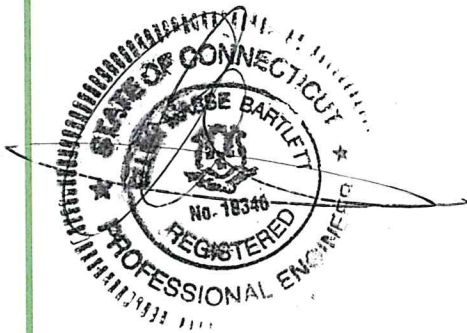# DRAINAGE CALCULATIONS, HYDRAULICS & HYDROLOGY REPORT

**1492 Hartford – New London Turnpike (CT Route 85)
Montville, CT**

**April 8th, 2024
Revised 5/1/24
Revised 6/20/24**

Green Site Design, LLC

DRAINAGE HYDRAULICS AND HYDROLOGY REPORT

1492 Hartford – New London Turnpike (CT Route 85)
Montville, CT

EXISTING CONDITIONS

The site is approximately 5.62 acres in area and is shown on the Existing Conditions Survey (Sheet 1 of the site plans). The site has frontage on Hartford – New London Turnpike (Route 85). There are approximately 0.38 acres of wetlands on the site.

PROPOSED DEVELOPMENT

The project proposes the development of a processing, material storage, and equipment storage facility. There will be no free standing buildings on the site but there will be several storage bays and a construction trailer.

The 5.62 acres site contains wetlands as shown on sheet 1. Of the 5.62 acres, 4.08 acres will be disturbed during the development process. There will be no disturbance within the wetlands or upland review area.

EXISTING AND PROPOSED HYDRAULICS

The stormwater management system has been designed to provide for zero increase in peak stormwater discharge from the site. The project has been designed to actually result in a decrease in the peak stormwater rates leaving the project site. The proposed stormwater water quality basin will provide treatment of the runoff from the proposed site.

The current site is divided into two, existing, drainage areas:

Existing Drainage Area 1	2.98 Acres
Existing Drainage Area 2	2.64 Acres

The development of the proposed site will result in two drainage areas:

Proposed Drainage Area 1	4.08 Acres
Proposed Drainage Area 2	1.54 Acres

Proposed Drainage Area 1 contains the developed site. The stormwater runoff from this area will be treated by the water quality basin in the northwestern corner of the site. Proposed Drainage Area 2 contains the wetlands and upland review area and will remain undeveloped. The basin has been modelled to assume that the basin will have water in it up to elevation 205.8 at the onset of the storm event. The basin will drain between storms down to elevation 205.8 thru the new outlet structure and then connect to the existing drainage system in Route 85.

Both the existing and the proposed conditions for the development site have been analyzed for the 2-year, 10-year, 25-year, 50-year, and 100 year design storms using the SCS model and the NOAA Type D rainfall distribution.

Drainage Area 1

	2 Year	10 Year	25 Year	50 Year	100 Year
Existing	6.08 cfs	9.11 cfs	11.01 cfs	12.40 cfs	13.91 cfs
Proposed	1.77 cfs	6.48 cfs	9.49 cfs	11.66 cfs	13.90 cfs

Drainage Area 2

	2 Year	10 Year	25 Year	50 Year	100 Year
Existing	4.94 cfs	7.40 cfs	8.94 cfs	10.08 cfs	11.30 cfs
Proposed	2.88 cfs	4.32 cfs	5.22 cfs	5.88 cfs	6.59 cfs

EROSION & SEDIMENTATION CONTROL

The 2002 CT Guidelines for Soil Erosion & Sedimentation Control applies to the construction phase of the project. A detailed erosion and sediment control plan has been provided in the site development plans. The proposed stormwater water quality basin has been designed to function as sedimentation traps during stabilization.

The first calculation required by the Guidelines is for the sediment storage volume (SSV). The sediment storage volume is the calculation for one year of predicted sediment load. The required SSV calculation for the temporary sediment trap is shown below.

Drainage Area 1A

$$SSV = A(134CY/Acre)$$
$$A = 4.08 \ ACRE$$
$$SSV = 546.72 \ CY = \underline{\textbf{14,760 CF}}$$

The second calculation required by the Guidelines is for wet storage volume (WSV). The wet storage volume is the volume in the basin that is located below the bottom of the riprap for the level spreader outlet of the basin. The volume of the wet storage is required to be half of the required SSV. The required wet storage volume is shown below along with the dry storage volumes (DSV).

Drainage Area 1A

$$WSV = DSV = SSV/2$$
$$= \underline{\textbf{7,380 CF}}$$

The required and provided storage for each basin are as follows:

Drainage Area 1   (Outlet structure inlet elevation = 205.8)
Sedimentation Trap

Forebay and Basin:

7,380 CF of Wet Storage Volume Required	16,910 CF Provided
7,380 CF of Dry Storage Volume Required	21,090 CF Provided
14,760 CF of Sediment Storage Volume Required	38,000 CF Total Provided

CONNECTICUT STORMWATER QUALITY MANUAL

The Connecticut 2024 Stormwater Quality Manual (Manual) applies to the post construction phase, for the operation of the facility. The temporary sediment traps have been designed to function as water quality basins after the site is stabilized. They all meet the criteria of the Connecticut Stormwater Quality Manual for a Water Quality Basin.

Drainage Area 1

$WQV = (1.3")(R)(A)/12$

$A = 4.08$ Acre

$R = 0.05 + 0.009(I)$

$I = 3.8$ Acres / 4.08 Acres $= 0.93$ (93%)

$R = 0.88$

WQV = 0.388 Ac-Ft = 16,901 CF   (Required)

16,910 CF   (Provided in Water Quality Basin and forebay between elevation 204.0 and 205.8)

Once development of the site is completed, there will be a decrease in runoff from the site. The temporary sedimentation basin provides ample wet and dry storage volume to meet and exceed the requirements of the 2002 CT Guidelines for Soil & Sedimentation Control. Likewise, Water Quality Basin meets and exceeds the post construction requirements of the Connecticut 2024 Stormwater Quality Manual.

DRAINAGE SWALE:

The attached drainage calculations shows that for a 25 year design storm, the swale will have a peak flow of 7.8 cfs and a depth of 0.6 feet, providing 16 inches of free board in the swale. The calculations also show a velocity of 3.45 ft/sec.

The site soils are generally gravel or sandy-loam. The stormwater velocity within the swales are below the Maximum Permissible Velocity for good condition as outlined in the chart below. The swales will be stable during the early stabilization phase, as the plans call for North American Green S-150 on the sides and bottom of the swale, and when fully grown-in and stable post construction.

Figure VW-1 Maximum Permissible Velocity (ft./sec.)				
Soil Texture	Channel Vegetation Condition[1]			
	Poor	Fair	Good	Stone Center
Sand, silt loam, sandy loam, loamy sand, loam and muck	2.0	2.5	3.5	8.0
Silty clay loam, sandy clay loam, clay, clay loam, sandy clay, silty clay	3.0	4.0	5.0	8.0

[1]For channels with geosynthetic turf reinforcement, permissible velocities shall be designed on a product-specific basis and for long duration flows (>24 hours).

Source: USDA-NRCS

Channel Report

\<Name\>

Trapezoidal
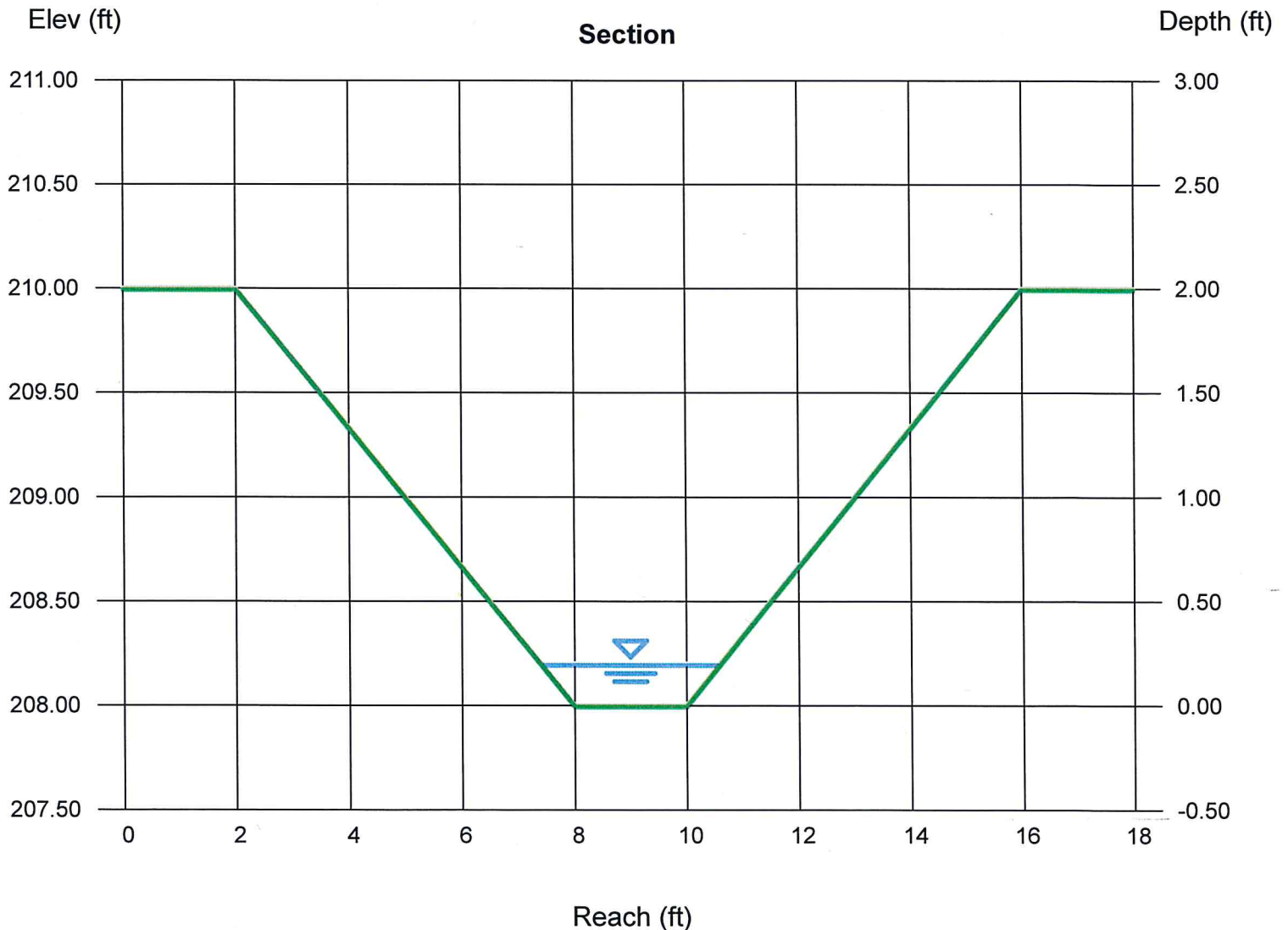Bottom Width (ft) = 2.00
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft)   = 2.00
Invert Elev (ft)   = 208.00
Slope (%)   = 3.00
N-Value   = 0.040

Calculations
Compute by: Q vs Depth
No. Increments   = 10

Highlighted
Depth (ft)   = 0.20
Q (cfs)   = 0.983
Area (sqft)   = 0.52
Velocity (ft/s)   = 1.89
Wetted Perim (ft)   = 3.26
Crit Depth, Yc (ft) = 0.01
Top Width (ft)   = 3.20
EGL (ft)   = 0.26

Section

Depth	Q	Area	Veloc
(ft)	(cfs)	(sqft)	(ft/s)
0.20	0.983	0.520	1.89
0.40	3.545	1.280	2.77
0.60	7.875	2.280	3.45
0.80	14.24	3.520	4.05
1.00	22.90	5.000	4.58
1.20	34.11	6.720	5.08
1.40	48.12	8.680	5.54
1.60	65.15	10.88	5.99
1.80	85.43	13.32	6.41
2.00	109.2	16.00	6.82

TR55 Tc Worksheet

Hyd. No. 1

Existing Area 1

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.240	0.400	0.011	
Flow length (ft)	= 200.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.45	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	= 23.93 +	0.00 +	0.00 =	23.93
Shallow Concentrated Flow				
Flow length (ft)	= 300.00	0.00	0.00	
Watercourse slope (%)	= 10.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 5.10	0.00	0.00	
Travel Time (min)	= 0.98 +	0.00 +	0.00 =	0.98
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	= 0.00 +	0.00 +	0.00 =	0.00

Total Travel Time, Tc .... **24.91 min**

TR55 Tc Worksheet

Hyd. No. 2

Proposed Area 1

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.240	0.400	0.011	
Flow length (ft)	= 240.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.45	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	= 27.69 +	0.00 +	0.00 =	27.69
Shallow Concentrated Flow				
Flow length (ft)	= 260.00	0.00	0.00	
Watercourse slope (%)	= 5.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 4.55	0.00	0.00	
Travel Time (min)	= 0.95 +	0.00 +	0.00 =	0.95
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	= 0.00 +	0.00 +	0.00 =	0.00

Total Travel Time, Tc .... **28.64 min**

TR55 Tc Worksheet

Hyd. No. 5

Existing Area 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.400		0.011		
Flow length (ft)	= 240.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 27.69**	**+**	**0.00**	**+**	**0.00**	**=**	**27.69**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		0.00		0.00		
Watercourse slope (%)	= 5.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 3.61		0.00		0.00		
Travel Time (min)	**= 1.20**	**+**	**0.00**	**+**	**0.00**	**=**	**1.20**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... **28.89 min**

TR55 Tc Worksheet

Hyd. No. 6

Proposed Area 2

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.240	0.400	0.011	
Flow length (ft)	= 240.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.45	0.00	0.00	
Land slope (%)	= 2.00	0.00	0.00	
Travel Time (min)	= 27.69 +	0.00 +	0.00 =	27.69
Shallow Concentrated Flow				
Flow length (ft)	= 260.00	0.00	0.00	
Watercourse slope (%)	= 5.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 3.61	0.00	0.00	
Travel Time (min)	= 1.20 +	0.00 +	0.00 =	1.20
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	= 0.00 +	0.00 +	0.00 =	0.00

Total Travel Time, Tc .... **28.89 min**

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066
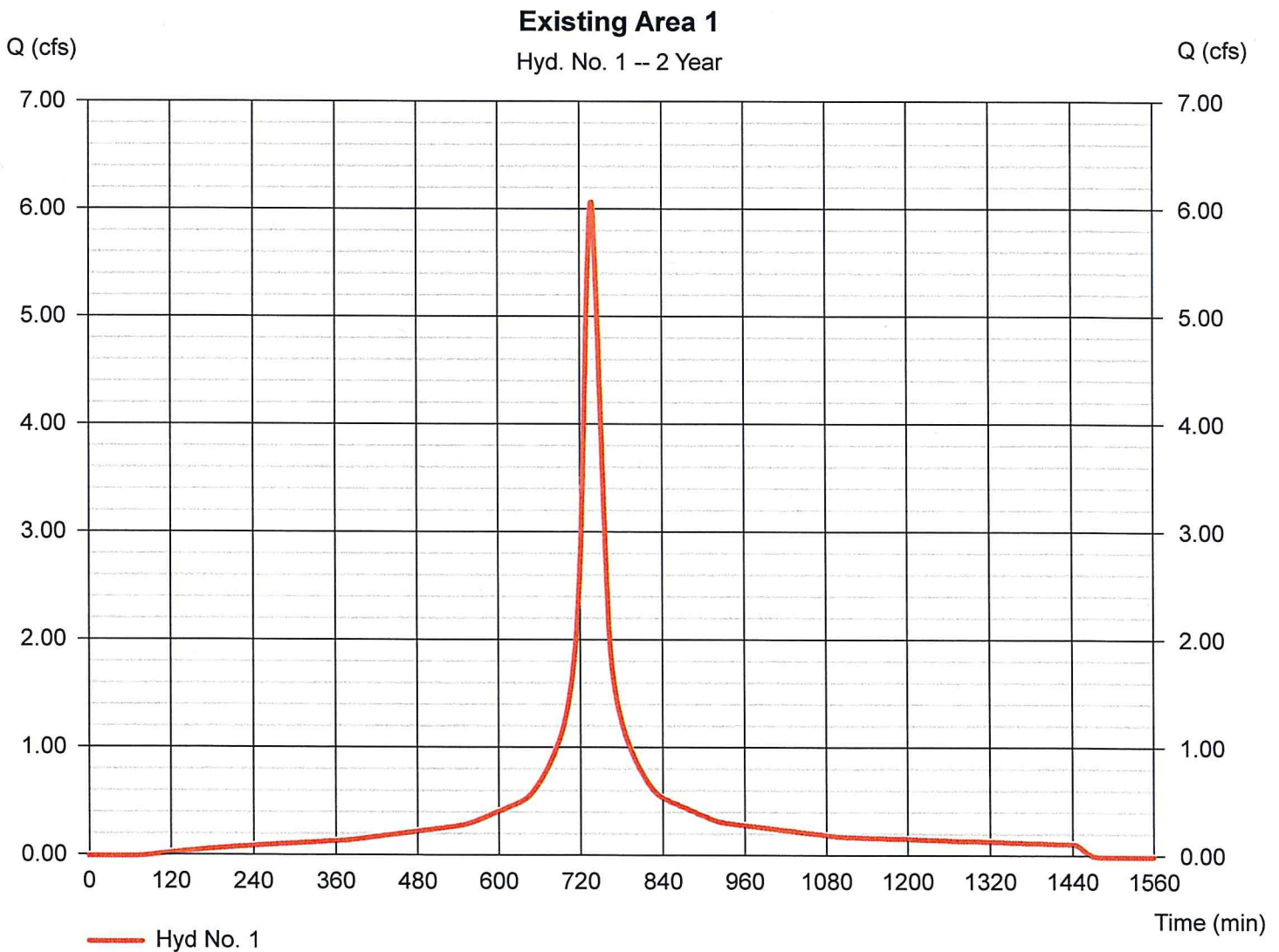
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	6.077	1	738	34,796	------	------	------	Existing Area 1
2	SCS Runoff	8.216	2	738	47,640	------	------	------	Proposed Area 1
3	Reservoir	8.119	2	742	47,639	2	206.05	1,538	forebay
4	Reservoir	1.767	2	782	47,570	3	207.57	23,353	Water Quality Basin
5	SCS Runoff	4.936	1	741	30,826	------	------	------	Existing Area 2
6	SCS Runoff	2.879	1	741	17,982	------	------	------	Proposed Area 2
8	Rational	4.349	1	7	1,827	------	------	------	Runoff to Swale

GSD 69 - Drainage Calculations - SCSgpw.gpw Return Period: 2 Year   Thursday, Jun 20, 2024

Hydrograph Report

Hyd. No. 1

Existing Area 1

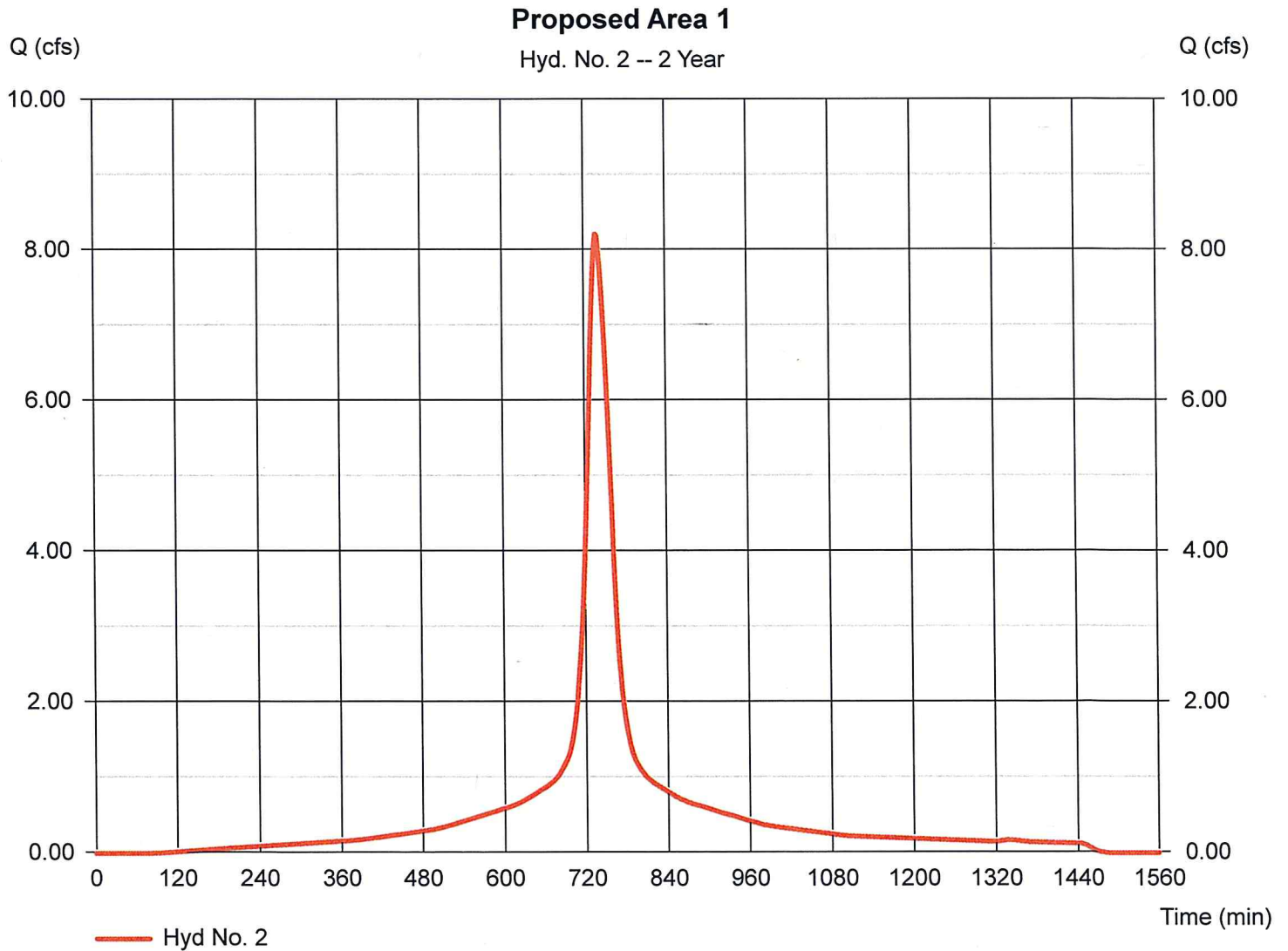|				
Hydrograph type	= SCS Runoff	Peak discharge	= 6.077 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 1 min	Hyd. volume	= 34,796 cuft
Drainage area	= 2.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.91 min
Total precip.	= 3.45 in	Distribution	= Custom
Storm duration	= NOAA Type D Distribution 1 min.cds	Shape factor	= 484

Existing Area 1

Hyd. No. 1 -- 2 Year

— Hyd No. 1

Hydrograph Report

Hyd. No. 2

Proposed Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 8.216 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 47,640 cuft
Drainage area	= 4.080 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.64 min
Total precip.	= 3.45 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Proposed Area 1

Hyd. No. 2 -- 2 Year

Q (cfs)

— Hyd No. 2

Time (min)

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066   Thursday, Jun 20, 2024

Hyd. No. 3

forebay

Hydrograph type	= Reservoir		Peak discharge	= 8.119 cfs
Storm frequency	= 2 yrs		Time to peak	= 742 min
Time interval	= 2 min		Hyd. volume	= 47,639 cuft
Inflow hyd. No.	= 2 - Proposed Area 1		Max. Elevation	= 206.05 ft
Reservoir name	= forbay		Max. Storage	= 1,538 cuft

Storage Indication method used.
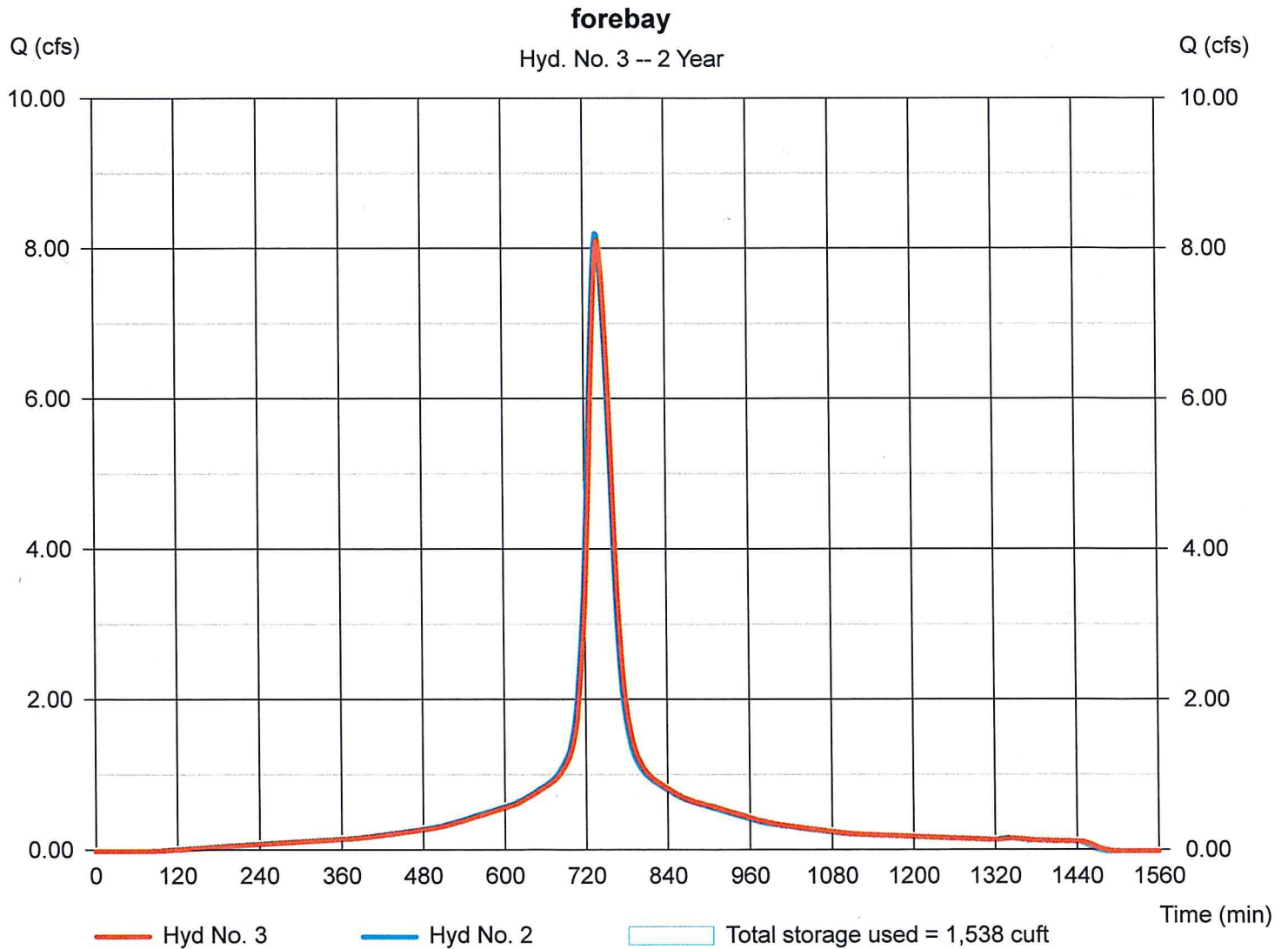
forebay

Hyd. No. 3 -- 2 Year

Hyd No. 3   Hyd No. 2   Total storage used = 1,538 cuft

Hydrograph Report

Thursday, Jun 20, 2024

Hyd. No. 4

Water Quality Basin

Hydrograph type	= Reservoir		Peak discharge	= 1.767 cfs
Storm frequency	= 2 yrs		Time to peak	= 782 min
Time interval	= 2 min		Hyd. volume	= 47,570 cuft
Inflow hyd. No.	= 3 - forebay		Max. Elevation	= 207.57 ft
Reservoir name	= Pond 1		Max. Storage	= 23,353 cuft

Storage Indication method used.

Water Quality Basin

Hyd. No. 4 -- 2 Year

Legend: — Hyd No. 4   — Hyd No. 3   Total storage used = 23,353 cuft
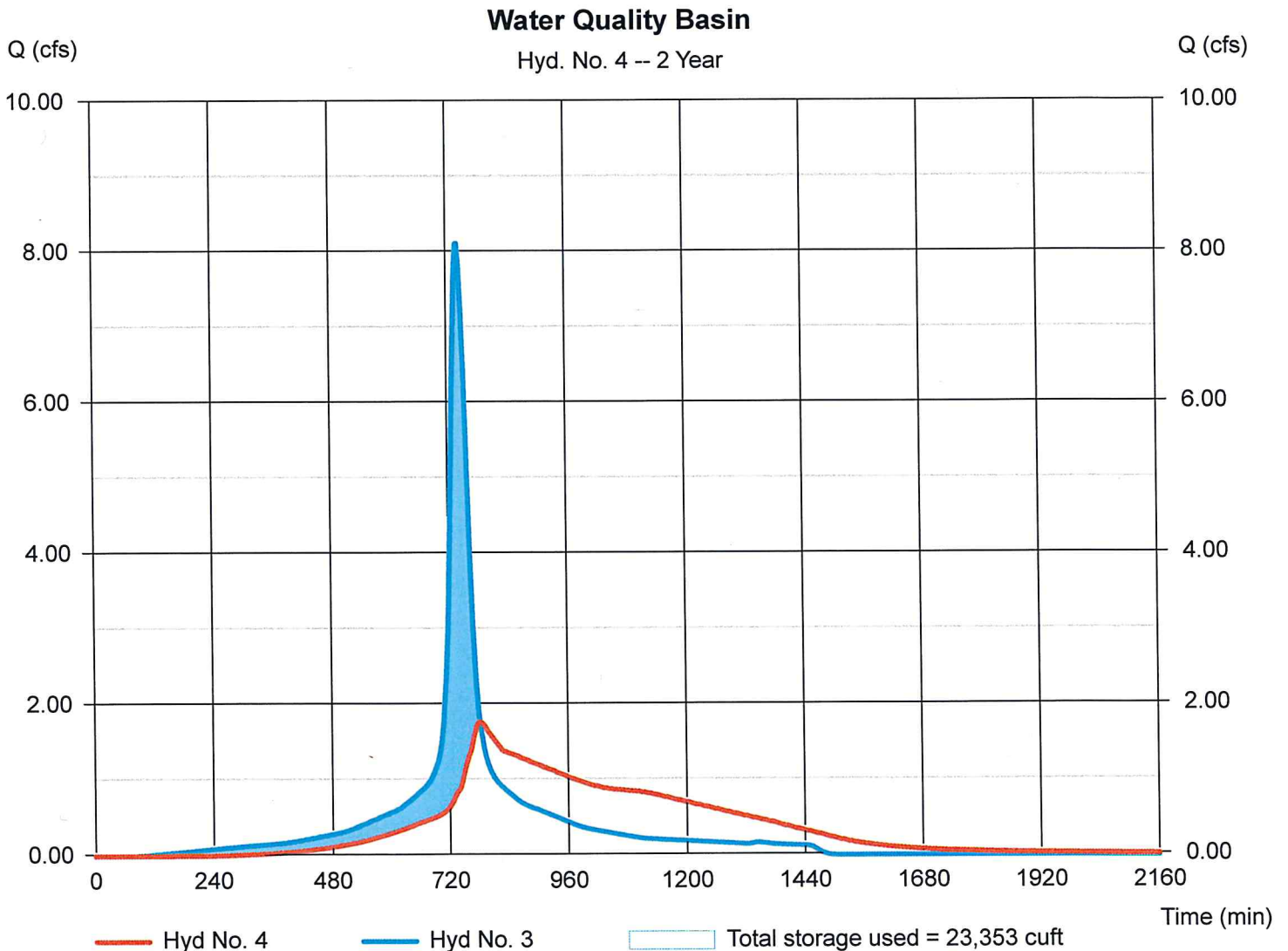
Hydrograph Report

Hyd. No. 5

Existing Area 2

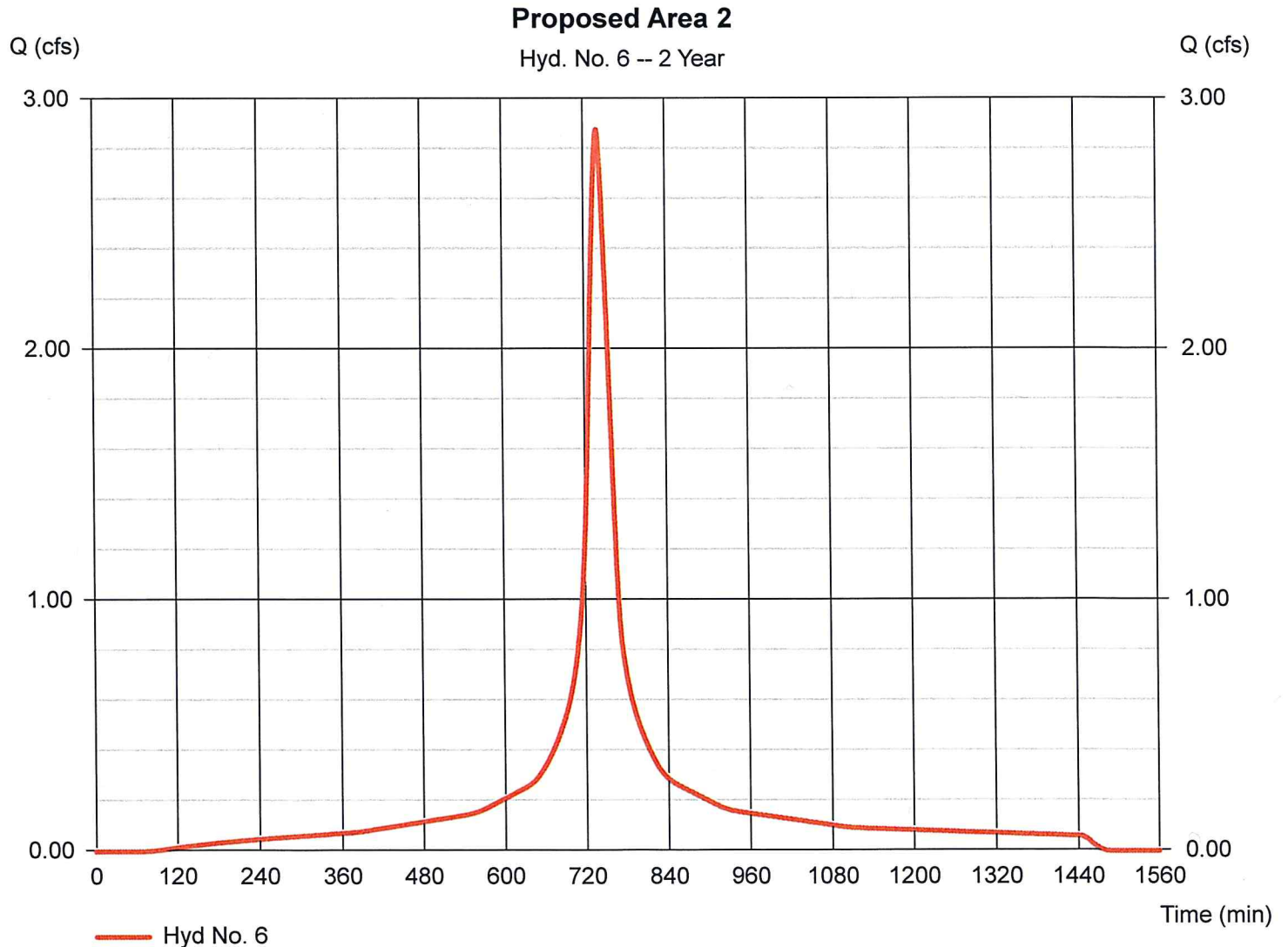|				
Hydrograph type	= SCS Runoff		Peak discharge	= 4.936 cfs
Storm frequency	= 2 yrs		Time to peak	= 741 min
Time interval	= 1 min		Hyd. volume	= 30,826 cuft
Drainage area	= 2.640 ac		Curve number	= 98
Basin Slope	= 0.0 %		Hydraulic length	= 0 ft
Tc method	= TR55		Time of conc. (Tc)	= 28.89 min
Total precip.	= 3.45 in		Distribution	= Custom
Storm duration	= NOAA Type D Distribution 1 min.cds		Shape factor	= 484

Existing Area 2

Hyd. No. 5 -- 2 Year

Hyd No. 5

Hydrograph Report

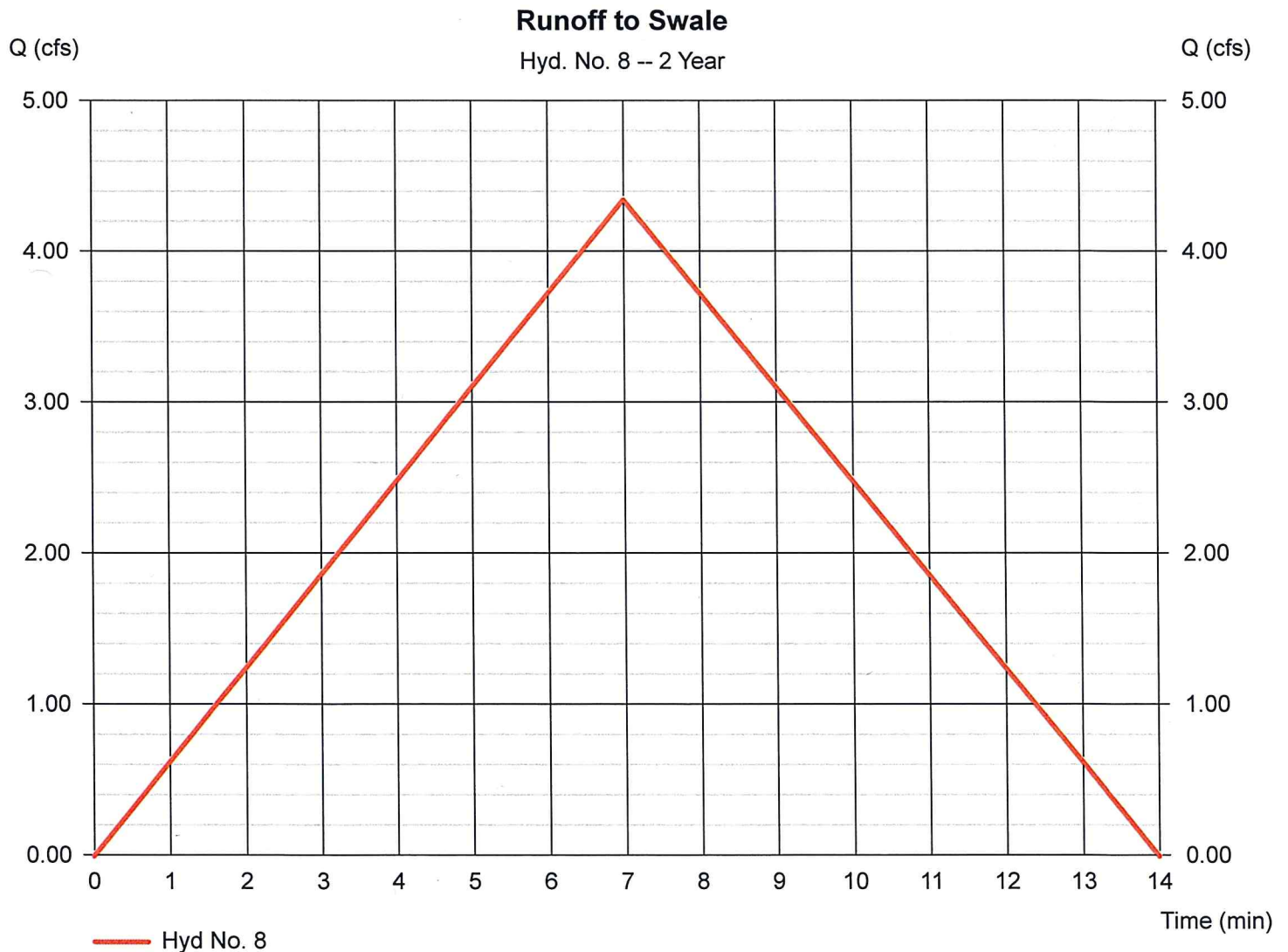Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066   Thursday, Jun 20, 2024
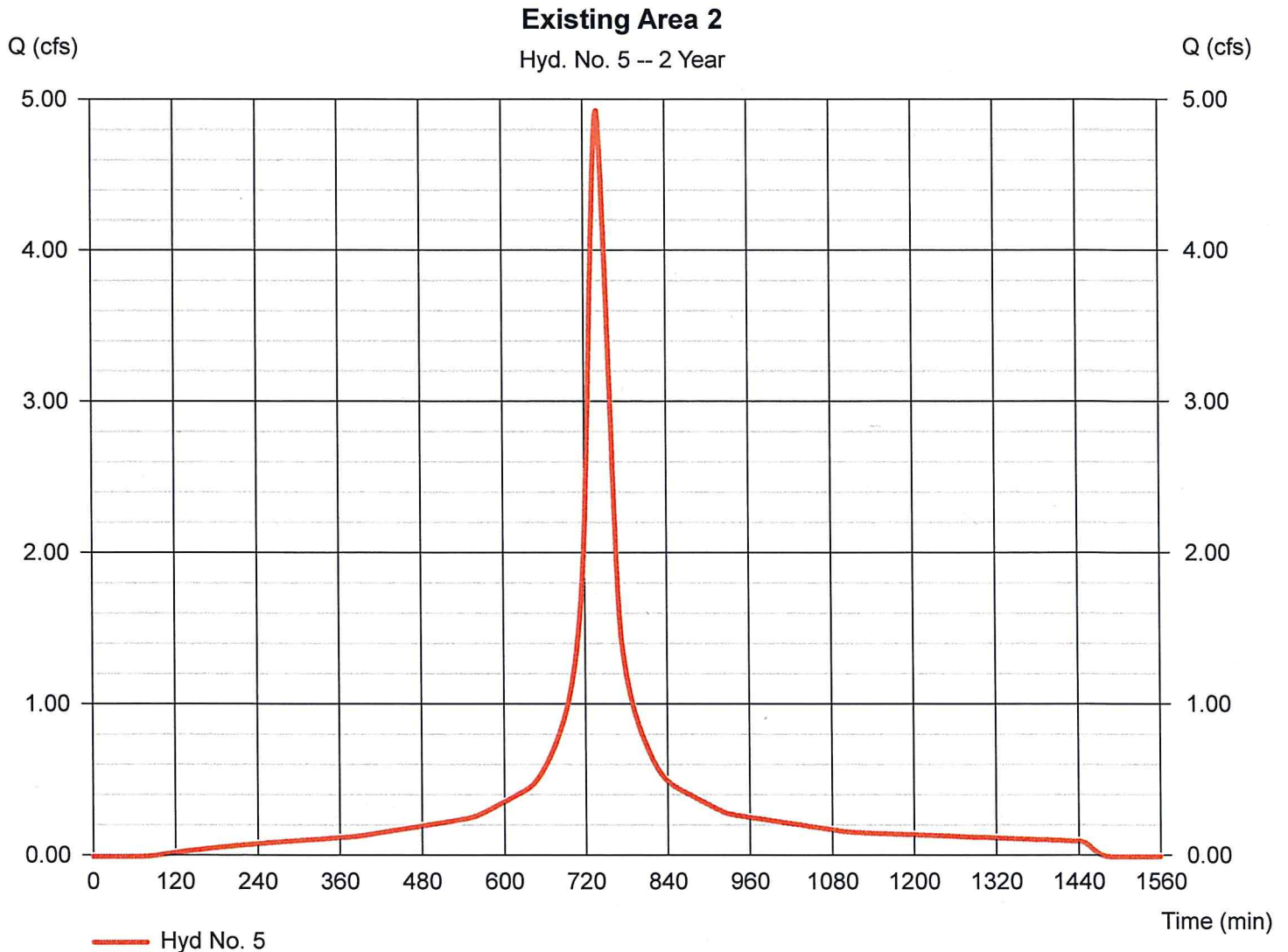
Hyd. No. 6

Proposed Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.879 cfs
Storm frequency	= 2 yrs	Time to peak	= 741 min
Time interval	= 1 min	Hyd. volume	= 17,982 cuft
Drainage area	= 1.540 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.89 min
Total precip.	= 3.45 in	Distribution	= Custom
Storm duration	= NOAA Type D Distribution 1 min.cds	Shape factor	= 484

Proposed Area 2

Hyd. No. 6 -- 2 Year

Hyd No. 6

Hydrograph Report

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Hyd. No. 8

Runoff to Swale

Hydrograph type	= Rational		Peak discharge	= 4.349 cfs
Storm frequency	= 2 yrs		Time to peak	= 7 min
Time interval	= 1 min		Hyd. volume	= 1,827 cuft
Drainage area	= 1.300 ac		Runoff coeff.	= 0.8
Intensity	= 4.182 in/hr		Tc by User	= 7.00 min
IDF Curve	= GSD-60 NOAA.IDF		Asc/Rec limb fact	= 1/1

Runoff to Swale

Hyd. No. 8 -- 2 Year
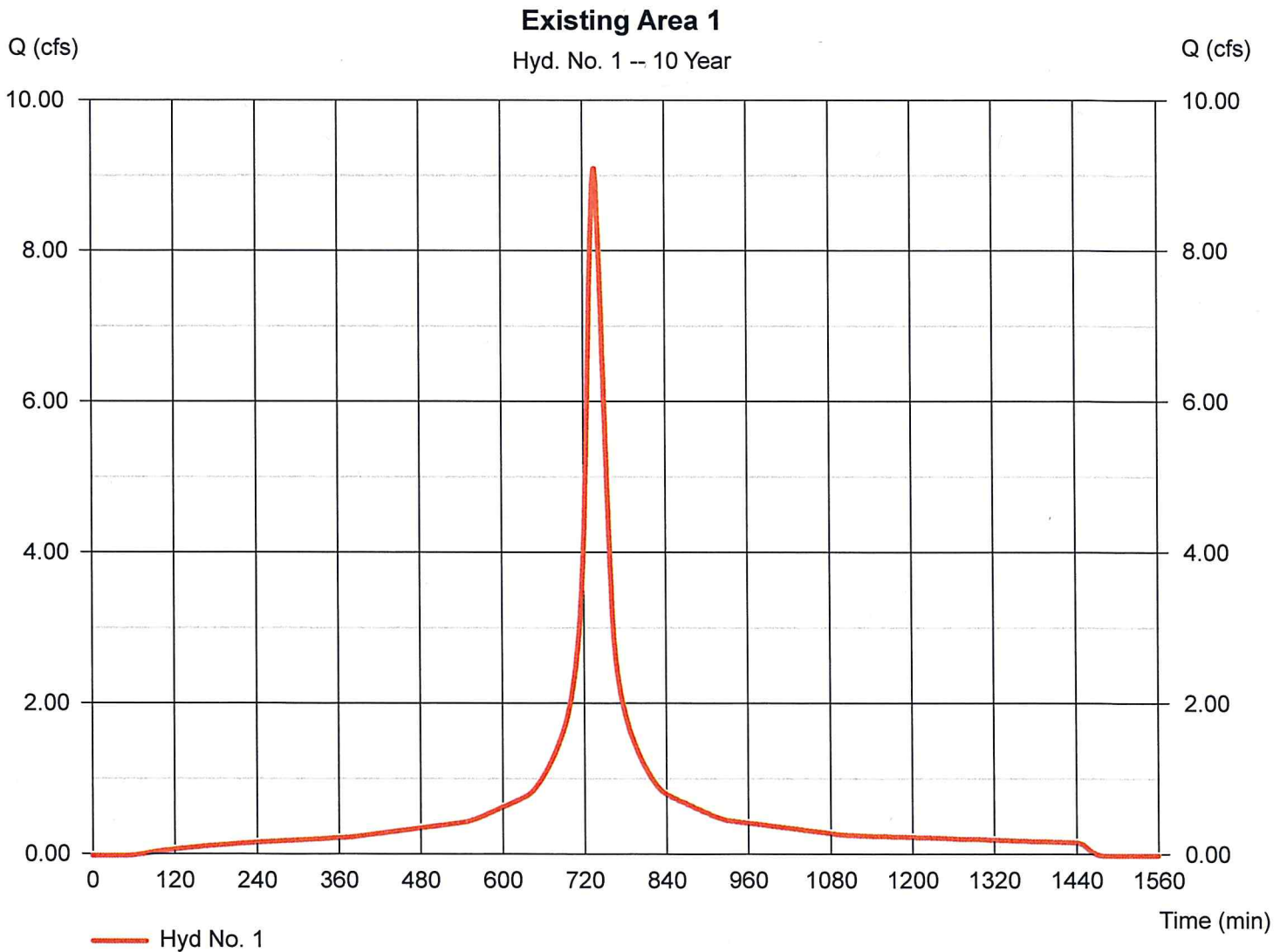
Hydrograph Summary Report

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	9.111	1	738	53,037	------	------	------	Existing Area 1
2	SCS Runoff	12.33	2	738	72,615	------	------	------	Proposed Area 1
3	Reservoir	12.22	2	740	72,614	2	206.22	2,022	forebay
4	Reservoir	6.483	2	764	72,546	3	207.93	29,677	Water Quality Basin
5	SCS Runoff	7.401	1	741	46,986	------	------	------	Existing Area 2
6	SCS Runoff	4.317	1	741	27,408	------	------	------	Proposed Area 2
8	Rational	6.520	1	7	2,739	------	------	------	Runoff to Swale

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Hydrograph Report

Hyd. No. 1

Existing Area 1

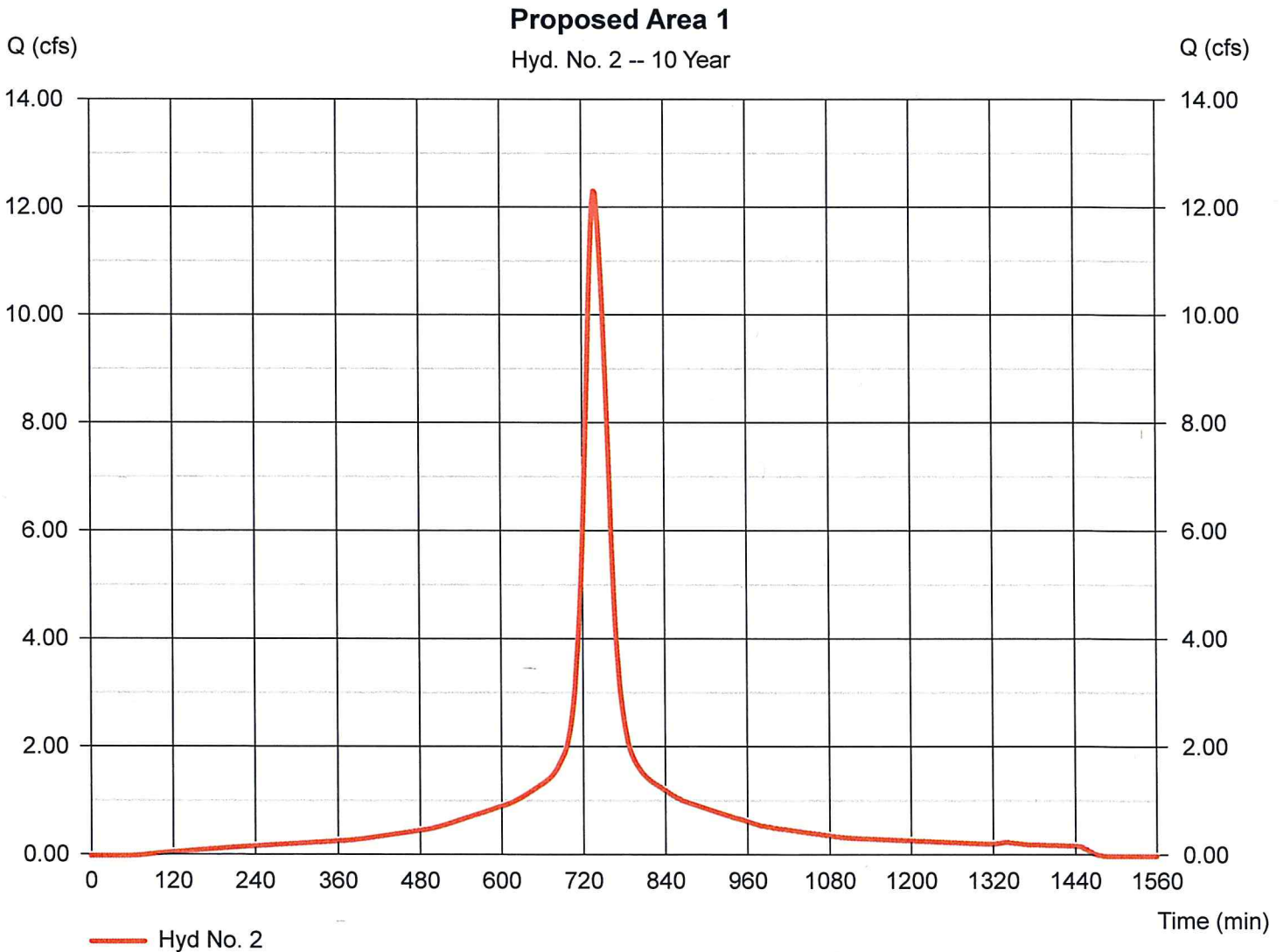|			
Hydrograph type	= SCS Runoff	Peak discharge	= 9.111 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 1 min	Hyd. volume	= 53,037 cuft
Drainage area	= 2.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.91 min
Total precip.	= 5.14 in	Distribution	= Custom
Storm duration	= NOAA Type D Distribution 1 min.cds	Shape factor	= 484

Existing Area 1

Hyd. No. 1 -- 10 Year

Q (cfs)

Time (min)

Hyd No. 1

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066   Thursday, Jun 20, 2024

Hyd. No. 2

Proposed Area 1

Hydrograph type	= SCS Runoff	Peak discharge	= 12.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 72,615 cuft
Drainage area	= 4.080 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.64 min
Total precip.	= 5.14 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Proposed Area 1

Hyd. No. 2 -- 10 Year

Hydrograph Report

Hyd. No. 3

forebay

Hydrograph type	= Reservoir	Peak discharge	= 12.22 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 72,614 cuft
Inflow hyd. No.	= 2 - Proposed Area 1	Max. Elevation	= 206.22 ft
Reservoir name	= forbay	Max. Storage	= 2,022 cuft

Storage Indication method used.

forebay
Hyd. No. 3 -- 10 Year

— Hyd No. 3   — Hyd No. 2   Total storage used = 2,022 cuft
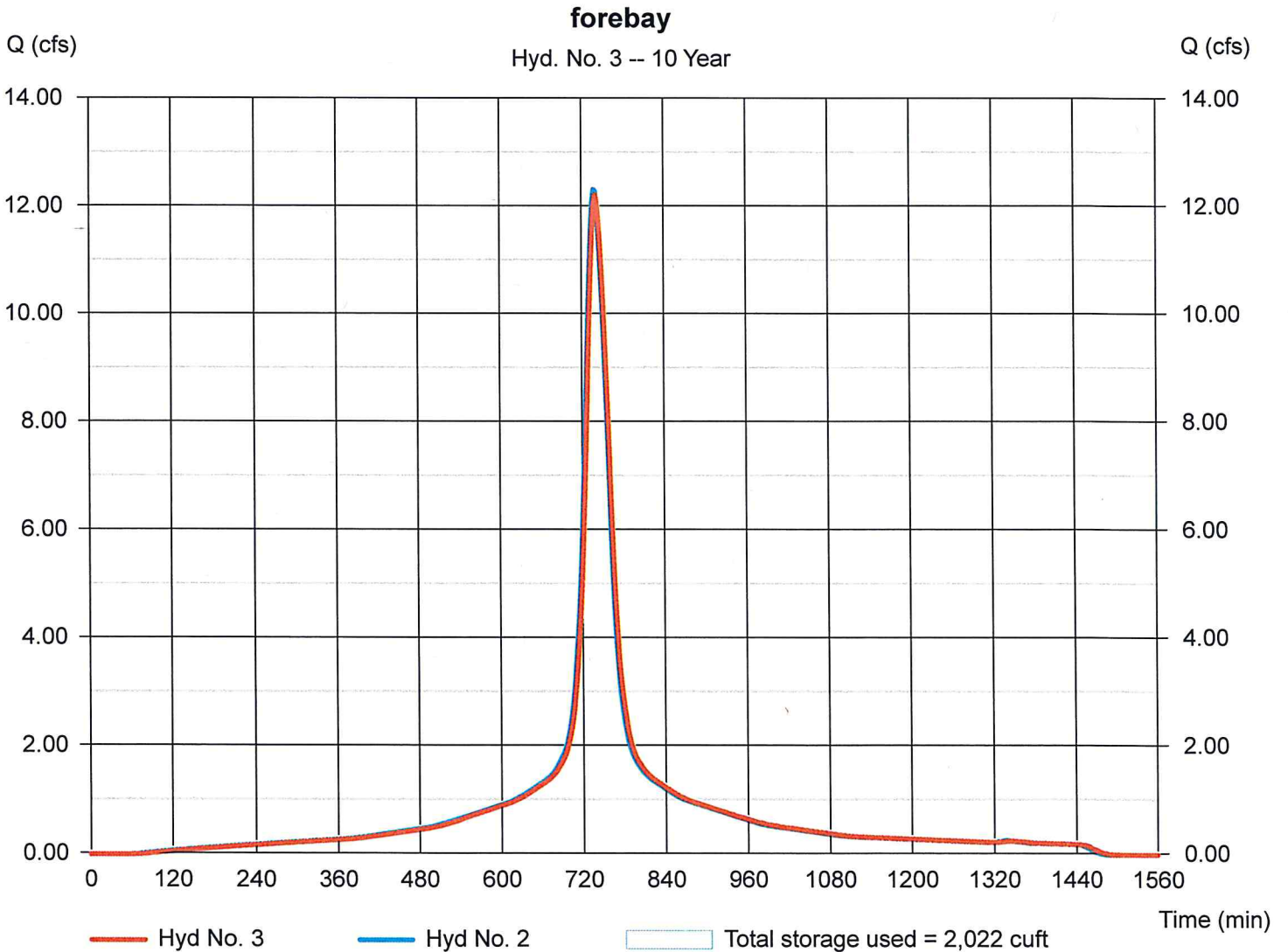
Hydrograph Report

Hyd. No. 4

Water Quality Basin

Hydrograph type	= Reservoir		Peak discharge	= 6.483 cfs
Storm frequency	= 10 yrs		Time to peak	= 764 min
Time interval	= 2 min		Hyd. volume	= 72,546 cuft
Inflow hyd. No.	= 3 - forebay		Max. Elevation	= 207.93 ft
Reservoir name	= Pond 1		Max. Storage	= 29,677 cuft

Storage Indication method used.
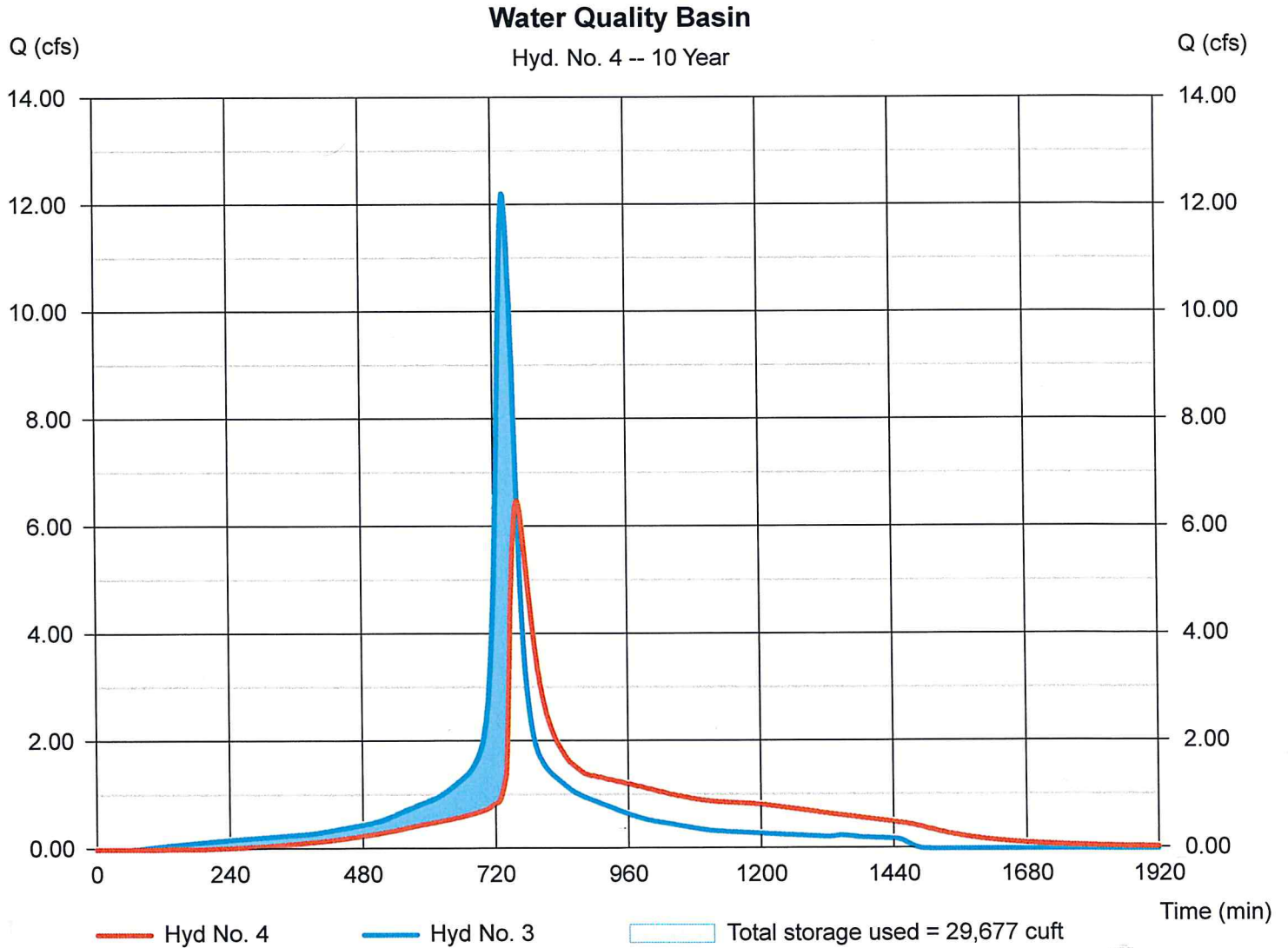
Water Quality Basin

Hyd. No. 4 -- 10 Year

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066   Thursday, Jun 20, 2024

Hyd. No. 5

Existing Area 2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.401 cfs
Storm frequency	= 10 yrs	Time to peak	= 741 min
Time interval	= 1 min	Hyd. volume	= 46,986 cuft
Drainage area	= 2.640 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.89 min
Total precip.	= 5.14 in	Distribution	= Custom
Storm duration	= NOAA Type D Distribution 1 min.cds	Shape factor	= 484

Existing Area 2

Hyd. No. 5 -- 10 Year

Hyd No. 5