PICKETT/WHITAKER MINOR PLAT

Preliminary Drainage Study

Commercial Development

Franklin, Johnson County, Indiana

NORTHPOINTE ENGINEERING & SURVEYING, Inc.

WBE/DBE Certified

11/10/2015

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Pickett/Whitaker

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Professional Certification

Pickett/Whitaker

The following report and accompanying computations have been developed by me or under my direct supervision.

Venus Thorne
Professional Engineer
Registration Number: 11200278

NORTHPOINTE ENGINEERING & SURVEYING, Inc.
WBE/DBE Certified

Preliminary Drainage Summary

Pickett/Whitaker

The proposed project is a commercial development located in the City of Franklin in Johnson County. The project site for the proposed development consists of 3.14 acres.

Analytical Methodology:
The site was designed per Section 6.19 General Drainage Standards of the City of Franklin Subdivision Control Ordnance.
Runoff Estimates - Runoff for the project were determined using the rational method since detention is not proposed for the site.
Times-of-Concentration – The existing and proposed times-of-concentration were determined using the TR-55 methodology. The flow paths are delineated on the enclosed existing and proposed site maps.
Runoff Coefficient –The curve numbers were determined using soil conditions and surface descriptions. Calculations for the existing and proposed runoff curve numbers are included within this report.

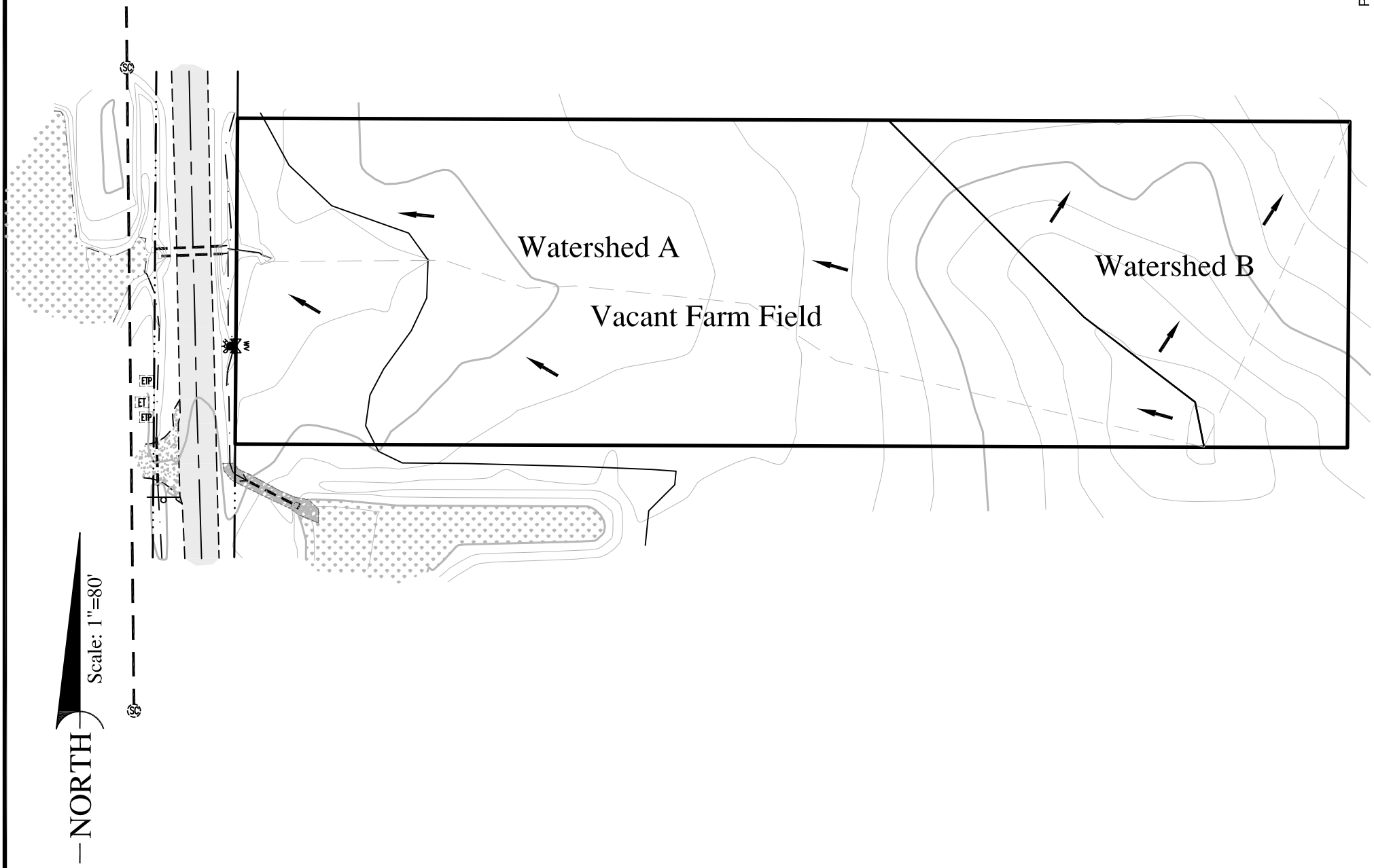
Existing Site Conditions:
The existing site contains a vacant farm field. The site is split into two watersheds as shown on the enclosed maps. The site currently sheet drains.
Watershed A – Watershed A consists of 2.31 acres and outlets to the west of the site to an existing drainage pipe and detention.
Watershed B – Watershed B consist of 0.83 acres and outlets to the west of the site.

Proposed Site Conditions:
The existing drainage pattern for the site will continue in developed conditions. The existing drainage basins will remain the same and the site will sheet drain as in existing conditions. The improvements for the site consist of a concrete drive and gravel parking area. A summary of the runoff rates is shown below:

Watershed A	Runoff Rates (cfs)			
	2YR	10YR	25YR	100YR
Existing	2.13	3.26	3.83	4.66
Proposed	4.54	6.72	7.80	9.37

Watershed B	Runoff Rates (cfs)			
	2YR	10YR	25YR	100YR
Existing	0.90	1.36	1.60	1.93
Proposed	2.25	3.30	3.82	4.58

Existing Site Conditions



TYPE OF SURFACE	RUNOFF COEFFICIENT
Non-Urban Areas	
Bare Earth	0.55
Steep Grassed Areas (slope 2:1)	0.60
Turf Meadows	0.25
Forested Areas	0.20
Cultivated Fields	0.30
Urban Areas	
All Watertight Roof Surfaces	0.90
Pavement (concrete, asphalt)	0.85
Gravel	0.85
Impervious Soils (Heavy)	0.55
Impervious Soils (with turf)	0.45
Slightly Pervious Soil	0.25
Slightly Pervious Soil (with turf)	0.20
Moderately Pervious Soil	0.15
Moderately Pervious Soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 ft^2	0.45
Lots < 12,000 ft^2	0.45
Lots < 17,000 ft^2	0.40
Lots > ½ Acre	0.35
Park, Cemetery or Unimproved Area	0.30

210-VI-TR-55, Second Edition, June 1986

Table 3.1.1 (TR-55 Table 3-1) : Runoff Coefficient's for use in the Rational Method calculations for Pipe, Channel and Detention Design

TR55 Tc Worksheet

Hyd. No. 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 2.10		0.00		0.00		
Travel Time (min)	**= 10.58**	**+**	**0.00**	**+**	**0.00**	**=**	**10.58**
Shallow Concentrated Flow							
Flow length (ft)	= 515.00		0.00		0.00		
Watercourse slope (%)	= 2.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.34		0.00		0.00		
Travel Time (min)	**= 3.67**	**+**	**0.00**	**+**	**0.00**	**=**	**3.67**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 14.25 min

Hydrograph Report

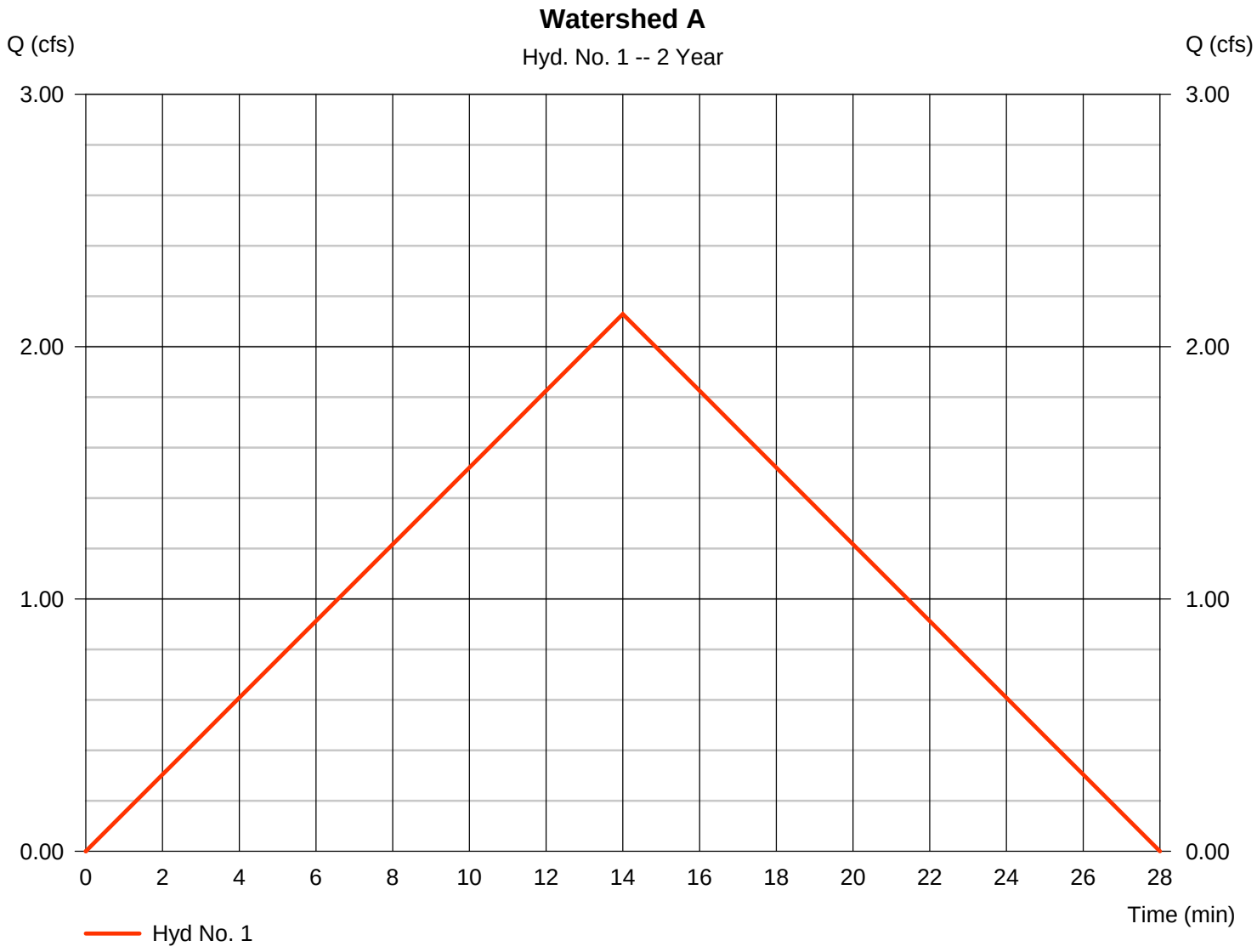
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	2.129 cfs
Storm frequency	=	2 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	1,789 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.3*
Intensity	=	3.073 in/hr	Tc by User	=	14.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



Hydrograph Report

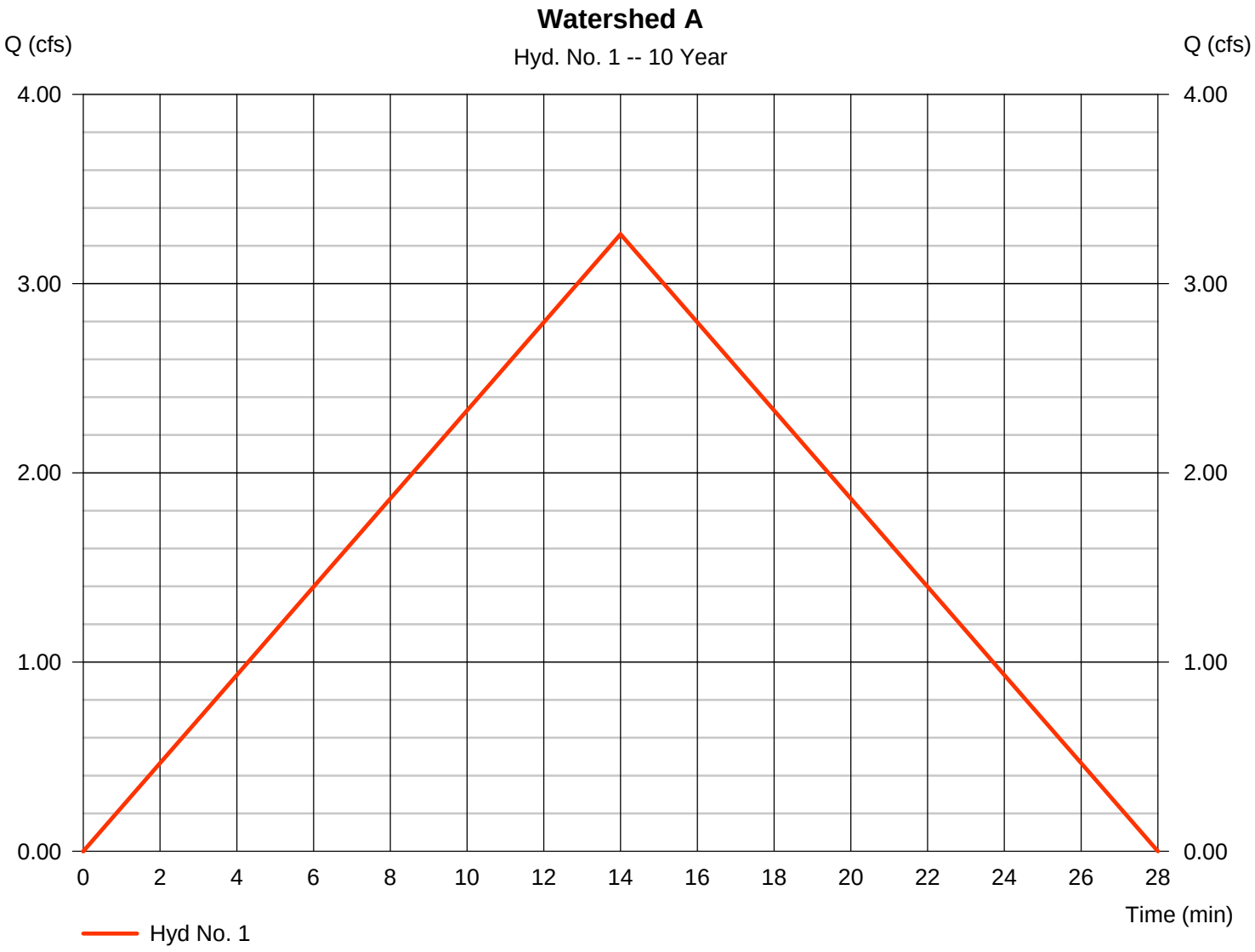
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	3.261 cfs
Storm frequency	=	10 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	2,740 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.3*
Intensity	=	4.706 in/hr	Tc by User	=	14.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	3.832 cfs
Storm frequency	=	25 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	3,219 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.3*
Intensity	=	5.530 in/hr	Tc by User	=	14.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310

Hydrograph Report

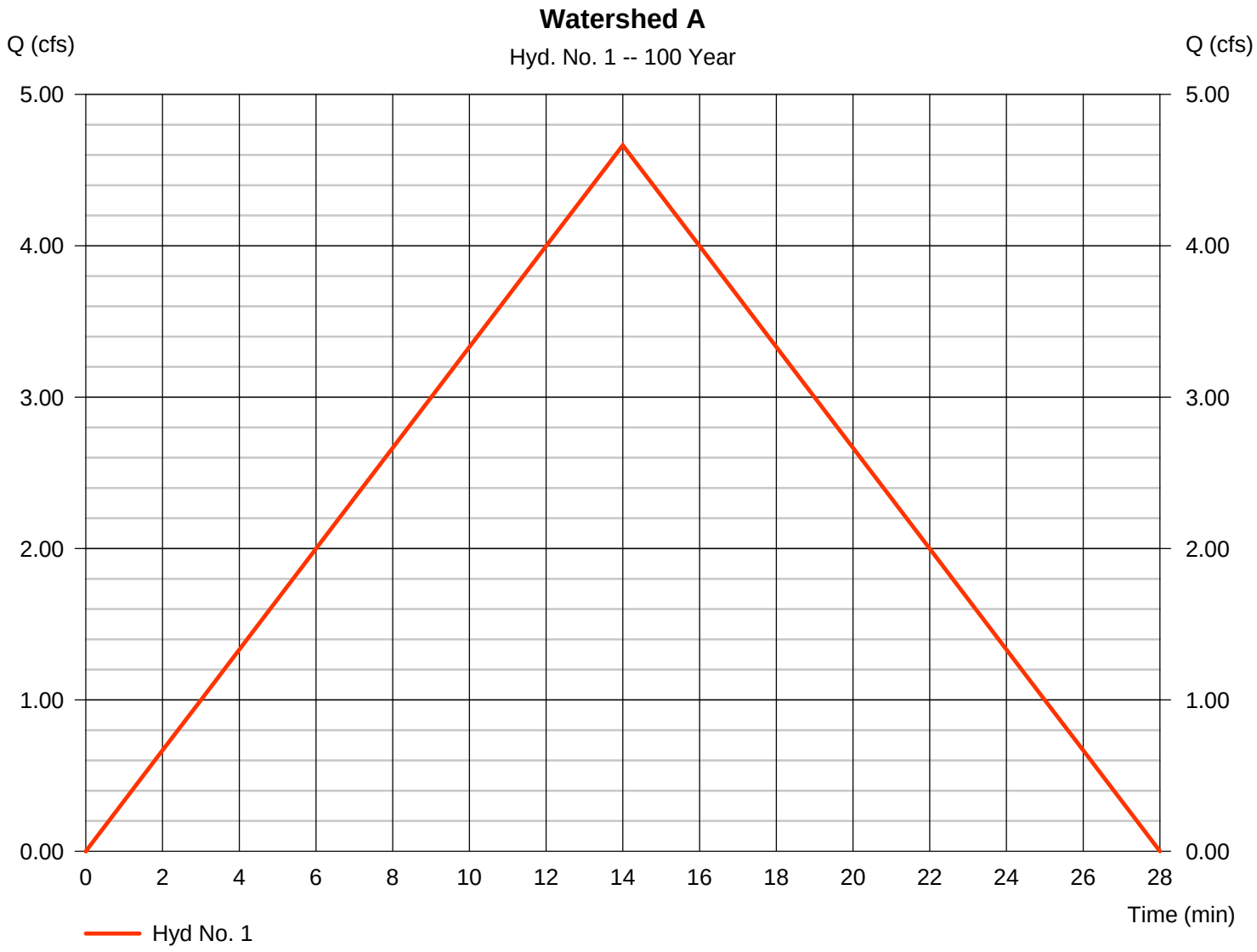
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 1

Watershed A

Hydrograph type	= Rational	Peak discharge	= 4.664 cfs
Storm frequency	= 100 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 3,918 cuft
Drainage area	= 2.310 ac	Runoff coeff.	= 0.3*
Intensity	= 6.731 in/hr	Tc by User	= 14.00 min
IDF Curve	= IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



TYPE OF SURFACE	RUNOFF COEFFICIENT
Non-Urban Areas	
Bare Earth	0.55
Steep Grassed Areas (slope 2:1)	0.60
Turf Meadows	0.25
Forested Areas	0.20
Cultivated Fields	0.30
Urban Areas	
All Watertight Roof Surfaces	0.90
Pavement (concrete, asphalt)	0.85
Gravel	0.85
Impervious Soils (Heavy)	0.55
Impervious Soils (with turf)	0.45
Slightly Pervious Soil	0.25
Slightly Pervious Soil (with turf)	0.20
Moderately Pervious Soil	0.15
Moderately Pervious Soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 ft^2	0.45
Lots < 12,000 ft^2	0.45
Lots < 17,000 ft^2	0.40
Lots > ½ Acre	0.35
Park, Cemetery or Unimproved Area	0.30

210-VI-TR-55, Second Edition, June 1986

Table 3.1.1 (TR-55 Table 3-1) : Runoff Coefficient's for use in the Rational Method calculations for Pipe, Channel and Detention Design

TR55 Tc Worksheet

Hyd. No. 2

Watershed A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 3.20		0.00		0.00		
Travel Time (min)	**= 8.94**	**+**	**0.00**	**+**	**0.00**	**=**	**8.94**
Shallow Concentrated Flow							
Flow length (ft)	= 119.00		0.00		0.00		
Watercourse slope (%)	= 3.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.89		0.00		0.00		
Travel Time (min)	**= 0.69**	**+**	**0.00**	**+**	**0.00**	**=**	**0.69**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 9.63 min

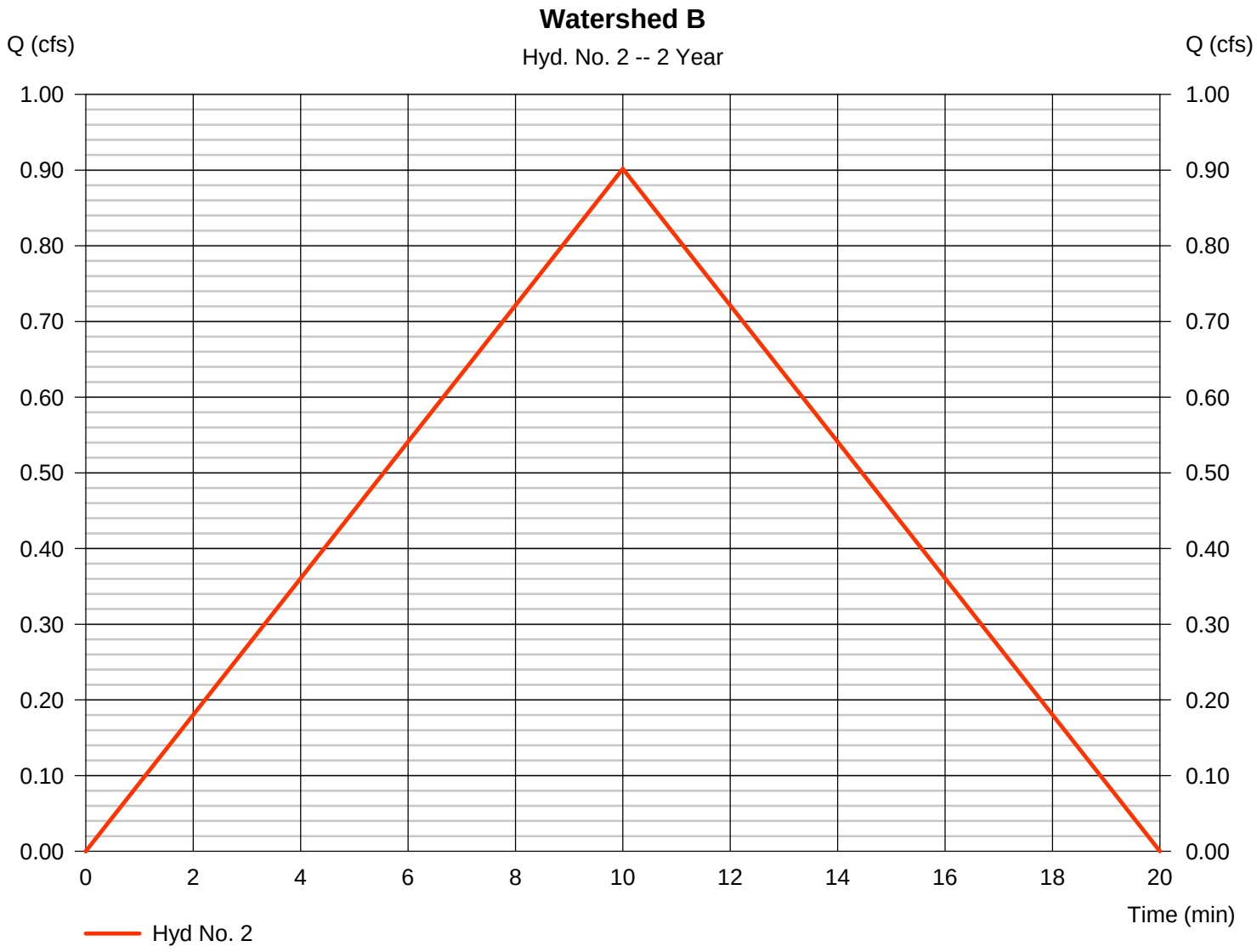
Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	0.902 cfs
Storm frequency	=	2 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	541 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.3*
Intensity	=	3.621 in/hr	Tc by User	=	10.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830



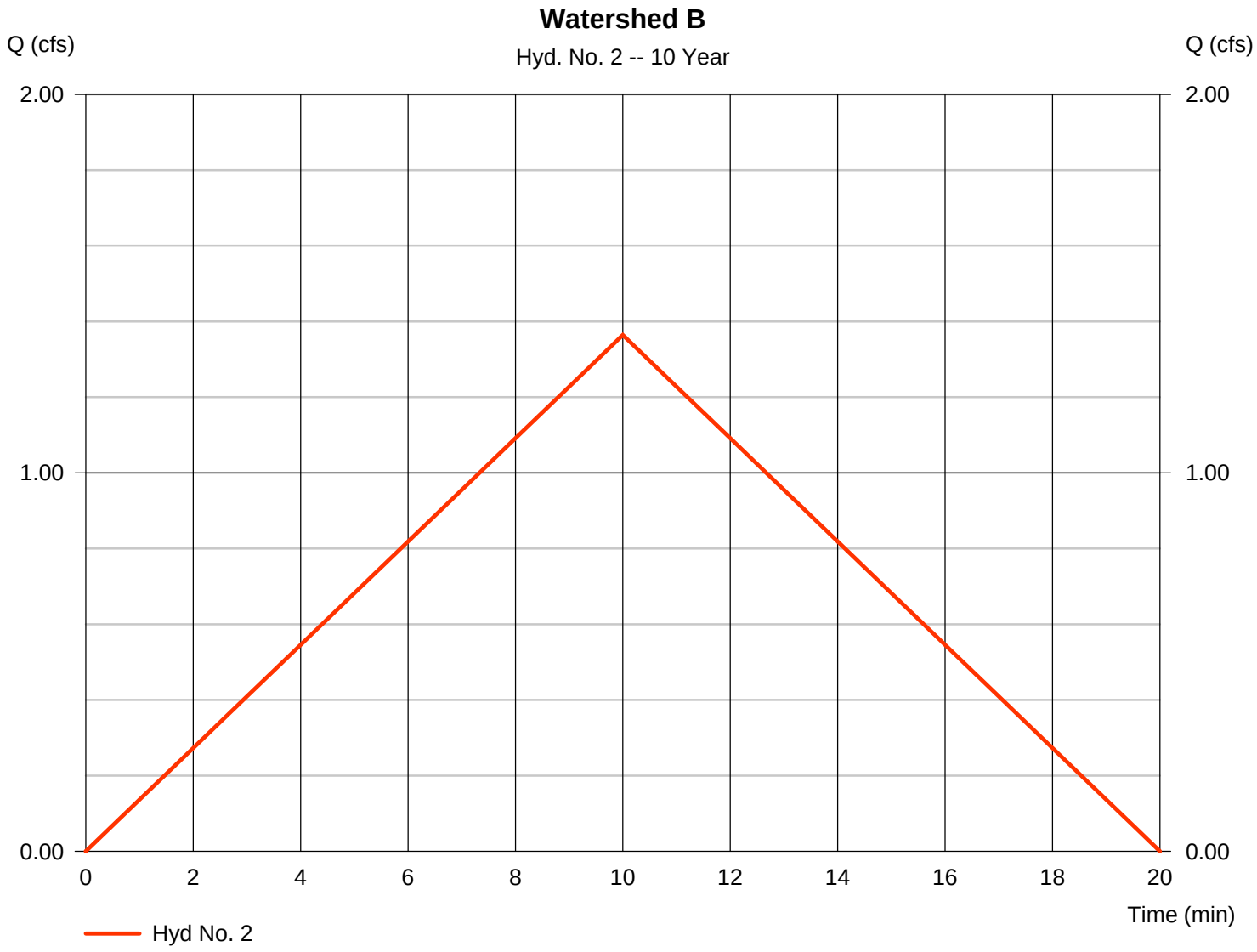
Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	1.364 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	819 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.3*
Intensity	=	5.479 in/hr	Tc by User	=	10.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830



Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	1.596 cfs
Storm frequency	=	25 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	957 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.3*
Intensity	=	6.408 in/hr	Tc by User	=	10.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830

Hydrograph Report

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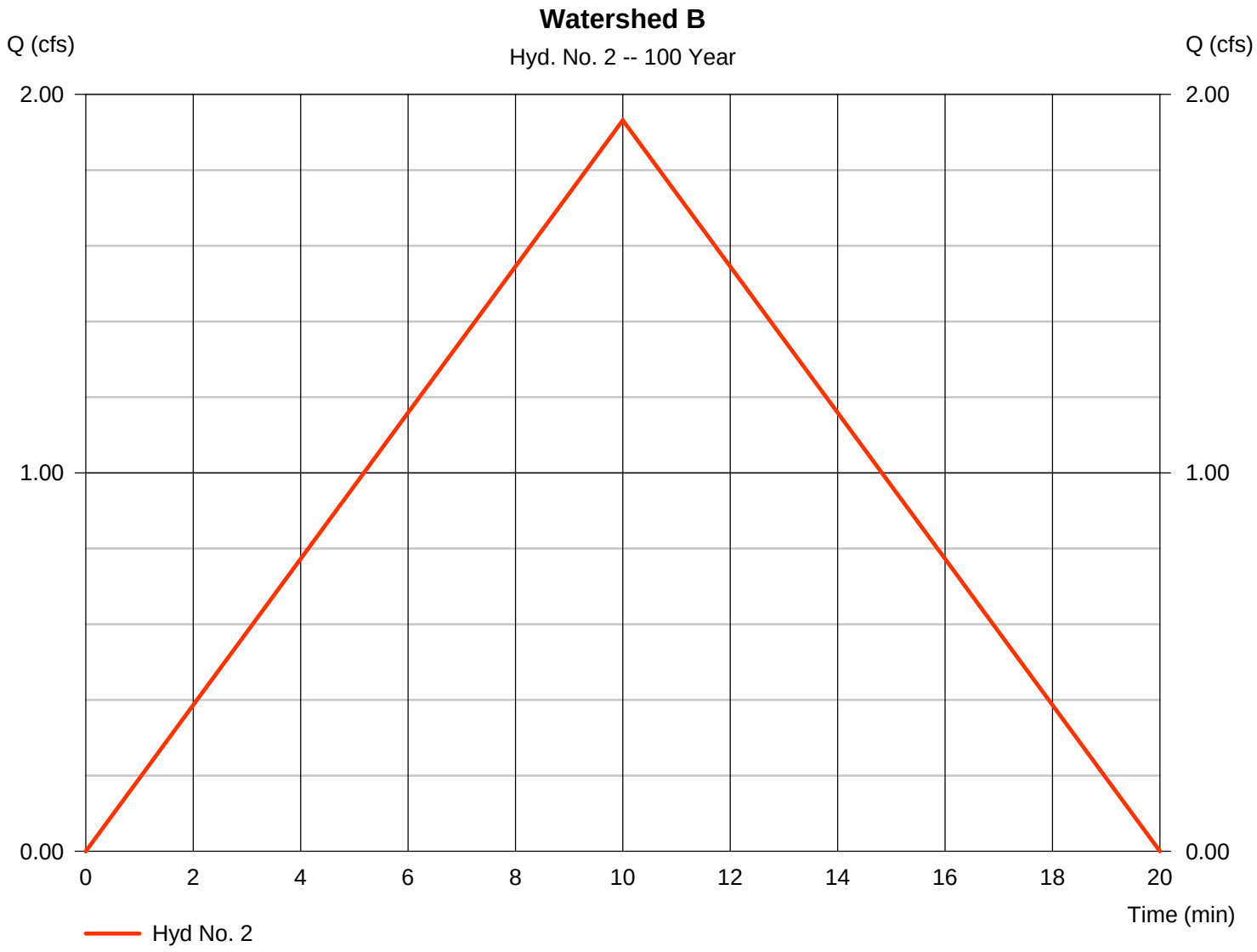
Hyd. No. 2

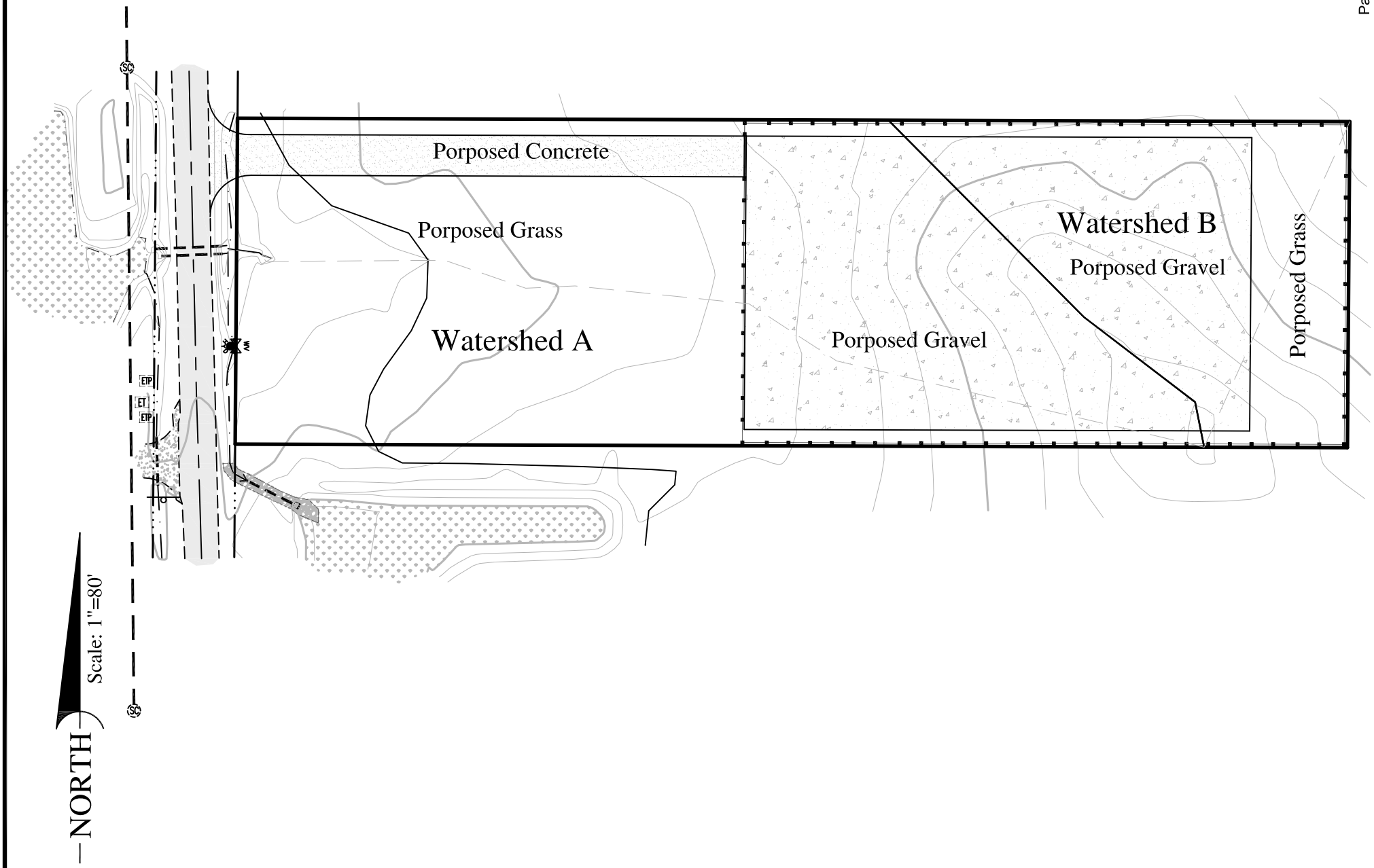
Watershed B

Hydrograph type	= Rational	Peak discharge	= 1.932 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 1,159 cuft
Drainage area	= 0.830 ac	Runoff coeff.	= 0.3*
Intensity	= 7.758 in/hr	Tc by User	= 10.00 min
IDF Curve	= IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830



Proposed Site Conditions



TYPE OF SURFACE	RUNOFF COEFFICIENT
Non-Urban Areas	
Bare Earth	0.55
Steep Grassed Areas (slope 2:1)	0.60
Turf Meadows	0.25
Forested Areas	0.20
Cultivated Fields	0.30
Urban Areas	
All Watertight Roof Surfaces	0.90
Pavement (concrete, asphalt)	0.85
Gravel	0.85
Impervious Soils (Heavy)	0.55
Impervious Soils (with turf)	0.45
Slightly Pervious Soil	0.25
Slightly Pervious Soil (with turf)	0.20
Moderately Pervious Soil	0.15
Moderately Pervious Soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 ft^2	0.45
Lots < 12,000 ft^2	0.45
Lots < 17,000 ft^2	0.40
Lots > ½ Acre	0.35
Park, Cemetery or Unimproved Area	0.30

210-VI-TR-55, Second Edition, June 1986

Table 3.1.1 (TR-55 Table 3-1) : Runoff Coefficient's for use in the Rational Method calculations for Pipe, Channel and Detention Design

TR55 Tc Worksheet

Hyd. No. 1

Watershed A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 1.76**	**+**	**0.00**	**+**	**0.00**	**=**	**1.76**
Shallow Concentrated Flow							
Flow length (ft)	= 200.00		315.00		0.00		
Watercourse slope (%)	= 1.00		2.10		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=2.03		2.34		0.00		
Travel Time (min)	**= 1.64**	**+**	**2.25**	**+**	**0.00**	**=**	**3.89**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.65 min

Hydrograph Report

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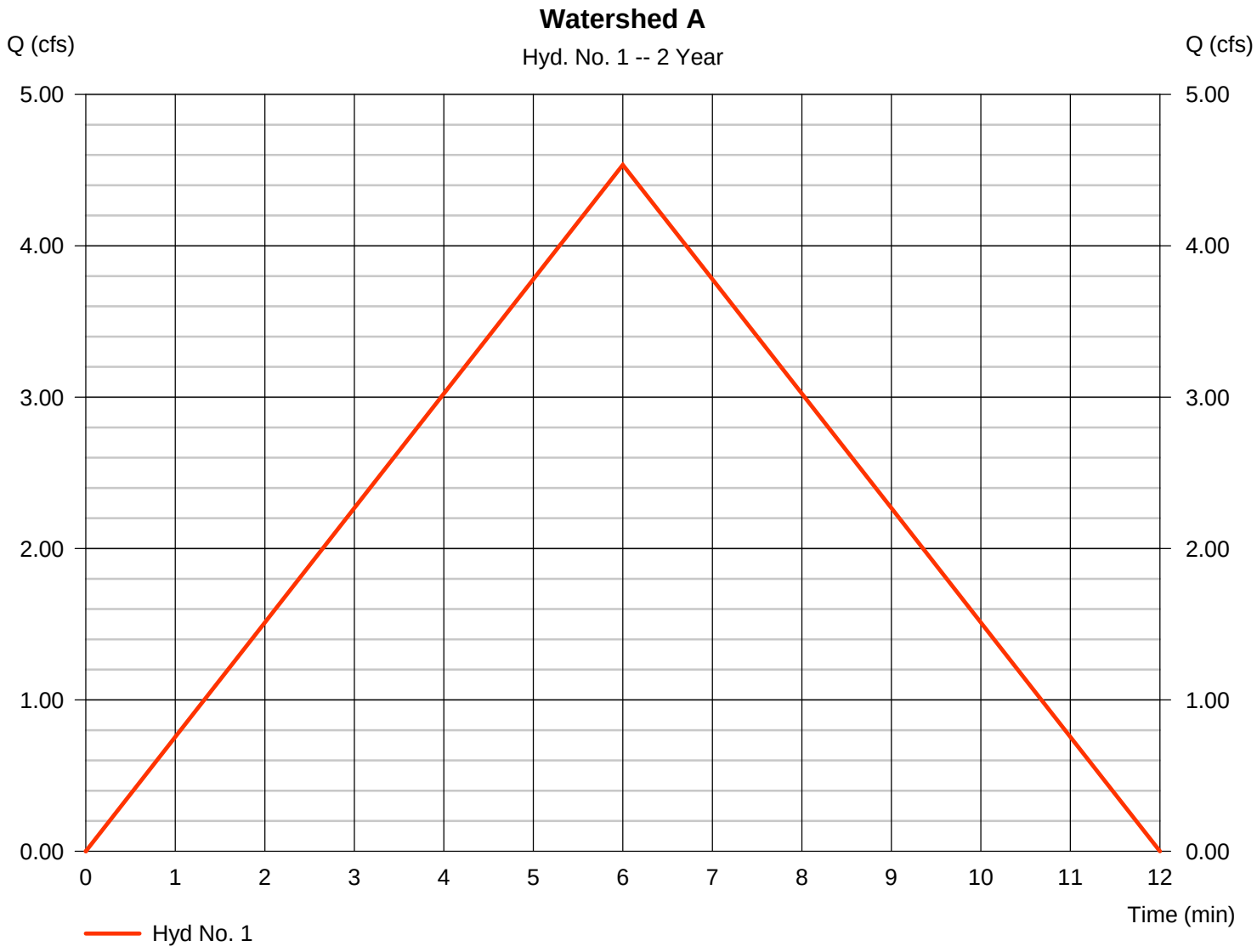
Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	4.535 cfs
Storm frequency	=	2 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	1,633 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.44*
Intensity	=	4.462 in/hr	Tc by User	=	6.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



Hydrograph Report

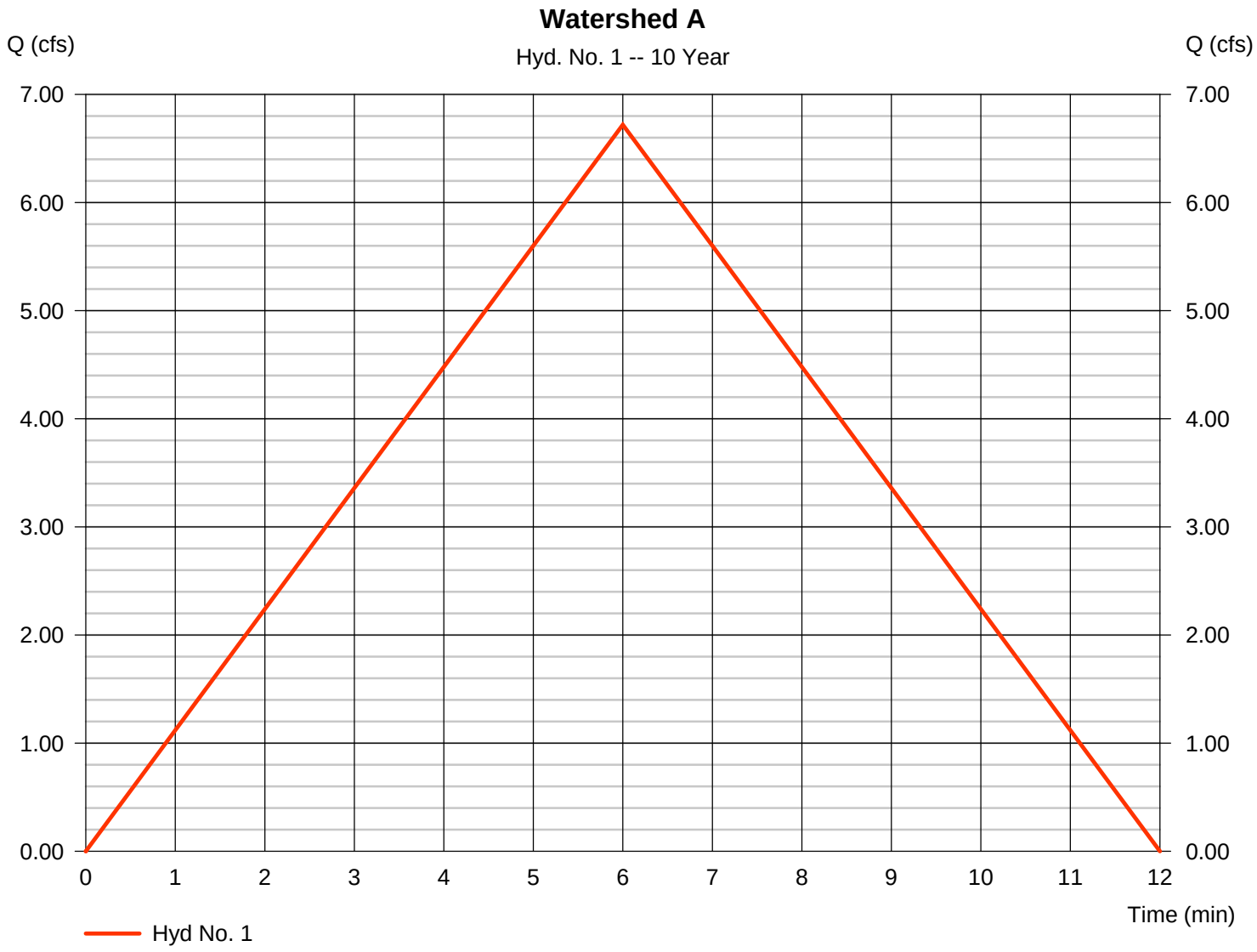
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	6.720 cfs
Storm frequency	=	10 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	2,419 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.44*
Intensity	=	6.611 in/hr	Tc by User	=	6.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



Hydrograph Report

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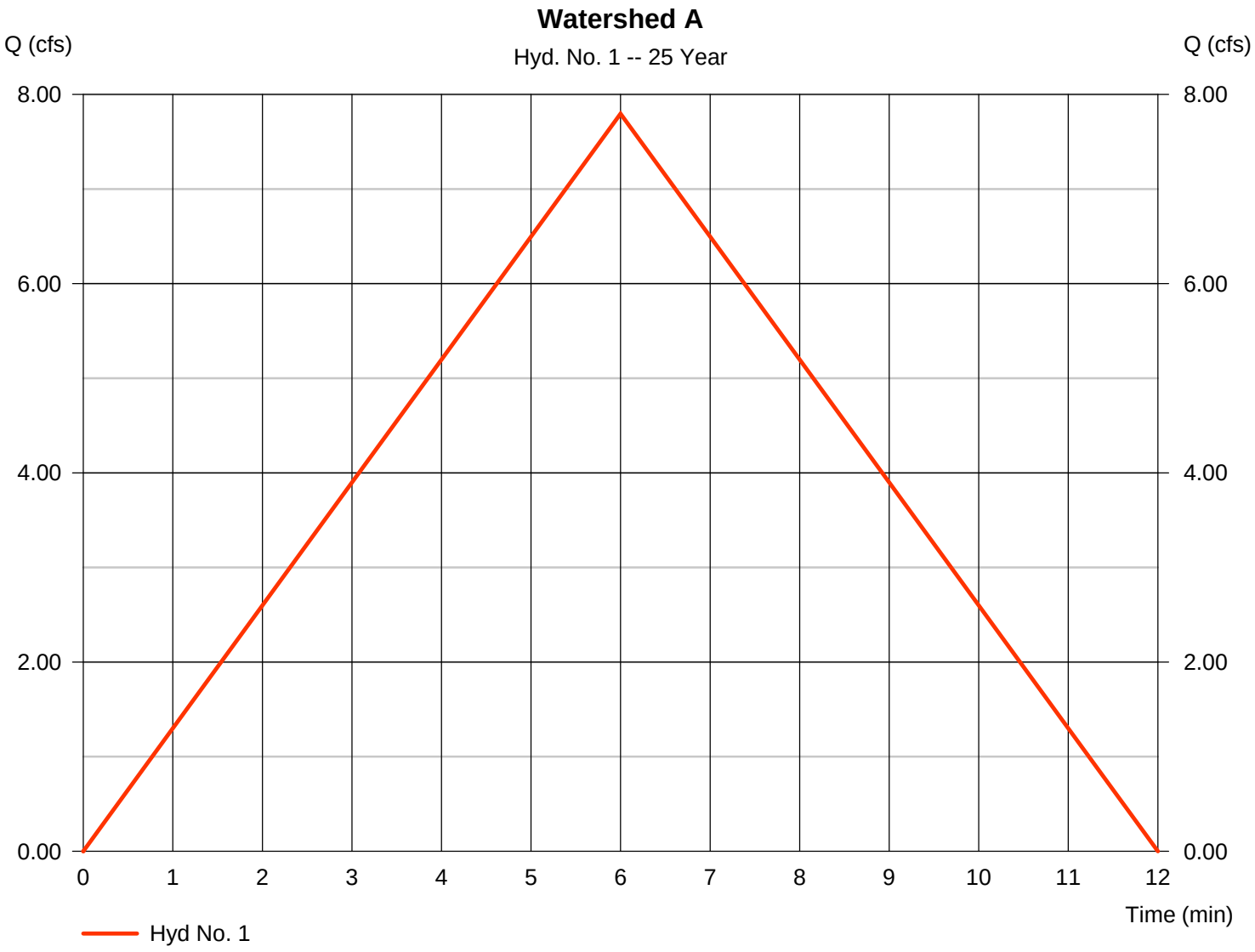
Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	7.796 cfs
Storm frequency	=	25 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	2,807 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.44*
Intensity	=	7.670 in/hr	Tc by User	=	6.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



Hydrograph Report

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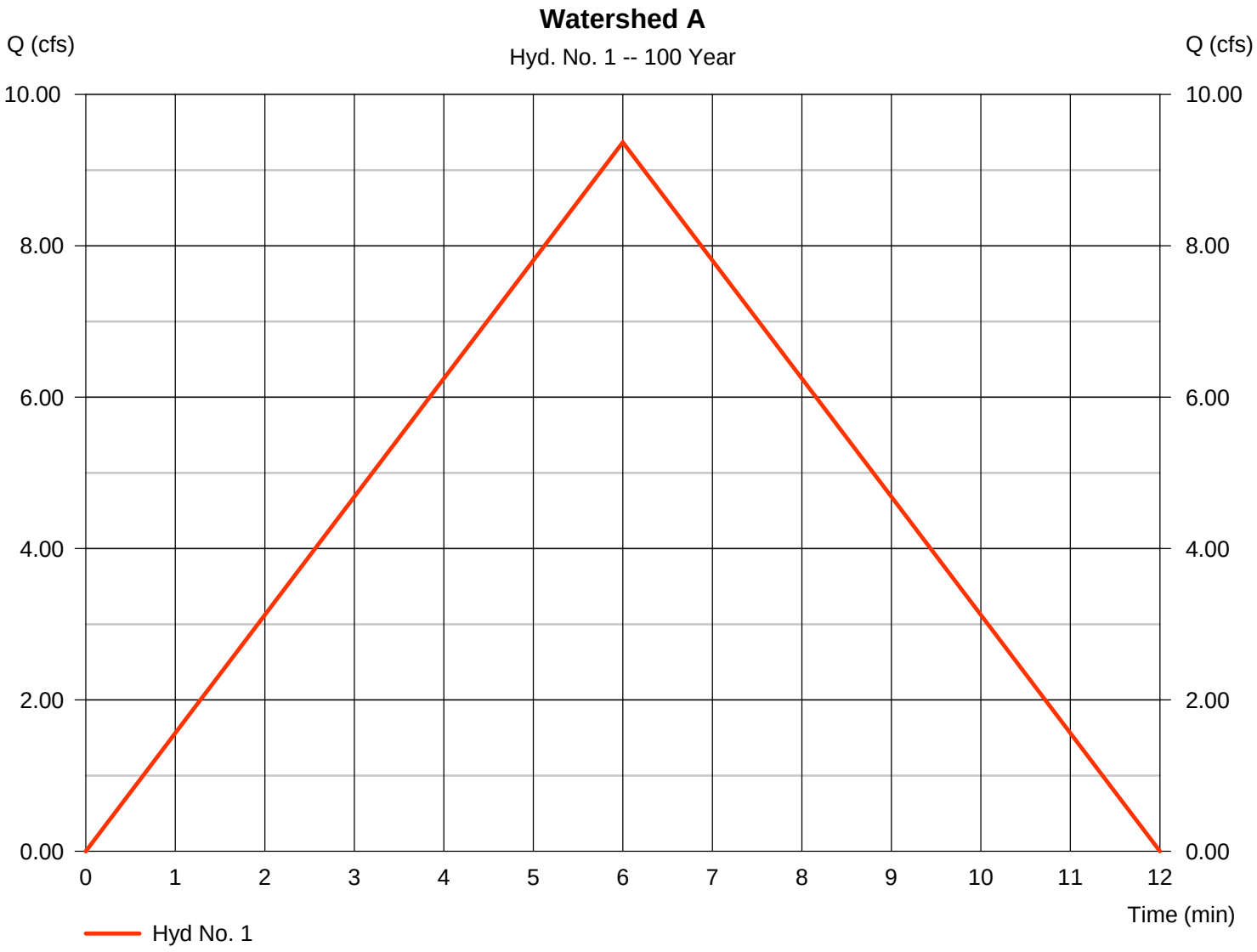
Hyd. No. 1

Watershed A

Hydrograph type	=	Rational	Peak discharge	=	9.368 cfs
Storm frequency	=	100 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	3,373 cuft
Drainage area	=	2.310 ac	Runoff coeff.	=	0.44*
Intensity	=	9.217 in/hr	Tc by User	=	6.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.790 x 0.85) + (0.180 x 0.85) + (1.340 x 0.15)] / 2.310



TYPE OF SURFACE	RUNOFF COEFFICIENT
Non-Urban Areas	
Bare Earth	0.55
Steep Grassed Areas (slope 2:1)	0.60
Turf Meadows	0.25
Forested Areas	0.20
Cultivated Fields	0.30
Urban Areas	
All Watertight Roof Surfaces	0.90
Pavement (concrete, asphalt)	0.85
Gravel	0.85
Impervious Soils (Heavy)	0.55
Impervious Soils (with turf)	0.45
Slightly Pervious Soil	0.25
Slightly Pervious Soil (with turf)	0.20
Moderately Pervious Soil	0.15
Moderately Pervious Soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 ft^2	0.45
Lots < 12,000 ft^2	0.45
Lots < 17,000 ft^2	0.40
Lots > ½ Acre	0.35
Park, Cemetery or Unimproved Area	0.30

210-VI-TR-55, Second Edition, June 1986

Table 3.1.1 (TR-55 Table 3-1) : Runoff Coefficient's for use in the Rational Method calculations for Pipe, Channel and Detention Design

TR55 Tc Worksheet

Hyd. No. 2

Watershed B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 72.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 1.35**	**+**	**0.00**	**+**	**0.00**	**=**	**1.35**
Shallow Concentrated Flow							
Flow length (ft)	= 147.00		0.00		0.00		
Watercourse slope (%)	= 3.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.89		0.00		0.00		
Travel Time (min)	**= 0.85**	**+**	**0.00**	**+**	**0.00**	**=**	**0.85**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 2.20 min

Hydrograph Report

Hyd. No. 2

Watershed B

Hydrograph type	= Rational	Peak discharge	= 2.247 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 674 cuft
Drainage area	= 0.830 ac	Runoff coeff.	= 0.57*
Intensity	= 4.749 in/hr	Tc by User	= 5.00 min
IDF Curve	= IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830

Hydrograph Report

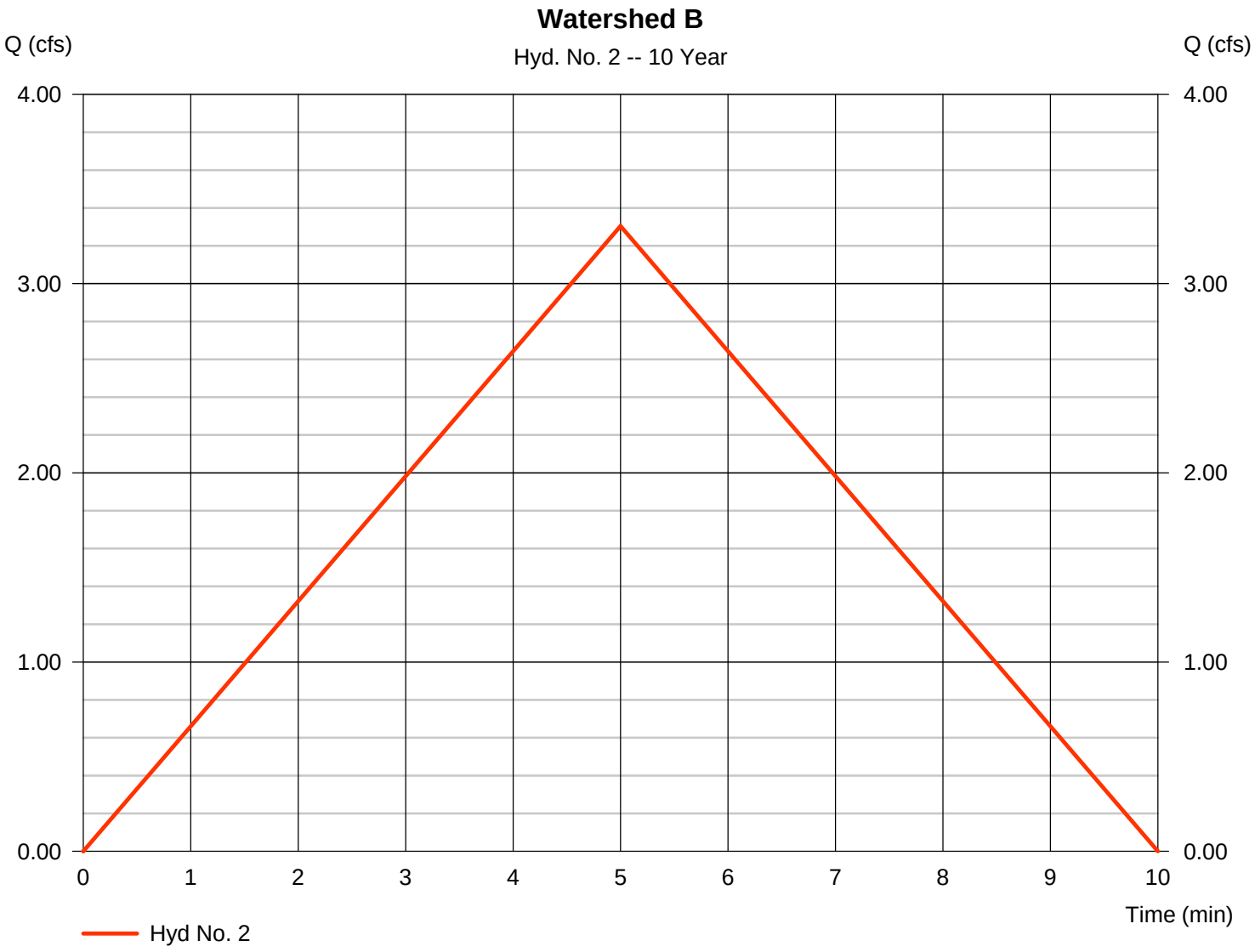
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	3.304 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	991 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.57*
Intensity	=	6.984 in/hr	Tc by User	=	5.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	3.822 cfs
Storm frequency	=	25 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	1,147 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.57*
Intensity	=	8.078 in/hr	Tc by User	=	5.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

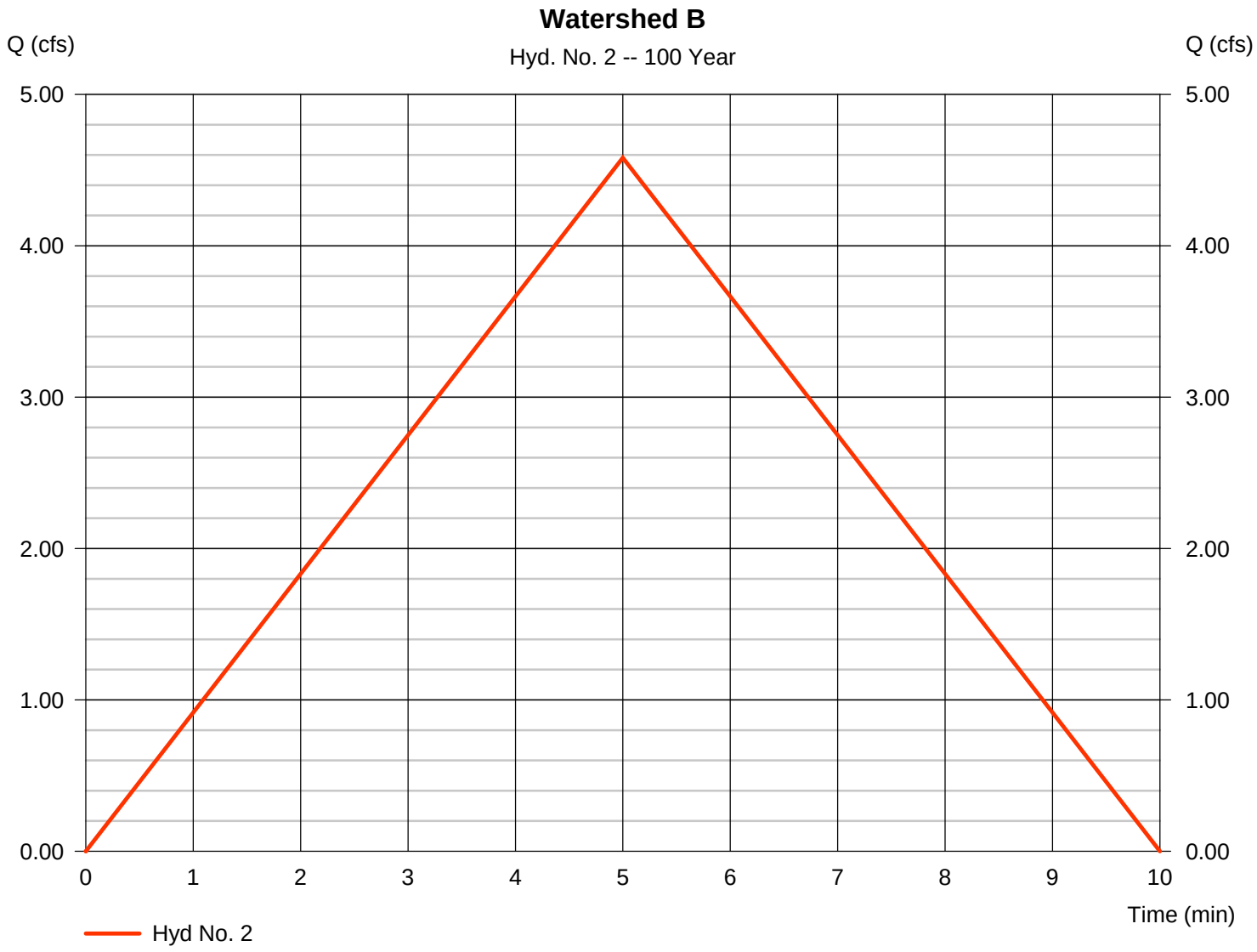
* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 11 / 12 / 2015

Hyd. No. 2

Watershed B

Hydrograph type	=	Rational	Peak discharge	=	4.582 cfs
Storm frequency	=	100 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	1,375 cuft
Drainage area	=	0.830 ac	Runoff coeff.	=	0.57*
Intensity	=	9.685 in/hr	Tc by User	=	5.00 min
IDF Curve	=	IDF_Marion_01.24.14.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.500 x 0.85) + (0.330 x 0.15)] / 0.830