STORM WATER MANAGEMENT FACILITIES REPORT: CALCULATIONS FOR

QuikTrip Store #0662S

955 Bryan Road
O'Fallon, Mo. 63366

PREPARED BY:

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A Zak Company

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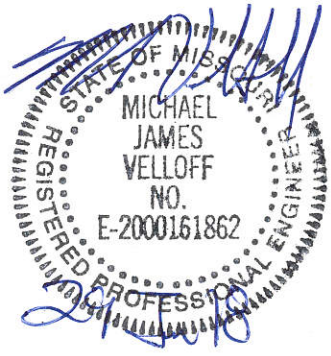
HAI #161105
01/29/18



QuikTrip #662S
955 Bryan Road
Storm Water Management Facilities Report: Calculations

Table of Contents

SECTION 1

Project Site Data Summary

PROJECT SITE DATA:

Location: 955 Bryan Road
O'Fallon, MO 63366

Contact: QuikTrip Corporation, Gwen Keen (Real Estate Project Manager)
2255 Bluestone Drive, St. Charles, Missouri 63303
(636) 627-0003

Locator Number: 2-0057-8997-00-0001.000000000

Area of Parcel: 3.18 acres:

Total Disturbed Area: 3.63 acres

Existing Site: Impervious Area .....1.66 ac. x 3.85 = 6.39 c.f.s.
Pervious Area.....1.52 ac. x 1.87 = 2.84 c.f.s.
Total Existing Runoff .....9.23 c.f.s.

Proposed Site: Impervious Area.....1.62 ac. x 3.85 = 6.24 c.f.s.
Pervious Area .....1.56 ac. x 1.87 = 2.92 c.f.s.
Total Proposed Runoff.....9.16 c.f.s.

Differential Runoff: ..... 9.16 c.f.s. – 9.23 c.f.s. = -0.07 c.f.s.

Watershed: Belleau Creek
Flood Protection (Qp): ..... 15yr./20min. differential runoff = -0.07 c.f.s.

Channel Protection (CPv): .....Overall development is less than 5 acres.

PROJECT DESCRIPTION:

QuikTrip Corporation will tear down their existing facility to construct a 4,840 square convenient store and gas station located at 955 Bryan Road in O'Fallon Missouri. The site generally slopes to Bryan Road and is collected in a piped system. The proposed site drainage will maintain the existing drainage pattern. The site currently has detention pipe installed. The proposed condition will provide detention to the lastest standards in a grass basin. The total disturbed area associated with these improvements will be 3.63 acres. Water quality collected will be addressed for 1.89 acres by the installation of an off-line Contech CDS Water Quality unit.

SECTION 2

Contech CDS Unit
Water Quality calculations

Project Name	QuikTrip#662
Location:	O'Fallon MO
Project No.:	161105
Structure No.	2-11
Prepared For:	QuikTrip Corp
Prepared By:	RKF

Drainage Area	**1.89**	**acre**	Impervious Area	1.53	**acre**
	82,329	ft^2		66,647	ft^2
	1.89	acre		1.53	acre
	0.00295313	mi^2		0.0023906	mi^2

% Impervious	81.0%	% Impervious Over-ride	0

P	1.14	in
Rv	0.779	volumetric runoff coefficient
Qa	0.89	watershed inches
WQV	6,089.4	ft3
	0.140	acre-ft
CN	97.6	
Tc	**5**	min
	0.08	hr

Rainfall Type	**II**	
Potential Abstraction, "S"	0.25	inches
Initial Abstraction, "Ia"	0.05	inches

Treatment System	Vortechs	
Micron Rating	110	
qu	1010.41	
WQF	**2.65**	cfs

SECTION 3

15 Year 20 Minute
Storm Sewer Hydraulics

Hydraflow HGL Computation Procedure

WATER QUALITY PROFILE

General Procedure:

Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

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Col. 16 Cross-sectional area of the flow at the upstream end.

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Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

MSDReport

Line No.	Line ID	Invert Dn (ft)	Invert Up (ft)	Line Size (in)	Line Length (ft)	Line Slope (%)	n-val Pipe	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	HGL Dn (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Hw (ft)	Rim-Hw (ft)	Defl Ang (Deg)	
1	EP2-10toCDS2-11	613.00	613.40	12	26.000	1.54	0.013	2.65	4.42	3.37	616.96	617.10	0.00	621.80	3.83	4.57	-54.348	
2	CDS2-11toMH2-2	613.40	613.63	12	13.000	1.77	0.013	2.65	4.74	3.37	617.23	617.30	621.80	622.25	3.85	4.77	-42.214	

Project File: WQStormSystem1.stm | Number of lines: 2 | Date: 1/26/2018

NOTES: ** Critical depth

MSDReport

Minor Loss (ft)	
0.13	
0.18	

Project File: WQStormSystem1.stm	Number of lines: 2	Date: 1/26/2018

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	12	2.65	613.00	616.96	1.00	0.79	3.37	0.18	617.14	0.554	26.000	613.40	617.10	1.00	0.79	3.37	0.18	617.28	0.554	0.554	0.144	0.72	0.13
2	12	2.65	613.40	617.23	1.00	0.79	3.37	0.18	617.41	0.554	13.000	613.63	617.30	1.00	0.79	3.37	0.18	617.48	0.554	0.554	0.072	1.00	0.18

Project File: WQStormSystem1.stm | Number of lines: 2 | Run Date: 1/26/2018

; c = cir e = ellip b = box

Hydraflow HGL Computation Procedure

General Procedure:

Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

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MSDReport

Line No.	Line ID	Invert Dn (ft)	Invert Up (ft)	Line Size (in)	Line Length (ft)	Line Slope (%)	n-val Pipe	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	HGL Dn (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Hw (ft)	Rim-Hw (ft)	Defl Ang (Deg)	
1	FES1-1toAI1-2	610.00	612.86	15	75.000	3.81	0.013	6.94	12.61	8.40	610.66	613.92	0.00	619.50	1.06	5.58	-47.986	

Project File: 15YrStormSystem1.stm | Number of lines: 1 | Date: 1/26/2018

NOTES: ** Critical depth

MSDReport

Minor Loss (ft)	
n/a	

Project File: 15YrStormSystem1.stm	Number of lines: 1	Date: 1/26/2018

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
(1)	(in) (2)	(cfs) (3)	(ft) (4)	(ft) (5)	(ft) (6)	(sqft) (7)	(ft/s) (8)	(ft) (9)	(ft) (10)	(%) (11)	(ft) (12)	(ft) (13)	(ft) (14)	(ft) (15)	(sqft) (16)	(ft/s) (17)	(ft) (18)	(ft) (19)	(%) (20)	(%) (21)	(ft) (22)	(K) (23)	(ft) (24)
1	15	6.94	610.00	610.66	0.66	0.66	10.52	0.61	611.27	0.000	75.000	612.86	613.92	1.06**	1.11	6.28	0.61	614.53	0.000	0.000	n/a	1.00	n/a

Project File: 15YrStormSystem1.stm | Number of lines: 1 | Run Date: 1/26/2018

Notes: ; ** Critical depth. ; c = cir e = ellip b = box

MSDReport

Line No.	Line ID	Invert Dn (ft)	Invert Up (ft)	Line Size (in)	Line Length (ft)	Line Slope (%)	n-val Pipe	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	HGL Dn (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Hw (ft)	Rim-Hw (ft)	Defl Ang (Deg)	
1	EP2-1toMH2-2	613.00	614.95	15	33.000	5.91	0.013	6.49	15.70	5.29	616.64	616.97	0.00	622.25	2.45	4.85	-55.044	
2	MH2-2toCI2-3	613.83	614.06	15	23.000	1.00	0.013	2.59	6.46	2.11	617.40	617.44	622.25	621.82	3.44	4.32	38.800	
3	CI2-3toCI2-4	614.26	618.02	15	85.000	4.42	0.013	1.88	13.58	2.60	617.50	618.57 j	621.82	622.00	0.55	3.43	-35.725	
4	MH2-2toCI2-5	613.83	615.37	15	154.000	1.00	0.013	3.40	6.46	2.77	617.40	617.83	622.25	623.00	2.61	5.02	-76.525	
5	CI2-5toCI2-6	615.57	616.79	15	122.000	1.00	0.013	2.02	6.46	1.65	617.98	618.10	623.00	623.75	1.36	5.60	56.805	
6	CI2-6toCI2-7	616.99	618.67	15	168.000	1.00	0.013	1.05	6.46	1.98	618.15	619.07 j	623.75	622.85	0.40	3.78	49.794	
7	CI2-6toCI2-8	616.99	617.62	15	63.000	1.00	0.013	0.42	6.46	1.37	618.15	617.87	623.75	624.05	0.25	6.18	-45.143	

Project File: 15YrStormSystem2.stm | Number of lines: 7 | Date: 1/26/2018

NOTES: ** Critical depth

MSDReport

Minor Loss (ft)	
0.43	
0.07	
n/a	
0.16	
0.05	
n/a	
n/a	

Project File: 15YrStormSystem2.stm	Number of lines: 7	Date: 1/26/2018

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	15	6.49	613.00	616.64	1.25	1.23	5.29	0.43	617.08	1.011	33.000	614.95	616.97	1.25	1.23	5.29	0.43	617.41	1.010	1.010	0.333	0.98	0.43
2	15	2.59	613.83	617.40	1.25	1.23	2.11	0.07	617.47	0.161	23.000	614.06	617.44	1.25	1.23	2.11	0.07	617.51	0.161	0.161	0.037	0.95	0.07
3	15	1.88	614.26	617.50	1.25	0.51	1.53	0.04	617.54	0.085	85.000	618.02	618.57 j	0.55**	0.51	3.66	0.21	618.77	0.547	0.316	n/a	1.00	0.21
4	15	3.40	613.83	617.40	1.25	1.23	2.77	0.12	617.52	0.277	154.000	615.37	617.83	1.25	1.23	2.77	0.12	617.95	0.277	0.277	0.427	1.30	0.16
5	15	2.02	615.57	617.98	1.25	1.23	1.65	0.04	618.02	0.098	122.000	616.79	618.10	1.25	1.23	1.65	0.04	618.14	0.098	0.098	0.119	1.20	0.05
6	15	1.05	616.99	618.15	1.16	0.34	0.88	0.15	618.30	0.000	168.000	618.67	619.07 j	0.40**	0.34	3.07	0.15	619.22	0.000	0.000	n/a	1.00	n/a
7	15	0.42	616.99	618.15	1.16	0.18	0.35	0.09	618.24	0.000	63.000	617.62	617.87	0.25**	0.18	2.38	0.09	617.96	0.000	0.000	n/a	1.00	n/a

Project File: 15YrStormSystem2.stm | Number of lines: 7 | Run Date: 1/26/2018

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

SECTION 4

100 Year 20 Minute
Storm Sewer Hydraulics

Hydraflow HGL Computation Procedure

General Procedure:

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Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

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Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

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Col. 13 The elevation of the upstream invert.

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MSDReport

Line No.	Line ID	Invert Dn (ft)	Invert Up (ft)	Line Size (in)	Line Length (ft)	Line Slope (%)	n-val Pipe	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	HGL Dn (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Hw (ft)	Rim-Hw (ft)	Defl Ang (Deg)	
1	FES1-1toAI1-2	610.00	612.86	15	75.000	3.81	0.013	10.99	12.61	10.32	610.90	614.06	0.00	619.50	1.20	5.44	-47.986	

Project File: 100YrStormSystem1.stm | Number of lines: 1 | Date: 1/26/2018

NOTES: ** Critical depth

MSDReport

Minor Loss (ft)	
n/a	

Project File: 100YrStormSystem1.stm	Number of lines: 1	Date: 1/26/2018

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	15	10.99	610.00	610.90	0.90	0.95	11.58	1.28	612.18	0.000	75.000	612.86	614.06	1.20**	1.21	9.07	1.28	615.34	0.000	0.000	n/a	1.00	n/a

Project File: 100YrStormSystem1.stm | Number of lines: 1 | Run Date: 1/26/2018

Notes: ; ** Critical depth. ; c = cir e = ellip b = box

MSDReport

Line No.	Line ID	Invert Dn (ft)	Invert Up (ft)	Line Size (in)	Line Length (ft)	Line Slope (%)	n-val Pipe	Flow Rate (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	HGL Dn (ft)	HGL Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Hw (ft)	Rim-Hw (ft)	Defl Ang (Deg)	
1	EP2-1toMH2-2	613.00	614.95	15	33.000	5.91	0.013	10.28	15.70	8.38	616.64	617.48	0.00	622.25	3.60	3.70	-55.044	
2	MH2-2toCI2-3	613.83	614.06	15	23.000	1.00	0.013	4.09	6.46	3.33	618.55	618.64	622.25	621.82	4.74	3.02	38.800	
3	CI2-3toCI2-4	614.26	618.02	15	85.000	4.42	0.013	2.97	13.58	2.72	618.80	618.95	621.82	622.00	1.07	2.91	-35.725	
4	MH2-2toCI2-5	613.83	615.37	15	154.000	1.00	0.013	5.40	6.46	4.40	618.55	619.62	622.25	623.00	4.64	2.99	-76.525	
5	CI2-5toCI2-6	615.57	616.79	15	122.000	1.00	0.013	3.21	6.46	2.62	620.01	620.32	623.00	623.75	3.65	3.31	56.805	
6	CI2-6toCI2-7	616.99	618.67	15	168.000	1.00	0.013	1.66	6.46	1.35	620.44	620.56	623.75	622.85	1.91	2.27	49.794	
7	CI2-6toCI2-8	616.99	617.62	15	63.000	1.00	0.013	0.67	6.46	0.55	620.44	620.45	623.75	624.05	2.84	3.59	-45.143	

Project File: 100YrStormSystem2.stm | Number of lines: 7 | Date: 1/26/2018

NOTES: ** Critical depth

MSDReport

Minor Loss (ft)	
1.07	
0.16	
0.14	
0.39	
0.13	
0.03	
0.00	

Project File: 100YrStormSystem2.stm	Number of lines: 7	Date: 1/26/2018

NOTES: ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
(1)	(in) (2)	(cfs) (3)	(ft) (4)	(ft) (5)	(ft) (6)	(sqft) (7)	(ft/s) (8)	(ft) (9)	(ft) (10)	(%) (11)	(ft) (12)	(ft) (13)	(ft) (14)	(ft) (15)	(sqft) (16)	(ft/s) (17)	(ft) (18)	(ft) (19)	(%) (20)	(%) (21)	(ft) (22)	(K) (23)	(ft) (24)
1	15	10.28	613.00	616.64	1.25	1.23	8.38	1.09	617.73	2.535	33.000	614.95	617.48	1.25	1.23	8.38	1.09	618.57	2.534	2.535	0.837	0.98	1.07
2	15	4.09	613.83	618.55	1.25	1.23	3.33	0.17	618.72	0.401	23.000	614.06	618.64	1.25	1.23	3.33	0.17	618.81	0.401	0.401	0.092	0.95	0.16
3	15	2.97	614.26	618.80	1.25	1.23	2.42	0.09	618.89	0.212	85.000	618.02	618.95	0.93	0.98	3.03	0.14	619.09	0.258	0.235	0.200	1.00	0.14
4	15	5.40	613.83	618.55	1.25	1.23	4.40	0.30	618.85	0.700	154.000	615.37	619.62	1.25	1.23	4.40	0.30	619.92	0.699	0.699	1.077	1.30	0.39
5	15	3.21	615.57	620.01	1.25	1.23	2.62	0.11	620.12	0.247	122.000	616.79	620.32	1.25	1.23	2.62	0.11	620.42	0.247	0.247	0.302	1.20	0.13
6	15	1.66	616.99	620.44	1.25	1.23	1.35	0.03	620.47	0.066	168.000	618.67	620.56	1.25	1.23	1.35	0.03	620.58	0.066	0.066	0.111	1.00	0.03
7	15	0.67	616.99	620.44	1.25	1.23	0.55	0.00	620.45	0.011	63.000	617.62	620.45	1.25	1.23	0.55	0.00	620.46	0.011	0.011	0.007	1.00	0.00

Project File: 100YrStormSystem2.stm | Number of lines: 7 | Run Date: 1/26/2018

; c = cir e = ellip b = box

SECTION 5

Inlet Capacity Calculations

Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Area Inlet 1-2

Drop Curb Inlet

Location	= Sag
Curb Length (ft)	= 11.67
Throat Height (in)	= 0.50
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

Slope, Sw (ft/ft)	= 0.330
Slope, Sx (ft/ft)	= 0.330
Local Depr (in)	= -0-
Gutter Width (ft)	= -0-
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

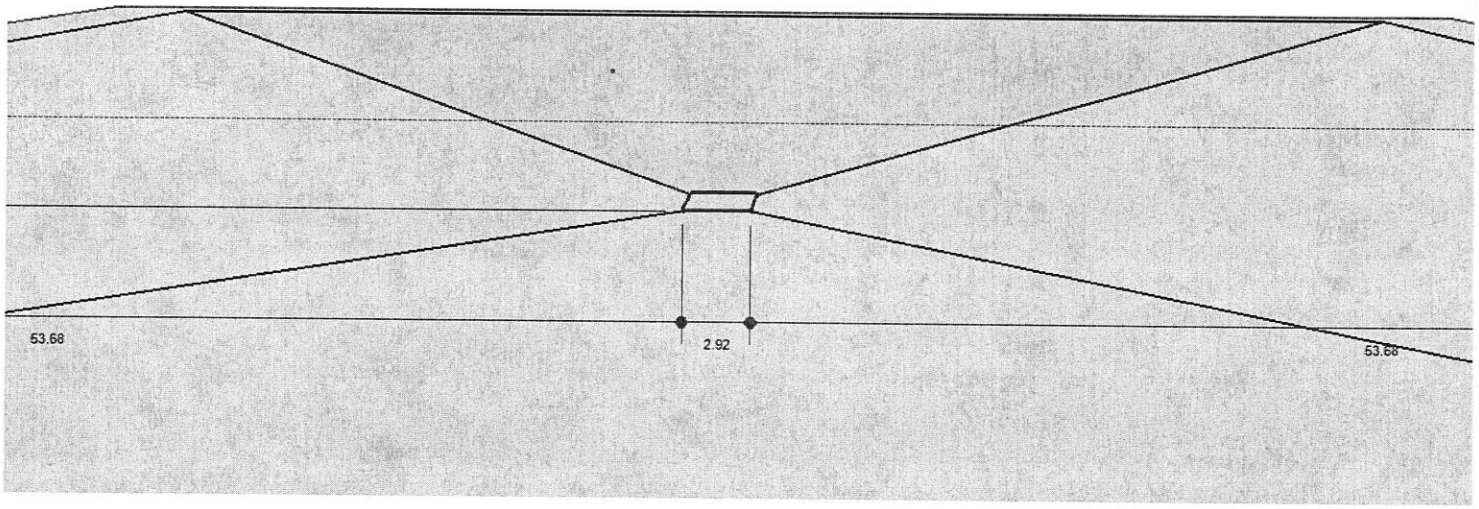
Calculations

Compute by:	Known Q
Q (cfs)	= 10.99

Highlighted

Q Total (cfs)	= 10.99
Q Capt (cfs)	= 10.99
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 212.56
Efficiency (%)	= 100
Gutter Spread (ft)	= 53.68
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-3

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

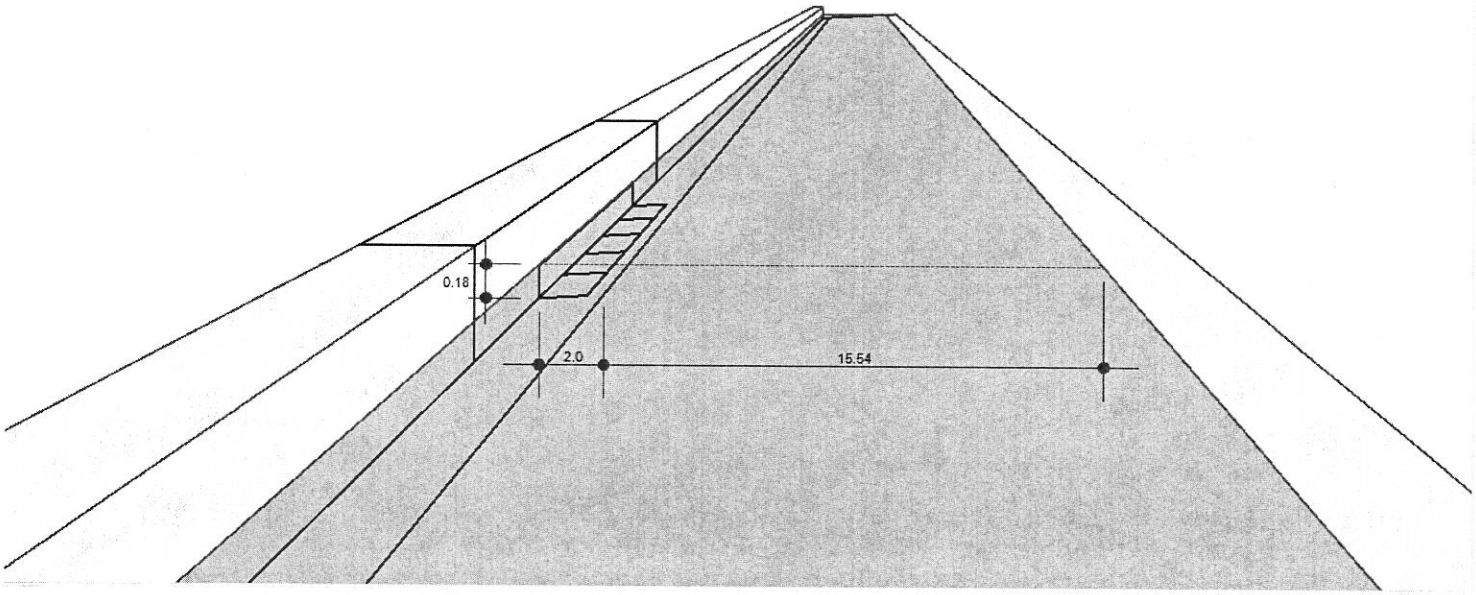
Calculations

Compute by:	Known Q
Q (cfs)	= 1.12

Highlighted

Q Total (cfs)	= 1.12
Q Capt (cfs)	= 1.12
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.10
Efficiency (%)	= 100
Gutter Spread (ft)	= 17.54
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-4

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

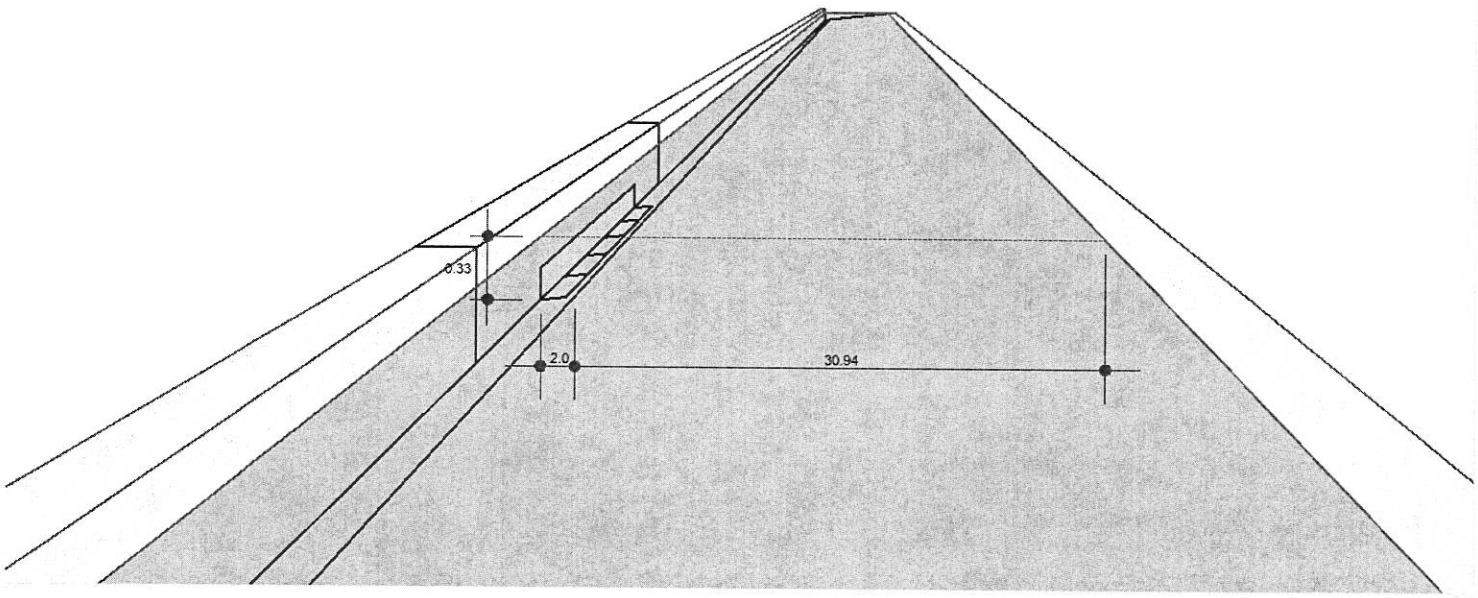
Calculations

Compute by:	Known Q
Q (cfs)	= 2.97

Highlighted

Q Total (cfs)	= 2.97
Q Capt (cfs)	= 2.97
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 3.95
Efficiency (%)	= 100
Gutter Spread (ft)	= 32.94
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-5

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

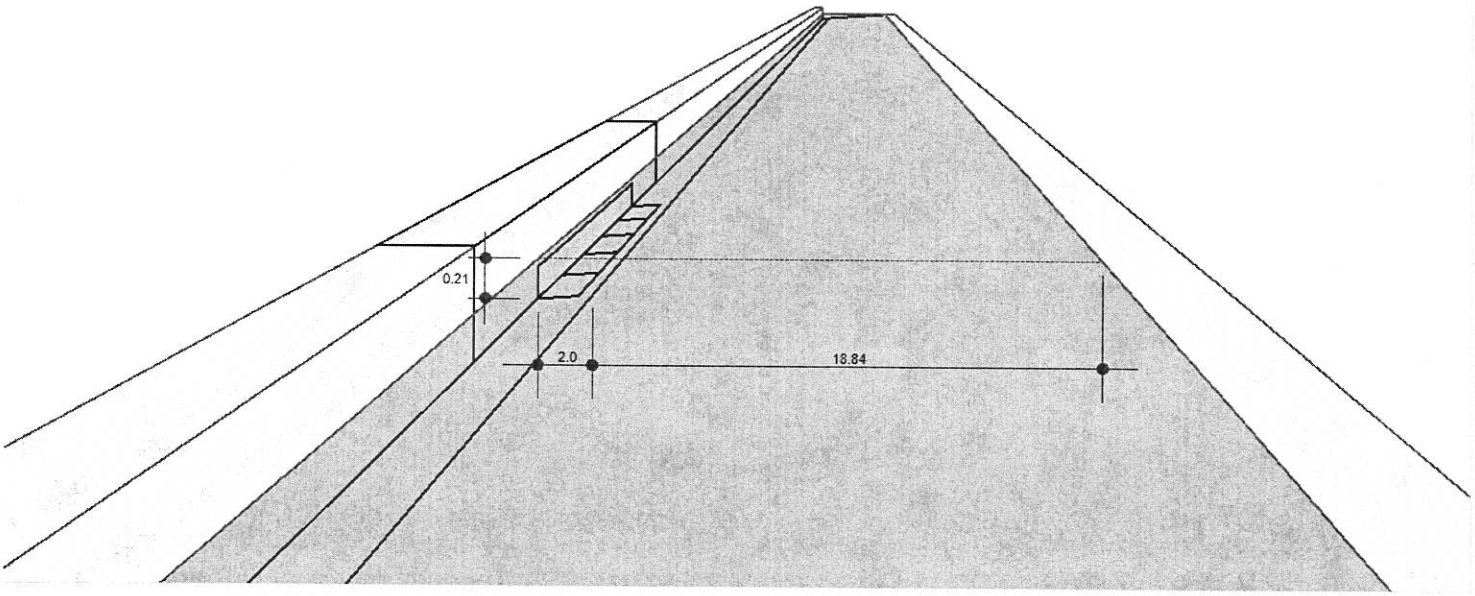
Calculations

Compute by:	Known Q
Q (cfs)	= 1.46

Highlighted

Q Total (cfs)	= 1.46
Q Capt (cfs)	= 1.46
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.50
Efficiency (%)	= 100
Gutter Spread (ft)	= 20.84
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-6

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

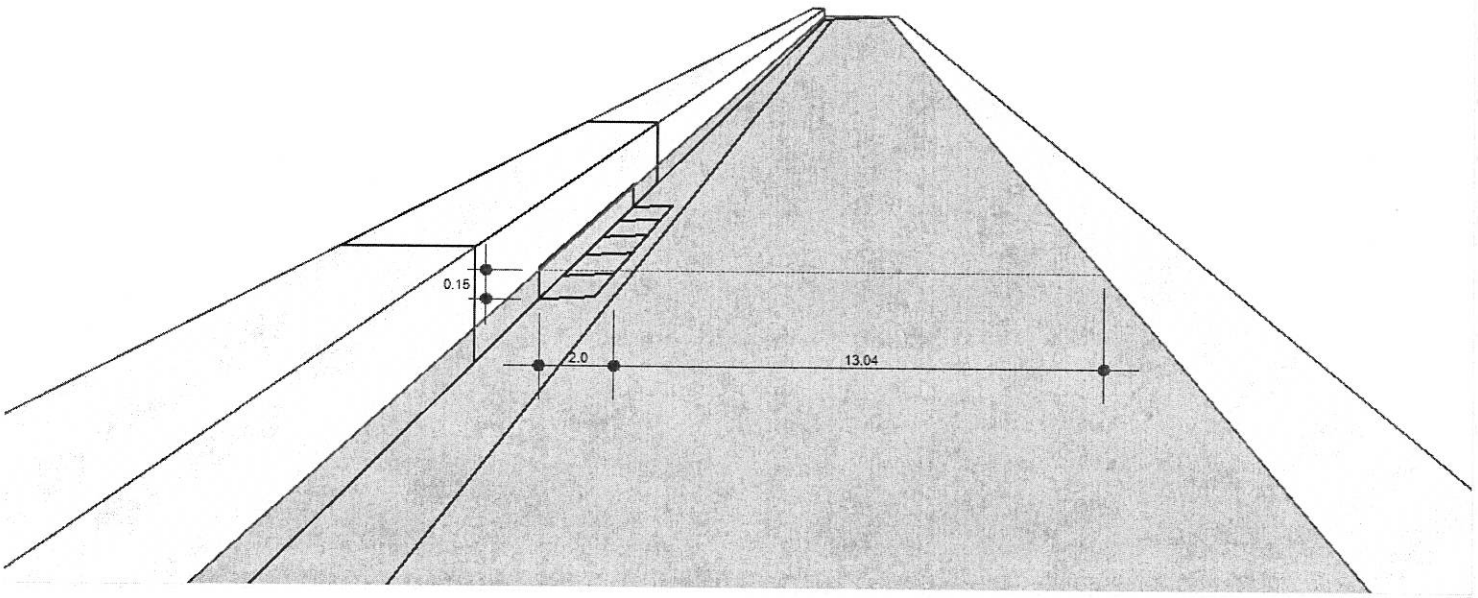
Calculations

Compute by:	Known Q
Q (cfs)	= 0.88

Highlighted

Q Total (cfs)	= 0.88
Q Capt (cfs)	= 0.88
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 1.80
Efficiency (%)	= 100
Gutter Spread (ft)	= 15.04
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-7

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

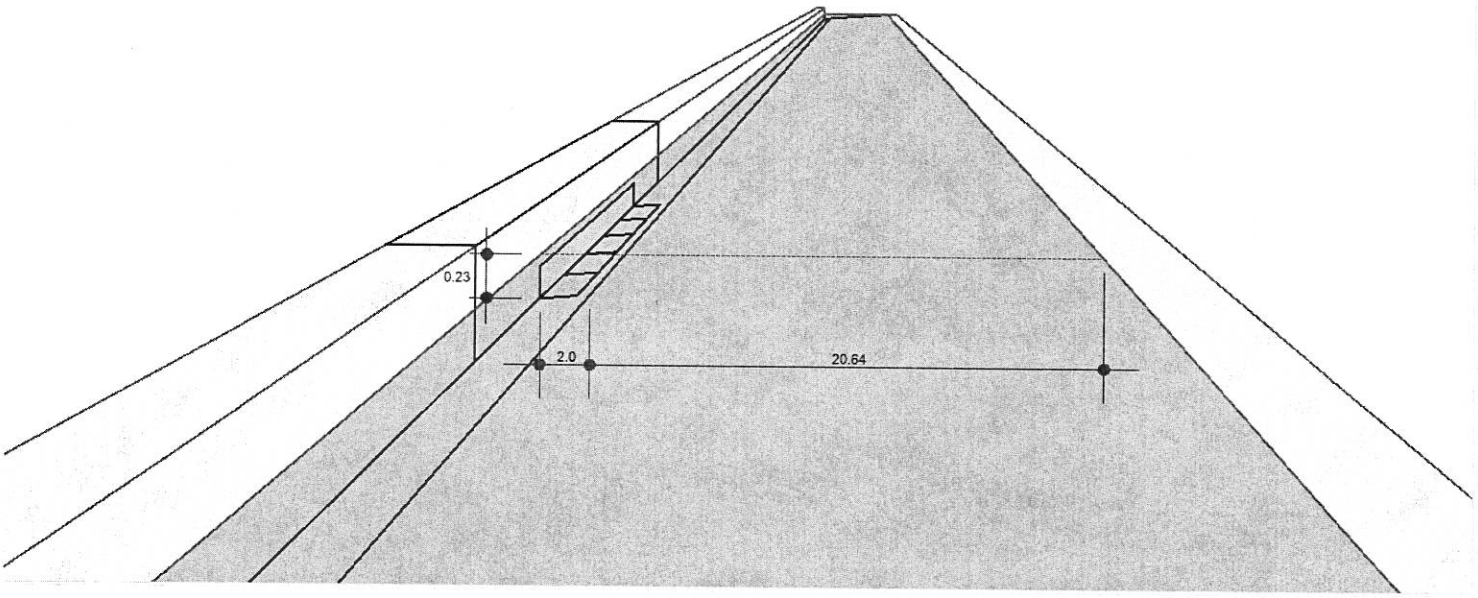
Calculations

Compute by:	Known Q
Q (cfs)	= 1.67

Highlighted

Q Total (cfs)	= 1.67
Q Capt (cfs)	= 1.67
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.72
Efficiency (%)	= 100
Gutter Spread (ft)	= 22.64
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 26 2018

Single Combo Curb Inlet 2-8

Combination Inlet

Location	= Sag
Curb Length (ft)	= 2.48
Throat Height (in)	= 0.44
Grate Area (sqft)	= 1.50
Grate Width (ft)	= 1.48
Grate Length (ft)	= 2.48

Gutter

Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= -0-
Gutter Width (ft)	= 2.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

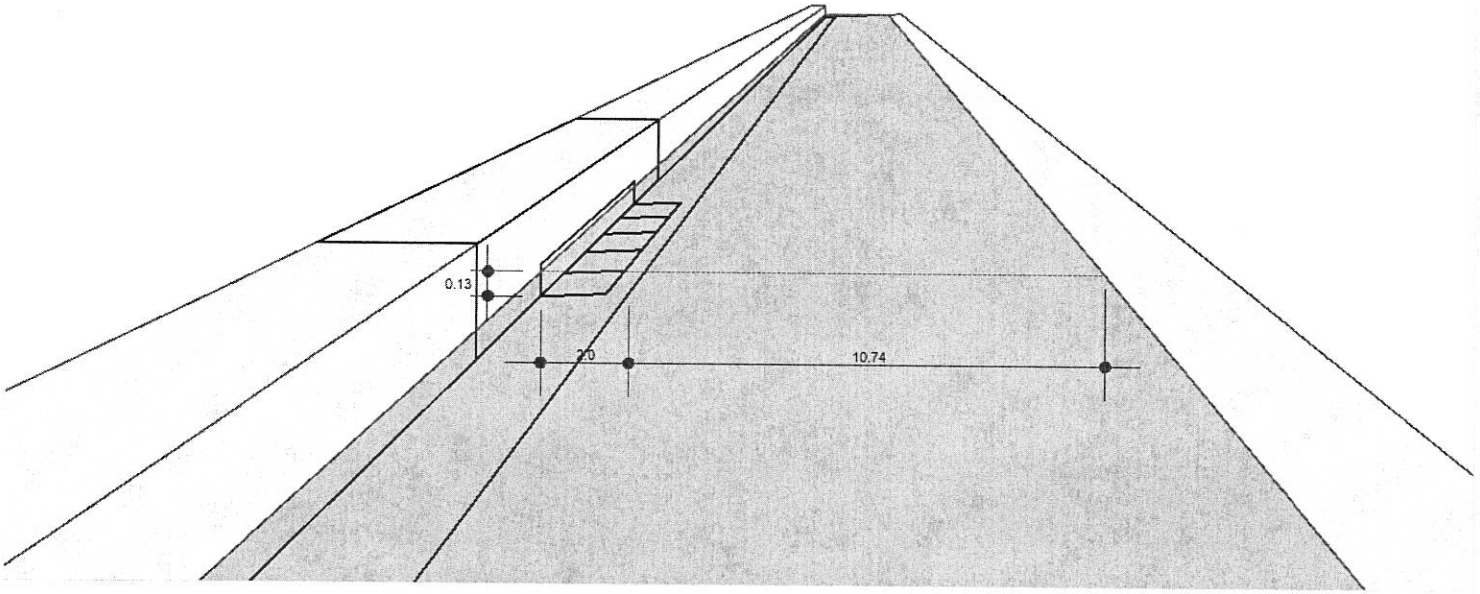
Calculations

Compute by:	Known Q
Q (cfs)	= 0.67

Highlighted

Q Total (cfs)	= 0.67
Q Capt (cfs)	= 0.67
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 1.53
Efficiency (%)	= 100
Gutter Spread (ft)	= 12.74
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



SECTION 6

Flow Splitter Calculations

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jan 15 2018

Flow Splitter MH#2-2

Invert Elev Dn (ft)	= 613.40
Pipe Length (ft)	= 13.00
Slope (%)	= 1.77
Invert Elev Up (ft)	= 613.63
Rise (in)	= 12.0
Shape	= Circular
Span (in)	= 12.0
No. Barrels	= 1
n-Value	= 0.013
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

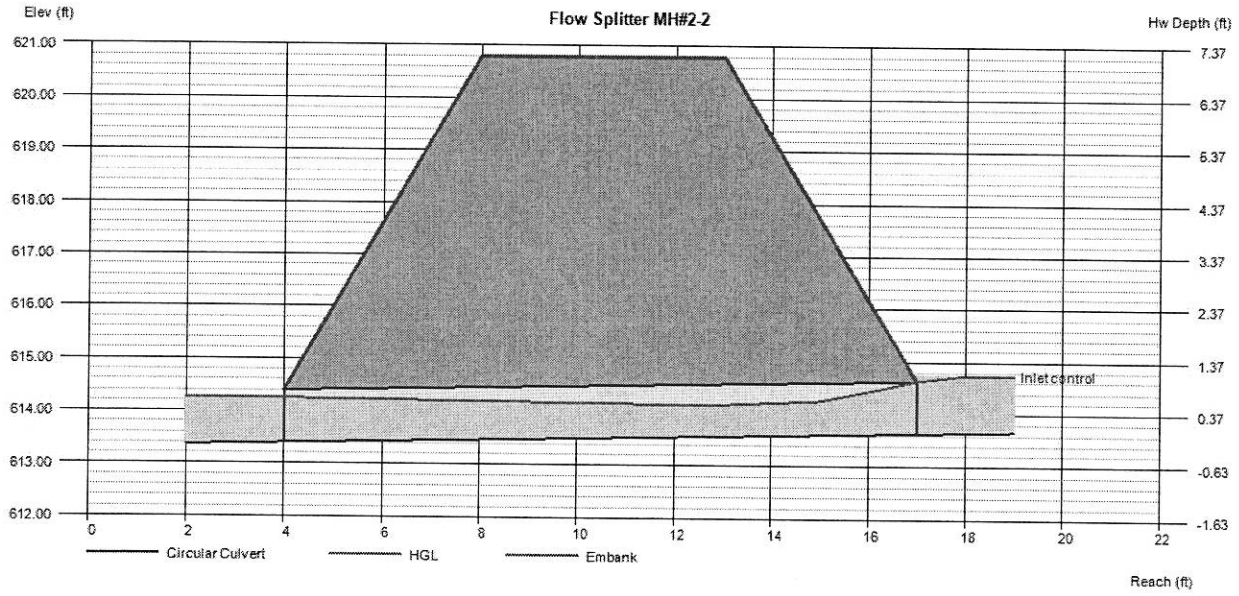
Top Elevation (ft)	= 620.80
Top Width (ft)	= 5.00
Crest Width (ft)	= 0.00

Calculations

Qmin (cfs)	= 2.65
Qmax (cfs)	= 2.65
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 2.65
Qpipe (cfs)	= 2.65
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 3.73
Veloc Up (ft/s)	= 4.53
HGL Dn (ft)	= 614.25
HGL Up (ft)	= 614.33
Hw Elev (ft)	= 614.75
Hw/D (ft)	= 1.12
Flow Regime	= Inlet Control



SECTION 7

Flood Protection Calculations

HEIDEMAN | ASSOCIATES, INC.
A Zak Company
240 Larkin Williams Industrial Court | Fenton, Missouri 63026 > p 636.492.3200 > f 636.492.3202

QUIKTRIP #662 - DETENTION SUMMARY

The existing site is comprised of a commercial lot consisting of an existing QuikTrip convenient store/gas station. The site is abutted by Bryan Road to the South, and Veterans Memorial Parkway to the North. QuikTrip will demolish the building and parking facilities to construct a new gas station/convenient store. Existing soils comprise of 60124 urban land harvester complex with a hydrologic classification of "C".

Total Site Area = 3.18 acres. Tributary area to detention = 2.15 acres. Remaining 1.03 acres as bypass. The site currently has an underground detention pipe. The developed condition provides detention in an open grass basin. Water Quality is also provided with the use of a hydrodynamic separator unit installed upstream of the detention basin.

EXISTING CONDITIONS AND ALLOWABLE RELEASE RATES
2 Year – 4.84 cfs
10 Year – 10.33 cfs
25 Year – 13.56 cfs
100 Year – 16.91 cfs

PROPOSED CONDITIONS
INFLOW (DETAINED)
A = 2.15 acres
CN = 91
Tc = 6.8 min.
Impervious area = 1.53 acres
Pervious area = 0.62 acres
Q2 = 7.20 cfs
Q10 = 11.64 cfs
Q25 = 13.99 cfs
Q100 = 16.32 cfs

OPEN BASIN (Top Elev. 621.00, Spillway Elev. 620.00)
OUTFLOW: Q2 = 1.78 cfs @ 615.34 and 5,805 cu.ft.
Q10 = 6.35 cfs @ 616.10 and 8,404 cu.ft.
Q25 = 8.17 cfs @ 616.38 and 9,599 cu.ft.
Q100 = 9.08 cfs @ 616.72 and 10,978 cu.ft.

LOW FLOW BLOCKED: Q100 = 9.79 cfs @ 617.12 and 12,764 cu.ft.

BYPASS
A = 1.03 acres @ CN 77
Tc = 2.7 min., Use 5 min.
Impervious area = 0.11 acres
Pervious area = 0.92 acres
Q2 = 2.00 cfs
Q10 = 3.98 cfs
Q25 = 5.12 cfs
Q100 = 6.29 cfs

HEIDEMAN | ASSOCIATES, INC.
A Zak Company
240 Larkin Williams Industrial Court | Fenton, Missouri 63026 > p 636.492.3200 > f 636.492.3202

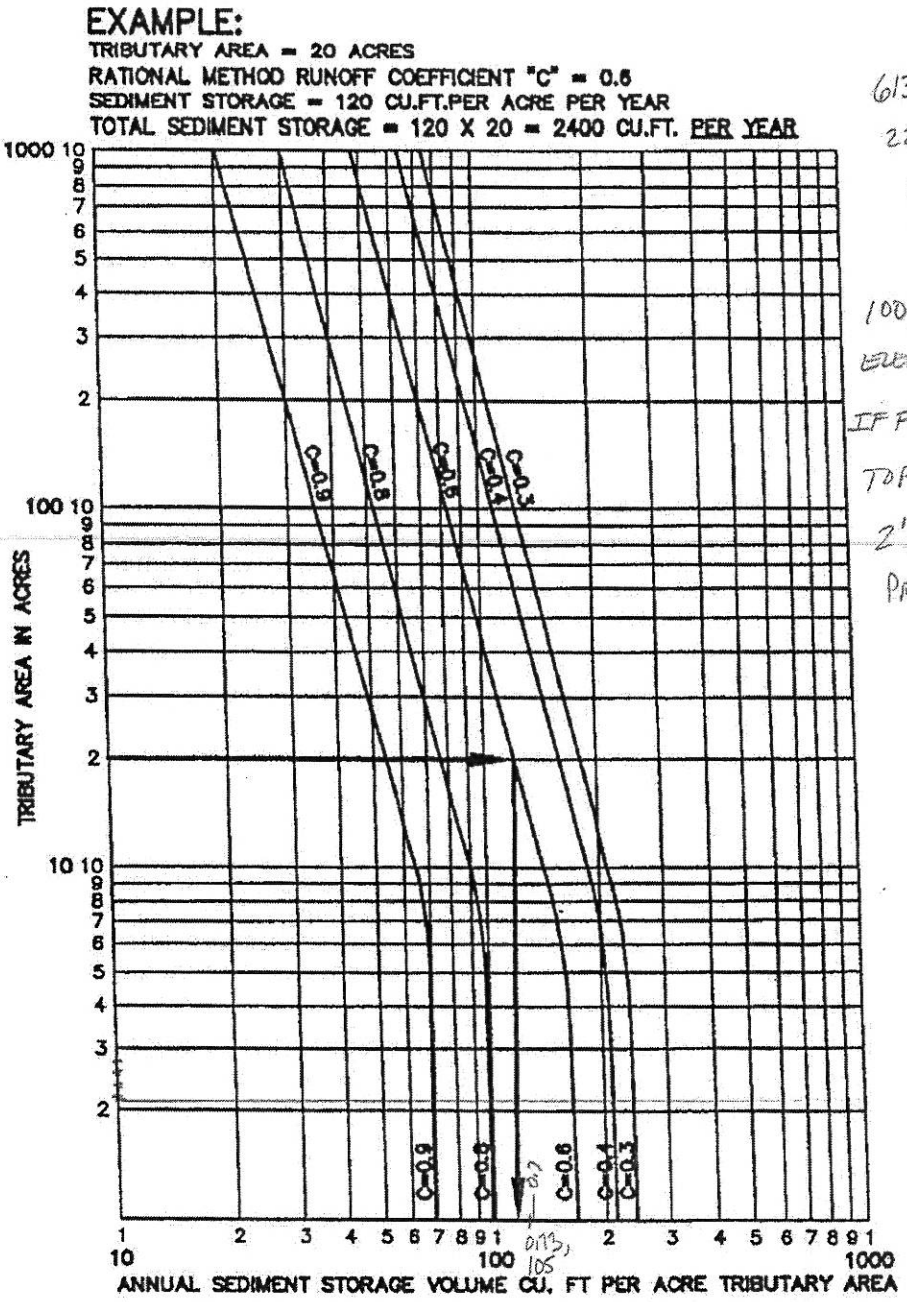
TOTAL OUTFLOW FROM SITE WITH BYPASS ADDED
Q2 = 3.43 cfs
Q10 = 7.81 cfs
Q25 = 11.06 cfs
Q100 = 13.58 cfs

All storm events release less water than controlled release rates, okay.

TRIBUTARY = 2.15 Ac.
IMPERVIOUS = 1.53 X 0.90 = 1.38
PERVIOUS = 0.62 Ac. X 0.30 = 0.19
1.57 CFS
C = 1.57 / 2.15 Ac. = 0.73.

TOTAL STORAGE = 2.15 X 105 = 225.75 CU.FT. PER YEAR

FIGURE #1



613 CONTOUR AREA = 1314 SF
225.75 / 1314 = 0.17' DEPTH OR ABOUT 2" IN PONDING DEPTH.

100 YEAR LOW FLOW BLOCKED ELEVATION = 617.12'

IF FULL, 617.12 + 0.17' = 617.29

TOP OF BERM = 621.00

2' PLUS OF FREEBOARD PROVIDED.

ANNUAL SEDIMENT STORAGE

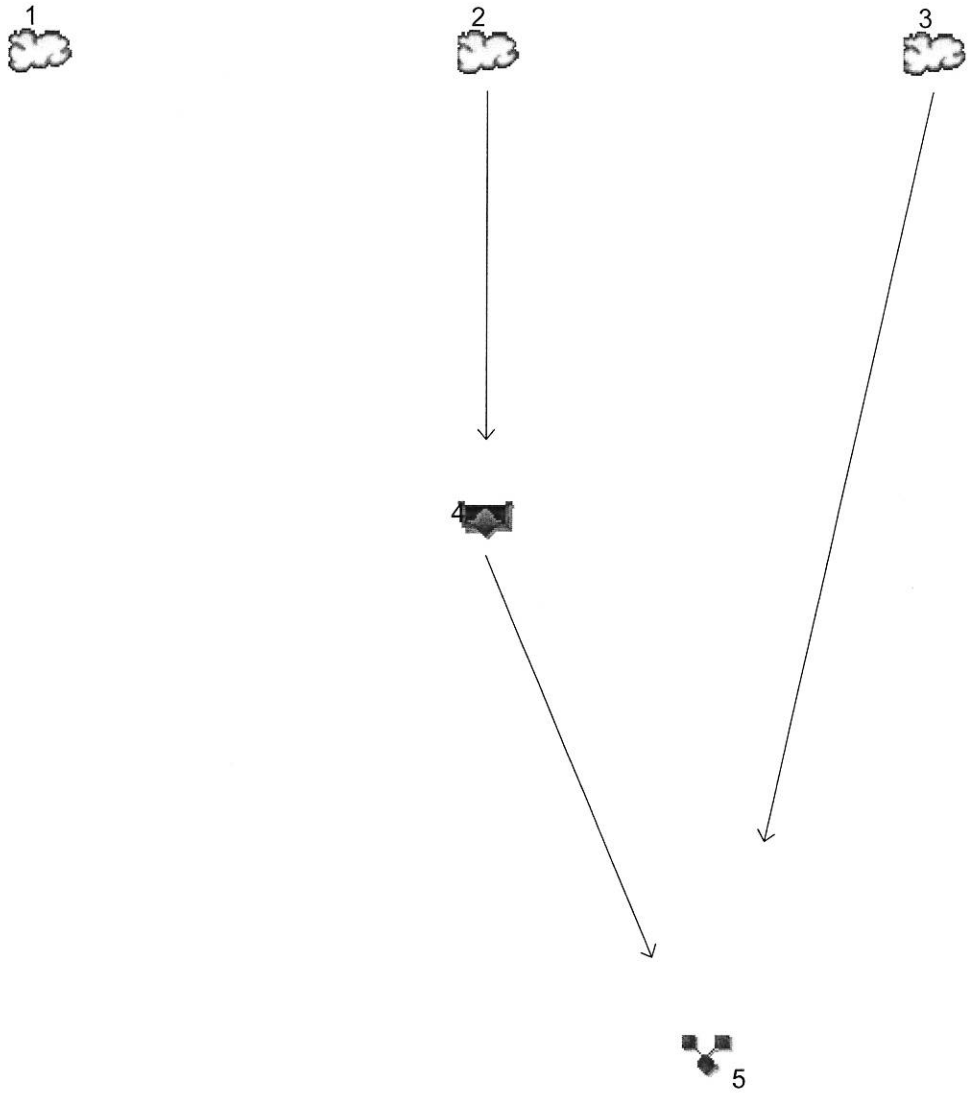
Hydraflow Table of Contents

662 Detention Model.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

Friday, 01 / 26 / 2018

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Existing Conditions (Back to grass)
2	SCS Runoff	Proposed Detained
3	SCS Runoff	Bypass Area
4	Reservoir	Detention Pond
5	Combine	Adding Bypass

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	SCS Runoff	------	-------	4.835	-------	-------	10.33	13.56	-------	16.91	Existing Conditions (Back to grass)
2	SCS Runoff	------	-------	7.200	-------	-------	11.64	13.99	-------	16.32	Proposed Detained
3	SCS Runoff	------	-------	2.000	-------	-------	3.978	5.121	-------	6.287	Bypass Area
4	Reservoir	2	-------	1.787	-------	-------	6.350	8.173	-------	9.076	Detention Pond
5	Combine	3, 4	-------	3.428	-------	-------	7.812	11.06	-------	13.58	Adding Bypass

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

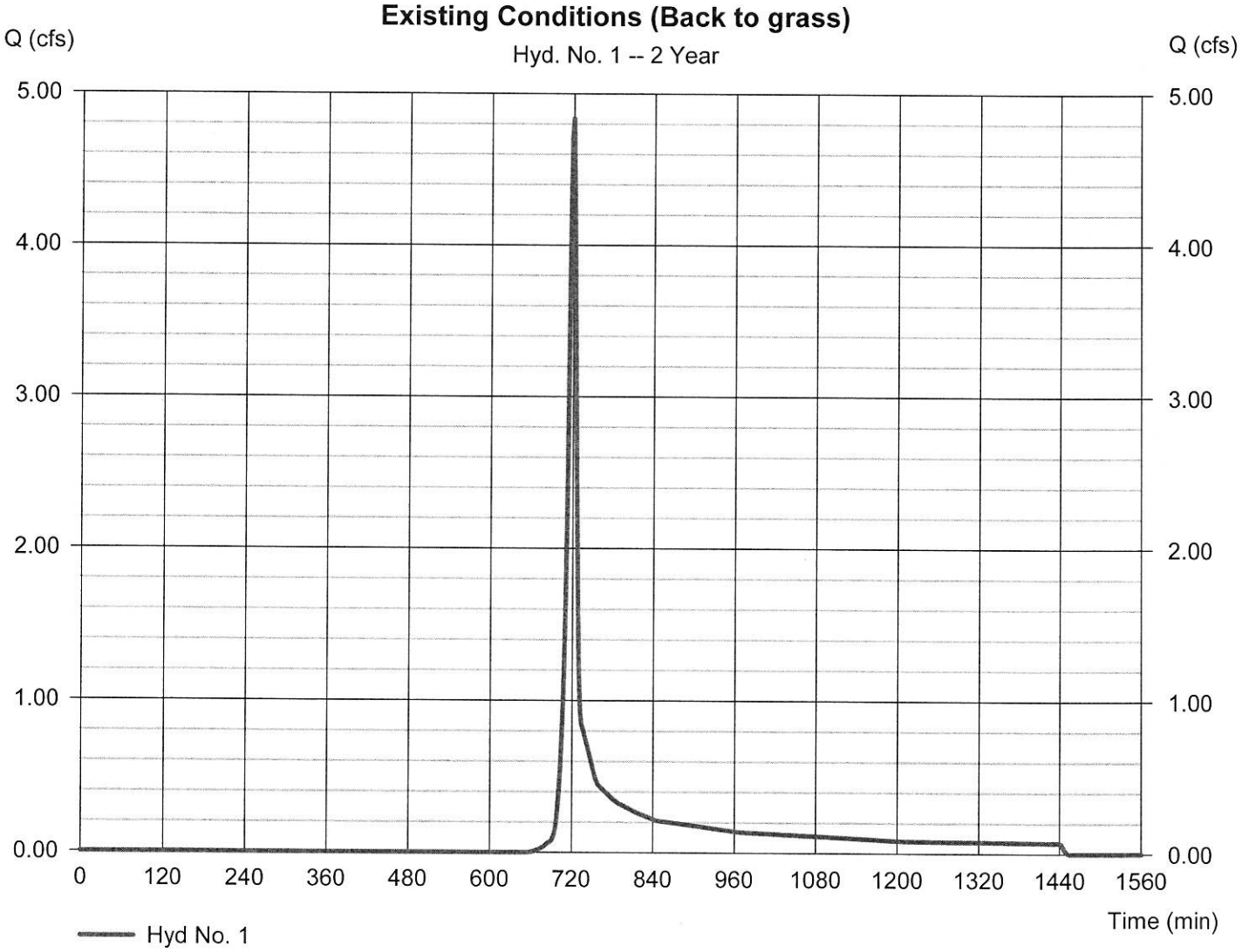
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.835	2	720	11,224	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	7.200	2	718	16,893	------	------	------	Proposed Detained
3	SCS Runoff	2.000	2	718	3,999	------	------	------	Bypass Area
4	Reservoir	1.787	2	730	16,881	2	615.34	5,805	Detention Pond
5	Combine	3.428	2	718	20,880	3, 4	------	------	Adding Bypass

Hydrograph Report

Hyd. No. 1

Existing Conditions (Back to grass)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.835 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 11,224 cuft
Drainage area	= 3.180 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

Hyd. No. 1

Existing Conditions (Back to grass)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 65.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 5.50		0.00		0.00		
Travel Time (min)	**= 4.71**	**+**	**0.00**	**+**	**0.00**	**=**	**4.71**
Shallow Concentrated Flow							
Flow length (ft)	= 302.00		0.00		0.00		
Watercourse slope (%)	= 1.25		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.80		0.00		0.00		
Travel Time (min)	**= 2.79**	**+**	**0.00**	**+**	**0.00**	**=**	**2.79**
Channel Flow							
X sectional flow area (sqft)	= 0.79		0.00		0.00		
Wetted perimeter (ft)	= 3.14		0.00		0.00		
Channel slope (%)	= 1.58		0.00		0.00		
Manning's n-value	= 0.013		0.015		0.015		
Velocity (ft/s)	=5.69						
			0.00				
					0.00		
Flow length (ft)	({0})184.0		0.0		0.0		
Travel Time (min)	**= 0.54**	**+**	**0.00**	**+**	**0.00**	**=**	**0.54**

Total Travel Time, Tc ..... 8.00 min

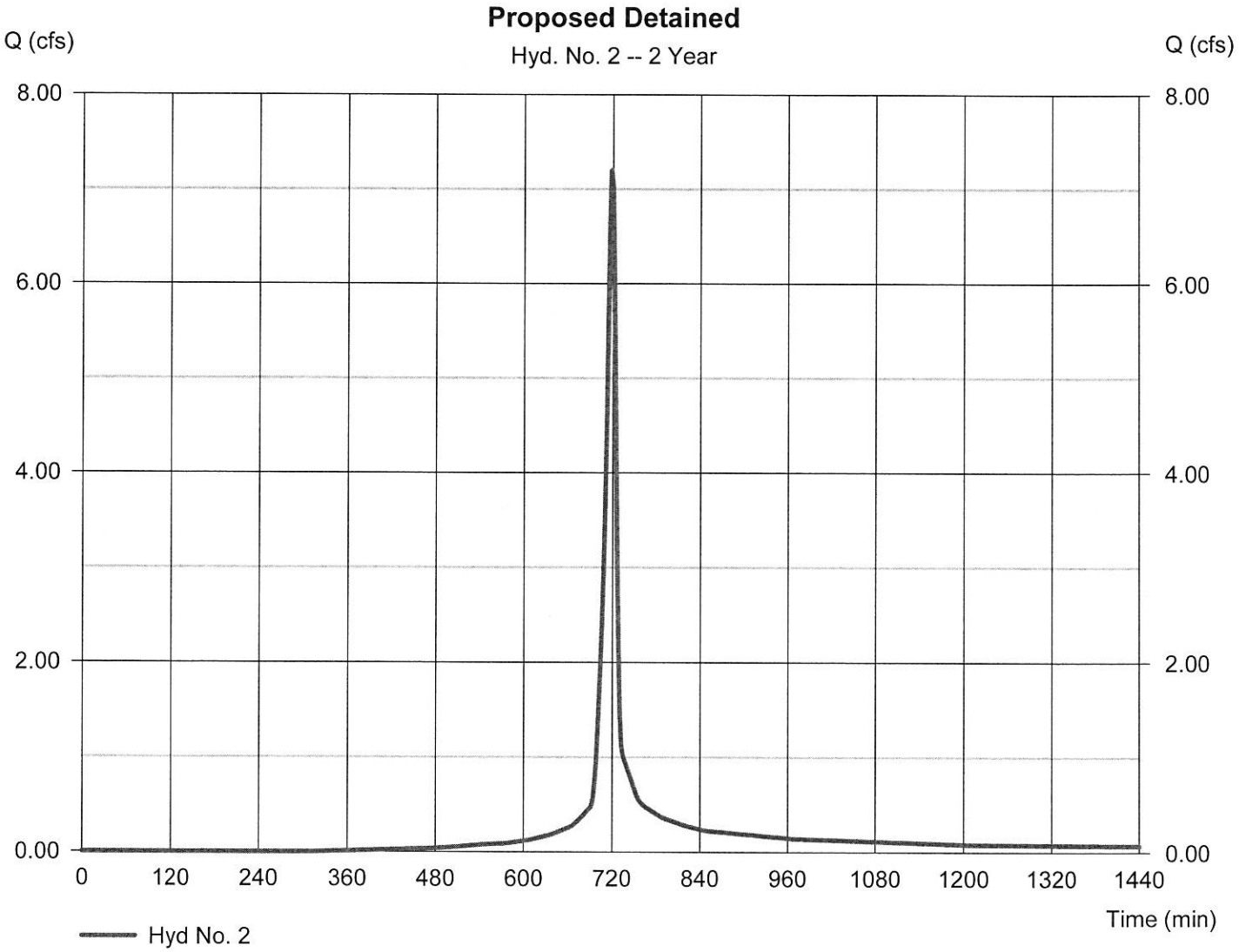
Hydrograph Report

Hyd. No. 2

Proposed Detained

Hydrograph type	= SCS Runoff	Peak discharge	= 7.200 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,893 cuft
Drainage area	= 2.150 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.530 x 98) + (0.620 x 74)] / 2.150



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

Hyd. No. 2

Proposed Detained

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 67.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.10		0.00		0.00		
Land slope (%)	= 5.50		0.00		0.00		
Travel Time (min)	**= 4.82**	**+**	**0.00**	**+**	**0.00**	**=**	**4.82**
Shallow Concentrated Flow							
Flow length (ft)	= 202.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=2.49		0.00		0.00		
Travel Time (min)	**= 1.35**	**+**	**0.00**	**+**	**0.00**	**=**	**1.35**
Channel Flow							
X sectional flow area (sqft)	= 1.23		0.00		0.00		
Wetted perimeter (ft)	= 3.93		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.013		0.015		0.015		
Velocity (ft/s)	=5.26						
			0.00				
					0.00		
Flow length (ft)	({0})193.0		0.0		0.0		
Travel Time (min)	**= 0.61**	**+**	**0.00**	**+**	**0.00**	**=**	**0.61**

Total Travel Time, Tc ..... 6.80 min

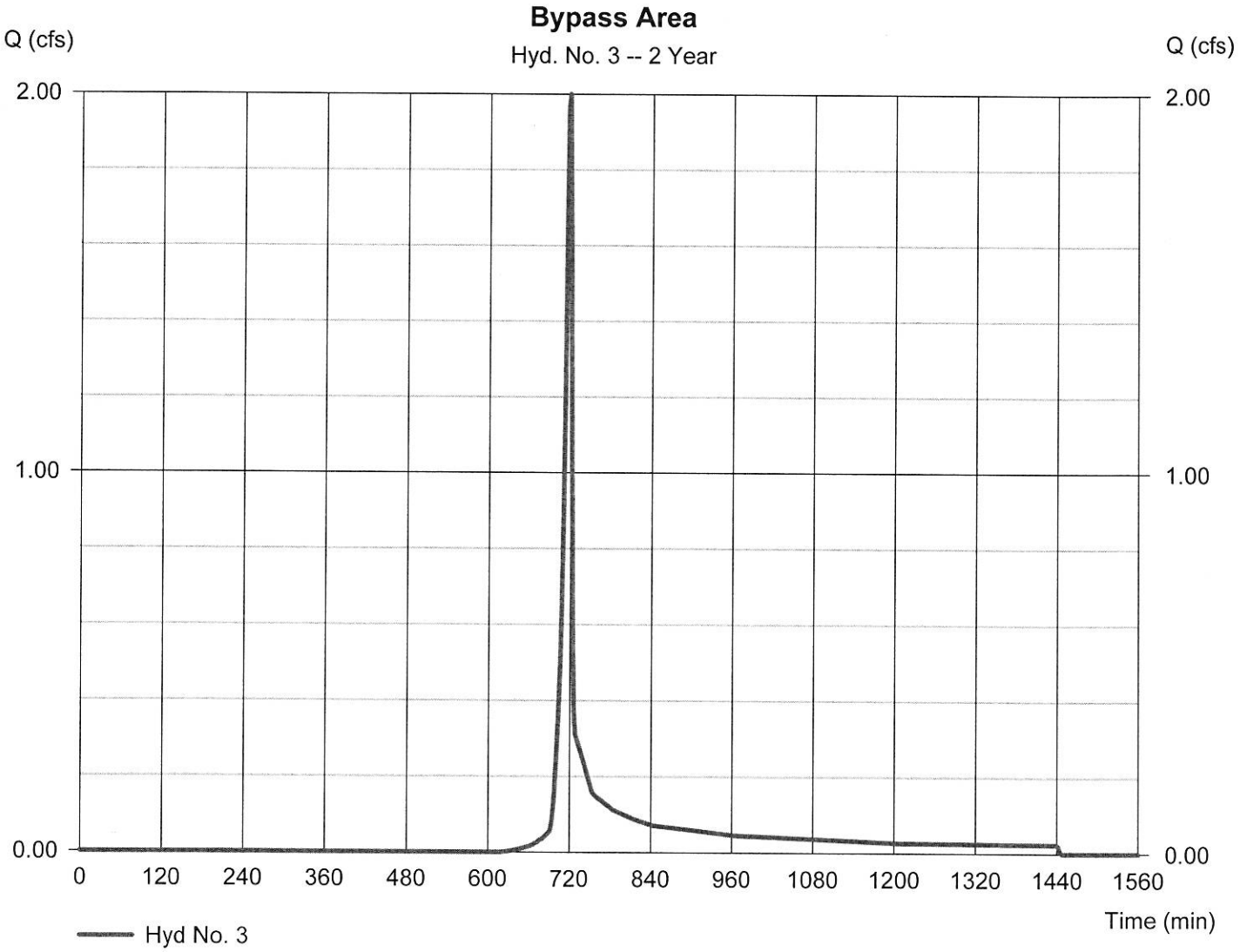
Hydrograph Report

Hyd. No. 3

Bypass Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,999 cuft
Drainage area	= 1.030 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.110 x 98) + (0.920 x 74)] / 1.030



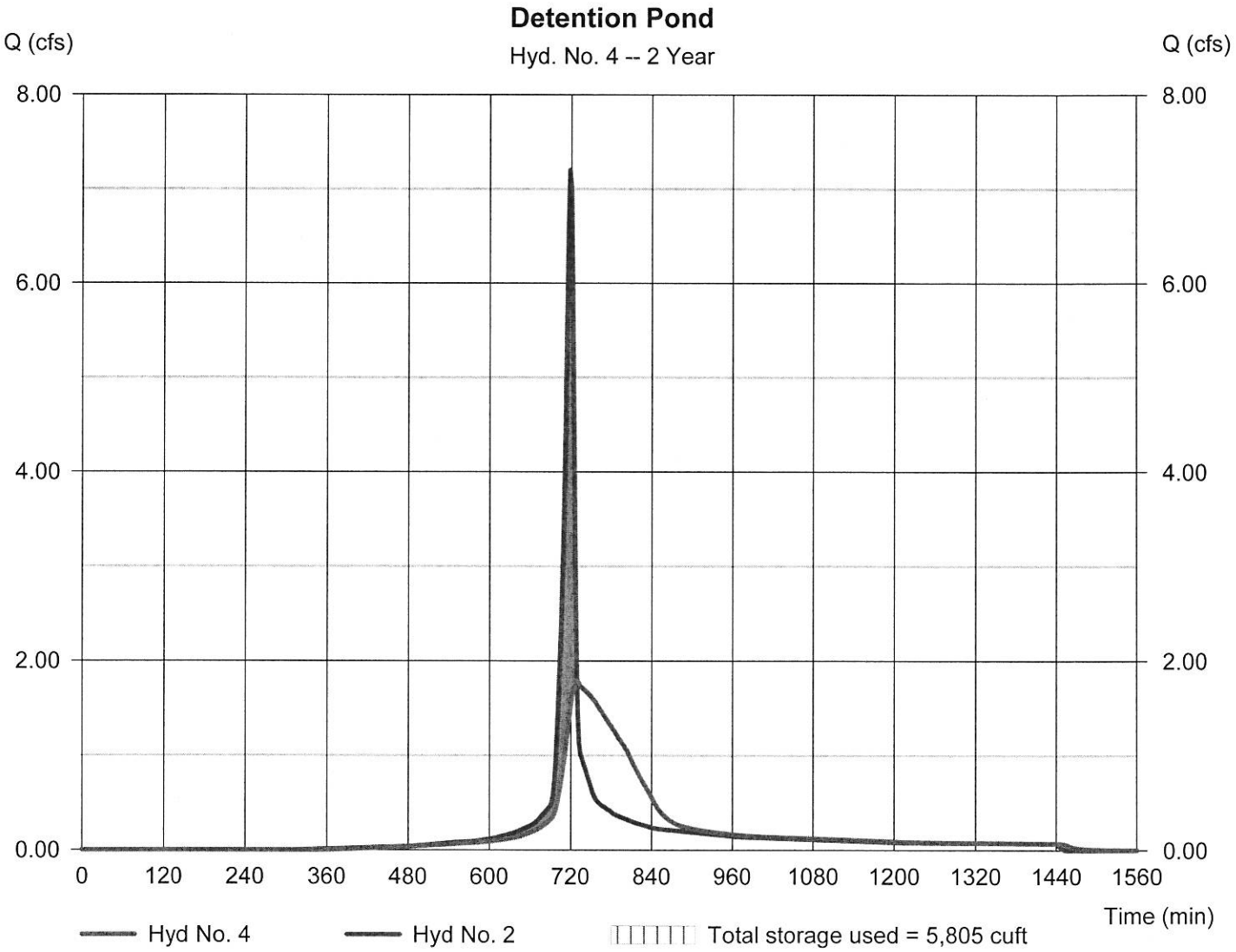
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 1.787 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 16,881 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 615.34 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 5,805 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Pond Volume

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 612.85 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	612.85	05	0	0
0.15	613.00	1,422	76	76
1.15	614.00	2,381	1,881	1,956
2.15	615.00	3,039	2,703	4,659
3.15	616.00	3,754	3,390	8,049
4.15	617.00	4,525	4,133	12,182
5.15	618.00	5,353	4,933	17,115
6.15	619.00	6,237	5,789	22,904
7.15	620.00	7,178	6,701	29,605
8.15	621.00	8,176	7,671	37,276

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	7.00	0.00	0.00
Span (in)	= 15.00	7.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 612.85	612.86	0.00	0.00
Length (ft)	= 100.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	2.25	0.00	0.00
Crest El. (ft)	= 619.50	615.34	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	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

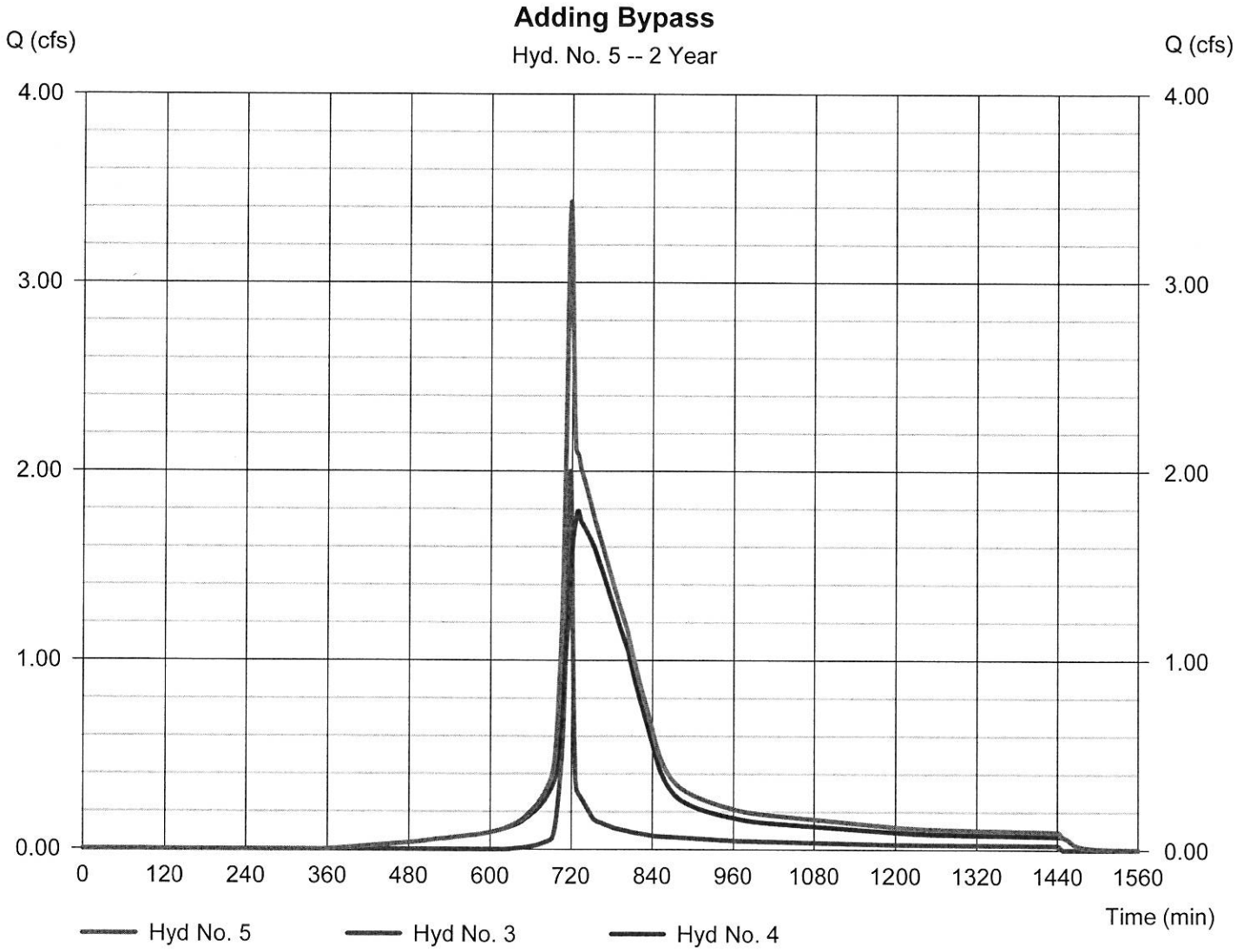
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	612.85	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.15	76	613.00	0.06 ic	0.05 ic	---	---	0.00	0.00	---	---	---	---	0.053
1.15	1,956	614.00	1.05 ic	1.05 ic	---	---	0.00	0.00	---	---	---	---	1.051
2.15	4,659	615.00	1.60 ic	1.60 ic	---	---	0.00	0.00	---	---	---	---	1.597
3.15	8,049	616.00	5.65 ic	1.63 ic	---	---	0.00	4.02	---	---	---	---	5.650
4.15	12,182	617.00	9.64 oc	0.65 ic	---	---	0.00	8.99 s	---	---	---	---	9.638
5.15	17,115	618.00	11.06 oc	0.40 ic	---	---	0.00	10.66 s	---	---	---	---	11.06
6.15	22,904	619.00	12.21 oc	0.29 ic	---	---	0.00	11.91 s	---	---	---	---	12.21
7.15	29,605	620.00	13.25 oc	0.14 ic	---	---	4.46 s	8.65 s	---	---	---	---	13.25
8.15	37,276	621.00	14.19 oc	0.06 ic	---	---	8.22 s	5.80 s	---	---	---	---	14.08

Hydrograph Report

Hyd. No. 5

Adding Bypass

Hydrograph type	= Combine	Peak discharge	= 3.428 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,880 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.030 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

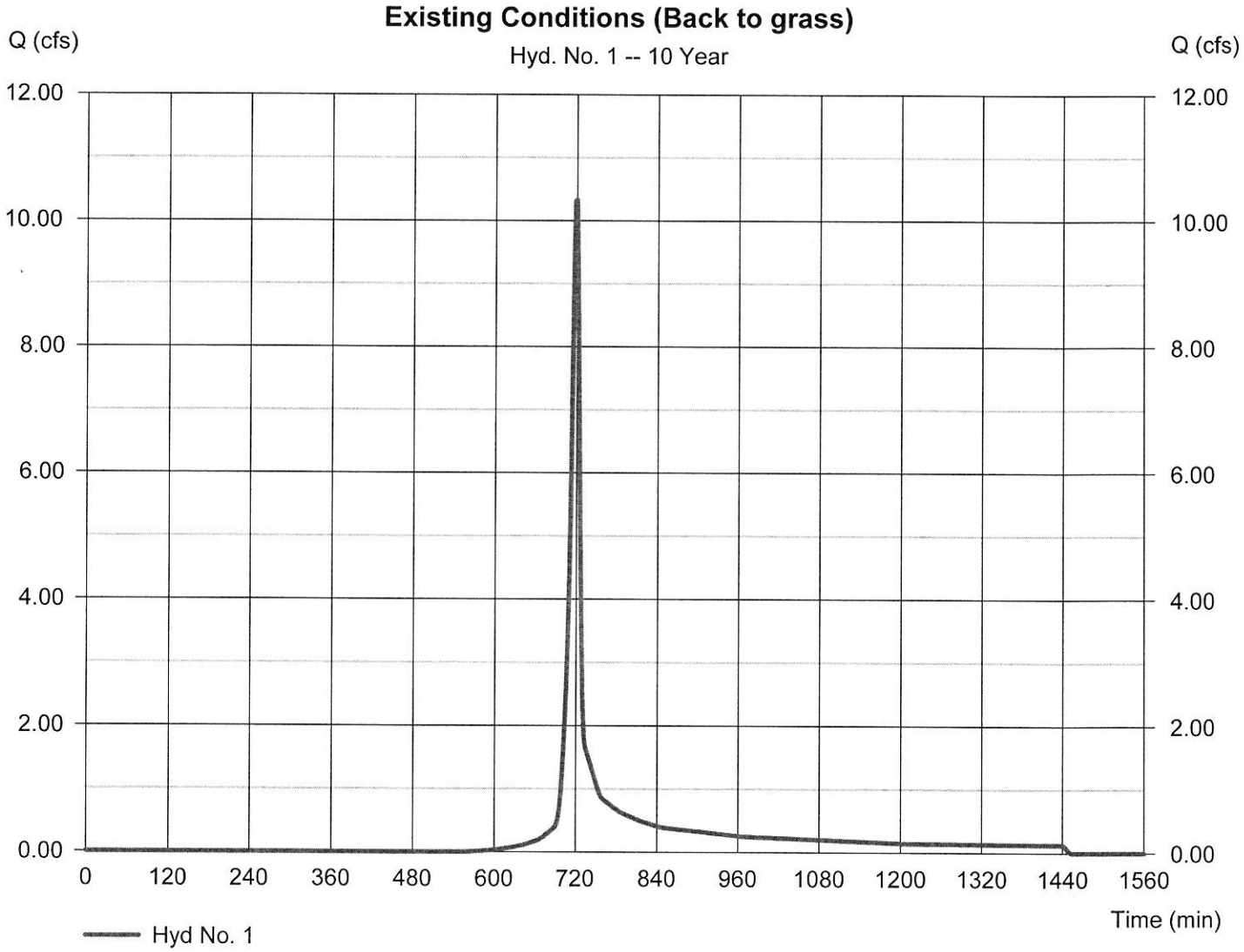
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.33	2	720	23,659	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	11.64	2	718	28,054	------	------	------	Proposed Detained
3	SCS Runoff	3.978	2	716	8,034	------	------	------	Bypass Area
4	Reservoir	6.350	2	724	28,041	2	616.10	8,404	Detention Pond
5	Combine	7.812	2	722	36,076	3, 4	------	------	Adding Bypass

Hydrograph Report

Hyd. No. 1

Existing Conditions (Back to grass)

Hydrograph type	= SCS Runoff	Peak discharge	= 10.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 23,659 cuft
Drainage area	= 3.180 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



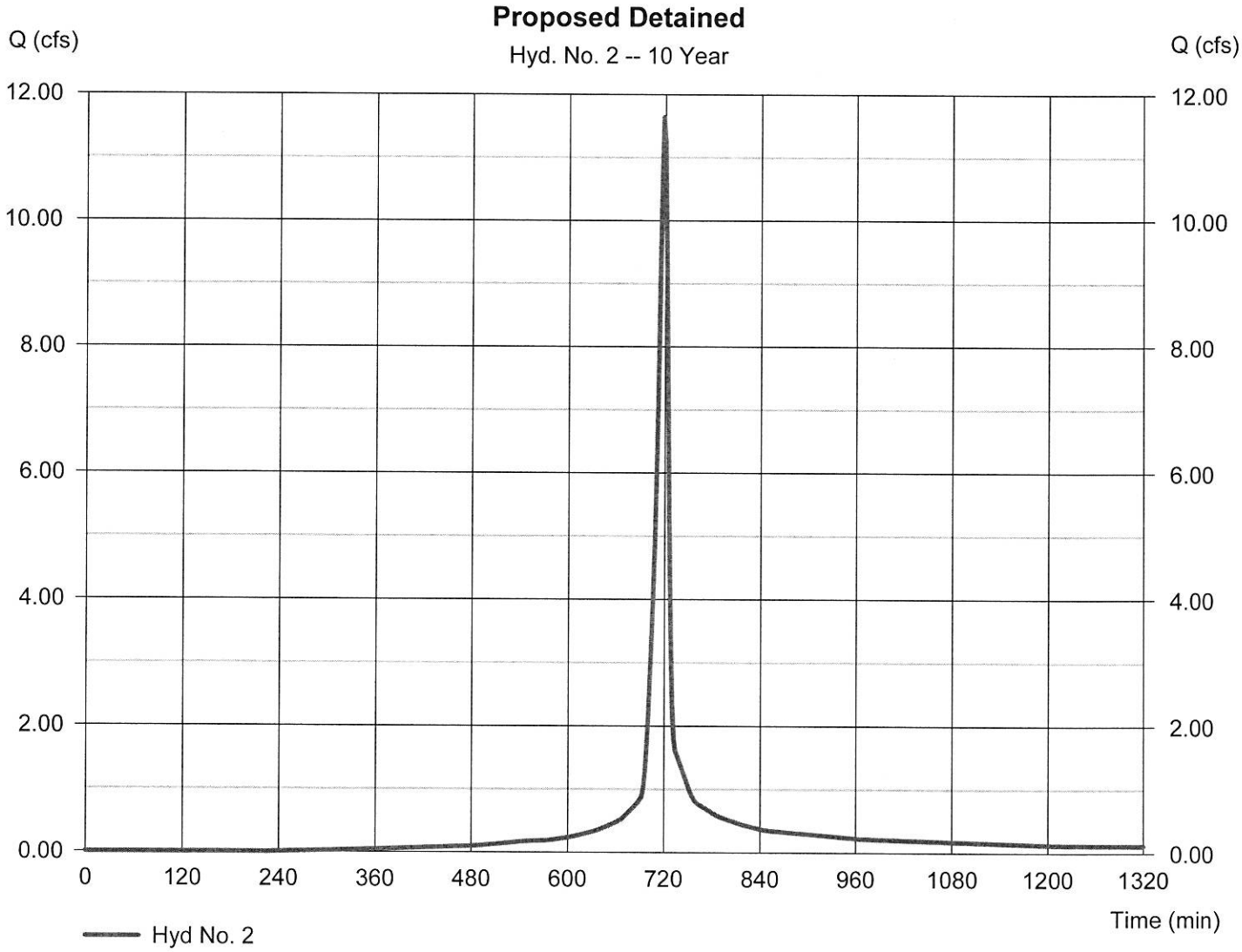
Hydrograph Report

Hyd. No. 2

Proposed Detained

Hydrograph type	= SCS Runoff	Peak discharge	= 11.64 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 28,054 cuft
Drainage area	= 2.150 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.530 x 98) + (0.620 x 74)] / 2.150



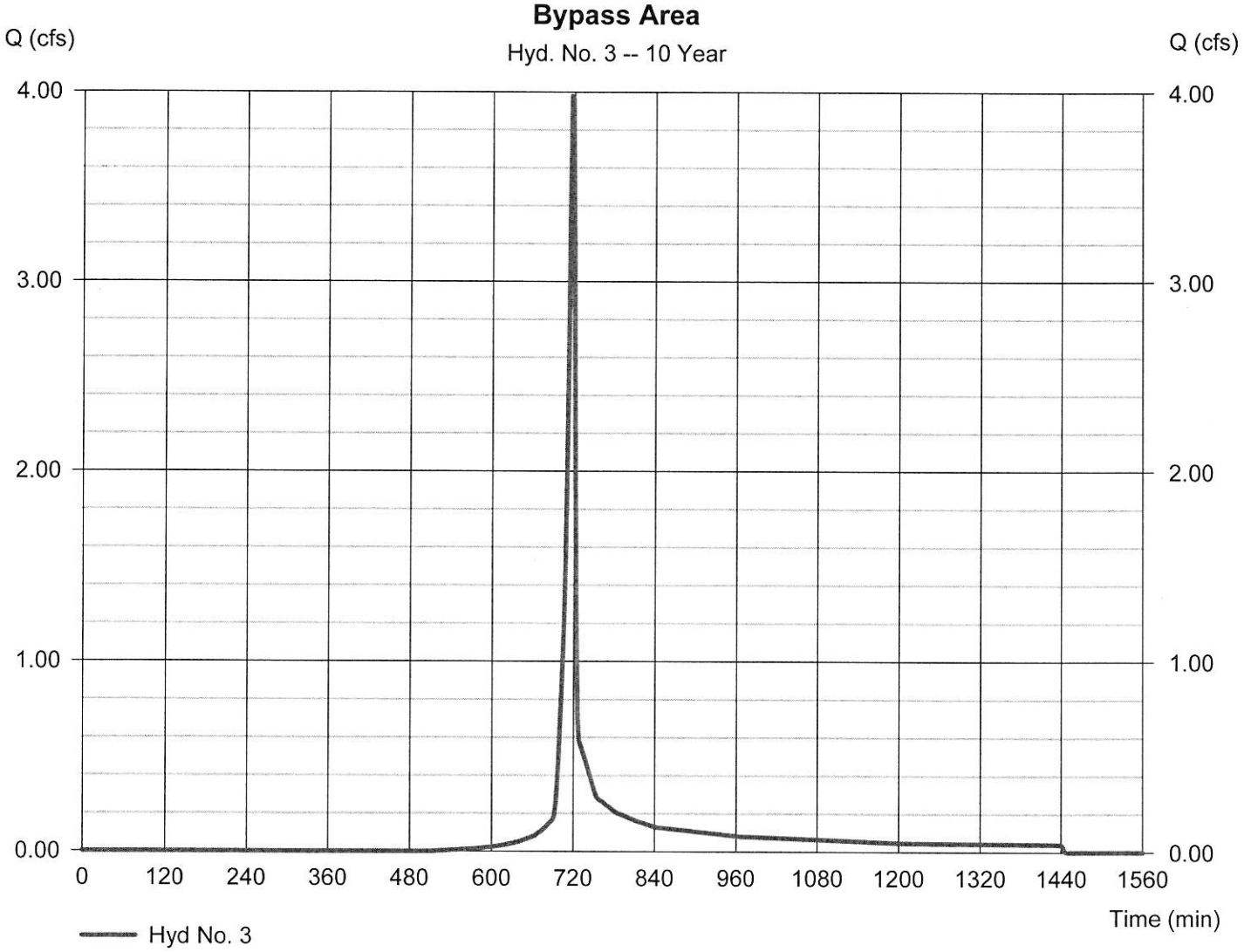
Hydrograph Report

Hyd. No. 3

Bypass Area

Hydrograph type	= SCS Runoff	Peak discharge	= 3.978 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,034 cuft
Drainage area	= 1.030 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.110 x 98) + (0.920 x 74)] / 1.030



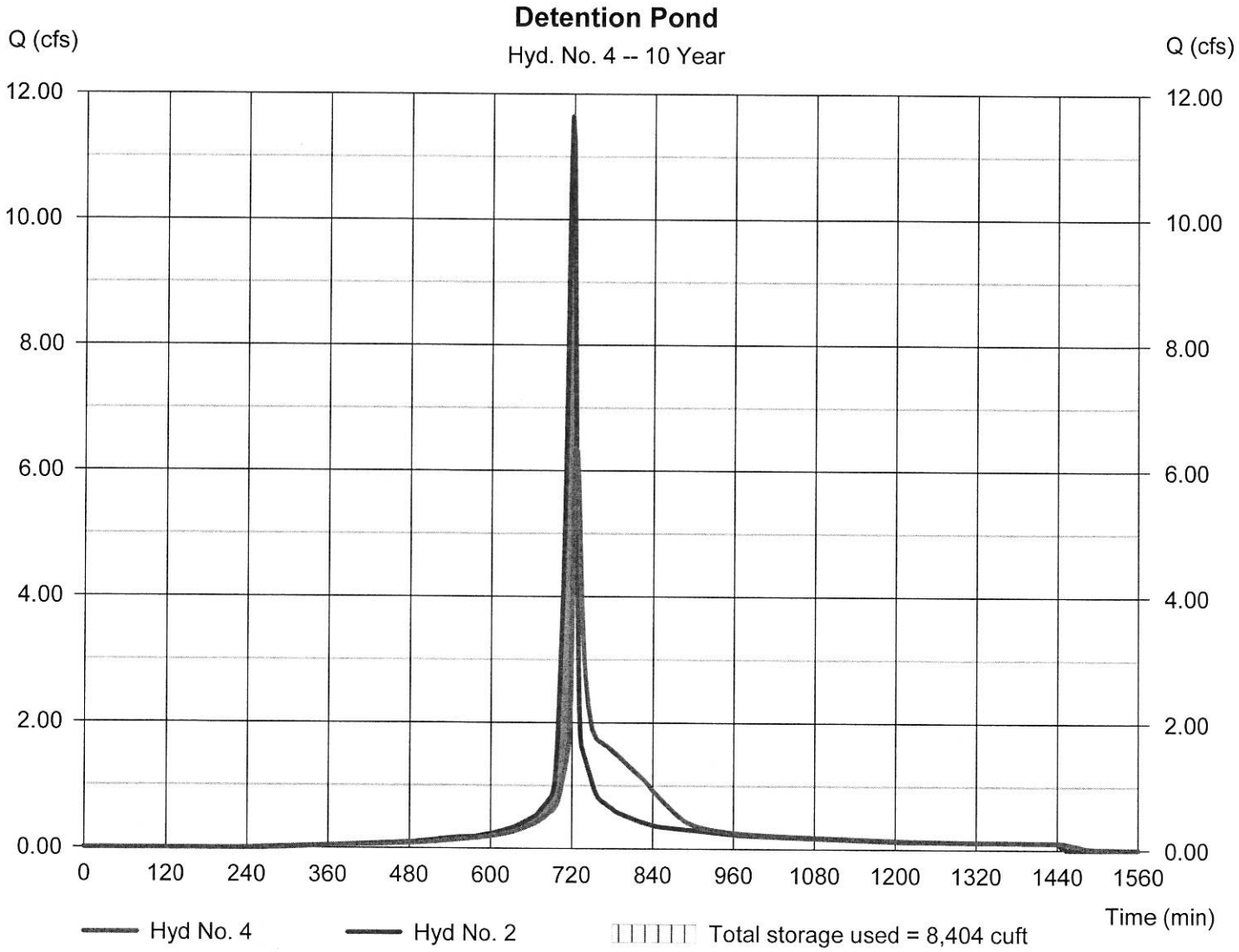
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 6.350 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 28,041 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 616.10 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 8,404 cuft

Storage Indication method used.

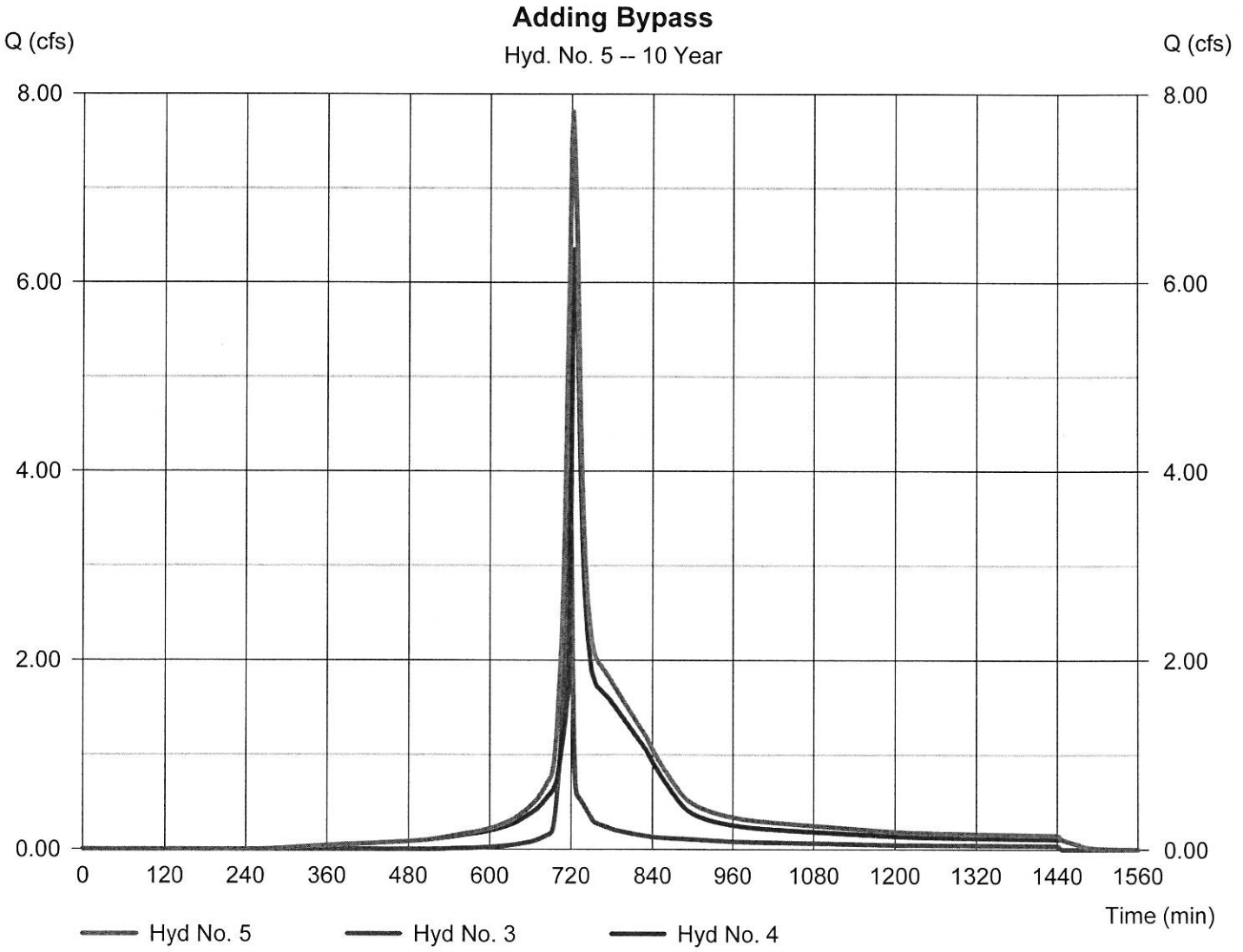


Hydrograph Report

Hyd. No. 5

Adding Bypass

Hydrograph type	= Combine	Peak discharge	= 7.812 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 36,076 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.030 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

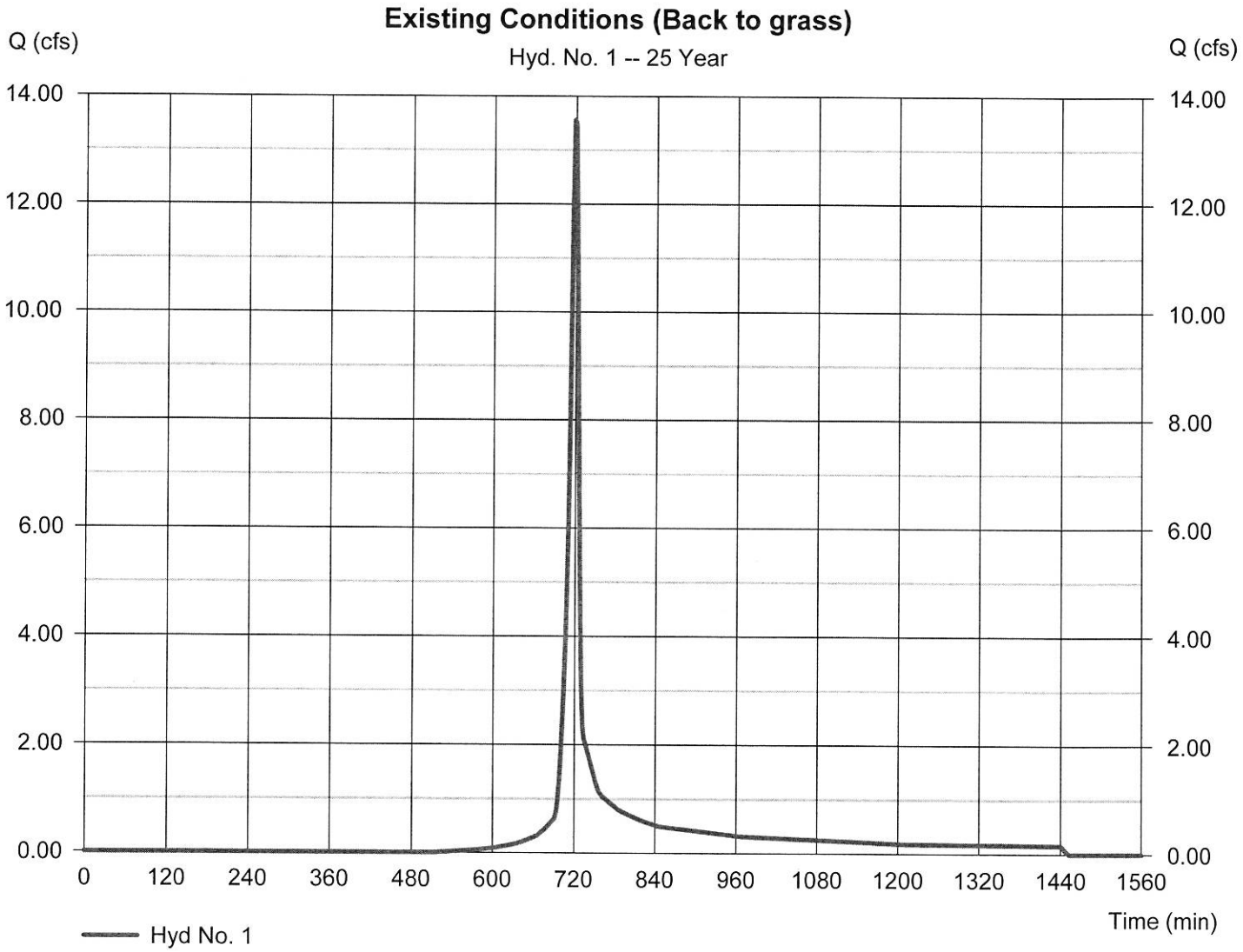
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	13.56	2	718	31,020	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	13.99	2	718	34,115	------	------	------	Proposed Detained
3	SCS Runoff	5.121	2	716	10,379	------	------	------	Bypass Area
4	Reservoir	8.173	2	724	34,102	2	616.38	9,599	Detention Pond
5	Combine	11.06	2	720	44,481	3, 4	------	------	Adding Bypass

Hydrograph Report

Hyd. No. 1

Existing Conditions (Back to grass)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.56 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 31,020 cuft
Drainage area	= 3.180 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 5.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



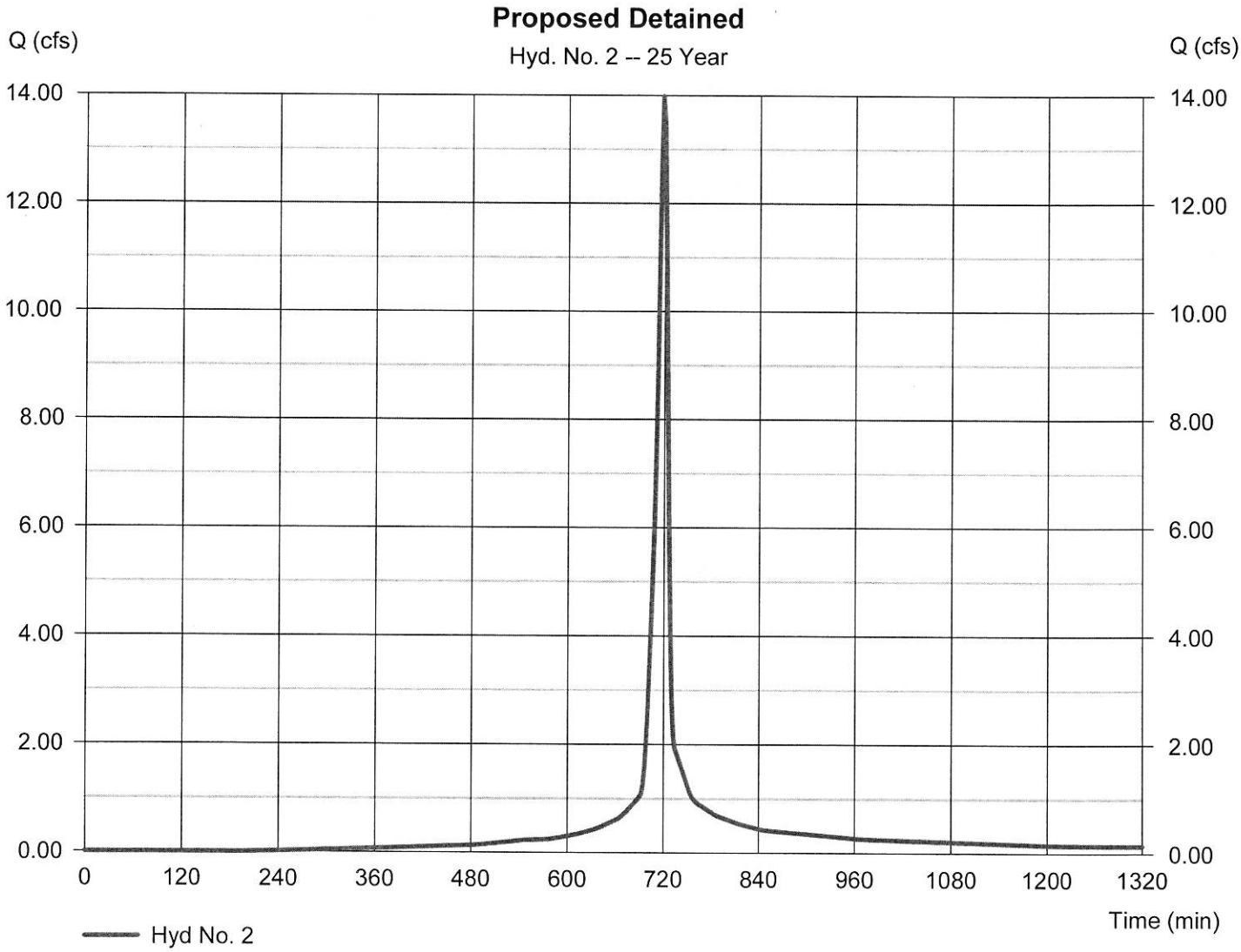
Hydrograph Report

Hyd. No. 2

Proposed Detained

Hydrograph type	= SCS Runoff	Peak discharge	= 13.99 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 34,115 cuft
Drainage area	= 2.150 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 5.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.530 x 98) + (0.620 x 74)] / 2.150



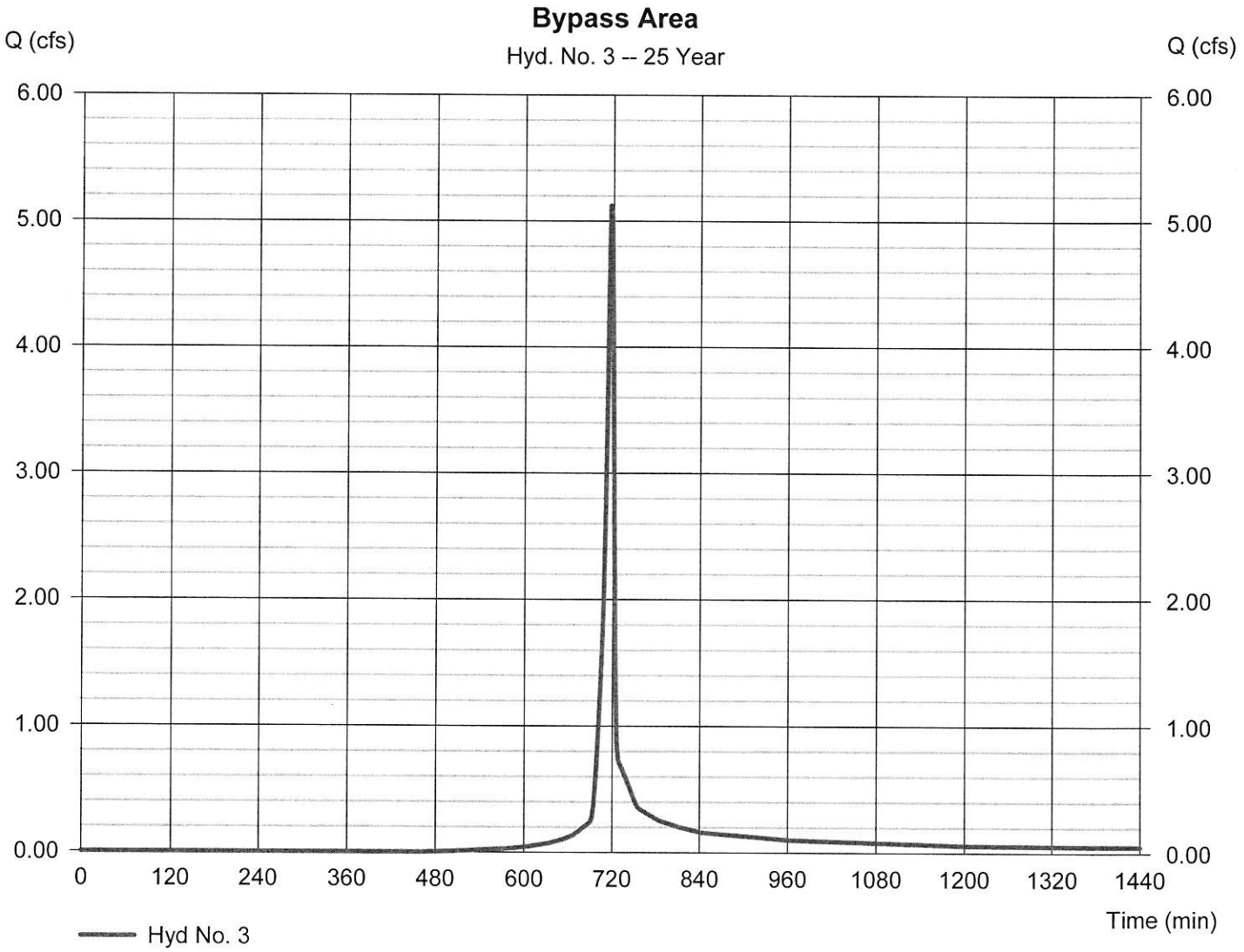
Hydrograph Report

Hyd. No. 3

Bypass Area

Hydrograph type	= SCS Runoff	Peak discharge	= 5.121 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 10,379 cuft
Drainage area	= 1.030 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.110 x 98) + (0.920 x 74)] / 1.030



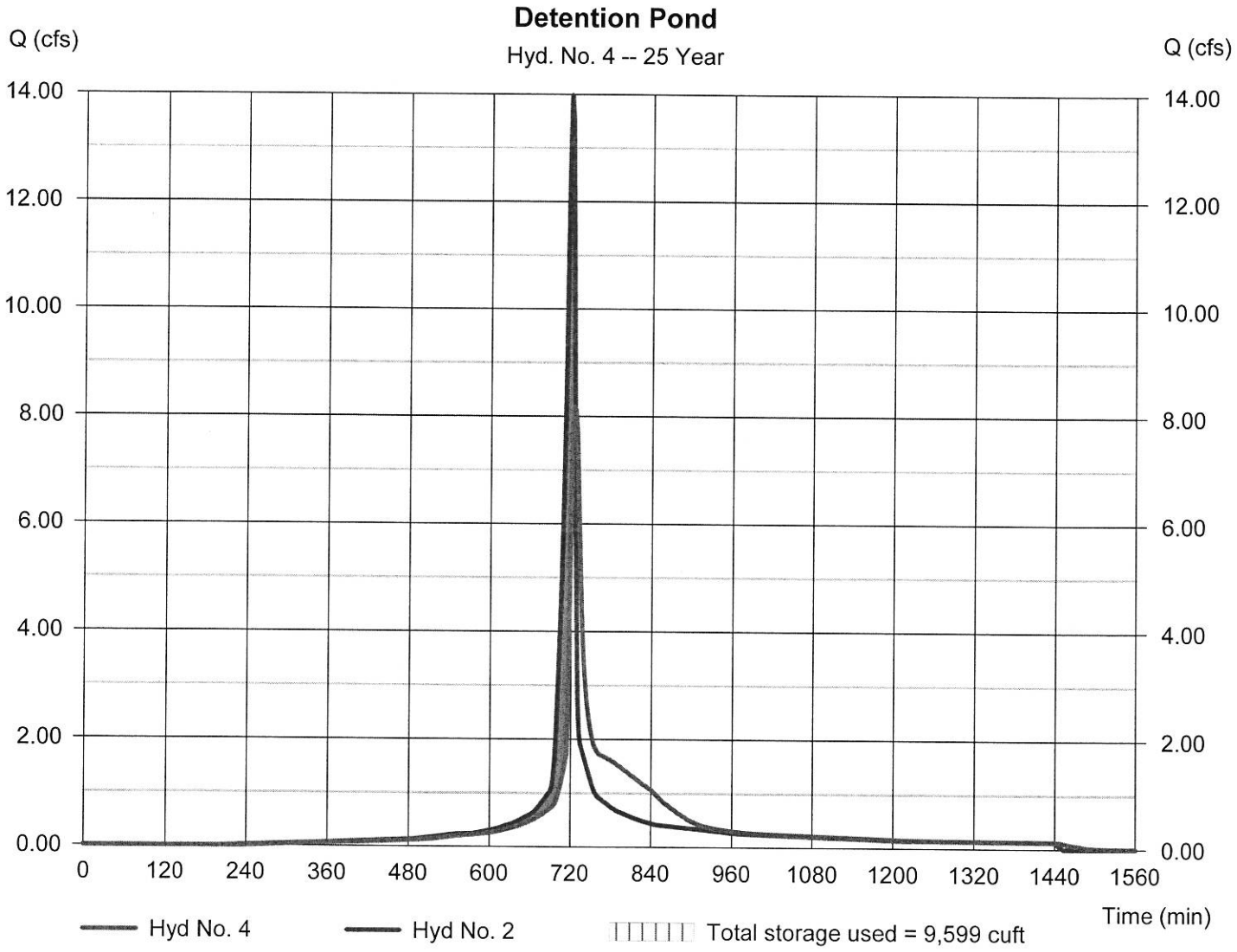
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 8.173 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 34,102 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 616.38 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 9,599 cuft

Storage Indication method used.

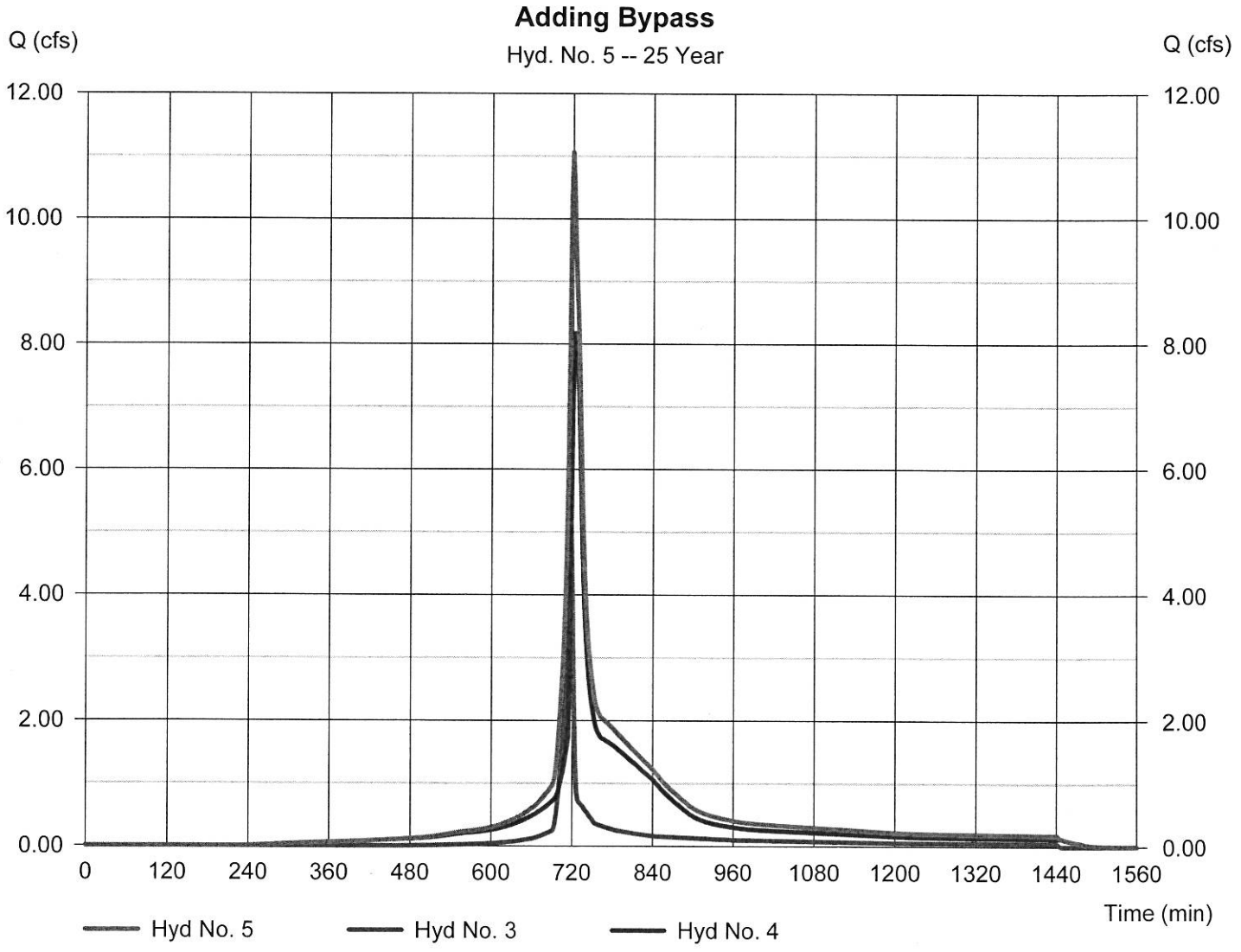


Hydrograph Report

Hyd. No. 5

Adding Bypass

Hydrograph type	= Combine	Peak discharge	= 11.06 cfs
Storm frequency	= 25 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 44,481 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.030 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

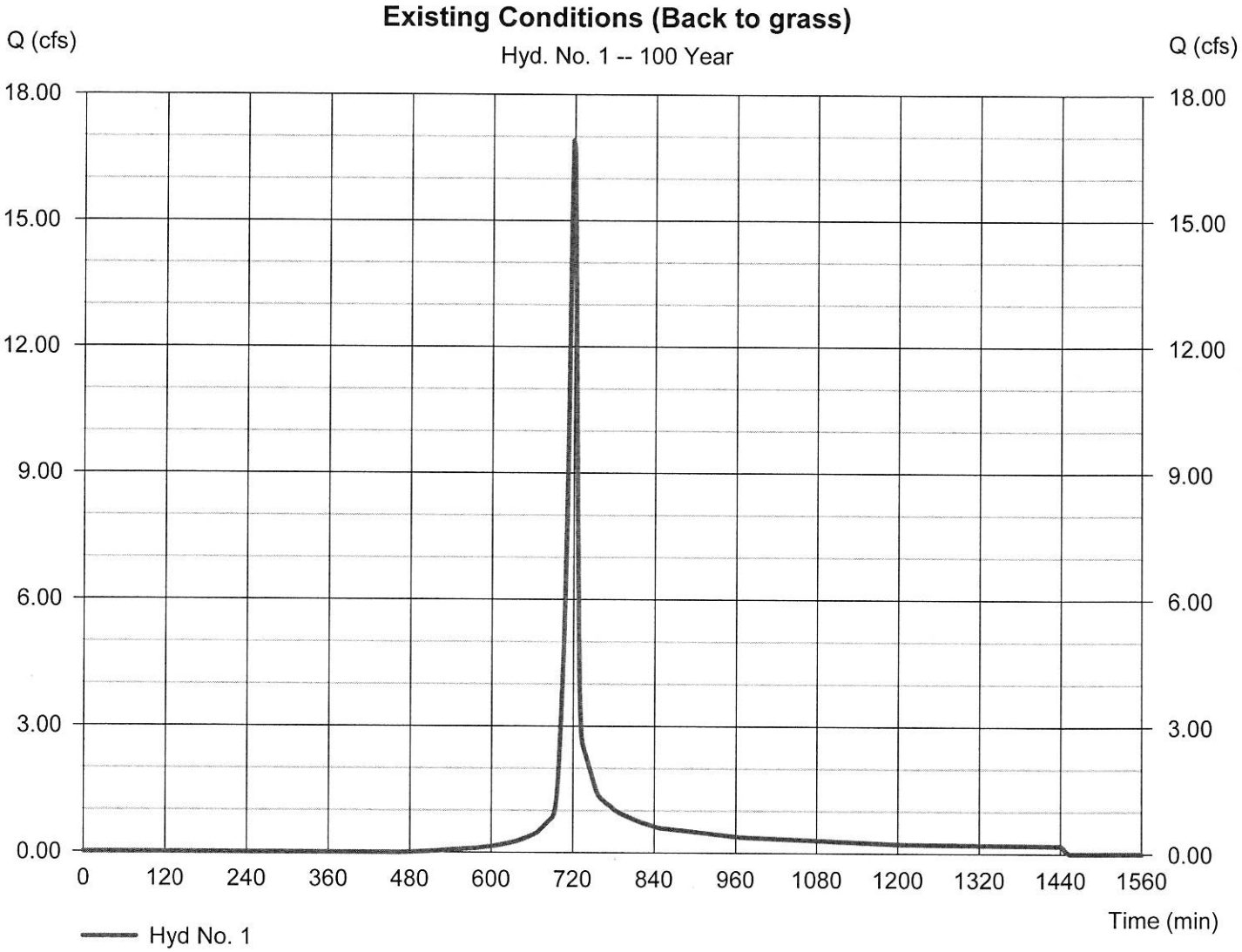
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	16.91	2	718	38,714	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	16.32	2	718	40,217	------	------	------	Proposed Detained
3	SCS Runoff	6.287	2	716	12,809	------	------	------	Bypass Area
4	Reservoir	9.076	2	724	40,205	2	616.72	10,978	Detention Pond
5	Combine	13.58	2	718	53,014	3, 4	------	------	Adding Bypass

Hydrograph Report

Hyd. No. 1

Existing Conditions (Back to grass)

Hydrograph type	= SCS Runoff	Peak discharge	= 16.91 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 38,714 cuft
Drainage area	= 3.180 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



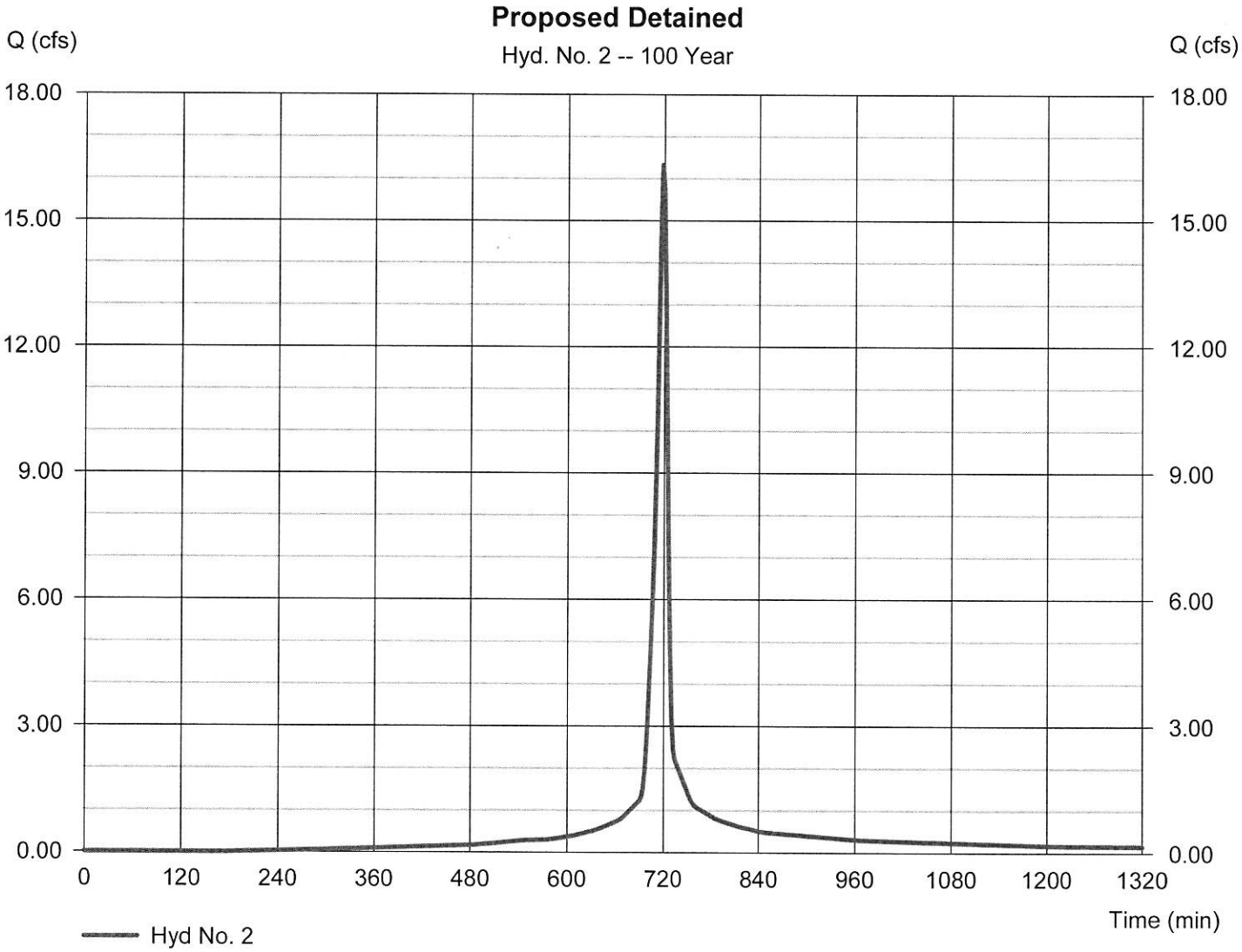
Hydrograph Report

Hyd. No. 2

Proposed Detained

Hydrograph type	= SCS Runoff	Peak discharge	= 16.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 40,217 cuft
Drainage area	= 2.150 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.530 x 98) + (0.620 x 74)] / 2.150



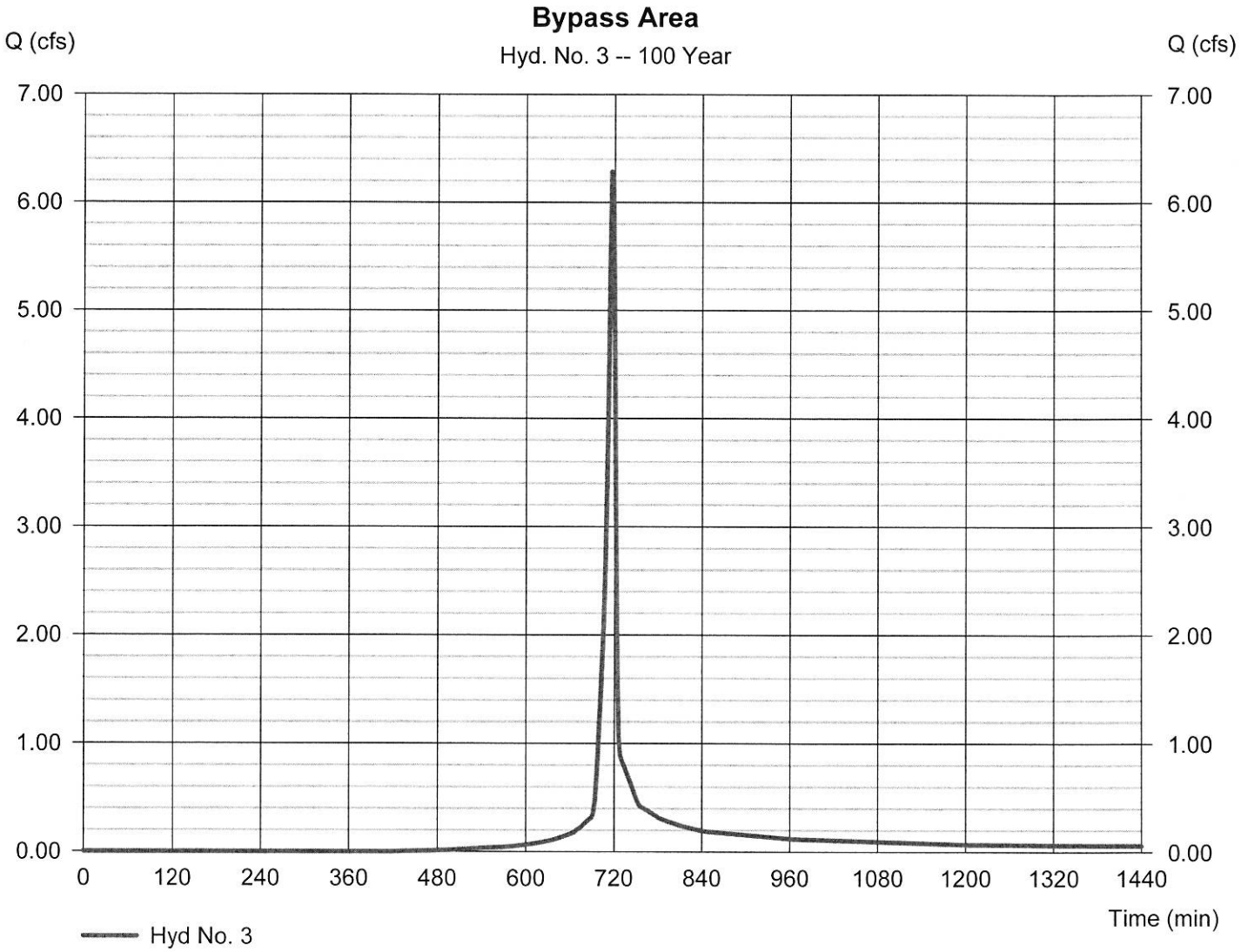
Hydrograph Report

Hyd. No. 3

Bypass Area

Hydrograph type	= SCS Runoff	Peak discharge	= 6.287 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 12,809 cuft
Drainage area	= 1.030 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.110 x 98) + (0.920 x 74)] / 1.030



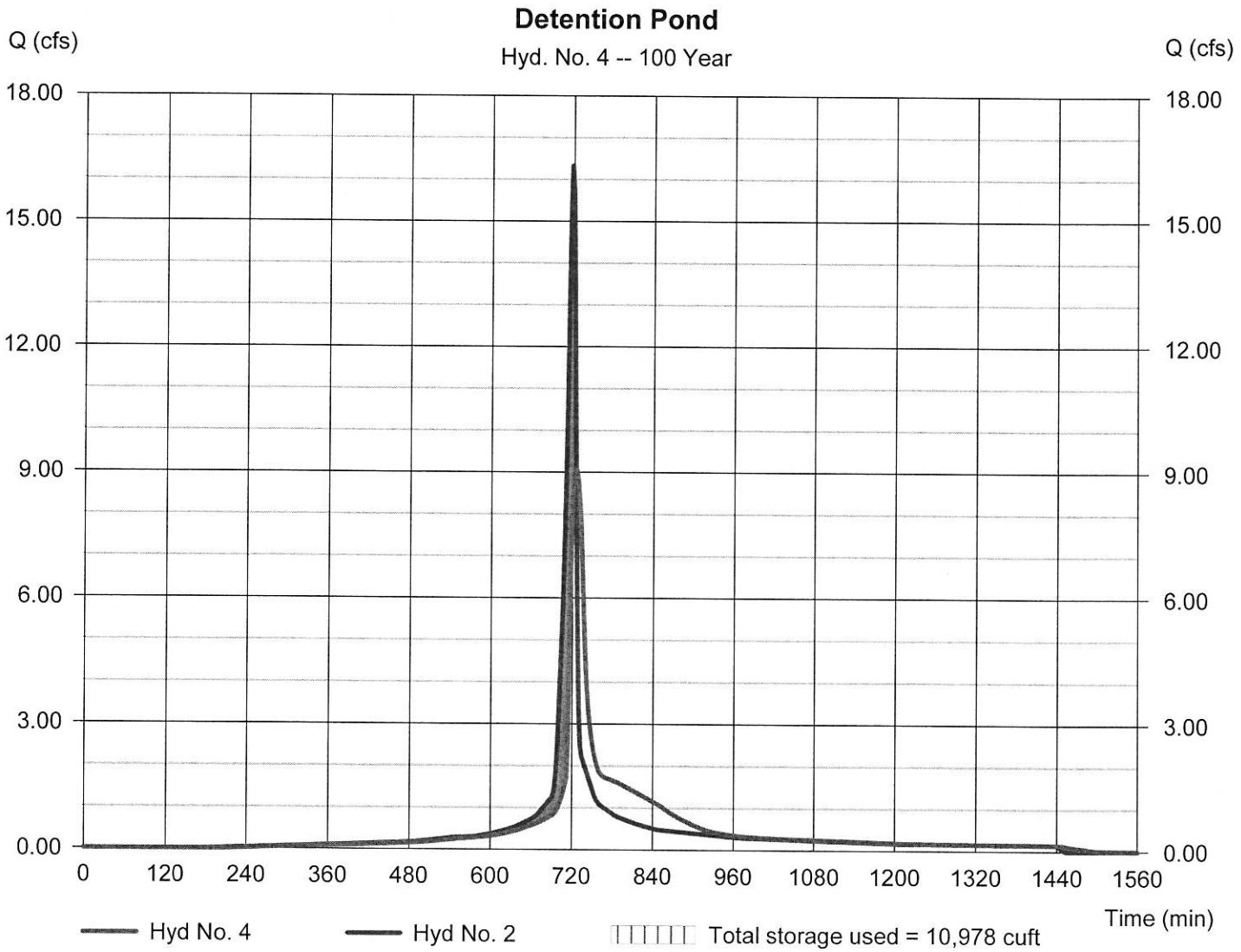
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 9.076 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 40,205 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 616.72 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 10,978 cuft

Storage Indication method used.

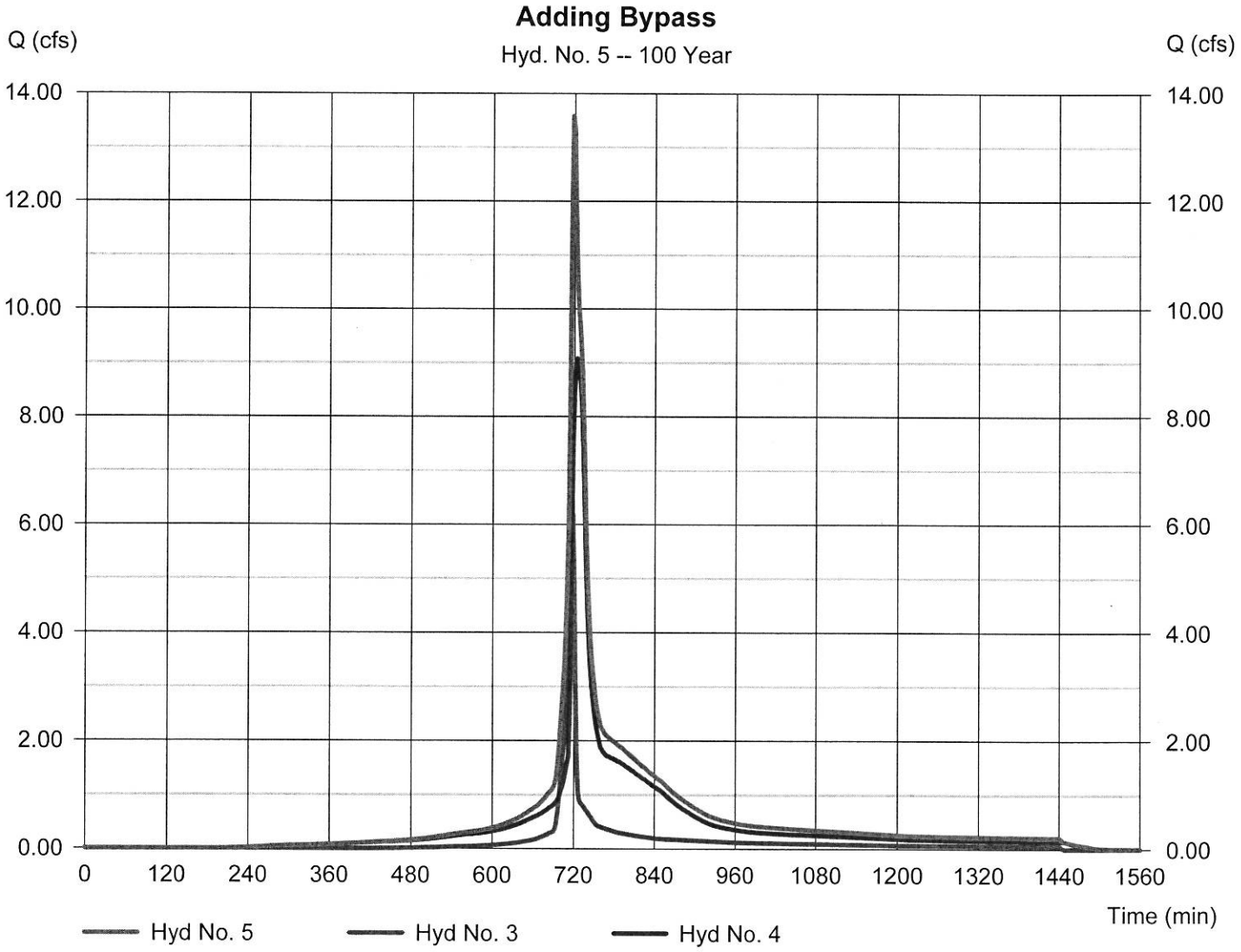


Hydrograph Report

Hyd. No. 5

Adding Bypass

Hydrograph type	= Combine	Peak discharge	= 13.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 53,014 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.030 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	47.7469	9.9000	0.8071	--------
3	0.0000	0.0000	0.0000	--------
5	58.5141	11.2000	0.7943	--------
10	66.9022	11.9000	0.7911	--------
25	79.2027	12.6000	0.7889	--------
50	89.4253	13.1000	0.7892	--------
100	99.5476	13.5000	0.7893	--------

File name: OFallon MO Rainfall IDF.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.40	4.27	3.57	3.08	2.72	2.44	2.22	2.03	1.88	1.76	1.65	1.55
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	6.40	5.17	4.37	3.81	3.38	3.05	2.79	2.57	2.38	2.23	2.09	1.98
10	7.15	5.82	4.95	4.32	3.85	3.48	3.19	2.94	2.74	2.56	2.41	2.27
25	8.24	6.77	5.78	5.07	4.53	4.10	3.76	3.48	3.24	3.03	2.85	2.70
50	9.10	7.50	6.43	5.65	5.06	4.59	4.21	3.89	3.62	3.40	3.20	3.02
100	9.95	8.24	7.08	6.23	5.58	5.07	4.65	4.30	4.01	3.76	3.54	3.35

Tc = time in minutes. Values may exceed 60.

Precip. file name: I:\Rainfall Data\OFallon MO Precipitation PCP.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	3.00	3.10	0.00	4.50	4.60	5.40	6.60	6.20
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hydraflow Table of Contents

662 Detention Model.gpw

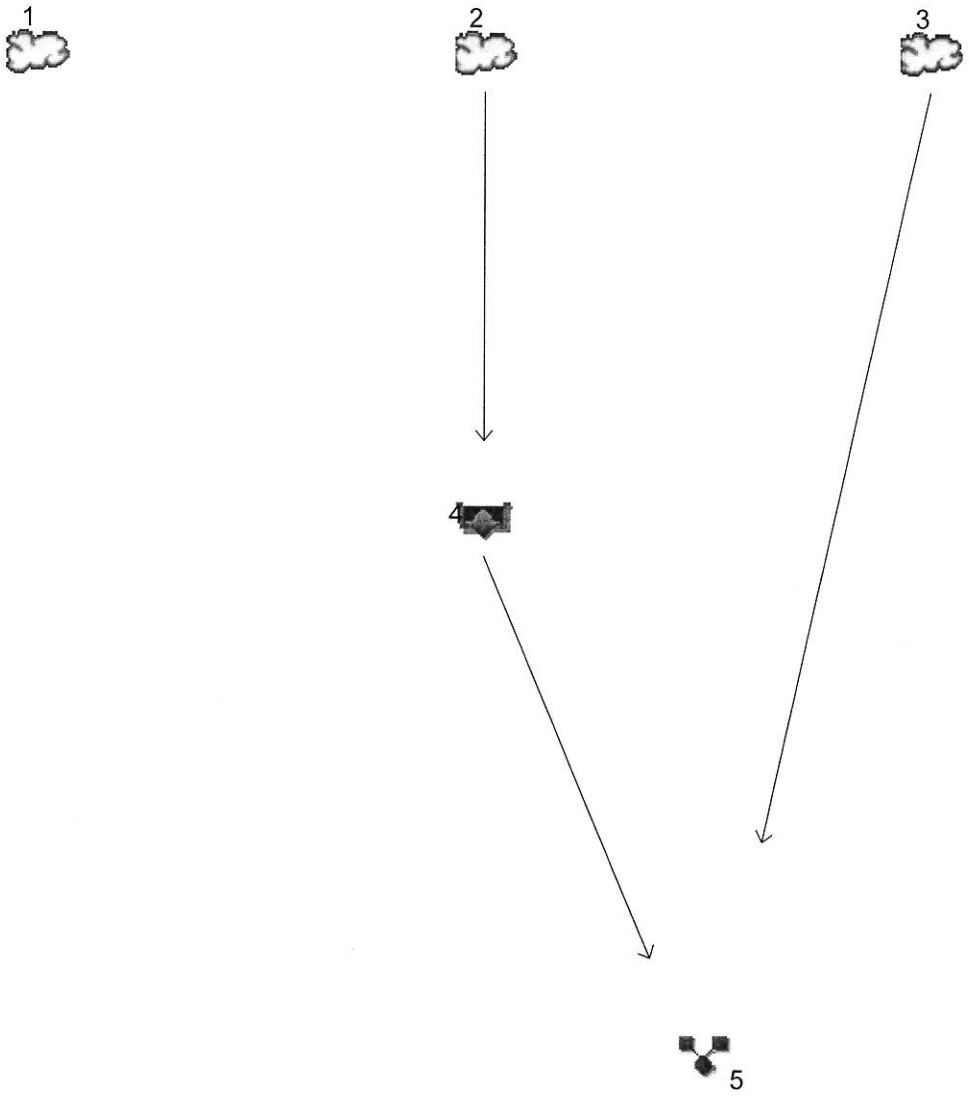
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

Friday, 01 / 26 / 2018

Low Flow Blocked

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11



Legend

Hyd.	Origin	Description
1	SCS Runoff	Existing Conditions (Back to grass)
2	SCS Runoff	Proposed Detained
3	SCS Runoff	Bypass Area
4	Reservoir	Detention Pond
5	Combine	Adding Bypass

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	SCS Runoff	------	-------	4.835	-------	-------	10.33	13.56	-------	16.91	Existing Conditions (Back to grass)
2	SCS Runoff	------	-------	7.200	-------	-------	11.64	13.99	-------	16.32	Proposed Detained
3	SCS Runoff	------	-------	2.000	-------	-------	3.978	5.121	-------	6.287	Bypass Area
4	Reservoir	2	-------	3.604	-------	-------	8.297	9.183	-------	9.785	Detention Pond
5	Combine	3, 4	-------	4.087	-------	-------	11.17	13.48	-------	15.20	Adding Bypass

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	SCS Runoff	4.835	2	720	11,224	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	7.200	2	718	16,893	------	------	------	Proposed Detained
3	SCS Runoff	2.000	2	718	3,999	------	------	------	Bypass Area
4	Reservoir	3.604	2	726	11,214	2	615.96	7,890	Detention Pond
5	Combine	4.087	2	724	15,213	3, 4	------	------	Adding Bypass

Hydrograph Report

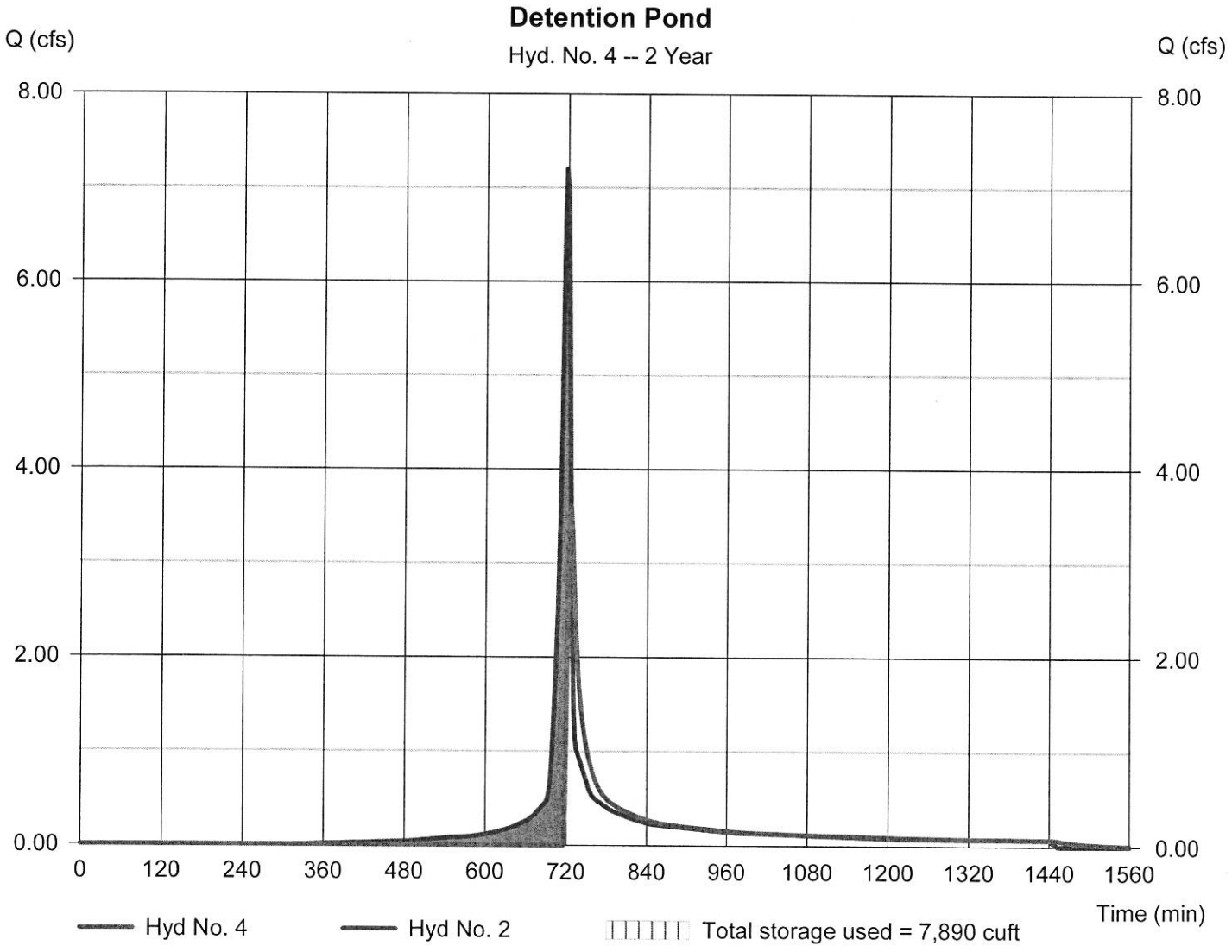
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Friday, 01 / 26 / 2018

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 3.604 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 11,214 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 615.96 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 7,890 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Pond Volume

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 612.85 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	612.85	05	0	0
0.15	613.00	1,422	76	76
1.15	614.00	2,381	1,881	1,956
2.15	615.00	3,039	2,703	4,659
3.15	616.00	3,754	3,390	8,049
4.15	617.00	4,525	4,133	12,182
5.15	618.00	5,353	4,933	17,115
6.15	619.00	6,237	5,789	22,904
7.15	620.00	7,178	6,701	29,605
8.15	621.00	8,176	7,671	37,276

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	Inactive	0.00	0.00
Span (in)	= 15.00	7.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 612.85	612.86	0.00	0.00
Length (ft)	= 100.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	2.25	0.00	0.00
Crest El. (ft)	= 619.50	615.34	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	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	612.85	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.15	76	613.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.15	1,956	614.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
2.15	4,659	615.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
3.15	8,049	616.00	4.02 ic	0.00	---	---	0.00	4.02	---	---	---	---	4.017
4.15	12,182	617.00	9.57 oc	0.00	---	---	0.00	9.57 s	---	---	---	---	9.574
5.15	17,115	618.00	11.05 oc	0.00	---	---	0.00	11.05 s	---	---	---	---	11.05
6.15	22,904	619.00	12.21 oc	0.00	---	---	0.00	12.20 s	---	---	---	---	12.20
7.15	29,605	620.00	13.25 oc	0.00	---	---	4.50 s	8.74 s	---	---	---	---	13.24
8.15	37,276	621.00	14.19 oc	0.00	---	---	8.22 s	5.80 s	---	---	---	---	14.02

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	SCS Runoff	10.33	2	720	23,659	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	11.64	2	718	28,054	------	------	------	Proposed Detained
3	SCS Runoff	3.978	2	716	8,034	------	------	------	Bypass Area
4	Reservoir	8.297	2	724	22,375	2	616.51	10,092	Detention Pond
5	Combine	11.17	2	720	30,409	3, 4	------	------	Adding Bypass

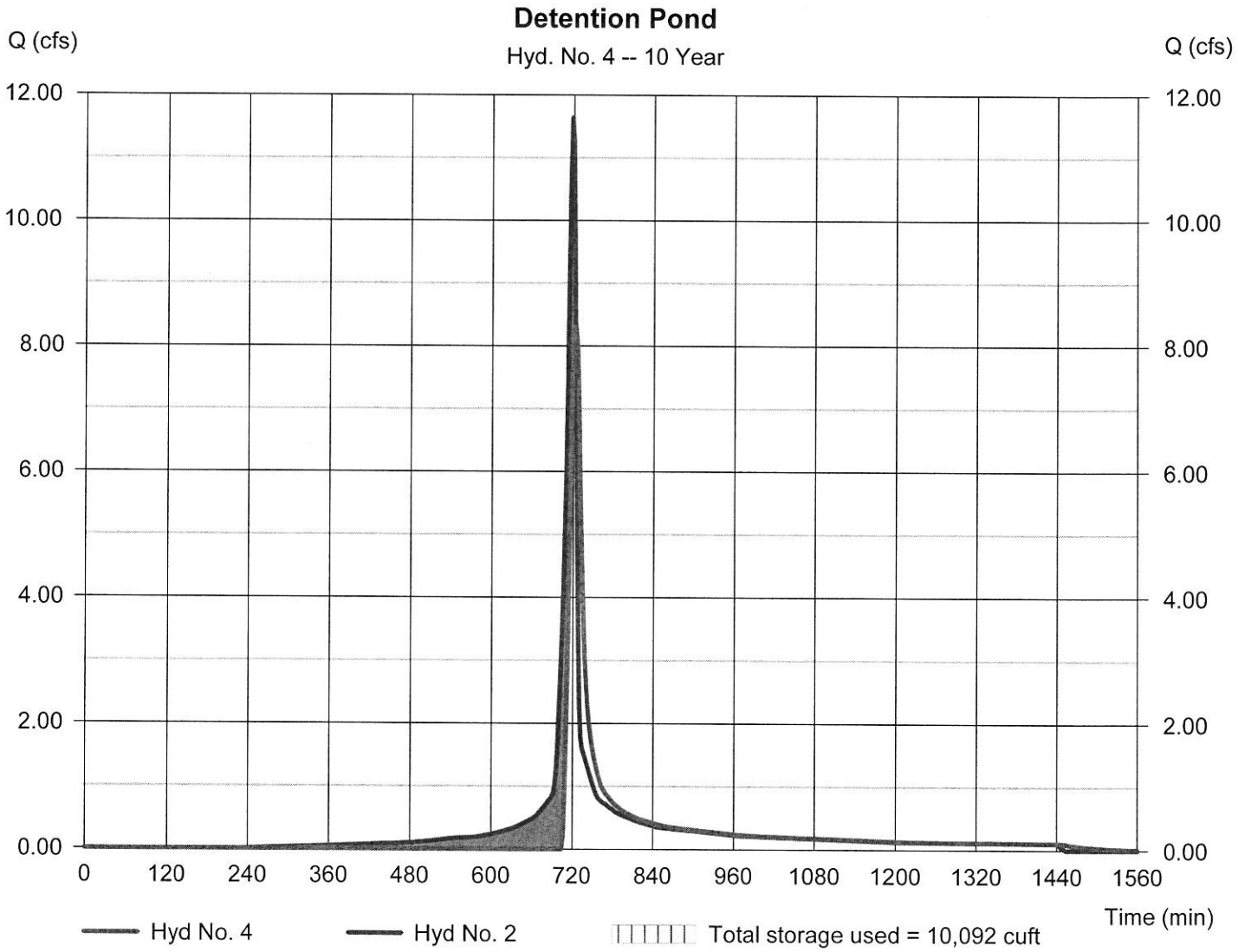
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 8.297 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 22,375 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 616.51 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 10,092 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	SCS Runoff	13.56	2	718	31,020	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	13.99	2	718	34,115	------	------	------	Proposed Detained
3	SCS Runoff	5.121	2	716	10,379	------	------	------	Bypass Area
4	Reservoir	9.183	2	724	28,435	2	616.81	11,392	Detention Pond
5	Combine	13.48	2	718	38,814	3, 4	------	------	Adding Bypass

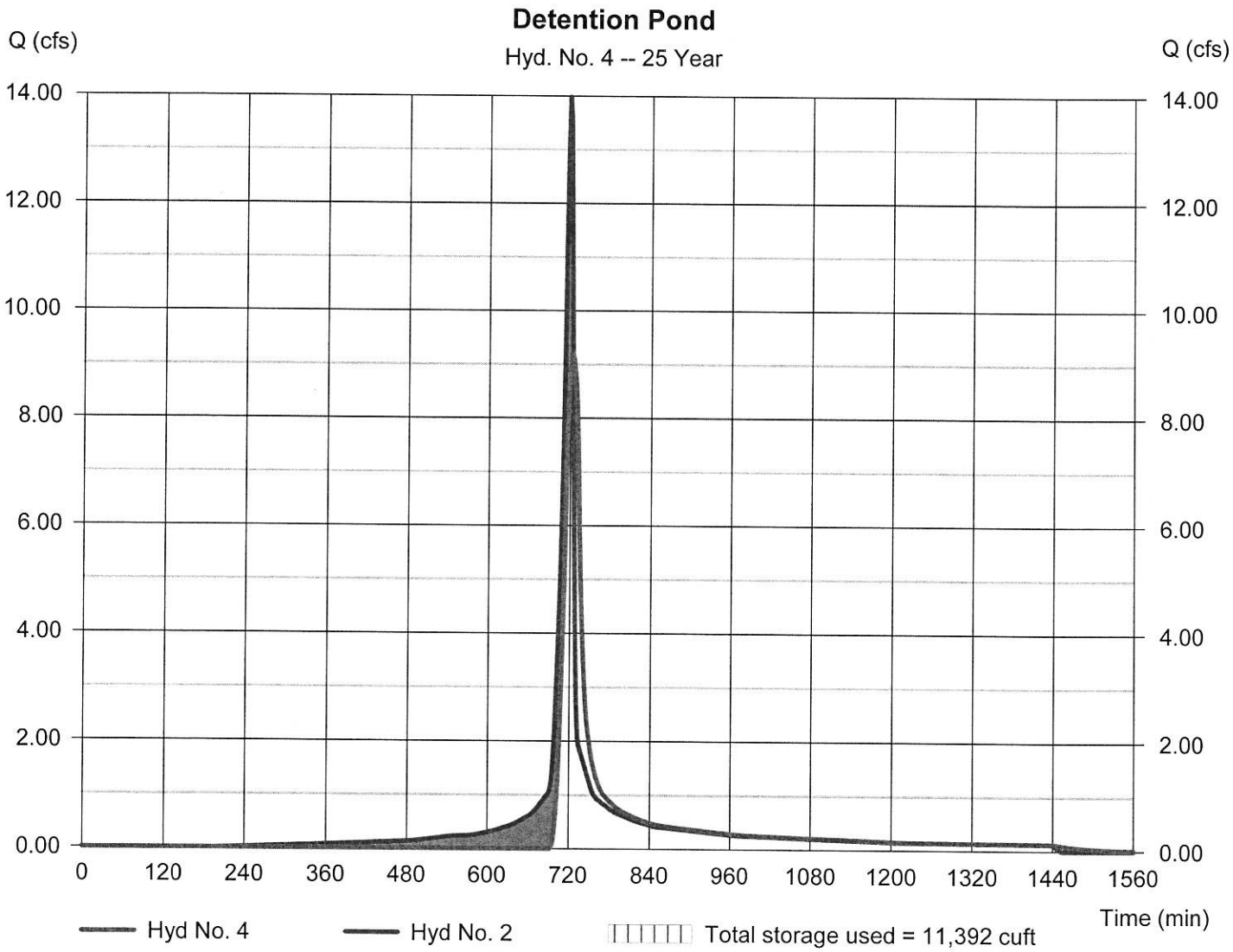
Hydrograph Report

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 9.183 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 28,435 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 616.81 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 11,392 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11

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	SCS Runoff	16.91	2	718	38,714	------	------	------	Existing Conditions (Back to grass)
2	SCS Runoff	16.32	2	718	40,217	------	------	------	Proposed Detained
3	SCS Runoff	6.287	2	716	12,809	------	------	------	Bypass Area
4	Reservoir	9.785	2	724	34,538	2	617.12	12,764	Detention Pond
5	Combine	15.20	2	718	47,347	3, 4	------	------	Adding Bypass

Hydrograph Report

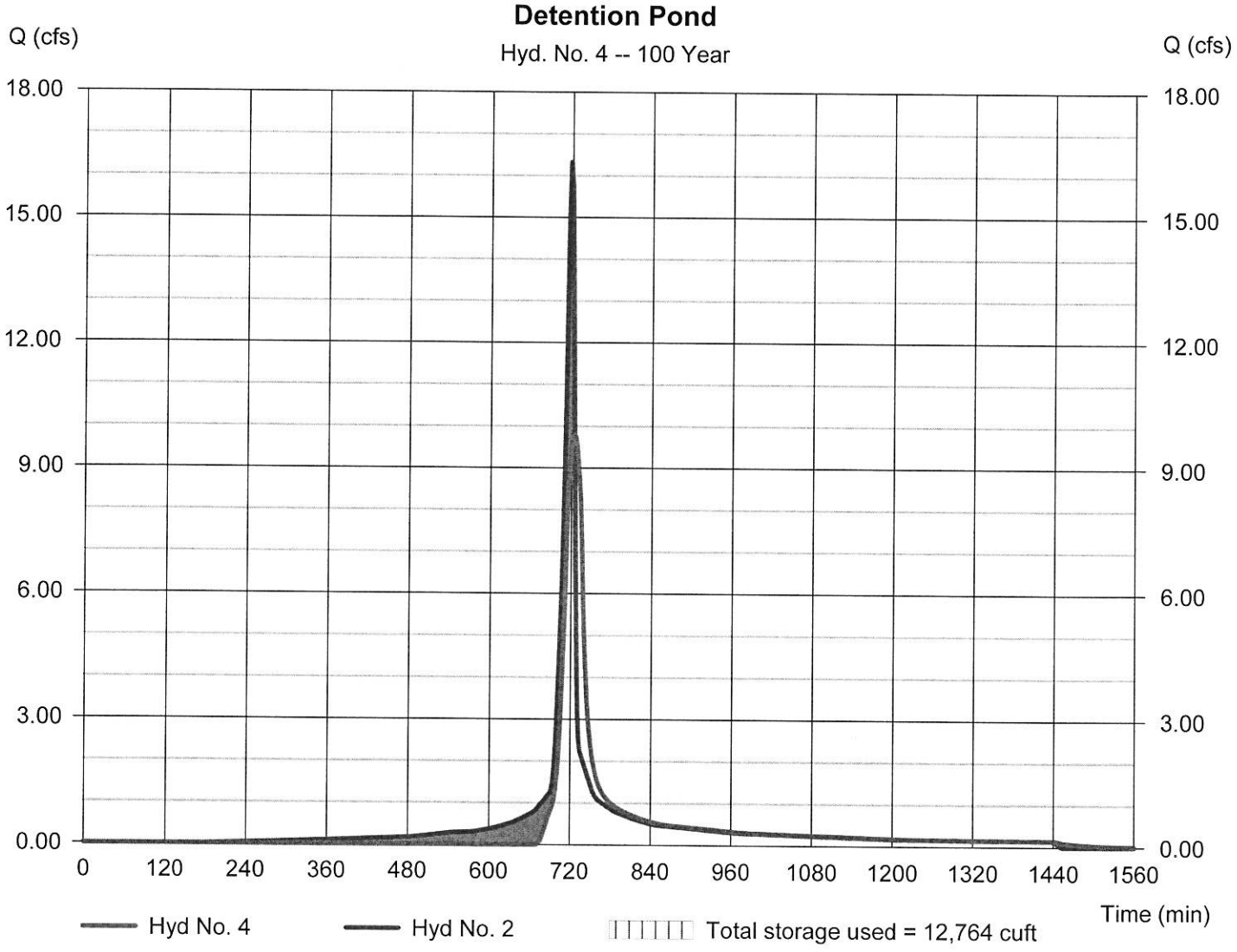
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v11 Friday, 01 / 26 / 2018

Hyd. No. 4

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 9.785 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 34,538 cuft
Inflow hyd. No.	= 2 - Proposed Detained	Max. Elevation	= 617.12 ft
Reservoir name	= Detention Pond Volume	Max. Storage	= 12,764 cuft

Storage Indication method used.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	47.7469	9.9000	0.8071	--------
3	0.0000	0.0000	0.0000	--------
5	58.5141	11.2000	0.7943	--------
10	66.9022	11.9000	0.7911	--------
25	79.2027	12.6000	0.7889	--------
50	89.4253	13.1000	0.7892	--------
100	99.5476	13.5000	0.7893	--------

File name: OFallon MO Rainfall IDF.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.40	4.27	3.57	3.08	2.72	2.44	2.22	2.03	1.88	1.76	1.65	1.55
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	6.40	5.17	4.37	3.81	3.38	3.05	2.79	2.57	2.38	2.23	2.09	1.98
10	7.15	5.82	4.95	4.32	3.85	3.48	3.19	2.94	2.74	2.56	2.41	2.27
25	8.24	6.77	5.78	5.07	4.53	4.10	3.76	3.48	3.24	3.03	2.85	2.70
50	9.10	7.50	6.43	5.65	5.06	4.59	4.21	3.89	3.62	3.40	3.20	3.02
100	9.95	8.24	7.08	6.23	5.58	5.07	4.65	4.30	4.01	3.76	3.54	3.35

Tc = time in minutes. Values may exceed 60.

Precip. file name: I:\Rainfall Data\OFallon MO Precipitation PCP.pcp

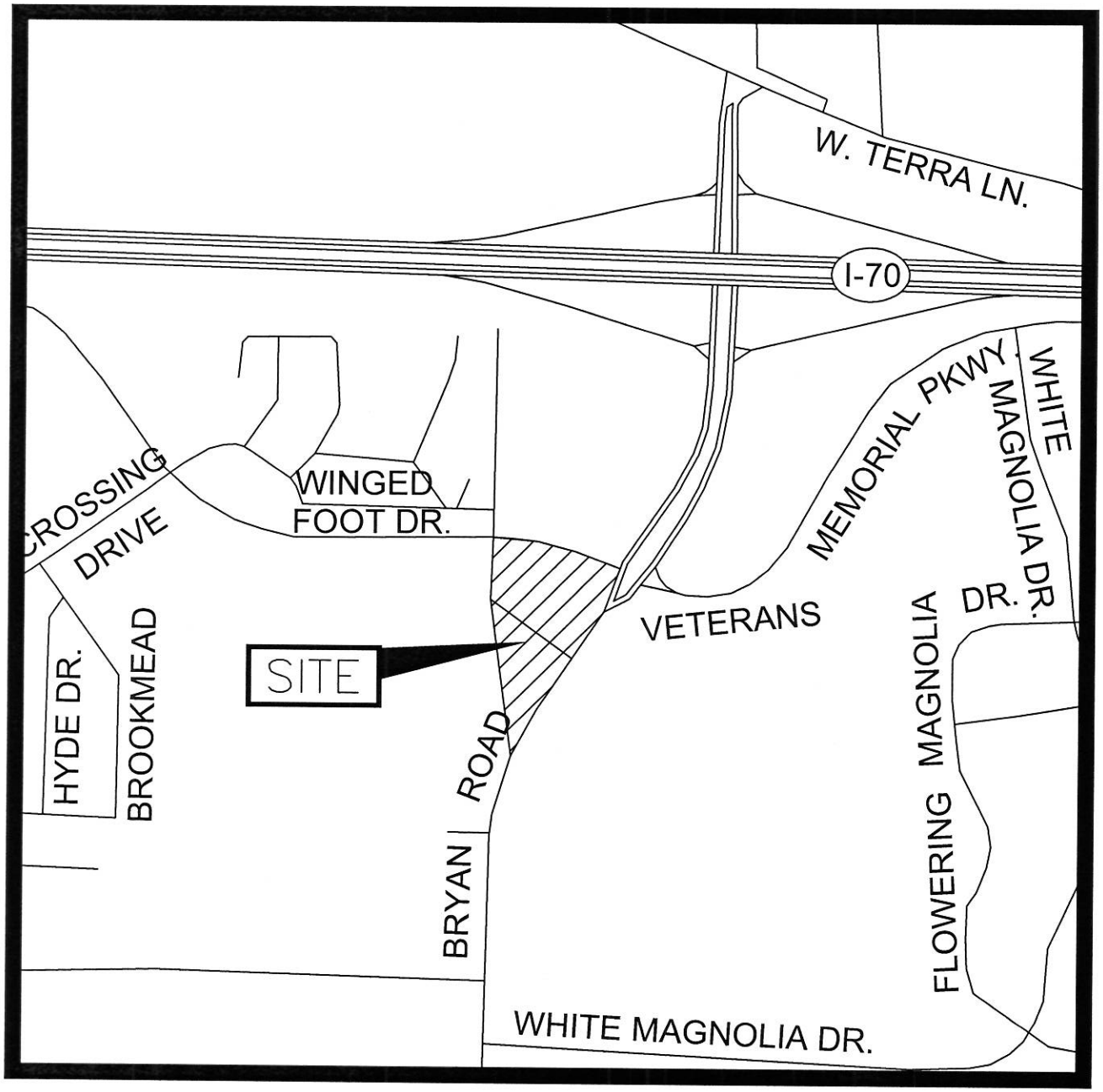
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	3.00	3.10	0.00	4.50	4.60	5.40	6.60	6.20
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

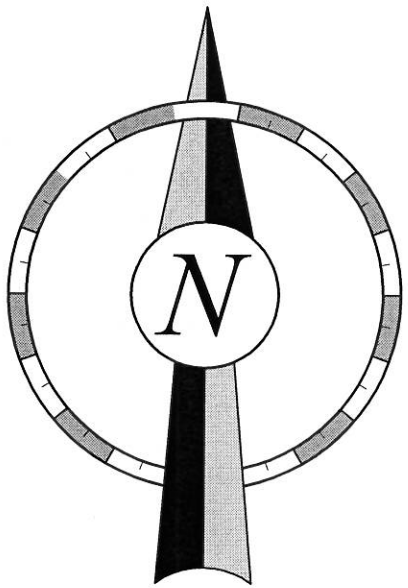
SECTION 8

Supporting Data

EXHIBIT A

Site Location Map





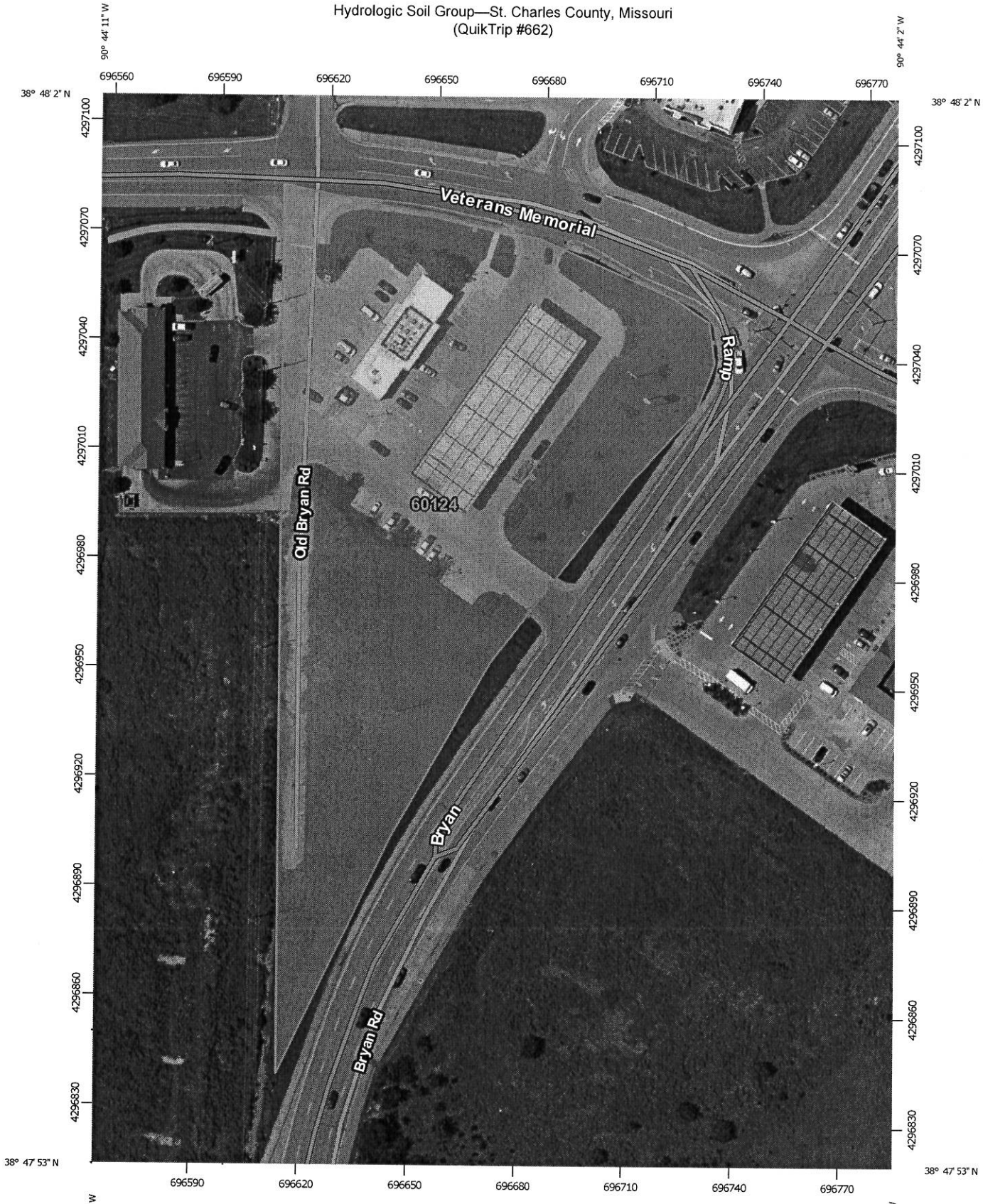
Vicinity Map

Not to Scale

EXHIBIT B

NRCS Hydrologic Soil Group

Hydrologic Soil Group—St. Charles County, Missouri
(QuikTrip #662)



Map Scale: 1:1,430 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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: http://websoilsurvey.nrcs.usda.gov
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: St. Charles County, Missouri
Survey Area Data: Version 14, Sep 14, 2015

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

Date(s) aerial images were photographed: Jun 13, 2014—Jun 25, 2014

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — St. Charles County, Missouri (MO183)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
60124	Harvester-Urban land complex, 2 to 9 percent slopes	C	3.6	100.0%
Totals for Area of Interest			**3.6**	**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.

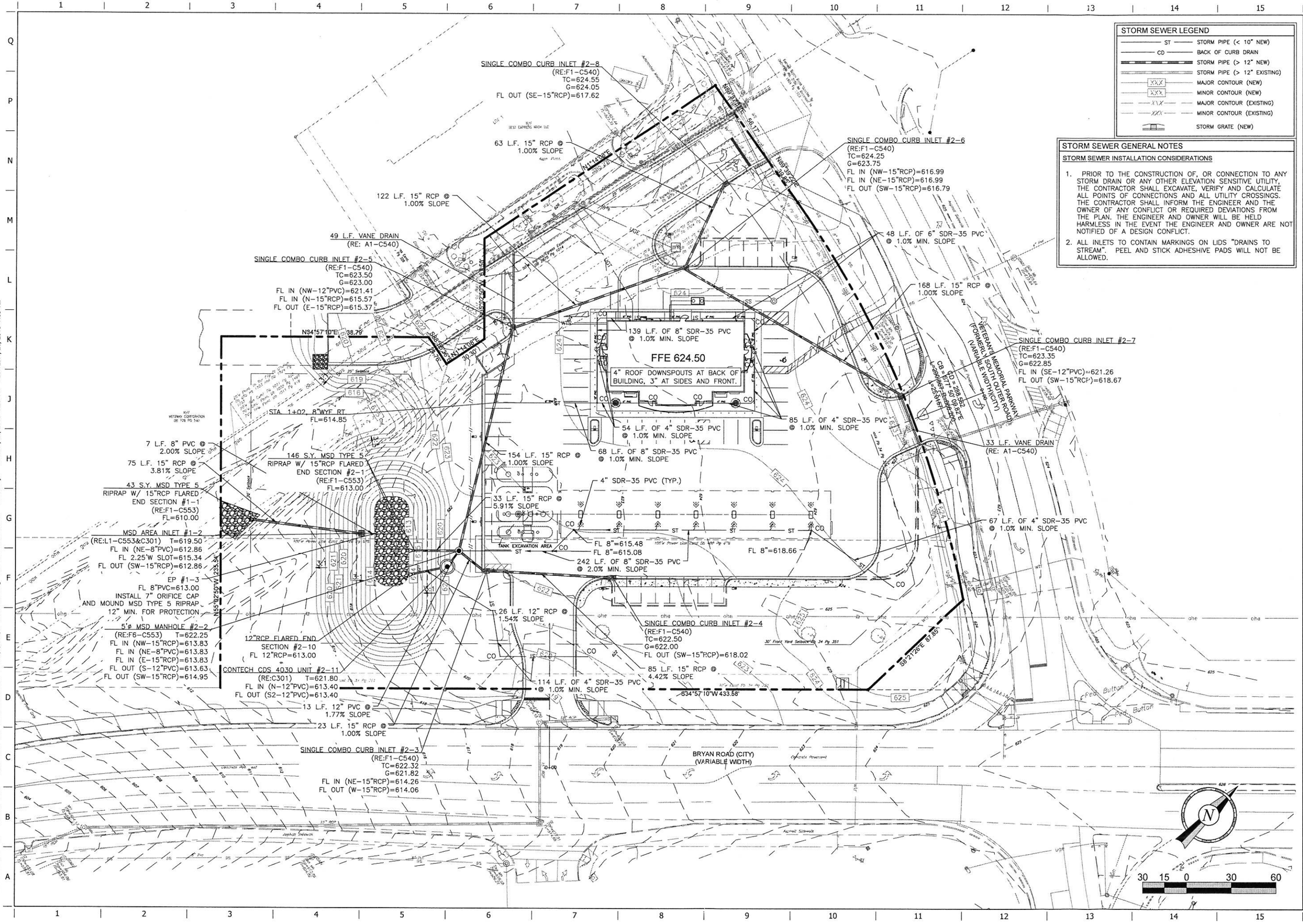
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher



STORM SEWER LEGEND

- ST — STORM PIPE (< 10" NEW)
- CD — BACK OF CURB DRAIN
- STORM PIPE (> 12" NEW)
- STORM PIPE (> 12" EXISTING)
- XXX MAJOR CONTOUR (NEW)
- XXX MINOR CONTOUR (NEW)
- XXX MAJOR CONTOUR (EXISTING)
- XXX MINOR CONTOUR (EXISTING)
- STORM GRATE (NEW)

STORM SEWER GENERAL NOTES

STORM SEWER INSTALLATION CONSIDERATIONS

1. PRIOR TO THE CONSTRUCTION OF, OR CONNECTION TO ANY STORM DRAIN OR ANY OTHER ELEVATION SENSITIVE UTILITY, THE CONTRACTOR SHALL EXCAVATE, VERIFY AND CALCULATE ALL POINTS OF CONNECTIONS AND ALL UTILITY CROSSINGS. THE CONTRACTOR SHALL INFORM THE ENGINEER AND THE OWNER OF ANY CONFLICT OR REQUIRED DEVIATIONS FROM THE PLAN. THE ENGINEER AND OWNER WILL BE HELD HARMLESS IN THE EVENT THE ENGINEER AND OWNER ARE NOT NOTIFIED OF A DESIGN CONFLICT.
2. ALL INLETS TO CONTAIN MARKINGS ON LIDS "DRAINS TO STREAM". PEEL AND STICK ADHESIVE PADS WILL NOT BE ALLOWED.

STATE OF MISSOURI
REGISTERED PROFESSIONAL ENGINEER
MICHAEL JAMES VELLOFF
NO. E-2000161862

PROJECT NO.:161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

THE SEAL OF MICHAEL J. VELLOFF ON THIS DRAWING APPLIES ONLY TO THE CIVIL/SITE ENGINEERING SHOWN. IT DOES NOT APPLY, NOR IS ANY RESPONSIBILITY TAKEN FOR ENVIRONMENTAL, GEOTECHNICAL (INCLUDING BUT NOT LIMITED TO SLOPE STABILITY), STRUCTURAL, HVAC, PLUMBING, ELECTRICAL, FIRE PROTECTION, TRAFFIC ENGINEERING, SURVEYING (BOUNDARY AND TOPOGRAPHIC), OR ARCHITECTURAL (BUILDING OR LANDSCAPE).

QuikTrip No. 0662

955 BRYAN ROAD
O'FALLAN, MO 63366

PROTOTYPE:	P-92-02
DIVISION:	06
VERSION:	001
DESIGNED BY:	RKF
DRAWN BY:	RKF
REVIEWED BY:	MJV

REV	DATE	DESCRIPTION

ORIGINAL ISSUE DATE: 02/02/17

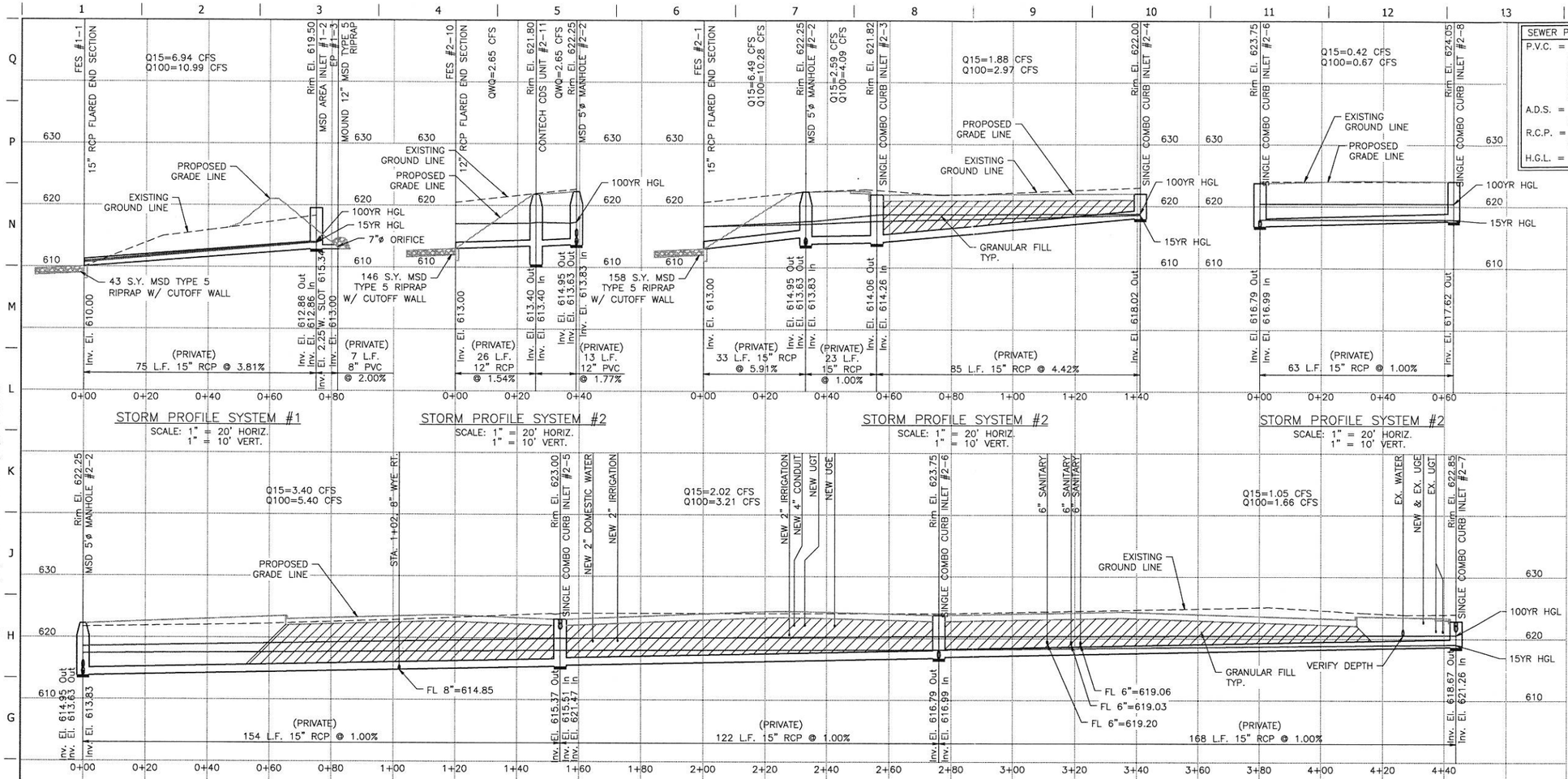
SHEET TITLE:

STORM SEWER PLAN

SHEET NUMBER:

C120

FILE LOCATION=K:\161105 - QuikTrip #662 - Bryan Road and Veterans Memorial Parkway\Civil\06-0662 Civil.dwg TAB NAME=C120 Storm USER=rkfryer SAVED=1/25/2018 1:20 PM PLOTTED=1/26/2018 7:03 AM



SEWER PIPE SPECIFICATIONS:

P.V.C. = POLYVINYL CHLORIDE PIPE (ASTM D-3034, WALL THICKNESS SDR 35) FITTINGS: P.V.C., ASTM D-3034 SOLVENT CEMENT: ASTM D-2855 GASKETS AND SEALS: ELASTOMERIC, STANDARD TO THE MANUFACTURER

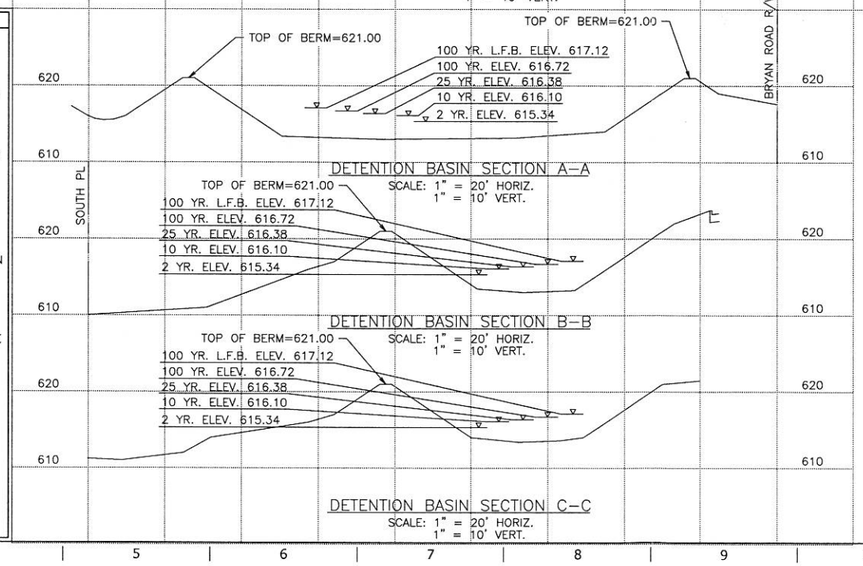
A.D.S. = POLYPROPYLENE (ASTM F-2736 FOR 12"-30" ASTM F-2764 FOR 30"-60")(SANITITE HP)

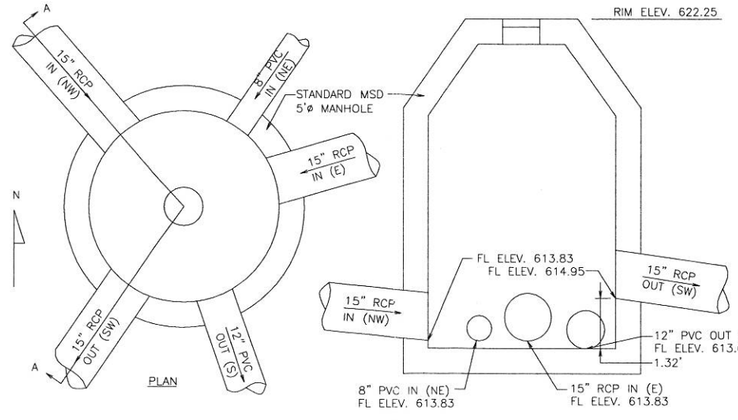
R.C.P. = REINFORCED CONCRETE PIPE, CLASS V (ASTM C-76)

H.G.L. = HYDRAULIC GRADE LINE

STORM SEWER PROFILE GENERAL NOTES

1. PRIOR TO THE CONSTRUCTION OF, OR CONNECTION TO ANY STORM DRAIN OR ANY OTHER ELEVATION SENSITIVE UTILITY, THE CONTRACTOR SHALL EXCAVATE, VERIFY AND CALCULATE ALL POINTS OF CONNECTIONS AND ALL UTILITY CROSSINGS. THE CONTRACTOR SHALL INFORM THE ENGINEER AND THE OWNER OF ANY CONFLICT OR REQUIRED DEVIATIONS FROM THE PLAN. THE ENGINEER AND OWNER WILL BE HELD HARMLESS IN THE EVENT THE ENGINEER AND OWNER ARE NOT NOTIFIED OF A DESIGN CONFLICT.
2. CONTRACTOR SHALL INSTALL NEW PIPE USING VERTICAL SHORING METHODS ACCEPTABLE TO OSHA LAWS AND REGULATIONS.
3. FOR SEWER PIPE (STORM, SANITARY AND COMBINED) WITH A DESIGN GRADE LESS THAN ONE PERCENT (1%), VERIFICATION OF THE PIPE GRADE WILL BE REQUIRED FOR EACH INSTALLED REACH OF SEWER, PRIOR TO ANY SURFACE RESTORATION OR INSTALLATION OF ANY SURFACE IMPROVEMENTS. THE CONTRACTOR'S FIELD SUPERVISOR WILL BE REQUIRED TO PROVIDE DAILY DOCUMENTATION VERIFYING THAT THE AS-BUILT PIPE GRADE MEETS THE DESIGN GRADE THROUGH THE SUBMITTAL OF SIGNED CUT SHEETS TO THE DISTRICT INSPECTOR UPON REQUEST.
4. THE CONTRACTOR WILL BE REQUIRED TO REMOVE AND REPLACE ANY SEWER REACH HAVING AN AS-BUILT GRADE FLATTER THAN THE DESIGN GRADE BY MORE THAN 0.1%. SEWERS WITH GRADES GREATER THAN THE DESIGN GRADE MAY BE LEFT IN PLACE PROVIDED NO OTHER SEWER GRADE IS REDUCED BY THIS VARIANCE IN THE AS-BUILT GRADE.
5. CITY ALSO RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO REMOVE AND REPLACE ANY SEWER (AT ANY TIME PRIOR TO CONSTRUCTION APPROVAL) FOR WHICH THE AS-BUILT GRADE DOES NOT COMPLY WITH THE GRADE TOLERANCE STATED IN THE ABOVE PARAGRAPHS.
6. FIELD SURVEYED VERIFICATION MUST BE MADE UNDER THE DIRECTION OF THE LICENSED LAND SURVEYOR OR REGISTERED ENGINEER. THE SEWER CONTRACTOR SHALL BE RESPONSIBLE FOR ANY COST ASSOCIATED WITH THE FIELD VERIFICATION OF THE SEWER GRADE, OR REMOVAL AND REPLACEMENT OF THE SEWER PIPE OR ASSOCIATED APPURTENANCES.
7. TBR&R - THE REMOVAL AND REPLACEMENT, OR REHABILITATION OF THE EXISTING STRUCTURES WILL BE DETERMINED BY THE CITY FIELD INSPECTOR. IF THE STRUCTURE IS DETERMINED TO REMAIN IN PLACE THEN THE TOP SHALL BE ADJUSTED TO GRADE IF NEEDED.
8. ALL INLETS TO CONTAIN MARKINGS ON LIDS "DRAINS TO STREAM". PEEL AND STICK ADHESIVE PADS WILL NOT BE ALLOWED.
9. ALL PIPE CONNECTONS TO CONTAIN A-LOK FITTINGS. NO GROUT CONNECTIONS ALLOWED.





NOTES:
1. THE CONTRACTOR MUST VERIFY THE RELATIONSHIP BETWEEN THE INVERT OF THE FLOW SPLITTER PIPE AND THE INVERT OF THE OVERFLOW PIPE PRIOR TO BACKFILLING AROUND THE STRUCTURE. NOTIFY THE DESIGN ENGINEER IMMEDIATELY IF THERE IS A DISCREPANCY.

FLOW SPLITTER STRUCTURE
MANHOLE #2-2
SCALE: 1/2" = 1'-0"

STATE OF MISSOURI
MICHAEL JAMES VELLOFF
NO. E-2000161862
REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

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QuikTrip No. 0662
955 BRYAN ROAD
O'FALLAN, MO 63366

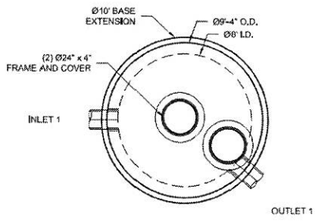
PROTOTYPE: P-92-02
DIVISION: 06
VERSION: 001
DESIGNED BY: RKF
DRAWN BY: RKF
REVIEWED BY: MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

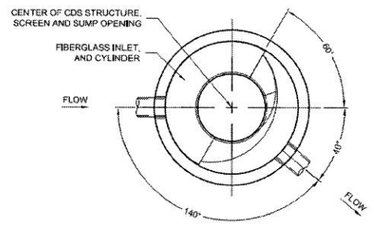
SHEET TITLE:
STORM SEWER PROFILES

SHEET NUMBER:
C300

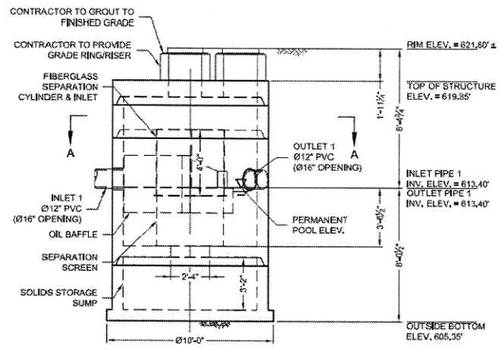
FILE LOCATION:K:\161105 - QuikTrip #662 - Bryn Road and Veterans Memorial Parkway\Civil\06-0662 Civil.dwg TAB NAME:C300 Storm Profiles USER:rkfryer SAVED:1/25/2018 1:20 PM PLOTTED:1/26/2018 7:04 AM



PLAN VIEW



SECTION A-A



ELEVATION VIEW

MATERIAL LIST (PROVIDED BY CONTECH)

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET AND CYLINDER	CONTECH
1	2400 micron, 4' O.D. x 3.04' SEP. SCREEN	CONTECH
1	SEALANT FOR JOINTS (BY PRECASTER)	CONTRACTOR
2	Ø24" x 4" FRAME & COVER, EJ#41600389, OR EQUIV.	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	2.65 CFS
PEAK FLOW RATE	N/A CFS
RETURN PERIOD OF PEAK FLOW	N/A YRS

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE, www.ContechES.com
3. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. STRUCTURE SHALL MEET AASHTO –NONE– LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.
6. CDS STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = 27000 LBS.
STRUCTURE IS DELIVERED IN 4 PIECES

MAX FOOTPRINT = Ø10'

CONTECH **PROPOSAL** DRAWING

REVISION DESCRIPTION	DATE	BY

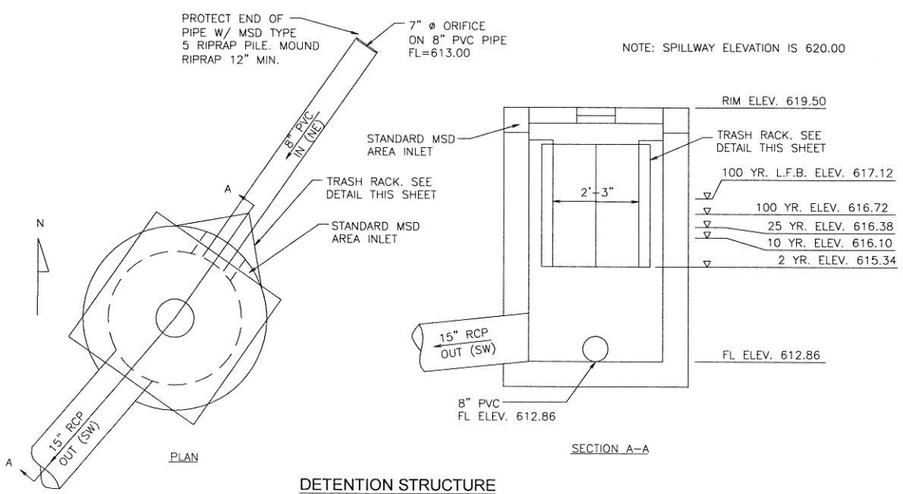
CDS4030-8-C - 553285-10
QUIK TRIP #662
OFALLON, MO
for SYSTEM: #2-11

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
800.338.1122 513.645.7000 513.645.7993 FAX
9025 Centre Pointe Drive, Suite 400, West Chester, OH 45069

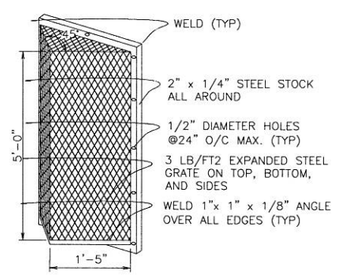
DATE: 11/17/16	SCALE: 3/16" = 1'-0"
DESIGNED: CMF	DRAWN: CMF
CHECKED: XXX	APPROVED: —
KIEN PROJECT No.: 553285	SEQUENCE No.: 10
SHEET: 1 of 1	
LAYOUT 1A	
4030-8-F-CIS	
1185 / KIEN10	

Project Name QuikTrip#662
Location: O'Fallon MO
Project No.: 161105
Structure No. 2-11
Prepared For: QuikTrip Corp
Prepared By: RKF

Drainage Area	1.89 acre	Impervious Area	1.53 acre
	82,329 ft²		66,647 ft²
	1.89 acre		1.53 acre
	0.00295313 mi²		0.0023906 mi²
% Impervious	81.0%	% Impervious Over-ride	0
P	1.14 in		
Rv	0.779 volumetric runoff coefficient		
Qa	0.89 watershed inches		
WQV	6,069.4 ft3		
	0.140 acre-ft		
CN	97.6		
Tc	5 min		
	0.08 hr		
Rainfall Type	II		
Potential Abstraction, "S"	0.25 inches		
Initial Abstraction, "Ia"	0.05 inches		
Treatment System	Vortechs		
Micron Rating	110		
qu	1010.41		
WQF	2.65 cfs		



DETENTION STRUCTURE
MSD AREA INLET #1-2
SCALE: 1/2" = 1'-0"



NOTES:
1. TRASH RAKE TO BE CENTERED OVER OPENING.
2. STEEL TO COMFORM TO ASTM A-36.
3. ALL SURFACES TO BE COATED WITH ZRC COLD GALVANIZING COMPOUND AFTER WELDING.
4. TRASH RACK TO BE FASTENED TO THE WALL WITH 1/2" MASONARY ANCHORS. TRASH RACK TO BE REMOVABLE.

TRASH RACK DETAIL
N.T.S.

STATE OF MISSOURI
MICHAEL JAMES VELLOFF
NO. E-2000161862
REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

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QuikTrip No. 0662

955 BRYAN ROAD
O'FALLAN, MO 63366

QT

PROTOTYPE:	P-92-02
DIVISION:	06
VERSION:	001
DESIGNED BY:	RKF
DRAWN BY:	RKF
REVIEWED BY:	MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

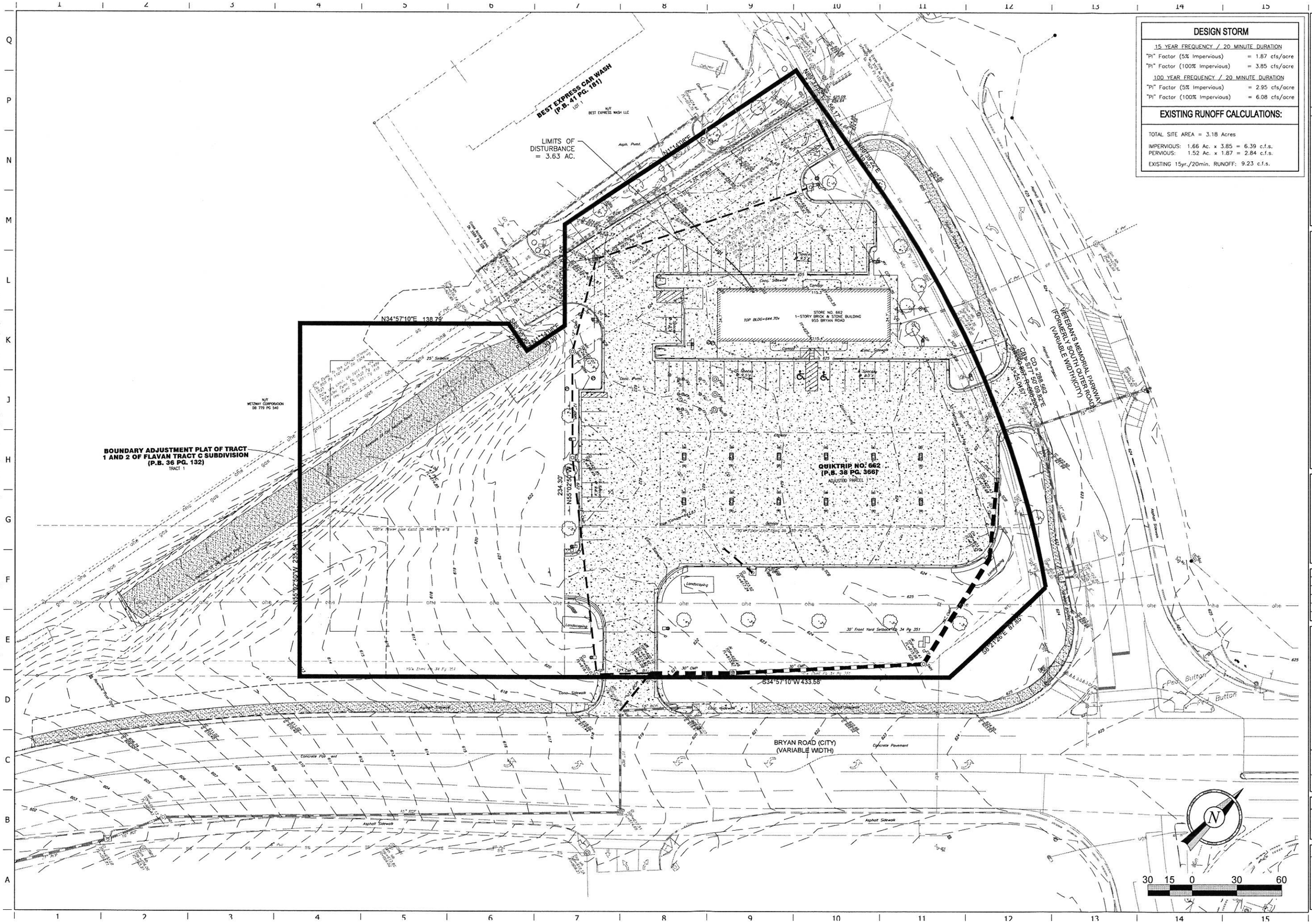
SHEET TITLE:
WATER QUALITY DETAILS

SHEET NUMBER:
C301

FILE LOCATION:K:\161105 - QuikTrip #662 - Bryan Road and Veterans Memorial Parkway\Civil\06-0662 Civil.dwg TAB NAME:C301 Water Quality Details USER:rkfryer SAVED:1/25/2018 1:20 PM PLOTTED:1/26/2018 7:04 AM

EXHIBIT D

Pre-Developed Drainage Area Map



DESIGN STORM

15 YEAR FREQUENCY / 20 MINUTE DURATION

"PI" Factor (5% Impervious)	= 1.87 cfs/acre
"PI" Factor (100% Impervious)	= 3.85 cfs/acre

100 YEAR FREQUENCY / 20 MINUTE DURATION

"PI" Factor (5% Impervious)	= 2.95 cfs/acre
"PI" Factor (100% Impervious)	= 6.08 cfs/acre

EXISTING RUNOFF CALCULATIONS:

TOTAL SITE AREA = 3.18 Acres

IMPERVIOUS: 1.66 Ac. x 3.85 = 6.39 c.f.s.
PERVIOUS: 1.52 Ac. x 1.87 = 2.84 c.f.s.

EXISTING 15yr./20min. RUNOFF: 9.23 c.f.s.

STATE OF MISSOURI
MICHAEL JAMES VELLOFF
NO. E-2000161862
REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:161105

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QuikTrip No. 0662

955 BRYAN ROAD
O'FALLAN, MO 63366

PROTOTYPE:	P-92-02
DIVISION:	06
VERSION:	001
DESIGNED BY:	RKF
DRAWN BY:	RKF
REVIEWED BY:	MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

SHEET TITLE:
PRE-DEVELOPED DRAINAGE MAP

SHEET NUMBER:
C400

FILE LOCATION:K:\161105 - QuikTrip #662 - Bryan Road and Veterans Memorial Parkway\Civil\08-0662 Civil.dwg TAB NAME:C400 Pre Dev Map USER:rkfryer SAVED:1/25/2018 1:20 PM PLOTTED:1/26/2018 6:35 AM

EXHIBIT E

Post-Developed Drainage Area Map

PROPOSED STORM SEWER RUNOFF TABLE

I.D.	TO STRUCTURE NO.	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	15Yr./20Min. Composite PI Factor (cfs/ac.)	15Yr./20Min. Total Q (cfs)	100Yr./20Min. Composite PI Factor (cfs/ac.)	100Yr./20Min. Total Q (cfs)
A	CI 2-5	0.12	0.12	0.000	3.850	0.462	6.080	0.730
B	MH 2-2	0.13	0.13	0.000	3.850	0.501	6.080	0.790
C	CI 2-4	0.54	0.44	0.100	3.483	1.881	5.500	2.970
D	CI 2-3	0.22	0.15	0.070	3.220	0.708	5.084	1.119
E	GI 1-2	0.24	0.00	0.240	1.870	0.449	2.950	0.708
F	CI 2-5	0.25	0.23	0.020	3.692	0.923	5.830	1.457
G	CI 2-6	0.18	0.11	0.070	3.080	0.554	4.863	0.875
H	CI 2-7	0.32	0.23	0.090	3.293	1.054	5.200	1.664
I	CI 2-8	0.13	0.09	0.040	3.241	0.421	5.117	0.665

(See Stormwater Management Facilities Report for Calculations)

NOTE: IMPERVIOUS AREAS FOR FUTURE PARKING BUILDOUT INCLUDED IN RUNOFF.

(#) = Drainage Area I.D.

SINGLE COMBO CURB INLET #2-8
(RE:F1-C540)
TC=624.55
G=624.05
FL OUT (SE-15"RCP)=617.62

63 L.F. 15" RCP @ 1.00% SLOPE

LIMITS OF DISTURBANCE = 3.63 AC.

122 L.F. 15" RCP @ 1.00% SLOPE

49 L.F. VANE DRAIN
(RE: A1-C540)

SINGLE COMBO CURB INLET #2-5
(RE:F1-C540)
TC=623.50
G=623.00
FL IN (NW-12"PVC)=621.41
FL IN (N-15"RCP)=615.57
FL OUT (E-15"RCP)=615.37

N34°57'10"E 38.79

STA 1+02, 8"WYE RT
FL=614.85

7 L.F. 8" PVC @ 2.00% SLOPE

75 L.F. 15" RCP @ 3.81% SLOPE

146 S.Y. MSD TYPE 5 RIPRAP W/ 15"RCP FLARED END SECTION #2-1
(RE:F1-C553)
FL=613.00

43 S.Y. MSD TYPE 5 RIPRAP W/ 15"RCP FLARED END SECTION #1-1
(RE:F1-C553)
FL=610.00

MSD AREA INLET #1-2
(RE:L1-C553&C301) T=619.50
FL IN (NE-8"PVC)=612.86
FL 2.25'W SLOT=615.34
FL OUT (SW-15"RCP)=612.86

EP #1-3
FL 8"PVC=613.00
INSTALL 7" ORIFICE CAP AND MOUND MSD TYPE 5 RIPRAP 12" MIN. FOR PROTECTION

5'ø MSD MANHOLE #2-2
(RE:F6-C553) T=622.25
FL IN (NW-15"RCP)=613.83
FL IN (NE-8"PVC)=613.83
FL IN (E-15"RCP)=613.83
FL OUT (S-12"PVC)=613.63
FL OUT (SW-15"RCP)=614.95

S35°32'55"W 236.34'

12"RCP FLARED END SECTION #2-10
FL 12"RCP=613.00

CONTECH CDS 4030 UNIT #2-11
(RE:C301) T=621.80
FL IN (N-12"PVC)=613.40
FL OUT (S2-12"PVC)=613.40

13 L.F. 12" PVC @ 1.77% SLOPE

23 L.F. 15" RCP @ 1.00% SLOPE

SINGLE COMBO CURB INLET #2-3
(RE:F1-C540)
TC=622.32
G=621.82
FL IN (NE-15"RCP)=614.26
FL OUT (W-15"RCP)=614.06

139 L.F. OF 8" SDR-35 PVC @ 1.0% MIN. SLOPE

FFE 624.50

4" ROOF DOWNSPOUTS AT BACK OF BUILDING, 3" AT SIDES AND FRONT.

54 L.F. OF 4" SDR-35 PVC @ 1.0% MIN. SLOPE

68 L.F. OF 8" SDR-35 PVC @ 1.0% MIN. SLOPE

154 L.F. 15" RCP @ 1.00% SLOPE

4" SDR-35 PVC (TYP.)

33 L.F. 15" RCP @ 5.91% SLOPE

FL 8"=615.48
FL 8"=615.08
242 L.F. OF 8" SDR-35 PVC @ 2.0% MIN. SLOPE

FL 8"=618.66

26 L.F. 12" RCP @ 1.54% SLOPE

SINGLE COMBO CURB INLET #2-4
(RE:F1-C540)
TC=622.50
G=622.00
FL OUT (SW-15"RCP)=618.02

85 L.F. 15" RCP @ 4.42% SLOPE

114 L.F. OF 4" SDR-35 PVC @ 1.0% MIN. SLOPE

S34°57'10"W 433.58'

SINGLE COMBO CURB INLET #2-6
(RE:F1-C540)
TC=624.25
G=623.75
FL IN (NW-15"RCP)=616.99
FL IN (NE-15"RCP)=616.99
FL OUT (SW-15"RCP)=616.79

48 L.F. OF 6" SDR-35 PVC @ 1.0% MIN. SLOPE

168 L.F. 15" RCP @ 1.00% SLOPE

SINGLE COMBO CURB INLET #2-7
(RE:F1-C540)
TC=623.35
G=622.85
FL IN (SE-12"PVC)=621.26
FL OUT (SW-15"RCP)=618.67

VETERANS MEMORIAL PARKWAY (FORMERLY SOUTH OUTER ROAD) (VARIABLE WIDTH)

CB = S17°60'00.92E 288.06'
CL = S17°60'00.92E 288.06'

33 L.F. VANE DRAIN
(RE: A1-C540)

85 L.F. OF 4" SDR-35 PVC @ 1.0% MIN. SLOPE

67 L.F. OF 4" SDR-35 PVC @ 1.0% MIN. SLOPE

S35°32'55"E 67.65'

BRYAN ROAD (CITY) (VARIABLE WIDTH)

30 15 0 30 60

DESIGN STORM

15 YEAR FREQUENCY / 20 MINUTE DURATION
"PI" Factor (5% Impervious) = 1.87 cfs/acre
"PI" Factor (100% Impervious) = 3.85 cfs/acre

100 YEAR FREQUENCY / 20 MINUTE DURATION
"PI" Factor (5% Impervious) = 2.95 cfs/acre
"PI" Factor (100% Impervious) = 6.08 cfs/acre

EXISTING RUNOFF CALCULATIONS:

TOTAL SITE AREA = 3.18 Acres

IMPERVIOUS: 1.66 Ac. x 3.85 = 6.39 c.f.s.
PERVIOUS: 1.52 Ac. x 1.87 = 2.84 c.f.s.

EXISTING 15yr./20min. RUNOFF: 9.23 c.f.s.

PROPOSED RUNOFF CALCULATIONS:

TOTAL SITE AREA = 3.18 Acres

IMPERVIOUS: 1.62 Ac. x 3.85 = 6.24 c.f.s.
PERVIOUS: 1.56 Ac. x 1.87 = 2.92 c.f.s.

PROPOSED 15yr./20min. RUNOFF: 9.16 c.f.s.

DIFFERENTIAL RUNOFF CALCULATIONS:

TOTAL SITE AREA = 3.18 Acres

DIFFERENTIAL=PROPOSED-EXISTING=9.16-9.23=-0.07
NET DECREASE = 0.07 c.f.s.

SITE HAS EXISTING DETENTION.

STATE OF MISSOURI
MICHAEL JAMES VELLOFF
NO. E-2000161862
REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

THE SEAL OF MICHAEL J. VELLOFF ON THIS DRAWING APPLIES ONLY TO THE CIVIL/SITE ENGINEERING SHOWN. IT DOES NOT APPLY, NOR IS ANY RESPONSIBILITY TAKEN FOR ENVIRONMENTAL, GEOTECHNICAL (INCLUDING BUT NOT LIMITED TO SLOPE STABILITY), STRUCTURAL, HVAC, PLUMBING, ELECTRICAL, FIRE PROTECTION, TRAFFIC ENGINEERING, SURVEYING (BOUNDARY AND TOPOGRAPHIC), OR ARCHITECTURAL (BUILDING OR LANDSCAPE).

QuikTrip No. 0662

955 BRYAN ROAD
O'FALLAN, MO 63366

PROTOTYPE:	P-92-02
DIVISION:	06
VERSION:	001
DESIGNED BY:	RKF
DRAWN BY:	RKF
REVIEWED BY:	MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

SHEET TITLE:
POST-DEVELOPED DRAINAGE MAP

SHEET NUMBER:
C401

EXHIBIT F

Pre-Developed Detention Drainage Map

STATE OF MISSOURI
REGISTERED PROFESSIONAL ENGINEER
MICHAEL JAMES VELLOFF
NO. E-2000161862

PROJECT NO.: 161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

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O'FALLAN, MO 63366

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REVIEWED BY:	MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

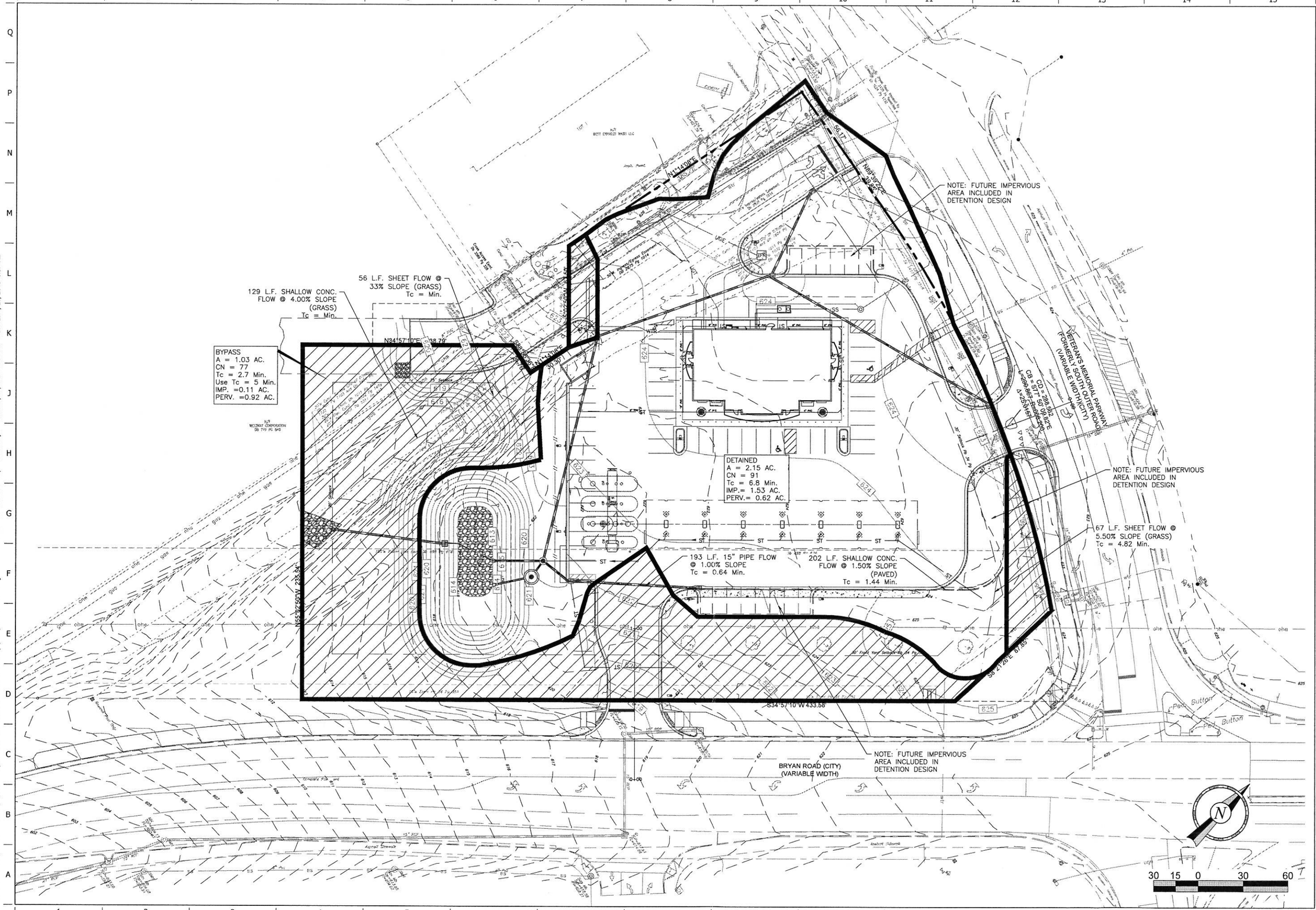
SHEET TITLE:
PRE-DEVELOPED DETENTION DRAINAGE MAP

SHEET NUMBER:
C402

FILE LOCATION:K:\161105 - QuikTrip #662 - Bryan Road and Veterans Memorial Parkway\Civil\06-0662 Civil.dwg TAB NAME:C402 Pre Det Dev Map USER:rkfryer SAVED:1/25/2018 1:20 PM PLOTTED:1/26/2018 6:37 AM

EXHIBIT G

Post-Developed Detention Drainage Map



FILE LOCATION:K:\161105 - QuikTrip #662 - Bryan Road and Veterans Memorial Parkway\Civil\06-0662 Civil.dwg TAB NAME:C403 Post Detention Map USER:rkfryer SAVED:1/25/2018 1:20 PM PLOTTED:1/26/2018 6:37 AM

MICHAEL JAMES VELLOFF NO. E-2000161862 — STATE OF MISSOURI — REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:161105

NAME: MICHAEL J. VELLOFF
LICENSE NUMBER: E-2000161862
DISCIPLINE: CIVIL
CORPORATION AUTHORITY NUMBER: 001194

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DRAWN BY:	RKF
REVIEWED BY:	MJV

REV	DATE	DESCRIPTION
		ORIGINAL ISSUE DATE: 02/02/17

SHEET TITLE:
POST-DEVELOPED DETENTION DRAINAGE MAP

SHEET NUMBER:
C403