STORMWATER MANAGEMENT REPORT

6 - UNIT RESIDENTIAL BUILDING DEVELOPMENT

235 LOWELL STREET
SOMERVILLE, MASSACHUSETTS

NOVEMBER 25, 2013

Prepared for;
231 LOWELL ST., LLC

Prepared by;
D & A Survey Associates, Inc.

Table of Contents

Narrative

1.0 Introduction and Background

The following report provides technical information on the stormwater management controls provided to satisfy the objectives of the City of Somerville Zoning Ordinance for the development of a site located at 235 Lowell Street (refer to Figure 1: USGS Locus Map). This report includes an analysis of the present and proposed hydrologic characteristics of the site and information on the performance of stormwater controls proposed to mitigate the impacts of the stormwater generated by the project.

2.0 Existing Conditions

The site is located along the east side of Lowell St. approximately 40 feet north of Woodbine St. The property is bounded by Lowell to the west, a multi-family development to the north, and a commercial building to the south and east. The subject property is located in the Residential RC zoning district and has a total land area of approximately 5,753 square feet. It is referred to as lot 3 in block B on the City of Somerville assessor's map 42.

Presently there is a single commercial use building located on the rear portion of the property. The foot print area of the existing building is approximately 4,000 s.f.. The remaining area of the property is entirely made of a bituminous concrete parking area with a 55' foot wide curb cut on to Lowell St. The total existing impervious cover on the property is approximately 5,753 s.f. or 100 % of the total parcel area.

Storm water generated from the site presently flows to the municipal stormwater system in Lowell St. Figure 2 depicts the existing topographic conditions and the existing stormwater watersheds.

The USDA Conservation Service has mapped the underlying soils in the area of the site as Scio-Urban land complex. These soils are typically made up of moderately well drained silt loams that are considered to be in the Hydrologic Soil Group "B". Supporting information on the site's soils has been included in the report's appendix.

3.0 Project Description

The project consists of the demolition of the existing commercial building and the construction of a new 43' by 56' (2,600 s.f. footprint) 6 unit residential building and parking area. A majority of the parking area proposed will be constructed of a pervious

pavement surface. With the removal of the existing bituminous concrete parking area and walkways the post construction area of impervious surfaces on the property will be approximately 3,500 s.f. or 61% of the property. This will result in a net decrease of impervious surfaces on the property of approximately 2,200 s.f.. The remaining open space areas will become manicured grass and planted landscape areas.

The proposed building will include a roof drainage system of gutters and downspouts that will be directly piped to an underground ground water recharge system. Stormwater from the proposed driveway will also be captured through a deep sump catch basin connected to the recharge system. Information on the design of these systems has been included in the appendix of this report and is detailed on the project site plans.

The project will require some minor site work outside the limits of the property. The "curb cut" access to the property will be a single location 12 feet in width onto Lowell Street. Other improvements include installation of granite curbing and concrete sidewalk as required along the frontage of the property to close off approximately 40 feet of the existing curb cut. The installation of new utility services will also be required to facilitate the new building. The project's site plans provide detail information on the proposed work.

4.0 Peak Flow Runoff Rates

Peak flow rates were studied under existing and proposed conditions for the 2, 10, and 100 year, 24-hour Type III storm events. A single point of comparison or study point (SP "A"), as described below in Table 1 and as shown in Figures 2 and 3 was developed and studied in an effort to micro-analyze runoff rates to the abutting properties and roadway. The study point was consistent between pre- and post-development conditions.

TABLE 1: STUDY POINT OF COMPARISON

Study Point	Description
1	Flows to municipal drainage system in Lowell Street.

For both pre- and post-development conditions, the site was divided into subcatchment areas based on topography, drainage patterns, and the study points. One subcatchment (E-1) was utilized to study pre-development conditions, and two subcatchments (P-1 & P-2) were utilized to study post-development conditions (refer to Figures 2 and 3). One of the post development subcatchments (P-2) represents the areas of the site that will drain

to the recharge system. This subcatchment was utilized to determine the performance of the system.

Technical Release 55 (TR-55) was utilized to obtain weighted curve numbers (CNs) for each of the pre- and post-development subcatchment areas. Inputs for obtaining the weighted CNs were based on ground cover type and hydrologic soil group (HSG) soils classified by United States Department of Agriculture (USDA) soil survey data. Supporting information on the weighted curve numbers has been included in the report's appendix.

TR-55 was also utilized to obtain times of concentration (TCs) for each of the pre- and post-development subcatchment areas. Various flow paths were evaluated for each subcatchment area to determine the most hydrologically remote point within that subcatchment, which did not necessarily correspond to the longest flow path. Flow paths generally include a segment of sheet flow of up to 100 feet, segment(s) of shallow concentrated flow, and in some cases segment(s) of channel flow, with the sheet flow having the greatest impact on the TC. For each segment of flow, the length, slope, and cover type were entered to calculate the TC. The same methodology for calculating TC was employed consistently between pre-and post development conditions. Refer to the attached TR-55 TC data. Since such small watersheds make up this study area a 6 minute time of concentration was assumed for both the pre and post development condition.

CNs and TCs obtained from TR-55 were input into the *Hydraflow*® Hydrographs software package, which utilizes the National Resources Conservation Service (NRCS) (formerly "SCS") method to generate and route hydrographs. The resulting hydrographs have been included in the report's appendix.

The resulting analysis determines flows to the "POC's", as the post-development peak runoff rates do not exceed the pre-development peak runoff rates for the design storms. Table 2 (below) summarizes the attached *Hydraflow*® Hydrographs analysis.

TABLE 2: RUNOFF COMPARISON

Storm Event	**Study Points**			
	"A"			
	Pre (cfs)	Post (cfs)		
2 -yr	***0.42***	***.09***		
10 -yr	***0.61***	***0.26***		
100-yr	***0.88***	***0.81***		

5.0 Groundwater Recharge

Due to the fact that the site will realize a decrease in the overall impervious surfaces, the site will create improved groundwater recharge in the post development condition. A stormwater ground water recharge system has also been provided to further improve the annual loss of groundwater recharge from the site's present condition. The system has been sized to meet MA DEP's standard for the impervious surfaces in the post development condition. The system consists of HDPE chambers placed in a crushed stone envelope. Design specifications of the systems have been included in project site plans. Information on the performance of the system has been included in appendix of the report.

6.0 T.S.S. Removal

The project includes the removal of the existing bituminous concrete parking area and the creation of a smaller access driveway and pervious parking area. By reducing the impervious surface area used by motor vehicles on the property the generation of suspended solids will be reduce. The impervious portion of the parking area will be drained through a treatment train of a deep sump catch basin and infiltration area that will further improve TSS generation from the site. The appendix includes the removal rate worksheet for the proposed treatment train.

7.0 Erosion and Sediment Control Plan

The project will include appropriate erosion and sediment controls to insure that exposed soils will be contained and sediment will not be released from the proposed limit of work. A sediment control plan has been prepared for the project and has been included in the appendix of report.

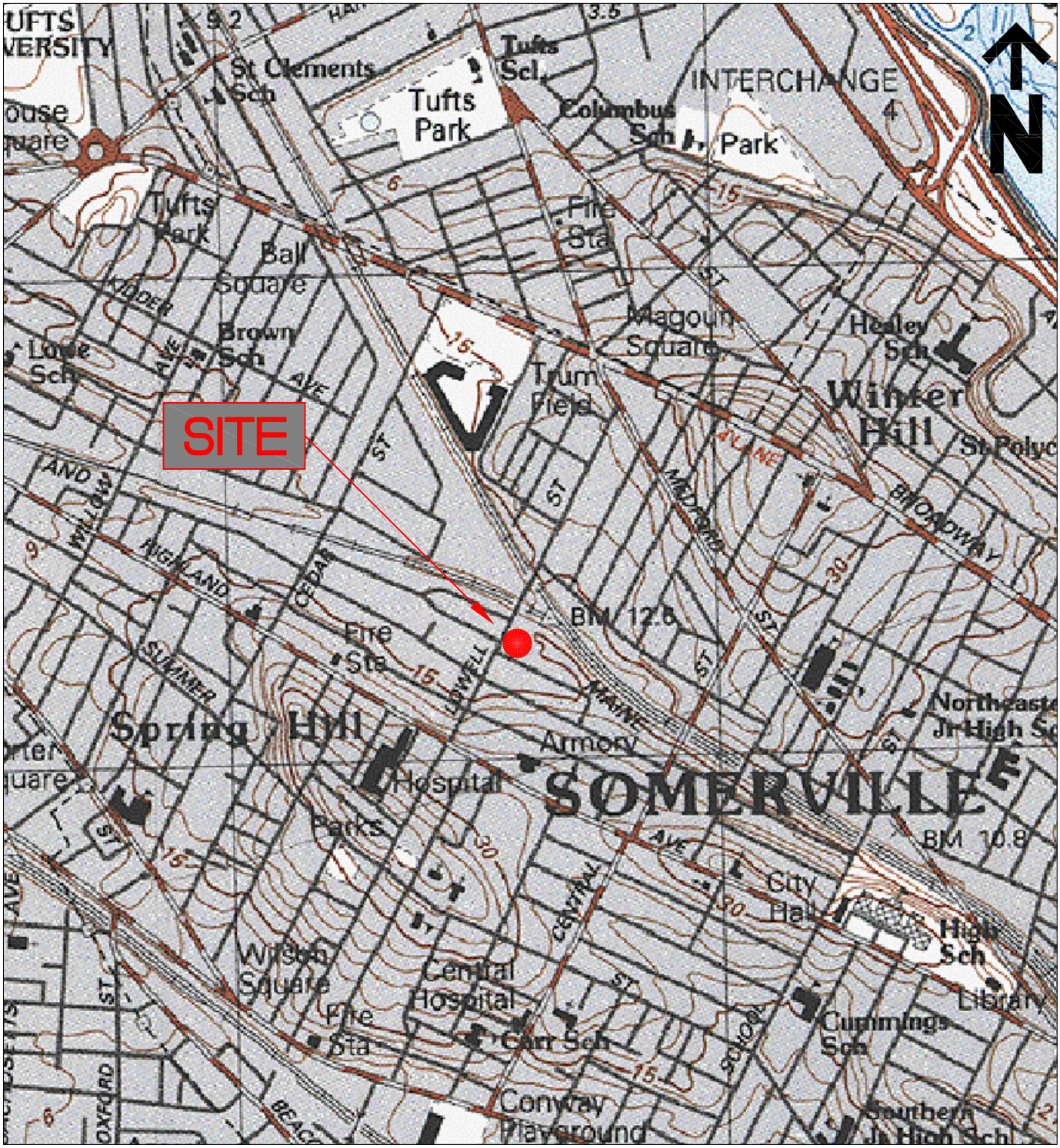
8.0 Operation & Maintenance Plan

An Operation and Maintenance Plan has been provided for the property. The O & M Plan details the maintenance schedule and requirements for the project's BMP's. The plan also states the parties responsible. The O & M Plan has been included in the appendix of report.

9.0 Conclusion

Based on the analysis performed, the storm water controls proposed will assure that their will be no increased impacts from the storm water runoff generated from the site.

FIGURE 1



USGS LOCUS MAP

235 LOWELL STREET

SOMERVILLE, MASSACHUSETTS

DRAWN FOR

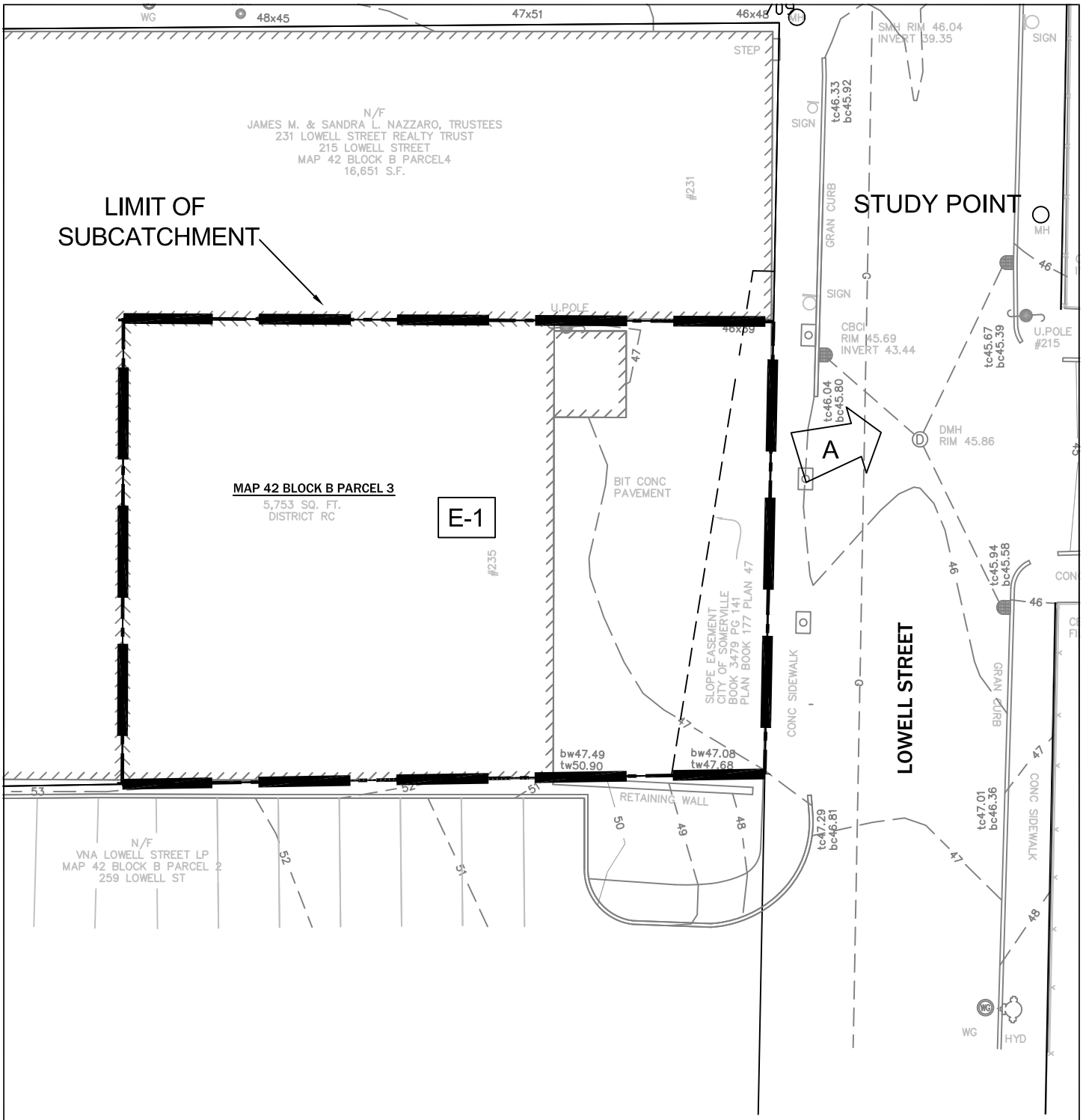
ENJ DEVELOPMENT & CONTRACTING

Salem Village Consulting

90 PINE STREET
DANVERS, MA. 01923
(978) 204-2390

DATE: NOVEMBER 2013

SCALE: 1"=1000' ±



NOTE: EXISTING CONDITIONS AND PROPERTY LINE INFORMATION FROM PLAN BY D&A ASSOC. INC., DATED; 7/23/13.

FIGURE 2

PRE-DEVELOPMENT SUBCATCHMENTS

235 LOWELL STREET
SOMERVILLE, MASSACHUSETTS

DRAWN FOR

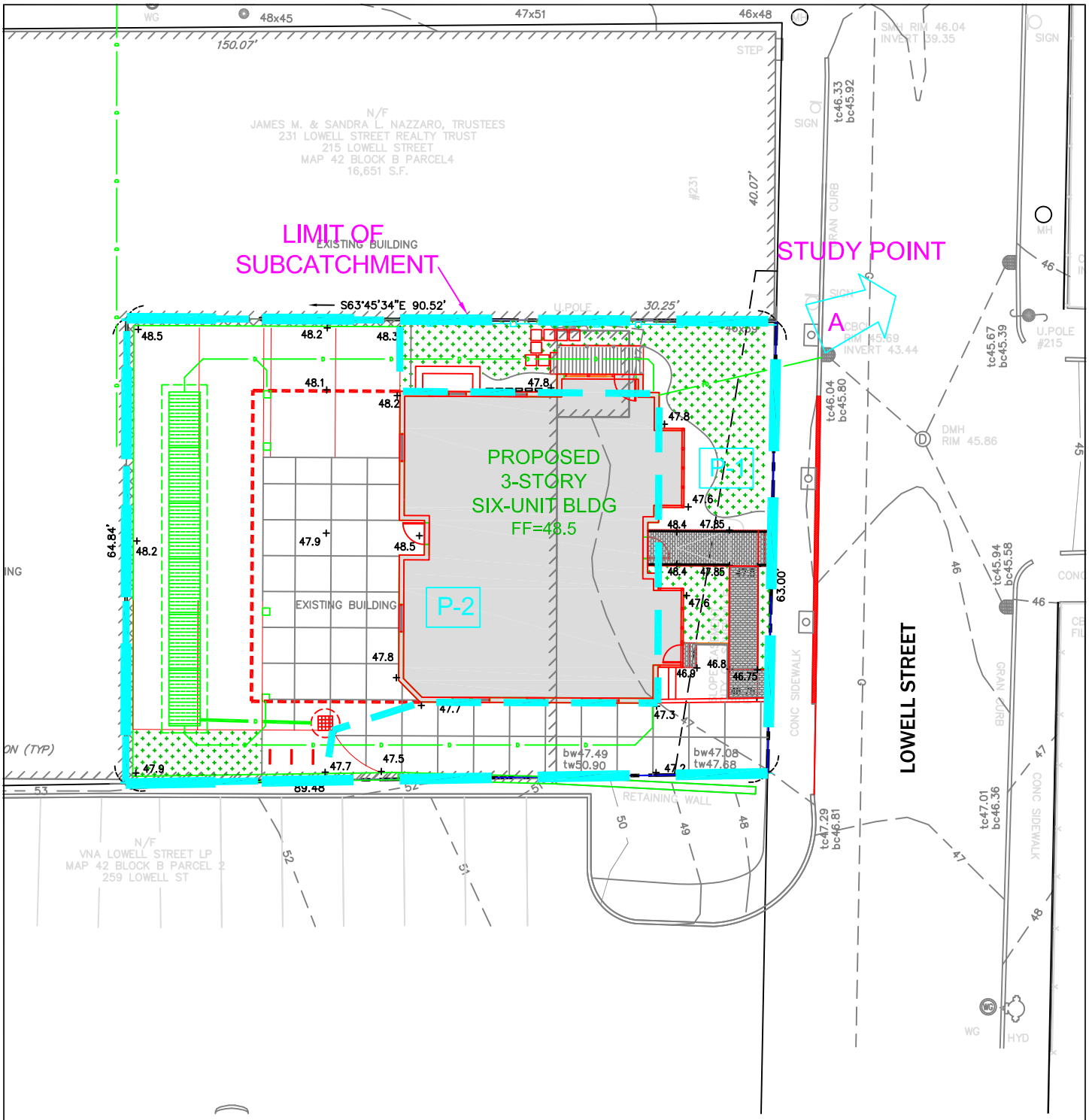
231 LOWELL ST., LLC

D & A SURVEY ASSOCIATES

P.O. BOX 621
MEDFORD, MA 02155

DATE: NOVEMBER 2013

SCALE: 1"=30'



NOTE: EXISTING CONDITIONS AND PROPERTY LINE INFORMATION FROM PLAN BY D&A ASSOC. INC., DATED; 7/23/13.

FIGURE 3

POST DEVELOPMENT SUBCATCHMENTS

235 LOWELL STREET
SOMERVILLE, MASSACHUSETTS

DRAWN FOR

231 LOWELL ST., LLC

D & A SURVEY ASSOCIATES

P.O. BOX 621
MEDFORD, MA 02155

DATE: NOVEMBER 2013

SCALE: 1"=30'

APPENDIX

SITE SOIL INFORMATION

CURVE NUMBER COMPUTATIONS

HYDROGRAPH REPORTS

RECHARGE AREA CHARACTERISTICS

REHARGE VOLUME CALCULATIONS

TSS REMOVAL RATE WORKSHEET

OPERATION & MAINTENANCE PLAN

EROSION & SEDIMENT CONTROL PLAN

SITE SOIL INFORMATION

Middlesex County, Massachusetts

621B—Scio-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Scio and similar soils: 40 percent
Urban land: 40 percent
Minor components: 20 percent

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Description of Scio

Setting

Landform: Terraces, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy and/or silty glaciofluvial deposits

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water capacity: High (about 11.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 2e
Hydrologic Soil Group: B

Typical profile

0 to 8 inches: Very fine sandy loam

8 to 35 inches: Very fine sandy loam
35 to 65 inches: Silt loam

Minor Components

Haven
Percent of map unit: 10 percent
Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex

Tisbury
Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave

Sudbury
Percent of map unit: 4 percent
Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave

Unnamed
Percent of map unit: 1 percent

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 12, Feb 26, 2010

Soil Map—Middlesex County, Massachusetts

Map Scale: 1:759 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 12, Feb 26, 2010

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
621B	Scio-Urban land complex, 0 to 8 percent slopes	1.7	92.3%
627C	Newport-Urban land complex, 3 to 15 percent slopes	0.1	7.7%
Totals for Area of Interest		**1.8**	**100.0%**

CURVE NUMBER COMPUTATIONS

Project	By	Date
235 LOWELL ST.	JB	11/22/13
Location SOMERVILLE	**Checked**	**Date**

Check one: ☑ Present ☐ Developed "E-1"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi^2 ☐ %	Product of CN x area
	IMPERVIOUS	98			0.13	

1/ Use only one CN source per line

Totals ➡ 0.13

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____ ; **Use CN** ➡ 98

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Project	235 LOWELL ST.	By	JB	Date	11/22/13
Location	SOMERVILLE	Checked		Date	

Check one: ☐ Present ☑ Developed "P-1"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area ☐ acres ☐ mi^2 ☐ %	Product of CN x area
	IMPERVIOUS	98			0.02	1.96
C	OPEN SPACE (GOOD)	74			0.02	1.48

[1] Use only one CN source per line

Totals ➡ 0.04 | 3.44

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3.44}{0.04} = 86$; Use CN ➡ 86

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

Project	235 LOWELL ST.	By	JB	Date	11/22/13
Location	SOMERVILLE	Checked		Date	

Check one: ☐ Present ☑ Developed "P-2"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☑ acres ☐ mi² ☐ %	Product of CN x area
	IMPERVIOUS	98			0.06	5.88
C	OPEN SPACE (GOOD)	74			0.03	2.22

1/ Use only one CN source per line

Totals ➡ 0.09 8.10

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{8.10}{0.09} = 90$; Use CN ➡ 90

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

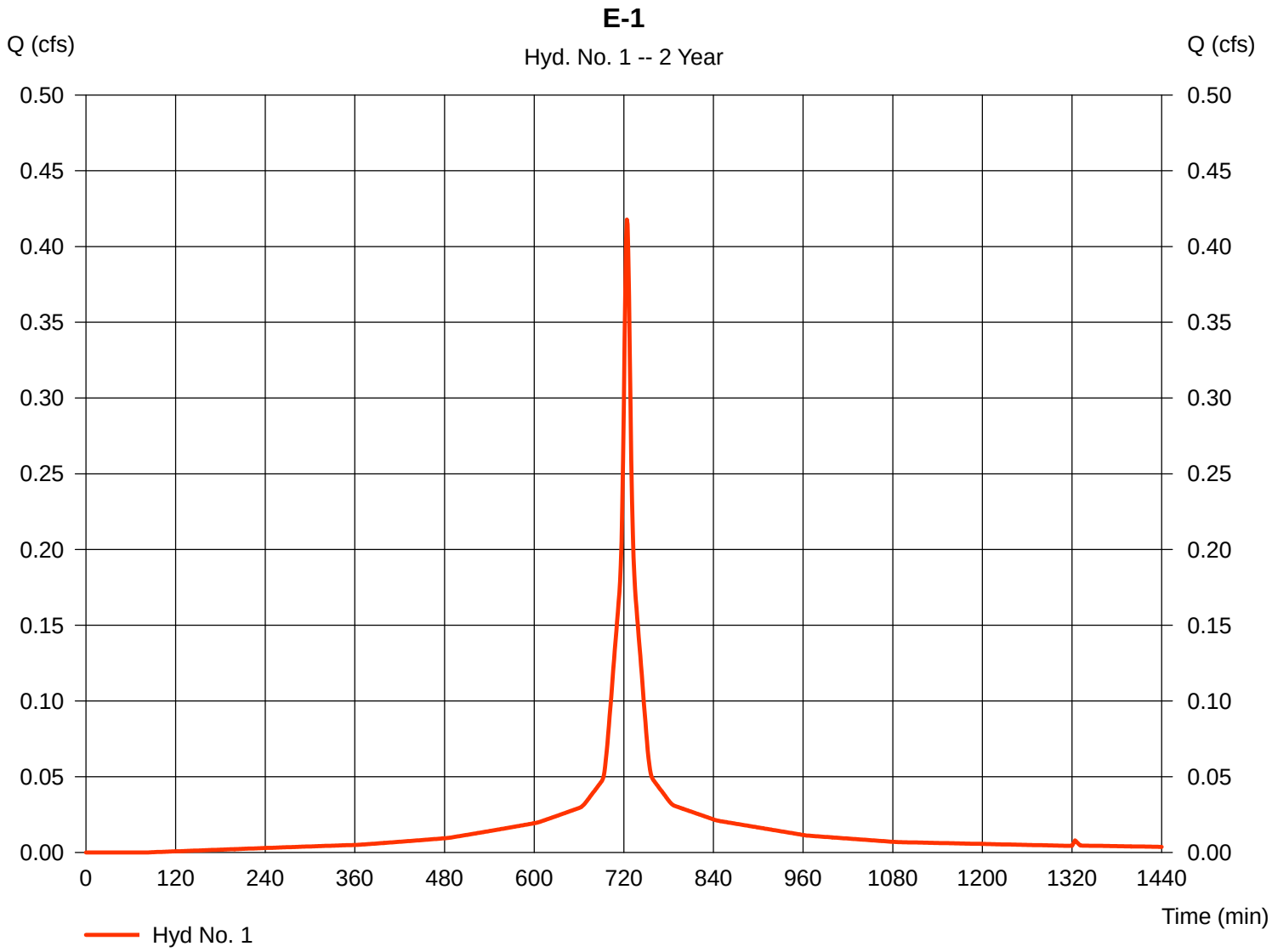
HYDROGRAPH REPORTS

Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.418 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	1,444 cuft
Drainage area	=	0.130 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

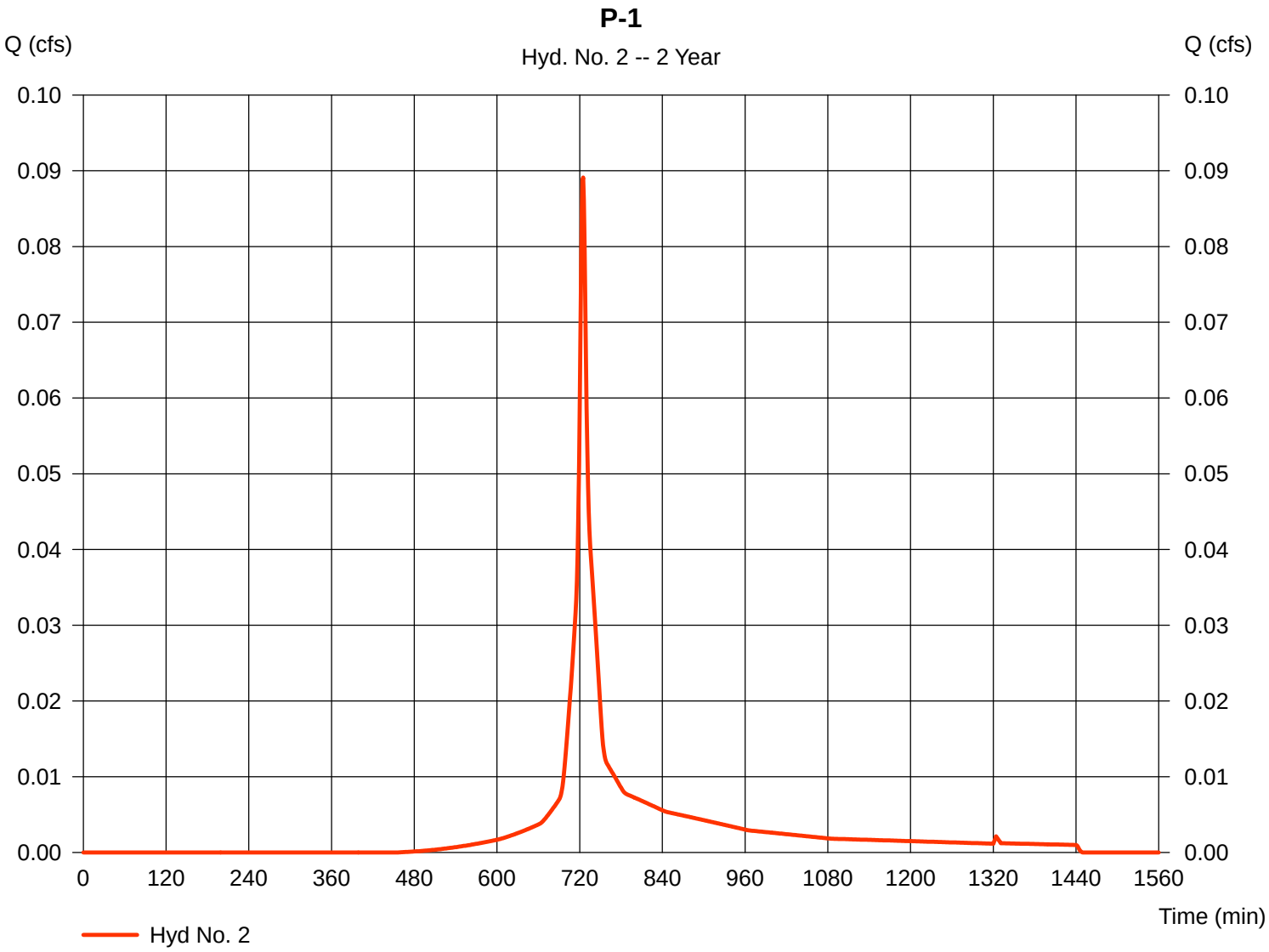


Hydrograph Report

Hyd. No. 2

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.089 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	275 cuft
Drainage area	=	0.040 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

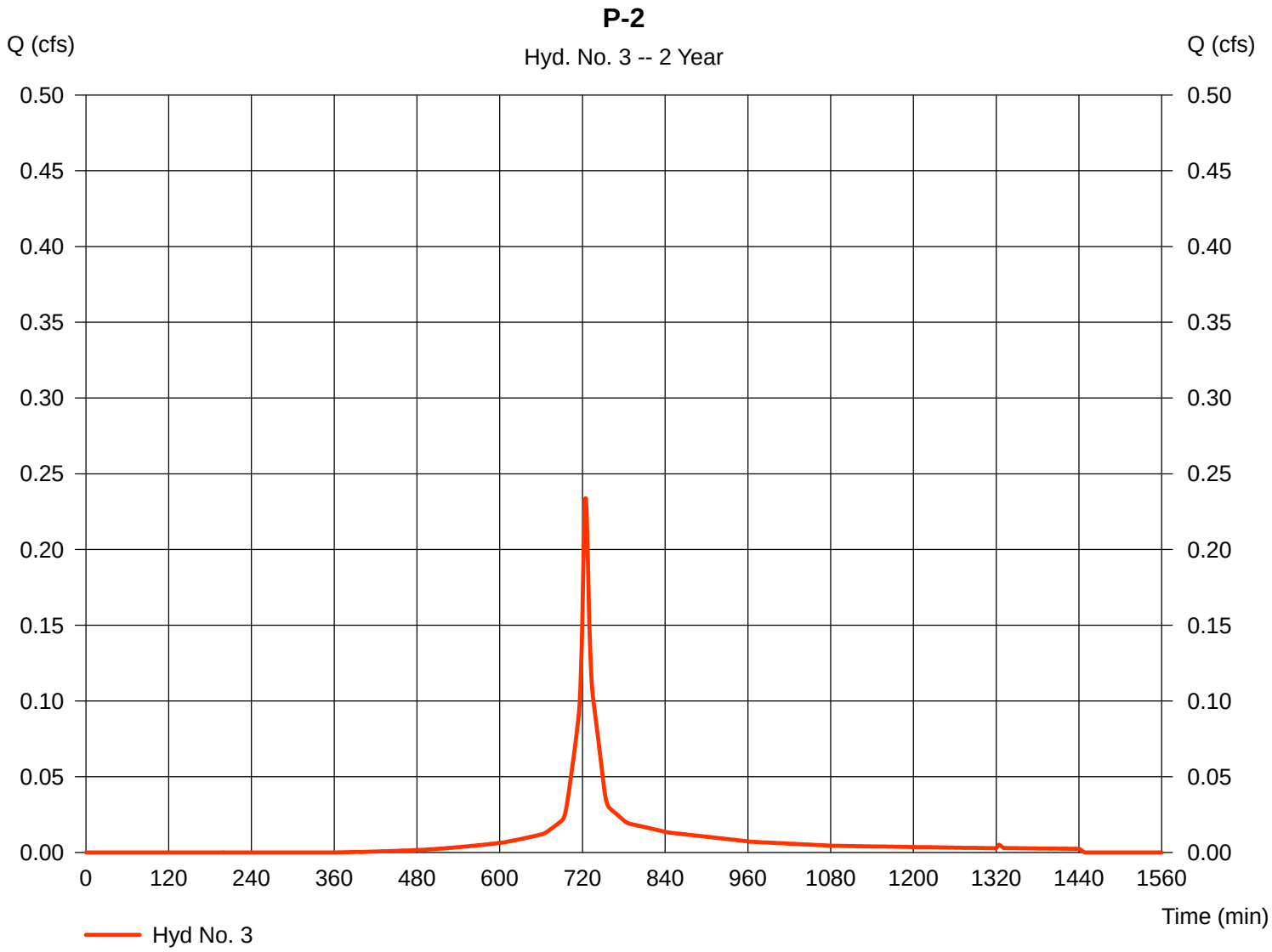


Hydrograph Report

Hyd. No. 3

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.234 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	731 cuft
Drainage area	=	0.090 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.20 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



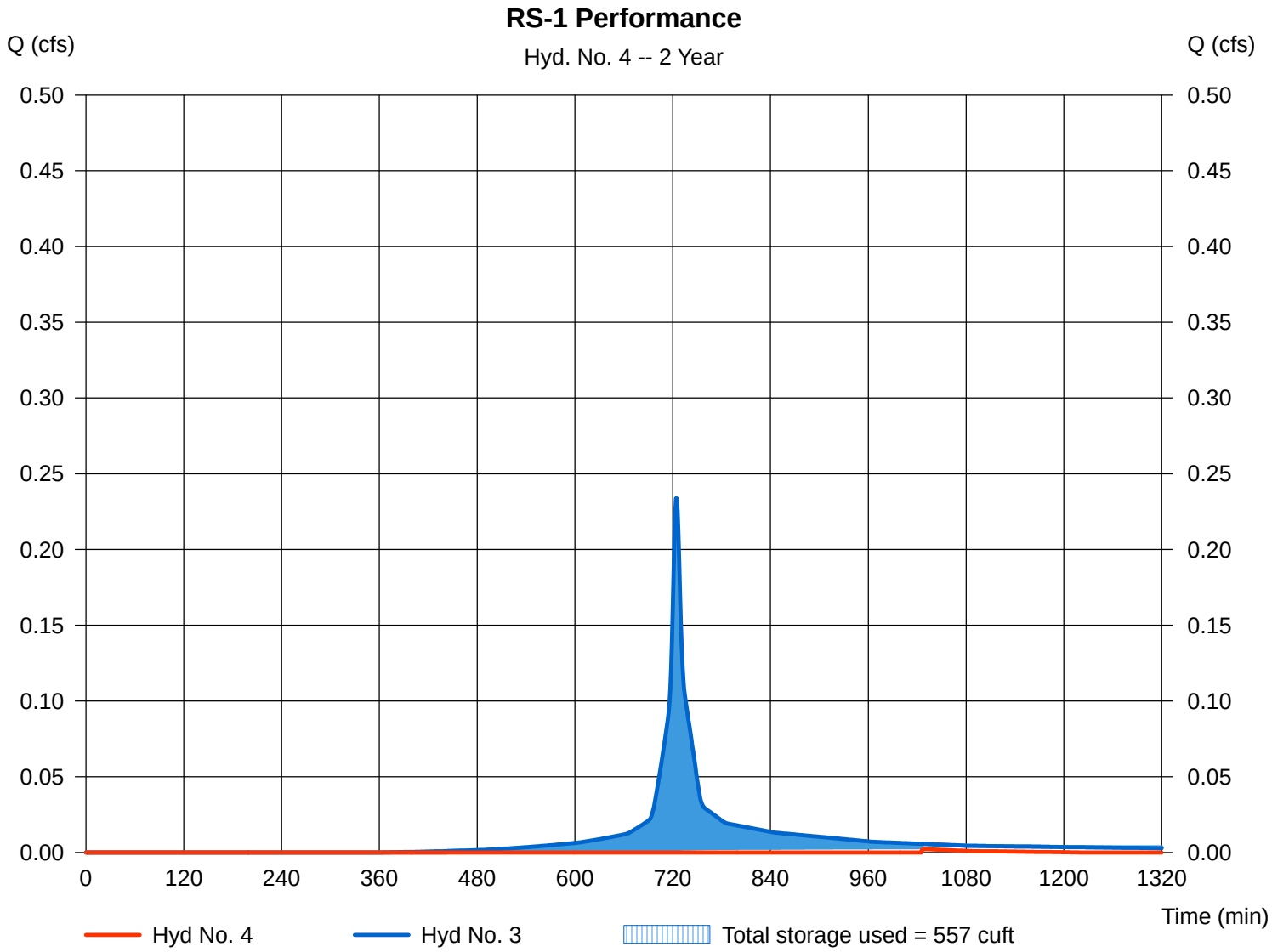
Hydrograph Report

Hyd. No. 4

RS-1 Performance

Hydrograph type	=	Reservoir	Peak discharge	=	0.002 cfs
Storm frequency	=	2 yrs	Time to peak	=	1027 min
Time interval	=	1 min	Hyd. volume	=	10 cuft
Inflow hyd. No.	=	3 - P-2	Max. Elevation	=	46.19 ft
Reservoir name	=	RS-1	Max. Storage	=	557 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

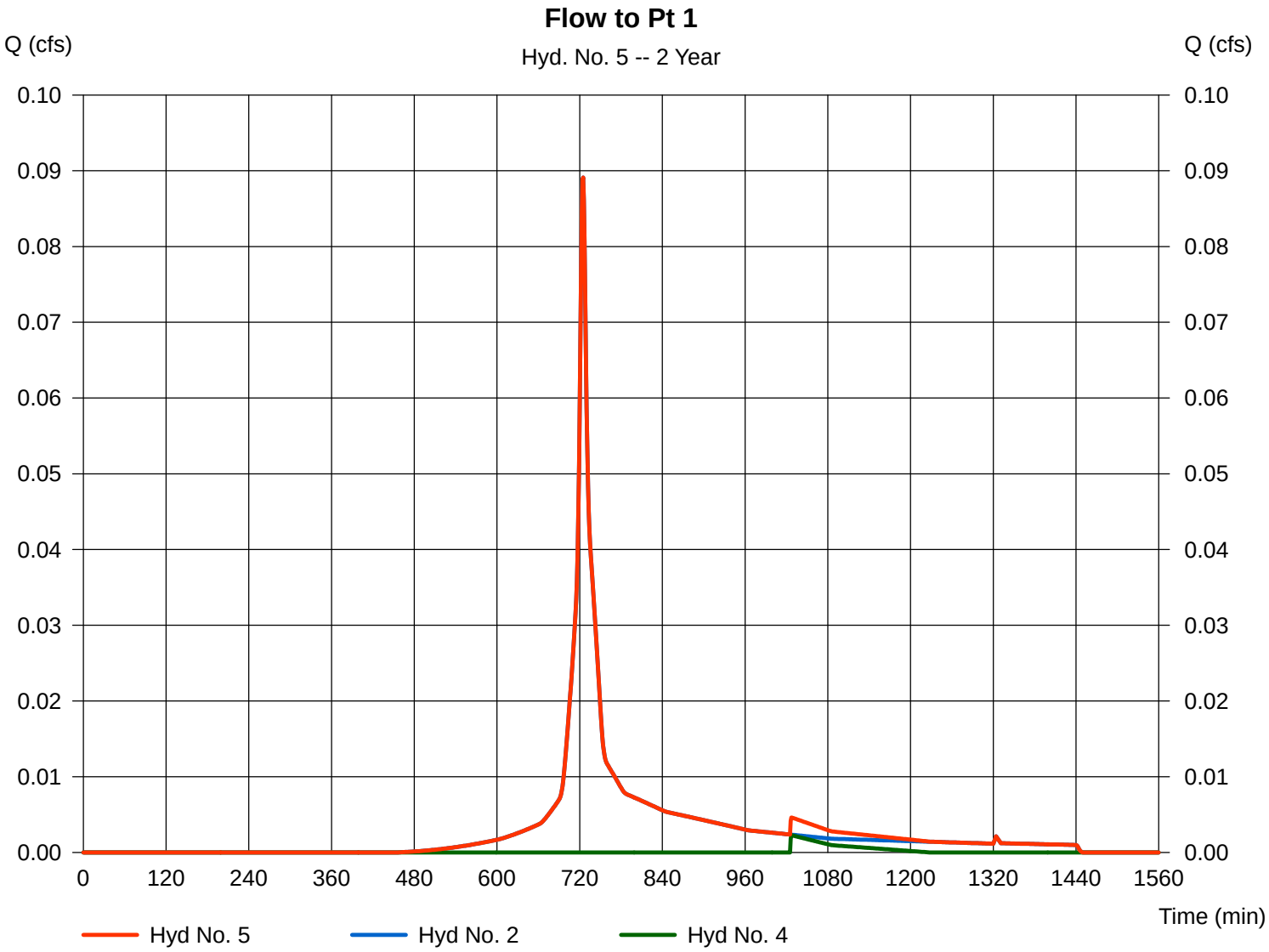


Hydrograph Report

Hyd. No. 5

Flow to Pt 1

Hydrograph type	=	Combine	Peak discharge	=	0.089 cfs
Storm frequency	=	2 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	285 cuft
Inflow hyds.	=	2, 4	Contrib. drain. area	=	0.040 ac

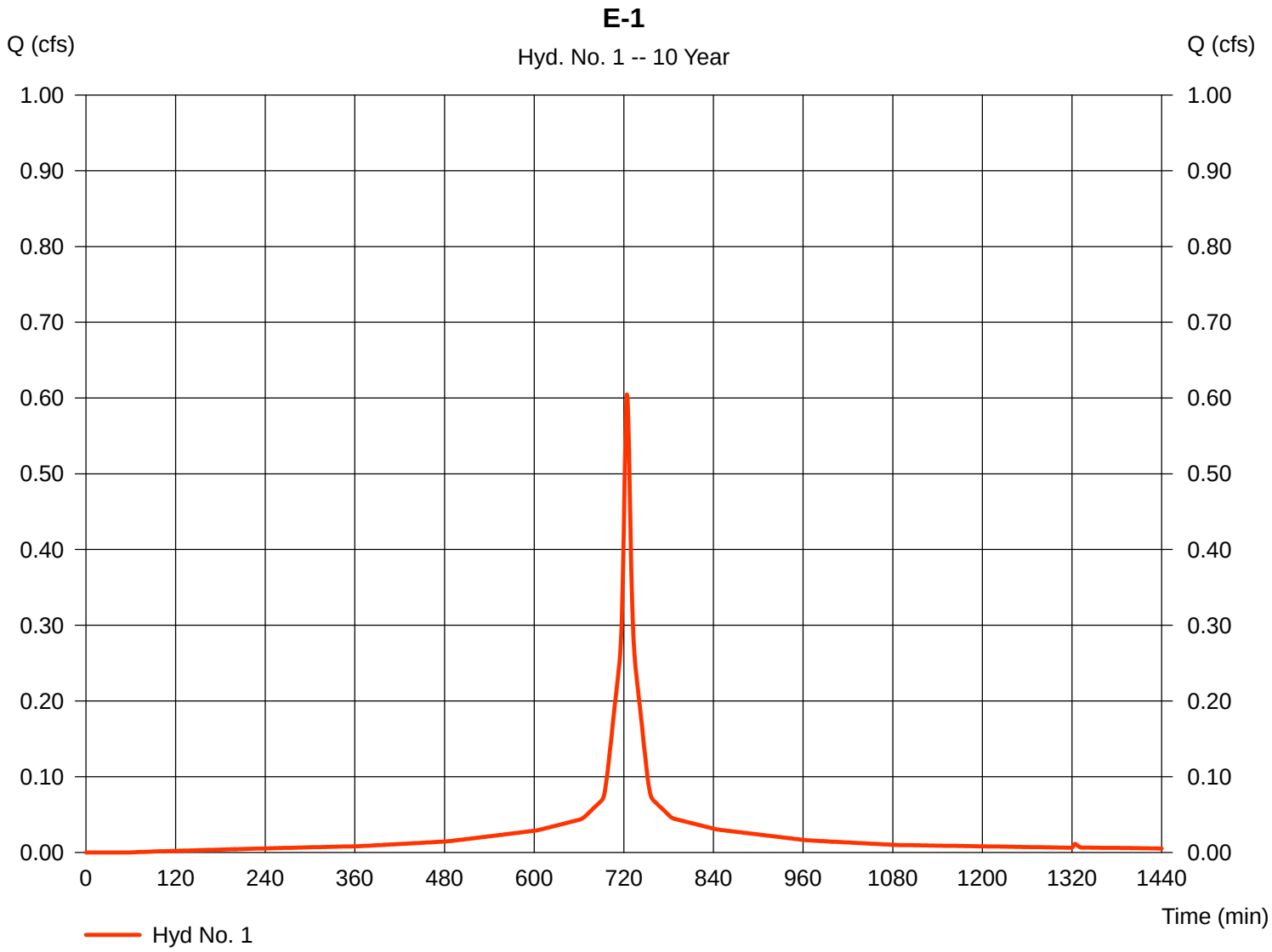


Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.605 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	2,124 cuft
Drainage area	=	0.130 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	4.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

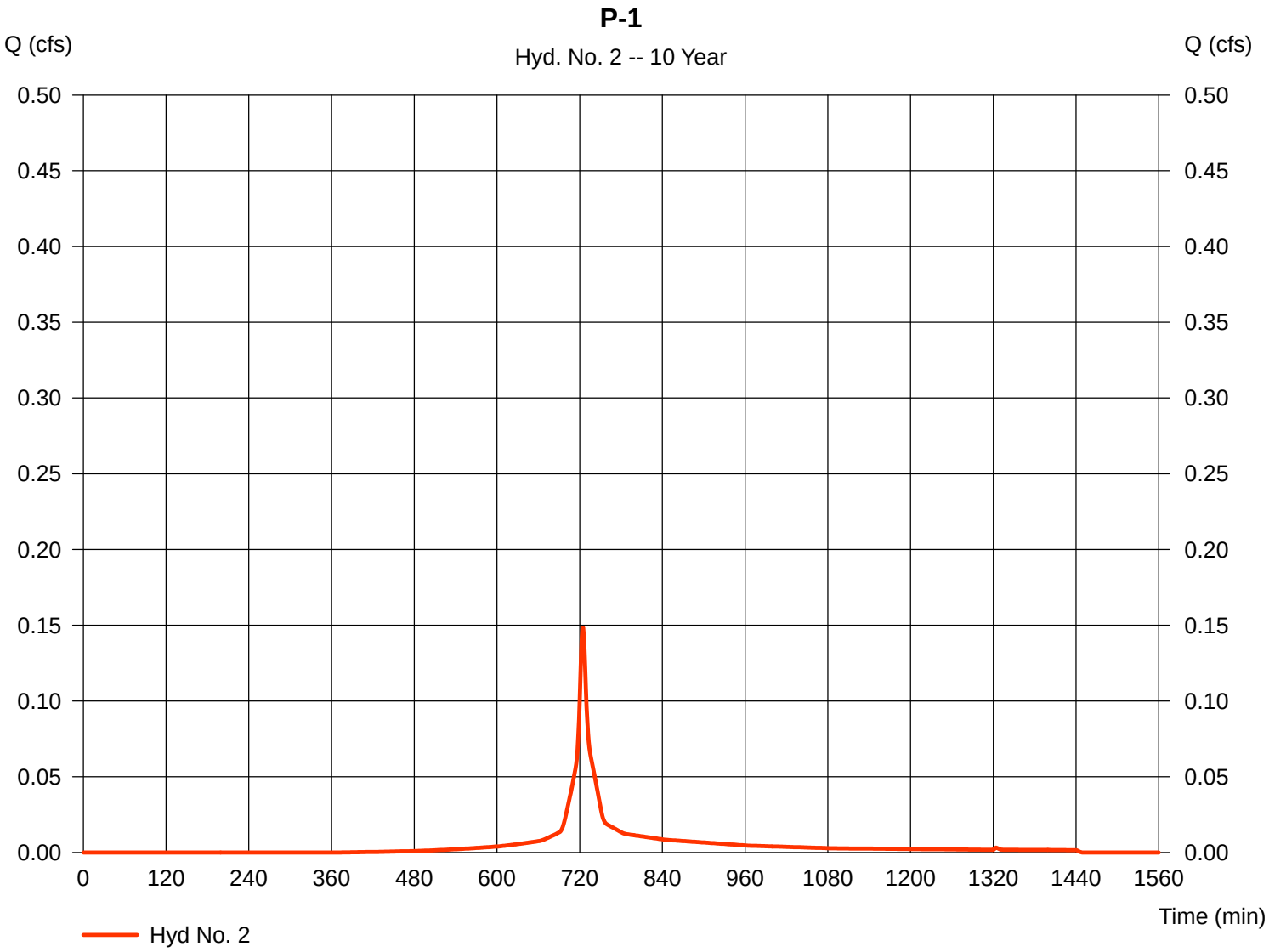


Hydrograph Report

Hyd. No. 2

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.148 cfs
Storm frequency	=	10 yrs	Time to peak	=	725 min
Time interval	=	1 min	Hyd. volume	=	464 cuft
Drainage area	=	0.040 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	4.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

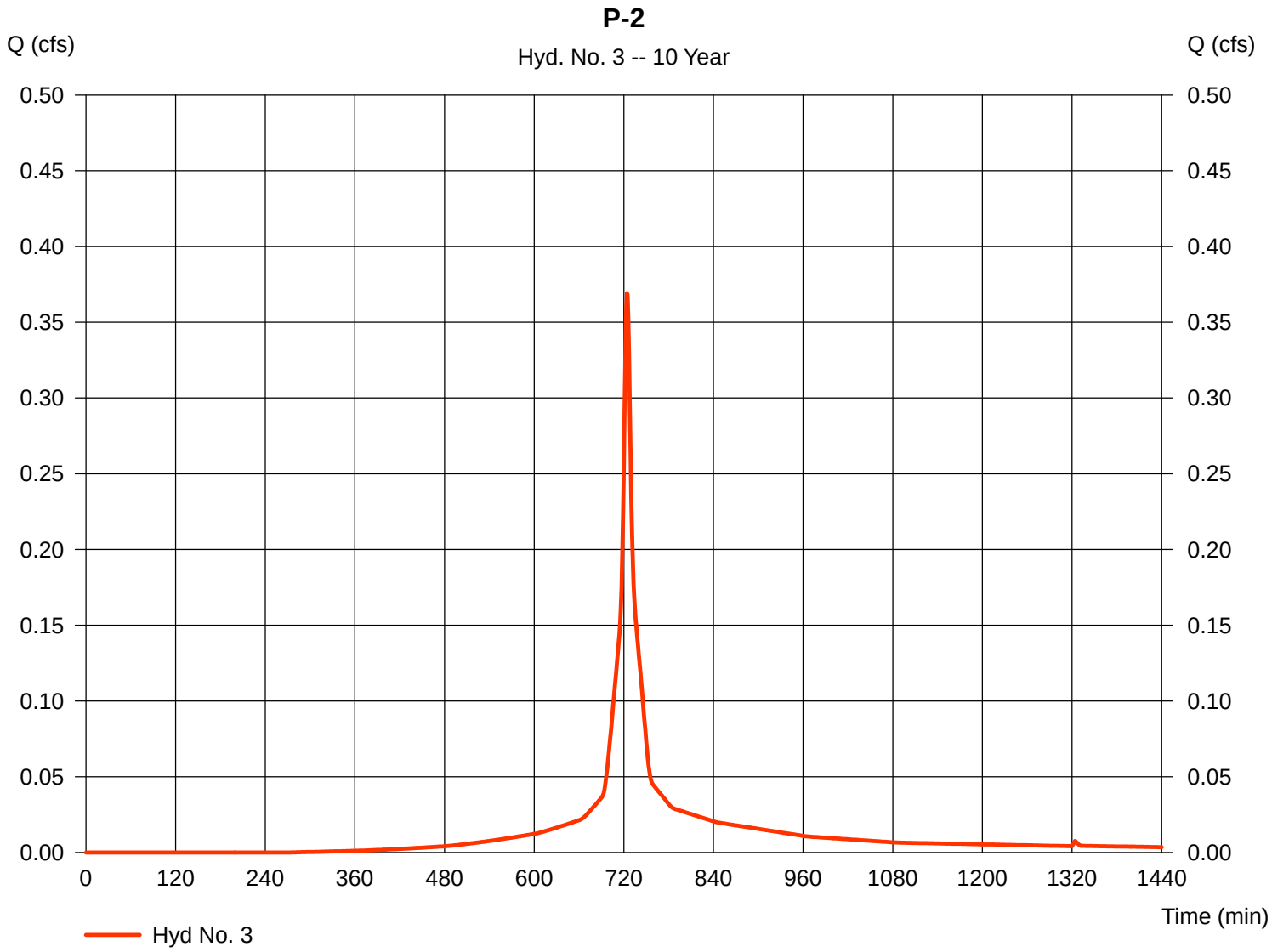


Hydrograph Report

Hyd. No. 3

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.369 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	1,176 cuft
Drainage area	=	0.090 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	4.60 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



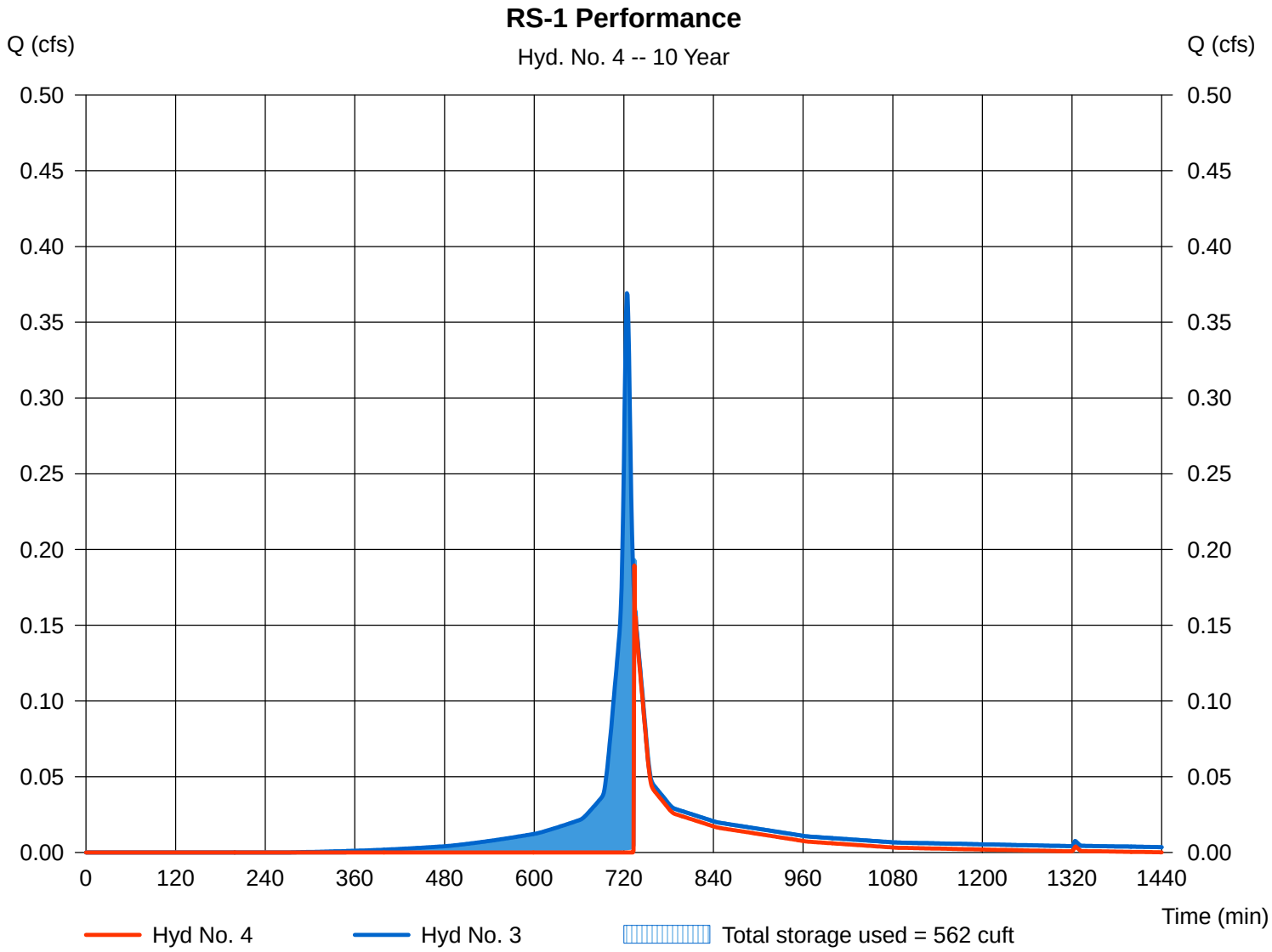
Hydrograph Report

Hyd. No. 4

RS-1 Performance

Hydrograph type	=	Reservoir	Peak discharge	=	0.189 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	433 cuft
Inflow hyd. No.	=	3 - P-2	Max. Elevation	=	46.24 ft
Reservoir name	=	RS-1	Max. Storage	=	562 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

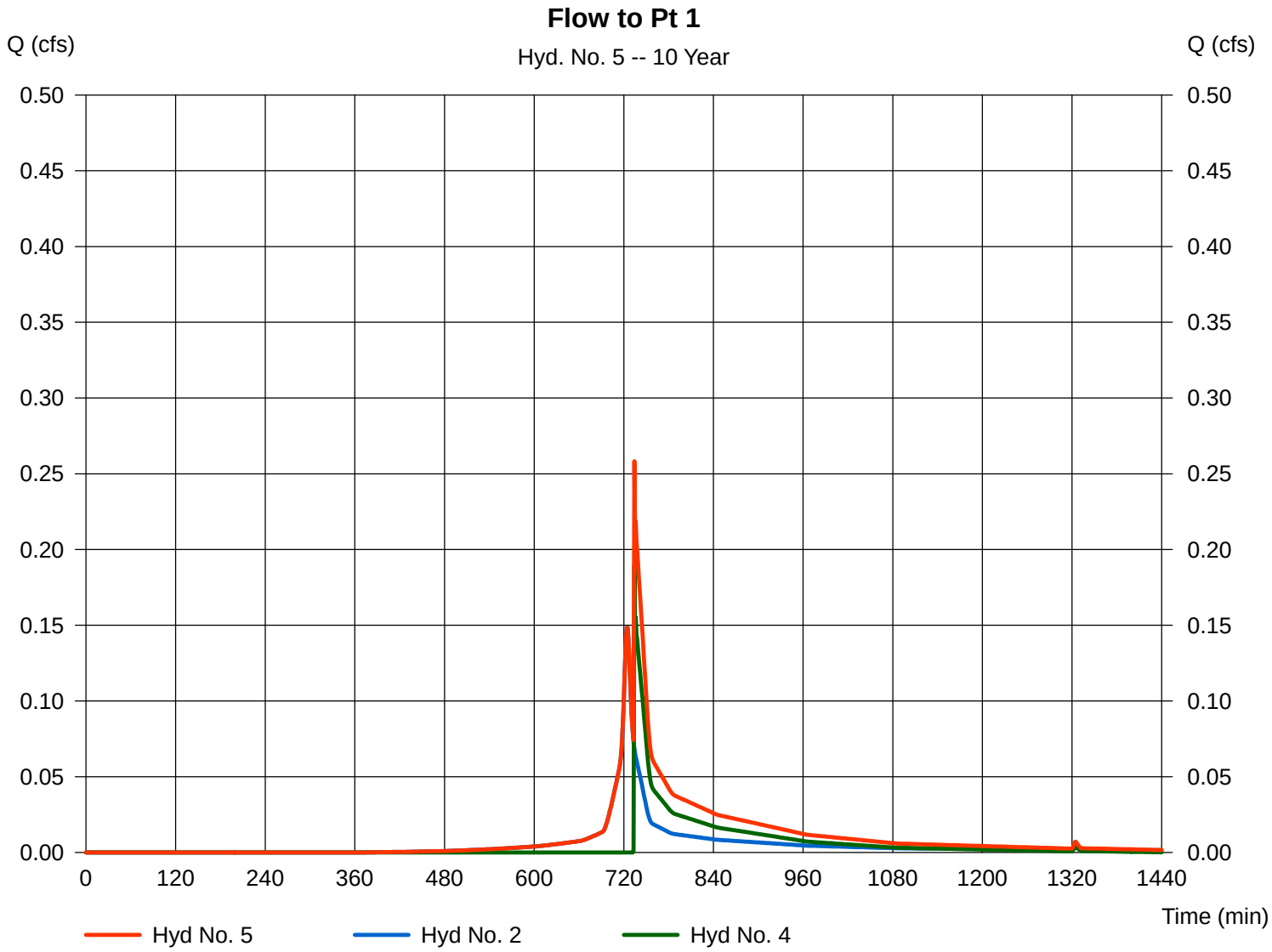


Hydrograph Report

Hyd. No. 5

Flow to Pt 1

Hydrograph type	=	Combine	Peak discharge	=	0.258 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	896 cuft
Inflow hyds.	=	2, 4	Contrib. drain. area	=	0.040 ac

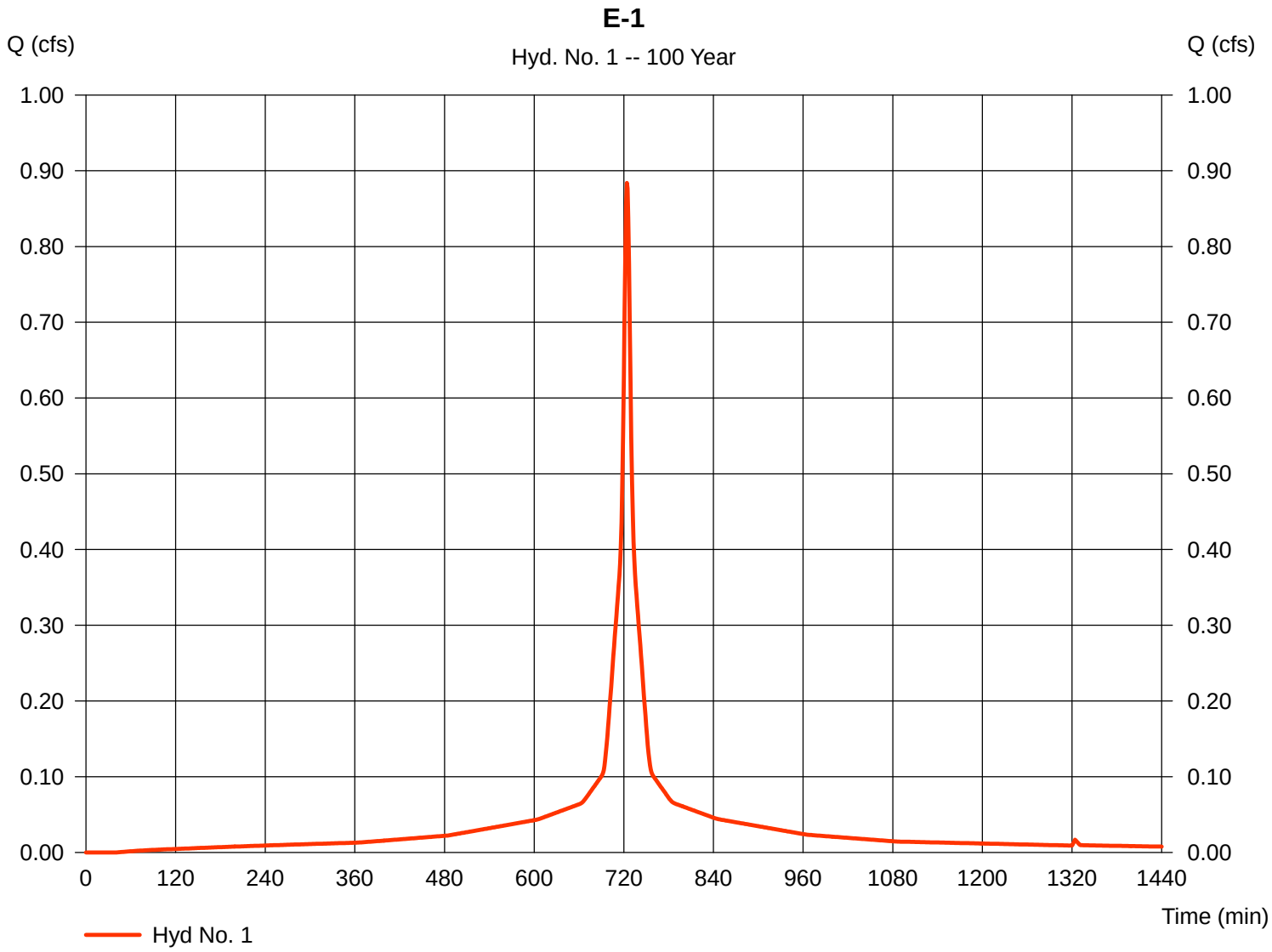


Hydrograph Report

Hyd. No. 1

E-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.884 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	3,144 cuft
Drainage area	=	0.130 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.70 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

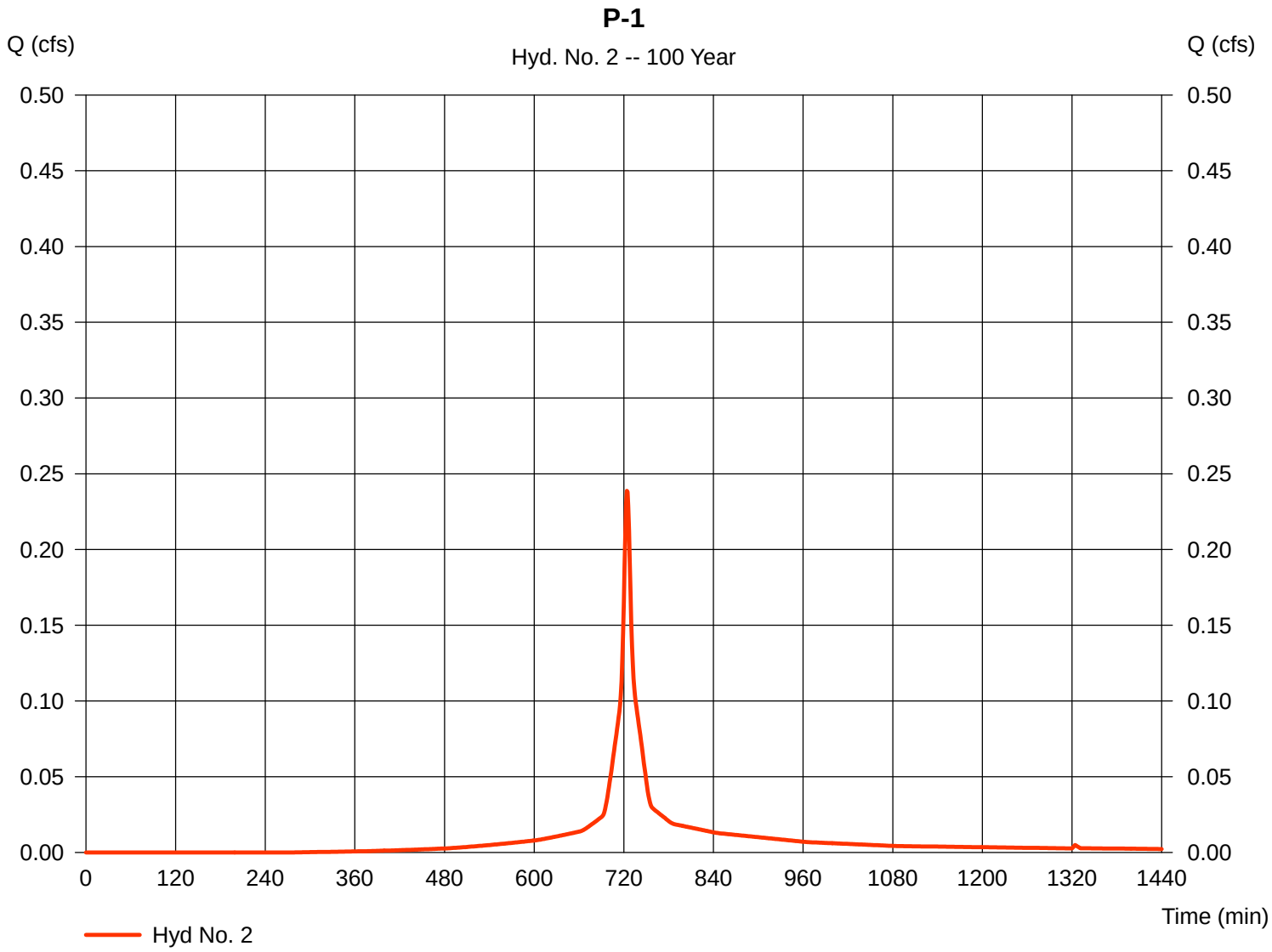


Hydrograph Report

Hyd. No. 2

P-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.239 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	760 cuft
Drainage area	=	0.040 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.70 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

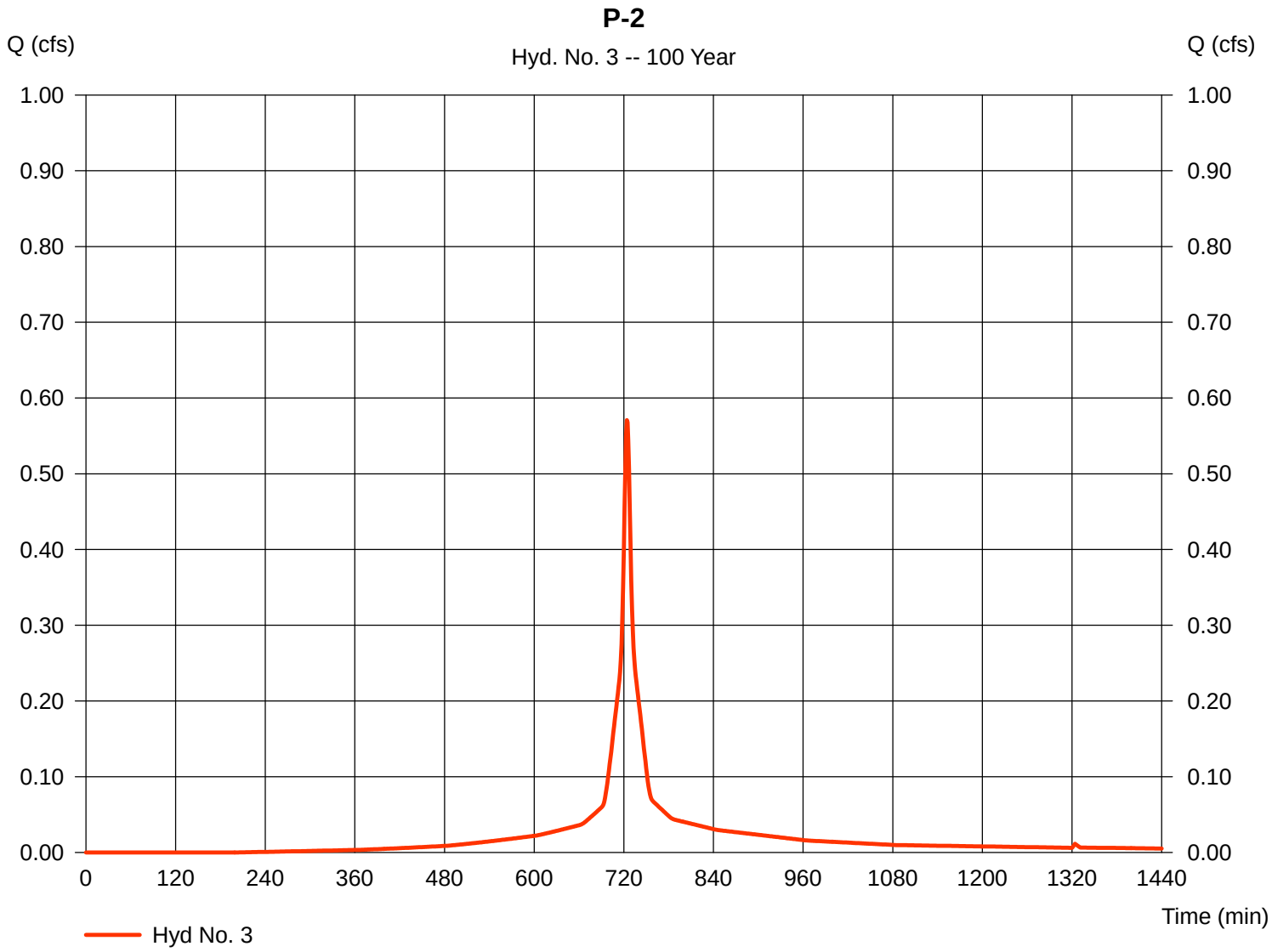


Hydrograph Report

Hyd. No. 3

P-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.571 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	1,863 cuft
Drainage area	=	0.090 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	6.00 min
Total precip.	=	6.70 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



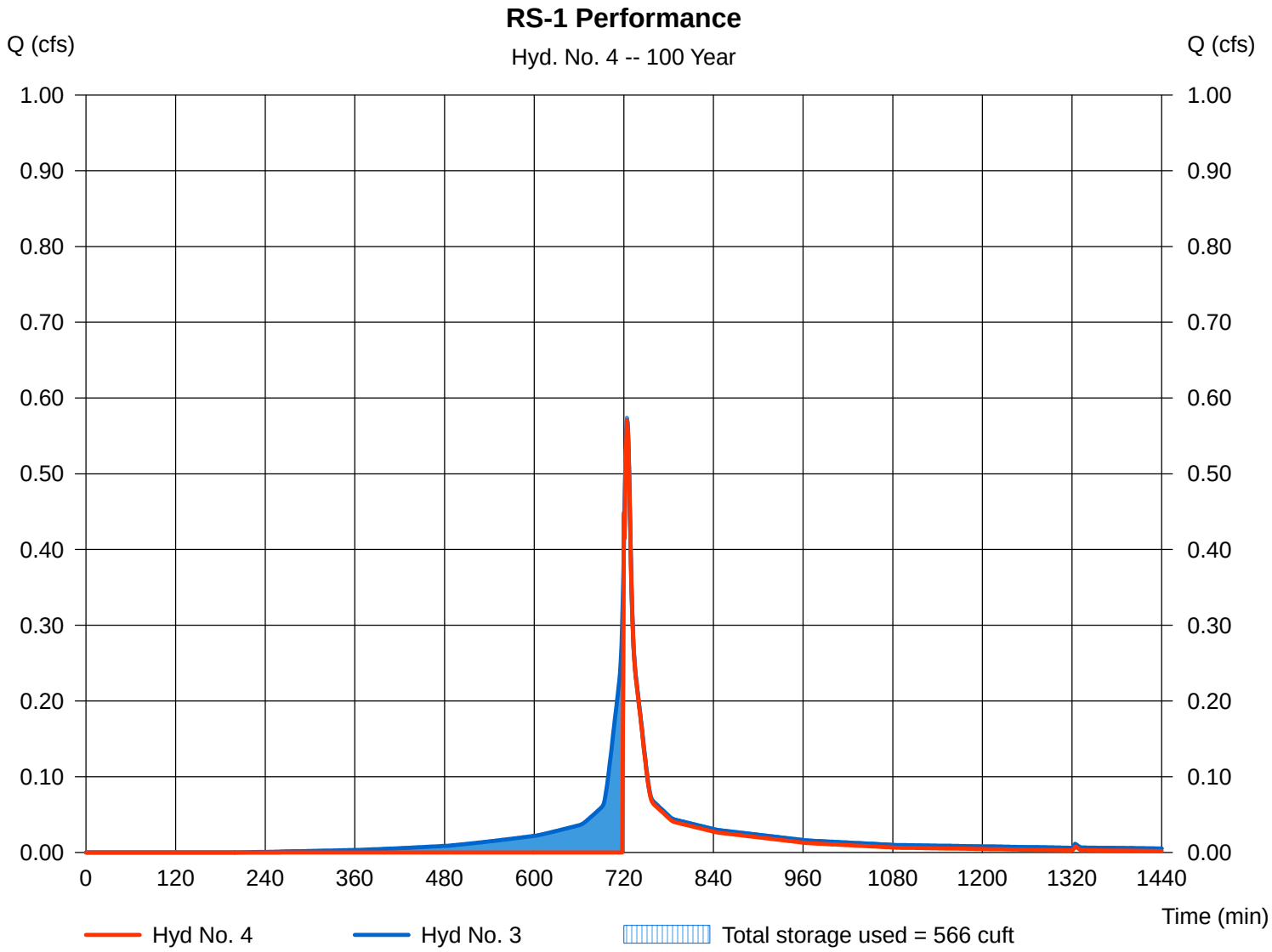
Hydrograph Report

Hyd. No. 4

RS-1 Performance

Hydrograph type	=	Reservoir	Peak discharge	=	0.570 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	1,105 cuft
Inflow hyd. No.	=	3 - P-2	Max. Elevation	=	46.28 ft
Reservoir name	=	RS-1	Max. Storage	=	566 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

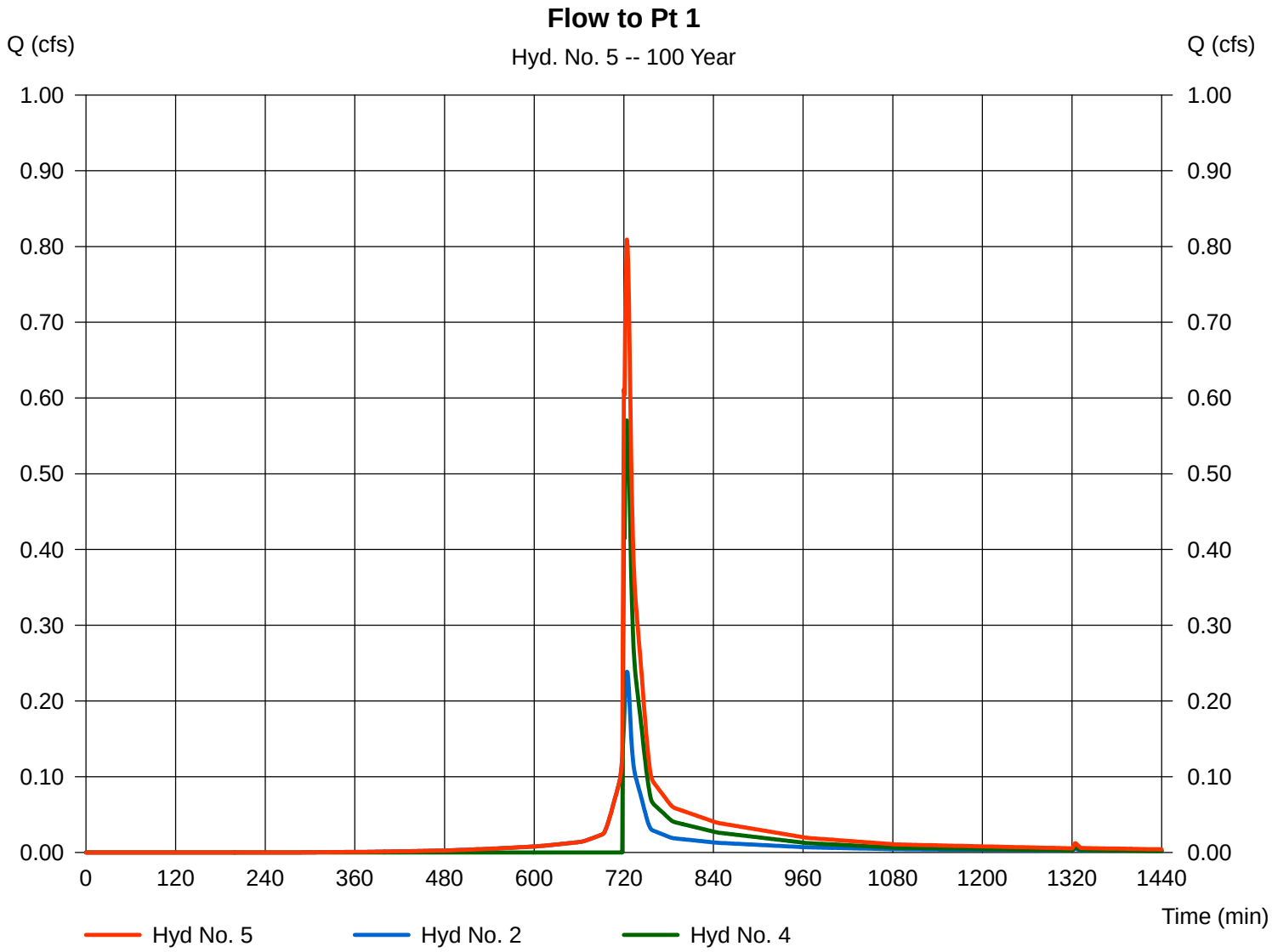


Hydrograph Report

Hyd. No. 5

Flow to Pt 1

Hydrograph type	=	Combine	Peak discharge	=	0.809 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	1,866 cuft
Inflow hyds.	=	2, 4	Contrib. drain. area	=	0.040 ac



RECHARGE AREA CHARACTERISTICS

Pond Report

Pond No. 1 - RS-1

Pond Data

UG Chambers - Invert elev. = 43.40 ft, Rise x Span = 2.50 x 4.33 ft, Barrel Len = 46.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 42.90 ft, Width = 5.33 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	42.90	n/a	0	0
0.35	43.25	n/a	34	34
0.70	43.60	n/a	58	93
1.05	43.95	n/a	76	168
1.40	44.30	n/a	74	243
1.75	44.65	n/a	72	315
2.10	45.00	n/a	69	383
2.45	45.35	n/a	64	447
2.80	45.70	n/a	56	503
3.15	46.05	n/a	41	544
3.50	46.40	n/a	34	578

Culvert / Orifice Structures

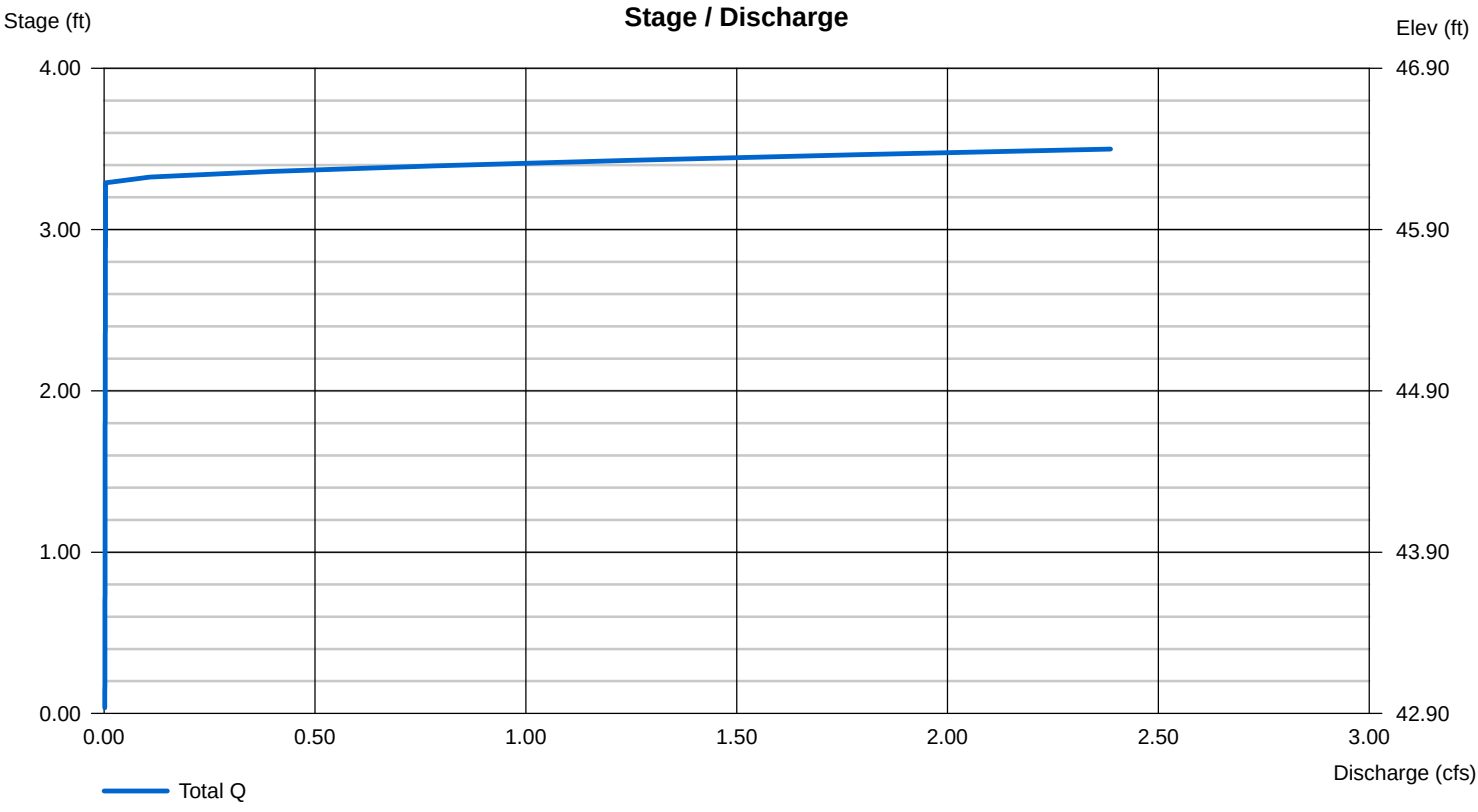
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No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

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 46.20	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.270 (by Wet area)
TW Elev. (ft) = 0.00

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



RECHARGE VOLUME CALCULATIONS

CULTEC, Inc.
P.O. Box 280
878 Federal Road
Brookfield, CT 06804

Phone: 203-775-4416
Toll Free: 800-4-CULTEC
Fax: 203-775-1462
Web: www.cultec.com

Manufacturer & Distributor of
Contactor® & Recharger® Plastic Chambers
for Septic Leachfields & Subsurface Stormwater Management

235 LOWELL ST. 11/22/13

GROUNDWATER RECHARGE PROVIDED:

POST DEVELOPMENT IMPERVIOUS AREA = 3,500 SF

"C" SOIL TARGET DEPTH = 0.25" (DEP STANDARD)

$0.25''/12 \times 3{,}500\,SF = 73\,FT^3$

VOLUME PROVIDED IN PROP. RECHARGE AREA = 578 FT^3 (STATIC ONLY)

T.S.S. REMOVAL RATE WORKSHEET

Location: PARKING AREA

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
DEEP SUMP HOODED CATCH BASIN	0.25	1.00*	0.25	0.75
INFILTRATION CHAMBERS	0.80	0.75	0.60	0.15
Total TSS Removal =			0.85	= 85%

Project: 235 LOWELL ST
Prepared By: JB
Date: 11/22/13

* Equals remaining load from previous BMP (E) which enters the BMP

OPERATION & MAINTENANCE PLAN

Operation and Maintenance Plan

This Stormwater Operation and Maintenance Plan covers the post-construction operation and maintenance of the stormwater management system components for the development at 235 Lowell St. in Somerville, Massachusetts.

The procedures, practices, and schedule outlined in this plan are intended to be ongoing requirements and are an important factor in ensuring the continued proper functioning of the stormwater management system and integrity of the discharged stormwater.

The following maintenance requirements are the sole responsibility of the property owner(s) and/or the properties home owners association.

Recharge System

- Inspect systems after every major storm in the first three months of construction to ensure proper stabilization and function. Thereafter, inspect quarterly.

Roof Drainage System

- Clean gutters, downspouts, roof leaders at least twice per year, or more frequently, as needed to prevent accumulation of sediment and other debris in the system.

Catch Basin

- Remove leaf litter and other debris from grate of the channel trench and drains as needed to ensure adequate capacity for collection of runoff.

- Inspect system at least four times per year and clean sump when debris is accumulated to a depth of one-foot.

EROSION & SEDIMENT CONTROL PLAN

Erosion and Sediment Control Plan

This Erosion and Sediment Control Plan for 235 Lowell St. in Somerville, Massachusetts has been created to insure that soils and sediment exposed during construction activities will be contained on the property and will not be conveyed to abutting properties or the public roadways and the municipal storm drainage systems.

Reference is made to the Sediment Control Plan included in development's site plan set.

The installation and maintenance requirements are the sole responsibility of the property owner(s) during construction operations and shall continue until the site has been stabilized to the satisfaction of the appropriate local authorities.

Catch Basin Inlet Protection "Silt Sack"

- Inspect during every major storm to ensure proper installation and function.
- Inspect after major storms and remove sediment and other debris once it has accumulated to with in six inches of the overflow elevation.

Stabilized Construction Entrance

- Once sediment has built up over the stone and is no longer effective the stone should be removed and replaced. Care should be taken to insure that the filter fabric is not derogated and should be properly reinstalled beneath the stone if necessary.

Driveway & Street Sweeping

- Any sediment that has accumulated on to the adjacent public way should be swept and removed as soon as possible. Once an impervious driveway and/or parking area has been constructed on the property sweeping of these areas shall take place weekly. Sediment collected should be removed from the site and properly disposed of.

Erosion Control Barrier (Silt Fence)

- Inspect during every major storm to ensure proper installation and function.
- Inspect after major storms and remove sediment and other debris once it has accumulated to 12 inches.