MACRO STORM WATER DRAINAGE STUDY

Main Orchard
Lots 1 – 6
SITE ACREAGE: 2.31 ACRES
DRAINAGE AREA: 52.52 ACRES
Lee's Summit, MO

PREPARED BY:

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Submittal Date: September 13, 2019

Anthony Philipsheck, PE

Revision

Date	Comment	By
10-14-19	City Comments	MJS
10-29-19	City Comments	AEP

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3. GENERAL INFORMATION

This storm study has been prepared to evaluate the potential impacts of developing 5 additional residential lots located at the Northwest corner of Orchard and Main in Lee's Summit, Missouri. There is an existing home located at 510 NW Main Street which is to remain and be part of the proposed 6 lot single family residential development called Main Orchard. The overall site is 2.31 acres. Currently 1.38 acres serves as a single family residence with the remaining 0.93 acres being undeveloped. The 2.31 acre proposed development will contain an impervious area of 28.2%. The site drains primarily to the southwest with a portion draining to the north. Runoff from the site is conveyed via roadside ditches and a few pipe culverts.

Both the Existing and Proposed Sites contain two overall drainage areas labeled as A and B for the purposes of this report. Area A will drain to the north and ultimately beneath Chipman Road and Area B will drain to the southwest and ultimately into a culvert beneath the railroad. See Exhibit A for the Overall Drainage Map. The overall drainage map is shown in the pre developed condition and details the extent of the overall boundaries for drainage areas A and B. Areas A and B were divided into smaller Subareas at or near the property boundaries of the project site to evaluate potential negative impacts adjacent to the site.

Drainage Areas (Existing)

Area A

-Contains 19.72 acres, with 0.27 acres being located within the development area. The northern portion of the site drains to the north via open road ditches and ultimately to POI A which consists of dual 36-inch storm pipes beneath Chipman Road.

Subarea A-1

-Contains 1.01 acres and includes 0.27 acres of the proposed development of which 0.26 acres are developed (C=0.51) and 0.01 acres are undeveloped (C=0.30). Tributary area for Subarea A-1 converges at the drainage ditch just north of the property line on the west side of Main Street. This point is called POI A-1.

Area B

-Contains 32.80 acres, with 2.04 acres being located within the development area. The site drains to the southwest into a 48-inch storm pipe beneath the Railroad. The storm water is directed to the 48-inch culvert through open road ditches and 3 culverts:

1. Central and Orchard – 12-inch culvert on the north side of Orchard
2. Orchard and Olive – 15-inch culvert on the east side of Olive
3. Central St - 15-inch culvert crossing east to west

All culverts appear to convey the lower intensity storms and allow the storm water to cross atop the street during the higher intensity storm events. The 48-inch culvert crosses beneath the railroad adjacent to the existing commercial development located at 315 NW Olive St. The site has indications that the storm water backs up during higher intensity rain events and an illustration is provided in Exhibit B within the report.

Subarea B-1

-Contains 6.27 acres, with 2.06 acres being located within the development area. Subarea B-1 contains Onsite Subareas B-2 and B-3. Tributary area for Subarea B-1 converges at a 12 inch culvert on the north side of Orchard crossing Central from west to east. This point is called POI B-1.

Subarea B-2

-contains 0.93 acres all of which are located within the proposed development. Subarea B-2 is currently undeveloped C=0.30. Subarea B-2 drains to a swale located on the neighboring property adjacent to the west property line. This point is called POI B-2.

Subarea B-3

-contains 1.13 acres all of which are located within the proposed development. Subarea B-3 is currently developed C=0.51. Subarea B-3 drains to the southwest property corner (POI B-3) via a swale section where it crosses the adjacent west property for eventual conveyance by the culvert at POI B-1.

4. METHODOLOGY

This Macro Storm Drainage Study has been prepared to evaluate potential hydrologic impacts from the proposed development and recommend improvements to eliminate potential negative impacts. The study utilized existing city contours to create the Pre-Development Drainage Area Map. The study conforms to the requirements of the City of Lee's Summit, Missouri "Design and Construction Manual" and all applicable codes and criteria referred to therein.

Using the above criteria, the proposed site was evaluated using the Rational Method to calculate storm runoff volumes, peak rates of discharge, pre and post developed hydrographs and required storage volumes for detention facilities. The analysis contains results for the 2, 10 and 100-year design storms.

A soils map for the site may be found in Exhibit C. A Pre-Development Drainage Map may be found in Exhibit D. A complete breakdown of Rational Method hydrographs may be found in Exhibit E. The following tables summarize the results of the Existing Conditions analysis.

Table 4.1 Existing Conditions Subarea Data

Subarea	Area (ac.)	Runoff Coefficient	Tc (min)
A	19.72	0.58	19.1
A-1	1.01	0.51	12.9
B	32.80	0.55	16.6
B-1	6.27	0.48	11.8
B-2	0.93	0.30	10.9
B-3	1.13	0.51	7.8

*Development area is located partially in Area A and B

Table 4.2 Existing Conditions Subarea/Point of Interest Peak Discharge Rates

Subarea	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	36.78	54.22	81.99
A-1	1.94	2.86	4.33
B	60.99	89.91	135.95
B-1	11.69	17.23	26.06
B-2	1.12	1.65	2.49
B-3	2.54	3.75	5.68

*Area B has an inlet control release located on 315 NW Olive beneath the Railroad. The existing 100-year peak discharge has a 100 year back water elevation of 1009.75'

Per APWA Section 5608.4 and City of Lee's Summit criteria, the performance criteria for detention is to provide detention to limit peak flow rates at downstream points of interest to maximum release rates:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

Allowable release rates are comprised of a combination of peak offsite flows and allowable onsite post development peak flows at each point of interest. Since some offsite areas have substantially higher curve numbers the area ratio method will not be used to determine allowable release rates. Instead, peak flows from onsite areas will be determined for each point of interest and subtracted from the overall peak discharge rates (Table 4-2) then the allowable release rate for onsite area will be added back to give the allowable peak release rate at each point of interest.

Allowable Release Example Calculation Subarea A (2-Yr): 36.78 – 0.43 + (0.27 x 0.5) = 36.49

Table 4.3 Existing Conditions Onsite Subarea Data

Subarea	Area (ac.)	Composite CN	Tc (min.)
A	0.27	0.50	19.1
A-1	0.27	0.50	12.9
B	2.06	0.42	16.6
B-1	2.06	0.42	11.8
B-2	0.93	0.30	10.9
B-3	1.13	0.51	7.8

Table 4.4 Existing Conditions Subarea/Point of Interest Onsite Peak Discharge Rates

Subarea	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	0.43	0.64	0.97
A-1	0.51	0.75	1.14
B	2.93	4.31	6.52
B-1	3.36	4.95	7.49
B-2	1.12	1.65	2.49
B-3	2.54	3.75	5.68

Table 4.5 Existing Conditions Subarea/Point of Interest Allowable Peak Discharge Release Rates

Subarea	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	36.49	54.12	81.83
A-1	1.57	2.65	4.00
B	59.09	89.72	135.61
B-1	9.36	16.40	24.75
B-2	0.47	1.86	2.79
B-3	0.57	2.26	3.39

5. PROPOSED CONDITIONS

The Proposed Conditions analysis assumes completion of all new residential homes, including construction of a new garage / loft on Lot 3. The difference between the Existing Conditions model and the Proposed Conditions model is a direct result of the construction of the new residential homes and incorporating new detention pits for each home. Geometry for Subareas A-1, B-1, B-2 and B-3 have been slightly modified due to proposed grading that will take place during construction of the proposed improvements. Subarea A-1 will contain 0.01 acres more land area. Tributary land area for Subareas B-2 and B-3 will be reduced due to the addition of roof drain systems and detention pits. A small portion of Area B-2 will be redirected to Subarea B-1 after development due to finish grading around proposed residences. A Post Development Drainage Map may be found in Exhibit F.

Post-Development Flow Rates

The post development flow rates were calculated based on a runoff coefficient of 0.51 for the developed site area. This runoff coefficient was determined based on APWA Table 5602-3 for residential lots. The peak discharge rates for Subareas A, B and B-1 were developed by combining Subarea hydrographs within each Point of Interest. Subarea data shown below has been broken down for each specific Subarea so they may be combined together to determine downstream peak discharge rates at a given Point of Interest. The Subarea information in parenthesis for each lot refers to the Subarea in which each lot contributes runoff.

Table 5.1 Proposed Conditions Subarea Data

Subarea	Area (ac.)	Runoff Coefficient "c"	Tc (min)
A	18.72	0.58	19.0
A-1	1.02	0.51	13.8
B	26.54	0.57	16.6
B-1	4.49	0.51	11.8
B-2	0.49	0.51	7.8
B-3	0.96	0.51	7.8
Lot 1 – Building Imp. (B-3)	0.055	0.90	5.0
Lot 2 – Building Imp. (B-3)	0.055	0.90	5.0
Lot 3 – Building Imp. (B-3)	0.055	0.90	5.0
Lot 4 – Building Imp. (B-2)	0.055	0.90	5.0
Lot 5 – Building Imp. (B-2)	0.055	0.90	5.0
Lot 6 – Building Imp. (B-1)	0.055	0.90	5.0

The roof runoff for each lot will be collected via a piped roof drain system and routed to a detention pit located in the rear yard. See Section 6 for a general detail of the proposed detention pits. The detention pits modeled in this report are 15'x15'x3' deep with large diameter aggregate filling the volume. A conservative voids ratio of 25% has been assumed within the detention pit. The detention pits are sized to store the 100-year runoff volume from 2,400 sf of impervious roof area which equates to 163 cubic feet. The objective is twofold, to reduce overall runoff by infiltration and reduce peak discharge rates by attenuating collected runoff with the aid of a 1" dia. PVC drain pipe located 2' above the bottom of the pits. An additional 20'x20'x5" deep minimum containment area will be provided above the detention pits for times when the detention pits are inundated. The additional surface volume will accommodate runoff from a consecutive 100-year storm while allowing attenuation of all design storm events. The detention pits modeled in the report have their outlet pipe elevation assumed as the bottom of the pit so the metering effect may be accounted for during all storm events. If not done this way the software yields zero peak discharge for the 2 and 10 year events since the available storage

below the outlet pipe elevation is greater than the hydraulic volume of the rainfall event. This method of modeling the detention pits is the most conservative providing the highest factor of safety.

Table 5.2 Proposed Conditions Subarea/Point of Interest Peak Discharge Rates

Subarea	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	34.91	51.47	77.83
A-1	1.96	2.89	4.37
B	51.14	75.40	114.01
B-1	8.89	13.11	19.83
B-2	1.10	1.63	2.46
B-3	2.16	3.19	4.82
Lot 1 – Lot 6 (Un-detained)*	0.244	0.360	0.544
Lot 1 – Lot 6 (Detained)*	0.009	0.009	0.009

*Residential House flows and attenuated peak flows are identical for each lot. Three decimal point precision used to account for small tributary area and associated flow rates.

Table 5.3 Proposed Conditions Combined Subarea/Point of Interest Peak Discharge Rates

Subarea	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	36.14	53.28	80.56
B-3	2.19	3.21	4.85
B-2	1.12	1.65	2.48
B-1	8.90	13.12	19.84
B	56.38	83.10	125.63

*Area B has an inlet control release located on 315 NW Olive beneath the Railroad. The proposed (Combined) 100-year peak discharge has a 100 year back water elevation of 1009.68' which is 0.07' lower than the existing condition.

Table 5.4 below provides a comparison of runoff data between Existing, Proposed and Allowable Conditions at the various Points of Interest.

Table 5.4 Point of Interest Peak Discharge Comparison

Point of Interest	Condition	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
A	Proposed	36.14	53.28	80.56
	Existing	36.78	54.22	81.99
	Difference	-0.64	-0.94	-1.43
	Allowable	36.49	54.12	81.83
	Difference	-0.35	-0.84	-1.27
A-1	Proposed	1.96	2.89	4.37
	Existing	1.94	2.86	4.33
	Difference	0.02	0.03	0.04
	Allowable	1.57	2.65	4.00
	Difference	0.39	0.24	0.37
B-3	Proposed	2.19	3.21	4.85
	Existing	2.54	3.75	5.68
	Difference	-0.35	-0.54	-0.83
	Allowable	0.57	2.26	3.39
	Difference	1.62	0.95	1.46

B-2	Proposed	1.12	1.65	2.48
	Existing	1.12	1.65	2.49
	Difference	0	0	-0.01
	Allowable	0.47	1.86	2.79
	Difference	0.65	-0.21	-0.31
B-1	Proposed	10.57	15.57	23.52
	Existing	11.69	17.23	26.06
	Difference	-1.12	-1.66	-2.54
	Allowable	9.36	16.40	24.75
	Difference	1.21	-0.83	-1.23
B	Proposed	56.38	83.10	125.63
	Existing	60.99	89.91	135.95
	Difference	-4.61	-6.81	-10.32
	Allowable	59.09	89.72	135.61
	Difference	-2.71	-6.62	-9.98

POI A: Peak discharges for all storm events will be attenuated below existing and allowable.

POI A-1: Peak discharges for existing conditions will be slightly above existing due to a slight increase in tributary area however the anticipated increases are negligible. Allowable flows will not be met and a waiver will be requested for Subarea A-1.

POI B: Peak discharges for all storm events will be attenuated below existing and allowable.

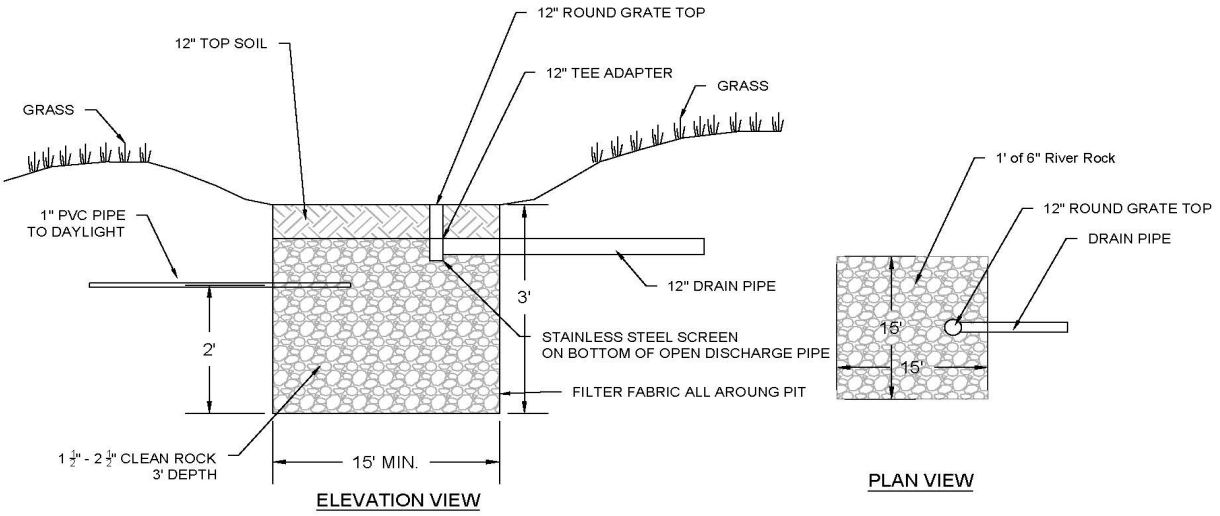
POI B-1: Peak discharges for all storm events will be attenuated below existing and allowable except for the allowable 2-year event. No negative impacts will be created due to the development of the proposed site. A waiver will be requested for Subarea B-1.

POI B-2: Peak discharges for all storm events will be attenuated at or below existing and allowable except for the allowable 2-year event. No negative impacts will be created due to the development of the proposed site. A waiver will be requested for Subarea B-2.

POI B-3: Peak discharges for all storm events will be attenuated below existing. Allowable rates will not be met however there will be no increase in net runoff from the proposed site. A waiver will be requested for Subarea B-3.

6. Best Management Practices Report

The development will use individual onsite detention pits for the new residential units by connecting the downspouts to the 15' x 15' x 3' pit. The pit will consist of 3 feet of clean 1.5 to 2.5-inch gravel to promote infiltration, however due to the low infiltration capacity (Ksat(avg)= 0.13 in/hr) of the soil in the area a 1-inch outlet pipe will be installed 2 feet above the bottom of the detention pit to allow for the water to drain. The detention pit is sized to store the runoff generated by the impervious area of the home for the 100-year storm event. In addition, the detention pit will be depressed providing capacity to store a consecutive 100-year storm event. The top of the detention pit shall incorporate deep rooted plantings to help accelerate infiltration into the pit.



7. Conclusions & Recommendations

Runoff from the proposed development will be reduced below existing for all subareas except Subarea A-1 which is negligible. No negative impact is anticipated downstream from the proposed development. Allowable release rates which are peak discharge rate goals will not be met for several subareas due to the size of the subareas however as previously stated the downstream drainage system and property will not be adversely affected but overall storm drainage for the subarea will be improved by the employ of individual detention pits on Lots 1 – 6 as opposed to a shared onsite storm water detention facility. Engineering Solutions recommends approval of this macro storm water drainage study.

There are existing storm water backups located at 315 NW Olive Street (POI B). The development of this project will reduce the impact of the existing downstream backups.

Waiver Requests:
A-1 (2-Yr), (10-Yr), (100-Yr) Allowable & Proposed (Increase is negligible 0.02 – 0.04 cfs)
B-1 (2-Yr) Allowable
B-2 (2-Yr) Allowable
B-3 (2-Yr), (10-Yr), (100-Yr) Allowable

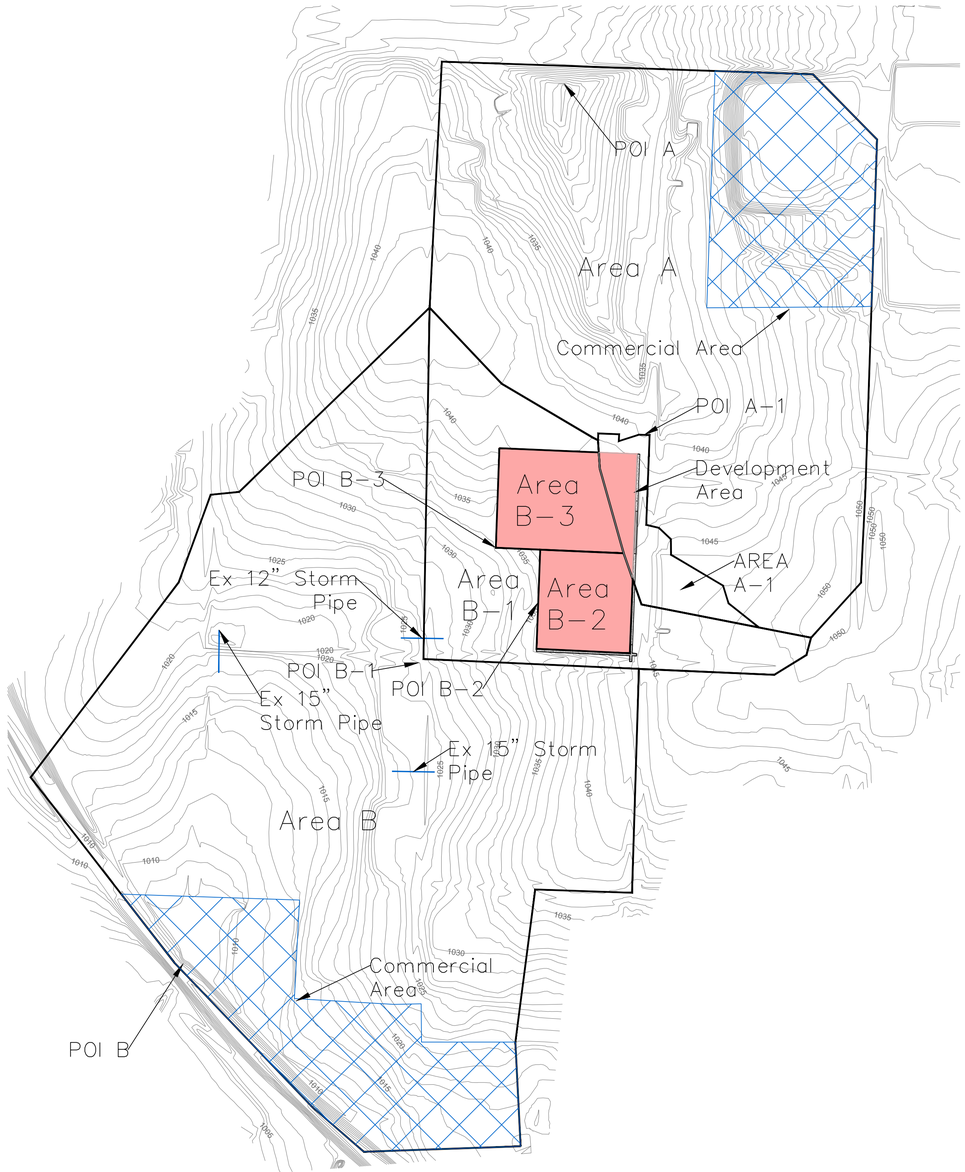
8. MAPS & EXHIBITS

EXHIBITS:

- **Exhibit A**
  - **Overall Drainage Map**
- **Exhibit B**
  - **315 NW Olive Storage Map**
- **Exhibit C**
  - **USDA Soils Map**
- **Exhibit D**
  - **Pre Development Drainage Map**
- **Exhibit E**
  - **Hydraflow Hydrograph Analysis**
- **Exhibit F**
  - **Post Development Drainage Map**

Exhibit A

Overall Drainage Map



0 30' 60' 120'

OVERALL DRAINAGE MAP

SCALE: 1" = 150'

Pre Development Condition
Areas A & B Exterior Boundaries Remain Unchanged
Common Boundaries See Pre & Post Development Maps

APWA STORM DRAINAGE "TC" COMPUTATIONS FOR : MAIN ORCHARD

					Surface types:	Asph/Conc	Bus/Com	Dirt	Grass/Park	Lake	MultFam	SnglFam	Undev	Other							
	yellow areas are self computing overwrite if necessary				SURFACE CODES	A	B	D	G	L	M	S	U	Z							
					"C" Values	0.90	0.87	0.60	0.30	0.90	0.66	0.51	0.3				TC COMPUTATION				
		TOTAL WATERSHED				Overwrite Length - DnElev or Slope if necessary				SURFACE CODE	P=Paved U=Unpaved		Overwrite Slope or Elevations if necessary								
						OVERLAND FLOW - 100' MAX				P or U	CHANNEL FLOW - FIRST REACH						Cal Overland	Used Max 15	Cal Channel One	Cal Channel Two	Total
AREA ID	TOTAL ACRES	WTRSHD LENGTH	UP ELEV	DN ELEV	SURFACE CODE	"C" VALUE	OVRLND LENGTH	UP ELEV	DN ELEV	SLOPE %	CHANNEL LENGTH	UP ELEV	DN ELEV	SLOPE %	VELOCITY F/S		Flow T(i)	Max 15 T(i)	One T(T)	Two T(T)	T@ 10	AREA ID
PRE																						PRE
A	18.71	1654.0	1050.0	1018.0	Z	0.57	100.0	1050.0	1048.0	2.0	U	1554.0	1048.0	1018.0	1.93	2.2	7.6	7.6	11.6	0.0	19.1	A
A1	1.01	602.6	1048.6	1040.0	Z	0.51	100.0	1048.6	1046.6	2.0	U	502.6	1046.6	1040.0	1.32	1.9	8.4	8.4	4.5	0.0	12.9	A1
B	26.53	1531.0	1042.0	1007.0	Z	0.56	100.0	1042.0	1039.0	3.0	U	1431.0	1039.0	1007.0	2.24	2.4	6.7	6.7	9.9	0.0	16.6	B
B-1	6.27	736.0	1042.0	1025.0	Z	0.51	100.0	1042.0	1039.0	3.0	U	636.0	1039.0	1025.0	2.20	2.4	7.4	7.4	4.4	0.0	11.8	B-1
B-2	0.93	236.0	1042.0	1036.0	Z	0.30	100.0	1042.0	1039.0	3.0	U	136.0	1039.0	1036.0	2.21	2.4	10.0	10.0	0.9	0.0	10.9	B-2
B-3	1.13	200.0	1042.0	1034.0	Z	0.51	100.0	1042.0	1039.0	3.0	U	100.0	1039.0	1034.0	5.00	3.6	7.4	7.4	0.5	0.0	7.8	B-3
POST																						
A	18.72	1654.0	1050.0	1018.0	Z	0.57	100.0	1050.0	1048.0	2.0	U	1554.0	1048.0	1018.0	1.93	2.2	7.6	7.6	11.6	0.0	19.1	A
A1	1.02	602.6	1048.6	1040.0	Z	0.51	100.0	1048.6	1046.6	2.0	U	502.6	1046.6	1040.0	1.32	1.9	8.4	8.4	4.5	0.0	12.9	A1
B	26.54	1531.0	1042.0	1007.0	Z	0.56	100.0	1042.0	1039.0	3.0	U	1431.0	1039.0	1007.0	2.24	2.4	6.7	6.7	9.9	0.0	16.6	B
B-1	4.49	736.0	1042.0	1025.0	Z	0.51	100.0	1042.0	1039.0	3.0	U	636.0	1039.0	1025.0	2.20	2.4	7.4	7.4	4.4	0.0	11.8	B-1
B-2	0.49	193.4	1042.0	1035.0	Z	0.51	100.0	1042.0	1039.0	3.0	U	93.4	1039.0	1035.0	4.28	3.3	7.4	7.4	0.5	0.0	7.8	B-2
B-3	0.96	200.0	1042.0	1034.0	Z	0.51	100.0	1042.0	1039.0	3.0	U	100.0	1039.0	1034.0	5.00	3.6	7.4	7.4	0.5	0.0	7.8	B-3

* Velocity = 16.1345 x SQRT(slope) [Unpaved] Velocity = 20.3282 x SQRT(slope) [Paved] Formula taken from "Urban Hydrology for Small Watersheds - Technical Release 55", Appendix F, Figure 3-1.
** T(i) = 1.8 x (1.1-C) x SQRT(overland length) / (slope)^1/3 Formula taken from American Public Works Association 5602.5.
*** T(T) = Channel Length / Velocity Formula taken from "Urban Hydrology for Small Watersheds - Technical Release 55", Eq. 3-1.

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Engineering 6254
Nebraska
Engineering CA2821

510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Project: 510 NW MAIN ST LS,MO
Issue Date: September 13, 2019

Drainage Area Map
Construction Plans for:
510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit

Exhibit B

Storage Map

STORAGE MAP

SCALE: 1" = 50'

0 15' 30' 60'

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Oklahoma
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Nebraska
Engineering CA2821

510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Project: 510 NW MAIN ST LS,MO
Issue Date: September 13, 2019

315 NW OLIVE STORM
Construction Plans for:
510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit

Exhibit C

USDA Soils Map

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 Jackson County, Missouri

510 Orchard Main

October 29, 2019

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.

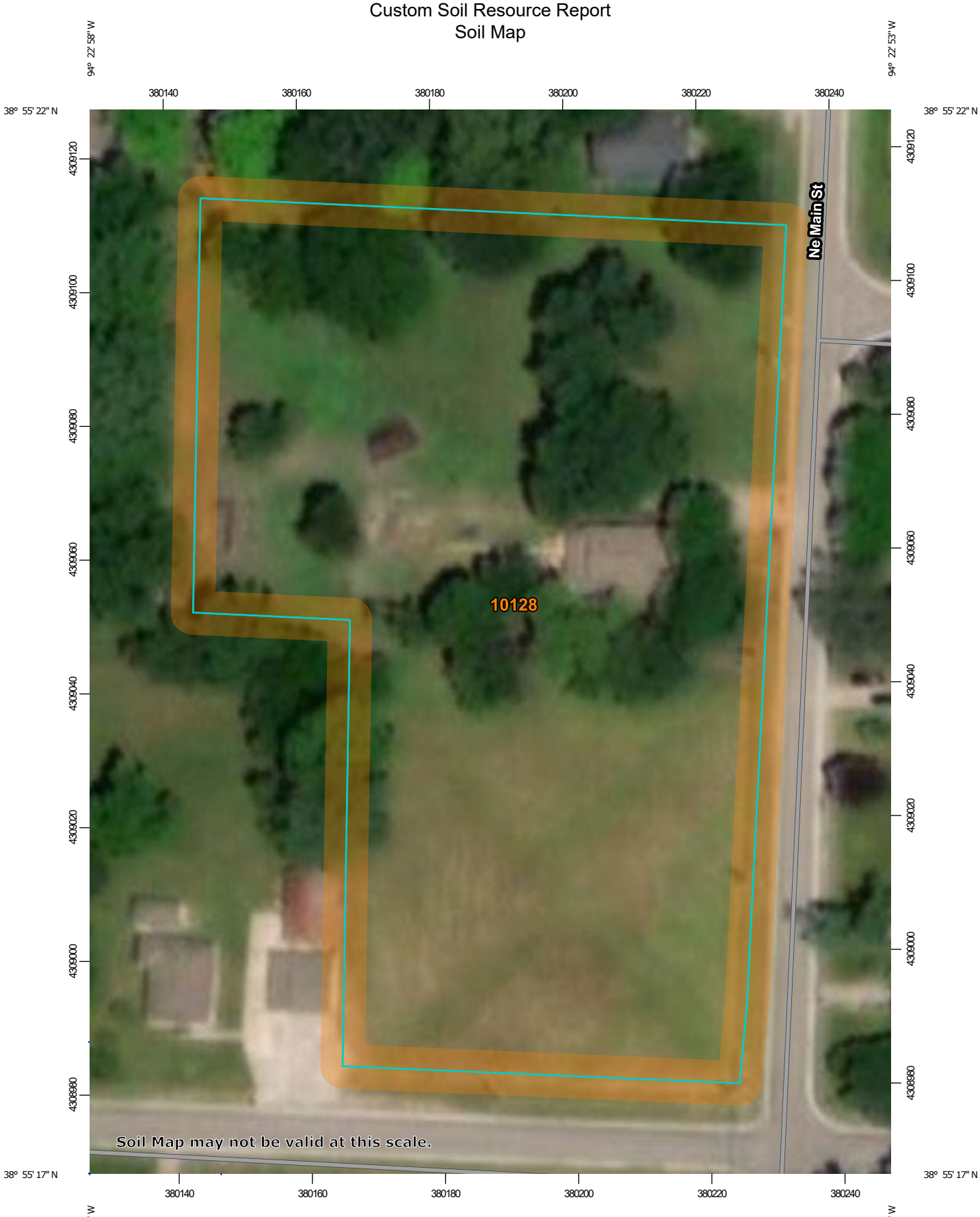
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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: 1:776 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N 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 1:24,000.

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: Jackson County, Missouri
Survey Area Data: Version 20, Sep 16, 2019

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

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

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
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	2.4	100.0%
Totals for Area of Interest		**2.4**	**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.

Jackson County, Missouri

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql09
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 55 inches: silty clay loam
C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: High
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: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: Loess Upland Prairie (R109XY002MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

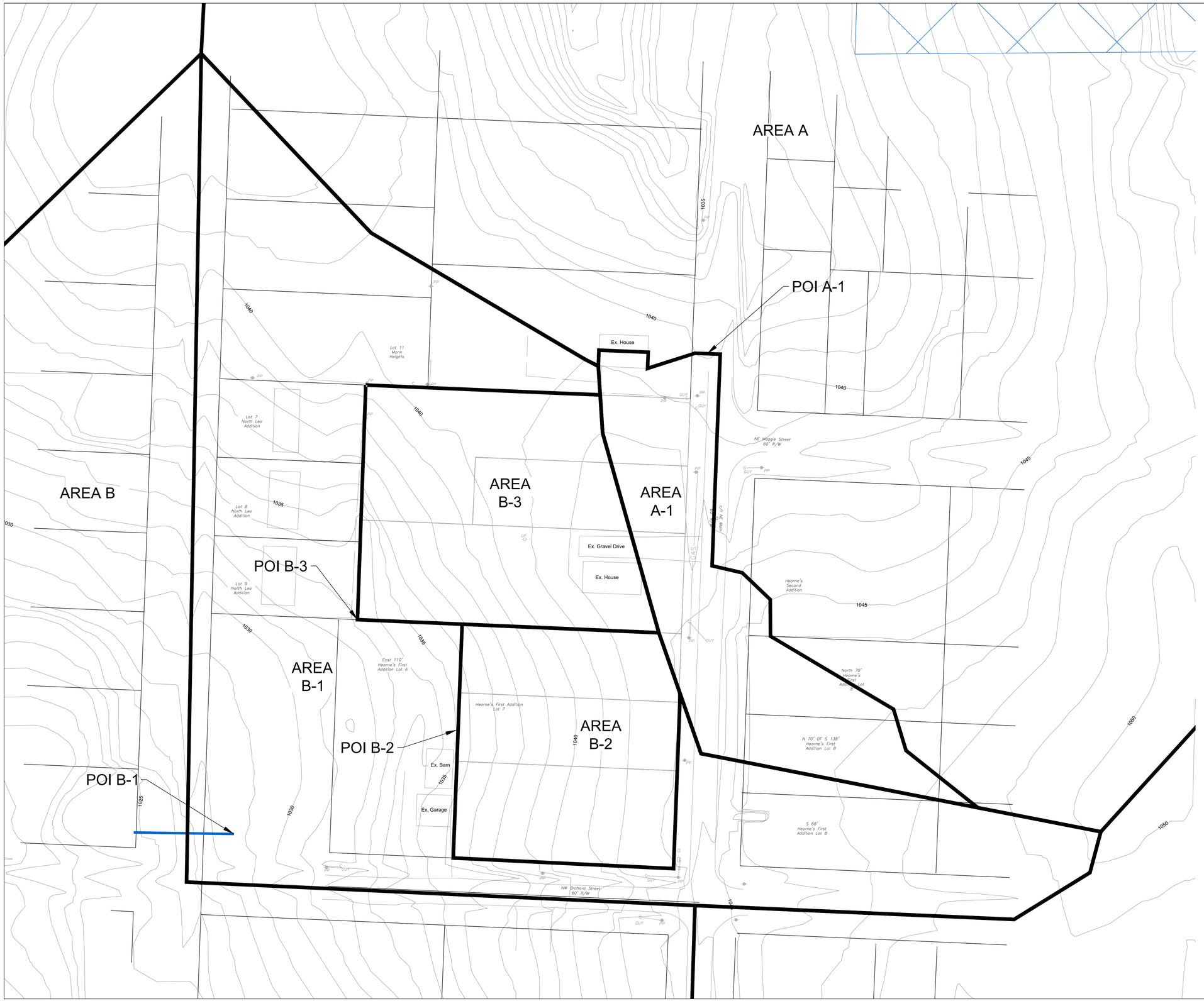
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Exhibit D

Pre Development Drainage Map



PRE-DEVELOPMENT DRAINAGE MAP

SCALE: 1" = 40'

ENGINEERING SOLUTIONS
ENGINEERING & SURVEYING
50 SE 30TH STREET
LEE'S SUMMIT, MO 64082
P:(816) 623-9888 F:(816)623-9849

Professional Registration
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Surveying 2005008319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Project: 510 NW MAIN ST LS,MO
Issue Date: September 13, 2019

Pre-Development Drainage Map
Construction Plans for:
510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit

Exhibit E

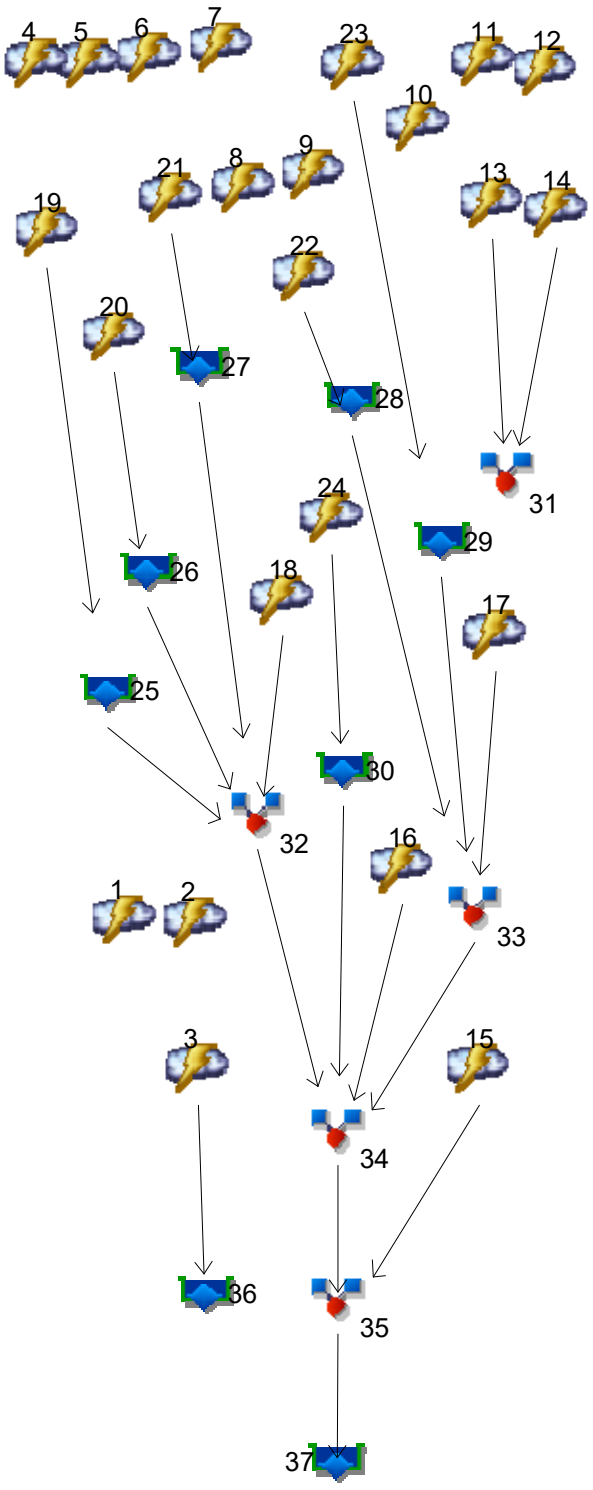
Hydraflow Hydrograph Analysis

Hydraflow Table of Contents

10 - Year

100 - Year

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	Ex. A
2	Rational	Ex. A-1
3	Rational	Ex. B
4	Rational	Ex. B-1
5	Rational	Ex. B-2
6	Rational	Ex. B-3
7	Rational	Ex. Onsite A
8	Rational	Ex. Onsite A-1
9	Rational	Ex. Onsite B
10	Rational	Ex. Onsite B-1
11	Rational	Ex. Onsite B-2
12	Rational	Ex. Onsite B-3
13	Rational	Prop. A
14	Rational	Prop. A-1
15	Rational	Prop. B
16	Rational	Prop. B-1
17	Rational	Prop. B-2
18	Rational	Prop. B-3
19	Rational	Lot 1
20	Rational	Lot 2
21	Rational	Lot 3
22	Rational	Lot 4
23	Rational	Lot 5
24	Rational	Lot 6
25	Reservoir	Lot 1 Detention
26	Reservoir	Lot 2 Detention
27	Reservoir	Lot 3 Detention
28	Reservoir	Lot 4 Detention
29	Reservoir	Lot 5 Detention
30	Reservoir	Lot 6 Detention
31	Combine	Combined A
32	Combine	Combined B-3
33	Combine	Combined B-2
34	Combine	Combined B-1
35	Combine	Combined B
36	Reservoir	Ex. B Routed
37	Reservoir	Combined B Routed

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	------	-------	36.78	-------	-------	54.22	-------	-------	81.99	Ex. A
2	Rational	------	-------	1.942	-------	-------	2.863	-------	-------	4.330	Ex. A-1
3	Rational	------	-------	60.99	-------	-------	89.91	-------	-------	135.95	Ex. B
4	Rational	------	-------	11.69	-------	-------	17.23	-------	-------	26.06	Ex. B-1
5	Rational	------	-------	1.117	-------	-------	1.647	-------	-------	2.490	Ex. B-2
6	Rational	------	-------	2.543	-------	-------	3.752	-------	-------	5.675	Ex. B-3
7	Rational	------	-------	0.434	-------	-------	0.640	-------	-------	0.968	Ex. Onsite A
8	Rational	------	-------	0.509	-------	-------	0.750	-------	-------	1.135	Ex. Onsite A-1
9	Rational	------	-------	2.925	-------	-------	4.312	-------	-------	6.520	Ex. Onsite B
10	Rational	------	-------	3.359	-------	-------	4.954	-------	-------	7.491	Ex. Onsite B-1
11	Rational	------	-------	1.117	-------	-------	1.647	-------	-------	2.490	Ex. Onsite B-2
12	Rational	------	-------	2.543	-------	-------	3.752	-------	-------	5.675	Ex. Onsite B-3
13	Rational	------	-------	34.91	-------	-------	51.47	-------	-------	77.83	Prop. A
14	Rational	------	-------	1.961	-------	-------	2.892	-------	-------	4.373	Prop. A-1
15	Rational	------	-------	51.14	-------	-------	75.40	-------	-------	114.01	Prop. B
16	Rational	------	-------	8.891	-------	-------	13.11	-------	-------	19.83	Prop. B-1
17	Rational	------	-------	1.103	-------	-------	1.627	-------	-------	2.461	Prop. B-2
18	Rational	------	-------	2.160	-------	-------	3.188	-------	-------	4.822	Prop. B-3
19	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 1
20	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 2
21	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 3
22	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 4
23	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 5
24	Rational	------	-------	0.244	-------	-------	0.360	-------	-------	0.544	Lot 6
25	Reservoir	19	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 1 Detention
26	Reservoir	20	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 2 Detention
27	Reservoir	21	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 3 Detention
28	Reservoir	22	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 4 Detention
29	Reservoir	23	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 5 Detention
30	Reservoir	24	-------	0.009	-------	-------	0.009	-------	-------	0.009	Lot 6 Detention
31	Combine	13, 14,	-------	35.97	-------	-------	53.03	-------	-------	80.19	Combined A
32	Combine	18, 25, 26, 27,	-------	2.186	-------	-------	3.214	-------	-------	4.849	Combined B-3
33	Combine	17, 28, 29,	-------	1.120	-------	-------	1.645	-------	-------	2.479	Combined B-2
34	Combine	16, 30, 32, 33	-------	10.57	-------	-------	15.57	-------	-------	23.52	Combined B-1

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
35	Combine	15, 34	-------	56.38	-------	-------	83.10	-------	-------	125.63	Combined B
36	Reservoir	3	-------	25.83	-------	-------	36.23	-------	-------	51.98	Ex. B Routed
37	Reservoir	35	-------	24.66	-------	-------	34.98	-------	-------	49.94	Combined B Routed

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	36.78	1	19	41,925	------	------	------	Ex. A
2	Rational	1.942	1	13	1,515	------	------	------	Ex. A-1
3	Rational	60.99	1	17	62,206	------	------	------	Ex. B
4	Rational	11.69	1	12	8,414	------	------	------	Ex. B-1
5	Rational	1.117	1	11	737	------	------	------	Ex. B-2
6	Rational	2.543	1	8	1,221	------	------	------	Ex. B-3
7	Rational	0.434	1	19	495	------	------	------	Ex. Onsite A
8	Rational	0.509	1	13	397	------	------	------	Ex. Onsite A-1
9	Rational	2.925	1	17	2,983	------	------	------	Ex. Onsite B
10	Rational	3.359	1	12	2,419	------	------	------	Ex. Onsite B-1
11	Rational	1.117	1	11	737	------	------	------	Ex. Onsite B-2
12	Rational	2.543	1	8	1,221	------	------	------	Ex. Onsite B-3
13	Rational	34.91	1	19	39,799	------	------	------	Prop. A
14	Rational	1.961	1	13	1,530	------	------	------	Prop. A-1
15	Rational	51.14	1	17	52,164	------	------	------	Prop. B
16	Rational	8.891	1	12	6,402	------	------	------	Prop. B-1
17	Rational	1.103	1	8	529	------	------	------	Prop. B-2
18	Rational	2.160	1	8	1,037	------	------	------	Prop. B-3
19	Rational	0.244	1	5	73	------	------	------	Lot 1
20	Rational	0.244	1	5	73	------	------	------	Lot 2
21	Rational	0.244	1	5	73	------	------	------	Lot 3
22	Rational	0.244	1	5	73	------	------	------	Lot 4
23	Rational	0.244	1	5	73	------	------	------	Lot 5
24	Rational	0.244	1	5	73	------	------	------	Lot 6
25	Reservoir	0.009	1	10	72	19	1038.03	69.2	Lot 1 Detention
26	Reservoir	0.009	1	10	72	20	1040.03	69.2	Lot 2 Detention
27	Reservoir	0.009	1	10	72	21	1037.03	69.2	Lot 3 Detention
28	Reservoir	0.009	1	10	72	22	1039.03	69.2	Lot 4 Detention
29	Reservoir	0.009	1	10	72	23	1038.03	69.2	Lot 5 Detention
30	Reservoir	0.009	1	10	72	24	1038.03	69.2	Lot 6 Detention
31	Combine	35.97	1	19	41,329	13, 14,	------	------	Combined A
32	Combine	2.186	1	8	1,253	18, 25, 26, 27,	------	------	Combined B-3
33	Combine	1.120	1	8	673	17, 28, 29,	------	------	Combined B-2
34	Combine	10.57	1	12	8,399	16, 30, 32, 33	------	------	Combined B-1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

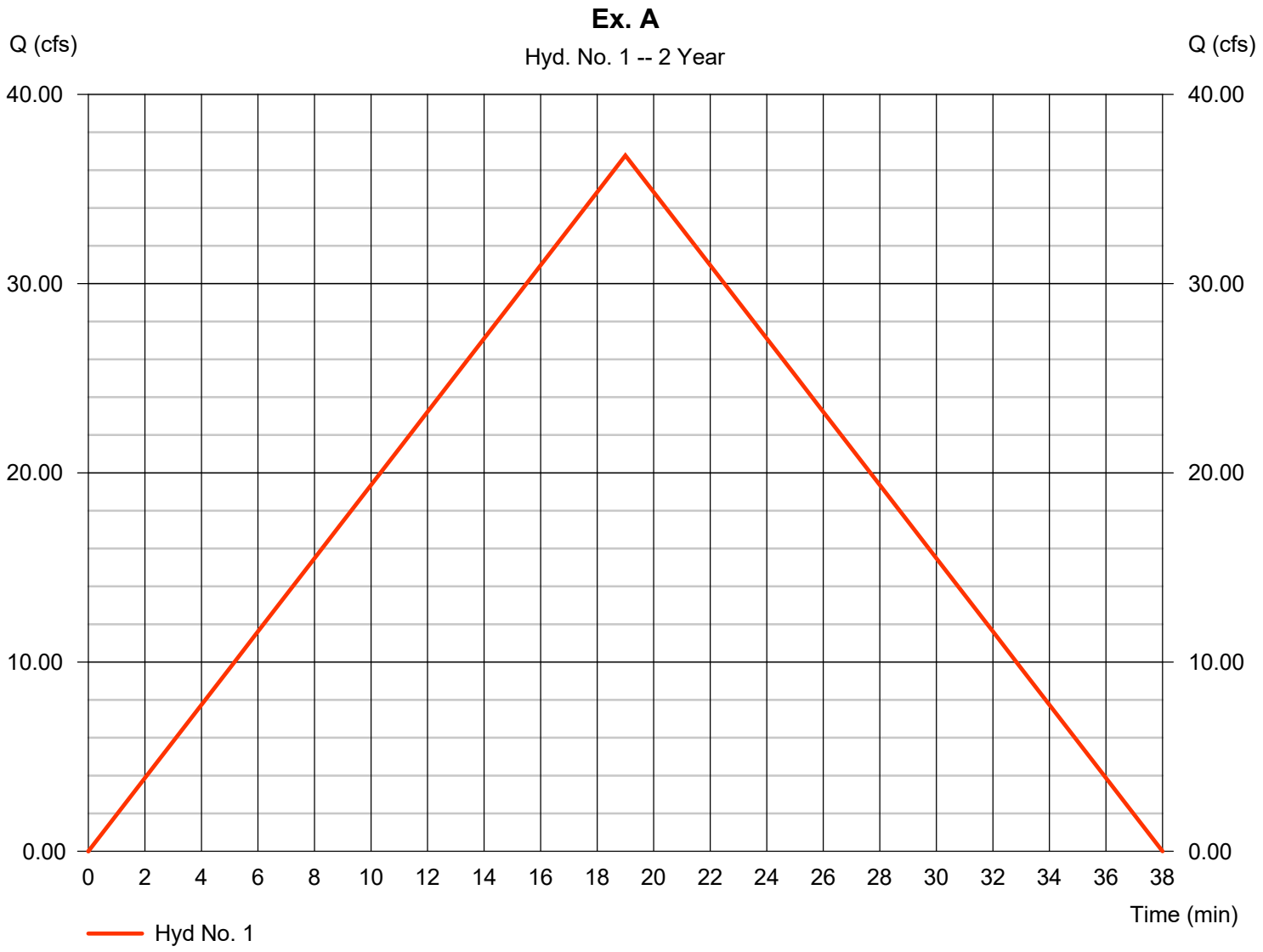
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
35	Combine	56.38	1	17	60,563	15, 34	------	------	Combined B
36	Reservoir	25.83	1	27	62,197	3	1008.83	36,351	Ex. B Routed
37	Reservoir	24.66	1	26	60,554	35	1008.78	34,789	Combined B Routed

Hydrograph Report

Hyd. No. 1

Ex. A

Hydrograph type	=	Rational	Peak discharge	=	36.78 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	41,925 cuft
Drainage area	=	19.720 ac	Runoff coeff.	=	0.58
Intensity	=	3.215 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

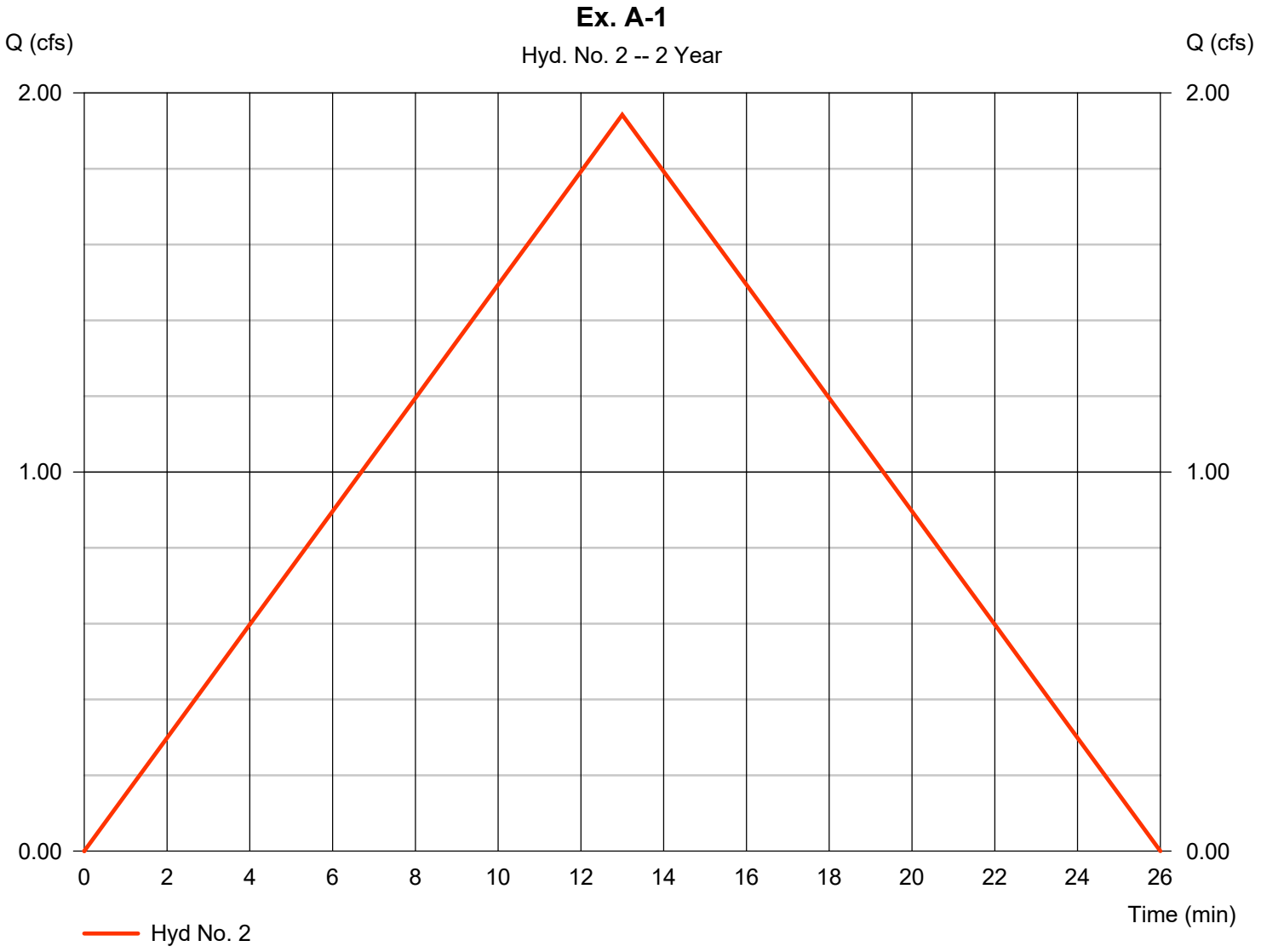


Hydrograph Report

Hyd. No. 2

Ex. A-1

Hydrograph type	=	Rational	Peak discharge	=	1.942 cfs
Storm frequency	=	2 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	1,515 cuft
Drainage area	=	1.010 ac	Runoff coeff.	=	0.51
Intensity	=	3.770 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

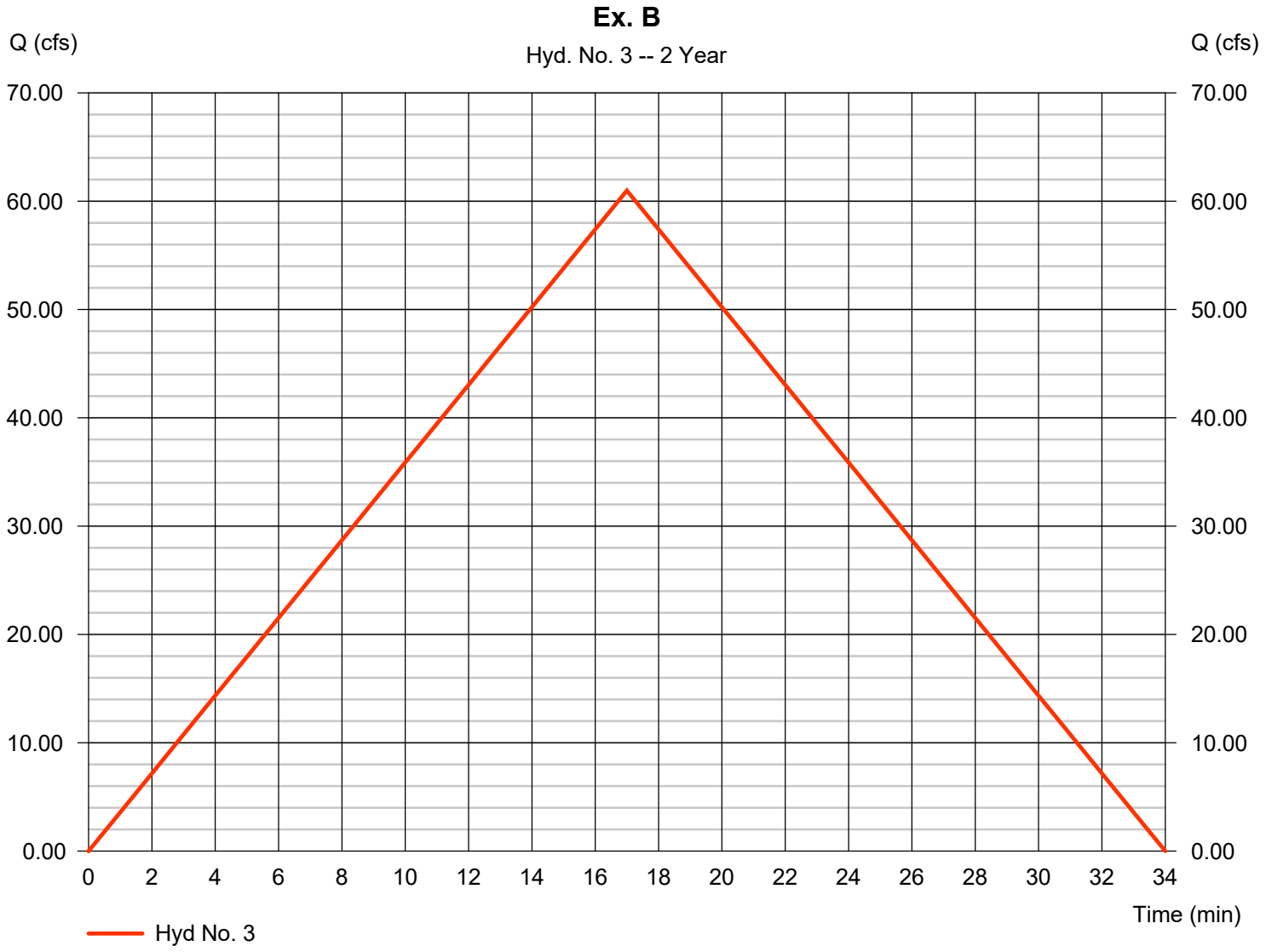


Hydrograph Report

Hyd. No. 3

Ex. B

Hydrograph type	=	Rational	Peak discharge	=	60.99 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	62,206 cuft
Drainage area	=	32.800 ac	Runoff coeff.	=	0.55
Intensity	=	3.381 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

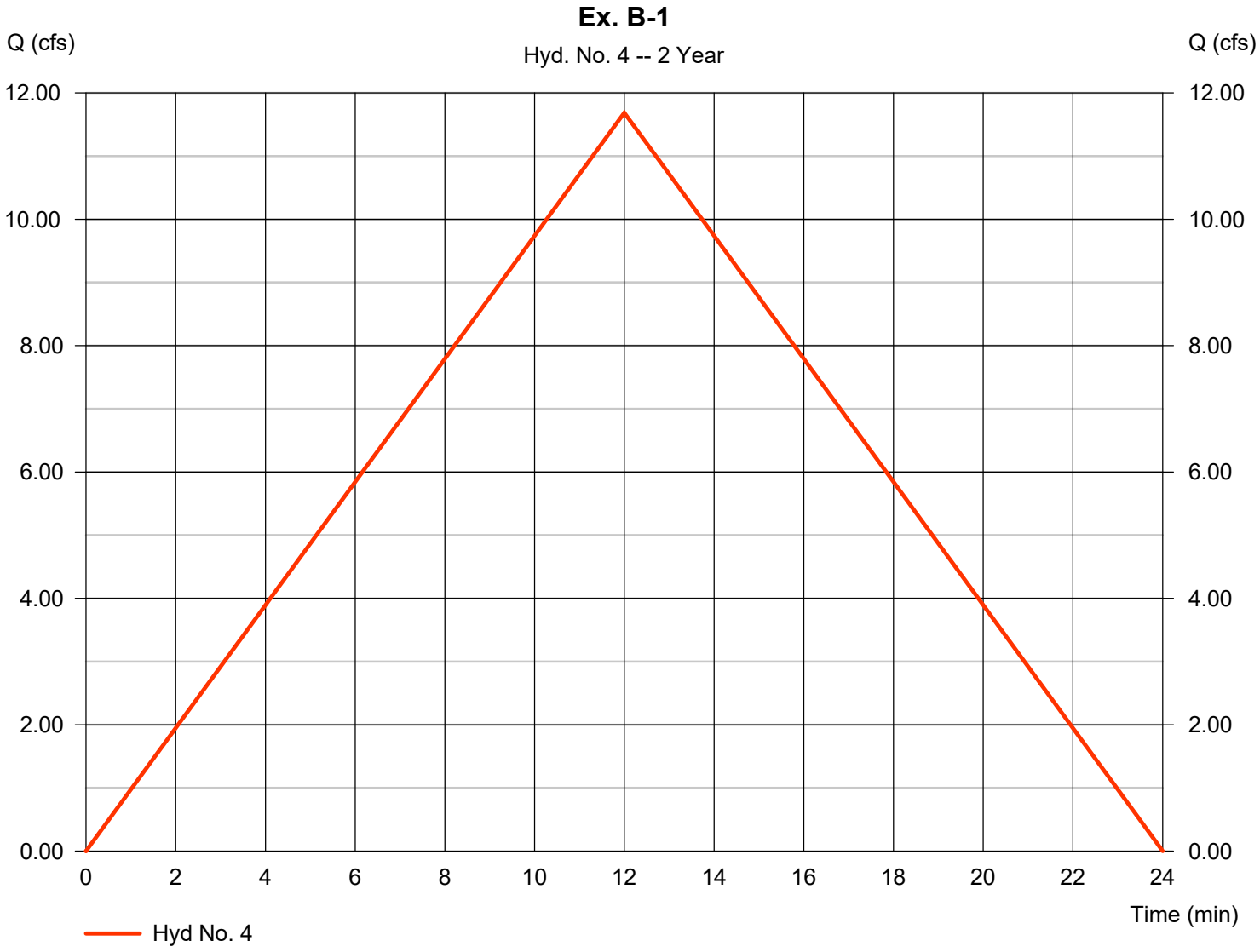


Hydrograph Report

Hyd. No. 4

Ex. B-1

Hydrograph type	=	Rational	Peak discharge	=	11.69 cfs
Storm frequency	=	2 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	8,414 cuft
Drainage area	=	6.270 ac	Runoff coeff.	=	0.48
Intensity	=	3.883 in/hr	Tc by User	=	12.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

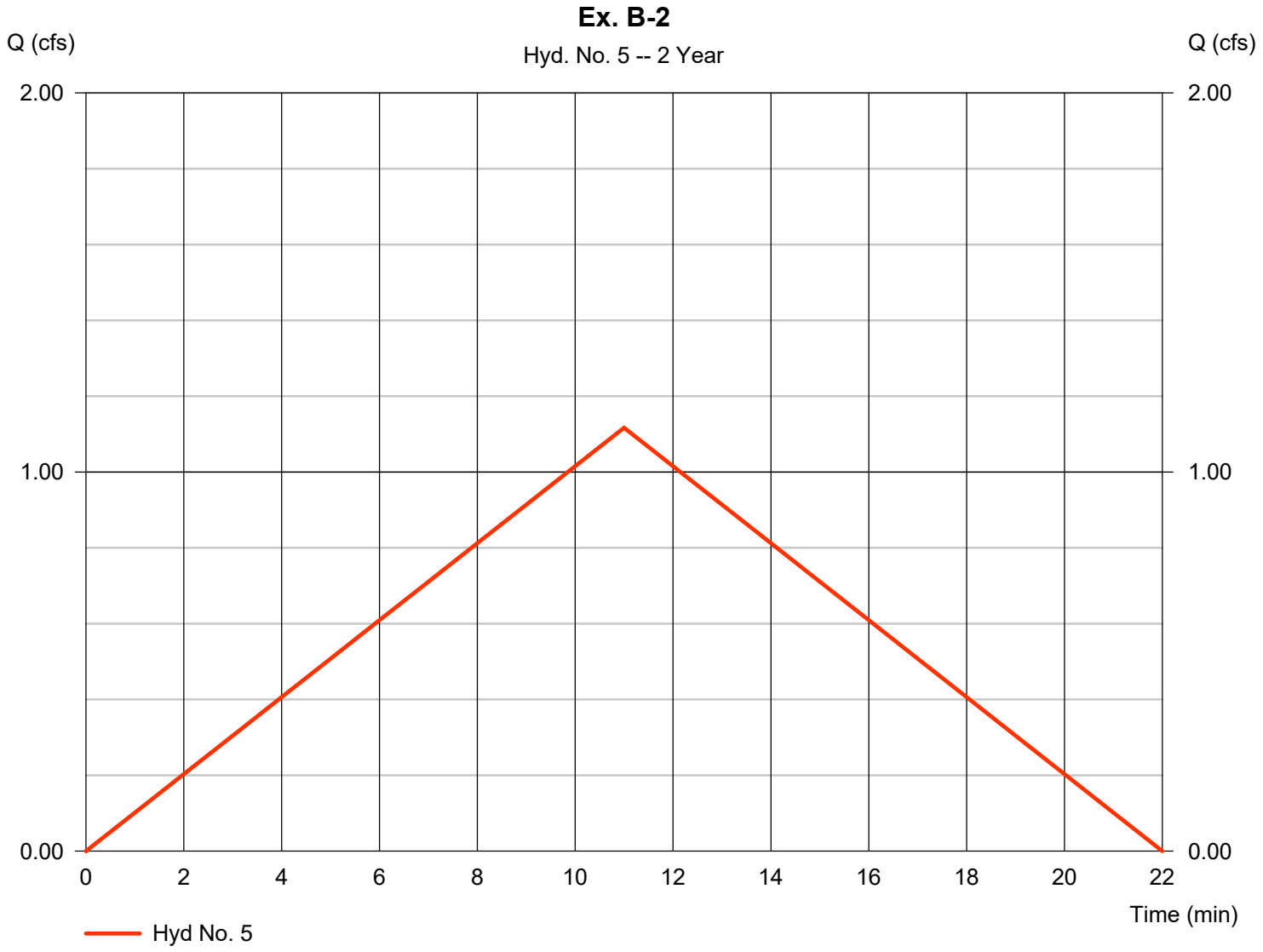


Hydrograph Report

Hyd. No. 5

Ex. B-2

Hydrograph type	=	Rational	Peak discharge	=	1.117 cfs
Storm frequency	=	2 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	737 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	4.002 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

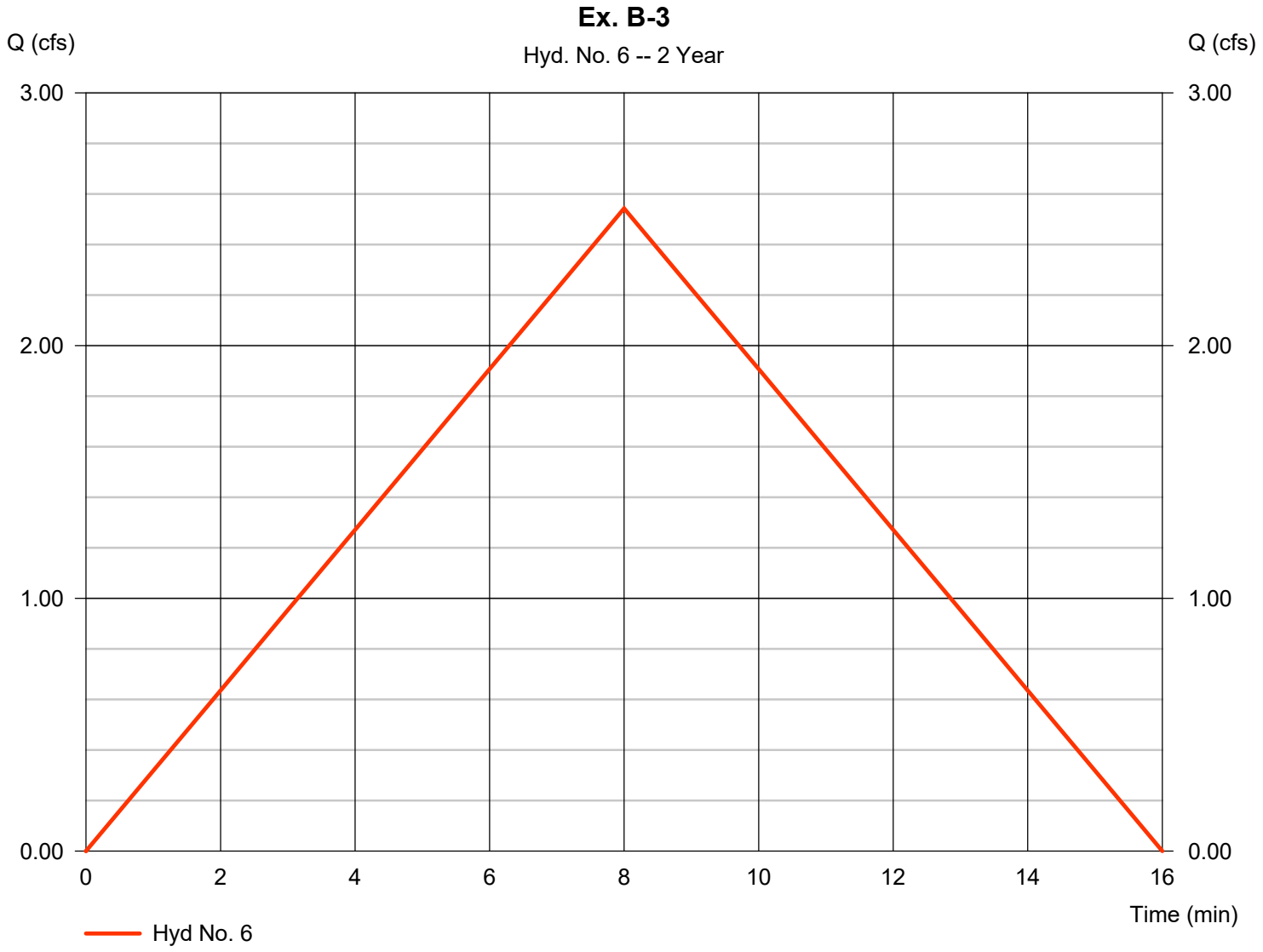


Hydrograph Report

Hyd. No. 6

Ex. B-3

Hydrograph type	=	Rational	Peak discharge	=	2.543 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,221 cuft
Drainage area	=	1.130 ac	Runoff coeff.	=	0.51
Intensity	=	4.412 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

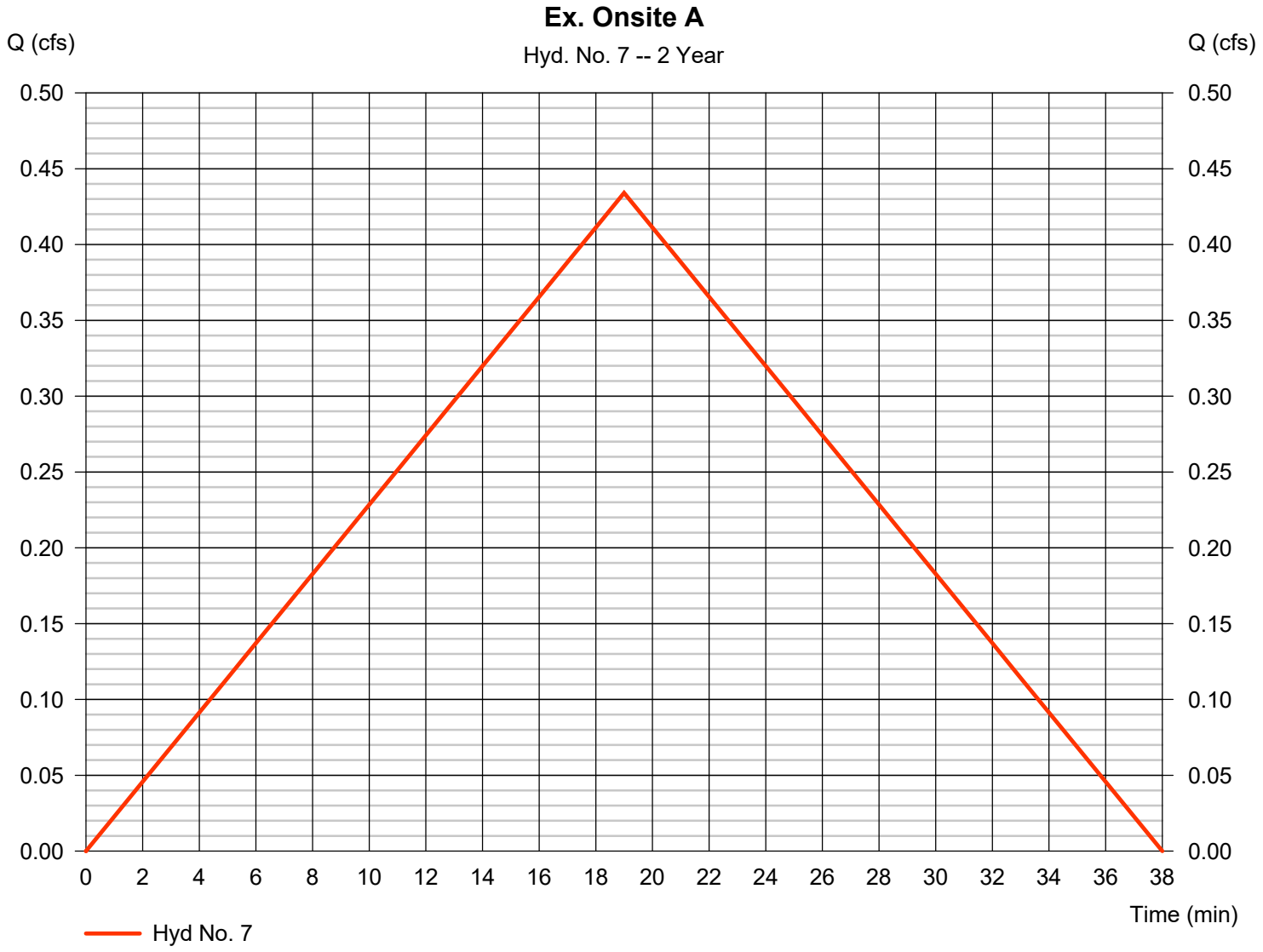


Hydrograph Report

Hyd. No. 7

Ex. Onsite A

Hydrograph type	=	Rational	Peak discharge	=	0.434 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	495 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	3.215 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

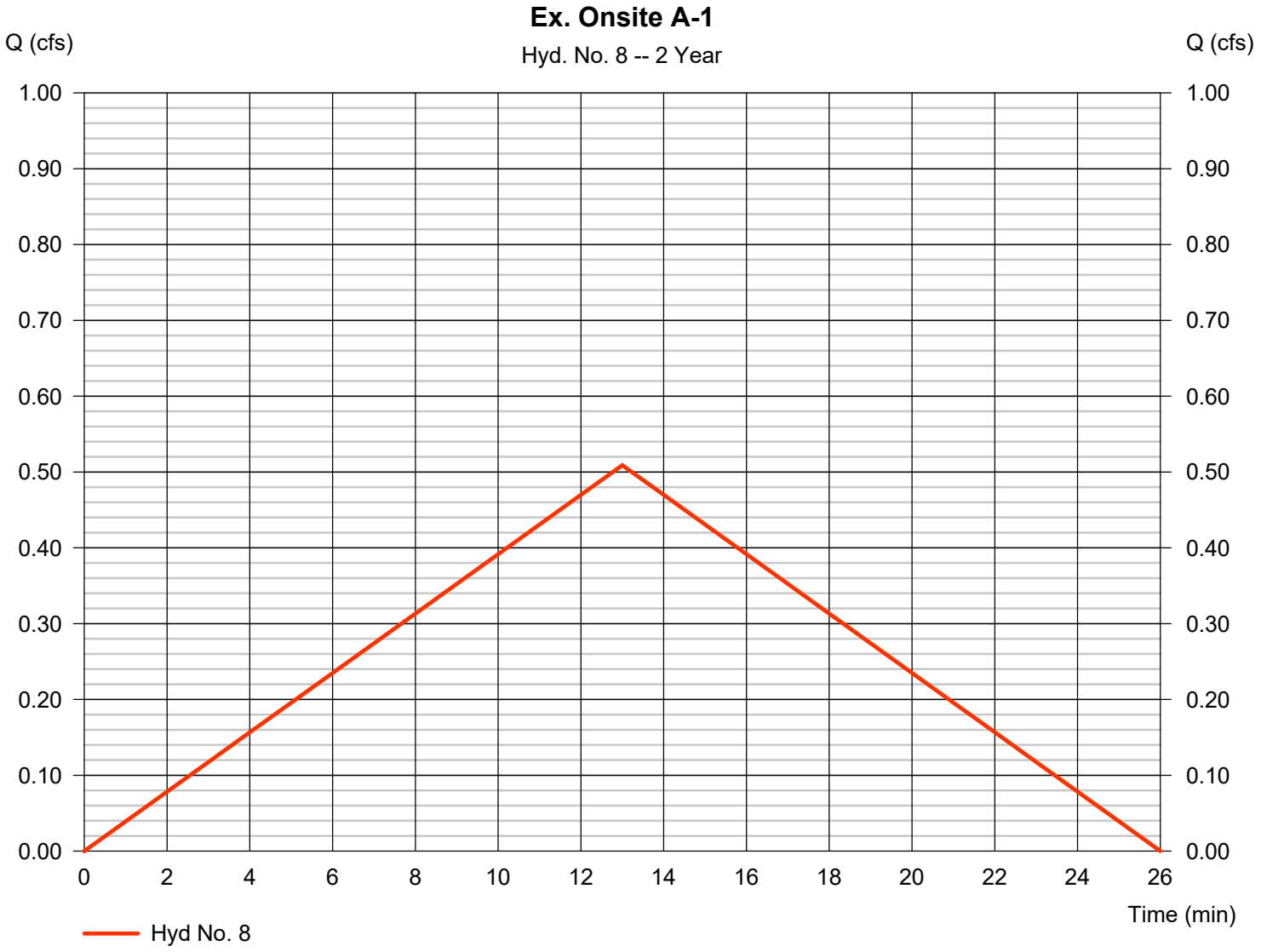


Hydrograph Report

Hyd. No. 8

Ex. Onsite A-1

Hydrograph type	=	Rational	Peak discharge	=	0.509 cfs
Storm frequency	=	2 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	397 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	3.770 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

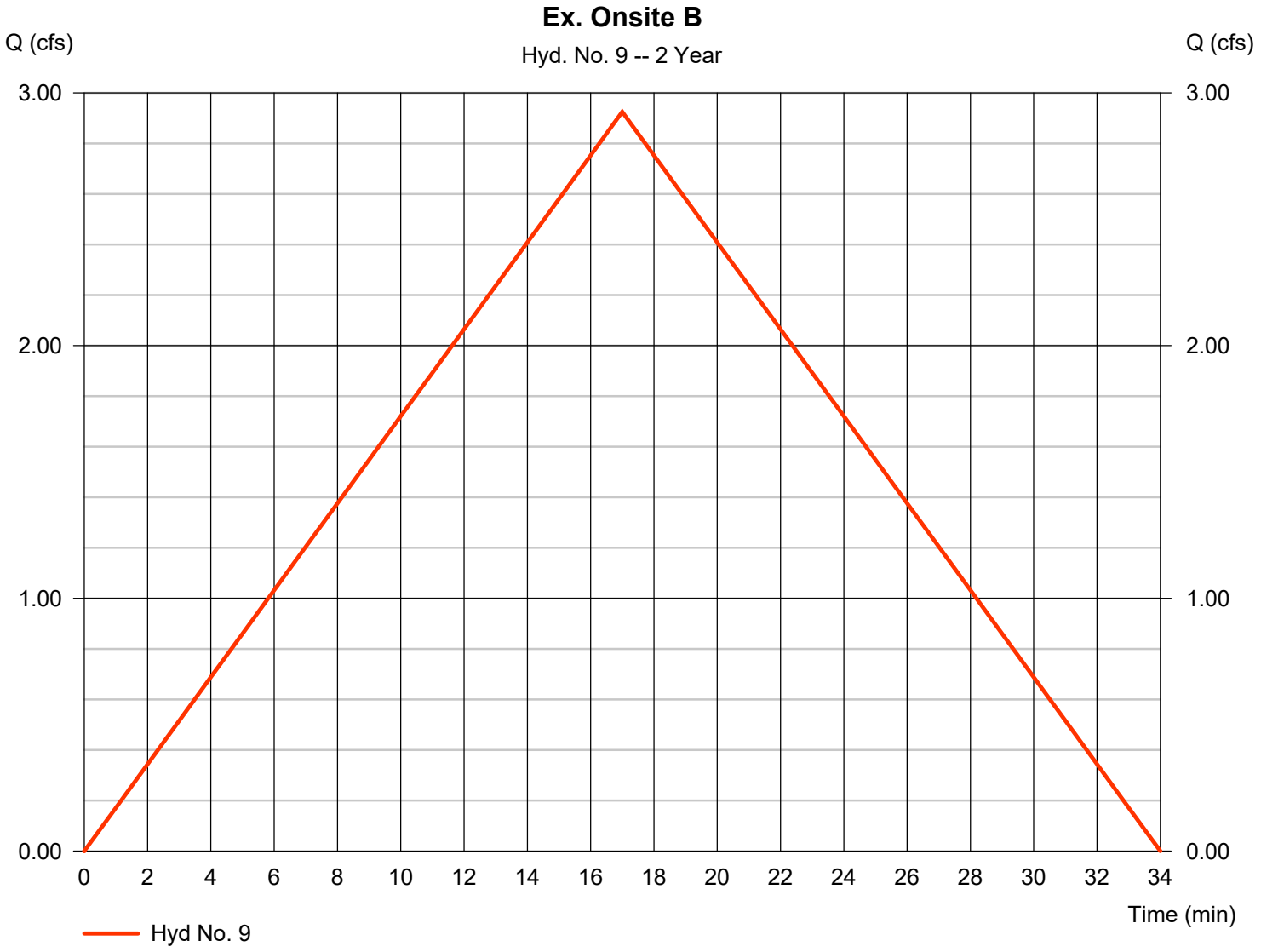


Hydrograph Report

Hyd. No. 9

Ex. Onsite B

Hydrograph type	=	Rational	Peak discharge	=	2.925 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	2,983 cuft
Drainage area	=	2.060 ac	Runoff coeff.	=	0.42
Intensity	=	3.381 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

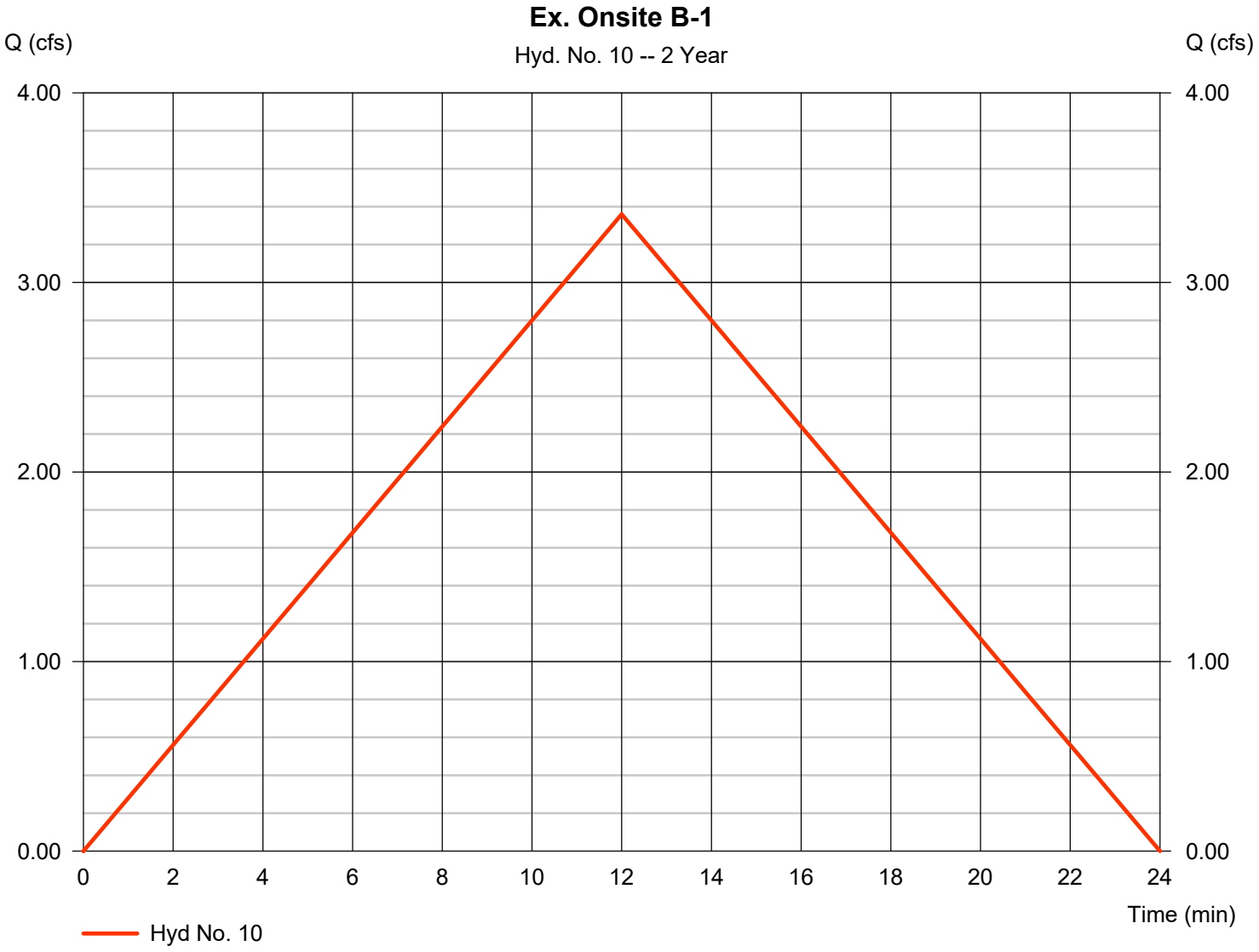


Hydrograph Report

Hyd. No. 10

Ex. Onsite B-1

Hydrograph type	= Rational	Peak discharge	= 3.359 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 2,419 cuft
Drainage area	= 2.060 ac	Runoff coeff.	= 0.42
Intensity	= 3.883 in/hr	Tc by User	= 12.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

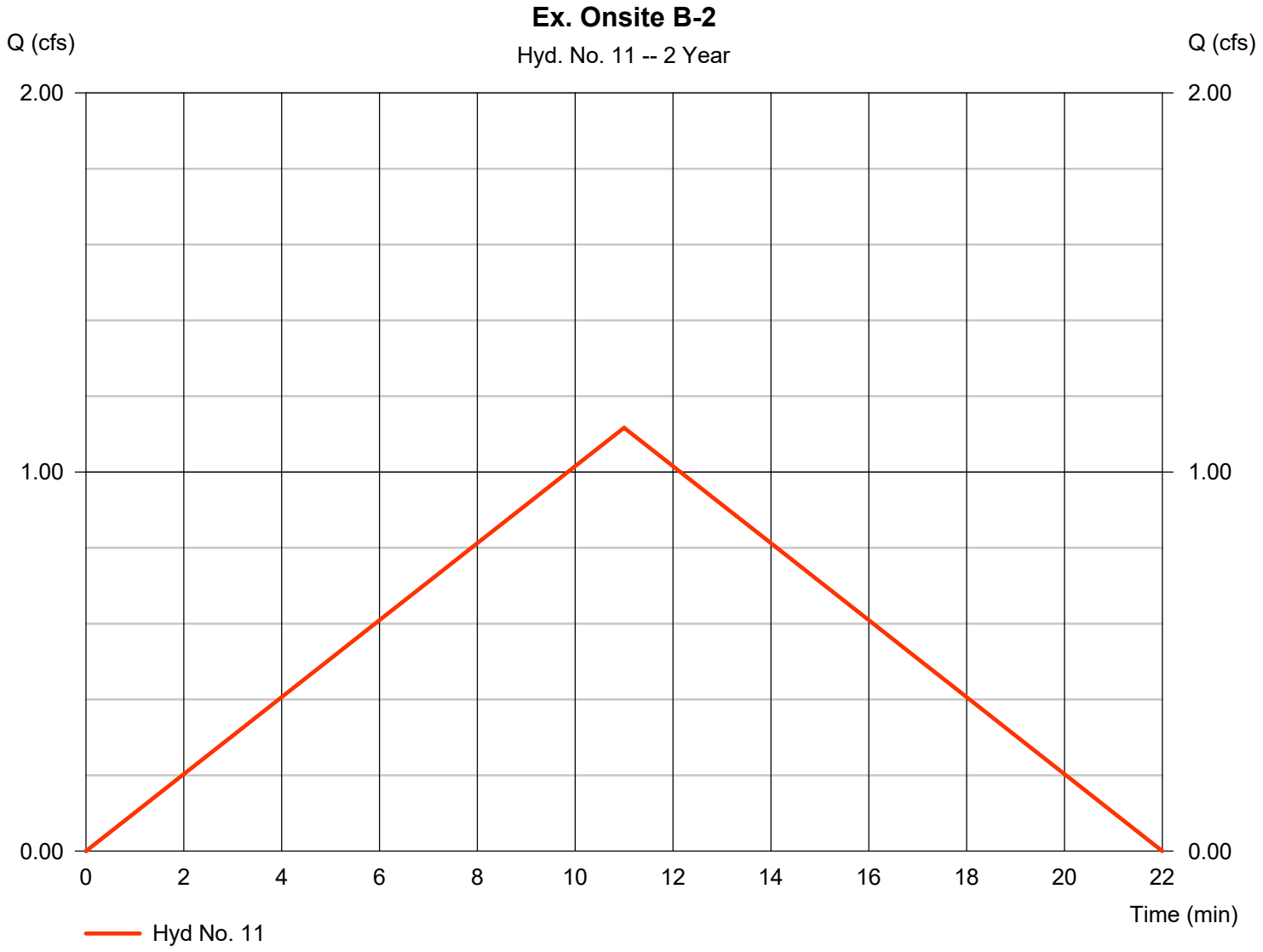


Hydrograph Report

Hyd. No. 11

Ex. Onsite B-2

Hydrograph type	=	Rational	Peak discharge	=	1.117 cfs
Storm frequency	=	2 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	737 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	4.002 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

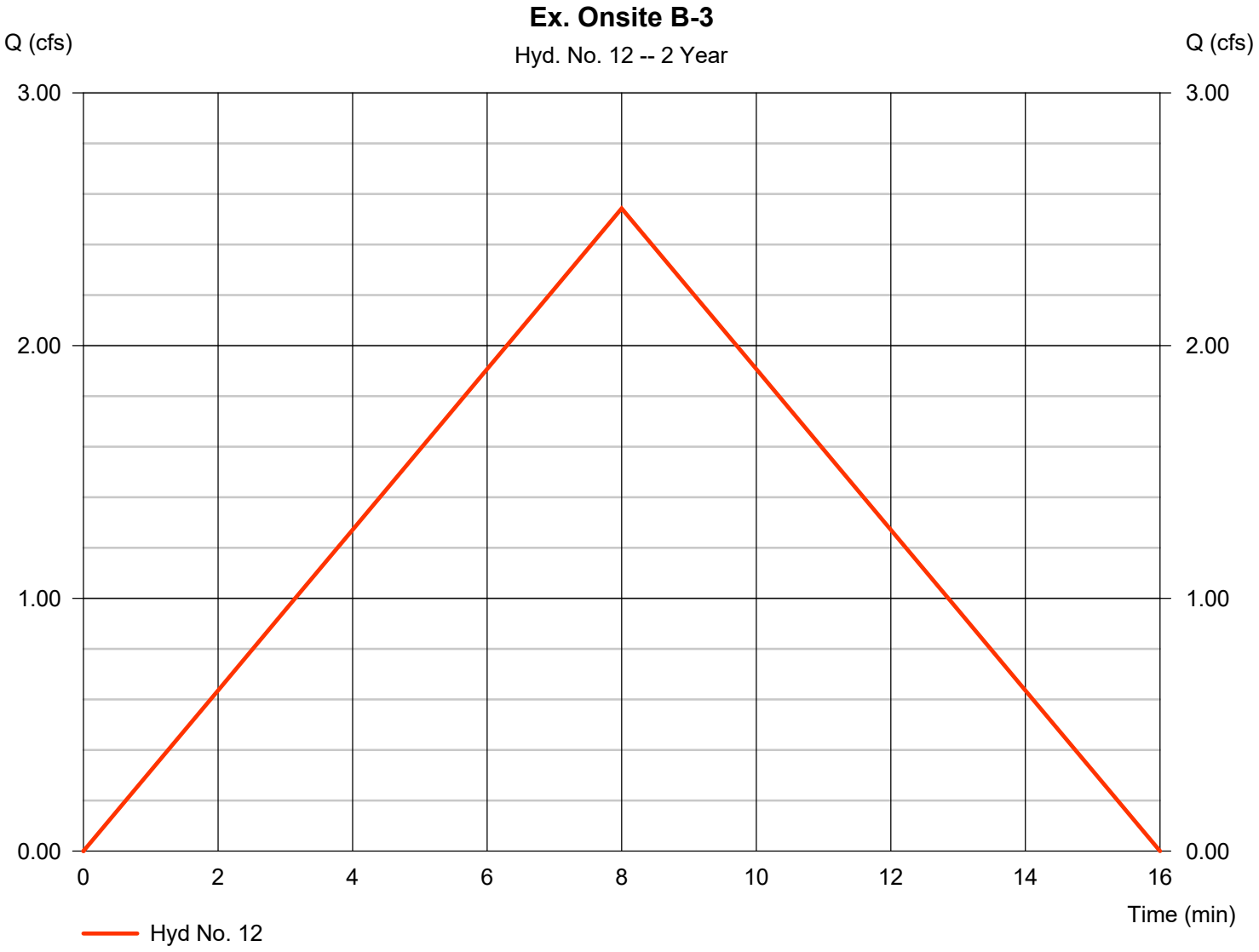


Hydrograph Report

Hyd. No. 12

Ex. Onsite B-3

Hydrograph type	= Rational	Peak discharge	= 2.543 cfs
Storm frequency	= 2 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 1,221 cuft
Drainage area	= 1.130 ac	Runoff coeff.	= 0.51
Intensity	= 4.412 in/hr	Tc by User	= 8.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

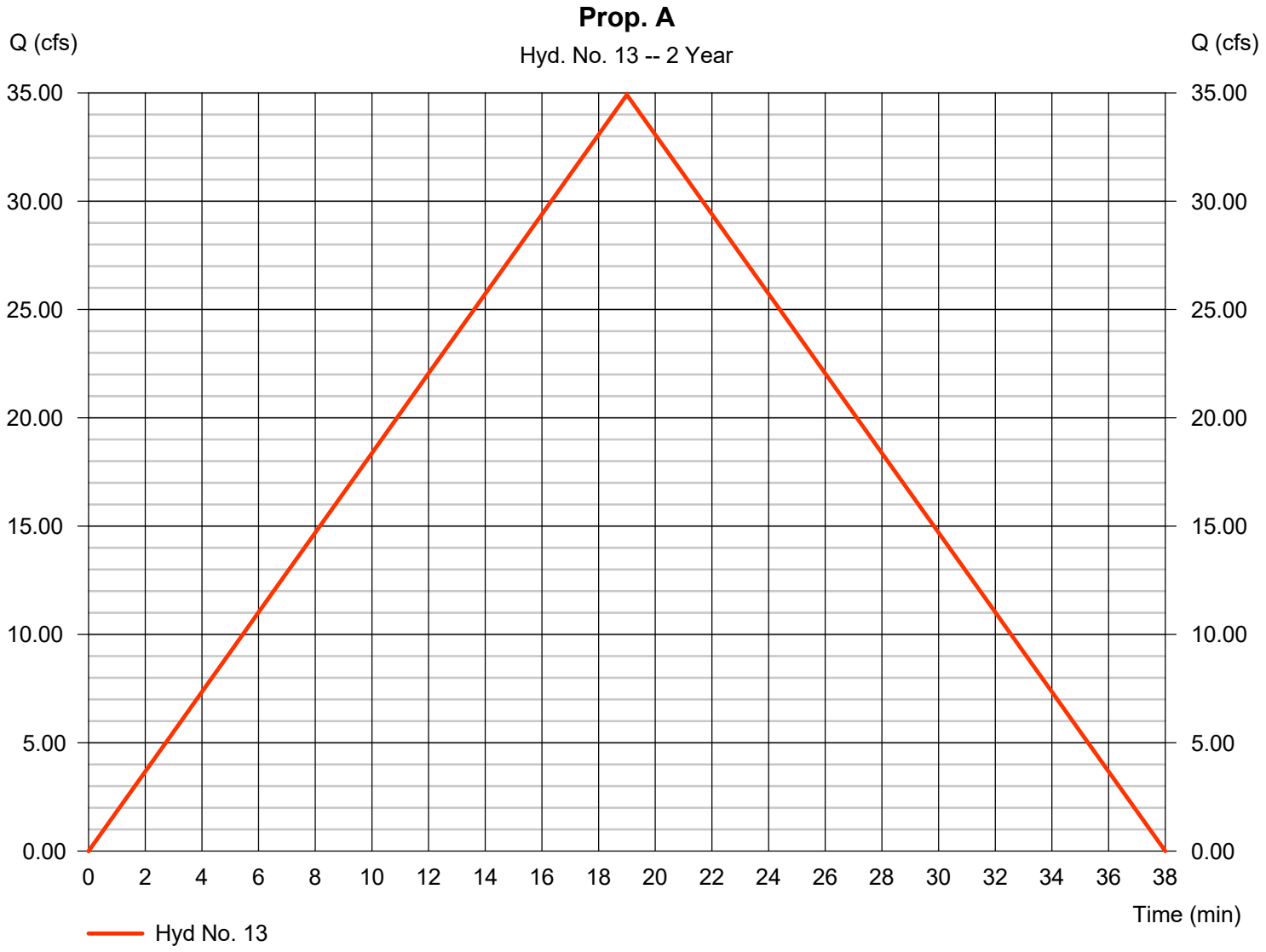


Hydrograph Report

Hyd. No. 13

Prop. A

Hydrograph type	=	Rational	Peak discharge	=	34.91 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	39,799 cuft
Drainage area	=	18.720 ac	Runoff coeff.	=	0.58
Intensity	=	3.215 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 14

Prop. A-1

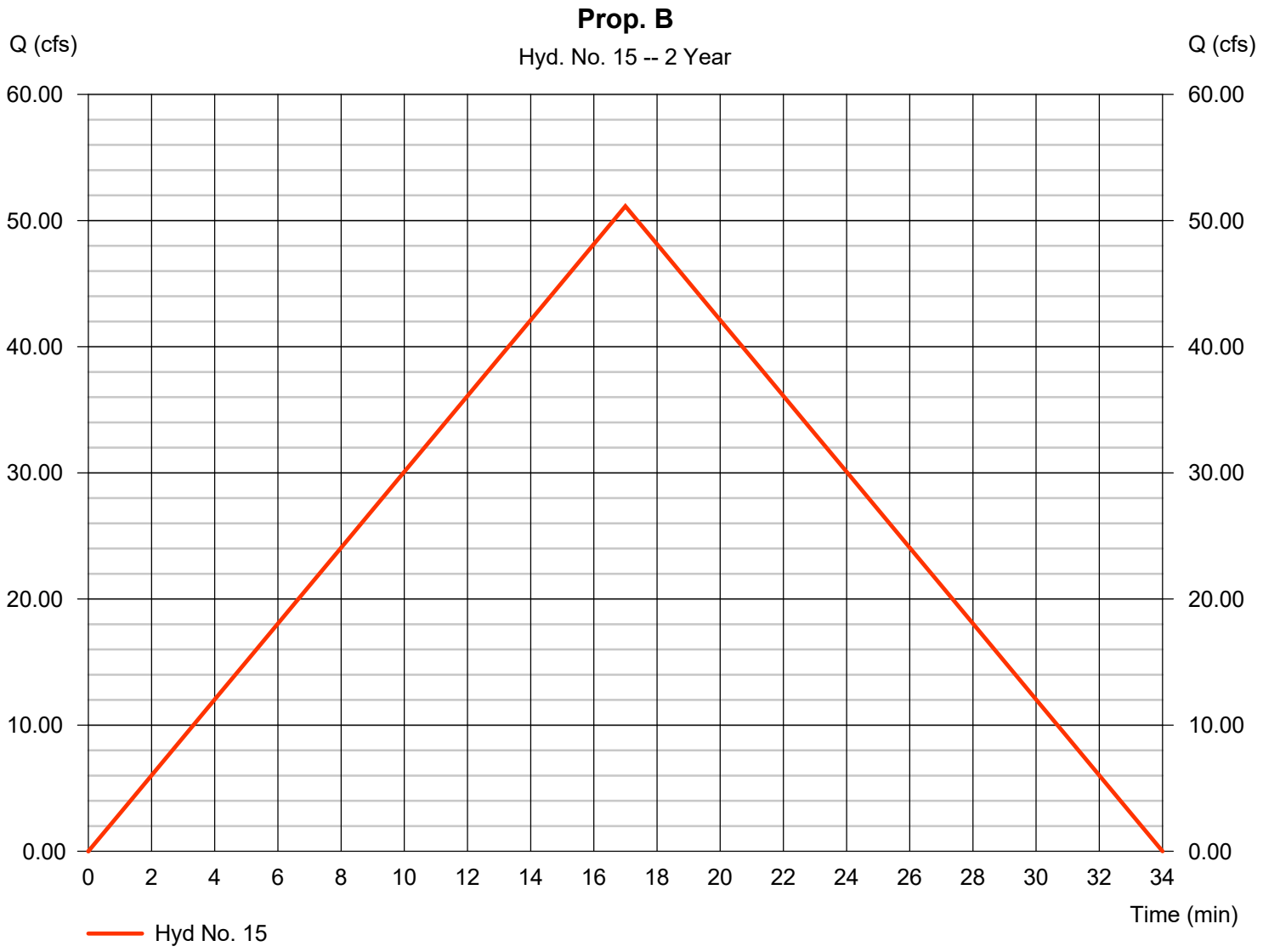
Hydrograph type	=	Rational	Peak discharge	=	1.961 cfs
Storm frequency	=	2 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	1,530 cuft
Drainage area	=	1.020 ac	Runoff coeff.	=	0.51
Intensity	=	3.770 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 15

Prop. B

Hydrograph type	=	Rational	Peak discharge	=	51.14 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	52,164 cuft
Drainage area	=	26.540 ac	Runoff coeff.	=	0.57
Intensity	=	3.381 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

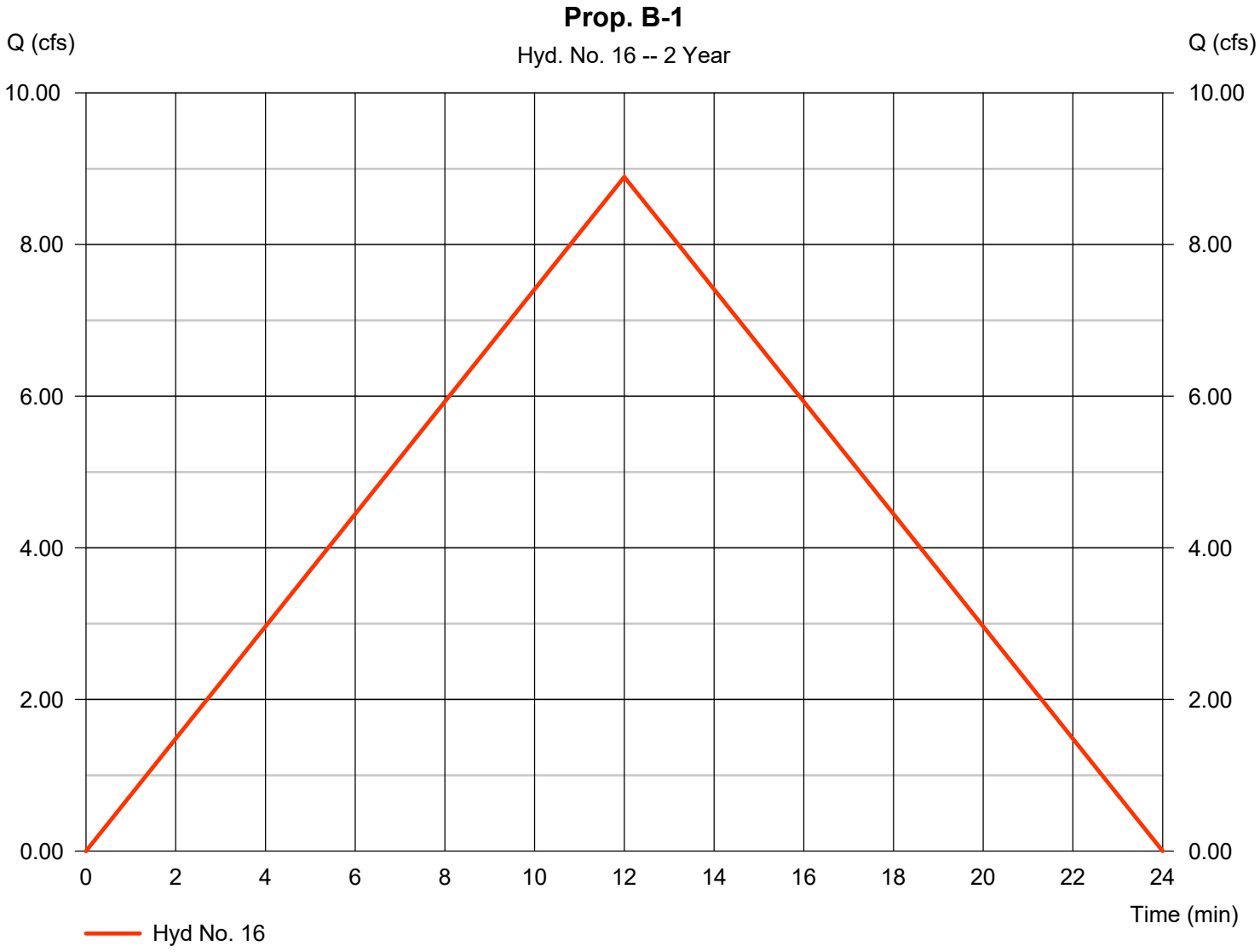


Hydrograph Report

Hyd. No. 16

Prop. B-1

Hydrograph type	= Rational	Peak discharge	= 8.891 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 6,402 cuft
Drainage area	= 4.490 ac	Runoff coeff.	= 0.51
Intensity	= 3.883 in/hr	Tc by User	= 12.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

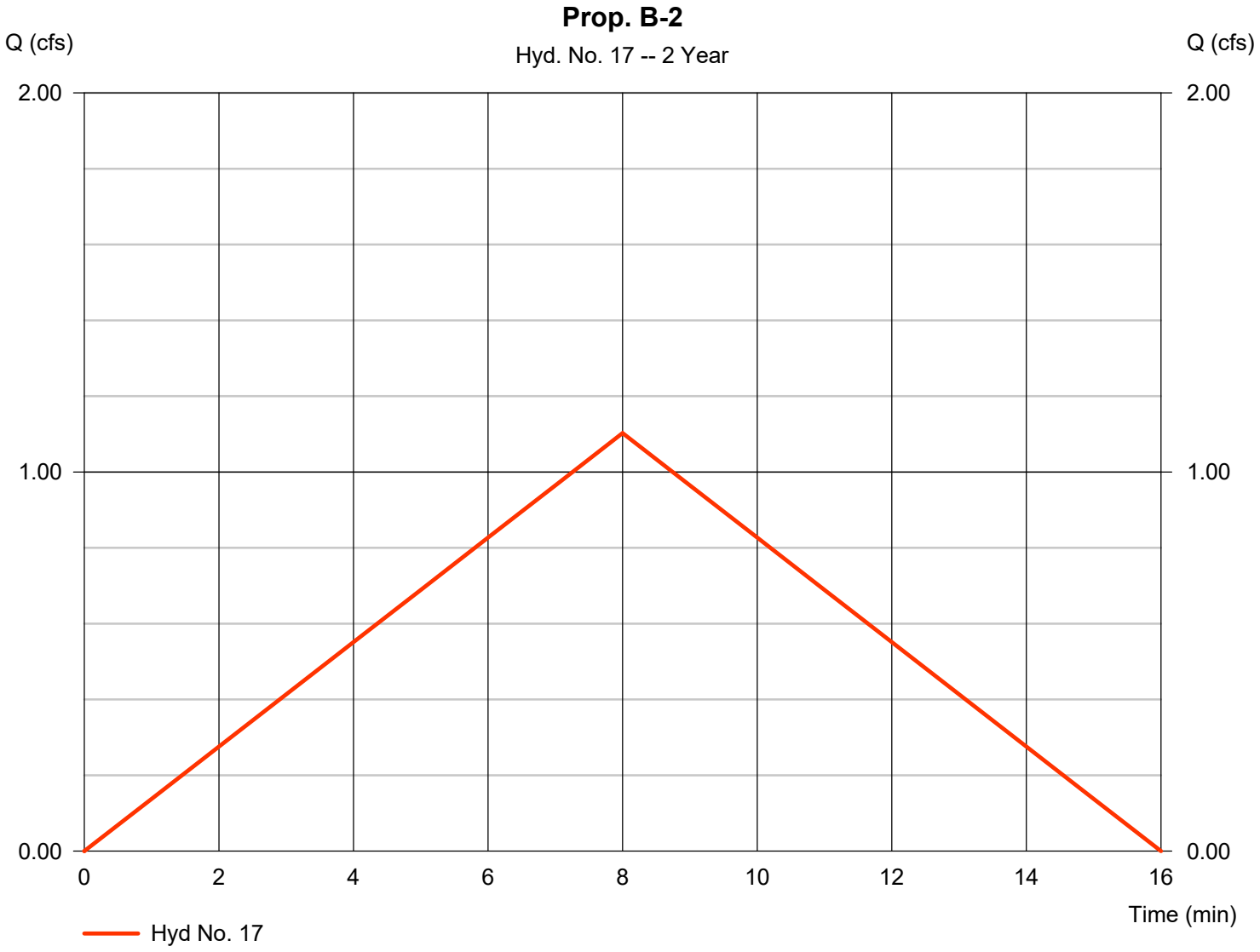


Hydrograph Report

Hyd. No. 17

Prop. B-2

Hydrograph type	=	Rational	Peak discharge	=	1.103 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	529 cuft
Drainage area	=	0.490 ac	Runoff coeff.	=	0.51
Intensity	=	4.412 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

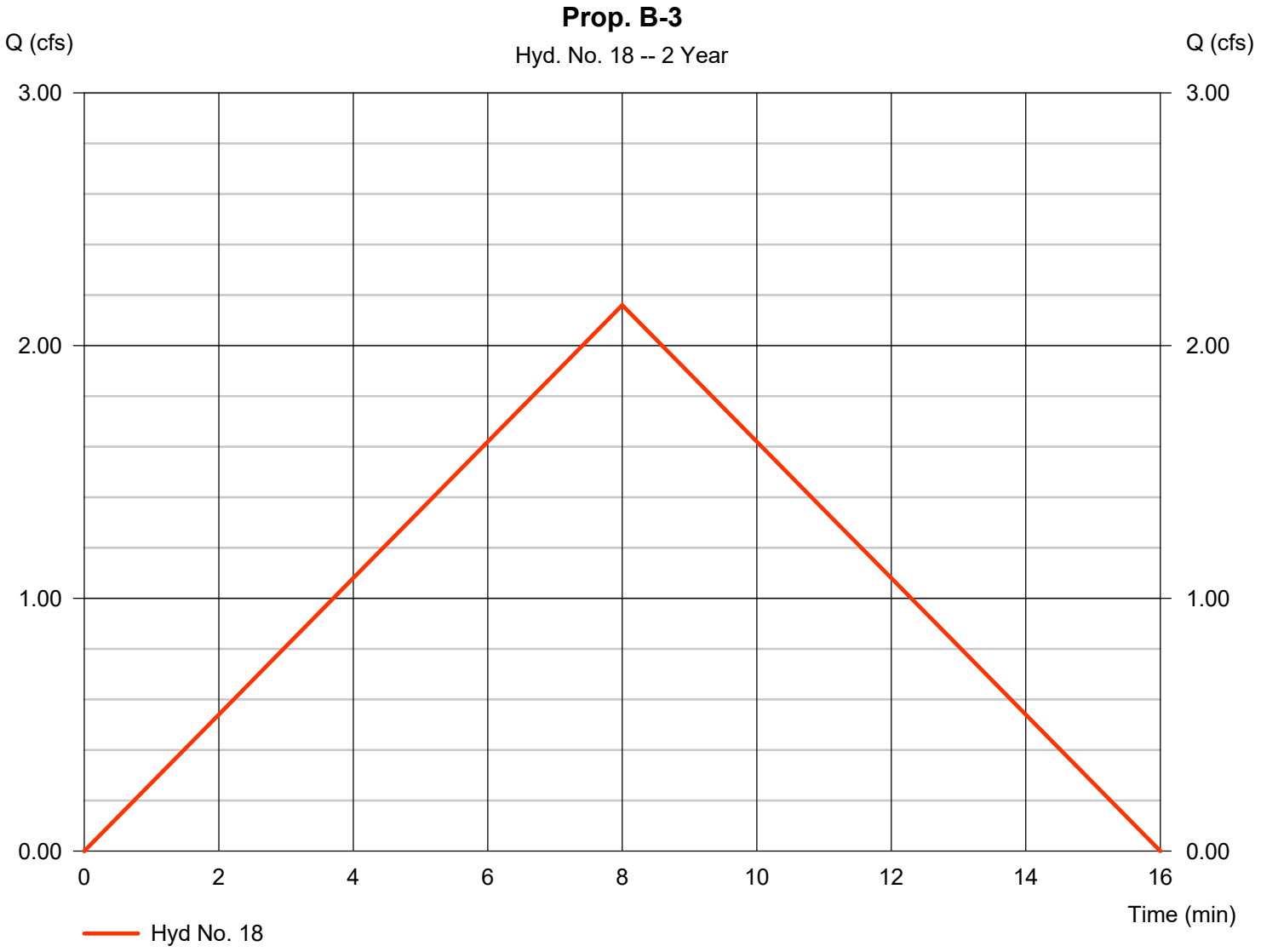


Hydrograph Report

Hyd. No. 18

Prop. B-3

Hydrograph type	=	Rational	Peak discharge	=	2.160 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,037 cuft
Drainage area	=	0.960 ac	Runoff coeff.	=	0.51
Intensity	=	4.412 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

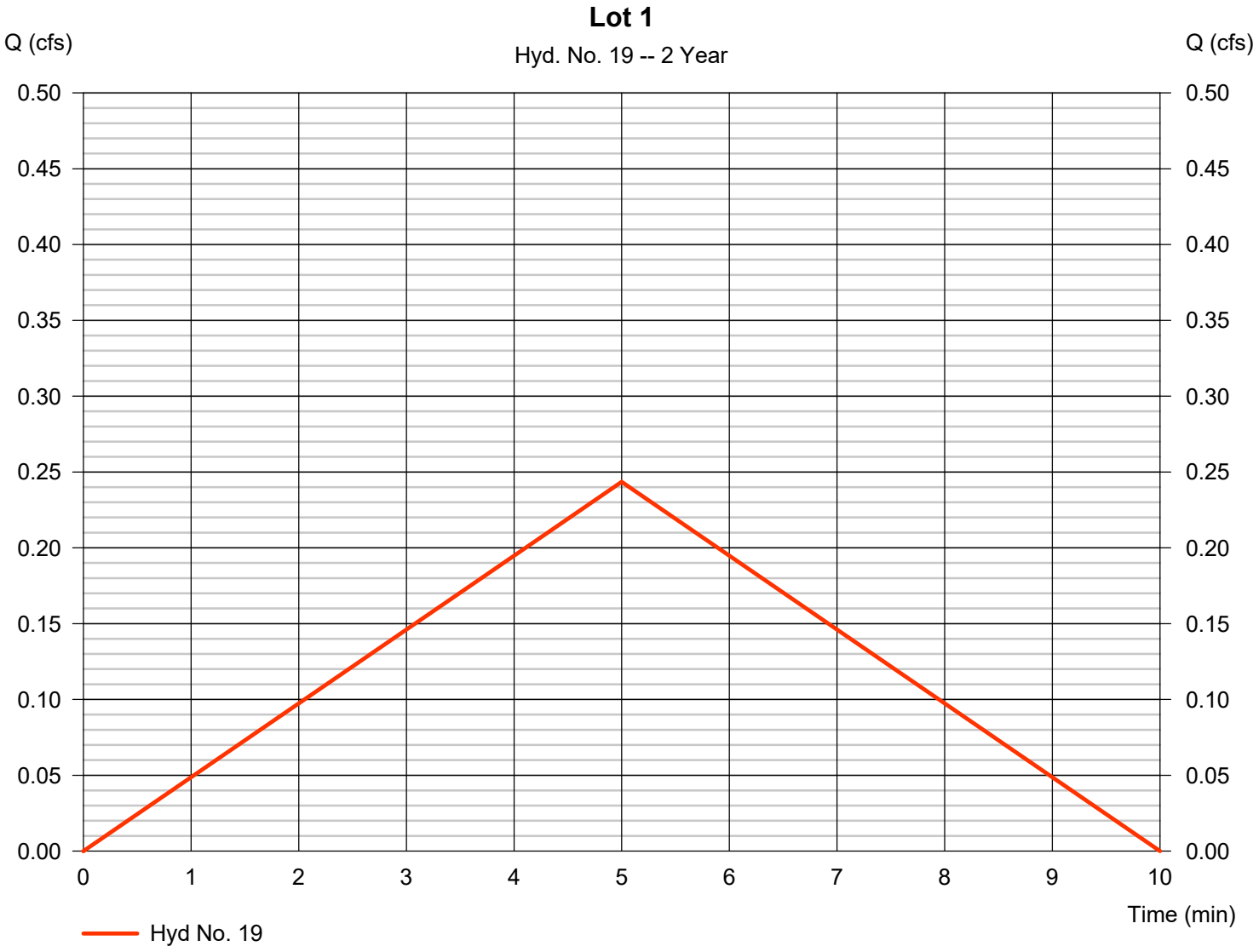


Hydrograph Report

Hyd. No. 19

Lot 1

Hydrograph type	= Rational	Peak discharge	= 0.244 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 73 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 4.920 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

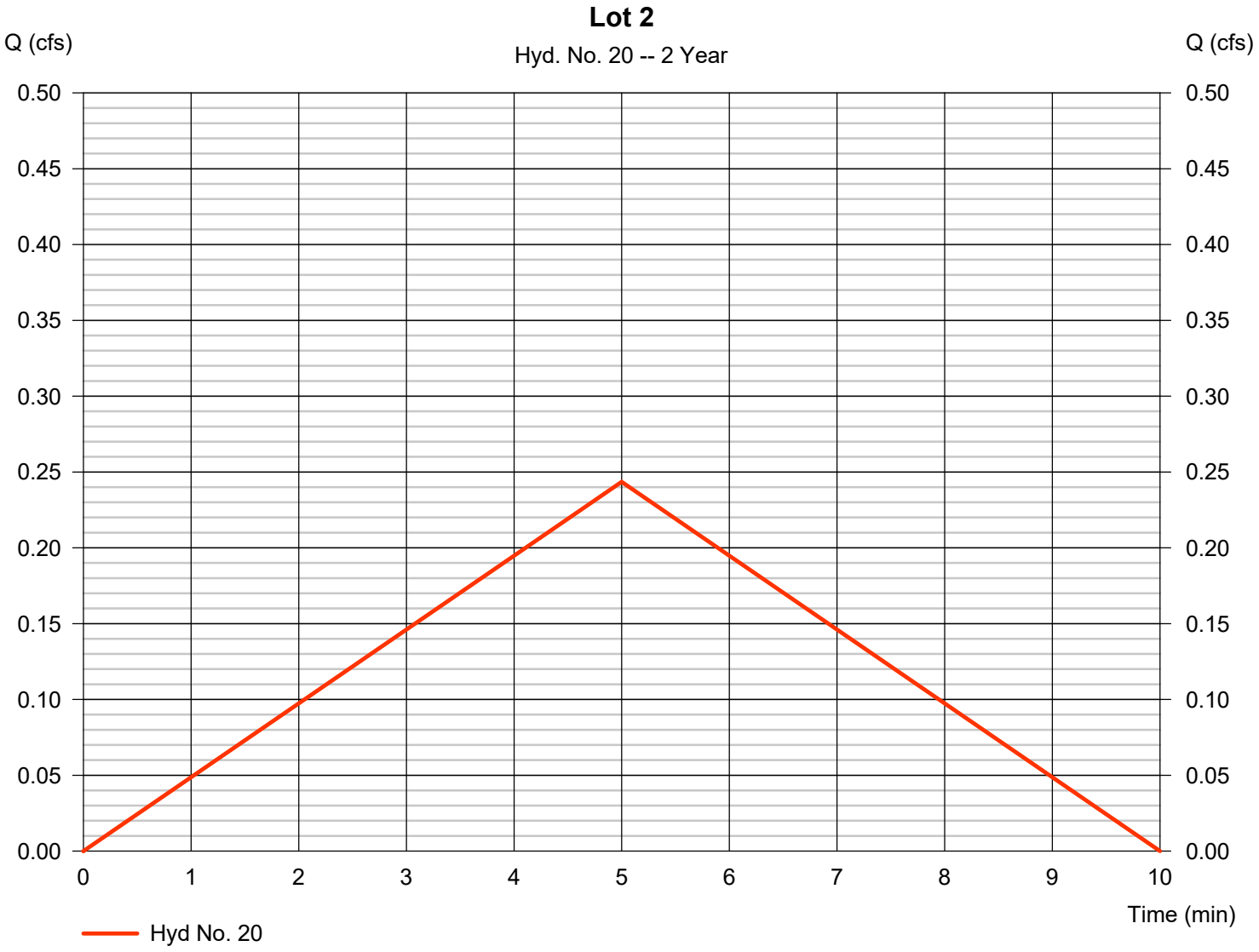


Hydrograph Report

Hyd. No. 20

Lot 2

Hydrograph type	= Rational	Peak discharge	= 0.244 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 73 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 4.920 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

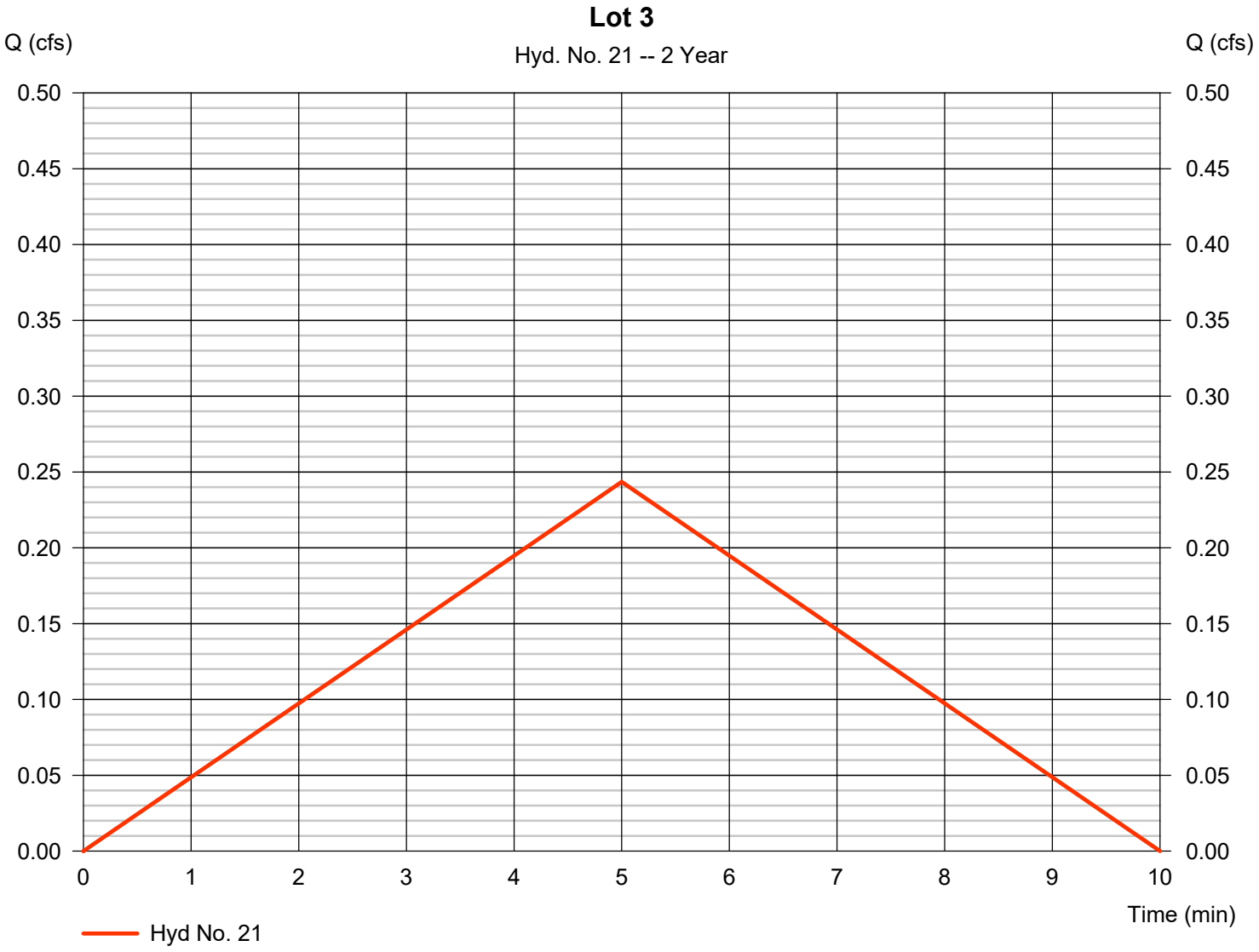


Hydrograph Report

Hyd. No. 21

Lot 3

Hydrograph type	= Rational	Peak discharge	= 0.244 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 73 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 4.920 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

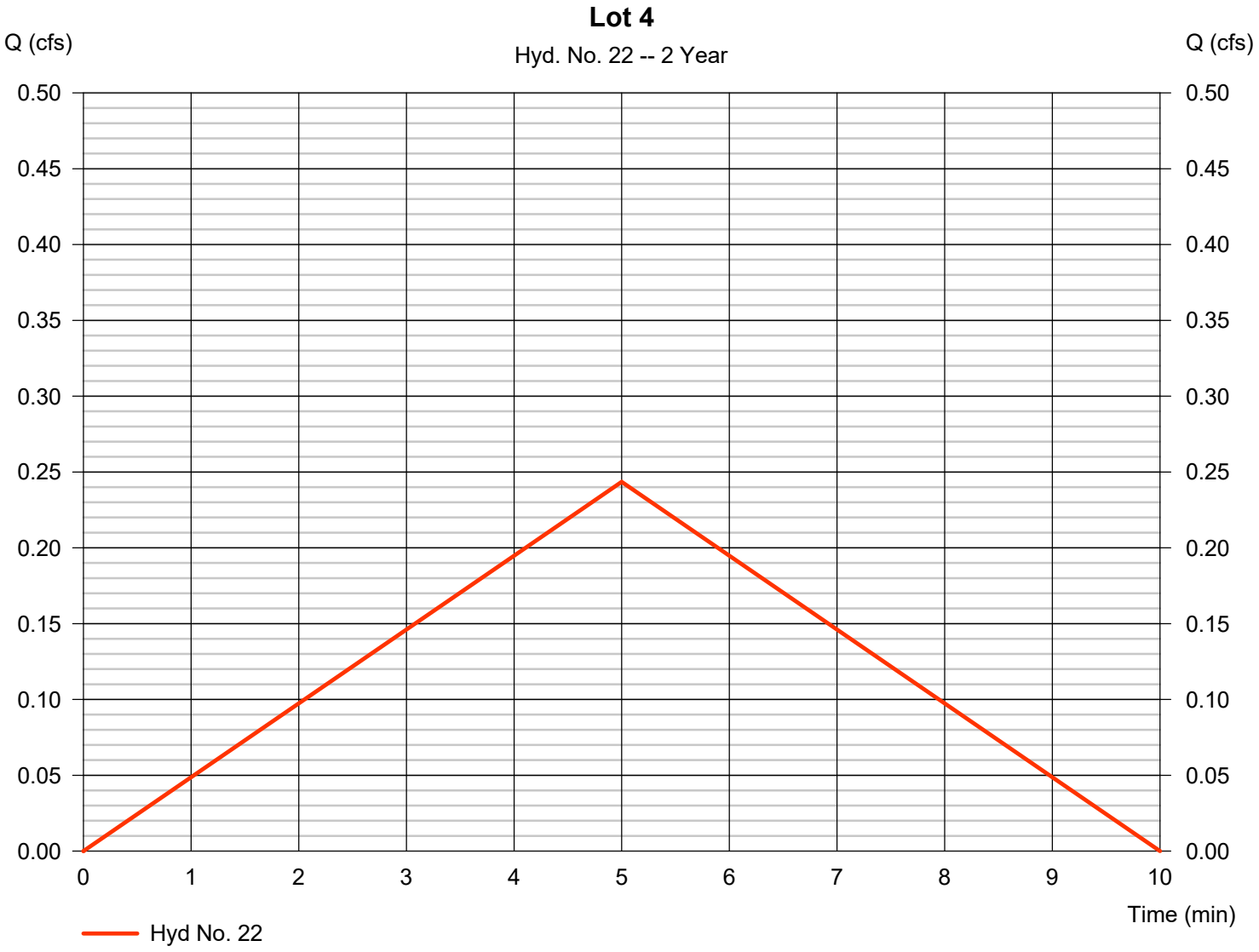


Hydrograph Report

Hyd. No. 22

Lot 4

Hydrograph type	=	Rational	Peak discharge	=	0.244 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	73 cuft
Drainage area	=	0.055 ac	Runoff coeff.	=	0.9
Intensity	=	4.920 in/hr	Tc by User	=	5.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

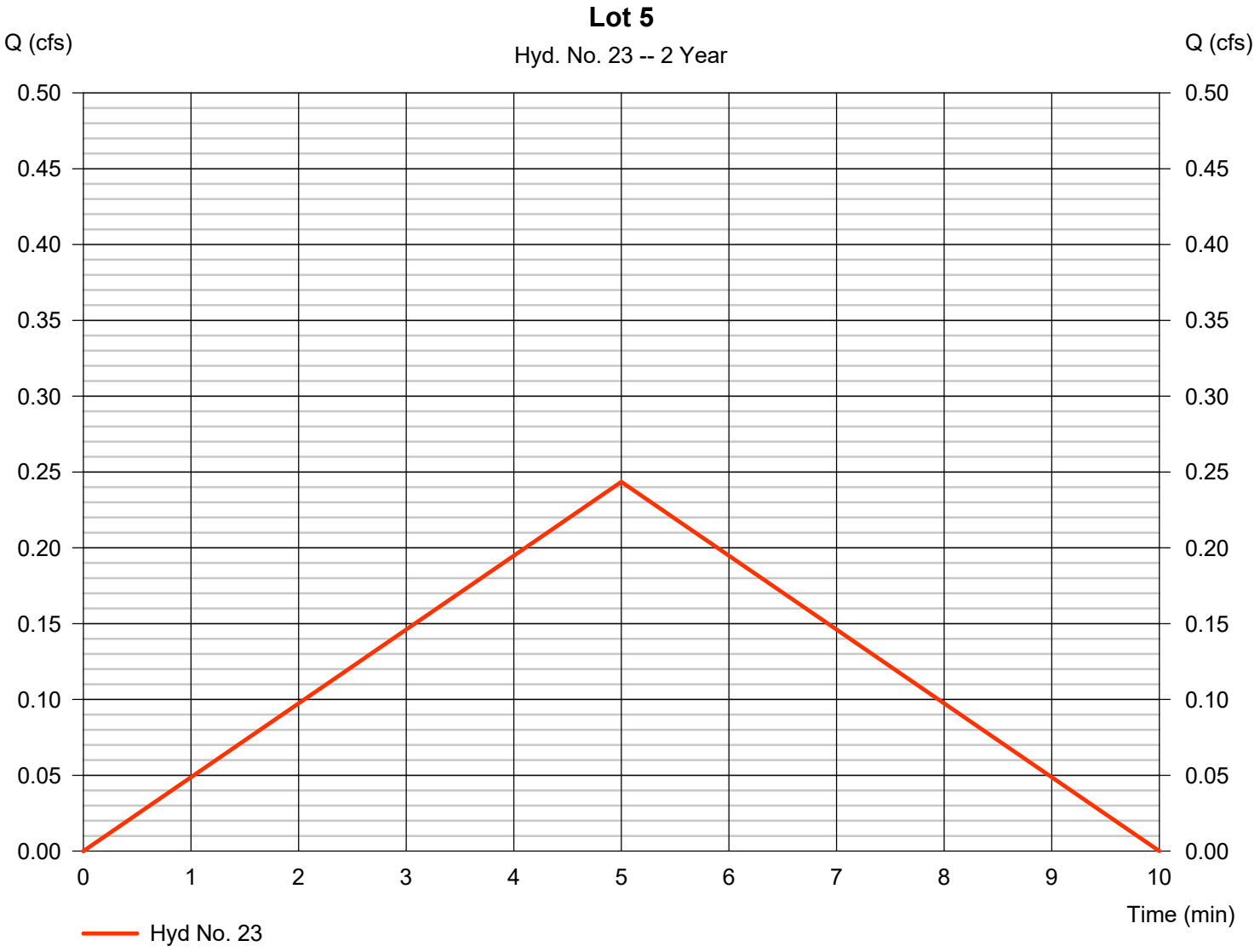


Hydrograph Report

Hyd. No. 23

Lot 5

Hydrograph type	= Rational	Peak discharge	= 0.244 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 73 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 4.920 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

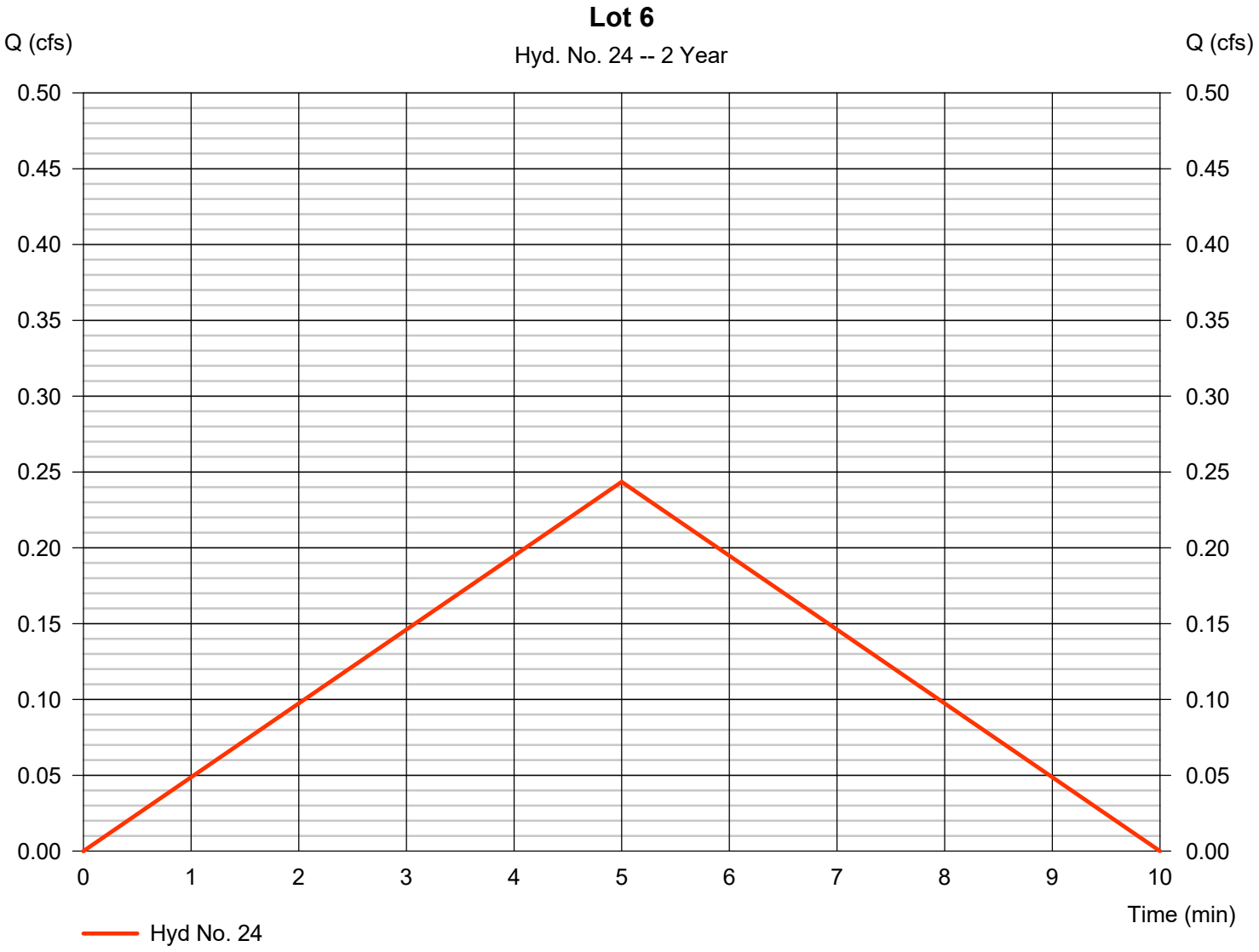


Hydrograph Report

Hyd. No. 24

Lot 6

Hydrograph type	=	Rational	Peak discharge	=	0.244 cfs
Storm frequency	=	2 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	73 cuft
Drainage area	=	0.055 ac	Runoff coeff.	=	0.9
Intensity	=	4.920 in/hr	Tc by User	=	5.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1



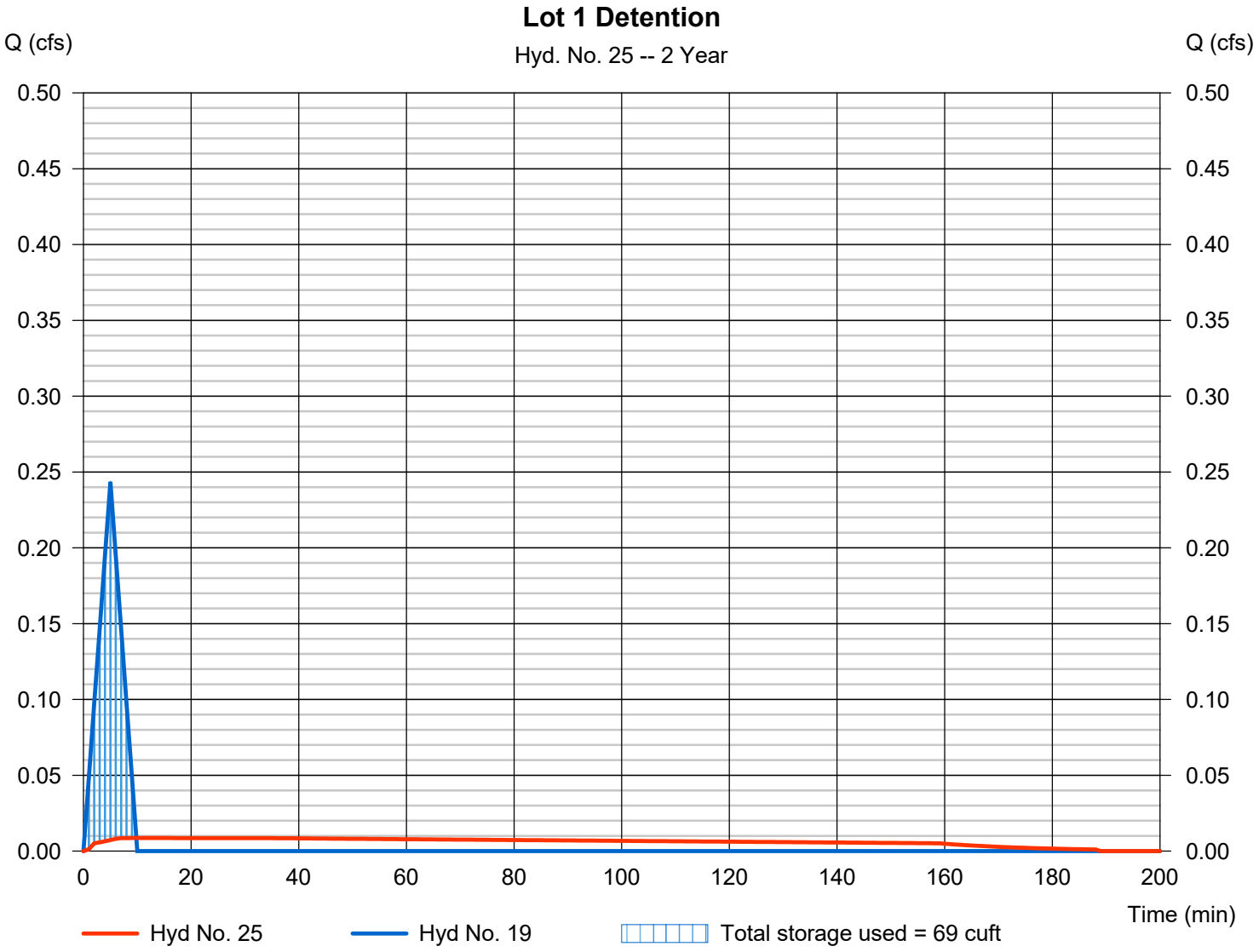
Hydrograph Report

Hyd. No. 25

Lot 1 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	72 cuft
Inflow hyd. No.	=	19 - Lot 1	Max. Elevation	=	1038.03 ft
Reservoir name	=	Lot 1 Detention Pit	Max. Storage	=	69 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Lot 1 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1037.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1037.00	225	0	0
1.00	1038.00	225	56	56
1.42	1038.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1037.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1038.42	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1037.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1038.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1038.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

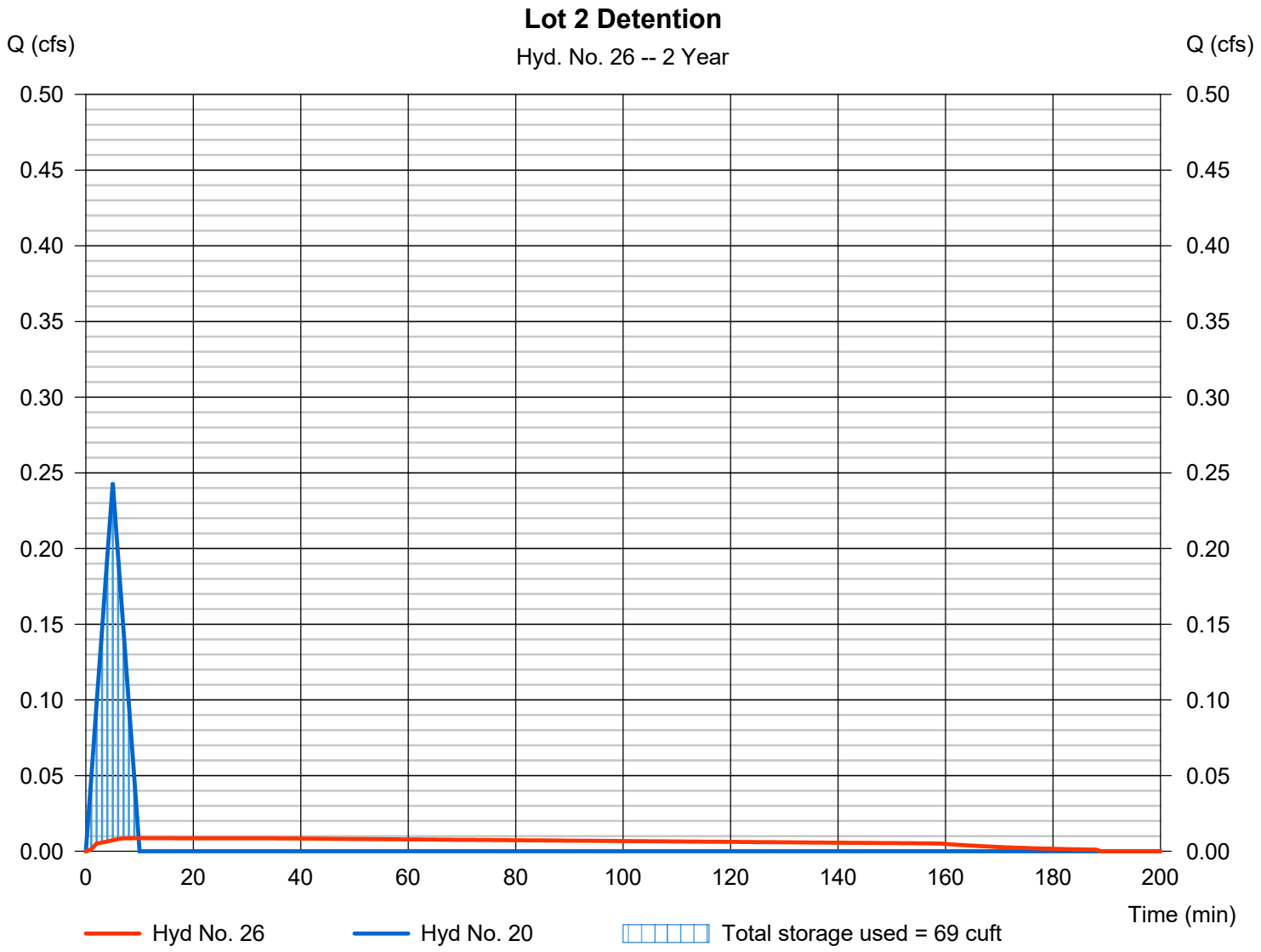
Hydrograph Report

Hyd. No. 26

Lot 2 Detention

Hydrograph type	= Reservoir	Peak discharge	= 0.009 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 72 cuft
Inflow hyd. No.	= 20 - Lot 2	Max. Elevation	= 1040.03 ft
Reservoir name	= Lot 2 Detention Pit	Max. Storage	= 69 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Lot 2 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1039.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1039.00	225	0	0
1.00	1040.00	225	56	56
1.42	1040.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1039.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1040.42	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1039.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1040.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1040.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

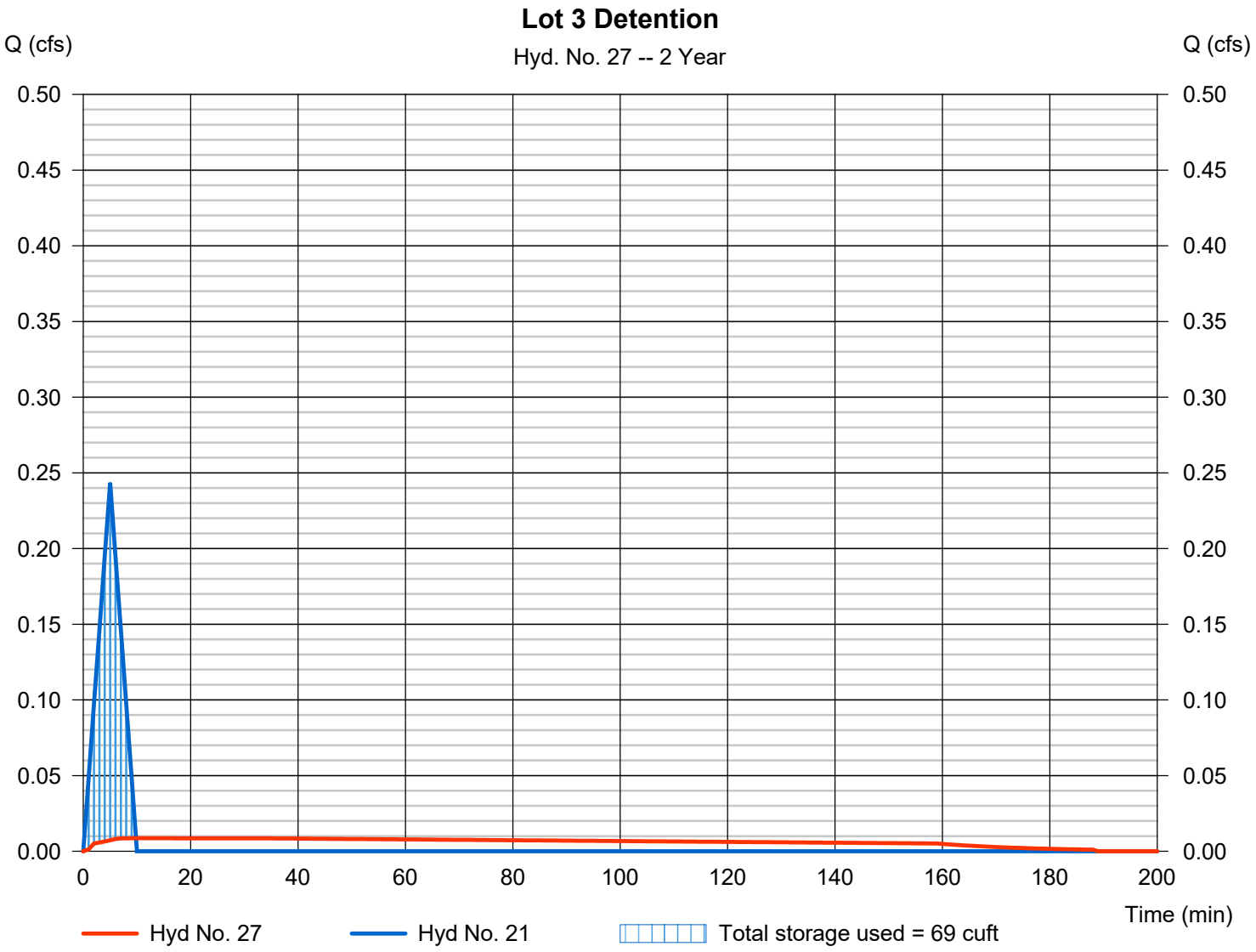
Hydrograph Report

Hyd. No. 27

Lot 3 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	72 cuft
Inflow hyd. No.	=	21 - Lot 3	Max. Elevation	=	1037.03 ft
Reservoir name	=	Lot 3 Detention Pit	Max. Storage	=	69 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - Lot 3 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1036.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1036.00	225	0	0
1.00	1037.00	225	56	56
1.42	1037.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1036.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1037.42	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1036.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1037.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1037.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

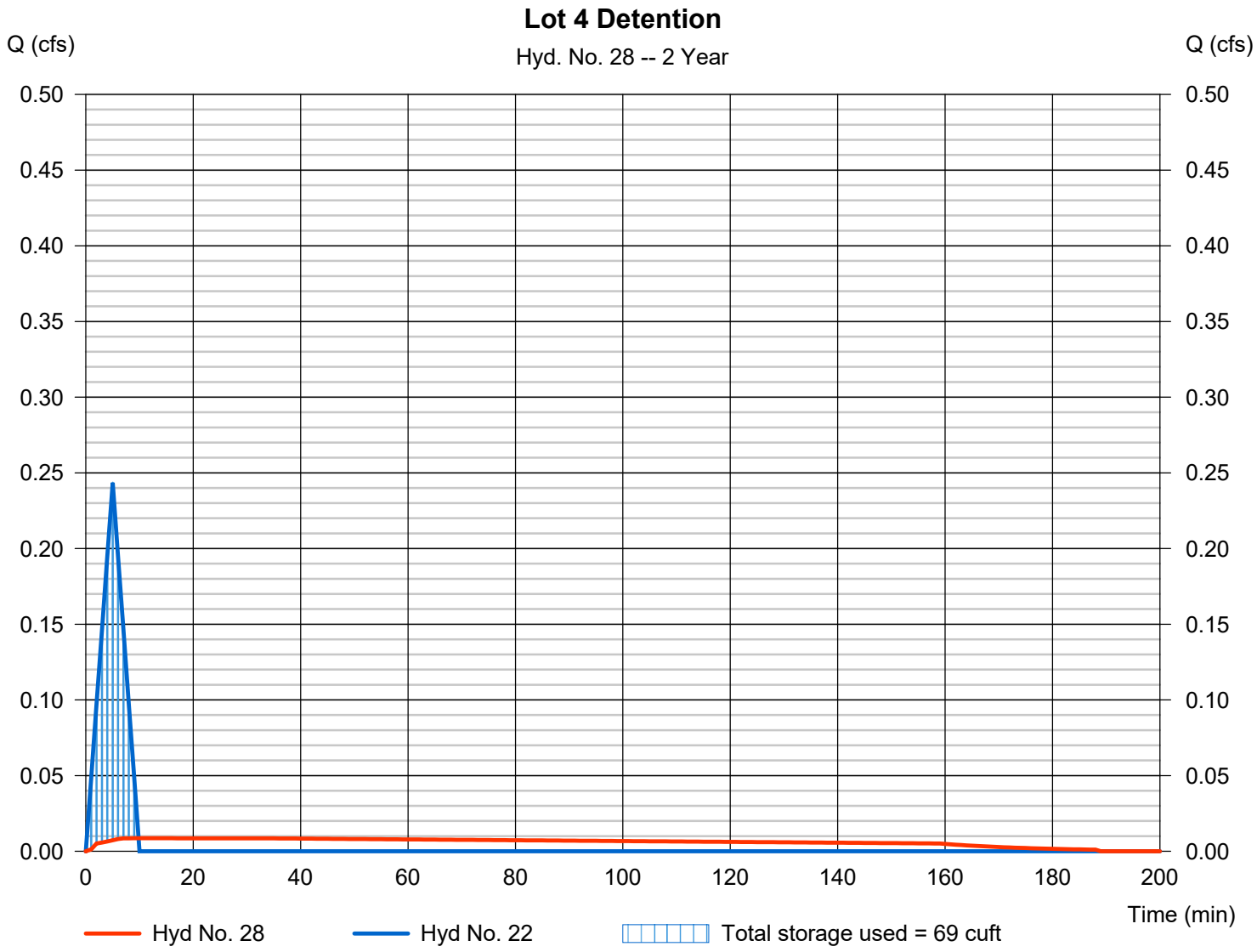
Hydrograph Report

Hyd. No. 28

Lot 4 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	72 cuft
Inflow hyd. No.	=	22 - Lot 4	Max. Elevation	=	1039.03 ft
Reservoir name	=	Lot 4 Detention Pit	Max. Storage	=	69 cuft

Storage Indication method used.



Pond Report

Pond No. 5 - Lot 4 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1038.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1038.00	225	0	0
1.00	1039.00	225	56	56
1.42	1039.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1038.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1039.42	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1038.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1039.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1039.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

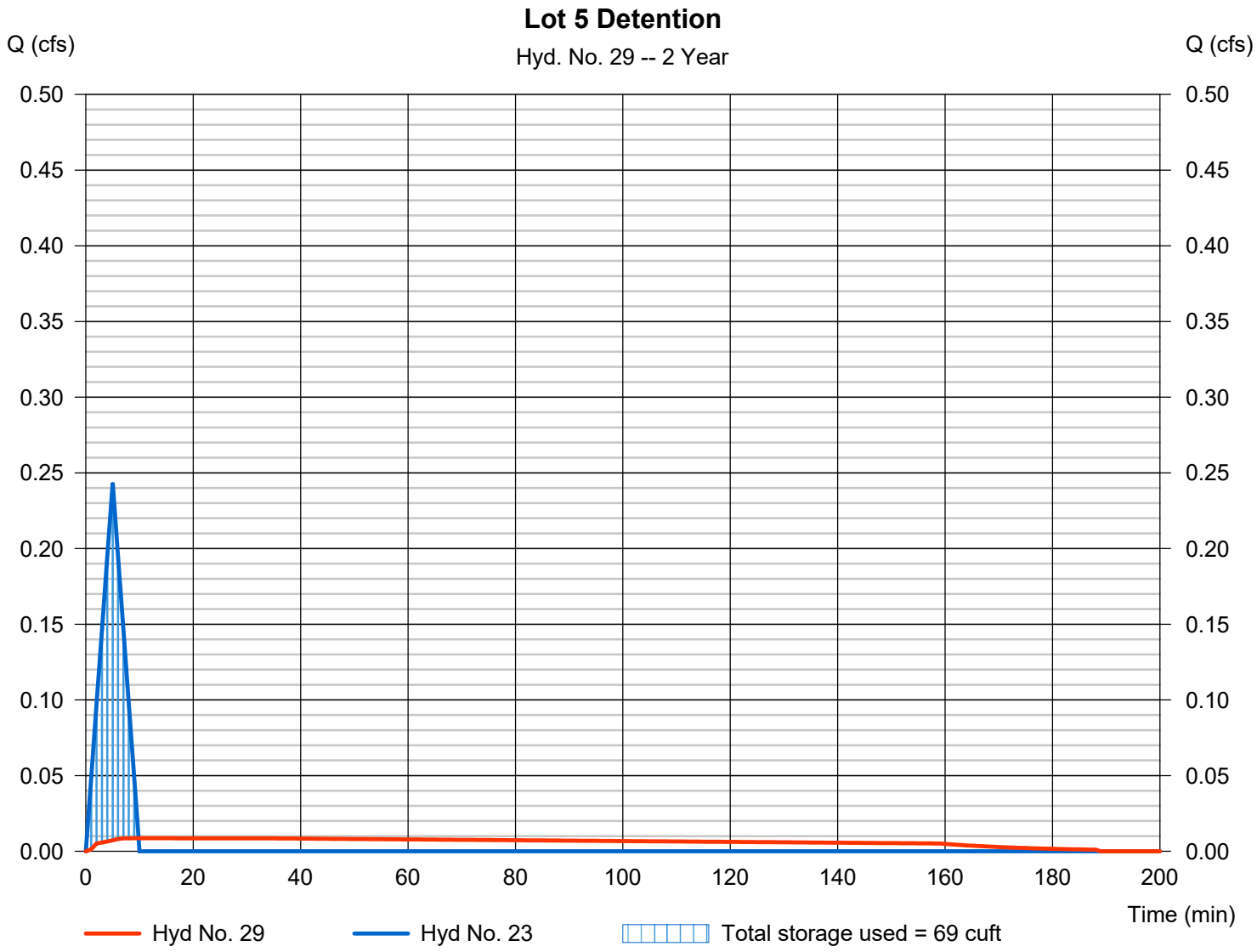
Hydrograph Report

Hyd. No. 29

Lot 5 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	72 cuft
Inflow hyd. No.	=	23 - Lot 5	Max. Elevation	=	1038.03 ft
Reservoir name	=	Lot 5 Detention Pit	Max. Storage	=	69 cuft

Storage Indication method used.



Pond Report

Pond No. 6 - Lot 5 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1037.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1037.00	225	0	0
1.00	1038.00	225	56	56
1.42	1038.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1037.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1038.42	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1037.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1038.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1038.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

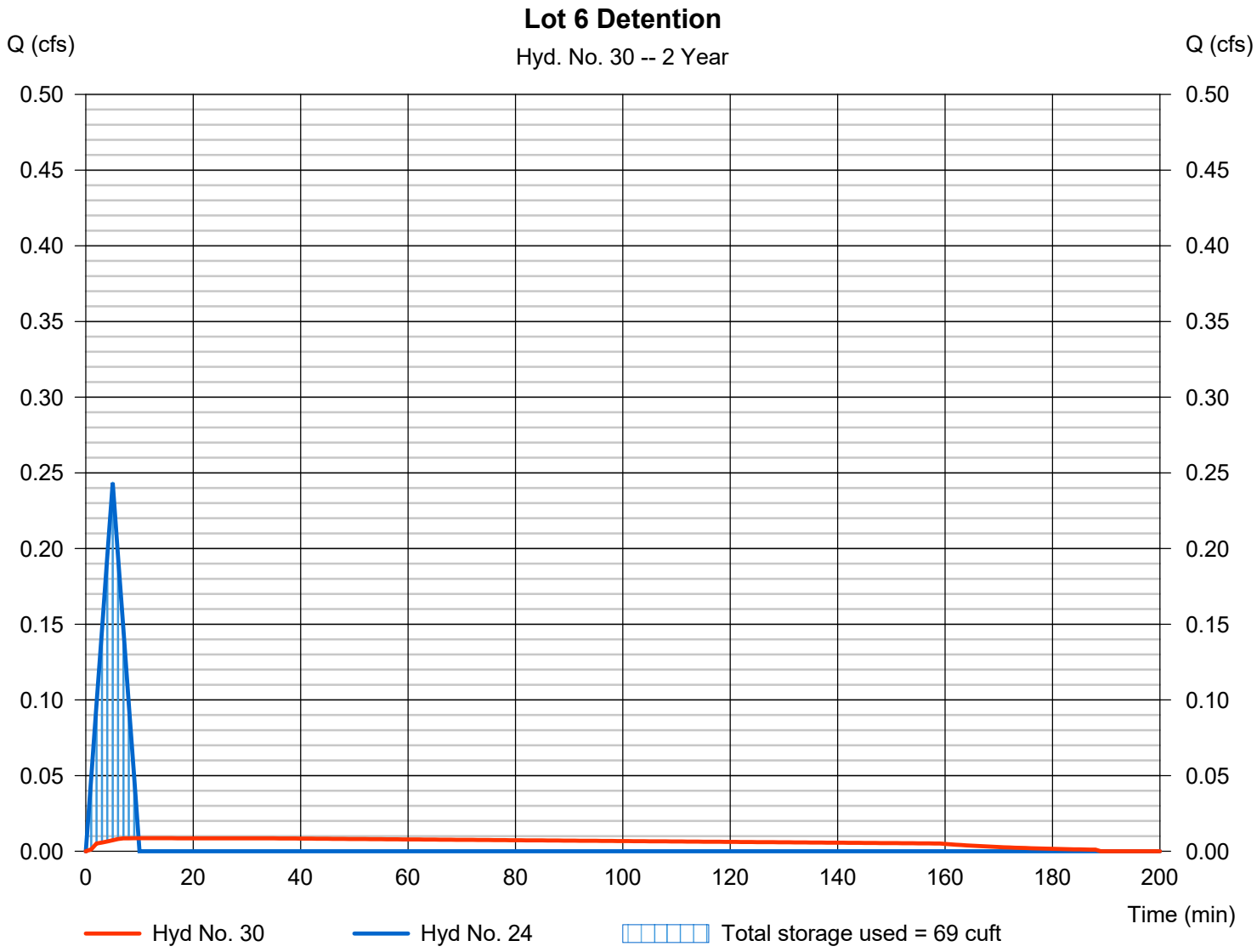
Hydrograph Report

Hyd. No. 30

Lot 6 Detention

Hydrograph type	= Reservoir	Peak discharge	= 0.009 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 72 cuft
Inflow hyd. No.	= 24 - Lot 6	Max. Elevation	= 1038.03 ft
Reservoir name	= Lot 6 Detention Pit	Max. Storage	= 69 cuft

Storage Indication method used.



Pond Report

Pond No. 7 - Lot 6 Detention Pit

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1037.00 ft. Voids = 25.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1037.00	225	0	0
1.00	1038.00	225	56	56
1.42	1038.42	3,675	168	225

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 1.00	0.00	0.00	0.00
Span (in)	= 1.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1037.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1038.42	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

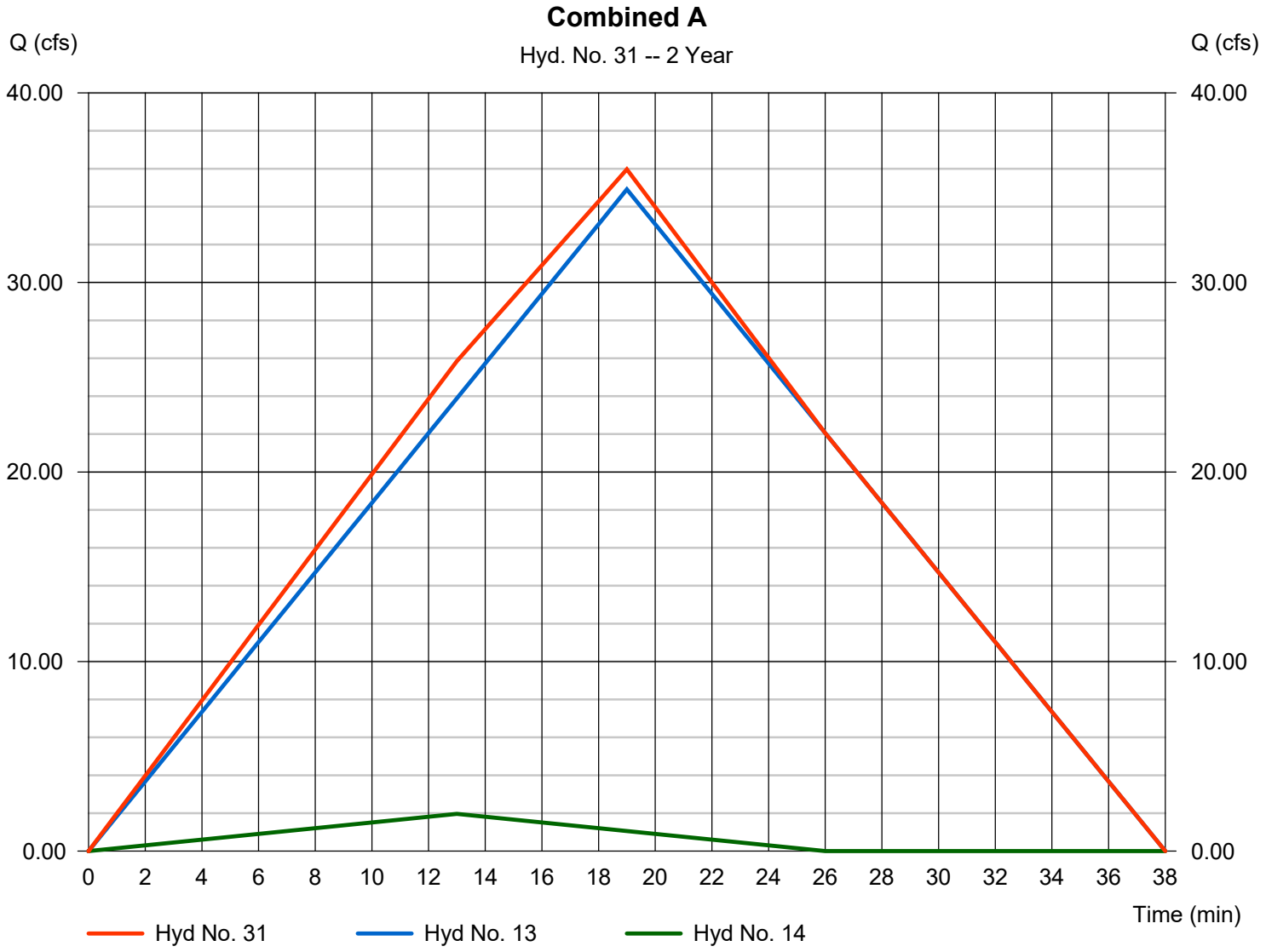
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1037.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	56	1038.00	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.009
1.42	225	1038.42	0.01 oc	---	---	---	0.00	---	---	---	---	---	0.010

Hydrograph Report

Hyd. No. 31

Combined A

Hydrograph type	= Combine	Peak discharge	= 35.97 cfs
Storm frequency	= 2 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 41,329 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 19.740 ac

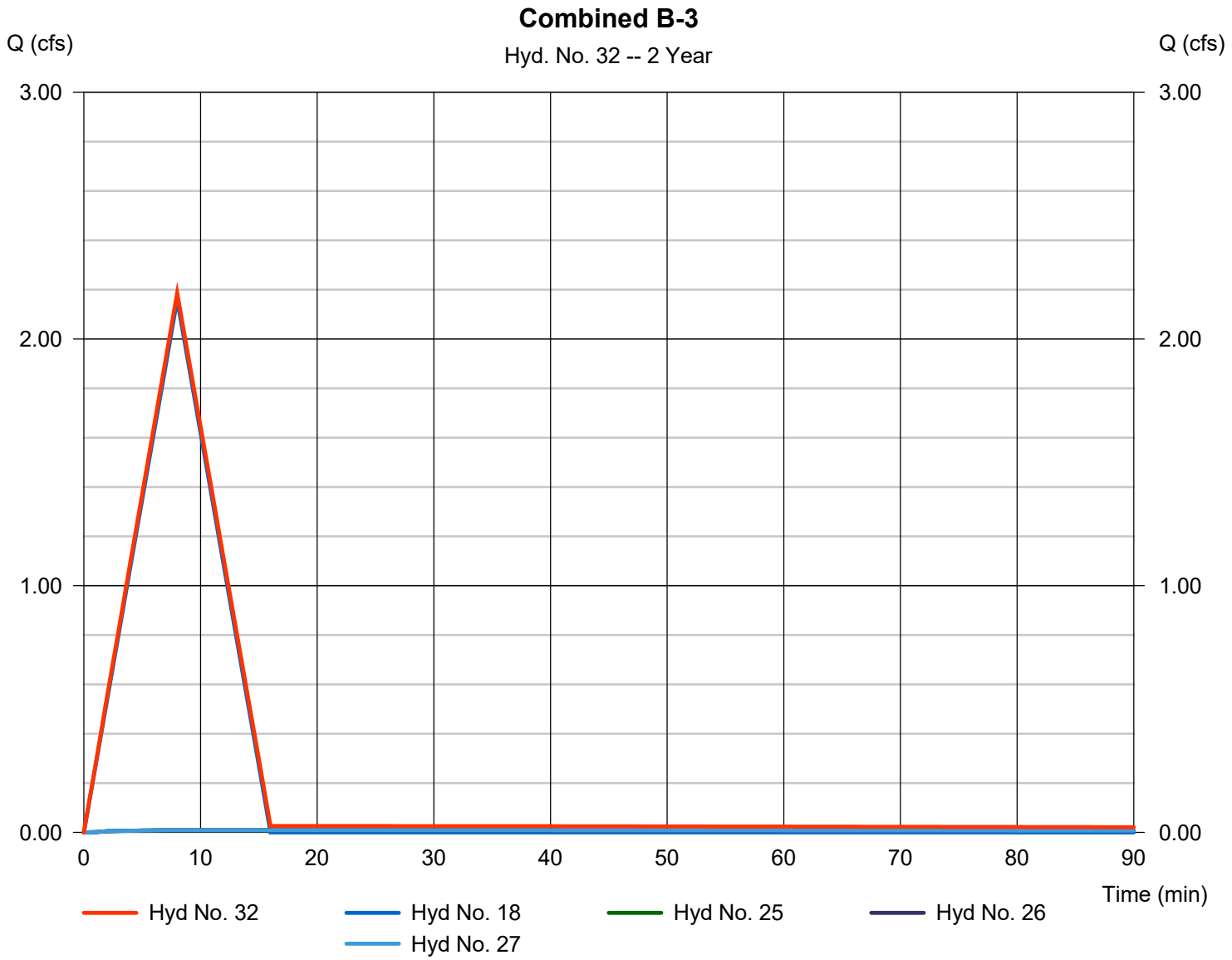


Hydrograph Report

Hyd. No. 32

Combined B-3

Hydrograph type	=	Combine	Peak discharge	=	2.186 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,253 cuft
Inflow hyds.	=	18, 25, 26, 27	Contrib. drain. area	=	0.960 ac

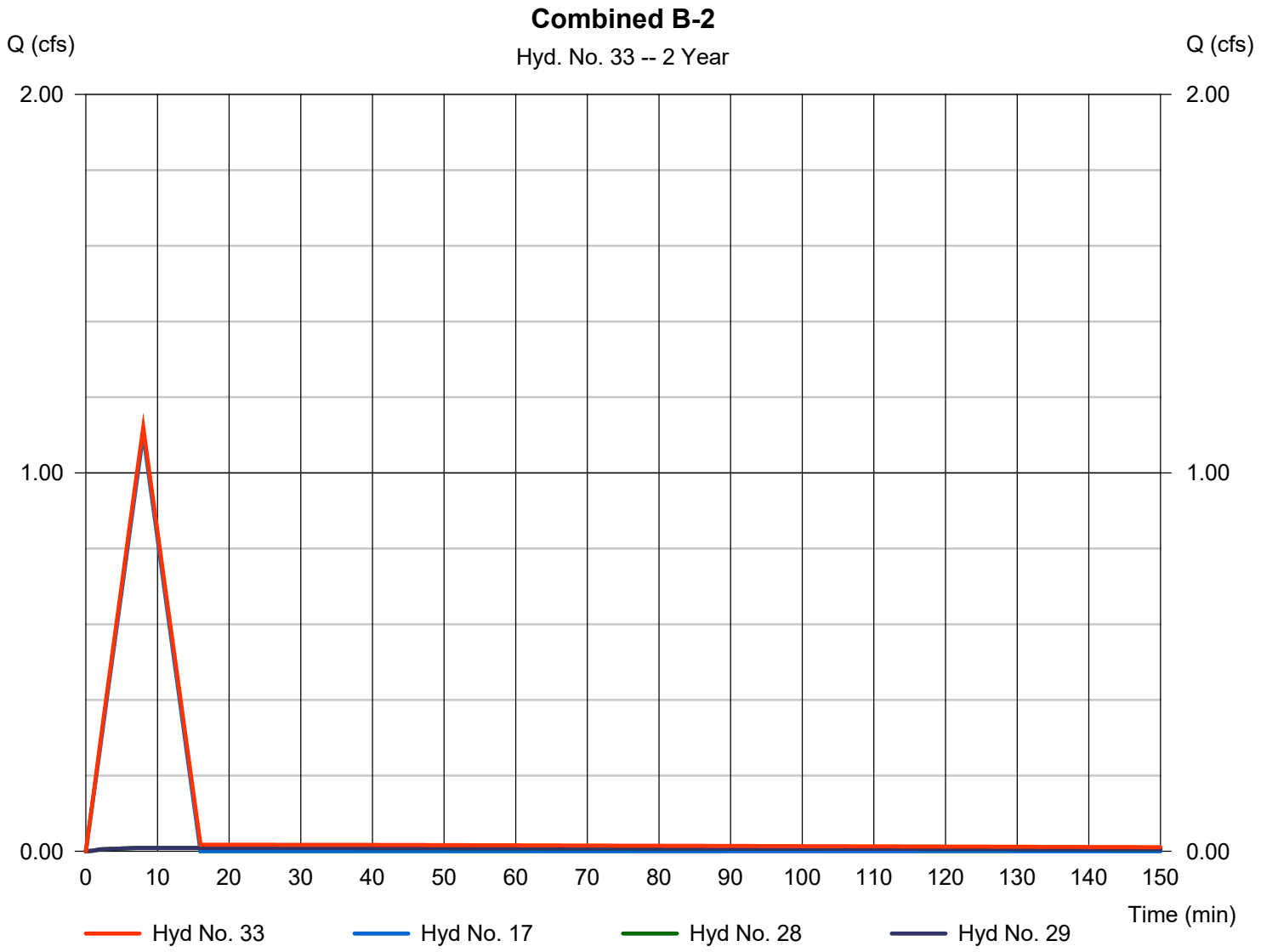


Hydrograph Report

Hyd. No. 33

Combined B-2

Hydrograph type	= Combine	Peak discharge	= 1.120 cfs
Storm frequency	= 2 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 673 cuft
Inflow hyds.	= 17, 28, 29	Contrib. drain. area	= 0.490 ac

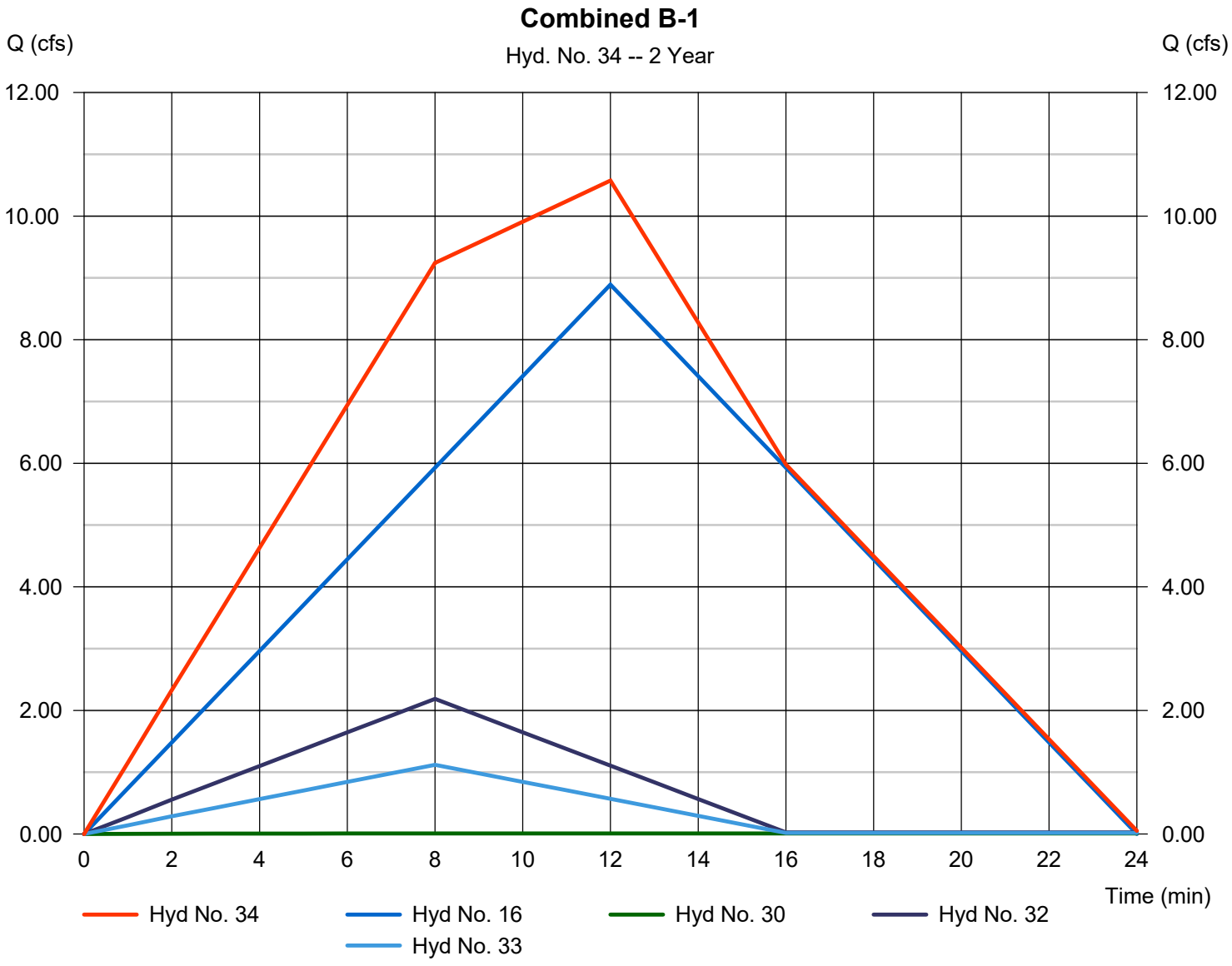


Hydrograph Report

Hyd. No. 34

Combined B-1

Hydrograph type	=	Combine	Peak discharge	=	10.57 cfs
Storm frequency	=	2 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	8,399 cuft
Inflow hyds.	=	16, 30, 32, 33	Contrib. drain. area	=	4.490 ac

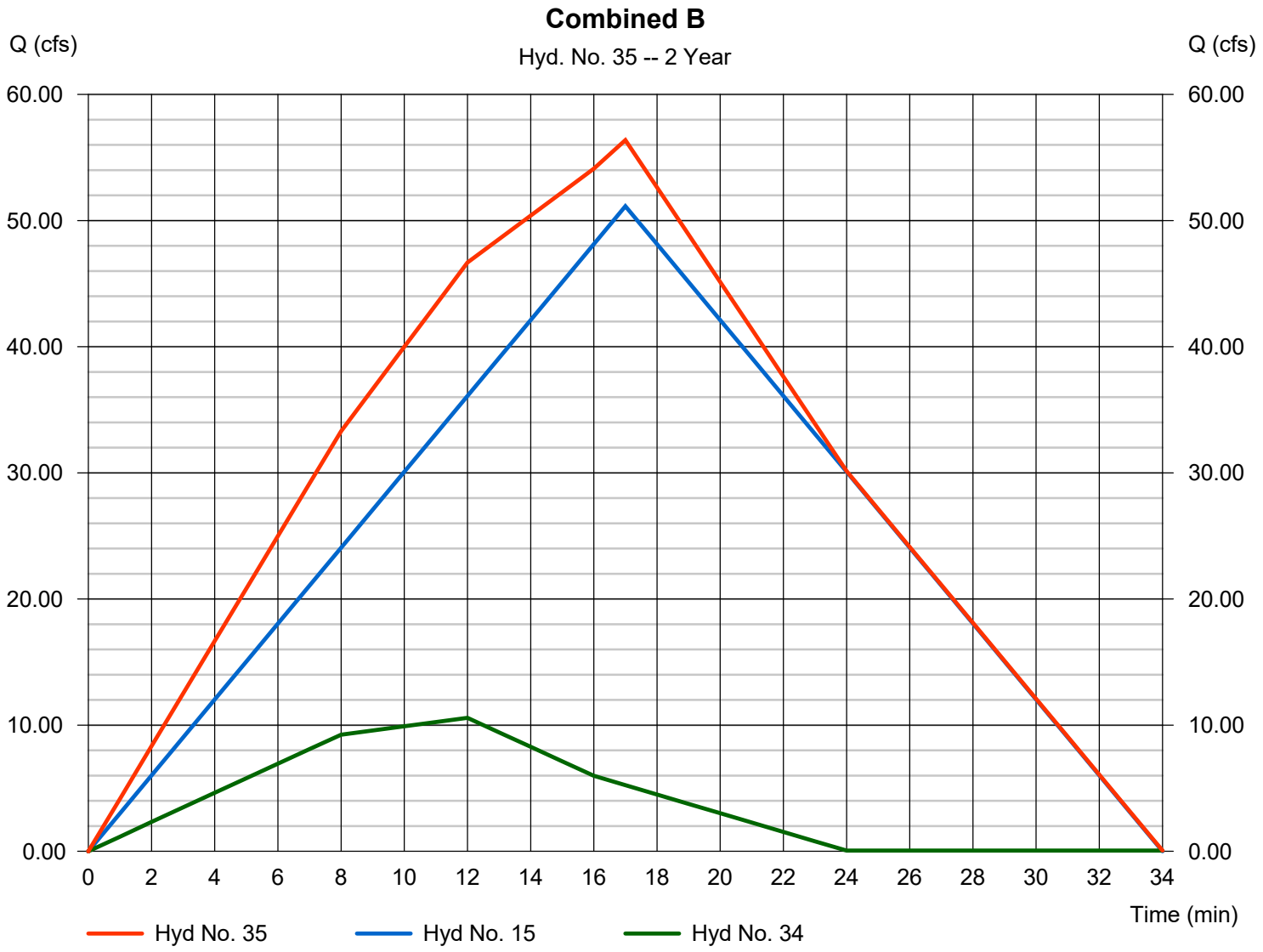


Hydrograph Report

Hyd. No. 35

Combined B

Hydrograph type	=	Combine	Peak discharge	=	56.38 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	60,563 cuft
Inflow hyds.	=	15, 34	Contrib. drain. area	=	26.540 ac



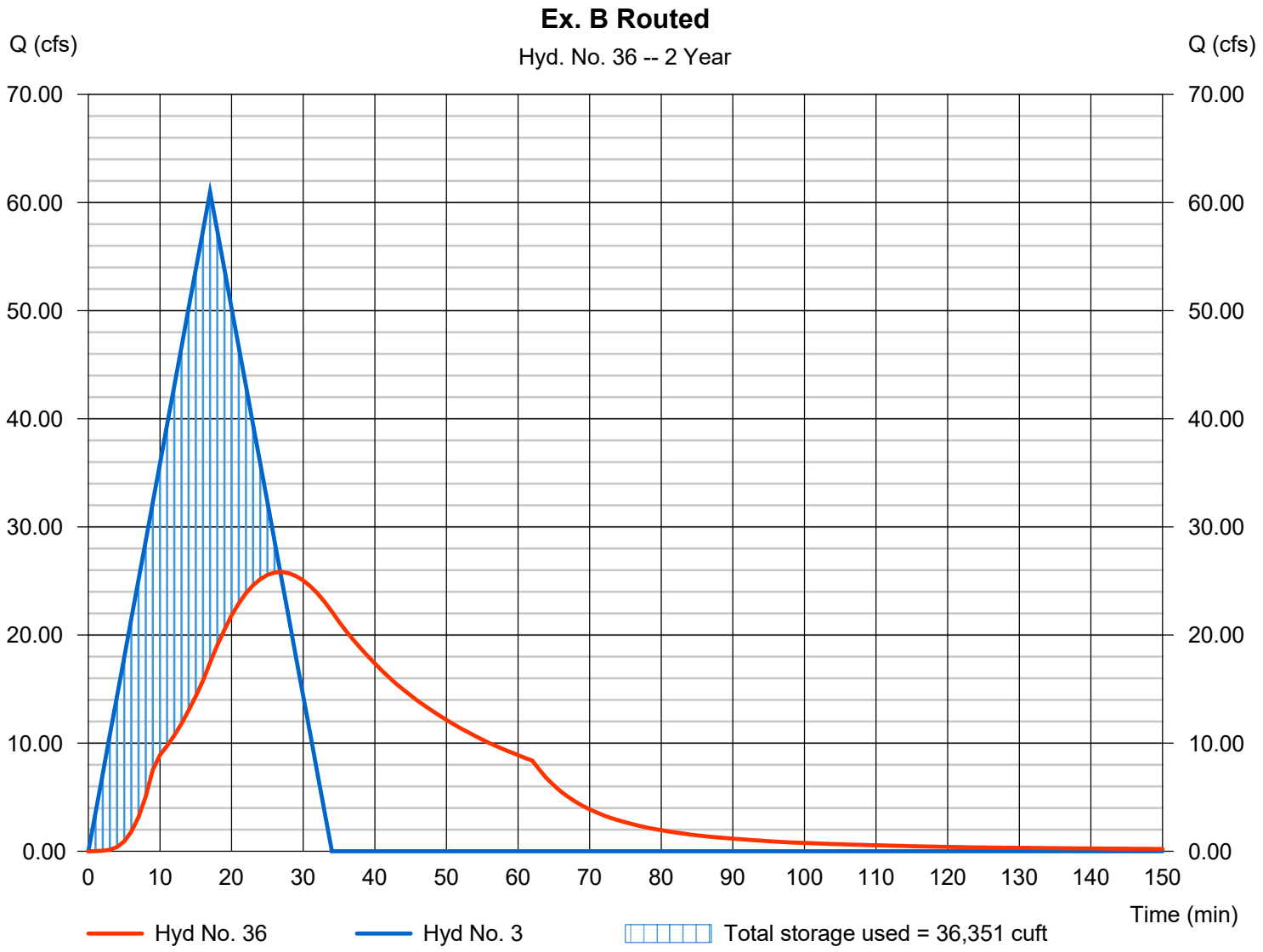
Hydrograph Report

Hyd. No. 36

Ex. B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	25.83 cfs
Storm frequency	=	2 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	62,197 cuft
Inflow hyd. No.	=	3 - Ex. B	Max. Elevation	=	1008.83 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	36,351 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - 315 NW Olive

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1007.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1007.00	00	0	0
1.00	1008.00	24,769	8,256	8,256
2.00	1009.00	43,967	33,909	42,164
3.00	1010.00	70,835	56,864	99,028

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1017.00	0.00	0.00	0.00
Length (ft)	= 41.18	0.00	0.00	0.00
Slope (%)	= 3.00	0.00	0.00	n/a
N-Value	= .024	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1007.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	8,256	1008.00	8.38 ic	---	---	---	---	---	---	---	---	---	8.375
2.00	42,164	1009.00	30.31 ic	---	---	---	---	---	---	---	---	---	30.31
3.00	99,028	1010.00	59.65 ic	---	---	---	---	---	---	---	---	---	59.65

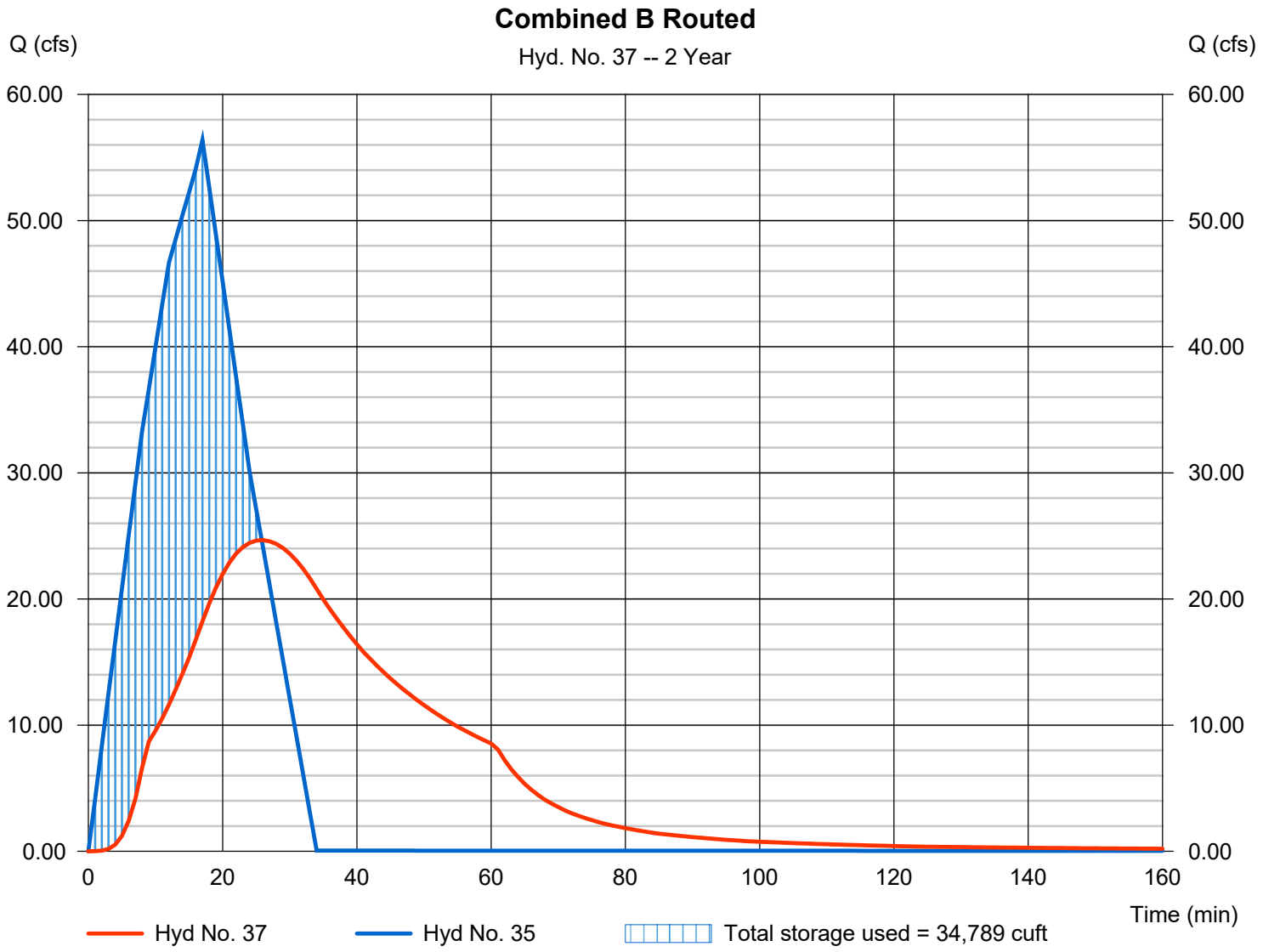
Hydrograph Report

Hyd. No. 37

Combined B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	24.66 cfs
Storm frequency	=	2 yrs	Time to peak	=	26 min
Time interval	=	1 min	Hyd. volume	=	60,554 cuft
Inflow hyd. No.	=	35 - Combined B	Max. Elevation	=	1008.78 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	34,789 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - 315 NW Olive

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1007.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1007.00	00	0	0
1.00	1008.00	24,769	8,256	8,256
2.00	1009.00	43,967	33,909	42,164
3.00	1010.00	70,835	56,864	99,028

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1017.00	0.00	0.00	0.00
Length (ft)	= 41.18	0.00	0.00	0.00
Slope (%)	= 3.00	0.00	0.00	n/a
N-Value	= .024	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1007.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	8,256	1008.00	8.38 ic	---	---	---	---	---	---	---	---	---	8.375
2.00	42,164	1009.00	30.31 ic	---	---	---	---	---	---	---	---	---	30.31
3.00	99,028	1010.00	59.65 ic	---	---	---	---	---	---	---	---	---	59.65

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	54.22	1	19	61,816	------	------	------	Ex. A
2	Rational	2.863	1	13	2,233	------	------	------	Ex. A-1
3	Rational	89.91	1	17	91,710	------	------	------	Ex. B
4	Rational	17.23	1	12	12,406	------	------	------	Ex. B-1
5	Rational	1.647	1	11	1,087	------	------	------	Ex. B-2
6	Rational	3.752	1	8	1,801	------	------	------	Ex. B-3
7	Rational	0.640	1	19	730	------	------	------	Ex. Onsite A
8	Rational	0.750	1	13	585	------	------	------	Ex. Onsite A-1
9	Rational	4.312	1	17	4,398	------	------	------	Ex. Onsite B
10	Rational	4.954	1	12	3,567	------	------	------	Ex. Onsite B-1
11	Rational	1.647	1	11	1,087	------	------	------	Ex. Onsite B-2
12	Rational	3.752	1	8	1,801	------	------	------	Ex. Onsite B-3
13	Rational	51.47	1	19	58,681	------	------	------	Prop. A
14	Rational	2.892	1	13	2,256	------	------	------	Prop. A-1
15	Rational	75.40	1	17	76,906	------	------	------	Prop. B
16	Rational	13.11	1	12	9,440	------	------	------	Prop. B-1
17	Rational	1.627	1	8	781	------	------	------	Prop. B-2
18	Rational	3.188	1	8	1,530	------	------	------	Prop. B-3
19	Rational	0.360	1	5	108	------	------	------	Lot 1
20	Rational	0.360	1	5	108	------	------	------	Lot 2
21	Rational	0.360	1	5	108	------	------	------	Lot 3
22	Rational	0.360	1	5	108	------	------	------	Lot 4
23	Rational	0.360	1	5	108	------	------	------	Lot 5
24	Rational	0.360	1	5	108	------	------	------	Lot 6
25	Reservoir	0.009	1	10	107	19	1038.12	104	Lot 1 Detention
26	Reservoir	0.009	1	10	107	20	1040.12	104	Lot 2 Detention
27	Reservoir	0.009	1	10	107	21	1037.12	104	Lot 3 Detention
28	Reservoir	0.009	1	10	107	22	1039.12	104	Lot 4 Detention
29	Reservoir	0.009	1	10	107	23	1038.12	104	Lot 5 Detention
30	Reservoir	0.009	1	10	107	24	1038.12	104	Lot 6 Detention
31	Combine	53.03	1	19	60,937	13, 14,	------	------	Combined A
32	Combine	3.214	1	8	1,851	18, 25, 26, 27,	------	------	Combined B-3
33	Combine	1.645	1	8	995	17, 28, 29,	------	------	Combined B-2
34	Combine	15.57	1	12	12,392	16, 30, 32, 33	------	------	Combined B-1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

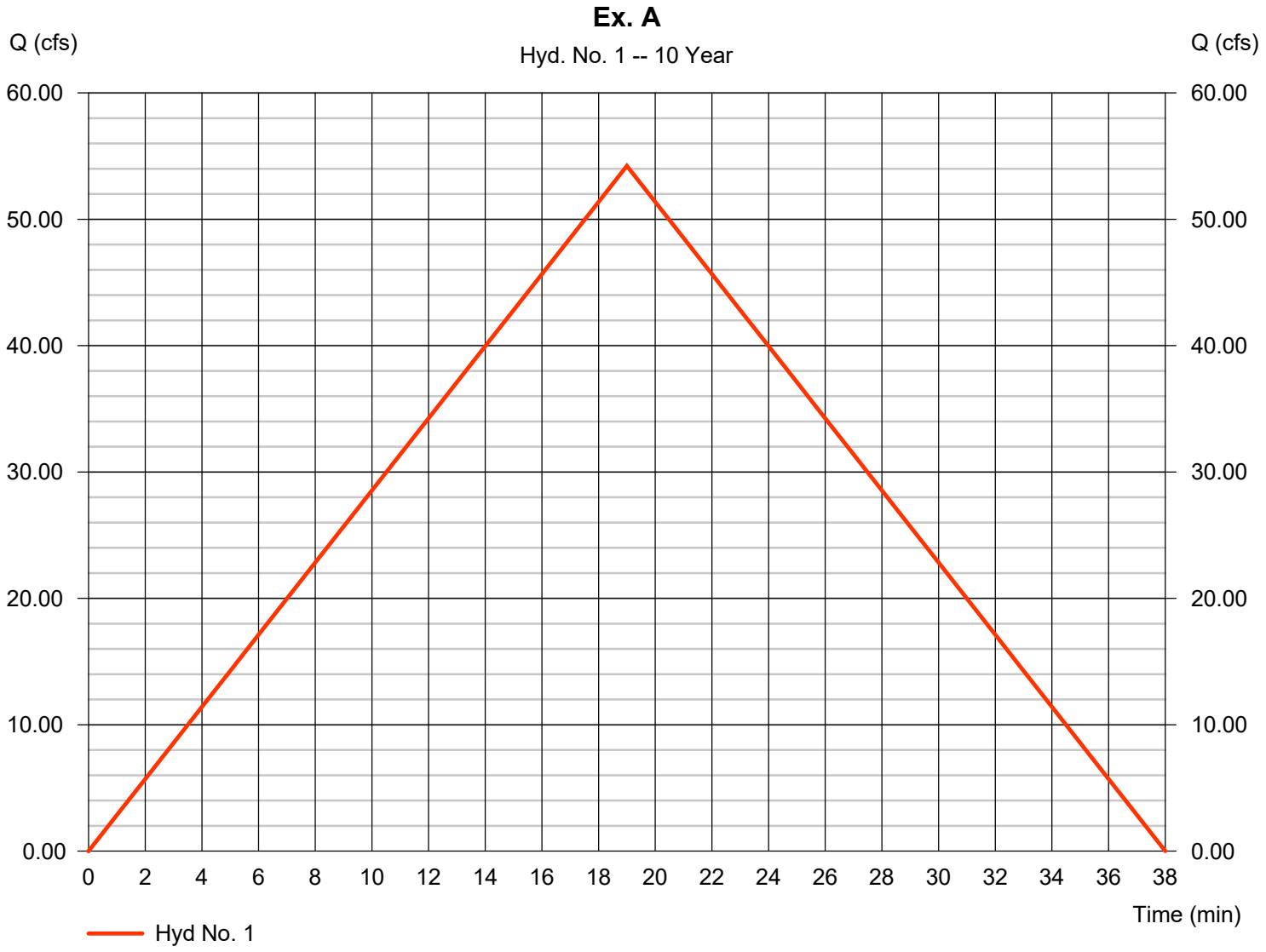
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
35	Combine	83.10	1	17	89,297	15, 34	------	------	Combined B
36	Reservoir	36.23	1	27	91,701	3	1009.22	54,438	Ex. B Routed
37	Reservoir	34.98	1	26	89,288	35	1009.17	51,916	Combined B Routed

Hydrograph Report

Hyd. No. 1

Ex. A

Hydrograph type	=	Rational	Peak discharge	=	54.22 cfs
Storm frequency	=	10 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	61,816 cuft
Drainage area	=	19.720 ac	Runoff coeff.	=	0.58
Intensity	=	4.741 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

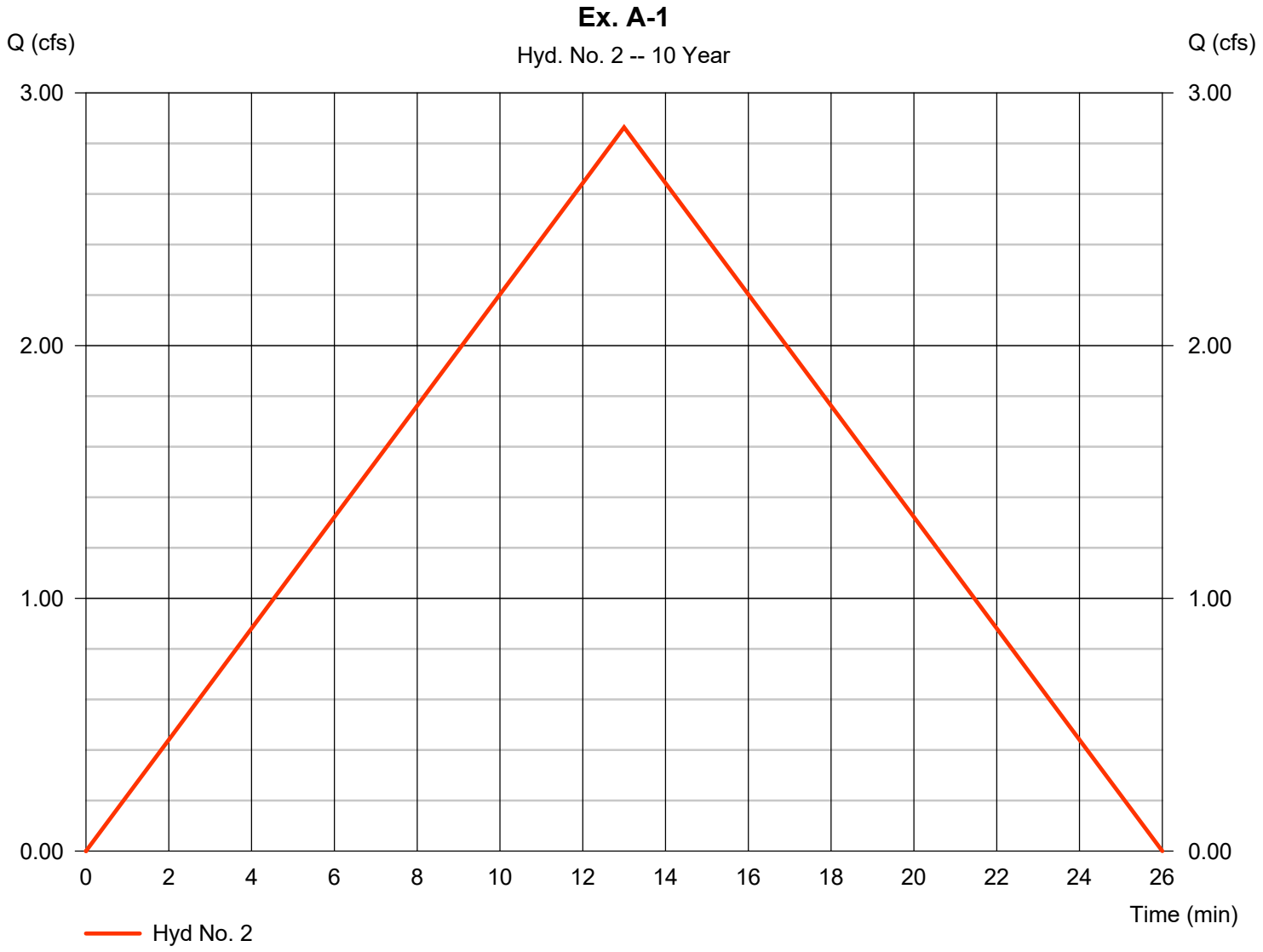


Hydrograph Report

Hyd. No. 2

Ex. A-1

Hydrograph type	=	Rational	Peak discharge	=	2.863 cfs
Storm frequency	=	10 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	2,233 cuft
Drainage area	=	1.010 ac	Runoff coeff.	=	0.51
Intensity	=	5.559 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

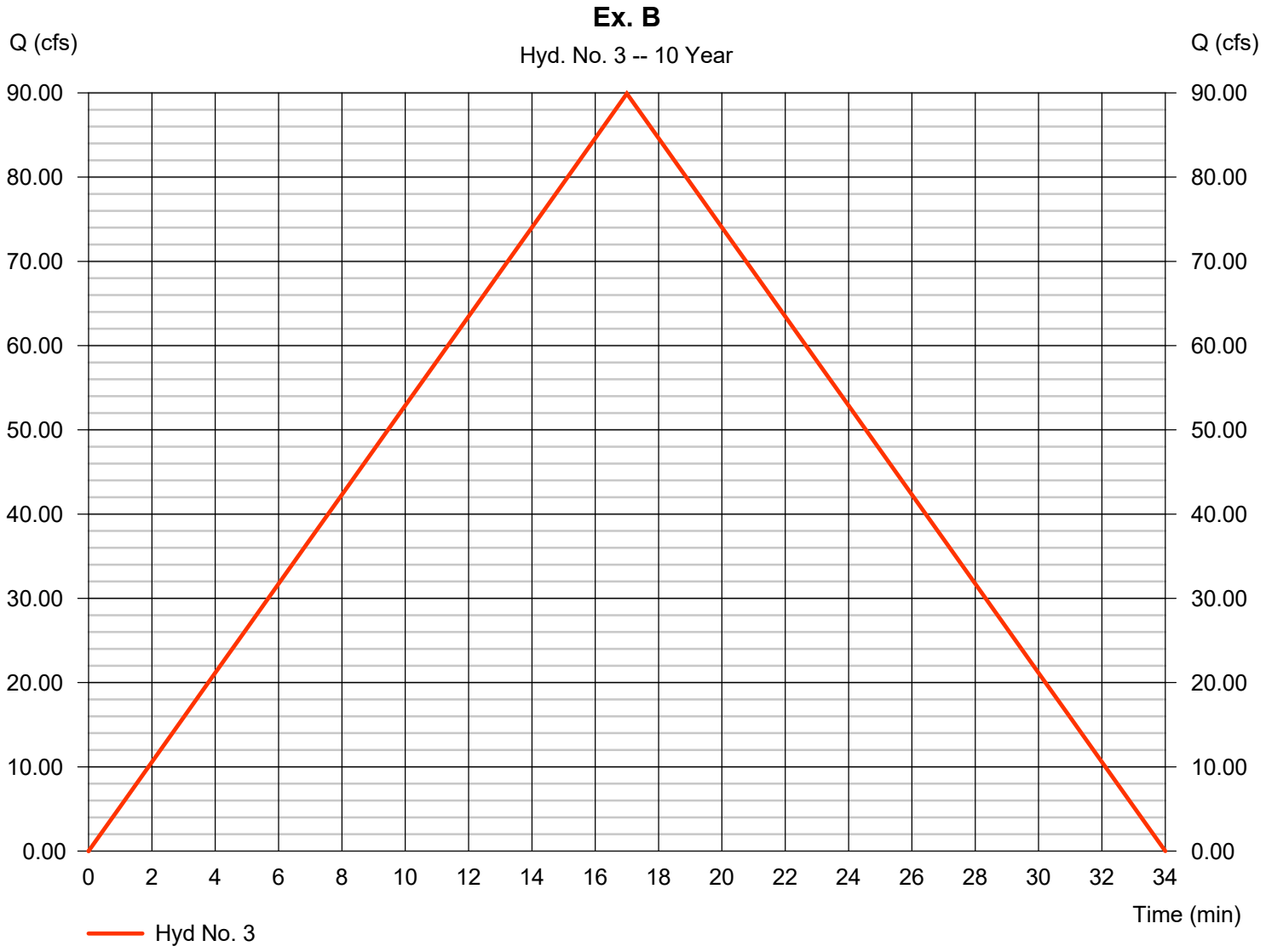


Hydrograph Report

Hyd. No. 3

Ex. B

Hydrograph type	=	Rational	Peak discharge	=	89.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	91,710 cuft
Drainage area	=	32.800 ac	Runoff coeff.	=	0.55
Intensity	=	4.984 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

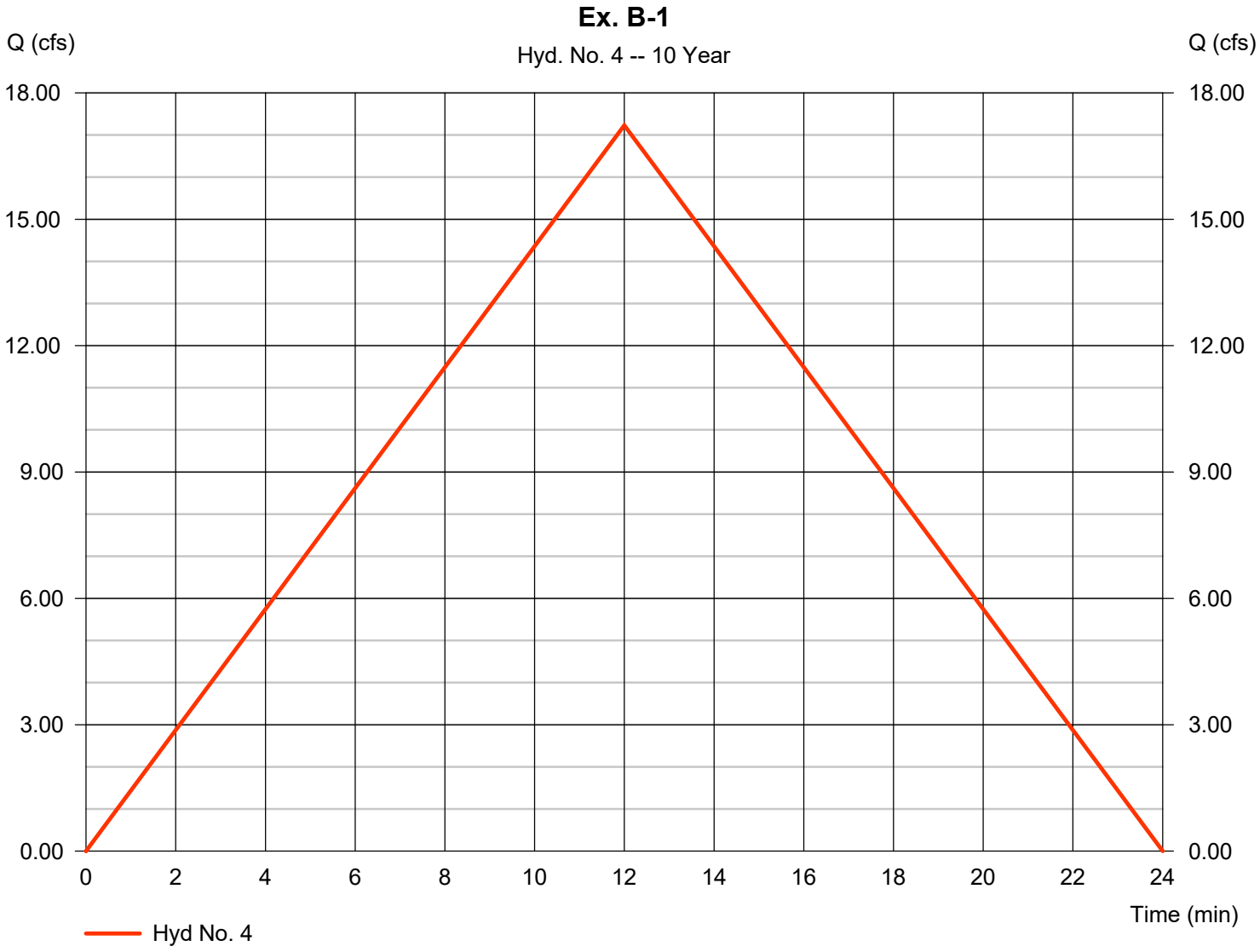


Hydrograph Report

Hyd. No. 4

Ex. B-1

Hydrograph type	=	Rational	Peak discharge	=	17.23 cfs
Storm frequency	=	10 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	12,406 cuft
Drainage area	=	6.270 ac	Runoff coeff.	=	0.48
Intensity	=	5.725 in/hr	Tc by User	=	12.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 5

Ex. B-2

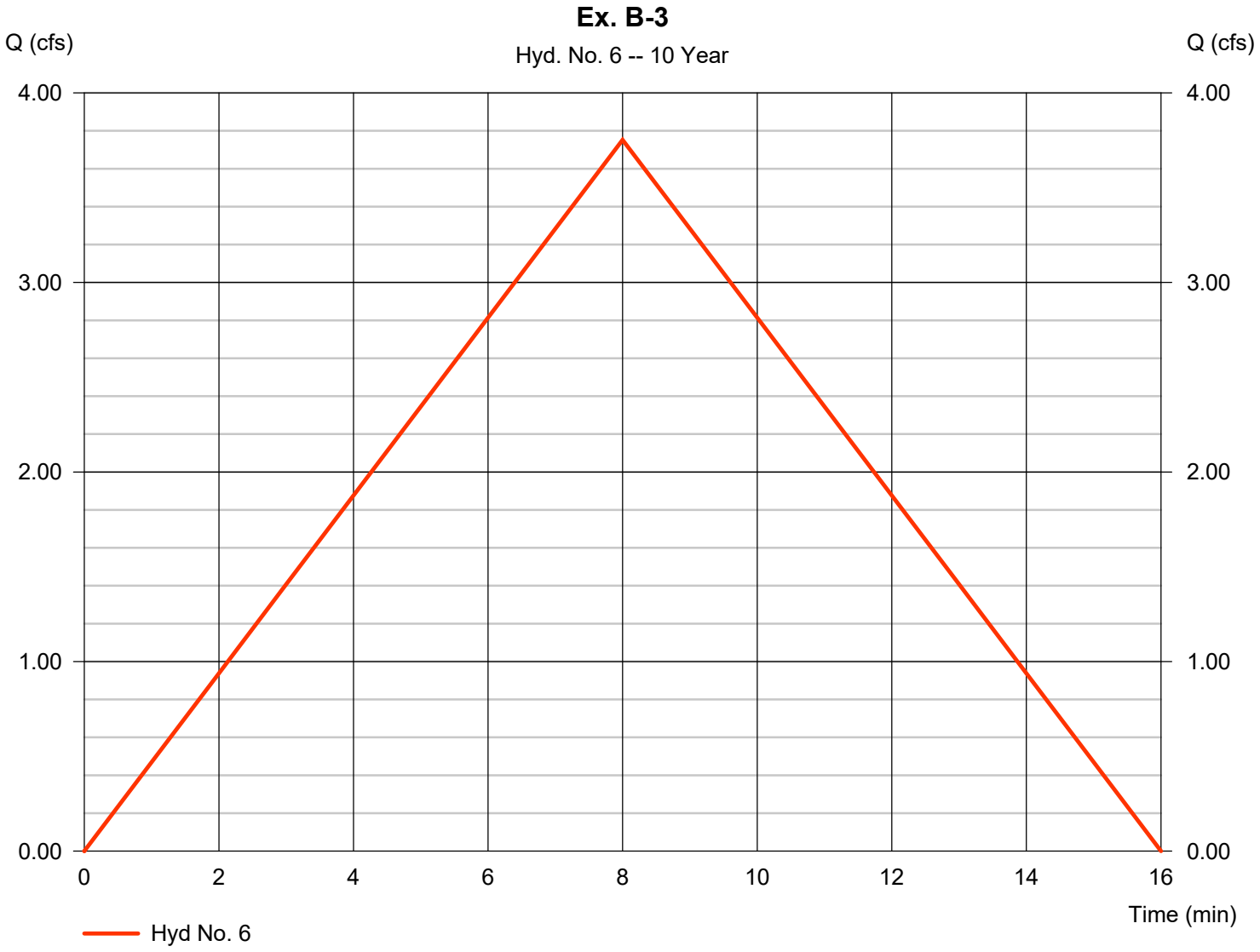
Hydrograph type	=	Rational	Peak discharge	=	1.647 cfs
Storm frequency	=	10 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	1,087 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	5.903 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 6

Ex. B-3

Hydrograph type	=	Rational	Peak discharge	=	3.752 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,801 cuft
Drainage area	=	1.130 ac	Runoff coeff.	=	0.51
Intensity	=	6.511 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

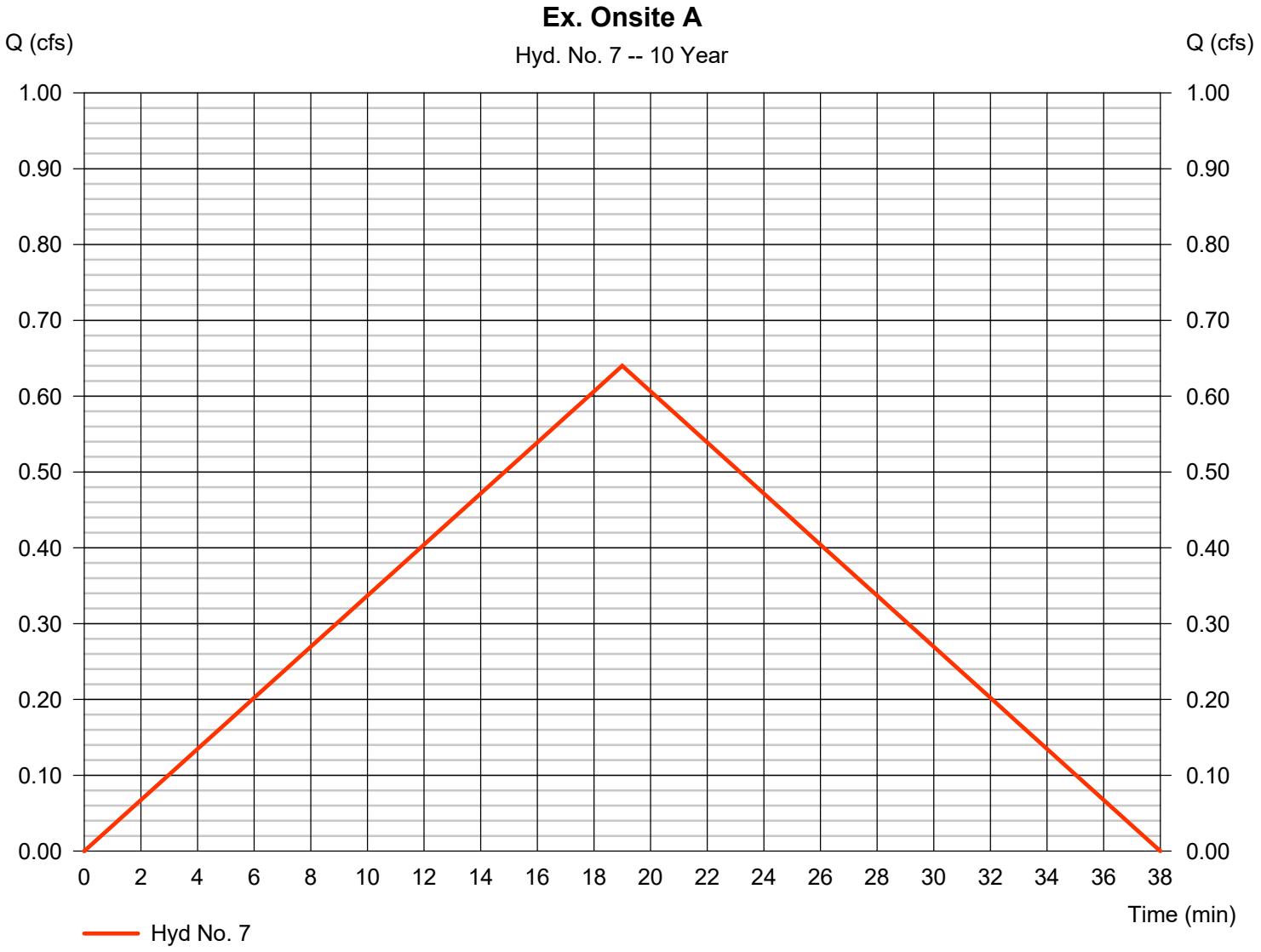


Hydrograph Report

Hyd. No. 7

Ex. Onsite A

Hydrograph type	=	Rational	Peak discharge	=	0.640 cfs
Storm frequency	=	10 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	730 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	4.741 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 8

Ex. Onsite A-1

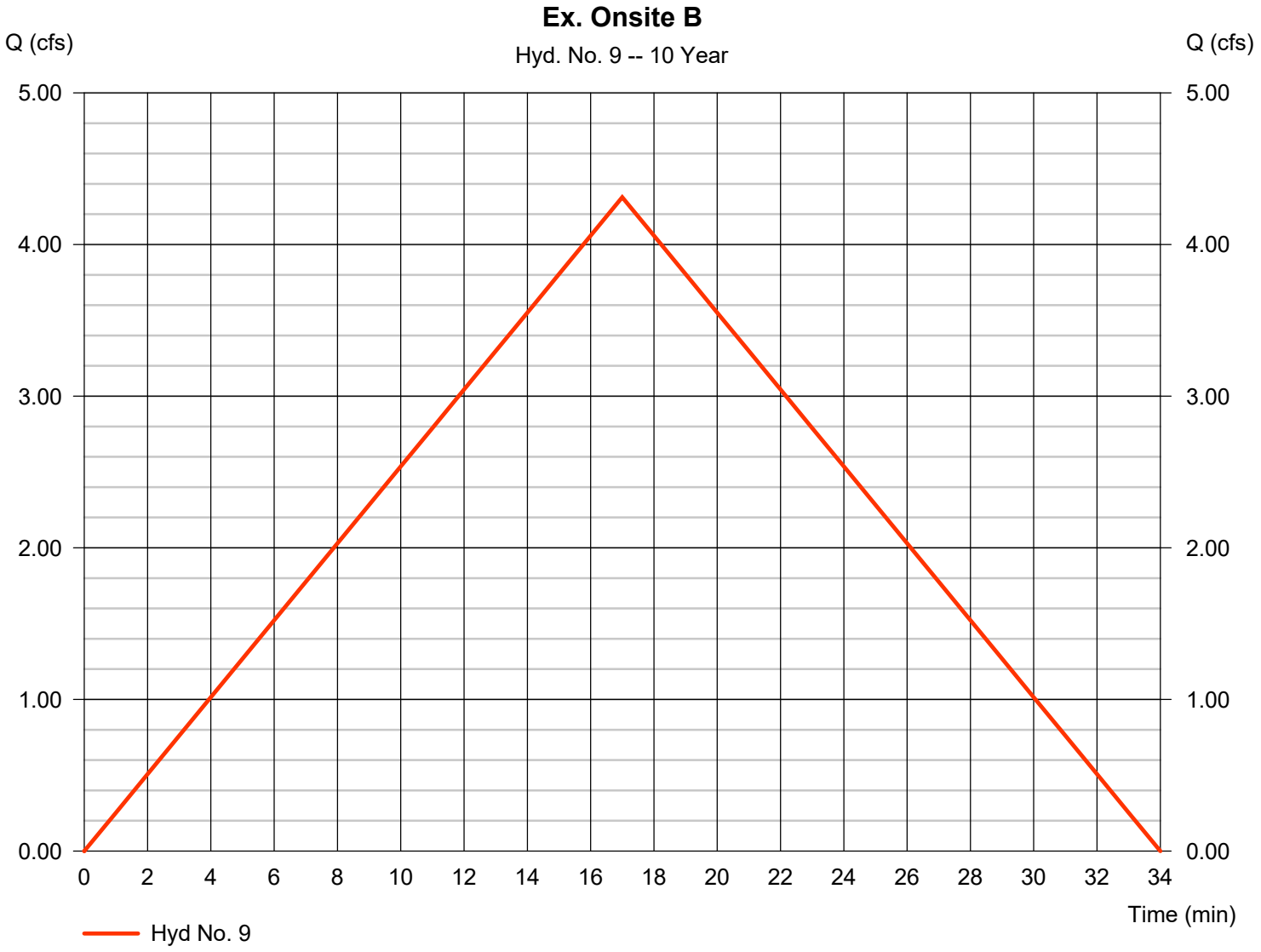
Hydrograph type	=	Rational	Peak discharge	=	0.750 cfs
Storm frequency	=	10 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	585 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	5.559 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 9

Ex. Onsite B

Hydrograph type	=	Rational	Peak discharge	=	4.312 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	4,398 cuft
Drainage area	=	2.060 ac	Runoff coeff.	=	0.42
Intensity	=	4.984 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

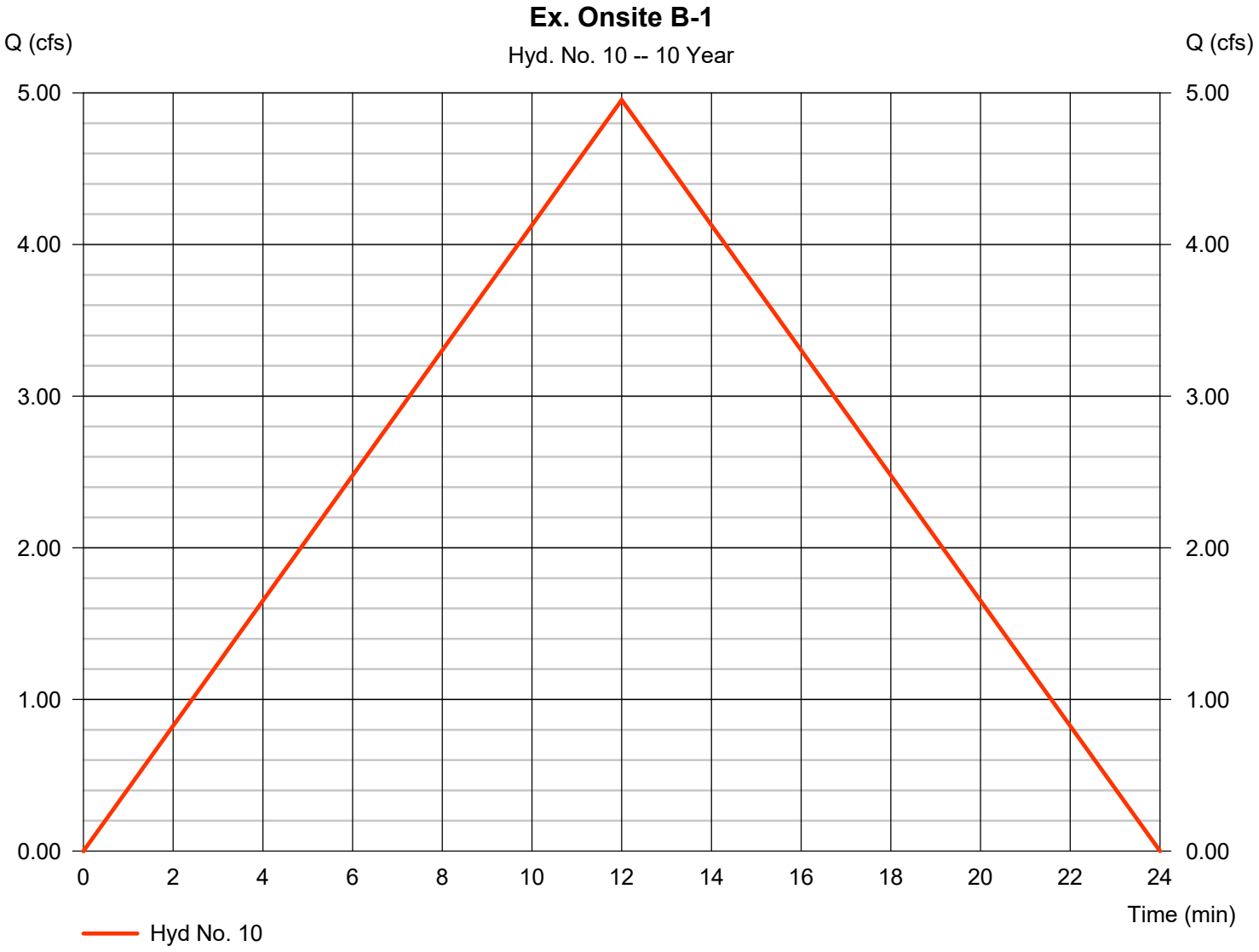


Hydrograph Report

Hyd. No. 10

Ex. Onsite B-1

Hydrograph type	= Rational	Peak discharge	= 4.954 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 3,567 cuft
Drainage area	= 2.060 ac	Runoff coeff.	= 0.42
Intensity	= 5.725 in/hr	Tc by User	= 12.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

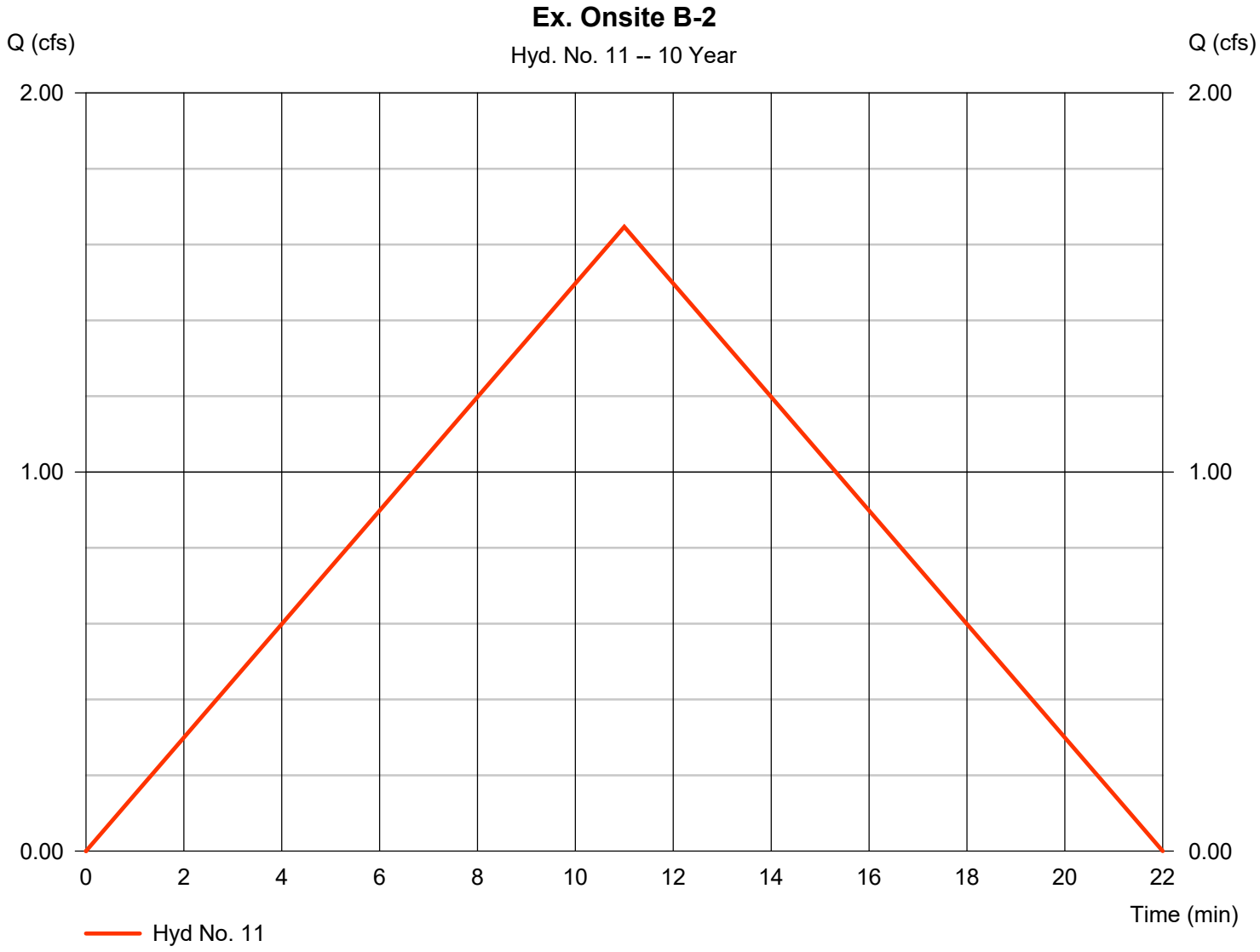


Hydrograph Report

Hyd. No. 11

Ex. Onsite B-2

Hydrograph type	=	Rational	Peak discharge	=	1.647 cfs
Storm frequency	=	10 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	1,087 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	5.903 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

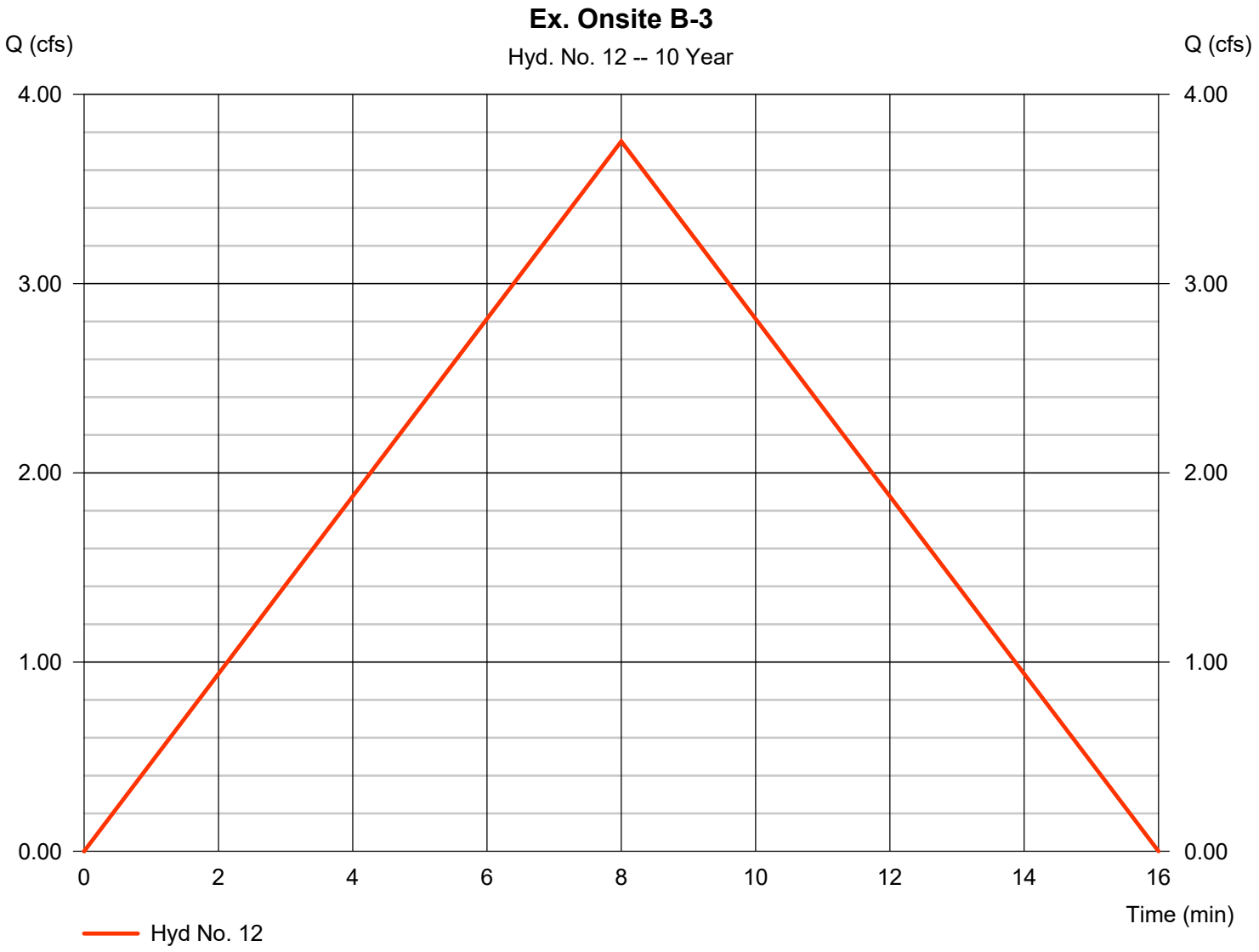


Hydrograph Report

Hyd. No. 12

Ex. Onsite B-3

Hydrograph type	=	Rational	Peak discharge	=	3.752 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,801 cuft
Drainage area	=	1.130 ac	Runoff coeff.	=	0.51
Intensity	=	6.511 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

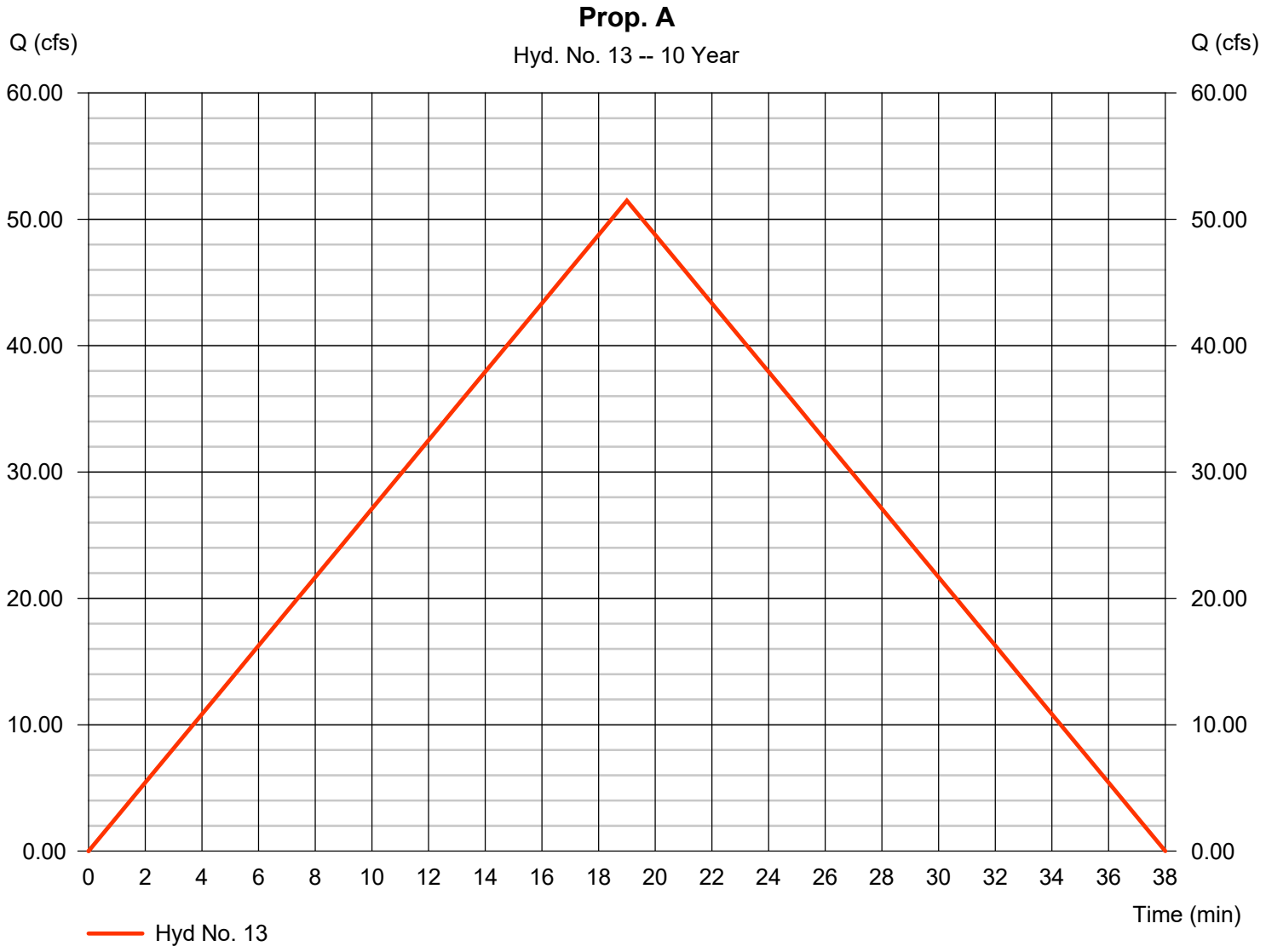


Hydrograph Report

Hyd. No. 13

Prop. A

Hydrograph type	=	Rational	Peak discharge	=	51.47 cfs
Storm frequency	=	10 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	58,681 cuft
Drainage area	=	18.720 ac	Runoff coeff.	=	0.58
Intensity	=	4.741 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

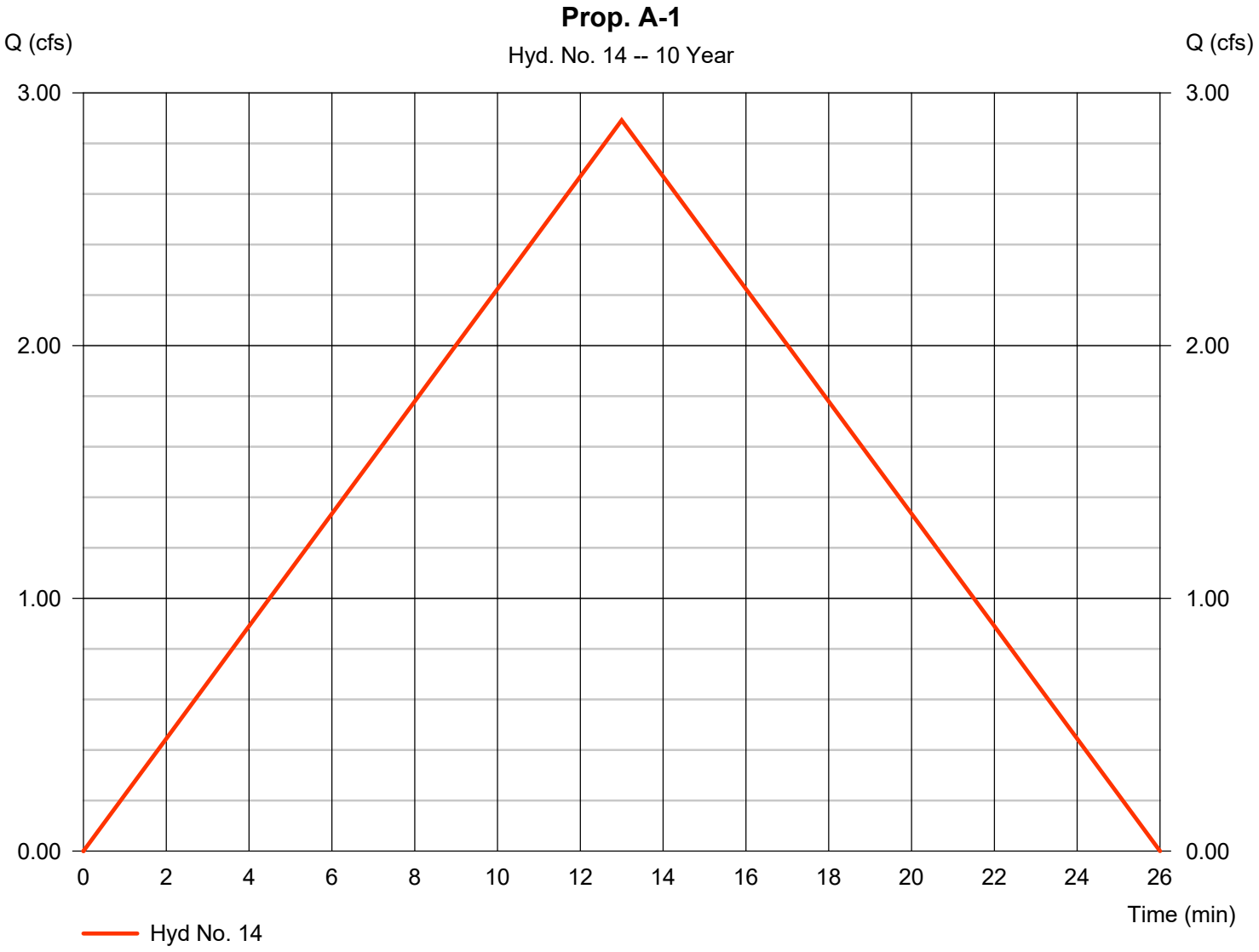


Hydrograph Report

Hyd. No. 14

Prop. A-1

Hydrograph type	=	Rational	Peak discharge	=	2.892 cfs
Storm frequency	=	10 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	2,256 cuft
Drainage area	=	1.020 ac	Runoff coeff.	=	0.51
Intensity	=	5.559 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

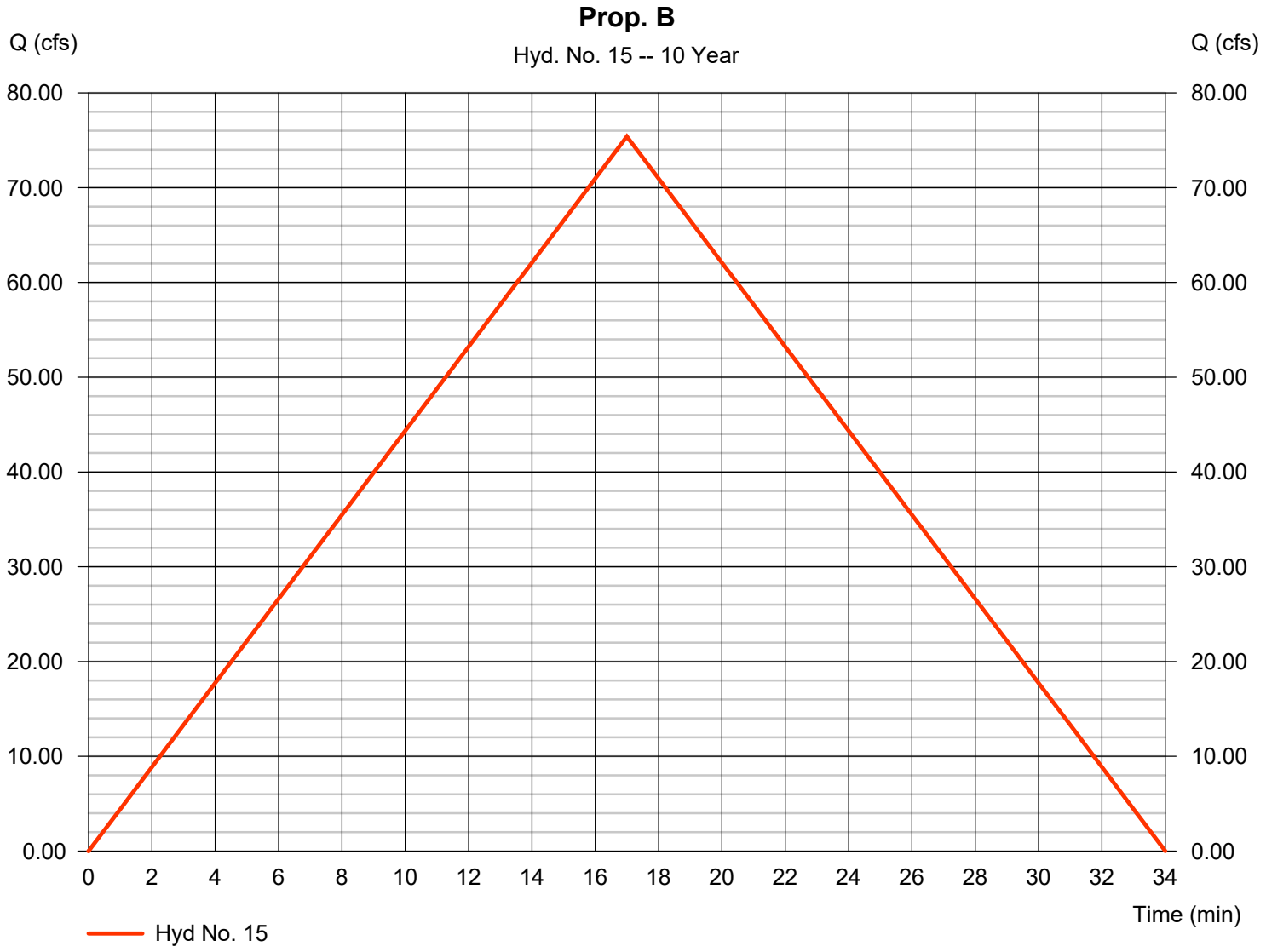


Hydrograph Report

Hyd. No. 15

Prop. B

Hydrograph type	=	Rational	Peak discharge	=	75.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	76,906 cuft
Drainage area	=	26.540 ac	Runoff coeff.	=	0.57
Intensity	=	4.984 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

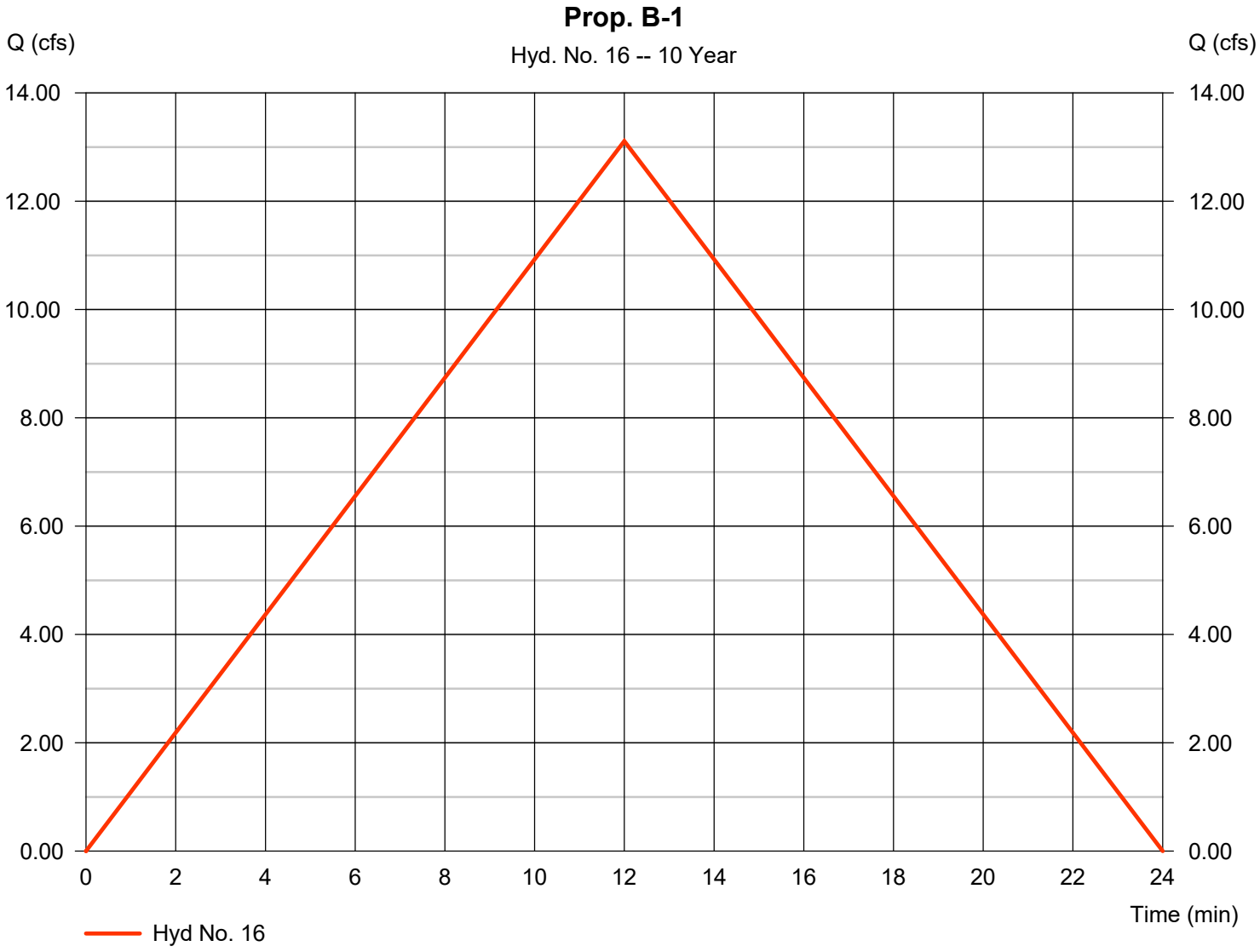


Hydrograph Report

Hyd. No. 16

Prop. B-1

Hydrograph type	=	Rational	Peak discharge	=	13.11 cfs
Storm frequency	=	10 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	9,440 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.51
Intensity	=	5.725 in/hr	Tc by User	=	12.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

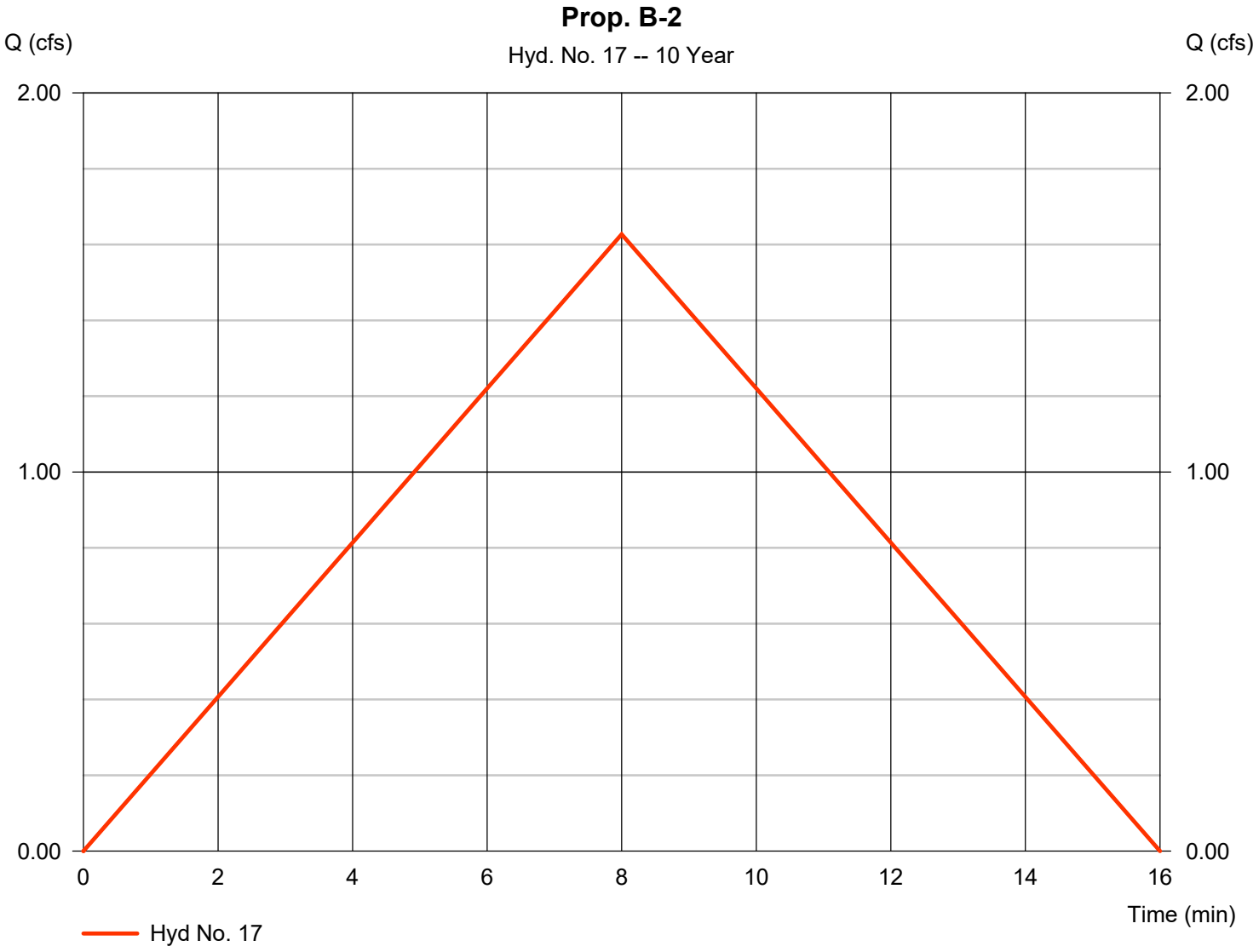


Hydrograph Report

Hyd. No. 17

Prop. B-2

Hydrograph type	=	Rational	Peak discharge	=	1.627 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	781 cuft
Drainage area	=	0.490 ac	Runoff coeff.	=	0.51
Intensity	=	6.511 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

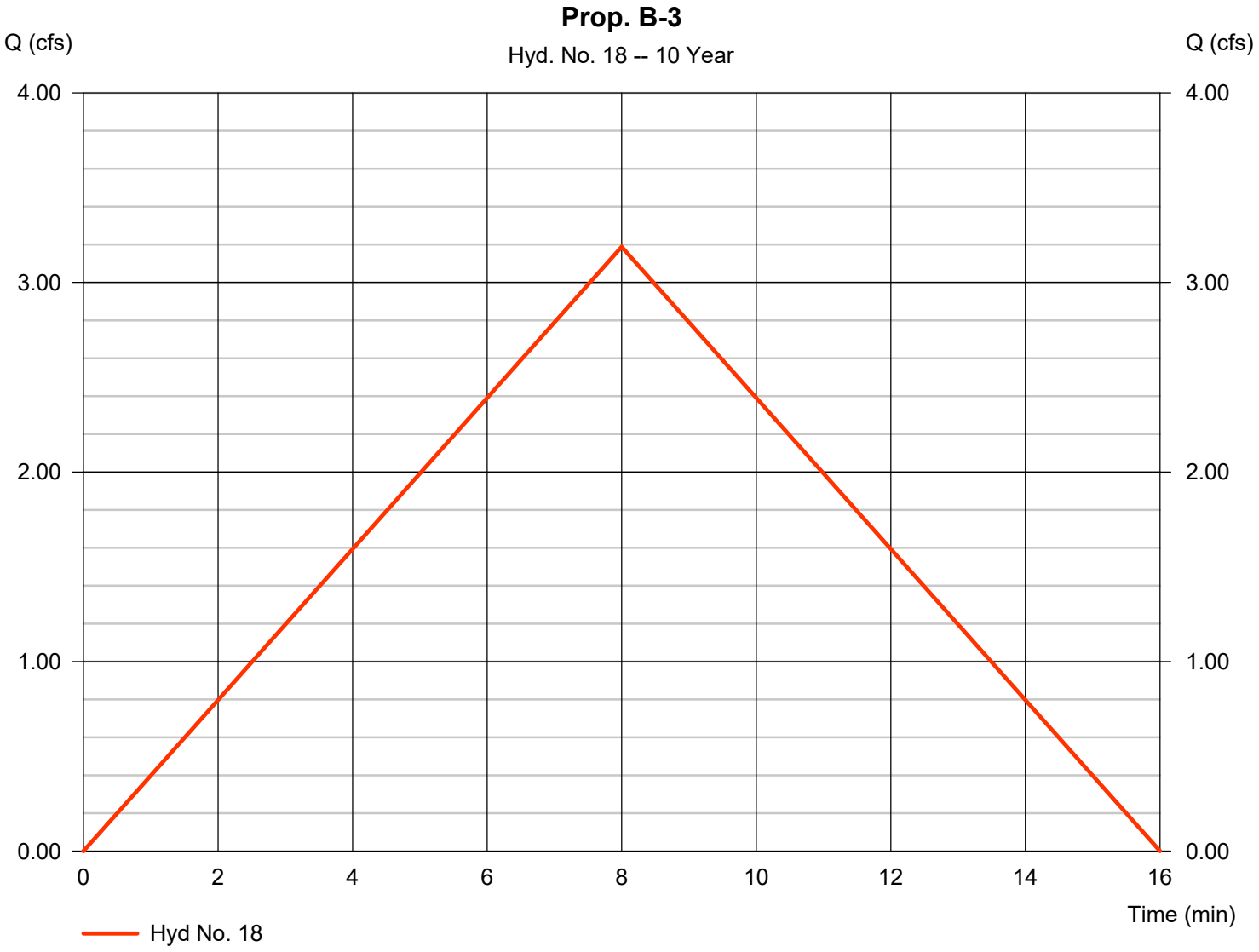


Hydrograph Report

Hyd. No. 18

Prop. B-3

Hydrograph type	=	Rational	Peak discharge	=	3.188 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,530 cuft
Drainage area	=	0.960 ac	Runoff coeff.	=	0.51
Intensity	=	6.511 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

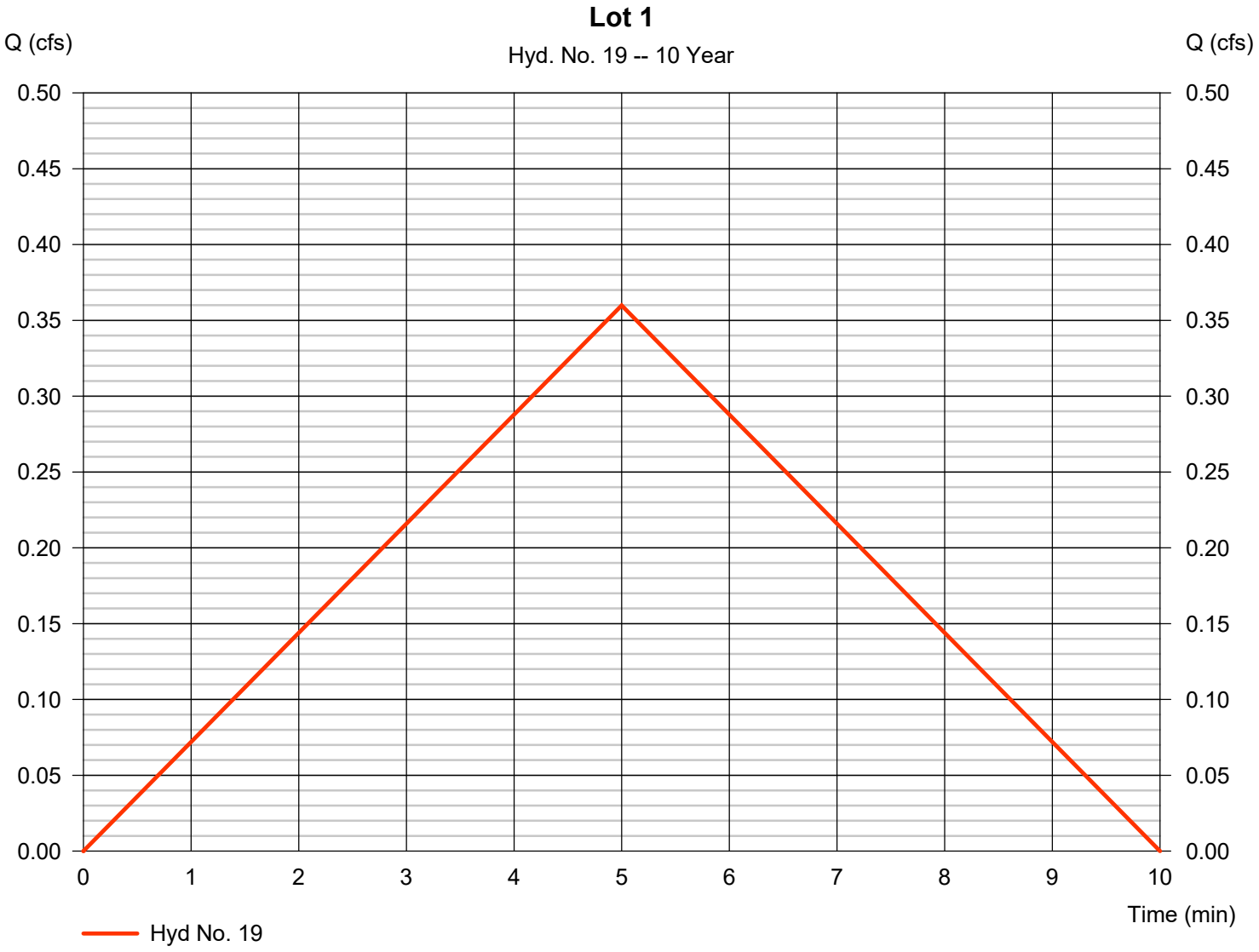


Hydrograph Report

Hyd. No. 19

Lot 1

Hydrograph type	= Rational	Peak discharge	= 0.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 108 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 7.269 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

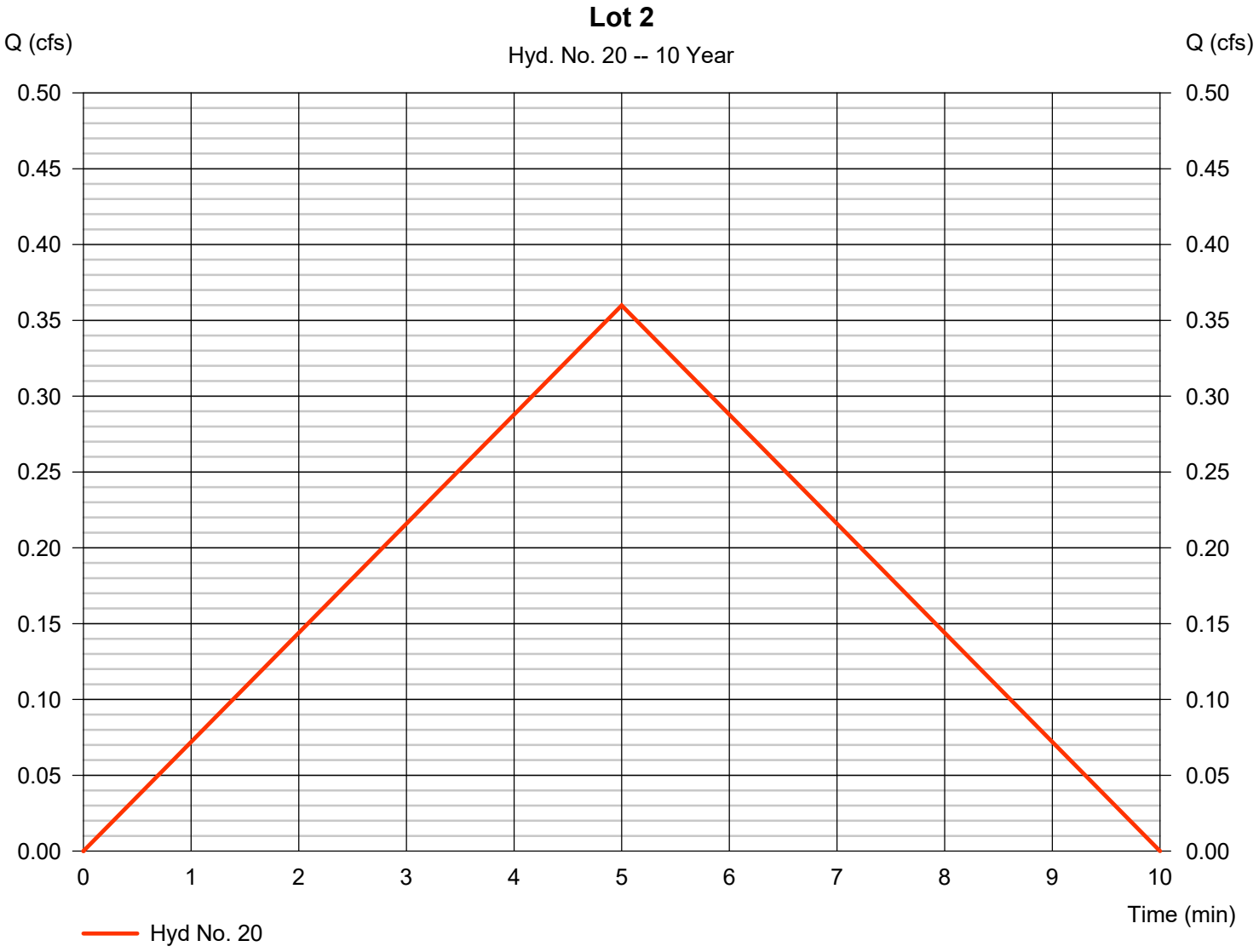


Hydrograph Report

Hyd. No. 20

Lot 2

Hydrograph type	= Rational	Peak discharge	= 0.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 108 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 7.269 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

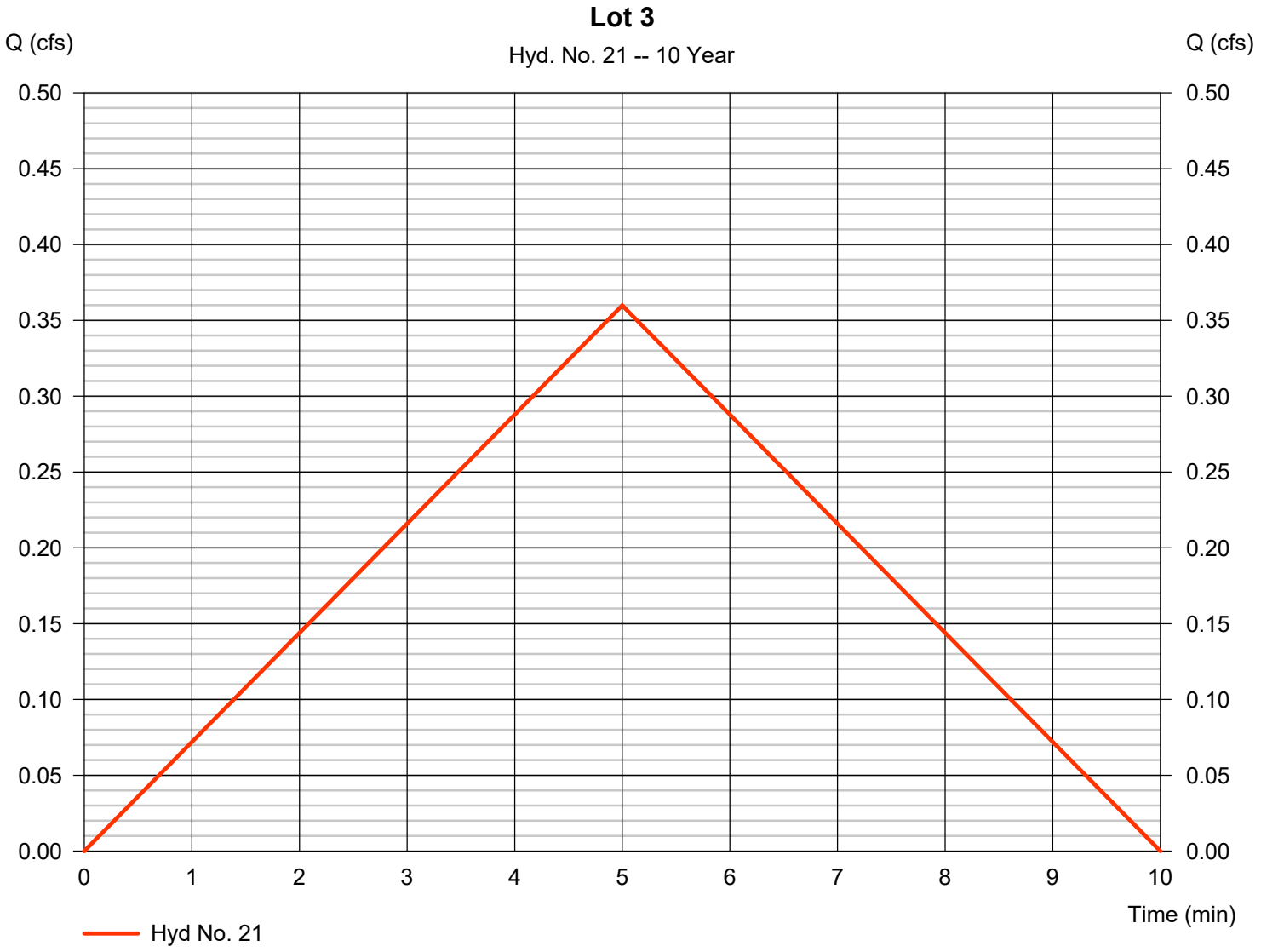


Hydrograph Report

Hyd. No. 21

Lot 3

Hydrograph type	=	Rational	Peak discharge	=	0.360 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	108 cuft
Drainage area	=	0.055 ac	Runoff coeff.	=	0.9
Intensity	=	7.269 in/hr	Tc by User	=	5.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

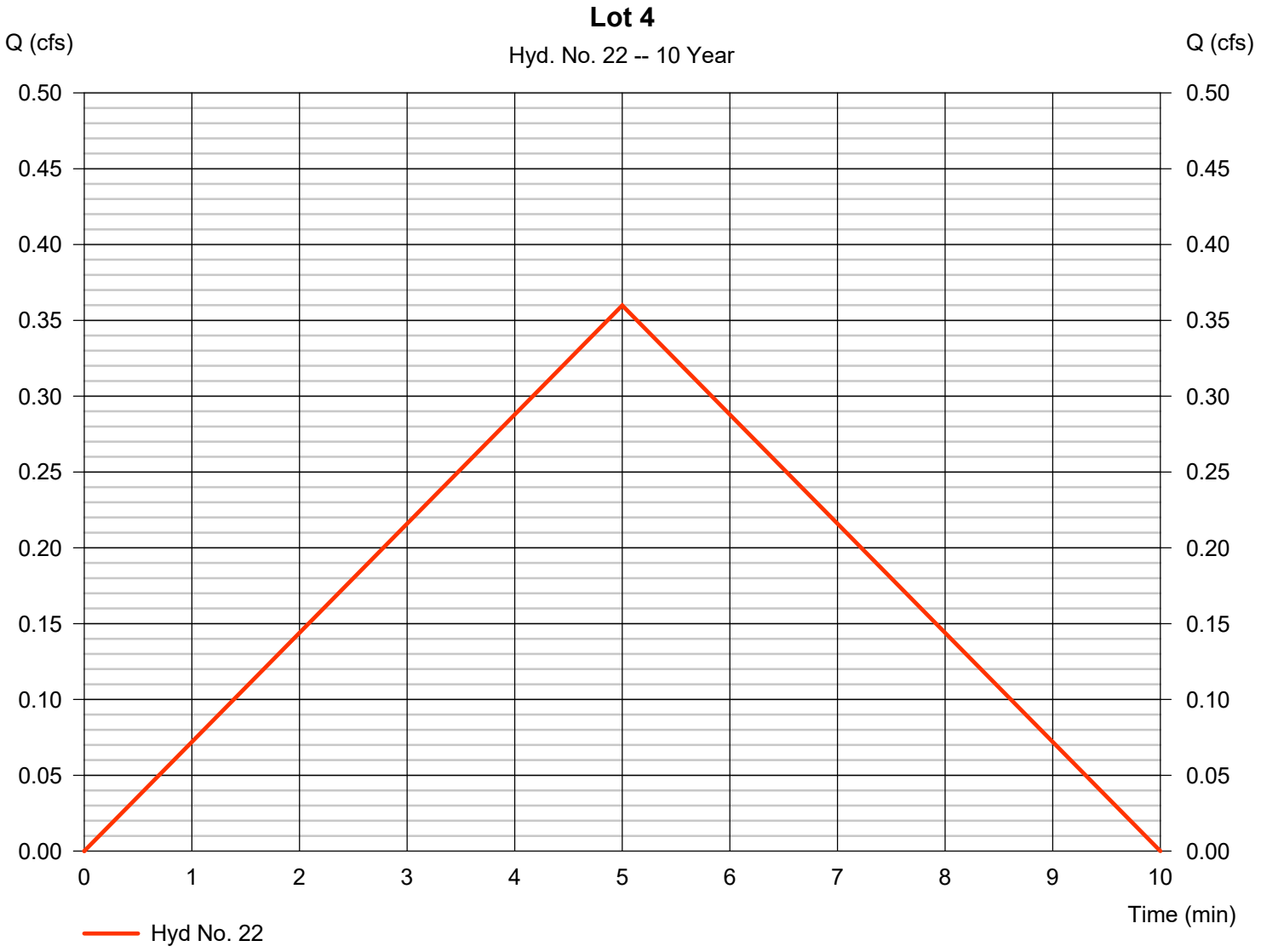


Hydrograph Report

Hyd. No. 22

Lot 4

Hydrograph type	=	Rational	Peak discharge	=	0.360 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	108 cuft
Drainage area	=	0.055 ac	Runoff coeff.	=	0.9
Intensity	=	7.269 in/hr	Tc by User	=	5.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

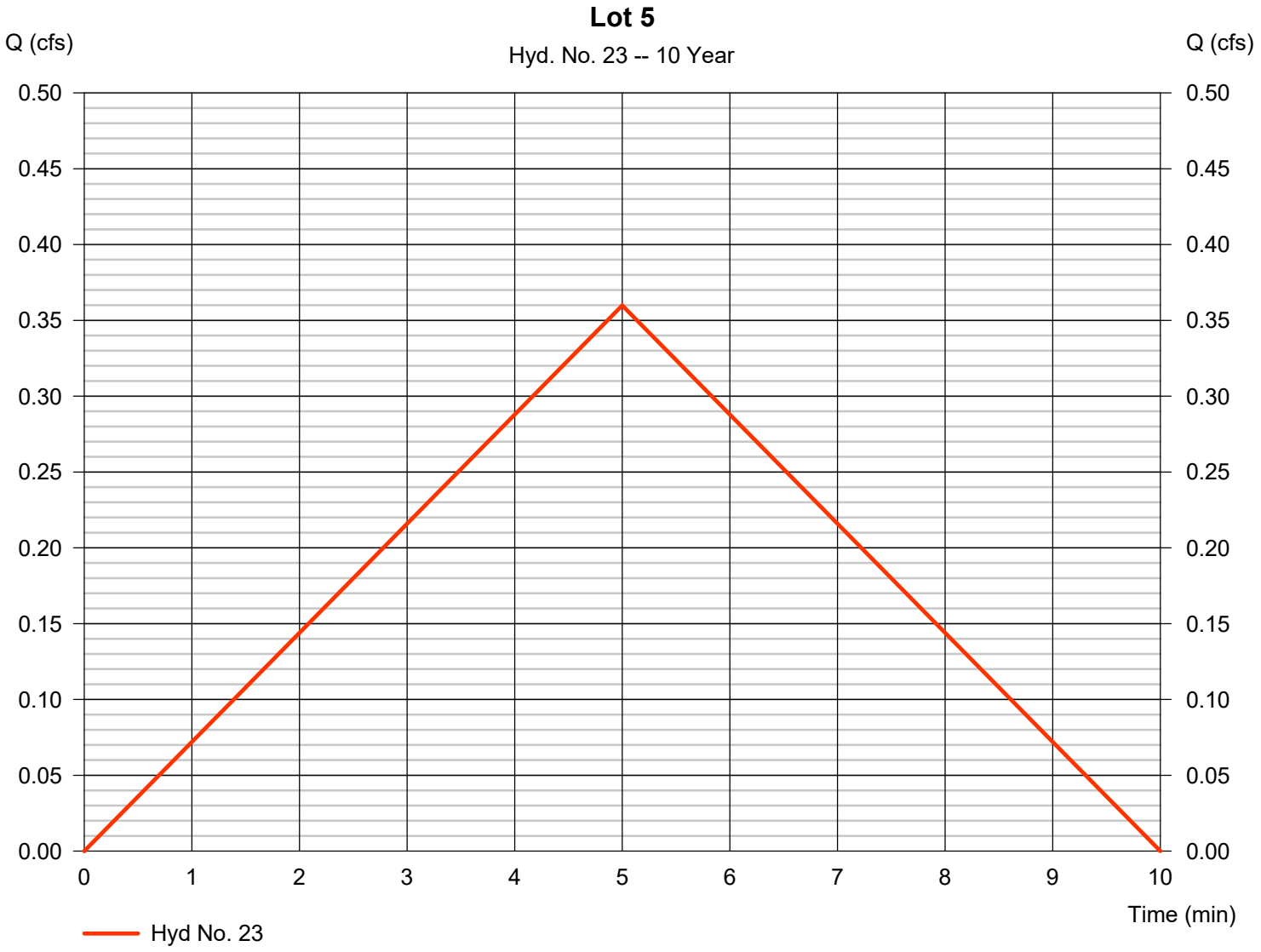


Hydrograph Report

Hyd. No. 23

Lot 5

Hydrograph type	=	Rational	Peak discharge	=	0.360 cfs
Storm frequency	=	10 yrs	Time to peak	=	5 min
Time interval	=	1 min	Hyd. volume	=	108 cuft
Drainage area	=	0.055 ac	Runoff coeff.	=	0.9
Intensity	=	7.269 in/hr	Tc by User	=	5.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

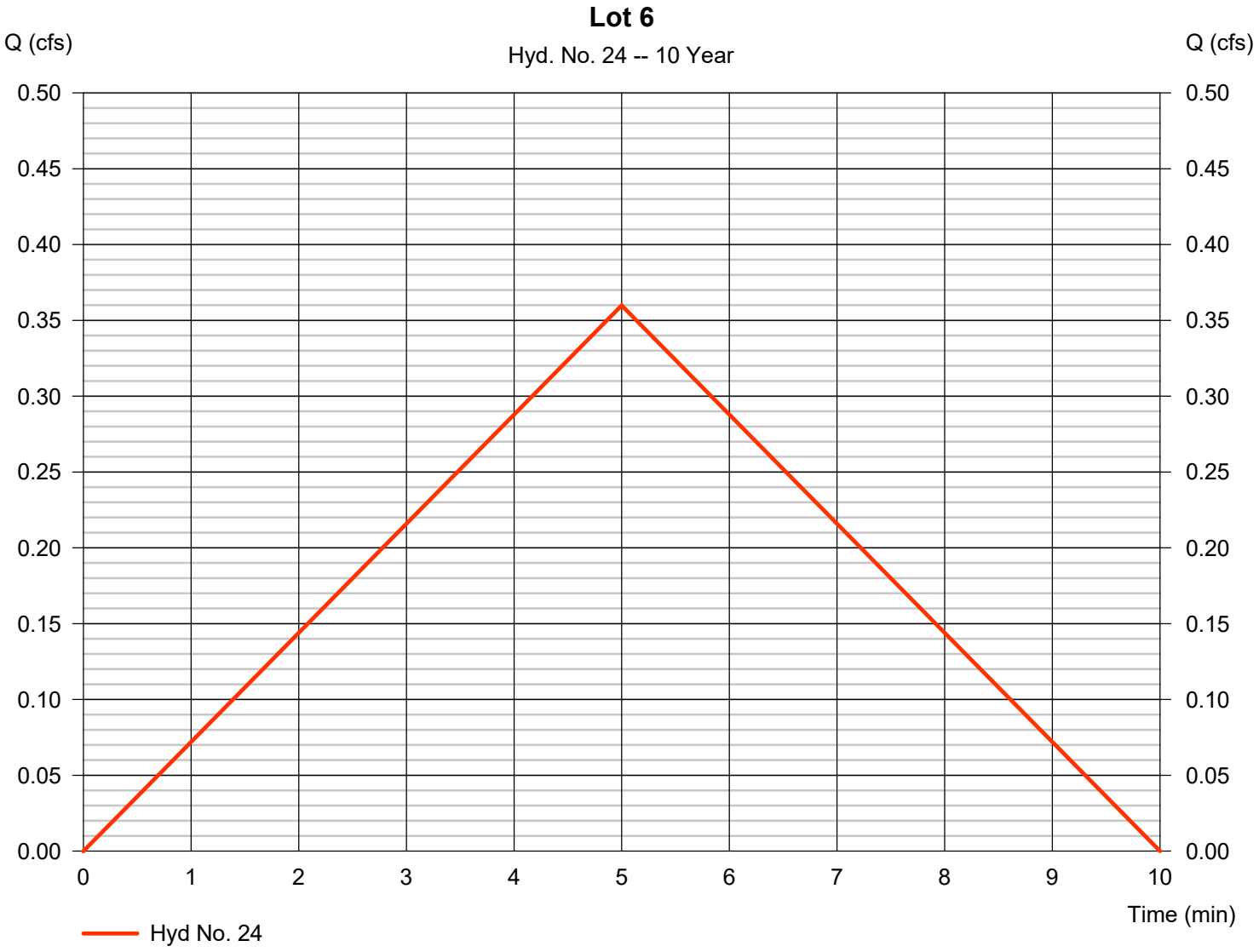


Hydrograph Report

Hyd. No. 24

Lot 6

Hydrograph type	= Rational	Peak discharge	= 0.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 108 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 7.269 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



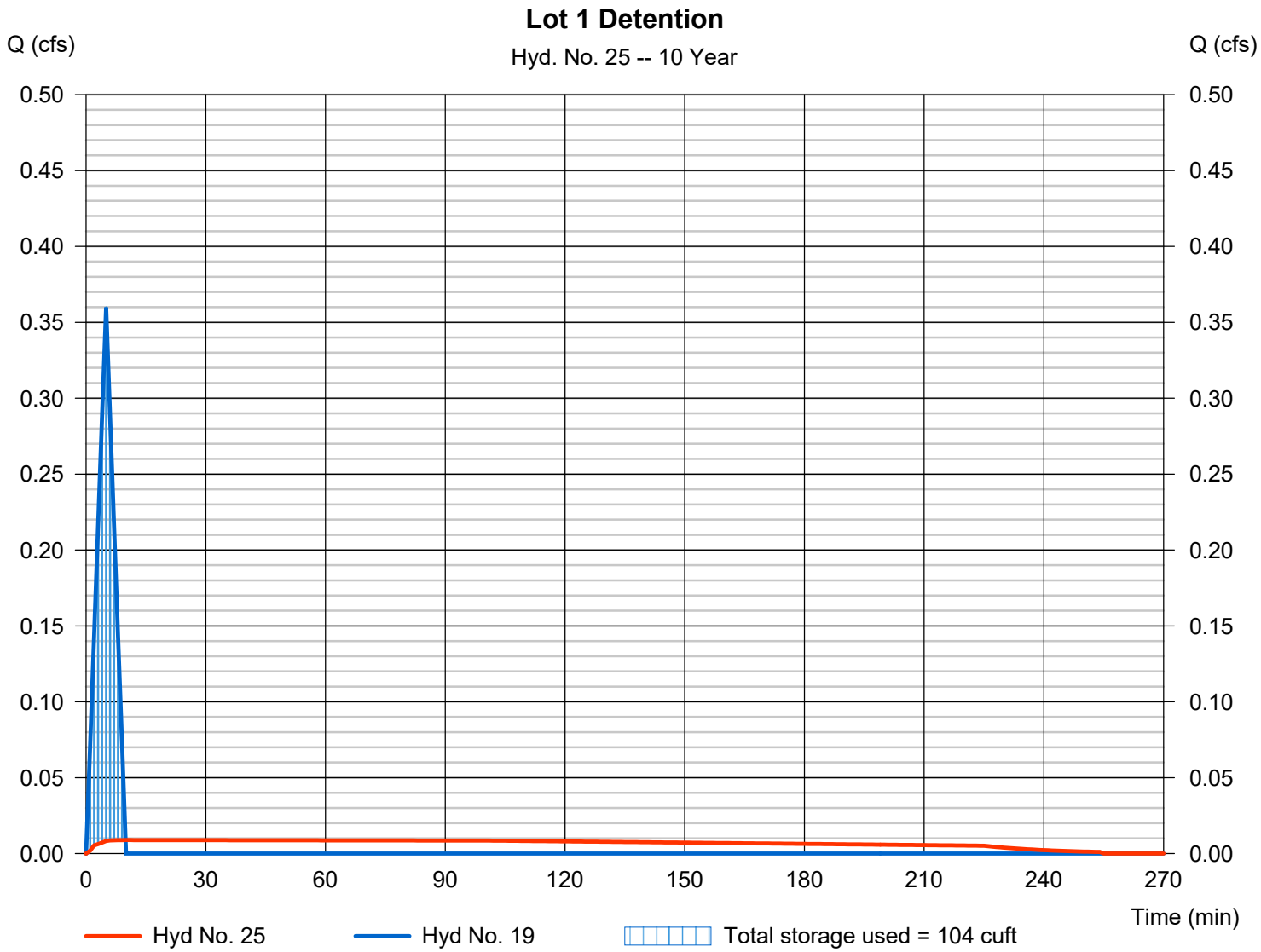
Hydrograph Report

Hyd. No. 25

Lot 1 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	19 - Lot 1	Max. Elevation	=	1038.12 ft
Reservoir name	=	Lot 1 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.



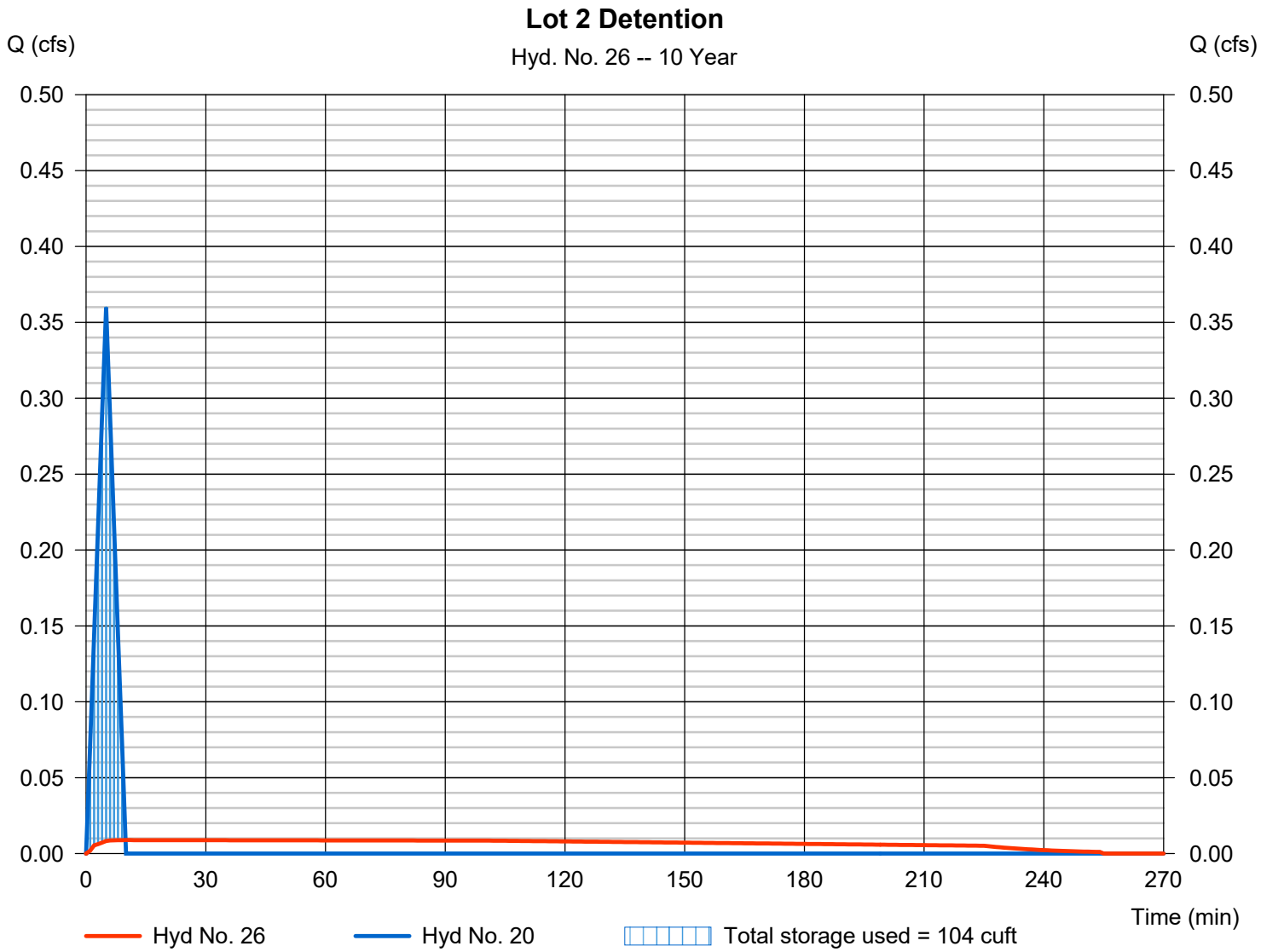
Hydrograph Report

Hyd. No. 26

Lot 2 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	20 - Lot 2	Max. Elevation	=	1040.12 ft
Reservoir name	=	Lot 2 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.



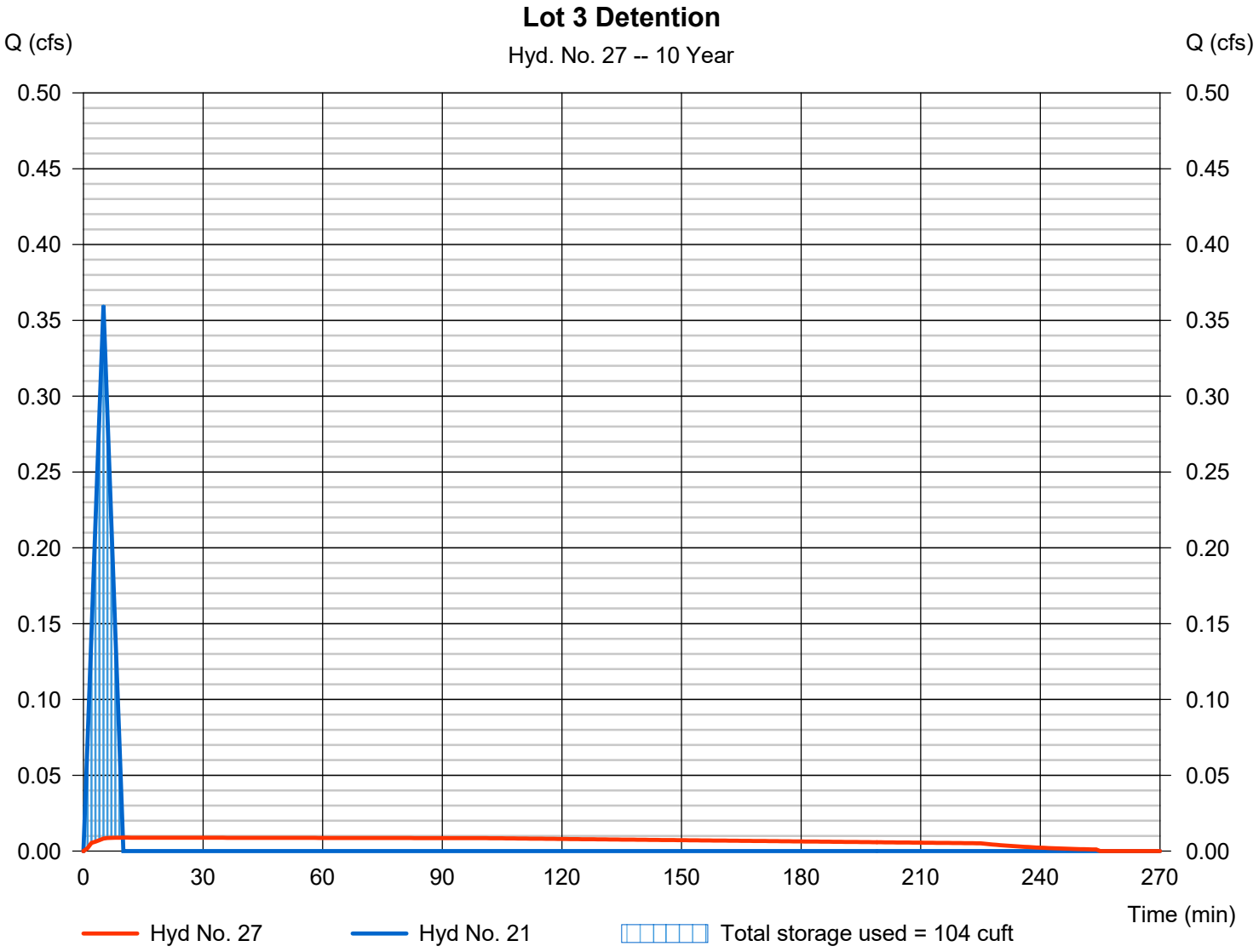
Hydrograph Report

Hyd. No. 27

Lot 3 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	21 - Lot 3	Max. Elevation	=	1037.12 ft
Reservoir name	=	Lot 3 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.



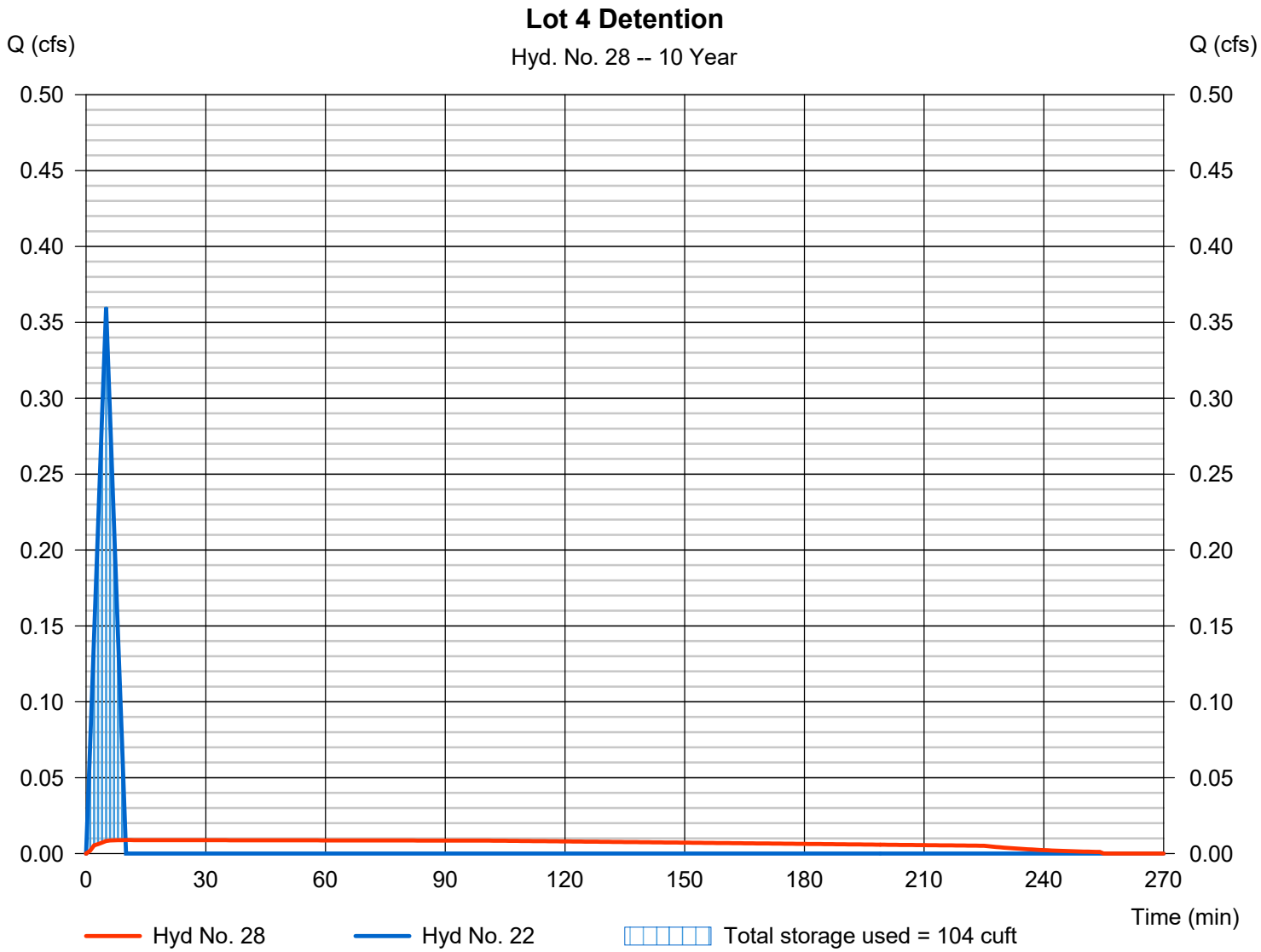
Hydrograph Report

Hyd. No. 28

Lot 4 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	22 - Lot 4	Max. Elevation	=	1039.12 ft
Reservoir name	=	Lot 4 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.



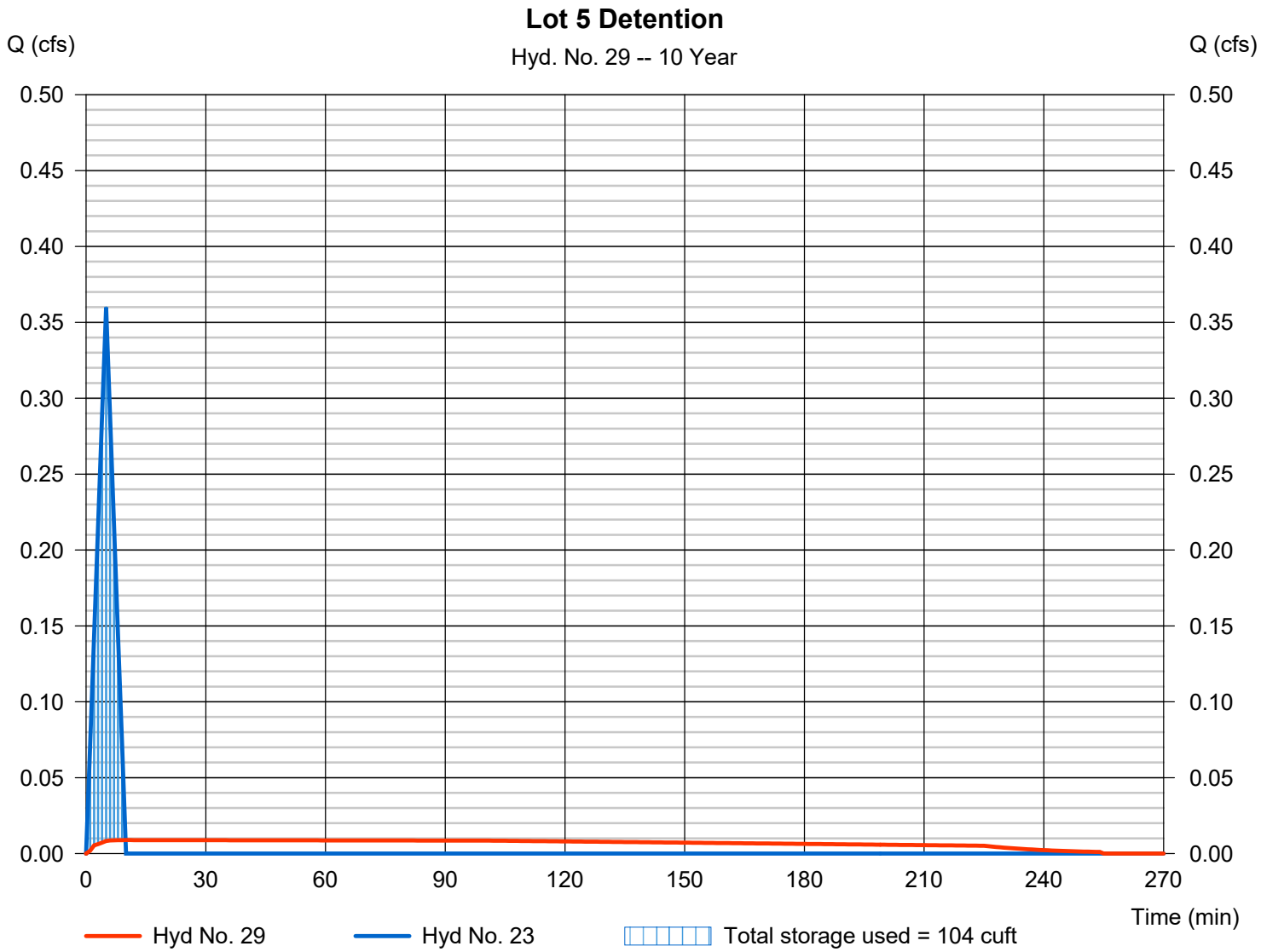
Hydrograph Report

Hyd. No. 29

Lot 5 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	23 - Lot 5	Max. Elevation	=	1038.12 ft
Reservoir name	=	Lot 5 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.



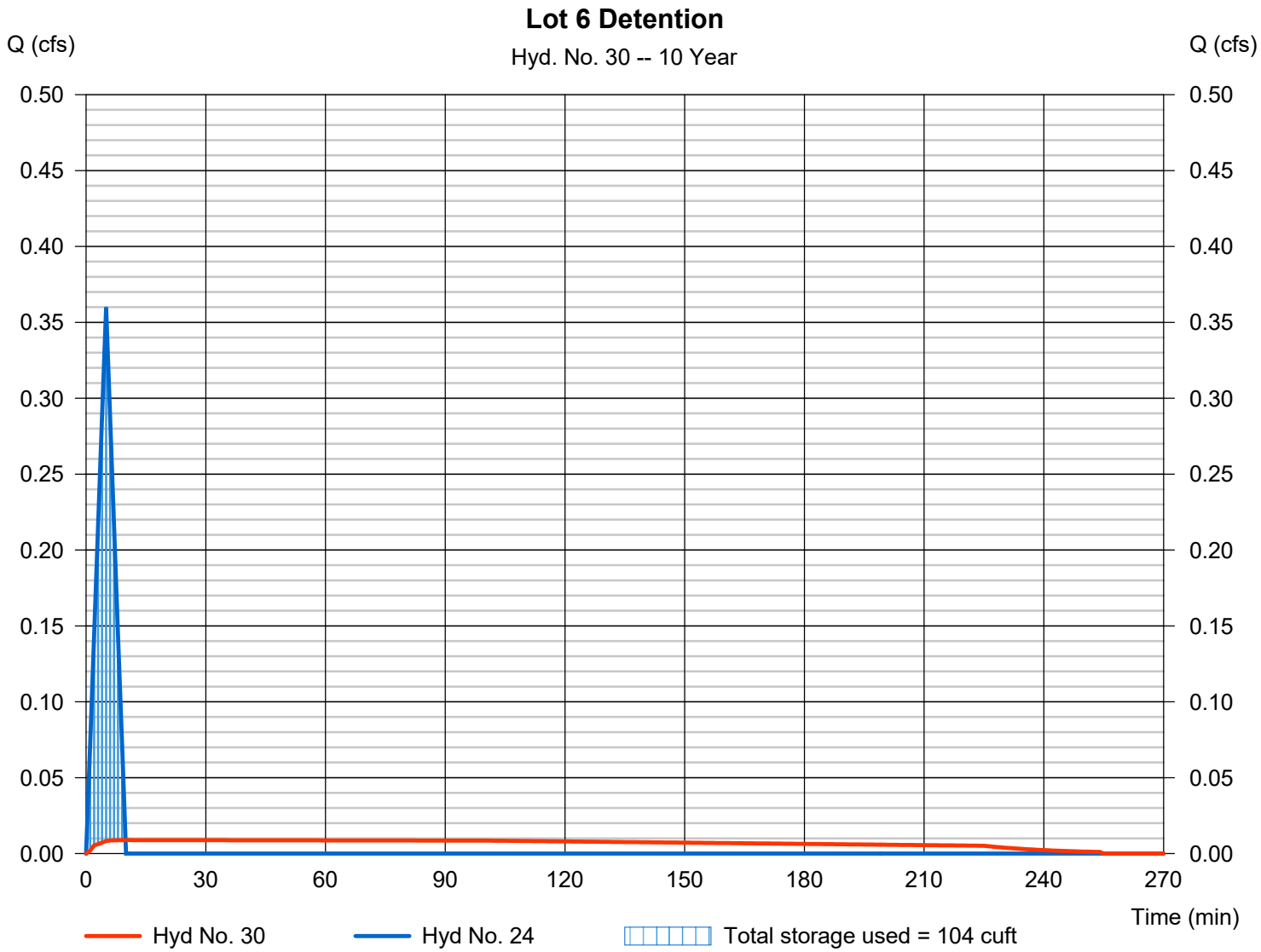
Hydrograph Report

Hyd. No. 30

Lot 6 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	24 - Lot 6	Max. Elevation	=	1038.12 ft
Reservoir name	=	Lot 6 Detention Pit	Max. Storage	=	104 cuft

Storage Indication method used.

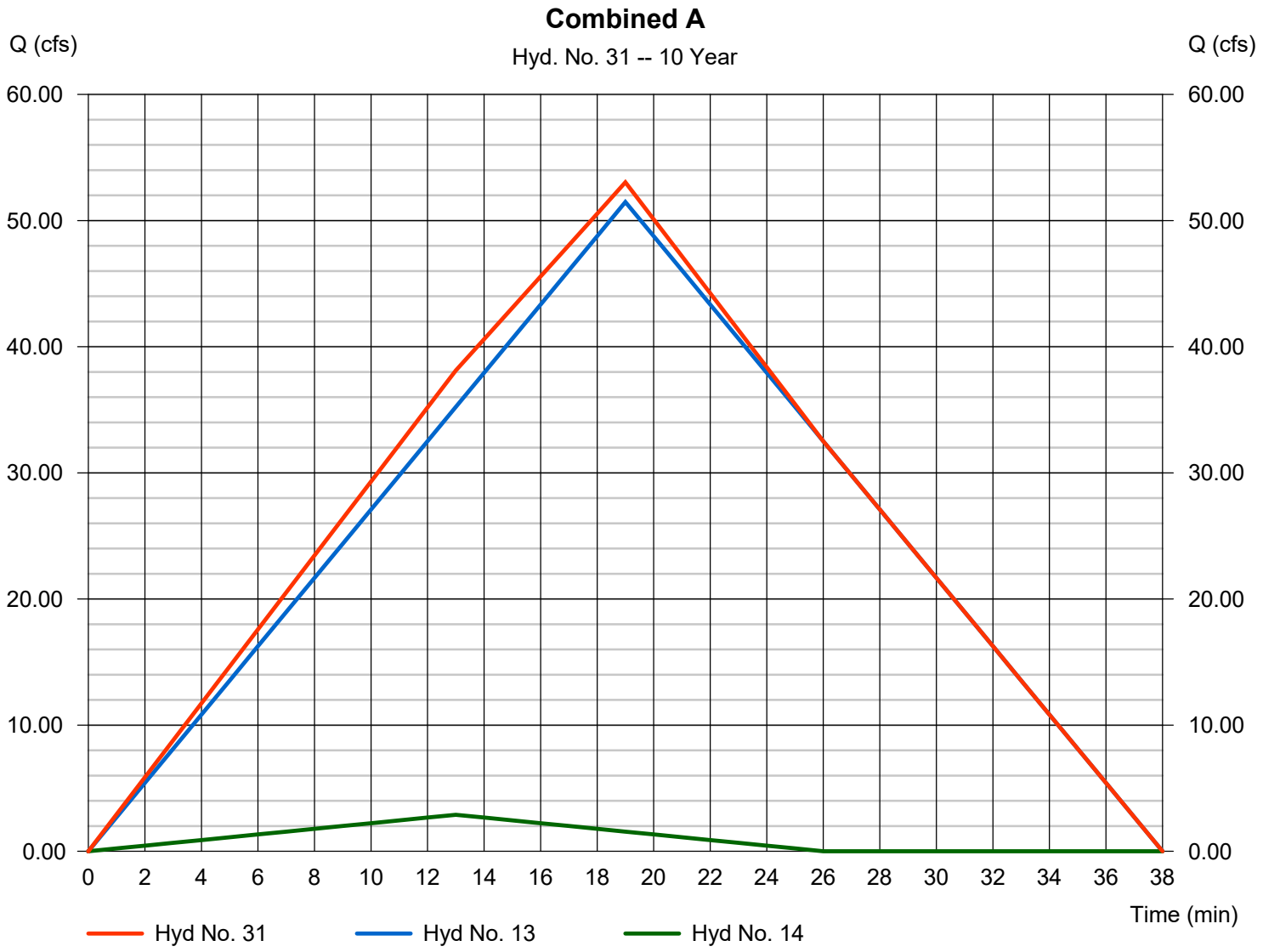


Hydrograph Report

Hyd. No. 31

Combined A

Hydrograph type	=	Combine	Peak discharge	=	53.03 cfs
Storm frequency	=	10 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	60,937 cuft
Inflow hyds.	=	13, 14	Contrib. drain. area	=	19.740 ac

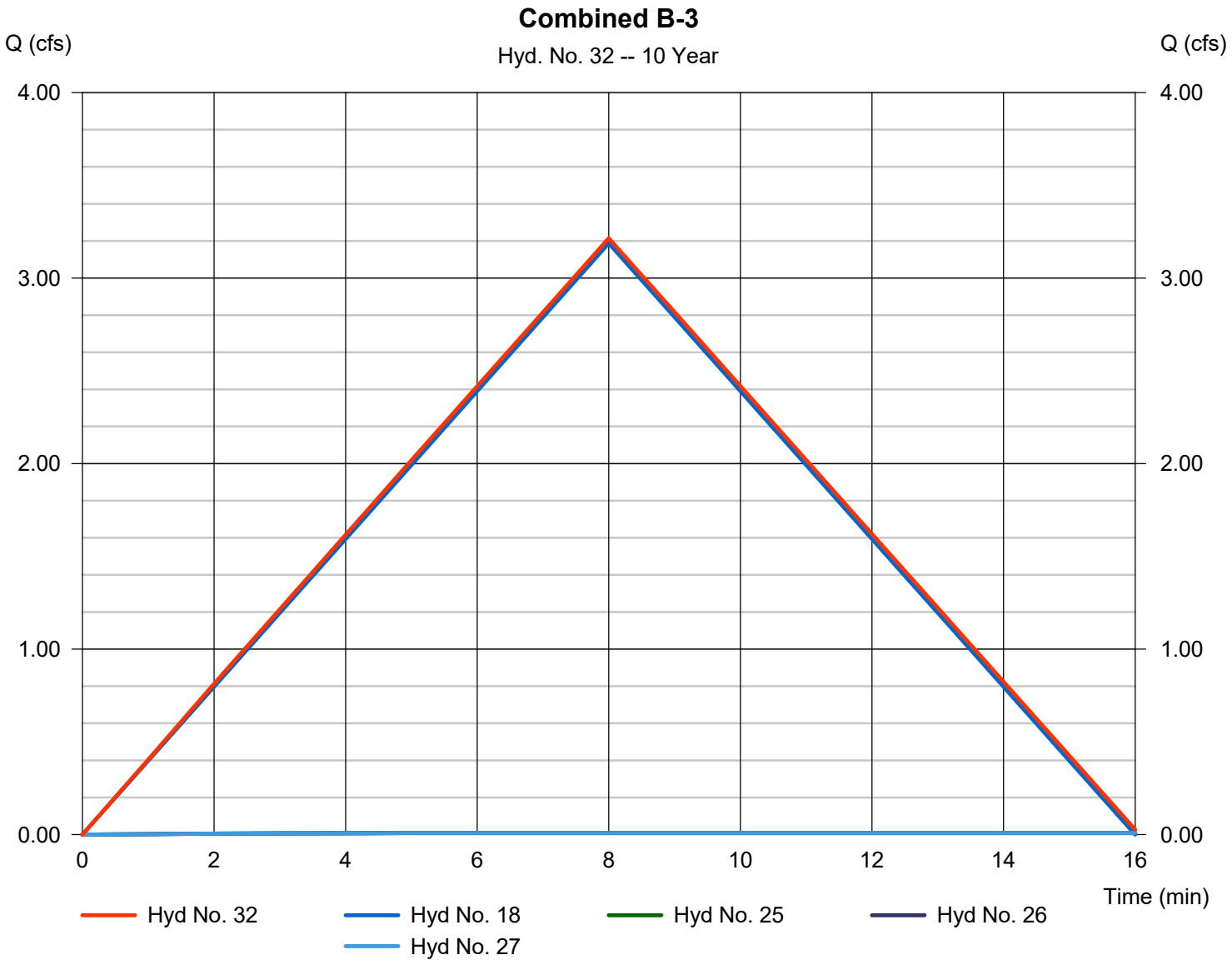


Hydrograph Report

Hyd. No. 32

Combined B-3

Hydrograph type	=	Combine	Peak discharge	=	3.214 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,851 cuft
Inflow hyds.	=	18, 25, 26, 27	Contrib. drain. area	=	0.960 ac

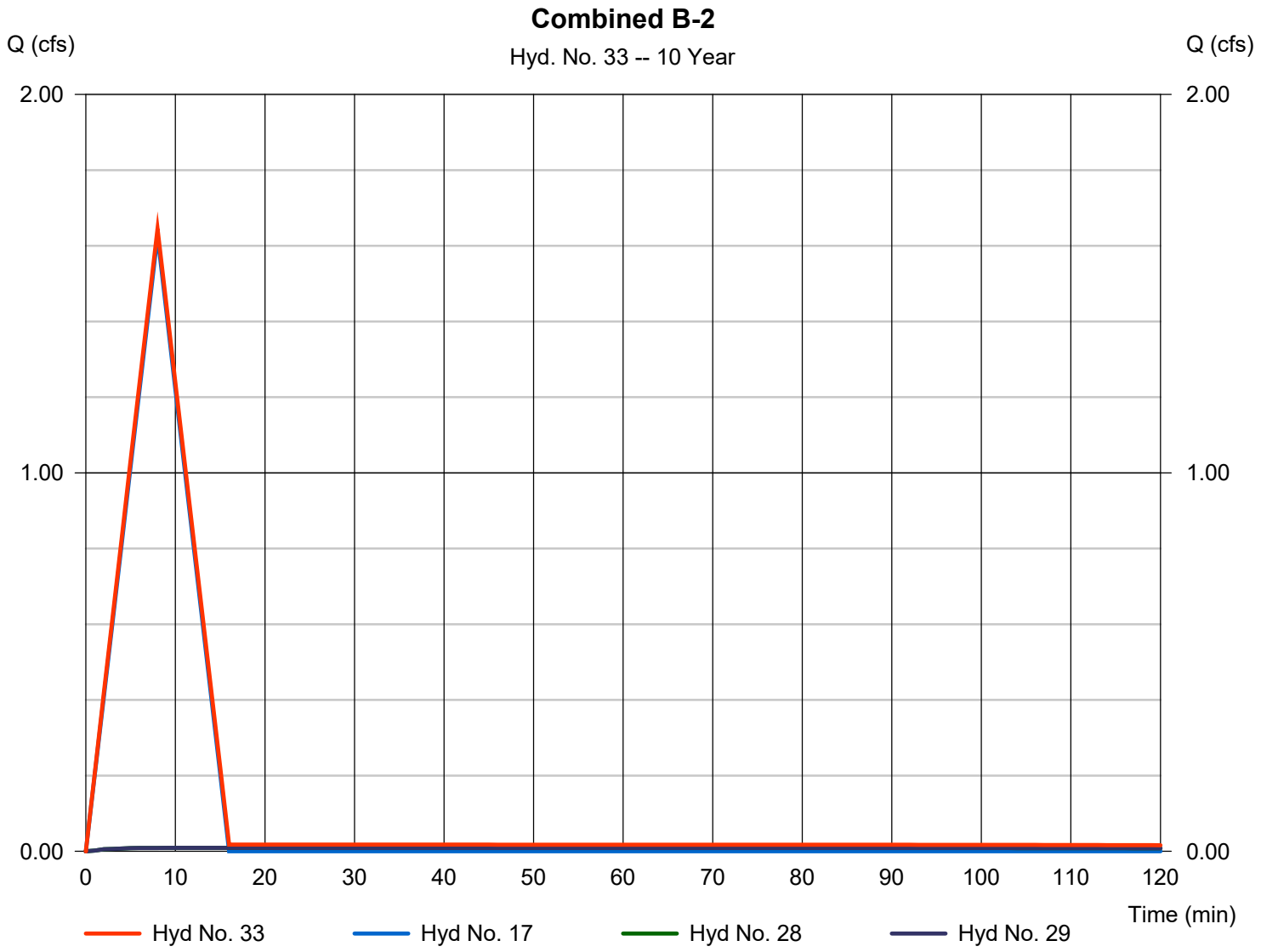


Hydrograph Report

Hyd. No. 33

Combined B-2

Hydrograph type	=	Combine	Peak discharge	=	1.645 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	995 cuft
Inflow hyds.	=	17, 28, 29	Contrib. drain. area	=	0.490 ac

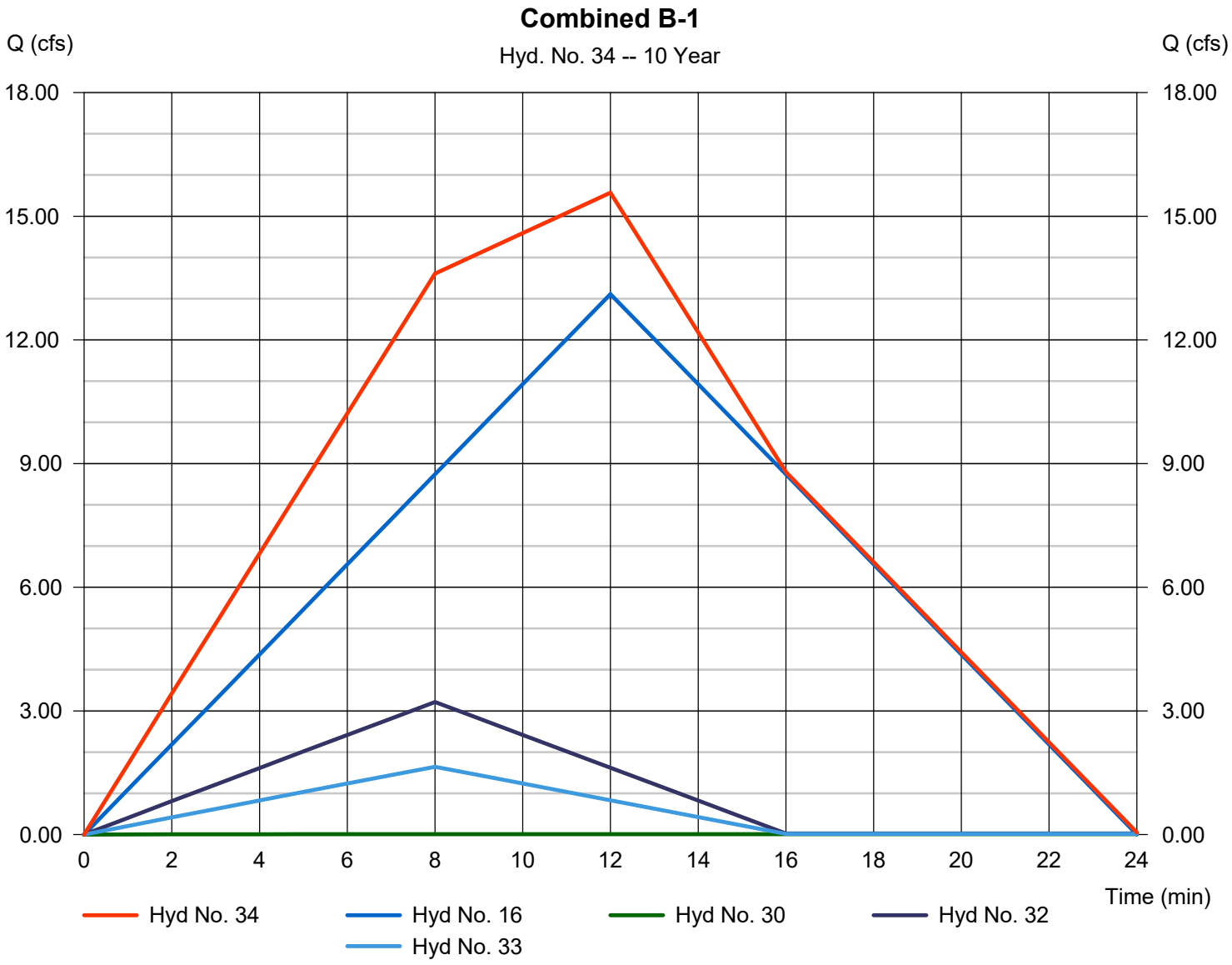


Hydrograph Report

Hyd. No. 34

Combined B-1

Hydrograph type	=	Combine	Peak discharge	=	15.57 cfs
Storm frequency	=	10 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	12,392 cuft
Inflow hyds.	=	16, 30, 32, 33	Contrib. drain. area	=	4.490 ac

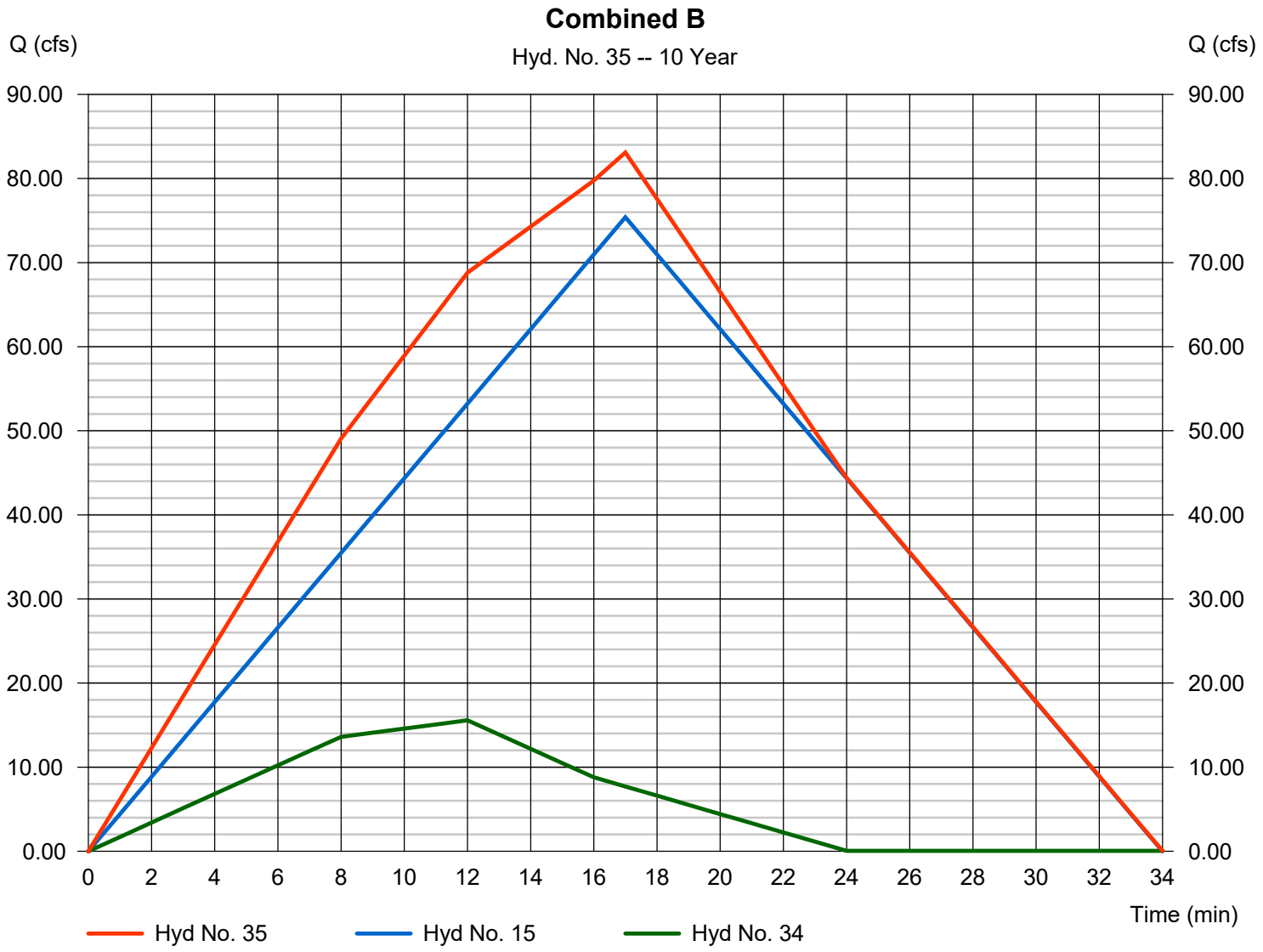


Hydrograph Report

Hyd. No. 35

Combined B

Hydrograph type	=	Combine	Peak discharge	=	83.10 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	89,297 cuft
Inflow hyds.	=	15, 34	Contrib. drain. area	=	26.540 ac



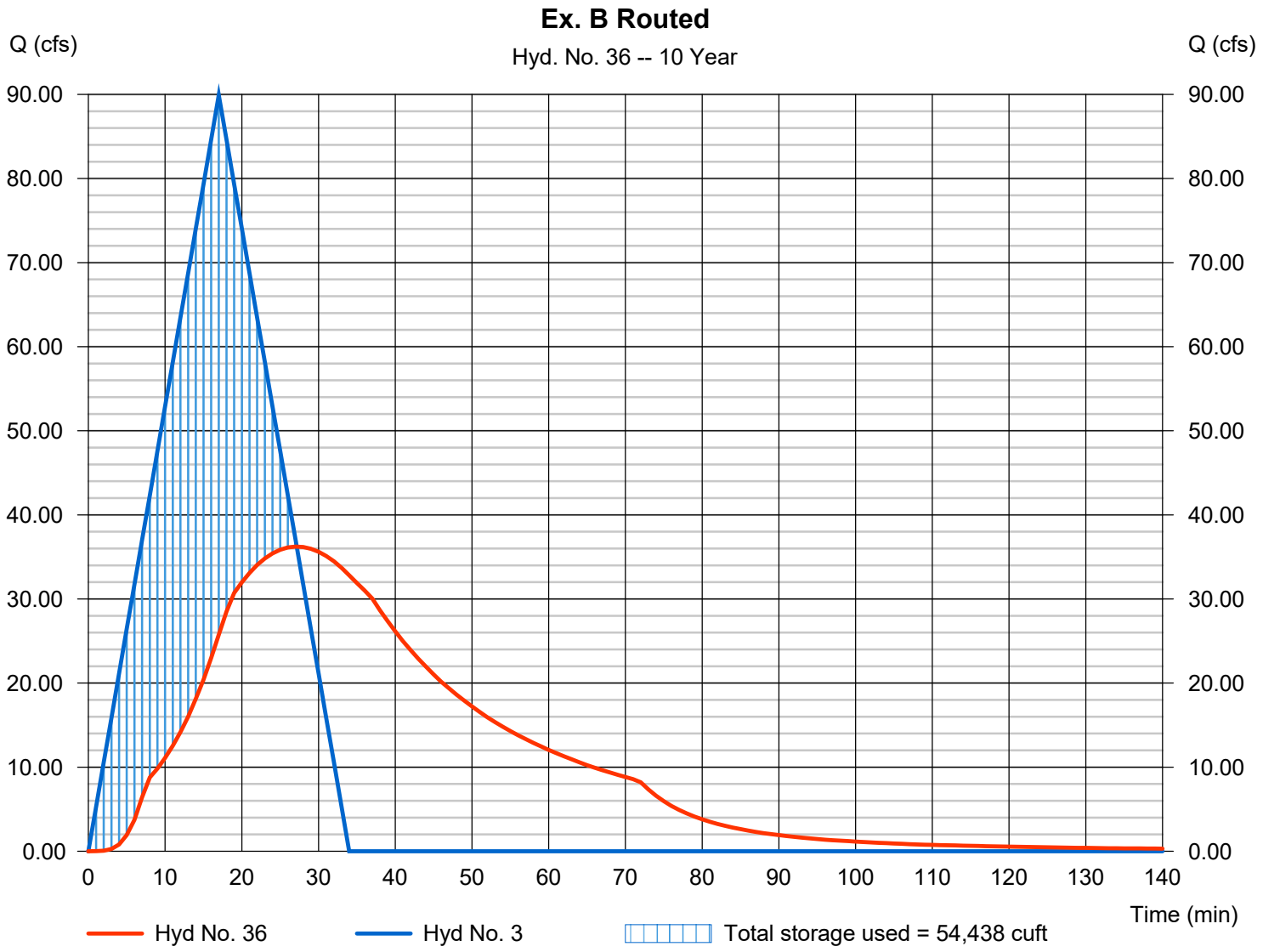
Hydrograph Report

Hyd. No. 36

Ex. B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	36.23 cfs
Storm frequency	=	10 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	91,701 cuft
Inflow hyd. No.	=	3 - Ex. B	Max. Elevation	=	1009.22 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	54,438 cuft

Storage Indication method used.



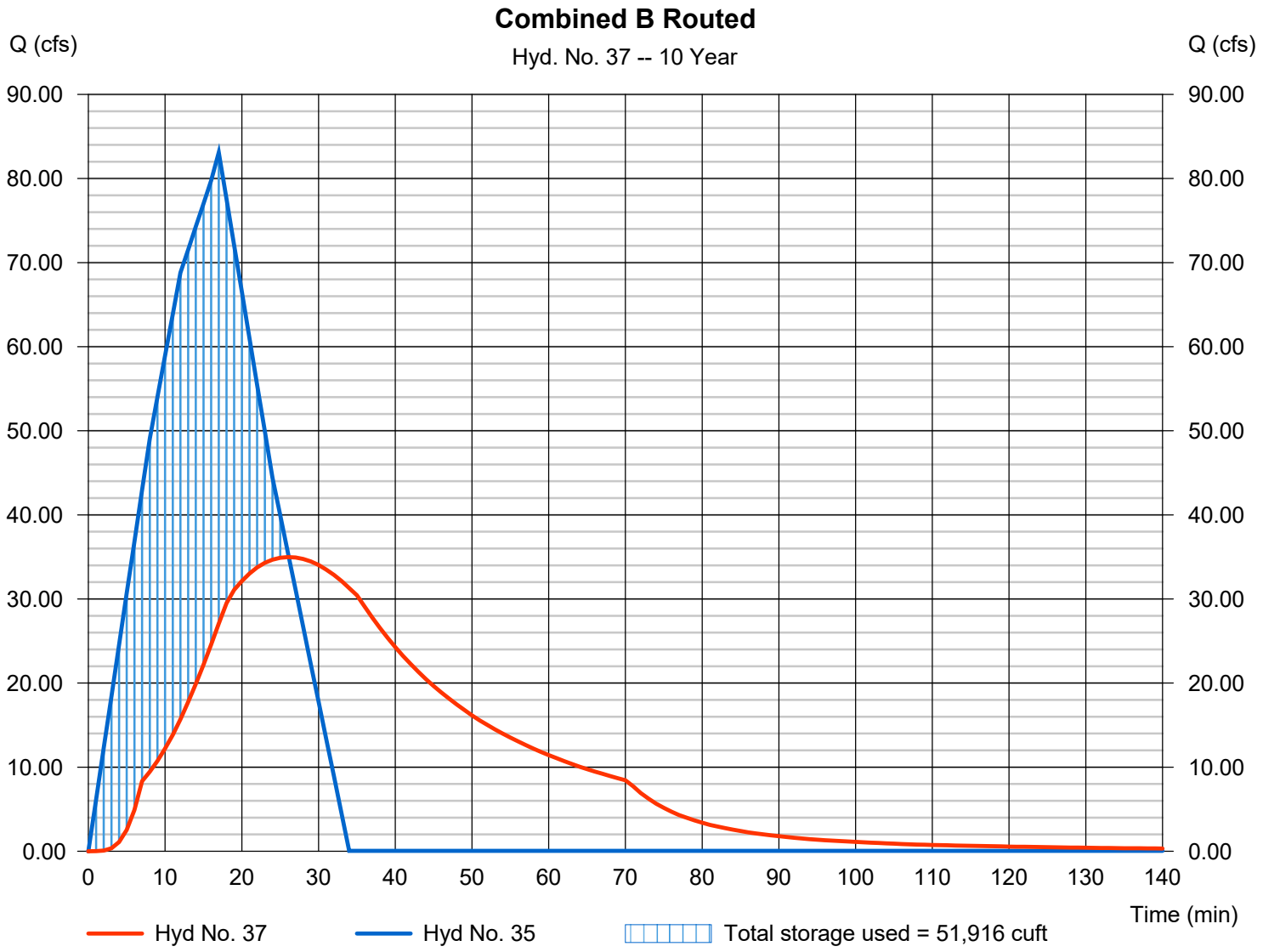
Hydrograph Report

Hyd. No. 37

Combined B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	34.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	26 min
Time interval	=	1 min	Hyd. volume	=	89,288 cuft
Inflow hyd. No.	=	35 - Combined B	Max. Elevation	=	1009.17 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	51,916 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	81.99	1	19	93,468	------	------	------	Ex. A
2	Rational	4.330	1	13	3,378	------	------	------	Ex. A-1
3	Rational	135.95	1	17	138,674	------	------	------	Ex. B
4	Rational	26.06	1	12	18,762	------	------	------	Ex. B-1
5	Rational	2.490	1	11	1,644	------	------	------	Ex. B-2
6	Rational	5.675	1	8	2,724	------	------	------	Ex. B-3
7	Rational	0.968	1	19	1,103	------	------	------	Ex. Onsite A
8	Rational	1.135	1	13	885	------	------	------	Ex. Onsite A-1
9	Rational	6.520	1	17	6,651	------	------	------	Ex. Onsite B
10	Rational	7.491	1	12	5,394	------	------	------	Ex. Onsite B-1
11	Rational	2.490	1	11	1,644	------	------	------	Ex. Onsite B-2
12	Rational	5.675	1	8	2,724	------	------	------	Ex. Onsite B-3
13	Rational	77.83	1	19	88,728	------	------	------	Prop. A
14	Rational	4.373	1	13	3,411	------	------	------	Prop. A-1
15	Rational	114.01	1	17	116,288	------	------	------	Prop. B
16	Rational	19.83	1	12	14,275	------	------	------	Prop. B-1
17	Rational	2.461	1	8	1,181	------	------	------	Prop. B-2
18	Rational	4.822	1	8	2,314	------	------	------	Prop. B-3
19	Rational	0.544	1	5	163	------	------	------	Lot 1
20	Rational	0.544	1	5	163	------	------	------	Lot 2
21	Rational	0.544	1	5	163	------	------	------	Lot 3
22	Rational	0.544	1	5	163	------	------	------	Lot 4
23	Rational	0.544	1	5	163	------	------	------	Lot 5
24	Rational	0.544	1	5	163	------	------	------	Lot 6
25	Reservoir	0.009	1	10	162	19	1038.26	159	Lot 1 Detention
26	Reservoir	0.009	1	10	162	20	1040.26	159	Lot 2 Detention
27	Reservoir	0.009	1	10	162	21	1037.26	159	Lot 3 Detention
28	Reservoir	0.009	1	10	162	22	1039.26	159	Lot 4 Detention
29	Reservoir	0.009	1	10	162	23	1038.26	159	Lot 5 Detention
30	Reservoir	0.009	1	10	162	24	1038.26	159	Lot 6 Detention
31	Combine	80.19	1	19	92,139	13, 14,	------	------	Combined A
32	Combine	4.849	1	8	2,801	18, 25, 26, 27,	------	------	Combined B-3
33	Combine	2.479	1	8	1,506	17, 28, 29,	------	------	Combined B-2
34	Combine	23.52	1	12	18,744	16, 30, 32, 33	------	------	Combined B-1

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

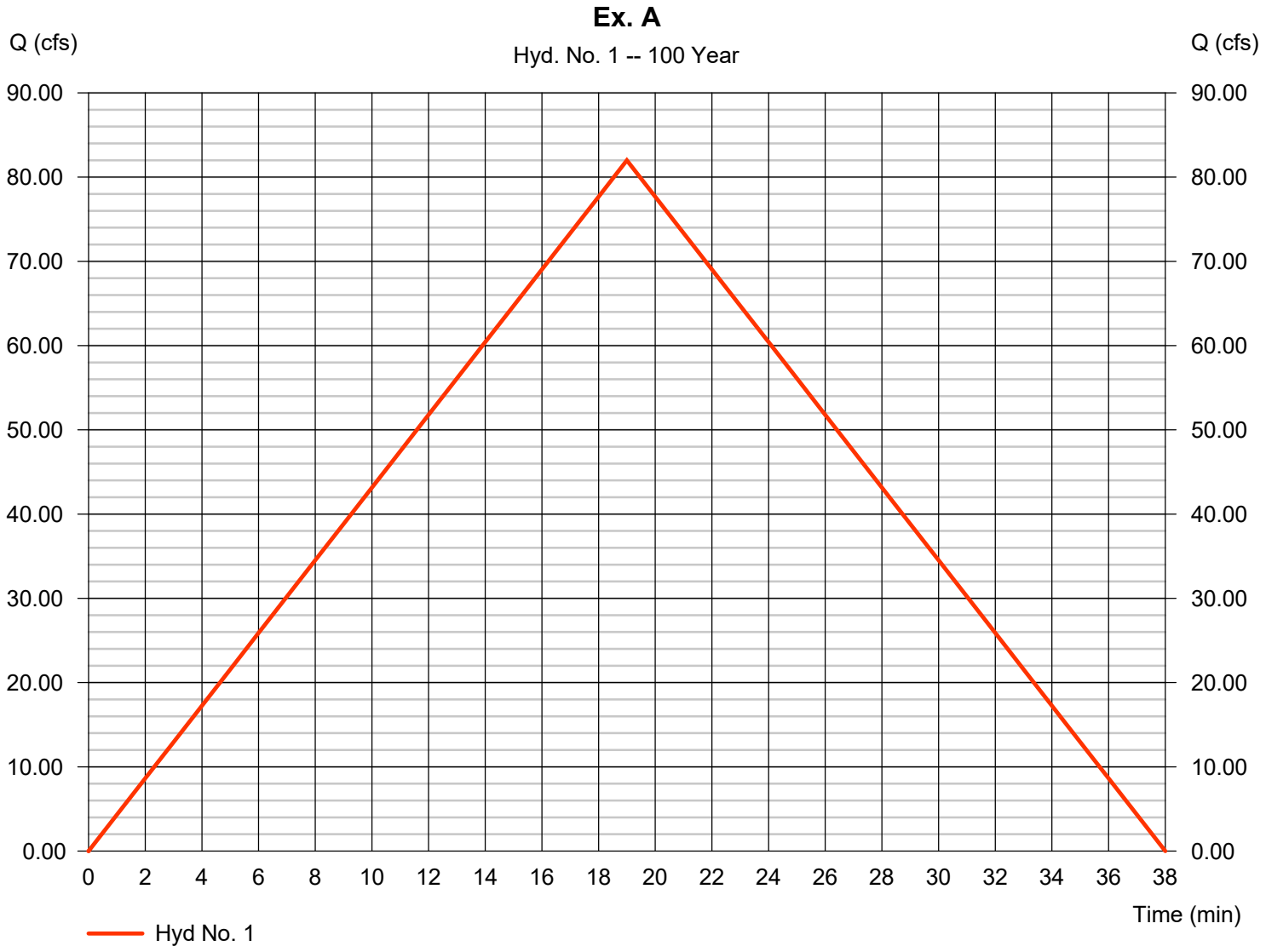
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
35	Combine	125.63	1	17	135,032	15, 34	------	------	Combined B
36	Reservoir	51.98	1	27	138,665	3	1009.75	84,744	Ex. B Routed
37	Reservoir	49.94	1	27	135,023	35	1009.68	80,904	Combined B Routed

Hydrograph Report

Hyd. No. 1

Ex. A

Hydrograph type	=	Rational	Peak discharge	=	81.99 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	93,468 cuft
Drainage area	=	19.720 ac	Runoff coeff.	=	0.58
Intensity	=	7.168 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

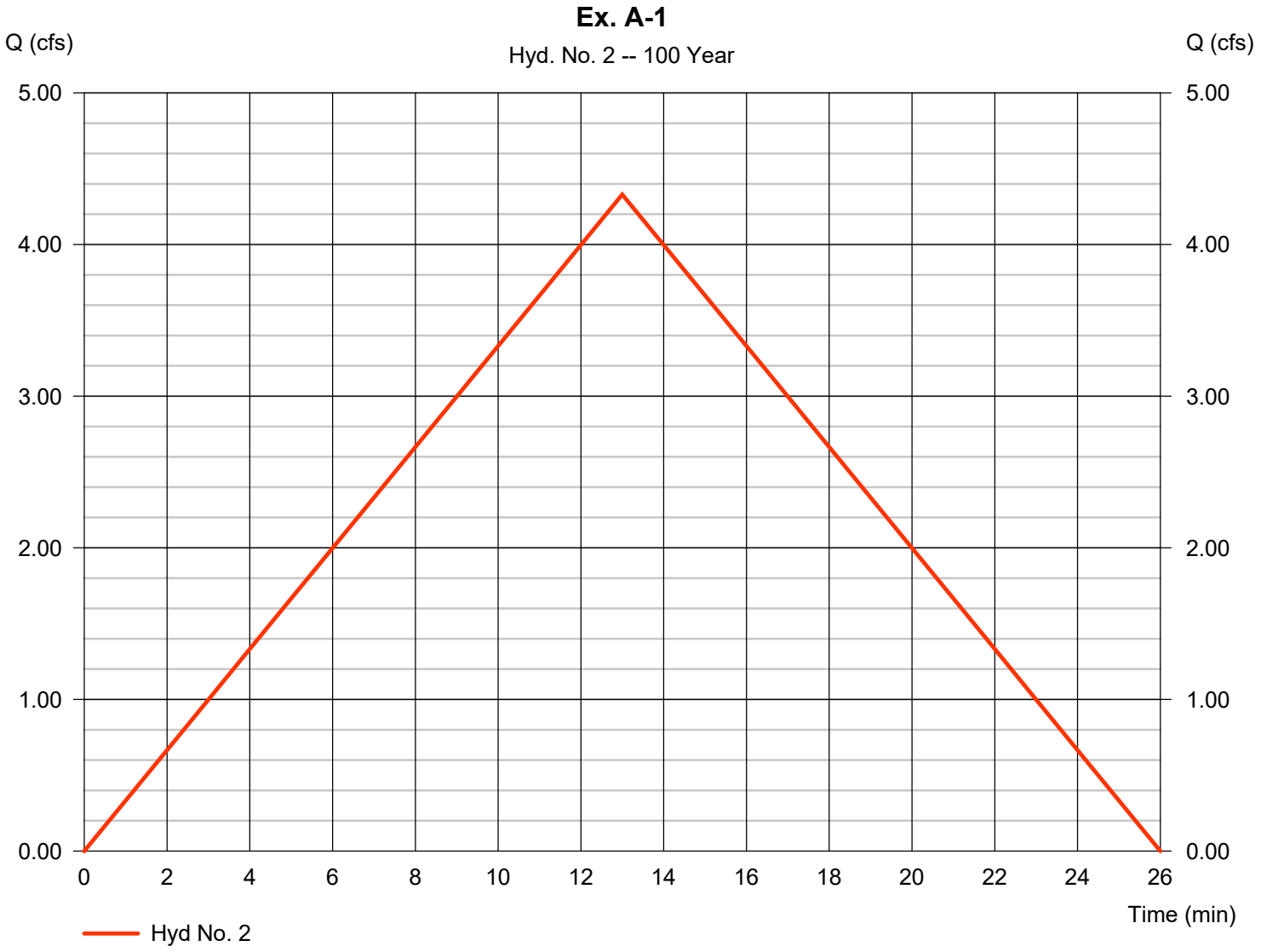


Hydrograph Report

Hyd. No. 2

Ex. A-1

Hydrograph type	=	Rational	Peak discharge	=	4.330 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	3,378 cuft
Drainage area	=	1.010 ac	Runoff coeff.	=	0.51
Intensity	=	8.406 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

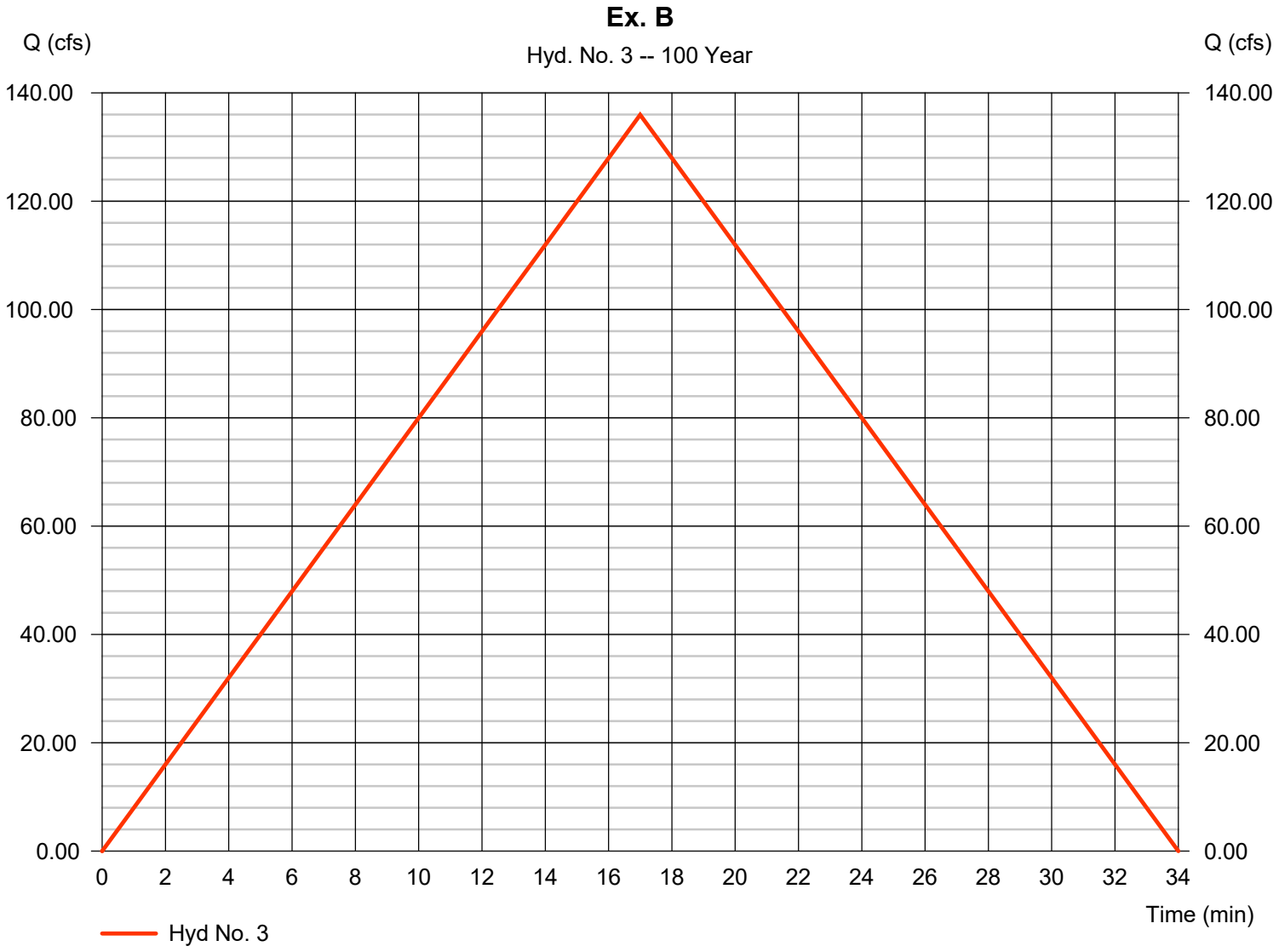


Hydrograph Report

Hyd. No. 3

Ex. B

Hydrograph type	=	Rational	Peak discharge	=	135.95 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	138,674 cuft
Drainage area	=	32.800 ac	Runoff coeff.	=	0.55
Intensity	=	7.536 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

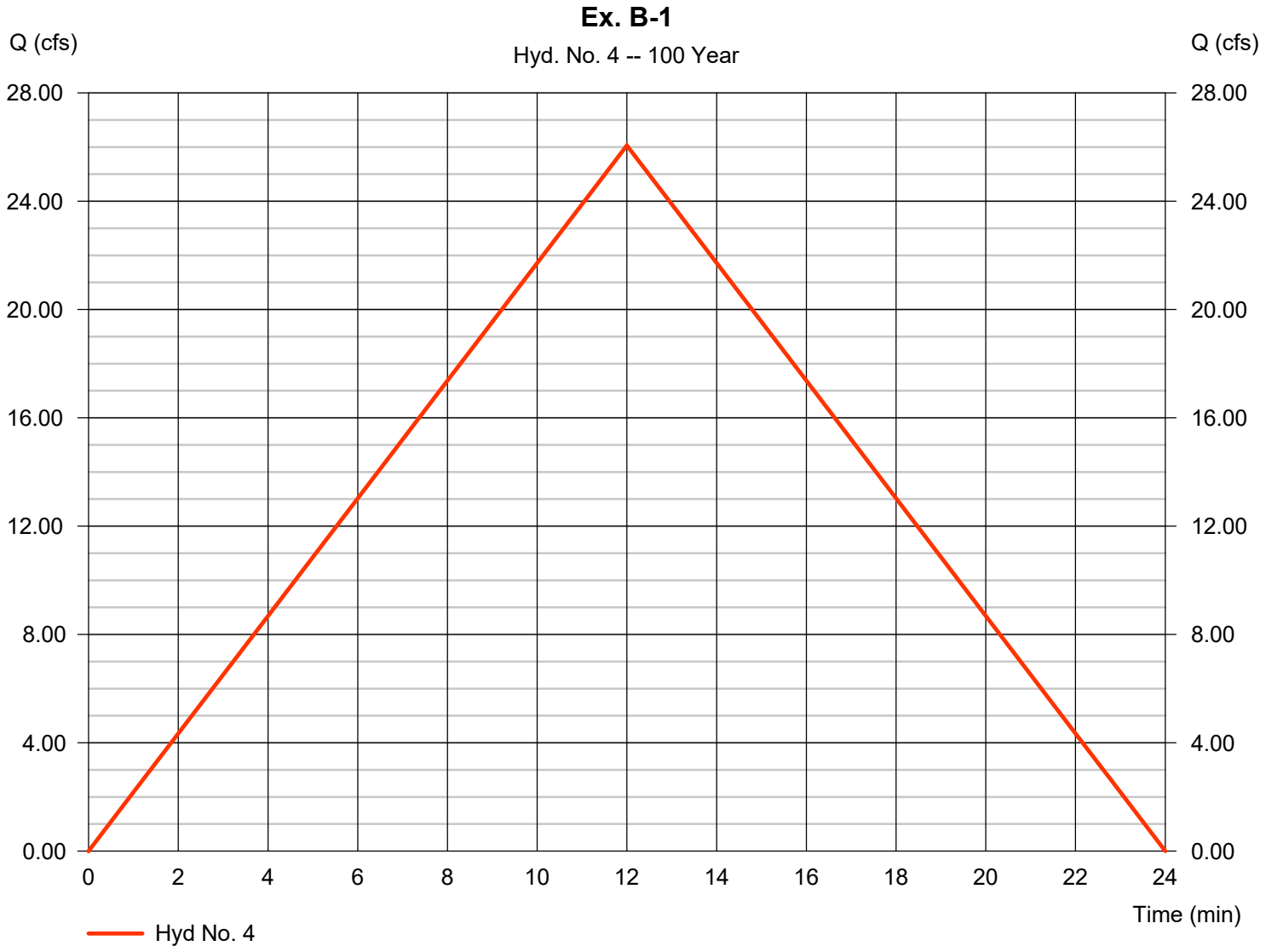


Hydrograph Report

Hyd. No. 4

Ex. B-1

Hydrograph type	=	Rational	Peak discharge	=	26.06 cfs
Storm frequency	=	100 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	18,762 cuft
Drainage area	=	6.270 ac	Runoff coeff.	=	0.48
Intensity	=	8.658 in/hr	Tc by User	=	12.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

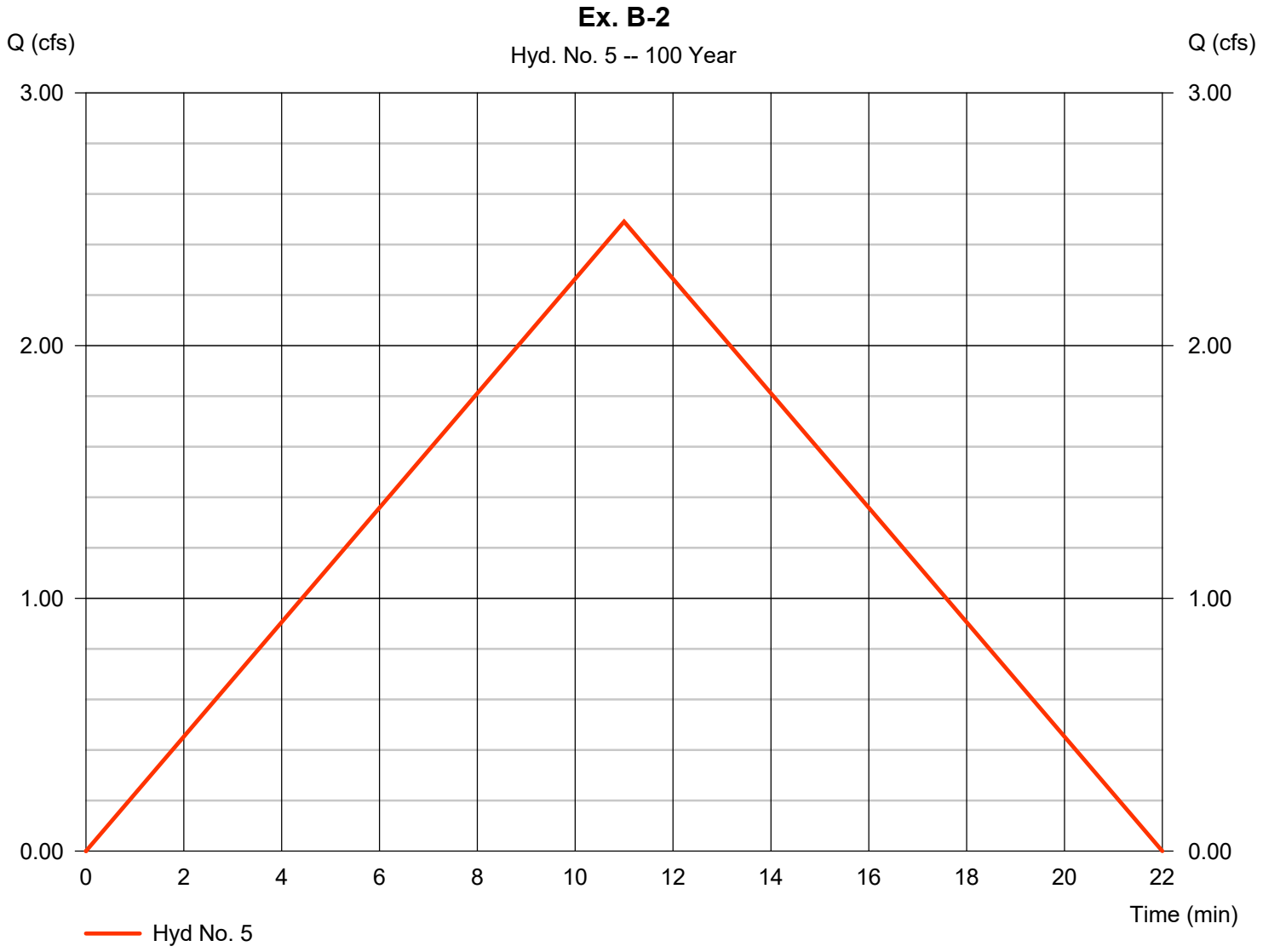


Hydrograph Report

Hyd. No. 5

Ex. B-2

Hydrograph type	=	Rational	Peak discharge	=	2.490 cfs
Storm frequency	=	100 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	1,644 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	8.926 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

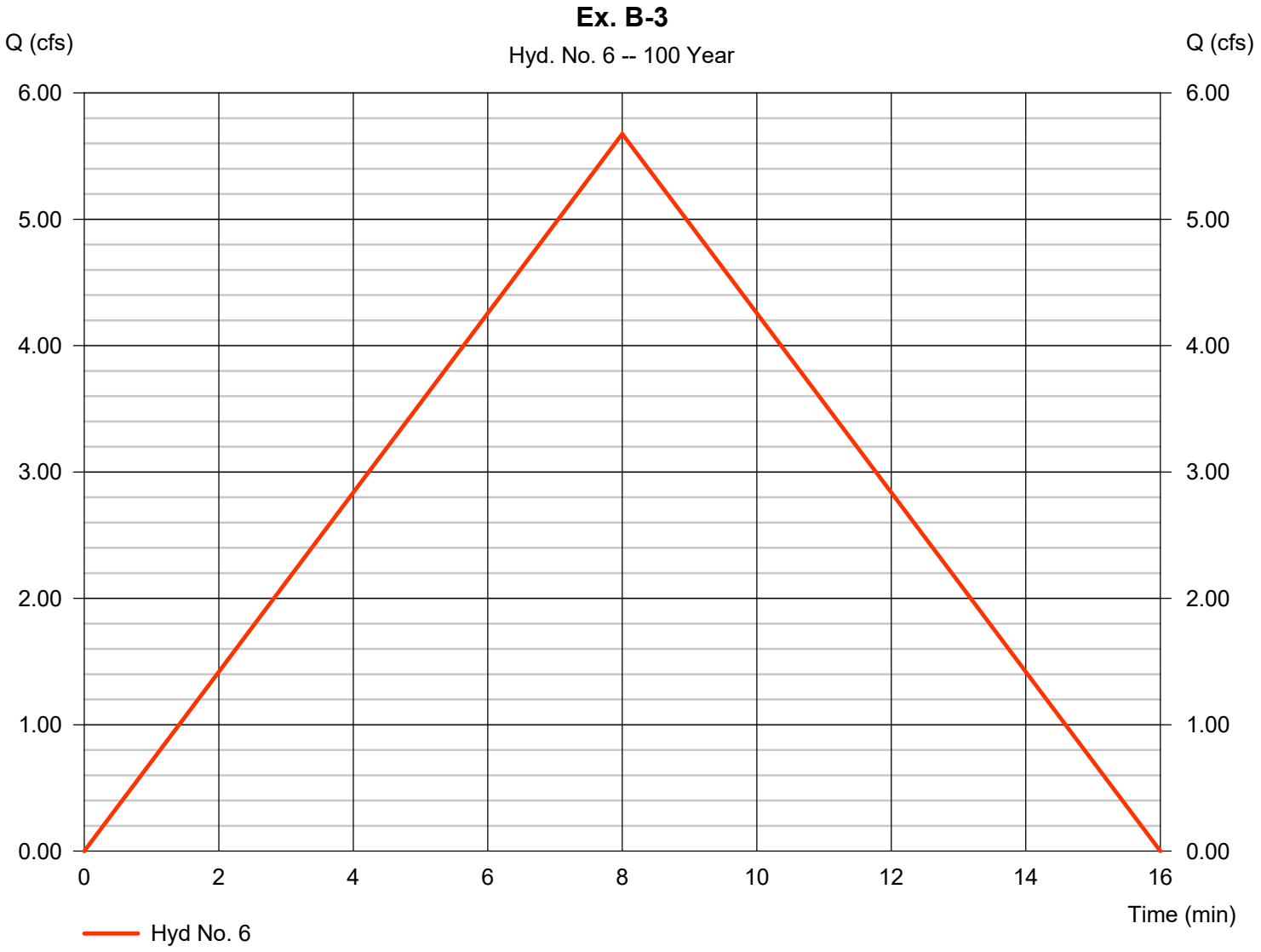


Hydrograph Report

Hyd. No. 6

Ex. B-3

Hydrograph type	=	Rational	Peak discharge	=	5.675 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	2,724 cuft
Drainage area	=	1.130 ac	Runoff coeff.	=	0.51
Intensity	=	9.848 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

Hyd. No. 7

Ex. Onsite A

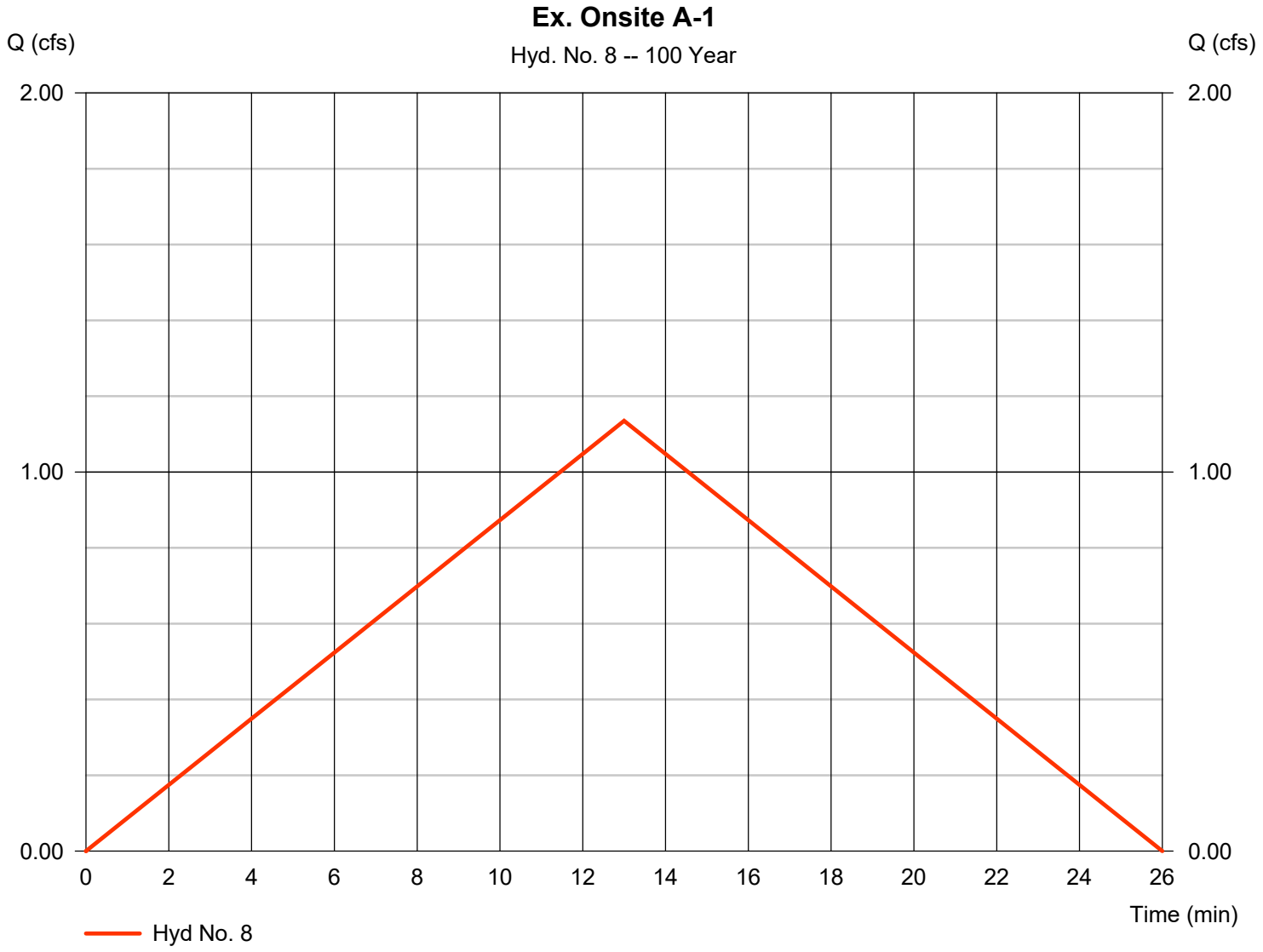
Hydrograph type	=	Rational	Peak discharge	=	0.968 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	1,103 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	7.168 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Report

Hyd. No. 8

Ex. Onsite A-1

Hydrograph type	=	Rational	Peak discharge	=	1.135 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	885 cuft
Drainage area	=	0.270 ac	Runoff coeff.	=	0.5
Intensity	=	8.406 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

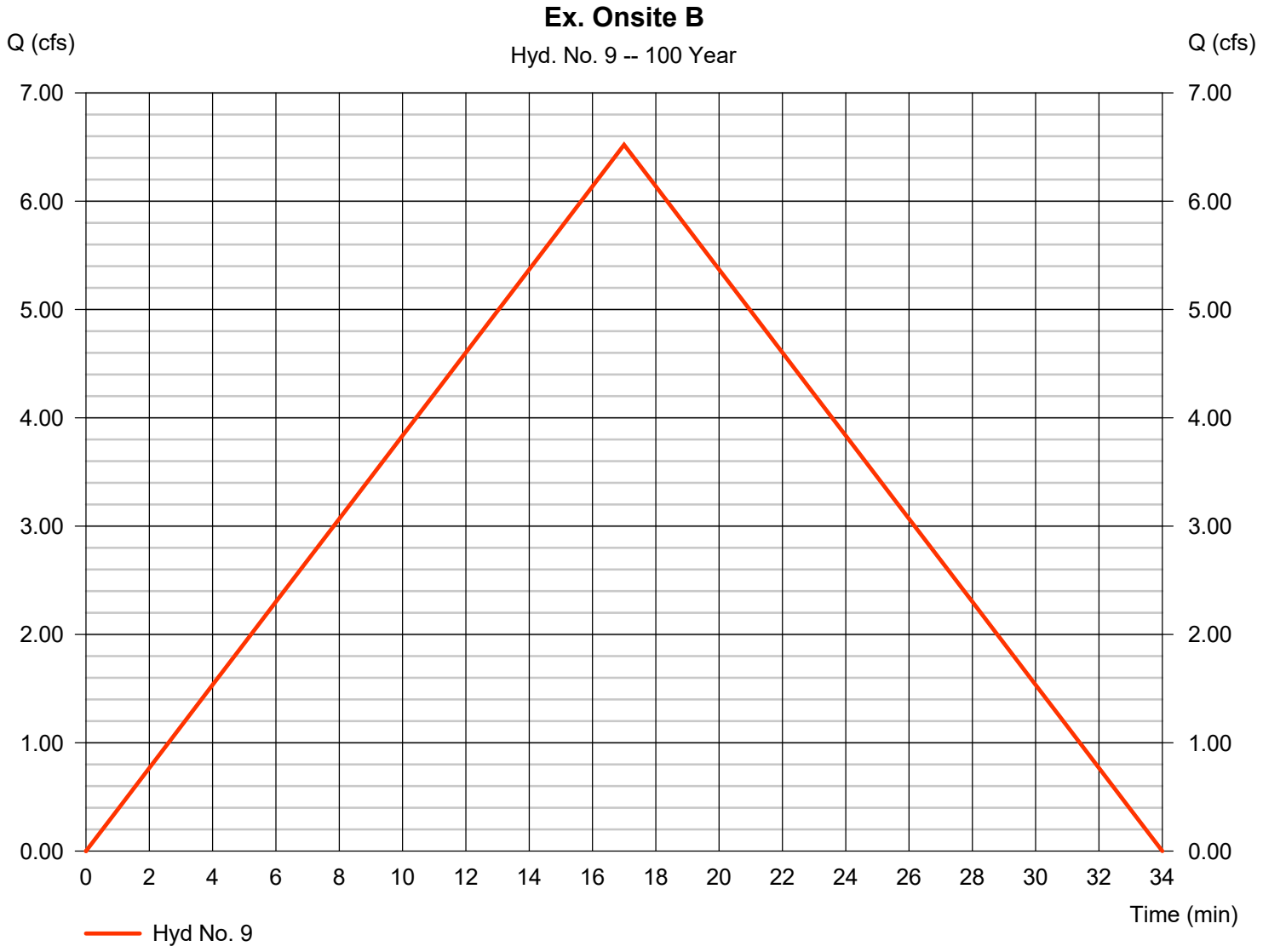


Hydrograph Report

Hyd. No. 9

Ex. Onsite B

Hydrograph type	=	Rational	Peak discharge	=	6.520 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	6,651 cuft
Drainage area	=	2.060 ac	Runoff coeff.	=	0.42
Intensity	=	7.536 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

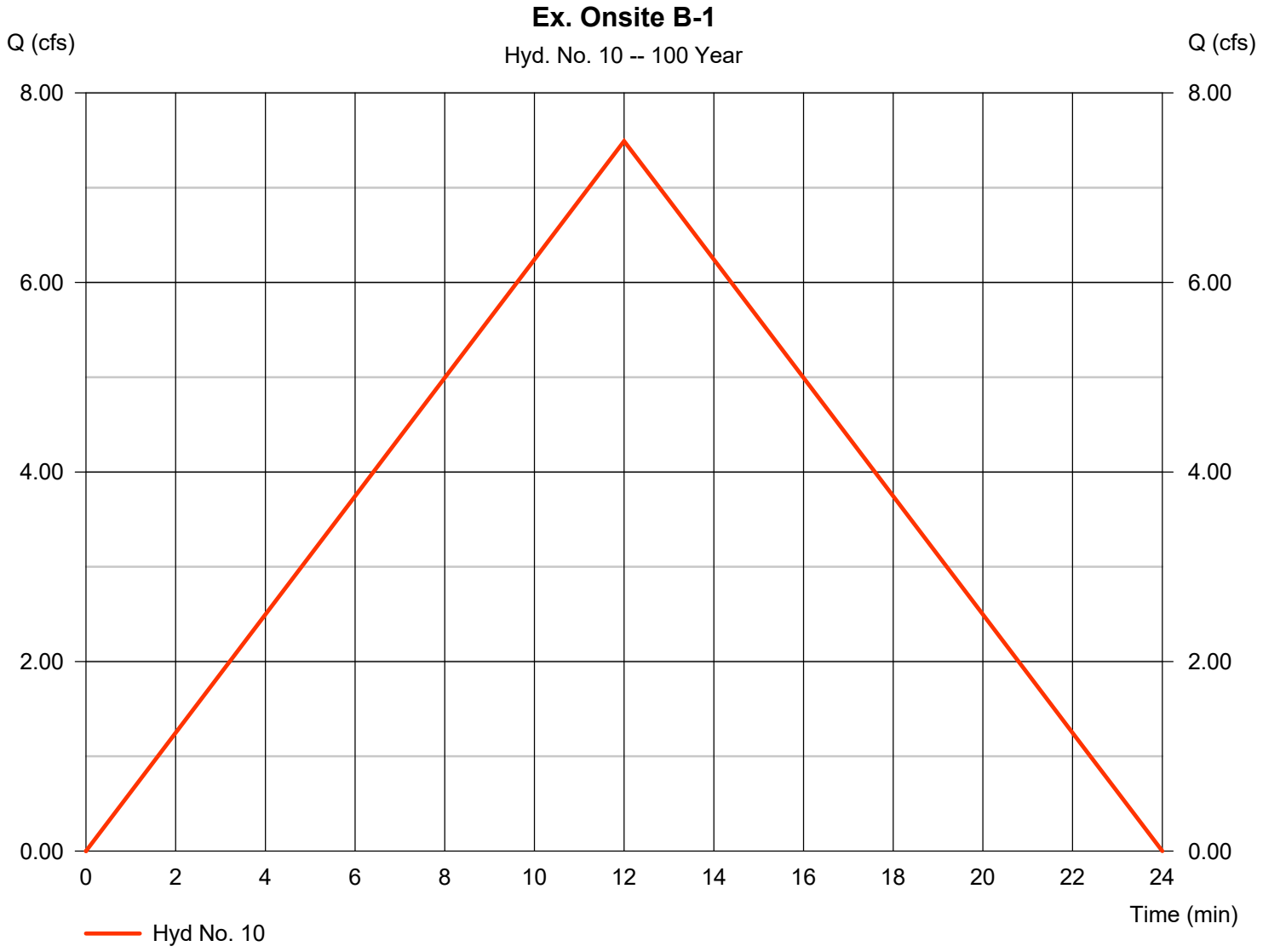


Hydrograph Report

Hyd. No. 10

Ex. Onsite B-1

Hydrograph type	= Rational	Peak discharge	= 7.491 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 5,394 cuft
Drainage area	= 2.060 ac	Runoff coeff.	= 0.42
Intensity	= 8.658 in/hr	Tc by User	= 12.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

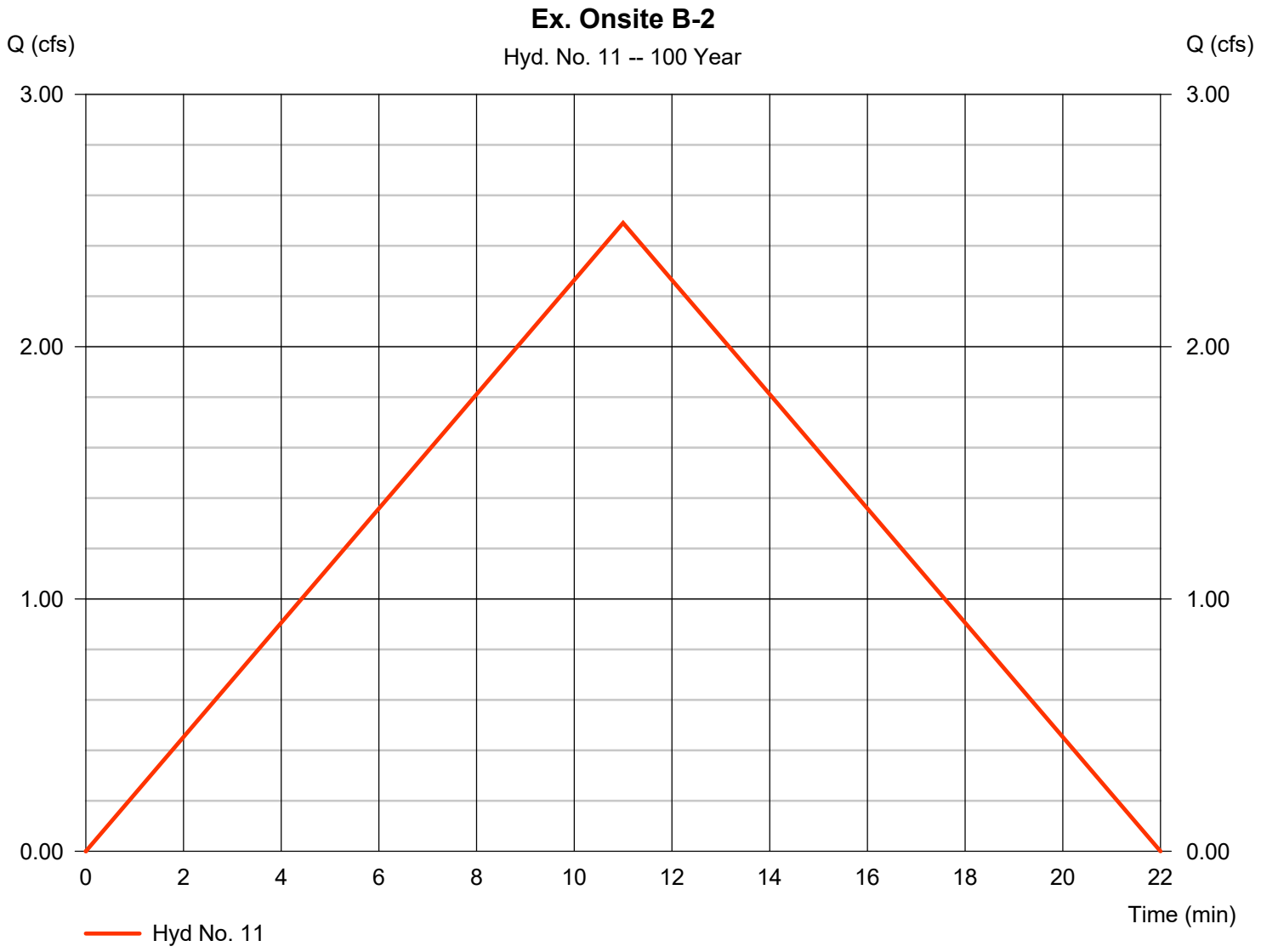


Hydrograph Report

Hyd. No. 11

Ex. Onsite B-2

Hydrograph type	=	Rational	Peak discharge	=	2.490 cfs
Storm frequency	=	100 yrs	Time to peak	=	11 min
Time interval	=	1 min	Hyd. volume	=	1,644 cuft
Drainage area	=	0.930 ac	Runoff coeff.	=	0.3
Intensity	=	8.926 in/hr	Tc by User	=	11.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

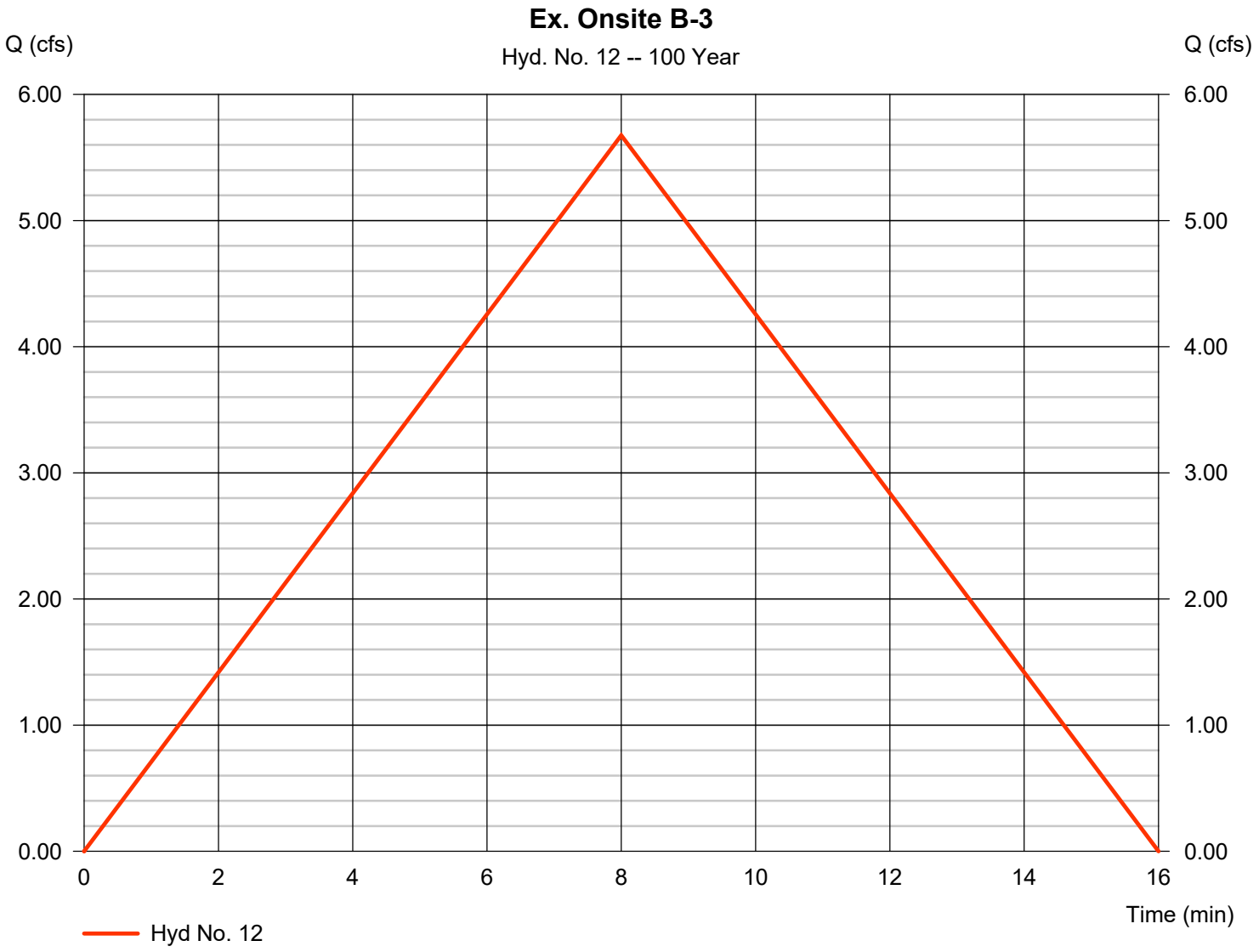


Hydrograph Report

Hyd. No. 12

Ex. Onsite B-3

Hydrograph type	=	Rational	Peak discharge	=	5.675 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	2,724 cuft
Drainage area	=	1.130 ac	Runoff coeff.	=	0.51
Intensity	=	9.848 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

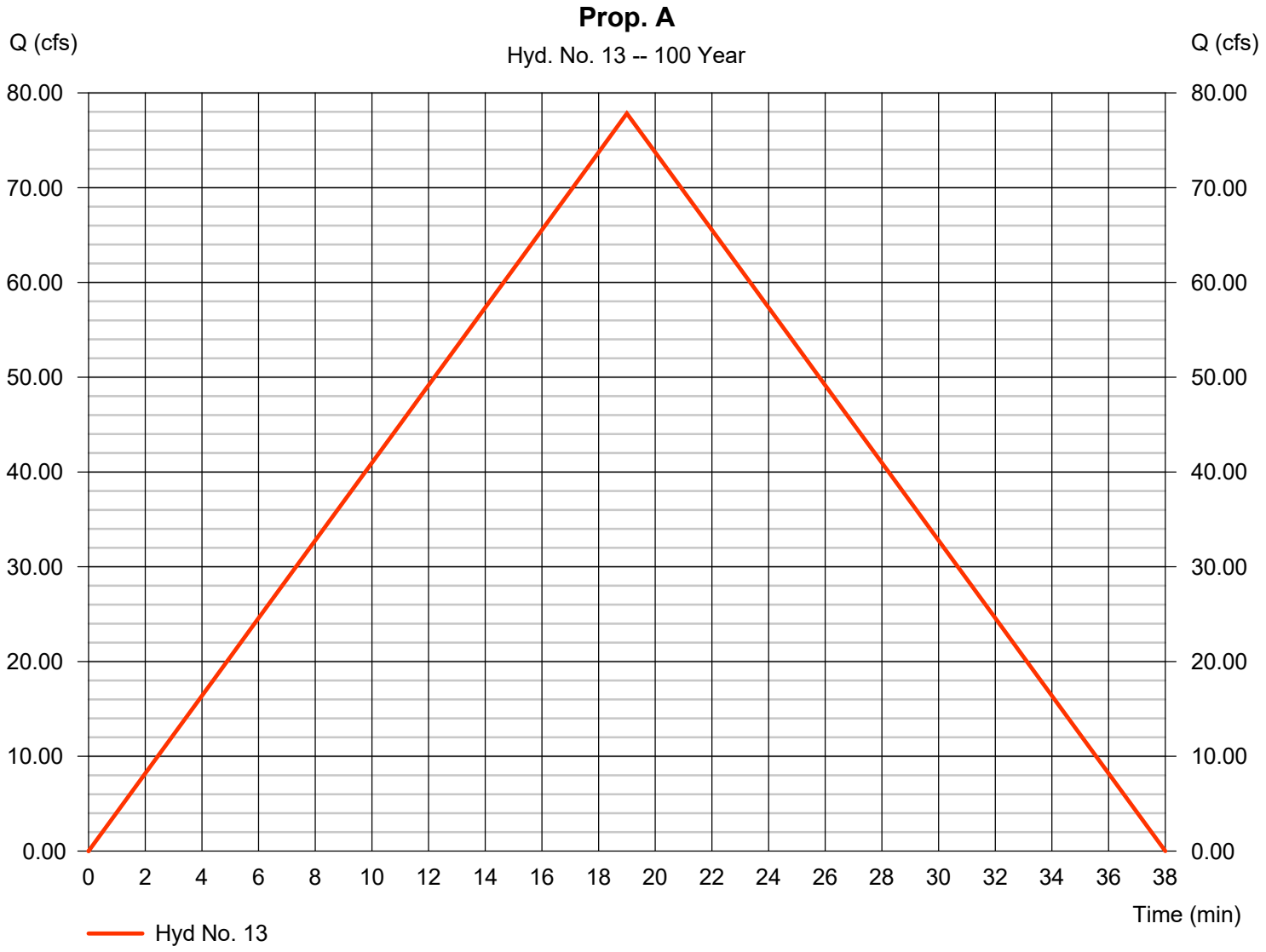


Hydrograph Report

Hyd. No. 13

Prop. A

Hydrograph type	=	Rational	Peak discharge	=	77.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	88,728 cuft
Drainage area	=	18.720 ac	Runoff coeff.	=	0.58
Intensity	=	7.168 in/hr	Tc by User	=	19.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

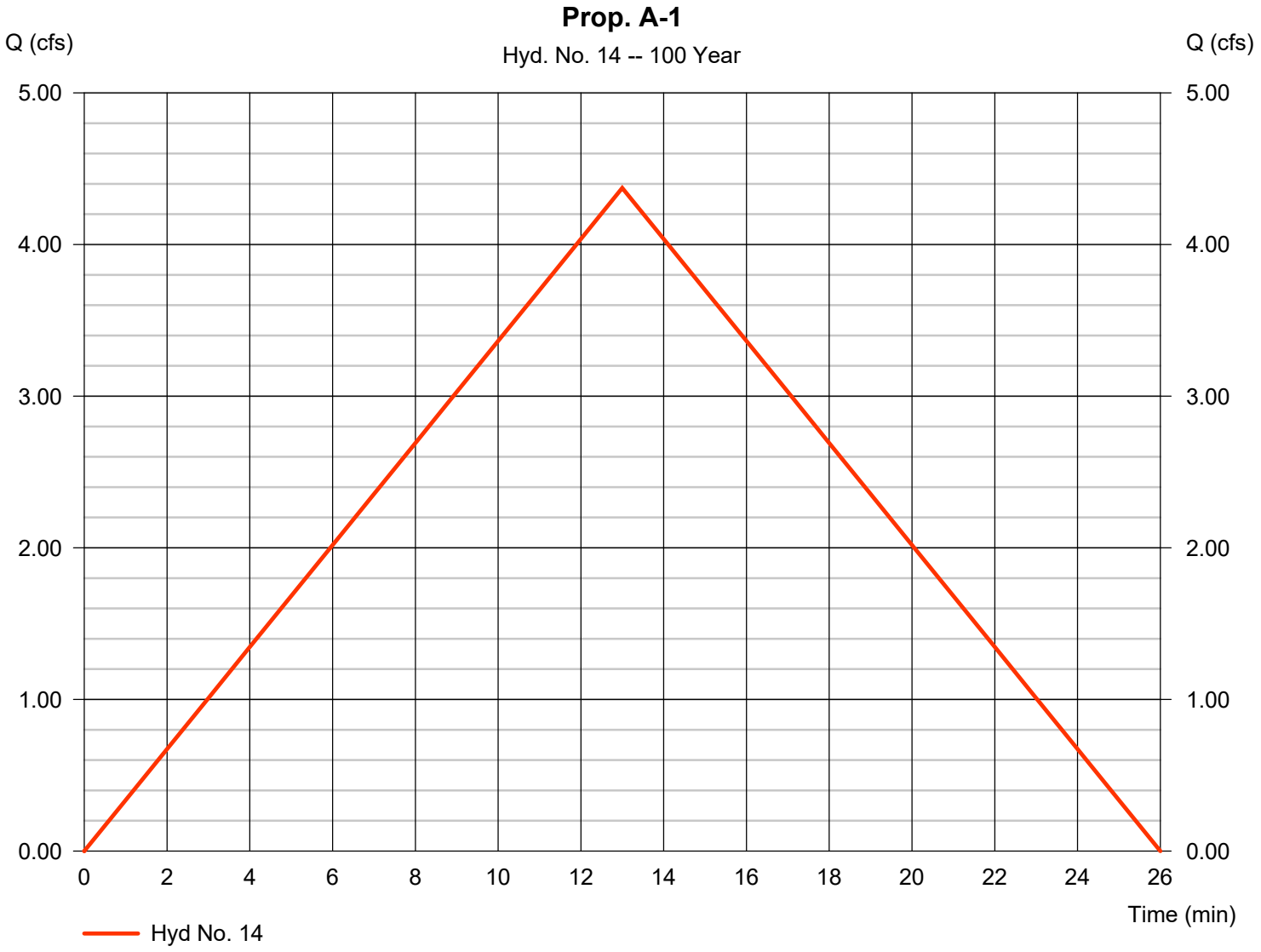


Hydrograph Report

Hyd. No. 14

Prop. A-1

Hydrograph type	=	Rational	Peak discharge	=	4.373 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	3,411 cuft
Drainage area	=	1.020 ac	Runoff coeff.	=	0.51
Intensity	=	8.406 in/hr	Tc by User	=	13.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

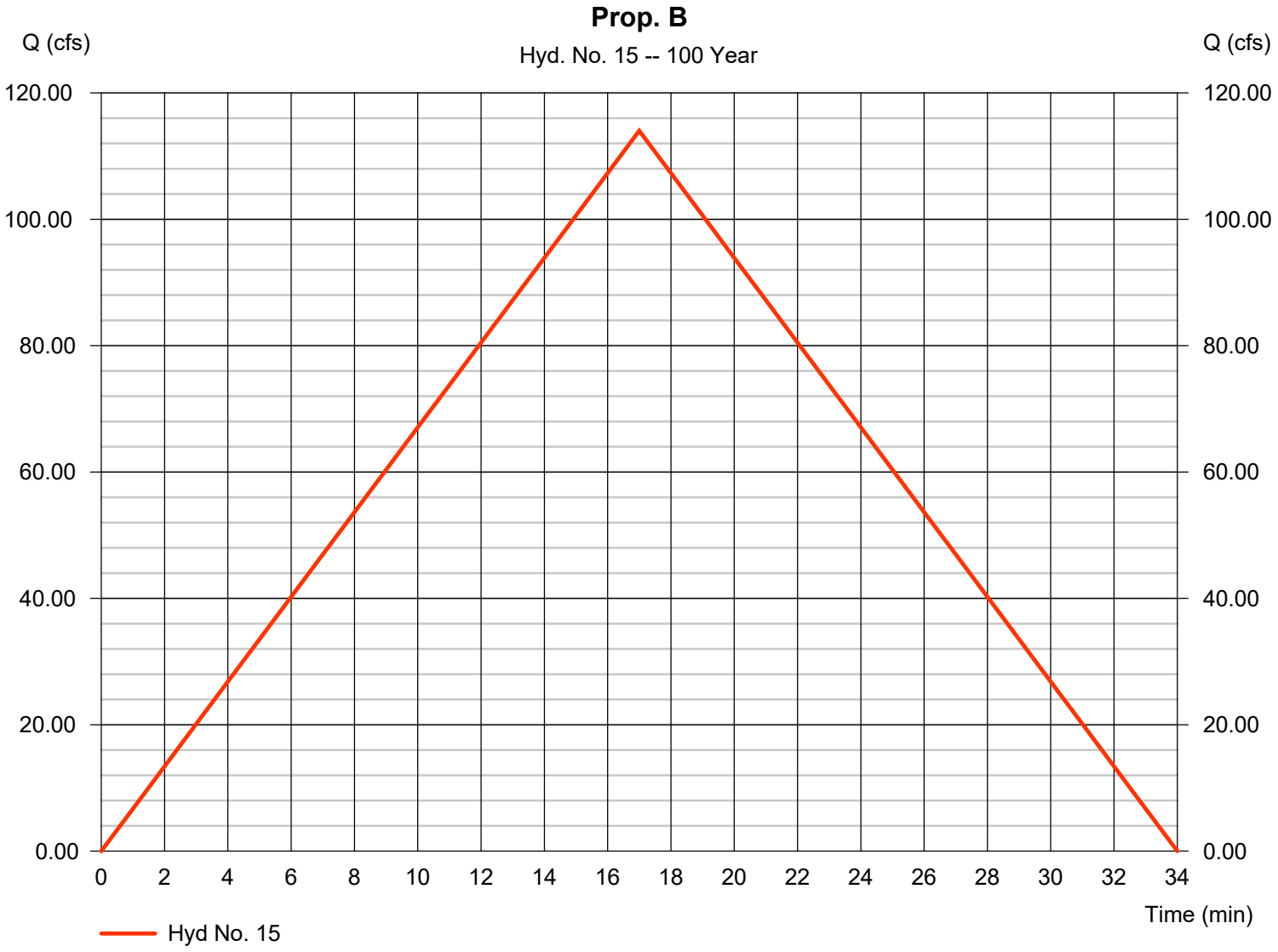


Hydrograph Report

Hyd. No. 15

Prop. B

Hydrograph type	=	Rational	Peak discharge	=	114.01 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	116,288 cuft
Drainage area	=	26.540 ac	Runoff coeff.	=	0.57
Intensity	=	7.536 in/hr	Tc by User	=	17.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

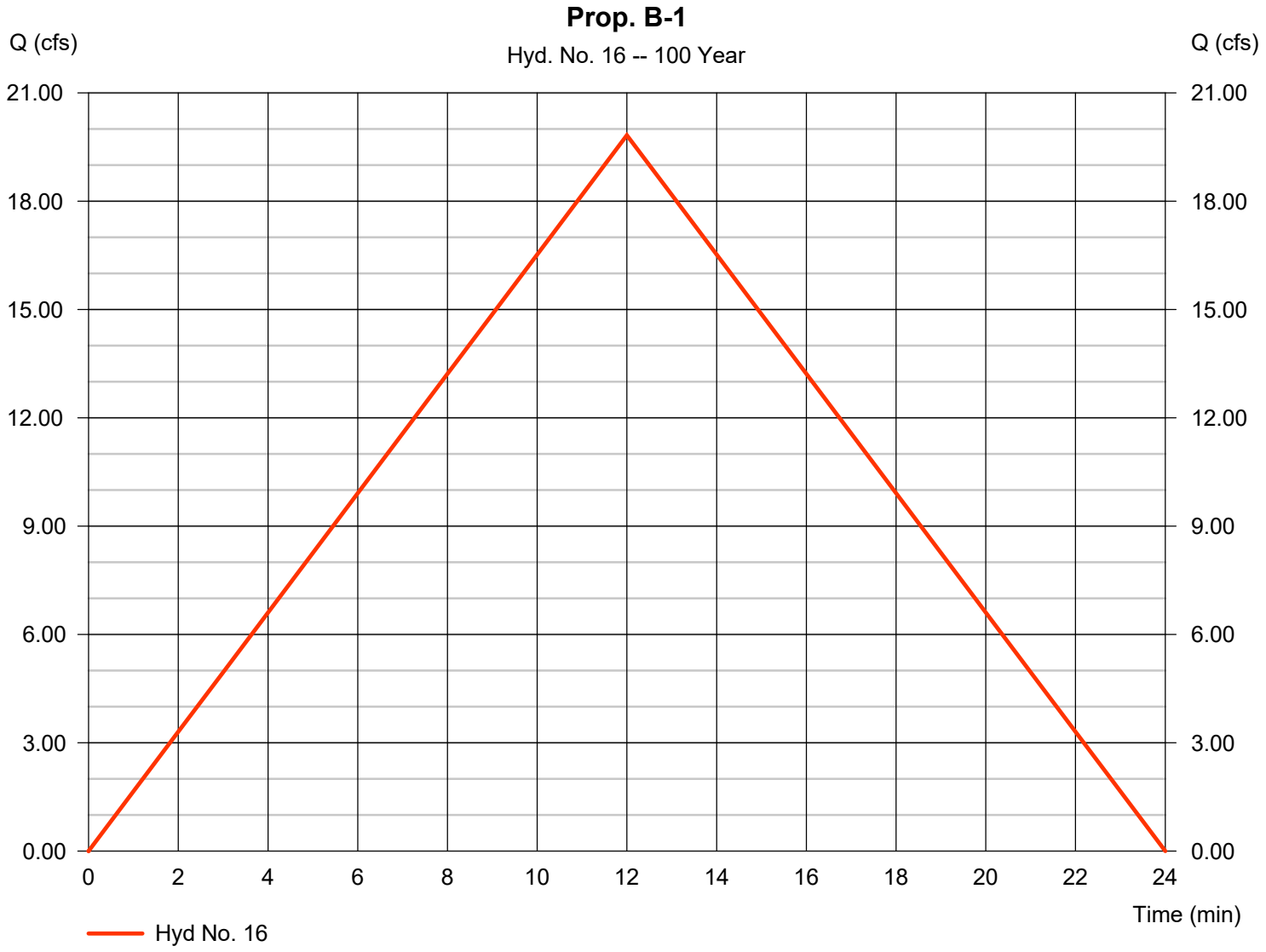


Hydrograph Report

Hyd. No. 16

Prop. B-1

Hydrograph type	=	Rational	Peak discharge	=	19.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	14,275 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.51
Intensity	=	8.658 in/hr	Tc by User	=	12.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

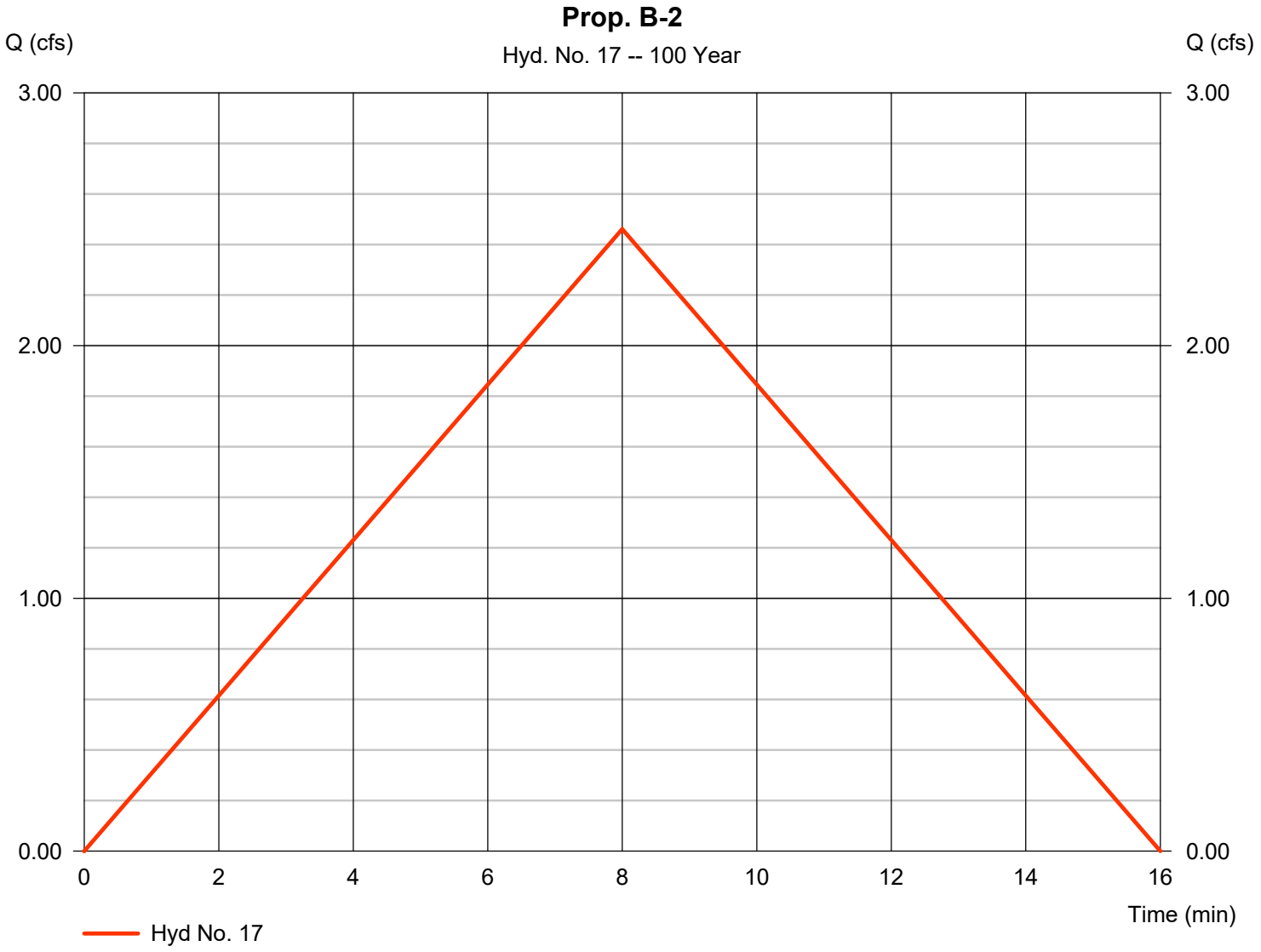


Hydrograph Report

Hyd. No. 17

Prop. B-2

Hydrograph type	=	Rational	Peak discharge	=	2.461 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,181 cuft
Drainage area	=	0.490 ac	Runoff coeff.	=	0.51
Intensity	=	9.848 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

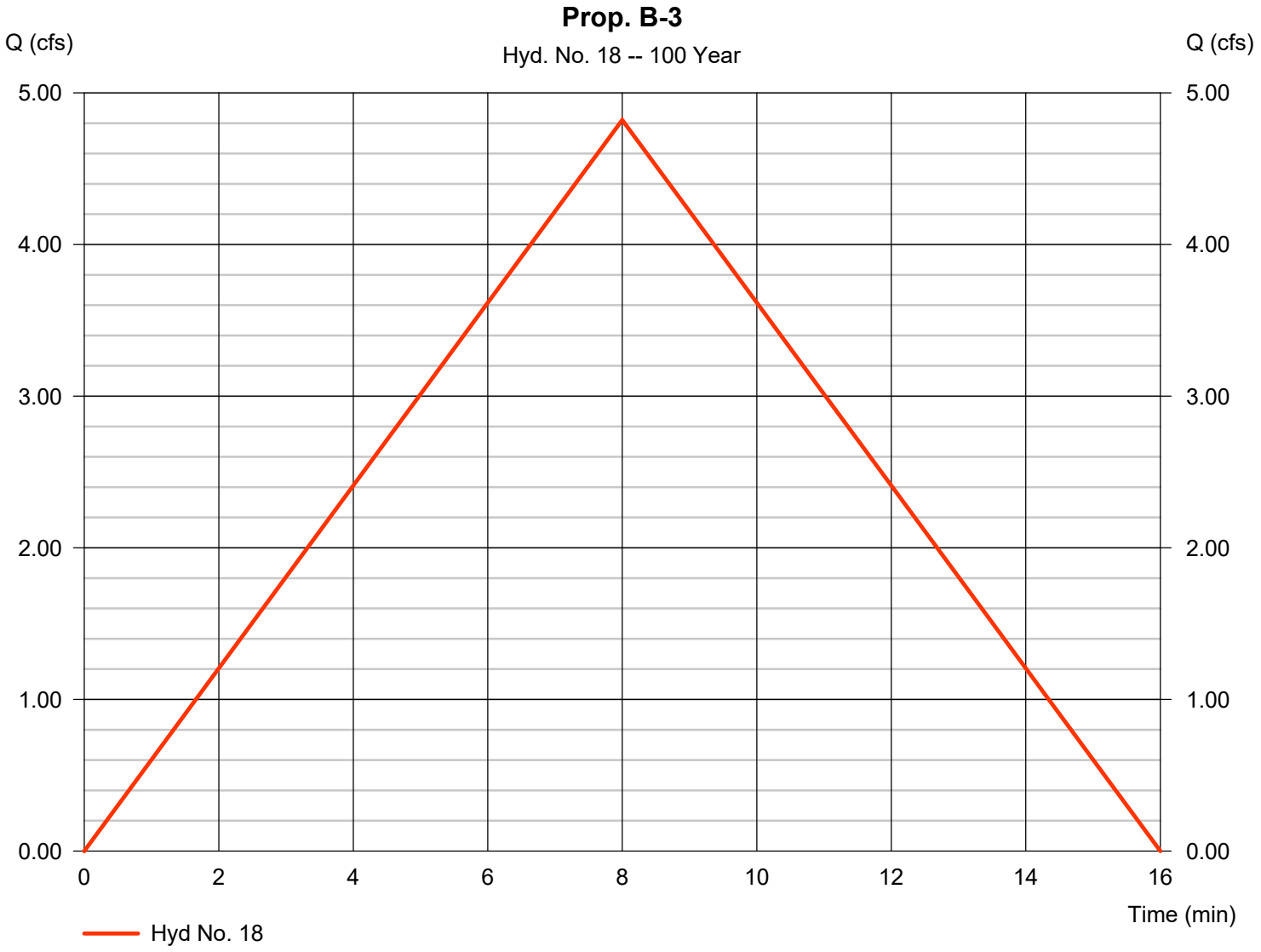


Hydrograph Report

Hyd. No. 18

Prop. B-3

Hydrograph type	=	Rational	Peak discharge	=	4.822 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	2,314 cuft
Drainage area	=	0.960 ac	Runoff coeff.	=	0.51
Intensity	=	9.848 in/hr	Tc by User	=	8.00 min
IDF Curve	=	KCMO.IDF	Asc/Rec limb fact	=	1/1

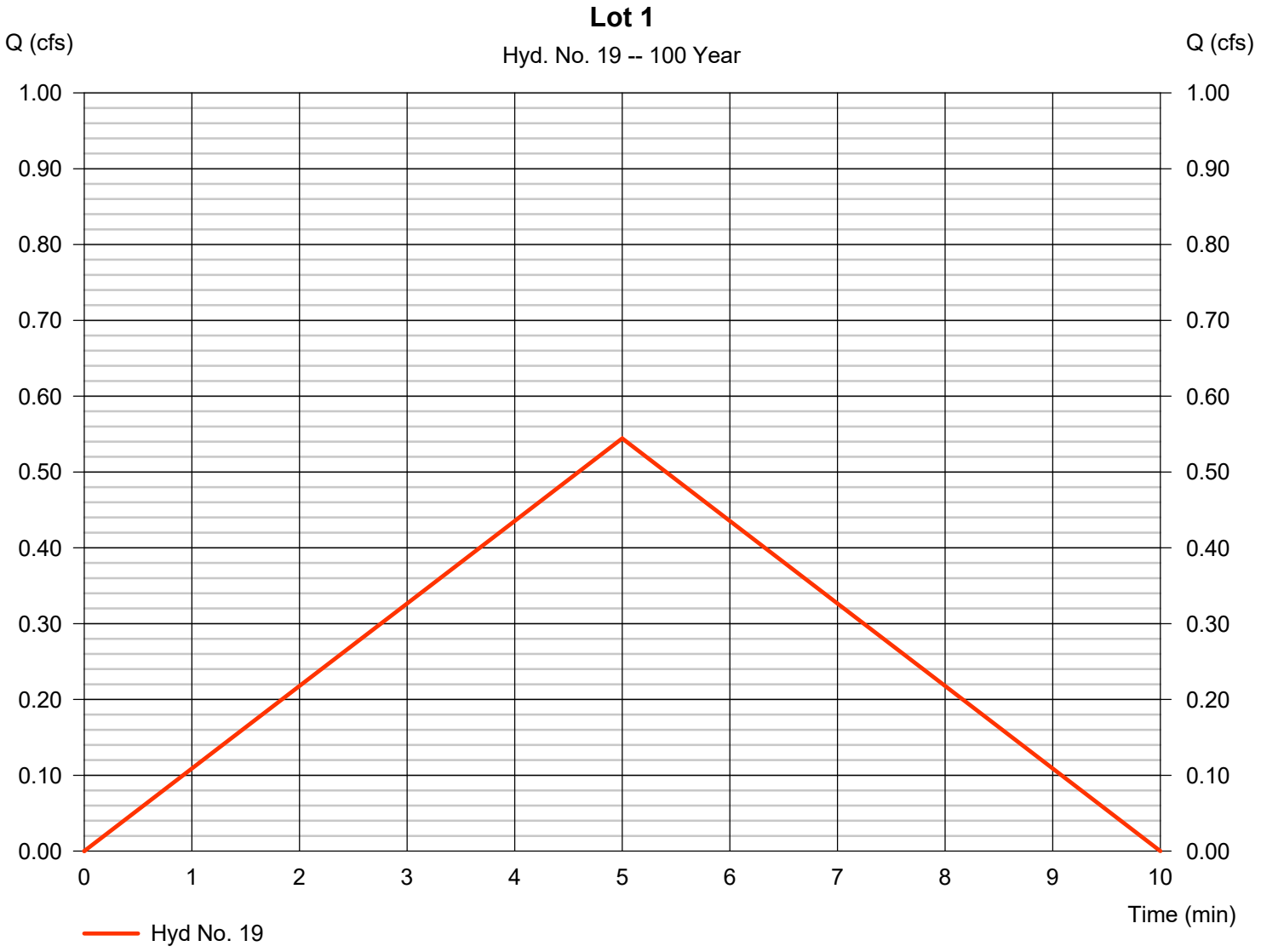


Hydrograph Report

Hyd. No. 19

Lot 1

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

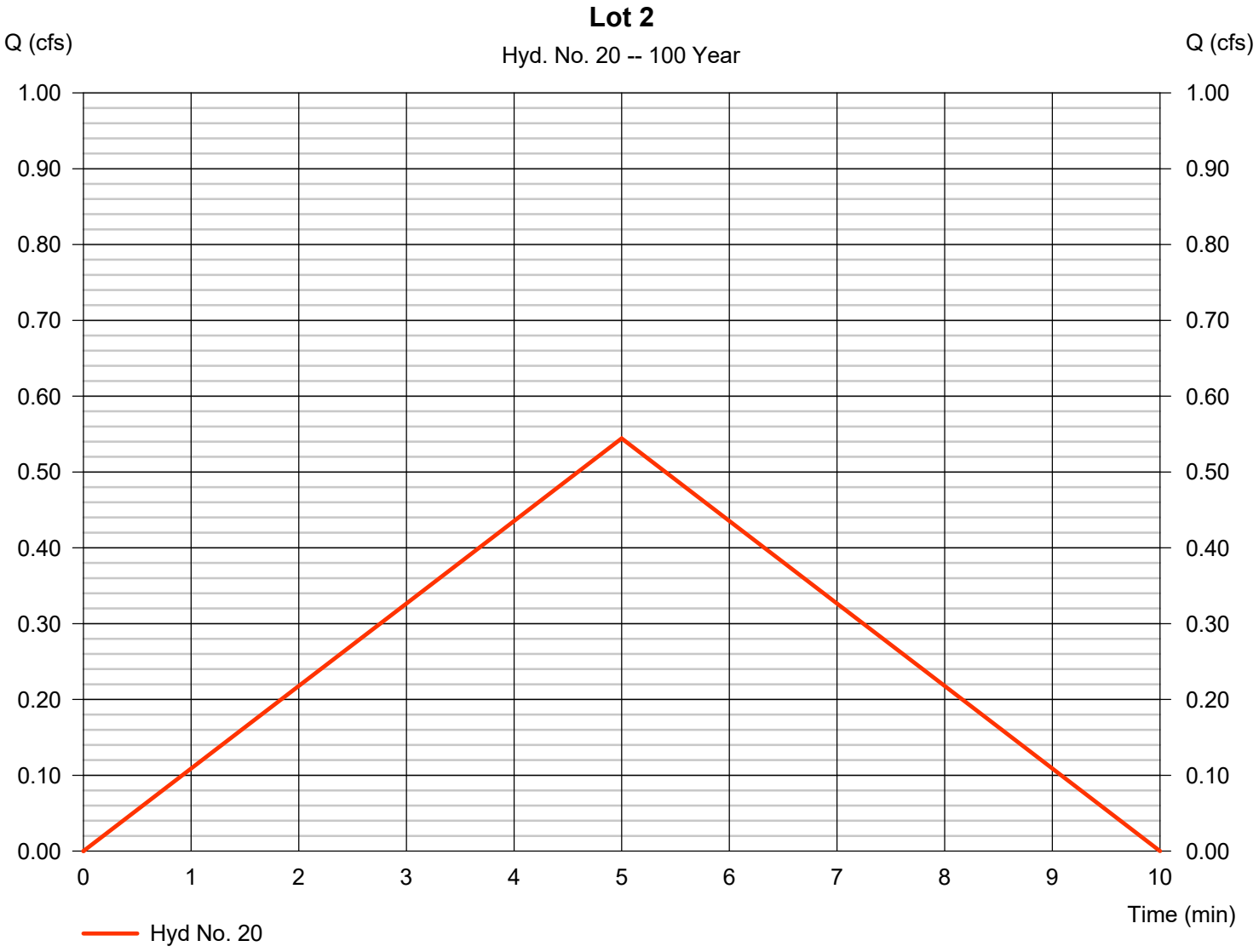


Hydrograph Report

Hyd. No. 20

Lot 2

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

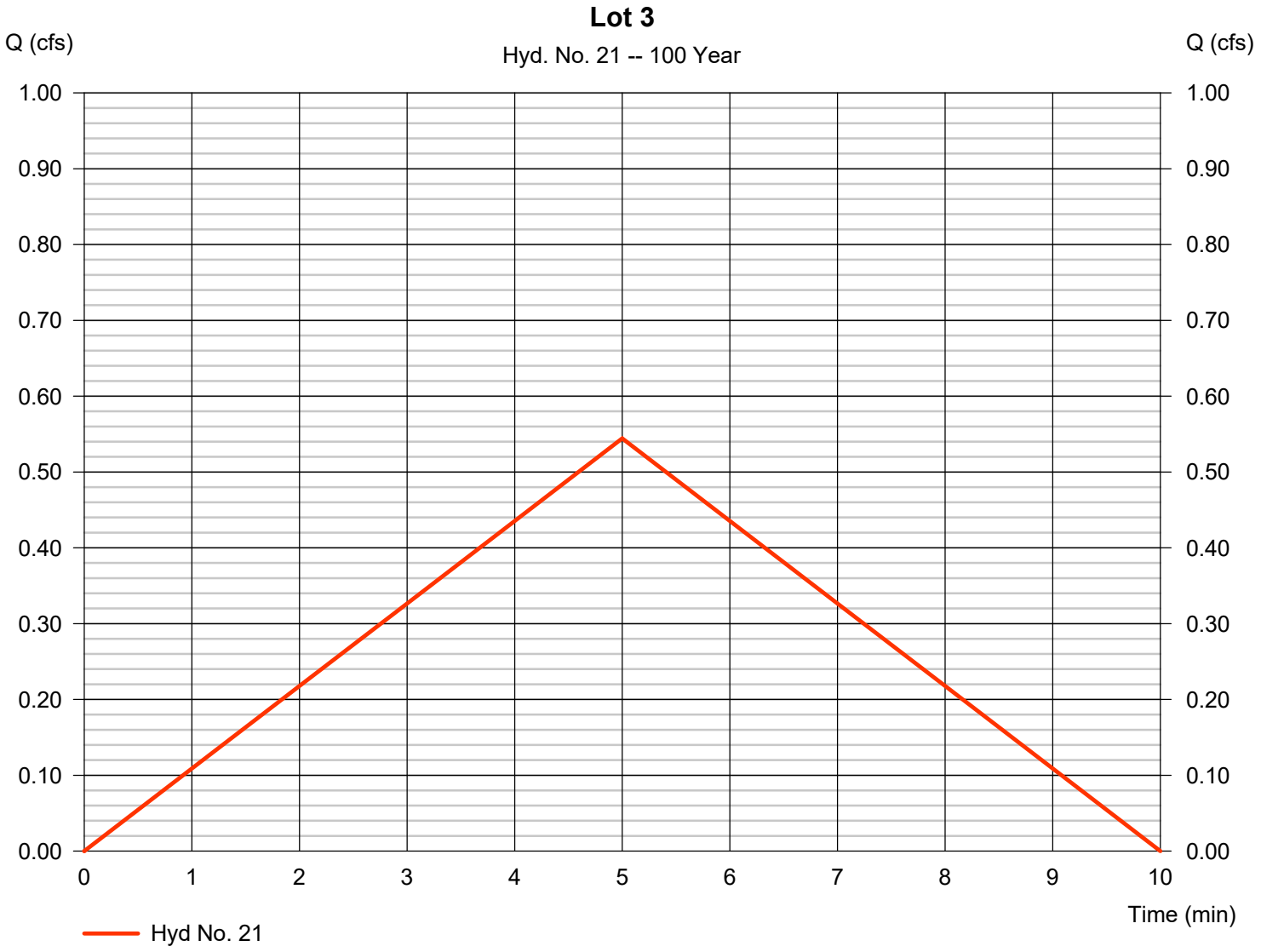


Hydrograph Report

Hyd. No. 21

Lot 3

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

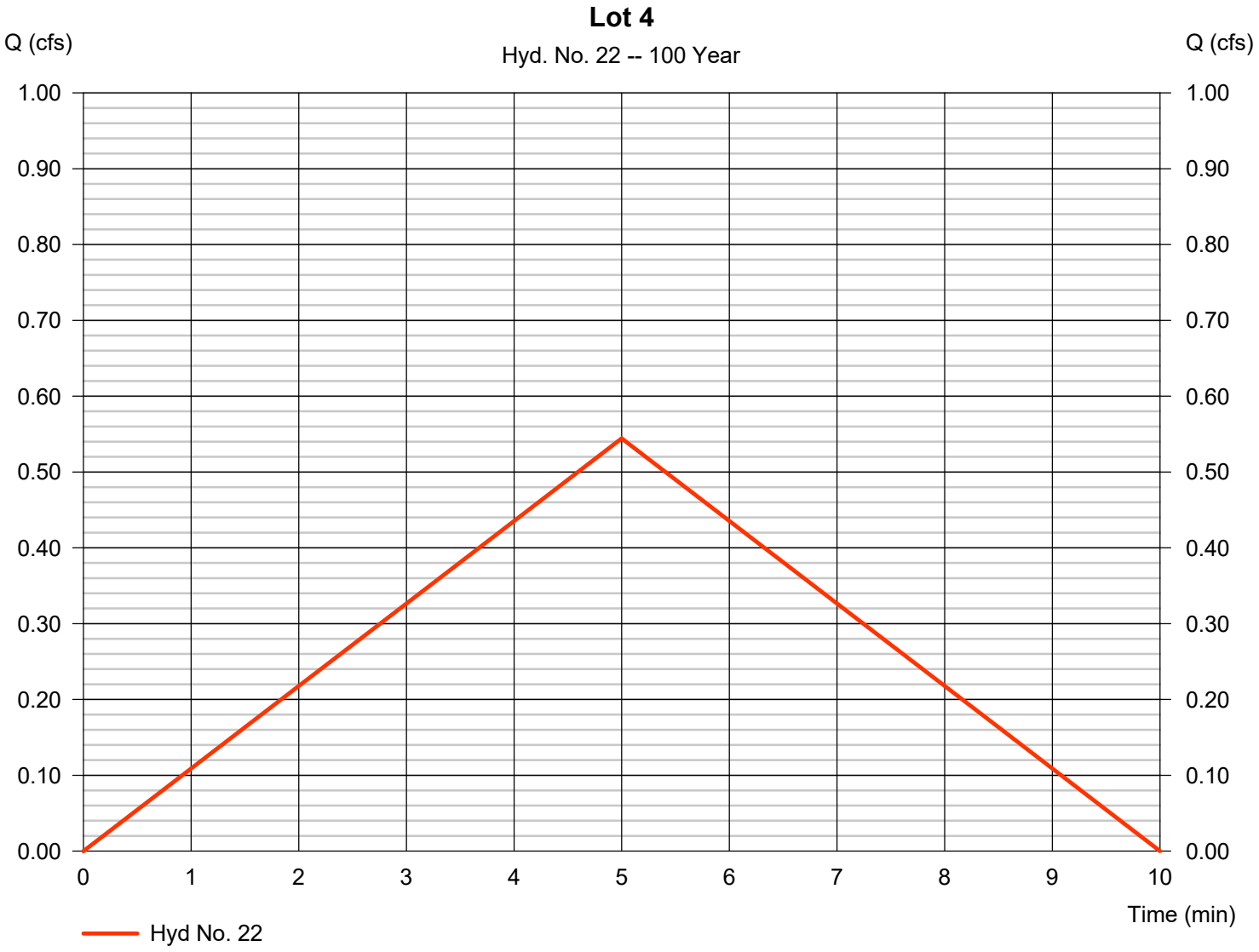


Hydrograph Report

Hyd. No. 22

Lot 4

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

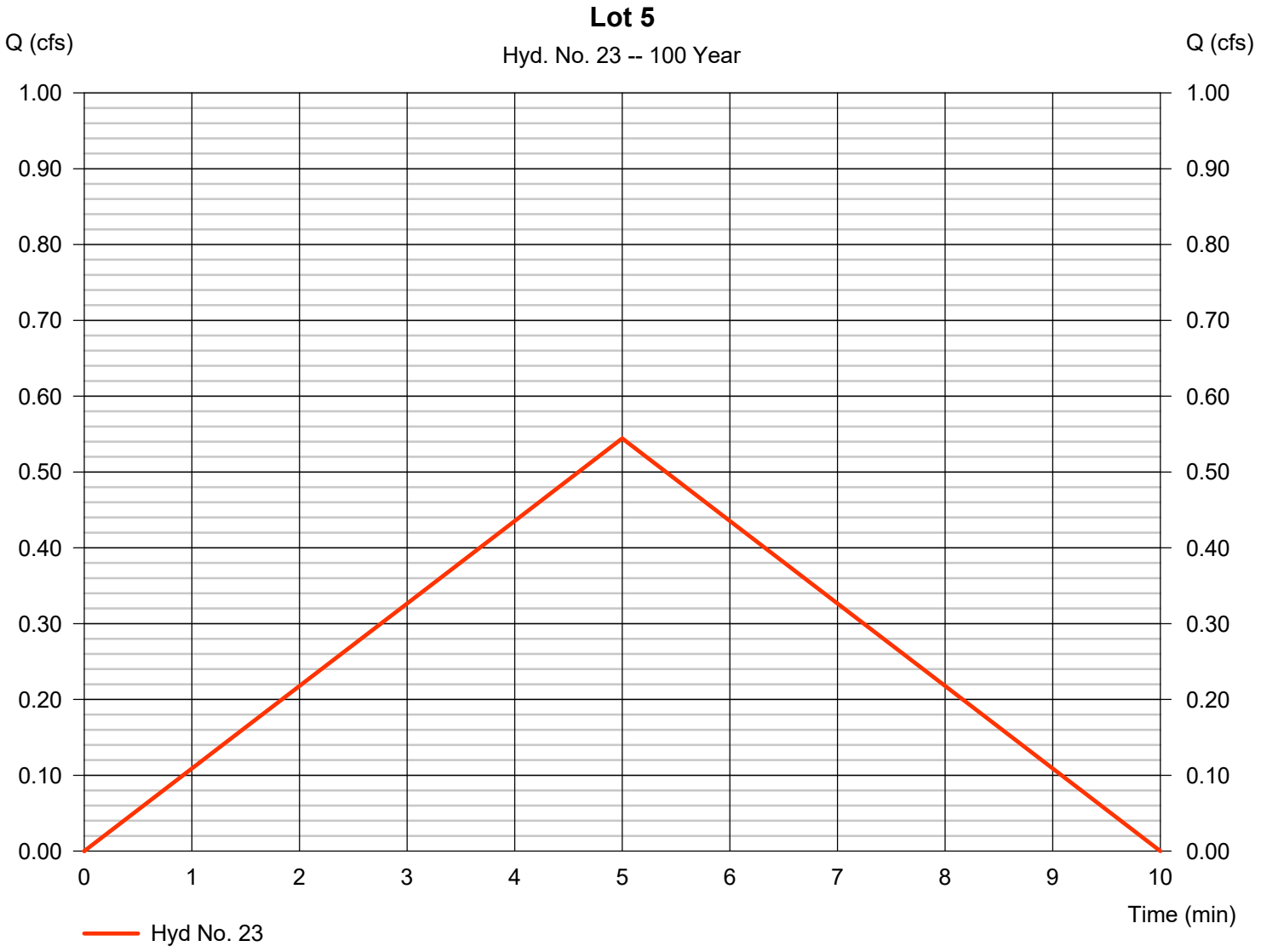


Hydrograph Report

Hyd. No. 23

Lot 5

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

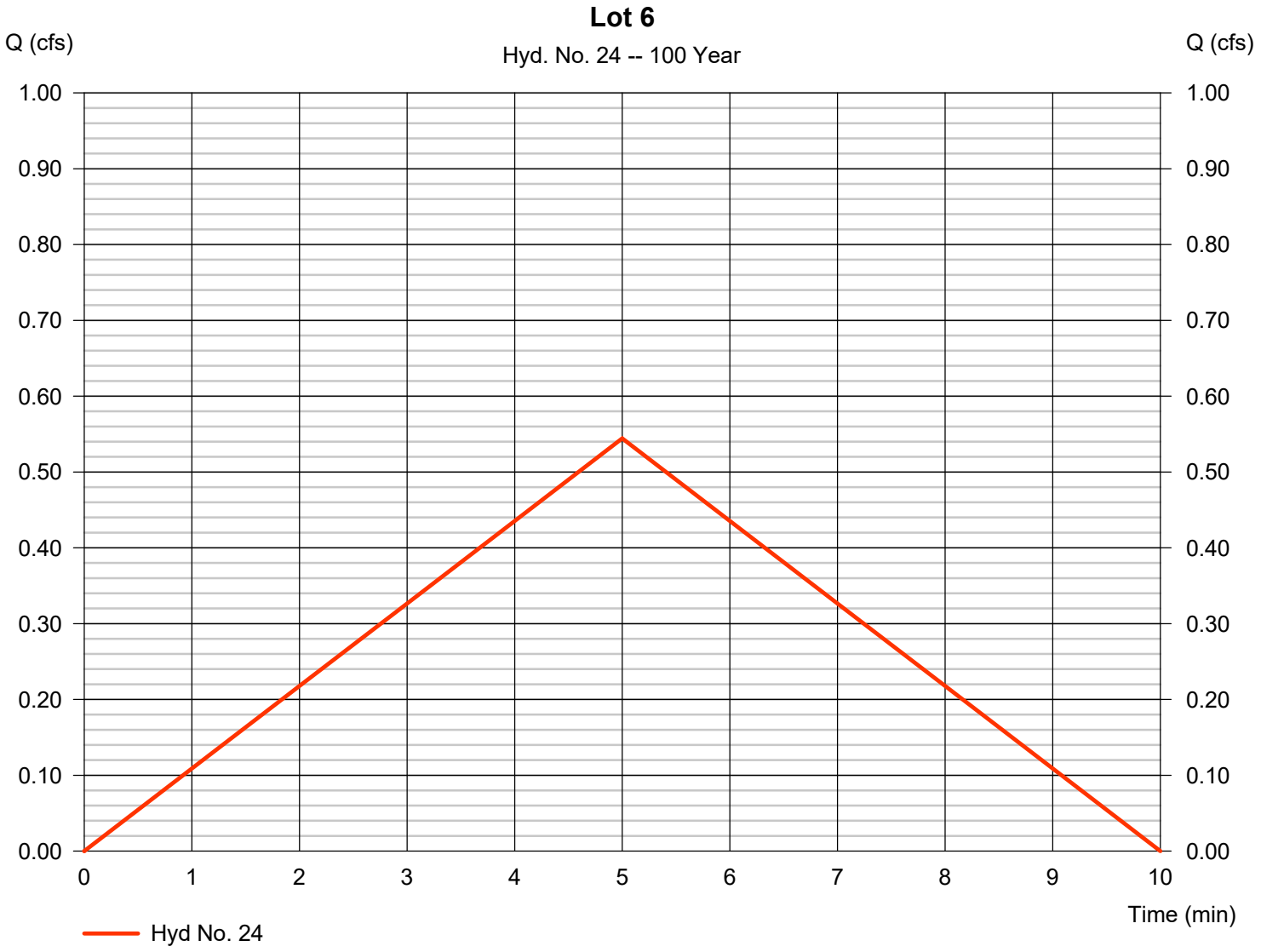


Hydrograph Report

Hyd. No. 24

Lot 6

Hydrograph type	= Rational	Peak discharge	= 0.544 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 163 cuft
Drainage area	= 0.055 ac	Runoff coeff.	= 0.9
Intensity	= 10.996 in/hr	Tc by User	= 5.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



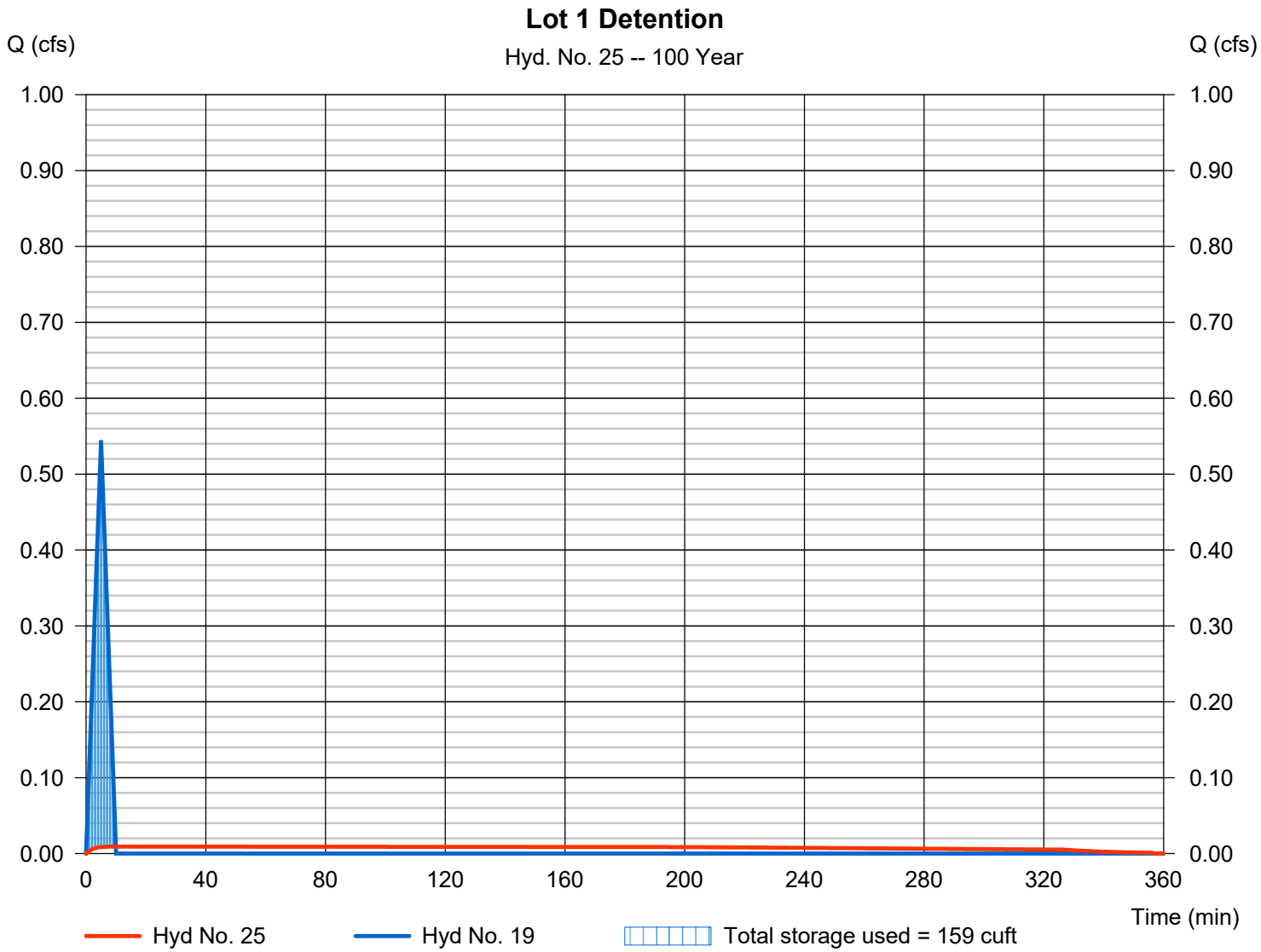
Hydrograph Report

Hyd. No. 25

Lot 1 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	19 - Lot 1	Max. Elevation	=	1038.26 ft
Reservoir name	=	Lot 1 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.



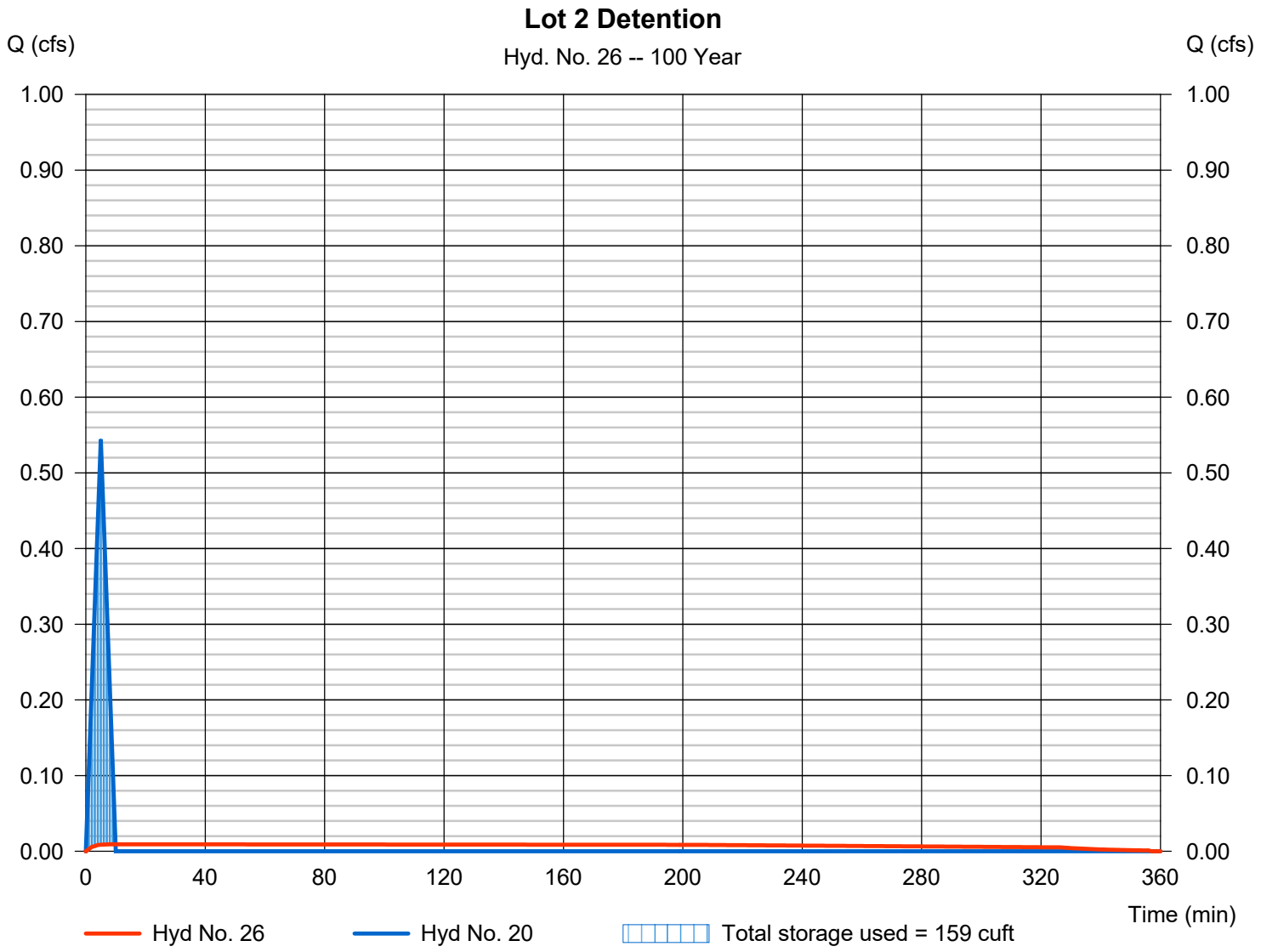
Hydrograph Report

Hyd. No. 26

Lot 2 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	20 - Lot 2	Max. Elevation	=	1040.26 ft
Reservoir name	=	Lot 2 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.



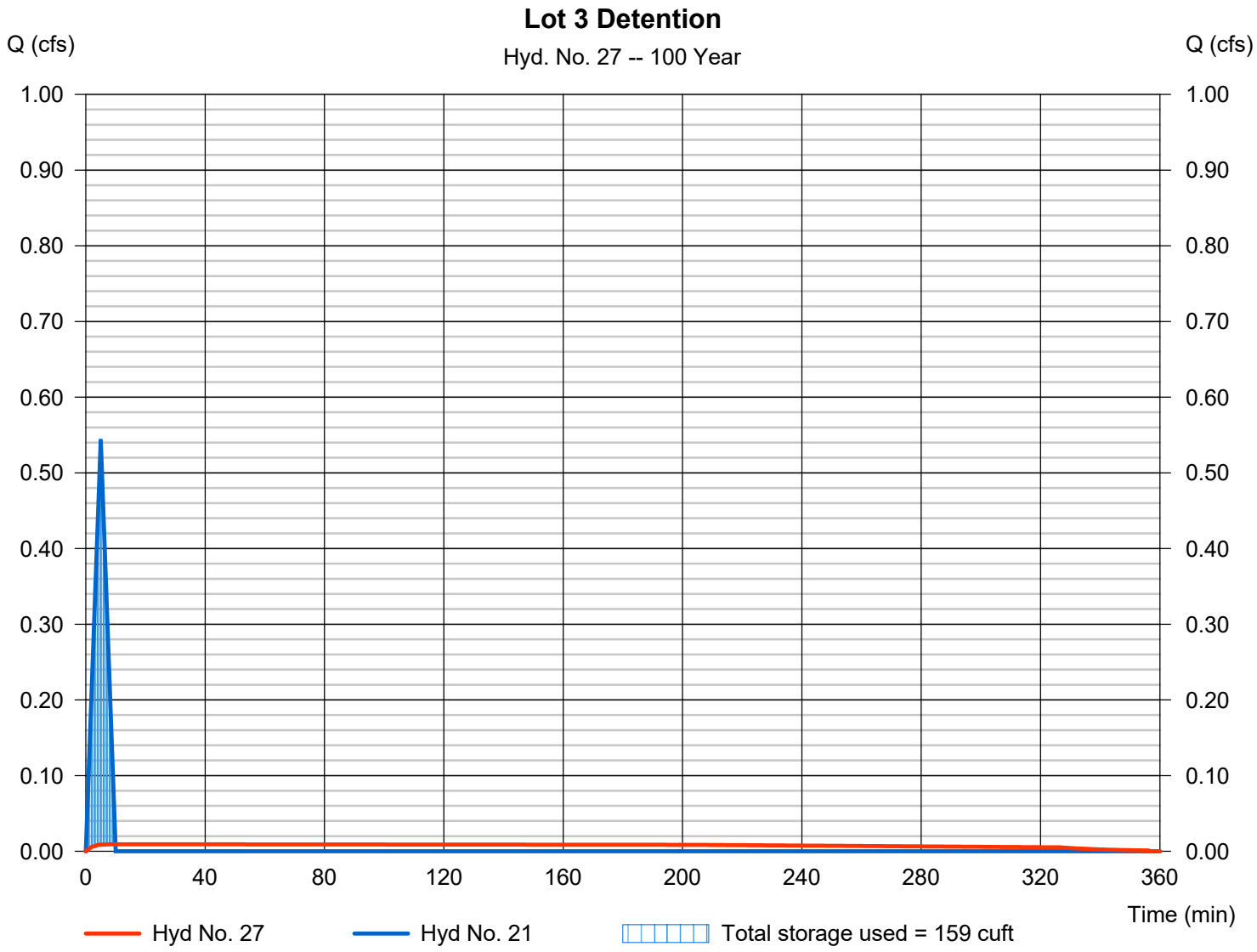
Hydrograph Report

Hyd. No. 27

Lot 3 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	21 - Lot 3	Max. Elevation	=	1037.26 ft
Reservoir name	=	Lot 3 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.



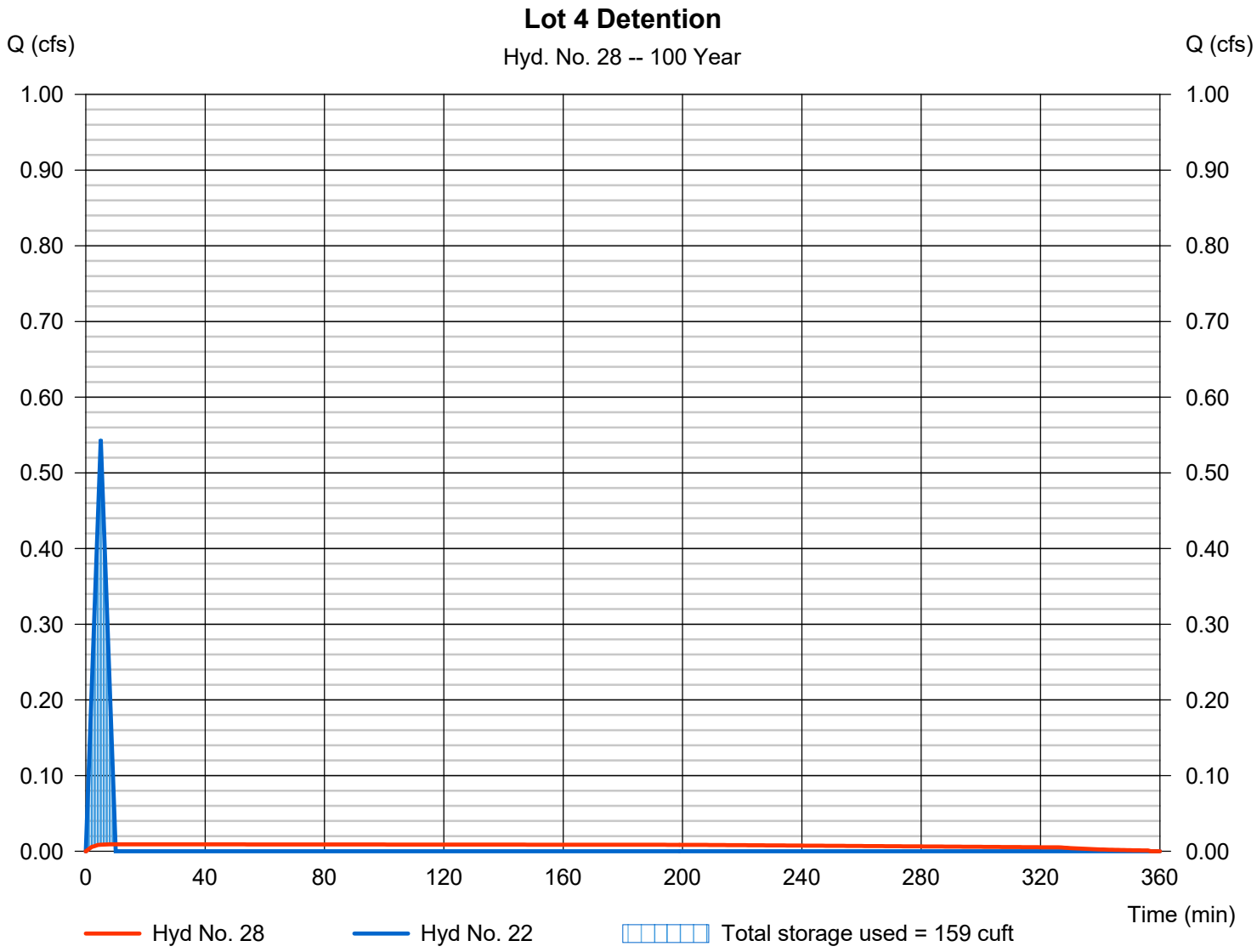
Hydrograph Report

Hyd. No. 28

Lot 4 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	22 - Lot 4	Max. Elevation	=	1039.26 ft
Reservoir name	=	Lot 4 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.



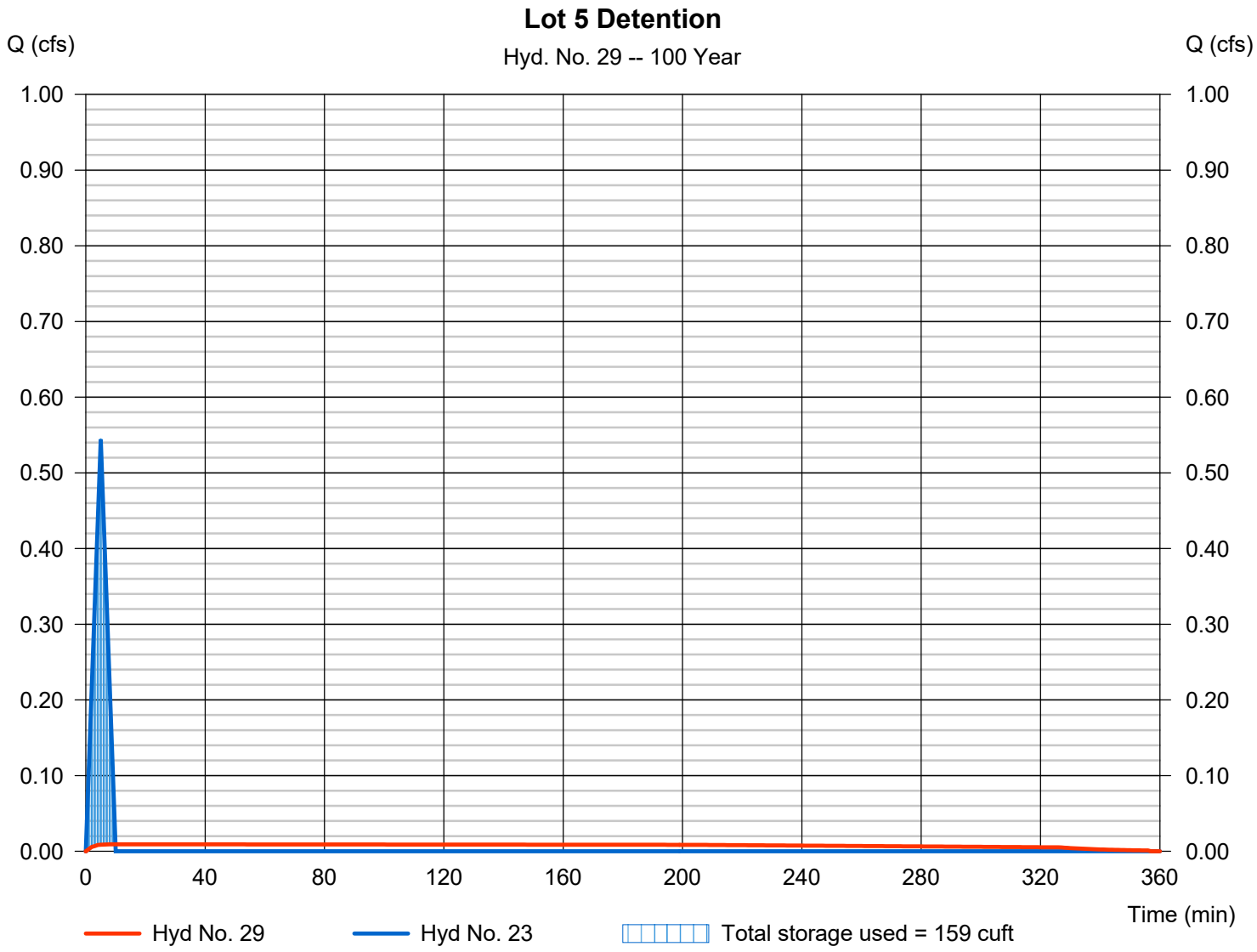
Hydrograph Report

Hyd. No. 29

Lot 5 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	23 - Lot 5	Max. Elevation	=	1038.26 ft
Reservoir name	=	Lot 5 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.



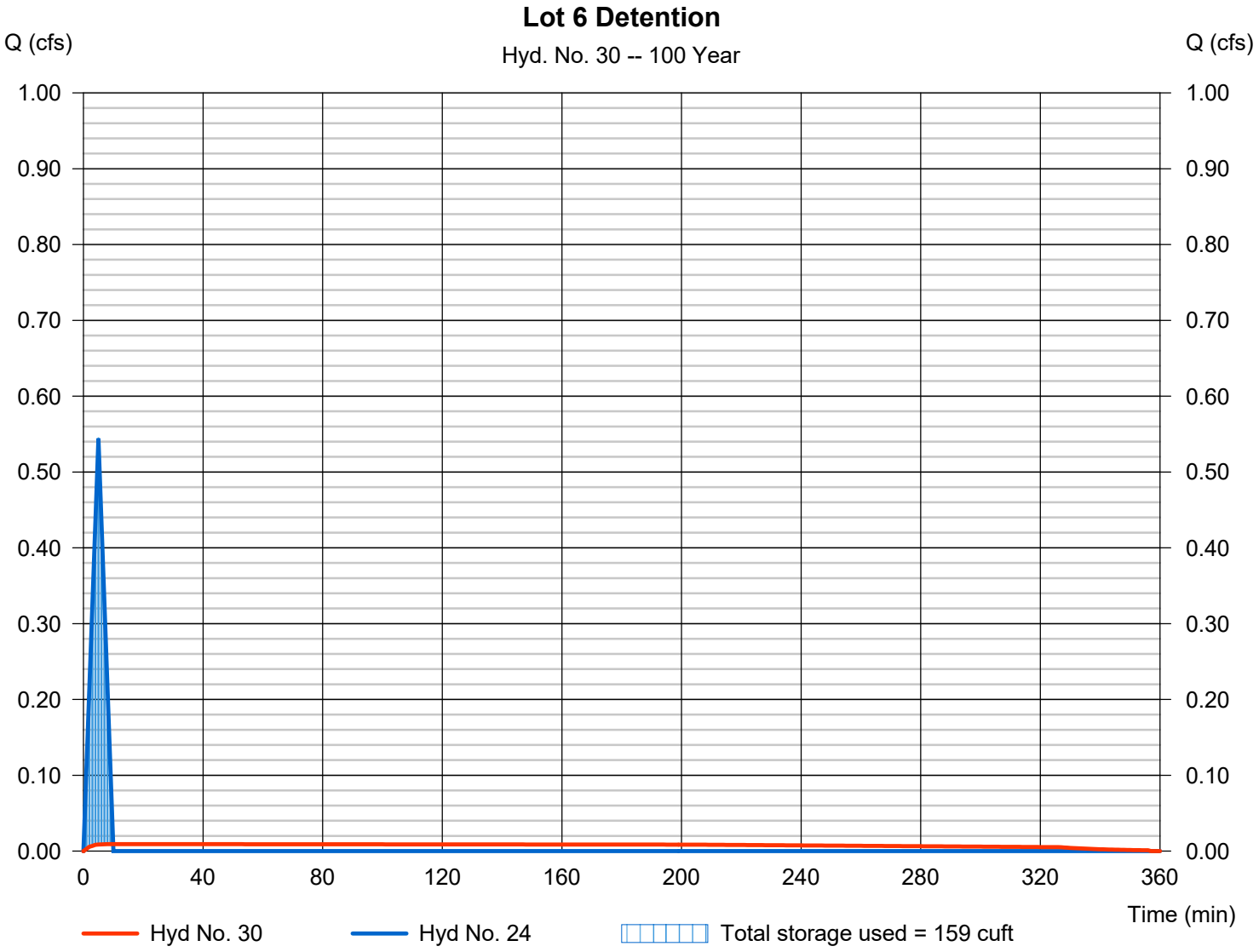
Hydrograph Report

Hyd. No. 30

Lot 6 Detention

Hydrograph type	=	Reservoir	Peak discharge	=	0.009 cfs
Storm frequency	=	100 yrs	Time to peak	=	10 min
Time interval	=	1 min	Hyd. volume	=	162 cuft
Inflow hyd. No.	=	24 - Lot 6	Max. Elevation	=	1038.26 ft
Reservoir name	=	Lot 6 Detention Pit	Max. Storage	=	159 cuft

Storage Indication method used.

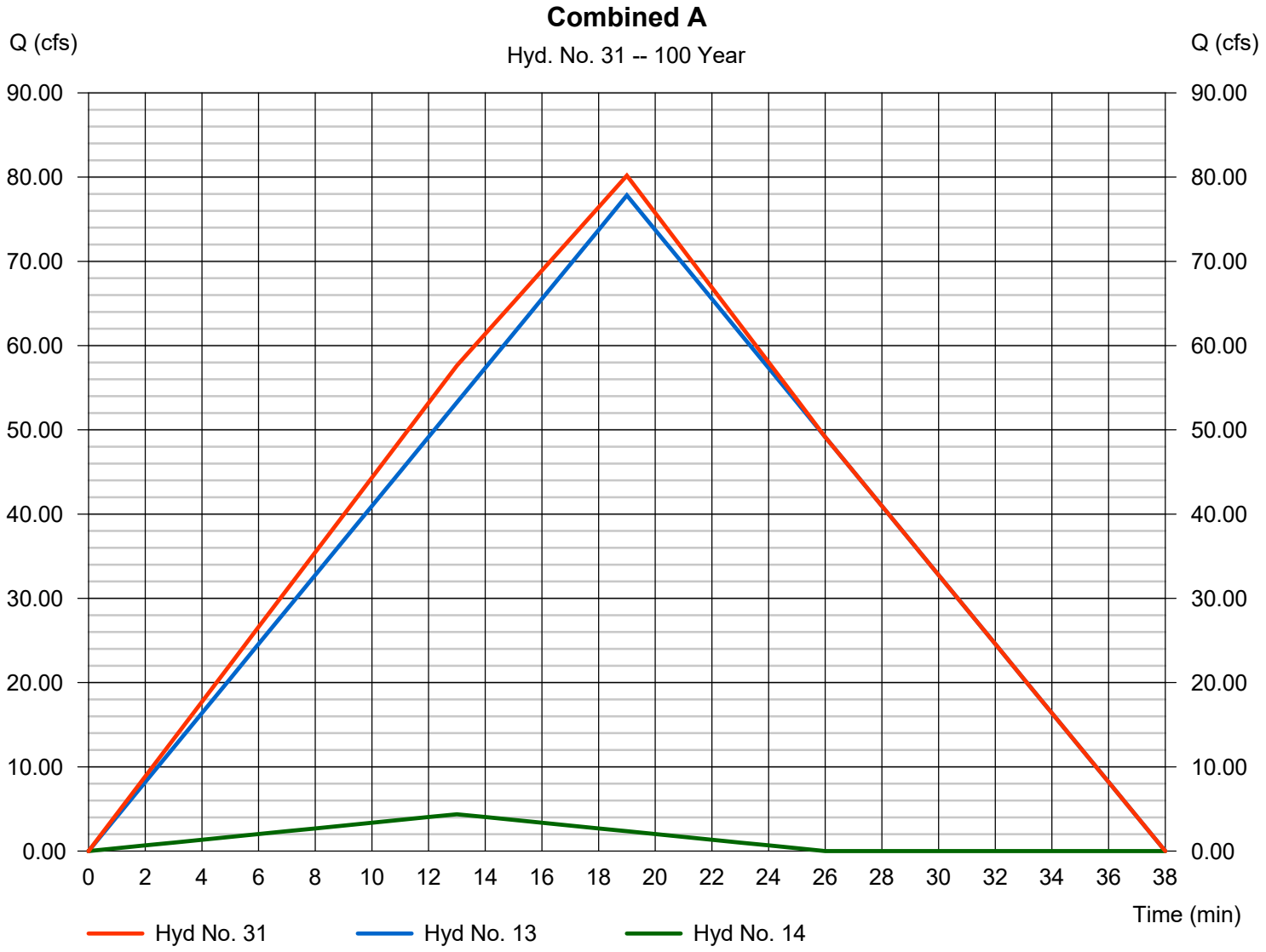


Hydrograph Report

Hyd. No. 31

Combined A

Hydrograph type	=	Combine	Peak discharge	=	80.19 cfs
Storm frequency	=	100 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	92,139 cuft
Inflow hyds.	=	13, 14	Contrib. drain. area	=	19.740 ac

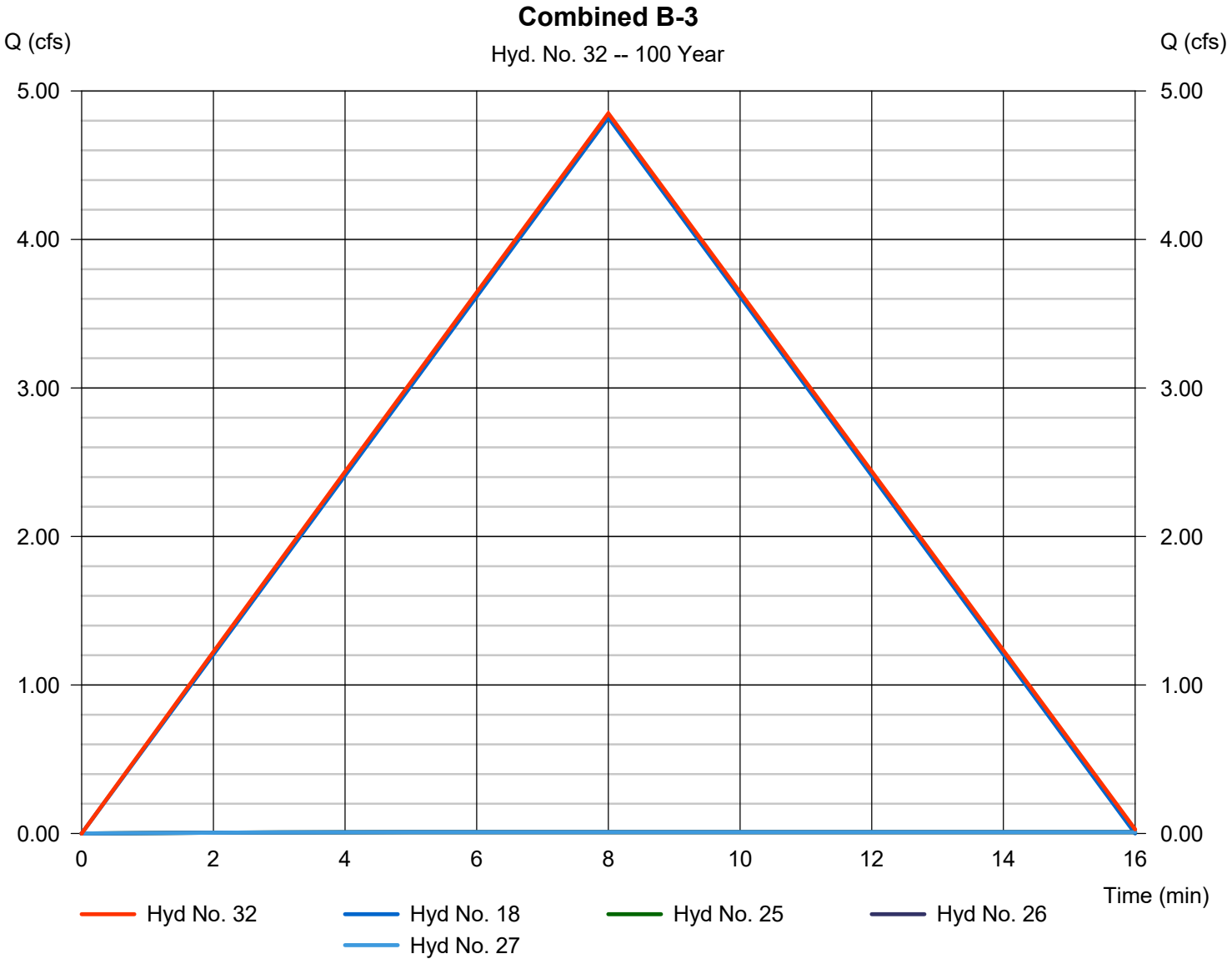


Hydrograph Report

Hyd. No. 32

Combined B-3

Hydrograph type	=	Combine	Peak discharge	=	4.849 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	2,801 cuft
Inflow hyds.	=	18, 25, 26, 27	Contrib. drain. area	=	0.960 ac

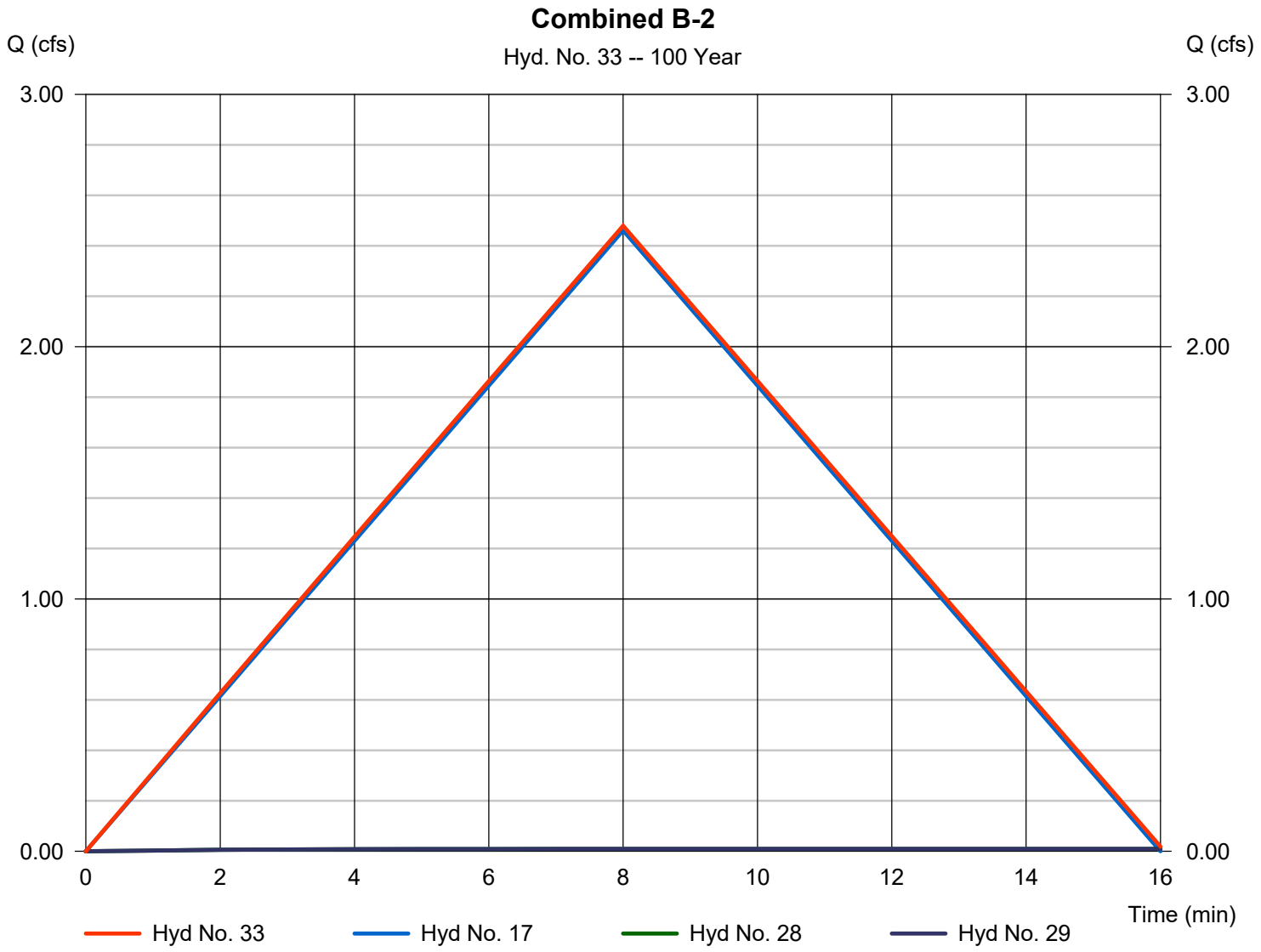


Hydrograph Report

Hyd. No. 33

Combined B-2

Hydrograph type	=	Combine	Peak discharge	=	2.479 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	1,506 cuft
Inflow hyds.	=	17, 28, 29	Contrib. drain. area	=	0.490 ac

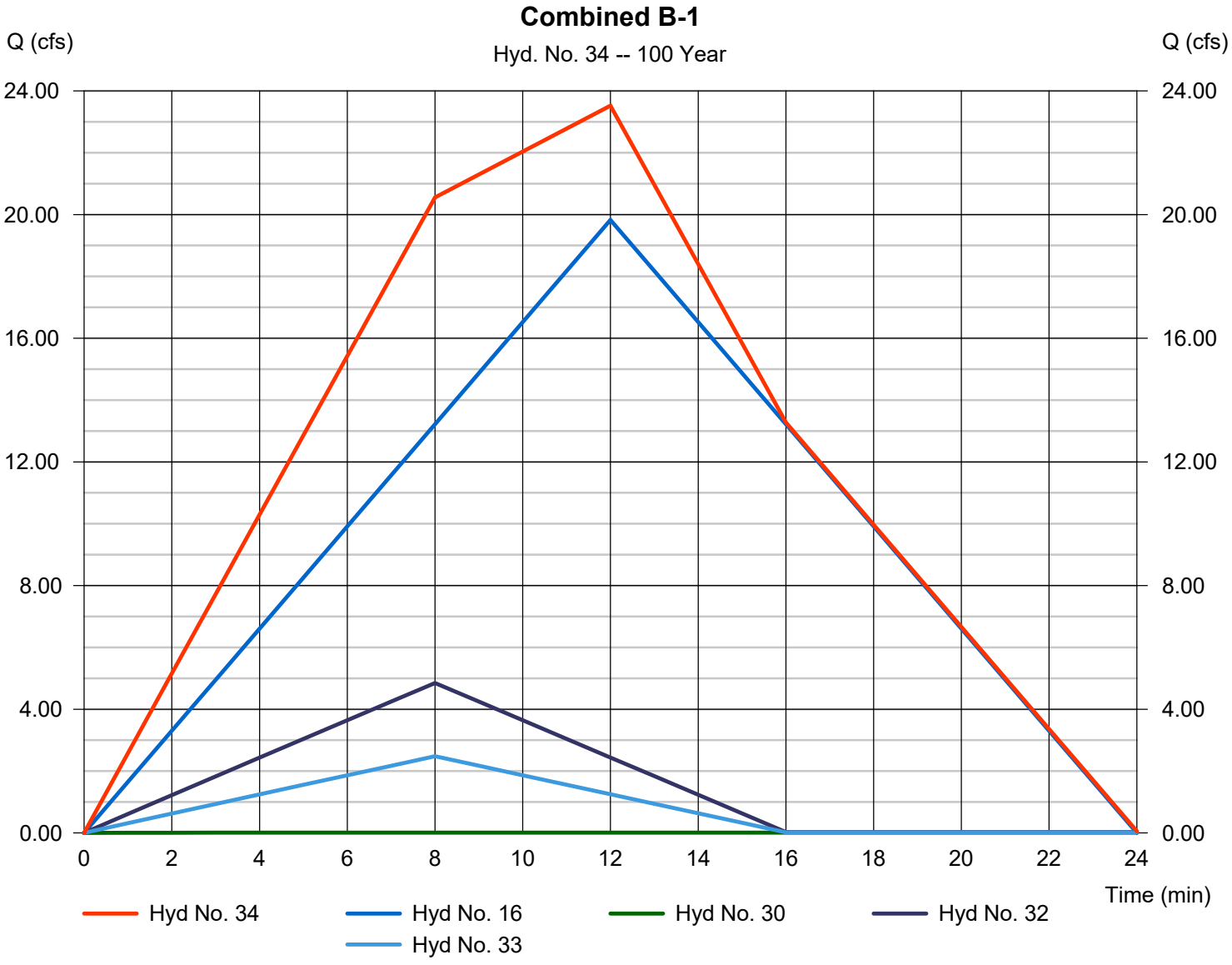


Hydrograph Report

Hyd. No. 34

Combined B-1

Hydrograph type	=	Combine	Peak discharge	=	23.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	12 min
Time interval	=	1 min	Hyd. volume	=	18,744 cuft
Inflow hyds.	=	16, 30, 32, 33	Contrib. drain. area	=	4.490 ac

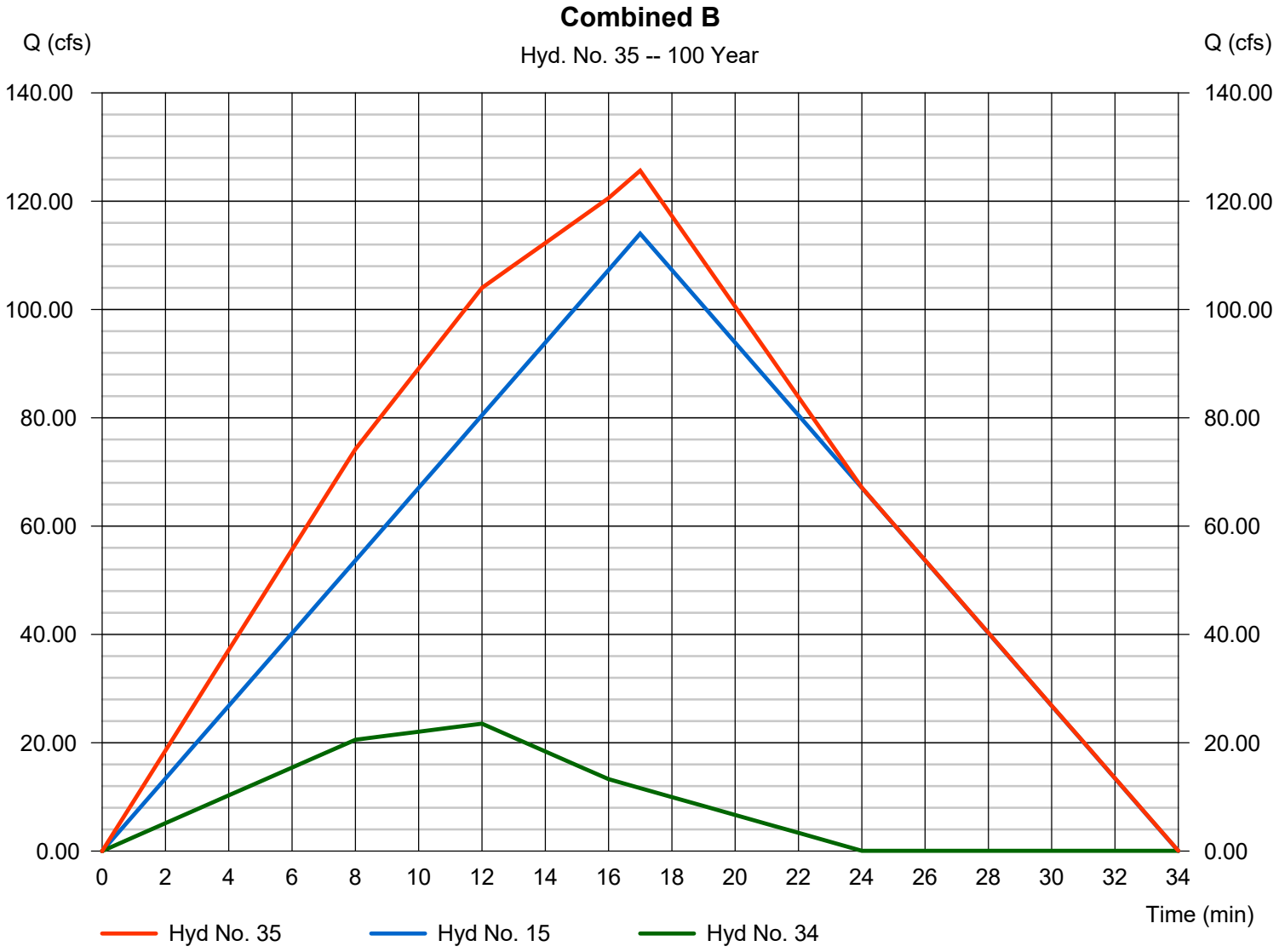


Hydrograph Report

Hyd. No. 35

Combined B

Hydrograph type	=	Combine	Peak discharge	=	125.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	135,032 cuft
Inflow hyds.	=	15, 34	Contrib. drain. area	=	26.540 ac



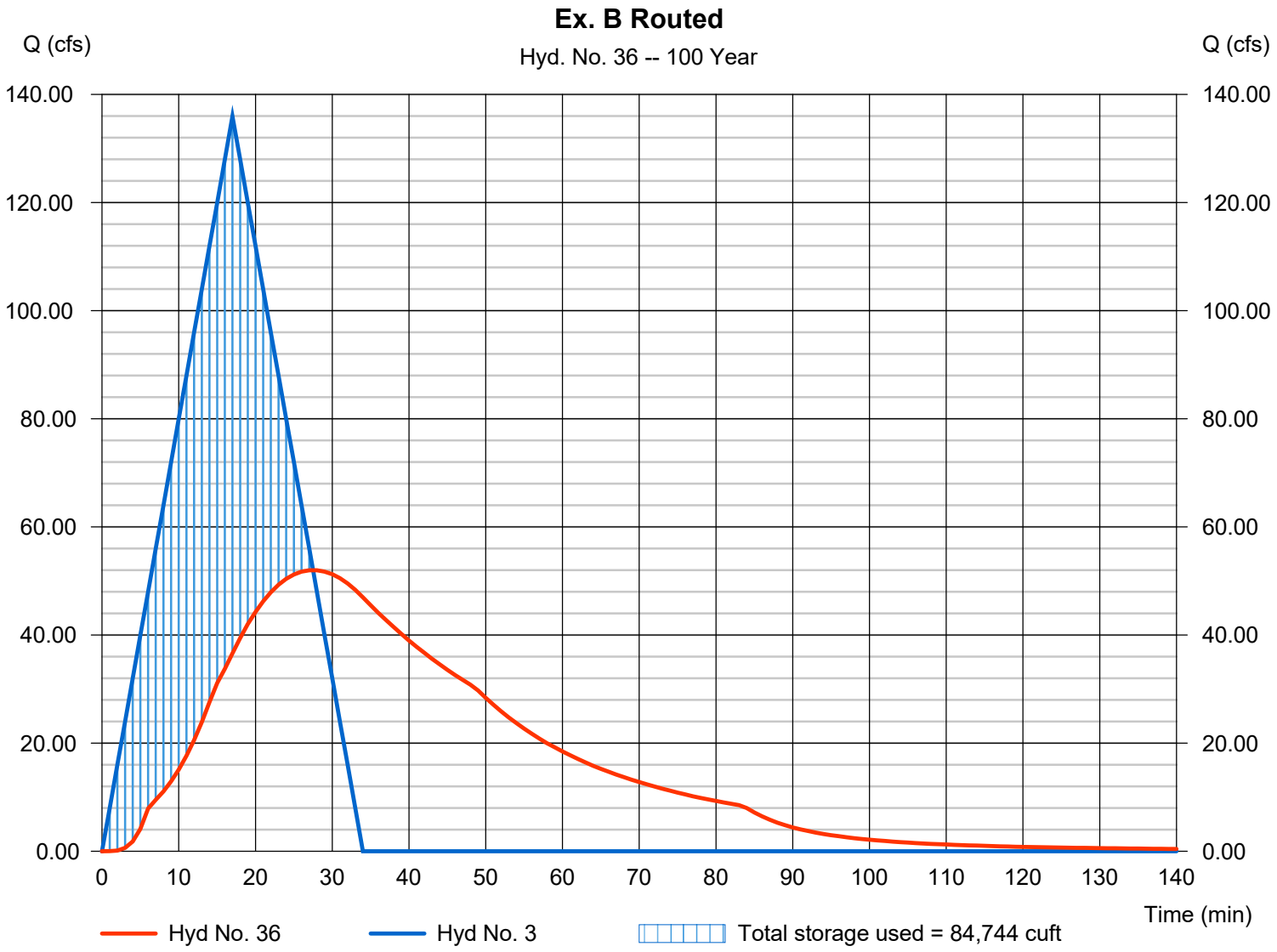
Hydrograph Report

Hyd. No. 36

Ex. B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	51.98 cfs
Storm frequency	=	100 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	138,665 cuft
Inflow hyd. No.	=	3 - Ex. B	Max. Elevation	=	1009.75 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	84,744 cuft

Storage Indication method used.



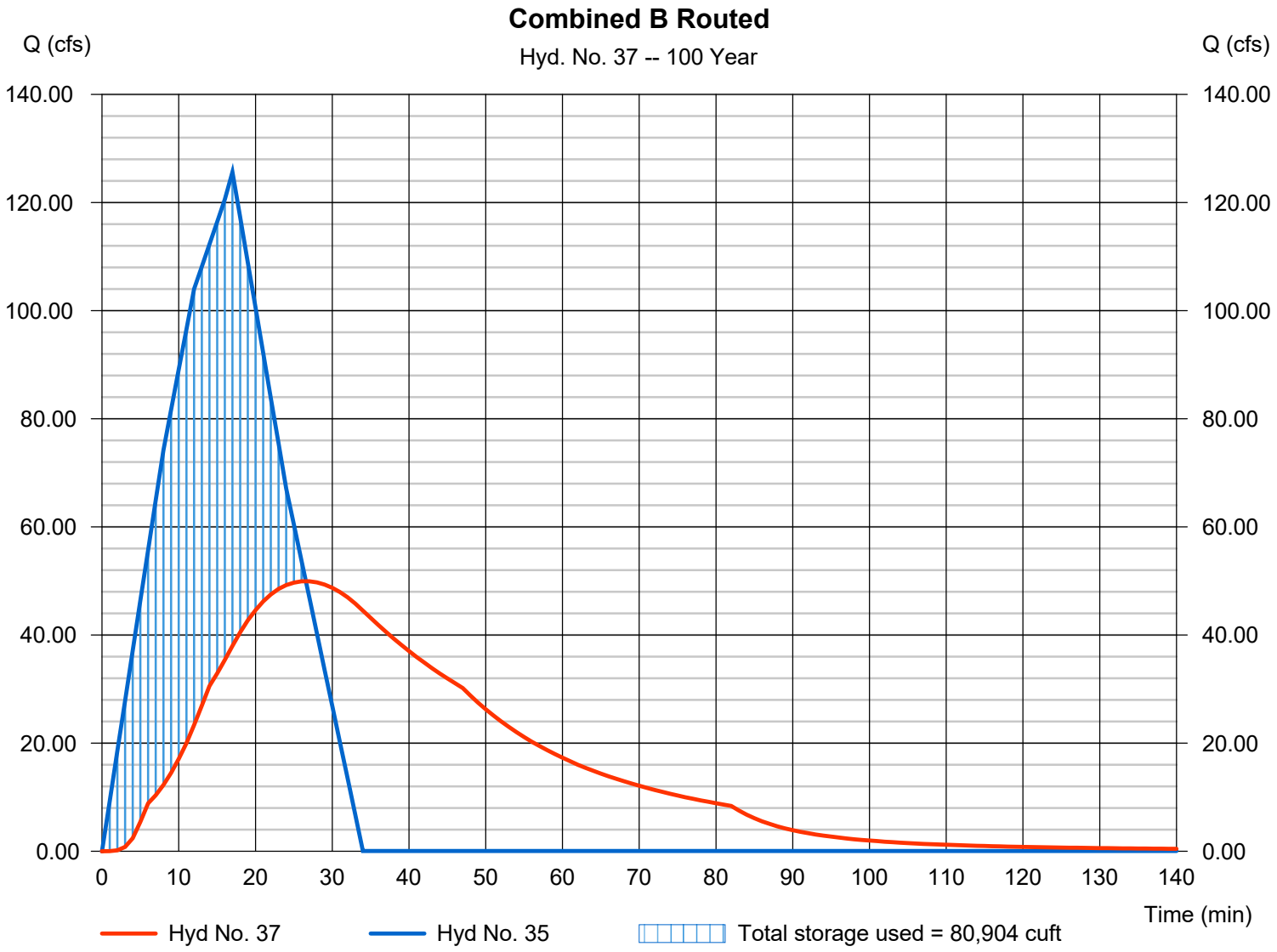
Hydrograph Report

Hyd. No. 37

Combined B Routed

Hydrograph type	=	Reservoir	Peak discharge	=	49.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	135,023 cuft
Inflow hyd. No.	=	35 - Combined B	Max. Elevation	=	1009.68 ft
Reservoir name	=	315 NW Olive	Max. Storage	=	80,904 cuft

Storage Indication method used.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	64.1474	17.7000	0.8922	--------
2	95.7859	19.2000	0.9317	--------
3	0.0000	0.0000	0.0000	--------
5	118.7799	19.1000	0.9266	--------
10	125.1300	18.2000	0.9051	--------
25	158.9867	18.7000	0.9180	--------
50	171.2459	18.3000	0.9078	--------
100	187.3624	18.1000	0.9031	--------

File name: KCMO.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.96	3.31	2.86	2.52	2.25	2.04	1.87	1.72	1.60	1.49	1.40	1.32
2	4.92	4.13	3.56	3.14	2.81	2.54	2.32	2.14	1.98	1.85	1.73	1.63
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.23	5.23	4.51	3.98	3.56	3.22	2.94	2.71	2.52	2.35	2.20	2.07
10	7.27	6.09	5.26	4.63	4.14	3.75	3.43	3.16	2.93	2.74	2.57	2.42
25	8.70	7.30	6.30	5.54	4.96	4.49	4.10	3.78	3.51	3.27	3.07	2.89
50	9.83	8.24	7.11	6.26	5.60	5.07	4.64	4.27	3.97	3.70	3.47	3.27
100	11.00	9.21	7.95	7.00	6.26	5.67	5.19	4.78	4.44	4.14	3.89	3.66

Tc = time in minutes. Values may exceed 60.

Precip. file name: Z:\acad\KCMO.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.93	3.50	0.00	3.30	5.20	6.00	6.80	7.70
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	2.49	3.10	0.00	4.01	4.64	5.52	6.21	6.90
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

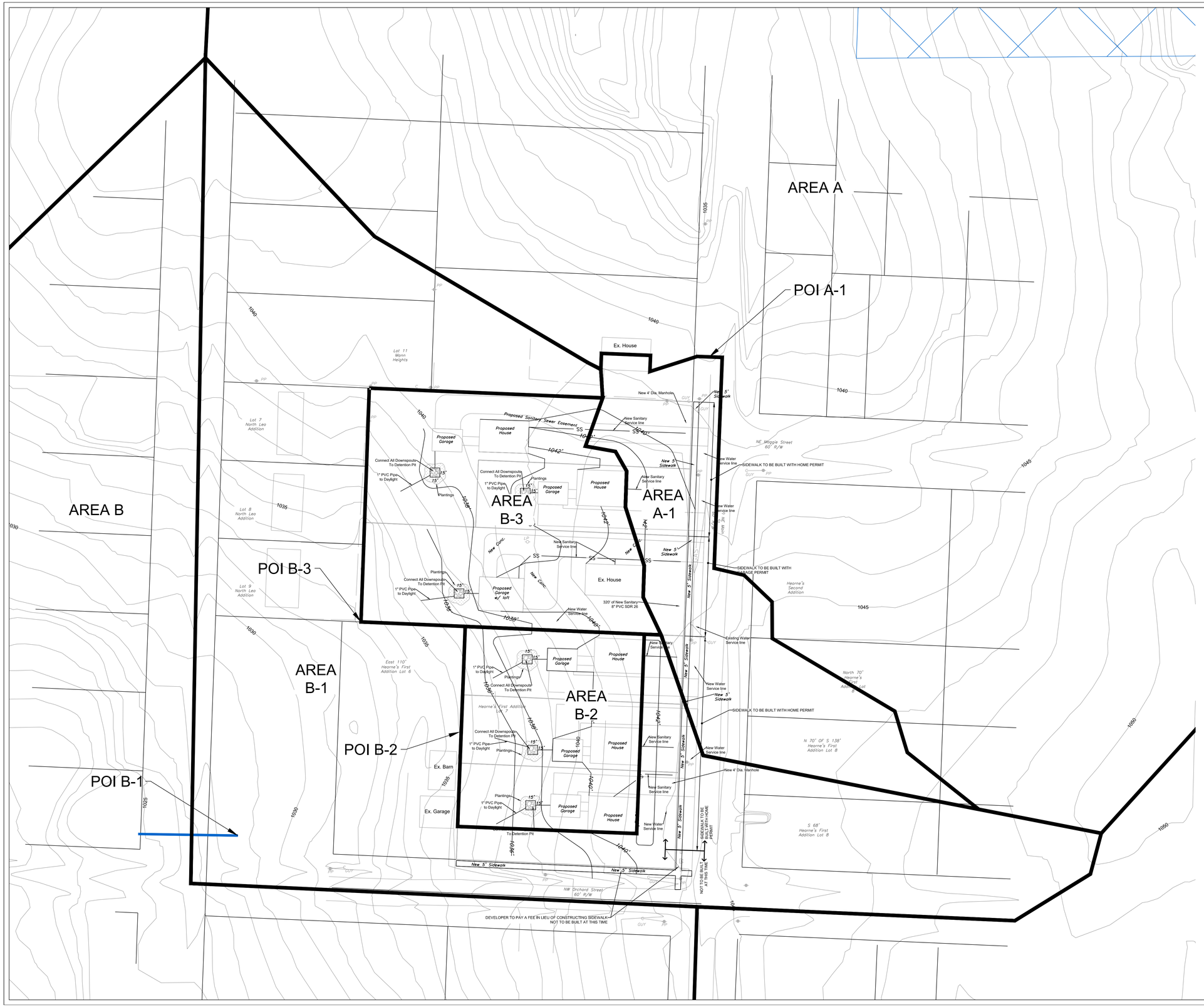
Hydraflow Table of Contents

10 - Year

100 - Year

Exhibit F

Post Development Drainage Map



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Missouri
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Surveying 2005006319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Project: 510 NW MAIN ST LS,MO
Issue Date: September 13, 2019

Post Development Drainage Map
Construction Plans for:
510 NW MAIN STREET
Section 6, Township 47 North, Range 31 West
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit