



STORM WATER MANAGEMENT

**WYSTEAD SECTION 3
LAKE 1**

PREPARED: 5-09-16

Project: Wynstead Section Three

Drainage Area Description:

Area tributary Lake #1

Job #: 04M027.003
Initials: GJK
Date: 5/5/2016

Drainage Area: 27.90 Acres

Soil Types: 100 % Type C

Land Use: Open Space 70.0 % 19.52 Acres
 Lake 1.4 % 0.38 Acres
 Impervious 28.7 % 8.00 Acres

Composite Runoff Curve Number:

Ground Cover	Soil Type	CN	Soil Type %	Land Use %	
Open Space	B	74	100	70.0	51.77
Lake	B	100	100	1.4	1.36
Impervious	B	98	100	28.7	28.10

Composite CN = 81.2

Time of Concentration:

From Storm Sewer Calculations:

Tc = 0.23 hr
13.90 min



Water Quality Volume

Project: <u>Wynstead Section 3</u>	Designed By: <u>GJK</u>	Date: <u>5/9/16</u>
Job No.: <u>04M027-003</u>	Checked By: _____	Date: _____
Basin ID: <u>Lake #1</u>	Revised By: _____	Date: _____

Required Water Quality Volume

$$WQ_v = P C A/12$$

Site Drainage Area (A) = <u>27.90</u> acres	(To Basin)	WQ _v = <u>0.959</u> acre-ft.
Rainfall Depth (P) = <u>0.75</u> in.	Sediment Storage Allowance = <u>-25</u> %	
Runoff Coefficient (C) = <u>0.55</u>	Sediment Storage Allowance = <u>-0.24</u> Ac-ft	

Total WQ_v = 0.719 Ac-ft
= 31,333 cu.ft.

Water Quality Release Rate

$$Q_{wqv} = \text{Total WQ}_v / RT$$

Required Retention Time (RT) 24 hours

Provided Retention Time (PT) 25.17 hours

Q_{wqv} = 0.363 cfs

Water Quality Outlet Orifice

Contour Areas

	Elevation ft	Area ft ²	Volume ft ³	Cum. Vol. ft ³	Elevation at V	Storage at Elev
Basin Inv. =	742.00	17266.00	0.00	0.00		
Contour 1 =	744.00	20848.00	38114.00	38114.00	743.64	31332.57
Contour 2 =	746.00	24655.00	45503.00	83617.00		
Contour 3 =	746.50	25642.00	12574.25	96191.25		
Contour 4 =						
Contour 5 =						

$$Q = N C_d A_o (2 g \Delta h)^{1/2}$$

C_d = 0.61

A_o = 0.09 π D²/4 for circular orifices; = h * w for rectangular orifices

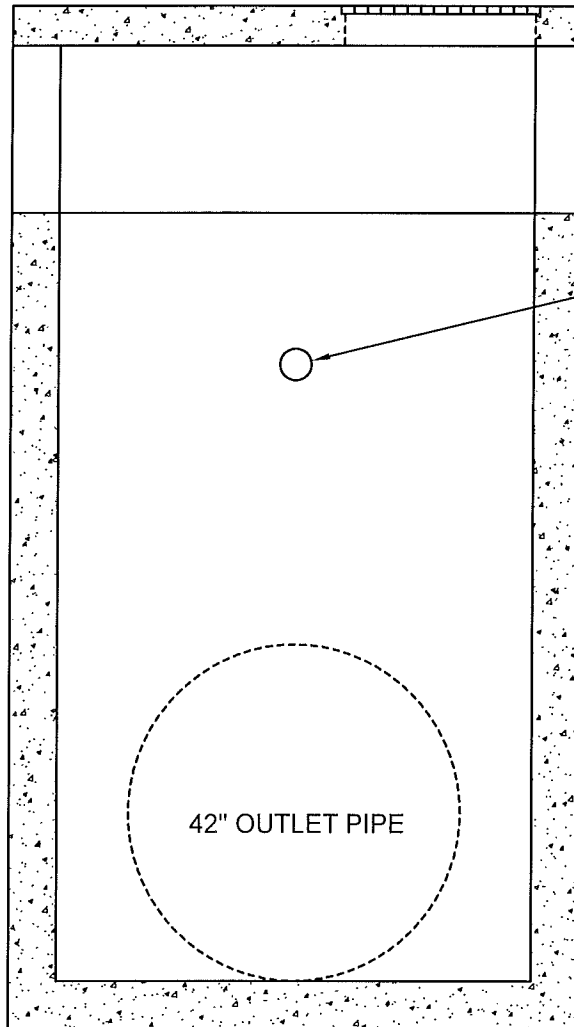
g = 32.20 ft/sec²

Q = 0.346 cfs

Orifice h = 4.000 inch Orifice w = 0.00 inch (= 0 for circular orifice)

Number of orifices = N = 1

Δh_{avg} = (Elev at V - Basin Inv)/2 - 1/2 h = 0.66 ft



T/GR=745.92
 ELEV=745.50

(4) 5'-0" WINDOWS
 ELEV=743.75

(1) 4" ORIFICE

4" INV=742.00
 N. POOL ELEV=742.00

42" OUTLET PIPE

42" INV=735.75

O.D.O.T CB 2-5 MODIFIED

LAKE #1 OUTLET STRUCTURE
SIDE VIEW DETAIL

N.T.S.

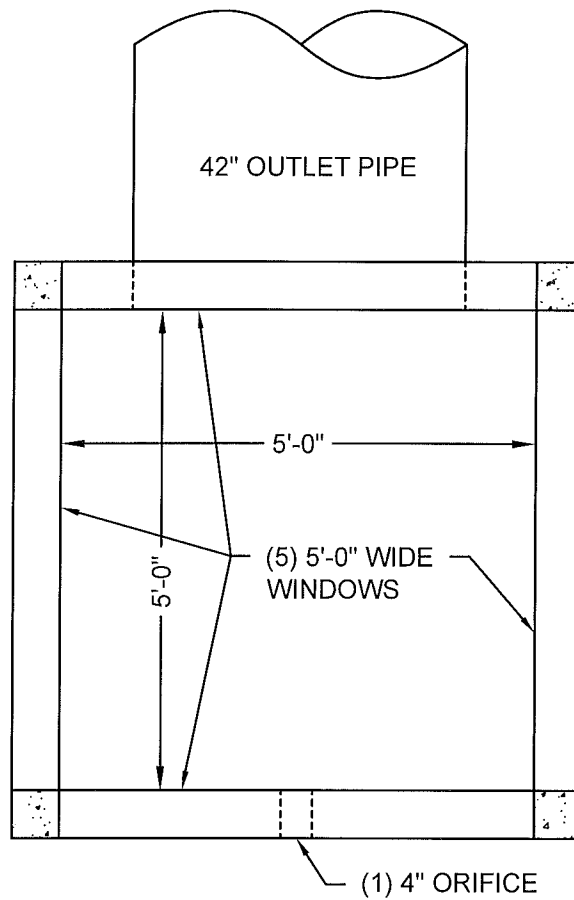
Drawing:	04M027-003 CD C3D
Scale:	NTS
Drawn by:	GJK
Checked By:	
Issue Date:	05-09-16

WYNSTEAD
SECTION THREE
 MILITARY SURVEY No. 1546
 VILLAGE OF SOUTH LEBANON
 WARREN COUNTY, OHIO

LAKE #1 OUTLET STRUCTURE - SIDE VIEW



6900 Tylersville Road, Suite A
 Mason, OH 45040 - 513.336.6600



LAKE #1 OUTLET STRUCTURE
TOP VIEW DETAIL

N.T.S.

Drawing:	04M027-003 CD C3D
Scale:	NTS
Drawn by:	GJK
Checked By:	
Issue Date:	05-09-16

WYNSTEAD
SECTION THREE
 MILITARY SURVEY No. 1546
 VILLAGE OF SOUTH LEBANON
 WARREN COUNTY, OHIO

LAKE #1 OUTLET STRUCTURE - TOP VIEW



6900 Tylersville Road, Suite A
 Mason, OH 45040 - 513.336.6600

Pond Report

Pond No. 1 - Lake #1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 742.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	742.00	17,266	0	0
2.00	744.00	20,848	38,054	38,054
4.00	746.00	24,655	45,445	83,499
4.50	746.50	25,642	12,572	96,071

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	4.00	0.00	0.00
Span (in)	= 42.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 735.75	742.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 743.75	0.00	0.00	0.00
Weir Coeff.	= 3.00	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	742.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.20	3,805	742.20	98.26 ic	0.08 ic	---	---	0.00	---	---	---	---	---	0.083
0.40	7,611	742.40	98.26 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.203
0.60	11,416	742.60	98.26 ic	0.28 ic	---	---	0.00	---	---	---	---	---	0.277
0.80	15,222	742.80	98.26 ic	0.33 ic	---	---	0.00	---	---	---	---	---	0.334
1.00	19,027	743.00	98.26 ic	0.38 ic	---	---	0.00	---	---	---	---	---	0.384
1.20	22,832	743.20	98.26 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.427
1.40	26,638	743.40	98.26 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.467
1.60	30,443	743.60	98.26 ic	0.50 ic	---	---	0.00	---	---	---	---	---	0.503
1.80	34,249	743.80	98.26 ic	0.54 ic	---	---	0.67	---	---	---	---	---	1.210
2.00	38,054	744.00	98.26 ic	0.57 ic	---	---	7.50	---	---	---	---	---	8.069
2.20	42,598	744.20	98.26 ic	0.60 ic	---	---	18.11	---	---	---	---	---	18.71
2.40	47,143	744.40	98.26 ic	0.63 ic	---	---	31.44	---	---	---	---	---	32.07
2.60	51,688	744.60	98.26 ic	0.66 ic	---	---	47.02	---	---	---	---	---	47.68
2.80	56,232	744.80	98.26 ic	0.68 ic	---	---	64.56	---	---	---	---	---	65.24
3.00	60,777	745.00	98.26 ic	0.71 ic	---	---	83.86	---	---	---	---	---	84.57
3.20	65,321	745.20	105.44 ic	0.67 ic	---	---	104.77	---	---	---	---	---	105.44
3.40	69,866	745.40	120.01 ic	0.46 ic	---	---	119.55 s	---	---	---	---	---	120.01
3.60	74,410	745.60	124.71 ic	0.39 ic	---	---	124.32 s	---	---	---	---	---	124.70
3.80	78,955	745.80	128.13 ic	0.34 ic	---	---	127.78 s	---	---	---	---	---	128.12
4.00	83,499	746.00	130.93 ic	0.30 ic	---	---	130.62 s	---	---	---	---	---	130.92
4.05	84,756	746.05	131.56 ic	0.29 ic	---	---	131.26 s	---	---	---	---	---	131.56
4.10	86,014	746.10	132.18 ic	0.28 ic	---	---	131.89 s	---	---	---	---	---	132.17
4.15	87,271	746.15	132.77 ic	0.28 ic	---	---	132.49 s	---	---	---	---	---	132.76
4.20	88,528	746.20	133.35 ic	0.27 ic	---	---	133.08 s	---	---	---	---	---	133.35
4.25	89,785	746.25	133.92 ic	0.26 ic	---	---	133.64 s	---	---	---	---	---	133.91
4.30	91,043	746.30	134.47 ic	0.26 ic	---	---	134.20 s	---	---	---	---	---	134.46
4.35	92,300	746.35	135.00 ic	0.25 ic	---	---	134.75 s	---	---	---	---	---	135.00
4.40	93,557	746.40	135.53 ic	0.24 ic	---	---	135.28 s	---	---	---	---	---	135.52
4.45	94,814	746.45	136.05 ic	0.24 ic	---	---	135.80 s	---	---	---	---	---	136.04
4.50	96,071	746.50	136.55 ic	0.23 ic	---	---	136.31 s	---	---	---	---	---	136.54

Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

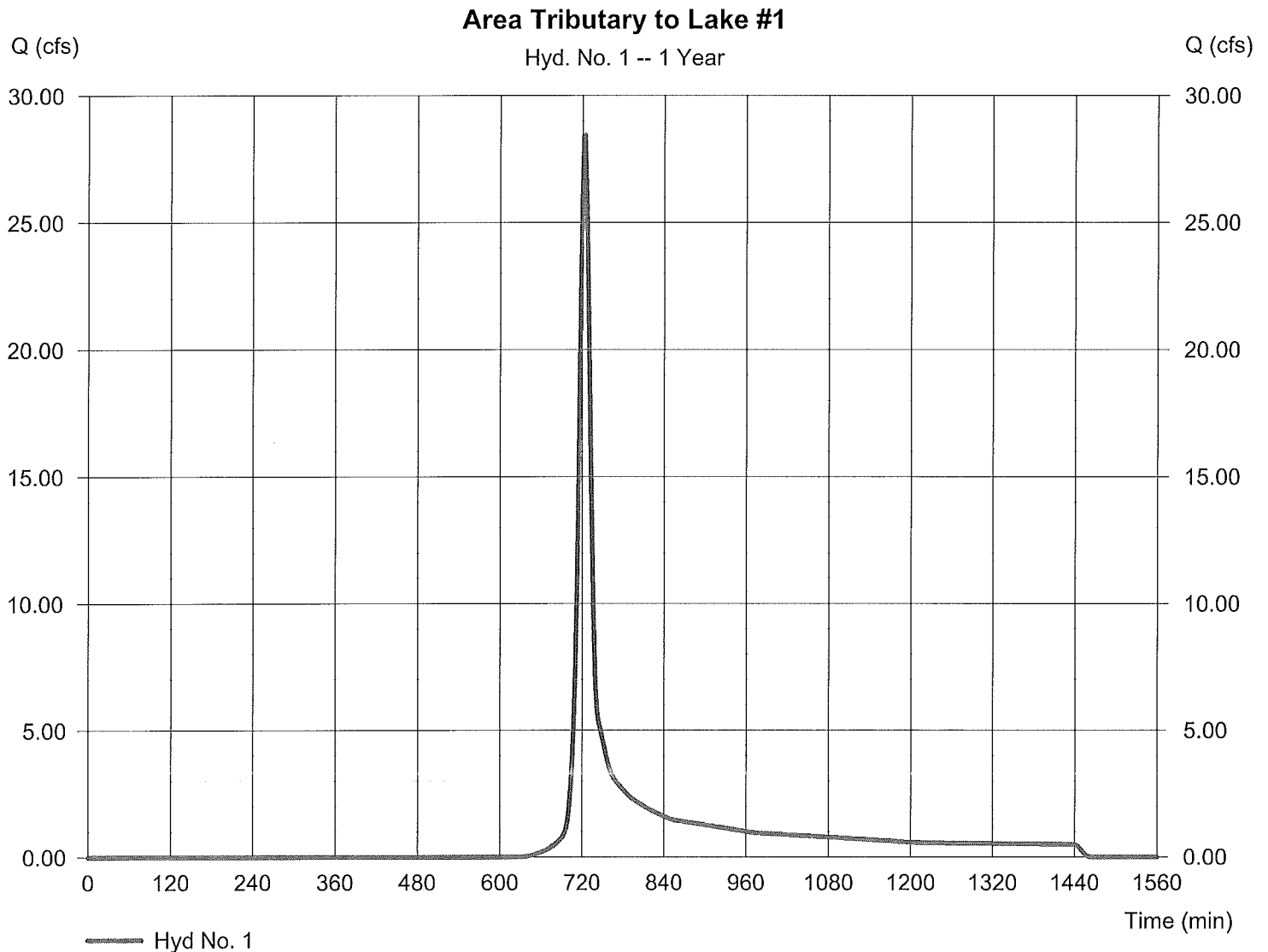
Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	28.45	42.48	-----	60.31	75.01	96.40	115.37	137.61	Area Tributary to Lake #1
2	Reservoir	1	4.836	22.05	-----	45.03	62.71	86.48	105.47	121.33	Lake #1 Outlet

Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type	= SCS Runoff	Peak discharge	= 28.45 cfs
Storm frequency	= 1 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 82,295 cuft
Drainage area	= 27.900 ac	Curve number	= 81.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.90 min
Total precip.	= 2.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



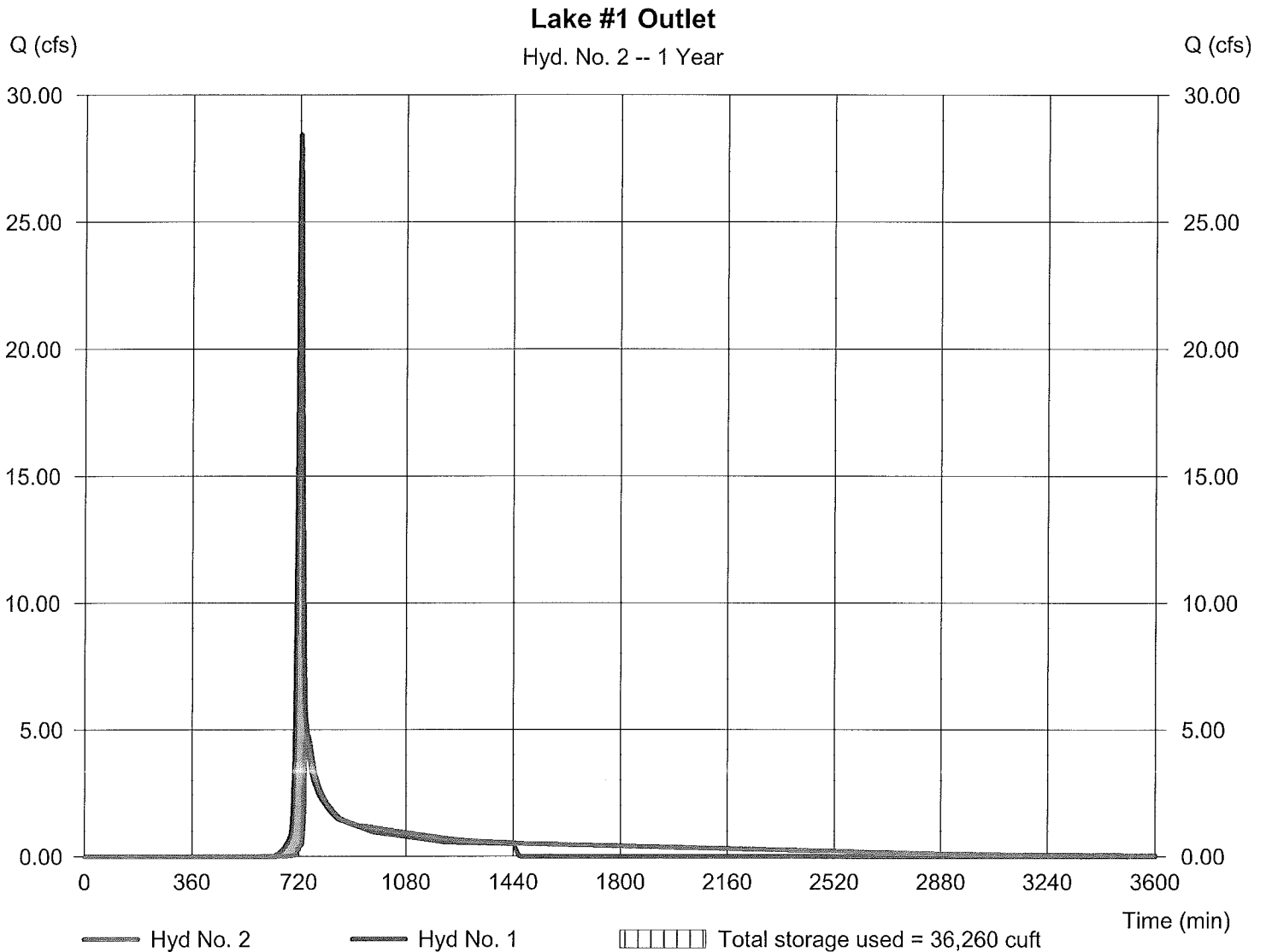
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 4.836 cfs
Storm frequency	= 1 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 82,193 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 743.91 ft
Reservoir name	= Lake #1	Max. Storage	= 36,260 cuft

Storage Indication method used.

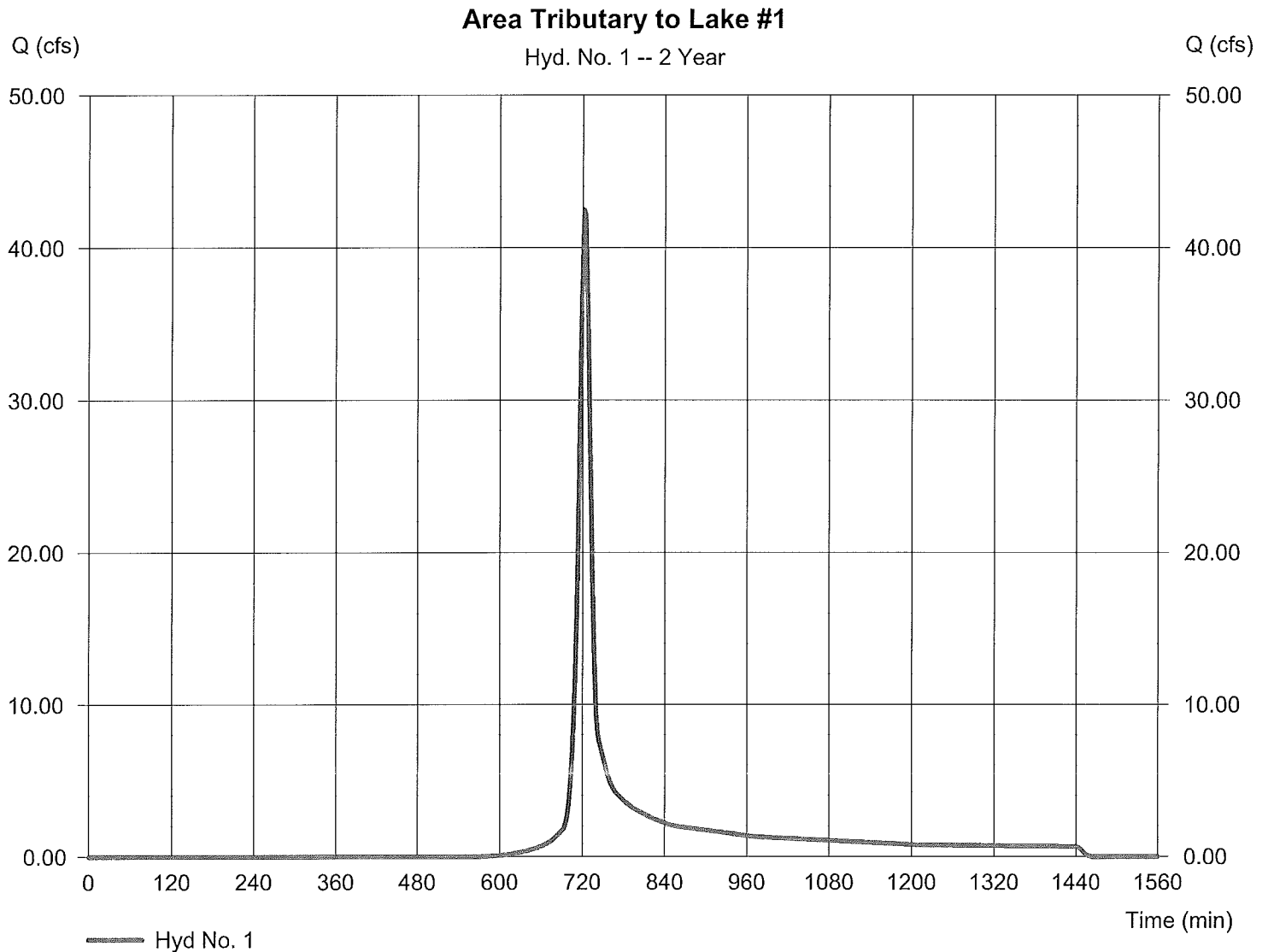


Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type	= SCS Runoff	Peak discharge	= 42.48 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 120,394 cuft
Drainage area	= 27.900 ac	Curve number	= 81.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.90 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



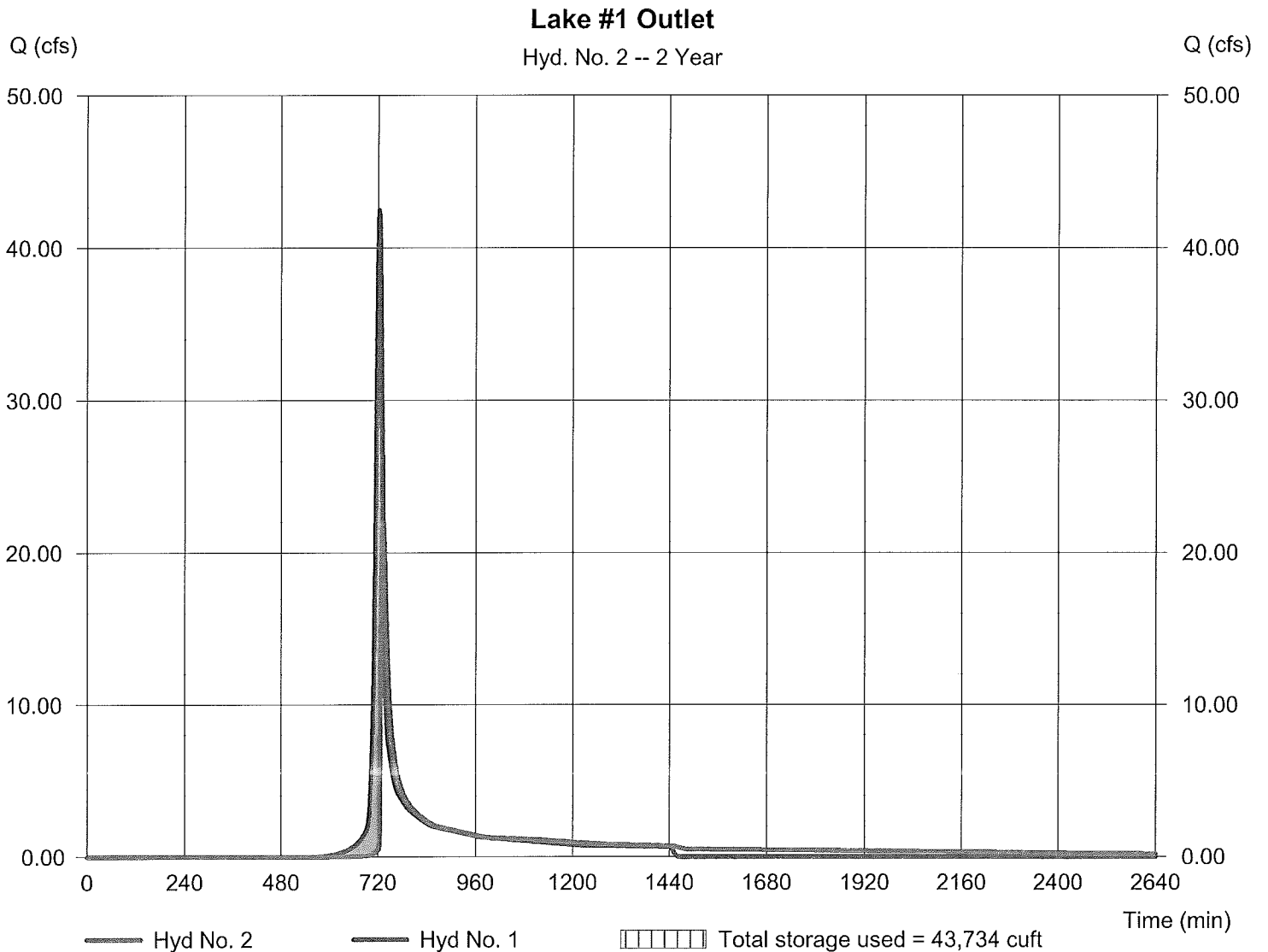
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 22.05 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 120,289 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 744.25 ft
Reservoir name	= Lake #1	Max. Storage	= 43,734 cuft

Storage Indication method used.

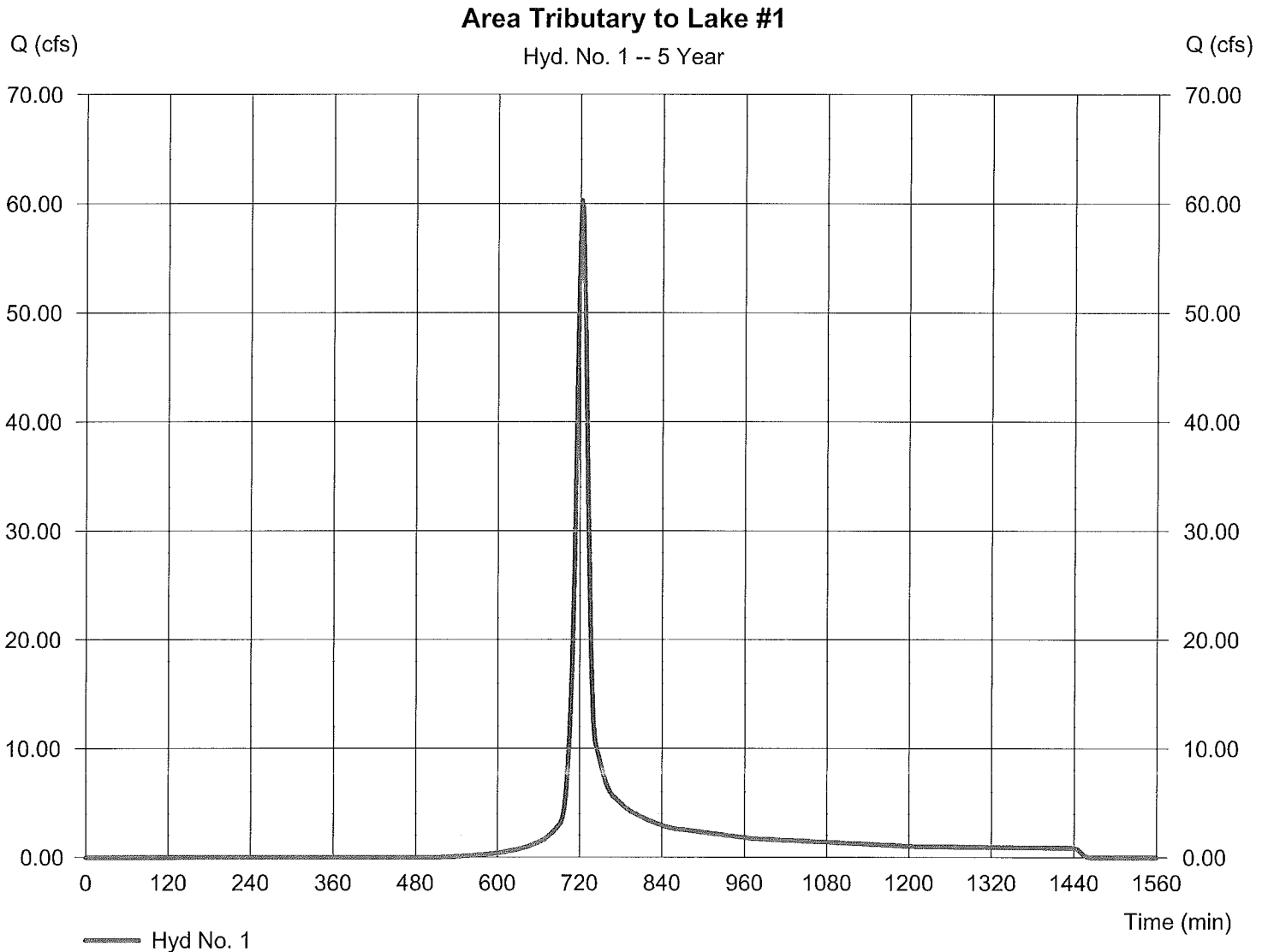


Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type	= SCS Runoff	Peak discharge	= 60.31 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 169,357 cuft
Drainage area	= 27.900 ac	Curve number	= 81.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.90 min
Total precip.	= 3.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



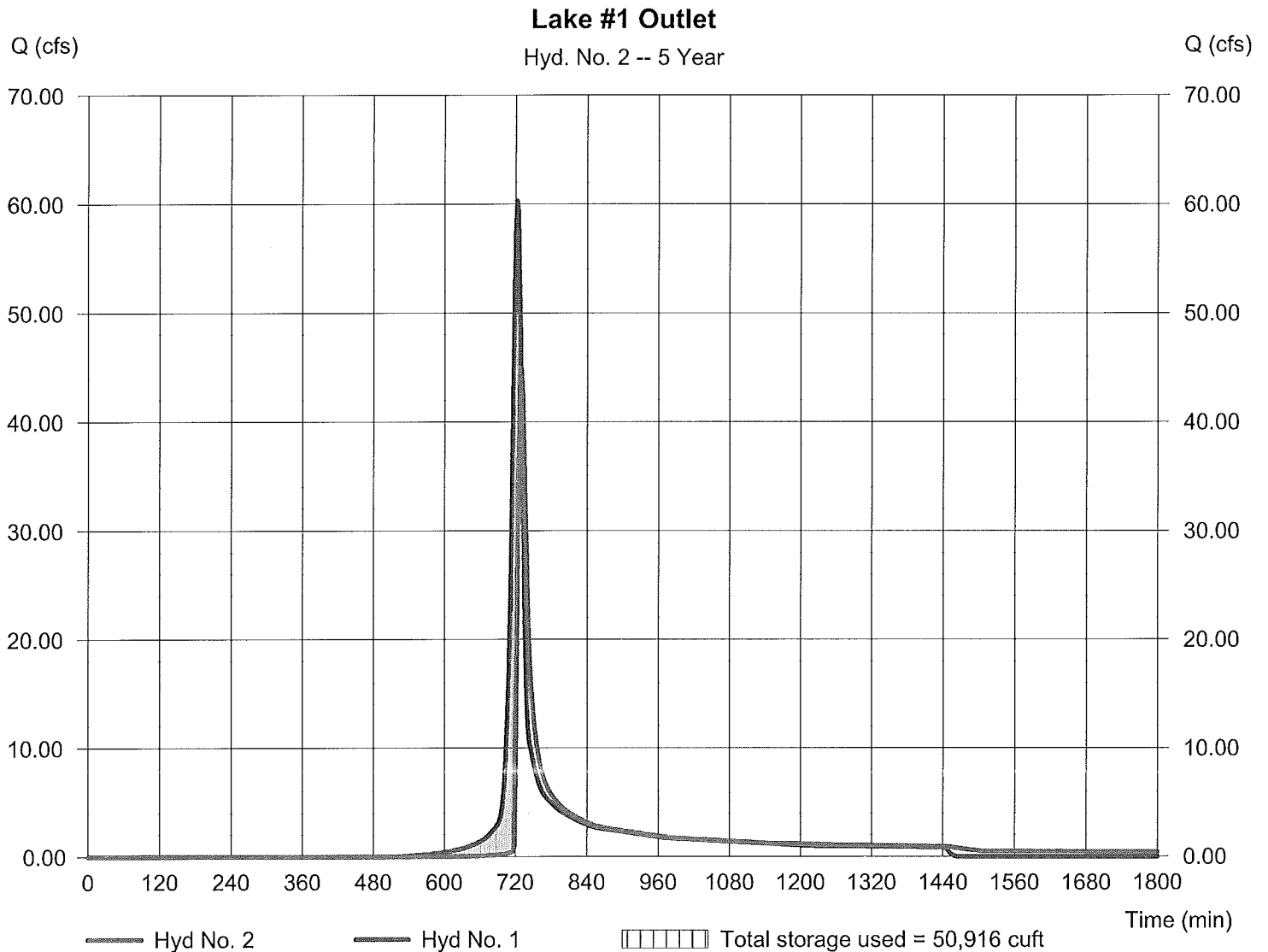
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 45.03 cfs
Storm frequency	= 5 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 169,249 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 744.57 ft
Reservoir name	= Lake #1	Max. Storage	= 50,916 cuft

Storage Indication method used.

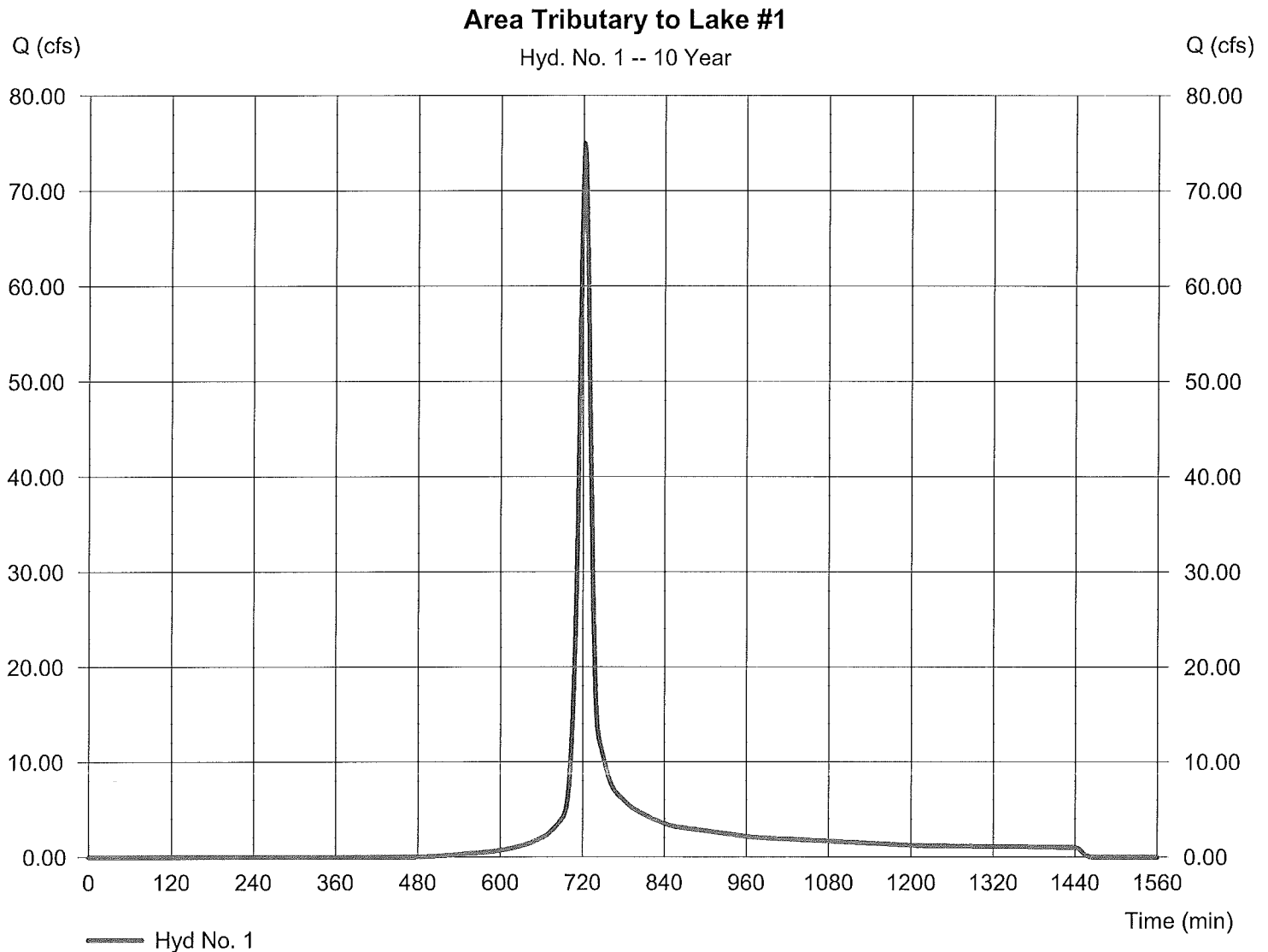


Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type	= SCS Runoff	Peak discharge	= 75.01 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 210,250 cuft
Drainage area	= 27.900 ac	Curve number	= 81.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.90 min
Total precip.	= 3.99 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



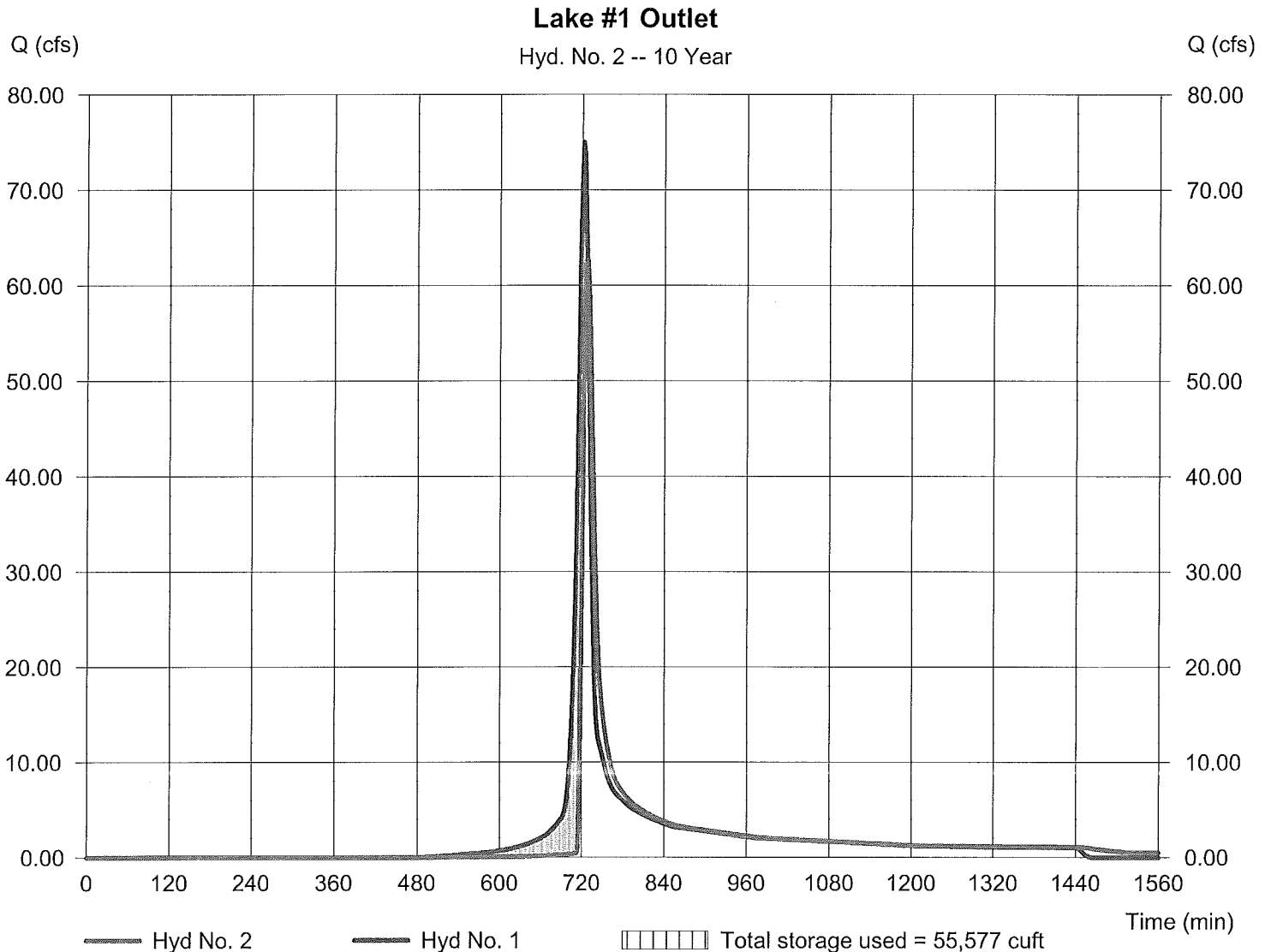
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 62.71 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 210,139 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 744.78 ft
Reservoir name	= Lake #1	Max. Storage	= 55,577 cuft

Storage Indication method used.

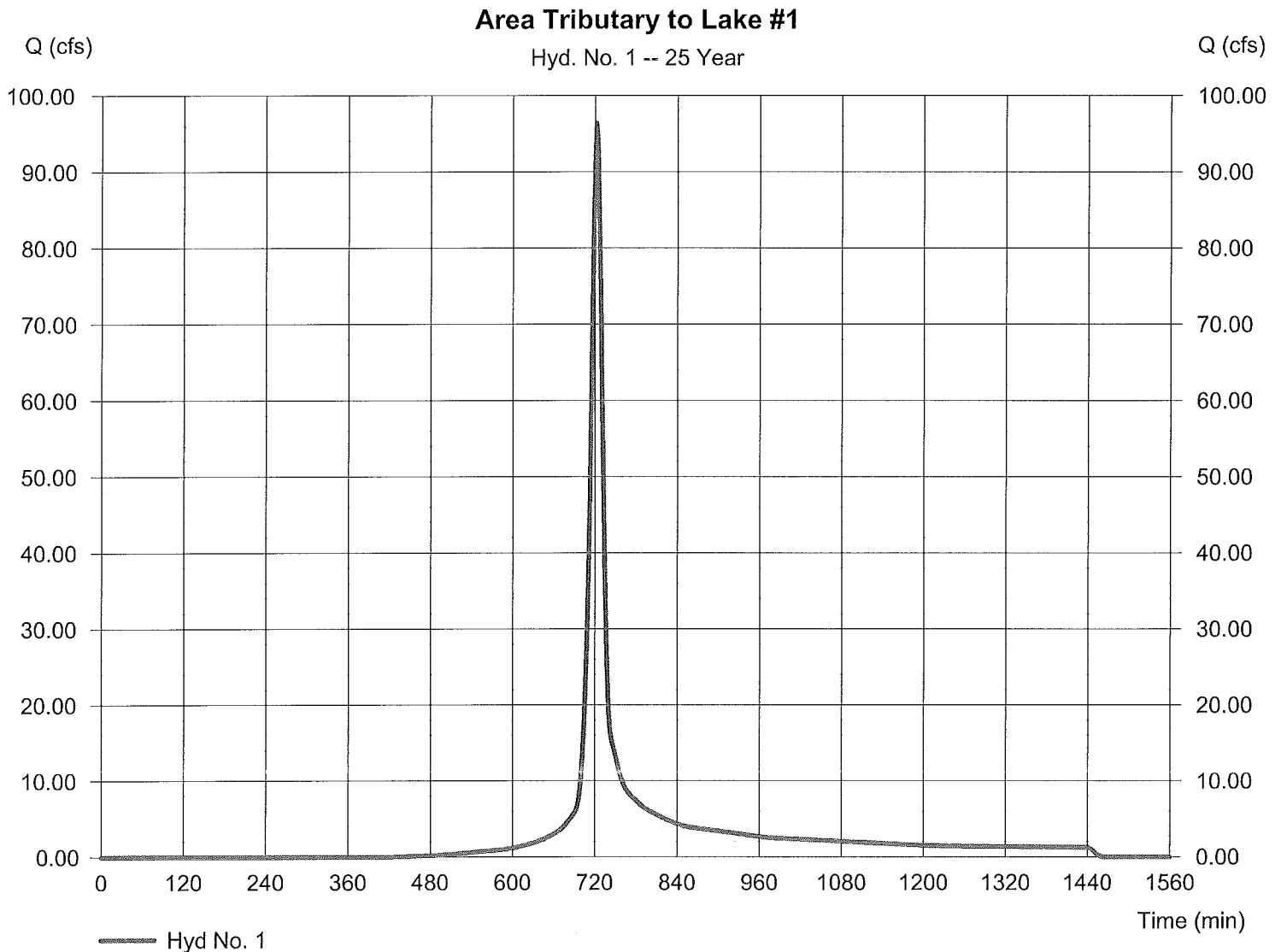


Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type	= SCS Runoff	Peak discharge	= 96.40 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 270,541 cuft
Drainage area	= 27.900 ac	Curve number	= 81.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.90 min
Total precip.	= 4.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



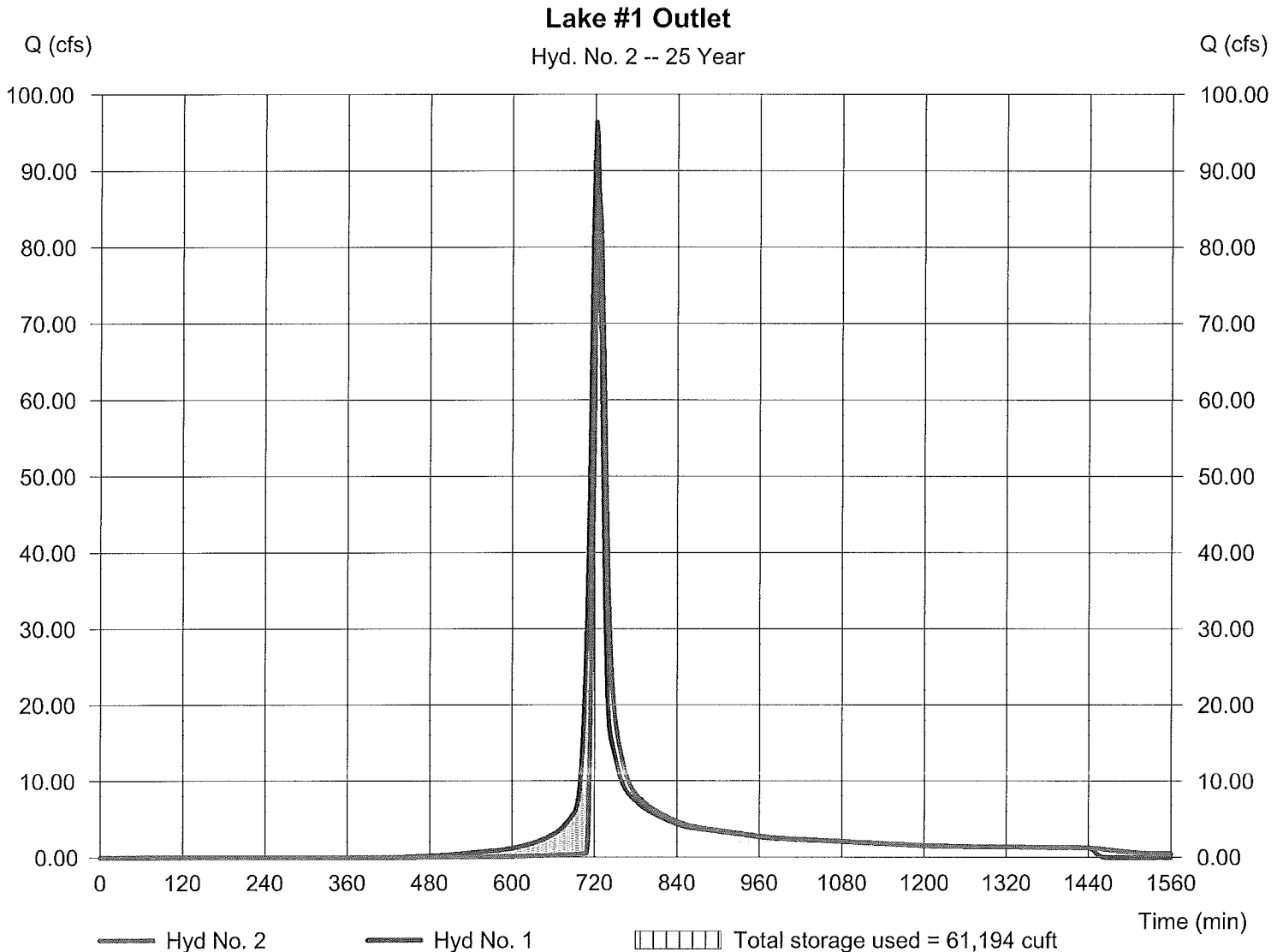
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 86.48 cfs
Storm frequency	= 25 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 270,429 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 745.02 ft
Reservoir name	= Lake #1	Max. Storage	= 61,194 cuft

Storage Indication method used.



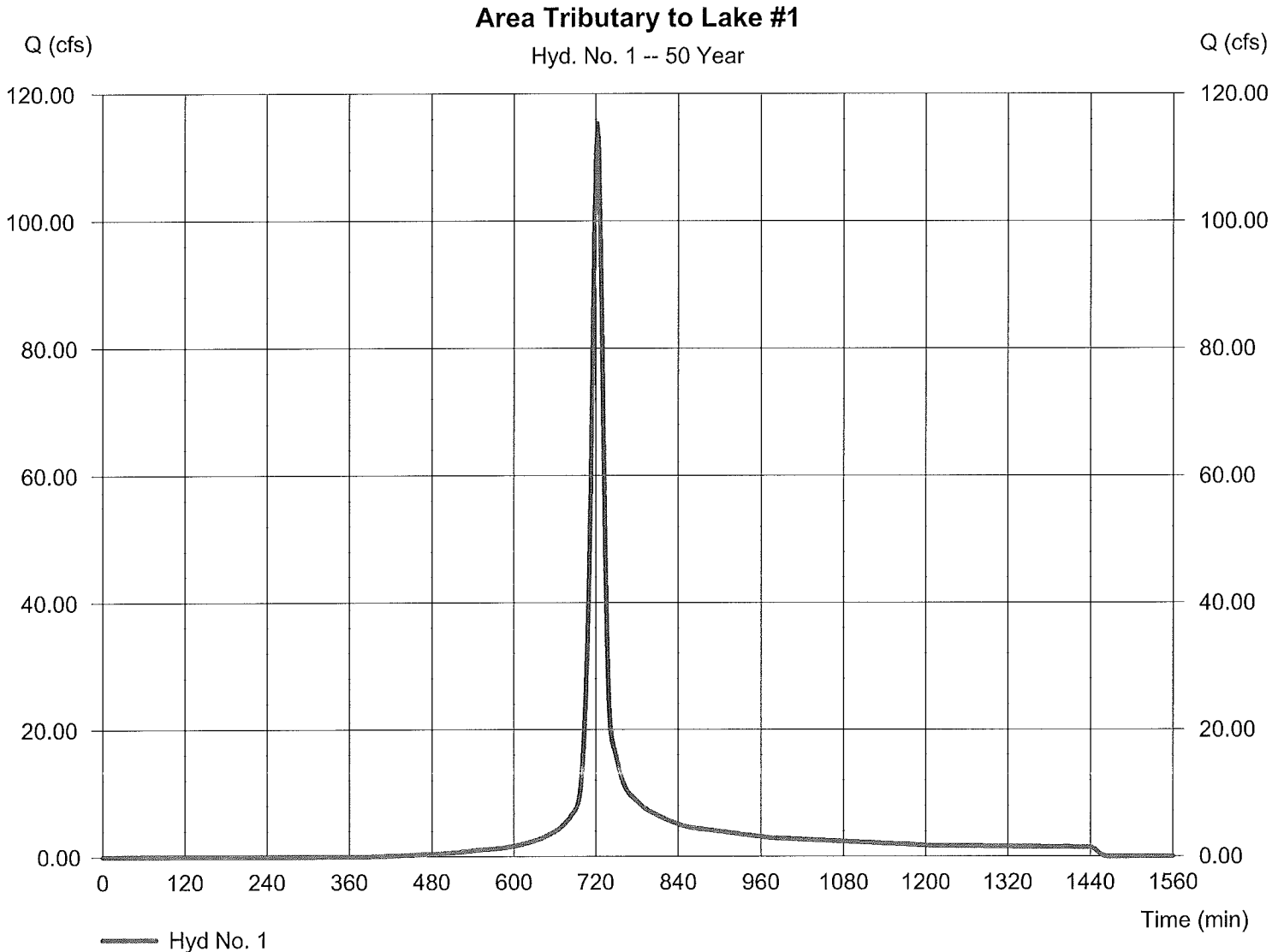
Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type = SCS Runoff
Storm frequency = 50 yrs
Time interval = 2 min
Drainage area = 27.900 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.32 in
Storm duration = 24 hrs

Peak discharge = 115.37 cfs
Time to peak = 722 min
Hyd. volume = 324,779 cuft
Curve number = 81.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 13.90 min
Distribution = Type II
Shape factor = 484



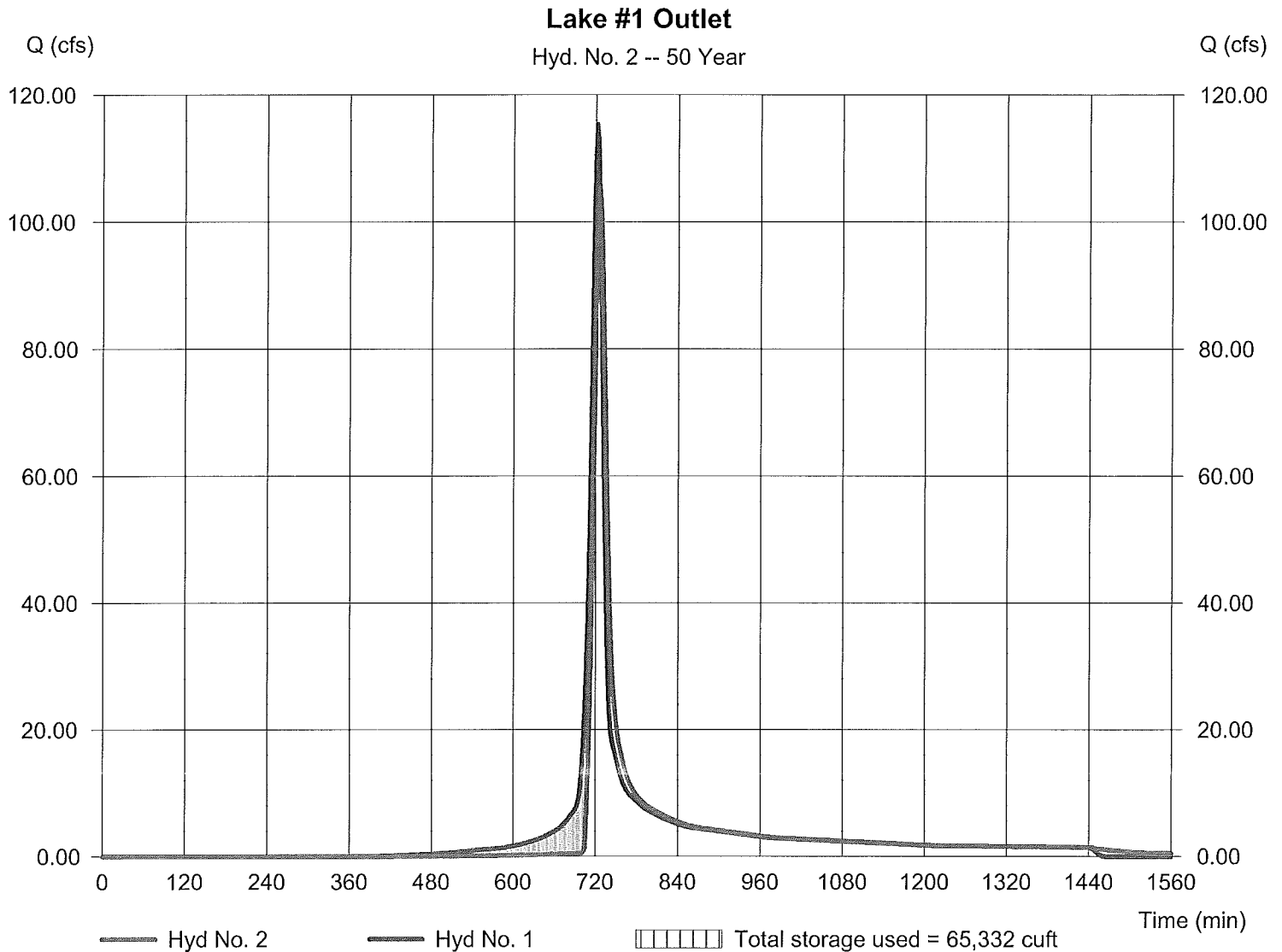
Hydrograph Report

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 105.47 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 324,667 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 745.21 ft
Reservoir name	= Lake #1	Max. Storage	= 65,332 cuft

Storage Indication method used.



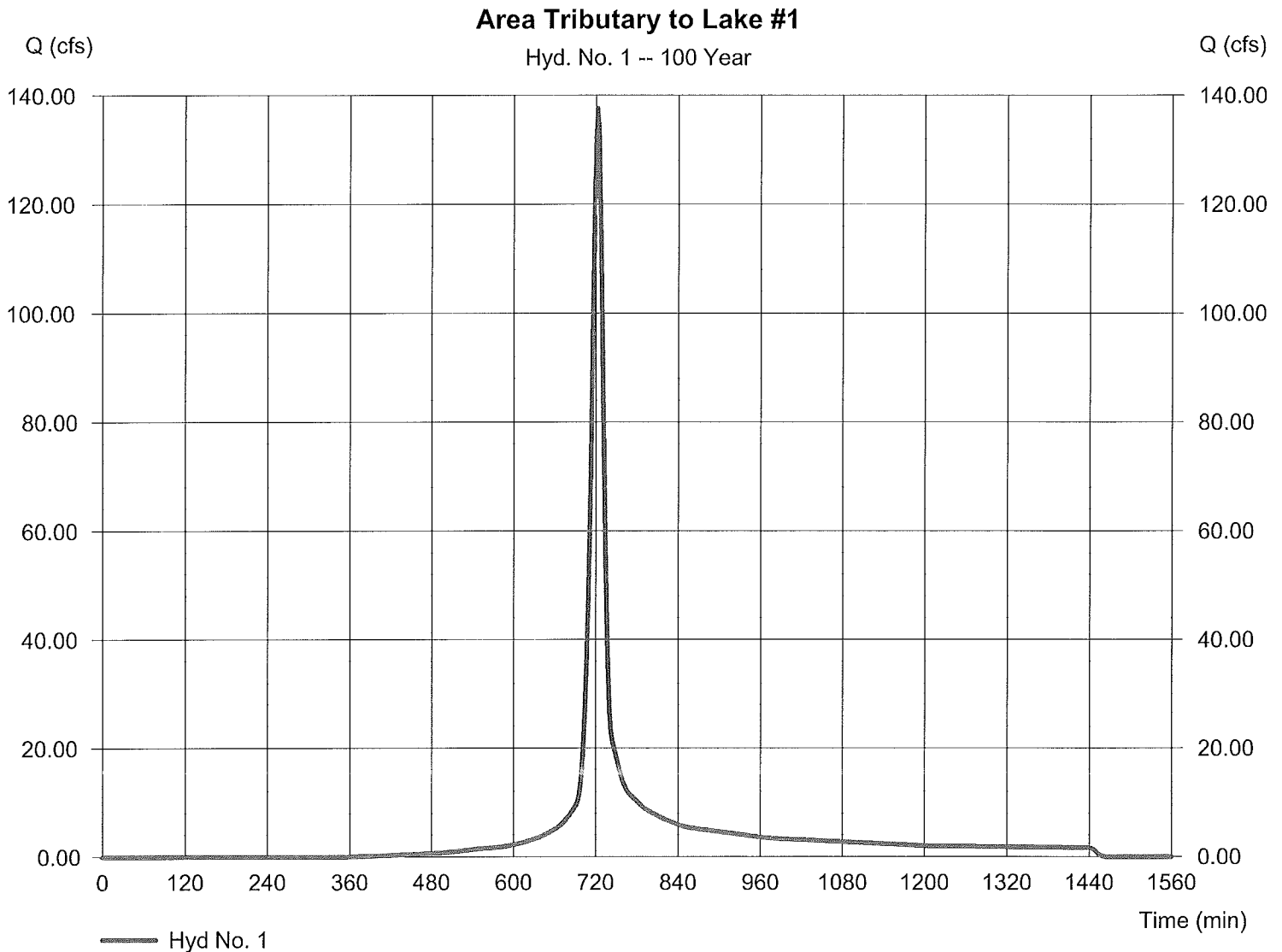
Hydrograph Report

Hyd. No. 1

Area Tributary to Lake #1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 27.900 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 6.04 in
Storm duration = 24 hrs

Peak discharge = 137.61 cfs
Time to peak = 722 min
Hyd. volume = 389,143 cuft
Curve number = 81.2
Hydraulic length = 0 ft
Time of conc. (Tc) = 13.90 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Friday, 05 / 20 / 2016

Hyd. No. 2

Lake #1 Outlet

Hydrograph type	= Reservoir	Peak discharge	= 121.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 389,031 cuft
Inflow hyd. No.	= 1 - Area Tributary to Lake #1	Max. Elevation	= 745.46 ft
Reservoir name	= Lake #1	Max. Storage	= 71,142 cuft

Storage Indication method used.

