ADDENDUM TO STORMWATER MANAGEMENT REPORT

REVISED 03/30/2015

NEWTON NEXUS
131, 141-143, 151-153, 165, 173, & 181 NEEDHAM STREET
NEWTON, MA

PREPARED FOR:

David Noel Kelly
2015.03.31 10:04:24 -04'00'

WELLFORD ASSOCIATES
C/O CROSSPOINT ASSOCIATES, INC.
300 THIRD AVENUE, SUITE 2
WALTHAM, MA 02451

PREPARED BY:

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE BRAINTREE MA 02184
PHONE: 781 843 4333 FAX: 781 843 0028

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***This is an Addendum to the Stormwater Management Report by Kelly Engineering Group, Inc. dated 01/09/15. This Addendum analyzes and compares peak runoff rates and volumes. This Addendum also includes a frimpter adjustment based on test pits conducted.**

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PEAK RUNOFF SUMMARY

Total Site Runoff

Storm	Existing	Proposed	Difference
(yr, inches)	(cfs)	(cfs)	(cfs)
2,3.1	27.94	23.65	-4.29
10,4.5	42.87	37.32	-5.55
25,5.3	51.42	45.15	-6.27
50,5.9	57.84	50.87	-6.97
100,7.0	69.59	61.21	-8.38

Drain Line 1

Storm	Existing	Proposed	Difference
(yr, inches)	(cfs)	(cfs)	(cfs)
2,3.1	6.23	4.19	-2.04
10,4.5	9.32	6.36	-2.96
25,5.3	11.07	7.59	-3.48
50,5.9	12.38	8.51	-3.87
100,7.0	14.78	10.19	-4.59

Drain Line 2

Storm	Existing	Proposed	Difference
(yr, inches)	(cfs)	(cfs)	(cfs)
2,3.1	17.61	16.43	-1.18
10,4.5	26.22	25.54	-0.68
25,5.3	31.11	30.71	-0.40
50,5.9	34.76	34.42	-0.34
100,7.0	41.44	41.08	-0.36

Drain Line 3

Storm	Existing	Proposed	Difference
(yr, inches)	(cfs)	(cfs)	(cfs)
2,3.1	2.11	1.65	-0.47
10,4.5	3.34	2.60	-0.75
25,5.3	4.04	3.13	-0.91
50,5.9	4.57	3.54	-1.03
100,7.0	5.52	4.27	-1.25

RUNOFF VOLUME SUMMARY

Total Site Runoff

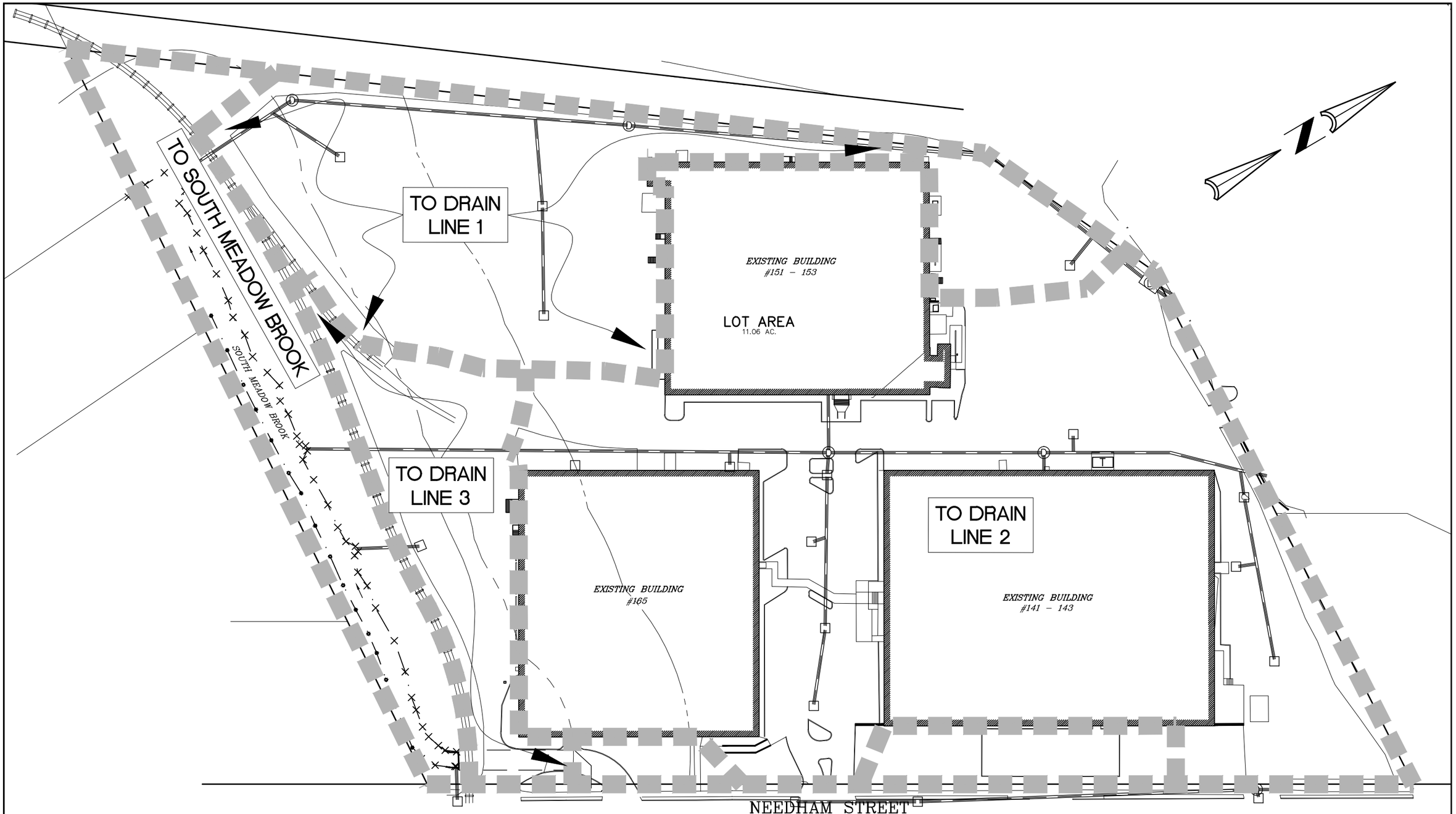
Storm	Existing	Proposed	Difference
(yr, inches)	(cf)	(cf)	(cf)
2,3.1	88,990	84,887	-4,103
10,4.5	139,162	135,518	-3,644
25,5.3	168,283	164,821	-3,462
50,5.9	190,259	186,909	-3,350
100,7.0	230,763	227,581	-3,182

Drain Line 1

Storm	Existing	Proposed	Difference
(yr, inches)	(cf)	(cf)	(cf)
2,3.1	19,843	13,107	-6,736
10,4.5	30,467	20,437	-10,030
25,5.3	36,572	24,662	-11,910
50,5.9	41,159	27,841	-13,318
100,7.0	49,583	33,683	-15,900

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment A
Existing Conditions



131,141-143,151-153,165,173,&181
NEEDHAM STREET
NEWTON, MA

SCALE: 1"= 80'
DATE: 03/04/15
2013–075–EXDR01

EXISTING DRAINAGE EXHIBIT

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE · BRAINTREE MA · 02184
PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/02/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - To Drain Line #1**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	9285	640665
Roof Area		98	0	0
Wetlands		98	0	0
Paved/Concrete		98	89269	8748362
		Totals =	98554.00	9389027
		Acres =	2.26248852	

CN or C (weighted) = total product/total area = **95.3**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/02/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - To Drain Line #2**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	20611	1422159
Roof Area		98	154768	1.5E+07
Wetlands		98	0	0
Paved/Concrete		98	100039	9803822
		Totals =	275418.00	2.6E+07
		Acres =	6.32272727	

CN or C (weighted) = total product/total area = **95.8**

Reference:
Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/02/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - To Drain Line #3**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	9567	660123
Roof Area		98	0	0
Wetlands		98	0	0
Paved/Concrete		98	28742	2816716
		Totals =	38309.00	3476839
		Acres =	0.87945363	

CN or C (weighted) = total product/total area = **90.8**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/02/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - To Needham Street System**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	11464	791016
Roof Area		98	0	0
Wetlands		98	0	0
Paved/Concrete		98	6654	652092
		Totals =	18118.00	1443108
		Acres =	0.41593205	

CN or C (weighted) = total product/total area = **79.7**

Reference:
Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/02/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Existing Conditions - To South Meadow Brook**

Circle One: **Pre** or Post

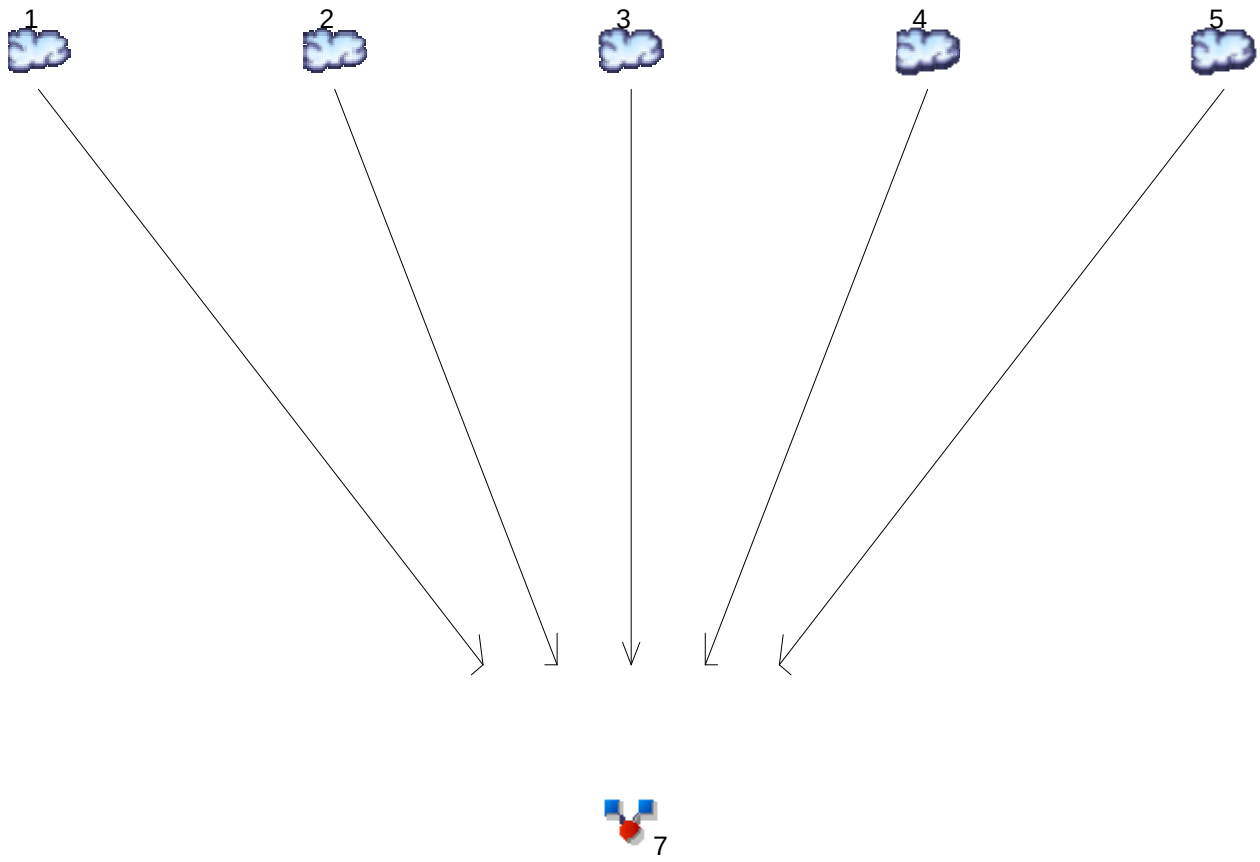
Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	39715	2740335
Roof Area		98	0	0
Wetlands		98	11869	1163162
Paved/Concrete		98	0	0
		Totals =	51584.00	3903497
		Acres =	1.18420569	

CN or C (weighted) = total product/total area = **75.7**

Reference:
Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	To Drain Line 1
2	SCS Runoff	To Drain Line 2
3	SCS Runoff	To Drain Line 3
4	SCS Runoff	To Needham St. System
5	SCS Runoff	To South Meadow Brook
7	Combine	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	6.227	-------	-------	9.321	11.07	12.38	14.78	To Drain Line 1
2	SCS Runoff	------	-------	17.61	-------	-------	26.22	31.11	34.76	41.44	To Drain Line 2
3	SCS Runoff	------	-------	2.112	-------	-------	3.344	4.043	4.565	5.516	To Drain Line 3
4	SCS Runoff	------	-------	0.611	-------	-------	1.154	1.478	1.725	2.182	To Needham St. System
5	SCS Runoff	------	-------	1.380	-------	-------	2.827	3.717	4.402	5.680	To South Meadow Brook
7	Combine	1, 2, 3, 4, 5,	-------	27.94	-------	-------	42.87	51.42	57.84	69.59	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	6.227	2	724	19,843	------	------	------	To Drain Line 1
2	SCS Runoff	17.61	2	724	56,581	------	------	------	To Drain Line 2
3	SCS Runoff	2.112	2	724	6,421	------	------	------	To Drain Line 3
4	SCS Runoff	0.611	2	724	1,849	------	------	------	To Needham St. System
5	SCS Runoff	1.380	2	724	4,296	------	------	------	To South Meadow Brook
7	Combine	27.94	2	724	88,990	1, 2, 3, 4, 5,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	9.321	2	724	30,467	------	------	------	To Drain Line 1
2	SCS Runoff	26.22	2	724	86,359	------	------	------	To Drain Line 2
3	SCS Runoff	3.344	2	724	10,402	------	------	------	To Drain Line 3
4	SCS Runoff	1.154	2	724	3,448	------	------	------	To Needham St. System
5	SCS Runoff	2.827	2	724	8,486	------	------	------	To South Meadow Brook
7	Combine	42.87	2	724	139,162	1, 2, 3, 4, 5,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	11.07	2	724	36,572	------	------	------	To Drain Line 1
2	SCS Runoff	31.11	2	724	103,452	------	------	------	To Drain Line 2
3	SCS Runoff	4.043	2	724	12,720	------	------	------	To Drain Line 3
4	SCS Runoff	1.478	2	724	4,427	------	------	------	To Needham St. System
5	SCS Runoff	3.717	2	724	11,113	------	------	------	To South Meadow Brook
7	Combine	51.42	2	724	168,283	1, 2, 3, 4, 5,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	12.38	2	724	41,159	------	------	------	To Drain Line 1
2	SCS Runoff	34.76	2	724	116,292	------	------	------	To Drain Line 2
3	SCS Runoff	4.565	2	724	14,470	------	------	------	To Drain Line 3
4	SCS Runoff	1.725	2	724	5,181	------	------	------	To Needham St. System
5	SCS Runoff	4.402	2	724	13,157	------	------	------	To South Meadow Brook
7	Combine	57.84	2	724	190,259	1, 2, 3, 4, 5,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	14.78	2	724	49,583	------	------	------	To Drain Line 1
2	SCS Runoff	41.44	2	724	139,861	------	------	------	To Drain Line 2
3	SCS Runoff	5.516	2	724	17,696	------	------	------	To Drain Line 3
4	SCS Runoff	2.182	2	724	6,598	------	------	------	To Needham St. System
5	SCS Runoff	5.680	2	724	17,026	------	------	------	To South Meadow Brook
7	Combine	69.59	2	724	230,763	1, 2, 3, 4, 5,	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

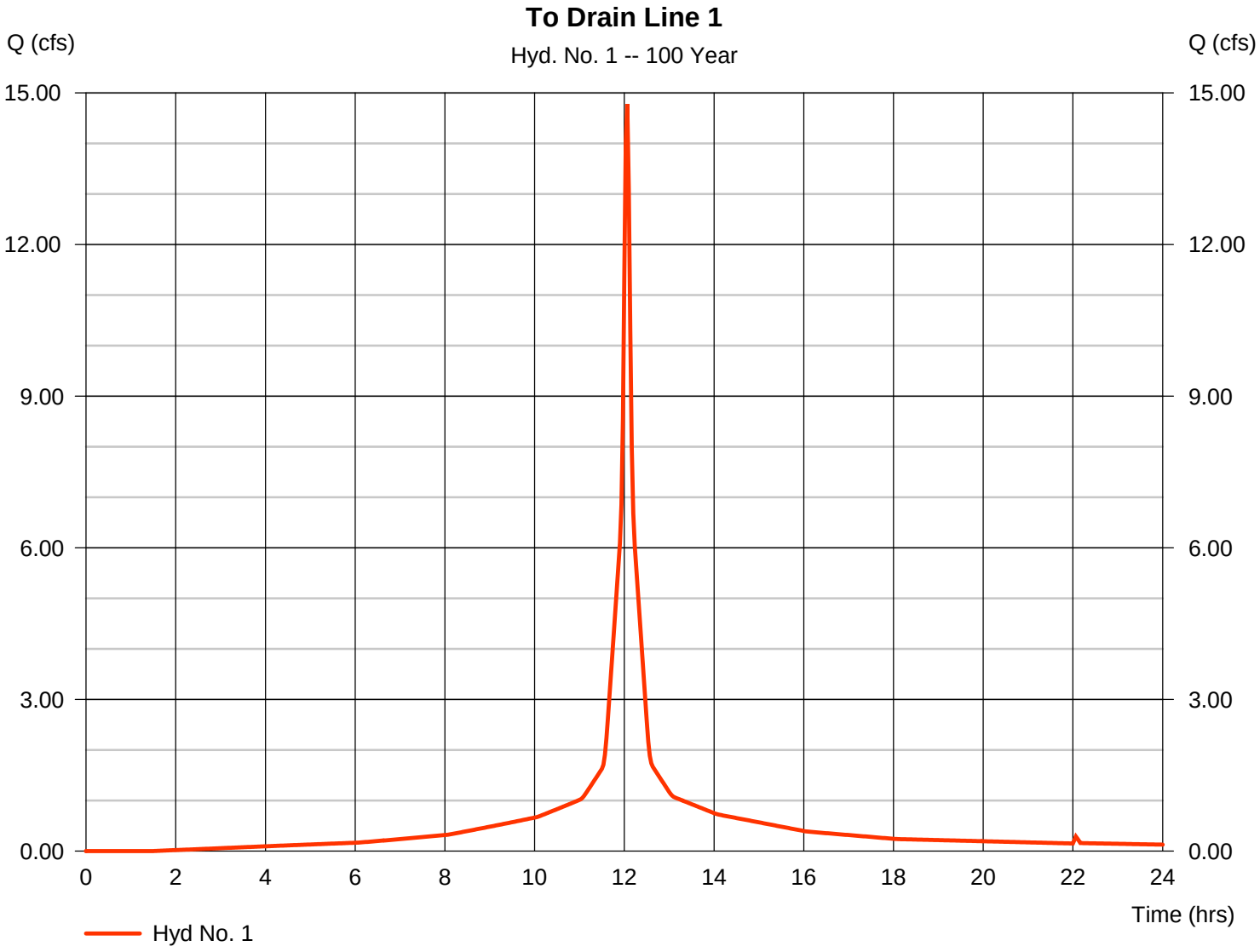
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.10	0.00	3.30	4.50	5.30	5.90	7.00
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Report

Hyd. No. 1

To Drain Line 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.78 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	49,583 cuft
Drainage area	=	2.262 ac	Curve number	=	95.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

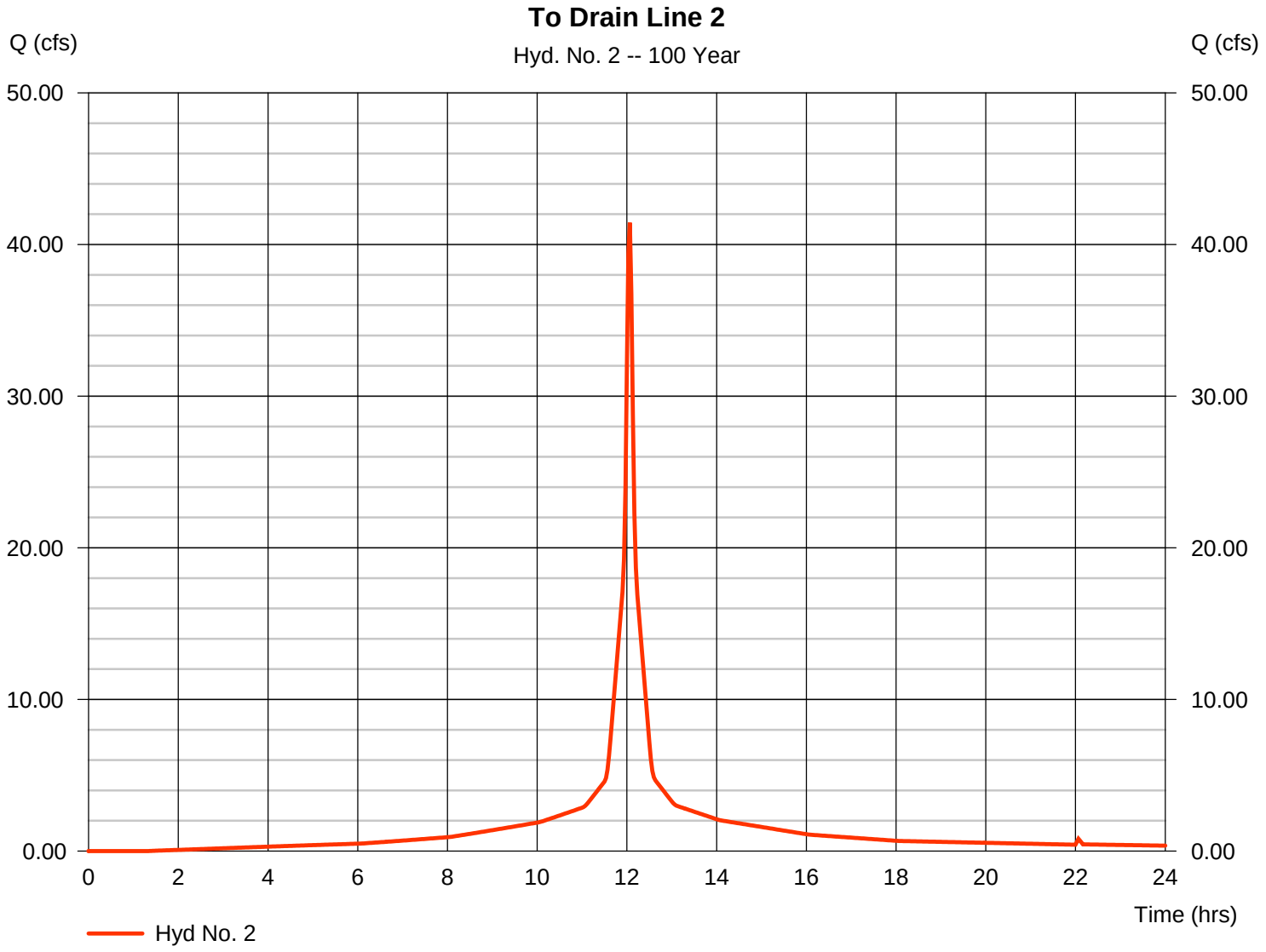


Hydrograph Report

Hyd. No. 2

To Drain Line 2

Hydrograph type	= SCS Runoff	Peak discharge	= 41.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 139,861 cuft
Drainage area	= 6.323 ac	Curve number	= 95.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

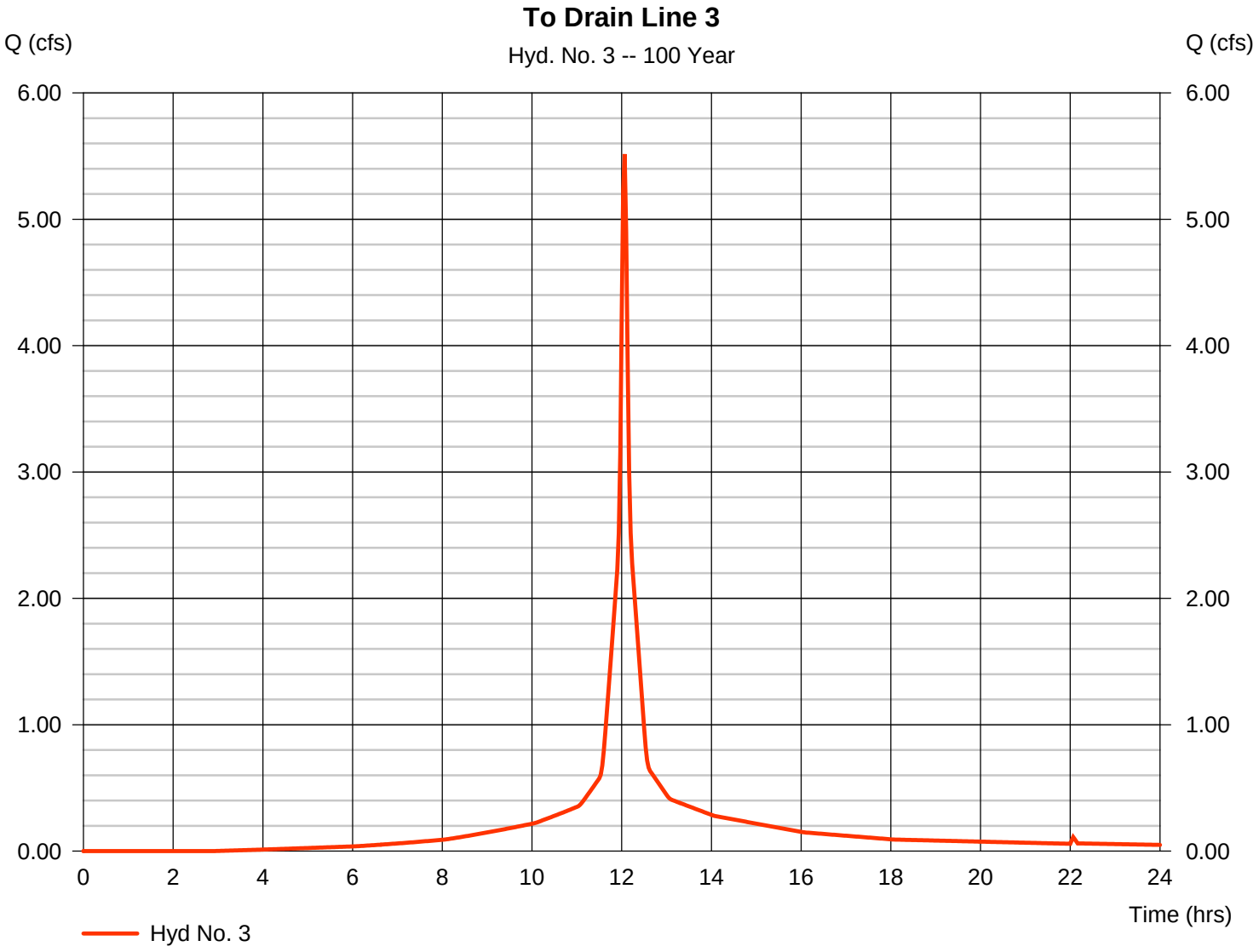


Hydrograph Report

Hyd. No. 3

To Drain Line 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.516 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	17,696 cuft
Drainage area	=	0.879 ac	Curve number	=	90.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

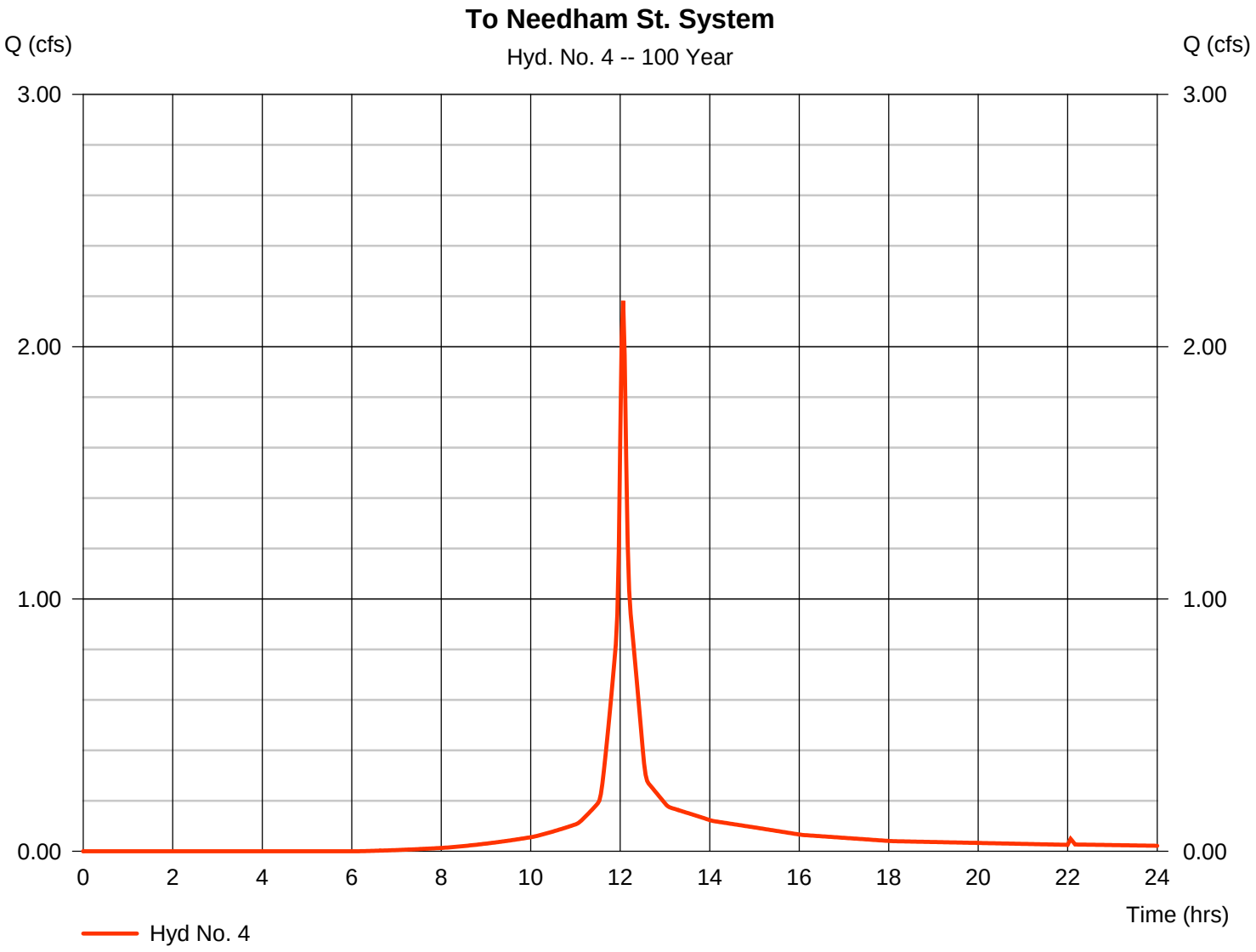


Hydrograph Report

Hyd. No. 4

To Needham St. System

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.182 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	6,598 cuft
Drainage area	=	0.416 ac	Curve number	=	79.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

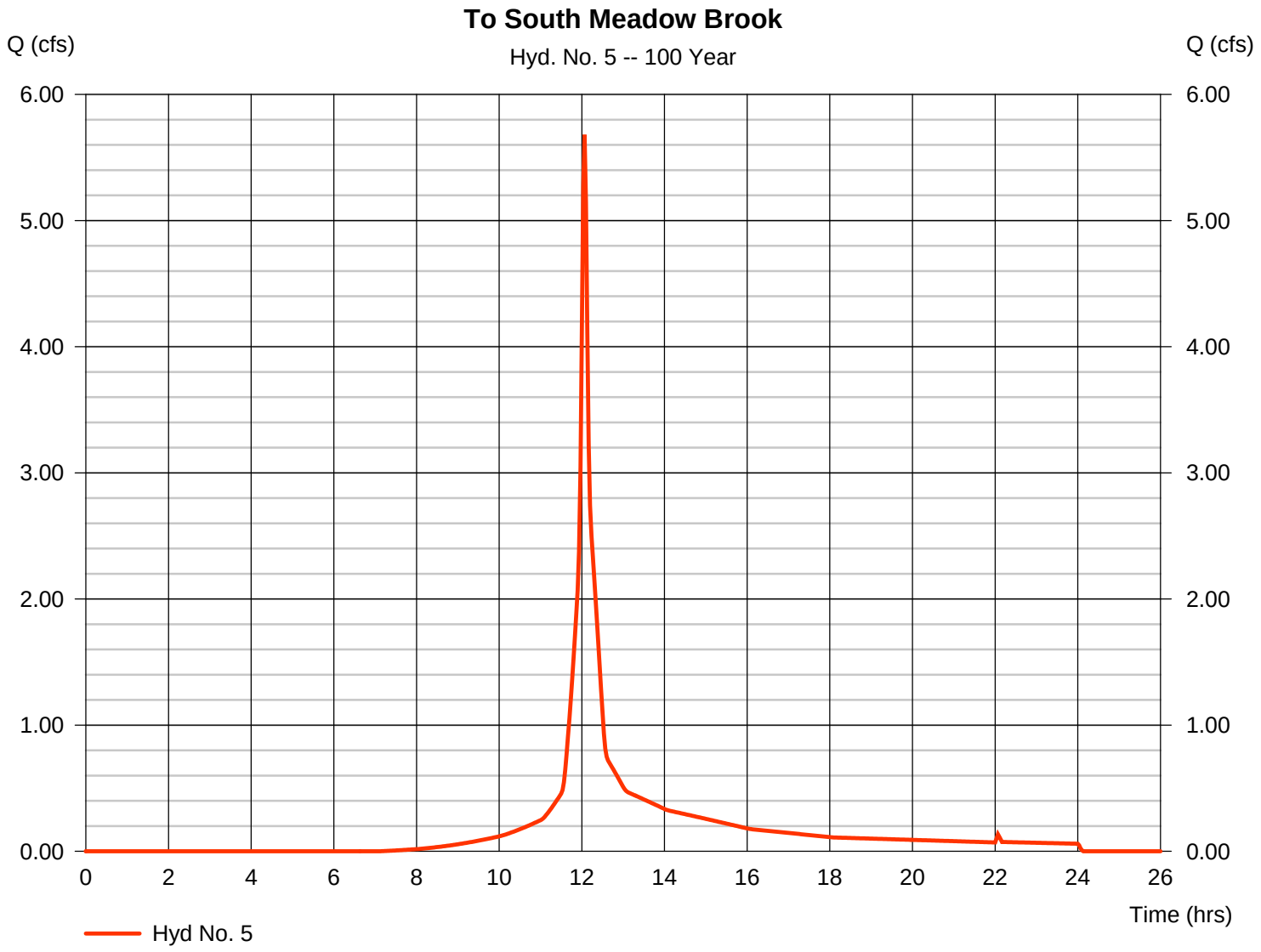


Hydrograph Report

Hyd. No. 5

To South Meadow Brook

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.680 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	17,026 cuft
Drainage area	=	1.184 ac	Curve number	=	75.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

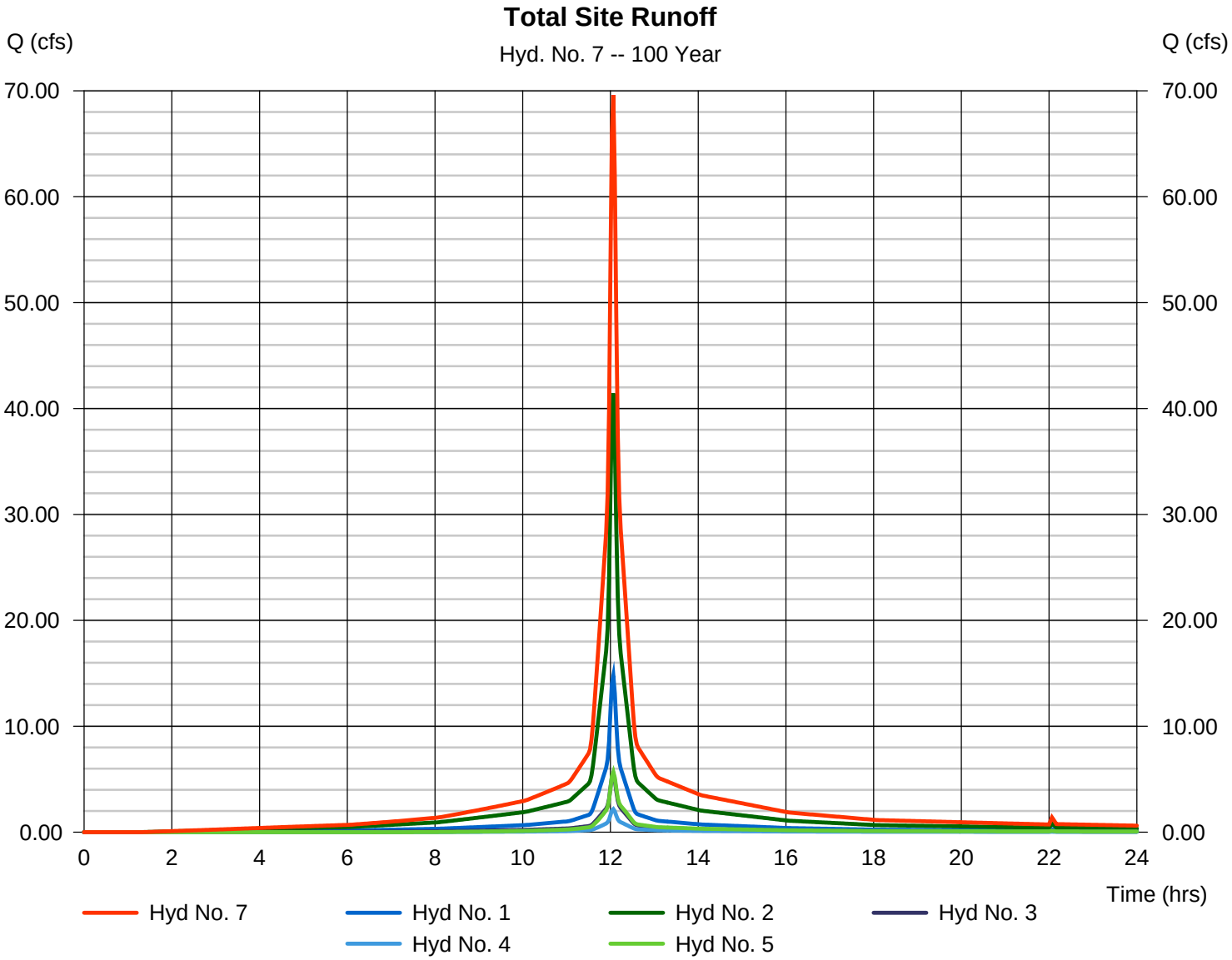


Hydrograph Report

Hyd. No. 7

Total Site Runoff

Hydrograph type	=	Combine	Peak discharge	=	69.59 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	230,763 cuft
Inflow hyds.	=	1, 2, 3, 4, 5	Contrib. drain. area	=	11.064 ac



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment B
Proposed Conditions

TO DRAIN LINE 1

TO SOUTH MEADOW BROOK

SOUTH MEADOW BROOK

TO RECHARGE

SUBSURFACE RECHARGE SYSTEM

#151 – 153

TO DRAIN LINE 1

TO DRAIN LINE 3

#165

TO DRAIN LINE 2

#141 – 143

NEEDHAM STREET

131, 141-143, 151-153, 165, 173, & 181 NEEDHAM STREET NEWTON, MA	SCALE: 1"= 80' DATE: 03/30/15 2013–075–PRDR02	PROPOSED DRAINAGE EXHIBIT	KELLY ENGINEERING GROUP, INC. CIVIL ENGINEERING CONSULTANTS 0 CAMPANELLI DRIVE · BRAINTREE MA · 02184 PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/26/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to Drain Line 1**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	9459	652671
Roof Area		98	0	0
Wetlands		98	0	0
Paved/Concrete		98	59087	5790526
		Totals =	68546.00	6443197
		Acres =	1.57359963	

CN or C (weighted) = total product/total area = **94.0**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/26/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to Recharge 1**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	1683	116127
Roof Area		98	31472	3084256
Wetlands		98	0	0
Paved/Concrete		98	44013	4313274
		Totals =	77168.00	7513657
		Acres =	1.77153352	

CN or C (weighted) = total product/total area = **97.4**

Reference:
Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/26/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to Drain Line 2**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	16745	1155405
Roof Area		98	101488	9945824
Wetlands		98	0	0
Paved/Concrete		98	136916	1.3E+07
		Totals =	255149.00	2.5E+07
		Acres =	5.85741506	

CN or C (weighted) = total product/total area = **96.1**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/26/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to Drain Line 3**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	7004	483276
Roof Area		98	0	0
Wetlands		98	0	0
Paved/Concrete		98	22531	2208038
		Totals =	29535.00	2691314
		Acres =	0.6780303	

CN or C (weighted) = total product/total area = **91.1**

Reference:

Urban Hydrology for Small Watersheds
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Crosspoint Associates, Inc. **By:** hk **Date:** 03/26/15
Location : 131, 141-143, 151-153, 165, 173, 181 Needham St., Newton, MA
Description: **Proposed Conditions - Area to South Meadow Brook**

Circle One: **Pre** or Post

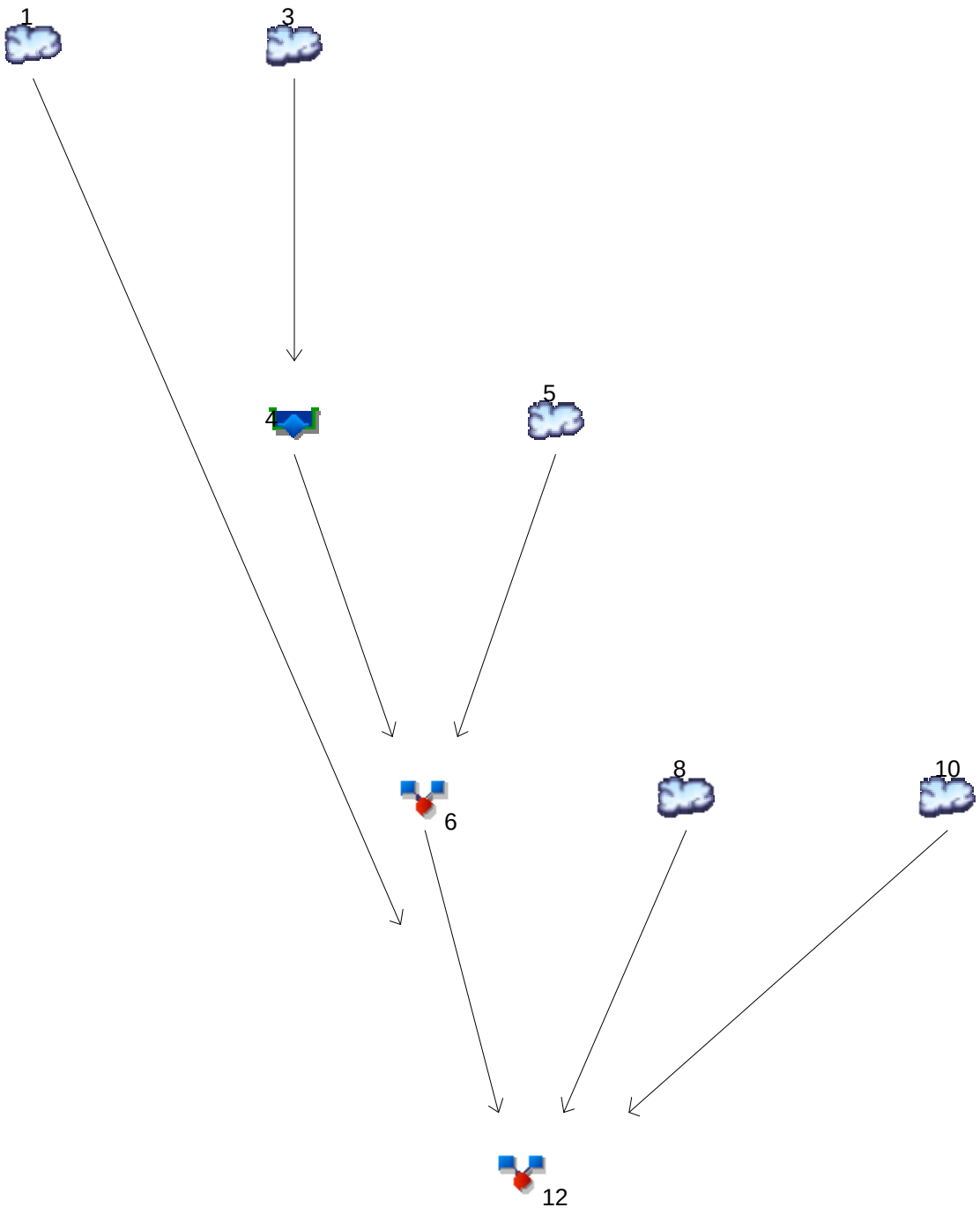
Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Green Area	Fair Condition; Hydrologic Group B	69	39716	2740404
Roof Area		98	0	0
Wetlands		98	11869	1163162
Paved/Concrete		98	0	0
		Totals =	51585.00	3903566
		Acres =	1.18422865	

CN or C (weighted) = total product/total area = **75.7**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	To Drain Line 1
3	SCS Runoff	To Recharge 1
4	Reservoir	Through Recharge 1
5	SCS Runoff	Area to Drain Line 2
6	Combine	Total to Drain Line 2
8	SCS Runoff	To Drain Line 3
10	SCS Runoff	To South Meadow Brook
12	Combine	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	4.188	-------	-------	6.362	7.592	8.511	10.19	To Drain Line 1
3	SCS Runoff	------	-------	5.092	-------	-------	7.475	8.830	9.846	11.70	To Recharge 1
4	Reservoir	3	-------	0.696	-------	-------	1.965	2.484	2.835	3.523	Through Recharge 1
5	SCS Runoff	------	-------	16.42	-------	-------	24.38	28.90	32.28	38.45	Area to Drain Line 2
6	Combine	4, 5	-------	16.43	-------	-------	25.54	30.71	34.42	41.08	Total to Drain Line 2
8	SCS Runoff	------	-------	1.647	-------	-------	2.596	3.134	3.536	4.269	To Drain Line 3
10	SCS Runoff	------	-------	1.380	-------	-------	2.827	3.717	4.402	5.680	To South Meadow Brook
12	Combine	1, 6, 8, 10,	-------	23.65	-------	-------	37.32	45.15	50.87	61.21	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	4.188	2	724	13,107	------	------	------	To Drain Line 1
3	SCS Runoff	5.092	2	724	16,892	------	------	------	To Recharge 1
4	Reservoir	0.696	2	754	9,428	3	105.35	10,542	Through Recharge 1
5	SCS Runoff	16.42	2	724	53,041	------	------	------	Area to Drain Line 2
6	Combine	16.43	2	724	62,469	4, 5	------	------	Total to Drain Line 2
8	SCS Runoff	1.647	2	724	5,015	------	------	------	To Drain Line 3
10	SCS Runoff	1.380	2	724	4,296	------	------	------	To South Meadow Brook
12	Combine	23.65	2	724	84,887	1, 6, 8, 10,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	6.362	2	724	20,437	------	------	------	To Drain Line 1
3	SCS Runoff	7.475	2	724	25,296	------	------	------	To Recharge 1
4	Reservoir	1.965	2	744	17,832	3	105.88	13,919	Through Recharge 1
5	SCS Runoff	24.38	2	724	80,668	------	------	------	Area to Drain Line 2
6	Combine	25.54	2	724	98,500	4, 5	------	------	Total to Drain Line 2
8	SCS Runoff	2.596	2	724	8,095	------	------	------	To Drain Line 3
10	SCS Runoff	2.827	2	724	8,486	------	------	------	To South Meadow Brook
12	Combine	37.32	2	724	135,518	1, 6, 8, 10,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	7.592	2	724	24,662	------	------	------	To Drain Line 1
3	SCS Runoff	8.830	2	724	30,107	------	------	------	To Recharge 1
4	Reservoir	2.484	2	742	22,643	3	106.21	15,859	Through Recharge 1
5	SCS Runoff	28.90	2	724	96,517	------	------	------	Area to Drain Line 2
6	Combine	30.71	2	724	119,160	4, 5	------	------	Total to Drain Line 2
8	SCS Runoff	3.134	2	724	9,886	------	------	------	To Drain Line 3
10	SCS Runoff	3.717	2	724	11,113	------	------	------	To South Meadow Brook
12	Combine	45.15	2	724	164,821	1, 6, 8, 10,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	8.511	2	724	27,841	------	------	------	To Drain Line 1
3	SCS Runoff	9.846	2	724	33,718	------	------	------	To Recharge 1
4	Reservoir	2.835	2	742	26,253	3	106.48	17,225	Through Recharge 1
5	SCS Runoff	32.28	2	724	108,420	------	------	------	Area to Drain Line 2
6	Combine	34.42	2	724	134,673	4, 5	------	------	Total to Drain Line 2
8	SCS Runoff	3.536	2	724	11,238	------	------	------	To Drain Line 3
10	SCS Runoff	4.402	2	724	13,157	------	------	------	To South Meadow Brook
12	Combine	50.87	2	724	186,909	1, 6, 8, 10,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	10.19	2	724	33,683	------	------	------	To Drain Line 1
3	SCS Runoff	11.70	2	724	40,340	------	------	------	To Recharge 1
4	Reservoir	3.523	2	742	32,876	3	107.12	19,412	Through Recharge 1
5	SCS Runoff	38.45	2	724	130,266	------	------	------	Area to Drain Line 2
6	Combine	41.08	2	724	163,142	4, 5	------	------	Total to Drain Line 2
8	SCS Runoff	4.269	2	724	13,729	------	------	------	To Drain Line 3
10	SCS Runoff	5.680	2	724	17,026	------	------	------	To South Meadow Brook
12	Combine	61.21	2	724	227,581	1, 6, 8, 10,	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

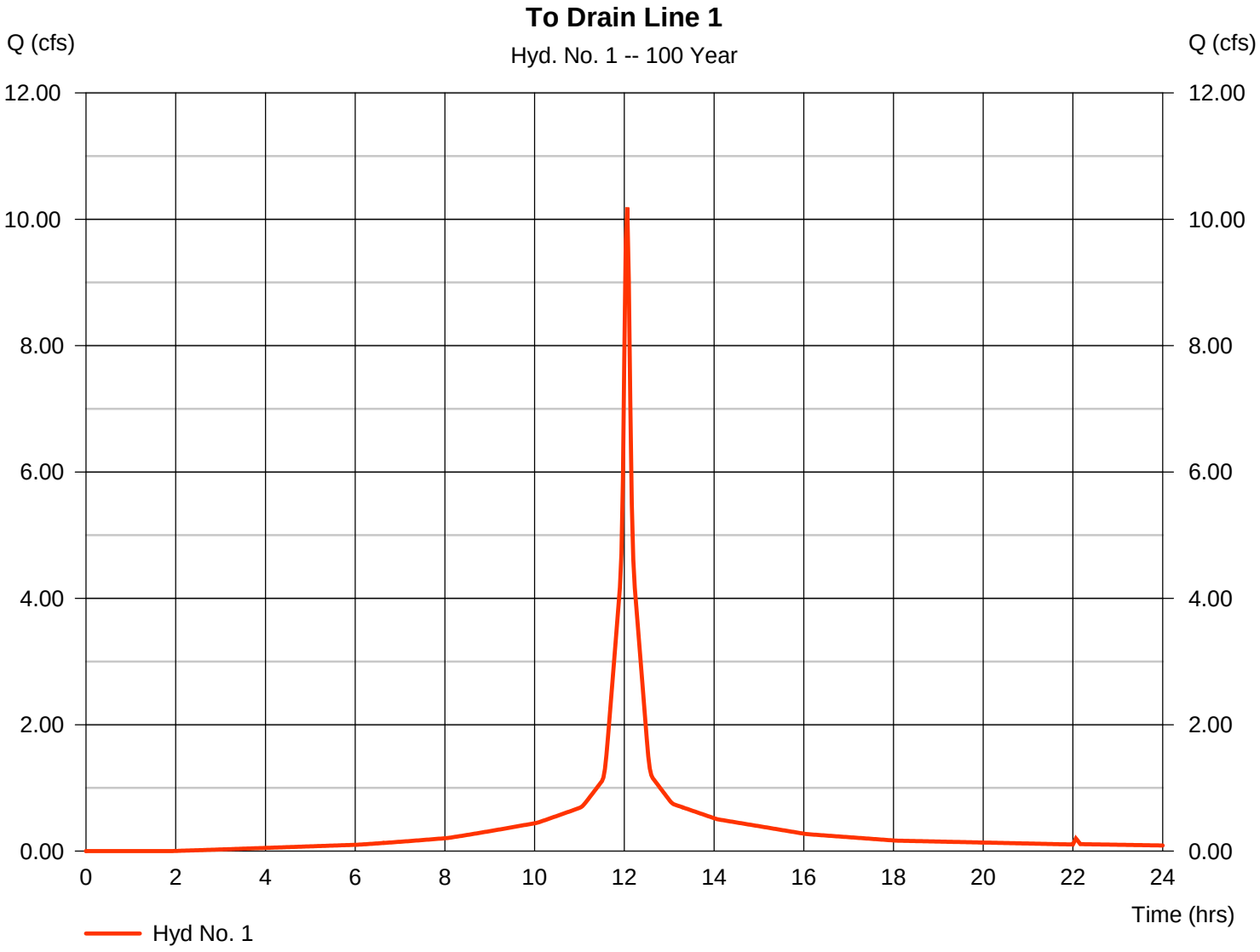
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.10	0.00	3.30	4.50	5.30	5.90	7.00
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydrograph Report

Hyd. No. 1

To Drain Line 1

Hydrograph type	= SCS Runoff	Peak discharge	= 10.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 33,683 cuft
Drainage area	= 1.574 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

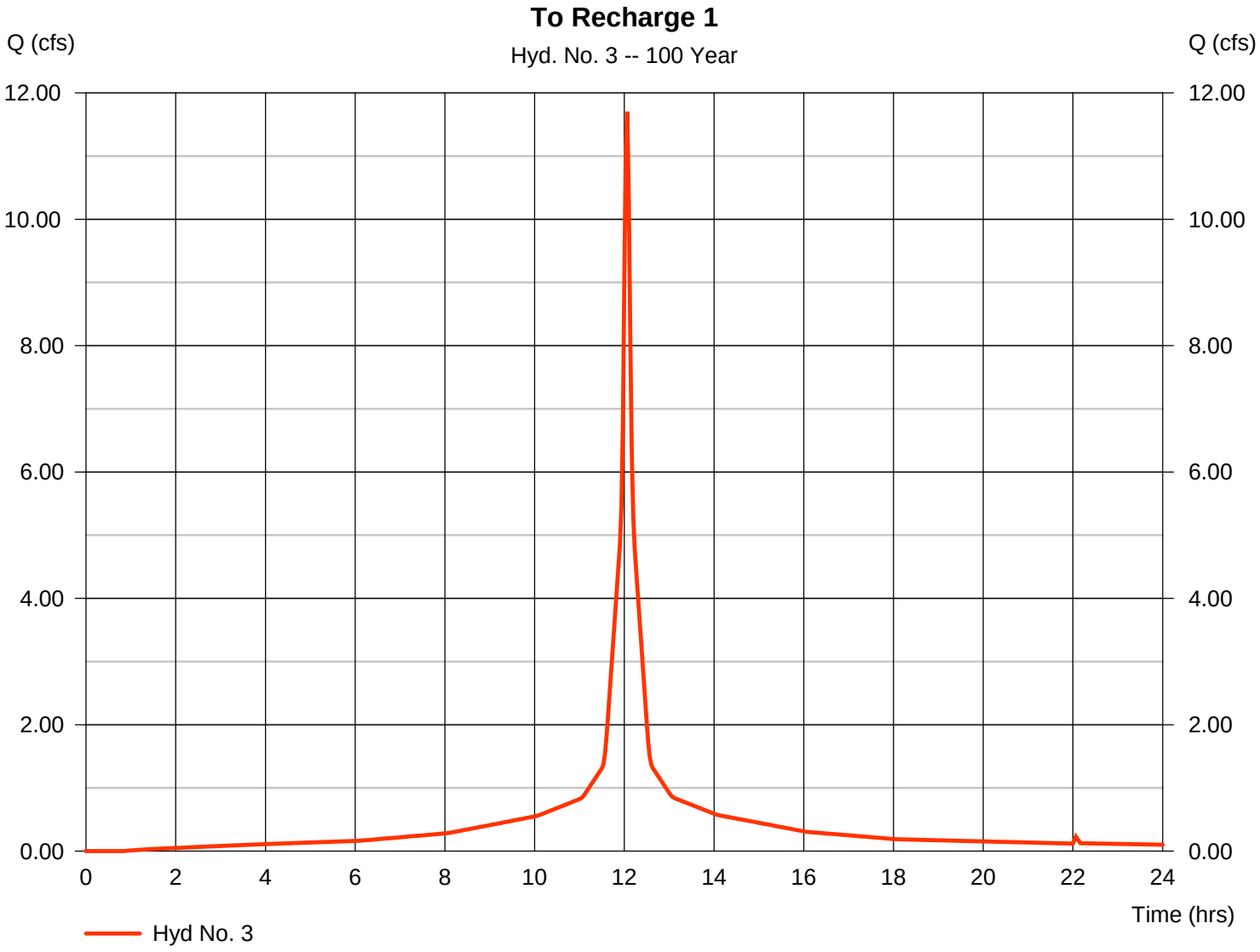


Hydrograph Report

Hyd. No. 3

To Recharge 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.70 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	40,340 cuft
Drainage area	=	1.772 ac	Curve number	=	97.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



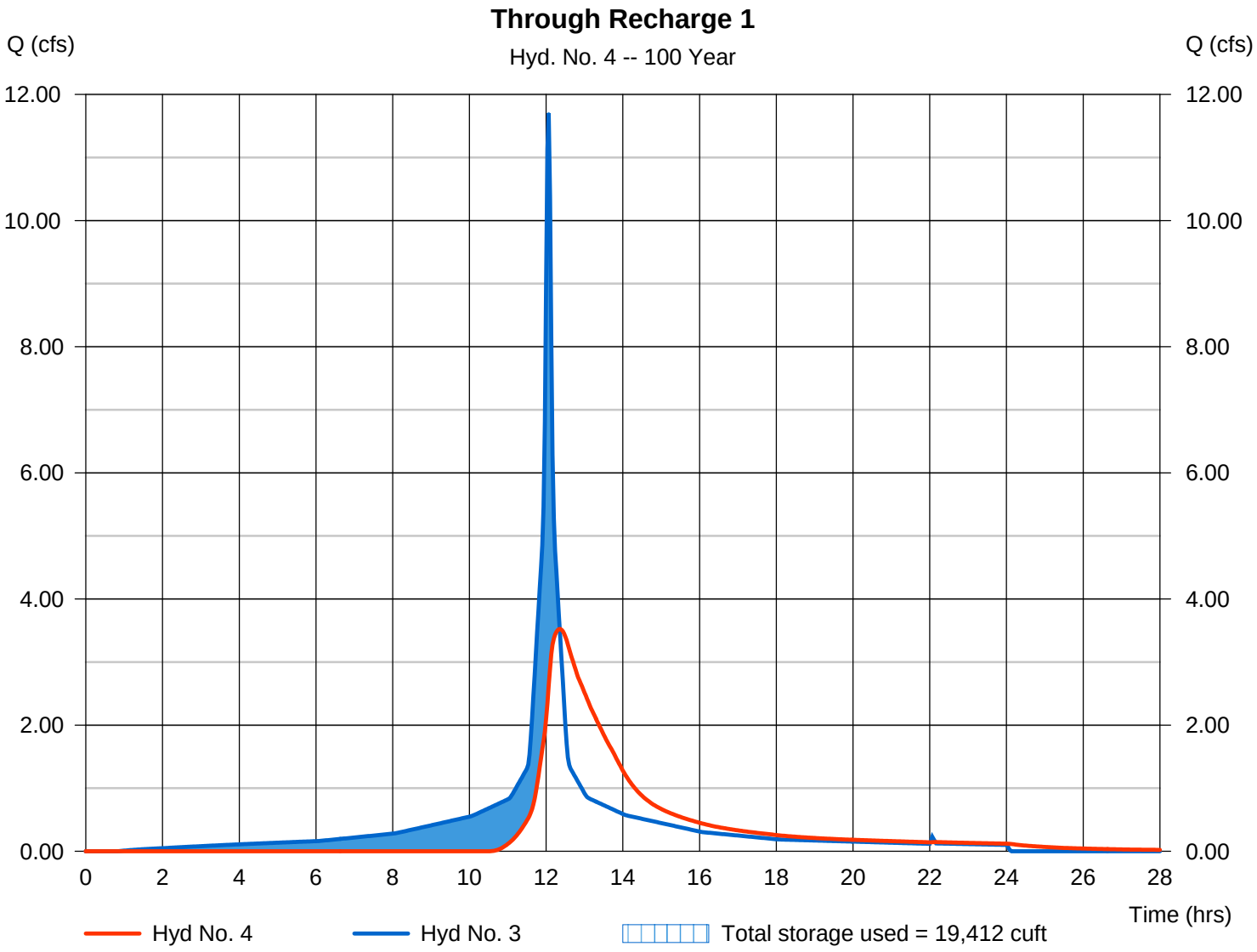
Hydrograph Report

Hyd. No. 4

Through Recharge 1

Hydrograph type	=	Reservoir	Peak discharge	=	3.523 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.37 hrs
Time interval	=	2 min	Hyd. volume	=	32,876 cuft
Inflow hyd. No.	=	3 - To Recharge 1	Max. Elevation	=	107.12 ft
Reservoir name	=	Subsurface Recharge System	Max. Storage	=	19,412 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Subsurface Recharge System

Pond Data

UG Chambers -Invert elev. = 104.10 ft, Rise x Span = 2.54 x 4.30 ft, Barrel Len = 7.00 ft, No. Barrels = 233, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 103.60 ft, Width = 4.80 ft, Height = 3.54 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	103.60	n/a	0	0
0.35	103.95	n/a	1,109	1,109
0.71	104.31	n/a	1,983	3,092
1.06	104.66	n/a	2,580	5,672
1.42	105.02	n/a	2,533	8,205
1.77	105.37	n/a	2,452	10,657
2.12	105.72	n/a	2,331	12,988
2.48	106.08	n/a	2,156	15,144
2.83	106.43	n/a	1,889	17,033
3.19	106.79	n/a	1,342	18,375
3.54	107.14	n/a	1,109	19,484

Culvert / Orifice Structures

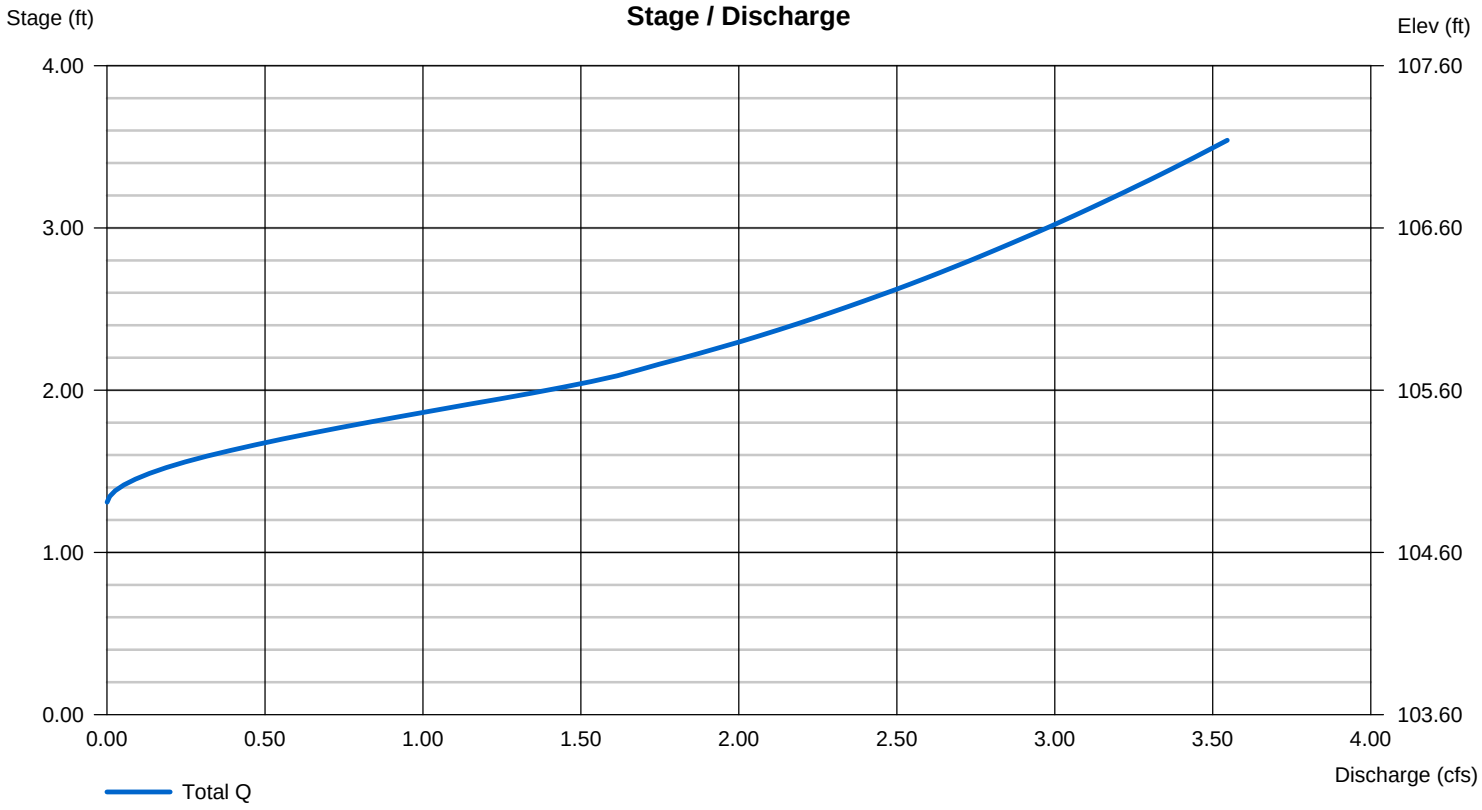
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	0.00	0.00	0.00
Span (in)	= 10.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 104.90	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	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) = 0.000 (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).

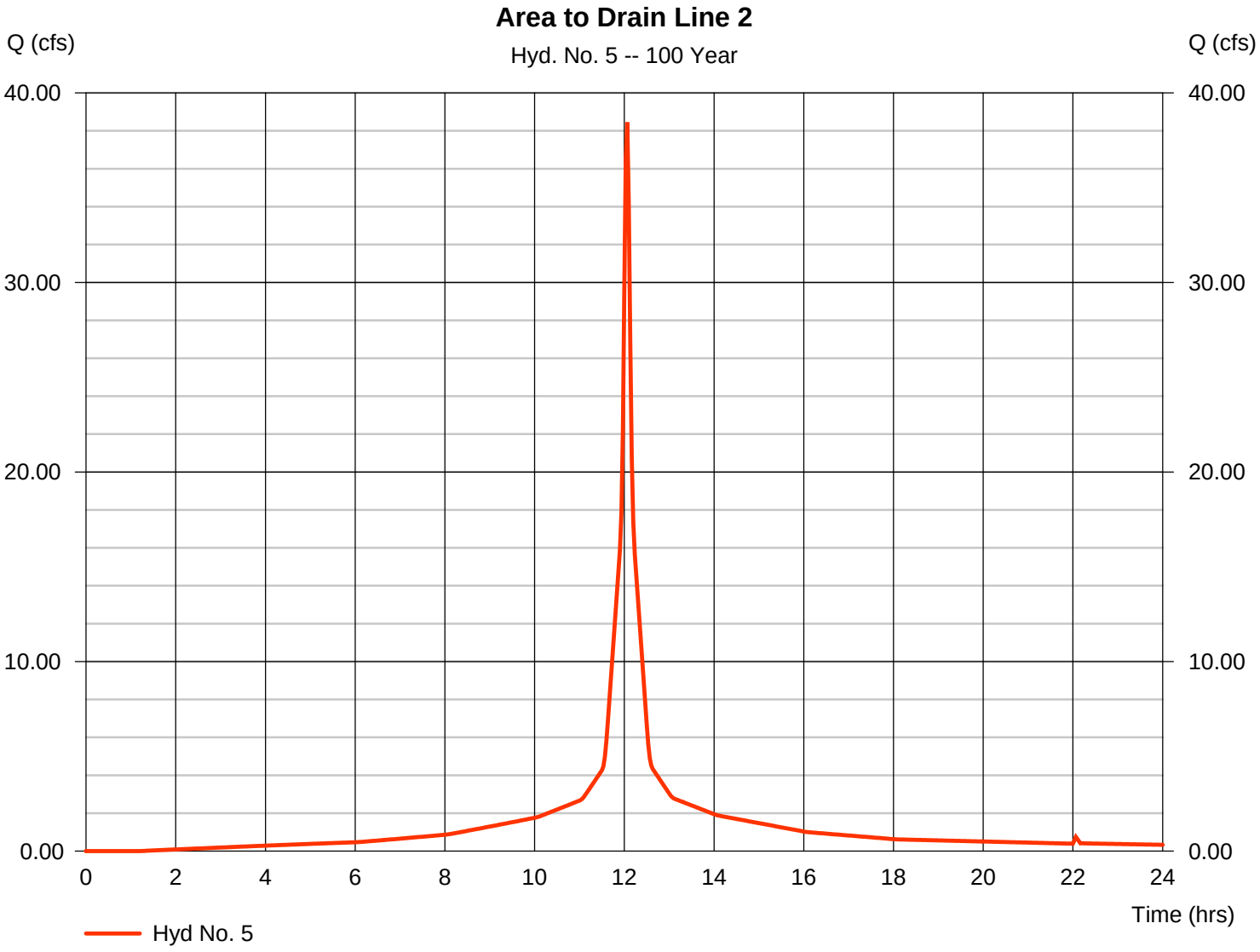


Hydrograph Report

Hyd. No. 5

Area to Drain Line 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	130,266 cuft
Drainage area	=	5.857 ac	Curve number	=	96.1
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

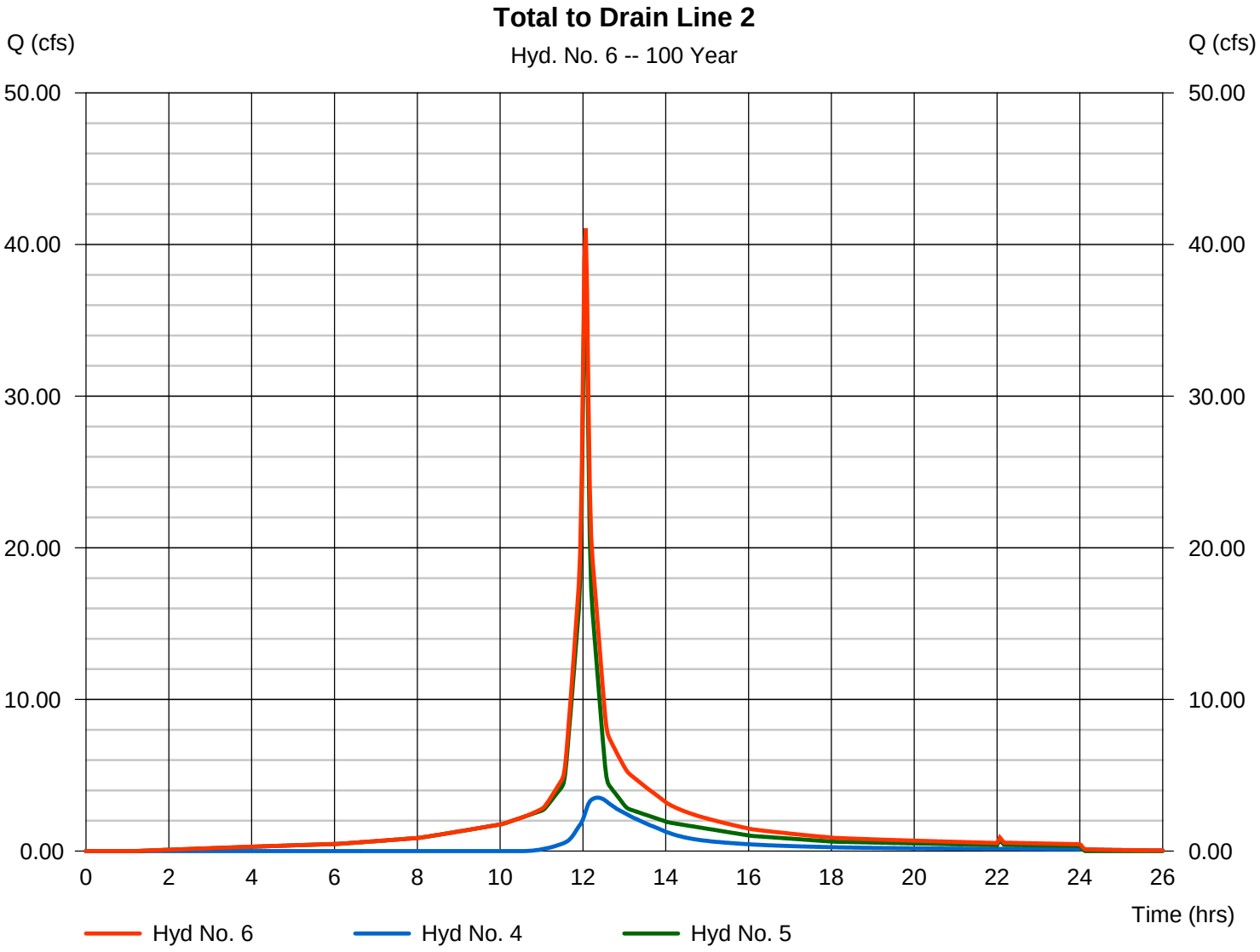


Hydrograph Report

Hyd. No. 6

Total to Drain Line 2

Hydrograph type	= Combine	Peak discharge	= 41.08 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 163,142 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 5.857 ac

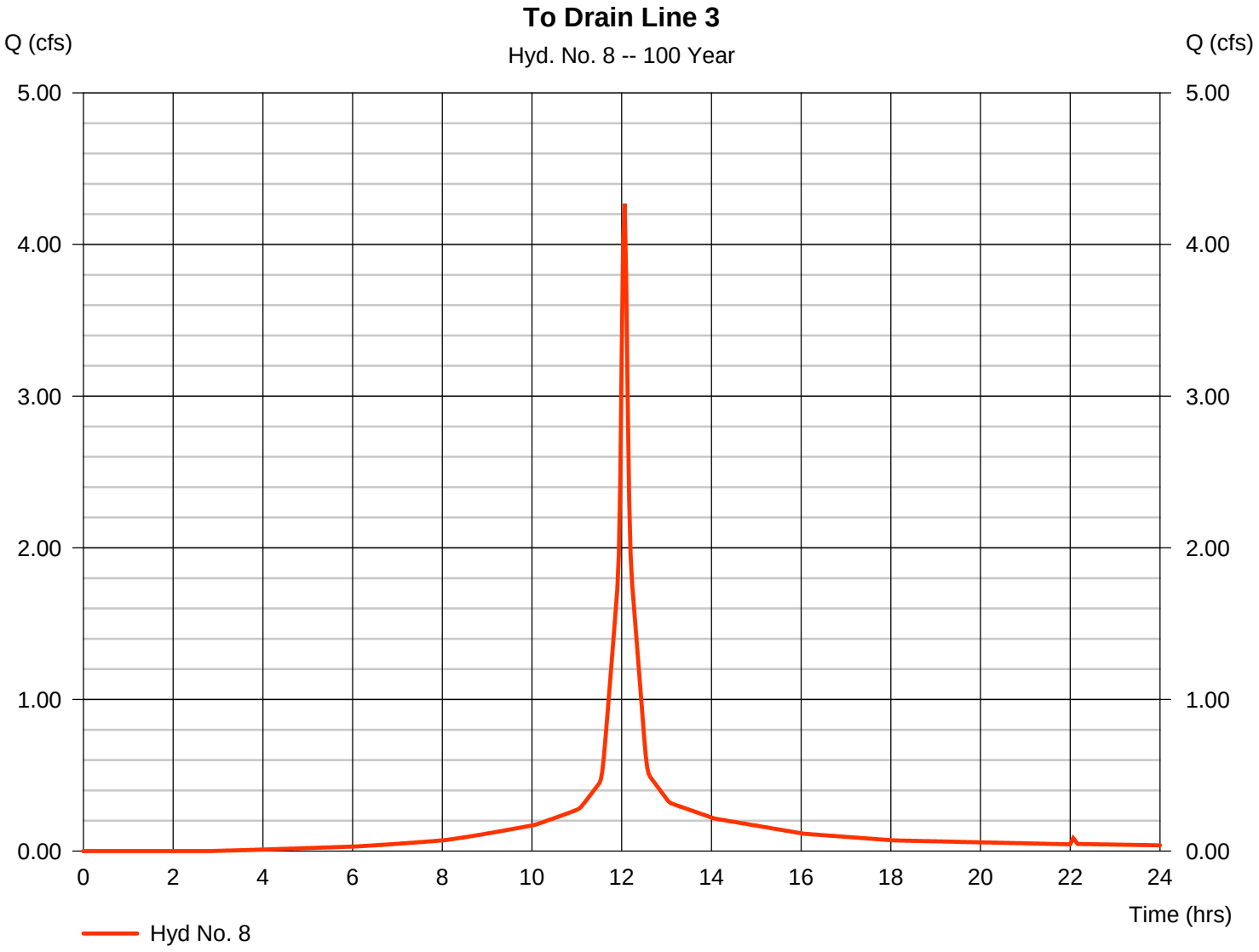


Hydrograph Report

Hyd. No. 8

To Drain Line 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.269 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	13,729 cuft
Drainage area	=	0.678 ac	Curve number	=	91.1
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

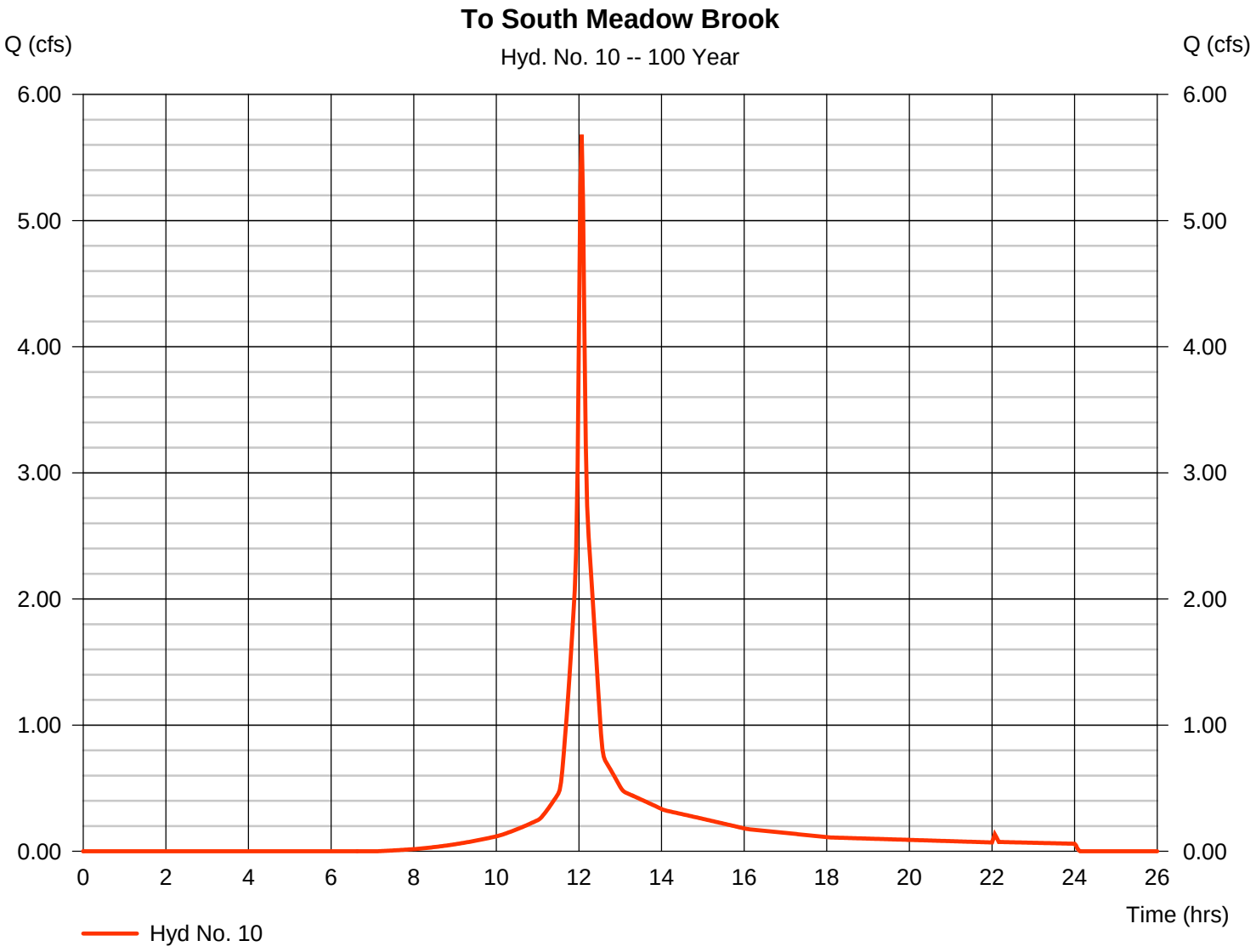


Hydrograph Report

Hyd. No. 10

To South Meadow Brook

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.680 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	17,026 cuft
Drainage area	=	1.184 ac	Curve number	=	75.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

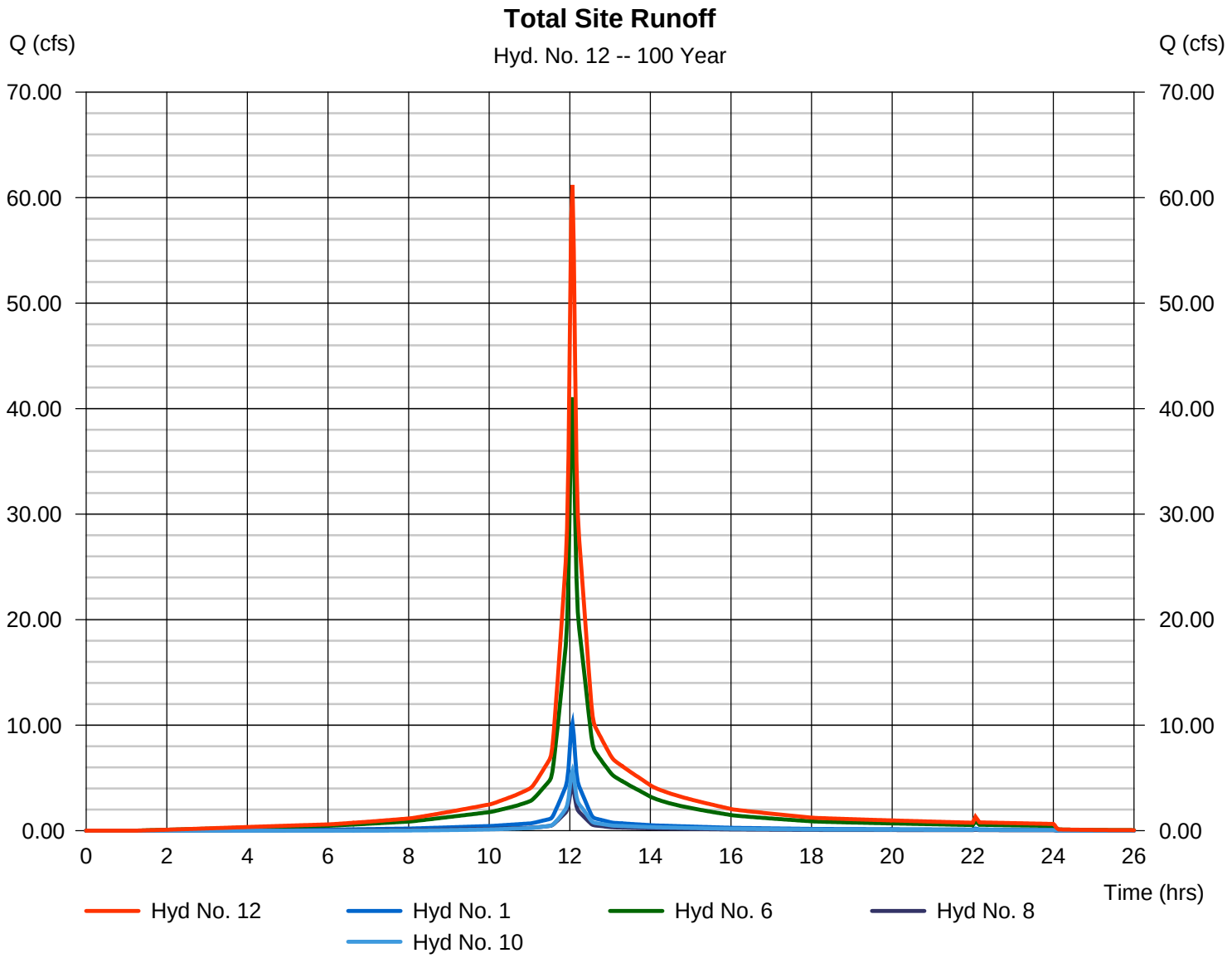


Hydrograph Report

Hyd. No. 12

Total Site Runoff

Hydrograph type	=	Combine	Peak discharge	=	61.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	227,581 cuft
Inflow hyds.	=	1, 6, 8, 10	Contrib. drain. area	=	3.436 ac



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment C

Miscellaneous

ZERO CAMPANELLI DRIVE BRAINTREE MA 02184
PHONE- 781 843 4333 FAX -781 843 0028

KELLY ENGINEERING GROUP, INC

Groundwater Adjustment (USGS Methodology)

Mottling (seasonal high groundwater) was not determined but standing water was encountered in TP-2. The following is the estimated high groundwater adjustment using USGS Methodology (Frimpter Method). The site is located in the City of Newton and soils in TP-2 are sands and gravels. USGS observation well MA-WKW 2 Wayland, MA was chosen for its proximity and similar soil type to the site.

TP-2

Frimpter Method $S_h=S_c-[S_r(OW_c-OW_{max})/OW_r]$

S_h =estimate depth to the high groundwater elevation

S_c =10.83' (measured depth to the current groundwater elevation at the site)

See Site Development Plans by Kelly Engineering Group, Inc.

S_r =4.2' (expected range in water levels at the site. This value is based on the combined records of all observation wells for that parent material and landform)

See Fig. 3. Probability of water level range in sands and gravels in valley flats.

OW_c =15.77' (measured depth to the present groundwater elevation in the selected observation well)

See USGS observation well MA-WKW 2 Wayland, MA March 25, 2015.

OW_{max} =13.39' (maximum groundwater elevation on record for the selected observation well)

See USGS maximum water level for observation well MA-WKW 2 Wayland, MA

OW_r =3.70' (historical upper limit of the annual range for the selected observation well)

See USGS observation well MA-NNW 27 Norfolk, MA

S_h =10.83'-[4.2'(15.77'-13.39')/3.70']

=10.83'-2.7'

=**8.1'**

Surface elevation at test hole TP-2 is 109.7. The estimated adjusted high groundwater elevation is **101.6.**

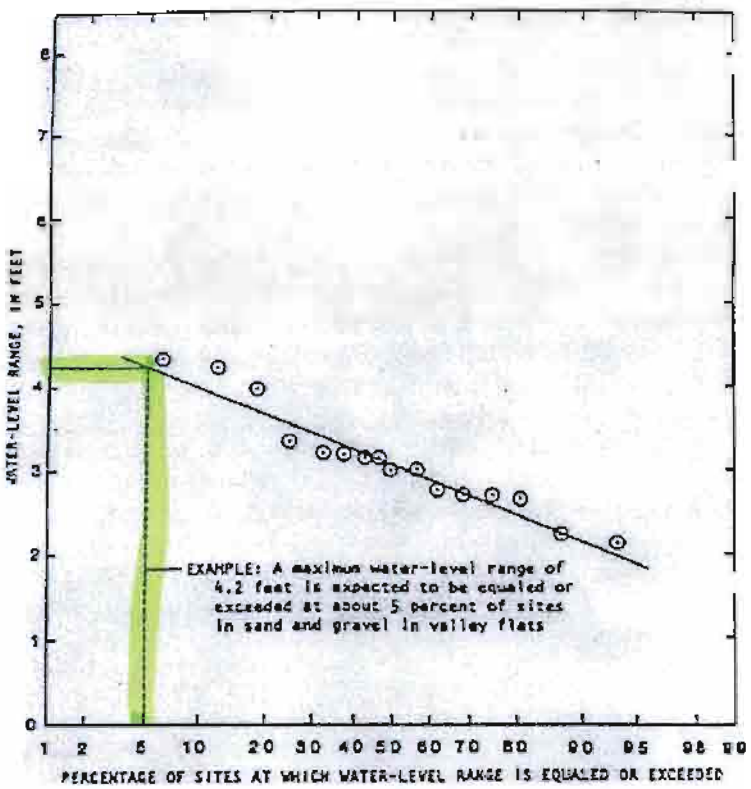


Fig. 3. Probability of water level range in sands and gravels in valley flats. (source: Frimpter, 1981)

Sample Calculation to Estimate High Groundwater Elevation Using the USGS Method

The following provides an example demonstrating how one may calculate the high groundwater elevation at a site in Lakeville located in southeastern Massachusetts. An earlier soil evaluation showed that the site was located on stratified sandy deposits on a kame terrace. The groundwater level at the proposed building site is 8.0 feet below the soil surface. The groundwater level was measured on February 27, 2000.

National Water Information System: Map View

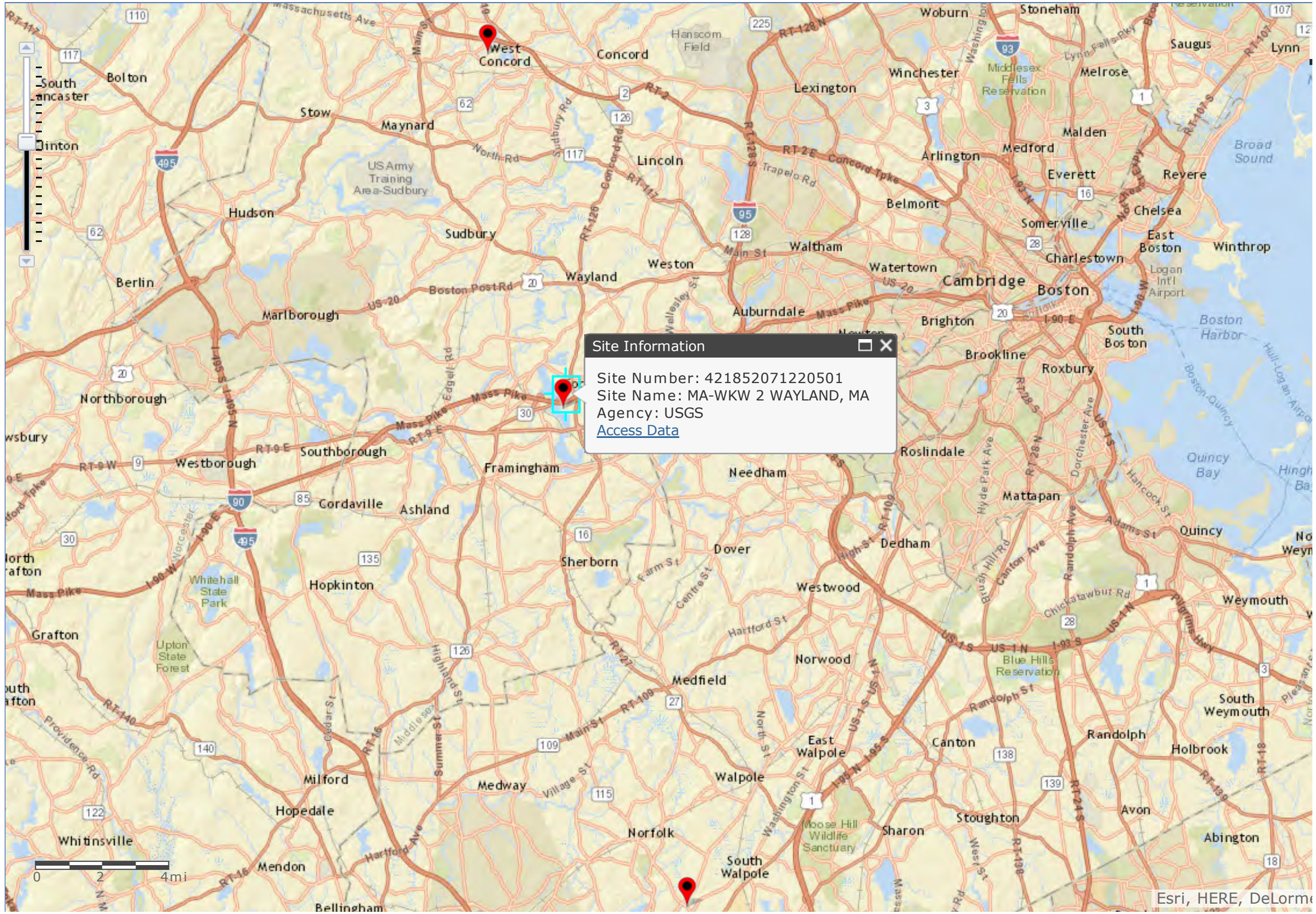
Map Layers

Search Results

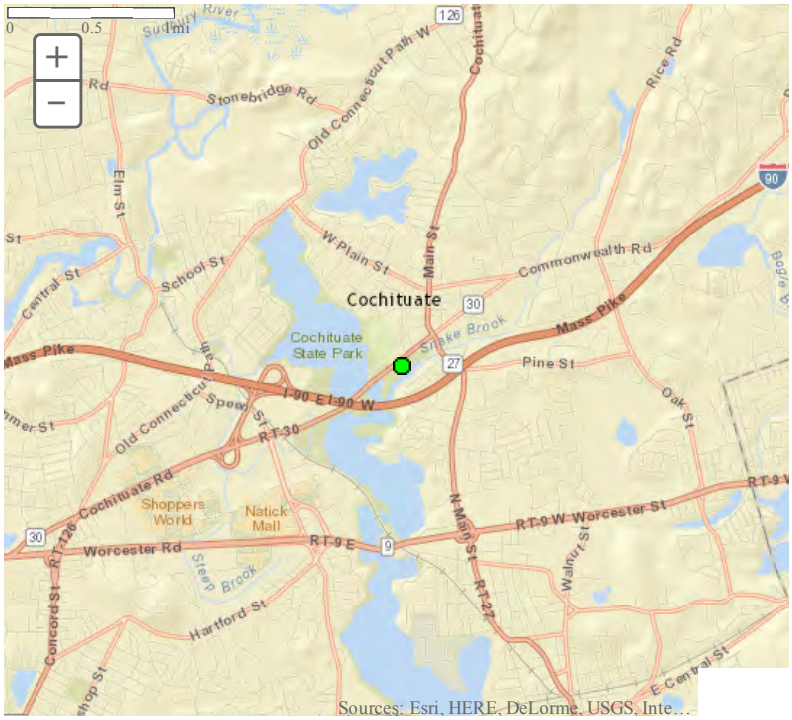
414936076014301	MA-BMW 22 BREWSTER, MA
414714071175901	MA-SHW 275 SEEKONK, MA
415228070554601	MA-LKW 14 LAKEVILLE, MA
415353069585401	MA-WNW 17 WELLFLEET, MA
415453070434901	MA-PWW 22 PLYMOUTH, MA
420206070045901	MA-TSW 89 TRURO, MA
420259072581701	MA-GLW 6 GRANVILLE, MA
420321070433502	MA-D4W 79 DUXBURY, MA
420351073193602	MA-SJW 58 SHEFFIELD, MA
420545071174001	MA-NNW 27 NORFOLK, MA
421852071220501	MA-WKW 2 WAYLAND, MA
422103072241102	MA-PDW 23 PELHAM, MA
422341071464901	MA-WSW 26 WEST BOYLSTON, MA
422745073112001	MA-PTW 51 PITTSFIELD, MA
422812071244401	MA-ACW 158 ACTON, MA
422906072124301	MA-PHW 16 PETERSHAM, MA
423115071032001	MA-WAW 38 WAKEFIELD, MA
423401071093801	MA-XMW 78 WILMINGTON, MA
423505070491702	MA-WPW 76 WENHAM, MA
424520070562401	MA-NIW 27 NEWBURY, MA
424841071004101	MA-HLW 23 HAVERHILL, MA

Search Parameters

Explanation of Symbols



Site Number: 421852071220501 - MA-WKW 2 WAYLAND, MA



Groundwater Watch Help Page

DESCRIPTION:
Latitude 42°18'52", Longitude 71°22'05" NAD27
Middlesex County, Massachusetts, Hydrologic Unit 01070005
Well depth: 33.0 feet
Hole depth: 37.5 feet
Land surface altitude: 153.78feet above NGVD29.
Well completed in "Sand and gravel aquifers (glaciated regions)" (N100GLCIAL) national aquifer.
Well completed in "Outwash" (112OTSH) local aquifer

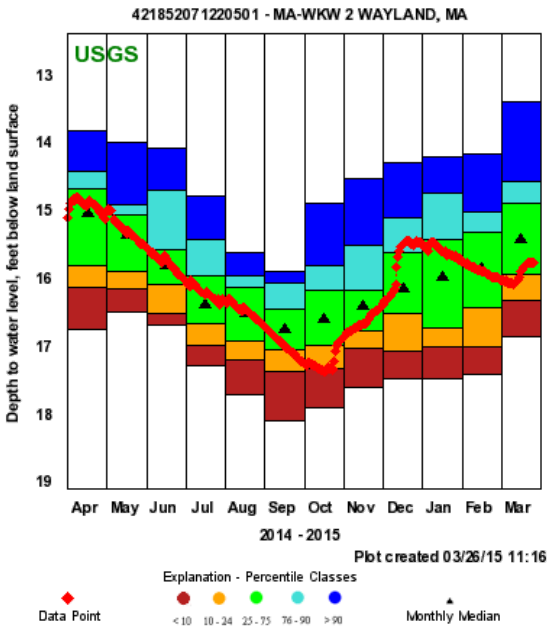
AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations	2011-10-01	2015-03-21	
Daily Data			
Depth to water level, feet below land surface	2011-10-01	2015-03-20	1207
Daily Statistics			
Depth to water level, feet below land surface	2011-10-01	2014-11-02	1070
Monthly Statistics			
Depth to water level, feet below land surface	2011-10	2014-11	
Annual Statistics			
Depth to water level, feet below land surface	2012	2015	
Field groundwater-level measurements	1965-01-29	2015-02-03	583
Field/Lab water-quality samples			
Water-Year Summary	2005	2014	8

Additional Data Sources	Begin Date	End Date	Count
Groundwater Watch **offsite**	1965	2015	1782

OPERATION:
Record for this site is maintained by the USGS Massachusetts Water Science Center
Email questions about this site to Massachusetts Water Science Center Water-Data Inquiries

Site Statistics



Most recent data value: 15.77 on 3/25/2015
Period of Record Monthly Statistics for 421852071220501
Depth to water level, feet below land surface
All Approved Continuous & Periodic Data Used In Analysis
Note: Highlighted values in the table indicate closest statistic to the most recent data value.

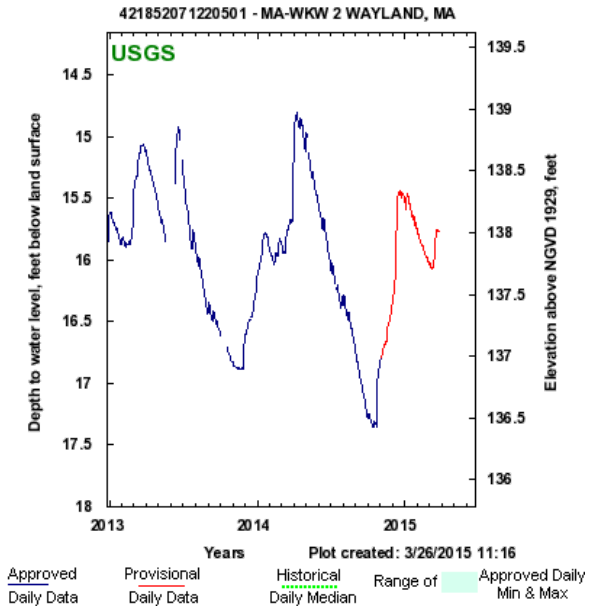
Month	Lowest Median	10th % ile	25th % ile	50th % ile	75th % ile	90th % ile	Highest Median	Number of Years
Jan	17.47	17.00	16.73	15.99	15.42	14.75	14.20	48
Feb	17.41	17.00	16.42	15.86	15.31	15.01	14.17	49
Mar	16.85	16.32	15.93	15.43	14.89	14.57	13.39	49
Apr	16.75	16.14	15.81	15.05	14.67	14.42	13.82	50
May	16.50	16.15	15.89	15.37	15.07	14.91	13.99	48
Jun	16.68	16.52	16.08	15.80	15.58	14.70	14.08	50
Jul	17.29	16.98	16.66	16.39	15.95	15.43	14.78	49
Aug	17.71	17.19	16.93	16.51	16.14	15.95	15.62	48
Sep	18.10	17.37	17.05	16.75	16.45	16.06	15.90	50
Oct	17.90	17.33	16.98	16.61	16.18	15.81	14.88	50
Nov	17.60	17.03	16.77	16.40	16.17	15.50	14.52	50
Dec	17.48	17.08	16.52	16.16	15.62	15.1	14.29	48

As of 3/20/2015 23:40-2

Statistics Options

View month/year statistics

Daily Groundwater Data



Most recent Provisional daily data value: 15.77 on 03/25/15

Summary for Period of Continuous Record

Depth to water level, feet below land surface

Approved Daily Mean Values Data Used in Analysis

Begin Date	End Date	Days	% Complete
10/01/11	11/02/14	1,070	94

Daily Data Options

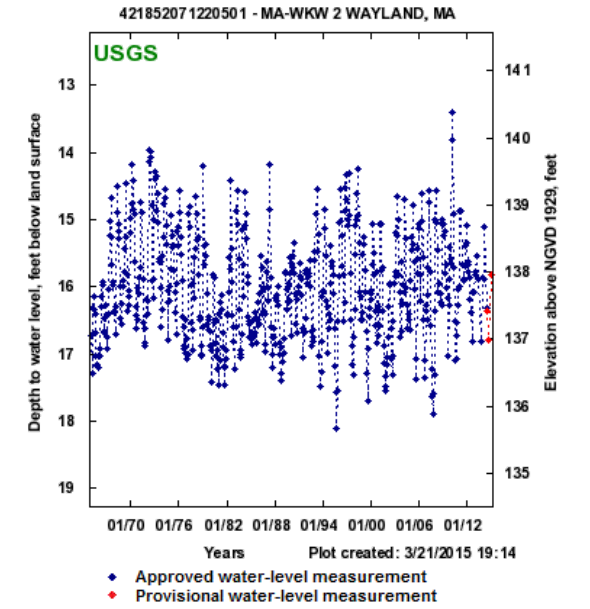
View latest data on NWISWeb

View data in calendar format

Download data in text format

View daily medians

Periodic Groundwater Data



Summary for Period of Record Periodic Water Levels

Depth to water level, feet below land surface

Approved Periodic Water Level Values

Begin Date	End Date	Number of Values
01/29/65	02/03/15	583

Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL
13.39	03/26/10	18.1	09/26/95

Groundwater Levels Options

View latest data on NWISWeb

Download Groundwater levels in text format

Period of Record - All Data Types

Summary for Period of Record - All Data Types

Depth to water level, feet below land surface

Begin Date	End Date	Number of Values
01/29/65	03/25/15	2,473

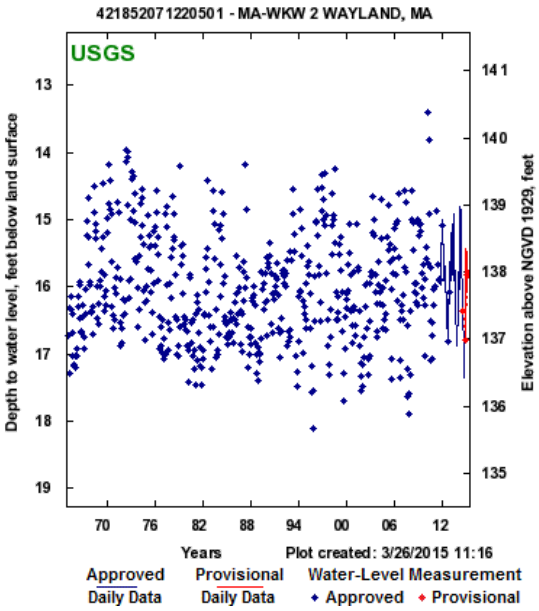
Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL
13.39	03/26/10	18.1	09/26/95

Period of Record Options

View latest data on NWISWeb for all data types

View annual monthly statistics for all data types

Download Groundwater levels in text format of all data types



Return to Groundwater Watch | Return to County Page | Return to State Page

*References to non-Department of the Interior (DOI) products do not constitute an endorsement by the DOI.

Start year of record - 1959
Land-surface elevation 21 ft, well depth 12.5 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 3.28, LOW 12.5 (dry), (OWr) 7.52

WAYLAND (WKW) 2 (real-time data since October 2010)
Start year of record - 1965
Land-surface elevation 157.75 ft, well depth 33.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 13.39, LOW 18.10, (OWr) 3.70

WEBSTER (WLW) 1
Start year of record - 1958
Land-surface elevation 500 ft, well depth 27.0 ft
Lithology - SAND
Topographic setting - HILLTOP
Remarks - none
Period of record - HIGH (OWmax) 10.28, LOW 17.91, (OWr) 6.50

WELLFLEET (WNW) 17 (real-time data since May 2012)
Start year of record - 1962
Land-surface elevation 19.10 ft, well depth 42.0 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - none
Period of record - HIGH (OWmax) 7.27, LOW 12.75, (OWr) 4.63

WENHAM (WPW) 76 (real-time data since May 2012)
Start year of record - 1965
Land-surface elevation 60 ft, well depth 22.0 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - none
Period of record - HIGH (OWmax) 0.39, LOW 4.65, (OWr) 3.83

WEST BOYLSTON (WSW) 26 (real-time data since May 2012)
Start year of record - 1995
Land-surface elevation 485 ft, well depth 16.8 ft
Lithology - SAND
Topographic setting - HILLSIDE
Remarks - none
Period of record - HIGH (OWmax) 1.19, LOW 11.64, (OWr) 10.18

WEST BROOKFIELD (WUW) 2
Start year of record - 1959
Land-surface elevation 630 ft, well depth 43.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 15.79, LOW 23.63, (OWr) 3.36

WESTHAMPTON (WXW) 20

Click to hideNews Bulletins

- March 24, 2015 - Help is back online
- Try our new Mobile-friendly water data site from your mobile device!
- Full News

USGS 421852071220501 MA-WKW 2 WAYLAND, MA

PROVISIONAL DATA SUBJECT TO REVISION

Available data for this site Time-series: Daily data ▼ GO

Click to hidestation-specific text

LOCATION--Lat 42°18'52", long 71°22'05", Middlesex County, Hydrologic Unit 01070005, 0.25 mi west of State Highway 27 and 125 ft southeast of State Highway 30, at Cochituate State Park Headquarters in Wayland, MA.
AQUIFER--Sand and gravel, glaciated regions; outwash deposits.
WELL CHARACTERISTICS--Drilled observation water-table well, depth 33 ft, screened 31 ft to 33 ft.
INSTRUMENTATION--Data Collection Platform with telephone telemeter, October 2010 to current year. Monthly measurements prior to October 2010.
DATUM--Elevation of land-surface datum of well is 153.78 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of well casing, 2.76 ft above land-surface datum.
PERIOD OF RECORD-- January 1965 to current year.
COOPERATION--Town of Framingham

Click here to view values used in "Frimpter Method" estimates, OWmax and OWr values and topographic and lithologic settings.

Click here to view most recent monthly and daily groundwater levels (OWc values

for "Frimpter Method" estimates) and for monthly and historical statistics.

Available Parameters	Period of Record
All 1 Available Parameters for this site	
72019 WaterLevel, BelowLSD(Mean)	2011-10-01 2015-03-25

Output format

- Graph
- Graph w/ stats
- Graph w/ meas
- Graph w/ (up to 3) parms NEW
- Table
- Tab-separated
- Tab-separated w/ meas

Days (3) Summary of all available data for this site GO
Instantaneous-data availability statement

-- or --

Begin date 2015-03-22

End date 2015-03-25

Daily Mean Depth to water level, feet below land surface

DATE	Mar 2015
22	15.76 P
23	15.76 P
24	15.77 P
25	15.77 P
COUNT	4
MAX	15.77
MIN	15.76

Explanation

P	Provisional data subject to revision.

Questions about sites/data?
Feedback on this web site
Automated retrievals
Help

Recharge System Calculations

Required Recharge for Hydrologic Group A Soils = 0.6”

Required Dedicated Recharge Volume = 16,175 s.f *0.6”*(1’/12”)
= **809 cu.ft**

Provided Recharge Volume at Orifice (el=104.9) = **7,360 cu.ft**. (see Pond Report in Attachment B)

Drain Down Time

Draw down analysis is based on soil texture from NRCS soil survey.
The soils are assumed to be Loamy Sands (2.41 in/hr).

Subsurface Recharge Chambers
Bottom Contact Area = 2,844 s.f.
Recharge Rate = 2,844 s.f. * 2.41 in/hr *1’/12” = 571 cu.ft/ hr
Drain Time for recharge volume = 7360 cu.ft / 571 cu.ft/hr = **13 hours**

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

CROSSPOINT ASSOCIATES - NEEDHAM ST.
NEWTON UPPER FALLS, MA
for SYSTEM: WQD #4

Area	1.01	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	6	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.02	0.02	99.7	10.1
0.04	9.6%	19.8%	0.04	0.04	98.9	9.5
0.06	9.4%	29.3%	0.05	0.05	98.0	9.3
0.08	7.7%	37.0%	0.07	0.07	97.1	7.5
0.10	8.6%	45.6%	0.09	0.09	96.2	8.3
0.12	6.3%	51.9%	0.11	0.11	95.4	6.0
0.14	4.7%	56.5%	0.13	0.13	94.5	4.4
0.16	4.6%	61.2%	0.15	0.15	93.6	4.3
0.18	3.5%	64.7%	0.16	0.16	92.7	3.3
0.20	4.3%	69.1%	0.18	0.18	91.9	4.0
0.25	8.0%	77.1%	0.23	0.23	89.7	7.2
0.30	5.6%	82.7%	0.27	0.27	87.5	4.9
0.35	4.4%	87.0%	0.32	0.32	85.3	3.7
0.40	2.5%	89.5%	0.36	0.36	83.1	2.1
0.45	2.5%	92.1%	0.41	0.41	80.9	2.0
0.50	1.4%	93.5%	0.45	0.45	78.7	1.1
0.75	5.0%	98.5%	0.68	0.68	67.8	3.4
1.00	1.0%	99.5%	0.91	0.91	56.9	0.6
1.50	0.0%	99.5%	1.36	1.36	35.0	0.0
2.00	0.0%	99.5%	1.82	1.40	25.6	0.0
3.00	0.5%	100.0%	2.73	1.40	17.1	0.1
						91.8
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.3%
					Predicted Net Annual Load Removal Efficiency =	**85.4%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Project: Crosspoint Associates - Needham St
Location: Newton, MA
Prepared For: Brandon Li - Kelly Engineering Group, Inc.

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)
WQD #1	2.47	0.0038596	10.0	0.167	1.00
WQD #2	5.25	0.0082000	15.0	0.250	1.00
WQD #3	0.42	0.0006556	6.0	0.100	1.00
WQD #4	1.01	0.0015787	6.0	0.100	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
WQD #1	700.00
WQD #2	628.00
WQD #3	774.00
WQD #4	774.00

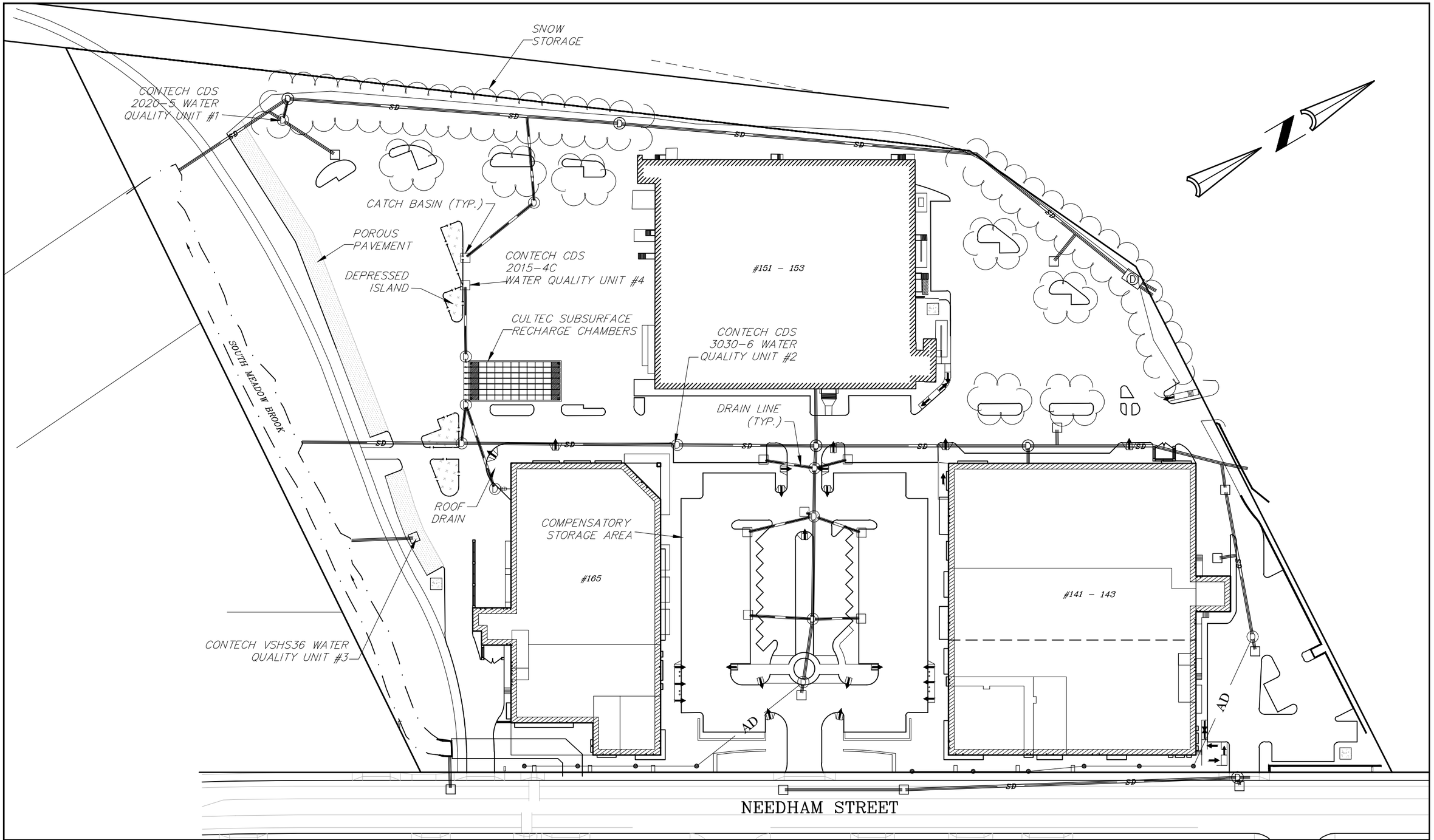
1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
WQD #1	2.70
WQD #2	5.15
WQD #3	0.51
WQD #4	1.22



141-143, 151-153, 165, 173, & 181 NEEDHAM STREET NEWTON, MA	SCALE: 1"= 80' DATE: 03/30/15 2013-075-BMP01	BMP LOCATION MAP	KELLY ENGINEERING GROUP, INC. CIVIL ENGINEERING CONSULTANTS 0 CAMPANELLI DRIVE · BRAINTREE MA · 02184 PHONE: 781 843 4333 FAX: 781 843 0028