Introduction
This storm water memorandum will study the re-development of a 0.44-acre site located at the Northwest corner of Maple Street and NE Douglas Street, Lee's Summit, Jackson County, Missouri. The site is located in the Cedar Creek watershed and drains southeasterly toward an existing public storm sewer system and northwesterly via overland flow. The development will NOT meet the City of Lee's Summit and APWA Section 5600 storm water detention requirements for Comprehensive Controls. The site will develop a parking lot and deck area and onsite storm water detention with extended 40-hour controls for the Water Quality storm event.

Purpose
This memorandum has been prepared to evaluate potential hydrologic and hydraulic issues related to the development of the proposed projects and recommend improvements if necessary to mitigate any anticipated negative downstream impacts. Exhibit A is the Proposed Drainage Area Map

Storm Study Methodology

Rational Method	
Site Impervious Area	24.1% of Site (PRE) 45.2% of Site (POST)
Rational Coefficient	0.48 Pre / 0.65 Post
Hydrologic Soil Group	C

Additional Resources

Exhibit		
C	FEMA Firmette, 29095C0417G, dated January 20, 2017	None
D	US Fish and Wildlife Wetland Inventory	None Identified
E	Soil Map	

APWA Section 5600.4.C.1 Comprehensive Control

- Ground Cover: Commercial
- Drainage Area: 0.44 acres
- Runoff Coefficient: Pre A (0.48) Pre B (0.37) Post A (0.65)
- Time of Concentration: Pre A (9.6) Pre B (9.1) Post A (7.2) minutes
  Allowable Discharge Rates
  - 2-YR: 0.22 cfs
  - 10-YR: 0.88 cfs
  - 100-YR: 1.32 cfs

Peak Discharge Summary and Allowable Detention Basin Discharge

Condition	Q (2-YR) cfs	Q (10-YR) cfs	Q (100-YR) cfs
Area A	0.89	1.32	1.99
Area B	0.22	0.33	0.49
Allowable Site Discharge	0.22	0.44	1.32
Design Detention Discharge	0.22	0.33	1.25

The proposed release rates will meet the APWA Section 5600 Allowable Release Rates

Hydraflow Report which includes both proposed hydrographs along with detention basin sizing and routing hydrographs may be found in Exhibit B.

Detention Design
Designation: Detention Basin
Type: Earthen Basin
Side Slopes: 3:1 Max.
Bottom Slope: 2% Min., Turf Lined
Basin Bottom Elevation: 1038.00
Basin Top Berm Elevation: 1043.50
Basin Volume: 2,118 cf @ 1043.50
Control Structure: Infiltration
Control Structure Effluent Pipe: 6" HDPE, FL (Out) = 1042.00'
Emergency Spillway: Earthen Broad Crested Weir, Crest Elevation=1042.50, Crest Length=50'
Top of Dam: 1043.50, Q=1.99, Depth=0.22', Velocity=2.13 fps
See Table below for a summary of detention basin data.

Detention Basin Data

	Peak Q In (cfs)	Tp In (min.)	Peak Q Out (cfs)	Tp Out (min)	Peak W.S.E.	Max. Storage Vol. (cf)
Detention Basin						
2-Year	1.11	10	0.22	0	1042.04	374
10-Year	1.64	10	0.33	0	1042.25	552
100-Year	1.48	10	0.76	12	1042.51	779

As shown in the above table, post detention peak discharge rates have been attenuated well below existing.

Conclusion
The development along with the proposed infiltration basin will meet all requirements of the City of Lee's Summit and APWA Section 5600 for storm water attenuation. There are no known Stream Buffer setback areas required due to the size of the upstream watershed. There are no known floodplain or wetlands onsite per the exhibits provided within this report from FEMA and National Wetland Mapper. Additionally, there are no required stream buffers due to the upstream watershed area being less than 40 acres.

Due to the reduction in existing peak flow rates from this site the development will not create a negative impact on the downstream system and will provide the required storm attenuation for the proposed development of the site.

STATE OF MISSOURI MATTHEW J SCHLICHT NUMBER PE-2006019708 PROFESSIONAL ENGINEER
STATE OF MISSOURI PROFESSIONAL ENGINEERS AND LAND SURVEYORS
1/23/2025

Matt Schlicht, PE 2006019708

Exhibit A
Proposed Drainage Area Map

50 SE 30th Street Lee's Summit, MO 64082
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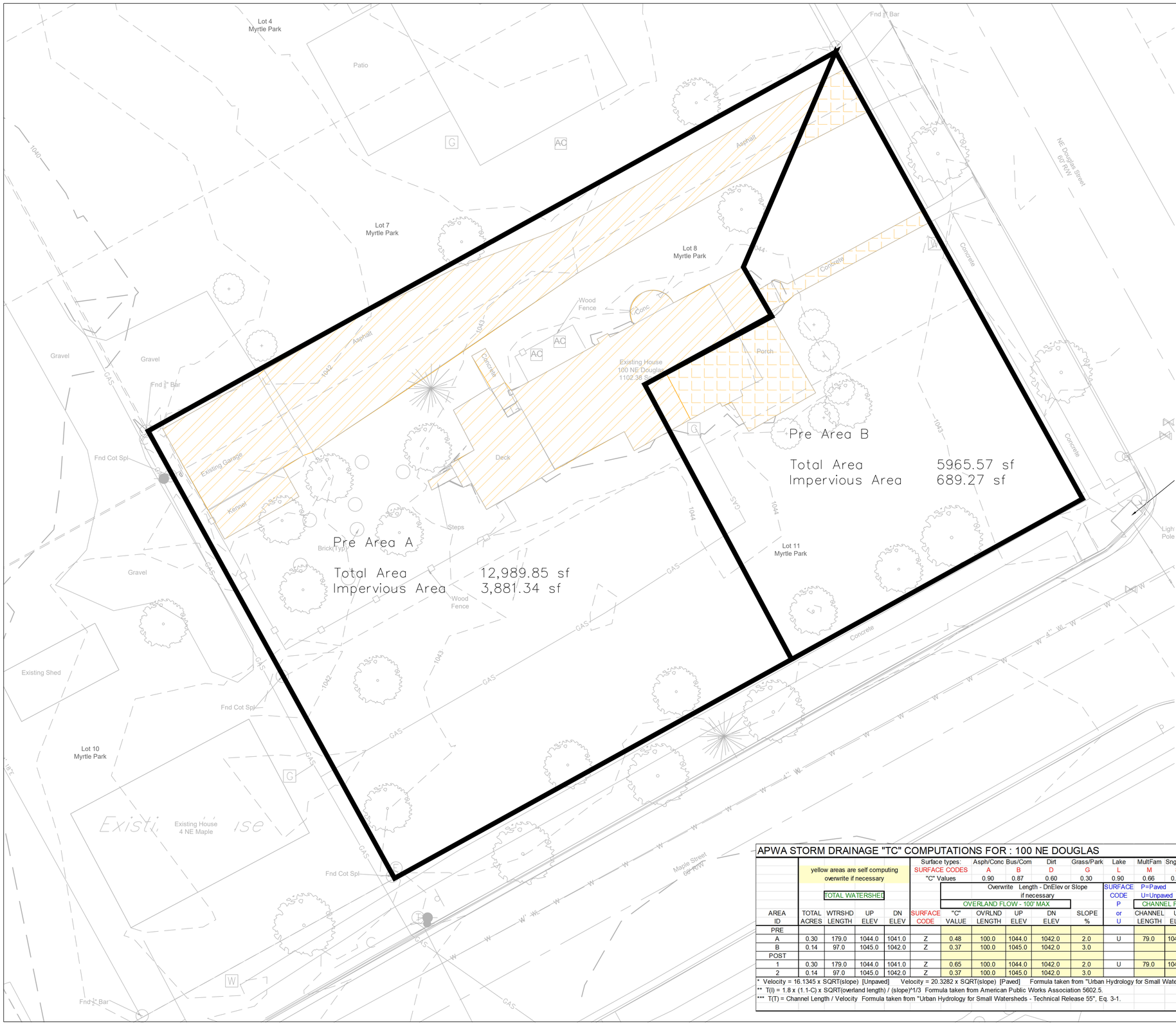

North

0 5' 10' 20'

PRE DEVELOPMENT DRAINAGE PLAN

SCALE: 1" = 10'

APWA STORM DRAINAGE "TC" COMPUTATIONS FOR : 100 NE DOUGLAS

Surface types: Asph/Conc, Bus/Com, Dirt, Grass/Park, Lake, MultFam, SnglFam, Undev, Other

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

yellow areas are self computing overwrite if necessary

TOTAL WATERSHED | OVERLAND FLOW - 100' MAX (Overwrite Length - DnElev or Slope if necessary) | CHANNEL FLOW - FIRST REACH (SURFACE CODE P=Paved, U=Unpaved; Overwrite Slope or Elevations if necessary) | TC COMPUTATION

AREA ID	TOTAL ACRES	WTRSHD LENGTH	UP ELEV	DN ELEV	SURFACE CODE	"C" VALUE	OVRLND LENGTH	UP ELEV	DN ELEV	SLOPE %	P or U	CHANNEL LENGTH	UP ELEV	DN ELEV	SLOPE %	VELOCITY F/S	Cal Overland Flow T(i)	Used Min 5 T(i)	Cal Channel One T(T)	Cal Channel Two T(T)	Total T© 10	AREA ID
PRE																						PRE
A	0.30	179.0	1044.0	1041.0	Z	0.48	100.0	1044.0	1042.0	2.0	U	79.0	1042.0	1041.0	1.27	1.8	8.9	8.9	0.7	0.0	9.6	A
B	0.14	97.0	1045.0	1042.0	Z	0.37	100.0	1045.0	1042.0	3.0							9.1	9.1	0.0	0.0	9.1	B
POST																						
1	0.30	179.0	1044.0	1041.0	Z	0.65	100.0	1044.0	1042.0	2.0	U	79.0	1042.0	1041.0	1.27	1.8	6.4	6.4	0.7	0.0	7.2	1.0
2	0.14	97.0	1045.0	1042.0	Z	0.37	100.0	1045.0	1042.0	3.0							9.1	9.1	0.0	0.0	9.1	2.0

* 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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Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

100 NE DOUGLAS STREET
Lee's Summit, Jackson County, Missouri

Project: 100 NE DOUGLAS LSMO
Issue Date: January 24, 2025

Pre Development
Preliminary Development Plans for:
100 NE DOUGLAS STREET
Lee's Summit, Jackson County, Missouri

STATE OF MISSOURI
MATTHEW J. SCHLICHT
NUMBER PE-2006019708
01/24/25
PROFESSIONAL ENGINEER

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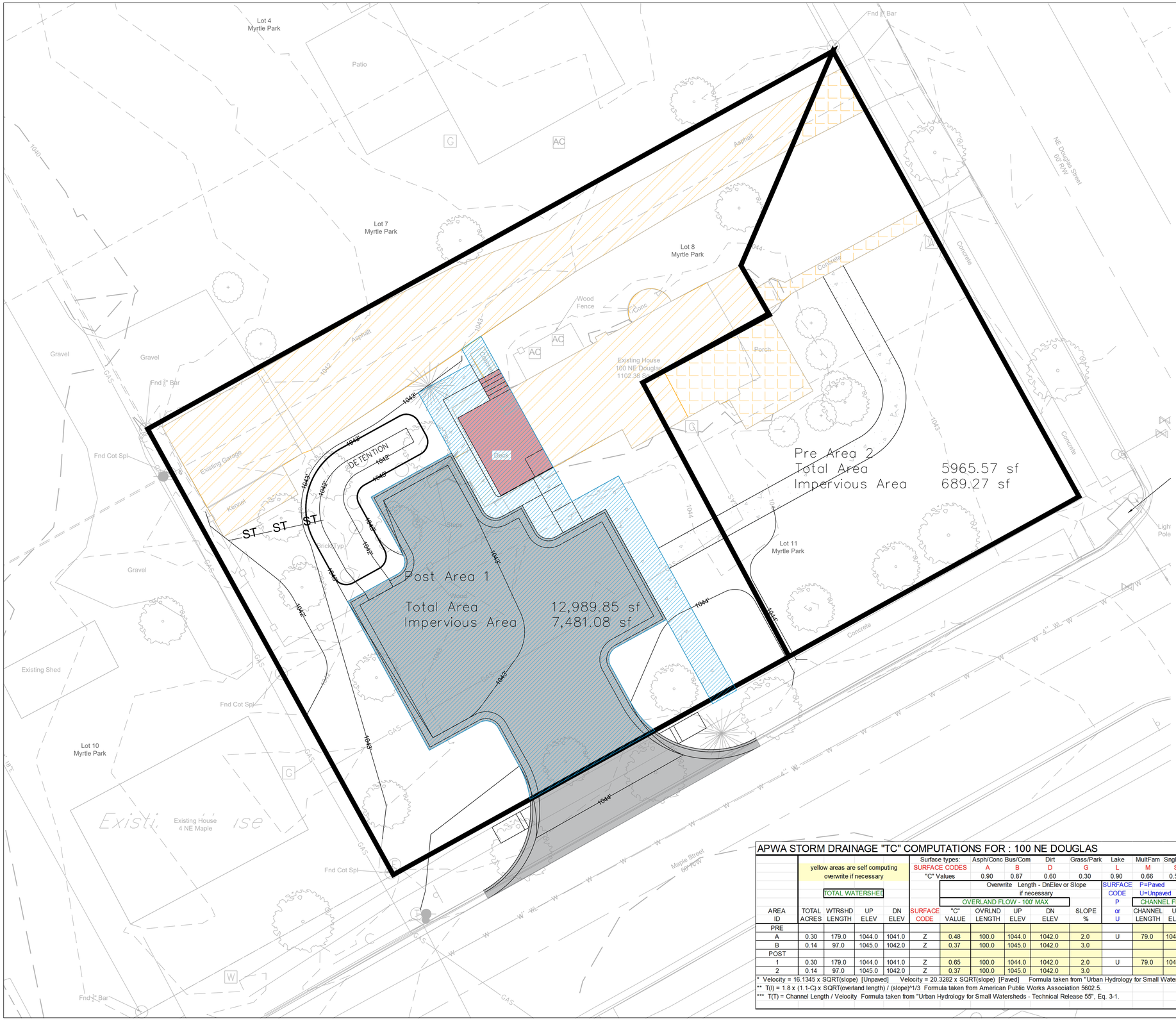
NE PE E-14335

REVISIONS

C.201



North

0 5' 10' 20'

POST DEVELOPMENT DRAINAGE PLAN

SCALE: 1" = 10'

APWA STORM DRAINAGE "TC" COMPUTATIONS FOR : 100 NE DOUGLAS

					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				Cal Overland	Used Min 5	Cal Channel	Cal Channel	Total	
					OVERLAND FLOW - 100' MAX					P	CHANNEL FLOW - FIRST REACH												
AREA ID	TOTAL ACRES	WTRSHD LENGTH	UP ELEV	DN ELEV	SURFACE CODE	"C" VALUE	OVRLND LENGTH	UP ELEV	DN ELEV	SLOPE %	or U	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	0.30	179.0	1044.0	1041.0	Z	0.48	100.0	1044.0	1042.0	2.0	U	79.0	1042.0	1041.0	1.27	1.8		8.9	8.9	0.7	0.0	9.6	A
B	0.14	97.0	1045.0	1042.0	Z	0.37	100.0	1045.0	1042.0	3.0								9.1	9.1	0.0	0.0	9.1	B
POST																							
1	0.30	179.0	1044.0	1041.0	Z	0.65	100.0	1044.0	1042.0	2.0	U	79.0	1042.0	1041.0	1.27	1.8		6.4	6.4	0.7	0.0	7.2	1.0
2	0.14	97.0	1045.0	1042.0	Z	0.37	100.0	1045.0	1042.0	3.0								9.1	9.1	0.0	0.0	9.1	2.0

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STATE OF MISSOURI — MATTHEW J. SCHLICHT — NUMBER PE-2006019708 — PROFESSIONAL ENGINEER

Matthew J. Schlicht
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NE PE E-14335

REVISIONS

APWA STORM DRAINAGE "TC" COMPUTATIONS FOR : 100 NE DOUGLAS

yellow areas are self computing overwrite if necessary

					Surface types:	Asph/Conc	Bus/Com	Dirt	Grass/Park	Lake	MultFam	SnglFam	Undev	Other							
					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								
		TOTAL WATERSHED				Overwrite Length - DnElev or Slope				SURFACE	P=Paved		Overwrite Slope or Elevations			TC COMPUTATION				
						if necessary				CODE	U=Unpaved		if necessary								
						OVERLAND FLOW - 100' MAX				P	CHANNEL FLOW - FIRST REACH					Cal	Used	Cal	Cal		
AREA	TOTAL	WTRSHD	UP	DN	SURFACE	"C"	OVRLND	UP	DN	SLOPE	or	CHANNEL	UP	DN	SLOPE	VELOCITY	Overland	Min 5	Channel	Channel	Total	
ID	ACRES	LENGTH	ELEV	ELEV	CODE	VALUE	LENGTH	ELEV	ELEV	%	U	LENGTH	ELEV	ELEV	%	F/S	Flow T(I)	Max 15 T(I)	One T(T)	Two T(T)	T© 10	AREA ID
PRE																						PRE
A	0.30	179.0	1044.0	1041.0	Z	0.48	100.0	1044.0	1042.0	2.0	U	79.0	1042.0	1041.0	1.27	1.8	8.9	8.9	0.7	0.0	9.6	A
B	0.14	97.0	1045.0	1042.0	Z	0.37	100.0	1045.0	1042.0	3.0							9.1	9.1	0.0	0.0	9.1	B
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Exhibit B
Hydraflow Report

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Hydraflow Table of Contents

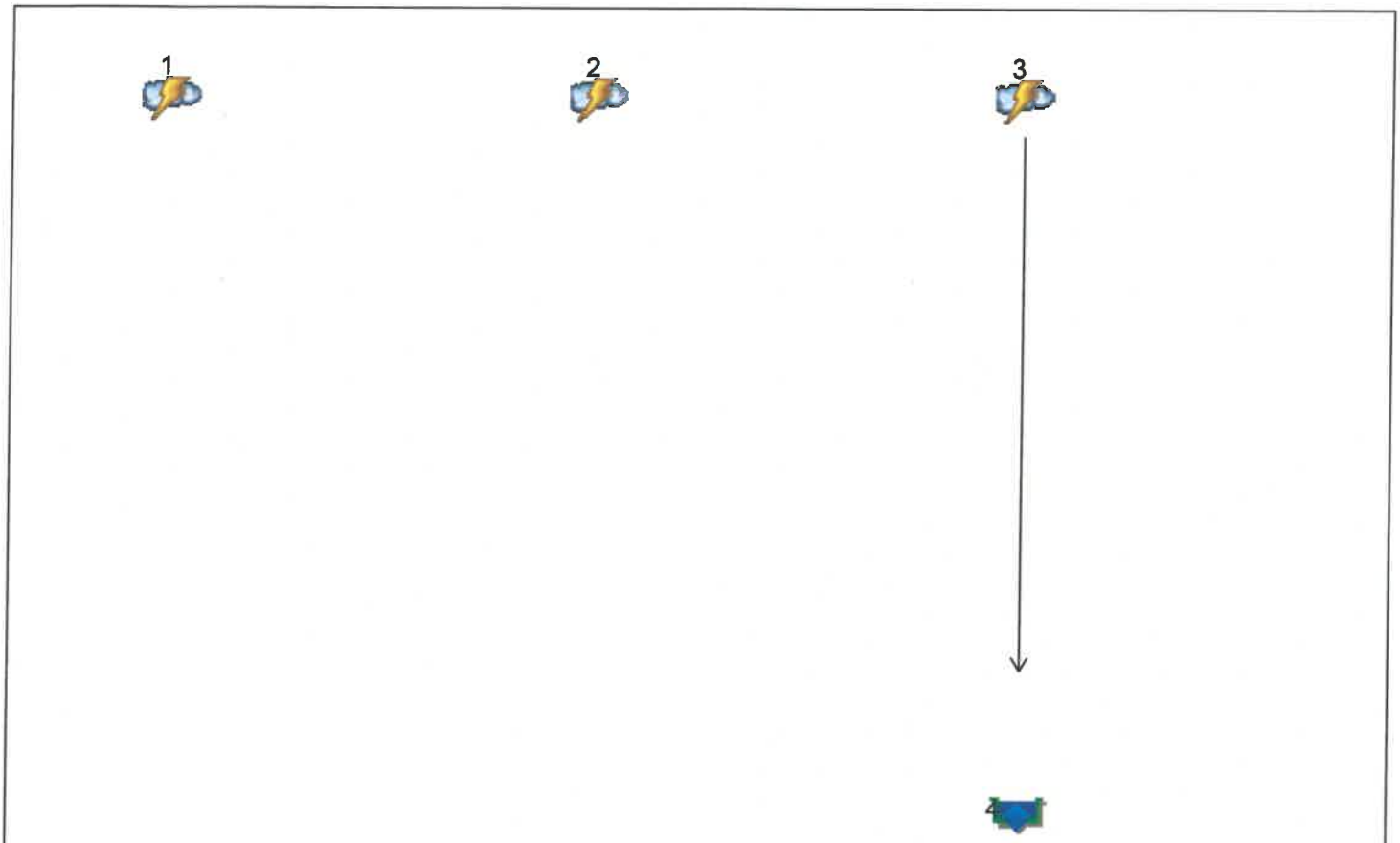
C:\acad\100 NE DOUGLAS LSMO\STORM STUDY\100 NE Douglas Storm.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Thursday, 01 / 23 / 2025

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Legend

Hyd.	Origin	Description
1	Rational	Pre A
2	Rational	Pre B
3	Rational	Post A
4	Reservoir	Infiltration

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

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	------	-------	0.595	-------	-------	0.877	-------	-------	1.327	Pre A
2	Rational	------	-------	0.221	-------	-------	0.326	-------	-------	0.493	Pre B
3	Rational	------	-------	0.891	-------	-------	1.315	-------	-------	1.989	Post A
4	Reservoir	3	-------	0.000	-------	-------	0.000	-------	-------	0.761	Infiltration

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

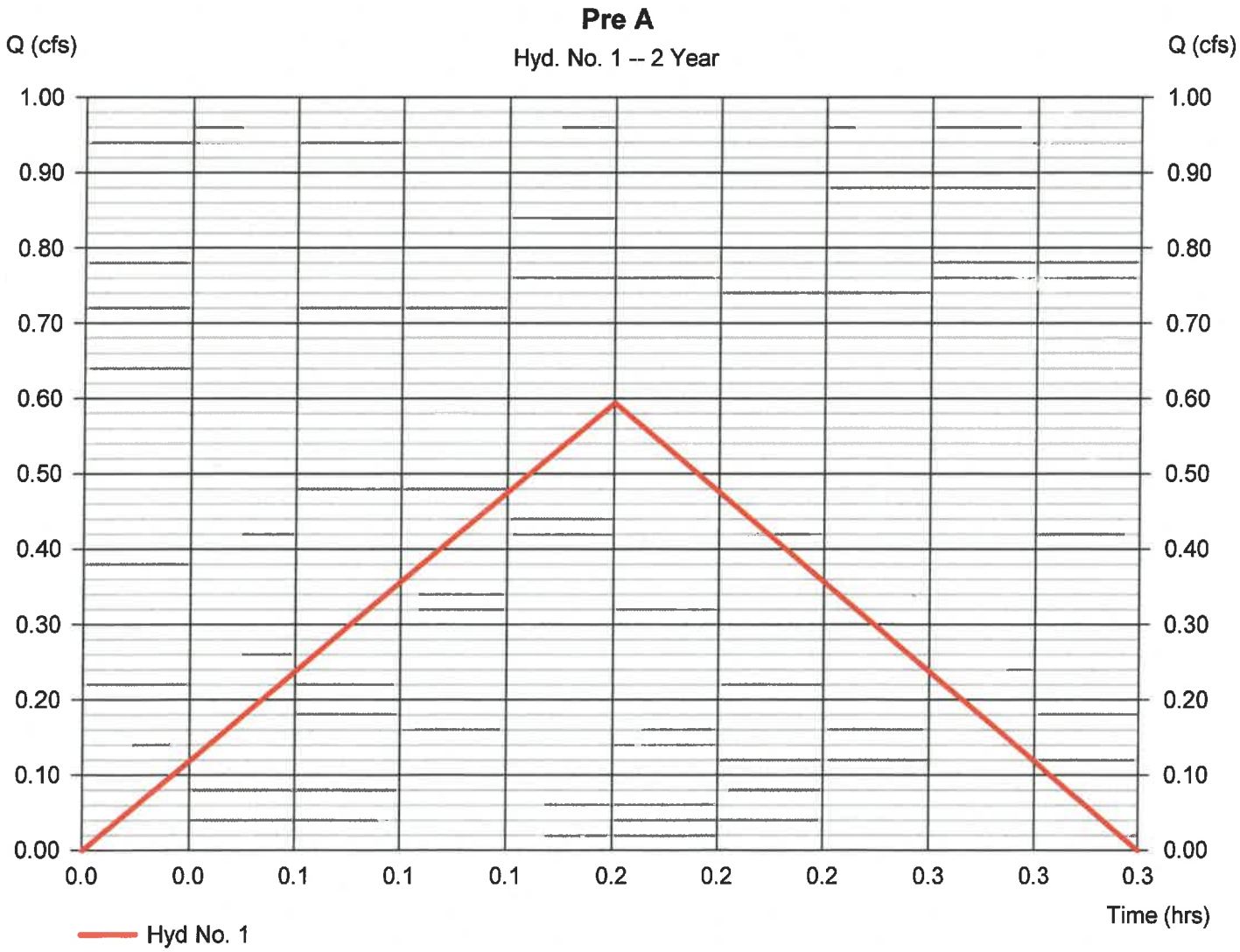
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.595	1	10	357	------	------	------	Pre A
2	Rational	0.221	1	9	119	------	------	------	Pre B
3	Rational	0.891	1	7	374	------	------	------	Post A
4	Reservoir	0.000	1	n/a	0	3	1042.04	374	Infiltration

Hydrograph Report

Hyd. No. 1

Pre A

Hydrograph type	= Rational	Peak discharge	= 0.595 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 357 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.48
Intensity	= 4.130 in/hr	Tc by User	= 10.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

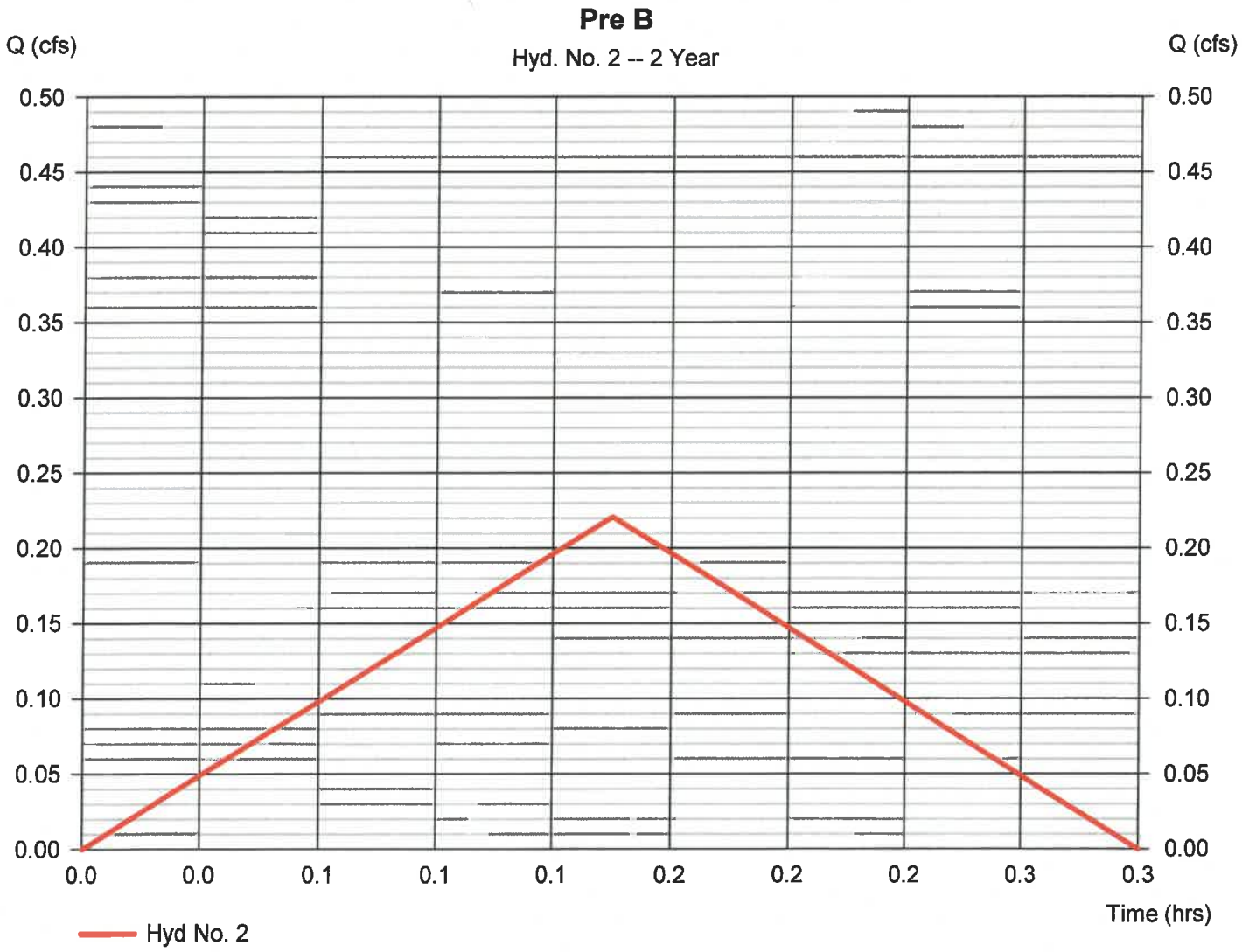


Hydrograph Report

Hyd. No. 2

Pre B

Hydrograph type	= Rational	Peak discharge	= 0.221 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.15 hrs
Time interval	= 1 min	Hyd. volume	= 119 cuft
Drainage area	= 0.140 ac	Runoff coeff.	= 0.37
Intensity	= 4.266 in/hr	Tc by User	= 9.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



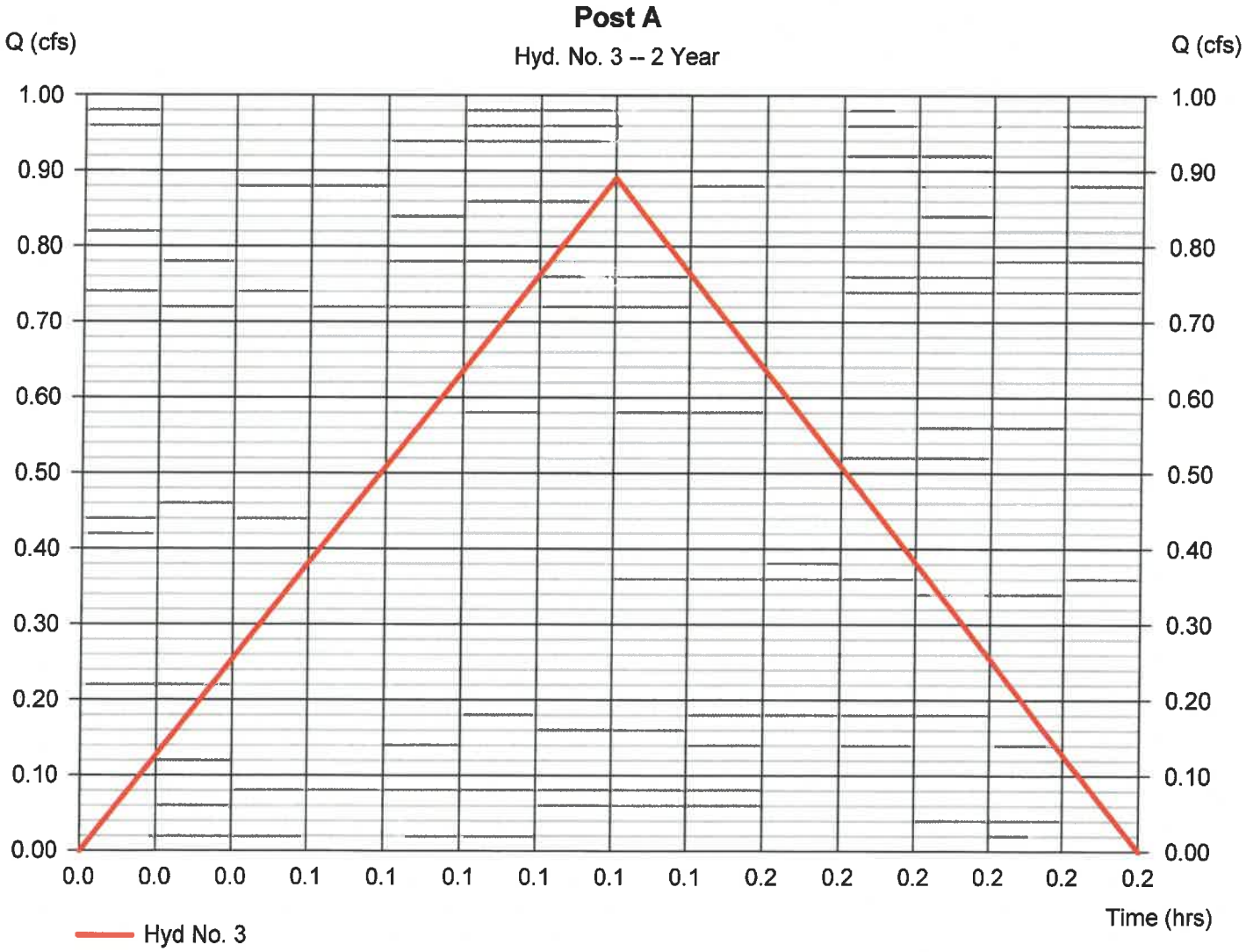
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Thursday, 01 / 23 / 2025

Hyd. No. 3

Post A

Hydrograph type	= Rational	Peak discharge	= 0.891 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.12 hrs
Time interval	= 1 min	Hyd. volume	= 374 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.65
Intensity	= 4.569 in/hr	Tc by User	= 7.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

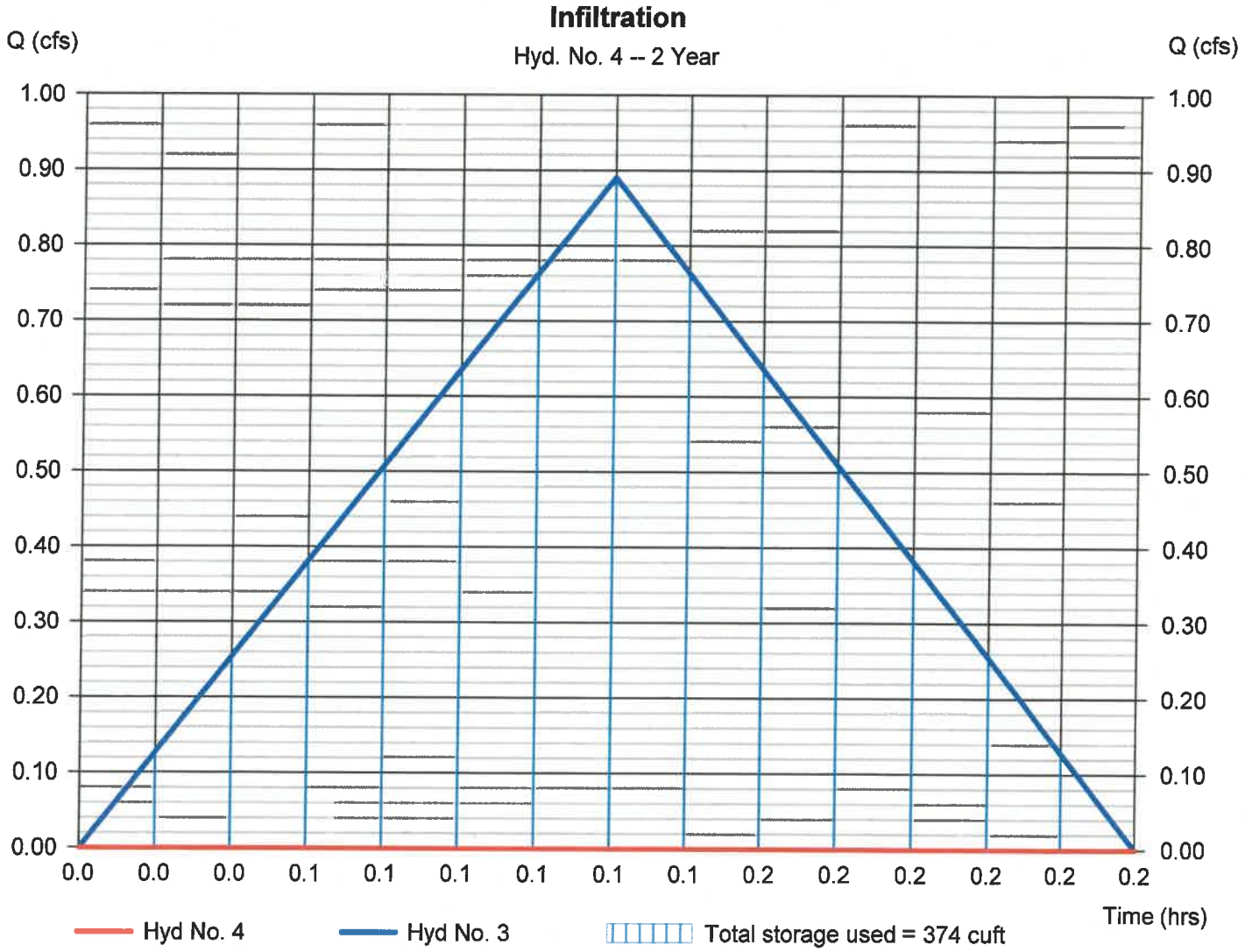
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 01 / 23 / 2025

Hyd. No. 4

Infiltration

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post A	Max. Elevation	= 1042.04 ft
Reservoir name	= Infiltration	Max. Storage	= 374 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 01 / 23 / 2025

Pond No. 1 - Infiltration

Pond Data

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

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1038.00	73	0	0
1.00	1039.00	73	73	73
2.00	1040.00	73	73	146
3.00	1041.00	73	73	218
4.00	1042.00	182	123	342
5.00	1043.00	1,795	849	1,191
5.50	1043.50	1,914	927	2,118

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.00	0.00	0.00
Span (in)	= 8.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1042.50	0.00	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.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)	= 50.00	0.00	0.00	0.00
Crest El. (ft)	= 1042.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Ciplti	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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
0.10	7	1038.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.20	15	1038.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.30	22	1038.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.40	29	1038.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.50	36	1038.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.60	44	1038.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.70	51	1038.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.80	58	1038.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.90	66	1038.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	73	1039.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.10	80	1039.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.20	87	1039.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.30	95	1039.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.40	102	1039.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.50	109	1039.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.60	116	1039.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.70	124	1039,70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.80	131	1039.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.90	138	1039.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.00	146	1040.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.10	153	1040.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.20	160	1040.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.30	167	1040.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.40	175	1040.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.50	182	1040.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.60	189	1040.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.70	197	1040.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.80	204	1040.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
2.90	211	1040.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.00	218	1041.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.10	231	1041.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.20	243	1041.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.30	255	1041.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000

Continues on next page...

Infiltration

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
3.40	268	1041.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.50	280	1041.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.60	292	1041.60	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.70	305	1041.70	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.80	317	1041.80	0.00	---	---	---	0.00	---	---	---	---	---	0.000
3.90	329	1041.90	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.00	342	1042.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.10	427	1042.10	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.20	512	1042.20	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.30	596	1042.30	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.40	681	1042.40	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.50	766	1042.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
4.60	851	1042.60	0.04 ic	---	---	---	5.25	---	---	---	---	---	5.289
4.70	936	1042.70	0.13 ic	---	---	---	14.87	---	---	---	---	---	15.01
4.80	1,021	1042.80	0.28 ic	---	---	---	27.33	---	---	---	---	---	27.62
4.90	1,106	1042.90	0.47 ic	---	---	---	42.09	---	---	---	---	---	42.56
5.00	1,191	1043.00	0.68 ic	---	---	---	58.87	---	---	---	---	---	59.54
5.05	1,284	1043.05	0.78 ic	---	---	---	67.92	---	---	---	---	---	68.70
5.10	1,377	1043.10	0.83 oc	---	---	---	77.40	---	---	---	---	---	78.23
5.15	1,469	1043.15	0.85 oc	---	---	---	87.28	---	---	---	---	---	88.14
5.20	1,562	1043.20	0.89 oc	---	---	---	97.55	---	---	---	---	---	98.44
5.25	1,655	1043.25	0.96 oc	---	---	---	108.20	---	---	---	---	---	109.16
5.30	1,747	1043.30	1.03 oc	---	---	---	119.20	---	---	---	---	---	120.23
5.35	1,840	1043.35	1.10 oc	---	---	---	130.56	---	---	---	---	---	131.66
5.40	1,933	1043.40	1.16 oc	---	---	---	142.25	---	---	---	---	---	143.41
5.45	2,025	1043.45	1.22 oc	---	---	---	154.28	---	---	---	---	---	155.49
5.50	2,118	1043.50	1.27 oc	---	---	---	166.50	---	---	---	---	---	167.77

...End

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

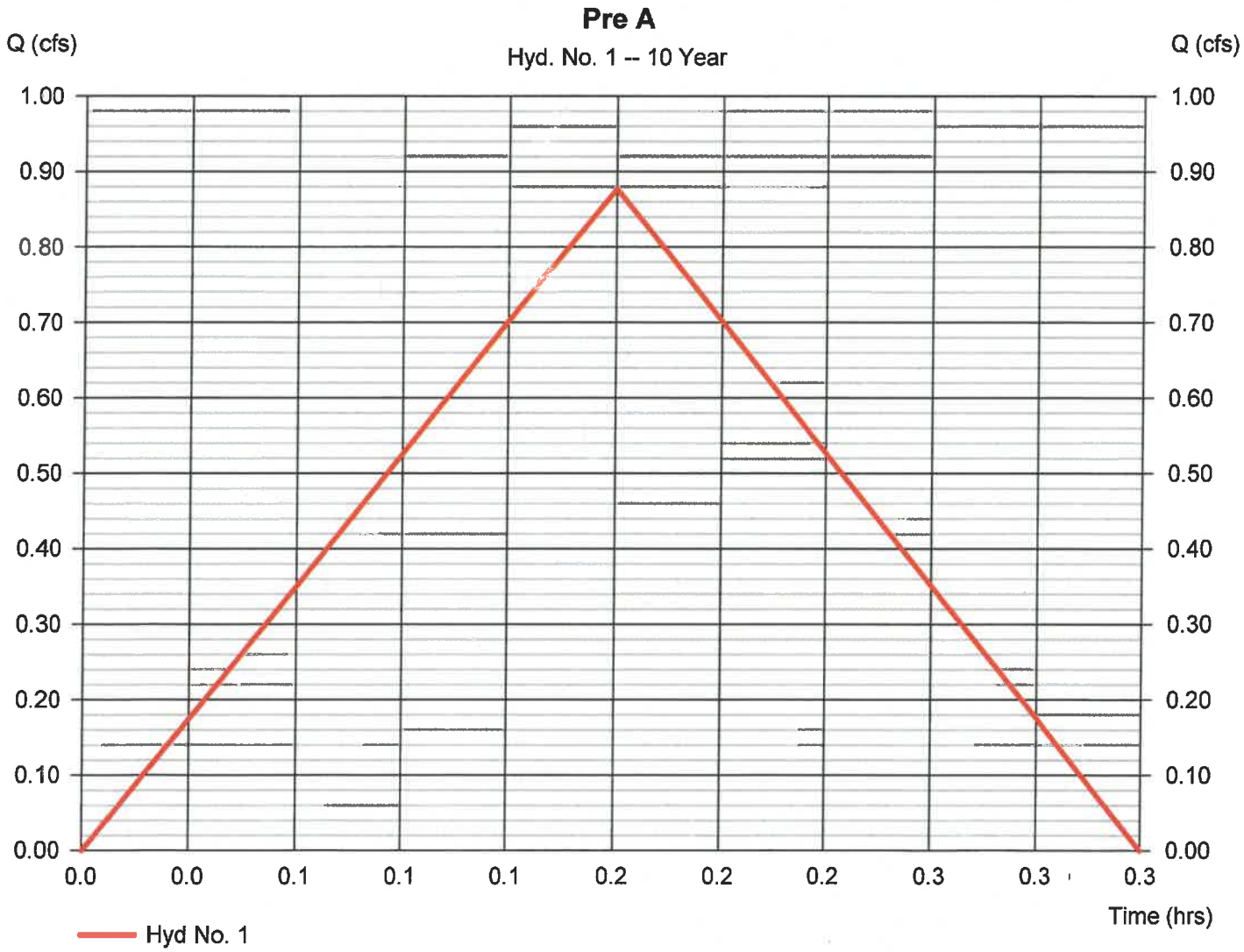
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	0.877	1	10	526	------	------	------	Pre A
2	Rational	0.326	1	9	176	------	------	------	Pre B
3	Rational	1.315	1	7	552	------	------	------	Post A
4	Reservoir	0.000	1	n/a	0	3	1042.25	552	Infiltration

Hydrograph Report

Hyd. No. 1

Pre A

Hydrograph type	= Rational	Peak discharge	= 0.877 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 526 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.48
Intensity	= 6.092 in/hr	Tc by User	= 10.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



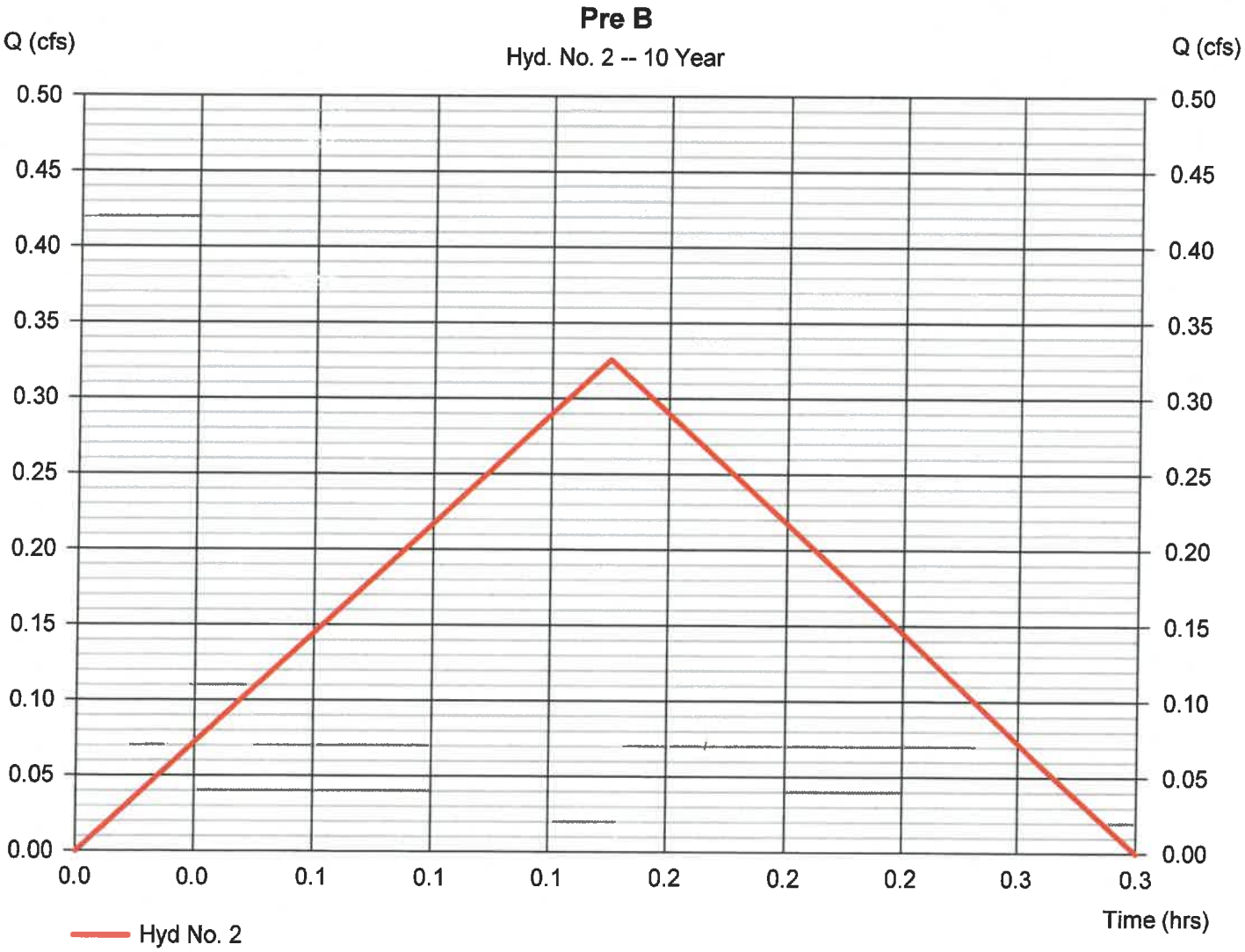
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 01 / 23 / 2025

Hyd. No. 2

Pre B

Hydrograph type	= Rational	Peak discharge	= 0.326 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.15 hrs
Time interval	= 1 min	Hyd. volume	= 176 cuft
Drainage area	= 0.140 ac	Runoff coeff.	= 0.37
Intensity	= 6.294 in/hr	Tc by User	= 9.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

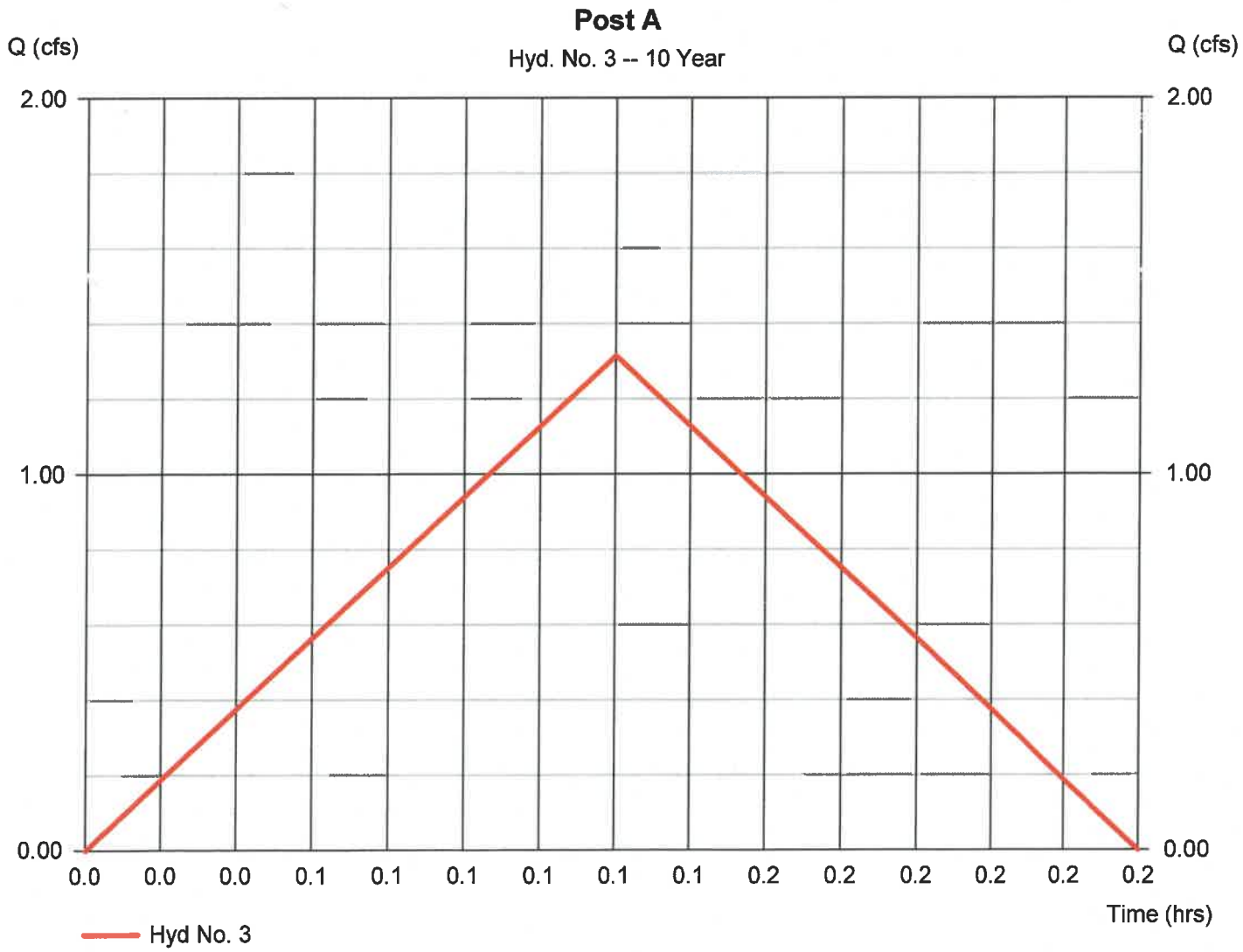


Hydrograph Report

Hyd. No. 3

Post A

Hydrograph type	= Rational	Peak discharge	= 1.315 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.12 hrs
Time interval	= 1 min	Hyd. volume	= 552 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.65
Intensity	= 6.745 in/hr	Tc by User	= 7.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



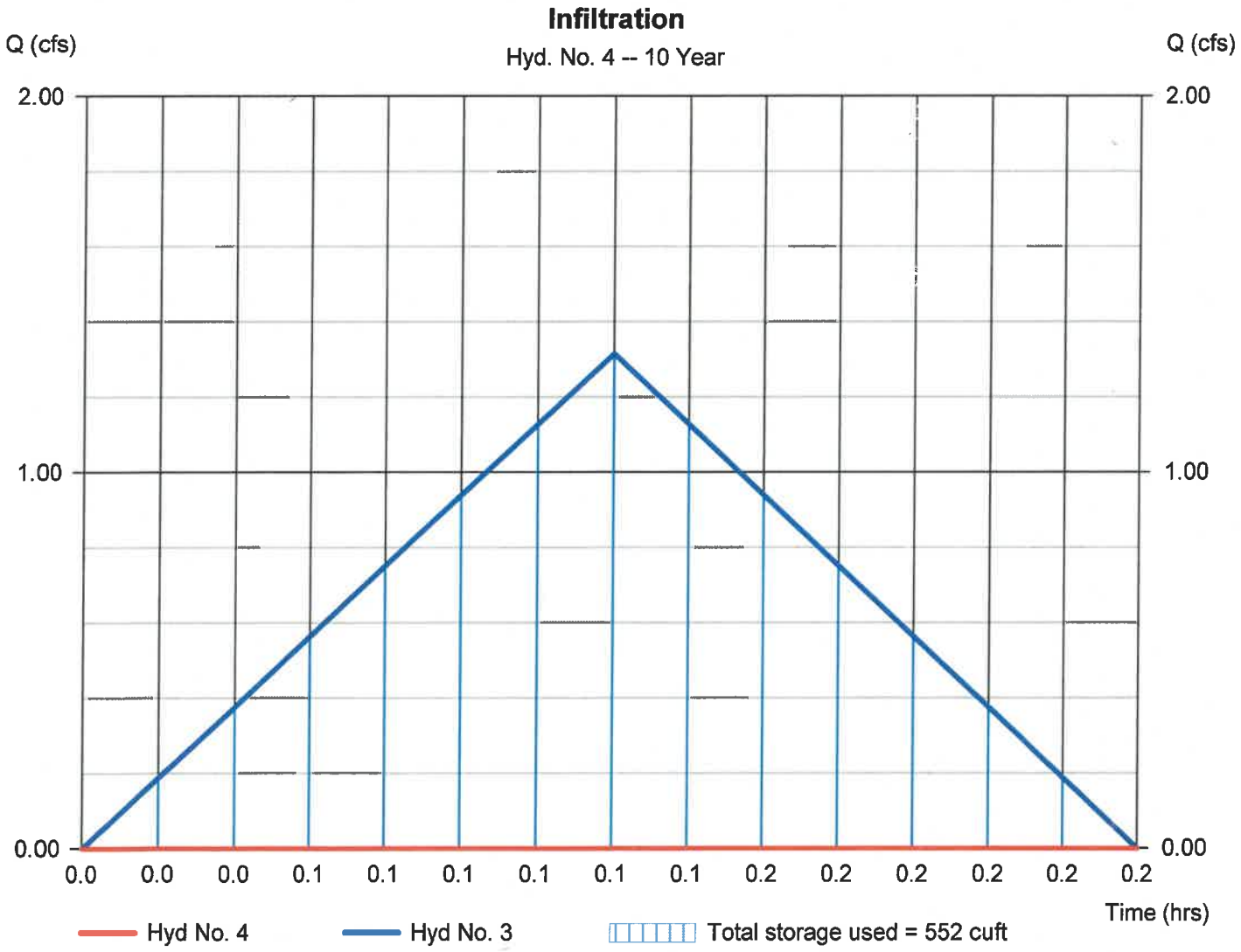
Hydrograph Report

Hyd. No. 4

Infiltration

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post A	Max. Elevation	= 1042.25 ft
Reservoir name	= Infiltration	Max. Storage	= 552 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

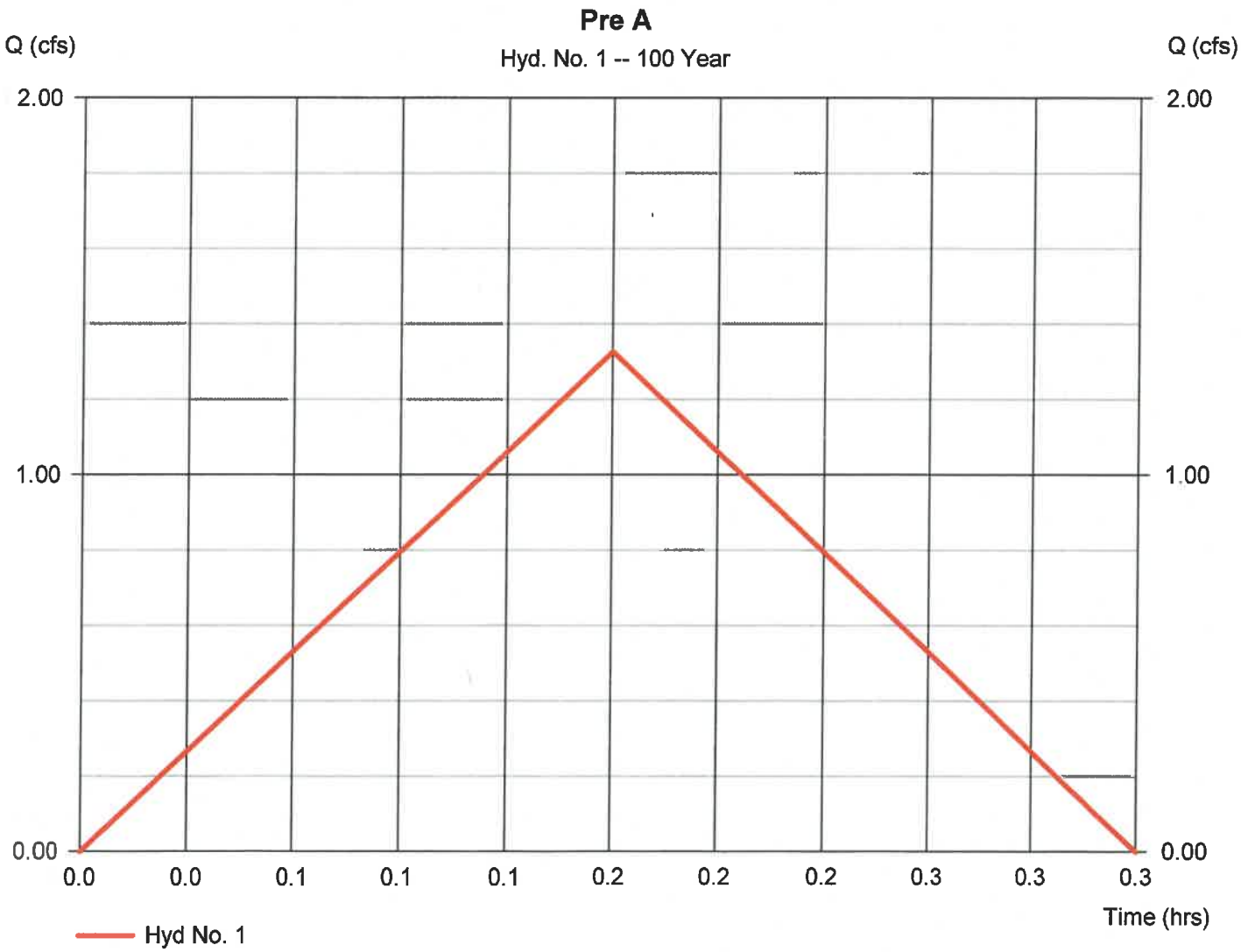
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.327	1	10	796	------	------	------	Pre A
2	Rational	0.493	1	9	266	------	------	------	Pre B
3	Rational	1.989	1	7	836	------	------	------	Post A
4	Reservoir	0.761	1	12	70	3	1042.51	779	Infiltration

Hydrograph Report

Hyd. No. 1

Pre A

Hydrograph type	= Rational	Peak discharge	= 1.327 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 796 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.48
Intensity	= 9.213 in/hr	Tc by User	= 10.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

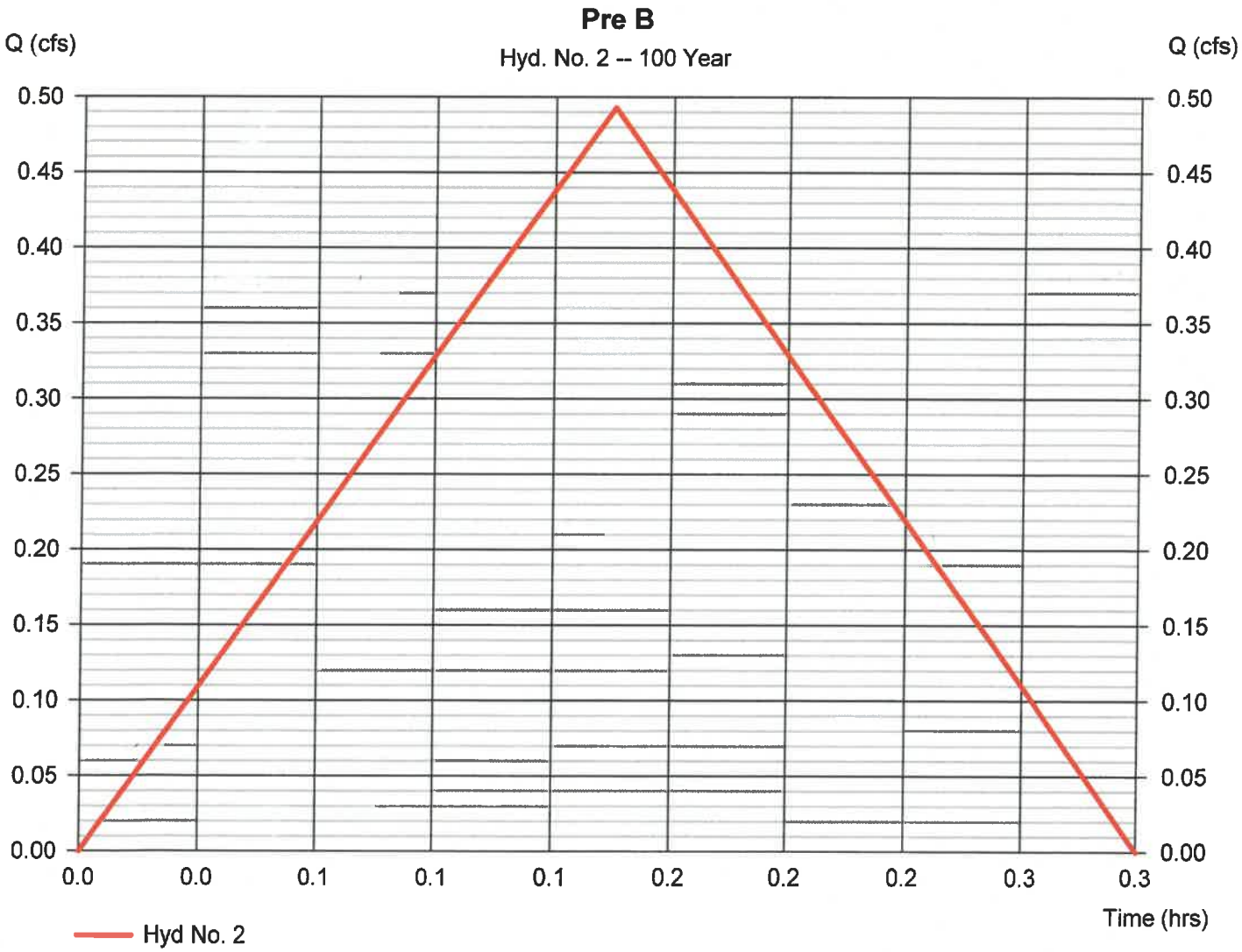


Hydrograph Report

Hyd. No. 2

Pre B

Hydrograph type	= Rational	Peak discharge	= 0.493 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.15 hrs
Time interval	= 1 min	Hyd. volume	= 266 cuft
Drainage area	= 0.140 ac	Runoff coeff.	= 0.37
Intensity	= 9.519 in/hr	Tc by User	= 9.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1

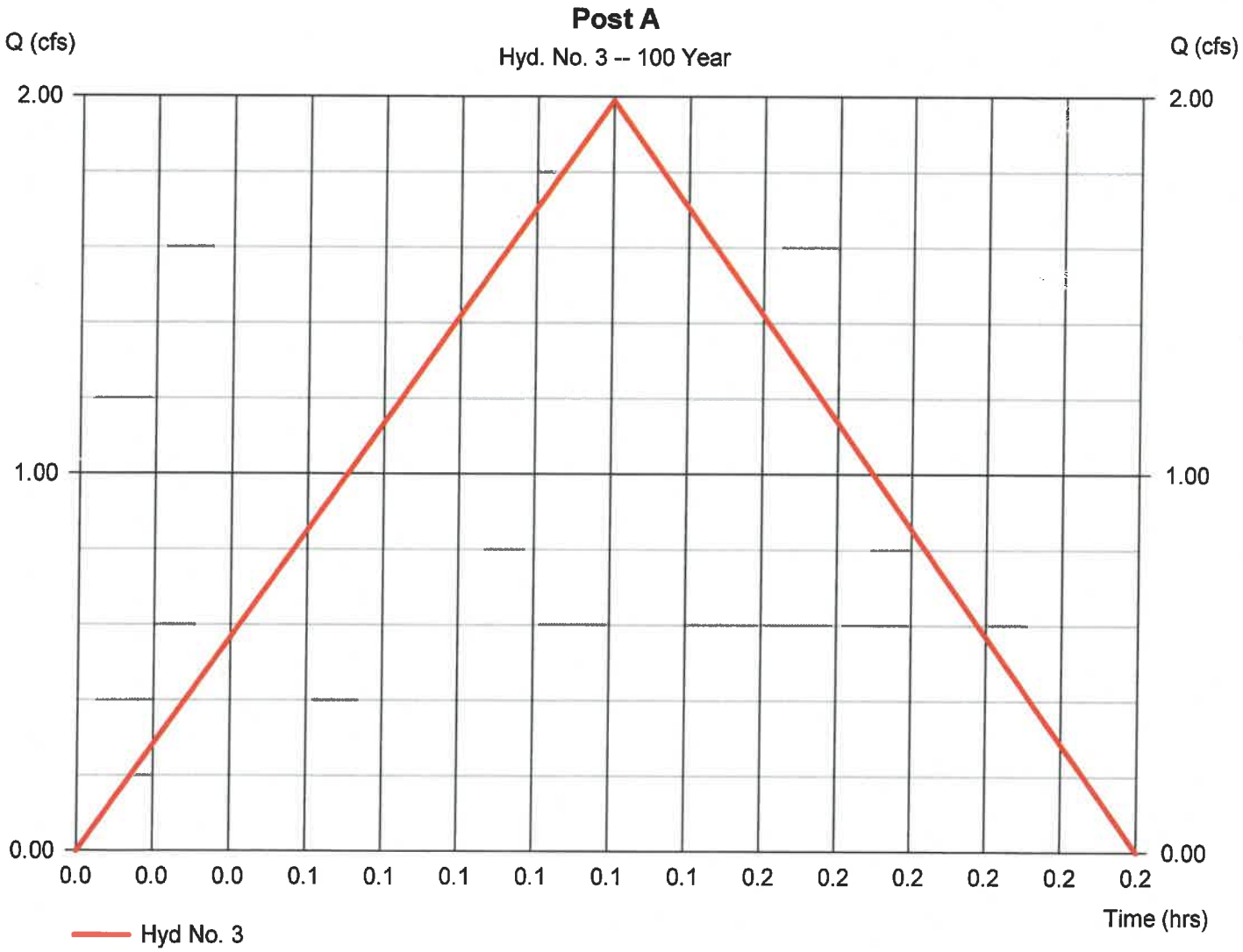


Hydrograph Report

Hyd. No. 3

Post A

Hydrograph type	= Rational	Peak discharge	= 1.989 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.12 hrs
Time interval	= 1 min	Hyd. volume	= 836 cuft
Drainage area	= 0.300 ac	Runoff coeff.	= 0.65
Intensity	= 10.202 in/hr	Tc by User	= 7.00 min
IDF Curve	= KCMO.IDF	Asc/Rec limb fact	= 1/1



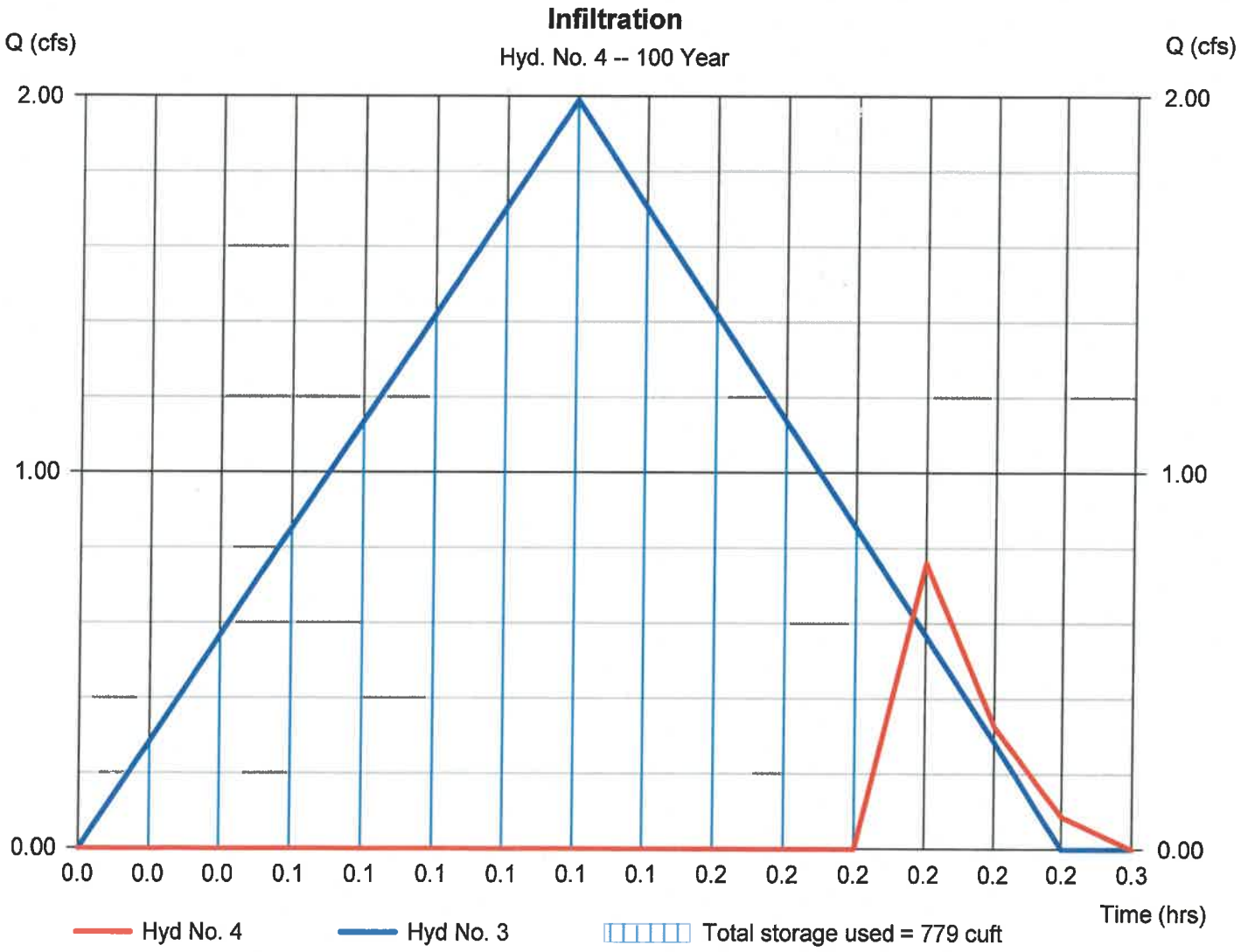
Hydrograph Report

Hyd. No. 4

Infiltration

Hydrograph type	= Reservoir	Peak discharge	= 0.761 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.20 hrs
Time interval	= 1 min	Hyd. volume	= 70 cuft
Inflow hyd. No.	= 3 - Post A	Max. Elevation	= 1042.51 ft
Reservoir name	= Infiltration	Max. Storage	= 779 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	1.37	3.71	0.00	3.30	5.68	6.00	6.80	9.26
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

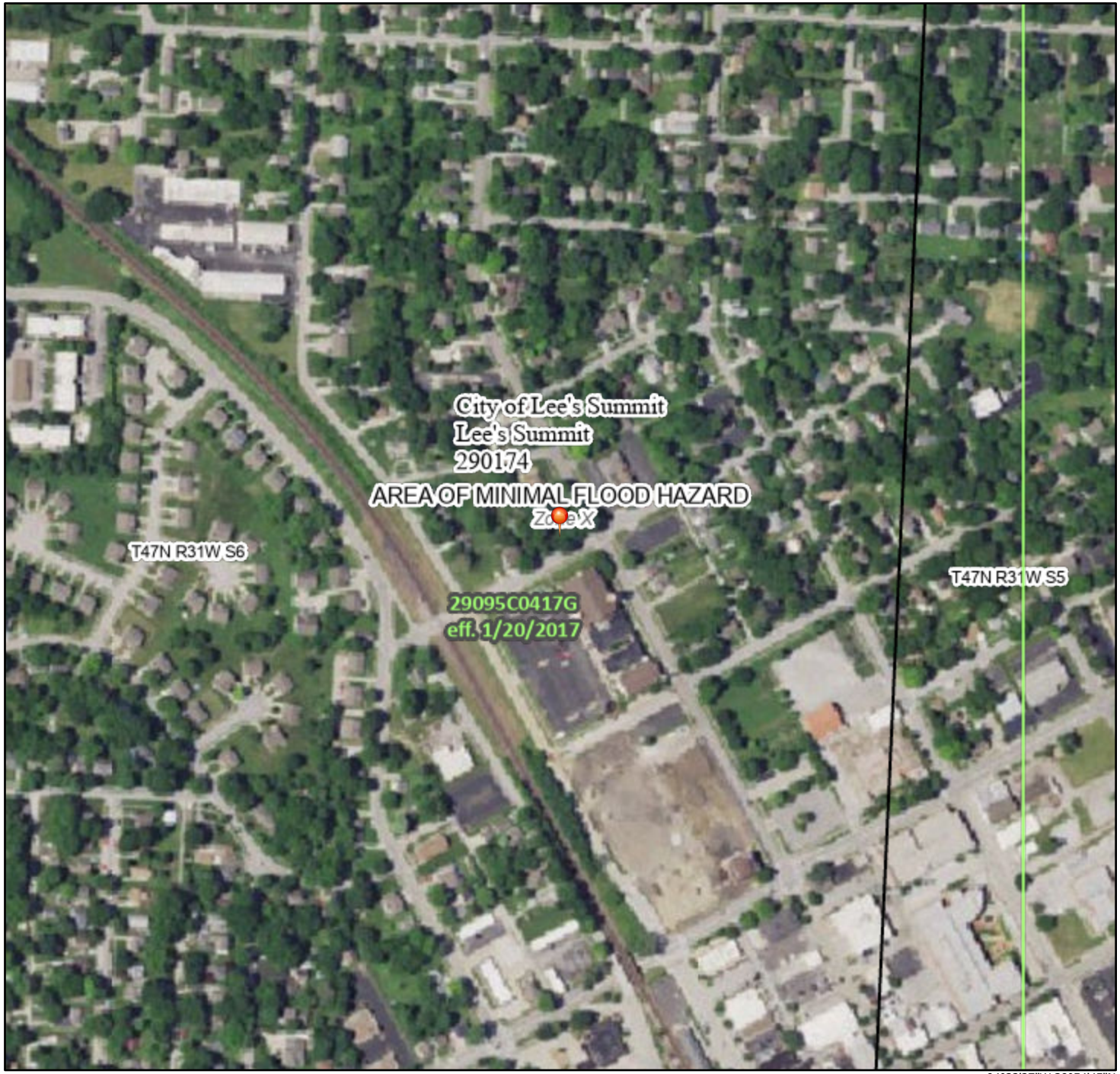
Exhibit C
FEMA FIRMette

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

National Flood Hazard Layer FIRMette

FEMA

94°23'4"W 38°55'13"N



94°22'27"W 38°54'45"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/23/2025 at 9:13 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Exhibit D
Wetland Inventory Map

50 SE 30th Street Lee's Summit, MO 64082
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Exhibit E
Soil Map

50 SE 30th Street Lee's Summit, MO 64082
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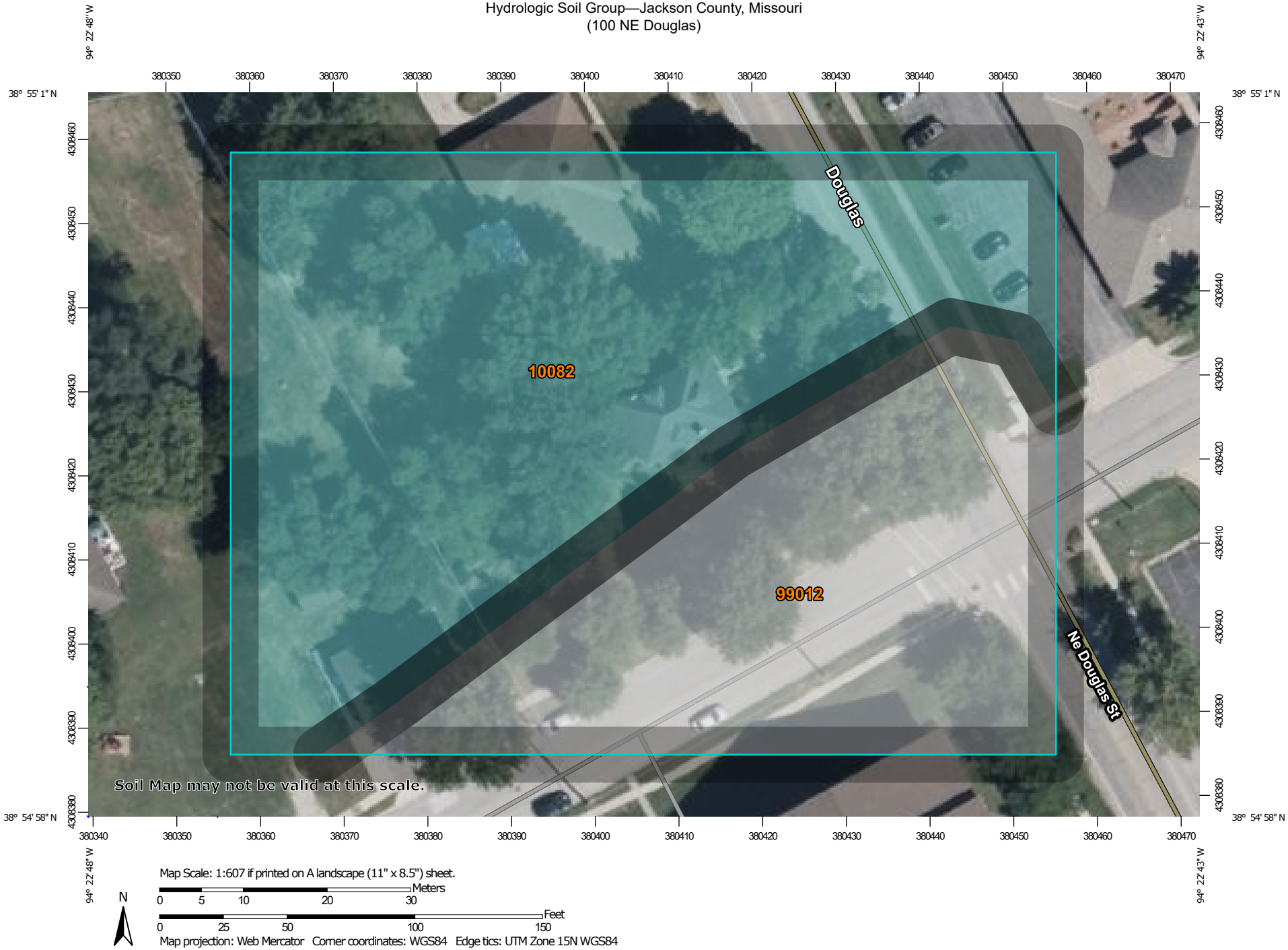
Hydrologic Soil Group—Jackson County, Missouri
(100 NE Douglas)



Map Scale: 1:607 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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 Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 27, Aug 27, 2024

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

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	1.1	63.0%
99012	Urban land, upland, 5 to 9 percent slopes		0.6	37.0%
Totals for Area of Interest			**1.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher