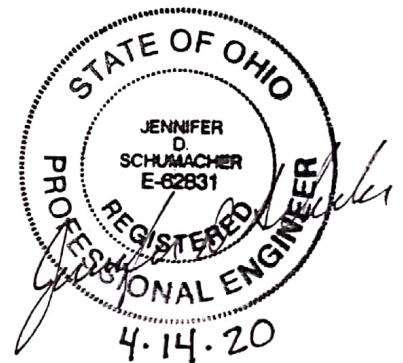


**Post-Construction Storm Water Management Report
Massillon City Schools Operation Facility**

Located in the City of Massillon,
Stark County, Ohio

February 2020
Revised April 2020



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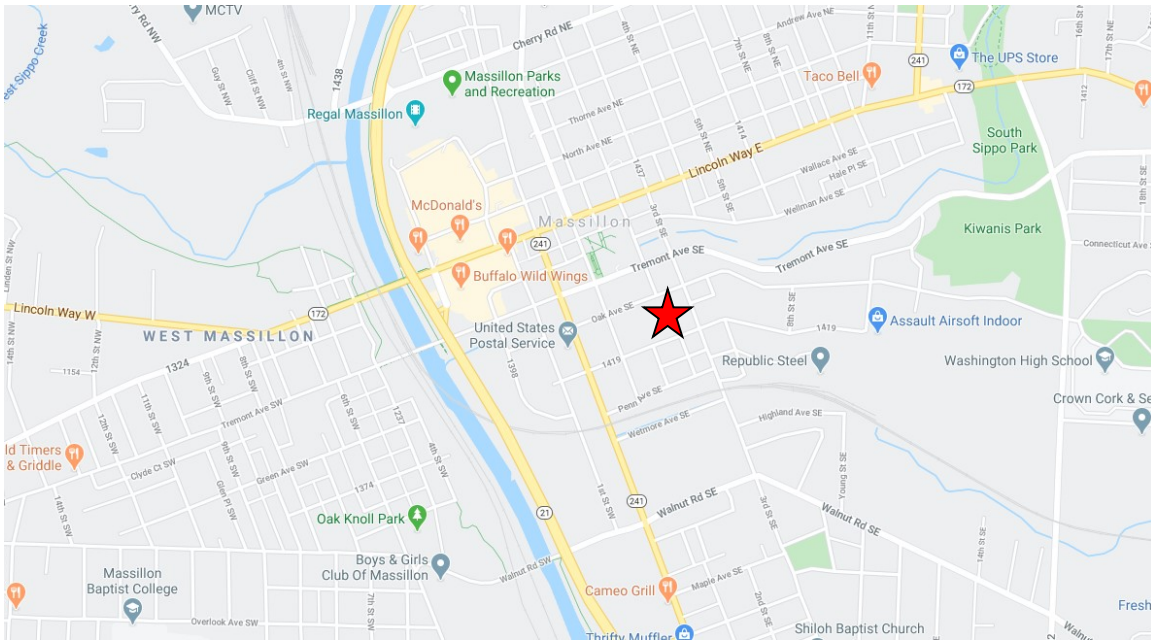
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Vicinity Map
N.T.S.



Section 1: Drainage Narrative



Overview

- Location: 207 Oak Ave. S.E. City of Massillon, Stark County, Ohio 44646
- Current: Massillon City School District operation facility, paved parking, gravel parking, and lawn areas. (Old high school building)
- Proposed: Partial building demo throughout the property. Re-development including car parking area on the west side of the property and bus parking on the east side of the property and re-grading of applicable areas to allow for proper drainage and new storm pipes. A Bio Retention Cell is proposed in the northwest corner of the property. The bio retention cell is added to address water quality for this redevelopment project and adds some retainage of storm water or slowing the rate of runoff to the existing storm sewers to the south.

Point/Line of Analysis:

This project is a site re-development. Existing conditions show that the drainage is split between flowing north to Oak Avenue and south to South Avenue. The north portion includes the NE bus parking area through an existing catch basin and two 6" pipes to the curb line and a portion of the northwest parking lot.

Total Pre- Dev Onsite Drainage area to Oak Ave. (north)= 0.76 Ac.

All other areas on site (including the building) drain south via storm sewers to an existing MH located along South Ave.

Total Pre- Dev Onsite Drainage area to South Ave. MH (south) = 3.23 Ac.

Post development flows include the following:

Total Post Dev Onsite Drainage Area to Oak Ave (north) = 0.08Ac.

Total Post Dev Onsite Drainage Area to South Ave MH (south) = 3.91 Ac.

The drainage area to the north to Oak avenue is reduced in area and thus the flowrate is reduced and detention storage is not needed. The drainage area to the south analysis point, the existing MH located in South Ave. is increased. The bio retention basin in the NW corner provides some detention or slowing down of the flow rate from the site and oversized pipes are being used to contain outflows to existing rates.

The hydrograph information to compare pre to post flowrates is included in Section 2.



The 10-year capacity and 100-year storm hydraulic grade line calculations through the proposed onsite storm and existing storm sewer in Oak Ave. show that the existing 18" storm has capacity without overtopping catch basin grates within the analyzed storm system, except for CB #4 which is within the bio retention basin. The calculations show that it will overflow, but the amount is minimal and will not affect overall drainage and use of the bio retention. See storm sewer calcs in section 3.

Drainage Maps

Two drainage maps are provided in Section 5.

1. Pre-Development
2. Post-Development/Catch Basin

Summary of Storm Sewer Calculations

The enclosed storm sewer flow calculations were computed using ODOT CDSS Design Software, which are included in section 3.

Water Quality

The total site disturbance is 2.90 Ac. Water quality will not be required for entire site. Stark Soil and Water Conservation district requires the treatment of 20% of total impervious area for re-development sites. A bioretention cell will be utilized to meet this requirement. See section 4 for calculations and plan sheet C3.1 for details.

Water Quality Structures

Bio-Cell Drainage Area=	0.58 Ac. (20% of total disturbed area)
6" discharge Pipe	Inv. 946.84
Top of CB	Inv. 949.50
Top of Bio Cell Storage Area	Elev. 950.00
Bottom of Bio Cell Storage Area=	Elev. 949.00
Required Filter Bed Area=	1,185 sq. ft.
Provided Filter Bed Area=	1,242 sq. ft.



Section 2: Pre vs Post Development Calculations



Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	-----	-----	2.287	-----	2.768	3.129	3.573	3.893	4.196	Pre-Dev to the North (Oak)
2	Rational	-----	-----	0.201	-----	0.243	0.274	0.313	0.342	0.368	Post Dev to North (Oak)
3	Rational	-----	-----	10.72	-----	12.97	14.66	16.74	18.24	19.66	Pre-Dev to the South
4	Rational	-----	-----	9.705	-----	11.77	13.32	15.23	16.60	17.89	Post Dev South
Proj. file: 2020-04-14 Hydrographs.gpw										Wednesday, 04 / 15 / 2020	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	2.287	1	10	1,372	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.201	1	10	120	-----	-----	-----	Post Dev to North (Oak)
3	Rational	10.72	1	10	6,430	-----	-----	-----	Pre-Dev to the South
4	Rational	9.705	1	13	7,570	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 2 Year			Wednesday, 04 / 15 / 2020	

Hydrograph Report

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

Wednesday, 04 / 15 / 2020

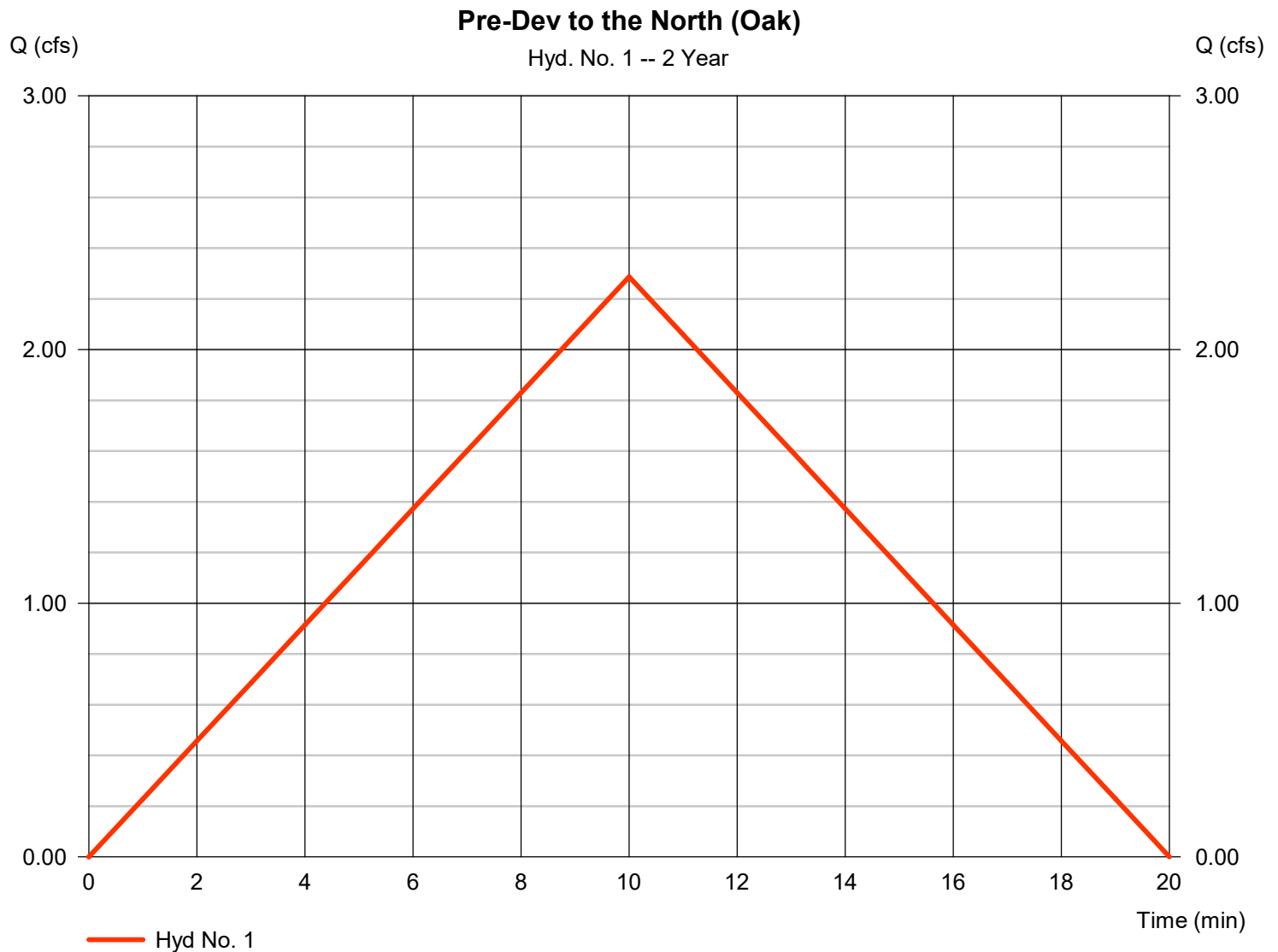
Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 0.760 ac
Intensity = 3.858 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 2.287 cfs
Time to peak = 10 min
Hyd. volume = 1,372 cuft
Runoff coeff. = 0.78*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.530 \times 0.90) + (0.060 \times 0.80) + (0.170 \times 0.40)] / 0.760$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

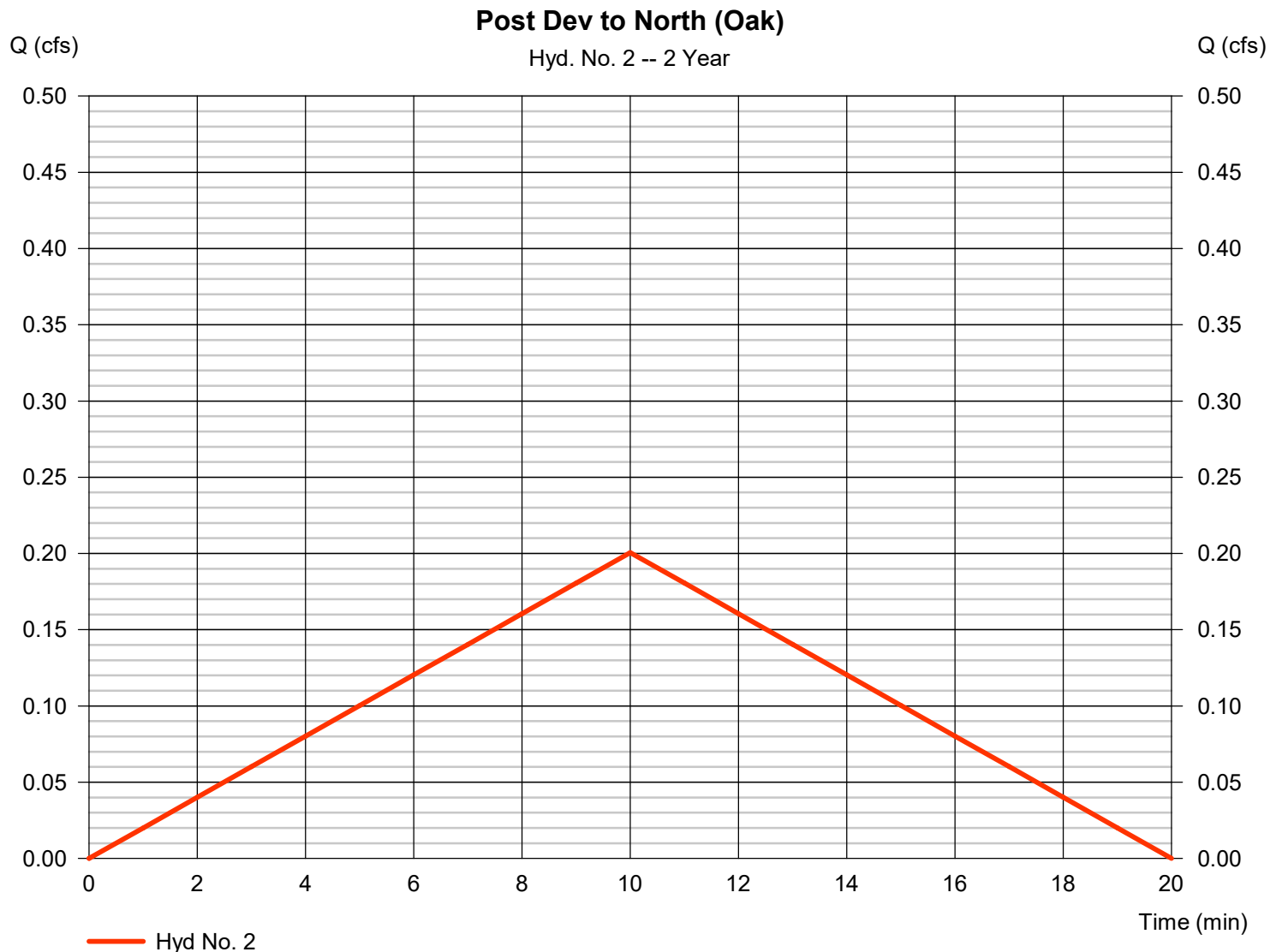
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 3.858 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.201 cfs
Time to peak = 10 min
Hyd. volume = 120 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

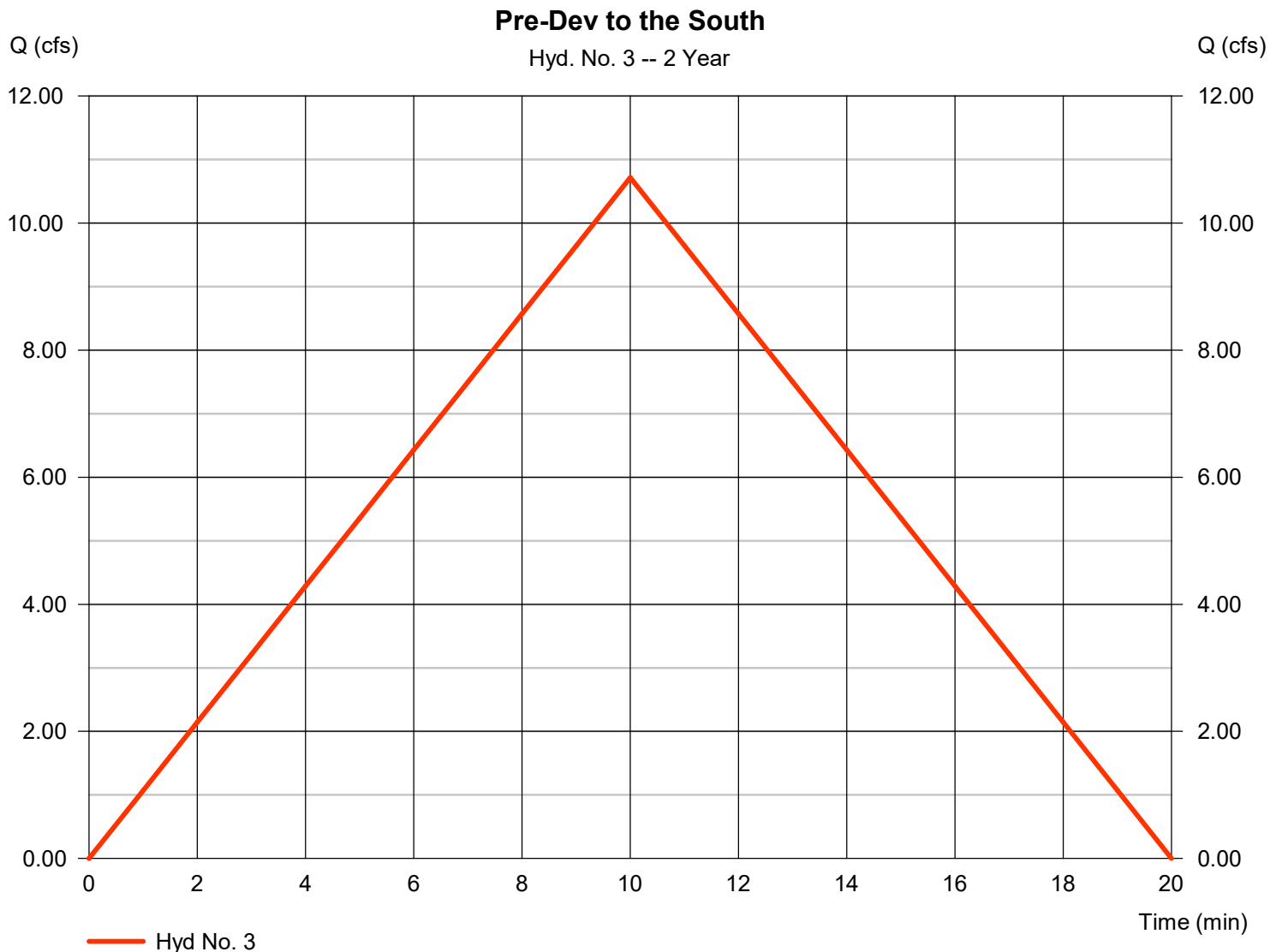
Hyd. No. 3

Pre-Dev to the South

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 3.230 ac
Intensity = 3.858 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 10.72 cfs
Time to peak = 10 min
Hyd. volume = 6,430 cuft
Runoff coeff. = 0.86*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(2.940 \times 0.90) + (0.060 \times 0.80) + (0.240 \times 0.40)] / 3.230$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

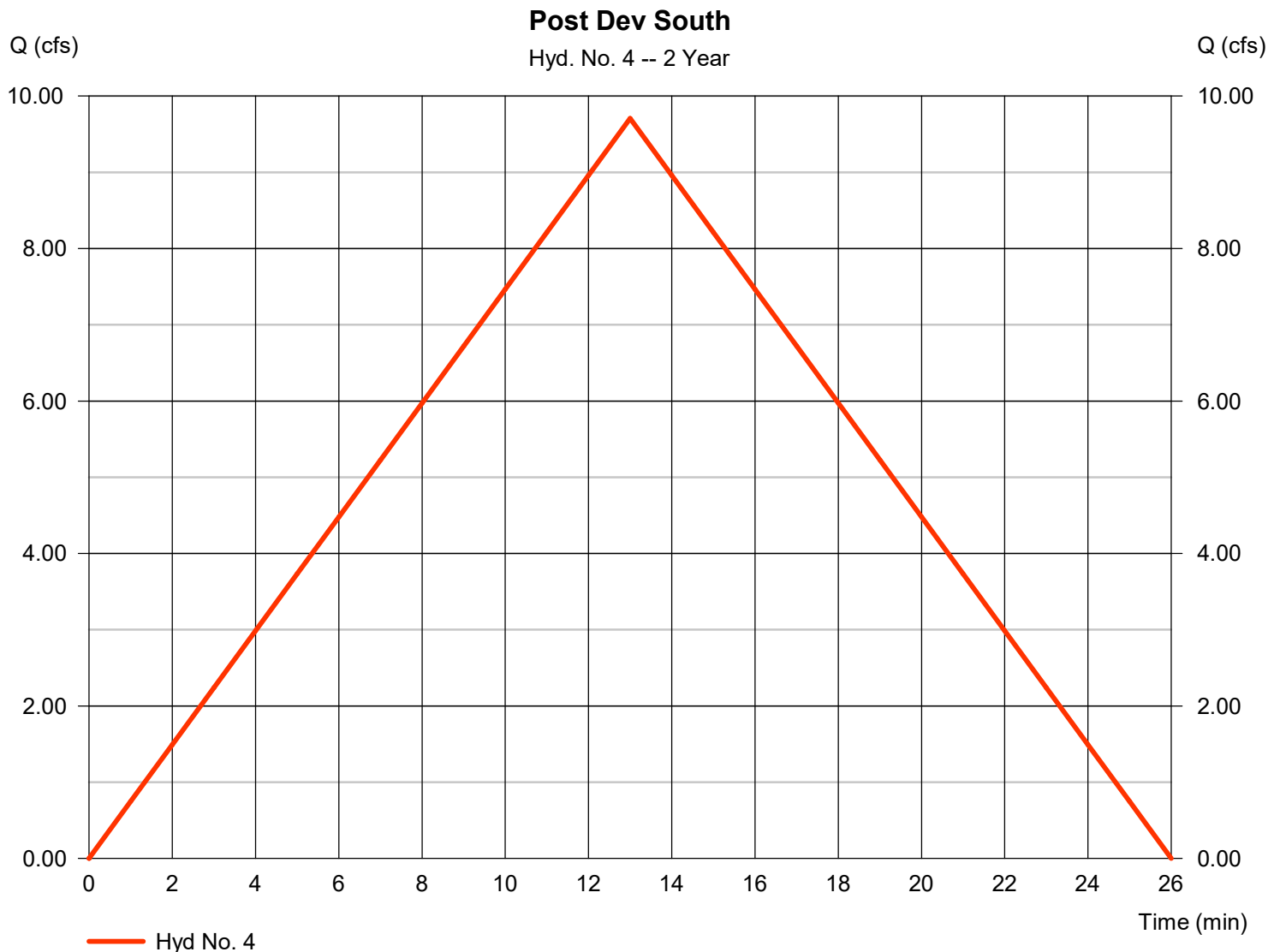
Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 3.418 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 9.705 cfs
Time to peak = 13 min
Hyd. volume = 7,570 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(3.110 \times 0.90) + (0.042 \times 0.80) + (0.038 \times 0.40)] / 3.190$



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	2.768	1	10	1,661	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.243	1	10	146	-----	-----	-----	Post Dev to North (Oak)
3	Rational	12.97	1	10	7,781	-----	-----	-----	Pre-Dev to the South
4	Rational	11.77	1	13	9,180	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 5 Year			Wednesday, 04 / 15 / 2020	

Hydrograph Report

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

Wednesday, 04 / 15 / 2020

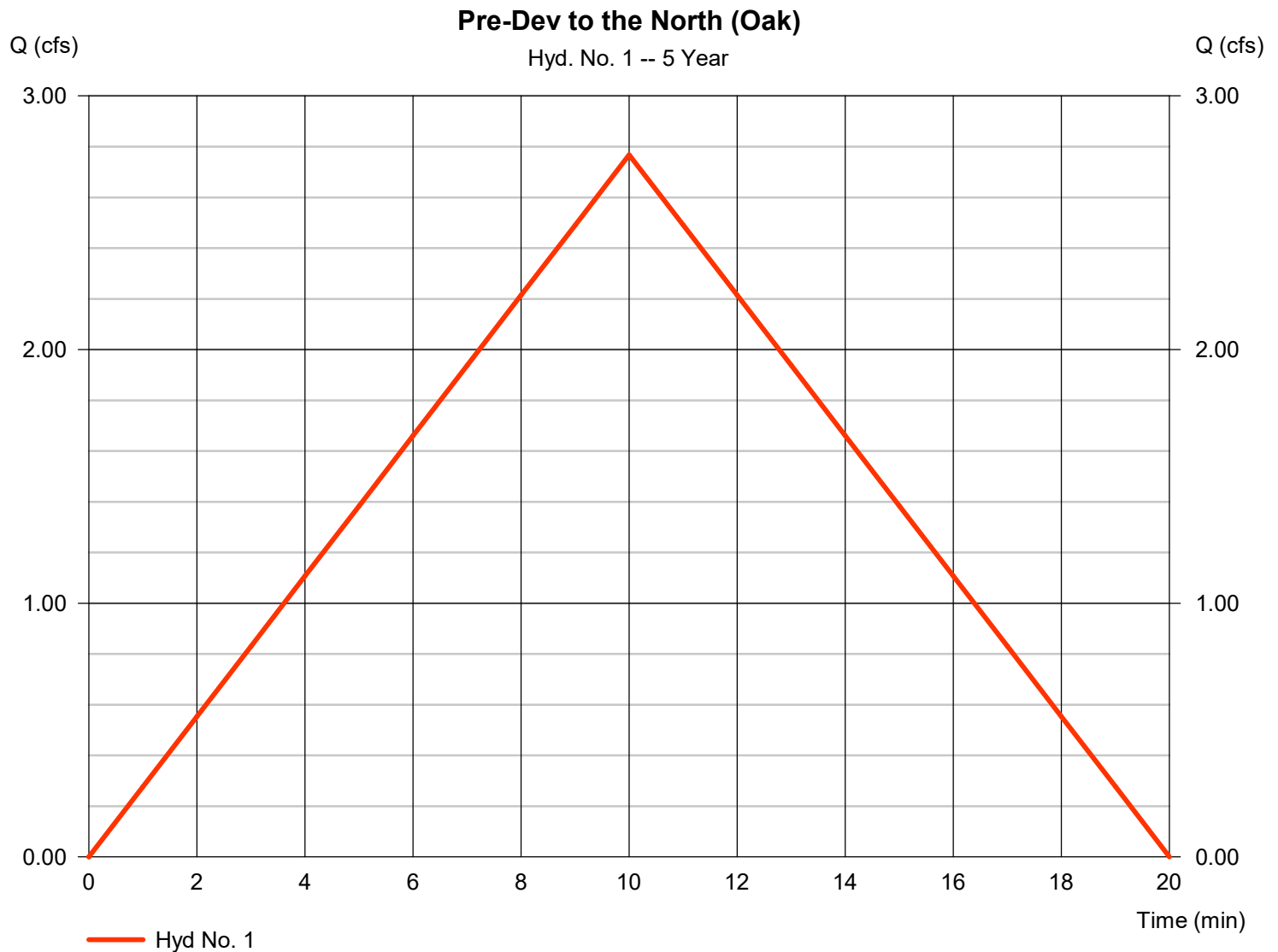
Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type = Rational
Storm frequency = 5 yrs
Time interval = 1 min
Drainage area = 0.760 ac
Intensity = 4.669 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 2.768 cfs
Time to peak = 10 min
Hyd. volume = 1,661 cuft
Runoff coeff. = 0.78*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.530 \times 0.90) + (0.060 \times 0.80) + (0.170 \times 0.40)] / 0.760$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

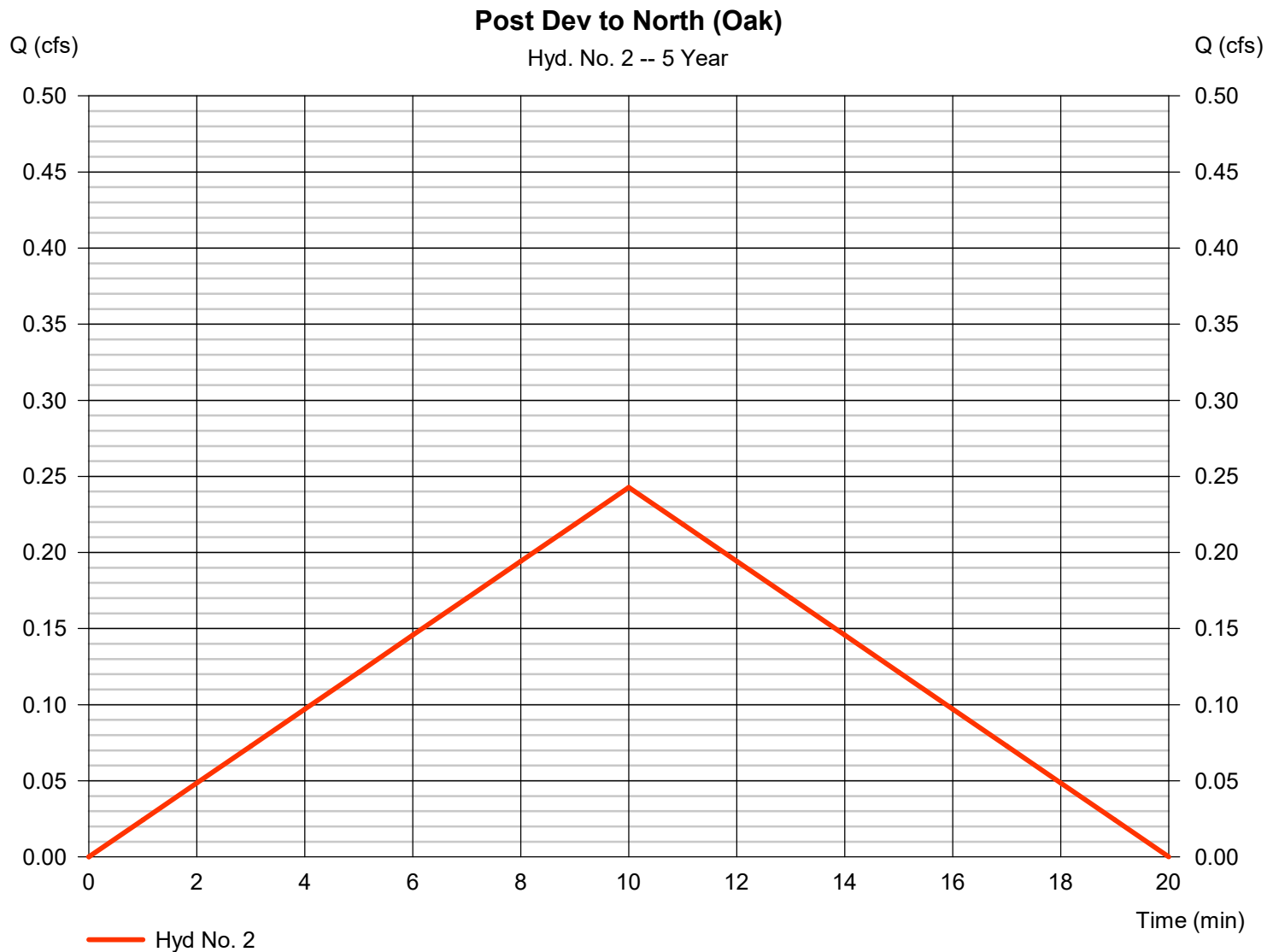
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 5 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 4.669 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.243 cfs
Time to peak = 10 min
Hyd. volume = 146 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

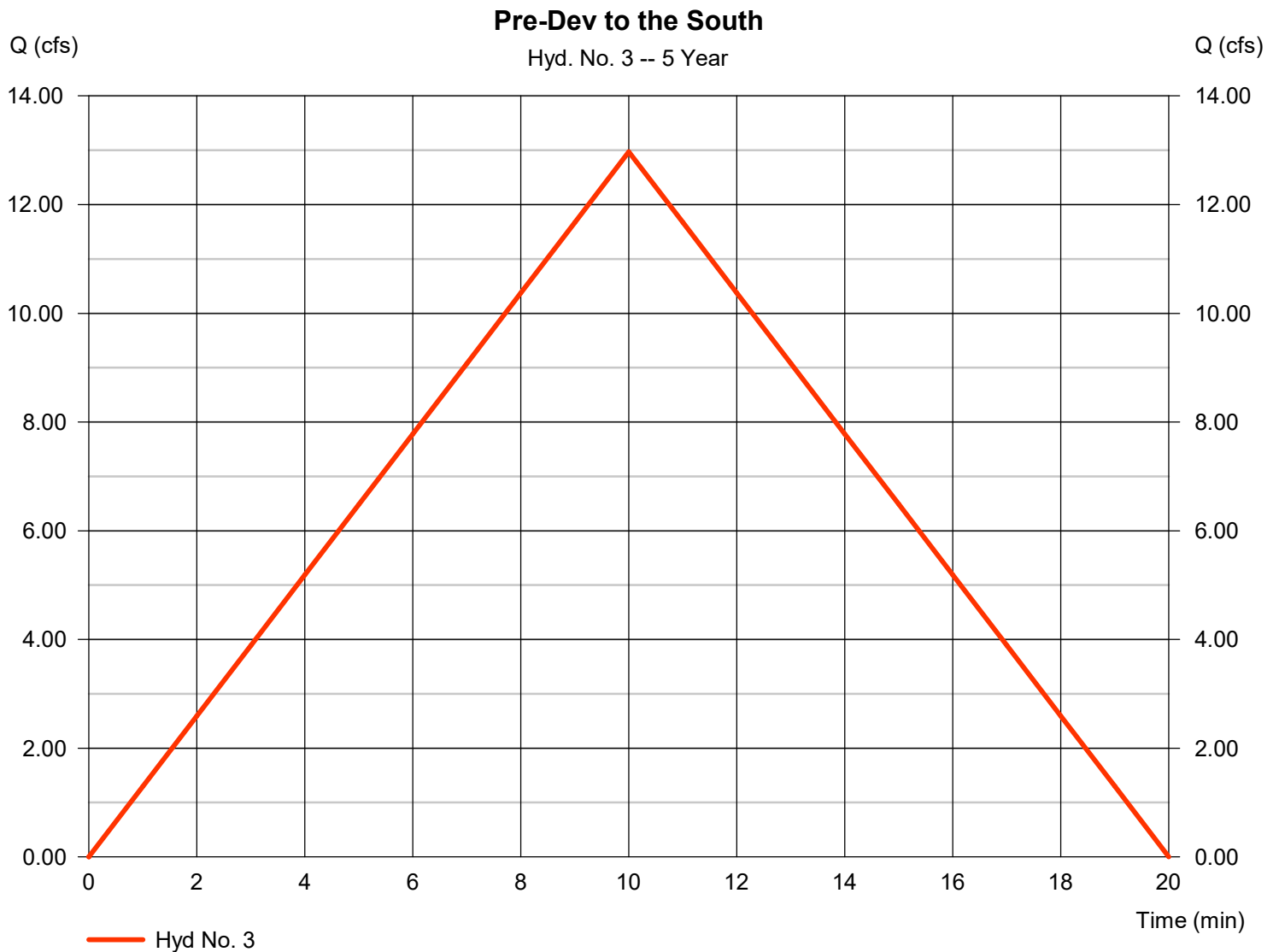
Hyd. No. 3

Pre-Dev to the South

Hydrograph type = Rational
Storm frequency = 5 yrs
Time interval = 1 min
Drainage area = 3.230 ac
Intensity = 4.669 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 12.97 cfs
Time to peak = 10 min
Hyd. volume = 7,781 cuft
Runoff coeff. = 0.86*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(2.940 \times 0.90) + (0.060 \times 0.80) + (0.240 \times 0.40)] / 3.230$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

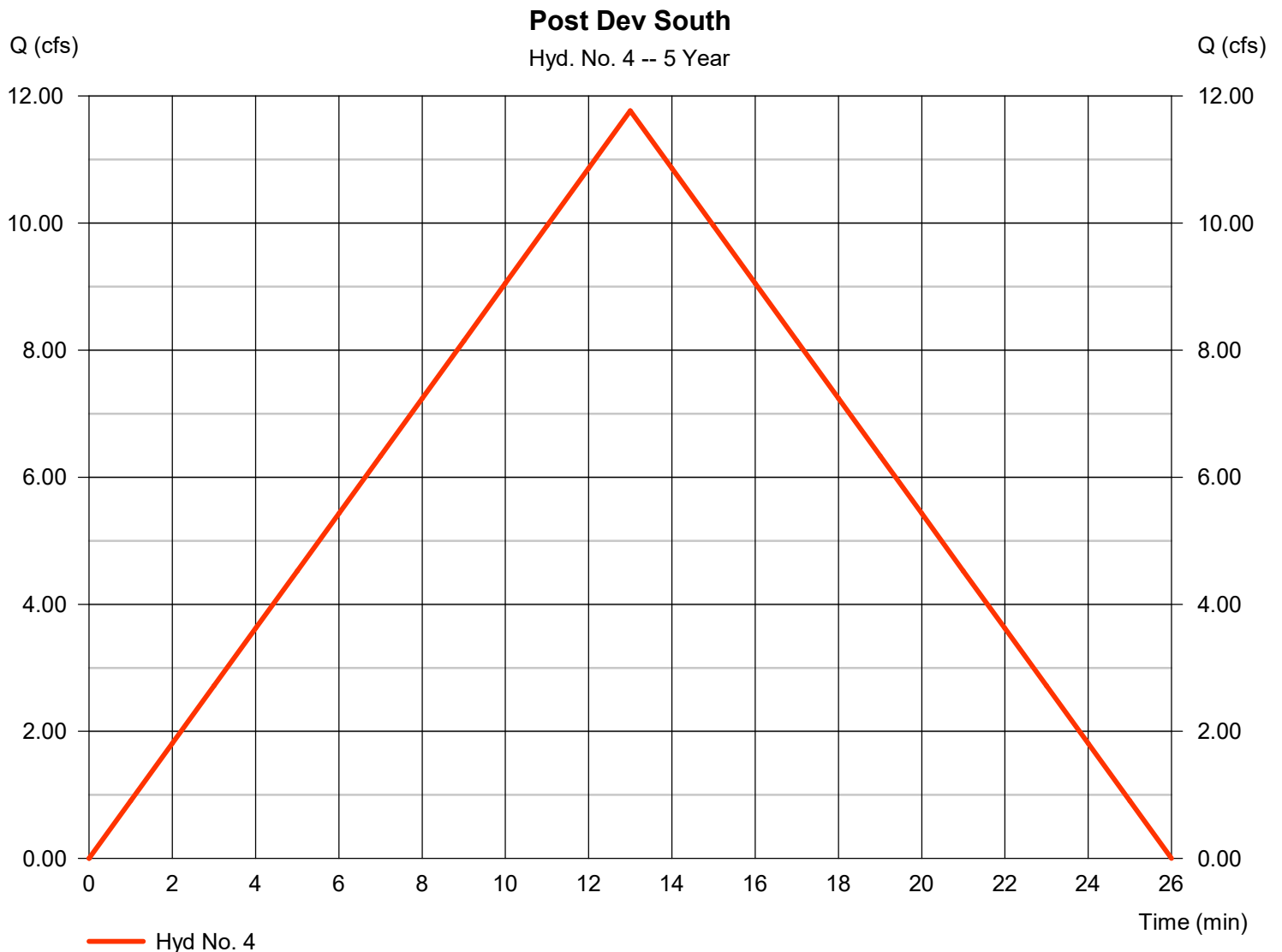
Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 5 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 4.145 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 11.77 cfs
Time to peak = 13 min
Hyd. volume = 9,180 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(3.110 \times 0.90) + (0.042 \times 0.80) + (0.038 \times 0.40)] / 3.190$



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	3.129	1	10	1,877	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.274	1	10	165	-----	-----	-----	Post Dev to North (Oak)
3	Rational	14.66	1	10	8,796	-----	-----	-----	Pre-Dev to the South
4	Rational	13.32	1	13	10,388	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 10 Year			Wednesday, 04 / 15 / 2020	

Hydrograph Report

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

Wednesday, 04 / 15 / 2020

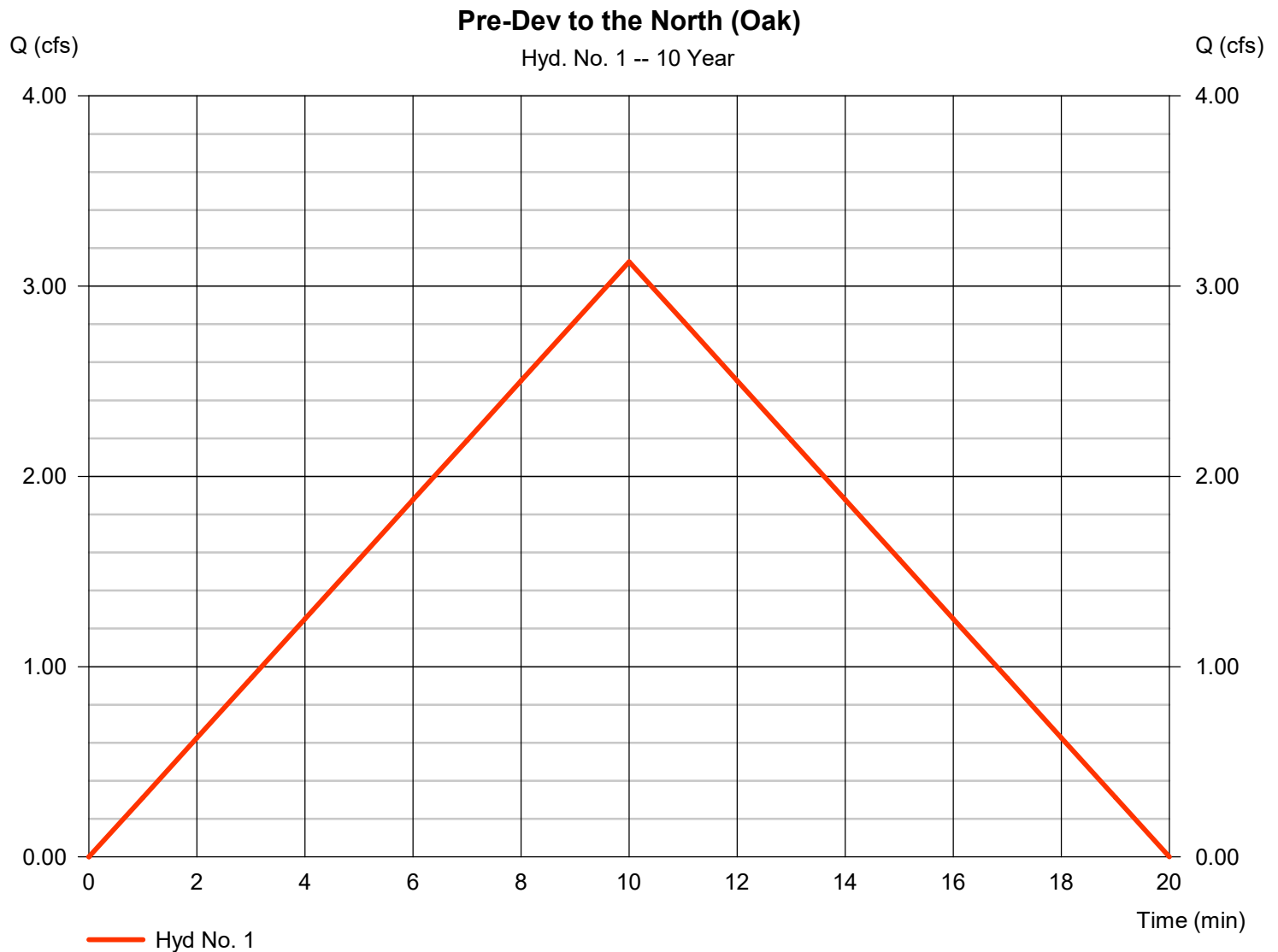
Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 0.760 ac
Intensity = 5.278 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 3.129 cfs
Time to peak = 10 min
Hyd. volume = 1,877 cuft
Runoff coeff. = 0.78*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.530 \times 0.90) + (0.060 \times 0.80) + (0.170 \times 0.40)] / 0.760$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

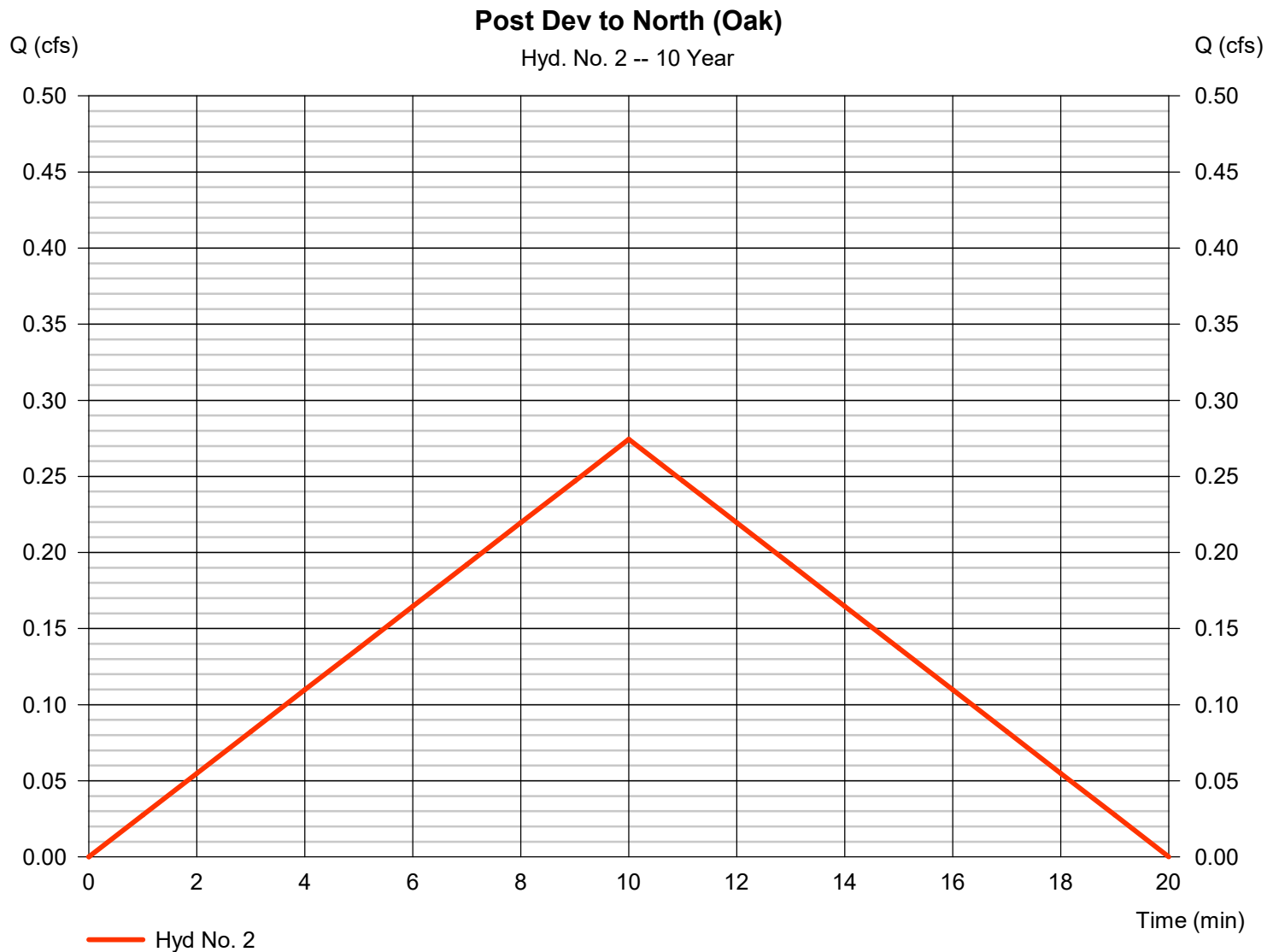
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 5.278 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.274 cfs
Time to peak = 10 min
Hyd. volume = 165 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



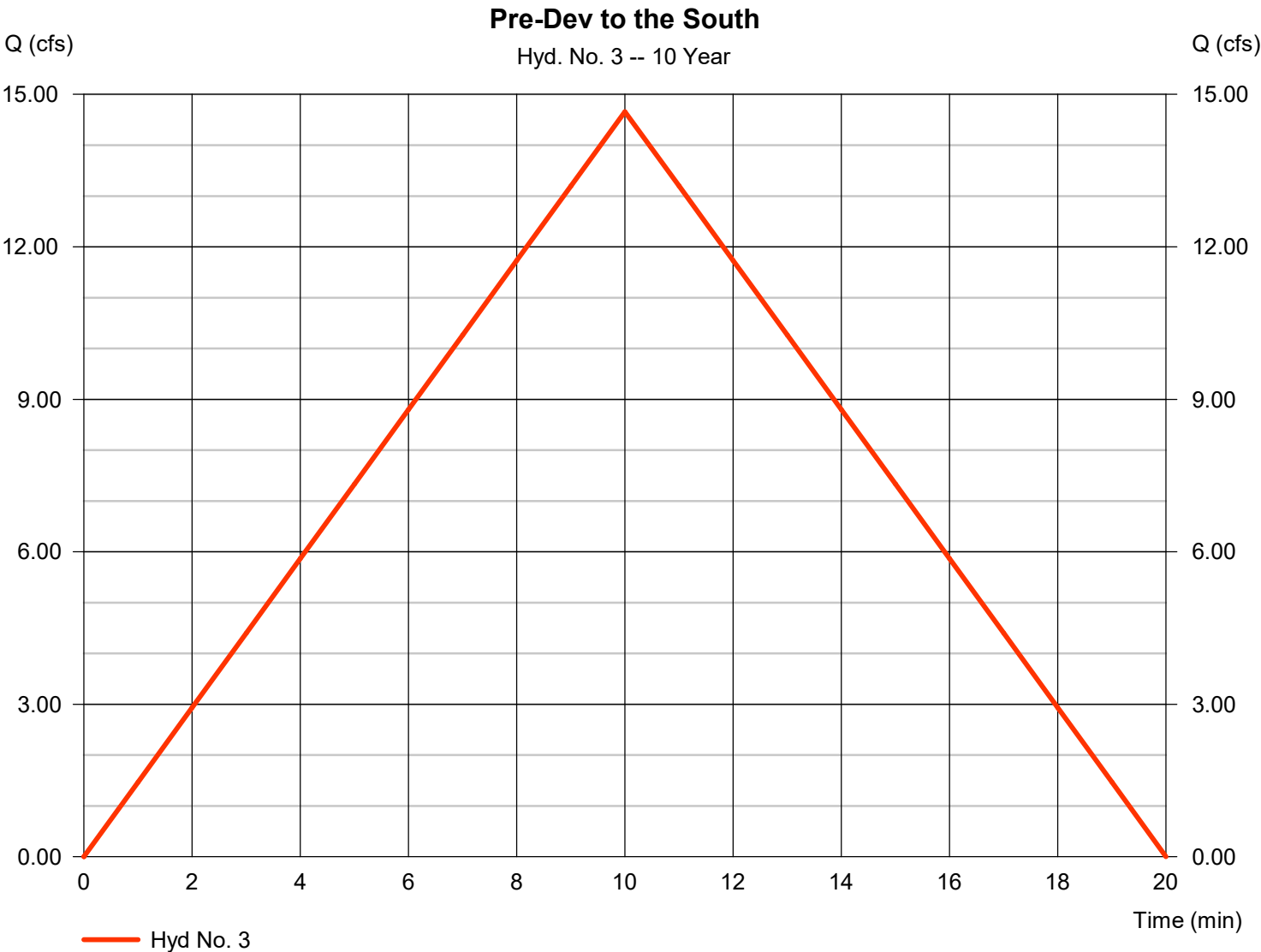
Hydrograph Report

Hyd. No. 3

Pre-Dev to the South

Hydrograph type	= Rational	Peak discharge	= 14.66 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 8,796 cuft
Drainage area	= 3.230 ac	Runoff coeff.	= 0.86*
Intensity	= 5.278 in/hr	Tc by User	= 10.00 min
IDF Curve	= Crestline.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(2.940 x 0.90) + (0.060 x 0.80) + (0.240 x 0.40)] / 3.230



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 4.691 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 13.32 cfs
Time to peak = 13 min
Hyd. volume = 10,388 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(3.110 x 0.90) + (0.042 x 0.80) + (0.038 x 0.40)] / 3.190



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	3.573	1	10	2,144	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.313	1	10	188	-----	-----	-----	Post Dev to North (Oak)
3	Rational	16.74	1	10	10,047	-----	-----	-----	Pre-Dev to the South
4	Rational	15.23	1	13	11,883	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 25 Year			Wednesday, 04 / 15 / 2020	

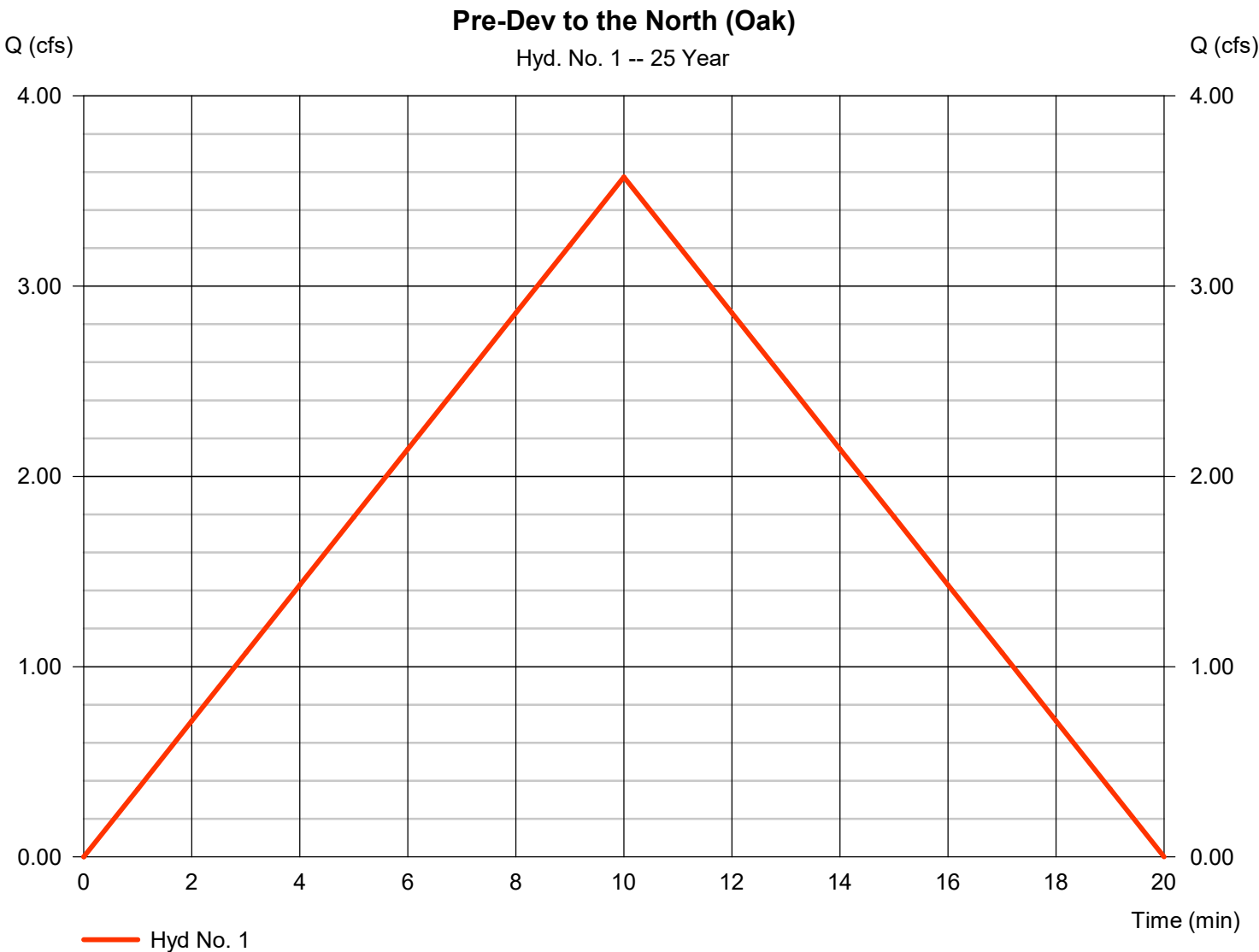
Hydrograph Report

Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type	= Rational	Peak discharge	= 3.573 cfs
Storm frequency	= 25 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 2,144 cuft
Drainage area	= 0.760 ac	Runoff coeff.	= 0.78*
Intensity	= 6.028 in/hr	Tc by User	= 10.00 min
IDF Curve	= Crestline.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.530 x 0.90) + (0.060 x 0.80) + (0.170 x 0.40)] / 0.760



Hydrograph Report

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

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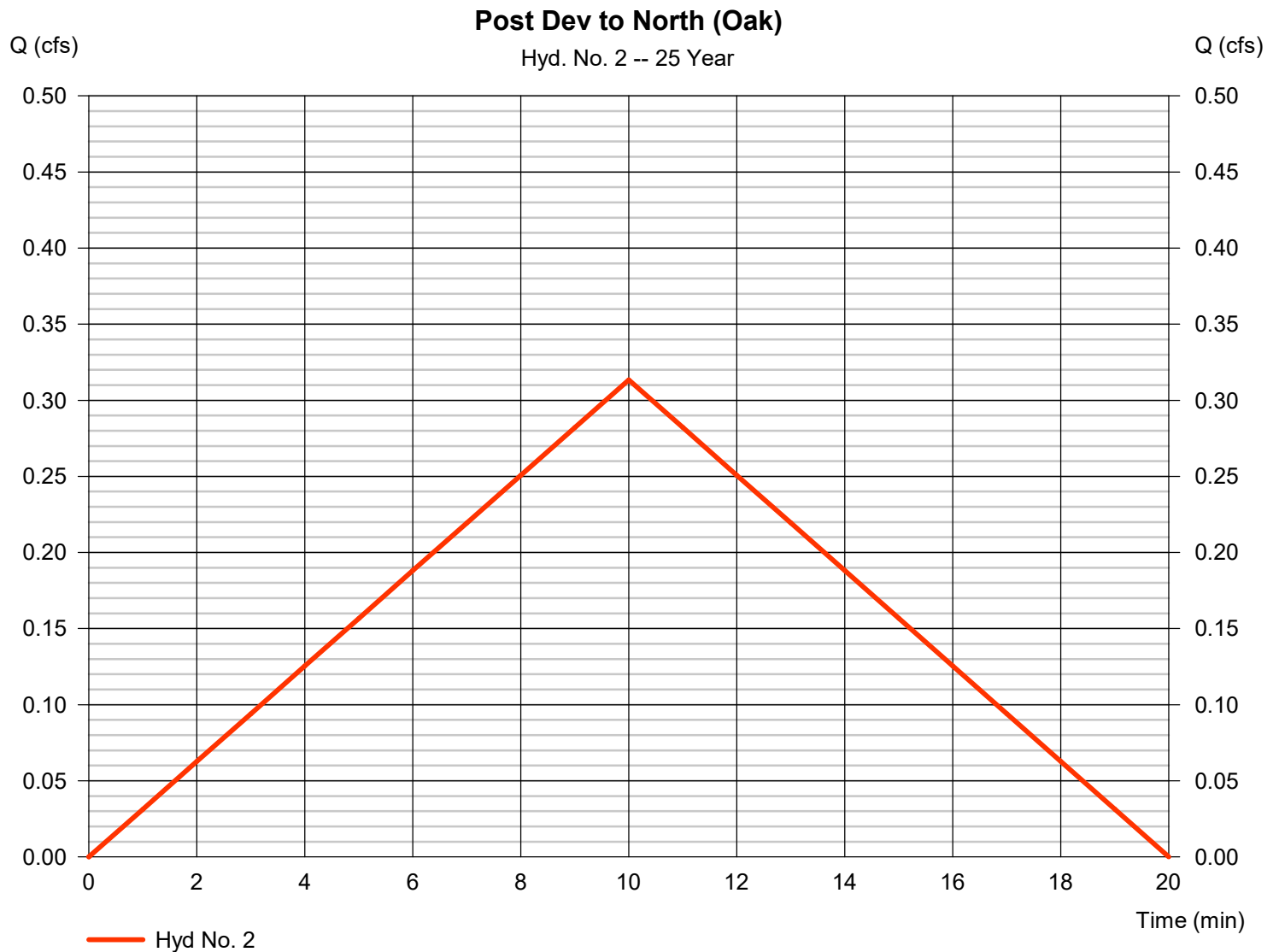
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 6.028 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.313 cfs
Time to peak = 10 min
Hyd. volume = 188 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

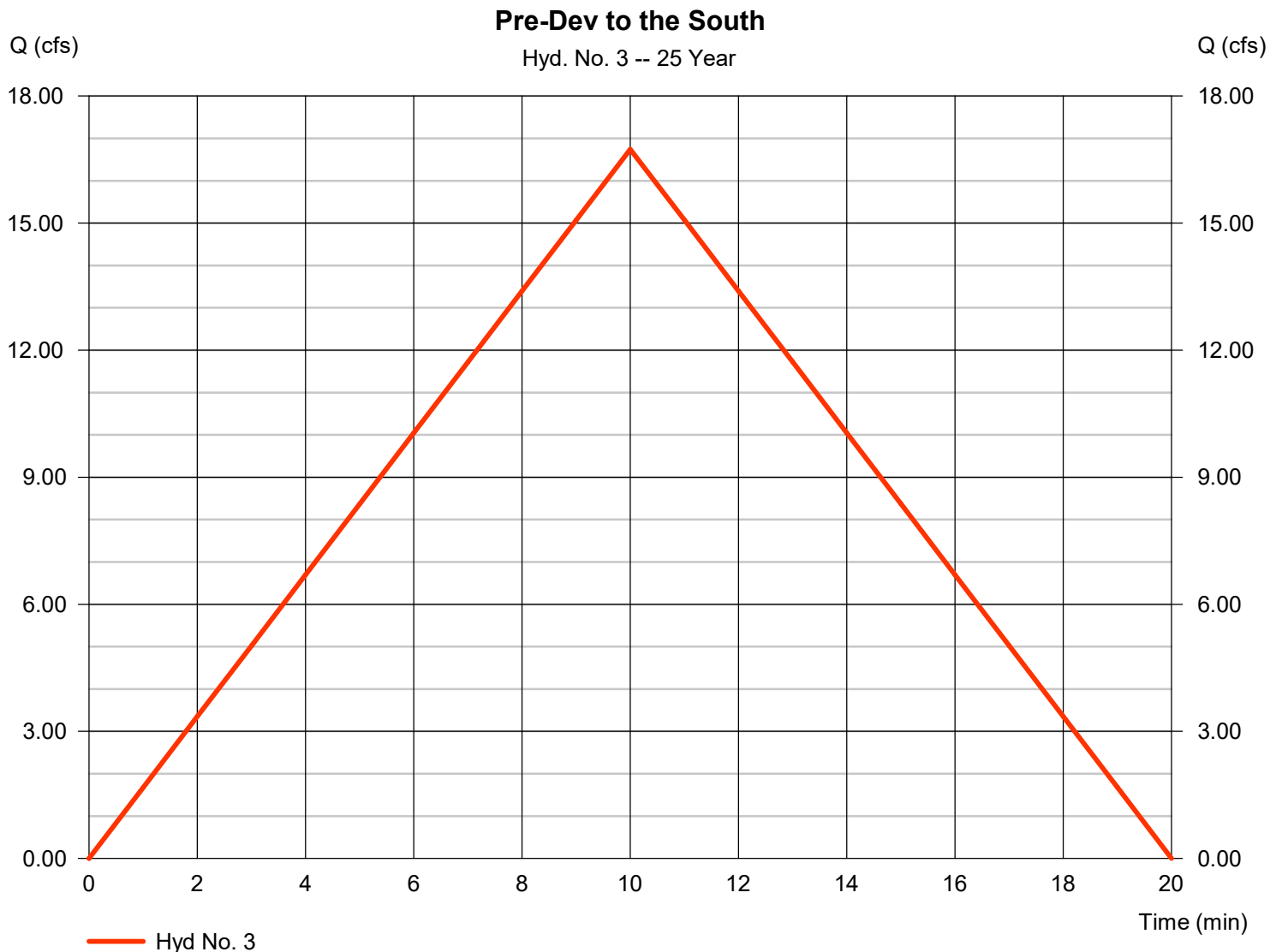
Hyd. No. 3

Pre-Dev to the South

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 3.230 ac
Intensity = 6.028 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 16.74 cfs
Time to peak = 10 min
Hyd. volume = 10,047 cuft
Runoff coeff. = 0.86*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(2.940 x 0.90) + (0.060 x 0.80) + (0.240 x 0.40)] / 3.230



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 5.366 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 15.23 cfs
Time to peak = 13 min
Hyd. volume = 11,883 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(3.110 \times 0.90) + (0.042 \times 0.80) + (0.038 \times 0.40)] / 3.190$



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	3.893	1	10	2,336	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.342	1	10	205	-----	-----	-----	Post Dev to North (Oak)
3	Rational	18.24	1	10	10,947	-----	-----	-----	Pre-Dev to the South
4	Rational	16.60	1	13	12,949	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 50 Year			Wednesday, 04 / 15 / 2020	

Hydrograph Report

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

Wednesday, 04 / 15 / 2020

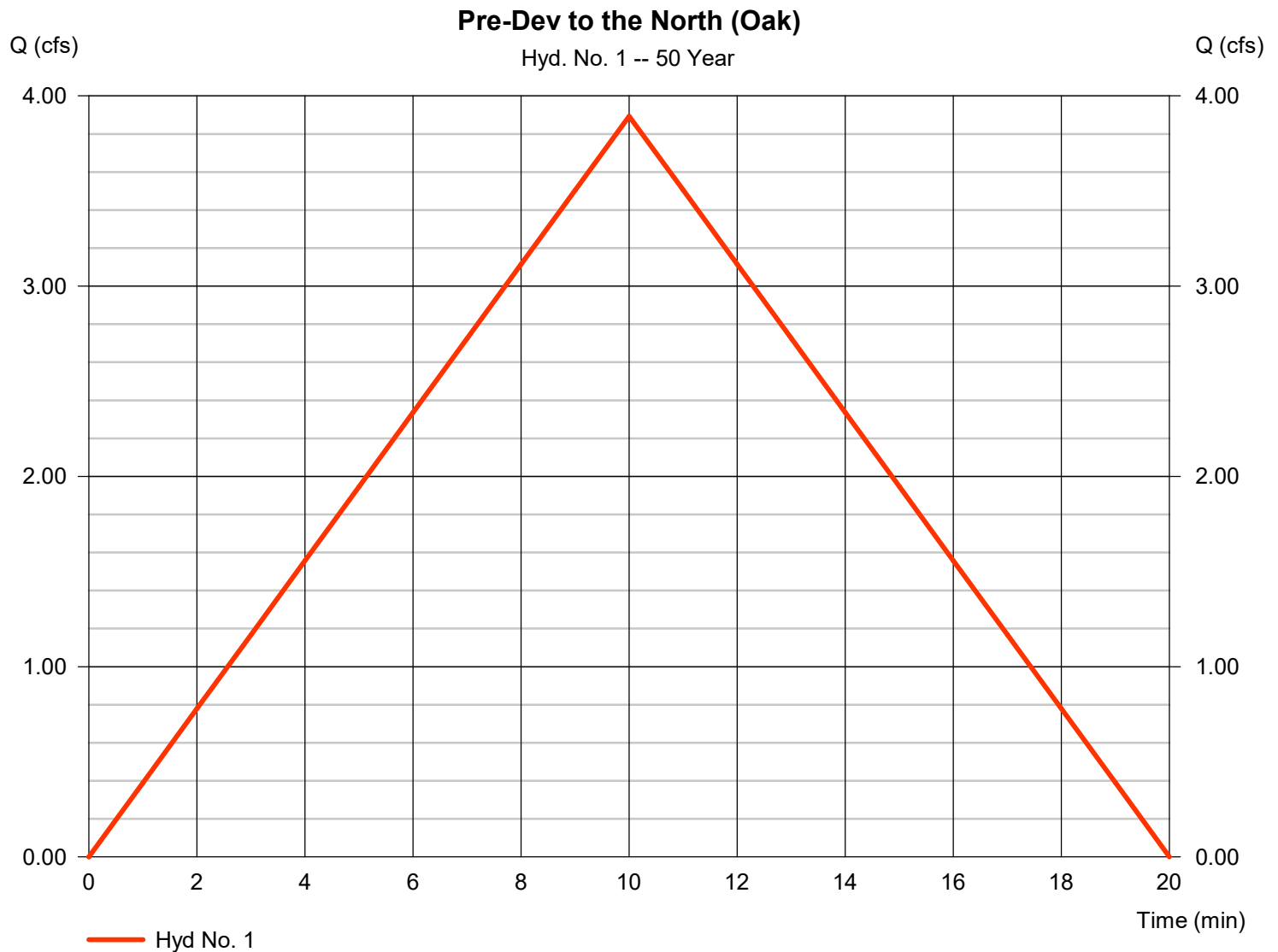
Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type = Rational
Storm frequency = 50 yrs
Time interval = 1 min
Drainage area = 0.760 ac
Intensity = 6.568 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 3.893 cfs
Time to peak = 10 min
Hyd. volume = 2,336 cuft
Runoff coeff. = 0.78*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.530 \times 0.90) + (0.060 \times 0.80) + (0.170 \times 0.40)] / 0.760$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

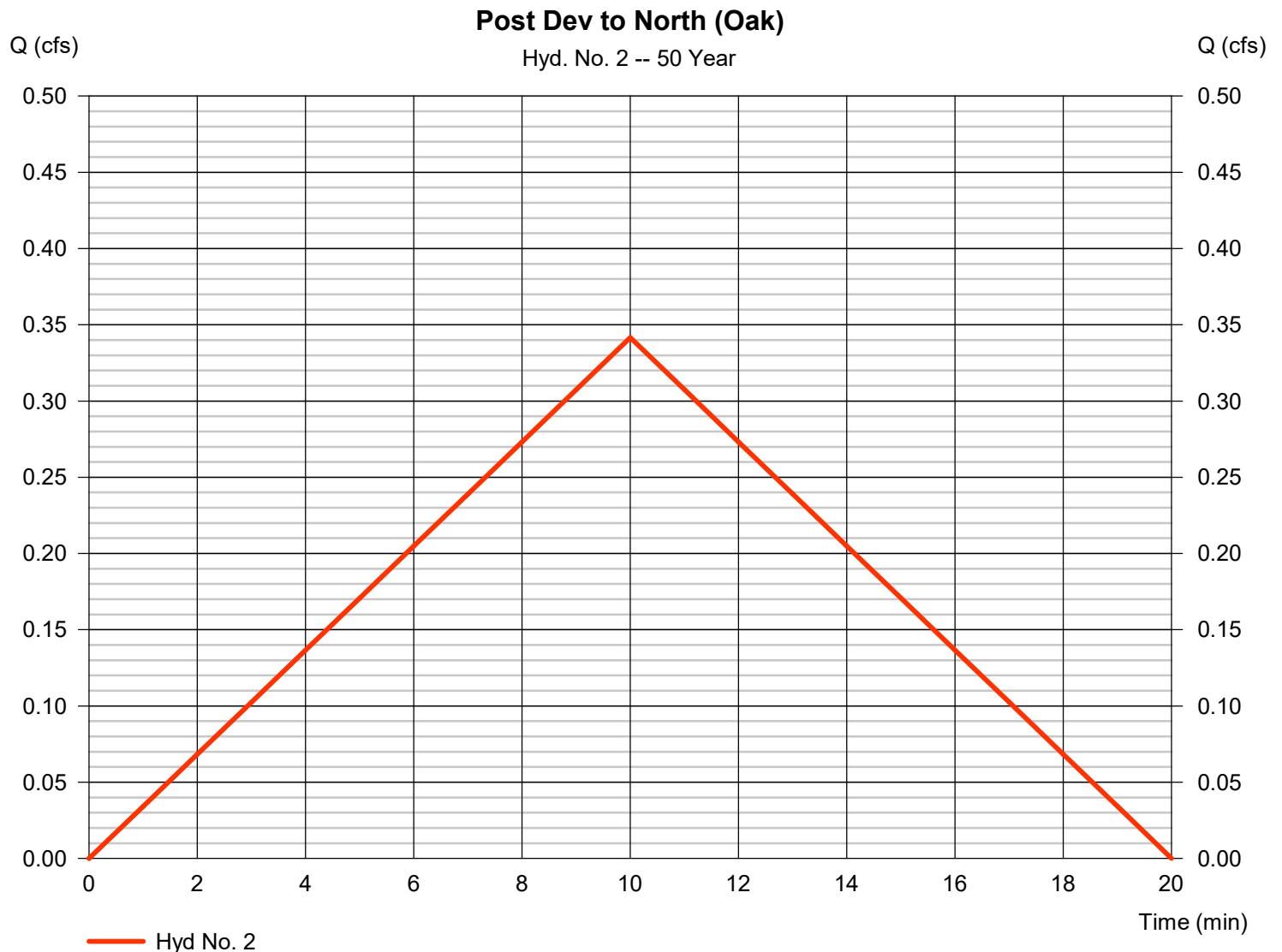
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 50 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 6.568 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.342 cfs
Time to peak = 10 min
Hyd. volume = 205 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

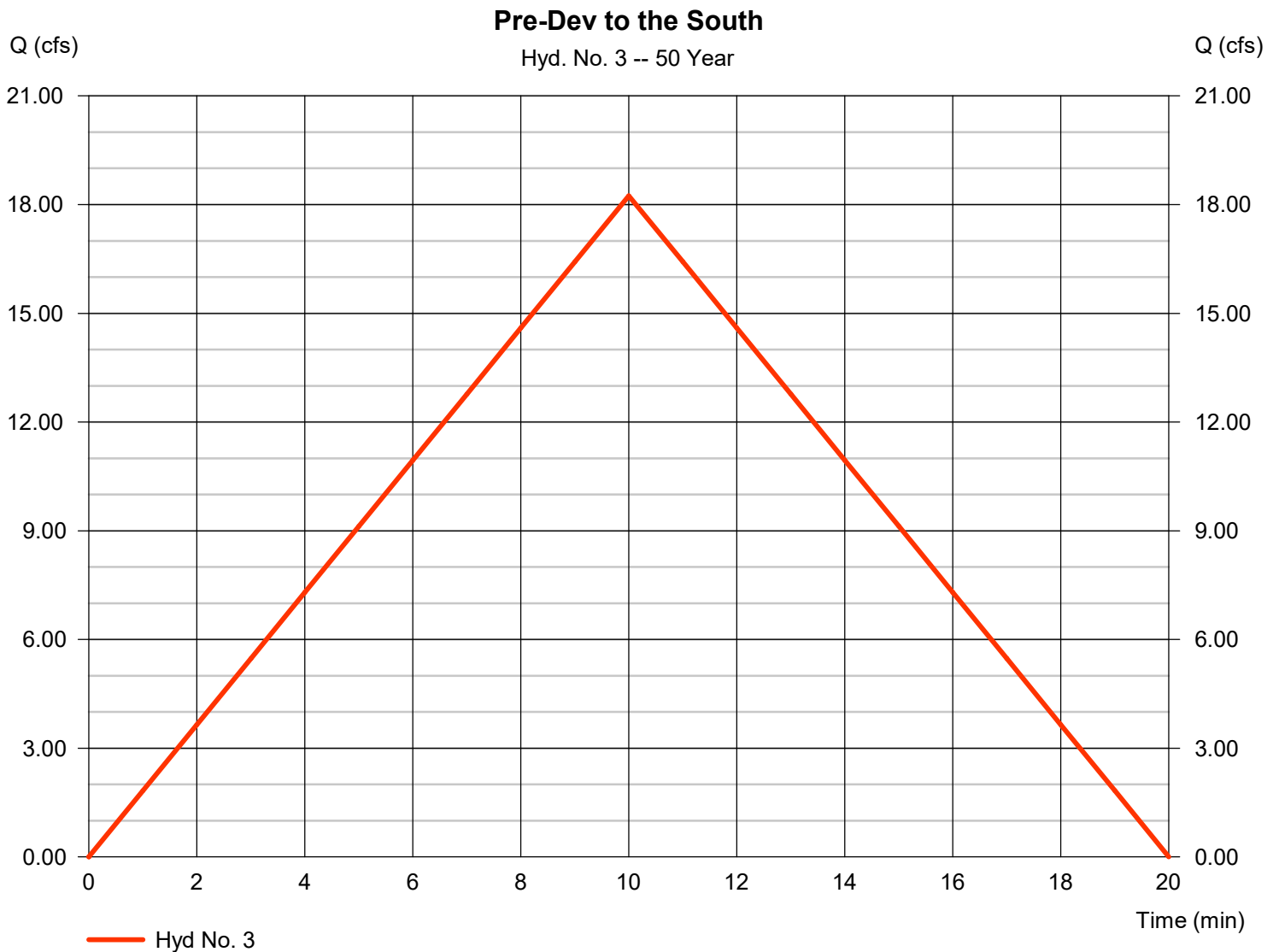
Hyd. No. 3

Pre-Dev to the South

Hydrograph type = Rational
Storm frequency = 50 yrs
Time interval = 1 min
Drainage area = 3.230 ac
Intensity = 6.568 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 18.24 cfs
Time to peak = 10 min
Hyd. volume = 10,947 cuft
Runoff coeff. = 0.86*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(2.940 x 0.90) + (0.060 x 0.80) + (0.240 x 0.40)] / 3.230



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 50 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 5.847 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 16.60 cfs
Time to peak = 13 min
Hyd. volume = 12,949 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(3.110 \times 0.90) + (0.042 \times 0.80) + (0.038 \times 0.40)] / 3.190$



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	Rational	4.196	1	10	2,518	-----	-----	-----	Pre-Dev to the North (Oak)
2	Rational	0.368	1	10	221	-----	-----	-----	Post Dev to North (Oak)
3	Rational	19.66	1	10	11,798	-----	-----	-----	Pre-Dev to the South
4	Rational	17.89	1	13	13,957	-----	-----	-----	Post Dev South
2020-04-14 Hydrographs.gpw					Return Period: 100 Year			Wednesday, 04 / 15 / 2020	

Hydrograph Report

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

Wednesday, 04 / 15 / 2020

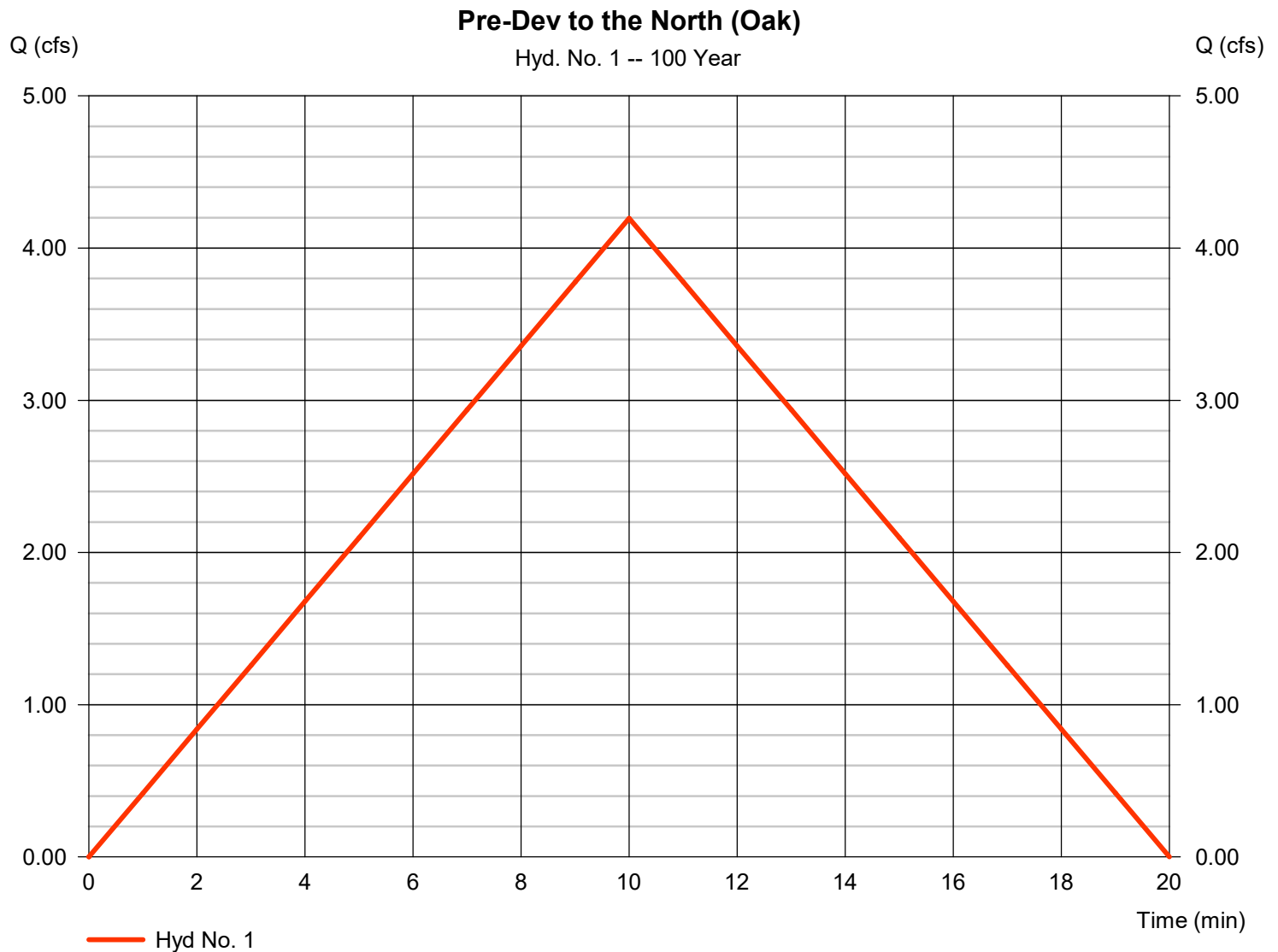
Hyd. No. 1

Pre-Dev to the North (Oak)

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 0.760 ac
Intensity = 7.078 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 4.196 cfs
Time to peak = 10 min
Hyd. volume = 2,518 cuft
Runoff coeff. = 0.78*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.530 \times 0.90) + (0.060 \times 0.80) + (0.170 \times 0.40)] / 0.760$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

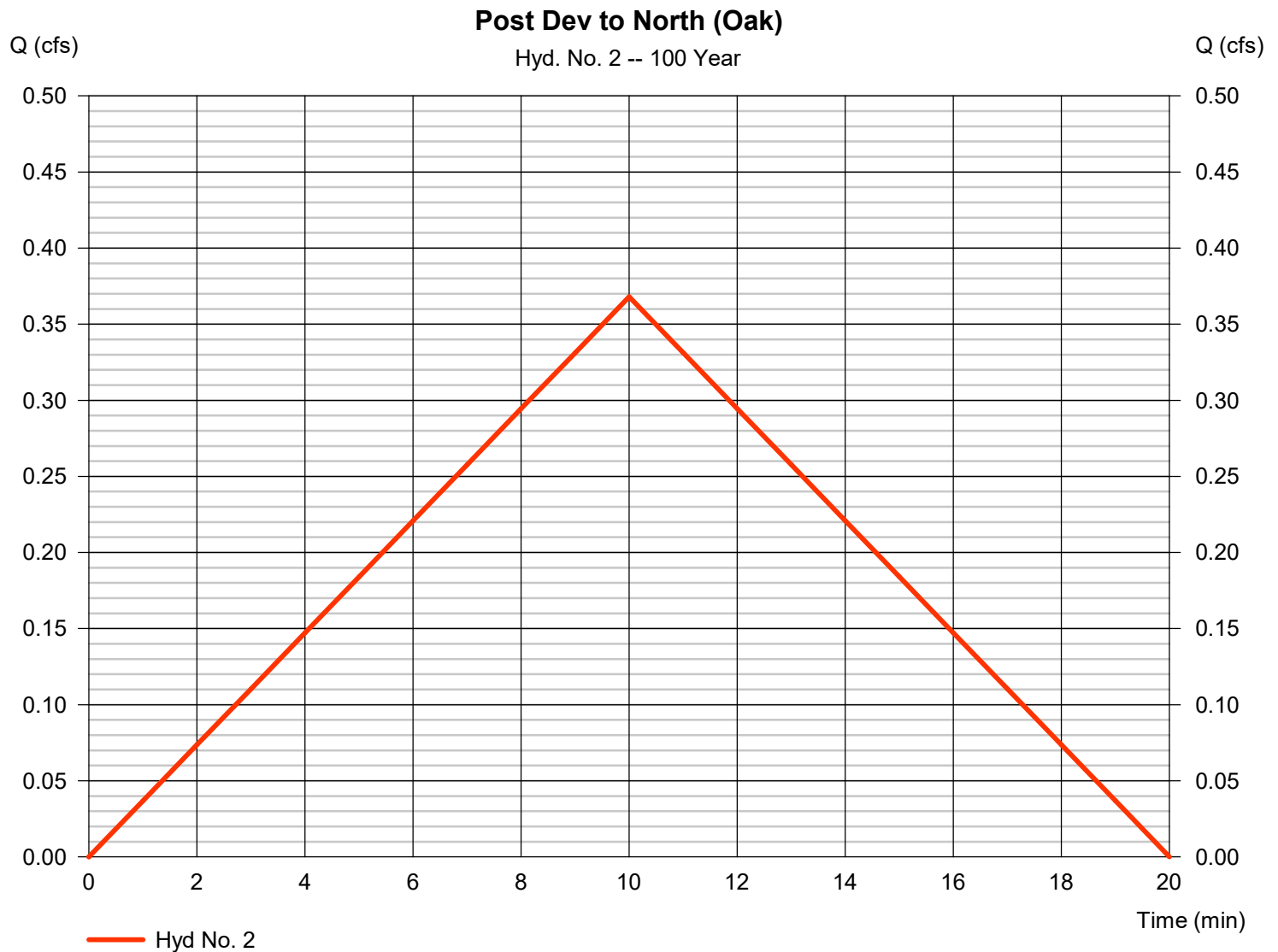
Hyd. No. 2

Post Dev to North (Oak)

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 0.080 ac
Intensity = 7.078 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 0.368 cfs
Time to peak = 10 min
Hyd. volume = 221 cuft
Runoff coeff. = 0.65*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(0.040 \times 0.90) + (0.040 \times 0.40)] / 0.080$



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

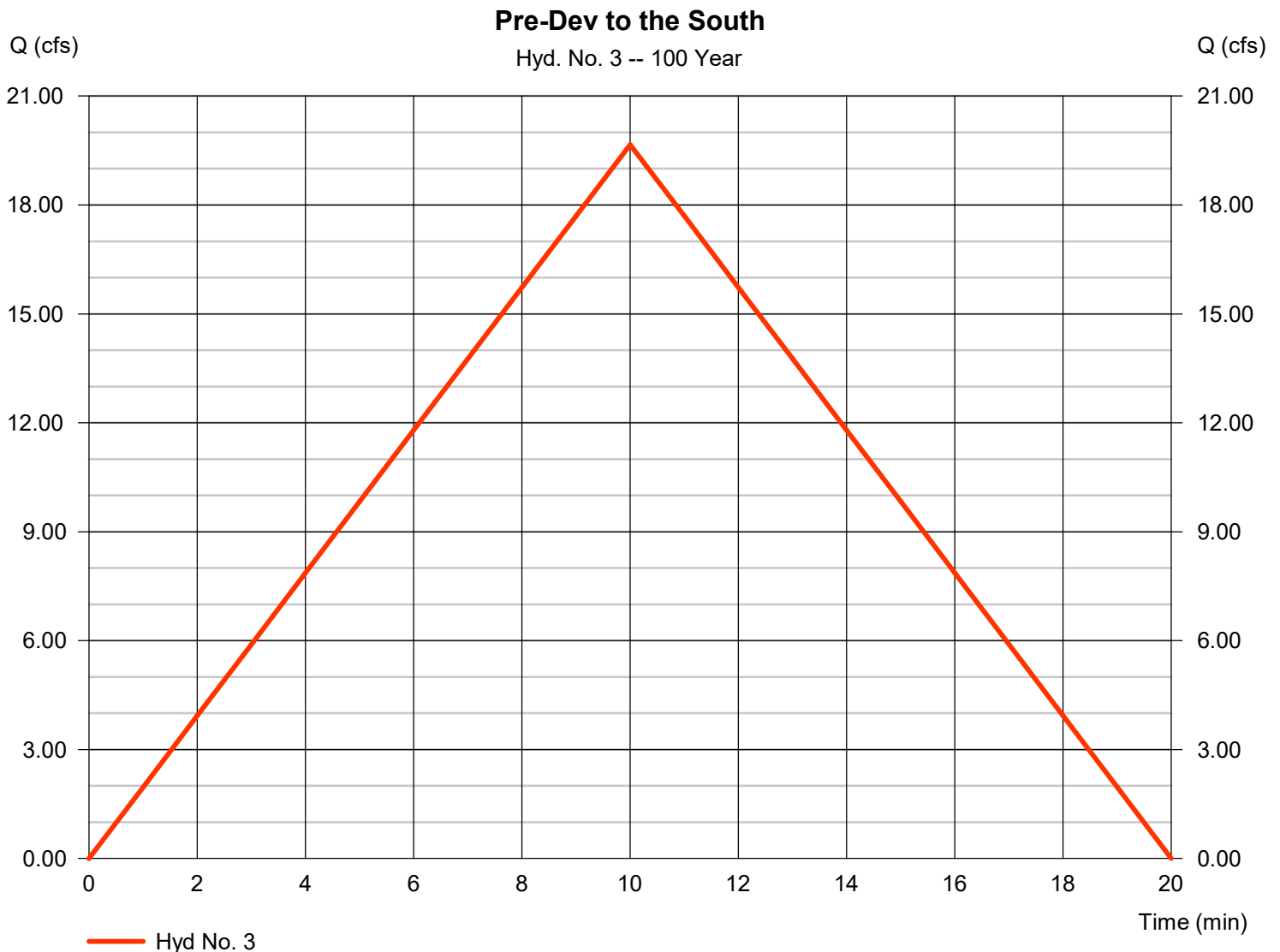
Hyd. No. 3

Pre-Dev to the South

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 3.230 ac
Intensity = 7.078 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 19.66 cfs
Time to peak = 10 min
Hyd. volume = 11,798 cuft
Runoff coeff. = 0.86*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(2.940 x 0.90) + (0.060 x 0.80) + (0.240 x 0.40)] / 3.230



Hydrograph Report

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

Wednesday, 04 / 15 / 2020

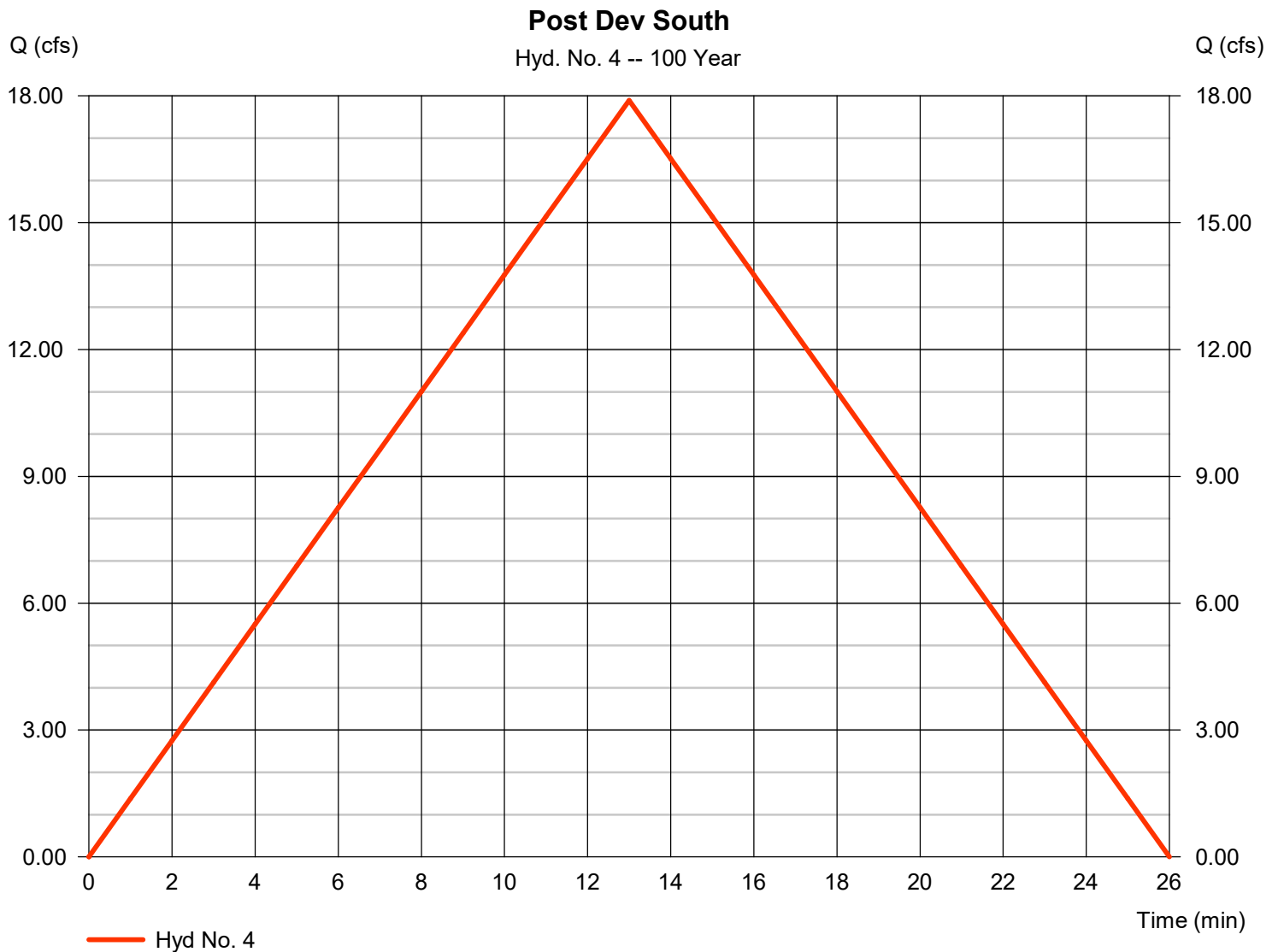
Hyd. No. 4

Post Dev South

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 3.190 ac
Intensity = 6.303 in/hr
IDF Curve = Crestline.IDF

Peak discharge = 17.89 cfs
Time to peak = 13 min
Hyd. volume = 13,957 cuft
Runoff coeff. = 0.89*
Tc by User = 13.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(3.110 \times 0.90) + (0.042 \times 0.80) + (0.038 \times 0.40)] / 3.190$



Section 3: Storm Sewer Analysis





STORM SEWER SYSTEM

PID : **Date :** 12/06/2019 **Project :** Massillon Operations

Location : 207 Oak Ave. SE Massillon, OH

Description : Storm Sewer Analysis

Designer : JLB

Rainfall Area: A

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 100

Minimum Pipe Size : 0.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE			PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(100)	(10 yrs.)	(100)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
CB1	CB2		0.17 0.17	0.15 0.15	10.00	5.10	7.38	0.8	1.1	18	124.0	0.0100	957.48 956.24	3.15	9.79	0.0002	957.84 957.22	961.50 961.50	3.66	2.52	CB 2-2B 0.015
CB2	MH1		0.87 1.04	0.78 0.94	10.66	4.95	7.38	4.6	6.9	18	103.0	0.0100	956.24 955.21	5.18	9.79	0.0057	957.22 956.47	961.50 964.50	4.28	3.76	CB 2-2B 0.015
MH1	EMH1		0.59 1.63	0.37 1.31	10.99	4.89	7.35	6.4	9.6	18	46.0	0.0300	955.21 953.83	8.46	16.96	0.0111	956.06 955.18	964.50 962.93	8.44	7.79	MH 3 0.015
EMH1	MH4		0.61 2.24	0.55 1.86	11.08	4.87	6.82	9.0	12.7	18	170.0	0.0530	953.83 944.82	11.41	22.55	0.0193	954.67 948.03	962.93 952.00	8.26	7.60	MH 3 0.015
CB7	CB3		0.29 2.53	0.26 2.12	10.00	5.10	7.54	1.3	2.0	12	185.0	0.0378	958.00 951.00	6.16	6.46	0.0041	958.39 951.80	961.50 954.56	3.11	2.50	CB 2-3 0.015
CB3	MH2		0.88 3.41	0.79 2.91	10.50	4.99	6.82	5.3	7.2	18	140.0	0.0035	946.64 946.15	3.47	5.79	0.0062	950.33 949.46	954.56 949.70	4.23	6.42	CB 2-2B 0.015
CB4	MH2		0.58 3.99	0.52 3.43	10.00	5.10	6.82	2.7	3.6	15	23.0	0.0300	946.84 946.15	6.74	10.43	0.0040	949.56 949.46	949.50 949.70	-0.06	1.41	CB 2-2B 0.015
MH2	MH3		0.00 3.99	0.00 3.43	11.17	4.85	6.82	7.6	10.7	24	208.0	0.0035	946.15 945.42	3.95	12.49	0.0030	949.46 948.84	949.70 950.83	0.24	1.55	MH 3 0.015



STORM SEWER SYSTEM

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(100 (10 yrs.)	(100 (10 yrs.)	(cfs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
CB5	MH3			0.37 4.36	0.33 3.76	10.00	5.10	6.82	1.7	2.3	18	51.0	0.0441	947.67 945.42	6.66	20.57	0.0006	948.87 948.84	950.67 950.83	1.80	1.50	CB 2-2B 0.015
MH3	CB6			0.00 4.36	0.00 3.76	12.05	4.68	6.82	8.9	13.0	24	75.0	0.0035	945.42 945.16	4.06	12.42	0.0044	948.84 948.51	950.83 951.50	1.99	3.41	MH 3 0.015
CB6	MH4			0.15 4.51	0.14 3.90	12.36	4.63	6.82	9.5	13.9	24	96.0	0.0035	945.16 944.82	4.13	12.55	0.0050	948.51 948.03	951.50 952.00	2.99	4.34	CB 2-2B 0.015
MH4	EMH2			0.00 4.51	0.00 3.90	12.75	4.56	6.82	17.8	26.6	24	35.0	0.0051	944.82 944.64	5.66	15.12	0.0184	948.03 947.38	952.00 950.78	3.97	5.18	MH 3 0.015
Warning																						
EMH2	EMH3			0.41 4.92	0.37 4.27	12.85	4.54	6.82	19.4	29.1	18	19.0	0.0363	944.64 943.95	10.97	18.66	0.1020	947.38 945.45	950.78 949.85	3.40	4.64	MH 3 0.015
Warning																						

Section 4: Water Quality Calculations



Project Name: Massillon City Schools - Track & Field Facility
Location: Middle School on 29th Street in Massillon

Date: 4/15/17
Pg.1-1

Bio Retention Cell 1

A. Determine Impervious Percentage of Contributing Drainage Area:

Contributing Drainage Area = 0.65 ac = 28,314 sf

Contributing Impervious Area = 0.6 ac = 26,136 sf

Impervious Percentage, i = 92.3% => If " i " is greater than 25%, Complete Section B.
If " i " is less than 25%, Complete Section C.

B. Determine Bioretention Filter Bed Area ("i" is Greater than 25%):

Area Required is a minimum of 5% of the Contributing Impervious Area

$A_{\text{Filter Bed}} = 1,307 \text{ sf}$
--

C. Determine Bioretention Filter Bed Area ("i" is Less than 25%):

Area Required is a minimum of the Water Quality Volume (WQv) divided by the maximum ponding depth of 1 foot.

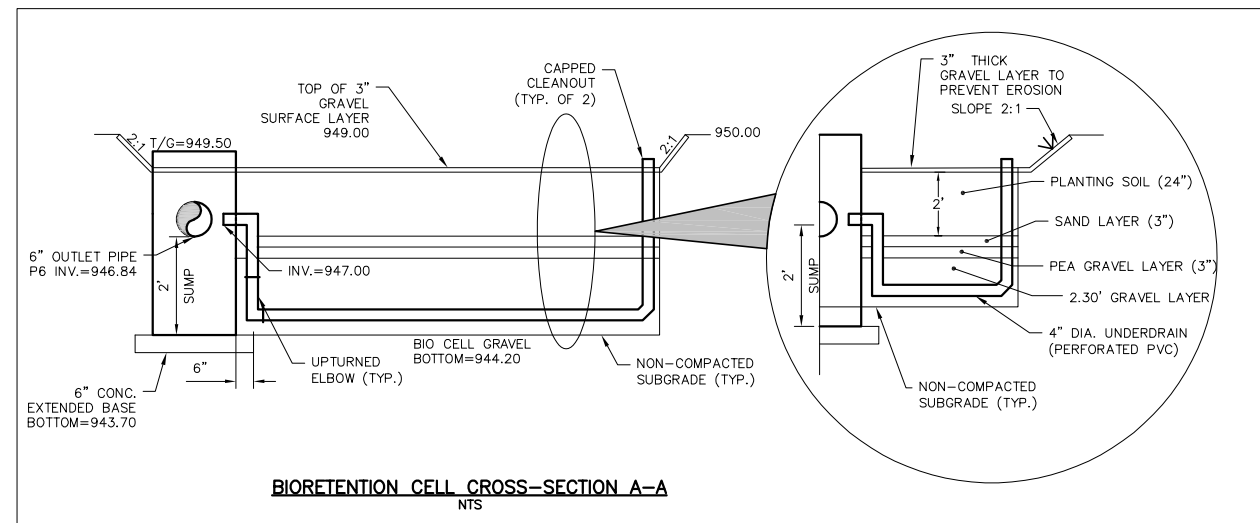
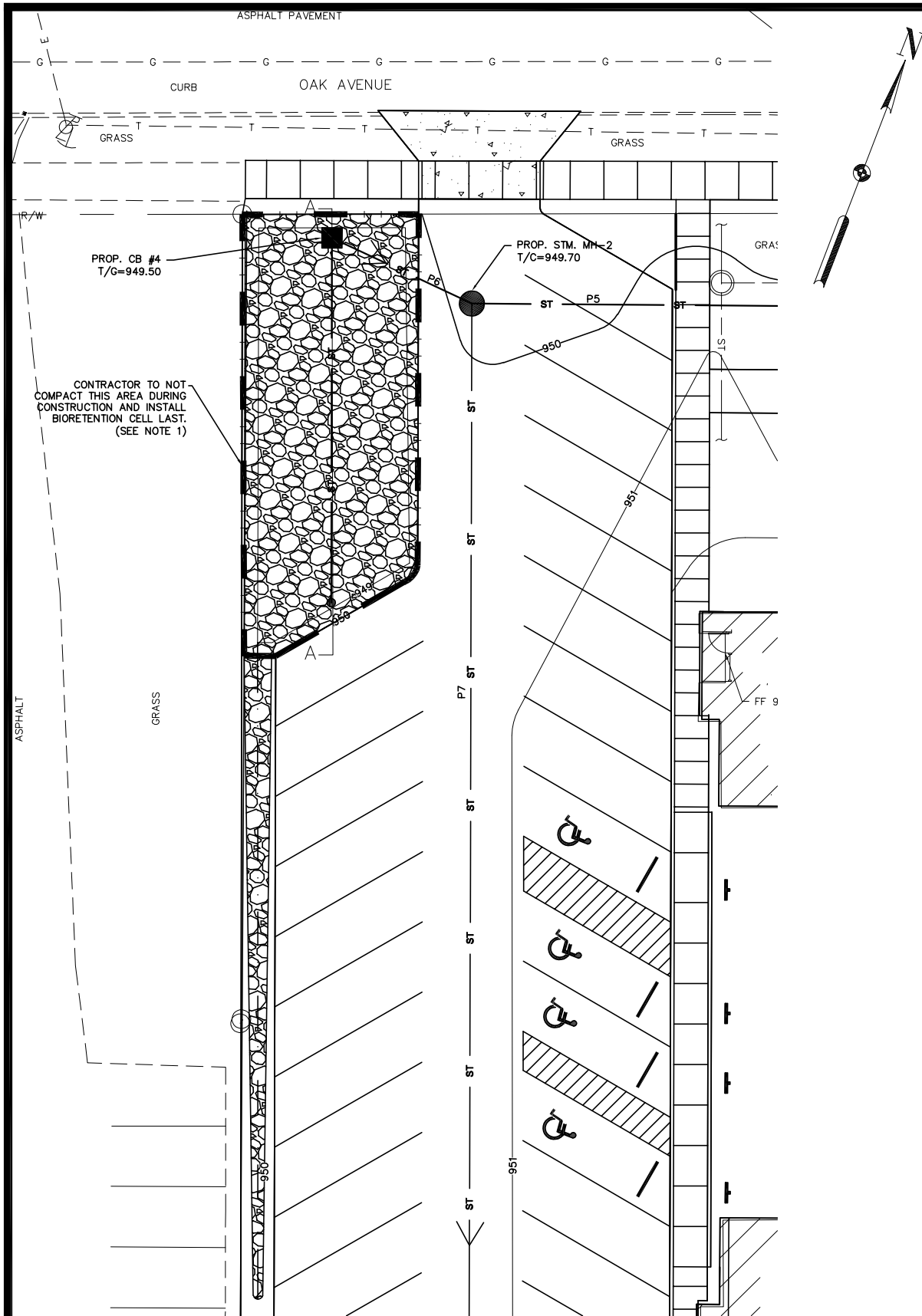
WQv = N/A cf (From WQv Worksheet)

$A_{\text{Filter Bed}} = \text{N/A sf}$

D. Bioretention Filter Bed Area Provided:

Filter Area Provided (From Plans)

$A_{\text{Filter Bed}} = 1,150 \text{ sf}$
--



SPECIFICATIONS:

SURFACE GRAVEL - #4 STONE (USE THIS ON ALL OF BIO-RETENTION BASIN)
 BIOFILTER SOIL MIX/PLANTING SOIL - SOIL MIX MUST BE CERTIFIED BY A LABORATORY AND HAVE THE FOLLOWING CHARACTERISTICS:
 -TEXTURE CLASS: LOAMY SAND; HAVING NO LESS THAN 80% SAND AND NO MORE THAN 10% CLAY (CONSIDERING THE MINERAL FRACTION OF THE SOIL).
 -pH RANGE: 5.2-8.0
 -SOLUBLE SALTS: 500 PPM MAX.
 -DECOMPOSED ORGANIC MATTER: 3-5% BY WEIGHT
 -PHOSPHORUS: BETWEEN 10-30 PPM AS DETERMINED BY THE MEHLICH III TEST.
 -SAND ADDED SHALL BE CLEAN AND MEET ASTM C-33 WITH A GRAIN SIZE OF 0.02-0.04 INCHES.
 -SOIL RESULTS MUST BE SUBMITTED TO STARK SWCD FOR REVIEW & APPROVAL PRIOR TO INSTALLATION
 SAND LAYER - CLEAN MEDIUM CONCRETE SAND (ASTM C-33)
 PEA GRAVEL - #8 OR #78 STONE
 GRAVEL LAYER - #57 WASHED STONE
 COMPACTION - PLANTING SOIL SHALL BE PLACED IN 12" LIFTS AND LIGHTLY SETTLED BY GENTLY SOAKING WITH WATER TO PROMOTE SETTLING. PLANTING SOIL SHOULD BE PLACED TO A DEPTH 5% HIGHER THAN THE FINISH GRADE TO ALLOW FOR SETTLEMENT.

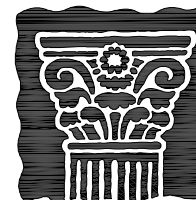
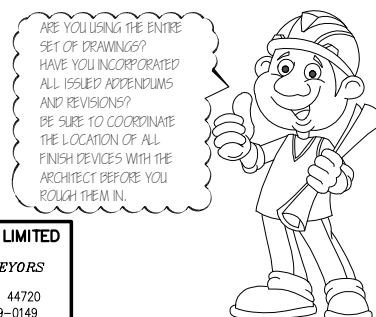
NOTE:

- BIORETENTION FACILITIES SHALL BE CONSTRUCTED AFTER ALL OTHER AREAS OF THE DRAINAGE ARE HAVE BEEN CONSTRUCTED AND FINALLY STABILIZED. SEDIMENT-LADEN RUNOFF FROM CONSTRUCTION SHALL NOT PASS THROUGH THE PRACTICE.
- UNDERDRAIN SHALL HAVE A MINIMUM 3" OF GRAVEL ABOVE AND BELOW PERFORATED PVC PIPE.

SCALE: 1" = 10'
 0 5' 10' 20'
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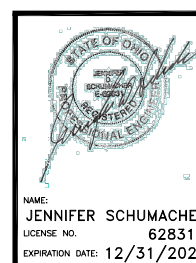
BIORETENTION DETAILS

HAMMONTREE & ASSOCIATES, LIMITED
 ENGINEERS, PLANNERS, SURVEYORS
 5233 STONEHAM RD. NORTH CANTON, OH 44720
 PHN: (330) 499-8817 FAX: (330) 499-0149
 TOLL FREE: 1-800-394-8817
 www.hammontree-engineers.com



**JOHN PATRICK
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 SUITE 102
 MASSILLON, OH 44646
 PHONE (330) 471-9000
 EMAIL: jpparchitect@yahoo.com

**OPERATIONS FACILITY FOR
 MASSILLON CITY SCHOOLS**
 207 OAK AVENUE SOUTHEAST
 MASSILLON, OHIO 44646



Project Number 16025
 Date 04-14-20
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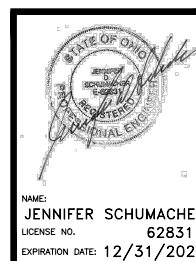
C-3.1

Section 5: Drainage Maps





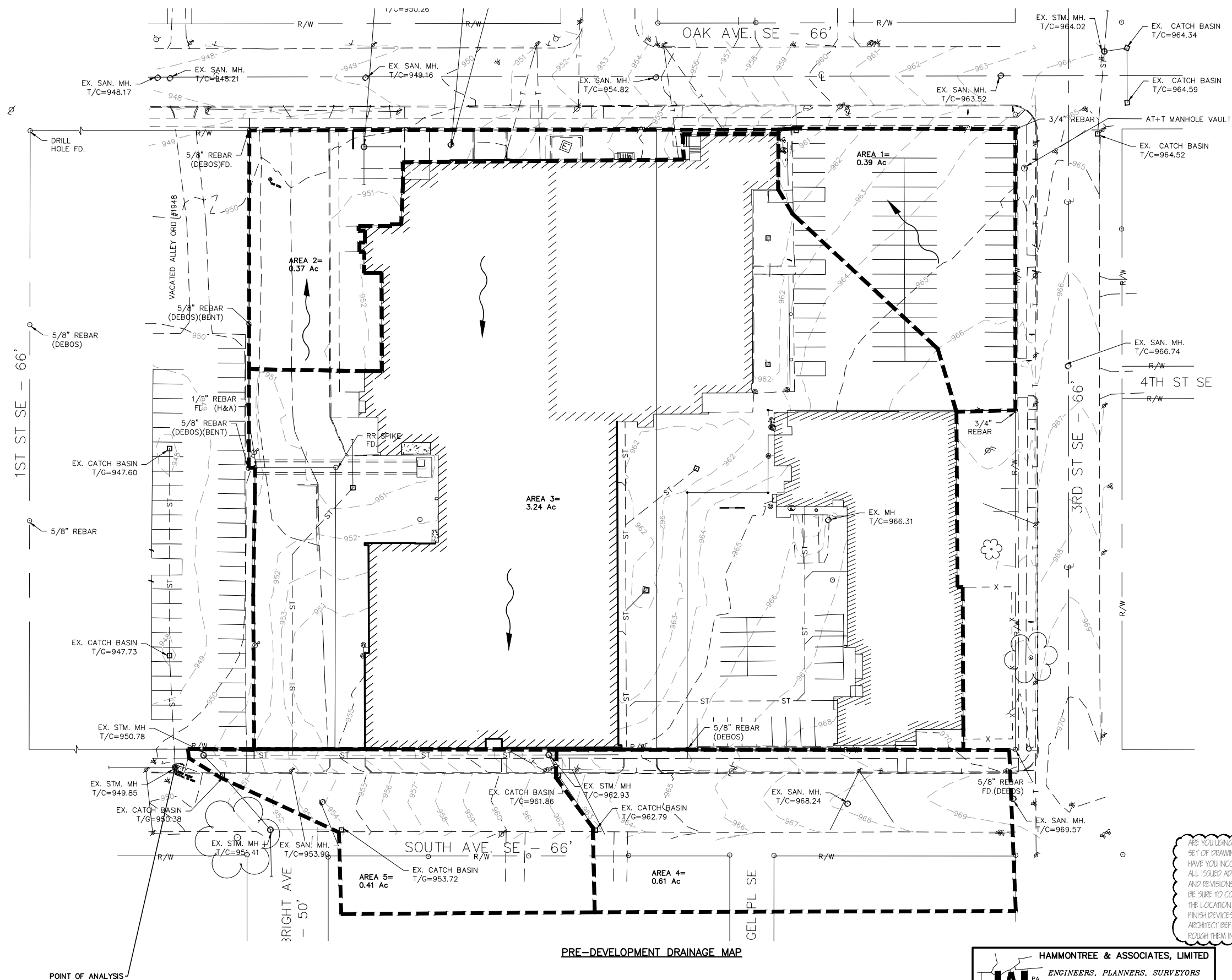
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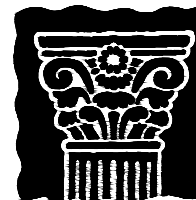


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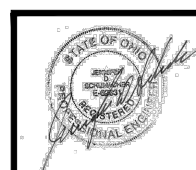
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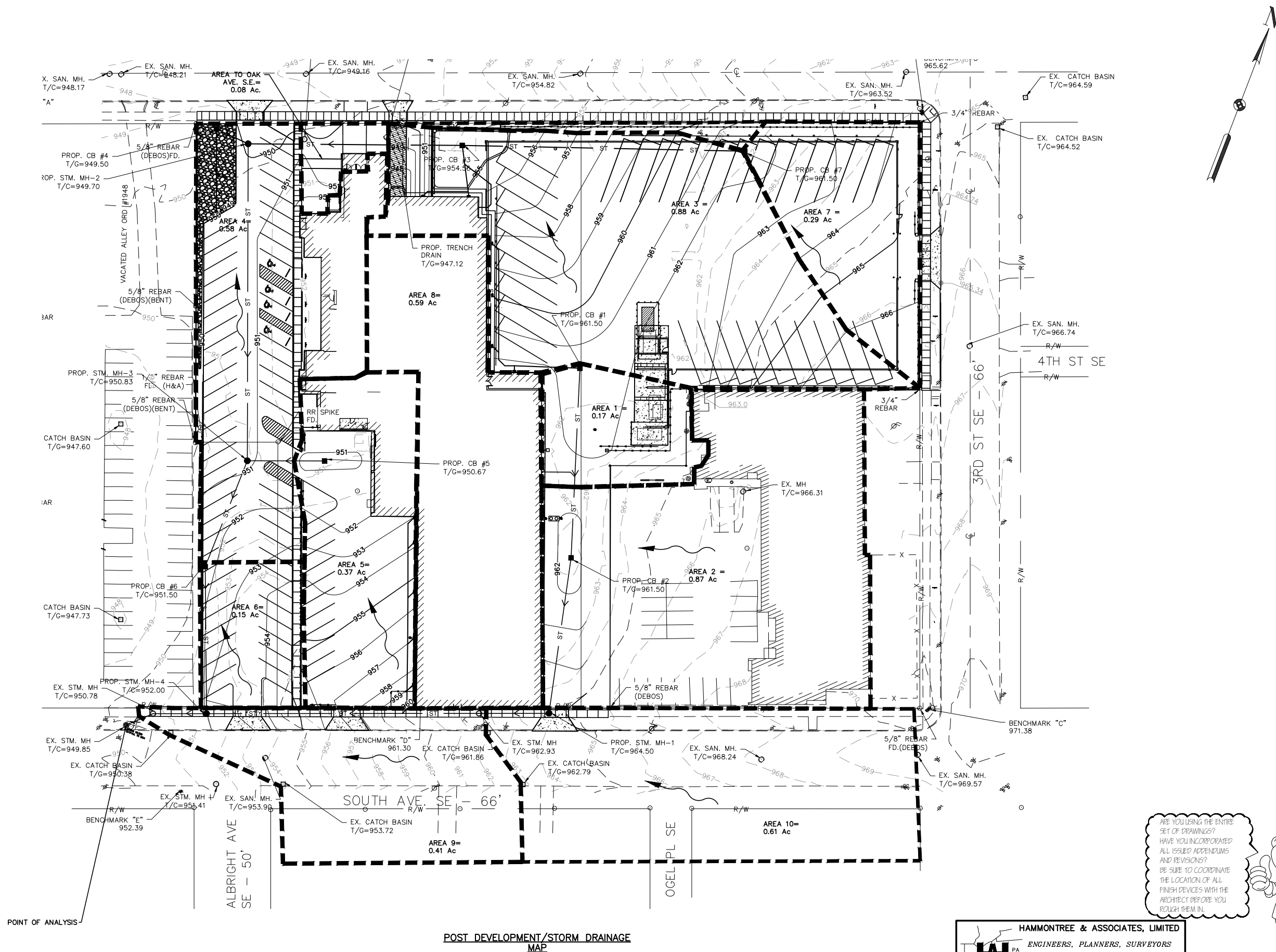


NAME: JENNIFER SCHUMACHER
LICENSE NO. 62831
EXPIRATION DATE: 12/31/2021

Project Number 16025
Date 02-10-20



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