

**APPENDIX G**  
**HYDROLOGY AND HYDRAULICS REPORT**

**HYDROLOGY  
and  
HYDRAULICS REPORT**

**for  
KA Enterprises Mega Mart**

**Prepared for:  
City of Riverside  
Public Works- Engineering  
3900 Main Street- 4<sup>th</sup> Floor  
Riverside, CA 92522**

**Project Site Address  
Northeast Corner of  
Sycamore Canyon Blvd & Central Ave  
Riverside, CA**

**Study Prepared by:  
Omega Engineering Consultants  
4340 Viewridge Ave Suite B  
San Diego, CA 92123  
(858) 634-8620**

**Preparation Date  
April 6, 2018**

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**Patric de Boer                      RCE 83583  
Registration Expires              3-31-2019**

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## **SITE AND PROJECT DESCRIPTION**

This Hydrology and Hydraulics report has been prepared as part of the Preliminary Grading Plan set for the project located at the Northeast Corner of Sycamore Canyon Blvd and Central Ave, Riverside, CA. The project site is currently a vacant lot adjacent to the State Highway 60 off-ramp. The project proposes to regrade the entire site and build a restaurant and a gas station with an adjacent car-wash. The proposed design implements several bioretention areas and an associated storm drain network.

The site drainage basin is located in the Santa Ana Hydrologic Area of the Middle Santa Ana River Hydrologic Unit of the Riverside Hydraulic Region (801.27). See Figure No. 1 for the vicinity map. See Figure No. 2 for the existing drainage limits. See Figure No. 3 for the proposed drainage limits.

## **METHODOLOGY**

This drainage report has been prepared in accordance with current County of Riverside regulations and procedures. All of the proposed pipes and facilities have been designed to intercept and convey the 100-year storm. The Modified Rational Method was used to compute the anticipated runoff. See the attached calculations for particulars. The following references have been used in preparation of this report:

- (1) Handbook of Hydraulics, E.F. Brater & H.W. King, 6<sup>th</sup> Ed., 1976.
- (2) Modern Sewer Design, American Iron & Steel Institute, 1<sup>st</sup> Ed., 1980.
- (3) County of Riverside Hydrology Manual, 1978

## **EXISTING SITE CONDITIONS:**

The existing site consists of an irregular-shaped vacant lot. The site has been previously mass graded. A soil stockpile is located in the central area of the site and a slope is present along the westerly edge of the property which slopes downward toward Sycamore Canyon Boulevard. The ground surface conditions consists of artificial fill with several scattered trees on the easterly portion and on the westerly portion consists of exposed soil with native grass and shrubs along the periphery.

The existing drainage condition is overland flow starting from the northeasterly edge and flowing towards the westerly slope of the property adjacent to Sycamore Canyon Boulevard. The runoff continues draining across Sycamore Canyon Boulevards and sheet flows at the corner of Central Avenue on a gutter. It then continues to flow 2,250 feet away from the proposed development into an existing storm drain inlet.

## **DEVELOPED SITE CONDITIONS:**

The project proposes to regrade the entire site and build a restaurant and a gas station with an attached car-wash. The proposed development foot print will be approximately 95,000 square feet with an increase of impervious area from 0% to 65%. Onsite drainage patterns will be modified but the ultimate discharge point will remain the same. Four biofiltration systems shall

take majority of the onsite runoff and have enough ponding depth for a high intensity storm. Each bioretention basin will have a 4" flow control orifice and the drainage from each bioretention basin shall confluence and discharge at the southeasterly corner of the proposed site via an existing 18" RCP drop inlet.

**EXISTING RUNOFF ANALYSIS:**

The Rational Method was used for calculating existing peak flow rates for the 10 and 100-year storms. Analysis of the existing condition is represented by a single basin. All of the existing site drains via overland flow to a single outlet point at the southeasterly corner on Sycamore Canyon Boulevard and Central Avenue.

Basin #	Area (ac)	Intensity (in/hr)	Runoff Coeff. (C)	Time of Conc. (T <sub>c</sub> )	Peak 100-year (Q <sub>100</sub> )
EX-1	2.19	2.84	0.87	9.25 mins	5.41 cfs
-	-			-	-
-	-			-	-

The time of concentration was calculated using the Riverside County Hydrology Manual nomograph (plate D-3). Intensities were estimated using the values found in the hydrology manual on plate 4.1 (included as appendix 3 of this report and the runoff coefficient was found via the equation on plate D-3).

See the attached calculations for details.

**DEVELOPED RUNOFF ANALYSIS:**

The developed site calculations divide the site into 6 separate basins (A-1, A-2, A-3, A-4, A-5 and A-6). All basin drains to a confluence point located at the northerly corner of the site. The runoff then discharges into an existing 18" RCP pipe that runs along Central Avenue. Basin A-5 and A-6 are Self-Retaining areas.

Basin #	Area (ac)	Intensity (in/hr)	Runoff Coeff (C)	Time of Conc. (T <sub>c</sub> )	*Peak 100-year (Q <sub>100</sub> )	**Peak 100-year (Q <sub>100</sub> )
A-1	0.22	3.55	0.89	6.0 mins	0.70 cfs	0.56 cfs
A-2	0.47	3.26	0.88	7.0 mins	1.35 cfs	0.68 cfs
A-3	0.12	3.92	0.88	5.0 mins	0.41 cfs	0.35 cfs
A-4	0.85	3.92	0.88	5.0 mins	2.93 cfs	1.24 cfs
A-5	0.32	3.92	0.82	5.0 mins	1.03 cfs	1.03 cfs
A-6	0.21	3.92	0.86	5.0 mins	0.71 cfs	0.71 cfs

\*Pre- Bioretention Mitigation

\*\*Post- Bioretention Mitigation

The confluenced 100 year flow for all the basins was found to be **6.93 cfs** without mitigation from storage in the bioretention areas. The runoff for a 100-year storm using 4 bioretention facilities with orifice control reduces the flow to **3.65 cfs**.

The proposed development increases the overall impervious area. However, with the use of orifice control in the bioretention facilities, it decreases the amount of runoff leaving the site compared to the existing runoff condition.

The detention and flow control calculations have been included in the appendix 4.0 of this report.

## **RESULTS AND CONCLUSIONS**

The proposed development of the site shall result in an increase of peak runoff volume and flow rate for a 100 year storm event due to the increase of impervious area. However, this increase in rate and peak volume shall be mitigated through the use of orifice flow control and storage in the bioretention facilities. The result will be a proposed discharge that is less than the existing discharge condition.

It is the opinion of Omega Engineering Consultants that this project will not negatively effect the downstream waterways and receiving water bodies. A Project Specific Water Quality Management Plan has been prepared to discuss the water quality impacts for the proposed development.

**VICINITY MAP**  
NO SCALE



BASIN DATA			
BASIN	AREA (ac)	IMPERVIOUS %	$Q_{100}$ (cfs)
EX-1	2.19	0.0%	5.35

# EXISTING HYDROLOGY EXHIBIT

## KA ENTERPRISES MEGA MART

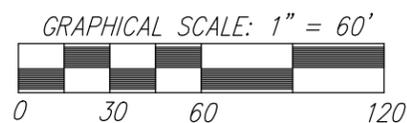
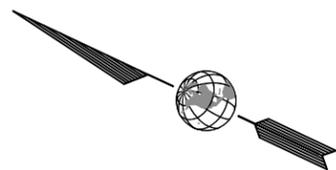
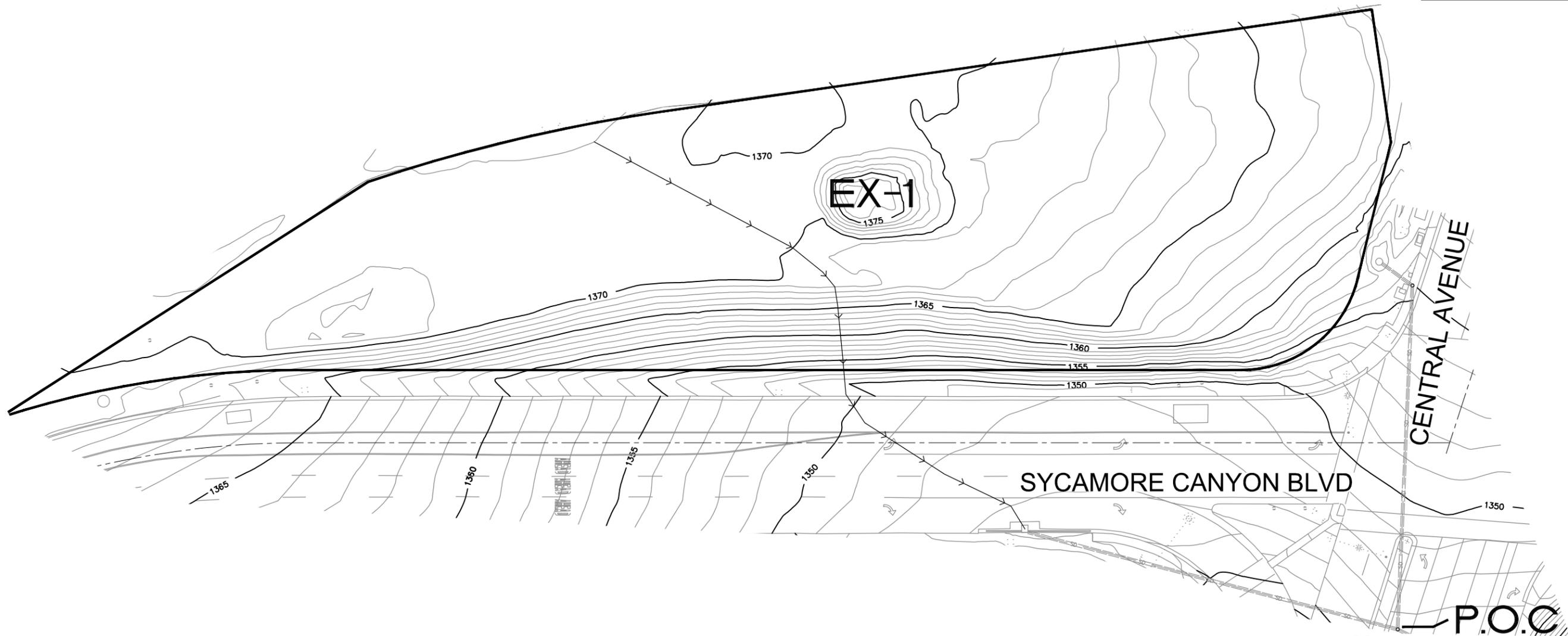
**LEGEND:**

AREA LIMITS ..... 

DRAINAGE DIRECTION ARROW ..... 

BASIN NUMBER ..... **EX-#**

PERVIOUS AREA ..... 



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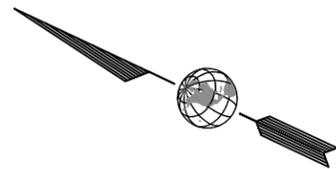
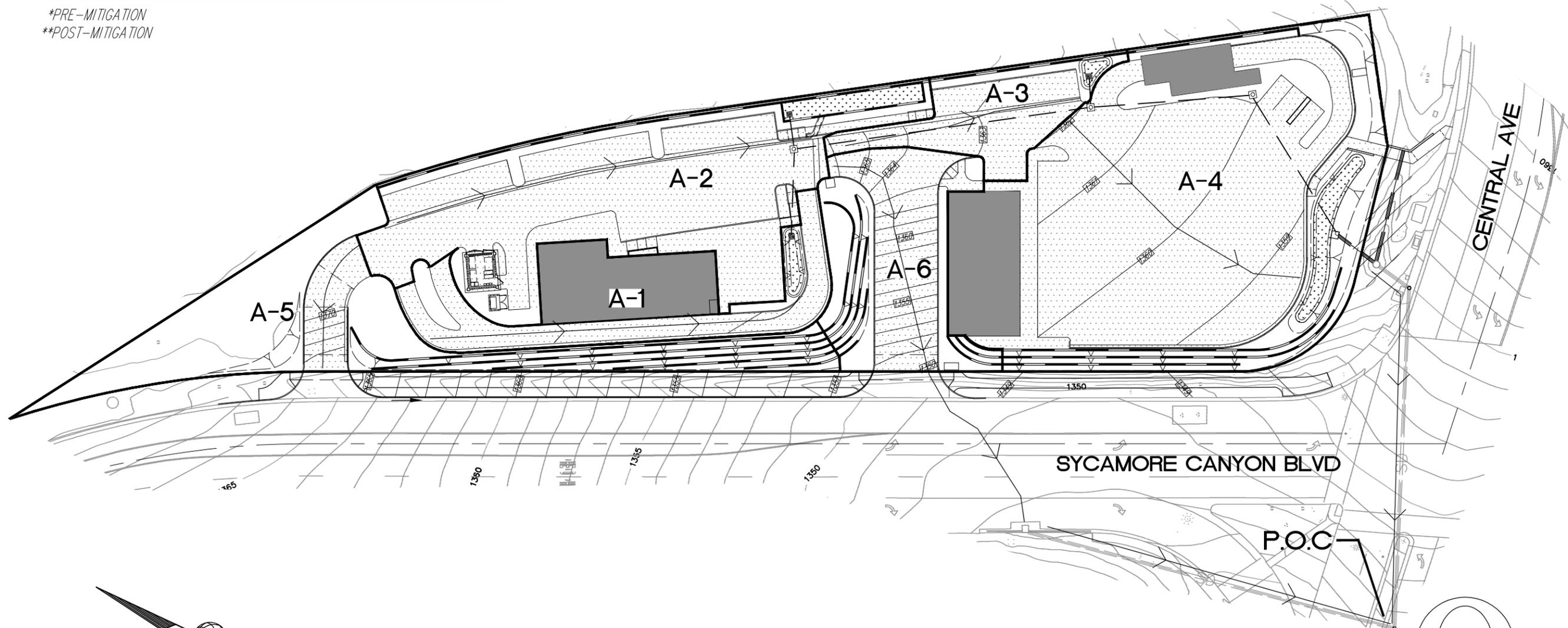
BASIN DATA				
BASIN	AREA (ac)	IMPERVIOUS %	*Q <sub>100</sub> (cfs)	**Q <sub>100</sub> (cfs)
A-1	0.22	89%	0.70	0.56
A-2	0.47	82%	1.35	0.68
A-3	0.12	82%	0.41	0.35
A-4	0.85	76%	2.93	1.24
A-5	0.32	13%	1.03	1.03
A-6	0.21	58%	0.71	0.71

\*PRE-MITIGATION  
 \*\*POST-MITIGATION

# PROPOSED HYDROLOGY EXHIBIT KA ENTERPRISES MEGA MART

## LEGEND:

- AREA LIMITS:
- DRAINAGE DIRECTION ARROW:
- BASIN NUMBER: **A-#**
- PERVIOUS AREA:
- IMPERVIOUS AREA:
- BIOFILTRATION AREA:



GRAPHICAL SCALE: 1" = 60'



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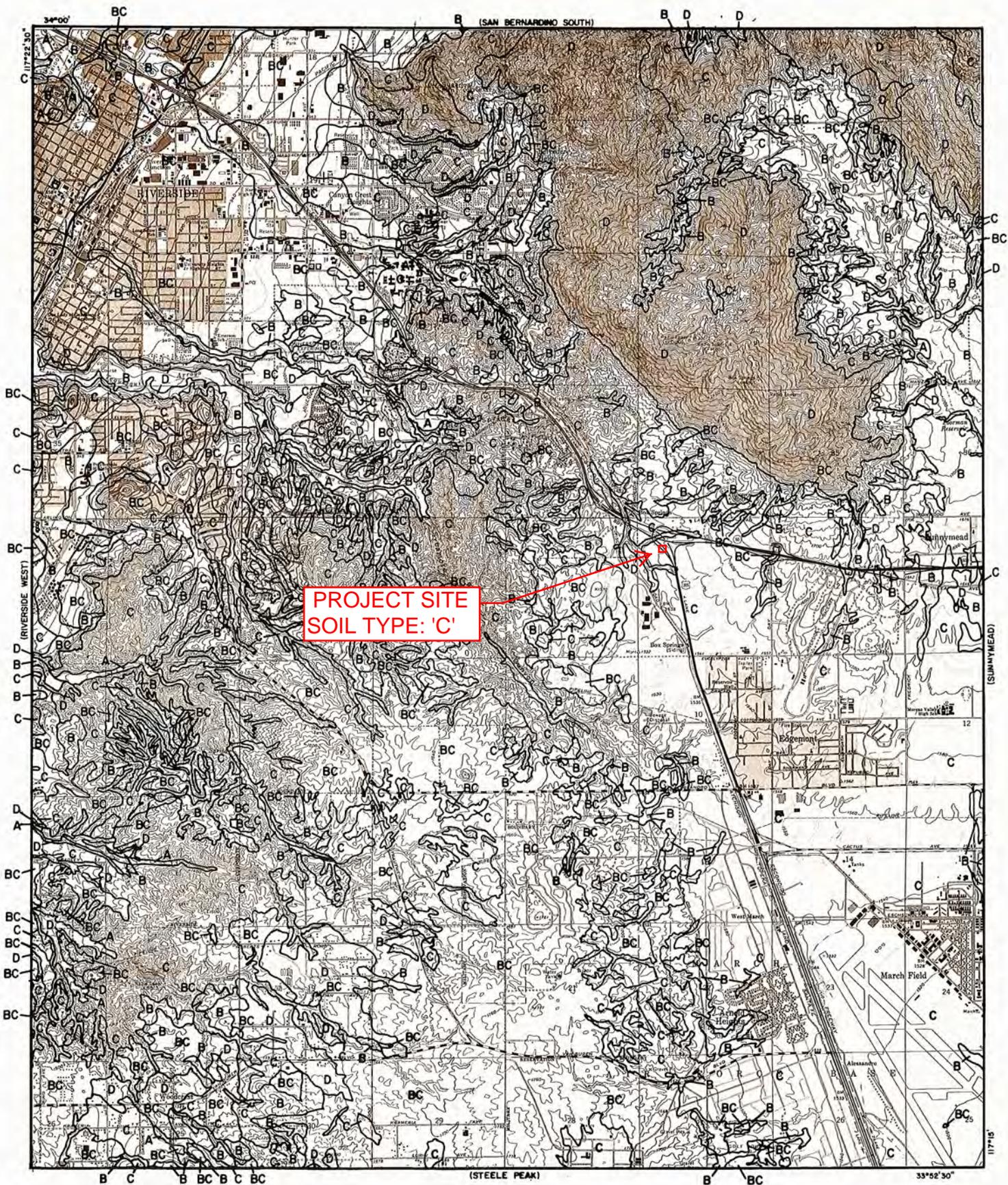








# **APPENDICES:**



**PROJECT SITE**  
SOIL TYPE: 'C'

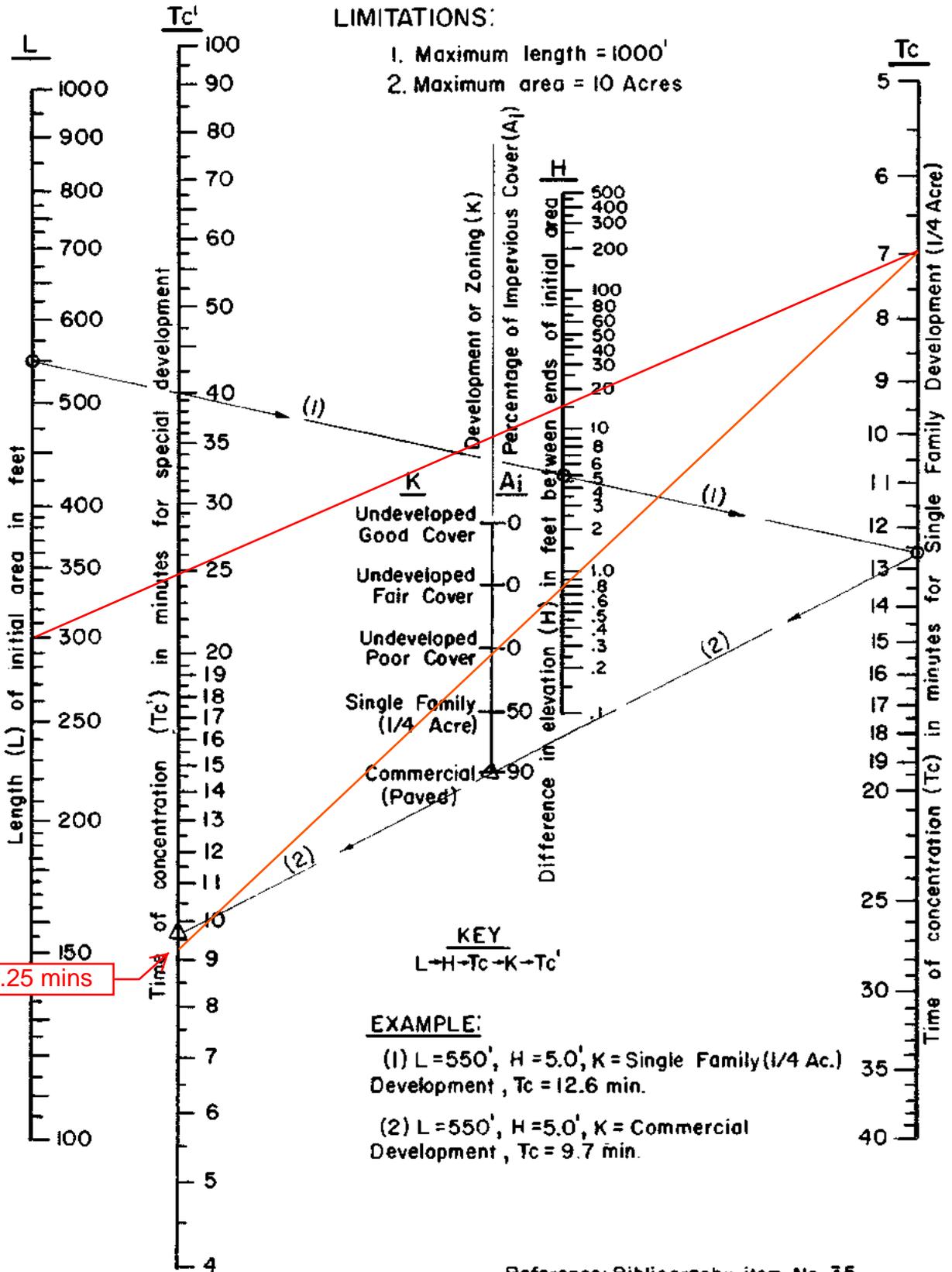
**LEGEND**

- SOILS GROUP BOUNDARY
- A SOILS GROUP DESIGNATION

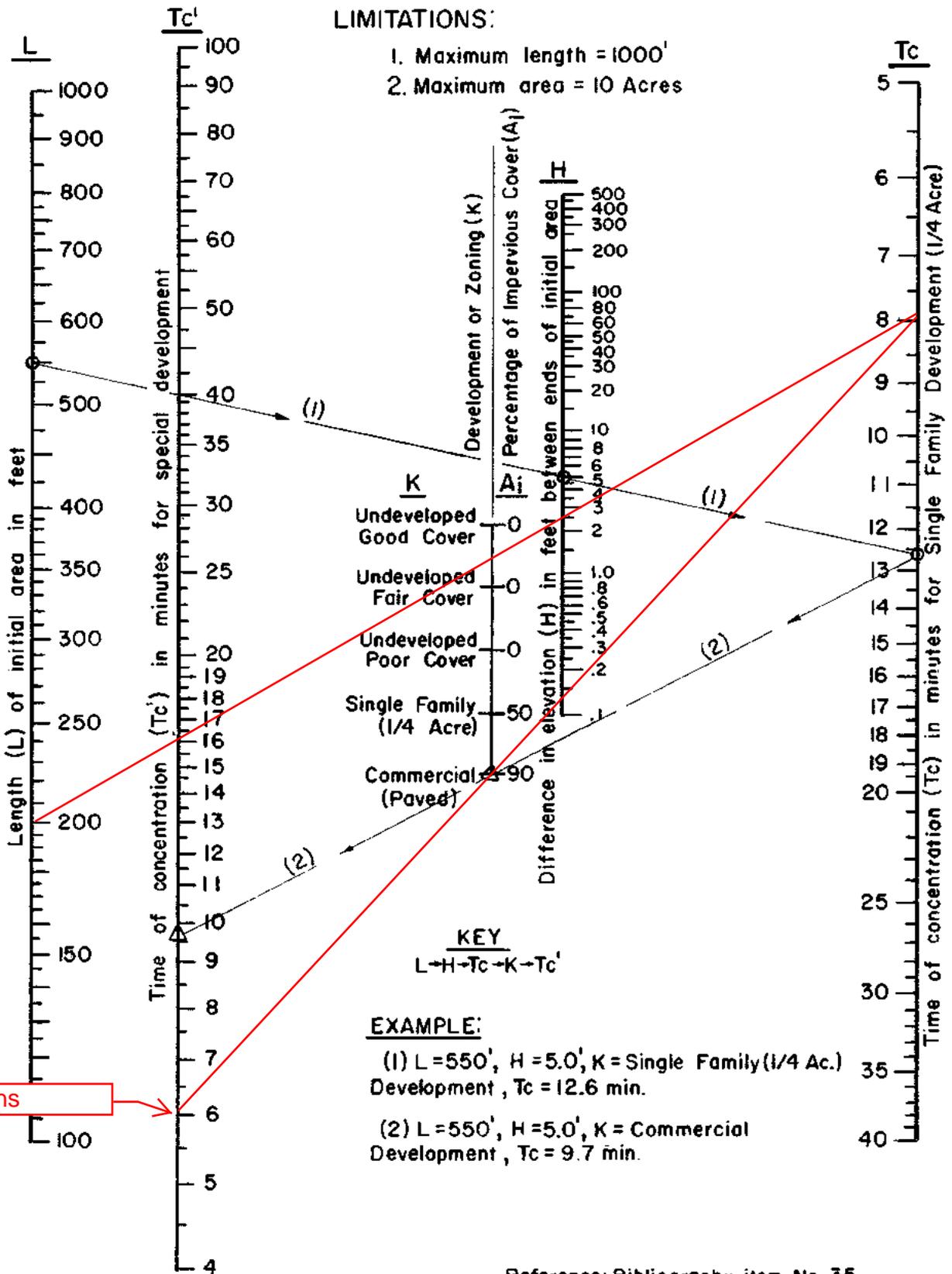
**RCFC & WCD**  
HYDROLOGY MANUAL

0 FEET 5000

**HYDROLOGIC SOILS GROUP MAP**  
FOR  
**RIVERSIDE-EAST**



EX-1: 9.25 mins



A-1: 6 mins

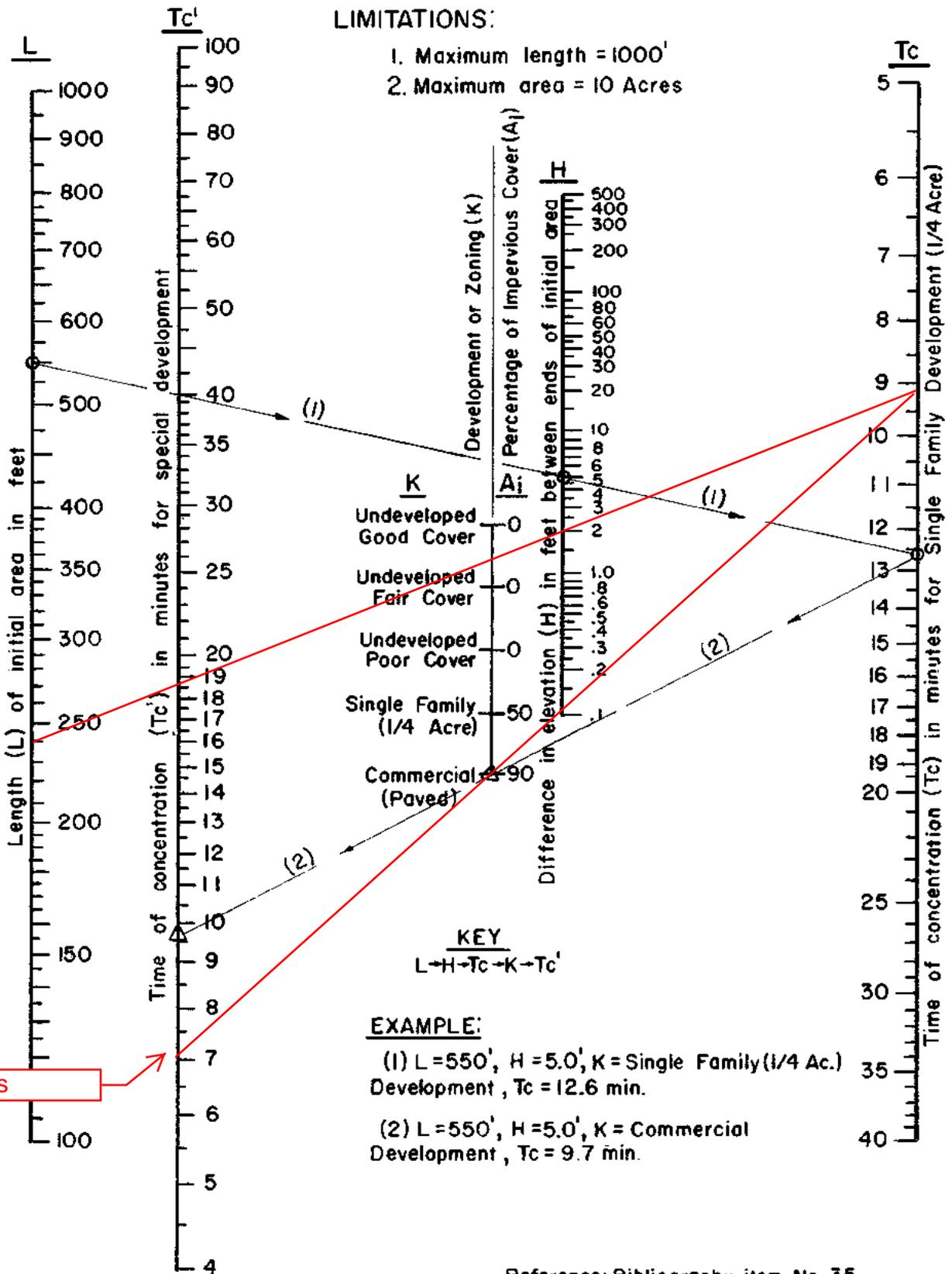
**RCFC & WCD**  
 HYDROLOGY MANUAL

Reference: Bibliography item No. 35.

**TIME OF CONCENTRATION  
 FOR INITIAL SUBAREA**

**LIMITATIONS:**

1. Maximum length = 1000'
2. Maximum area = 10 Acres

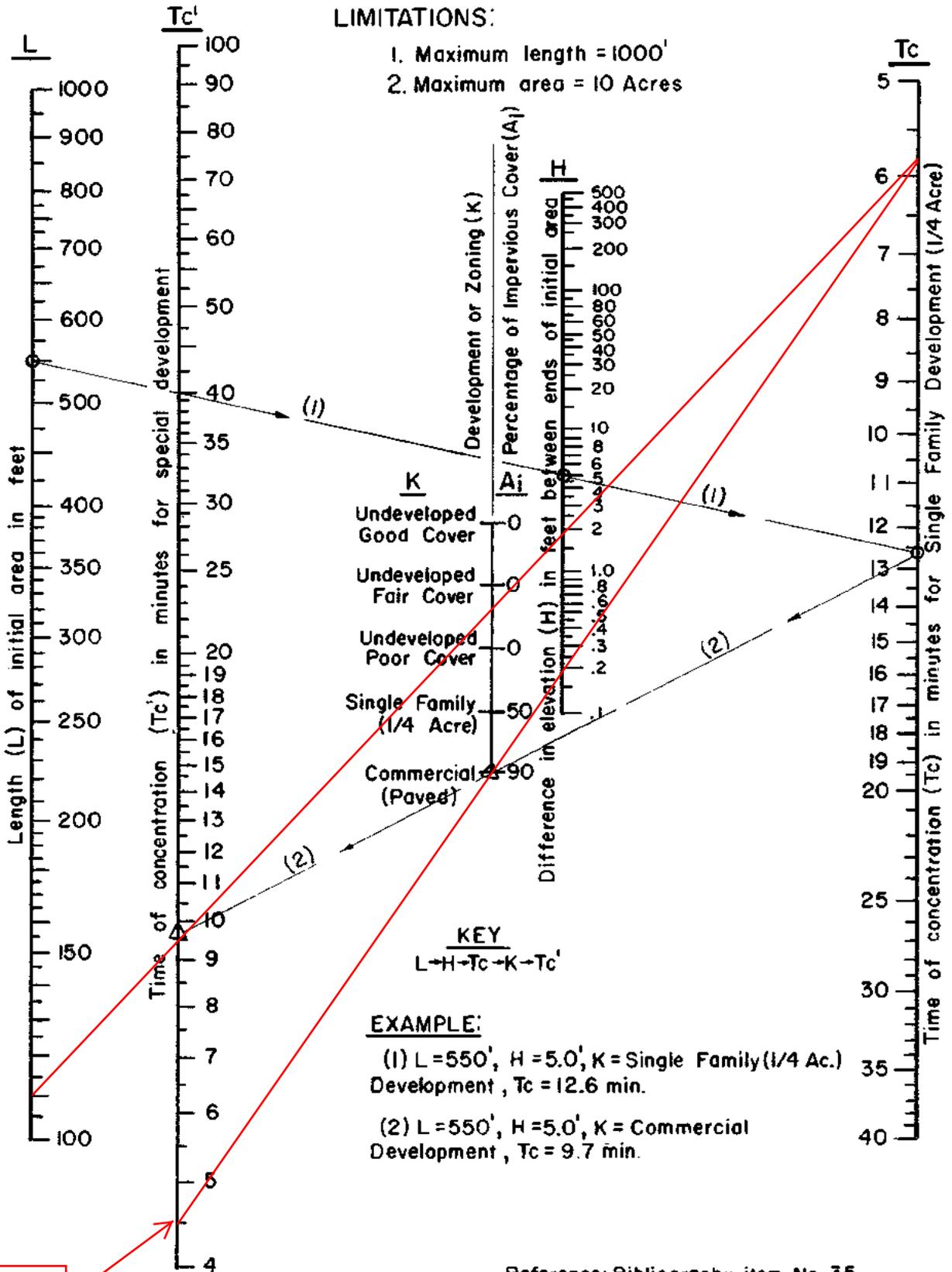


A-2: 7 mins

Reference: Bibliography item No. 35.

**RCFC & WCD**  
 HYDROLOGY MANUAL

**TIME OF CONCENTRATION**  
**FOR INITIAL SUBAREA**



**LIMITATIONS:**

1. Maximum length = 1000'
2. Maximum area = 10 Acres

**KEY**  
 $L \rightarrow H \rightarrow T_c \rightarrow K \rightarrow T_c'$

**EXAMPLE:**

(1)  $L = 550'$ ,  $H = 5.0'$ ,  $K = \text{Single Family (1/4 Ac.)}$   
 Development,  $T_c = 12.6 \text{ min.}$

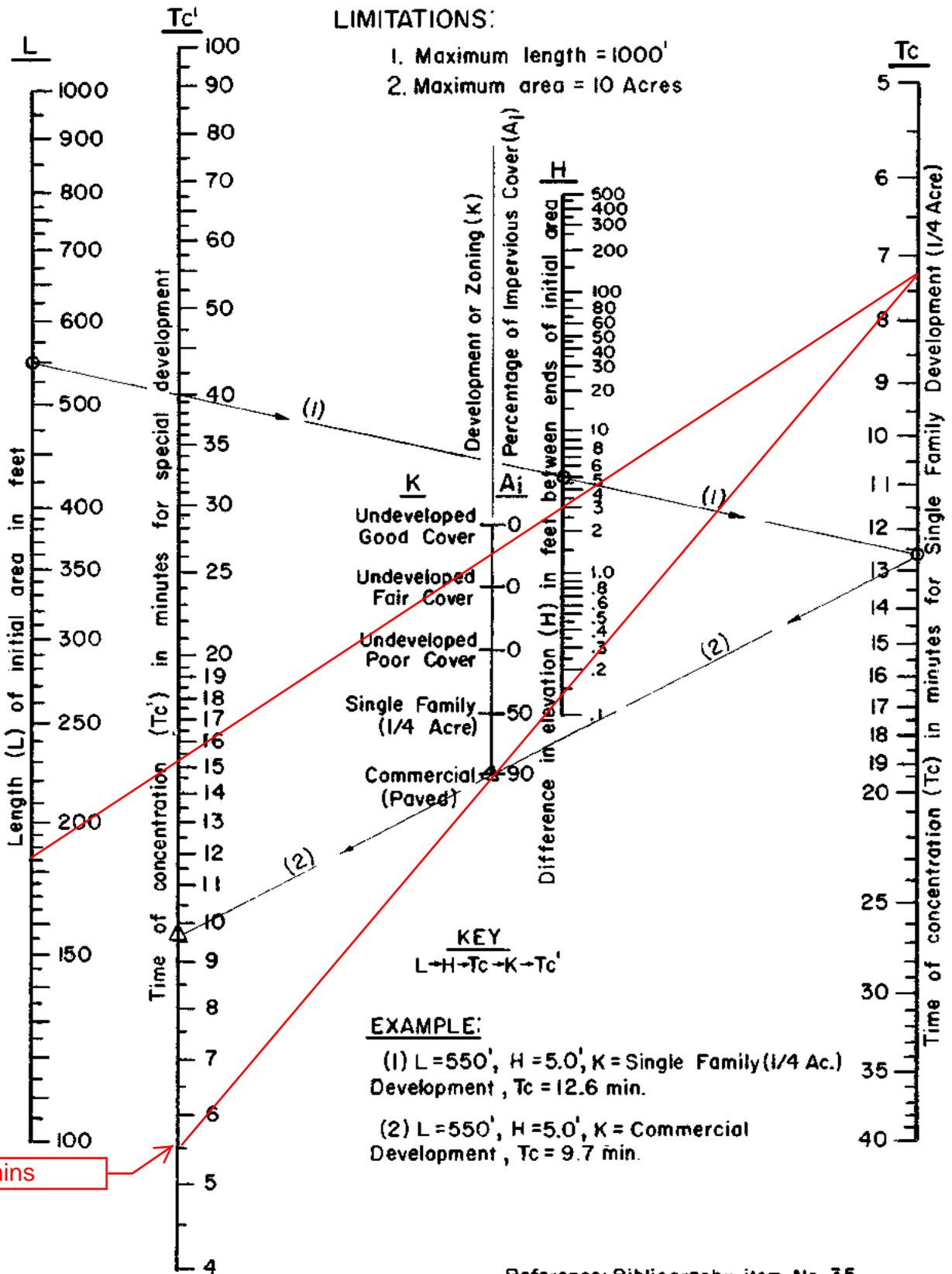
(2)  $L = 550'$ ,  $H = 5.0'$ ,  $K = \text{Commercial}$   
 Development,  $T_c = 9.7 \text{ min.}$

A-3: 4.5 mins

Reference: Bibliography item No. 35.

**RCFC & WCD**  
 HYDROLOGY MANUAL

**TIME OF CONCENTRATION**  
**FOR INITIAL SUBAREA**

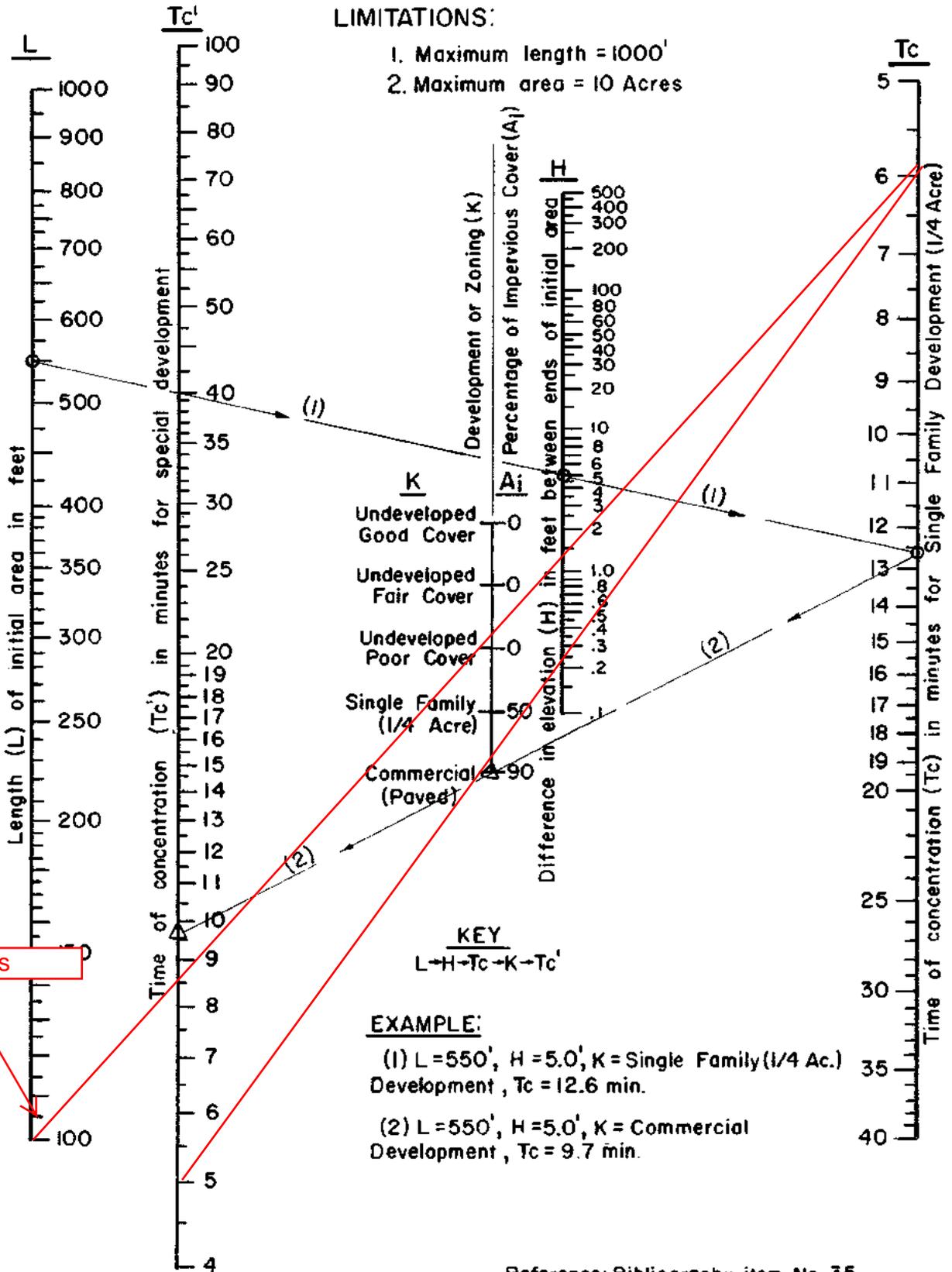


A-4: 5.5 mins

**RCFC & WCD**  
 HYDROLOGY MANUAL

Reference: Bibliography item No. 35.

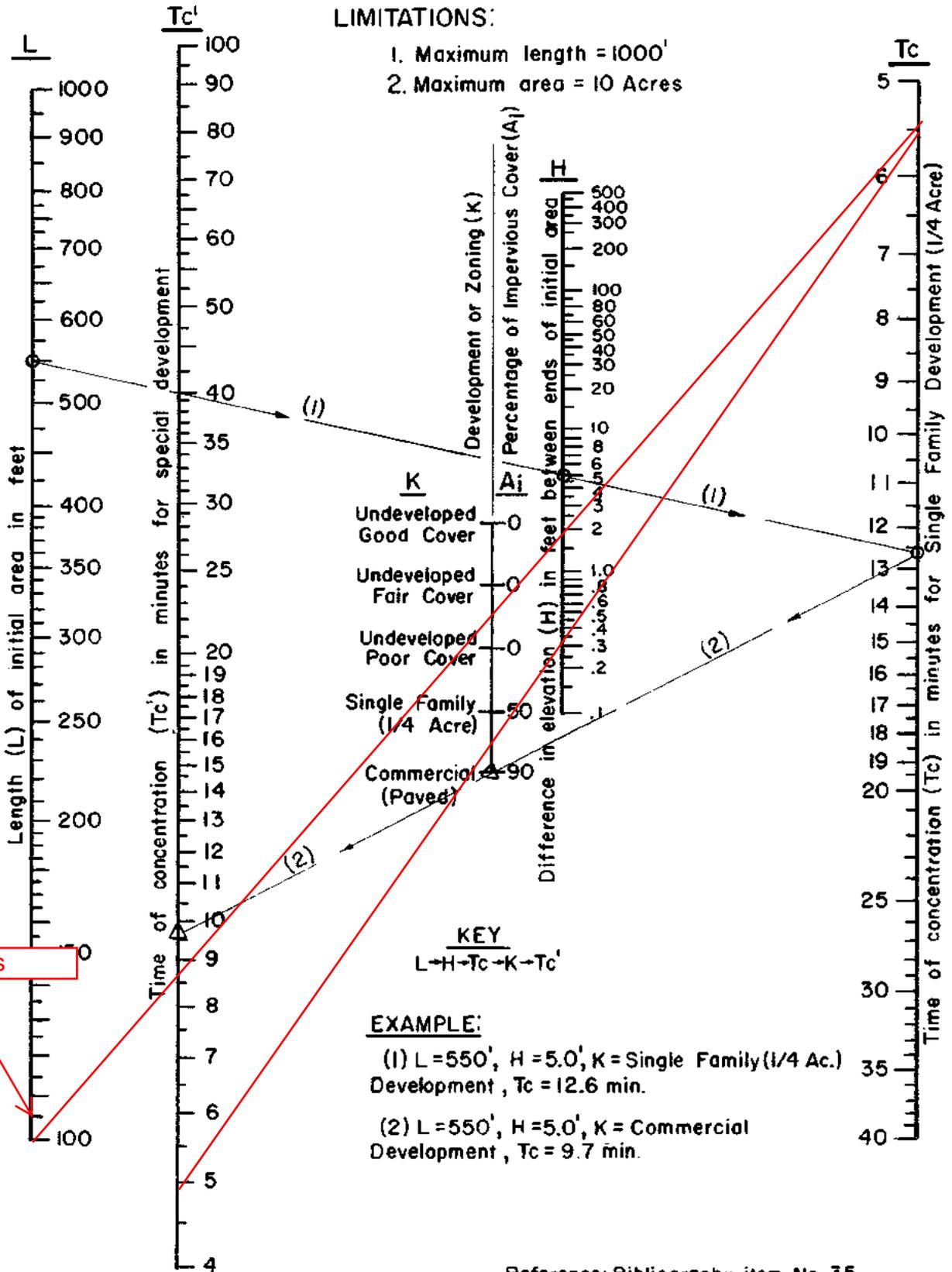
**TIME OF CONCENTRATION**  
**FOR INITIAL SUBAREA**



A-5: 5.0 mins

**RCFC & WCD**  
HYDROLOGY MANUAL

**TIME OF CONCENTRATION  
FOR INITIAL SUBAREA**



A-6: 5.0 mins

**RCFC & WCD**  
 HYDROLOGY MANUAL

**TIME OF CONCENTRATION**  
**FOR INITIAL SUBAREA**

A-3, A-4, A-5  
& A-6

# RAINFALL INTENSITY—INCHES PER HOUR

**RCFC & WCD**  
 HYDROLOGY MANUAL

A-1  
A-2  
EX-1

RIVERSIDE			RIVERSIDE (FOOTHILL AREAS)			RUBIDOUX			SAN JACINTO			SUN CITY		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	2.75	3.92	5	3.14	4.71	5	3.18	4.71	5	2.81	4.16	5	3.25	4.85
6	2.48	3.55	6	2.84	4.26	6	2.87	4.26	6	2.56	3.79	6	2.95	4.40
7	2.28	3.26	7	2.61	3.91	7	2.64	3.91	7	2.37	3.51	7	2.72	4.06
8	2.12	3.03	8	2.42	3.63	8	2.45	3.63	8	2.22	3.29	8	2.53	3.78
9	1.99	2.84	9	2.27	3.41	9	2.30	3.41	9	2.09	3.10	9	2.38	3.55
10	1.88	2.68	10	2.14	3.21	10	2.17	3.21	10	1.98	2.94	10	2.25	3.36
11	1.78	2.54	11	2.03	3.05	11	2.06	3.05	11	1.89	2.80	11	2.14	3.19
12	1.70	2.42	12	1.94	2.91	12	1.96	2.91	12	1.81	2.68	12	2.04	3.05
13	1.62	2.32	13	1.86	2.78	13	1.88	2.78	13	1.74	2.58	13	1.96	2.92
14	1.56	2.23	14	1.78	2.67	14	1.80	2.67	14	1.68	2.48	14	1.88	2.81
15	1.50	2.14	15	1.71	2.57	15	1.74	2.57	15	1.62	2.40	15	1.81	2.71
16	1.45	2.07	16	1.66	2.48	16	1.68	2.48	16	1.57	2.32	16	1.75	2.62
17	1.40	2.00	17	1.60	2.40	17	1.62	2.40	17	1.52	2.25	17	1.70	2.54
18	1.36	1.94	18	1.55	2.33	18	1.57	2.33	18	1.48	2.19	18	1.65	2.46
19	1.32	1.88	19	1.51	2.26	19	1.52	2.26	19	1.44	2.13	19	1.60	2.39
20	1.28	1.83	20	1.46	2.20	20	1.48	2.20	20	1.40	2.08	20	1.56	2.33
22	1.22	1.74	22	1.39	2.08	22	1.41	2.08	22	1.34	1.98	22	1.48	2.21
24	1.16	1.66	24	1.32	1.99	24	1.34	1.99	24	1.28	1.90	24	1.41	2.11
26	1.11	1.58	26	1.27	1.90	26	1.28	1.90	26	1.23	1.82	26	1.36	2.03
28	1.06	1.52	28	1.22	1.82	28	1.23	1.82	28	1.19	1.76	28	1.30	1.95
30	1.02	1.46	30	1.17	1.76	30	1.19	1.76	30	1.15	1.70	30	1.26	1.88
32	.99	1.41	32	1.13	1.70	32	1.14	1.70	32	1.11	1.64	32	1.21	1.81
34	.96	1.37	34	1.09	1.64	34	1.11	1.64	34	1.08	1.59	34	1.18	1.76
36	.93	1.32	36	1.06	1.59	36	1.07	1.59	36	1.05	1.55	36	1.14	1.70
38	.90	1.29	38	1.03	1.54	38	1.04	1.54	38	1.02	1.51	38	1.11	1.66
40	.87	1.25	40	1.00	1.50	40	1.01	1.50	40	.99	1.47	40	1.08	1.61
45	.82	1.17	45	.94	1.41	45	.95	1.41	45	.94	1.39	45	1.01	1.51
50	.77	1.11	50	.88	1.33	50	.90	1.33	50	.89	1.31	50	.96	1.43
55	.73	1.05	55	.84	1.26	55	.85	1.26	55	.85	1.25	55	.91	1.36
60	.70	1.00	60	.80	1.20	60	.81	1.20	60	.81	1.20	60	.87	1.30
65	.67	.96	65	.77	1.15	65	.78	1.15	65	.78	1.15	65	.83	1.25
70	.64	.92	70	.73	1.10	70	.74	1.10	70	.75	1.11	70	.80	1.20
75	.62	.88	75	.71	1.06	75	.72	1.06	75	.72	1.07	75	.77	1.15
80	.60	.85	80	.68	1.02	80	.69	1.02	80	.70	1.04	80	.75	1.12
85	.58	.83	85	.66	.99	85	.67	.99	85	.68	1.01	85	.72	1.08

SLOPE = .550

SLOPE = .550

SLOPE = .550

SLOPE = .500

SLOPE = .530

STANDARD  
 INTENSITY - DURATION  
 CURVES DATA

**RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II**

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<b><u>NATURAL COVERS -</u></b>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
<b><u>URBAN COVERS -</u></b>					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
<b><u>AGRICULTURAL COVERS -</u></b>					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

**EXISTING  
PROJECT  
TYPICAL  
COVER  
TYPE**

**RCFC & WCD**  
HYDROLOGY MANUAL

**RUNOFF INDEX NUMBERS  
FOR  
PERVIOUS AREAS**

**RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II**

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<b><u>NATURAL COVERS -</u></b>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
<b><u>URBAN COVERS -</u></b>					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
<b><u>AGRICULTURAL COVERS -</u></b>					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

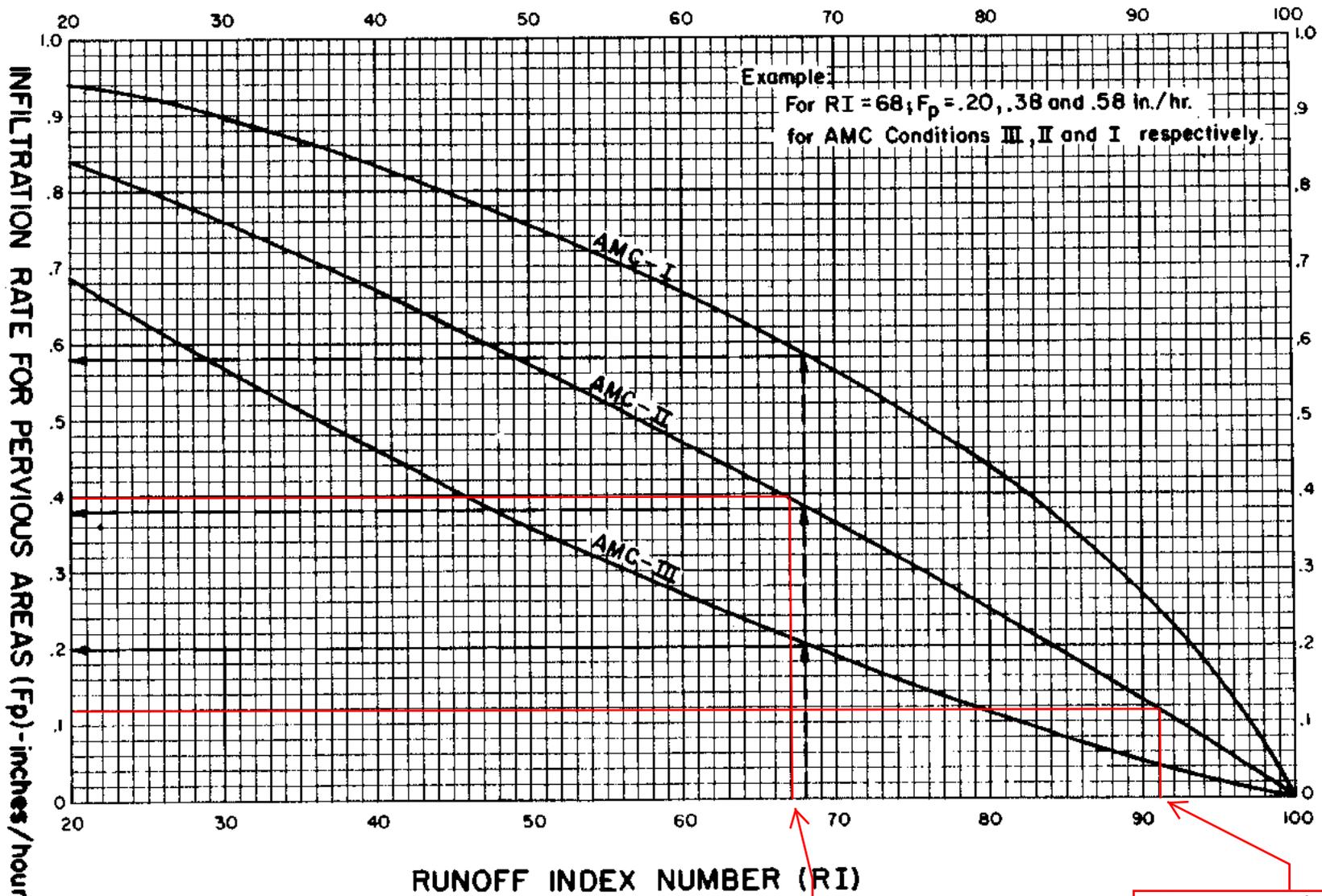
PROPOSED  
PROJECT  
TYPICAL  
COVER  
TYPE

**RCFC & WCD**  
HYDROLOGY MANUAL

**RUNOFF INDEX NUMBERS  
FOR  
PERVIOUS AREAS**

NOTES:

I. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography item No. 36.

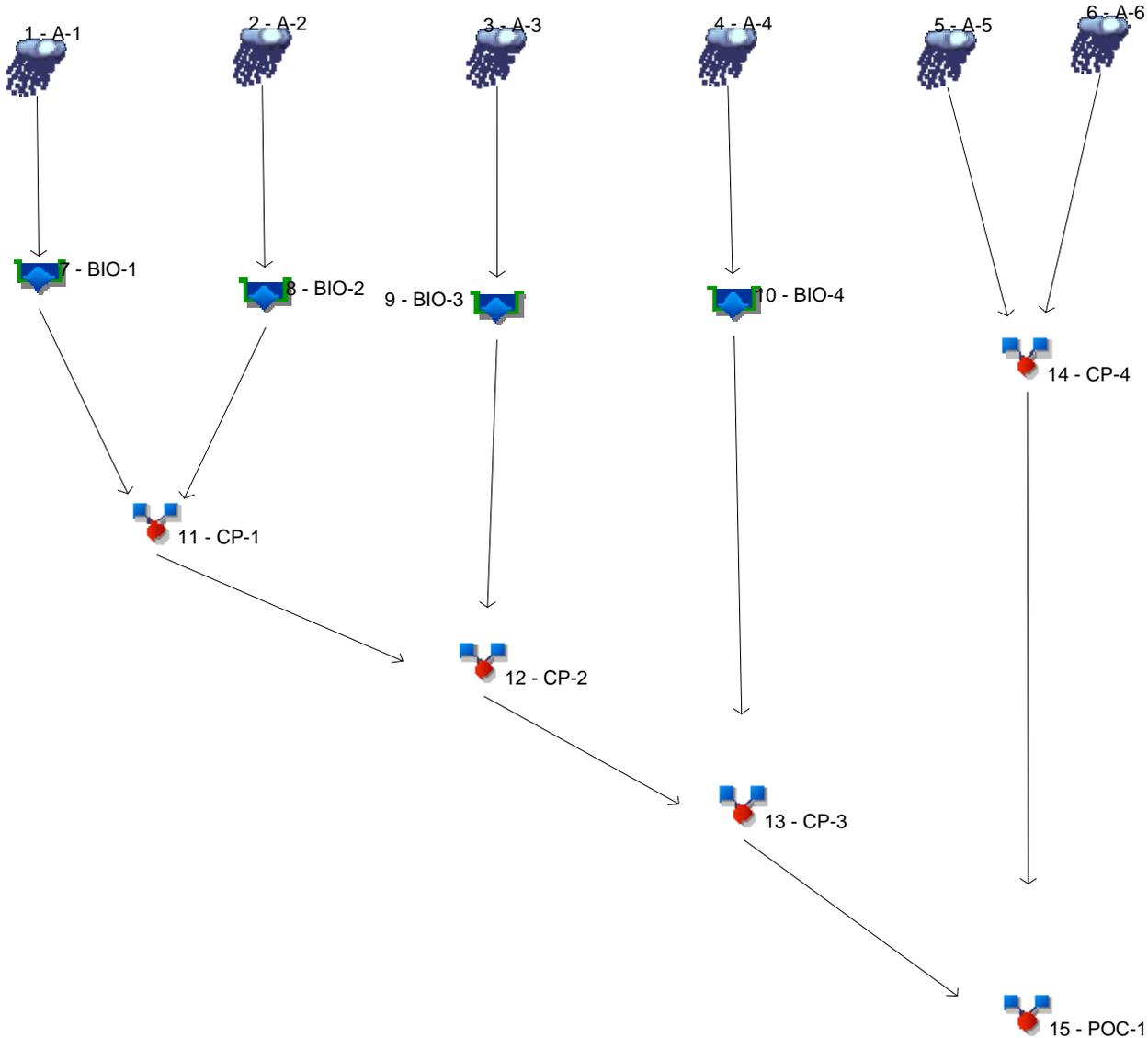


PROPOSED PROJECT SITE = 0.40 in/hr

EX-1 = 0.11 in/hr

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



## Legend

Hyd.	Origin	Description
1	Manual	A-1
2	Manual	A-2
3	Manual	A-3
4	Manual	A-4
5	Manual	A-5
6	Manual	A-6
7	Reservoir	BIO-1
8	Reservoir	BIO-2
9	Reservoir	BIO-3
10	Reservoir	BIO-4
11	Combine	CP-1
12	Combine	CP-2
13	Combine	CP-3
14	Combine	CP-4
15	Combine	POC-1

# Hydrograph Report

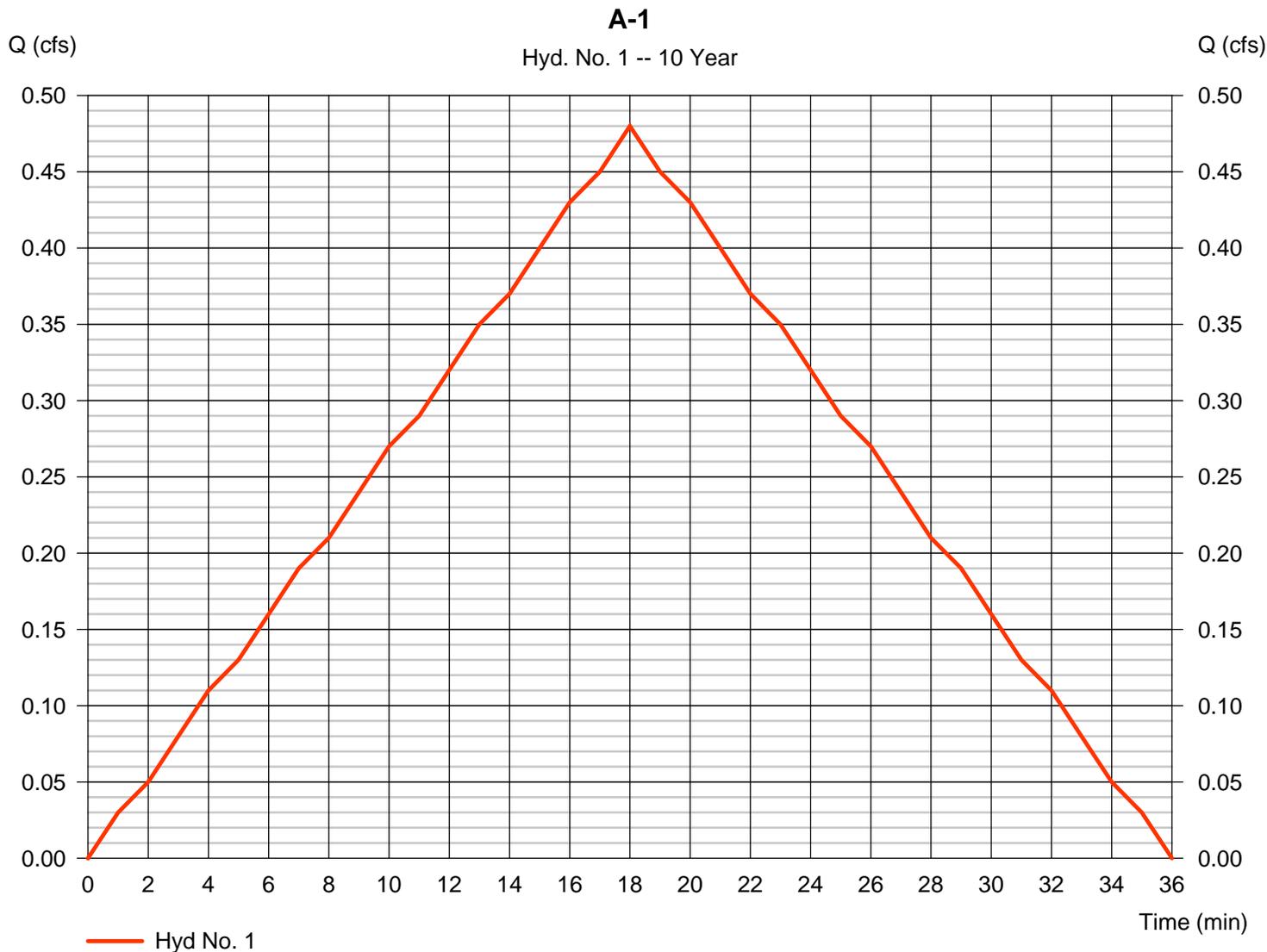
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 1

A-1

Hydrograph type	= Manual	Peak discharge	= 0.480 cfs
Storm frequency	= 10 yrs	Time to peak	= 18 min
Time interval	= 1 min	Hyd. volume	= 518 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

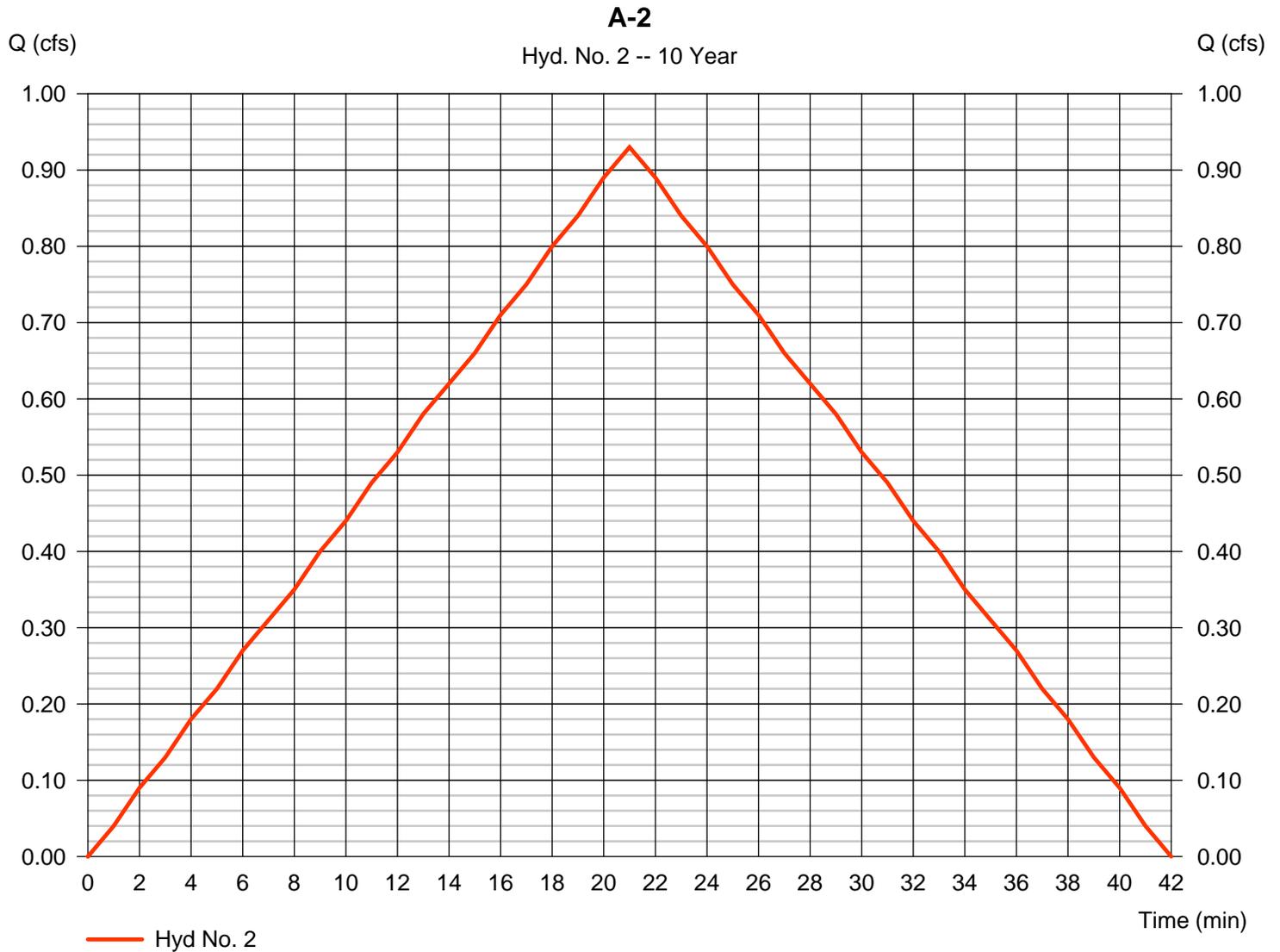
Tuesday, 04 / 3 / 2018

## Hyd. No. 2

A-2

Hydrograph type = Manual  
Storm frequency = 10 yrs  
Time interval = 1 min

Peak discharge = 0.930 cfs  
Time to peak = 21 min  
Hyd. volume = 1,172 cuft



# Hydrograph Report

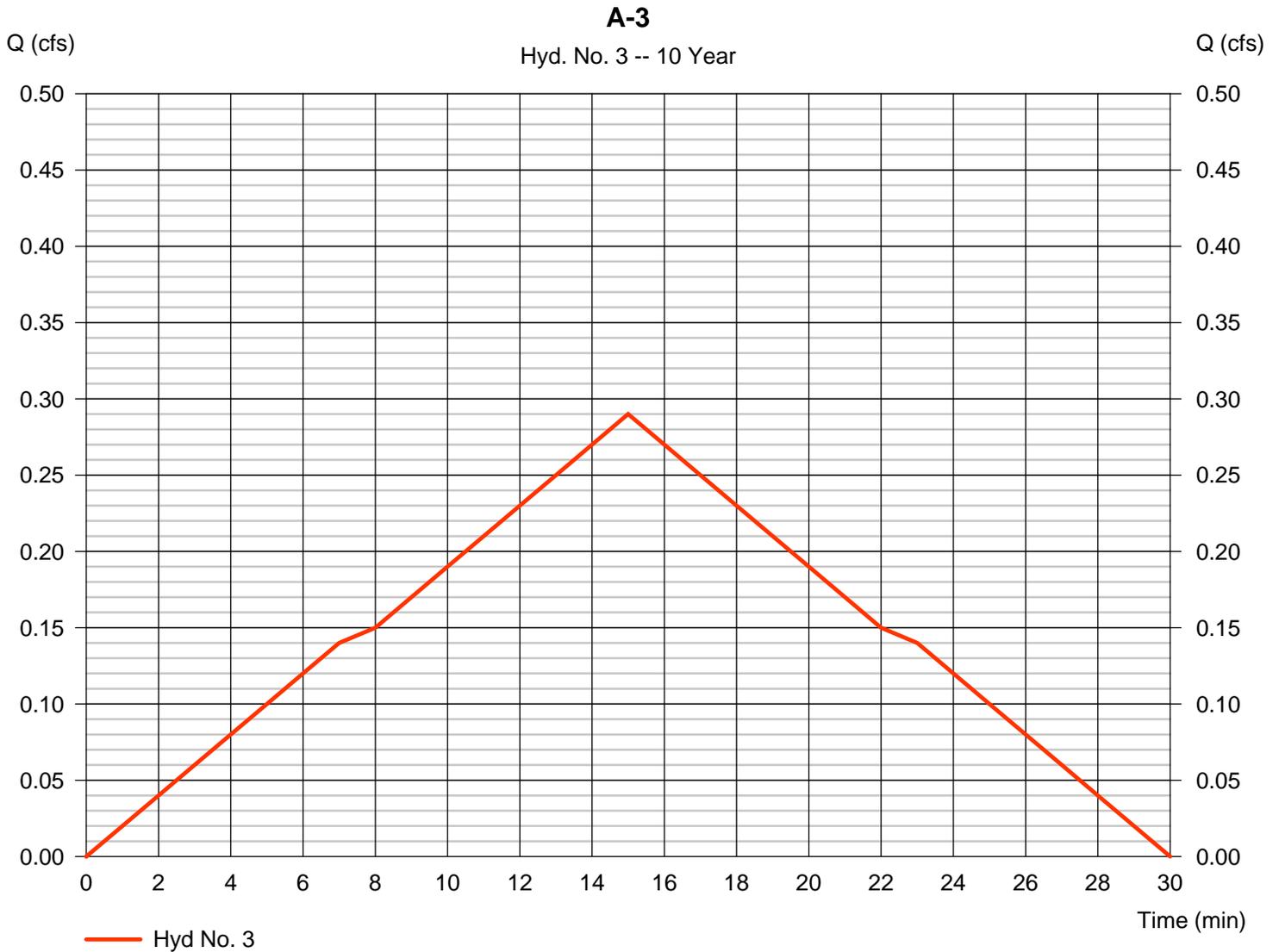
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 3

A-3

Hydrograph type	= Manual	Peak discharge	= 0.290 cfs
Storm frequency	= 10 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 261 cuft



# Hydrograph Report

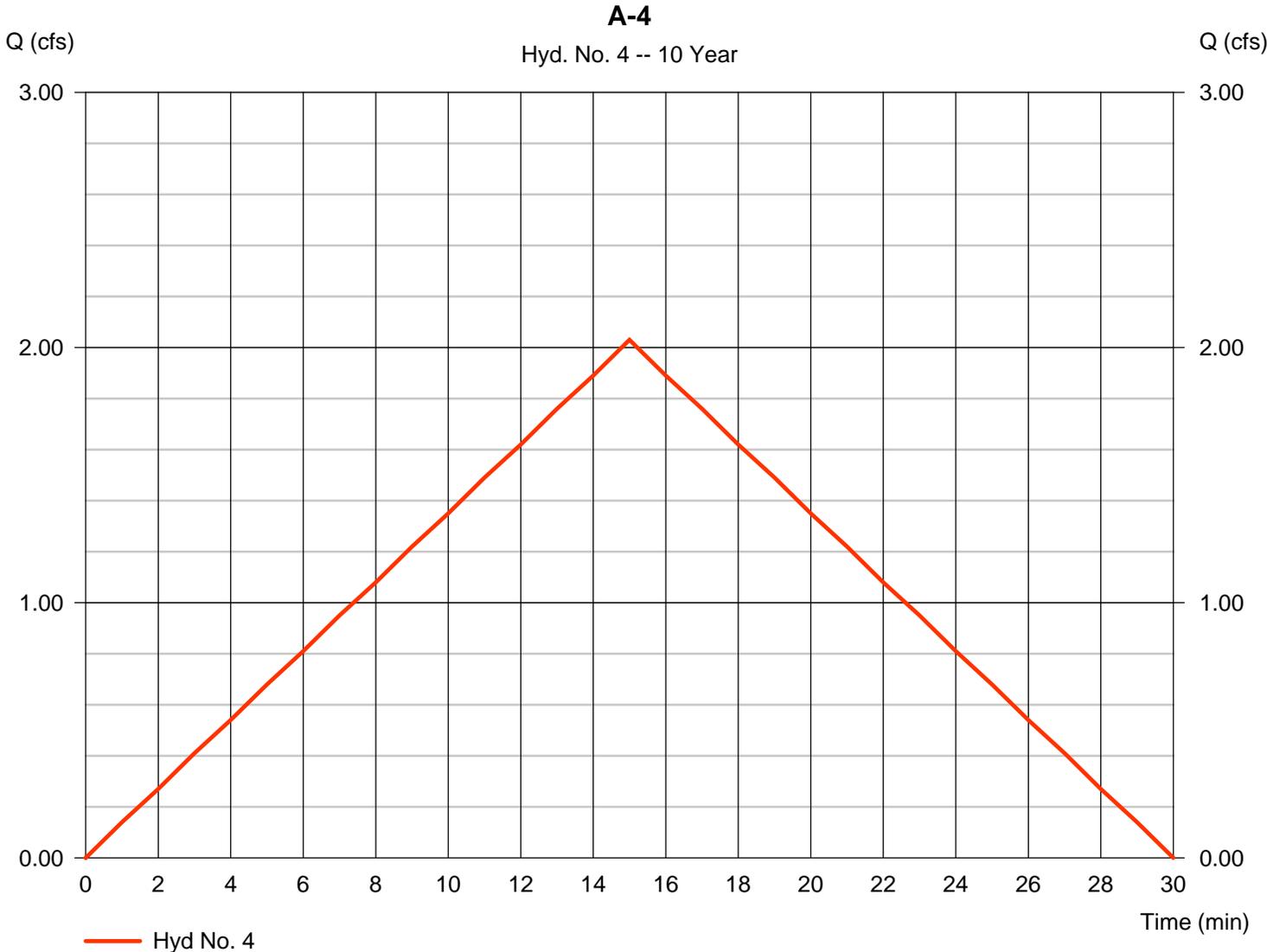
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 4

A-4

Hydrograph type	= Manual	Peak discharge	= 2.030 cfs
Storm frequency	= 10 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 1,827 cuft

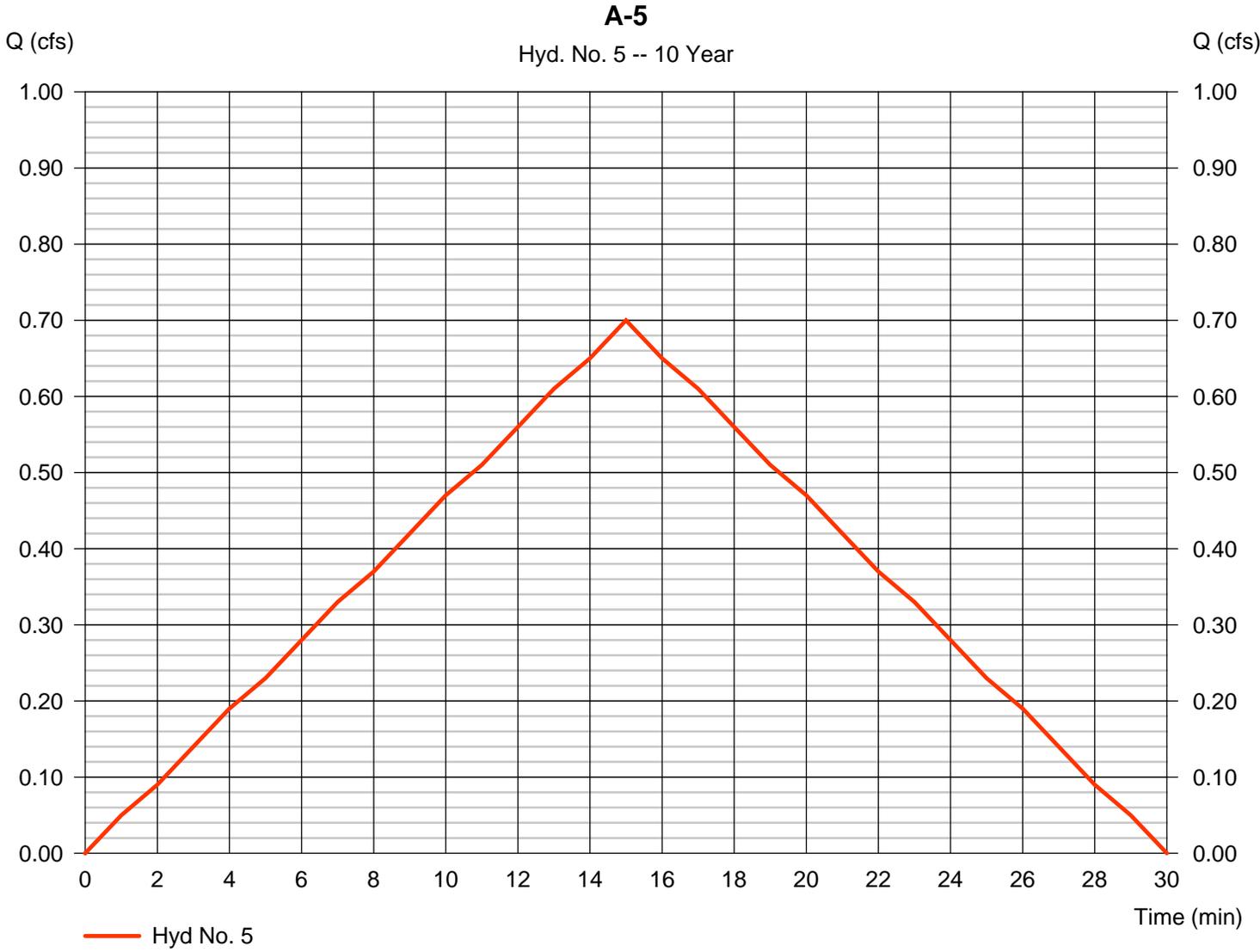


# Hydrograph Report

## Hyd. No. 5

A-5

Hydrograph type	= Manual	Peak discharge	= 0.700 cfs
Storm frequency	= 10 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 630 cuft



# Hydrograph Report

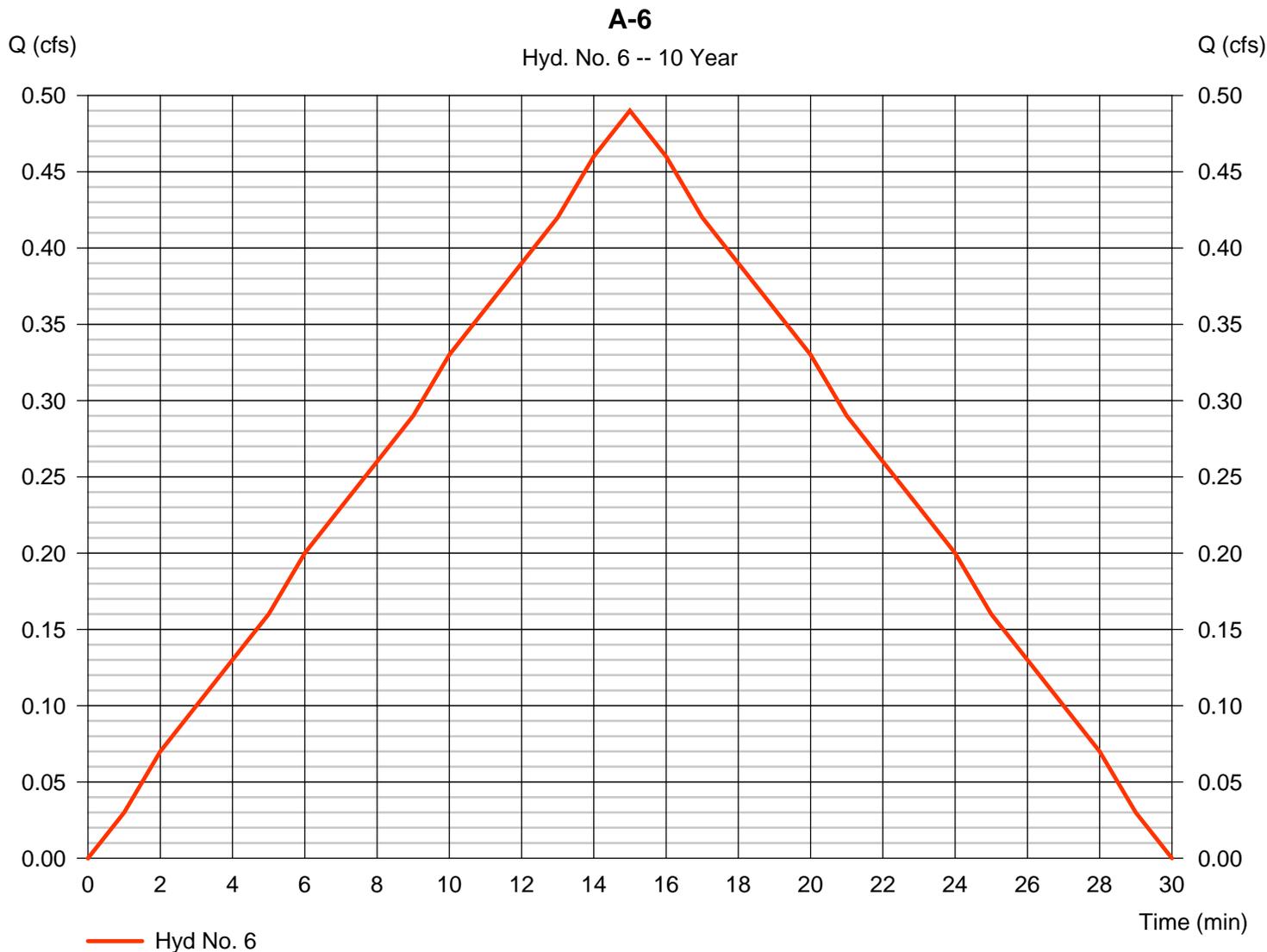
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 6

A-6

Hydrograph type	= Manual	Peak discharge	= 0.490 cfs
Storm frequency	= 10 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 441 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

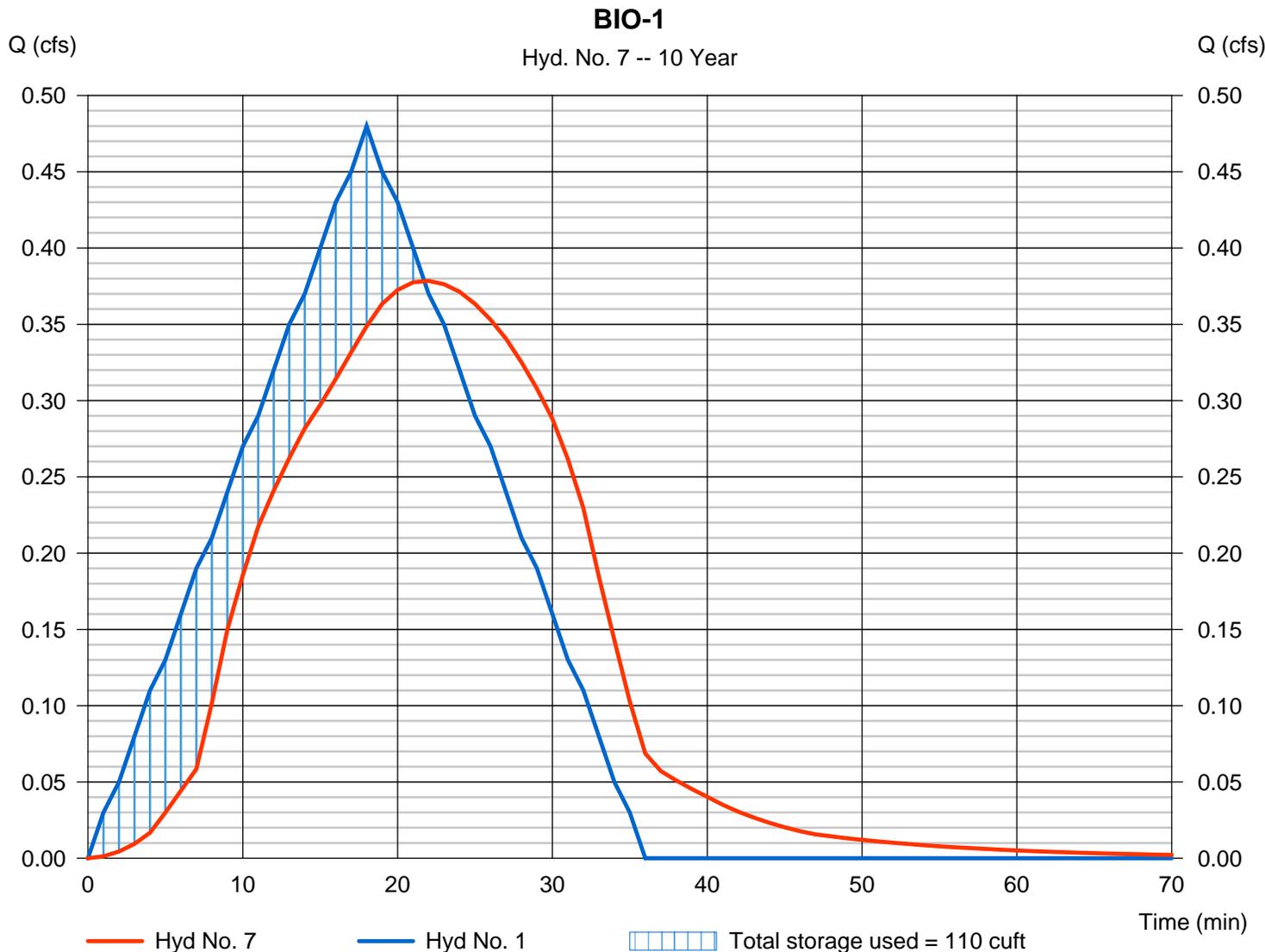
Tuesday, 04 / 3 / 2018

## Hyd. No. 7

BIO-1

Hydrograph type	= Reservoir	Peak discharge	= 0.378 cfs
Storm frequency	= 10 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 518 cuft
Inflow hyd. No.	= 1 - A-1	Max. Elevation	= 100.98 ft
Reservoir name	= BIO-1	Max. Storage	= 110 cuft

Storage Indication method used.



# Hydrograph Report

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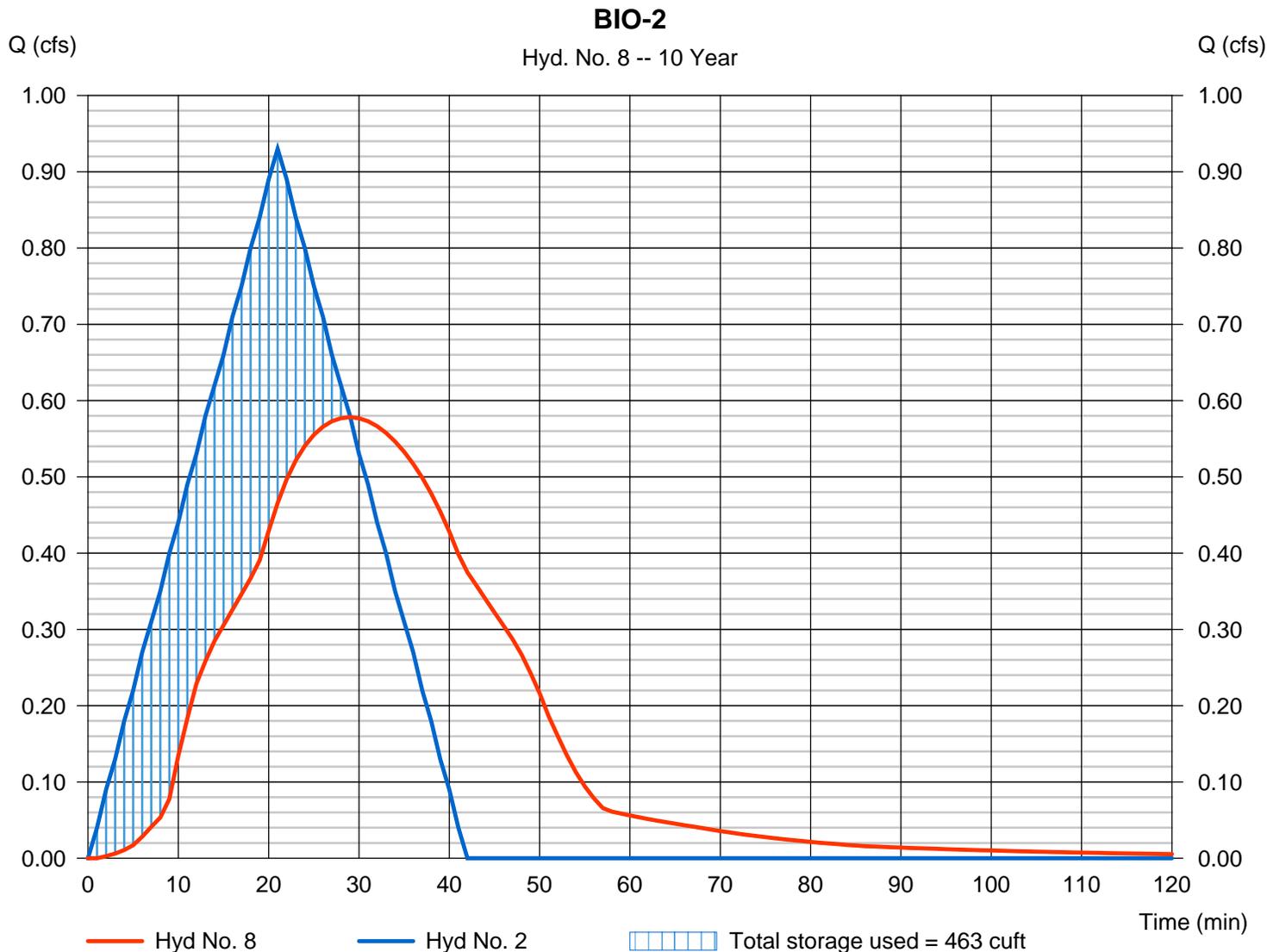
Tuesday, 04 / 3 / 2018

## Hyd. No. 8

BIO-2

Hydrograph type	= Reservoir	Peak discharge	= 0.578 cfs
Storm frequency	= 10 yrs	Time to peak	= 29 min
Time interval	= 1 min	Hyd. volume	= 1,170 cuft
Inflow hyd. No.	= 2 - A-2	Max. Elevation	= 102.06 ft
Reservoir name	= BIO-2	Max. Storage	= 463 cuft

Storage Indication method used.



# Hydrograph Report

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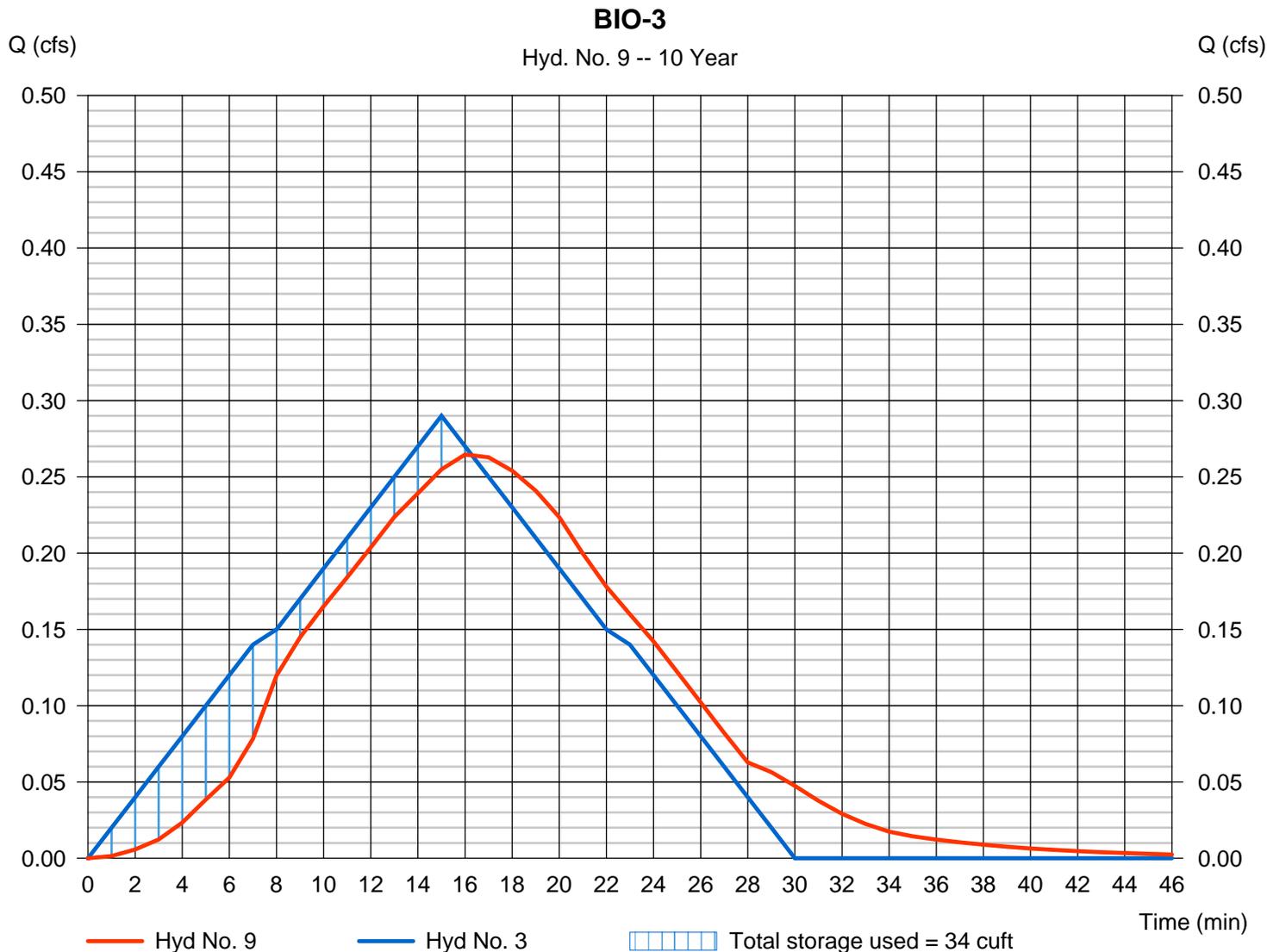
Tuesday, 04 / 3 / 2018

## Hyd. No. 9

BIO-3

Hydrograph type	= Reservoir	Peak discharge	= 0.265 cfs
Storm frequency	= 10 yrs	Time to peak	= 16 min
Time interval	= 1 min	Hyd. volume	= 261 cuft
Inflow hyd. No.	= 3 - A-3	Max. Elevation	= 100.58 ft
Reservoir name	= BIO-3	Max. Storage	= 34 cuft

Storage Indication method used.



# Hydrograph Report

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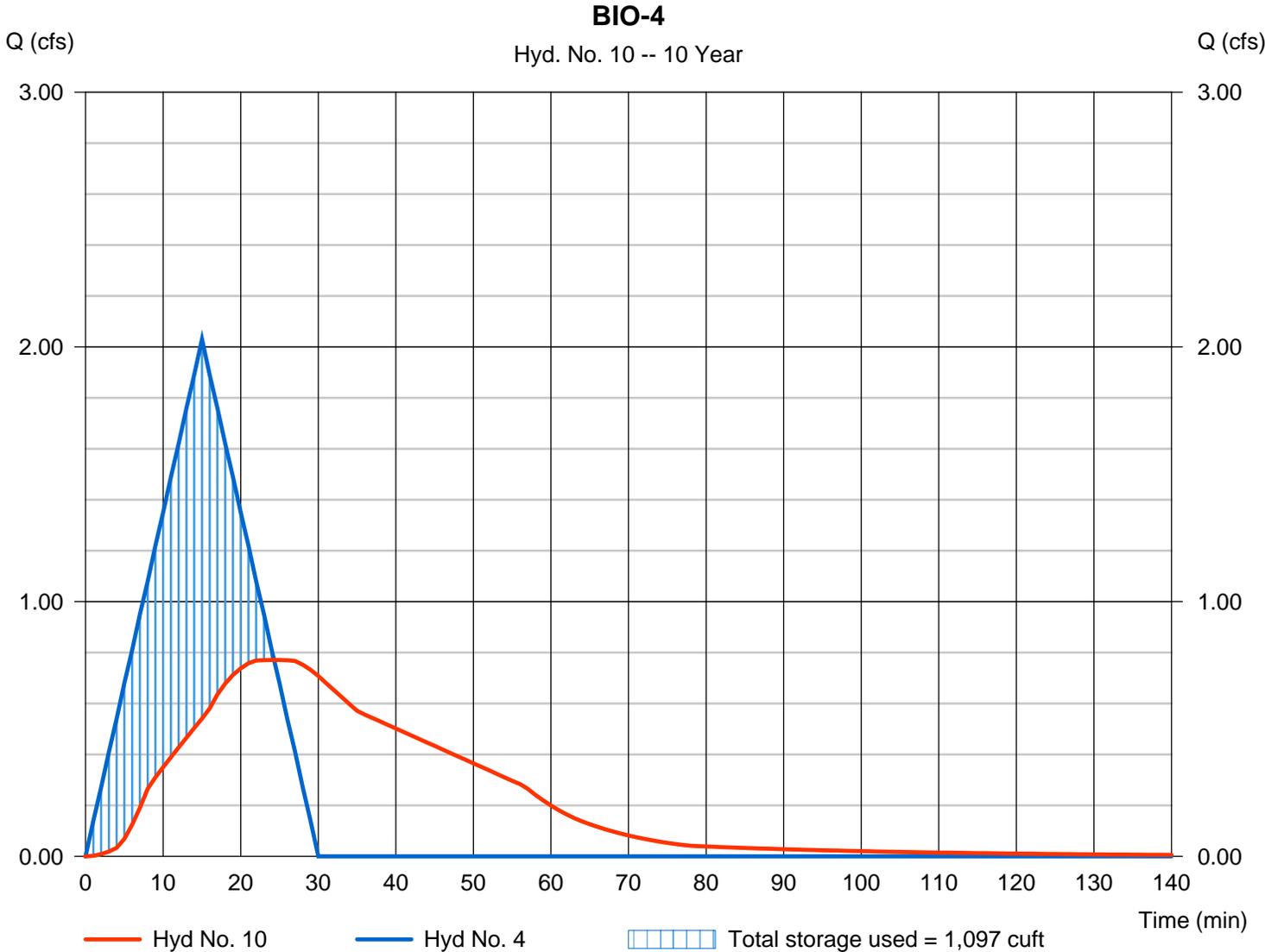
Tuesday, 04 / 3 / 2018

## Hyd. No. 10

BIO-4

Hydrograph type	= Reservoir	Peak discharge	= 0.771 cfs
Storm frequency	= 10 yrs	Time to peak	= 24 min
Time interval	= 1 min	Hyd. volume	= 1,825 cuft
Inflow hyd. No.	= 4 - A-4	Max. Elevation	= 103.54 ft
Reservoir name	= BIO-4	Max. Storage	= 1,097 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

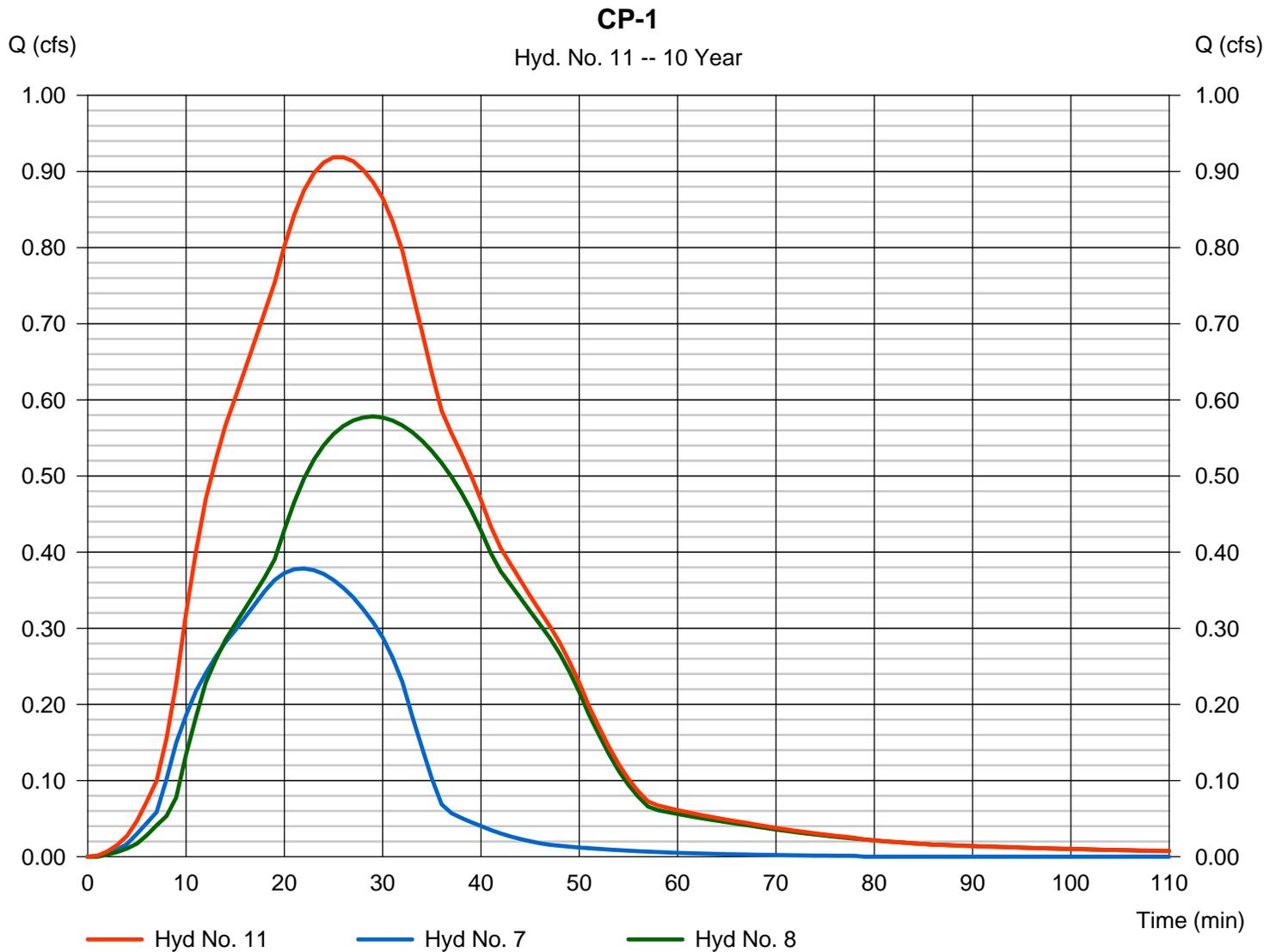
Tuesday, 04 / 3 / 2018

## Hyd. No. 11

CP-1

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 7, 8

Peak discharge = 0.919 cfs  
Time to peak = 26 min  
Hyd. volume = 1,688 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

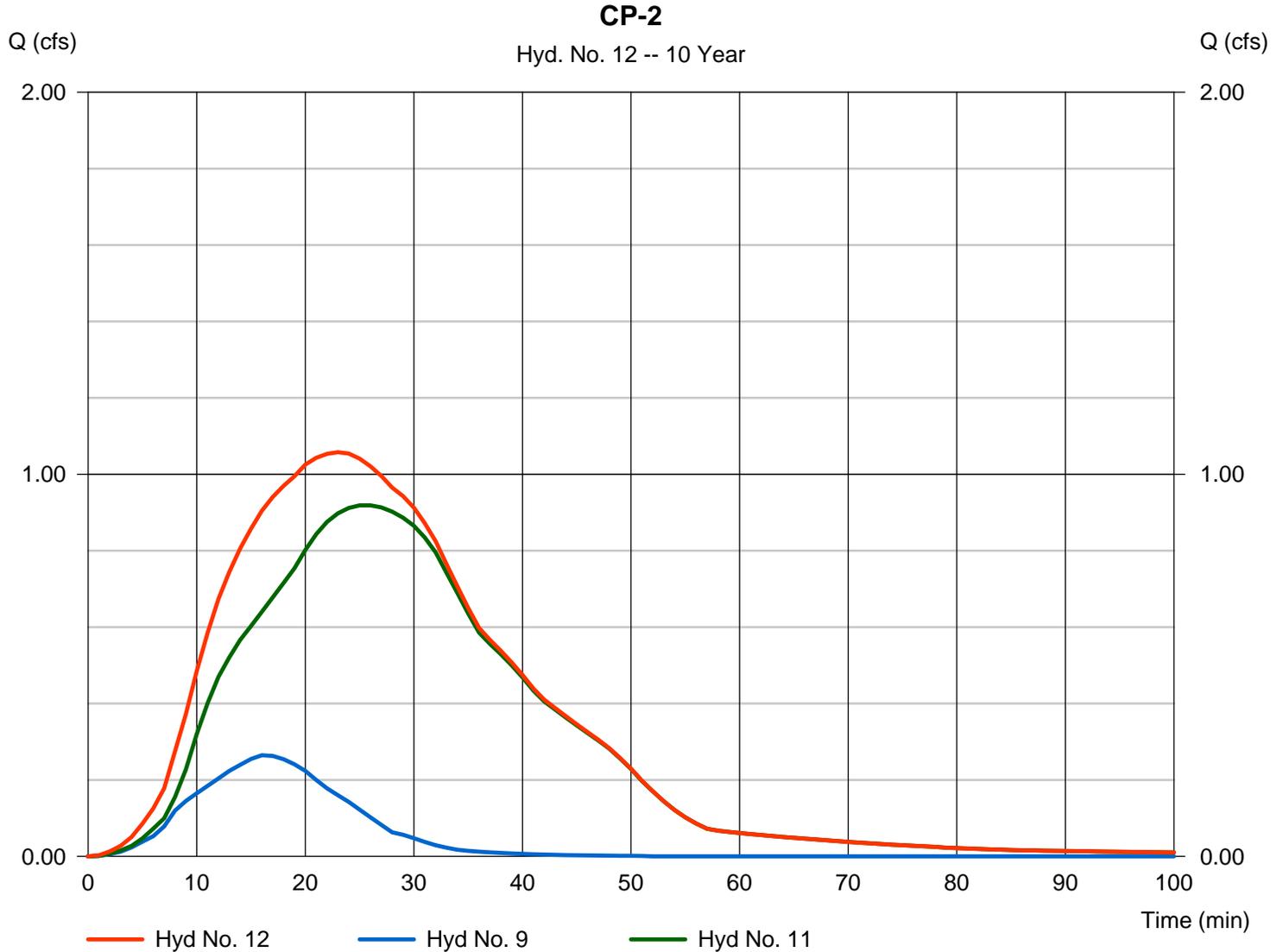
Tuesday, 04 / 3 / 2018

## Hyd. No. 12

CP-2

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 9, 11

Peak discharge = 1.058 cfs  
Time to peak = 23 min  
Hyd. volume = 1,948 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

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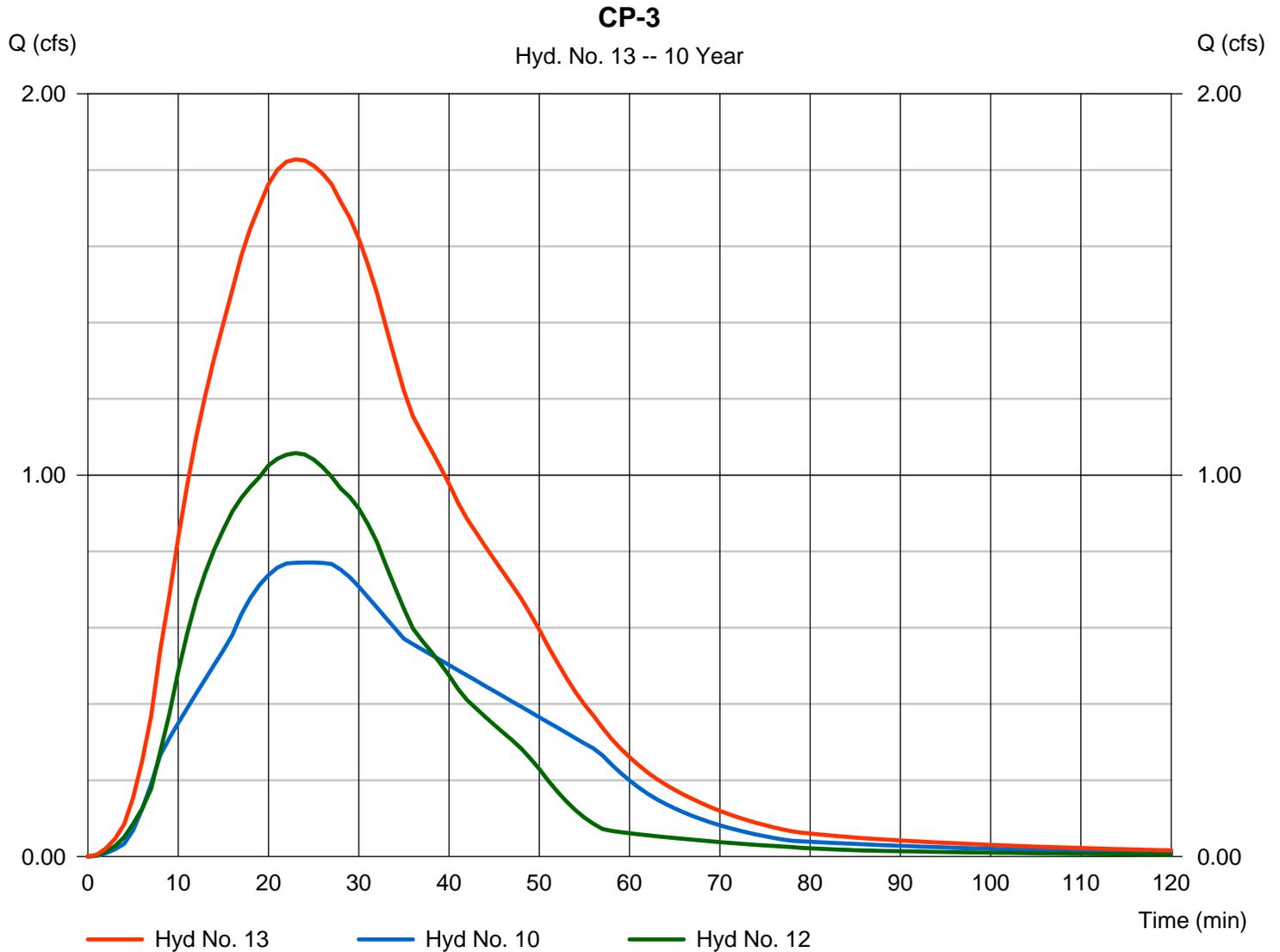
Tuesday, 04 / 3 / 2018

## Hyd. No. 13

CP-3

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 10, 12

Peak discharge = 1.828 cfs  
Time to peak = 23 min  
Hyd. volume = 3,773 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

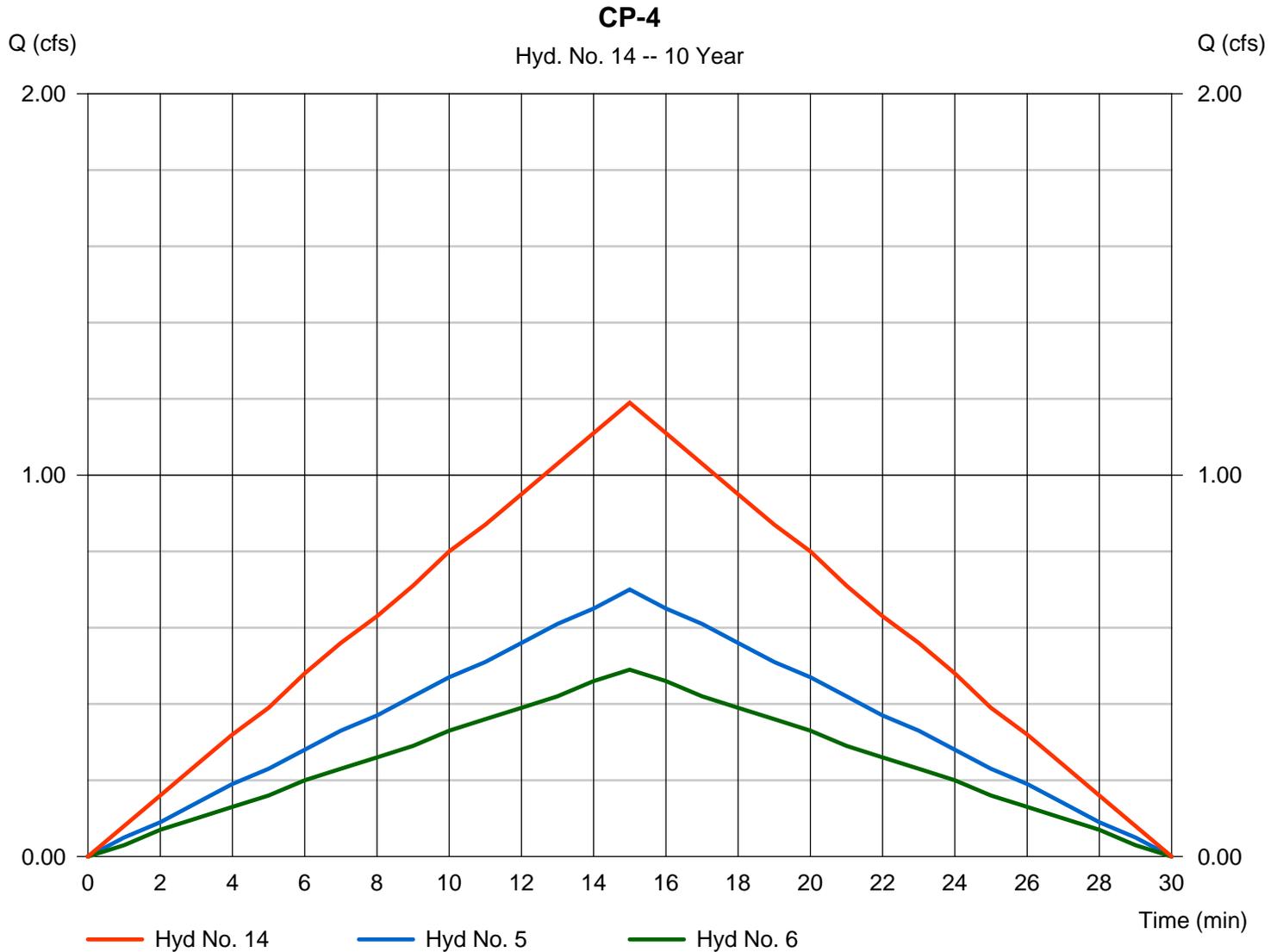
Tuesday, 04 / 3 / 2018

## Hyd. No. 14

CP-4

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 5, 6

Peak discharge = 1.190 cfs  
Time to peak = 15 min  
Hyd. volume = 1,071 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

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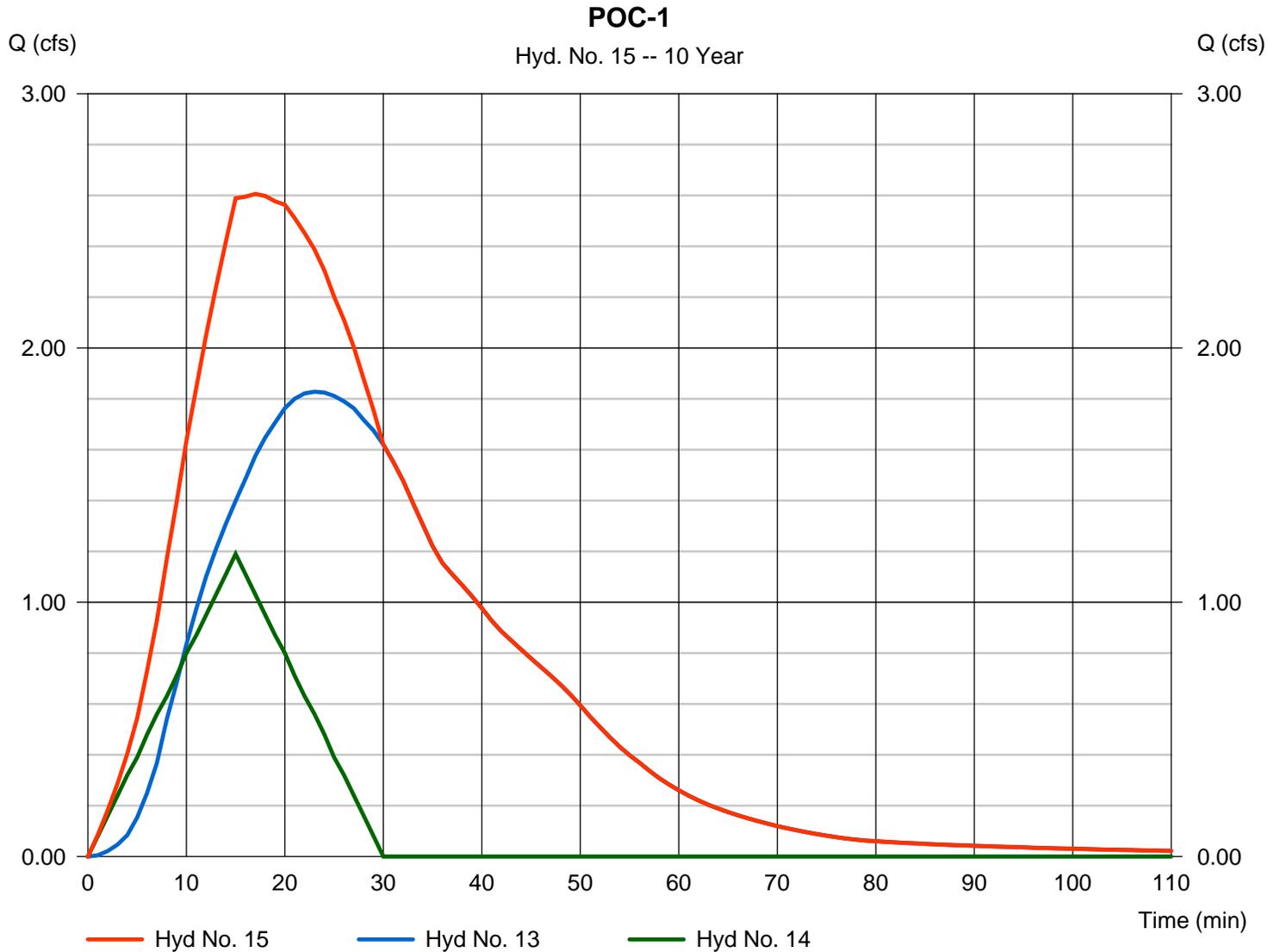
Tuesday, 04 / 3 / 2018

## Hyd. No. 15

POC-1

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 13, 14

Peak discharge = 2.606 cfs  
Time to peak = 17 min  
Hyd. volume = 4,844 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

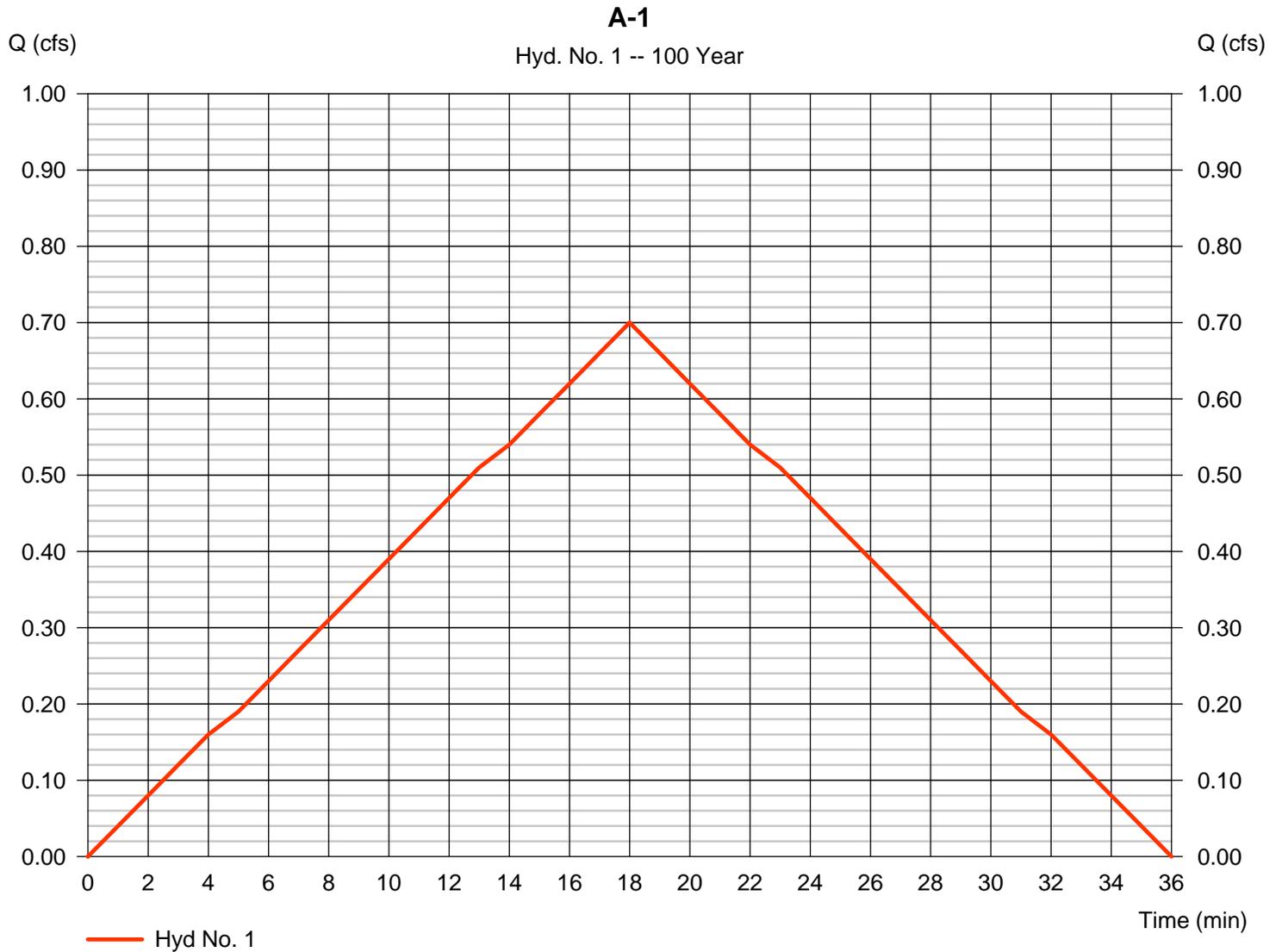
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 1

A-1

Hydrograph type	= Manual	Peak discharge	= 0.700 cfs
Storm frequency	= 100 yrs	Time to peak	= 18 min
Time interval	= 1 min	Hyd. volume	= 756 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 2

A-2

Hydrograph type = Manual  
Storm frequency = 100 yrs  
Time interval = 1 min

Peak discharge = 1.350 cfs  
Time to peak = 21 min  
Hyd. volume = 1,699 cuft



# Hydrograph Report

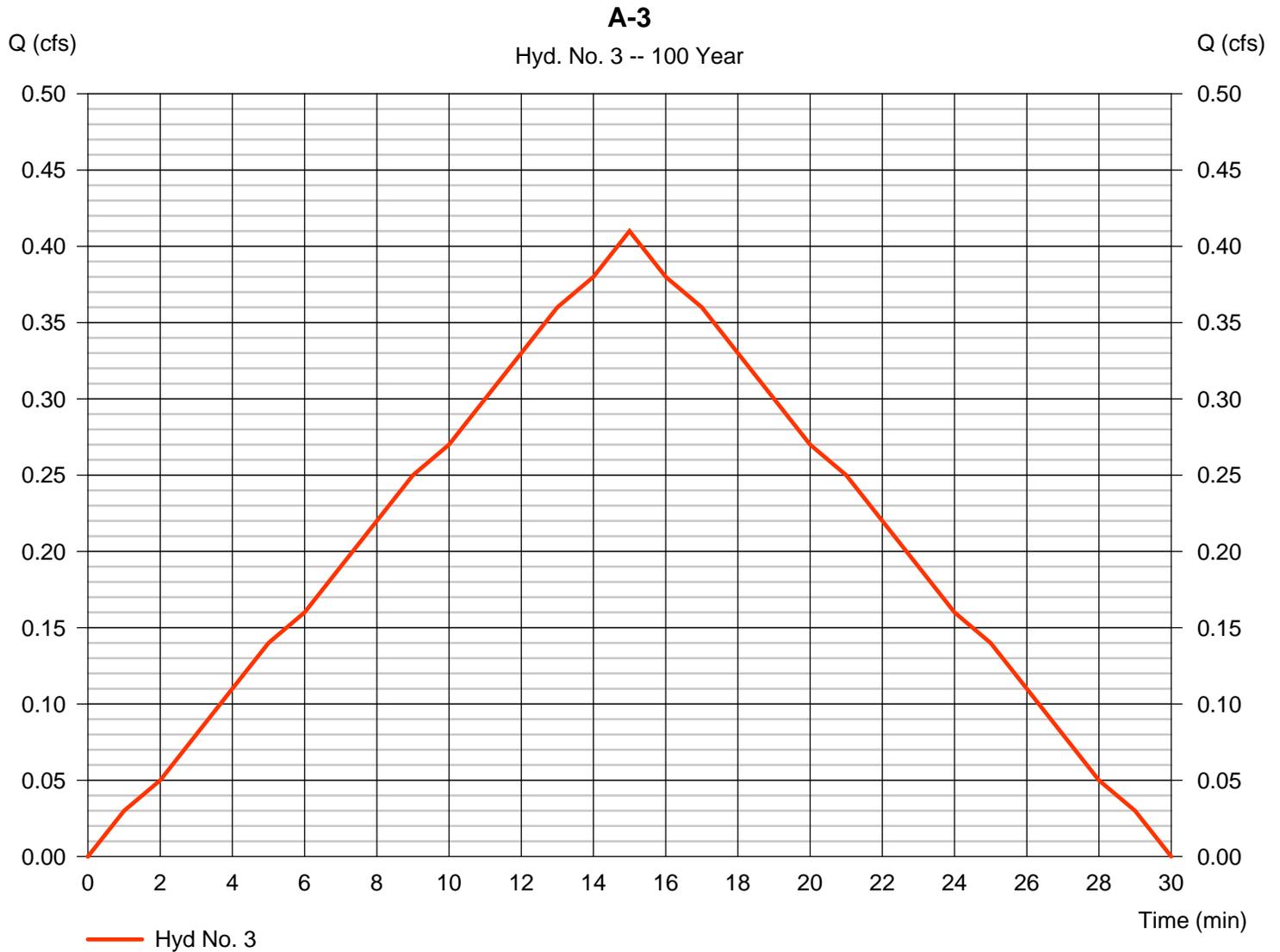
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

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## Hyd. No. 3

A-3

Hydrograph type	= Manual	Peak discharge	= 0.410 cfs
Storm frequency	= 100 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 369 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

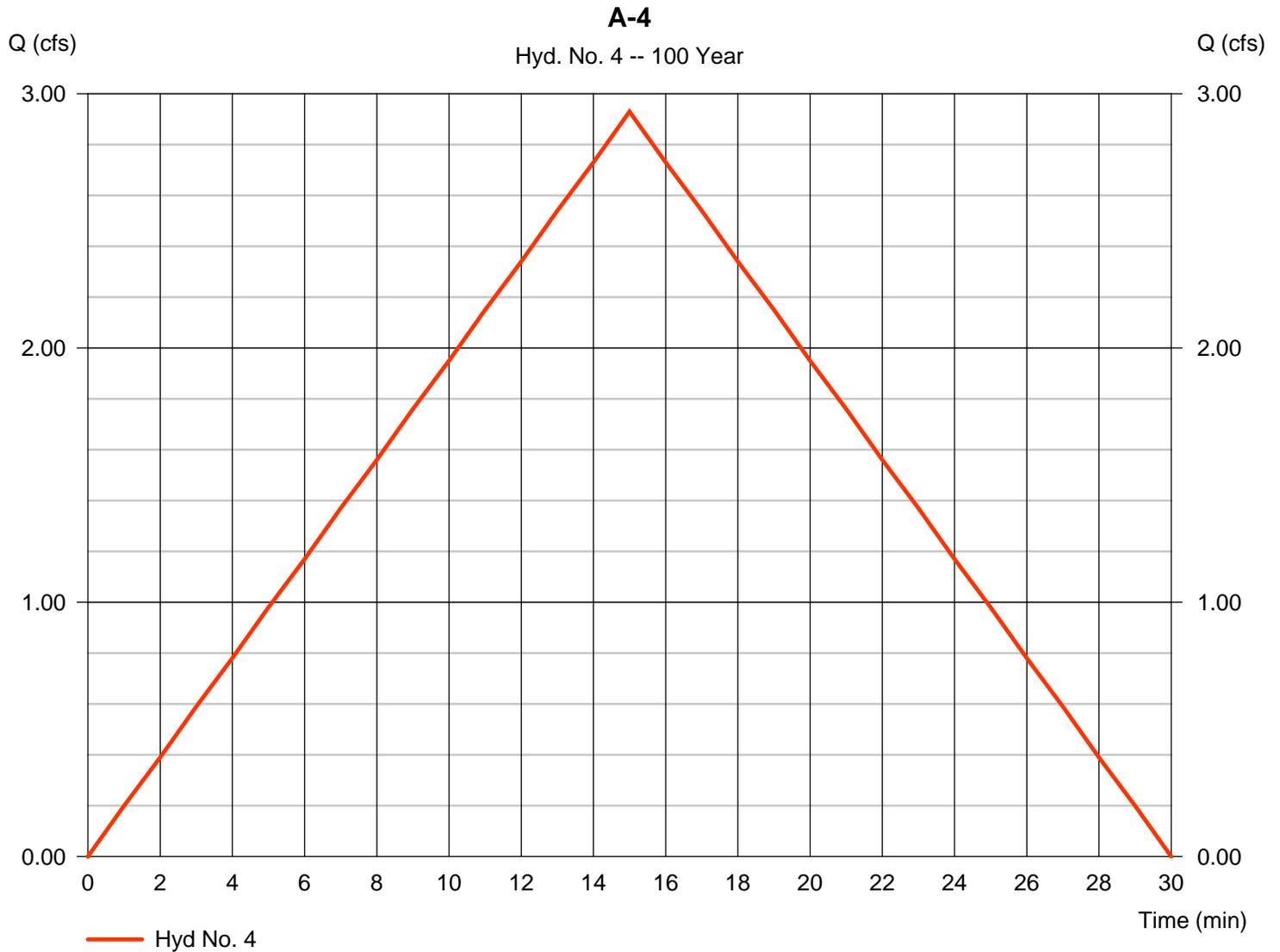
Tuesday, 04 / 3 / 2018

## Hyd. No. 4

A-4

Hydrograph type = Manual  
Storm frequency = 100 yrs  
Time interval = 1 min

Peak discharge = 2.930 cfs  
Time to peak = 15 min  
Hyd. volume = 2,637 cuft



# Hydrograph Report

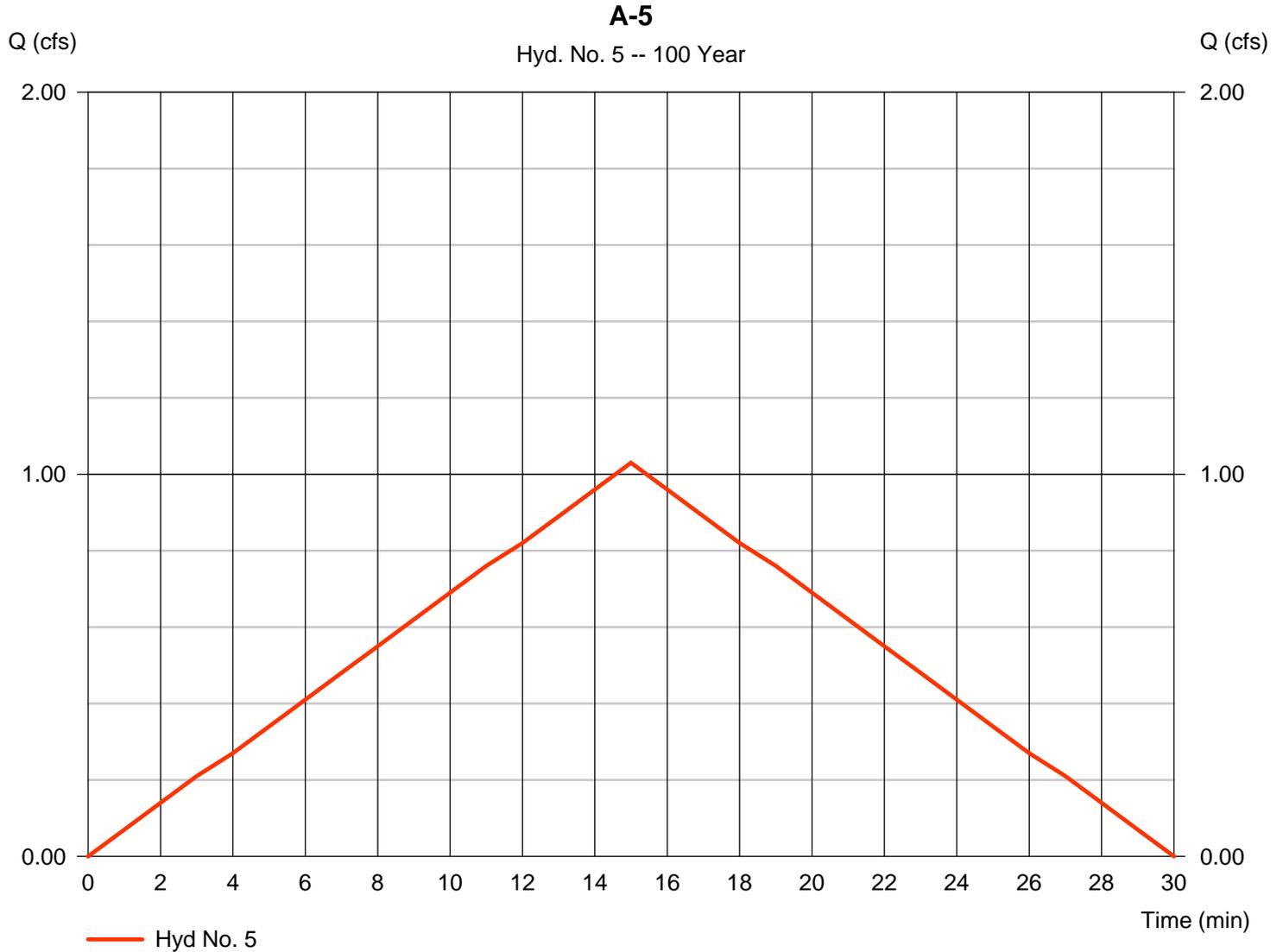
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 5

A-5

Hydrograph type	= Manual	Peak discharge	= 1.030 cfs
Storm frequency	= 100 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 927 cuft



# Hydrograph Report

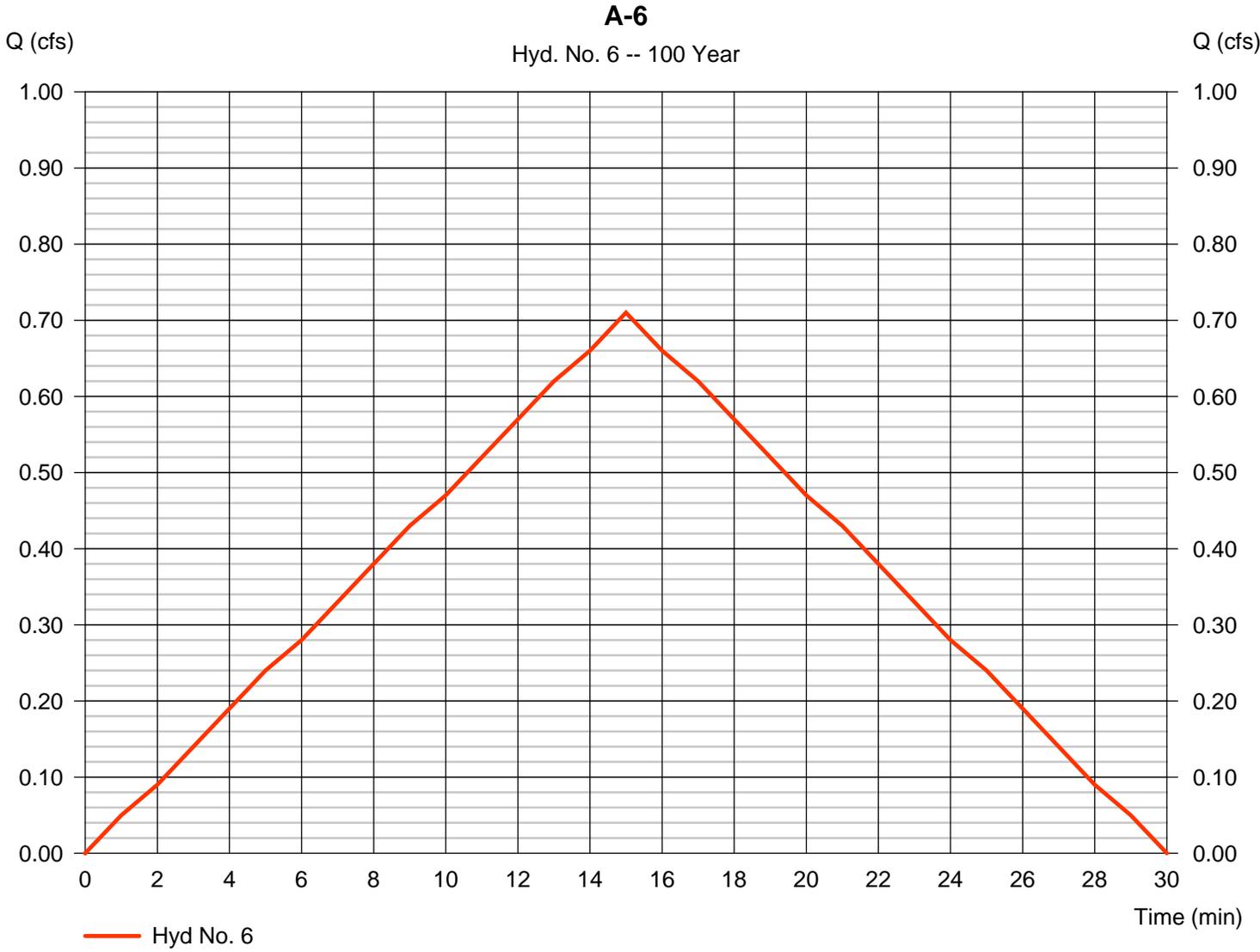
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 6

A-6

Hydrograph type	= Manual	Peak discharge	= 0.710 cfs
Storm frequency	= 100 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 639 cuft



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

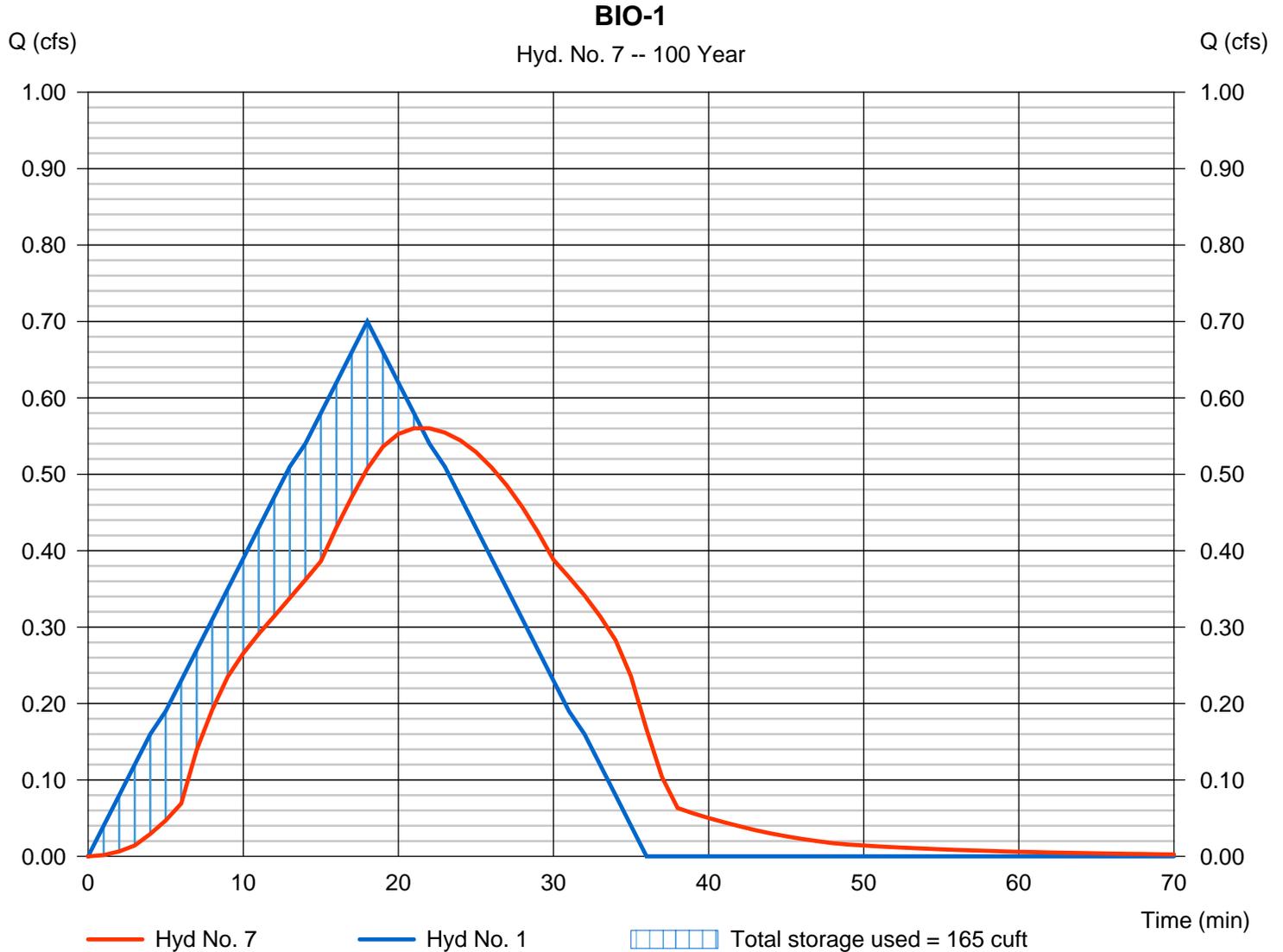
Tuesday, 04 / 3 / 2018

## Hyd. No. 7

BIO-1

Hydrograph type	= Reservoir	Peak discharge	= 0.560 cfs
Storm frequency	= 100 yrs	Time to peak	= 21 min
Time interval	= 1 min	Hyd. volume	= 755 cuft
Inflow hyd. No.	= 1 - A-1	Max. Elevation	= 101.95 ft
Reservoir name	= BIO-1	Max. Storage	= 165 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

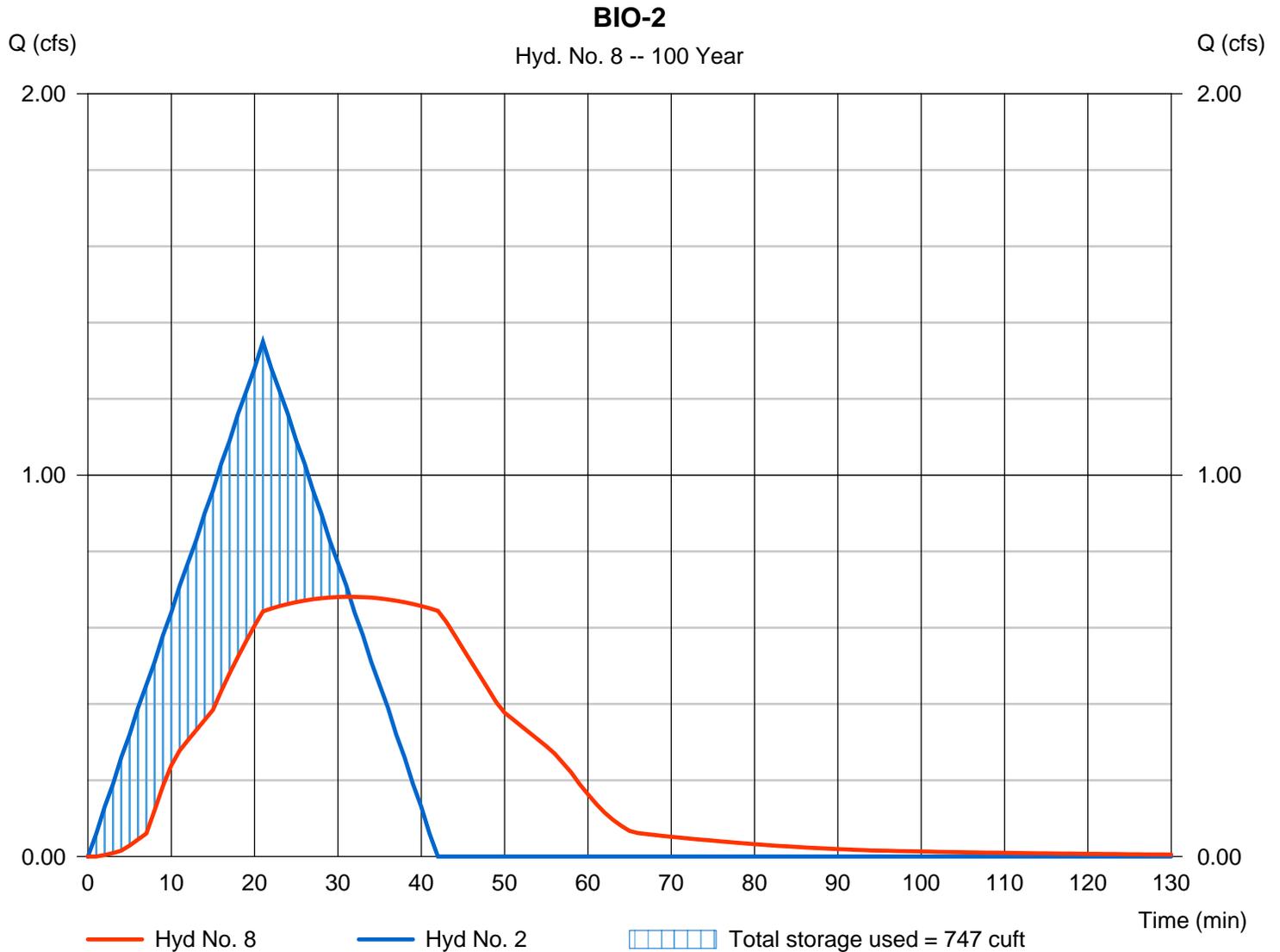
Tuesday, 04 / 3 / 2018

## Hyd. No. 8

BIO-2

Hydrograph type	= Reservoir	Peak discharge	= 0.681 cfs
Storm frequency	= 100 yrs	Time to peak	= 31 min
Time interval	= 1 min	Hyd. volume	= 1,697 cuft
Inflow hyd. No.	= 2 - A-2	Max. Elevation	= 102.79 ft
Reservoir name	= BIO-2	Max. Storage	= 747 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

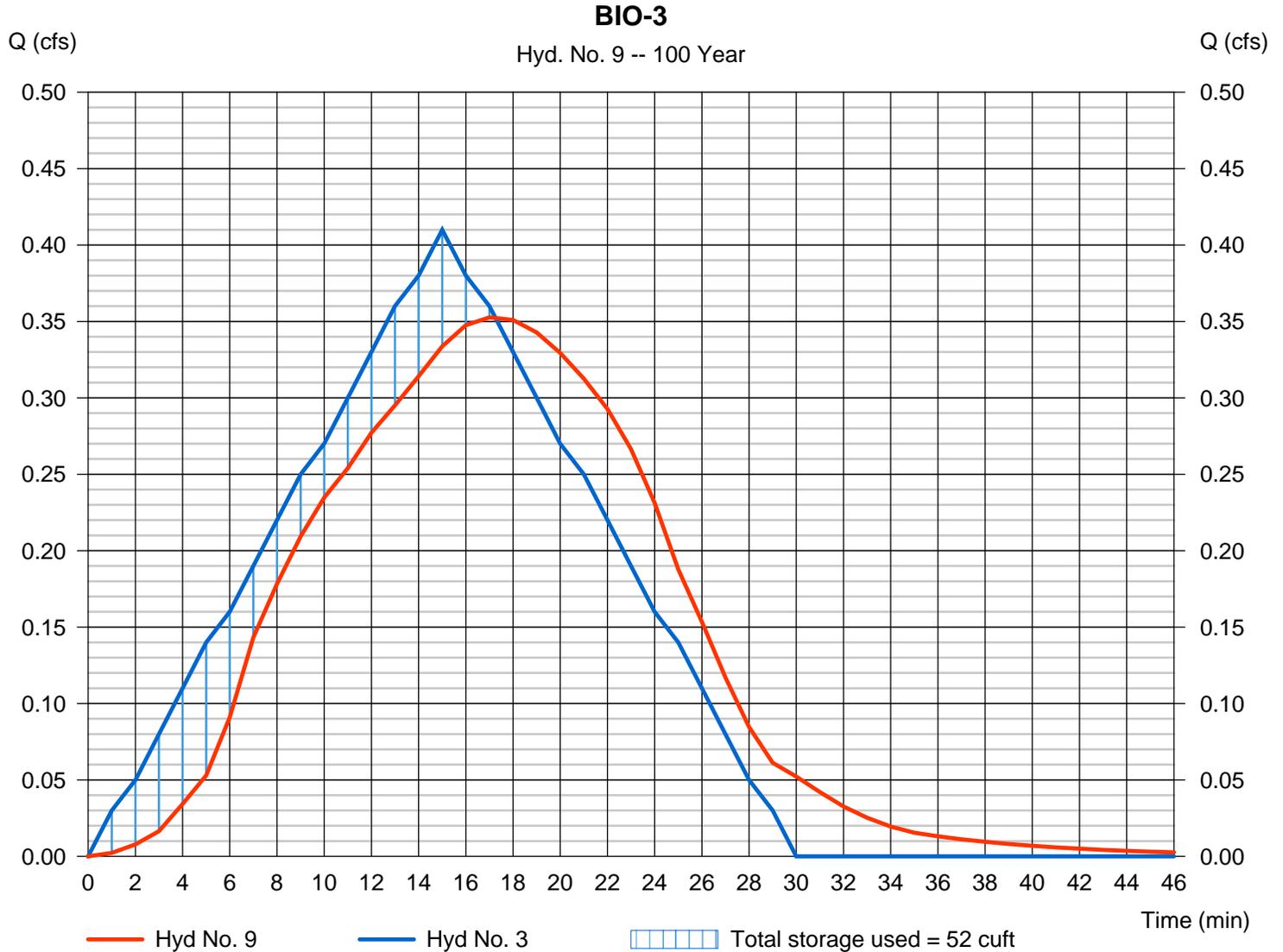
Tuesday, 04 / 3 / 2018

## Hyd. No. 9

BIO-3

Hydrograph type	= Reservoir	Peak discharge	= 0.353 cfs
Storm frequency	= 100 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 369 cuft
Inflow hyd. No.	= 3 - A-3	Max. Elevation	= 100.88 ft
Reservoir name	= BIO-3	Max. Storage	= 52 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

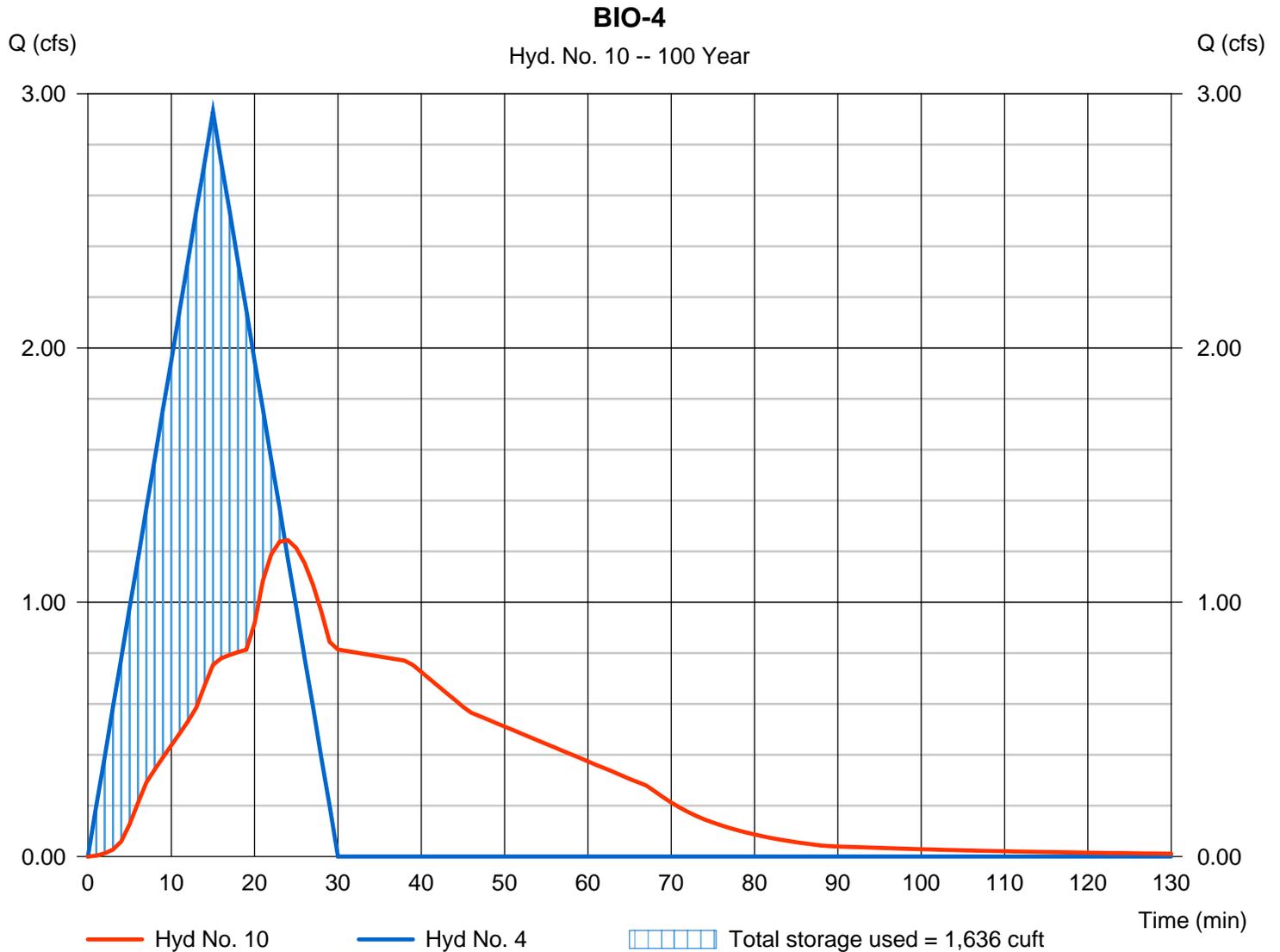
Tuesday, 04 / 3 / 2018

## Hyd. No. 10

BIO-4

Hydrograph type	= Reservoir	Peak discharge	= 1.244 cfs
Storm frequency	= 100 yrs	Time to peak	= 24 min
Time interval	= 1 min	Hyd. volume	= 2,635 cuft
Inflow hyd. No.	= 4 - A-4	Max. Elevation	= 104.09 ft
Reservoir name	= BIO-4	Max. Storage	= 1,636 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

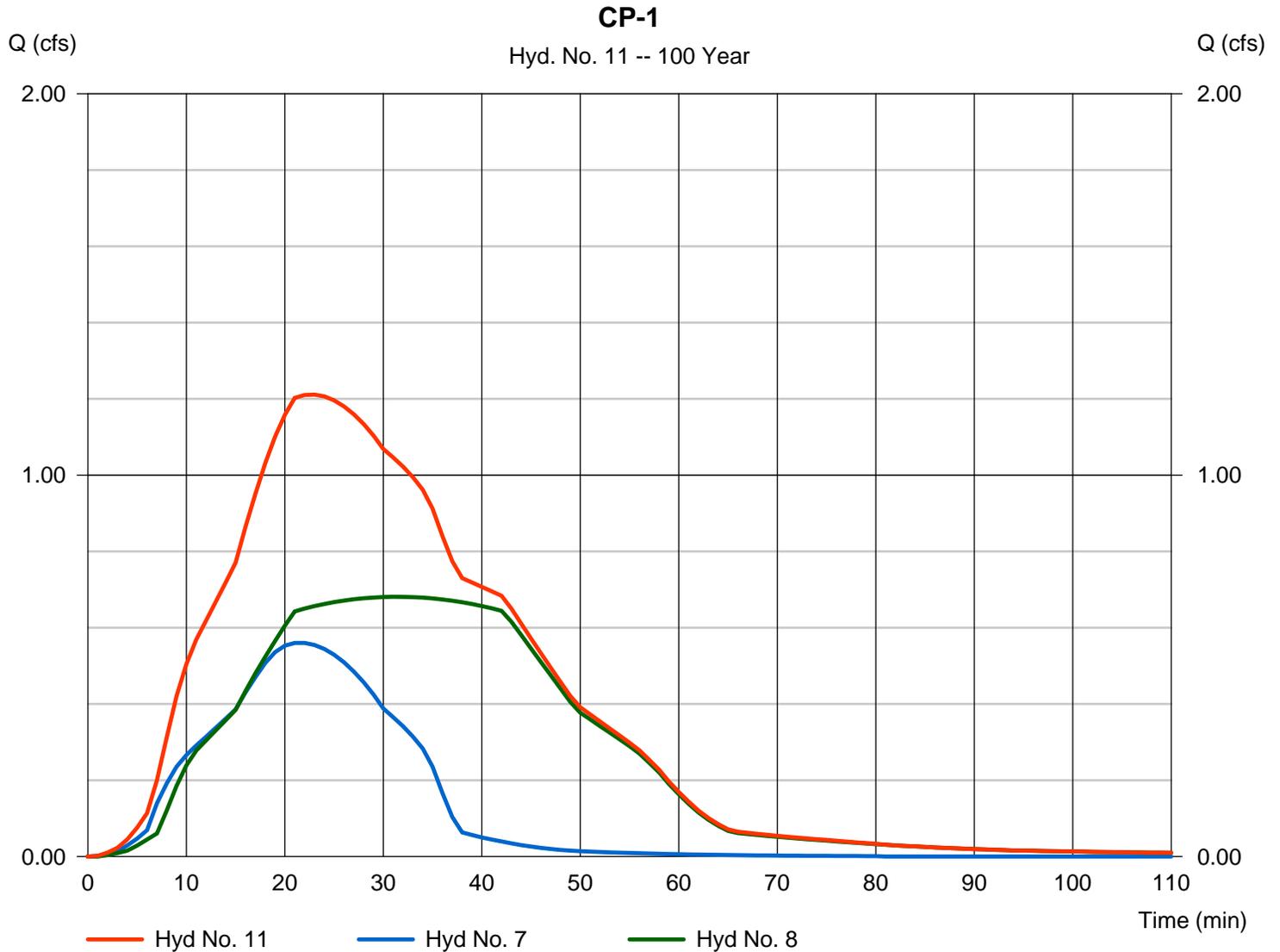
Tuesday, 04 / 3 / 2018

## Hyd. No. 11

CP-1

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Inflow hyds. = 7, 8

Peak discharge = 1.211 cfs  
 Time to peak = 23 min  
 Hyd. volume = 2,452 cuft  
 Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

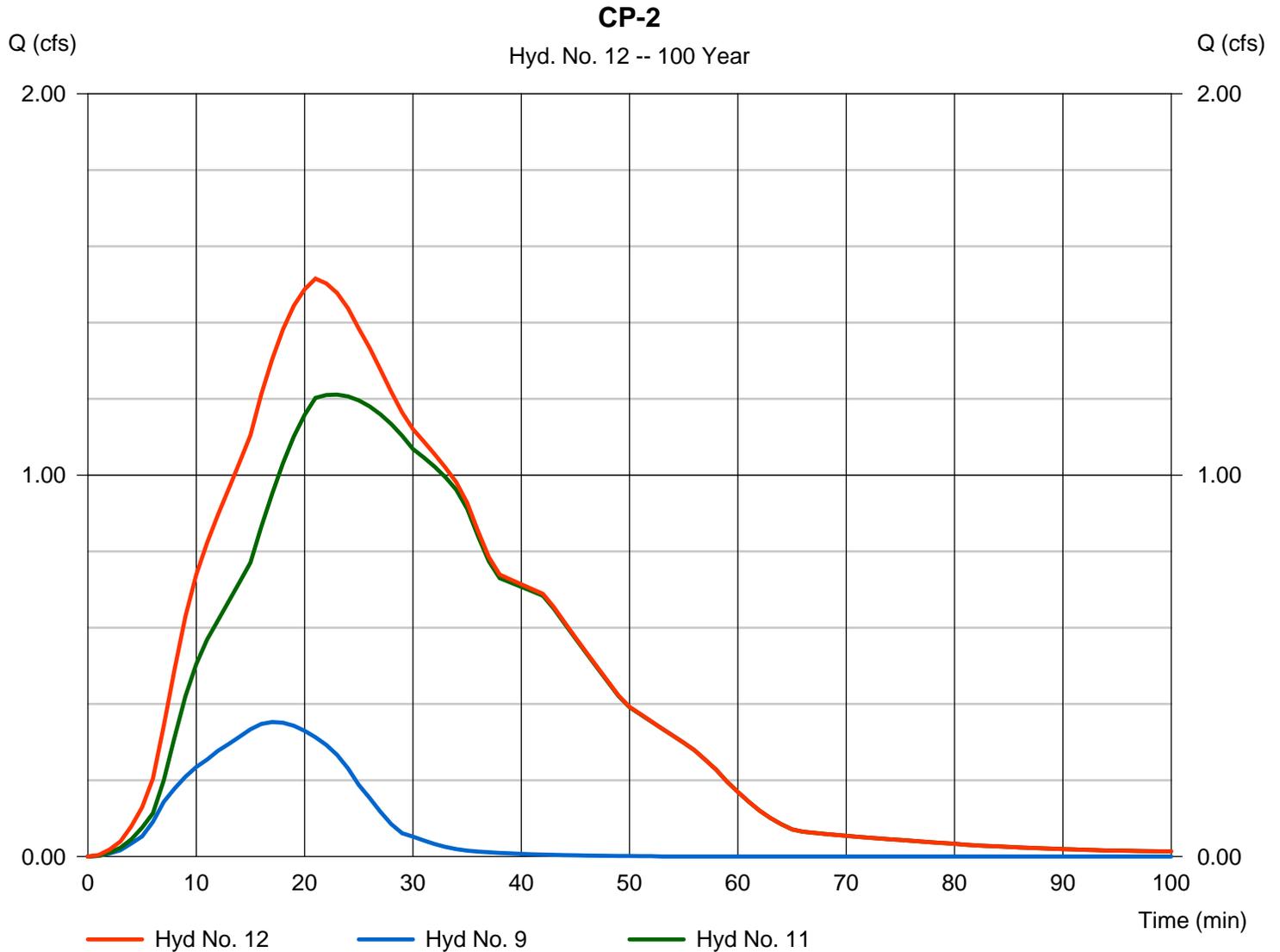
Tuesday, 04 / 3 / 2018

## Hyd. No. 12

CP-2

Hydrograph type = Combine  
Storm frequency = 100 yrs  
Time interval = 1 min  
Inflow hyds. = 9, 11

Peak discharge = 1.515 cfs  
Time to peak = 21 min  
Hyd. volume = 2,821 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

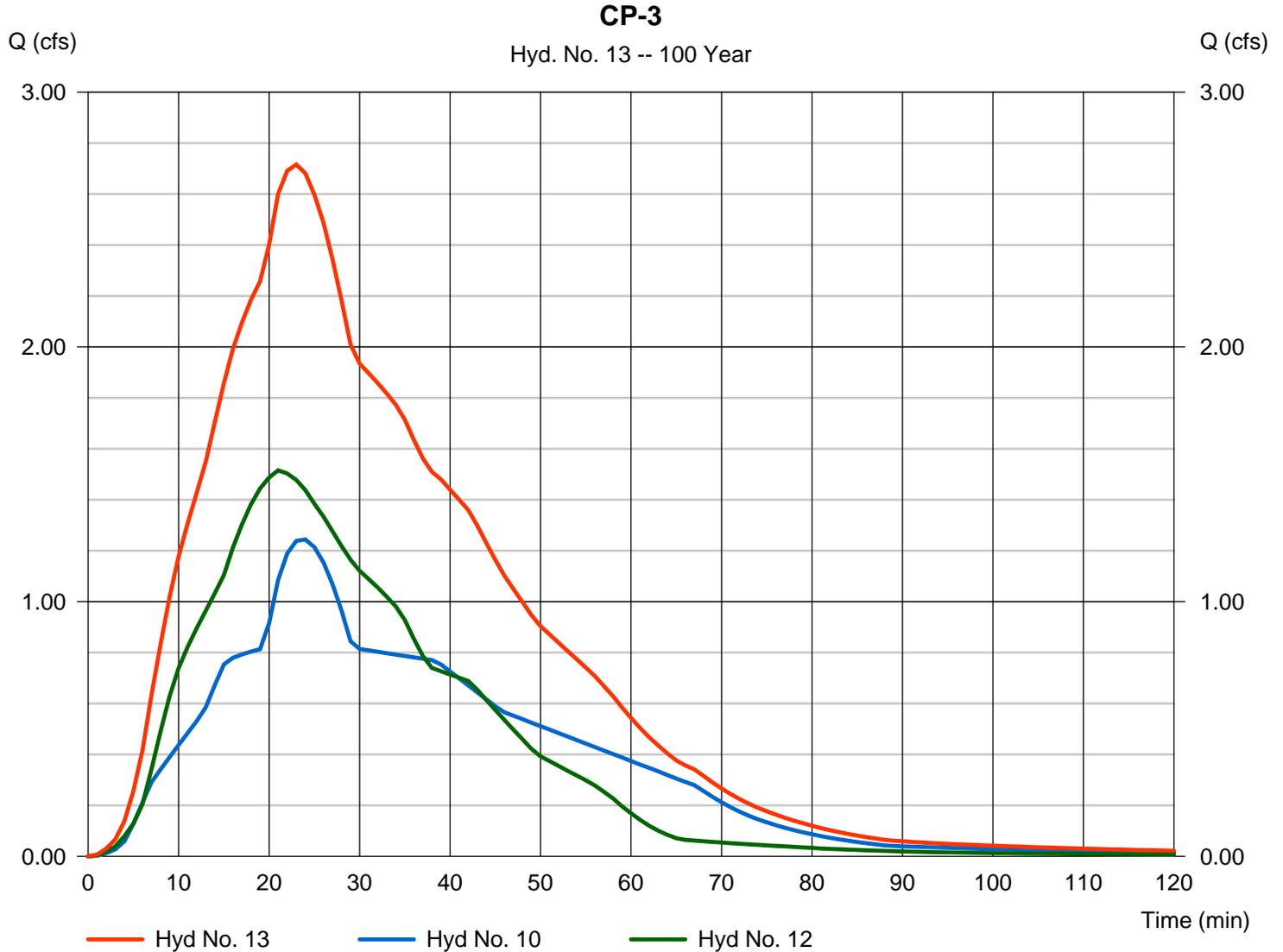
Tuesday, 04 / 3 / 2018

## Hyd. No. 13

CP-3

Hydrograph type = Combine  
Storm frequency = 100 yrs  
Time interval = 1 min  
Inflow hyds. = 10, 12

Peak discharge = 2.716 cfs  
Time to peak = 23 min  
Hyd. volume = 5,456 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

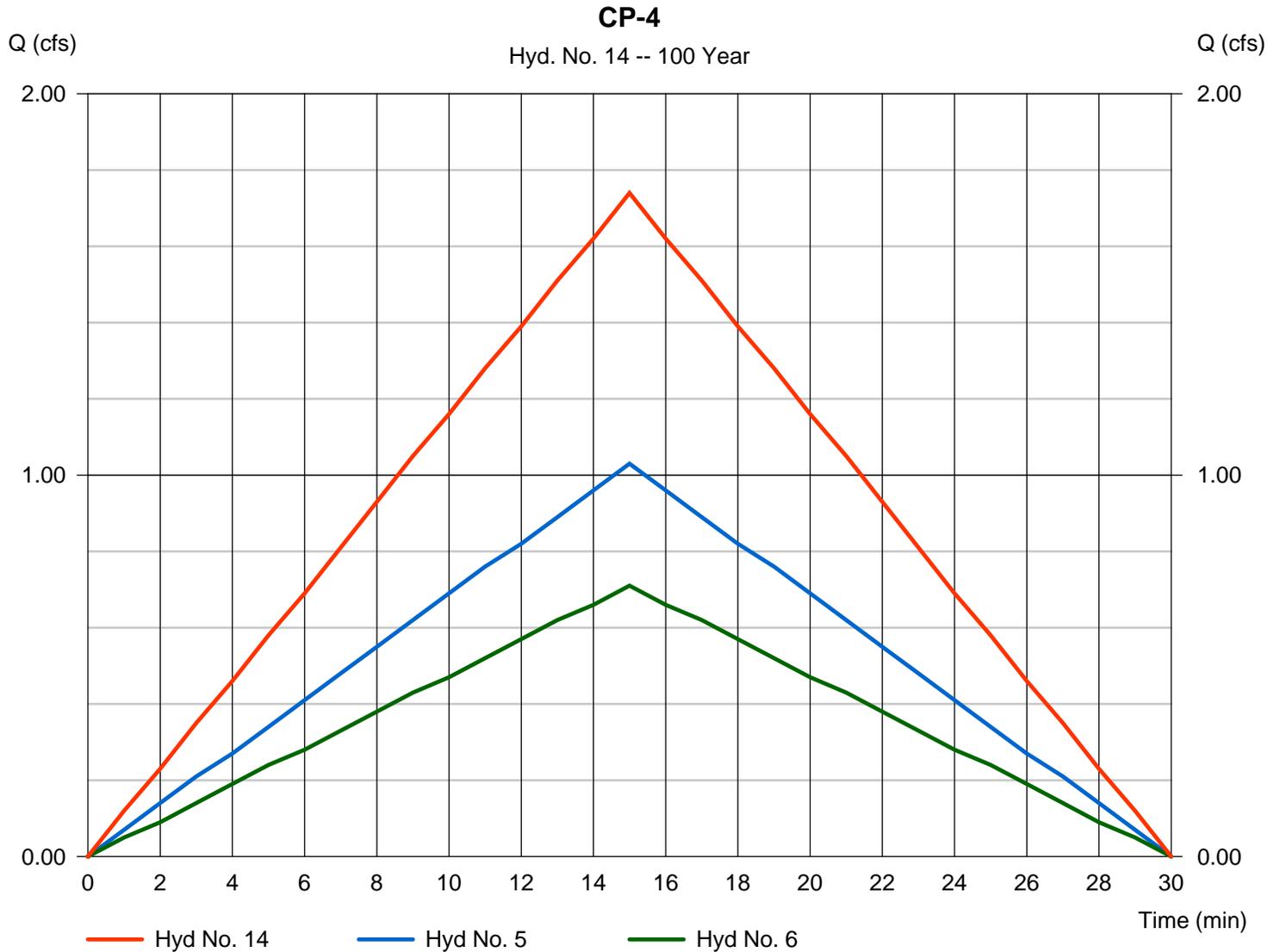
Tuesday, 04 / 3 / 2018

## Hyd. No. 14

CP-4

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Inflow hyds. = 5, 6

Peak discharge = 1.740 cfs  
 Time to peak = 15 min  
 Hyd. volume = 1,566 cuft  
 Contrib. drain. area = 0.000 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Tuesday, 04 / 3 / 2018

## Hyd. No. 15

POC-1

Hydrograph type = Combine  
Storm frequency = 100 yrs  
Time interval = 1 min  
Inflow hyds. = 13, 14

Peak discharge = 3.650 cfs  
Time to peak = 21 min  
Hyd. volume = 7,022 cuft  
Contrib. drain. area = 0.000 ac

POST MITIGATION  
FOR 100-YR STORM

