STORMWATER MANAGEMENT REPORT

for

Middlesex Borough Warehouse Project

Block No. 353, Lot No. 1.01 & 1.02
Borough of Middlesex
Middlesex County, New Jersey

Prepared For:

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04/08/2020

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100594413

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF DRAWINGS

1.0 INTRODUCTION

This report presents the results of the stormwater management and conveyance system design for the proposed warehouse development on Block 353, Lot 1.01 & 1.02 in Middlesex, Middlesex County, New Jersey. Refer to Figure 1. The proposed stormwater management system was designed in accordance with the following:

- Standards for Soil Erosion and Sediment Control in New Jersey;
- N.J.A.C. 7:8 Stormwater Management Regulations;
- New Jersey Stormwater Best Management Practices Manual; and
- Stormwater Management Ordinance of the Borough of Middlesex, Chapter 355.

2.0 DESIGN METHODOLOGY

2.1. Stormwater Runoff Quantity Management

The proposed stormwater quantity management design is in accordance with the Stormwater Management Ordinance of the Borough of Middlesex, Chapter 355, N.J.A.C. 7:8-5.4(a)(3), and N.J.A.C. 5:21-7.1 through 7.9. The stormwater management design will comply with the following requirements listed below and further described in Section 4.2 of this report:

- The post-construction peak runoff rates for the 2, 10, and 100-year storm events are 50, 75, and 80 percent, respectively, of the pre-construction peak runoff rates for those watersheds that are affected by the proposed improvements.

- Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events.

The stormwater quantity calculations were performed using the method described by the USDA Soil Conservation Service (SCS) Publication TR-55, "Urban Hydrology for Small Watersheds." TR-55 outlines procedures for calculating peak runoff rates resulting from precipitation events and procedures for developing runoff hydrographs. The TR-55 procedure simulates runoff from a watershed using the drainage area, curve number (CN), time of concentration (Tc) and a prescribed rainfall distribution.

As prescribed in the New Jersey Stormwater Best Management Practices Manual, hydrographs have been computed separately for pervious and impervious areas.

The curve number is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct stormwater runoff. CN values were determined based on the coverage of soil group and land use in each area of the watershed. The NRCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have a lower CN value and the lowest runoff potential and "D" soils have a higher CN value and the greatest runoff potential. Soils throughout the project area are rated as NRCS hydrologic soil group "A", hydrologic soil group "B", and hydrologic soil group "B/D", as shown on Figure 4.

The following curve numbers were used:

CURVE NUMBERS

Hydrologic Soil Group	Land Cover	CN
A	Open Space	39
A	Gravel	76
B	Open Space	61
D	Open Space	80
A / B / B/D	Impervious	98

The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined based on land cover and slope of the flow path using methods described in TR-55.

The 24-hour SCS Type D cumulative rainfall distribution was used in the analysis. The total rainfall depth that was used for each return-period storm was taken for Middlesex County.

2.2. Stormwater Runoff Water Quality Design

Stormwater quality management for the site has been designed using the pollutant removal requirements set forth in the NJDEP Stormwater Management Rules (N.J.A.C. 7:8-5.5), and the Stormwater Management Ordinance of the Borough of Middlesex, Chapter 355. For new development, the standards require an 80% reduction of the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm as compared to the pre-construction load. For redeveloped areas (where new impervious surfaces replace existing impervious surfaces), the standards require a 50% reduction in post-construction load of TSS from the water quality design storm. Since a portion of the site is developed, a weighted TSS removal rate was calculated for each watershed and is further described in Section 4.4 of this report.

The design complies with the stormwater quality requirements by incorporating two bioretention basins. The NJDEP stormwater quality design storm consisting of 1.25 inches of rainfall in two hours with a variable distribution was used in the stormwater quality analysis. Refer to Appendix B for water quality calculations.

2.3. Groundwater Recharge Design

Complying with groundwater recharge requirements could potentially exacerbate the existing groundwater contamination impacts under the project site. Therefore, groundwater recharge is not required.

2.4. Stormwater Conveyance Design

The storm sewer conveyance system was analyzed using the Rational Method for estimating runoff from a 25-year design storm. The site was divided into sub-areas, each contributing runoff to an individual catch basin inlet or roof drain. A value for area, time of concentration, and runoff coefficient were entered for each sub-area. Times of concentration of 6 minutes were used for the inlets and roof drains. Each sub-area was assigned a weighted average runoff coefficient based on the percentage of each type of land cover. The below runoff coefficient values were used and are conservatively based on Hydrologic Group B soils.

LAND COVER	C
Open Space	0.25
Gravel	0.76
Paved	0.99
Roof	0.99

Rainfall intensities were determined from NOAA Atlas 14 for Borough of Middlesex. Storm drainage pipes were sized with Manning's Equation using the computer program Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2018.

3.0 EXISTING CONDITIONS

3.1. Existing Site Description and History

The project site is approximately 30 acres and is known as Block 353, Lots 1.01 and 1.02, Middlesex County, New Jersey. The site is bound by Baekeland Avenue to the north and east, industrial properties to the south, and River Road to the west (Refer to Figure 1).

The site was previously operated by DOW and is located within a proposed redevelopment area.

The project site generally slopes from east to west with an elevation change from elevation 56 to 33 across the site. Stormwater runoff from the eastern portion of the site is collected by a series of catch basins and conveyed and discharged to the Raritan River. Stormwater runoff from the western portion of the site flows overland toward the roadway where runoff is collected by the conveyance system within the roadway and discharged to the Raritan River.

3.2. Existing Site Soils

The on-site soils are identified as primarily Dunellen – Urban land complex, Ellington moderately deep variant-Urban land complex, and Bowmansville silt loam. These soils are designated as hydrologic soil group "A", hydrologic soil group "B", and hydrologic soil group "B/D" in accordance with the NRCS Soil Map (Figure 4).

3.3. Existing Watersheds and Drainage Description

The project consists of 3 watersheds as shown on drawing DA 101 and described below. Watershed 1 conveys runoff to the existing conveyance system at the intersection of Baekeland Avenue and River Road located in the northwestern portion of the site. This stormwater is ultimately conveyed to the Raritan River. Watershed 2 conveys runoff to the western portion of the site via overland flow or through and existing conveyance system on site. This stormwater is ultimately conveyed to the Raritan River. Watershed 3 conveys runoff to the western portion of the site via overland flow. This stormwater is ultimately discharged to the Raritan River.

The peak discharges for the site are summarized in the following table. Watershed data and hydrographs are provided in Appendix A.

Summary of Existing Peak Discharges

Storm Frequency (year)	Watershed 1 (cfs)	Watershed 2 (cfs)	Watershed 3 (cfs)
2	6.50	28.36	6.72
10	10.30	43.63	10.34
100	23.61	76.31	19.11

4.0 PROPOSED CONDITIONS

4.1. Proposed Development

The proposed development consists of a 400,000 square-foot warehouse building and associated driveways, car parking areas, truck loading areas and trailer parking areas. In addition, associated site improvements including utilities, landscaping, and lighting will be incorporated into the proposed development. The total area of impervious surface proposed is approximately 19 acres and the total land area that will be disturbed is approximately 31.1 acres.

Consistent with the Stormwater Management Ordinance of the Borough of Middlesex, stormwater inlets, conveyance pipes, bioretention and detention basins will be constructed to manage stormwater runoff from the development.

4.2. Proposed Watersheds and Drainage Description

The proposed site consists of three watersheds, similar to that of the existing conditions. These watersheds are shown on DA 102 and described below.

Watershed 1 conveys undetained stormwater runoff to the existing conveyance system at the intersection of Baekeland Avenue and River Road located in the northwestern portion of the site. This stormwater is ultimately conveyed to the Raritan River.

Peak reductions were applied to Watershed 1 to determine the allowable flow. The proposed watershed data and hydrographs are provided in Appendix A. The results are summarized below.

Summary of Allowable Flows and Proposed Discharges

WATERSHED 1				
STORM EVENT	EXISTING FLOW	REDUCTION	ALLOWABLE FLOW	PROPOSED FLOW
2	6.50 cfs	50 %	3.25 cfs	0.66 cfs
10	10.30 cfs	75 %	7.72 cfs	1.03 cfs
100	23.61 cfs	80 %	18.88 cfs	3.50 cfs

Watershed 2 conveys runoff to the western portion of the site via overland flow or through the proposed conveyance system on site. This stormwater is ultimately conveyed to the Raritan River. Watershed 2 is divided into 5 subwatersheds, as further described below.

Watershed 2A: Watershed 2A includes half of the proposed building, a portion of the proposed trailer parking and drive aisle, and Detention Basin 1.

Watershed 2B: Watershed 2B includes a small western portion of the truck loading area, as well as the truck turning area and Bioretention Basin 1.

Watershed 2C: Watershed 2C includes the remaining portion of the truck court, the employee parking lot located east of the building and Bioretention Basin 2.

Watershed 2D: Watershed 2D includes half of the proposed building, the north and west employee parking lots, and Detention Basin 2.

Watershed 2E: Watershed 2E is made up of the pervious area between Bioretention Basin 1 and River Road.

All of these subwatersheds convey detained stormwater runoff to an existing pipe on the western portion of the site, which ultimately conveys stormwater runoff to the Raritan River. Peak reductions were applied to Watershed 2 to determine the allowable flow of the proposed development.

The proposed watershed data and hydrographs are provided in Appendix A. The results are summarized below.

Summary of Allowable Flows and Proposed Discharges

WATERSHED 2				
STORM EVENT	**EXISTING FLOW**	**REDUCTION**	**ALLOWABLE FLOW**	**PROPOSED FLOW**
2	28.36 cfs	50 %	14.18 cfs	13.79 cfs
10	43.63 cfs	75 %	32.72 cfs	22.07 cfs
100	76.31 cfs	80 %	61.04 cfs	45.09 cfs

Watershed 3 conveys undetained stormwater runoff to the western portion of the site via overland flow. This stormwater is ultimately discharged to the Raritan River. Peak reductions were applied to Watershed 3 to determine the allowable flow of the proposed development.

The proposed watershed data and hydrographs are provided in Appendix A. The results are summarized below.

Summary of Allowable Flows and Proposed Discharges

WATERSHED 3				
STORM EVENT	**EXISTING FLOW**	**REDUCTION**	**ALLOWABLE FLOW**	**PROPOSED FLOW**
2	6.72 cfs	50 %	3.36 cfs	1.01 cfs
10	10.34 cfs	75 %	7.75 cfs	1.55 cfs
100	19.11 cfs	80 %	15.28 cfs	3.67 cfs

4.3. Proposed Stormwater Management

The below tables provide a summary of the peak discharges and water surface elevations for the basins. The information is summarized below and the computations and outflow hydrographs are provided in Appendix A.

Bioretention Basin 1			
Storm Frequency (year)	**Peak Outflow (cfs)**	**Maximum Water Surface Elevation (ft)**	**Spillway Elevation (ft)**
2	1.47	37.78	39.56
10	2.33	37.81	39.56
25	2.95	37.83	39.56
100	4.28	37.87	39.56

Bioretention Basin 2			
Storm Frequency (year)	**Peak Outflow (cfs)**	**Maximum Water Surface Elevation (ft)**	**Spillway Elevation (ft)**
2	13.99	37.91	38.82
10	23.20	38.07	38.82
25	30.13	38.19	38.82
100	44.31	38.39	38.82

Detention Basin 1			
Storm Frequency (year)	**Peak Outflow (cfs)**	**Maximum Water Surface Elevation (ft)**	**Spillway Elevation (ft)**
2	11.11	31.99	37.55
10	17.52	32.69	37.55
25	24.04	33.13	37.55
100	35.77	33.93	37.55

Detention Basin 2			
Storm Frequency (year)	**Peak Outflow (cfs)**	**Maximum Water Surface Elevation (ft)**	**Spillway Elevation (ft)**
2	2.68	30.70	34.50
10	4.59	31.50	34.50
25	6.12	32.04	34.50
100	9.19	32.95	34.50

4.4. Proposed Water Quality Analysis

The water quality standards set forth in the proposed NJDEP Stormwater Management Rules (N.J.A.C. 7:8, Subchapter 5) and related Best Management Practices have provided the basis for the water quality design. As required, a weighted TSS removal has been provided for the project, based on the areas of new development to be treated at 80% TSS removal and the redeveloped areas to be treated at 50% TSS removal. Refer to Drawings DA 104 TSS Removal Required and DA 105 TSS Removal Provided. A description of the water quality design for each watershed is provided below.

The required weighted TSS removal rate for the project is 64.8%. The proposed weighted TSS removal rate for the project is 66.8%.

The proposed bioretentions basins proposed for stormwater quality treatment provide treatment at 90% TSS removal for the eastern employee parking lot and truck court south of the building. The northern and western employee parking lots are not treated by the bioretention basins and thus have a water quality treatment removal rate of 0%. The weighted average removal rate of these areas provides a TSS removal rate higher than the rate required.

4.5. Groundwater Recharge

Complying with groundwater recharge requirements could potentially exacerbate the existing groundwater contamination impacts under the project site. Refer to Appendix C for a letter from the site Licensed Site Remediation Professional addressing the impacts of groundwater recharge on the ongoing groundwater remediation onsite.

4.6. Stormwater Conveyance

Storm pipes were designed to convey the flows resulting from a 25-year storm event. The results of the hydraulic calculations are provided in Appendix D and the drainage areas to each inlet are shown on Drawing DA 103.

Conduit outlet protection for the stormwater conveyance outfalls have been designed in accordance with the "Standards for Soil Erosion and Sediment Control in New Jersey". The analyses of the proposed rip rap aprons are included in Appendix E.

4.7. Low Impact Development

The NJDEP Low Impact Development checklist has also been included in Appendix F to discuss the Low Impact Development strategies incorporated into the design of this project.

5.0 FLOOD STORAGE ANALYSIS

According to N.J.A.C. 7:13-3.2(c), the flood hazard area shall be determined utilizing Method 1 or Method 3, whichever results in a higher flood hazard area design flood elevation. Using Method 1 at N.J.A.C. 7:13-3.3, the Department Delineation Method, the elevation of the flood hazard area ranges from 34.75 to 35.0 (NGVD 29), equal to 33.82 to 34.06 (NAVD 88), based on the NJDEP Delineation of Floodway and Flood Hazard Area for Raritan River Station 954+00 to Station 1036+00, Franklin Township, Piscataway Township, South Bound Brook Boro, Middlesex Boro, Bound Brook Boro, last revised January 2, 1986 (See Figure 7 – NJDEP Flood Hazard Area Map and Profile). According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), a small portion of the site along the site's western boundary with River Road is mapped within the 100-year floodplain (See Figure 6 – Preliminary FEMA FIRM). The 100-year floodplain is mapped by FEMA at approximately el. 31.5 to 32.5 (NAVD 88). Using Method 3 at N.J.A.C. 7:13-3.4(e), the FEMA Fluvial Method, the elevation of the flood hazard area would be approximately el. 32.5 to 33.5 (FEMA 100-year elevation + 1-foot) (NAVD 88). Therefore, Method 1 results in a higher flood hazard area design flood elevation and elevations 33.83 to 34.06 were used for the flood storage analysis described below.

A grid method was used to calculate the storage volumes to verify that the flood storage volume within the project is not being displaced. A 25-foot grid was superimposed over the existing topography, and the proposed grading and storage depths at each corner of the grid were averaged and then multiplied by the area of the grid to determine the storage volume of that grid (See drawings CG110 and CG111). Each grid was added to determine the overall volume of existing and proposed flood storage.

The existing flood storage volume within the flood hazard area for the 100-year flood is 6,177 cubic yards. The proposed flood storage volume within the flood hazard area for the 100-year flood is 6,197 cubic yards. As such, the proposed improvements will increase the flood storage volume on the site by 20 cubic yards. See Appendix H for the existing and proposed flood storage volume calculations.

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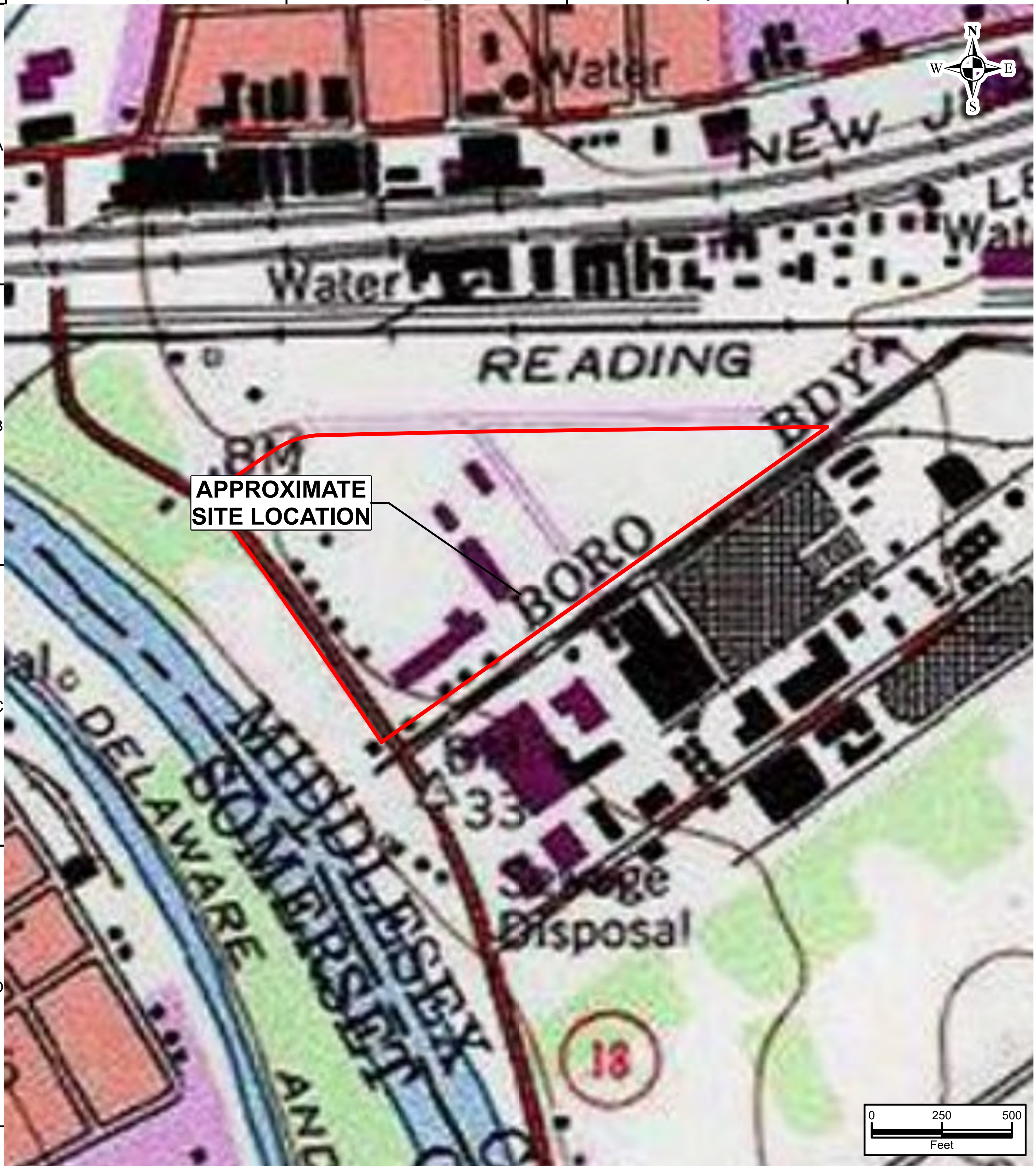
FIGURES



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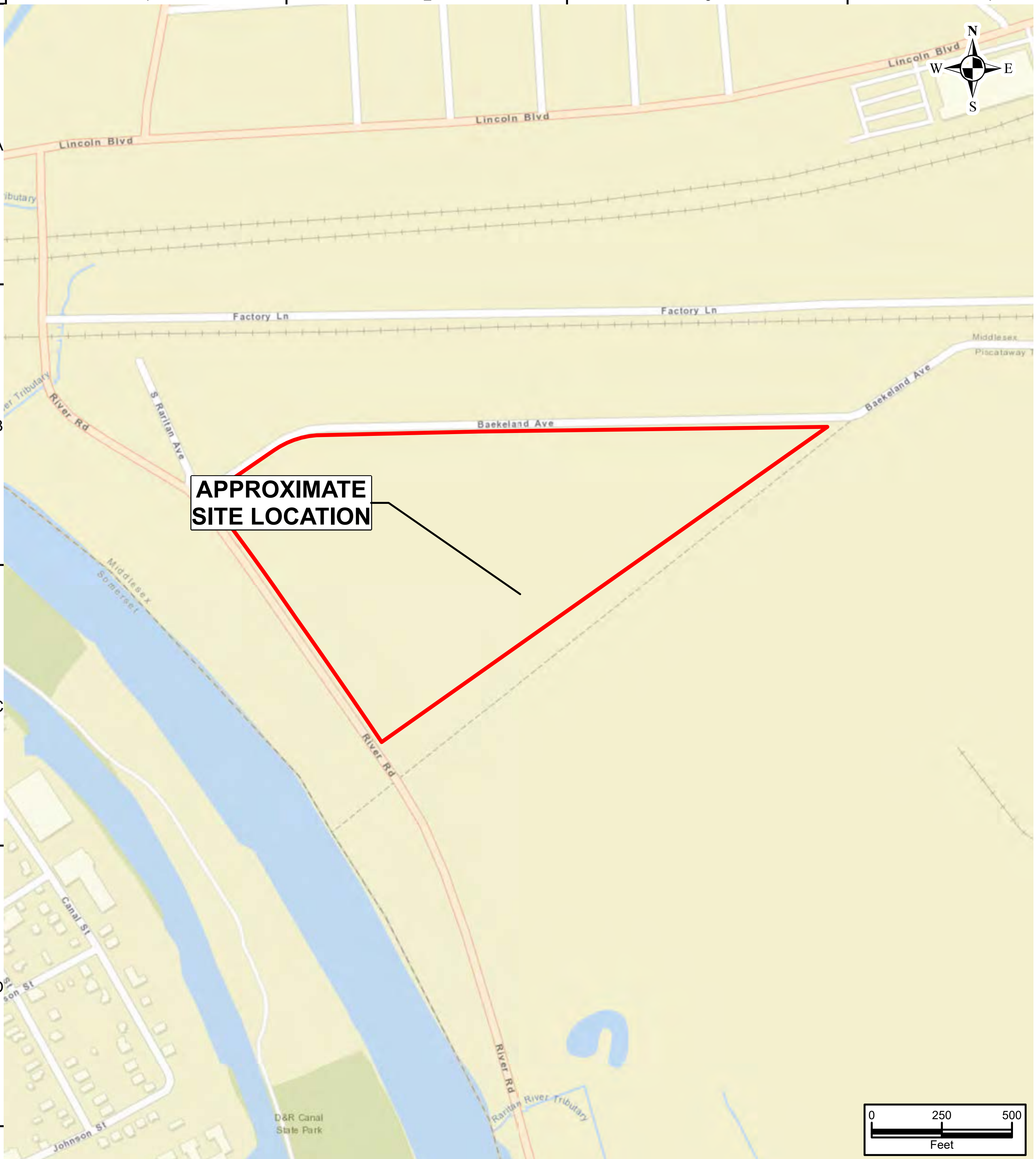
Project		Project No.	Figure
MIDDLESEX BOROUGH WAREHOUSE MIDDLESEX COUNTY MIDDLESEX NEW JERSEY	SITE LOCATION	100594413	1
		Date 7/8/2019	
		Scale 1:500	
		Drawn By Site Analyzer	
		Submission Date 06/28/2019	Sheet 1 of 6

Spatial



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community; Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

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Project MIDDLESEX BOROUGH WAREHOUSE MIDDLESEX COUNTY MIDDLESEX NEW JERSEY	VICINITY MAP	Project No. 100594413 Date 7/8/2019 Scale 1:500 Drawn By Site Analyzer Submission Date 06/28/2019	Figure 2 Sheet 2 of 6

Spatial

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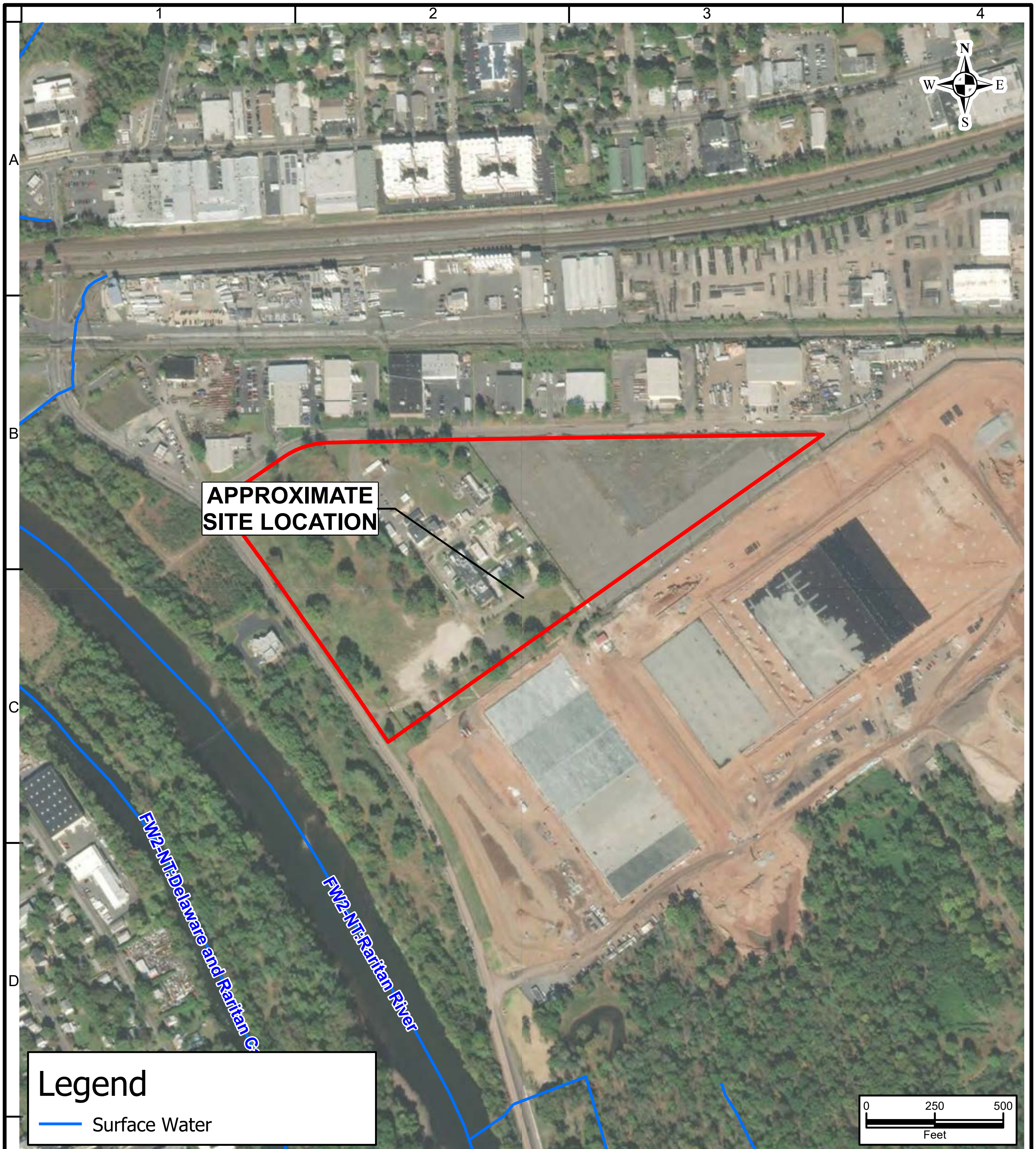

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Project	MIDDLESEX BOROUGH WAREHOUSE
	MIDDLESEX
COUNTY	
MIDDLESEX	NEW JERSEY
	NJDEP SURFACE WATERS MAP
Project No.	100594413
Date	7/8/2019
Scale	1:500
Drawn By	Site Analyzer
Submission Date	06/28/2019
Figure	3
	Sheet 3 of 6

Spatial

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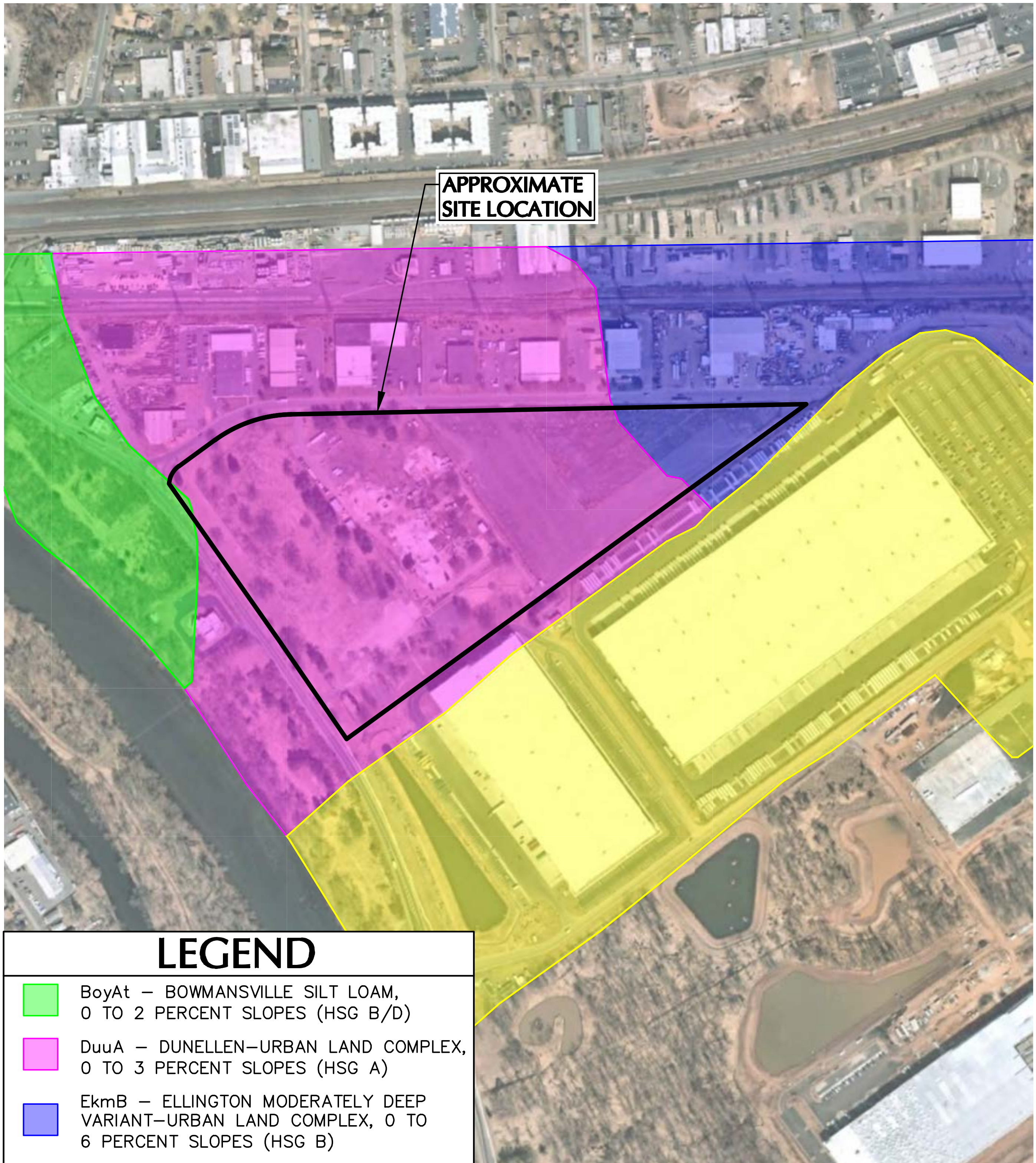

LEGEND

- BoyAt – BOWMANSVILLE SILT LOAM, 0 TO 2 PERCENT SLOPES (HSG B/D)
- DuuA – DUNELLEN–URBAN LAND COMPLEX, 0 TO 3 PERCENT SLOPES (HSG A)
- EkmB – ELLINGTON MODERATELY DEEP VARIANT–URBAN LAND COMPLEX, 0 TO 6 PERCENT SLOPES (HSG B)
- UR – URBAN LAND (HSG NOT RATED)

REFERENCES: AERIAL IMAGE OBTAINED FROM NEARMAP, DATED 3/28/2019. SOIL INFORMATION OBTAINED FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE WEB SOIL SURVEY.

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Project	Drawing Title	Project No.	Drawing No.
MIDDLESEX BOROUGH WAREHOUSE MIDDLESEX COUNTY MIDDLESEX NEW JERSEY	NJ SOILS MAP	100594413	4
		Date: 1/20/2020	
		Scale: 1"=500'	
		Drawn By: SLK / Checked By: MRW	Sheet 4 of 6

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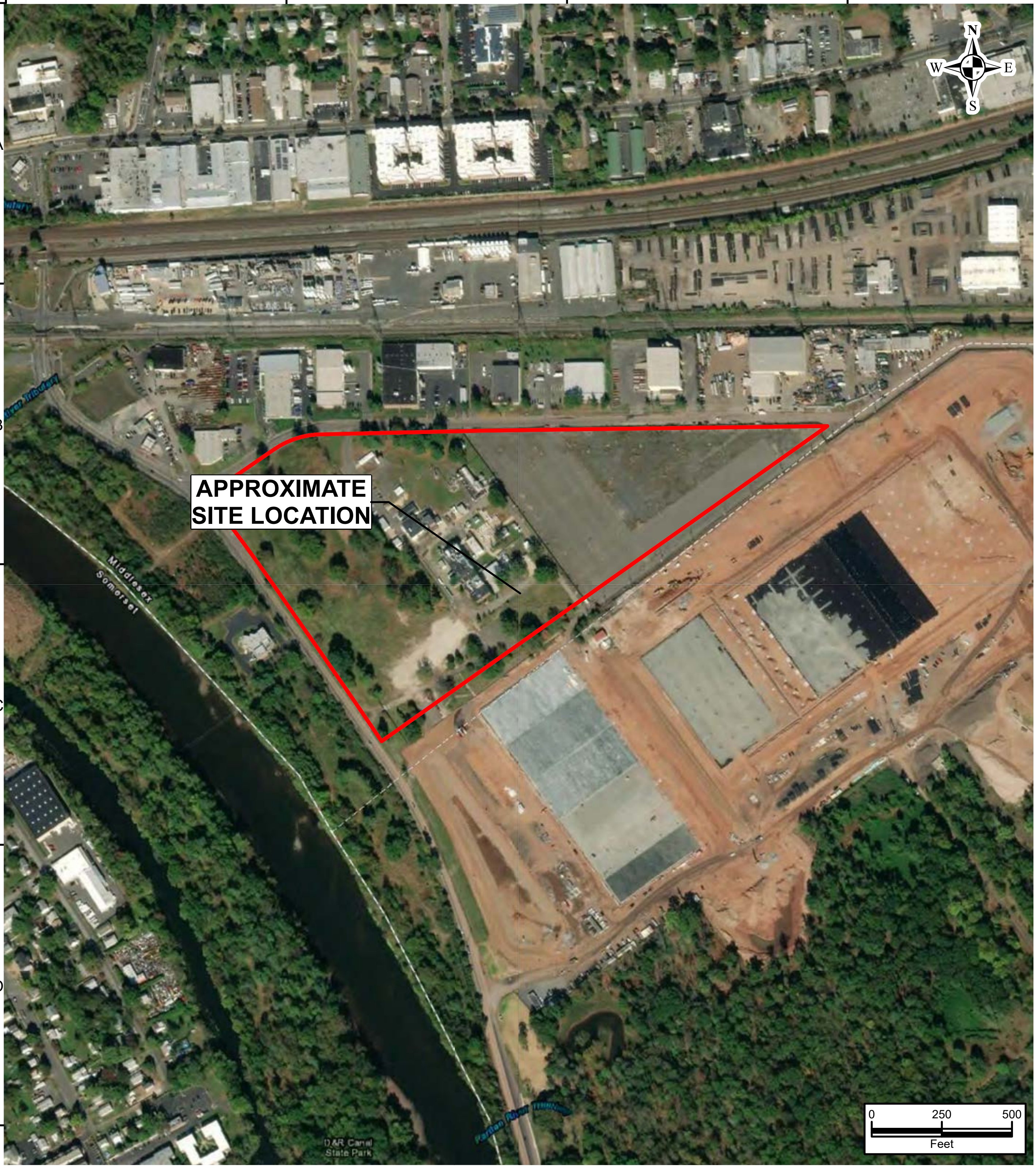

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Project

MIDDLESEX BOROUGH WAREHOUSE

MIDDLESEX
COUNTY
MIDDLESEX NEW JERSEY

IMAGERY WITH LABELS

Spatial

Project No. 100594413	Figure
Date 7/8/2019	5
Scale 1:500	
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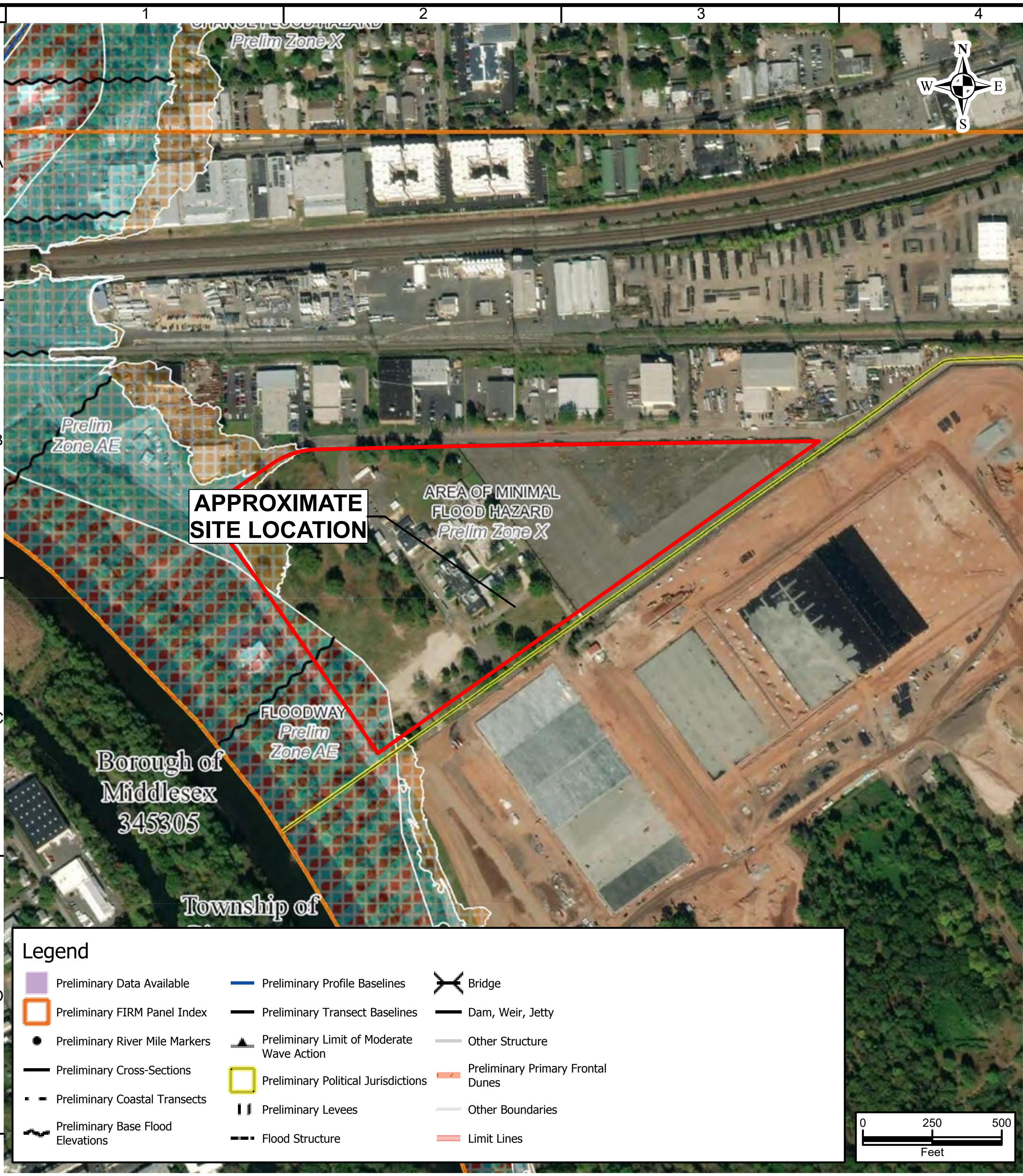
Submission Date 06/28/2019	Sheet 5 of 6



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community; FEMA RiskMap CDS

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Project

MIDDLESEX BOROUGH WAREHOUSE

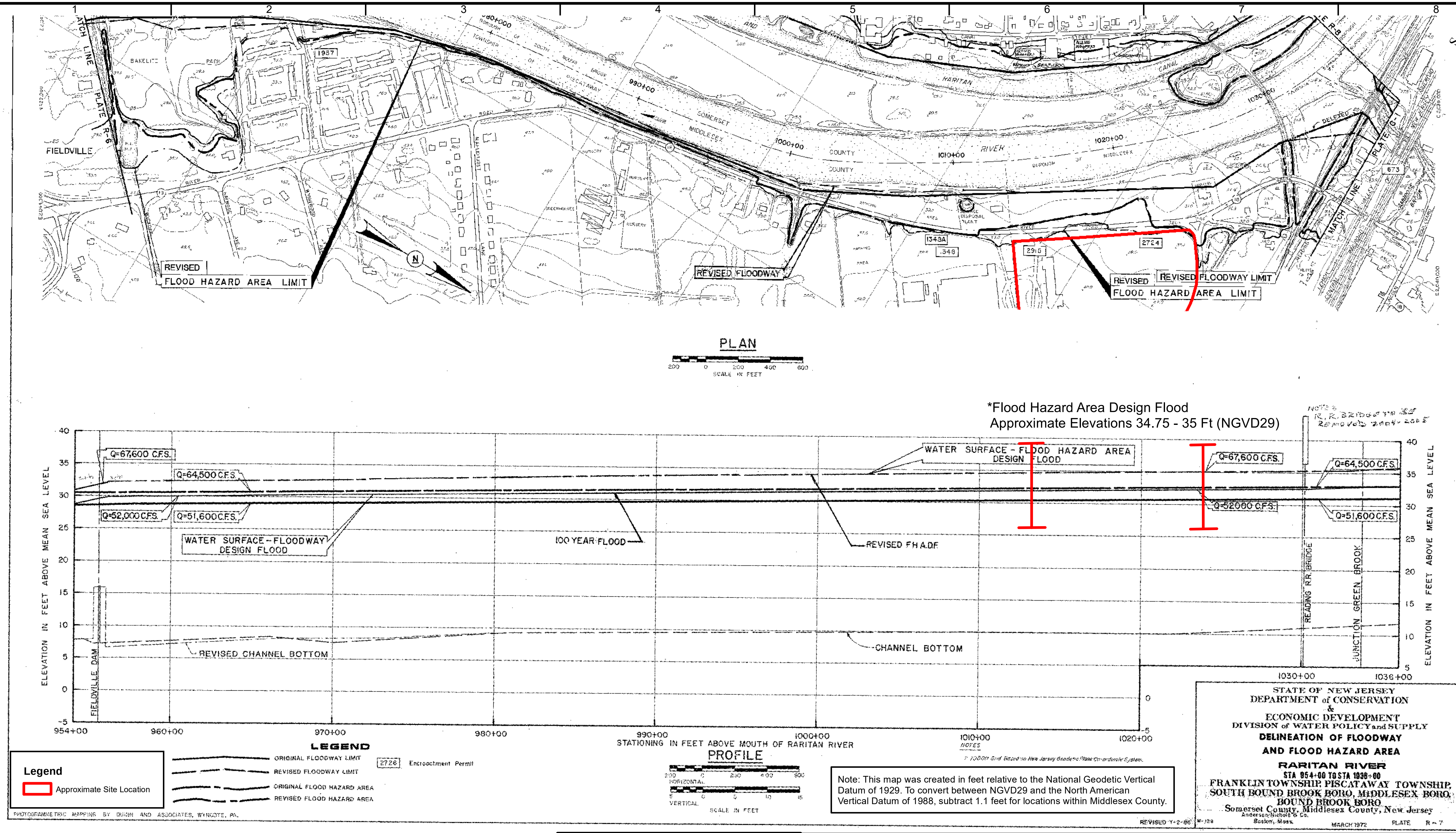
MIDDLESEX

COUNTY MIDDLESEX NEW JERSEY

Spatial

PRELIMINARY FEMA FIRM

Project No. 100594413	Figure
Date 7/8/2019	6
Scale 1:500	
Drawn By Site Analyzer	
Submission Date 06/28/2019	Sheet 6 of 6



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SCALE IN FEET

Map References: NJDEP Flood Study - Raritan River Plate R-7, March 1972, Revised 1.2.1986

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Project
MIDDLESEX BOROUGH WAREHOUSE PROJECT
BLOCK No. 353, LOT No. 1.01 & 1.02
BOROUGH OF MIDDLESEX
MIDDLESEX COUNTY NEW JERSEY

Drawing Title
NJDEP FLOOD HAZARD AREA MAP AND PROFILE

Project No.	100594413
Date	10/22/2019
Scale	1 " = 600 '
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Figure
7

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APPENDIX A

PRE-DEVELOPMENT AND POST-DEVELOPMENT WATERSHED HYDROGRAPHS

Project	**Middlesex Warehouse**	By **SLK**	Date **3/23/2020**
Location	**Middlesex, NJ**	Checked **MRW**	Date **3/23/2020**
Circle one:	Present Developed	**Existing Watershed 1 - Impervious**	

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 (x acres / mi² / %)	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
A	**Impervious (Asphalt and Buildings)**	**98**			**1.65**	**161.22**
A	**Impervious (Gravel)**	**76**			**0.47**	**35.64**
B	**Impervious (Asphalt and Buildings)**	**98**			**1.11**	**108.87**
				Totals =	**3.23**	**305.73**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{305.73}{3.23} = 94.80$$

Use CN = **95**

Project **Middlesex Warehouse** By **SLK** Date **3/23/2020**

Location **Middlesex, NJ** Checked **MRW** Date **3/23/2020**

Circle one: Present Developed **Existing Watershed 1 - Pervious**

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**7.72**	**301.08**
B/D	**Open Space (Good)**	**80**			**0.17**	**13.72**
				Totals =	**7.89**	**314.80**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{314.80}{7.89} = 39.89$$

Use CN = **40**

Project	**Middlesex Warehouse**	By **SLK**	Date **3/23/2020**
Location	**Middlesex, NJ**	Checked **MRW**	Date **3/23/2020**

Circle one: Present Developed **Existing Watershed 2 - Impervious**

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] Table 2-2	Figure 2-3	Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt and Buildings)**	**98**			**8.59**	**841.72**
B	**Impervious (Asphalt and Buildings)**	**98**			**1.39**	**136.56**
				Totals =	**9.98**	**978.27**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{978.27}{9.98}$ = 98.00 Use CN = **98**

Project **Middlesex Warehouse** By **SLK** Date **3/23/2020**

Location **Middlesex, NJ** Checked **MRW** Date **3/23/2020**

Circle one: Present Developed **Existing Watershed 2 - Pervious**

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 [x] acres [ ] mi^2 [ ] %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
A	**Open Space (Good)**	**39**			**4.46**	**174.04**
B	**Open Space (Good)**	**61**			**0.15**	**9.26**
				Totals =	**4.61**	**183.30**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{183.30}{4.61}$ = 39.72 Use CN = **40**

Project **Middlesex Warehouse** By **SLK** Date **3/23/2020**

Location **Middlesex, NJ** Checked **MRW** Date **3/23/2020**

Circle one: Present Developed **Existing Watershed 3 - Impervious**

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt and Buildings)**	**98**			**2.06**	**201.75**
				Totals =	**2.06**	**201.75**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{201.75}{2.06} = 98.00$$

Use CN = **98**

Project **Middlesex Warehouse** By **SLK** Date **3/23/2020**

Location **Middlesex, NJ** Checked **MRW** Date **3/23/2020**

Circle one: Present Developed **Existing Watershed 3 - Pervious**

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	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4	[x] acres [ ] mi^2 [ ] %	
A	**Open Space (Good)**	**39**			**4.79**	**187.00**
				Totals =	**4.79**	**187.00**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{187.00}{4.79}$ = 39.00 Use CN = **39**

Project	Middlesex Warehouse	By	SLK	Date	7/8/2019
Location	Middlesex, NJ	Checked	MRW	Date	7/8/2019

Circle One: Present Developed

Circle One: T_c T_t through subarea **Existing Watershed 1 - Pervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

			Segment ID	1		
1.	Surface description (table 3-1)			Grass		
2.	Manning's roughness coeff., n (table 3-1)			0.150		
3.	Flow Length, L (total L ≤ 150 ft)		ft	150		
4.	Two-yr 24-hr rainfall, P_2		in	3.35		
5.	Land slope, s		ft/ft	0.010		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.291	=	0.291

Shallow concentrated flow

			Segment ID	2	3	4	5	6		
7.	Surface description (paved or unpaved)			Unpaved	Paved	Unpaved	Unpaved	Paved		
8.	Flow length, L		ft	173	151	126	74	355		
9.	Watercourse slope, s		ft/ft	0.02	0.01	0.01	0.04	0.02		
10.	Average velocity, V (figure 3-1)		ft/s	2	2	1.5	3	2		
11.	$T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.024 +	0.021 +	0.023 +	0.0 +	0.049	=	0.124

Channel flow

			Segment ID			
12.	Cross sectional flow area, a		ft^2			
13.	Wetted perimeter, p_w		ft			
14.	Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft			
15.	Channel slope, s		ft/ft			
16.	Manning's roughness coeff., n					
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s			
18.	Flow length, L		ft			
19.	$T_t = \frac{L}{3600\ V}$	Compute T_t	hr		=	0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				hr	0.416

Use Tc = 25

Project Middlesex Warehouse By SLK Date 3/23/2020

Location Middlesex, NJ Checked MRW Date 3/23/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea Existing Watershed 1 - Impervious

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment ID	1	
1.	Surface description (table 3-1)		Pavement	
2.	Manning's roughness coeff., n (table 3-1)		0.011	
3.	Flow Length, L (total L ≤ 150 ft)	ft	150	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	
5.	Land slope, s	ft/ft	0.010	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.036	= 0.036

Shallow concentrated flow

		Segment ID	2	3	4		
7.	Surface description (paved or unpaved)		Paved	Paved	Paved		
8.	Flow length, L	ft	823	847	519		
9.	Watercourse slope, s	ft/ft	0.01	0.007	0.017		
10.	Average velocity, V (figure 3-1)	ft/s	2	1.6	2.6		
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.114 +	0.147 +	0.055 +		= 0.317

Channel flow

		Segment ID		
12.	Cross sectional flow area, a	ft^2		
13.	Wetted perimeter, p_w	ft		
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft		
15.	Channel slope, s	ft/ft		
16.	Manning's roughness coeff., n			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		
18.	Flow length, L	ft		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr		= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)			hr 0.353

Use Tc = 21

Project	Middlesex Warehouse	By	SLK
Location	Middlesex, NJ	Checked	MRW

Date 3/23/2020

Date 3/23/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea **Existing Watershed 2 - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit	Segment ID 1	Total
1.	Surface description (table 3-1)		Pavement	
2.	Manning's roughness coeff., n (table 3-1)		0.011	
3.	Flow Length, L (total L ≤ 150 ft)	ft	150	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	
5.	Land slope, s	ft/ft	0.015	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.031	= 0.031

Shallow concentrated flow

		Unit	Segment ID 2				Total
7.	Surface description (paved or unpaved)		Paved				
8.	Flow length, L	ft	630				
9.	Watercourse slope, s	ft/ft	0.015				
10.	Average velocity, V (figure 3-1)	ft/s	2.4				
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.073 +	+	+		= 0.073

Channel flow

		Unit	Segment ID 3 (12")	Segment ID 4 (12")	Total
12.	Cross sectional flow area, a	ft^2	0.79	0.79	
13.	Wetted perimeter, p_w	ft	3.14	3.14	
14.	Hydraulic radius, r; $r = \frac{a}{p_w}$ Compute r	ft	0.25	0.25	
15.	Channel slope, s	ft/ft	0.02	0.013	
16.	Manning's roughness coeff., n		0.015	0.015	
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.57	4.49	
18.	Flow length, L	ft	248	890	
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.012 +	0.055 +	= 0.067
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.171

Use Tc = 10

Project	Middlesex Warehouse	By SLK	Date 7/8/2019
Location	Middlesex, NJ	Checked MRW	Date 7/8/2019

Circle One: Present Developed

Circle One: T_c T_t through subarea **Existing Watershed 2 - Pervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit			
	Segment ID		1	2	
1. Surface description (table 3-1)			Grass	Grass	
2. Manning's roughness coeff., n (table 3-1)			0.150	0.150	
3. Flow Length, L (total L ≤ 150 ft)		ft	100	50	
4. Two-yr 24-hr rainfall, P_2		in	3.35	3.35	
5. Land slope, s		ft/ft	0.015	0.100	
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$	Compute T_t	hr	0.179 +	0.048	= 0.227

Shallow concentrated flow

		Unit					
	Segment ID		3	4	5	6	
7. Surface description (paved or unpaved)			Unpaved	Unpaved	Unpaved	Paved	
8. Flow length, L		ft	336	58	27	16	
9. Watercourse slope, s		ft/ft	0.006	0.020	0.067	0.012	
10. Average velocity, V (figure 3-1)		ft/s	1.2	2.2	4.2	2.2	
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.078 +	0.007 +	0.002 +	0.002	= 0.089

Channel flow

		Unit			
	Segment ID				
12. Cross sectional flow area, a		ft^2			
13. Wetted perimeter, p_w		ft			
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s		ft/ft			
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s			
18. Flow length, L		ft			
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	+	= 0.000

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) hr **0.316**

Use Tc = 19

Project	Middlesex Warehouse	By	SLK	Date	1/27/2020
Location	Middlesex, NJ	Checked	MRW	Date	1/27/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea **Existing Watershed 3 - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment ID	1	
1.	Surface description (table 3-1)		Pavement	
2.	Manning's roughness coeff., n (table 3-1)		0.011	
3.	Flow Length, L (total L $\leq$ 150 ft)	ft	150	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	
5.	Land slope, s	ft/ft	0.033	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.022	= 0.022

Shallow concentrated flow

		Segment ID	2	3			
7.	Surface description (paved or unpaved)		Paved	Paved			
8.	Flow length, L	ft	239	143			
9.	Watercourse slope, s	ft/ft	0.033	0.013			
10.	Average velocity, V (figure 3-1)	ft/s	3.6	2.2			
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.018 +	0.018 +	+		= 0.036

Channel flow

			Segment ID			
12.	Cross sectional flow area, a		ft^2			
13.	Wetted perimeter, p_w		ft			
14.	Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft			
15.	Channel slope, s		ft/ft			
16.	Manning's roughness coeff., n					
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s			
18.	Flow length, L		ft			
19.	$T_t = \frac{L}{3600\ V}$	Compute T_t	hr	+	+	= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				hr	0.059

Use Tc = 4

Project	Middlesex Warehouse	By SLK	Date 7/8/2019
Location	Middlesex, NJ	Checked MRW	Date 7/8/2019
Circle One:	Present Developed		
Circle One:	T_c T_t through subarea	Existing Watershed 3 - Pervious	

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit	1	2	3	Total
Segment ID		1	2	3	
1. Surface description (table 3-1)		Grass	Grass	Grass	
2. Manning's roughness coeff., n (table 3-1)		0.150	0.150	0.150	
3. Flow Length, L (total L ≤ 150 ft)	ft	45	40	65	
4. Two-yr 24-hr rainfall, P_2	in	3.35	3.35	3.35	
5. Land slope, s	ft/ft	0.009	0.095	0.015	
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.117 +	0.041 +	0.127 +	= 0.285

Shallow concentrated flow

	Unit	4	5	6	7	Total
Segment ID		4	5	6	7	
7. Surface description (paved or unpaved)		Unpaved	Unpaved	Paved	Paved	
8. Flow length, L	ft	174	119	58	256	
9. Watercourse slope, s	ft/ft	0.015	0.035	0.035	0.013	
10. Average velocity, V (figure 3-1)	ft/s	2	3	3.8	2.2	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.024 +	0.011 +	0.004 +	0.032	= 0.072

Channel flow

	Unit			Total
Segment ID				
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, r $\quad r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	+	+	= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.357

Use Tc = 21

Projec Middlesex Warehouse By SLK Date 3/25/2020

Locati Middlesex, NJ Checked MRW Date 3/25/2020

Circle one: Present Developed Proposed Watershed 1 - Impervious

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] Table 2-2	Figure 2-3	Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt)**	98			0.26	25.29
				Totals =	0.26	25.29

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{25.29}{0.26}$ = 98.00 Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 3/25/2020

Locati Middlesex, NJ | Checked MRW | Date 3/25/2020

Circle one: Present Developed | **Proposed Watershed 1 - Pervious**

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] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area [x] acres [ ] mi² [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**3.07**	**119.87**
B	**Open Space (Good)**	**61**			**0.34**	**20.76**
B/D	**Open Space (Good)**	**80**			**0.09**	**7.01**
				Totals =	**3.50**	**147.64**

1) Use only one CN source per line

CN (weighted) = total product / total area = 147.64 / 3.50 = 42.16 Use CN = **42**

Projec Middlesex Warehouse | By SLK | Date 1/27/2020

Locati Middlesex, NJ | Checked MRW | Date 1/27/2020

Circle one: Present Developed | Proposed Watershed 2A - Impervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt and Buildings)**	**98**			**5.15**	**504.87**
				Totals =	**5.15**	**504.87**

1) Use only one CN source per line

I (weighted) = total product / total area = 504.87 / 5.15 = 98.00 Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 1/27/2020

Locati Middlesex, NJ | Checked MRW | Date 1/27/2020

Circle one: Present (Developed) | **Proposed Watershed 2A - Pervious**

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**1.52**	**59.16**
			Totals =		**1.52**	**59.16**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{59.16}{1.52} = 39.00$ Use CN = **39**

Projec Middlesex Warehouse | By SLK | Date 3/25/2020

Locati Middlesex, NJ | Checked MRW | Date 3/25/2020

Circle one: Present Developed | Proposed Watershed 2B - Impervious

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] Table 2-2	CN[1] Figure 2-3	CN[1] Figure 2-4	Area (x) acres ( ) mi^2 ( ) %	Product of CN x area
A	**Impervious (Asphalt)**	**98**			**0.53**	**51.85**
				Totals =	**0.53**	**51.85**

1) Use only one CN source per line

CN (weighted) = total product / total area = 51.85 / 0.53 = 98.00 Use CN = **98**

Projec Middlesex Warehouse By SLK Date 3/25/2020

Locati Middlesex, NJ Checked MRW Date 3/25/2020

Circle one: Present Developed — Proposed Watershed 2B - Pervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	39			0.28	11.09
				Totals =	0.28	11.09

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{11.09}{0.28}$ = 39.00 Use CN = **39**

Projec Middlesex Warehouse | By SLK | Date 3/24/2020

Locati Middlesex, NJ | Checked MRW | Date 3/24/2020

Circle one: Present Developed | Proposed Watershed 2C - Impervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt)**	**98**			**5.34**	**523.07**
B	**Impervious (Asphalt)**	**98**			**1.16**	**113.76**
				Totals =	**6.50**	**636.83**

1) Use only one CN source per line

I (weighted) = total product / total area = 636.83 / 6.50 = 98.00 Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 3/24/2020

Locati Middlesex, NJ | Checked MRW | Date 3/24/2020

Circle one: Present Developed | Proposed Watershed 2C - Pervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**2.88**	**112.34**
B	**Open Space (Good)**	**61**			**1.24**	**75.81**
				Totals =	**4.12**	**188.15**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{188.15}{4.12}$ = 45.63 Use CN = **46**

Projec Middlesex Warehouse By SLK Date 1/27/2020

Locati Middlesex, NJ Checked MRW Date 1/27/2020

Circle one: Present Developed Proposed Watershed 2D - Impervious

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	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4	x acres / mi² / %	
A	**Impervious (Asphalt and Buildings)**	**98**			**6.28**	**615.25**
				Totals =	**6.28**	**615.25**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{615.25}{6.28} = 98.00$$

Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 1/27/2020

Locati Middlesex, NJ | Checked MRW | Date 1/27/2020

Circle one: Present Developed | **Proposed Watershed 2D - Pervious**

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**1.17**	**45.52**
			Totals =		**1.17**	**45.52**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{45.52}{1.17}$ = 39.00 Use CN = **39**

Projec Middlesex Warehouse | By SLK | Date 3/25/2020

Locati Middlesex, NJ | Checked MRW | Date 3/25/2020

Circle one: Present Developed | Proposed Watershed 2E - Impervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Impervious (Asphalt)**	**98**			**0.03**	**3.06**
				Totals =	**0.03**	**3.06**

1) Use only one CN source per line

I (weighted) = total product / total area = 3.06 / 0.03 = 98.00 Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 3/25/2020

Locati Middlesex, NJ | Checked MRW | Date 3/25/2020

Circle one: Present Developed | Proposed Watershed 2E - Pervious

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] Table 2-2	Figure 2-3	Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**0.41**	**15.94**
				Totals =	**0.41**	**15.94**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{15.94}{0.41} = 39.00$$

Use CN = **39**

Projec Middlesex Warehouse | By SLK | Date 3/24/2020

Locati Middlesex, NJ | Checked MRW | Date 3/24/2020

Circle one: Present Developed | Proposed Watershed 3 - Impervious

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi² [ ] %	Product of CN x area
A	**Impervious (Asphalt)**	**98**			**0.31**	**29.92**
				Totals =	**0.31**	**29.92**

1) Use only one CN source per line

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{29.92}{0.31}$ = 98.00 Use CN = **98**

Projec Middlesex Warehouse | By SLK | Date 3/24/2020

Locati Middlesex, NJ | Checked MRW | Date 3/24/2020

Circle one: Present Developed | **Proposed Watershed 3 - Pervious**

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] Table 2-2	CN [1] Figure 2-3	CN [1] Figure 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
A	**Open Space (Good)**	**39**			**2.51**	**97.97**
				Totals =	**2.51**	**97.97**

1) Use only one CN source per line

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{97.97}{2.51} = 39.00$$

Use CN = **39**

Project	Middlesex Warehouse	By	SLK	Date 7/8/2019
Location	Middlesex, NJ	Checked	MRW	Date 7/8/2019

Circle One: Present Developed

Circle One: T_c T_t through subarea **Proposed Watershed 1 - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment ID	1	
1.	Surface description (table 3-1)		Pavement	
2.	Manning's roughness coeff., n (table 3-1)		0.011	
3.	Flow Length, L (total L ≤ 150 ft)	ft	54	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	
5.	Land slope, s	ft/ft	0.015	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.014	= 0.014

Shallow concentrated flow

		Segment ID	2	3	4		
7.	Surface description (paved or unpaved)		Paved	Paved	Paved		
8.	Flow length, L	ft	96	934	519		
9.	Watercourse slope, s	ft/ft	0.015	0.007	0.017		
10.	Average velocity, V (figure 3-1)	ft/s	2.4	1.8	2.6		
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.011 +	0.144 +	0.055		= 0.211

Channel flow

		Segment ID		
12.	Cross sectional flow area, a	ft^2		
13.	Wetted perimeter, p_w	ft		
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft		
15.	Channel slope, s	ft/ft		
16.	Manning's roughness coeff., n			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		
18.	Flow length, L	ft		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr		= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr		0.224

Use Tc = 13

Project	Middlesex Warehouse	By	SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked	MRW	Date 1/27/2020
Circle One:	Present Developed			
Circle One:	T_c T_t through subarea		Proposed Watershed 1 - Pervious	

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit			
	Segment ID		1		
1.	Surface description (table 3-1)		Grass		
2.	Manning's roughness coeff., n (table 3-1)		0.150		
3.	Flow Length, L (total L $\leq$ 150 ft)	ft	150		
4.	Two-yr 24-hr rainfall, P_2	in	3.35		
5.	Land slope, s	ft/ft	0.01		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.318		= 0.318

Shallow concentrated flow

		Unit					
	Segment ID		2	3	4	5	
7.	Surface description (paved or unpaved)		Unpaved	Paved	Paved	Paved	
8.	Flow length, L	ft	354	85	934	519	
9.	Watercourse slope, s	ft/ft	0.01	0.015	0.007	0.02	
10.	Average velocity, V (figure 3-1)	ft/s	1.6	2.4	1.8	2.8	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.061 +	0.010 +	0.144 +	0.051	= 0.267

Channel flow

		Unit		
	Segment ID			
12.	Cross sectional flow area, a	ft^2		
13.	Wetted perimeter, p_w	ft		
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft		
15.	Channel slope, s	ft/ft		
16.	Manning's roughness coeff., n			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		
18.	Flow length, L	ft		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr		= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr		0.585

Use Tc = 35

Project **Middlesex Warehouse** By **SLK** # Date **1/27/2020**

Location **Middlesex, NJ** Checked **MRW** Date **1/27/2020**

Circle One: Present Developed

Circle One: T_c T_t through subarea **Proposed Watershed 2A - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	1	
1. Surface description (table 3-1)			Roof	
2. Manning's roughness coeff., n (table 3-1)			0.011	
3. Flow Length, L (total L ≤ 150 ft)		ft	47.5	
4. Two-yr 24-hr rainfall, P_2		in	3.35	
5. Land slope, s		ft/ft	0.020	
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.011	= 0.011

Shallow concentrated flow		Segment ID	2								
7. Surface description (paved or unpaved)			Roof								
8. Flow length, L		ft	210								
9. Watercourse slope, s		ft/ft	0.02								
10. Average velocity, V (figure 3-1)		ft/s	2.8								
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.021								= 0.021

Channel flow		Segment ID	3 (15")	4 (18")	5 (24")	6 (30")	7 (42")	8 (48")		
12. Cross sectional flow area, a		ft^2	1.23	1.77	3.14	4.91	9.62	12.57		
13. Wetted perimeter, p_w		ft	3.93	4.71	6.28	7.85	11.00	12.57		
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.31	0.38	0.50	0.63	0.88	1.00		
15. Channel slope, s		ft/ft	0.0096	0.0096	0.0096	0.0096	0.0096	0.0096		
16. Manning's roughness coeff., n			0.013	0.013	0.013	0.013	0.013	0.013		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.17	5.84	7.07	8.21	10.27	11.23		
18. Flow length, L		ft	148	108	324	244	161	121		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.008 +	0.005 +	0.013 +	0.008 +	0.004 +	0.003		= 0.041

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) hr **0.073**

Use Tc = 4

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020
Circle One:	Present Developed		
Circle One:	T_c T_t through subarea	Proposed Watershed 2A - Pervious	

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit	Segment ID 1			Total
1. Surface description (table 3-1)			Grass			
2. Manning's roughness coeff., n (table 3-1)			0.150			
3. Flow Length, L (total L $\leq$ 150 ft)		ft	43			
4. Two-yr 24-hr rainfall, P_2		in	3.35			
5. Land slope, s		ft/ft	0.040			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$	Compute T_t	hr	0.062		=	0.062

Shallow concentrated flow

		Unit	Segment ID 2			Total
7. Surface description (paved or unpaved)			Paved			
8. Flow length, L		ft	112			
9. Watercourse slope, s		ft/ft	0.035			
10. Average velocity, V (figure 3-1)		ft/s	3.8			
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.008		=	0.008

Channel flow

		Unit	Segment ID 3 (18")	4 (48")		Total
12. Cross sectional flow area, a		ft^2	1.77	12.57		
13. Wetted perimeter, p_w		ft	4.71	12.57		
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.38	1.00		
15. Channel slope, s		ft/ft	0.019	0.0092		
16. Manning's roughness coeff., n			0.013	0.013		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	8.22	10.99		
18. Flow length, L		ft	65	46		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.002 +	0.001	=	0.003
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)					hr	0.073

Use Tc = 4

Project	Middlesex Warehouse	By	SLK	Date	3/25/2020
Location	Middlesex, NJ	Checked	MRW	Date	3/25/2020
Circle One:	Present Developed				
Circle One:	T_c T_t	through subarea	Proposed Watershed 2B - Impervious		

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Unit				
Segment ID		1	2	3	
1. Surface description (table 3-1)		Pavement	Grass	Pavement	
2. Manning's roughness coeff., n (table 3-1)		0.011	0.150	0.011	
3. Flow Length, L (total L ≤ 150 ft)	ft	5	55	90	
4. Two-yr 24-hr rainfall, P_2	in	3.35	3.35	3.35	
5. Land slope, s	ft/ft	0.040	0.016	0.040	
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$ Compute T_t	hr	0.001 +	0.108 +	0.014	= 0.123

Shallow concentrated flow

	Unit					
Segment ID		4				
7. Surface description (paved or unpaved)		Paved				
8. Flow length, L	ft	25				
9. Watercourse slope, s	ft/ft	0.016				
10. Average velocity, V (figure 3-1)	ft/s	2.8				
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.003				= 0.003

Channel flow

	Unit			
Segment ID		5 (18")		
12. Cross sectional flow area, a	ft^2	1.77		
13. Wetted perimeter, p_w	ft	4.71		
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.38		
15. Channel slope, s	ft/ft	0.01		
16. Manning's roughness coeff., n		0.013		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.96		
18. Flow length, L	ft	38		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.002		= 0.002

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19) hr **0.128**

Use Tc = 8

Project Middlesex Warehouse By SLK Date 3/25/2020

Location Middlesex, NJ Checked MRW Date 3/25/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea Proposed Watershed 2B - Pervious

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment ID	1	2		
1.	Surface description (table 3-1)		Grass	Pavement		
2.	Manning's roughness coeff., n (table 3-1)		0.150	0.011		
3.	Flow Length, L (total L ≤ 150 ft)	ft	92	58		
4.	Two-yr 24-hr rainfall, P_2	in	3.35	3.35		
5.	Land slope, s	ft/ft	0.040	0.016		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.113 +	0.014	=	0.127

Shallow concentrated flow

		Segment ID	3					
7.	Surface description (paved or unpaved)		Paved					
8.	Flow length, L	ft	55					
9.	Watercourse slope, s	ft/ft	0.016					
10.	Average velocity, V (figure 3-1)	ft/s	2.6					
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.007				=	0.007

Channel flow

		Segment ID	4 (18")			
12.	Cross sectional flow area, a	ft^2	1.77			
13.	Wetted perimeter, p_w	ft	4.71			
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.38			
15.	Channel slope, s	ft/ft	0.01			
16.	Manning's roughness coeff., n		0.013			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.96			
18.	Flow length, L	ft	38			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.002		=	0.002
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)				hr	0.136

Use Tc = 8

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020

Circle One: Present **Developed**

Circle One: $\boxed{T_c}$ T_t through subarea **Proposed Watershed 2C - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Units			
	Segment ID		1		
1.	Surface description (table 3-1)		Pavement		
2.	Manning's roughness coeff., n (table 3-1)		0.011		
3.	Flow Length, L (total L ≤ 150 ft)	ft	60		
4.	Two-yr 24-hr rainfall, P_2	in	3.35		
5.	Land slope, s	ft/ft	0.022		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.013	=	0.013

Shallow concentrated flow

		Units						
	Segment ID		2					
7.	Surface description (paved or unpaved)		Paved					
8.	Flow length, L	ft	215					
9.	Watercourse slope, s	ft/ft	0.014					
10.	Average velocity, V (figure 3-1)	ft/s	2.4					
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.025				=	0.025

Channel flow

		Units						
	Segment ID		3 (15")	4 (18")	5 (30")	6 (36")		
12.	Cross sectional flow area, a	ft^2	1.23	1.77	4.91	7.07		
13.	Wetted perimeter, p_w	ft	3.93	4.71	7.85	9.42		
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft	0.31	0.38	0.63	0.75		
15.	Channel slope, s	ft/ft	0.01	0.01	0.005	0.005		
16.	Manning's roughness coeff., n		0.013	0.013	0.013	0.013		
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.28	5.96	5.92	6.69		
18.	Flow length, L	ft	182	183	549	28		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.010 +	0.009 +	0.026 +	0.001	=	0.045
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr						0.083

Use Tc = 5

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020

Circle One: Present **Developed**

Circle One: T_c T_t through subarea **Proposed Watershed 2C - Pervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit			
	Segment ID		1		
1. Surface description (table 3-1)			Grass		
2. Manning's roughness coeff., n (table 3-1)			0.150		
3. Flow Length, L (total L ≤ 150 ft)		ft	150		
4. Two-yr 24-hr rainfall, P_2		in	3.35		
5. Land slope, s		ft/ft	0.010		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$	Compute T_t	hr	0.291		= 0.291

Shallow concentrated flow

		Unit					
	Segment ID		2	3			
7. Surface description (paved or unpaved)			Unpaved	Paved			
8. Flow length, L		ft	137	100			
9. Watercourse slope, s		ft/ft	0.010	0.010			
10. Average velocity, V (figure 3-1)		ft/s	1.6	2			
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.024 +	0.014			= 0.038

Channel flow

		Unit					
	Segment ID		4 (15")	5 (30")	6 (36")		
12. Cross sectional flow area, a		ft^2	1.23	4.91	7.07		
13. Wetted perimeter, p_w		ft	3.93	7.85	9.42		
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.31	0.63	0.75		
15. Channel slope, s		ft/ft	0.01	0.005	0.005		
16. Manning's roughness coeff., n			0.013	0.013	0.013		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.28	5.92	6.69		
18. Flow length, L		ft	172	549	28		
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.009 +	0.026 +	0.001		= 0.035
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)		hr					0.364

Use Tc = 22

Project Middlesex Warehouse By SLK # Date 1/27/2020

Location Middlesex, NJ Checked MRW Date 1/27/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea Proposed Watershed 2D - Impervious

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)	Segment ID		1								
1. Surface description (table 3-1)			Roof								
2. Manning's roughness coeff., n (table 3-1)			0.011								
3. Flow Length, L (total L $\leq$ 150 ft)		ft	47.5								
4. Two-yr 24-hr rainfall, P_2		in	3.35								
5. Land slope, s		ft/ft	0.020								
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$	Compute T_t	hr	0.011							=	0.011
Shallow concentrated flow	Segment ID		2								
7. Surface description (paved or unpaved)			Roof								
8. Flow length, L		ft	190								
9. Watercourse slope, s		ft/ft	0.02								
10. Average velocity, V (figure 3-1)		ft/s	2.8								
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.019							=	0.019
Channel flow	Segment ID		3 (12")	4 (18")	5 (24")	6 (30")	7 (36")				
12. Cross sectional flow area, a		ft^2	0.79	1.77	3.14	4.91	7.07				
13. Wetted perimeter, p_w		ft	3.14	4.71	6.28	7.85	9.42				
14. Hydraulic radius, r $r = \frac{a}{p_w}$	Compute r	ft	0.25	0.38	0.50	0.63	0.75				
15. Channel slope, s		ft/ft	0.0123	0.0123	0.0123	0.0123	0.0125				
16. Manning's roughness coeff., n			0.013	0.013	0.013	0.013	0.013				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	5.04	6.61	8.01	9.29	10.58				
18. Flow length, L		ft	50	194	432	372	82				
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.003 +	0.008 +	0.015 +	0.011 +	0.002			=	0.039
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)										hr	0.069

Use Tc = 4

Project **Middlesex Warehouse** By **SLK** Date **1/27/2020**

Location **Middlesex, NJ** Checked **MRW** Date **1/27/2020**

Circle One: Present Developed

Circle One: T_c T_t through subarea **Proposed Watershed 2D - Pervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)		Segment ID	1	2	
1. Surface description (table 3-1)			Grass	Pavement	
2. Manning's roughness coeff., n (table 3-1)			0.150	0.011	
3. Flow Length, L (total L ≤ 150 ft)		ft	15	48	
4. Two-yr 24-hr rainfall, P_2		in	3.35	3.35	
5. Land slope, s		ft/ft	0.010	0.010	
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$	Compute T_t	hr	0.046 +	0.014 +	= 0.061

Shallow concentrated flow		Segment ID	3					
7. Surface description (paved or unpaved)			Paved					
8. Flow length, L		ft	44					
9. Watercourse slope, s		ft/ft	0.010					
10. Average velocity, V (figure 3-1)		ft/s	2					
11. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.006 +					= 0.006

Channel flow		Segment ID	4 (12")	5 (18")	6 (24")	7 (30")	8 (36")	
12. Cross sectional flow area, a		ft^2	0.79	1.77	3.14	4.91	7.07	
13. Wetted perimeter, p_w		ft	3.14	4.71	6.28	7.85	9.42	
14. Hydraulic radius, r	$r = \frac{a}{p_w}$ Compute r	ft	0.25	0.38	0.50	0.63	0.75	
15. Channel slope, s		ft/ft	0.01	0.0123	0.0123	0.0123	0.0125	
16. Manning's roughness coeff., n			0.013	0.013	0.013	0.013	0.013	
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V	ft/s	4.55	6.61	8.01	9.29	10.58	
18. Flow length, L		ft	25	194	432	372	82	
19. $T_t = \frac{L}{3600\ V}$	Compute T_t	hr	0.002 +	0.008 +	0.015 +	0.011 +	0.002	= 0.038
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)								hr 0.105

Use Tc = 6

Project	Middlesex Warehouse	By	SLK	Date	1/27/2020
Location	Middlesex, NJ	Checked	MRW	Date	1/27/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea **Proposed Watershed 2E - Impervious**

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

	Segment ID		1	2	
1.	Surface description (table 3-1)		Pavement	Grass	
2.	Manning's roughness coeff., n (table 3-1)		0.011	0.150	
3.	Flow Length, L (total L $\leq$ 150 ft)	ft	5	5	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	3.35	
5.	Land slope, s	ft/ft	0.015	0.015	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.002 +	0.016	= 0.018

Shallow concentrated flow

	Segment ID		3				
7.	Surface description (paved or unpaved)		Paved				
8.	Flow length, L	ft	63				
9.	Watercourse slope, s	ft/ft	0.005				
10.	Average velocity, V (figure 3-1)	ft/s	1.8				
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.010 +	+	+		= 0.010

Channel flow

	Segment ID				
12.	Cross sectional flow area, a	ft^2			
13.	Wetted perimeter, p_w	ft			
14.	Hydraulic radius, r $\quad r = \frac{a}{p_w}$ Compute r	ft			
15.	Channel slope, s	ft/ft			
16.	Manning's roughness coeff., n				
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s			
18.	Flow length, L	ft			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	+	+	= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.028

Use Tc = 2

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea Proposed Watershed 2E - Pervious

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

Segment ID		1			
1. Surface description (table 3-1)		Grass			
2. Manning's roughness coeff., n (table 3-1)		0.150			
3. Flow Length, L (total L ≤ 150 ft)	ft	127			
4. Two-yr 24-hr rainfall, P_2	in	3.35			
5. Land slope, s	ft/ft	0.025			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.177			= 0.177

Shallow concentrated flow

Segment ID		2	3			
7. Surface description (paved or unpaved)		Unpaved	Paved			
8. Flow length, L	ft	54	25			
9. Watercourse slope, s	ft/ft	0.050	0.028			
10. Average velocity, V (figure 3-1)	ft/s	3.6	3.4			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.004 +	0.002			= 0.006

Channel flow

Segment ID				
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	+	+	= 0.000
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.183

Use Tc = 11

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020
Circle One:	Present Developed		
Circle One:	T_c T_t through subarea	Proposed Watershed 3 - Impervious	

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Unit	Segment ID 1	Total
1.	Surface description (table 3-1)		Pavement	
2.	Manning's roughness coeff., n (table 3-1)		0.011	
3.	Flow Length, L (total L ≤ 150 ft)	ft	150	
4.	Two-yr 24-hr rainfall, P_2	in	3.35	
5.	Land slope, s	ft/ft	0.036	
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.022	= 0.022

Shallow concentrated flow

		Unit	Segment ID 2	3			Total
7.	Surface description (paved or unpaved)		Paved	Paved			
8.	Flow length, L	ft	131	248			
9.	Watercourse slope, s	ft/ft	0.025	0.014			
10.	Average velocity, V (figure 3-1)	ft/s	3.2	2.4			
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.011 +	0.029 +	+		= 0.040

Channel flow

		Unit	Segment ID		Total
12.	Cross sectional flow area, a	ft^2			
13.	Wetted perimeter, p_w	ft			
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft			
15.	Channel slope, s	ft/ft			
16.	Manning's roughness coeff., n				
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s			
18.	Flow length, L	ft			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	+	+	= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.062

Use Tc = 4

Project	Middlesex Warehouse	By SLK	Date 1/27/2020
Location	Middlesex, NJ	Checked MRW	Date 1/27/2020

Circle One: Present Developed

Circle One: T_c T_t through subarea Proposed Watershed 3 - Pervious

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c Only)

		Segment ID	1			
1.	Surface description (table 3-1)		Grass			
2.	Manning's roughness coeff., n (table 3-1)		0.150			
3.	Flow Length, L (total L ≤ 150 ft)	ft	150			
4.	Two-yr 24-hr rainfall, P_2	in	3.35			
5.	Land slope, s	ft/ft	0.010			
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.291			= 0.291

Shallow concentrated flow

		Segment ID	2	3	4	5	6	
7.	Surface description (paved or unpaved)		Unpaved	Unpaved	Unpaved	Unpaved	Paved	
8.	Flow length, L	ft	57	74	129	63	70	
9.	Watercourse slope, s	ft/ft	0.026	0.030	0.045	0.008	0.029	
10.	Average velocity, V (figure 3-1)	ft/s	2.6	2.8	3.4	1.6	3.4	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.006 +	0.007 +	0.011 +	0.011 +	0.006	= 0.041

Channel flow

		Segment ID			
12.	Cross sectional flow area, a	ft^2			
13.	Wetted perimeter, p_w	ft			
14.	Hydraulic radius, r $r = \frac{a}{p_w}$ Compute r	ft			
15.	Channel slope, s	ft/ft			
16.	Manning's roughness coeff., n				
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s			
18.	Flow length, L	ft			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t	hr	+	+	= 0.000
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, 19)	hr			0.332

Use Tc = 20

Hydraflow Table of Contents

25 - Year

Contents continued...

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	------	-------	6.497	-------	-------	10.27	12.89	-------	17.65	Ex 1 - Imp
2	SCS Runoff	------	-------	0.013	-------	-------	0.383	1.634	-------	6.592	Ex 1 - Pervious
3	Combine	1, 2	-------	6.497	-------	-------	10.30	13.86	-------	23.61	Ex 1
5	SCS Runoff	------	-------	28.36	-------	-------	43.63	54.30	-------	73.80	Ex 2 - Imp
6	SCS Runoff	------	-------	0.008	-------	-------	0.225	1.025	-------	4.331	Ex 2 - Pervious
7	Combine	5, 6	-------	28.36	-------	-------	43.63	54.54	-------	76.31	Ex 2
9	SCS Runoff	------	-------	6.724	-------	-------	10.34	12.87	-------	17.49	Ex 3 - Imp
10	SCS Runoff	------	-------	0.005	-------	-------	0.181	0.845	-------	3.860	Ex 3 - Pervious
11	Combine	9, 10	-------	6.724	-------	-------	10.34	12.96	-------	19.11	Ex 3
14	SCS Runoff	------	-------	0.662	-------	-------	1.018	1.267	-------	1.722	Pr 1 - Imp
15	SCS Runoff	------	-------	0.011	-------	-------	0.269	0.902	-------	2.978	Pr 1 - Pervious
16	Combine	14, 15	-------	0.662	-------	-------	1.030	1.486	-------	3.504	Pr 1
18	SCS Runoff	------	-------	16.81	-------	-------	25.85	32.17	-------	43.72	Pr 2A - Imp
19	SCS Runoff	------	-------	0.002	-------	-------	0.060	0.369	-------	2.090	Pr 2A - Pervious
20	Combine	18, 19	-------	16.81	-------	-------	25.85	32.44	-------	45.75	Pr 2A
22	SCS Runoff	------	-------	1.556	-------	-------	2.394	2.979	-------	4.049	Pr 2B - Imp
23	SCS Runoff	------	-------	0.000	-------	-------	0.010	0.062	-------	0.342	Pr 2B - Pervious
24	Combine	22, 23	-------	1.556	-------	-------	2.394	3.019	-------	4.376	Pr 2B
25	Reservoir	24	-------	1.473	-------	-------	2.329	2.952	-------	4.278	Bioretention Basin 1
27	SCS Runoff	------	-------	21.22	-------	-------	32.63	40.60	-------	55.18	Pr 2C - Imp
28	SCS Runoff	------	-------	0.037	-------	-------	0.797	2.218	-------	5.929	Pr 2C - Pervious
29	Combine	27, 28	-------	21.22	-------	-------	32.76	41.42	-------	58.39	Pr 2C
30	Reservoir	29	-------	13.99	-------	-------	23.20	30.13	-------	44.31	Bioretention Basin 2
32	Combine	20, 25, 30,	-------	30.44	-------	-------	48.82	62.38	-------	90.01	Pr 2A, Bio Basin 1, Bio Basin 2
34	Reservoir	32	-------	11.11	-------	-------	17.52	24.04	-------	35.77	Detention Basin 1
36	SCS Runoff	------	-------	20.50	-------	-------	31.52	39.23	-------	53.31	Pr 2D - Imp
37	SCS Runoff	------	-------	0.001	-------	-------	0.046	0.284	-------	1.609	Pr 2D - Pervious
38	Combine	36, 37	-------	20.50	-------	-------	31.52	39.44	-------	54.88	Pr 2D
40	Reservoir	38	-------	2.679	-------	-------	4.587	6.117	-------	9.185	Detention Basin 2

Proj. file: Middlesex Analysis.gpw	Wednesday, 03 / 25 / 2020

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	
42	SCS Runoff	------	-------	0.098	-------	-------	0.151	0.187	-------	0.255	Pr 2E - Imp
43	SCS Runoff	------	-------	0.000	-------	-------	0.016	0.086	-------	0.446	Pr 2E - Pervious
44	Combine	42, 43	-------	0.098	-------	-------	0.151	0.219	-------	0.639	Pr 2E
46	Combine	34, 40, 44,	-------	13.79	-------	-------	22.07	30.15	-------	45.09	Combined 2 Watersheds
48	SCS Runoff	------	-------	1.012	-------	-------	1.556	1.936	-------	2.632	Pr 3 - Imp
49	SCS Runoff	------	-------	0.003	-------	-------	0.094	0.449	-------	2.100	Pr 3 - Pervious
50	Combine	48, 49	-------	1.012	-------	-------	1.556	1.993	-------	3.670	Pr 3

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	6.497	1	736	33,049	------	------	------	Ex 1 - Imp
2	SCS Runoff	0.013	1	1440	229	------	------	------	Ex 1 - Pervious
3	Combine	6.497	1	736	33,278	1, 2	------	------	Ex 1
5	SCS Runoff	28.36	1	728	112,919	------	------	------	Ex 2 - Imp
6	SCS Runoff	0.008	1	1437	134	------	------	------	Ex 2 - Pervious
7	Combine	28.36	1	728	113,053	5, 6	------	------	Ex 2
9	SCS Runoff	6.724	1	727	24,036	------	------	------	Ex 3 - Imp
10	SCS Runoff	0.005	1	1440	54	------	------	------	Ex 3 - Pervious
11	Combine	6.724	1	727	24,091	9, 10	------	------	Ex 3
14	SCS Runoff	0.662	1	730	2,896	------	------	------	Pr 1 - Imp
15	SCS Runoff	0.011	1	1350	305	------	------	------	Pr 1 - Pervious
16	Combine	0.662	1	730	3,201	14, 15	------	------	Pr 1
18	SCS Runoff	16.81	1	727	60,091	------	------	------	Pr 2A - Imp
19	SCS Runoff	0.002	1	1436	18	------	------	------	Pr 2A - Pervious
20	Combine	16.81	1	727	60,109	18, 19	------	------	Pr 2A
22	SCS Runoff	1.556	1	727	5,847	------	------	------	Pr 2B - Imp
23	SCS Runoff	0.000	1	1436	3	------	------	------	Pr 2B - Pervious
24	Combine	1.556	1	727	5,850	22, 23	------	------	Pr 2B
25	Reservoir	1.473	1	729	4,375	24	37.78	1,899	Bioretention Basin 1
27	SCS Runoff	21.22	1	727	75,843	------	------	------	Pr 2C - Imp
28	SCS Runoff	0.037	1	871	1,168	------	------	------	Pr 2C - Pervious
29	Combine	21.22	1	727	77,011	27, 28	------	------	Pr 2C
30	Reservoir	13.99	1	731	57,339	29	37.91	30,492	Bioretention Basin 2
32	Combine	30.44	1	728	121,823	20, 25, 30,	------	------	Pr 2A, Bio Basin 1, Bio Basin 2
34	Reservoir	11.11	1	748	121,822	32	31.99	25,867	Detention Basin 1
36	SCS Runoff	20.50	1	727	73,276	------	------	------	Pr 2D - Imp
37	SCS Runoff	0.001	1	1436	14	------	------	------	Pr 2D - Pervious
38	Combine	20.50	1	727	73,289	36, 37	------	------	Pr 2D
40	Reservoir	2.679	1	764	70,903	38	30.70	28,008	Detention Basin 2

Middlesex Analysis.gpw	Return Period: 2 Year	Wednesday, 03 / 25 / 2020

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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
42	SCS Runoff	0.098	1	727	350	------	------	------	Pr 2E - Imp
43	SCS Runoff	0.000	1	1440	5	------	------	------	Pr 2E - Pervious
44	Combine	0.098	1	727	355	42, 43	------	------	Pr 2E
46	Combine	13.79	1	749	193,080	34, 40, 44,	------	------	Combined 2 Watersheds
48	SCS Runoff	1.012	1	727	3,617	------	------	------	Pr 3 - Imp
49	SCS Runoff	0.003	1	1440	28	------	------	------	Pr 3 - Pervious
50	Combine	1.012	1	727	3,645	48, 49	------	------	Pr 3

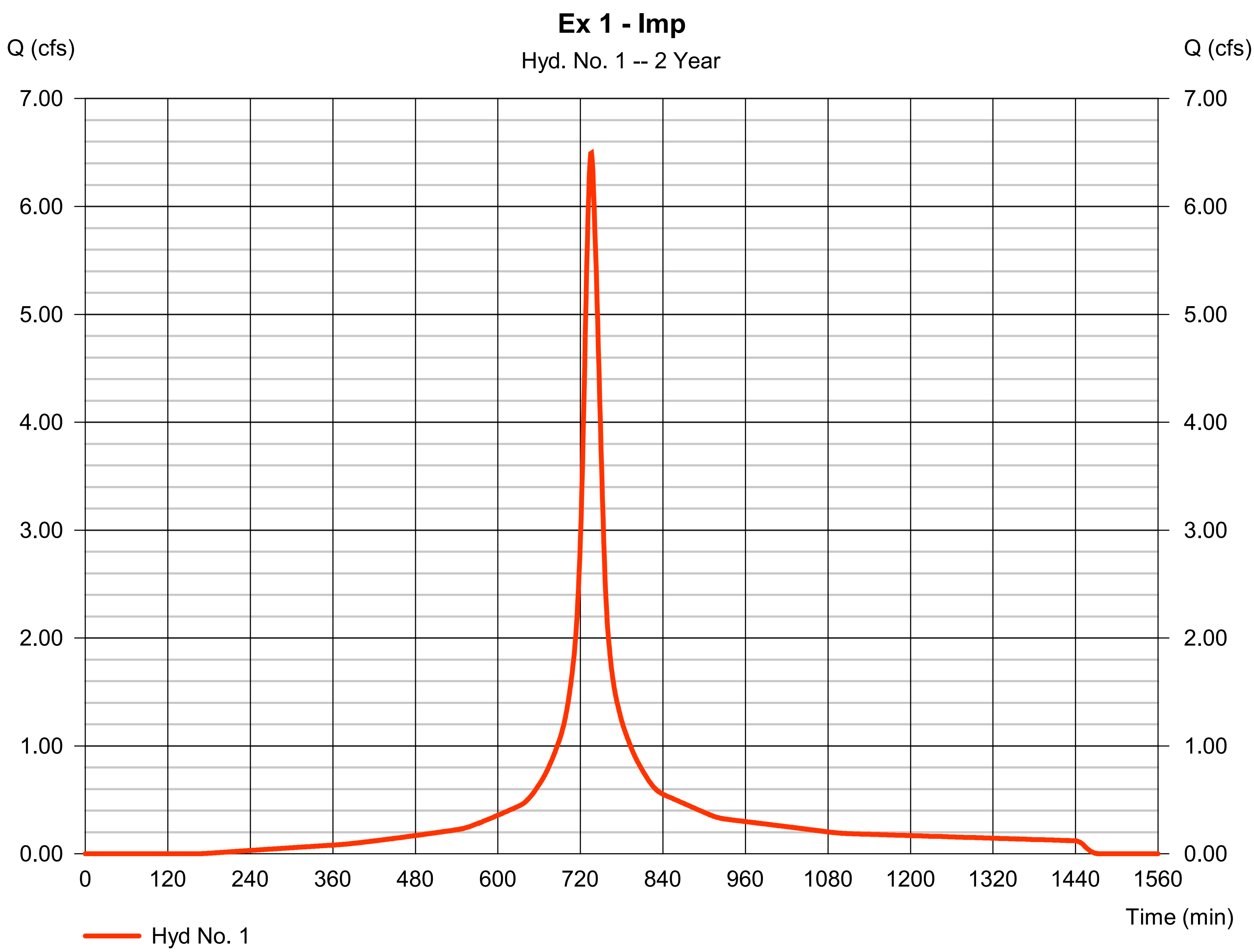
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 1

Ex 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 6.497 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 33,049 cuft
Drainage area	= 3.230 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



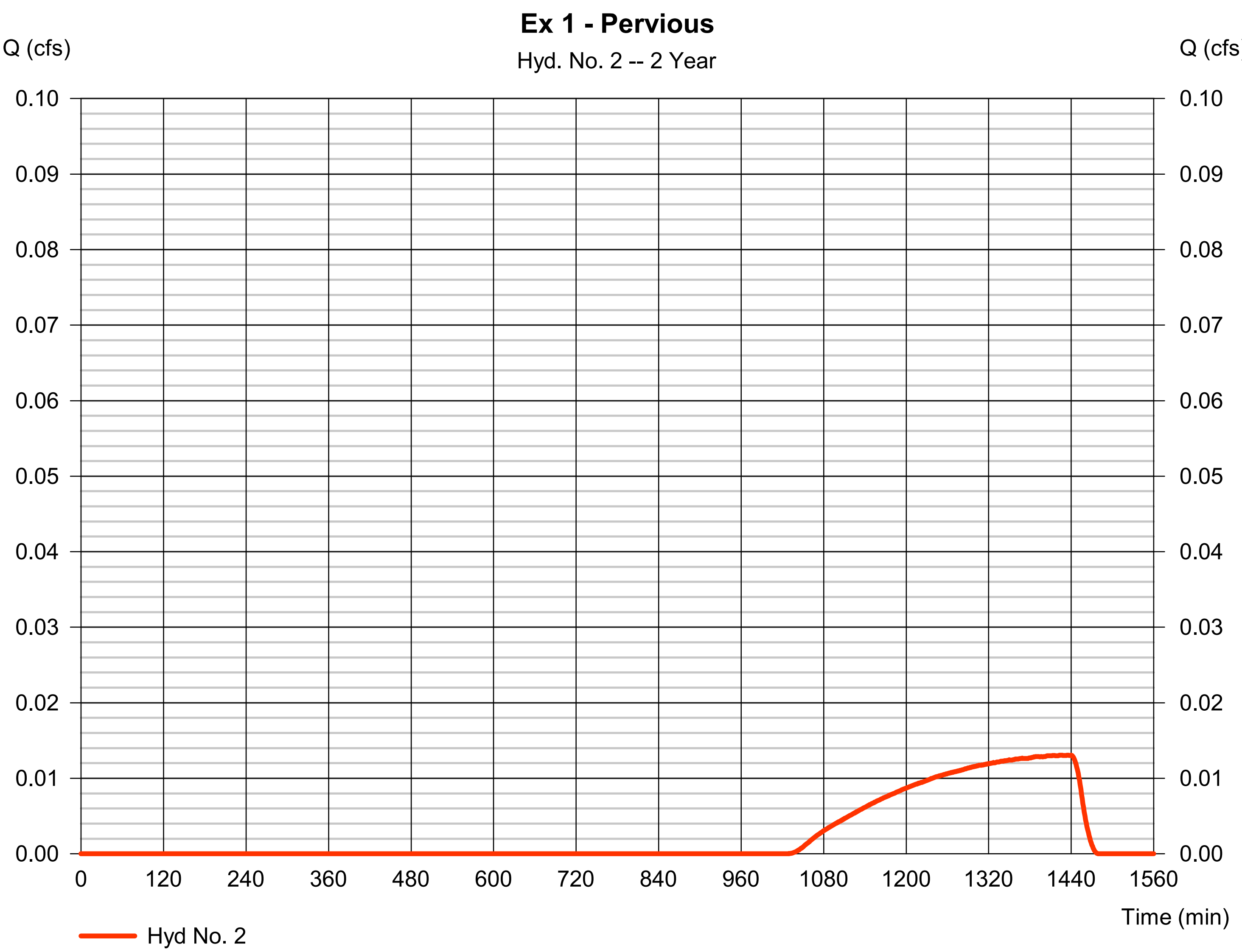
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 2

Ex 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.013 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 229 cuft
Drainage area	= 7.890 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



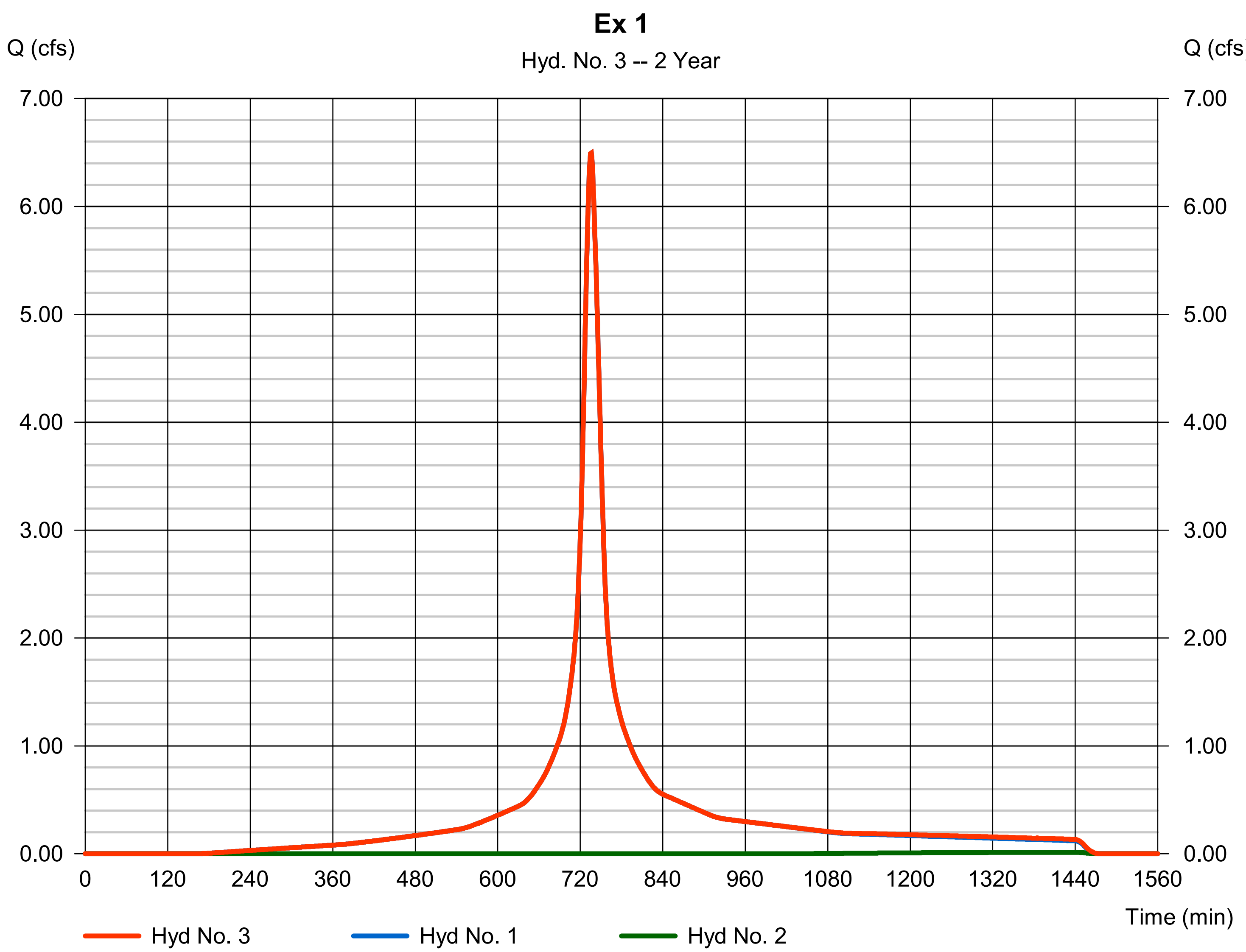
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 3

Ex 1

Hydrograph type	= Combine	Peak discharge	= 6.497 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 33,278 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 11.120 ac



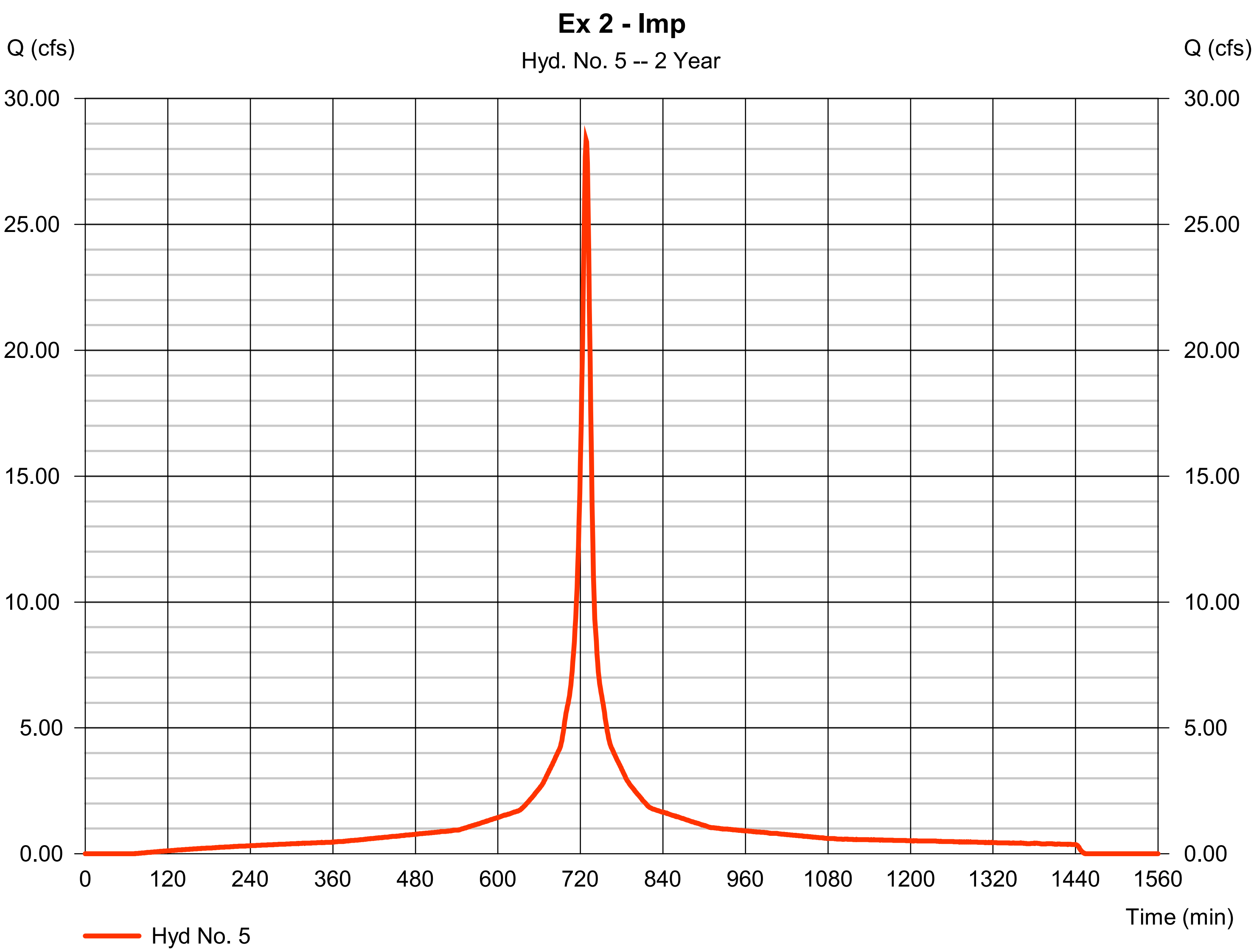
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 5

Ex 2 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 28.36 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 112,919 cuft
Drainage area	= 9.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



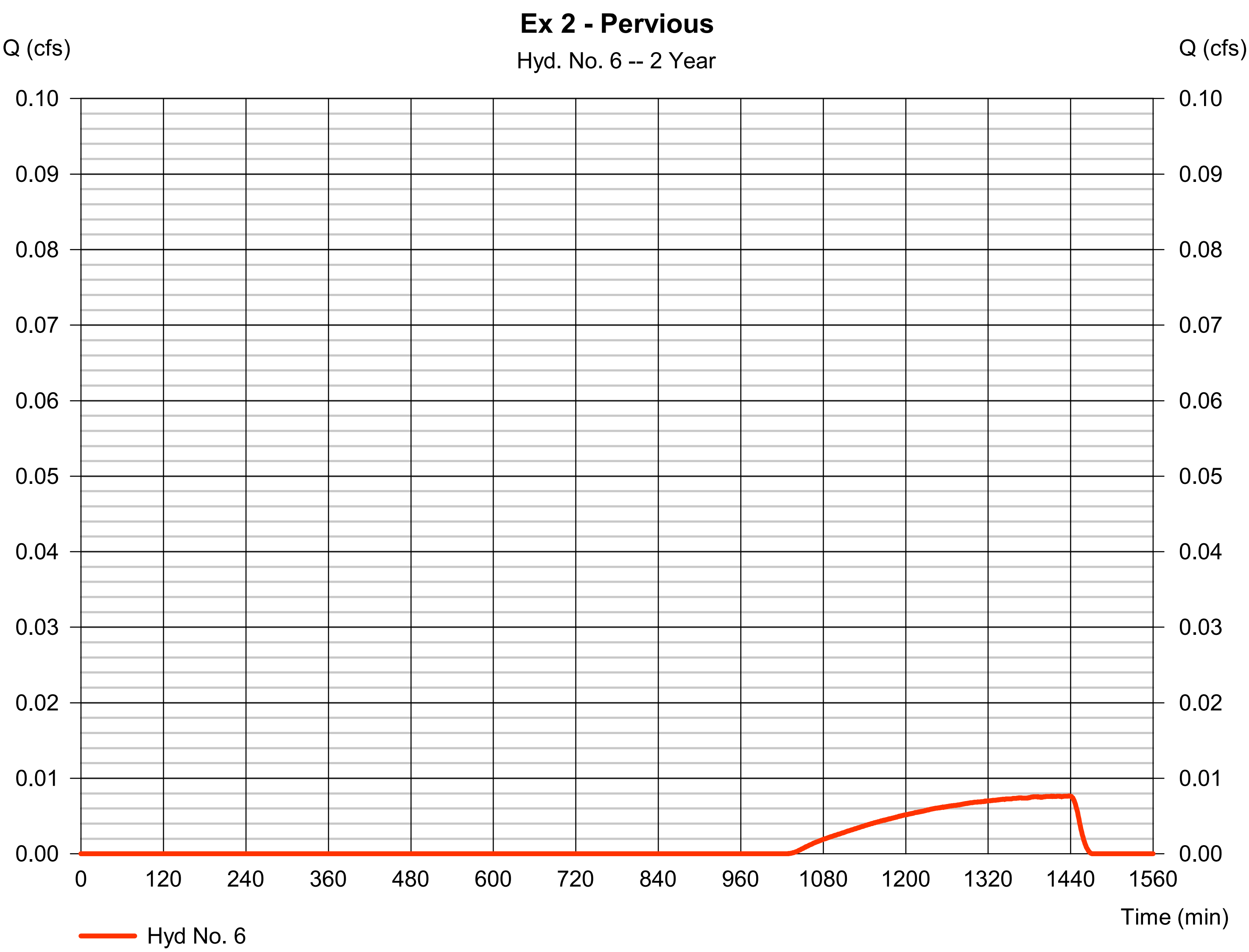
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 6

Ex 2 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.008 cfs
Storm frequency	= 2 yrs	Time to peak	= 1437 min
Time interval	= 1 min	Hyd. volume	= 134 cuft
Drainage area	= 4.610 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 19.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



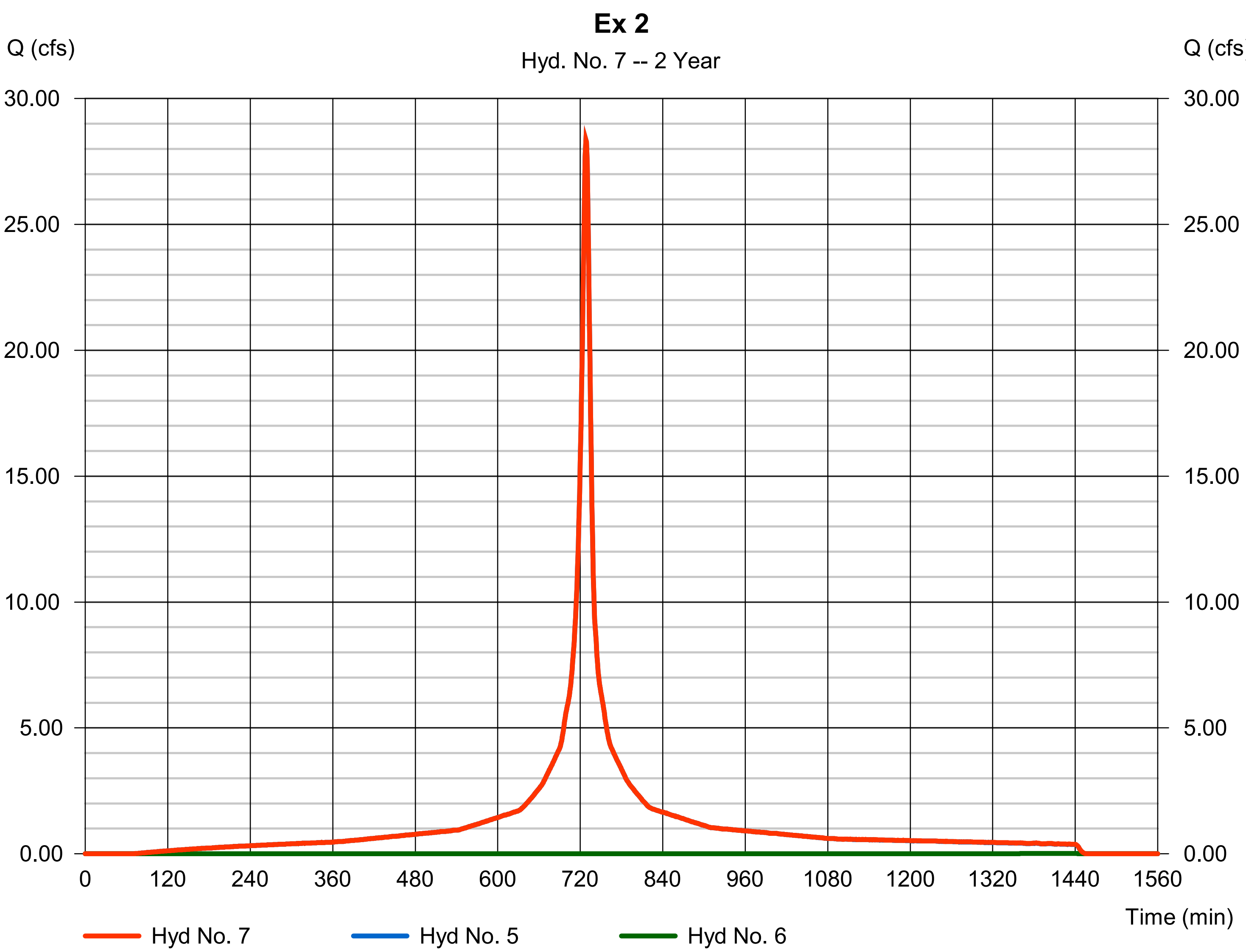
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 7

Ex 2

Hydrograph type	= Combine	Peak discharge	= 28.36 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 113,053 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 14.590 ac



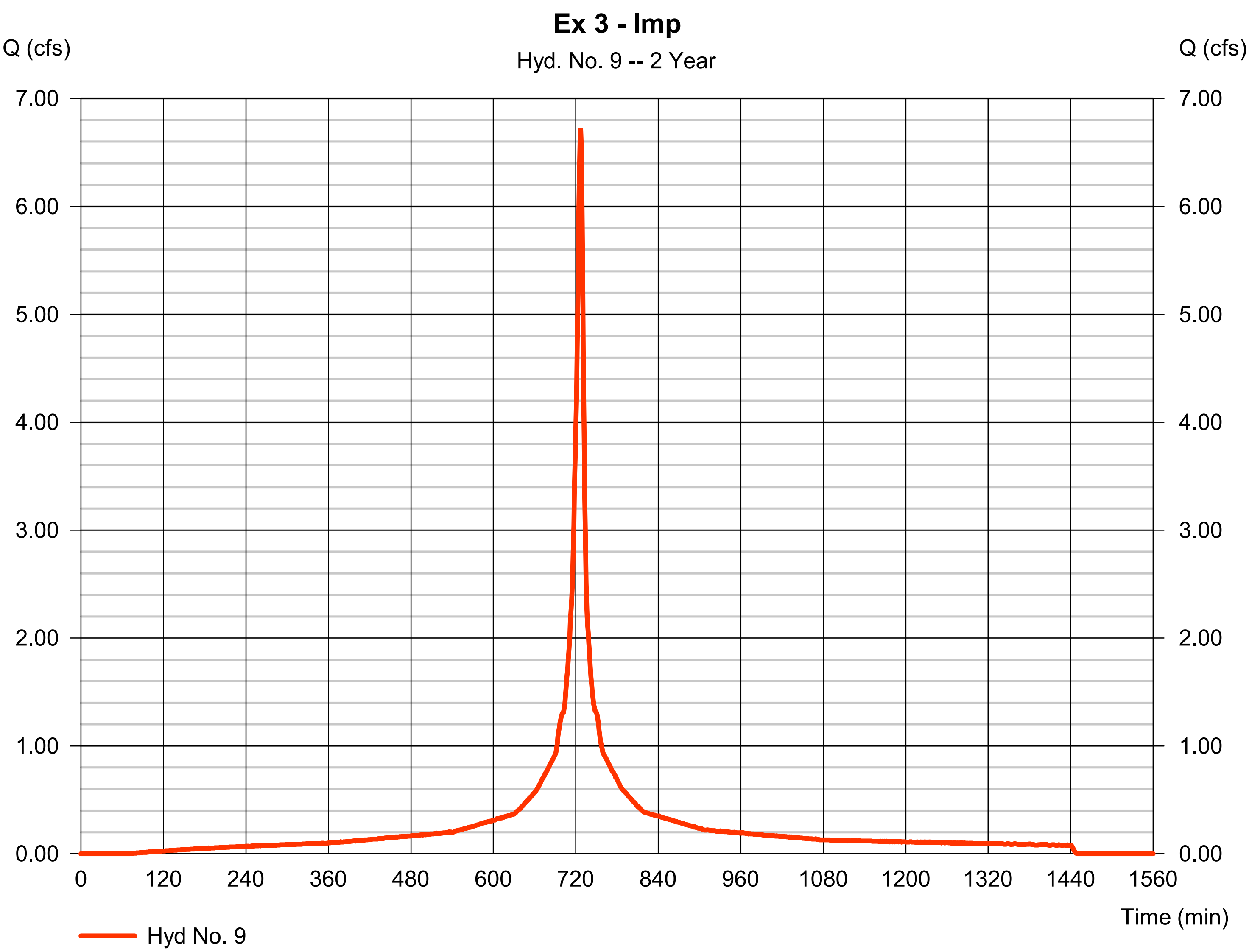
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 9

Ex 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 6.724 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 24,036 cuft
Drainage area	= 2.060 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



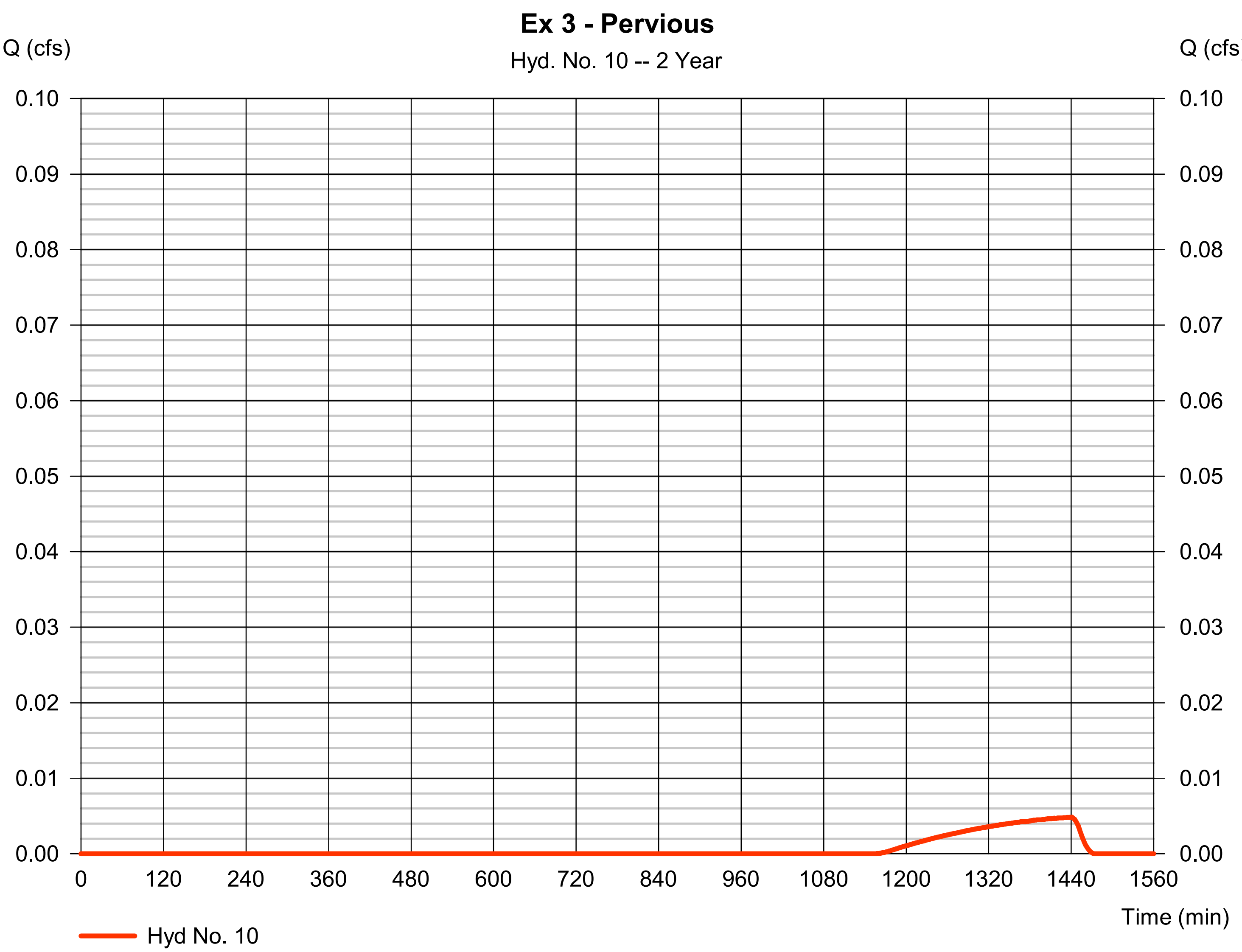
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 10

Ex 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 54 cuft
Drainage area	= 4.790 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



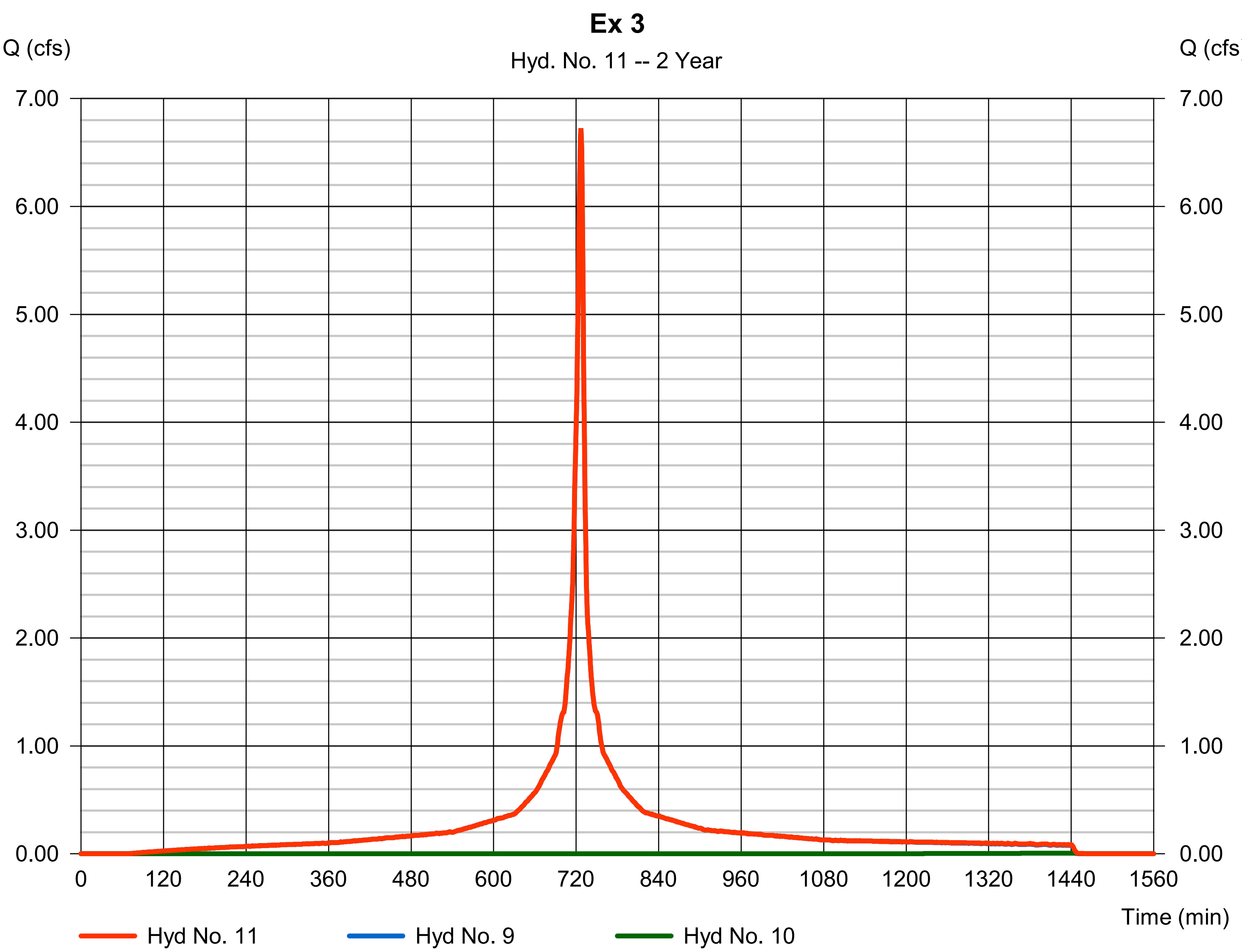
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 11

Ex 3

Hydrograph type	= Combine	Peak discharge	= 6.724 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 24,091 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 6.850 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

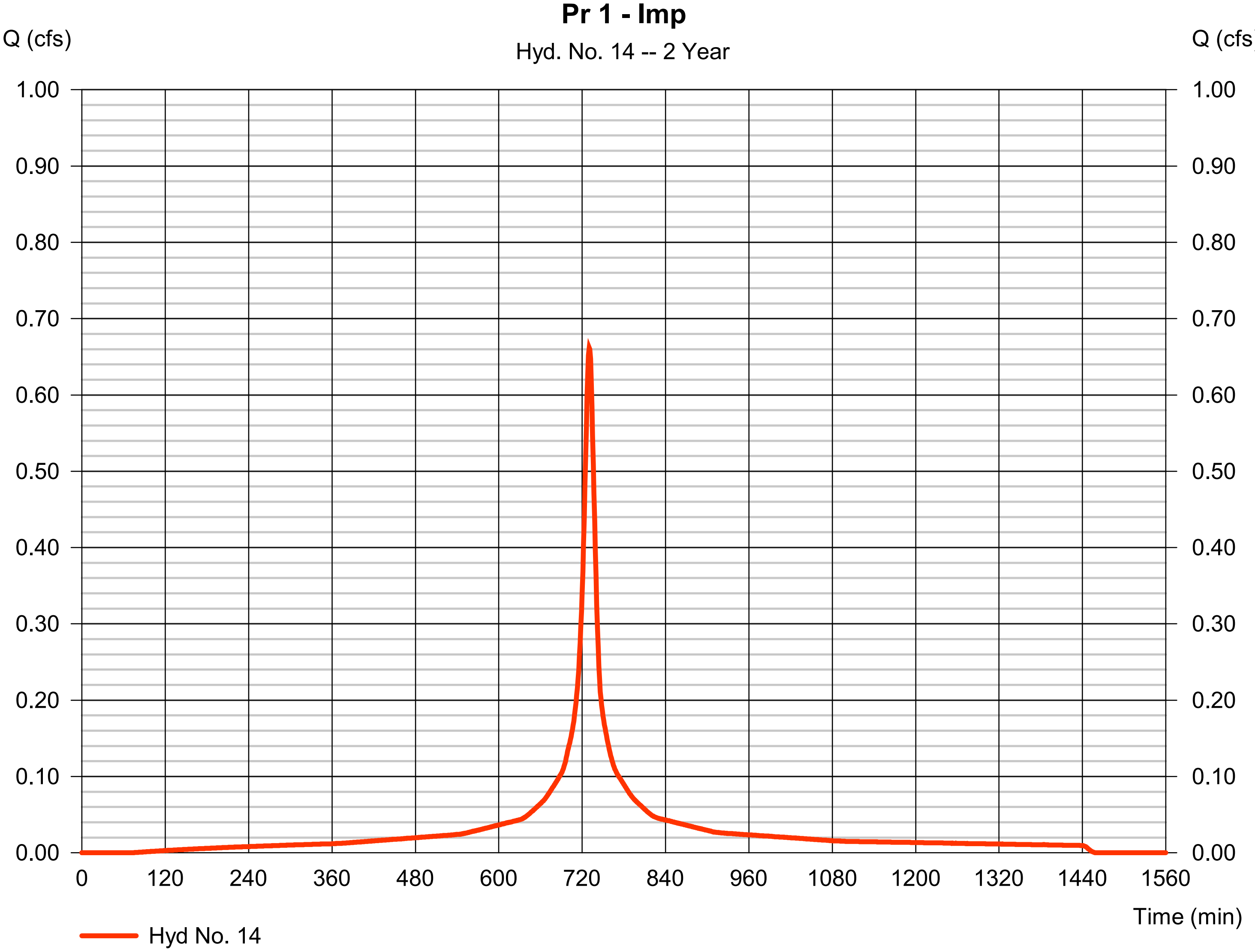
Hyd. No. 14

Pr 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.662 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 2,896 cuft
Drainage area	= 0.260 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

Pr 1 - Imp

Hyd. No. 14 -- 2 Year



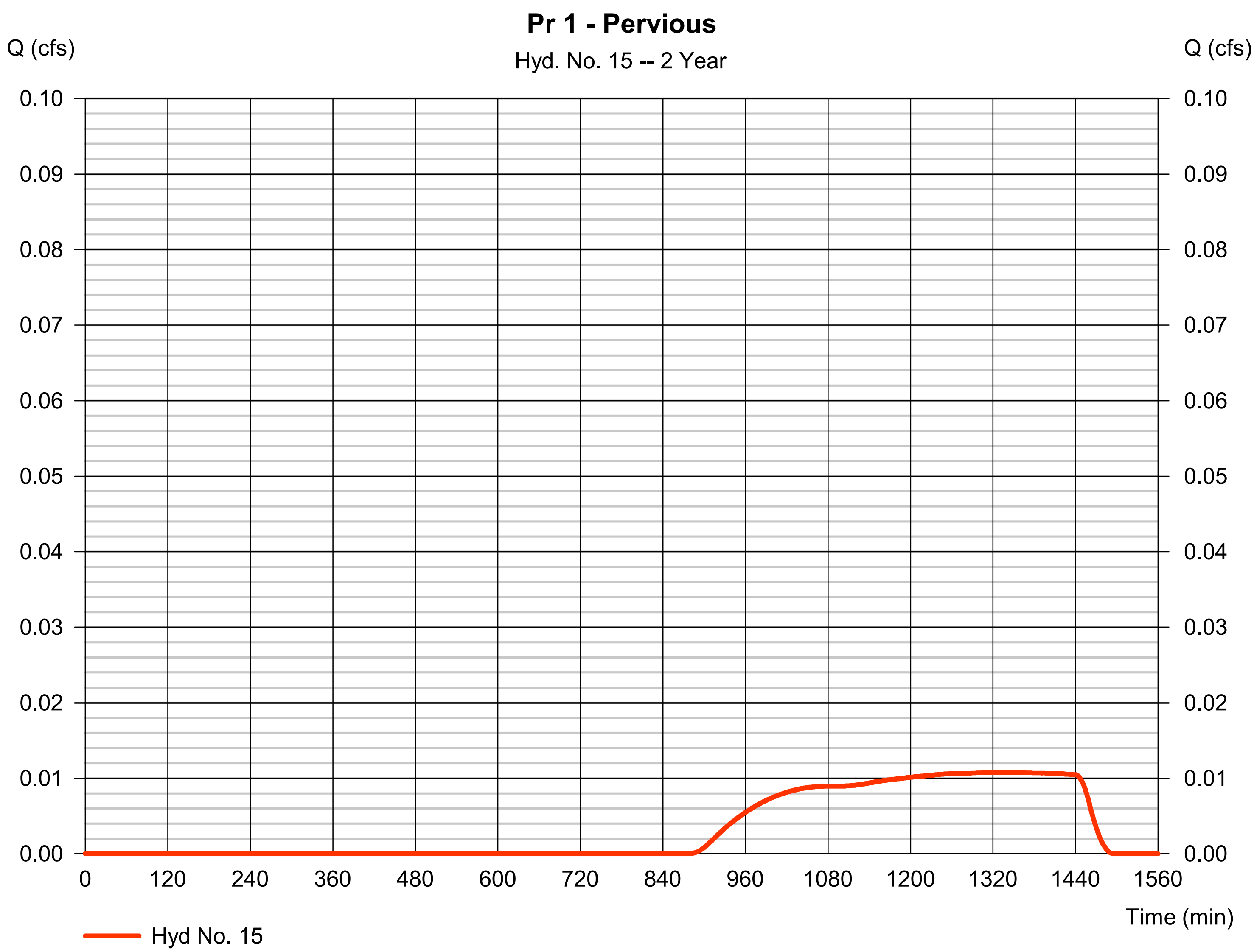
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 15

Pr 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.011 cfs
Storm frequency	= 2 yrs	Time to peak	= 1350 min
Time interval	= 1 min	Hyd. volume	= 305 cuft
Drainage area	= 3.500 ac	Curve number	= 42
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 35.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



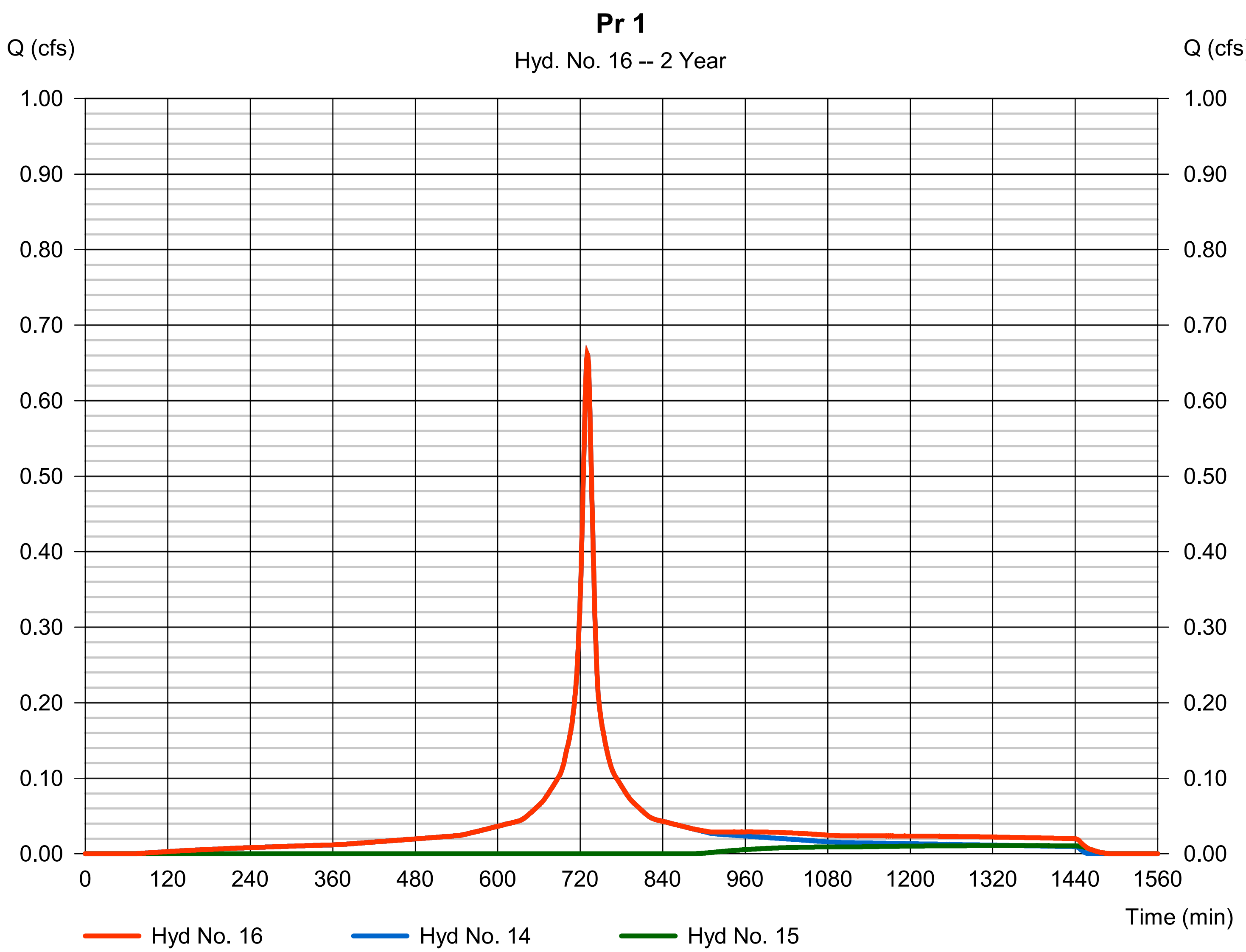
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 16

Pr 1

Hydrograph type	= Combine	Peak discharge	= 0.662 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 3,201 cuft
Inflow hyds.	= 14, 15	Contrib. drain. area	= 3.760 ac



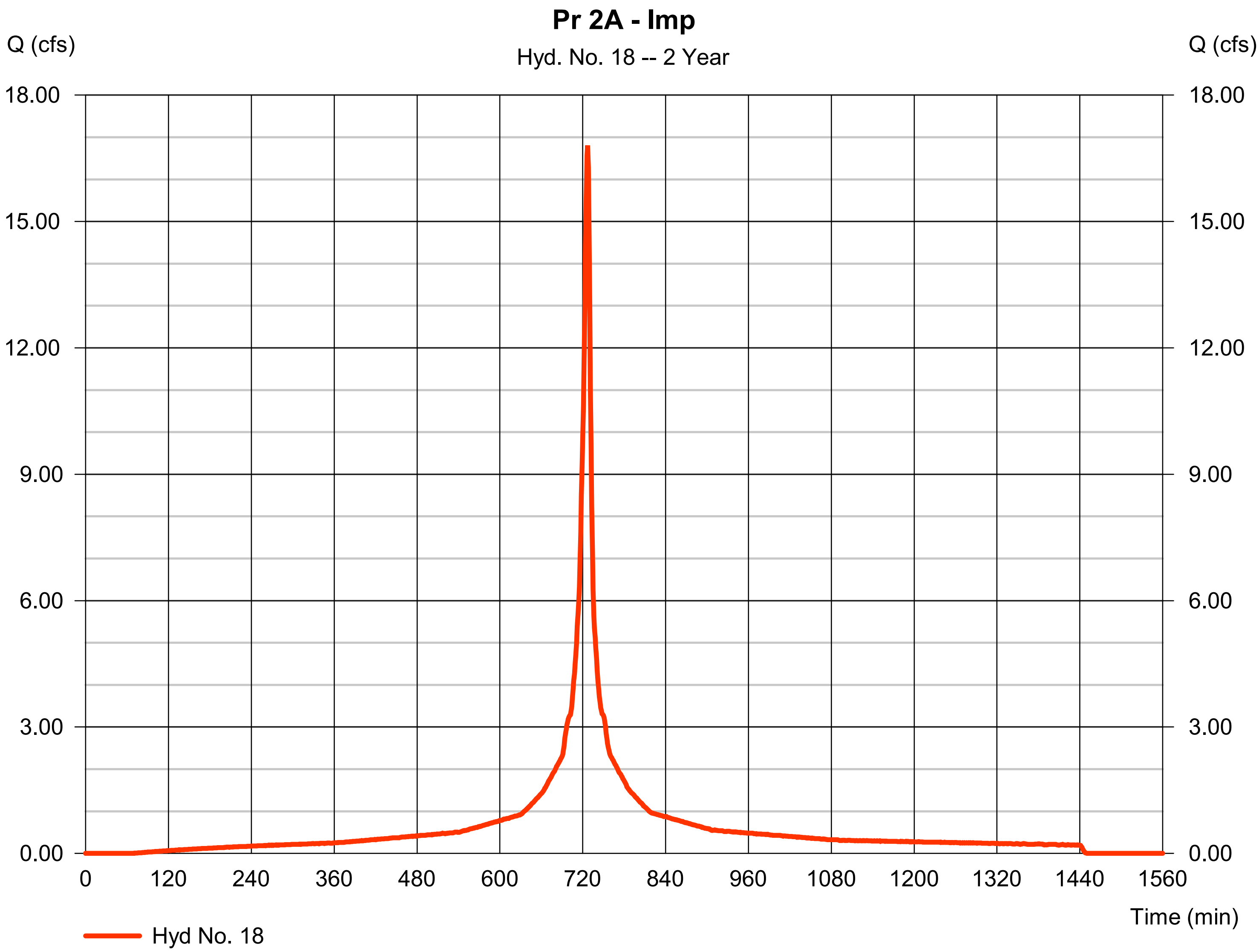
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 18

Pr 2A - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 16.81 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 60,091 cuft
Drainage area	= 5.150 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



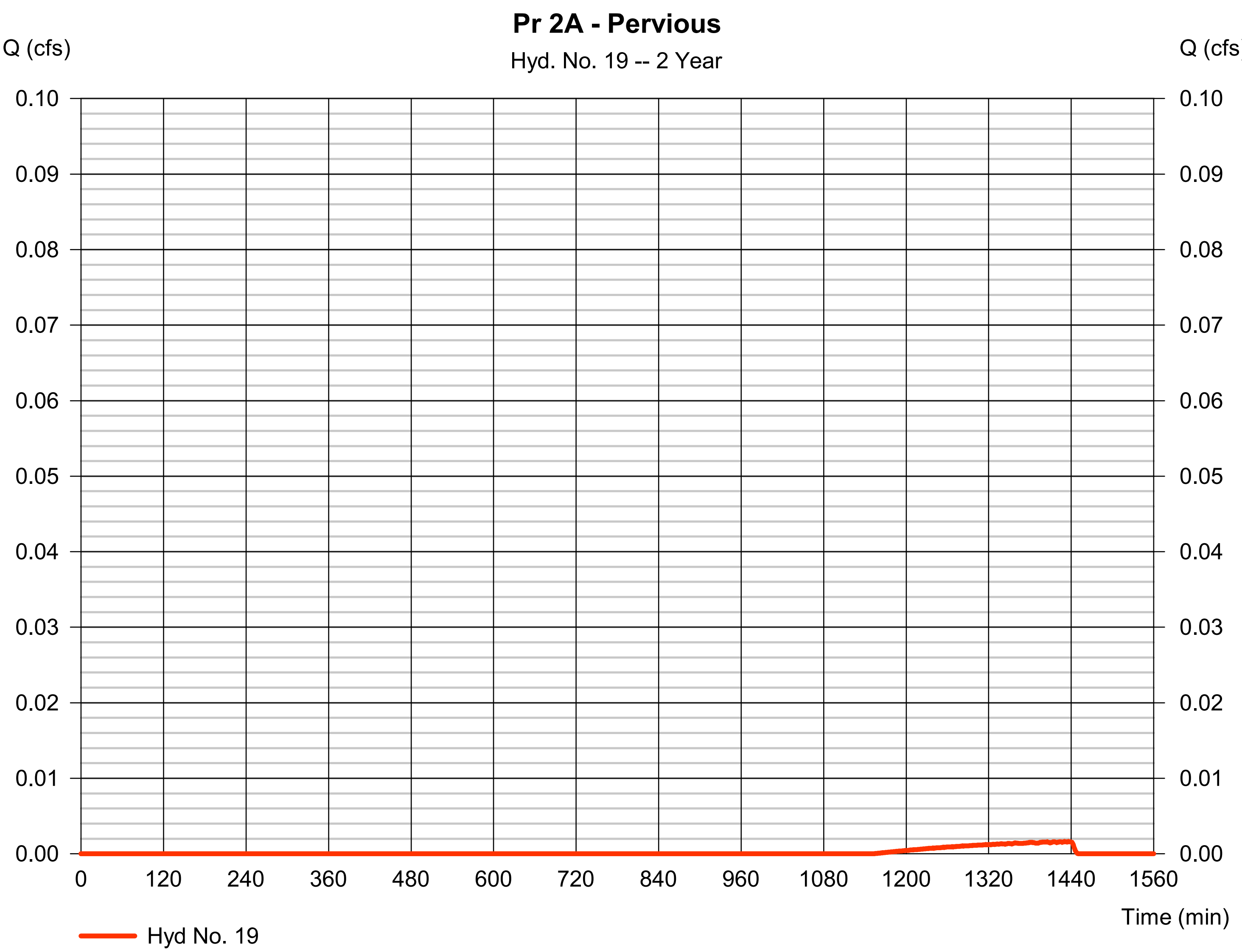
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 19

Pr 2A - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.002 cfs
Storm frequency	= 2 yrs	Time to peak	= 1436 min
Time interval	= 1 min	Hyd. volume	= 18 cuft
Drainage area	= 1.520 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



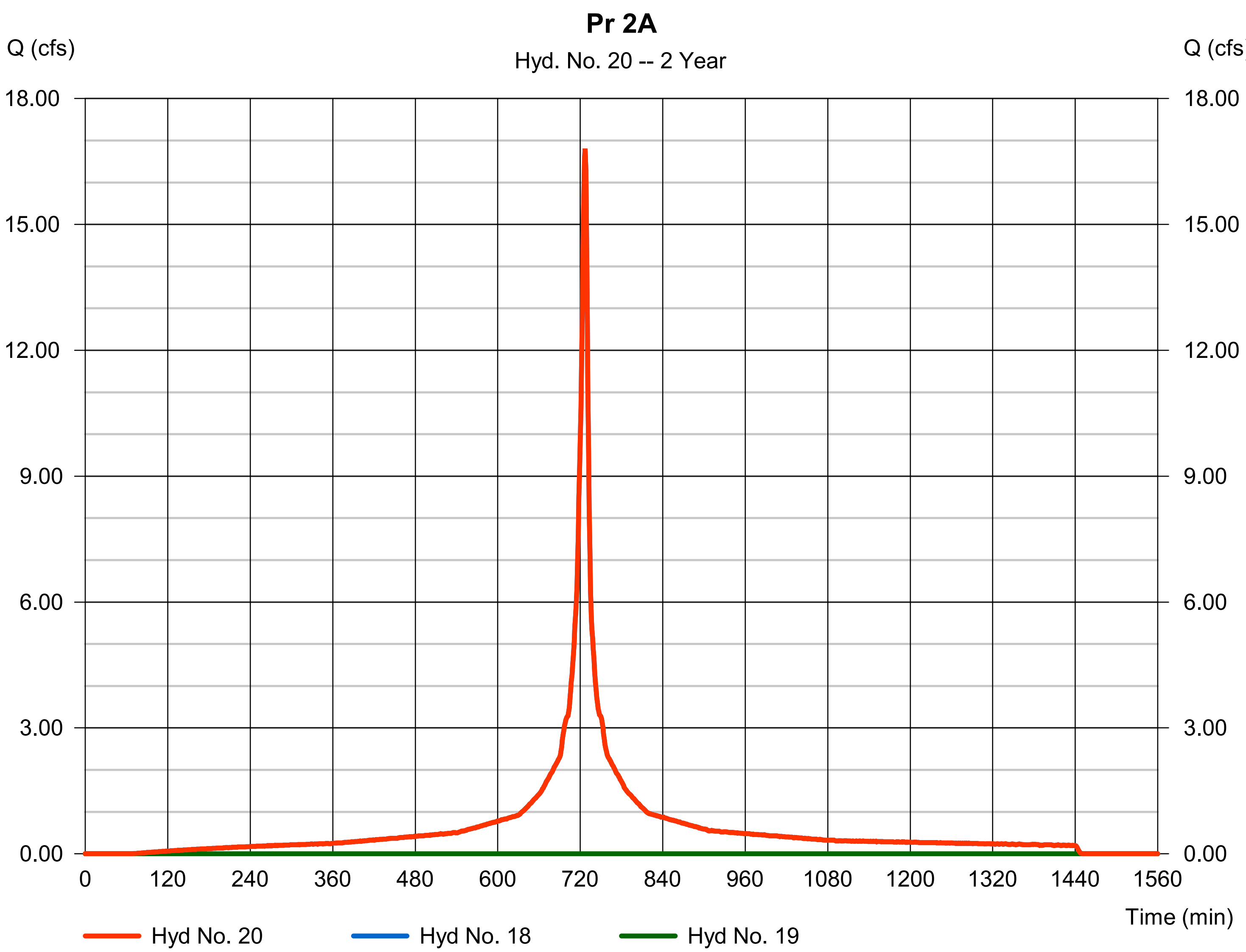
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 20

Pr 2A

Hydrograph type	= Combine	Peak discharge	= 16.81 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 60,109 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 6.670 ac



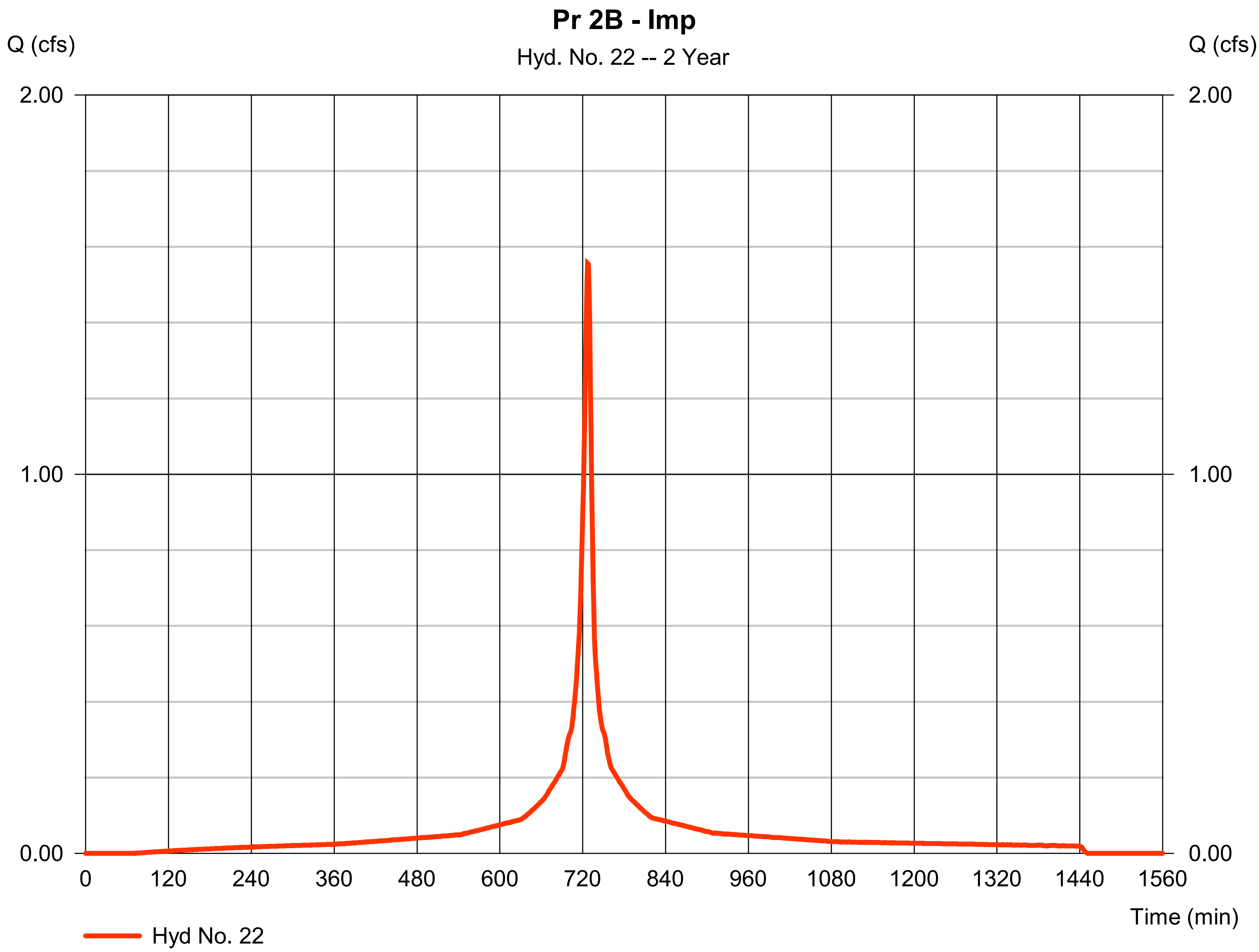
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 22

Pr 2B - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.556 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 5,847 cuft
Drainage area	= 0.530 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



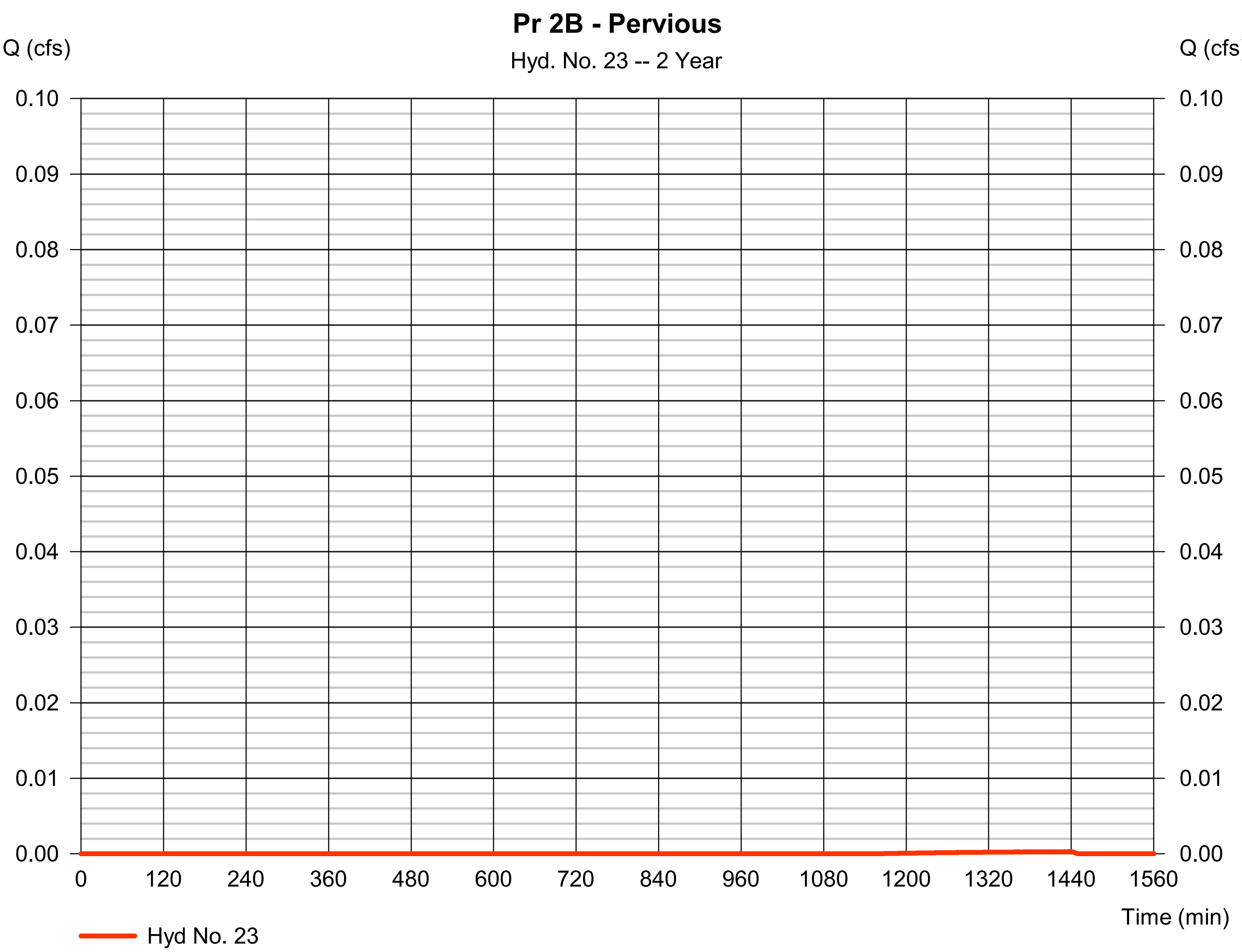
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 23

Pr 2B - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1436 min
Time interval	= 1 min	Hyd. volume	= 3 cuft
Drainage area	= 0.280 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



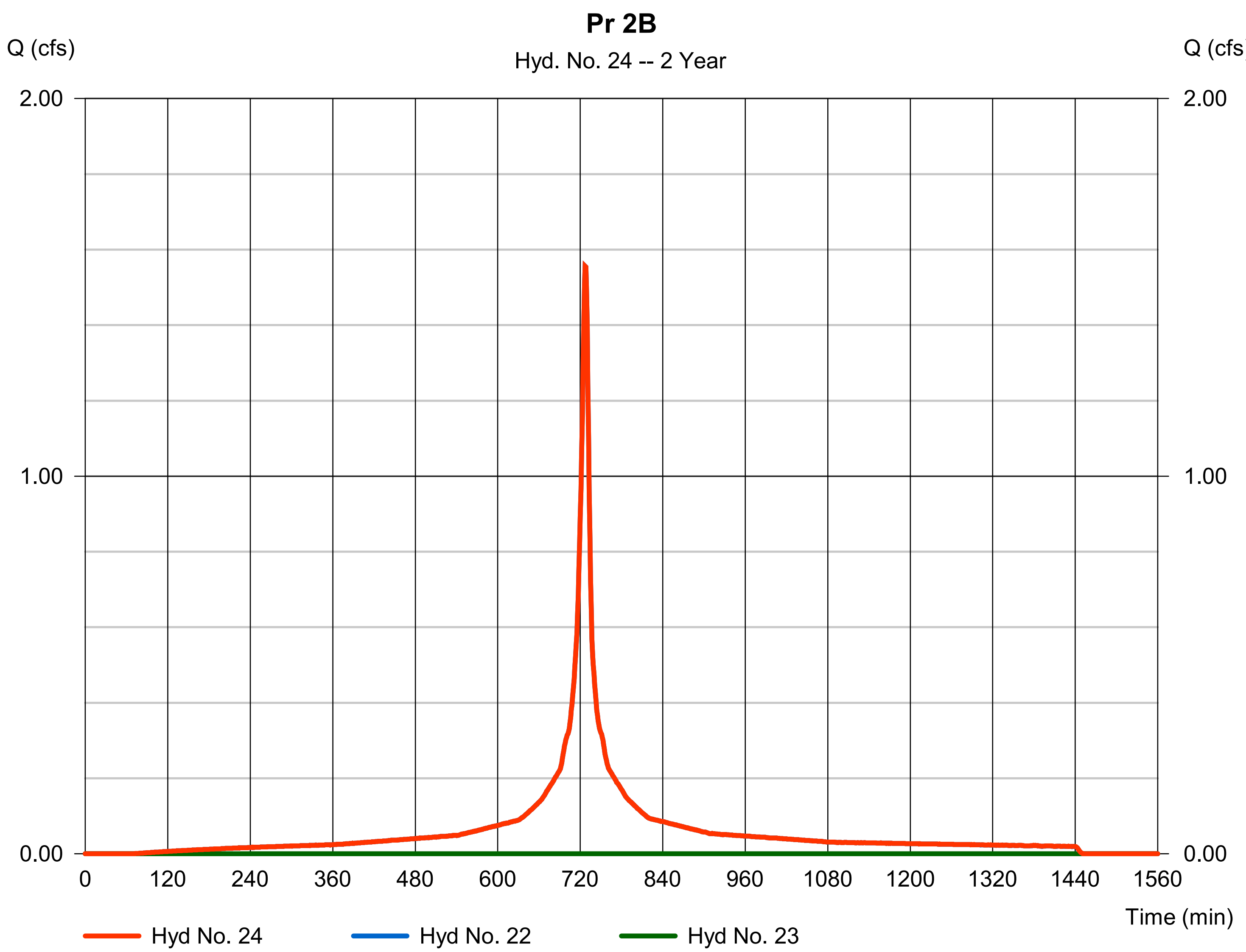
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 24

Pr 2B

Hydrograph type	= Combine	Peak discharge	= 1.556 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 5,850 cuft
Inflow hyds.	= 22, 23	Contrib. drain. area	= 0.810 ac



Hydrograph Report

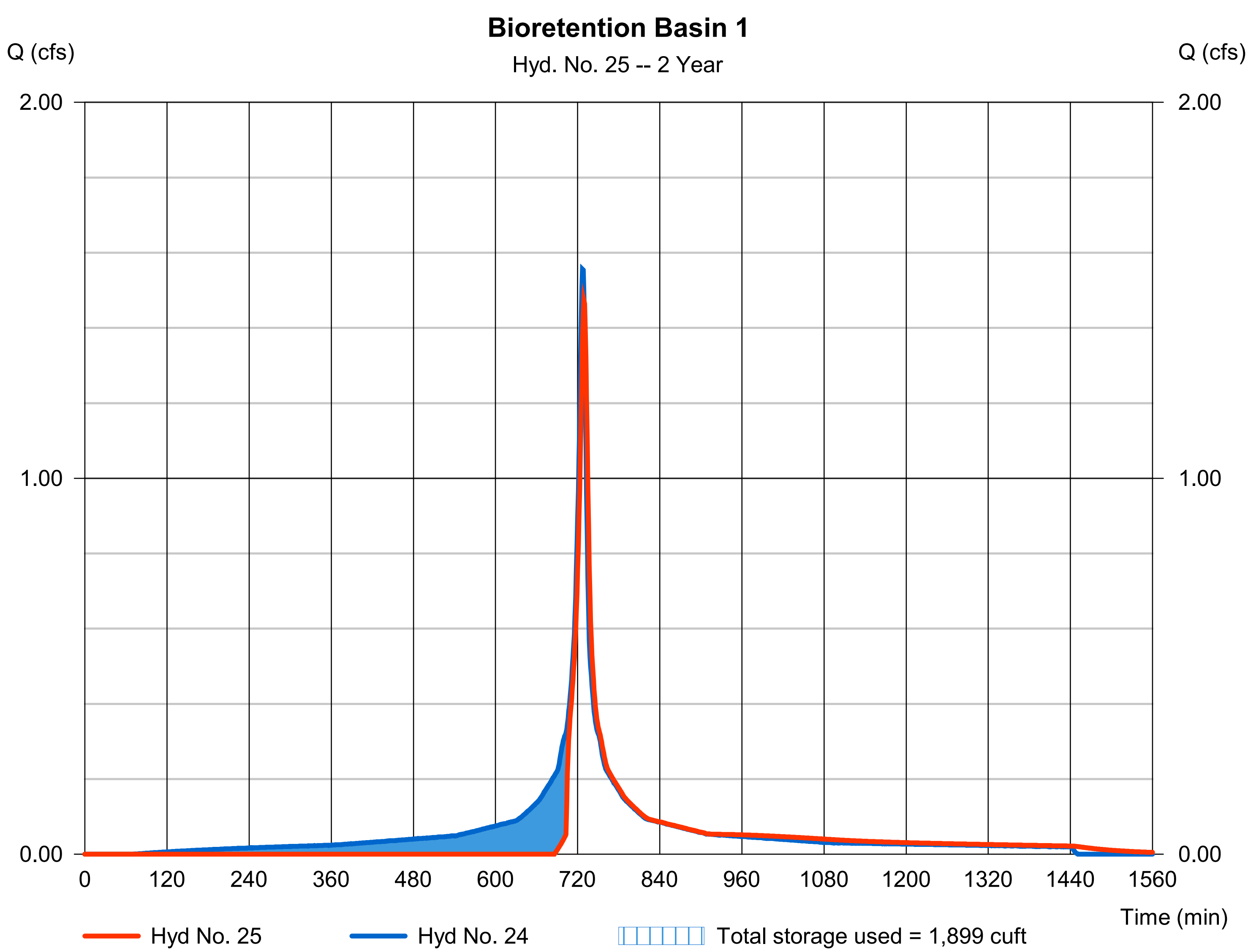
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 25

Bioretention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 1.473 cfs
Storm frequency	= 2 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 4,375 cuft
Inflow hyd. No.	= 24 - Pr 2B	Max. Elevation	= 37.78 ft
Reservoir name	= Bioretention Basin 1	Max. Storage	= 1,899 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Bioretention Basin 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 37.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	37.00	2,137	0	0
1.00	38.00	2,777	2,450	2,450
2.00	39.00	3,469	3,116	5,566
3.00	40.00	4,234	3,845	9,411

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	Inactive	Inactive
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 33.19	0.00	0.00	0.00
Length (ft)	= 51.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.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)	= 16.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 37.69	0.00	0.00	0.00
Weir Coeff.	= 3.33	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

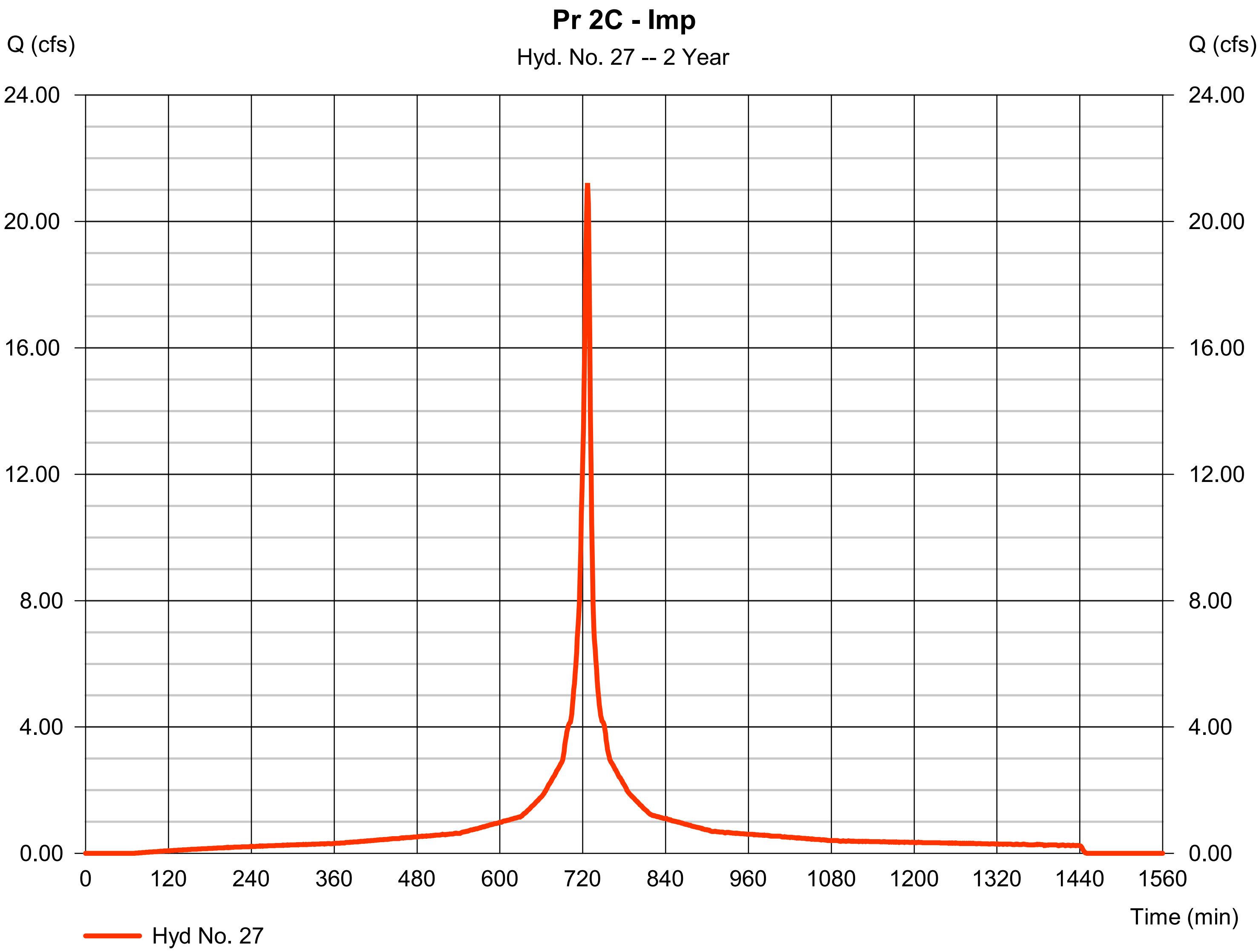
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	37.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.10	245	37.10	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.20	490	37.20	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.30	735	37.30	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.40	980	37.40	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.50	1,225	37.50	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.60	1,470	37.60	25.35 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.70	1,715	37.70	25.35 ic	---	---	---	0.05	---	---	---	---	---	0.053
0.80	1,960	37.80	25.35 ic	---	---	---	1.94	---	---	---	---	---	1.944
0.90	2,205	37.90	25.35 ic	---	---	---	5.13	---	---	---	---	---	5.127
1.00	2,450	38.00	25.35 ic	---	---	---	9.20	---	---	---	---	---	9.196
1.10	2,761	38.10	25.35 ic	---	---	---	13.99	---	---	---	---	---	13.99
1.20	3,073	38.20	25.35 ic	---	---	---	19.41	---	---	---	---	---	19.41
1.30	3,385	38.30	25.38 ic	---	---	---	25.38	---	---	---	---	---	25.38
1.40	3,696	38.40	29.26 ic	---	---	---	29.26 s	---	---	---	---	---	29.26
1.50	4,008	38.50	30.23 ic	---	---	---	30.23 s	---	---	---	---	---	30.23
1.60	4,320	38.60	30.93 ic	---	---	---	30.93 s	---	---	---	---	---	30.93
1.70	4,631	38.70	31.50 ic	---	---	---	31.50 s	---	---	---	---	---	31.50
1.80	4,943	38.80	31.99 ic	---	---	---	31.99 s	---	---	---	---	---	31.99
1.90	5,254	38.90	32.45 ic	---	---	---	32.44 s	---	---	---	---	---	32.44
2.00	5,566	39.00	32.87 ic	---	---	---	32.86 s	---	---	---	---	---	32.86
2.10	5,951	39.10	33.26 ic	---	---	---	33.25 s	---	---	---	---	---	33.25
2.20	6,335	39.20	33.64 ic	---	---	---	33.63 s	---	---	---	---	---	33.63
2.30	6,719	39.30	34.01 ic	---	---	---	34.00 s	---	---	---	---	---	34.00
2.40	7,104	39.40	34.37 ic	---	---	---	34.35 s	---	---	---	---	---	34.35
2.50	7,488	39.50	34.72 ic	---	---	---	34.71 s	---	---	---	---	---	34.71
2.60	7,873	39.60	35.07 ic	---	---	---	35.03 s	---	---	---	---	---	35.03
2.70	8,257	39.70	35.40 ic	---	---	---	35.38 s	---	---	---	---	---	35.38
2.80	8,642	39.80	35.74 ic	---	---	---	35.70 s	---	---	---	---	---	35.70
2.90	9,026	39.90	36.06 ic	---	---	---	36.06 s	---	---	---	---	---	36.06
3.00	9,411	40.00	36.39 ic	---	---	---	36.36 s	---	---	---	---	---	36.36

Hydrograph Report

Hyd. No. 27

Pr 2C - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 21.22 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 75,843 cuft
Drainage area	= 6.500 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



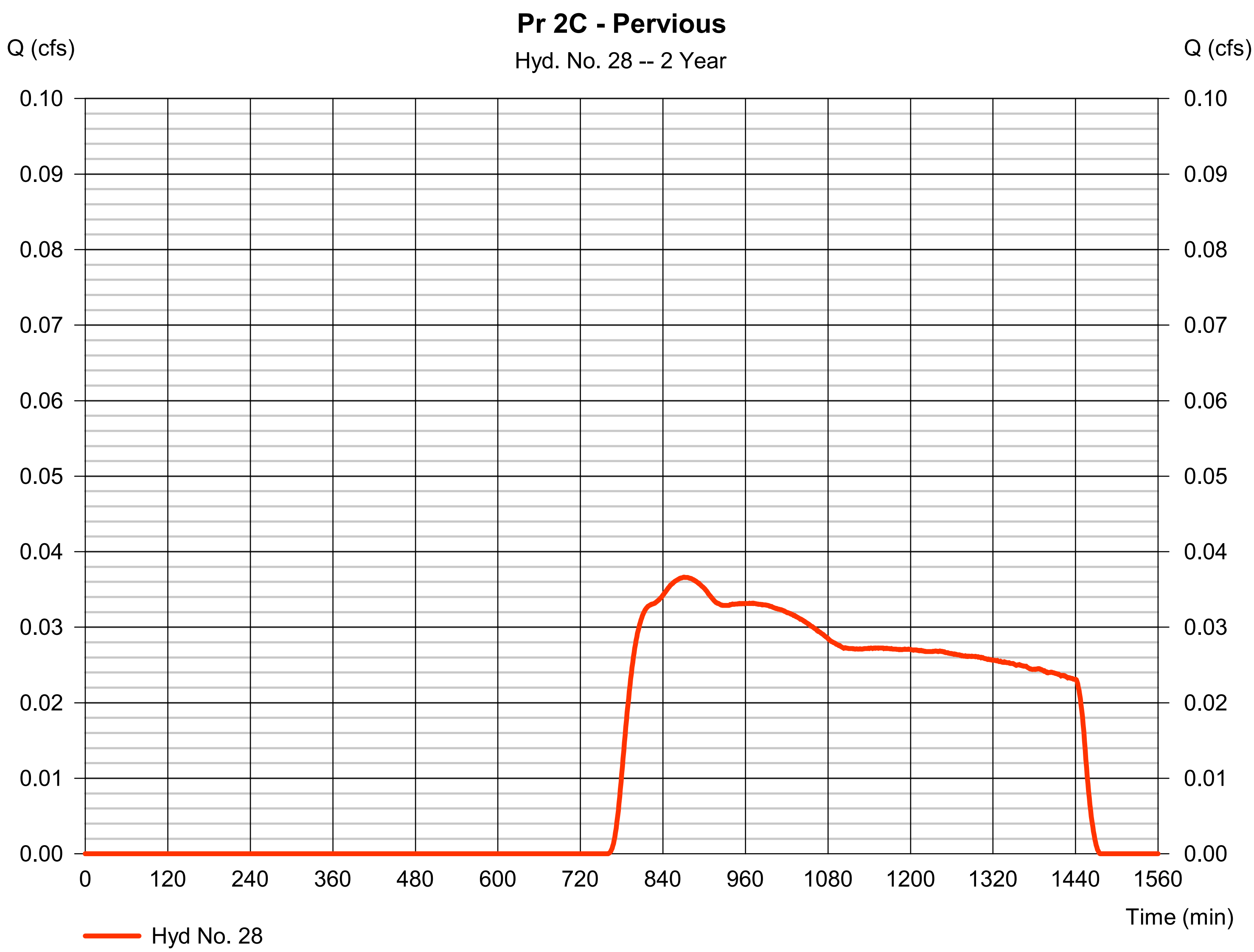
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 28

Pr 2C - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.037 cfs
Storm frequency	= 2 yrs	Time to peak	= 871 min
Time interval	= 1 min	Hyd. volume	= 1,168 cuft
Drainage area	= 4.120 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



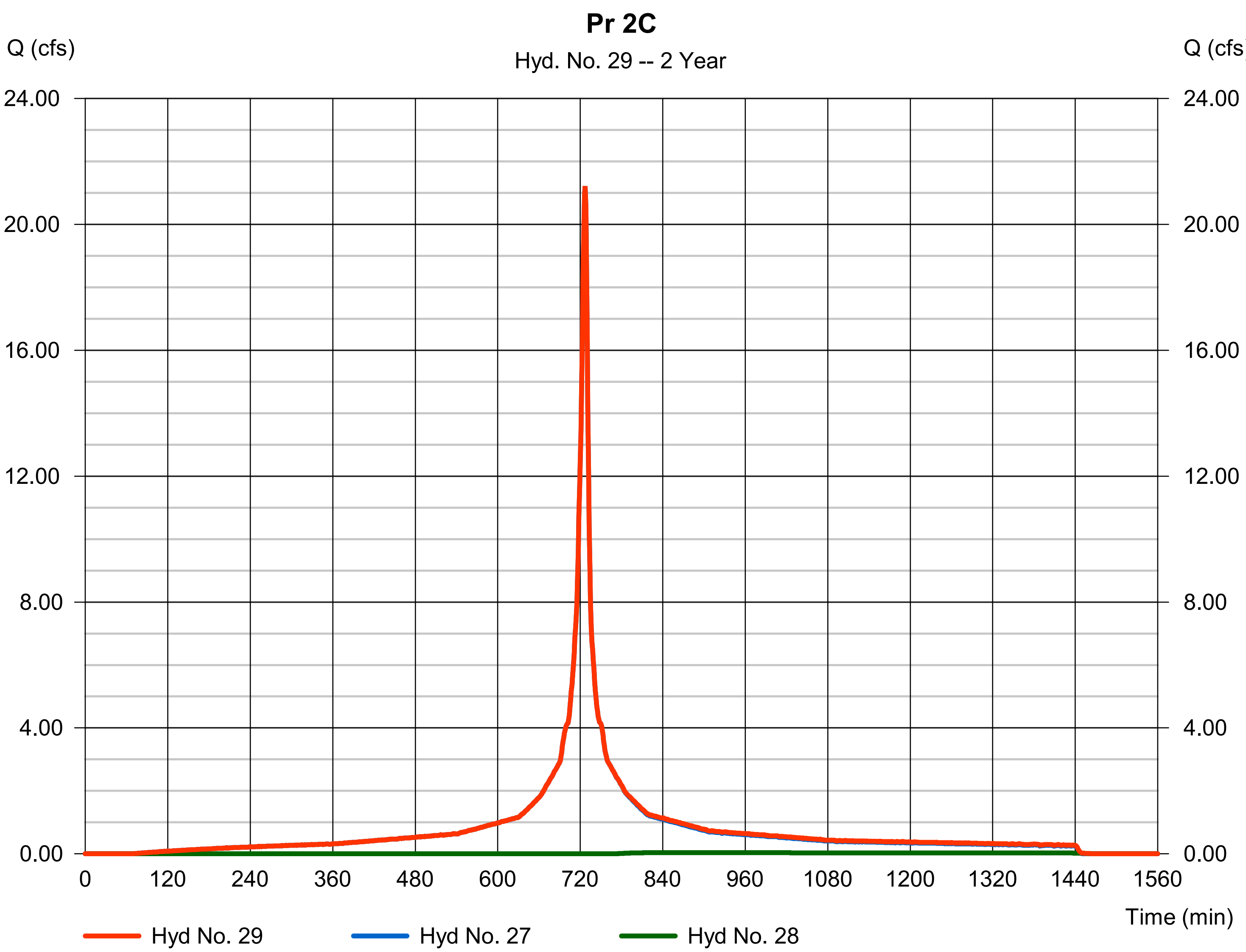
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 29

Pr 2C

Hydrograph type	= Combine	Peak discharge	= 21.22 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 77,011 cuft
Inflow hyds.	= 27, 28	Contrib. drain. area	= 10.620 ac



Hydrograph Report

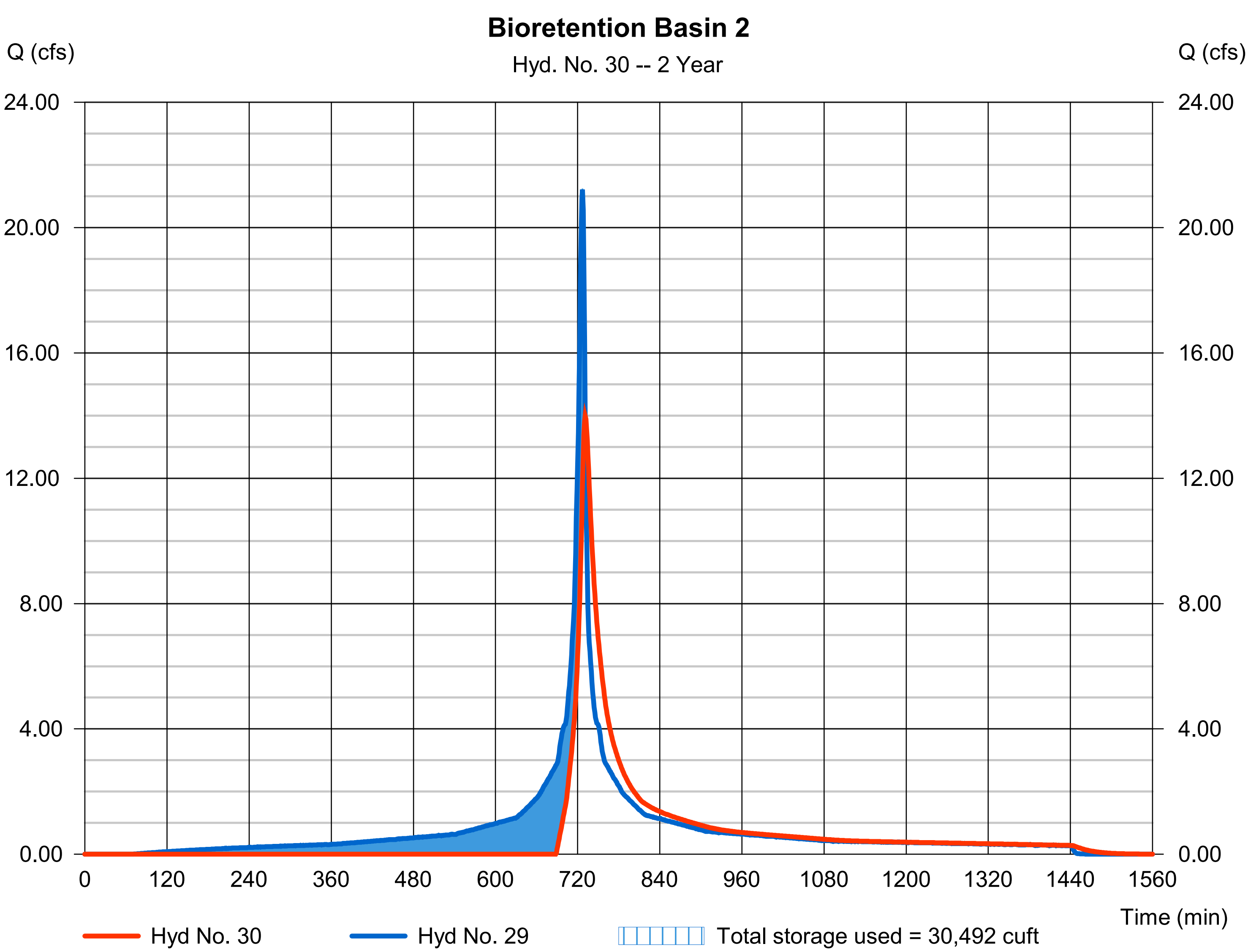
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 30

Bioretention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 13.99 cfs
Storm frequency	= 2 yrs	Time to peak	= 731 min
Time interval	= 1 min	Hyd. volume	= 57,339 cuft
Inflow hyd. No.	= 29 - Pr 2C	Max. Elevation	= 37.91 ft
Reservoir name	= Bioretention Basin 2	Max. Storage	= 30,492 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Pond No. 4 - Bioretention Basin 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 36.70 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	36.70	22,838	0	0
1.00	37.70	26,386	24,588	24,588
2.00	38.70	30,028	28,185	52,773
3.00	39.70	33,753	31,869	84,642

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	Inactive	Inactive	Inactive
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 31.68	0.00	0.00	0.00
Length (ft)	= 51.00	0.00	0.00	0.00
Slope (%)	= 1.34	0.00	0.00	n/a
N-Value	= .012	.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)	= 16.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 37.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	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	36.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.10	2,459	36.80	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.20	4,918	36.90	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.30	7,376	37.00	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.40	9,835	37.10	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.50	12,294	37.20	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.60	14,753	37.30	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.70	17,212	37.40	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.80	19,671	37.50	45.89 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.90	22,129	37.60	45.89 ic	---	---	---	1.68	---	---	---	---	---	1.685
1.00	24,588	37.70	45.89 ic	---	---	---	4.77	---	---	---	---	---	4.766
1.10	27,407	37.80	45.89 ic	---	---	---	8.75	---	---	---	---	---	8.755
1.20	30,225	37.90	45.89 ic	---	---	---	13.48	---	---	---	---	---	13.48
1.30	33,044	38.00	45.89 ic	---	---	---	18.84	---	---	---	---	---	18.84
1.40	35,862	38.10	45.89 ic	---	---	---	24.76	---	---	---	---	---	24.76
1.50	38,680	38.20	45.89 ic	---	---	---	31.20	---	---	---	---	---	31.20
1.60	41,499	38.30	45.89 ic	---	---	---	38.12	---	---	---	---	---	38.12
1.70	44,317	38.40	45.89 ic	---	---	---	45.49	---	---	---	---	---	45.49
1.80	47,136	38.50	51.55 ic	---	---	---	51.55 s	---	---	---	---	---	51.55
1.90	49,954	38.60	53.24 ic	---	---	---	53.24 s	---	---	---	---	---	53.24
2.00	52,773	38.70	54.44 ic	---	---	---	54.44 s	---	---	---	---	---	54.44
2.10	55,960	38.80	55.41 ic	---	---	---	55.40 s	---	---	---	---	---	55.40
2.20	59,147	38.90	56.24 ic	---	---	---	56.24 s	---	---	---	---	---	56.24
2.30	62,334	39.00	56.98 ic	---	---	---	56.97 s	---	---	---	---	---	56.97
2.40	65,520	39.10	57.66 ic	---	---	---	57.65 s	---	---	---	---	---	57.65
2.50	68,707	39.20	58.29 ic	---	---	---	58.28 s	---	---	---	---	---	58.28
2.60	71,894	39.30	58.89 ic	---	---	---	58.88 s	---	---	---	---	---	58.88
2.70	75,081	39.40	59.45 ic	---	---	---	59.44 s	---	---	---	---	---	59.44
2.80	78,268	39.50	60.00 ic	---	---	---	59.99 s	---	---	---	---	---	59.99
2.90	81,455	39.60	60.53 ic	---	---	---	60.52 s	---	---	---	---	---	60.52
3.00	84,642	39.70	61.04 ic	---	---	---	61.03 s	---	---	---	---	---	61.03

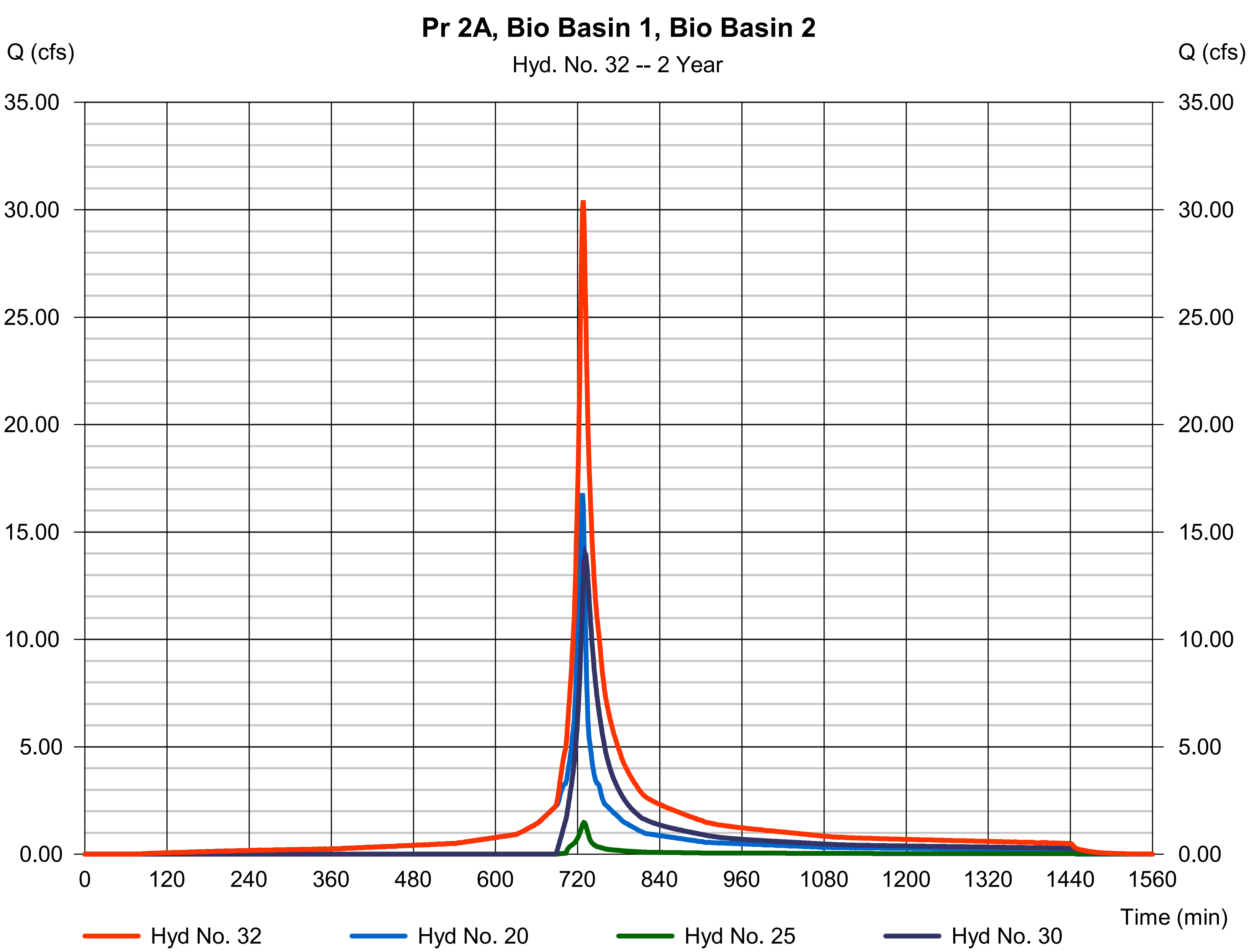
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 32

Pr 2A, Bio Basin 1, Bio Basin 2

Hydrograph type	= Combine	Peak discharge	= 30.44 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 121,823 cuft
Inflow hyds.	= 20, 25, 30	Contrib. drain. area	= 0.000 ac



Hydrograph Report

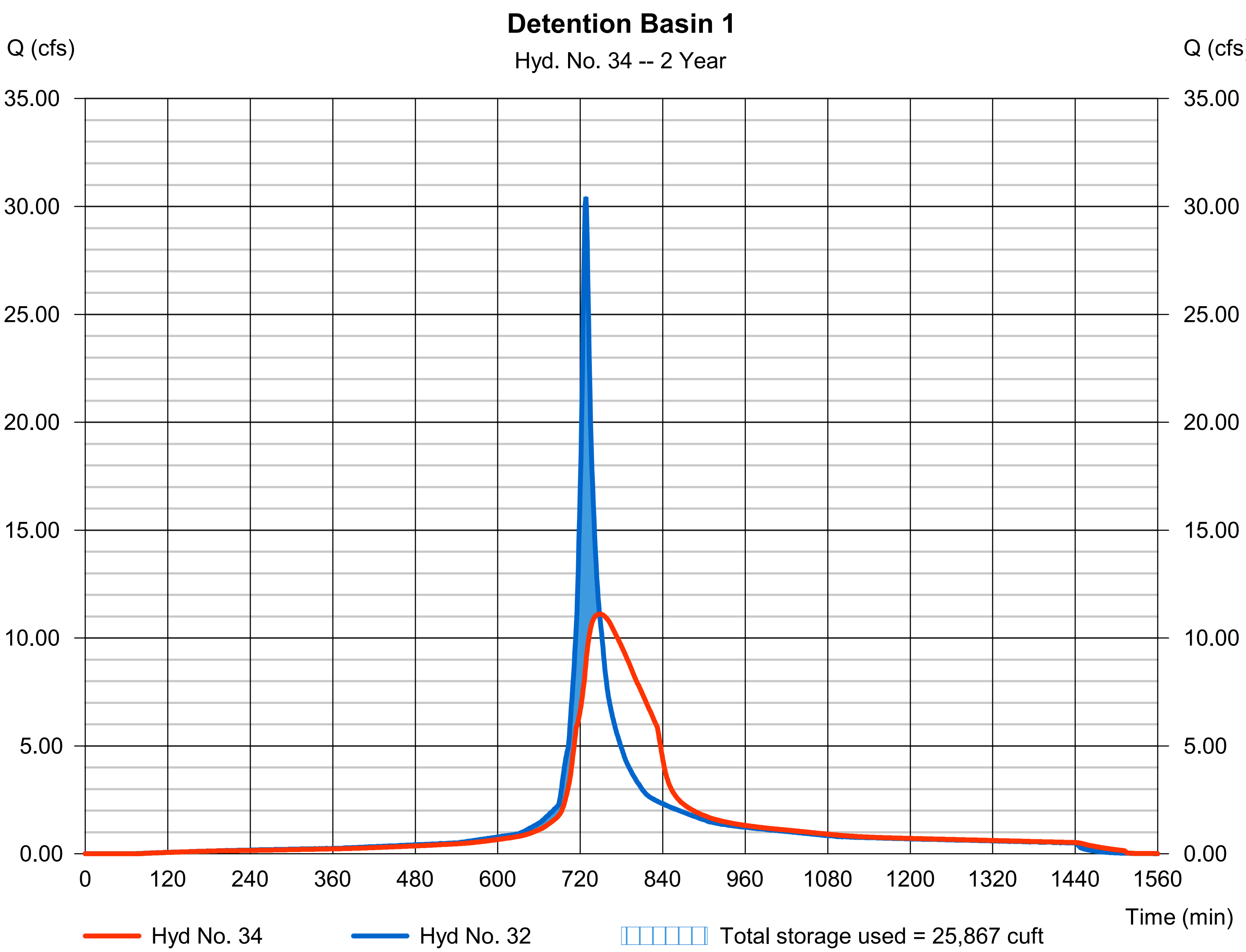
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 34

Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 11.11 cfs
Storm frequency	= 2 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 121,822 cuft
Inflow hyd. No.	= 32 - Pr 2A, Bio Basin 1, Bio Basin 2	Max. Elevation	= 31.99 ft
Reservoir name	= Detention Basin 1	Max. Storage	= 25,867 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Basin 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 29.86 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	29.86	01	0	0
0.14	30.00	427	21	21
1.14	31.00	14,058	5,644	5,665
2.14	32.00	27,701	20,496	26,161
3.14	33.00	32,796	30,210	56,371
4.14	34.00	35,354	34,064	90,434
5.14	35.00	37,997	36,664	127,098
6.14	36.00	40,724	39,349	166,447
7.14	37.00	43,534	42,117	208,564
8.14	38.00	45,543	44,530	253,094

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	12.00	15.00	Inactive
Span (in)	= 36.00	30.00	30.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 29.86	29.86	32.04	0.00
Length (ft)	= 265.00	0.00	0.00	0.00
Slope (%)	= 2.49	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 32.75	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	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).

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	29.86	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.01	2	29.87	0.00 ic	0.00 ic	0.00	---	0.00	---	---	---	---	---	0.002
0.03	4	29.89	0.01 ic	0.01 ic	0.00	---	0.00	---	---	---	---	---	0.007
0.04	6	29.90	0.01 ic	0.01 ic	0.00	---	0.00	---	---	---	---	---	0.013
0.06	8	29.92	0.03 ic	0.03 ic	0.00	---	0.00	---	---	---	---	---	0.026
0.07	10	29.93	0.04 ic	0.04 ic	0.00	---	0.00	---	---	---	---	---	0.040
0.08	13	29.94	0.06 ic	0.06 ic	0.00	---	0.00	---	---	---	---	---	0.056
0.10	15	29.96	0.07 ic	0.07 ic	0.00	---	0.00	---	---	---	---	---	0.072
0.11	17	29.97	0.10 ic	0.10 ic	0.00	---	0.00	---	---	---	---	---	0.097
0.13	19	29.99	0.12 ic	0.12 ic	0.00	---	0.00	---	---	---	---	---	0.116
0.14	21	30.00	0.15 ic	0.14 ic	0.00	---	0.00	---	---	---	---	---	0.142
0.24	585	30.10	0.41 ic	0.40 ic	0.00	---	0.00	---	---	---	---	---	0.397
0.34	1,150	30.20	0.74 ic	0.74 ic	0.00	---	0.00	---	---	---	---	---	0.743
0.44	1,714	30.30	1.22 ic	1.18 ic	0.00	---	0.00	---	---	---	---	---	1.177
0.54	2,279	30.40	1.76 ic	1.68 ic	0.00	---	0.00	---	---	---	---	---	1.680
0.64	2,843	30.50	2.31 ic	2.31 ic	0.00	---	0.00	---	---	---	---	---	2.314
0.74	3,408	30.60	2.96 ic	2.96 ic	0.00	---	0.00	---	---	---	---	---	2.964
0.84	3,972	30.70	3.70 ic	3.70 ic	0.00	---	0.00	---	---	---	---	---	3.703
0.94	4,536	30.80	4.53 ic	4.53 ic	0.00	---	0.00	---	---	---	---	---	4.533
1.04	5,101	30.90	5.26 ic	5.26 ic	0.00	---	0.00	---	---	---	---	---	5.262
1.14	5,665	31.00	6.01 ic	5.84 ic	0.00	---	0.00	---	---	---	---	---	5.844
1.24	7,715	31.10	6.55 ic	6.51 ic	0.00	---	0.00	---	---	---	---	---	6.506
1.34	9,764	31.20	7.13 ic	7.10 ic	0.00	---	0.00	---	---	---	---	---	7.102
1.44	11,814	31.30	7.73 ic	7.65 ic	0.00	---	0.00	---	---	---	---	---	7.646
1.54	13,864	31.40	8.36 ic	8.15 ic	0.00	---	0.00	---	---	---	---	---	8.150
1.64	15,913	31.50	8.72 ic	8.72 ic	0.00	---	0.00	---	---	---	---	---	8.724
1.74	17,963	31.60	9.35 ic	9.25 ic	0.00	---	0.00	---	---	---	---	---	9.247
1.84	20,012	31.70	9.74 ic	9.74 ic	0.00	---	0.00	---	---	---	---	---	9.741
1.94	22,062	31.80	10.39 ic	10.22 ic	0.00	---	0.00	---	---	---	---	---	10.22
2.04	24,111	31.90	10.75 ic	10.75 ic	0.00	---	0.00	---	---	---	---	---	10.75
2.14	26,161	32.00	11.17 ic	11.17 ic	0.00	---	0.00	---	---	---	---	---	11.17
2.24	29,182	32.10	11.86 ic	11.60 ic	0.13 ic	---	0.00	---	---	---	---	---	11.72
2.34	32,203	32.20	12.63 ic	11.92 ic	0.54 ic	---	0.00	---	---	---	---	---	12.47

Continues on next page...

Detention Basin 1

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
2.44	35,224	32.30	13.41 ic	12.24 ic	1.13 ic	---	0.00	---	---	---	---	---	13.37
2.54	38,245	32.40	14.29 ic	12.46 ic	1.84 ic	---	0.00	---	---	---	---	---	14.29
2.64	41,266	32.50	15.45 ic	12.72 ic	2.66 ic	---	0.00	---	---	---	---	---	15.37
2.74	44,287	32.60	16.71 ic	12.89 ic	3.57 ic	---	0.00	---	---	---	---	---	16.45
2.84	47,308	32.70	17.65 ic	13.09 ic	4.56 ic	---	0.00	---	---	---	---	---	17.65
2.94	50,329	32.80	18.94 ic	13.27 ic	5.64 ic	---	0.04	---	---	---	---	---	18.94
3.04	53,350	32.90	20.62 ic	13.38 ic	6.79 ic	---	0.19	---	---	---	---	---	20.36
3.14	56,371	33.00	21.96 ic	13.53 ic	8.01 ic	---	0.42	---	---	---	---	---	21.95
3.24	59,777	33.10	23.69 ic	13.60 ic	9.29 ic	---	0.69	---	---	---	---	---	23.58
3.34	63,183	33.20	25.43 ic	13.66 ic	10.63 ic	---	1.01	---	---	---	---	---	25.30
3.44	66,590	33.30	27.13 ic	13.73 ic	11.99 ic	---	1.36	---	---	---	---	---	27.08
3.54	69,996	33.40	28.48 ic	13.83 ic	12.90 ic	---	1.75	---	---	---	---	---	28.48
3.64	73,402	33.50	29.97 ic	14.02 ic	13.75 ic	---	2.16	---	---	---	---	---	29.93
3.74	76,809	33.60	31.49 ic	14.13 ic	14.55 ic	---	2.61	---	---	---	---	---	31.29
3.84	80,215	33.70	32.67 ic	14.28 ic	15.31 ic	---	3.08	---	---	---	---	---	32.67
3.94	83,621	33.80	34.03 ic	14.42 ic	16.03 ic	---	3.58	---	---	---	---	---	34.03
4.04	87,028	33.90	35.50 ic	14.56 ic	16.72 ic	---	4.11	---	---	---	---	---	35.39
4.14	90,434	34.00	36.71 ic	14.67 ic	17.39 ic	---	4.65	---	---	---	---	---	36.71
4.24	94,101	34.10	38.07 ic	14.81 ic	18.02 ic	---	5.22	---	---	---	---	---	38.05
4.34	97,767	34.20	39.31 ic	14.89 ic	18.61 ic	---	5.81	---	---	---	---	---	39.31
4.44	101,433	34.30	40.31 ic	15.05 ic	18.81 ic	---	6.43	---	---	---	---	---	40.29
4.54	105,100	34.40	41.20 ic	15.18 ic	18.98 ic	---	7.04 s	---	---	---	---	---	41.20
4.64	108,766	34.50	42.05 ic	15.29 ic	19.11 ic	---	7.64 s	---	---	---	---	---	42.05
4.74	112,433	34.60	42.99 ic	15.44 ic	19.29 ic	---	8.26 s	---	---	---	---	---	42.99
4.84	116,099	34.70	43.92 ic	15.57 ic	19.47 ic	---	8.88 s	---	---	---	---	---	43.92
4.94	119,765	34.80	44.85 ic	15.71 ic	19.64 ic	---	9.51 s	---	---	---	---	---	44.85
5.04	123,432	34.90	45.77 ic	15.84 ic	19.80 ic	---	10.14 s	---	---	---	---	---	45.77
5.14	127,098	35.00	46.69 ic	15.96 ic	19.95 ic	---	10.78 s	---	---	---	---	---	46.69
5.24	131,033	35.10	47.60 ic	16.08 ic	20.09 ic	---	11.43 s	---	---	---	---	---	47.60
5.34	134,968	35.20	48.51 ic	16.19 ic	20.23 ic	---	12.08 s	---	---	---	---	---	48.50
5.44	138,903	35.30	49.40 ic	16.29 ic	20.37 ic	---	12.74 s	---	---	---	---	---	49.40
5.54	142,838	35.40	50.30 ic	16.40 ic	20.50 ic	---	13.41 s	---	---	---	---	---	50.30
5.64	146,772	35.50	51.19 ic	16.49 ic	20.62 ic	---	14.08 s	---	---	---	---	---	51.19
5.74	150,707	35.60	52.07 ic	16.59 ic	20.73 ic	---	14.75 s	---	---	---	---	---	52.07
5.84	154,642	35.70	52.95 ic	16.67 ic	20.84 ic	---	15.43 s	---	---	---	---	---	52.95
5.94	158,577	35.80	53.83 ic	16.76 ic	20.95 ic	---	16.12 s	---	---	---	---	---	53.83
6.04	162,512	35.90	54.70 ic	16.84 ic	21.05 ic	---	16.81 s	---	---	---	---	---	54.70
6.14	166,447	36.00	55.56 ic	16.91 ic	21.14 ic	---	17.50 s	---	---	---	---	---	55.56
6.24	170,658	36.10	56.42 ic	16.99 ic	21.23 ic	---	18.20 s	---	---	---	---	---	56.42
6.34	174,870	36.20	57.28 ic	17.05 ic	21.32 ic	---	18.90 s	---	---	---	---	---	57.27
6.44	179,082	36.30	58.13 ic	17.12 ic	21.40 ic	---	19.60 s	---	---	---	---	---	58.12
6.54	183,294	36.40	58.97 ic	17.18 ic	21.48 ic	---	20.31 s	---	---	---	---	---	58.97
6.64	187,505	36.50	59.81 ic	17.24 ic	21.55 ic	---	21.02 s	---	---	---	---	---	59.81
6.74	191,717	36.60	60.65 ic	17.29 ic	21.62 ic	---	21.73 s	---	---	---	---	---	60.65
6.84	195,929	36.70	61.48 ic	17.35 ic	21.68 ic	---	22.45 s	---	---	---	---	---	61.48
6.94	200,140	36.80	62.30 ic	17.39 ic	21.74 ic	---	23.17 s	---	---	---	---	---	62.30
7.04	204,352	36.90	63.13 ic	17.44 ic	21.80 ic	---	23.89 s	---	---	---	---	---	63.13
7.14	208,564	37.00	63.94 ic	17.48 ic	21.85 ic	---	24.61 s	---	---	---	---	---	63.94
7.24	213,017	37.10	64.76 ic	17.52 ic	21.90 ic	---	25.33 s	---	---	---	---	---	64.76
7.34	217,470	37.20	65.57 ic	17.56 ic	21.95 ic	---	26.05 s	---	---	---	---	---	65.56
7.44	221,923	37.30	66.37 ic	17.59 ic	21.99 ic	---	26.78 s	---	---	---	---	---	66.37
7.54	226,376	37.40	67.17 ic	17.63 ic	22.03 ic	---	27.51 s	---	---	---	---	---	67.17
7.64	230,829	37.50	67.96 ic	17.66 ic	22.07 ic	---	28.23 s	---	---	---	---	---	67.96
7.74	235,282	37.60	68.75 ic	17.68 ic	22.11 ic	---	28.96 s	---	---	---	---	---	68.75
7.84	239,735	37.70	69.54 ic	17.71 ic	22.14 ic	---	29.69 s	---	---	---	---	---	69.54
7.94	244,188	37.80	70.32 ic	17.73 ic	22.17 ic	---	30.42 s	---	---	---	---	---	70.32
8.04	248,641	37.90	71.10 ic	17.75 ic	22.19 ic	---	31.15 s	---	---	---	---	---	71.10
8.14	253,094	38.00	71.87 ic	17.77 ic	22.21 ic	---	31.88 s	---	---	---	---	---	71.87

...End

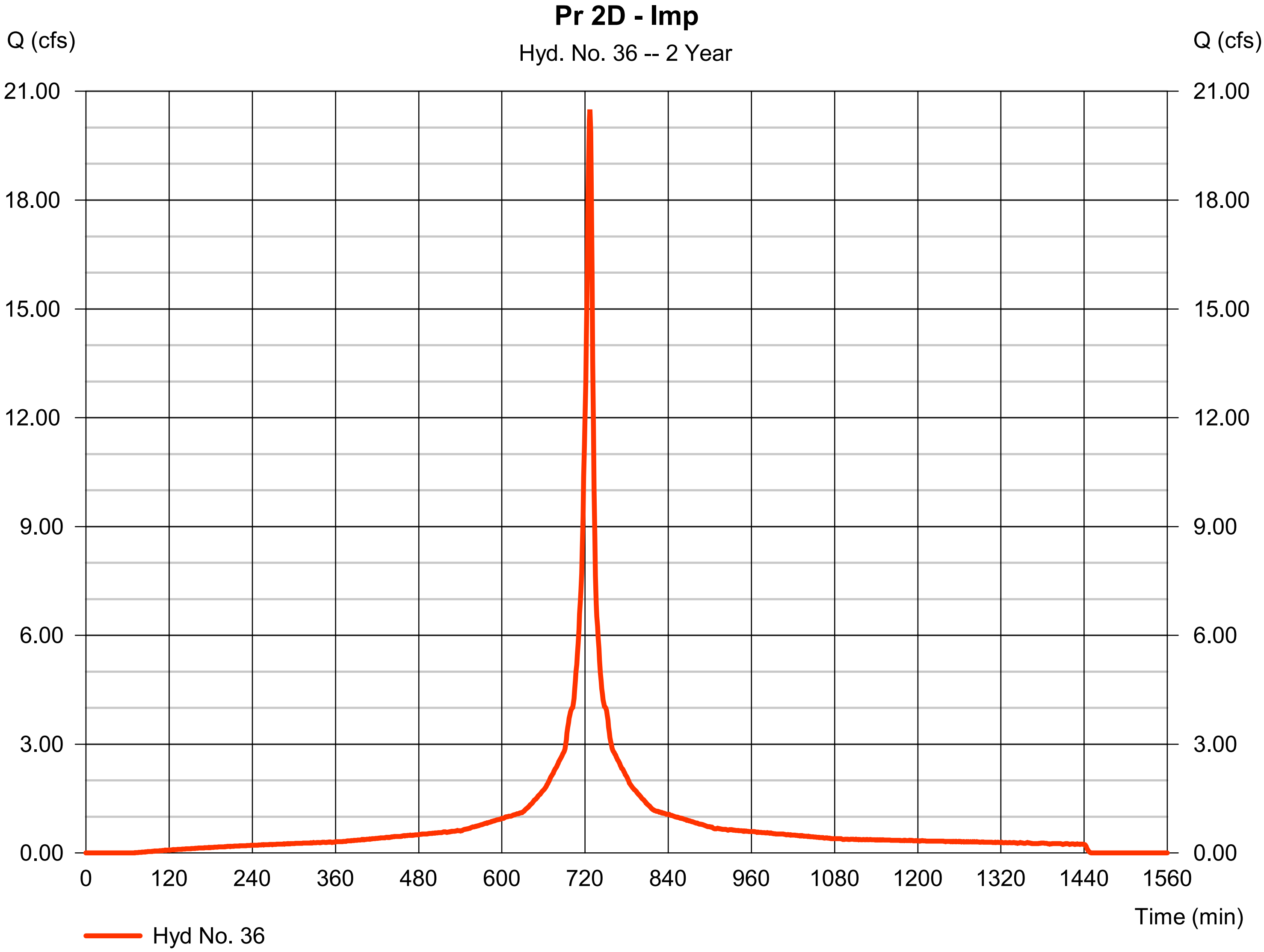
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 36

Pr 2D - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 20.50 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 73,276 cuft
Drainage area	= 6.280 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

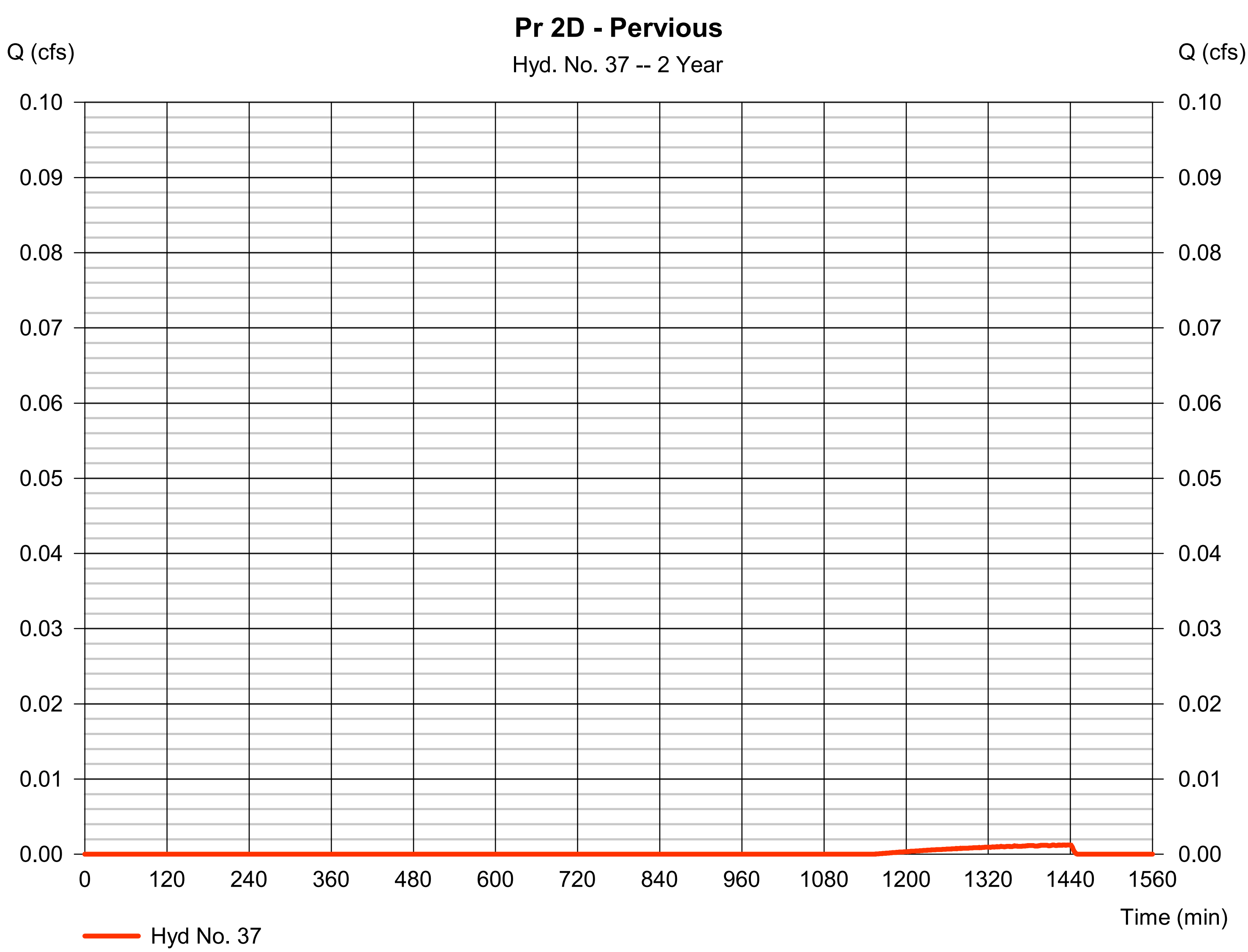


Hydrograph Report

Hyd. No. 37

Pr 2D - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.001 cfs
Storm frequency	= 2 yrs	Time to peak	= 1436 min
Time interval	= 1 min	Hyd. volume	= 14 cuft
Drainage area	= 1.170 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



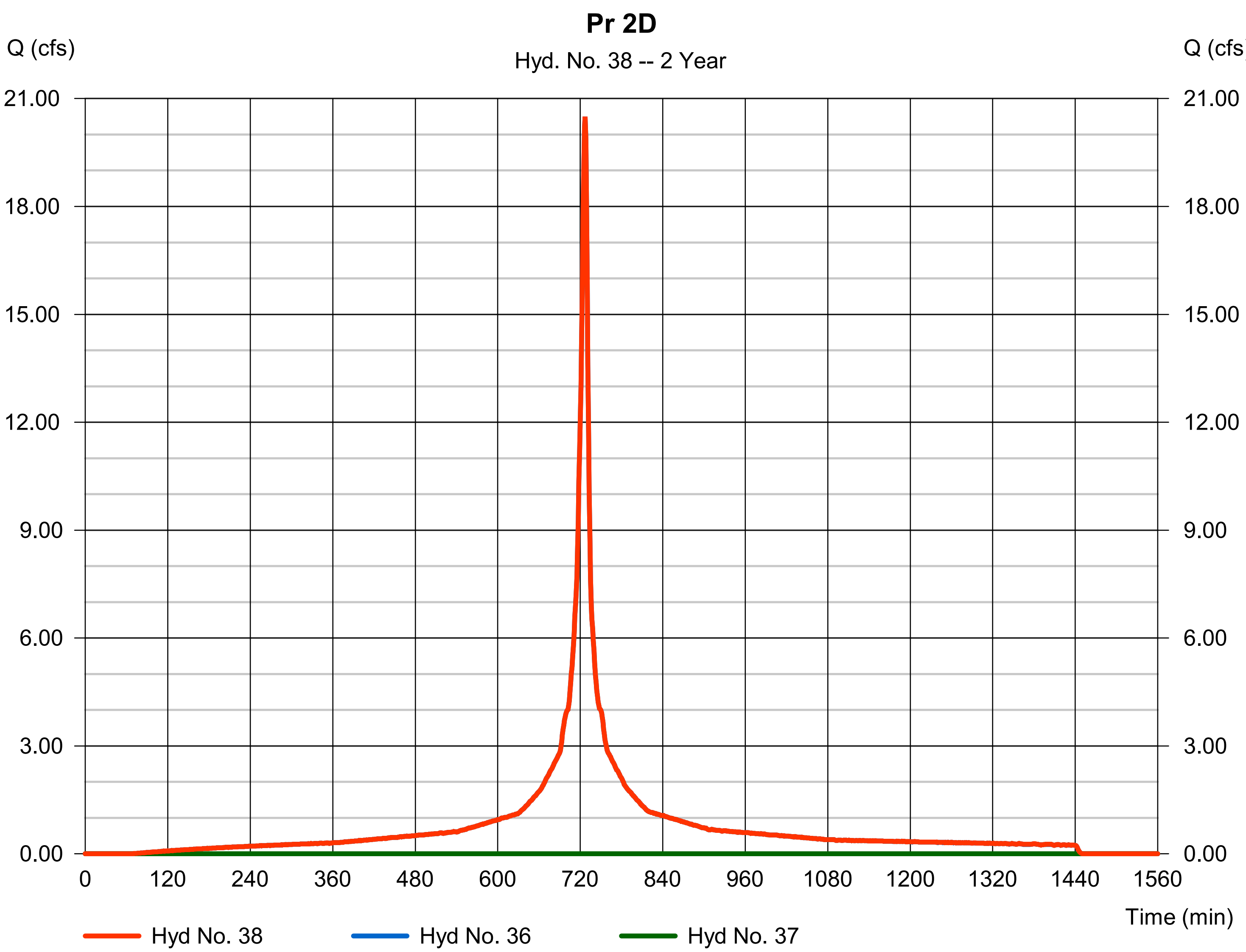
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 38

Pr 2D

Hydrograph type	= Combine	Peak discharge	= 20.50 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 73,289 cuft
Inflow hyds.	= 36, 37	Contrib. drain. area	= 7.450 ac



Hydrograph Report

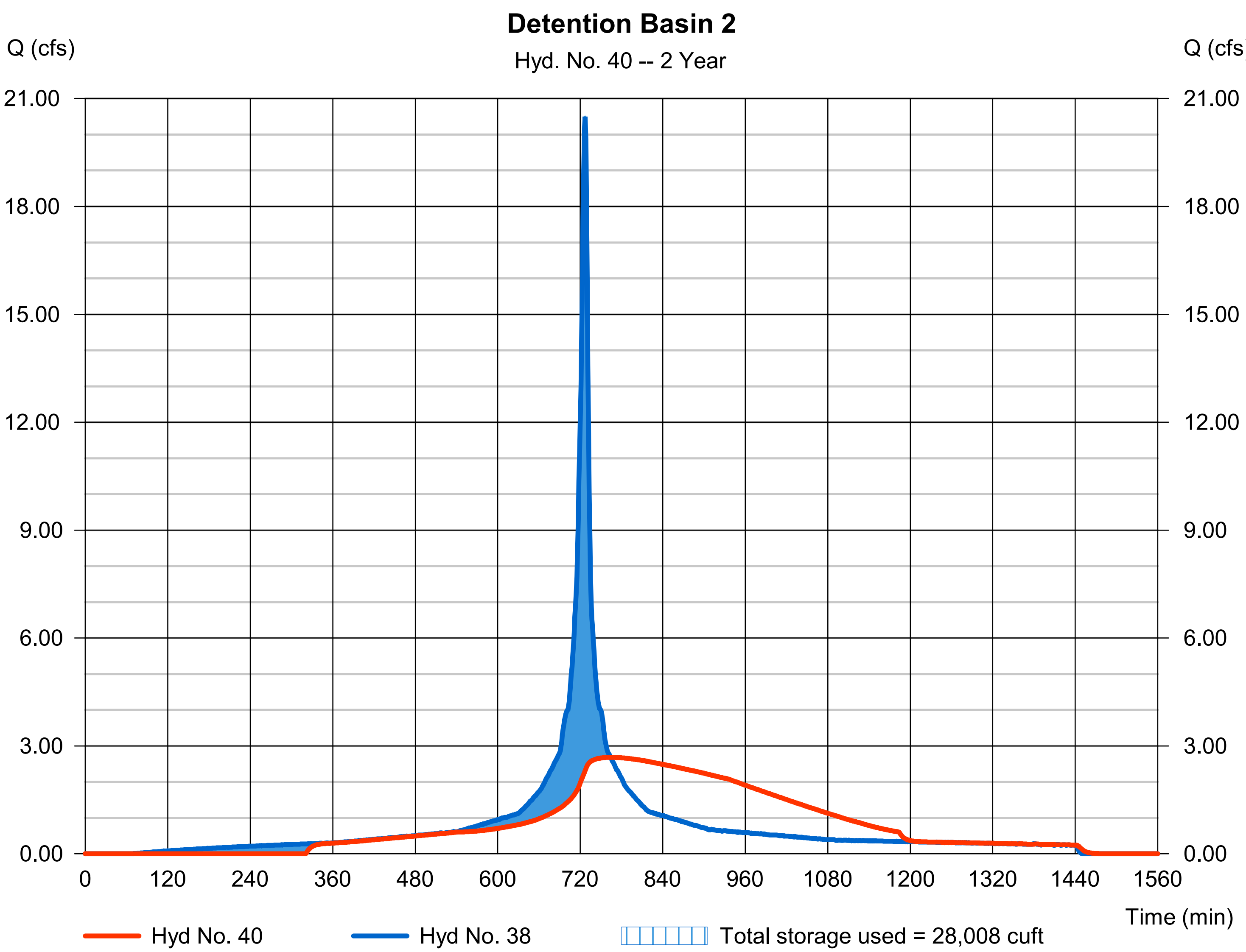
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 40

Detention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 2.679 cfs
Storm frequency	= 2 yrs	Time to peak	= 764 min
Time interval	= 1 min	Hyd. volume	= 70,903 cuft
Inflow hyd. No.	= 38 - Pr 2D	Max. Elevation	= 30.70 ft
Reservoir name	= Detention Basin 2	Max. Storage	= 28,008 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Detention Basin 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 28.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	28.00	01	0	0
1.00	29.00	7,864	2,651	2,651
2.00	30.00	17,430	12,333	14,984
3.00	31.00	19,999	18,698	33,682
4.00	32.00	22,639	21,303	54,985
5.00	33.00	25,349	23,979	78,964
6.00	34.00	28,128	26,724	105,687

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	9.00	9.50	Inactive
Span (in)	= 24.00	9.00	9.50	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 28.00	28.00	30.75	0.00
Length (ft)	= 472.00	0.00	0.00	0.00
Slope (%)	= 1.03	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.40	Inactive	Inactive	Inactive
Crest El. (ft)	= 31.56	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 28.90

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	28.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.10	265	28.10	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.20	530	28.20	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.30	795	28.30	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.40	1,060	28.40	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.50	1,325	28.50	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.60	1,591	28.60	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.70	1,856	28.70	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.80	2,121	28.80	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.90	2,386	28.90	0.00	0.00 ic	0.00	---	0.00	---	---	---	---	---	0.000
1.00	2,651	29.00	0.61 oc	0.60 ic	0.00	---	0.00	---	---	---	---	---	0.604
1.10	3,884	29.10	0.86 oc	0.86 ic	0.00	---	0.00	---	---	---	---	---	0.859
1.20	5,117	29.20	1.08 oc	1.06 ic	0.00	---	0.00	---	---	---	---	---	1.057
1.30	6,351	29.30	1.23 oc	1.23 ic	0.00	---	0.00	---	---	---	---	---	1.226
1.40	7,584	29.40	1.38 oc	1.38 ic	0.00	---	0.00	---	---	---	---	---	1.377
1.50	8,817	29.50	1.51 oc	1.51 ic	0.00	---	0.00	---	---	---	---	---	1.514
1.60	10,051	29.60	1.64 oc	1.64 ic	0.00	---	0.00	---	---	---	---	---	1.642
1.70	11,284	29.70	1.77 oc	1.76 ic	0.00	---	0.00	---	---	---	---	---	1.759
1.80	12,517	29.80	1.87 oc	1.87 ic	0.00	---	0.00	---	---	---	---	---	1.868
1.90	13,750	29.90	1.98 oc	1.98 ic	0.00	---	0.00	---	---	---	---	---	1.976
2.00	14,984	30.00	2.10 oc	2.08 ic	0.00	---	0.00	---	---	---	---	---	2.076
2.10	16,853	30.10	2.17 oc	2.17 ic	0.00	---	0.00	---	---	---	---	---	2.171
2.20	18,723	30.20	2.27 oc	2.27 ic	0.00	---	0.00	---	---	---	---	---	2.266
2.30	20,593	30.30	2.35 oc	2.35 ic	0.00	---	0.00	---	---	---	---	---	2.352
2.40	22,463	30.40	2.44 oc	2.44 ic	0.00	---	0.00	---	---	---	---	---	2.441
2.50	24,333	30.50	2.57 oc	2.52 ic	0.00	---	0.00	---	---	---	---	---	2.522
2.60	26,202	30.60	2.61 oc	2.61 ic	0.00	---	0.00	---	---	---	---	---	2.605
2.70	28,072	30.70	2.73 oc	2.68 ic	0.00	---	0.00	---	---	---	---	---	2.682
2.80	29,942	30.80	2.77 oc	2.76 ic	0.01 ic	---	0.00	---	---	---	---	---	2.771
2.90	31,812	30.90	2.92 oc	2.83 ic	0.09 ic	---	0.00	---	---	---	---	---	2.918
3.00	33,682	31.00	3.12 oc	2.89 ic	0.23 ic	---	0.00	---	---	---	---	---	3.118
3.10	35,812	31.10	3.38 oc	2.95 ic	0.43 ic	---	0.00	---	---	---	---	---	3.378
3.20	37,942	31.20	3.68 oc	3.01 ic	0.66 ic	---	0.00	---	---	---	---	---	3.668
3.30	40,073	31.30	4.00 oc	3.06 ic	0.93 ic	---	0.00	---	---	---	---	---	3.985
3.40	42,203	31.40	4.32 oc	3.11 ic	1.19 ic	---	0.00	---	---	---	---	---	4.301
3.50	44,333	31.50	4.64 oc	3.16 ic	1.42 ic	---	0.00	---	---	---	---	---	4.582

Continues on next page...

Detention Basin 2

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
3.60	46,463	31.60	4.82 oc	3.22 ic	1.60 ic	---	0.01	---	---	---	---	---	4.824
3.70	48,594	31.70	5.12 oc	3.27 ic	1.76 ic	---	0.07	---	---	---	---	---	5.102
3.80	50,724	31.80	5.44 oc	3.32 ic	1.92 ic	---	0.16	---	---	---	---	---	5.390
3.90	52,854	31.90	5.75 oc	3.36 ic	2.06 ic	---	0.26	---	---	---	---	---	5.687
4.00	54,985	32.00	6.06 oc	3.41 ic	2.19 ic	---	0.39	---	---	---	---	---	5.991
4.10	57,383	32.10	6.36 oc	3.46 ic	2.31 ic	---	0.53	---	---	---	---	---	6.303
4.20	59,781	32.20	6.66 oc	3.51 ic	2.43 ic	---	0.68	---	---	---	---	---	6.622
4.30	62,178	32.30	6.95 oc	3.55 ic	2.55 ic	---	0.85	---	---	---	---	---	6.947
4.40	64,576	32.40	7.27 oc	3.60 ic	2.65 ic	---	1.03	---	---	---	---	---	7.275
4.50	66,974	32.50	7.65 oc	3.64 ic	2.76 ic	---	1.21	---	---	---	---	---	7.609
4.60	69,372	32.60	7.95 oc	3.68 ic	2.86 ic	---	1.41	---	---	---	---	---	7.950
4.70	71,770	32.70	8.30 oc	3.72 ic	2.95 ic	---	1.62	---	---	---	---	---	8.296
4.80	74,168	32.80	8.65 oc	3.76 ic	3.05 ic	---	1.84	---	---	---	---	---	8.647
4.90	76,566	32.90	9.00 oc	3.80 ic	3.14 ic	---	2.07	---	---	---	---	---	9.001
5.00	78,964	33.00	9.36 oc	3.83 ic	3.23 ic	---	2.30	---	---	---	---	---	9.361
5.10	81,636	33.10	9.72 oc	3.87 ic	3.31 ic	---	2.55	---	---	---	---	---	9.723
5.20	84,308	33.20	10.09 oc	3.90 ic	3.40 ic	---	2.80	---	---	---	---	---	10.09
5.30	86,981	33.30	10.45 oc	3.92 ic	3.48 ic	---	3.06	---	---	---	---	---	10.45
5.40	89,653	33.40	10.76 oc	3.88 ic	3.56 ic	---	3.32	---	---	---	---	---	10.76
5.50	92,325	33.50	11.12 oc	3.89 ic	3.64 ic	---	3.60	---	---	---	---	---	11.12
5.60	94,998	33.60	11.49 oc	3.90 ic	3.71 ic	---	3.88	---	---	---	---	---	11.49
5.70	97,670	33.70	11.86 oc	3.90 ic	3.79 ic	---	4.17	---	---	---	---	---	11.86
5.80	100,343	33.80	12.24 oc	3.91 ic	3.86 ic	---	4.47	---	---	---	---	---	12.24
5.90	103,015	33.90	12.61 oc	3.91 ic	3.93 ic	---	4.77	---	---	---	---	---	12.61
6.00	105,687	34.00	12.99 oc	3.91 ic	4.00 ic	---	5.08	---	---	---	---	---	12.99

...End

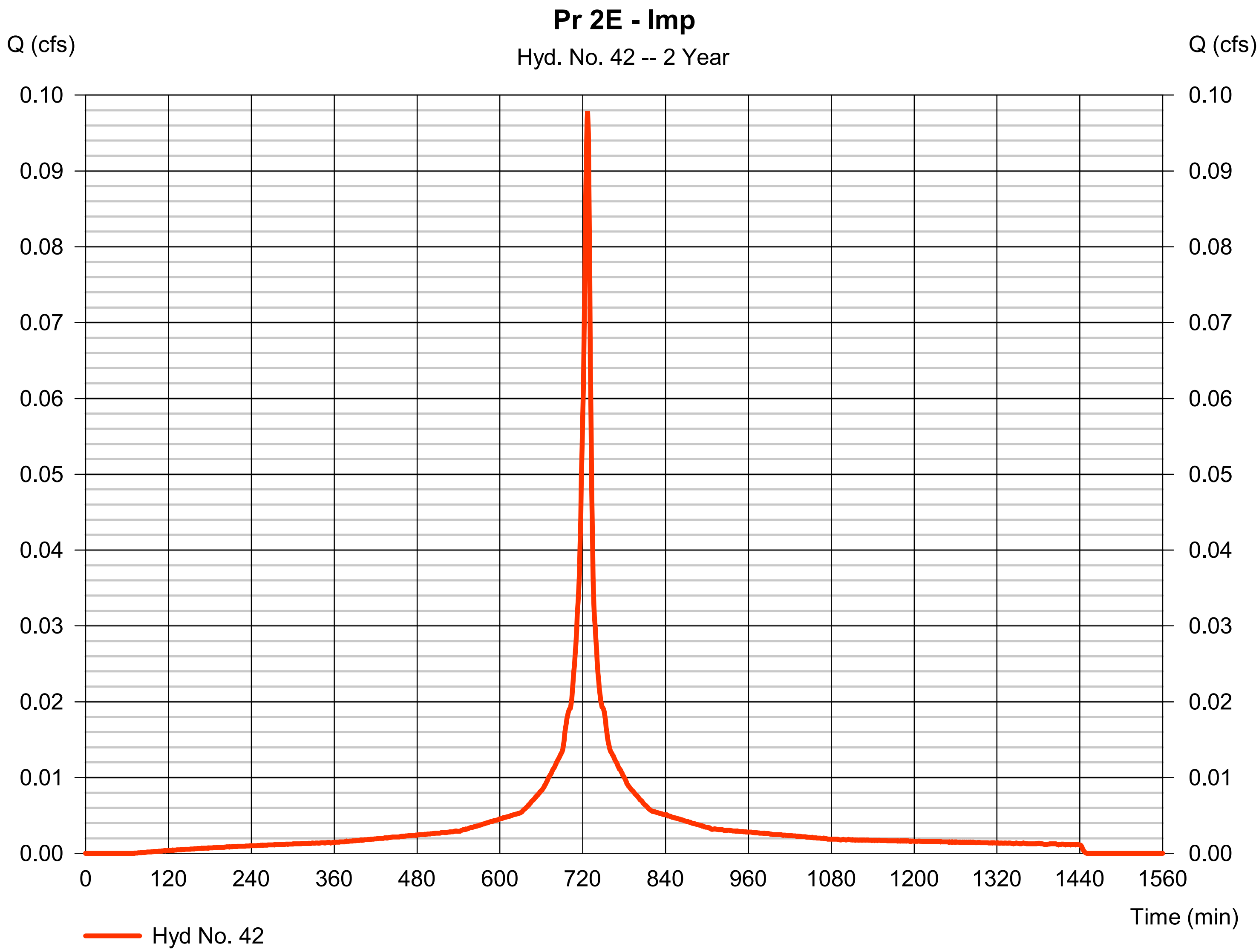
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 42

Pr 2E - Imp

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.098 cfs
Storm frequency	=	2 yrs	Time to peak	=	727 min
Time interval	=	1 min	Hyd. volume	=	350 cuft
Drainage area	=	0.030 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.35 in	Distribution	=	Custom
Storm duration	=	\\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	=	484



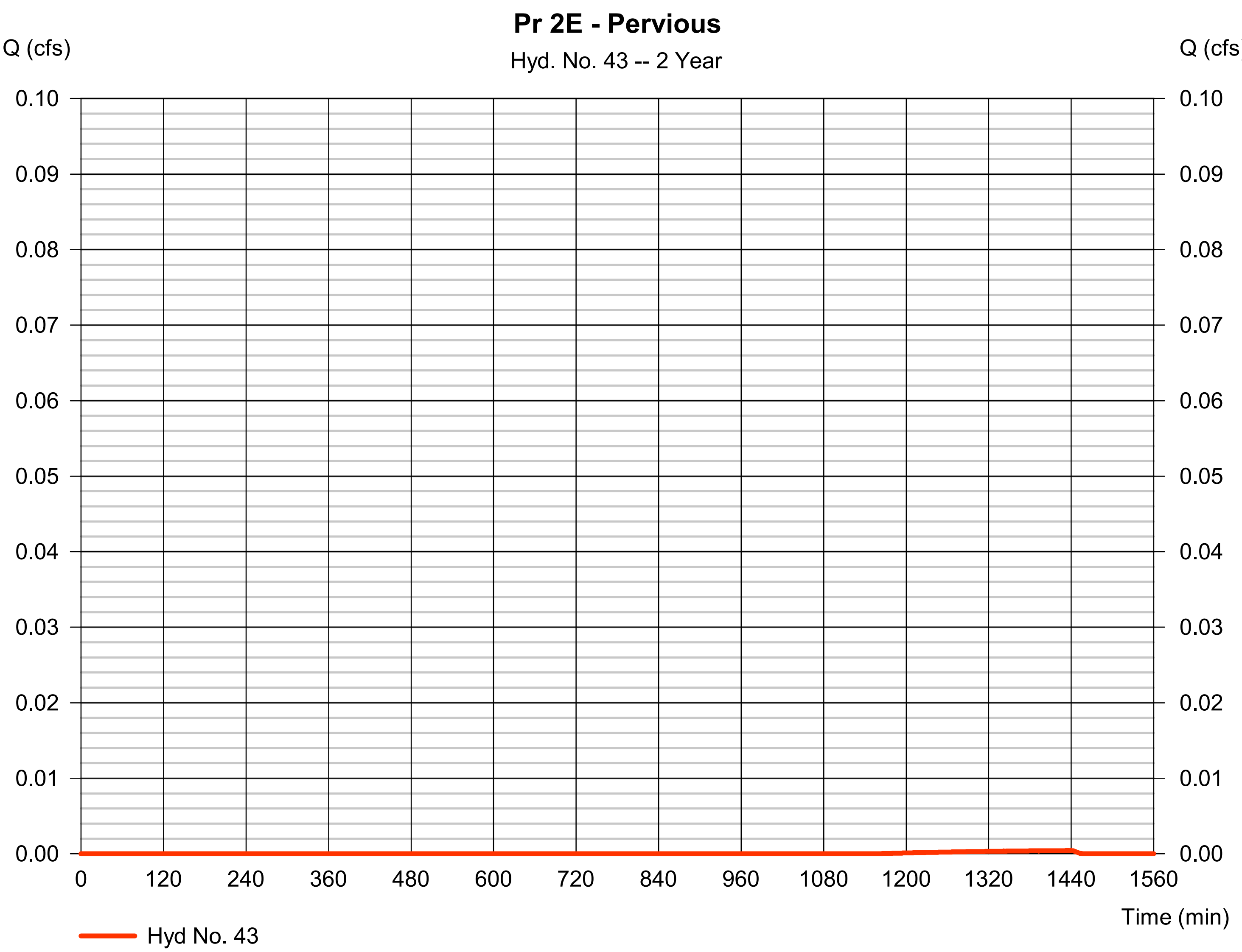
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 43

Pr 2E - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 5 cuft
Drainage area	= 0.410 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



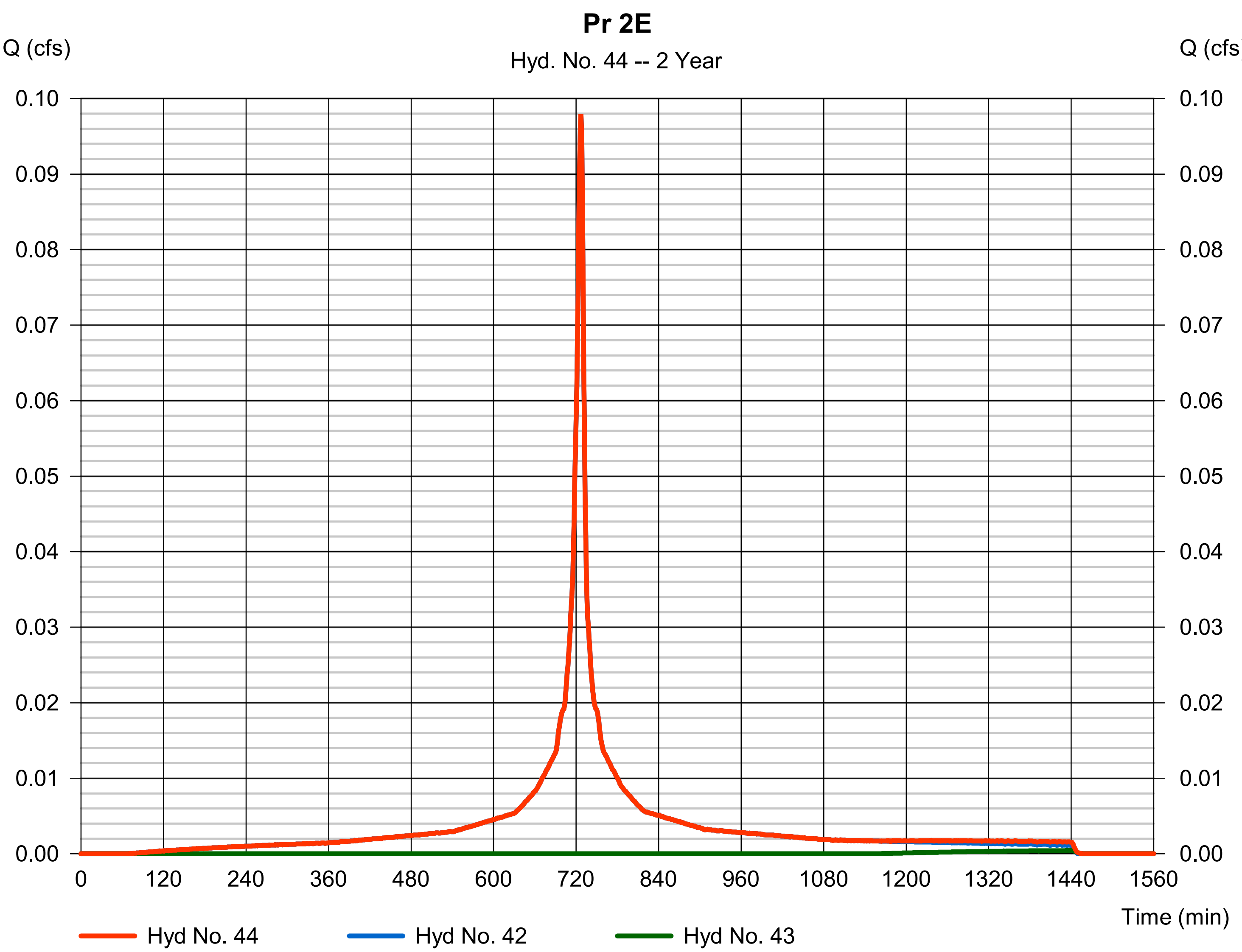
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 44

Pr 2E

Hydrograph type	= Combine	Peak discharge	= 0.098 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 355 cuft
Inflow hyds.	= 42, 43	Contrib. drain. area	= 0.440 ac



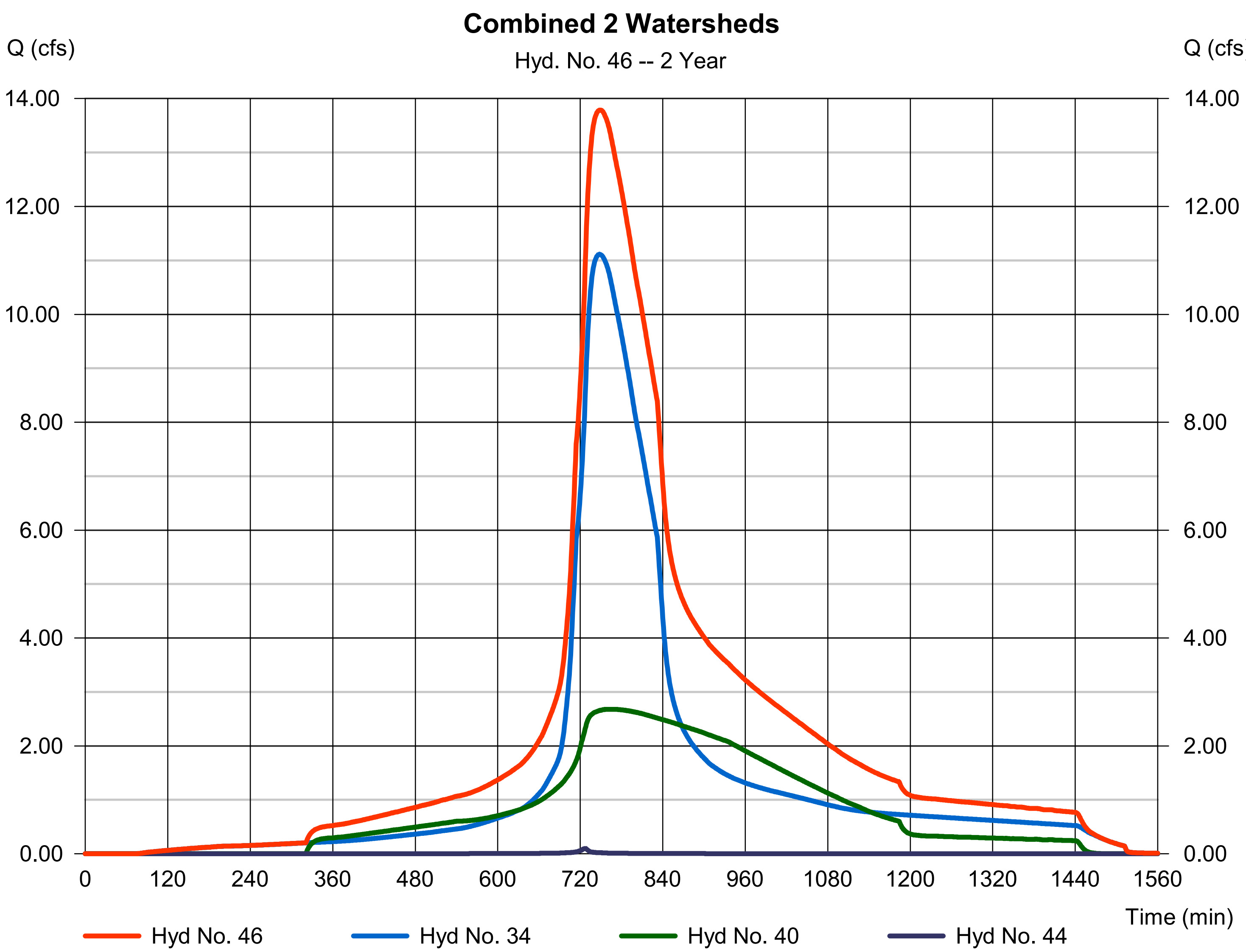
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 46

Combined 2 Watersheds

Hydrograph type	= Combine	Peak discharge	= 13.79 cfs
Storm frequency	= 2 yrs	Time to peak	= 749 min
Time interval	= 1 min	Hyd. volume	= 193,080 cuft
Inflow hyds.	= 34, 40, 44	Contrib. drain. area	= 0.000 ac



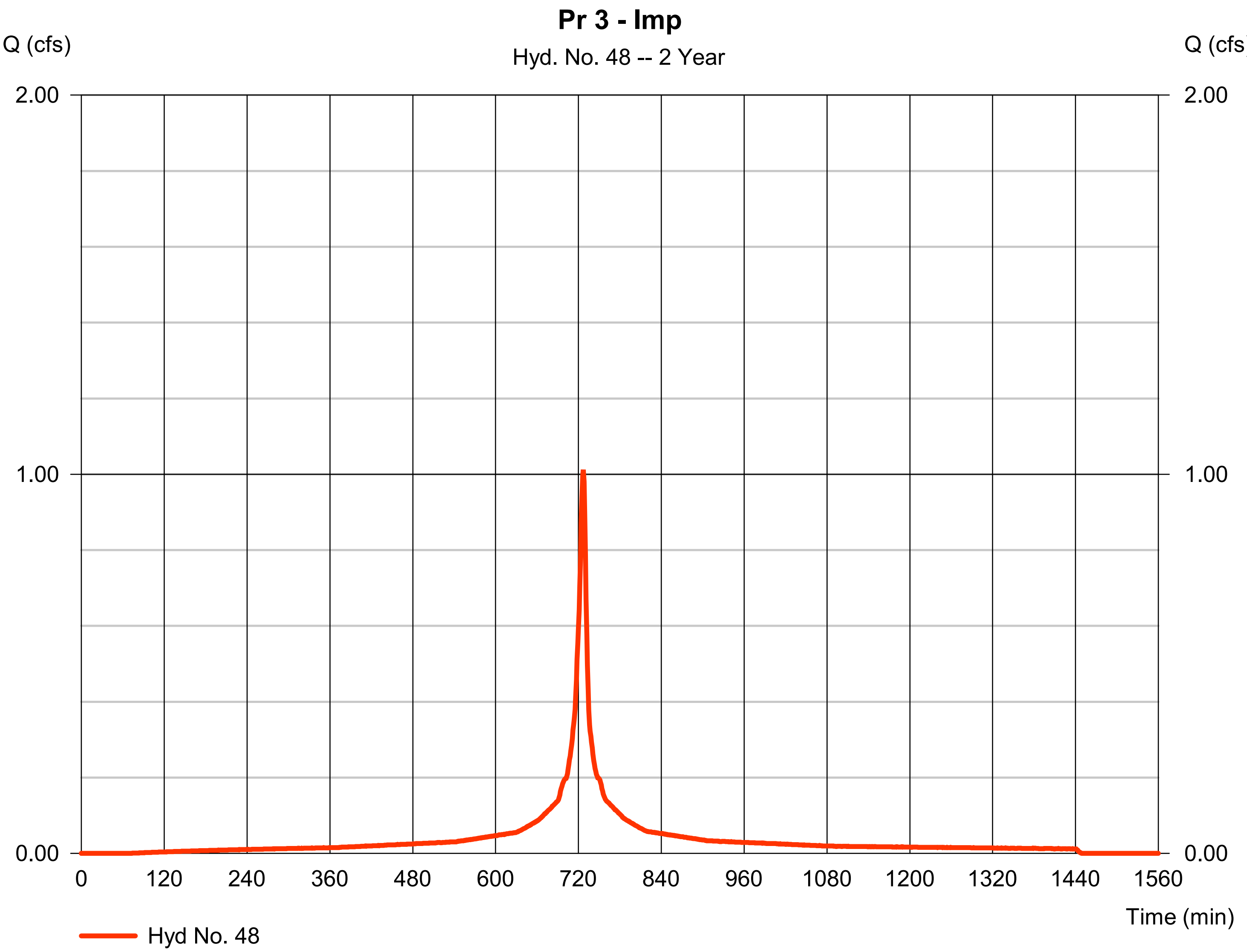
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 48

Pr 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.012 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 3,617 cuft
Drainage area	= 0.310 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

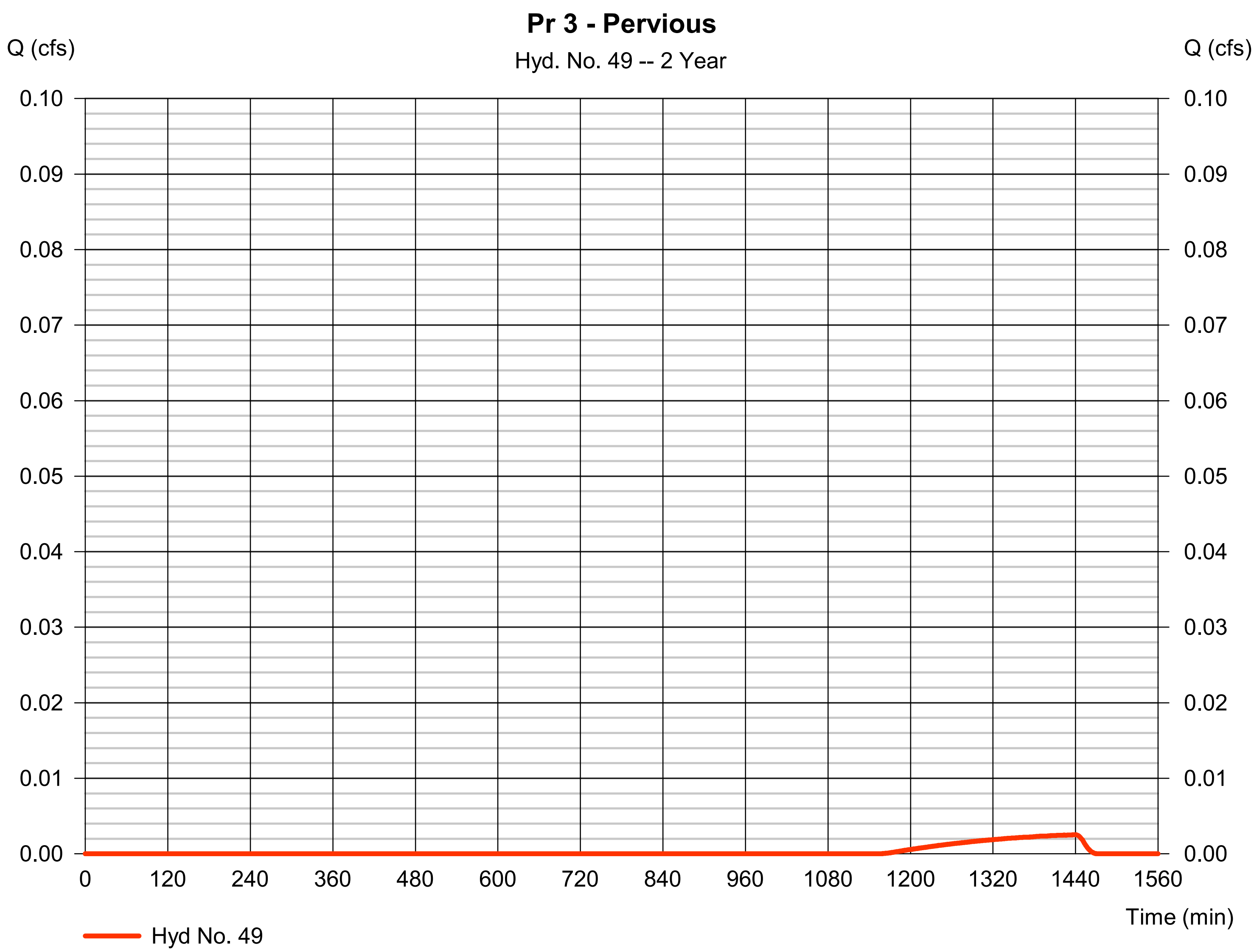


Hydrograph Report

Hyd. No. 49

Pr 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.003 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 1 min	Hyd. volume	= 28 cuft
Drainage area	= 2.510 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.00 min
Total precip.	= 3.35 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



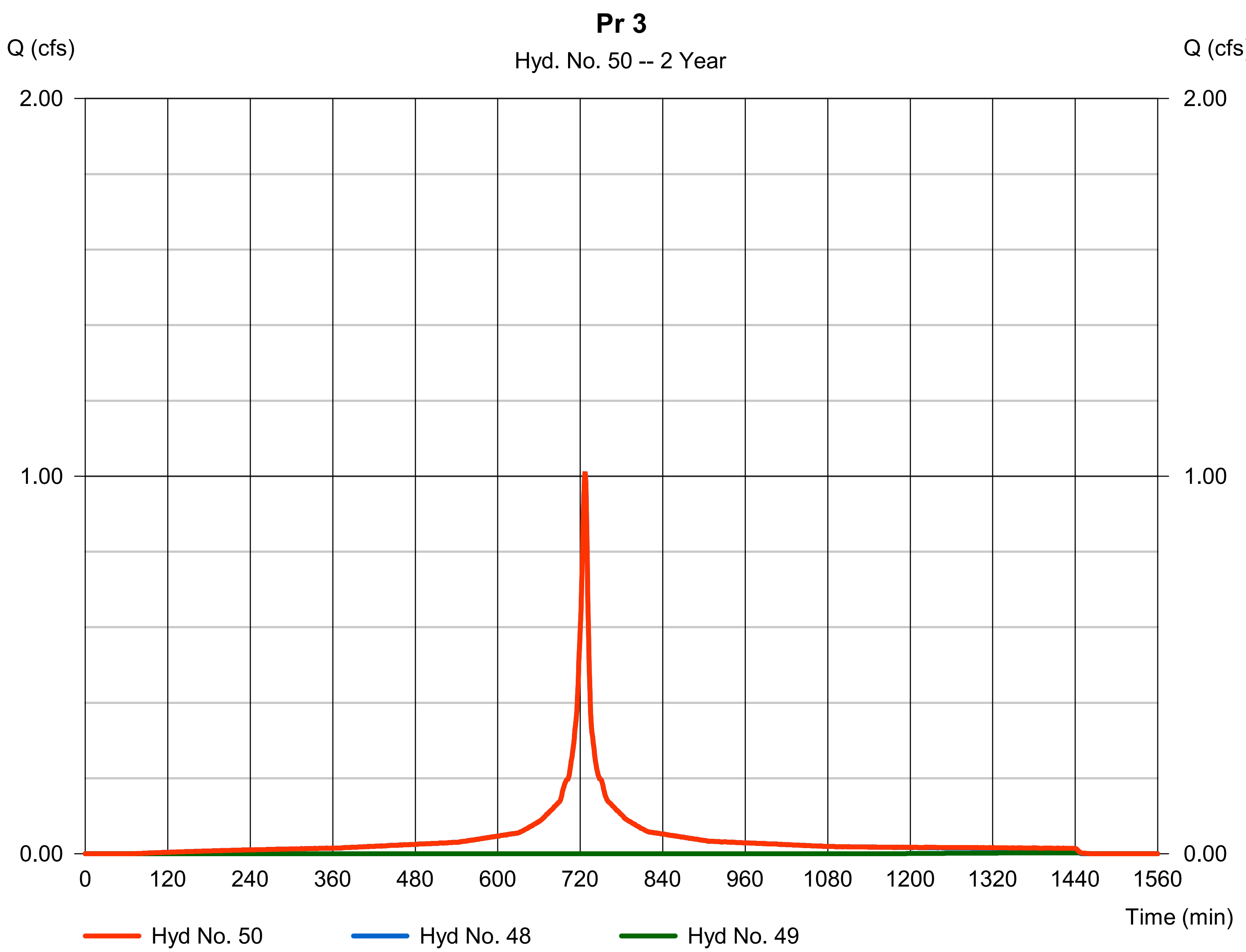
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 50

Pr 3

Hydrograph type	= Combine	Peak discharge	= 1.012 cfs
Storm frequency	= 2 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 3,645 cuft
Inflow hyds.	= 48, 49	Contrib. drain. area	= 2.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	10.27	1	736	53,724	------	------	------	Ex 1 - Imp
2	SCS Runoff	0.383	1	774	7,519	------	------	------	Ex 1 - Pervious
3	Combine	10.30	1	736	61,243	1, 2	------	------	Ex 1
5	SCS Runoff	43.63	1	728	176,898	------	------	------	Ex 2 - Imp
6	SCS Runoff	0.225	1	766	4,393	------	------	------	Ex 2 - Pervious
7	Combine	43.63	1	728	181,291	5, 6	------	------	Ex 2
9	SCS Runoff	10.34	1	727	37,655	------	------	------	Ex 3 - Imp
10	SCS Runoff	0.181	1	785	3,949	------	------	------	Ex 3 - Pervious
11	Combine	10.34	1	727	41,605	9, 10	------	------	Ex 3
14	SCS Runoff	1.018	1	730	4,537	------	------	------	Pr 1 - Imp
15	SCS Runoff	0.269	1	773	4,368	------	------	------	Pr 1 - Pervious
16	Combine	1.030	1	731	8,905	14, 15	------	------	Pr 1
18	SCS Runoff	25.85	1	727	94,138	------	------	------	Pr 2A - Imp
19	SCS Runoff	0.060	1	774	1,280	------	------	------	Pr 2A - Pervious
20	Combine	25.85	1	727	95,418	18, 19	------	------	Pr 2A
22	SCS Runoff	2.394	1	727	9,160	------	------	------	Pr 2B - Imp
23	SCS Runoff	0.010	1	775	223	------	------	------	Pr 2B - Pervious
24	Combine	2.394	1	727	9,382	22, 23	------	------	Pr 2B
25	Reservoir	2.329	1	729	7,908	24	37.81	1,989	Bioretention Basin 1
27	SCS Runoff	32.63	1	727	118,814	------	------	------	Pr 2C - Imp
28	SCS Runoff	0.797	1	748	7,850	------	------	------	Pr 2C - Pervious
29	Combine	32.76	1	727	126,664	27, 28	------	------	Pr 2C
30	Reservoir	23.20	1	731	106,992	29	38.07	35,118	Bioretention Basin 2
32	Combine	48.82	1	728	210,318	20, 25, 30,	------	------	Pr 2A, Bio Basin 1, Bio Basin 2
34	Reservoir	17.52	1	747	210,316	32	32.69	46,982	Detention Basin 1
36	SCS Runoff	31.52	1	727	114,793	------	------	------	Pr 2D - Imp
37	SCS Runoff	0.046	1	774	985	------	------	------	Pr 2D - Pervious
38	Combine	31.52	1	727	115,778	36, 37	------	------	Pr 2D
40	Reservoir	4.587	1	758	113,392	38	31.50	44,374	Detention Basin 2

Middlesex Analysis.gpw	Return Period: 10 Year	Wednesday, 03 / 25 / 2020

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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
42	SCS Runoff	0.151	1	727	548	------	------	------	Pr 2E - Imp
43	SCS Runoff	0.016	1	777	341	------	------	------	Pr 2E - Pervious
44	Combine	0.151	1	727	889	42, 43	------	------	Pr 2E
46	Combine	22.07	1	749	324,598	34, 40, 44,	------	------	Combined 2 Watersheds
48	SCS Runoff	1.556	1	727	5,667	------	------	------	Pr 3 - Imp
49	SCS Runoff	0.094	1	783	2,050	------	------	------	Pr 3 - Pervious
50	Combine	1.556	1	727	7,716	48, 49	------	------	Pr 3

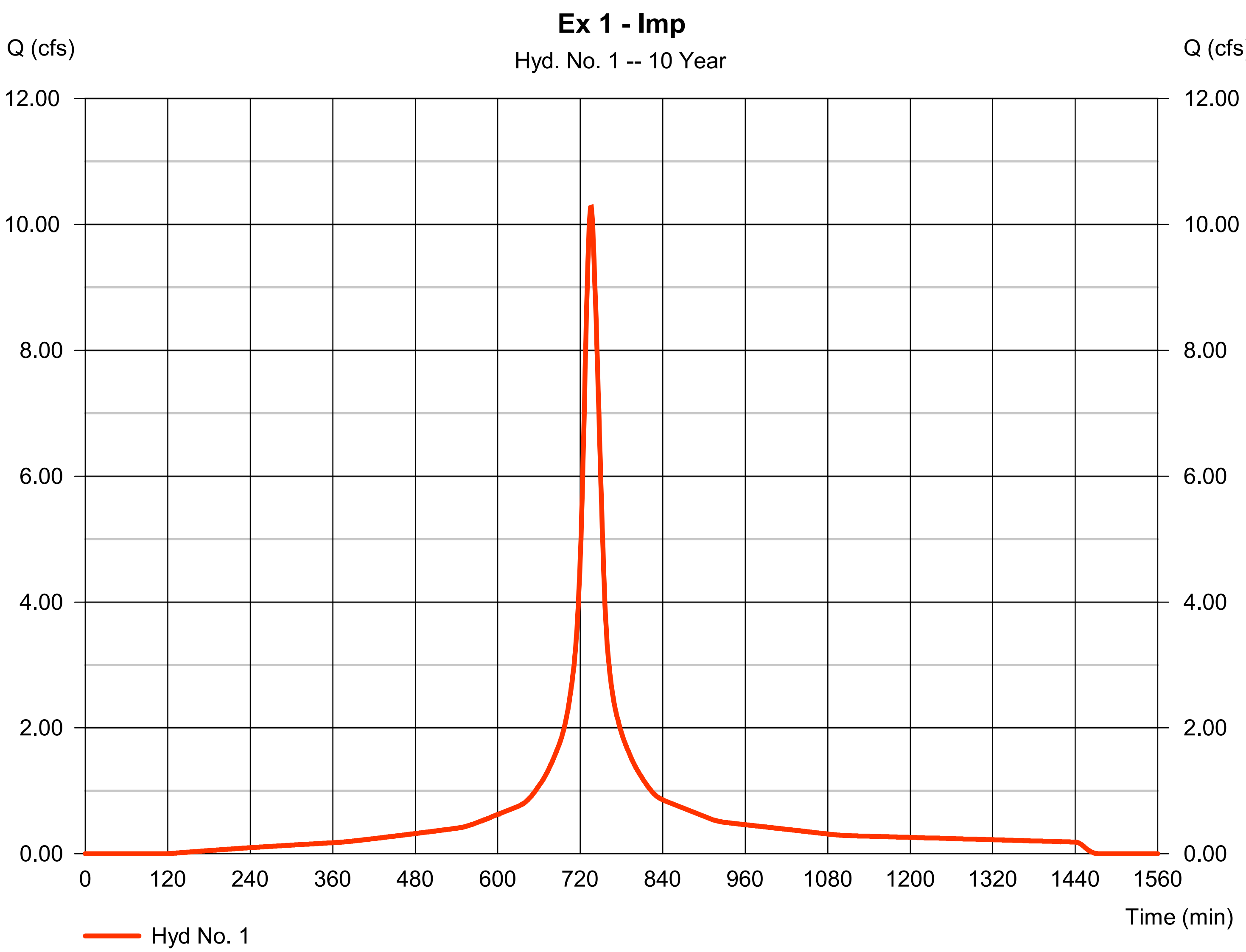
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 1

Ex 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 10.27 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 53,724 cuft
Drainage area	= 3.230 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



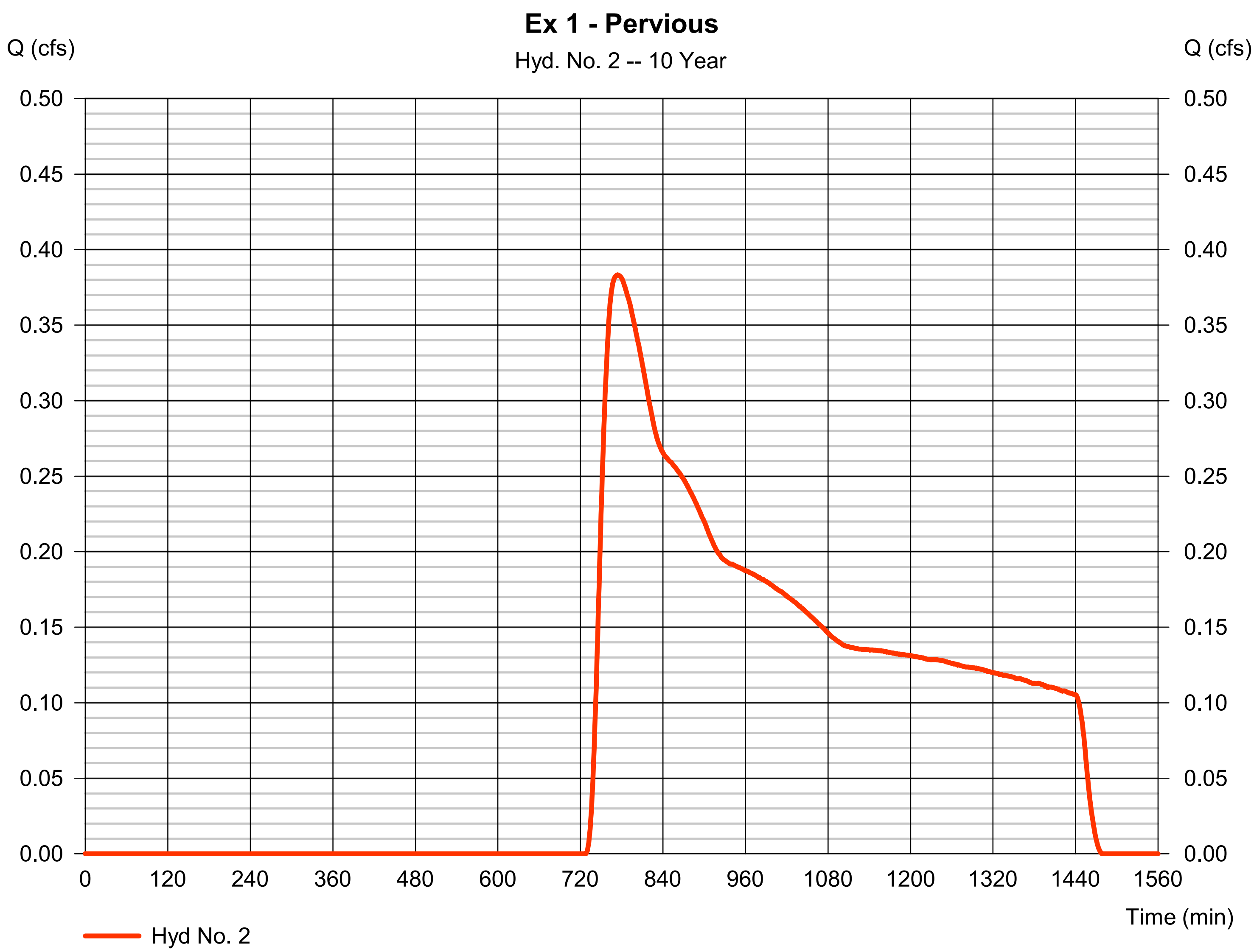
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 2

Ex 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.383 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 1 min	Hyd. volume	= 7,519 cuft
Drainage area	= 7.890 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



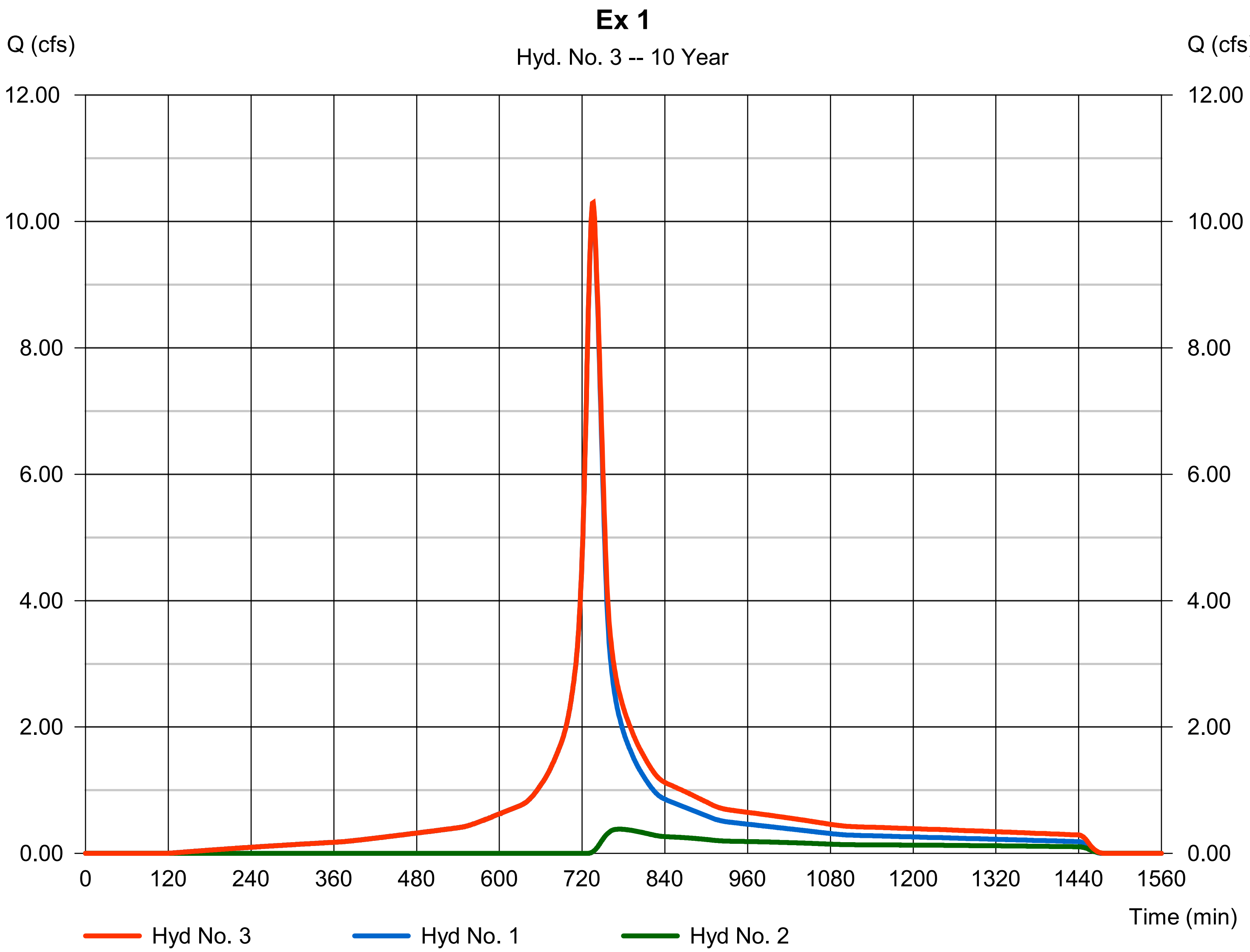
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 3

Ex 1

Hydrograph type	= Combine	Peak discharge	= 10.30 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 61,243 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 11.120 ac

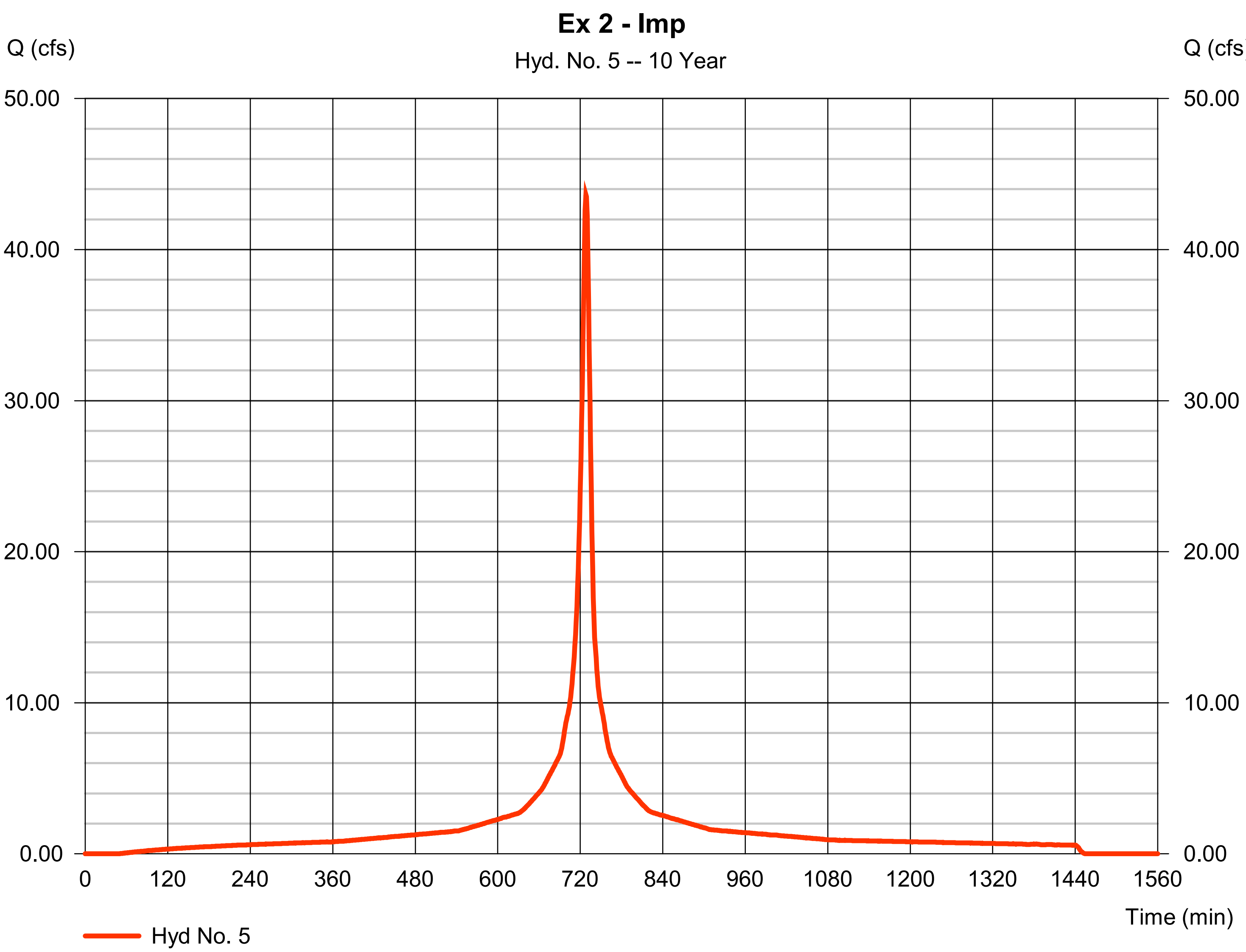


Hydrograph Report

Hyd. No. 5

Ex 2 - Imp

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.63 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	1 min	Hyd. volume	=	176,898 cuft
Drainage area	=	9.980 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.12 in	Distribution	=	Custom
Storm duration	=	\\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	=	484



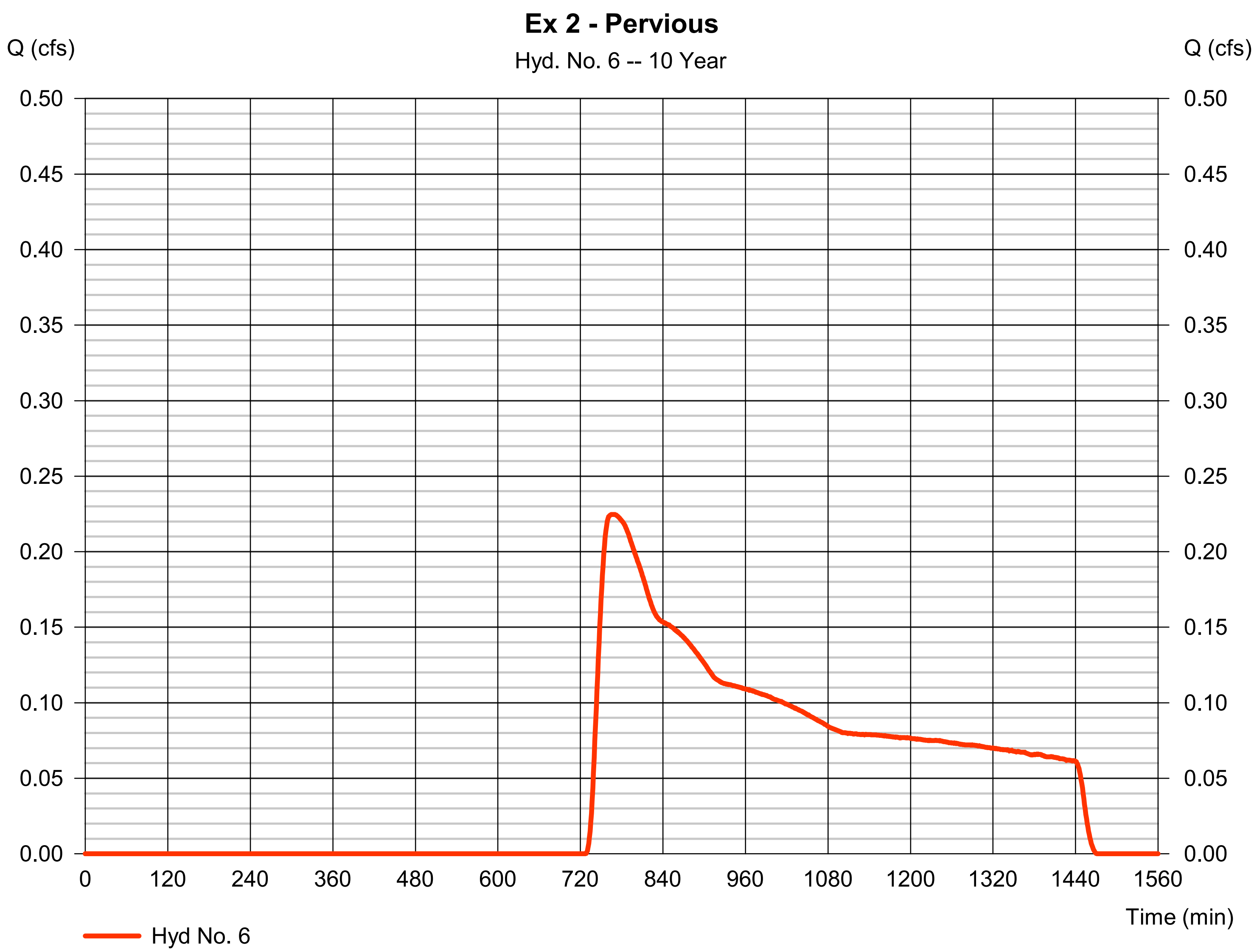
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 6

Ex 2 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.225 cfs
Storm frequency	= 10 yrs	Time to peak	= 766 min
Time interval	= 1 min	Hyd. volume	= 4,393 cuft
Drainage area	= 4.610 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 19.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



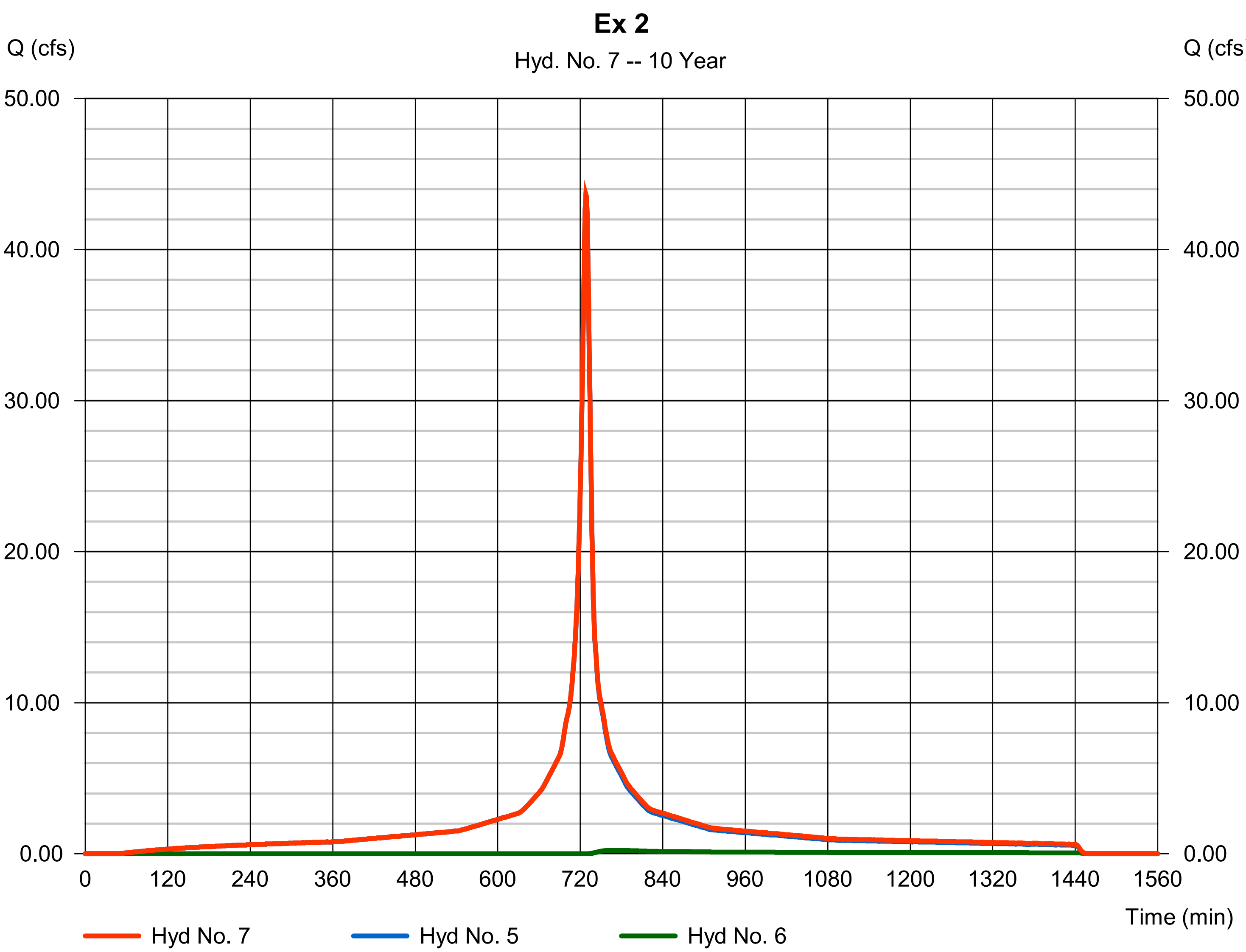
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 7

Ex 2

Hydrograph type	= Combine	Peak discharge	= 43.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 181,291 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 14.590 ac



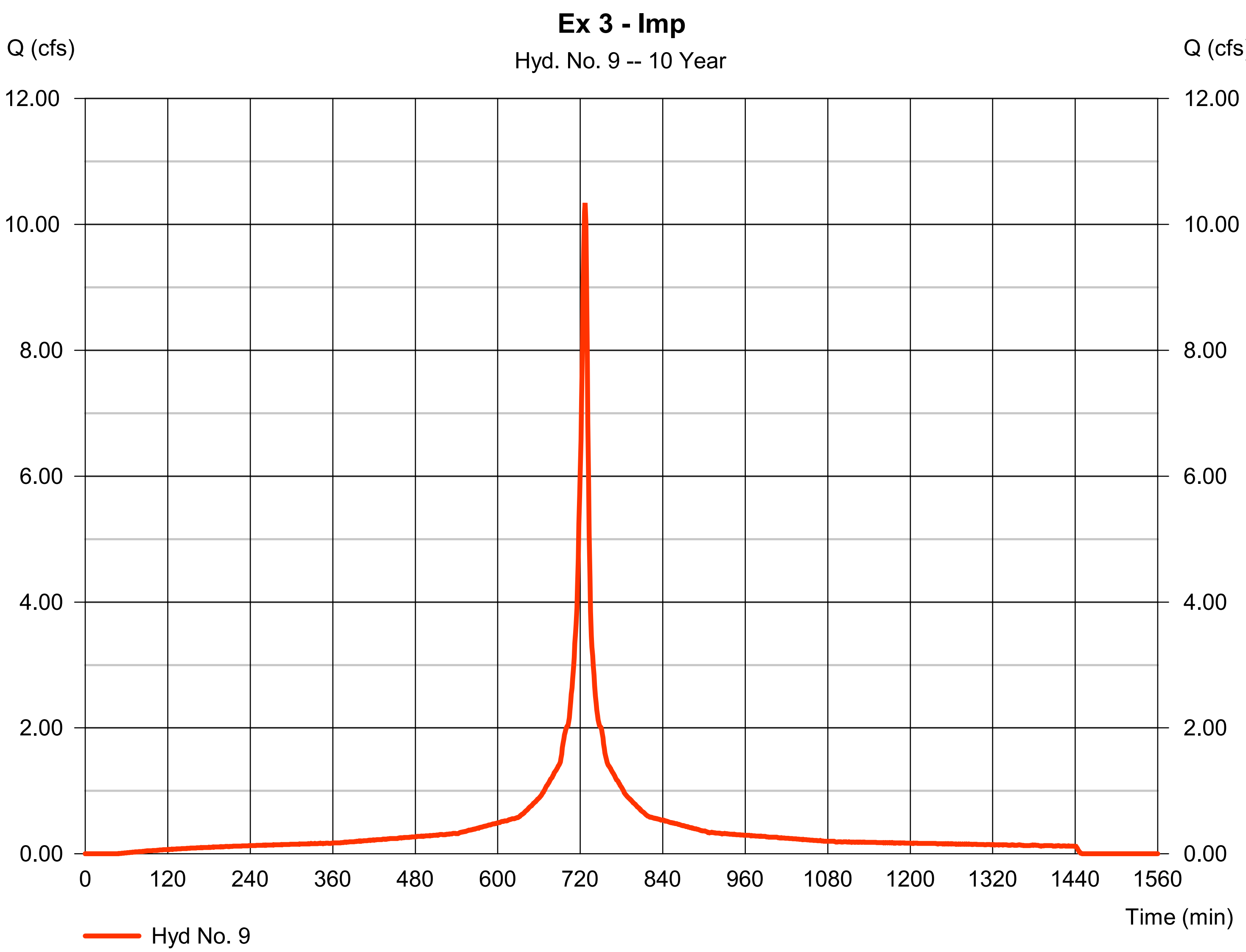
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 9

Ex 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 10.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 37,655 cuft
Drainage area	= 2.060 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

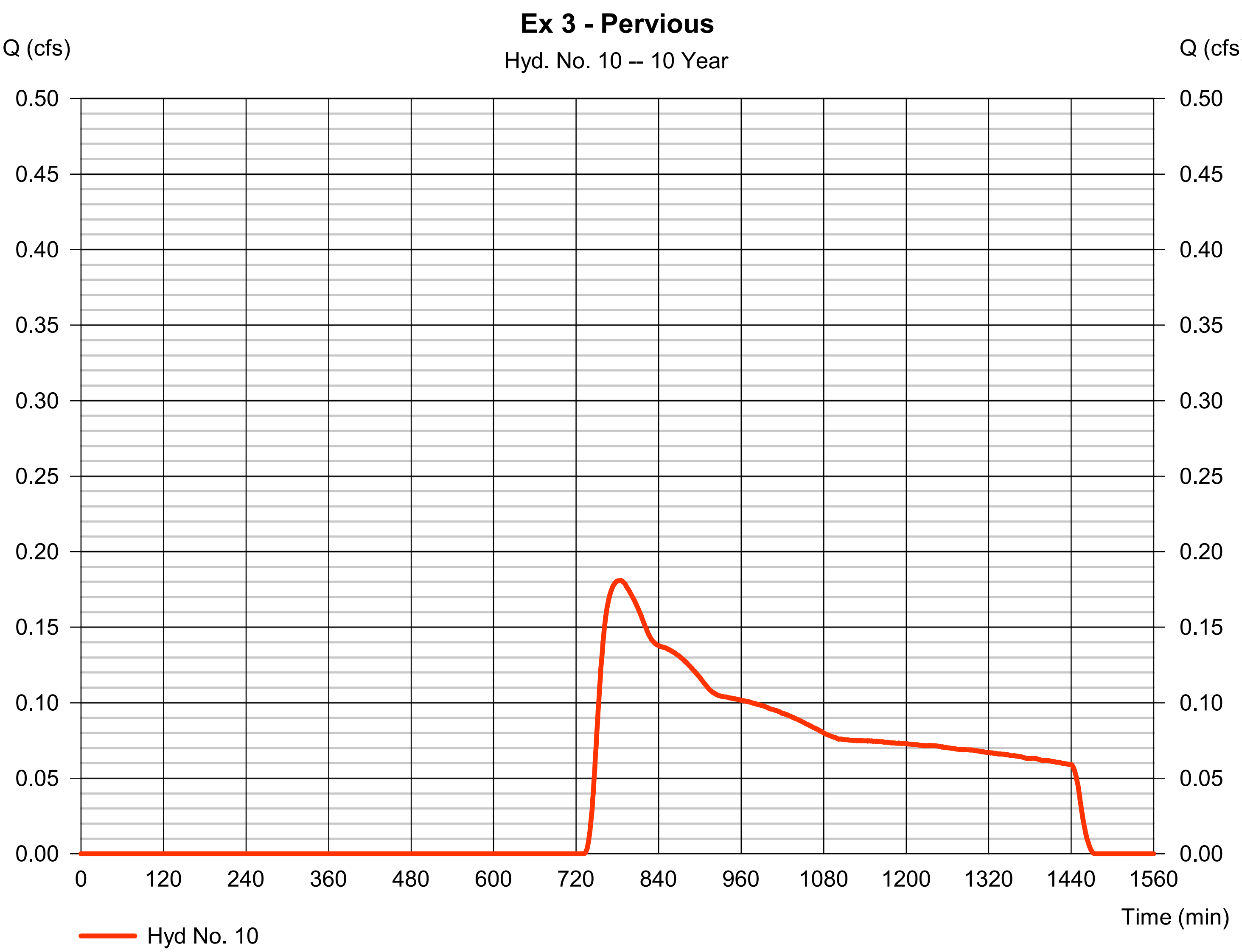


Hydrograph Report

Hyd. No. 10

Ex 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.181 cfs
Storm frequency	= 10 yrs	Time to peak	= 785 min
Time interval	= 1 min	Hyd. volume	= 3,949 cuft
Drainage area	= 4.790 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



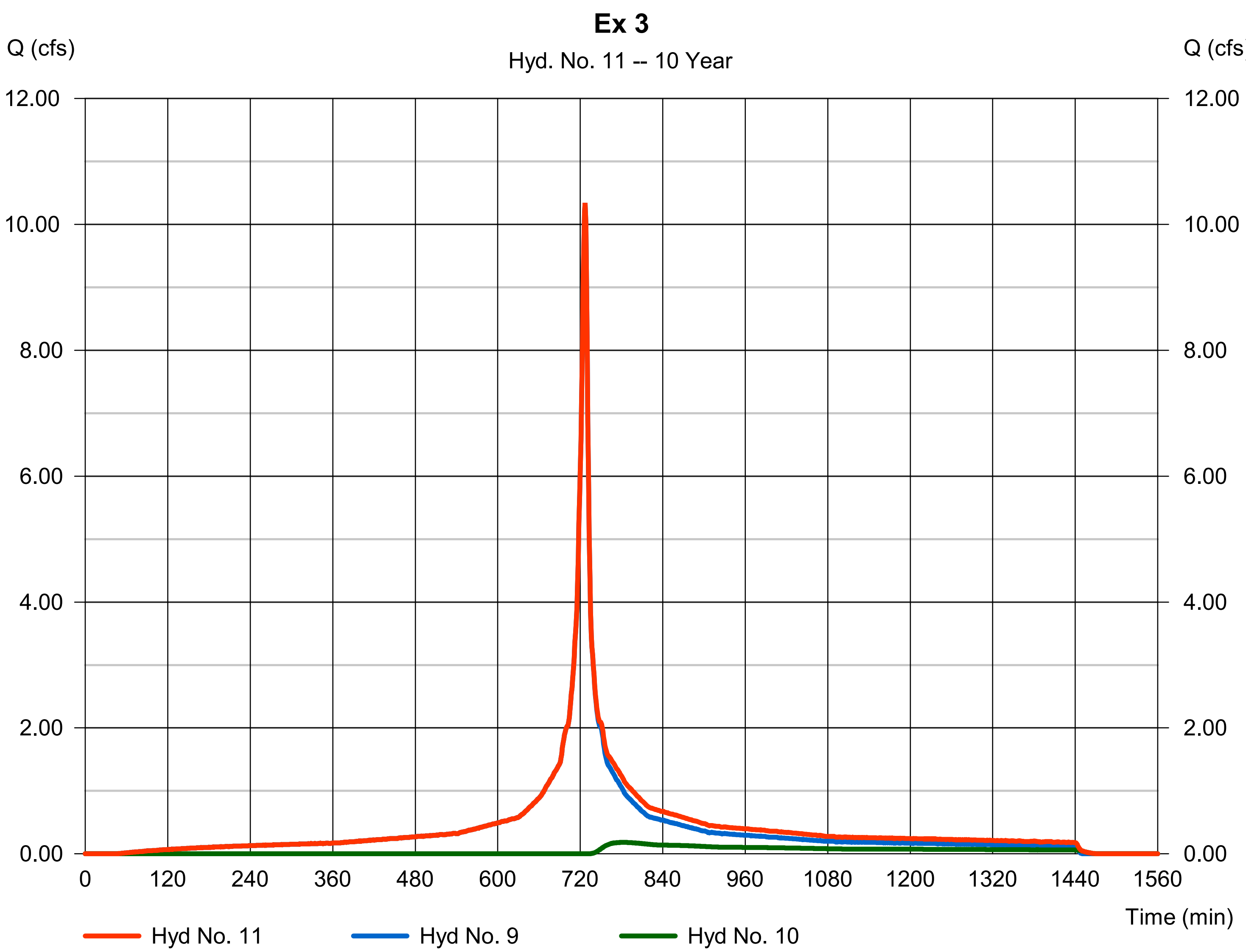
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 11

Ex 3

Hydrograph type	= Combine	Peak discharge	= 10.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 41,605 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 6.850 ac



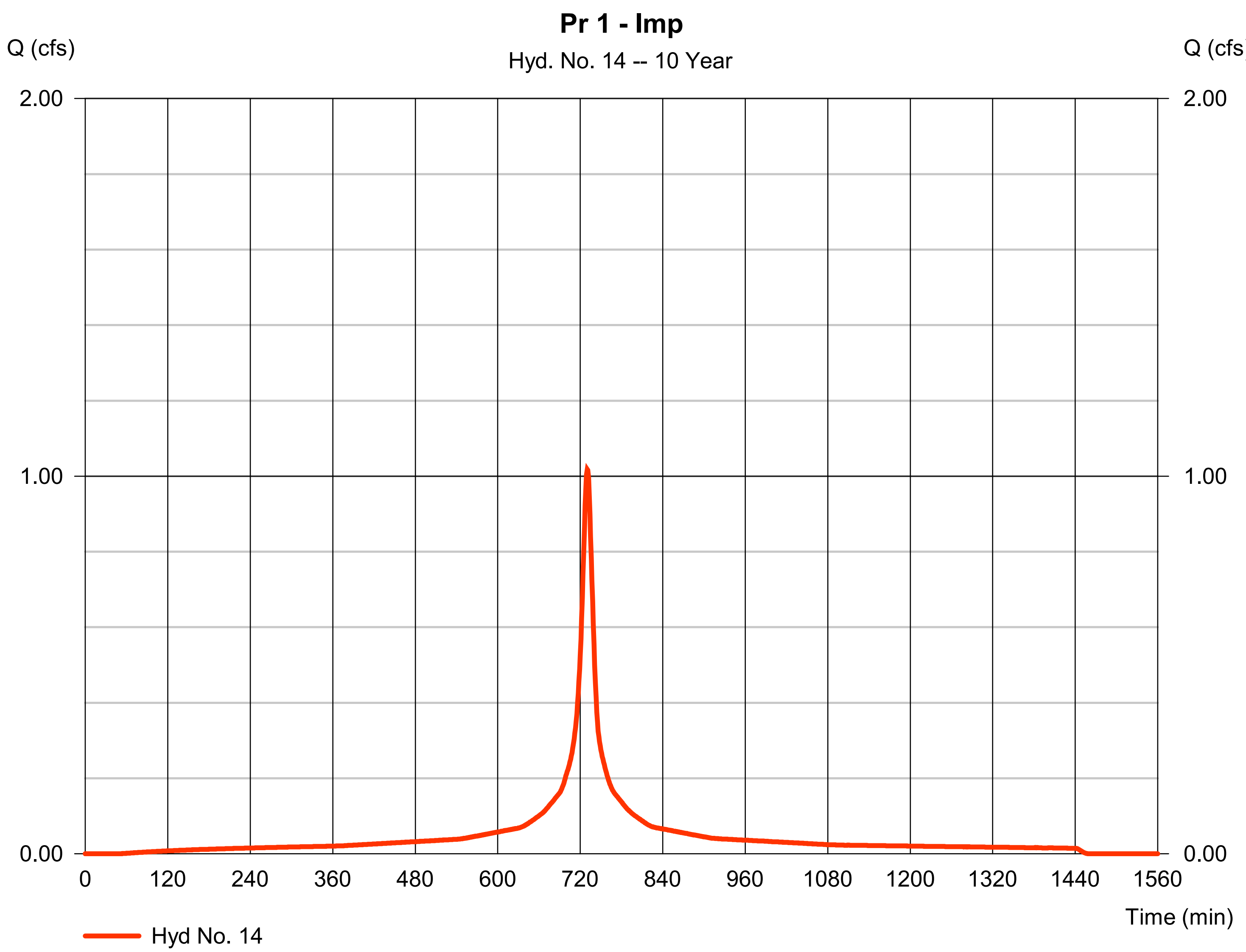
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 14

Pr 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.018 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 4,537 cuft
Drainage area	= 0.260 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



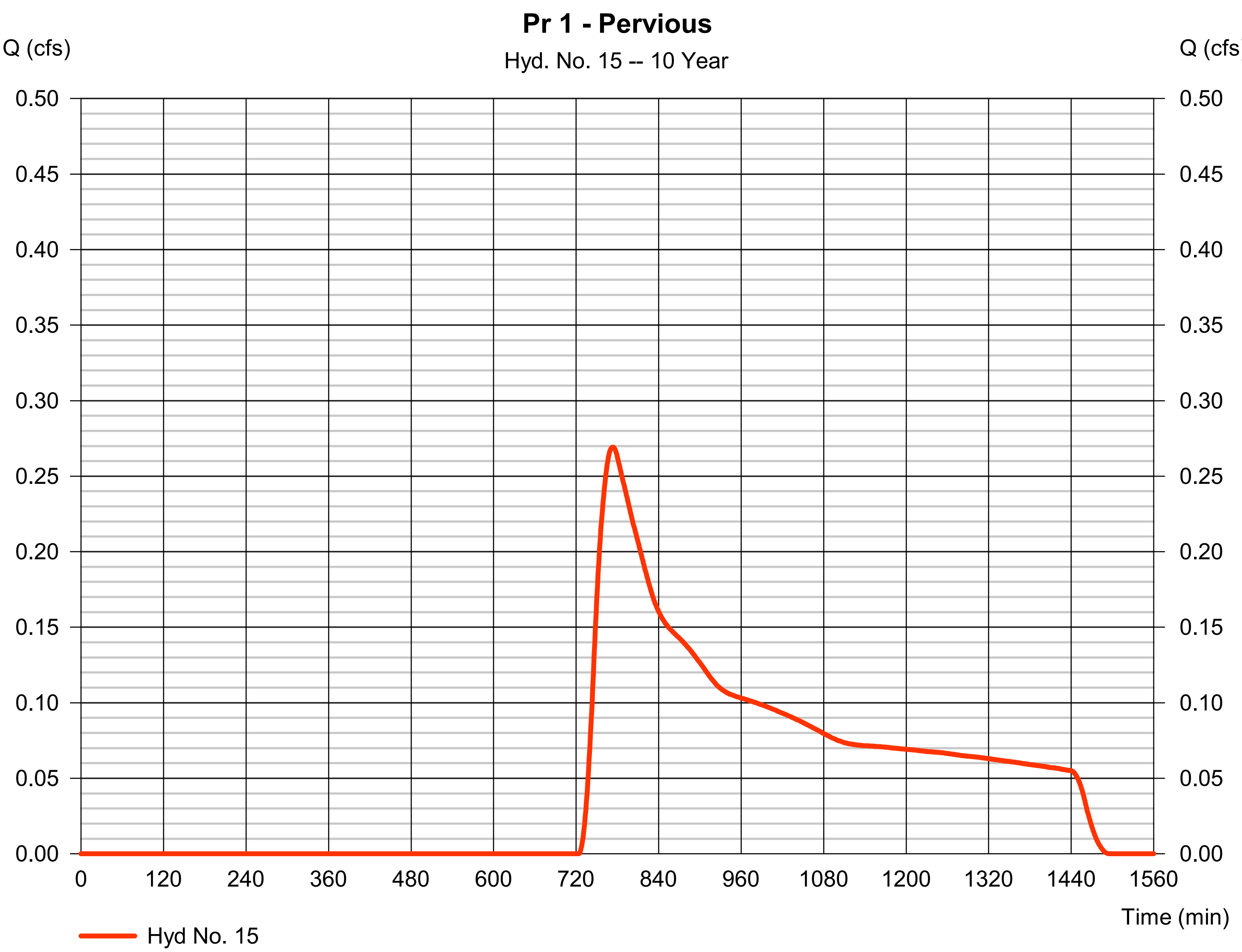
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 15

Pr 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.269 cfs
Storm frequency	= 10 yrs	Time to peak	= 773 min
Time interval	= 1 min	Hyd. volume	= 4,368 cuft
Drainage area	= 3.500 ac	Curve number	= 42
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 35.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



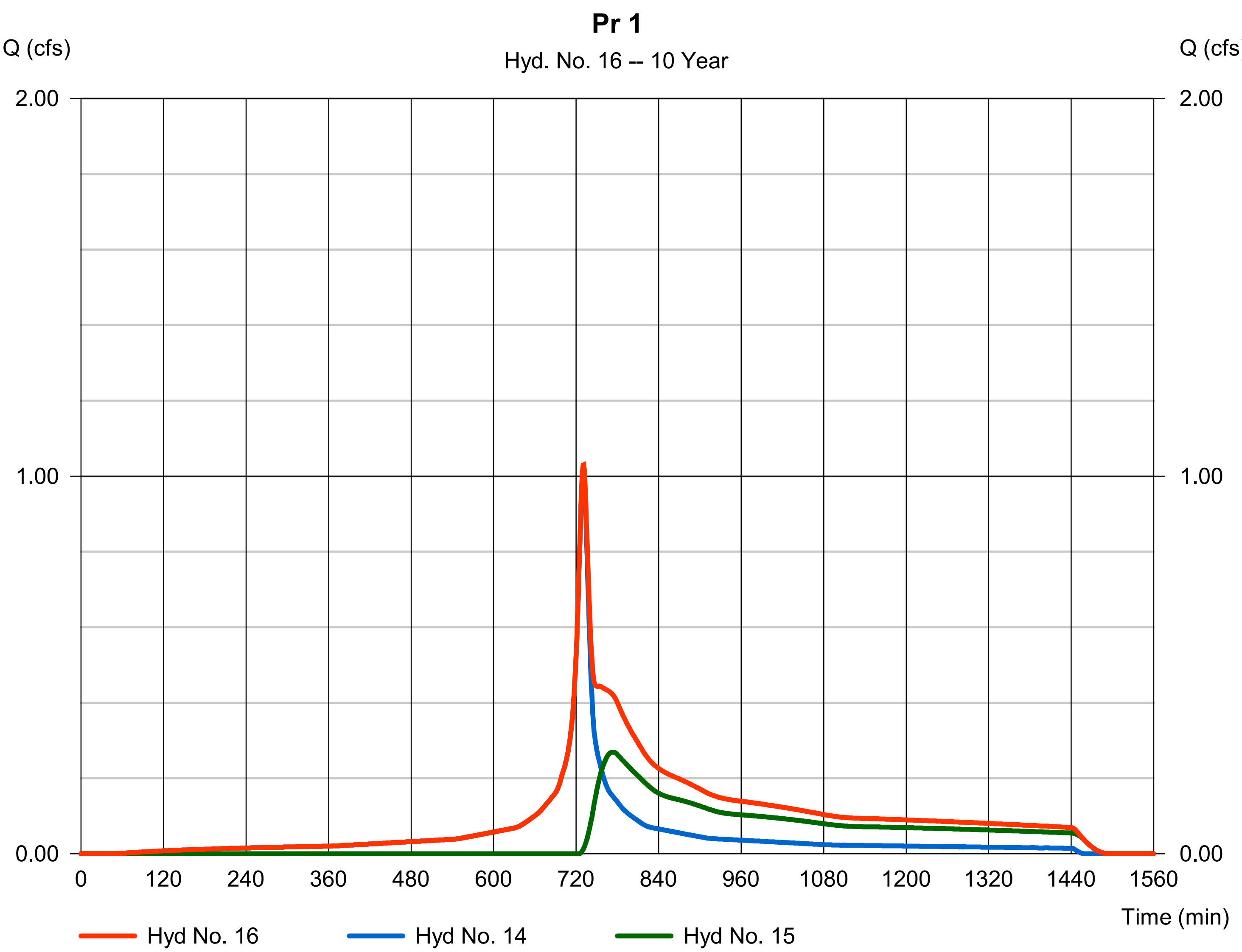
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 16

Pr 1

Hydrograph type	= Combine	Peak discharge	= 1.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 731 min
Time interval	= 1 min	Hyd. volume	= 8,905 cuft
Inflow hyds.	= 14, 15	Contrib. drain. area	= 3.760 ac



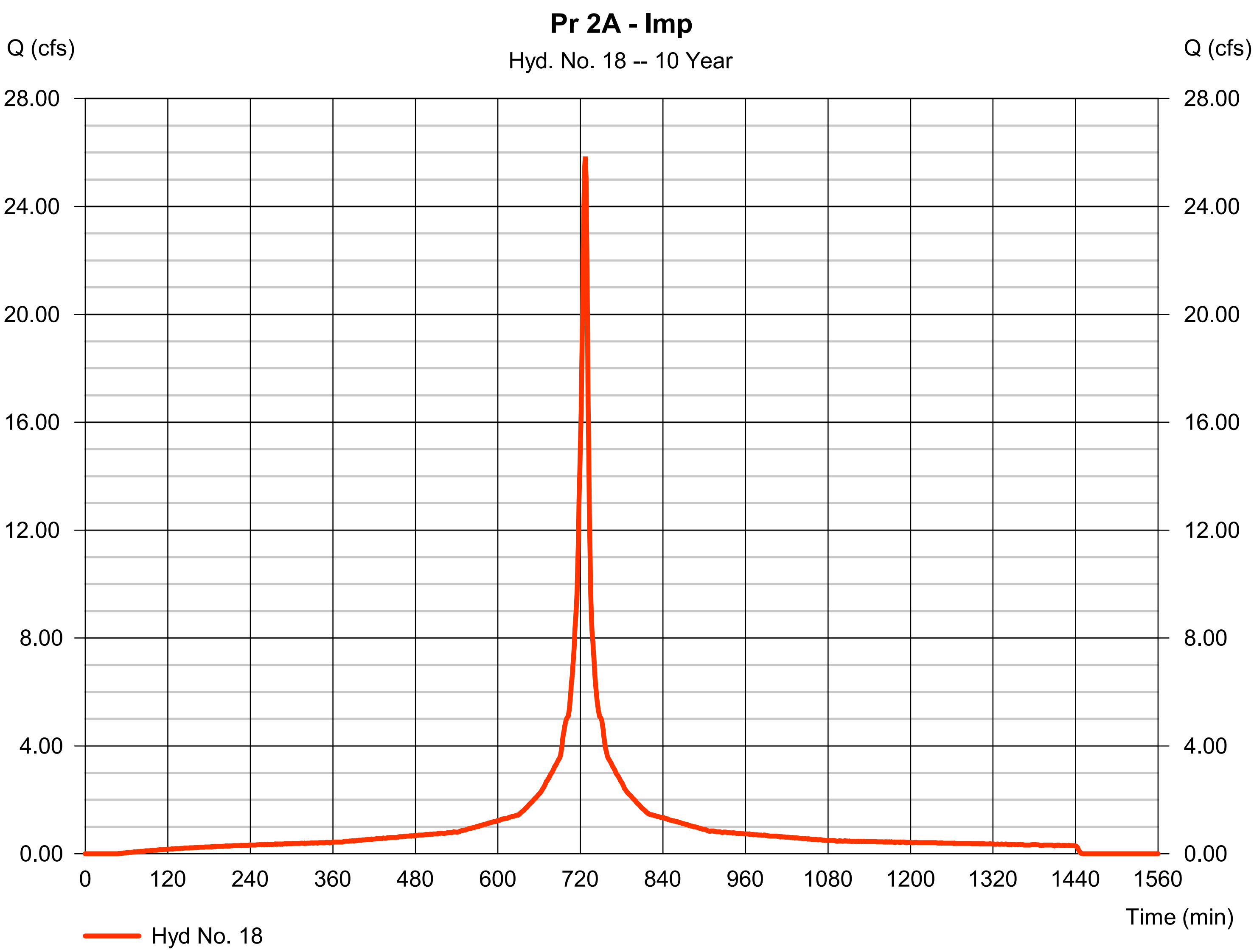
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 18

Pr 2A - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 25.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 94,138 cuft
Drainage area	= 5.150 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



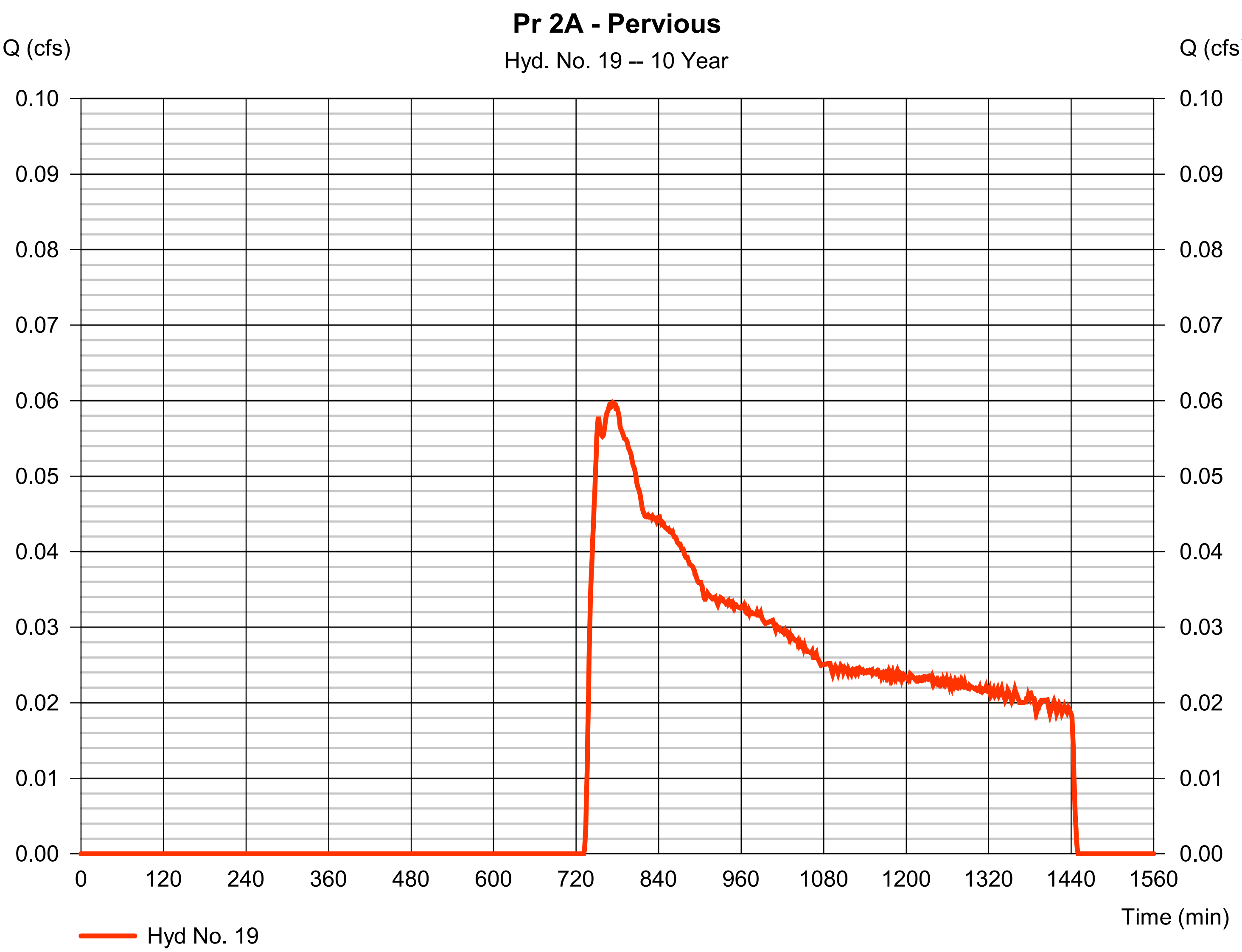
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 19

Pr 2A - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.060 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 1 min	Hyd. volume	= 1,280 cuft
Drainage area	= 1.520 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



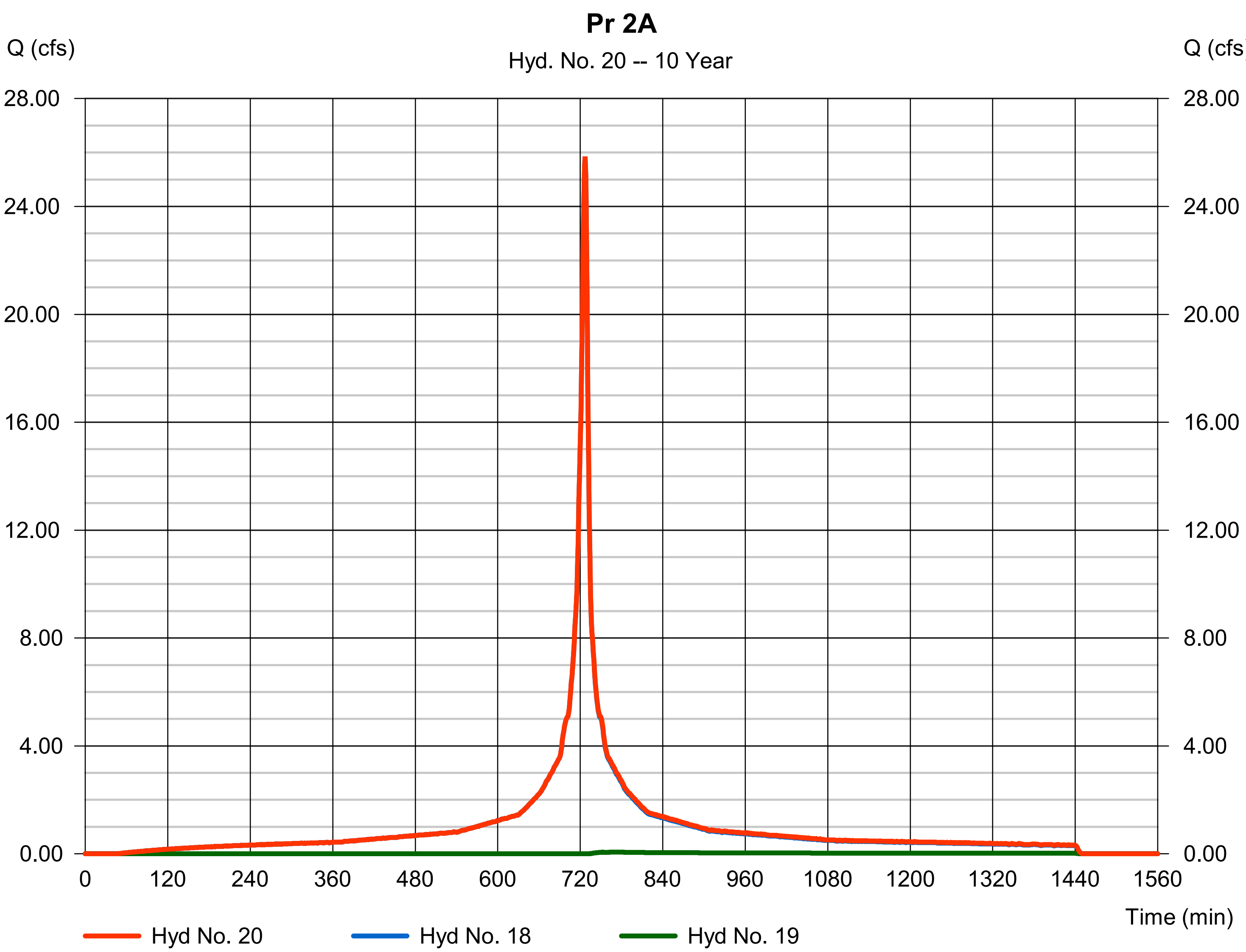
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 20

Pr 2A

Hydrograph type	= Combine	Peak discharge	= 25.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 95,418 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 6.670 ac



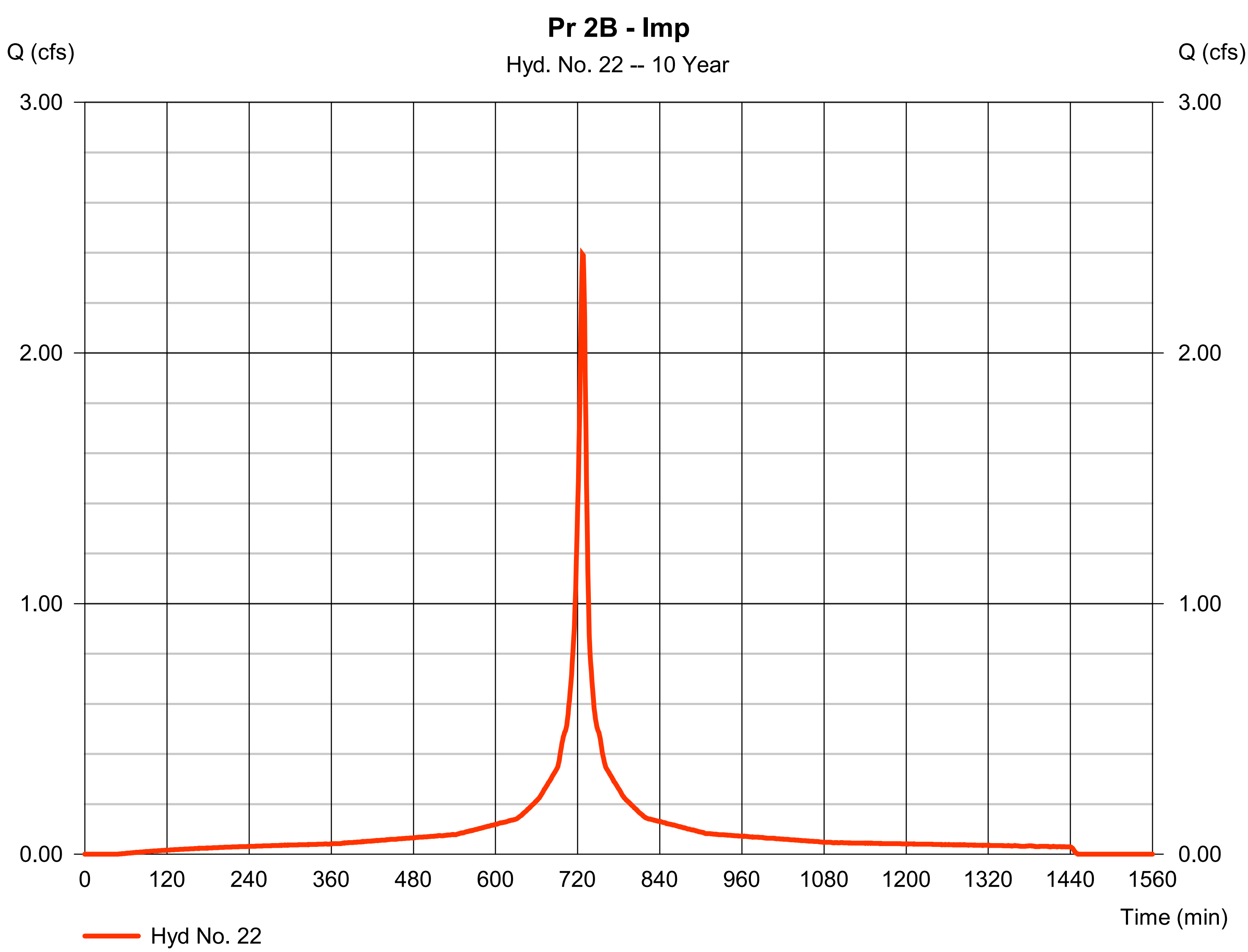
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 22

Pr 2B - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 2.394 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 9,160 cuft
Drainage area	= 0.530 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



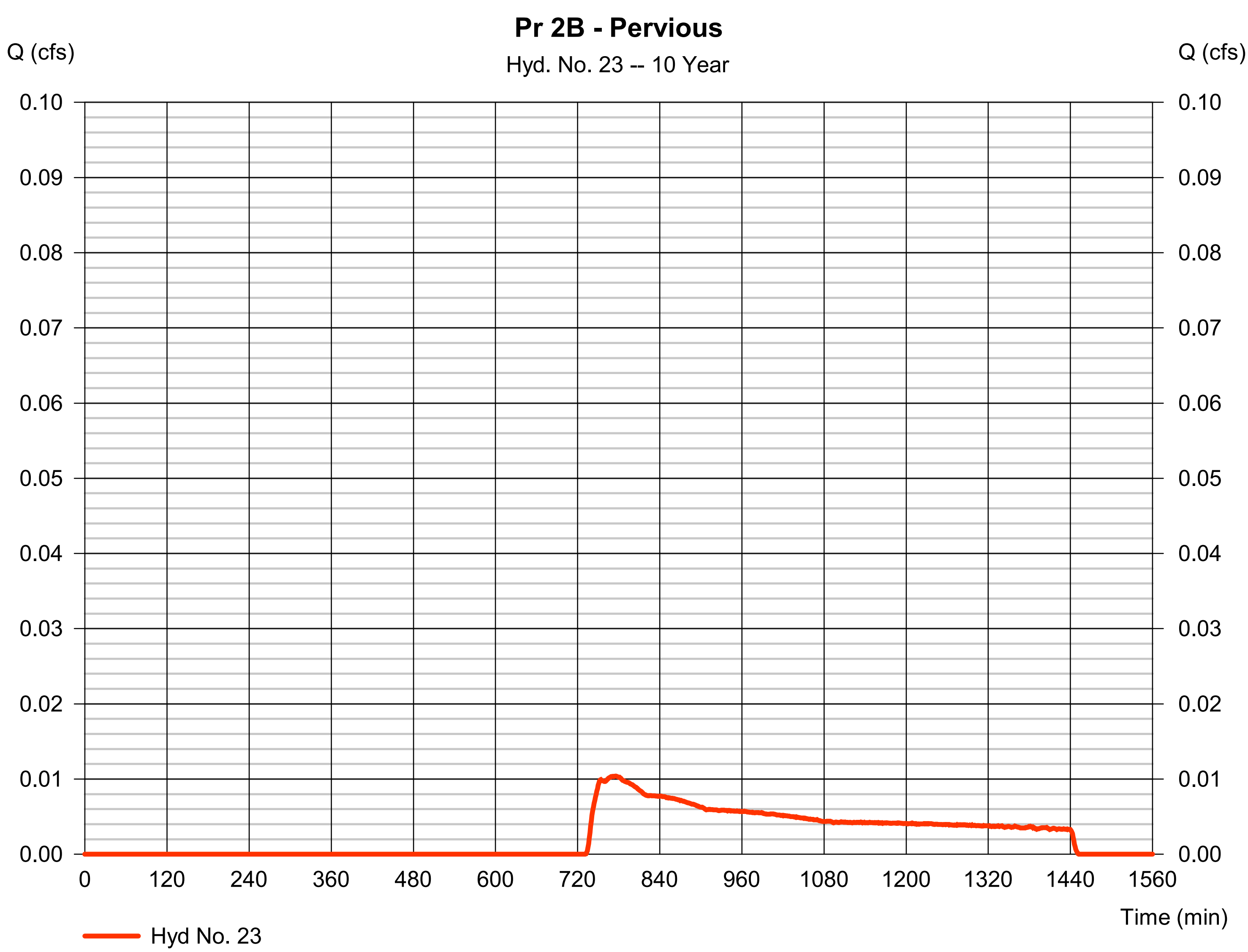
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 23

Pr 2B - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.010 cfs
Storm frequency	= 10 yrs	Time to peak	= 775 min
Time interval	= 1 min	Hyd. volume	= 223 cuft
Drainage area	= 0.280 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



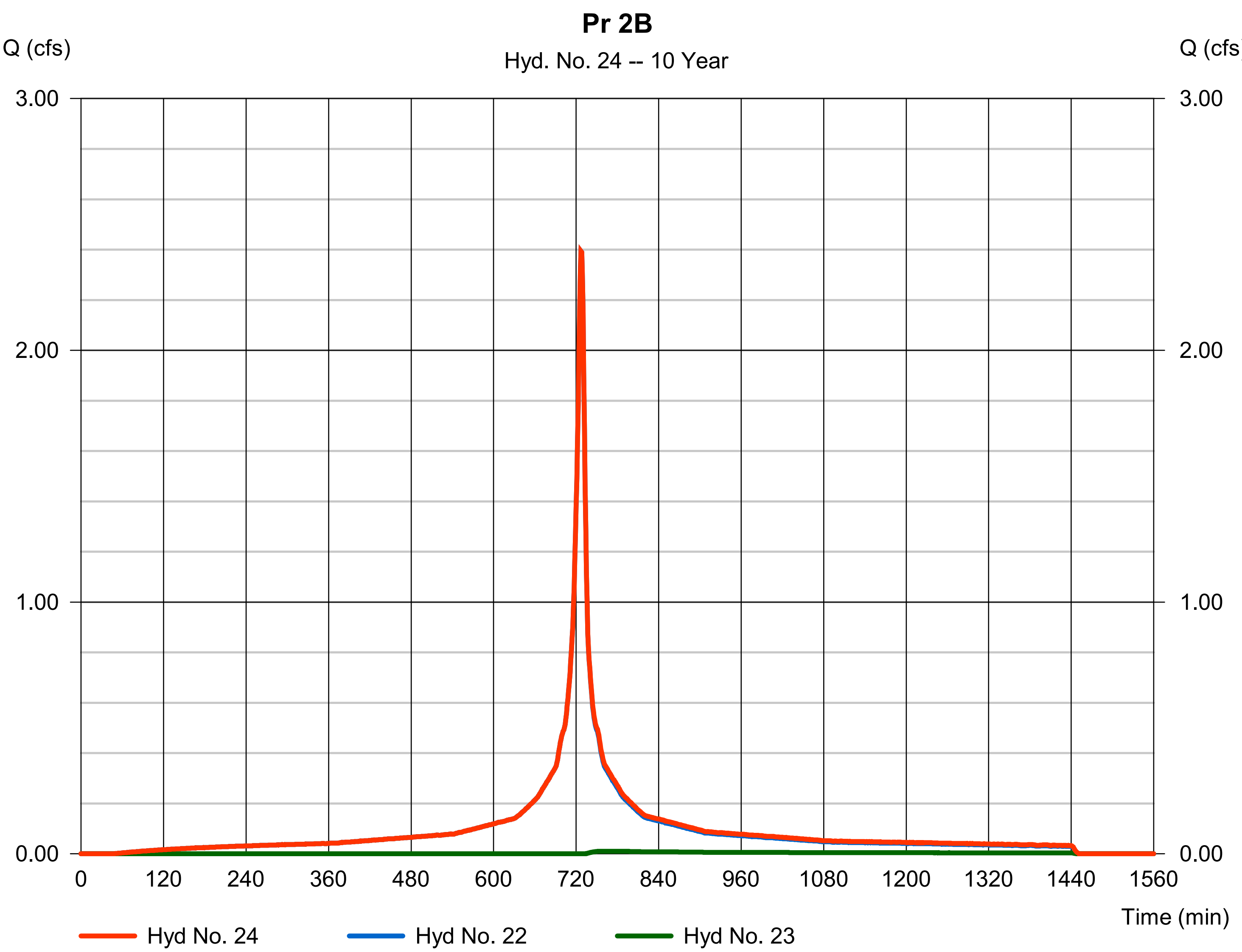
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 24

Pr 2B

Hydrograph type	= Combine	Peak discharge	= 2.394 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 9,382 cuft
Inflow hyds.	= 22, 23	Contrib. drain. area	= 0.810 ac



Hydrograph Report

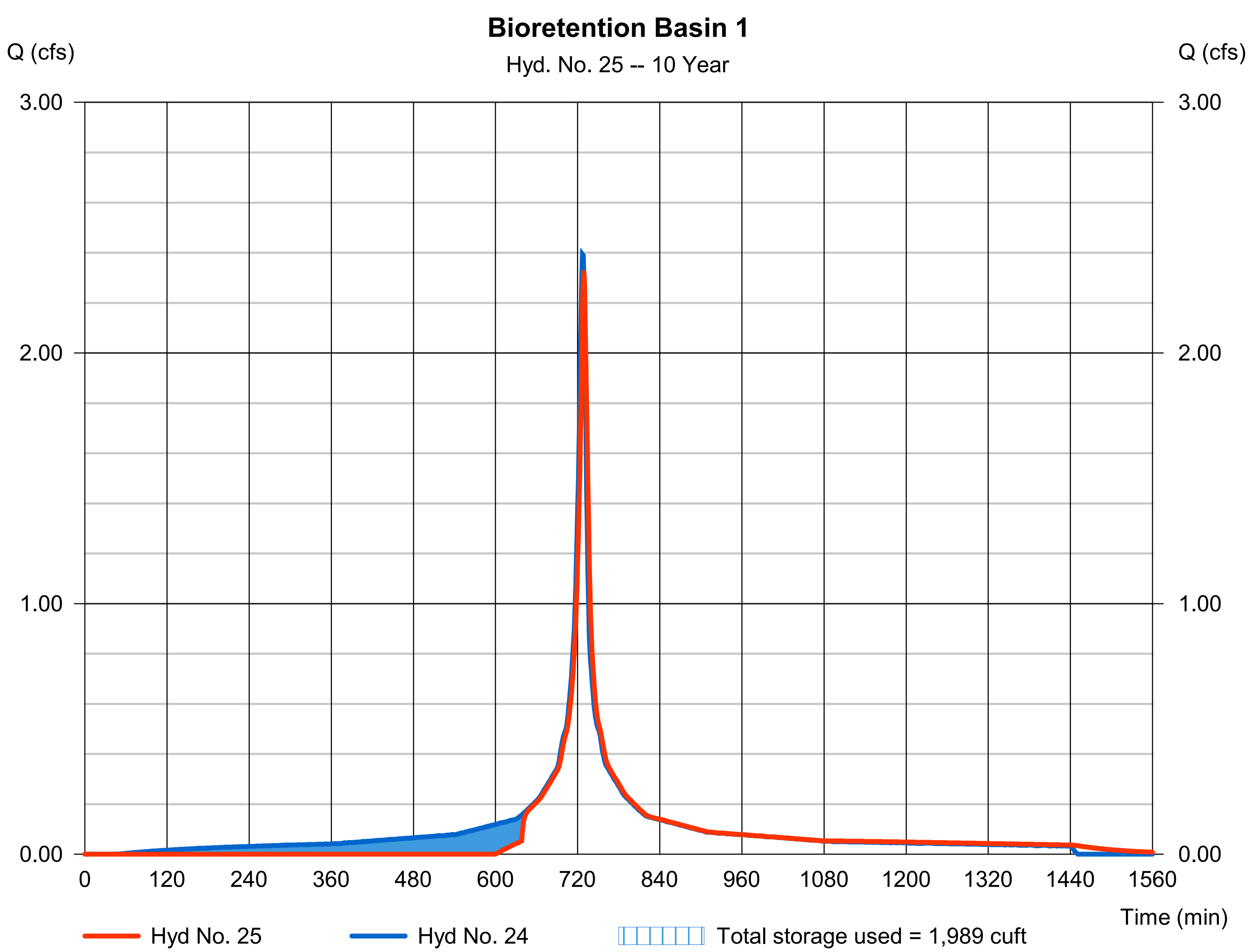
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 25

Bioretention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 2.329 cfs
Storm frequency	= 10 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 7,908 cuft
Inflow hyd. No.	= 24 - Pr 2B	Max. Elevation	= 37.81 ft
Reservoir name	= Bioretention Basin 1	Max. Storage	= 1,989 cuft

Storage Indication method used.



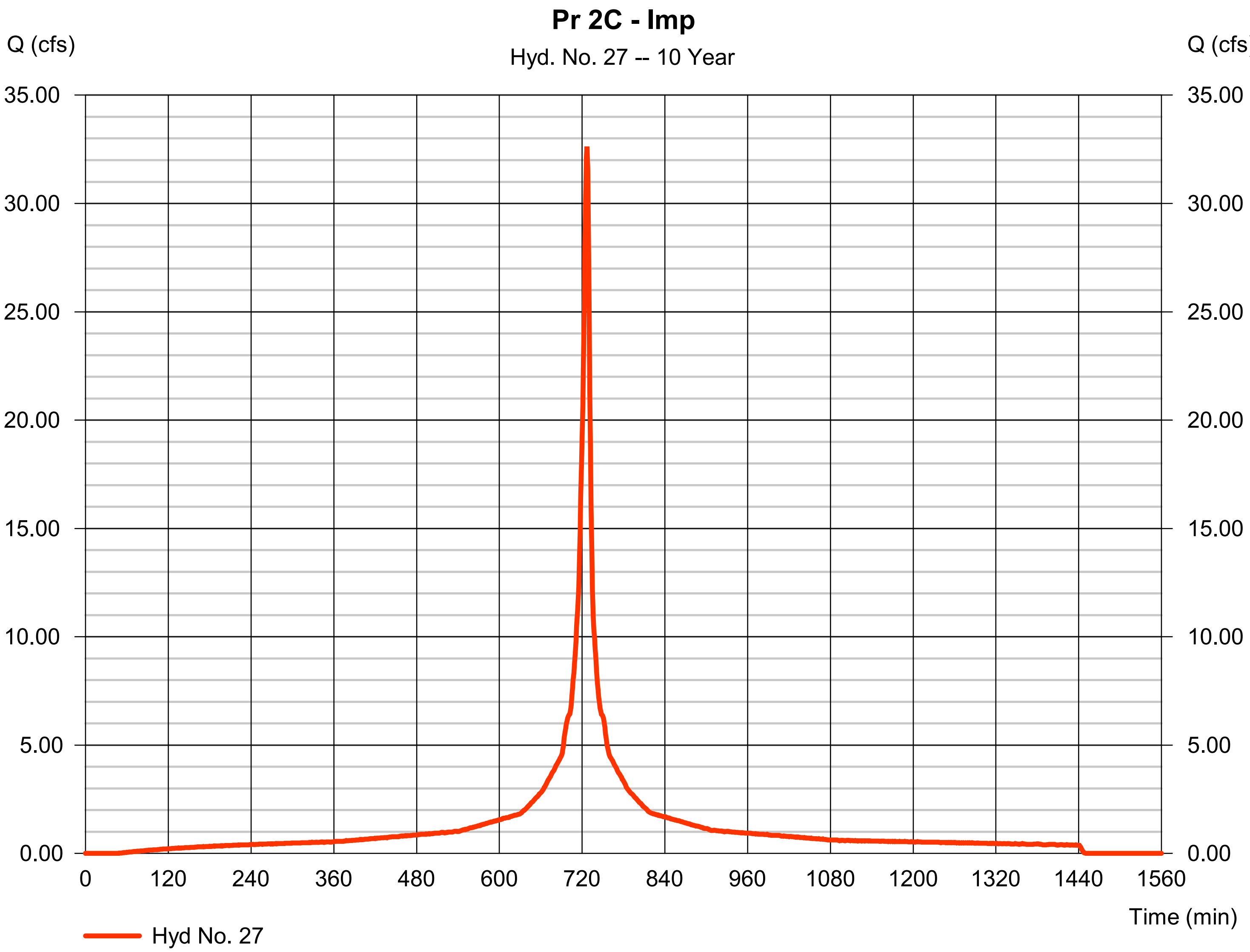
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 27

Pr 2C - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 32.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 118,814 cuft
Drainage area	= 6.500 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

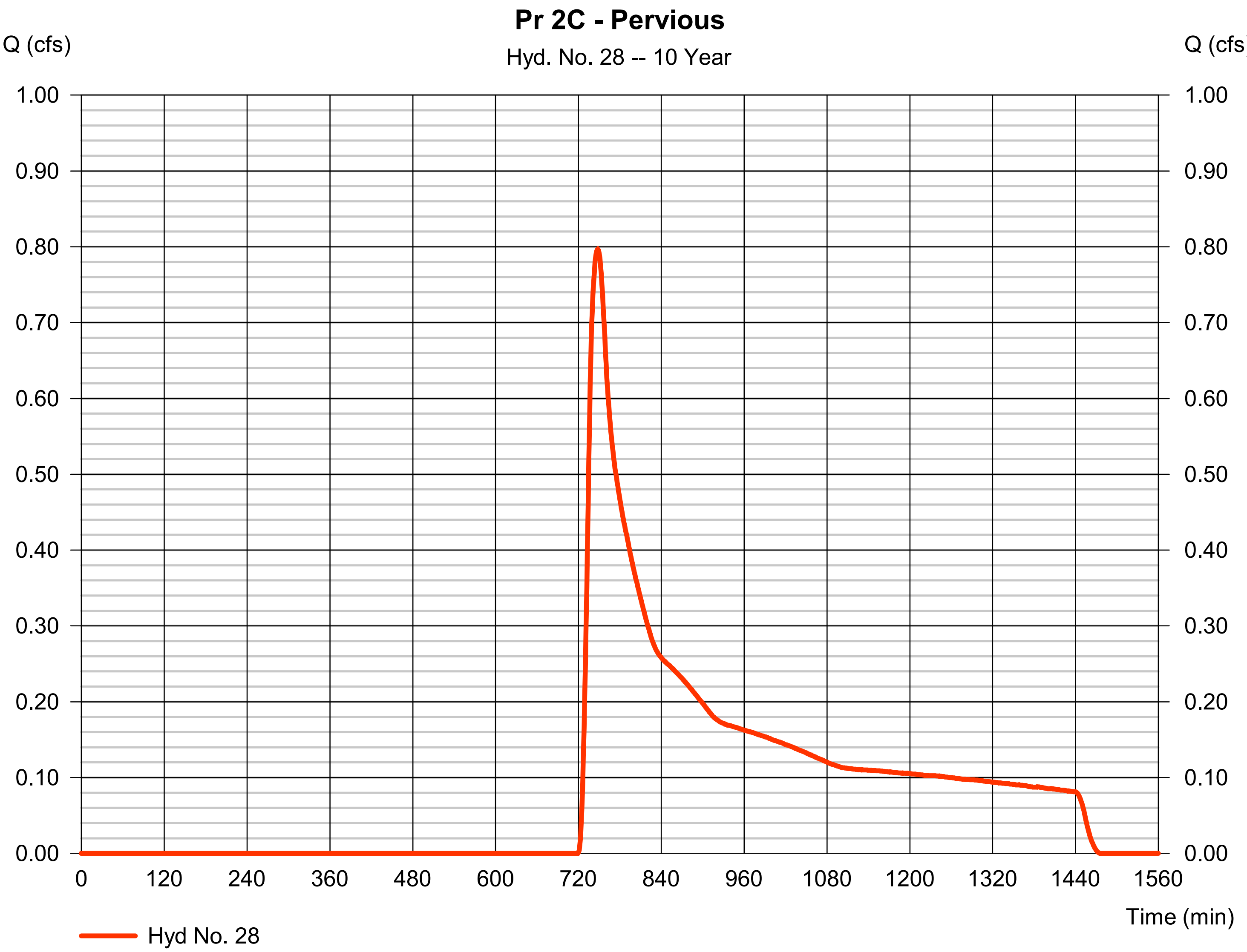


Hydrograph Report

Hyd. No. 28

Pr 2C - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.797 cfs
Storm frequency	= 10 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 7,850 cuft
Drainage area	= 4.120 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



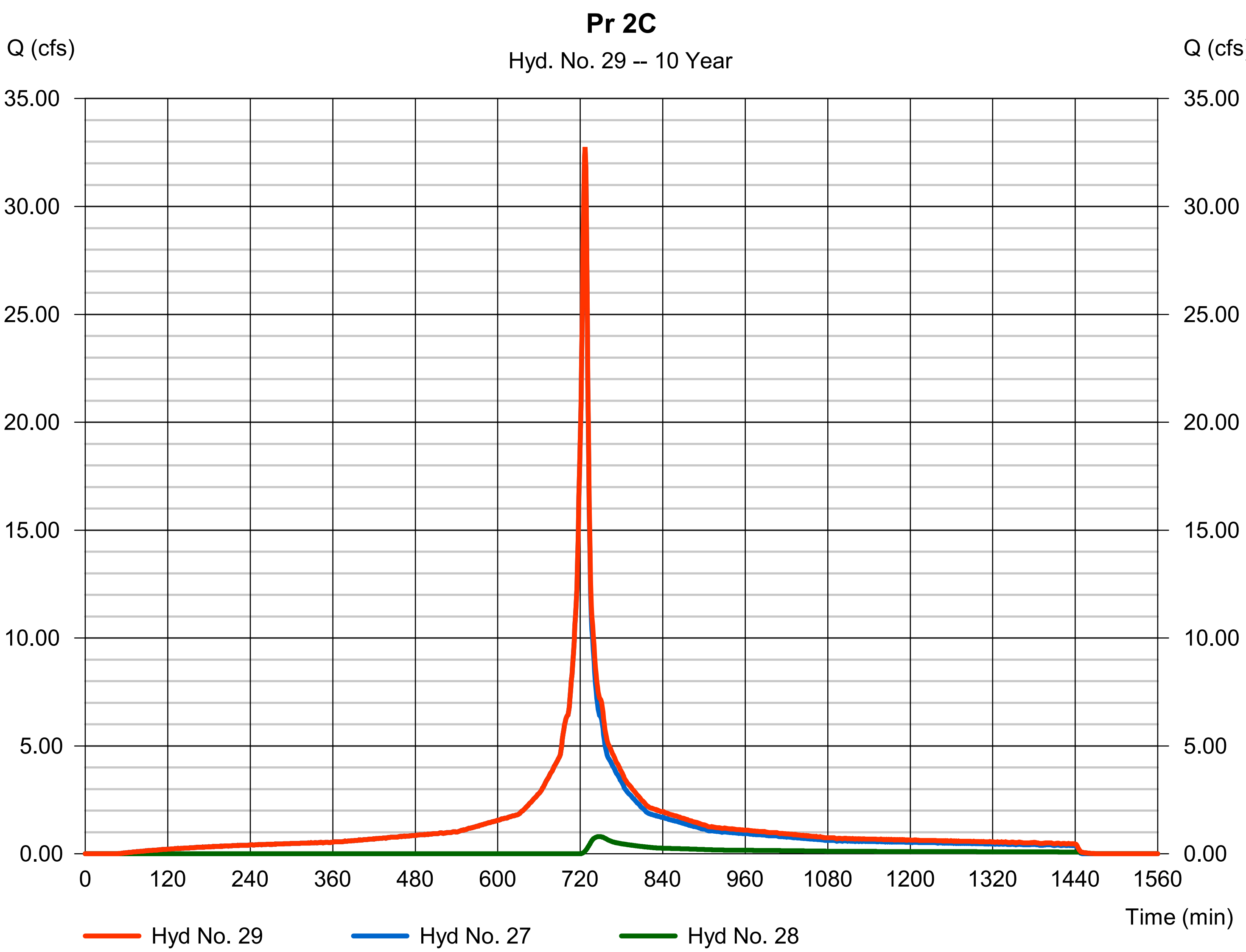
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 29

Pr 2C

Hydrograph type	= Combine	Peak discharge	= 32.76 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 126,664 cuft
Inflow hyds.	= 27, 28	Contrib. drain. area	= 10.620 ac



Hydrograph Report

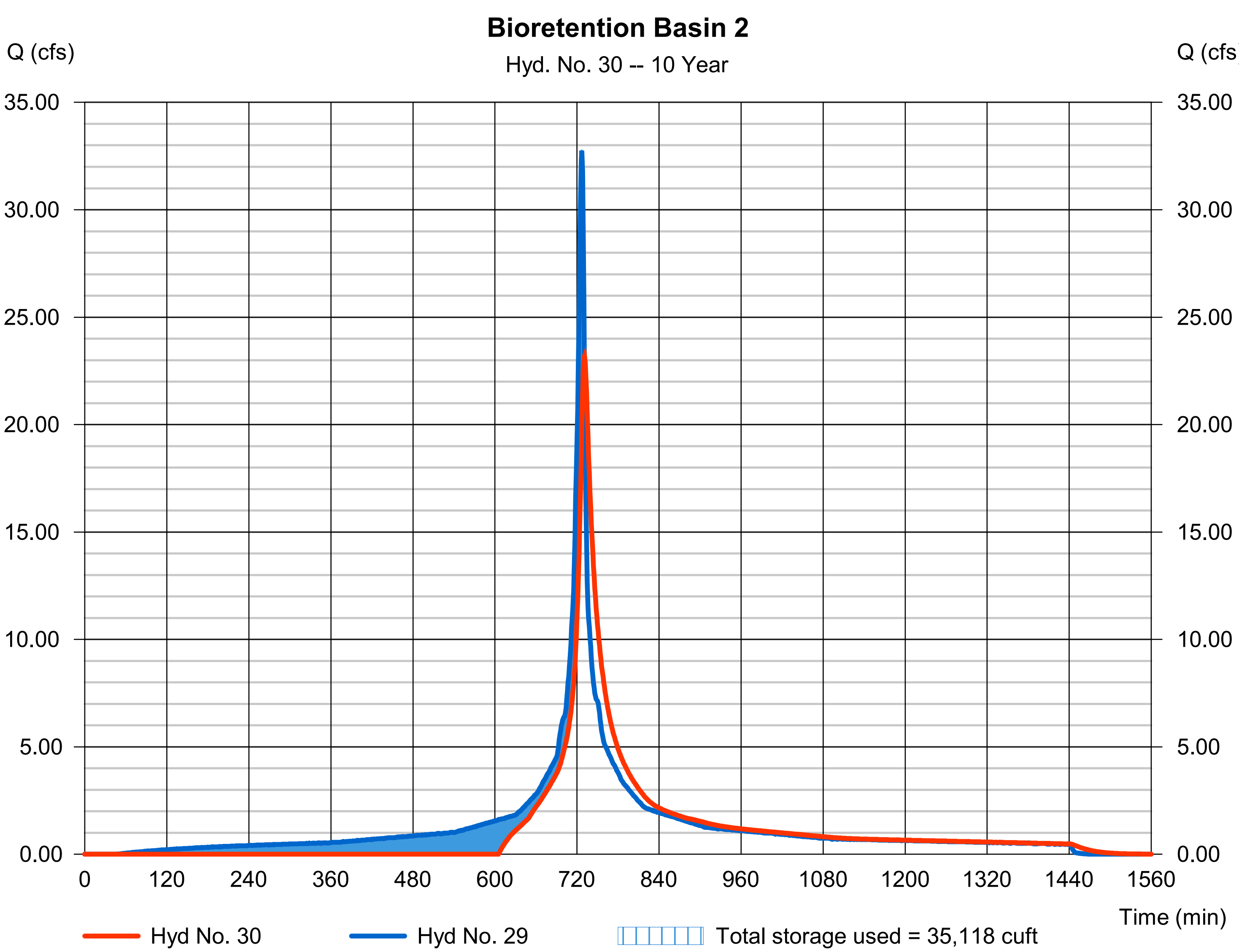
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 30

Bioretention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 23.20 cfs
Storm frequency	= 10 yrs	Time to peak	= 731 min
Time interval	= 1 min	Hyd. volume	= 106,992 cuft
Inflow hyd. No.	= 29 - Pr 2C	Max. Elevation	= 38.07 ft
Reservoir name	= Bioretention Basin 2	Max. Storage	= 35,118 cuft

Storage Indication method used.



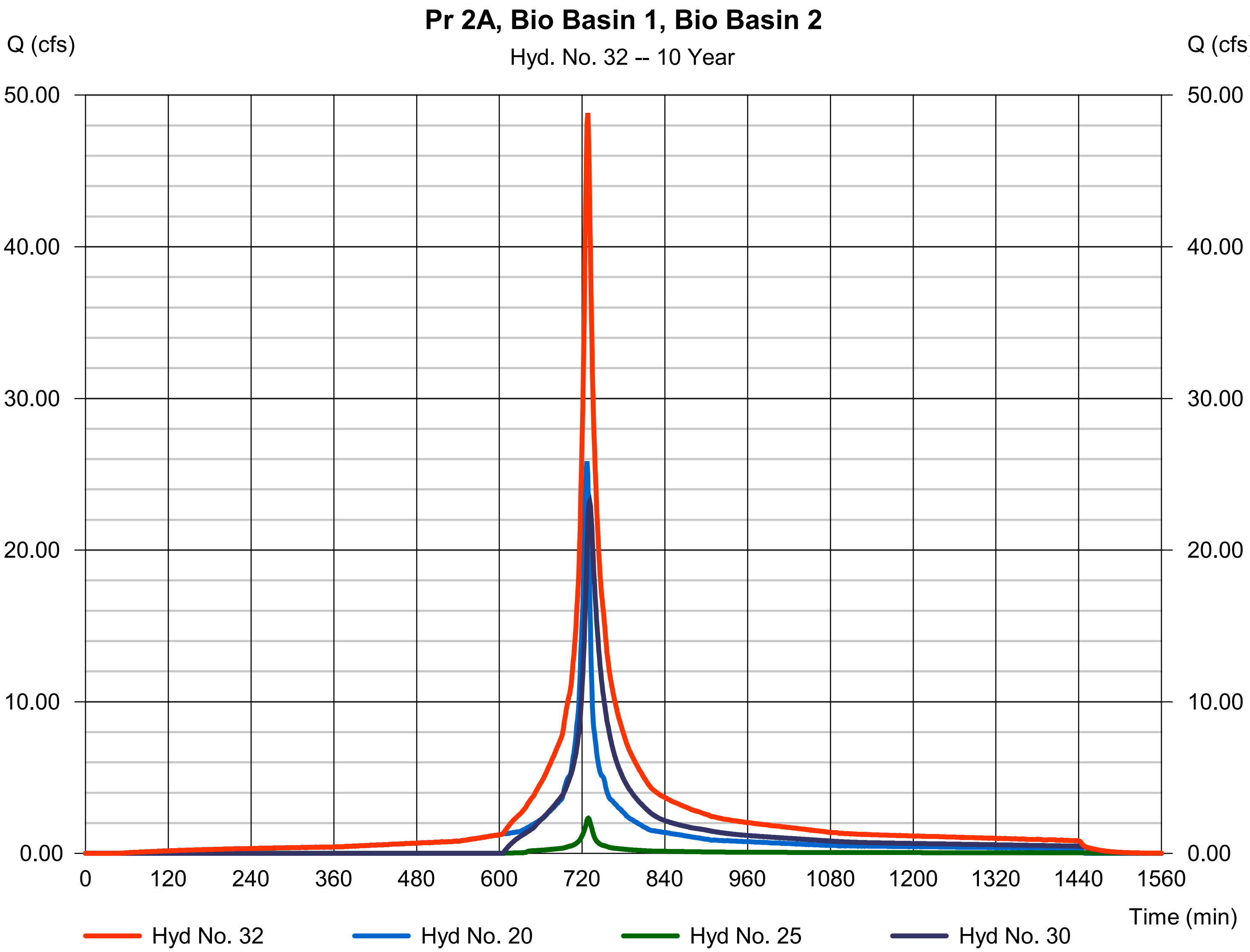
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 32

Pr 2A, Bio Basin 1, Bio Basin 2

Hydrograph type	= Combine	Peak discharge	= 48.82 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 210,318 cuft
Inflow hyds.	= 20, 25, 30	Contrib. drain. area	= 0.000 ac



Hydrograph Report

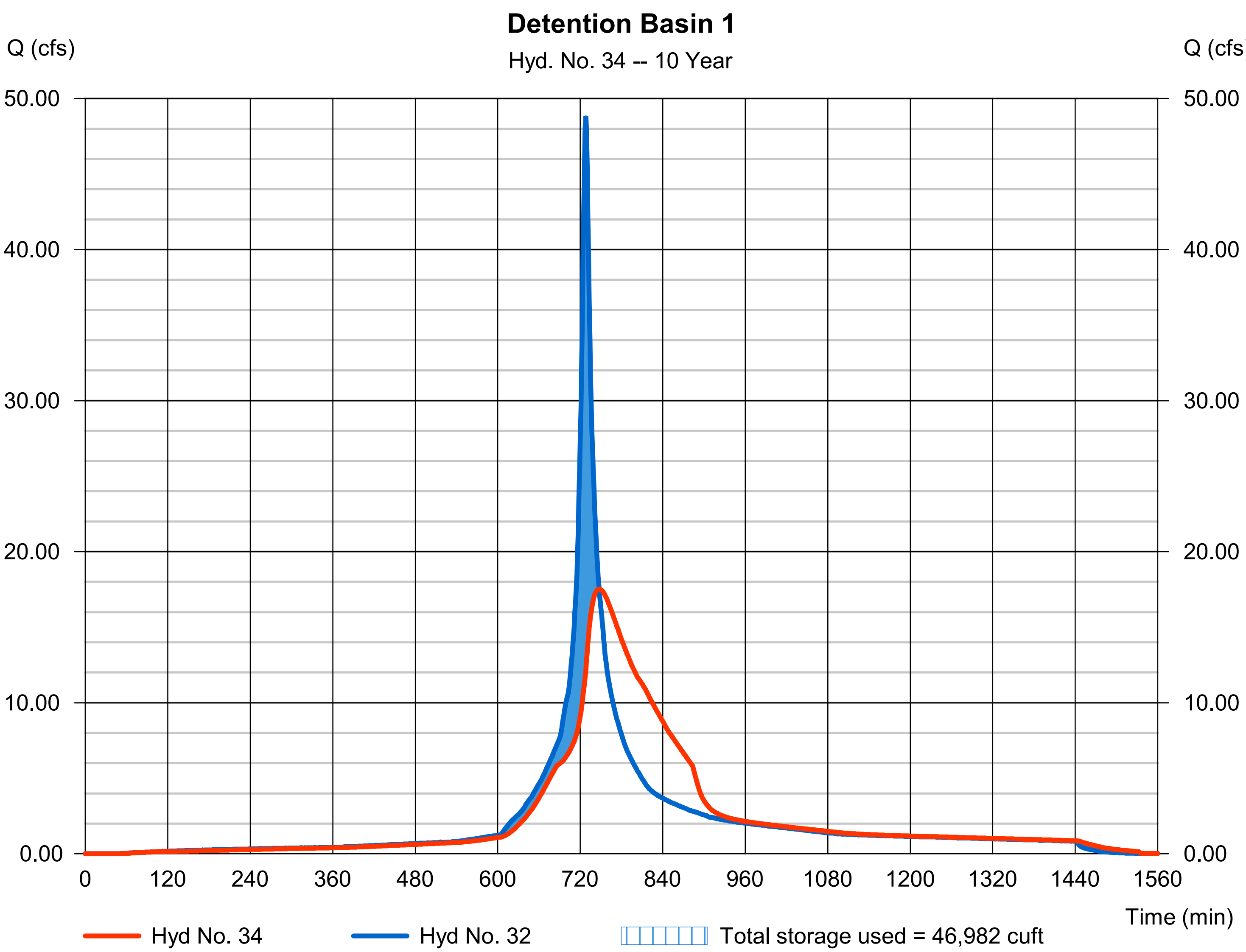
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 34

Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 17.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 747 min
Time interval	= 1 min	Hyd. volume	= 210,316 cuft
Inflow hyd. No.	= 32 - Pr 2A, Bio Basin 1, Bio Basin 2	Max. Elevation	= 32.69 ft
Reservoir name	= Detention Basin 1	Max. Storage	= 46,982 cuft

Storage Indication method used.



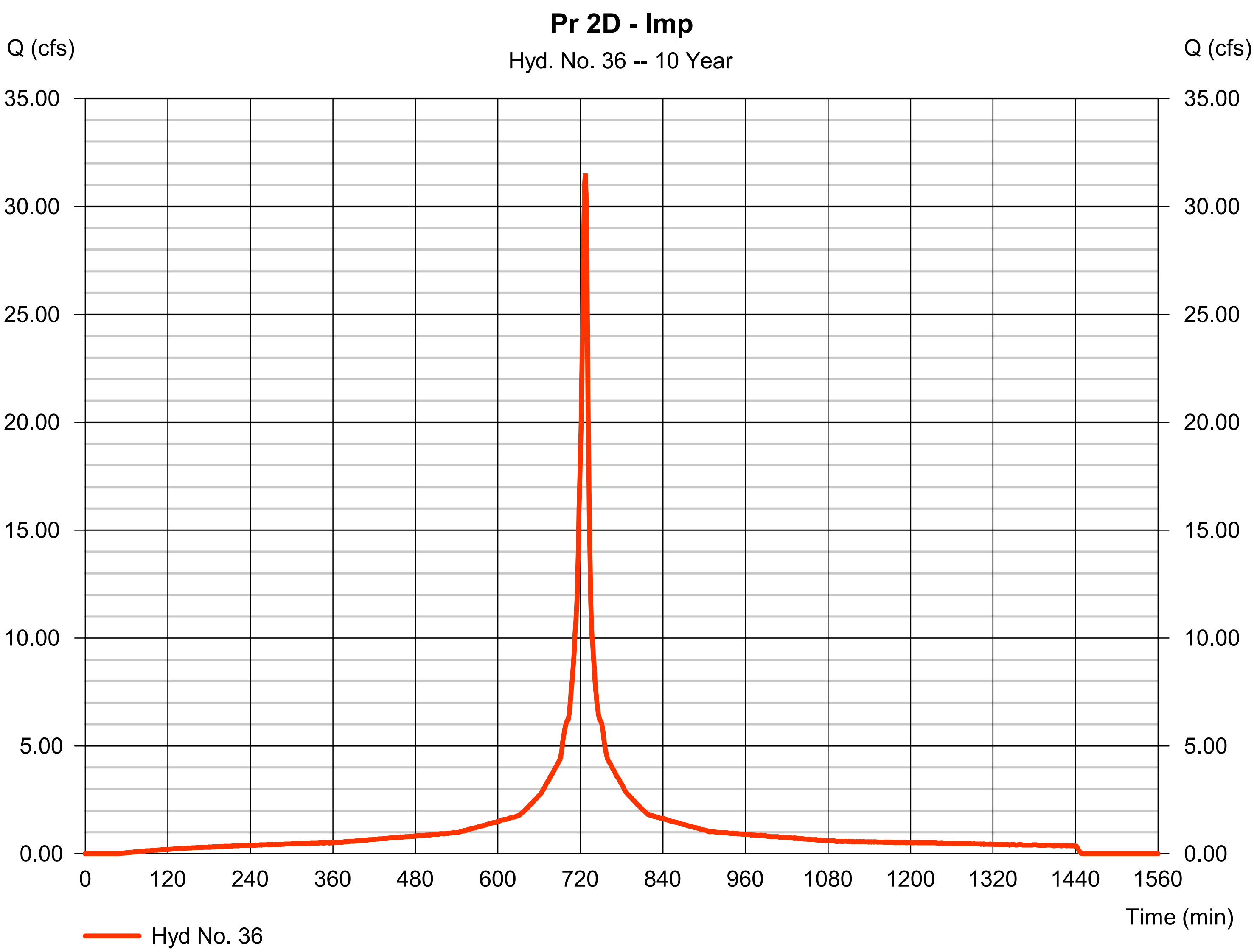
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 36

Pr 2D - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 31.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 114,793 cuft
Drainage area	= 6.280 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



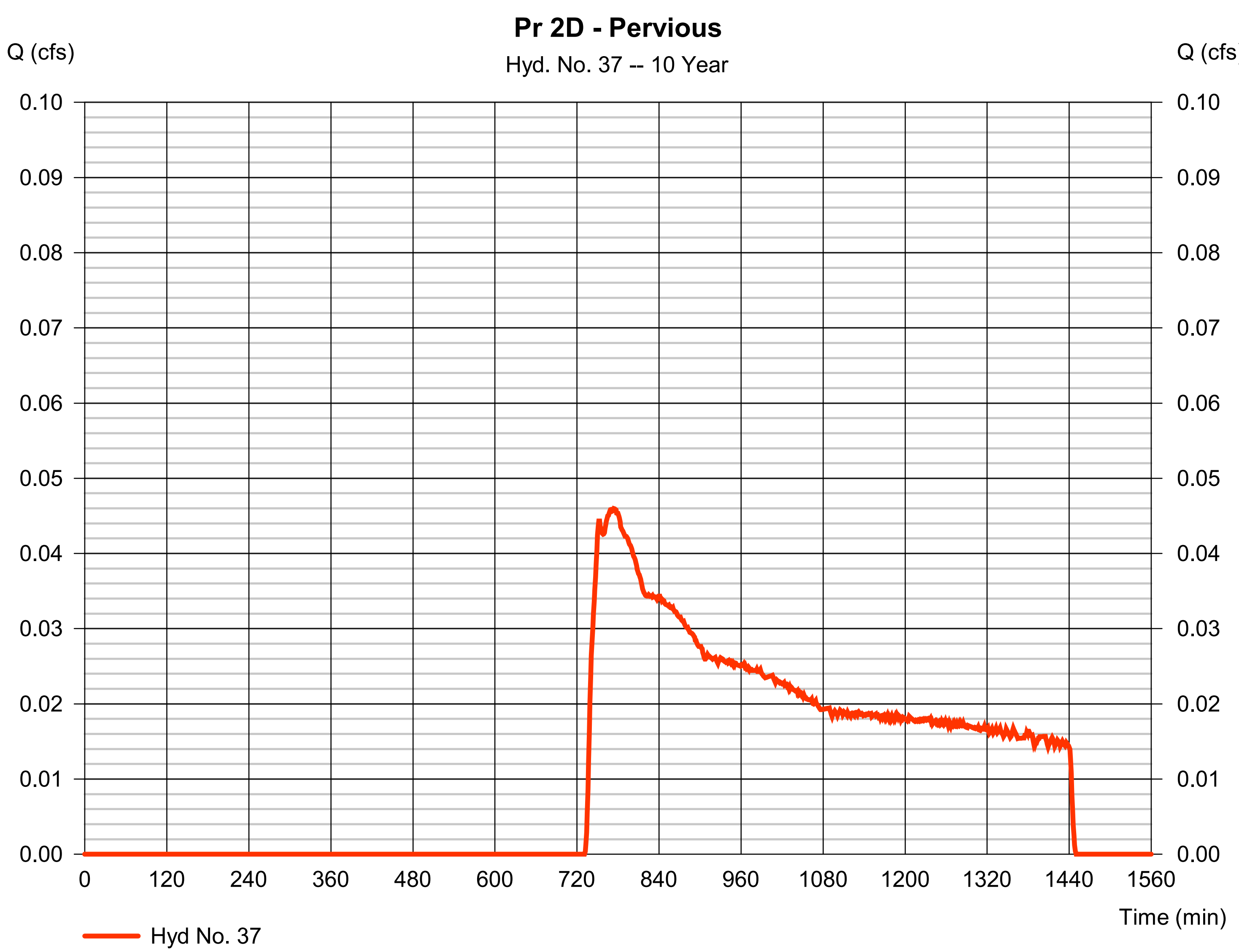
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 37

Pr 2D - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.046 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 1 min	Hyd. volume	= 985 cuft
Drainage area	= 1.170 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



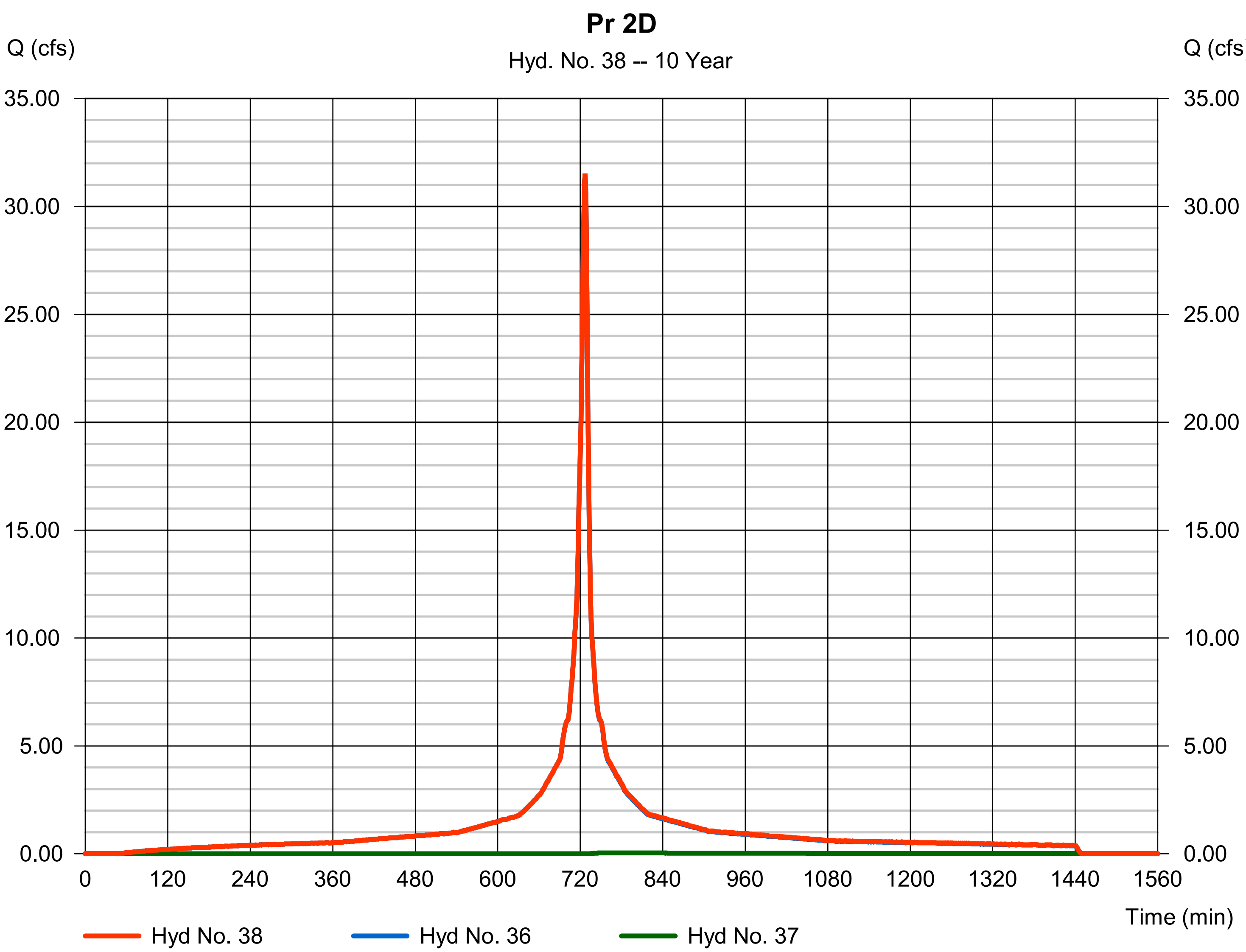
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 38

Pr 2D

Hydrograph type	= Combine	Peak discharge	= 31.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 115,778 cuft
Inflow hyds.	= 36, 37	Contrib. drain. area	= 7.450 ac



Hydrograph Report

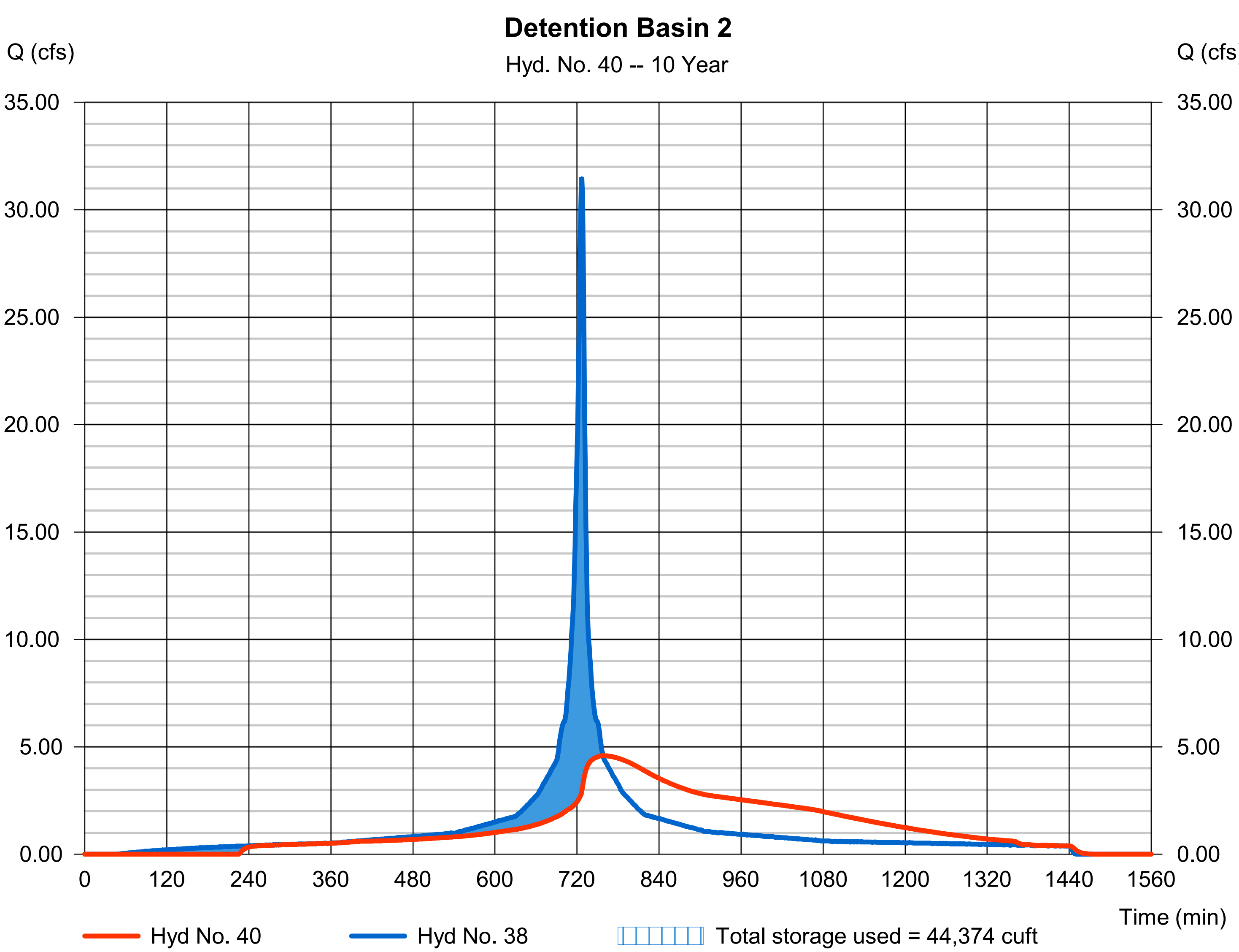
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 40

Detention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 4.587 cfs
Storm frequency	= 10 yrs	Time to peak	= 758 min
Time interval	= 1 min	Hyd. volume	= 113,392 cuft
Inflow hyd. No.	= 38 - Pr 2D	Max. Elevation	= 31.50 ft
Reservoir name	= Detention Basin 2	Max. Storage	= 44,374 cuft

Storage Indication method used.



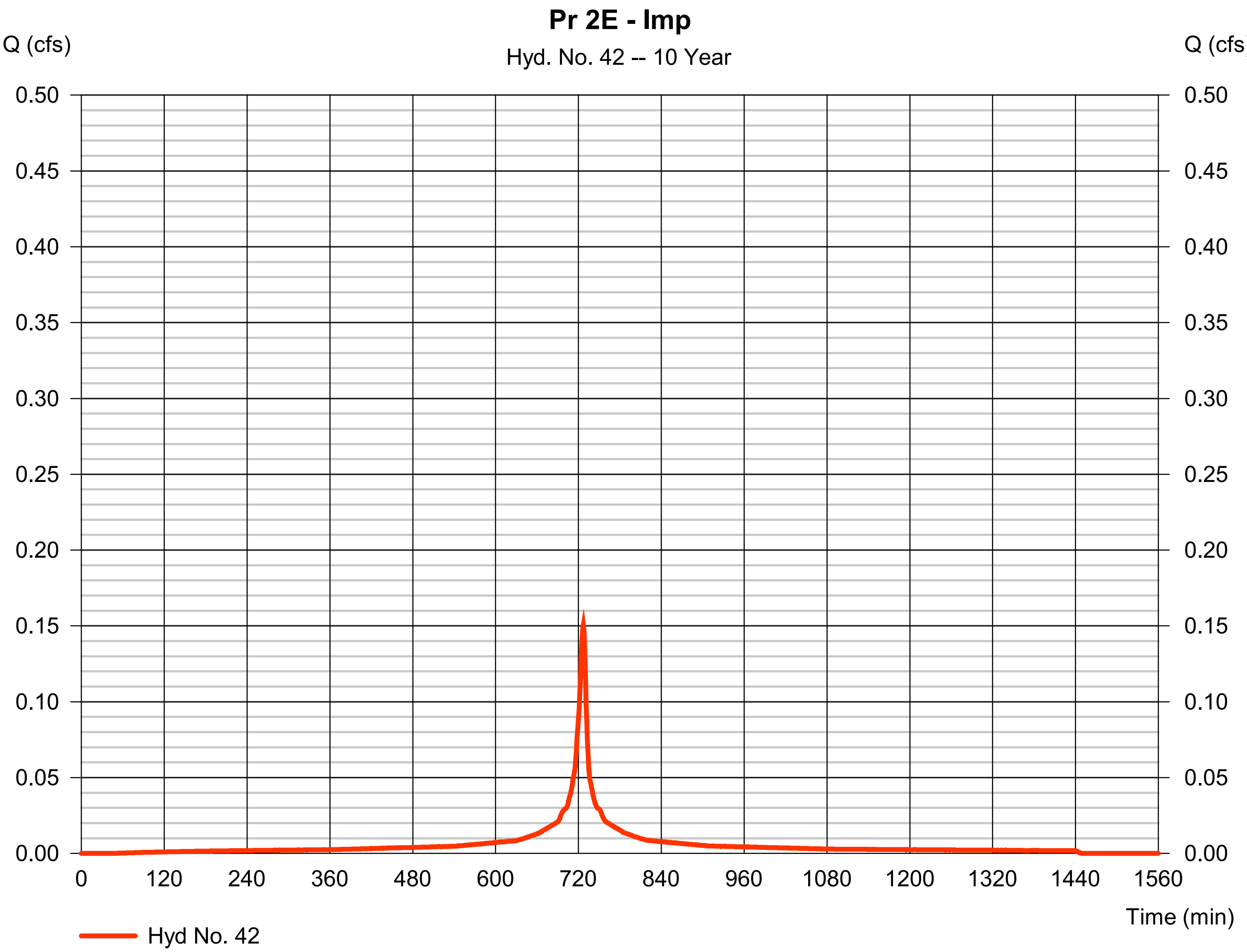
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 42

Pr 2E - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.151 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 548 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



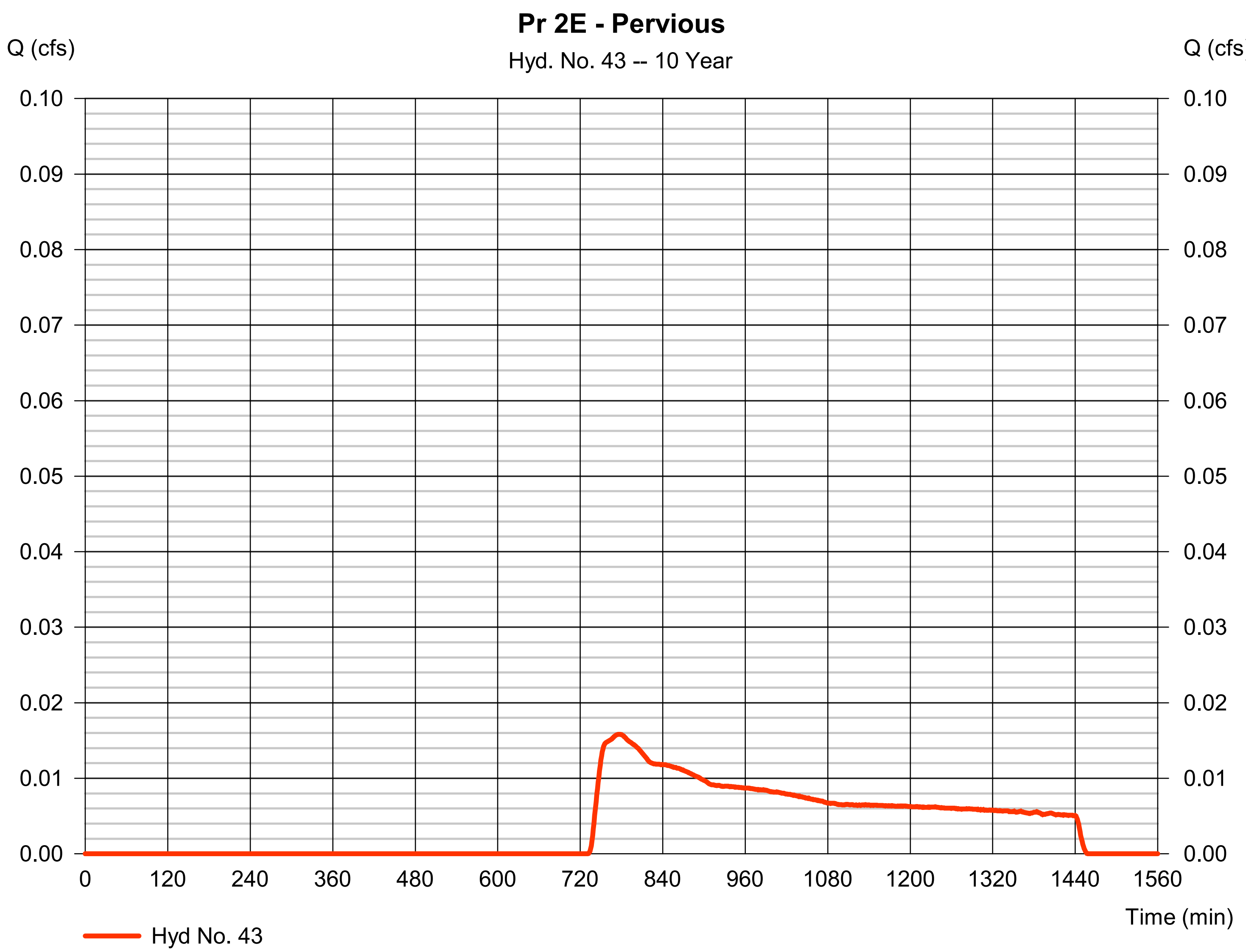
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 43

Pr 2E - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.016 cfs
Storm frequency	= 10 yrs	Time to peak	= 777 min
Time interval	= 1 min	Hyd. volume	= 341 cuft
Drainage area	= 0.410 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



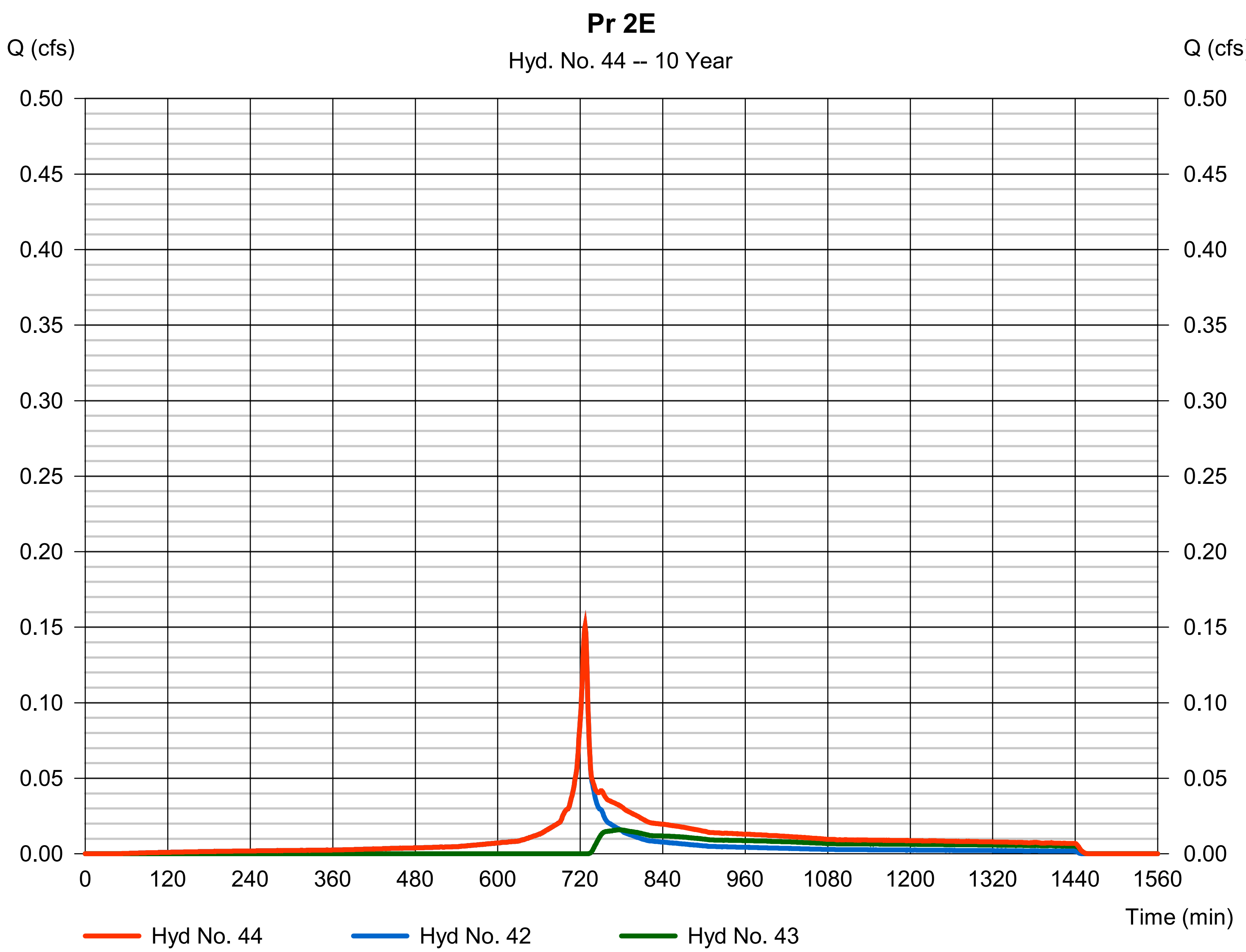
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 44

Pr 2E

Hydrograph type	= Combine	Peak discharge	= 0.151 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 889 cuft
Inflow hyds.	= 42, 43	Contrib. drain. area	= 0.440 ac



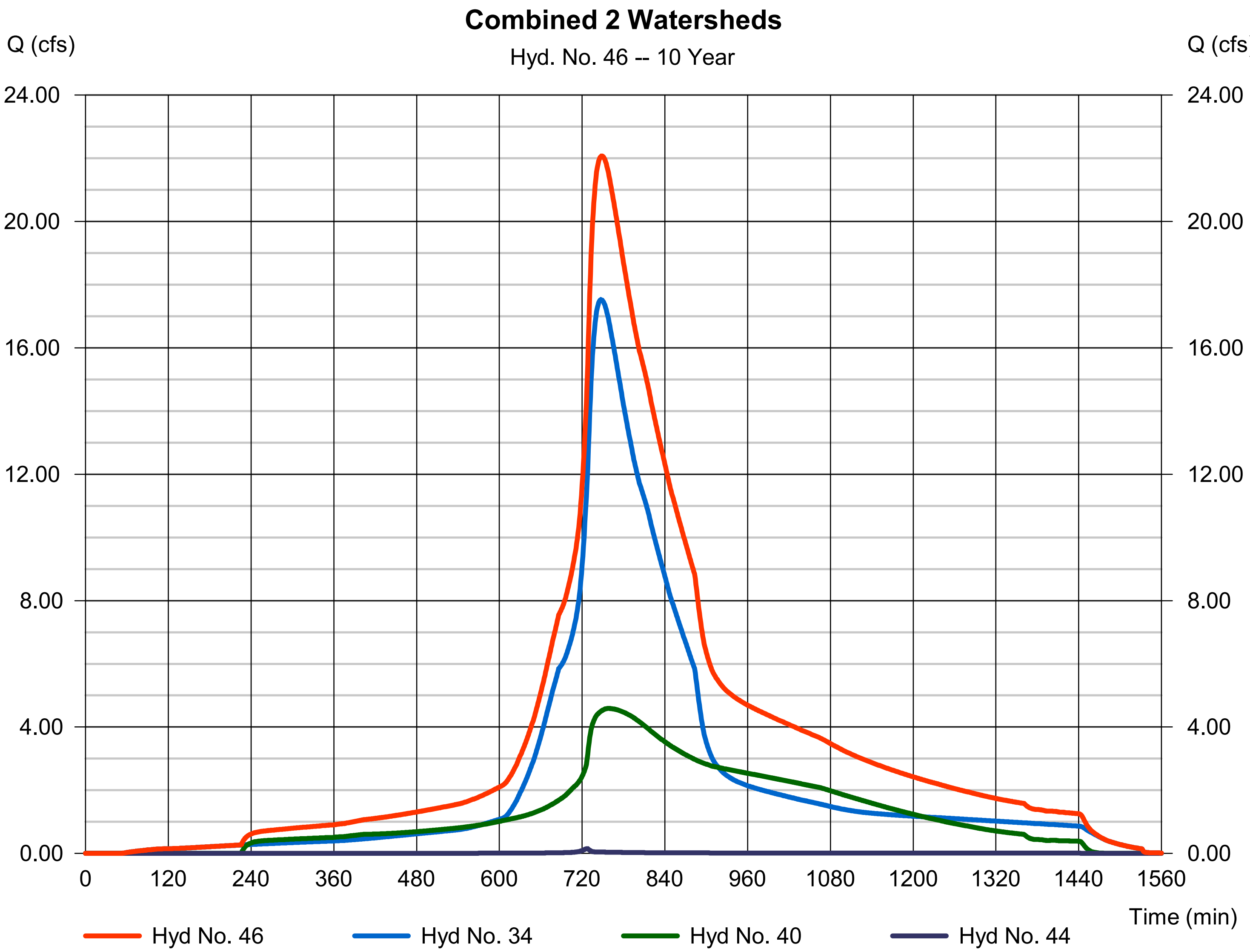
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 46

Combined 2 Watersheds

Hydrograph type	= Combine	Peak discharge	= 22.07 cfs
Storm frequency	= 10 yrs	Time to peak	= 749 min
Time interval	= 1 min	Hyd. volume	= 324,598 cuft
Inflow hyds.	= 34, 40, 44	Contrib. drain. area	= 0.000 ac



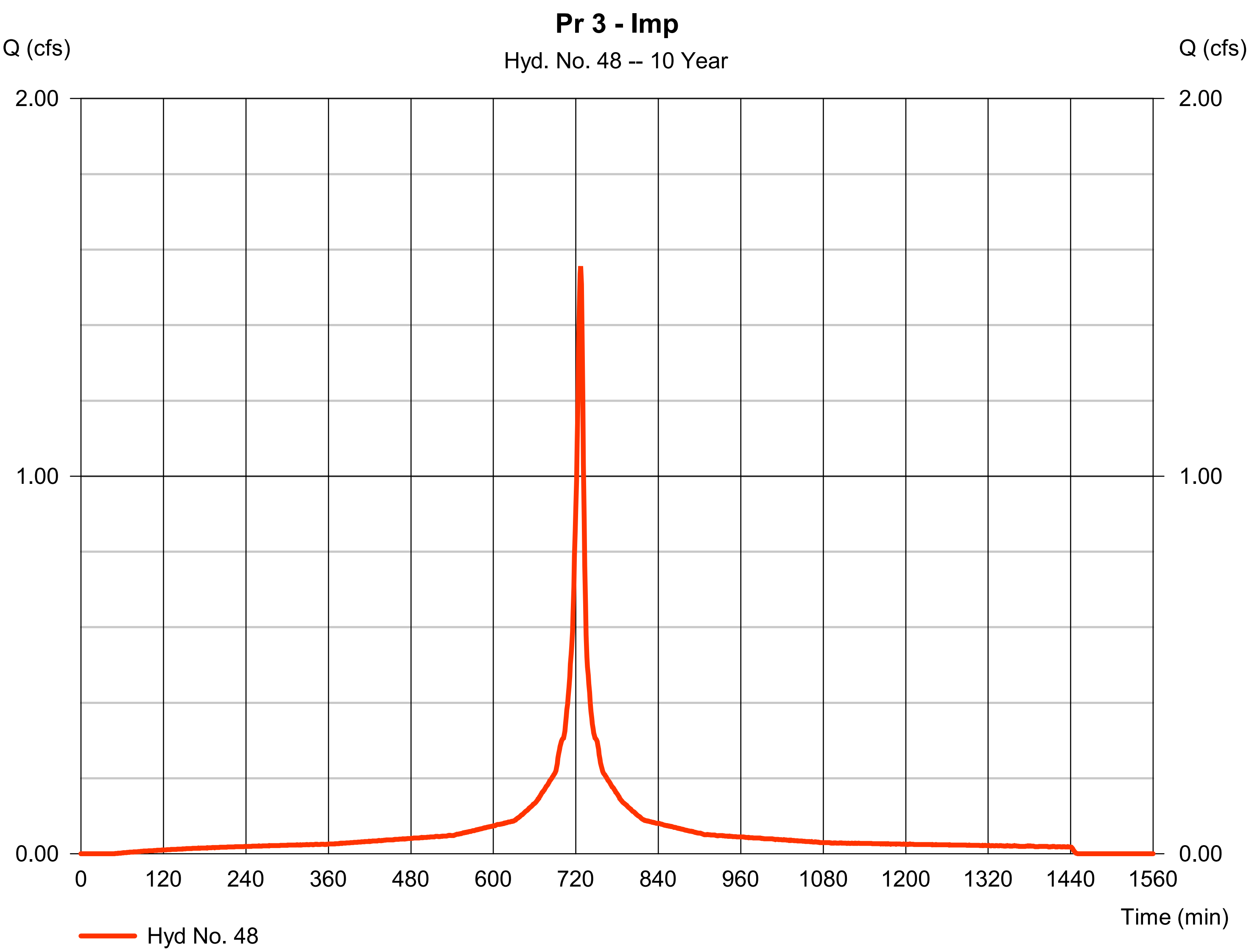
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 48

Pr 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.556 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 5,667 cuft
Drainage area	= 0.310 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



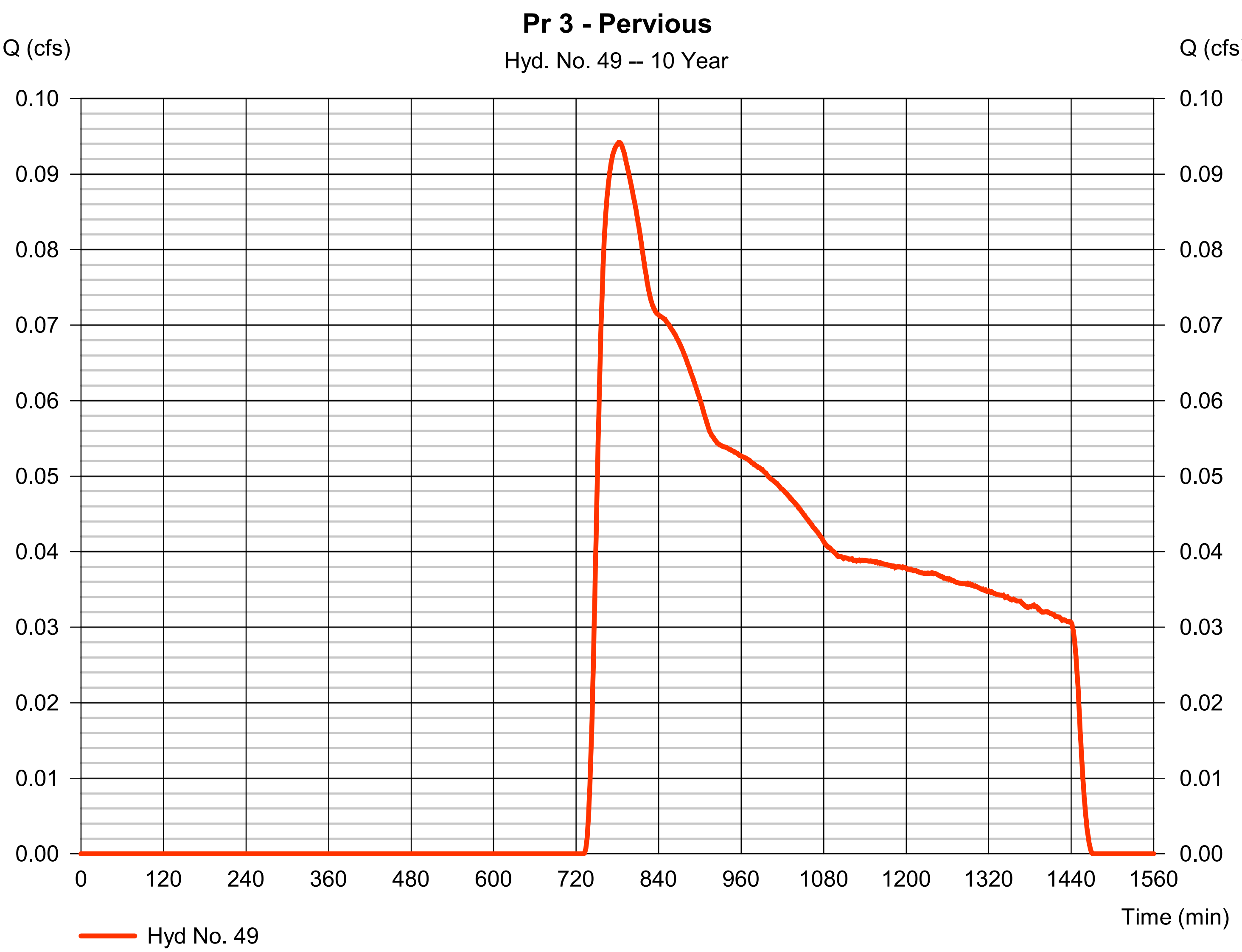
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 49

Pr 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.094 cfs
Storm frequency	= 10 yrs	Time to peak	= 783 min
Time interval	= 1 min	Hyd. volume	= 2,050 cuft
Drainage area	= 2.510 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.00 min
Total precip.	= 5.12 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



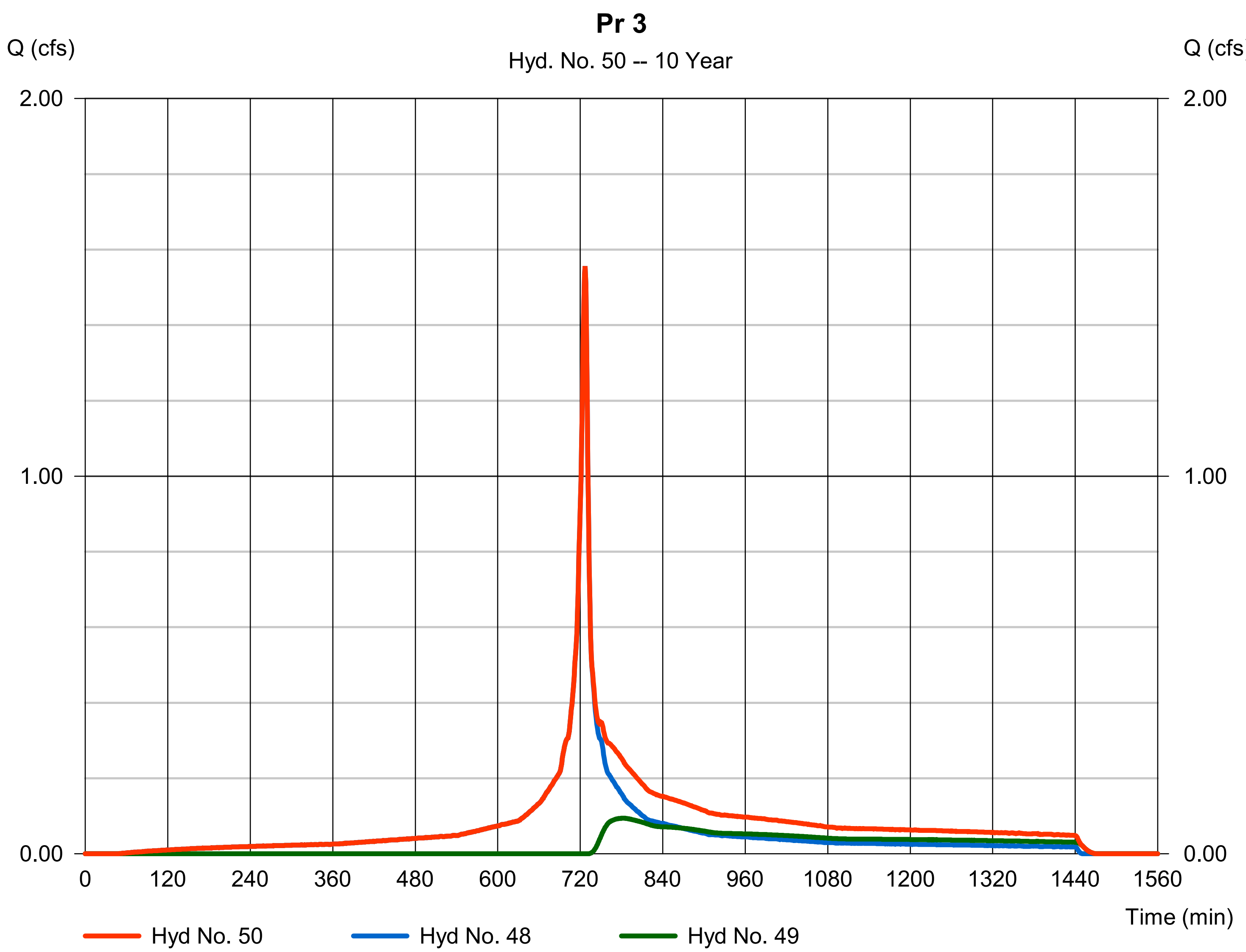
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 50

Pr 3

Hydrograph type	= Combine	Peak discharge	= 1.556 cfs
Storm frequency	= 10 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 7,716 cuft
Inflow hyds.	= 48, 49	Contrib. drain. area	= 2.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	12.89	1	736	68,294	------	------	------	Ex 1 - Imp
2	SCS Runoff	1.634	1	751	17,611	------	------	------	Ex 1 - Pervious
3	Combine	13.86	1	736	85,905	1, 2	------	------	Ex 1
5	SCS Runoff	54.30	1	728	221,765	------	------	------	Ex 2 - Imp
6	SCS Runoff	1.025	1	745	10,290	------	------	------	Ex 2 - Pervious
7	Combine	54.54	1	728	232,055	5, 6	------	------	Ex 2
9	SCS Runoff	12.87	1	727	47,206	------	------	------	Ex 3 - Imp
10	SCS Runoff	0.845	1	750	9,714	------	------	------	Ex 3 - Pervious
11	Combine	12.96	1	727	56,920	9, 10	------	------	Ex 3
14	SCS Runoff	1.267	1	730	5,687	------	------	------	Pr 1 - Imp
15	SCS Runoff	0.902	1	758	9,449	------	------	------	Pr 1 - Pervious
16	Combine	1.486	1	732	15,136	14, 15	------	------	Pr 1
18	SCS Runoff	32.17	1	727	118,014	------	------	------	Pr 2A - Imp
19	SCS Runoff	0.369	1	730	3,149	------	------	------	Pr 2A - Pervious
20	Combine	32.44	1	727	121,163	18, 19	------	------	Pr 2A
22	SCS Runoff	2.979	1	727	11,483	------	------	------	Pr 2B - Imp
23	SCS Runoff	0.062	1	732	548	------	------	------	Pr 2B - Pervious
24	Combine	3.019	1	728	12,031	22, 23	------	------	Pr 2B
25	Reservoir	2.952	1	729	10,557	24	37.83	2,037	Bioretention Basin 1
27	SCS Runoff	40.60	1	727	148,950	------	------	------	Pr 2C - Imp
28	SCS Runoff	2.218	1	741	15,148	------	------	------	Pr 2C - Pervious
29	Combine	41.42	1	727	164,098	27, 28	------	------	Pr 2C
30	Reservoir	30.13	1	731	144,426	29	38.19	38,210	Bioretention Basin 2
32	Combine	62.38	1	728	276,145	20, 25, 30,	------	------	Pr 2A, Bio Basin 1, Bio Basin 2
34	Reservoir	24.04	1	746	276,144	32	33.13	60,684	Detention Basin 1
36	SCS Runoff	39.23	1	727	143,909	------	------	------	Pr 2D - Imp
37	SCS Runoff	0.284	1	730	2,424	------	------	------	Pr 2D - Pervious
38	Combine	39.44	1	727	146,332	36, 37	------	------	Pr 2D
40	Reservoir	6.117	1	756	143,946	38	32.04	55,947	Detention Basin 2

Middlesex Analysis.gpw	Return Period: 25 Year	Wednesday, 03 / 25 / 2020

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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
42	SCS Runoff	0.187	1	727	687	------	------	------	Pr 2E - Imp
43	SCS Runoff	0.086	1	737	838	------	------	------	Pr 2E - Pervious
44	Combine	0.219	1	728	1,526	42, 43	------	------	Pr 2E
46	Combine	30.15	1	746	421,616	34, 40, 44,	------	------	Combined 2 Watersheds
48	SCS Runoff	1.936	1	727	7,104	------	------	------	Pr 3 - Imp
49	SCS Runoff	0.449	1	748	5,042	------	------	------	Pr 3 - Pervious
50	Combine	1.993	1	727	12,146	48, 49	------	------	Pr 3

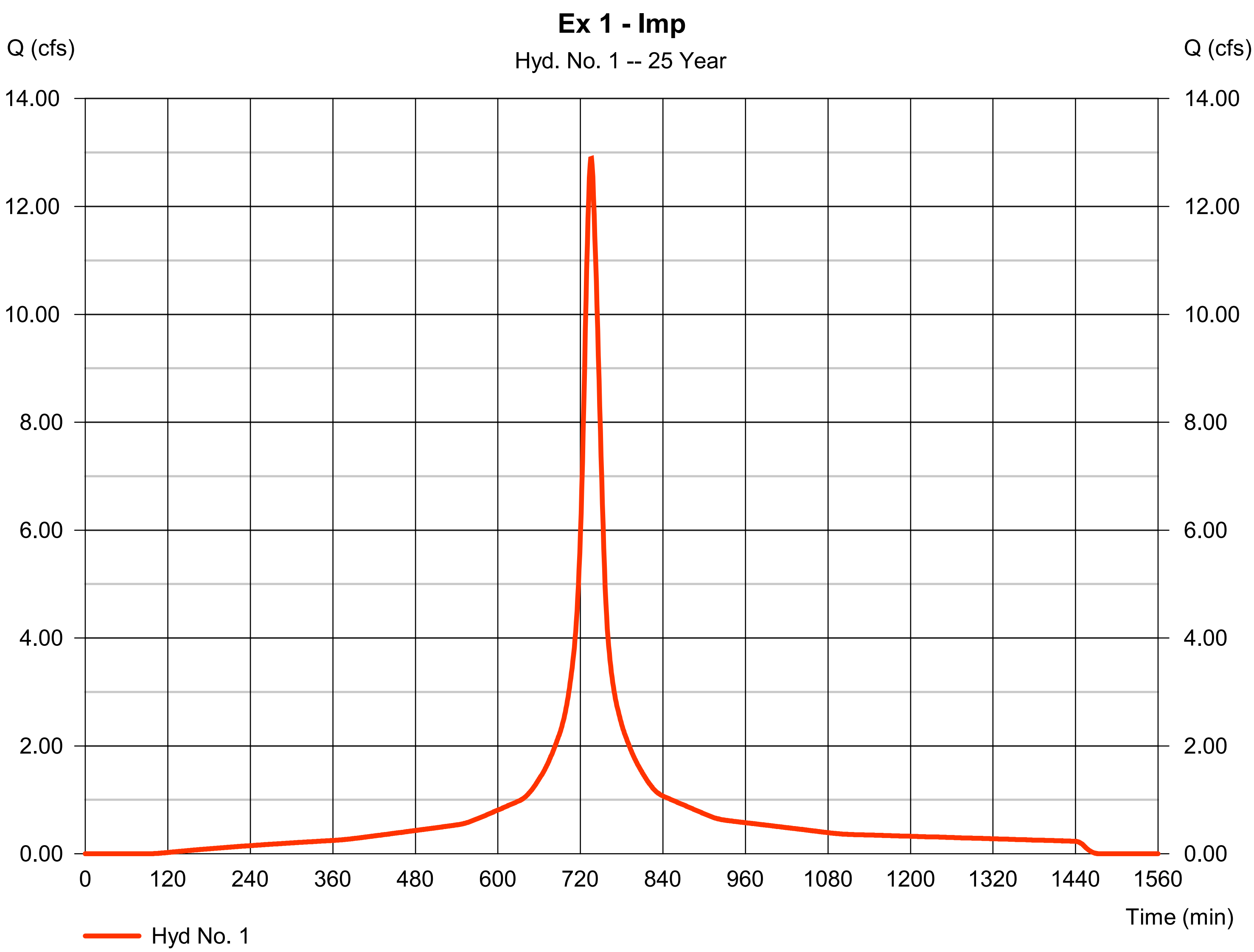
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 1

Ex 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 12.89 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 68,294 cuft
Drainage area	= 3.230 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



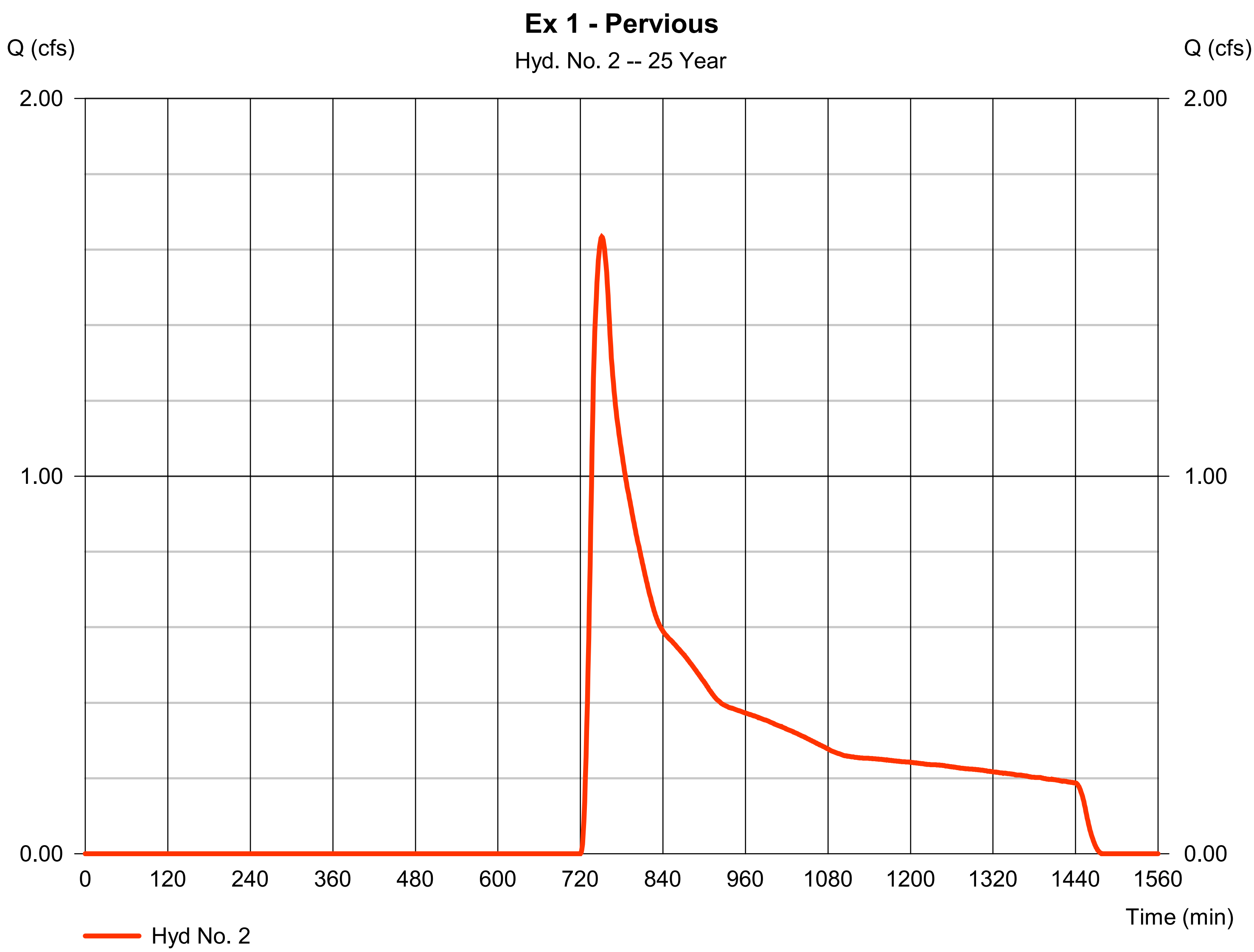
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 2

Ex 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.634 cfs
Storm frequency	= 25 yrs	Time to peak	= 751 min
Time interval	= 1 min	Hyd. volume	= 17,611 cuft
Drainage area	= 7.890 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



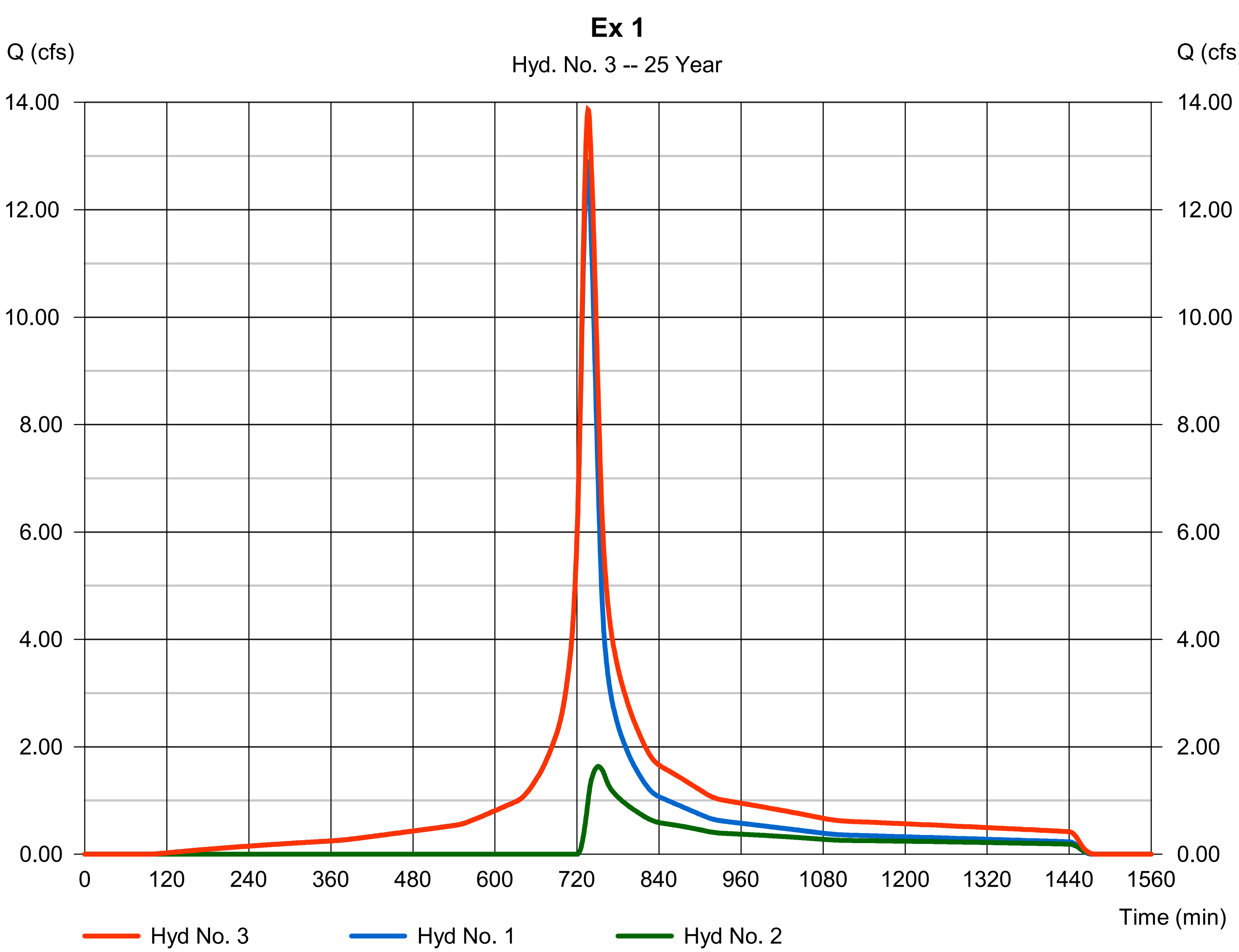
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 3

Ex 1

Hydrograph type	= Combine	Peak discharge	= 13.86 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 1 min	Hyd. volume	= 85,905 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 11.120 ac



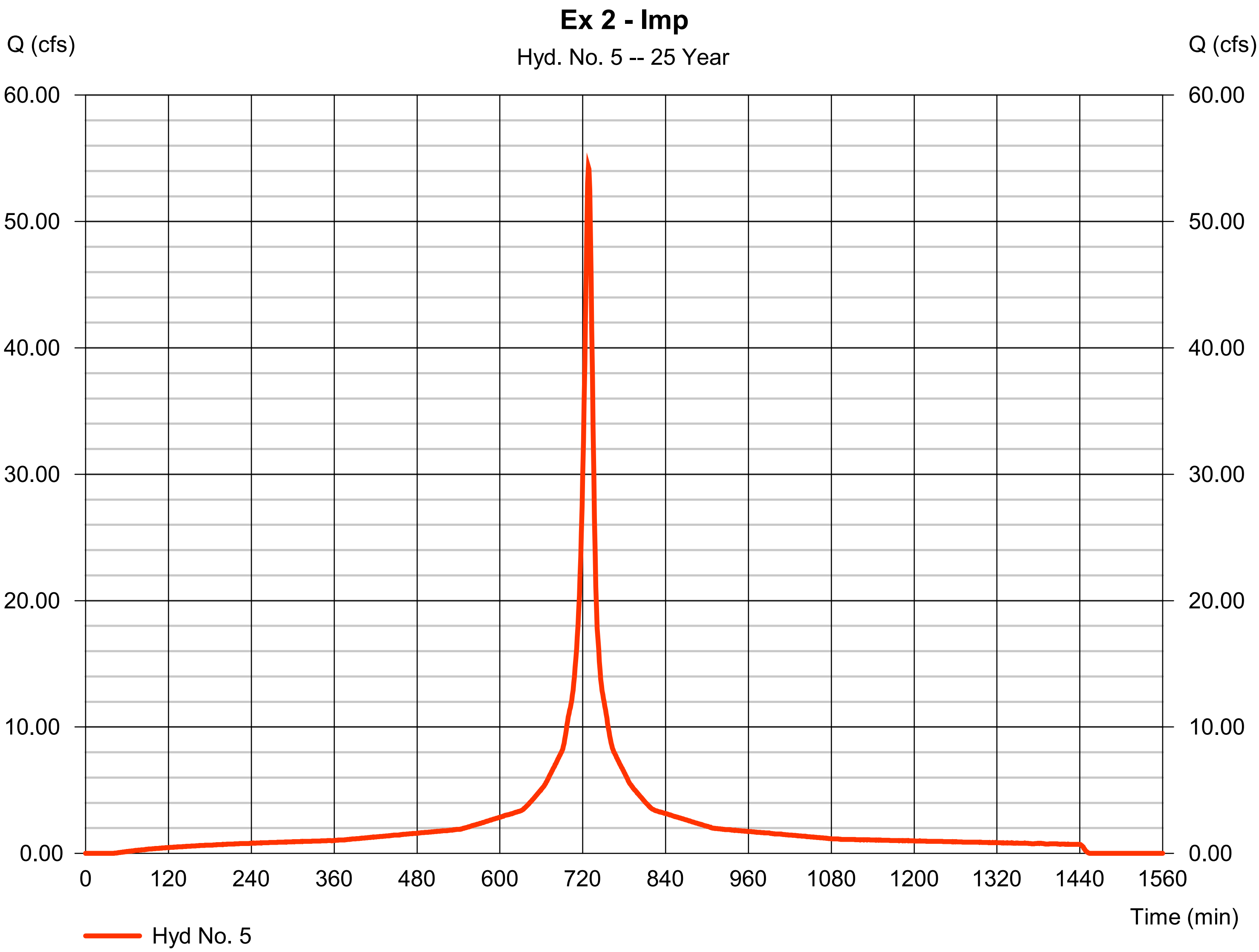
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 5

Ex 2 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 54.30 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 221,765 cuft
Drainage area	= 9.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



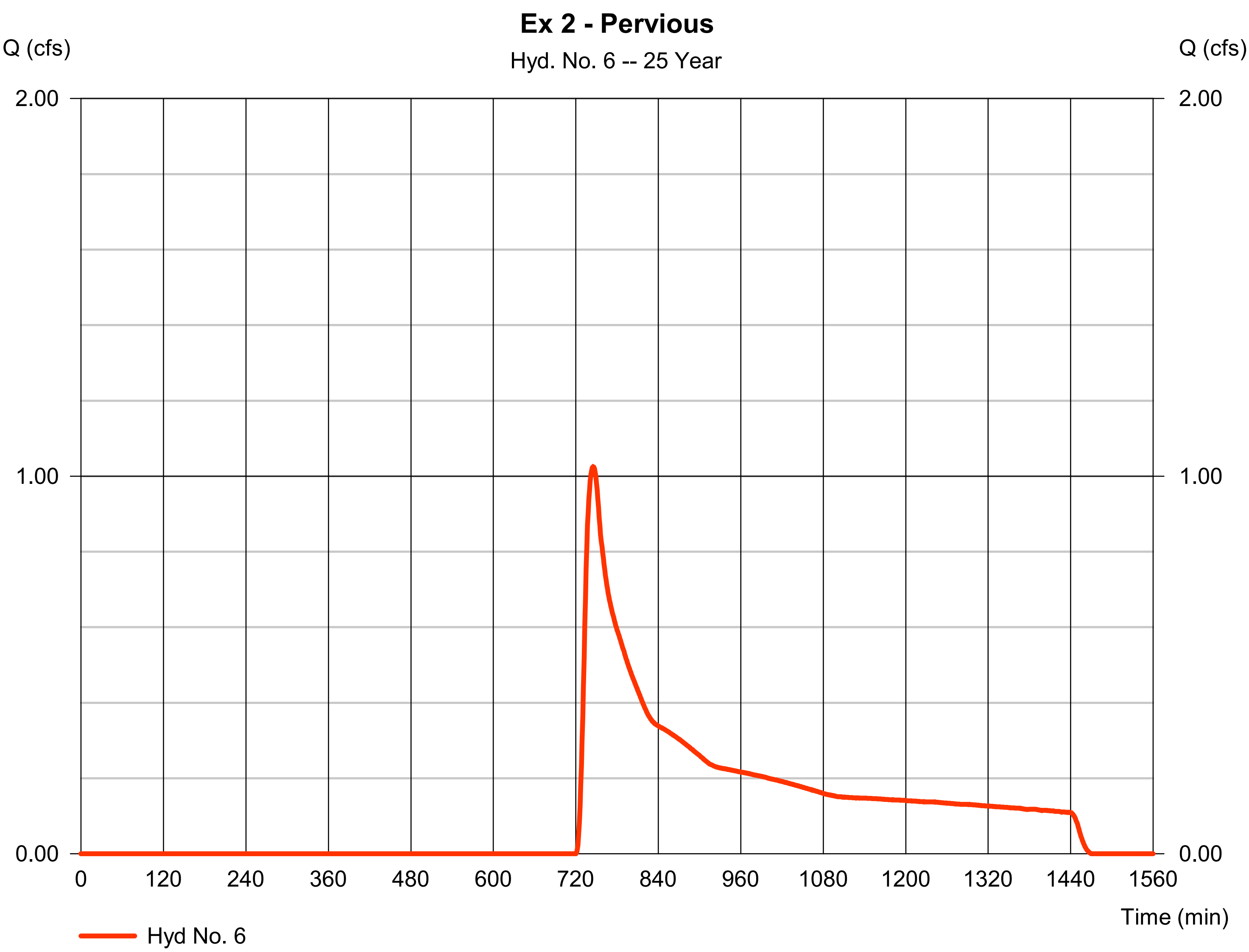
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 6

Ex 2 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.025 cfs
Storm frequency	= 25 yrs	Time to peak	= 745 min
Time interval	= 1 min	Hyd. volume	= 10,290 cuft
Drainage area	= 4.610 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 19.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



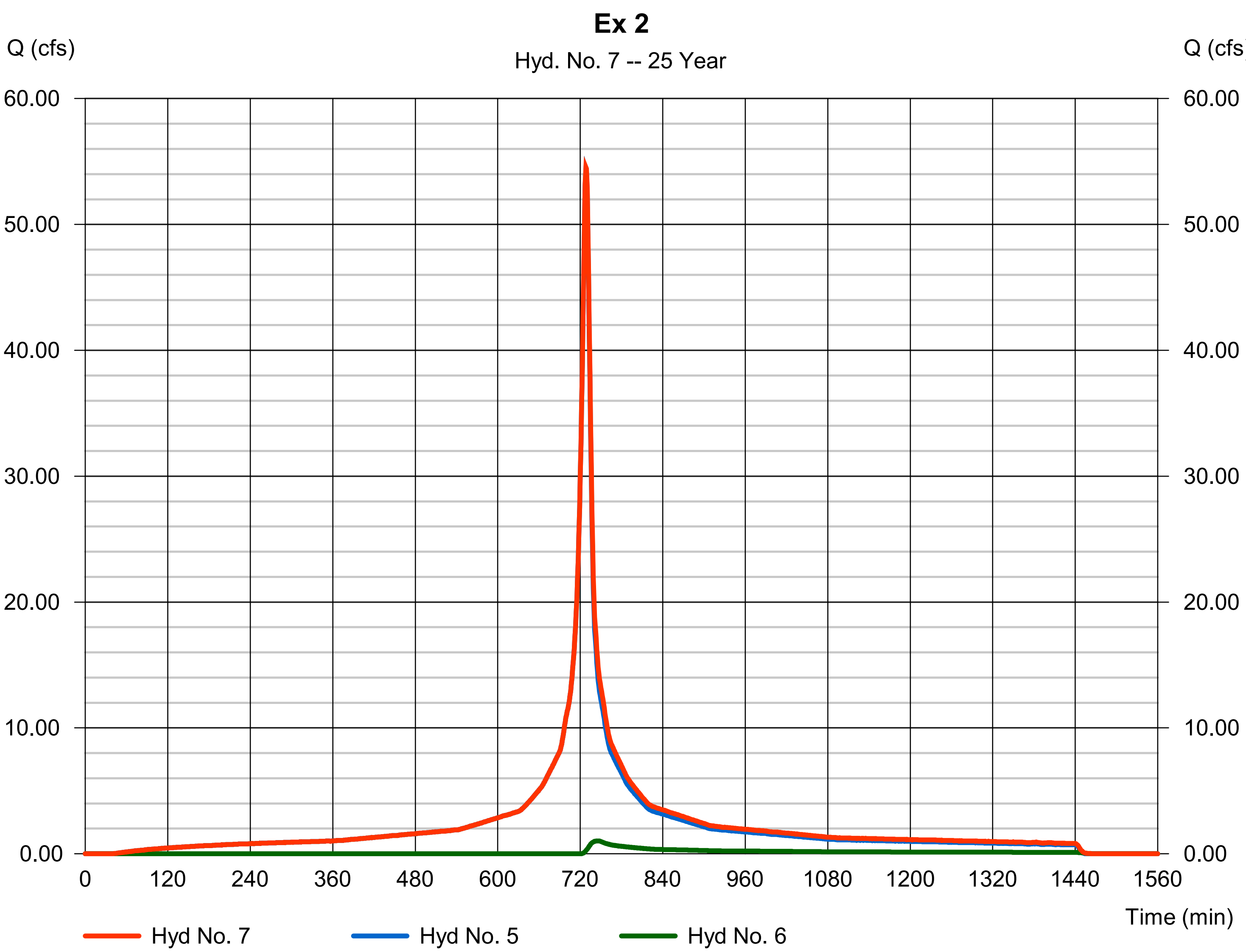
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 7

Ex 2

Hydrograph type	= Combine	Peak discharge	= 54.54 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 232,055 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 14.590 ac



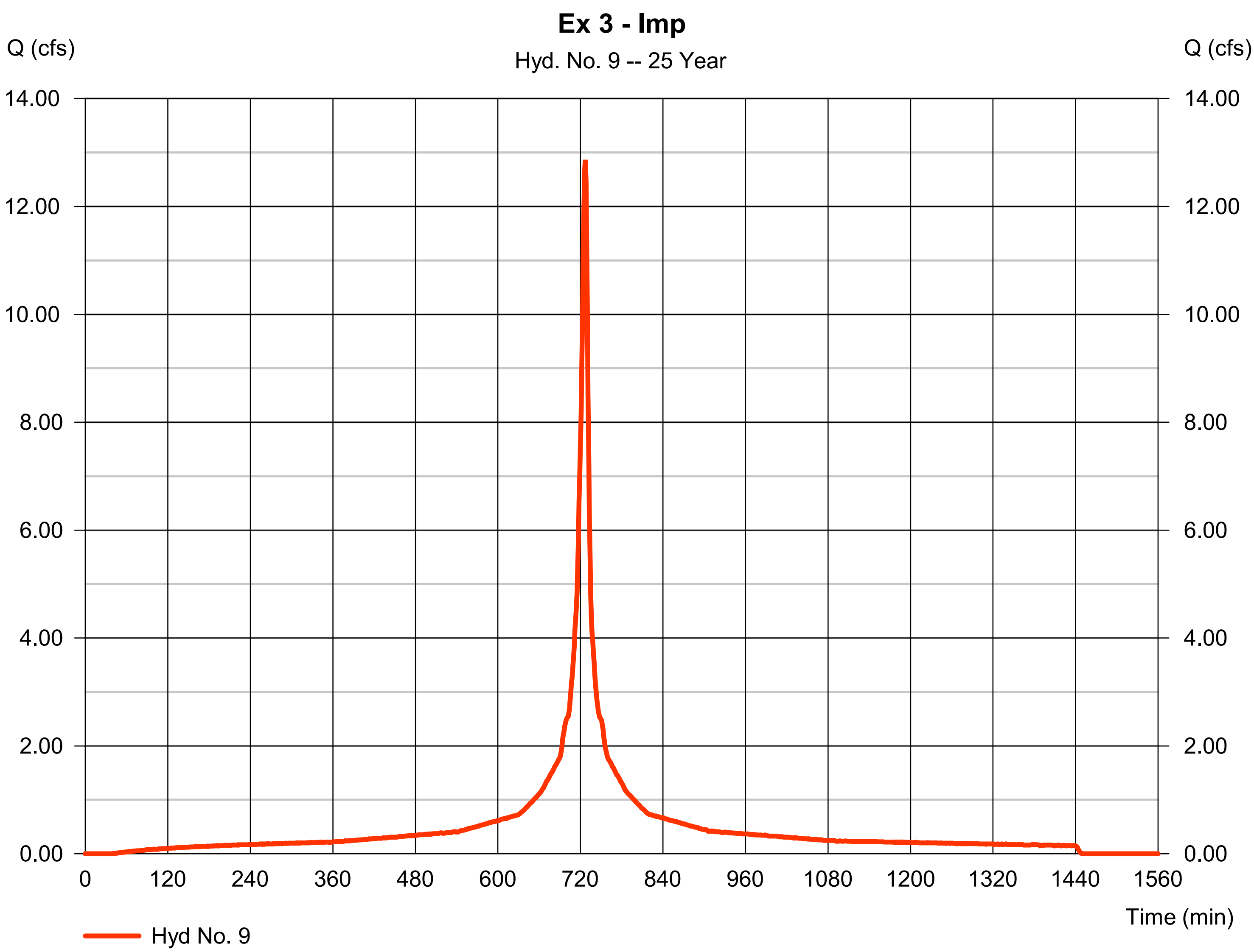
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 9

Ex 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 12.87 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 47,206 cuft
Drainage area	= 2.060 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



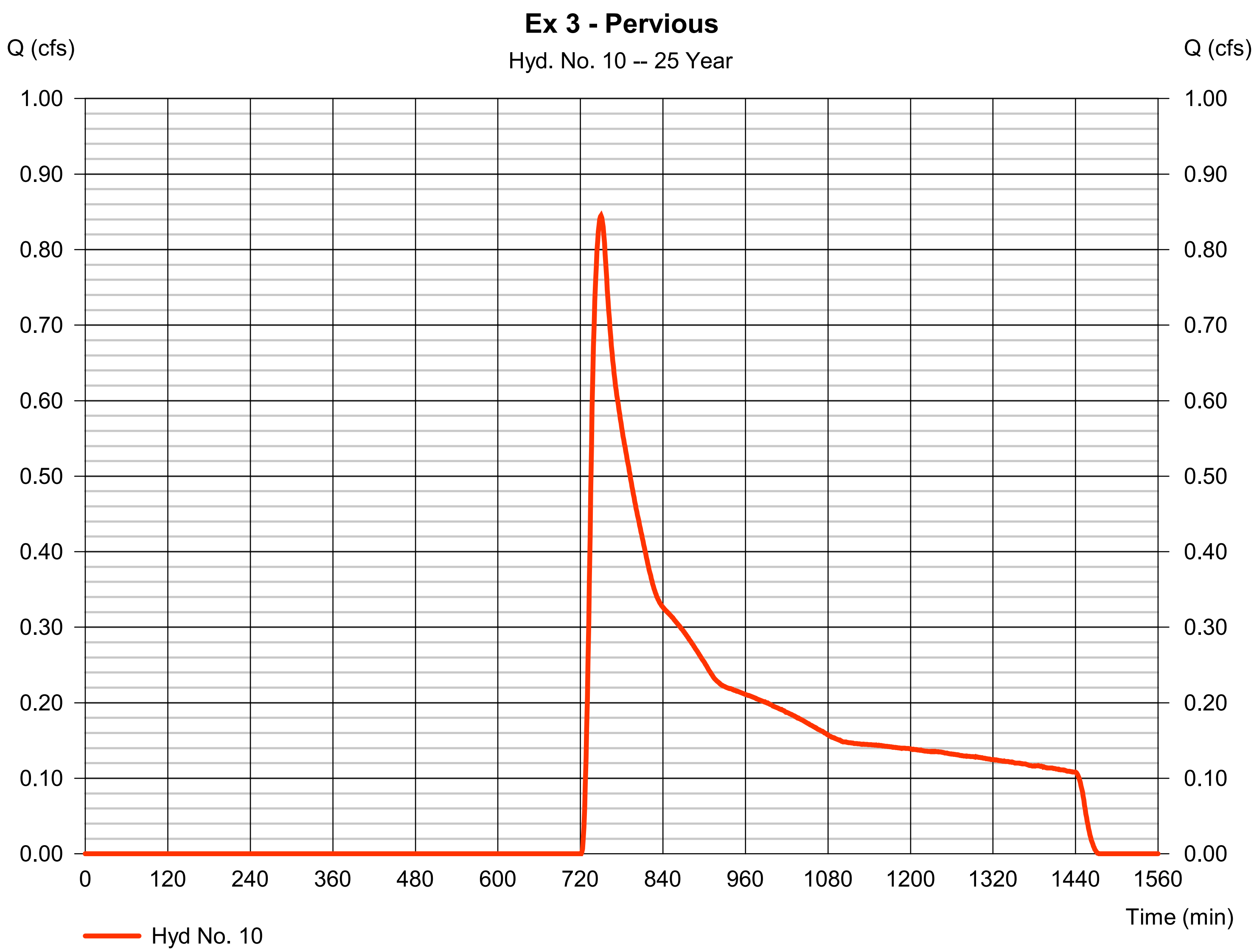
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 10

Ex 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.845 cfs
Storm frequency	= 25 yrs	Time to peak	= 750 min
Time interval	= 1 min	Hyd. volume	= 9,714 cuft
Drainage area	= 4.790 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



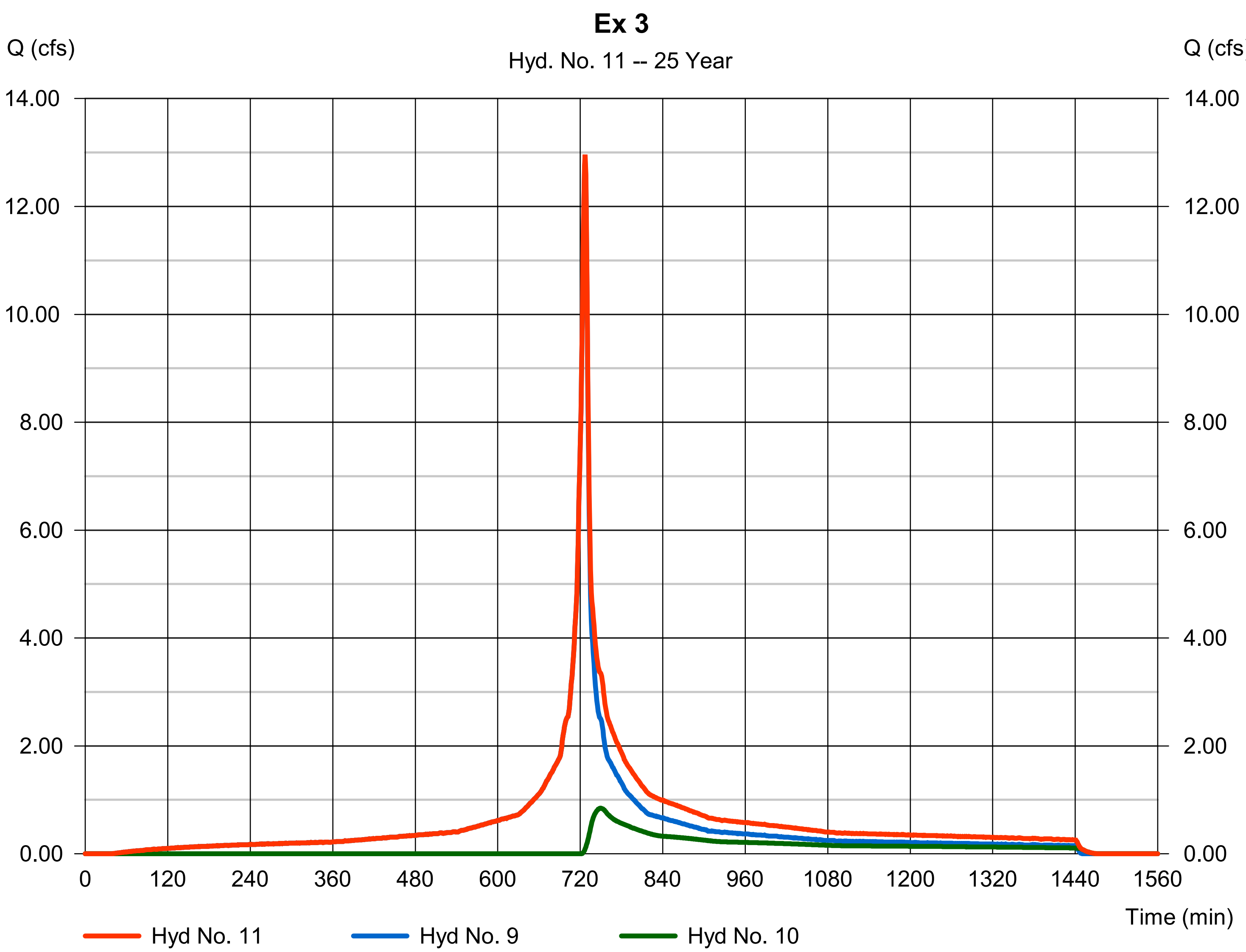
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 11

Ex 3

Hydrograph type	= Combine	Peak discharge	= 12.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 56,920 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 6.850 ac



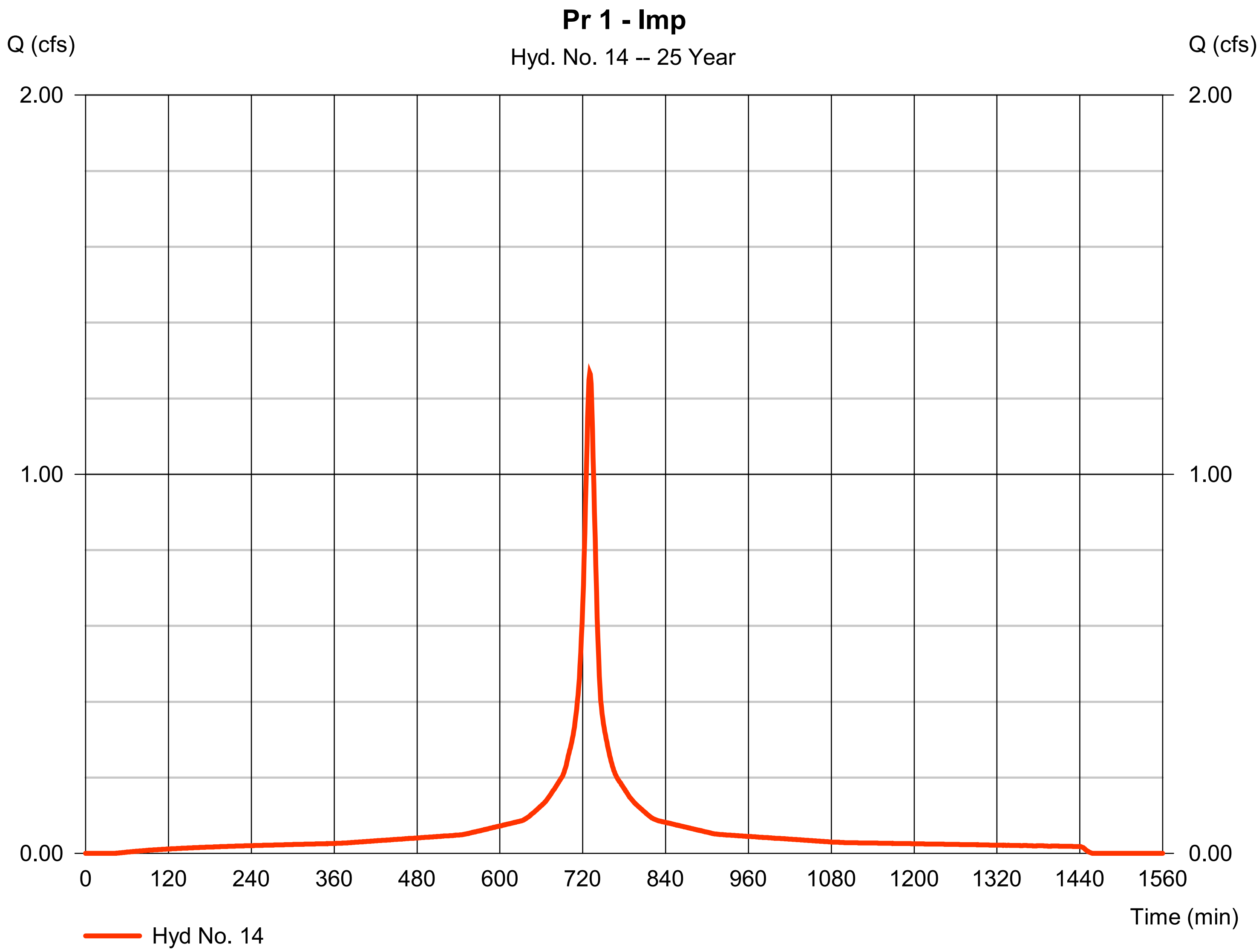
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 14

Pr 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.267 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 5,687 cuft
Drainage area	= 0.260 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



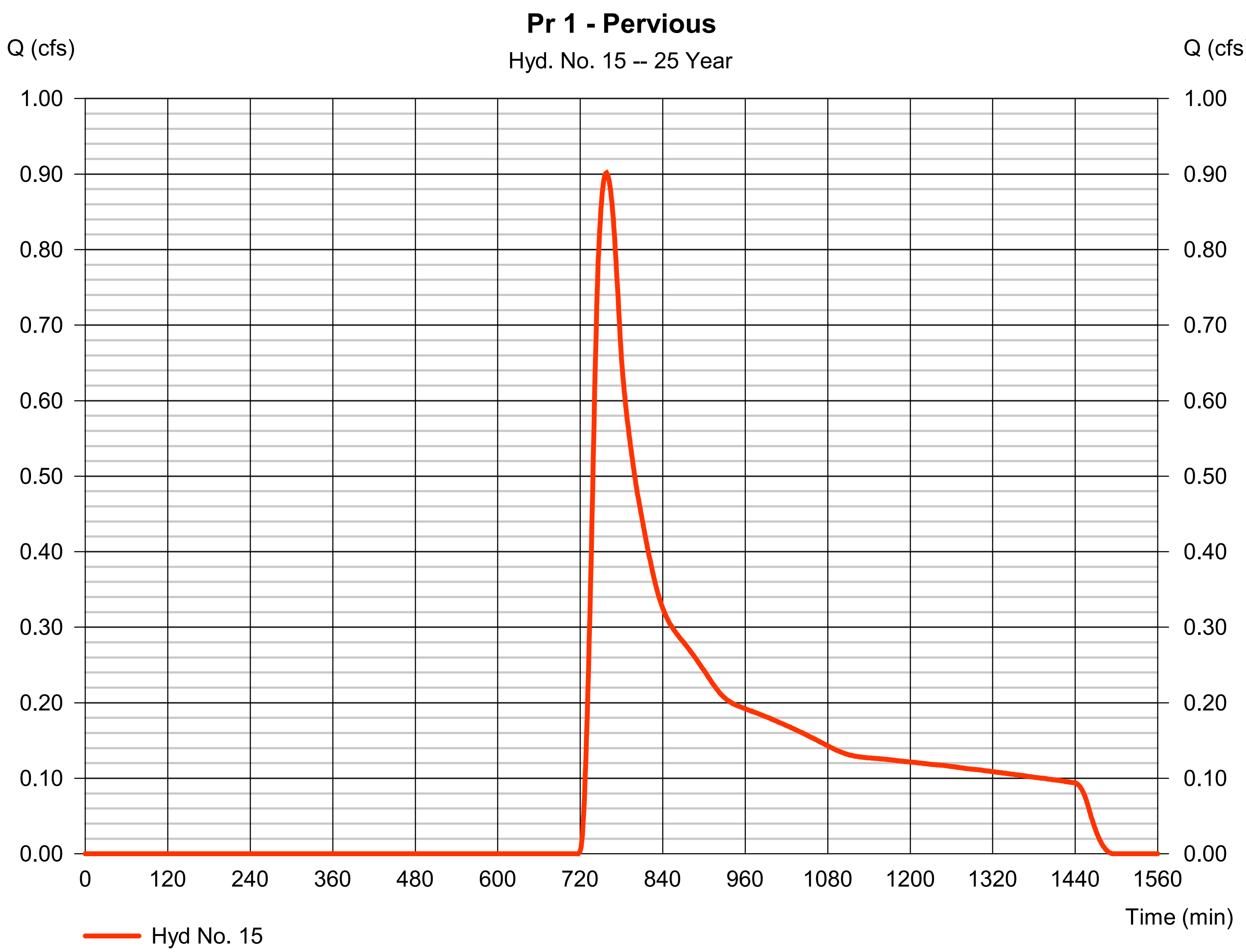
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 15

Pr 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.902 cfs
Storm frequency	= 25 yrs	Time to peak	= 758 min
Time interval	= 1 min	Hyd. volume	= 9,449 cuft
Drainage area	= 3.500 ac	Curve number	= 42
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 35.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



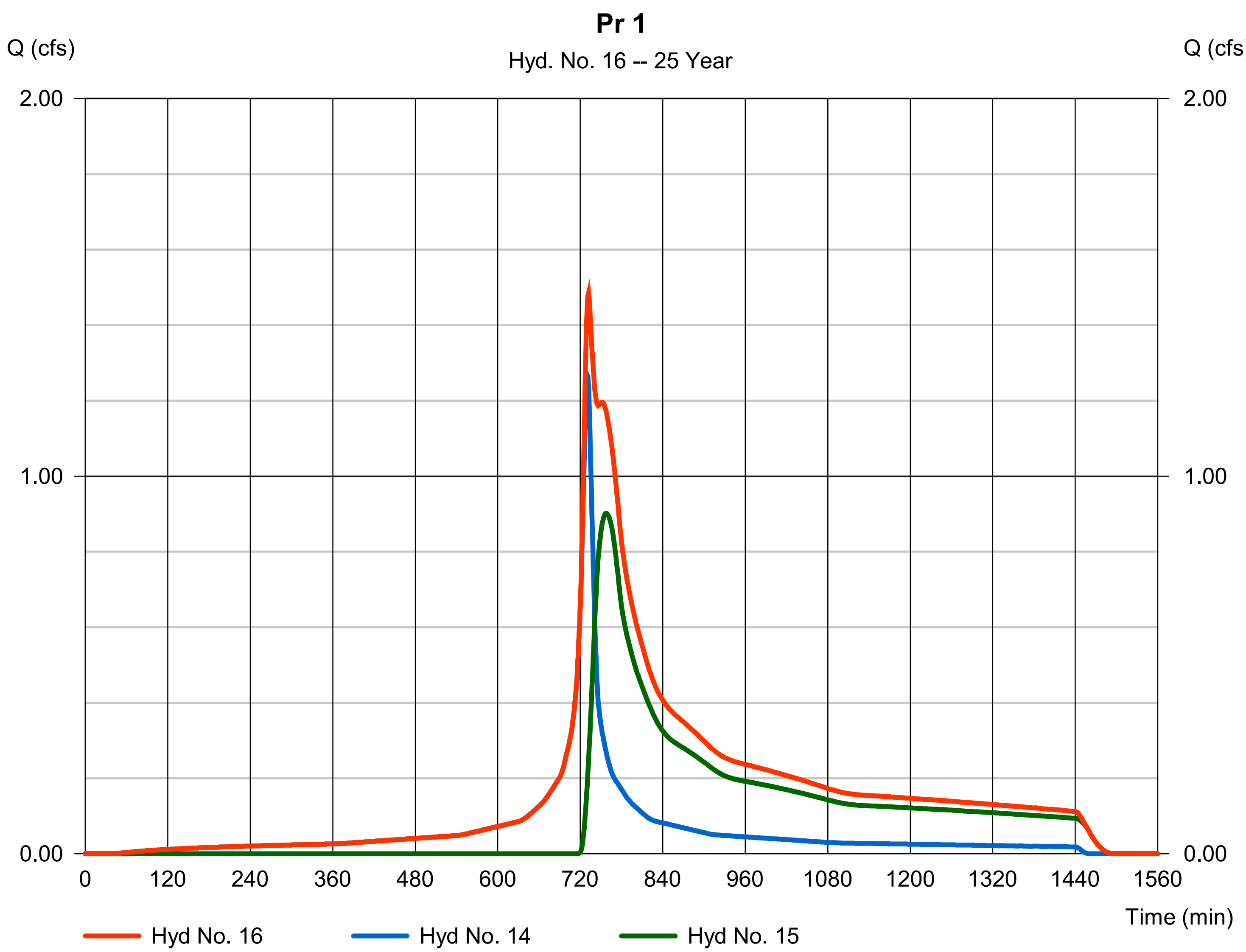
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 16

Pr 1

Hydrograph type	= Combine	Peak discharge	= 1.486 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 1 min	Hyd. volume	= 15,136 cuft
Inflow hyds.	= 14, 15	Contrib. drain. area	= 3.760 ac



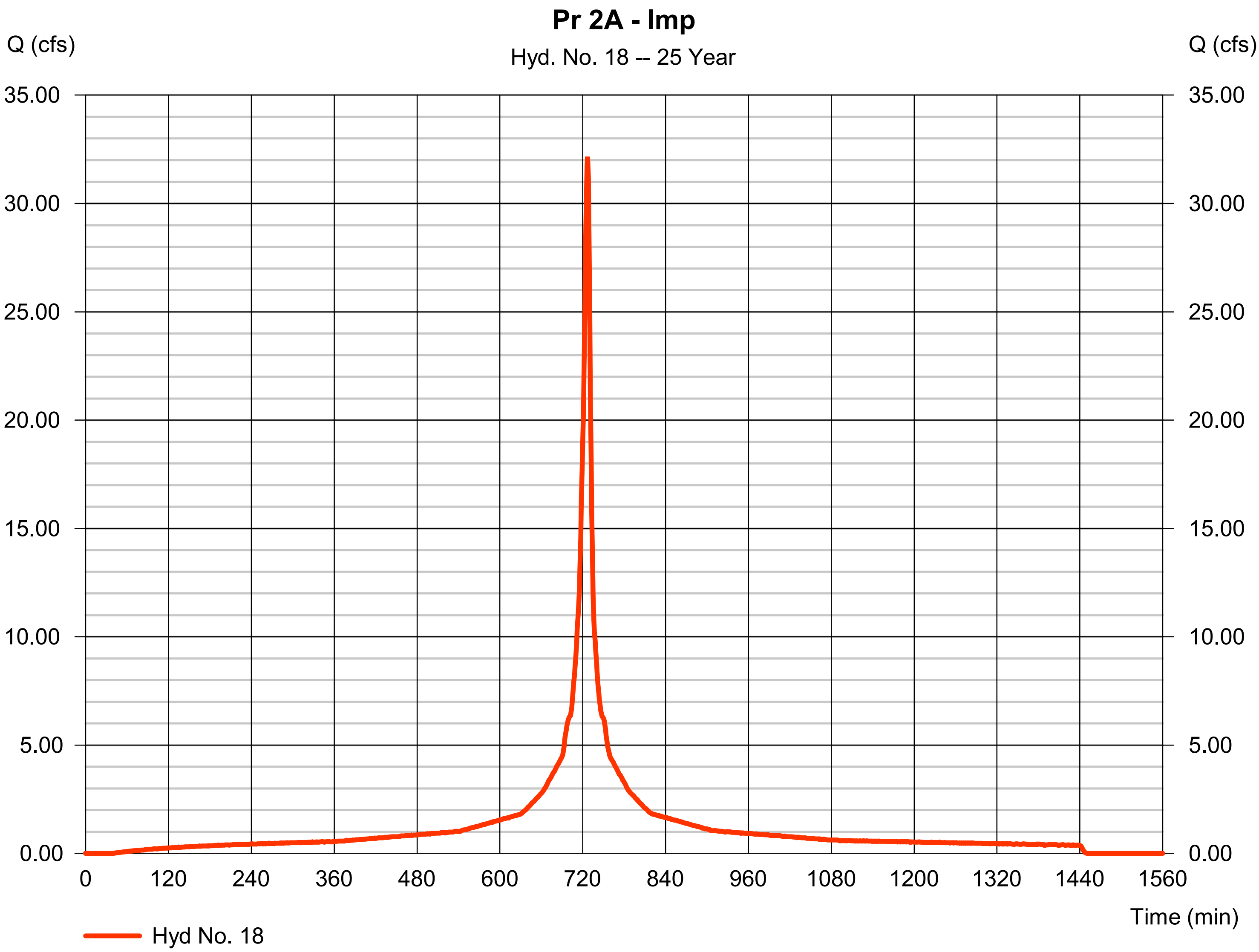
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 18

Pr 2A - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 32.17 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 118,014 cuft
Drainage area	= 5.150 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



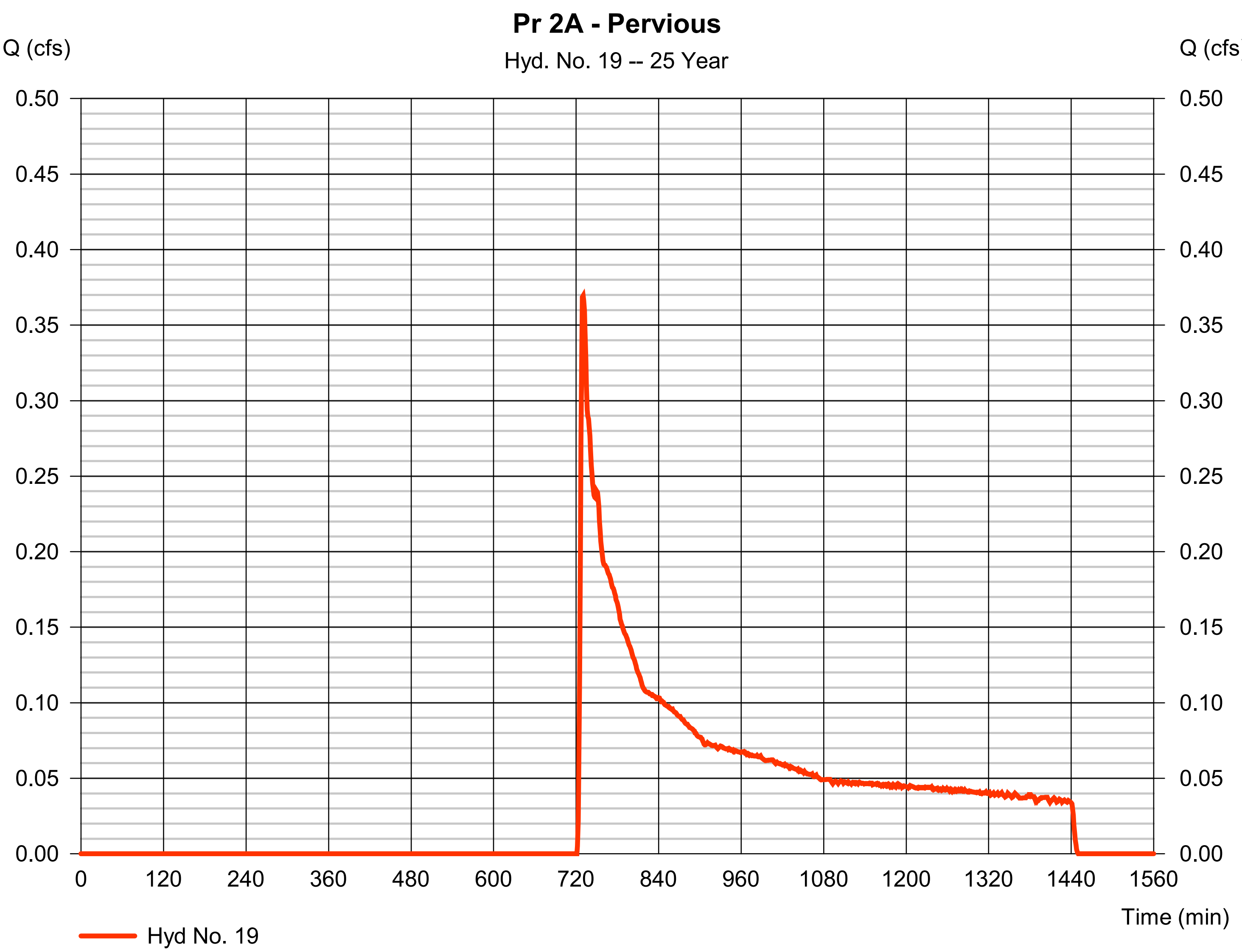
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 19

Pr 2A - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.369 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 3,149 cuft
Drainage area	= 1.520 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



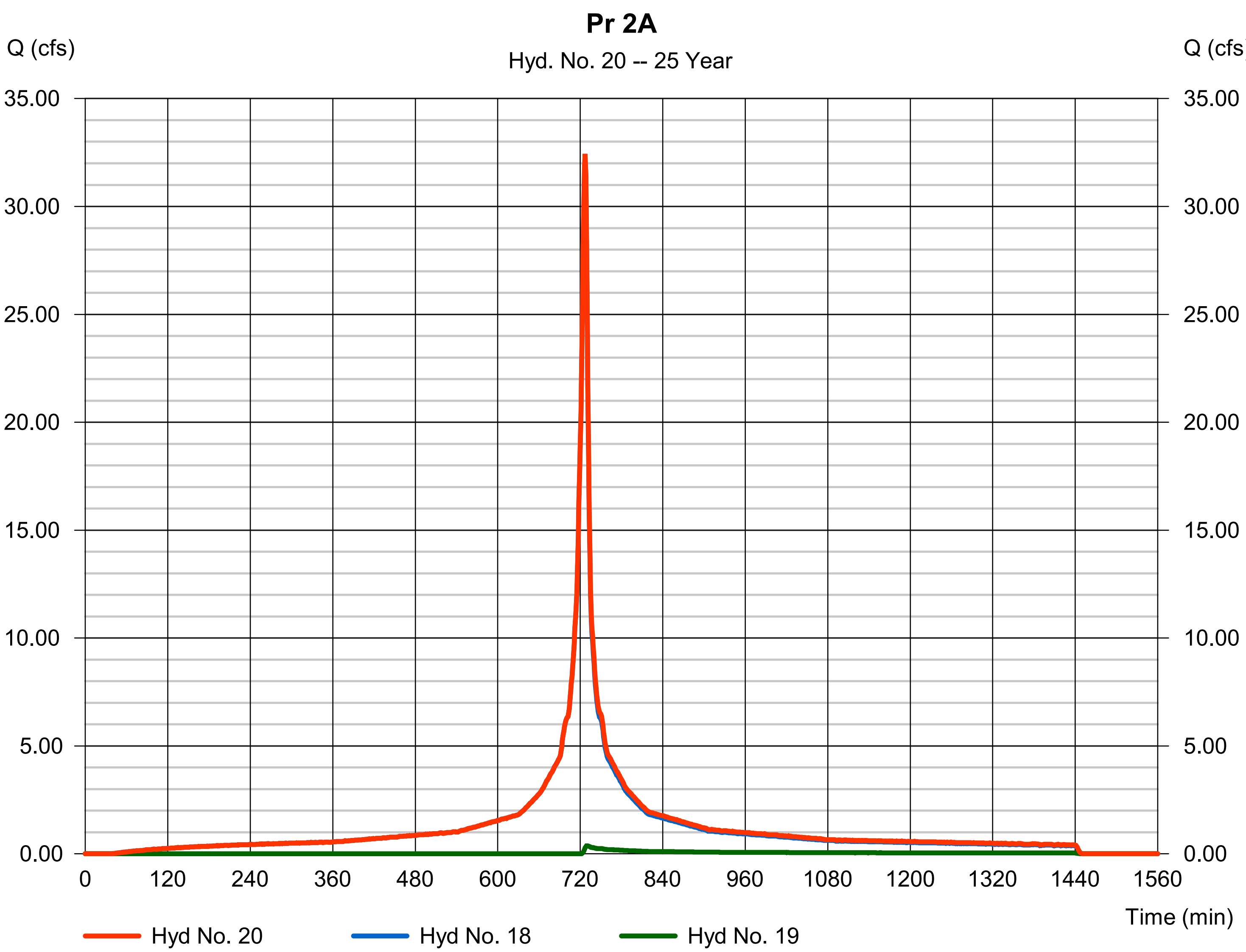
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 20

Pr 2A

Hydrograph type	= Combine	Peak discharge	= 32.44 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 121,163 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 6.670 ac



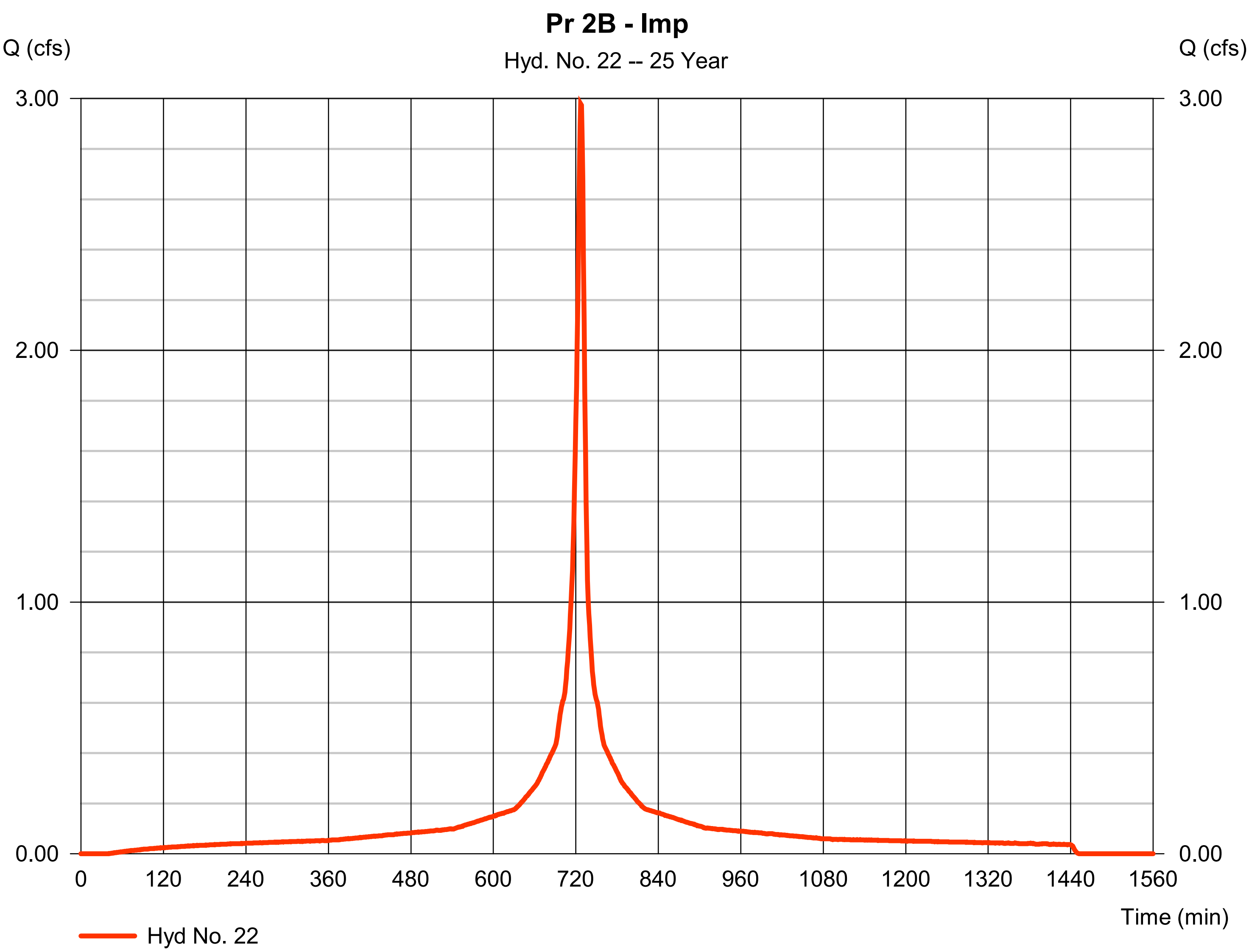
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 22

Pr 2B - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 2.979 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 11,483 cuft
Drainage area	= 0.530 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



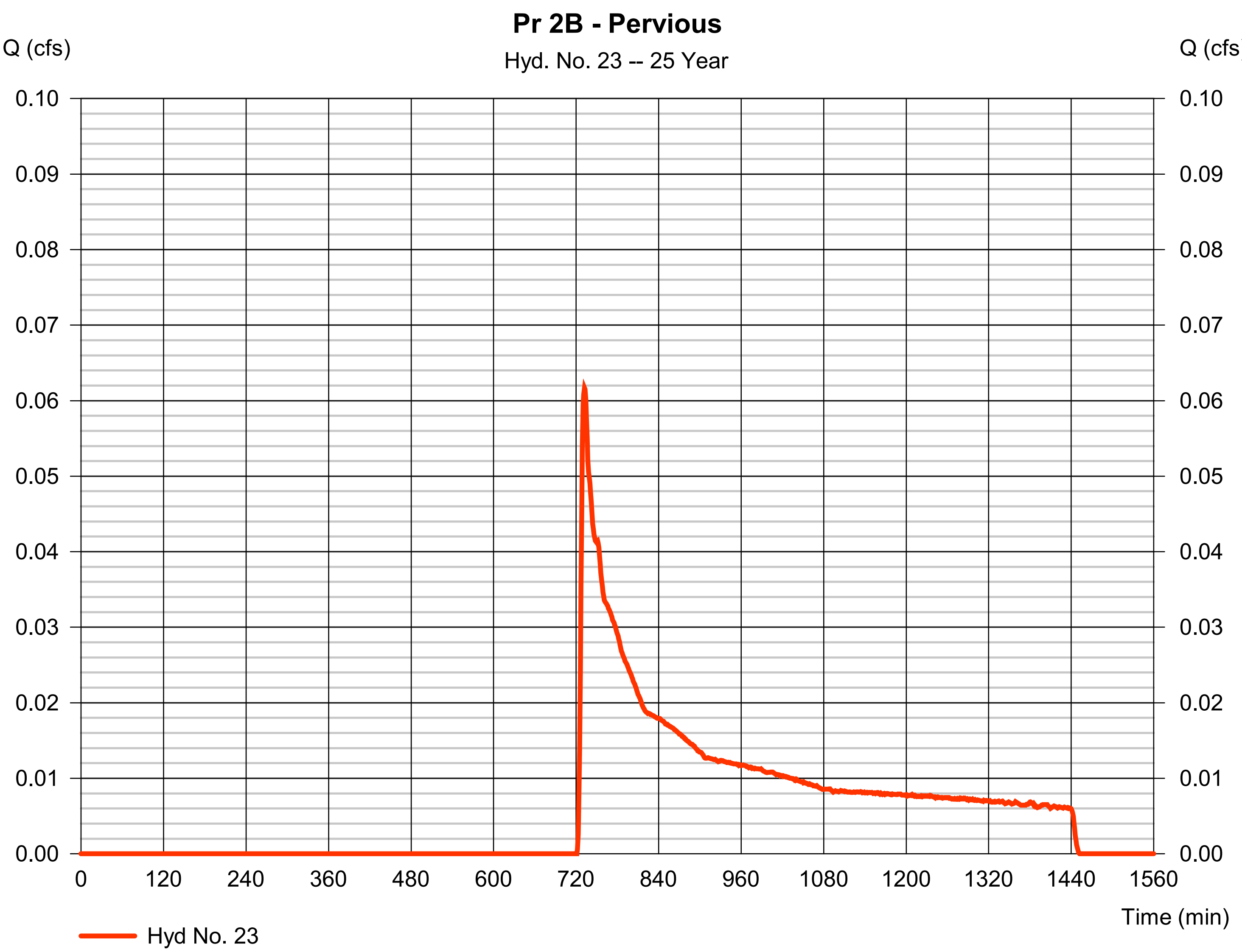
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 23

Pr 2B - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.062 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 1 min	Hyd. volume	= 548 cuft
Drainage area	= 0.280 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



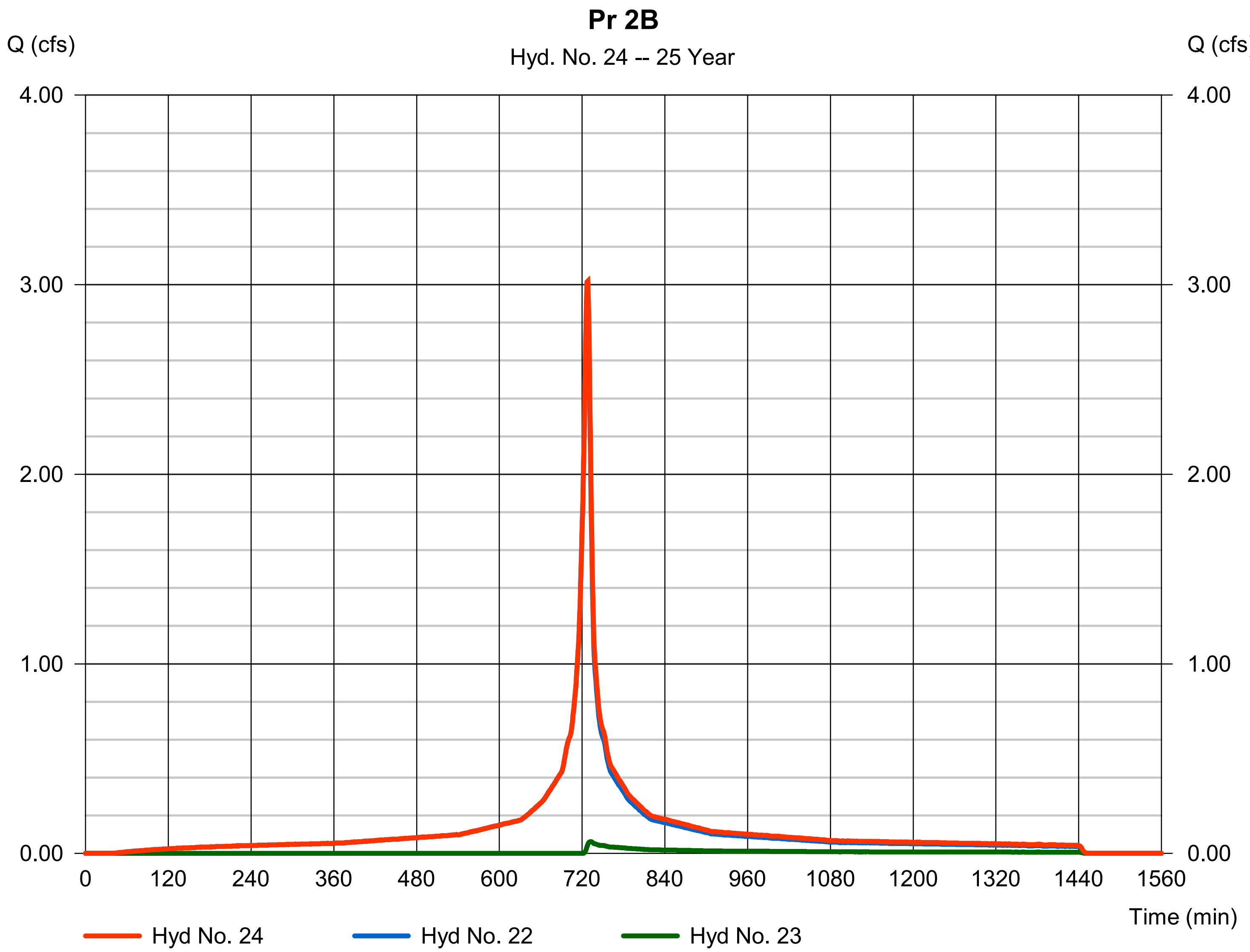
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 24

Pr 2B

Hydrograph type	= Combine	Peak discharge	= 3.019 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 12,031 cuft
Inflow hyds.	= 22, 23	Contrib. drain. area	= 0.810 ac



Hydrograph Report

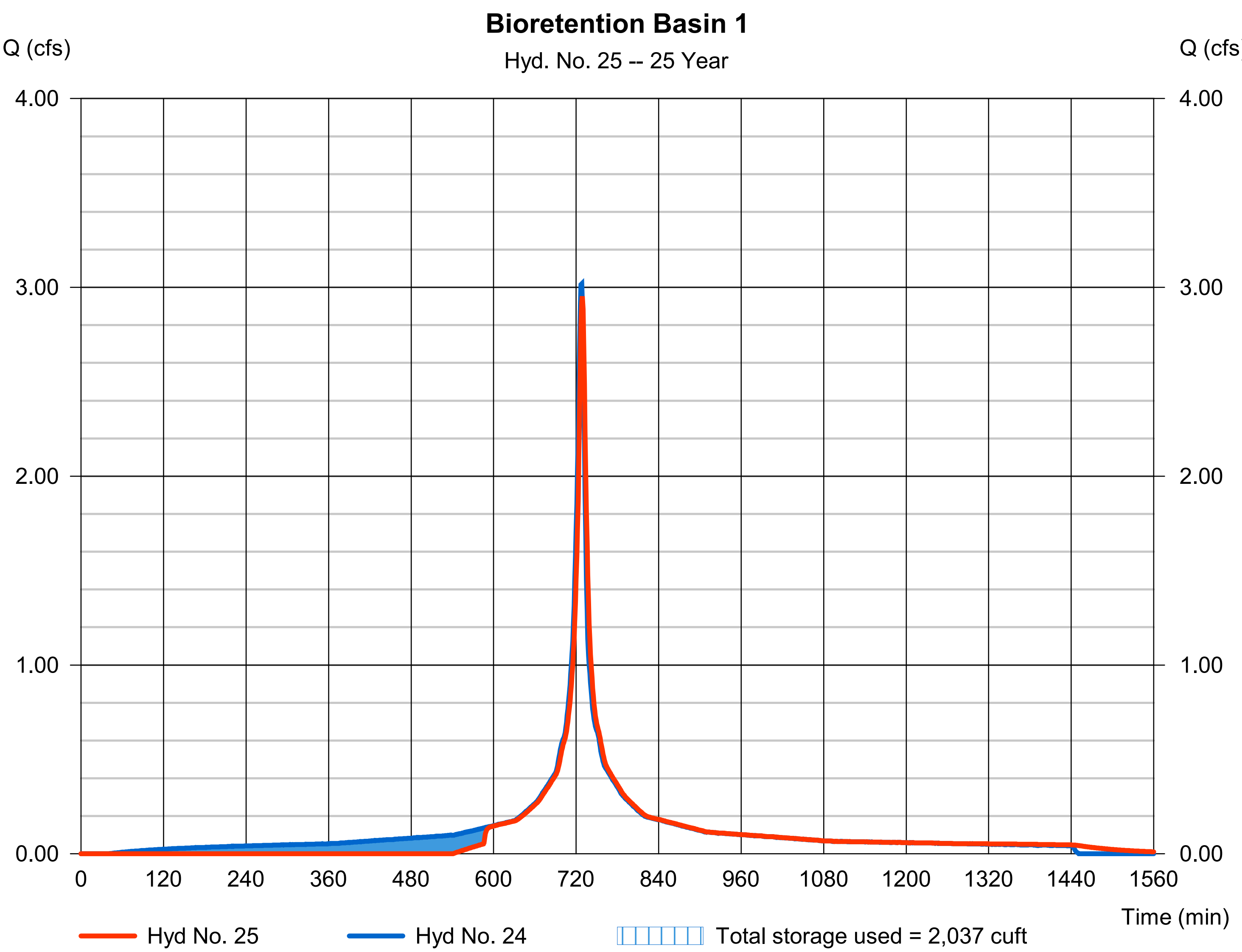
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 25

Bioretention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 2.952 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 10,557 cuft
Inflow hyd. No.	= 24 - Pr 2B	Max. Elevation	= 37.83 ft
Reservoir name	= Bioretention Basin 1	Max. Storage	= 2,037 cuft

Storage Indication method used.



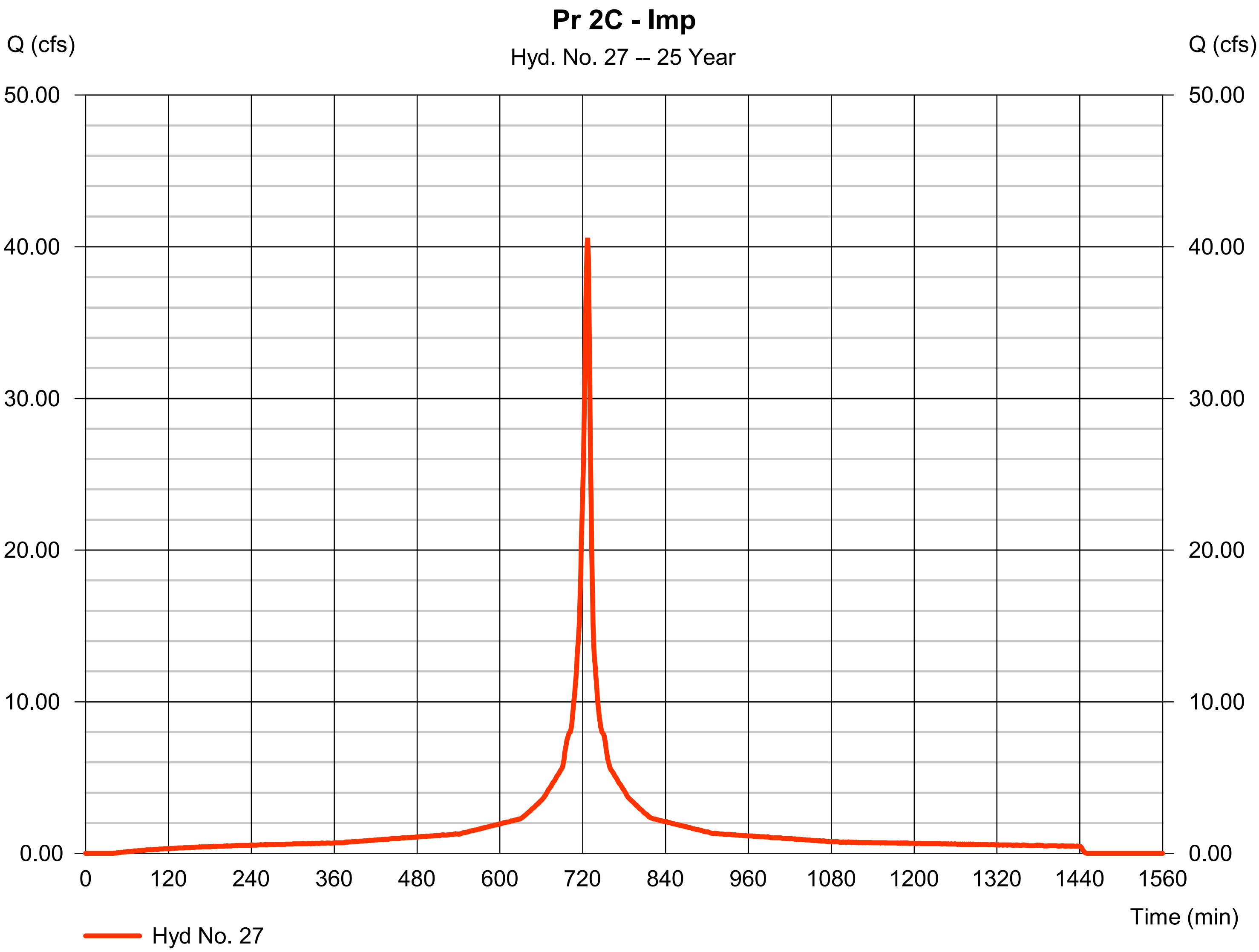
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 27

Pr 2C - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 40.60 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 148,950 cuft
Drainage area	= 6.500 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



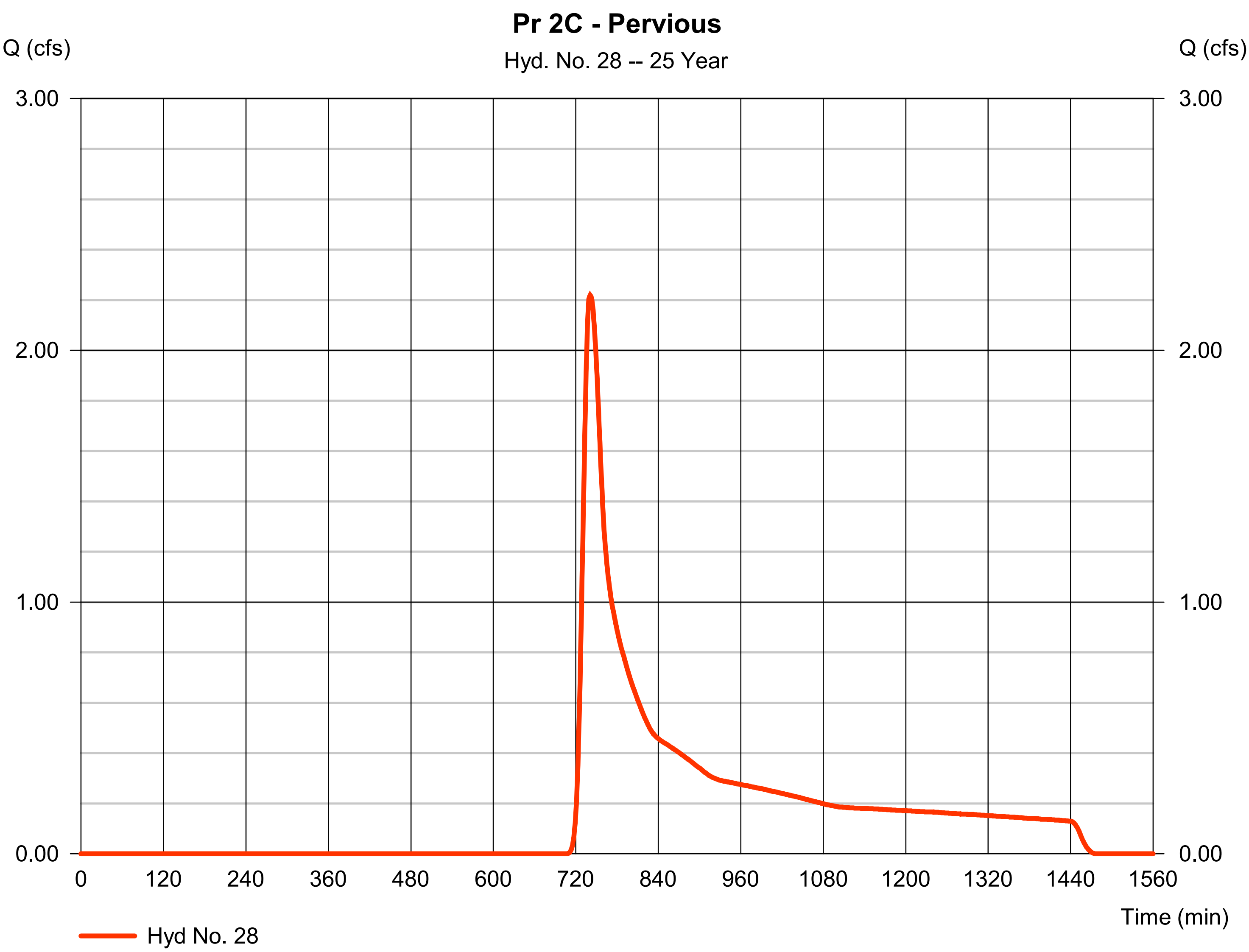
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 28

Pr 2C - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.218 cfs
Storm frequency	= 25 yrs	Time to peak	= 741 min
Time interval	= 1 min	Hyd. volume	= 15,148 cuft
Drainage area	= 4.120 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



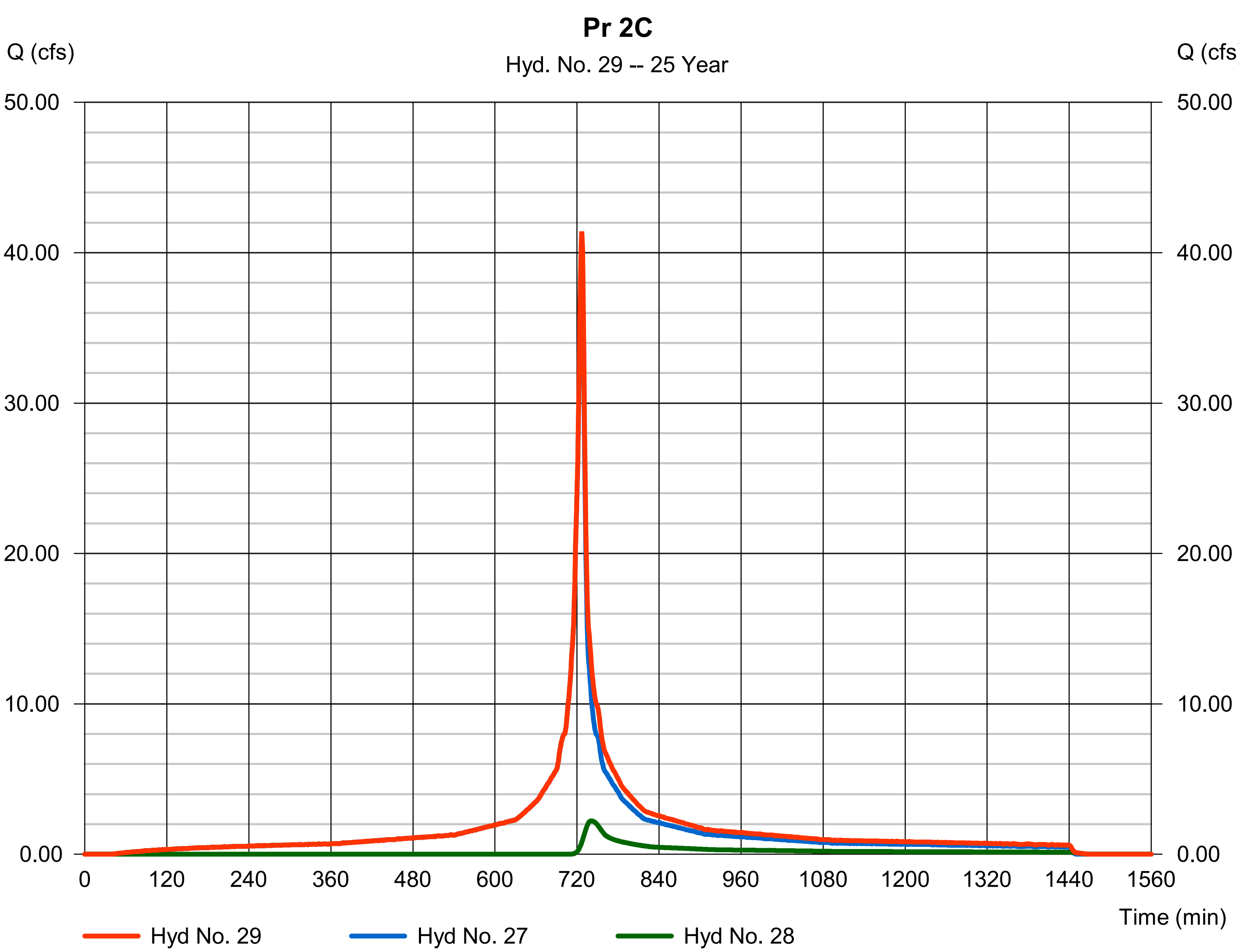
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 29

Pr 2C

Hydrograph type	= Combine	Peak discharge	= 41.42 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 164,098 cuft
Inflow hyds.	= 27, 28	Contrib. drain. area	= 10.620 ac



Hydrograph Report

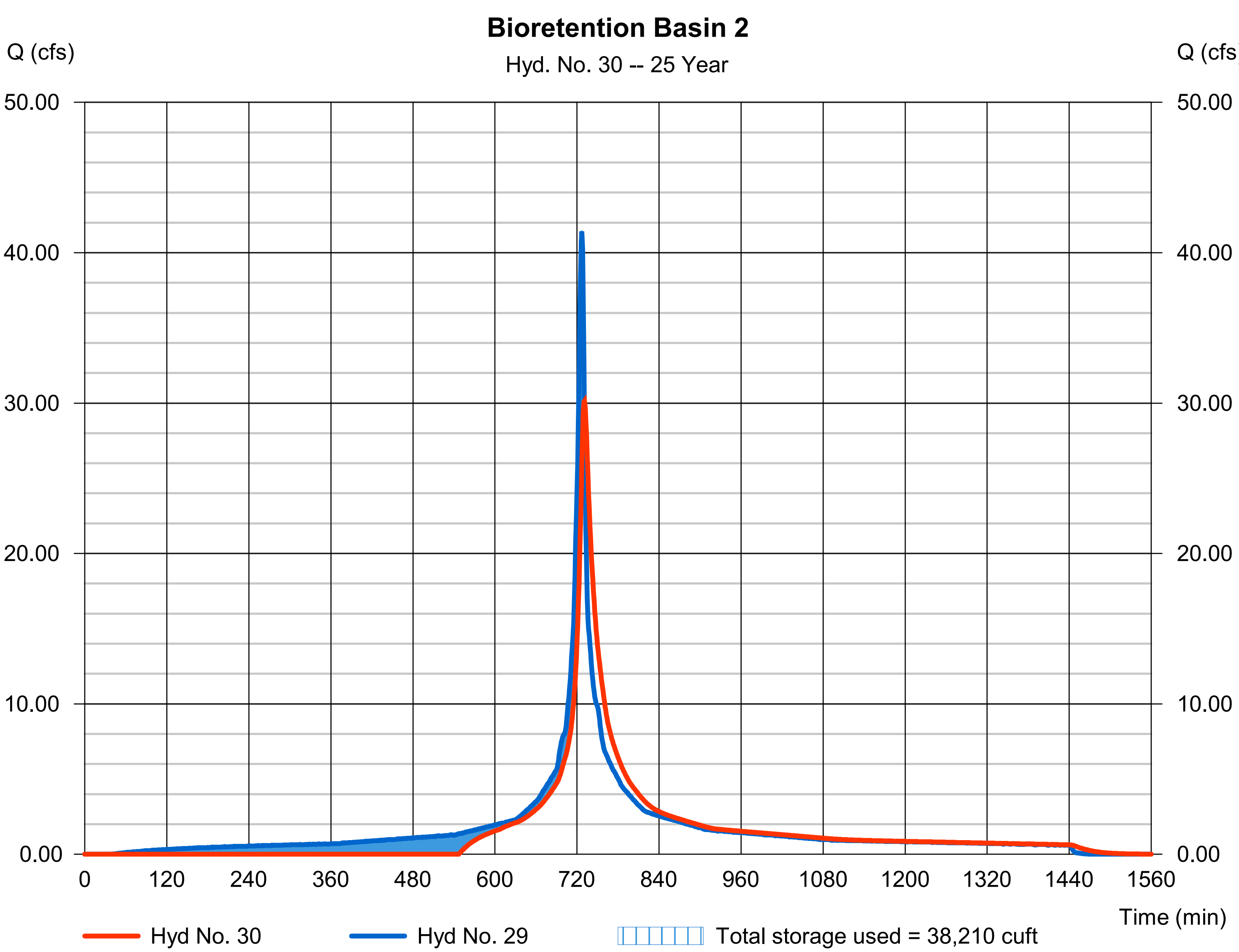
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 30

Bioretention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 30.13 cfs
Storm frequency	= 25 yrs	Time to peak	= 731 min
Time interval	= 1 min	Hyd. volume	= 144,426 cuft
Inflow hyd. No.	= 29 - Pr 2C	Max. Elevation	= 38.19 ft
Reservoir name	= Bioretention Basin 2	Max. Storage	= 38,210 cuft

Storage Indication method used.



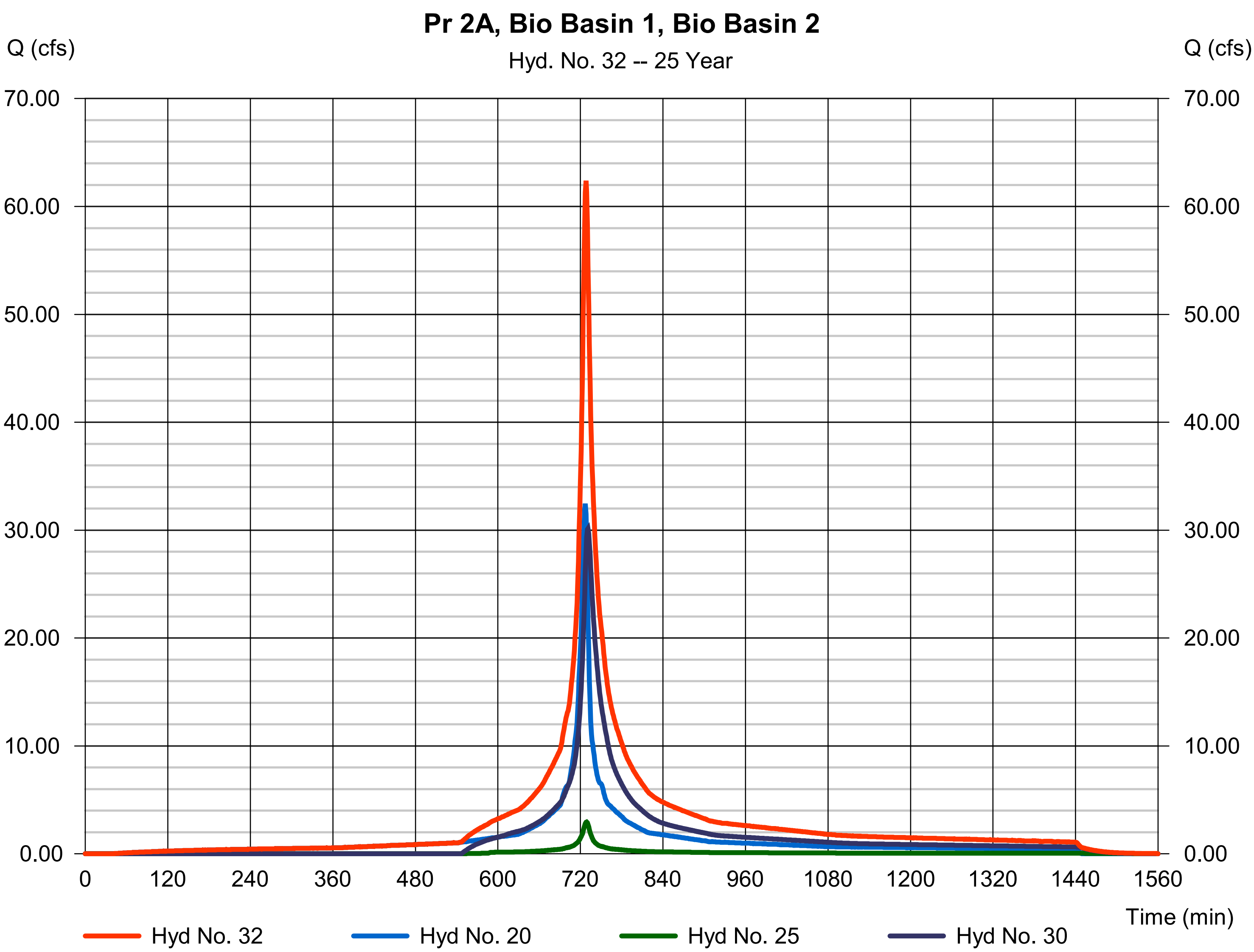
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 32

Pr 2A, Bio Basin 1, Bio Basin 2

Hydrograph type	= Combine	Peak discharge	= 62.38 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 276,145 cuft
Inflow hyds.	= 20, 25, 30	Contrib. drain. area	= 0.000 ac



Hydrograph Report

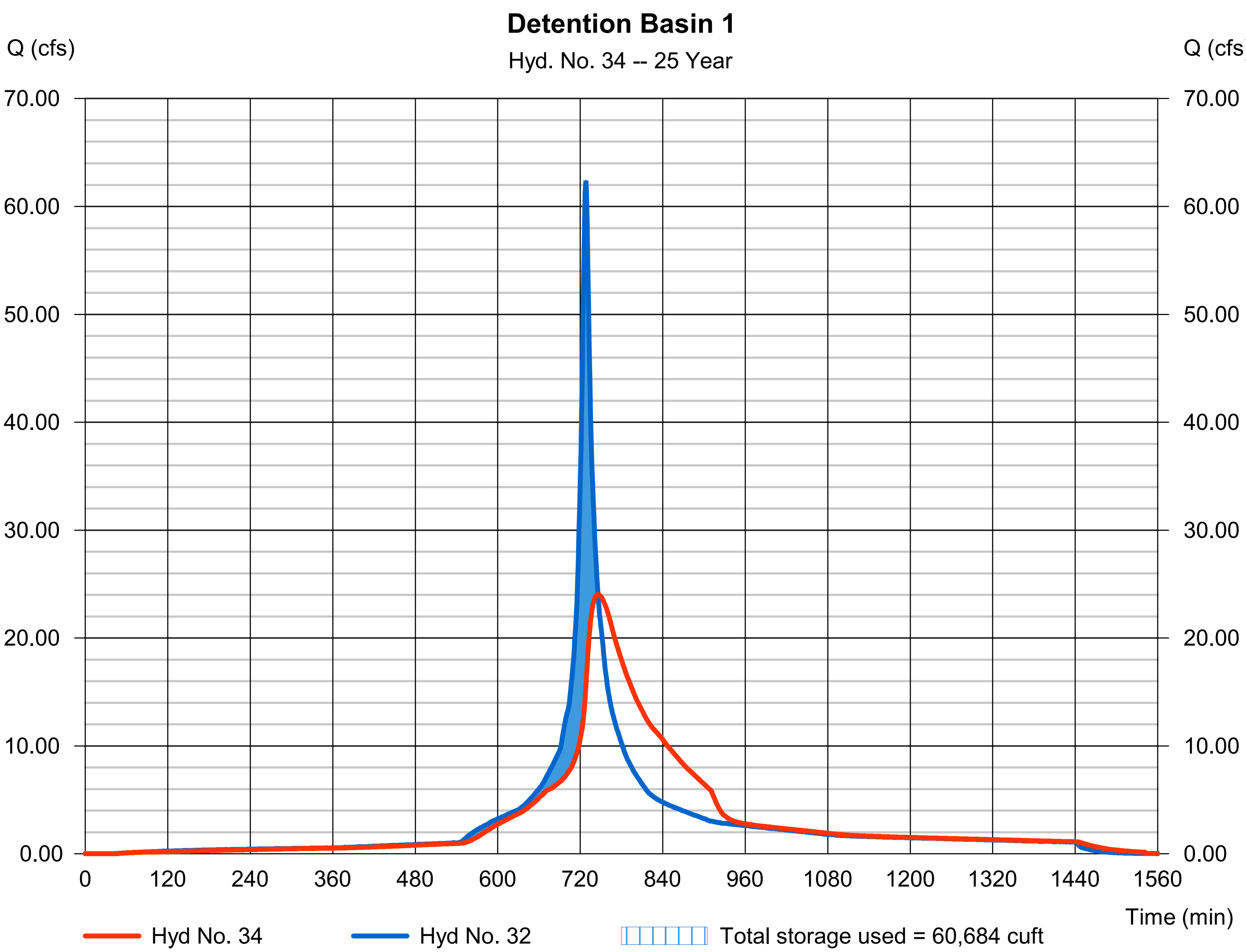
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 34

Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 24.04 cfs
Storm frequency	= 25 yrs	Time to peak	= 746 min
Time interval	= 1 min	Hyd. volume	= 276,144 cuft
Inflow hyd. No.	= 32 - Pr 2A, Bio Basin 1, Bio Basin 2	Max. Elevation	= 33.13 ft
Reservoir name	= Detention Basin 1	Max. Storage	= 60,684 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

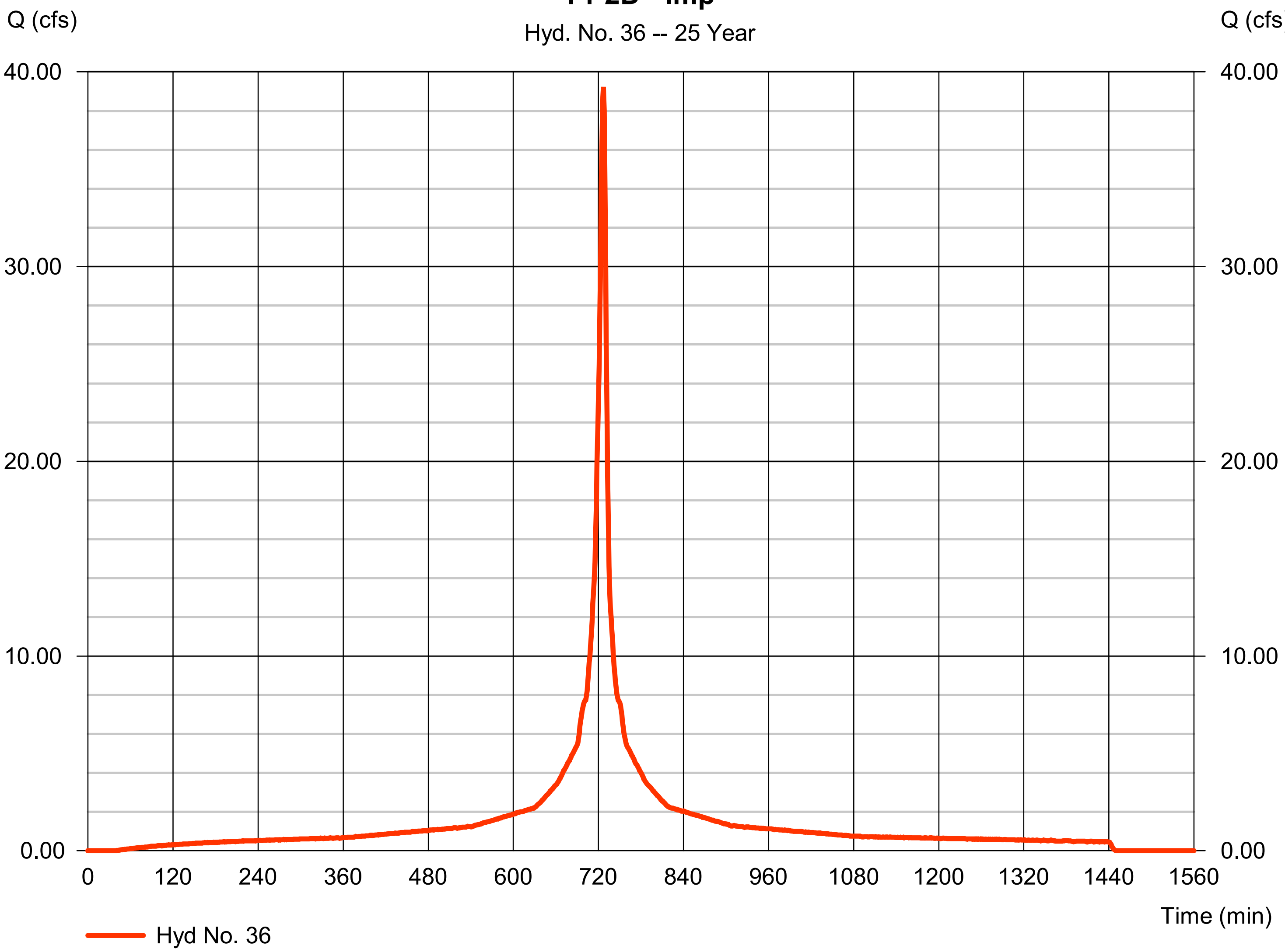
Hyd. No. 36

Pr 2D - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 39.23 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 143,909 cuft
Drainage area	= 6.280 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

Pr 2D - Imp

Hyd. No. 36 -- 25 Year



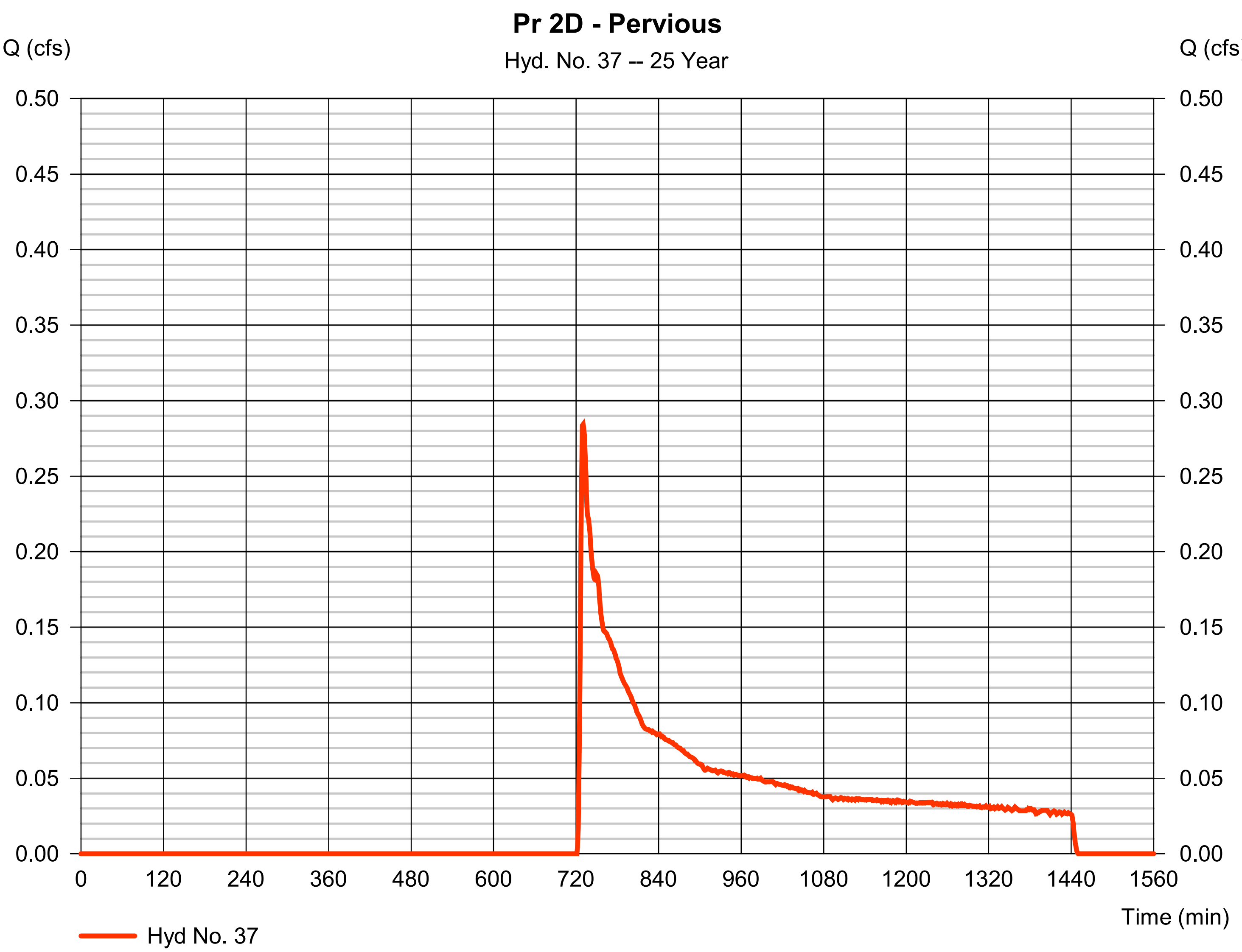
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 37

Pr 2D - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.284 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 2,424 cuft
Drainage area	= 1.170 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



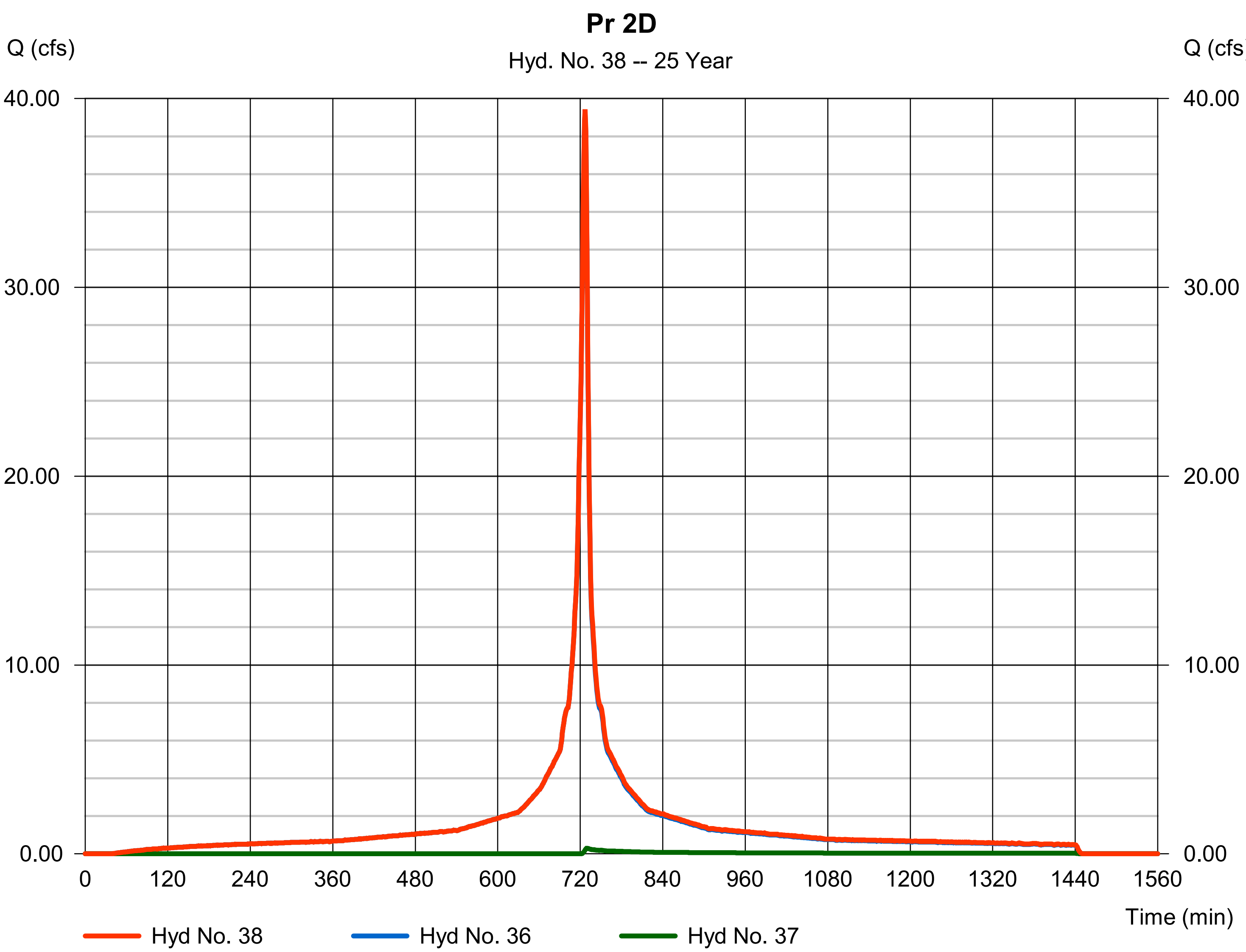
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 38

Pr 2D

Hydrograph type	= Combine	Peak discharge	= 39.44 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 146,332 cuft
Inflow hyds.	= 36, 37	Contrib. drain. area	= 7.450 ac



Hydrograph Report

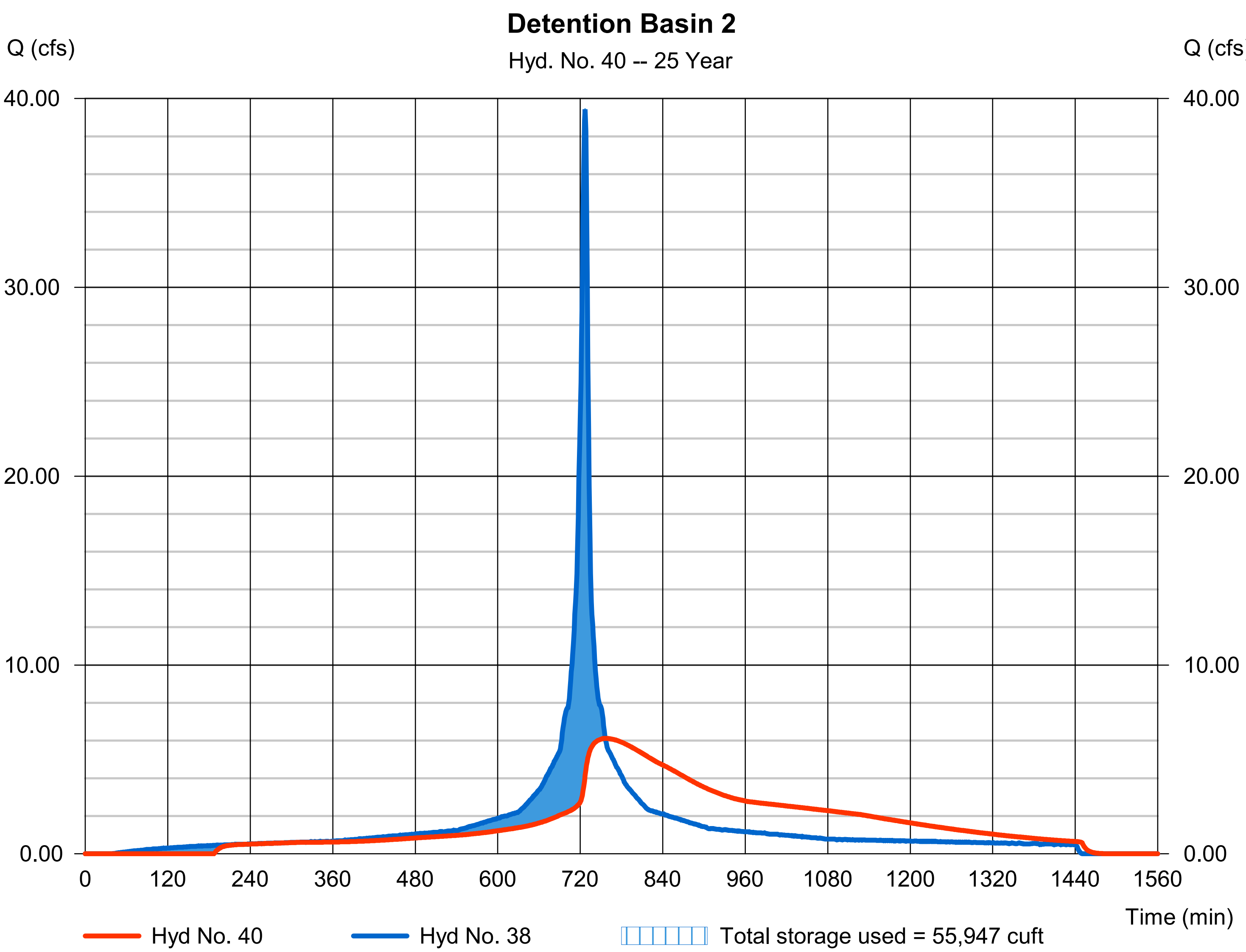
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 40

Detention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 6.117 cfs
Storm frequency	= 25 yrs	Time to peak	= 756 min
Time interval	= 1 min	Hyd. volume	= 143,946 cuft
Inflow hyd. No.	= 38 - Pr 2D	Max. Elevation	= 32.04 ft
Reservoir name	= Detention Basin 2	Max. Storage	= 55,947 cuft

Storage Indication method used.



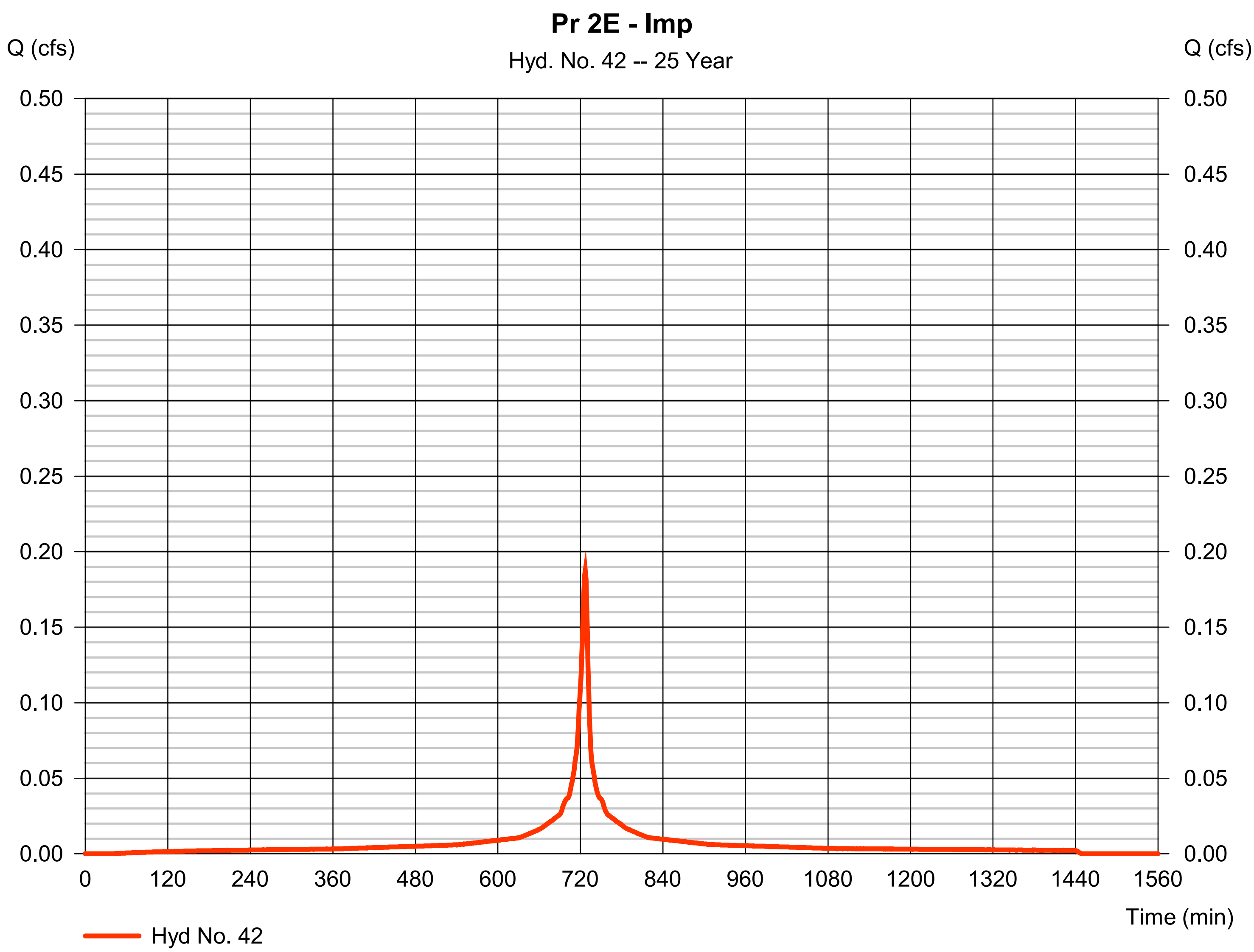
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 42

Pr 2E - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.187 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 687 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



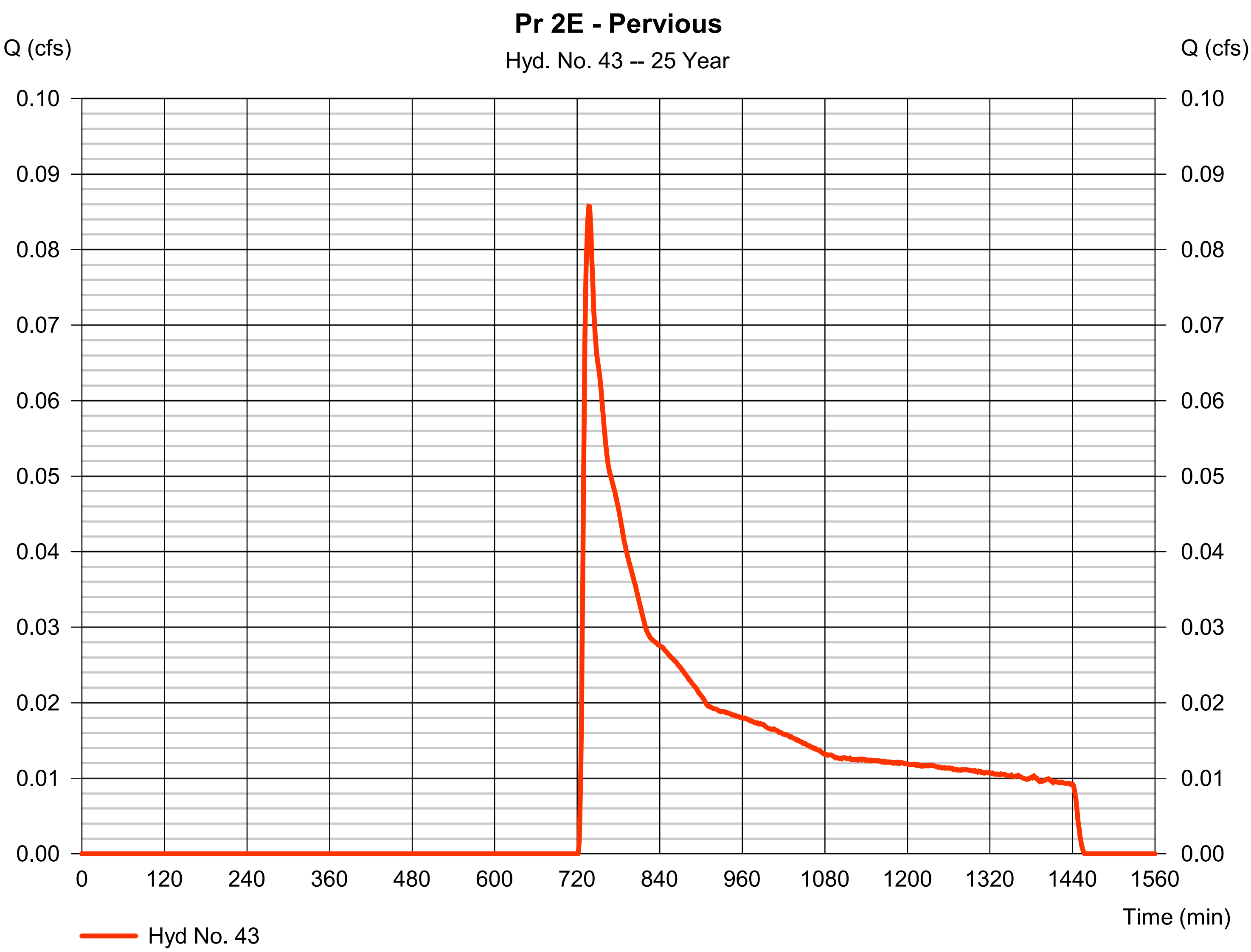
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 43

Pr 2E - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.086 cfs
Storm frequency	= 25 yrs	Time to peak	= 737 min
Time interval	= 1 min	Hyd. volume	= 838 cuft
Drainage area	= 0.410 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



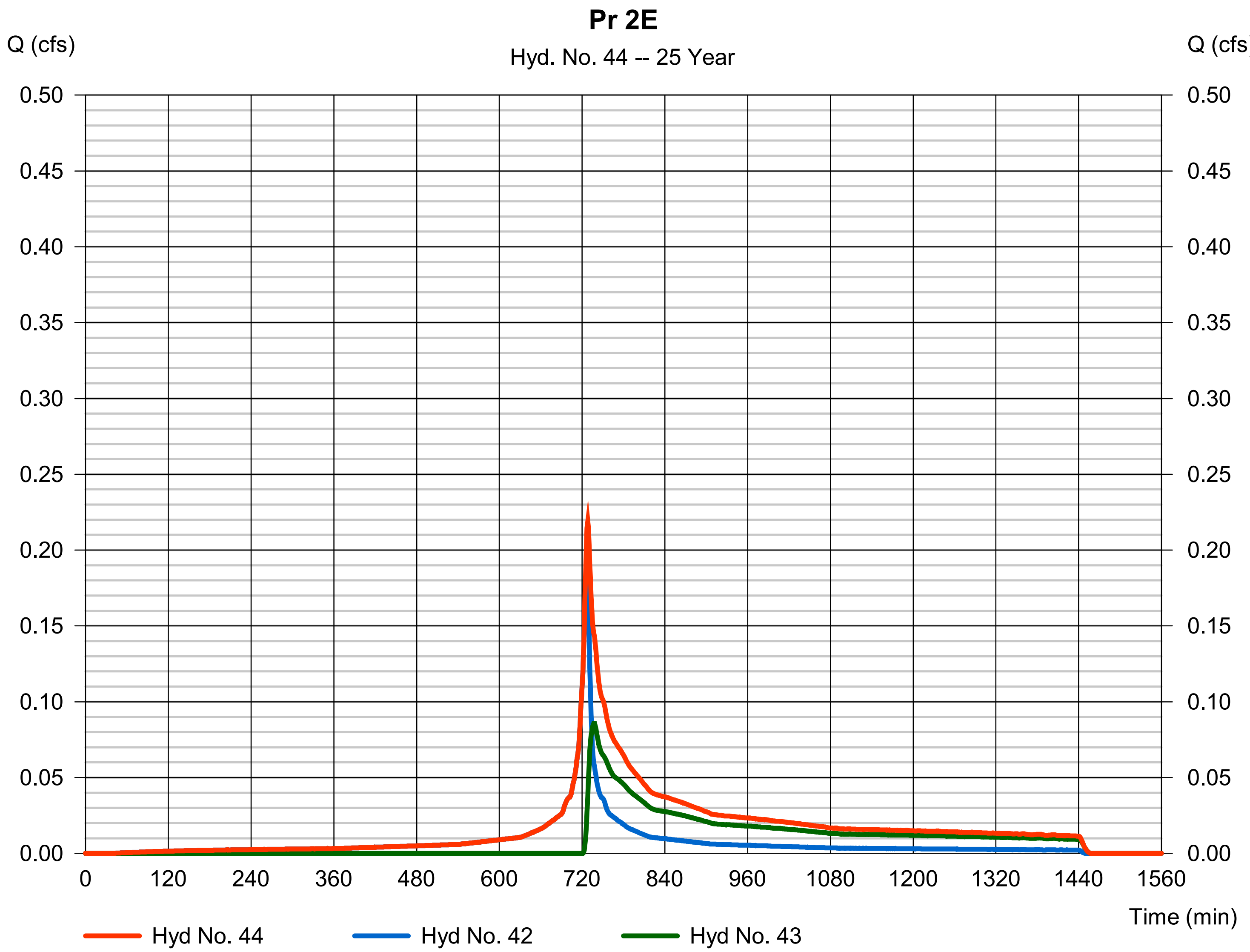
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 44

Pr 2E

Hydrograph type	= Combine	Peak discharge	= 0.219 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 1,526 cuft
Inflow hyds.	= 42, 43	Contrib. drain. area	= 0.440 ac



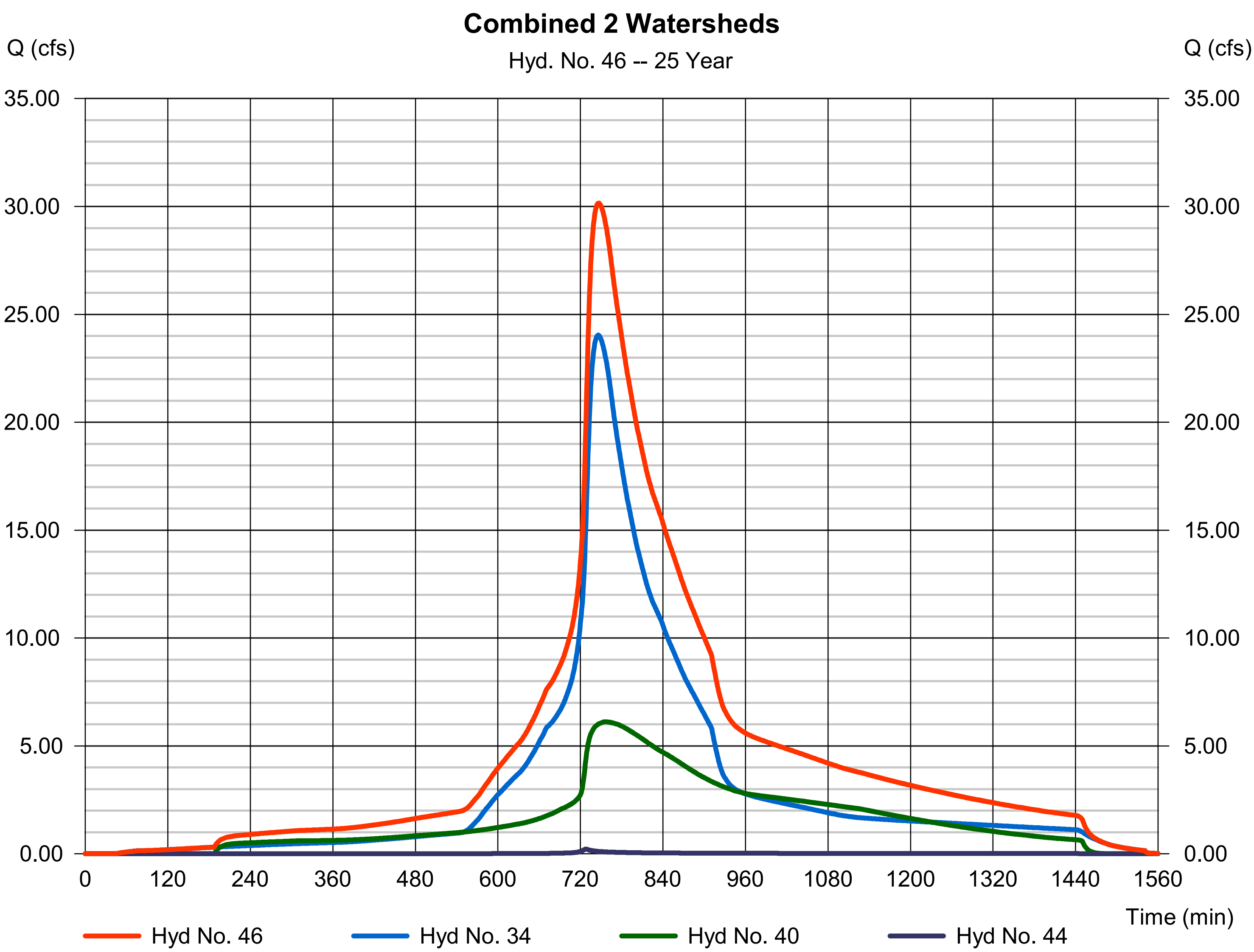
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 46

Combined 2 Watersheds

Hydrograph type	= Combine	Peak discharge	= 30.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 746 min
Time interval	= 1 min	Hyd. volume	= 421,616 cuft
Inflow hyds.	= 34, 40, 44	Contrib. drain. area	= 0.000 ac



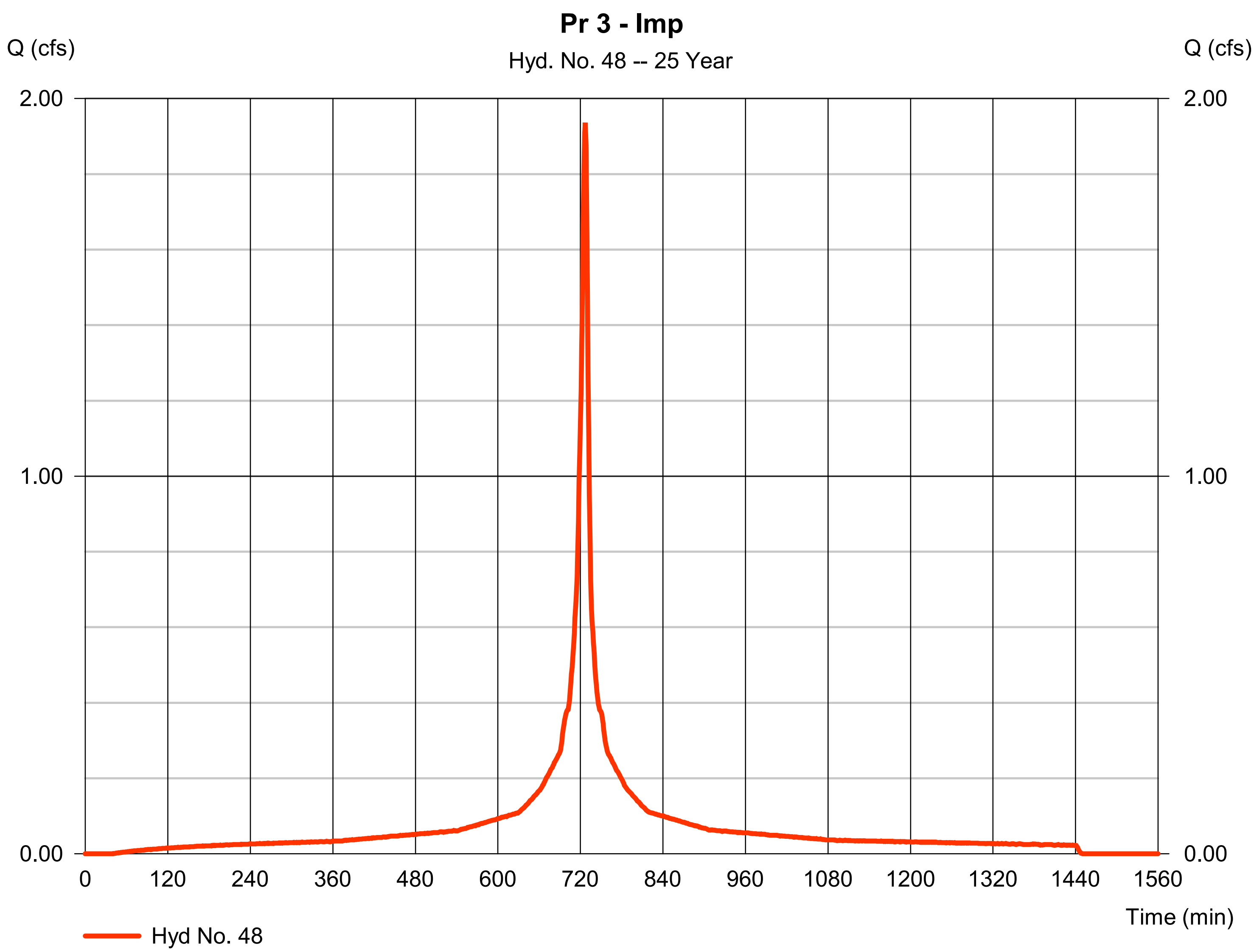
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 48

Pr 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.936 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 7,104 cuft
Drainage area	= 0.310 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



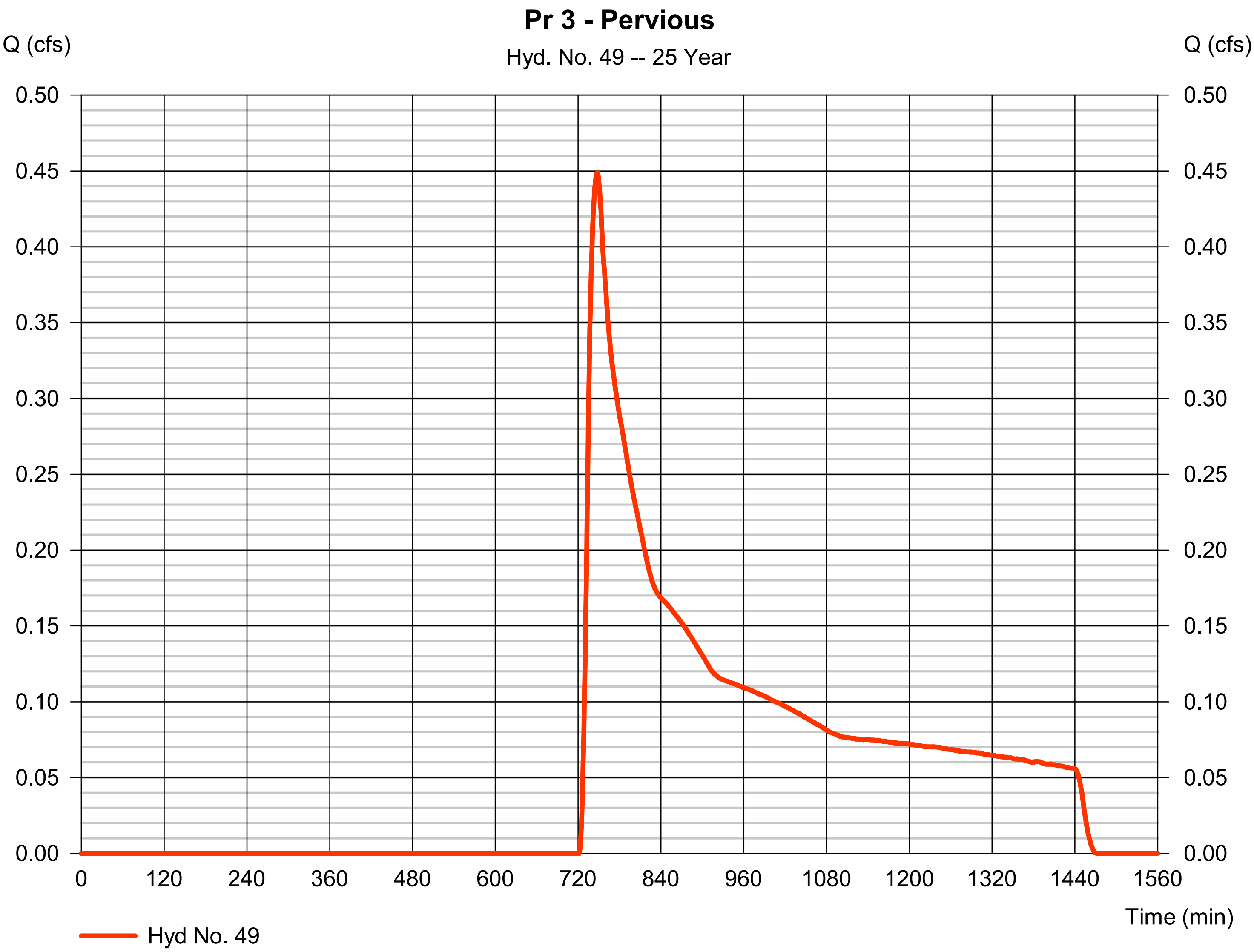
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 49

Pr 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.449 cfs
Storm frequency	= 25 yrs	Time to peak	= 748 min
Time interval	= 1 min	Hyd. volume	= 5,042 cuft
Drainage area	= 2.510 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.00 min
Total precip.	= 6.36 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



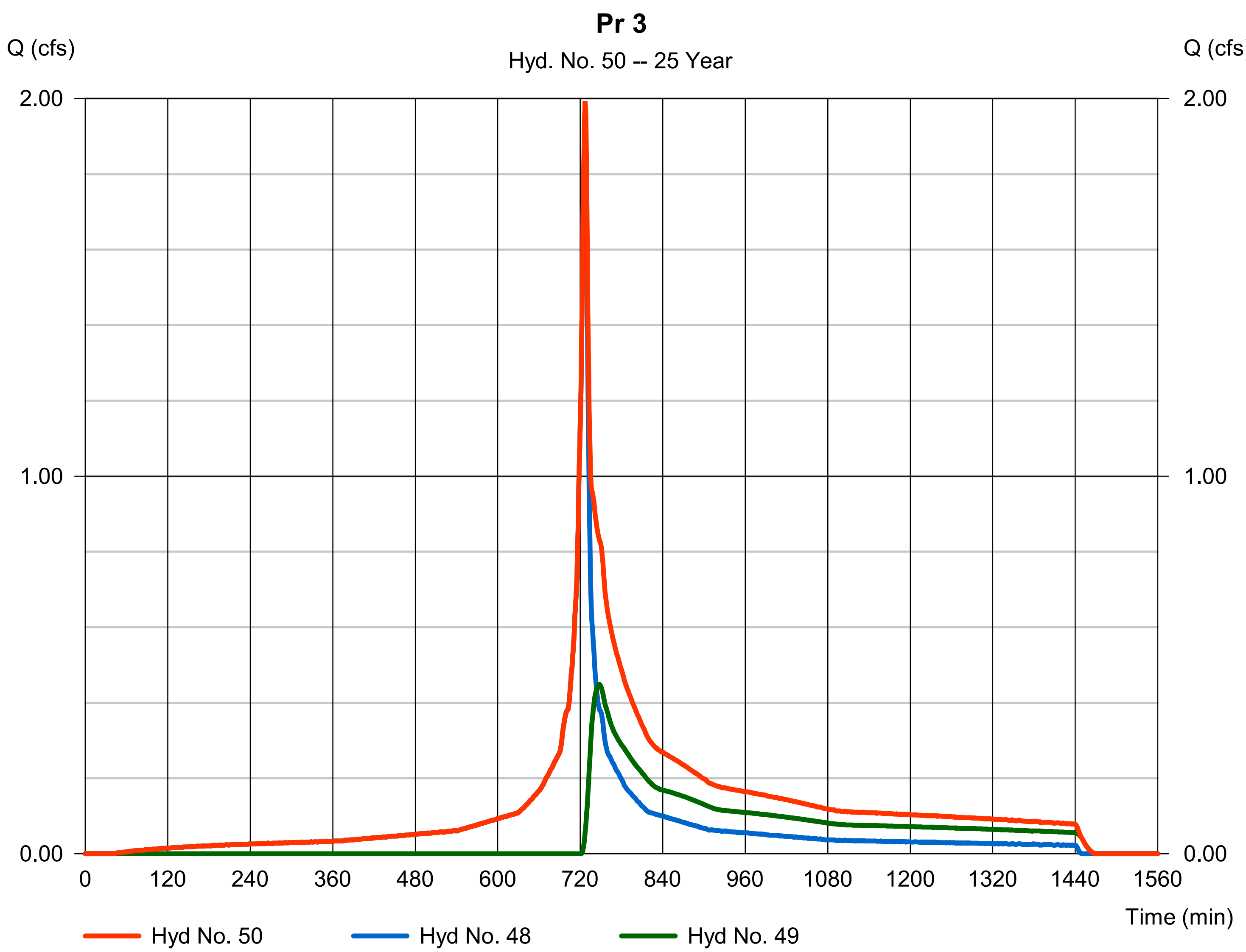
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 50

Pr 3

Hydrograph type	= Combine	Peak discharge	= 1.993 cfs
Storm frequency	= 25 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 12,146 cuft
Inflow hyds.	= 48, 49	Contrib. drain. area	= 2.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	17.65	1	735	95,045	------	------	------	Ex 1 - Imp
2	SCS Runoff	6.592	1	741	44,005	------	------	------	Ex 1 - Pervious
3	Combine	23.61	1	737	139,050	1, 2	------	------	Ex 1
5	SCS Runoff	73.80	1	728	303,942	------	------	------	Ex 2 - Imp
6	SCS Runoff	4.331	1	737	25,711	------	------	------	Ex 2 - Pervious
7	Combine	76.31	1	729	329,653	5, 6	------	------	Ex 2
9	SCS Runoff	17.49	1	727	64,698	------	------	------	Ex 3 - Imp
10	SCS Runoff	3.860	1	739	25,133	------	------	------	Ex 3 - Pervious
11	Combine	19.11	1	727	89,831	9, 10	------	------	Ex 3
14	SCS Runoff	1.722	1	730	7,795	------	------	------	Pr 1 - Imp
15	SCS Runoff	2.978	1	749	22,233	------	------	------	Pr 1 - Pervious
16	Combine	3.504	1	745	30,028	14, 15	------	------	Pr 1
18	SCS Runoff	43.72	1	727	161,745	------	------	------	Pr 2A - Imp
19	SCS Runoff	2.090	1	728	8,146	------	------	------	Pr 2A - Pervious
20	Combine	45.75	1	727	169,892	18, 19	------	------	Pr 2A
22	SCS Runoff	4.049	1	727	15,738	------	------	------	Pr 2B - Imp
23	SCS Runoff	0.342	1	729	1,419	------	------	------	Pr 2B - Pervious
24	Combine	4.376	1	728	17,156	22, 23	------	------	Pr 2B
25	Reservoir	4.278	1	729	15,682	24	37.87	2,139	Bioretention Basin 1
27	SCS Runoff	55.18	1	727	204,144	------	------	------	Pr 2C - Imp
28	SCS Runoff	5.929	1	739	32,460	------	------	------	Pr 2C - Pervious
29	Combine	58.39	1	727	236,604	27, 28	------	------	Pr 2C
30	Reservoir	44.31	1	730	216,932	29	38.39	43,866	Bioretention Basin 2
32	Combine	90.01	1	728	402,506	20, 25, 30,	------	------	Pr 2A, Bio Basin 1, Bio Basin 2
34	Reservoir	35.77	1	745	402,504	32	33.93	88,011	Detention Basin 1
36	SCS Runoff	53.31	1	727	197,235	------	------	------	Pr 2D - Imp
37	SCS Runoff	1.609	1	728	6,270	------	------	------	Pr 2D - Pervious
38	Combine	54.88	1	727	203,505	36, 37	------	------	Pr 2D
40	Reservoir	9.185	1	755	201,119	38	32.95	77,791	Detention Basin 2

Middlesex Analysis.gpw	Return Period: 100 Year	Wednesday, 03 / 25 / 2020

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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
42	SCS Runoff	0.255	1	727	942	------	------	------	Pr 2E - Imp
43	SCS Runoff	0.446	1	732	2,169	------	------	------	Pr 2E - Pervious
44	Combine	0.639	1	729	3,111	42, 43	------	------	Pr 2E
46	Combine	45.09	1	745	606,735	34, 40, 44,	------	------	Combined 2 Watersheds
48	SCS Runoff	2.632	1	727	9,736	------	------	------	Pr 3 - Imp
49	SCS Runoff	2.100	1	737	13,044	------	------	------	Pr 3 - Pervious
50	Combine	3.670	1	728	22,781	48, 49	------	------	Pr 3

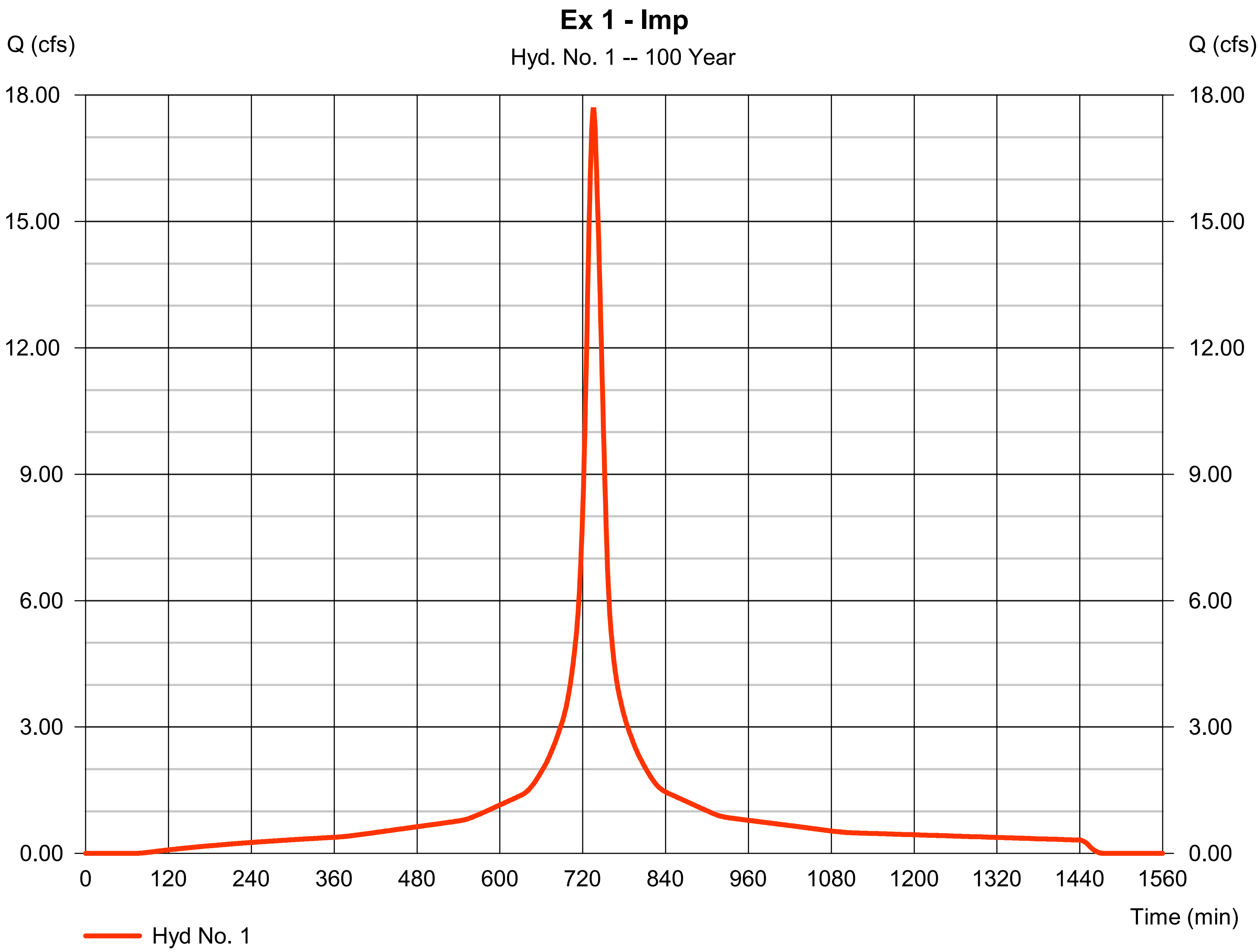
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 1

Ex 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 17.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 735 min
Time interval	= 1 min	Hyd. volume	= 95,045 cuft
Drainage area	= 3.230 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



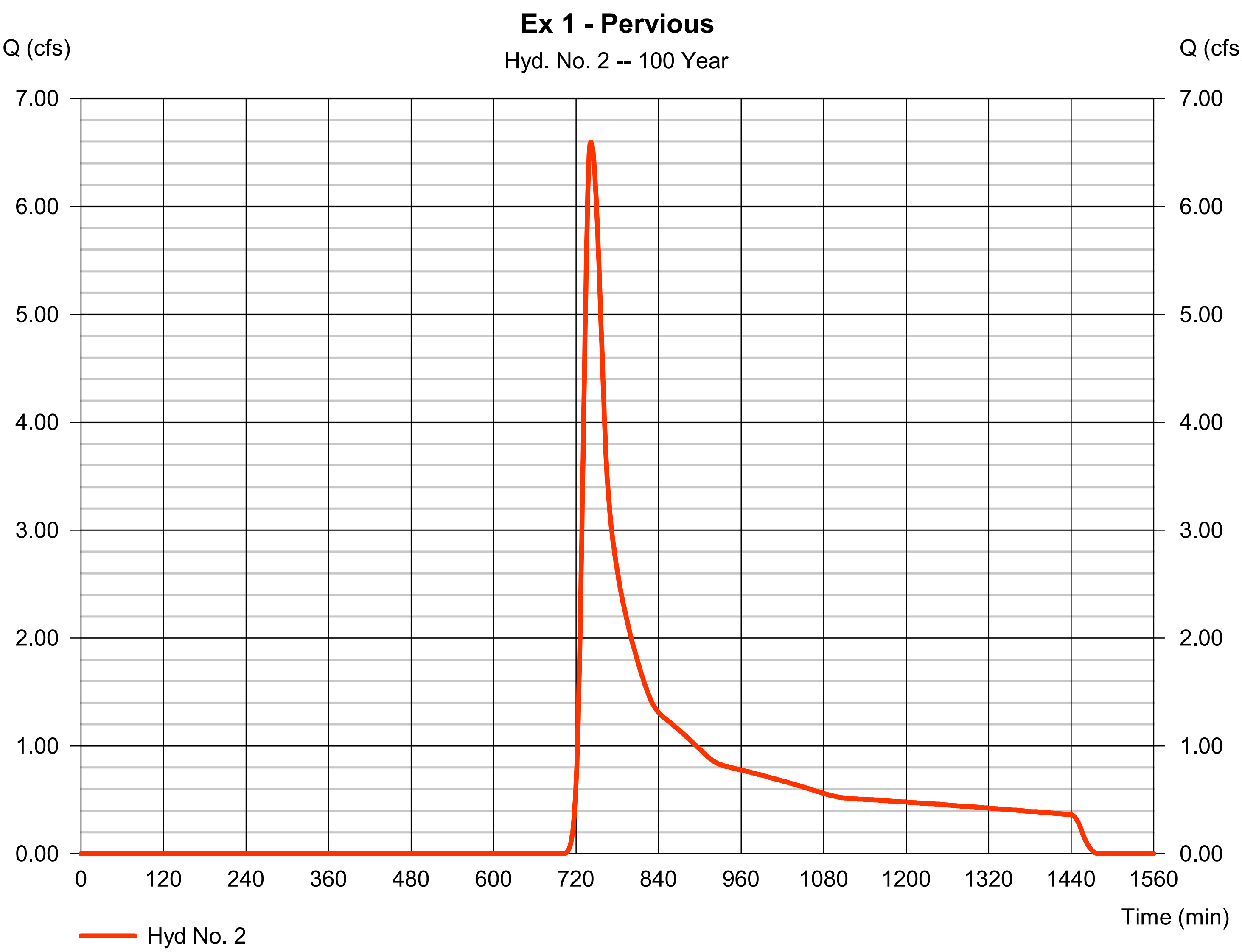
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 2

Ex 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 6.592 cfs
Storm frequency	= 100 yrs	Time to peak	= 741 min
Time interval	= 1 min	Hyd. volume	= 44,005 cuft
Drainage area	= 7.890 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

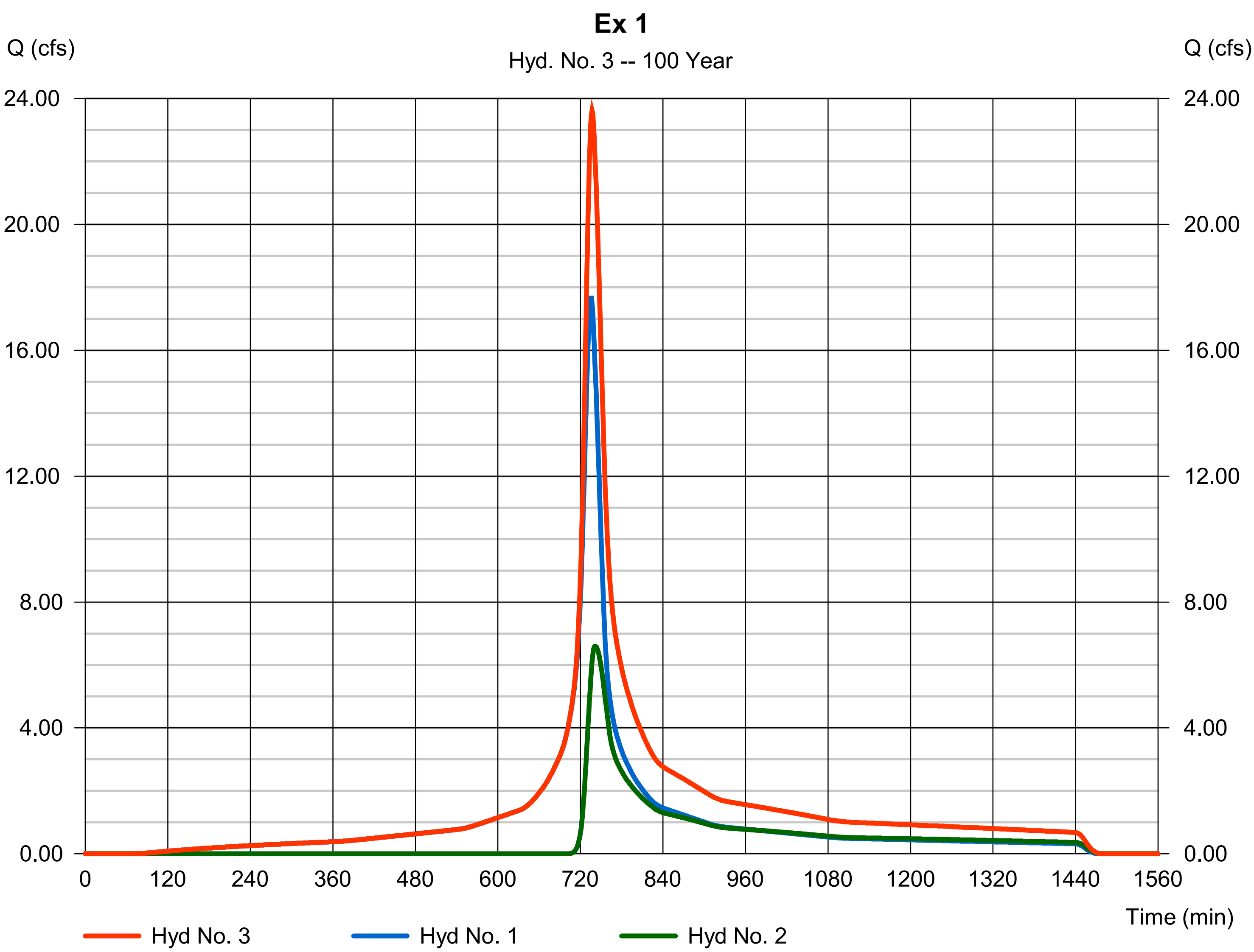


Hydrograph Report

Hyd. No. 3

Ex 1

Hydrograph type	= Combine	Peak discharge	= 23.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 737 min
Time interval	= 1 min	Hyd. volume	= 139,050 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 11.120 ac



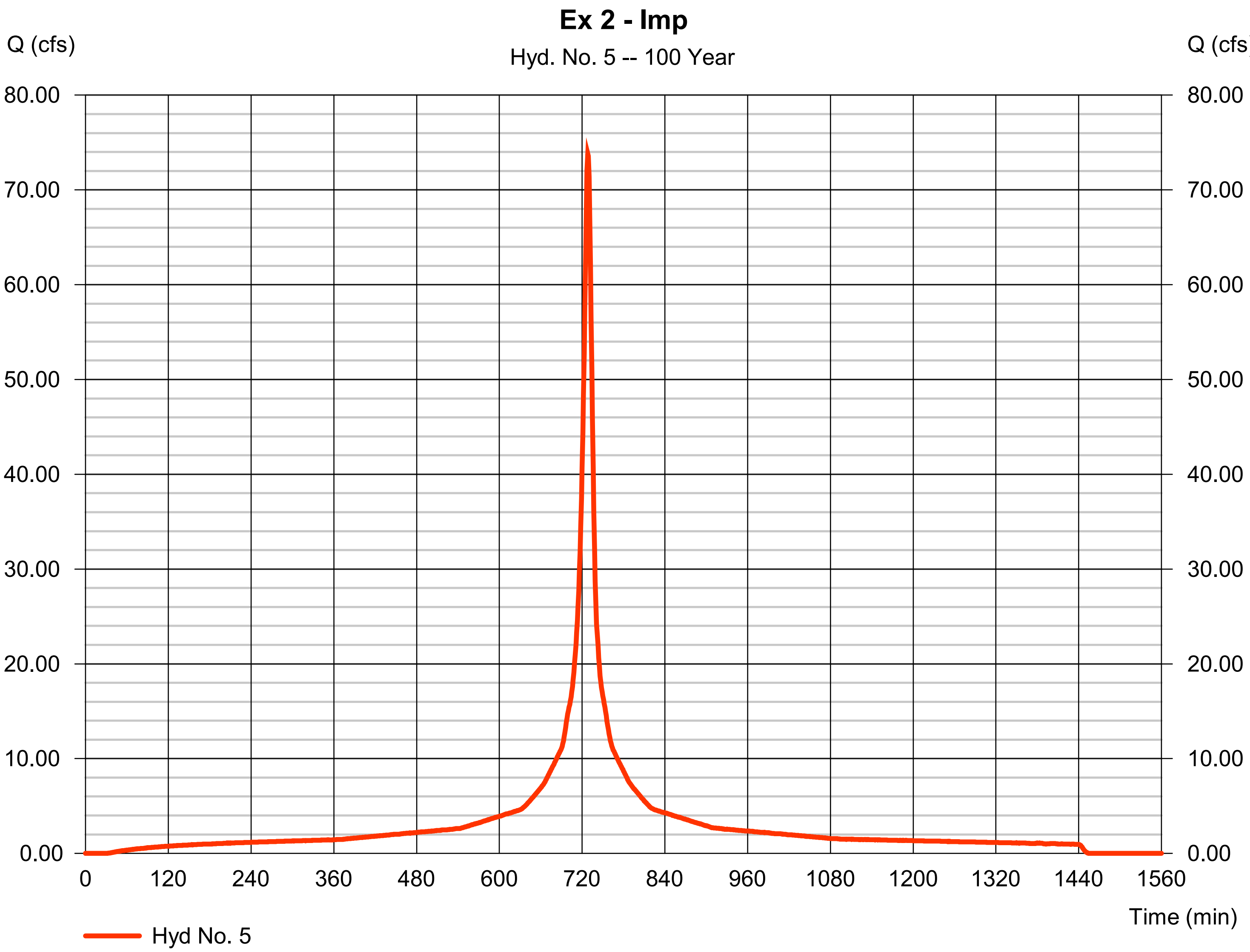
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 5

Ex 2 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 73.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 303,942 cuft
Drainage area	= 9.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



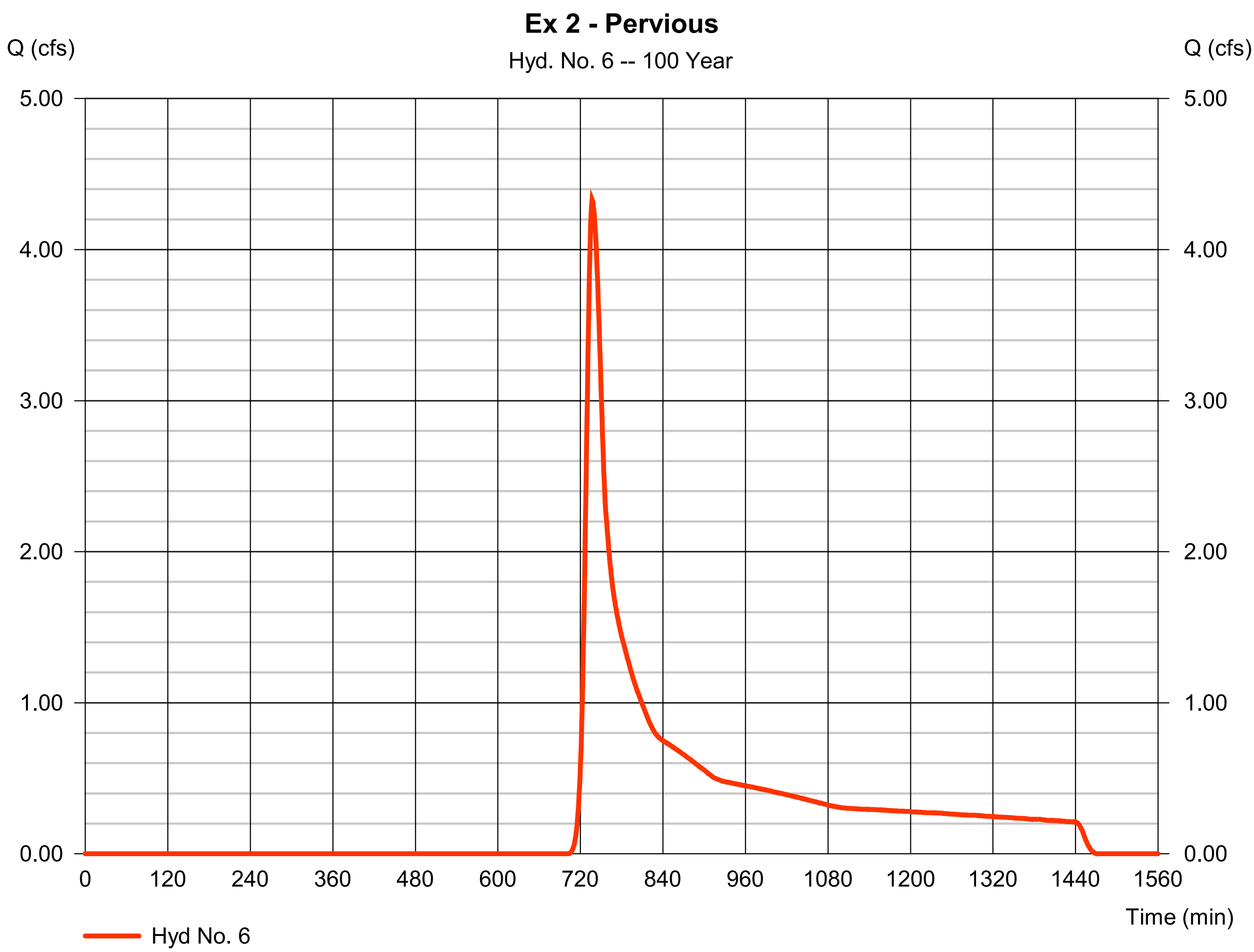
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 6

Ex 2 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 4.331 cfs
Storm frequency	= 100 yrs	Time to peak	= 737 min
Time interval	= 1 min	Hyd. volume	= 25,711 cuft
Drainage area	= 4.610 ac	Curve number	= 40
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 19.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



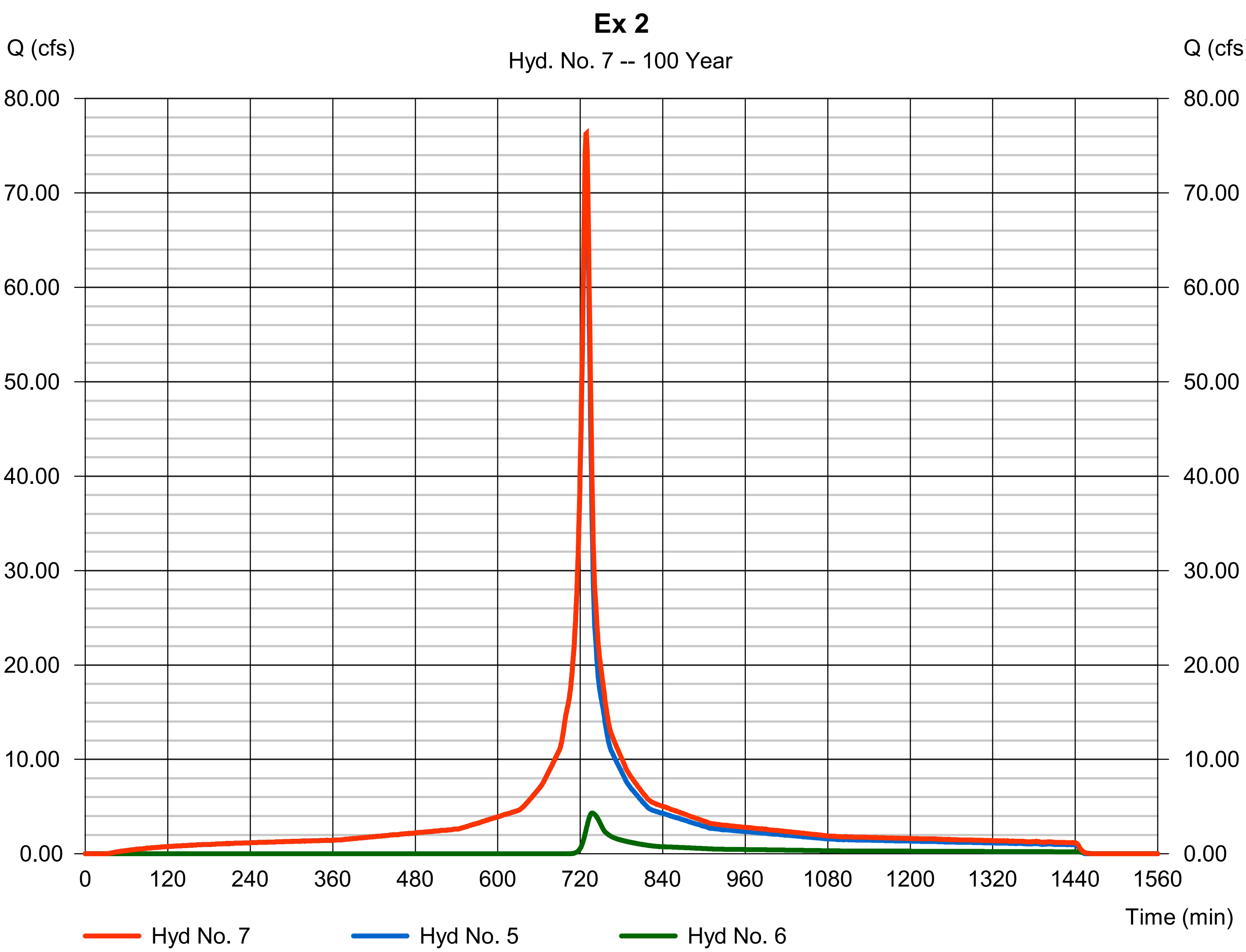
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 7

Ex 2

Hydrograph type	= Combine	Peak discharge	= 76.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 329,653 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 14.590 ac



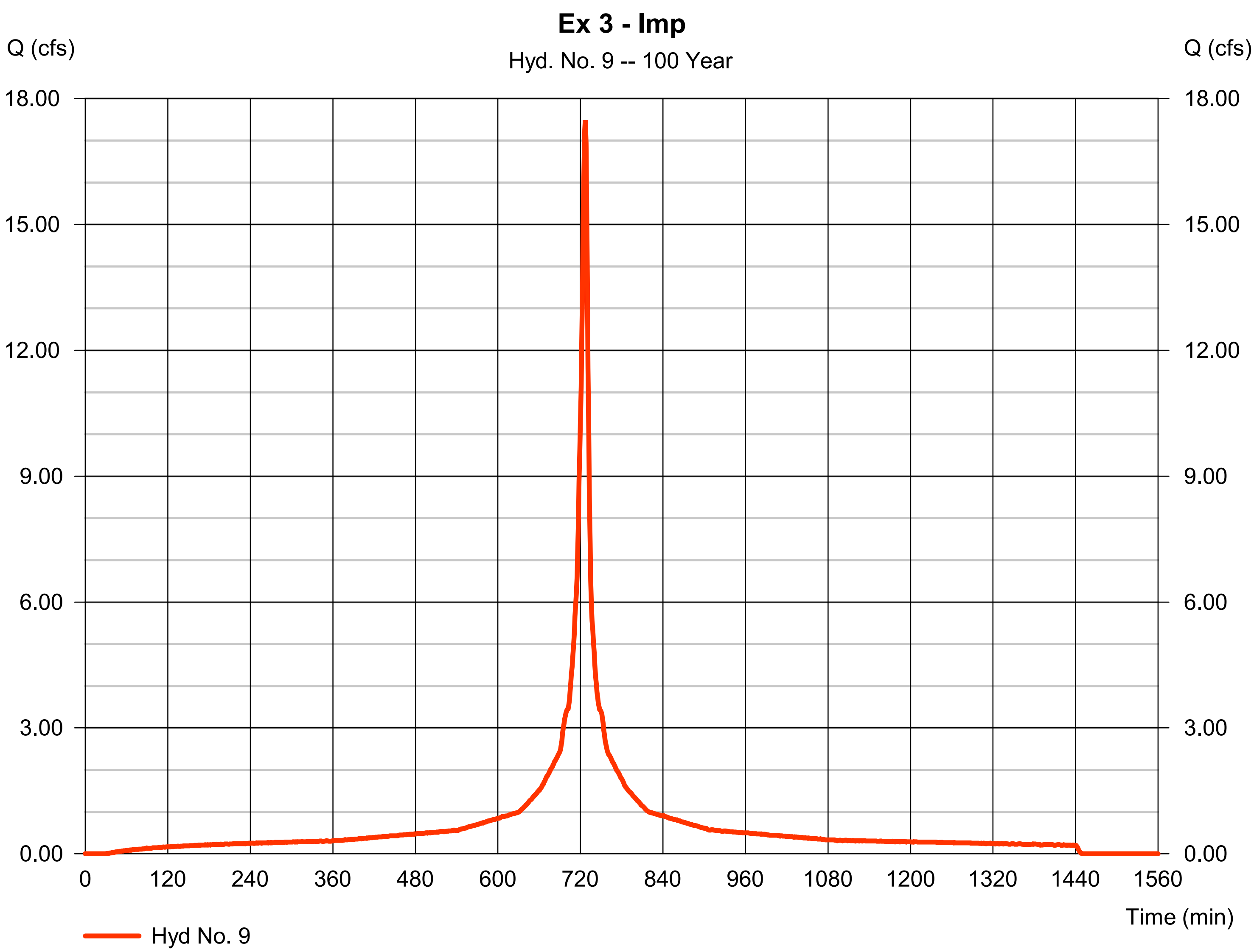
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 9

Ex 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 17.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 64,698 cuft
Drainage area	= 2.060 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



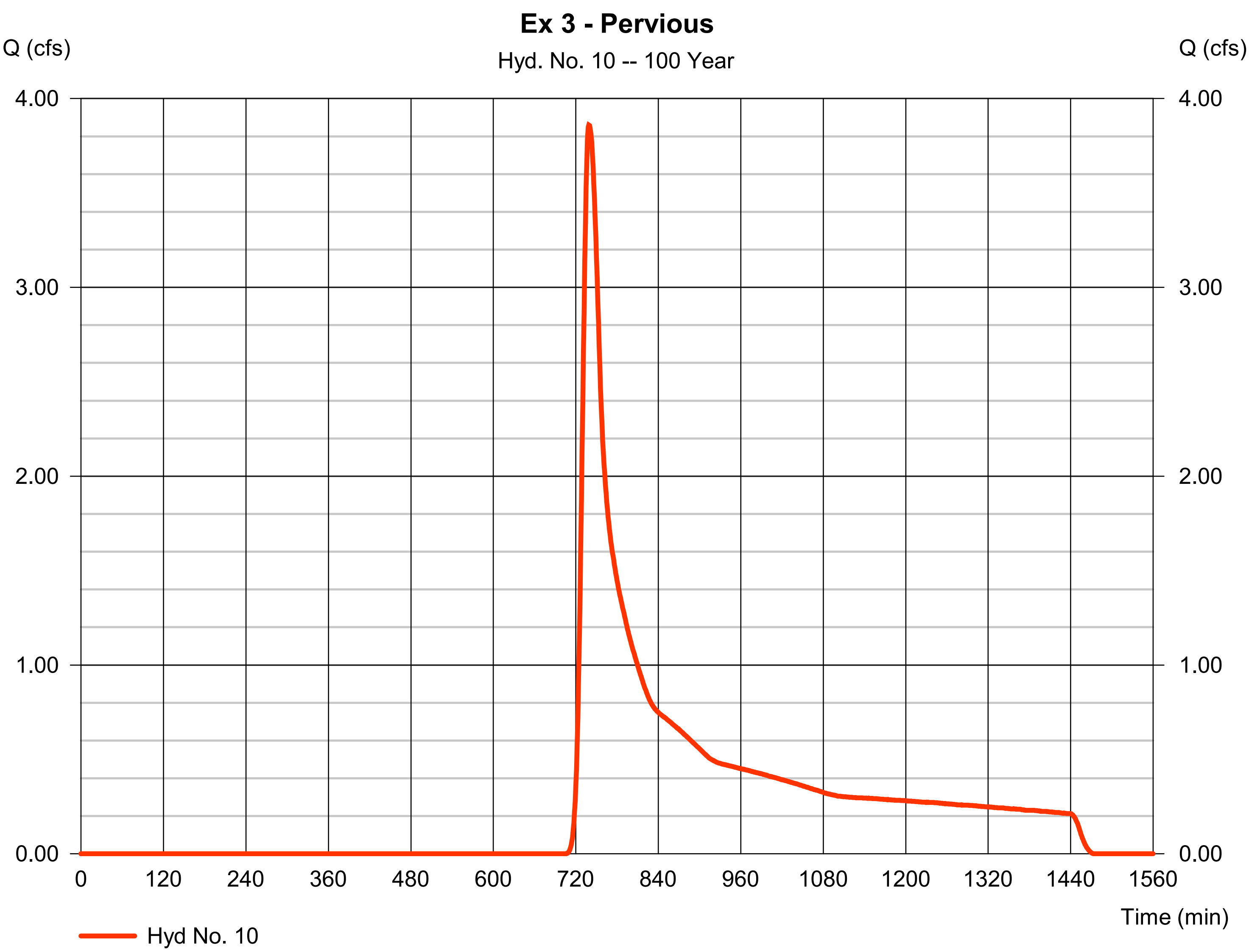
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 10

Ex 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 3.860 cfs
Storm frequency	= 100 yrs	Time to peak	= 739 min
Time interval	= 1 min	Hyd. volume	= 25,133 cuft
Drainage area	= 4.790 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 21.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



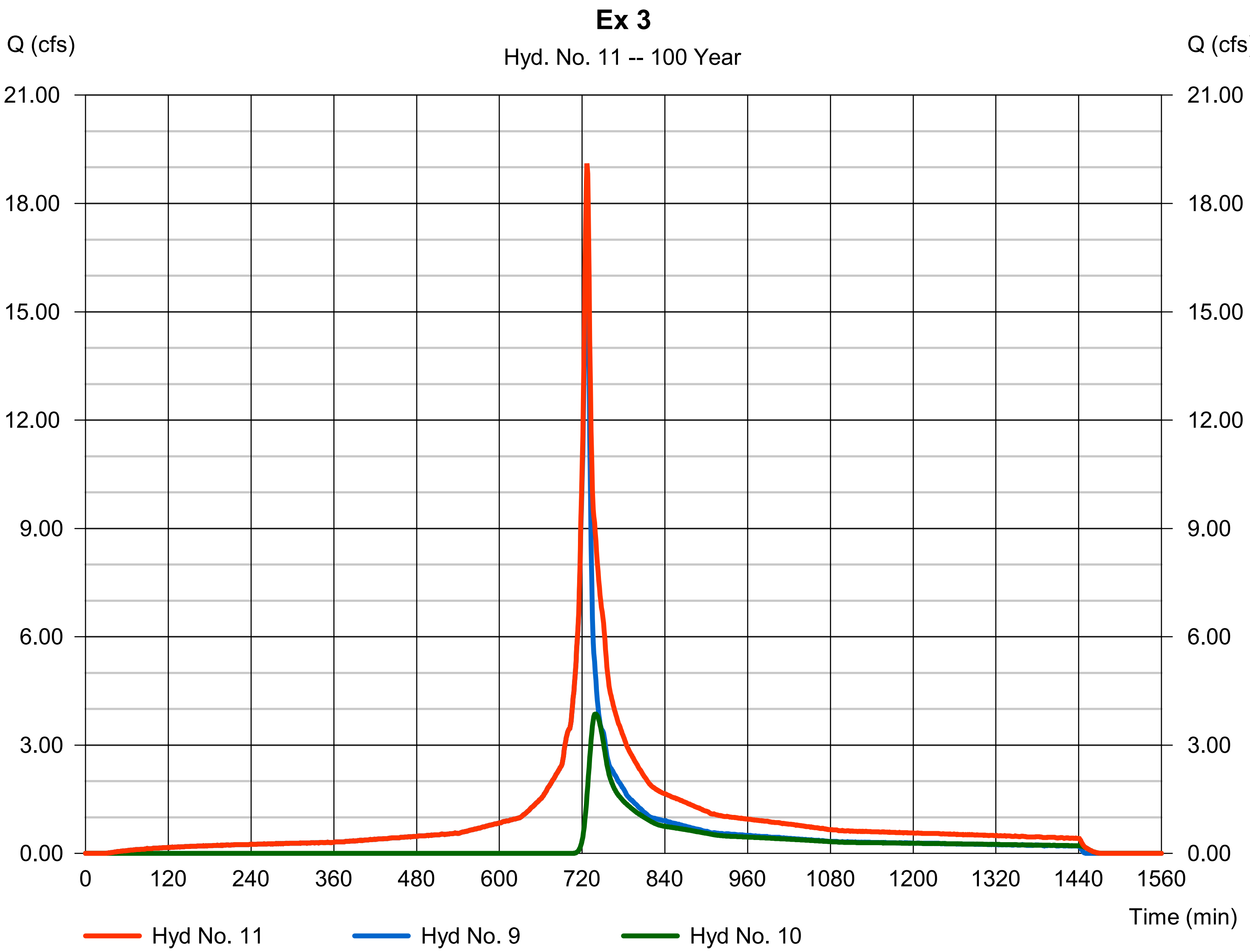
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 11

Ex 3

Hydrograph type	= Combine	Peak discharge	= 19.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 89,831 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 6.850 ac



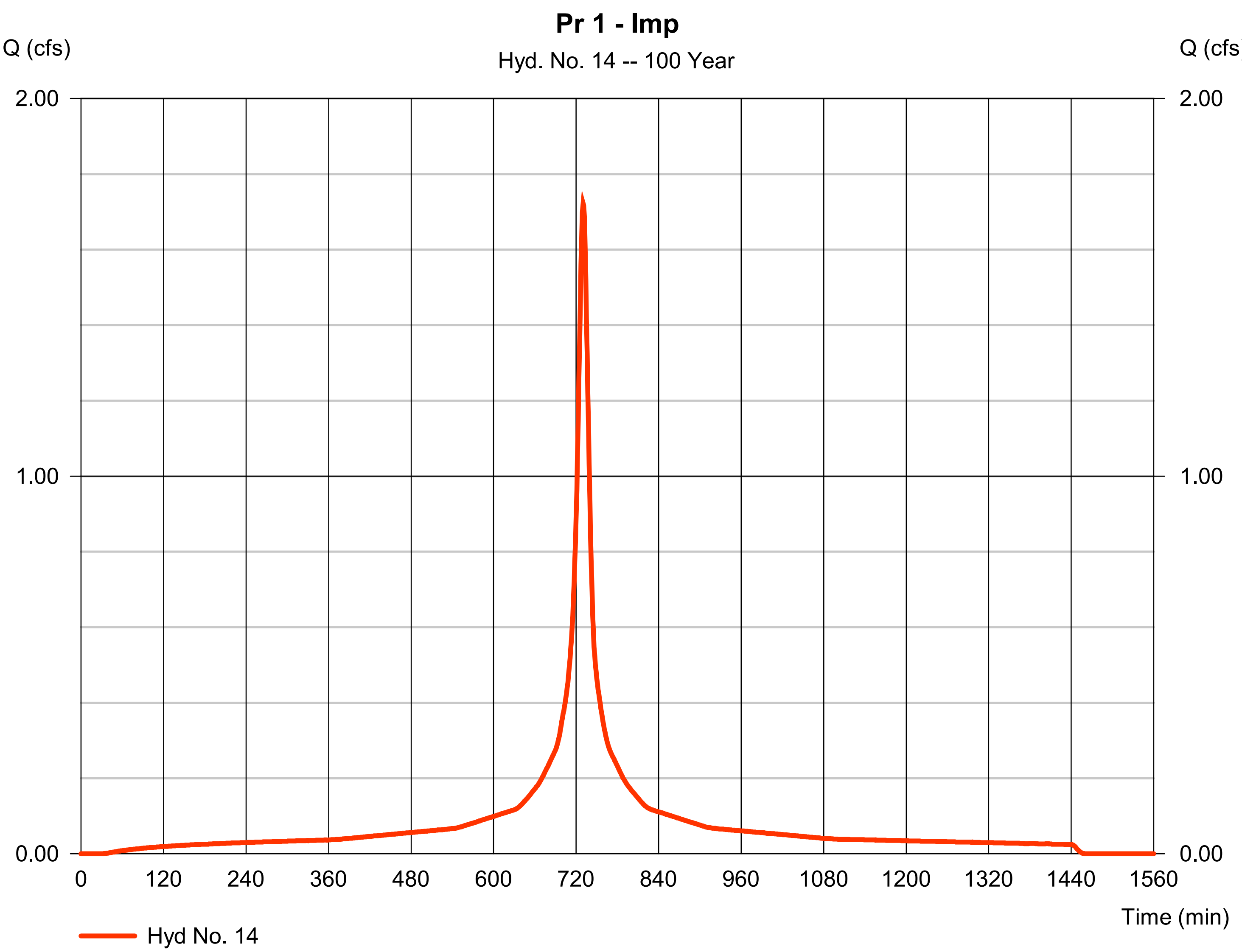
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 14

Pr 1 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.722 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 7,795 cuft
Drainage area	= 0.260 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



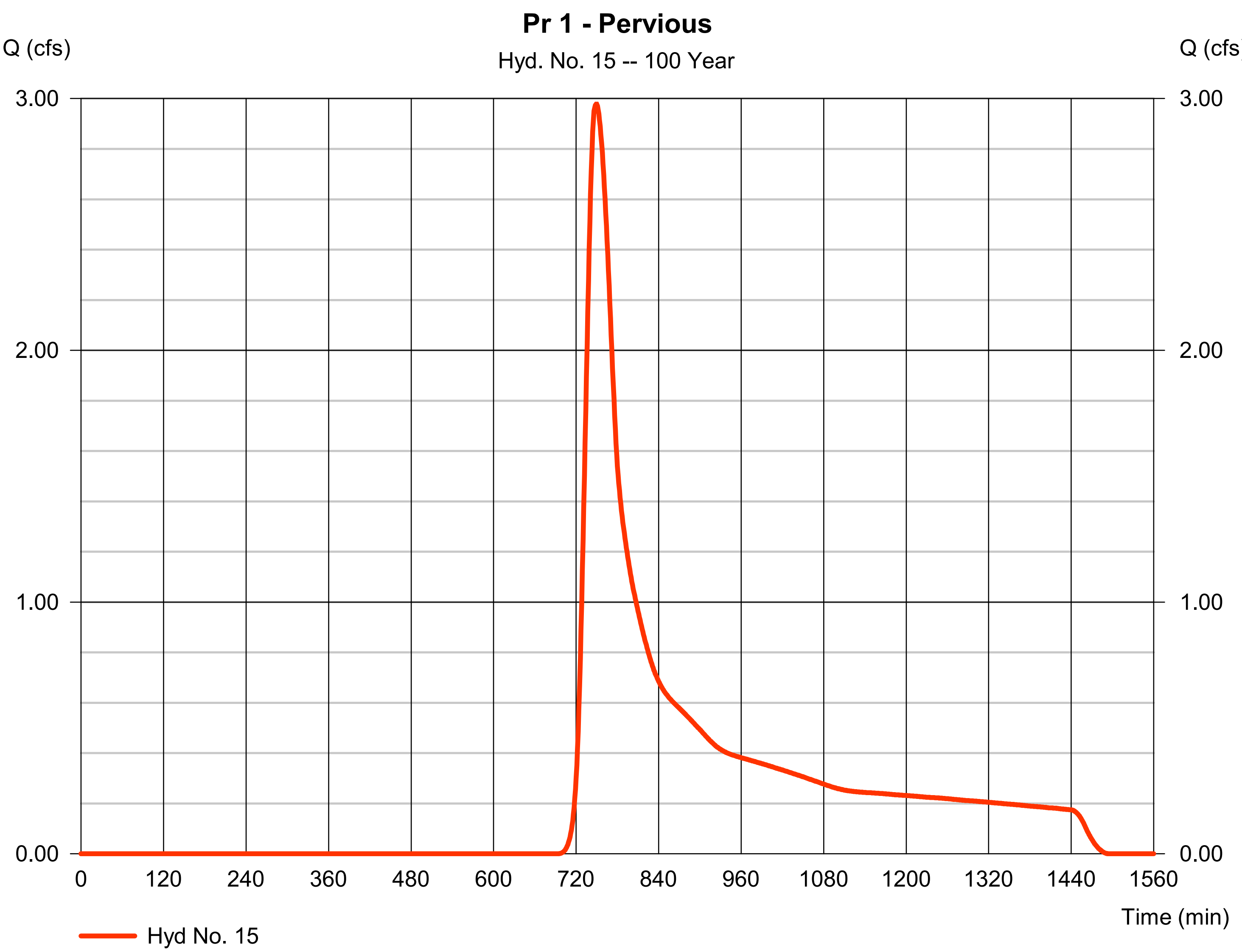
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 15

Pr 1 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.978 cfs
Storm frequency	= 100 yrs	Time to peak	= 749 min
Time interval	= 1 min	Hyd. volume	= 22,233 cuft
Drainage area	= 3.500 ac	Curve number	= 42
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 35.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



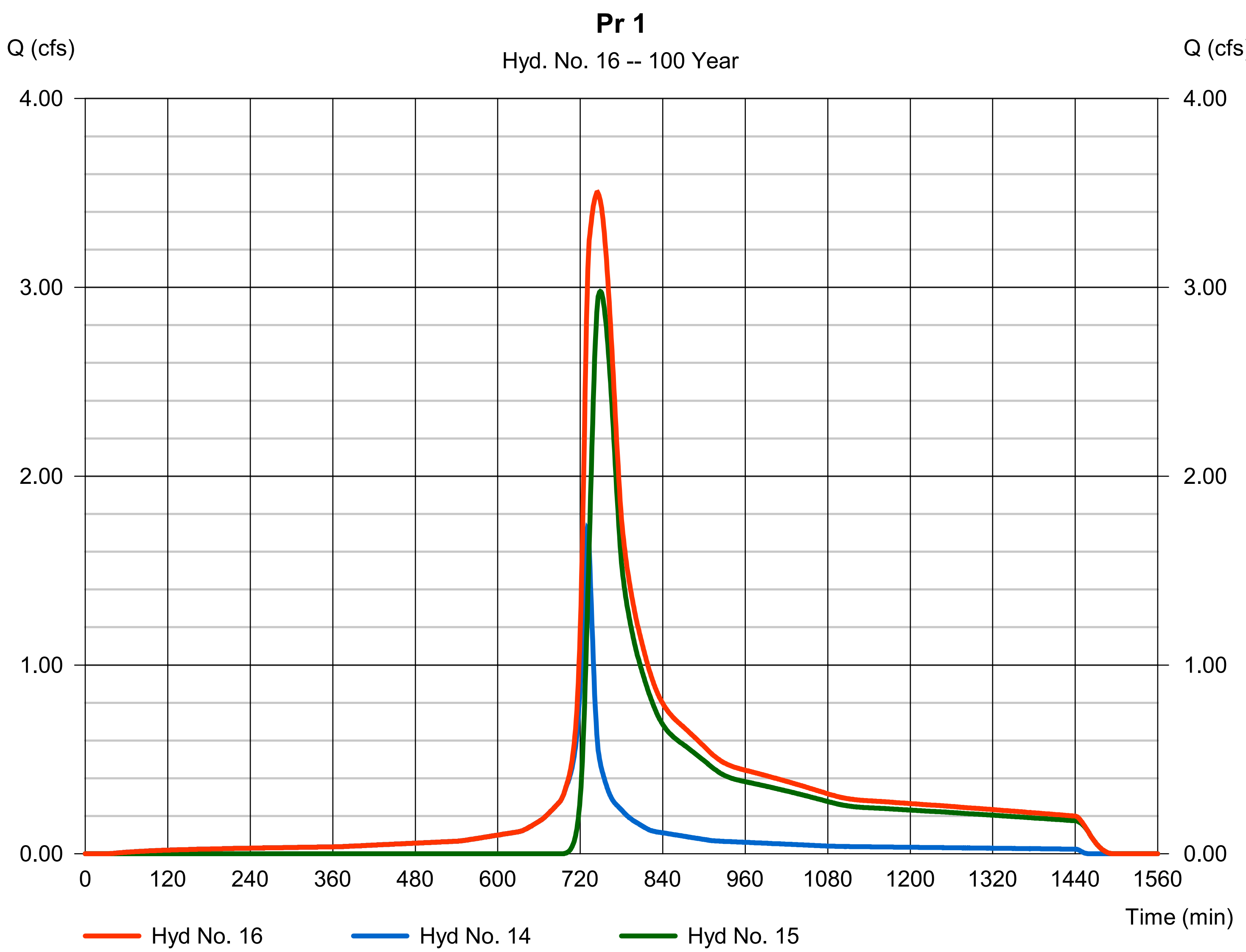
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 16

Pr 1

Hydrograph type	= Combine	Peak discharge	= 3.504 cfs
Storm frequency	= 100 yrs	Time to peak	= 745 min
Time interval	= 1 min	Hyd. volume	= 30,028 cuft
Inflow hyds.	= 14, 15	Contrib. drain. area	= 3.760 ac

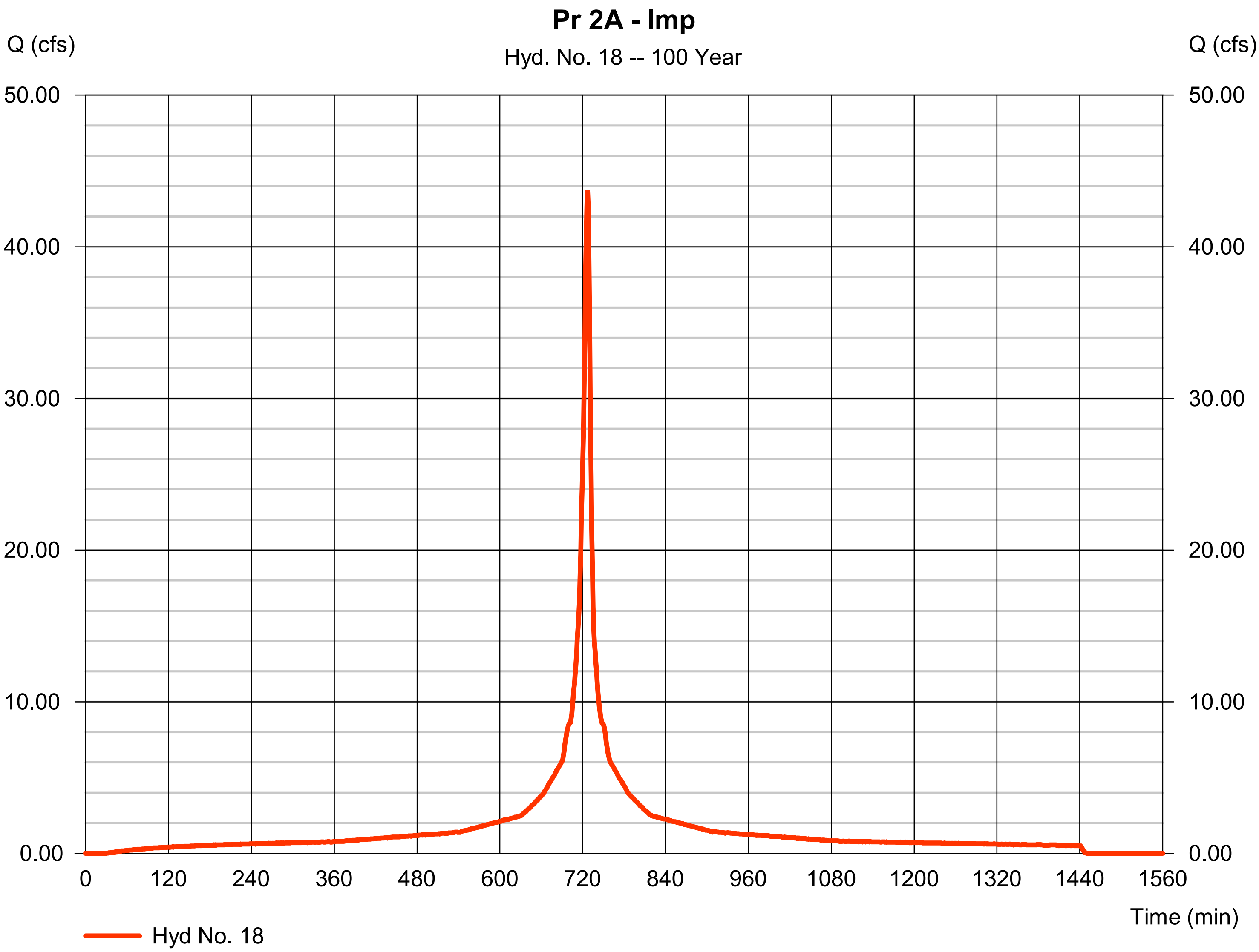


Hydrograph Report

Hyd. No. 18

Pr 2A - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 43.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 161,745 cuft
Drainage area	= 5.150 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



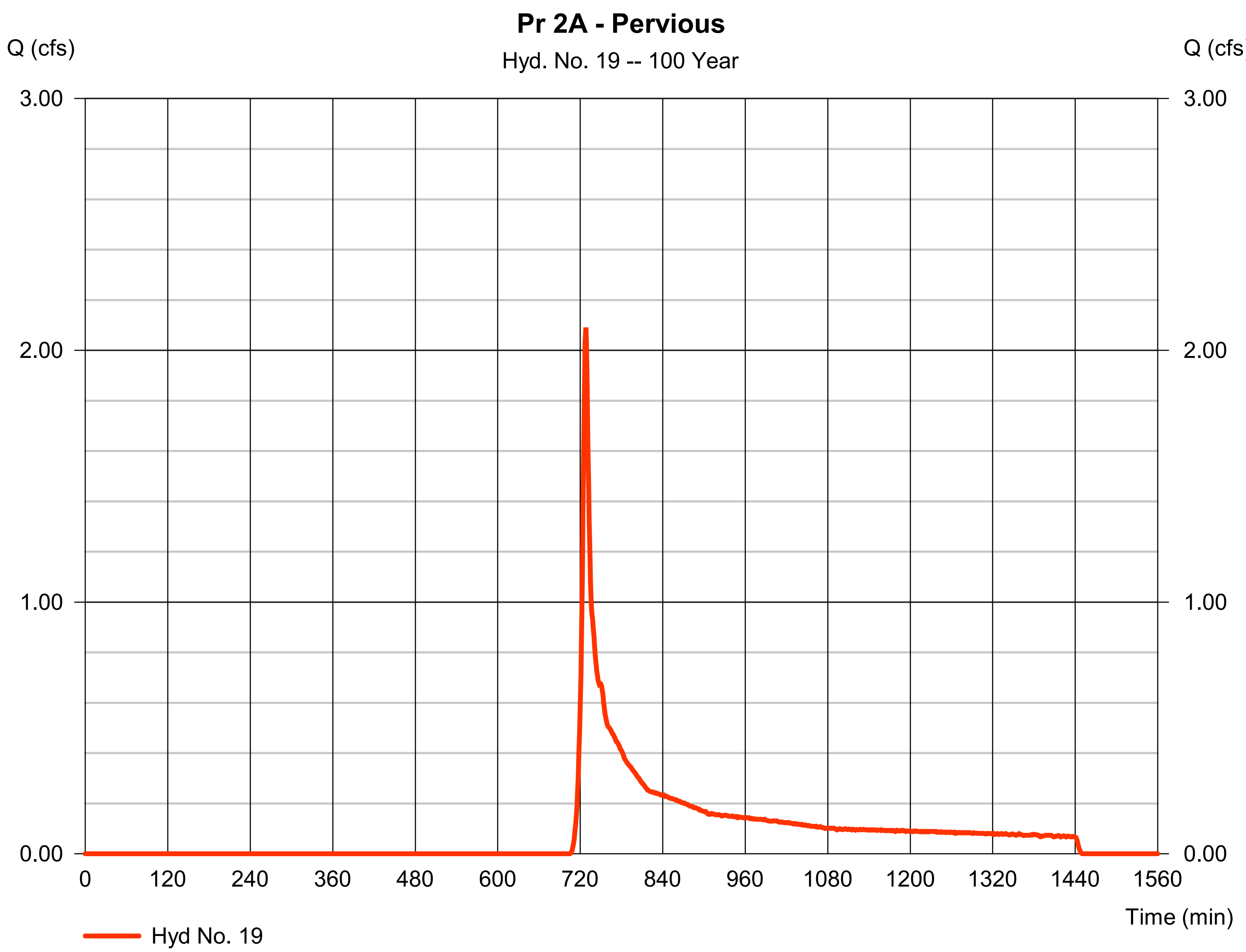
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 19

Pr 2A - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.090 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 8,146 cuft
Drainage area	= 1.520 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



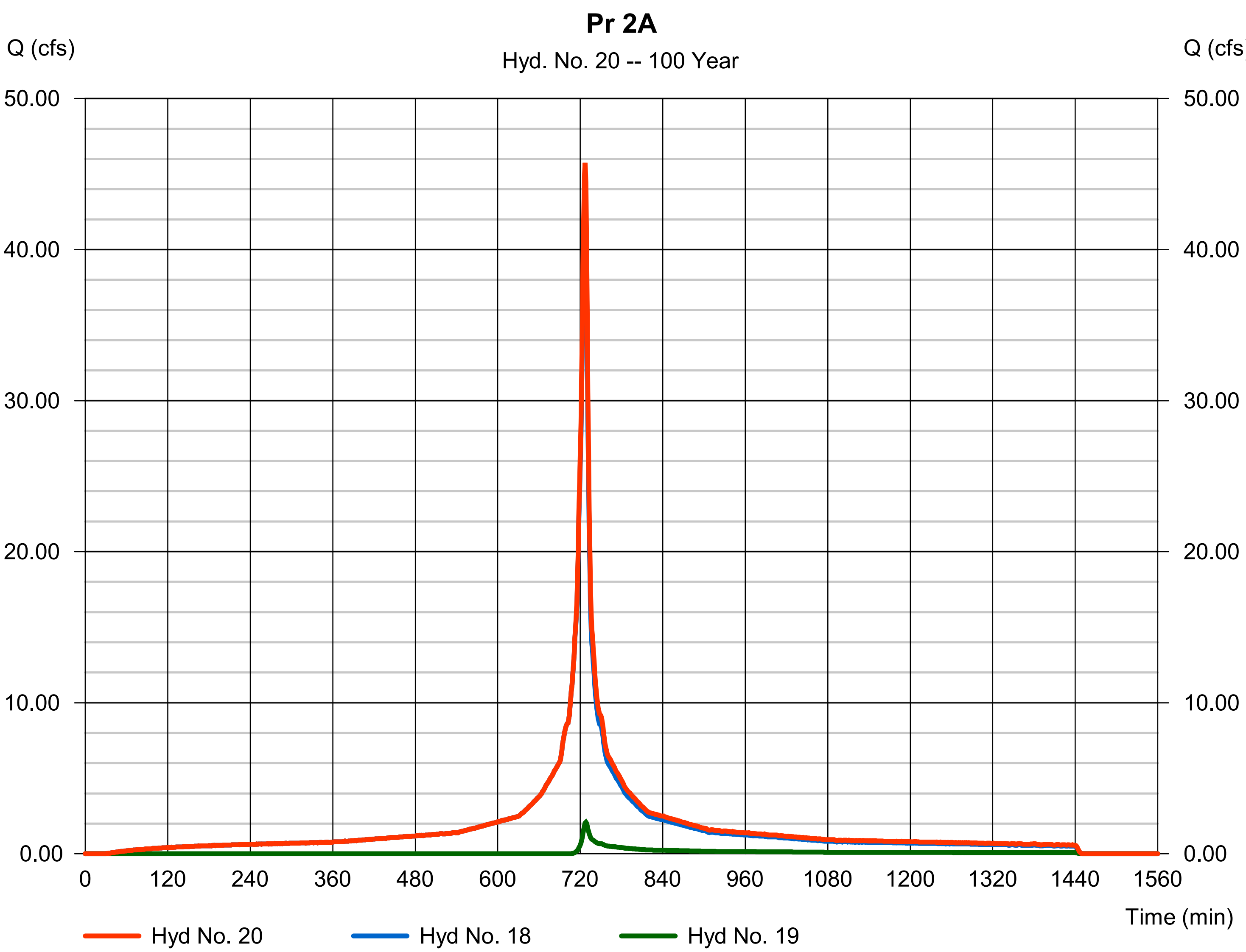
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 20

Pr 2A

Hydrograph type	= Combine	Peak discharge	= 45.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 169,892 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 6.670 ac



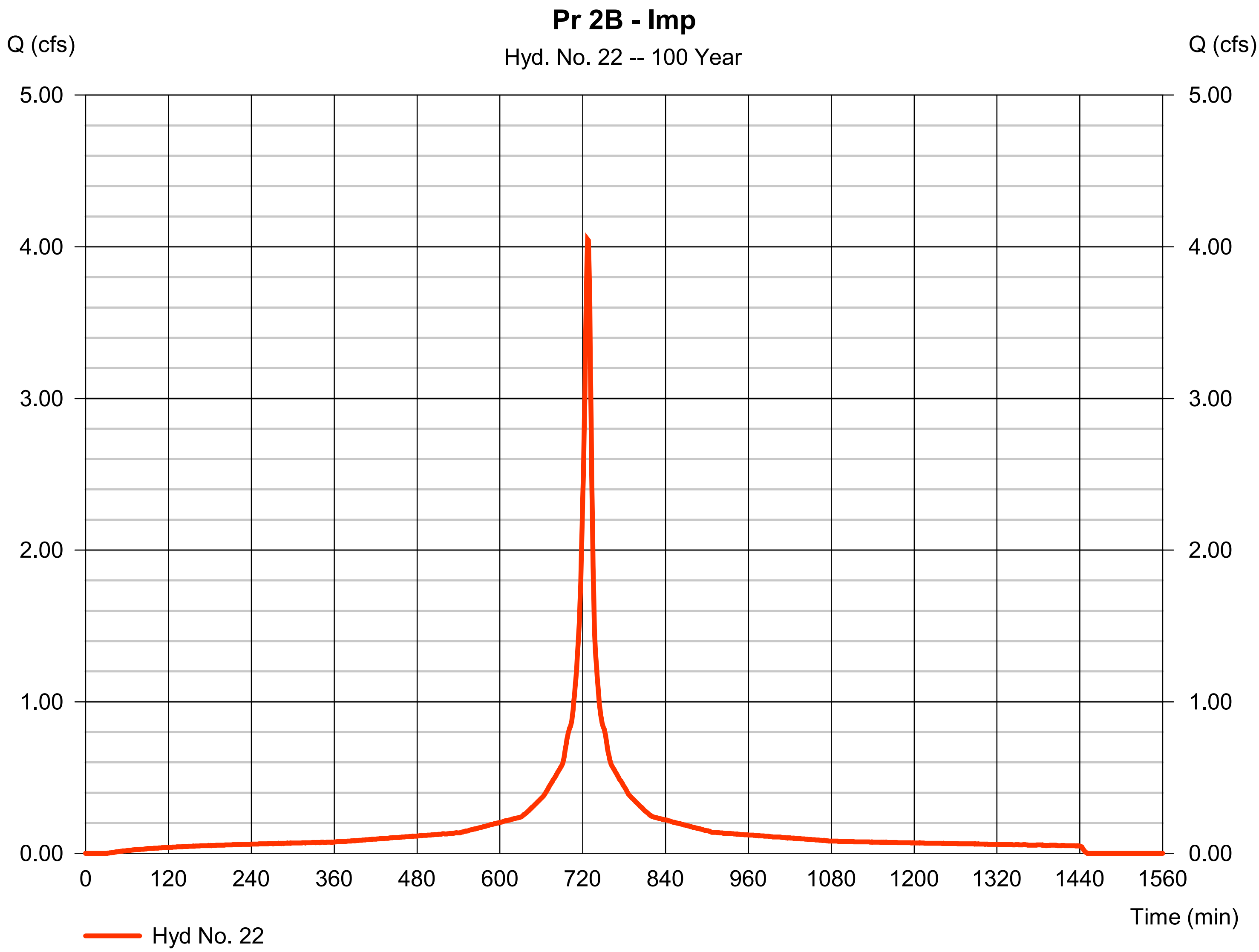
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 22

Pr 2B - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 4.049 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 15,738 cuft
Drainage area	= 0.530 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



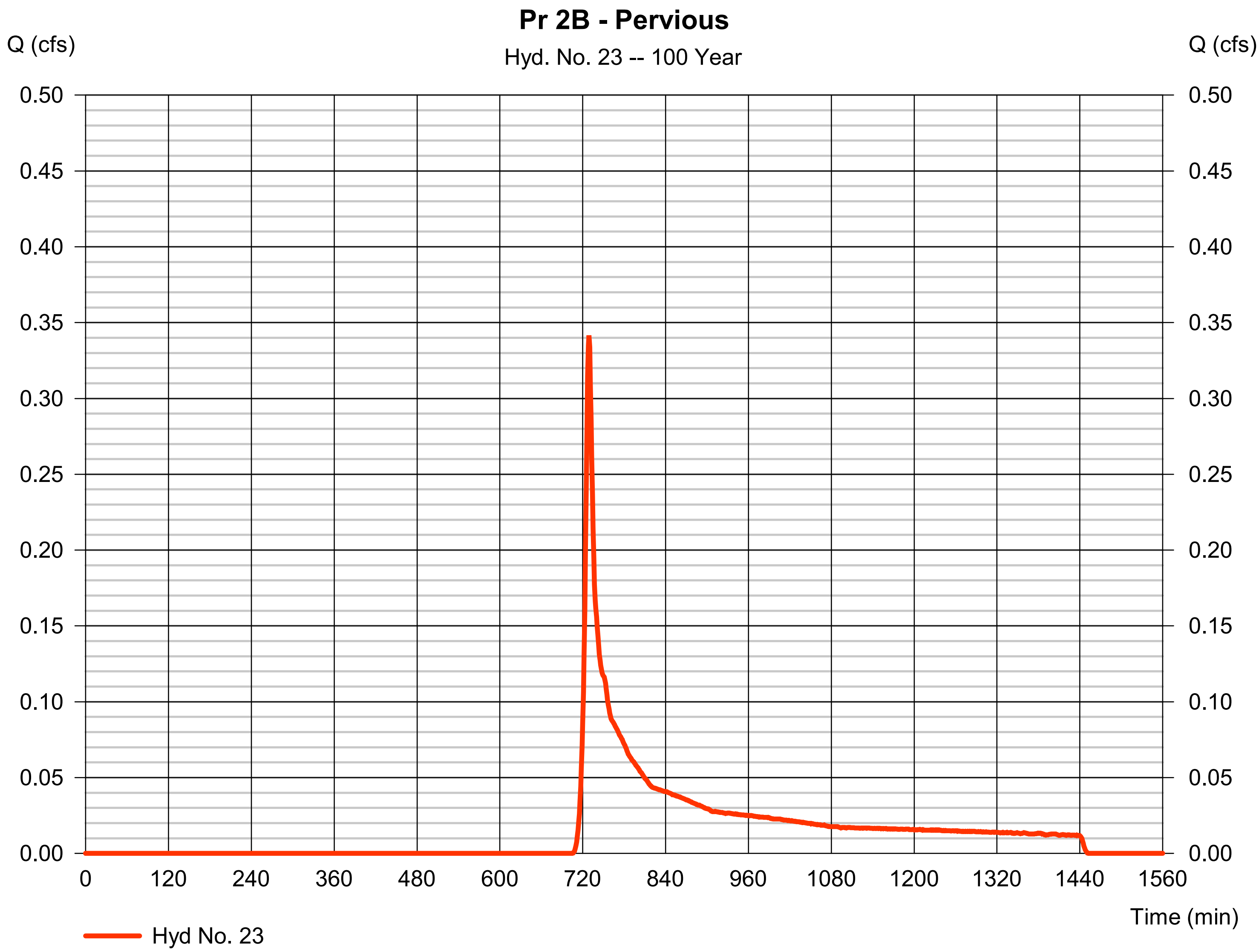
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 23

Pr 2B - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.342 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 1,419 cuft
Drainage area	= 0.280 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



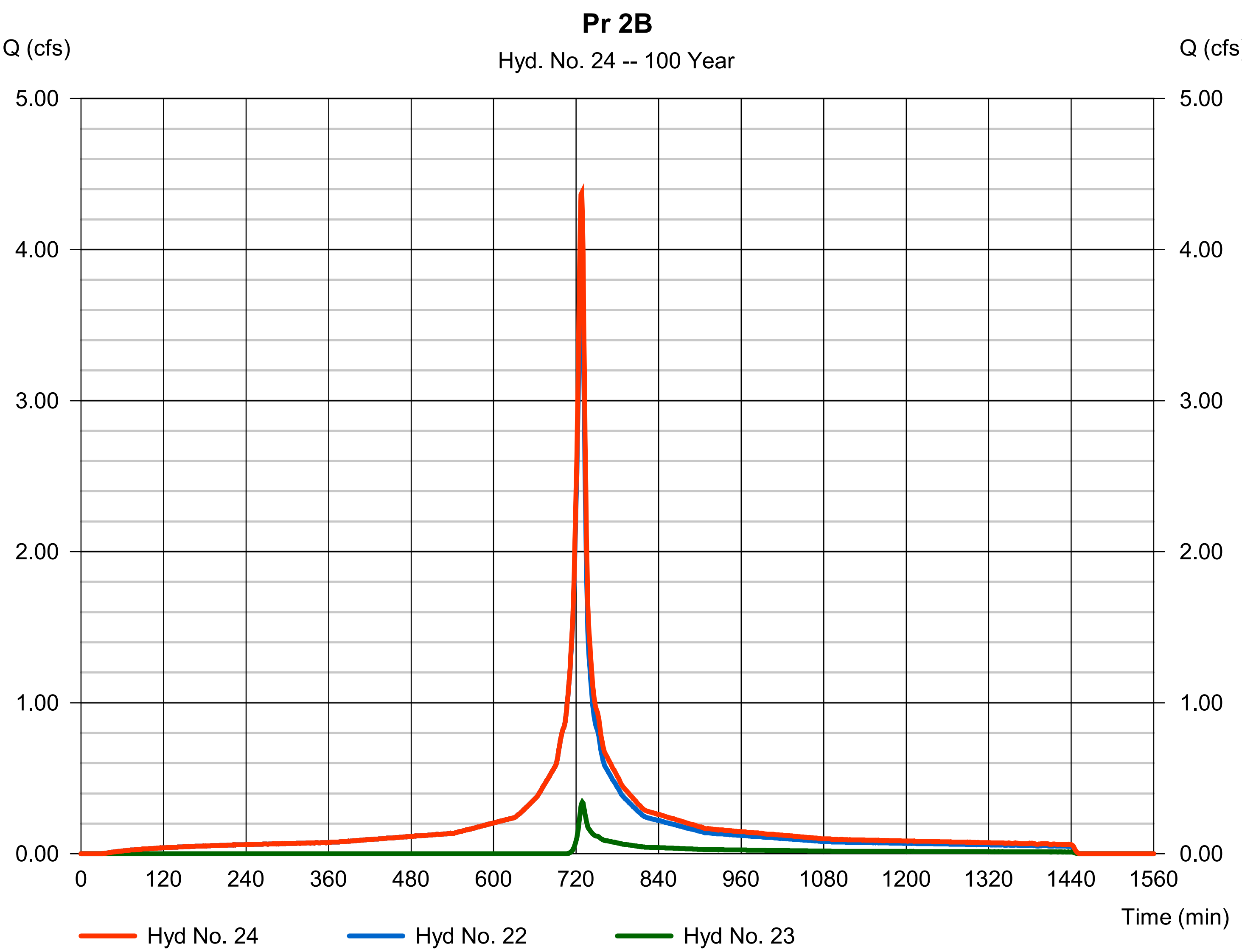
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 24

Pr 2B

Hydrograph type	= Combine	Peak discharge	= 4.376 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 17,156 cuft
Inflow hyds.	= 22, 23	Contrib. drain. area	= 0.810 ac



Hydrograph Report

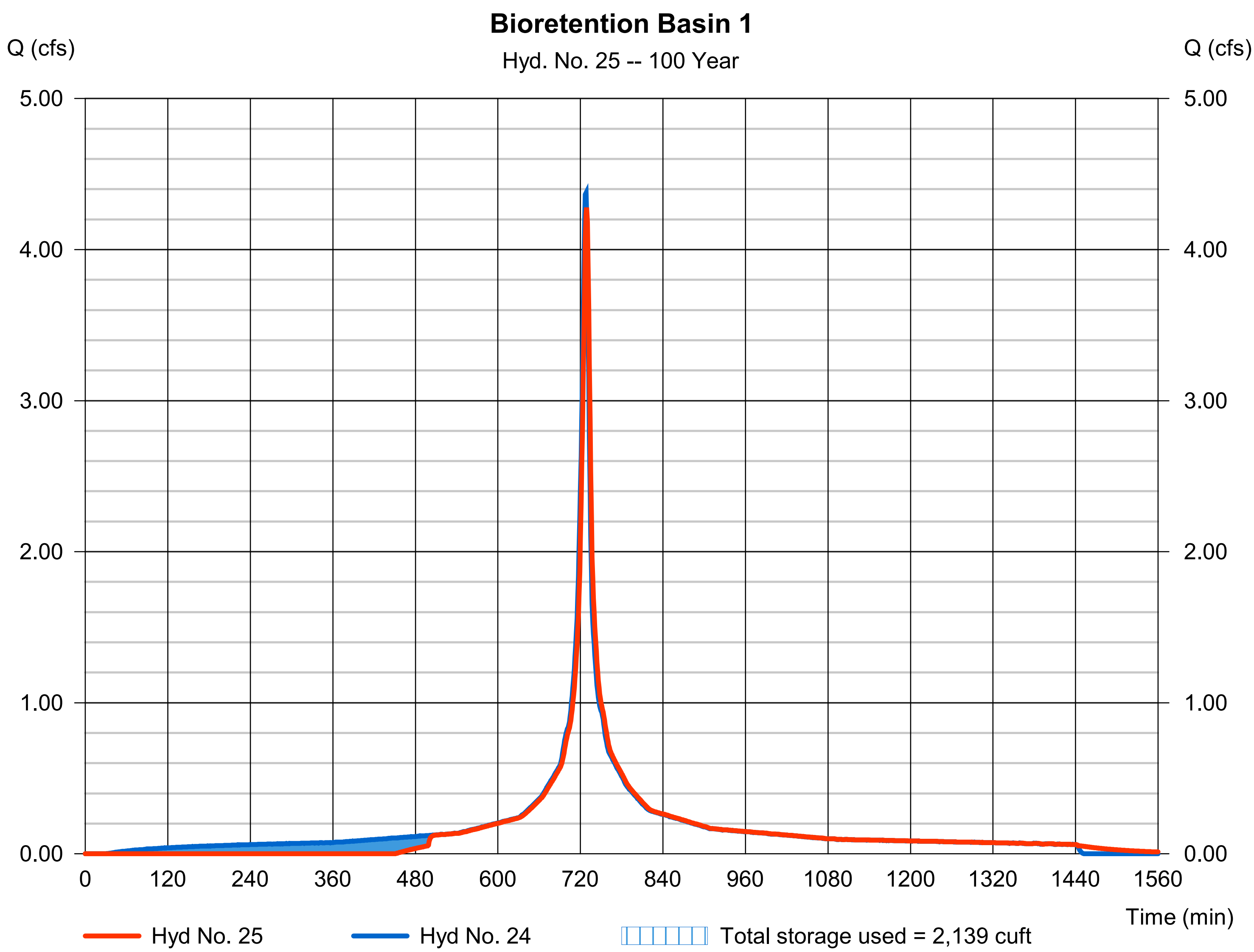
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 25

Bioretention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 4.278 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 15,682 cuft
Inflow hyd. No.	= 24 - Pr 2B	Max. Elevation	= 37.87 ft
Reservoir name	= Bioretention Basin 1	Max. Storage	= 2,139 cuft

Storage Indication method used.



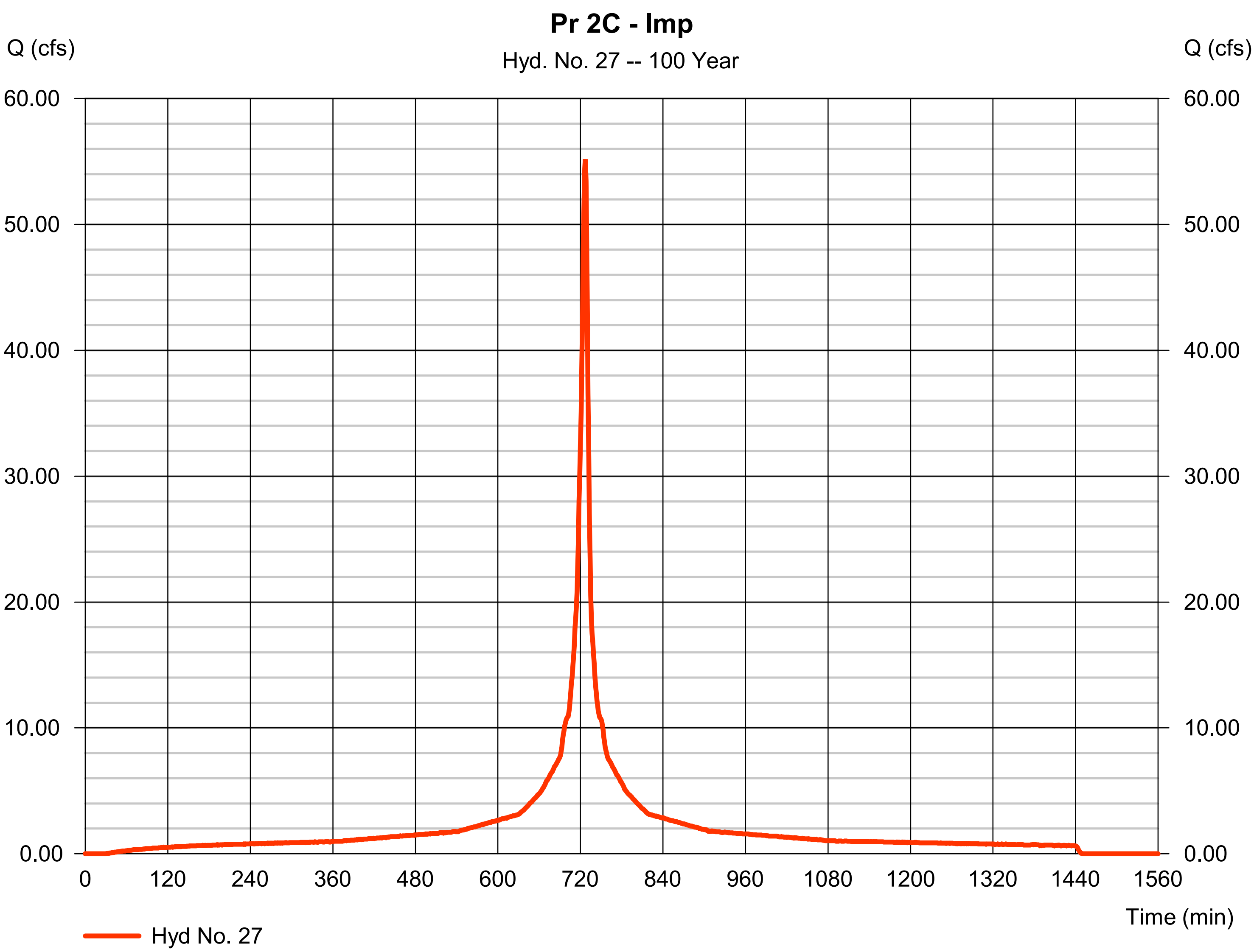
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 27

Pr 2C - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 55.18 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 204,144 cuft
Drainage area	= 6.500 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



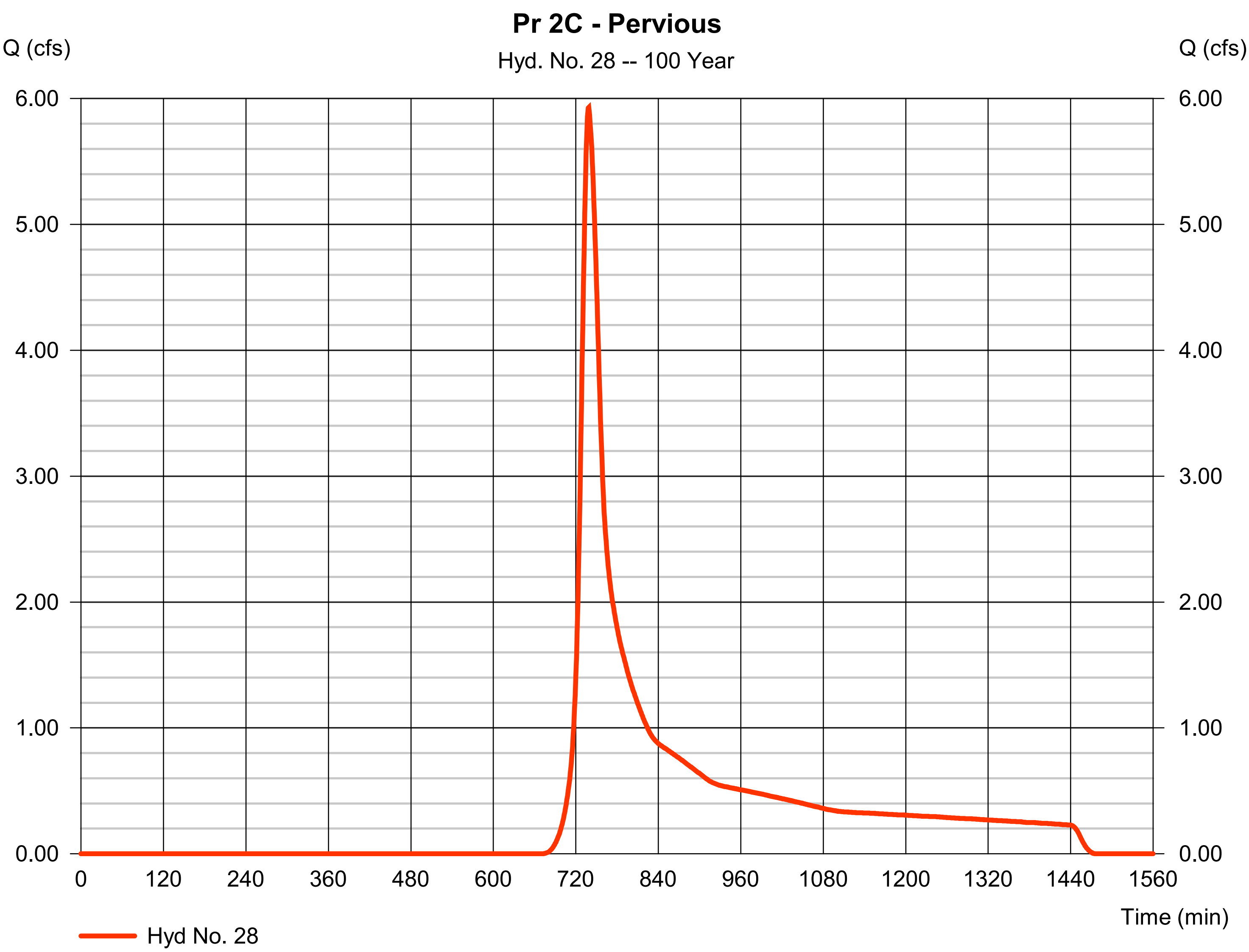
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 28

Pr 2C - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 5.929 cfs
Storm frequency	= 100 yrs	Time to peak	= 739 min
Time interval	= 1 min	Hyd. volume	= 32,460 cuft
Drainage area	= 4.120 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



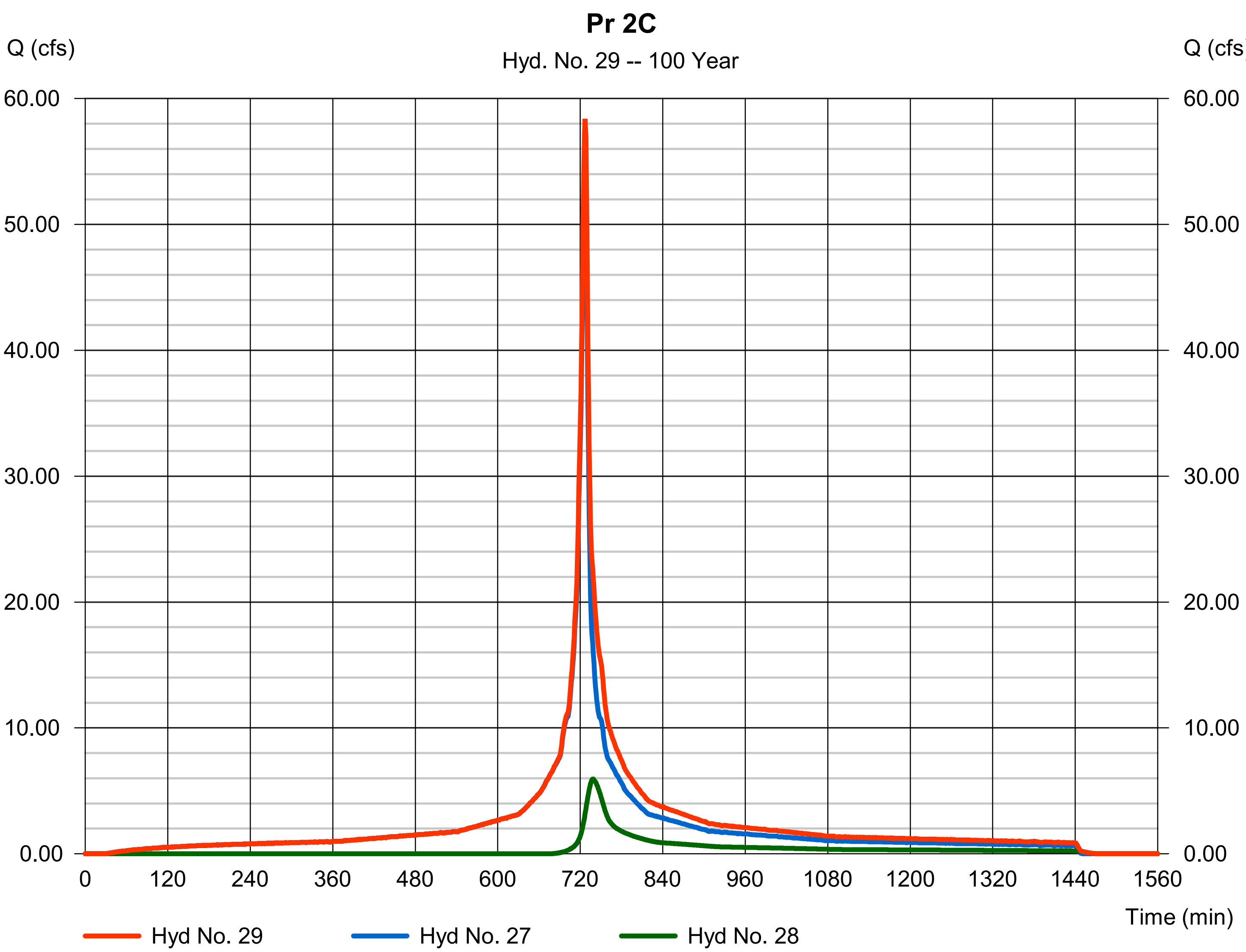
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 29

Pr 2C

Hydrograph type	= Combine	Peak discharge	= 58.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 236,604 cuft
Inflow hyds.	= 27, 28	Contrib. drain. area	= 10.620 ac



Hydrograph Report

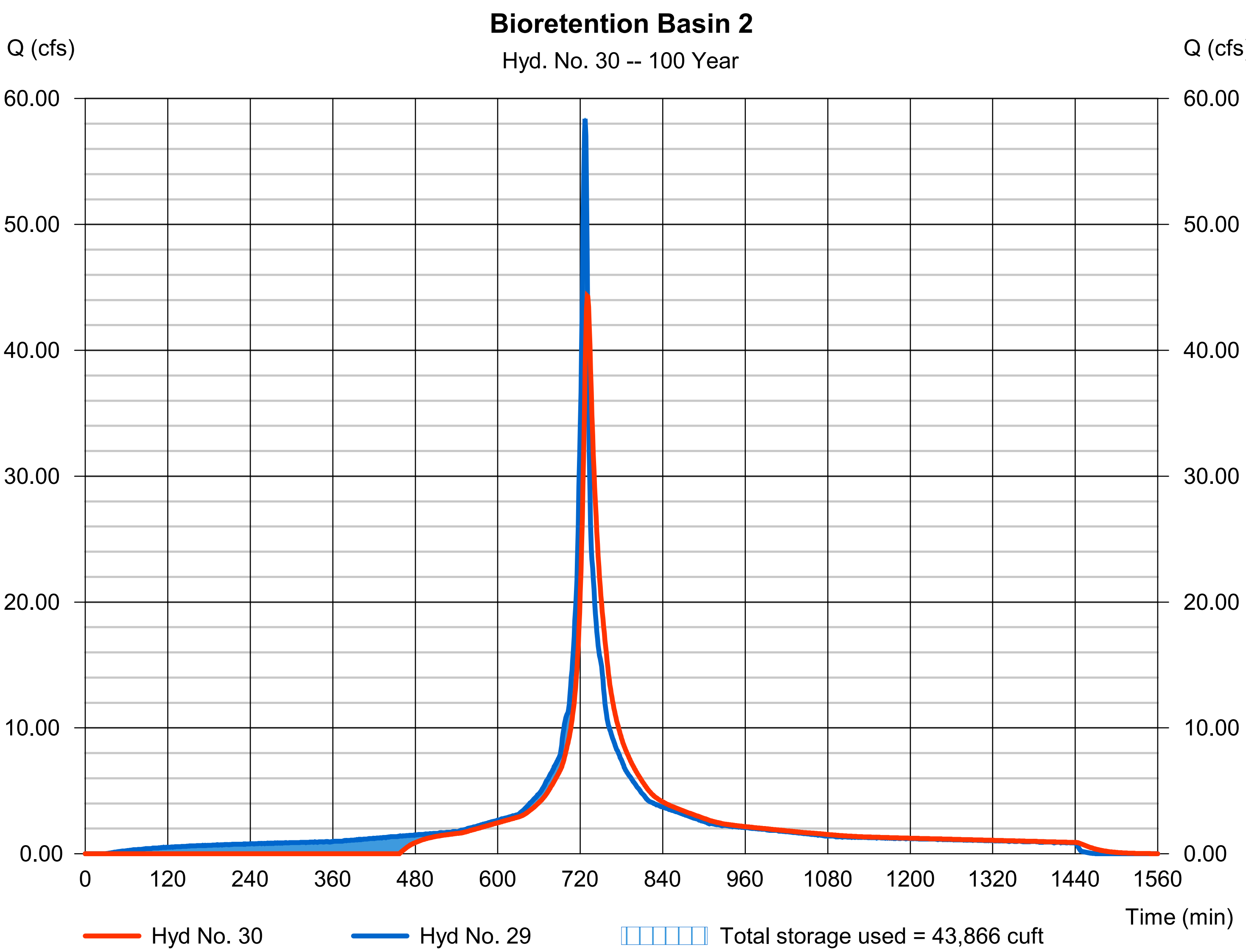
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 30

Bioretention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 44.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 216,932 cuft
Inflow hyd. No.	= 29 - Pr 2C	Max. Elevation	= 38.39 ft
Reservoir name	= Bioretention Basin 2	Max. Storage	= 43,866 cuft

Storage Indication method used.



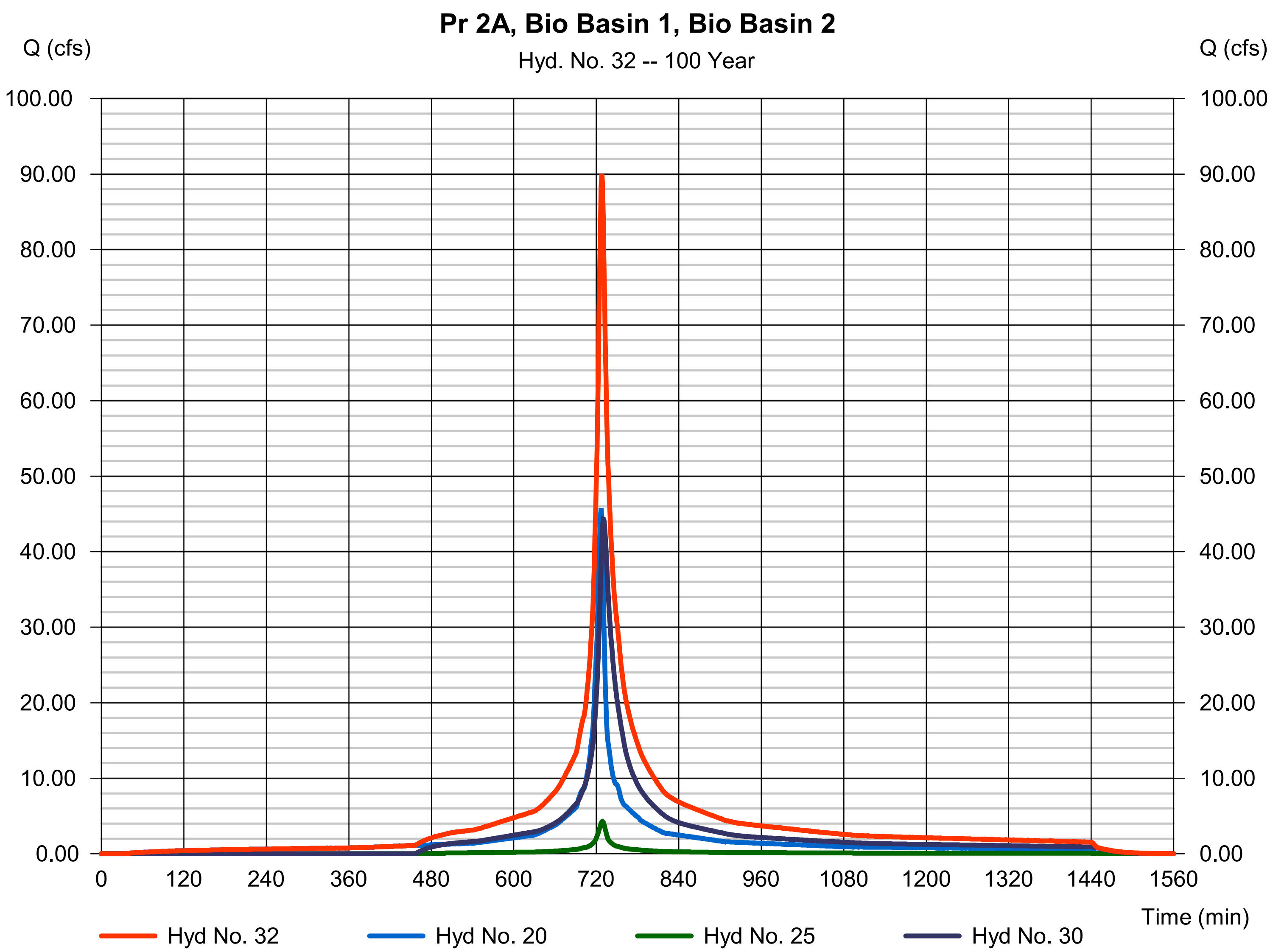
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 32

Pr 2A, Bio Basin 1, Bio Basin 2

Hydrograph type	= Combine	Peak discharge	= 90.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 402,506 cuft
Inflow hyds.	= 20, 25, 30	Contrib. drain. area	= 0.000 ac



Hydrograph Report

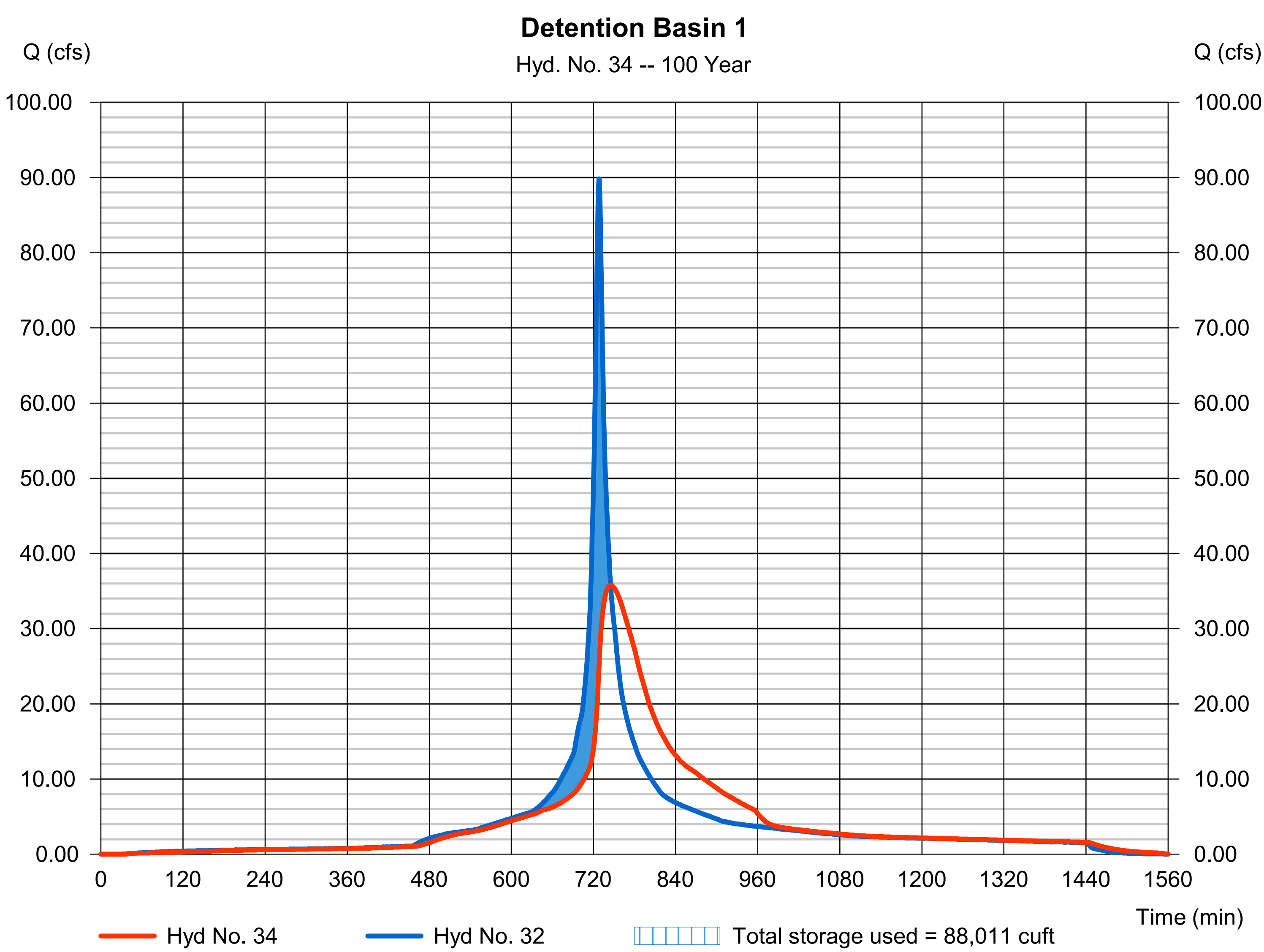
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 34

Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 35.77 cfs
Storm frequency	= 100 yrs	Time to peak	= 745 min
Time interval	= 1 min	Hyd. volume	= 402,504 cuft
Inflow hyd. No.	= 32 - Pr 2A, Bio Basin 1, Bio Basin 2	Max. Elevation	= 33.93 ft
Reservoir name	= Detention Basin 1	Max. Storage	= 88,011 cuft

Storage Indication method used.



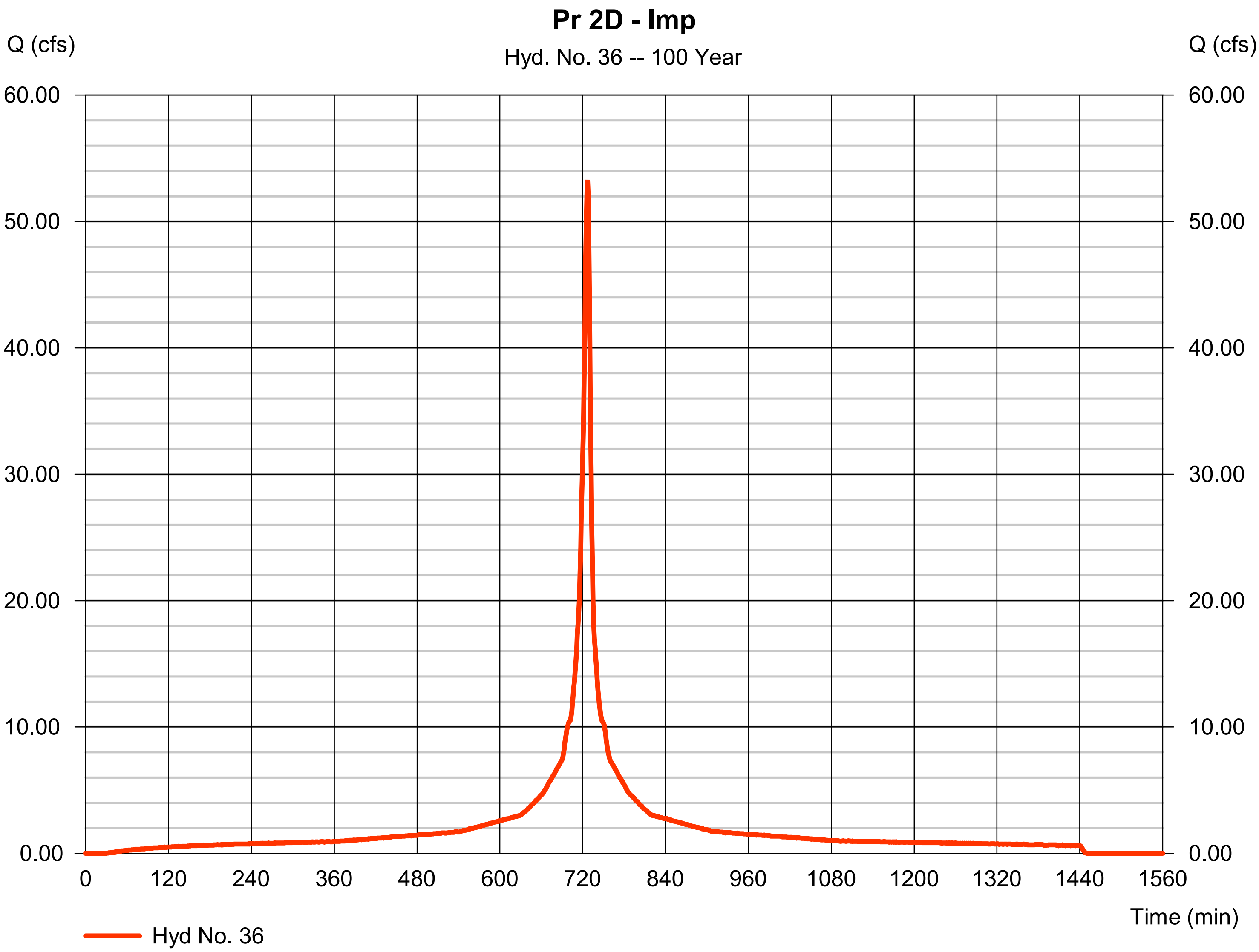
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 36

Pr 2D - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 53.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 197,235 cuft
Drainage area	= 6.280 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



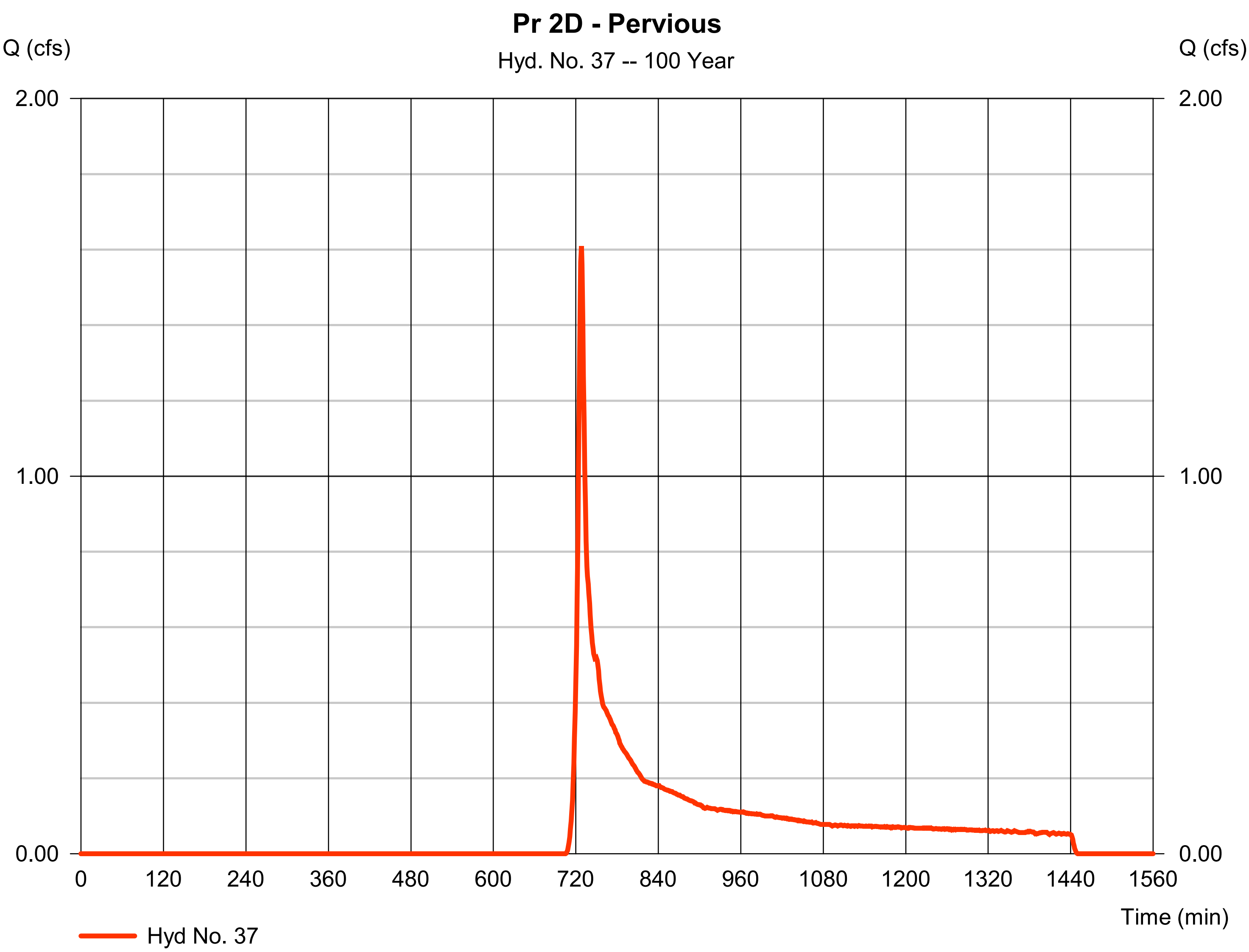
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 37

Pr 2D - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.609 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 6,270 cuft
Drainage area	= 1.170 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



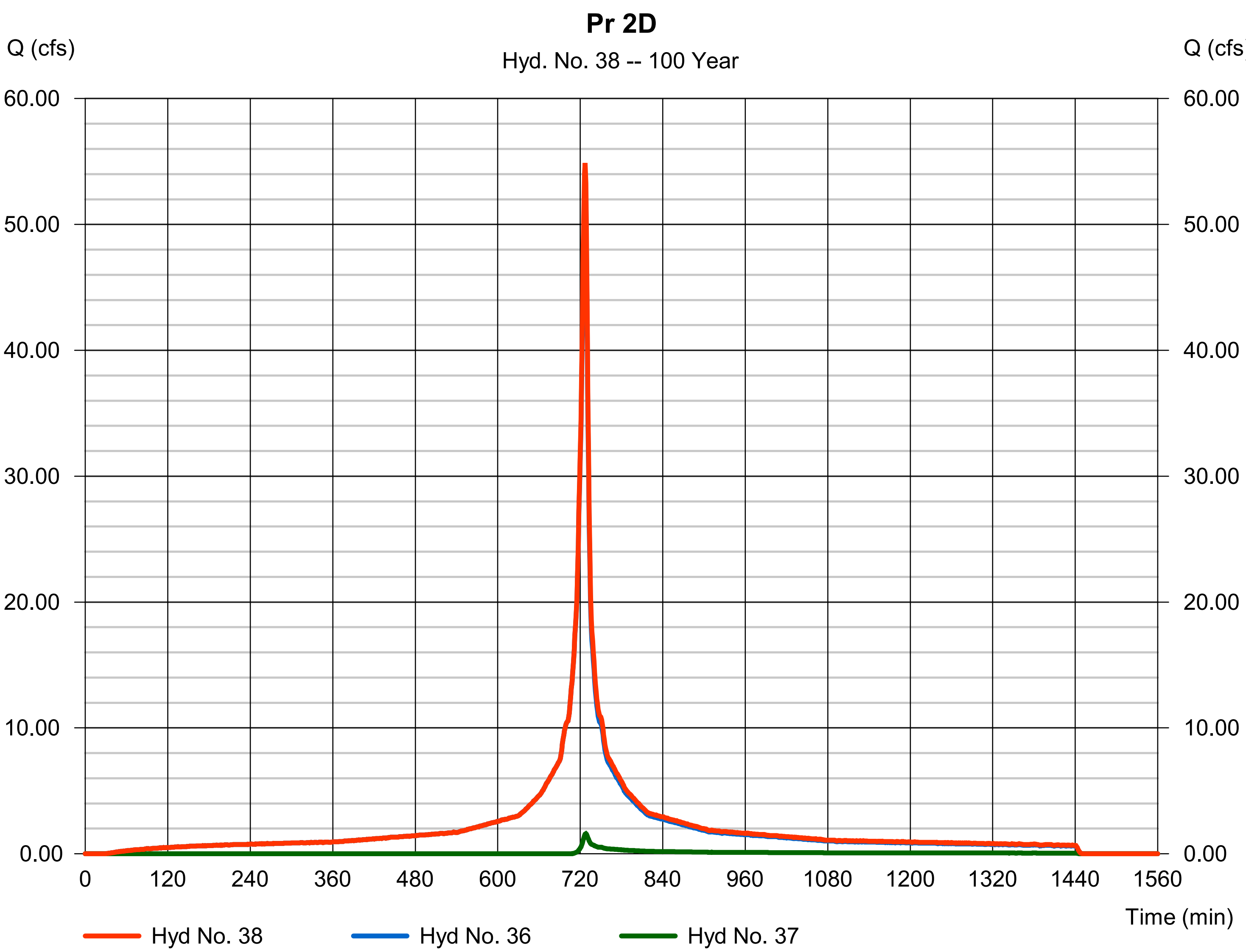
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Wednesday, 03 / 25 / 2020

Hyd. No. 38

Pr 2D

Hydrograph type	= Combine	Peak discharge	= 54.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 203,505 cuft
Inflow hyds.	= 36, 37	Contrib. drain. area	= 7.450 ac



Hydrograph Report

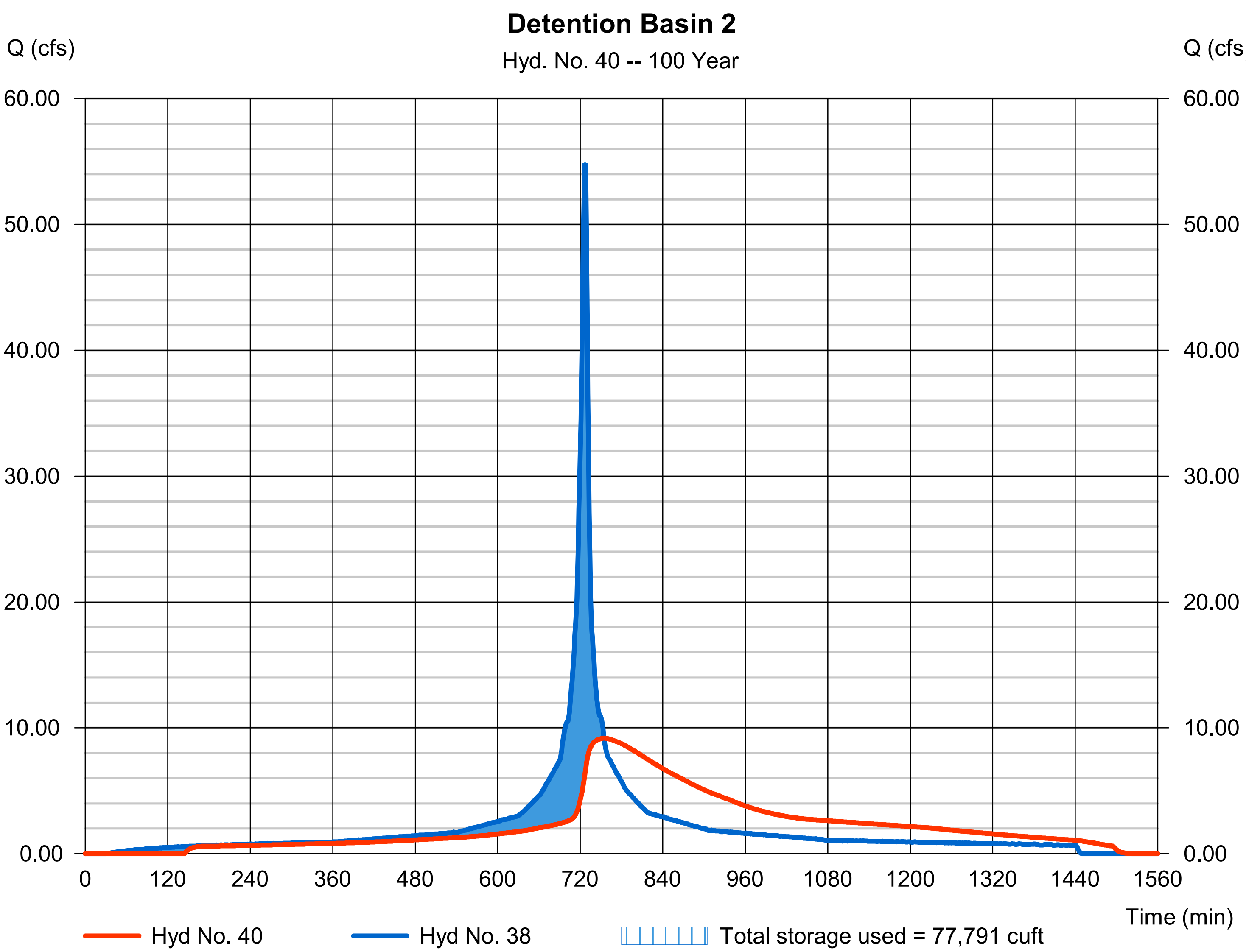
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 40

Detention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 9.185 cfs
Storm frequency	= 100 yrs	Time to peak	= 755 min
Time interval	= 1 min	Hyd. volume	= 201,119 cuft
Inflow hyd. No.	= 38 - Pr 2D	Max. Elevation	= 32.95 ft
Reservoir name	= Detention Basin 2	Max. Storage	= 77,791 cuft

Storage Indication method used.



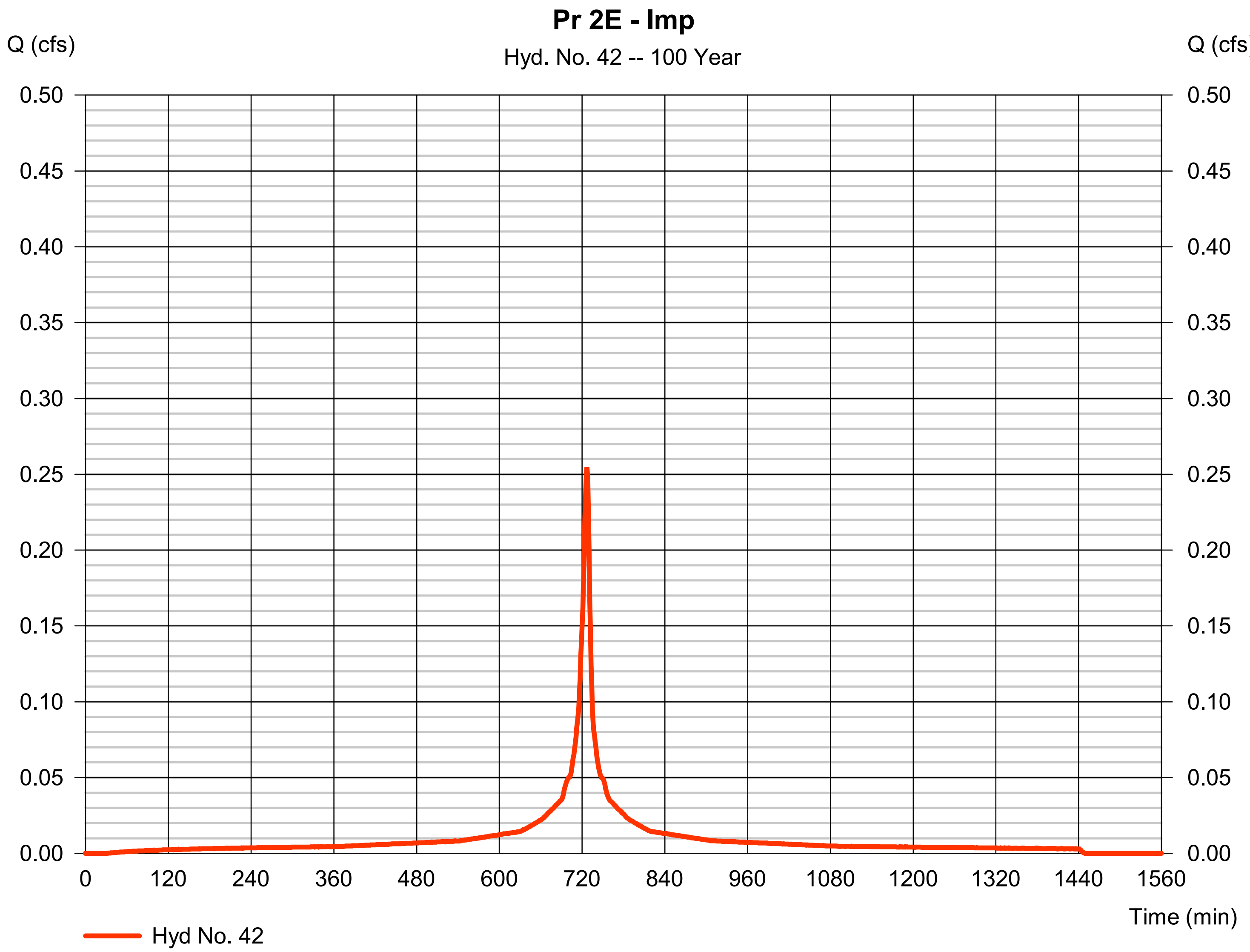
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 42

Pr 2E - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 0.255 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 942 cuft
Drainage area	= 0.030 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



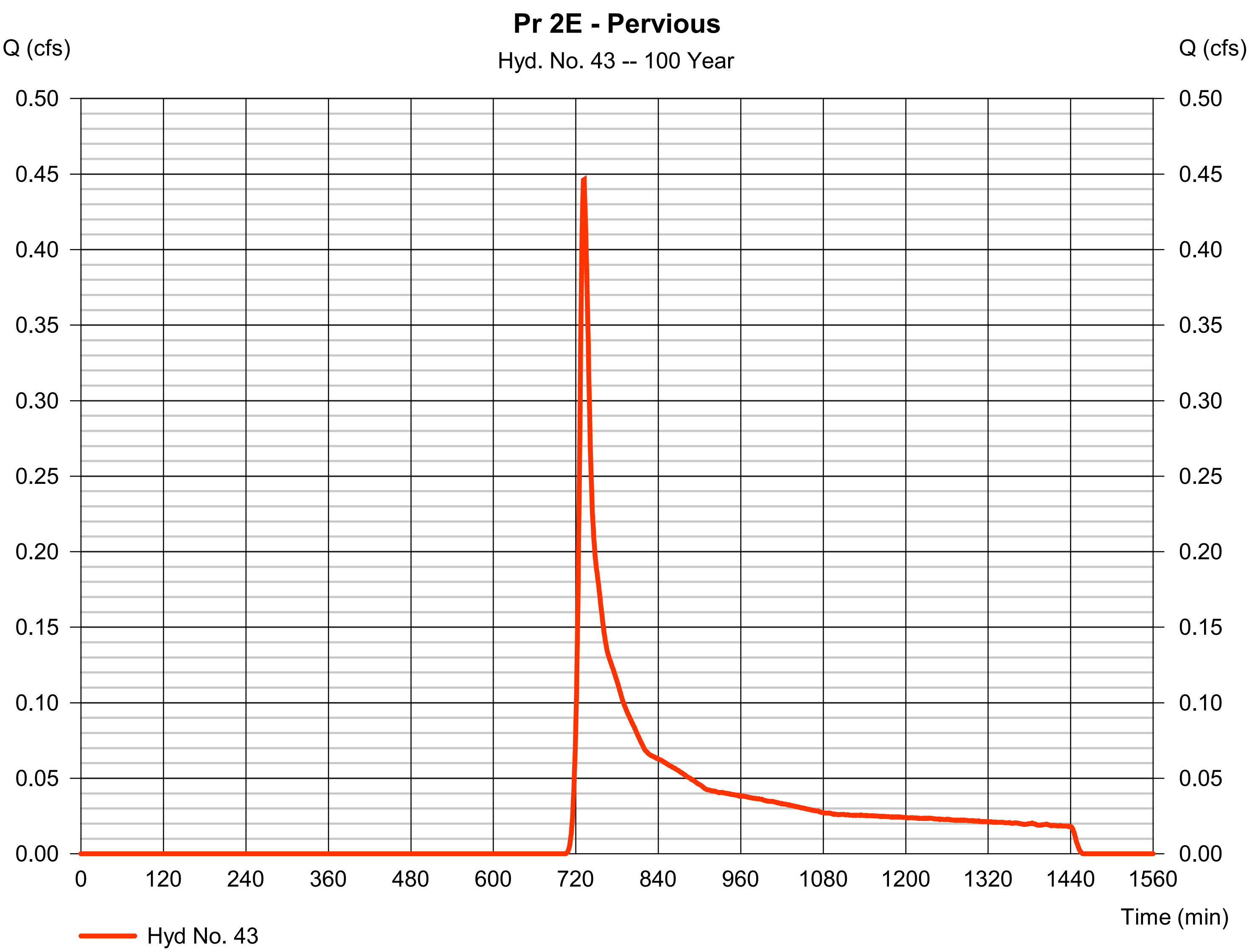
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 43

Pr 2E - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.446 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 1 min	Hyd. volume	= 2,169 cuft
Drainage area	= 0.410 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



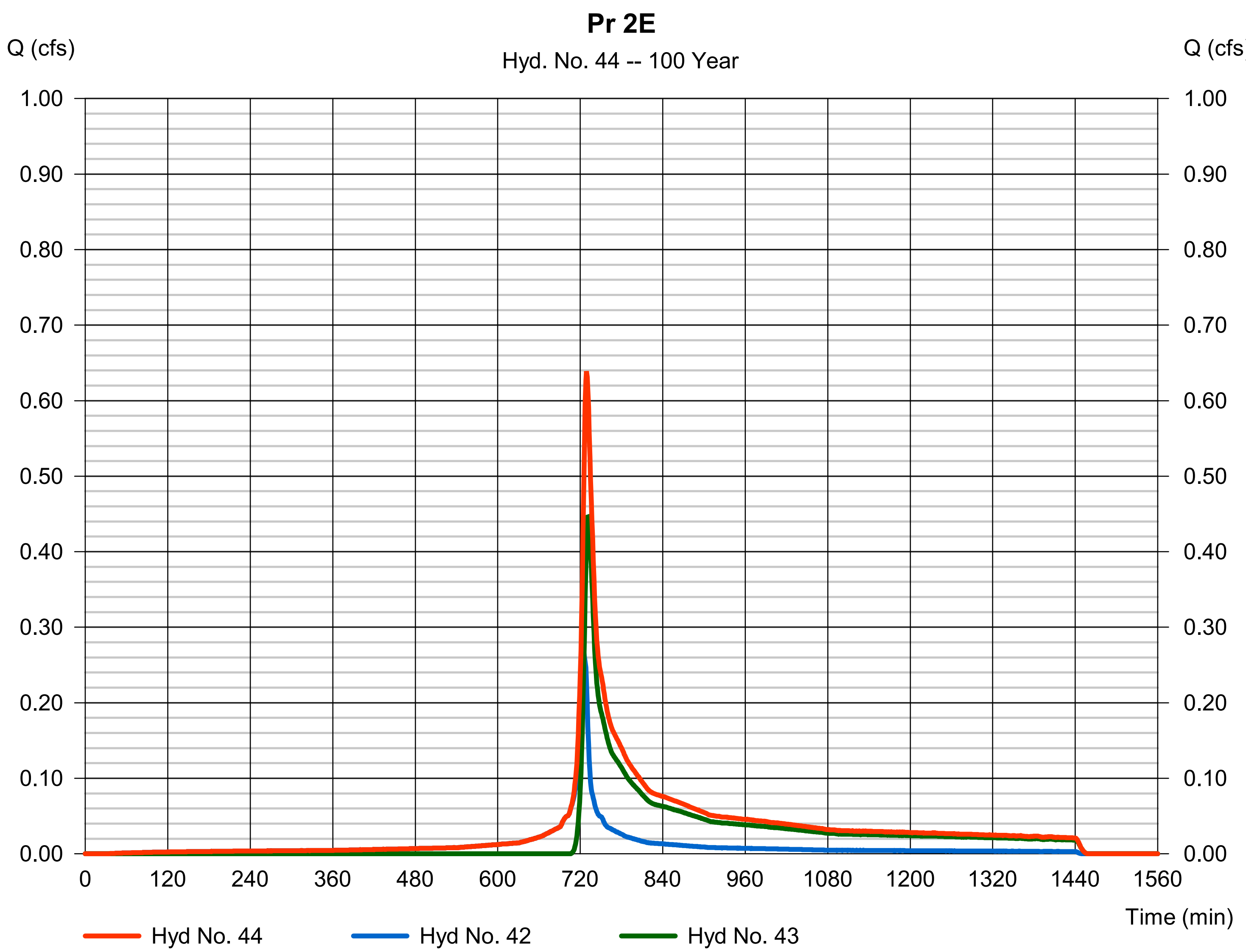
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 44

Pr 2E

Hydrograph type	= Combine	Peak discharge	= 0.639 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 1 min	Hyd. volume	= 3,111 cuft
Inflow hyds.	= 42, 43	Contrib. drain. area	= 0.440 ac



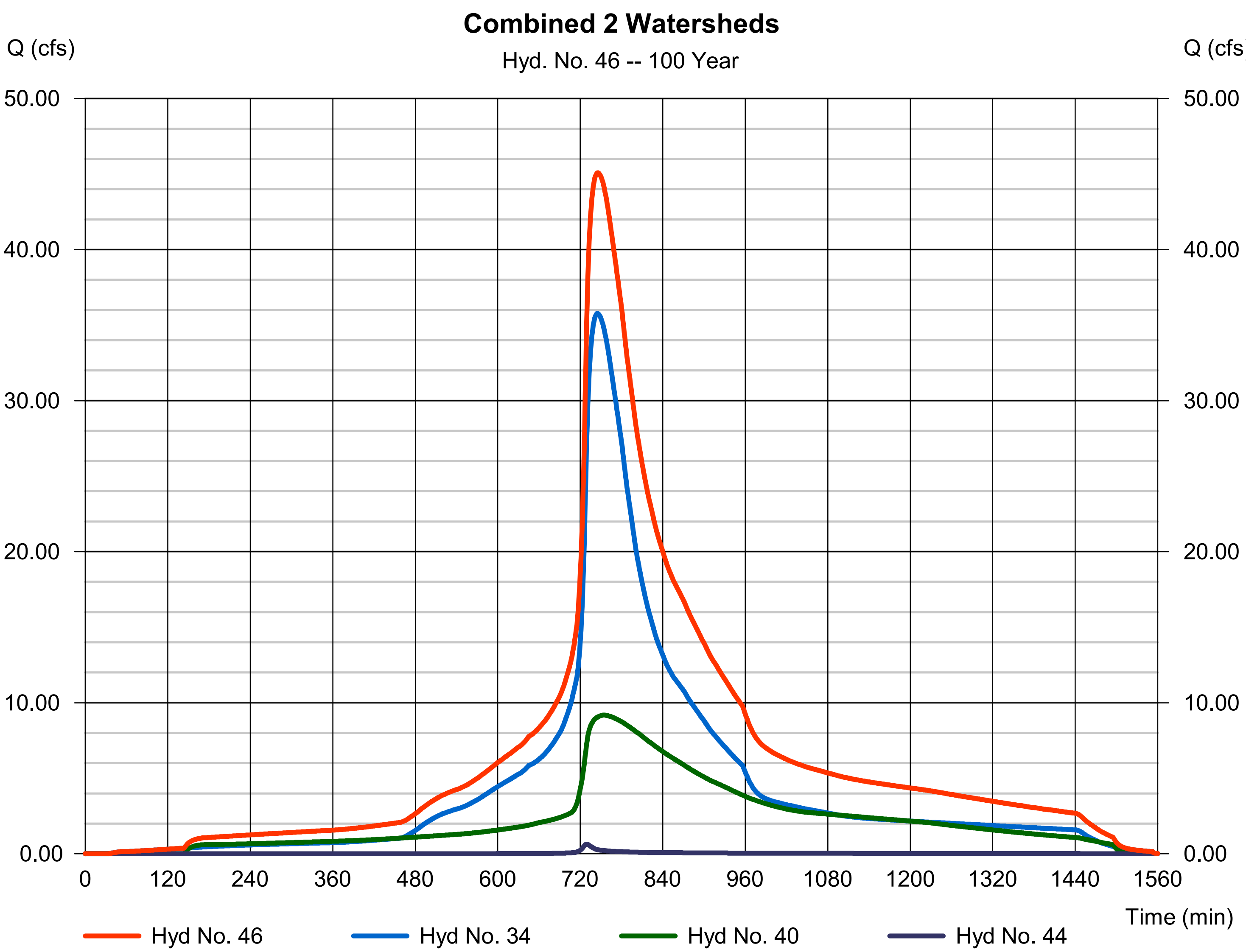
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 46

Combined 2 Watersheds

Hydrograph type	= Combine	Peak discharge	= 45.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 745 min
Time interval	= 1 min	Hyd. volume	= 606,735 cuft
Inflow hyds.	= 34, 40, 44	Contrib. drain. area	= 0.000 ac



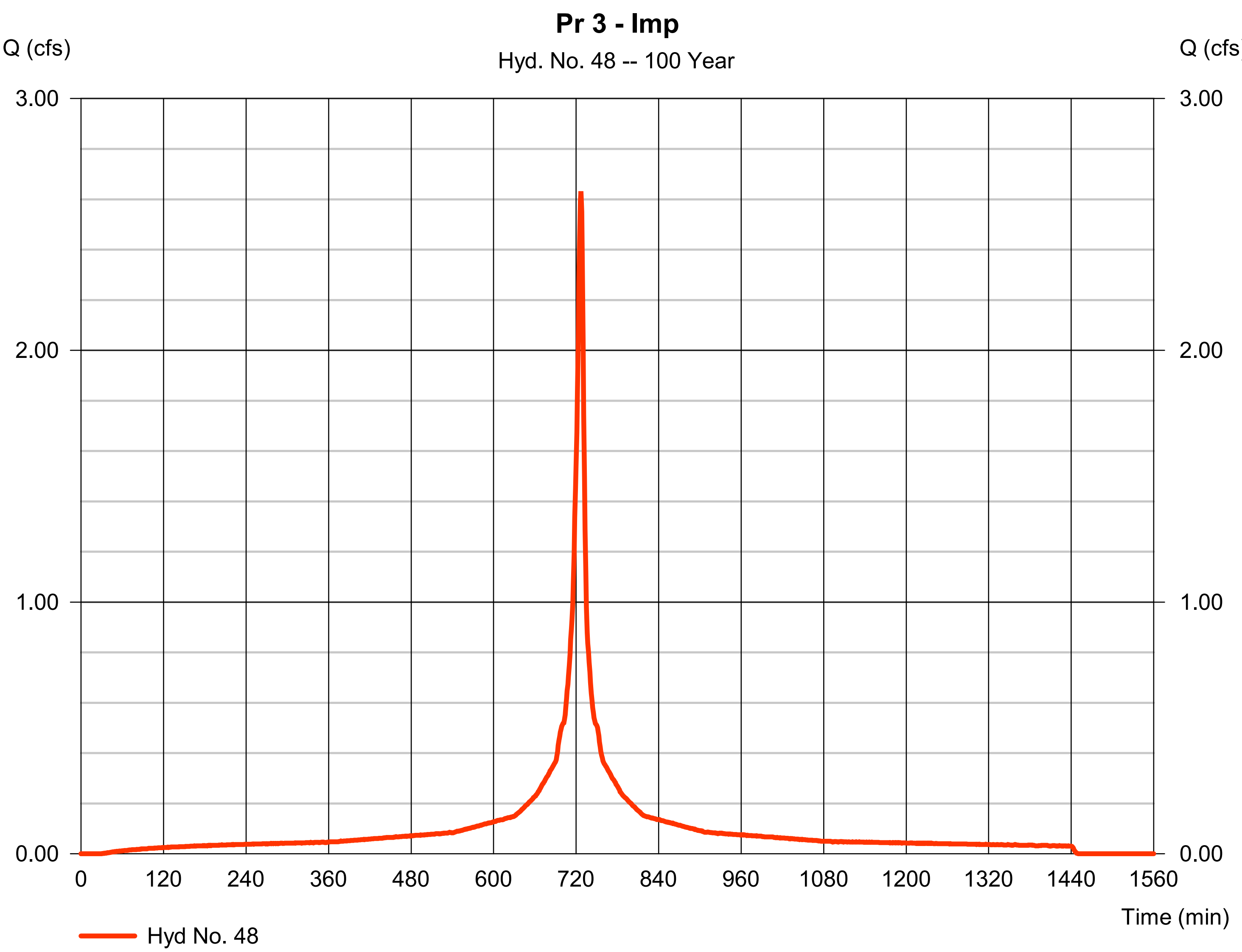
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 48

Pr 3 - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 2.632 cfs
Storm frequency	= 100 yrs	Time to peak	= 727 min
Time interval	= 1 min	Hyd. volume	= 9,736 cuft
Drainage area	= 0.310 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

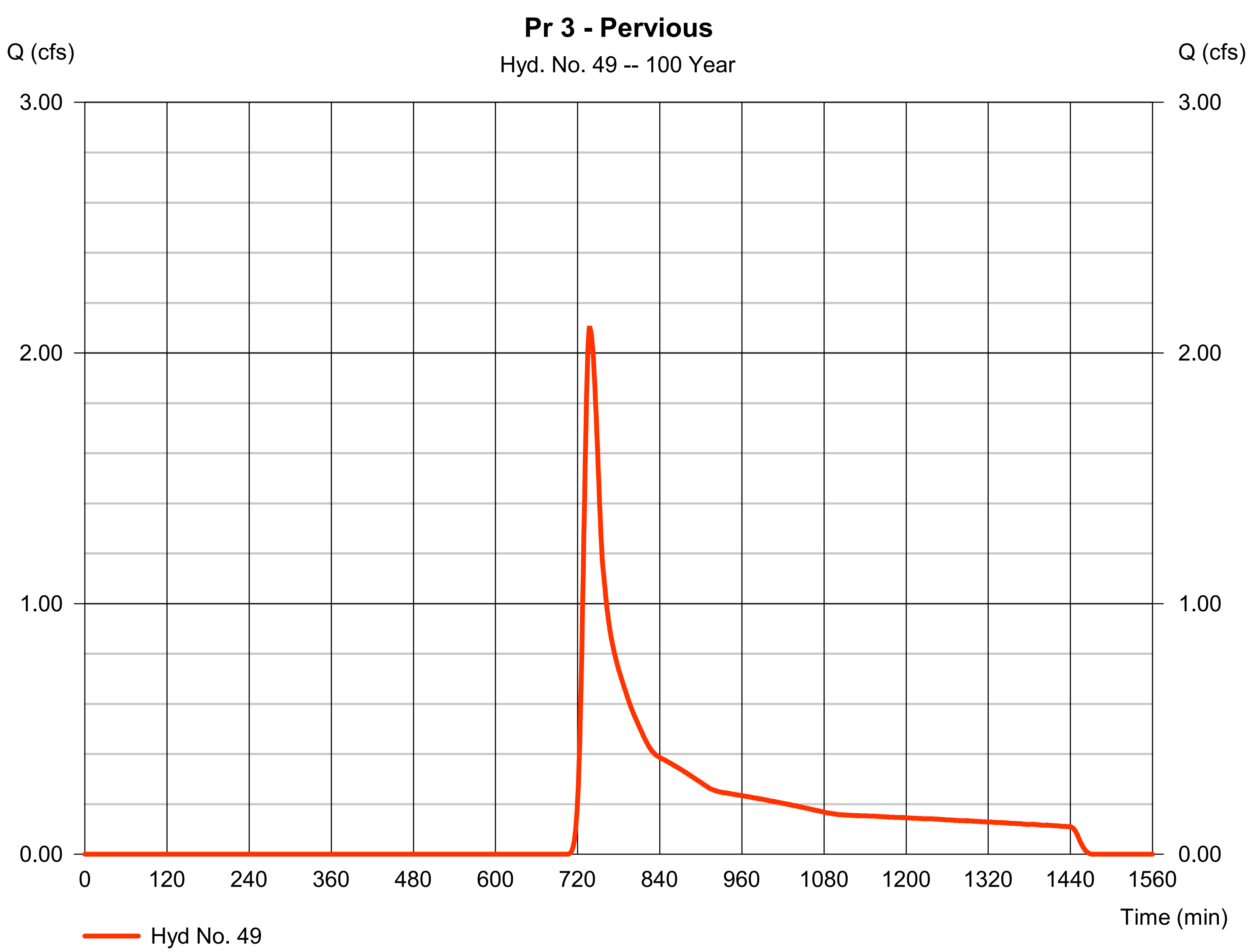


Hydrograph Report

Hyd. No. 49

Pr 3 - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.100 cfs
Storm frequency	= 100 yrs	Time to peak	= 737 min
Time interval	= 1 min	Hyd. volume	= 13,044 cuft
Drainage area	= 2.510 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.00 min
Total precip.	= 8.63 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storr	Shape factor	= 484



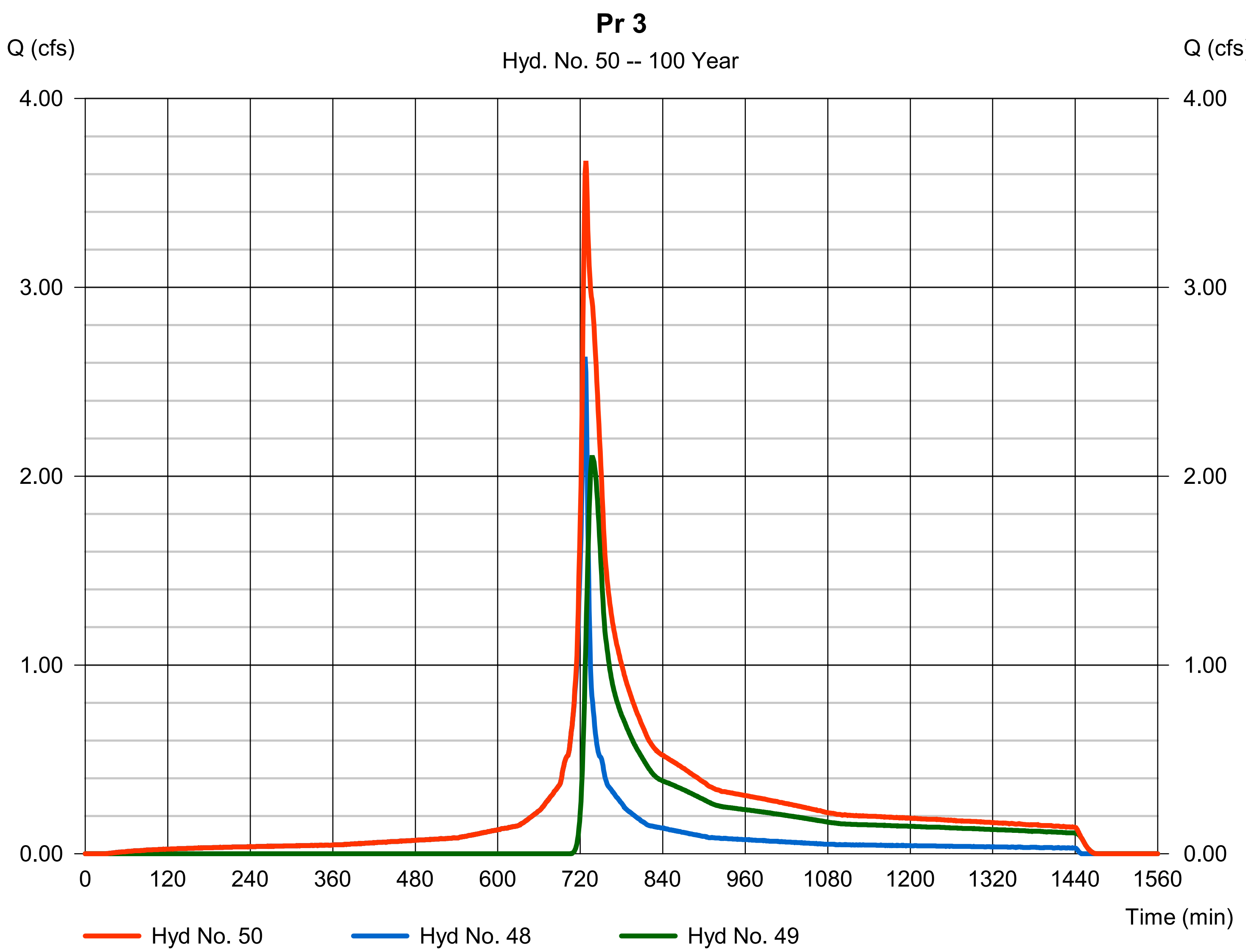
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 50

Pr 3

Hydrograph type	= Combine	Peak discharge	= 3.670 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 1 min	Hyd. volume	= 22,781 cuft
Inflow hyds.	= 48, 49	Contrib. drain. area	= 2.820 ac



APPENDIX B

WATER QUALITY CALCULATIONS

Hydraflow Table of Contents

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	------	1.504	-------	-------	-------	-------	-------	-------	-------	Pr 2B - Imp
2	SCS Runoff	------	0.000	-------	-------	-------	-------	-------	-------	-------	Pr 2B - Pervious
3	Combine	1, 2	1.504	-------	-------	-------	-------	-------	-------	-------	Pr 2B
4	Reservoir	3	0.184	-------	-------	-------	-------	-------	-------	-------	Bioretention Basin 1
6	SCS Runoff	------	20.18	-------	-------	-------	-------	-------	-------	-------	Pr 2C - Imp
7	SCS Runoff	------	0.000	-------	-------	-------	-------	-------	-------	-------	Pr 2C - Pervious
8	Combine	6, 7	20.18	-------	-------	-------	-------	-------	-------	-------	Pr 2C
9	Reservoir	8	2.283	-------	-------	-------	-------	-------	-------	-------	Bioretention Basin 2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	1.504	1	66	1,941	------	------	------	Pr 2B - Imp
2	SCS Runoff	0.000	1	n/a	0	------	------	------	Pr 2B - Pervious
3	Combine	1.504	1	66	1,941	1, 2	------	------	Pr 2B
4	Reservoir	0.184	1	94	1,933	3	37.60	1,400	Bioretention Basin 1
6	SCS Runoff	20.18	1	65	25,173	------	------	------	Pr 2C - Imp
7	SCS Runoff	0.000	1	n/a	0	------	------	------	Pr 2C - Pervious
8	Combine	20.18	1	65	25,173	6, 7	------	------	Pr 2C
9	Reservoir	2.283	1	94	25,165	8	37.45	18,382	Bioretention Basin 2

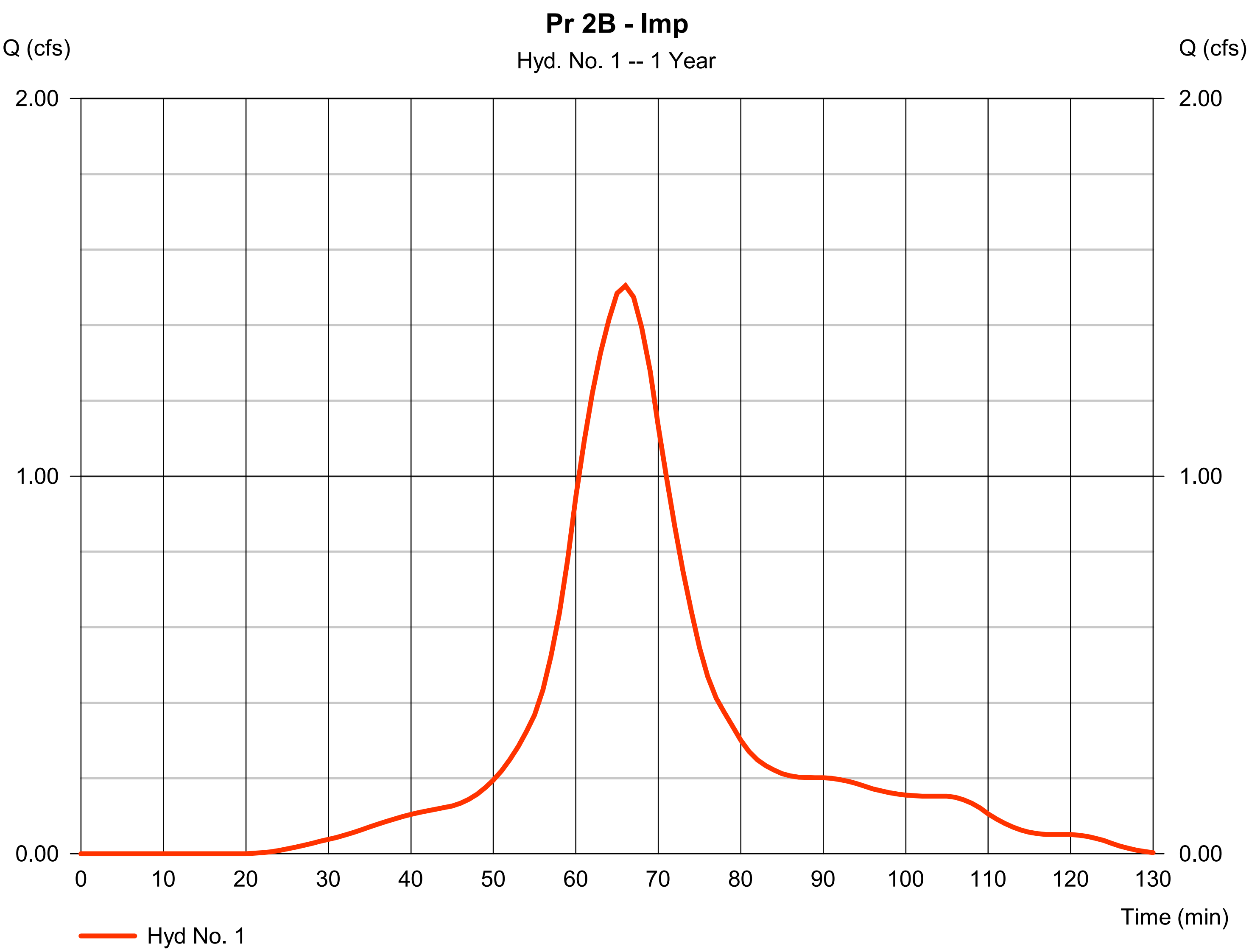
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Wednesday, 03 / 25 / 2020

Hyd. No. 1

Pr 2B - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 1.504 cfs
Storm frequency	= 1 yrs	Time to peak	= 66 min
Time interval	= 1 min	Hyd. volume	= 1,941 cuft
Drainage area	= 0.530 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



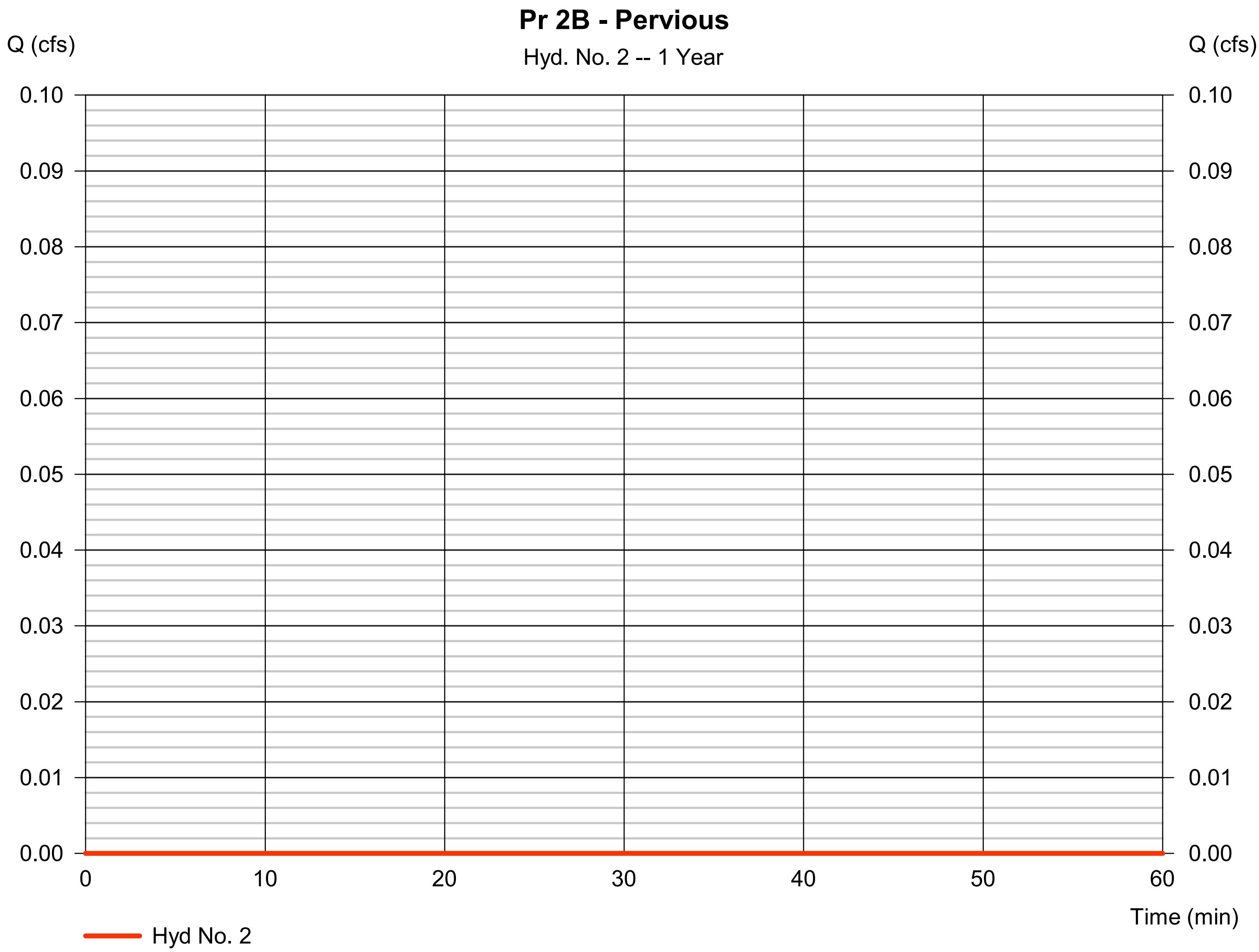
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 2

Pr 2B - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 0.280 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484

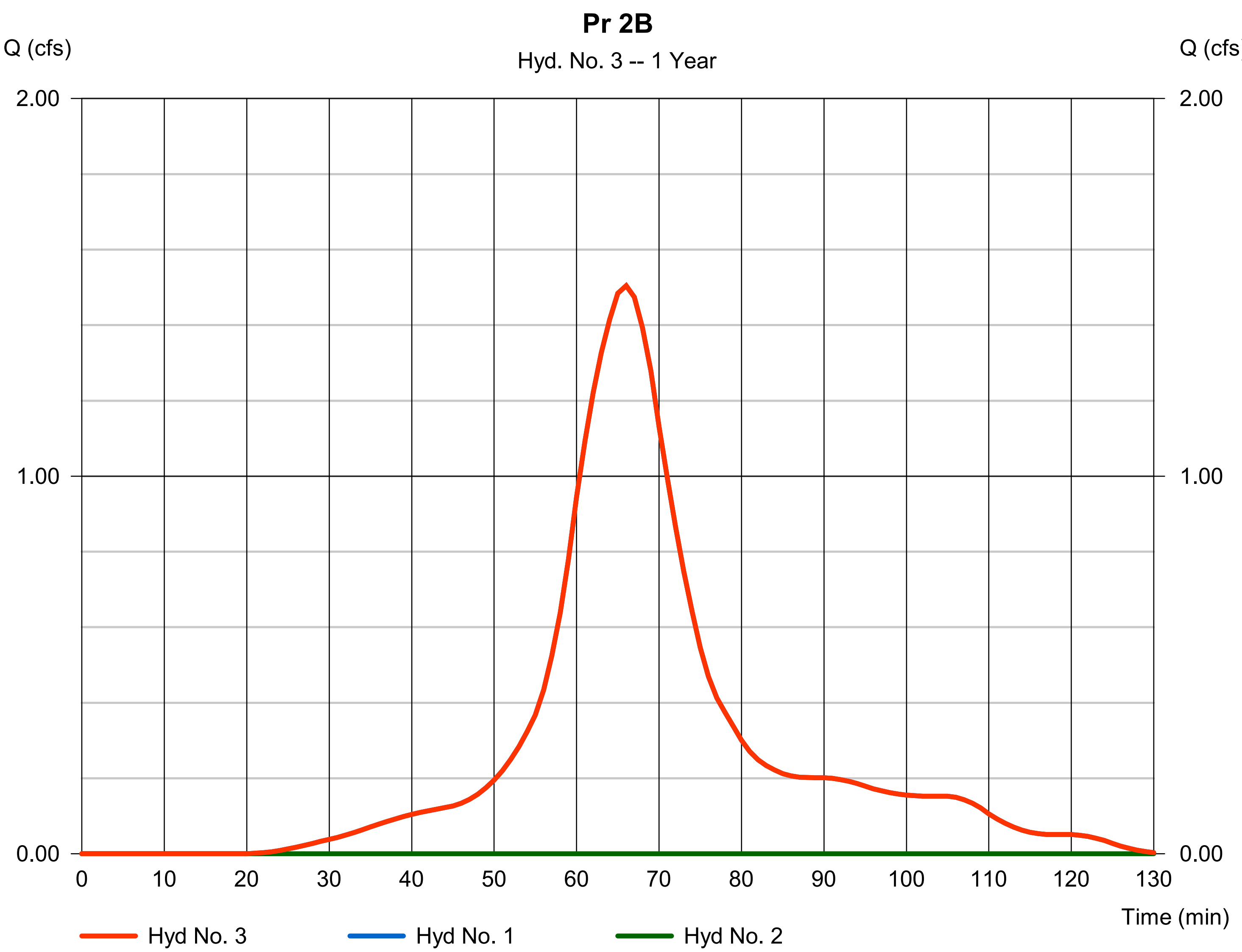


Hydrograph Report

Hyd. No. 3

Pr 2B

Hydrograph type	= Combine	Peak discharge	= 1.504 cfs
Storm frequency	= 1 yrs	Time to peak	= 66 min
Time interval	= 1 min	Hyd. volume	= 1,941 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 0.810 ac



Hydrograph Report

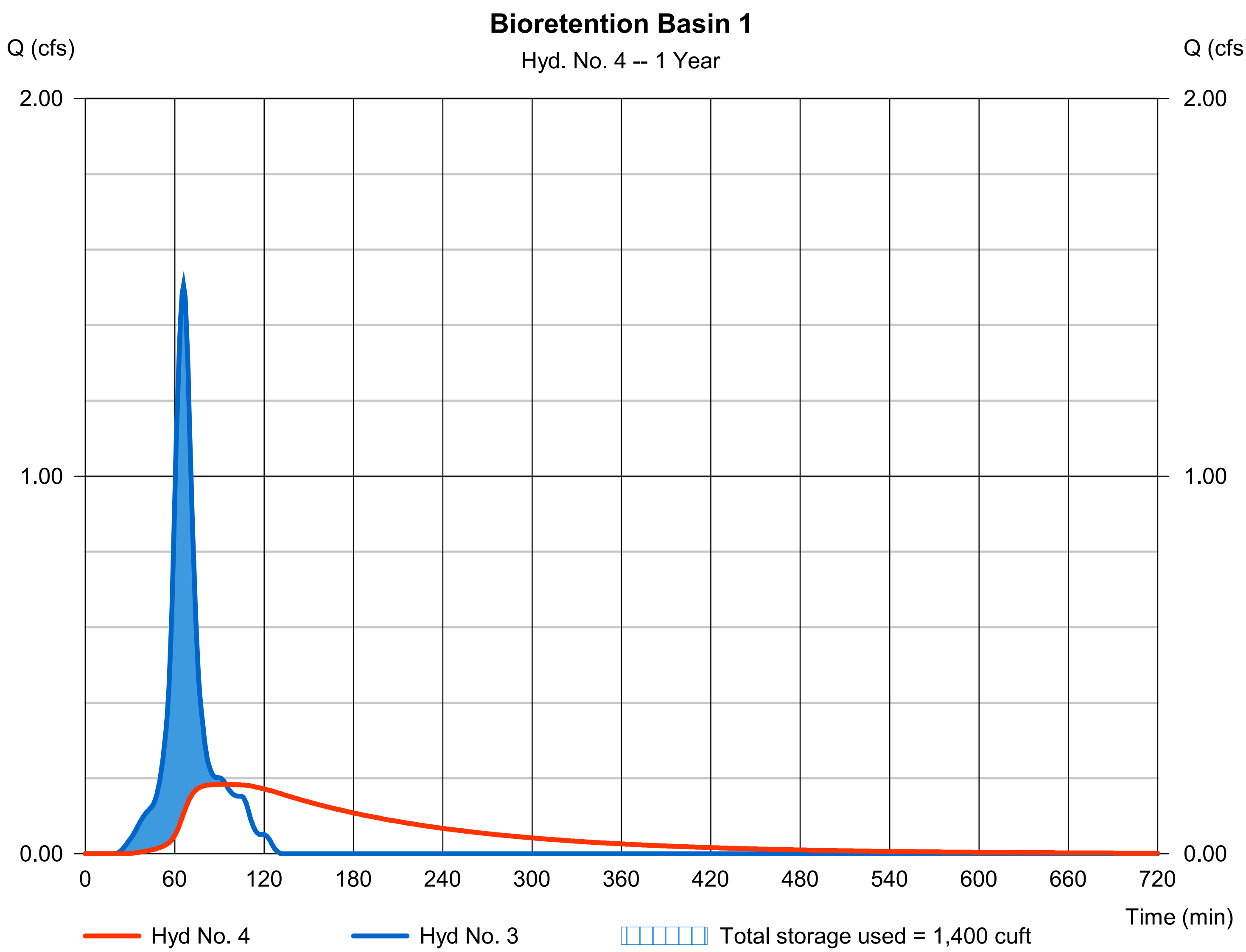
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 4

Bioretention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 0.184 cfs
Storm frequency	= 1 yrs	Time to peak	= 94 min
Time interval	= 1 min	Hyd. volume	= 1,933 cuft
Inflow hyd. No.	= 3 - Pr 2B	Max. Elevation	= 37.60 ft
Reservoir name	= Bioretention Basin 1	Max. Storage	= 1,400 cuft

Storage Indication method used. Outflow includes exfiltration.



Pond Report

Pond No. 1 - Bioretention Basin 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 37.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	37.00	2,034	0	0
1.00	38.00	2,656	2,338	2,338
2.00	39.00	3,328	2,985	5,323
3.00	40.00	4,071	3,693	9,016

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	Inactive	Inactive
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 33.19	0.00	0.00	0.00
Length (ft)	= 51.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.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)	= 16.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 37.69	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 5.000 (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	37.00	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	234	37.10	25.35 ic	---	---	---	0.00	---	---	---	0.031	---	0.031
0.20	468	37.20	25.35 ic	---	---	---	0.00	---	---	---	0.061	---	0.061
0.30	701	37.30	25.35 ic	---	---	---	0.00	---	---	---	0.092	---	0.092
0.40	935	37.40	25.35 ic	---	---	---	0.00	---	---	---	0.123	---	0.123
0.50	1,169	37.50	25.35 ic	---	---	---	0.00	---	---	---	0.154	---	0.154
0.60	1,403	37.60	25.35 ic	---	---	---	0.00	---	---	---	0.184	---	0.184
0.70	1,637	37.70	25.35 ic	---	---	---	0.05	---	---	---	0.215	---	0.268
0.80	1,870	37.80	25.35 ic	---	---	---	1.94	---	---	---	0.246	---	2.190
0.90	2,104	37.90	25.35 ic	---	---	---	5.13	---	---	---	0.277	---	5.404
1.00	2,338	38.00	25.35 ic	---	---	---	9.20	---	---	---	0.307	---	9.504
1.10	2,636	38.10	25.35 ic	---	---	---	13.99	---	---	---	0.315	---	14.30
1.20	2,935	38.20	25.35 ic	---	---	---	19.41	---	---	---	0.323	---	19.73
1.30	3,233	38.30	25.38 ic	---	---	---	25.38	---	---	---	0.331	---	25.71
1.40	3,532	38.40	29.26 ic	---	---	---	29.26 s	---	---	---	0.339	---	29.60
1.50	3,831	38.50	30.23 ic	---	---	---	30.23 s	---	---	---	0.346	---	30.58
1.60	4,129	38.60	30.93 ic	---	---	---	30.93 s	---	---	---	0.354	---	31.28
1.70	4,428	38.70	31.50 ic	---	---	---	31.50 s	---	---	---	0.362	---	31.86
1.80	4,726	38.80	31.99 ic	---	---	---	31.99 s	---	---	---	0.370	---	32.36
1.90	5,025	38.90	32.45 ic	---	---	---	32.44 s	---	---	---	0.377	---	32.82
2.00	5,323	39.00	32.87 ic	---	---	---	32.86 s	---	---	---	0.385	---	33.24
2.10	5,693	39.10	33.26 ic	---	---	---	33.25 s	---	---	---	0.394	---	33.65
2.20	6,062	39.20	33.64 ic	---	---	---	33.63 s	---	---	---	0.402	---	34.03
2.30	6,431	39.30	34.01 ic	---	---	---	34.00 s	---	---	---	0.411	---	34.41
2.40	6,800	39.40	34.37 ic	---	---	---	34.35 s	---	---	---	0.420	---	34.77
2.50	7,170	39.50	34.72 ic	---	---	---	34.71 s	---	---	---	0.428	---	35.13
2.60	7,539	39.60	35.07 ic	---	---	---	35.03 s	---	---	---	0.437	---	35.47
2.70	7,908	39.70	35.40 ic	---	---	---	35.38 s	---	---	---	0.445	---	35.83
2.80	8,278	39.80	35.74 ic	---	---	---	35.70 s	---	---	---	0.454	---	36.16
2.90	8,647	39.90	36.06 ic	---	---	---	36.06 s	---	---	---	0.463	---	36.52
3.00	9,016	40.00	36.39 ic	---	---	---	36.36 s	---	---	---	0.471	---	36.83

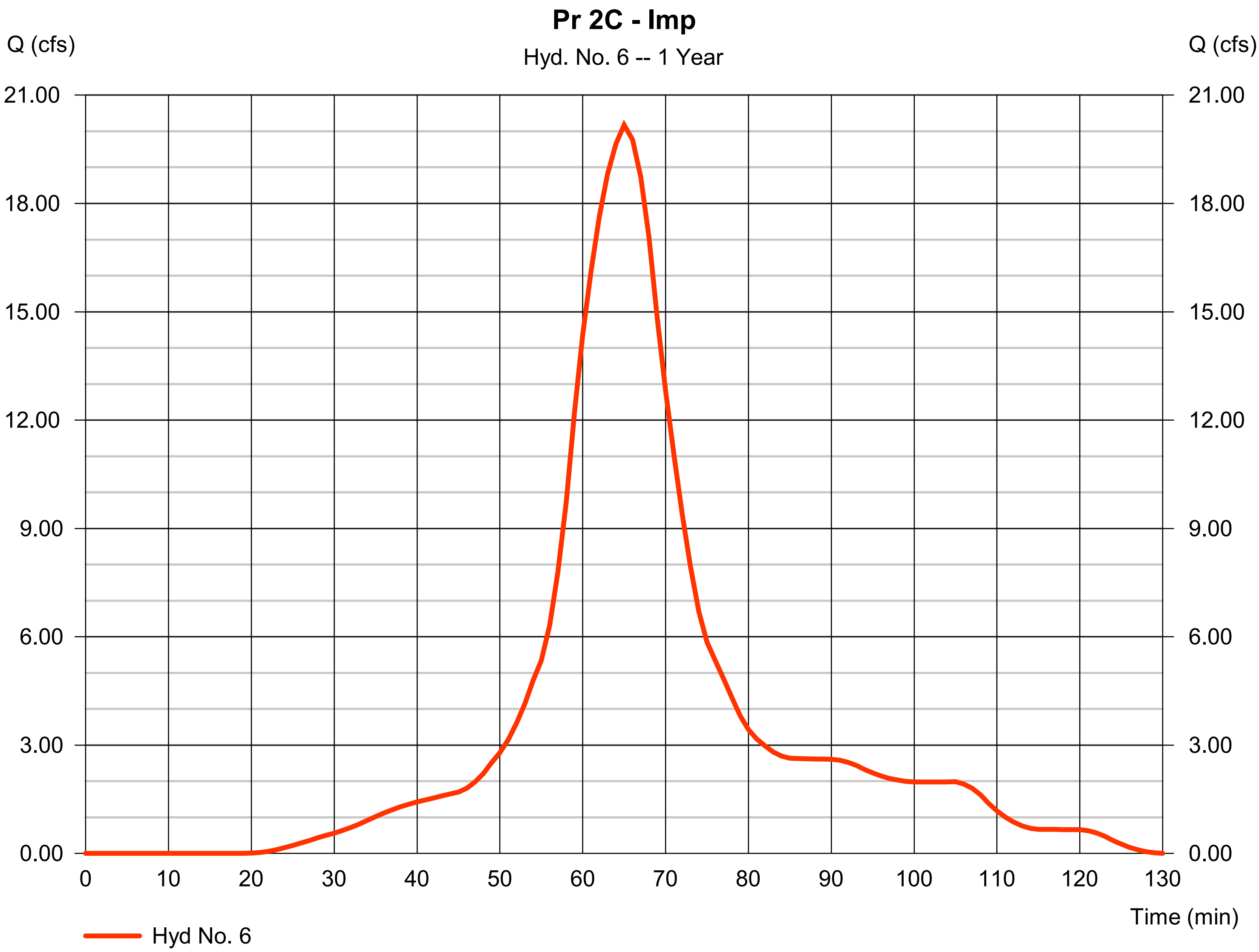
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 6

Pr 2C - Imp

Hydrograph type	= SCS Runoff	Peak discharge	= 20.18 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 25,173 cuft
Drainage area	= 6.500 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



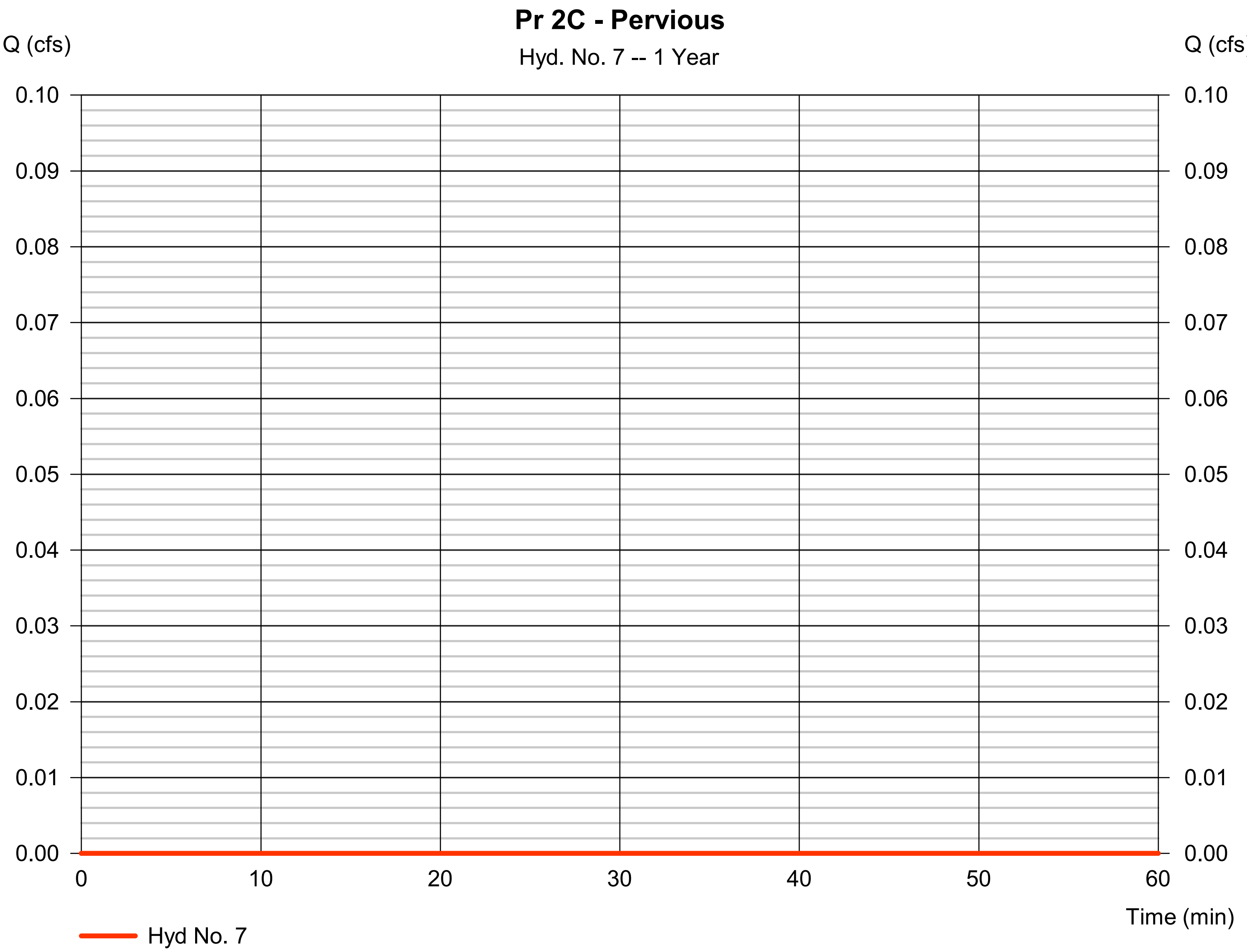
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 7

Pr 2C - Pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Drainage area	= 4.120 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.00 min
Total precip.	= 1.25 in	Distribution	= Custom
Storm duration	= \\langan.com\data\PAR\data4\100594113\Project Data_Discipline\Site Civil\Storm	Shape factor	= 484



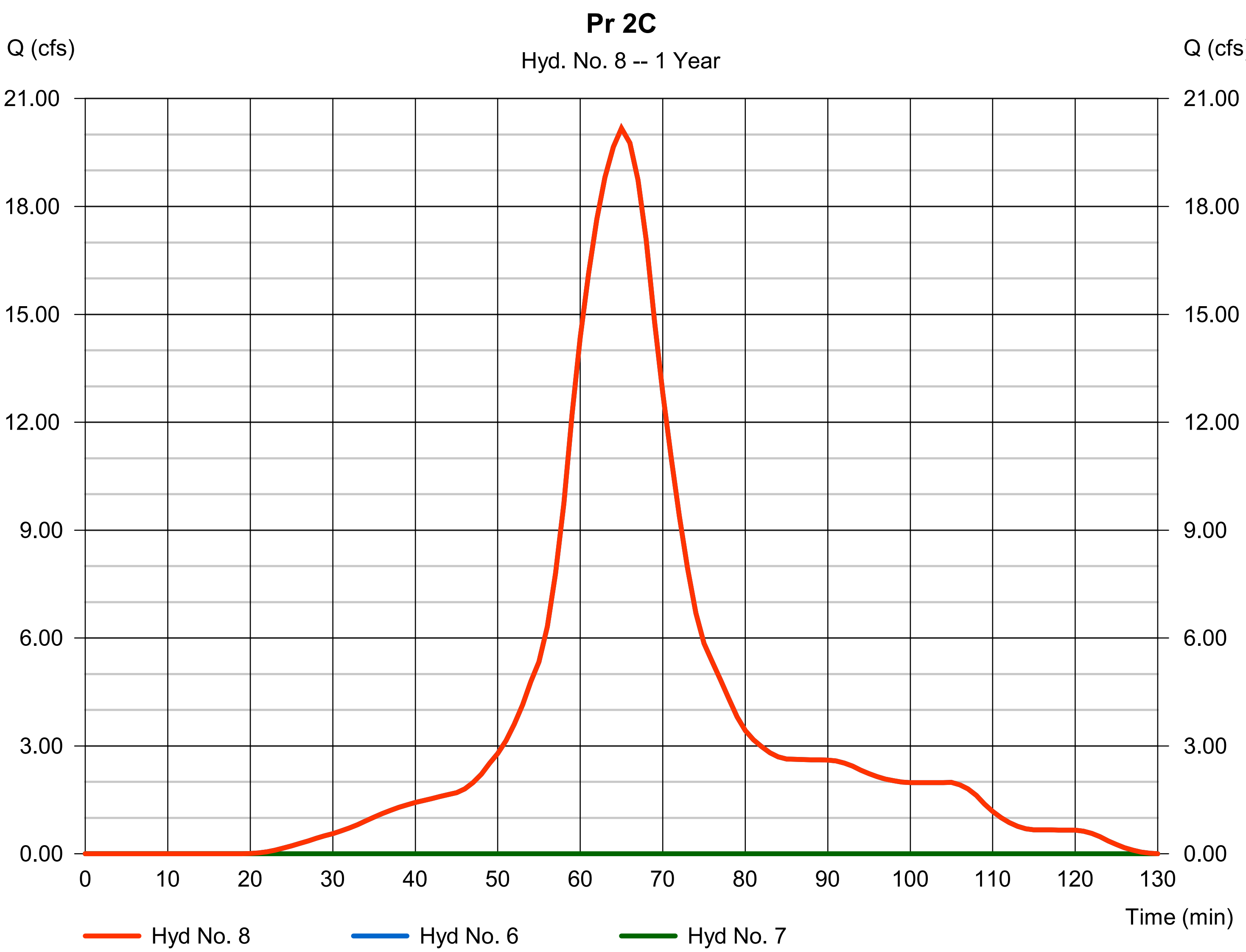
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 8

Pr 2C

Hydrograph type	= Combine	Peak discharge	= 20.18 cfs
Storm frequency	= 1 yrs	Time to peak	= 65 min
Time interval	= 1 min	Hyd. volume	= 25,173 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 10.620 ac



Hydrograph Report

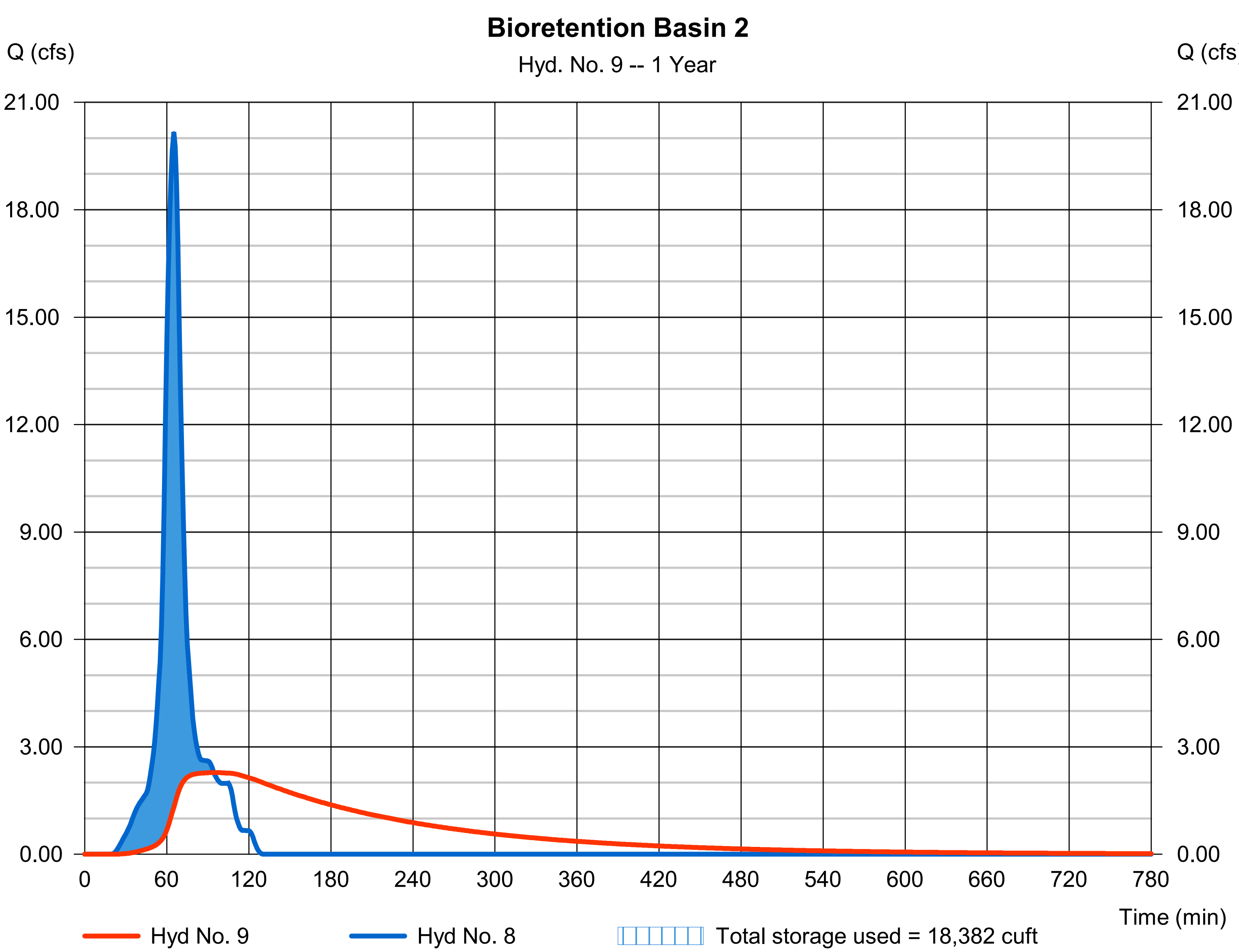
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Hyd. No. 9

Bioretention Basin 2

Hydrograph type	= Reservoir	Peak discharge	= 2.283 cfs
Storm frequency	= 1 yrs	Time to peak	= 94 min
Time interval	= 1 min	Hyd. volume	= 25,165 cuft
Inflow hyd. No.	= 8 - Pr 2C	Max. Elevation	= 37.45 ft
Reservoir name	= Bioretention Basin 2	Max. Storage	= 18,382 cuft

Storage Indication method used. Outflow includes exfiltration.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Wednesday, 03 / 25 / 2020

Pond No. 2 - Bioretention Basin 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 36.70 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	36.70	22,838	0	0
1.00	37.70	26,386	24,588	24,588
2.00	38.70	30,028	28,185	52,773
3.00	39.70	33,753	31,869	84,642

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	Inactive	Inactive	Inactive
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 31.68	0.00	0.00	0.00
Length (ft)	= 51.00	0.00	0.00	0.00
Slope (%)	= 1.34	0.00	0.00	n/a
N-Value	= .012	.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)	= 16.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 37.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 5.000 (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	36.70	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	2,459	36.80	45.89 ic	---	---	---	0.00	---	---	---	0.305	---	0.305
0.20	4,918	36.90	45.89 ic	---	---	---	0.00	---	---	---	0.611	---	0.611
0.30	7,376	37.00	45.89 ic	---	---	---	0.00	---	---	---	0.916	---	0.916
0.40	9,835	37.10	45.89 ic	---	---	---	0.00	---	---	---	1.222	---	1.222
0.50	12,294	37.20	45.89 ic	---	---	---	0.00	---	---	---	1.527	---	1.527
0.60	14,753	37.30	45.89 ic	---	---	---	0.00	---	---	---	1.832	---	1.832
0.70	17,212	37.40	45.89 ic	---	---	---	0.00	---	---	---	2.138	---	2.138
0.80	19,671	37.50	45.89 ic	---	---	---	0.00	---	---	---	2.443	---	2.443
0.90	22,129	37.60	45.89 ic	---	---	---	1.68	---	---	---	2.749	---	4.433
1.00	24,588	37.70	45.89 ic	---	---	---	4.77	---	---	---	3.054	---	7.819
1.10	27,407	37.80	45.89 ic	---	---	---	8.75	---	---	---	3.096	---	11.85
1.20	30,225	37.90	45.89 ic	---	---	---	13.48	---	---	---	3.138	---	16.62
1.30	33,044	38.00	45.89 ic	---	---	---	18.84	---	---	---	3.180	---	22.02
1.40	35,862	38.10	45.89 ic	---	---	---	24.76	---	---	---	3.223	---	27.98
1.50	38,680	38.20	45.89 ic	---	---	---	31.20	---	---	---	3.265	---	34.47
1.60	41,499	38.30	45.89 ic	---	---	---	38.12	---	---	---	3.307	---	41.43
1.70	44,317	38.40	45.89 ic	---	---	---	45.49	---	---	---	3.349	---	48.84
1.80	47,136	38.50	51.55 ic	---	---	---	51.55 s	---	---	---	3.391	---	54.94
1.90	49,954	38.60	53.24 ic	---	---	---	53.24 s	---	---	---	3.433	---	56.67
2.00	52,773	38.70	54.44 ic	---	---	---	54.44 s	---	---	---	3.475	---	57.91
2.10	55,960	38.80	55.41 ic	---	---	---	55.40 s	---	---	---	3.519	---	58.92
2.20	59,147	38.90	56.24 ic	---	---	---	56.24 s	---	---	---	3.562	---	59.80
2.30	62,334	39.00	56.98 ic	---	---	---	56.97 s	---	---	---	3.605	---	60.58
2.40	65,520	39.10	57.66 ic	---	---	---	57.65 s	---	---	---	3.648	---	61.30
2.50	68,707	39.20	58.29 ic	---	---	---	58.28 s	---	---	---	3.691	---	61.97
2.60	71,894	39.30	58.89 ic	---	---	---	58.88 s	---	---	---	3.734	---	62.61
2.70	75,081	39.40	59.45 ic	---	---	---	59.44 s	---	---	---	3.777	---	63.22
2.80	78,268	39.50	60.00 ic	---	---	---	59.99 s	---	---	---	3.820	---	63.81
2.90	81,455	39.60	60.53 ic	---	---	---	60.52 s	---	---	---	3.863	---	64.38
3.00	84,642	39.70	61.04 ic	---	---	---	61.03 s	---	---	---	3.907	---	64.94

APPENDIX C

GROUNDWATER RECHARGE DOCUMENTATION

James P. Mack LLC
Licensed Site Remediation Professional
25 Starview Drive
Hillsborough, New Jersey 08844
908 448 6566
jamespmack@jpm-llc.com

January 27, 2016

Carl J. Coker
Remediation Leader
Environmental Remediation and Restoration
The Dow Chemical Company
310 George Patterson Blvd., Suite 100
Bristol, PA 19007

RE: **Use of Groundwater Recharge as Stormwater Management Method**
Union Carbide Corp Chemicals and Plastics
Union Carbide Corporation
171 River Road
Piscataway, New Jersey 08854
Program Interest #: 008332
Piscataway Township Block 3502; Lots 1.05, 6.04 & 6.05
Middlesex Borough Block 353; Lots 1.01 & 1.02
Middlesex Borough Block 356; Lot 1

Dear Mr. Coker

I am the Licensed Site Remediation Professional of Record for the above noted facility. The subject site is currently undergoing remediation to address residual soil and groundwater contamination associated with past use of the site as a manufacturing facility. The remaining soil contamination is being managed by limiting direct contact human exposure by capping the impacted soil with existing and proposed buildings, paved areas and other fill material. Remaining groundwater impacts at the site is being addressed through a groundwater pump and treatment system. Storm water infiltration associated with future site development may result in mobilization and leaching of the soil impacts, which consist of concentrations of volatile, and semi volatile compounds and metals above the New Jersey Department of Environmental Protection Direct Contact and Impact to Groundwater Soil Remediation Standards and potential impacts to areas undergoing groundwater remediation. Under these circumstances, stormwater

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25 Starview Drive
Hillsborough, New Jersey 08844
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infiltration or other water discharge that would result in additional hydraulic loading above impacted soil is not recommended at the referenced site.

Thank you. If you have any additional question please contact me at 908 448 6566 or jamespmack@jpm-llc.com.

Sincerely

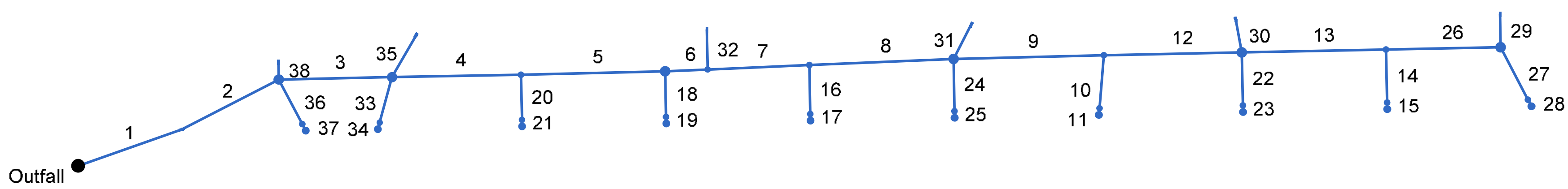
James P Mack

James Mack

APPENDIX D

STORM SEWER CONVEYANCE CALCULATIONS

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 100.stm	Number of lines: 38	Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	82.189	-19.519	Comb	0.00	0.07	0.76	6.0	29.83	1.44	31.01	36	Cir	0.012	0.50	40.94	CB-101 TO FES-101
2	1	81.991	-7.810	MH	0.00	0.00	0.00	6.0	31.01	1.23	32.02	30	Cir	0.012	1.00	41.18	MH-101 TO CB-101
3	2	84.849	26.181	MH	0.00	0.00	0.00	6.0	32.02	1.23	33.06	30	Cir	0.012	1.00	46.36	MH-102 TO MH-101
4	3	96.572	0.000	MH	0.00	0.00	0.00	6.0	33.06	1.23	34.25	30	Cir	0.012	1.00	47.73	INSERTA TEE-101 TO
5	4	108.001	-0.218	MH	0.00	0.00	0.00	6.0	34.25	1.23	35.58	30	Cir	0.012	1.00	47.44	MH-103 TO INSERTA
6	5	31.833	-1.085	MH	0.00	0.00	0.00	6.0	35.58	1.23	35.97	24	Cir	0.012	1.00	47.43	INSERTA TEE-102 TO
7	6	76.195	0.000	MH	0.00	0.00	0.00	6.0	35.97	1.23	36.91	24	Cir	0.012	1.00	47.80	INSERTA TEE-103 TO
8	7	108.028	0.000	MH	0.00	0.00	0.00	6.0	36.91	1.22	38.23	24	Cir	0.012	1.00	47.61	MH-104 TO INSERTA
9	8	112.634	0.990	MH	0.00	0.00	0.00	6.0	38.23	1.23	39.62	24	Cir	0.012	1.00	47.97	INSERTA TEE-104 TO
10	9	40.134	96.200	MH	0.00	0.00	0.00	6.0	44.90	1.00	45.30	12	Cir	0.012	0.15	48.91	CO-107 TO INSERTA
11	10	5.027	0.000	MH	0.00	0.47	0.99	6.0	45.30	0.99	45.35	12	Cir	0.012	1.00	49.00	RL-107 TO CO-107
12	9	103.368	0.313	MH	0.00	0.00	0.00	6.0	39.62	1.23	40.89	24	Cir	0.012	1.00	47.60	MH-105 TO INSERTA
13	12	108.000	0.000	MH	0.00	0.00	0.00	6.0	40.89	1.23	42.22	18	Cir	0.012	1.00	47.82	INSERTA TEE-105 TO
14	13	39.923	90.000	MH	0.00	0.00	0.00	6.0	44.90	1.00	45.30	12	Cir	0.012	0.15	48.75	CO-109 TO INSERTA
15	14	5.000	0.000	MH	0.00	0.47	0.99	6.0	45.30	1.00	45.35	12	Cir	0.012	1.00	48.83	RL-109 TO CO-109
16	7	36.852	91.303	MH	0.00	0.00	0.00	6.0	44.70	1.00	45.07	12	Cir	0.012	0.15	48.92	CO-105 TO INSERTA
17	16	5.000	0.000	MH	0.00	0.47	0.99	6.0	45.07	1.00	45.12	12	Cir	0.012	1.00	49.00	RL-105 TO CO-105
18	5	34.396	90.218	MH	0.00	0.00	0.00	6.0	44.70	0.99	45.04	12	Cir	0.012	0.15	48.78	CO-104 TO MH-103
19	18	5.000	0.000	MH	0.00	0.47	0.99	6.0	45.04	1.00	45.09	12	Cir	0.012	1.00	48.86	RL-104 TO CO-104
20	4	33.986	90.000	MH	0.00	0.00	0.00	6.0	44.70	1.00	45.04	12	Cir	0.012	0.15	48.71	CO-103 TO INSERTA
21	20	5.000	0.000	MH	0.00	0.47	0.99	6.0	45.04	1.00	45.09	12	Cir	0.012	1.00	48.79	RL-103 TO CO-103
22	12	39.923	90.000	MH	0.00	0.00	0.00	6.0	44.50	1.00	44.90	12	Cir	0.012	0.15	48.85	CO-108 TO MH-105
23	22	5.000	0.000	MH	0.00	0.47	0.99	6.0	44.90	1.00	44.95	12	Cir	0.012	1.00	48.92	RL-108 TO CO-108

Project File: Storm 100.stm | Number of lines: 38 | Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	8	39.307	91.303	MH	0.00	0.00	0.00	6.0	44.50	0.99	44.89	12	Cir	0.012	0.15	48.85	CO-106 TO MH-104
25	24	5.000	0.000	MH	0.00	0.47	0.99	6.0	44.89	1.00	44.94	12	Cir	0.012	1.00	48.93	RL-106 TO CO-106
26	13	85.824	0.000	MH	0.00	0.00	0.00	6.0	42.22	1.22	43.27	18	Cir	0.012	1.00	47.60	MH-106 TO INSERTA
27	26	44.522	63.727	MH	0.00	0.00	0.00	6.0	43.27	1.24	43.82	12	Cir	0.012	0.15	48.33	CO-110 TO MH-106
28	27	5.576	0.000	MH	0.00	0.41	0.99	6.0	43.82	1.26	43.89	12	Cir	0.012	1.00	48.40	RL-110 TO CO-110
29	26	25.077	-90.000	Comb	0.00	0.27	0.94	6.0	43.78	1.00	44.03	12	Cir	0.012	1.00	47.04	CB-107 TO MH-106
30	12	25.423	-99.454	Comb	0.00	0.33	0.99	6.0	43.59	1.02	43.85	12	Cir	0.012	1.00	47.04	CB-106 TO MH-105
31	8	29.176	-60.414	Comb	0.00	0.30	0.99	6.0	43.58	0.99	43.87	12	Cir	0.012	1.00	47.04	CB-105 TO MH-104
32	6	29.880	-88.697	Comb	0.00	0.29	0.99	6.0	43.53	1.47	43.97	12	Cir	0.012	1.00	46.74	CB-104 TO INSERTA
33	3	35.416	106.338	MH	0.00	0.00	0.00	6.0	42.50	0.99	42.85	12	Cir	0.012	0.15	48.18	CO-102 TO MH-102
34	33	5.210	0.000	MH	0.00	0.35	0.99	6.0	42.85	1.15	42.91	12	Cir	0.012	1.00	48.58	RL-102 TO CO-102
35	3	36.150	-59.087	Comb	0.00	0.18	0.99	6.0	42.10	1.77	42.74	12	Cir	0.012	1.00	46.68	CB-103 TO MH-102
36	2	37.969	89.701	MH	0.00	0.00	0.00	6.0	37.98	1.00	38.36	12	Cir	0.012	0.15	47.86	CO-101 TO MH-101
37	36	5.586	0.000	MH	0.00	0.30	0.99	6.0	38.36	1.07	38.42	12	Cir	0.012	1.00	48.92	RL-101 TO CO-101
38	2	13.003	-63.818	Comb	0.00	0.09	0.85	6.0	37.57	0.38	37.62	12	Cir	0.012	1.00	40.97	CB-102 TO MH-101

Project File: Storm 100.stm	Number of lines: 38	Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	CB-101 TO FES-101	42.03	36	Cir	82.189	29.83	31.01	1.436	32.08	33.12	n/a	33.12 j	End	Combination
2	MH-101 TO CB-101	41.84	30	Cir	81.991	31.01	32.02	1.232	33.12	34.19	1.33	34.19	1	Manhole
3	MH-102 TO MH-101	39.32	30	Cir	84.849	32.02	33.06	1.226	34.19	35.17	n/a	35.17 j	2	Manhole
4	INSERTA TEE-101 TO MH-102	35.70	30	Cir	96.572	33.06	34.25	1.232	35.17	36.28	n/a	36.28 j	3	Manhole
5	MH-103 TO INSERTA TEE-101	32.51	30	Cir	108.001	34.25	35.58	1.231	36.28	37.52	n/a	37.52 j	4	Manhole
6	INSERTA TEE-102 TO MH-103	29.10	24	Cir	31.833	35.58	35.97	1.225	37.52	37.82	1.43	37.82	5	Manhole
7	INSERTA TEE-103 TO INSERTA TE	27.08	24	Cir	76.195	35.97	36.91	1.234	37.82	38.72	n/a	38.72 j	6	Manhole
8	MH-104 TO INSERTA TEE-103	23.77	24	Cir	108.028	36.91	38.23	1.222	38.72	39.96	n/a	39.96 j	7	Manhole
9	INSERTA TEE-104 TO MH-104	18.19	24	Cir	112.634	38.23	39.62	1.234	39.96	41.15	n/a	41.15 j	8	Manhole
10	CO-107 TO INSERTA TEE-104	3.69	12	Cir	40.134	44.90	45.30	0.997	45.69	46.12	0.07	46.12	9	Manhole
11	RL-107 TO CO-107	3.70	12	Cir	5.027	45.30	45.35	0.995	46.12	46.17	n/a	46.17	10	Manhole
12	MH-105 TO INSERTA TEE-104	14.78	24	Cir	103.368	39.62	40.89	1.229	41.15	42.27	n/a	42.27 j	9	Manhole
13	INSERTA TEE-105 TO MH-105	8.77	18	Cir	108.000	40.89	42.22	1.231	42.27	43.37	n/a	43.37 j	12	Manhole
14	CO-109 TO INSERTA TEE-105	3.69	12	Cir	39.923	44.90	45.30	1.002	45.68	46.12	0.07	46.12	13	Manhole
15	RL-109 TO CO-109	3.70	12	Cir	5.000	45.30	45.35	1.000	46.12	46.17	n/a	46.17	14	Manhole
16	CO-105 TO INSERTA TEE-103	3.69	12	Cir	36.852	44.70	45.07	1.004	45.48	45.89	0.07	45.89	7	Manhole
17	RL-105 TO CO-105	3.70	12	Cir	5.000	45.07	45.12	1.000	45.89	45.94	n/a	45.94	16	Manhole
18	CO-104 TO MH-103	3.69	12	Cir	34.396	44.70	45.04	0.988	45.49	45.86	0.07	45.86	5	Manhole
19	RL-104 TO CO-104	3.70	12	Cir	5.000	45.04	45.09	1.000	45.86	45.91	n/a	45.91	18	Manhole
20	CO-103 TO INSERTA TEE-101	3.69	12	Cir	33.986	44.70	45.04	1.000	45.48	45.86	0.07	45.86	4	Manhole
21	RL-103 TO CO-103	3.70	12	Cir	5.000	45.04	45.09	1.000	45.86	45.91	n/a	45.91	20	Manhole
22	CO-108 TO MH-105	3.69	12	Cir	39.923	44.50	44.90	1.002	45.28	45.72	0.07	45.72	12	Manhole
23	RL-108 TO CO-108	3.70	12	Cir	5.000	44.90	44.95	1.000	45.72	45.77	n/a	45.77	22	Manhole
24	CO-106 TO MH-104	3.69	12	Cir	39.307	44.50	44.89	0.992	45.29	45.71	0.07	45.71	8	Manhole

Project File: Storm 100.stm | Number of lines: 38 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	RL-106 TO CO-106	3.70	12	Cir	5.000	44.89	44.94	1.000	45.71	45.76	n/a	45.76	24	Manhole
26	MH-106 TO INSERTA TEE-105	5.21	18	Cir	85.824	42.22	43.27	1.223	43.37	44.15	n/a	44.15 j	13	Manhole
27	CO-110 TO MH-106	3.22	12	Cir	44.522	43.27	43.82	1.235	44.15	44.59	n/a	44.59 j	26	Manhole
28	RL-110 TO CO-110	3.22	12	Cir	5.576	43.82	43.89	1.255	44.59	44.66	n/a	44.66	27	Manhole
29	CB-107 TO MH-106	2.02	12	Cir	25.077	43.78	44.03	0.997	44.29	44.64	0.26	44.64	26	Combination
30	CB-106 TO MH-105	2.60	12	Cir	25.423	43.59	43.85	1.023	44.19	44.54	0.31	44.54	12	Combination
31	CB-105 TO MH-104	2.36	12	Cir	29.176	43.58	43.87	0.994	44.15	44.53	n/a	44.53	8	Combination
32	CB-104 TO INSERTA TEE-102	2.28	12	Cir	29.880	43.53	43.97	1.473	44.02	44.62	0.28	44.62	6	Combination
33	CO-102 TO MH-102	2.75	12	Cir	35.416	42.50	42.85	0.988	43.13	43.56	n/a	43.56	3	Manhole
34	RL-102 TO CO-102	2.75	12	Cir	5.210	42.85	42.91	1.152	43.56	43.62	0.33	43.62	33	Manhole
35	CB-103 TO MH-102	1.42	12	Cir	36.150	42.10	42.74	1.770	42.46	43.24	0.20	43.24	3	Combination
36	CO-101 TO MH-101	2.36	12	Cir	37.969	37.98	38.36	1.001	38.54	39.02	0.04	39.02	2	Manhole
37	RL-101 TO CO-101	2.36	12	Cir	5.586	38.36	38.42	1.074	39.02	39.08	n/a	39.08	36	Manhole
38	CB-102 TO MH-101	0.61	12	Cir	13.003	37.57	37.62	0.385	37.91	37.96	0.10	38.06	2	Combination

Project File: Storm 100.stm | Number of lines: 38 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	82.189	0.07	5.88	0.76	0.05	5.78	6.0	8.6	7.3	42.03	86.57	7.65	36	1.44	29.83	31.01	32.08	33.12	29.83	40.94	CB-101 TO FES-1
2	1	81.991	0.00	5.81	0.00	0.00	5.73	6.0	8.4	7.3	41.84	49.31	9.36	30	1.23	31.01	32.02	33.12	34.19	40.94	41.18	MH-101 TO CB-1
3	2	84.849	0.00	5.42	0.00	0.00	5.35	6.0	8.3	7.3	39.32	49.19	8.79	30	1.23	32.02	33.06	34.19	35.17	41.18	46.36	MH-102 TO MH-1
4	3	96.572	0.00	4.89	0.00	0.00	4.83	6.0	8.1	7.4	35.70	49.32	8.22	30	1.23	33.06	34.25	35.17	36.28	46.36	47.73	INSERTA TEE-10
5	4	108.001	0.00	4.42	0.00	0.00	4.36	6.0	7.8	7.5	32.51	49.30	7.79	30	1.23	34.25	35.58	36.28	37.52	47.73	47.44	MH-103 TO INSE
6	5	31.833	0.00	3.95	0.00	0.00	3.90	6.0	7.8	7.5	29.10	27.12	9.47	24	1.23	35.58	35.97	37.52	37.82	47.44	47.43	INSERTA TEE-10
7	6	76.195	0.00	3.66	0.00	0.00	3.61	6.0	7.6	7.5	27.08	27.22	9.00	24	1.23	35.97	36.91	37.82	38.72	47.43	47.80	INSERTA TEE-10
8	7	108.028	0.00	3.19	0.00	0.00	3.14	6.0	7.4	7.6	23.77	27.09	8.10	24	1.22	36.91	38.23	38.72	39.96	47.80	47.61	MH-104 TO INSE
9	8	112.634	0.00	2.42	0.00	0.00	2.38	6.0	7.1	7.6	18.19	27.22	6.67	24	1.23	38.23	39.62	39.96	41.15	47.61	47.97	INSERTA TEE-10
10	9	40.134	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.85	5.48	12	1.00	44.90	45.30	45.69	46.12	47.97	48.91	CO-107 TO INSE
11	10	5.027	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.85	5.37	12	0.99	45.30	45.35	46.12	46.17	48.91	49.00	RL-107 TO CO-10
12	9	103.368	0.00	1.95	0.00	0.00	1.92	6.0	6.8	7.7	14.78	27.16	6.04	24	1.23	39.62	40.89	41.15	42.27	47.97	47.60	MH-105 TO INSE
13	12	108.000	0.00	1.15	0.00	0.00	1.13	6.0	6.5	7.8	8.77	12.62	5.60	18	1.23	40.89	42.22	42.27	43.37	47.60	47.82	INSERTA TEE-10
14	13	39.923	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.86	5.48	12	1.00	44.90	45.30	45.68	46.12	47.82	48.75	CO-109 TO INSE
15	14	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	45.30	45.35	46.12	46.17	48.75	48.83	RL-109 TO CO-10
16	7	36.852	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.87	5.49	12	1.00	44.70	45.07	45.48	45.89	47.80	48.92	CO-105 TO INSE
17	16	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	45.07	45.12	45.89	45.94	48.92	49.00	RL-105 TO CO-10
18	5	34.396	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.84	5.47	12	0.99	44.70	45.04	45.49	45.86	47.44	48.78	CO-104 TO MH-1
19	18	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	45.04	45.09	45.86	45.91	48.78	48.86	RL-104 TO CO-10
20	4	33.986	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.86	5.48	12	1.00	44.70	45.04	45.48	45.86	47.73	48.71	CO-103 TO INSE
21	20	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	45.04	45.09	45.86	45.91	48.71	48.79	RL-103 TO CO-10
22	12	39.923	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.86	5.48	12	1.00	44.50	44.90	45.28	45.72	47.60	48.85	CO-108 TO MH-1

Project File: Storm 100.stm | Number of lines: 38 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

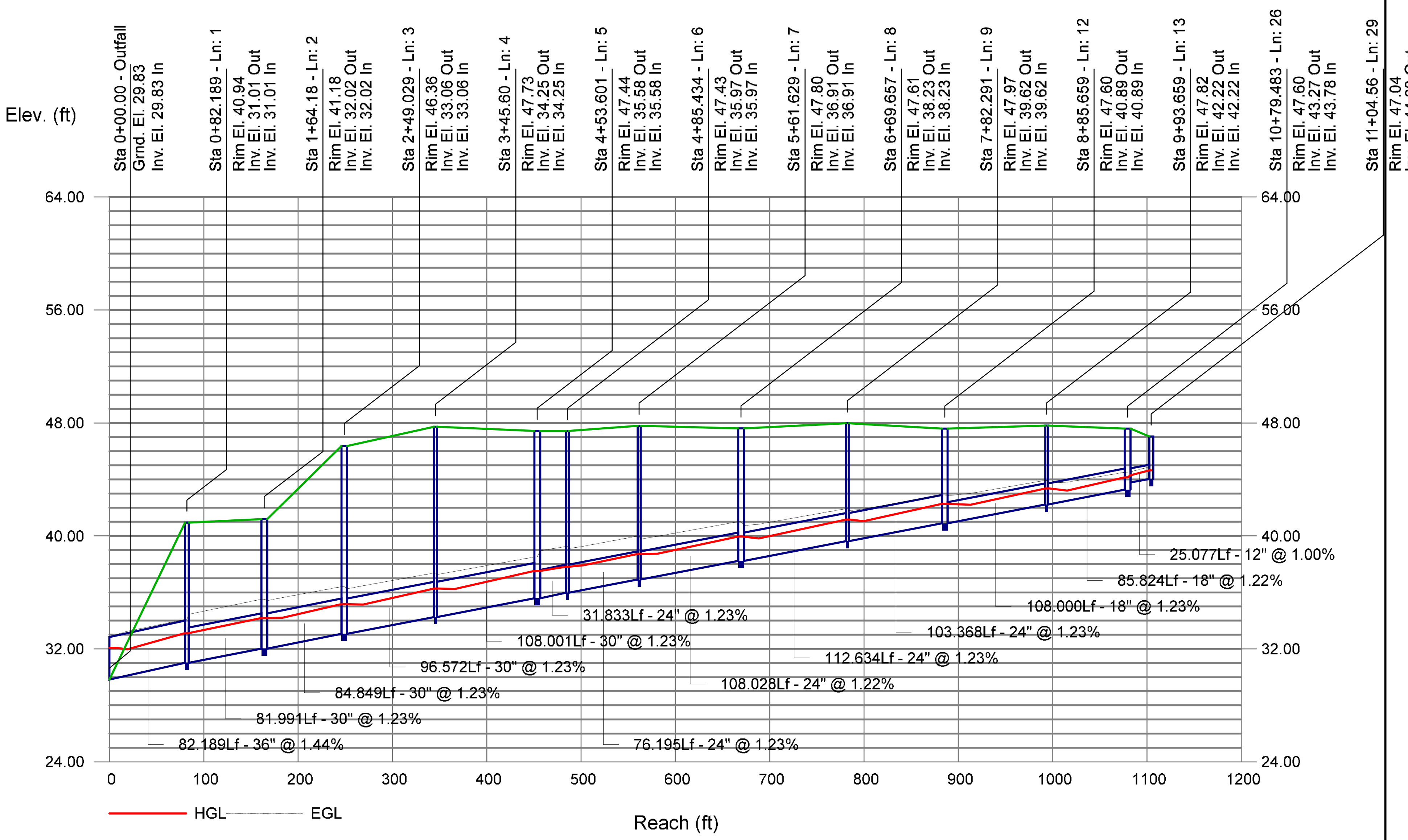
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	22	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	44.90	44.95	45.72	45.77	48.85	48.92	RL-108 TO CO-10
24	8	39.307	0.00	0.47	0.00	0.00	0.47	6.0	6.0	7.9	3.69	3.84	5.47	12	0.99	44.50	44.89	45.29	45.71	47.61	48.85	CO-106 TO MH-1
25	24	5.000	0.47	0.47	0.99	0.47	0.47	6.0	6.0	7.9	3.70	3.86	5.37	12	1.00	44.89	44.94	45.71	45.76	48.85	48.93	RL-106 TO CO-10
26	13	85.824	0.00	0.68	0.00	0.00	0.66	6.0	6.2	7.9	5.21	12.58	4.22	18	1.22	42.22	43.27	43.37	44.15	47.82	47.60	MH-106 TO INSE
27	26	44.522	0.00	0.41	0.00	0.00	0.41	6.0	6.0	7.9	3.22	4.29	4.69	12	1.24	43.27	43.82	44.15	44.59	47.60	48.33	CO-110 TO MH-1
28	27	5.576	0.41	0.41	0.99	0.41	0.41	6.0	6.0	7.9	3.22	4.32	4.98	12	1.26	43.82	43.89	44.59	44.66	48.33	48.40	RL-110 TO CO-11
29	26	25.077	0.27	0.27	0.94	0.25	0.25	6.0	6.0	7.9	2.02	3.85	4.51	12	1.00	43.78	44.03	44.29	44.64	47.60	47.04	CB-107 TO MH-1
30	12	25.423	0.33	0.33	0.99	0.33	0.33	6.0	6.0	7.9	2.60	3.90	4.90	12	1.02	43.59	43.85	44.19	44.54	47.60	47.04	CB-106 TO MH-1
31	8	29.176	0.30	0.30	0.99	0.30	0.30	6.0	6.0	7.9	2.36	3.85	4.73	12	0.99	43.58	43.87	44.15	44.53	47.61	47.04	CB-105 TO MH-1
32	6	29.880	0.29	0.29	0.99	0.29	0.29	6.0	6.0	7.9	2.28	4.68	5.09	12	1.47	43.53	43.97	44.02	44.62	47.43	46.74	CB-104 TO INSE
33	3	35.416	0.00	0.35	0.00	0.00	0.35	6.0	6.0	7.9	2.75	3.84	4.96	12	0.99	42.50	42.85	43.13	43.56	46.36	48.18	CO-102 TO MH-1
34	33	5.210	0.35	0.35	0.99	0.35	0.35	6.0	6.0	7.9	2.75	4.14	4.61	12	1.15	42.85	42.91	43.56	43.62	48.18	48.58	RL-102 TO CO-10
35	3	36.150	0.18	0.18	0.99	0.18	0.18	6.0	6.0	7.9	1.42	5.13	4.58	12	1.77	42.10	42.74	42.46	43.24	46.36	46.68	CB-103 TO MH-1
36	2	37.969	0.00	0.30	0.00	0.00	0.30	6.0	6.0	7.9	2.36	3.86	4.73	12	1.00	37.98	38.36	38.54	39.02	41.18	47.86	CO-101 TO MH-1
37	36	5.586	0.30	0.30	0.99	0.30	0.30	6.0	6.0	7.9	2.36	4.00	4.31	12	1.07	38.36	38.42	39.02	39.08	47.86	48.92	RL-101 TO CO-10
38	2	13.003	0.09	0.09	0.85	0.08	0.08	6.0	6.0	7.9	0.61	2.39	2.55	12	0.38	37.57	37.62	37.91	37.96	41.18	40.97	CB-102 TO MH-1

Project File: Storm 100.stm | Number of lines: 38 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: Storm 100.stm



Storm Sewers

Storm Sewer Profile

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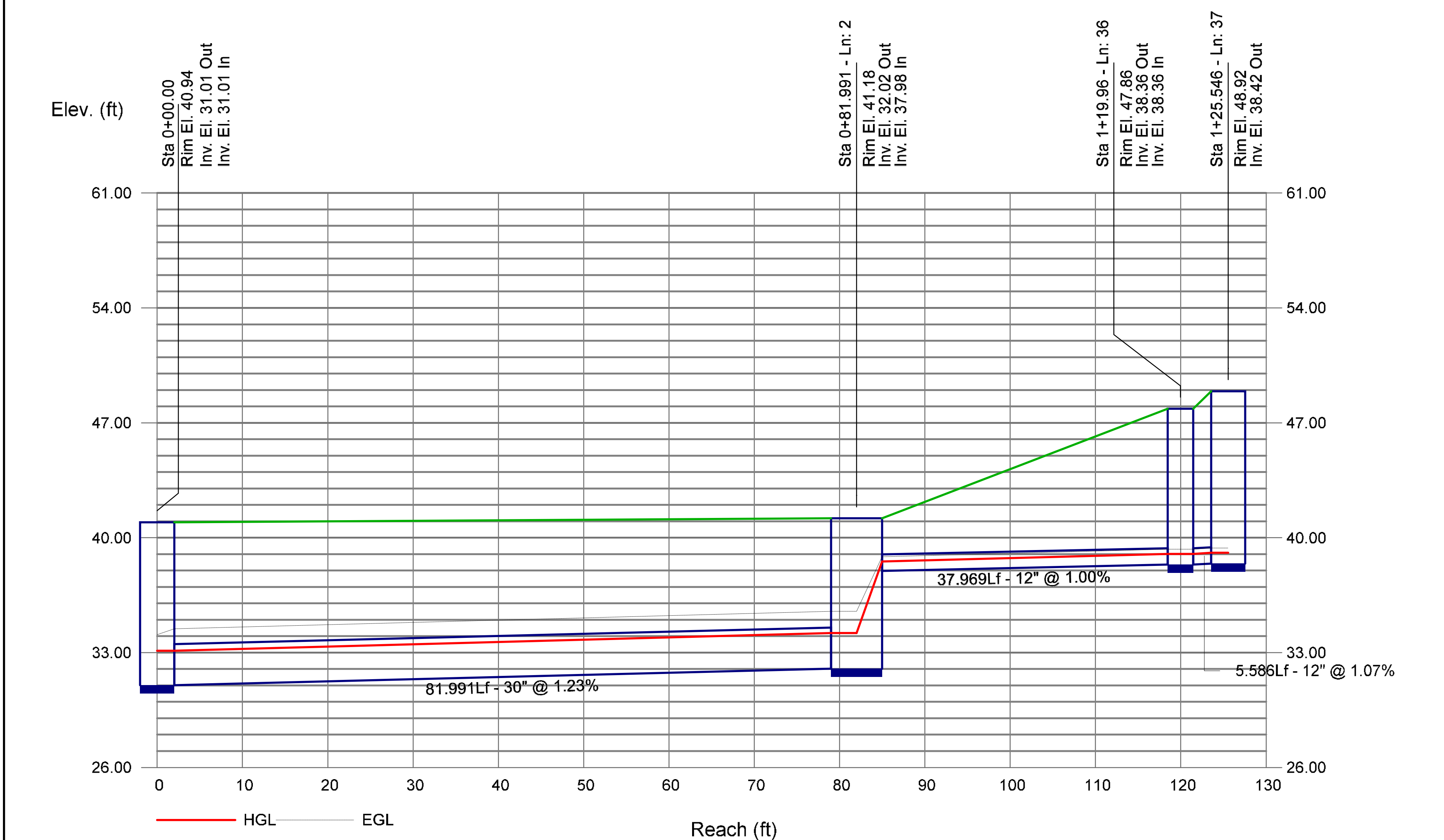

Storm Sewer Profile

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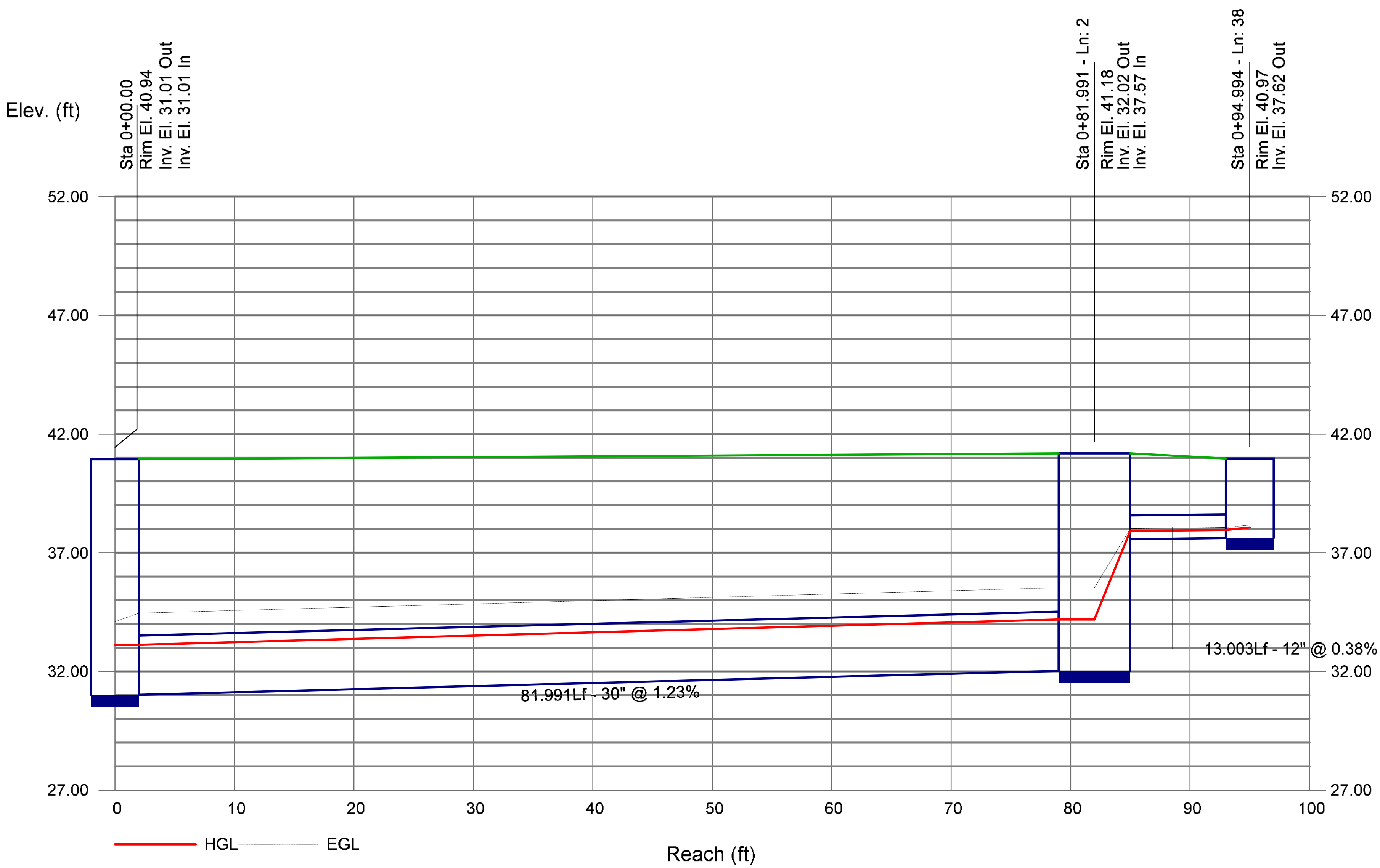

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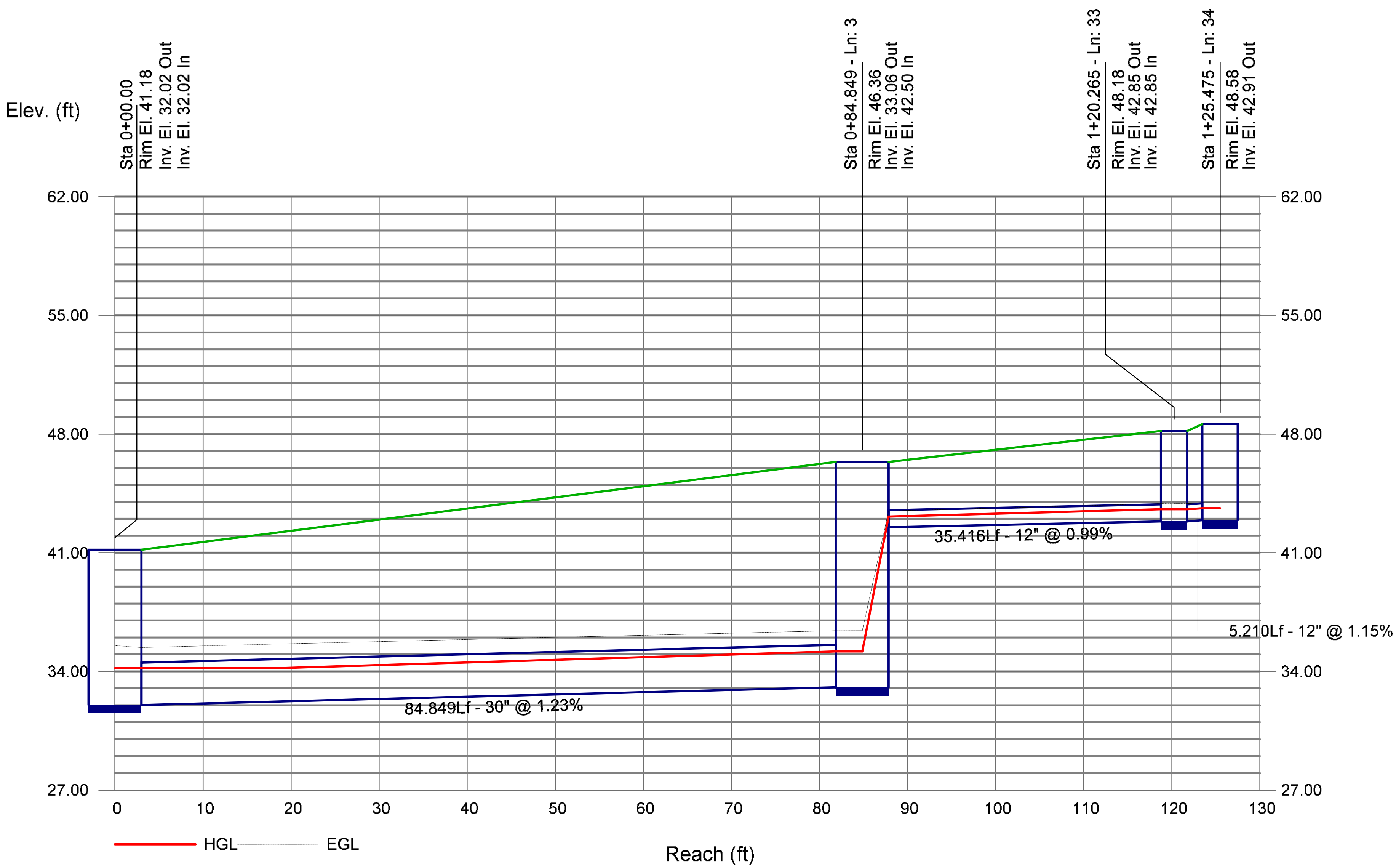

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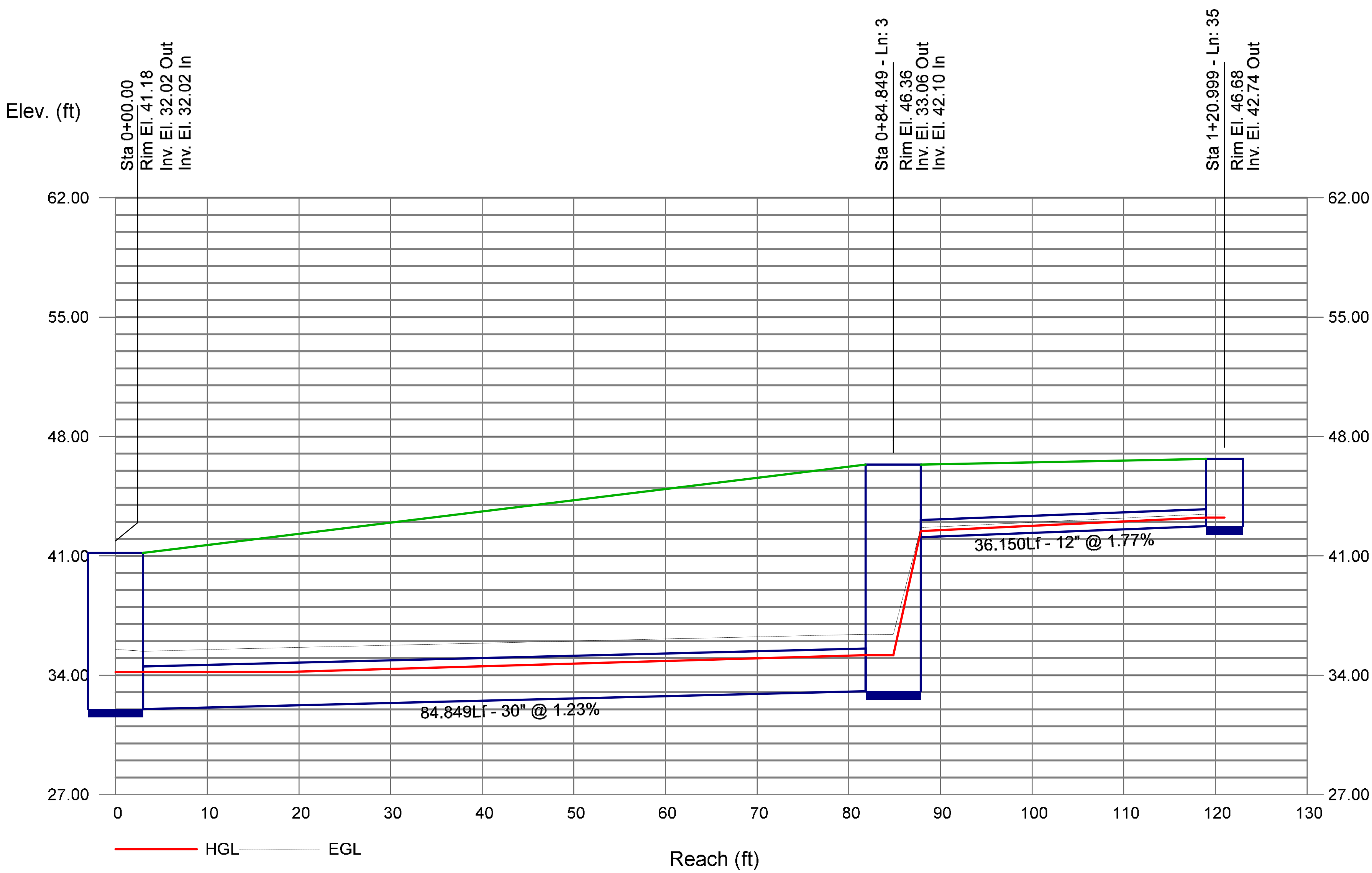

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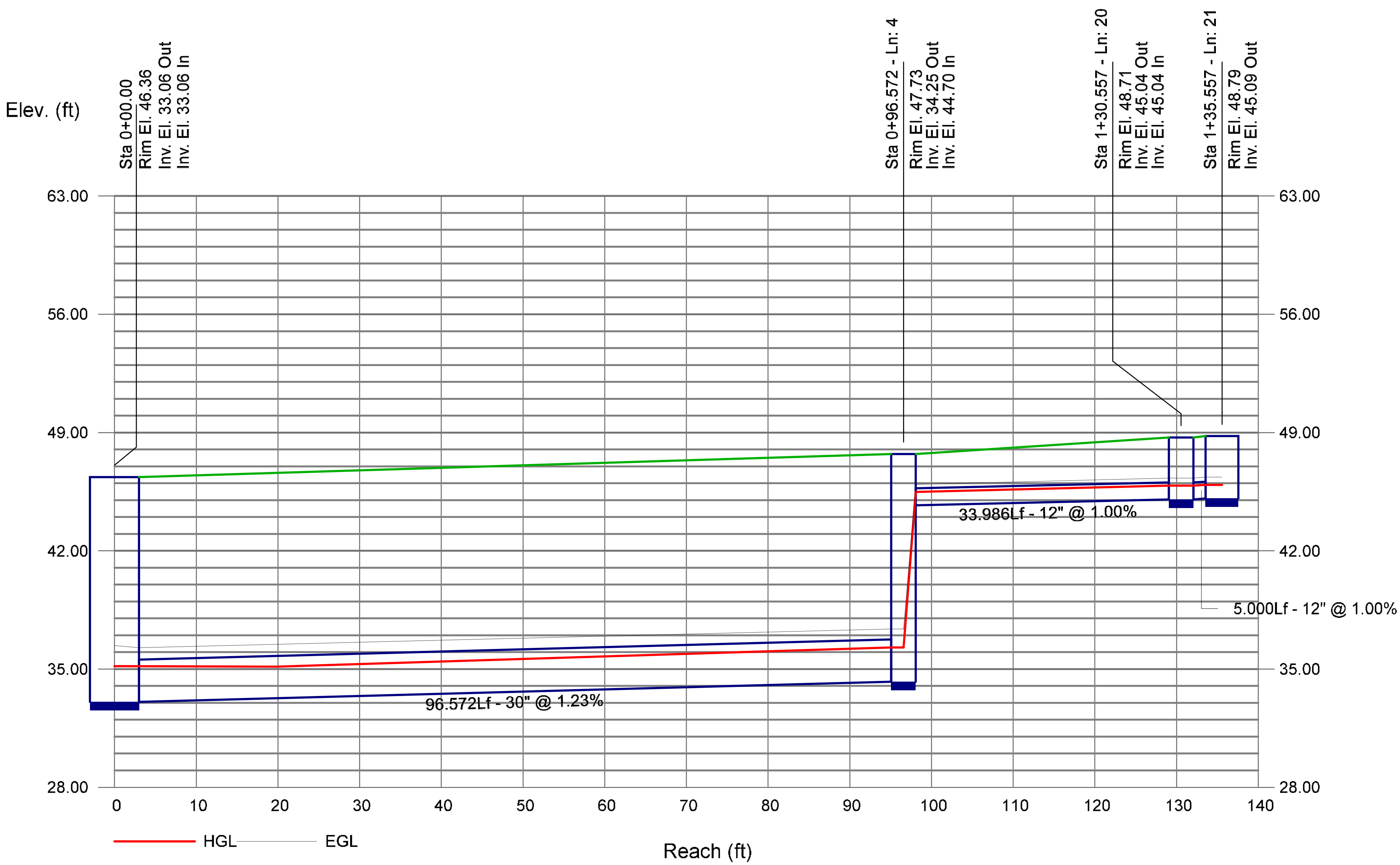

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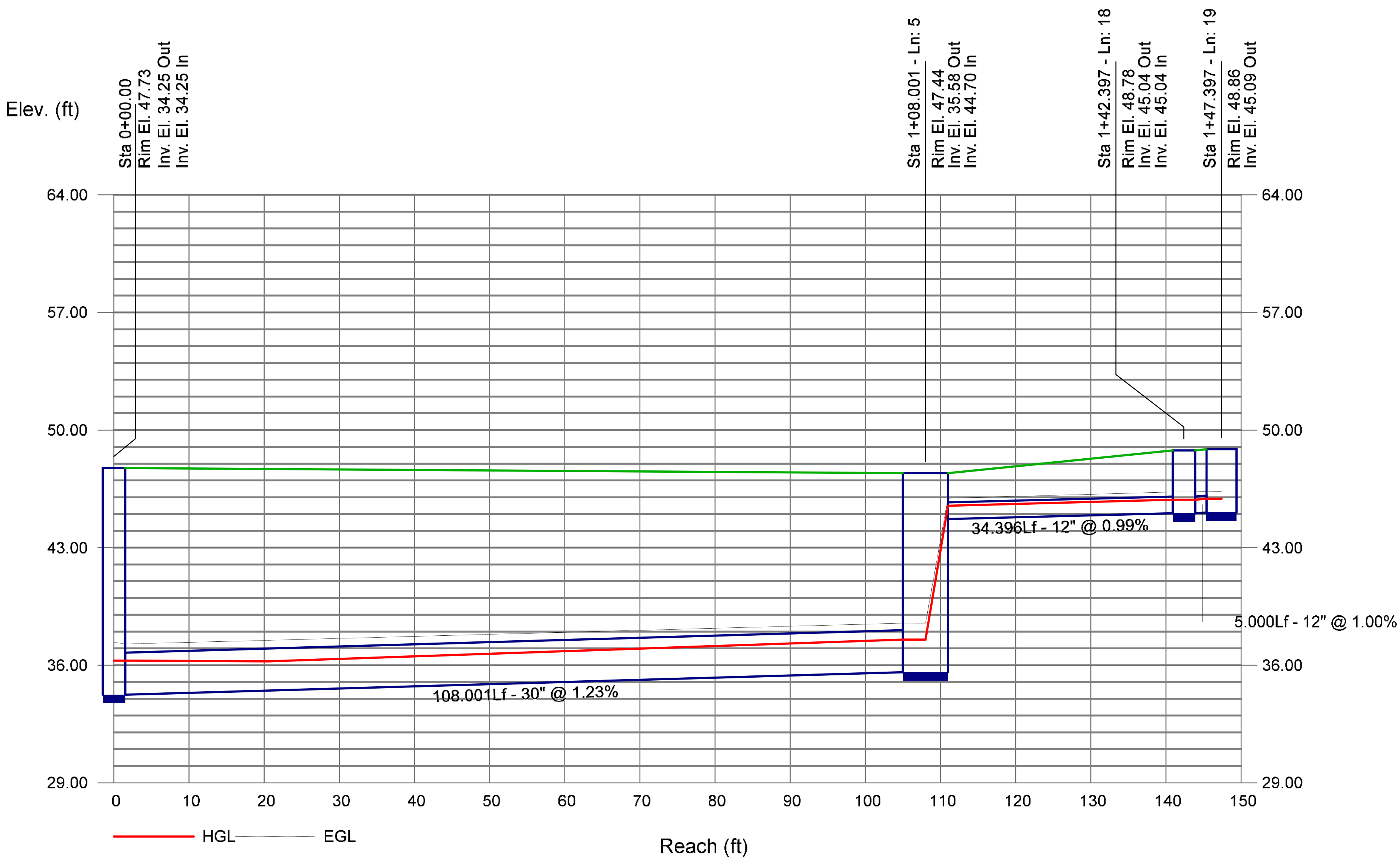

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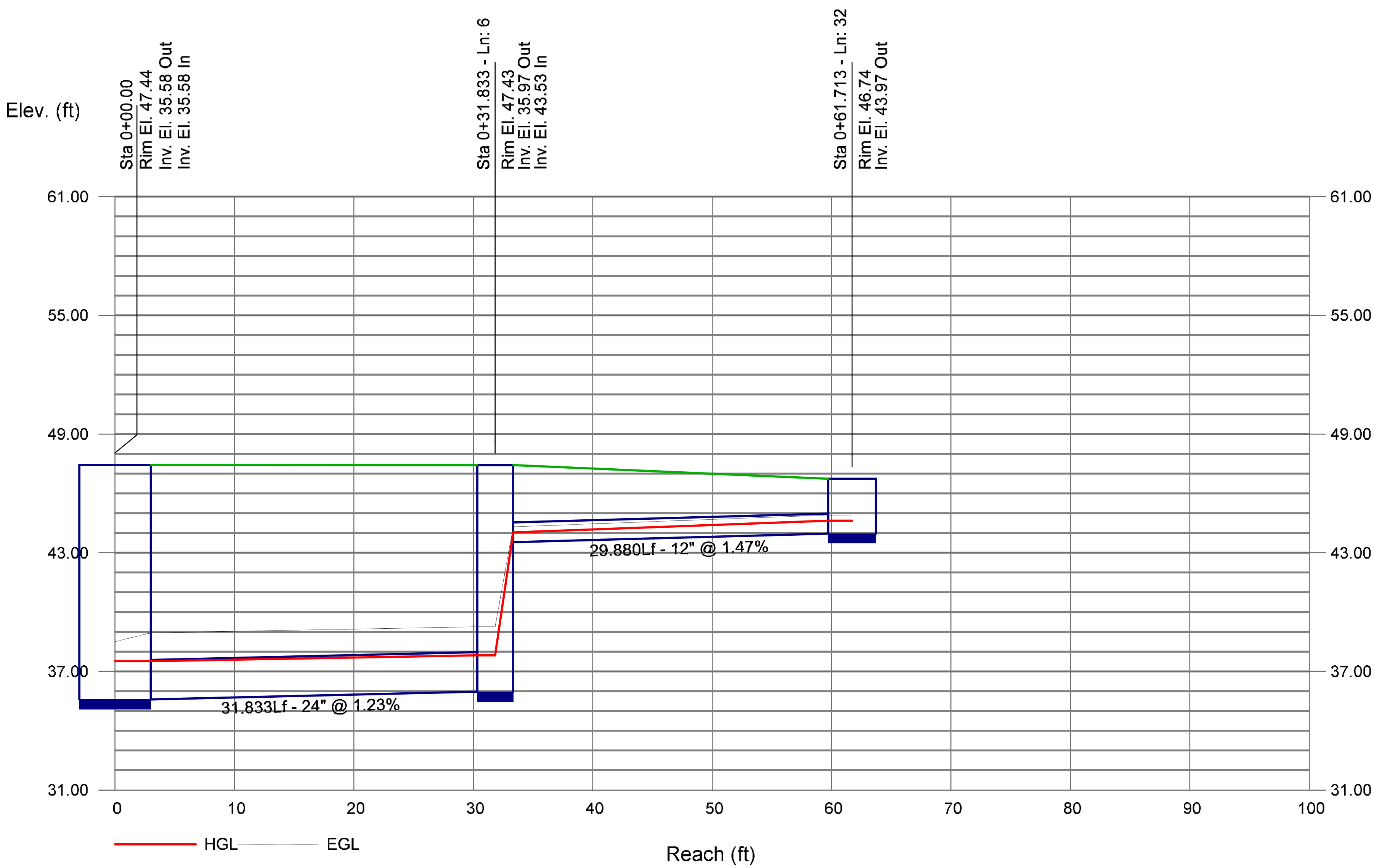

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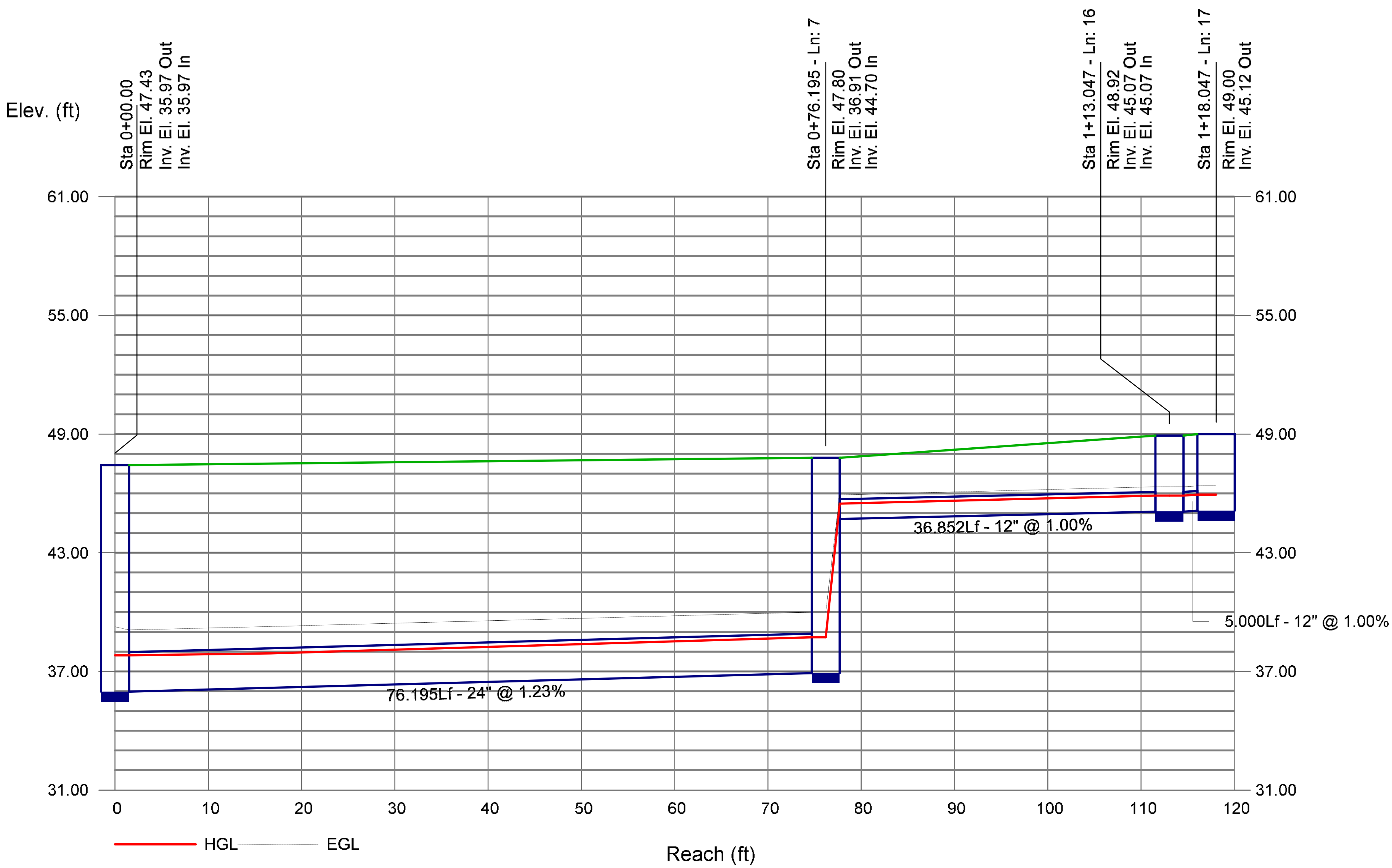

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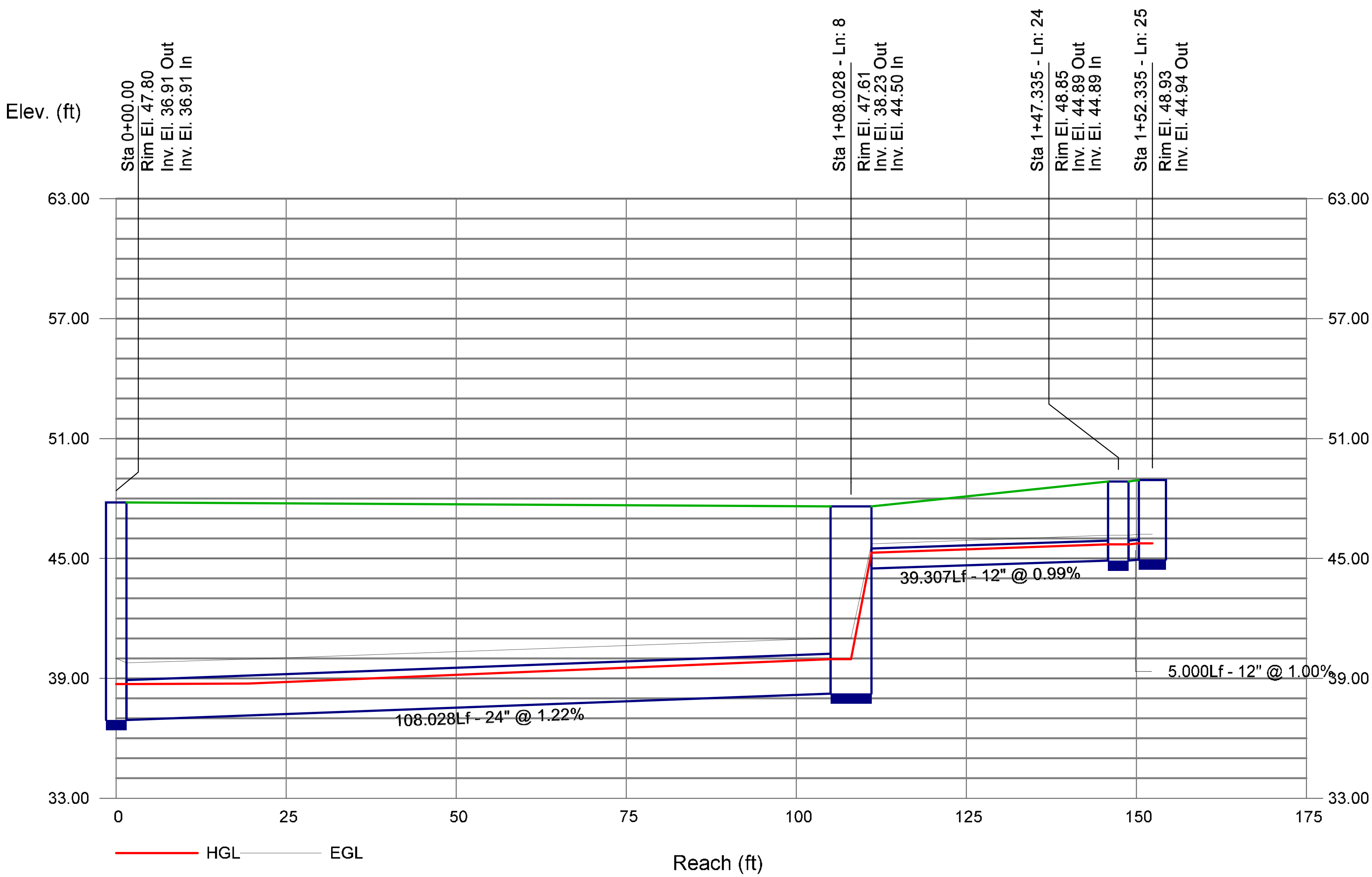

Storm Sewers

Storm Sewer Profile

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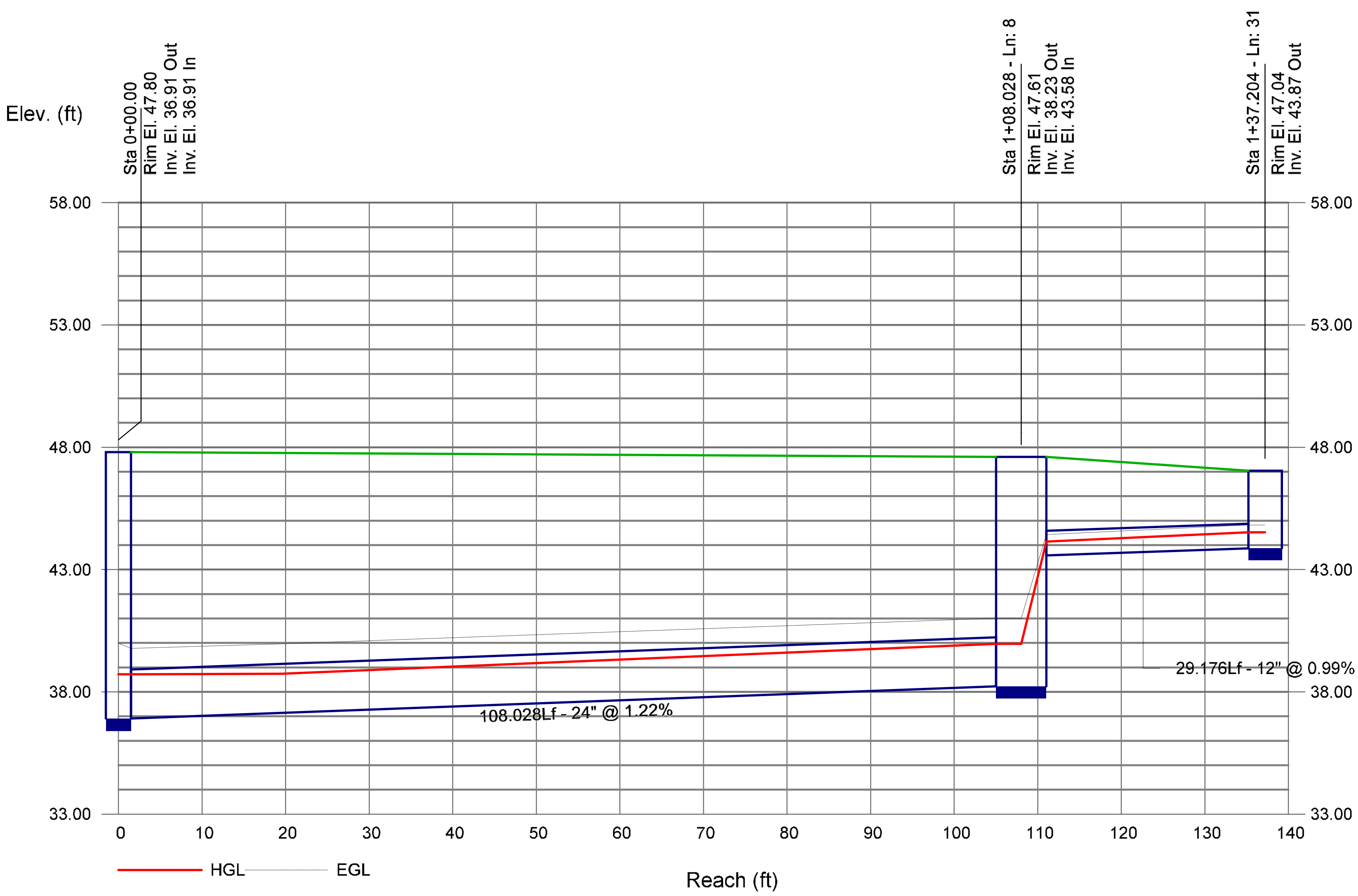
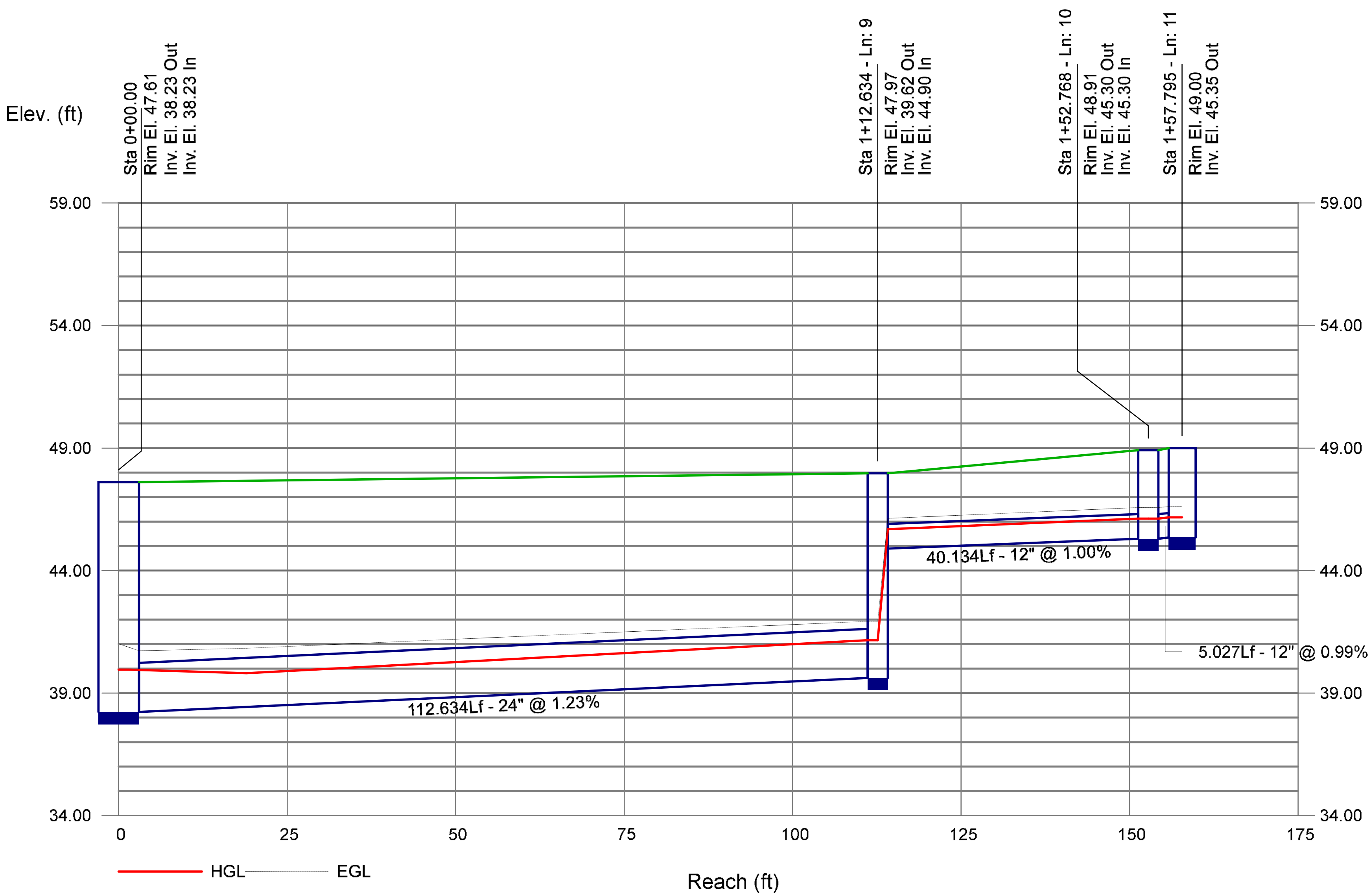


Storm Sewers

Storm Sewer Profile



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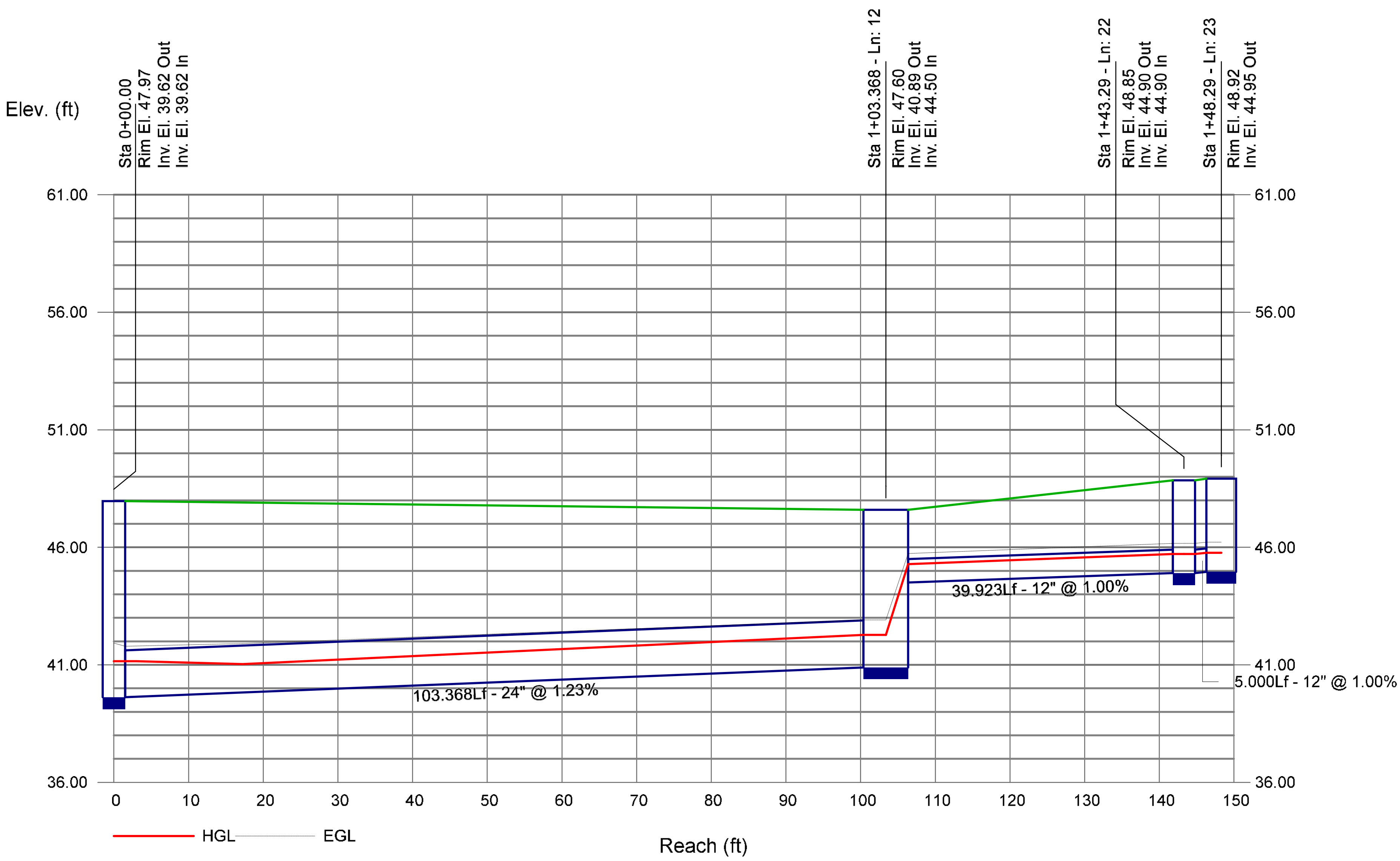

Storm Sewer Profile

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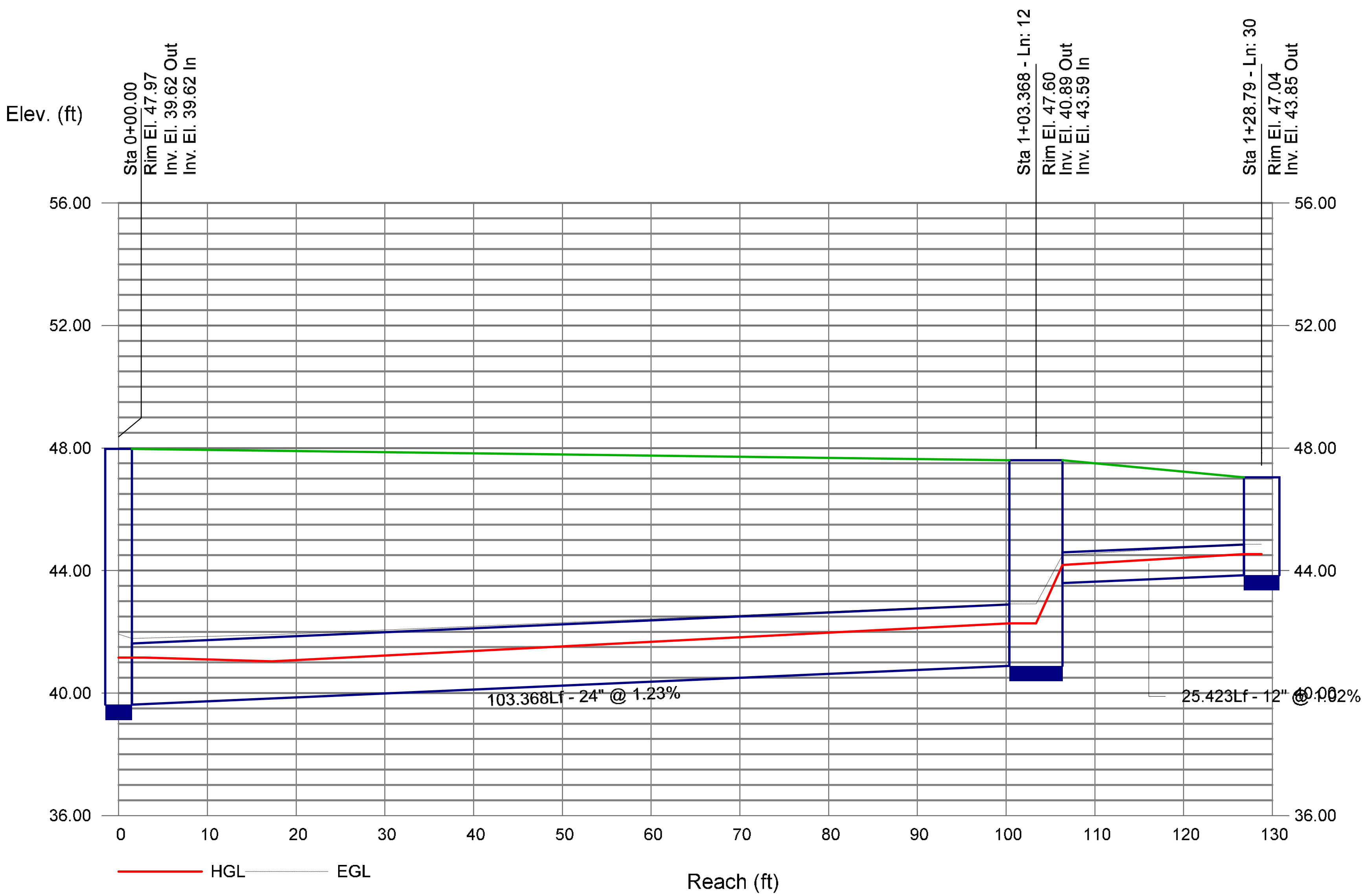
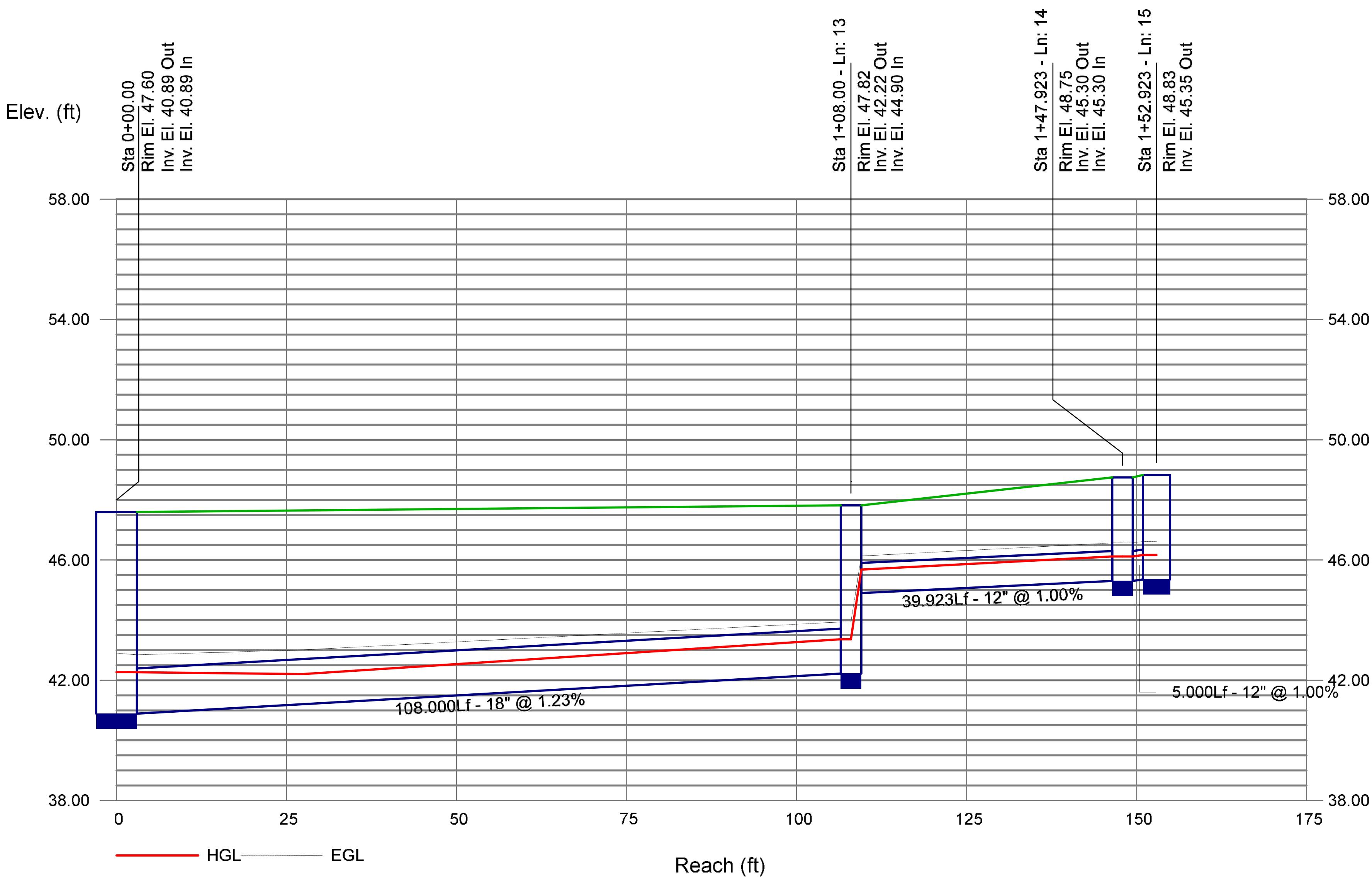
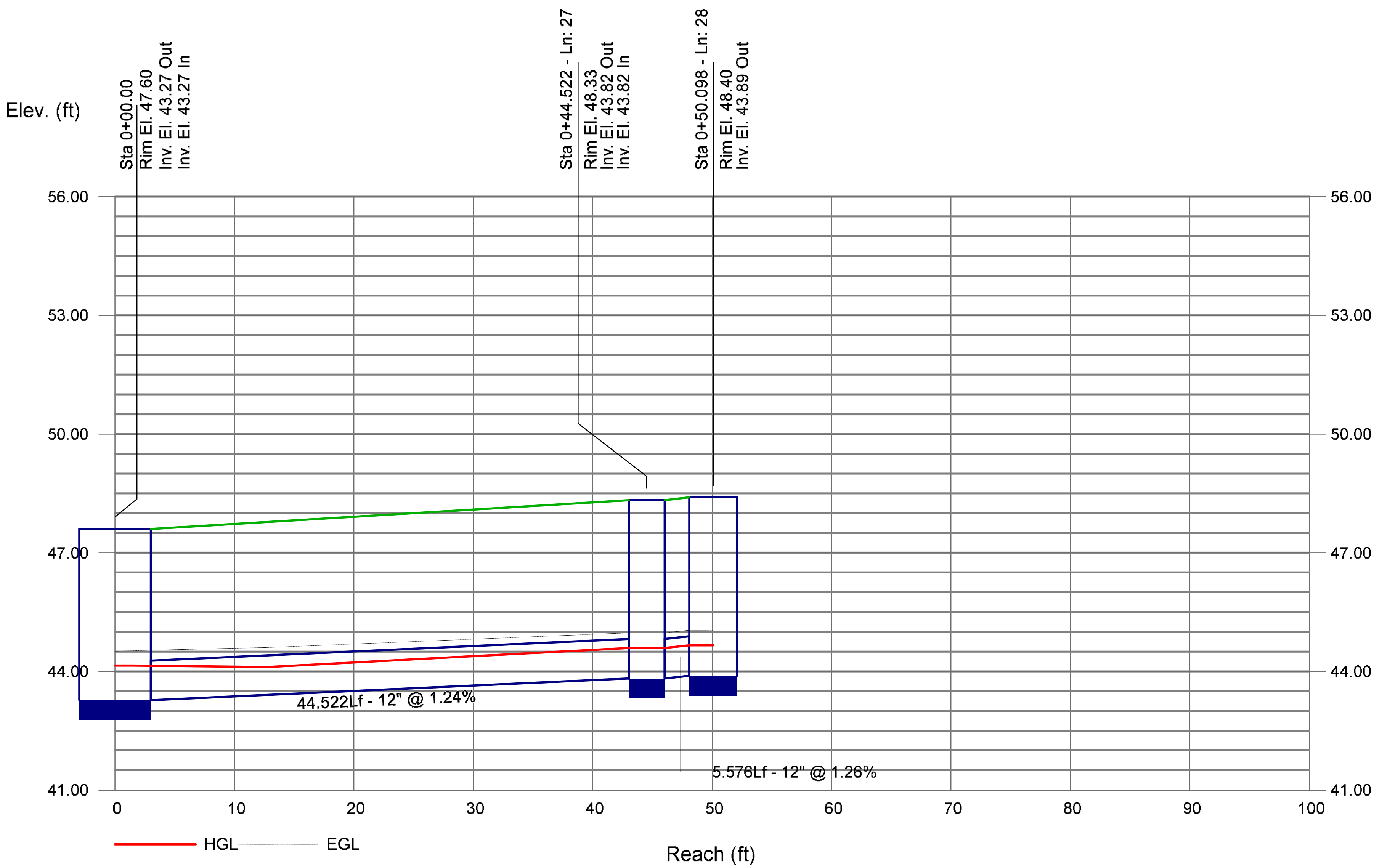


Storm Sewers

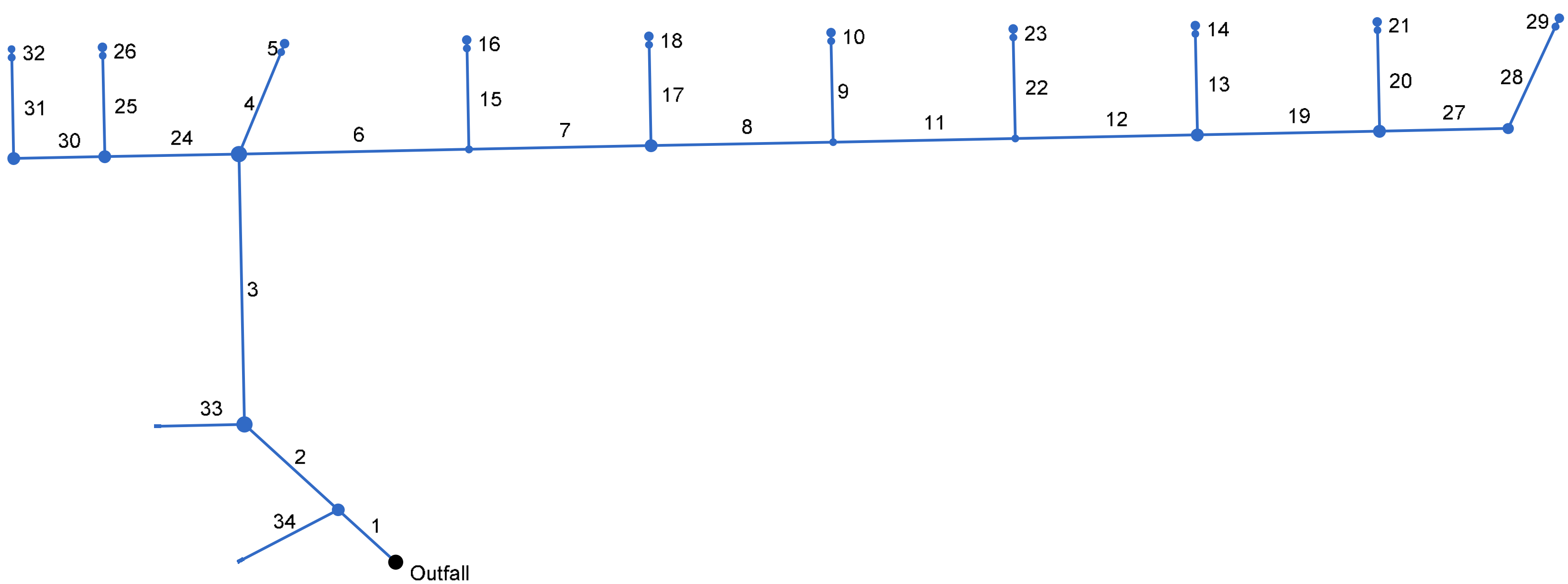
Storm Sewer Profile



Storm Sewer Profile



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 200.stm	Number of lines: 34	Date: 3/25/2020

Storm Sewers v2018.30

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	46.152	-137.636	MH	0.00	0.00	0.00	6.0	31.00	0.91	31.42	48	Cir	0.012	0.95	38.56	MH-201 TO FES-201
2	1	75.304	0.000	MH	0.00	0.00	0.00	6.0	31.42	0.93	32.12	48	Cir	0.012	0.77	40.29	MH-202 TO MH-201
3	2	160.712	46.487	MH	0.00	0.00	0.00	6.0	32.12	0.96	33.66	42	Cir	0.012	1.00	44.31	MH-203 TO MH-202
4	3	65.482	23.606	MH	0.00	0.00	0.00	6.0	41.10	0.99	41.75	12	Cir	0.012	0.15	44.95	CO-203 TO MH-203
5	4	5.457	0.000	MH	0.00	0.52	0.99	6.0	41.75	1.10	41.81	12	Cir	0.012	1.00	45.00	RL-203 TO CO-203
6	3	136.407	90.000	MH	0.00	0.00	0.00	6.0	33.66	0.96	34.97	30	Cir	0.012	1.00	44.33	INSERTA TEE-201 TO
7	6	108.000	0.000	MH	0.00	0.00	0.00	6.0	34.97	0.96	36.01	30	Cir	0.012	1.00	44.33	MH-204 TO INSERTA
8	7	108.007	0.000	MH	0.00	0.00	0.00	6.0	36.01	0.96	37.05	24	Cir	0.012	1.00	44.33	INSERTA TEE-202 TO
9	8	60.002	-90.006	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-206 TO INSERTA
10	9	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-206 TO CO-206
11	8	108.000	0.000	MH	0.00	0.00	0.00	6.0	37.05	0.95	38.08	24	Cir	0.012	1.00	44.33	INSERTA TEE-203 TO
12	11	108.000	0.000	MH	0.00	0.00	0.00	6.0	38.08	0.96	39.12	24	Cir	0.012	1.00	44.33	MH-205 TO INSERTA
13	12	60.002	-90.006	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-208 TO MH-205
14	13	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-208 TO CO-208
15	6	60.002	-90.000	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-204 TO INSERTA
16	15	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-204 TO CO-204
17	7	60.002	-90.000	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-205 TO MH-204
18	17	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-205 TO CO-205
19	12	107.994	0.000	MH	0.00	0.00	0.00	6.0	39.12	0.96	40.16	18	Cir	0.012	1.00	44.33	MH-206 TO MH-205
20	19	60.002	-90.000	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-209 TO MH-206
21	20	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-209 TO CO-209
22	11	60.002	-90.006	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-207 TO INSERTA
23	22	5.000	0.000	MH	0.00	0.52	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-207 TO CO-207

Project File: Storm 200.stm | Number of lines: 34 | Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	3	79.593	-90.000	MH	0.00	0.00	0.00	6.0	38.76	1.01	39.56	15	Cir	0.012	1.00	44.30	MH-208 TO MH-203
25	24	60.002	90.000	MH	0.00	0.00	0.00	6.0	41.10	1.00	41.70	12	Cir	0.012	0.15	44.95	CO-202 TO MH-208
26	25	5.000	0.000	MH	0.00	0.39	0.99	6.0	41.70	1.00	41.75	12	Cir	0.012	1.00	45.00	RL-202 TO CO-202
27	19	76.333	0.000	MH	0.00	0.00	0.00	6.0	40.16	0.96	40.89	15	Cir	0.012	0.92	44.36	MH-207 TO MH-206
28	27	66.744	-64.026	MH	0.00	0.00	0.00	6.0	40.89	1.00	41.56	15	Cir	0.012	0.15	48.78	CO-210 TO MH-207
29	28	5.562	0.000	MH	0.00	0.46	0.99	6.0	41.56	0.90	41.61	15	Cir	0.012	1.00	49.00	RL-210 TO CO-210
30	24	54.000	0.000	MH	0.00	0.00	0.00	6.0	39.56	1.00	40.10	12	Cir	0.012	1.00	44.30	MH-209 TO MH-208
31	30	60.002	90.000	MH	0.00	0.00	0.00	6.0	40.10	1.00	40.70	12	Cir	0.012	0.15	44.95	CO-201 TO MH-209
32	31	5.000	0.000	MH	0.00	0.33	0.99	6.0	40.70	1.00	40.75	12	Cir	0.012	1.00	45.00	RL-201 TO CO-201
33	2	51.284	-43.513	MH	2.95	0.00	0.00	6.0	32.68	0.99	33.19	24	Cir	0.012	1.00	37.00	OCS-201 TO MH-202
34	1	65.411	-69.834	Comb	0.00	0.34	0.97	6.0	31.42	1.91	32.67	18	Cir	0.012	1.00	37.43	CB-201 TO MH-201

Project File: Storm 200.stm | Number of lines: 34 | Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	MH-201 TO FES-201	39.52	48	Cir	46.152	31.00	31.42	0.910	33.14	33.29	n/a	33.29 j	End	Manhole
2	MH-202 TO MH-201	37.36	48	Cir	75.304	31.42	32.12	0.930	33.29	33.94	n/a	33.94 j	1	Manhole
3	MH-203 TO MH-202	34.85	42	Cir	160.712	32.12	33.66	0.958	33.94	35.49	n/a	35.49	2	Manhole
4	CO-203 TO MH-203	4.09	12	Cir	65.482	41.10	41.75	0.993	42.00	42.65	0.07	42.72	3	Manhole
5	RL-203 TO CO-203	4.09	12	Cir	5.457	41.75	41.81	1.100	42.72	42.66	n/a	42.66	4	Manhole
6	INSERTA TEE-201 TO MH-203	26.17	30	Cir	136.407	33.66	34.97	0.960	35.49	36.71	n/a	36.71 j	3	Manhole
7	MH-204 TO INSERTA TEE-201	22.58	30	Cir	108.000	34.97	36.01	0.963	36.71	37.63	n/a	37.63 j	6	Manhole
8	INSERTA TEE-202 TO MH-204	18.90	24	Cir	108.007	36.01	37.05	0.963	37.63	38.61	n/a	38.61 j	7	Manhole
9	CO-206 TO INSERTA TEE-202	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	8	Manhole
10	RL-206 TO CO-206	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	9	Manhole
11	INSERTA TEE-203 TO INSERTA TE	15.19	24	Cir	108.000	37.05	38.08	0.954	38.61	39.48	n/a	39.48 j	8	Manhole
12	MH-205 TO INSERTA TEE-203	11.41	24	Cir	108.000	38.08	39.12	0.963	39.48	40.33	n/a	40.33 j	11	Manhole
13	CO-208 TO MH-205	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	12	Manhole
14	RL-208 TO CO-208	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	13	Manhole
15	CO-204 TO INSERTA TEE-201	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	6	Manhole
16	RL-204 TO CO-204	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	15	Manhole
17	CO-205 TO MH-204	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	7	Manhole
18	RL-205 TO CO-205	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	17	Manhole
19	MH-206 TO MH-205	7.55	18	Cir	107.994	39.12	40.16	0.963	40.33	41.22	n/a	41.22 j	12	Manhole
20	CO-209 TO MH-206	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	19	Manhole
21	RL-209 TO CO-209	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	20	Manhole
22	CO-207 TO INSERTA TEE-203	4.09	12	Cir	60.002	41.10	41.70	1.000	41.99	42.59	0.07	42.66	11	Manhole
23	RL-207 TO CO-207	4.09	12	Cir	5.000	41.70	41.75	1.000	42.66	42.71	0.43	43.14	22	Manhole
24	MH-208 TO MH-203	5.57	15	Cir	79.593	38.76	39.56	1.005	39.60	40.52	0.48	40.52	3	Manhole

Project File: Storm 200.stm | Number of lines: 34 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	CO-202 TO MH-208	3.07	12	Cir	60.002	41.10	41.70	1.000	41.77	42.45	n/a	42.45	24	Manhole
26	RL-202 TO CO-202	3.07	12	Cir	5.000	41.70	41.75	1.000	42.45	42.50	n/a	42.50	25	Manhole
27	MH-207 TO MH-206	3.58	15	Cir	76.333	40.16	40.89	0.956	41.22	41.65	n/a	41.65 j	19	Manhole
28	CO-210 TO MH-207	3.62	15	Cir	66.744	40.89	41.56	1.004	41.65	42.33	n/a	42.33	27	Manhole
29	RL-210 TO CO-210	3.62	15	Cir	5.562	41.56	41.61	0.899	42.33	42.38	n/a	42.38	28	Manhole
30	MH-209 TO MH-208	2.57	12	Cir	54.000	39.56	40.10	1.000	40.52	40.79	n/a	40.79 j	24	Manhole
31	CO-201 TO MH-209	2.59	12	Cir	60.002	40.10	40.70	1.000	40.79	41.39	n/a	41.39	30	Manhole
32	RL-201 TO CO-201	2.60	12	Cir	5.000	40.70	40.75	1.000	41.39	41.44	0.31	41.44	31	Manhole
33	OCS-201 TO MH-202	2.95	24	Cir	51.284	32.68	33.19	0.994	33.94	33.79	0.22	33.79	2	Manhole
34	CB-201 TO MH-201	2.62	18	Cir	65.411	31.42	32.67	1.911	33.29	33.29	n/a	33.51 j	1	Combination

Project File: Storm 200.stm | Number of lines: 34 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	46.152	0.00	5.16	0.00	0.00	5.10	6.0	9.0	7.2	39.52	148.5	6.30	48	0.91	31.00	31.42	33.14	33.29	31.00	38.56	MH-201 TO FES-
2	1	75.304	0.00	4.82	0.00	0.00	4.77	6.0	8.8	7.2	37.36	150.0	6.59	48	0.93	31.42	32.12	33.29	33.94	38.56	40.29	MH-202 TO MH-2
3	2	160.712	0.00	4.82	0.00	0.00	4.77	6.0	8.4	7.3	34.85	106.7	6.87	42	0.96	32.12	33.66	33.94	35.49	40.29	44.31	MH-203 TO MH-2
4	3	65.482	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.84	5.51	12	0.99	41.10	41.75	42.00	42.65	44.31	44.95	CO-203 TO MH-2
5	4	5.457	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	4.05	5.49	12	1.10	41.75	41.81	42.72	42.66	44.95	45.00	RL-203 TO CO-20
6	3	136.407	0.00	3.58	0.00	0.00	3.54	6.0	8.1	7.4	26.17	43.54	6.98	30	0.96	33.66	34.97	35.49	36.71	44.31	44.33	INSERTA TEE-20
7	6	108.000	0.00	3.06	0.00	0.00	3.03	6.0	7.8	7.5	22.58	43.60	6.46	30	0.96	34.97	36.01	36.71	37.63	44.33	44.33	MH-204 TO INSE
8	7	108.007	0.00	2.54	0.00	0.00	2.51	6.0	7.6	7.5	18.90	24.04	7.06	24	0.96	36.01	37.05	37.63	38.61	44.33	44.33	INSERTA TEE-20
9	8	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-206 TO INSE
10	9	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-206 TO CO-20
11	8	108.000	0.00	2.02	0.00	0.00	2.00	6.0	7.3	7.6	15.19	23.93	6.11	24	0.95	37.05	38.08	38.61	39.48	44.33	44.33	INSERTA TEE-20
12	11	108.000	0.00	1.50	0.00	0.00	1.49	6.0	6.9	7.7	11.41	24.04	5.29	24	0.96	38.08	39.12	39.48	40.33	44.33	44.33	MH-205 TO INSE
13	12	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-208 TO MH-2
14	13	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-208 TO CO-20
15	6	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-204 TO INSE
16	15	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-204 TO CO-20
17	7	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-205 TO MH-2
18	17	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-205 TO CO-20
19	12	107.994	0.00	0.98	0.00	0.00	0.97	6.0	6.6	7.8	7.55	11.16	5.29	18	0.96	39.12	40.16	40.33	41.22	44.33	44.33	MH-206 TO MH-2
20	19	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-209 TO MH-2
21	20	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-209 TO CO-20
22	11	60.002	0.00	0.52	0.00	0.00	0.51	6.0	6.0	7.9	4.09	3.86	5.54	12	1.00	41.10	41.70	41.99	42.59	44.33	44.95	CO-207 TO INSE

Project File: Storm 200.stm | Number of lines: 34 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

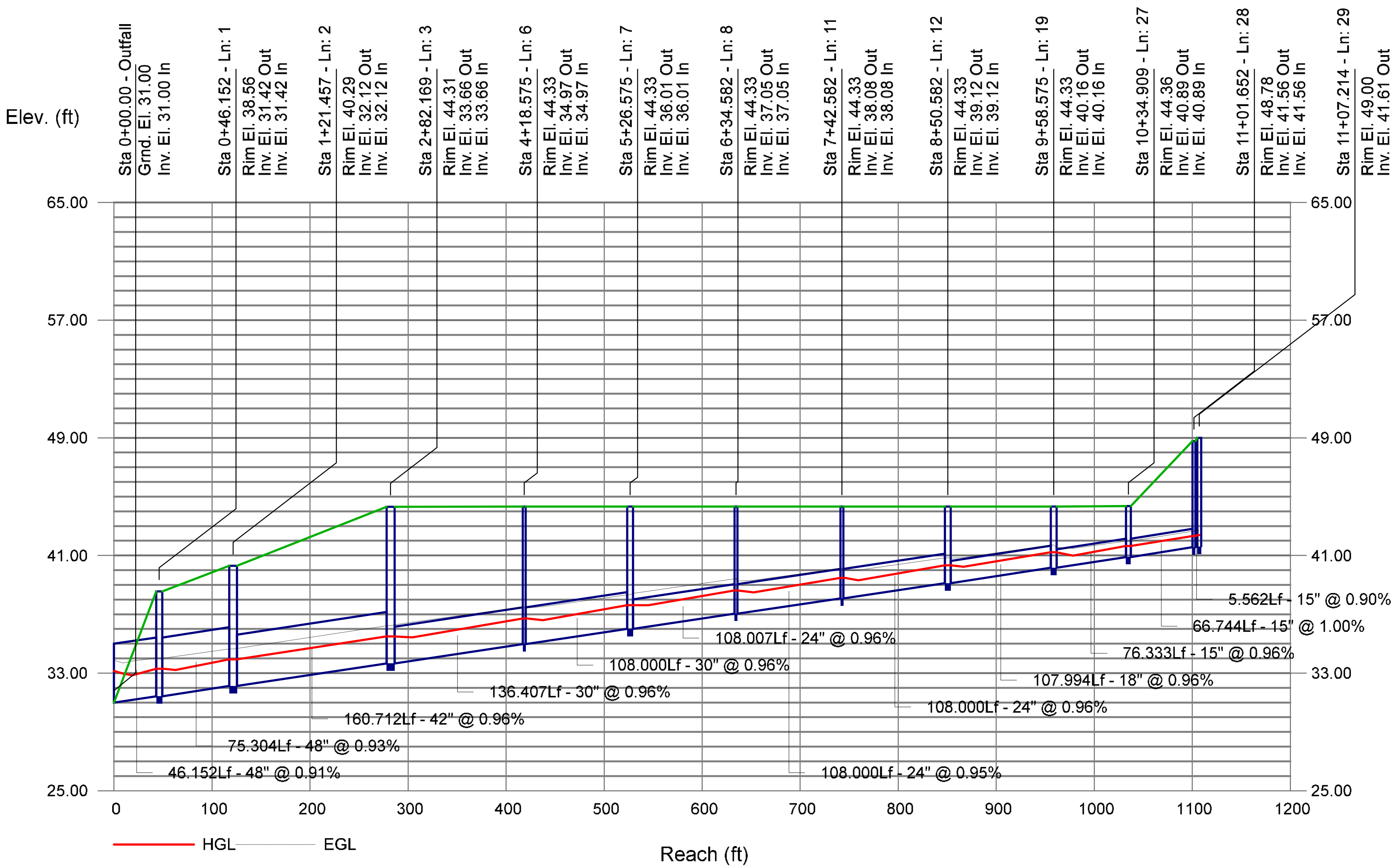
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	22	5.000	0.52	0.52	0.99	0.51	0.51	6.0	6.0	7.9	4.09	3.86	5.28	12	1.00	41.70	41.75	42.66	42.71	44.95	45.00	RL-207 TO CO-20
24	3	79.593	0.00	0.72	0.00	0.00	0.71	6.0	6.5	7.8	5.57	7.01	5.94	15	1.01	38.76	39.56	39.60	40.52	44.31	44.30	MH-208 TO MH-2
25	24	60.002	0.00	0.39	0.00	0.00	0.39	6.0	6.0	7.9	3.07	3.86	5.15	12	1.00	41.10	41.70	41.77	42.45	44.30	44.95	CO-202 TO MH-2
26	25	5.000	0.39	0.39	0.99	0.39	0.39	6.0	6.0	7.9	3.07	3.86	4.86	12	1.00	41.70	41.75	42.45	42.50	44.95	45.00	RL-202 TO CO-20
27	19	76.333	0.00	0.46	0.00	0.00	0.46	6.0	6.3	7.9	3.58	6.84	3.89	15	0.96	40.16	40.89	41.22	41.65	44.33	44.36	MH-207 TO MH-2
28	27	66.744	0.00	0.46	0.00	0.00	0.46	6.0	6.0	7.9	3.62	7.01	4.59	15	1.00	40.89	41.56	41.65	42.33	44.36	48.78	CO-210 TO MH-2
29	28	5.562	0.46	0.46	0.99	0.46	0.46	6.0	6.0	7.9	3.62	6.63	4.58	15	0.90	41.56	41.61	42.33	42.38	48.78	49.00	RL-210 TO CO-21
30	24	54.000	0.00	0.33	0.00	0.00	0.33	6.0	6.2	7.9	2.57	3.86	3.90	12	1.00	39.56	40.10	40.52	40.79	44.30	44.30	MH-209 TO MH-2
31	30	60.002	0.00	0.33	0.00	0.00	0.33	6.0	6.0	7.9	2.59	3.86	4.50	12	1.00	40.10	40.70	40.79	41.39	44.30	44.95	CO-201 TO MH-2
32	31	5.000	0.33	0.33	0.99	0.33	0.33	6.0	6.0	7.9	2.60	3.86	4.49	12	1.00	40.70	40.75	41.39	41.44	44.95	45.00	RL-201 TO CO-20
33	2	51.284	0.00	0.00	0.00	0.00	0.00	6.0	6.0	0.0	2.95	24.43	2.57	24	0.99	32.68	33.19	33.94	33.79	40.29	37.00	OCS-201 TO MH-
34	1	65.411	0.34	0.34	0.97	0.33	0.33	6.0	6.0	7.9	2.62	15.73	2.65	18	1.91	31.42	32.67	33.29	33.29	38.56	37.43	CB-201 TO MH-2

Project File: Storm 200.stm | Number of lines: 34 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile



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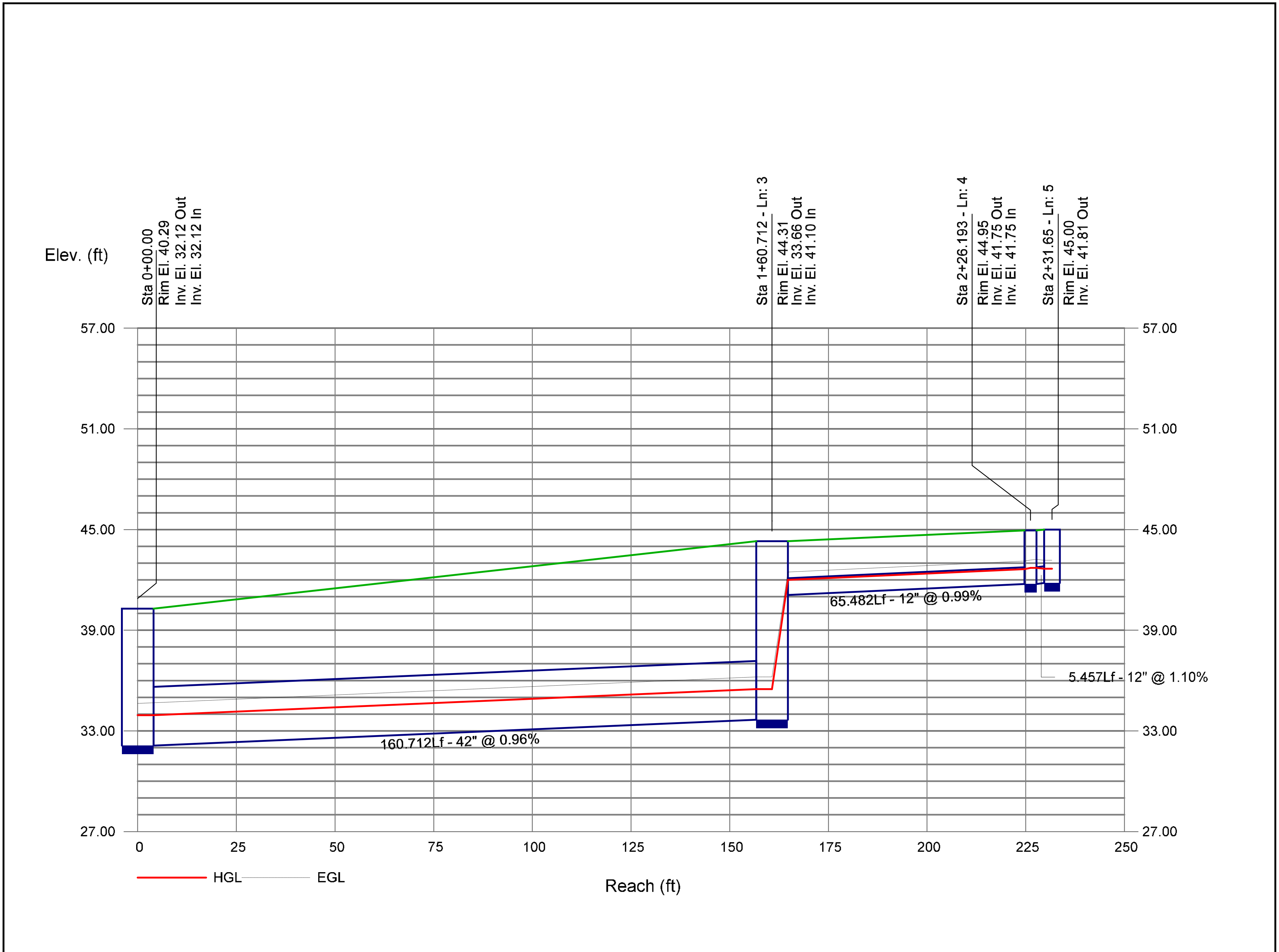
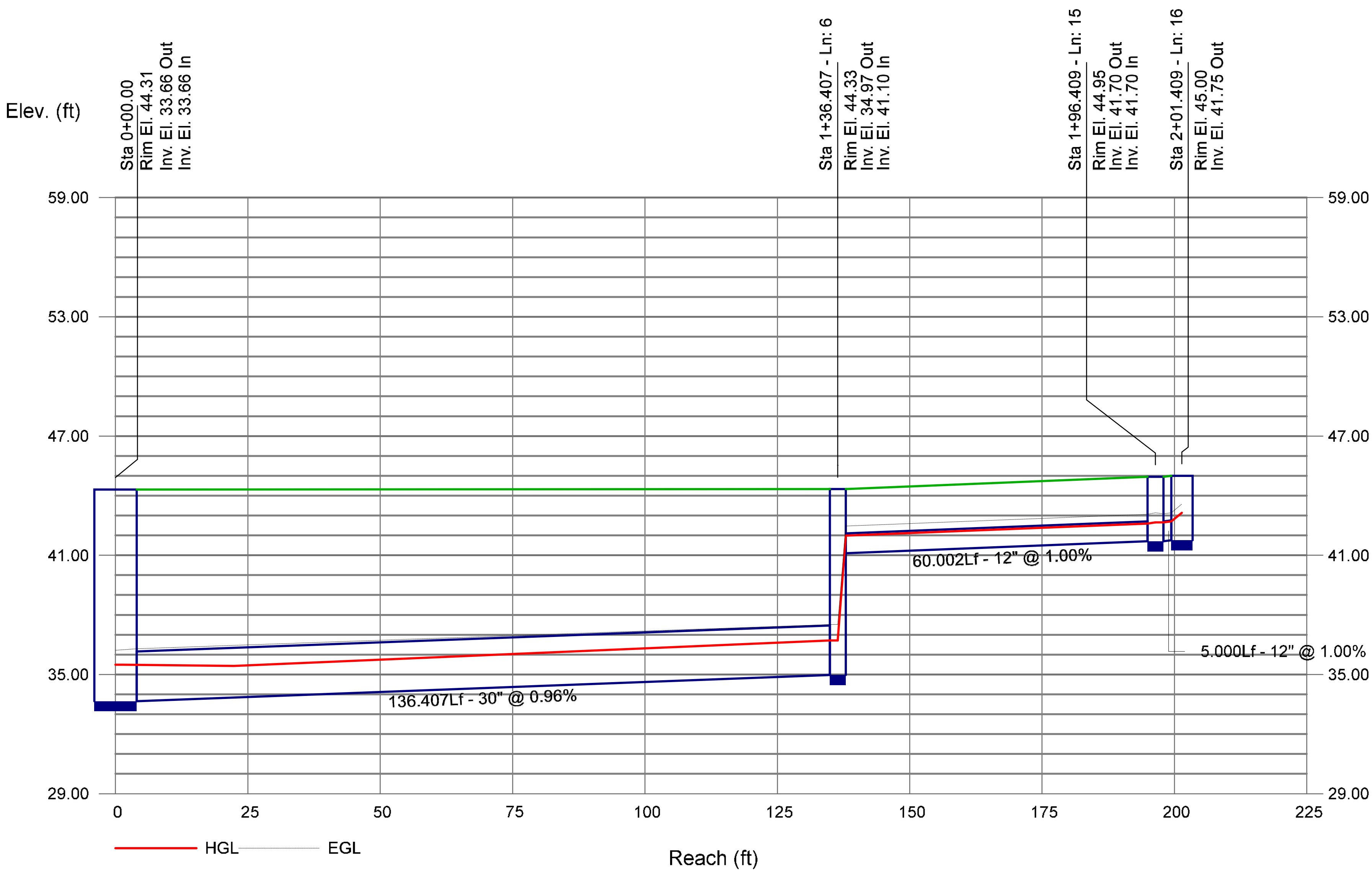


Storm Sewer Profile

Proj. file: Storm 200.stm



Storm Sewer Profile

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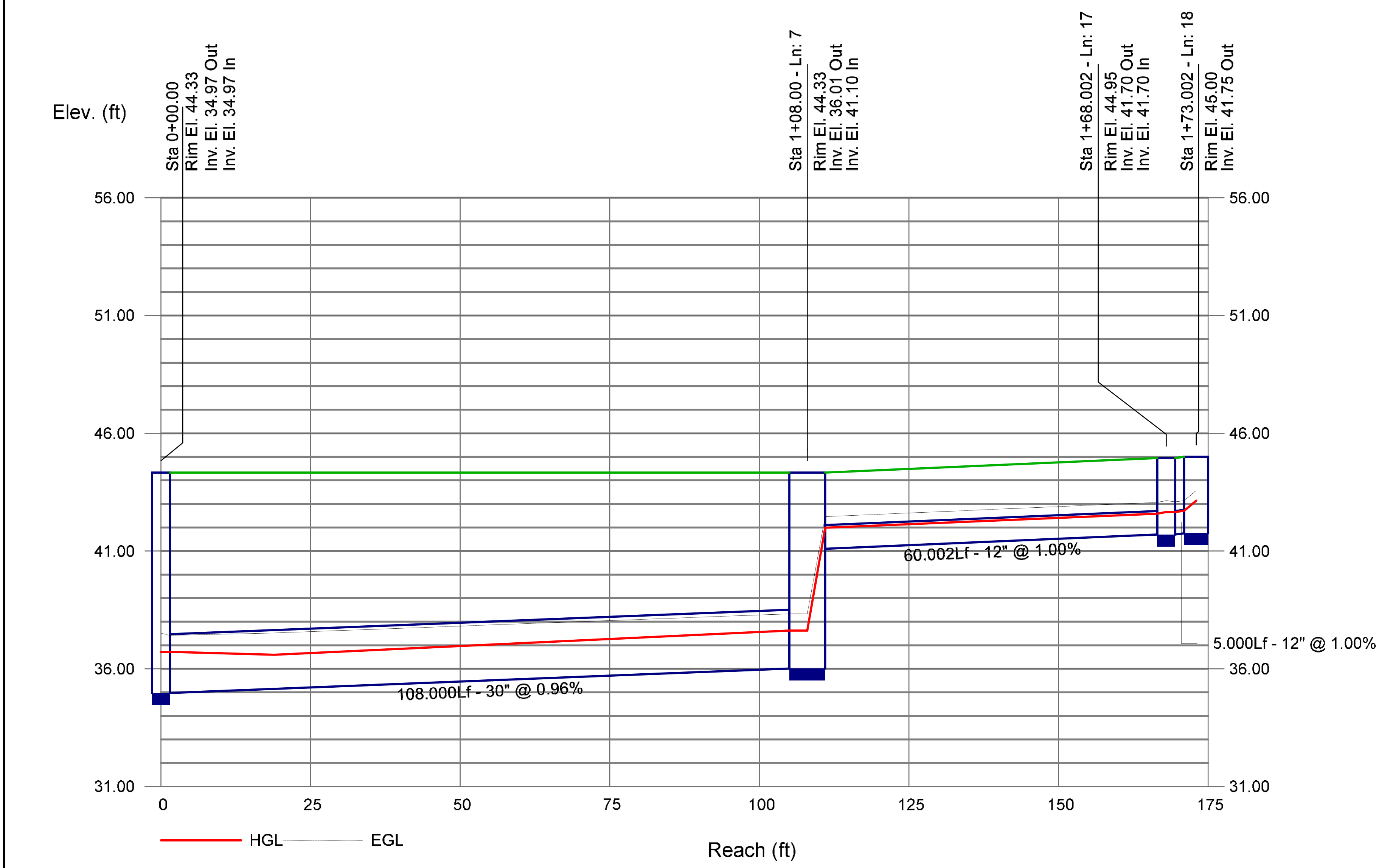

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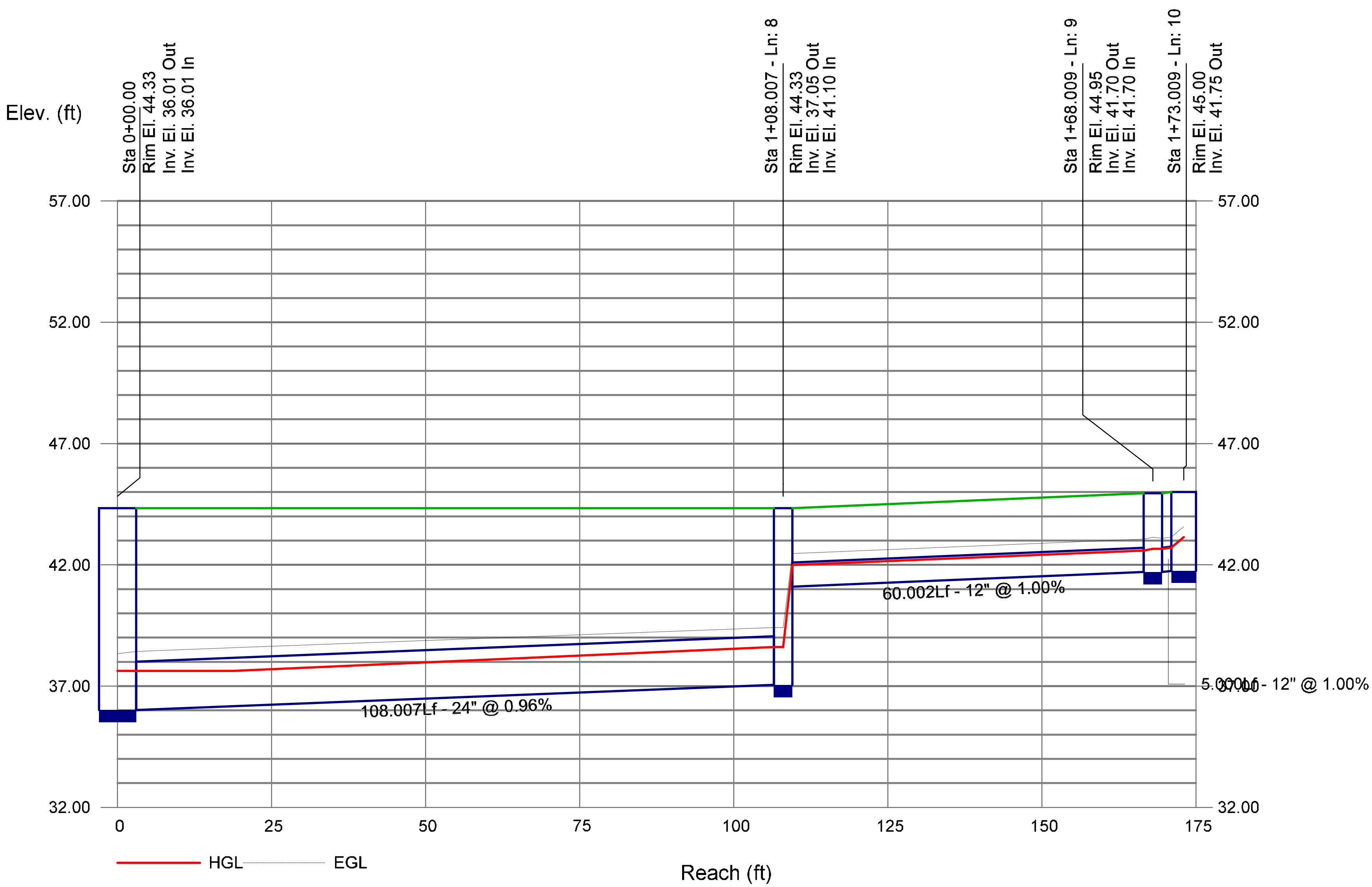

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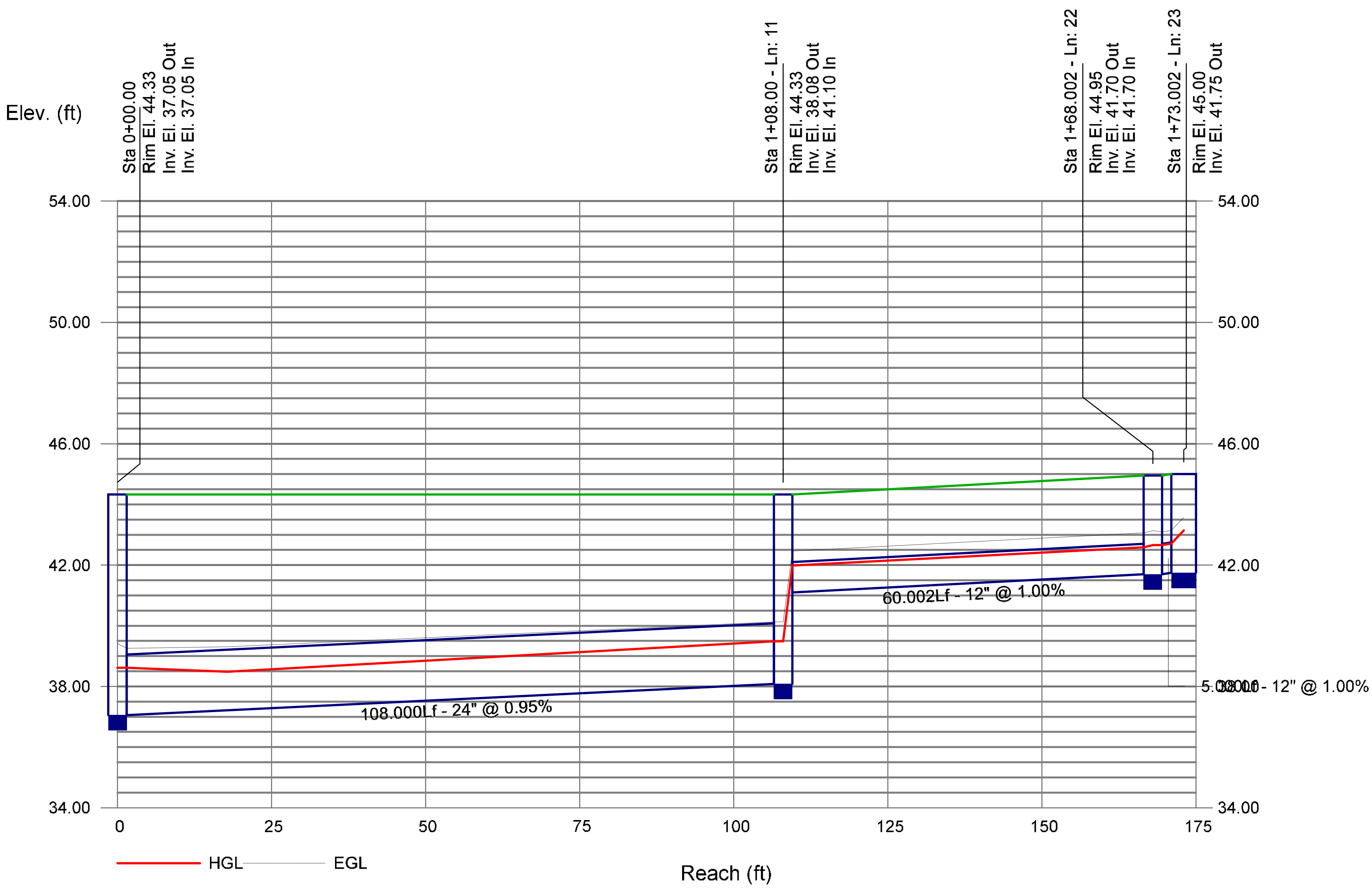

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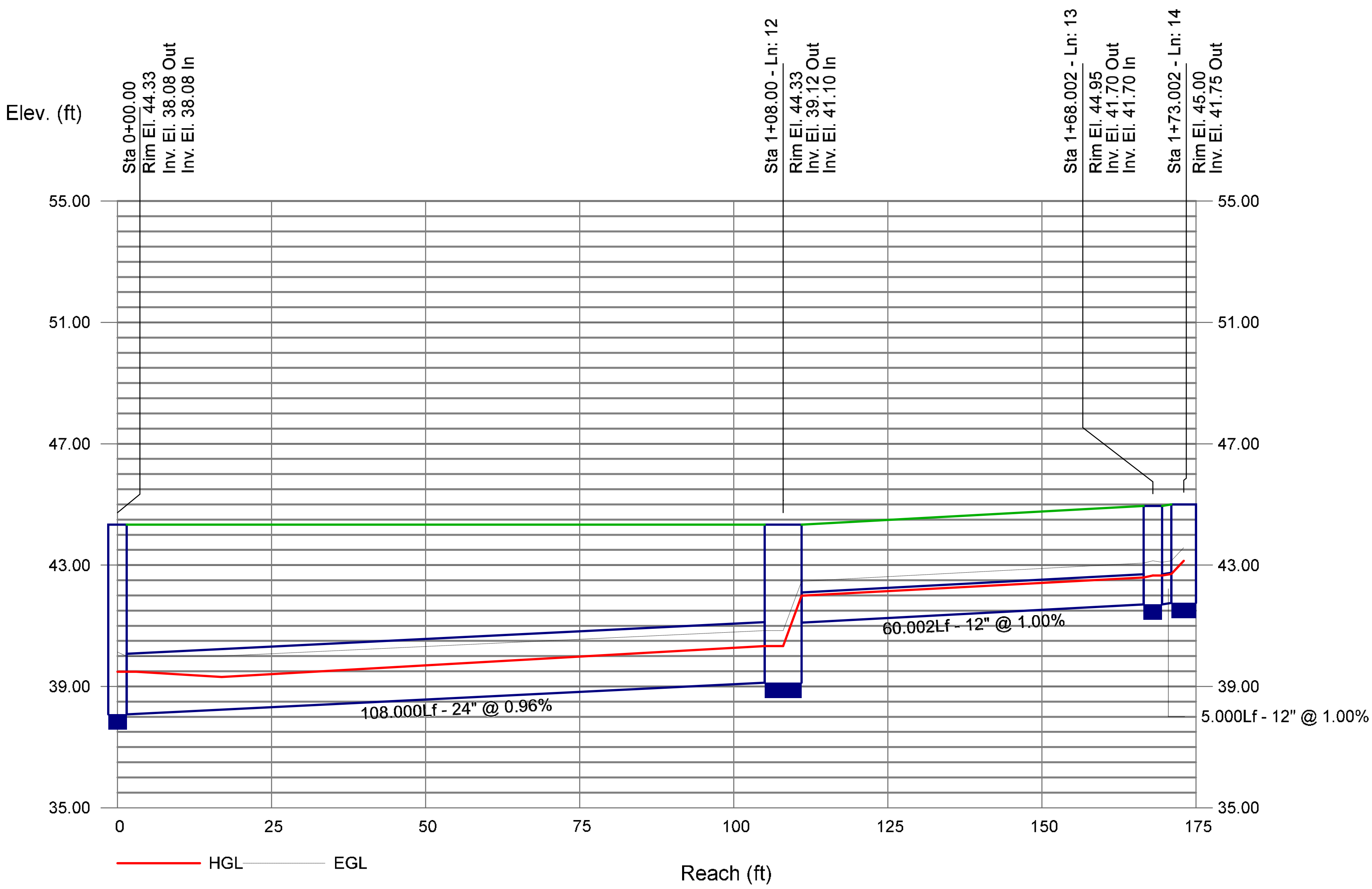

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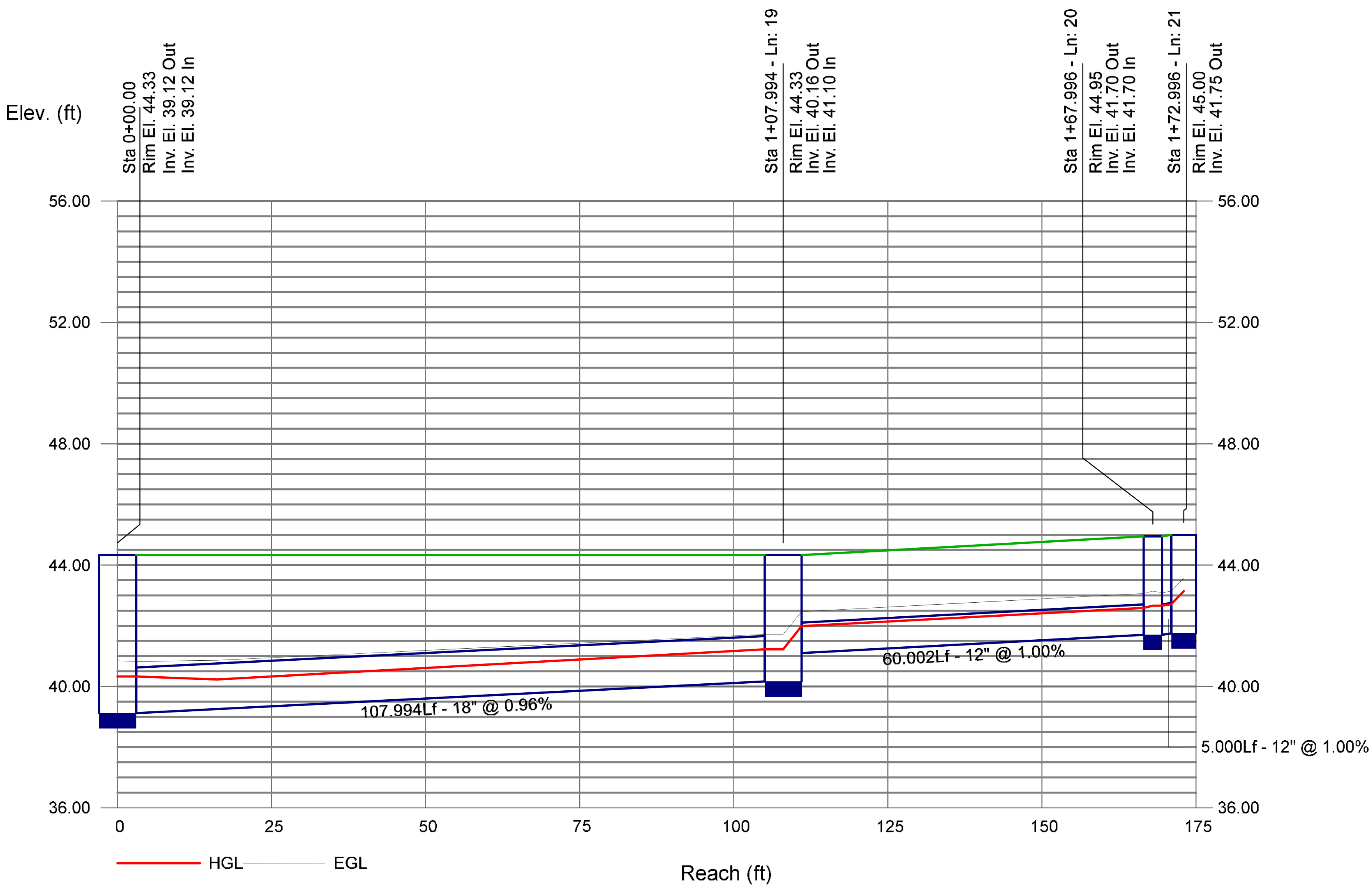

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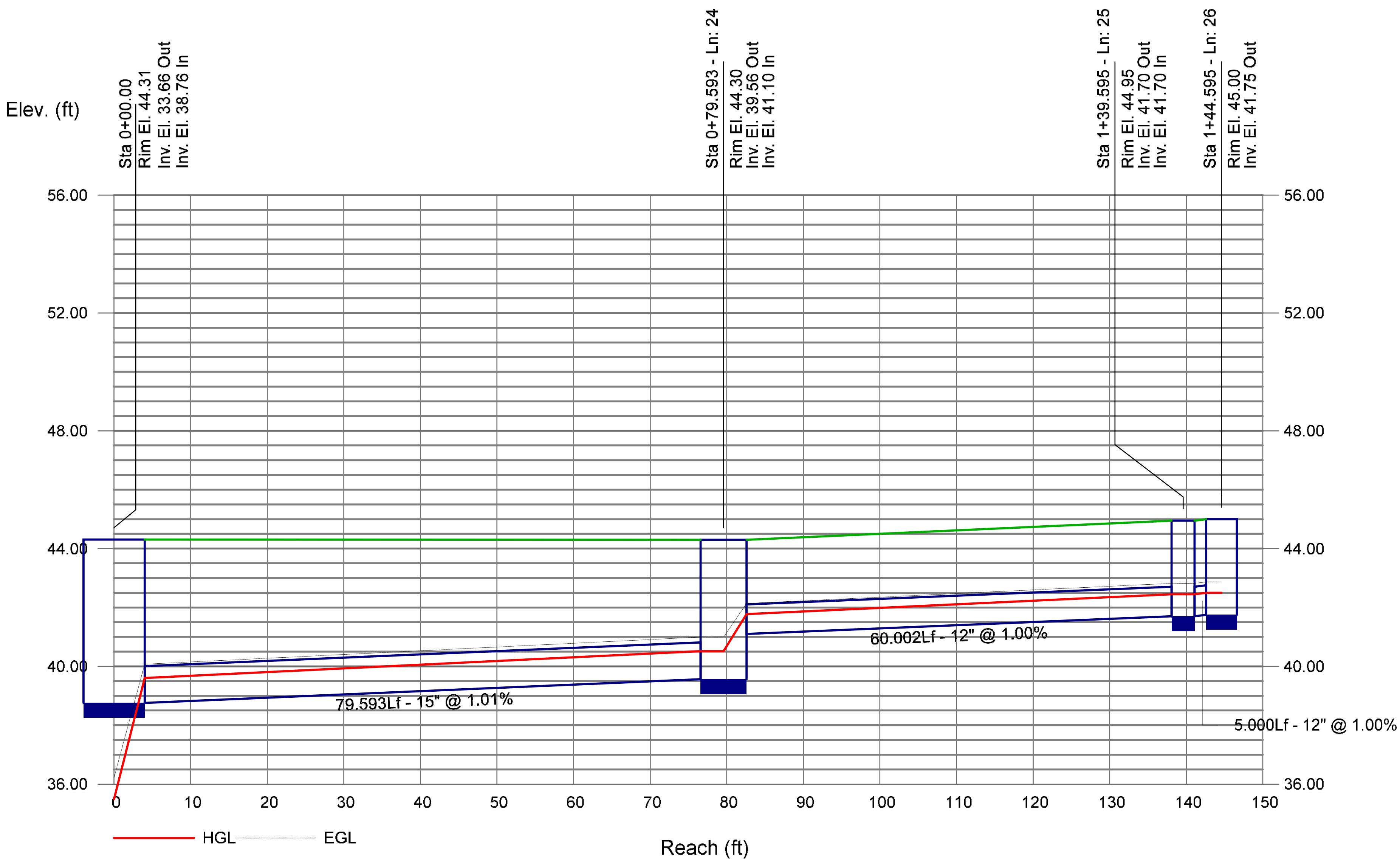

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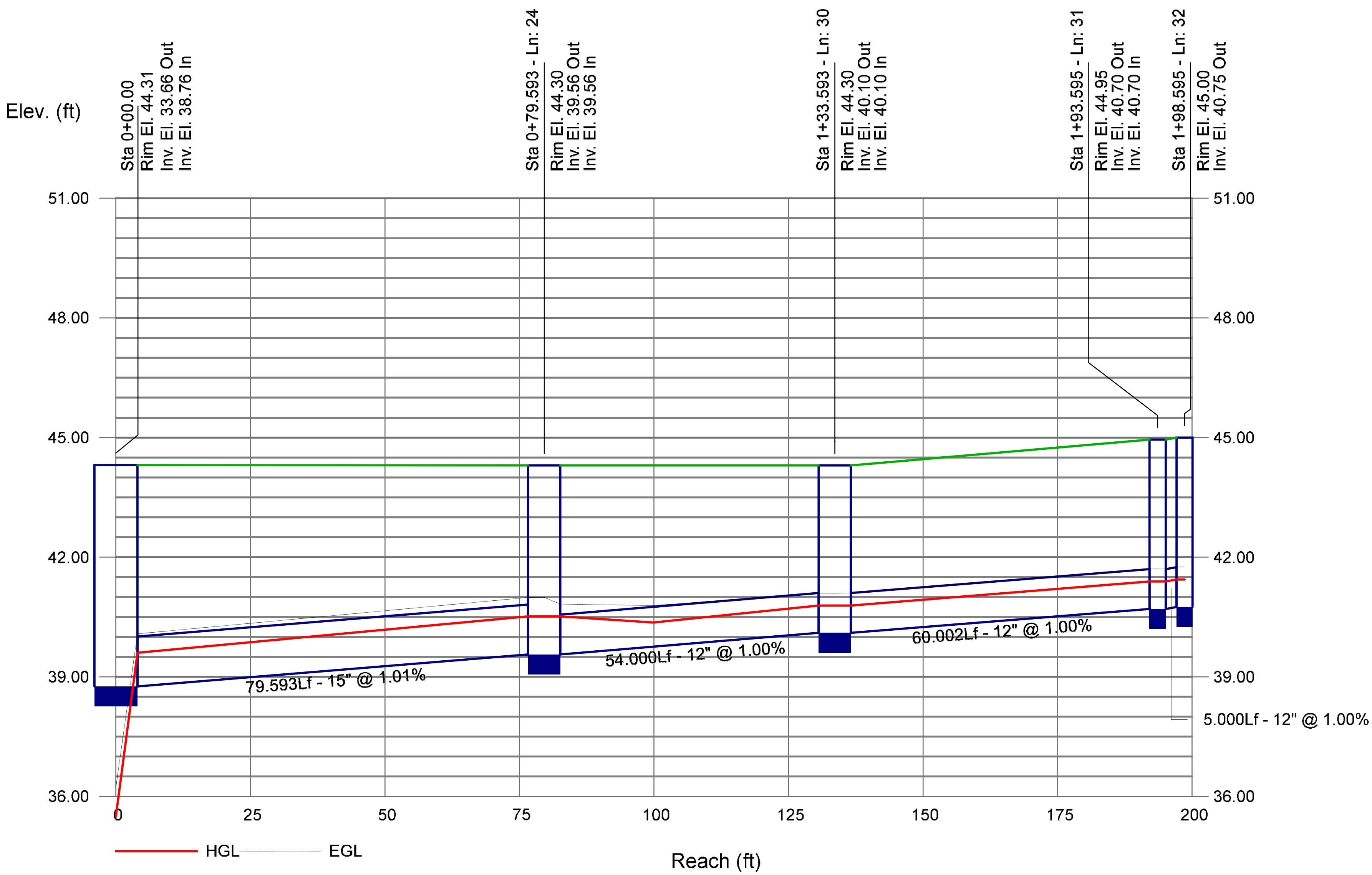

Storm Sewer Profile

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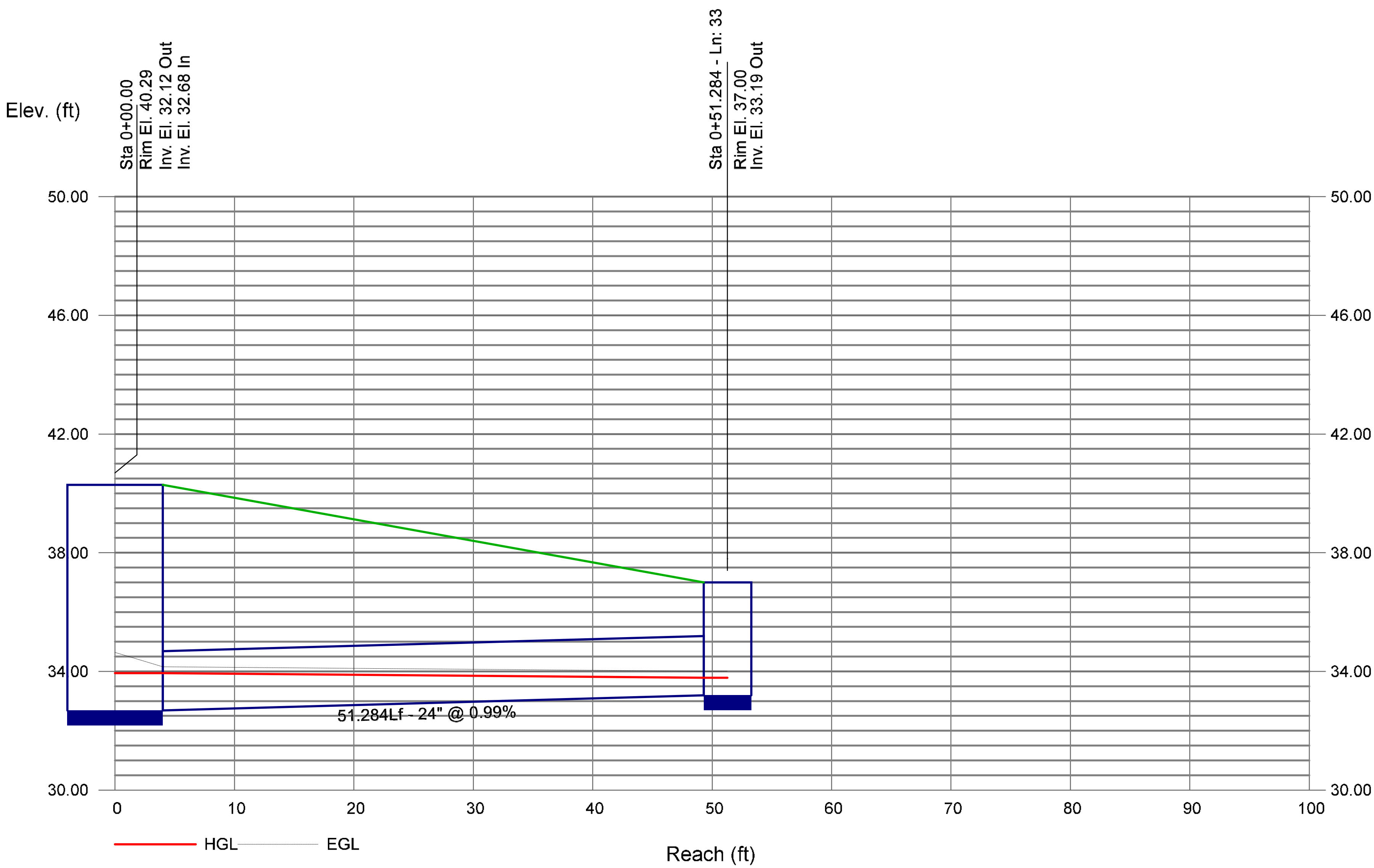

Storm Sewer Profile

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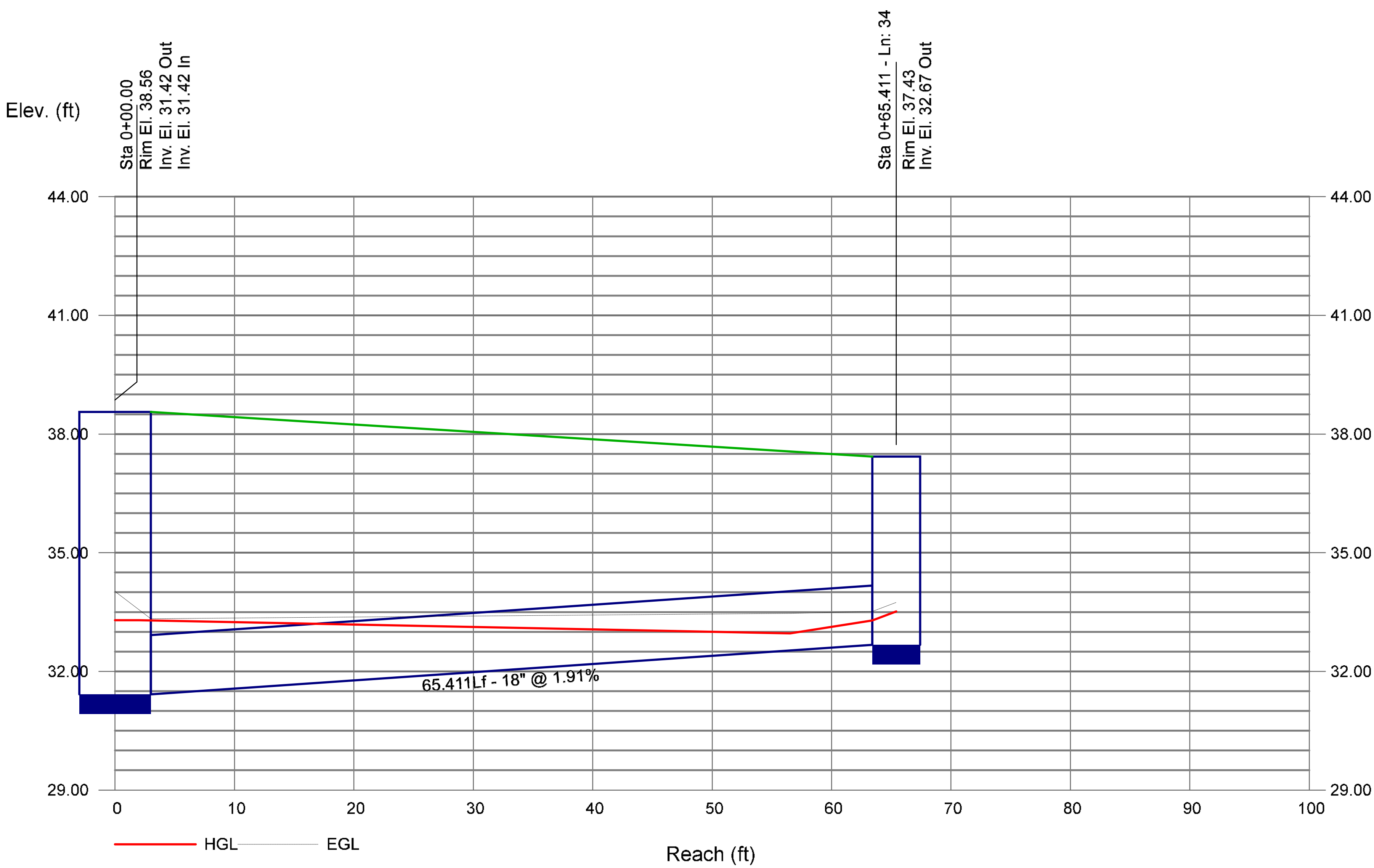
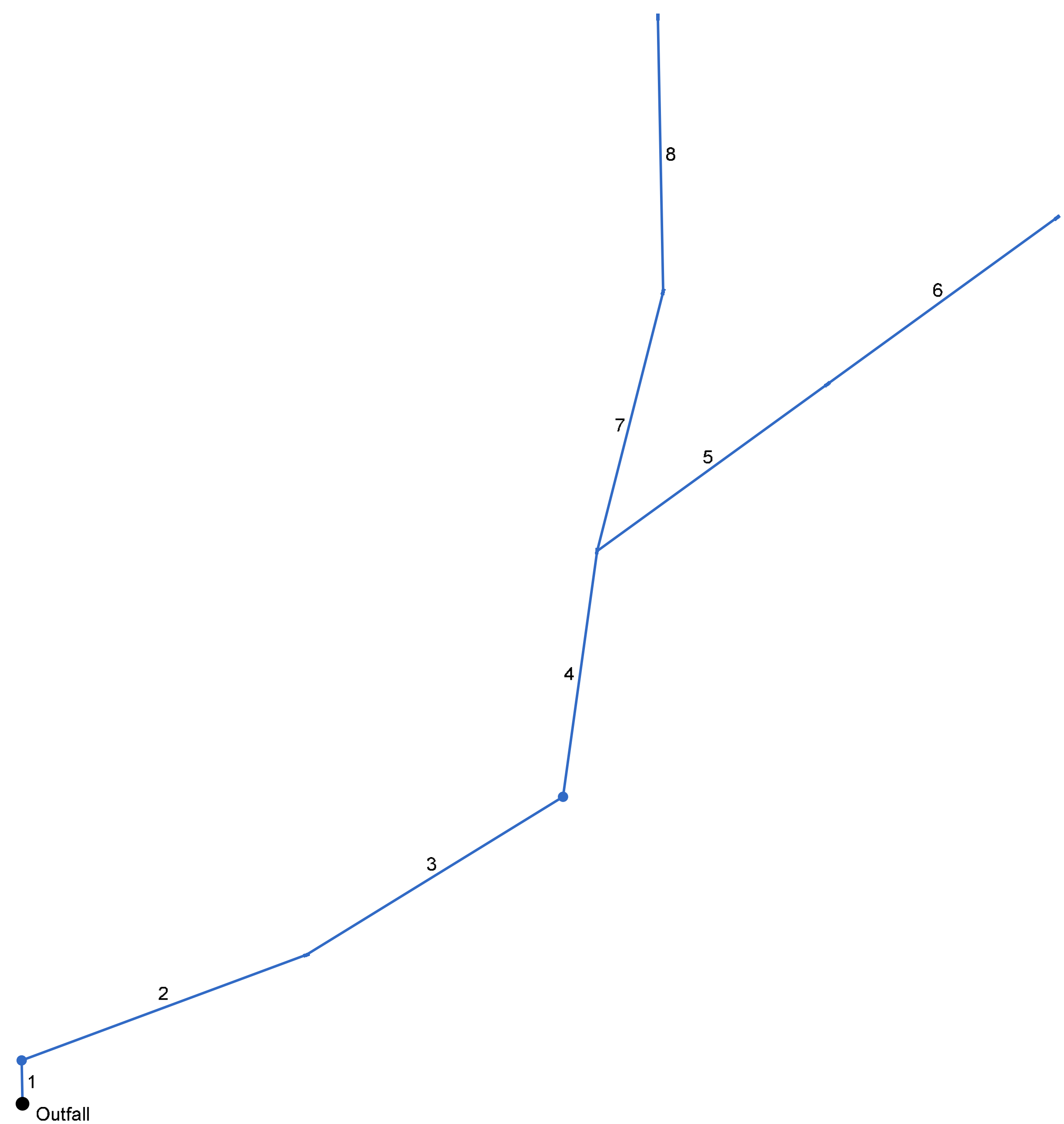


Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 300.stm	Number of lines: 8	Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	27.900	-91.105	MH	0.00	0.00	0.00	6.0	36.70	0.50	36.84	36	Cir	0.012	0.95	42.59	MH-301 to FES-301
2	1	195.086	70.649	Comb	0.00	0.49	0.81	6.0	36.84	0.50	37.82	30	Cir	0.012	0.50	43.47	CB-301 to MH-301
3	2	193.623	-11.270	MH	0.00	0.00	0.00	6.0	37.82	0.50	38.79	30	Cir	0.012	0.81	45.80	MH-302 to CB-301
4	3	159.957	-50.426	Comb	0.00	2.12	0.64	6.0	38.79	0.50	39.59	30	Cir	0.012	1.14	43.90	CB-302 to MH-302
5	4	182.718	46.079	Grate	0.00	0.96	0.84	6.0	39.59	1.00	41.42	18	Cir	0.012	0.50	46.27	CB-303 to CB-302
6	5	182.330	0.012	Grate	0.00	1.34	0.62	6.0	41.42	1.00	43.24	15	Cir	0.012	1.00	48.64	CB-304 to CB-303
7	4	172.395	6.396	Comb	0.00	1.11	0.64	6.0	39.59	1.00	41.31	15	Cir	0.012	0.50	46.14	CB-305 to CB-302
8	7	177.302	-15.347	Comb	0.00	0.23	0.79	6.0	41.31	1.00	43.08	15	Cir	0.012	1.00	46.72	CB-306 to CB-305

Project File: Storm 300.stm | Number of lines: 8 | Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	MH-301 to FES-301	29.37	36	Cir	27.900	36.70	36.84	0.502	38.33	38.59	0.69	38.59	End	Manhole
2	CB-301 to MH-301	29.77	30	Cir	195.086	36.84	37.82	0.502	38.78	39.76	0.41	40.17	1	Combination
3	MH-302 to CB-301	27.45	30	Cir	193.623	37.82	38.79	0.501	40.17	40.71	0.58	41.29	2	Manhole
4	CB-302 to MH-302	27.85	30	Cir	159.957	38.79	39.59	0.500	41.29	41.81	0.65	42.46	3	Combination
5	CB-303 to CB-302	12.74	18	Cir	182.718	39.59	41.42	1.002	42.46*	44.75*	0.40	45.16	4	Grate
6	CB-304 to CB-303	6.60	15	Cir	182.330	41.42	43.24	0.998	45.16*	46.78*	0.45	47.23	5	Grate
7	CB-305 to CB-302	6.51	15	Cir	172.395	39.59	41.31	0.998	42.46*	43.95*	0.22	44.17	4	Combination
8	CB-306 to CB-305	1.44	15	Cir	177.302	41.31	43.08	0.998	44.17	44.24	0.02	44.26	7	Combination

Project File: Storm 300.stm	Number of lines: 8	Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).

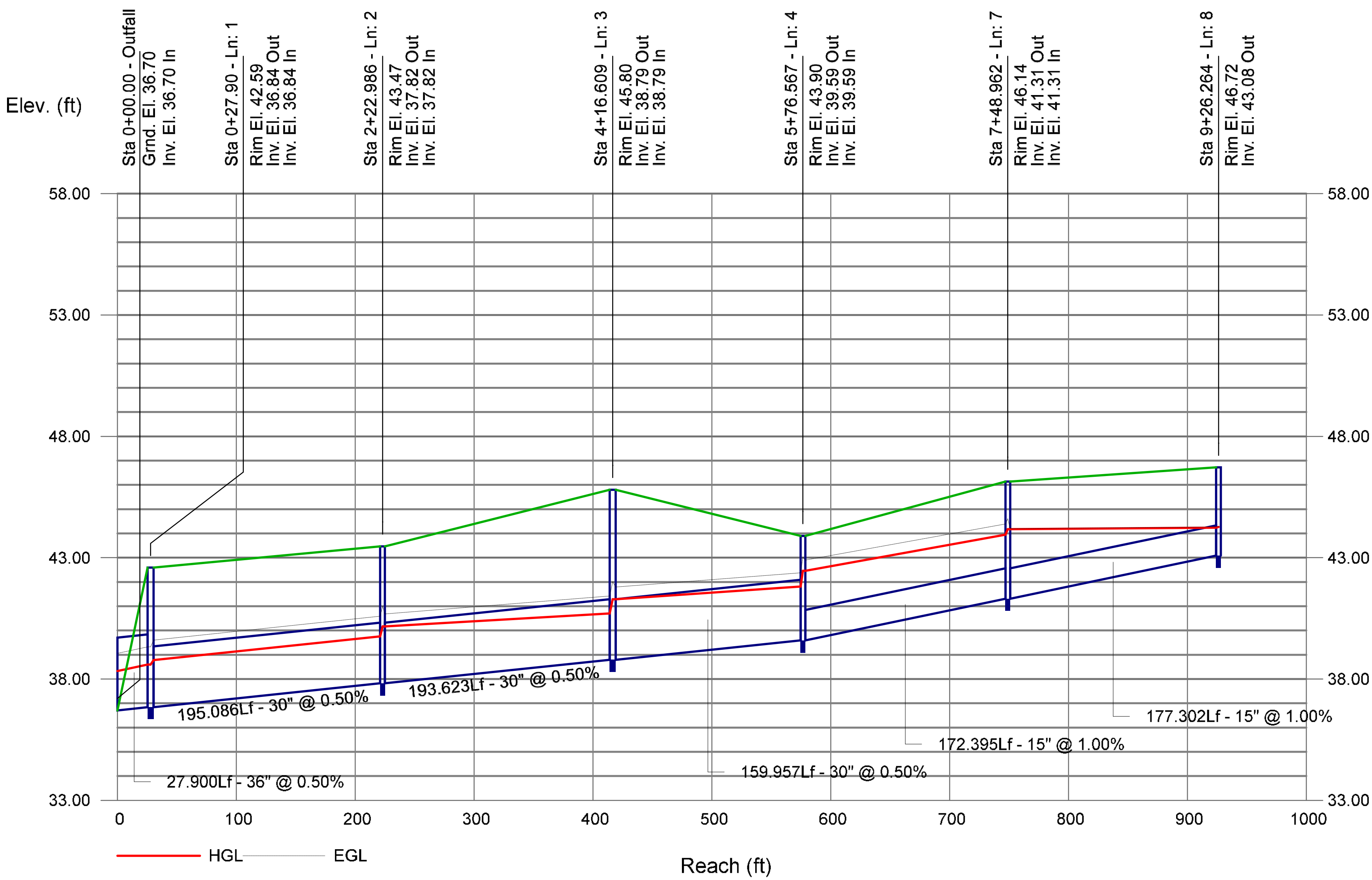
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	27.900	0.00	6.25	0.00	0.00	4.28	6.0	10.4	6.9	29.37	51.18	7.16	36	0.50	36.70	36.84	38.33	38.59	36.70	42.59	MH-301 to FES-3
2	1	195.086	0.49	6.25	0.81	0.40	4.28	6.0	10.0	7.0	29.77	31.49	7.29	30	0.50	36.84	37.82	38.78	39.76	42.59	43.47	CB-301 to MH-30
3	2	193.623	0.00	5.76	0.00	0.00	3.89	6.0	9.5	7.1	27.45	31.45	6.27	30	0.50	37.82	38.79	40.17	40.71	43.47	45.80	MH-302 to CB-30
4	3	159.957	2.12	5.76	0.64	1.36	3.89	6.0	9.0	7.2	27.85	31.42	5.86	30	0.50	38.79	39.59	41.29	41.81	45.80	43.90	CB-302 to MH-30
5	4	182.718	0.96	2.30	0.84	0.81	1.64	6.0	6.6	7.8	12.74	11.39	7.21	18	1.00	39.59	41.42	42.46	44.75	43.90	46.27	CB-303 to CB-302
6	5	182.330	1.34	1.34	0.62	0.83	0.83	6.0	6.0	7.9	6.60	6.99	5.38	15	1.00	41.42	43.24	45.16	46.78	46.27	48.64	CB-304 to CB-303
7	4	172.395	1.11	1.34	0.64	0.71	0.89	6.0	8.5	7.3	6.51	6.99	5.30	15	1.00	39.59	41.31	42.46	43.95	43.90	46.14	CB-305 to CB-302
8	7	177.302	0.23	0.23	0.79	0.18	0.18	6.0	6.0	7.9	1.44	6.99	1.20	15	1.00	41.31	43.08	44.17	44.24	46.14	46.72	CB-306 to CB-305

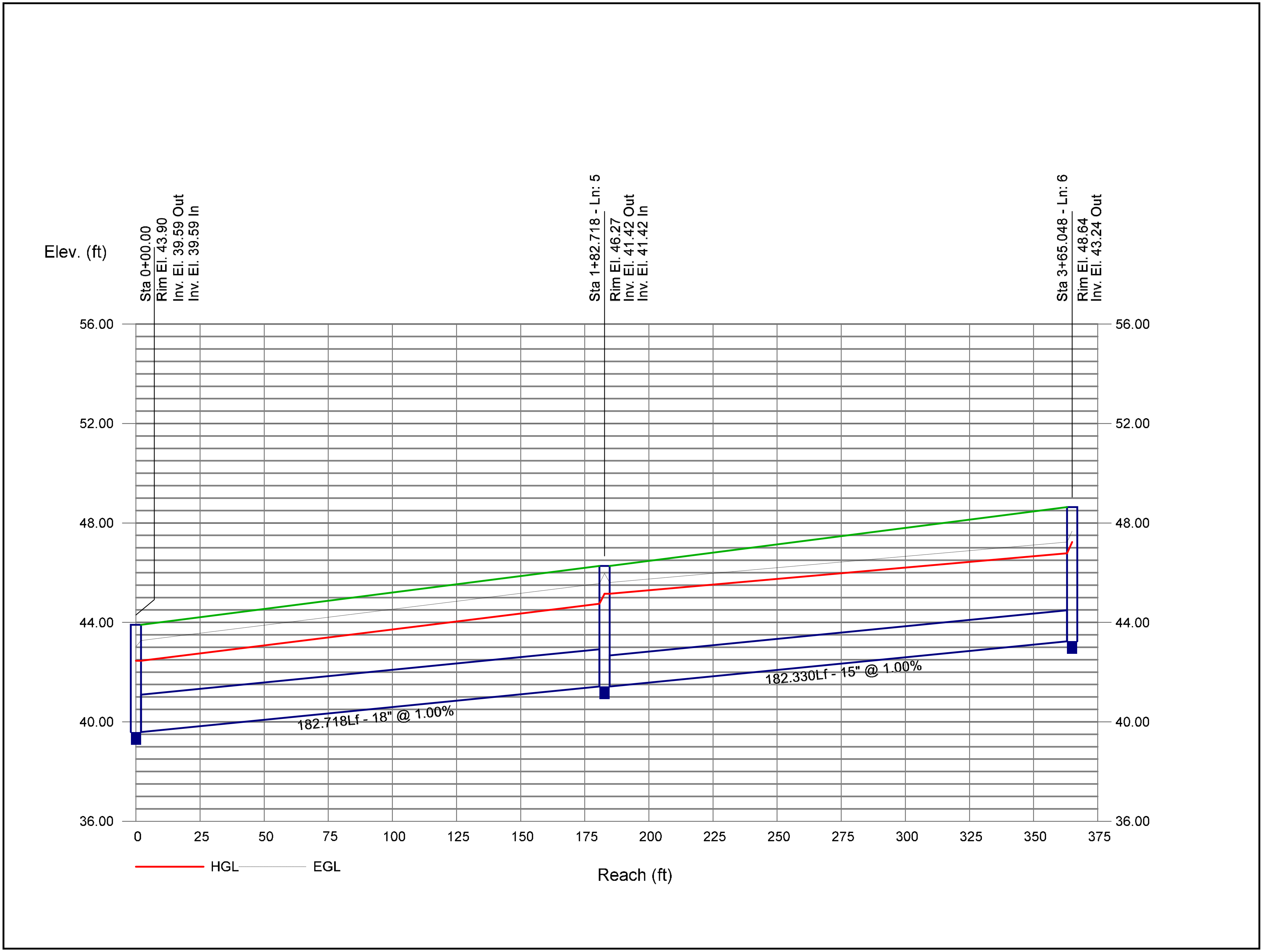
Project File: Storm 300.stm | Number of lines: 8 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

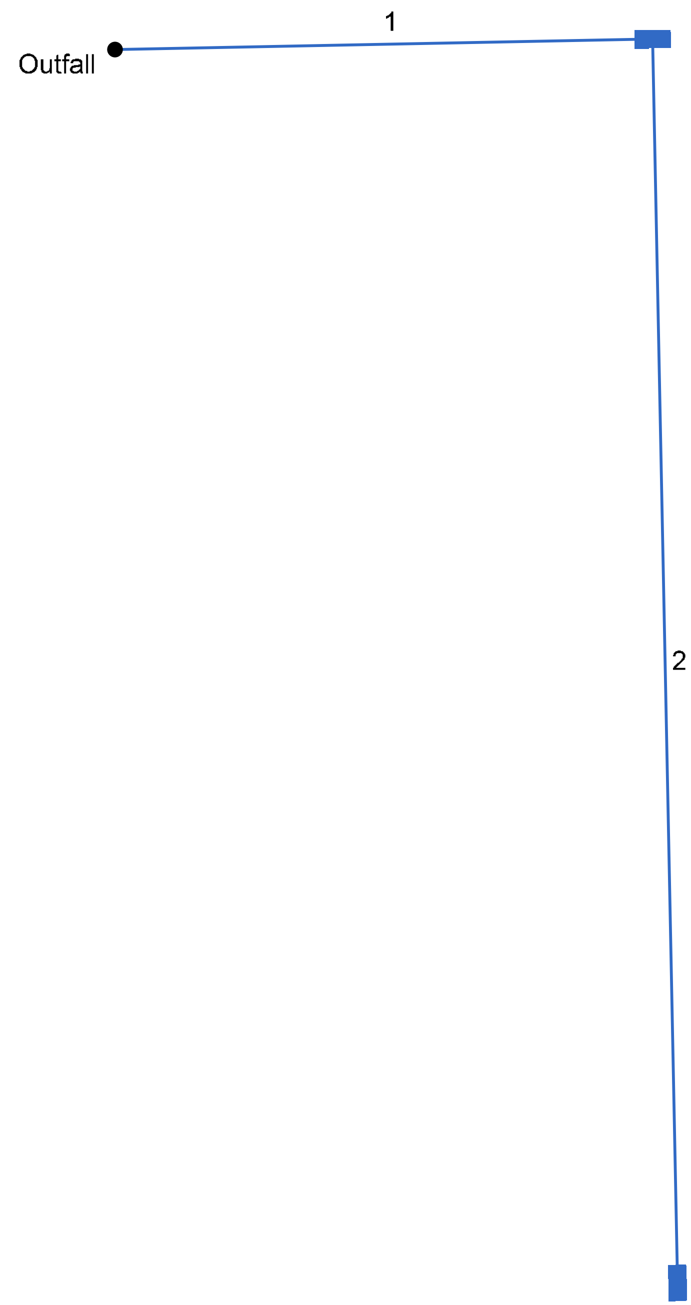
Storm Sewer Profile



Storm Sewer Profile



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 400.stm	Number of lines: 2	Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	60.000	-1.149	Comb	0.00	0.22	0.97	6.0	29.10	2.47	30.58	18	Cir	0.012	1.50	47.04	CB-402 to FES-401
2	1	139.500	90.000	Comb	0.00	0.23	0.99	6.0	30.58	1.25	32.32	15	Cir	0.012	1.00	47.04	CB-401 to CB-402

Project File: Storm 400.stm | Number of lines: 2 | Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	CB-402 to FES-401	3.39	18	Cir	60.000	29.10	30.58	2.467	32.08*	32.13*	0.09	32.22	End	Combination
2	CB-401 to CB-402	1.81	15	Cir	139.500	30.58	32.32	1.247	32.22	32.85	n/a	32.85 j	1	Combination

Project File: Storm 400.stm | Number of lines: 2 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

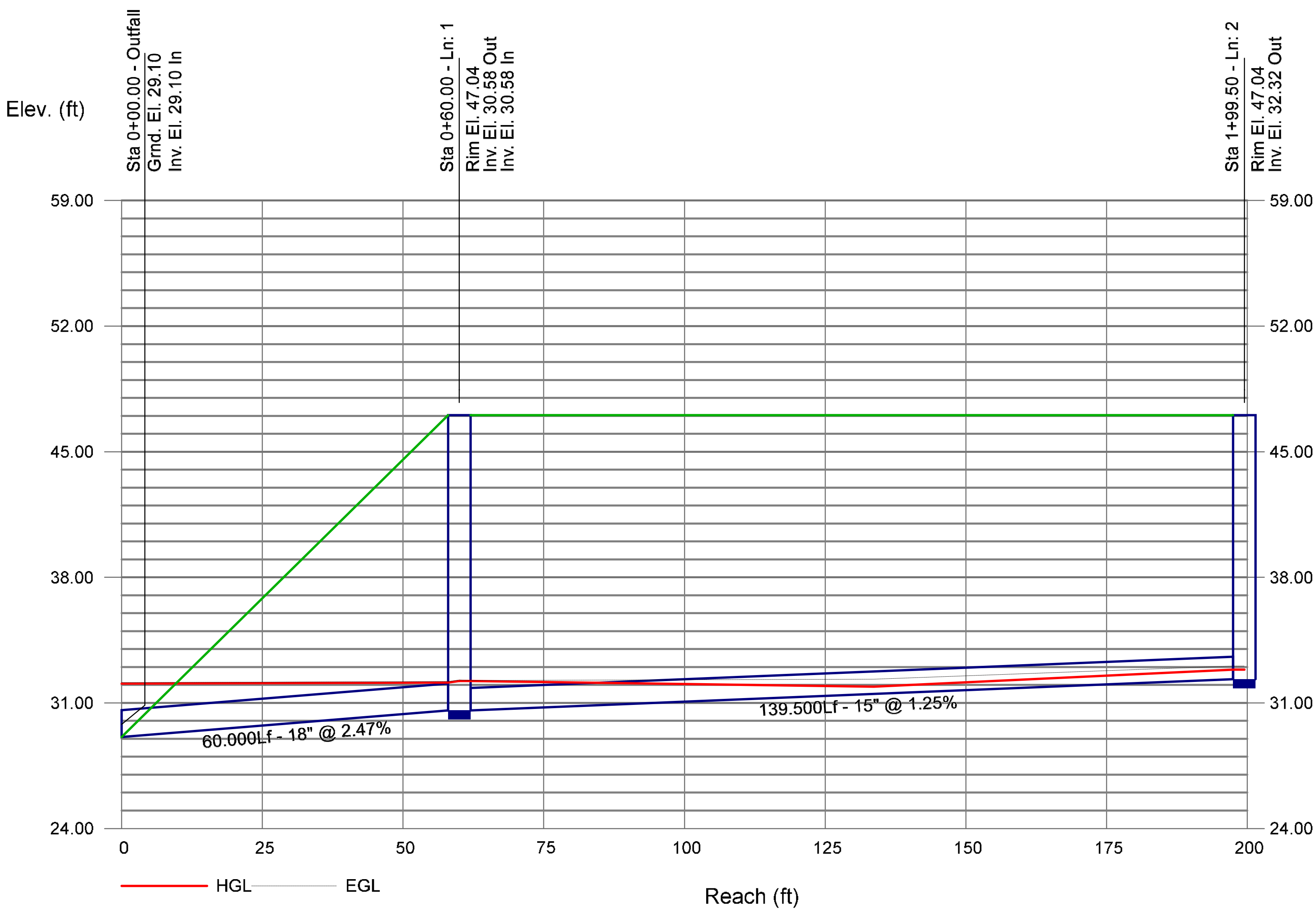
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	60.000	0.22	0.45	0.97	0.21	0.44	6.0	6.9	7.7	3.39	17.87	1.92	18	2.47	29.10	30.58	32.08	32.13	29.10	47.04	CB-402 to FES-40
2	1	139.500	0.23	0.23	0.99	0.23	0.23	6.0	6.0	7.9	1.81	7.81	2.54	15	1.25	30.58	32.32	32.22	32.85	47.04	47.04	CB-401 to CB-402

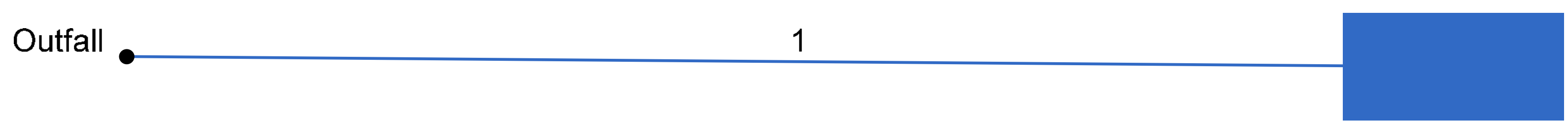
Project File: Storm 400.stm | Number of lines: 2 | Run Date: 3/25/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 500.stm	Number of lines: 1	Date: 1/27/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	24.017	0.411	Comb	0.00	0.09	0.99	6.0	37.00	1.00	37.24	12	Cir	0.012	1.00	41.09	CB-501 TO FES-501

Project File: Storm 500.stm	Number of lines: 1	Date: 1/27/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	CB-501 TO FES-501	0.71	12	Cir	24.017	37.00	37.24	0.999	38.68*	38.69*	0.01	38.70	End	Combination

Project File: Storm 500.stm | Number of lines: 1 | Run Date: 1/27/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).

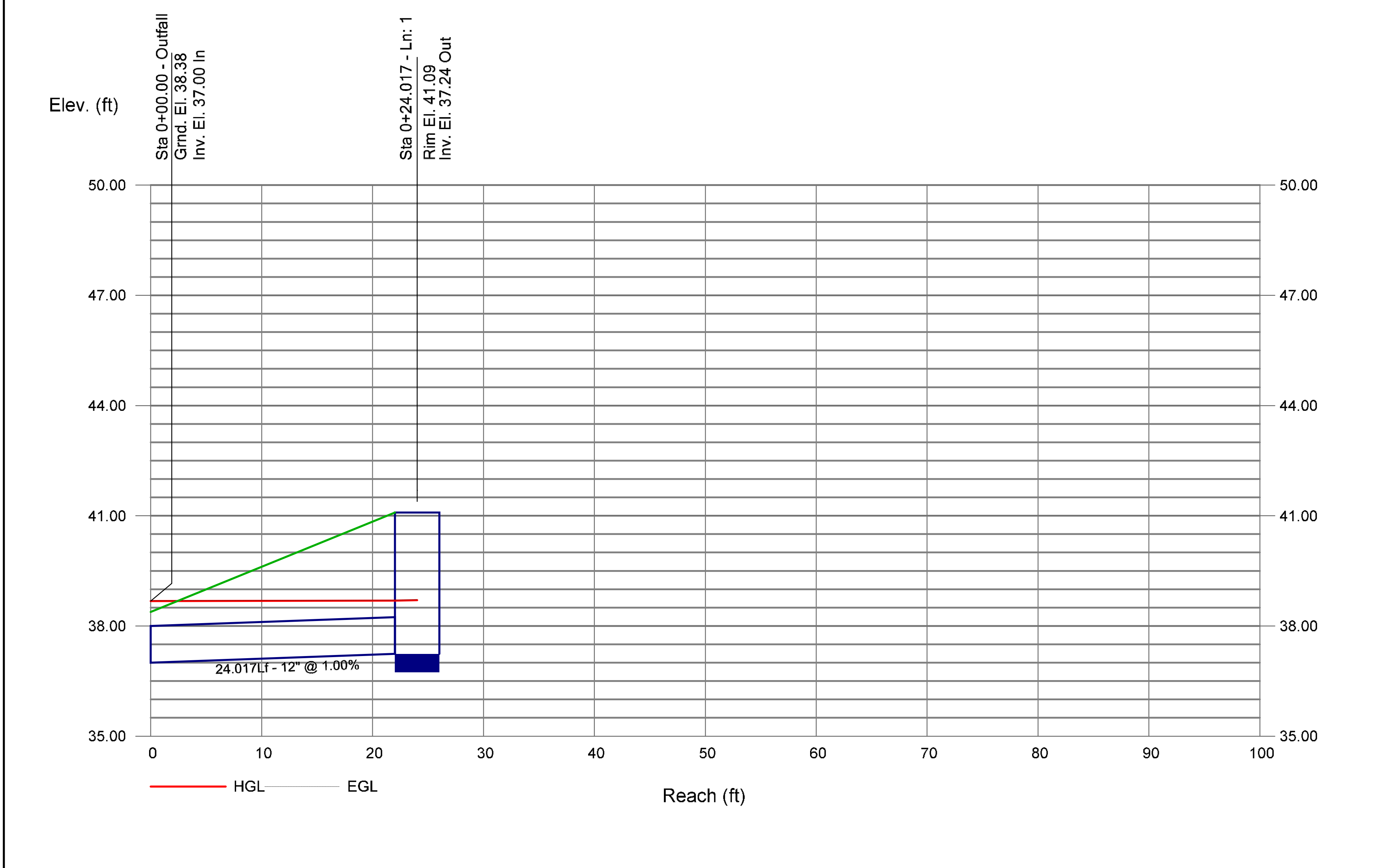
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	24.017	0.09	0.09	0.99	0.09	0.09	6.0	6.0	7.9	0.71	3.86	0.90	12	1.00	37.00	37.24	38.68	38.69	38.38	41.09	CB-501 TO FES-5

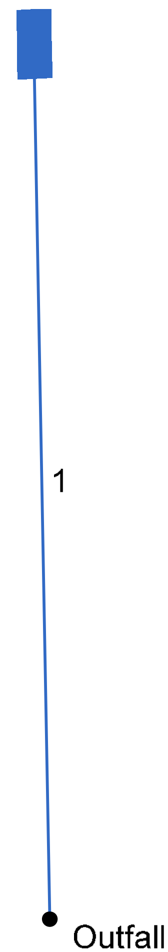
Project File: Storm 500.stm | Number of lines: 1 | Run Date: 1/27/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 600.stm	Number of lines: 1	Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	50.680	-91.042	MH	30.13	0.00	0.00	6.0	31.00	1.34	31.68	36	Cir	0.012	1.00	36.70	OCS-601 TO FES-601

Project File: Storm 600.stm | Number of lines: 1 | Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	OCS-601 TO FES-601	30.13	36	Cir	50.680	31.00	31.68	1.342	33.14	33.46	n/a	33.46 j	End	Manhole

Project File: Storm 600.stm | Number of lines: 1 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

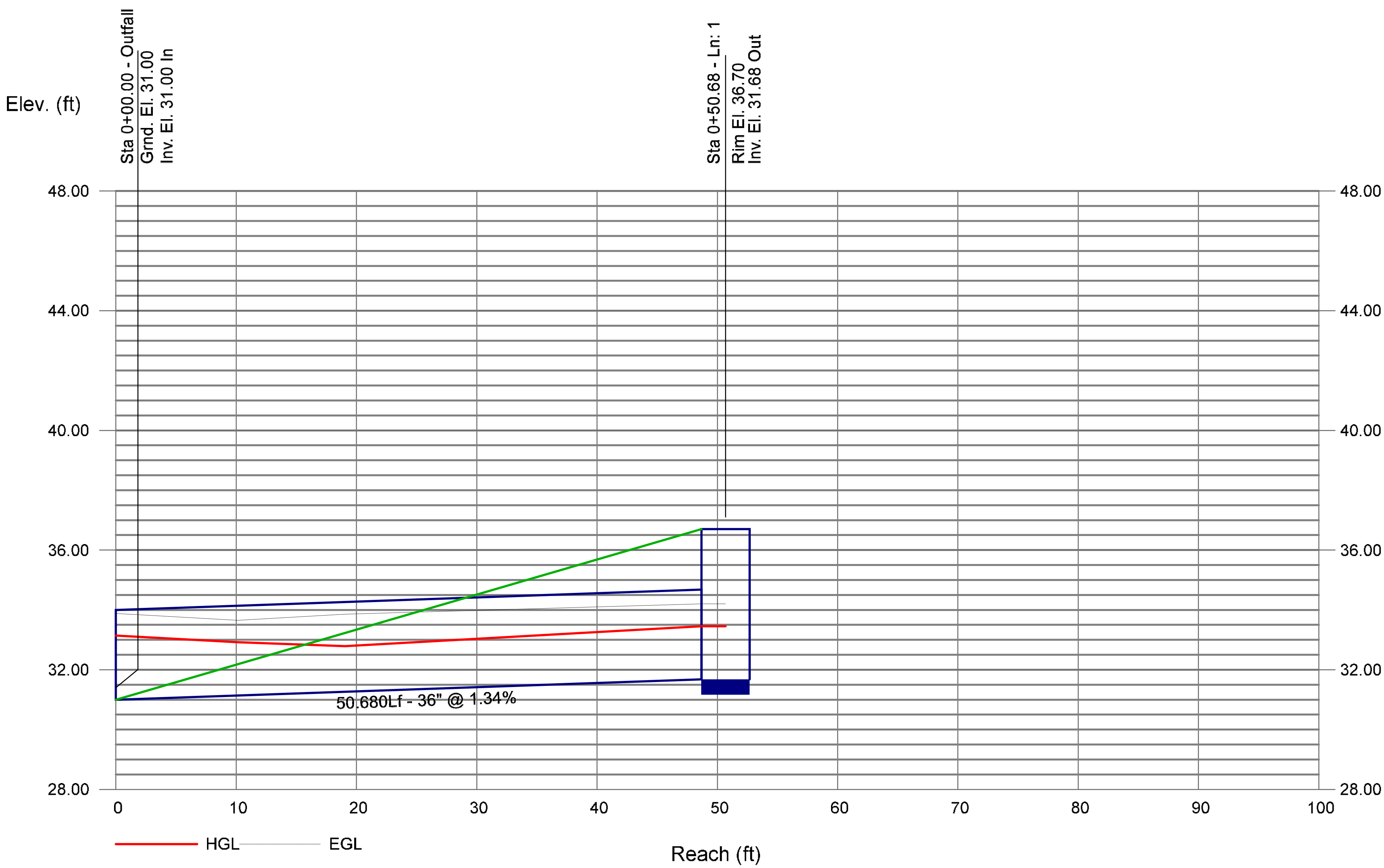
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	50.680	0.00	0.00	0.00	0.00	0.00	6.0	6.0	0.0	30.13	83.69	6.25	36	1.34	31.00	31.68	33.14	33.46	31.00	36.70	OCS-601 TO FES

Project File: Storm 600.stm | Number of lines: 1 | Run Date: 3/25/2020

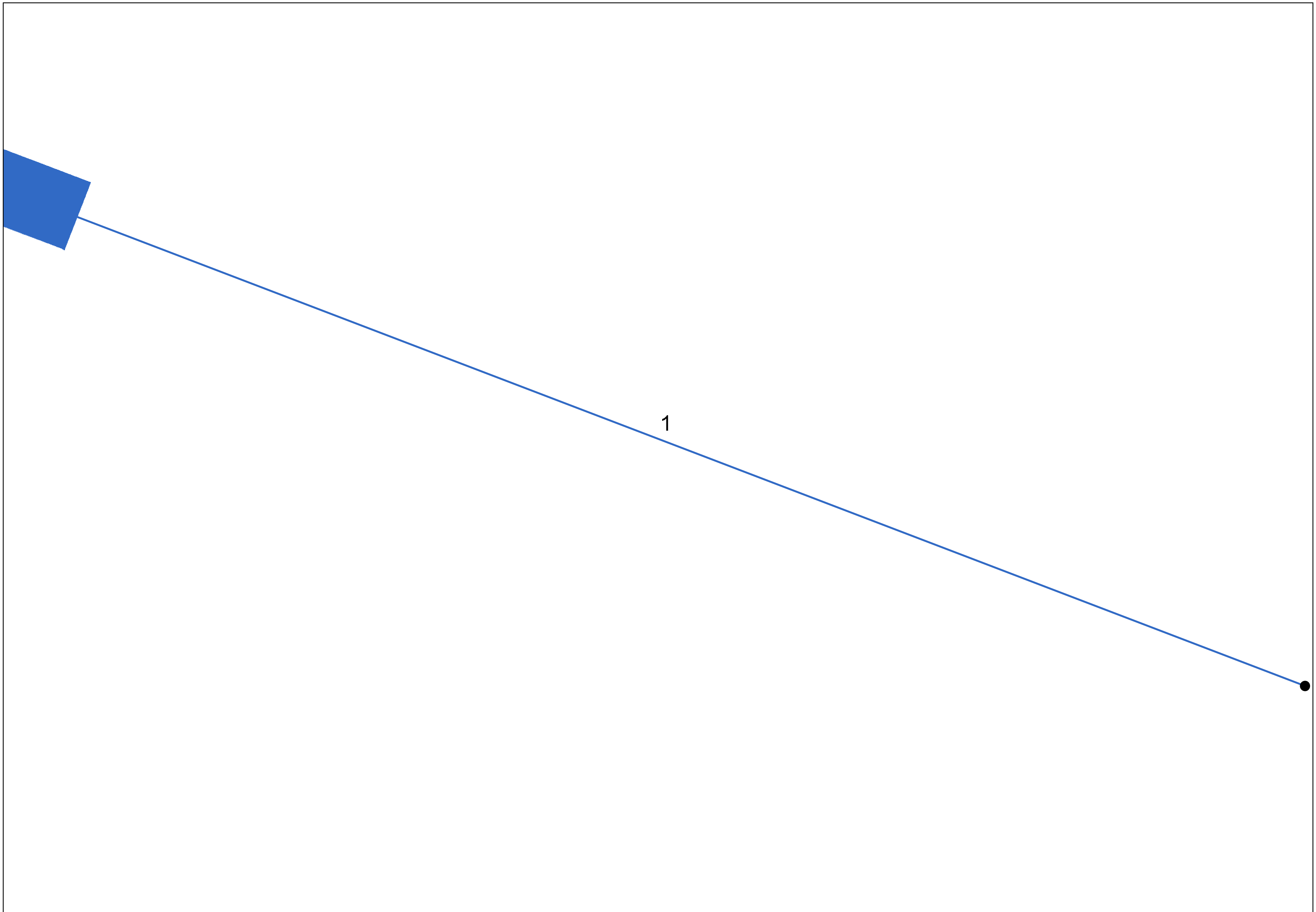
NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: Storm 600.stm



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 700.stm	Number of lines: 1	Date: 3/25/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	38.048	-158.762	Comb	0.00	0.58	0.81	6.0	37.00	1.00	37.38	15	Cir	0.012	1.00	41.05	CB-701 TO FES-701

Project File: Storm 700.stm | Number of lines: 1 | Date: 3/25/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	CB-701 TO FES-701	3.73	15	Cir	38.048	37.00	37.38	0.999	37.83	38.16	n/a	38.16 j	End	Combination

Project File: Storm 700.stm | Number of lines: 1 | Run Date: 3/25/2020

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

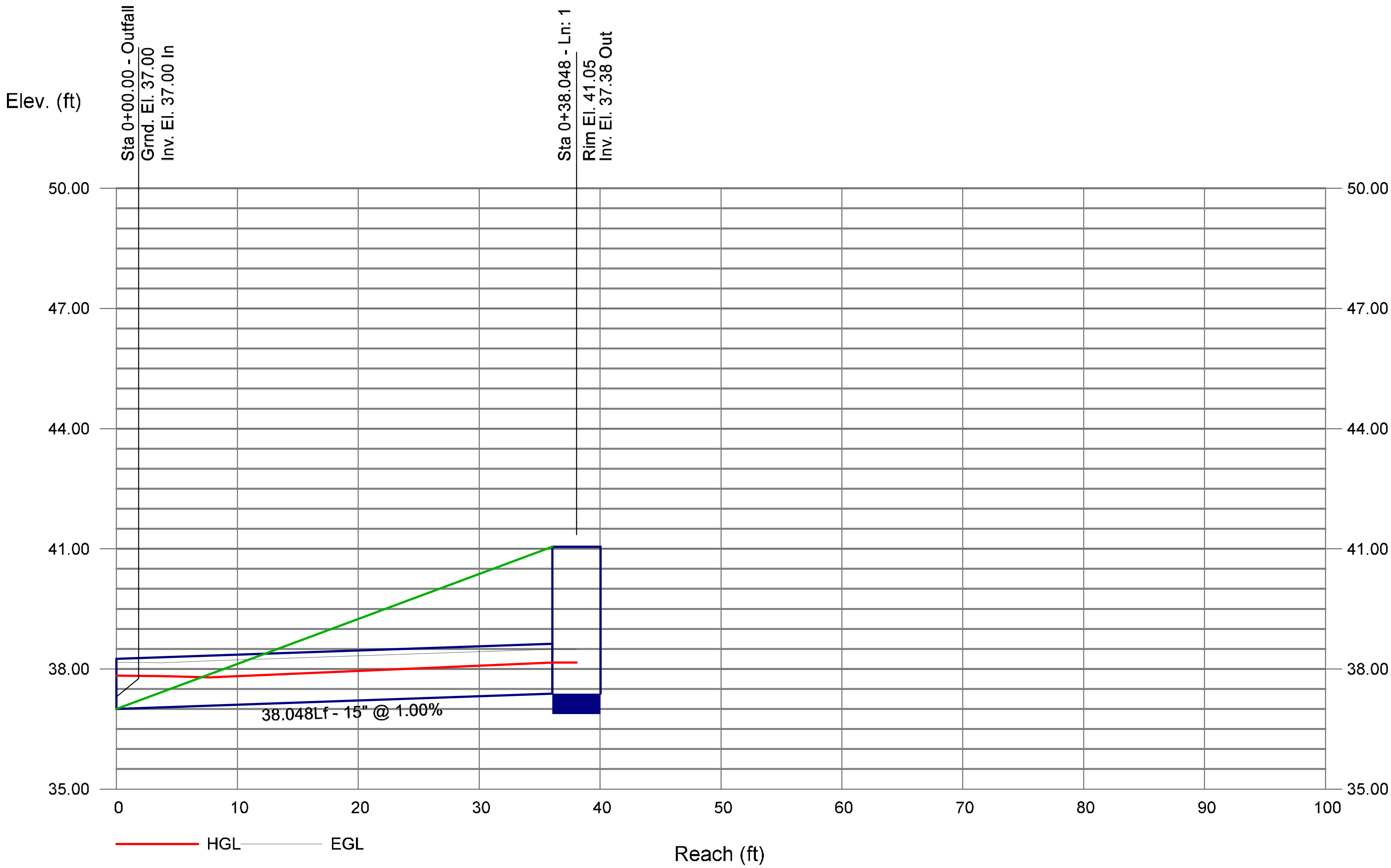
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	38.048	0.58	0.58	0.81	0.47	0.47	6.0	6.0	7.9	3.73	6.99	4.47	15	1.00	37.00	37.38	37.83	38.16	37.00	41.05	CB-701 TO FES-7

Project File: Storm 700.stm | Number of lines: 1 | Run Date: 3/25/2020

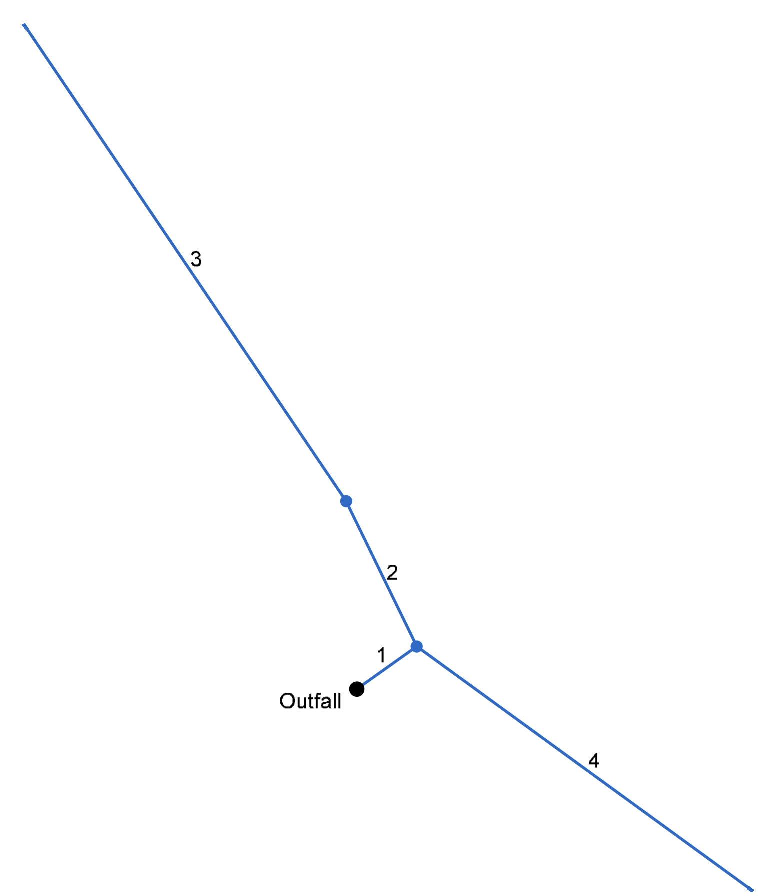
NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: Storm 700.stm



Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 800.stm	Number of lines: 4	Date: 1/27/2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	47.205	-35.576	MH	0.00	0.00	0.00	0.0	22.67	1.00	23.14	30	Cir	0.012	0.99	38.02	MH-801 to EX. MH
2	1	104.054	-80.203	MH	0.00	0.00	0.00	0.0	23.14	1.03	24.21	24	Cir	0.012	0.17	42.93	MH-802 to MH-801
3	2	368.800	-8.125	MH	9.34	0.00	0.00	0.0	24.21	1.03	28.00	24	Cir	0.012	1.00	33.00	OCS-802 to MH-802
4	1	265.179	71.766	MH	49.70	0.00	0.00	0.0	23.14	2.53	29.86	30	Cir	0.012	1.00	37.07	OCS-801 to MH-801

Project File: Storm 800.stm	Number of lines: 4	Date: 1/27/2020

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	MH-801 to EX. MH	59.04	30	Cir	47.205	22.67	23.14	0.996	28.90*	29.73*	2.23	31.96	End	Manhole
2	MH-802 to MH-801	9.34	24	Cir	104.054	23.14	24.21	1.028	31.96*	32.11*	0.02	32.14	1	Manhole
3	OCS-802 to MH-802	9.34	24	Cir	368.800	24.21	28.00	1.028	32.14*	32.67*	0.14	32.81	2	Manhole
4	OCS-801 to MH-801	49.70	30	Cir	265.179	23.14	29.86	2.534	31.96*	35.28*	1.59	36.87	1	Manhole

Project File: Storm 800.stm | Number of lines: 4 | Run Date: 1/27/2020

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

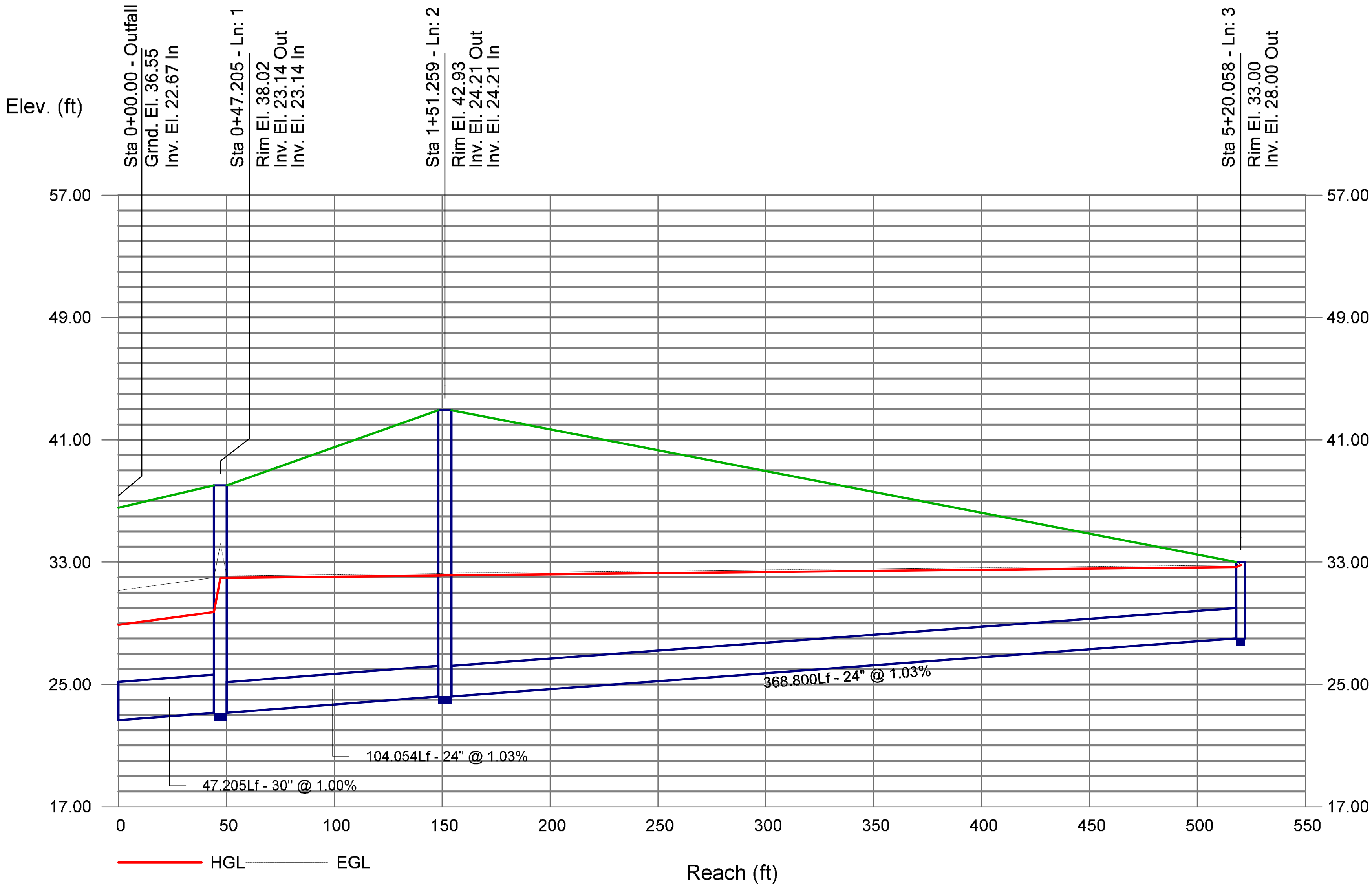
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	47.205	0.00	0.00	0.00	0.00	0.00	0.0	2.7	0.0	59.04	44.33	12.03	30	1.00	22.67	23.14	28.90	29.73	36.55	38.02	MH-801 to EX. M
2	1	104.054	0.00	0.00	0.00	0.00	0.00	0.0	2.1	0.0	9.34	24.85	2.97	24	1.03	23.14	24.21	31.96	32.11	38.02	42.93	MH-802 to MH-80
3	2	368.800	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	9.34	24.84	2.97	24	1.03	24.21	28.00	32.14	32.67	42.93	33.00	OCS-802 to MH-8
4	1	265.179	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	49.70	70.72	10.13	30	2.53	23.14	29.86	31.96	35.28	38.02	37.07	OCS-801 to MH-8

Project File: Storm 800.stm | Number of lines: 4 | Run Date: 1/27/2020

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

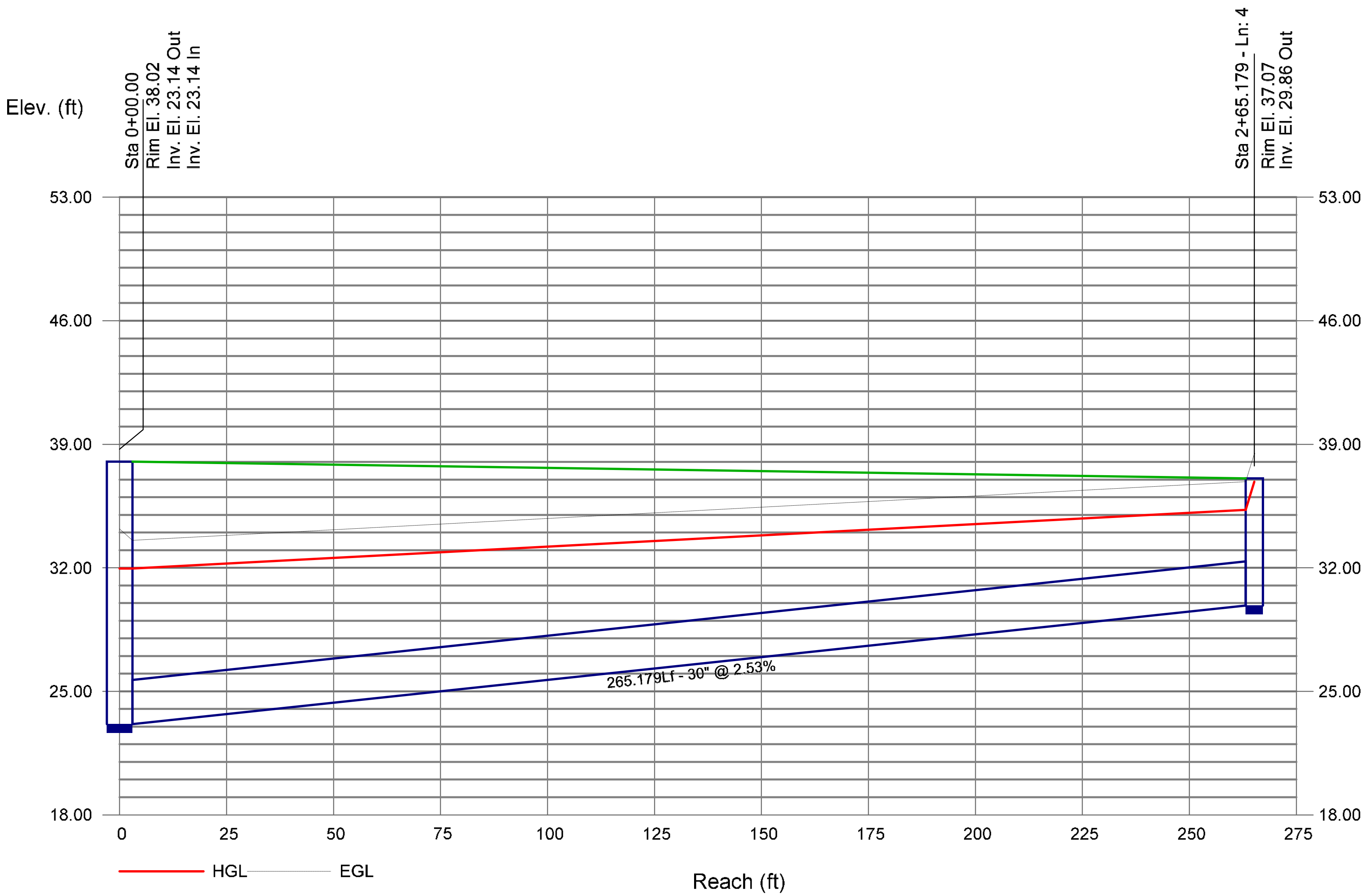
Storm Sewer Profile

Proj. file: Storm 800.stm



Storm Sewers

Storm Sewer Profile



APPENDIX E

CONDUIT OUTLET PROTECTION, SEDIMENT BASIN & EMERGENCY SPILLWAY CALCULATIONS

Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 7.93 ft/sec
Rip Rap Apron required? 1 (1 = yes, 0 = no)

Given:

D_o (max inside height) = 3 feet
W_o (max inside width) = 3 feet
Q (discharge) = 42.03 cfs (25 year storm)
*q (unit discharge, = Q/W_o) = 14.0 cfs / foot
** T_w (tail water) = 2.08 feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½\ D_o$ L_a = 0 feet

$$L_a = 3\frac{q}{D_o^{1/2}}$$

$T_w > ½\ D_o$ **L_a = 24 feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = 19 feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = 0 feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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Project: **Rip Rap Apron at Flared End Section 101**

RIP-RAP APRON DESIGN CALCULATIONS
PROPOSED WAREHOUSE
BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

For Horizontal Apron: $\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$ Where $q = Q/D_o$

D_{50} = 0.32 feet *OR* **D_{50} = 3.9 inches**

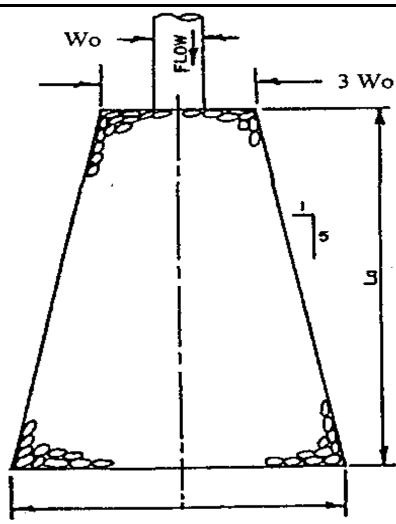
Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.
* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used. t = 11.6 inches
2. A thickness of at least two times the D_{50} size if a filter layer is used. **t = 7.7 inches**

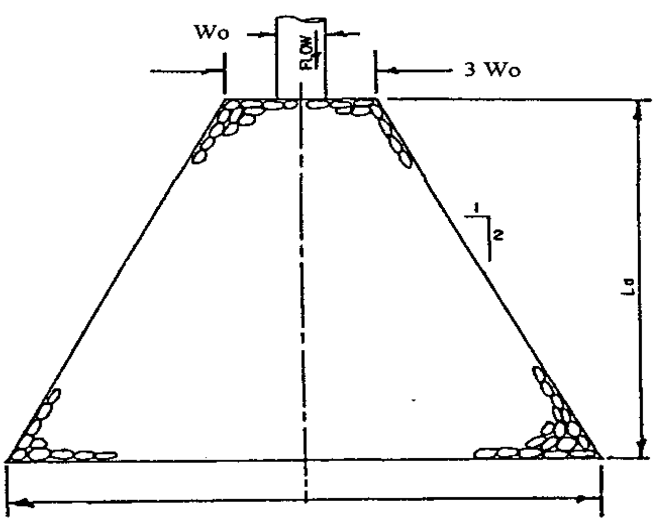
* The minimum thickness shall be 6 inches.



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 24 feet

W= 19 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

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Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 8.53 ft/sec
Rip Rap Apron required? 1 (1 = yes, 0 = no)

Given:

D_o (max inside height) = 4 feet
W_o (max inside width) = 4 feet
Q (discharge) = 107.16 cfs (25 year storm)
*q (unit discharge, = Q/W_o) = 26.8 cfs / foot
** T_w (tail water) = 4.61 feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8 \frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½\ D_o$ L_a = 0 feet

$$L_a = 3 \frac{q}{D_o^{1/2}}$$

$T_w > ½\ D_o$ **L_a = 40 feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = 28 feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = 0 feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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Project: **Rip Rap Apron at Flared End Section 201**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

For Horizontal Apron: $$\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$$

Where $q = Q/D_o$

D_{50} = 0.34 feet *OR* **D_{50} = 4.1 inches**

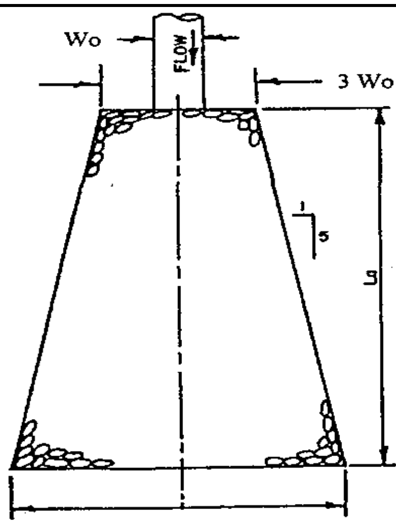
Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.
* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used. t = 12.4 inches
2. A thickness of at least two times the D_{50} size if a filter layer is used. **t = 8.3 inches**

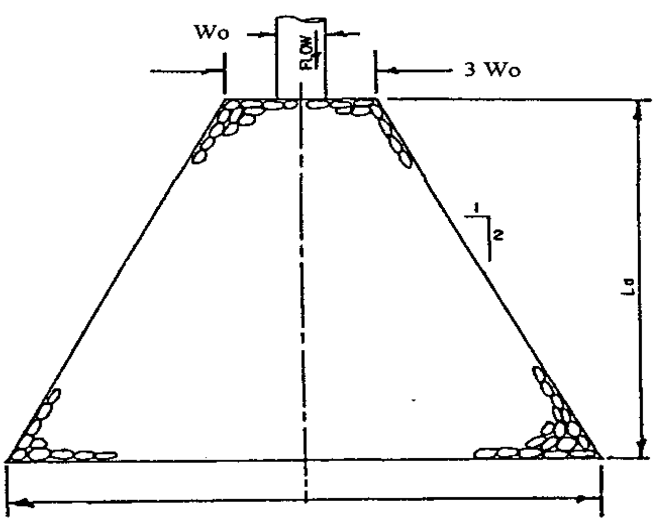
* The minimum thickness shall be 6 inches.



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 40 feet

W= 28 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

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Project: **Rip Rap Apron at Flared End Section 201**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	2 of 2

Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 7.06 ft/sec
Rip Rap Apron required? 1 (1 = yes, 0 = no)

Given:

D_o (max inside height) = 3 feet
W_o (max inside width) = 3 feet
Q (discharge) = 28.08 cfs (25 year storm)
*q (unit discharge, = Q/W_o) = 9.4 cfs / foot
** T_w (tail water) = 1.59 feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½\ D_o$ L_a = 0 feet

$$L_a = 3\frac{q}{D_o^{1/2}}$$

$T_w > ½\ D_o$ **L_a = 16 feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = 15 feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = 0 feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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Project: **Rip Rap Apron at Flared End Section 301**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

Where $q = Q/D_o$

For Horizontal Apron: $$\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$$

$D_{50} =$ 0.25 feet *OR* **D_{50} = 3.0 inches**

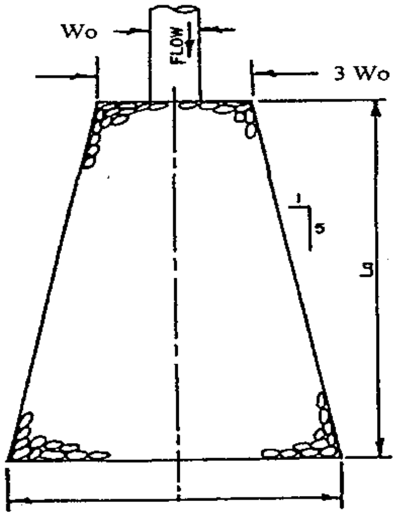
Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.
* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used. t = 9.0 inches
2. A thickness of at least two times the D_{50} size if a filter layer is used. **t = 6.0 inches**

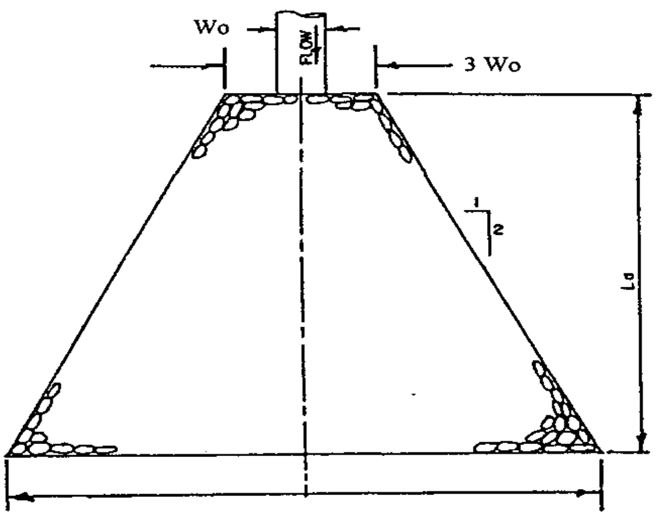
* The minimum thickness shall be 6 inches.



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 16 feet

W= 15 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

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Project No. 100594413	Date: 1/27/2020	By: SLK	Ckd: LM	Sheet. No. 2 of 2

Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 1.92 ft/sec
Rip Rap Apron required? 0 (1 = yes, 0 = no)

Given:

D_o (max inside height) = ____ feet
W_o (max inside width) = ____ feet
Q (discharge) = ____ cfs (25 year storm)
*q (unit discharge, = Q/W_o) = ____ cfs / foot
** T_w (tail water) = ____ feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½\ D_o$ L_a = feet

$$L_a = 3\frac{q}{D_o^{1/2}}$$

$T_w > ½\ D_o$ **L_a = feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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Project: **Rip Rap Apron at Flared End Section 401**

RIP-RAP APRON DESIGN CALCULATIONS
PROPOSED WAREHOUSE
BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

For Horizontal Apron:

$$\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$$

Where q = Q/D_o

D_{50} = ##### feet *OR* **D_{50} = inches**

Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.
* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

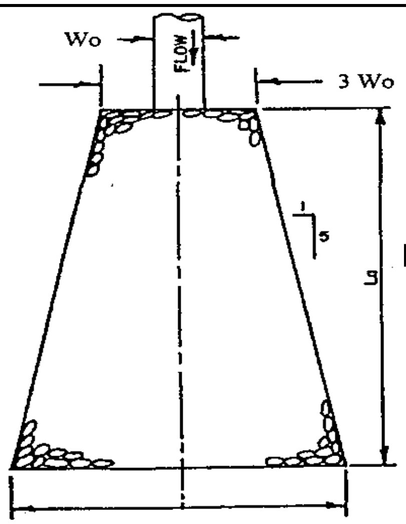
The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used.
2. A thickness of at least two times the D_{50} size if a filter layer is used.

* The minimum thickness shall be 6 inches.

t = 0.0 inches

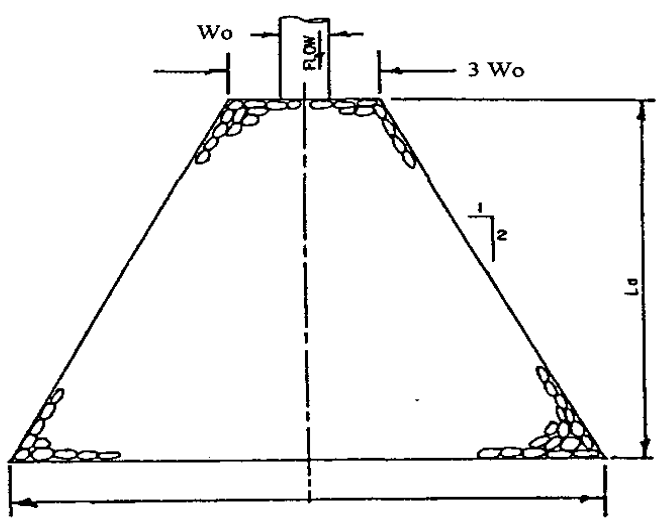
t = inches



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

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Project: **Rip Rap Apron at Flared End Section 401**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	2 of 2

Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 0.9 ft/sec
Rip Rap Apron required? 0 (1 = yes, 0 = no)

Given:

D_o (max inside height) = ______ feet
W_o (max inside width) = ______ feet
Q (discharge) = ______ cfs (25 year storm)
*q (unit discharge, = Q/W_o) = ______ cfs / foot
** T_w (tail water) = ______ feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½ D_o$ — L_a = feet

$$L_a = 3\frac{q}{D_o^{1/2}}$$

$T_w > ½ D_o$ — **L_a = feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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Project: **Rip Rap Apron at Flared End Section 501**

RIP-RAP APRON DESIGN CALCULATIONS
PROPOSED WAREHOUSE
BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

Where $q = Q/D_o$

For Horizontal Apron: $$\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$$

D_{50} = ##### feet *OR* **D_{50} = inches**

Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.

* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

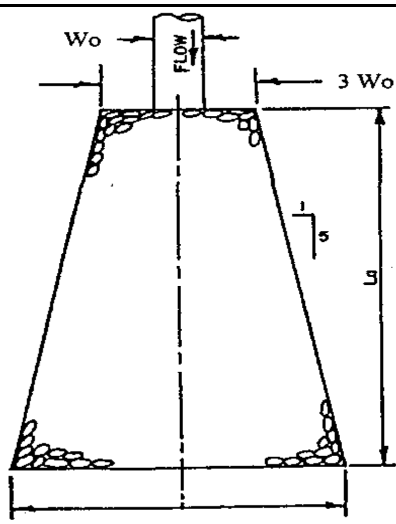
The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used.
2. A thickness of at least two times the D_{50} size if a filter layer is used.

* The minimum thickness shall be 6 inches.

t = 0.0 inches

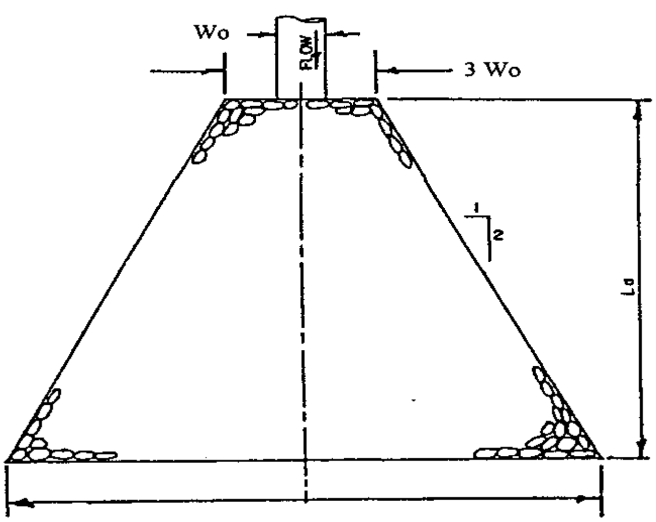
t = inches



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

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Project: **Rip Rap Apron at Flared End Section 501**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	2 of 2

Based on "Standards for Soil Erosion and Sediment Control in New Jersey," dated January 2014

TABLE 12-1 ALLOWABLE VELOCITIES FOR VARIOUS SOILS

SOIL TEXTURE	ALLOWABLE VELOCITY (ft./sec.)
1. Sand	1.8
2. Sandy Loam	2.5
3. Silt loam (also high lime clay), loam	3.0
4. Sandy clay loam	3.5
5. Clay loam	4.0
6. Clay, fine gravel, graded loam to gravel	5.0
7. Cobbles	5.5
8. Shale (non-weathered)	6.0

Soil type where outfall is located = 3 (Note: Select number designating soil texture above)
allowable velocity = 3.0 ft/sec
v (velocity) = 7.81 ft/sec
Rip Rap Apron required? 1 (1 = yes, 0 = no)

Given:

D_o (max inside height) = 3 feet
W_o (max inside width) = 3 feet
Q (discharge) = 38.32 cfs (25 year storm)
*q (unit discharge, = Q/W_o) = 12.8 cfs / foot
** T_w (tail water) = 4.61 feet

* for the conduit design storm or the 25 year storm, whichever is greater
** for areas where T_w cannot be computed, use $T_w = 0.2\ D_o$. For discharge into detention basins, Tw shall equal the 2 year storm elevation in the basin.

Riprap Apron Dimensions

I. The length of the apron, L (in feet), shall be determined from the formula:

$$L_a = (1.8\frac{q}{D_o^{1/2}}) + 7D_o$$

$T_w < ½\ D_o$ L_a = 0 feet

$$L_a = 3\frac{q}{D_o^{1/2}}$$

$T_w > ½\ D_o$ **L_a = 22 feet**

II. Where there is no well-defined channel immediately downstream of the apron, the width, W, of the outlet end of the apron shall be as follows:

For tailwater elevation greater than or equal to the elevation of the center of the pipe,

$$W = 3W_o + 0.4L_a$$

W = 18 feet

For tailwater elevation less than the elevation of the center of the pipe,

$$W = 3W_o + L_a$$

W = 0 feet

Where L_a is the length of the apron determined from the formula and W_o is the culvert width.

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NJ Certificate of Authorization No: 24GA27996400

Project: **Rip Rap Apron at Flared End Section 601**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	1 of 2

*Riprap Median Stone Diameter**

The median stone diameter, D_{50}, in feet, shall be determined from the formula:

For Horizontal Apron: $\boxed{D_{50} = \frac{0.02}{T_w} q^{1.33}}$ Where $q = Q/D_o$

D_{50} = 0.13 feet *OR* **D_{50} = 3.0 inches**

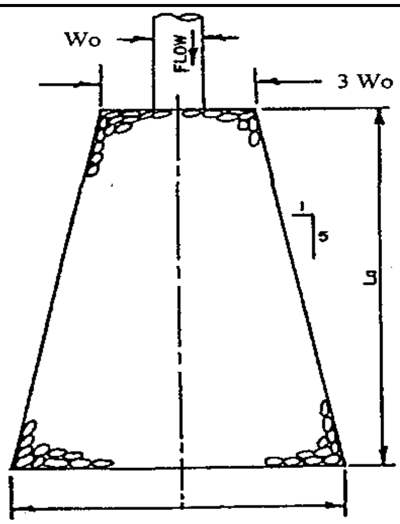
Note: For discharge into Detention Basins, analyze the hydraulic characteristics of the basin for the design storm to determine the combination of conduit discharge and tailwater that results in the largest required D50 stone size.
* The minimum d50 stone size shall be 3 inches.

*Riprap Lining Thickness**

The thickness of riprap lining shall meet at least one of the following criteria:

1. A thickness of at least three times the D_{50} size if a filter layer is not used. t = 9.0 inches
2. A thickness of at least two times the D_{50} size if a filter layer is used. **t = 6.0 inches**

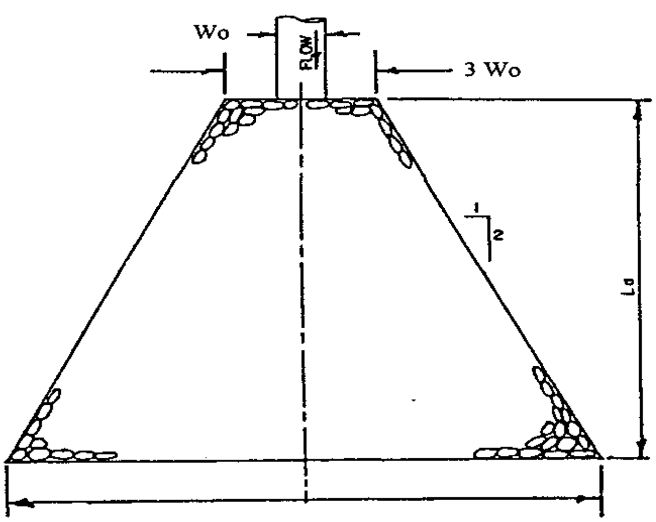
* The minimum thickness shall be 6 inches.



For tailwater elevation greater than or equal to the elevation of the center of the pipe

L_a = 22 feet

W= 18 feet



For tailwater elevation less than the elevation of the center of the pipe

L_a = 0 feet

W= 0 feet

LANGAN

300 Kimball Drive Parsippany, NJ
P: 973.560.4900 F: 973.560.4901
NJ Certificate of Authorization No: 24GA27996400

Project: **Rip Rap Apron at Flared End Section 601**

RIP-RAP APRON DESIGN CALCULATIONS

PROPOSED WAREHOUSE

BOROUGH OF MIDDLESEX, MIDDLESEX COUNTY, NEW JERSEY

Project No.	Date:	By:	Ckd:	Sheet. No.
100594413	1/27/2020	SLK	LM	2 of 2

SEDIMENT BASIN SIZING CALCULATIONS

Middlesex Borough Warehouse Project
100594413
1/21/2019

The volume in the sediment basin within the proposed excavated flood storage areas shall be the larger of:

1) The volume necessary to obtain 70% trap efficiency at the start of the basin's useful life, or
2) The volume necessary to provide sediment storage capacity and provide for temporary stormwater runoff storage from a 2-year frequency, 24-hour duration, Type III storm.

Using procedure in Section 24 of the "Standards for Soil Erosion and Sediment Control in New Jersey."

I. VOLUME FOR ADEQUATE EFFICIENCY

Set Trap Efficiency at:	75%	(For a normally dry sediment basin, the actual trap efficiency is reduced 5% where the incoming sediment is sand or coarse grained)	
Curve 24-1: C/I =	0.025	(Using Coarse-Grained Curve)	
Figure 24-1: Average Annual Runoff =	19.50	inches	
Area =	30.95	acres	(Existing Watershed 1, 2, & 3)
I = Runoff x Area =	50.29	acre-feet	
C/I = 0.025 C =	1.26	acre-feet	

This represents the minimum volume in the sediment basin within the proposed excavated flood storage areas to obtain 70% trap efficiency.

II. SEDIMENT STORAGE CAPACITY

Volume for Sediment Storage

Drainage Area =	30.95	acres	
Drainage Area =	0.048	sq. mi.	
Average Annual Erosion A =	50	ton/ac/yr	(For Construction Areas)
Erosion (DA)(A) =	1547.5	tons	(12 Months of Land Disturbance)
Curve 24-2: DR =	29%		(Sandy)
From Table 24-1: γ =	100	lb/cuft	(Sand)
V = (DA)(A)(DR)(TE)(1/γ)(2,000 lbs/ton)(1/43,560 sf/ac) =	0.15	acre-feet	

Volume for Stormwater Storage

Stormwater Storage Volume =	3.85	acre-feet	(From Hydrographs)
Total Volume Required =	4.00	acre-feet	
Total Volume Provided =	4.78	acre-feet	provided at elevation +/- 37

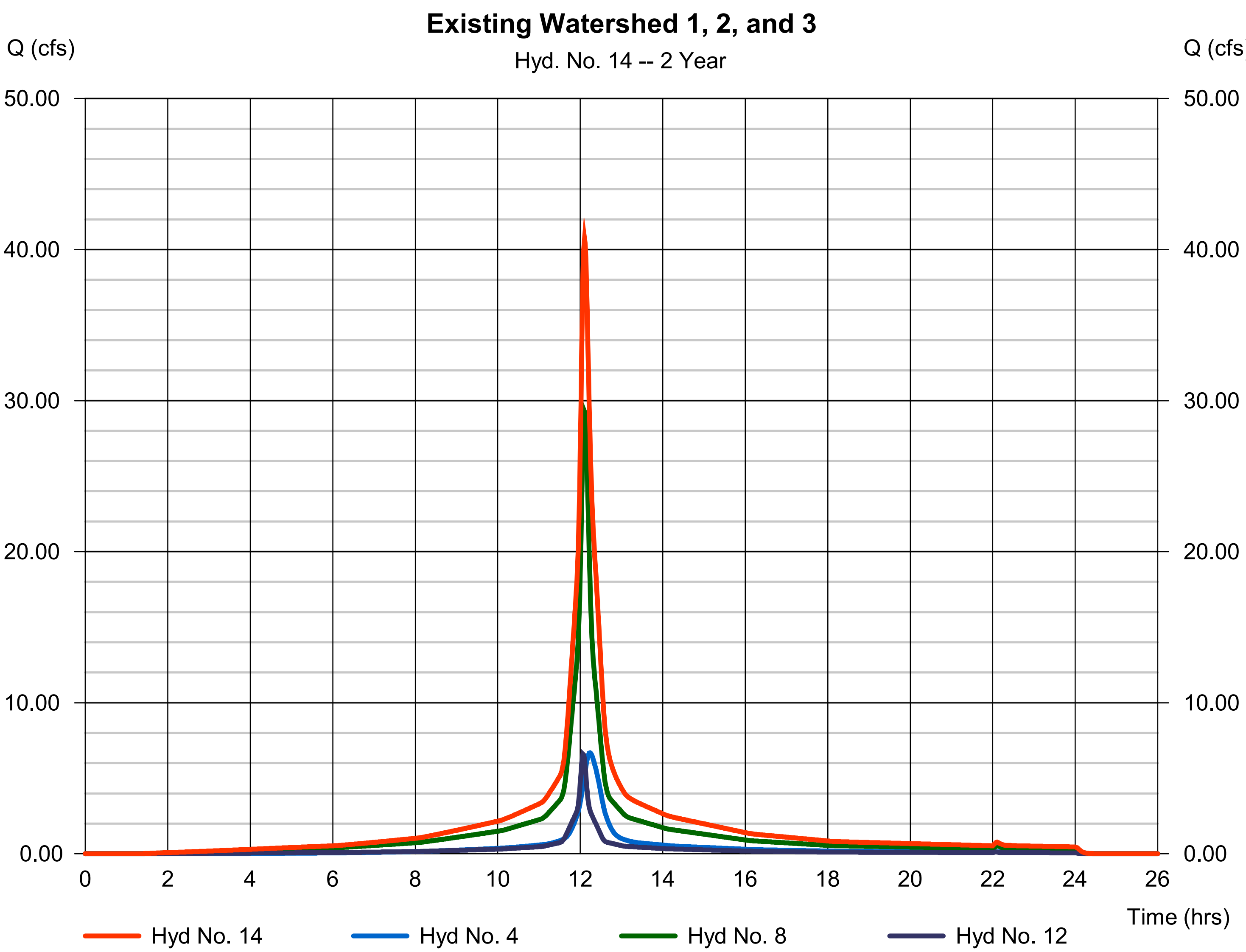
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Monday, 07 / 8 / 2019

Hyd. No. 14

Existing Watershed 1, 2, and 3

Hydrograph type	= Combine	Peak discharge	= 40.72 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 167,859 cuft
Inflow hyds.	= 4, 8, 12	Contrib. drain. area	= 0.000 ac



Pond Report

Pond No. 1 - Sediment Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 31.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	31.00	38,604	0	0
1.00	32.00	41,254	39,918	39,918
2.00	33.00	43,848	42,540	82,458
3.00	34.00	46,524	45,175	127,633
4.00	35.00	49,295	47,898	175,531
5.00	36.00	52,164	50,718	226,248
6.00	37.00	55,140	53,640	279,888
7.00	38.00	58,228	56,671	336,560
8.00	39.00	61,419	59,810	396,370

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	Inactive
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	Inactive	Inactive	Inactive
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	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).

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	31.00	---	---	---	---	---	---	---	---	---	---	0.000
1.00	39,918	32.00	---	---	---	---	---	---	---	---	---	---	0.000
2.00	82,458	33.00	---	---	---	---	---	---	---	---	---	---	0.000
3.00	127,633	34.00	---	---	---	---	---	---	---	---	---	---	0.000
4.00	175,531	35.00	---	---	---	---	---	---	---	---	---	---	0.000
5.00	226,248	36.00	---	---	---	---	---	---	---	---	---	---	0.000
6.00	279,888	37.00	---	---	---	---	---	---	---	---	---	---	0.000
7.00	336,560	38.00	---	---	---	---	---	---	---	---	---	---	0.000
8.00	396,370	39.00	---	---	---	---	---	---	---	---	---	---	0.000

EMERGENCY SPILLWAY

Design Criteria: 150% of the 100-year storm must pass assuming outlet control structure is completely blocked. 100% of 100-year storm based on Class III Dam.

Peak inflow into the basin during 150% of 100-year storm is $1.5 \times Q_{100}$ = 6 (cfs)

The width of the spillway is set at 5.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$Q = 3.1\ B\ H^{3/2}$

where Q = flow rate through spillway, cfs
H = weir height, ft
B = bottom of spillway width 5.00 ft
Side slopes = 4:1

Solving for H, $H = (Q / 3.1\ B)^{2/3}$

Substituting and solving for H yields a height of 0.56 ft

Average Velocity V = Q/A = Q/(B+4H)H = 1.60 ft/sec

Allowable velocity for soil type Loam is 3.00 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.60 **OK**

Proposed Warehouse Facility	BY	SLK	DATE	3/25/2020	PROJ NO. 100594413
Bioretention Basin 1 Emergency Spillway					SHEET 1 OF 4

EMERGENCY SPILLWAY

Design Criteria: 100% of the 100-year storm must pass assuming outlet control structure is completely blocked. 100% of 100-year storm based on Class III Dam.

Peak inflow into the basin during 150% of 100-year storm is 1.5 x Q_{100} = 66 (cfs)

The width of the spillway is set at 29.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$Q = 3.1\ B\ H^{3/2}$

where
Q = flow rate through spillway, cfs
H = weir height, ft
B = bottom of spillway width 29.00 ft
Side slopes = 4:1

Solving for H, $H = (Q / 3.1\ B)^{2/3}$

Substituting and solving for H yields a height of 0.82 ft

Average Velocity V = Q/A = Q/(B+4H)H = 2.52 ft/sec

Allowable velocity for soil type Loam is 3.00 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 2.52 **OK**

Proposed Warehouse Facility	BY	SLK	DATE	3/24/2020	PROJ NO.	100594413	
Bioretention Basin 2 Emergency Spillway					SHEET	2	OF 4

EMERGENCY SPILLWAY

Design Criteria: 100% of the 100-year storm must pass assuming outlet control structure is completely blocked. 100% of 100-year storm based on Class III Dam.

Peak inflow into the basin during 150% of 100-year storm is 1.5 x Q_{100} = 54 (cfs)

The width of the spillway is set at 20.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$Q = 3.1\ B\ H^{3/2}$

where
- Q = flow rate through spillway, cfs
- H = weir height, ft
- B = bottom of spillway width 20.00 ft
- Side slopes = 4:1

Solving for H, $H = (Q / 3.1\ B)^{2/3}$

Substituting and solving for H yields a height of 0.91 ft

Average Velocity V = Q/A = Q/(B+4H)H = 2.50 ft/sec

Allowable velocity for soil type Loam is 3.00 ft/sec

Actual velocity during 1.0 x 100-year emergency spillway discharge is 2.50 **OK**

Proposed Warehouse Facility	BY	SLK	DATE	3/25/2020	PROJ NO.	100594413	
Detention Basin 1 Emergency Spillway					SHEET	3 OF	4

EMERGENCY SPILLWAY

Design Criteria: 100% of the 100-year storm must pass assuming outlet control structure is completely blocked. 100% of 100-year storm based on Class III Dam.

Peak inflow into the basin during 150% of 100-year storm is 1.5 x Q_{100} = 82 (cfs)

The width of the spillway is set at 65.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$Q = 3.1\ B\ H^{3/2}$

where
- Q = flow rate through spillway, cfs
- H = weir height, ft
- B = bottom of spillway width 65.00 ft
- Side slopes = 4:1

Solving for H, $H = (Q / 3.1\ B)^{2/3}$

Substituting and solving for H yields a height of 0.55 ft

Average Velocity V = Q/A = Q/(B+4H)H = 2.22 ft/sec

Allowable velocity for soil type Loam is 3.00 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 2.22 **OK**

Proposed Warehouse Facility	BY	SLK	DATE	1/27/2020	PROJ NO.	100594413	
Detention Basin 2 Emergency Spillway					SHEET	3	OF 4

Standard for Conduit Outlet Protection

Table 12-1 from NJ SESC Manual

SOIL TEXTURE	ALLOWABLE VELOCITY, ft/sec
Sand	1.80
Sandy Loam	2.50
Silt loam (also high lime clay), loam	3.00
Sandy clay loam	3.50
Clay loam	4.00
Clay, fine gravel, graded loam to gravel	5.00
Cobbles	5.50
Shale (non-weathered)	6.00

APPENDIX F

LOW IMPACT DEVELOPMENT CHECKLIST

A P P E N D I X   A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: Borough of Middlesex

County: Middlesex Date: 7/8/2019

Review board or agency: Borough of Middlesex/ New Jersey Department of Environmental Protection

Proposed land development name: Proposed Warehouse

Lot(s): 1.01 and 1.02 Block(s): 353

Project or application number: TBD

Applicant's name: RG-Middlesex LLC

Applicant's address: 92 Headquarters Plaza North Towner, 9th Floor,

Morristown, New Jersey 07960

Telephone: Fax:

Email address: habramsohn@rockefellergroup.com

Designer's name: Langan Engineering and Environmental Services, Inc.

Designer's address: 300 Kimball Drive, Parsippany, NJ 07054

Telephone: (973)560-4900 Fax: (973)560-4901

Email address: rburrow@langan.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

Four stormwater basins are provided on site: two bioretention basins and two detention basins.

Bioretention Basin 1, an above-ground bioretention basin, is designed to detain and infiltrate runoff from the truck turn around area and a portion of the loading area into a perforated pipe. This basin provides 90% TSS removal and sends the flow from the subwatershed to detention basin 1.

Bioretention Basin 2, an above-ground bioretention basin, is designed to detain and infiltrate runoff from the remainder of the loading area, the truck parking lot, and a portion of the employee parking lot into a perforated pipe. This basin provides 90% TSS removal and sends the flow from the subwatershed to detention basin 1.

Detention Basin 1 is designed to detain runoff from half of the proposed building and the two bioretention basins. This basin attenuates the outflow from subwatersheds 2A, 2B, and 2C.

Detention Basin 2 is design to detain the remainder of employee parking lots and the other half of the proposed building. This basin attenuates the outflow from the subwatershed 2D.

The runoff from the detention basins are discharged through an existing outlet pipe located at the property line along River Road.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

NJDEP Best Management Practices and Chapter 355, Stormwater Management - Borough of Middlesex Ordinances, October 2006

Do regulations include nonstructural requirements? Yes: X No: ______

If yes, briefly describe: The non-structural requirements of Chapter 355 are modeled after the non-structural requirements of the NJDEP Stormwater Regulations contained in N.J.A.C. 7:8.

List LID-BMPs prohibited by local regulations: None

Pre-design meeting held? Yes: X Date: Multiple No: ______

Meeting held with: Borough of Middlesex

Pre-design site walk held? Yes: ______ Date: ______ No: X

Site walk held with: ______

Other agencies with stormwater review jurisdiction:

Name: New Jersey Department of Environmental Protection

Required approval: Flood Hazard Area Individual Permit

Name: Middlesex County

Required approval: Middlesex County Planning

Name: Freehold Soil Conservation District

Required approval: ______

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No: ____

If yes, was this inventory a factor in the site's layout and design? Yes: X No: ____

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: ____ No: X If yes, specify % of site: ____

Native ground cover? Yes: ____ No: X If yes, specify % of site: ____

Vegetated buffers? Yes: ____ No: X If yes, specify % of site: ____

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: ____ If yes, specify % of site: Not Specified

Native ground cover? Yes: X No: ____ If yes, specify % of site: Not Specified

Vegetated buffers? Yes: X No: ____ If yes, specify % of site: Not Specified

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: ____ No: X

Reduce runoff pollutant loads through runoff treatment: Yes: ____ No: X

Maintain groundwater recharge by preserving natural areas: Yes: ____ No: X

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: ________

If yes, were these inventories factors in the site's layout and design? Yes: X No: ________

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: ________ No: X

If yes, how: ____

____

Restrict temporary site disturbance during construction? Yes: X No: ________

If yes, how: Demarcation of limit of development

____

Consider soils and slopes in selecting disturbance limits? Yes: ________ No: X

If yes, how: ____

____

C. Specify percentage of site to be cleared: ~87% Regraded: ~87%

D. Specify percentage of cleared areas done so for buildings: ~18%

For driveways and parking: ~29% For roadways: ~2%

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

The proposed impacts are as minimal as can be for the proposed development. There are no site changes that could be made to reduce the impacts for this use.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: ~92% HSG B: ~7.75% HSG C: N/A HSG D: ~0.25%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: ~58% HSG B: ~3% HSG C: N/A HSG D: N/A

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

None, the existing site has almost all HSG A and B soils (99.75%).

I. Does the site include Karst topography? Yes: ______ No: X

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 15.06 Acres Proposed: 19.06 Acres

B. Specify maximum site impervious coverage allowed by regulations: 95%

C. Compare proposed street cartway widths with those required by regulations: N/A *

** SITE DOES NOT CONTAIN ANY PUBLIC RIGHT-OF-WAY/ROADWAYS*

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking		
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9' X 18' Regulations: 9' X 18'

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 334 Regulations: TBD in Parking Demand Study

F. Specify percentage of total site impervious cover created by buildings: 49%

By driveways and parking: 50% By roadways: 1%

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

The proposed impacts are as minimal as can be for the proposed development. There are no site changes that could be made to reduce the impacts for this use.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: 0%

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: 0%

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 91% Vegetated swale: 0% Natural channel: 0%

Stormwater management facility: 9% Other: 0%

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

The existing developed site was drained by existing storm sewer systems. The proposed site will continue to be drained by an updated storm sewer system.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: The proposed slopes within the developed area collected by the storm sewer system have been designed with mild cross and longitudinal slopes.

Increase overland flow roughness: The majority of the proposed development is occupied by buildings, drive aisle, truck loading, and parking. It would not be practical to increase the flow roughness in these areas. All pervious areas will be planted with grass and landscaping.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles N/A

Specify the number of trash receptacles provided: ____________________________

Specify the spacing between the trash receptacles: ____________________________

Compare trash receptacles proposed with those required by regulations:

Proposed: ______________________ Regulations: ____________________________

B. Pet Waste Stations N/A

Specify the number of pet waste stations provided: ___________________________

Specify the spacing between the pet waste stations: ___________________________

Compare pet waste stations proposed with those required by regulations:

Proposed: ______________________ Regulations: ____________________________

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%*

*All inlets within the redevelopment area will have compliant NJPDES storm drain inlet frames/castings. Outlet control structures will have trash racks.

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: As needed* Regulations: N/A

Litter collection: Proposed: As needed* Regulations: N/A

*Because the project is a private warehouse development, it is not anticipated that scheduled/frequent street sweeping or litter collection will be required.

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

____

____

E. Prevention and Containment of Spills N/A

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: ______________________________ Location: ______________________________

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: ______________________________ Location: ______________________________

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: ______________________________ Location: ______________________________

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: ______________________________ Location: ______________________________

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: ______________________________ Location: ______________________________

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.		X
3.	Maximize the protection of natural drainage features and vegetation.		X
4.	Minimize the decrease in the pre-construction time of concentration.		X
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.		X
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

The proposed impacts are as minimal as can be for the proposed development. There are no site changes that could be made to reduce the impacts for this use. Existing naturally vegetated areas that do not need to be disturbed for the development are going to be maintained, including existing mature trees. The impervious surfaces that are proposed are that which are required for the use. Some areas sheet flow into bioretention basins, which are then connected to the detention basin via storm sewers to reduce post-construction flows.

APPENDIX G

NOAA RAINFALL FREQUENCY AND PRECIPITATION DATA

NOAA Atlas 14, Volume 2, Version 3
Location name: Piscataway, New Jersey, USA*
Latitude: 40.5599°, Longitude: -74.5181°
Elevation: 42.44 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**3.98** (3.61-4.40)	**4.75** (4.31-5.24)	**5.63** (5.09-6.20)	**6.26** (5.65-6.91)	**7.03** (6.32-7.75)	**7.58** (6.78-8.34)	**8.12** (7.24-8.94)	**8.60** (7.62-9.48)	**9.20** (8.08-10.2)	**9.64** (8.41-10.7)
10-min	**3.19** (2.89-3.52)	**3.80** (3.44-4.19)	**4.51** (4.07-4.97)	**5.01** (4.52-5.53)	**5.60** (5.04-6.17)	**6.04** (5.40-6.64)	**6.45** (5.75-7.10)	**6.82** (6.04-7.51)	**7.28** (6.39-8.03)	**7.59** (6.62-8.40)
15-min	**2.65** (2.41-2.93)	**3.18** (2.88-3.51)	**3.80** (3.44-4.19)	**4.22** (3.81-4.66)	**4.74** (4.26-5.22)	**5.10** (4.56-5.60)	**5.44** (4.84-5.98)	**5.74** (5.08-6.32)	**6.10** (5.36-6.74)	**6.35** (5.54-7.03)
30-min	**1.82** (1.65-2.01)	**2.20** (1.99-2.43)	**2.70** (2.44-2.98)	**3.06** (2.76-3.37)	**3.51** (3.16-3.86)	**3.84** (3.43-4.22)	**4.16** (3.71-4.58)	**4.46** (3.95-4.92)	**4.86** (4.27-5.36)	**5.14** (4.49-5.69)
60-min	**1.13** (1.03-1.25)	**1.38** (1.25-1.52)	**1.73** (1.57-1.91)	**1.99** (1.80-2.20)	**2.34** (2.10-2.57)	**2.60** (2.33-2.86)	**2.87** (2.55-3.16)	**3.13** (2.77-3.45)	**3.49** (3.06-3.85)	**3.75** (3.28-4.16)
2-hr	**0.693** (0.624-0.770)	**0.844** (0.761-0.937)	**1.07** (0.964-1.19)	**1.25** (1.12-1.38)	**1.49** (1.33-1.65)	**1.69** (1.50-1.87)	**1.90** (1.67-2.10)	**2.11** (1.85-2.34)	**2.41** (2.09-2.68)	**2.65** (2.27-2.94)
3-hr	**0.514** (0.464-0.573)	**0.626** (0.566-0.699)	**0.795** (0.717-0.886)	**0.927** (0.833-1.03)	**1.11** (0.992-1.23)	**1.26** (1.12-1.40)	**1.41** (1.25-1.57)	**1.58** (1.38-1.75)	**1.80** (1.56-2.00)	**1.98** (1.69-2.20)
6-hr	**0.330** (0.298-0.369)	**0.401** (0.362-0.447)	**0.509** (0.457-0.565)	**0.597** (0.534-0.661)	**0.722** (0.641-0.799)	**0.827** (0.730-0.913)	**0.940** (0.821-1.04)	**1.06** (0.918-1.17)	**1.24** (1.05-1.36)	**1.38** (1.16-1.53)
12-hr	**0.200** (0.180-0.225)	**0.243** (0.219-0.272)	**0.310** (0.278-0.346)	**0.366** (0.327-0.408)	**0.450** (0.398-0.500)	**0.523** (0.459-0.579)	**0.601** (0.522-0.665)	**0.689** (0.591-0.762)	**0.818** (0.689-0.906)	**0.929** (0.770-1.03)
24-hr	**0.114** (0.106-0.124)	**0.138** (0.128-0.150)	**0.177** (0.164-0.192)	**0.210** (0.194-0.227)	**0.259** (0.238-0.281)	**0.302** (0.275-0.327)	**0.349** (0.315-0.378)	**0.402** (0.359-0.436)	**0.481** (0.422-0.523)	**0.548** (0.474-0.598)
2-day	**0.066** (0.061-0.073)	**0.080** (0.074-0.088)	**0.102** (0.094-0.113)	**0.121** (0.110-0.133)	**0.148** (0.134-0.162)	**0.171** (0.154-0.187)	**0.196** (0.175-0.215)	**0.223** (0.197-0.245)	**0.262** (0.229-0.290)	**0.296** (0.254-0.328)
3-day	**0.047** (0.043-0.051)	**0.057** (0.052-0.062)	**0.072** (0.066-0.079)	**0.085** (0.077-0.093)	**0.103** (0.094-0.113)	**0.119** (0.107-0.130)	**0.135** (0.121-0.148)	**0.153** (0.136-0.168)	**0.179** (0.157-0.198)	**0.201** (0.174-0.223)
4-day	**0.037** (0.034-0.041)	**0.045** (0.041-0.049)	**0.057** (0.052-0.062)	**0.067** (0.061-0.073)	**0.081** (0.073-0.088)	**0.092** (0.084-0.101)	**0.105** (0.094-0.115)	**0.119** (0.105-0.130)	**0.138** (0.121-0.152)	**0.154** (0.134-0.170)
7-day	**0.025** (0.023-0.027)	**0.030** (0.028-0.033)	**0.037** (0.034-0.040)	**0.043** (0.040-0.047)	**0.052** (0.047-0.056)	**0.059** (0.054-0.064)	**0.066** (0.060-0.072)	**0.074** (0.067-0.081)	**0.086** (0.076-0.094)	**0.095** (0.083-0.105)
10-day	**0.020** (0.019-0.021)	**0.024** (0.022-0.026)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.040** (0.036-0.043)	**0.045** (0.041-0.048)	**0.050** (0.045-0.054)	**0.055** (0.050-0.060)	**0.063** (0.056-0.069)	**0.069** (0.061-0.076)
20-day	**0.013** (0.013-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.025** (0.023-0.026)	**0.027** (0.025-0.029)	**0.030** (0.028-0.032)	**0.032** (0.030-0.035)	**0.036** (0.033-0.039)	**0.039** (0.035-0.042)
30-day	**0.011** (0.011-0.012)	**0.013** (0.012-0.014)	**0.015** (0.015-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.023** (0.021-0.024)	**0.024** (0.023-0.026)	**0.026** (0.024-0.028)	**0.028** (0.026-0.030)
45-day	**0.009** (0.009-0.010)	**0.011** (0.011-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.020-0.023)
60-day	**0.009** (0.008-0.009)	**0.010** (0.010-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.015)	**0.016** (0.015-0.016)	**0.016** (0.016-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

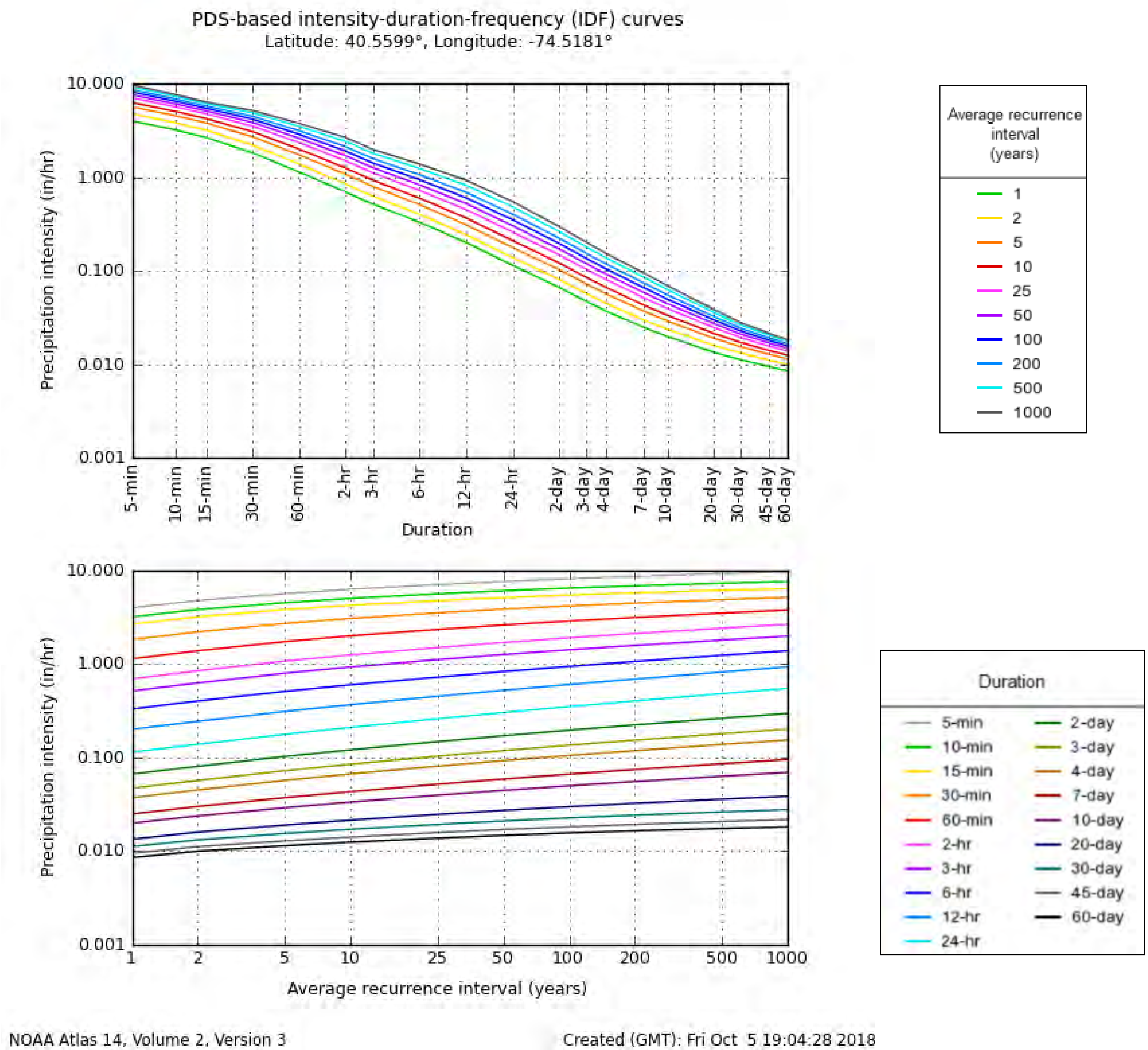
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

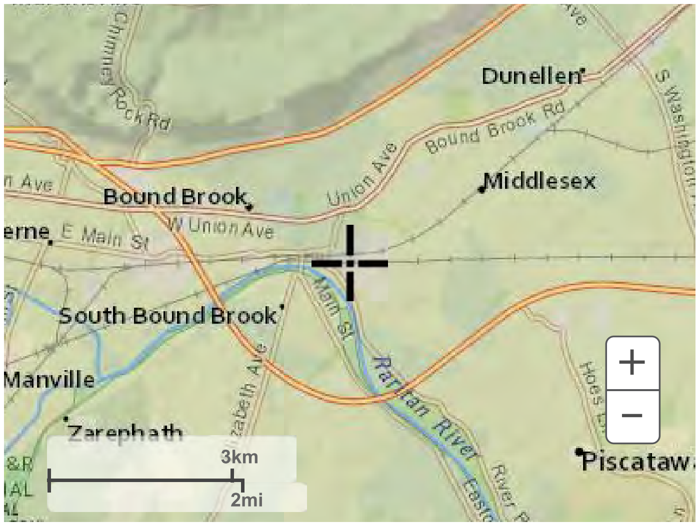
PF graphical



Back to Top

Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial


Waterbury
Connecticut
Scranton
Bridgeport
New Jersey
New York
New York
Allentown
Edison
Reading
rrisburg
Trenton
Philadelphia
Toms River
New Jersey
100km
60mi
Baltimore
Atlantic City

[Back to Top](#)

NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

Rainfall amounts in Inches

County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

Notes: The average point rainfall amounts listed above were developed from data contained in NOAA Atlas 14 Volume 2.

Point rainfall estimates for specific locations may be obtained from the Precipitation Frequency Data Server located at http://www.nws.noaa.gov/ohd/hdsc/

For most hydrologic design procedures, the rainfall amounts listed above may be rounded to the nearest tenth of an inch.

APPENDIX H

EXISTING AND PROPOSED FLOOD STORAGE TABLES

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
1	1	5.52	6.27	6.01	5.46	5.81	140	811.76
1	2	5.46	6.01	6.41	6.11	6.00	222	1330.16
1	3	6.11	6.41	5.14	5.14	5.70	180	1025.60
1	4	5.14	5.14	4.60	4.45	4.83	172	832.87
1	5	4.45	4.60	4.15	3.99	4.30	172	740.55
1	6	3.99	4.15	3.65	3.52	3.83	172	659.63
1	7	3.52	3.65	3.34	3.31	3.46	172	595.56
1	8	3.31	3.34	2.73	2.89	3.07	172	528.76
1	9	2.89	2.73	2.44	2.33	2.60	172	447.64
1	10	2.33	2.44	2.46	2.41	2.41	172	415.12
1	11	2.41	2.46	2.15	1.92	2.23	172	384.80
1	12	1.92	2.15	1.88	1.69	1.91	172	328.76
1	13	1.69	1.88	1.63	1.57	1.69	172	291.29
1	14	1.57	1.63	1.42	1.78	1.60	172	275.46
1	15	1.78	1.42	1.98	2.27	1.86	165	307.59
1	19	2.88	1.82	1.85	2.89	2.36	14	33.51
1	20	2.89	1.85	1.72	2.68	2.28	372	850.39
1	21	2.68	1.72	1.60	2.29	2.07	372	771.24
1	22	2.29	1.60	1.12	1.81	1.71	372	635.05
1	23	1.81	1.12	0.79	1.33	1.26	372	470.56
1	24	1.33	0.79	0.49	1.32	0.98	372	365.84
1	25	1.32	0.49	0.27	0.90	0.74	372	277.20
1	26	0.90	0.27	0.48	0.77	0.61	372	225.33
1	27	0.77	0.48	0.30	0.71	0.57	372	210.45
1	28	0.71	0.30	0.09	0.42	0.38	372	141.02
1	29	0.42	0.09	0.42	0.68	0.40	373	149.38
1	30	0.68	0.42	0.23	0.85	0.55	377	205.41
1	31	0.85	0.23	0.44	0.94	0.62	382	235.00
1	32	0.94	0.44	0.72	1.13	0.81	388	312.58
1	33	1.13	0.72	0.90	1.64	1.10	393	431.33
1	34	1.64	0.90	0.79	1.91	1.31	399	522.38
1	35	1.91	0.79	0.91	1.65	1.32	404	532.22
1	36	1.65	0.91	1.66	2.50	1.68	410	688.98
1	37	2.50	1.66	1.85	2.77	2.20	416	912.59
1	38	2.77	1.85	2.05	3.00	2.42	421	1018.17
1	39	3.00	2.05	2.23	3.23	2.63	427	1120.66
1	40	3.23	2.23	2.40	3.41	2.82	432	1217.66

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
1	41	3.41	2.40	2.64	3.46	2.98	438	1303.65
1	42	3.46	2.64	2.86	3.64	3.15	443	1396.17
1	43	3.64	2.86	2.95	3.69	3.28	449	1474.49
1	44	3.69	2.95	3.22	4.34	3.55	455	1613.90
1	45	4.34	3.22	3.20	3.75	3.63	460	1669.54
1	46	3.75	3.20	3.22	3.59	3.44	151	518.12
2	1	6.27	5.42	5.31	6.01	5.75	322	1849.87
2	2	6.01	5.31	4.94	6.41	5.67	625	3542.29
2	3	6.41	4.94	4.55	5.14	5.26	625	3289.21
2	4	5.14	4.55	4.19	4.60	4.62	625	2889.13
2	5	4.60	4.19	3.86	4.15	4.20	625	2624.82
2	6	4.15	3.86	3.56	3.65	3.80	625	2377.25
2	7	3.65	3.56	3.24	3.34	3.45	625	2154.93
2	8	3.34	3.24	2.91	2.73	3.06	625	1910.93
2	9	2.73	2.91	2.58	2.44	2.67	625	1666.02
2	10	2.44	2.58	2.22	2.46	2.42	625	1514.01
2	11	2.46	2.22	1.83	2.15	2.16	625	1351.38
2	12	2.15	1.83	1.78	1.88	1.91	625	1192.04
2	13	1.88	1.78	1.44	1.63	1.68	625	1049.48
2	14	1.63	1.44	1.16	1.42	1.41	625	881.44
2	15	1.42	1.16	1.17	1.78	1.38	620	857.28
2	16	1.78	1.17	1.02	1.36	1.33	522	695.31
2	17	1.36	1.02	0.86	1.33	1.14	522	596.01
2	18	1.33	0.86	0.70	1.24	1.03	522	539.60
2	19	1.24	0.70	0.52	1.85	1.08	527	568.90
2	20	1.85	0.52	0.31	1.72	1.10	625	686.98
2	21	1.72	0.31	0.12	1.60	0.94	625	584.82
2	22	1.60	0.12	0.25	1.12	0.77	625	483.75
2	23	1.12	0.25	0.25	0.79	0.61	625	378.19
2	24	0.79	0.25	0.23	0.49	0.44	625	275.48
2	25	0.49	0.23	0.00	0.27	0.25	625	154.30
2	26	0.27	0.00	0.00	0.48	0.19	565	105.97
2	27	0.48	0.00	0.00	0.30	0.20	488	95.37
2	28	0.30	0.00	0.00	0.09	0.10	299	28.76
2	29	0.09	0.00	0.00	0.42	0.13	89	11.16
2	30	0.42	0.00	0.00	0.23	0.16	176	28.62
2	31	0.23	0.00	0.00	0.44	0.17	203	34.06

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
2	32	0.44	0.00	0.00	0.72	0.29	307	88.64
2	33	0.72	0.00	0.30	0.90	0.48	562	269.82
2	34	0.90	0.30	0.00	0.79	0.50	564	280.70
2	35	0.79	0.00	0.00	0.91	0.43	593	252.75
2	36	0.91	0.00	0.23	1.66	0.70	625	437.45
2	37	1.66	0.23	0.43	1.85	1.04	625	651.65
2	38	1.85	0.43	0.62	2.05	1.24	625	772.94
2	39	2.05	0.62	1.12	2.23	1.50	625	939.59
2	40	2.23	1.12	1.54	2.40	1.82	625	1139.31
2	41	2.40	1.54	1.68	2.64	2.06	625	1290.56
2	42	2.64	1.68	1.74	2.86	2.23	625	1393.42
2	43	2.86	1.74	1.86	2.95	2.35	625	1471.10
2	44	2.95	1.86	2.16	3.22	2.55	625	1593.82
2	45	3.22	2.16	2.65	3.20	2.81	625	1755.85
2	46	3.20	2.65	2.74	3.22	2.95	193	569.96
3	1	5.42	4.73	4.73	5.31	5.05	333	1680.04
3	2	5.31	4.73	4.84	4.94	4.95	625	3096.74
3	3	4.94	4.84	4.74	4.55	4.77	625	2981.24
3	4	4.55	4.74	4.51	4.19	4.50	625	2811.60
3	5	4.19	4.51	4.20	3.86	4.19	625	2617.71
3	6	3.86	4.20	3.93	3.56	3.88	625	2427.98
3	7	3.56	3.93	3.65	3.24	3.59	625	2245.10
3	8	3.24	3.65	3.37	2.91	3.29	625	2058.54
3	9	2.91	3.37	3.10	2.58	2.99	625	1869.77
3	10	2.58	3.10	2.91	2.22	2.70	625	1687.79
3	11	2.22	2.91	2.72	1.83	2.42	625	1511.25
3	12	1.83	2.72	2.49	1.78	2.20	625	1377.98
3	13	1.78	2.49	1.90	1.44	1.90	625	1188.45
3	14	1.44	1.90	1.31	1.16	1.45	625	907.75
3	15	1.16	1.31	0.88	1.17	1.13	625	706.96
3	16	1.17	0.88	0.55	1.02	0.90	625	564.75
3	17	1.02	0.55	0.38	0.86	0.70	625	438.41
3	18	0.86	0.38	0.26	0.70	0.55	625	344.69
3	19	0.70	0.26	0.43	0.52	0.48	625	300.35
3	20	0.52	0.43	0.00	0.31	0.32	625	197.66
3	21	0.31	0.00	0.00	0.12	0.11	613	65.72
3	22	0.12	0.00	0.00	0.25	0.09	591	55.11

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
3	23	0.25	0.00	0.00	0.25	0.13	565	71.24
3	24	0.25	0.00	0.00	0.23	0.12	534	64.41
3	25	0.23	0.00	0.00	0.00	0.06	213	12.23
3	26	0.00	0.00	0.00	0.00	0.00	40	0.00
3	27	0.00	0.00	0.00	0.00	0.00	4	0.00
3	32		0.00	0.00	0.00	0.00	36	0.00
3	33	0.00	0.00	0.00	0.30	0.08	408	30.88
3	34	0.30	0.00	0.00	0.00	0.08	296	22.44
3	35	0.00	0.00	0.00	0.00	0.00	386	0.00
3	36	0.00	0.00	1.17	0.23	0.35	561	196.71
3	37	0.23	1.17	1.23	0.43	0.76	625	478.04
3	38	0.43	1.23	1.28	0.62	0.89	625	556.06
3	39	0.62	1.28	1.44	1.12	1.12	625	698.07
3	40	1.12	1.44	1.51	1.54	1.41	625	878.62
3	41	1.54	1.51	2.13	1.68	1.72	625	1073.32
3	42	1.68	2.13	2.22	1.74	1.94	625	1214.44
3	43	1.74	2.22	2.88	1.86	2.18	625	1360.44
3	44	1.86	2.88	2.21	2.16	2.28	625	1426.00
3	45	2.16	2.21	2.67	2.65	2.42	625	1515.30
3	46	2.65	2.67	2.35	2.74	2.60	182	472.82
4	1	4.73	5.21	4.85	4.73	4.88	344	1680.16
4	2	4.73	4.85	3.84	4.84	4.57	625	2853.65
4	3	4.84	3.84	2.09	4.74	3.88	625	2424.92
4	4	4.74	2.09	1.74	4.51	3.27	625	2043.79
4	5	4.51	1.74	1.40	4.20	2.96	625	1850.41
4	6	4.20	1.40	1.09	3.93	2.66	625	1659.38
4	7	3.93	1.09	1.05	3.65	2.43	625	1519.01
4	8	3.65	1.05	1.08	3.37	2.29	625	1430.85
4	9	3.37	1.08	0.96	3.10	2.13	625	1331.34
4	10	3.10	0.96	1.01	2.91	1.99	625	1246.76
4	11	2.91	1.01	0.75	2.72	1.85	625	1153.91
4	12	2.72	0.75	0.64	2.49	1.65	625	1030.86
4	13	2.49	0.64	0.41	1.90	1.36	625	849.22
4	14	1.90	0.41	0.00	1.31	0.91	625	565.76
4	15	1.31	0.00	0.00	0.88	0.55	455	249.39
4	16	0.88	0.00	0.00	0.55	0.36	246	87.91
4	17	0.55	0.00	0.00	0.38	0.23	189	43.89

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
4	18	0.38	0.00	0.00	0.26	0.16	131	21.07
4	19	0.26	0.00	0.00	0.43	0.17	101	17.44
4	20	0.43	0.00		0.00	0.14	52	7.58
4	36	0.00	0.00	0.00	1.17	0.29	124	36.35
4	37	1.17	0.00	0.00	1.23	0.60	420	252.00
4	38	1.23	0.00	0.78	1.28	0.82	614	505.59
4	39	1.28	0.00	0.00	1.44	0.68	92	62.85
4	40	1.44	0.00	0.88	1.51	0.96	458	439.74
4	41	1.51	0.88	0.66	2.13	1.30	625	810.47
4	42	2.13	0.66	0.00	2.22	1.25	383	479.63
4	43	2.22	0.00	0.00	2.88	1.27	247	315.16
4	44	2.88	0.00	2.32	2.21	1.85	514	953.40
4	45	2.21	2.32	2.77	2.67	2.49	625	1557.86
4	46	2.67	2.77	2.56	2.35	2.59	170	440.48
5	1	5.21	4.53	2.32	4.85	4.23	356	1503.37
5	2	4.85	2.32	1.01	3.84	3.01	625	1878.63
5	3	3.84	1.01	0.54	2.09	1.87	625	1169.79
5	4	2.09	0.54	0.47	1.74	1.21	625	757.02
5	5	1.74	0.47	0.38	1.40	1.00	625	623.84
5	6	1.40	0.38	0.13	1.09	0.75	625	469.18
5	7	1.09	0.13	0.00	1.05	0.57	569	323.77
5	8	1.05	0.00	0.00	1.08	0.53	305	162.72
5	9	1.08	0.00	0.00	0.96	0.51	334	170.91
5	10	0.96	0.00	0.00	1.01	0.49	331	163.20
5	11	1.01	0.00	0.18	0.75	0.49	563	273.16
5	12	0.75	0.18	0.00	0.64	0.39	598	234.35
5	13	0.64	0.00	0.00	0.41	0.26	311	81.00
5	14	0.41	0.00	0.00	0.00	0.10	200	20.37
5	38	0.00	0.00	0.00	0.78	0.20	205	40.02
5	39	0.78	0.00	0.00	0.00	0.20	379	74.13
5	40	0.00	0.00	0.00	0.88	0.22	416	91.37
5	41	0.88	0.00	0.46	0.66	0.50	618	308.32
5	42	0.66	0.46	1.05	0.00	0.54	424	229.18
5	43	0.00	1.05	1.62	0.00	0.67	356	237.23
5	44	0.00	1.62	2.01	2.32	1.49	586	871.48
5	45	2.32	2.01	2.35	2.77	2.36	625	1476.39
5	46	2.77	2.35	2.17	2.56	2.46	159	391.63

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
6	1	4.53	3.10	0.83	2.32	2.69	367	988.57
6	2	2.32	0.83	0.00	1.01	1.04	468	486.15
6	3	1.01	0.00	0.32	0.54	0.47	602	281.74
6	4	0.54	0.32	0.18	0.47	0.38	625	236.22
6	5	0.47	0.18	0.00	0.38	0.26	623	160.55
6	6	0.38	0.00	0.00	0.13	0.13	439	56.11
6	7	0.13	0.00		0.00	0.04	33	1.40
6	11	0.00		0.00	0.18	0.06	46	2.81
6	12	0.18	0.00		0.00	0.06	113	6.90
6	39	0.00			0.00	0.00	17	0.00
6	41	0.00		0.00	0.46	0.15	173	26.35
6	42	0.46	0.00	0.22	1.05	0.43	530	228.11
6	43	1.05	0.22	0.70	1.62	0.90	625	559.80
6	44	1.62	0.70	0.67	2.01	1.25	625	781.01
6	45	2.01	0.67	0.59	2.35	1.41	625	878.17
6	46	2.35	0.59	0.59	2.17	1.42	148	210.30
7	1	3.10	2.88	1.19	0.83	2.00	378	755.98
7	2	0.83	1.19	0.59	0.00	0.65	585	380.73
7	3	0.00	0.59	0.00	0.32	0.23	611	139.55
7	4	0.32	0.00	0.00	0.18	0.12	466	57.98
7	5	0.18	0.00		0.00	0.06	130	7.62
7	42	0.00		0.00	0.22	0.07	20	1.43
7	43	0.22	0.00	0.00	0.70	0.23	333	76.13
7	44	0.70	0.00	0.00	0.67	0.34	397	136.12
7	45	0.67	0.00	0.00	0.59	0.31	396	124.63
7	46	0.59	0.00	0.00	0.59	0.29	66	19.33
8	1	2.88	2.64	1.25	1.19	1.99	390	774.91
8	2	1.19	1.25	0.39	0.59	0.85	625	533.94
8	3	0.59	0.39	0.00	0.00	0.25	474	116.40
9	1	2.64	2.10	0.82	1.25	1.70	401	682.10
9	2	1.25	0.82	0.00	0.39	0.61	575	352.83
9	3	0.39	0.00		0.00	0.13	89	11.58
10	1	2.10	1.96	0.68	0.82	1.39	412	572.80
10	2	0.82	0.68	0.00	0.00	0.37	270	101.12

EXISTING FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Existing Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
11	1	1.96	1.34	0.07	0.68	1.01	424	428.89
11	2	0.68	0.07	0.00	0.00	0.19	119	22.32
12	1	1.34	0.79	0.00	0.07	0.55	307	169.00
12	2	0.07	0.00		0.00	0.02	1	0.03
13	1	0.79	0.65	0.00	0.00	0.36	190	68.33
14	1	0.65	0.47	0.00	0.00	0.28	171	47.74
15	1	0.47	0.19	0.00	0.00	0.17	106	17.52
16	1	0.19	0.00		0.00	0.06	7	0.44
						Total Flood Storage (CF) =		166785
						Total Flood Storage (CY) =		6177

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
1	1	5.52	6.27	6.01	5.46	5.81	140	811.76
1	2	5.46	6.01	6.41	6.11	6.00	222	1330.16
1	3	6.11	6.41	5.14	5.14	5.70	180	1025.60
1	4	5.14	5.14	4.60	4.45	4.83	172	832.87
1	5	4.45	4.60	4.15	3.99	4.30	172	740.55
1	6	3.99	4.15	3.65	3.52	3.83	172	659.63
1	7	3.52	3.65	3.34	3.31	3.46	172	595.56
1	8	3.31	3.34	2.73	2.89	3.07	172	528.76
1	9	2.89	2.73	2.44	2.33	2.60	172	447.64
1	10	2.33	2.44	2.46	2.41	2.41	172	415.12
1	11	2.41	2.46	2.15	1.92	2.23	172	384.80
1	12	1.92	2.15	1.88	1.69	1.91	172	328.76
1	13	1.69	1.88	1.63	1.57	1.69	172	291.29
1	14	1.57	1.63	1.42	1.78	1.60	172	275.46
1	15	1.78	1.42	1.98	2.27	1.86	165	307.59
1	19	2.88	1.82	1.85	2.89	2.36	14	33.51
1	20	2.89	1.85	1.72	2.68	2.28	372	850.39
1	21	2.68	1.72	1.60	2.29	2.07	372	771.24
1	22	2.29	1.60	1.12	1.81	1.71	372	635.05
1	23	1.81	1.12	0.79	1.33	1.26	372	470.56
1	24	1.33	0.79	0.49	1.32	0.98	372	365.84
1	25	1.32	0.49	0.27	0.90	0.74	372	277.20
1	26	0.90	0.27	0.48	0.77	0.61	372	225.33
1	27	0.77	0.48	0.30	0.71	0.57	372	210.45
1	28	0.71	0.30	0.09	0.42	0.38	372	141.02
1	29	0.42	0.09	0.42	0.68	0.40	373	149.38
1	30	0.68	0.42	0.23	0.85	0.55	377	205.41
1	31	0.85	0.23	0.44	0.94	0.62	382	235.00
1	32	0.94	0.44	0.72	1.13	0.81	388	312.58
1	33	1.13	0.72	0.90	1.64	1.10	393	431.33
1	34	1.64	0.90	0.79	1.91	1.31	399	522.38
1	35	1.91	0.79	0.91	1.65	1.32	404	532.22
1	36	1.65	0.91	1.66	2.50	1.68	410	688.98
1	37	2.50	1.66	1.85	2.77	2.20	416	912.59
1	38	2.77	1.85	2.05	3.00	2.42	421	1018.17
1	39	3.00	2.05	2.23	3.23	2.63	427	1120.66
1	40	3.23	2.23	2.40	3.41	2.82	432	1217.66

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
1	41	3.41	2.40	2.64	3.46	2.98	438	1303.65
1	42	3.46	2.64	2.86	3.64	3.15	443	1396.17
1	43	3.64	2.86	2.95	3.69	3.28	449	1474.49
1	44	3.69	2.95	3.22	4.34	3.55	455	1613.90
1	45	4.34	3.22	3.20	3.75	3.63	460	1669.54
1	46	3.75	3.20	3.22	3.59	3.44	151	518.12
2	1	6.27	5.42	5.31	6.01	5.75	322	1849.87
2	2	6.01	5.31	4.94	6.41	5.67	625	3542.29
2	3	6.41	4.94	4.55	5.14	5.26	625	3289.21
2	4	5.14	4.55	4.19	4.60	4.62	625	2889.13
2	5	4.60	4.19	3.86	4.15	4.20	625	2624.82
2	6	4.15	3.86	3.56	3.65	3.80	625	2377.25
2	7	3.65	3.56	3.24	3.34	3.45	625	2154.93
2	8	3.34	3.24	2.91	2.73	3.06	625	1910.93
2	9	2.73	2.91	2.58	2.44	2.67	625	1666.68
2	10	2.44	2.58	2.22	2.46	2.42	625	1515.20
2	11	2.46	2.22	1.83	2.15	2.16	625	1352.05
2	12	2.15	1.83	1.78	1.88	1.91	625	1192.18
2	13	1.88	1.78	1.44	1.63	1.68	625	1049.48
2	14	1.63	1.44	1.18	1.42	1.42	625	884.58
2	15	1.42	1.18	1.17	1.78	1.39	620	860.40
2	16	1.78	1.17	1.02	1.36	1.33	522	695.93
2	17	1.36	1.02	0.86	1.33	1.14	522	596.73
2	18	1.33	0.86	0.70	1.24	1.03	522	539.27
2	19	1.24	0.70	0.52	1.85	1.08	527	567.82
2	20	1.85	0.52	0.31	1.72	1.10	625	686.21
2	21	1.72	0.31	0.12	1.60	0.94	625	584.59
2	22	1.60	0.12	0.25	1.12	0.77	625	483.28
2	23	1.12	0.25	0.25	0.79	0.60	625	377.95
2	24	0.79	0.25	0.23	0.49	0.44	625	275.58
2	25	0.49	0.23	0.00	0.27	0.25	625	154.40
2	26	0.27	0.00	0.00	0.48	0.19	563	105.61
2	27	0.48	0.00	0.00	0.30	0.20	488	95.37
2	28	0.30	0.00	0.00	0.09	0.10	299	28.76
2	29	0.09	0.00	0.00	0.42	0.13	89	11.16
2	30	0.42	0.00	0.00	0.23	0.16	175	28.52
2	31	0.23	0.00	0.00	0.44	0.17	195	32.72

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
2	32	0.44	0.00	0.00	0.72	0.29	290	83.68
2	33	0.72	0.00	0.00	0.90	0.40	384	155.33
2	34	0.90	0.00	0.00	0.79	0.42	564	238.02
2	35	0.79	0.00	0.00	0.91	0.43	573	244.27
2	36	0.91	0.00	0.23	1.66	0.70	625	437.45
2	37	1.66	0.23	0.43	1.85	1.04	625	651.65
2	38	1.85	0.43	0.62	2.05	1.24	625	773.57
2	39	2.05	0.62	1.12	2.23	1.50	625	939.91
2	40	2.23	1.12	1.54	2.40	1.82	625	1138.56
2	41	2.40	1.54	1.68	2.64	2.06	625	1290.34
2	42	2.64	1.68	1.74	2.86	2.23	625	1393.65
2	43	2.86	1.74	1.86	2.95	2.35	625	1471.10
2	44	2.95	1.86	2.16	3.22	2.55	625	1593.06
2	45	3.22	2.16	2.65	3.20	2.81	625	1754.91
2	46	3.20	2.65	2.74	3.22	2.95	193	569.90
3	1	5.42	4.73	4.73	5.31	5.05	333	1680.04
3	2	5.31	4.73	4.84	4.94	4.95	625	3096.74
3	3	4.94	4.84	4.74	4.55	4.77	625	2980.66
3	4	4.55	4.74	4.51	4.19	4.50	625	2811.73
3	5	4.19	4.51	4.11	3.86	4.17	625	2604.19
3	6	3.86	4.11	3.90	3.56	3.86	625	2409.50
3	7	3.56	3.90	3.69	3.24	3.60	625	2247.72
3	8	3.24	3.69	3.44	2.91	3.32	625	2075.73
3	9	2.91	3.44	3.13	2.58	3.02	625	1885.08
3	10	2.58	3.13	2.90	2.22	2.71	625	1692.19
3	11	2.22	2.90	2.63	1.83	2.40	625	1496.88
3	12	1.83	2.63	2.35	1.78	2.15	625	1341.85
3	13	1.78	2.35	2.11	1.44	1.92	625	1199.11
3	14	1.44	2.11	1.43	1.18	1.54	625	961.95
3	15	1.18	1.43	1.09	1.17	1.22	625	760.90
3	16	1.17	1.09	0.76	1.02	1.01	625	631.21
3	17	1.02	0.76	0.48	0.86	0.78	625	487.50
3	18	0.86	0.48	0.27	0.70	0.58	625	360.94
3	19	0.70	0.27	0.06	0.52	0.39	625	242.19
3	20	0.52	0.06	0.00	0.31	0.22	625	138.65
3	21	0.31	0.00	0.00	0.12	0.11	519	55.47
3	22	0.12	0.00	0.00	0.25	0.09	445	41.18

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
3	23	0.25	0.00	0.00	0.25	0.13	350	44.07
3	24	0.25	0.00	0.00	0.23	0.12	192	23.22
3	25	0.23	0.00		0.00	0.08	51	3.94
3	30		0.00	0.16	0.00	0.05	49	2.63
3	31	0.00	0.16	0.30	0.00	0.12	114	13.08
3	32	0	0.30	0.43	0.00	0.18	178	32.47
3	33	0.00	0.43	0.60	0.00	0.26	250	64.43
3	34	0.00	0.60	0.76	0.00	0.34	346	117.61
3	35	0.00	0.76	0.21	0.00	0.24	443	107.48
3	36	0.00	0.21	0.60	0.23	0.26	576	149.38
3	37	0.23	0.60	0.59	0.43	0.46	625	288.62
3	38	0.43	0.59	0.60	0.62	0.56	625	349.88
3	39	0.62	0.60	0.91	1.12	0.81	625	507.81
3	40	1.12	0.91	1.05	1.54	1.16	625	721.88
3	41	1.54	1.05	1.06	1.68	1.33	625	832.81
3	42	1.68	1.06	0.57	1.74	1.26	625	789.73
3	43	1.74	0.57	1.15	1.86	1.33	625	832.70
3	44	1.86	1.15	1.87	2.16	1.76	625	1100.78
3	45	2.16	1.87	1.93	2.65	2.15	625	1345.31
3	46	2.65	1.93	2.35	2.74	2.42	182	439.26
4	1	4.73	5.21	4.85	4.73	4.88	344	1680.16
4	2	4.73	4.85	3.84	4.84	4.57	625	2853.65
4	3	4.84	3.84	2.09	4.74	3.88	625	2424.34
4	4	4.74	2.09	1.76	4.51	3.28	625	2047.21
4	5	4.51	1.76	1.45	4.11	2.96	625	1848.44
4	6	4.11	1.45	1.09	3.90	2.64	625	1649.14
4	7	3.90	1.09	1.05	3.69	2.43	625	1521.02
4	8	3.69	1.05	1.08	3.44	2.32	625	1446.88
4	9	3.44	1.08	0.96	3.13	2.15	625	1345.44
4	10	3.13	0.96	1.01	2.90	2.00	625	1250.13
4	11	2.90	1.01	0.75	2.63	1.82	625	1139.06
4	12	2.63	0.75	0.64	2.35	1.59	625	994.61
4	13	2.35	0.64	0.41	2.11	1.38	625	859.88
4	14	2.11	0.41	0.00	1.43	0.99	625	616.82
4	15	1.43	0.00	0.00	1.09	0.63	455	286.34
4	16	1.09	0.00	0.00	0.76	0.46	248	114.47
4	17	0.76	0.00	0.00	0.48	0.31	193	59.95

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
4	18	0.48	0.00	0.00	0.27	0.19	163	30.53
4	19	0.27	0.00	0.00	0.06	0.08	144	11.88
4	20	0.06	0.00		0.00	0.02	17	0.35
4	30	0.00	0.00	0.00	0.16	0.04	162	6.50
4	31	0.16	0.00	0.00	0.30	0.12	290	33.34
4	32	0.30	0.00	0.00	0.43	0.18	437	79.77
4	33	0.43	0.00	0.00	0.60	0.26	528	135.96
4	34	0.60	0.00	0.00	0.76	0.34	474	161.16
4	35	0.76	0.00	0.00	0.21	0.24	170	41.25
4	36	0.21	0.00	0.00	0.60	0.20	161	32.66
4	37	0.60	0.00	0.00	0.59	0.30	419	124.71
4	38	0.59	0.00	0.80	0.60	0.50	625	310.94
4	39	0.60	0.80	0.85	0.91	0.79	625	493.75
4	40	0.91	0.85	0.90	1.05	0.93	625	579.69
4	41	1.05	0.90	1.04	1.06	1.01	625	632.81
4	42	1.06	1.04	1.33	0.57	1.00	625	625.00
4	43	0.57	1.33	1.90	1.15	1.24	625	773.44
4	44	1.15	1.90	2.32	1.87	1.81	625	1131.25
4	45	1.87	2.32	2.77	1.93	2.22	625	1388.81
4	46	1.93	2.77	2.56	2.35	2.40	170	409.08
5	1	5.21	4.53	2.32	4.85	4.23	356	1503.37
5	2	4.85	2.32	1.01	3.84	3.01	625	1878.63
5	3	3.84	1.01	0.54	2.09	1.87	625	1169.79
5	4	2.09	0.54	0.47	1.76	1.22	625	760.32
5	5	1.76	0.47	0.38	1.45	1.02	625	635.39
5	6	1.45	0.38	0.13	1.09	0.76	625	477.43
5	7	1.09	0.13	0.00	1.05	0.57	569	323.21
5	8	1.05	0.00	0.00	1.08	0.53	305	162.15
5	9	1.08	0.00	0.00	0.96	0.51	334	170.61
5	10	0.96	0.00	0.00	1.01	0.49	331	163.28
5	11	1.01	0.00	0.18	0.75	0.49	563	273.34
5	12	0.75	0.18	0.00	0.64	0.39	598	234.38
5	13	0.64	0.00	0.00	0.41	0.26	311	81.00
5	14	0.41	0.00	0.00	0.00	0.10	200	20.37
5	38	0.00	0.00	0.00	0.80	0.20	205	40.92
5	39	0.80	0.00	0.00	0.85	0.41	517	213.22
5	40	0.85	0.00	0.00	0.90	0.44	441	192.72

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
5	41	0.90	0.00	0.46	1.04	0.60	618	370.28
5	42	1.04	0.46	0.97	1.33	0.95	625	593.10
5	43	1.33	0.97	1.66	1.90	1.47	625	915.63
5	44	1.90	1.66	2.01	2.32	1.97	625	1232.25
5	45	2.32	2.01	2.35	2.77	2.36	625	1476.39
5	46	2.77	2.35	2.17	2.56	2.46	159	391.63
6	1	4.53	3.10	0.83	2.32	2.69	367	988.57
6	2	2.32	0.83	0.00	1.01	1.04	468	486.15
6	3	1.01	0.00	0.32	0.54	0.47	602	281.74
6	4	0.54	0.32	0.18	0.47	0.38	625	236.22
6	5	0.47	0.18	0.00	0.38	0.26	623	160.55
6	6	0.38	0.00	0.00	0.13	0.13	439	56.11
6	7	0.13	0.00		0.00	0.04	33	1.40
6	11	0.00		0.00	0.18	0.06	46	2.81
6	12	0.18	0.00		0.00	0.06	113	6.90
6	39	0.00			0.00	0.00	17	0.00
6	41	0.00		0.00	0.46	0.15	173	26.35
6	42	0.46	0.00	0.22	0.97	0.41	530	217.74
6	43	0.97	0.22	0.70	1.66	0.89	625	553.78
6	44	1.66	0.70	0.67	2.01	1.26	625	787.23
6	45	2.01	0.67	0.59	2.35	1.41	625	878.17
6	46	2.35	0.59	0.59	2.17	1.42	148	210.30
7	1	3.10	2.88	1.19	0.83	2.00	378	755.98
7	2	0.83	1.19	0.59	0.00	0.65	585	380.73
7	3	0.00	0.59	0.00	0.32	0.23	611	139.55
7	4	0.32	0.00	0.00	0.18	0.12	466	57.98
7	5	0.18	0.00		0.00	0.06	130	7.62
7	42	0.00		0.00	0.22	0.07	20	1.43
7	43	0.22	0.00	0.00	0.70	0.23	333	76.13
7	44	0.70	0.00	0.00	0.67	0.34	397	136.12
7	45	0.67	0.00	0.00	0.59	0.31	396	124.63
7	46	0.59	0.00	0.00	0.59	0.29	66	19.33
8	1	2.88	2.64	1.25	1.19	1.99	390	774.91
8	2	1.19	1.25	0.39	0.59	0.85	625	533.94
8	3	0.59	0.39	0.00	0.00	0.25	474	116.40

PROPOSED FLOOD STORAGE VOLUME
PROPOSED WAREHOUSE
PROJECT# 100594413
10/22/2019

Row	Column	Proposed Flood Storage				Average Depth	Area	Volume (CF)
		LL	UL	UR	LR			
9	1	2.64	2.10	0.82	1.25	1.70	401	682.10
9	2	1.25	0.82	0.00	0.39	0.61	575	352.83
9	3	0.39	0.00		0.00	0.13	89	11.58
10	1	2.10	1.96	0.68	0.82	1.39	412	572.80
10	2	0.82	0.68	0.00	0.00	0.37	270	101.12
11	1	1.96	1.34	0.07	0.68	1.01	424	428.89
11	2	0.68	0.07	0.00	0.00	0.19	119	22.32
12	1	1.34	0.79	0.00	0.07	0.55	307	169.00
12	2	0.07	0.00		0.00	0.02	1	0.03
13	1	0.79	0.65	0.00	0.00	0.36	190	68.33
14	1	0.65	0.47	0.00	0.00	0.28	171	47.74
15	1	0.47	0.19	0.00	0.00	0.17	106	17.52
16	1	0.19	0.00		0.00	0.06	7	0.44
						Total Flood Storage (CF) =		167318
						Total Flood Storage (CY) =		6197

DRAWINGS

REFER TO CS002 FOR GENERAL AND GRADING AND DRAINAGE NOTES

60 0 20 40 60
SCALE IN FEET

Date	Description	No.
3/27/2020	REVISED FOR BOROUGH, COUNTY, AND NJDEP COMMENTS	4
1/30/2020	REVISED FOR BOROUGH ENGINEER AND NJDEP COMMENTS	3
10/22/19	REVISED FOR NJDEP SUBMISSION	2
9/4/19	REVISED FOR FSCD COMMENTS AND PLANNING BOARD SUBMISSION	1

REVISIONS

SIGNATURE RICHARD BURROW 04/08/2020 DATE SIGNED
PROFESSIONAL ENGINEER NJ Lic. No. 24GE04459300

LANGAN
Langan Engineering and Environmental Services, Inc.
300 Kimball Drive
Parsippany, NJ 07054
T: 973.560.4900 F: 973.560.4901 www.langan.com
NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project
MIDDLESEX BOROUGH WAREHOUSE PROJECT
BLOCK No. 353, LOTS No. 1.01 AND 1.02
BOROUGH OF MIDDLESEX
MIDDLESEX COUNTY NEW JERSEY

Drawing Title
GRADING PLAN

Project No. 100594413
Date 7/8/2019
Scale 1" = 60'
Drawn By SLK
Checked By MRW

Drawing No. CG101
Sheet 4 of 22

Filename: \\langan.com\data\PAR\data4\100594413\Project Data\CAD\13\SheetFiles\Site Plan Submission\100594413-CG101-0101.dwg Date: 3/25/2020 Time: 19:22 User: skattowski Style Table: Langan.stb Layout: CG101 - GRADING PLAN