Drainage Calculations

Outdoor Education Area
IEA
840 North Main Street

West Hartford, CT 06107
September 23, 2019

TORRES ENGINEERING, INC.
63 Reed Drive
Wethersfield, CT 06109
(860) 232-9833 FAX (860) 232-9838

TORRES ENGINEERING, INC.

September 23, 2019

Chuck Guarino, P.E.
Civil Engineer
Engineering Division
Town of West Hartford
50 South Main Street
West Hartford, CT 06107

Re: Drainage Calculations for the Outdoor Education Area, Intensive Education Academy
840 North Main Street, West Hartford, Ct
File # 1917

Dear Mr. Guarino:

We are happy to submit to you our final Drainage Calculations for the above referenced project. We used the SCS TR55 Hydrographs, with Hydrologic Soil group C, and Flood routed the runoff through the proposed Detention System. As you can see from the Summary and Conclusions (page 1), there will be no increase in runoff to the downstream areas, for up to the 100 Year Storm.

If you have any questions, please do not hesitate to contact us at your earliest convenience.

Sincerely,

Ozzie Torres, President
Torres Engineering, Inc.

Cc: Tom Linden, Linden Landscaping

Torres Engineering, Inc., 63 Reed Drive, Wethersfield, CT 06109 – (860)232-9833
Email: ot.torreseng@gmail.com

TABLE OF CONTENTS

Summary & Conclusions 1

Existing Conditions Drainage Area Plan 2

SCS TR-55 Existing and Proposed Conditions Data Sheet..... 3

Hydrograph Model..... 4

Existing Conditions Runoff Hydrographs..... 5-10

Proposed Conditions Drainage Area Plan 11

Proposed Conditions Runoff Hydrographs (to Detention System)..... 12-17

SC-740 Chambers Detail..... 18

Storage Volume Calculations 19

Outlet Structure 20

Pond Report 21

Outflow Hydrographs from Storage Chamber..... 22-27

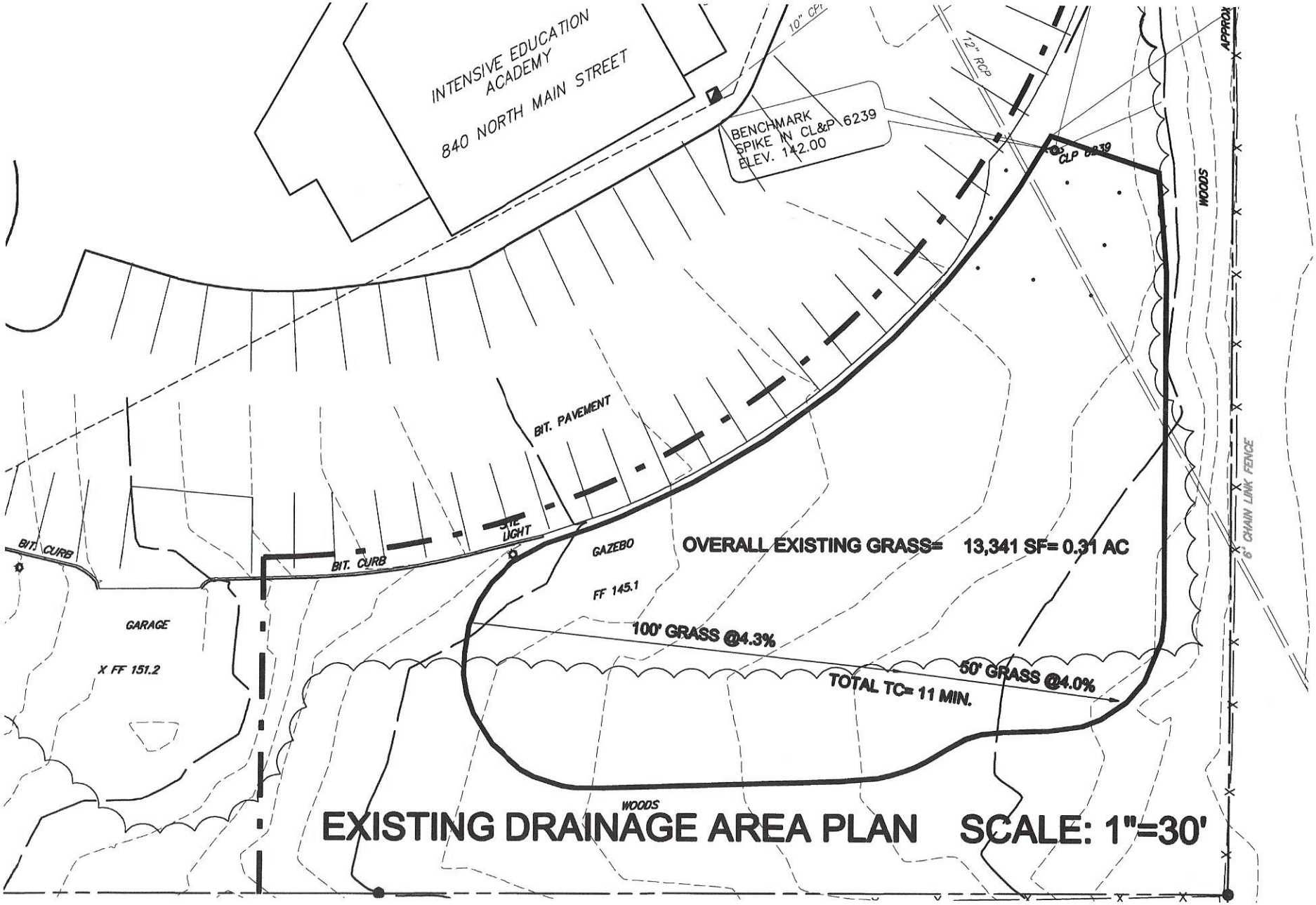
Playscape, IEA
West Hartford, CT

SUMMARY & CONCLUSIONS

9/23/2019

Hydrograph Storm Year	Existing Conditions Runnoff No. 1 CFS	Proposed Conditions Runnoff No. 2 Prop1 CFS	Outflow Discharge No. 3 CFS
2	**0.33**	0.46	**0.33**
5	**0.59**	0.72	**0.42**
10	**0.82**	0.95	**0.5**
25	**1.15**	1.26	**0.6**
50	**1.41**	1.51	**0.69**
100	**1.68**	1.75	**1.18**

Conclusion: There will be no increase in peak runoff for up to the 100 year storm.



EXISTING DRAINAGE AREA PLAN SCALE: 1"=30'

WinTR-55 Current Data Description

--- Identification Data ---

User: O. Torres
Project: Playscape
SubTitle: Playscape E & P
State:
County:
Filename: C:\From Server - Drawings\1917-Playscape-WH-Tom L\Drainage\TR-55\Playscape.w55

Date: 9/22/2019
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
PlayscapeE			0.31	74	.179
PlayscapeP			0.31	82	.228

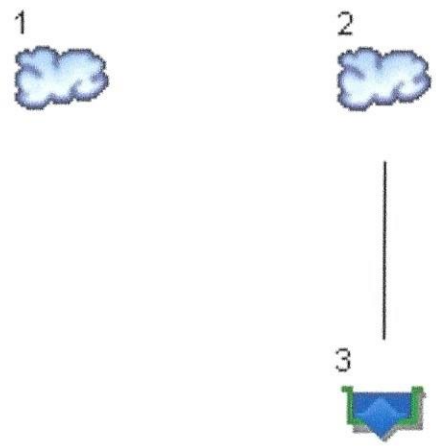
Total area: .62 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.21	4.22	5.05	6.2	7.09	7.98	2.59

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type III
Dimensionless Unit Hydrograph: <standard>



Legend

Hyd.	Origin	Description
1	SCS Runoff	PlayscapeE
2	SCS Runoff	PlayscapeP
3	Reservoir	Outflow

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

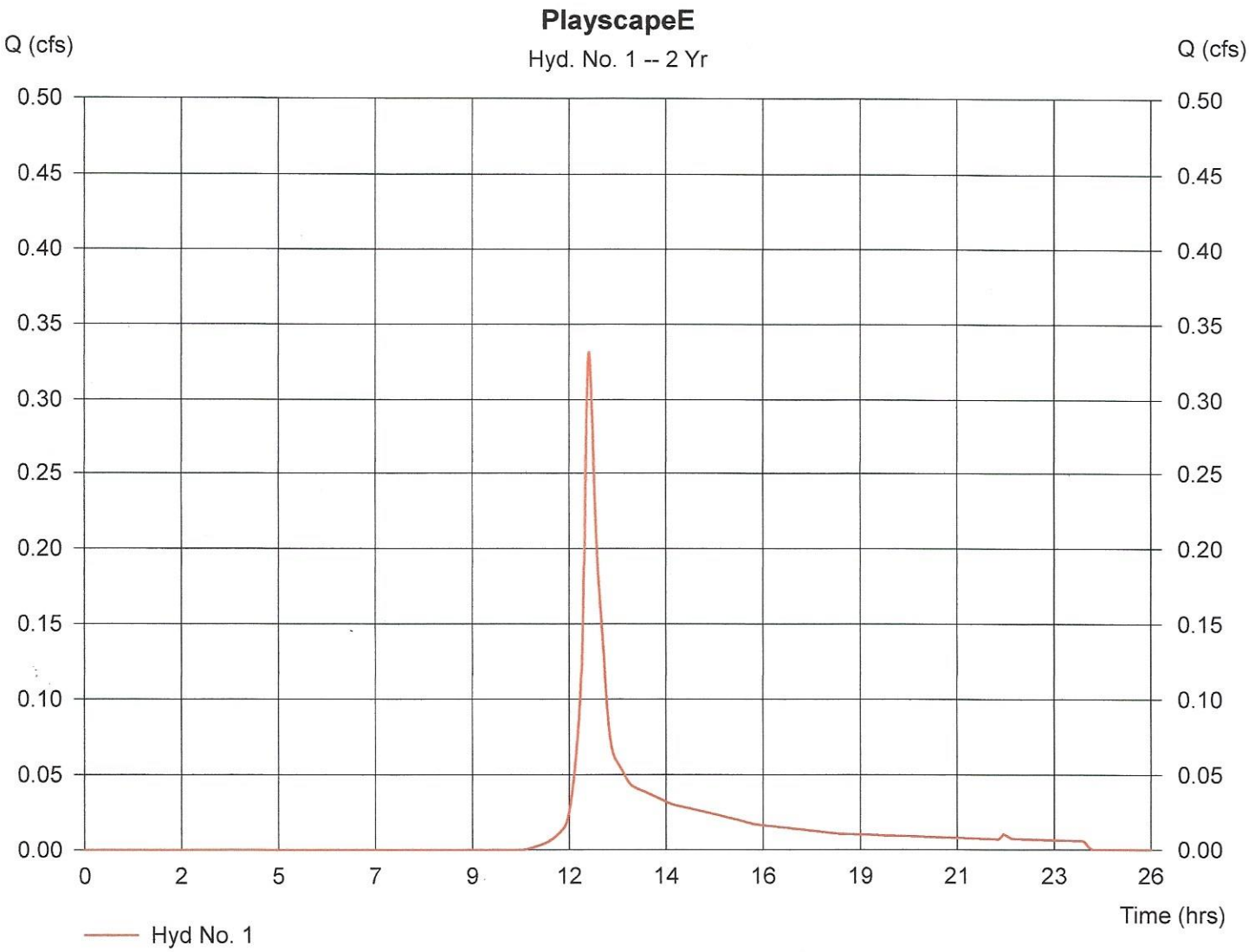
Sunday, Sep 22 2019, 12:20 PM

Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.33 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,264 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

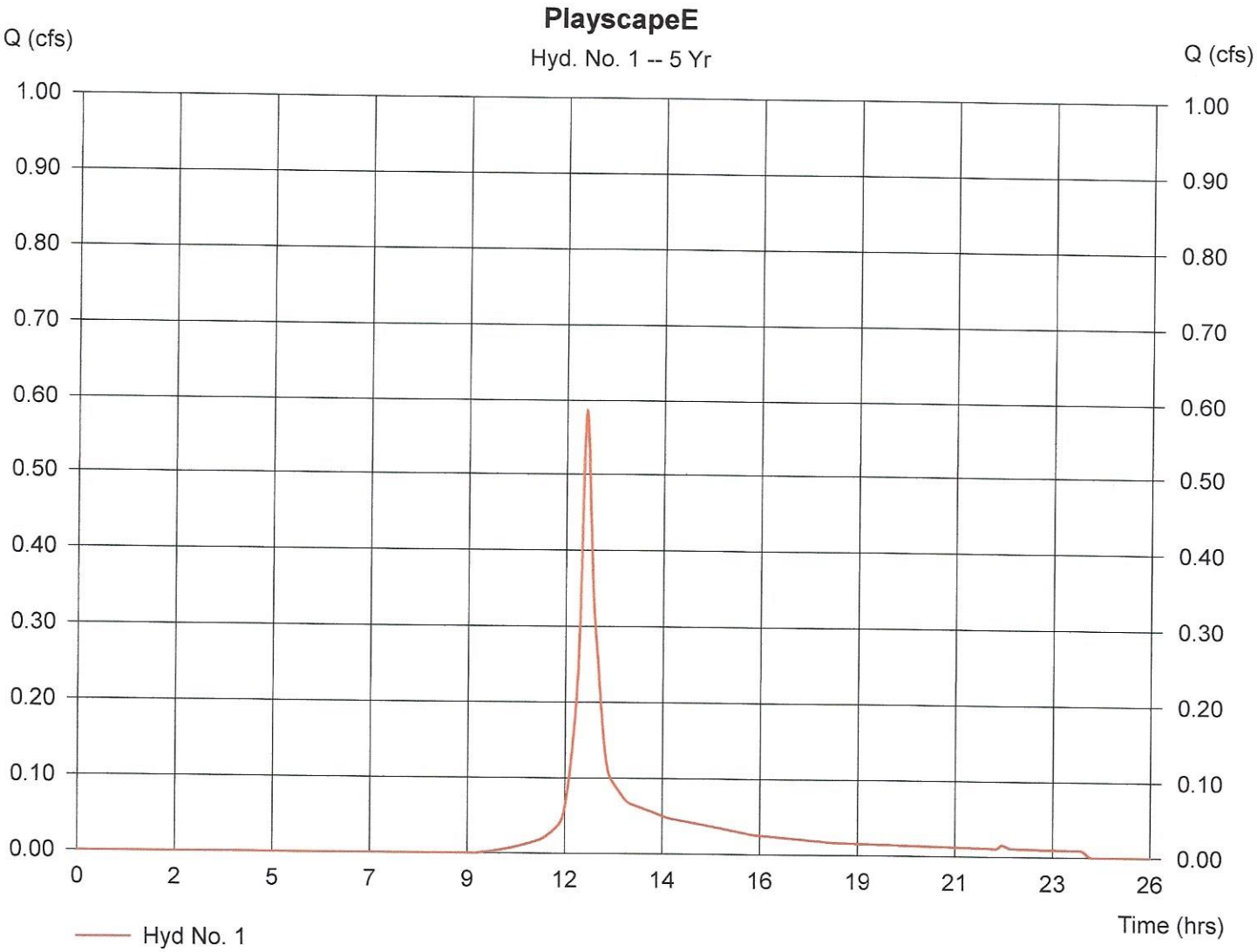
Sunday, Sep 22 2019, 12:20 PM

Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.59 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 4.39 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,163 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

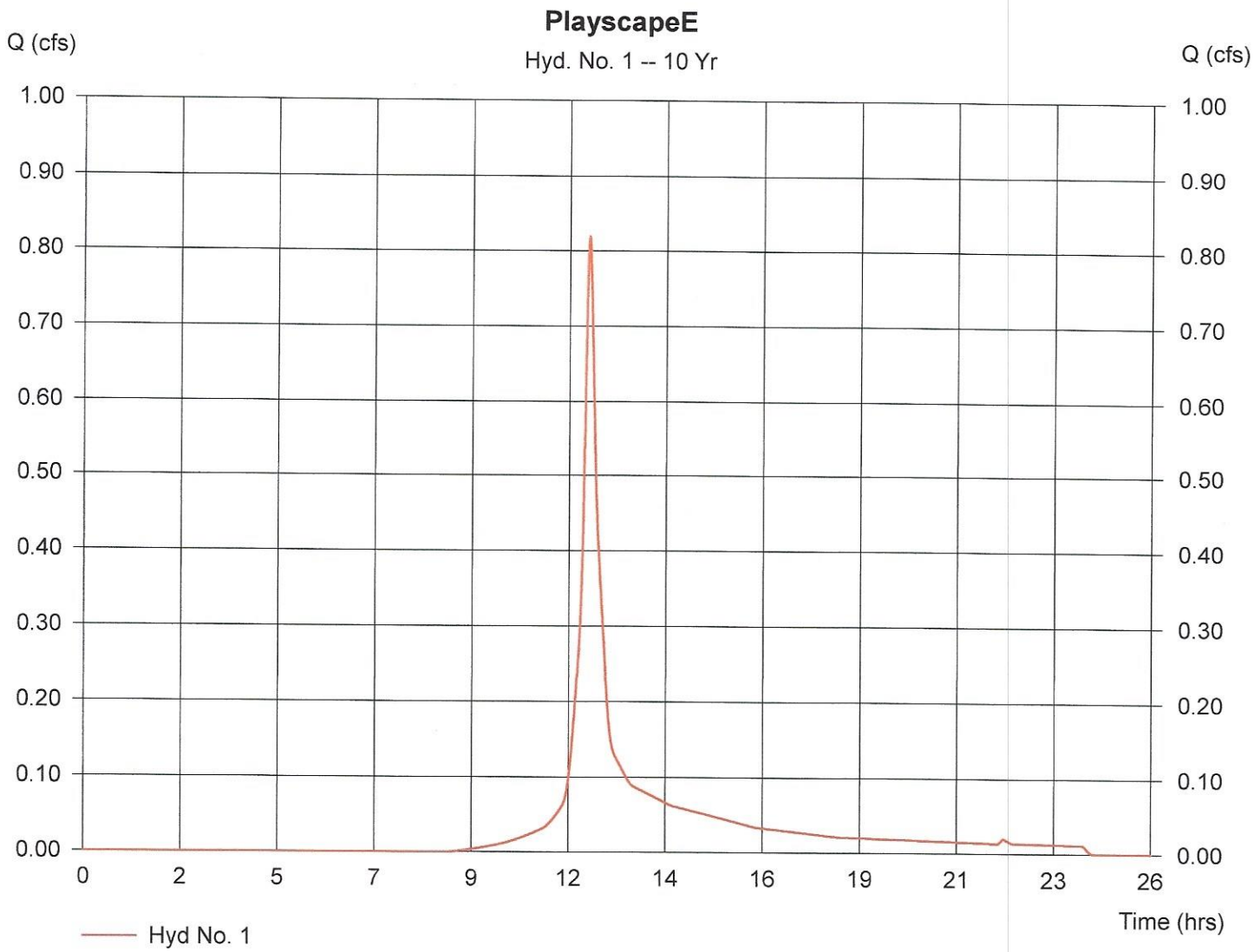
Sunday, Sep 22 2019, 12:19 PM

Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.82 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,985 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

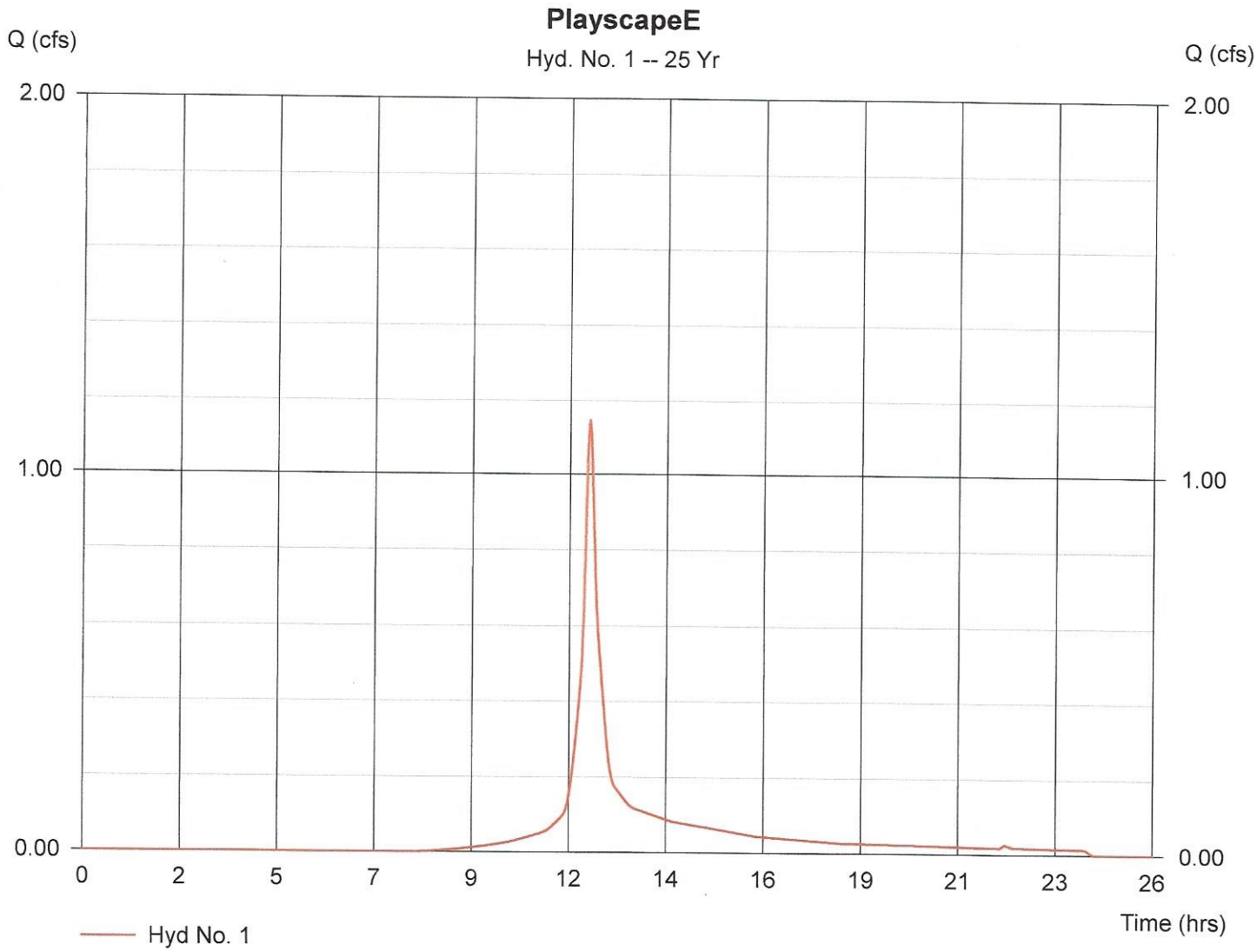
Sunday, Sep 22 2019, 12:19 PM

Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 1.15 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 6.54 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,174 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

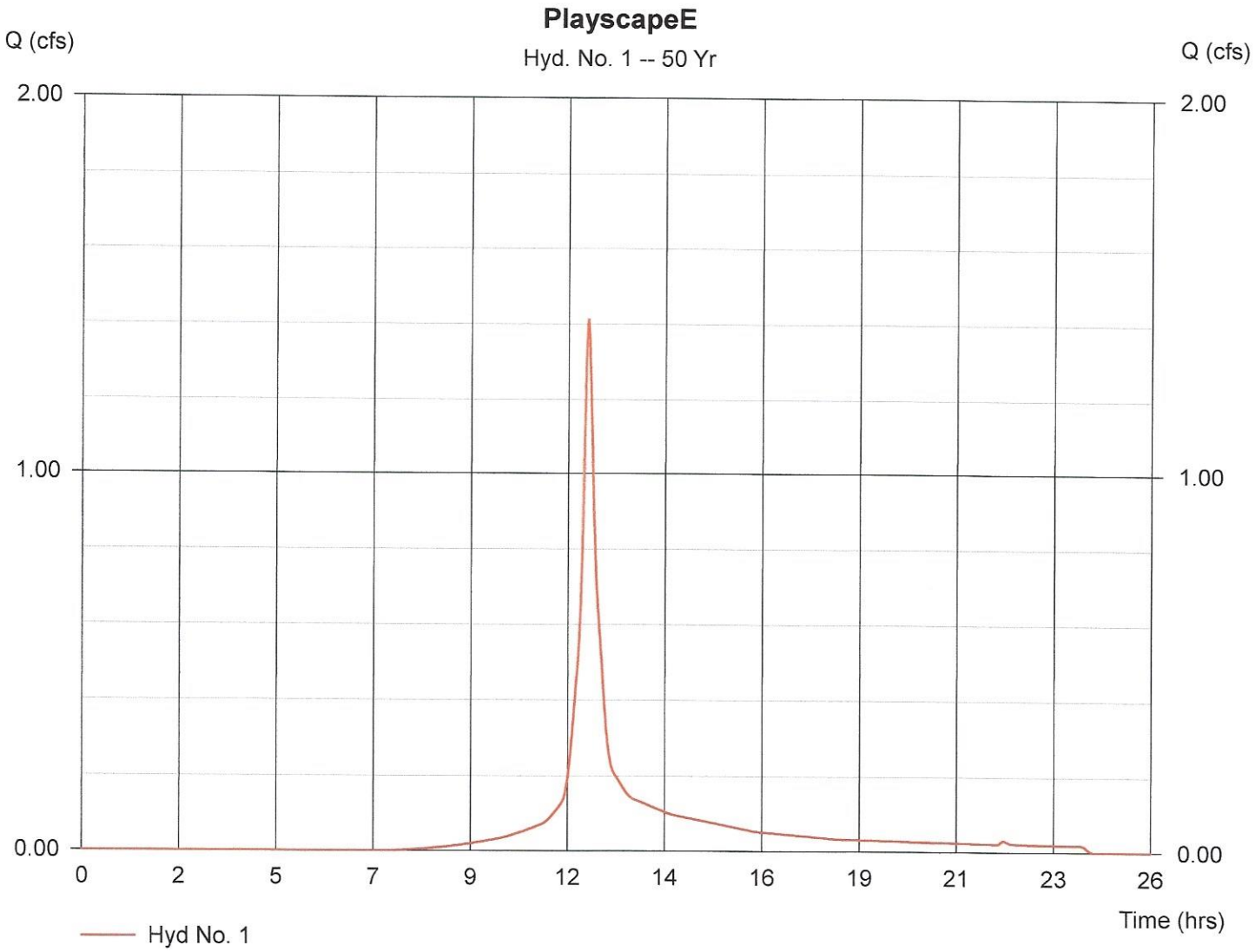
Sunday, Sep 22 2019, 12:19 PM

Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 1.41 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 7.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,133 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

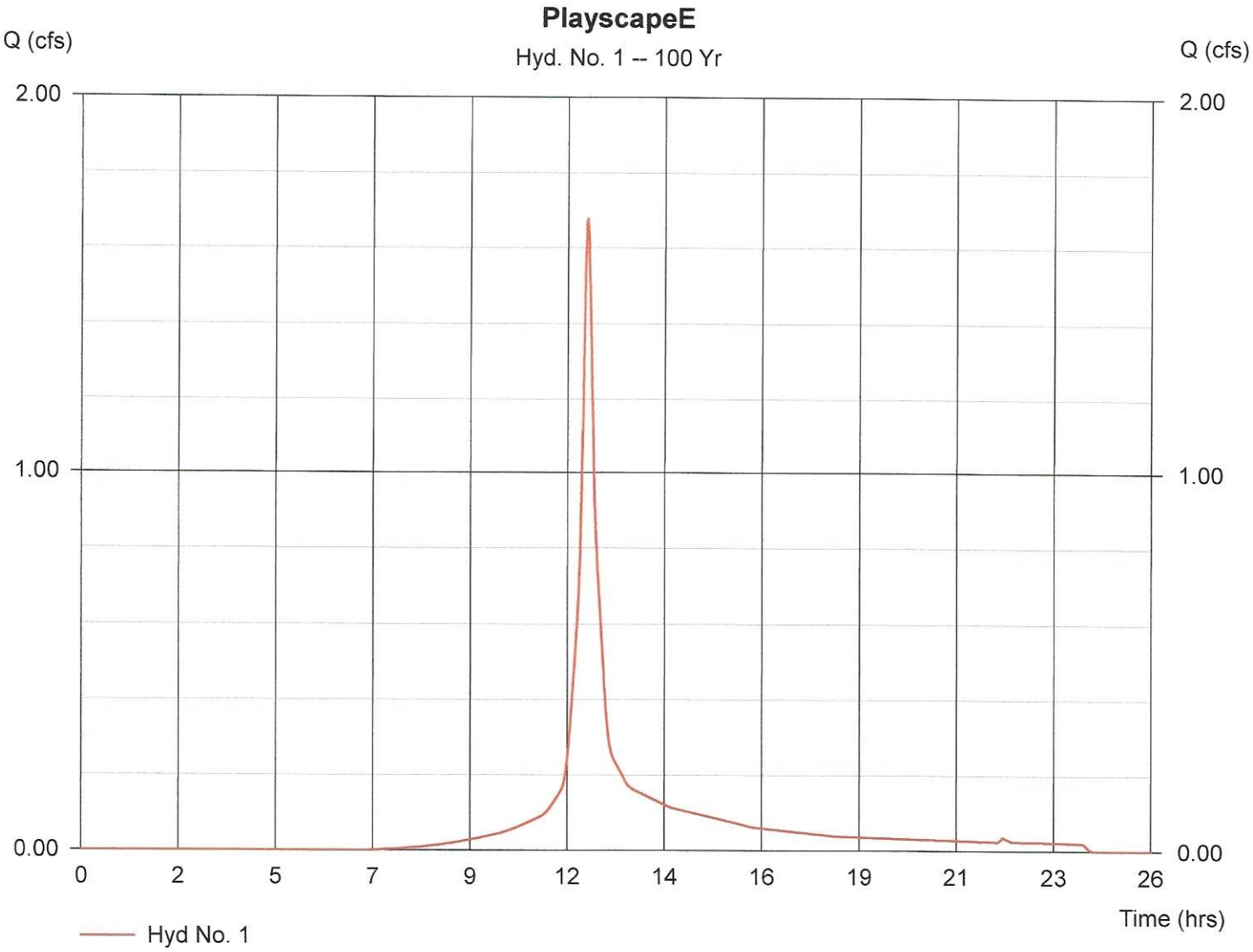
Sunday, Sep 22 2019, 12:19 PM

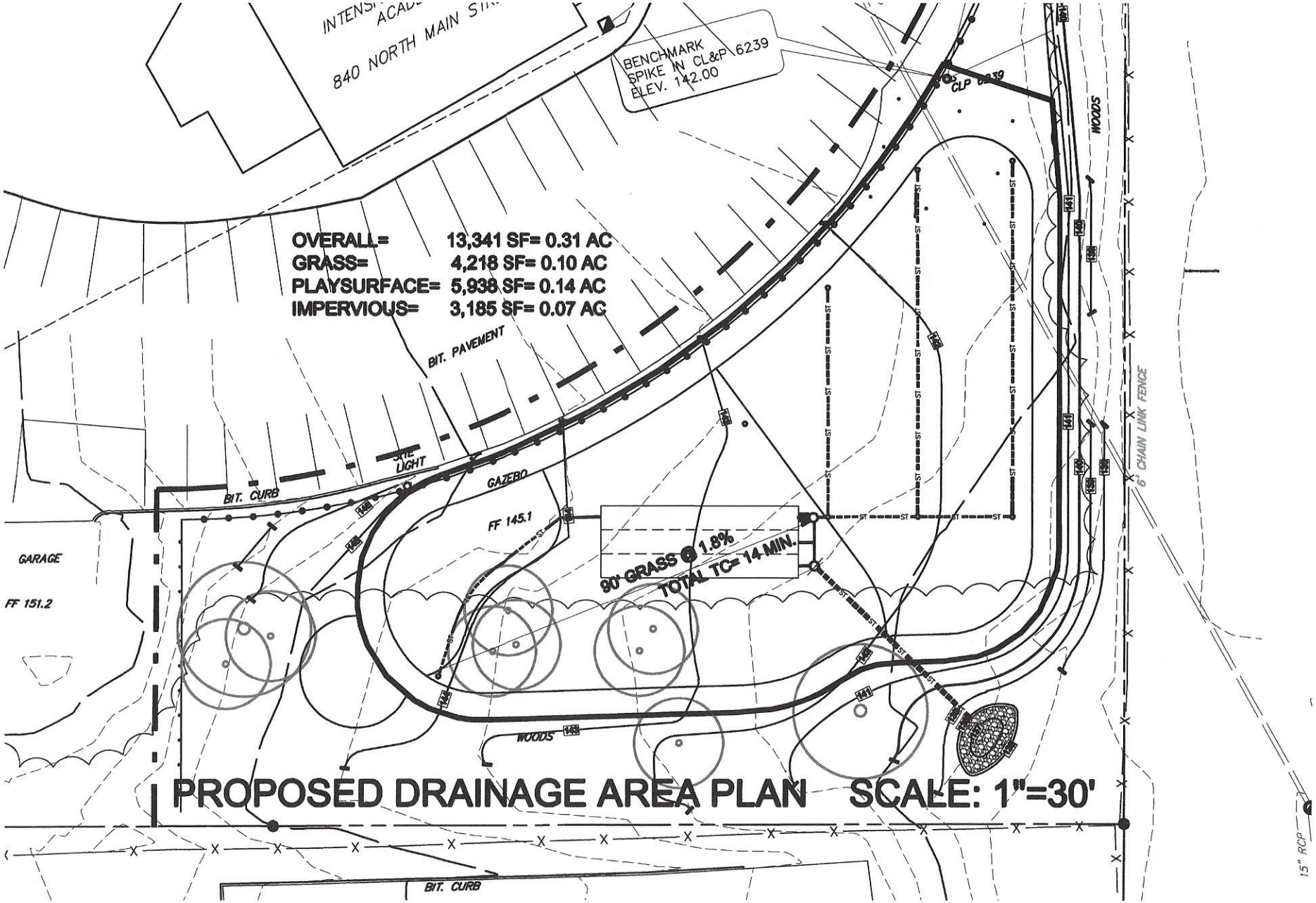
Hyd. No. 1

PlayscapeE

Hydrograph type	= SCS Runoff	Peak discharge	= 1.68 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.00 min
Total precip.	= 8.46 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,115 cuft





PROPOSED DRAINAGE AREA PLAN SCALE: 1"=30'

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

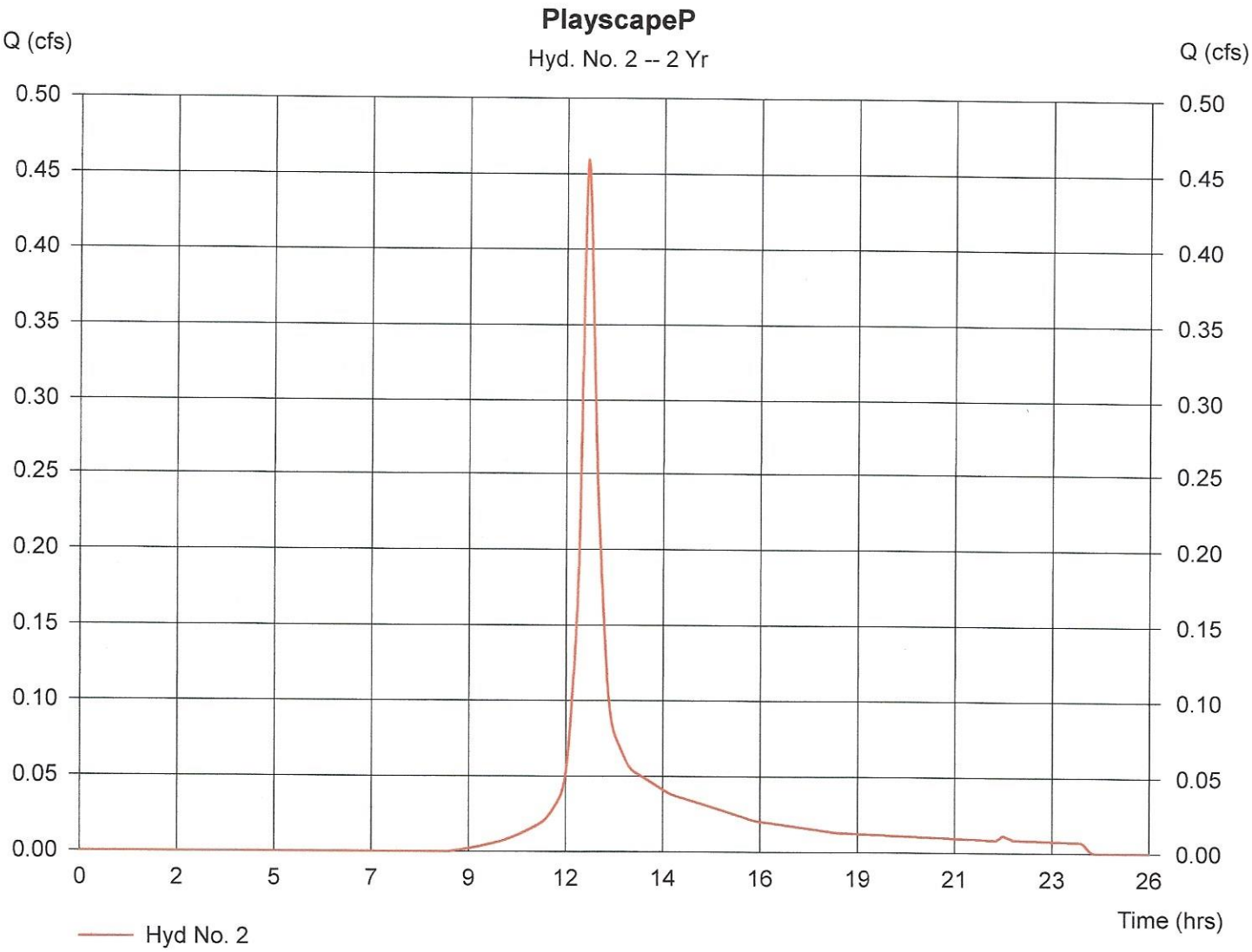
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.46 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,822 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

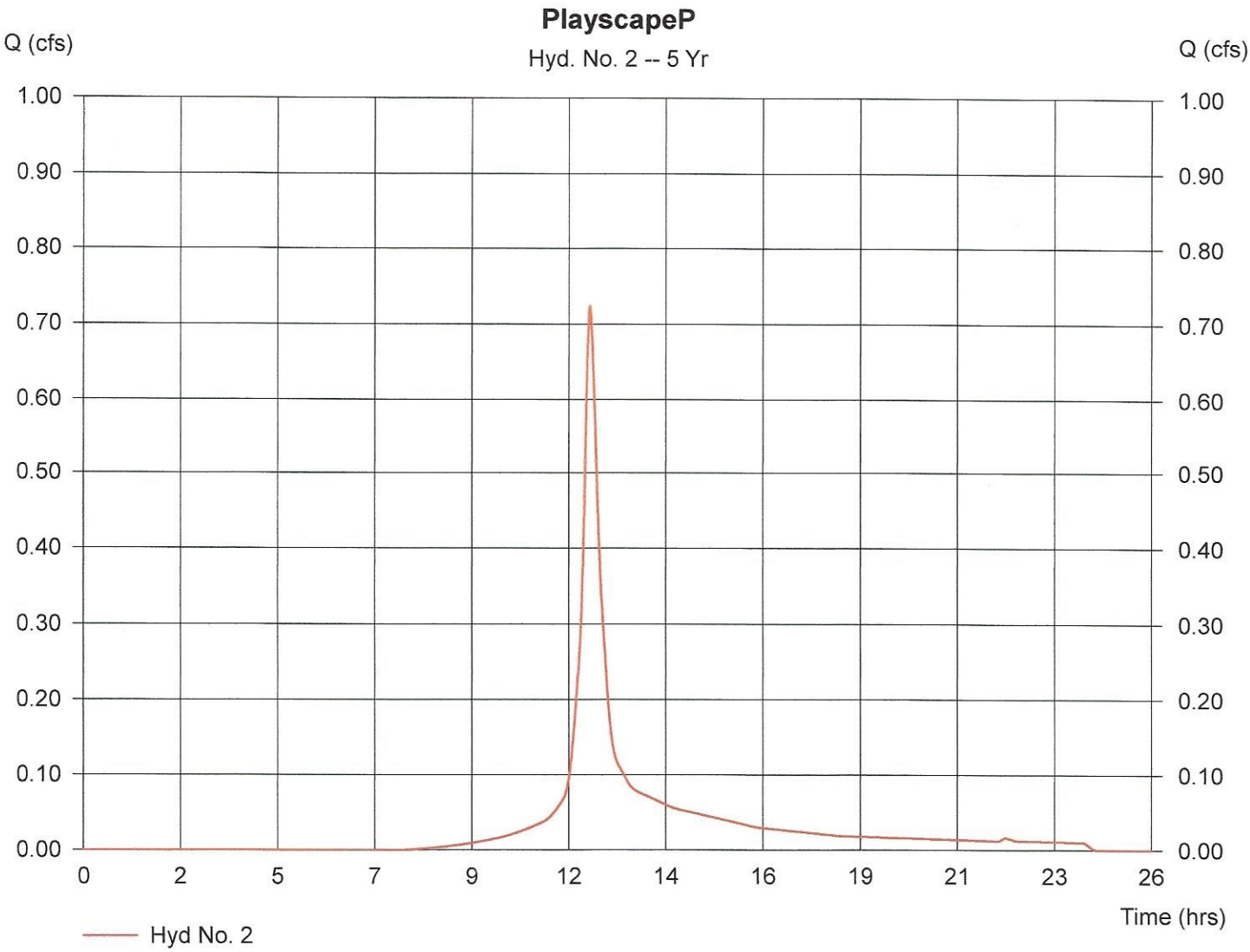
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.72 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 4.39 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,858 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

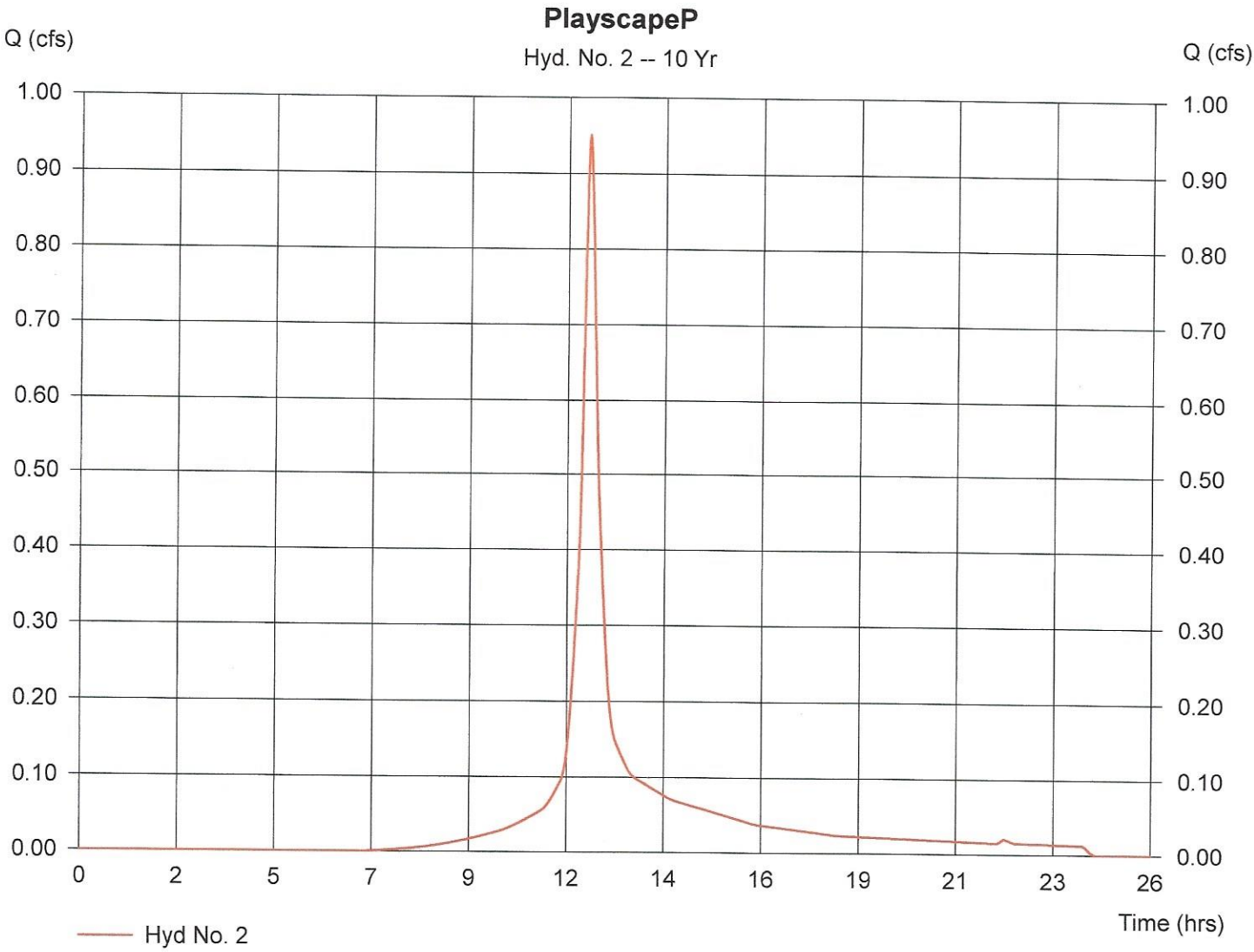
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.95 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,768 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

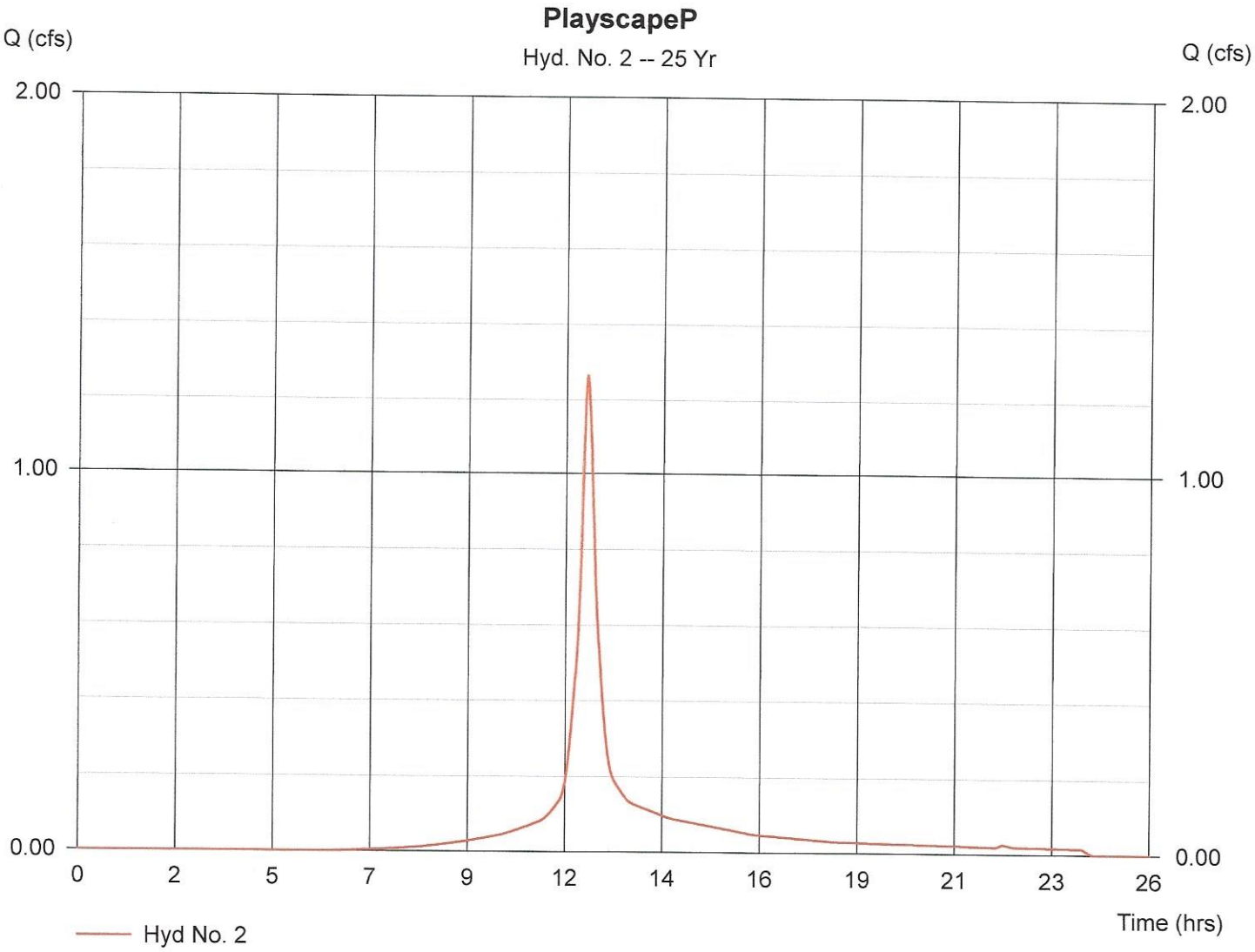
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 1.26 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 6.54 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,049 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

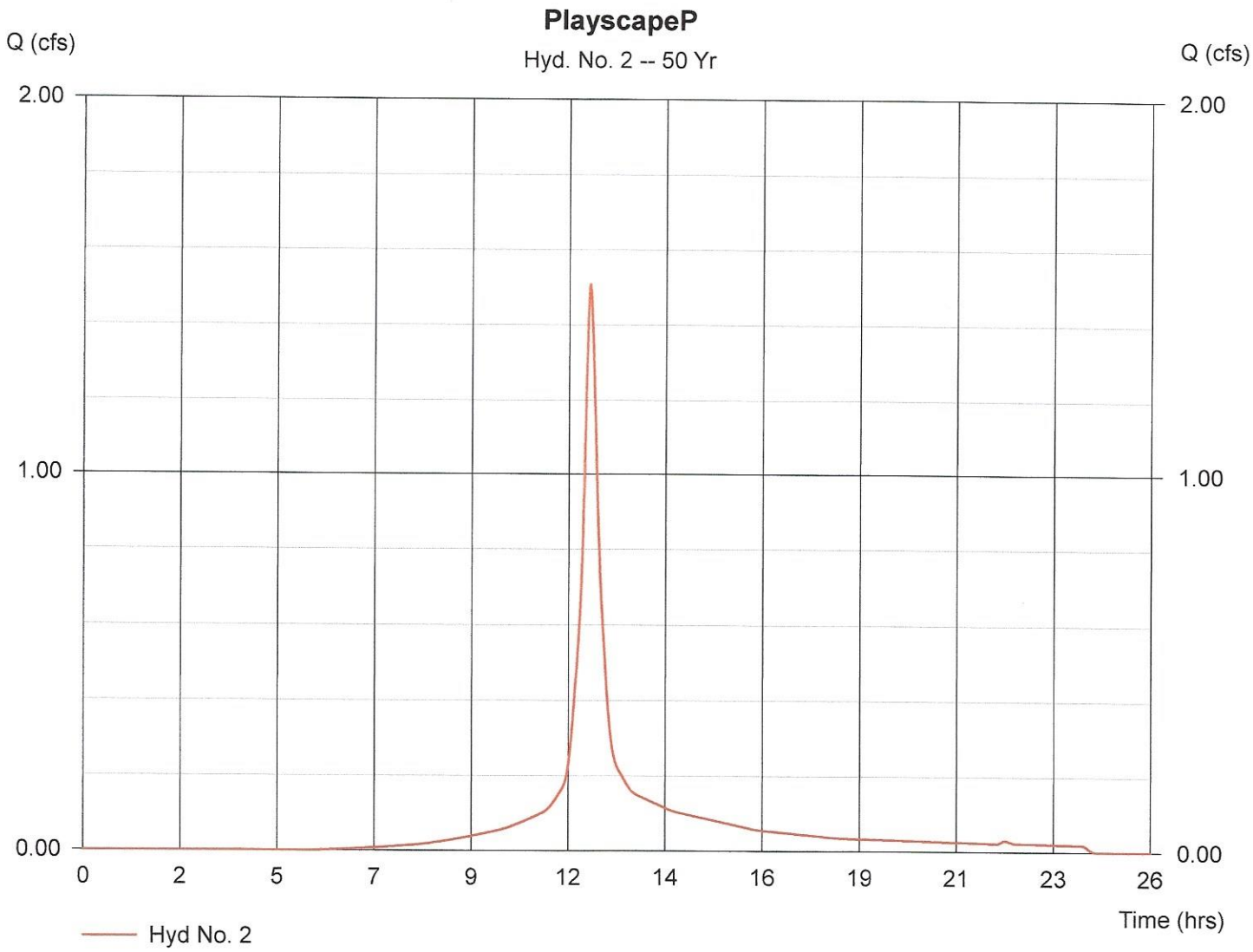
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 1.51 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 7.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,061 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

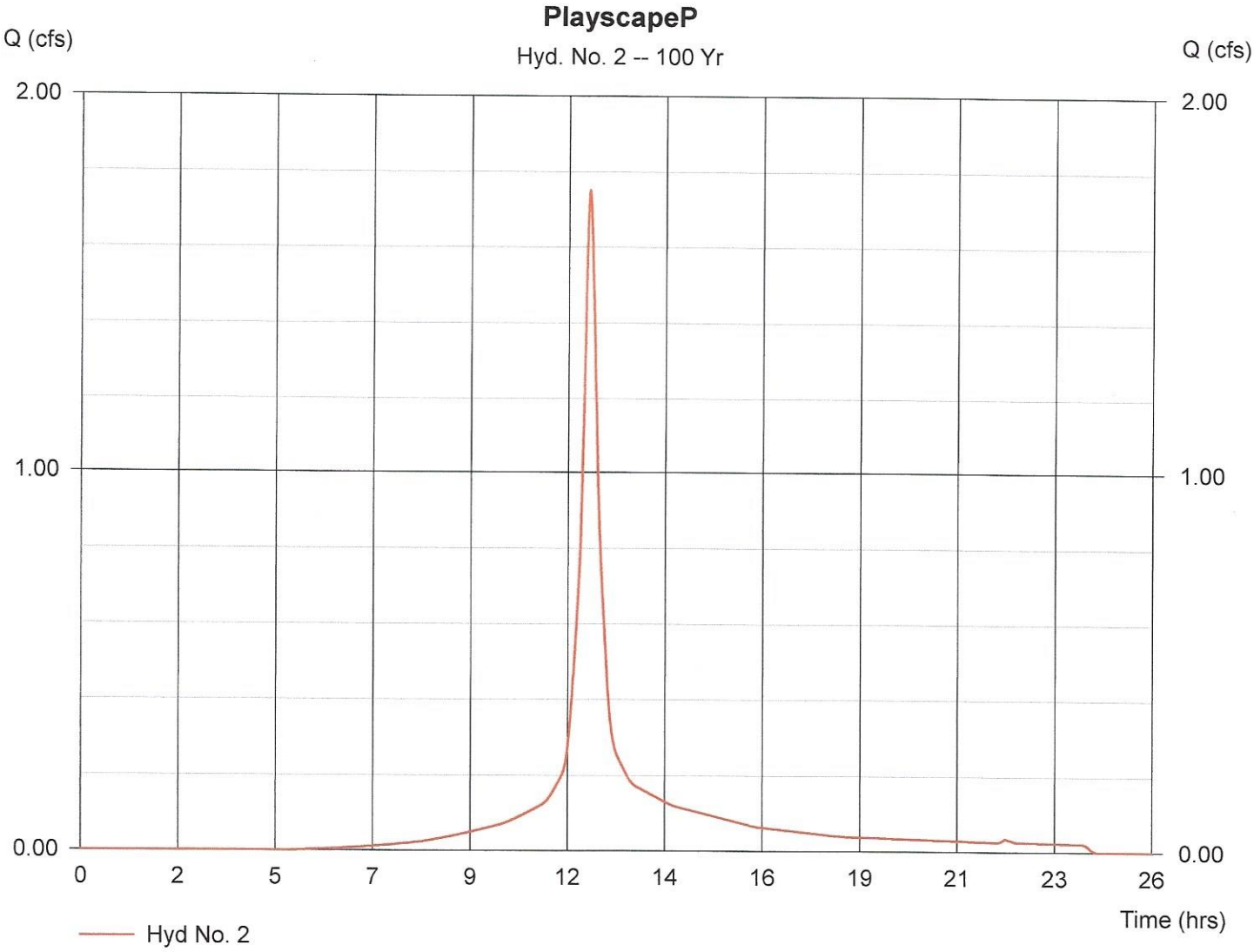
Sunday, Sep 22 2019, 12:22 PM

Hyd. No. 2

PlayscapeP

Hydrograph type	= SCS Runoff	Peak discharge	= 1.75 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.310 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.00 min
Total precip.	= 8.46 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,087 cuft



SC-740 CHAMBER
CHAMBERS SHALL MEET ASTM F 2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".

AASHTO M288 CLASS 2 NON-WOVEN GEOTEXTILE ALL AROUND ANGULAR STONE

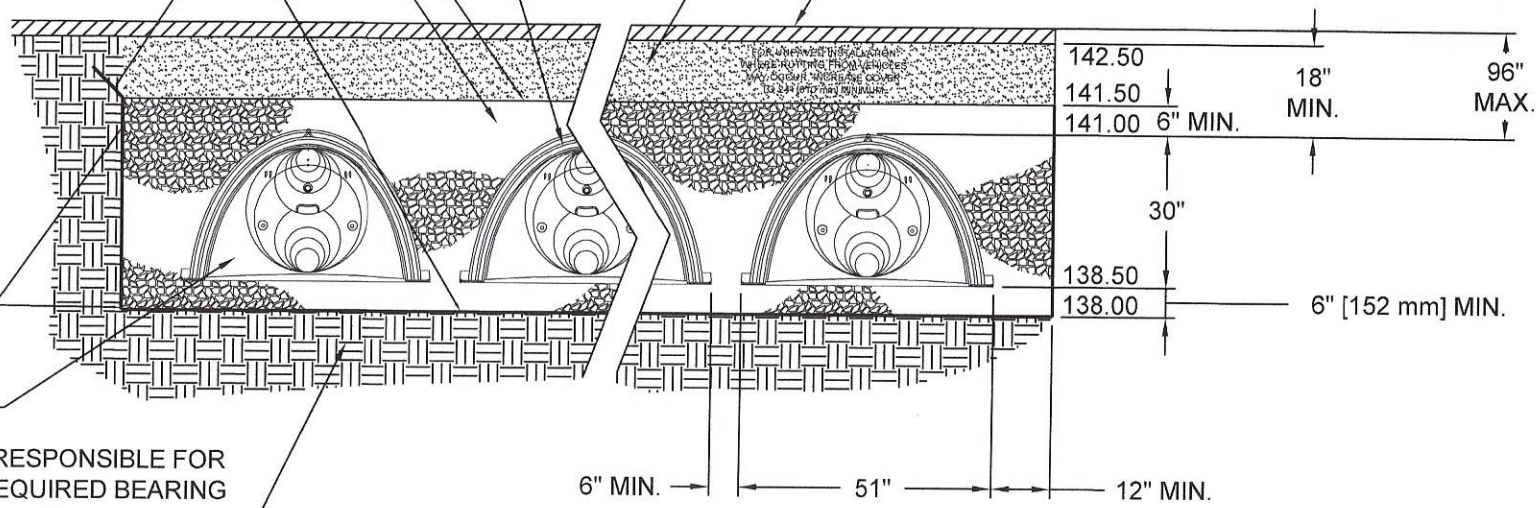
3/4" - 2" [19 mm - 51 mm] CLEAN, CRUSHED, ANGULAR STONE

ADS 601 GEOTEXTILE OR EQUAL PLACED ON BOTH SIDES OF THERMOPLASTIC MEMBRANE (UNDERNEATH AND ALONG THE SIDES OF SYSTEM)

THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCE.

GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES, <35% FINES. COMPACT IN 6" [152 mm] LIFTS TO 95% STANDARD PROCTOR DENSITY. SEE THE TABLE OF ACCEPTABLE FILL MATERIALS

PAVEMENT



THERMOPLASTIC MEMBRANE
*SEE TECH SHEET #2

SC-740 ENDCAP

DESIGN ENGINEER RESPONSIBLE FOR ENSURING THE REQUIRED BEARING CAPACITY OF SUBGRADE SOILS

SC - 740 SECTION

N.T.S.

Project:

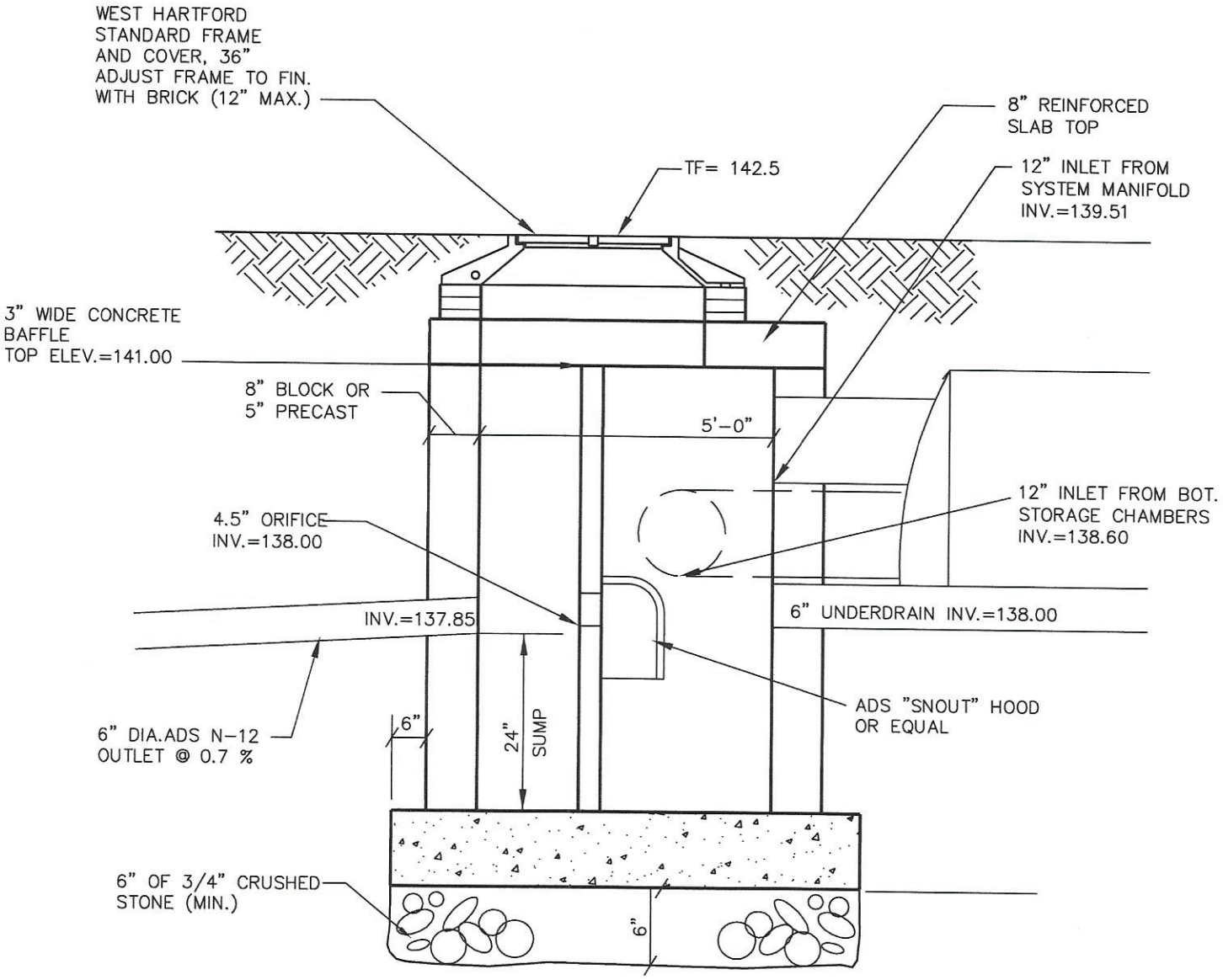
StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	SC-740	
Units -	Imperial	Click Here for Metric
Number of chambers -	18	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	138.00	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	704	sf Min. Area - 608 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Total Chamber (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch & St (cubic feet)	Cumulative Chamber (cubic feet)	Elevation (feet)
42	0.00	0.00	23.47	23.47	1481.87	141.50
41	0.00	0.00	23.47	23.47	1458.40	141.42
40	0.00	0.00	23.47	23.47	1434.94	141.33
39	0.00	0.00	23.47	23.47	1411.47	141.25
38	0.00	0.00	23.47	23.47	1388.00	141.17
37	0.00	0.00	23.47	23.47	1364.54	141.08
36	0.05	0.99	23.07	24.06	1341.07	141.00
35	0.16	2.93	22.29	25.23	1317.01	140.92
34	0.28	5.07	21.44	26.51	1291.78	140.83
33	0.60	10.87	19.12	29.99	1265.27	140.75
32	0.80	14.43	17.69	32.13	1235.28	140.67
31	0.95	17.11	16.62	33.73	1203.16	140.58
30	1.07	19.34	15.73	35.07	1169.42	140.50
29	1.18	21.25	14.97	36.22	1134.35	140.42
28	1.27	22.78	14.35	37.14	1098.13	140.33
27	1.36	24.39	13.71	38.10	1061.00	140.25
26	1.45	26.17	13.00	39.17	1022.90	140.17
25	1.52	27.45	12.49	39.93	983.73	140.08
24	1.58	28.48	12.07	40.56	943.79	140.00
23	1.64	29.56	11.64	41.20	903.24	139.92
22	1.70	30.59	11.23	41.82	862.03	139.83
21	1.75	31.55	10.85	42.40	820.21	139.75
20	1.80	32.45	10.49	42.94	777.81	139.67
19	1.85	33.39	10.11	43.50	734.88	139.58
18	1.89	34.08	9.84	43.91	691.38	139.50
17	1.93	34.81	9.54	44.35	647.46	139.42
16	1.97	35.55	9.25	44.80	603.11	139.33
15	2.01	36.18	9.00	45.17	558.31	139.25
14	2.04	36.81	8.74	45.55	513.14	139.17
13	2.07	37.35	8.53	45.88	467.59	139.08
12	2.10	37.89	8.31	46.20	421.71	139.00
11	2.13	38.37	8.12	46.49	375.51	138.92
10	2.15	38.77	7.96	46.73	329.02	138.83
9	2.18	39.19	7.79	46.98	282.29	138.75
8	2.20	39.57	7.64	47.21	235.31	138.67
7	2.21	39.73	7.57	47.31	188.11	138.58
6	0.00	0.00	23.47	23.47	140.80	138.50
5	0.00	0.00	23.47	23.47	117.33	138.42
4	0.00	0.00	23.47	23.47	93.87	138.33
3	0.00	0.00	23.47	23.47	70.40	138.25
2	0.00	0.00	23.47	23.47	46.93	138.17
1	0.00	0.00	23.47	23.47	23.47	138.08
					0	138.0



STORM MANHOLE OUTLET STRUCTURE

N.T.S.

Pond Report

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 4:13 PM

Pond No. 1 - SC-740 18 - 4.5 in

Pond Data

Pond storage is based on known values

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	138.00	00	0	0
0.50	138.50	00	141	141
1.00	139.00	00	281	422
1.50	139.50	00	269	691
2.00	140.00	00	253	944
2.50	140.50	00	225	1,169
3.00	141.00	00	172	1,341
3.50	141.50	00	141	1,482

Culvert / Orifice Structures

		[A]	[B]	[C]	[D]
Rise (in)	=	6.00	4.50	0.00	0.00
Span (in)	=	6.00	4.50	0.00	0.00
No. Barrels	=	1	1	0	0
Invert El. (ft)	=	137.85	138.00	0.00	0.00
Length (ft)	=	50.00	0.00	0.00	0.00
Slope (%)	=	0.70	0.00	0.00	0.00
N-Value	=	.013	.013	.000	.000
Orif. Coeff.	=	0.60	0.60	0.00	0.00
Multi-Stage	=	n/a	Yes	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	5.00	0.00	0.00	0.00
Crest El. (ft)	=	141.00	0.00	0.00	0.00
Weir Coeff.	=	3.33	0.00	0.00	0.00
Weir Type	=	Riser	---	---	---
Multi-Stage	=	Yes	No	No	No

Exfiltration = 0.000 in/hr (Wet area) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control. Weir riser checked for orifice conditions.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	138.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.50	141	138.50	0.29	0.29	---	---	0.00	---	---	---	---	0.29
1.00	422	139.00	0.42	0.42	---	---	0.00	---	---	---	---	0.42
1.50	691	139.50	0.51	0.51	---	---	0.00	---	---	---	---	0.51
2.00	944	140.00	0.59	0.59	---	---	0.00	---	---	---	---	0.59
2.50	1,169	140.50	0.66	0.66	---	---	0.00	---	---	---	---	0.66
3.00	1,341	141.00	0.72	0.72	---	---	0.00	---	---	---	---	0.72
3.50	1,482	141.50	1.27	0.04	---	---	1.23	---	---	---	---	1.27

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 9:56 AM

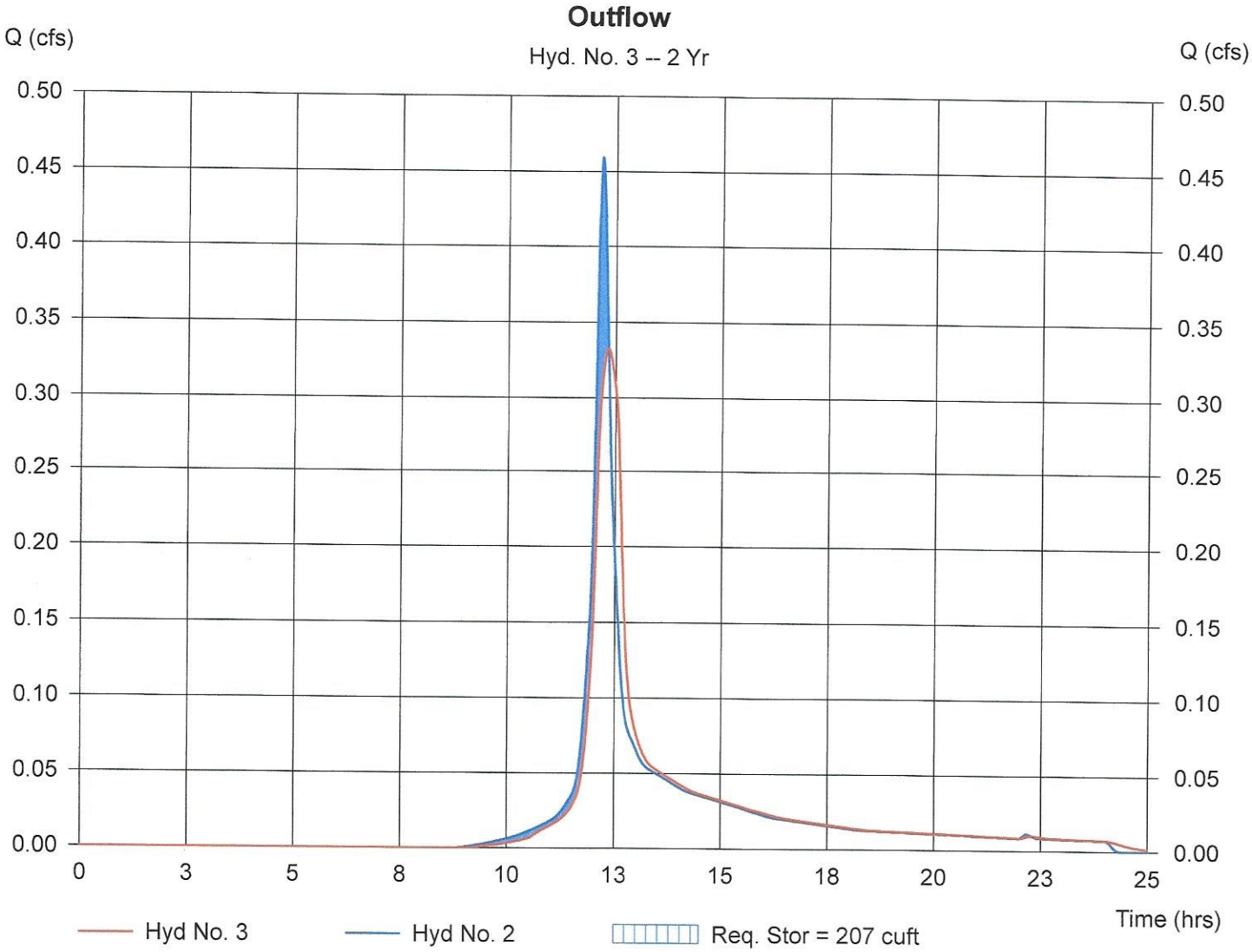
Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.33 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 138.62 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 207 cuft

Storage Indication method used.

Hydrograph Volume = 1,820 cuft



2 c

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 9:56 AM

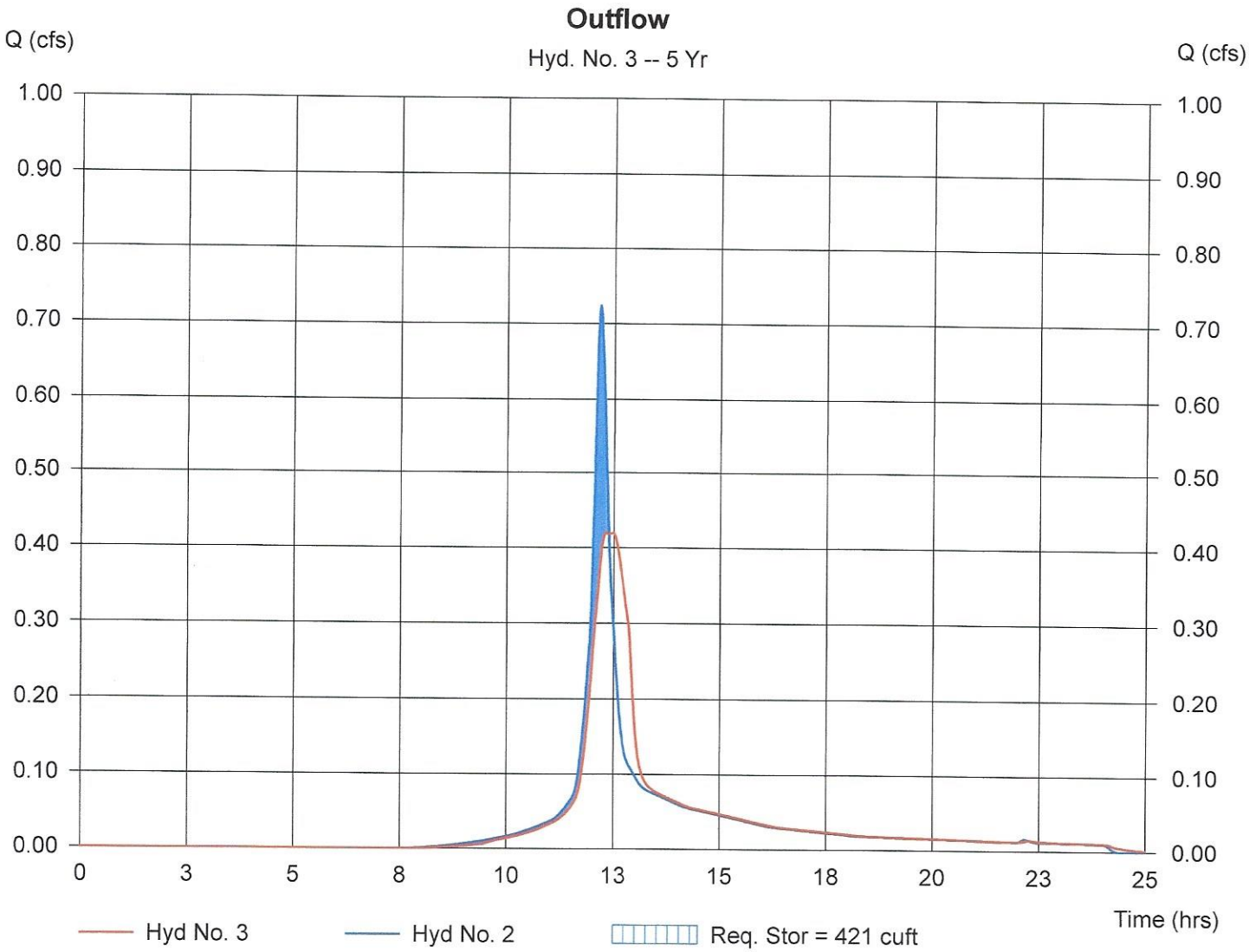
Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.42 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 138.95 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 421 cuft

Storage Indication method used.

Hydrograph Volume = 2,856 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 9:56 AM

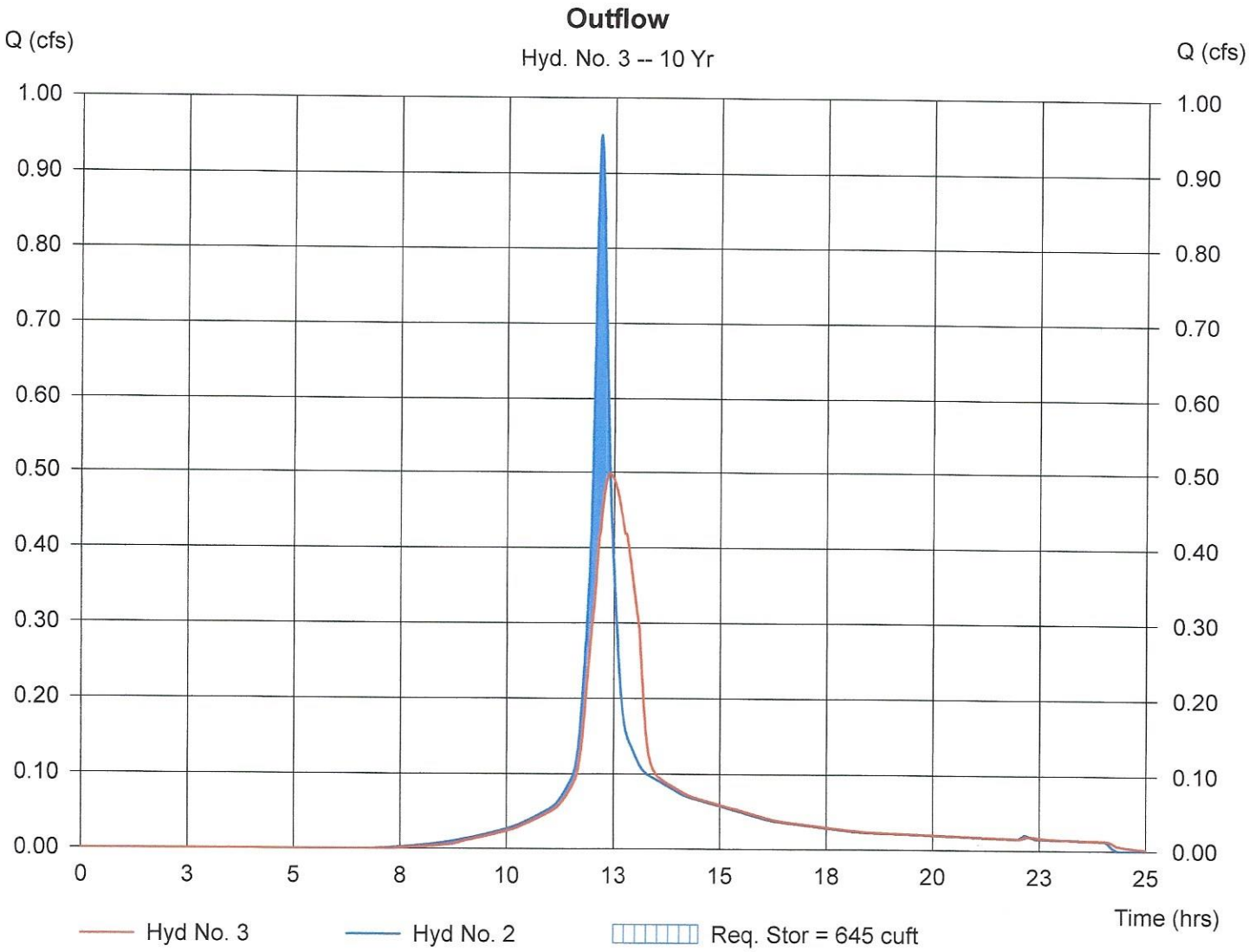
Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.50 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 139.41 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 645 cuft

Storage Indication method used.

Hydrograph Volume = 3,766 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 9:56 AM

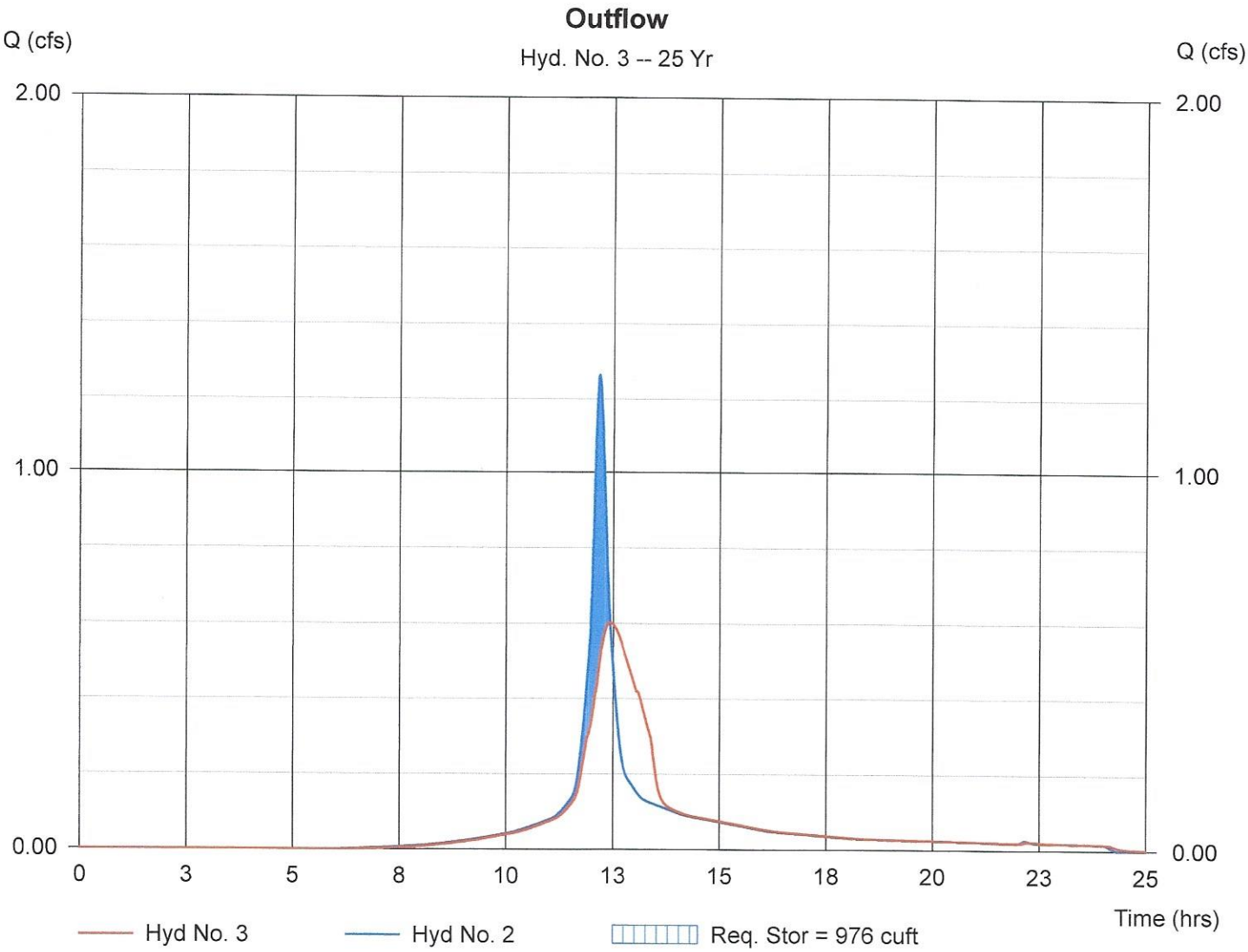
Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.60 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 140.07 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 976 cuft

Storage Indication method used.

Hydrograph Volume = 5,047 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 9:56 AM

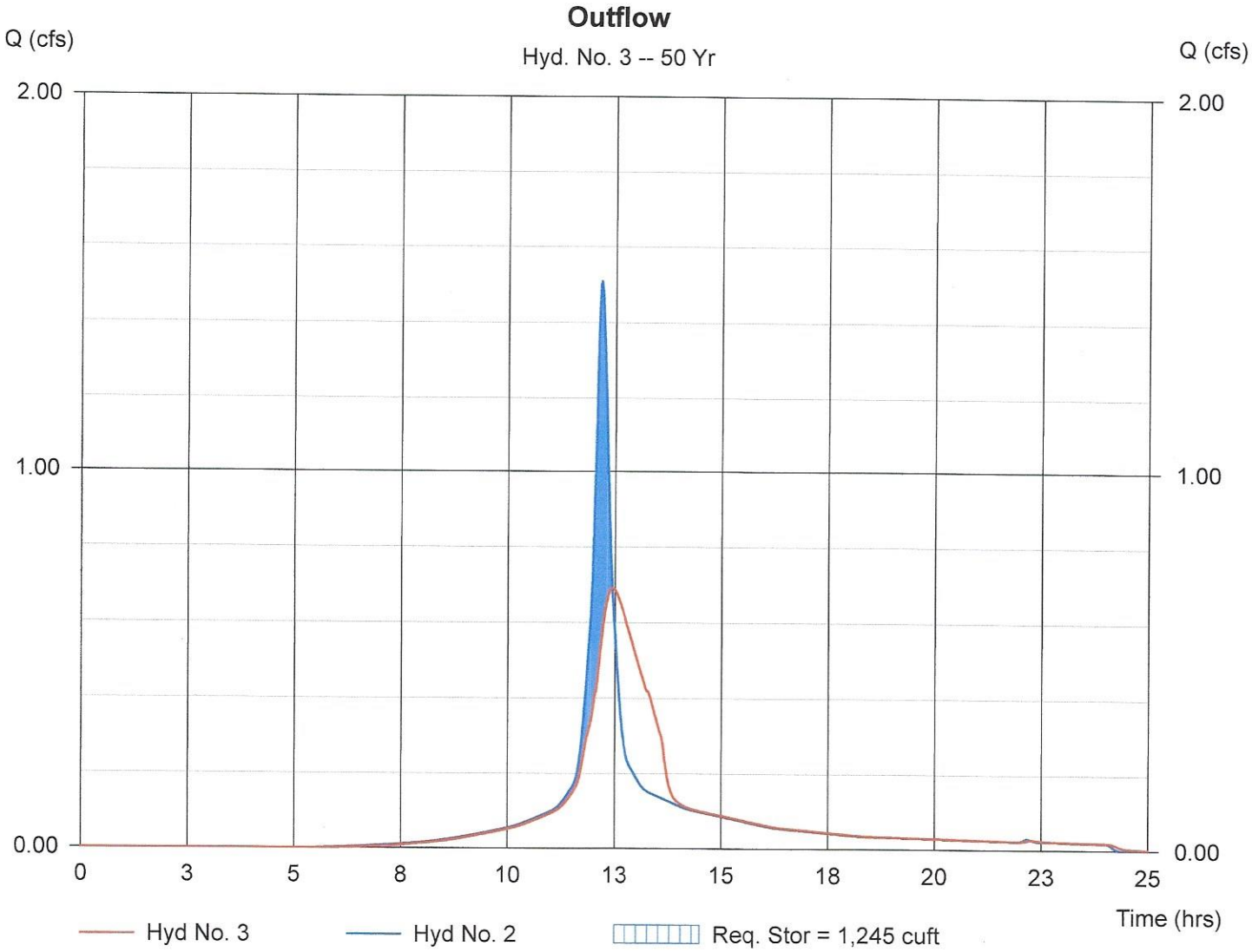
Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 0.69 cfs
Storm frequency	= 50 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 140.72 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 1,245 cuft

Storage Indication method used.

Hydrograph Volume = 6,059 cuft



Hydrograph Plot

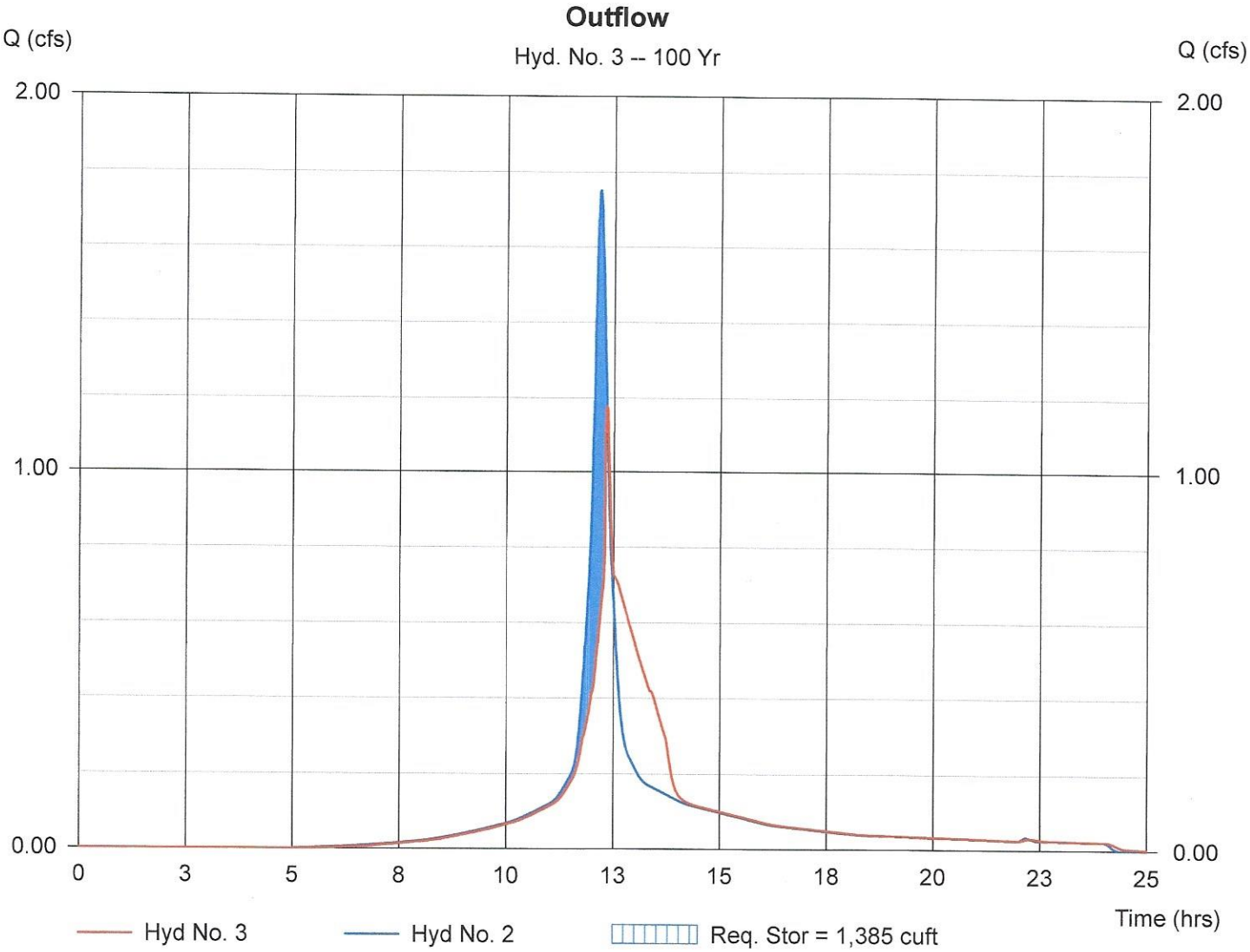
Hydraflow Hydrographs by Intelisolve

Monday, Sep 23 2019, 4:16 PM

Hyd. No. 3

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 1.18 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 141.16 ft
Reservoir name	= SC-740 18 - 4.5 in	Max. Storage	= 1,385 cuft

Storage Indication method used.

Hydrograph Volume = 7,085 cuft