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February 22, 2021

Honorable Members of the
Borough of Caldwell Planning Board
Municipal Building
1 Provost Square
Caldwell, New Jersey 07006

Re: Storm Water Management
Caldwell Village
4, 12, 14 and 18 Lane Avenue
Block 41, Lots 2, 3.01, 3 and 4
Borough of Caldwell, Essex County
MCBEA FILE NUMBER 4226

Dear Honorable Members,

On behalf of our Client, regarding the above referenced development project, this storm water management report is being submitted in conjunction with the site plan documents entitled, *"Preliminary / Final Site Plan for The Caldwell Village, Block 41 – Lots 2, 3.01, 3 & 4, Borough of Caldwell, Essex County, New Jersey"*, dated February 22, 2021. The site currently contains four (4) existing residential structures. The Applicant proposes to continue to use one (1) existing building, renovate one (1) existing building and remove two (2) existing buildings and replace them with one (1) new multi-story, residential apartment building. The existing site has eighteen (18) residential units. The proposal is for one-hundred, fourteen (114) residential units, an increase of ninety-six (96) residential units. Because the proposed development increases the area of impervious coverage, a storm water management design is required to mitigate the additional runoff due to the reduction of storm water infiltration. The design for this system is as follows.

Major vs. Non-Major Development

Per N.J.A.C. 7:8, a land development project is determined to be "major development" if it proposes to disturb more than one (1) acres of land or proposes more than 1/4 (one-quarter) acre of new impervious cover. This project proposes to disturb more than one (1) acre of land. This project also proposes to increase the impervious coverage by more than one-quarter (1/4) acres. It is our opinion that the scope of development proposed for this project exceeds the threshold of major development.

This determination means that the storm water management system must be designed to address peak flow reduction, water quality enhancement and ground water recharge.

Peak Flow Reduction

METHODOLOGY AND DESIGN CRITERIA

Because of the relatively small size of the subject property (under twenty acres), the rational method is used to determine the increase / decrease of peak flow. Once determined that peak flow has increased, the modified rational method was utilized for routing computations to size the detention basin(s). This project proposes a residential use and is obliged to reduce the post development peak flow rate to be 50%, 75% and 80% of the existing conditions peak flow rate for the 2, 10 and 100 year storm events, respectively. This strategy is accomplished by proposing two (2) underground pipe systems.

OVERALL EXISTING CONDITIONS

The total existing drainage study area is estimated to be 2.89 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.67. A breakdown of land use ground covers is

indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The existing conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	10 year	100 year
Existing Conditions [Hydrograph 1]	8.10 cfs	10.76 cfs	14.72 cfs

OVERALL PROPOSED CONDITIONS

The total proposed drainage study area is estimated to be 2.89 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.84. A breakdown of land use ground covers is indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The proposed conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	10 year	100 year
Proposed Conditions [Hydrograph 2]	10.15 cfs	13.49 cfs	18.45 cfs

SUMMARY OF FINDINGS – OVERALL SITE

Because the proposed conditions peak flow is higher than the existing conditions peak flow, water quantity reduction must be provided. For this project, this will be done by examining the site in two pieces, 4 and 12 Lane Avenue as one system and 14 and 18 Lane Avenue as a second system. The combined impact of these two storm water management systems must reduce the peak runoff from the site to be less than 50%, 75% and 80% of the existing conditions peak flow rate for the two (2), ten (10) and one-hundred (100) year storm event respectively.

Storm Water System One – 4 and 12 Lane Avenue

EXISTING CONDITIONS ON 4 AND 12 LANE AVENUE

The total existing drainage study area is estimated to be 1.06 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.81. A breakdown of land use ground covers is indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The existing conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	10 year	100 year
Existing Conditions [Hydrograph 3]	3.58 cfs	4.75 cfs	6.50 cfs

PROPOSED CONDITIONS ON 4 AND 12 LANE AVENUE

The total proposed drainage study area is estimated to be 1.06 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.87. A breakdown of land use ground covers is indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The proposed conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	**10 year**	**100 year**
Proposed Conditions [Hydrograph 4]	3.84 cfs	5.10 cfs	6.98 cfs

SUMMARY OF FINDINGS – 4 AND 12 LANE AVENUE

Because the proposed conditions peak flow rates exceed the existing conditions peak flow rates, peak flow reduction is required. Accordingly, the proposed detention basin must be designed to reduce the proposed conditions peak flow rates to be less than 50%, 75% and 80% of the existing conditions peak flow rate for the two (2), ten (10) and one-hundred (100) year storm event respectively. The summary table below outlines this criterion. The documents in the attached appendix supplement these findings.

	2 year	**10 year**	**100 year**
Existing Conditions Peak Flow Rate [Hyd. No. 3]	3.58 cfs	4.75 cfs	6.50 cfs
Target Flow Percentage [N.J.A.C. 7:8]	50%	75%	80%
Target Flow Rates [N.J.A.C. 7:8]	1.79 cfs	3.56 cfs	5.2 cfs
Routed Peak Flow [Hyd. No. 6]	1.29 cfs	2.24 cfs	3.48 cfs
Water Surface Elevation	280.11	280.69	281.58
[1]Reduction of Flow	36.0%	47.2%	53.5%

[1]Percentage difference between routed flow and existing conditions flow rate.

Storm Water System Two – 14 and 18 Lane Avenue

EXISTING CONDITIONS ON 14 AND 18 LANE AVENUE

The total existing drainage study area is estimated to be 1.84 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.59. A breakdown of land use ground covers is indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The existing conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	**10 year**	**100 year**
Existing Conditions [Hydrograph 7]	4.54 cfs	6.03 cfs	8.25 cfs

PROPOSED CONDITIONS ON 14 AND 18 LANE AVENUE

The total proposed drainage study area is estimated to be 1.84 acres [size of subject properties]. The onsite soils are presumed to be hydrologic soil group C based on a web soil survey, see appendices later in this report. The weighted runoff coefficient is computed to be 0.82. A breakdown of land use ground covers is indicated in the appendices. Because of the relatively small drainage basin and the fact that there is a high amount of impervious cover, the time of concentration for existing conditions is assumed to be the statutory minimum of ten (10) minutes.

The proposed conditions peak flow rates based on this hydrology is estimated to be as follows. Hydrograph summaries are attached to this memorandum.

	2 year	**10 year**	**100 year**
Proposed Conditions [Hydrograph 8]	6.31 cfs	8.38 cfs	11.47 cfs

SUMMARY OF FINDINGS – 14 AND 18 LANE AVENUE

Because the proposed conditions peak flow rates exceed the existing conditions peak flow rates, peak flow reduction is required. Accordingly, the proposed detention basin must be designed to reduce the proposed conditions peak flow rates to be less than 50%, 75% and 80% of the existing conditions peak flow rate for the two (2), ten (10) and one-hundred (100) year storm event respectively. The summary table below outlines this criterion. The documents in the attached appendix supplement these findings.

	2 year	**10 year**	**100 year**
Existing Conditions Peak Flow Rate [Hyd. No. 7]	4.54 cfs	6.03 cfs	8.25 cfs
Target Flow Percentage [N.J.A.C. 7:8]	50%	75%	80%
Target Flow Rates [N.J.A.C. 7:8]	2.27 cfs	4.52 cfs	6.60 cfs
Routed Peak Flow [Hyd. No. 9]	2.25 cfs	3.99 cfs	6.40 cfs
Water Surface Elevation	278.11	278.77	279.48
[1]Reduction of Flow	49.6%	66.2%	77.5%

[1]Percentage difference between routed flow and existing conditions flow rate.

SUMMARY OF FINDINGS – OVERALL SITE

In addition to obtaining peak flow reduction in each of the two (2) subareas, the project must also accomplish these same peak flow reductions on the entire site. Thus, the proposed detention basins must together be designed to reduce the proposed conditions peak flow rates for the entire site to be less than 50%, 75% and 80% of the existing conditions peak flow rate for the two (2), ten (10) and one-hundred (100) year storm event respectively. The summary table below outlines this criterion. The documents in the attached appendix supplement these findings.

	2 year	**10 year**	**100 year**
Existing Conditions [Hydrograph 1]	8.10 cfs	10.76 cfs	14.72 cfs
Target Flow Percentage [N.J.A.C. 7:8]	50%	75%	80%
Target Flow Rates [N.J.A.C. 7:8]	4.05 cfs	8.07 cfs	11.78 cfs
Overall Site Runoff [Hydrograph 11]	3.48 cfs	6.13 cfs	9.74 cfs
[1]Reduction of Flow	43.0%	57.0%	66.2%

[1]Percentage difference between overall site runoff and existing conditions flow rate.

As evidenced by the summary tables above, peak flow reduction is accomplished for the overall site as well as each subdrainage area per the N.J.A.C. 7:8 criteria.

WATER QUALITY ENHANCEMENT

Because this project proposes to increase impervious cover by more than one-quarter acre, water quality enhancement must be incorporated into the storm water management design. Because this site is a redevelopment site and does not involve the removal of 'woodland' areas, the water quality enhancement required is fifty (50) percent total suspended solid removal. This is accomplished by proposing a hydrodynamic separator on the downstream side of each of the two detention basins. Further water quality enhancement is obtained by the construction strategy to build a building over a parking area, thus eliminating roughly two-thirds of the parking lots from being exposed to precipitation.

GROUND WATER RECHARGE

This property is previously developed and is located with the Metropolitan Planning Area 1, which is considered an urban redevelopment area. Per section 7:8-5.4(a)2ii, ground water recharge requirements do not apply to projects within the urban redevelopment area. Accordingly, ground water recharge analysis is not provided for this project.

STORM WATER MANAGEMENT MAINTENANCE MANUAL

All storm water management for major development scopes require a maintenance manual be prepared as emphasized in the Borough of Caldwell ordinance under section 206-04 and as outlined in section 206-10. Typically, a draft maintenance manual is prepared after the storm water design is complete but before the construction is completed. Once the storm water management system is fully installed, the draft report should undergo a revision to make it consistent with the 'as constructed' conditions. In addition to outlining the maintenance responsibilities of the system itself, the manual should also identify the person / entity responsible for the maintenance of the basin. This draft manual will be prepared under separate cover from this design report.

Thank you in advance for your continued consideration of this project.

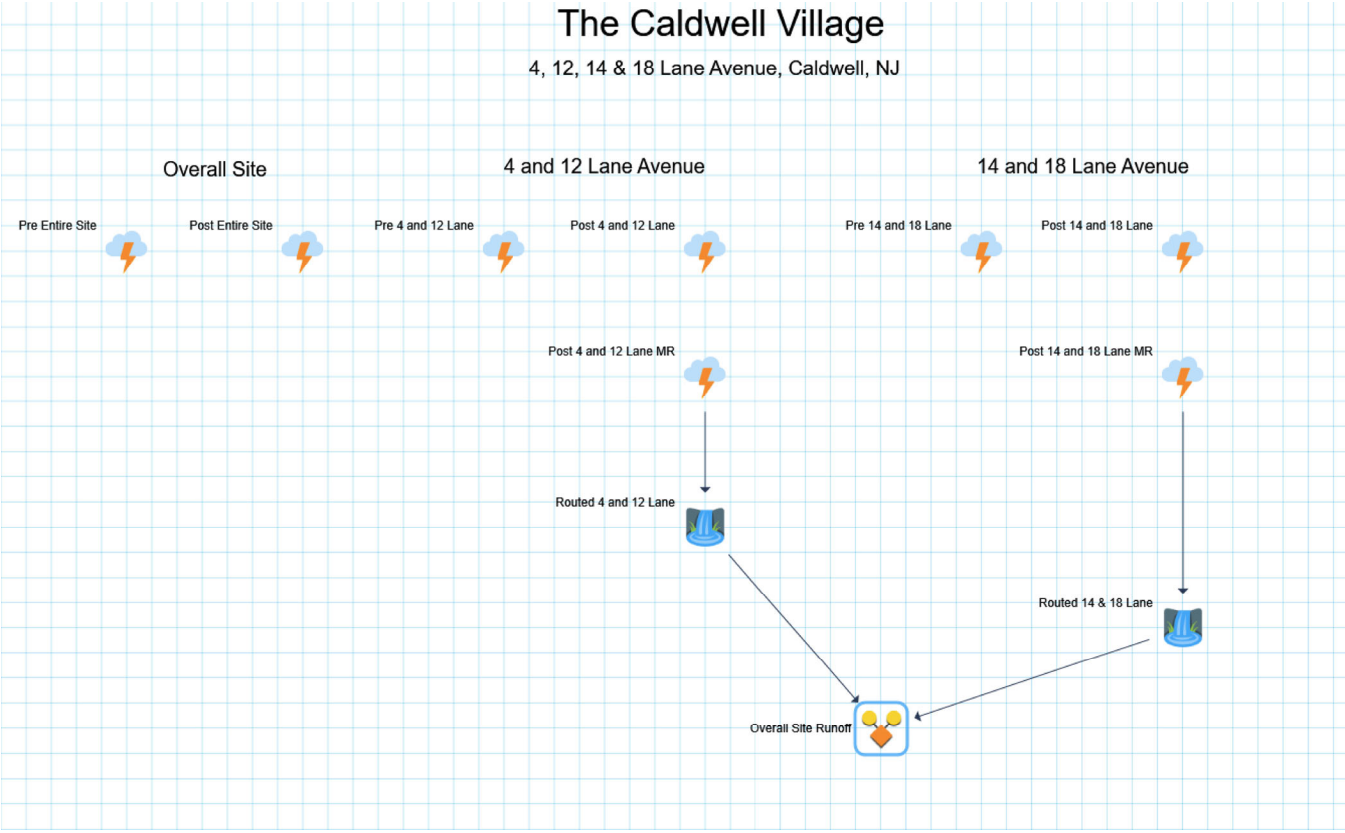
Very truly yours,
MCB ENGINEERING ASSOCIATES, LLC

Patrick D. McClellan, P.E.
For the firm

APPENDIX A
STORM WATER MANAGEMENT
COMPUTATION SUMMARY

Table of Contents

Contents continued...


The Caldwell Village
4, 12, 14 & 18 Lane Avenue, Caldwell, NJ
Overall Site
4 and 12 Lane Avenue
14 and 18 Lane Avenue
Pre Entire Site
Post Entire Site
Pre 4 and 12 Lane
Post 4 and 12 Lane
Pre 14 and 18 Lane
Post 14 and 18 Lane
Post 4 and 12 Lane MR
Post 14 and 18 Lane MR
Routed 4 and 12 Lane
Routed 14 & 18 Lane
Overall Site Runoff

Hydrograph by Return Period

Project Name: Caldwell Village

02-21-2021

Hydrology Studio v 3.0.0.17

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	Rational	Pre Entire Site		8.097			10.76			14.72
2	Rational	Post Entire Site		10.15			13.49			18.45
3	Rational	Pre 4 and 12 Lane		3.575			4.752			6.500
4	Rational	Post 4 and 12 Lane		3.855			5.123			7.008
5	Mod Rational	Post 4 and 12 Lane MR		2.309			3.783			5.192
6	Pond Route	Routed 4 and 12 Lane		1.290			2.239			3.480
7	Rational	Pre 14 and 18 Lane		4.538			6.031			8.249
8	Rational	Post 14 and 18 Lane		6.307			8.381			11.47
9	Mod Rational	Post 14 and 18 Lane MR		3.225			5.472			7.448
10	Pond Route	Routed 14 & 18 Lane		2.250			3.989			6.397
11	Junction	Overall Site Runoff		3.484			6.132			9.741

Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

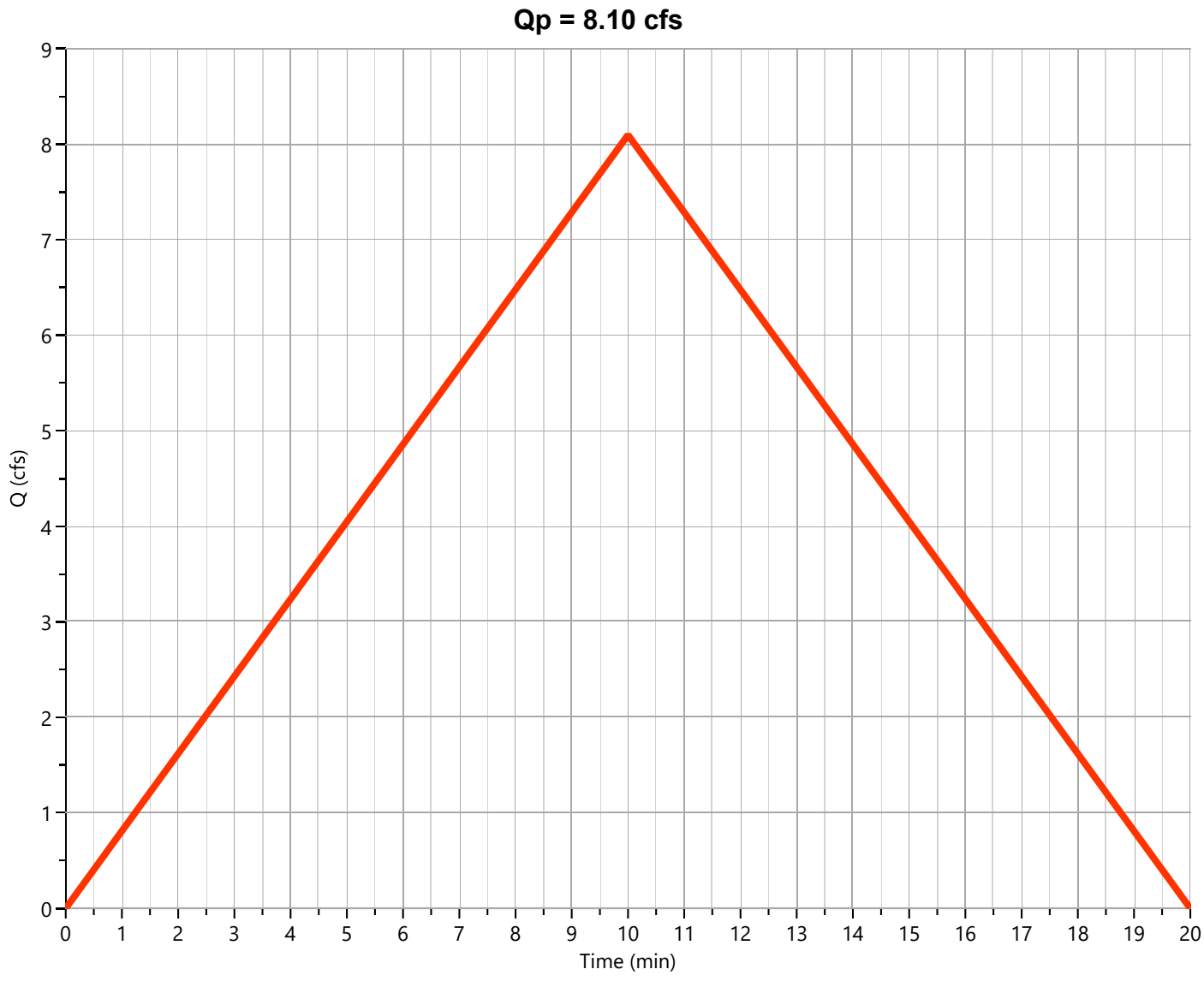
Pre Entire Site

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 8.097 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 4,858 cuft
Drainage Area	= 2.891 ac	Runoff Coeff.	= 0.67*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.945	0.99	Pavement
1.946	0.51	Grass
2.891	**0.67**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

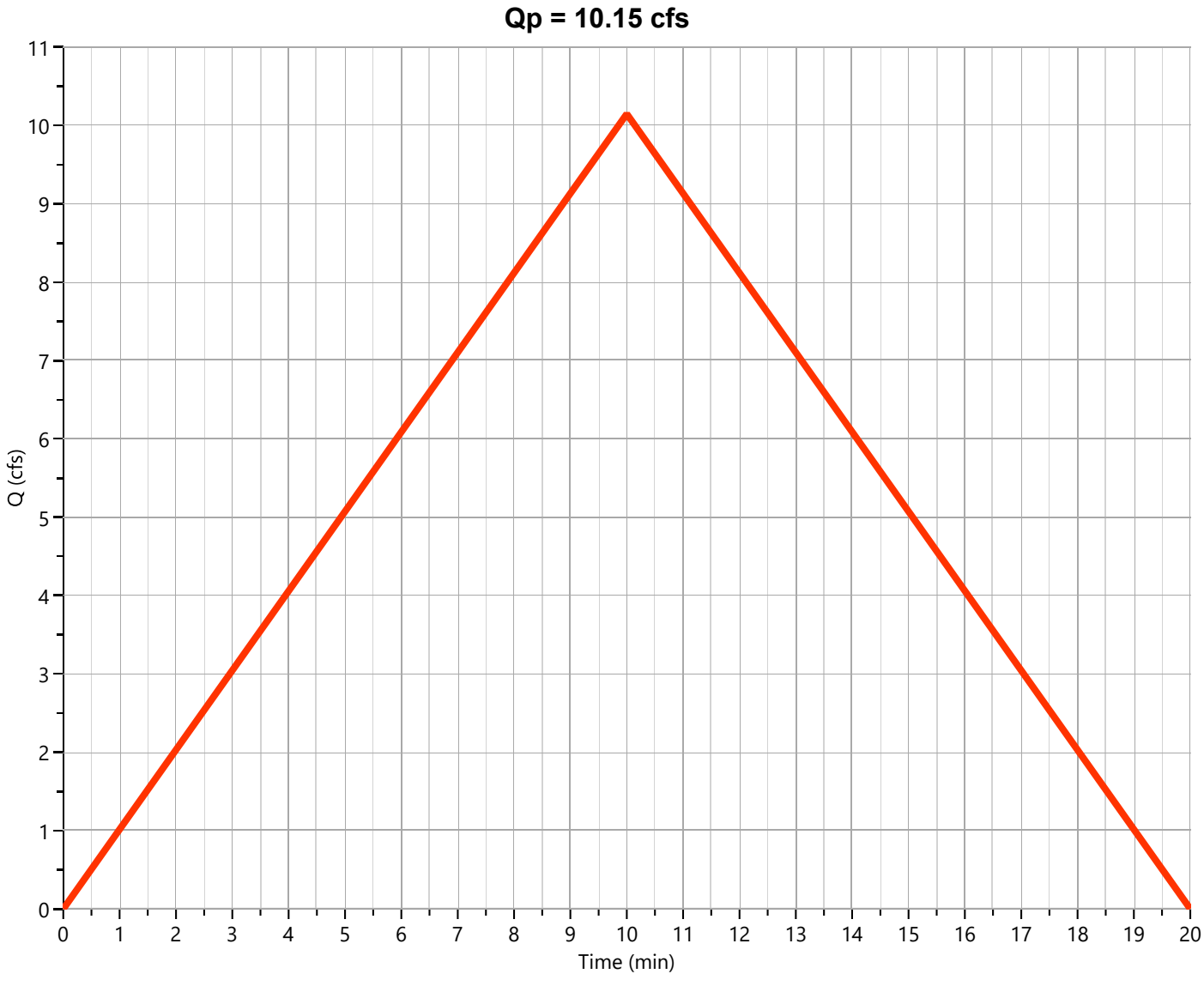
Post Entire Site

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 10.15 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 6,089 cuft
Drainage Area	= 2.89 ac	Runoff Coeff.	= 0.84*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.989	0.99	Pavement
0.902	0.51	Grass
2.89	**0.84**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

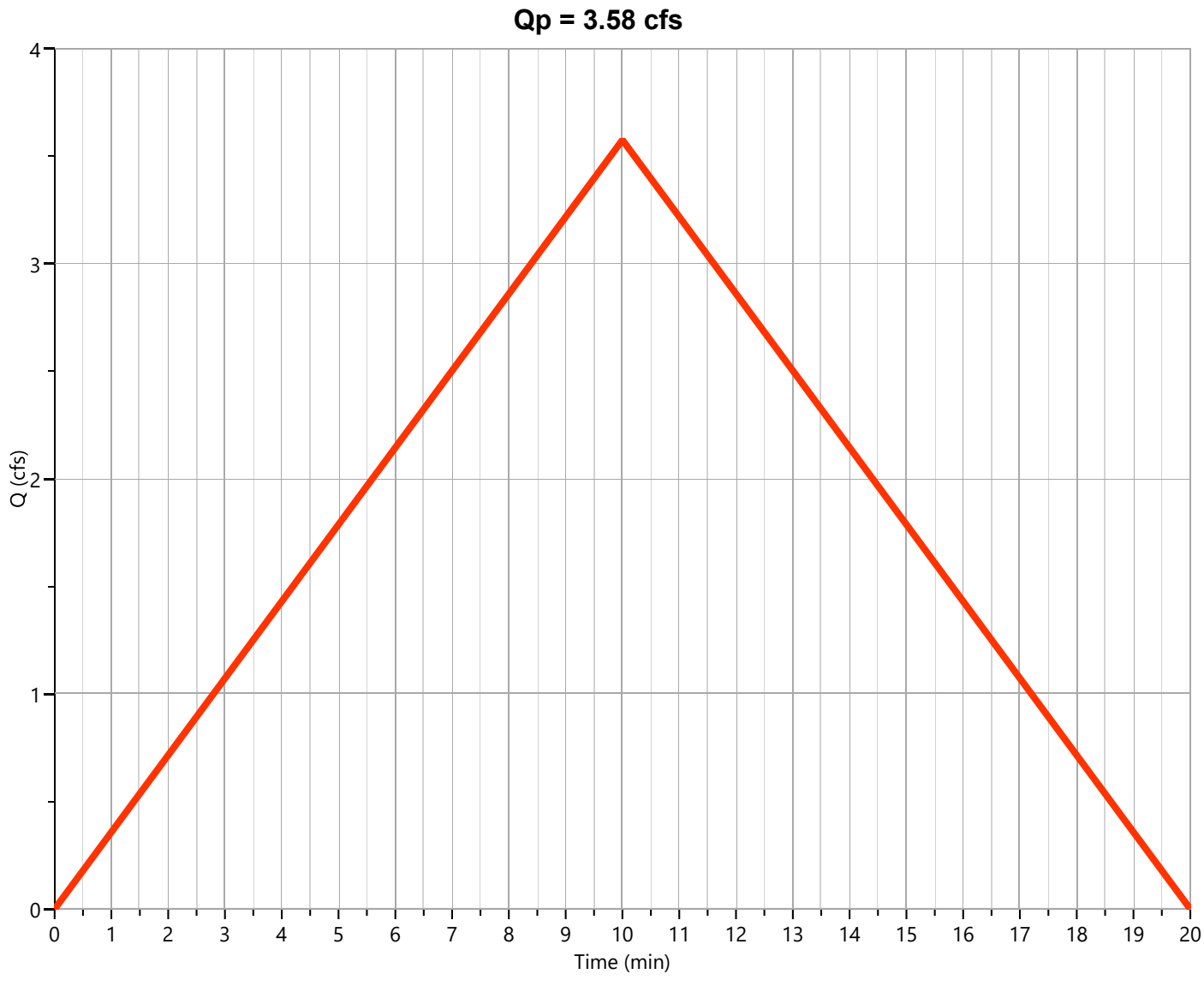
Pre 4 and 12 Lane

Hyd. No. 3

Hydrograph Type	= Rational	Peak Flow	= 3.575 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 2,145 cuft
Drainage Area	= 1.056 ac	Runoff Coeff.	= 0.81*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.656	0.99	Pavement
0.4	0.51	Grass
1.056	**0.81**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

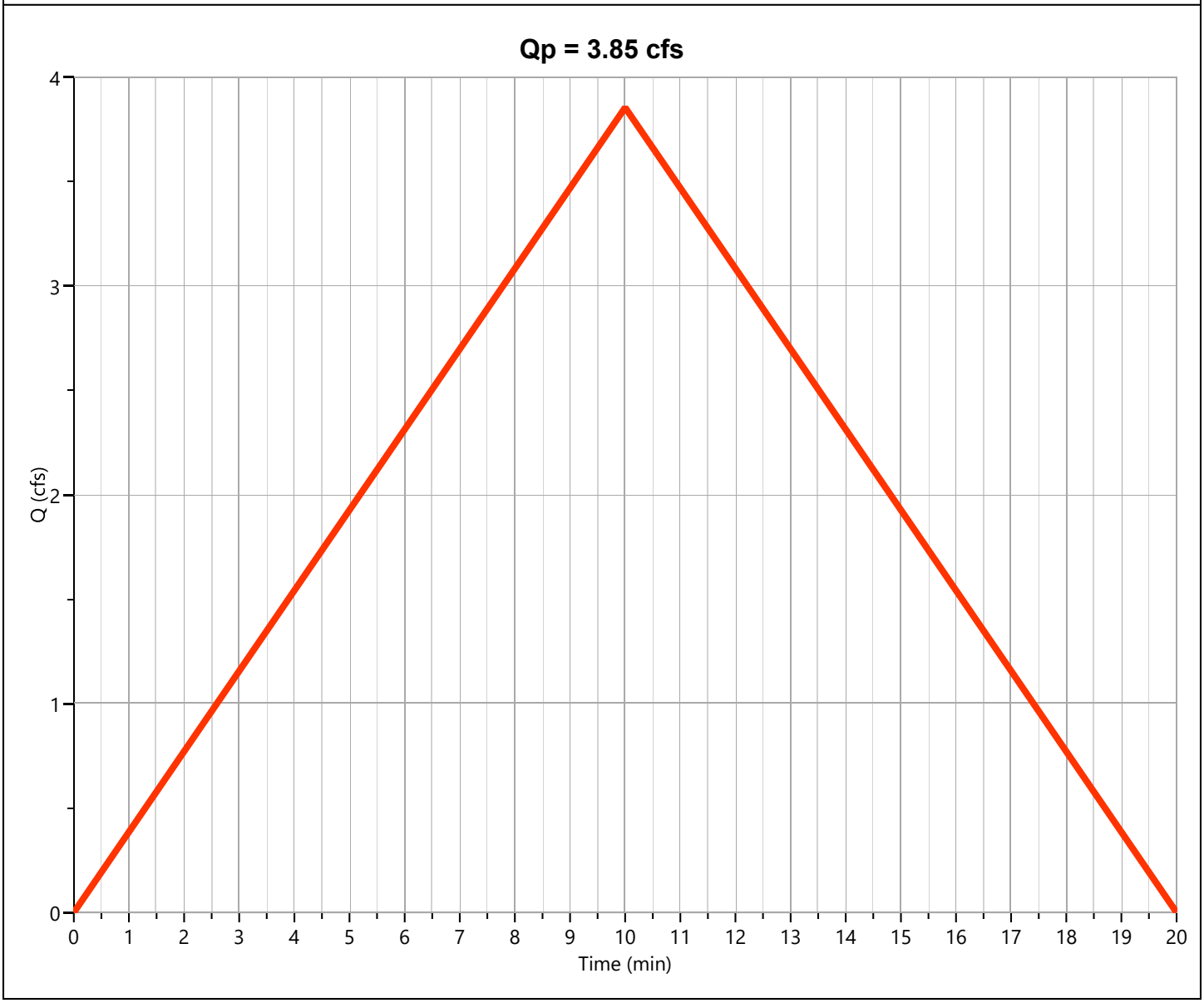
Post 4 and 12 Lane

Hyd. No. 4

Hydrograph Type	= Rational	Peak Flow	= 3.855 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 2,313 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

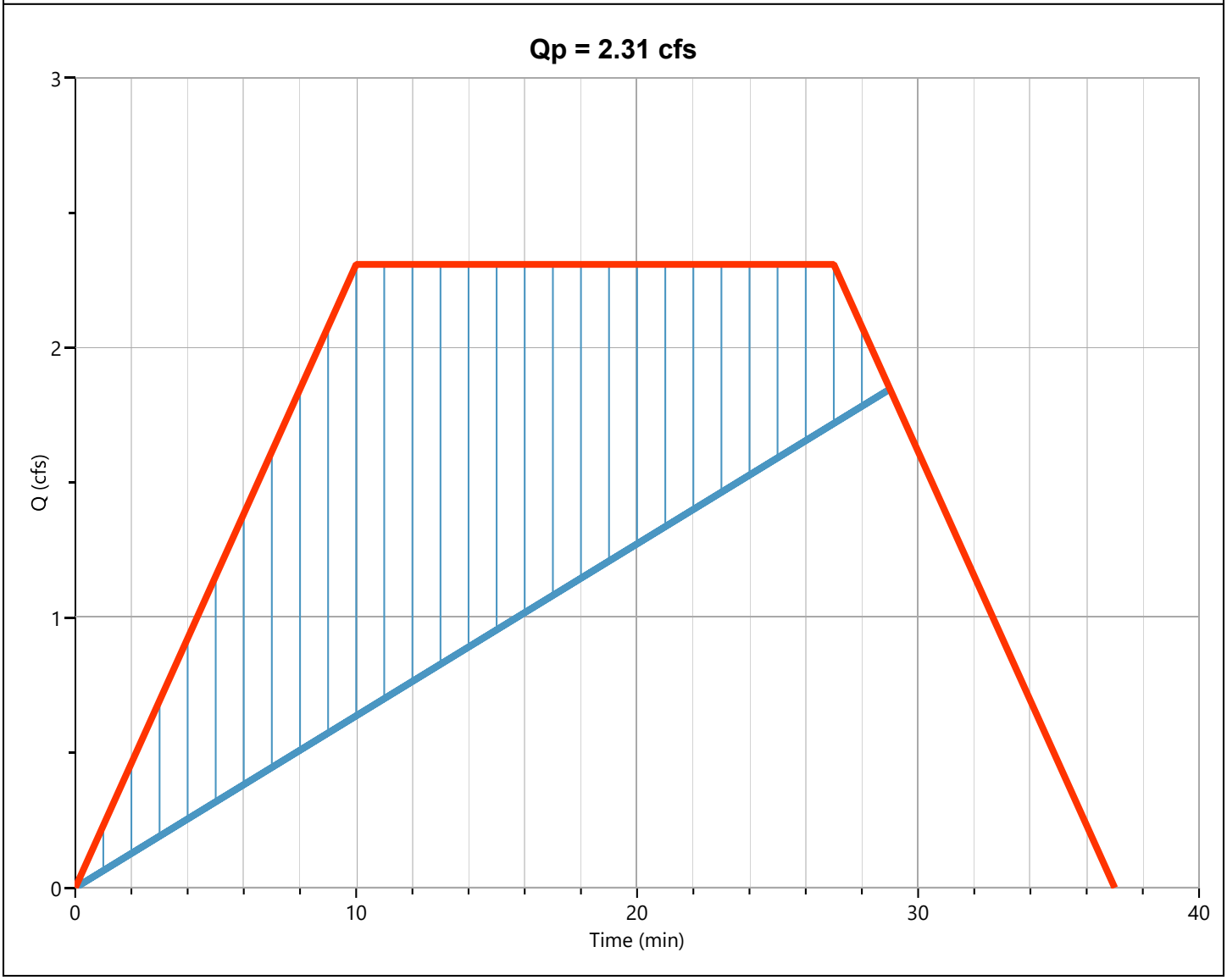
Post 4 and 12 Lane MR

Hyd. No. 5

Hydrograph Type	= Mod Rational	Peak Flow	= 2.309 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,879 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 2.50 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.8 x Tc
Target Q	= 1.790 cfs	Required Storage	= 1,892 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

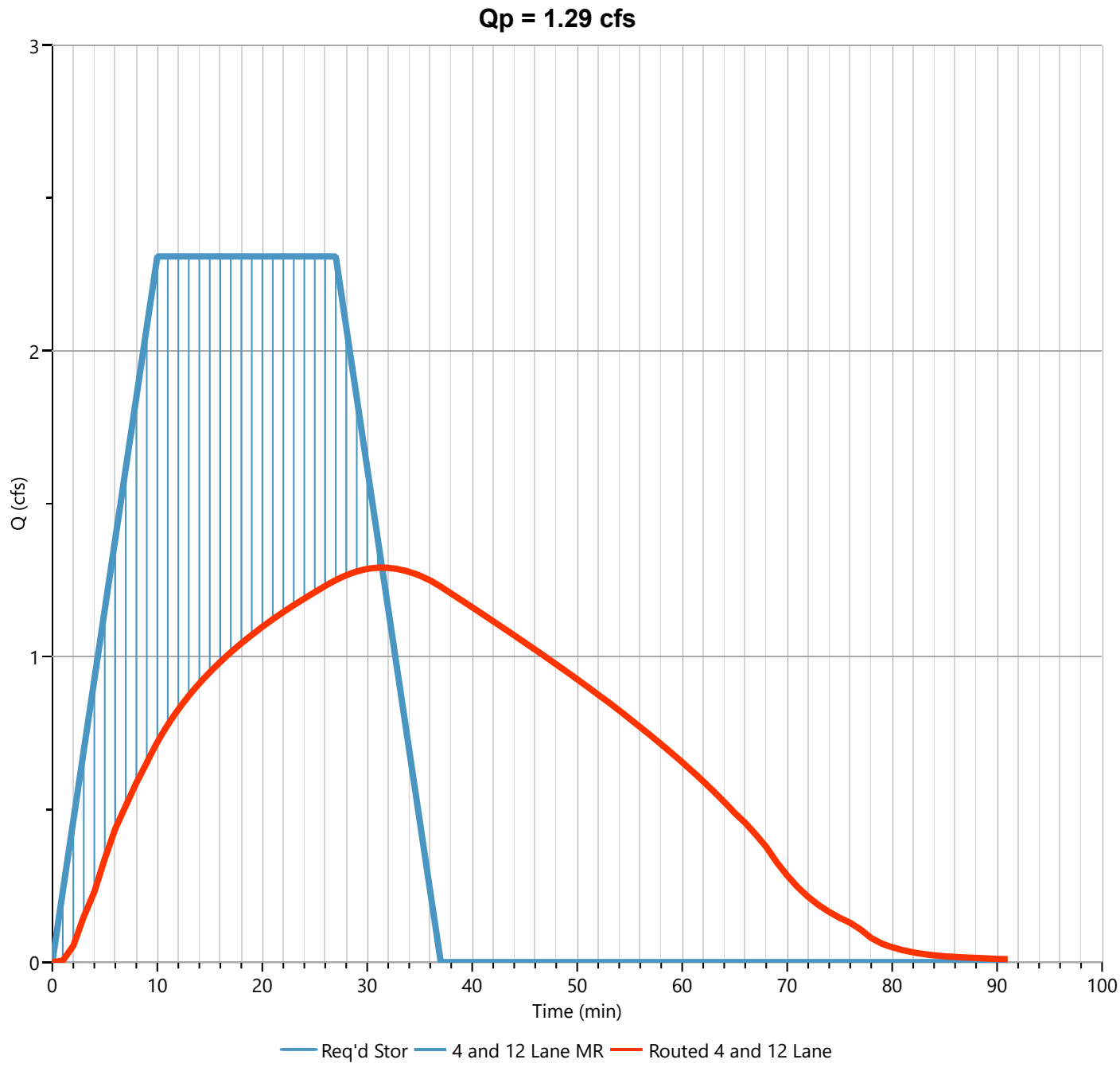
Routed 4 and 12 Lane

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 1.290 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.52 hrs
Time Interval	= 1 min	Hydrograph Volume	= 3,737 cuft
Inflow Hydrograph	= 5 - 4 and 12 Lane MR	Max. Elevation	= 280.11 ft
Pond Name	= 4 and 12 Lane Avenue	Max. Storage	= 1,930 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 18 min



Pond Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

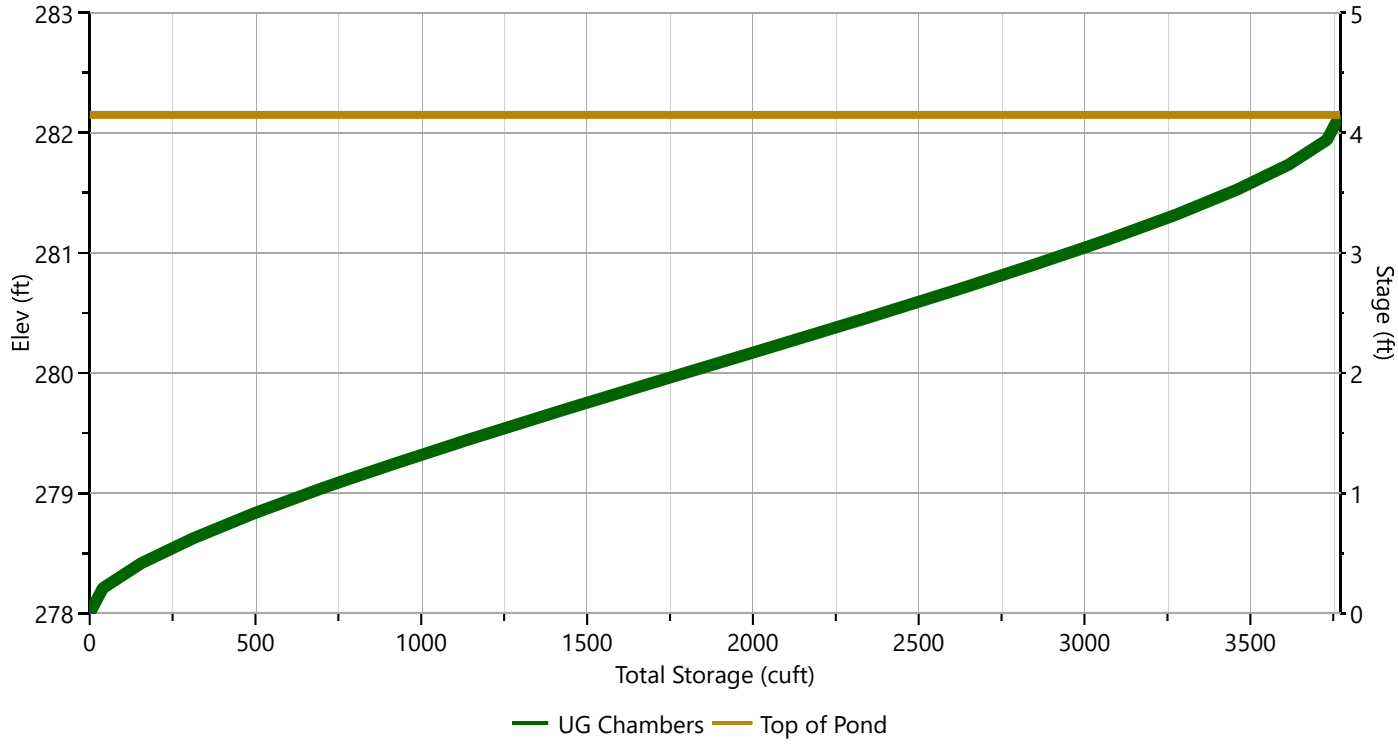
4 and 12 Lane Avenue

Stage-Storage

Underground Chambers	
Description	**Input**
Invert Elev Down, ft	278.00
Chamber Rise, ft	4.00
Chamber Shape	Circular
Chamber Span, ft	4.00
Barrel Length, ft	150.00
No. Barrels	2
Barrel Slope, %	0.10
Headers, y/n	No
Stone Encasement, y/n	No
Encasement Bottom Elevation, ft	0.00
Encasement Width per Chamber, ft	0.00
Encasement Depth, ft	0.00
Encasement Voids, %	40.00

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	278.00	n/a	0.000	0.000
0.21	278.21	n/a	39.8	39.8
0.42	278.42	n/a	116	156
0.62	278.62	n/a	156	311
0.83	278.83	n/a	183	495
1.04	279.04	n/a	204	699
1.25	279.25	n/a	220	919
1.45	279.45	n/a	232	1,151
1.66	279.66	n/a	240	1,391
1.87	279.87	n/a	246	1,637
2.08	280.08	n/a	249	1,886
2.28	280.28	n/a	249	2,135
2.49	280.49	n/a	246	2,380
2.70	280.70	n/a	240	2,621
2.91	280.91	n/a	232	2,852
3.11	281.11	n/a	220	3,072
3.32	281.32	n/a	204	3,277
3.53	281.53	n/a	183	3,460
3.74	281.74	n/a	155	3,615
3.94	281.94	n/a	116	3,731
4.15	282.15	n/a	39.6	3,771



Pond Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

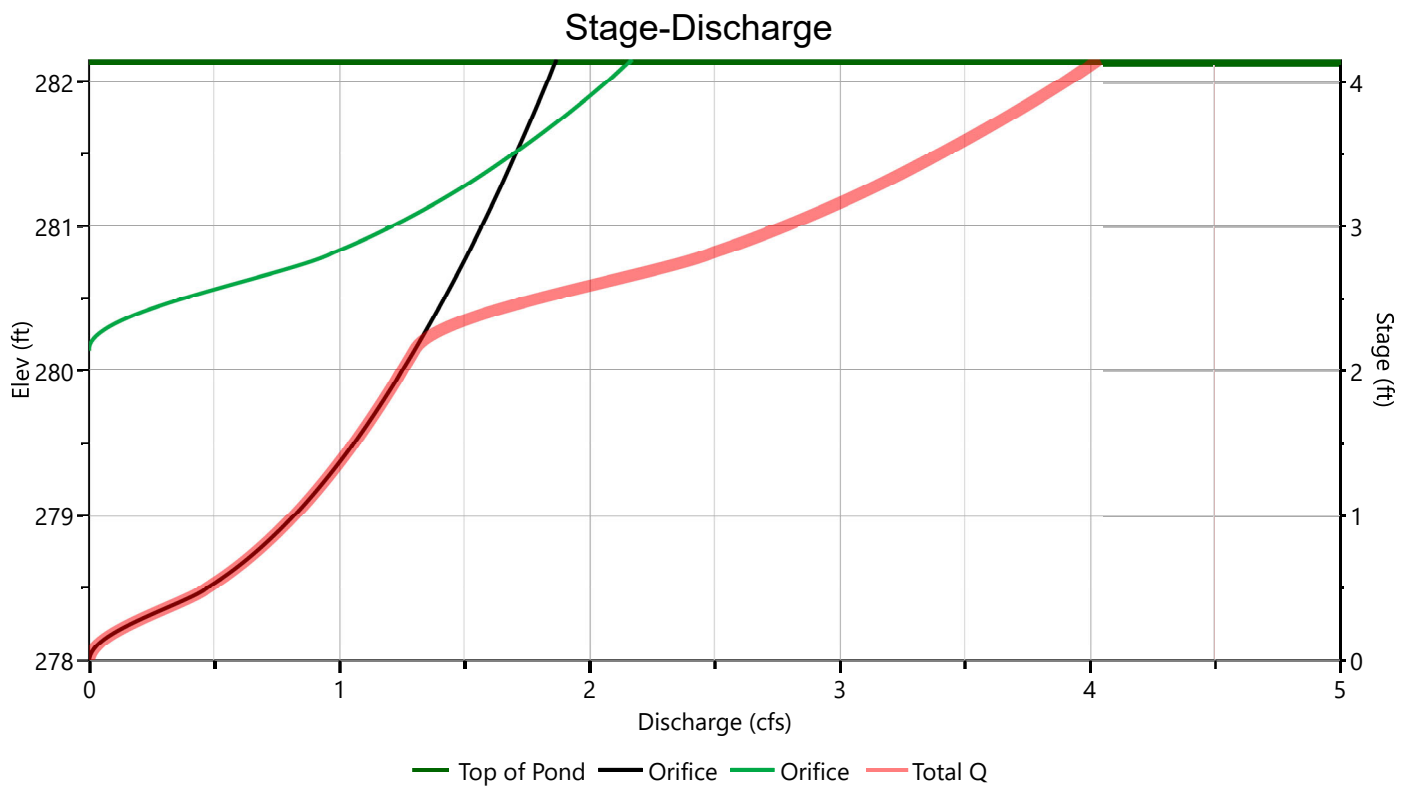
02-21-2021

4 and 12 Lane Avenue

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in		6	8		Hole Diameter, in	
Span, in		6	8		No. holes	
No. Barrels		1	1		Invert Elevation, ft	
Invert Elevation, ft		278.00	280.15		Height, ft	
Orifice Coefficient, Co		0.60	0.60		Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

**Routes through Culvert.*



Pond Report

4 and 12 Lane Avenue

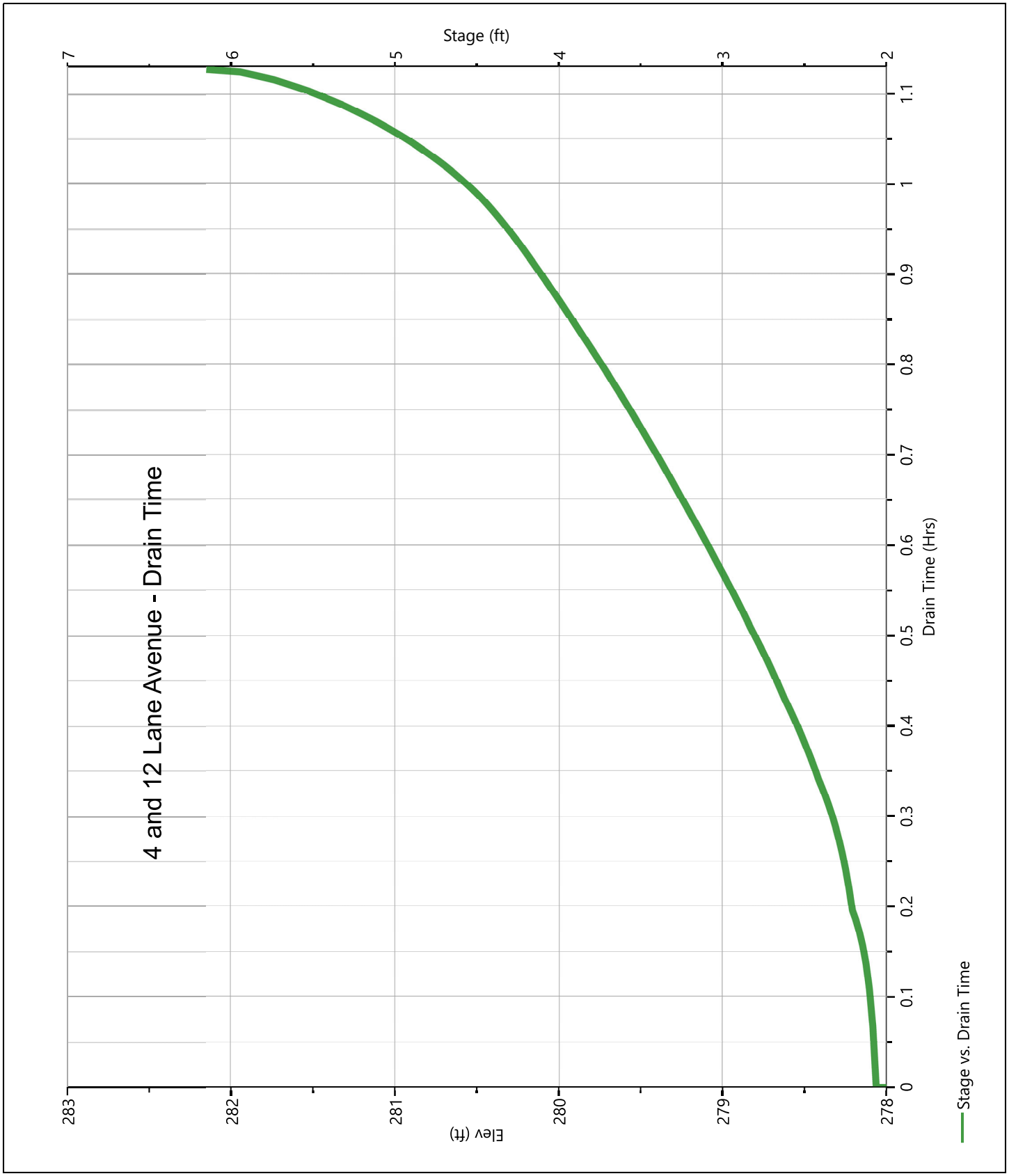
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	278.00	0.000		0.000	0.000									0.000
0.21	278.21	39.8		0.120	0.000									0.120
0.42	278.42	156		0.382	0.000									0.382
0.62	278.62	311		0.577	0.000									0.577
0.83	278.83	495		0.720	0.000									0.720
1.04	279.04	699		0.839	0.000									0.839
1.25	279.25	919		0.943	0.000									0.943
1.45	279.45	1,151		1.037	0.000									1.037
1.66	279.66	1,391		1.122	0.000									1.122
1.87	279.87	1,637		1.202	0.000									1.202
2.08	280.08	1,886		1.277	0.000									1.277
2.28	280.28	2,135		1.348	0.061									1.409
2.49	280.49	2,380		1.415	0.355									1.770
2.70	280.70	2,621		1.479	0.773									2.252
2.91	280.91	2,852		1.540	1.091									2.632
3.11	281.11	3,072		1.599	1.333									2.932
3.32	281.32	3,277		1.656	1.537									3.193
3.53	281.53	3,460		1.711	1.717									3.429
3.74	281.74	3,615		1.765	1.880									3.645
3.94	281.94	3,731		1.816	2.030									3.847
4.15	282.15	3,771		1.867	2.170									4.036

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

4 and 12 Lane Avenue

Pond Drawdown



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

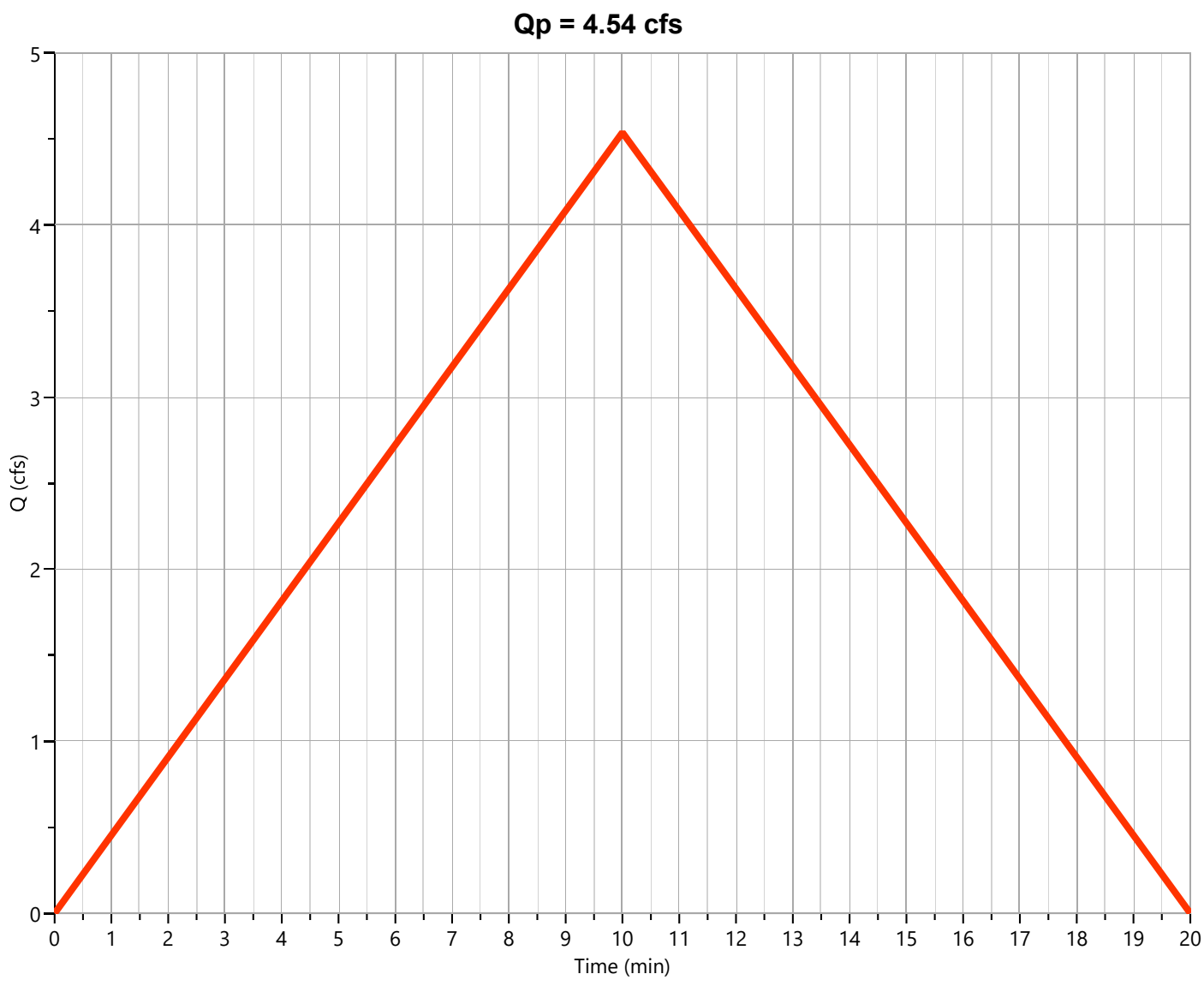
Pre 14 and 18 Lane

Hyd. No. 7

Hydrograph Type	= Rational	Peak Flow	= 4.538 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 2,723 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.59*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.289	0.99	Pavement
1.551	0.51	Grass
1.84	**0.59**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

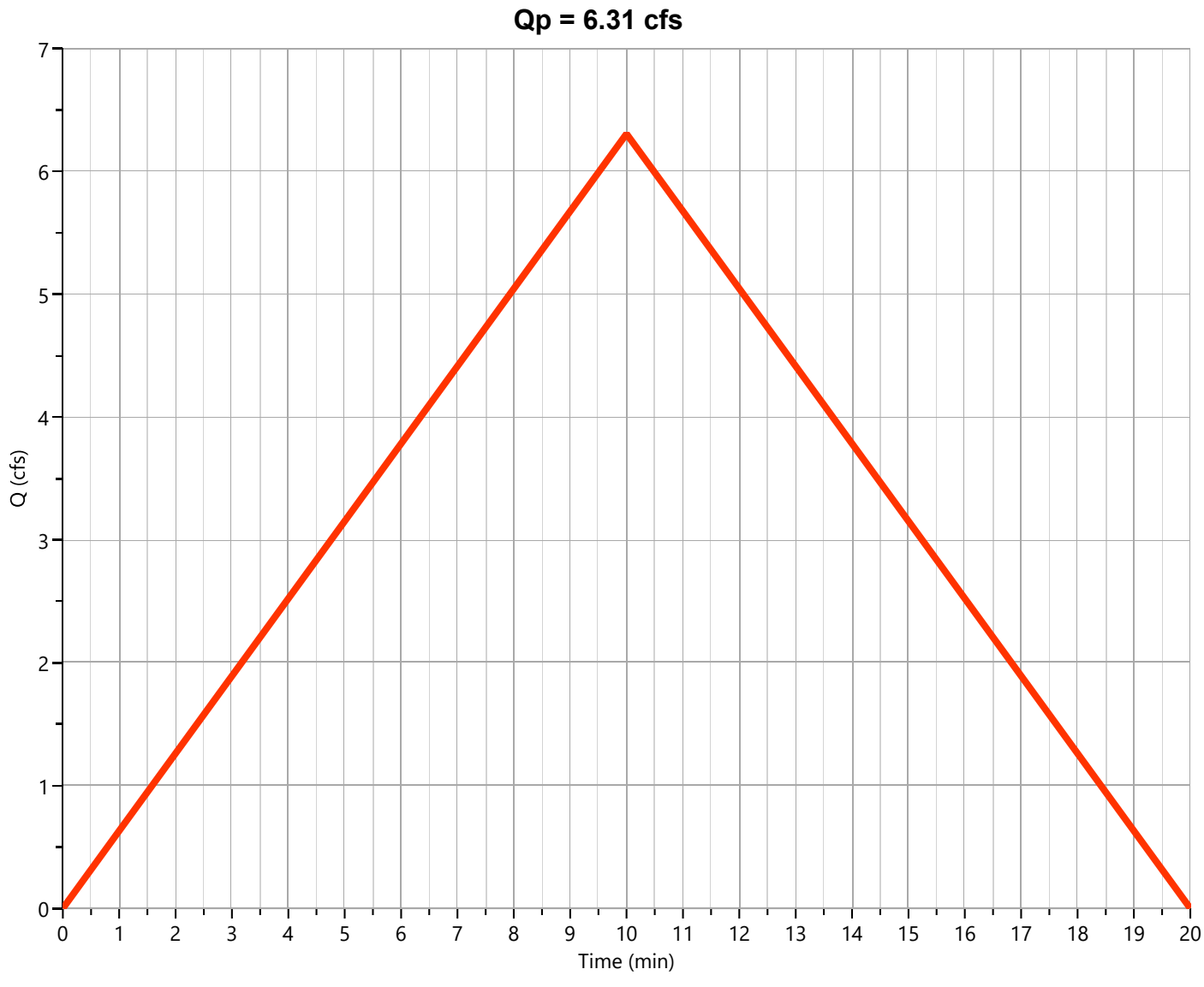
Post 14 and 18 Lane

Hyd. No. 8

Hydrograph Type	= Rational	Peak Flow	= 6.307 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,784 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.18 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

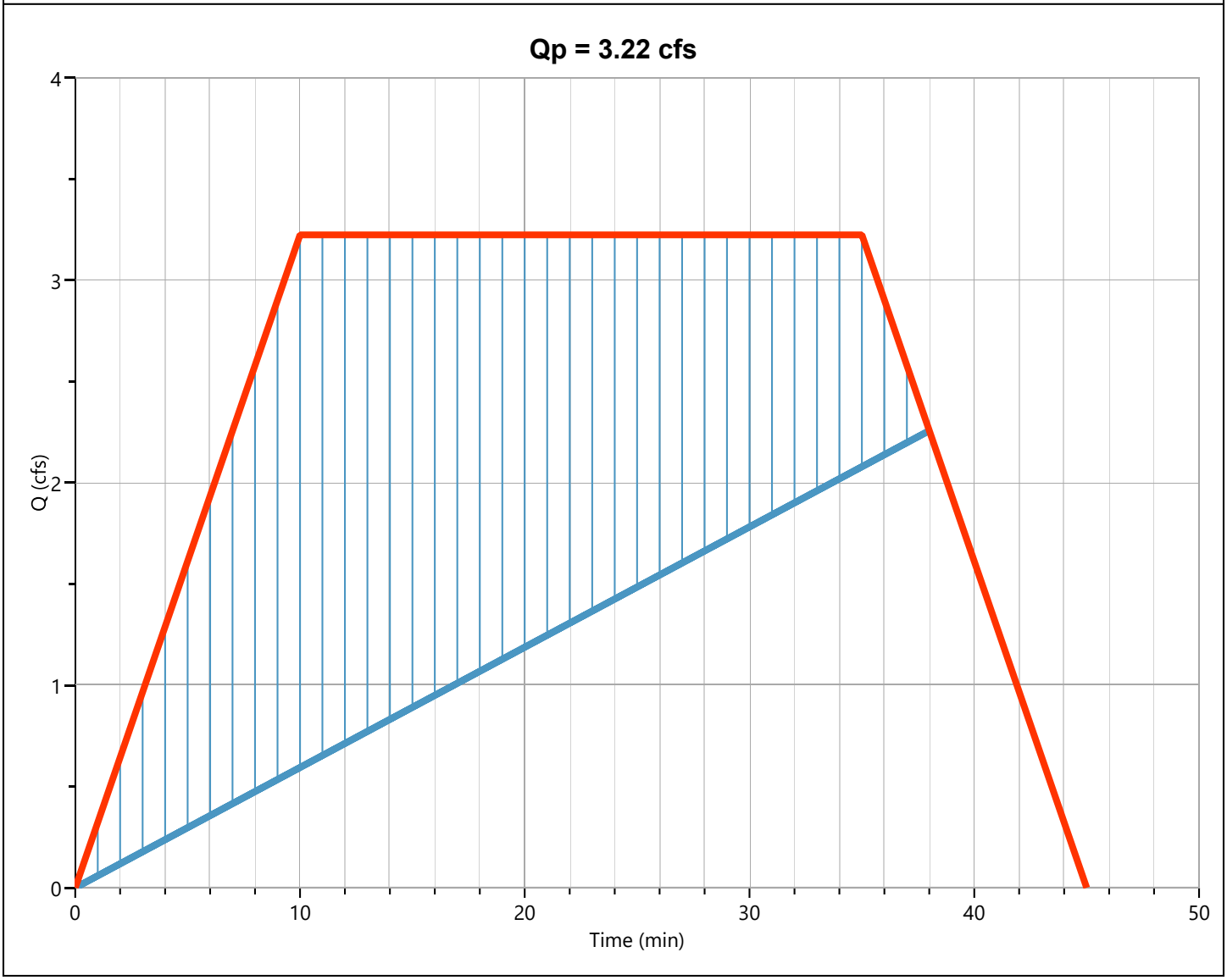
Post 14 and 18 Lane MR

Hyd. No. 9

Hydrograph Type	= Mod Rational	Peak Flow	= 3.225 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 6,965 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 2.14 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 3.6 x Tc
Target Q	= 2.270 cfs	Required Storage	= 3,901 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

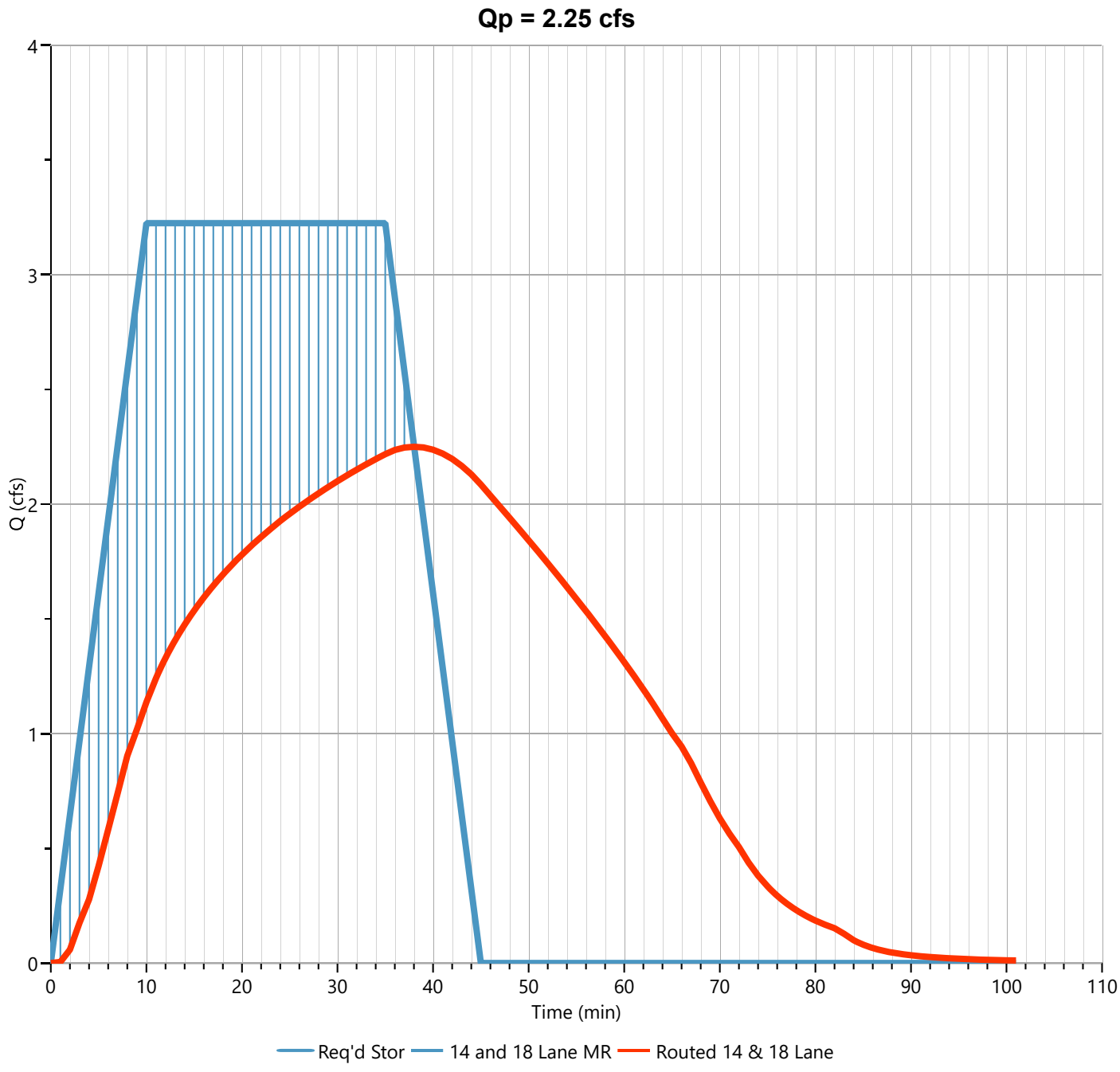
Routed 14 & 18 Lane

Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 2.250 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.63 hrs
Time Interval	= 1 min	Hydrograph Volume	= 6,768 cuft
Inflow Hydrograph	= 9 - 14 and 18 Lane MR	Max. Elevation	= 278.13 ft
Pond Name	= 14 and 18 Lane Avenue	Max. Storage	= 2,883 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 16 min



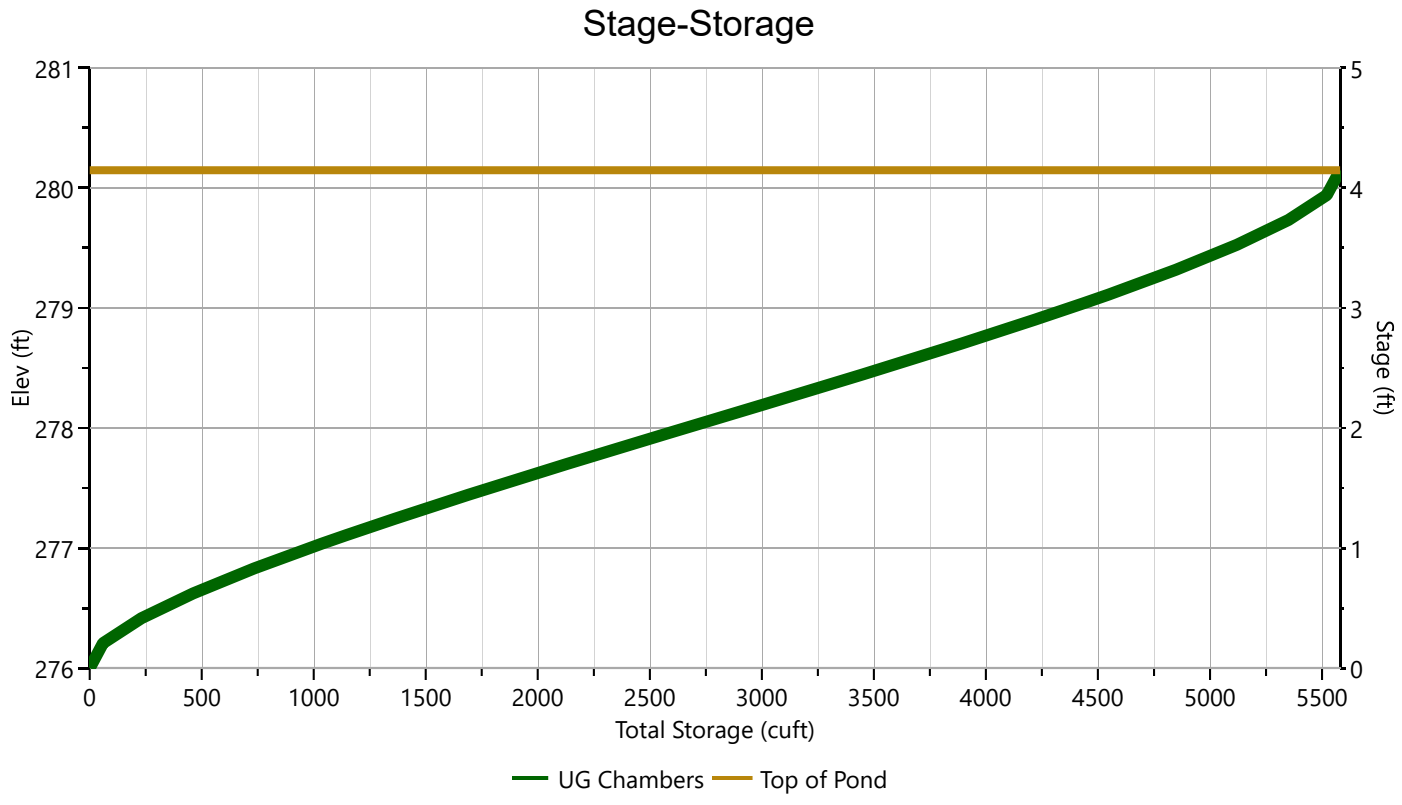
14 and 18 Lane Avenue

Stage-Storage

Underground Chambers	
Description	**Input**
Invert Elev Down, ft	276.00
Chamber Rise, ft	4.00
Chamber Shape	Circular
Chamber Span, ft	4.00
Barrel Length, ft	148.00
No. Barrels	3
Barrel Slope, %	0.10
Headers, y/n	No
Stone Encasement, y/n	No
Encasement Bottom Elevation, ft	0.00
Encasement Width per Chamber, ft	0.00
Encasement Depth, ft	0.00
Encasement Voids, %	40.00

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	276.00	n/a	0.000	0.000
0.21	276.21	n/a	59.3	59.3
0.41	276.41	n/a	171	231
0.62	276.62	n/a	231	461
0.83	276.83	n/a	272	733
1.04	277.04	n/a	302	1,036
1.24	277.24	n/a	326	1,362
1.45	277.45	n/a	342	1,704
1.66	277.66	n/a	356	2,060
1.87	277.87	n/a	364	2,423
2.07	278.07	n/a	368	2,791
2.28	278.28	n/a	368	3,159
2.49	278.49	n/a	364	3,523
2.70	278.70	n/a	355	3,878
2.90	278.90	n/a	343	4,221
3.11	279.11	n/a	325	4,546
3.32	279.32	n/a	302	4,848
3.53	279.53	n/a	272	5,120
3.73	279.73	n/a	230	5,350
3.94	279.94	n/a	171	5,521
4.15	280.15	n/a	59.2	5,581



Pond Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

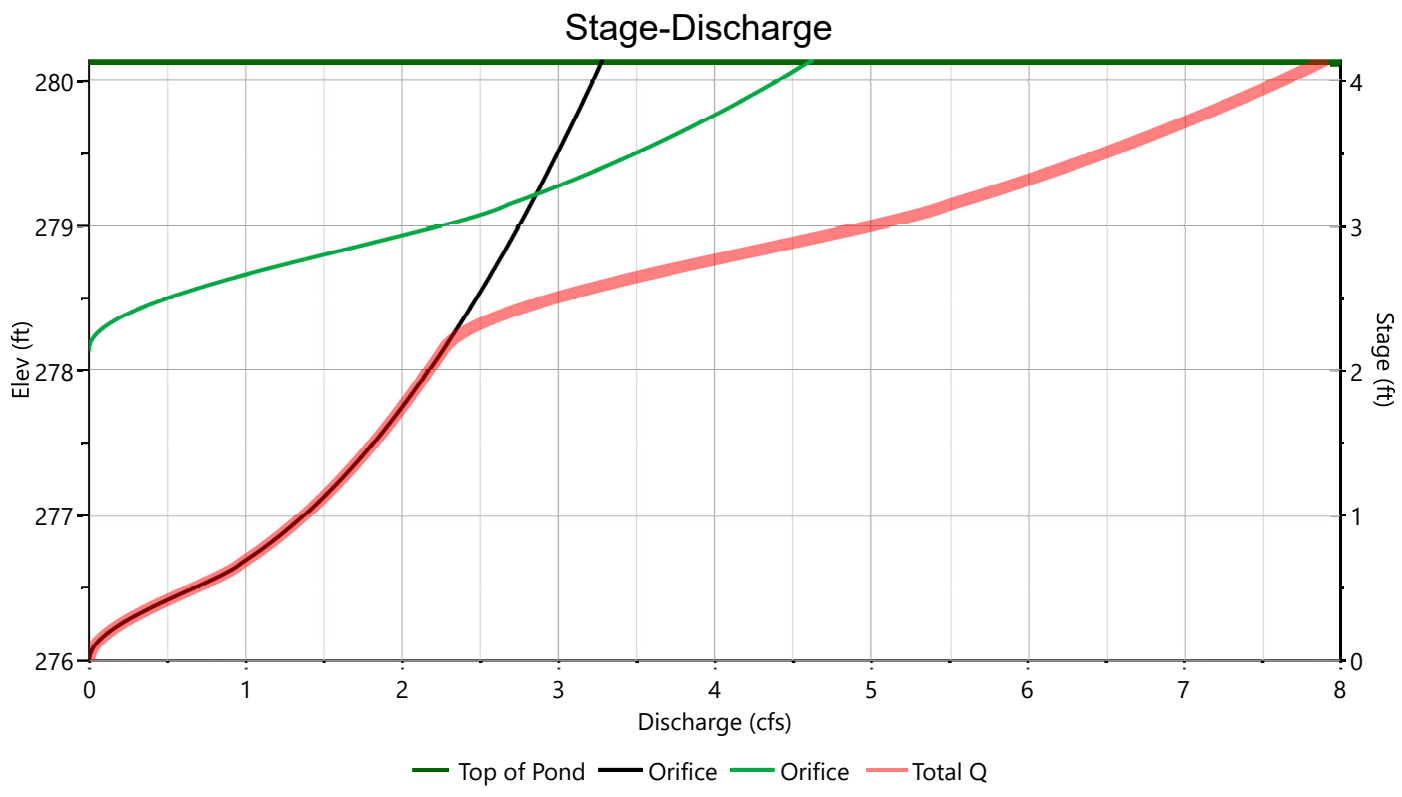
02-21-2021

14 and 18 Lane Avenue

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in		8	12		Hole Diameter, in	
Span, in		8	12		No. holes	
No. Barrels		1	1		Invert Elevation, ft	
Invert Elevation, ft		276.00	278.15		Height, ft	
Orifice Coefficient, Co		0.60	0.60		Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type					Exfiltration, in/hr	
Crest Elevation, ft						
Crest Length, ft						
Angle, deg						
Weir Coefficient, Cw						

**Routes through Culvert.*



14 and 18 Lane Avenue

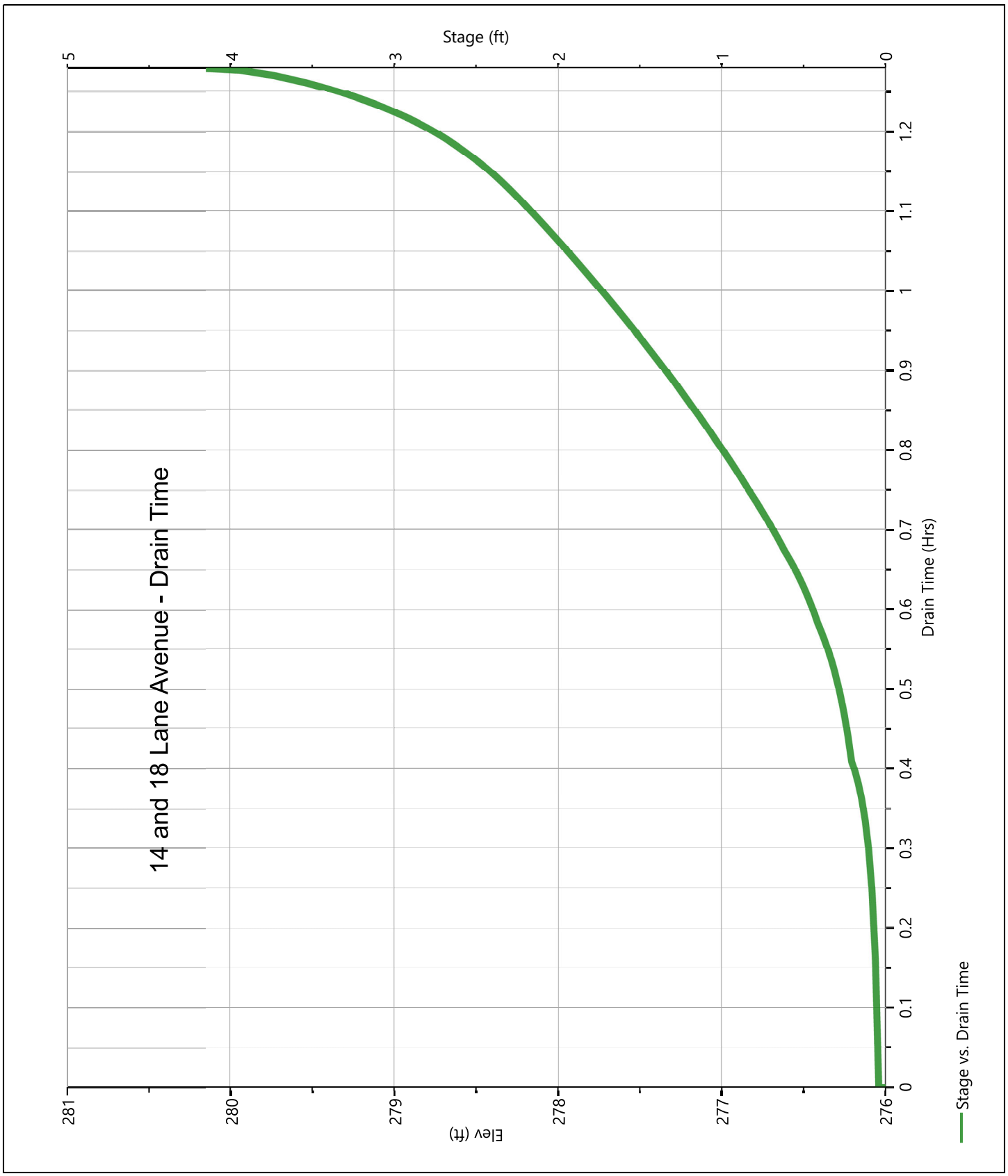
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	276.00	0.000		0.000	0.000									0.000
0.21	276.21	59.3		0.144	0.000									0.144
0.41	276.41	231		0.501	0.000									0.501
0.62	276.62	461		0.911	0.000									0.911
0.83	276.83	733		1.184	0.000									1.184
1.04	277.04	1,036		1.410	0.000									1.410
1.24	277.24	1,362		1.604	0.000									1.604
1.45	277.45	1,704		1.777	0.000									1.777
1.66	277.66	2,060		1.935	0.000									1.935
1.87	277.87	2,423		2.081	0.000									2.081
2.07	278.07	2,791		2.217	0.000									2.217
2.28	278.28	3,159		2.346	0.076									2.421
2.49	278.49	3,523		2.467	0.466									2.933
2.70	278.70	3,878		2.583	1.104									3.688
2.90	278.90	4,221		2.694	1.877									4.572
3.11	279.11	4,546		2.801	2.588									5.388
3.32	279.32	4,848		2.904	3.091									5.995
3.53	279.53	5,120		3.003	3.539									6.541
3.73	279.73	5,350		3.099	3.935									7.034
3.94	279.94	5,521		3.192	4.296									7.487
4.15	280.15	5,581		3.282	4.628									7.910

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

14 and 18 Lane Avenue

Pond Drawdown



Hydrograph Report

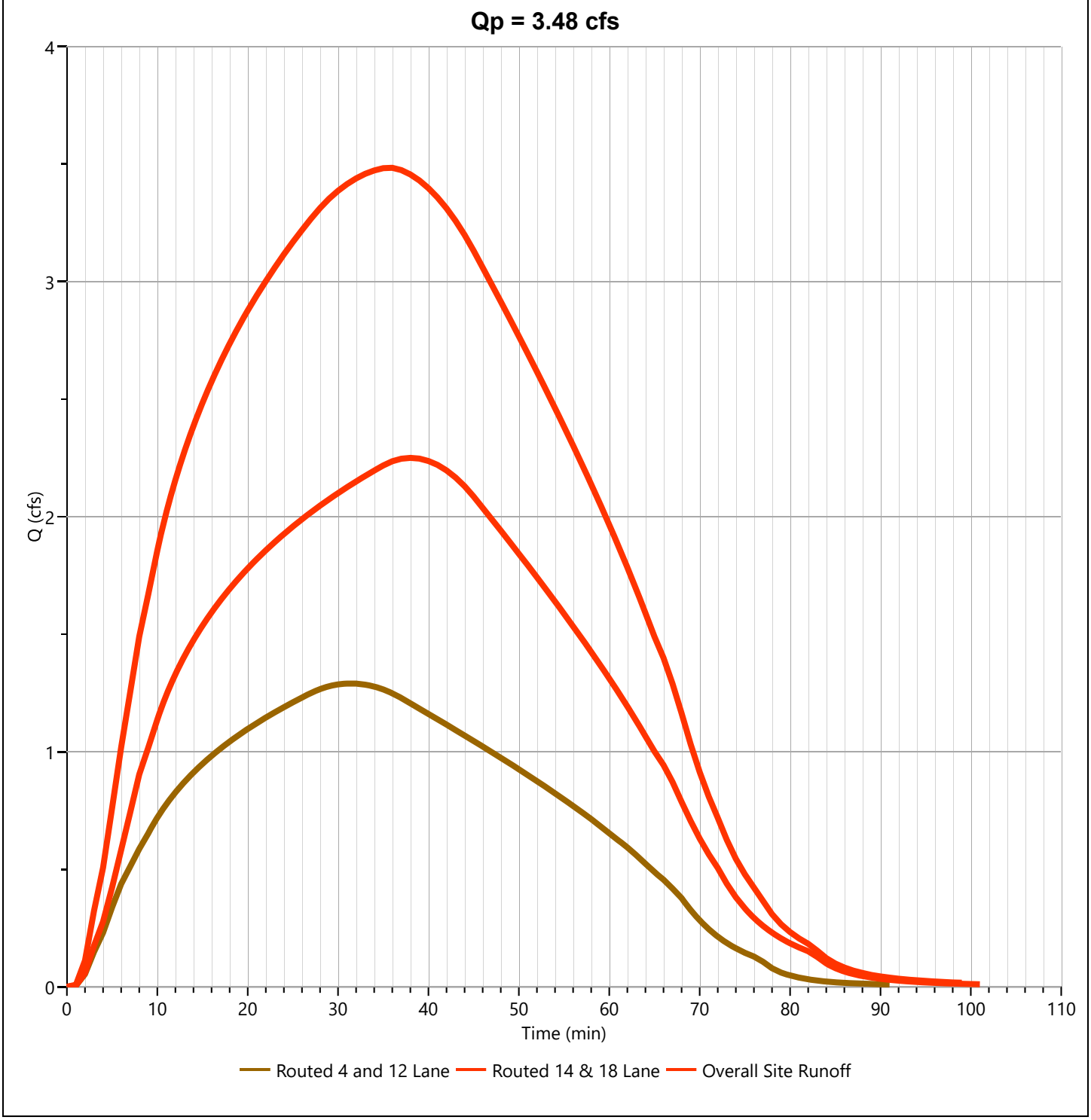
Hydrology Studio v 3.0.0.17

02-21-2021

Overall Site Runoff

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 3.484 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.60 hrs
Time Interval	= 1 min	Hydrograph Volume	= 10,506 cuft
Inflow Hydrographs	= 6, 10	Total Contrib. Area	= 0.0 ac



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

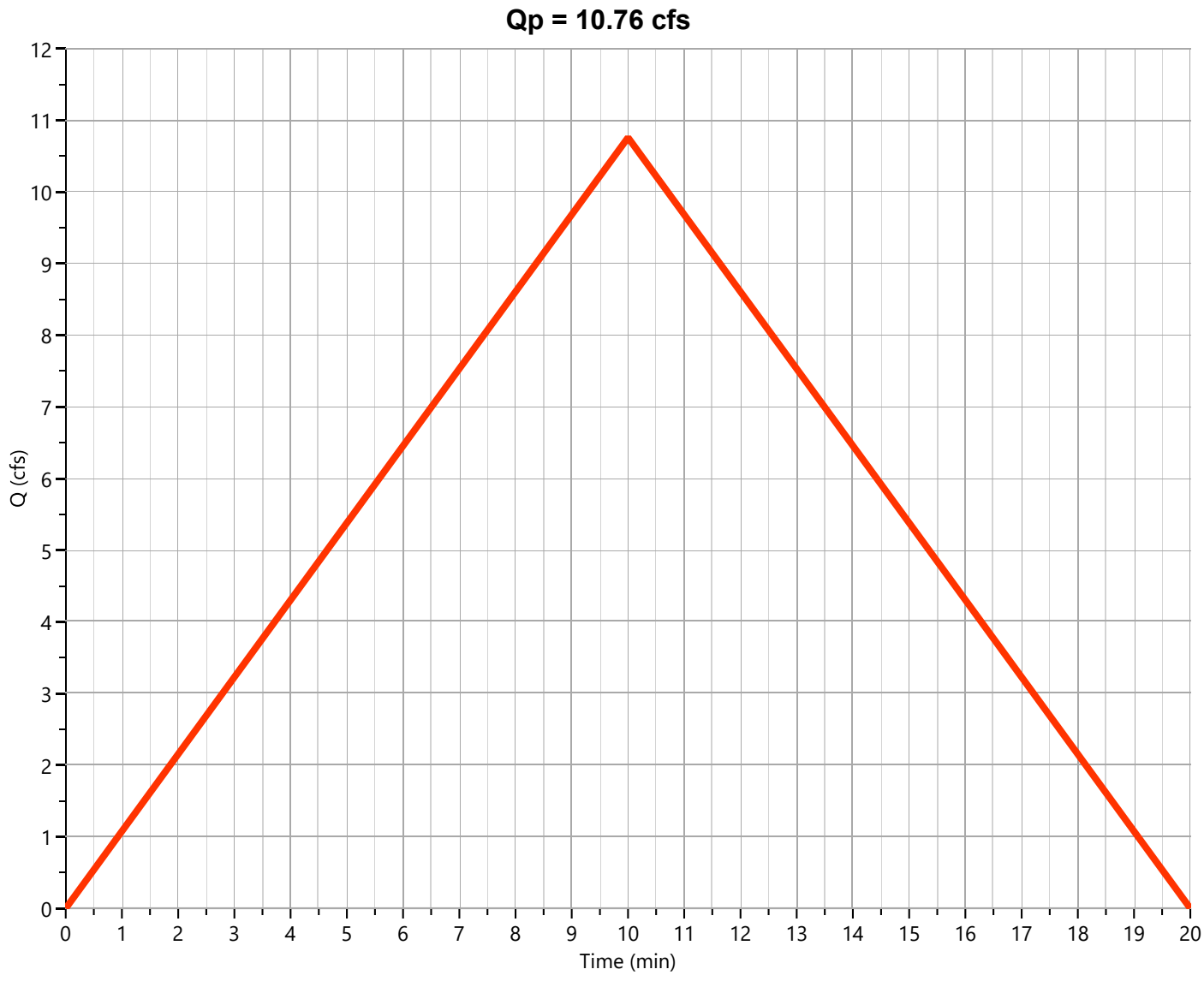
Pre Entire Site

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 10.76 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 6,456 cuft
Drainage Area	= 2.891 ac	Runoff Coeff.	= 0.67*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.945	0.99	Pavement
1.946	0.51	Grass
2.891	**0.67**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

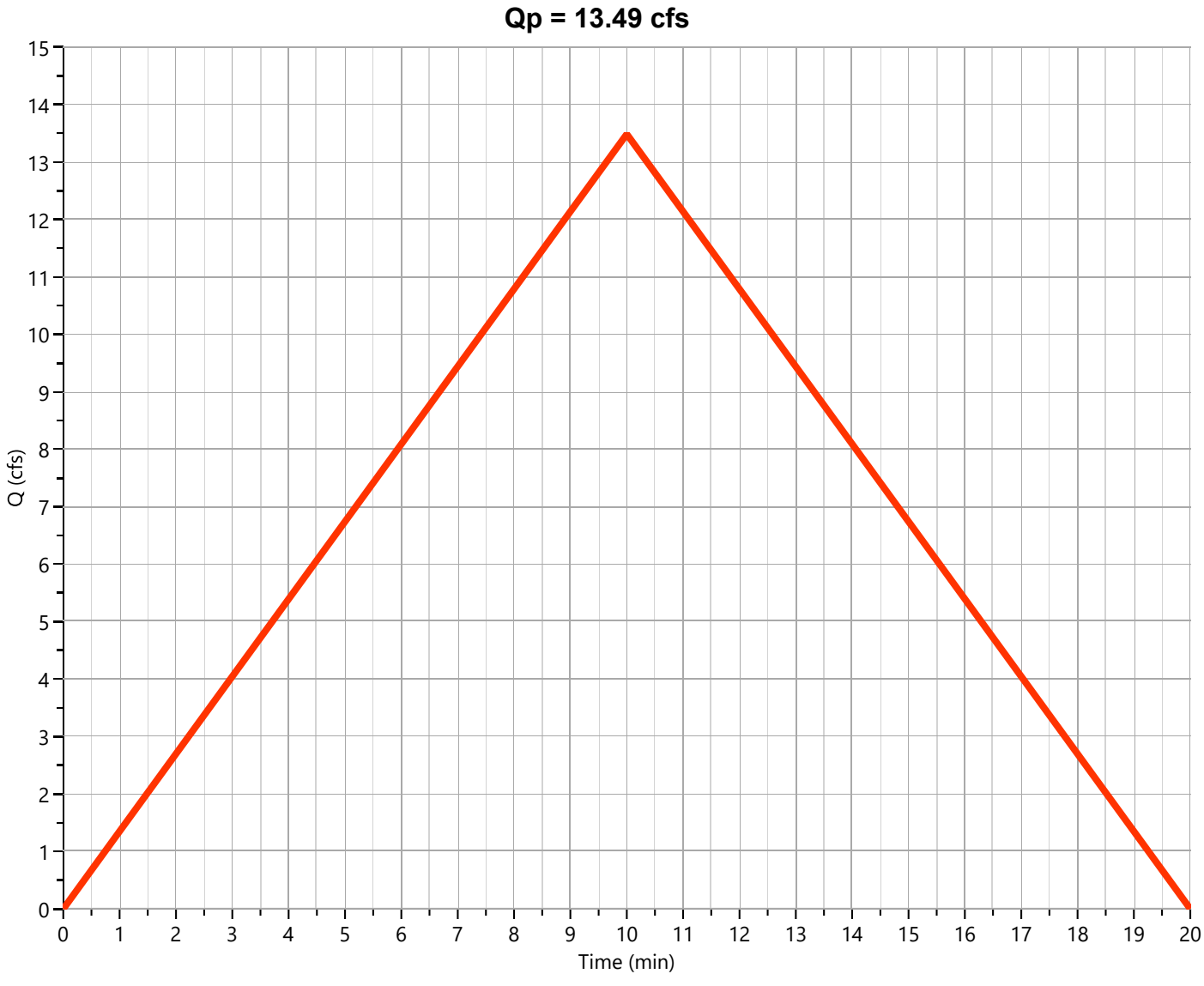
Post Entire Site

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 13.49 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 8,091 cuft
Drainage Area	= 2.89 ac	Runoff Coeff.	= 0.84*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.989	0.99	Pavement
0.902	0.51	Grass
2.89	**0.84**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

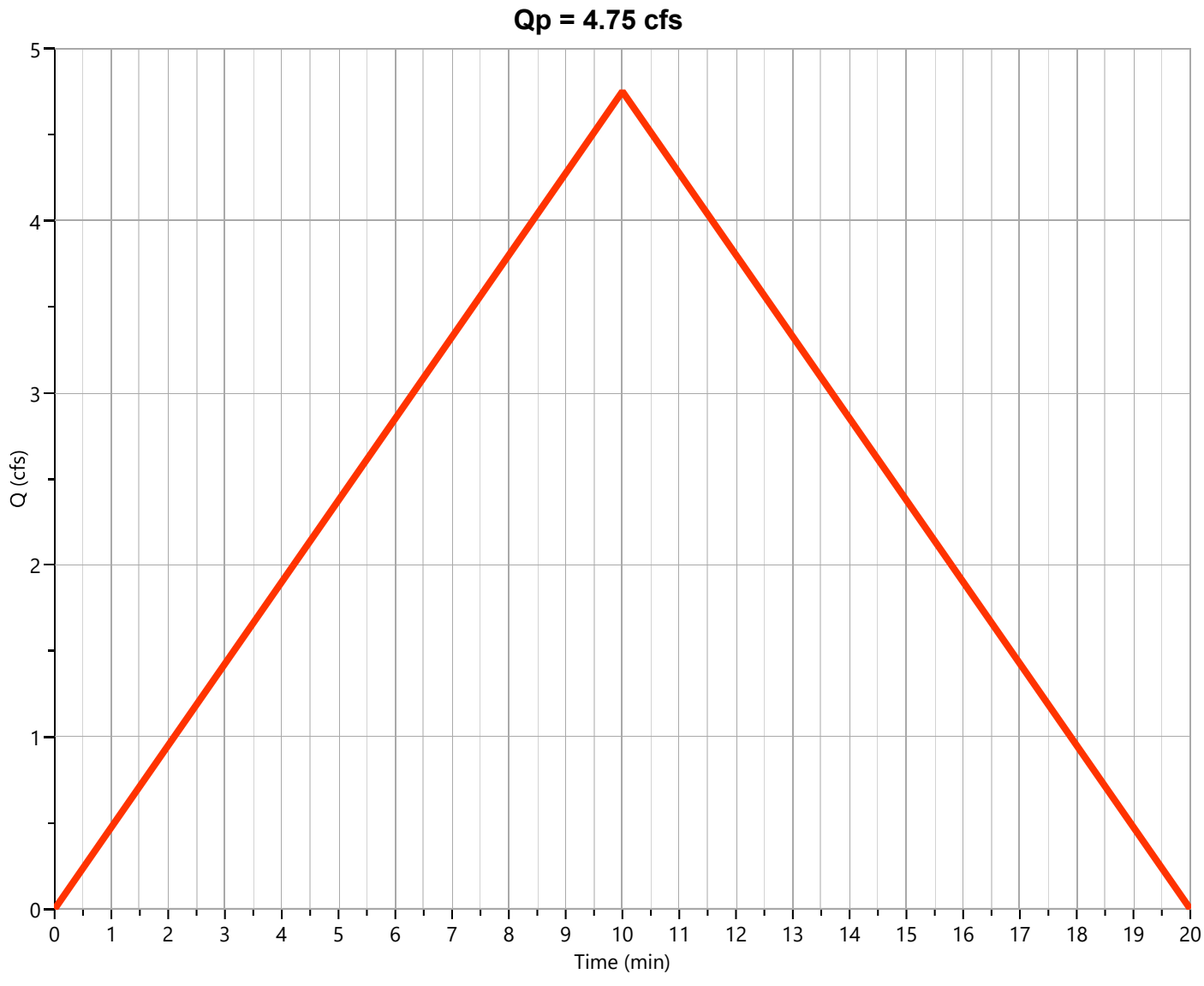
Pre 4 and 12 Lane

Hyd. No. 3

Hydrograph Type	= Rational	Peak Flow	= 4.752 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 2,851 cuft
Drainage Area	= 1.056 ac	Runoff Coeff.	= 0.81*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.656	0.99	Pavement
0.4	0.51	Grass
1.056	**0.81**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

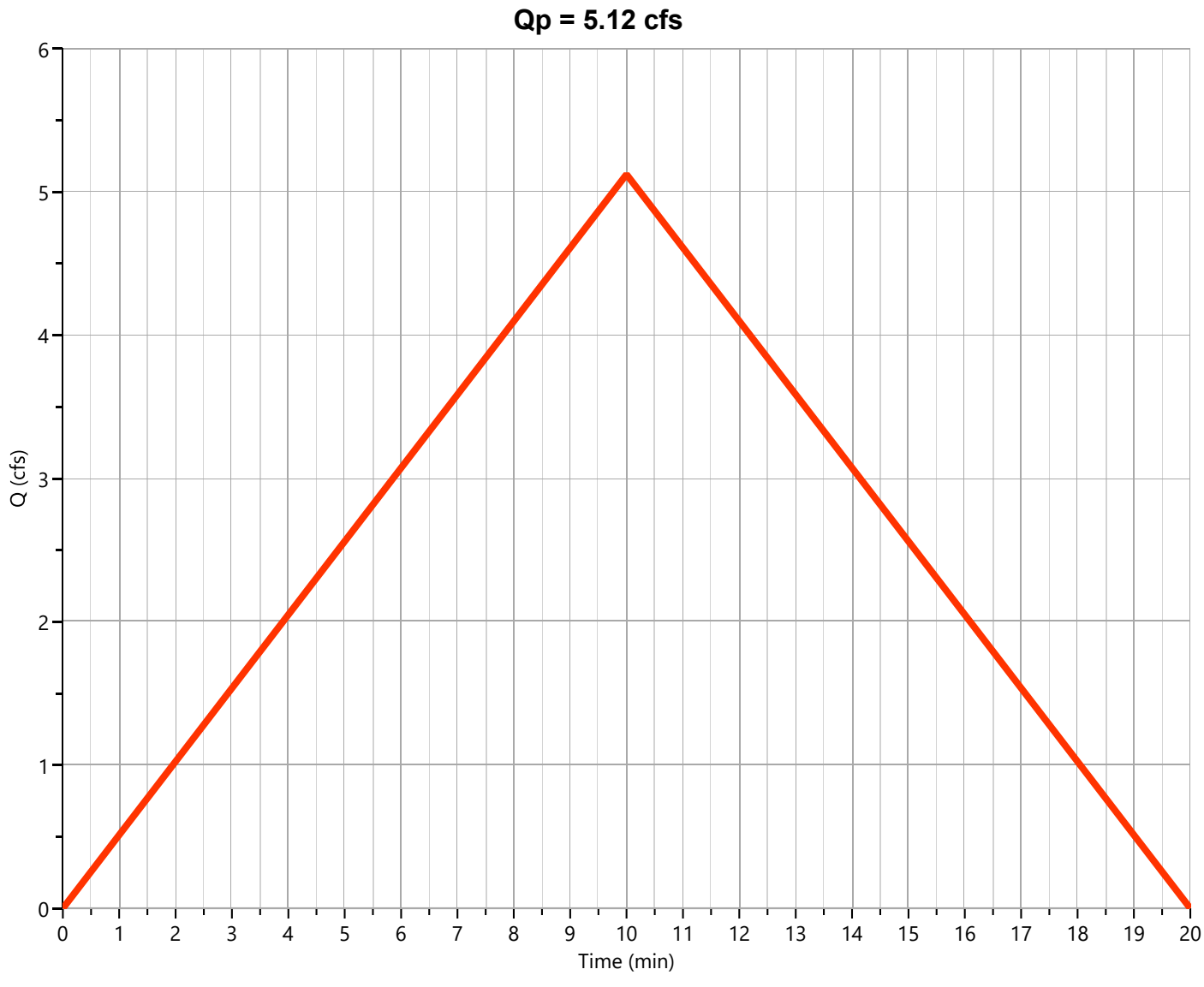
Post 4 and 12 Lane

Hyd. No. 4

Hydrograph Type	= Rational	Peak Flow	= 5.123 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,074 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

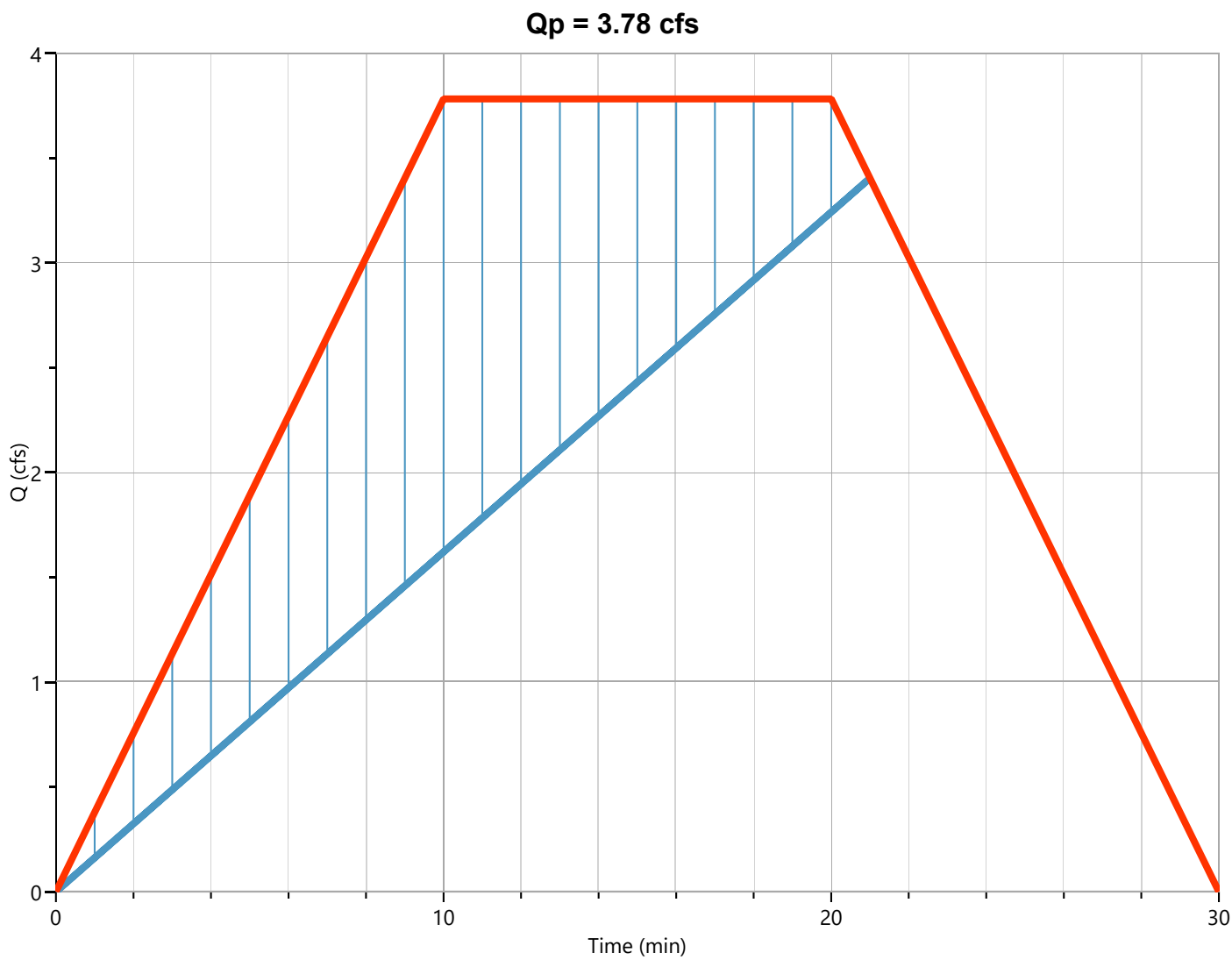
Post 4 and 12 Lane MR

Hyd. No. 5

Hydrograph Type	= Mod Rational	Peak Flow	= 3.783 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 4,539 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.10 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2 x Tc
Target Q	= 3.560 cfs	Required Storage	= 1,335 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

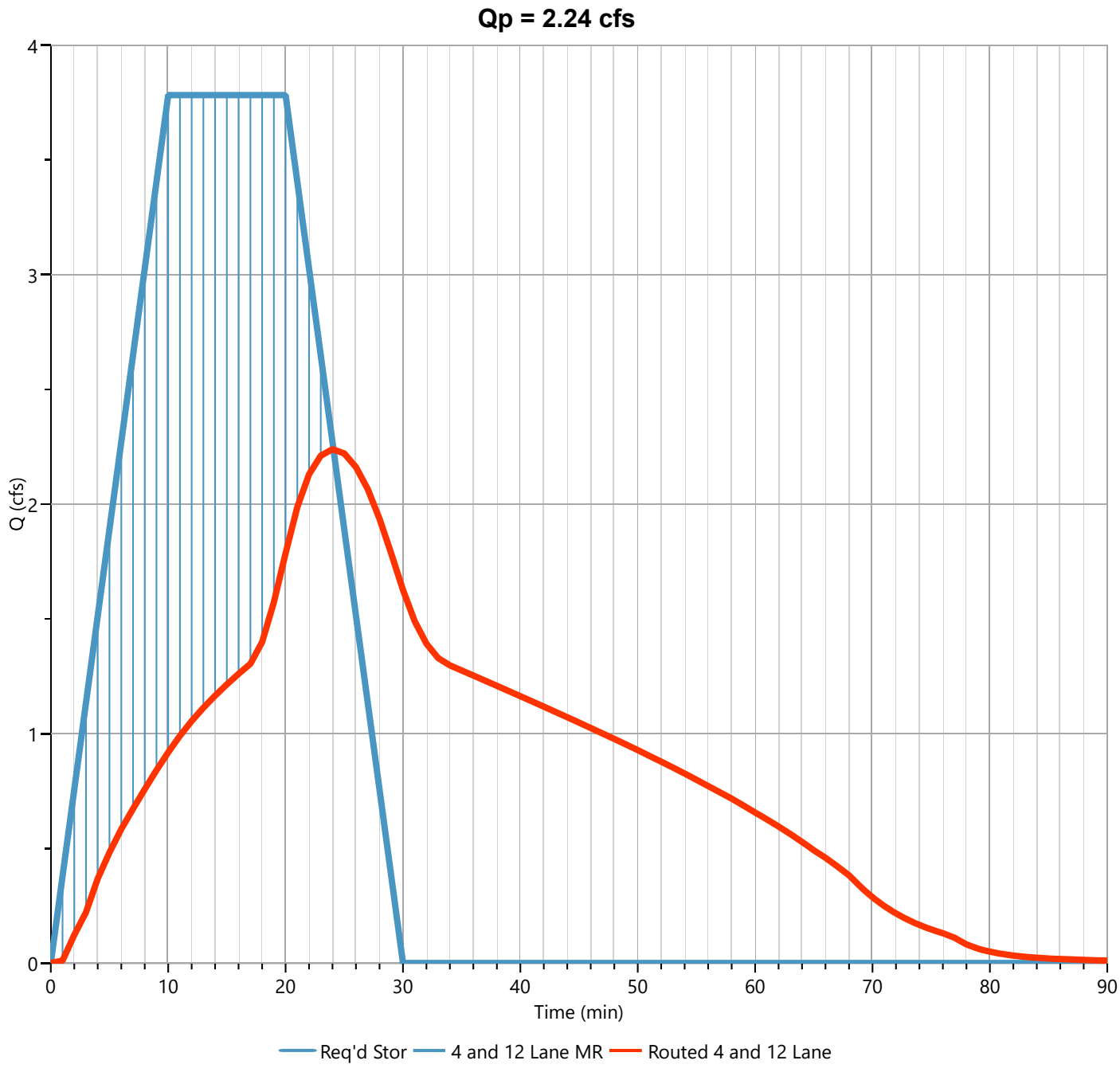
Routed 4 and 12 Lane

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 2.239 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 4,537 cuft
Inflow Hydrograph	= 5 - 4 and 12 Lane MR	Max. Elevation	= 280.69 ft
Pond Name	= 4 and 12 Lane Avenue	Max. Storage	= 2,614 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 19 min



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

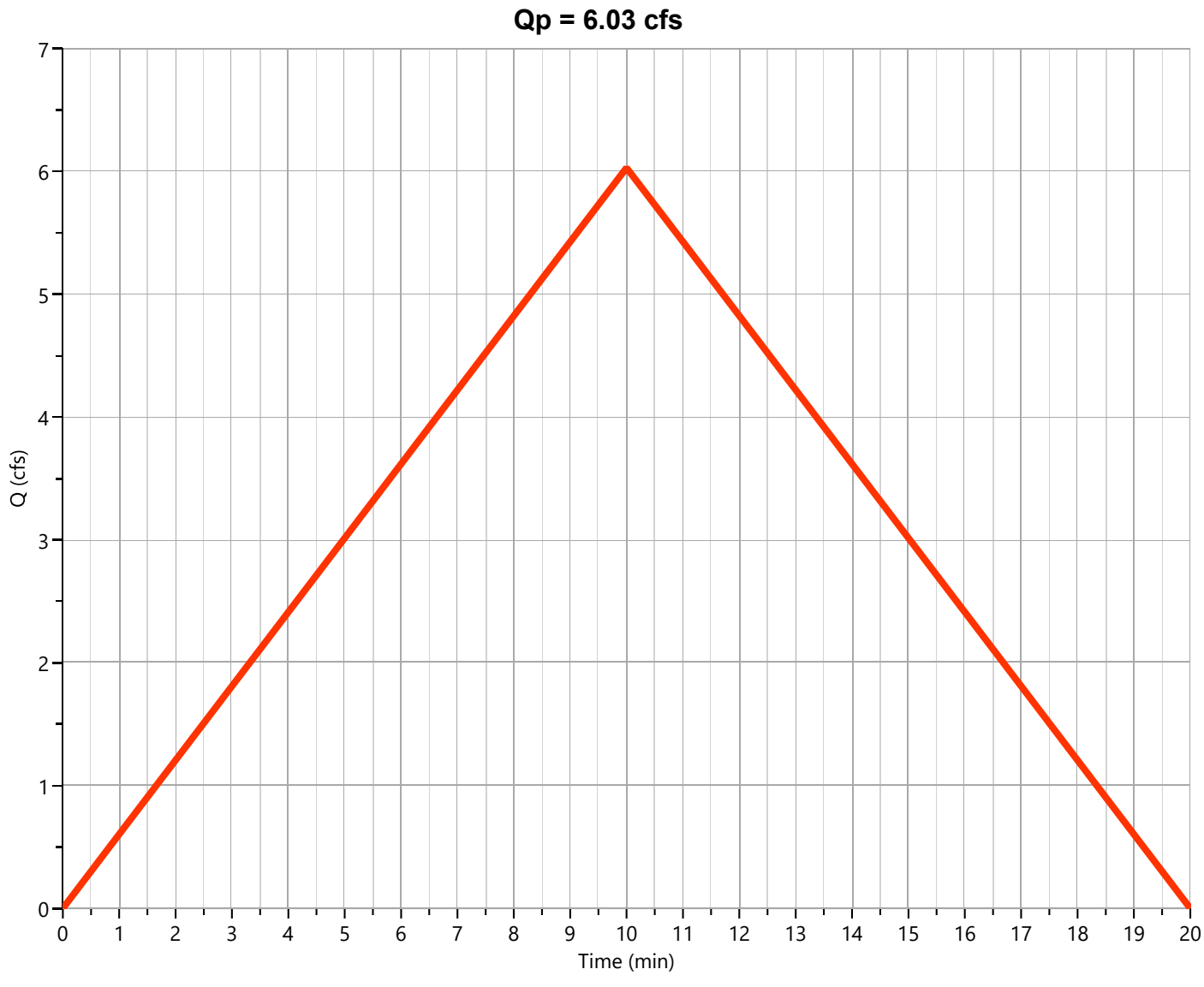
Pre 14 and 18 Lane

Hyd. No. 7

Hydrograph Type	= Rational	Peak Flow	= 6.031 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,618 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.59*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.289	0.99	Pavement
1.551	0.51	Grass
1.84	**0.59**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

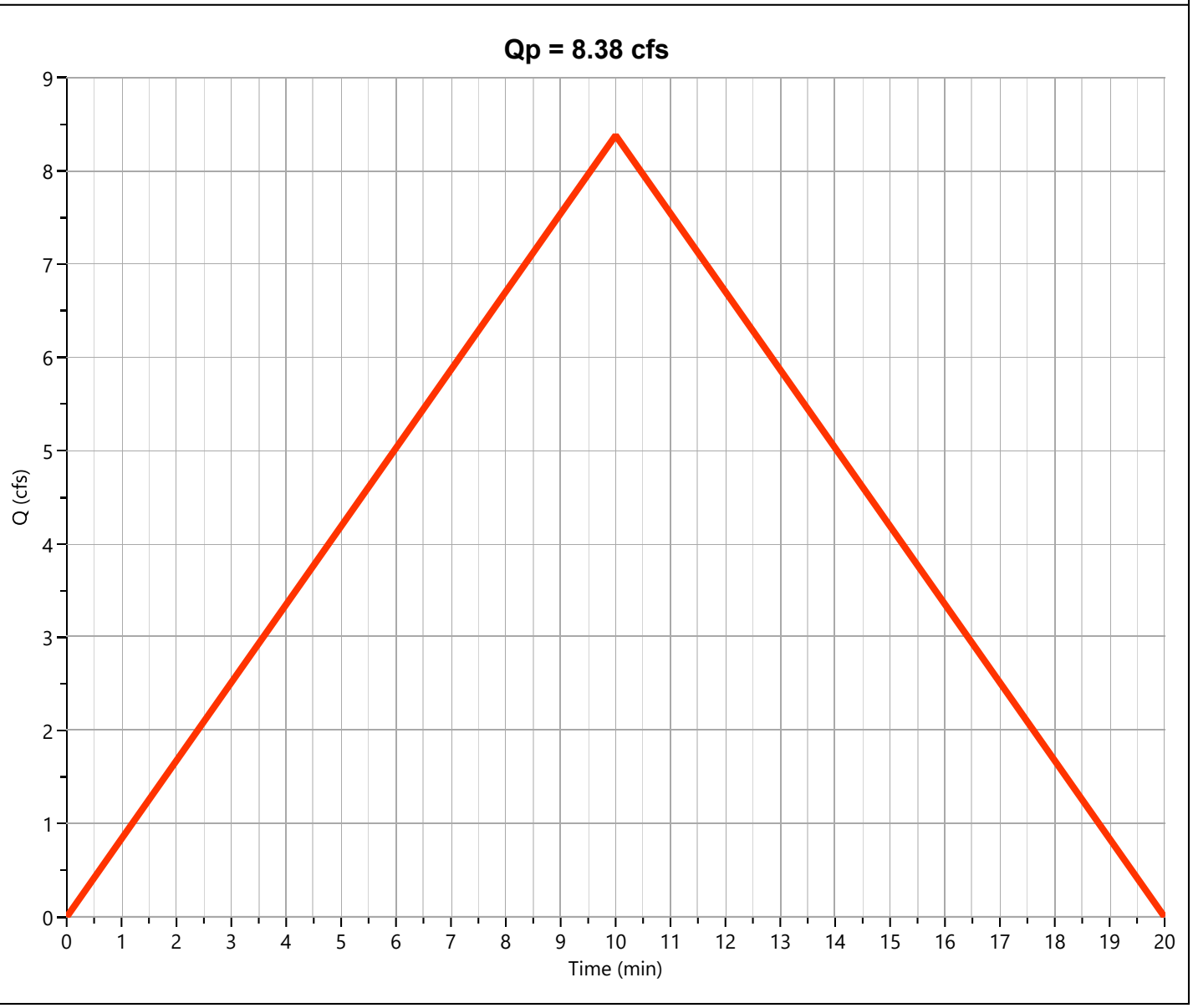
Post 14 and 18 Lane

Hyd. No. 8

Hydrograph Type	= Rational	Peak Flow	= 8.381 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 5,029 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.56 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

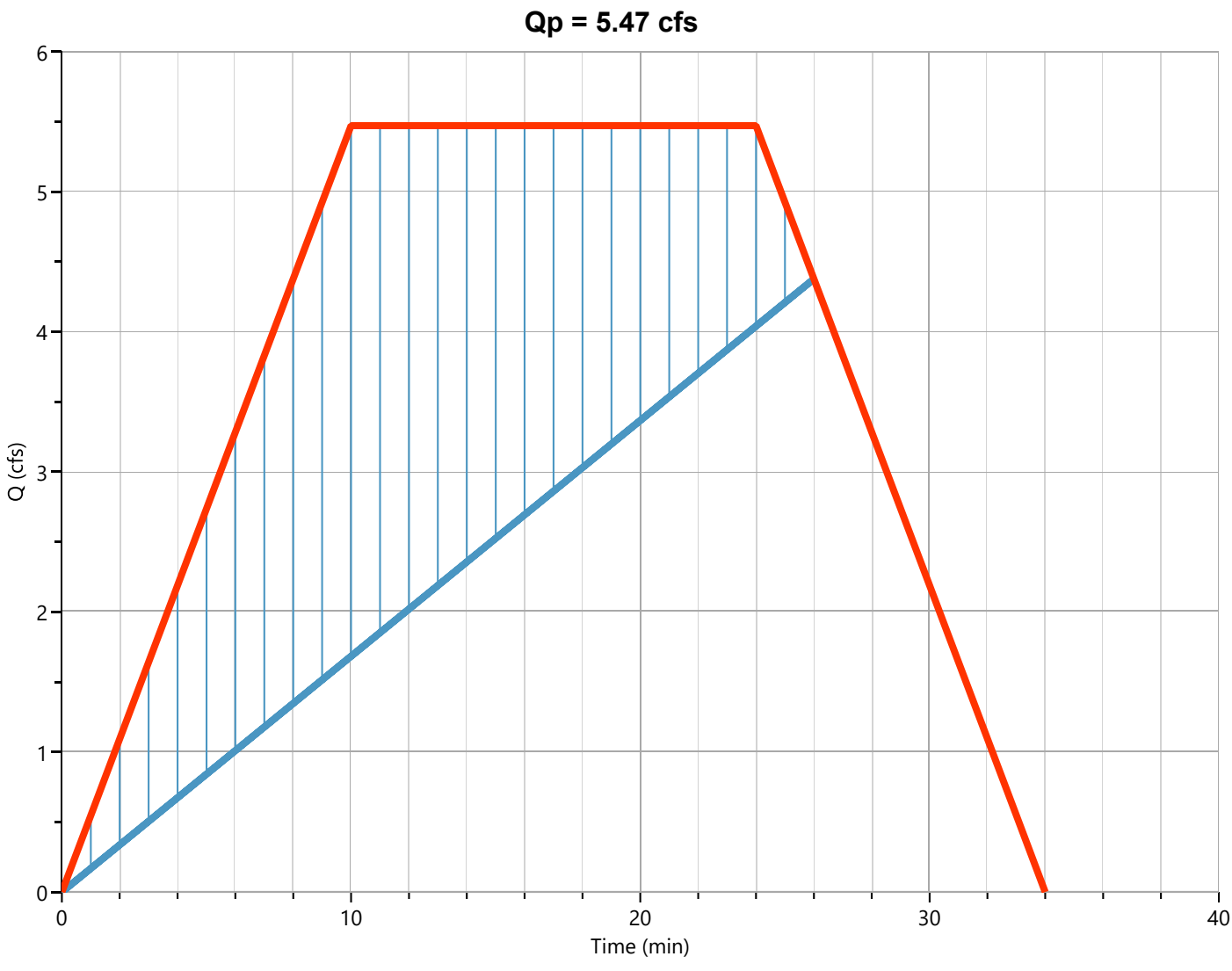
Post 14 and 18 Lane MR

Hyd. No. 9

Hydrograph Type	= Mod Rational	Peak Flow	= 5.472 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 8,208 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 3.63 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.5 x Tc
Target Q	= 4.520 cfs	Required Storage	= 3,598 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

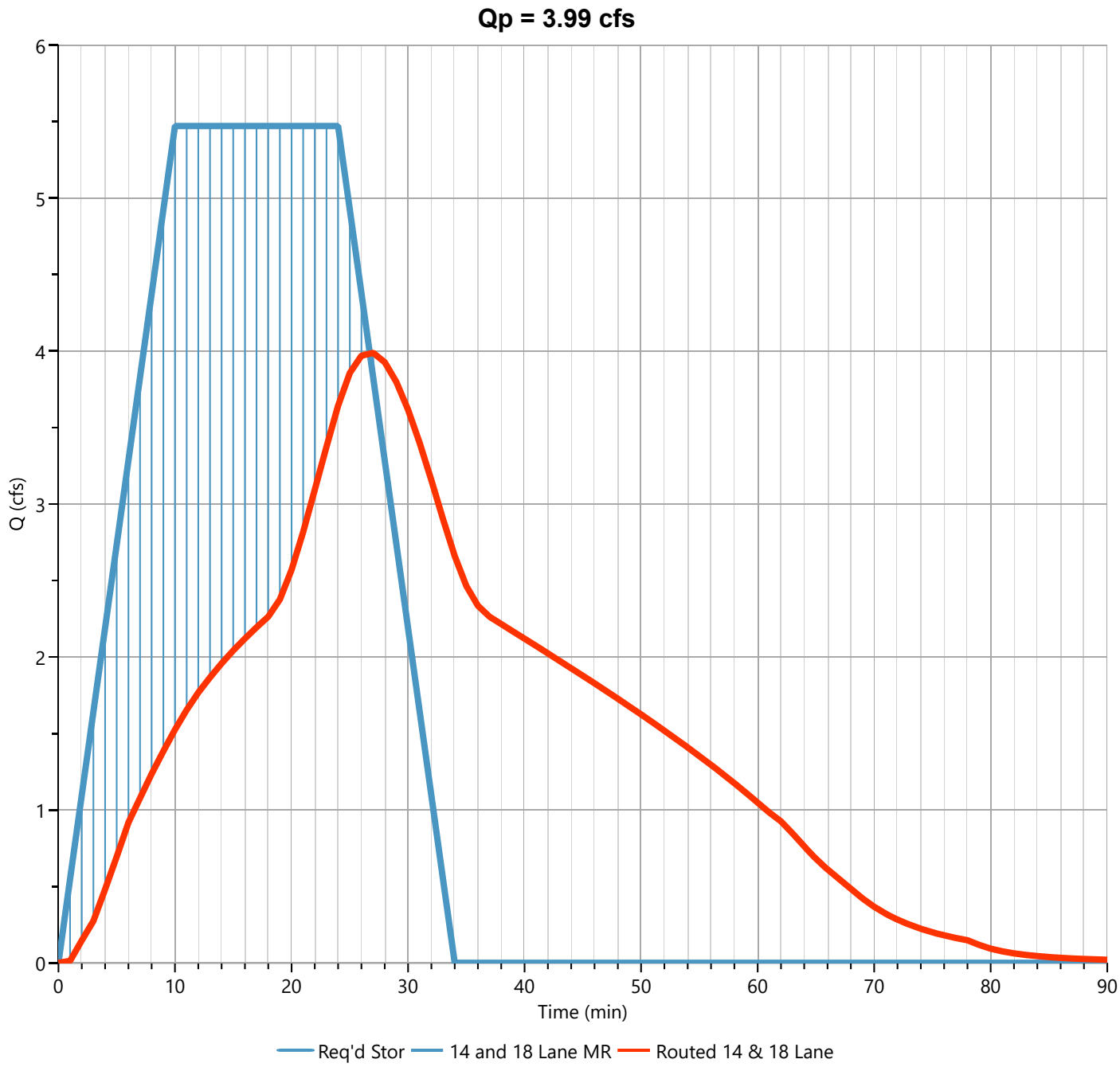
Routed 14 & 18 Lane

Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 3.989 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.45 hrs
Time Interval	= 1 min	Hydrograph Volume	= 7,876 cuft
Inflow Hydrograph	= 9 - 14 and 18 Lane MR	Max. Elevation	= 278.77 ft
Pond Name	= 14 and 18 Lane Avenue	Max. Storage	= 3,997 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 16 min



Hydrograph Report

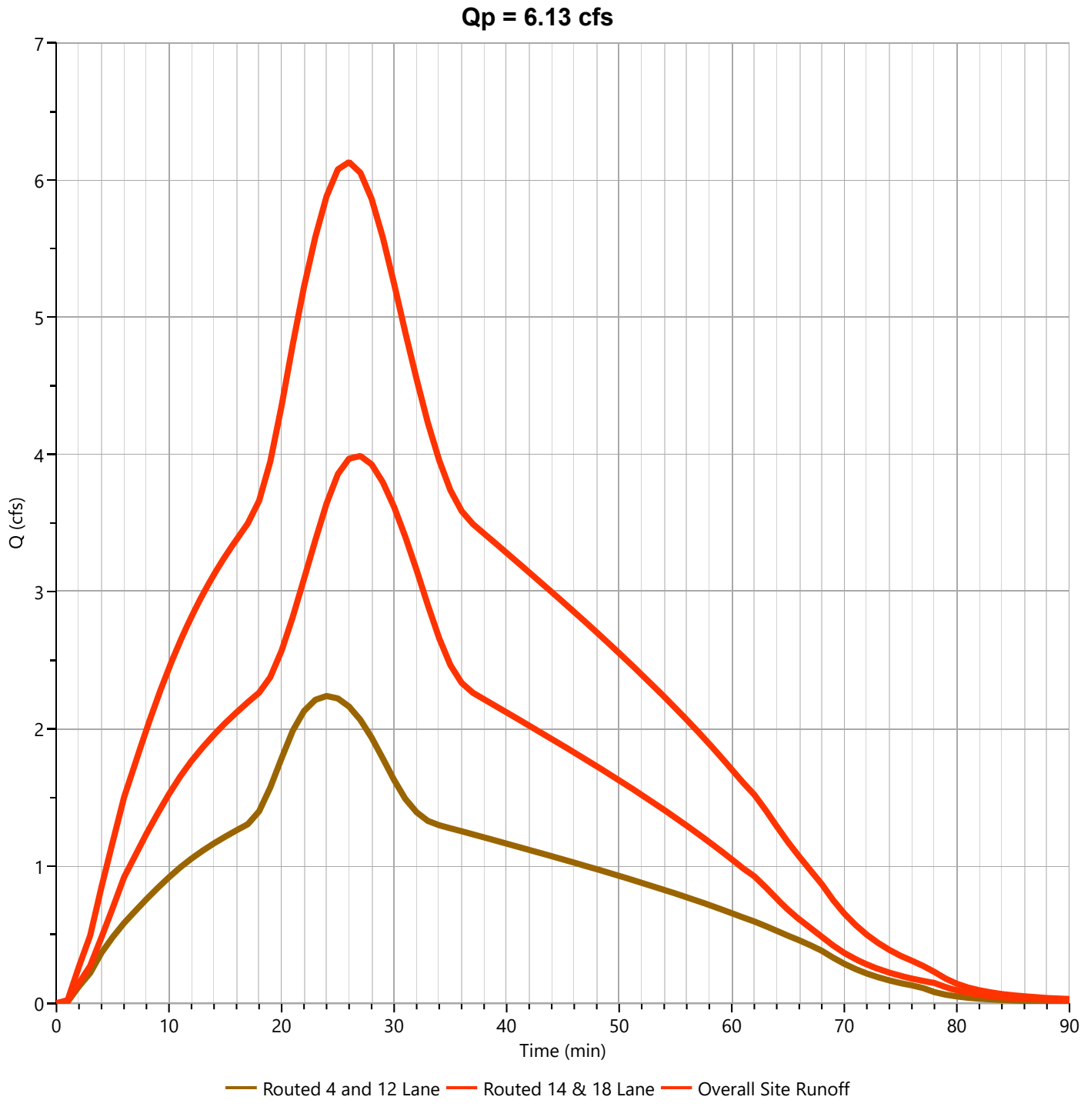
Hydrology Studio v 3.0.0.17

02-21-2021

Overall Site Runoff

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 6.132 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.43 hrs
Time Interval	= 1 min	Hydrograph Volume	= 12,413 cuft
Inflow Hydrographs	= 6, 10	Total Contrib. Area	= 0.0 ac



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

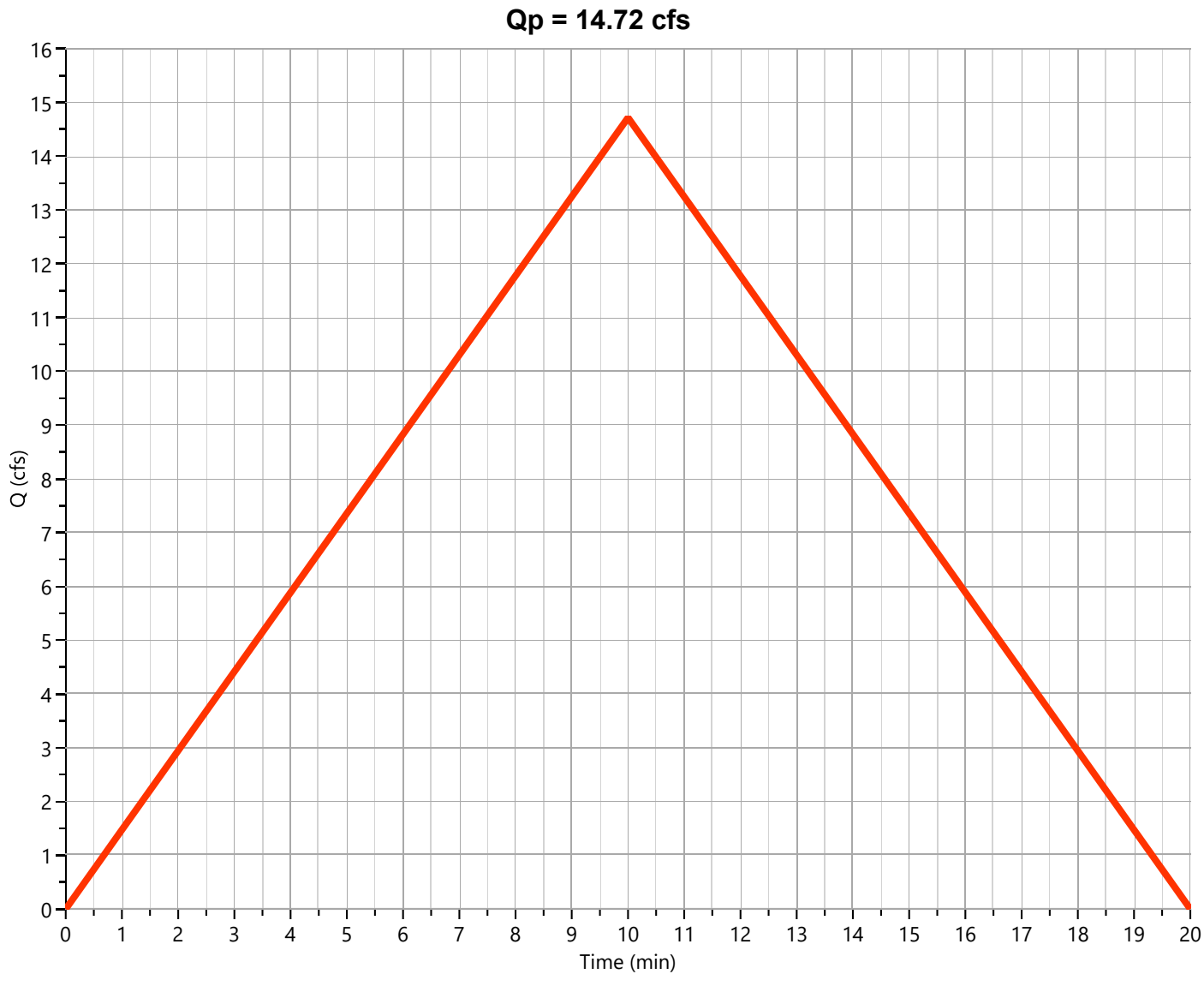
Pre Entire Site

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 14.72 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 8,831 cuft
Drainage Area	= 2.891 ac	Runoff Coeff.	= 0.67*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.945	0.99	Pavement
1.946	0.51	Grass
2.891	**0.67**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

Post Entire Site

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 18.45 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 11,068 cuft
Drainage Area	= 2.89 ac	Runoff Coeff.	= 0.84*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.989	0.99	Pavement
0.902	0.51	Grass
2.89	**0.84**	

Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

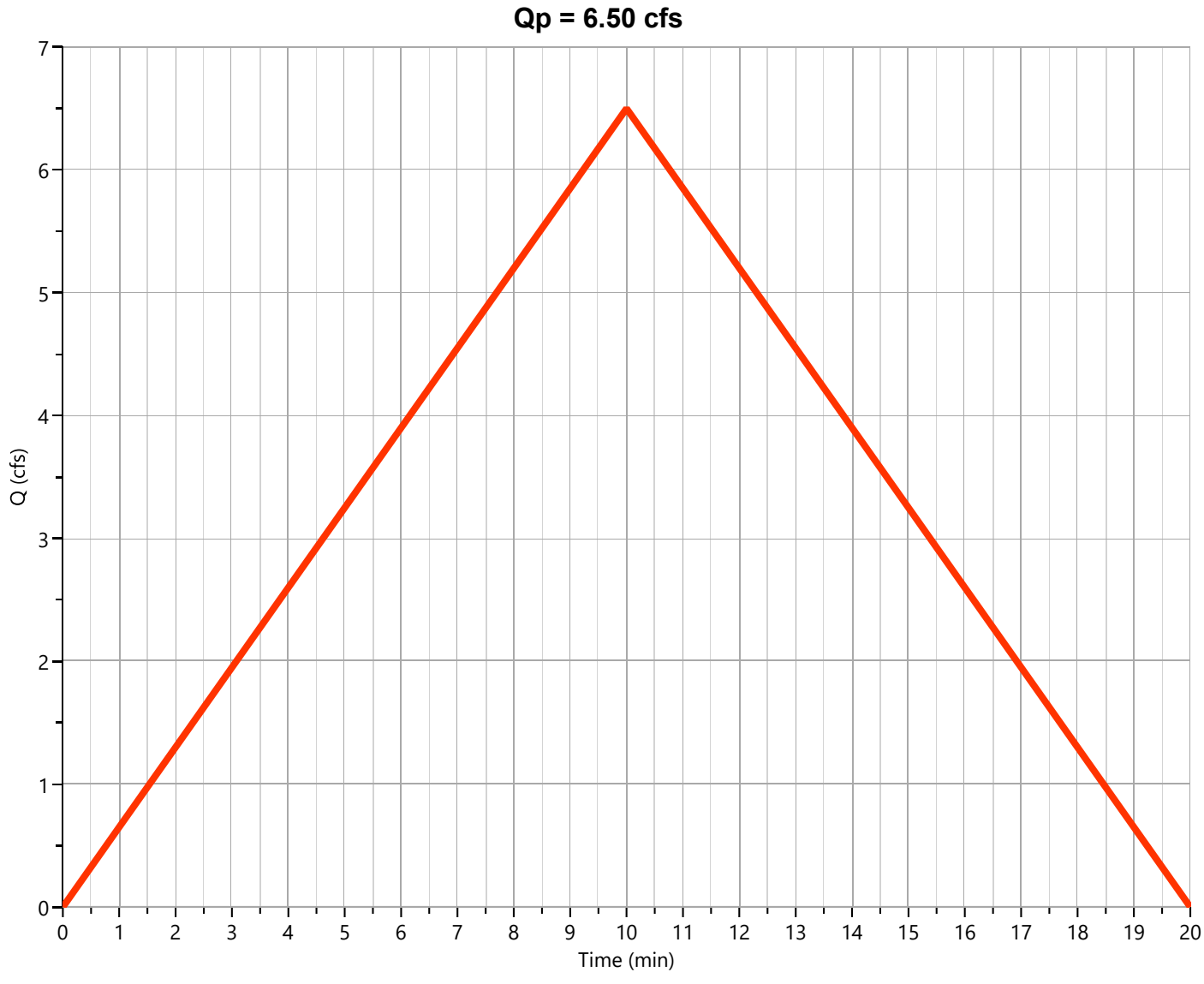
Pre 4 and 12 Lane

Hyd. No. 3

Hydrograph Type	= Rational	Peak Flow	= 6.500 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,900 cuft
Drainage Area	= 1.056 ac	Runoff Coeff.	= 0.81*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.656	0.99	Pavement
0.4	0.51	Grass
1.056	**0.81**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

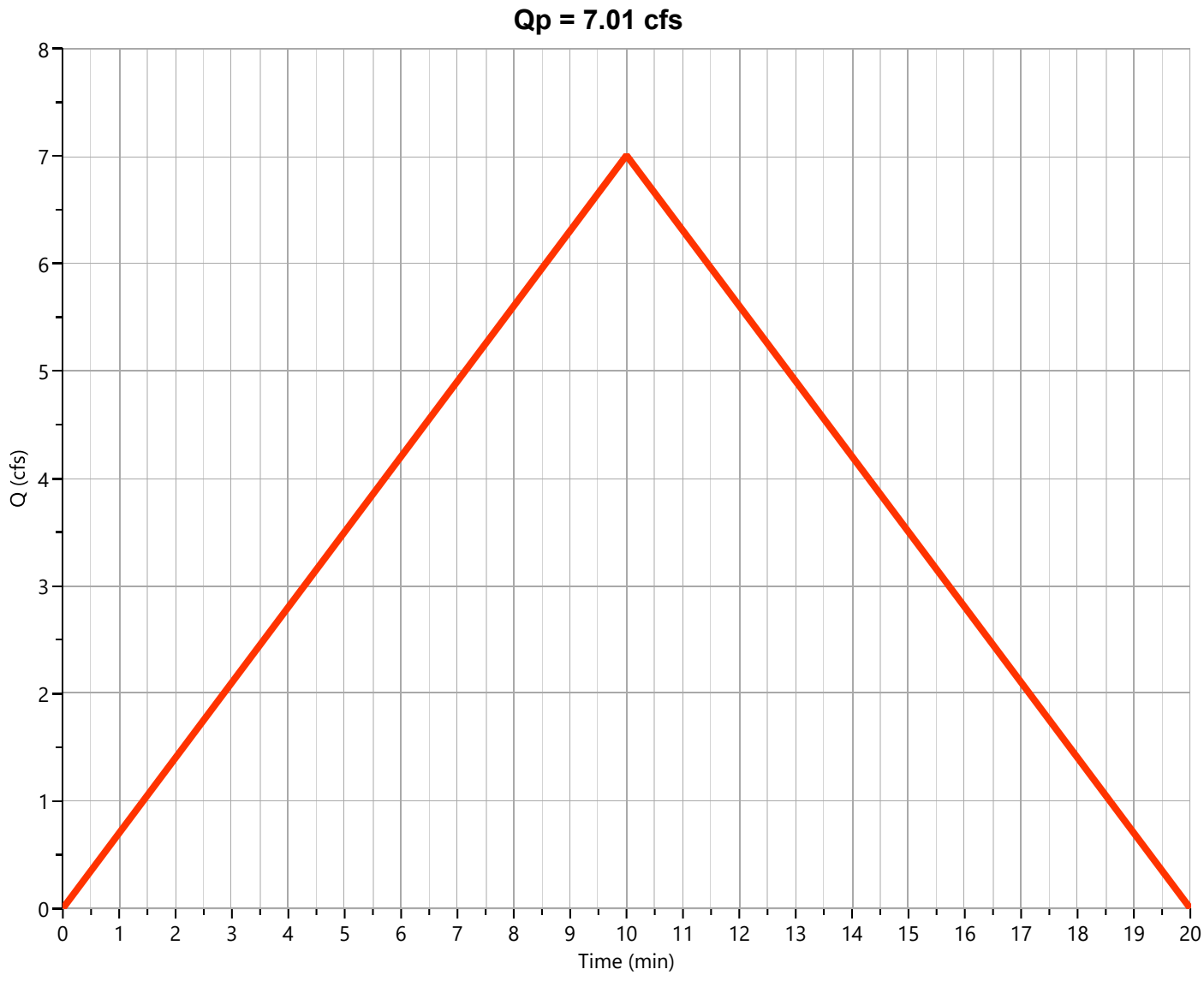
Post 4 and 12 Lane

Hyd. No. 4

Hydrograph Type	= Rational	Peak Flow	= 7.008 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 4,205 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

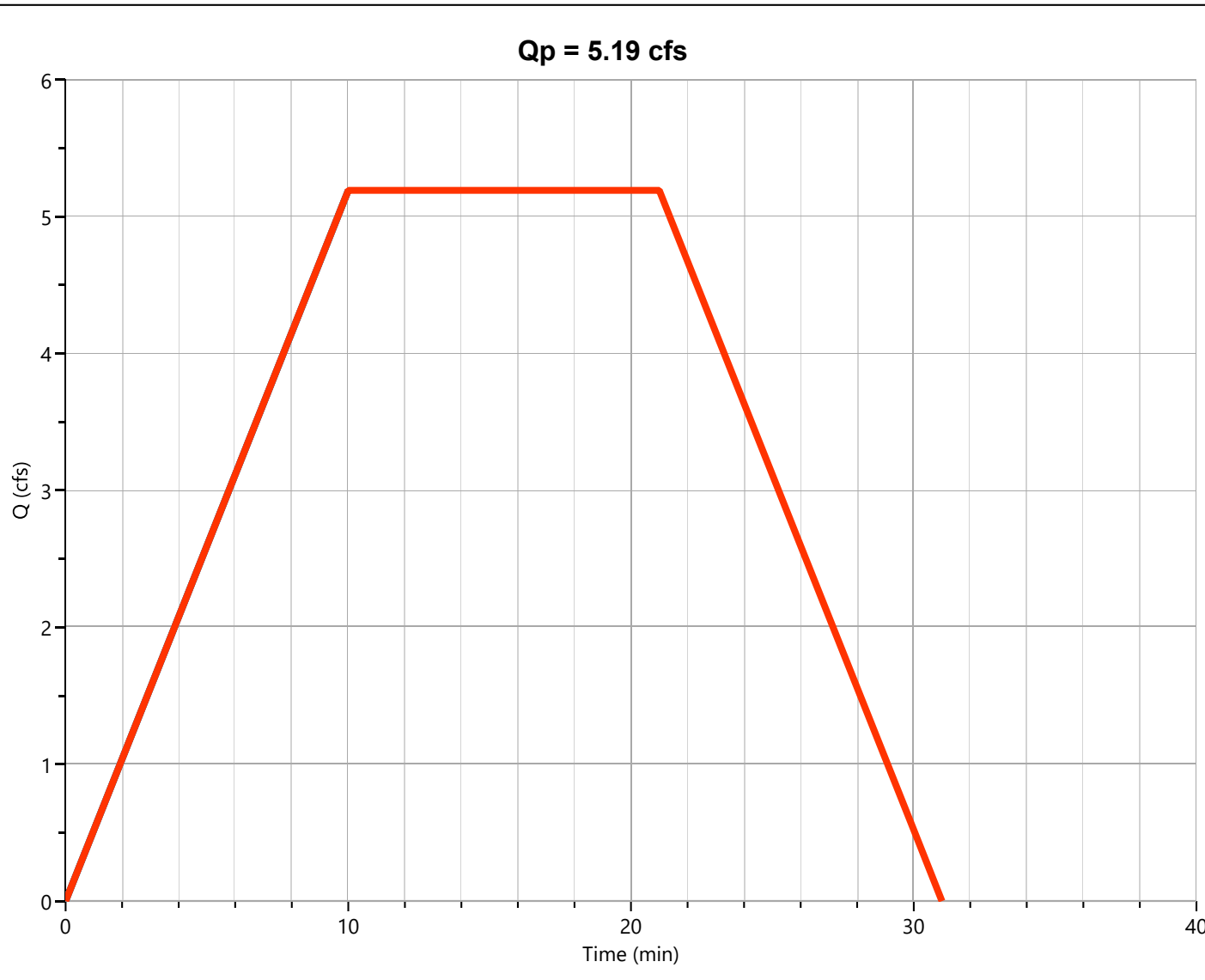
Post 4 and 12 Lane MR

Hyd. No. 5

Hydrograph Type	= Mod Rational	Peak Flow	= 5.192 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 6,542 cuft
Drainage Area	= 1.06 ac	Runoff Coeff.	= 0.87*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 5.63 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.1 x Tc
Target Q	= 5.200 cfs	Required Storage	= 1,706 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.786	0.99	Pavement
0.27	0.51	Grass
1.06	**0.87**	



Hydrograph Report

Hydrology Studio v 3.0.0.17

02-21-2021

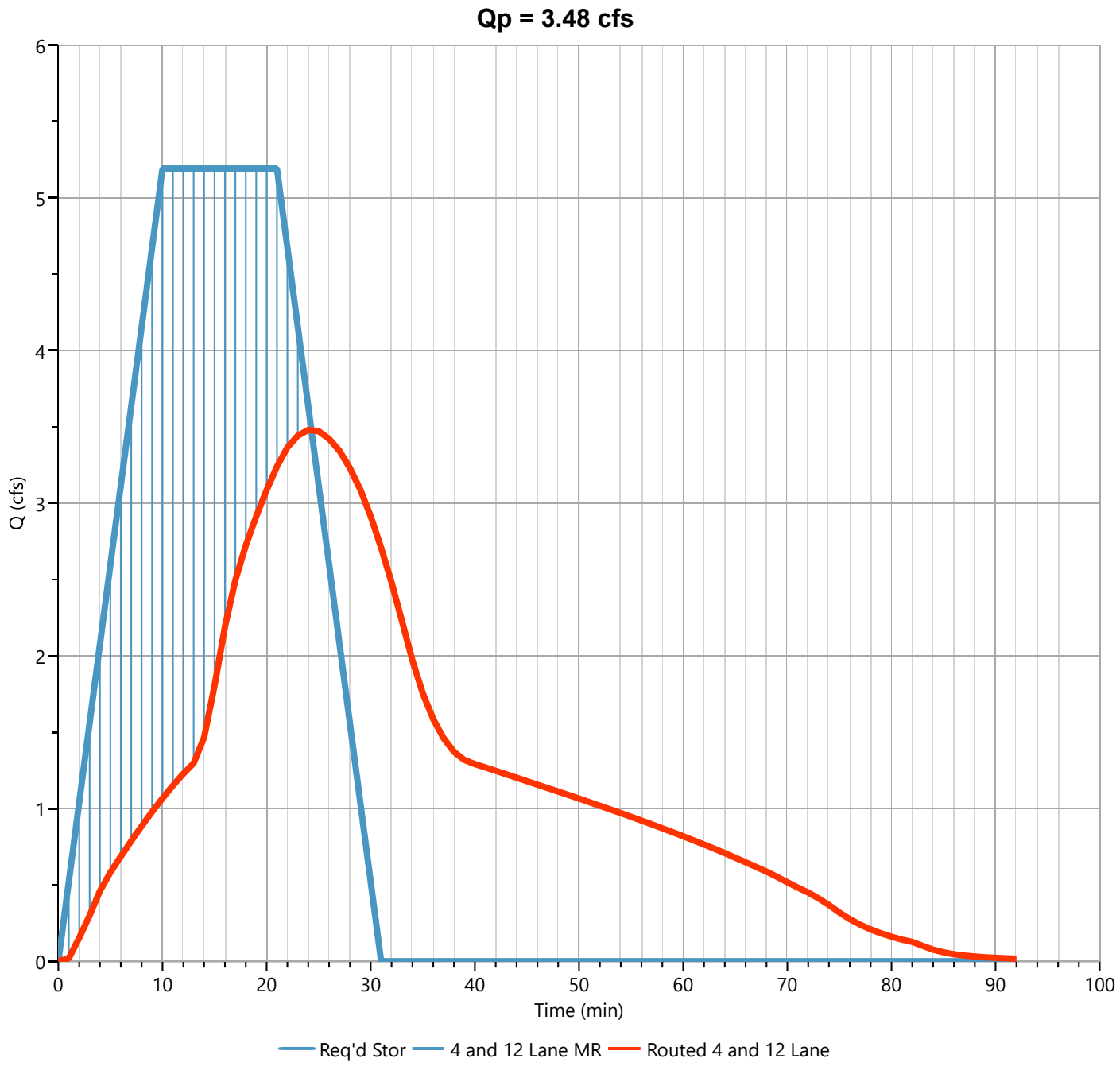
Routed 4 and 12 Lane

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 3.480 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 6,540 cuft
Inflow Hydrograph	= 5 - 4 and 12 Lane MR	Max. Elevation	= 281.58 ft
Pond Name	= 4 and 12 Lane Avenue	Max. Storage	= 3,496 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 18 min



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

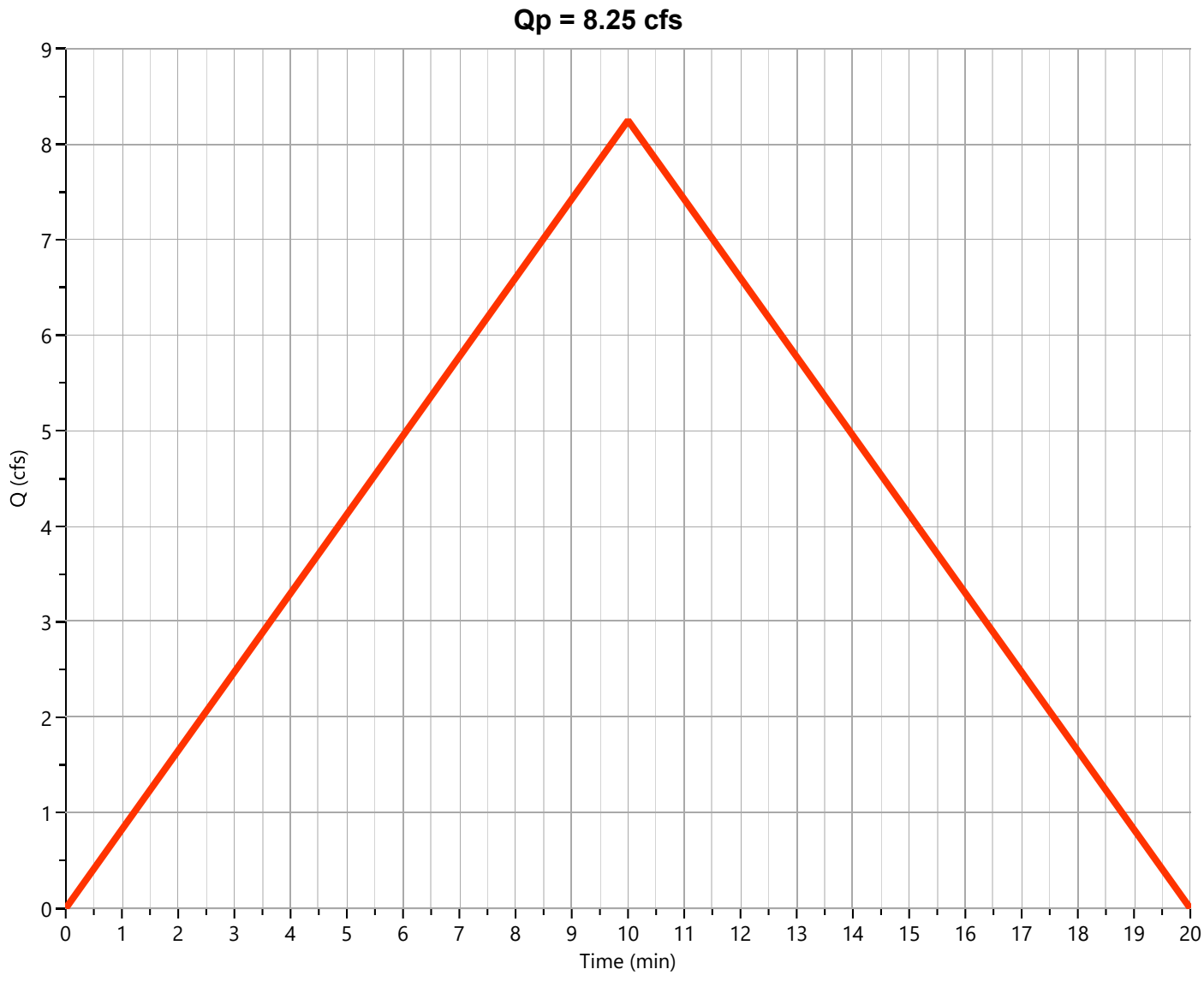
Pre 14 and 18 Lane

Hyd. No. 7

Hydrograph Type	= Rational	Peak Flow	= 8.249 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 4,950 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.59*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
0.289	0.99	Pavement
1.551	0.51	Grass
1.84	**0.59**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

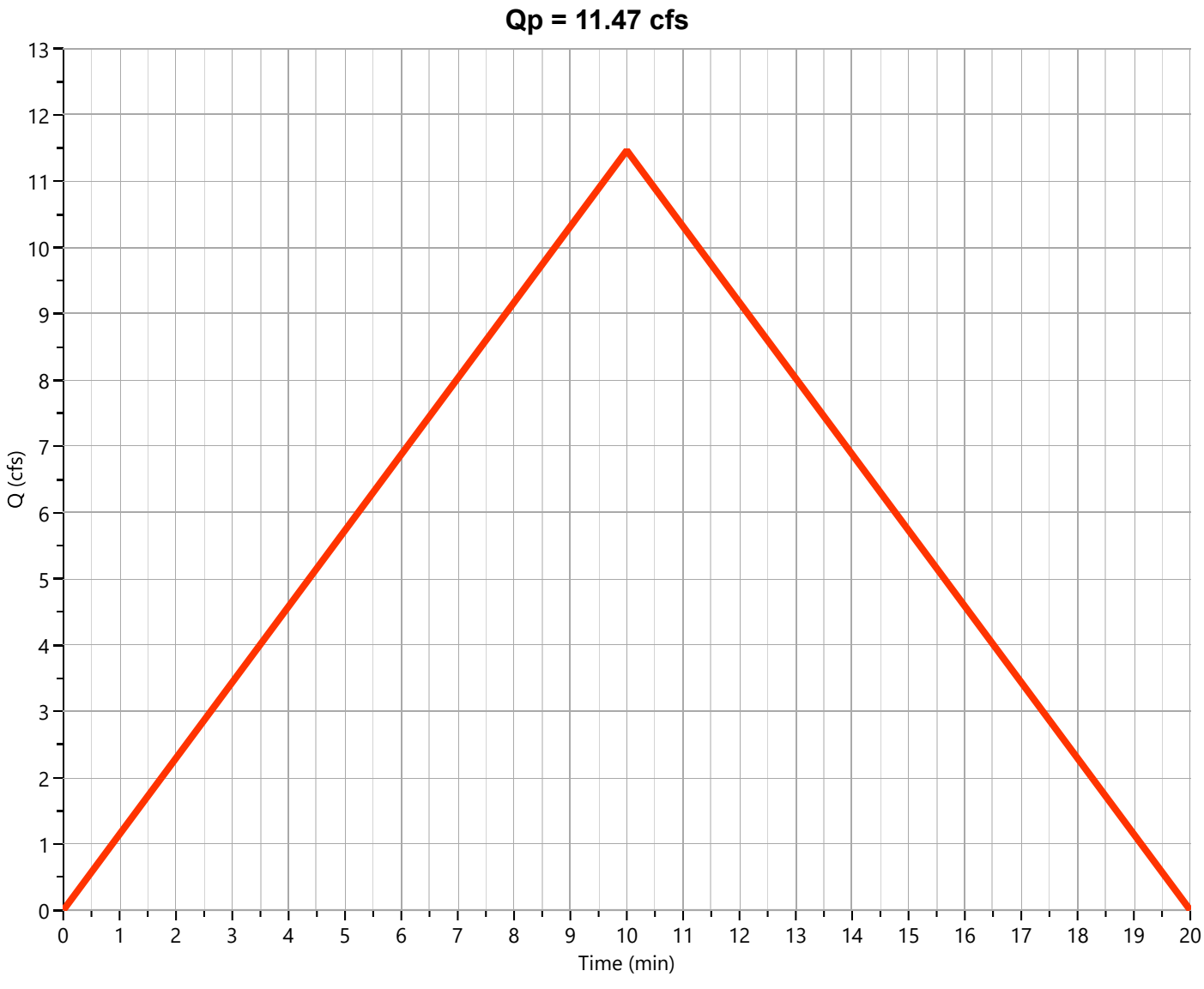
Post 14 and 18 Lane

Hyd. No. 8

Hydrograph Type	= Rational	Peak Flow	= 11.47 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 6,879 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 7.60 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Project Name: Caldwell Village

Hydrology Studio v 3.0.0.17

02-21-2021

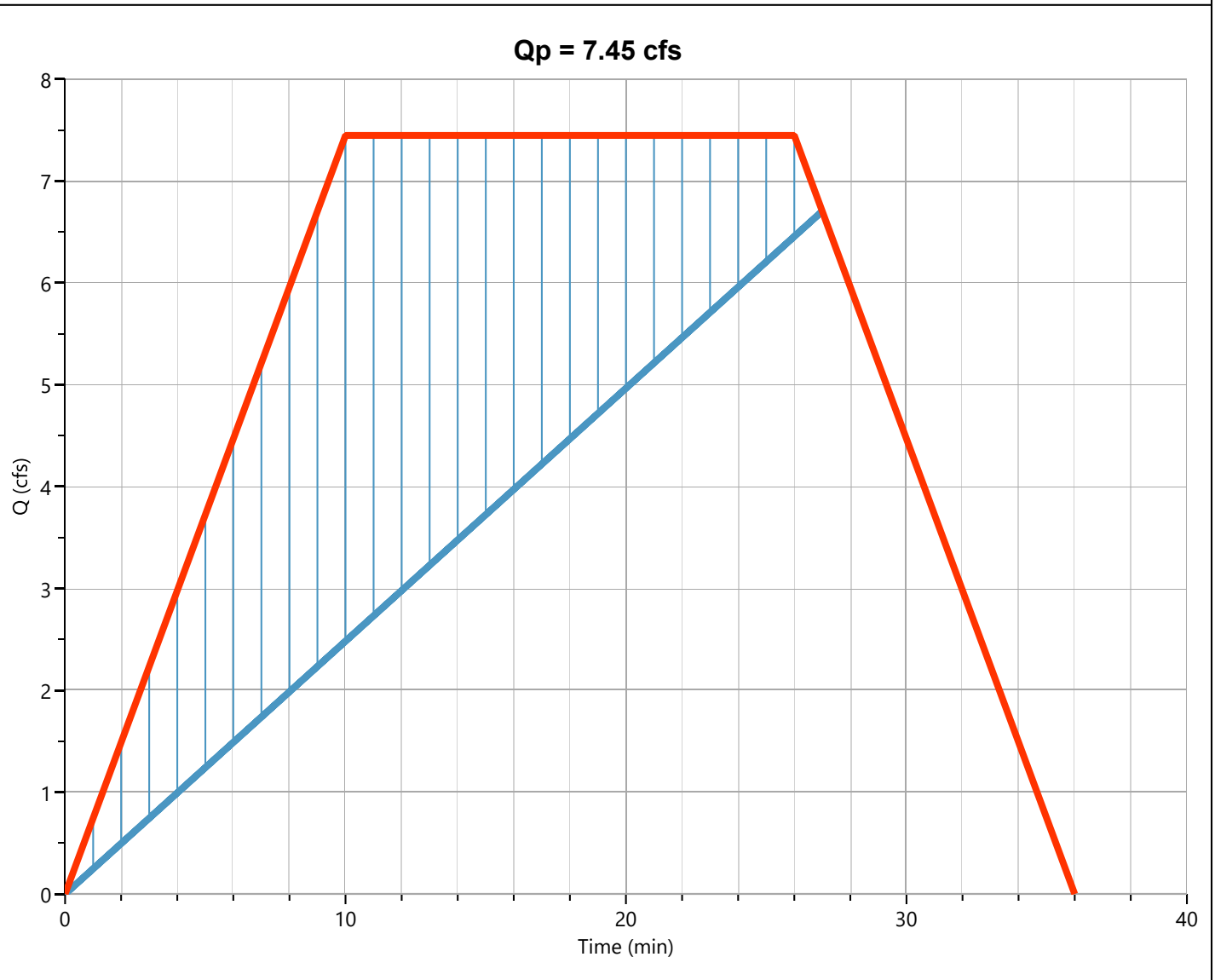
Post 14 and 18 Lane MR

Hyd. No. 9

Hydrograph Type	= Mod Rational	Peak Flow	= 7.448 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 12,065 cuft
Drainage Area	= 1.84 ac	Runoff Coeff.	= 0.82*
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF with WQ.idf	Intensity	= 4.94 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.7 x Tc
Target Q	= 6.600 cfs	Required Storage	= 4,937 cuft

*** Composite C Worksheet**

AREA (ac)	C	DESCRIPTION
1.2	0.99	Pavement
0.64	0.51	Grass
1.84	**0.82**	



Hydrograph Report

Hydrology Studio v 3.0.0.17

02-21-2021

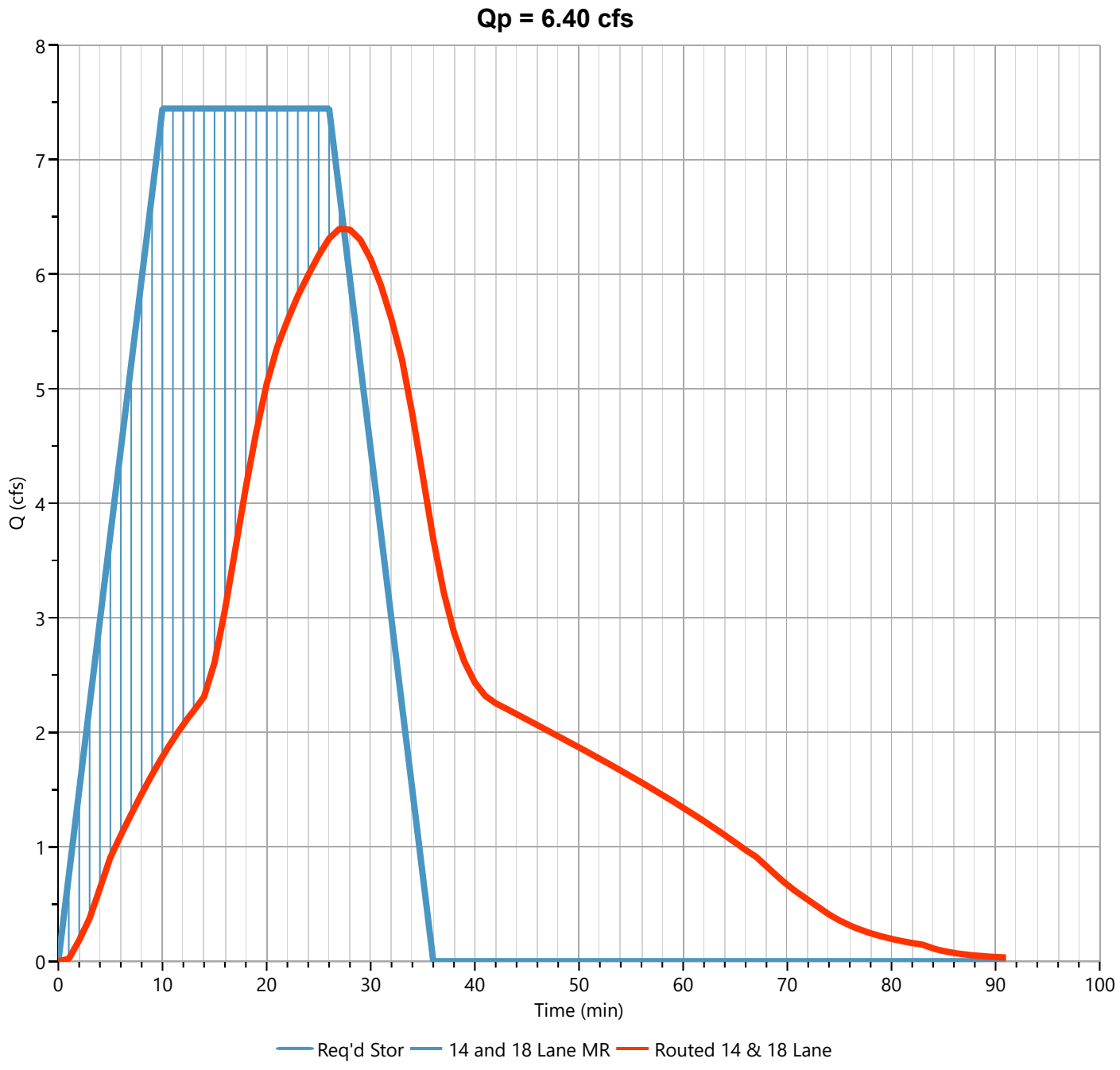
Routed 14 & 18 Lane

Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 6.397 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.45 hrs
Time Interval	= 1 min	Hydrograph Volume	= 11,615 cuft
Inflow Hydrograph	= 9 - 14 and 18 Lane MR	Max. Elevation	= 279.48 ft
Pond Name	= 14 and 18 Lane Avenue	Max. Storage	= 5,045 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 15 min

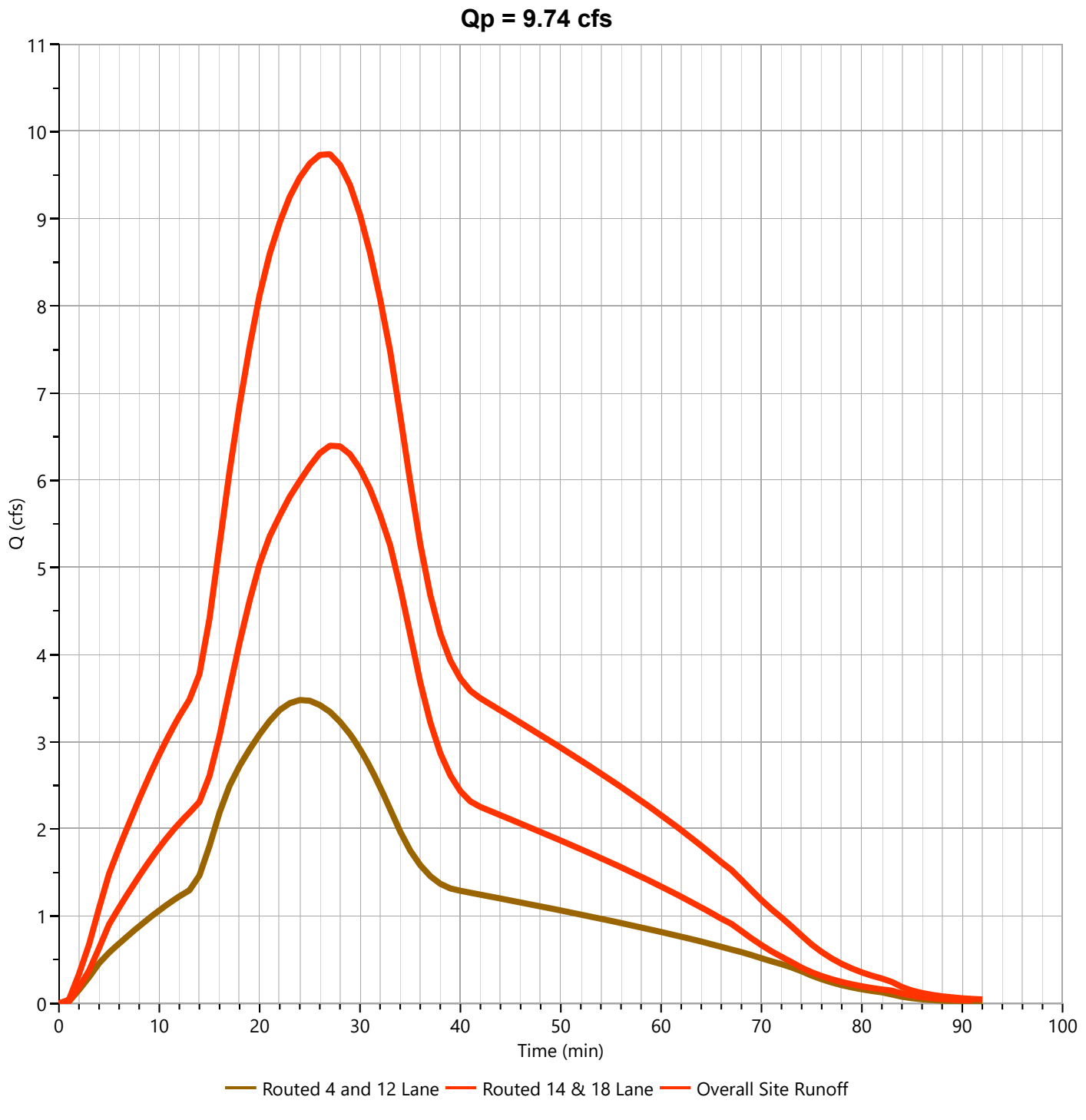


Hydrograph Report

Overall Site Runoff

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 9.741 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.45 hrs
Time Interval	= 1 min	Hydrograph Volume	= 18,154 cuft
Inflow Hydrographs	= 6, 10	Total Contrib. Area	= 0.0 ac



APPENDIX B
MODIFIED RATIONAL CRITICAL STORM ANALYSIS

4 and 12 Lane Avenue

Two Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	4.03	3.71	2,450	1.79	1,322	
2	1.2	12	3.88	3.58	2,578	1.79	1,396	
3	1.3	13	3.75	3.46	2,697	1.79	1,462	
4	1.4	14	3.63	3.34	2,809	1.79	1,520	
5	1.5	15	3.51	3.24	2,914	1.79	1,572	
6	1.6	16	3.4	3.14	3,013	1.79	1,617	
7	1.7	17	3.3	3.05	3,107	1.79	1,657	
8	1.8	18	3.21	2.96	3,195	1.79	1,692	
9	1.9	19	3.12	2.88	3,279	1.79	1,722	
10	2	20	3.04	2.8	3,359	1.79	1,748	
11	2.1	21	2.96	2.73	3,435	1.79	1,770	
12	2.2	22	2.88	2.66	3,507	1.79	1,789	
13	2.3	23	2.81	2.59	3,576	1.79	1,804	
14	2.4	24	2.74	2.53	3,642	1.79	1,870	
15	2.5	25	2.68	2.47	3,705	1.79	1,879	
16	2.6	26	2.62	2.41	3,765	1.79	1,886	
17	2.7	27	2.56	2.36	3,823	1.79	1,890	
18	2.8	28	2.5	2.31	3,879	1.79	1,892	<< Max Required Storage
19	2.9	29	2.45	2.26	3,932	1.79	1,892	
20	3	30	2.4	2.21	3,984	1.79	1,890	
21	3.1	31	2.35	2.17	4,034	1.79	1,886	
22	3.2	32	2.31	2.13	4,081	1.79	1,880	
23	3.3	33	2.26	2.08	4,128	1.79	1,872	

Ten Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	5.37	4.95	3,266	3.56	1,023	
2	1.2	12	5.19	4.78	3,445	3.56	1,095	
3	1.3	13	5.02	4.63	3,612	3.56	1,156	
4	1.4	14	4.87	4.49	3,769	3.56	1,206	
5	1.5	15	4.72	4.35	3,917	3.56	1,247	
6	1.6	16	4.58	4.23	4,056	3.56	1,279	
7	1.7	17	4.45	4.11	4,187	3.56	1,304	
8	1.8	18	4.33	3.99	4,311	3.56	1,321	
9	1.9	19	4.21	3.88	4,428	3.56	1,331	
10	2	20	4.1	3.78	4,539	3.56	1,335	<< Max Required Storage
11	2.1	21	4	3.69	4,645	3.56	1,334	
12	2.2	22	3.9	3.59	4,745	3.56	1,327	
13	2.3	23	3.8	3.51	4,840	3.56	1,316	

One-Hundred Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	7.36	6.79	4,482	5.2	1,206	
2	1.2	12	7.14	6.59	4,743	5.2	1,311	
3	1.3	13	6.94	6.4	4,989	5.2	1,401	
4	1.4	14	6.74	6.22	5,221	5.2	1,477	
5	1.5	15	6.56	6.05	5,441	5.2	1,541	
6	1.6	16	6.38	5.88	5,649	5.2	1,593	
7	1.7	17	6.21	5.73	5,846	5.2	1,634	
8	1.8	18	6.06	5.59	6,033	5.2	1,665	
9	1.9	19	5.91	5.45	6,211	5.2	1,687	
10	2	20	5.77	5.32	6,381	5.2	1,701	
11	2.1	21	5.63	5.19	6,542	5.2	1,706	<< WARNING: Could not provi
12	0	0	0	0	0	5.2	0	
13	0	0	0	0	0	5.2	0	
14	0	0	0	0	0	5.2	0	
15	0	0	0	0	0	5.2	0	
16	0	0	0	0	0	5.2	0	

Two Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	4.03	6.07	4,009	2.27	2,578	
2	1.2	12	3.88	5.86	4,218	2.27	2,719	
3	1.3	13	3.75	5.66	4,413	2.27	2,847	
4	1.4	14	3.63	5.47	4,596	2.27	2,962	
5	1.5	15	3.51	5.3	4,768	2.27	3,066	
6	1.6	16	3.4	5.14	4,930	2.27	3,160	
7	1.7	17	3.3	4.98	5,083	2.27	3,245	
8	1.8	18	3.21	4.84	5,228	2.27	3,321	
9	1.9	19	3.12	4.71	5,365	2.27	3,390	
10	2	20	3.04	4.58	5,496	2.27	3,453	
11	2.1	21	2.96	4.46	5,620	2.27	3,509	
12	2.2	22	2.88	4.35	5,738	2.27	3,559	
13	2.3	23	2.81	4.24	5,851	2.27	3,603	
14	2.4	24	2.74	4.14	5,958	2.27	3,711	
15	2.5	25	2.68	4.04	6,061	2.27	3,746	
16	2.6	26	2.62	3.95	6,160	2.27	3,777	
17	2.7	27	2.56	3.86	6,255	2.27	3,803	
18	2.8	28	2.5	3.78	6,346	2.27	3,826	
19	2.9	29	2.45	3.7	6,434	2.27	3,846	
20	3	30	2.4	3.62	6,518	2.27	3,862	
21	3.1	31	2.35	3.55	6,599	2.27	3,875	
22	3.2	32	2.31	3.48	6,678	2.27	3,885	
23	3.3	33	2.26	3.41	6,753	2.27	3,893	
24	3.4	34	2.22	3.35	6,826	2.27	3,898	
25	3.5	35	2.18	3.28	6,897	2.27	3,901	
26	3.6	36	2.14	3.22	6,965	2.27	3,901	<< Max Required Storage
27	3.7	37	2.1	3.17	7,032	2.27	3,899	
28	3.8	38	2.06	3.11	7,096	2.27	3,895	
29	3.9	39	2.03	3.06	7,158	2.27	3,889	
30	4	40	1.99	3.01	7,218	2.27	3,881	
31	4.1	41	1.96	2.96	7,277	2.27	3,872	

14 and 18 Lane Avenue

Ten Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	5.37	8.1	5,343	4.52	2,495	
2	1.2	12	5.19	7.83	5,636	4.52	2,653	
3	1.3	13	5.02	7.58	5,910	4.52	2,791	
4	1.4	14	4.87	7.34	6,167	4.52	2,913	
5	1.5	15	4.72	7.12	6,409	4.52	3,019	
6	1.6	16	4.58	6.91	6,636	4.52	3,111	
7	1.7	17	4.45	6.72	6,851	4.52	3,190	
8	1.8	18	4.33	6.53	7,054	4.52	3,257	
9	1.9	19	4.21	6.36	7,245	4.52	3,313	
10	2	20	4.1	6.19	7,427	4.52	3,359	
11	2.1	21	4	6.03	7,599	4.52	3,396	
12	2.2	22	3.9	5.88	7,763	4.52	3,424	
13	2.3	23	3.8	5.74	7,919	4.52	3,444	
14	2.4	24	3.71	5.6	8,067	4.52	3,592	
15	2.5	25	3.63	5.47	8,208	4.52	3,598	<< Max Required Storage
16	2.6	26	3.54	5.35	8,343	4.52	3,597	
17	2.7	27	3.47	5.23	8,472	4.52	3,590	
18	2.8	28	3.39	5.12	8,595	4.52	3,578	
19	2.9	29	3.32	5.01	8,713	4.52	3,561	
20	3	30	3.25	4.9	8,826	4.52	3,538	

One-Hundred Year Storm Event - Modified Rational Iteration								
Trial	SDF	Storm Dur	Intensity	Qpeak	Volume	Qtarget	Req. Stor	
		(min)	(in/hr)	(cfs)	(cuft)	(cfs)	(cuft)	
1	1.1	11	7.36	11.11	7,333	6.6	3,175	
2	1.2	12	7.14	10.78	7,760	6.6	3,404	
3	1.3	13	6.94	10.47	8,163	6.6	3,609	
4	1.4	14	6.74	10.17	8,543	6.6	3,791	
5	1.5	15	6.56	9.89	8,902	6.6	3,952	
6	1.6	16	6.38	9.63	9,242	6.6	4,094	
7	1.7	17	6.21	9.38	9,564	6.6	4,218	
8	1.8	18	6.06	9.14	9,871	6.6	4,327	
9	1.9	19	5.91	8.91	10,162	6.6	4,420	
10	2	20	5.77	8.7	10,439	6.6	4,499	
11	2.1	21	5.63	8.5	10,704	6.6	4,566	
12	2.2	22	5.5	8.3	10,957	6.6	4,621	
13	2.3	23	5.38	8.11	11,198	6.6	4,664	
14	2.4	24	5.26	7.94	11,429	6.6	4,895	
15	2.5	25	5.15	7.77	11,650	6.6	4,918	
16	2.6	26	5.04	7.6	11,862	6.6	4,932	
17	2.7	27	4.94	7.45	12,065	6.6	4,937	<< Max Required Storage
18	2.8	28	4.84	7.3	12,260	6.6	4,934	
19	2.9	29	4.74	7.15	12,448	6.6	4,924	
20	3	30	4.65	7.02	12,629	6.6	4,907	
21	3.1	31	4.56	6.88	12,802	6.6	4,882	
22	3.2	32	4.48	6.76	12,970	6.6	4,852	

APPENDIX C
WEB DATA SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, New Jersey

4-18 Lane Avenue, Caldwell

February 14, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:862 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, New Jersey
Survey Area Data: Version 16, Jun 1, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 25, 2014—Sep 27, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BogCc	Boonton loam, 8 to 15 percent slopes, extremely stony	0.0	0.1%
BouB	Boonton - Urban land, Boonton substratum complex, 0 to 8 percent slopes	0.1	4.9%
BouC	Boonton - Urban land, Boonton substratum complex, 8 to 15 percent slopes	1.5	94.9%
Totals for Area of Interest		**1.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, New Jersey

BogCc—Boonton loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: b120
Elevation: 50 to 500 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Boonton, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boonton, Extremely Stony

Setting

Landform: Ground moraines
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy basal till derived from basalt

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 3 inches: highly decomposed plant material
A - 3 to 5 inches: loam
BA - 5 to 8 inches: silt loam
BE - 8 to 17 inches: silt loam
Bt - 17 to 30 inches: silt loam
Btx1 - 30 to 40 inches: gravelly fine sandy loam
Btx2 - 40 to 47 inches: fine sandy loam
CBt1 - 47 to 58 inches: loamy sand
CBt2 - 58 to 72 inches: loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 10.0 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Boonton, moderately well drained, extremely stony
Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Haledon, extremely stony
Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

BouB—Boonton - Urban land, Boonton substratum complex, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: b12f
Elevation: 50 to 500 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition
Boonton and similar soils: 50 percent
Urban land, boonton substratum: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boonton

Setting
Landform: Ground moraines
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy basal till derived from basalt

Typical profile

A - 0 to 5 inches: loam
BA - 5 to 8 inches: silt loam
BE - 8 to 17 inches: silt loam
Bt - 17 to 30 inches: silt loam
Btx1 - 30 to 40 inches: gravelly fine sandy loam
Btx2 - 40 to 47 inches: fine sandy loam
CBt1 - 47 to 58 inches: loamy sand
CBt2 - 58 to 72 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land, Boonton Substratum

Setting

Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank, upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

H1 - 0 to 12 inches: material
H2 - 12 to 47 inches: silt loam
2CBt1 - 47 to 58 inches: loamy sand
2CBt2 - 58 to 72 inches: loamy sand

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents, boonton substratum

Percent of map unit: 10 percent
Landform: Ground moraines

Landform position (three-dimensional): Lower third of mountainflank, upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

BouC—Boonton - Urban land, Boonton substratum complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: b12d
Elevation: 50 to 500 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Boonton and similar soils: 50 percent
Urban land, boonton substratum: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boonton

Setting

Landform: Ground moraines
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy basal till derived from basalt

Typical profile

A - 0 to 5 inches: loam
BA - 5 to 8 inches: silt loam
BE - 8 to 17 inches: silt loam
Bt - 17 to 30 inches: silt loam
Btx1 - 30 to 40 inches: gravelly fine sandy loam
Btx2 - 40 to 47 inches: fine sandy loam
CBt1 - 47 to 58 inches: loamy sand
CBt2 - 58 to 72 inches: loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land, Boonton Substratum

Setting

Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank, upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

H1 - 0 to 12 inches: material
H2 - 12 to 47 inches: silt loam
2CBt1 - 47 to 58 inches: loamy sand
2CBt2 - 58 to 72 inches: loamy sand

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Udorthents, boonton substratum

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank, upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

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