

Stamski And McNary, Inc.
Engineering - Planning - Surveying
1000 Main Street; Acton, MA 01720 (978) 263-8585
www.stamskiandmcnary.com

Stormwater Management Report

For

Map U-1, Parcel 41, Pine Point Road
Stow, Massachusetts

October 2, 2017

Applicant: Habitat for Humanity- Carolyn Reed
138 Great Road
Acton, MA 01720

SM-5984

Table of Contents

Narrative

Pre-Development Hydrology

Post-Development Hydrology

Infiltration Trench Calculations

Pipe Sizing Calculations

Soil Testing

Drainage Maps: Pre and Post Development

Narrative

Stormwater Narrative

Pine Point Road, Stow, MA

1. Stormwater Management

Pre-Development

The site currently contains a gravel parking area and utility boxes. A large portion of the lot is woods. The site has been analyzed as one subcatchment, E1 (see attached *Predevelopment Drainage Map*). E1 consists of open space, woods, the gravel parking area, and utility boxes. E1 drains offsite onto either Sudbury or Pine Point Road.

Post-Development

The proposed development includes a 2 unit dwelling, with an associated driveway, lawn, walkways, and landscaping. The post-development site has been divided into 4 subcatchments as shown on the *Postdevelopment Drainage Map*.

Runoff from Subcatchment P1 continues to drain to Sudbury and Pine Point Road similar to E1, but a smaller area. Subcatchment P1 contains open space around the dwelling and undisturbed land (woods). A portion of a proposed walkway is also included in P1. Subcatchment P2 consists of woods, open space, and the dwelling. The overland flow drains to a drop inlet in the backyard, which directs flow into subsurface drywells. The proposed dwelling drains directly into these same subsurface drywells. P3 contains woods, open space, a portion of the walkways, and continues to drain to Pine Point Road. P4 contains a small amount of open space in front of the proposed dwelling, a large portion of the walkways, and the driveway. This flows into an infiltration trench on the low side of the proposed driveway.

The post development runoff rates and volume do not increase for the 2, 10, 25 and 100-year 24-hour storm events at any analysis points over existing conditions. See attached drainage calculations.

Discharge Summary Tables

Subcatchment 1: Peak Rate offsite

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
1.966	1.895	4.910	4.612	6.859	6.369	9.715	8.926

Subcatchment 1: Runoff Volume offsite

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cf)	Post (cf)	Pre (cf)	Post (cf)	Pre (cf)	Post (cf)	Pre (cf)	Post (cf)
7,866	7,382	17,580	16,137	23,969	21,850	33,424	30,268

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	1.966	2	728	7,866	---	-----	-----	E1	
2	SCS Runoff	0.691	2	728	2,701	---	-----	-----	P1	
3	SCS Runoff	0.379	2	726	1,372	---	-----	-----	P2	
4	Reservoir	0.000	2	868	0	3	139.78	200	Drywell	
5	SCS Runoff	1.200	2	728	4,669	---	-----	-----	P3	
6	SCS Runoff	0.101	2	724	311	---	-----	-----	P4	
7	Diversion1	0.068	2	720	300	6	-----	-----	Infiltration Trench	
8	Diversion2	0.033	2	724	11	6	-----	-----	Overflow	
9	Combine	1.895	2	728	7,382	2, 5, 8	-----	-----	Total Proposed Runoff	
5984-DRAINAGE-Revised2.gpw					Return Period: 2 Year			Monday, Oct 2, 2017		

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	4.910	2	726	17,580	---	-----	-----	E1	
2	SCS Runoff	1.666	2	726	5,912	---	-----	-----	P1	
3	SCS Runoff	0.796	2	726	2,743	---	-----	-----	P2	
4	Reservoir	0.000	2	882	0	3	140.67	702	Drywell	
5	SCS Runoff	2.874	2	726	10,180	---	-----	-----	P3	
6	SCS Runoff	0.157	2	724	495	---	-----	-----	P4	
7	Diversion1	0.068	2	716	449	6	-----	-----	Infiltration Trench	
8	Diversion2	0.089	2	724	46	6	-----	-----	Overflow	
9	Combine	4.612	2	726	16,137	2, 5, 8	-----	-----	Total Proposed Runoff	
5984-DRAINAGE-Revised2.gpw					Return Period: 10 Year			Monday, Oct 2, 2017		

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	6.859	2	726	23,969	----	-----	-----	E1	
2	SCS Runoff	2.304	2	726	8,007	----	-----	-----	P1	
3	SCS Runoff	1.054	2	726	3,607	----	-----	-----	P2	
4	Reservoir	0.000	2	1058	0	3	141.29	1,045	Drywell	
5	SCS Runoff	3.965	2	726	13,770	----	-----	-----	P3	
6	SCS Runoff	0.189	2	724	601	----	-----	-----	P4	
7	Diversion1	0.068	2	712	529	6	-----	-----	Infiltration Trench	
8	Diversion2	0.121	2	724	73	6	-----	-----	Overflow	
9	Combine	6.369	2	726	21,850	2, 5, 8	-----	-----	Total Proposed Runoff	
5984-DRAINAGE-Revised2.gpw					Return Period: 25 Year			Monday, Oct 2, 2017		

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	9.715	2	726	33,424	---	-----	-----	E1	
2	SCS Runoff	3.232	2	726	11,093	---	-----	-----	P1	
3	SCS Runoff	1.422	2	726	4,856	---	-----	-----	P2	
4	Reservoir	0.000	2	656	0	3	142.53	1,537	Drywell	
5	SCS Runoff	5.555	2	726	19,056	---	-----	-----	P3	
6	SCS Runoff	0.232	2	724	748	---	-----	-----	P4	
7	Diversion1	0.068	2	708	630	6	-----	-----	Infiltration Trench	
8	Diversion2	0.164	2	724	118	6	-----	-----	Overflow	
9	Combine	8.926	2	726	30,268	2, 5, 8	-----	-----	Total Proposed Runoff	
5984-DRAINAGE-Revised2.gpw					Return Period: 100 Year			Monday, Oct 2, 2017		

Pre-Development Hydrology

Worksheet 2: Runoff curve number and runoff

SM-5984

Project: Pine Point Road By DJC Date 9/27/17
 Location: Stow, MA Checked _____ Date _____
 Circle one: Present Developed E1

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) Square Ft	CN 1/			Area Acres	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley 253C A	Open Space	39			0.09	3.64
-	Impervious	98			0.02	1.83
Hinckley 253C A	Woods	30			0.08	2.55
Paxton 307D C	Woods	70			2.61	182.55
Paxton 307D C	Open Space	74			0.26	19.27
Hinckley 253C A	Gravel	76			0.02	1.63
Totals =					3.09	211.46

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{211.46}{3.09} = 68.51 ; \text{ Use CN} = \boxed{68.5}$$

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.)
 Runoff, Q..... cf
 D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.70	1.57	2.98

7863	17569	33399
------	-------	-------

 (210-VI-TR-55, Second Ed., June 1986)

Project: Pine Point Road

By DJC

Date 9/27/17

Location: Stow, MA

Checked _____

Date _____

Circle one:

Present
Tc

 Developed Tt

through subarea E1

Sheet 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 <= 300 ft)

4. Two-yr 24-hr rainfall, P2

5. Land Slope, s

6. $T_t = 0.007 (nL)^{0.8} / (P^2)^{0.5} s^{0.4}$

Segment ID	A-B		
	Woods		
	0.8		
	50		
	3.1		
	0.23		
	0.14		

Compute Tt hr

0.14

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. $T_t = L / 3600V$

Segment ID	B-C	C-D	D-E
	unpaved		
	530		
	0.2		
	7.22		
	0.02		

Compute Tt hr

0.02

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. $T_t = L / 3600V$

Segment ID			

Compute r ft

ft/ft

Compute V ft/s

Compute Tt hr

0

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

hr 0.16
min 9.4

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

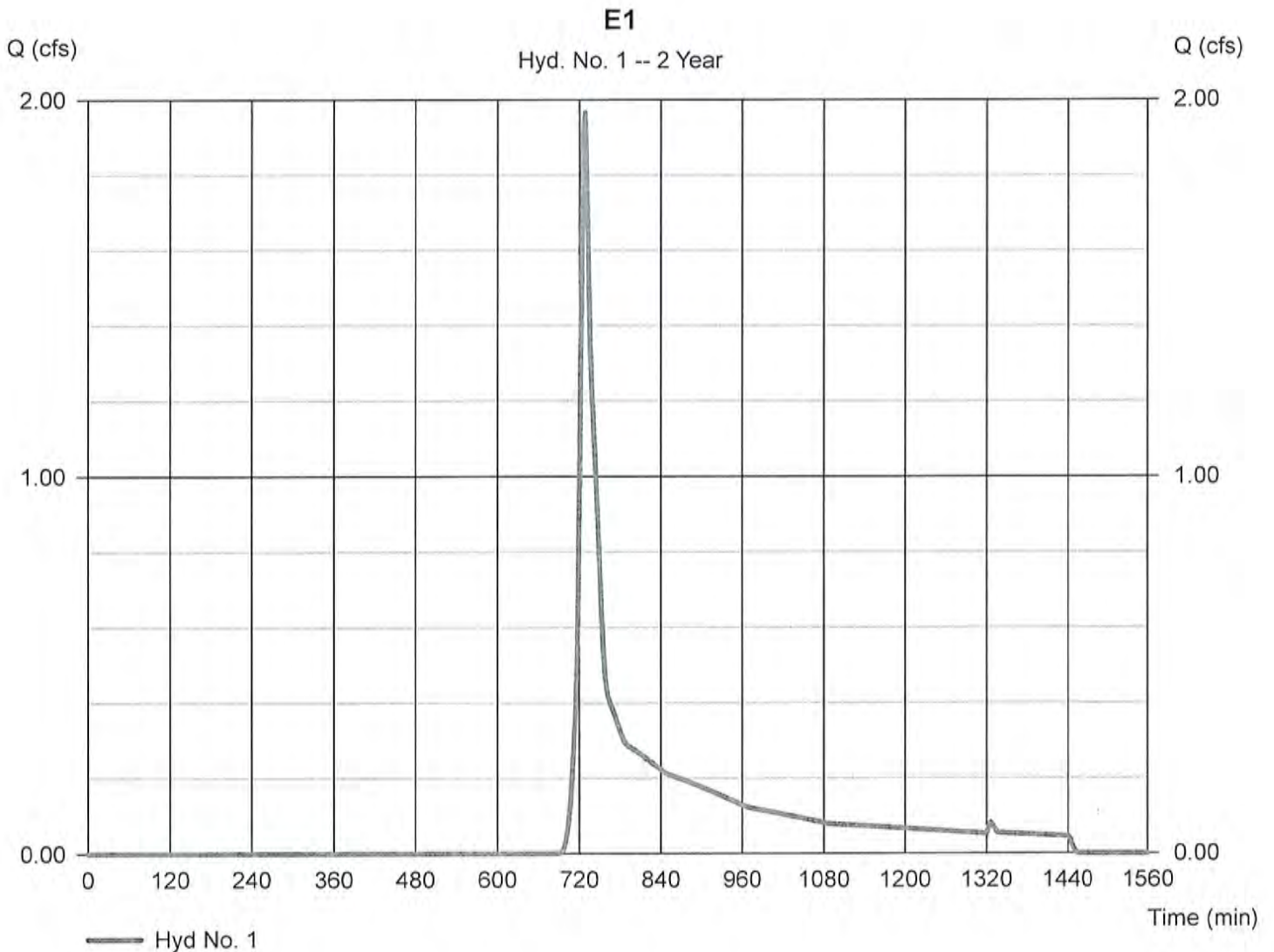
Monday, Oct 2, 2017

Hyd. No. 1

E1

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 3.090 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.10 in
Storm duration = 24 hrs

Peak discharge = 1.966 cfs
Time to peak = 728 min
Hyd. volume = 7,866 cuft
Curve number = 68.5
Hydraulic length = 0 ft
Time of conc. (Tc) = 9.40 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

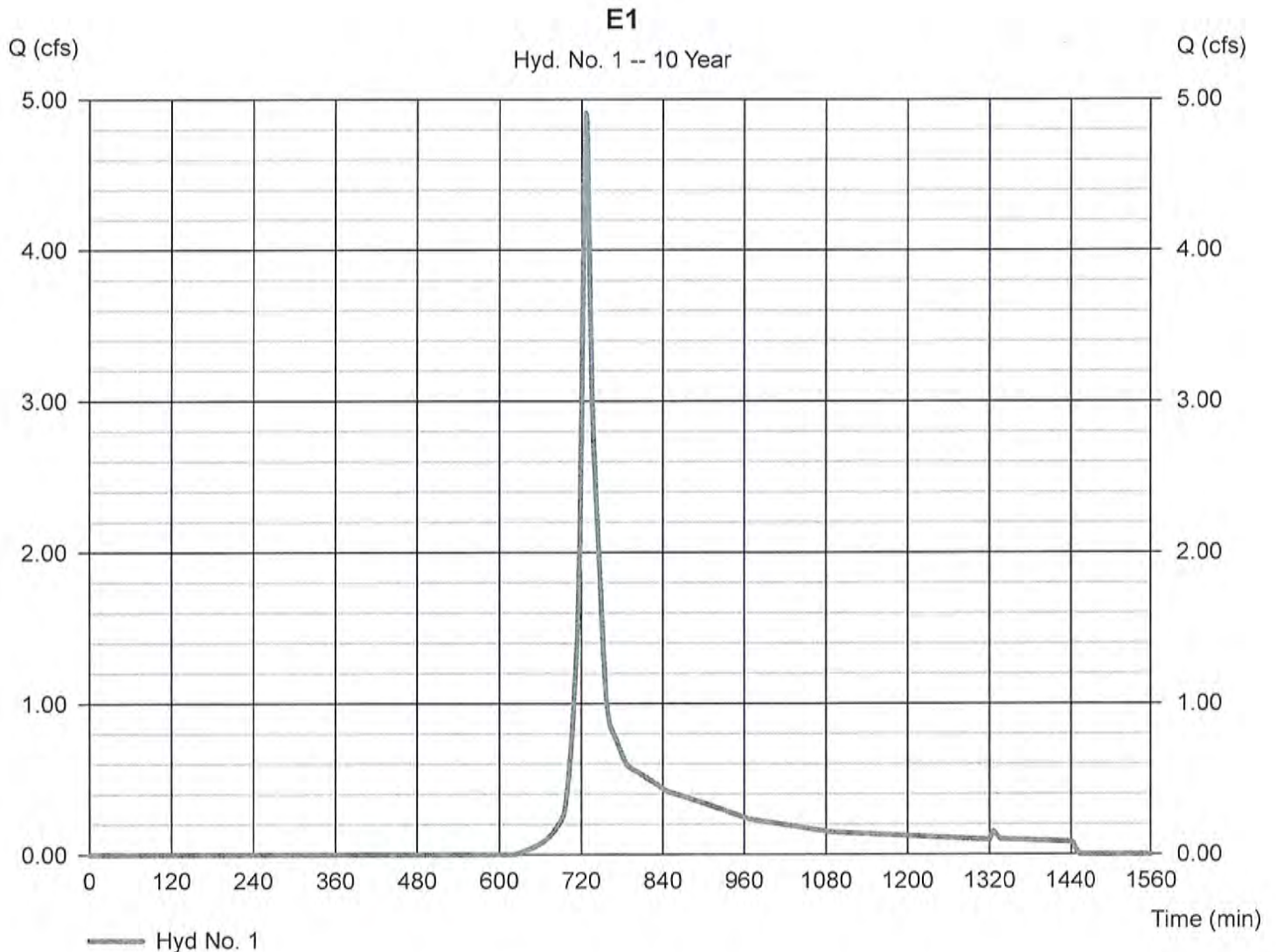
Monday, Oct 2, 2017

Hyd. No. 1

E1

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 3.090 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 4.910 cfs
Time to peak = 726 min
Hyd. volume = 17,580 cuft
Curve number = 68.5
Hydraulic length = 0 ft
Time of conc. (Tc) = 9.40 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

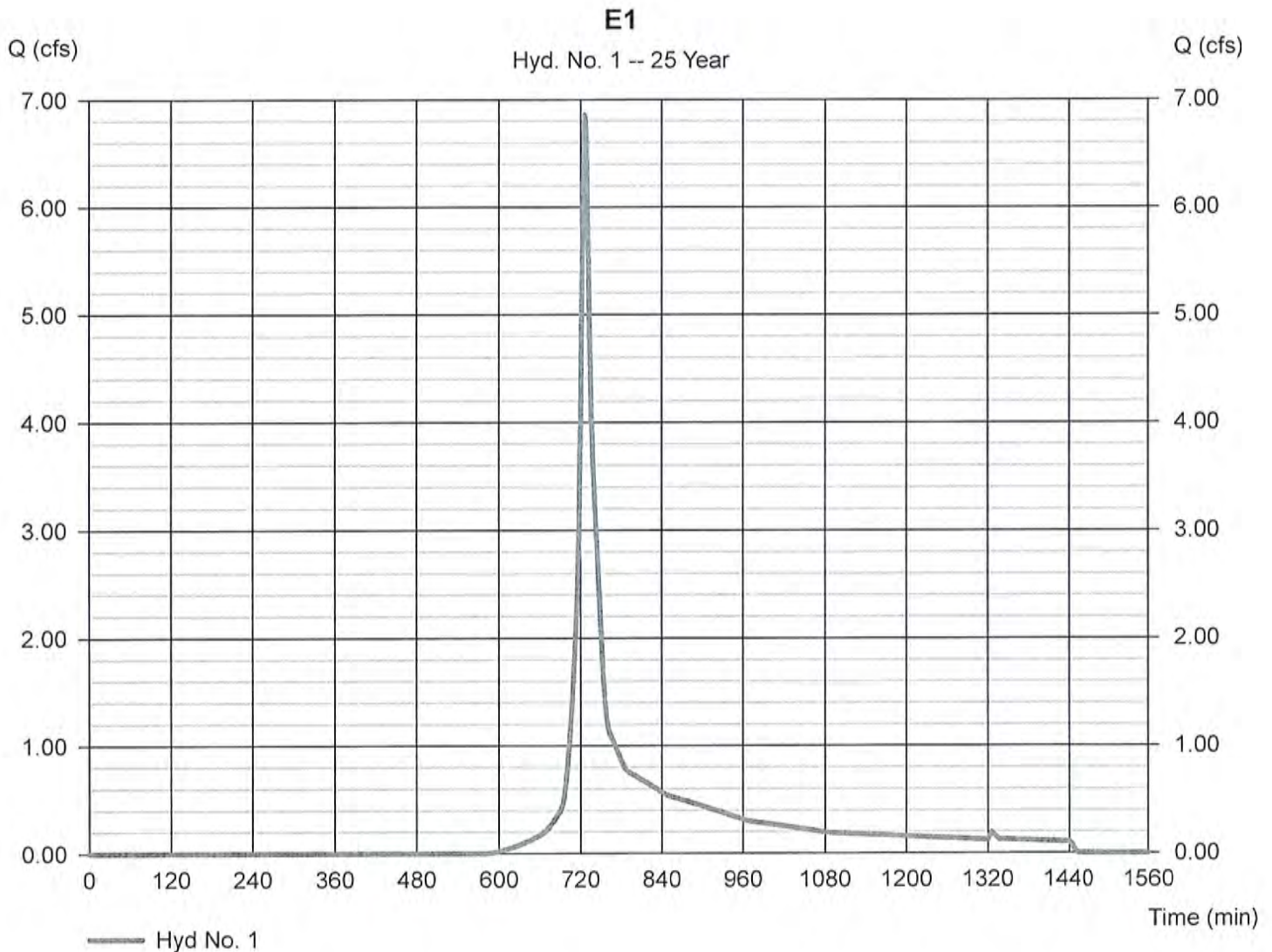
Monday, Oct 2, 2017

Hyd. No. 1

E1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 3.090 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.30 in
Storm duration = 24 hrs

Peak discharge = 6.859 cfs
Time to peak = 726 min
Hyd. volume = 23,969 cuft
Curve number = 68.5
Hydraulic length = 0 ft
Time of conc. (Tc) = 9.40 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

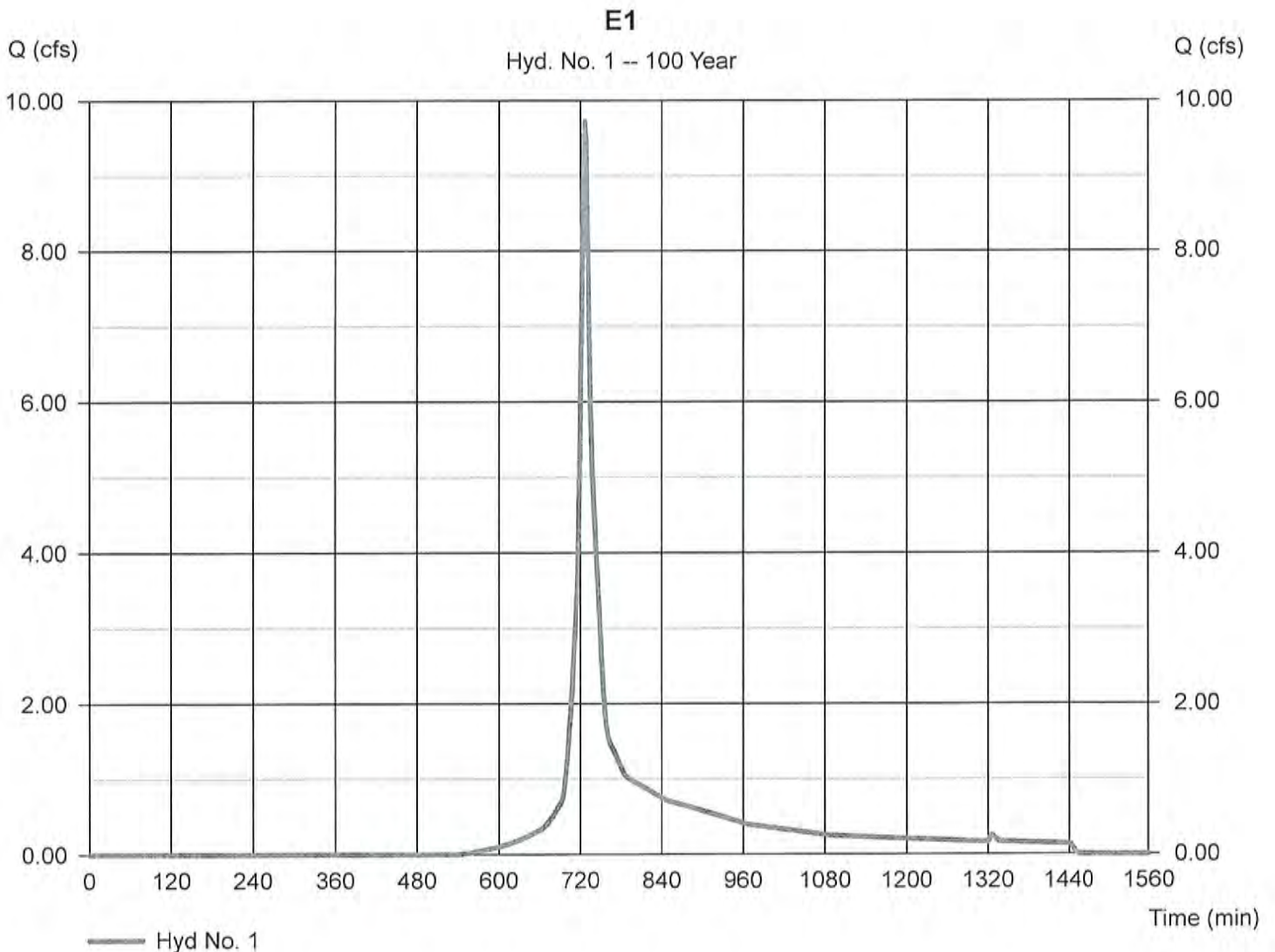
Monday, Oct 2, 2017

Hyd. No. 1

E1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 3.090 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 9.715 cfs
Time to peak = 726 min
Hyd. volume = 33,424 cuft
Curve number = 68.5
Hydraulic length = 0 ft
Time of conc. (Tc) = 9.40 min
Distribution = Type III
Shape factor = 484



Post-Development Hydrology

Worksheet 2: Runoff curve number and runoff

SM-5984

Project: Pine Point Road By DJC Date 9/27/17
 Location: Stow, MA Checked _____ Date _____
 Circle one: Present Developed P1-Northern Off Site

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		
Hinckley 253C A	Open Space	39			0.04	1.43
-	Impervious	98			0.00	0.36
Hinckley 253C A	Woods	30			0.00	0.00
Paxton 307D C	Woods	70			0.80	55.73
Paxton 307D C	Open Space	74			0.15	11.41
Totals =					0.99	68.94

1/ Use only one CN source per line.

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{68.94}{0.99} = 69.58 ; \text{ Use CN} = \boxed{69.6}$$

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.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.75	1.64	3.08

2700	5911	11095
------	------	-------

(210-VI-TR-55, Second Ed., June 1986)

Project: Pine Point Road

By DJC

Date 9/27/17

Location: Stow, MA

Checked _____

Date _____

Circle one: Present

Developed
Tt

 Circle one: Tc

Tt

through P1
 subarea _____

Sheet 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 <= 300 ft)
4. Two-yr 24-hr rainfall, P2
5. Land Slope, s
6. $Tt = 0.007 (nL)^{0.8} / (P2^{0.5} s^{0.4})$

Segment ID	A-B		
	Grass		
	0.8		
	50		
	3.1		
	0.24		
	0.13		

0.13

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. $Tt = L / 3600V$

Segment ID	B-C		
	unpaved		
	223		
	0.18		
	6.85		
	0.01		

0.01

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. $Tt = L / 3600V$

Segment ID			

0

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

hr 0.14
 min 8.6

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

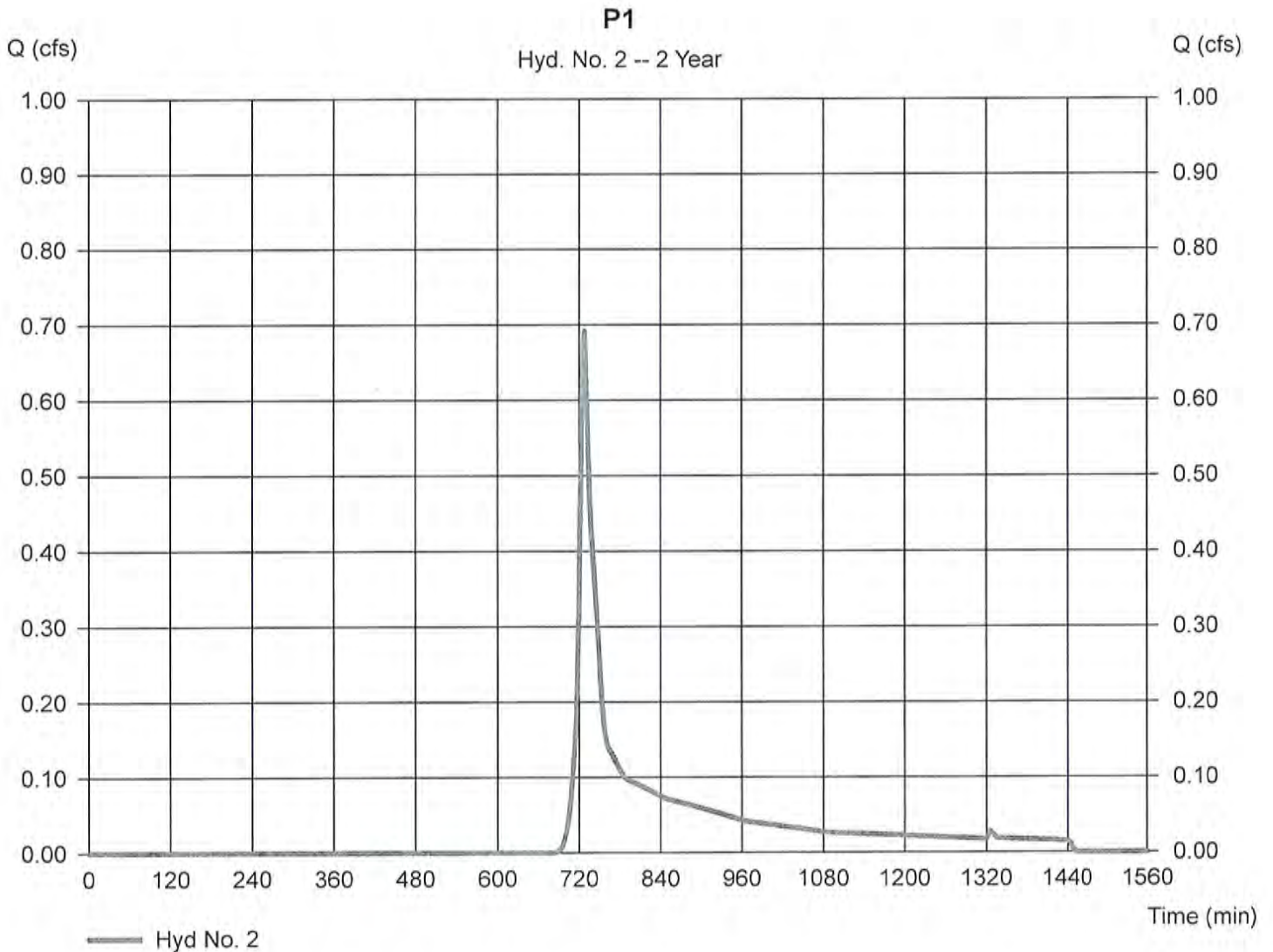
Monday, Oct 2, 2017

Hyd. No. 2

P1

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.990 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.10 in
Storm duration = 24 hrs

Peak discharge = 0.691 cfs
Time to peak = 728 min
Hyd. volume = 2,701 cuft
Curve number = 69.6
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.60 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

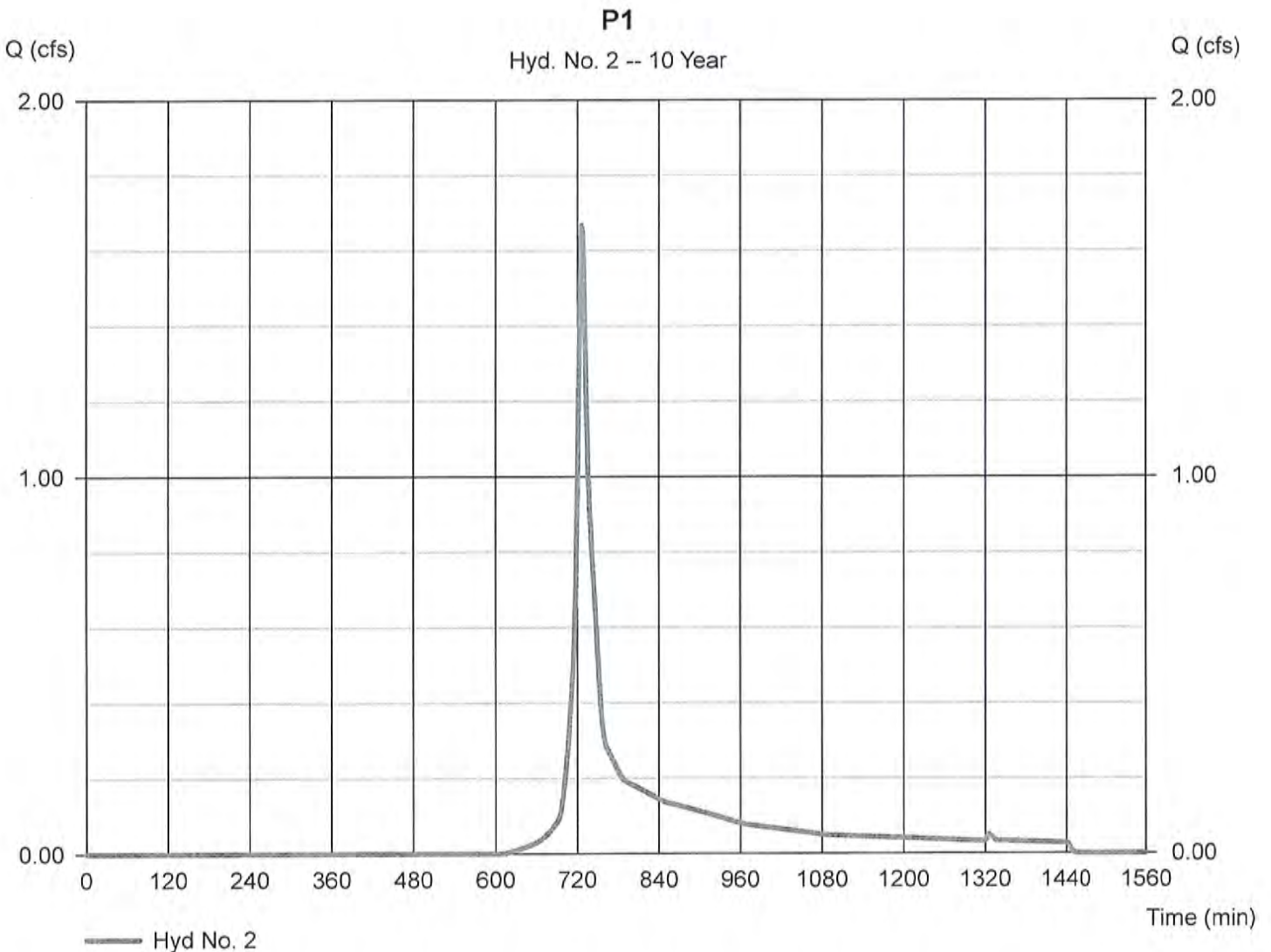
Monday, Oct 2, 2017

Hyd. No. 2

P1

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.990 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 1.666 cfs
Time to peak = 726 min
Hyd. volume = 5,912 cuft
Curve number = 69.6
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.60 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

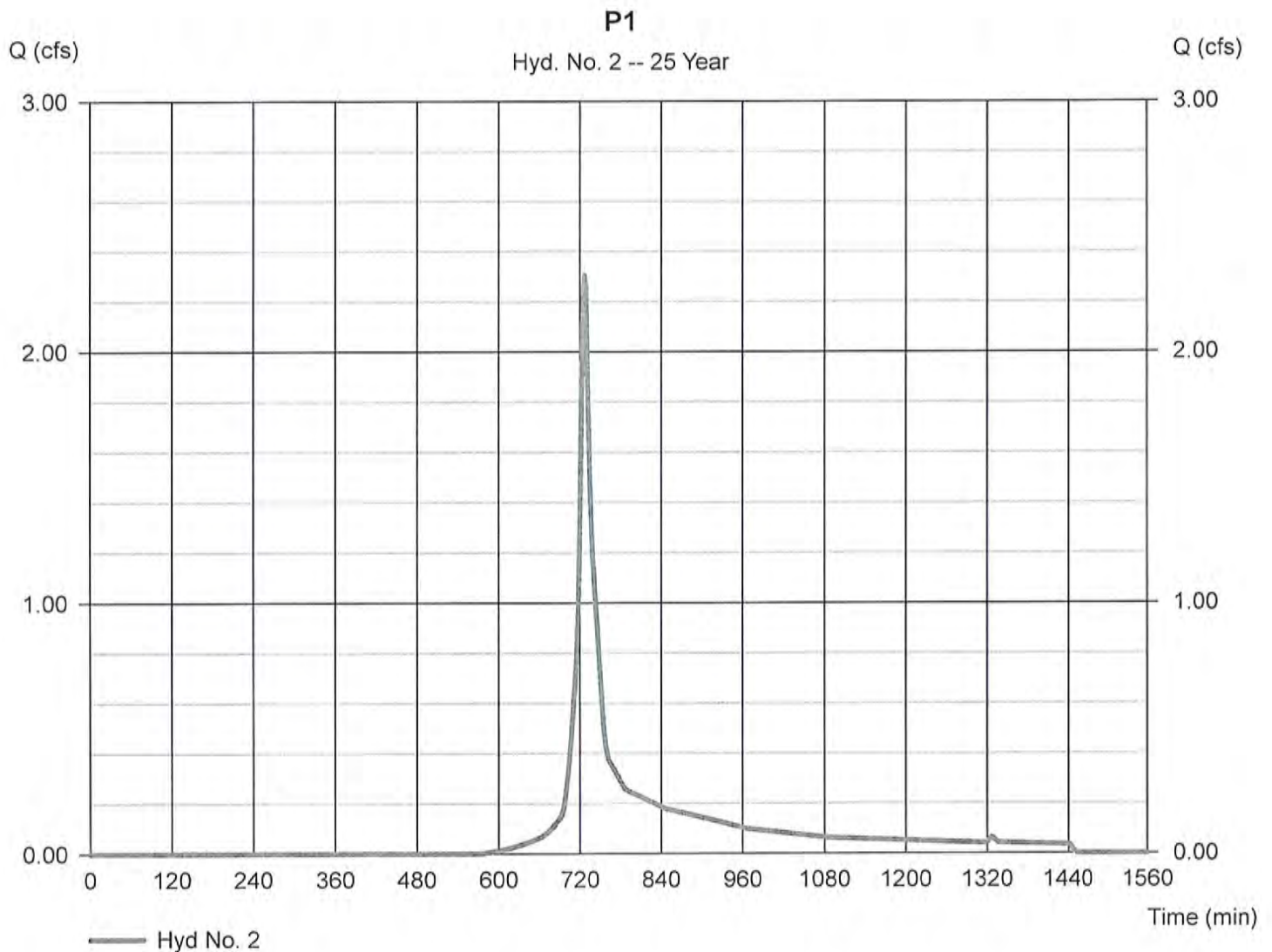
Monday, Oct 2, 2017

Hyd. No. 2

P1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.990 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.30 in
Storm duration = 24 hrs

Peak discharge = 2.304 cfs
Time to peak = 726 min
Hyd. volume = 8,007 cuft
Curve number = 69.6
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.60 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

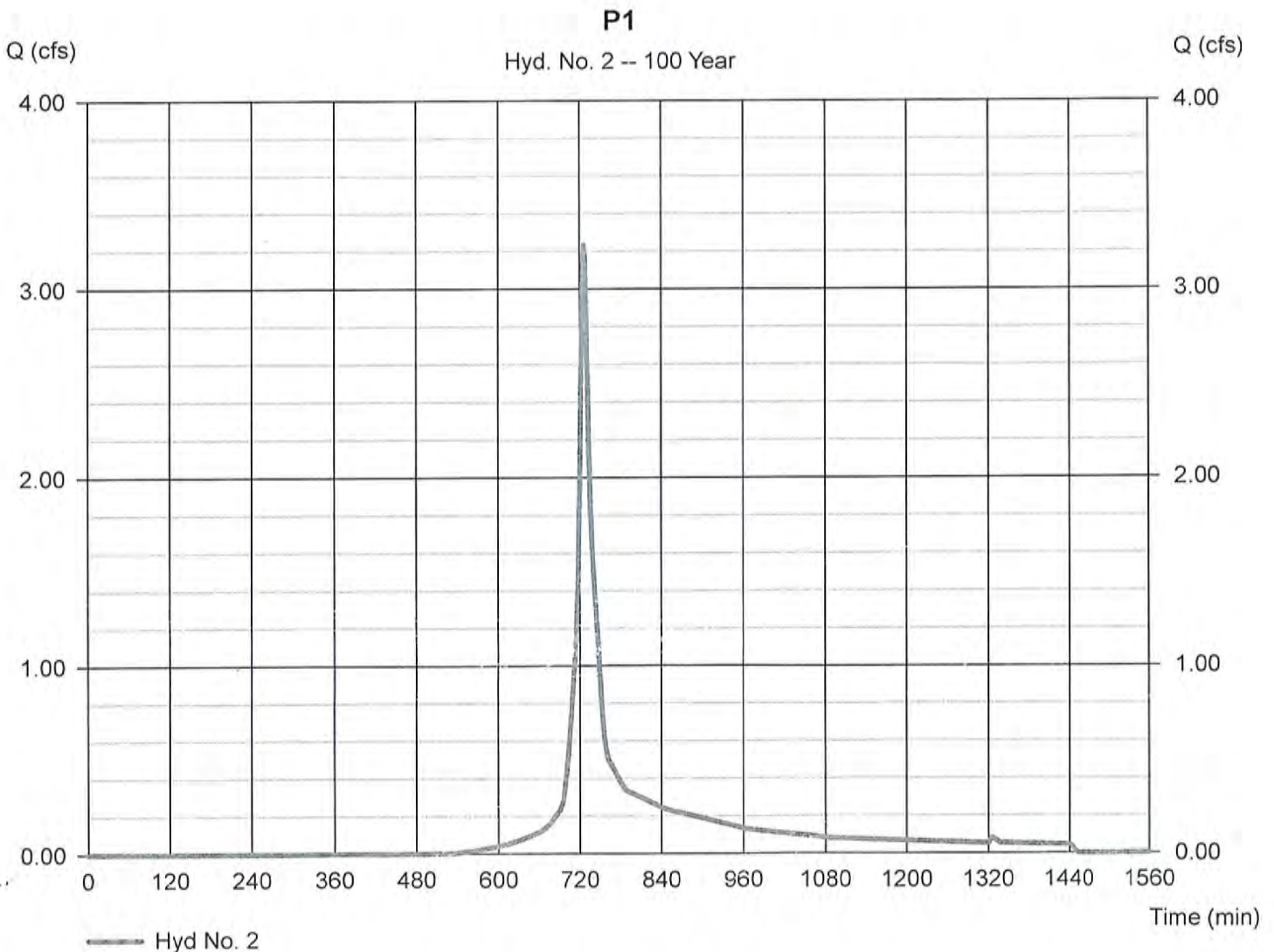
Monday, Oct 2, 2017

Hyd. No. 2

P1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.990 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 3.232 cfs
Time to peak = 726 min
Hyd. volume = 11,093 cuft
Curve number = 69.6
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.60 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

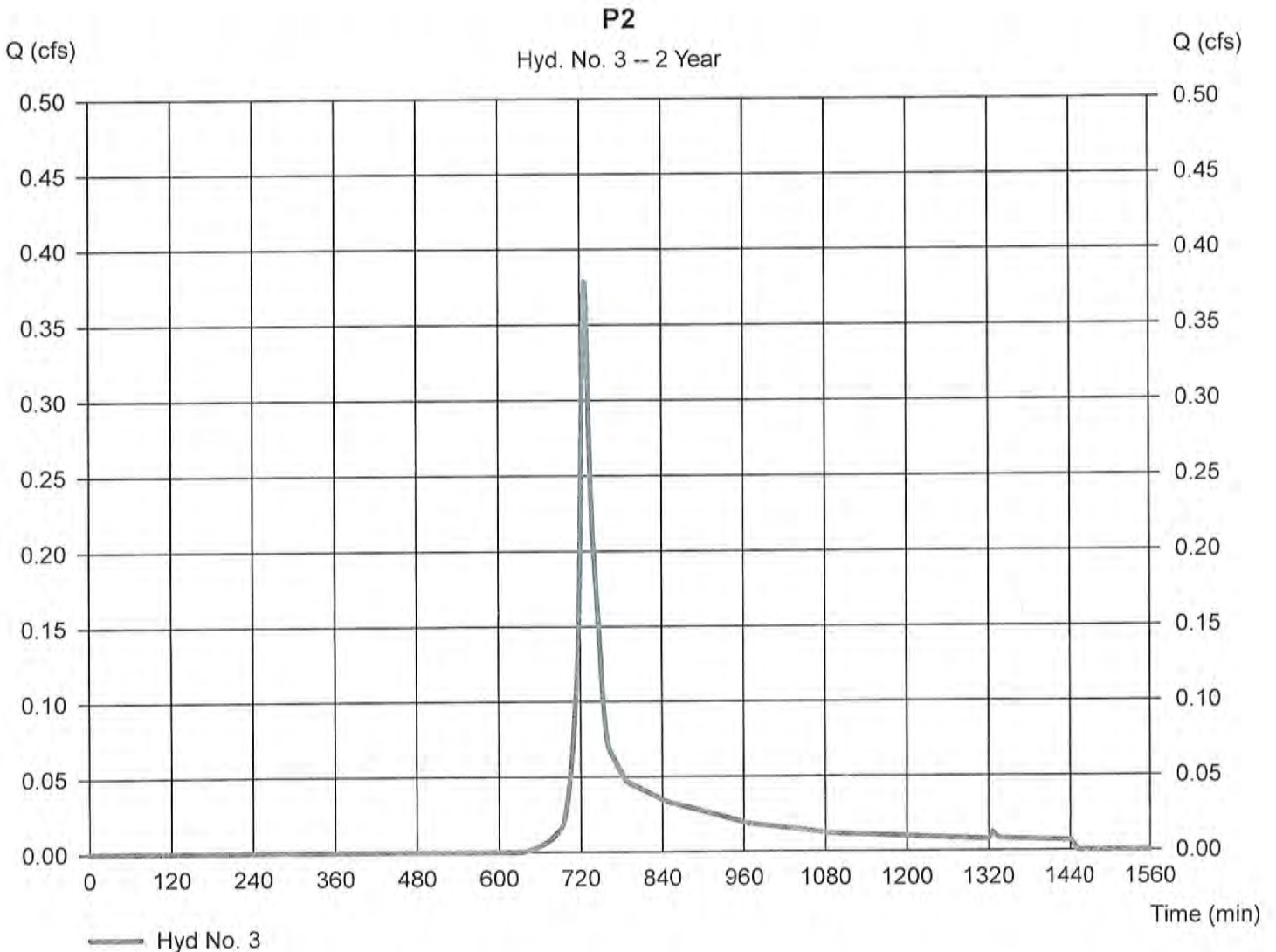
Monday, Oct 2, 2017

Hyd. No. 3

P2

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.370 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.10 in
Storm duration = 24 hrs

Peak discharge = 0.379 cfs
Time to peak = 726 min
Hyd. volume = 1,372 cuft
Curve number = 74.9
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.50 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

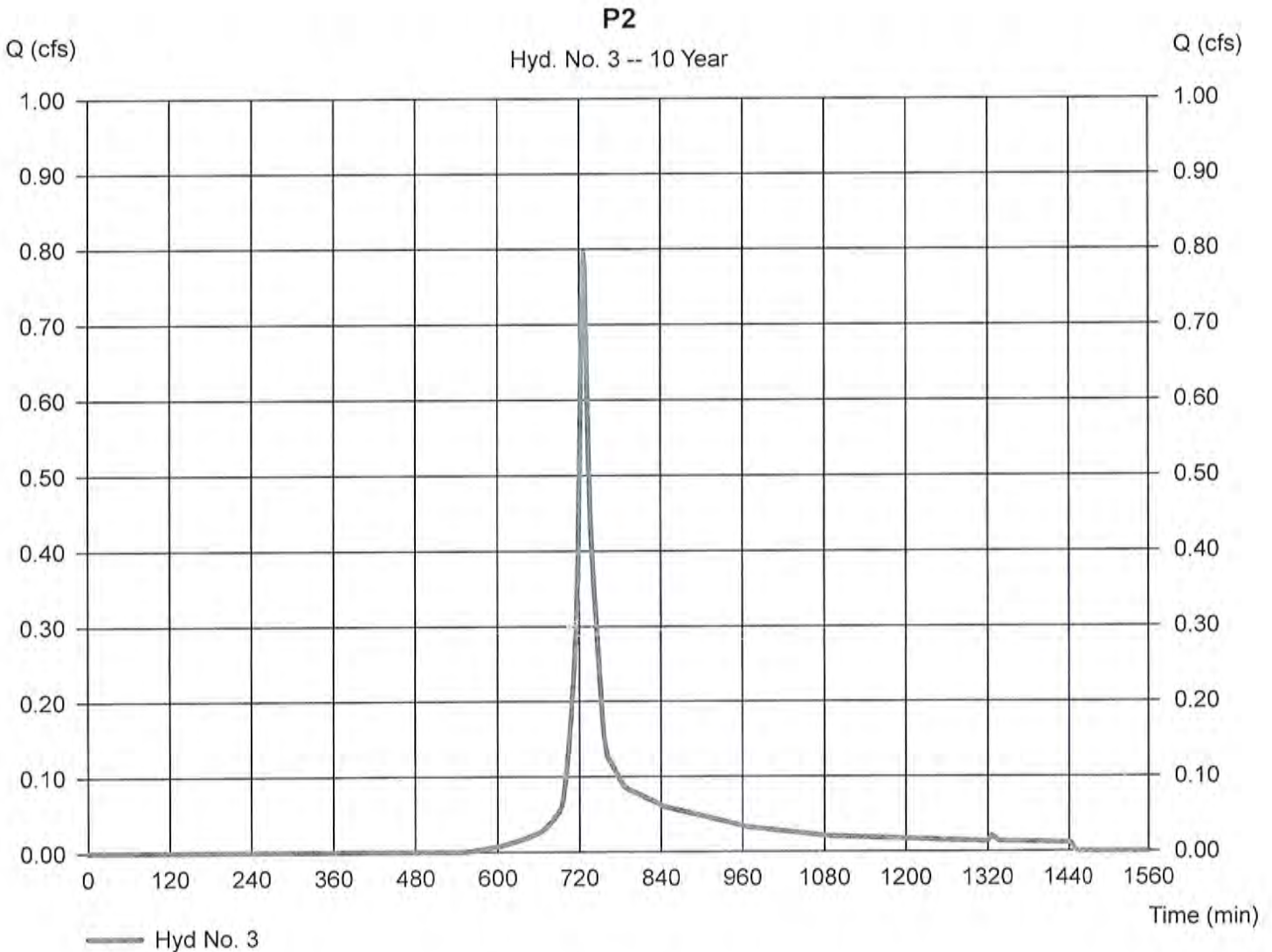
Monday, Oct 2, 2017

Hyd. No. 3

P2

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.370 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 0.796 cfs
Time to peak = 726 min
Hyd. volume = 2,743 cuft
Curve number = 74.9
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.50 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

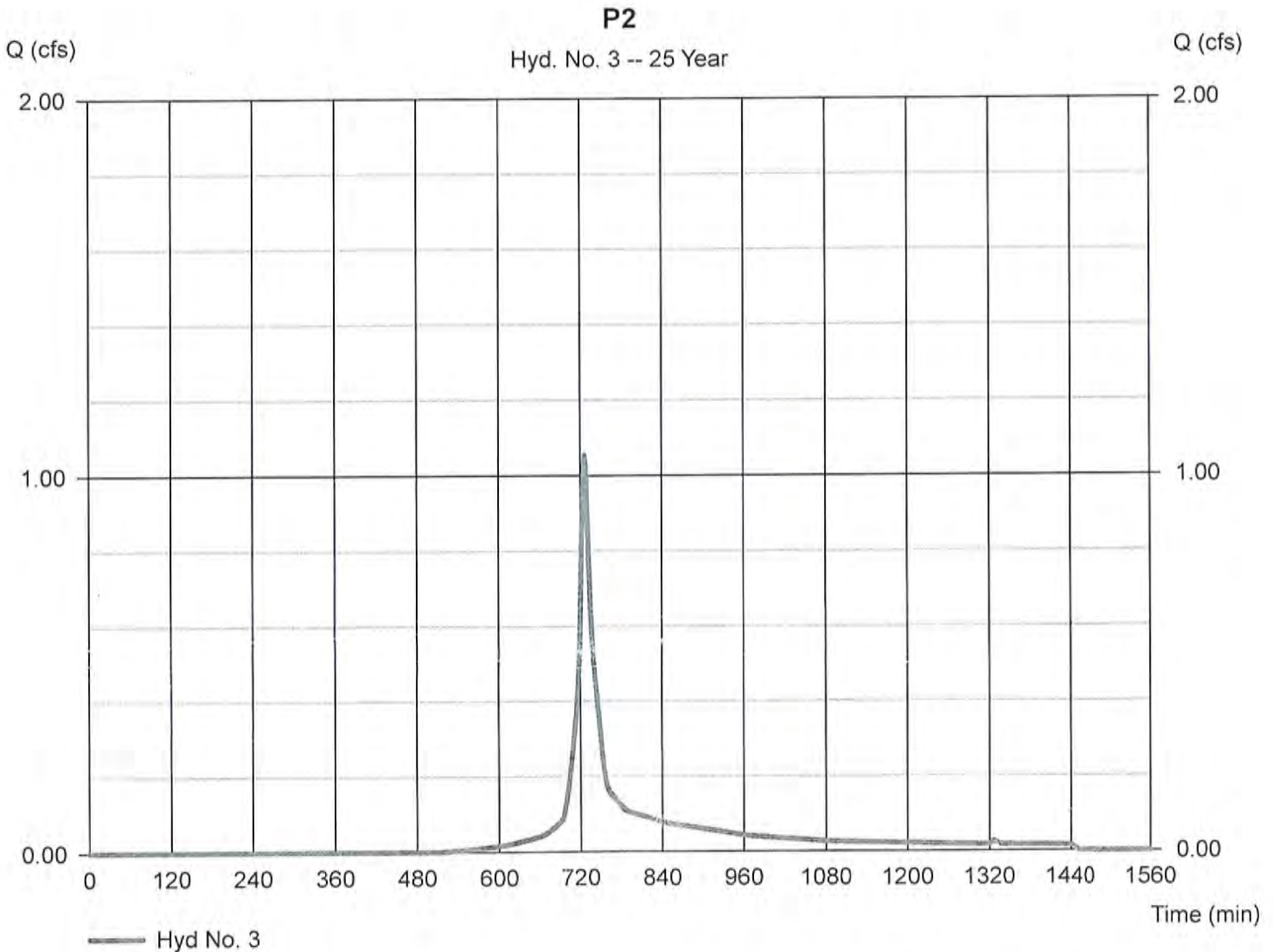
Monday, Oct 2, 2017

Hyd. No. 3

P2

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.370 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.30 in
Storm duration = 24 hrs

Peak discharge = 1.054 cfs
Time to peak = 726 min
Hyd. volume = 3,607 cuft
Curve number = 74.9
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.50 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

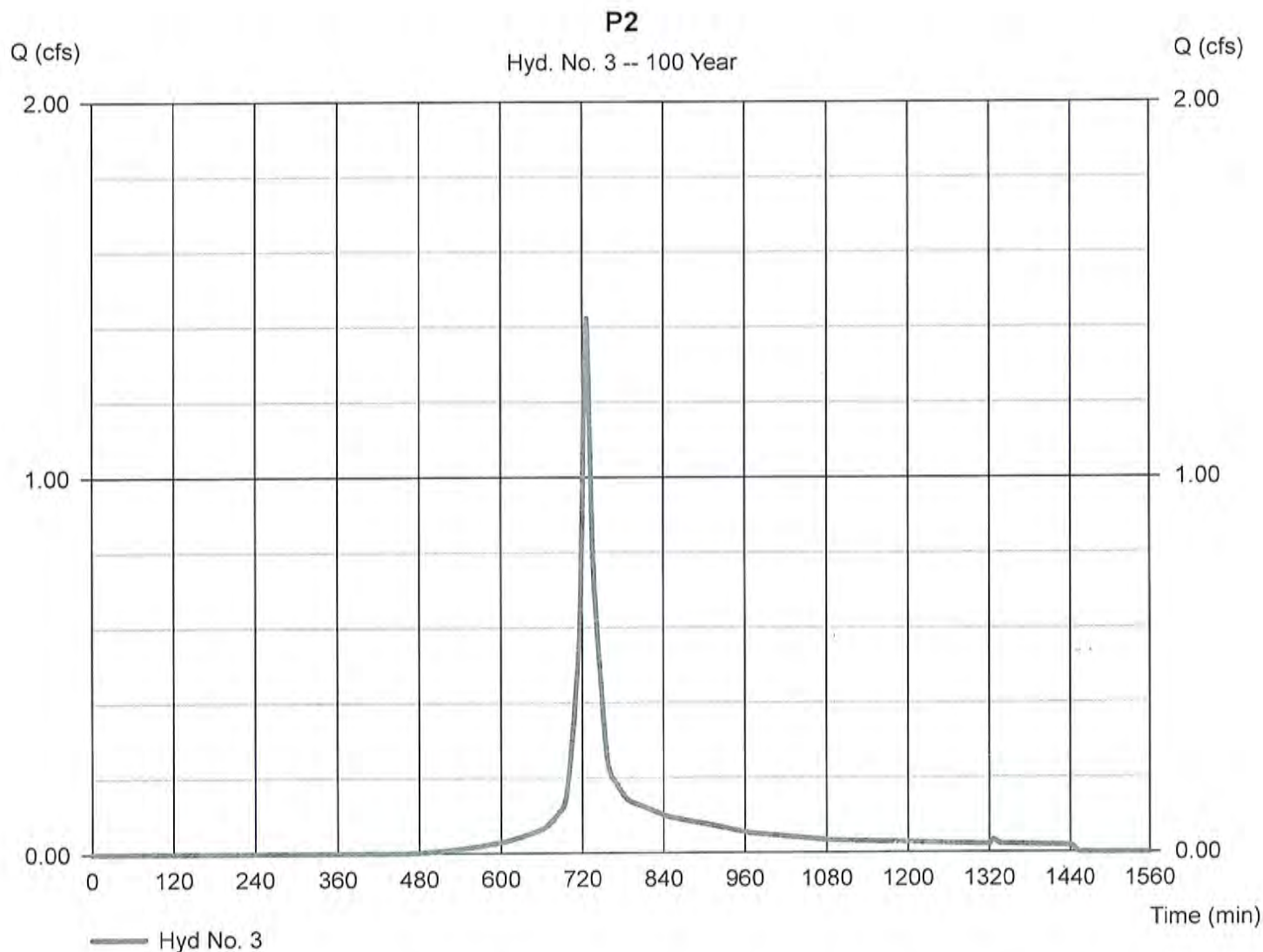
Monday, Oct 2, 2017

Hyd. No. 3

P2

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.370 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 1.422 cfs
Time to peak = 726 min
Hyd. volume = 4,856 cuft
Curve number = 74.9
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.50 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Oct 2, 2017

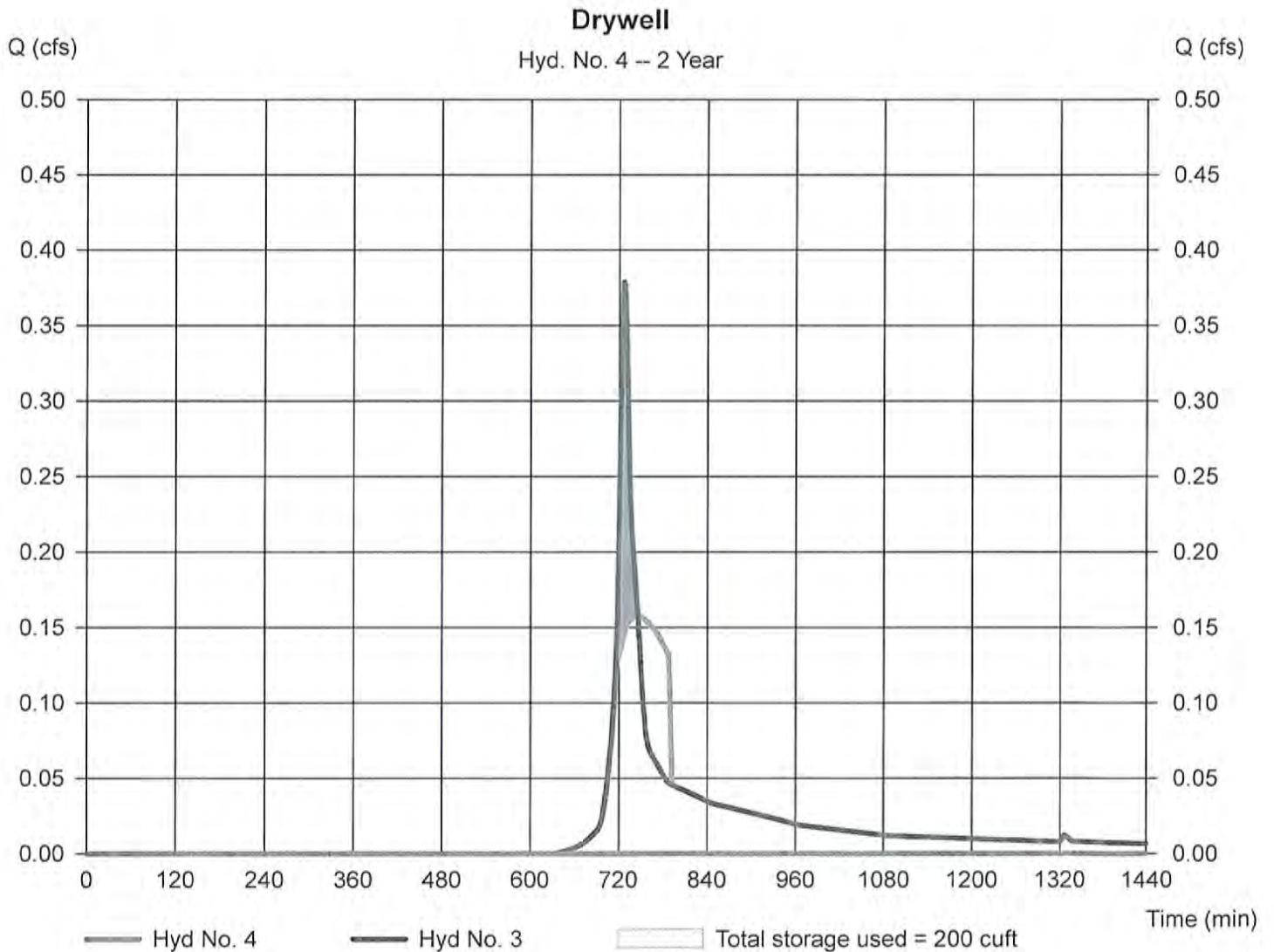
Hyd. No. 4

Drywell

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyd. No. = 3 - P2
Reservoir name = Stormtechs SC-740

Peak discharge = 0.000 cfs
Time to peak = 868 min
Hyd. volume = 0 cuft
Max. Elevation = 139.78 ft
Max. Storage = 200 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Oct 2, 2017

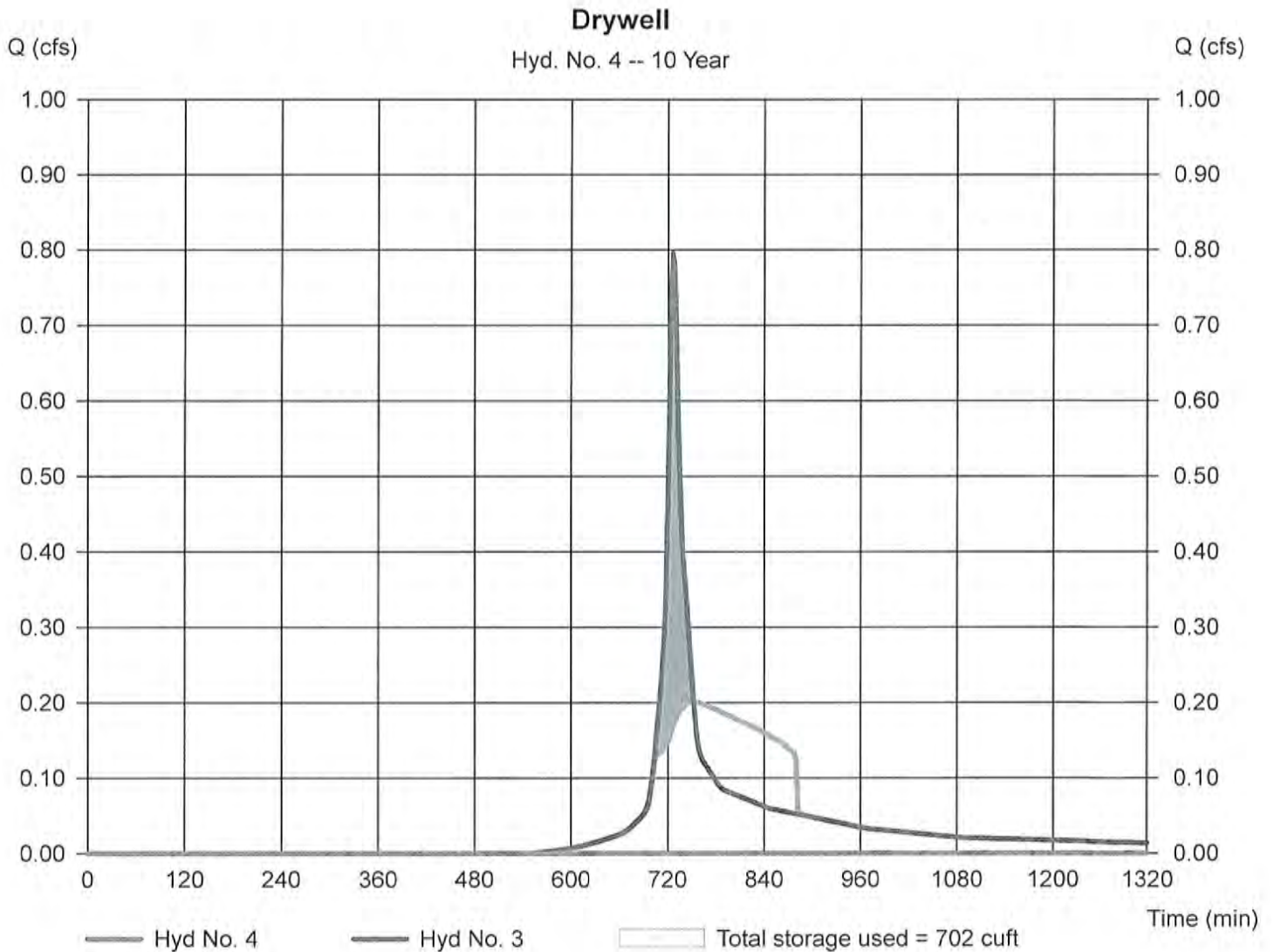
Hyd. No. 4

Drywell

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyd. No. = 3 - P2
Reservoir name = Stormtechs SC-740

Peak discharge = 0.000 cfs
Time to peak = 882 min
Hyd. volume = 0 cuft
Max. Elevation = 140.67 ft
Max. Storage = 702 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Oct 2, 2017

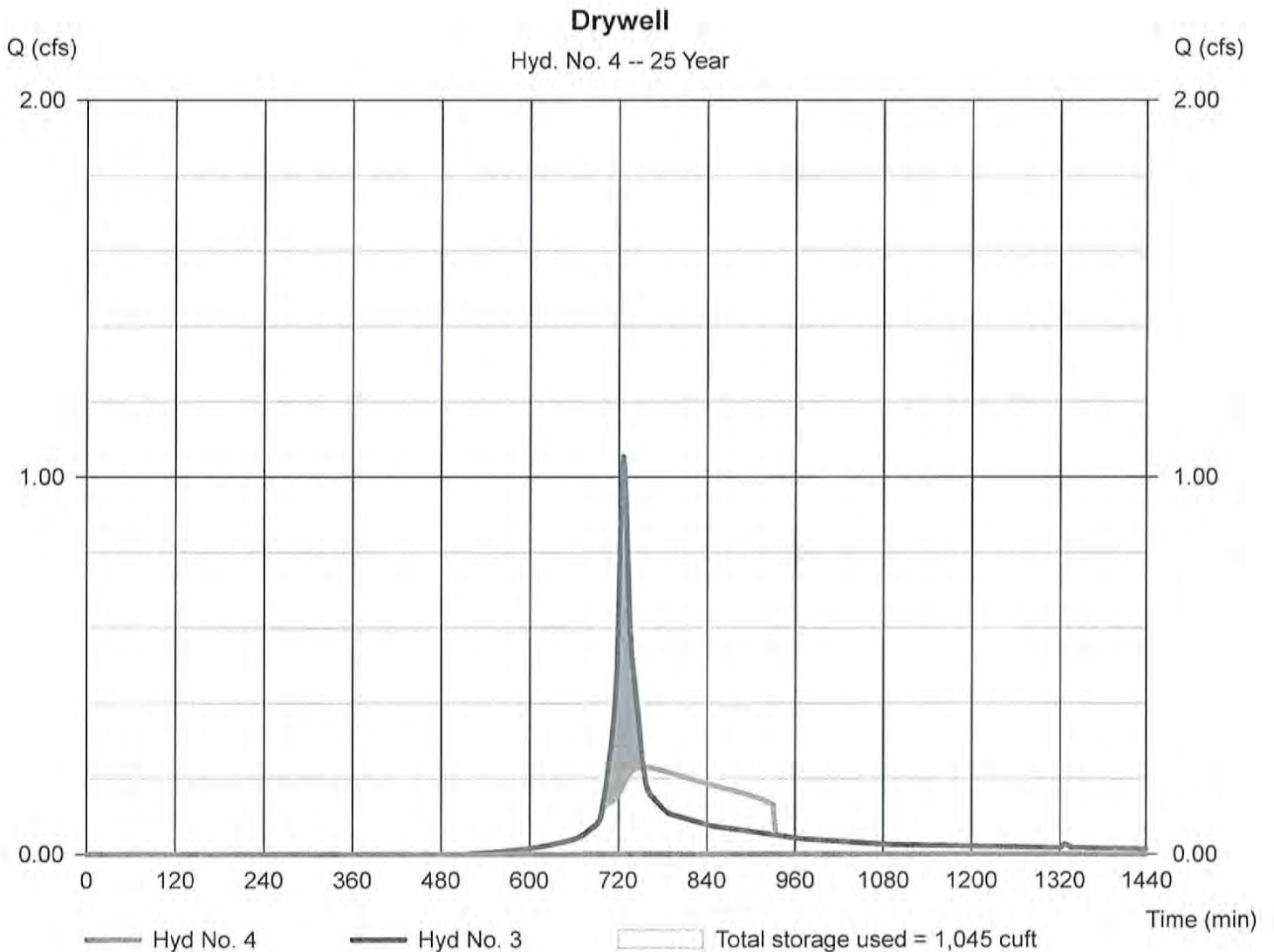
Hyd. No. 4

Drywell

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyd. No. = 3 - P2
Reservoir name = Stormtechs SC-740

Peak discharge = 0.000 cfs
Time to peak = 1058 min
Hyd. volume = 0 cuft
Max. Elevation = 141.29 ft
Max. Storage = 1,045 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Oct 2, 2017

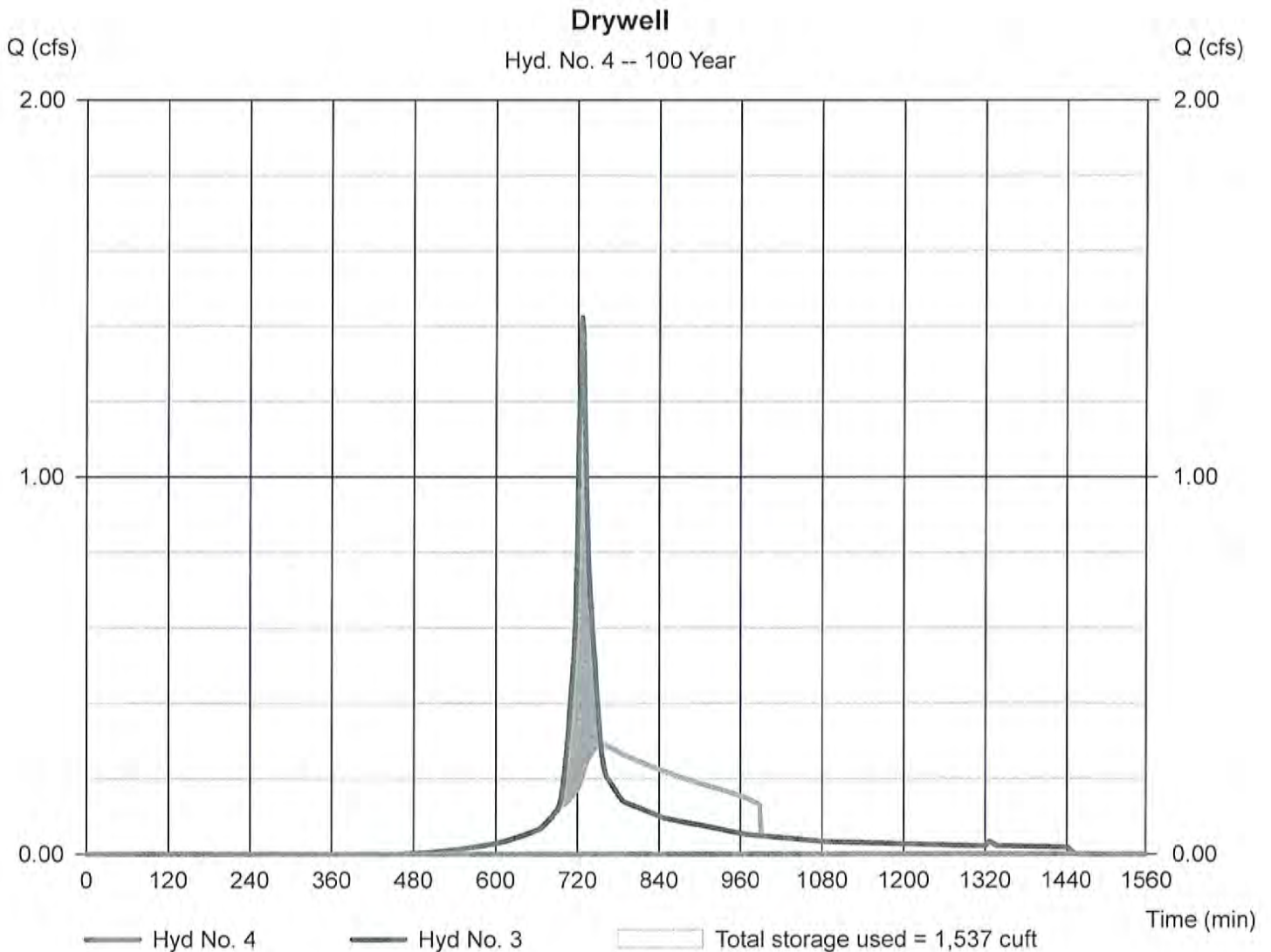
Hyd. No. 4

Drywell

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyd. No. = 3 - P2
Reservoir name = Stormtechs SC-740

Peak discharge = 0.000 cfs
Time to peak = 656 min
Hyd. volume = 0 cuft
Max. Elevation = 142.53 ft
Max. Storage = 1,537 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Oct 2, 2017

Pond No. 1 - Stormtechs SC-740

Pond Data

UG Chambers - Invert elev. = 139.70 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 42.72 ft, No. Barrels = 3, Slope = 0.00%, Headers = No
 Encasement - Invert elev. = 139.20 ft, Width = 5.25 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	139.20	n/a	0	0
0.35	139.55	n/a	94	94
0.70	139.90	n/a	160	254
1.05	140.25	n/a	207	461
1.40	140.60	n/a	204	665
1.75	140.95	n/a	197	862
2.10	141.30	n/a	188	1,050
2.45	141.65	n/a	175	1,225
2.80	142.00	n/a	154	1,378
3.15	142.35	n/a	111	1,490
3.50	142.70	n/a	94	1,584

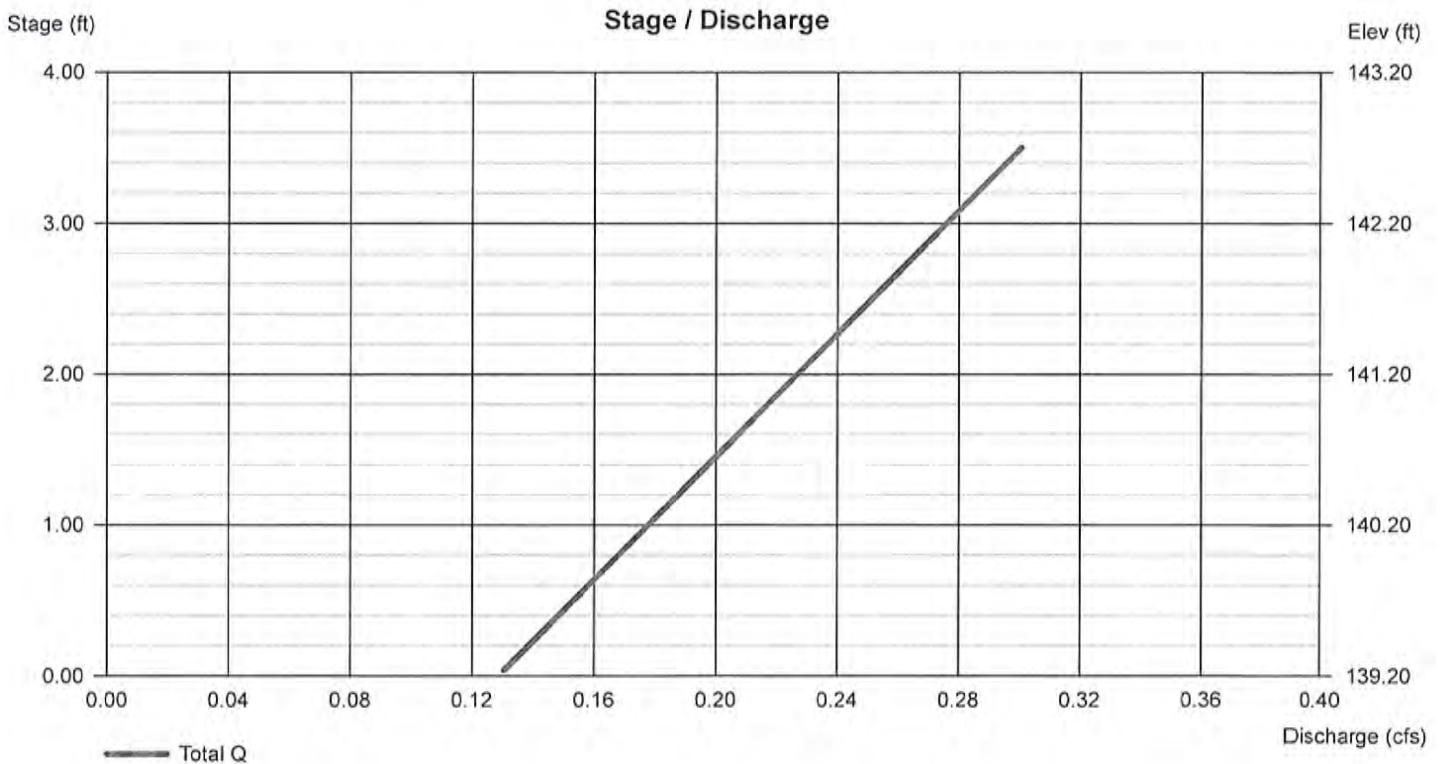
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	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)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 8.270 (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).



Worksheet 2: Runoff curve number and runoff

SM-5984

Project: Pine Point Road By DJC Date 9/27/17

Location: Stow, MA Checked _____ Date _____

Circle one: Present Developed P3-Southern Off Site Runoff

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 Square Ft
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley 253C A	Open Space	39			0.07	2.71
-	Impervious	98			0.01	1.39
Hinckley 253C A	Woods	30			0.00	0.00
Paxton 307D C	Woods	70			1.24	86.53
Paxton 307D C	Open Space	74			0.37	27.48
Totals =					1.69	118.12

1/ Use only one CN source per line.

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{118.12}{1.69} = 69.84 ; \text{ Use CN} = \boxed{69.8}$$

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.)

Runoff, Q..... cf
D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
0.76	1.66	3.11

4684 10204 19094
(210-VI-TR-55, Second Ed., June 1986)

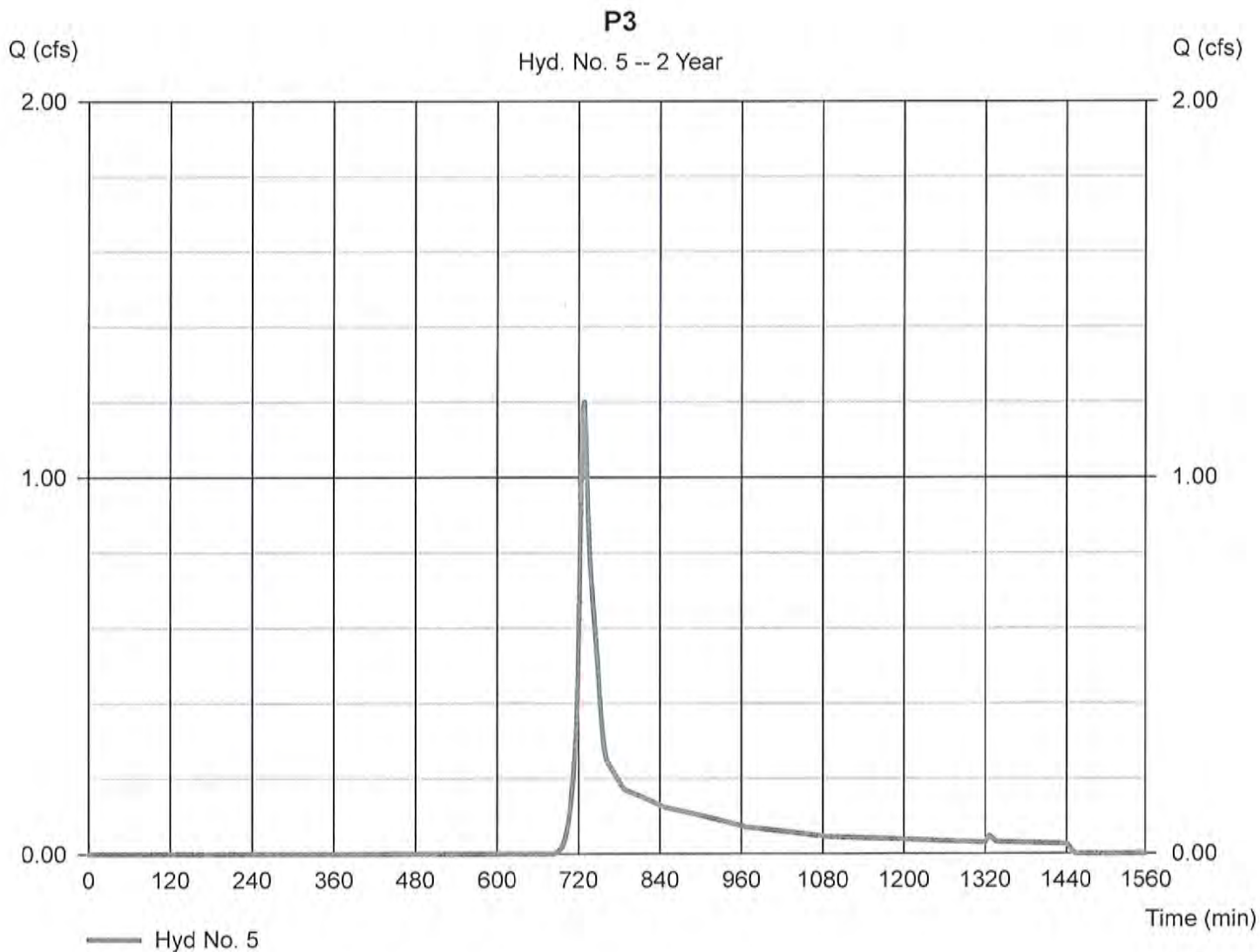
Hydrograph Report

Hyd. No. 5

P3

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 1.690 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.10 in
Storm duration = 24 hrs

Peak discharge = 1.200 cfs
Time to peak = 728 min
Hyd. volume = 4,669 cuft
Curve number = 69.8
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.80 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

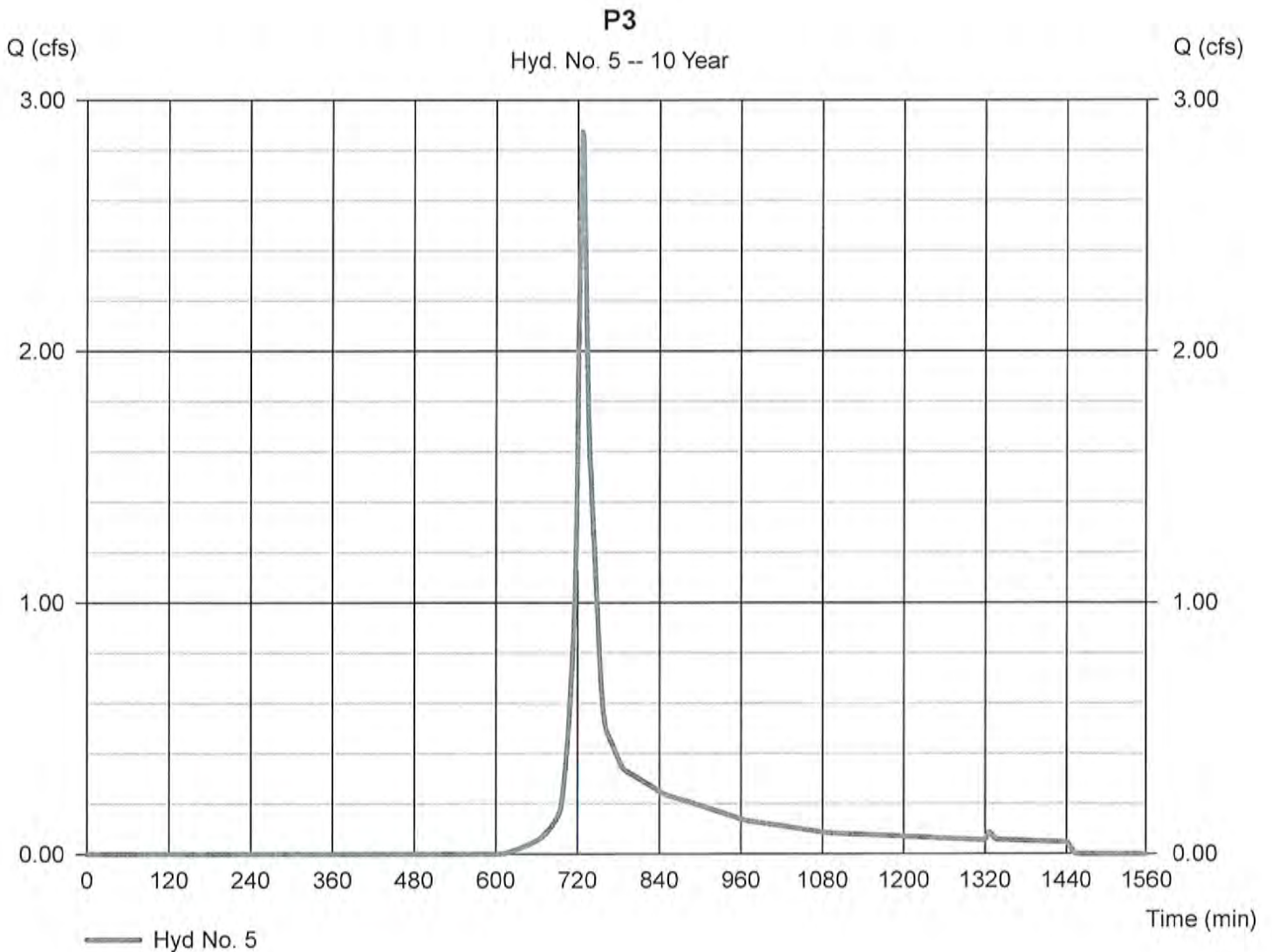
Monday, Oct 2, 2017

Hyd. No. 5

P3

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 1.690 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 2.874 cfs
Time to peak = 726 min
Hyd. volume = 10,180 cuft
Curve number = 69.8
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.80 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

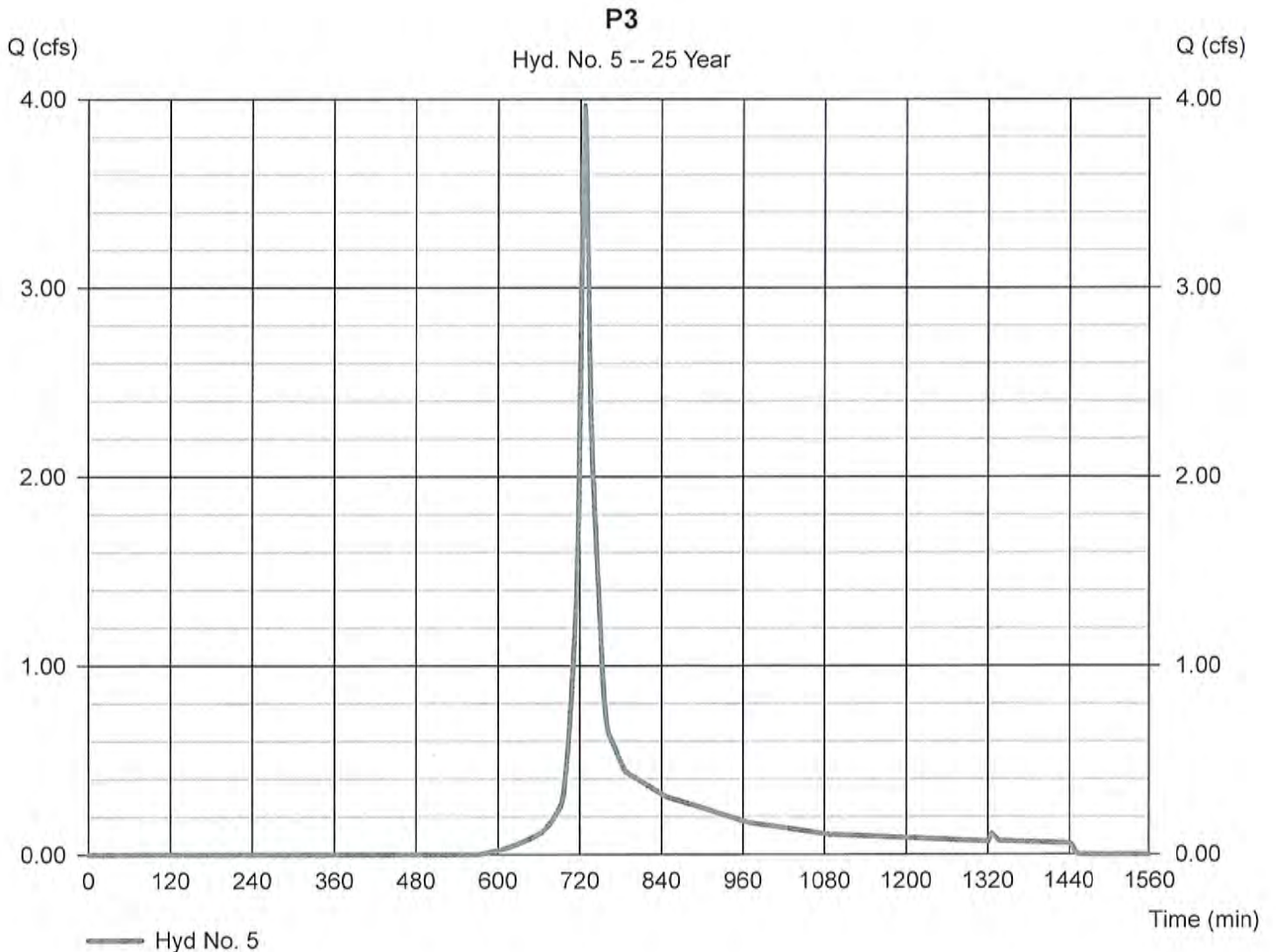
Monday, Oct 2, 2017

Hyd. No. 5

P3

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.690 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.30 in
Storm duration = 24 hrs

Peak discharge = 3.965 cfs
Time to peak = 726 min
Hyd. volume = 13,770 cuft
Curve number = 69.8
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.80 min
Distribution = Type III
Shape factor = 484



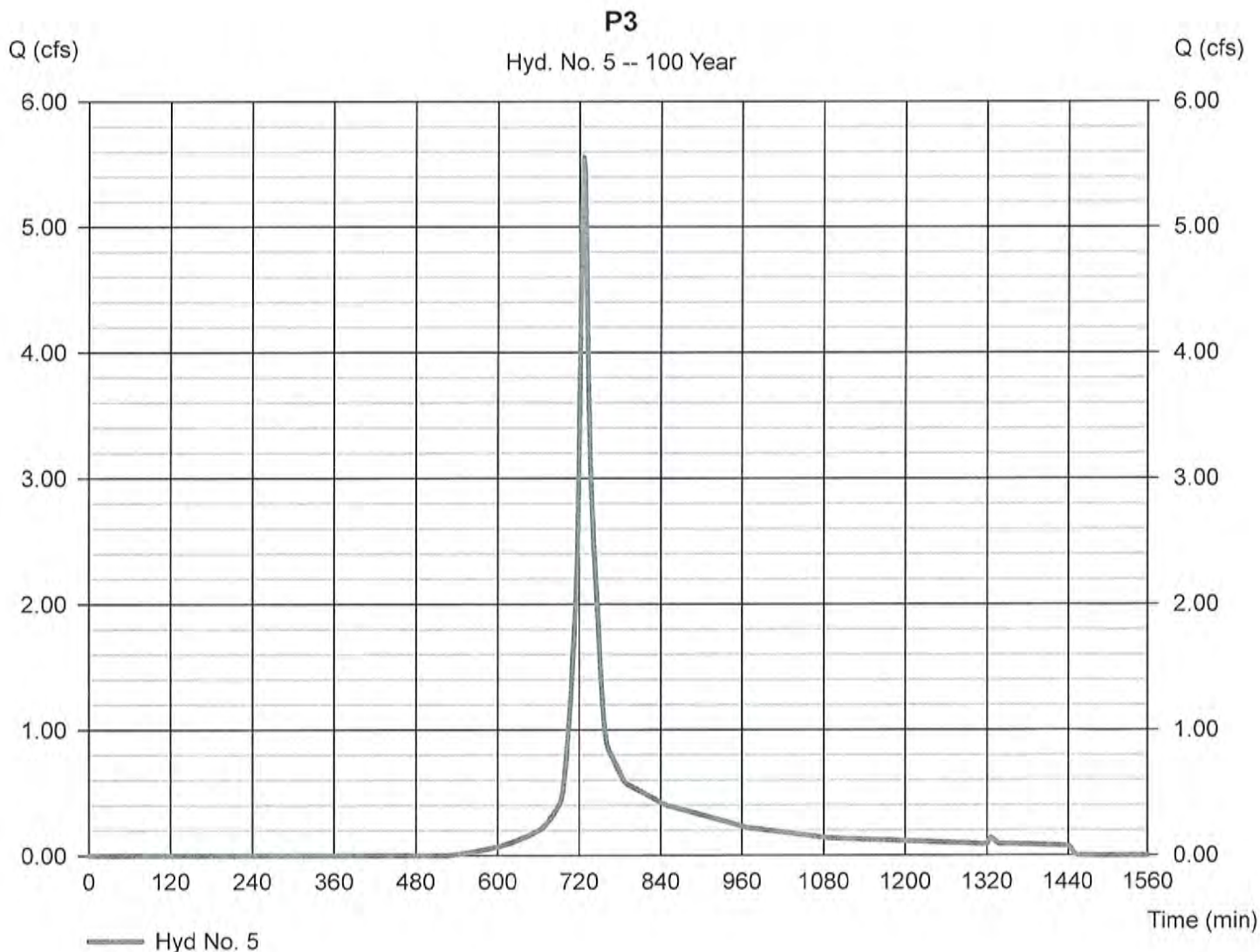
Hydrograph Report

Hyd. No. 5

P3

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 1.690 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 5.555 cfs
Time to peak = 726 min
Hyd. volume = 19,056 cuft
Curve number = 69.8
Hydraulic length = 0 ft
Time of conc. (Tc) = 8.80 min
Distribution = Type III
Shape factor = 484



Worksheet 2: Runoff curve number and runoff

SM-5984

Project: Pine Point Road By DJC Date 9/27/17

Location: Stow, MA Checked _____ Date _____

Circle one: Present Developed P4-Driveway & Open Space nearby

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 Square Ft
		Table 2-2	Fig. 2-3	Fig. 2-4		
Hinckley 253C A	Open Space	39			0.00	0.14
-	Impervious	98			0.03	3.22
Hinckley 253C A	Woods	30			0.00	0.00
Paxton 307D C	Woods	70			0.00	0.00
Paxton 307D C	Open Space	74			0.00	0.00
Totals =					0.04	3.36

1/ Use only one CN source per line.

$$CN \text{ (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{3.36}{0.04} = 92.34 ; \text{ Use CN} = \boxed{92.3}$$

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.)

Runoff, Q..... cf

D-2

Storm #1	Storm #2	Storm #3
2	10	100
3.1	4.5	6.4
2.29	3.64	5.50

302	480	726
-----	-----	-----

(210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

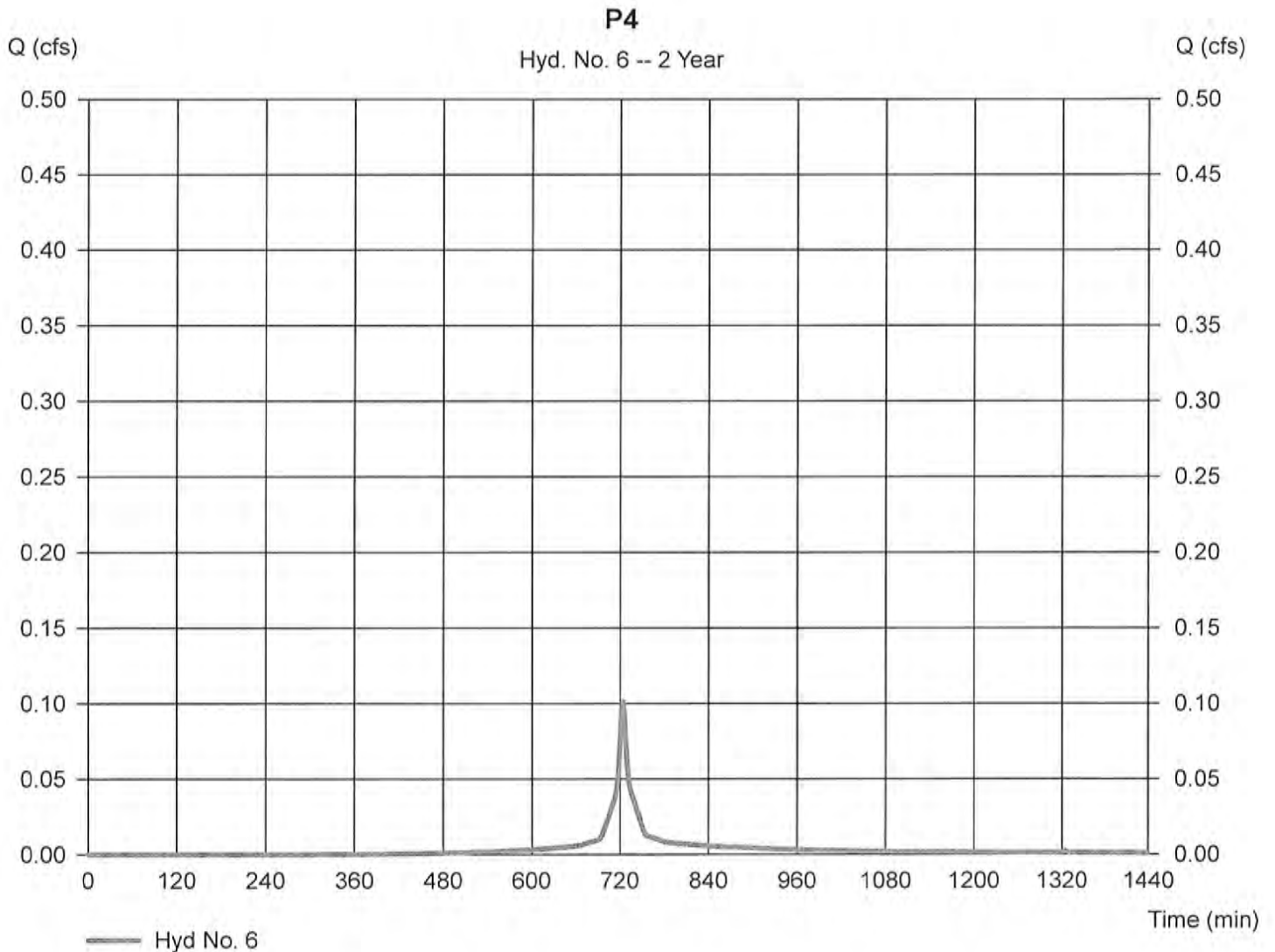
Monday, Oct 2, 2017

Hyd. No. 6

P4

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Time interval = 2 min
Drainage area = 0.040 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.10 in
Storm duration = 24 hrs

Peak discharge = 0.101 cfs
Time to peak = 724 min
Hyd. volume = 311 cuft
Curve number = 92.3
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



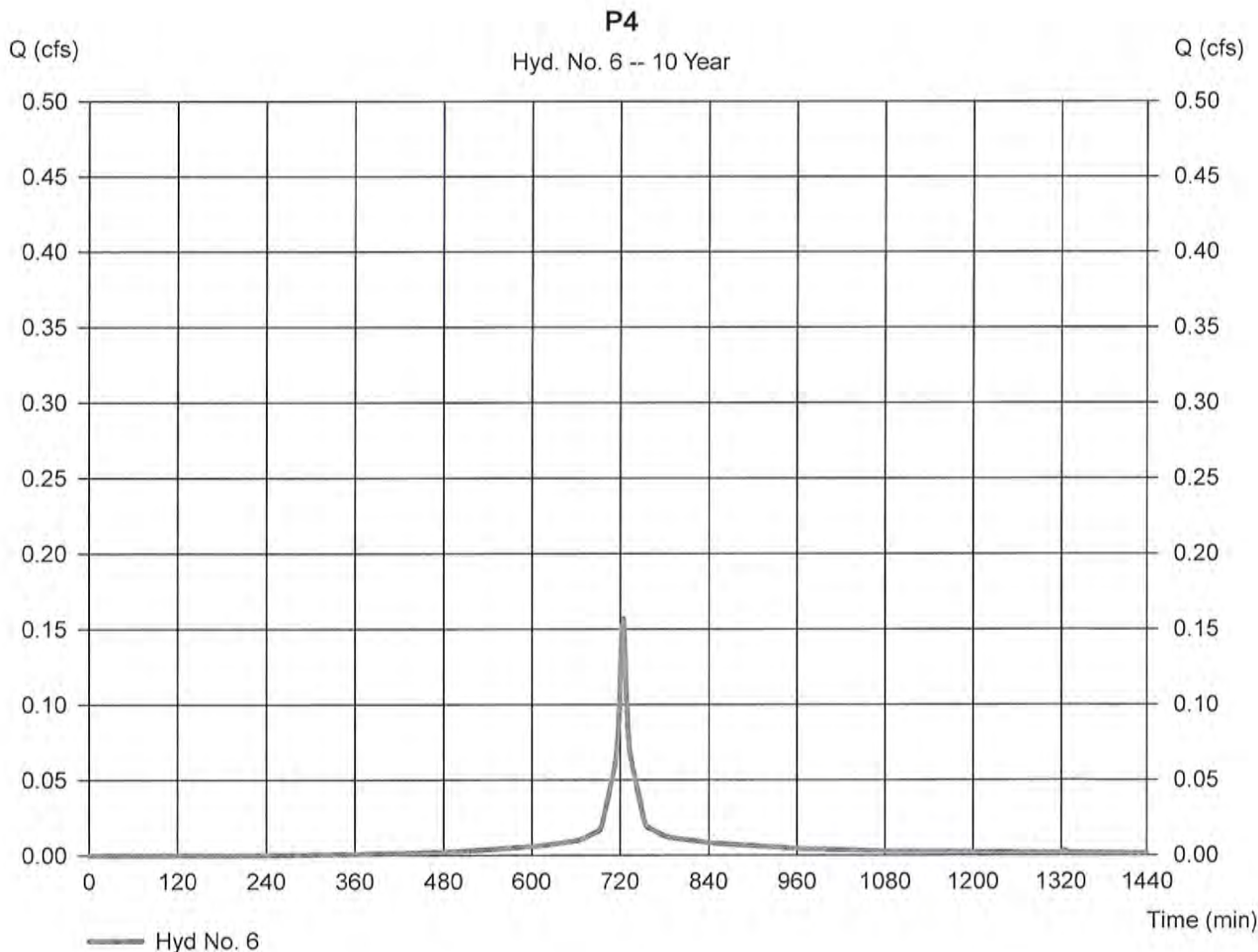
Hydrograph Report

Hyd. No. 6

P4

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 2 min
Drainage area = 0.040 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 4.50 in
Storm duration = 24 hrs

Peak discharge = 0.157 cfs
Time to peak = 724 min
Hyd. volume = 495 cuft
Curve number = 92.3
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

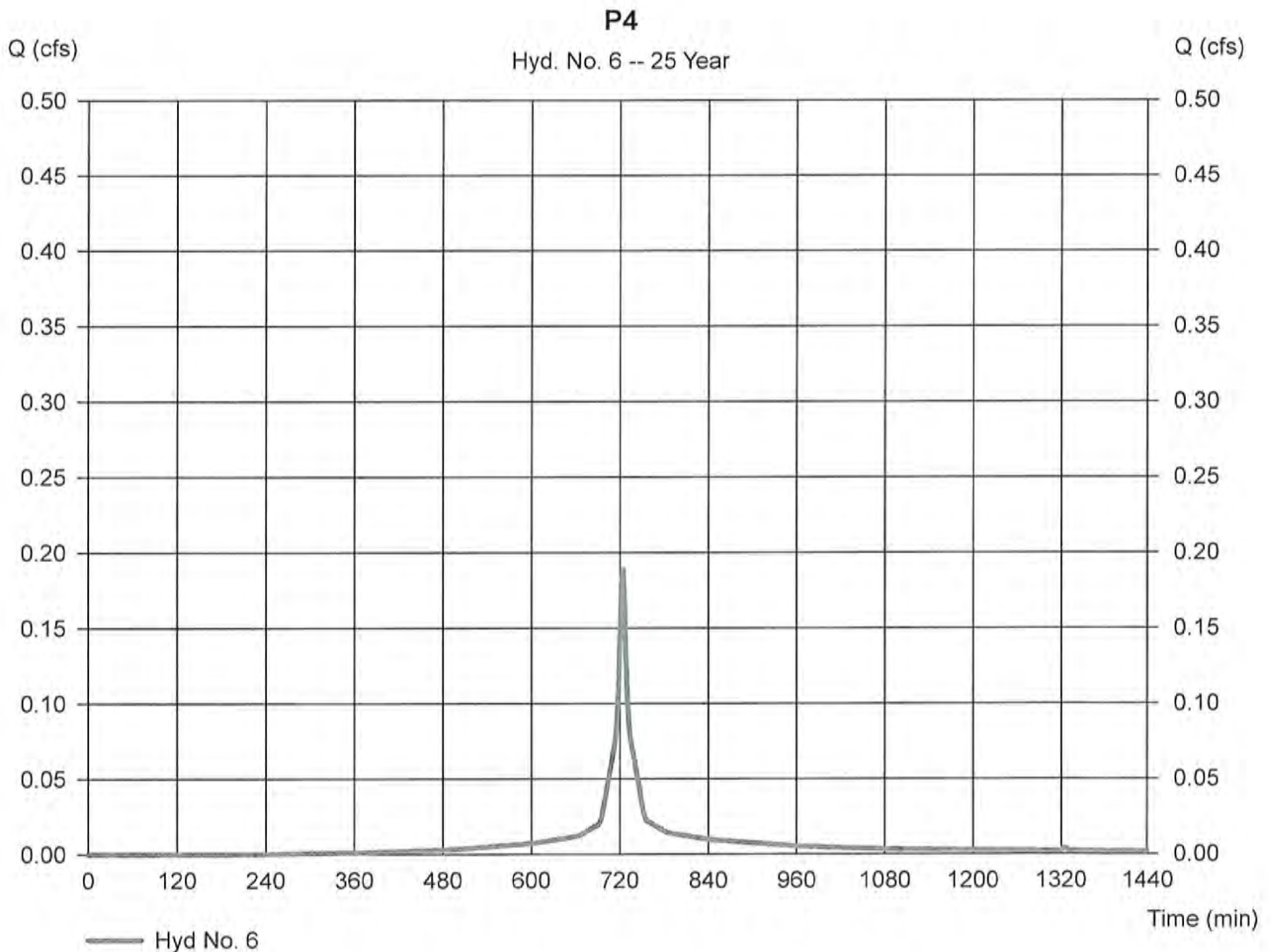
Monday, Oct 2, 2017

Hyd. No. 6

P4

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.040 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.30 in
Storm duration = 24 hrs

Peak discharge = 0.189 cfs
Time to peak = 724 min
Hyd. volume = 601 cuft
Curve number = 92.3
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

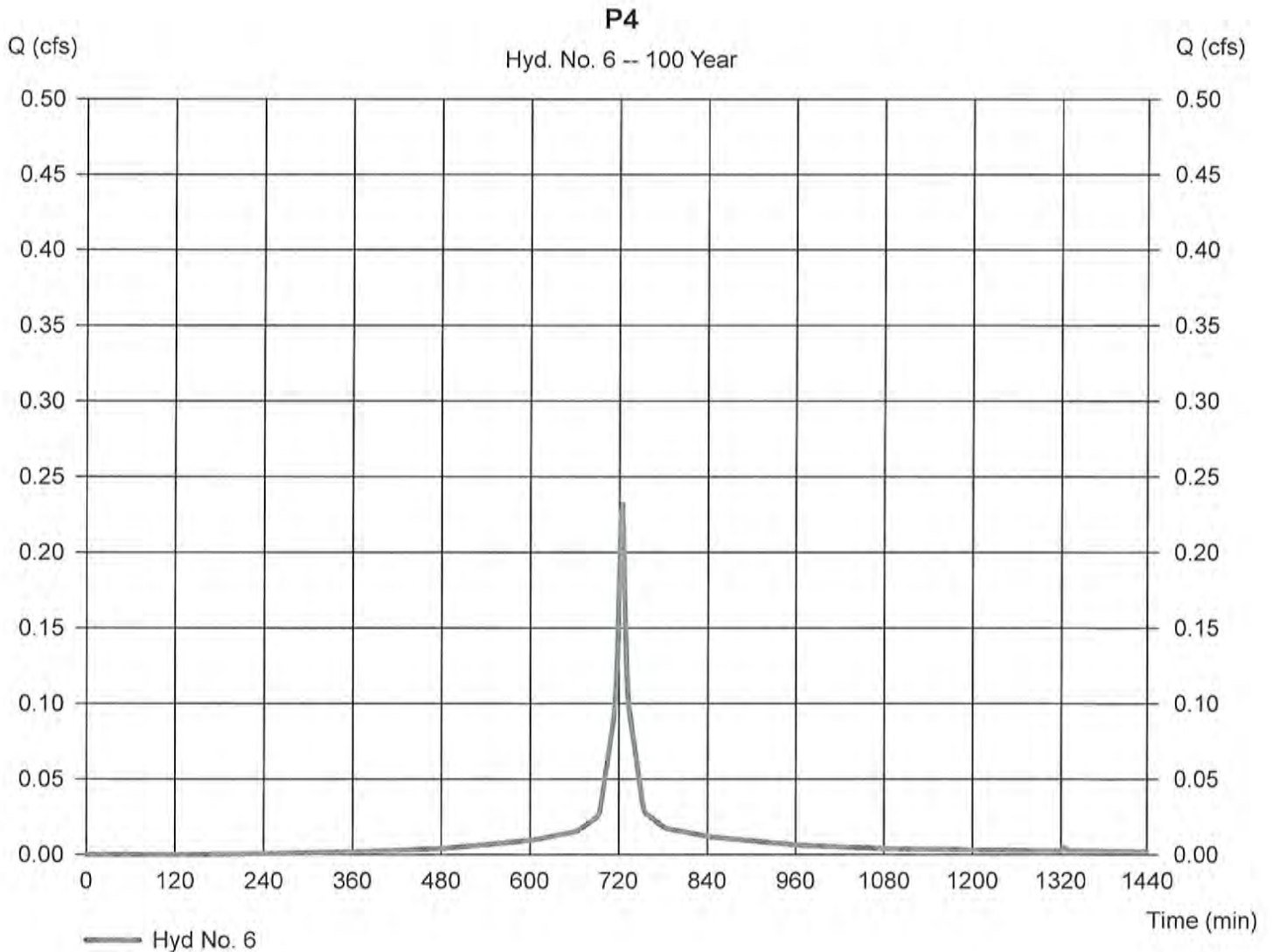
Monday, Oct 2, 2017

Hyd. No. 6

P4

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.040 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 0.232 cfs
Time to peak = 724 min
Hyd. volume = 748 cuft
Curve number = 92.3
Hydraulic length = 0 ft
Time of conc. (Tc) = 6.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

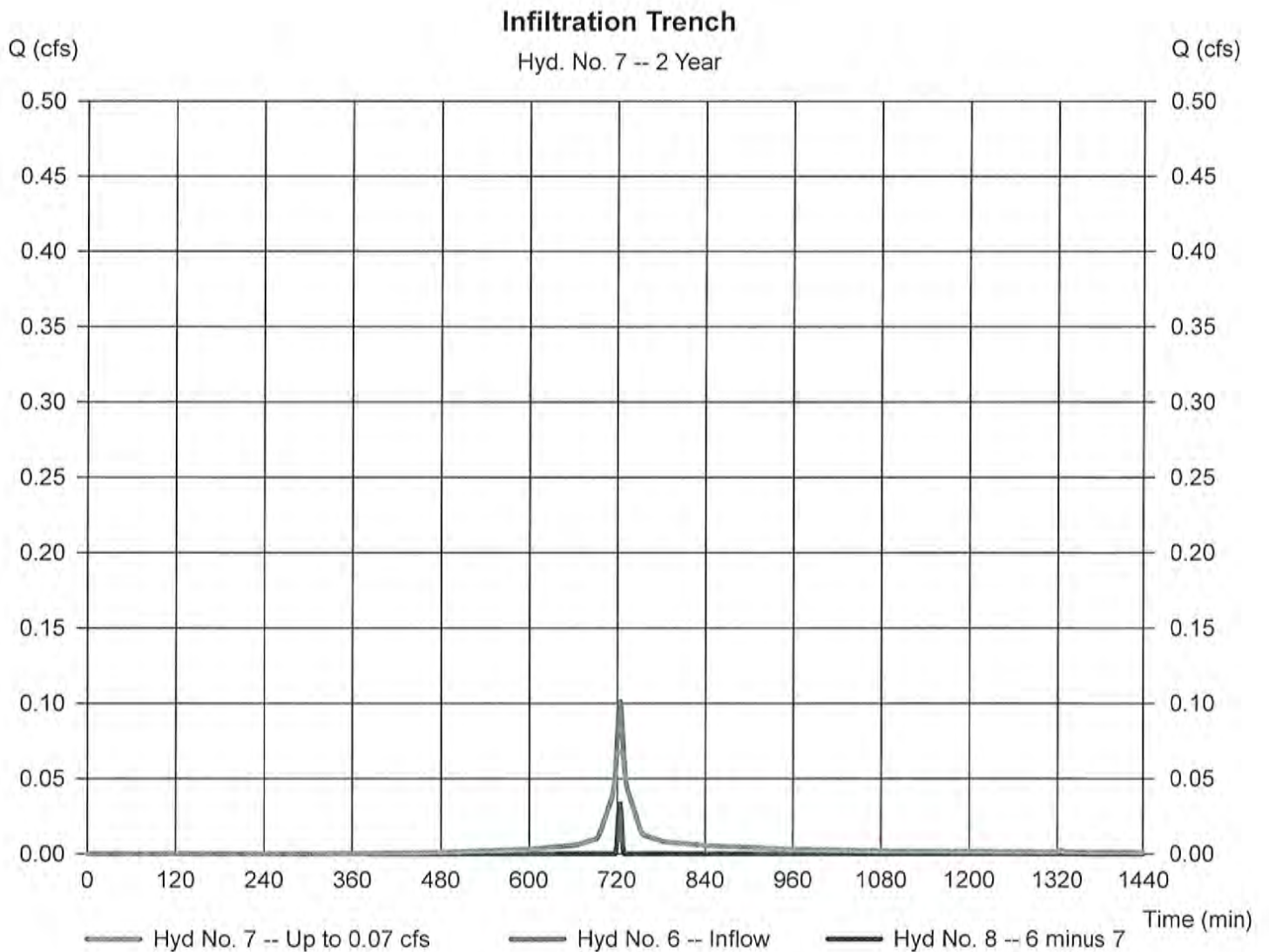
Monday, Oct 2, 2017

Hyd. No. 7

Infiltration Trench

Hydrograph type = Diversion1
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.068 cfs
Time to peak = 720 min
Hyd. volume = 300 cuft
2nd diverted hyd. = 8
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

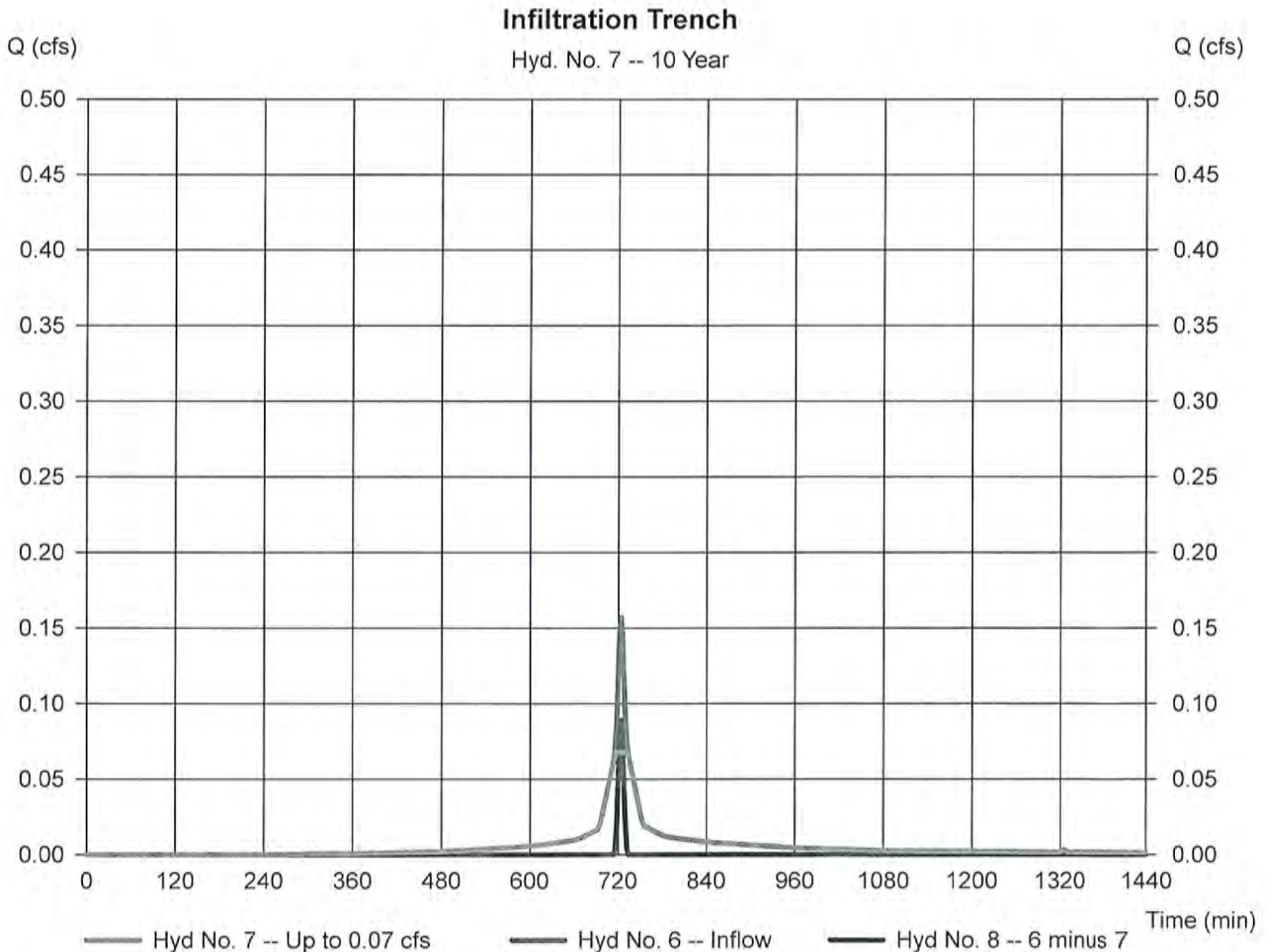
Monday, Oct 2, 2017

Hyd. No. 7

Infiltration Trench

Hydrograph type = Diversion1
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.068 cfs
Time to peak = 716 min
Hyd. volume = 449 cuft
2nd diverted hyd. = 8
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

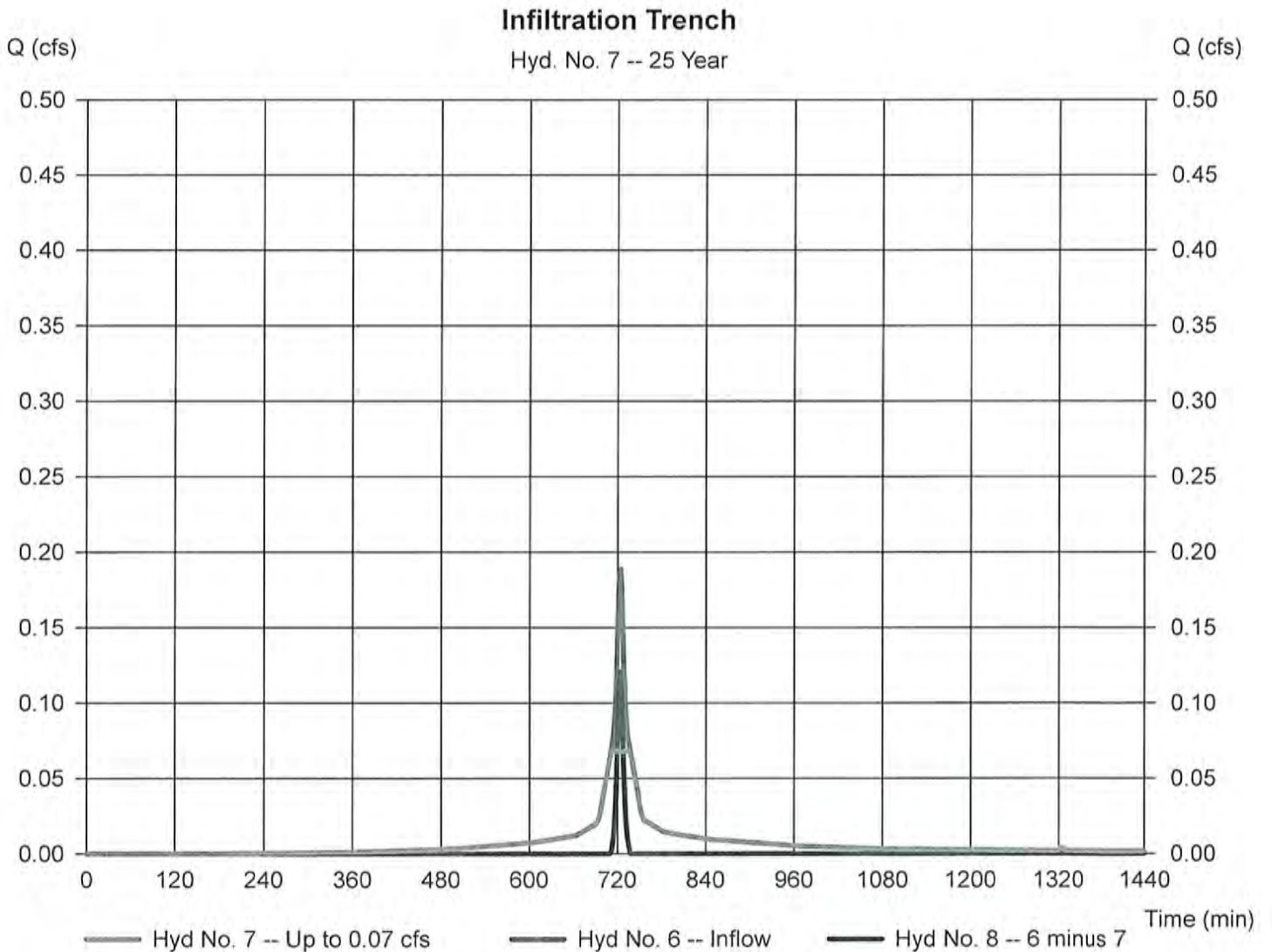
Monday, Oct 2, 2017

Hyd. No. 7

Infiltration Trench

Hydrograph type = Diversion1
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.068 cfs
Time to peak = 712 min
Hyd. volume = 529 cuft
2nd diverted hyd. = 8
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

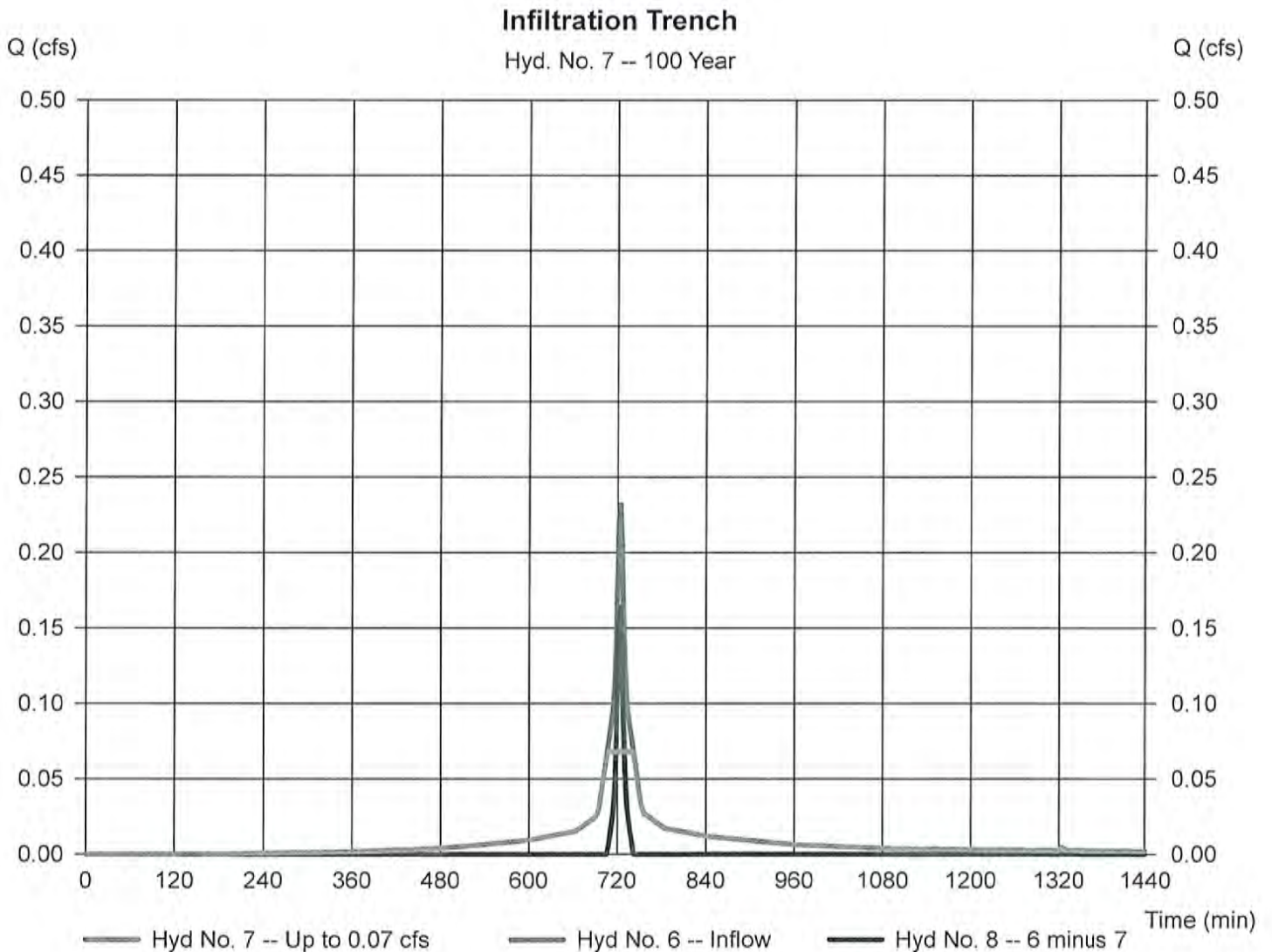
Monday, Oct 2, 2017

Hyd. No. 7

Infiltration Trench

Hydrograph type = Diversion1
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.068 cfs
Time to peak = 708 min
Hyd. volume = 630 cuft
2nd diverted hyd. = 8
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

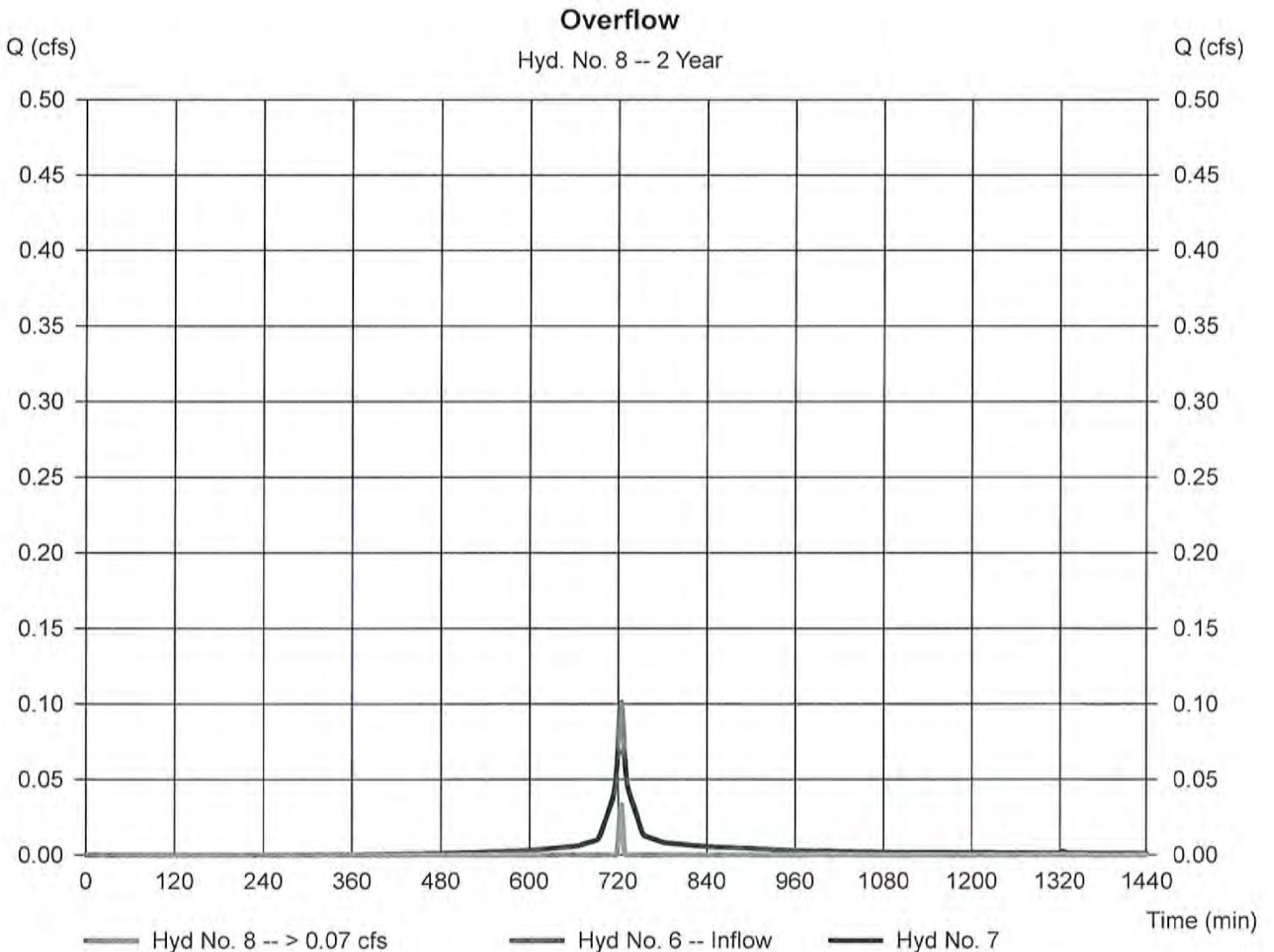
Monday, Oct 2, 2017

Hyd. No. 8

Overflow

Hydrograph type = Diversion2
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.033 cfs
Time to peak = 724 min
Hyd. volume = 11 cuft
2nd diverted hyd. = 7
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

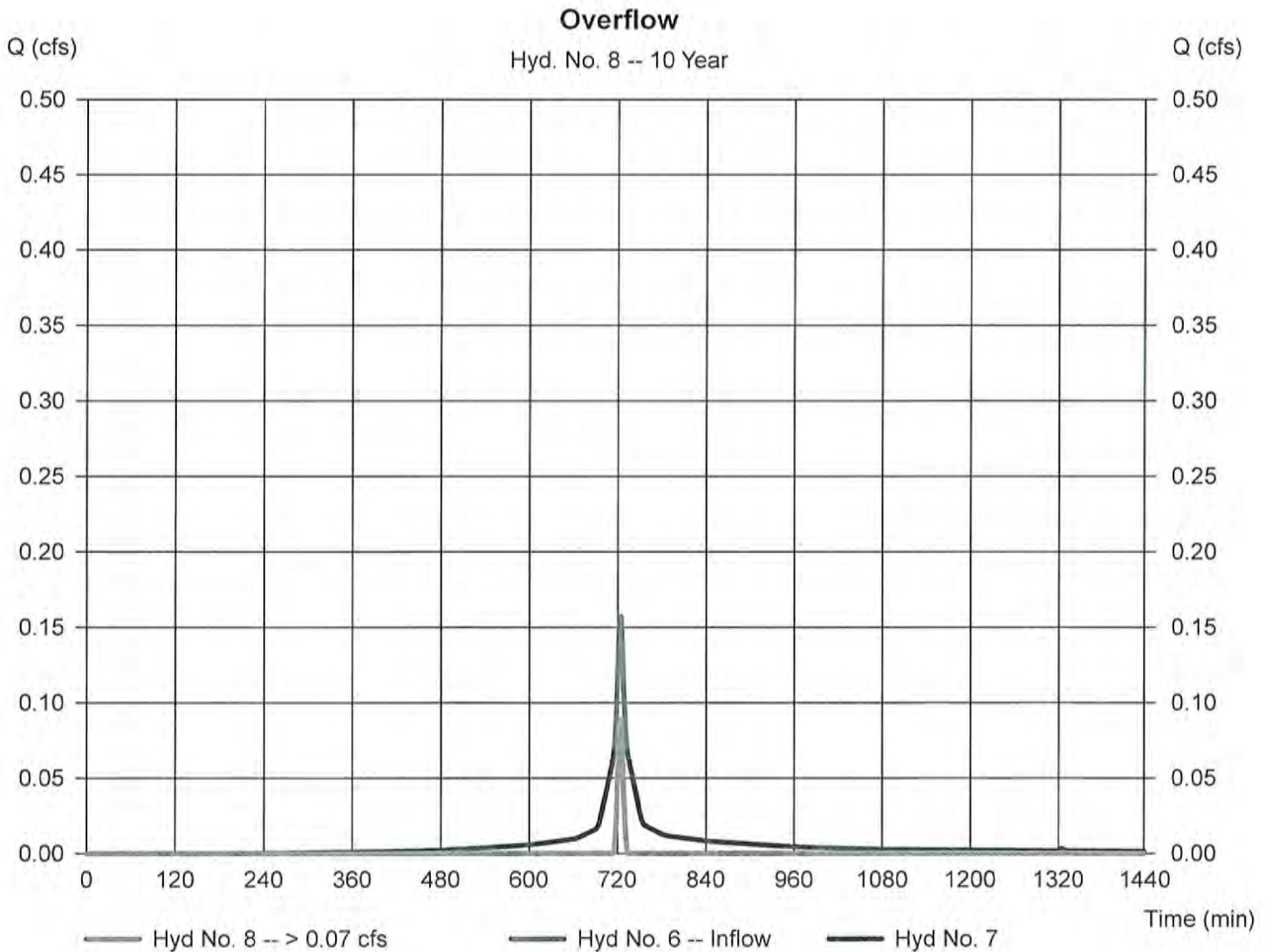
Monday, Oct 2, 2017

Hyd. No. 8

Overflow

Hydrograph type = Diversion2
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.089 cfs
Time to peak = 724 min
Hyd. volume = 46 cuft
2nd diverted hyd. = 7
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

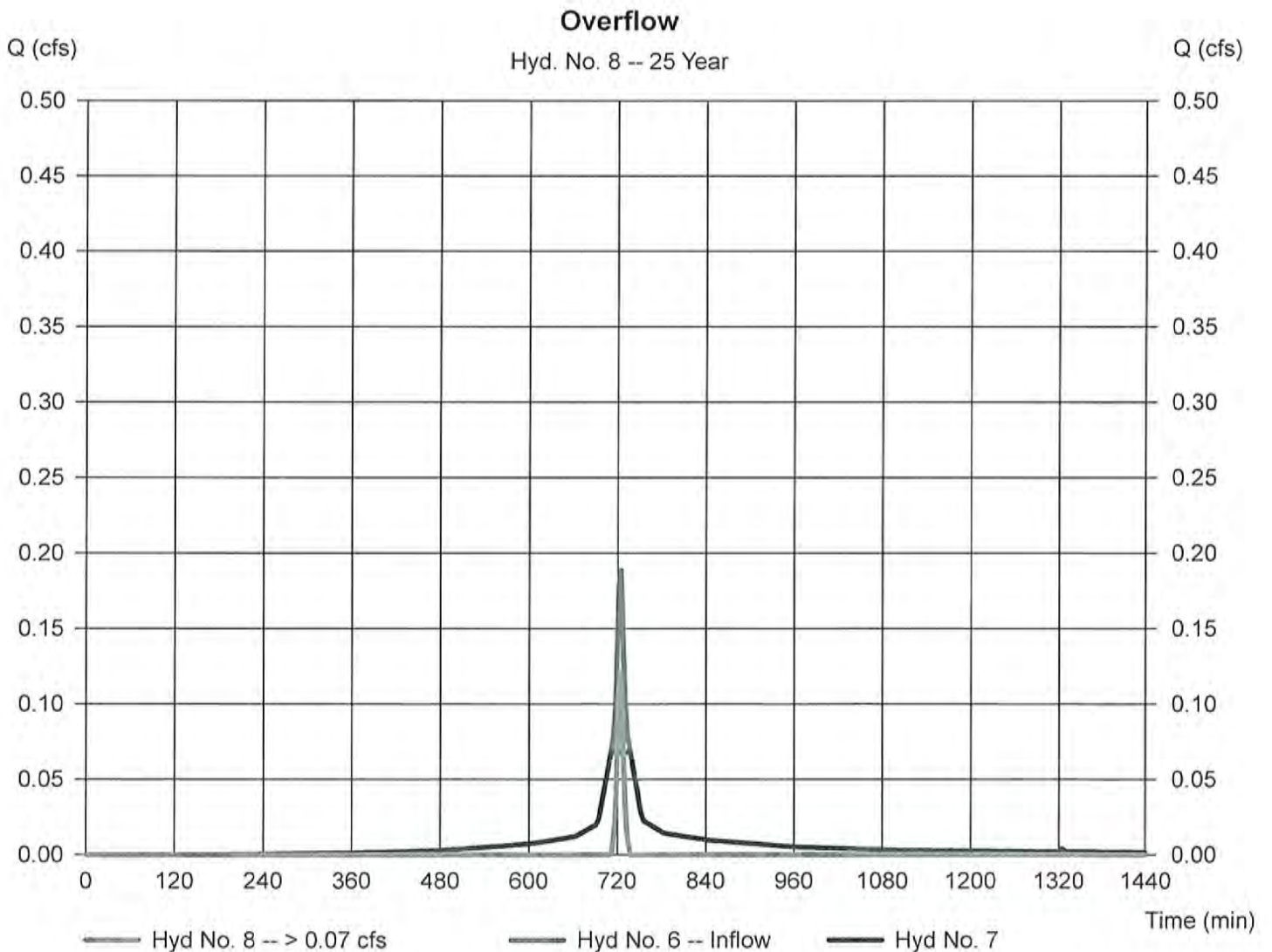
Monday, Oct 2, 2017

Hyd. No. 8

Overflow

Hydrograph type = Diversion2
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.121 cfs
Time to peak = 724 min
Hyd. volume = 73 cuft
2nd diverted hyd. = 7
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

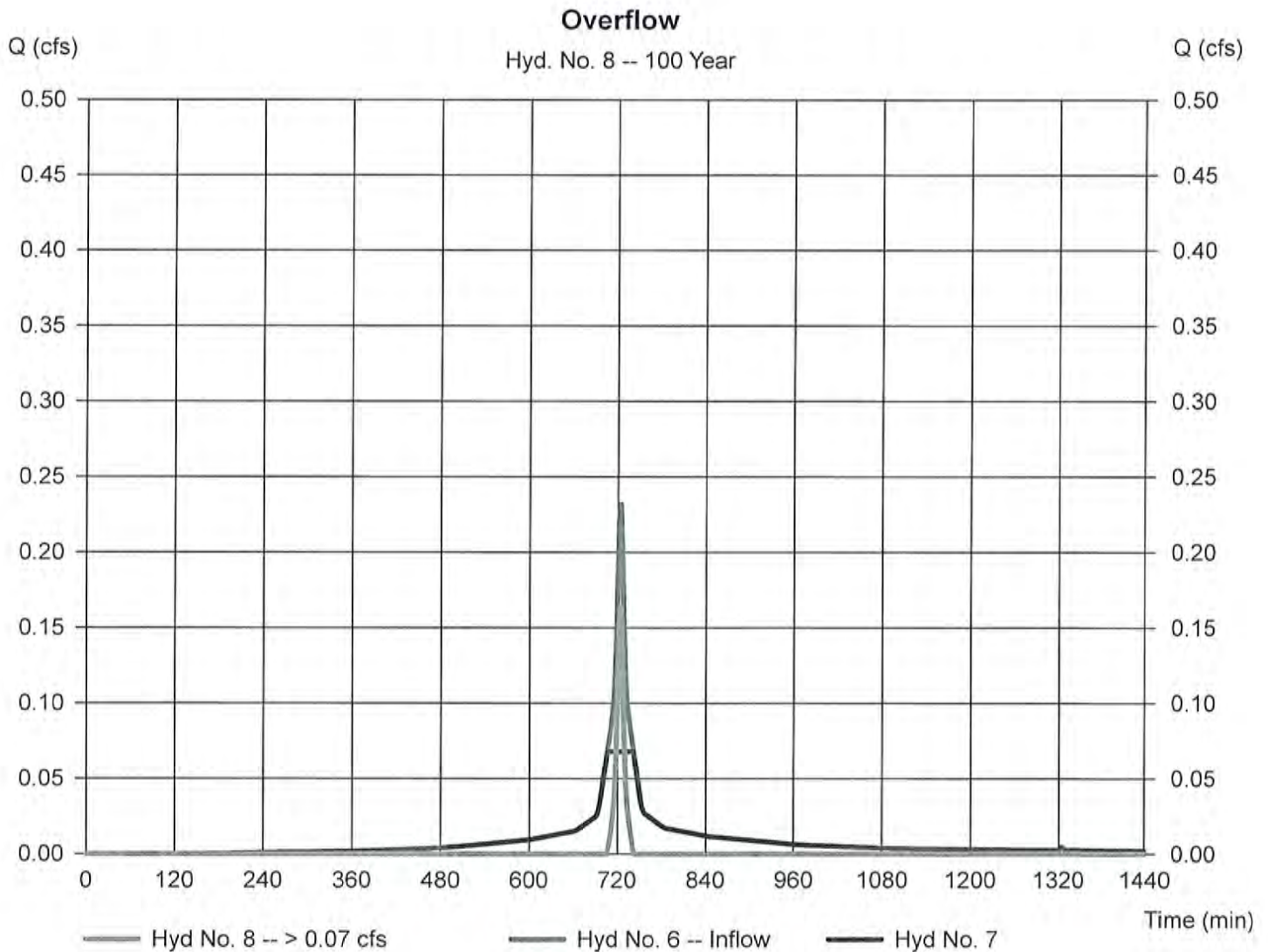
Monday, Oct 2, 2017

Hyd. No. 8

Overflow

Hydrograph type = Diversion2
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hydrograph = 6 - P4
Diversion method = Constant Q

Peak discharge = 0.164 cfs
Time to peak = 724 min
Hyd. volume = 118 cuft
2nd diverted hyd. = 7
Constant Q = 0.07 cfs



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

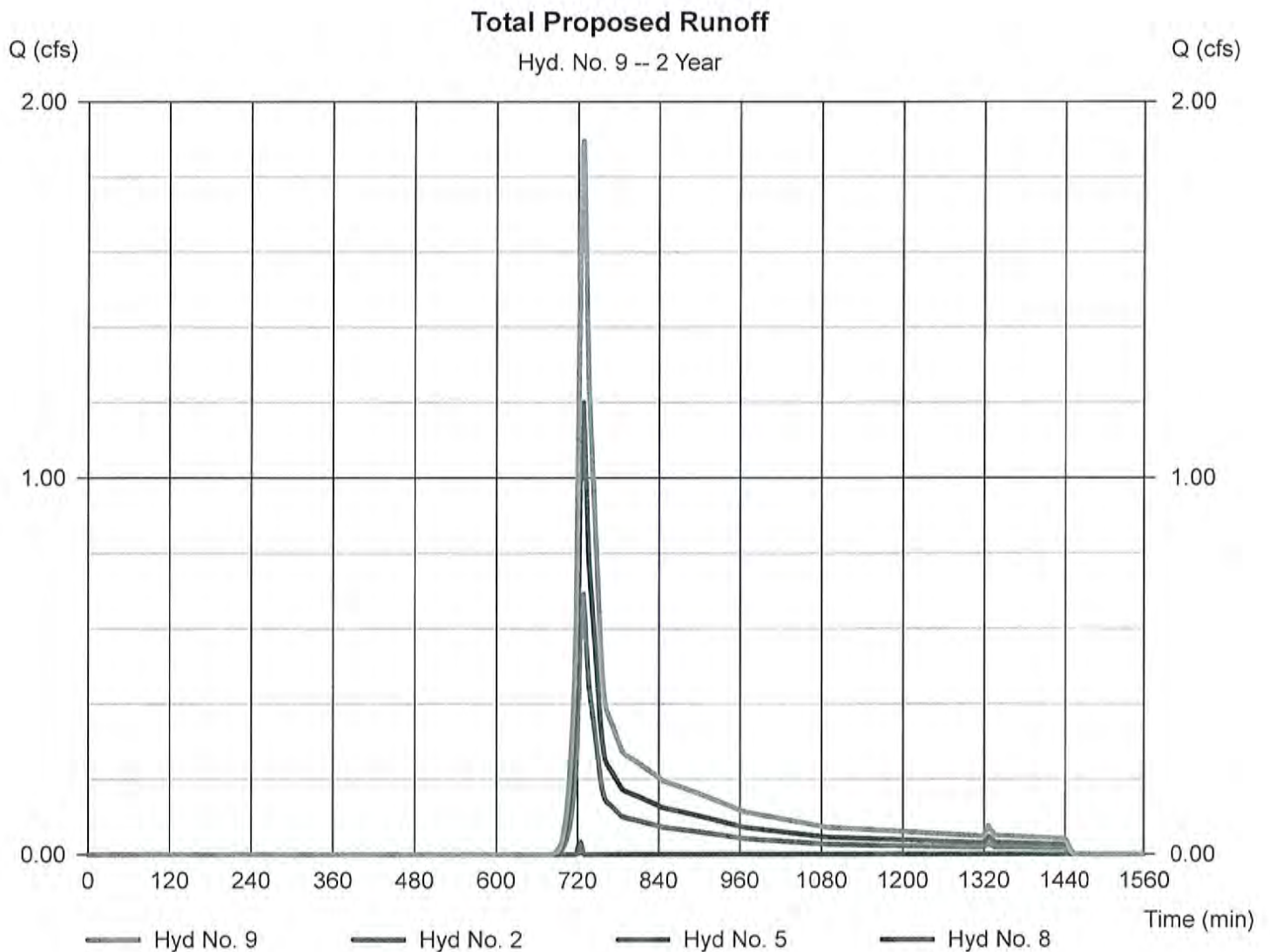
Monday, Oct 2, 2017

Hyd. No. 9

Total Proposed Runoff

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 5, 8

Peak discharge = 1.895 cfs
Time to peak = 728 min
Hyd. volume = 7,382 cuft
Contrib. drain. area = 2.680 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

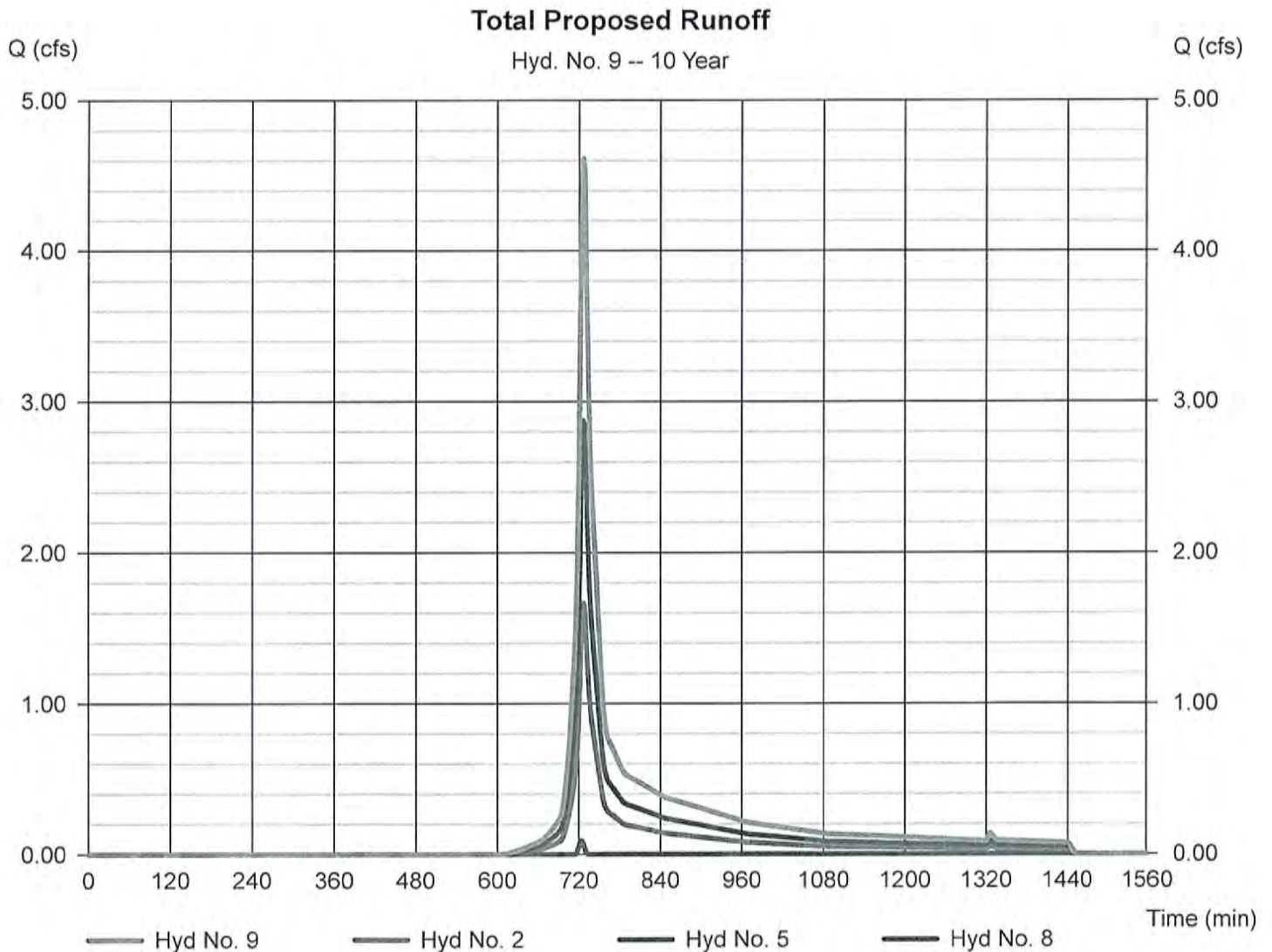
Monday, Oct 2, 2017

Hyd. No. 9

Total Proposed Runoff

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 5, 8

Peak discharge = 4.612 cfs
Time to peak = 726 min
Hyd. volume = 16,137 cuft
Contrib. drain. area = 2.680 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

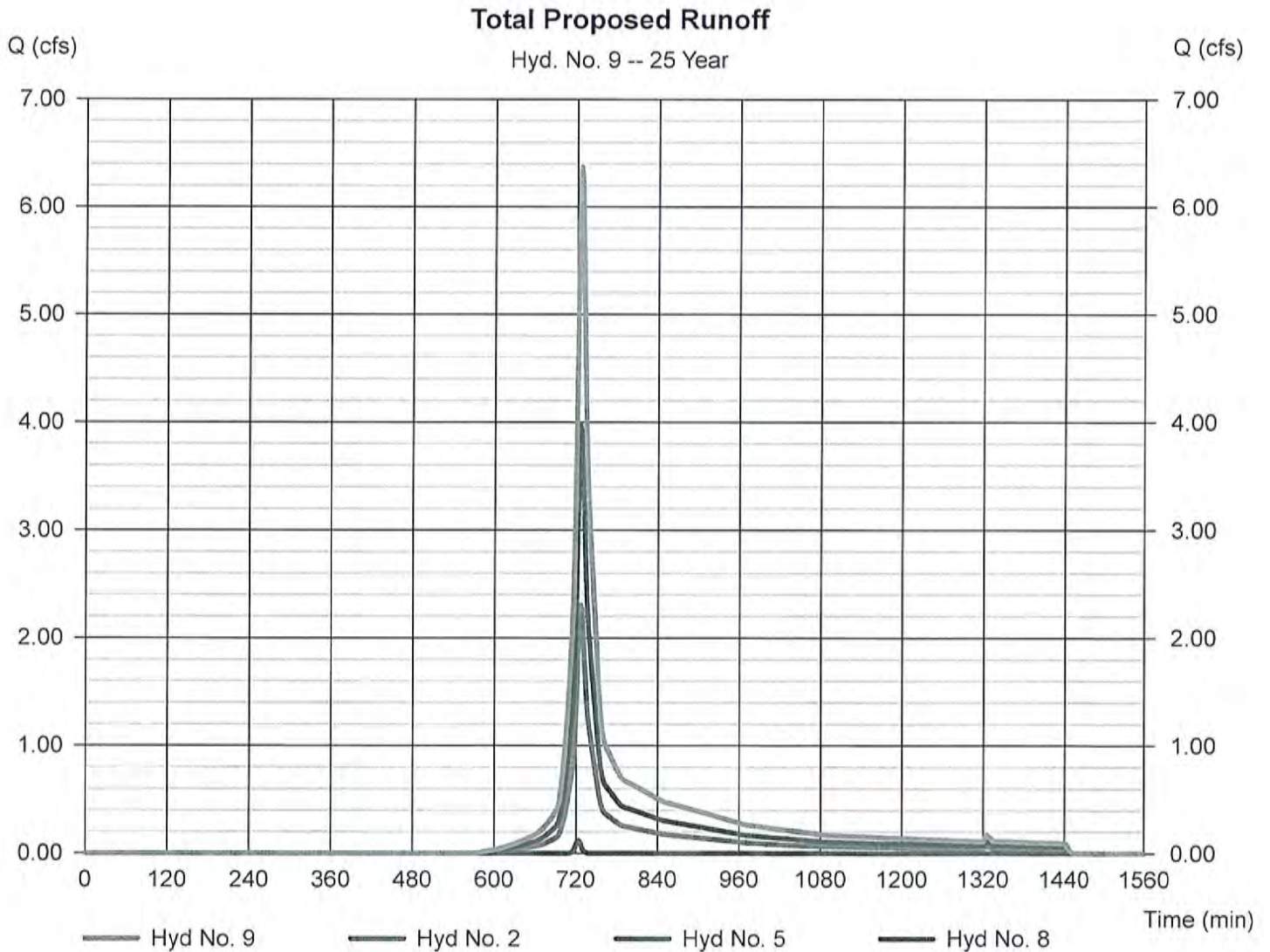
Monday, Oct 2, 2017

Hyd. No. 9

Total Proposed Runoff

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 2, 5, 8

Peak discharge = 6.369 cfs
Time to peak = 726 min
Hyd. volume = 21,850 cuft
Contrib. drain. area = 2.680 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

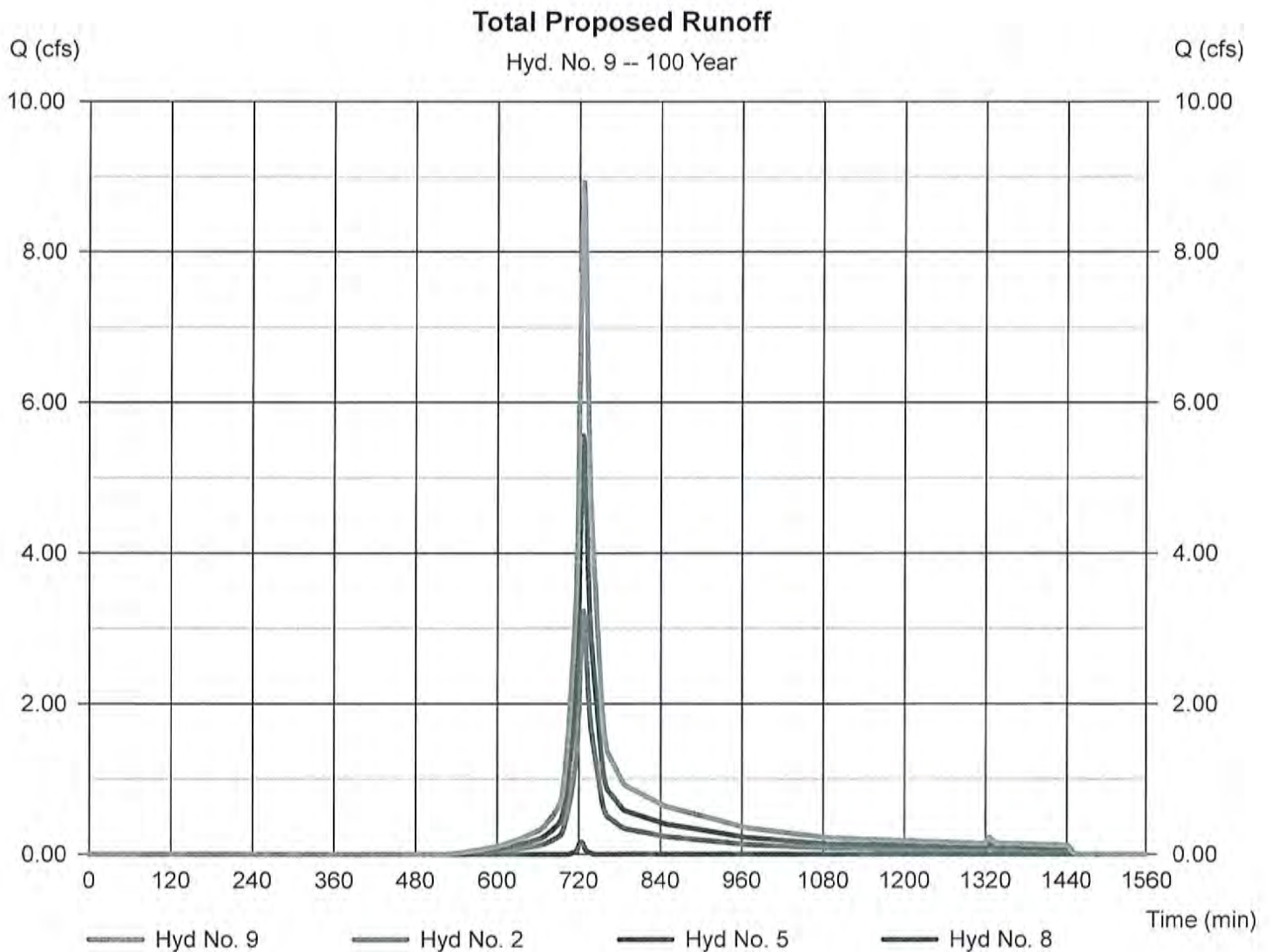
Monday, Oct 2, 2017

Hyd. No. 9

Total Proposed Runoff

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 5, 8

Peak discharge = 8.926 cfs
Time to peak = 726 min
Hyd. volume = 30,268 cuft
Contrib. drain. area = 2.680 ac



Infiltration Trench Calculations

Infiltration Trench Calculation

Project: Pine Point Road

by: DJC

Date: 10/2/2017

Location: Stow, MA

checked:

Date:

Infiltration Trench Sizing

Length:	58 ft
Depth:	2 ft
Width:	2 ft
Bottom Area:	116 SF
Sidewall Area:	240 SF
Total Area:	356 SF
Infiltration Rate:	8.27 in/hr
	0.000191 ft/sec
Q=	0.068 CFS

Pipe Sizing Calculations

DESIGN STORM: 100 YEAR
 DATE: 10/2/2017
 DONE BY: DJC
 FILE: 5984 RATIONAL METHOD

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-5984
 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				MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION		GROUND SURFACE	
			INCR. (ACRES)	TOTAL (ACRES)	TO UPPER END (MIN)	TIME IN SECTION (MIN)									VELOCITY (FPS)	VELOCITY HEAD (FT)	DEPTH OF FLOW (FT)	TOTAL ENERGY HEAD (FT)			UPPER END	LOWER END	UPPER END	LOWER END
DI-1	WT-1	54	0.316	0.32	10	0.15	0.21	7.6	0.51	0.040	6	0.012	1.21	6.17	5.88	0.54	0.23	0.76		2.16	171.10	168.94	174.10	172.10
WT-1	WT-2	111	0.316	0.32	10	0.16	0.21	7.6	0.51	0.260	6	0.012	3.09	15.73	11.64	2.10	0.14	2.24		28.86	168.94	140.08	172.10	145.50
WT-2	DRYWELL	12	0.316	0.32	10	0.04	0.21	7.6	0.51	0.023	6	0.012	0.92	4.71	4.82	0.36	0.27	0.63		0.28	139.98	139.70	145.50	144.47

Soil Testing



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name: TOWN OF STON
 Street Address: 22 QUINCY DRIVE Map/Lot #: 03 PARRELS SA+50
 City: STON State: MA Zip Code: _____

B. Site Information

- (Check one) New Construction Upgrade Repair
- Published Soil Survey Available? Yes No
 If yes: NE. SOIL Year Published: _____ Publication Scale: 1:5000 Soil Map Unit: 259A
 Soil Name: CAVEA LADAMY LOOSE SAND
- Surficial Geological Report Available? Yes No
 If yes: CLIFFA Year Published: _____ Publication Scale: 1:25000 Map Unit: _____
 Geologic Material: SAND + GRAVEL (DVTWASH)
- Flood Rate Insurance Map
 Above the 500-year flood boundary? Yes No
 Within the 500-year flood boundary? Yes No
- Wetland Area: National Wetland Inventory Map
 Wetlands Conservancy Program Map
 Name: _____
 Name: _____
- Current Water Resource Conditions (USGS): 11/13 Month/Year
 Range: Above Normal Normal Below Normal
- Other references reviewed: _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11-6-17 8:30 CLEAR
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-1 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: VACANT LOT None 0.5
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

WOODLAND _____
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
Property Line 210 feet Drinking Water Well 1100 feet Other _____ feet

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 120+
Inches elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: _____ Deep Hole Number: TP-1

Depth (In.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR 13/2	-	-	-	CLAY SAND	-	-	M	F	
10-30	B	10YR 5/4	-	-	-	FINE SAND	-	-	SG	LOOSE	
30-120	C	2.5Y 7/3	-	-	-	SAND	-	-	SG	LOOSE	

Additional Notes: ROOTS TO 9'+



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11/6/11 9:00 Clear
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-1 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: VACANT None 0-5
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

WOODLAND WOODLAND WOODLAND
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ feet
Drainage Way _____ feet
Possible Wet Area _____ feet
Property Line >10 feet Drinking Water Well >100 feet Other _____ feet

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water In Hole _____

Estimated Depth to High Groundwater: 120+ inches elevation _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-2

Depth (In.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR2/2	-	-	-	LS	-	-	M	F	
8-28	B	10YR5/4	-	-	-	FINE SAND	-	-	SG	LOOSE	
28-120	C	2.5Y7/2	-	-	-	SAND	-	-	SG	LOOSE	

Additional Notes ROCK TO 6'



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11-6-13 9:30 CLEAR
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-3 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: VACANT WOOD 11-5
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)
WOODLAND
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
Property Line >10 feet Drinking Water Well 7100 feet Other _____ feet

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes No
If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No
If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____
Estimated Depth to High Groundwater: 120+ inches elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-3

Depth (In.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A	10YR7/1A	-	-	-	LS	-	-	M	F	
10-30	B	10YR6.5/4	-	-	-	FINE SAND	-	-	SG	LOOSE	
30-120	C	2.5Y7/3	-	-	-	SAND	-	-	SG	LOOSE	

Additional Notes _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11-6-13 10:00 CLEAR
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-4 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: VACANT WASTE 0-5
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

WOODLAND _____
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
Property Line 210 feet Drinking Water Well 2100 feet Other _____ feet

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____
Inches elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: _____ Deep Hole Number: TP-4

Depth (In.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9	A	10YR 7/2	-	-	-	LS	-	-	M	F	
9-29	B	10YR 5/4	-	-	-	FINE SAND	-	-	SG	LOOSE	
29-72	C	2.5Y 7/3	-	-	-	SAND	-	-	SG	LOOSE	

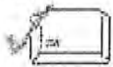
Additional Notes TEST HOLE FOR DRAINAGE PURPOSES



Commonwealth of Massachusetts
 City/Town of
Percolation Test
 Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

TOWN OF STOW
 Owner Name
 22 QUEENS LANE MAP VS PARCELS 5A+5B
 Street Address or Lot #
 STOW MA
 City/Town State Zip Code
 Contact Person (if different from Owner) Telephone Number

B. Test Results

	8-6-13 Date	8:45 Time	11-6-13 Date	9:15 Time
Observation Hole #	PT-A		PT-B	
Depth of Perc	48"		50"	
Start Pre-Soak	8:15		9:15	
End Pre-Soak	24 GAL VTS		24 GAL VTS	
Time at 12"				
Time at 9"				
Time at 6"				
Time (9"-6")				
Rate (Min./Inch)	2 MPE		2 MPE	

Test Passed:
 Test Failed:

Test Passed:
 Test Failed:

STAMSKI AND McMANAY, INC - BILL HALL
 Test Performed By:

STOW ROH - JACK WALLACE
 Witnessed By:

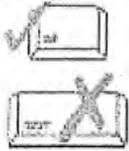
Comments:



Commonwealth of Massachusetts
 City/Town of
Percolation Test
 Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Town of STOW
 Owner Name
 27 QUEENS LANE MAP 1/3 PARCELS 5A+5B
 Street Address or Lot #
 STOW MA
 City/Town State Zip Code
 Contact Person (if different from Owner) Telephone Number

B. Test Results

	Date	Time	Date	Time
Observation Hole #	11-6-13	9:45		
Depth of Perc	PT-C			
Start Pre-Soak	46"			
End Pre-Soak	9:45			
Time at 12"	24 GAL VTS			
Time at 9"				
Time at 6"				
Time (9"-6")				
Rate (Min./Inch)	2 MPI			

Test Passed: Test Failed:
 Test Passed: Test Failed:

STAMSKI AND McNARY, INC - BELLEVILLE
 Test Performed By:

STOW BOH - JACK WALLACE
 Witnessed By:

Comments:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

- Depth observed standing water in observation hole A. SEE inches B. SEE inches
- Depth weeping from side of observation hole A. SOIL inches B. SOIL inches
- Depth to soil redoximorphic features (mottles) A. LOGS inches B. LOGS inches
- Groundwater adjustment (USGS methodology) A. _____ inches B. _____ inches

2.

Index Well Number _____ Reading Date _____ Index Well Level _____
 Adjustment Factor _____ Adjusted Groundwater Level _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

- Yes No

b. If yes, at what depth was it observed?

Upper boundary: SEE SOIL LOGS inches Lower boundary: SEE SOIL LOGS inches

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Bill Hall _____
 Signature of Soil Evaluator Date
BILL HALL SE 13592 7-2012
 Typed or Printed Name of Soil Evaluator / License # Date of Soil Evaluator Exam
JACK WILLIAMS _____
 Name of Board of Health Witness Board of Health

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

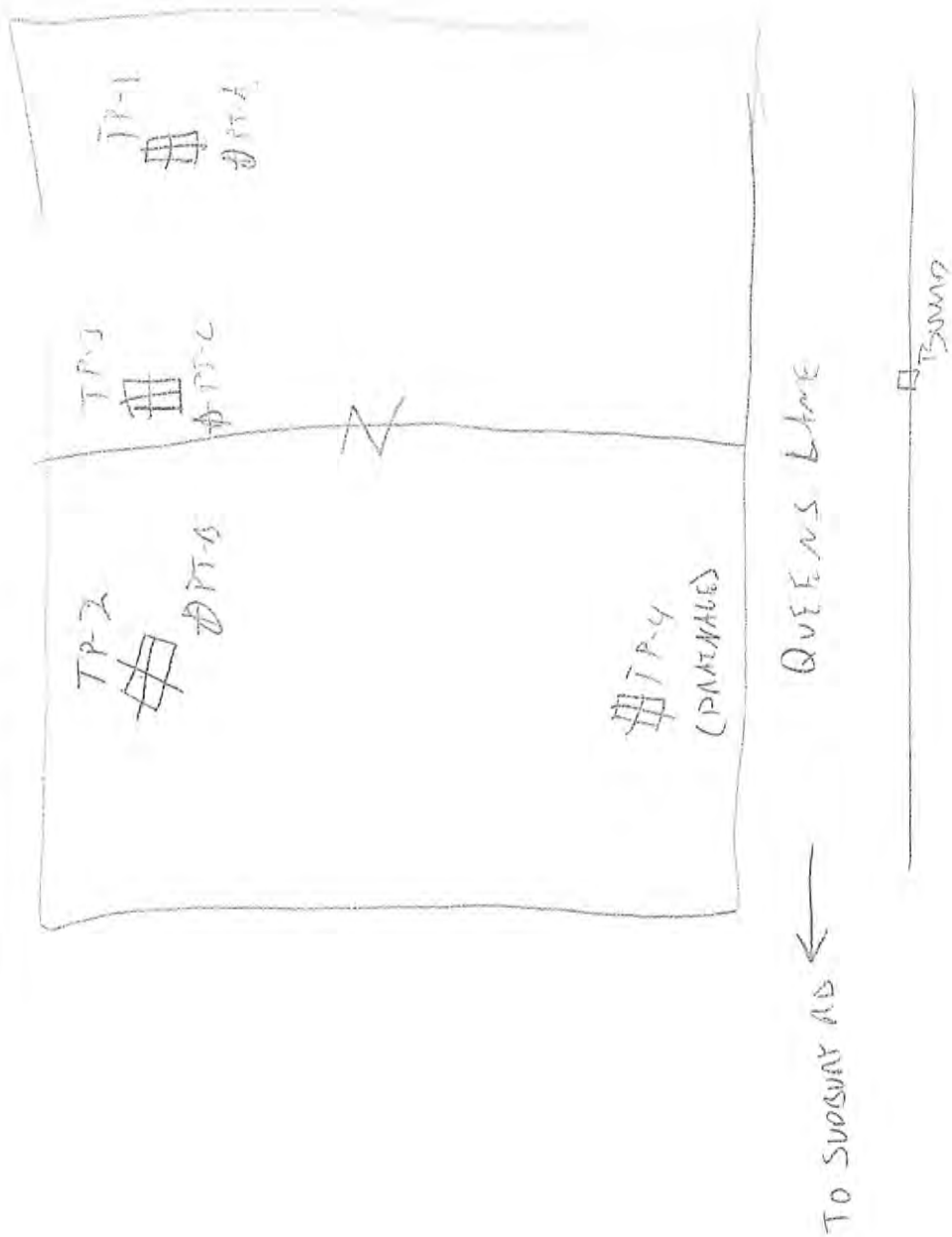


Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:





Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name TOWN OF STOW Map/Lot # _____
 Street Address PIPER POINT ROAD City STOW State MA Zip Code _____

B. Site Information

- (Check one) New Construction Upgrade Repair
- Published Soil Survey Available? Yes No
 If yes: NE SOIL Year Published _____ Publication Scale 1:75,000 Soil Map Unit 253C/307D
- Soil Name HINCKLEY LOAMY SANDS / PLATER FINE SAND CLAY Soil Limitations _____
 Surficial Geological Report Available? Yes No
 If yes: OLIVEA Year Published _____ Publication Scale _____ Map Unit _____

- Geologic Material TILL Landform _____
- Flood Rate Insurance Map
 - Above the 500-year flood boundary? Yes No
 - Within the 500-year flood boundary? Yes No
 - Welland Area: National Wetland Inventory Map
 - Within the 100-year flood boundary? Yes No
 - Within a velocity zone? Yes No
 - Wetlands Conservancy Program Map
 - Map Unit _____ Name _____
 - Range: Above Normal Normal Below Normal
 - Current Water Resource Conditions (USGS): 7/14 Month/Year
 - Other references reviewed: _____



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wastewater Permitting Program
 Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

PLANE ROAD
 Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 8-6-14 8:30 CLAY
 Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-8-1 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND Some 10+
 (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

Mixed Forest Landform Position on landscape (attach sheet)
 Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
 Property Line >10 feet Drinking Water Well >100 feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 36
 inches elevation



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wastewater Permitting Program
 Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

PLANE ROAD
 Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-8-1

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR 3/2	-	-	-	SL	-	-	~	F	
12-24	B	10YR 3/4	-	-	-	SL	-	-	~	F	
24-108	C	10YR 5/2	36"	~	5	SL	5	2	Subangular blocky	F	

Additional Notes: BOULDERS @ 10'



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wastewater Permitting Program
 Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

PIKE POINT
 Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 8-6-14 9 15 Clear
 Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-8-2 Ground Elevation at Surface of Hole _____
 Location (Identify on Plan) _____

2. Land Use: WOODLAND SAND 10+
 (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)
MIXED TREES CLAY CLAY
 Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ feet
 Drainage Way _____ feet
 Possible Wet Area _____ feet
 Property Line 210 feet Drinking Water Well 2100 feet Other _____ feet

4. Parent Material: TILL Unsuitable Materials Present: Yes No
 If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No
 If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____
 Estimated Depth to High Groundwater: 36 inches _____ elevation



Massachusetts Department of Environmental Protection
 Bureau of Resource Protection - Wastewater Permitting Program
 Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

PIKE POINT
 Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-8-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR 2/2				SL			M	F	
12-26	B	10YR 2/4				SL			M	F	
26-120	C	10YR 2/6	36"	High water	5	SL	5	3	SBK	F	

Additional Notes _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 8-6-14 10:30 CLEAR
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-8-1 Ground Elevation at Surface of Hole _____
Location (Identify on Plan) _____

2. Land Use: WOODLAND SOME 10+
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

MIXED TREES LANDFORM POSITION ON LANDSCAPE (ATTACH SHEET)
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
Property Line 210 feet Drinking Water Well 100 feet Other _____
feet feet feet

4. Parent Material: TILL Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 36 _____
Inches elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP 8-3

Depth (in.)	Soil Horizon/Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10YR 12/2	-	-	-	SL	-	-	M	F	
6-24	B	10YR 8/3				SL	-	-	M	F	
24-102	C	10YR 3/2	36	10YR 6/2	5	SL	5	10	M	F	

Additional Notes _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 8-6-14 11:30 LLFDN
Date Time Weather

1. Deep Observation Hole Logs

Deep Hole Number TP-8-4 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND SOME 10+
(e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones Slope (%)

MIXED TREES _____
Vegetation Landform Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ Drainage Way _____ Possible Wet Area _____
Property Line >10 feet Drinking Water Well >100 feet Other _____ feet

4. Parent Material: TILL Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 40 inches _____ elevation



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Deep Observation Hole A: Deep Hole Number: TP-8-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10YR 12/6	-	-	5	SL	-	-	M	F	
6-26	B	10YR 10/6	-	-	-	SL	-	-	M	F	
26-120	C	10YR 5/4	40"	10YR 5/4	5	SL	5	10	M	F	

Additional Notes _____



Commonwealth of Massachusetts
 City/Town of
Percolation Test
 Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Town of Stow
 Owner Name

PINE POINT MAINT-RANCELL 41
 Street Address or Lot #

STOW MA
 City/Town State Zip Code

 Contact Person (if different from Owner) Telephone Number

B. Test Results

Observation Hole #	Date	Time	Date	Time
		<u>8/6/14</u>	<u>9:43</u>	<u>8/6/14</u>
	<u>PT-8-A</u>		<u>PT-8-B</u>	
Depth of Perc	<u>40"</u>		<u>48"</u>	
Start Pre-Soak	<u>9:43</u>		<u>11:04</u>	
End Pre-Soak	<u>9:58</u>		<u>11:19</u>	
Time at 12"	<u>9:58</u>		<u>11:26</u>	
Time at 9"	<u>10:03</u>		<u>11:35</u>	
Time at 6"	<u>10:11</u>		<u>12:05</u>	
Time (9"-6")	<u>8 min</u>		<u>30 min</u>	
Rate (Min./Inch)	<u>3 MB</u>		<u>10 MB</u>	

Test Passed:
 Test Failed:

Test Passed:
 Test Failed:

STAMSKI AND MURPHY INC - WILLIAM HILL
 Test Performed By:

STOW BOARD OF HEALTH - JACK WALLACE
 Witnessed By:

Comments:



Commonwealth of Massachusetts
City/Town of
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Town of Stow
Owner Name
PIPER POINT MAPU-1 PIALEL 41
Street Address or Lot #
Stow MA
City/Town State Zip Code
Contact Person (if different from Owner) Telephone Number

B. Test Results

	Date	Time	Date	Time
Observation Hole #	8/6/14	12:25	8/6/14	1:22
Depth of Perc	7'-2"		7'-8"	
Start Pre-Soak	12:15		1:12	
End Pre-Soak	12:40		1:37	
Time at 12"	12:40		1:37	
Time at 9"	12:45		2:00	
Time at 6"	12:57		2:42	
Time (9"-6")	12 min		4:2 min	
Rate (Min./Inch)	41 MPI		14 MPI	

Test Passed:
Test Failed:

Test Passed:
Test Failed:

STANLEY AND MERRILL, Inc - William Hill
Test Performed By:

Stow BOH - JACOB WILKINSON
Witnessed By:

Comments:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

- | | | |
|--|--------------------------|--------------------------|
| <input type="checkbox"/> Depth observed standing water in observation hole | A. <u>SEE</u>
inches | B. <u>SEE</u>
inches |
| <input type="checkbox"/> Depth weeping from side of observation hole | A. <u>SOIL</u>
inches | B. <u>SOIL</u>
inches |
| <input type="checkbox"/> Depth to soil redoximorphic features (mottles) | A. <u>LOGS</u>
inches | B. <u>LOGS</u>
inches |
| <input type="checkbox"/> Groundwater adjustment (USGS methodology) | A. _____
inches | B. _____
inches |

2. _____
- | | | |
|-------------------------|----------------------------------|------------------------|
| Index Well Number _____ | Reading Date _____ | Index Well Level _____ |
| Adjustment Factor _____ | Adjusted Groundwater Level _____ | |

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

- Yes No

b. If yes, at what depth was it observed?

Upper boundary: SEE SOIL LOGS inches Lower boundary: SEE SOIL LOGS inches

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

William Hall
Signature of Soil Evaluator
WILLIAM HALL SE 12592
Typed or Printed Name of Soil Evaluator / License #
Jana Walker
Name of Board of Health Witness

8/6/14
Date
7/2012
Date of Soil Evaluator Exam
SMW
Board of Health

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

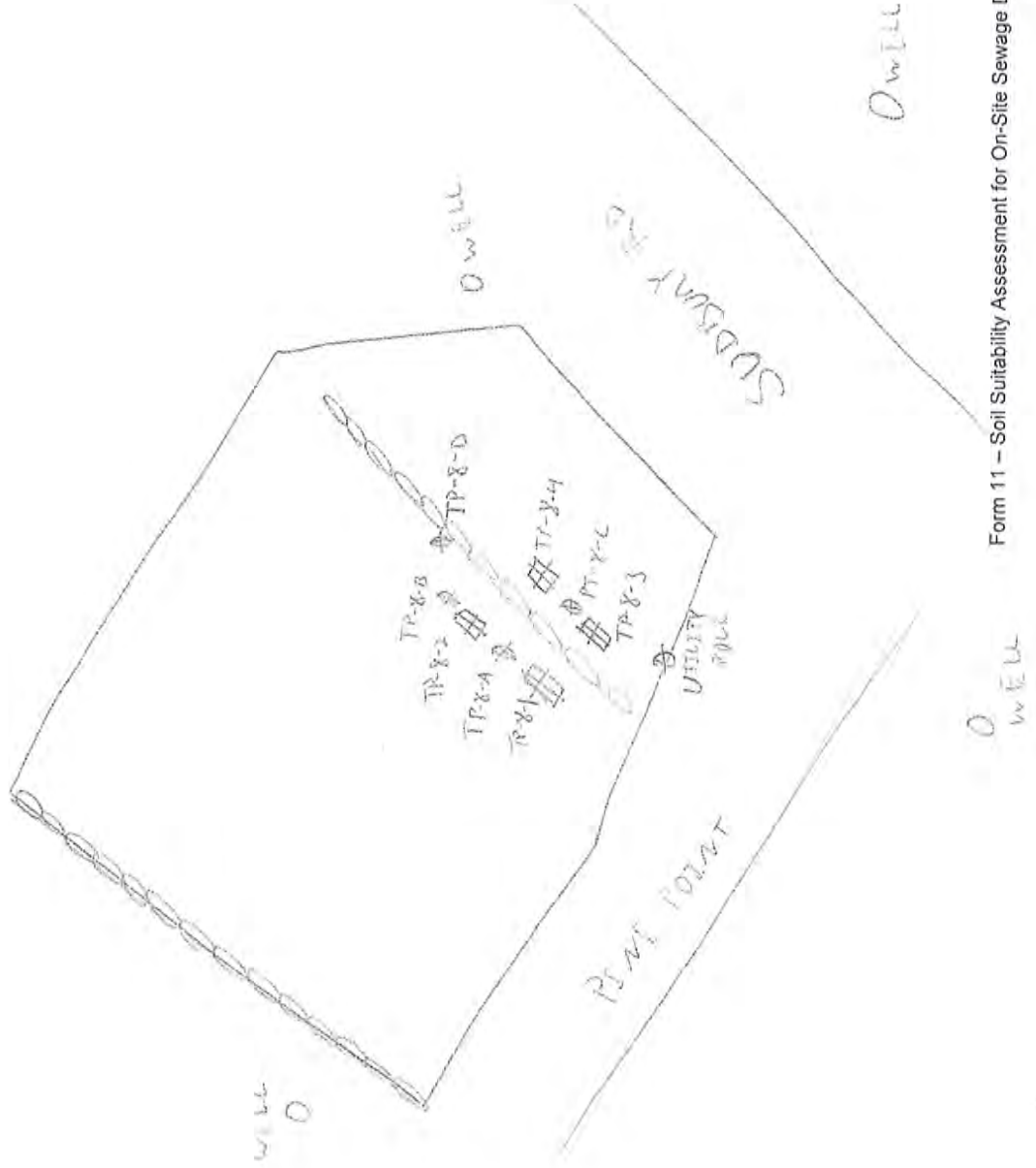


Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

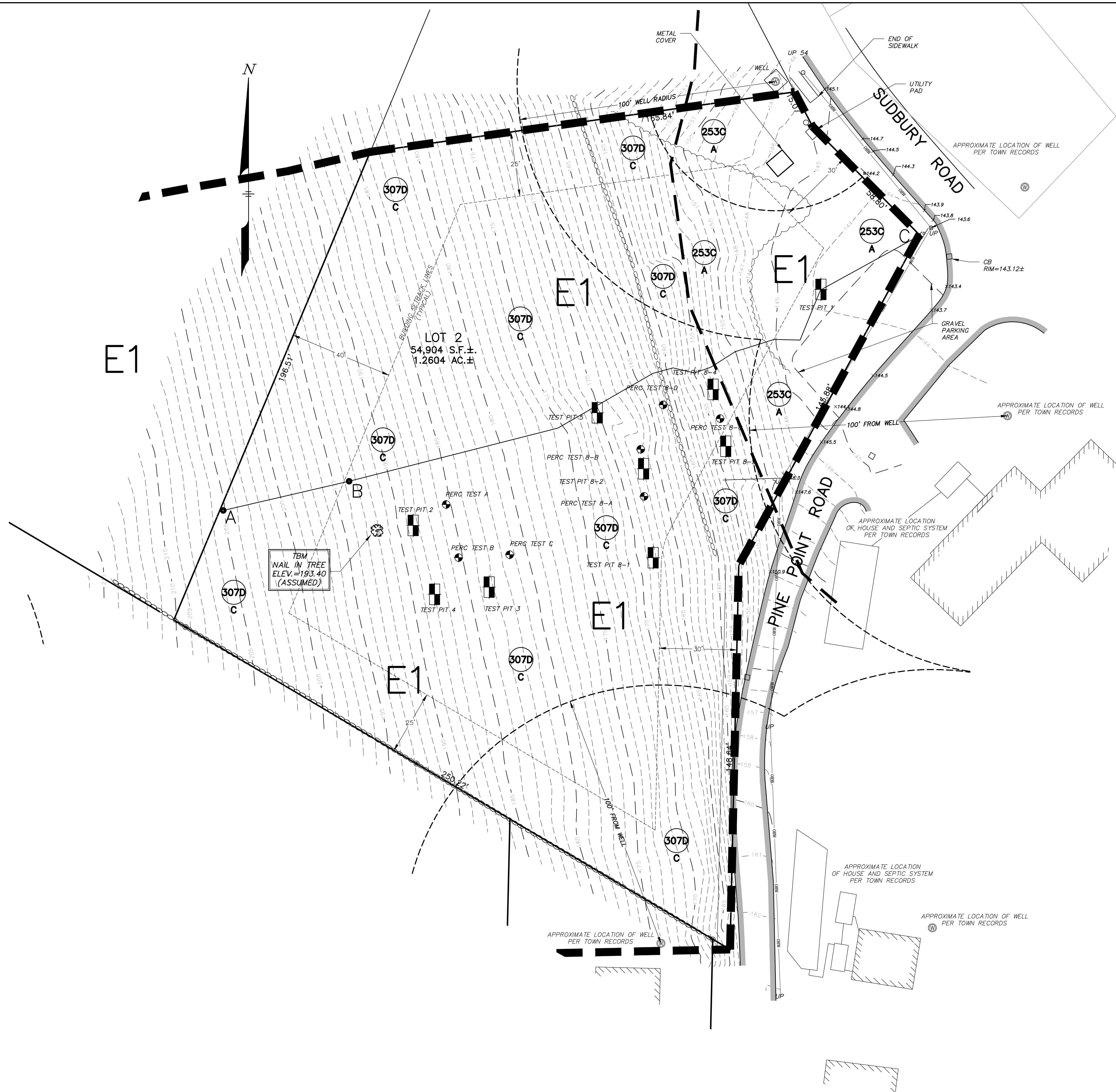
Field Diagrams

Use this sheet for field diagrams:



Drainage Maps

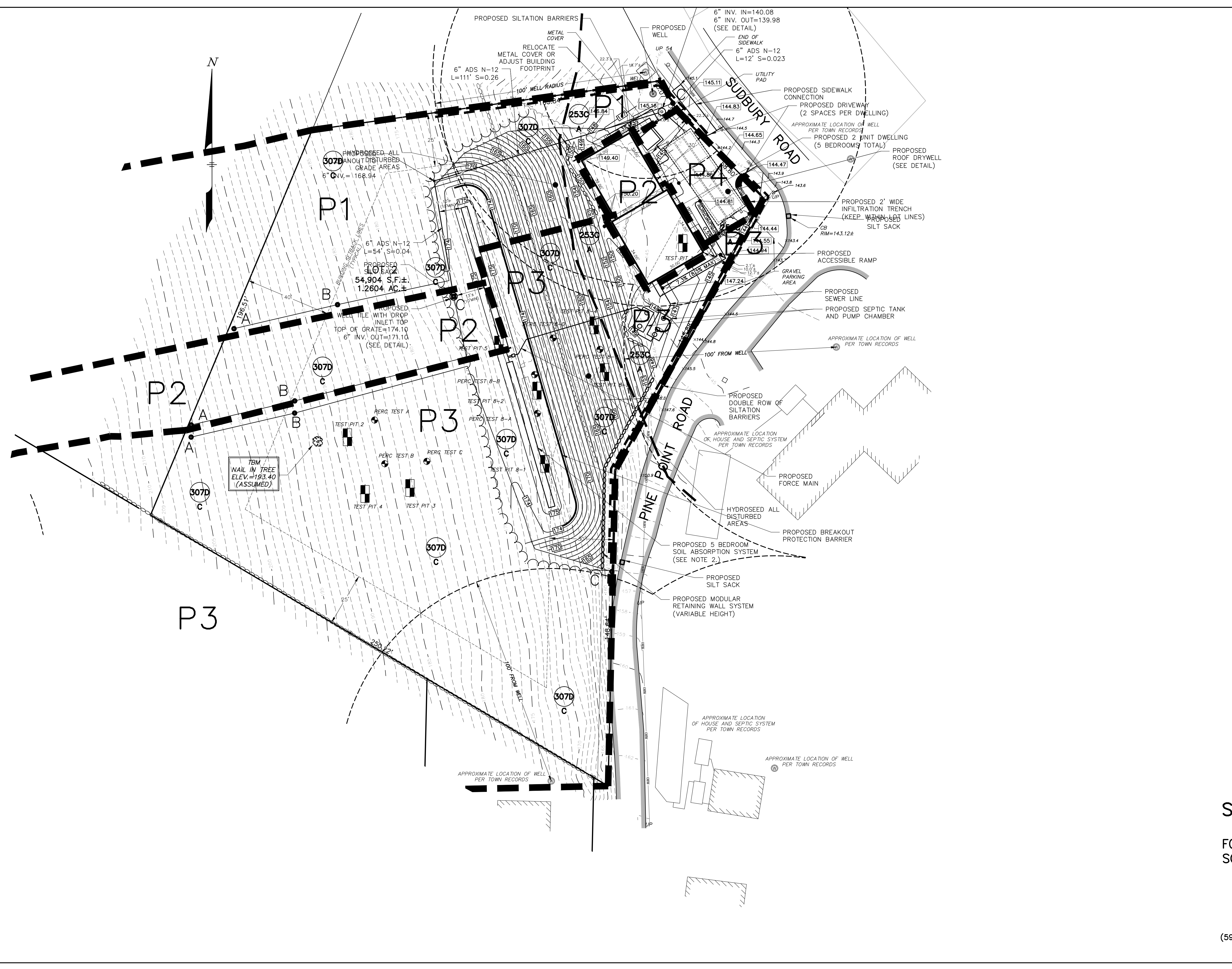
- LEGEND:**
- SUBCATCHMENT BORDER
 - SOIL DIVIDE
 - A B C TIME OF CONCENTRATION
 - 253C HINCKLEY LOAMY SAND
 - 307D PAXTON FINE SANDY LOAM
 - A HYDROLOGIC SOIL GROUP A
 - B HYDROLOGIC SOIL GROUP B
 - C HYDROLOGIC SOIL GROUP C
 - D HYDROLOGIC SOIL GROUP D



PREDEVELOPMENT
DRAINAGE MAP
IN
STOW, MASSACHUSETTS
(MIDDLESEX COUNTY)

FOR: HABITAT FOR HUMANITY
SCALE: 1"=20' OCTOBER 2, 2017
STAMSKI AND McNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING - PLANNING - SURVEYING





- LEGEND:**
- SUBCATCHMENT BORDER
 - SOIL DIVIDE
 - A B C TIME OF CONCENTRATION
 - 2530 HINCKLEY LOAMY SAND
 - 307D PAXTON FINE SANDY LOAM
 - A HYDROLOGIC SOIL GROUP A
 - B HYDROLOGIC SOIL GROUP B
 - C HYDROLOGIC SOIL GROUP C
 - D HYDROLOGIC SOIL GROUP D

POSTDEVELOPMENT
DRAINAGE MAP
IN
STOW, MASSACHUSETTS
(MIDDLESEX COUNTY)

FOR: HABITAT FOR HUMANITY
SCALE: 1"=20' OCTOBER 2, 2017
STAMSKI AND McNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING - PLANNING - SURVEYING

