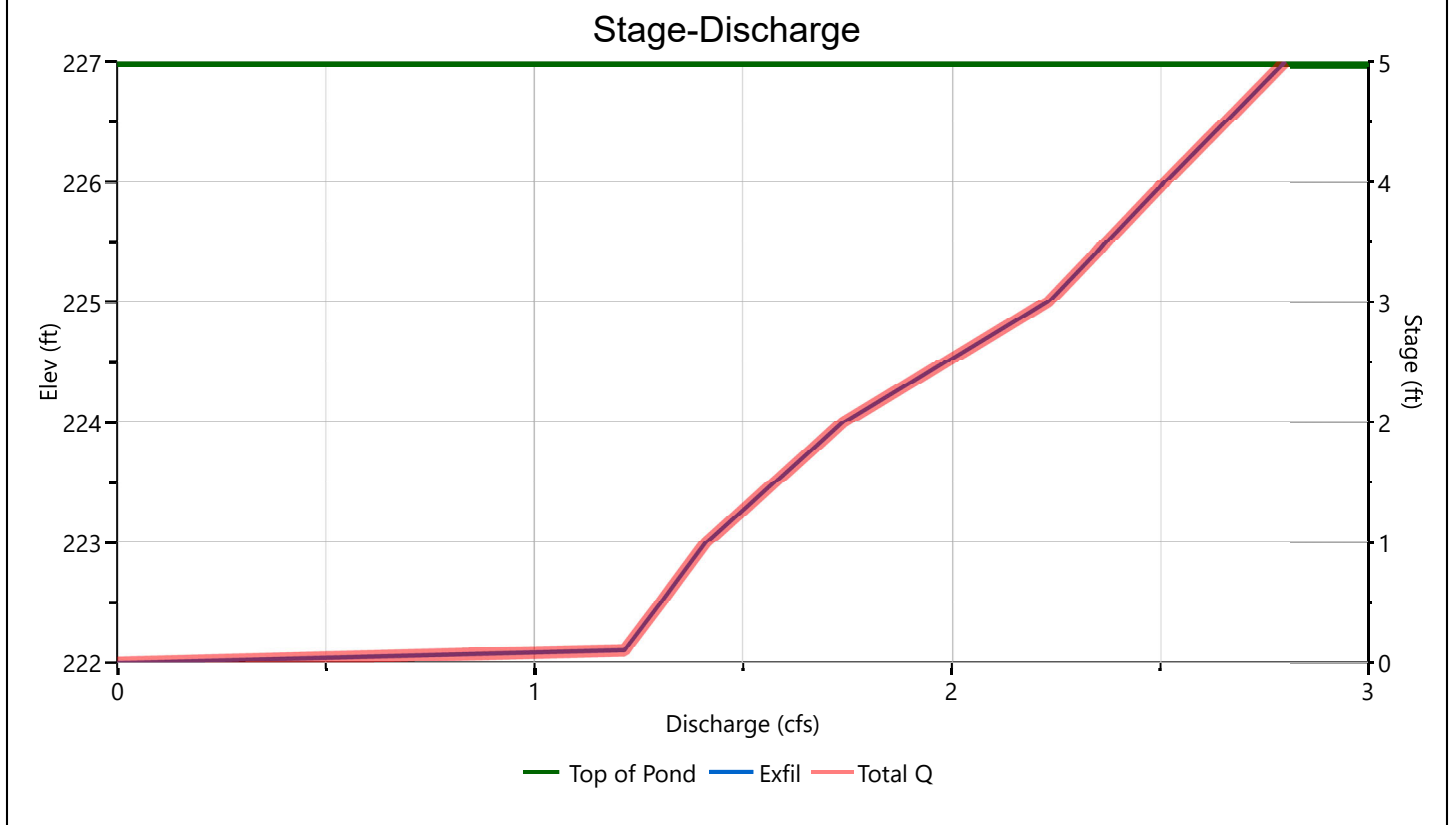
10-27-2022

## 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
Crest Elevation, ft					8.27**
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 3.0.0.21

10-27-2022

**IB-8**

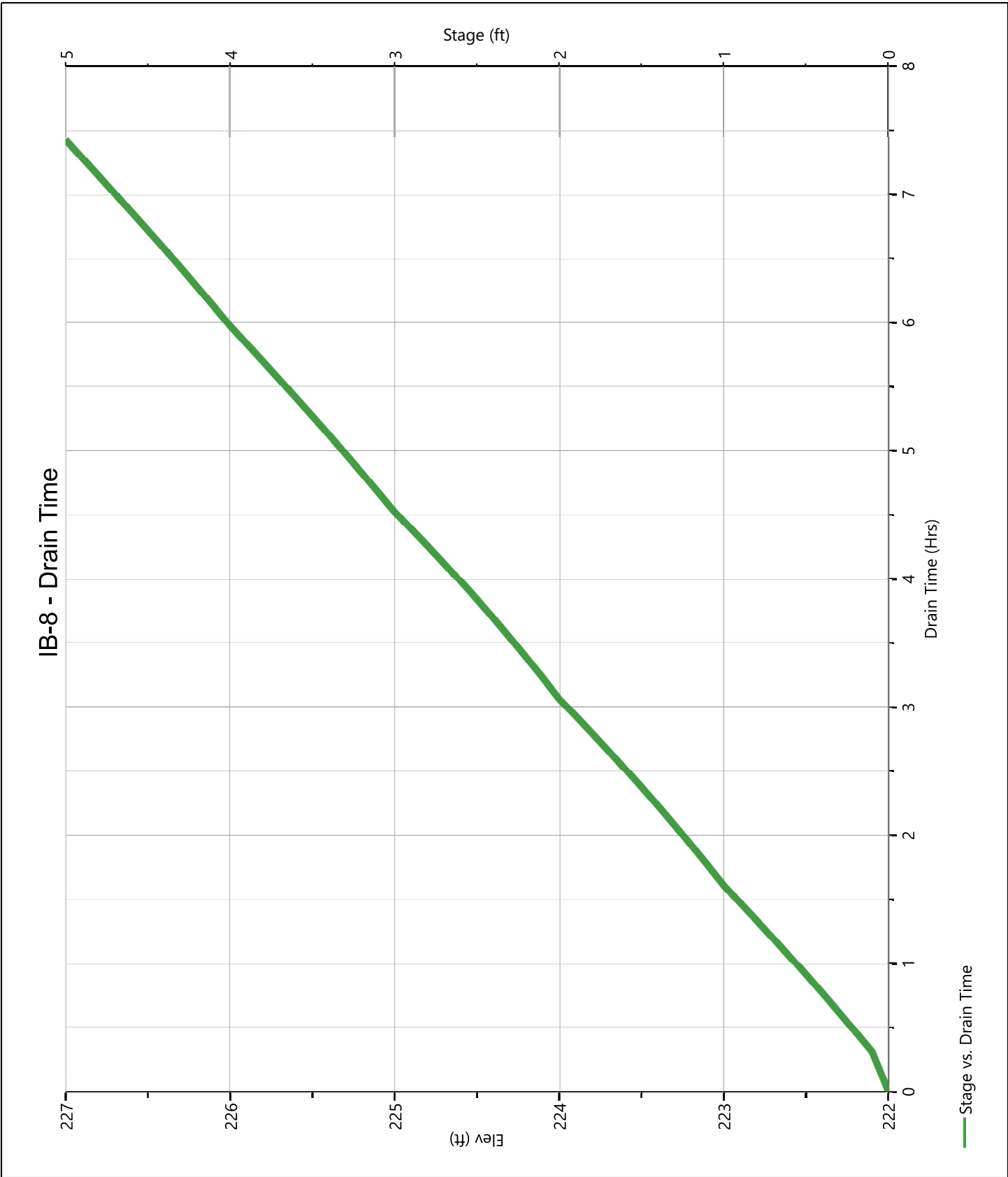
## Stage-Storage-Discharge Summary

[illegible]

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

IB-8

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By PFK Date 6/24/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			0.00	0.00
A	Woods Good Condition	30			1.73	51.77
A	Open Space Good Condition	39			1.43	55.89
A	Open Space Fair Condition	49			0.00	0.00
A	Gravel	76			0.14	10.92
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			5.28	369.48
C	Open Space Good Condition	74			1.19	88.14
C	Open Space Poor Condition	86			0.00	0.00
C	Gravel	89			0.12	11.00
D	BVW	77			0.35	26.97
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.		446305	Totals =		10.25	614.17

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{614.17}{10.25} = 59.94 ; \text{ Use CN} = \boxed{60}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.43	2.01	3.21

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present ☐ ☒ DevelopedSubcatchment P-10ACircle one: Tc ☐ ☐ Tt through  
subareaSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.38

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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.  $T_t = L / 3600V$ 

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:

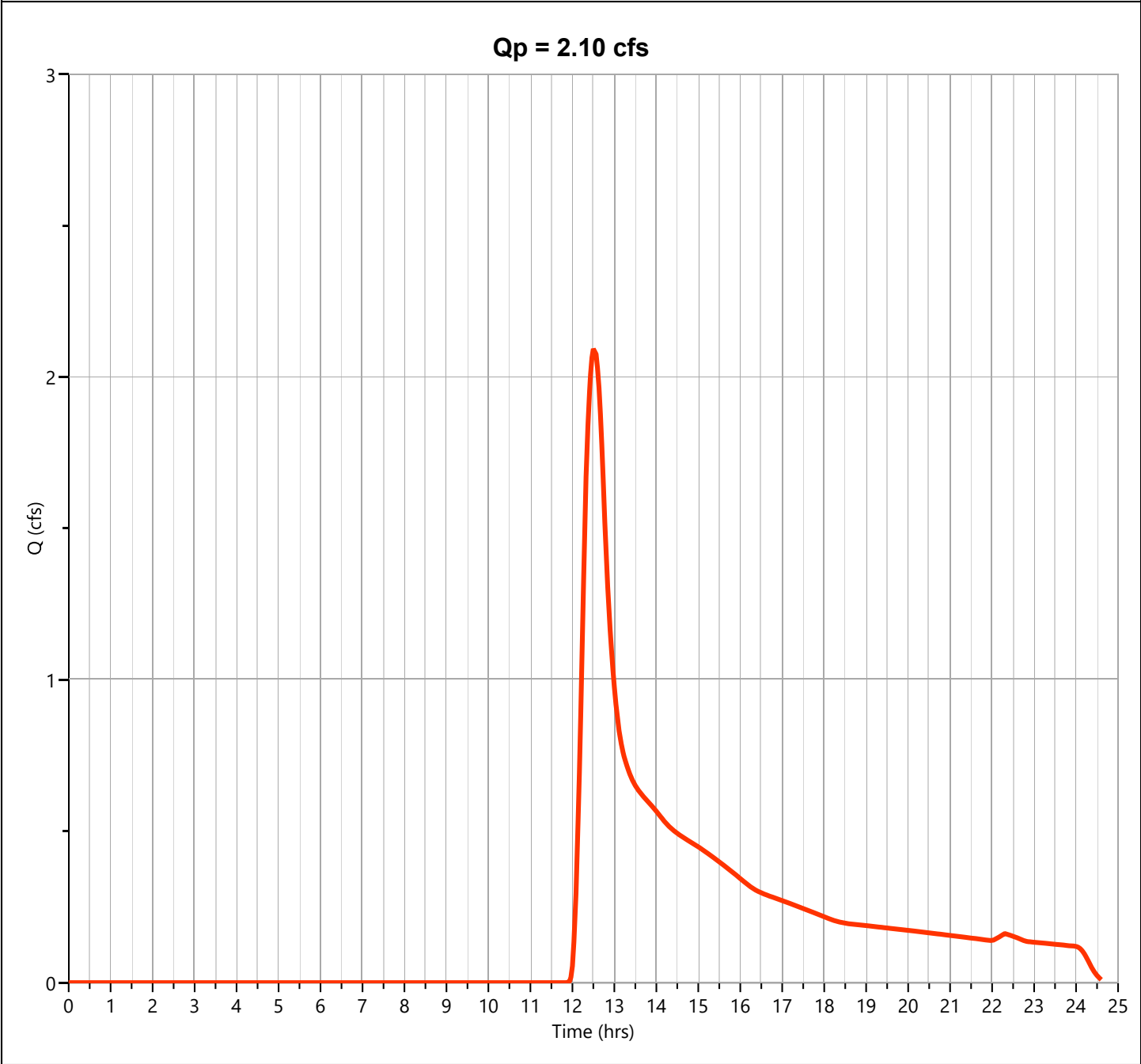
Hydrology Studio v 3.0.0.21

10-27-2022

P-10A

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.097 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Runoff Volume	= 16,218 cuft
Drainage Area	= 10.25 ac	Curve Number	= 60
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:

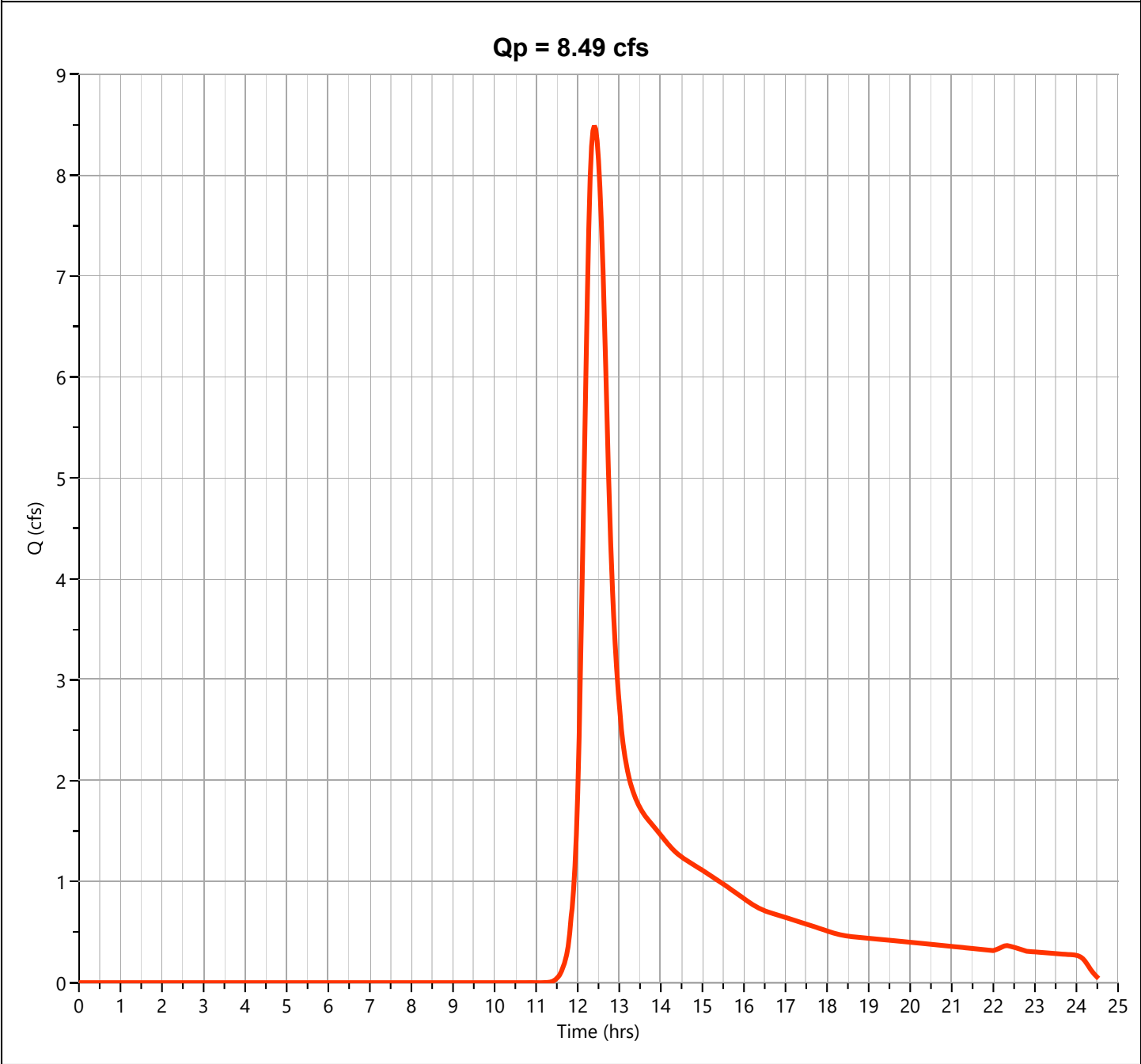
Hydrology Studio v 3.0.0.21

10-27-2022

P-10A

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.490 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 49,281 cuft
Drainage Area	= 10.25 ac	Curve Number	= 60
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:

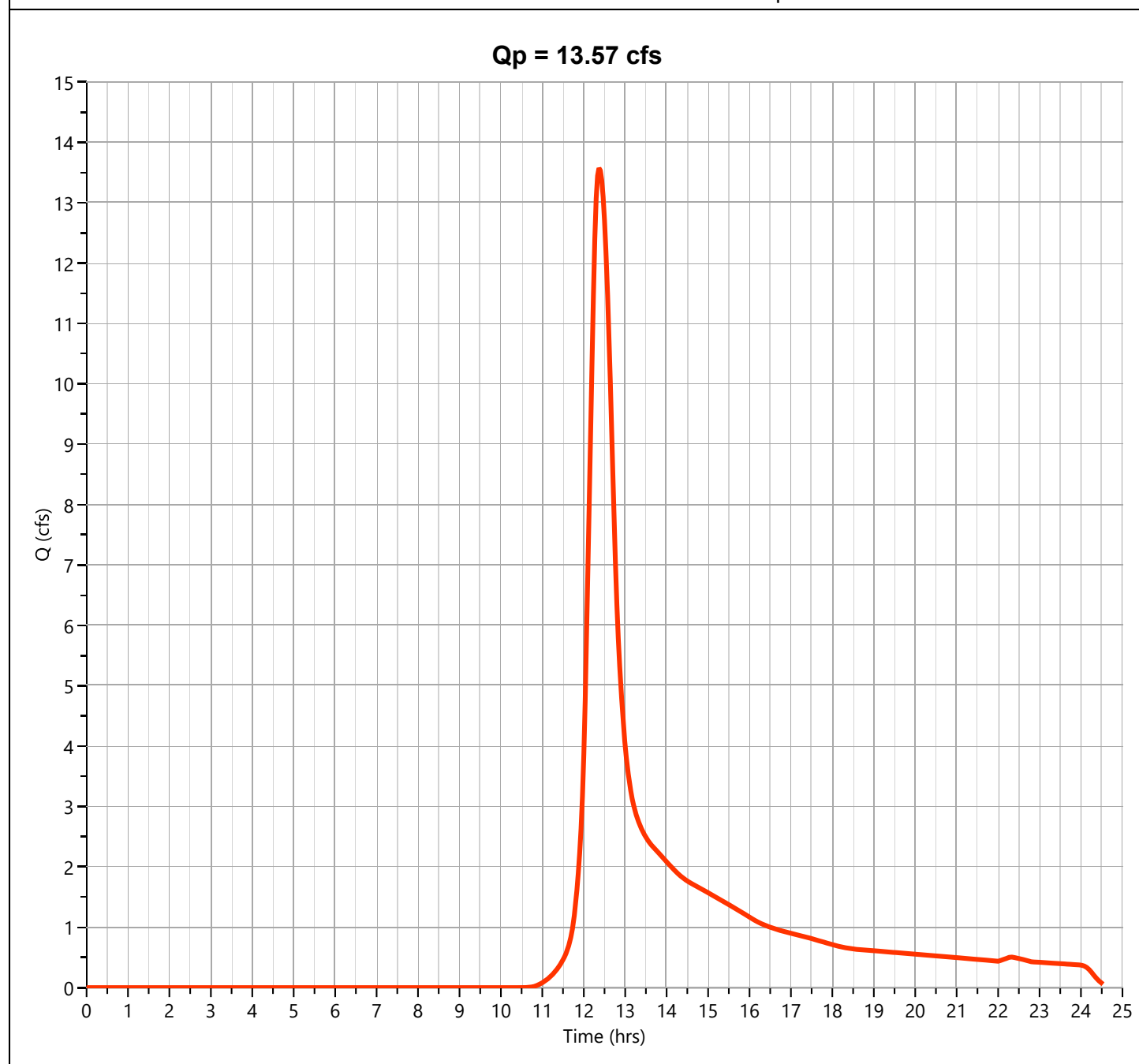
Hydrology Studio v 3.0.0.21

10-27-2022

**P-10A**

**Hyd. No. 53**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.57 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 74,925 cuft
Drainage Area	= 10.25 ac	Curve Number	= 60
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:

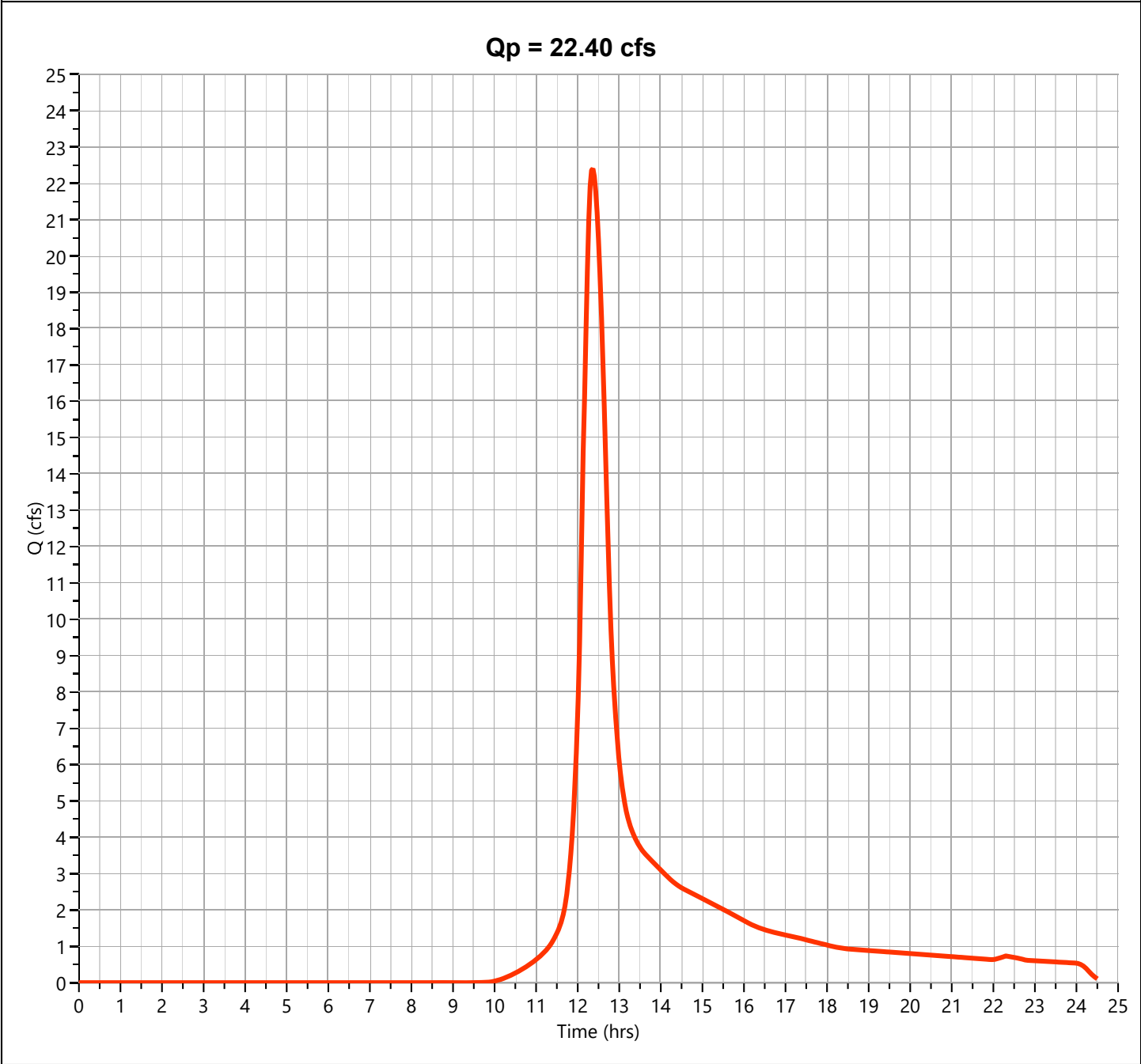
Hydrology Studio v 3.0.0.21

10-27-2022

P-10A

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 22.40 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 119,578 cuft
Drainage Area	= 10.25 ac	Curve Number	= 60
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 PFK' Date 6/24/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious	98			1.68	164.30
A	Woods Good Condition	30			0.00	0.00
A	Open Space Good Condition	39			0.52	20.21
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			0.70	52.16
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.		126303	Totals =		2.90	236.67

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{236.67}{2.90} = 81.62 ; \text{ Use CN} = \boxed{82}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.57	4.08	5.66

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present 

Developed
-----------

Circle one: Tc 

Tt
----

through  
subareaSubcatchment P-10BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.14

A-B		
LAWN		
0.24		
50		
3.1		
0.020		
0.14		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.03

B-C		
UNPAVED		
231		
0.020		
2.28		
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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr  
min0.17  
10.0

# Hydrograph Report

Project Name:

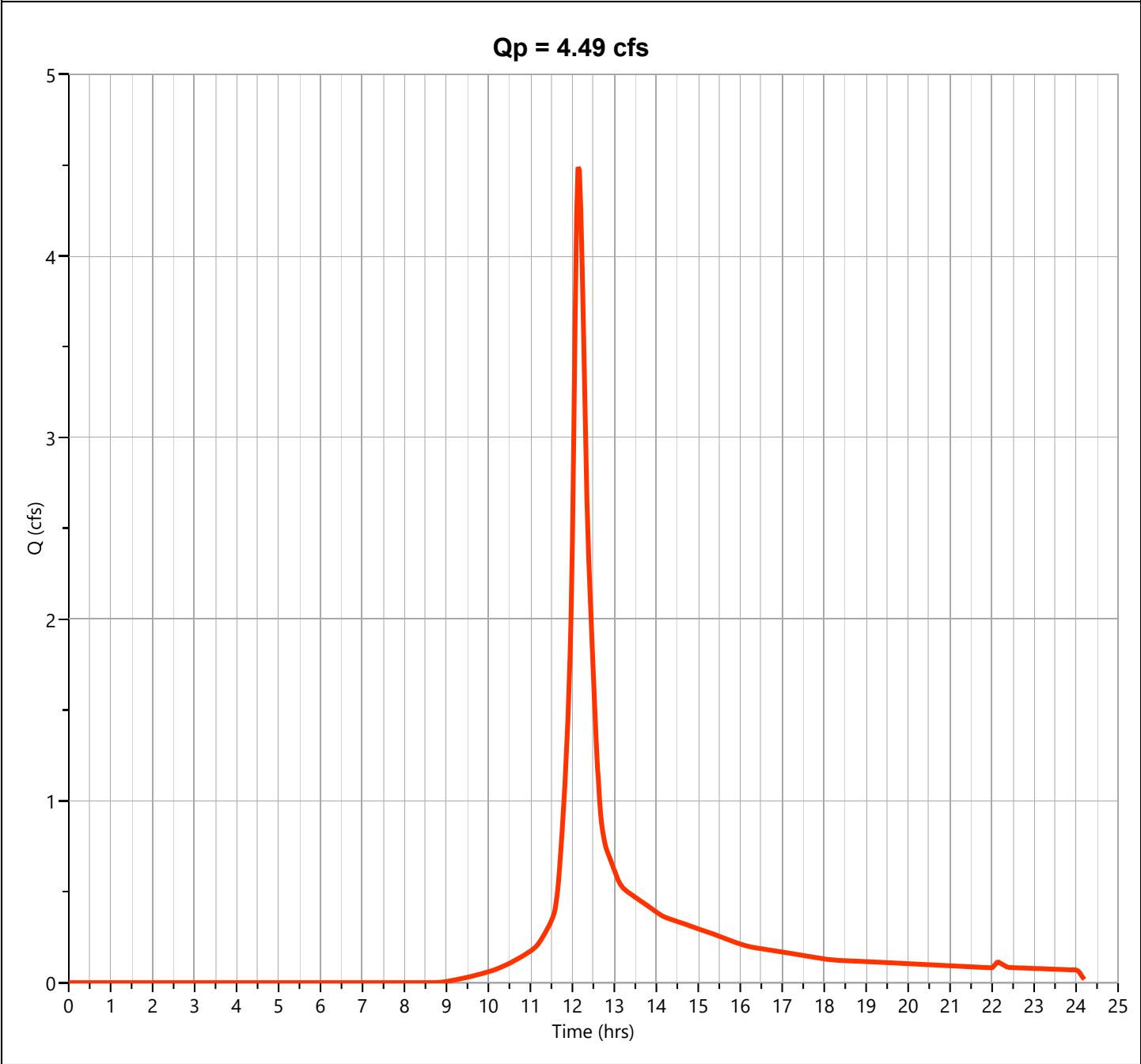
Hydrology Studio v 3.0.0.21

10-27-2022

P-10B

Hyd. No. 54

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.488 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 17,311 cuft
Drainage Area	= 2.9 ac	Curve Number	= 82
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:

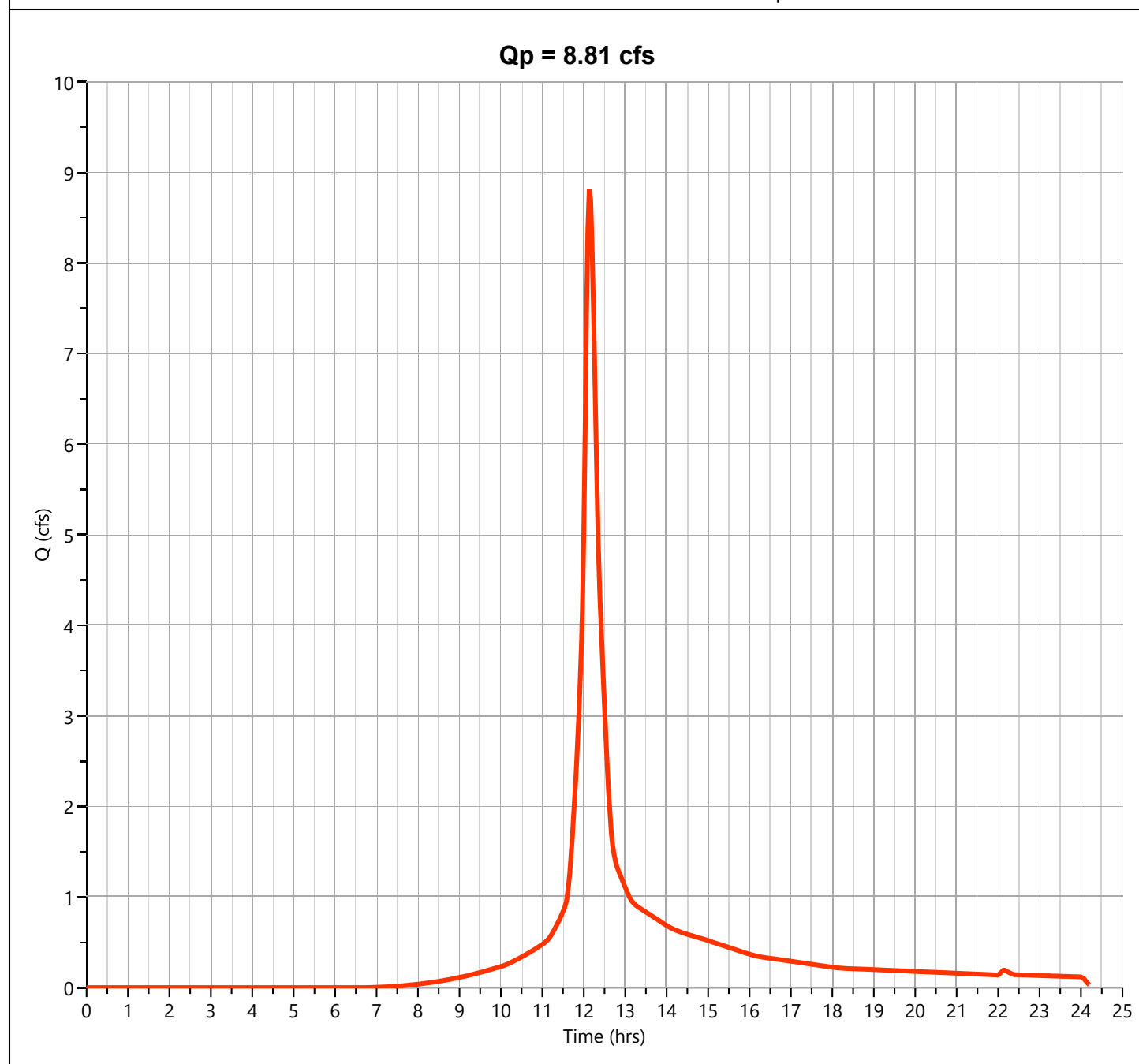
Hydrology Studio v 3.0.0.21

10-27-2022

**P-10B**

**Hyd. No. 54**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.811 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 33,815 cuft
Drainage Area	= 2.9 ac	Curve Number	= 82
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:

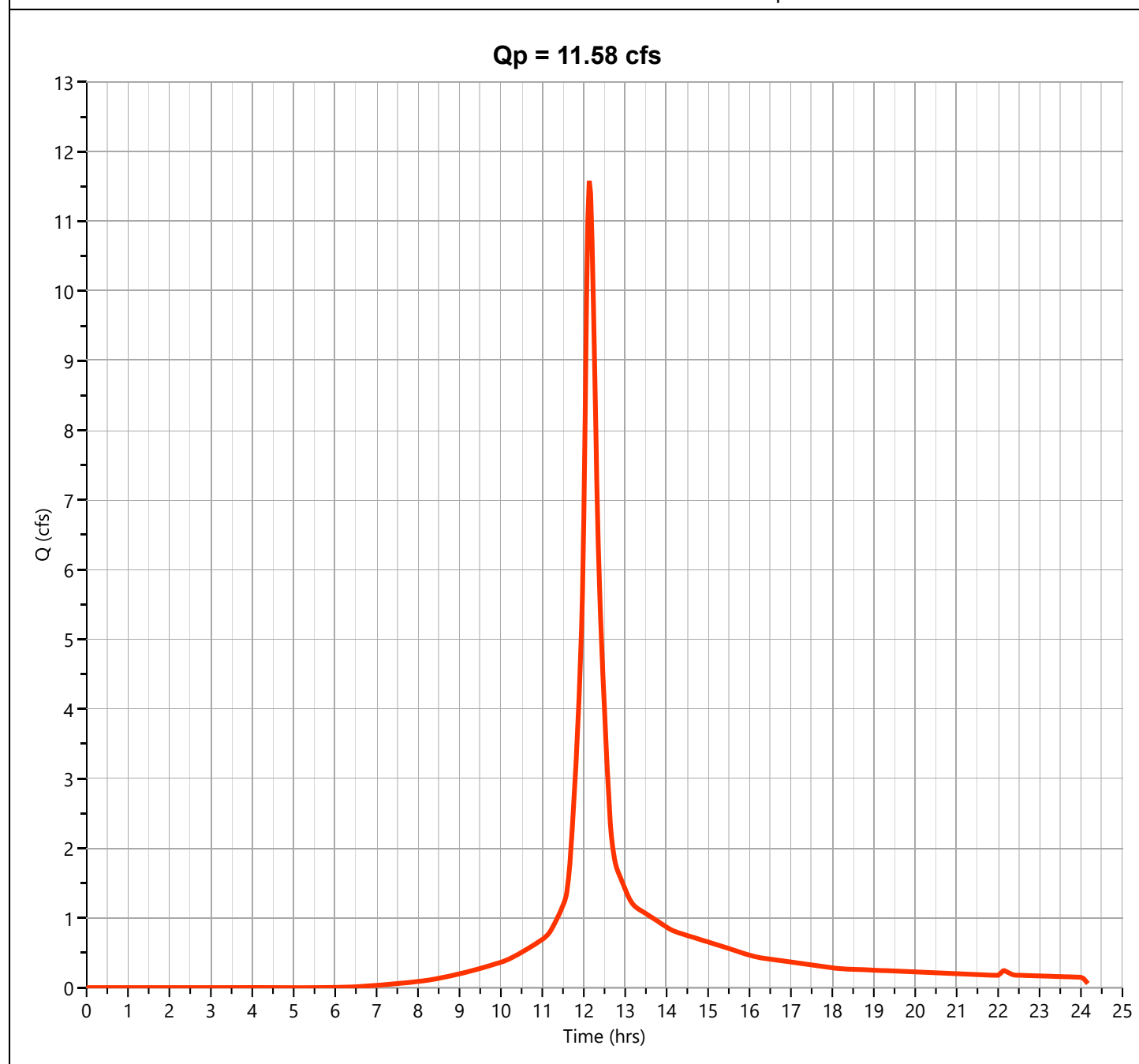
Hydrology Studio v 3.0.0.21

10-27-2022

**P-10B**

**Hyd. No. 54**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.58 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 44,684 cuft
Drainage Area	= 2.9 ac	Curve Number	= 82
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:

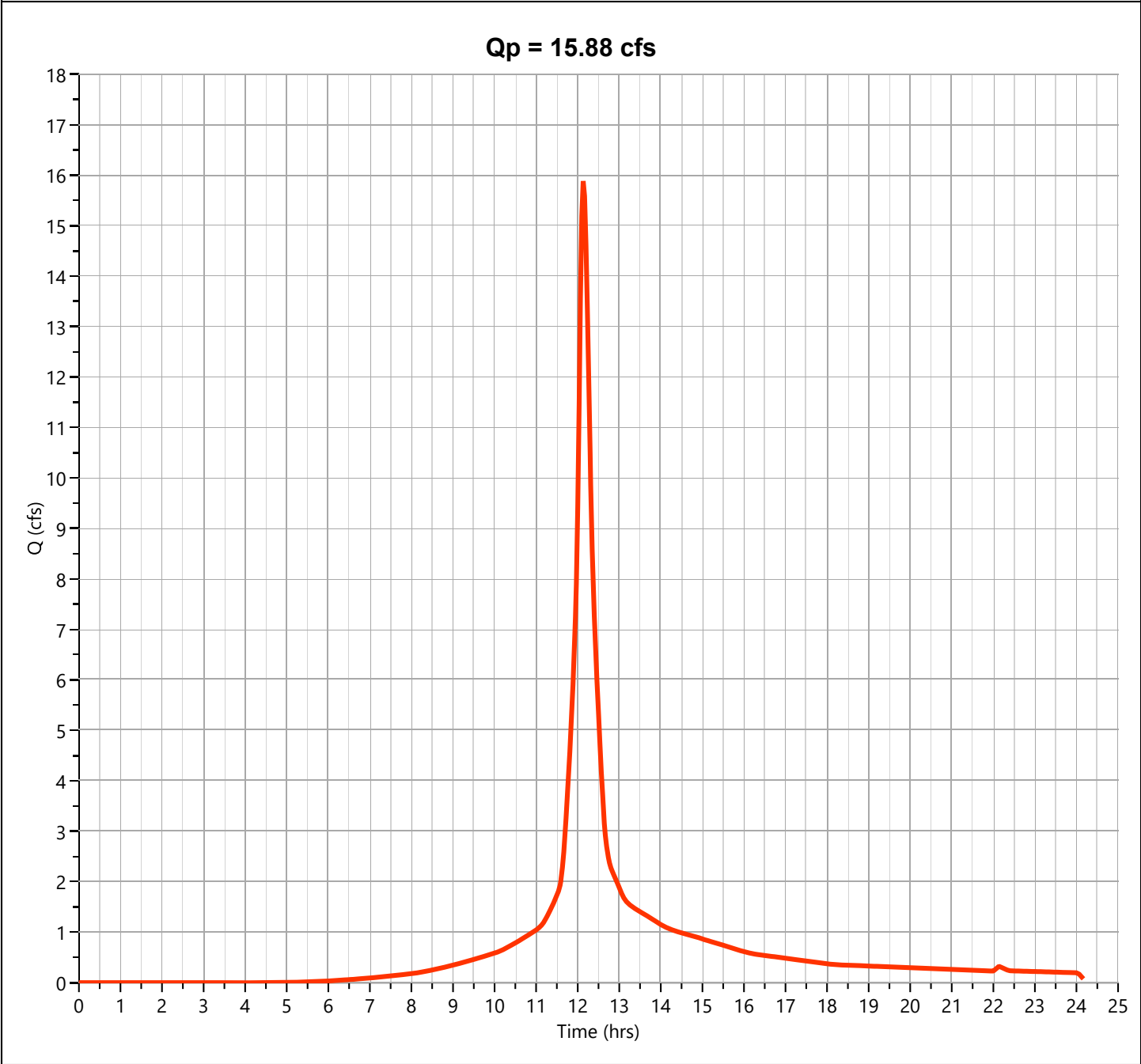
Hydrology Studio v 3.0.0.21

10-27-2022

P-10B

Hyd. No. 54

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.88 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 61,966 cuft
Drainage Area	= 2.9 ac	Curve Number	= 82
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 3.0.0.21

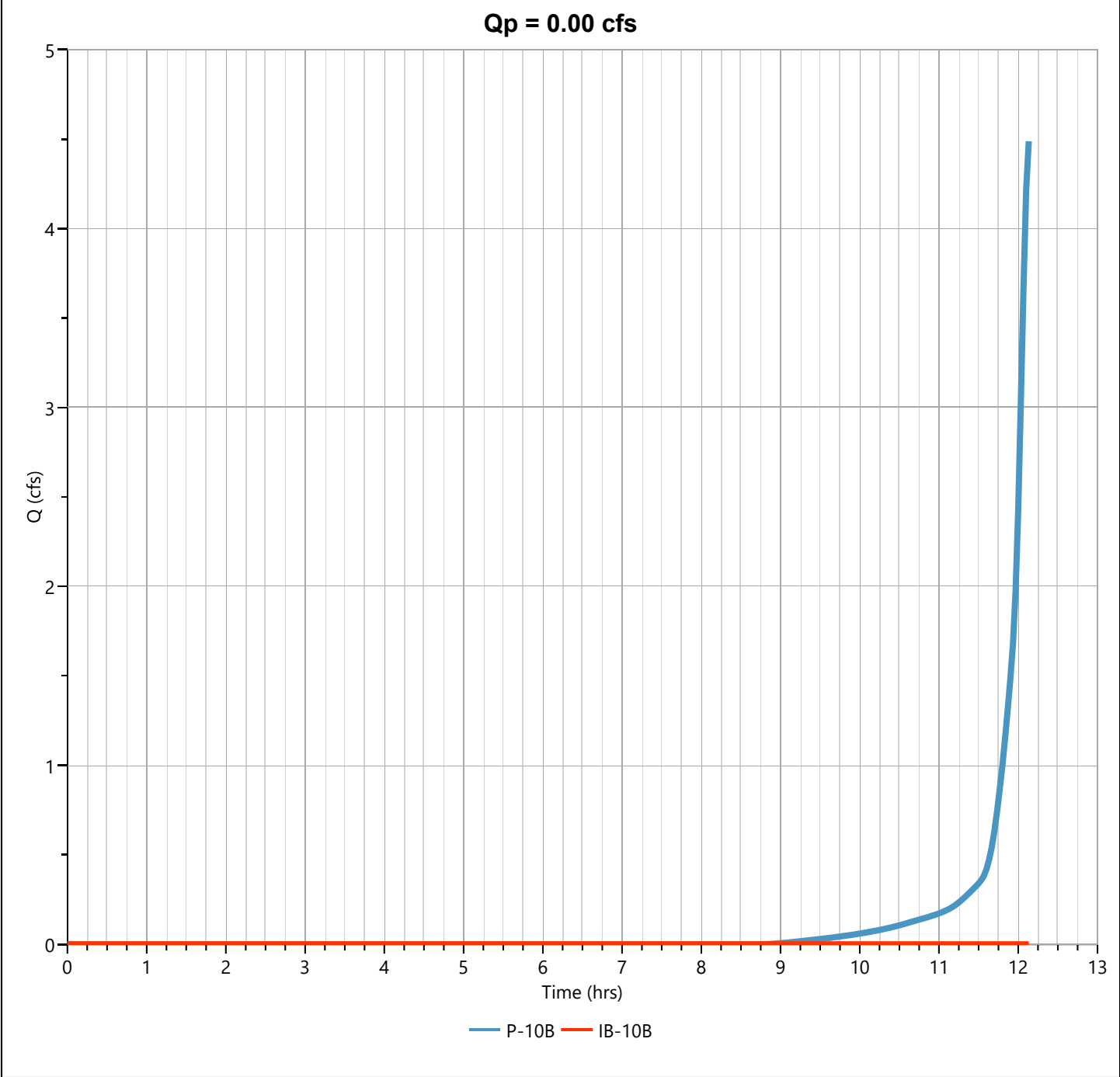
10-27-2022

IB-10B

Hyd. No. 55

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 54 - P-10B	Max. Elevation	= 225.90 ft
Pond Name	= IB-10B	Max. Storage	= 4,886 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

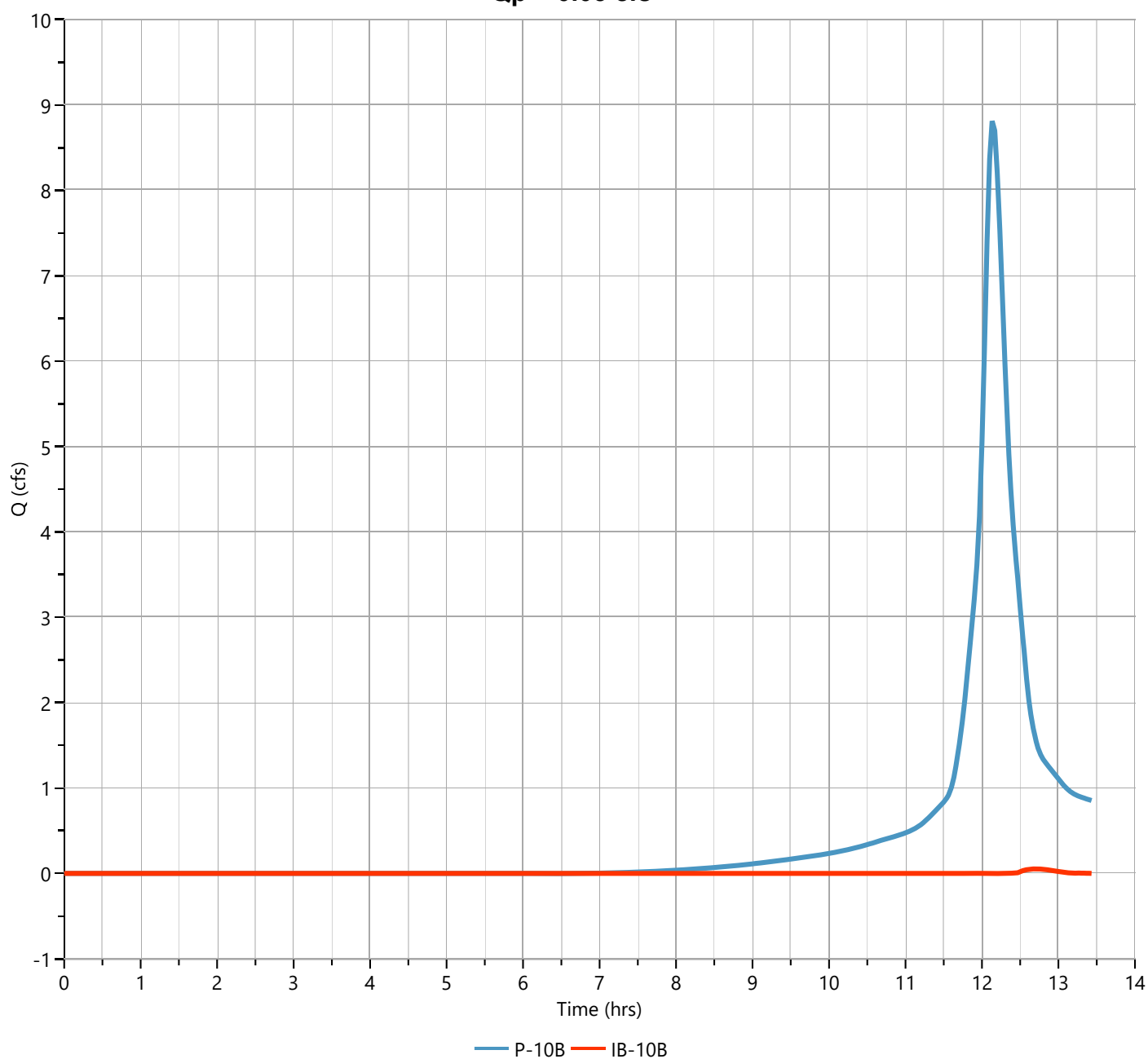
**IB-10B**

**Hyd. No. 55**

Hydrograph Type	= Pond Route	Peak Flow	= 0.053 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.67 hrs
Time Interval	= 2 min	Hydrograph Volume	= 88.3 cuft
Inflow Hydrograph	= 54 - P-10B	Max. Elevation	= 226.88 ft
Pond Name	= IB-10B	Max. Storage	= 11,821 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.05 cfs**





# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

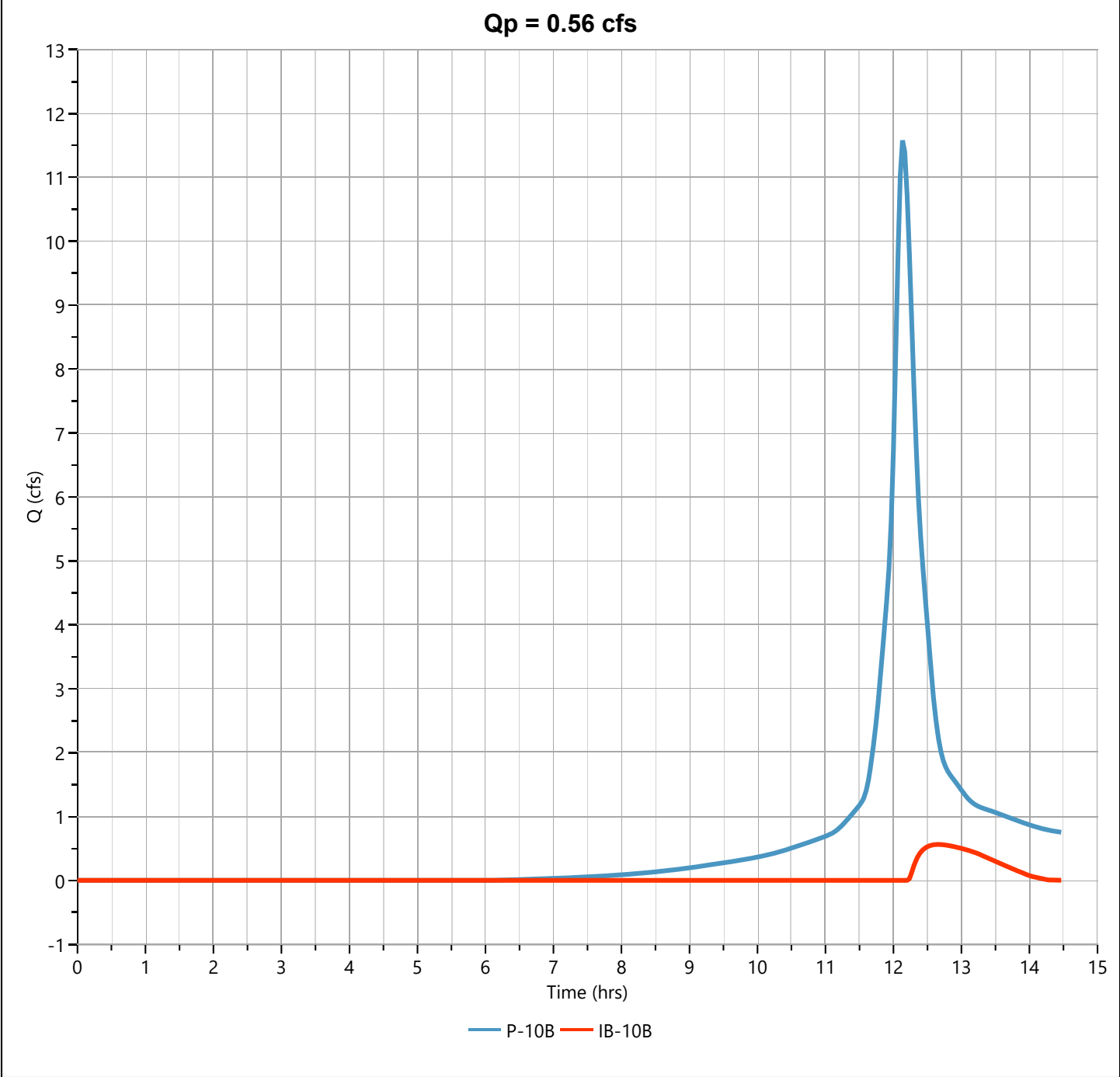
10-27-2022

IB-10B

Hyd. No. 55

Hydrograph Type	= Pond Route	Peak Flow	= 0.563 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.67 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,416 cuft
Inflow Hydrograph	= 54 - P-10B	Max. Elevation	= 227.36 ft
Pond Name	= IB-10B	Max. Storage	= 16,025 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

IB-10B

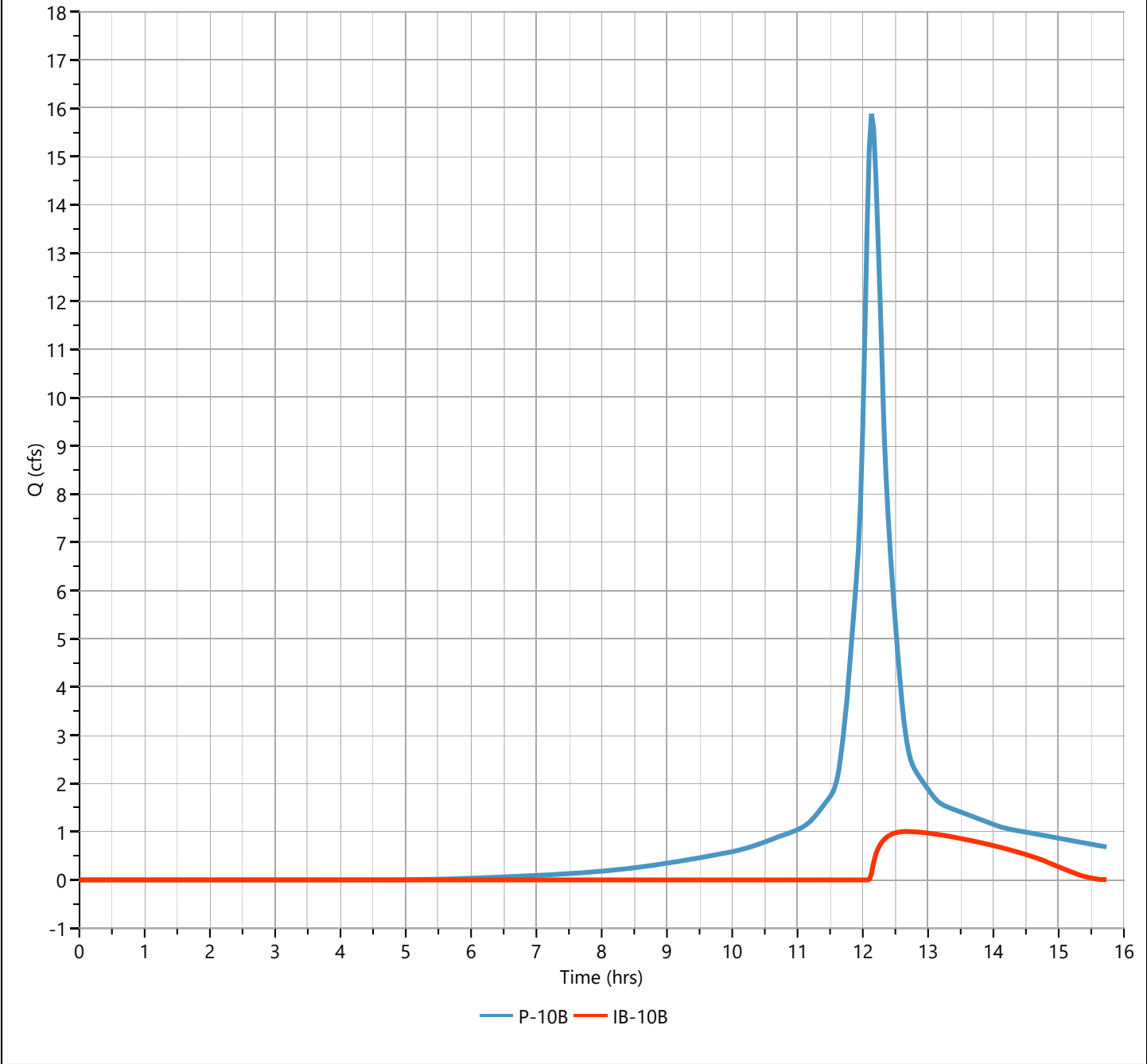
Hyd. No. 55

Hydrograph Type	= Pond Route	Peak Flow	= 1.003 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.67 hrs
Time Interval	= 2 min	Hydrograph Volume	= 7,962 cuft
Inflow Hydrograph	= 54 - P-10B	Max. Elevation	= 228.13 ft
Pond Name	= IB-10B	Max. Storage	= 23,335 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5 min

Qp = 1.00 cfs



# Pond Report

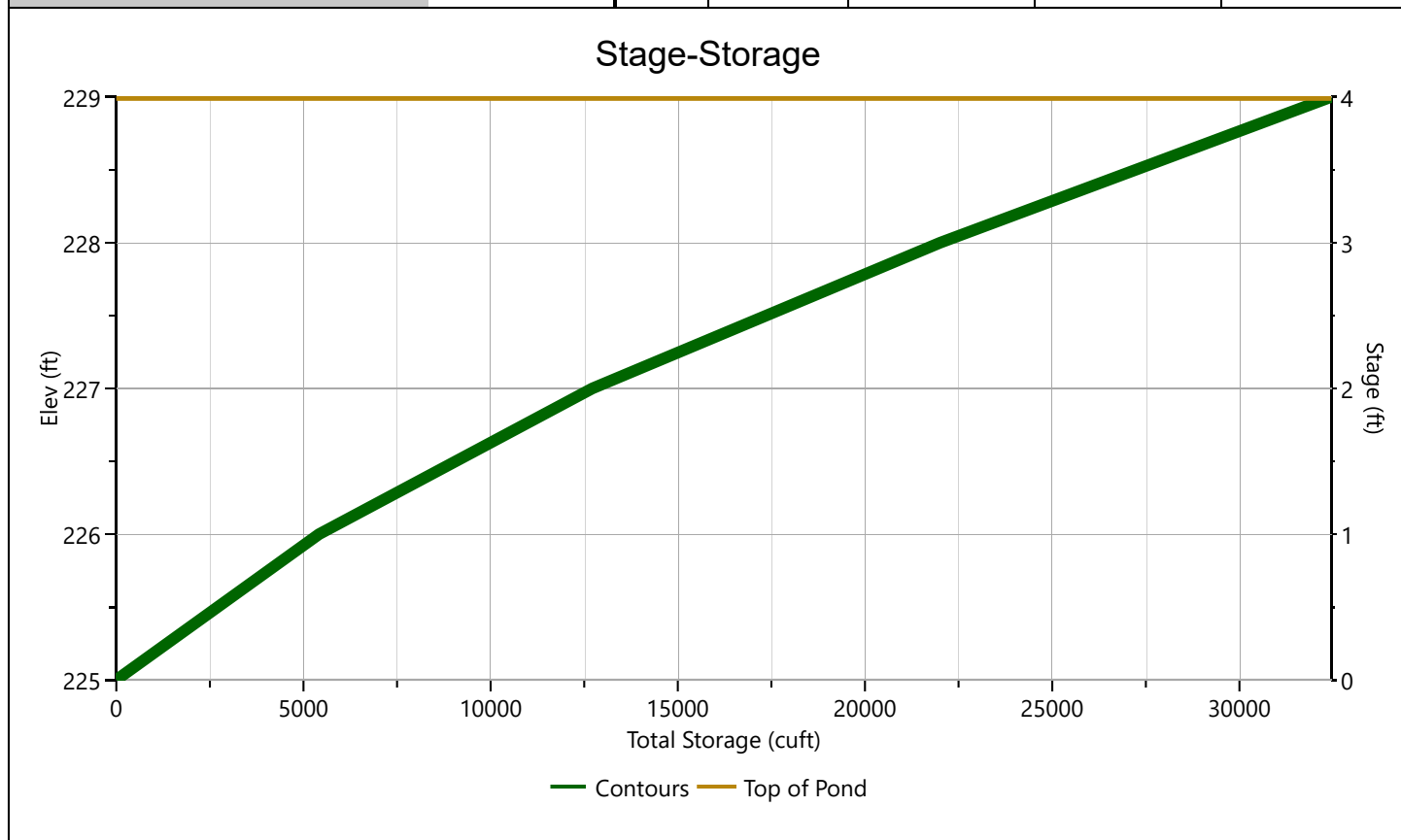
Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

# IB-10B

## Stage-Storage

[illegible]

# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

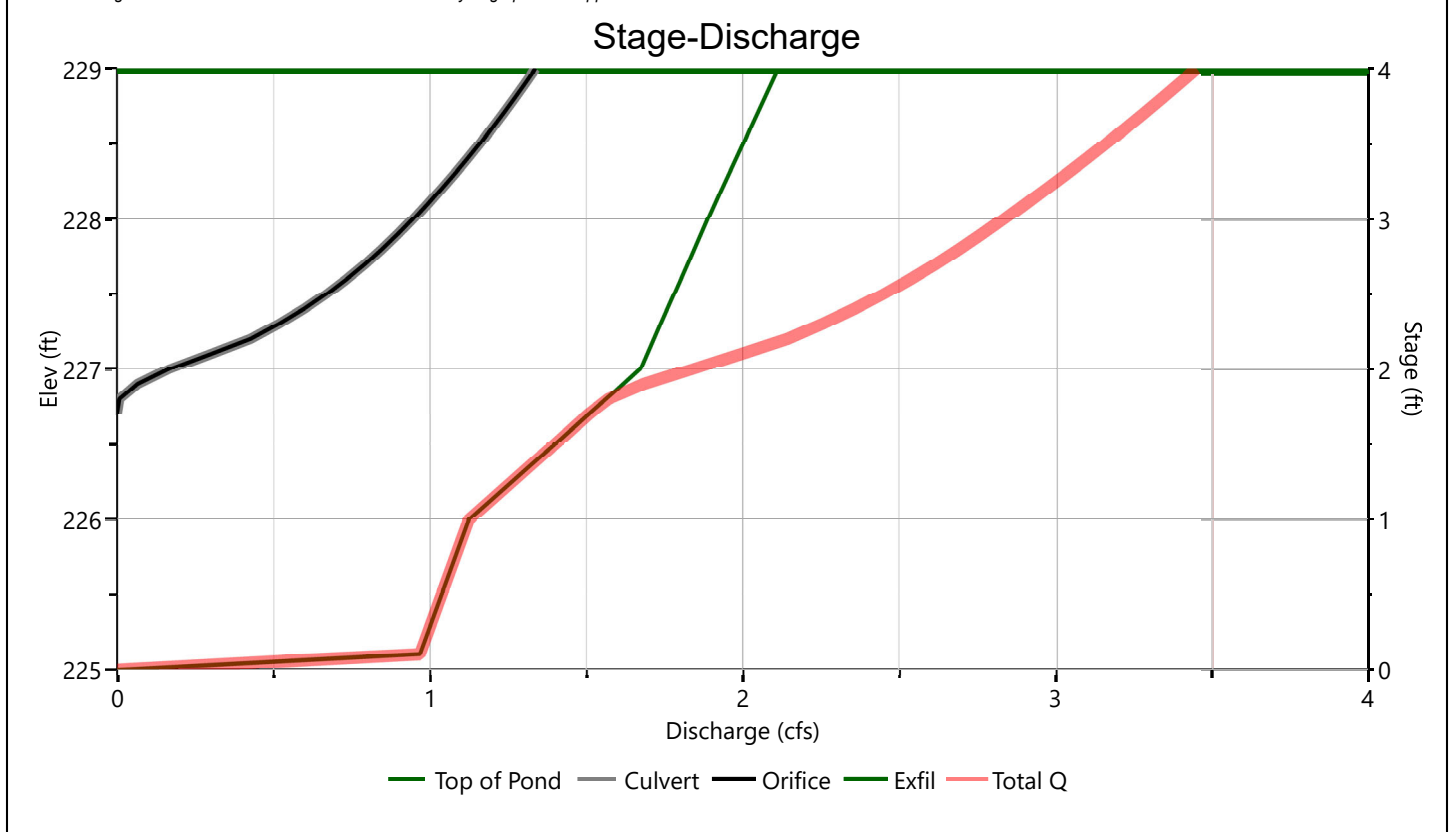
10-27-2022

## IB-10B

## Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	18	6			Hole Diameter, in
Span, in	18	6			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	225.00	226.75			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	55				
Barrel Slope, %	2				
N-Value, n	0.012				
Weirs	Riser*	Weirs			Ancillary
		1	2	3	
Shape / Type	Circular				Exfiltration, in/hr
Crest Elevation, ft					8.27**
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 3.0.0.21

10-27-2022

**IB-10B**

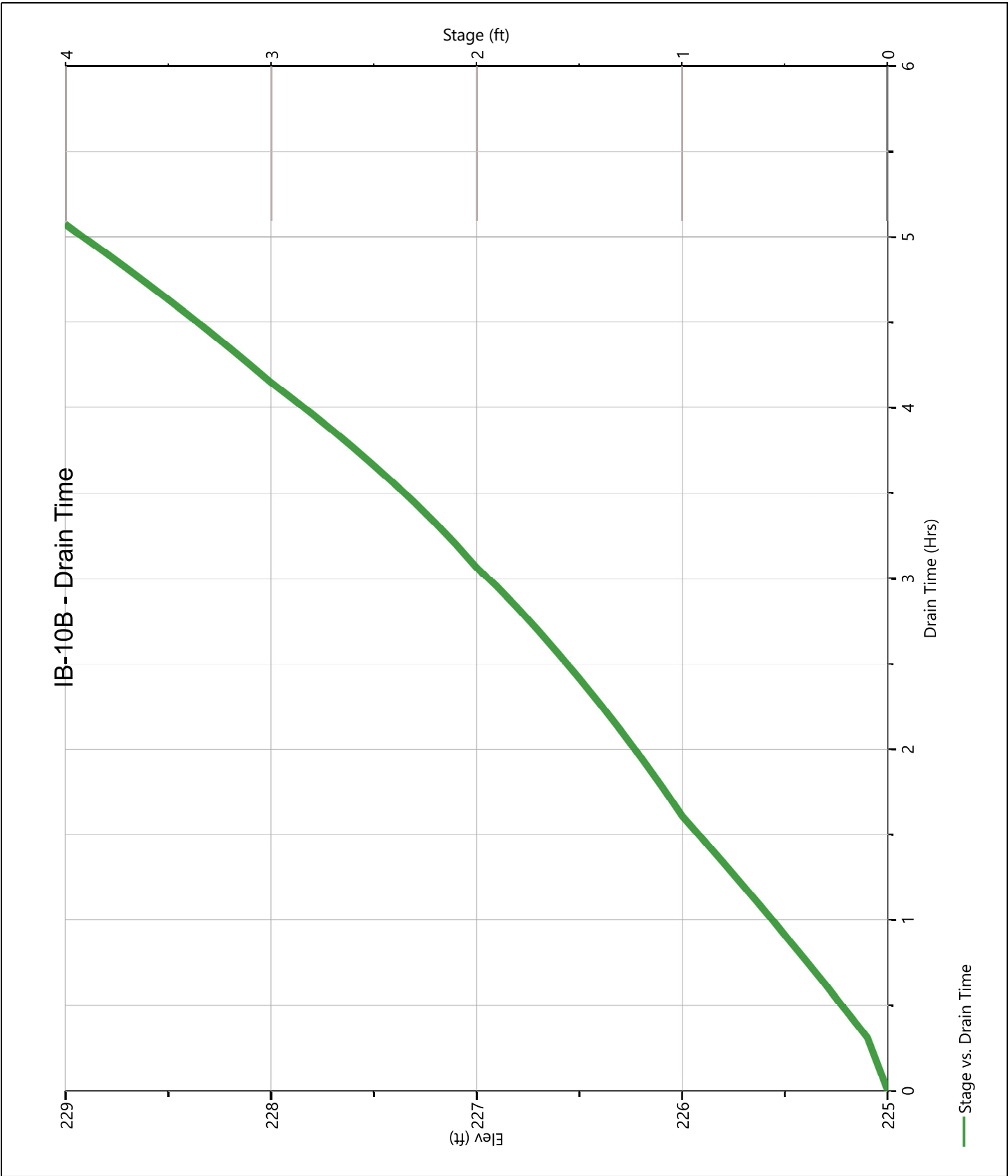
### Stage-Storage-Discharge Summary

[illegible]

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

IB-10B

Pond Drawdown



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By PFK Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☒ Developed Subcatchment P-9B

## 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			1.01	98.85
A	Woods	Good Condition	30			1.54	46.08
A	Open Space	Good Condition	39			1.06	41.53
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
C	Gravel		89			0.00	0.00
C	Woods	Good Condition	70			4.90	343.20
C	Open Space	Good Condition	74			3.41	252.00
D	Open Space	Good Condition	80			0.00	0.00
D	Open Space	Fair Condition	84			0.00	0.00
D	Woods	Good Condition	77			0.00	0.00
1/ Use only one CN source per line.			519132			Totals = 11.92	781.65

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{781.65}{11.92} = 65.59 ; \text{ Use CN} = \boxed{66}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.66	2.51	3.83

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 10/13/2022Location: Stow, MAChecked                     Rev Date                     Date                     Circle one: Present 

Developed
-----------

Circle one: Tc 

Tt
----

through  
subareaSubcatchment P-9BSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.26

A-B		
WOODS		
0.6		
50		
3.1		
0.026		
0.26		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.04

B-C		
UNPAVED		
629		
0.080		
4.56		
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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr

0.30

min

17.9



# Hydrograph Report

Project Name:

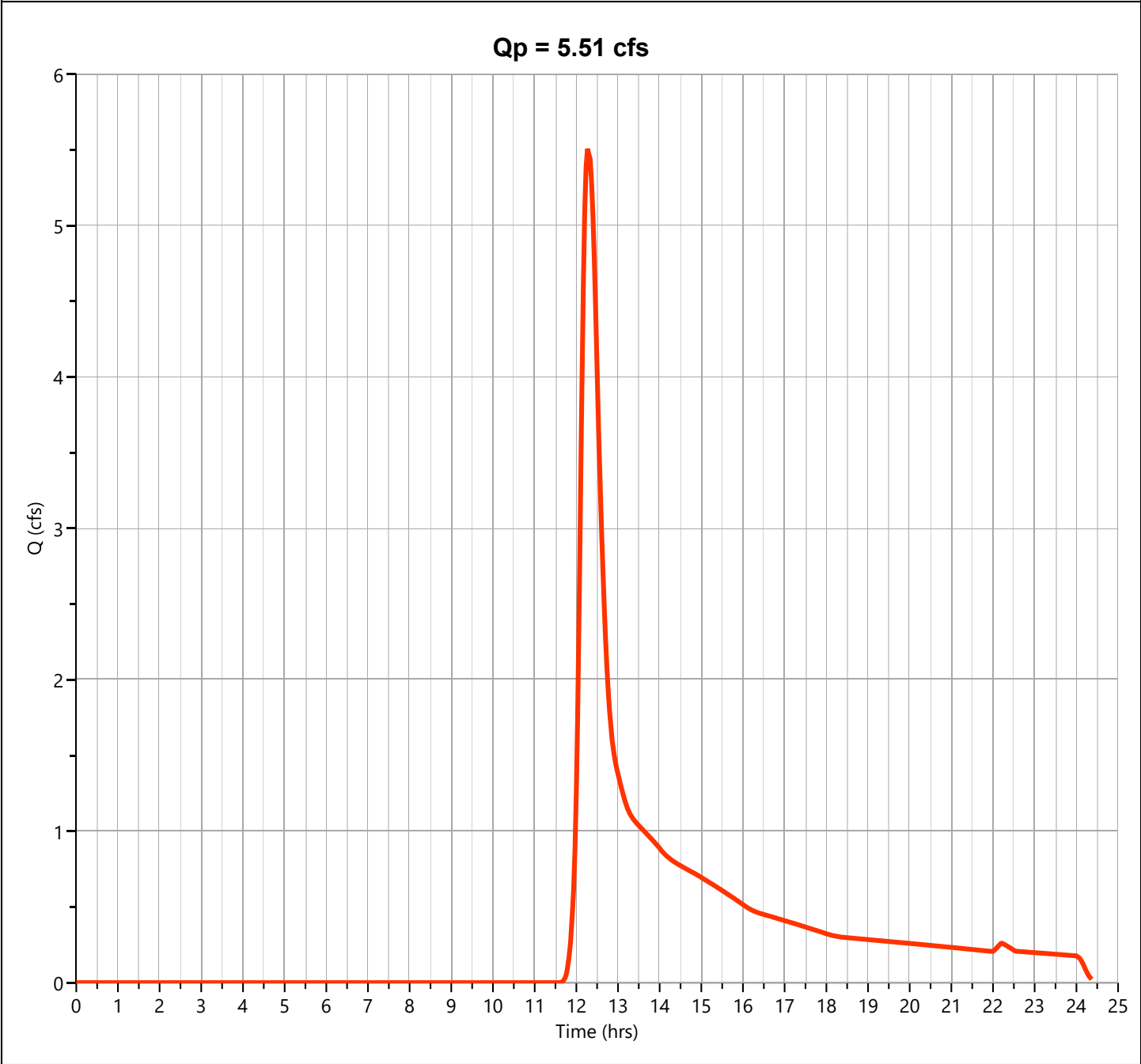
Hydrology Studio v 3.0.0.21

10-27-2022

P-9B

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.513 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 29,366 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

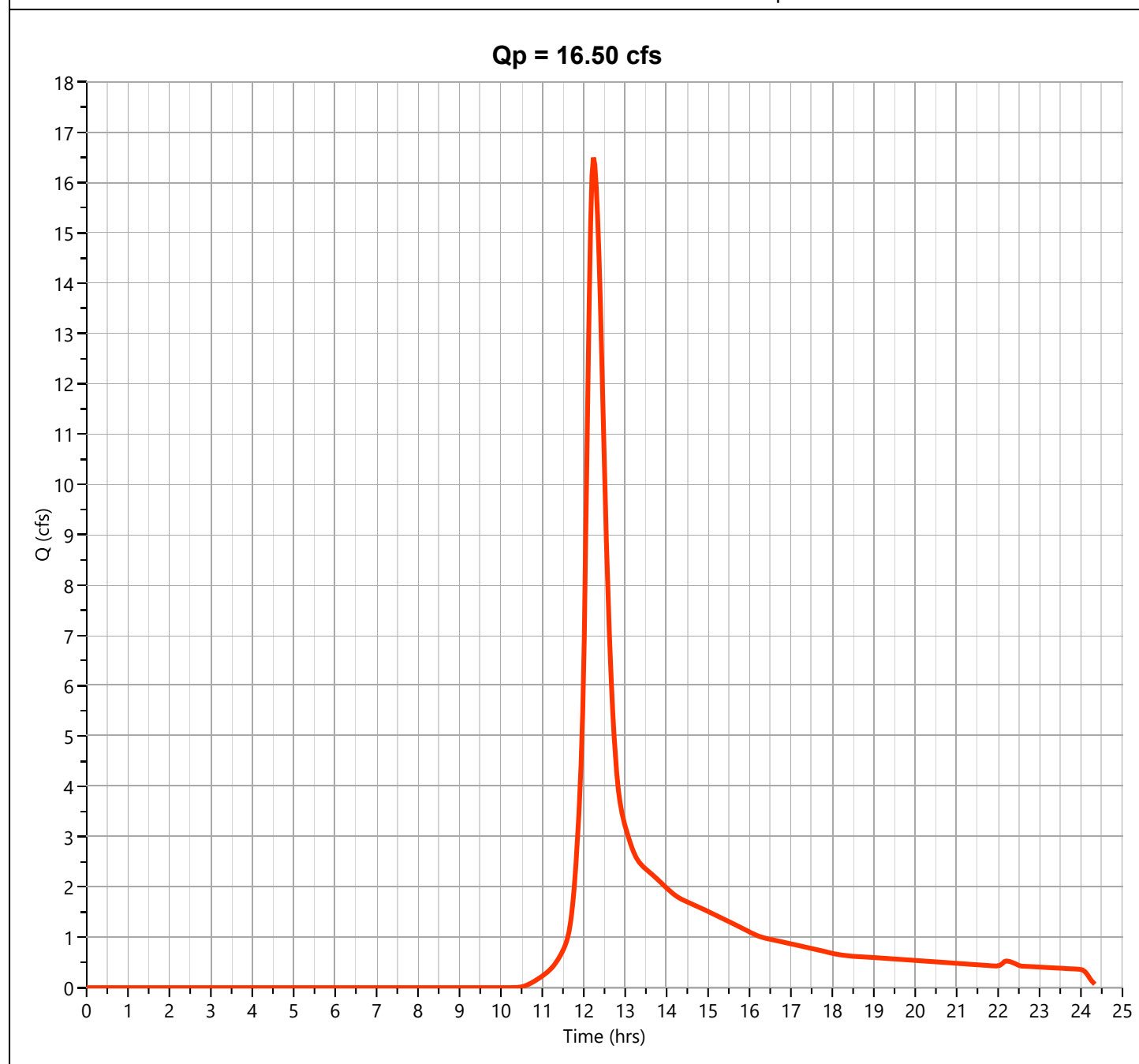
Hydrology Studio v 3.0.0.21

10-27-2022

**P-9B**

**Hyd. No. 49**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 16.50 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 75,937 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

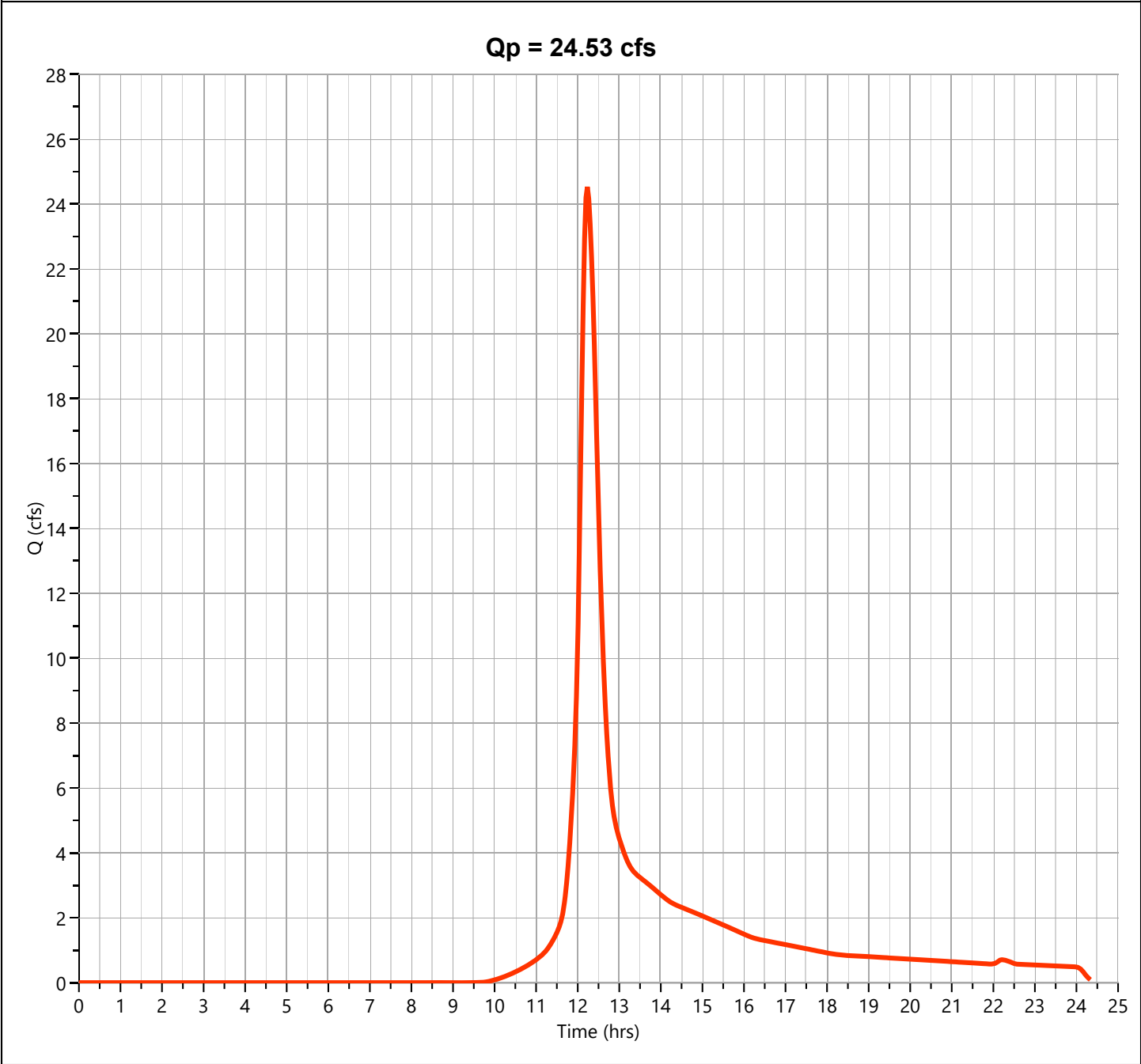
Hydrology Studio v 3.0.0.21

10-27-2022

P-9B

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 24.53 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 110,097 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

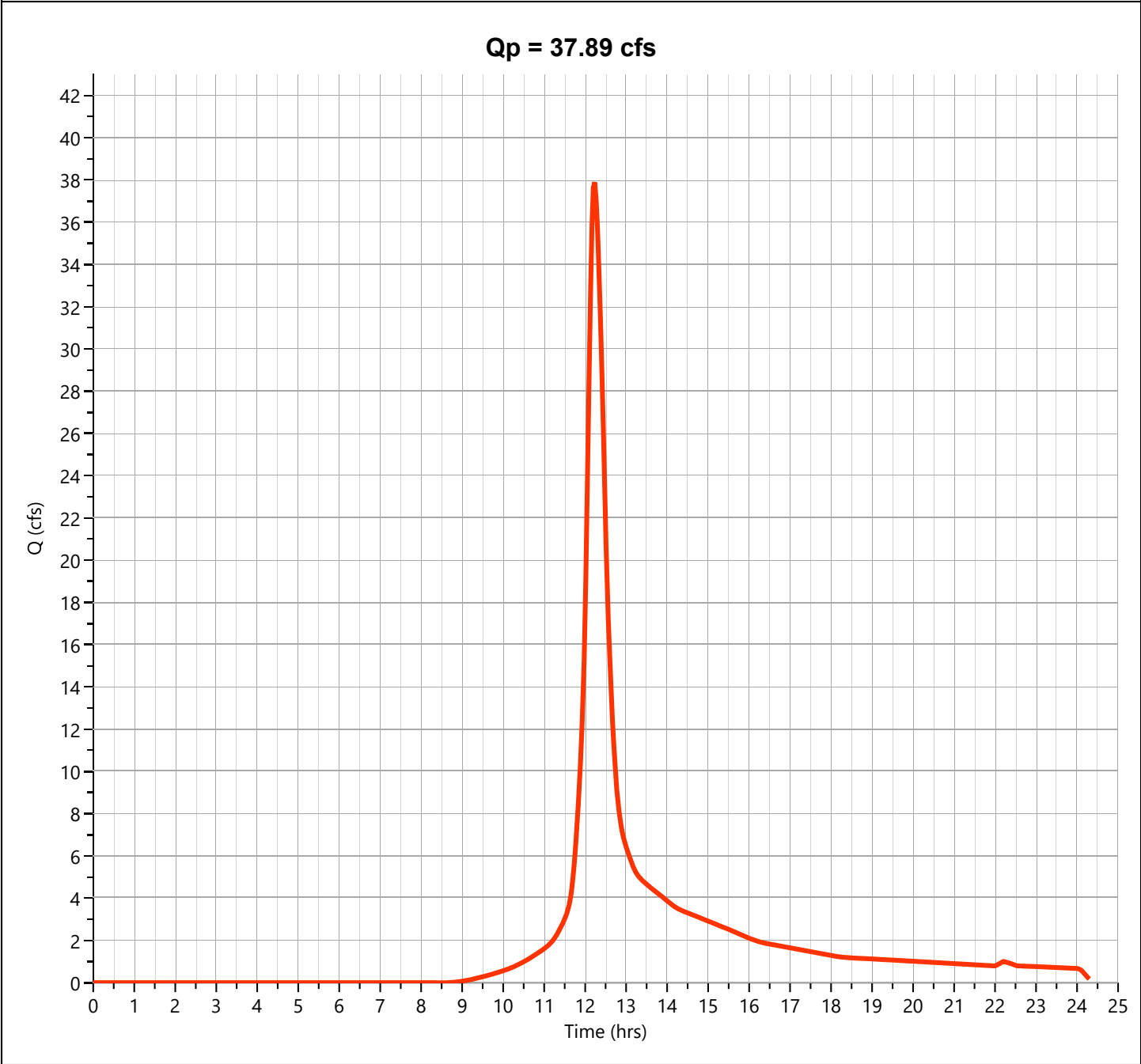
Hydrology Studio v 3.0.0.21

10-27-2022

P-9B

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 37.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 167,750 cuft
Drainage Area	= 11.92 ac	Curve Number	= 66
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DET. BASIN OUTFLOW

Hyd. No. 50

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 49 - P-9B	Max. Elevation	= 236.72 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 29,366 cuft

### Pond Routing by Storage Indication Method

**Qp = 0.00 cfs**

# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DET. BASIN OUTFLOW

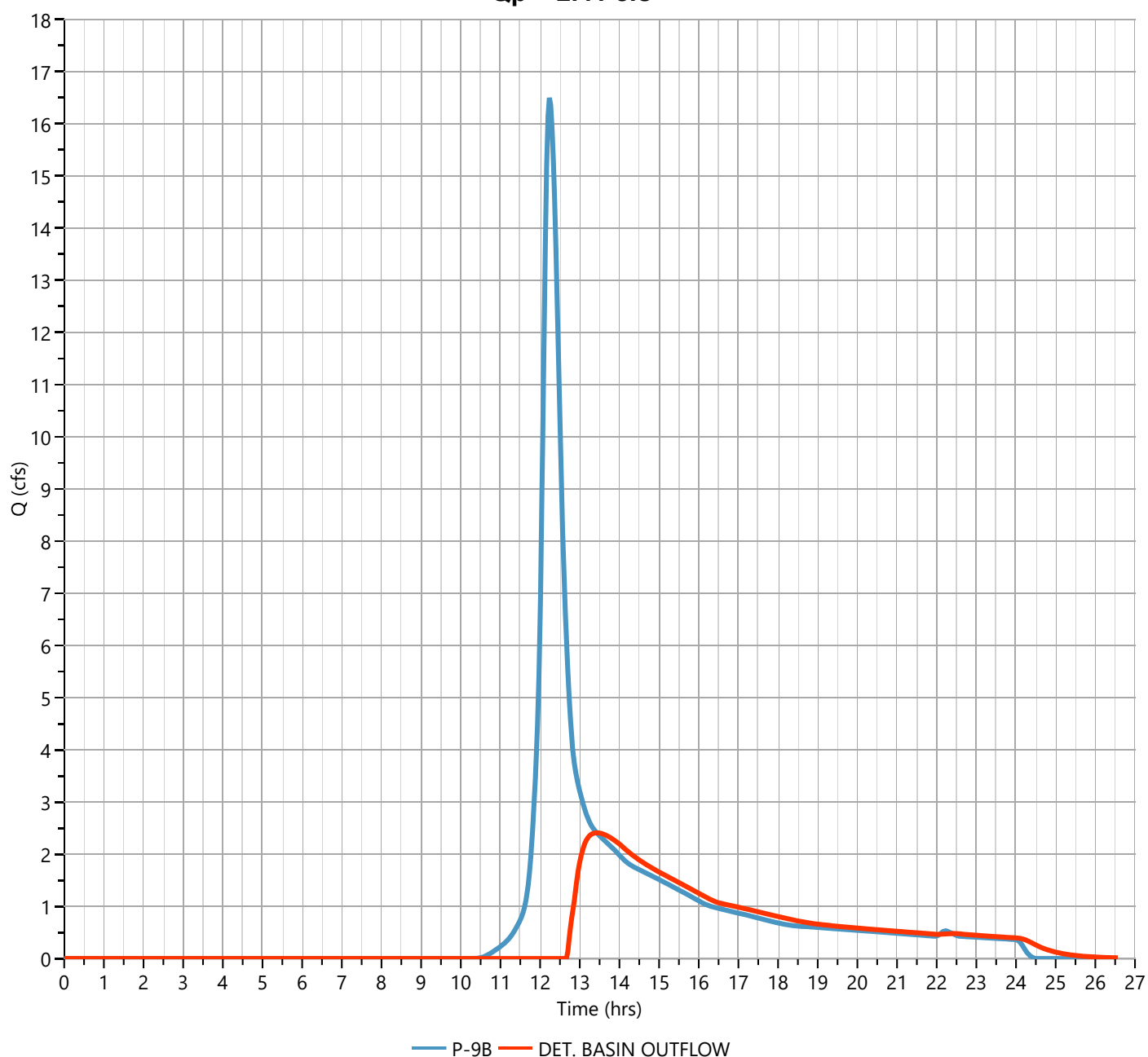
Hyd. No. 50

Hydrograph Type	= Pond Route	Peak Flow	= 2.408 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 41,634 cuft
Inflow Hydrograph	= 49 - P-9B	Max. Elevation	= 237.17 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 38,554 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2.41 hrs

**Qp = 2.41 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DET. BASIN OUTFLOW

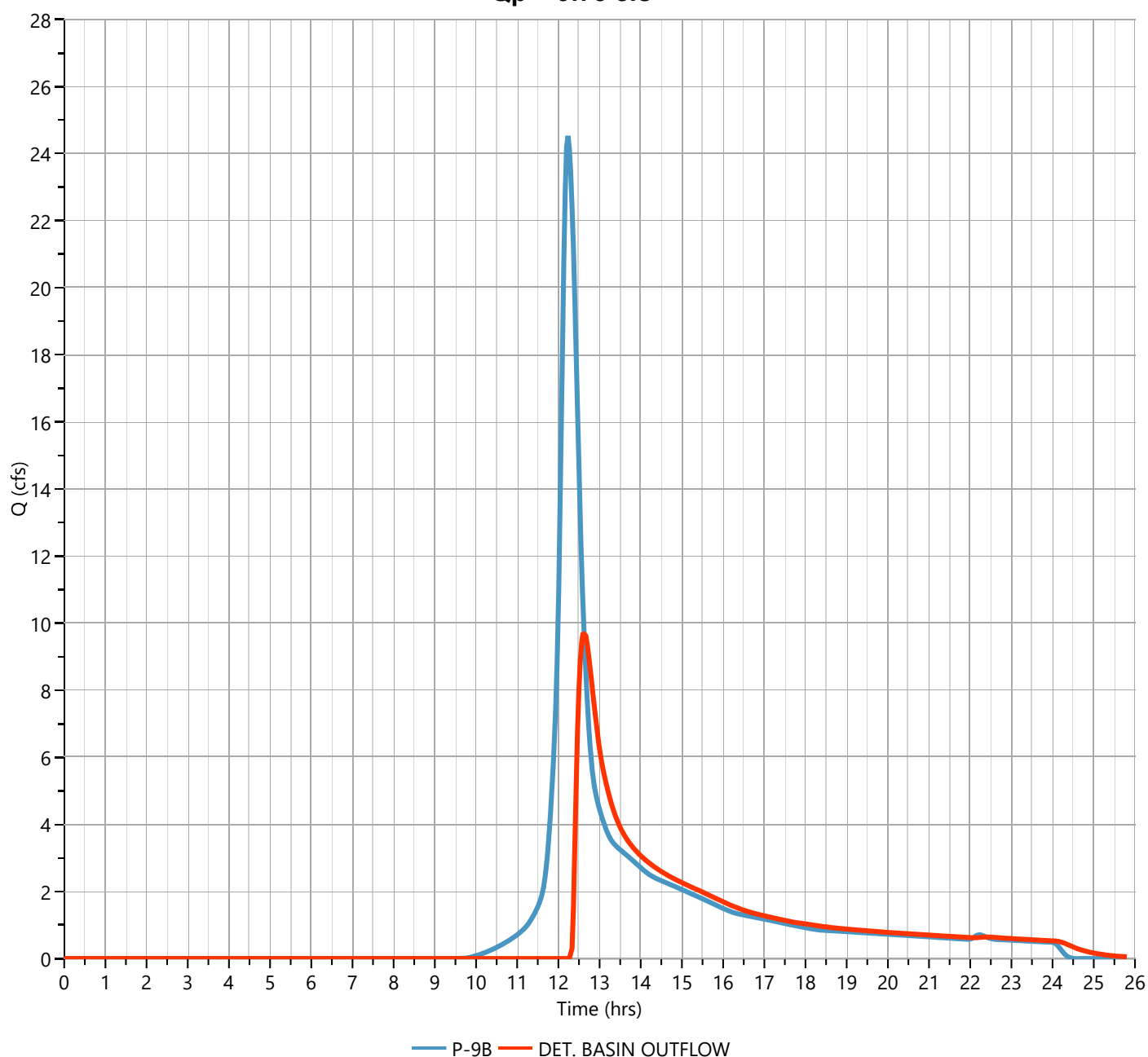
Hyd. No. 50

Hydrograph Type	= Pond Route	Peak Flow	= 9.751 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 75,794 cuft
Inflow Hydrograph	= 49 - P-9B	Max. Elevation	= 237.42 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 44,933 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.49 hrs

**Qp = 9.75 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## DET. BASIN OUTFLOW

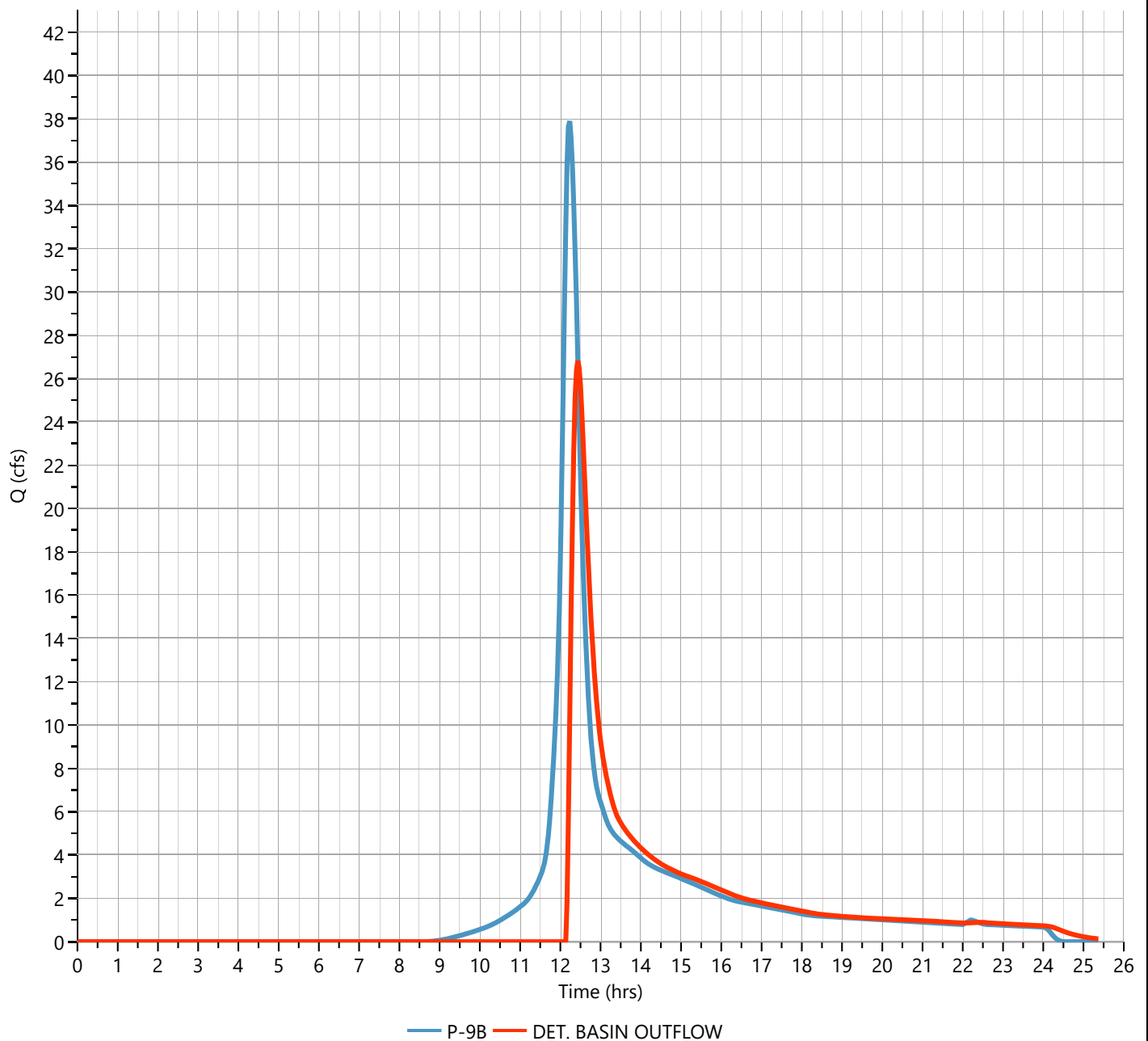
Hyd. No. 50

Hydrograph Type	= Pond Route	Peak Flow	= 26.82 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 133,448 cuft
Inflow Hydrograph	= 49 - P-9B	Max. Elevation	= 237.78 ft
Pond Name	= EXIST DETENTION	Max. Storage	= 54,171 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 58 min

**Qp = 26.82 cfs**





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

Project: Athens Street By PFK Date 10/13/22  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date \_\_\_\_\_  
 Date \_\_\_\_\_  
 Circle one: Present ☐ Developed ☒ Subcatchment P-9A

**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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			0.05	5.35
A	Woods	Good Condition	30			0.60	18.12
A	Open Space	Good Condition	39			1.83	71.41
A	Open Space	Fair Condition	49			0.00	0.00
A	Gravel		76			0.13	9.51
B	Woods	Good Condition	55			0.00	0.00
B	Open Space	Good Condition	61			0.00	0.00
C	Gravel		89			0.14	12.87
C	Woods	Good Condition	70			0.80	55.71
C	Open Space	Good Condition	74			1.22	90.21
D	Open Space	Good Condition	80			0.00	0.00
D	Open Space	Fair Condition	84			0.00	0.00
D	Woods	Good Condition	77			0.00	0.00
1/ Use only one CN source per line. 207971 Totals =						4.77	263.19

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{263.19}{4.77} = 55.13 ; \text{ Use CN} = \boxed{55}$$

**2. Runoff**

Frequency..... yr

Rainfall, P (24-hour)..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.28	1.61	2.69

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 10/13/2022Location: Stow, MAChecked                     Rev Date                     Date                     Circle one: Present DevelopedCircle one: Tc TtSubcatchment P-9Athrough                       
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.21

A-B		
WOODS		
0.6		
50		
3.1		
0.043		
0.21		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.02

B-C		
UNPAVED		
203		
0.030		
2.79		
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.  $T_t = L / 3600V$ 

Compute Tt hr

0


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

hr

0.23

min

14.0

# Hydrograph Report

Project Name:

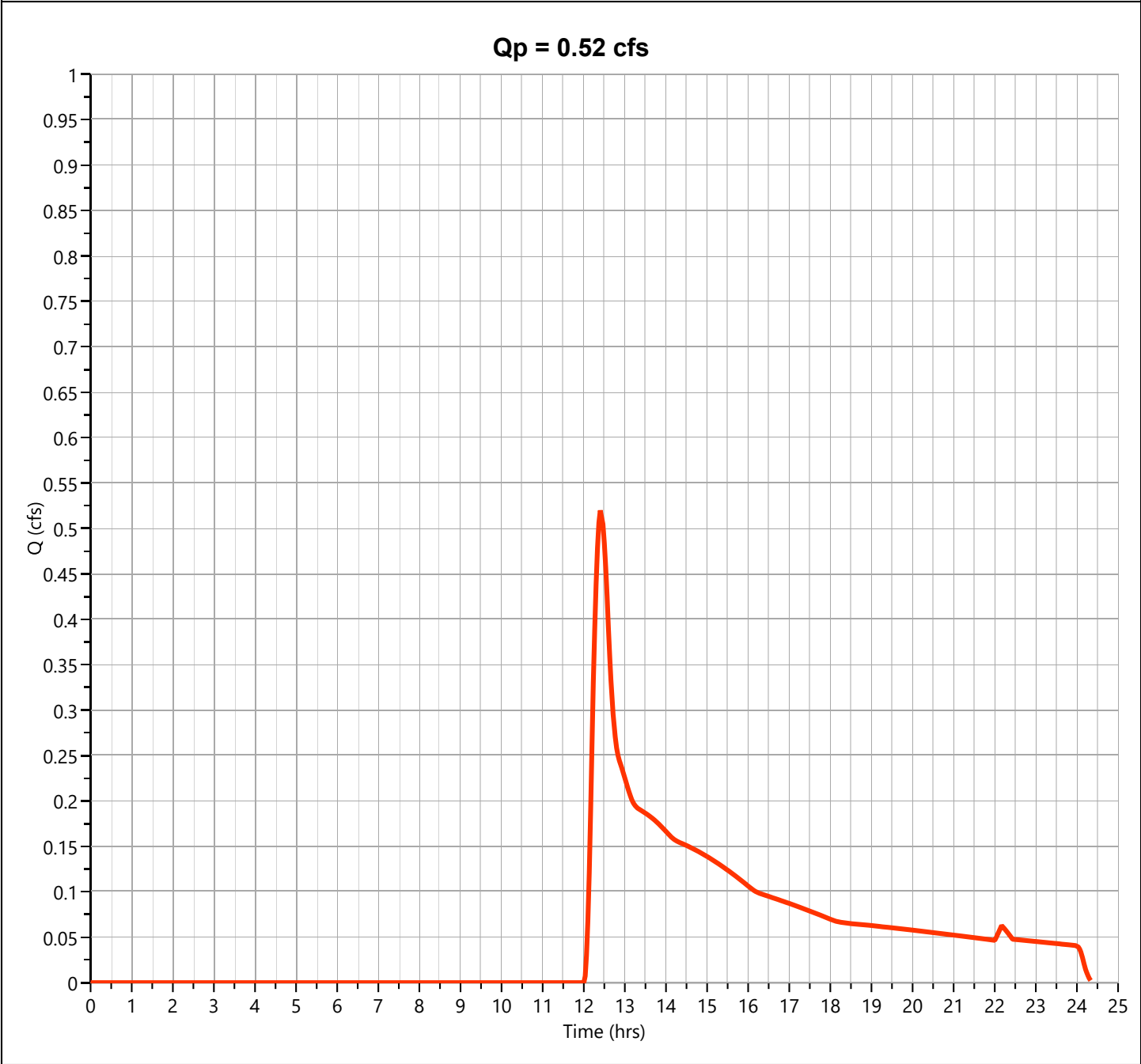
Hydrology Studio v 3.0.0.21

10-27-2022

P-9A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.520 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 4,590 cuft
Drainage Area	= 4.77 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

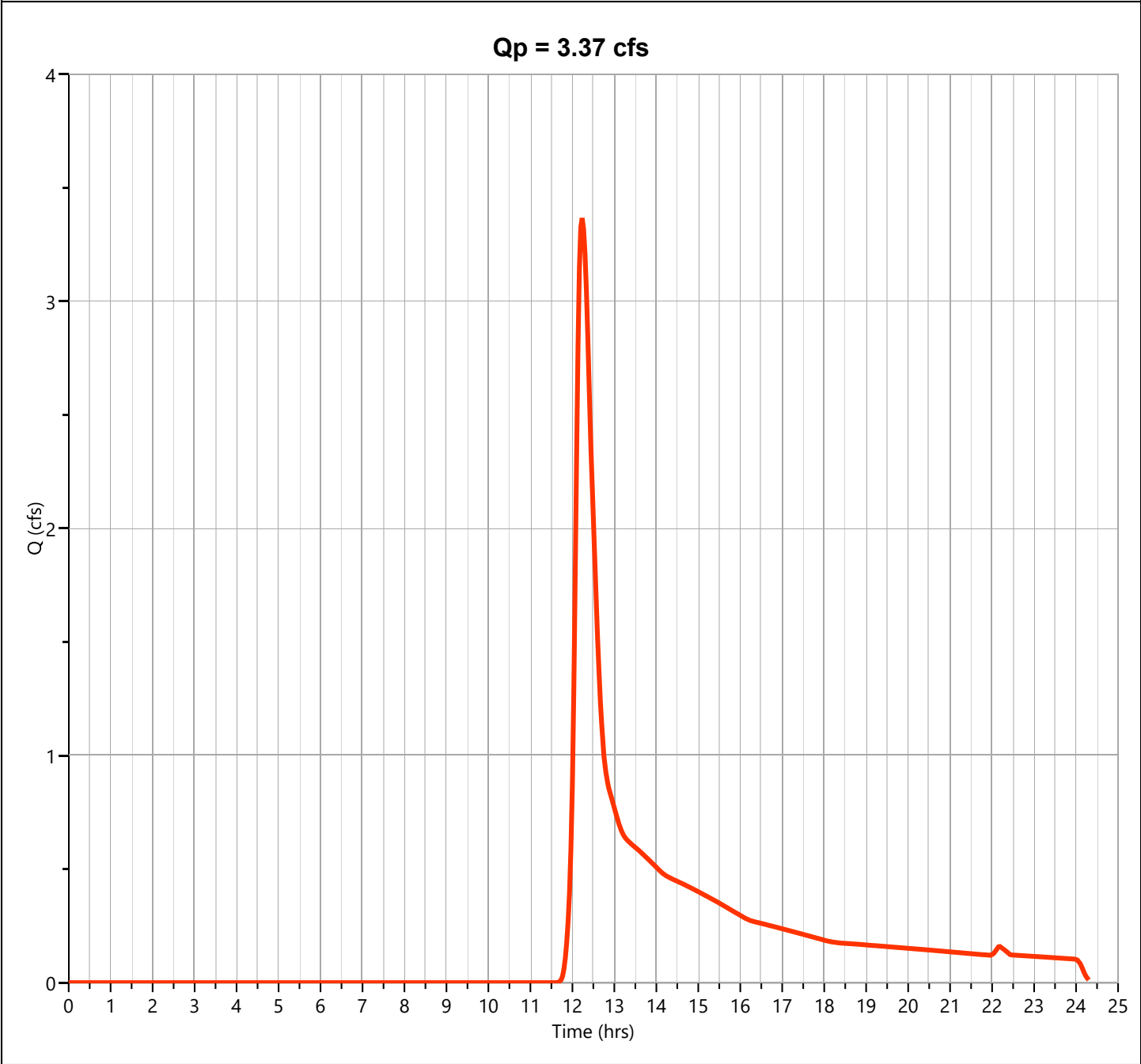
Hydrology Studio v 3.0.0.21

10-27-2022

P-9A

Hyd. No. 57

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.367 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 16,881 cuft
Drainage Area	= 4.77 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

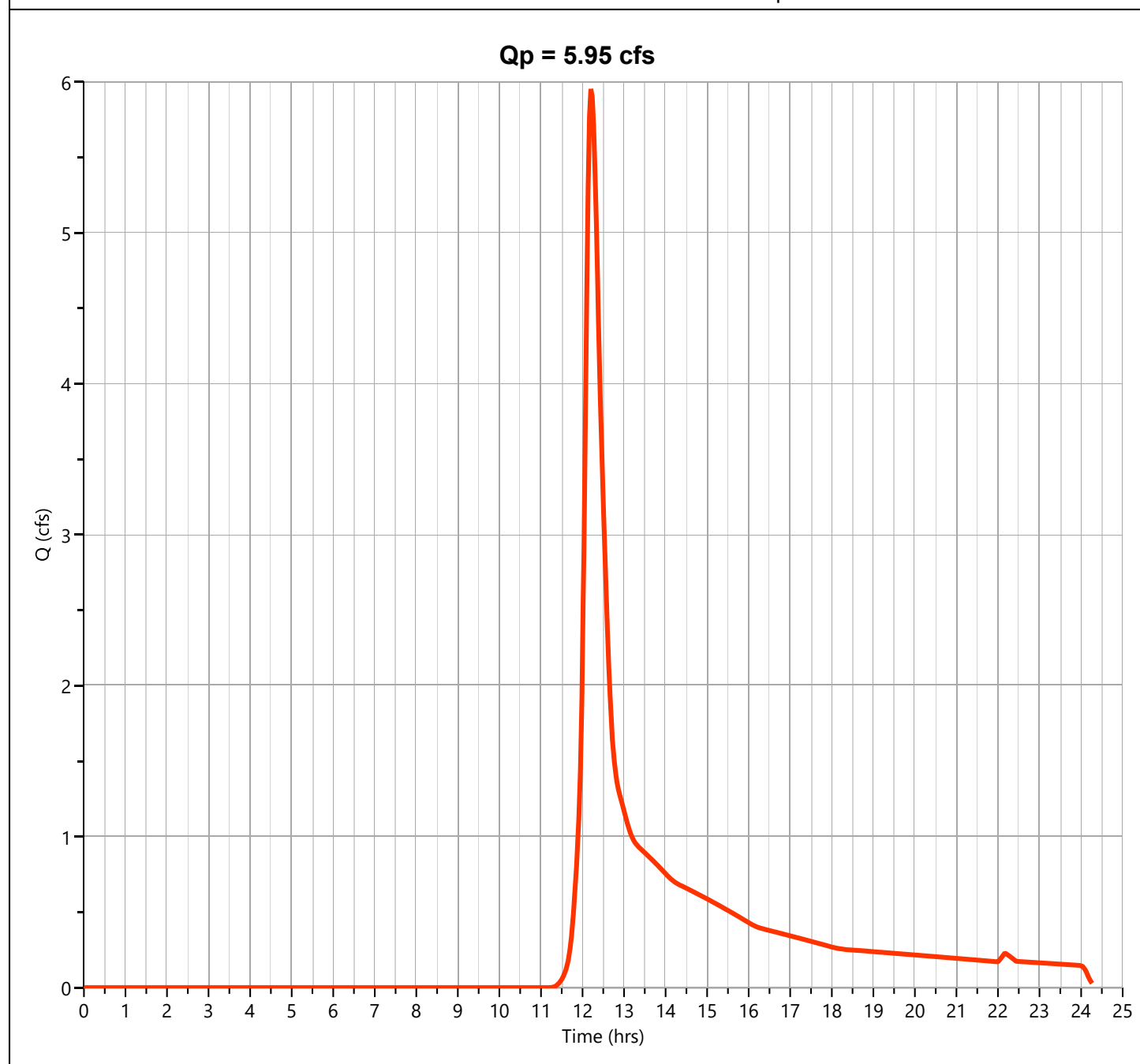
Hydrology Studio v 3.0.0.21

10-27-2022

**P-9A**

**Hyd. No. 57**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.954 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 26,993 cuft
Drainage Area	= 4.77 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

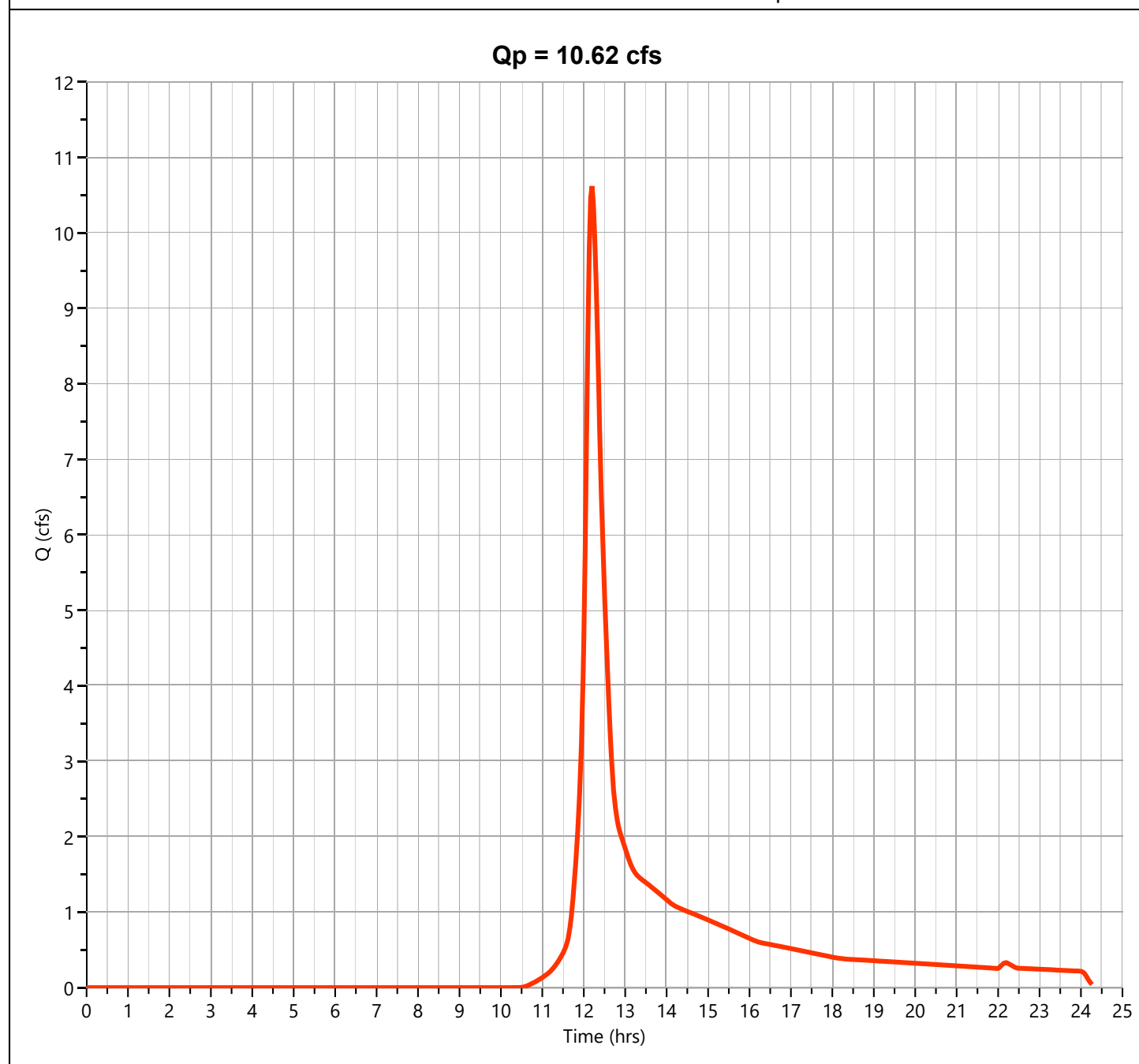
Hydrology Studio v 3.0.0.21

10-27-2022

**P-9A**

**Hyd. No. 57**

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.62 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 45,165 cuft
Drainage Area	= 4.77 ac	Curve Number	= 55
Tc Method	= User	Time of Conc. (Tc)	= 14.0 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  
 Location: Stow, MA Checked \_\_\_\_\_ Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	Impervious		98			3.35	328.03
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			4.32	319.60
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.			333940	Totals =		7.67	647.63

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{647.63}{7.67} = 84.48 ; \quad \text{Use CN} = \boxed{84}$$

## 2. Runoff

Frequency..... yr  
 Rainfall, P (24-hour)..... in  
 Runoff, Q..... in  
 (Use P and CN with table 2-1, fig. 2-1,  
 or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
1.78	4.38	6.00

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy PFKDate 6/24/2022Location: Stow, MAChecked           Rev Date 10/13/2022Date           Circle one: Present 

Developed
-----------

Subcatchment P-10CCircle one: Tc 

Tt
----

through  
subareaSheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.11

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $Tt = L / 3600V$ 

Compute Tt hr

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/ft

15. 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  
min0.14  
8.5



# Hydrograph Report

Project Name:

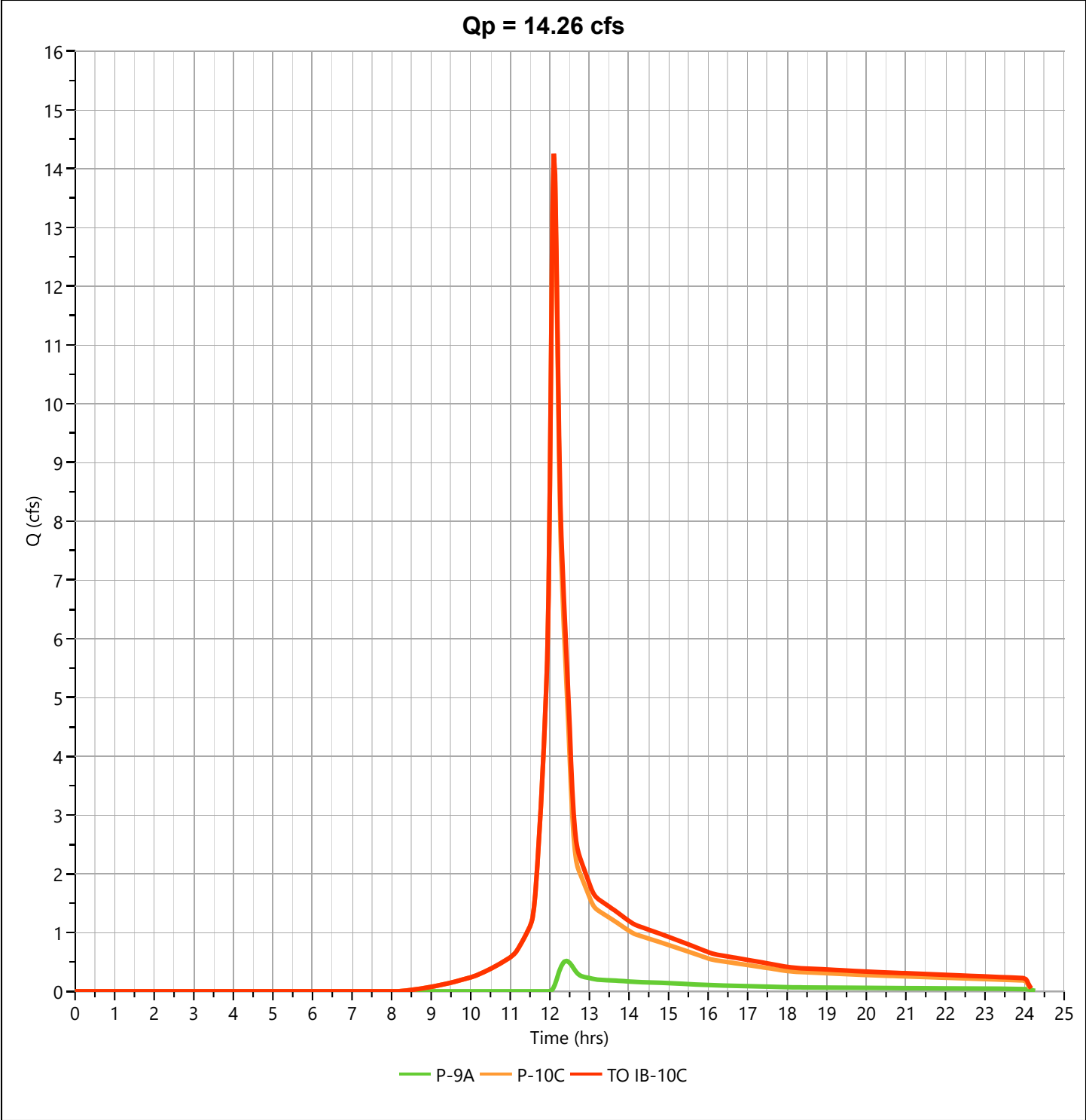
Hydrology Studio v 3.0.0.21

10-31-2022

TO IB-10C

Hyd. No. 56

Hydrograph Type	= Junction	Peak Flow	= 14.26 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 53,067 cuft
Inflow Hydrographs	= 53, 54, 55	Total Contrib. Area	= 12.44 ac



# Hydrograph Report

Project Name:

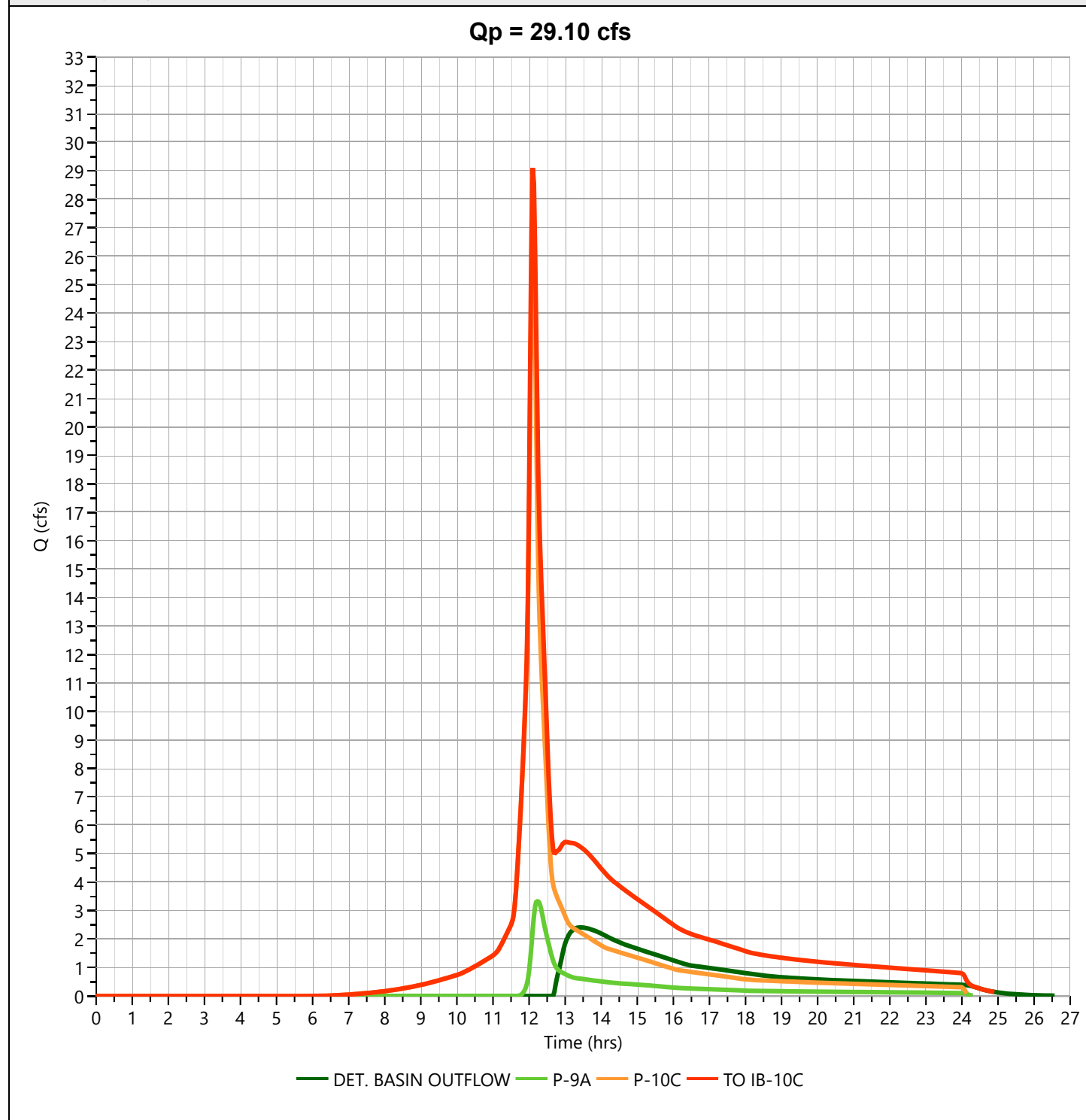
Hydrology Studio v 3.0.0.21

10-31-2022

## TO IB-10C

## Hyd. No. 56

Hydrograph Type	= Junction	Peak Flow	= 29.10 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 150,590 cuft
Inflow Hydrographs	= 53, 54, 55	Total Contrib. Area	= 12.44 ac



# Hydrograph Report

Project Name:

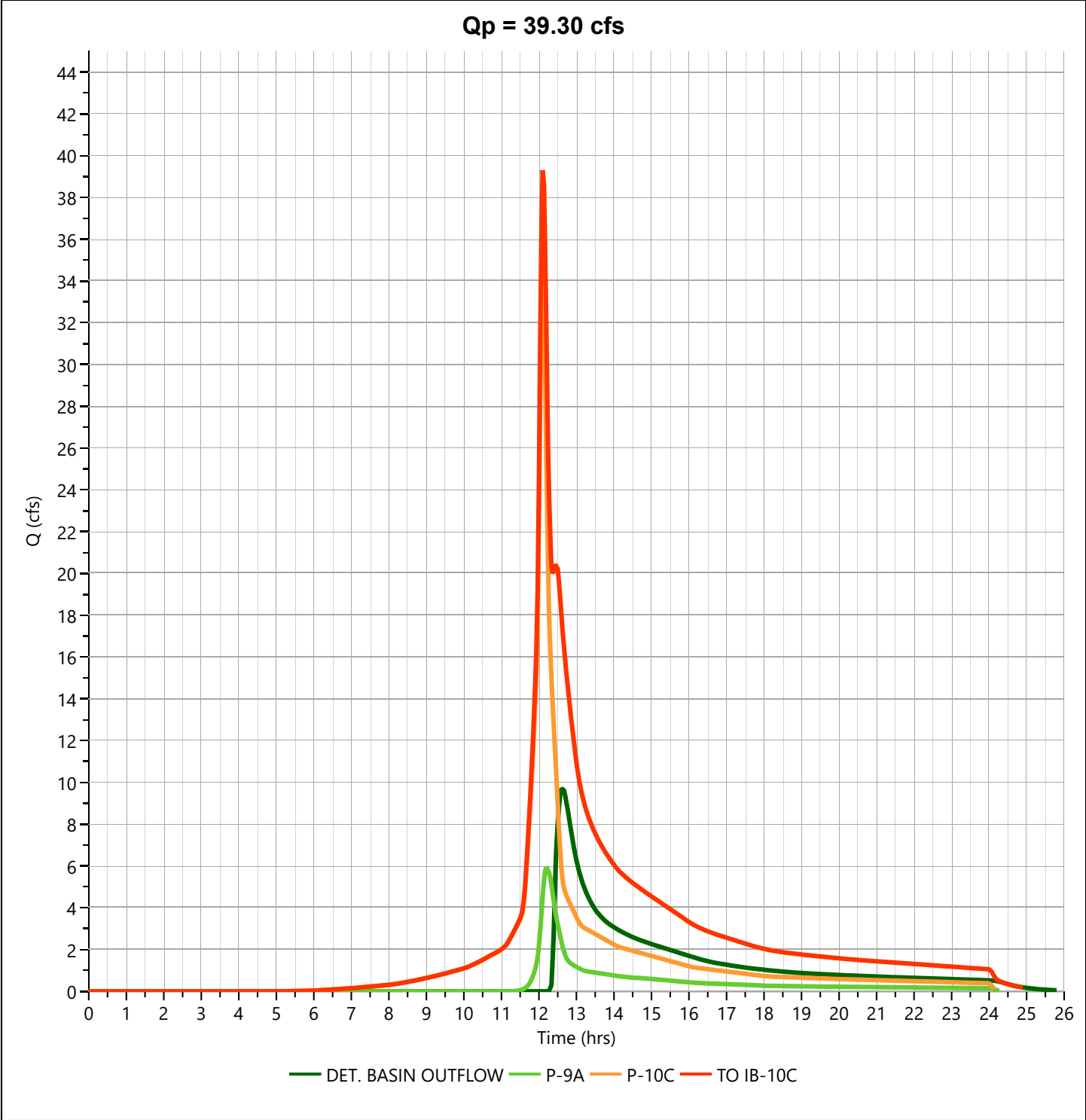
Hydrology Studio v 3.0.0.21

10-31-2022

TO IB-10C

Hyd. No. 56

Hydrograph Type	= Junction	Peak Flow	= 39.30 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 223,279 cuft
Inflow Hydrographs	= 53, 54, 55	Total Contrib. Area	= 12.44 ac



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

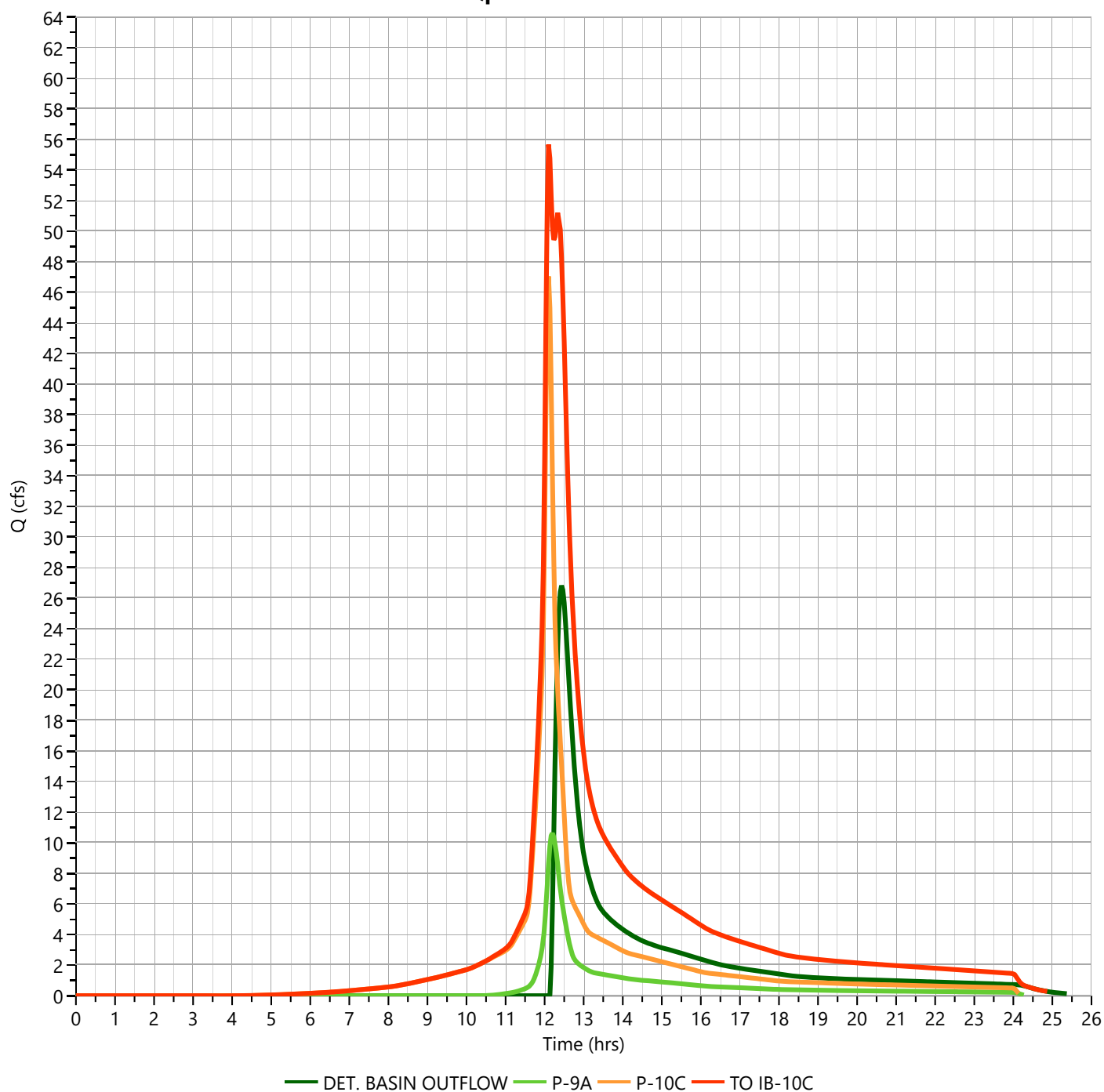
10-31-2022

**TO IB-10C**

**Hyd. No. 56**

Hydrograph Type	= Junction	Peak Flow	= 55.67 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 344,043 cuft
Inflow Hydrographs	= 53, 54, 55	Total Contrib. Area	= 12.44 ac

**Qp = 55.67 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

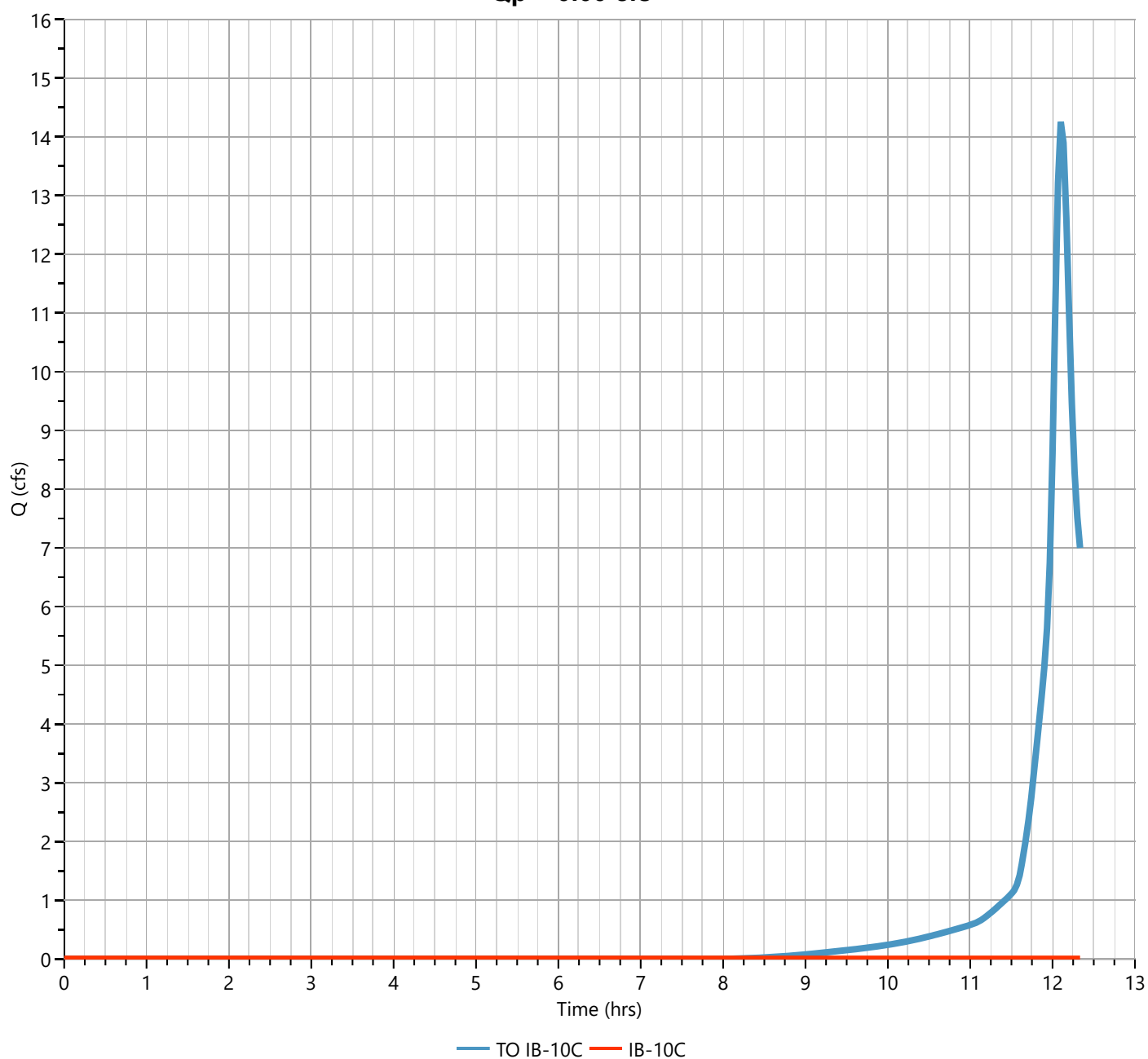
**IB-10C**

**Hyd. No. 57**

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.006 cuft
Inflow Hydrograph	= 56 - TO IB-10C	Max. Elevation	= 225.73 ft
Pond Name	= IB-10C	Max. Storage	= 13,225 cuft

*Pond Routing by Storage Indication Method*

**Qp = 0.00 cfs**



# Pond Report

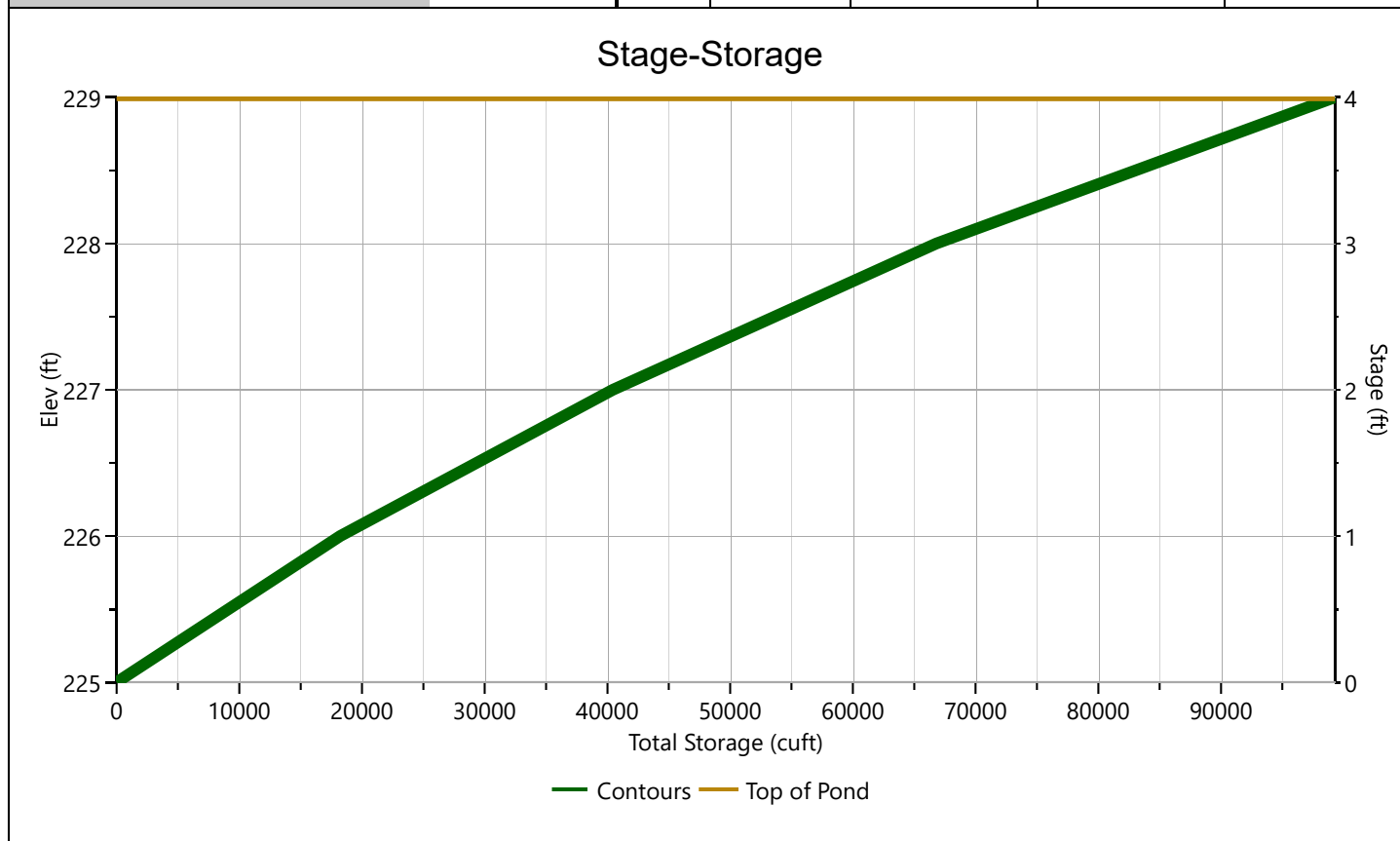
Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

# IB-10C

## Stage-Storage

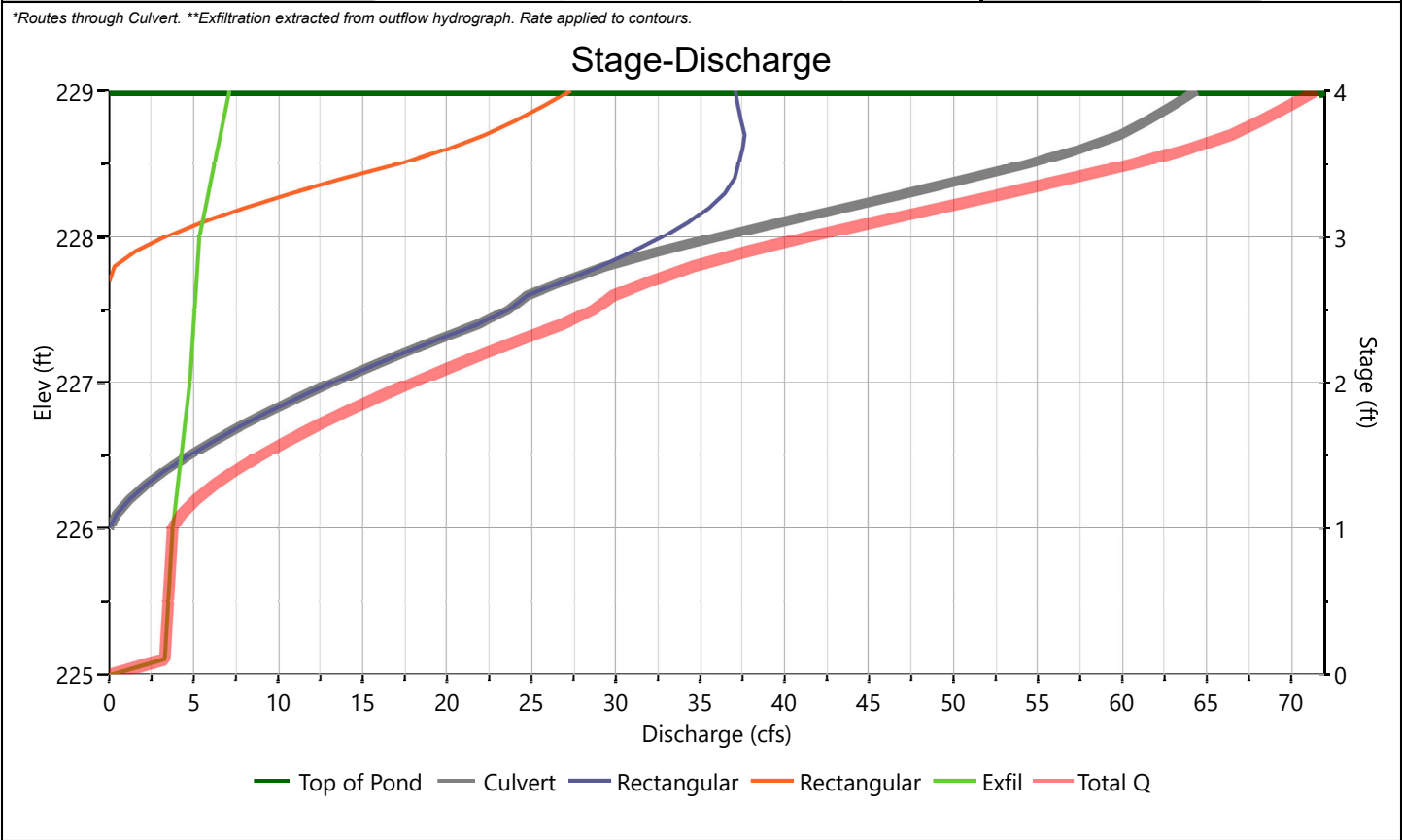
[illegible]

IB-10C

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	36				Hole Diameter, in	
Span, in	36				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	223.50				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	31					
Barrel Slope, %	1					
N-Value, n	0.012					
Weirs	Riser*	Weirs			Ancillary	
		1*	2*	3*		
Shape / Type	Circular	Rectangular	Rectangular	Rectangular	Exfiltration, in/hr	8.27**
Crest Elevation, ft		226	226.5	227.75		
Crest Length, ft		4	2	8		
Angle, deg						
Weir Coefficient, Cw		3.3	3.3	3.3		

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



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

**IB-10C**

## Stage-Storage-Discharge Summary

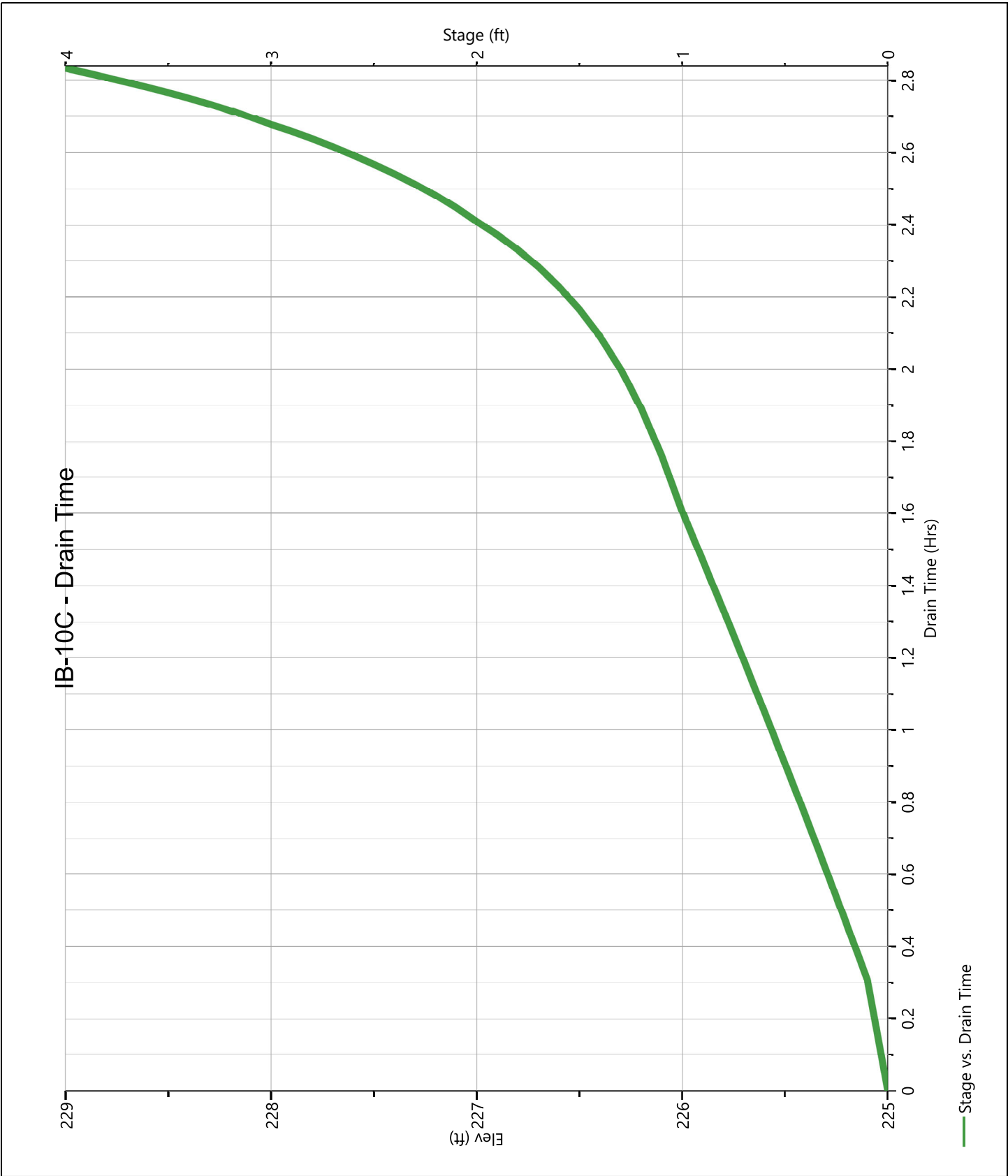
[illegible]

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



IB-10C

Pond Drawdown



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

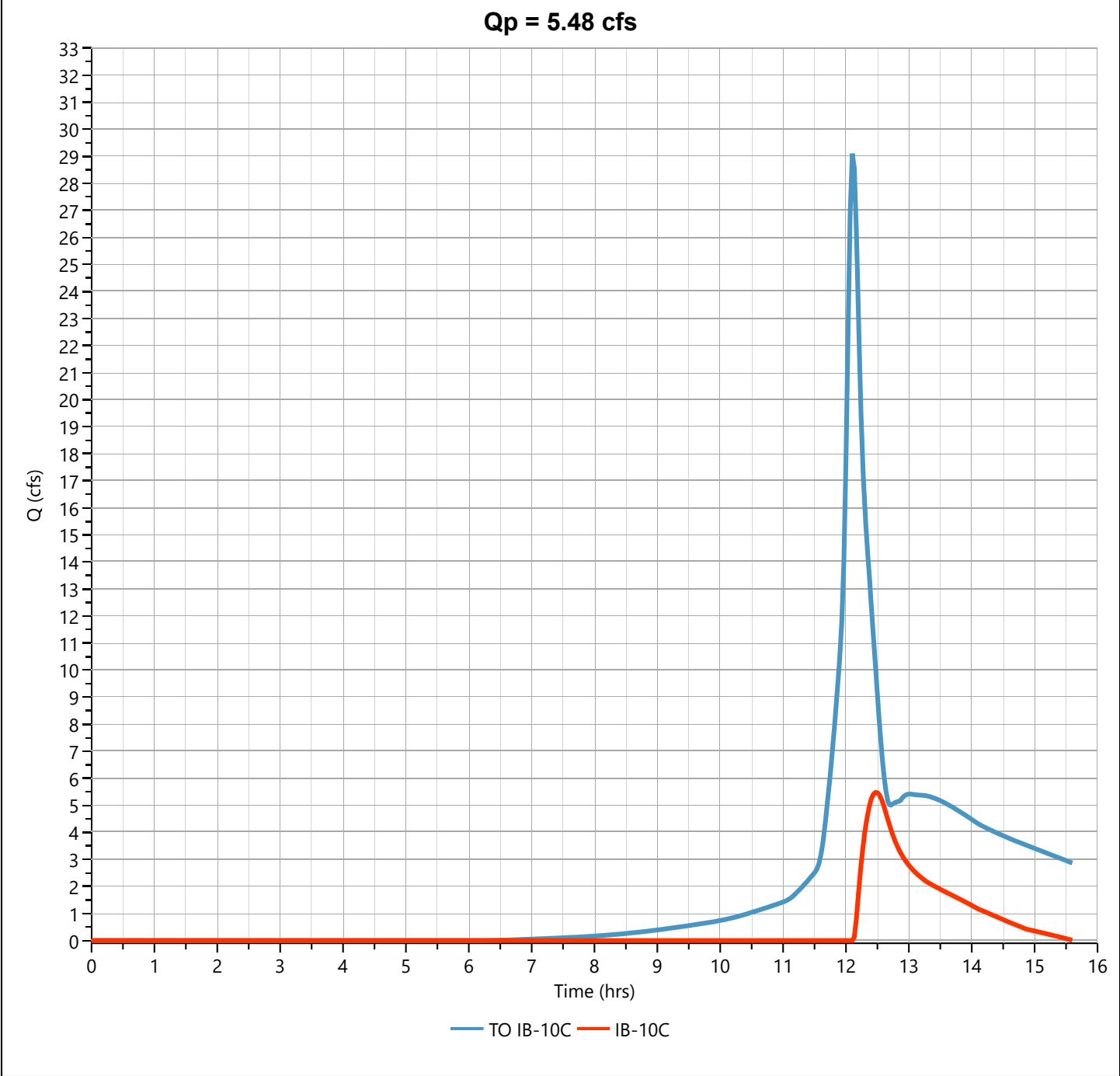
10-31-2022

IB-10C

Hyd. No. 57

Hydrograph Type	= Pond Route	Peak Flow	= 5.480 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 22,319 cuft
Inflow Hydrograph	= 56 - TO IB-10C	Max. Elevation	= 226.56 ft
Pond Name	= IB-10C	Max. Storage	= 30,560 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

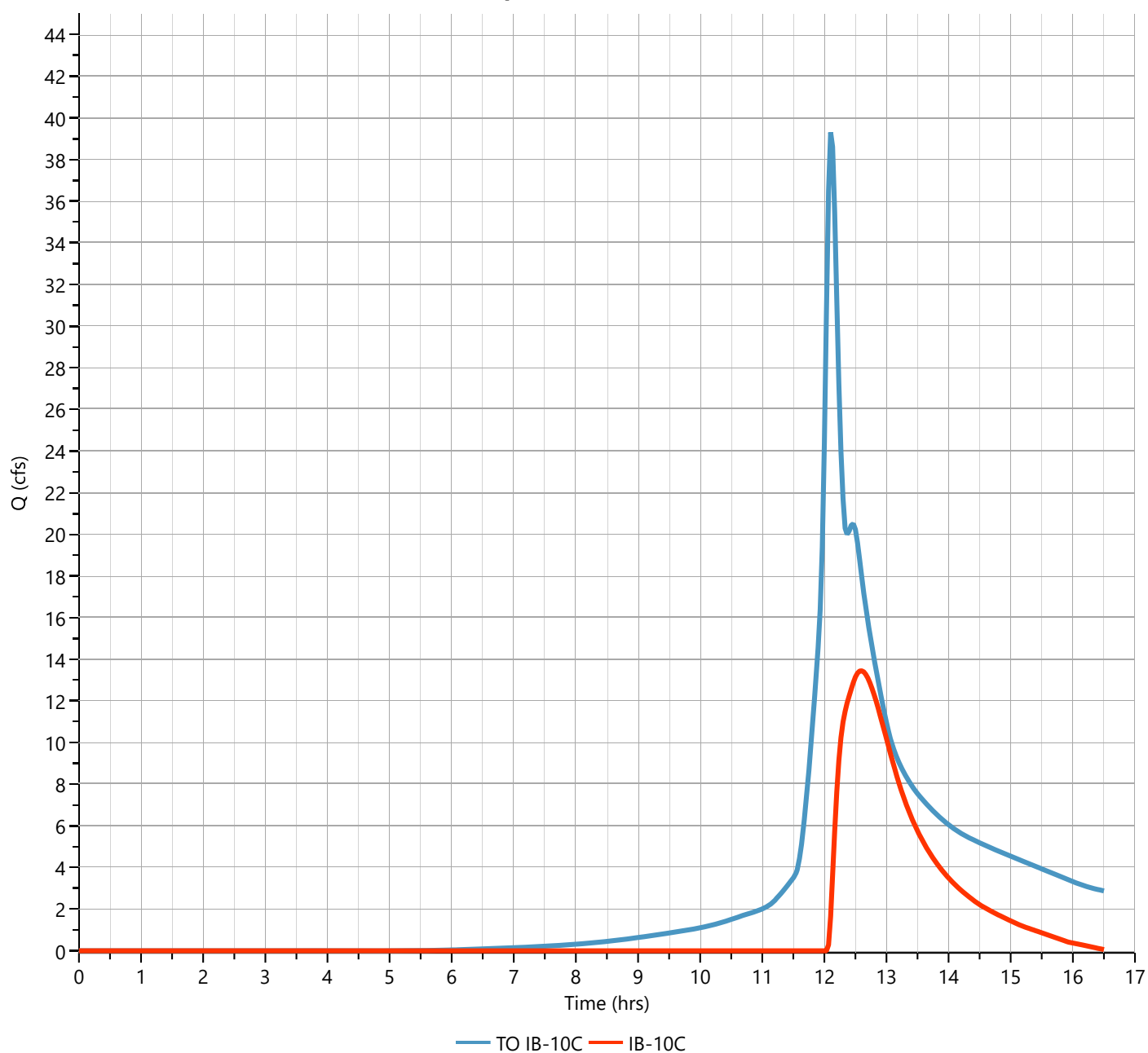
**IB-10C**

**Hyd. No. 57**

Hydrograph Type	= Pond Route	Peak Flow	= 13.45 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 70,155 cuft
Inflow Hydrograph	= 56 - TO IB-10C	Max. Elevation	= 227.01 ft
Pond Name	= IB-10C	Max. Storage	= 40,760 cuft

*Pond Routing by Storage Indication Method*

**Qp = 13.45 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

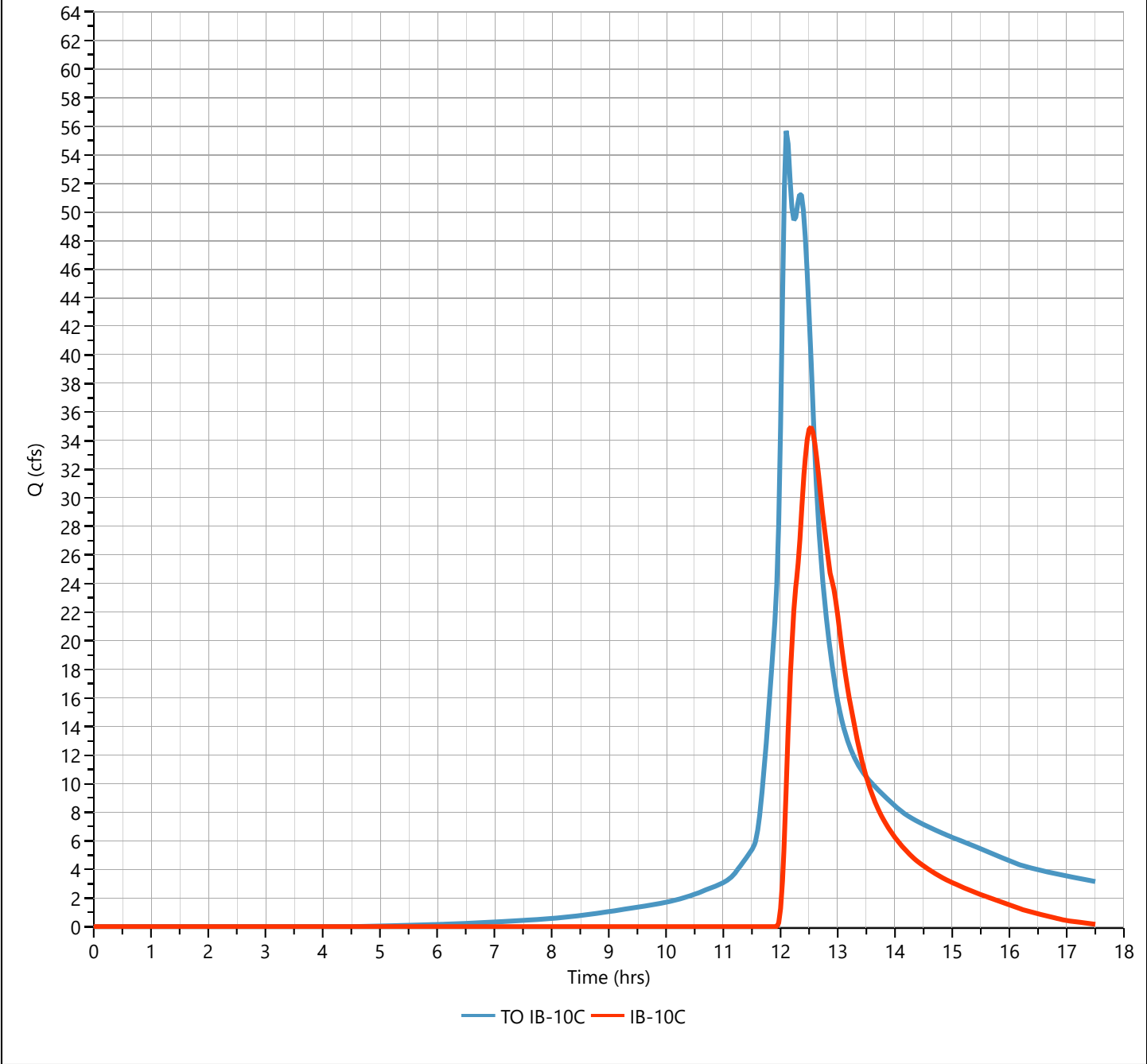
IB-10C

Hyd. No. 57

Hydrograph Type	= Pond Route	Peak Flow	= 34.95 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Hydrograph Volume	= 159,059 cuft
Inflow Hydrograph	= 56 - TO IB-10C	Max. Elevation	= 227.97 ft
Pond Name	= IB-10C	Max. Storage	= 65,966 cuft

Pond Routing by Storage Indication Method

Qp = 34.95 cfs



# Pond Report

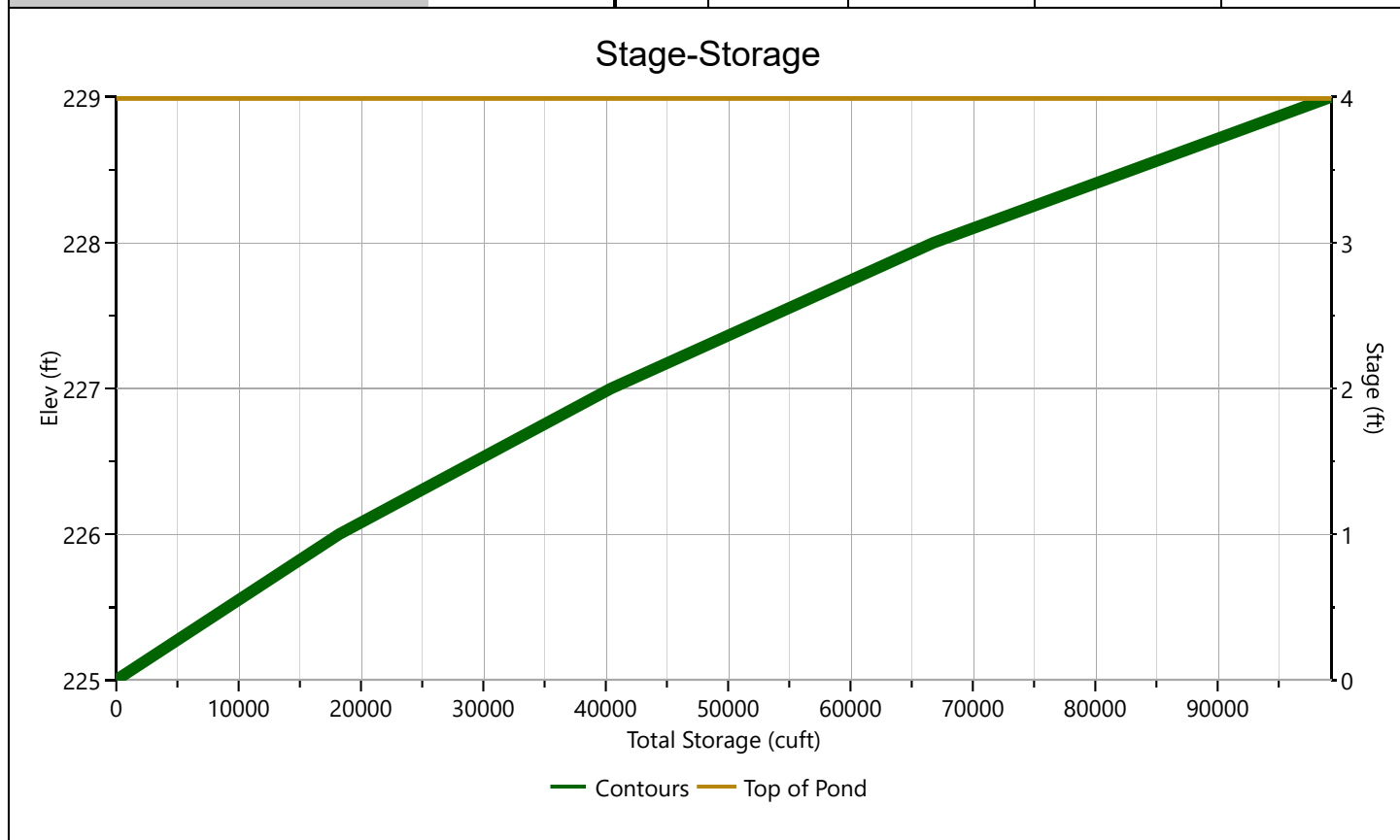
Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

**IB-10C**

## Stage-Storage

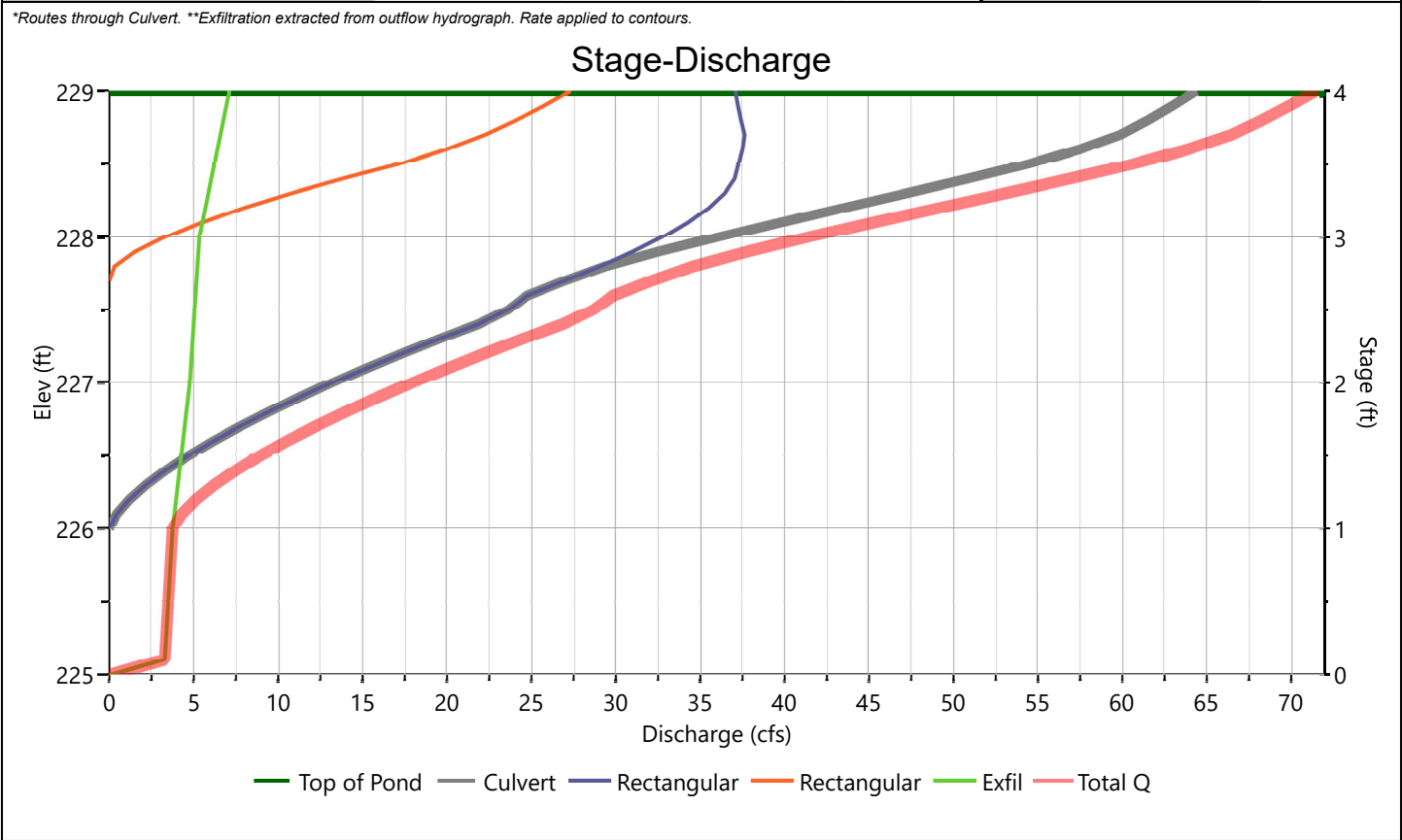
[illegible]

IB-10C

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in	36				Hole Diameter, in	
Span, in	36				No. holes	
No. Barrels	1				Invert Elevation, ft	
Invert Elevation, ft	223.50				Height, ft	
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co	
Length, ft	31					
Barrel Slope, %	1					
N-Value, n	0.012					
Weirs	Riser*	Weirs			Ancillary	
		1*	2*	3*		
Shape / Type	Circular	Rectangular	Rectangular	Rectangular	Exfiltration, in/hr	8.27**
Crest Elevation, ft		226	226.5	227.75		
Crest Length, ft		4	2	8		
Angle, deg						
Weir Coefficient, Cw		3.3	3.3	3.3		

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



# Pond Report

Project Name:

Hydrology Studio v 3.0.0.21

10-31-2022

**IB-10C**

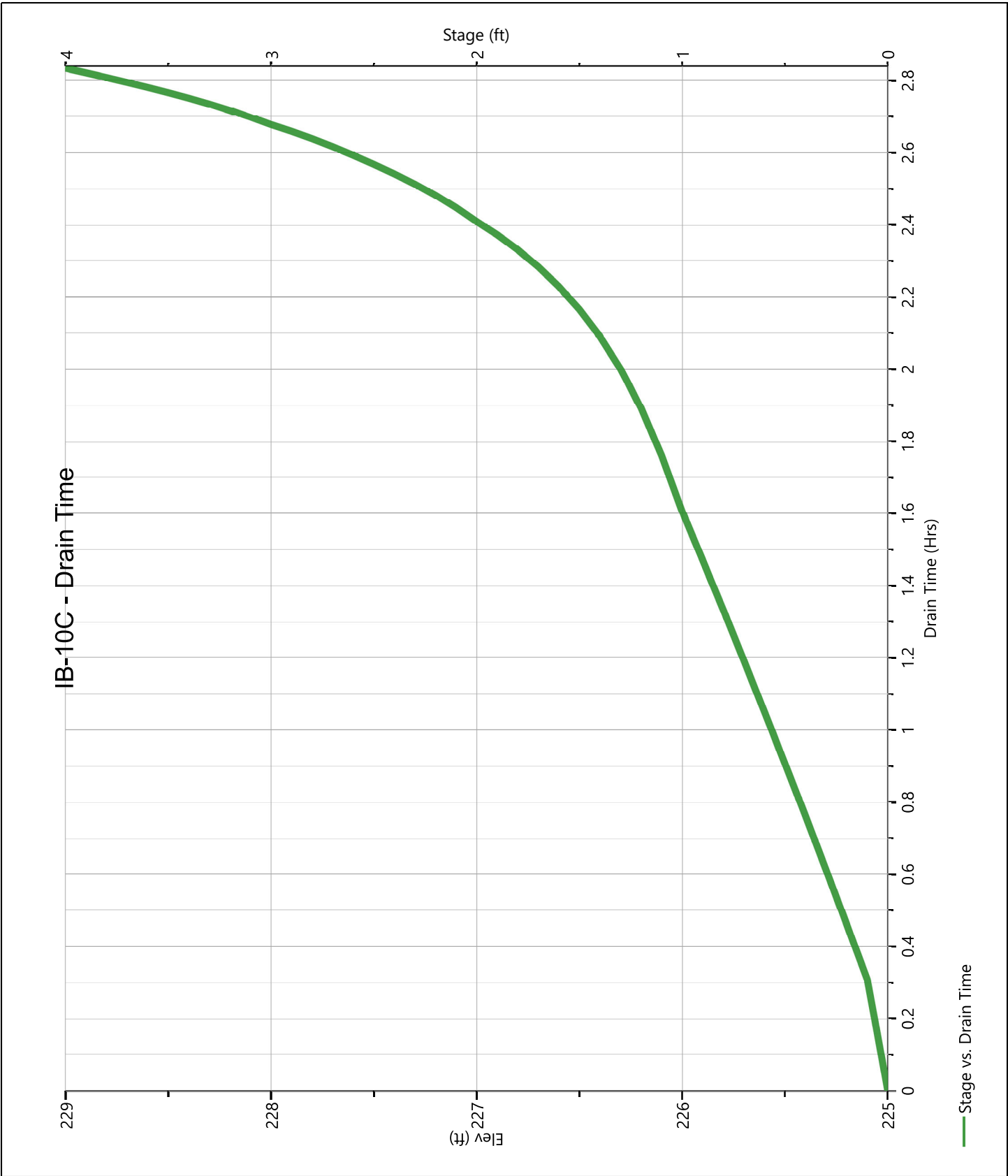
### Stage-Storage-Discharge Summary

[illegible]

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

IB-10C

Pond Drawdown





# Hydrograph Report

Project Name:

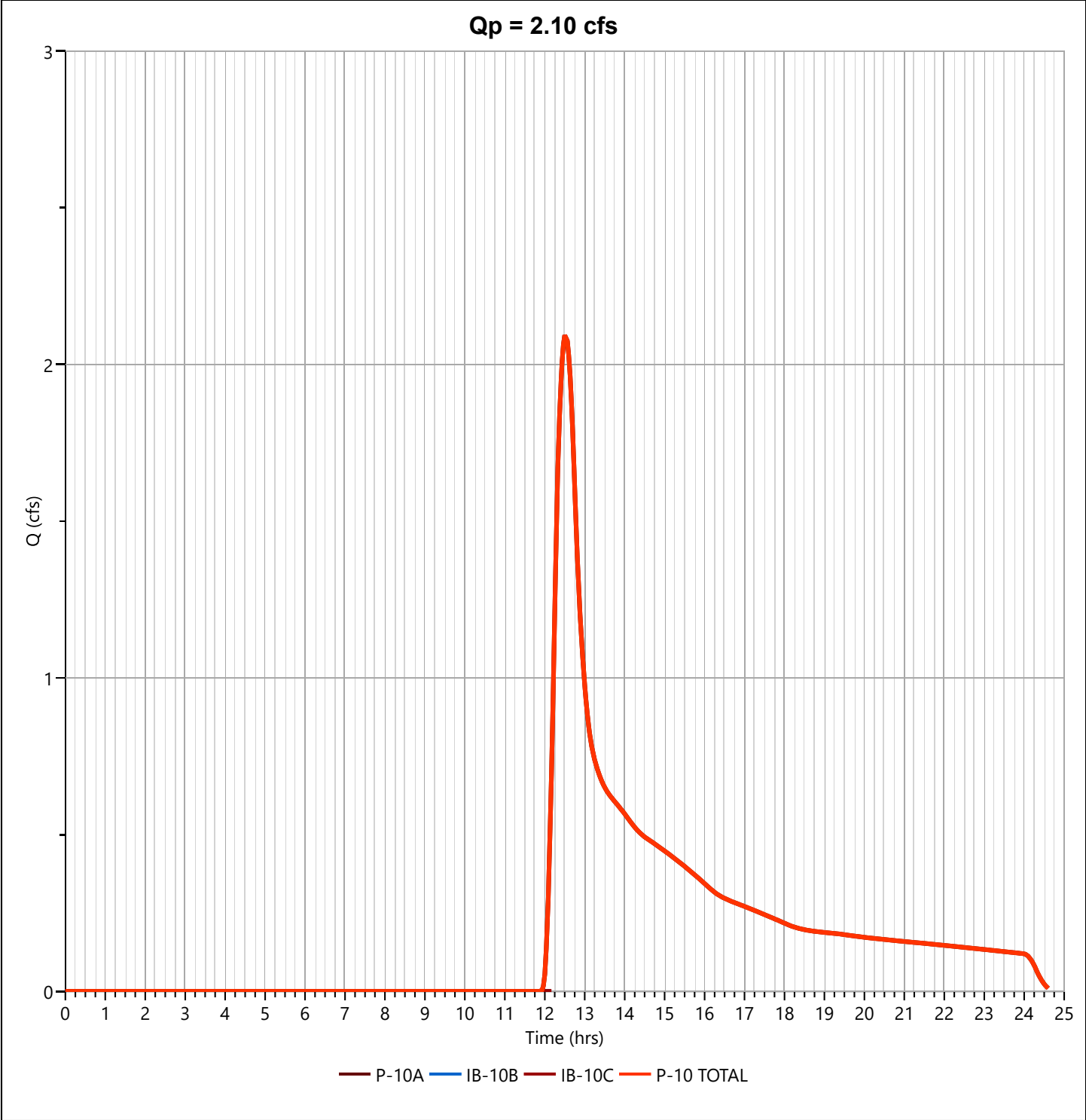
Hydrology Studio v 3.0.0.21

10-31-2022

## P-10 TOTAL

Hyd. No. 58

Hydrograph Type	= Junction	Peak Flow	= 2.097 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Hydrograph Volume	= 16,218 cuft
Inflow Hydrographs	= 49, 51, 57	Total Contrib. Area	= 10.25 ac



# Hydrograph Report

Project Name:

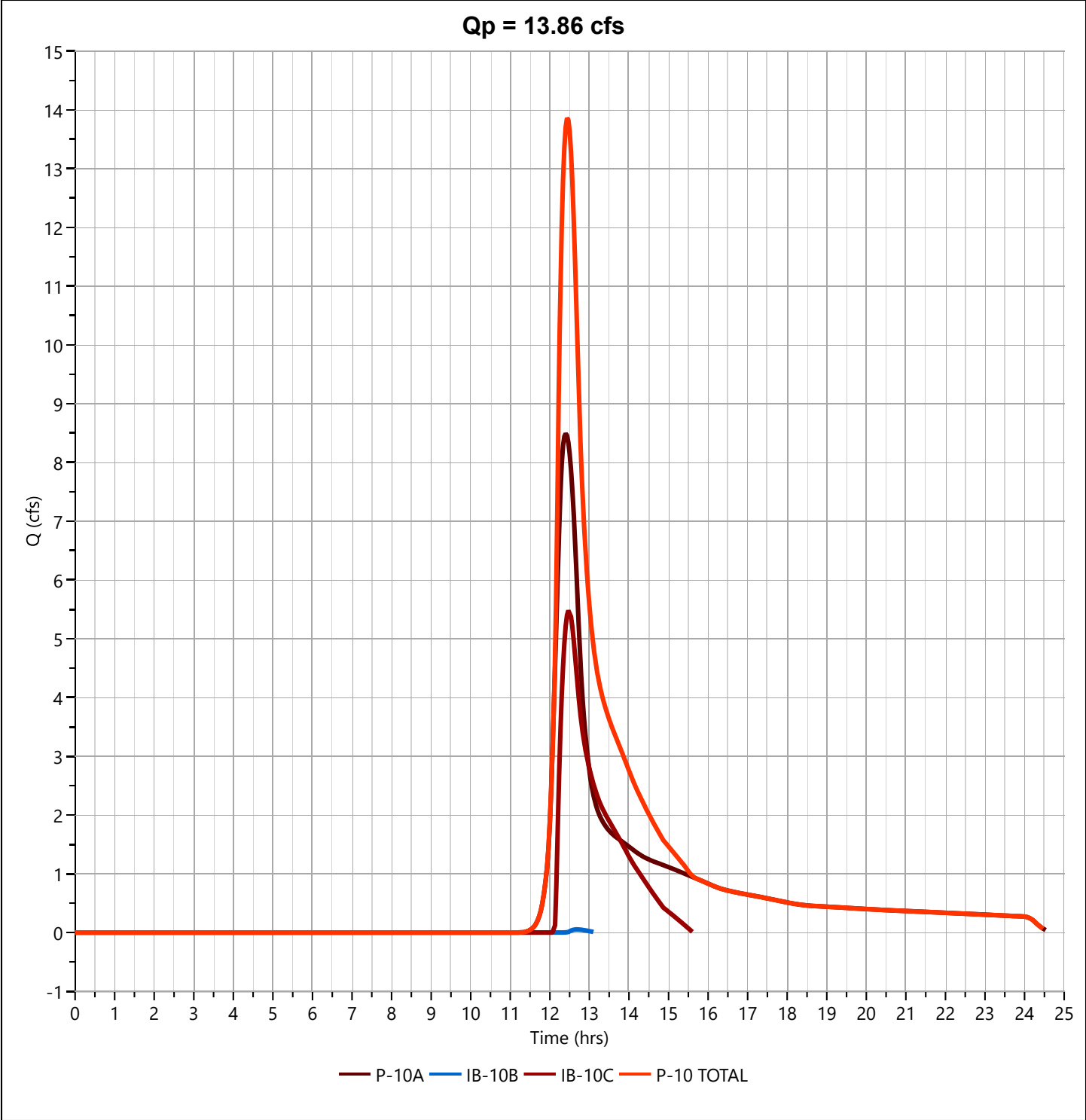
Hydrology Studio v 3.0.0.21

10-31-2022

## P-10 TOTAL

Hyd. No. 58

Hydrograph Type	= Junction	Peak Flow	= 13.86 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 71,688 cuft
Inflow Hydrographs	= 49, 51, 57	Total Contrib. Area	= 10.25 ac



# Hydrograph Report

Project Name:

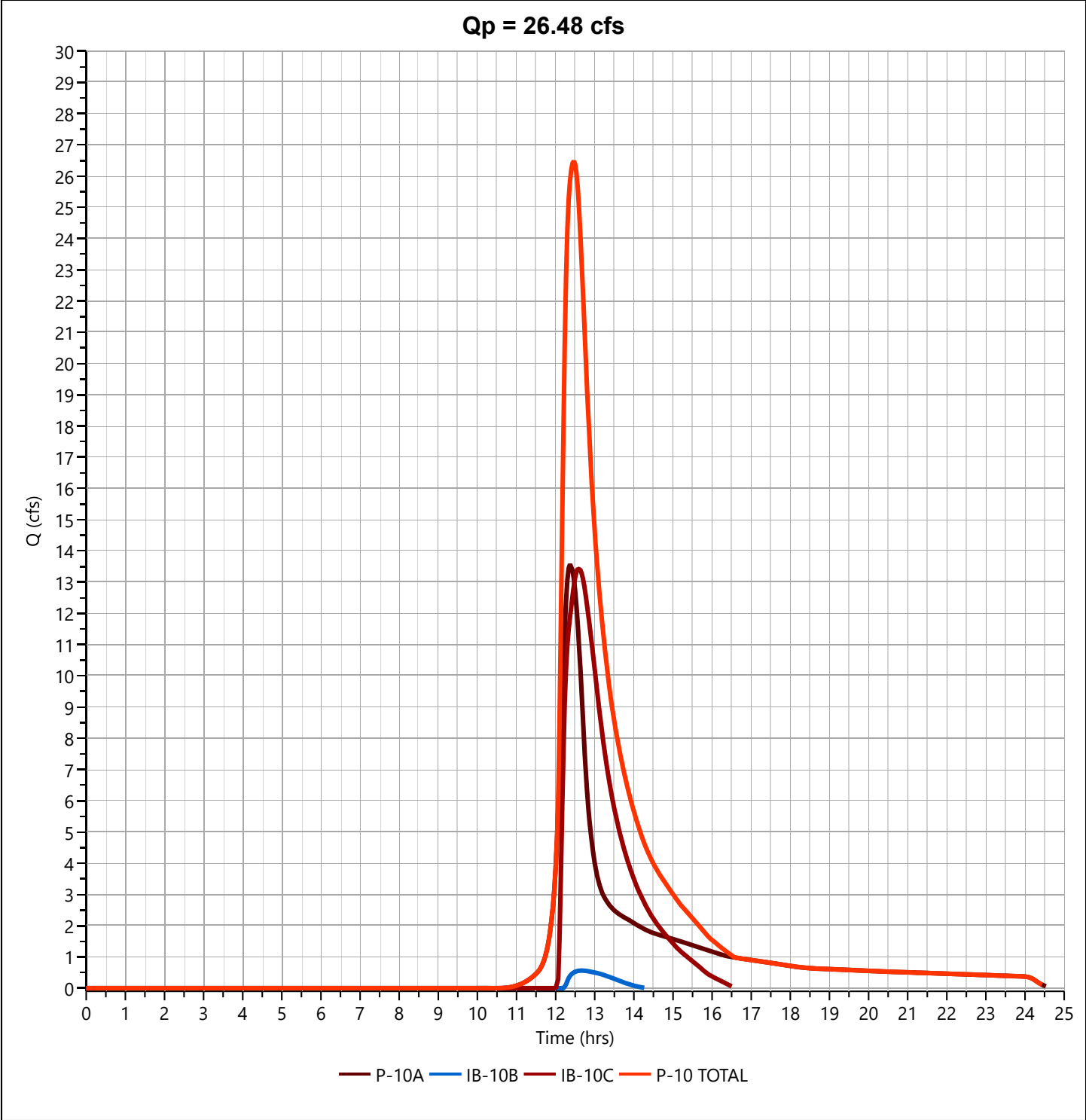
Hydrology Studio v 3.0.0.21

10-31-2022

## P-10 TOTAL

Hyd. No. 58

Hydrograph Type	= Junction	Peak Flow	= 26.48 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 147,496 cuft
Inflow Hydrographs	= 49, 51, 57	Total Contrib. Area	= 10.25 ac



# Hydrograph Report

Project Name:

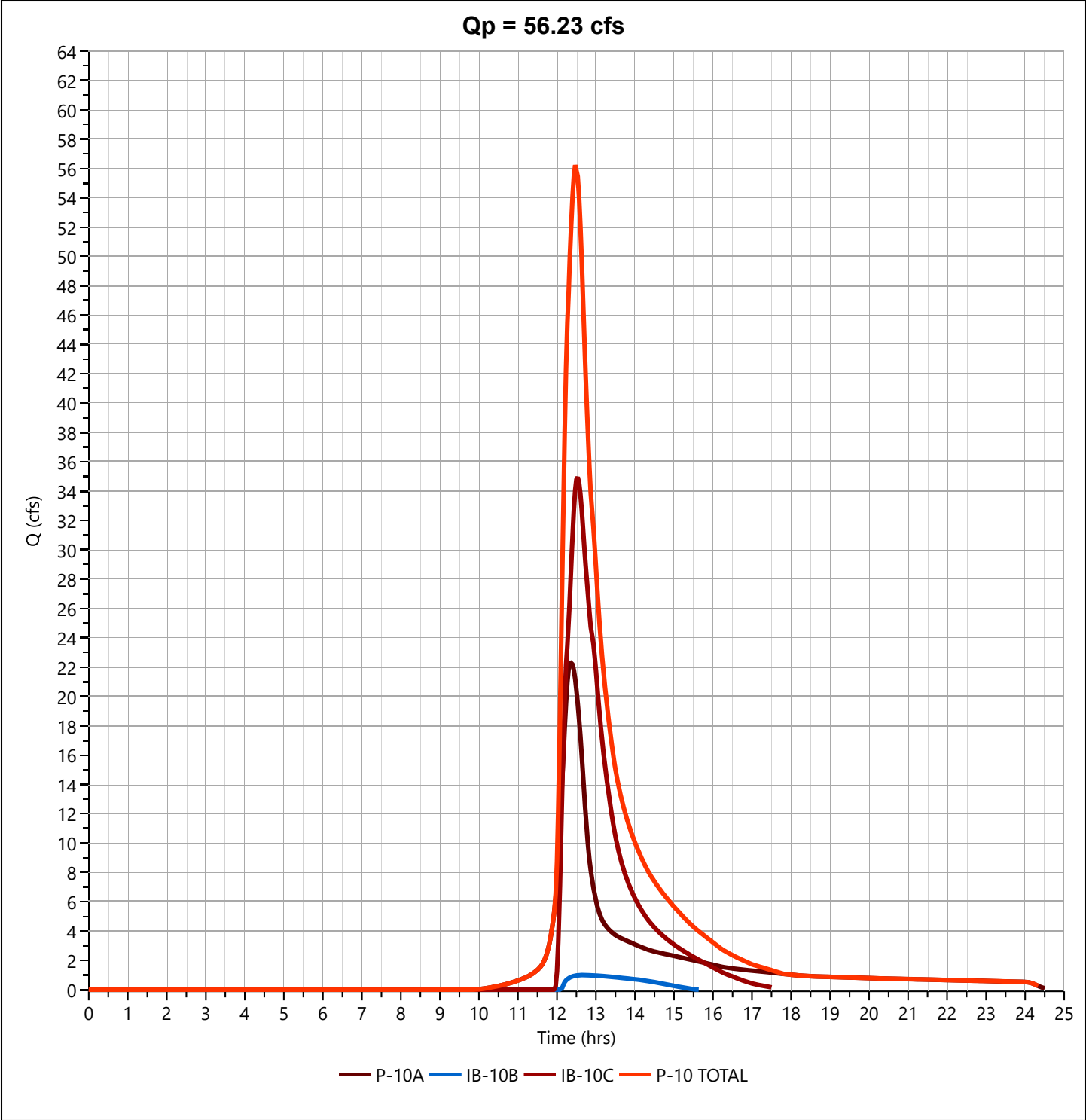
Hydrology Studio v 3.0.0.21

10-31-2022

## P-10 TOTAL

Hyd. No. 58

Hydrograph Type	= Junction	Peak Flow	= 56.23 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 286,599 cuft
Inflow Hydrographs	= 49, 51, 57	Total Contrib. Area	= 10.25 ac



## Worksheet 2: Runoff curve number and runoff

SM-3719C

Project: Athens Street By NC Date 6/24/22  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	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	698.11
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.			469446	Totals =		10.78	722.23

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{722.23}{10.78} = 67.02 ; \text{ Use CN} = \boxed{67}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

Runoff, Q..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.72	2.64	3.99

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 6/24/2022Location: Stow, MAChecked Rev Date 10/13/2022Date Circle one: Present ☐ Developed ☒Circle one: Tc ☐ Tt ☒Subcatchment P-11through  
subarea Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

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

Compute V ft/s

17.  $V = 1.49 r^{2/3} s^{1/2} / n$ 

18. Flow length, L

ft

19.  $T_t = L / 3600V$ 

Compute Tt hr

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:

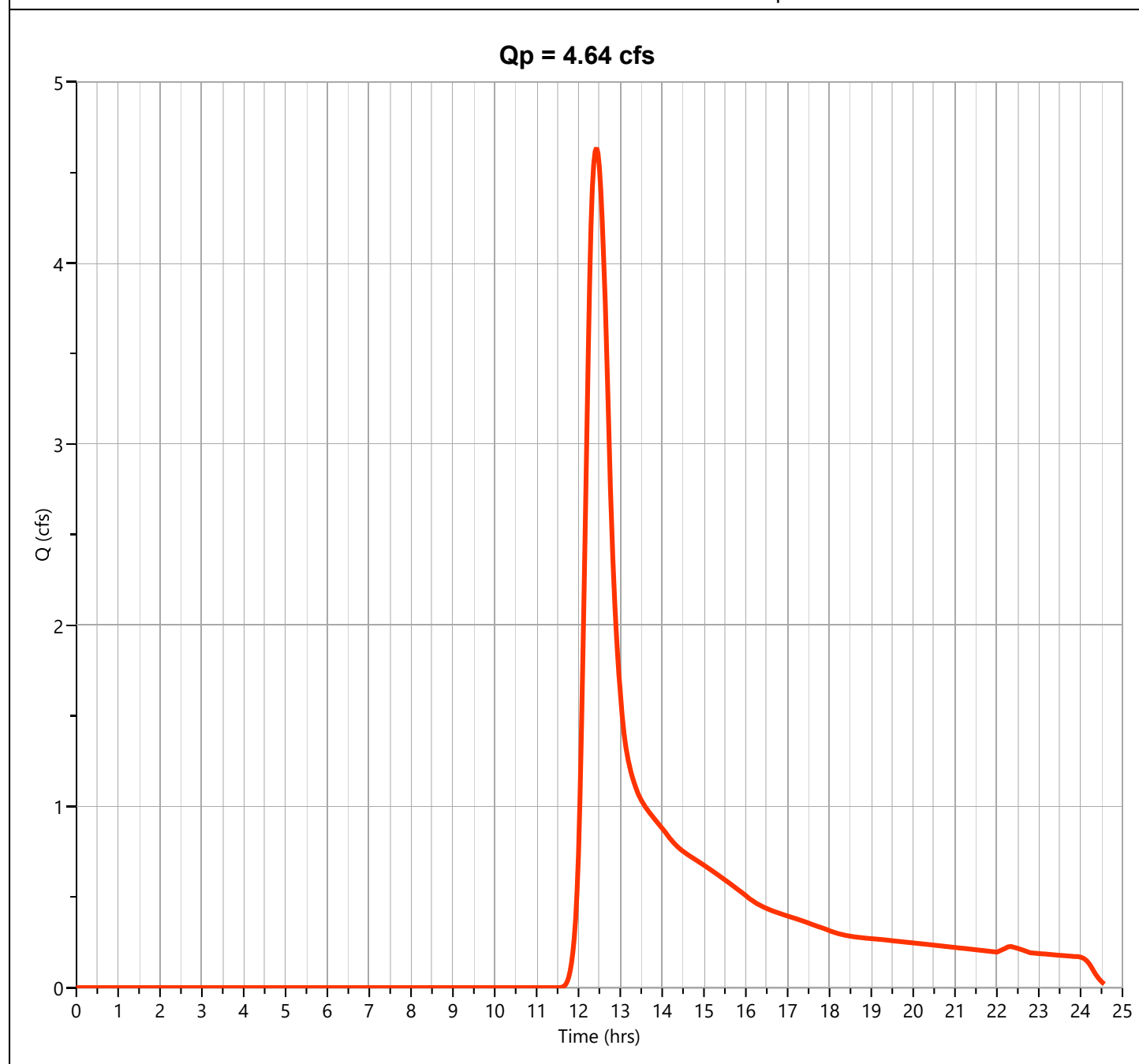
Hydrology Studio v 3.0.0.21

10-27-2022

**P-11**

**Hyd. No. 62**

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:

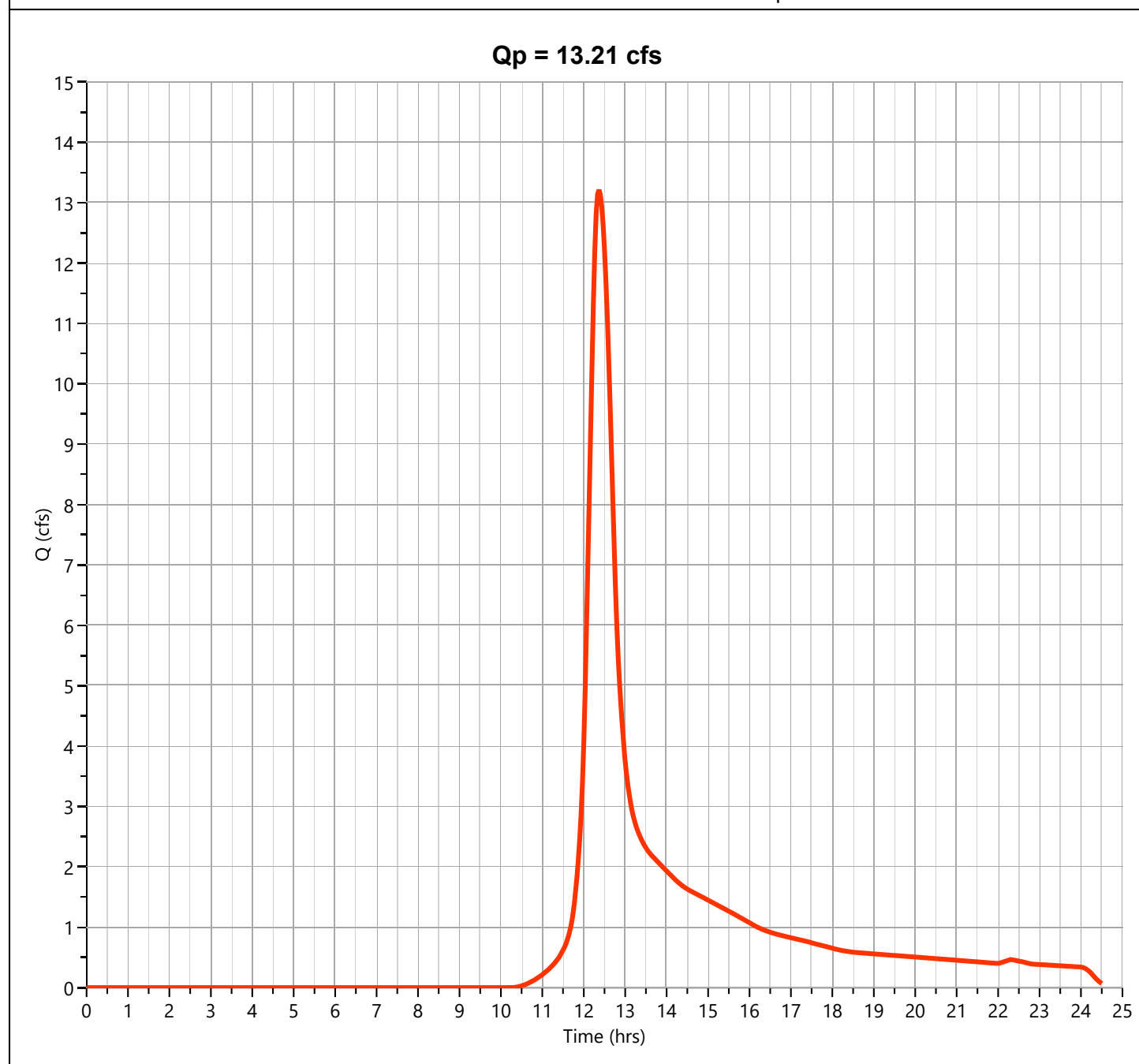
Hydrology Studio v 3.0.0.21

10-27-2022

**P-11**

**Hyd. No. 62**

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:

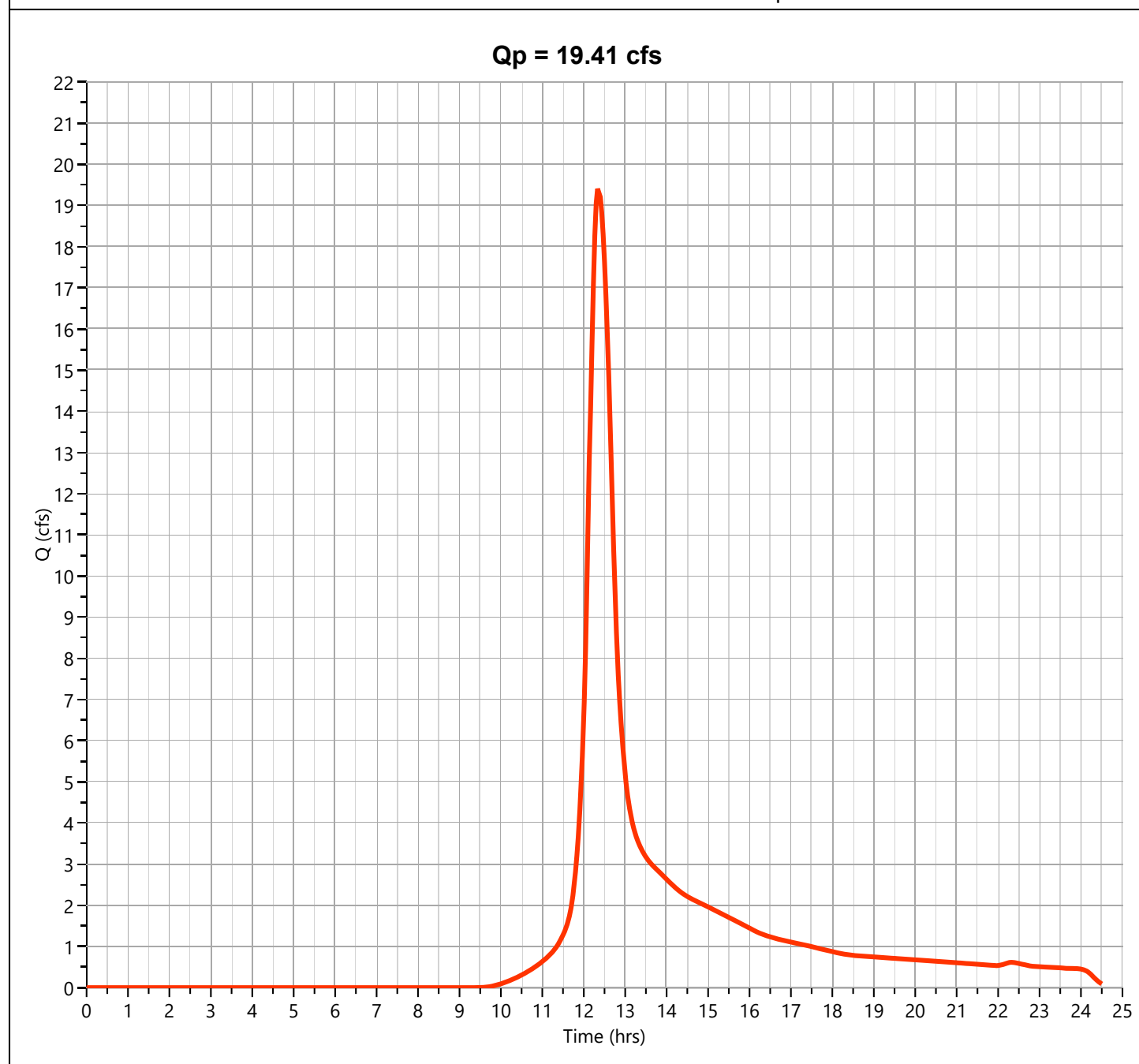
Hydrology Studio v 3.0.0.21

10-27-2022

**P-11**

**Hyd. No. 62**

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:

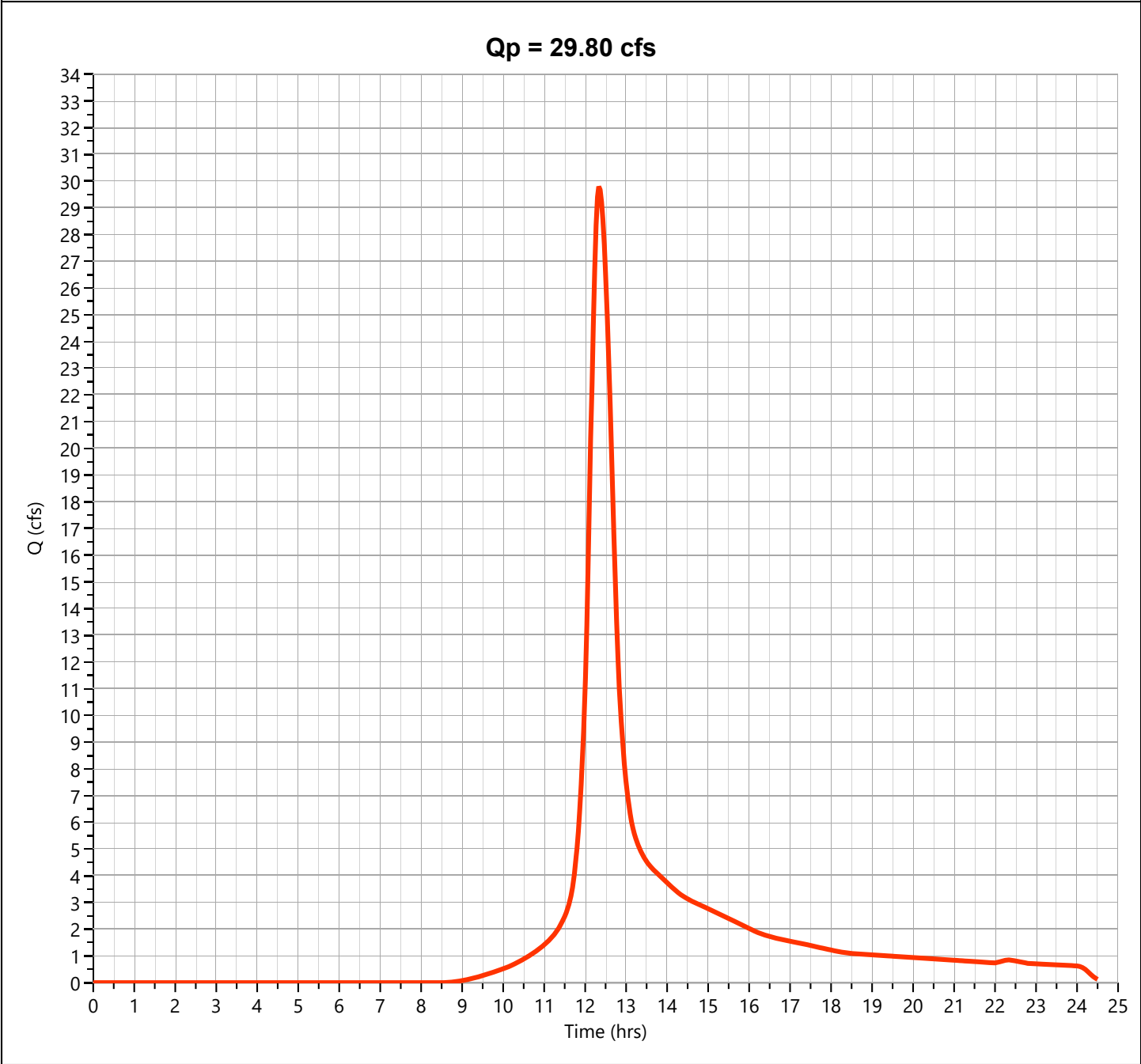
Hydrology Studio v 3.0.0.21

10-27-2022

P-11

Hyd. No. 62

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  
 Location: Stow, MA Checked            Rev Date 10/13/2022  
 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/			Area Acres	Product of CN x Area
			Table 2-2	Fig. 2-3	Fig. 2-4		
	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

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{6.53}{0.22} = 30.00 ; \text{ Use CN} = \boxed{30}$$

## 2. Runoff

Frequency..... yr

Rainfall, P (24-hour)..... in

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

Storm #1	Storm #2	Storm #3
2	25	100
3.27	6.14	7.84
0.09	0.09	0.38

## Worksheet 3: Time of Concentration (Tc) or travel time (Tt)

SM-3719C

Project: Athens StreetBy NCDate 6/24/2022Location: Stow, MAChecked                     Rev Date 10/13/2022Date                     Circle one: Present ☐ Developed ☒Circle one: Tc ☐ Tt ☒Subcatchment P-12through                       
subarea                     Sheet flow (Applicable to Tc only)

Segment ID

1. Surface Description (table 3-1)

2. Mannings roughness coeff., n (table 3-1)

3. Flow length, L (total L &lt;= 300 ft)

ft

4. Two-yr 24-hr rainfall, P2

in

5. Land Slope, s

ft/ft

6.  $T_t = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$ 

Compute Tt hr

0.14

A-B		
WOODS		
0.6		
50		
3.1		
0.122		
0.14		

Shallow concentrated Flow

Segment ID

7. Surface Description (paved or unpaved)

8. Flow Length, L

ft

9. Watercourse slope, s

ft/ft

10. Average Velocity, V (figure 3-1)

ft/s

11.  $T_t = L / 3600V$ 

Compute Tt hr

0.00

B-C		
UNPAVED		
57		
0.112		
5.40		
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.  $T_t = L / 3600V$ 

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 3.0.0.21

10-27-2022

**P-12**

**Hyd. No. 64**

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:

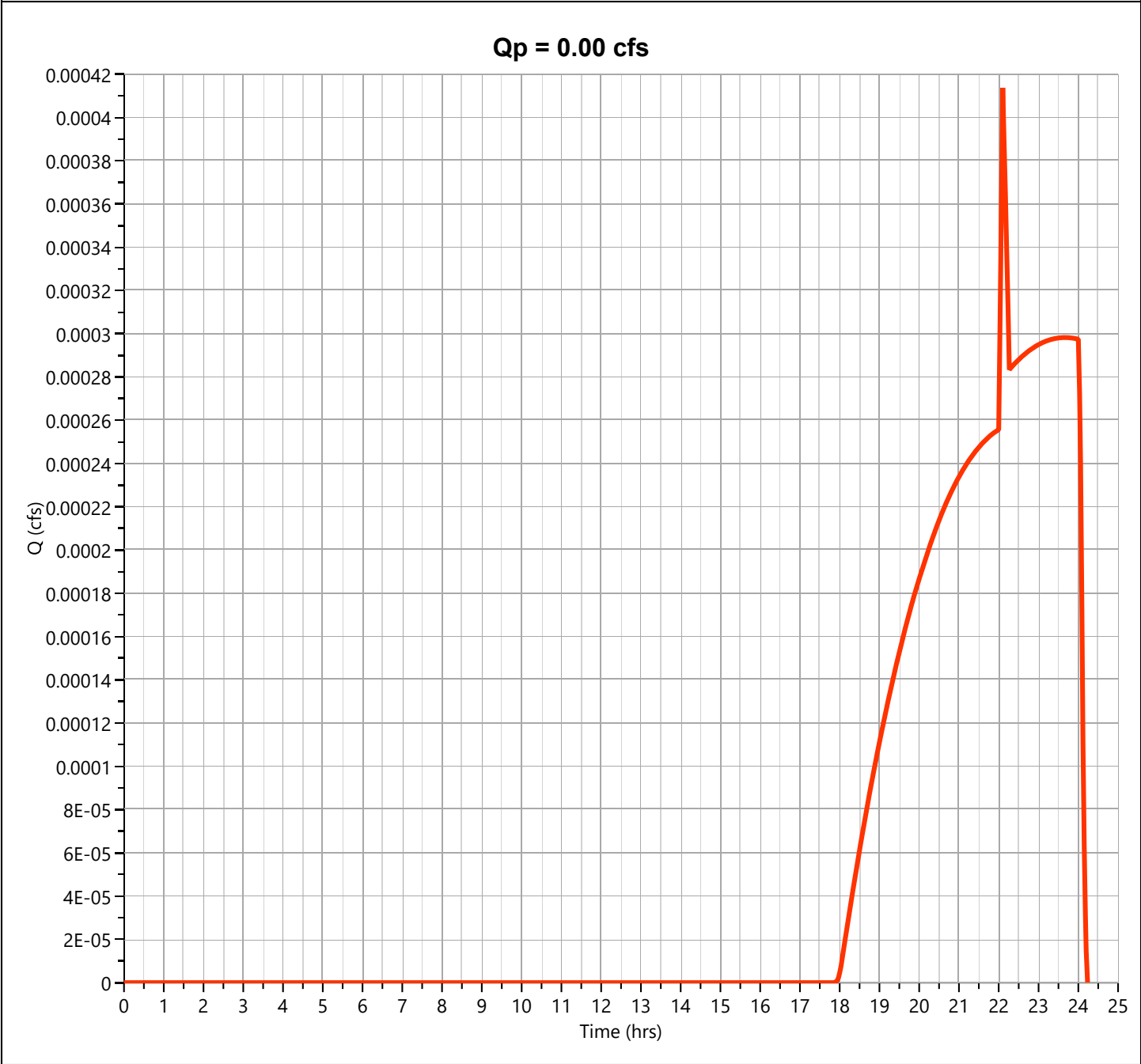
Hydrology Studio v 3.0.0.21

10-27-2022

P-12

Hyd. No. 64

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 22.10 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:

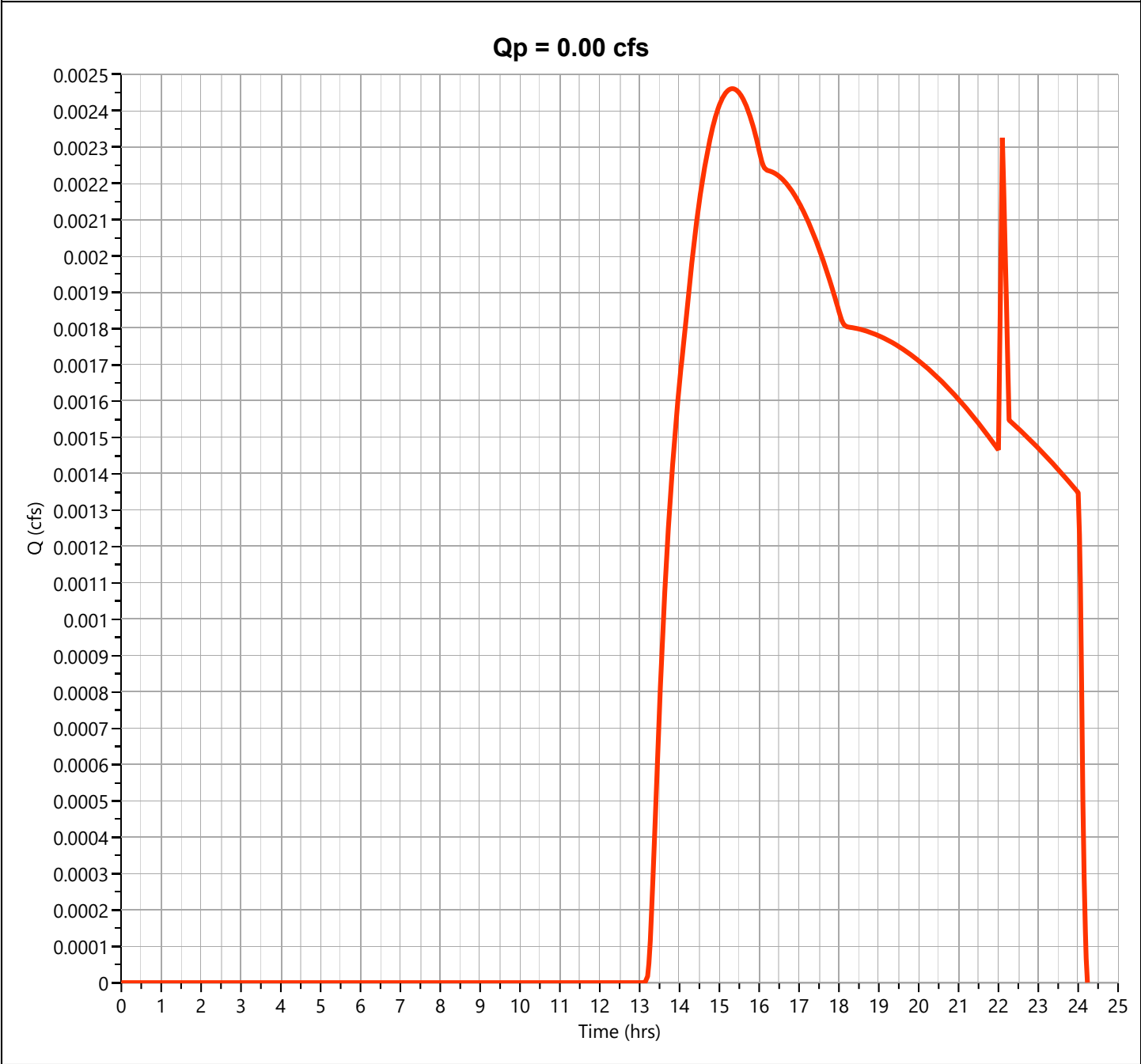
Hydrology Studio v 3.0.0.21

10-27-2022

P-12

Hyd. No. 64

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:

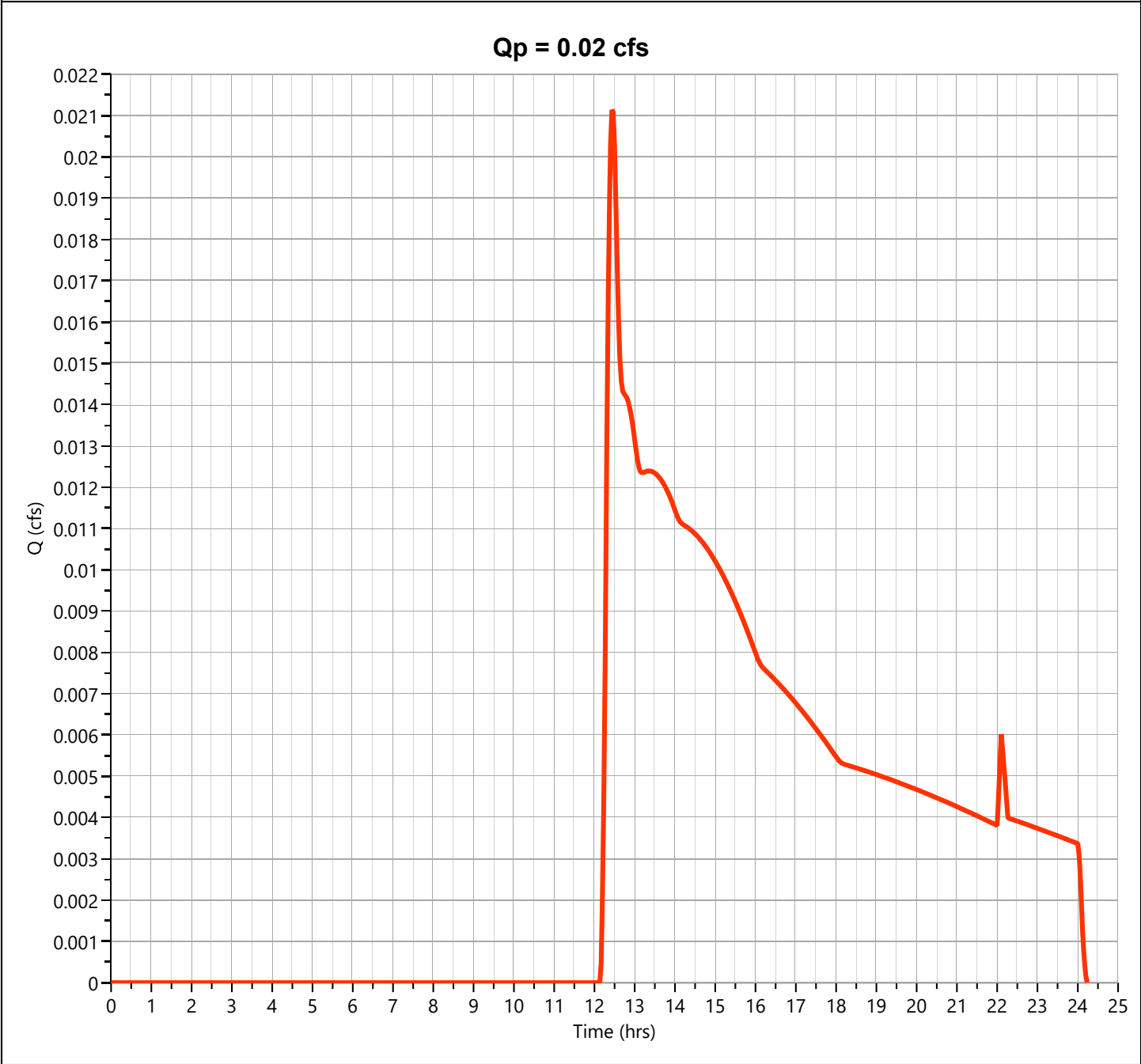
Hydrology Studio v 3.0.0.21

10-27-2022

P-12

Hyd. No. 64

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





# Hydrograph Report

Project Name:

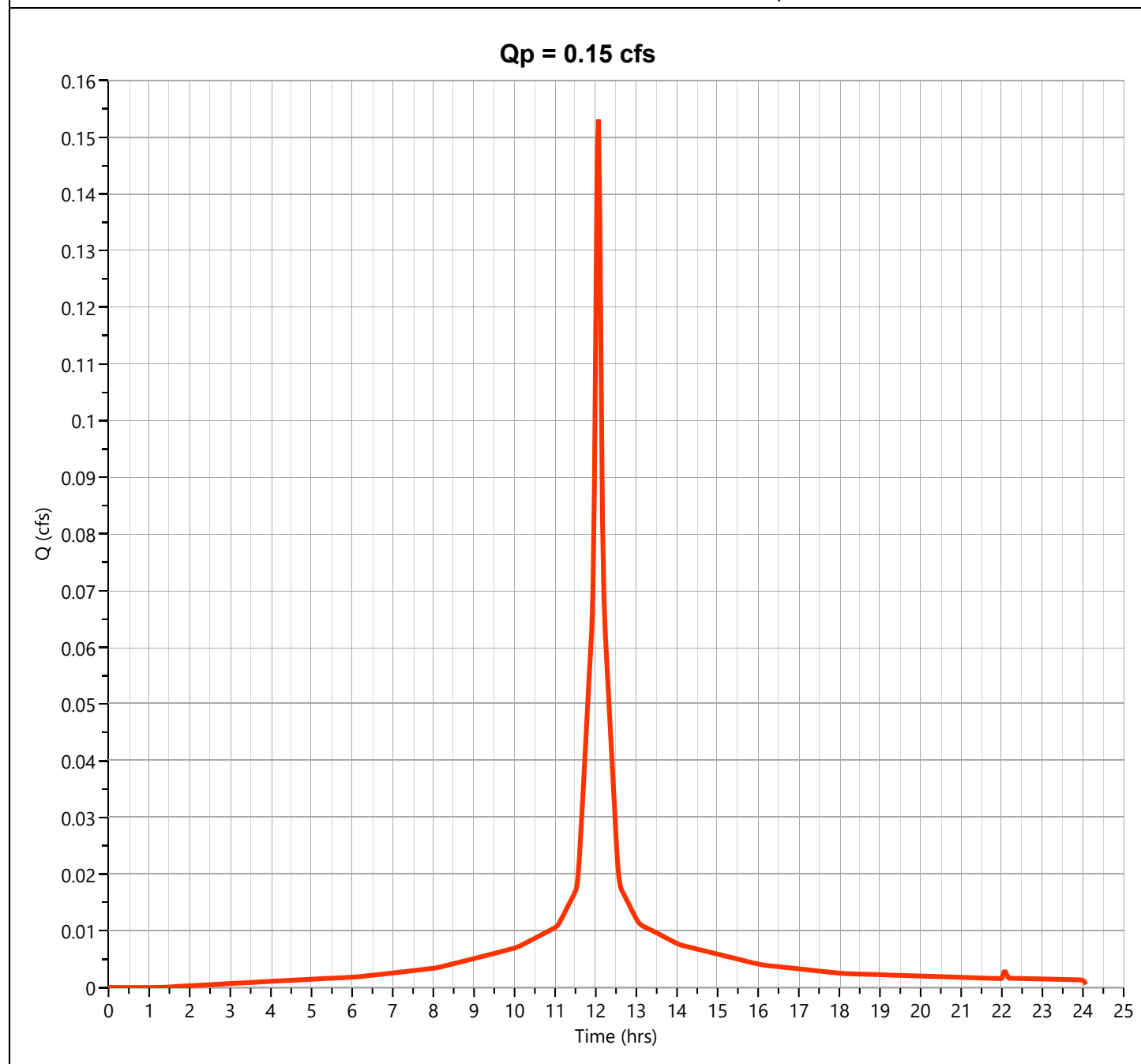
Hydrology Studio v 3.0.0.21

10-27-2022

## Roof Runoff

Hyd. No. 66

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.153 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 517 cuft
Drainage Area	= 0.05 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.27 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

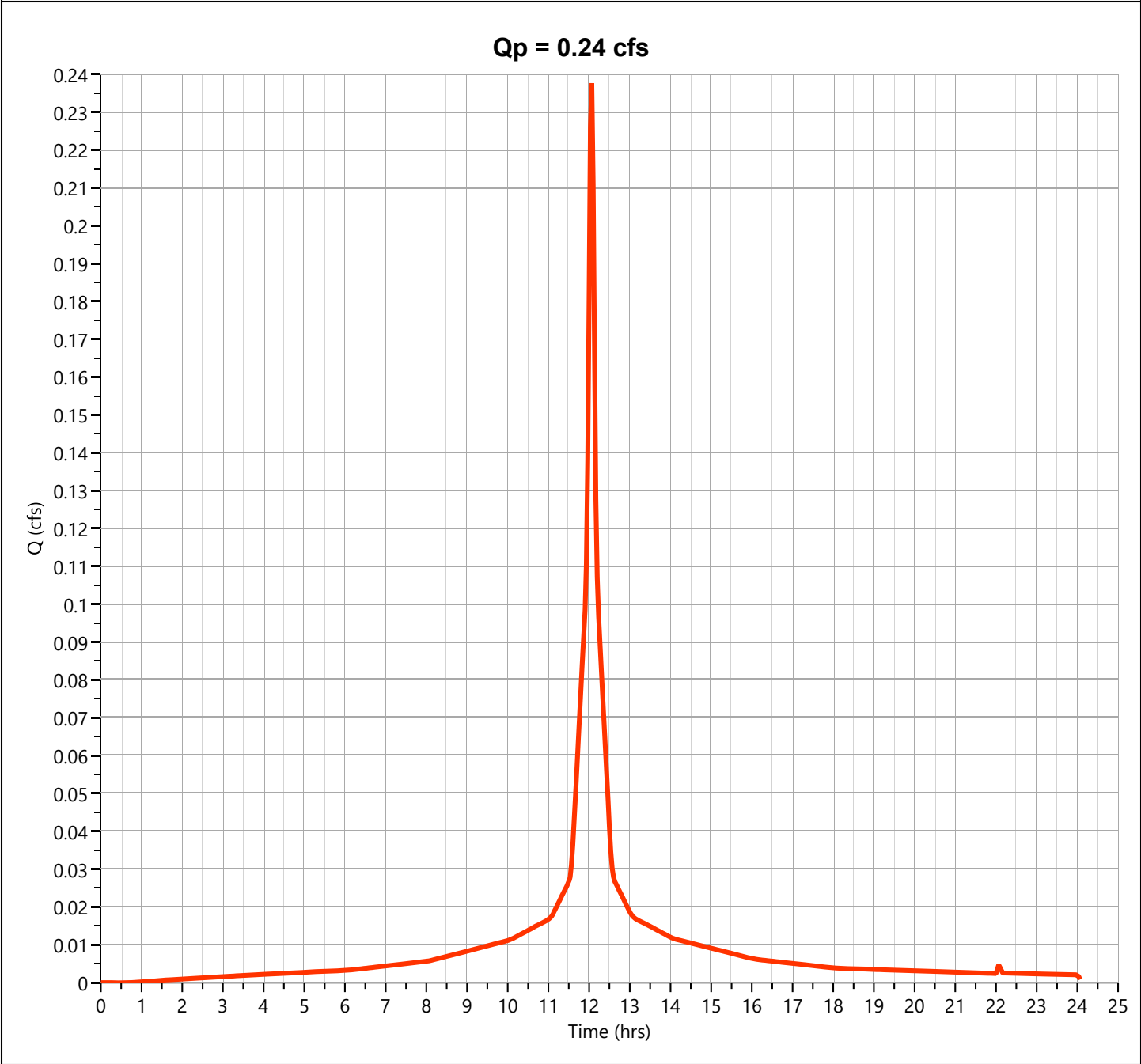
Hydrology Studio v 3.0.0.21

10-27-2022

## Roof Runoff

Hyd. No. 66

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.238 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 817 cuft
Drainage Area	= 0.05 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.04 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

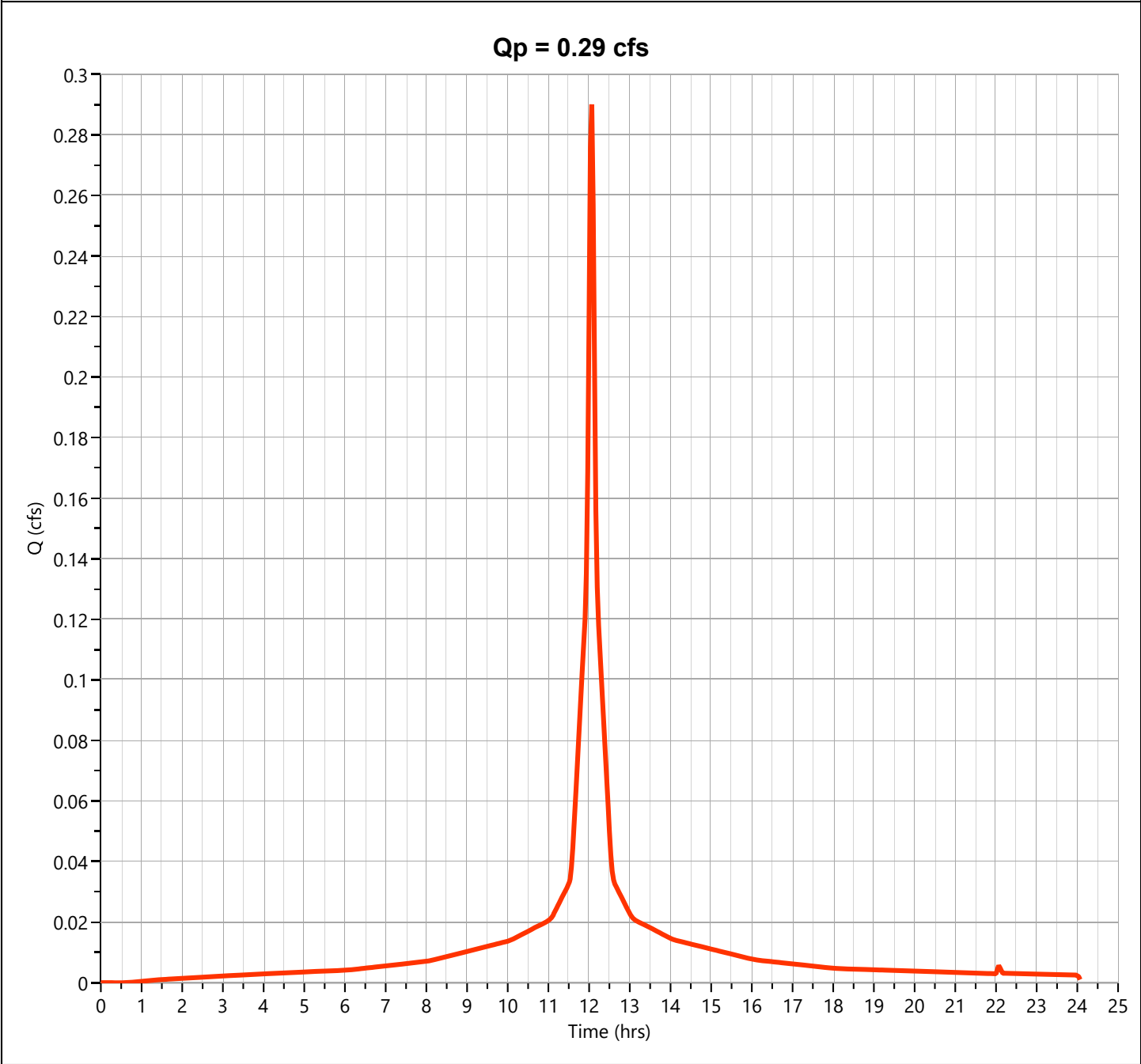
Hydrology Studio v 3.0.0.21

10-27-2022

## Roof Runoff

Hyd. No. 66

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.290 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 1,004 cuft
Drainage Area	= 0.05 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.14 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

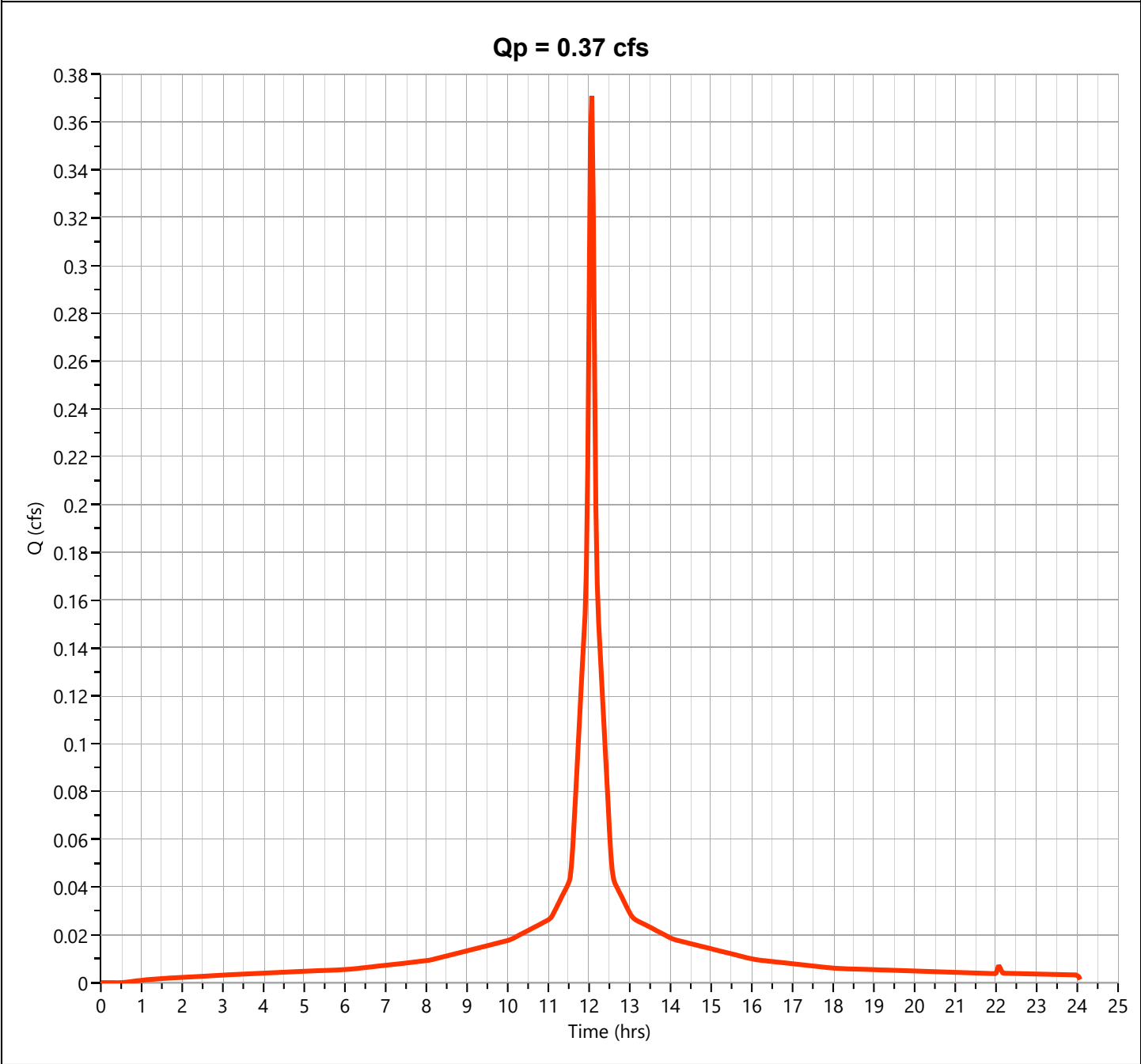
Hydrology Studio v 3.0.0.21

10-27-2022

## Roof Runoff

Hyd. No. 66

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.371 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 1,293 cuft
Drainage Area	= 0.05 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 7.84 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

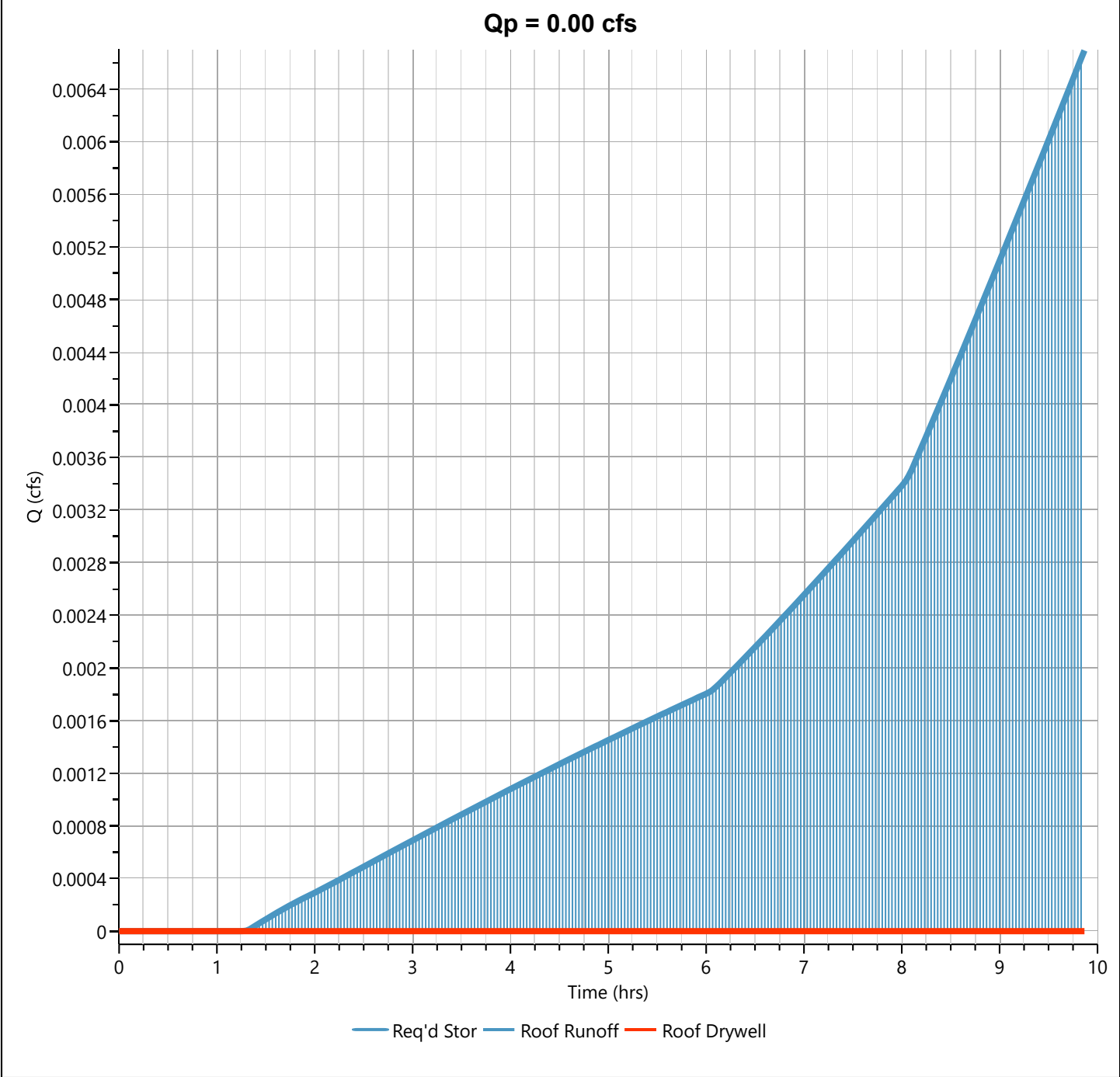
10-27-2022

## Roof Drywell

Hyd. No. 67

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 9.83 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 66 - Roof Runoff	Max. Elevation	= 101.06 ft
Pond Name	= Roof Drywell	Max. Storage	= 161 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

10-27-2022

## Roof Drywell

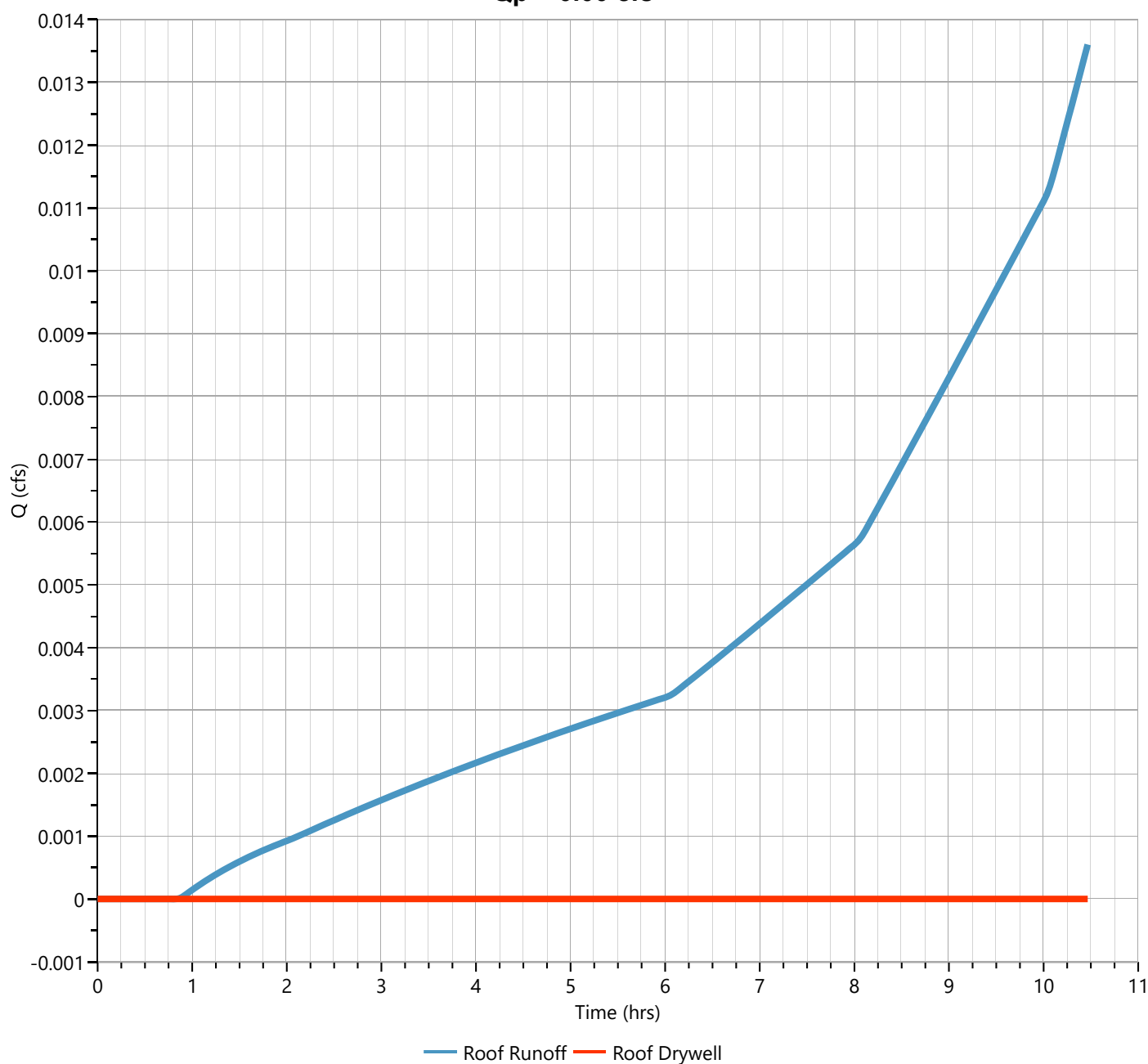
Hyd. No. 67

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 10.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 66 - Roof Runoff	Max. Elevation	= 101.75 ft
Pond Name	= Roof Drywell	Max. Storage	= 291 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 2.77 hrs

**Qp = 0.00 cfs**



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

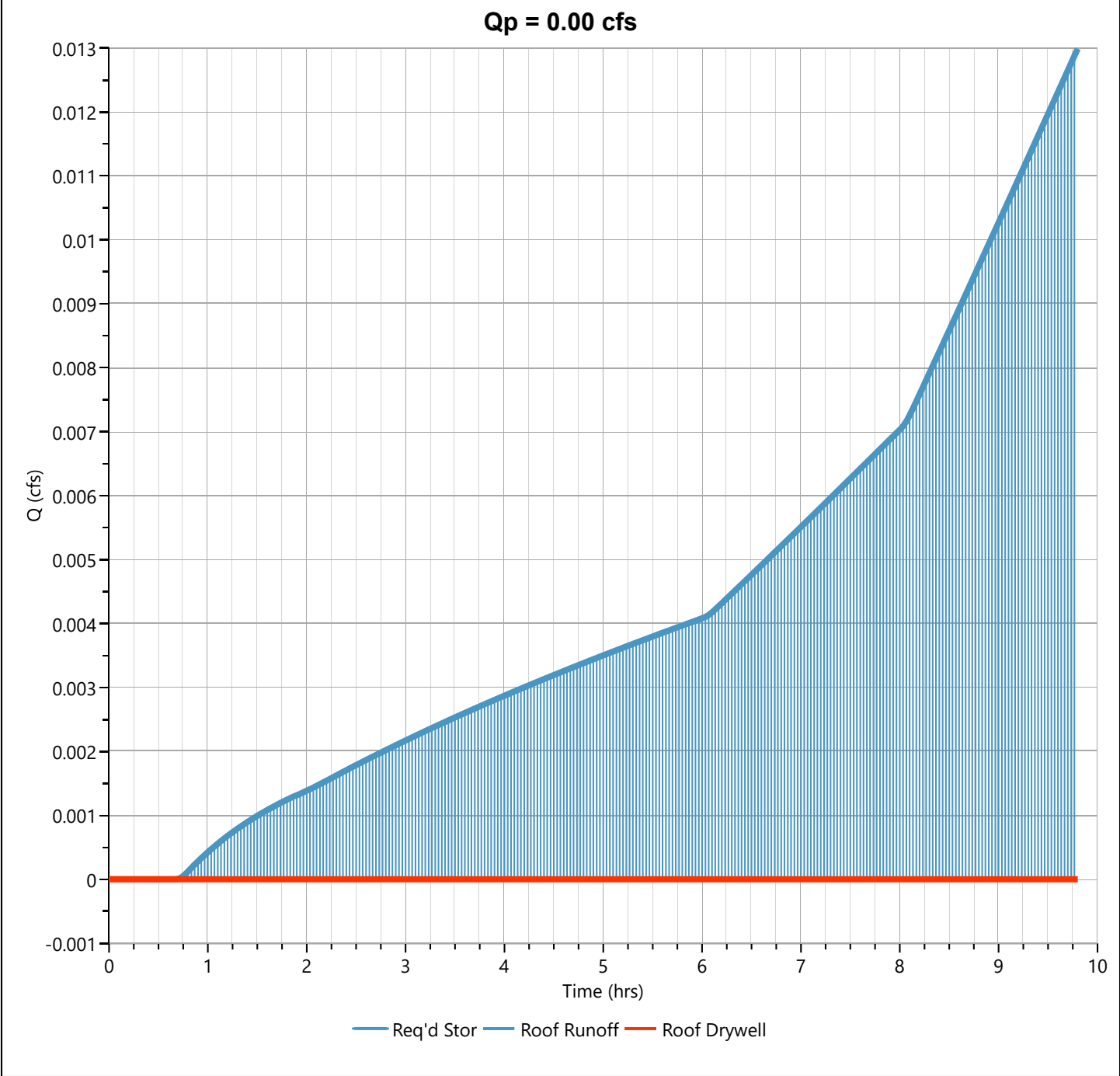
10-27-2022

## Roof Drywell

Hyd. No. 67

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 9.77 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 66 - Roof Runoff	Max. Elevation	= 102.24 ft
Pond Name	= Roof Drywell	Max. Storage	= 379 cuft

Pond Routing by Storage Indication Method



# Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.21

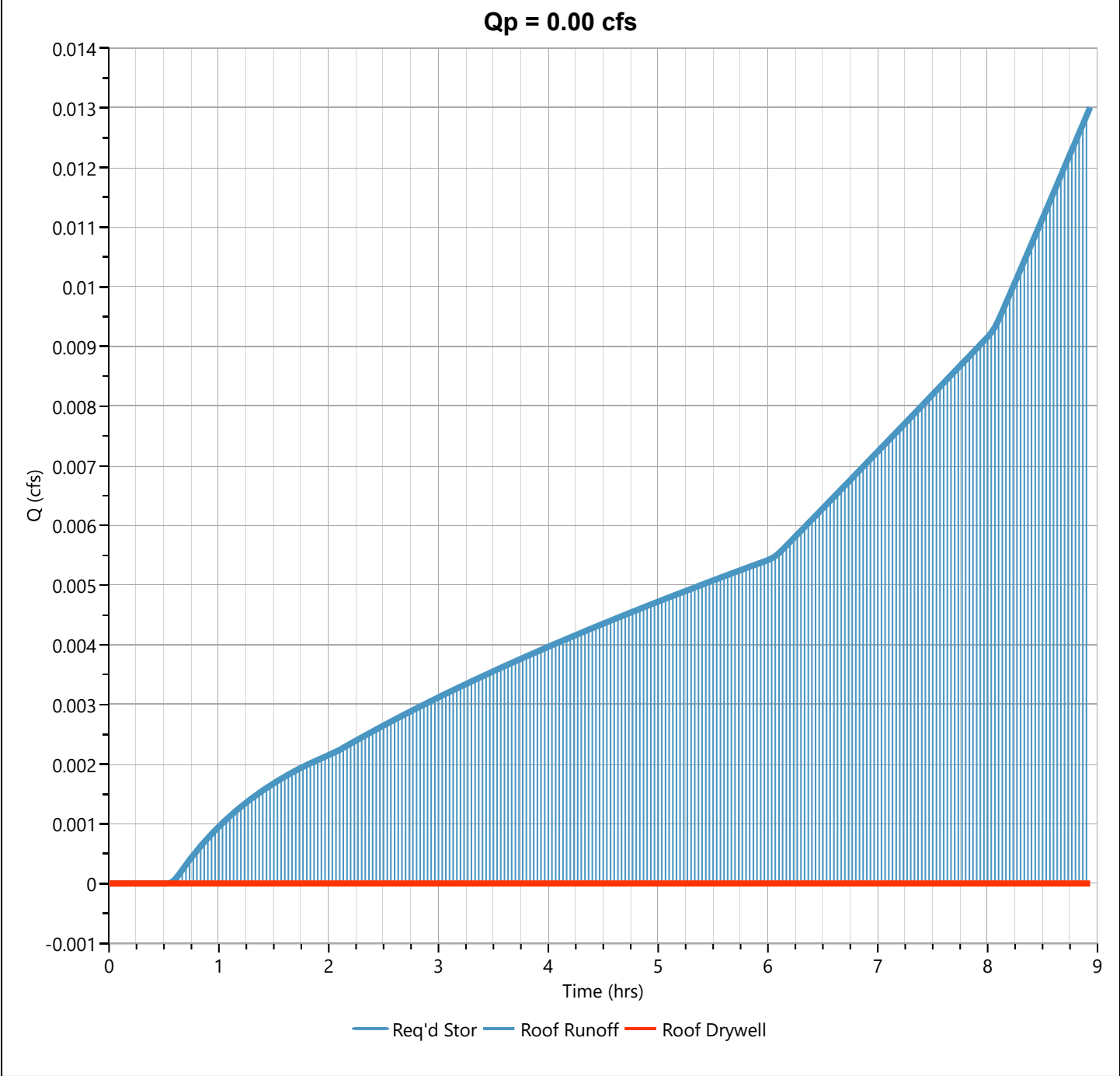
10-27-2022

## Roof Drywell

Hyd. No. 67

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 8.90 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 66 - Roof Runoff	Max. Elevation	= 103.25 ft
Pond Name	= Roof Drywell	Max. Storage	= 521 cuft

Pond Routing by Storage Indication Method

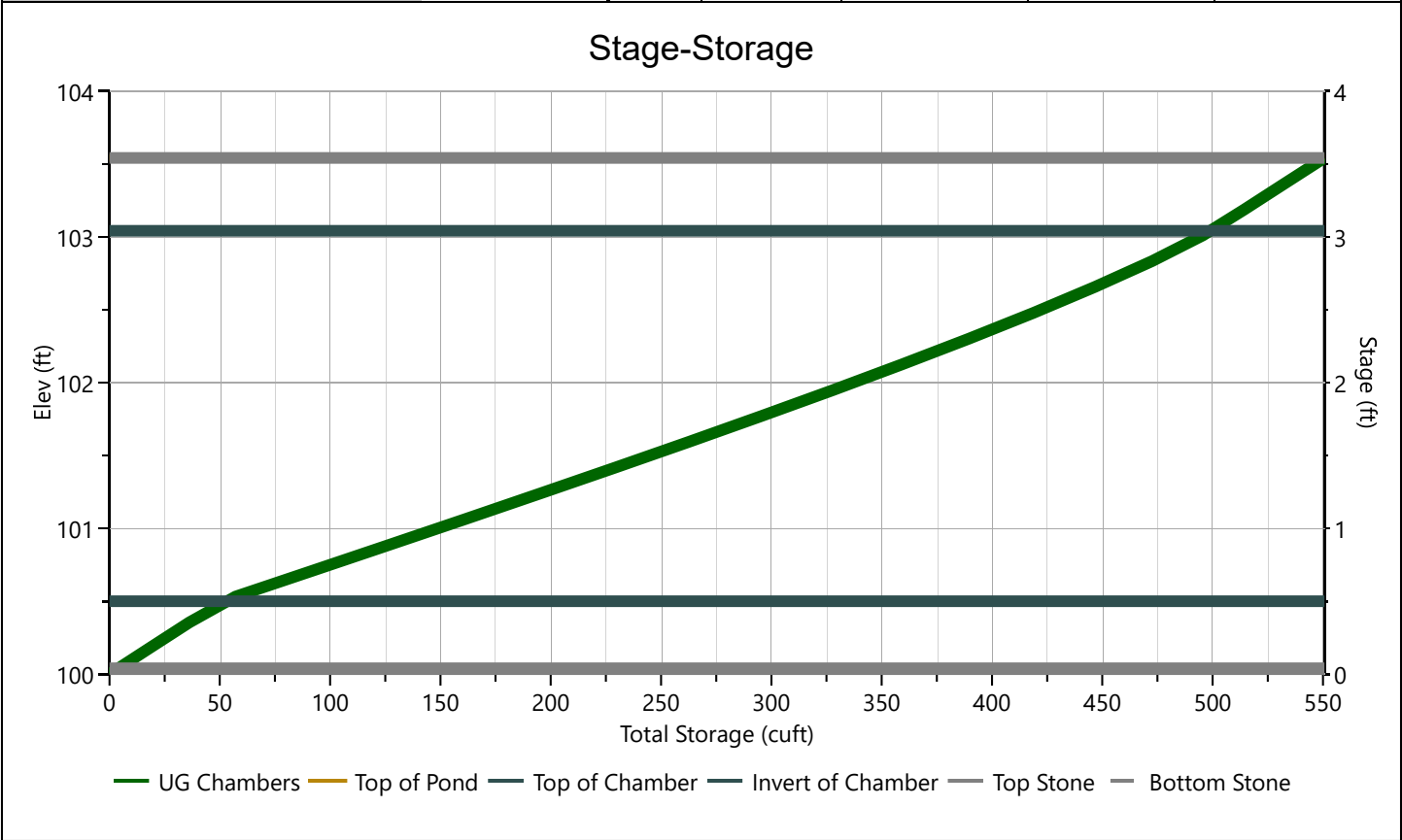




Roof Drywell

Stage-Storage

		Stage / Storage Table				
Description	Input	Stage (in)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Chamber Height, in	30.5	0.0	100.00	256	0.000	0.000
Chamber Shape	Arch	2.1	100.18	256	18.1	18.1
Chamber Width, in	52	4.2	100.35	256	18.1	36.3
Installed Length, ft	7.00	6.4	100.53	256	20.9	57.2
		8.5	100.71	256	34.8	92.0
No. Chambers	6	10.6	100.89	256	34.7	127
Bare Chamber Stor, cuft	313	12.7	101.06	256	34.5	161
		14.9	101.24	256	34.2	195
No. Rows	3	17.0	101.42	256	33.9	229
		19.1	101.59	256	33.4	263
Space Between Rows, in	6	21.2	101.77	256	32.9	296
Stone Above, in	6	23.4	101.95	256	32.2	328
Stone Below, in	6	25.5	102.13	256	31.4	359
		27.6	102.30	256	30.4	390
Stone Sides, in	12	29.7	102.48	256	29.3	419
Stone Ends, in	12	31.9	102.66	256	27.8	447
		34.0	102.83	256	25.9	473
Encasement Voids, %	40.00	36.1	103.01	256	23.1	496
		38.2	103.19	256	18.7	514
Encasement Bottom Elevation, ft	100.00	40.4	103.36	256	18.1	532
		42.5	103.54	256	18.1	551

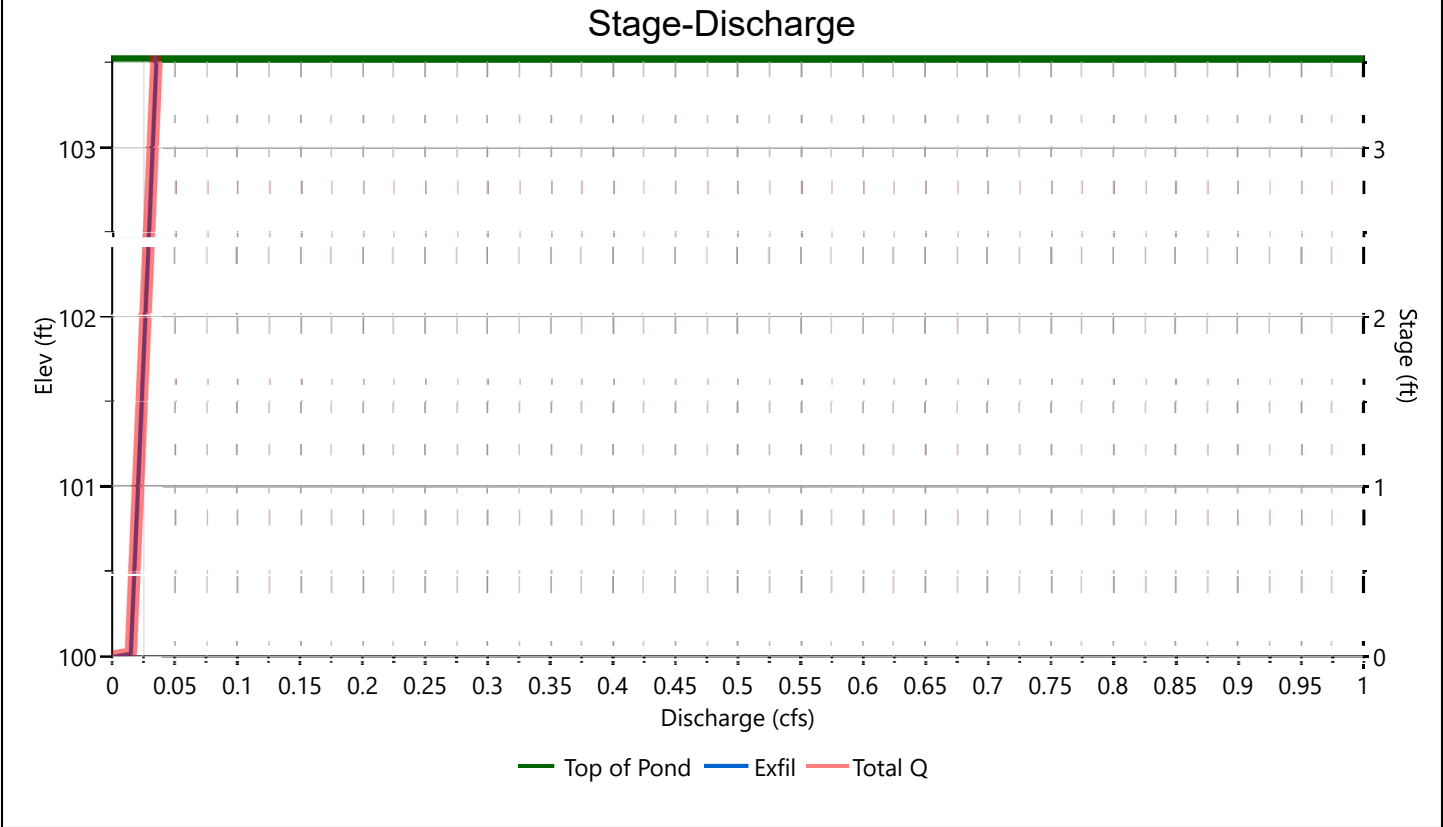


Roof Drywell

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	2.41**
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 3.0.0.21

10-27-2022

## Roof Drywell

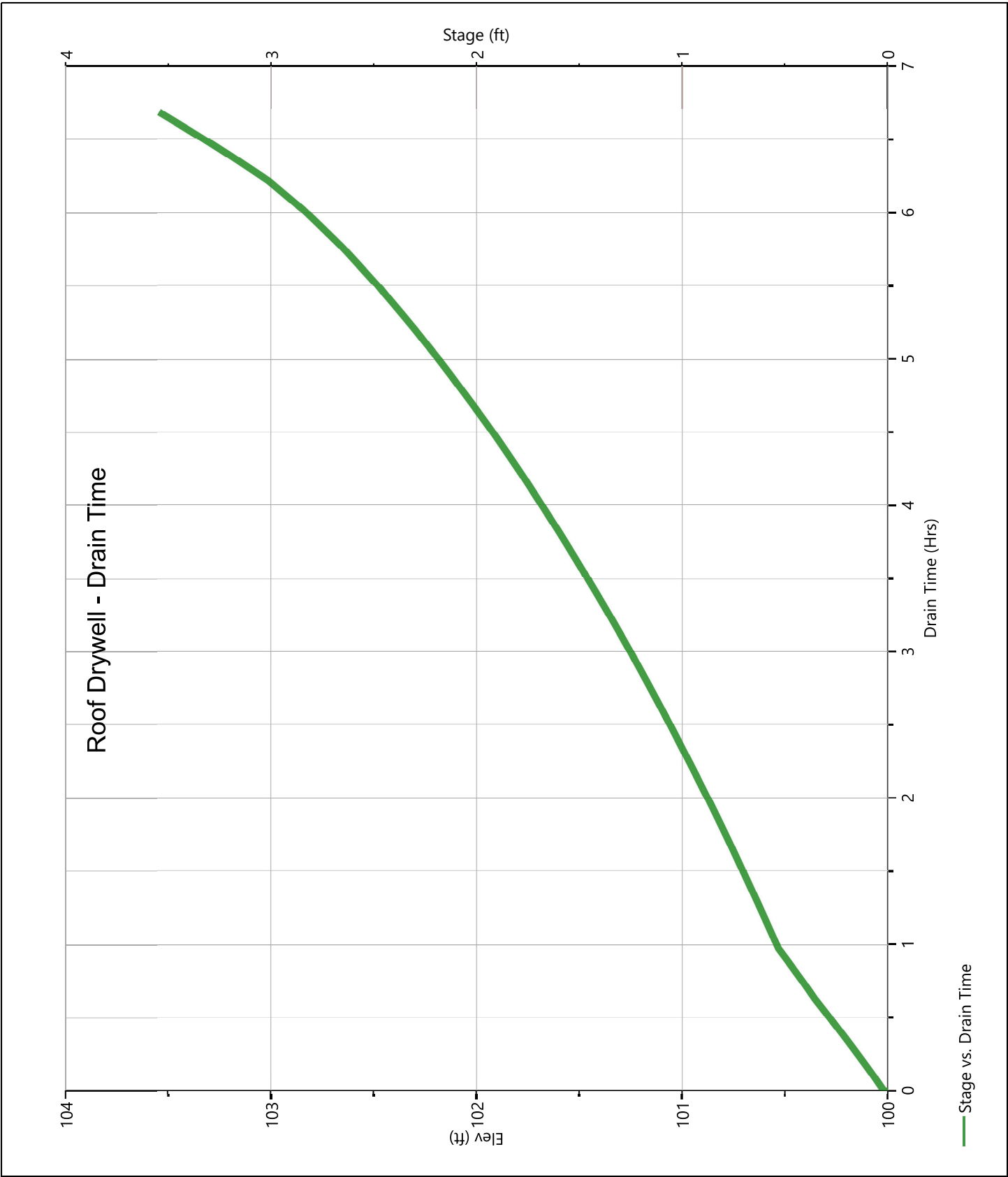
## Stage-Storage-Discharge Summary

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	100.00	0.000										0.000		0.000
0.18	100.18	18.1										0.015		0.015
0.35	100.35	36.3										0.016		0.016
0.53	100.53	57.2										0.017		0.017
0.71	100.71	92.0										0.018		0.018
0.89	100.89	127										0.019		0.019
1.06	101.06	161										0.020		0.020
1.24	101.24	195										0.021		0.021
1.42	101.42	229										0.022		0.022
1.59	101.59	263										0.023		0.023
1.77	101.77	296										0.024		0.024
1.95	101.95	328										0.025		0.025
2.12	102.13	359										0.026		0.026
2.30	102.30	390										0.027		0.027
2.48	102.48	419										0.028		0.028
2.66	102.66	447										0.029		0.029
2.83	102.83	473										0.030		0.030
3.01	103.01	496										0.031		0.031
3.19	103.19	514										0.032		0.032
3.36	103.36	532										0.033		0.033
3.54	103.54	551										0.034		0.034

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

Roof Drywell

Pond Drawdown



## **Recharge Volume Calculations**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-2A1

Soils: Merrimac Fine Sandy Loam  
Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.59 acres  
25,607 s.f.

### Required Recharge Volume (Rv)

$$Rv = 25,607 \text{ s.f.} \times \frac{0.6}{12} = 1,280 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 2.85 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 3,719 s.f.

Voids = 1.00

Rv = 15,725 c.f.

Basin Volume: 20,415 c.f. (Below Outlet)

> 1,280 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.88 \text{ Hours}$$

**1.88 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-2A2

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.49 acres

21,194 s.f.

### Required Recharge Volume (Rv)

$$Rv = 21,194 \text{ s.f.} \times \frac{0.6}{12} = 1,060 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 2.5 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 3,902 s.f.

Voids = 1.00

Rv = 15,133 c.f.

Basin Volume: 15,103 c.f. (Below Outlet)

> 1,060 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.45 \text{ Hours}$$

**1.45 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-2B-A

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.81 acres

35,120 s.f.

### Required Recharge Volume (Rv)

$$Rv = 35,120 \text{ s.f.} \times \frac{0.6}{12} = 1,756 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 0.3 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 8,666 s.f.

Voids = 1.00

Rv = 14,544 c.f.

Basin Volume: 15,103 c.f. (Below Outlet)

> 1,756 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.51 \text{ Hours}$$

1.51 < 72 hours O.K.



## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-3A

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.40 acres

17,634 s.f.

### Required Recharge Volume (Rv)

$$Rv = 17,634 \text{ s.f.} \times \frac{0.25}{12} = 367 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 0.5 ft

K (saturated hydraulic conductivity): 2.41 inches/hour

0.20 feet/hour

T (time): 2 hours

A = 1,532 s.f.

Voids = 1.00

Rv = 1,381 c.f.

Basin Volume: 894 c.f. (Below Outlet)

> 367 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 3.22 \text{ Hours}$$

**3.22 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-4A

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.27 acres  
11,863 s.f.

### Required Recharge Volume (Rv)

$$Rv = 11,863 \text{ s.f.} \times \frac{0.25}{12} = 247 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 0.5 ft

K (saturated hydraulic conductivity): 2.41 inches/hour

0.20 feet/hour

T (time): 2 hours

A = 2,195 s.f.

Voids = 1.00

Rv = 1,979 c.f.

Basin Volume: 1,270 c.f. (Below Outlet)

> 247 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 3.20 \text{ Hours}$$

**3.20 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-5B

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 0.47 acres

20,683 s.f.

### Required Recharge Volume (Rv)

$$Rv = 20,683 \text{ s.f.} \times \frac{0.25}{12} = 431 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 0.75 ft

K (saturated hydraulic conductivity): 2.41 inches/hour

0.20 feet/hour

T (time): 2 hours

A = 2,245 s.f.

Voids = 1.00

Rv = 2,585 c.f.

Basin Volume: 1,917 c.f. (Below Outlet)

> 431 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 3.69 \text{ Hours}$$

**3.69 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### 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)

$$Rv = 26,104 \text{ s.f.} \times \frac{0.25}{12} = 544 \text{ c.f.}$$

### 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 = 2,250 s.f.

Voids = 1.00

Rv = 6,979 c.f.

Basin Volume: 10,534 c.f. (Below Outlet)

> 544 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 7.52 \text{ Hours}$$

**7.52 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### 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

44,895 s.f.

### Required Recharge Volume (Rv)

$$Rv = 44,895 \text{ s.f.} \times \frac{0.25}{12} = 935 \text{ c.f.}$$

### 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 = 2,831 s.f.

Voids = 1.00

Rv = 6,143 c.f.

Basin Volume: 8,291 c.f. (Below Outlet)

> 935 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 15.88 \text{ Hours}$$

**15.88 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-6B

Soils: Merrimac Fine Sandy Loam  
Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.17 acres  
7,213 s.f.

### Required Recharge Volume (Rv)

$$Rv = 7,213 \text{ s.f.} \times \frac{0.6}{12} = 361 \text{ c.f.}$$

### 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 = 351 s.f.

Voids = 1.00

Rv = 1,537 c.f.

Basin Volume: 2,347 c.f. (Below Outlet)

> 361 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 2.22 \text{ Hours}$$

**2.22 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-7A

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 1.47 acres

64,127 s.f.

### Required Recharge Volume (Rv)

$$Rv = 64,127 \text{ s.f.} \times \frac{0.6}{12} = 3,206 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 3.4 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 3,716 s.f.

Voids = 1.00

Rv = 17,756 c.f.

Basin Volume: 19,516 c.f. (Below Outlet)

> 3,206 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.59 \text{ Hours}$$

**1.59 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-7B

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.52 acres  
22,486 s.f.

### Required Recharge Volume (Rv)

$$Rv = 22,486 \text{ s.f.} \times \frac{0.6}{12} = 1,124 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 2.5 ft

K (saturated hydraulic conductivity): 2.41 inches/hour

0.20 feet/hour

T (time): 2 hours

A = 1,667 s.f.

Voids = 1.00

Rv = 4,837 c.f.

Basin Volume: 6,600 c.f. (Below Outlet)

> 1,124 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 6.79 \text{ Hours}$$

**6.79 < 72 hours O.K.**



## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-8

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 2.01 acres

87,645 s.f.

### Required Recharge Volume (Rv)

$$Rv = 87,645 \text{ s.f.} \times \frac{0.6}{12} = 4,382 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 4 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 6,237 s.f.

Voids = 1.00

Rv = 33,545 c.f.

Basin Volume: 37,787 c.f. (Below Outlet)

> 4,382 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.63 \text{ Hours}$$

**1.63 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-10B

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.25 inches of runoff x impervious area

Impervious area: 1.68 acres

73,029 s.f.

### Required Recharge Volume (Rv)

$$Rv = 73,029 \text{ s.f.} \times \frac{0.25}{12} = 1,521 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 1.75 ft

K (saturated hydraulic conductivity): 2.41 inches/hour

0.20 feet/hour

T (time): 2 hours

A = 4,961 s.f.

Voids = 1.00

Rv = 10,674 c.f.

Basin Volume: 10,890 c.f. (Below Outlet)

> 1,521 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 5.08 \text{ Hours}$$

**5.08 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### IB-10C

Soils: Woodbridge Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 3.35 acres

145,806 s.f.

### Required Recharge Volume (Rv)

$$Rv = 145,806 \text{ s.f.} \times \frac{0.6}{12} = 7,290 \text{ c.f.}$$

### 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 = 16,659 s.f.

Voids = 1.00

Rv = 39,621 c.f.

Basin Volume: 18,217 c.f. (Below Outlet)

> 7,290 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 0.67 \text{ Hours}$$

**0.67 < 72 hours O.K.**

## Recharge Volume Calculations

Job: 3719C

Calculated NC

Date: 6/27/2022

Rev: 10/27/2022

### Drywell

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.05 acres  
2,274 s.f.

### Required Recharge Volume (Rv)

$$Rv = 2,274 \text{ s.f.} \times \frac{0.6}{12} = 114 \text{ c.f.}$$

### Simple Dynamic Method

$$A = Rv / (D + KT)$$

$$Rv = A(D + kT)$$

D (depth of infiltration facility): 3.54 ft

K (saturated hydraulic conductivity): 8.27 inches/hour

0.69 feet/hour

T (time): 2 hours

A = 256 s.f.

Voids = 0.40

Rv = 715 c.f.

Drywell Volume: 551 c.f. (Below Outlet)

> 114 c.f.

### 72 Hour Drawdown

$$Rv / (K \times \text{Bottom Area}) = 1.12 \text{ Hours}$$

**1.12 < 72 hours O.K.**

## Required Recharge Volume

Job: SM-3719C

Calculated by: NC  
Date: 6/27/2022  
Rev: 10/27/2022

### Required Recharge Volume

Soils: Sand  
Hydrologic Group: A  
Required Recharge Volume  
1 inches of runoff x impervious area  
Total Impervious Area: 16.99 acres  
**740,236 s.f.**

#### 1.) Required Recharge Volume (Rv)

$$Rv = 740,236 \text{ s.f.} \times \frac{1}{12} = 61,686 \text{ c.f.}$$

$$= 61,686 \text{ c.f.}$$

$$\frac{\text{Impervious Area draining to recharge facilities}}{740,236} = 646,612 \text{ s.f.}$$

$$\frac{740,236}{646,612} = 1.14$$

#### 2.) Adjusted Minimum Required Recharge Volume

$$3.) Rv = 61,686 \text{ s.f.} \times 1.14 = 70,618 \text{ c.f.}$$

4.)

### Recharge Volume Provided

IB-2A1	=	15,725 c.f.
IB-2A2	=	15,133 c.f.
IB-2B-A	=	14,544 c.f.
IB-3A	=	1,381 c.f.
IB-4A	=	1,979 c.f.
IB-5B	=	2,585 c.f.
IB-5C	=	6,979 c.f.
IB-5D	=	6,143 c.f.
IB-6B	=	1,537 c.f.
IB-7A	=	17,756 c.f.
IB-7B	=	4,837 c.f.
IB-8	=	33,545 c.f.
IB-10B	=	10,674 c.f.
IB-10C	=	39,621 c.f.
Drywell (x19)	=	13,592 c.f.
Total Recharge Volume Provided	=	<b>186,032 c.f.</b>

$$\underline{186,032} \text{ c.f.} \geq \underline{70,618} \text{ c.f.} \quad \text{OK}$$

$$= \frac{646,612}{740,236} = 87\%$$

$$\text{Total Impervious area} \\ \text{Impervious area being recharged} \quad \underline{87\%} \geq \underline{65\%} \quad \text{OK}$$

## **Water Quality Volume Calculations**

## Water Quality Volume Calculations

---

Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-2A1

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 0.59 acres  
25,607 s.f.

### Required Water Quality Volume

$$V = 25,607 \text{ s.f.} \times \frac{1}{12} = 2,134 \text{ c.f.}$$

Volume Provided 20,415 c.f. (storage below outlet)

20,415	c.f. >	2,134	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-2A2

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume 1 inch of runoff x impervious area

Impervious area: 0.49 acres  
21,194 s.f.

### Required Water Quality Volume

$$V = 21,194 \text{ s.f.} \times \frac{1}{12} = 1,766 \text{ c.f.}$$

Volume Provided 15,103 c.f. (storage below outlet)

15,103	c.f. >	1,766	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

**IB-2B-A**

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 0.81 acres  
35,120 s.f.

Required Water Quality Volume

$$V = 35,120 \text{ s.f.} \times \frac{1}{12} = 2,927 \text{ c.f.}$$

Volume Provided 2,996 c.f. (storage below outlet)

2,996	c.f. >	2,927	c.f. O.K.
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## Water Quality Volume Calculations

Job: 3719C

Calculated by: MKO

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-3A

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
0.5 inch of runoff x impervious area

Impervious area: 0.40 acres  
17,634 s.f.

### Required Water Quality Volume

$$V = 17,634 \text{ s.f.} \times \frac{0.5}{12} = 735 \text{ c.f.}$$

Volume Provided 894 c.f. (storage below outlet)

894	c.f. >	735	c.f. O.K.
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## Water Quality Volume Calculations

Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-4A

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
0.5 inch of runoff x impervious area

Impervious area: 0.27 acres  
11,863 s.f.

### Required Water Quality Volume

$$V = 11,863 \text{ s.f.} \times \frac{0.5}{12} = 494 \text{ c.f.}$$

Volume Provided 1,270 c.f. (storage below outlet)

1,270	c.f. >	494	c.f. O.K.
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## Water Quality Volume Calculations

Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-5B

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
0.5 inch of runoff x impervious area

Impervious area: 0.47 acres  
20,683 s.f.

### Required Water Quality Volume

$$V = 20,683 \text{ s.f.} \times \frac{0.5}{12} = 862 \text{ c.f.}$$

Volume Provided 1,917 c.f. (storage below outlet)

1,917	c.f. >	862	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### 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

$$V = 26,104 \text{ s.f.} \times \frac{0.5}{12} = 1,088 \text{ c.f.}$$

Volume Provided 10,534 c.f. (storage below outlet)

10,534	c.f. >	1,088	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### 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  
44,895 s.f.

### Required Water Quality Volume

$$V = 44,895 \text{ s.f.} \times \frac{1}{12} = 3,741 \text{ c.f.}$$

Volume Provided 8,291 c.f. (storage below outlet)

8,291	c.f. >	3,741	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

**IB-6B**

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: A

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 0.17 acres  
7,213 s.f.

Required Water Quality Volume

$$V = 7,213 \text{ s.f.} \times \frac{1}{12} = 601 \text{ c.f.}$$

Volume Provided 2,347 c.f.

2,347	c.f. >	601	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-7A

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: A

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 1.47 acres  
64,127 s.f.

### Required Water Quality Volume

$$V = 64,127 \text{ s.f.} \times \frac{1}{12} = 5,344 \text{ c.f.}$$

Volume Provided 19,516 c.f.

19,516	c.f. >	5,344	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-7B

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: A

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 0.52 acres  
22,486 s.f.

### Required Water Quality Volume

$$V = 22,486 \text{ s.f.} \times \frac{1}{12} = 1,874 \text{ c.f.}$$

Volume Provided 6,600 c.f.

6,600	c.f. >	1,874	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

**IB-8**

Soils: Merrimac Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 2.01 acres  
87,645 s.f.

Required Water Quality Volume

$$V = 87,645 \text{ s.f.} \times \frac{1}{12} = 7,304 \text{ c.f.}$$

Volume Provided 37,787 c.f.

37,787	c.f. >	7,304	c.f. O.K.
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## Water Quality Volume Calculations

Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### Treatment Trench

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

$$V = 1,964 \text{ s.f.} \times \frac{1}{12} = 164 \text{ c.f.}$$

Treatment Trench Volume Provided= L x W x D x 0.4 = **176 c.f.**

<b>176</b>	<b>c.f. &gt;</b>	<b>164</b>	<b>c.f. O.K.</b>
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-10B

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 1.68 acres  
73,029 s.f.

### Required Water Quality Volume

$$V = 73,029 \text{ s.f.} \times \frac{1}{12} = 6,086 \text{ c.f.}$$

Volume Provided 10,890 c.f. (storage below outlet)

10,890	c.f. >	6,086	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2022

### IB-10C

Soils: Woodbridge Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume 1 inch of runoff x impervious area

Impervious area: 3.35 acres  
145,806 s.f.

### Required Water Quality Volume

$$V = 145,806 \text{ s.f.} \times \frac{1}{12} = 12,151 \text{ c.f.}$$

Volume Provided 18,217 c.f. (storage below outlet)

18,217	c.f. >	12,151	c.f. O.K.
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## Water Quality Volume Calculations

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Job: 3719C

Calculated by: NC

Location: The Cottages at Wandering Pond

Date: 6/27/2022

Rev: 10/27/2002

### Drywell

Soils: Paxton Fine Sandy Loam

Hydrologic Group: C

Required First Flush Volume  
1 inch of runoff x impervious area

Impervious area: 0.05 acres  
2,274 s.f.

### Required Water Quality Volume

$$V = 2,274 \text{ s.f.} \times \frac{1}{12} = 190 \text{ c.f.}$$

Volume Provided 551 c.f. (storage below outlet)

551	c.f. >	190	c.f. O.K.
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## **Groundwater Mounding Calculations**

## Groundwater Mounding Analysis

Project: The Cottages at Wandering Pond  
Location: Off of Hudson Road, Stow, MA

SM-3719C

Date: 6/27/2022  
Rev: 10/27/2022  
By: NC

	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 2B-A	426	20.3	8,666	1,756	0.20	1 day	0.28	39	229.00	226.00	5.5	0.25
Infiltration Basin 6B	43.0	8.16	351	361	1.03				219.00	215.37	3	0.62
Infiltration Basin 7A	98.0	37.9	3,716	3,206	0.86				219.00	217.00	13	1.05
Infiltration Basin 8	146	42.7	6,237	4,382	0.70				222.00	218.50	4.5	1.63
Infiltration Basin 10B	106	46.8	4,961	1,521	0.31	1 day	0.18	8	225.00	222.13	5.33	0.69
Infiltration Basin 5B	60.0	37.4	2,245	431	0.19				283.00	279.10	13	0.55
Infiltration Basin 5D	108.0	26.2	2,831	935	0.33				230.00	226.80	13	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

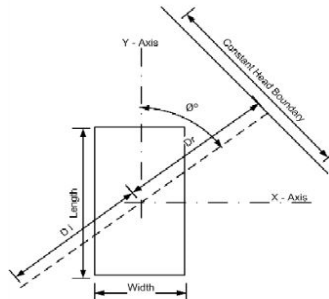
**Hydraulic Conductivity =** Value taken from attached table

**Initial Saturated Thickness =** Depth from bottom of deepest test pit (since depth to ledge is unknown) to estimated seasonal high groundwater (ESHWG)

**Distance to Constant Head Boundary (Di & Dr):**

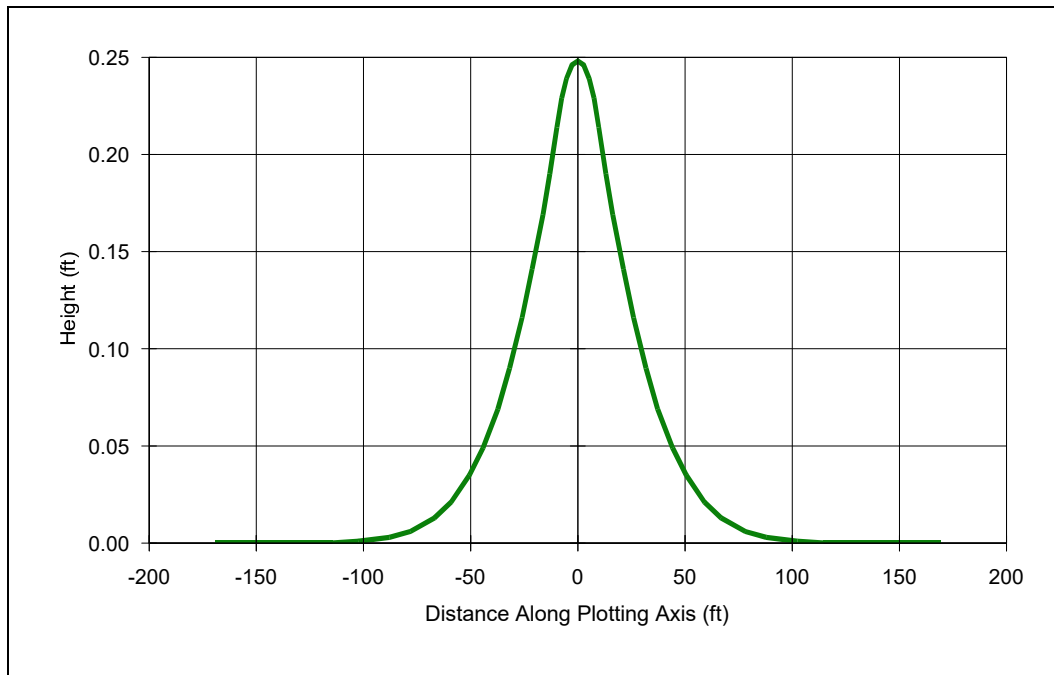
Bordering Vegetated Wetland used as constant head boundary

**Angle from z-axis ( $\phi$ ):**





## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-2B-A

ANALYST: NC

DATE: 10/27/2022 TIME: 4:39:30 PM

### INPUT PARAMETERS

Application rate: 0.2 c.ft/day/sq. ft

Duration of application: 1 days

Fillable porosity: 0.28

Hydraulic conductivity: 39 ft/day

Initial saturated thickness: 5.5 ft

Length of application area: 426 ft

Width of application area: 20.3 ft

Constant head boundary used at: 168 ft

Plotting axis from Y-Axis: 90 degrees

Edge of recharge area:

positive X: 10.2 ft

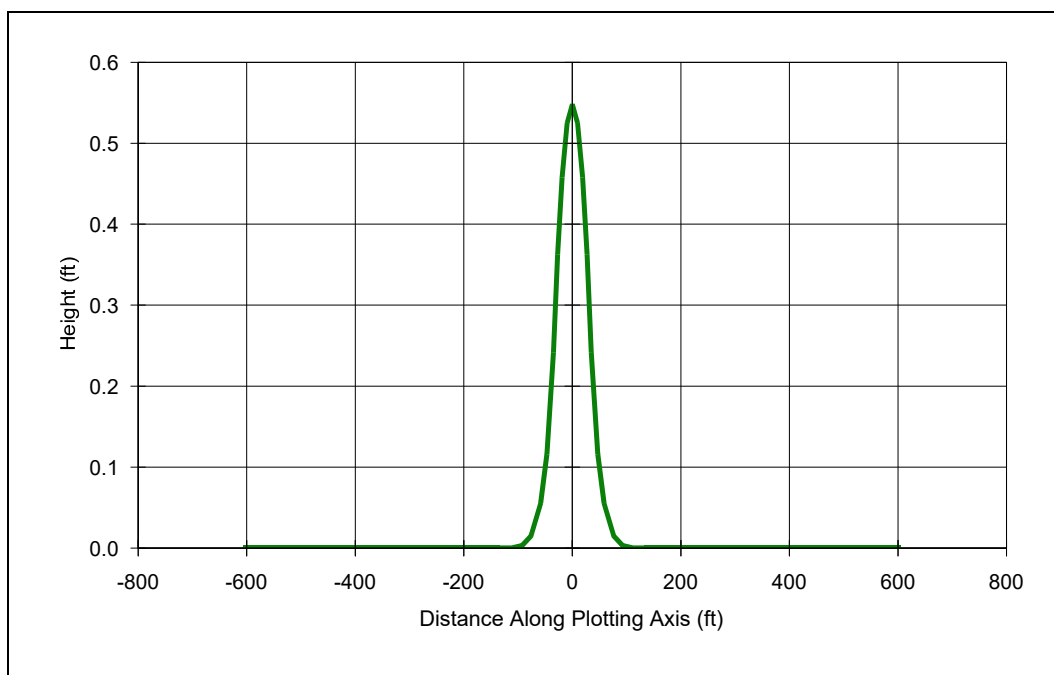
positive Y: 0 ft

Total volume applied: 1729.56 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-168	0	-168	0
-141.3	0	-141	0
-114.6	0	-115	0
-87.8	0	-88	0
-66.8	0	-67	0.01
-50.6	0	-51	0.04
-37.3	0	-37	0.07
-26	0	-26	0.12
-16.3	0	-16	0.17
-9.7	0	-10	0.21
-5.3	0	-5	0.24
0	0	0	0.25
5.3	0	5	0.24
9.7	0	10	0.21
16.3	0	16	0.17
26	0	26	0.12
37.3	0	37	0.07
50.6	0	51	0.04
66.8	0	67	0.01
87.8	0	88	0
114.6	0	115	0
141.3	0	141	0
168	0	168	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-5B

ANALYST: NC

DATE: 10/27/2022 TIME: 5:11:43 PM

### INPUT PARAMETERS

Application rate: 0.19 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: 60 ft

Width of application area: 37.4 ft

Constant head boundary used at: 601 ft

Plotting axis from Y-Axis: 22 degrees

Edge of recharge area:

positive X: 12.1 ft

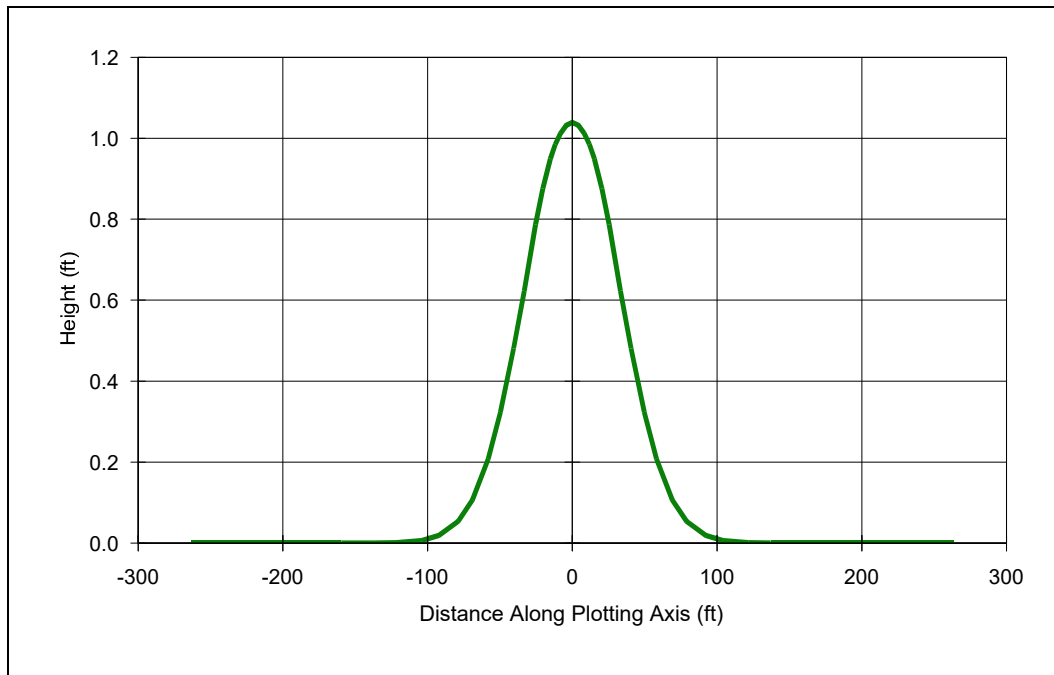
positive Y: 30 ft

Total volume applied: 426.36 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-225.1	-557.2	-601	0
-189.3	-468.6	-505	0
-153.5	-380	-410	0
-117.7	-291.4	-314	0
-89.6	-221.7	-239	0
-67.8	-167.7	-181	0
-49.9	-123.6	-133	0
-34.9	-86.3	-93	0
-21.8	-54	-58	0.06
-13.1	-32.3	-35	0.24
-7.1	-17.6	-19	0.46
0	0	0	0.55
7.1	17.6	19	0.46
13.1	32.3	35	0.24
21.8	54	58	0.06
34.9	86.3	93	0
49.9	123.6	133	0
67.8	167.7	181	0
89.6	221.7	239	0
117.7	291.4	314	0
153.5	380	410	0
189.3	468.6	505	0
225.1	557.2	601	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-5D

ANALYST: NC

DATE: 10/27/2022 TIME: 5:10:26 PM

### INPUT PARAMETERS

Application rate: 0.33 c.ft/day/sq. ft

Duration of application: 1 days

Fillable porosity: 0.16

Hydraulic conductivity: 6 ft/day

Initial saturated thickness: 13 ft

Length of application area: 108 ft

Width of application area: 26.2 ft

Constant head boundary used at: 262 ft

Plotting axis from Y-Axis: 29 degrees

Edge of recharge area:

positive X: 13.1 ft

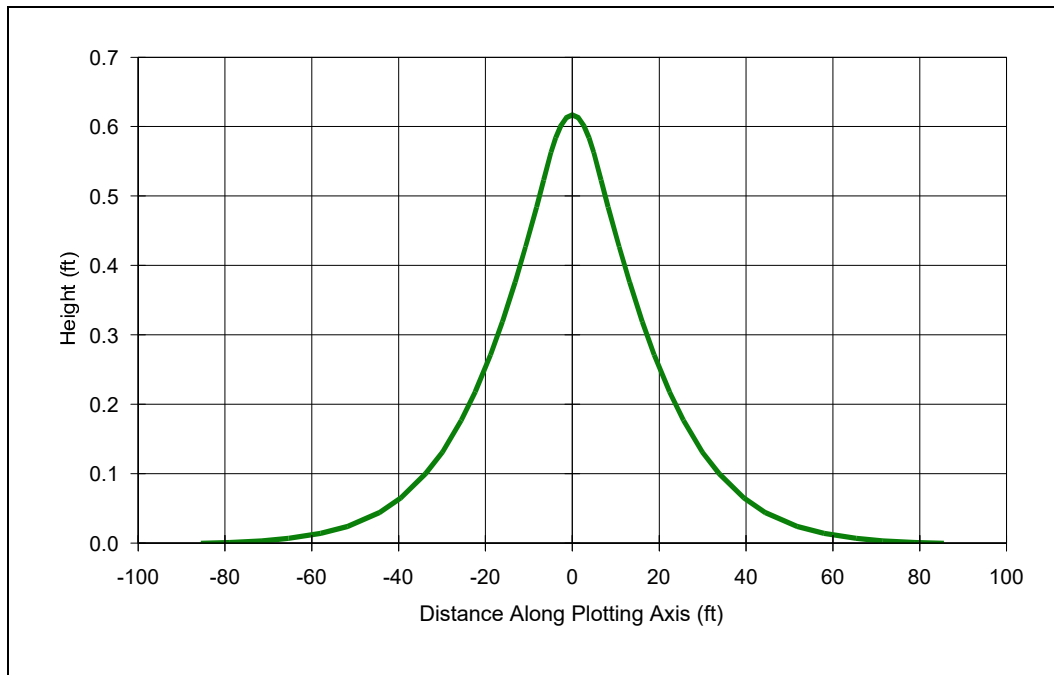
positive Y: 23.6 ft

Total volume applied: 933.768 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-127	-229.2	-262	0
-106.8	-192.7	-220	0
-86.6	-156.3	-179	0
-66.4	-119.8	-137	0
-50.5	-91.2	-104	0.01
-38.2	-69	-79	0.05
-28.2	-50.8	-58	0.21
-19.7	-35.5	-41	0.48
-12.3	-22.2	-25	0.79
-7.4	-13.3	-15	0.95
-4	-7.2	-8	1.01
0	0	0	1.04
4	7.2	8	1.01
7.4	13.3	15	0.95
12.3	22.2	25	0.79
19.7	35.5	41	0.48
28.2	50.8	58	0.21
38.2	69	79	0.05
50.5	91.2	104	0.01
66.4	119.8	137	0
86.6	156.3	179	0
106.8	192.7	220	0
127	229.2	262	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-6B

ANALYST: NC

DATE: 10/27/2022 TIME: 4:45:03 PM

### INPUT PARAMETERS

Application rate: 1.03 c.ft/day/sq. ft

Duration of application: 1 days

Fillable porosity: 0.28

Hydraulic conductivity: 39 ft/day

Initial saturated thickness: 3 ft

Length of application area: 43 ft

Width of application area: 8.16 ft

Constant head boundary used at: 85 ft

Plotting axis from Y-Axis: 48 degrees

Edge of recharge area:

positive X: 4.1 ft

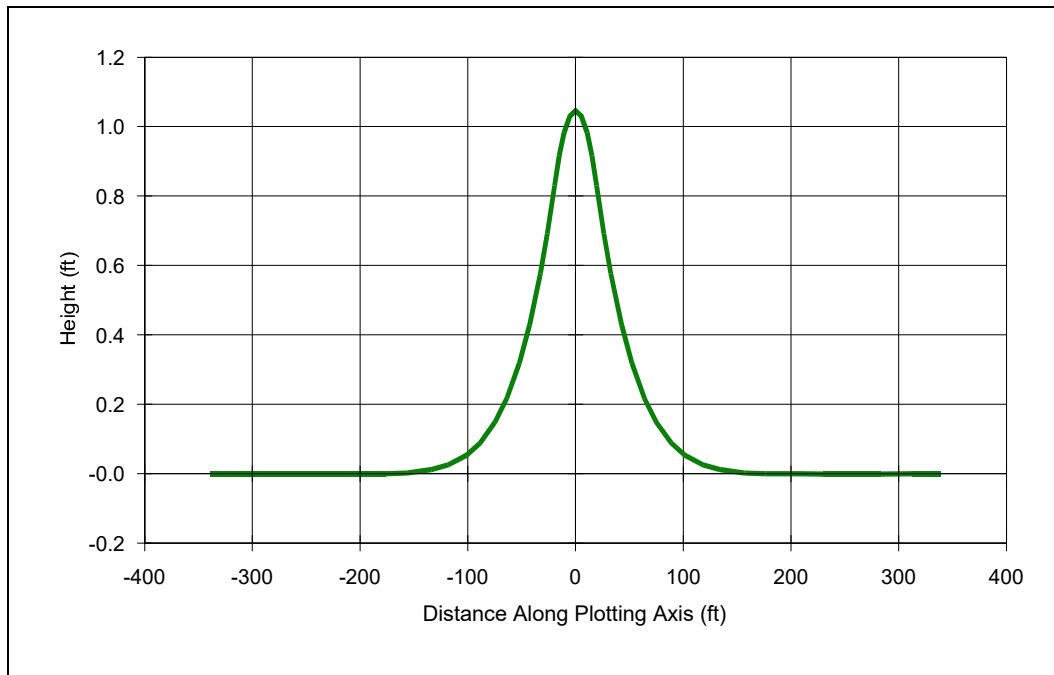
positive Y: 3.7 ft

Total volume applied: 361.4064 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-63.2	-56.9	-85	0
-53.1	-47.8	-71	0
-43.1	-38.8	-58	0.01
-33	-29.7	-44	0.04
-25.1	-22.6	-34	0.1
-19	-17.1	-26	0.18
-14	-12.6	-19	0.27
-9.8	-8.8	-13	0.38
-6.1	-5.5	-8	0.48
-3.7	-3.3	-5	0.56
-2	-1.8	-3	0.6
0	0	0	0.62
2	1.8	3	0.6
3.7	3.3	5	0.56
6.1	5.5	8	0.48
9.8	8.8	13	0.38
14	12.6	19	0.27
19	17.1	26	0.18
25.1	22.6	34	0.1
33	29.7	44	0.04
43.1	38.8	58	0.01
53.1	47.8	71	0
63.2	56.9	85	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-7A

ANALYST: NC

DATE: 10/27/2022 TIME: 4:57:45 PM

### INPUT PARAMETERS

Application rate: 0.86 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: 98 ft

Width of application area: 37.9 ft

Constant head boundary used at: 337 ft

Plotting axis from Y-Axis: 77 degrees

Edge of recharge area:

positive X: 19 ft

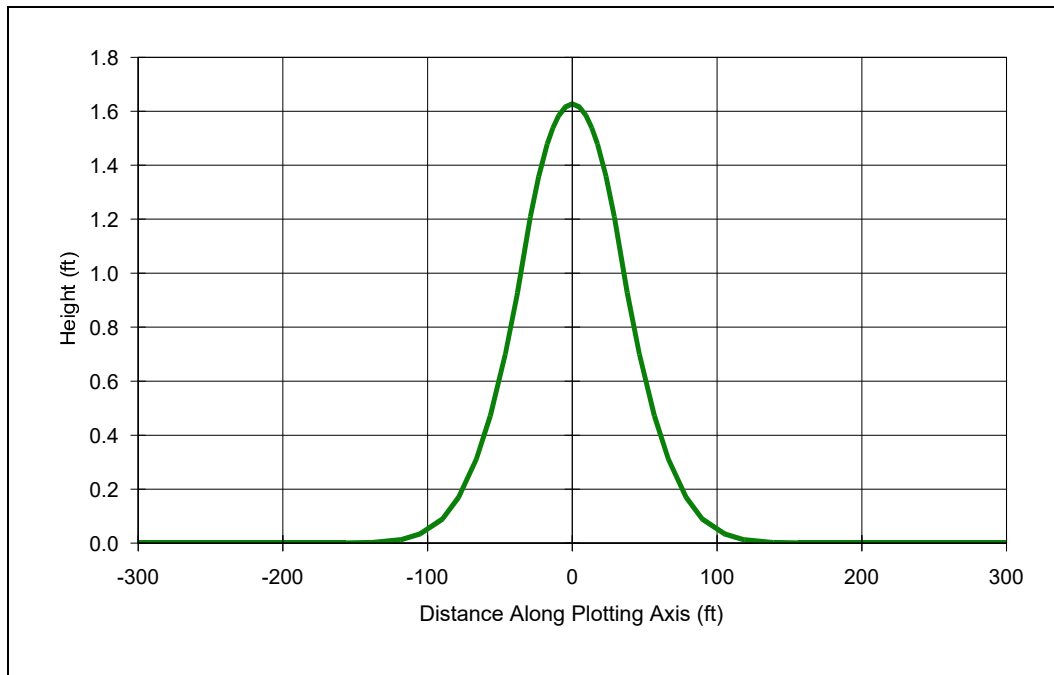
positive Y: 4.4 ft

Total volume applied: 3194.212 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-328.4	-75.8	-337	0
-276.2	-63.8	-283	0
-223.9	-51.7	-230	0
-171.7	-39.6	-176	0
-130.7	-30.2	-134	0.01
-98.8	-22.8	-101	0.05
-72.8	-16.8	-75	0.15
-50.9	-11.7	-52	0.32
-31.8	-7.3	-33	0.58
-19	-4.4	-20	0.83
-10.3	-2.4	-11	0.98
0	0	0	1.05
10.3	2.4	11	0.98
19	4.4	20	0.83
31.8	7.3	33	0.58
50.9	11.7	52	0.32
72.8	16.8	75	0.15
98.8	22.8	101	0.05
130.7	30.2	134	0.01
171.7	39.6	176	0
223.9	51.7	230	0
276.2	63.8	283	0
328.4	75.8	337	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-8

ANALYST: NC

DATE: 10/27/2022 TIME: 4:55:50 PM

### INPUT PARAMETERS

Application rate: 0.7 c.ft/day/sq. ft

Duration of application: 1 days

Fillable porosity: 0.28

Hydraulic conductivity: 39 ft/day

Initial saturated thickness: 4.5 ft

Length of application area: 146 ft

Width of application area: 42.7 ft

Constant head boundary used at: 299 ft

Plotting axis from Y-Axis: 41 degrees

Edge of recharge area:

positive X: 21.4 ft

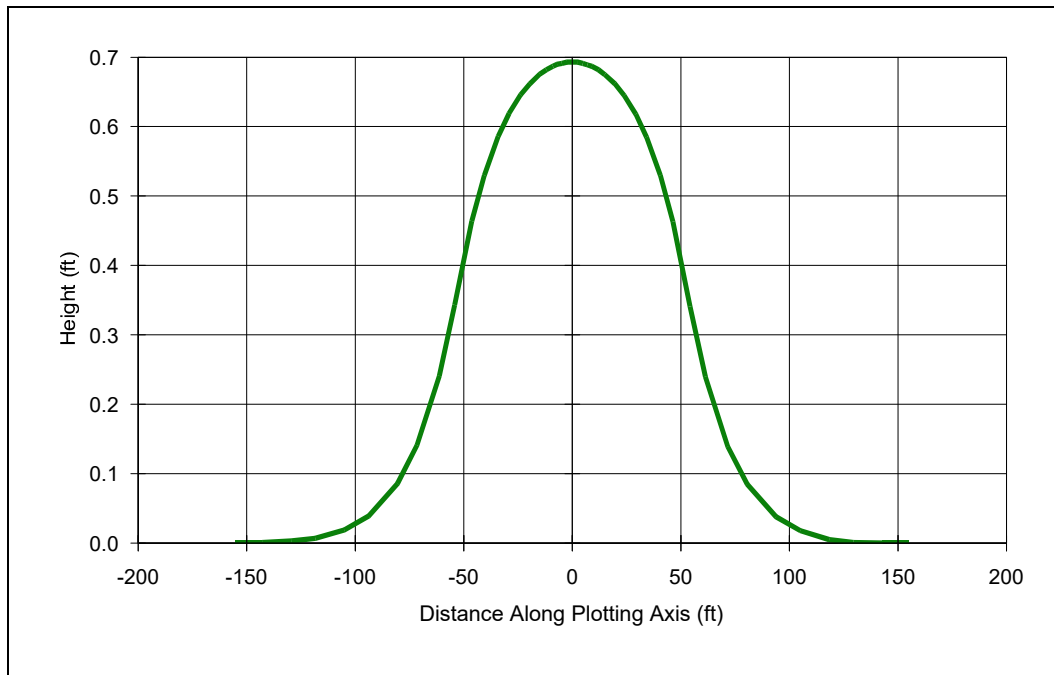
positive Y: 24.6 ft

Total volume applied: 4363.94 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-196.2	-225.7	-299	0
-165	-189.8	-251	0
-133.8	-153.9	-204	0
-102.6	-118	-156	0
-78.1	-89.8	-119	0.01
-59	-67.9	-90	0.09
-43.5	-50.1	-66	0.31
-30.4	-35	-46	0.7
-19	-21.9	-29	1.21
-11.4	-13.1	-17	1.48
-6.2	-7.1	-9	1.58
0	0	0	1.63
6.2	7.1	9	1.58
11.4	13.1	17	1.48
19	21.9	29	1.21
30.4	35	46	0.7
43.5	50.1	66	0.31
59	67.9	90	0.09
78.1	89.8	119	0.01
102.6	118	156	0
133.8	153.9	204	0
165	189.8	251	0
196.2	225.7	299	0

## Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary

PROJECT: 3719C IB-10B

ANALYST: NC

DATE: 10/27/2022 TIME: 5:02:34 PM

### INPUT PARAMETERS

Application rate: 0.31 c.ft/day/sq. ft

Duration of application: 1 days

Fillable porosity: 0.28

Hydraulic conductivity: 39 ft/day

Initial saturated thickness: 5.33 ft

Length of application area: 106 ft

Width of application area: 46.8 ft

Constant head boundary used at: 154 ft

Plotting axis from Y-Axis: 6 degrees

Edge of recharge area:

positive X: 5.6 ft

positive Y: 53 ft

Total volume applied: 1537.848 c.ft

### MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-16.1	-153.2	-154	0
-13.5	-128.8	-130	0
-11	-104.4	-105	0.02
-8.4	-80.1	-81	0.09
-6.4	-60.9	-61	0.24
-4.8	-46.1	-46	0.46
-3.6	-34	-34	0.59
-2.5	-23.7	-24	0.65
-1.6	-14.8	-15	0.68
-0.9	-8.9	-9	0.69
-0.5	-4.8	-5	0.69
0	0	0	0.69
0.5	4.8	5	0.69
0.9	8.9	9	0.69
1.6	14.8	15	0.68
2.5	23.7	24	0.64
3.6	34	34	0.58
4.8	46.1	46	0.46
6.4	60.9	61	0.24
8.4	80.1	81	0.08
11	104.4	105	0.02
13.5	128.8	130	0
16.1	153.2	154	0

## **Pipe Sizing Calculations**



## DESIGN STORM: 100 YEAR

DATE: 10/13/2022

DONE BY: PFK, NC

FILE: SM-3719C

## STORM SEWER DESIGN

(ADS N-12)"n"= 0.012

4"-10"

(ADS N-12)"n"= 0.012

12"-36"

(ADS N-12)"n"= 0.012

42"-60"

(Cast Iron)"n"= 0.011

PROJECT: SM-3719C

LOCATION: Stow, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA		TIME OF FLOW		RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW			TOTAL ENERGY HEAD (FT)	MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION	
			INCR. (ACRES)	TOTAL (ACRES)	TO UPPER END (MIN)	TIME IN SECTION (MIN)									VELOCITY (FPS)	VELOCITY HEAD (FT)	DEPTH OF FLOW (FT)				UPPER END	LOWER END
CB-WPC7	DMH-WPC6	14	0.28	0.28	10	0.05	0.59	7.8	1.30	0.011	12	0.012	3.99	5.08	4.53	0.32	0.39	0.71	0.15	309.53	309.38	
CB-WPC8	DMH-WPC6	14	0.10	0.10	10	0.07	0.67	7.8	0.52	0.011	12	0.012	3.99	5.08	3.47	0.19	0.24	0.43	0.15	309.53	309.38	
DMH-WPC6	DMH-WPC7	201	0.00	0.38	10	0.79	0.61	7.8	1.82	0.007	12	0.012	3.23	4.11	4.23	0.28	0.54	0.81	1.41	309.28	307.87	
DMH-WPC7	DMH-WPC8	121	0.00	0.38	10	0.49	0.61	7.8	1.82	0.007	12	0.012	3.15	4.02	4.14	0.27	0.54	0.81	0.81	307.77	306.96	
CB-WPC9	DMH-WPC8	42	0.47	0.47	10	0.08	0.39	7.8	1.43	0.065	12	0.012	9.82	12.51	8.87	1.22	0.26	1.48	2.73	309.69	306.96	
CB-WPC10	DMH-WPC8	42	0.18	0.18	10	0.09	0.70	7.8	1.02	0.065	12	0.012	9.82	12.51	8.03	1.00	0.22	1.22	2.73	309.69	306.96	
DMH-WPC8	FLARED END	122	0.00	1.03	10	0.39	0.53	7.8	4.27	0.007	15	0.012	5.87	4.78	5.21	0.42	0.79	1.21	0.86	306.86	306.00	
CB-WPC11	DMH-WPC9	14	0.83	0.83	10	0.05	0.35	7.8	2.31	0.010	12	0.012	3.85	4.91	5.12	0.41	0.56	0.96	0.14	302.58	302.44	
CB-WPC12	DMH-WPC9	14	0.29	0.29	10	0.05	0.77	7.8	1.73	0.010	12	0.012	3.85	4.91	4.76	0.35	0.47	0.82	0.14	302.58	302.44	
DMH-WPC9	FLARED END	79	0.00	1.12	10	0.22	0.46	7.8	4.04	0.011	15	0.012	7.29	5.95	6.09	0.58	0.66	1.24	0.86	306.86	306.00	
CB-SSL1	DMH-SSL1	13	0.32	0.32	10	0.05	0.69	7.8	1.71	0.010	12	0.012	3.81	4.85	4.70	0.34	0.47	0.81	0.13	235.78	235.66	
CB-SSL2	DMH-SSL1	13	0.68	0.68	10	0.05	0.33	7.8	1.79	0.010	12	0.012	3.81	4.85	4.77	0.35	0.48	0.83	0.13	235.78	235.66	
DMH-SSL1	DMH-SSL2	109	1.00	1.00	10	0.33	0.45	7.8	3.50	0.010	12	0.012	3.86	4.91	5.56	0.48	0.75	1.23	1.09	235.56	234.46	
DMH-SSL2	DMH-SSL3	63	1.00	1.00	10	0.19	0.45	7.8	3.50	0.010	12	0.012	3.86	4.92	5.57	0.48	0.75	1.23	0.63	234.36	233.73	
CB-SSL3	DMH-SSL3	16	0.04	0.04	10	0.10	0.69	7.8	0.23	0.010	12	0.012	3.85	4.91	2.69	0.11	0.17	0.28	0.16	236.00	235.84	
CB-SSL4	DMH-SSL3	15	0.13	0.13	10	0.09	0.30	7.8	0.30	0.010	12	0.012	3.85	4.91	2.88	0.13	0.19	0.31	0.15	236.00	235.85	
DMH-SSL3	DMH-SSL4	52	1.17	1.17	10	0.15	0.44	7.8	4.03	0.010	15	0.012	7.00	5.70	5.89	0.54	0.68	1.21	0.52	230.90	230.38	
DMH-SSL4	DMH-SSL5	71	1.17	1.17	10	0.20	0.44	7.8	4.03	0.010	15	0.012	6.99	5.70	5.90	0.54	0.68	1.22	0.71	230.28	229.57	
DMH-SSL5	IB-2B-A	47	1.17	1.17	10	0.13	0.44	7.8	4.03	0.010	15	0.012	7.00	5.71	5.89	0.54	0.68	1.21	0.47	229.47	229.00	
CB-WPC5	DMH-WPC5	14	0.66	0.66	10	0.04	0.49	7.8	2.51	0.010	12	0.012	3.85	4.91	5.22	0.42	0.59	1.01	0.14	291.18	291.04	
CB-WPC6	DMH-WPC5	14	0.19	0.19	10	0.06	0.69	7.8	1.05	0.010	12	0.012	3.85	4.91	4.17	0.27	0.36	0.62	0.14	291.18	291.04	
DMH-WPC5	FLARED END	75	0.00	0.85	10	0.15	0.53	7.8	3.56	0.026	12	0.012	6.20	7.89	8.15	1.03	0.54	1.57	1.94	290.94	289.00	
CB-WPC3	DMH-WPC2	20	1.19	1.19	10	0.07	0.23	7.8	2.11	0.010	12	0.012	3.85	4.91	5.01	0.39	0.53	0.91	0.20	287.57	287.37	
CB-WPC4	DMH-WPC2	20	0.32	0.32	10	0.07	0.62	7.8	1.53	0.010	12	0.012	3.85	4.91	4.61	0.33	0.44	0.76	0.20	287.57	287.37	
DMH-WPC2	DMH-WPC3	107	1.51	1.51	10	0.32	0.31	7.8	3.64	0.010	12	0.012	3.85	4.91	5.58	0.48	0.77	1.25	1.07	287.27	286.20	
DMH-WPC3	DMH-WPC4	74	1.51	1.51	10	0.22	0.31	7.8	3.64	0.010	12	0.012	3.88	4.94	5.61	0.49	0.77	1.25	0.75	286.10	285.35	
DMH-WPC4	FLARED END	115	1.51	1.51	10	0.21	0.31	7.8	3.64	0.037	12	0.012	7.41	9.43	9.35	1.36	0.49	1.85	4.25	285.25	281.00	
CB-WPC13	DMH-WPC10	39	0.25	0.25	10	0.08	0.63	7.8	1.24	0.056	12	0.012	9.09	11.58	8.02	1.00	0.25	1.24	2.17	291.65	289.48	
DMH-WPC10	DMH-WPC1	128	0.25	0.25	10	0.54	0.63	7.8	1.24	0.008	12	0.012	3.37	4.29	3.97	0.24	0.42	0.66	0.98	289.38	288.40	
CB-WPC1	DMH-WPC1	43	1.99	1.99	10	0.13	0.22	7.8	3.48	0.010	12	0.012	3.85	4.91	5.55	0.48	0.74	1.22	0.43	288.53	288.10	
CB-WPC2	DMH-WPC1	41	0.18	0.18	10	0.12	0.81	7.8	1.14	0.024	12	0.012	5.99	7.63	5.86	0.53	0.30	0.83	0.99	289.09	288.10	
DMH-WPC1	FLARED END	53	2.42	2.42	10	0.11	0.31	7.8	5.87	0.019	15	0.012	9.60	7.83	8.19	1.04	0.70	1.74	1.00	288.00	287.00	
CB-WPW13	DMH-WPW10	14	0.37	0.37	10	0.05	0.57	7.8	1.64	0.011	12	0.012	3.99	5.08	4.82	0.36	0.45	0.81	0.15	282.94	282.79	
CB-WPW14	DMH-WPW10	14	0.10	0.10	10	0.07	0.48	7.8	0.37	0.011	12	0.012	3.99	5.08	3.12	0.15	0.20	0.35	0.15	282.94	282.79	
DMH-WPW10	DMH-WPW9	175	0.47	0.47	10	0.27	0.55	7.8	2.00	0.085	12	0.012	11.20	14.27	10.76	1.80	0.29	2.08	14.79	282.69	267.90	
CB-WPW11	DMH-WPW9	14	0.37	0.37	10	0.04	0.70	7.8	2.06	0.021	12	0.012	5.64	7.18	6.60	0.68	0.42	1.09	0.30	268.20	267.90	
CB-WPW12	DMH-WPW9	14	0.09	0.09	10	0.06	0.59	7.8	0.39	0.021	12	0.012	5.64	7.18	4.08	0.26	0.18	0.43	0.30	268.20	267.90	
DMH-WPW9	DMH-WPW8	46	0.93	0.93	10	0.10	0.61	7.8	4.46	0.022	12	0.012	5.68	7.24	8.00	0.99	0.67	1.66	1.00	267.80	266.80	
DMH-WPW8	IB-5C	108	0.93	0.93	10	0.14	0.61	7.8	4.46	0.081	12	0.012	10.93	13.93	13.22	2.71	0.45	3.16	8.70	266.70	258.00	
CB-DFD3	DMH-DFD2	13	0.33	0.33	10	0.02	0.65	7.8	1.68	0.083	12	0.012	11.10	14.14	10.14	1.60	0.26	1.86	1.08	277.78	276.70	
CB-DFD4	DMH-DFD2	14	0.11	0.11	10	0.04	0.51	7.8	0.43	0.077	12	0.012	10.70	13.63	6.60	0.68	0.14	0.81	1.08	277.78	276.70	
DMH-DFD2	DMH-DFD1	187	0.44	0.44	10	0.33	0.61	7.8	2.11	0.056	12	0.012	9.10	11.59	9.40	1.37	0.33	1.70	10.43	276.60	266.17	
CB-DFD1	DMH-DFD1	14	0.41	0.41	10	0.04	0.76	7.8	2.45	0.010	12	0.012	3.85	4.91	5.20	0.42	0.58	1.00	0.14	266.31	266.17	
CB-DFD2	DMH-DFD1	13	0.42	0.42	10	0.05	0.28	7.8	0.91	0.011	12	0.012	4.00	5.09	4.09	0.26	0.32	0.58	0.14	266.31	266.17	
DMH-DFD1	DMH-WFW7	51	1.27	1.27	10	0.07	0.55	7.8	5.47	0.066	12	0.012	9.90	12.61	12.92	2.59	0.53	3.12	3.37	266.07	262.70	
DMH-WFW7	DMH-WFW6	100	1.27	1.27	10	0.12	0.55	7.8	5.47	0.076	12	0.012	10.58	13.48	13.59	2.87	0.51	3.38	7.55	262.60	255.05	
CB-WFW9	DMH-WFW6	13	0.20	0.20	10	0.03	0.52	7.8	0.82	0.088	12	0.012	11.46	14.60	8.42	1.10	0.18	1.28	1.15	256.20	255.05	
CB-WFW10	DMH-WFW6	13	0.24	0.24	10	0.02	0.72	7.8	1.33	0.088	12	0.012	11.46	14.60	9.75	1.48	0.23	1.71	1.15	256.20	255.05	
DMH-WFW6	DMH-WPW4	179	1.70	1.70	10	0.20	0.57	7.8	7.62	0.080	12	0.012	10.88	13.87	14.99	3.49	0.62	4.10	14.29	254.95	240.66	
CB-WFW7	DMH-WPW4	14	0.06	0.06	10	0.06	0.76	7.8	0.37	0.024	12	0.012										

CB-WPW2	DMH-WPW1	30	0.06	0.06	10	0.16	0.59	7.8	0.28	0.012	12	0.012	4.22	5.38	3.05	0.14	0.18	0.32		0.36	227.80	227.44
DMH-WPW1	FLARED END	66	0.10	0.10	10	0.40	0.72	7.8	0.59	0.005	12	0.012	2.76	3.52	2.78	0.12	0.31	0.43		0.34	227.34	227.00
CB-WPW3	DMH-WPW2	22	0.06	0.06	10	0.15	0.76	7.8	0.37	0.005	12	0.012	2.85	3.62	2.48	0.10	0.24	0.34		0.12	224.00	223.88
CB-WPW4	DMH-WPW2	10	0.31	0.31	10	0.03	0.65	7.8	1.56	0.012	12	0.012	4.22	5.38	4.97	0.38	0.42	0.80		0.12	224.00	223.88
DMH-WPW2	FLARED END	5	0.37	0.37	10	0.02	0.67	7.8	1.92	0.006	12	0.012	2.98	3.80	4.03	0.25	0.58	0.83		0.03	223.78	223.75
CB-DY2	CB-DY1	14	0.60	0.60	10	0.04	0.67	7.8	3.19	0.010	12	0.012	3.85	4.91	5.48	0.47	0.69	1.16		0.14	222.40	222.26
CB-DY1	DI-DY1	26	0.97	0.97	10	0.06	0.60	7.8	4.57	0.020	12	0.012	5.45	6.94	7.77	0.94	0.70	1.64		0.52	222.16	221.64
DI-DY1	IB-7A	156	0.97	0.97	10	0.37	0.60	7.8	4.57	0.016	12	0.012	4.88	6.21	7.06	0.77	0.77	1.54		2.50	221.50	219.00
CB-BC1	CB-BC2	14	0.56	0.56	10	0.04	0.64	7.8	2.83	0.010	12	0.012	3.85	4.91	5.36	0.45	0.64	1.08		0.14	221.09	220.95
CB-BC2	DI-BC2	6	1.11	1.11	10	0.01	0.65	7.8	5.64	0.025	12	0.012	6.09	7.76	8.80	1.20	0.76	1.96		0.15	220.85	220.70
DI-BC2	IB-7A	231	1.11	1.11	10	0.71	0.65	7.8	5.64	0.007	15	0.012	5.82	4.74	5.40	0.45	0.99	1.44		1.60	220.60	219.00
CB-CH3	IB-7B	66	0.30	0.30	10	0.21	0.39	7.8	0.91	0.021	12	0.012	5.61	7.15	5.23	0.43	0.27	0.70		1.40	225.40	224.00
CB-CH2	IB-7B	248	0.53	0.53	10	0.84	0.49	7.8	2.02	0.010	12	0.012	3.85	4.91	4.95	0.38	0.51	0.89		2.48	226.48	224.00
CB-WF4	DMH-WF2	14	0.14	0.14	10	0.06	0.90	7.8	0.96	0.010	8	0.012	1.30	3.74	4.08	0.26	0.42	0.68		0.14	224.91	224.77
CB-WF3	DMH-WF3	14	0.08	0.08	10	0.06	0.90	7.8	0.57	0.010	8	0.012	1.32	3.78	3.62	0.20	0.30	0.51		0.14	224.92	224.77
DMH-WF2	DMH-WF1	73	0.22	0.22	10	0.34	0.90	7.8	1.53	0.005	12	0.012	2.71	3.45	3.54	0.19	0.54	0.73		0.36	224.67	224.31
CB-WF1	DMH-WF1	122	0.05	0.05	10	0.51	0.90	7.8	0.34	0.020	8	0.012	1.85	5.30	3.99	0.25	0.19	0.44		2.45	226.95	224.50
DMH-WF1	IB-7B	41	0.26	0.26	10	0.18	0.90	7.8	1.87	0.005	12	0.012	2.76	3.51	3.76	0.22	0.60	0.82		0.21	224.21	224.00
CB-LP6	DMH-LP3	21	0.40	0.40	10	0.07	0.66	7.8	2.06	0.010	12	0.012	3.90	4.97	5.02	0.39	0.52	0.91		0.22	226.33	226.12
CB-LP5	DMH-LP3	10	0.04	0.04	10	0.06	0.90	7.8	0.28	0.010	12	0.012	3.85	4.91	2.83	0.12	0.18	0.30		0.10	226.37	226.27
DMH-LP3	IB-8	204	0.44	0.44	10	0.66	0.68	7.8	2.35	0.010	12	0.012	3.85	4.91	5.13	0.41	0.56	0.97		2.04	224.04	222.00
CB-WF5	DMH-WF3A	81	0.09	0.09	10	0.37	0.90	7.8	0.63	0.010	8	0.012	1.30	3.72	3.68	0.21	0.33	0.54		0.80	223.37	222.57
CB-WF5A	DMH-WF3A	16	0.10	0.10	10	0.07	0.90	7.8	0.73	0.011	8	0.012	1.34	3.86	3.92	0.24	0.35	0.58		0.17	222.74	222.57
DMH-WF3A	IB-8	47	0.19	0.19	11	0.18	0.90	7.8	1.36	0.010	12	0.012	3.85	4.91	4.46	0.31	0.41	0.71		0.47	222.47	222.00
CB-WF6	DMH-WF3	44	0.12	0.12	10	0.19	0.90	7.8	0.86	0.010	12	0.012	3.90	4.96	3.96	0.24	0.32	0.56		0.45	223.65	223.20
DMH-WF3	DMH-WF4	62	0.12	0.12	10	0.26	0.90	7.8	0.86	0.010	12	0.012	3.86	4.92	3.92	0.24	0.32	0.55		0.62	223.10	222.48
DMH-WF4	IB-8	37	0.12	0.12	10	0.16	0.90	7.8	0.86	0.010	12	0.012	3.88	4.94	3.94	0.24	0.32	0.56		0.38	222.38	222.00
CB-LP4	DMH-LP2	16	0.70	0.70	10	0.05	0.68	7.8	3.73	0.010	12	0.012	3.89	4.95	5.64	0.49	0.78	1.27		0.16	225.77	225.61
CB-LP3	DMH-LP2	16	0.23	0.23	10	0.07	0.53	7.8	0.94	0.010	12	0.012	3.89	4.95	4.08	0.26	0.34	0.59		0.16	225.77	225.61
DMH-LP2	DMH-LP4	180	0.92	0.92	10	0.49	0.64	7.8	4.67	0.010	15	0.012	6.99	5.70	6.09	0.58	0.74	1.32		1.80	225.51	223.71
DMH-LP4	DMH-LP1	116	0.92	0.92	10	0.35	0.64	7.8	4.67	0.008	15	0.012	6.24	5.09	5.58	0.48	0.81	1.29		0.92	223.97	223.04
CB-LP1	DMH-LP1	10	0.24	0.24	10	0.04	0.66	7.8	1.22	0.010	12	0.012	3.85	4.91	4.34	0.29	0.39	0.68		0.10	223.07	222.97
CB-LP2	DMH-LP1	20	0.58	0.58	10	0.06	0.79	7.8	3.57	0.010	12	0.012	3.90	4.97	5.63	0.49	0.75	1.24		0.20	223.07	222.87
DMH-LP1	IB-8	71	1.74	1.74	10	0.19	0.69	7.8	9.46	0.007	18	0.012	9.54	5.40	6.16	0.59	1.22	1.80		0.50	222.50	222.00
CB-WFW17	DMH-WFW10	14	0.52	0.52	10	0.03	0.73	7.8	2.98	0.021	12	0.012	5.64	7.18	7.27	0.82	0.52	1.34		0.30	264.15	263.85
CB-WFW18	DMH-WFW10	14	0.19	0.19	10	0.04	0.65	7.8	0.95	0.021	12	0.012	5.64	7.18	5.32	0.44	0.28	0.71		0.30	264.15	263.85
DMH-WFW10	DMH-WFW9	81	0.71	0.71	10	0.13	0.71	7.8	3.93	0.049	12	0.012	8.55	10.89	10.65	1.76	0.48	2.24		3.99	263.75	259.76
DMH-WFW9	DMH-WFW8	160	0.71	0.71	10	0.23	0.71	7.8	3.93	0.066	12	0.012	9.90	12.61	11.84	2.18	0.44	2.61		10.57	259.66	249.09
CB-WFW15	DMH-WFW8	14	0.41	0.41	10	0.03	0.68	7.8	2.16	0.028	12	0.012	6.43	8.19	7.35	0.84	0.40	1.23		0.39	249.48	249.09
CB-WFW16	DMH-WFW8	14	0.26	0.26	10	0.04	0.49	7.8	1.00	0.028	12	0.012	6.43	8.19	5.93	0.55	0.27	0.81		0.39	249.48	249.09
DMH-WFW8	DMH-WFW7	278	1.37	1.37	10	0.34	0.66	7.8	7.09	0.065	12	0.012	9.82	12.51	13.60	2.87	0.63	3.50		18.06	248.99	230.93
CB-WFW13	DMH-WFW7	14	0.56	0.56	10	0.04	0.72	7.8	3.15	0.011	12	0.012	3.99	5.08	5.63	0.49	0.67	1.16		0.15	231.08	230.93
CB-WFW14	DMH-WFW7	14	0.22	0.22	10	0.05	0.60	7.8	1.05	0.011	12	0.012	3.99	5.08	4.25	0.28	0.35	0.63		0.15	231.08	230.93
DMH-WFW7	FLARED END	80	2.15	2.15	10	0.08	0.67	7.8	11.29	0.073	15	0.012	18.87	15.38	16.05	4.00	0.69	4.69		5.83	230.83	225.00
CB-WFW11	DMH-WFW5	14	0.11	0.11	10	0.06	0.90	7.8	0.76	0.011	12	0.012	3.99	5.08	3.91	0.24	0.30	0.53		0.15	226.85	226.70
CB-WFW12	DMH-WFW5	14	0.19	0.19	10	0.06	0.67	7.8	1.00	0.011	12	0.012	3.99	5.08	4.22	0.28	0.34	0.62		0.15	226.85	226.70
DMH-WFW5	FLARED END	165	0.30	0.30	10	0.58	0.75	7.8	1.76	0.010	12	0.012	3.79	4.83	4.73	0.35	0.48	0.82		1.60	226.60	225.00
CB-WF19	DMH-WF11	14	0.58	0.58	10	0.03	0.72	7.8	3.26	0.021	12	0.012	5.64	7.18	7.44	0.86	0.55	1.41		0.30	265.80	265.50
CB-WF20	DMH-WF11	14	0.36	0.36	10	0.03	0.76	7.8	2.17	0.021	12	0.012	5.64	7.18	6.71	0.70	0.43	1.13		0.30	265.80	265.50
DMH-WF11	DMH-WF12	165	0.94	0.94	10	0.21	0.73	7.8	5.43	0.073	12	0.012	10.43	13.29	13.40	2.79	0.51	3.30		12.10	265.40	253.30
DMH-WF12	DMH-WF13	85	0.94	0.94	10	0.12	0.73	7.8	5.43	0.053	12	0.012	8.86	11.29	11.86	2.18	0.57	2.75		4.50	253.20	248.70
CB-WF21	DMH-WF13	14	0.46	0.46	10	0.03	0.73	7.8	2.64	0.021	12											

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By PFK, NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPC7 TO DMH-WPC6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.141095
lands/grass	0.12	0.2	0.024706
woods	0.00	0.15	0
sum =	0.28	sum =	0.17

C = **0.59** = total product / total area**CB-WPC8 TO DMH-WPC6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.07	0.9	0.059421
lands/grass	0.03	0.2	0.006433
woods	0.00	0.15	0
sum =	0.10	sum =	0.07

C = **0.67** = total product / total area**DMH-WPC6 TO DMH-WPC7**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.22	0.9	0.200517
lands/grass	0.16	0.2	0.031139
woods	0.00	0.15	0
sum =	0.38	sum =	0.23

$$C = \boxed{0.61} = \text{total product} / \text{total area}$$

#### **DMH-WPC7 TO DMH-WPC 8**

Surface Cover	A (ac)	C	Product A x C
impervious	0.22	0.9	0.200517
lands/grass	0.16	0.2	0.031139
woods	0.00	0.15	0
sum =	0.38	sum =	0.23

$$C = \boxed{0.61} = \text{total product} / \text{total area}$$

#### **CB-WPC9 TO DMH-WPC8**

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.115145
lands/grass	0.34	0.2	0.067847
woods	0.00	0.15	0
sum =	0.47	sum =	0.18

$$C = \boxed{0.39} = \text{total product} / \text{total area}$$

#### **CB-WPC10 TO DMH-WPC8**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.13	0.9	0.119401
lands/grass	0.05	0.2	0.010413
woods	0.00	0.15	<u>0</u>
sum =	0.18	sum =	0.13

$$C = \boxed{0.70} = \text{total product} / \text{total area}$$

#### **DMH-WPC8 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.48	0.9	0.435062
lands/grass	0.55	0.2	0.109399
woods	0.00	0.15	<u>0</u>
sum =	1.03	sum =	0.54

$$C = \boxed{0.53} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By PFK, NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPC11 TO DMH-WPC9**

Surface Cover	A (ac)	C	Product A x C
impervious	0.20	0.9	0.180248
lands/grass	0.38	0.2	0.076878
woods	0.25	0.15	0.037238
sum =	0.83	sum =	0.29

C = **0.35** = total product / total area**CB-WPC12 TO DMH-WPC9**

Surface Cover	A (ac)	C	Product A x C
impervious	0.23	0.9	0.210661
lands/grass	0.05	0.2	0.010275
woods	0.00	0.15	0
sum =	0.29	sum =	0.22

C = **0.77** = total product / total area**DMH-WPC9 TO FLARED END**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.43	0.9	0.390909
lands/grass	0.44	0.2	0.087153
woods	0.25	0.15	<u>0.037238</u>
sum =	1.12	sum =	0.52

$$C = \boxed{0.46} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/4/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-SSL1 TO DMH-SSL1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.22	0.9	0.199504
lands/grass	0.10	0.2	0.019013
woods	0.00	0.15	0
sum =	0.32	sum =	0.22

C = **0.69** = total product / total area**CB-SSL2 TO DMH-SSL1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.117665
lands/grass	0.55	0.2	0.110165
woods	0.00	0.15	0
sum =	0.68	sum =	0.23

C = **0.33** = total product / total area**DMH-SSL1 TO DMH-SSL2**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.35	0.9	0.317169
lands/grass	0.65	0.2	0.129178
woods	0.00	0.15	<u>0</u>
sum =	1.00	sum =	0.45

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

#### DMH-SSL2 TO DMH-SSL3

Surface Cover	A (ac)	C	Product A x C
impervious	0.35	0.9	0.317169
lands/grass	0.65	0.2	0.129178
woods	0.00	0.15	<u>0</u>
sum =	1.00	sum =	0.45

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

#### CB-SSL3 TO DMH-SSL3

Surface Cover	A (ac)	C	Product A x C
impervious	0.03	0.9	0.027107
lands/grass	0.01	0.2	0.002576
woods	0.00	0.15	<u>0</u>
sum =	0.04	sum =	0.03

$$C = \boxed{0.69} = \text{total product} / \text{total area}$$

#### CB-SSL4 TO DMH-SSL3

Surface Cover	A (ac)	C	Product A x C
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impervious	0.02	0.9	0.016446
lands/grass	0.11	0.2	0.022144
woods	0.00	0.15	<u>0</u>
sum =	0.13	sum =	0.04

$$C = \boxed{0.30} = \text{total product} / \text{total area}$$

#### DMH-SSL3 TO DMH-SSL4

Surface Cover	A (ac)	C	Product A x C
impervious	0.40	0.9	0.360723
lands/grass	0.77	0.2	0.153898
woods	0.00	0.15	<u>0</u>
sum =	1.17	sum =	0.51

$$C = \boxed{0.44} = \text{total product} / \text{total area}$$

#### DMH-SSL4 TO DMH-SSL5

Surface Cover	A (ac)	C	Product A x C
impervious	0.40	0.9	0.360723
lands/grass	0.77	0.2	0.153898
woods	0.00	0.15	<u>0</u>
sum =	1.17	sum =	0.51

$$C = \boxed{0.44} = \text{total product} / \text{total area}$$

#### DMH-SSL5 TO IB-2B-A

Surface Cover	A (ac)	C	Product A x C
impervious	0.40	0.9	0.360723



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Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPC5 TO DMH-WPC5**

Surface Cover	A (ac)	C	Product A x C
impervious	0.27	0.9	0.242066
lands/grass	0.39	0.2	0.077759
woods	0.00	0.15	0
sum =	0.66	sum =	0.32

C = **0.49** = total product / total area**CB-WPC6 TO DMH-WPC6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.14	0.9	0.122252
lands/grass	0.06	0.2	0.01174
woods	0.00	0.15	0
sum =	0.19	sum =	0.13

C = **0.69** = total product / total area**DMH-WPC6 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.40	0.9	0.364318
lands/grass	0.45	0.2	0.0895
woods	0.00	0.15	0
sum =	0.85	sum =	0.45

C = **0.53** = total product / total area

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By PFK Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPC3 TO DMH-WPC2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.08	0.9	0.075723
lands/grass	0.54	0.2	0.107337
woods	0.57	0.15	0.086085
sum =	1.19	sum =	0.27

C = **0.23** = total product / total area**CB-WPC4 TO DMH-WPC2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.19	0.9	0.16938
lands/grass	0.13	0.2	0.025693
woods	0.00	0.15	0
sum =	0.32	sum =	0.20

C = **0.62** = total product / total area**DMH-WPC2 TO DMH-WPC3**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.27	0.9	0.245103
lands/grass	0.67	0.2	0.13303
woods	0.57	0.15	<u>0.086085</u>
sum =	1.51	sum =	0.46

$$C = \boxed{0.31} = \text{total product} / \text{total area}$$

#### DMH-WPC3 TO DMH-WPC4

Surface Cover	A (ac)	C	Product A x C
impervious	0.27	0.9	0.245103
lands/grass	0.67	0.2	0.13303
woods	0.57	0.15	<u>0.086085</u>
sum =	1.51	sum =	0.46

$$C = \boxed{0.31} = \text{total product} / \text{total area}$$

#### DMH-WPC4 TO FLARED END

Surface Cover	A (ac)	C	Product A x C
impervious	0.27	0.9	0.245103
lands/grass	0.67	0.2	0.13303
woods	0.57	0.15	<u>0.086085</u>
sum =	1.51	sum =	0.46

$$C = \boxed{0.31} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPC13 TO DMH-WPC10**

Surface Cover	A (ac)	C	Product A x C
impervious	0.15	0.9	0.13938
lands/grass	0.10	0.2	0.01916
woods	0.00	0.15	0
sum =	0.25	sum =	0.16

C = **0.63** = total product / total area**DMH-WPC10 TO DMH-WPC1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.15	0.9	0.13938
lands/grass	0.10	0.2	0.01916
woods	0.00	0.15	0
sum =	0.25	sum =	0.16

C = **0.63** = total product / total area**CB-WPC1 TO DMH-WPC1**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.16	0.9	0.147149
lands/grass	0.46	0.2	0.092507
woods	1.37	0.15	<u>0.204814</u>
sum =	1.99	sum =	0.44

$$C = \boxed{0.22} = \text{total product} / \text{total area}$$

#### **CB-WPC2 TO DMH-WPC1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.140847
lands/grass	0.02	0.2	0.00477
woods	0.00	0.15	<u>0</u>
sum =	0.18	sum =	0.15

$$C = \boxed{0.81} = \text{total product} / \text{total area}$$

#### **DMH-WPC1 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.47	0.9	0.427376
lands/grass	0.58	0.2	0.116437
woods	1.37	0.15	<u>0.204814</u>
sum =	2.42	sum =	0.75

$$C = \boxed{0.31} = \text{total product} / \text{total area}$$



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Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WPW13 TO DMH-WPW10**

Surface Cover	A (ac)	C	Product A x C
impervious	0.19	0.9	0.174029
lands/grass	0.17	0.2	0.034913
woods	0.00	0.15	0
sum =	0.37	sum =	0.21

C = **0.57** = total product / total area**CB-WPW14 TO DMH-WPW10**

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.034793
lands/grass	0.06	0.2	0.01185
woods	0.00	0.15	0
sum =	0.10	sum =	0.05

C = **0.48** = total product / total area**DMH-WPW10 TO DMH-WPW9**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.23	0.9	0.208822
lands/grass	0.23	0.2	0.046763
woods	0.00	0.15	0
sum =	0.47	sum =	0.26

$$C = \boxed{0.55} = \text{total product} / \text{total area}$$

#### **CB-WFW11 TO DMH-WFW9**

Surface Cover	A (ac)	C	Product A x C
impervious	0.27	0.9	0.242211
lands/grass	0.11	0.2	0.021102
woods	0.00	0.15	0
sum =	0.37	sum =	0.26

$$C = \boxed{0.70} = \text{total product} / \text{total area}$$

#### **CB-WFW12 TO DMH-WFW9**

Surface Cover	A (ac)	C	Product A x C
impervious	0.05	0.9	0.042541
lands/grass	0.04	0.2	0.007635
woods	0.00	0.15	0
sum =	0.09	sum =	0.05

$$C = \boxed{0.59} = \text{total product} / \text{total area}$$

#### **DMH-WFW9 TO DMH-WFW8**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.55	0.9	0.493574
lands/grass	0.38	0.2	0.0755
woods	0.00	0.15	<u>0</u>
sum =	0.93	sum =	0.57

$$C = \boxed{0.61} = \text{total product} / \text{total area}$$

#### **DMH-WFW8 TO IB-5C**

Surface Cover	A (ac)	C	Product A x C
impervious	0.55	0.9	0.493574
lands/grass	0.38	0.2	0.0755
woods	0.00	0.15	<u>0</u>
sum =	0.93	sum =	0.57

$$C = \boxed{0.61} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-DFD3 TO DMH-DFD2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.21	0.9	0.190124
lands/grass	0.12	0.2	0.023898
woods	0.00	0.15	0
sum =	0.33	sum =	0.21

C = **0.65** = total product / total area**CB-DFD4 TO DMH-DFD2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.05	0.9	0.043285
lands/grass	0.06	0.2	0.01185
woods	0.00	0.15	0
sum =	0.11	sum =	0.06

C = **0.51** = total product / total area**DMH-DFD2 TO DMH-DFD1**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.26	0.9	0.233409
lands/grass	0.18	0.2	0.035748
woods	0.00	0.15	0
sum =	0.44	sum =	0.27

$$C = \boxed{0.61} = \text{total product} / \text{total area}$$

#### **CB-DFD1 TO DMH-DFD1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.33	0.9	0.297107
lands/grass	0.08	0.2	0.015969
woods	0.00	0.15	0
sum =	0.41	sum =	0.31

$$C = \boxed{0.76} = \text{total product} / \text{total area}$$

#### **CB-DFD2 TO DMH-DFD1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.05	0.9	0.04157
lands/grass	0.37	0.2	0.074279
woods	0.00	0.15	0
sum =	0.42	sum =	0.12

$$C = \boxed{0.28} = \text{total product} / \text{total area}$$

#### **DMH-DFD1 TO DMH-WFW7**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.64	0.9	0.572087
lands/grass	0.63	0.2	0.125996
woods	0.00	0.15	<u>0</u>
sum =	1.27	sum =	0.70

$$C = \boxed{0.55} = \text{total product} / \text{total area}$$

#### **DMH-WFW7 TO DMH-WFW6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.64	0.9	0.572087
lands/grass	0.63	0.2	0.125996
woods	0.00	0.15	<u>0</u>
sum =	1.27	sum =	0.70

$$C = \boxed{0.55} = \text{total product} / \text{total area}$$

#### **CB-WFW9 TO DMH-WFW6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.082893
lands/grass	0.11	0.2	0.021341
woods	0.00	0.15	<u>0</u>
sum =	0.20	sum =	0.10

$$C = \boxed{0.52} = \text{total product} / \text{total area}$$

#### **CB-WFW10 TO DMH-WFW6**

Surface Cover	A (ac)	C	Product A x C
impervious	0.18	0.9	0.157934
lands/grass	0.06	0.2	0.012025

woods	0.00	0.15	<u>0</u>
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sum =	0.24	sum =	0.17
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C = 0.72 = total product / total area

#### **DMH-WFW6 TO DMH-WFW4**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.90	0.9	0.812913
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lands/grass	0.80	0.2	0.159362
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woods	0.00	0.15	<u>0</u>
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sum =	1.70	sum =	0.97
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C = 0.57 = total product / total area

#### **CB-WFW7 TO DMH-WFW4**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.05	0.9	0.044483
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lands/grass	0.01	0.2	0.002553
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woods	0.00	0.15	<u>0</u>
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sum =	0.06	sum =	0.05
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C = 0.76 = total product / total area

#### **CB-WFW8 TO DMH-WFW4**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.08	0.9	0.07314
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lands/grass	0.07	0.2	0.013866
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woods	0.00	0.15	<u>0</u>
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sum = 0.15

sum = 0.09

$$C = \boxed{0.58} = \text{total product} / \text{total area}$$

#### **DMH-WFW4 TO DMH-WFW3**

Surface Cover	A (ac)	C	Product A x C
impervious	1.03	0.9	0.930537
lands/grass	0.88	0.2	0.175781
woods	0.00	0.15	<u>0</u>
sum =	1.91	sum =	1.11

$$C = \boxed{0.58} = \text{total product} / \text{total area}$$

#### **CB-WFW5 TO DMH-WFW3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.07	0.9	0.06593
lands/grass	0.03	0.2	0.005927
woods	0.00	0.15	<u>0</u>
sum =	0.10	sum =	0.07

$$C = \boxed{0.70} = \text{total product} / \text{total area}$$

#### **CB-WFW6 TO DMH-WFW3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.05	0.9	0.041467
lands/grass	0.01	0.2	0.002296
woods	0.00	0.15	<u>0</u>
sum =	0.06	sum =	0.04



$$C = \boxed{0.76} = \text{total product} / \text{total area}$$

**DMH-WFW3 TO IB-5D**

Surface Cover	A (ac)	C	Product A x C
impervious	1.15	0.9	1.037934
lands/grass	0.92	0.2	0.184004
woods	0.00	0.15	<u>0</u>
sum =	2.07	sum =	1.22

$$C = \boxed{0.59} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-AS1 TO DMH-AS1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.14	0.9	0.12595
lands/grass	0.16	0.2	0.032231
woods	0.00	0.15	0
sum =	0.30	sum =	0.16

C = **0.53** = total product / total area**CB-AS2 TO DMH-AS1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.23	0.9	0.202583
lands/grass	0.00	0.2	0
woods	0.00	0.15	0
sum =	0.23	sum =	0.20

C = **0.90** = total product / total area**DMH-AS1 TO FLARED END**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.37	0.9	0.328533
lands/grass	0.16	0.2	0.032231
woods	0.00	0.15	0
sum =	0.53	sum =	0.36

$$C = \boxed{0.69} = \text{total product} / \text{total area}$$

#### **CB-AS3 TO DMH-AS3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.11593
lands/grass	0.03	0.2	0.006116
woods	0.00	0.15	0
sum =	0.16	sum =	0.12

$$C = \boxed{0.77} = \text{total product} / \text{total area}$$

#### **CB-AS4 TO DMH-AS3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.21	0.9	0.187087
lands/grass	0.00	0.2	0
woods	0.00	0.15	0
sum =	0.21	sum =	0.19

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### **DMH-AS3 TO DMH-AS2**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.34	0.9	0.303017
lands/grass	0.03	0.2	0.006116
woods	0.00	0.15	<u>0</u>
sum =	0.37	sum =	0.31

$$C = \boxed{0.84} = \text{total product} / \text{total area}$$

#### **DMH-AS2 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.34	0.9	0.303017
lands/grass	0.03	0.2	0.006116
woods	0.00	0.15	<u>0</u>
sum =	0.37	sum =	0.31

$$C = \boxed{0.84} = \text{total product} / \text{total area}$$

#### **CB-WWP1 TO DMH-WPW1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.038595
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.04	sum =	0.04

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### **CB-WPW2 TO DMH-WPW1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.03	0.9	0.030847
lands/grass	0.03	0.2	0.005335

woods	0.00	0.15	<u>0</u>
sum =	0.06	sum =	0.04
C = <span style="border: 1px solid black;">0.59</span> = total product / total area			

#### **DMH-WPW1 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.08	0.9	0.069442
lands/grass	0.03	0.2	0.005335
woods	0.00	0.15	<u>0</u>
sum =	0.10	sum =	0.07
C = <span style="border: 1px solid black;">0.72</span> = total product / total area			

#### **CB-WPW3 TO DMH-WPW2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.05	0.9	0.044483
lands/grass	0.01	0.2	0.002553
woods	0.00	0.15	<u>0</u>
sum =	0.06	sum =	0.05
C = <span style="border: 1px solid black;">0.76</span> = total product / total area			

#### **CB-WPW4 TO DMH-WPW2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.20	0.9	0.176756
lands/grass	0.11	0.2	0.021736
woods	0.00	0.15	<u>0</u>

sum = 0.31

sum = 0.20

$$C = \boxed{0.65} = \text{total product} / \text{total area}$$

**DMH-WPW2 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.25	0.9	0.22124
lands/grass	0.12	0.2	0.024288
woods	0.00	0.15	<u>0</u>
sum =	0.37	sum =	0.25

$$C = \boxed{0.67} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/4/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-DY2 TO CB-DY1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.41	0.9	0.367583
lands/grass	0.20	0.2	0.039022
woods	0.00	0.15	<u>0</u>
sum =	0.60	sum =	0.41

C = **0.67** = total product / total area**CB-DY1 TO DI-DY1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.56	0.9	0.500021
lands/grass	0.41	0.2	0.082911
woods	0.00	0.15	<u>0</u>
sum =	0.97	sum =	0.58

C = **0.60** = total product / total area**DI-DY1 TO IB-7A**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.56	0.9	0.500021
lands/grass	0.41	0.2	0.082911
woods	0.00	0.15	<u>0</u>
sum =	0.97	sum =	0.58

$$C = \boxed{0.60} = \text{total product} / \text{total area}$$

#### CB-BC1 TO CB-BC2

Surface Cover	A (ac)	C	Product A x C
impervious	0.36	0.9	0.319876
lands/grass	0.21	0.2	0.041561
woods	0.00	0.15	<u>0</u>
sum =	0.56	sum =	0.36

$$C = \boxed{0.64} = \text{total product} / \text{total area}$$

#### CB-BC2 TO DI-BC2

Surface Cover	A (ac)	C	Product A x C
impervious	0.71	0.9	0.638905
lands/grass	0.40	0.2	0.080376
woods	0.00	0.15	<u>0</u>
sum =	1.11	sum =	0.72

$$C = \boxed{0.65} = \text{total product} / \text{total area}$$

#### DI-BC2 TO IB-7A

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------



impervious	0.71	0.9	0.638905
lands/grass	0.40	0.2	0.080376
woods	0.00	0.15	<u>0</u>
sum =	1.11	sum =	0.72

C = 0.65 = total product / total area

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/4/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-CH3 TO IB-7B**

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.07936
lands/grass	0.11	0.2	0.022163
woods	0.10	0.15	<u>0.014931</u>
sum =	0.30	sum =	0.12

C = **0.39** = total product / total area**CB-CH2 TO IB-7B**

Surface Cover	A (ac)	C	Product A x C
impervious	0.23	0.9	0.203244
lands/grass	0.19	0.2	0.038921
woods	0.10	0.15	<u>0.015706</u>
sum =	0.53	sum =	0.26

C = **0.49** = total product / total area**CB-WF4 TO DMH-WF2**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.14	0.9	0.122583
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.14	sum =	0.12

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### CB-WF3 TO DMH-WF2

Surface Cover	A (ac)	C	Product A x C
impervious	0.08	0.9	0.072479
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.08	sum =	0.07

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### DMH-WF2 TO DMH-WF1

Surface Cover	A (ac)	C	Product A x C
impervious	0.22	0.9	0.195062
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.22	sum =	0.20

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### CB-WF1 TO DMH-WF1

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.05	0.9	0.04312
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.05	sum =	0.04

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### DMH-WF1 TO IB-7B

Surface Cover	A (ac)	C	Product A x C
impervious	0.26	0.9	0.238182
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.26	sum =	0.24

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/4/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-LP6 TO DMH-LP3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.26	0.9	0.236054
lands/grass	0.14	0.2	0.027172
woods	0.00	0.15	0
sum =	0.40	sum =	0.26

C = **0.66** = total product / total area**CB-LP5 TO DMH-LP3**

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.03626
lands/grass	0.00	0.2	0
woods	0.00	0.15	0
sum =	0.04	sum =	0.04

C = **0.90** = total product / total area**DMH-LP3 TO IB-8**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.30	0.9	0.272314
lands/grass	0.14	0.2	0.027172
woods	0.00	0.15	<u>0</u>
sum =	0.44	sum =	0.30

$$C = \boxed{0.68} = \text{total product} / \text{total area}$$

#### **CB-WF5 TO DMH-WF3A**

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.080517
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.09	sum =	0.08

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### **CB-WF5A TO DMH-WF3A**

Surface Cover	A (ac)	C	Product A x C
impervious	0.10	0.9	0.092645
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.10	sum =	0.09

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### **DMH-WF3A TO IB-8**

Surface Cover	A (ac)	C	Product A x C
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impervious	0.19	0.9	0.173161
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.19	sum =	0.17

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### CB-WF6 TO DMH-WF3

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.109215
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.12	sum =	0.11

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### DMH-WF3 TO DMH-WF4

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.109215
lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.12	sum =	0.11

$$C = \boxed{0.90} = \text{total product} / \text{total area}$$

#### DMH-WF4 TO IB-8

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.109215

lands/grass	0.00	0.2	0
woods	0.00	0.15	<u>0</u>
sum =	0.12	sum =	0.11
C = <b>0.90</b> = total product / total area			

#### **CB-LP4 TO DMH-LP2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.48	0.9	0.431529
lands/grass	0.22	0.2	0.0436
woods	0.00	0.15	<u>0</u>
sum =	0.70	sum =	0.48
C = <b>0.68</b> = total product / total area			

#### **CB-LP3 TO DMH-LP2**

Surface Cover	A (ac)	C	Product A x C
impervious	0.11	0.9	0.096736
lands/grass	0.12	0.2	0.023783
woods	0.00	0.15	<u>0</u>
sum =	0.23	sum =	0.12
C = <b>0.53</b> = total product / total area			

#### **DMH-LP2 TO DMH-LP4**

Surface Cover	A (ac)	C	Product A x C
impervious	0.59	0.9	0.528264
lands/grass	0.34	0.2	0.067383



woods	0.00	0.15	<u>0</u>
sum =	0.92	sum =	0.60
C = <span style="border: 1px solid black; padding: 2px;">0.64</span> = total product / total area			

#### **DMH-LP4 TO DMH-LP1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.59	0.9	0.528264
lands/grass	0.34	0.2	0.067383
woods	0.00	0.15	<u>0</u>
sum =	0.92	sum =	0.60
C = <span style="border: 1px solid black; padding: 2px;">0.64</span> = total product / total area			

#### **CB-LP1 TO DMH-LP1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.15	0.9	0.13938
lands/grass	0.08	0.2	0.016607
woods	0.00	0.15	<u>0</u>
sum =	0.24	sum =	0.16
C = <span style="border: 1px solid black; padding: 2px;">0.66</span> = total product / total area			

#### **CB-LP2 TO DMH-LP1**

Surface Cover	A (ac)	C	Product A x C
impervious	0.49	0.9	0.436529
lands/grass	0.10	0.2	0.019068
woods	0.00	0.15	<u>0</u>

sum = 0.58

sum = 0.46

$$C = \boxed{0.79} = \text{total product} / \text{total area}$$

**DMH-LP1 TO IB-8**

Surface Cover	A (ac)	C	Product A x C
impervious	1.23	0.9	1.104174
lands/grass	0.52	0.2	0.103058
woods	0.00	0.15	<u>0</u>

sum = 1.74

sum = 1.21

$$C = \boxed{0.69} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By PFK, NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WFW17 TO DMH-WFW10**

Surface Cover	A (ac)	C	Product A x C
impervious	0.39	0.9	0.354525
lands/grass	0.13	0.2	0.025753
woods	0.00	0.15	0
sum =	0.52	sum =	0.38

C = **0.73** = total product / total area**CB-WFW18 TO DMH-WFW10**

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.107934
lands/grass	0.07	0.2	0.013072
woods	0.00	0.15	0
sum =	0.19	sum =	0.12

C = **0.65** = total product / total area**DMH-WFW10 TO DMH-WFW9**

Surface	A	C	Product
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Cover	(ac)		A x C
impervious	0.51	0.9	0.462459
lands/grass	0.19	0.2	0.038825
woods	0.00	0.15	0
sum =	0.71	sum =	0.50

$$C = \boxed{0.71} = \text{total product} / \text{total area}$$

#### DMH-WFW9 TO DMH-WFW8

Surface Cover	A (ac)	C	Product A x C
impervious	0.51	0.9	0.462459
lands/grass	0.19	0.2	0.038825
woods	0.00	0.15	0
sum =	0.71	sum =	0.50

$$C = \boxed{0.71} = \text{total product} / \text{total area}$$

#### CB-WFW15 TO DMH-WFW8

Surface Cover	A (ac)	C	Product A x C
impervious	0.28	0.9	0.250083
lands/grass	0.13	0.2	0.025514
woods	0.00	0.15	0
sum =	0.41	sum =	0.28

$$C = \boxed{0.68} = \text{total product} / \text{total area}$$

#### CB-WFW16 TO DMH-WFW8

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.11	0.9	0.097273
lands/grass	0.15	0.2	0.029931
woods	0.00	0.15	<u>0</u>
sum =	0.26	sum =	0.13

$$C = \boxed{0.49} = \text{total product} / \text{total area}$$

#### **DMH-WFW8 TO DMH-WFW7**

Surface Cover	A (ac)	C	Product A x C
impervious	0.90	0.9	0.809814
lands/grass	0.47	0.2	0.09427
woods	0.00	0.15	<u>0</u>
sum =	1.37	sum =	0.90

$$C = \boxed{0.66} = \text{total product} / \text{total area}$$

#### **CB-WFW13 TO DMH-WFW7**

Surface Cover	A (ac)	C	Product A x C
impervious	0.41	0.9	0.373079
lands/grass	0.15	0.2	0.029031
woods	0.00	0.15	<u>0</u>
sum =	0.56	sum =	0.40

$$C = \boxed{0.72} = \text{total product} / \text{total area}$$

#### **CB-WFW14 TO DMH-WFW7**

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.114153
lands/grass	0.10	0.2	0.01933

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	0.22	sum =	0.13
-------	------	-------	------

C = **0.60** = total product / total area

#### **DMH-WFW7 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	1.44	0.9	1.297045
------------	------	-----	----------

lands/grass	0.71	0.2	0.142631
-------------	------	-----	----------

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	2.15	sum =	1.44
-------	------	-------	------

C = **0.67** = total product / total area

#### **CB-WFW11 TO DMH-WFW5**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.11	0.9	0.096653
------------	------	-----	----------

lands/grass	0.00	0.2	0
-------------	------	-----	---

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	0.11	sum =	0.10
-------	------	-------	------

C = **0.90** = total product / total area

#### **CB-WFW12 TO DMH-WFW5**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.13	0.9	0.115145
------------	------	-----	----------

lands/grass	0.06	0.2	0.012397
-------------	------	-----	----------

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum = 0.19

sum = 0.13

$$C = \boxed{0.67} = \text{total product} / \text{total area}$$

**DMH-WFW5 TO FLARED END**

Surface Cover	A (ac)	C	Product A x C
impervious	0.24	0.9	0.211798
lands/grass	0.06	0.2	0.012397
woods	0.00	0.15	<u>0</u>
sum =	0.30	sum =	0.22

$$C = \boxed{0.75} = \text{total product} / \text{total area}$$

**Closed Drainage System****SM-3719C**Project: The Cottages at Wandering Pond By NC Date 10/13/2022Location: Stow, MA Checked \_\_\_\_\_ Date \_\_\_\_\_**Rational Method**

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,

A = area (ac)

C = 0.90 impervious

C = 0.20 landscaped / grass

C = 0.15 woods

**CB-WF19 TO DMH-WF11**

Surface Cover	A (ac)	C	Product A x C
impervious	0.43	0.9	0.385764
lands/grass	0.15	0.2	0.030441
woods	0.00	0.15	0
sum =	0.58	sum =	0.42

C = **0.72** = total product / total area**CB-WF20 TO DMH-WF11**

Surface Cover	A (ac)	C	Product A x C
impervious	0.29	0.9	0.262851
lands/grass	0.07	0.2	0.014118
woods	0.00	0.15	0
sum =	0.36	sum =	0.28

C = **0.76** = total product / total area**DMH-WF11 TO DMH-WF12**

Surface	A	C	Product
---------	---	---	---------



Cover	(ac)		A x C
impervious	0.72	0.9	0.648616
lands/grass	0.22	0.2	0.044559
woods	0.00	0.15	0
sum =	0.94	sum =	0.69
C = <b>0.73</b> = total product / total area			

#### **DMH-WF12 TO DMH-WF13**

Surface Cover	A (ac)	C	Product A x C
impervious	0.72	0.9	0.648616
lands/grass	0.22	0.2	0.044559
woods	0.00	0.15	0
sum =	0.94	sum =	0.69
C = <b>0.73</b> = total product / total area			

#### **CB-WF21 TO DMH-WF13**

Surface Cover	A (ac)	C	Product A x C
impervious	0.35	0.9	0.314256
lands/grass	0.11	0.2	0.022819
woods	0.00	0.15	0
sum =	0.46	sum =	0.34
C = <b>0.73</b> = total product / total area			

#### **CB-WF22 TO DMH-WF13**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.16	0.9	0.141736
lands/grass	0.13	0.2	0.025808
woods	0.00	0.15	<u>0</u>
sum =	0.29	sum =	0.17

$$C = \boxed{0.58} = \text{total product} / \text{total area}$$

#### **DMH-WF13 TO DMH-WF14**

Surface Cover	A (ac)	C	Product A x C
impervious	1.23	0.9	1.104607
lands/grass	0.47	0.2	0.093186
woods	0.00	0.15	<u>0</u>
sum =	1.69	sum =	1.20

$$C = \boxed{0.71} = \text{total product} / \text{total area}$$

#### **DMH-WF14 TO DMH-WF15**

Surface Cover	A (ac)	C	Product A x C
impervious	1.23	0.9	1.104607
lands/grass	0.47	0.2	0.093186
woods	0.00	0.15	<u>0</u>
sum =	1.69	sum =	1.20

$$C = \boxed{0.71} = \text{total product} / \text{total area}$$

#### **DMH-WF15 TO DMH-WF16**

Surface Cover	A (ac)	C	Product A x C
impervious	1.23	0.9	1.104607
lands/grass	0.47	0.2	0.093186

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	1.69	sum =	1.20
-------	------	-------	------

C = 0.71 = total product / total area

**DMH-WF16 TO IB-10C**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	1.23	0.9	1.104607
------------	------	-----	----------

lands/grass	0.47	0.2	0.093186
-------------	------	-----	----------

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	1.69	sum =	1.20
-------	------	-------	------

C = 0.71 = total product / total area

**CB-WF23 TO DMH-WF17**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.09	0.9	0.076715
------------	------	-----	----------

lands/grass	0.02	0.2	0.004408
-------------	------	-----	----------

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum =	0.11	sum =	0.08
-------	------	-------	------

C = 0.76 = total product / total area

**CB-WF24 TO DMH-WF17**

Surface Cover	A (ac)	C	Product A x C
------------------	-----------	---	------------------

impervious	0.70	0.9	0.629215
------------	------	-----	----------

lands/grass	2.52	0.2	0.503724
-------------	------	-----	----------

woods	0.00	0.15	<u>0</u>
-------	------	------	----------

sum = 3.22

sum = 1.13

$$C = \boxed{0.35} = \text{total product} / \text{total area}$$

#### **DMH-WF17 TO DMH-WF18**

Surface Cover	A (ac)	C	Product A x C
impervious	0.78	0.9	0.70593
lands/grass	2.54	0.2	0.508131
woods	0.00	0.15	<u>0</u>
sum =	3.33	sum =	1.21

$$C = \boxed{0.37} = \text{total product} / \text{total area}$$

#### **CB-69 TO DMH-WF21**

Surface Cover	A (ac)	C	Product A x C
impervious	0.40	0.9	0.359483
lands/grass	0.71	0.2	0.141368
woods	0.00	0.15	<u>0</u>
sum =	1.11	sum =	0.50

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

#### **CB-70 TO DMH-WF21**

Surface Cover	A (ac)	C	Product A x C
impervious	0.29	0.9	0.257934
lands/grass	0.06	0.2	0.012736
woods	0.00	0.15	<u>0</u>
sum =	0.35	sum =	0.27

$$C = \boxed{0.77} = \text{total product} / \text{total area}$$

#### **DMH-WF21 TO DMH-WF18**

Surface Cover	A (ac)	C	Product A x C
impervious	0.69	0.9	0.617417
lands/grass	0.77	0.2	0.154105
woods	0.00	0.15	<u>0</u>
sum =	1.46	sum =	0.77

$$C = \boxed{0.53} = \text{total product} / \text{total area}$$

#### **CB-WF25 TO DMH-WF18**

Surface Cover	A (ac)	C	Product A x C
impervious	0.56	0.9	0.507831
lands/grass	0.14	0.2	0.028999
woods	0.00	0.15	<u>0</u>
sum =	0.71	sum =	0.54

$$C = \boxed{0.76} = \text{total product} / \text{total area}$$

#### **CB-WF26 TO DMH-WF18**

Surface Cover	A (ac)	C	Product A x C
impervious	0.08	0.9	0.076343
lands/grass	0.39	0.2	0.077902
woods	0.00	0.15	<u>0</u>
sum =	0.47	sum =	0.15

$$C = \boxed{0.33} = \text{total product} / \text{total area}$$

**DMH-WF18 TO DMH-WF19**

Surface Cover	A (ac)	C	Product A x C
impervious	2.12	0.9	1.907521
lands/grass	3.85	0.2	0.769137
woods	0.00	0.15	0
sum =	5.97	sum =	2.68

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

**DMH-WF19 TO DMH-WF20**

Surface Cover	A (ac)	C	Product A x C
impervious	2.12	0.9	1.907521
lands/grass	3.85	0.2	0.769137
woods	0.00	0.15	0
sum =	5.97	sum =	2.68

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

**DMH-WF20 TO IB-10C**

Surface Cover	A (ac)	C	Product A x C
impervious	2.12	0.9	1.907521
lands/grass	3.85	0.2	0.769137
woods	0.00	0.15	0
sum =	5.97	sum =	2.68

$$C = \boxed{0.45} = \text{total product} / \text{total area}$$

## **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:

**TSS Removal  
Calculation Worksheet**

A BMP <sup>1</sup>	B TSS Removal Rate <sup>1</sup>	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	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:   
 Prepared By:   
 Date:

\*Equals remaining load from previous BMP (E)  
which enters the BMP



## **Soil Evaluation**



**C. On-Site Review** *(minimum of two holes required at every proposed primary and reserve disposal area)*

Description of Location: _____									
2.	Soil Parent Material:	OUTWASH			MORAINE			BS	
					Landform			Position on Landscape (SU, SH, BS, FS, TS)	
3.	Distances from:	Open Water Body	>>100	feet	Drainage Way	_____	feet	Wetlands	>>100
		Property Line	>>10	feet	Drinking Water Well	>100	feet	Other	_____
4.	Unsuitable Materials Present:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	If Yes:	<input type="checkbox"/> Disturbed Soil	<input type="checkbox"/> Fill Material	<input type="checkbox"/> Weathered/Fractured Rock	<input type="checkbox"/> Bedrock	
5.	Groundwater Observed:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	If yes:	Depth Weeping from Pit	Depth Standing Water in Hole			

[illegible]

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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 10/25/2021  
Hole # 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

10/25/2021

Hole #

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 10/25/2021 \_\_\_\_\_  
Hole # Date Time Weather Latitude Longitude:

1. Land Use (e.g., woodland, agricultural field, vacant lot, etc.) R02, PARCEL4  
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			
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 10/25/2021 \_\_\_\_\_  
Hole # Date Time Weather Latitude Longitude:

1. Athens Street \_\_\_\_\_  
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			
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 10/25/2021 \_\_\_\_\_  
Hole # 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: ~2 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation SOME Surface Stones (e.g., cobbles, stones, boulders, etc.)

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: ~5

1. Land Use: VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) 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 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: 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	75	5	5	SA	L	
60-72	C2	10YR 5/2	SL	↓	↓	↓	-	-	M	F	
72-138	C3	10YR 4/3	S	↓	↓	↓	10	15	SA	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: ~2

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) 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			
0-12	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	SH	L	

Additional Notes:



Commonwealth of Massachusetts  
City/Town of STON

## 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 SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) ~2 Slope (%)

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			
0-12	A	SL	10YR 3/3	-	-	-	-	-	M	F	
12-24	B	SL	10YR 3/6	-	-	-	-	-	M	F	
24-96	C1	S	10YR 5/2	-	-	-	S	S	SG	L	
96-104	C2	FINE S	10YR 4/2	-	-	-	-	-	SG	L	
104-156	C3	S	10YR 5/2	-	-	-	S	S	SC	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-ZS-5 Hole # 10/25/2021 Date 11:30 Time RAINY Weather Latitude Longitude: ~2  
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	SH	C	

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 4/8/2022 12PM 55d, CLOUDY  
Hole # Date Time Weather Latitude Longitude:  
1. Land Use WOODLAND WOODED SOME  
(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	
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:



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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 4/8/2022  
Hole # 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 4/8/2022  
Hole # 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 4/8/2022  
Hole # 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: \_\_\_\_\_





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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 SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) ~ 2 Slope (%)

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 SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) ~ 2 Slope (%)

1. Land Use VACANT  
(e.g., woodland, agricultural field, vacant lot, etc.)

WOODED  
Vegetation

SOME  
Surface Stones (e.g., cobbles, stones, boulders, etc.)

Longitude:  
~ 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: 8'4" 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	75	5	10	M	F	BOULDER

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: D3 Hole # 4/7/22 Date 10:30 Time OVERCAST Weather Latitude Longitude: ~5 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation NONE Surface Stones (e.g., cobbles, stones, boulders, etc.)

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: 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: \_\_\_\_\_



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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: D4 Hole # 4/7/22 Date 11:00 Time OVERCAST Weather Latitude Longitude: ~10 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation NONE Surface Stones (e.g., cobbles, stones, boulders, etc.)

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 750 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			
0-8	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	SA	L	
84-120	C2	FINE SAND	2.5Y 5/3	↓	↓	↓	-	-	SA	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: D5 Hole # 4/7/22 Date 11:30 Time OVERCAST Weather Latitude Longitude: N 0-2 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation NO Surface Stones (e.g., cobbles, stones, boulders, etc.)

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 7150 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: - 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	10 YR 3/2	-	-	-	-	-	M	F	
10-18	B	SL	10 YR 3/6	-	-	-	-	-	M	F	
18-120	C	S	10 YR 5/3	-	-	-	10	10	SC	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: D6 Hole # 47/22 Date 12:00 Time OVERCAST Weather YES Latitude ~0 Longitude: ~0 Slope (%)

1. Land Use COMMERCIAL (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation GRAVEL Surface Stones (e.g., cobbles, stones, boulders, etc.) YES

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	SA	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: D7 Hole # 4/7/22 Date 12:30 Time OVERCAST Weather NONE Surface Stones (e.g., cobbles, stones, boulders, etc.) NONE

Latitude ~2 Longitude: ~2 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation

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	SA	L	CAVE IN

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: D8 Hole # 4/7/22 Date 1:00 Time OVERCAST Weather Latitude Longitude: ~2 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation NONE Surface Stones (e.g., cobbles, stones, boulders, etc.)

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	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	SC	L	
96 - 132	C2	FINE LS	2.5 Y 5/3	-	-	-	-	-	M	F	

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: D9 Hole # 47/22 Date 1:30 Time OVERCAST Weather Latitude Longitude: ~ 2 Slope (%)

1. Land Use VACANT (e.g., woodland, agricultural field, vacant lot, etc.) WOODED Vegetation NONE Surface Stones (e.g., cobbles, stones, boulders, etc.)

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 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: 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	SA	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: ~2 Slope (%)

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:



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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: 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 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			
0-8	A	SL	10YR 3/2	-	-	-	-	-	M	F	
8-20	B	SL	10YR 3/6	-	-	-	-	-	M	F	
20-72	C1	S	10YR 5/3	-	-	-	-	-	Sh	L	
72-132	C2	FINE SAND	2.5Y 5/3	-	-	-	-	-	Sh	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: D12 Hole # 4/7/22 Date 3:30 Time OVERCAST Weather Latitude Longitude: ~0-2 Slope (%)

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.)

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: 77" 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	-	-	SC	L	
72-120	C2	FINE SAND	5YR 3/2	↓	↓	-	-	-	m	F	

Additional Notes: \_\_\_\_\_





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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 #Date 4/7/22Time 4:15Weather OVERCAST

Latitude \_\_\_\_\_

Longitude: \_\_\_\_\_

1. Land Use AGRICULTURAL FIELD  
(e.g., woodland, agricultural field, vacant lot, etc.)Vegetation BRUSH / MOSSSurface Stones (e.g., cobbles, stones, boulders, etc.) SOMESlope (%) ~2

Description of Location: \_\_\_\_\_

2. Soil Parent Material: GLACIOFLUVIAL

Landform \_\_\_\_\_

Position on Landscape (SU, SH, BS, FS, TS) \_\_\_\_\_

3. Distances from: Open Water Body - feetDrainage Way - feetWetlands ~200 feetProperty Line ~100 feetDrinking Water Well - feetOther - feet4. Unsuitable Materials Present: ☐ Yes ☒ NoIf Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock5. Groundwater Observed: ☐ Yes ☒ NoIf 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: \_\_\_\_\_



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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: D14 Hole # 4/7/22 Date 4:45 Time OVERCAST Weather Latitude Longitude: NO-2  
 1. Land Use AGRICULTURAL (e.g., woodland, agricultural field, vacant lot, etc.) BRUSH/MEADOW Vegetation SOME Surface Stones (e.g., cobbles, stones, boulders, etc.) 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: \_\_\_\_\_



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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: TP-7-1 7/20/22 8:30 AM 90d, SUNNY  
Hole # Date Time Weather Latitude Longitude

1. Land Use WOODLAND WOODED MANY  
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: ON DRUMLIN NEAR FARM

2. Soil Parent Material: TILL Landform Position on Landscape (SU, SH, BS, FS, TS, Plain)

3. Distances from: Open Water Body \_\_\_\_\_ 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: \_\_\_\_\_ Depth to Weeping in Hole \_\_\_\_\_ Depth to 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			
4	A	SL	10YR 3/3/	-	Cnc : Dpl:	-	-	-	M	F	
20	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
48	C1	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
120	C2	LS	10YR 5/3	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						

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: TP-7-2 7/20/22  
Hole # 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, Plain)

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 to Weeping in Hole \_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
22	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
60	C1	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
132	C2	LS	10YR 5/3	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						

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: TP-7-3

7/20/22

Hole #

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, Plain)

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 to Weeping in Hole

\_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
22	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
126	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

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: TP-7-4

7/20/22

Hole #

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, Plain)

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 to Weeping in Hole

\_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
24	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
78	C1	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
126	C2	LS	10YR 5/3	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						

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: TP-7-5 7/20/22  
Hole # 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, Plain)

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 to Weeping in Hole \_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
24	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
84*	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

\*NO REFUSAL, JUST LARGE BOULDERS



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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: TP-7-6

7/20/22

Hole #

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, Plain)

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 to Weeping in Hole

\_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
22	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
120	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

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: TP-7-7 7/20/22  
Hole # 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, Plain)

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 to Weeping in Hole \_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
24	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
120	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

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-7-8

7/20/22

Hole #

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, Plain)

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 to Weeping in Hole

\_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
22	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
120	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

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-7-9 7/22/22 8:30 AM  
Hole # 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, Plain)

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 to Weeping in Hole \_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
28	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
120	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

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-7-10

7/22/22

Hole #

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, Plain)

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 to Weeping in Hole

\_\_\_\_\_ 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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
30	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
100*	C	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

\*NO REFUSAL, JUST LARGE BOULDERS





**C. On-Site Review** (*minimum of two holes required at every proposed primary and reserve disposal area*)

**Deep Observation Hole Number:** TP-7-11

7/22/22

Hole #

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, Plain)

- ### 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 to Weeping in Hole                      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			
4	A	SL	10YR 3/3	-	Cnc : Dpl:	-	-	-	M	F	
28	B	LS	10YR 5/8	-	Cnc : Dpl:	-	-	-	M	F	
90	C1	LS	10YR 6/2	-	Cnc : Dpl:	-	15	15	M	F	
120	C2	LS	10YR 5/3	96	Cnc : Dpl:	5	15	15	M	F	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

# **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:**

**Street Sweeping**

**Catch Basin**

**Infiltration Basin**

**Sediment Forebay**

**Treatment Trench**

**Frequency:**

**Two times per year**

**Four times per year**

**Two times per year**

**Monthly**

**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: \_\_\_\_\_

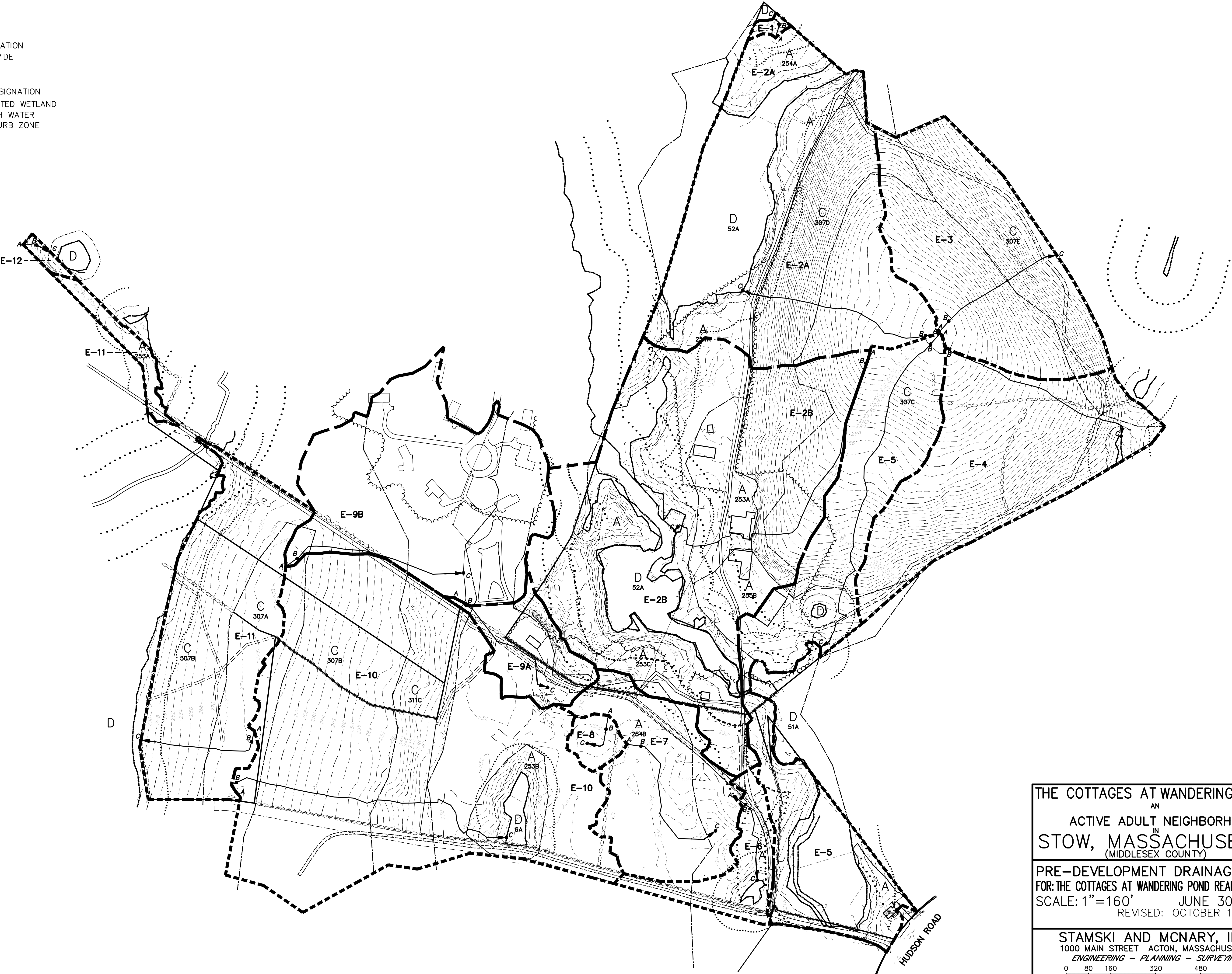
Comments:

Action Required:

## **Drainage Maps**

LEGEND:

- A ● —● B TIME OF CONCENTRATION  
--- SUBCATCHMENT DIVIDE  
--- SOIL DIVIDE  
256A SOIL UNIT SYMBOL  
E-1 SUBCATCHMENT DESIGNATION  
--- BORDERING VEGETATED WETLAND  
--- MEAN ANNUAL HIGH WATER  
--- 35-FOOT NO-DISTURB ZONE  
--- BUFFER ZONE  
--- RIVERFRONT AREA  
--- EXISTING CONTOUR  
--- STONE WALL  
N/F NOW OR FORMERLY  
● TREE  
--- TREE LINE



THE COTTAGES AT WANDERING POND  
AN  
ACTIVE ADULT NEIGHBORHOOD  
IN  
STOW, MASSACHUSETTS  
(MIDDLESEX COUNTY)

PRE-DEVELOPMENT DRAINAGE MAP  
FOR: THE COTTAGES AT WANDERING POND REALTY TRUST  
SCALE: 1"=160' JUNE 30, 2022  
REVISED: OCTOBER 13, 2022

STAMSKI AND MCNARY, INC.  
1000 MAIN STREET ACTON, MASSACHUSETTS  
ENGINEERING - PLANNING - SURVEYING  
0 80 160 320 480 640 FT



LEGEND:

- A ● B TIME OF CONCENTRATION  
--- SUBCATCHMENT DIVIDE  
--- SOIL DIVIDE  
256A SOIL UNIT SYMBOL  
E-1 SUBCATCHMENT DESIGNATION  
--- BORDERING VEGETATED WETLAND  
--- MEAN ANNUAL HIGH WATER  
--- 35-FOOT NO-DISTURB ZONE  
--- BUFFER ZONE  
--- RIVERFRONT AREA  
--- EXISTING CONTOUR  
--- STONE WALL  
N/F NOW OR FORMERLY  
● TREE  
--- TREE LINE  
■ ROOF AREA DIRECTED TO INDIVIDUAL DRYWELL



THE COTTAGES AT WANDERING POND  
AN  
ACTIVE ADULT NEIGHBORHOOD  
IN  
STOW, MASSACHUSETTS  
(MIDDLESEX COUNTY)

POST DEVELOPMENT DRAINAGE MAP  
FOR: THE COTTAGES AT WANDERING POND REALTY TRUST  
SCALE: 1"=160' JUNE 30, 2022  
REVISED: OCTOBER 26, 2022

STAMSKI AND MCNARY, INC.  
1000 MAIN STREET ACTON, MASSACHUSETTS  
ENGINEERING - PLANNING - SURVEYING  
0 75 150 300 600 900 FT  
SM-3719C (3719C.AAN.DWG) SHEET X OF 72