

STORMWATER SYSTEM & EROSION CONTROL CALCULATIONS

**WELLS INSURANCE OLEANDER DRIVE SITE**

5712 Oleander Drive

Wilmington, North Carolina

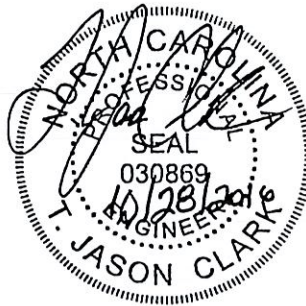
For

Wells Real Estate Holdings, LLC

1 North Third Street

Wilmington, NC 28401

(910) 251-5402



**Revised October 2016 (C.O.W. SW Revision)**

Revised September 2016 (NC DOT SW)

Revised August 2016

Revised July 2016

May 2016

Prepared by:

**NORRIS & TUNSTALL CONSULTING ENGINEERS, P.C.**

902 Market Street

Wilmington, North Carolina 28401

(910) 343-9653

(910) 343-9604 (Fax)

License # C-3641

N&T Project No. 15005

*Final SW Calcs  
DP 201602ARA  
12/22/16  
RAC*

**RECEIVED**

**OCT 31 2016**

**ENGINEERING**

Date 10/19/16	Design JAC	<b>NORRIS &amp; TUNSTALL</b> — CONSULTING ENGINEERS P.C. —	Wilmington, NC	Sheet
			Brunswick County, NC	Of
Check	Job Wells Ins. (5712 Oleander Dr)	For SWCALCS		Job No. 15005

- PROJECT PROPOSES LESS THAN 10,000 SF OF NEW IMP (After Pervious Credit)

- TOTAL SITE = 0.75 Ac / 32,625 SF  
EXISTING IMP = 2,720 SF (Asphalt/Concrete to Remain)

NEW IMP (ON-SITE)

- Proposed Building → 6,509 SF
- Pervious Pavement Parking - 8,126 @ 75% Credit → 2,032 SF
- Pervious Pavement Sidewalk - 1,950 @ 75% Credit → 488 SF
- Concrete C & G → 850 SF

9,879 SF  $\frac{IMP}{9028\%}$

(\*Doesn't Include C&G Required Sidewalk along Oleander Dr.)

- Soils Se - 'A' 75% Credit ⇒ SWNT @ 18" = 16' (From 175')

$i = 1.2 \text{ in/hr}$

N.D. PER NCDOT SITE MUST MEET 10' 25 yr PRE-POST + 0 DISCHARGE TO ROW.

→ This Requires South Side of Bldg. to Drain to Pervious Concrete

$A_p = 10,076 \text{ SF}$      $A_c = 850 + 3,444 \text{ SF} = 4,294 \text{ SF}$   
(C&G)                      (Blk)

$R = 0.426$

Determine Aggregate Depth

$D_{WQ} = \frac{P(1+R)}{n} = \frac{1.5(1.426)}{0.4} = \underline{5.35 \text{ in}}$       USE 6" MIN

$T_{WQ} = \frac{1.5''(1.426)}{24 \times 0.2 \times 1.2} = \underline{0.37 \text{ DAYS}}$       (OK)

\* Runoff From South Side of Building will Drain through 8" HDPE Perforated Pipe/Trench to NDS 10" Grates Located in the Pervious Concrete (See Plan)

\* All Grassed & Landscaped Areas Are to be Directed Away From PC.

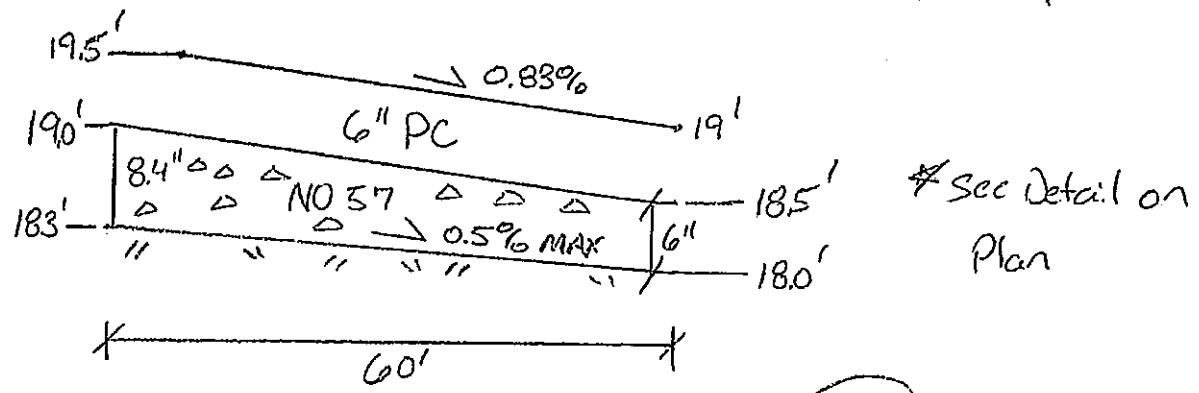
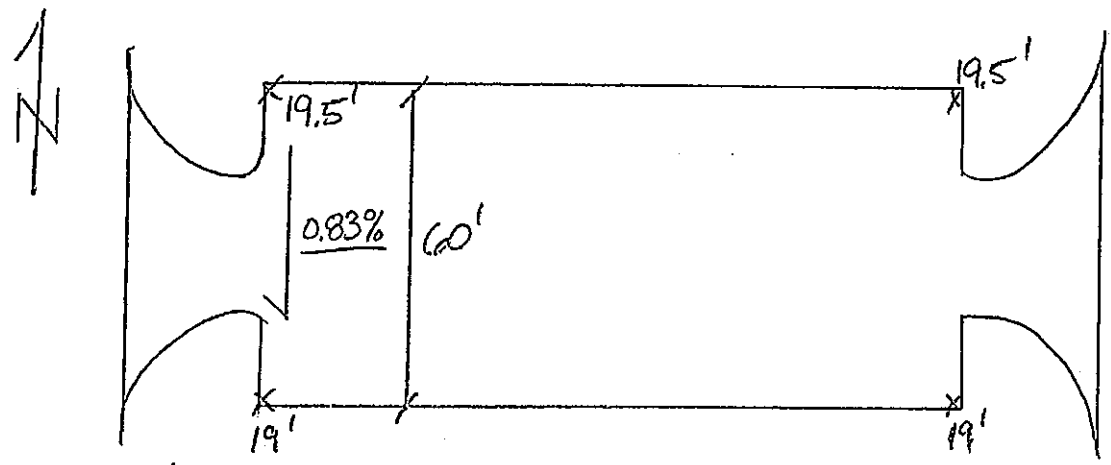
RUD 10/19/16

Date 8/3/16	Design JAC	<b>NORRIS &amp; TUNSTALL</b> CONSULTING ENGINEERS P.C.	Wilmington, NC	Sheet
			Brunswick County, NC	Of
Check	Job Wells Ins.	For SW Cales	Job No. 15005	

Dwa Required ~~4.1"~~  $\Rightarrow$  USE 6" MIN  
 5.35"

Max Slope @ Aggregate Base is 0.5%

\* Must maintain 0.5% Slope @ Agg Base. If cannot maintain 0.5% Slope, Baffles must be used.



8.4" more than twice Required Dwa = 4.1"  $\Rightarrow$  OK

\* North Parking Lot Line Required to have 8.4" Aggregate

\* South Parking Lot Line Required to have 6" Min Aggregate

Date 8/3/16	Design JLC	NORRIS & TUNSTALL CONSULTING ENGINEERS P.C.	Wilmington, NC Brunswick County, NC	Sheet
				Of
Check	Job	For		Job No.
	Wells Ins (5712 Oleander Dr.)	EC Calcs : SWALES		15005

- Per your e-mail this Address has an existing EC Permit for other Land Disturbance.
- To date Nothing has been Constructed. There is an Existing SW POND for The Shopping Center Behind Property. However, This Parcel is NOT INCLUDED IN THE APPROVED SW DESIGN. ∴ Runoff Cannot Flow into this Pond.

TRACT/PARCEL AREA = 0.75 Ac. ⇒ Disturbed Area = 0.76 Ac.

- All Inlets will be Protected with Inlet Protection and the Site will be wrapped with Silt Fence in Areas where runoff could possibly leave Site
- 2 minor Swales are being established to ensure runoff doesn't flow off-site to the South.
- The Site has to obtain a Drainage Plan Approval through the City of Wilmington.
  - Parking, Drives ! Proposed Sidewalks are to be PerVIOUS (With the Exception of the CDW required Sidewalk Along Oleander Dr.)

Required Silt Fence ⇒ 400 lf / Ac

Total Disturbance = 0.76 Ac ×  $\frac{400 \text{ lf}}{\text{Ac}}$  = 304 lf Required.

• Provide Minimum 304 lf Esf  
 ≈ 520 lf Provided

OK

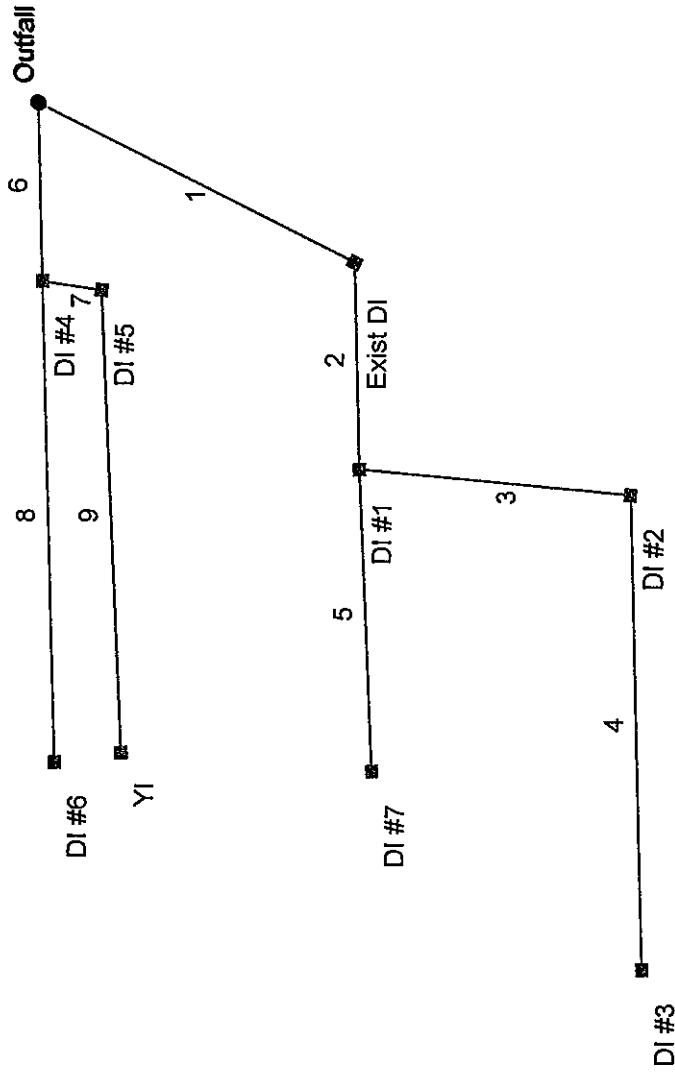
Wells Insurance - RVD 10-16

Drainage ID	Total Area (SF)	Total Area (AC)	Impervious Area (SF)	Impervious Area (AC)	Rational 'C'
DA-1	1701	0.04	0	0.00	0.20
DA-2	1218	0.03	0	0.00	0.20
DA-3	1300	0.03	0	0.00	0.20
DA-4	9850	0.23	6268	0.14	0.68
DA-5	7022	0.16	3337	0.08	0.56
DA-7	1716	0.04	0	0.00	0.20
DA-8	3810	0.09	2400	0.06	0.67
DA-PC	10926	0.25	850	0.02	0.26
DA-PC Bldg	3444	0.079	3444	0.079	0.95

Inlet ID	Contributing DA	Total Area (AC)	IMP Area (AC)	Rational 'C'
DI-1	DA-1	0.04	0.00	0.20
DI-2	DA-2, 1/2 PC & PCBldg	0.19	0.05	0.39
DI-3	DA-3, 1/2 PC & PCBldg	0.19	0.05	0.39
DI-4	DA-4	0.23	0.14	0.68
DI-5	DA-5	0.16	0.08	0.56
DI-6	-	0.02	0.0155	0.78
DI-7	DA-7	0.04	0.00	0.20
Existing DI	DA-8	0.09	0.06	0.67

Swale ID	Contributing DA	Total Area (AC)	IMP Area (AC)	Rational 'C'	tc	Q10 (CFS)	Slope (%)	Velocity-10 yr (fps)	Velocity - 25yr (fps)
Swale 1	DA-2, 1/2 PC & PCBldg	0.19	0.05	0.39	5	0.55	0.56	1.04	1.1
Swale 2	DA-3, 1/2 PC & PCBldg	0.19	0.05	0.39	5	0.55	0.4	0.91	0.96
Existing SW 1	-	0.23	0.15	0.68		1.13	1	1.53	1.61

# Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: SD's Calcs October 2016.stm

Number of lines: 9

Date: 10/26/16

# Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	100	0.09	0.55	0.67	0.06	0.22	5.0	24.9	4.6	1.04	1.85	1.72	12	0.27	14.18	14.45	15.00	15.10	16.29	16.95	1
2	1	58	0.04	0.46	0.20	0.01	0.16	5.0	24.2	4.7	0.77	1.48	1.51	12	0.17	14.45	14.55	15.10	15.14	16.95	19.00	2
3	2	78	0.19	0.38	0.39	0.07	0.15	5.0	8.3	6.6	0.98	1.80	2.10	12	0.26	14.55	14.75	15.16	15.29	19.00	17.25	3
4	3	133	0.19	0.19	0.39	0.07	0.07	5.0	5.0	7.2	0.54	2.18	1.69	12	0.38	14.75	15.25	15.36	15.59	17.25	17.10	4
5	2	85	0.04	0.04	0.20	0.01	0.01	5.0	5.0	7.2	0.06	4.65	0.79	12	1.71	14.55	16.00	15.18	16.10	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	40.3	3.7	1.28	11.69	2.21	18	1.24	14.18	14.80	15.00	15.22	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	10.3	6.3	0.88	9.91	2.28	15	2.35	14.80	15.20	15.37	15.57	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	7.2	0.11	12.78	0.91	18	1.48	14.80	16.80	15.37	16.92	18.00	19.00	8
9	7	130	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.32	2.79	1.56	12	0.62	15.20	16.00	15.70	16.23	18.00	19.00	9

Project File: SD's Calcs October 2016.stm

Number of lines: 9

Run Date: 10/26/16

NOTES: Intensity = 121.80 / (Inlet time + 23.50) ^ 0.84; Return period = Yrs. 10 ; c = cir e = ellip b = box

# Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Dmg Area		Rnoff coeff	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	100	0.09	0.55	0.67	0.06	0.22	5.0	22.7	5.5	1.25	1.85	1.59	12	0.27	14.18	14.45	15.50	15.62	16.29	16.95	1
2	1	58	0.04	0.46	0.20	0.01	0.16	5.0	22.1	5.6	0.92	1.48	1.17	12	0.17	14.45	14.55	15.64	15.68	16.95	19.00	2
3	2	78	0.19	0.38	0.39	0.07	0.15	5.0	7.9	7.6	1.12	1.80	1.43	12	0.26	14.55	14.75	15.68	15.75	19.00	17.25	3
4	3	133	0.19	0.19	0.39	0.07	0.07	5.0	5.0	8.1	0.60	2.18	1.06	12	0.38	14.75	15.25	15.75	15.80	17.25	17.10	4
5	2	85	0.04	0.04	0.20	0.01	0.01	5.0	5.0	8.1	0.07	4.65	0.80	12	1.71	14.55	16.00	15.70	16.10	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	36.3	4.5	1.73	11.69	2.23	18	1.24	14.18	14.80	15.50	15.29	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	8.1	7.5	1.22	9.91	2.54	15	2.35	14.80	15.20	15.46	15.64	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	8.1	0.13	12.78	0.93	18	1.48	14.80	16.80	15.47	16.93	18.00	19.00	8
9	7	130	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.55	2.79	1.91	12	0.62	15.20	16.00	15.79	16.31	18.00	19.00	9

Project File: SD's Calcs October 2016.stm

Number of lines: 9

Run Date: 10/26/16

NOTES: Intensity = 155.43 / (Inlet time + 26.20) ^ 0.86; Return period = Yrs. 25 ; c = cir e = ellip b = box



# Storm Sewer Tabulation

Station Line To Line	Len (ft)	Dmg Area (ac)		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID	
		Incr	Total		Inlet (min)	Syst (min)	Incr	Total					Inlet (min)	Syst (min)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)		Dn (ft)
1	End	100	0.09	0.55	0.67	0.06	0.22	5.0	20.0	7.0	1.57	1.85	2.00	12	0.27	14.18	14.45	15.90	16.09	16.29	16.95	1
2	1	58	0.04	0.46	0.20	0.01	0.16	5.0	19.5	7.1	1.16	1.48	1.48	12	0.17	14.45	14.55	16.12	16.18	16.95	19.00	2
3	2	78	0.19	0.38	0.39	0.07	0.15	5.0	7.4	9.0	1.34	1.80	1.71	12	0.26	14.55	14.75	16.18	16.29	19.00	17.25	3
4	3	133	0.19	0.19	0.39	0.07	0.07	5.0	5.0	9.6	0.71	2.18	0.91	12	0.38	14.75	15.25	16.33	16.38	17.25	17.10	4
5	2	85	0.04	0.04	0.20	0.01	0.01	5.0	5.0	9.6	0.08	4.65	0.33	12	1.71	14.55	16.00	16.22	16.23	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	31.6	5.8	2.36	11.69	1.51	18	1.24	14.18	14.80	15.90	15.91	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	7.0	9.1	1.66	9.91	2.48	15	2.35	14.80	15.20	15.91	15.71	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	9.6	0.15	12.78	0.93	18	1.48	14.80	16.80	15.96	16.94	18.00	19.00	8
9	7	130	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.84	2.79	2.25	12	0.62	15.20	16.00	15.89	16.38	18.00	19.00	9

Project File: SD's Calcs October 2016.stm

Number of lines: 9

Run Date: 10/26/16

NOTES: intensity = 198.56 / (Inlet time + 28.80) ^ 0.86; Return period = Yrs. 100 ; c = cir e = ellip b = box

Date 10/20/14	Design JAC	<b>NORRIS &amp; TUNSTALL</b> — CONSULTING ENGINEERS P.C. —	Wilmington, NC Brunswick County, NC	Sheet Of
Check	Job WELLS INS.	For NCDOT PRE-POST	Job No. 15005	

° PER NCDOT PRE-POST CALCS ARE REQUIRED

° WELLS SITE INCLUDES PERVIOUS CONCRETE FOR ALL ON-SITE (NEW) PARKING & SIDEWALK DESIGNED TO NCDEQ STANDARDS. THERE IS ZERO (0) OUTFLOW FROM THE PERVIOUS AREAS. (PARKING & SIDEWALK & SOUTH SIDE OF BLDG.)

SITE TOTALS

<u>PRE</u>	<u>POST</u>	
$Q_{10} = 3.9$ cfs	$Q_{10} = 3.5$ cfs	✓
$Q_{25} = 4.8$ cfs	$Q_{25} = 4.6$ cfs	✓

(OK)

ALL ROUTING DONE IN HYDRAFLOW

PRE |  $DA = 23,430$  sf / 0.54 Ac.  
 $Imp = 13,318$  sf / 0.306 Ac.

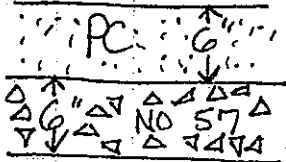
POST |

SEED MAP

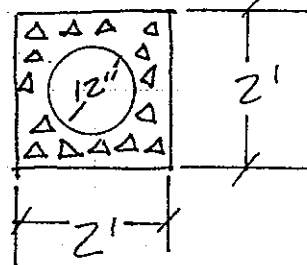
① PARKING & SIDEWALK & SOUTH 1/2 of BLDG. ROOF  
 DA-PC : DA-PC Bldg.

$DA = 0.33$  Ac.  $Imp = 0.16$  Ac.

(PERVIOUS CONCRETE RECEIVES 75% CREDIT.)



TYP. TRENCH



② SWALE through PERF HDPE  
 (PA-3)  $DA = 0.03$  Ac.  
 $Imp = \emptyset$

INFIL. TRENCH  $L = 133'$  →  
 PERF  $\phi = 12"$

③ SWALE (DA-2)  
 DA = 0.03 Ac.  
 Imp =  $\emptyset$

④ Building - NORTH SIDE (DA-5)  
 Two Small Infiltration Basins B1 & B2 will Each Collect  
 1/2 of DA-5.

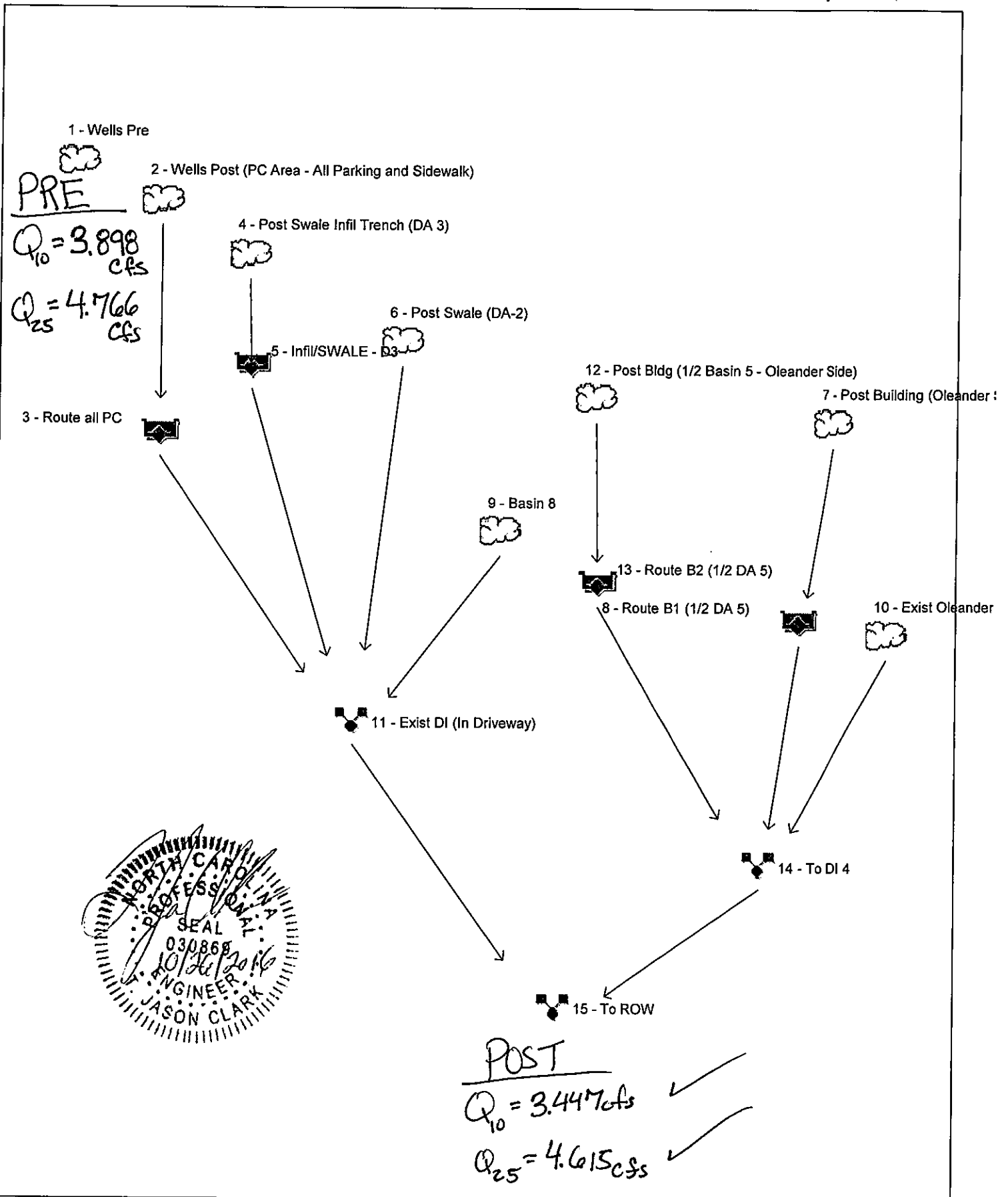
<u>B1</u>		<u>B2</u>		* Basins Catch: Hold Runoff to Meet Pre-Post Requirements From NCDOT
ELEV	SA	ELEV	SA	
18	195 SF	17.5	108 SF	
19	533 SF	18	233 SF	
19.2	645 SF	19	534 SF	
		19.2	604 SF	
DA = 0.08 Ac. Imp = 0.04 Ac.		DA = 0.08 Ac. Imp = 0.04 Ac.		

⑤ BASIN 8 (EXISTING)  
 DA = 0.19 Ac.  
 Imp = 0.16 Ac.

⑥ Existing OLEANDER DR. (EXISTING)  
 DA = 0.23 Ac.  
 Imp = 0.14 Ac.

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4







# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	3.898	1	718	7,955	----	----	----	Wells Pre	
2	SCS Runoff	2.089	1	718	4,213	----	----	----	Wells Post (PC Area - All Parking a	
3	Reservoir	0.000	1	727	0	2	18.45	1,808	Route all PC	
4	SCS Runoff	0.029	1	720	86	----	----	----	Post Swale Infil Trench (DA 3)	
5	Reservoir	0.000	1	839	0	4	14.63	14.9	Infil/SWALE - D3	
6	SCS Runoff	0.029	1	720	86	----	----	----	Post Swale (DA-2)	
7	SCS Runoff	0.521	1	718	1,052	----	----	----	Post Building (Oleander Side-1/2 D	
8	Reservoir	0.324	1	722	277	7	19.08	399	Route B1 (1/2 DA 5)	
9	SCS Runoff	1.686	1	717	3,576	----	----	----	Basin 8	
10	SCS Runoff	1.739	1	718	3,573	----	----	----	Exist Oleander ROW DA 4	
11	Combine	1.708	1	717	3,662	3, 5, 6, 9,	----	----	Exist DI (In Driveway)	
12	SCS Runoff	0.521	1	718	1,052	----	----	----	Post Bldg (1/2 Basin 5 - Oleander Si	
13	Reservoir	0.091	1	727	165	12	19.04	477	Route B2 (1/2 DA 5)	
14	Combine	1.742	1	719	4,014	8, 10, 13	----	----	To DI 4	
15	Combine	3.447	1	717	7,676	11, 14	----	----	To ROW	
									Total ↗ Post	
Perv Pavement Routing10-19-16.gpw					Return Period: 10 Year			Wednesday, 10 / 26 / 2016		

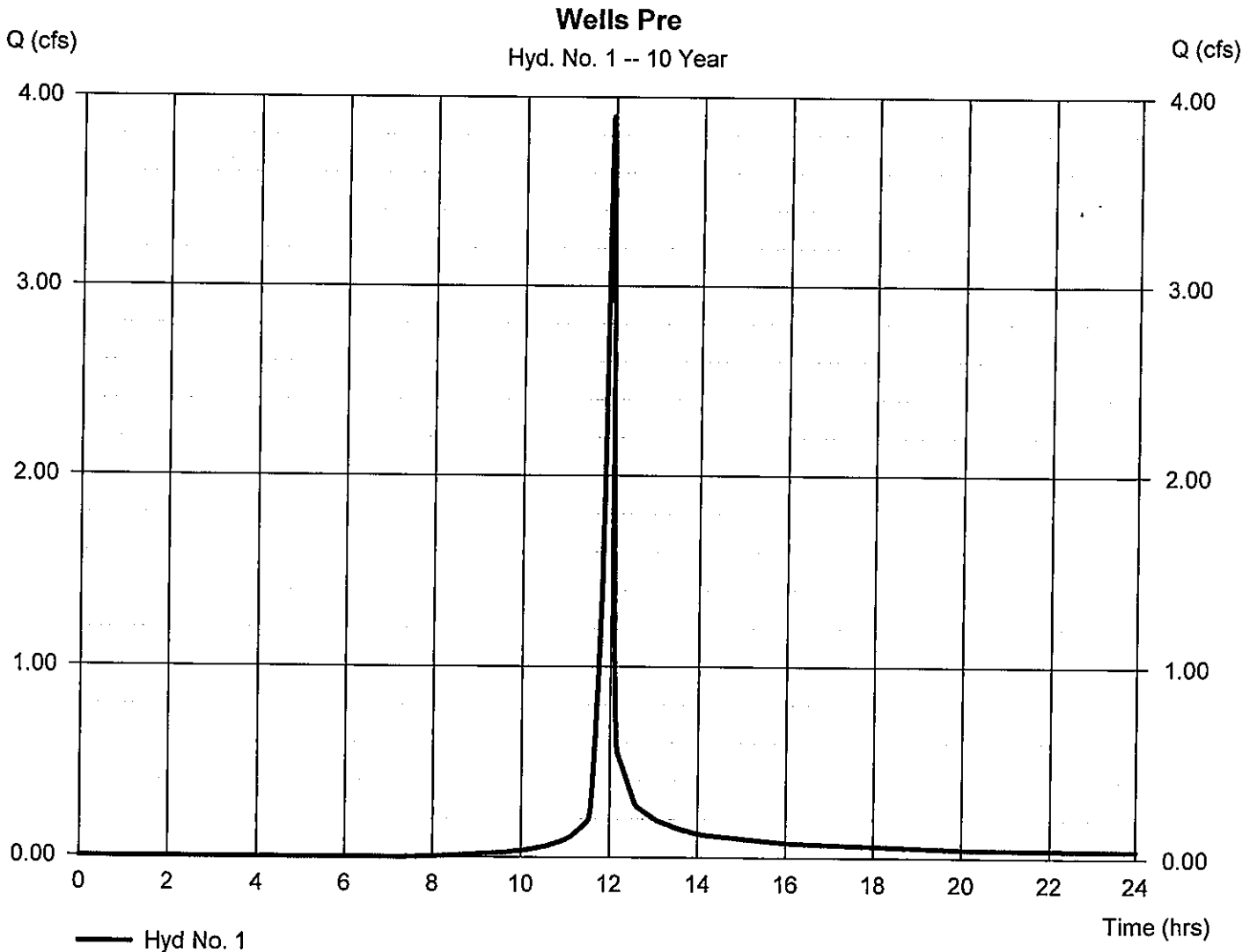
# Hydrograph Report

## Hyd. No. 1

Wells Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 3.898 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 7,955 cuft
Drainage area	= 0.540 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.230 \times 39) + (0.310 \times 98)] / 0.540$





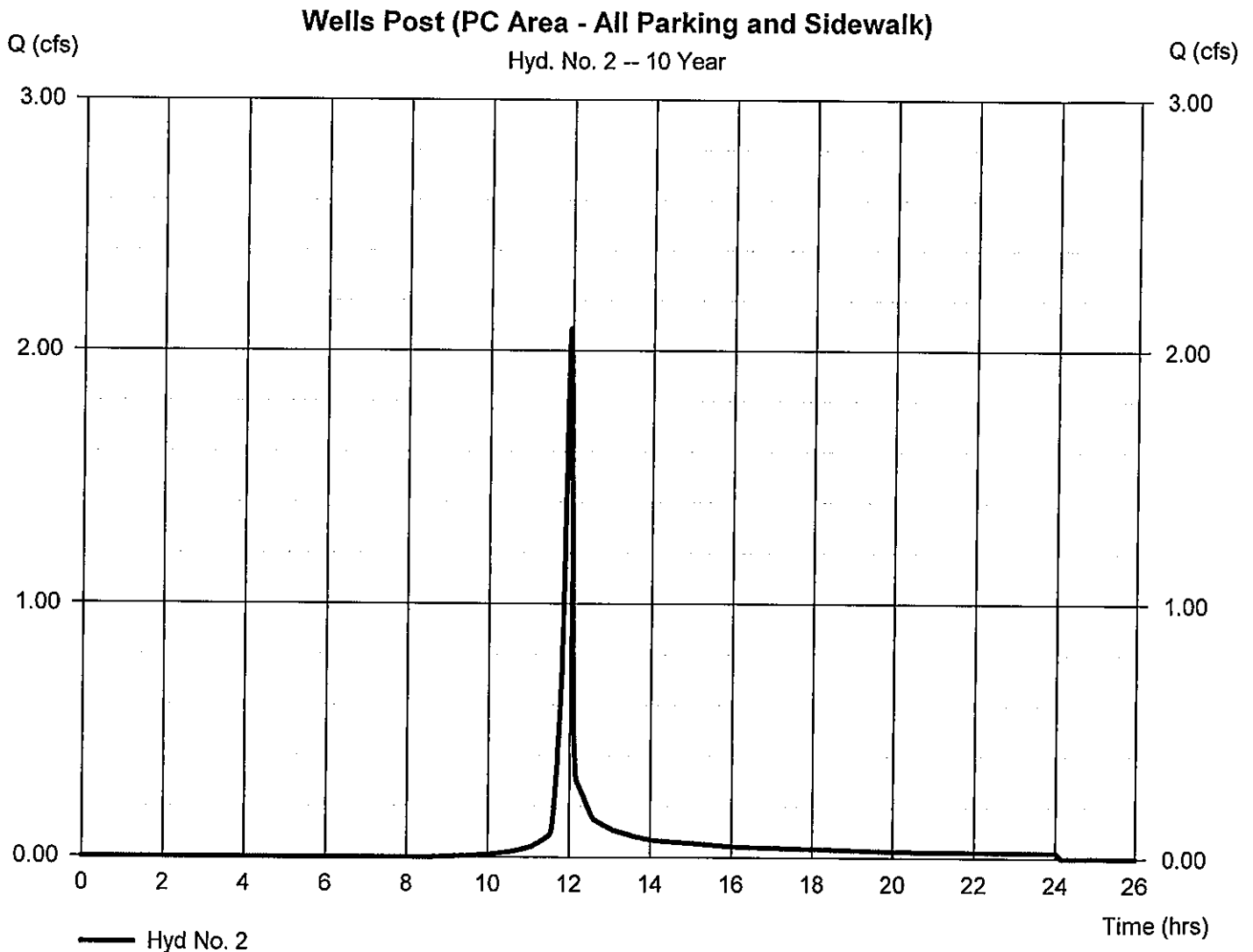
# Hydrograph Report

## Hyd. No. 2

Wells Post (PC Area - All Parking and Sidewalk)

Hydrograph type	= SCS Runoff	Peak discharge	= 2.089 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 4,213 cuft
Drainage area	= 0.330 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.160 \times 98) + (0.170 \times 39)] / 0.330$



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

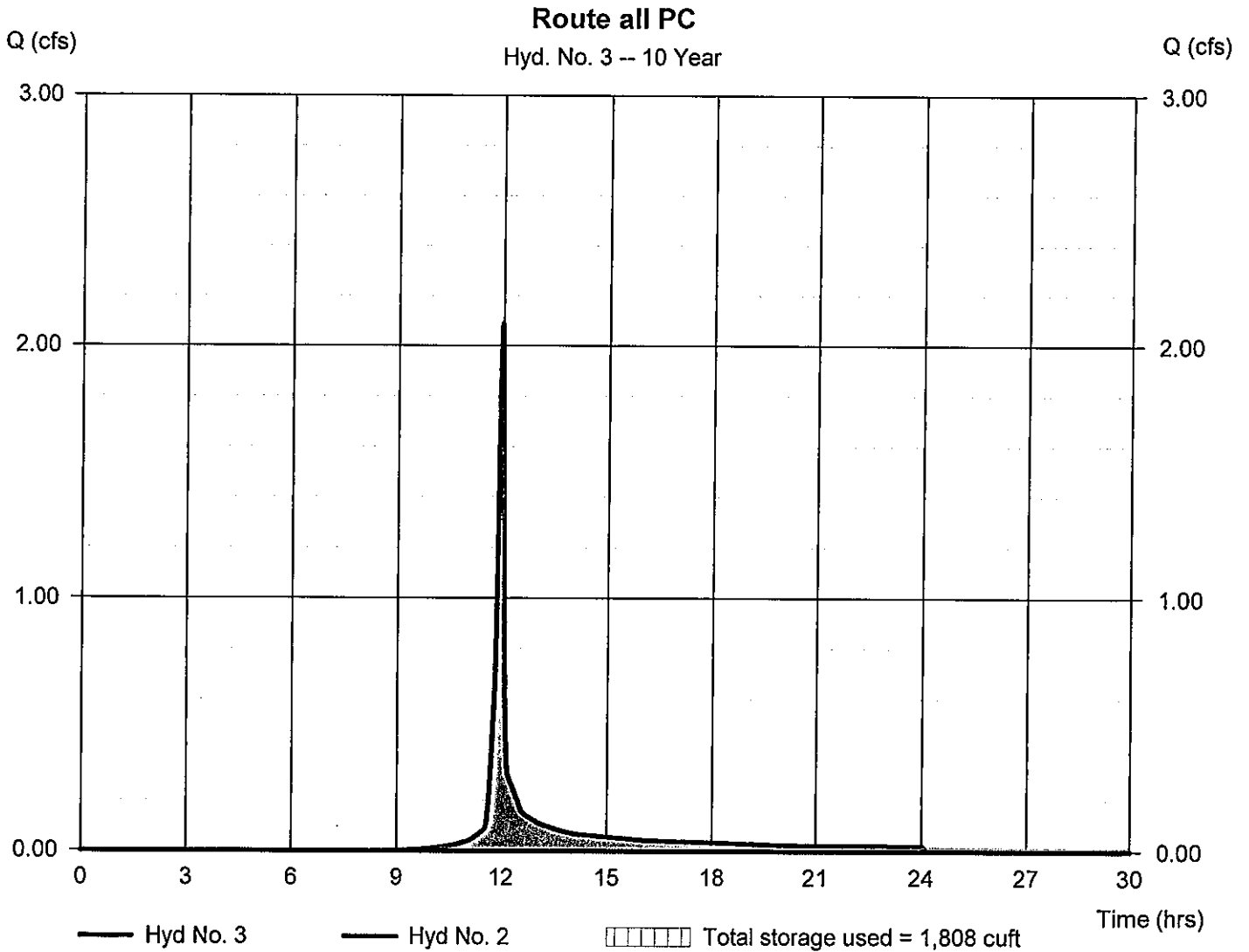
Wednesday, 10 / 26 / 2016

## Hyd. No. 3

Route all PC

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.12 hrs
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Wells Post (PC Area - All Parking and Sidewalk)	Max. Flood	= 18.45 ft
Reservoir name	= Pervious Concrete	Max. Storage	= 1,808 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Pond Report

## Pond No. 1 - Pervious Concrete

### Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 18.00 ft. Voids = 40.00%

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	18.00	10,076	0	0
0.50	18.50	10,076	2,015	2,015
1.00	19.00	10,076	2,015	4,030

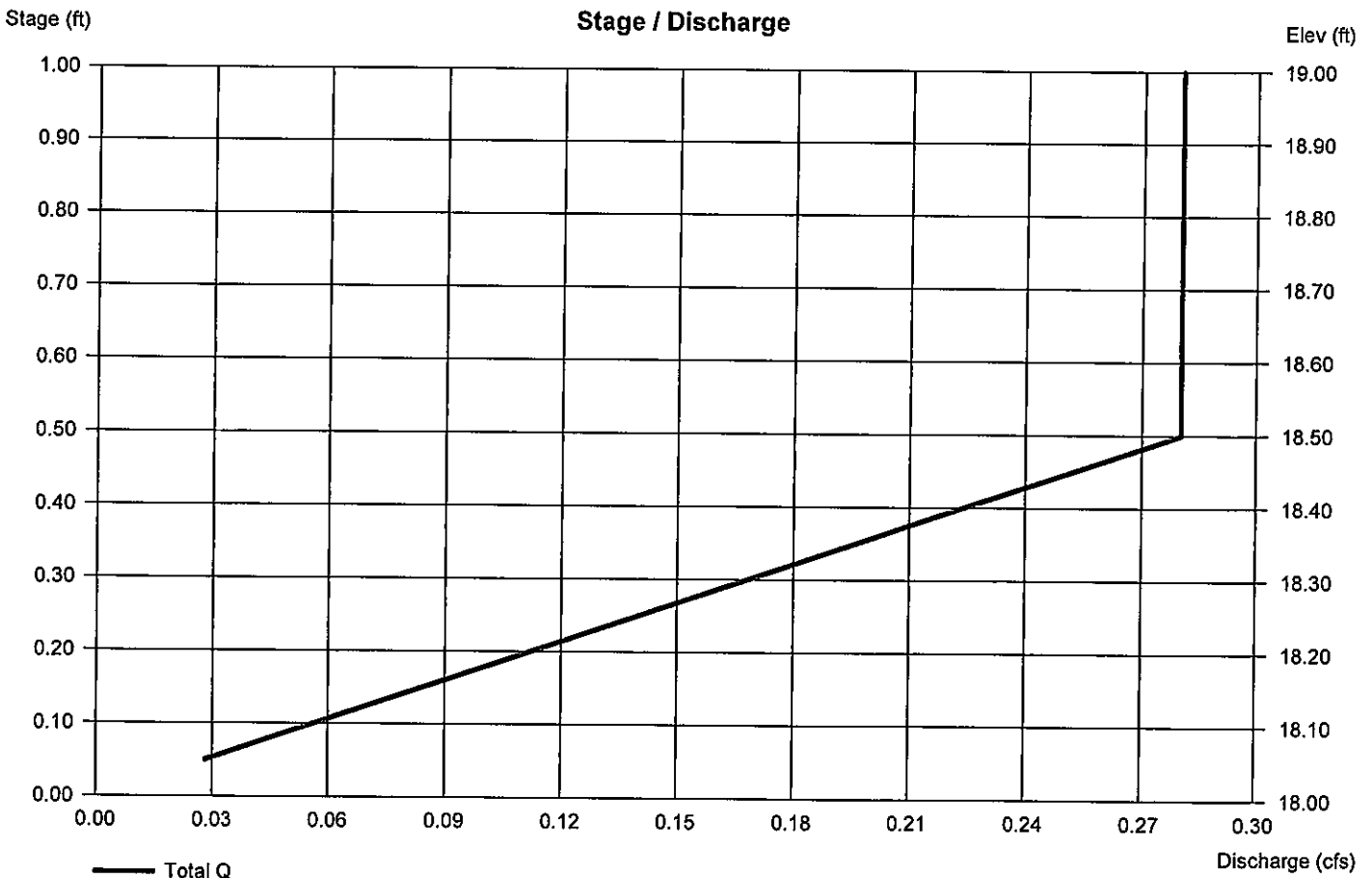
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	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)	= 0.00	126.00	0.00	0.00
Crest El. (ft)	= 0.00	19.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= ---	Broad	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 1.200 (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).



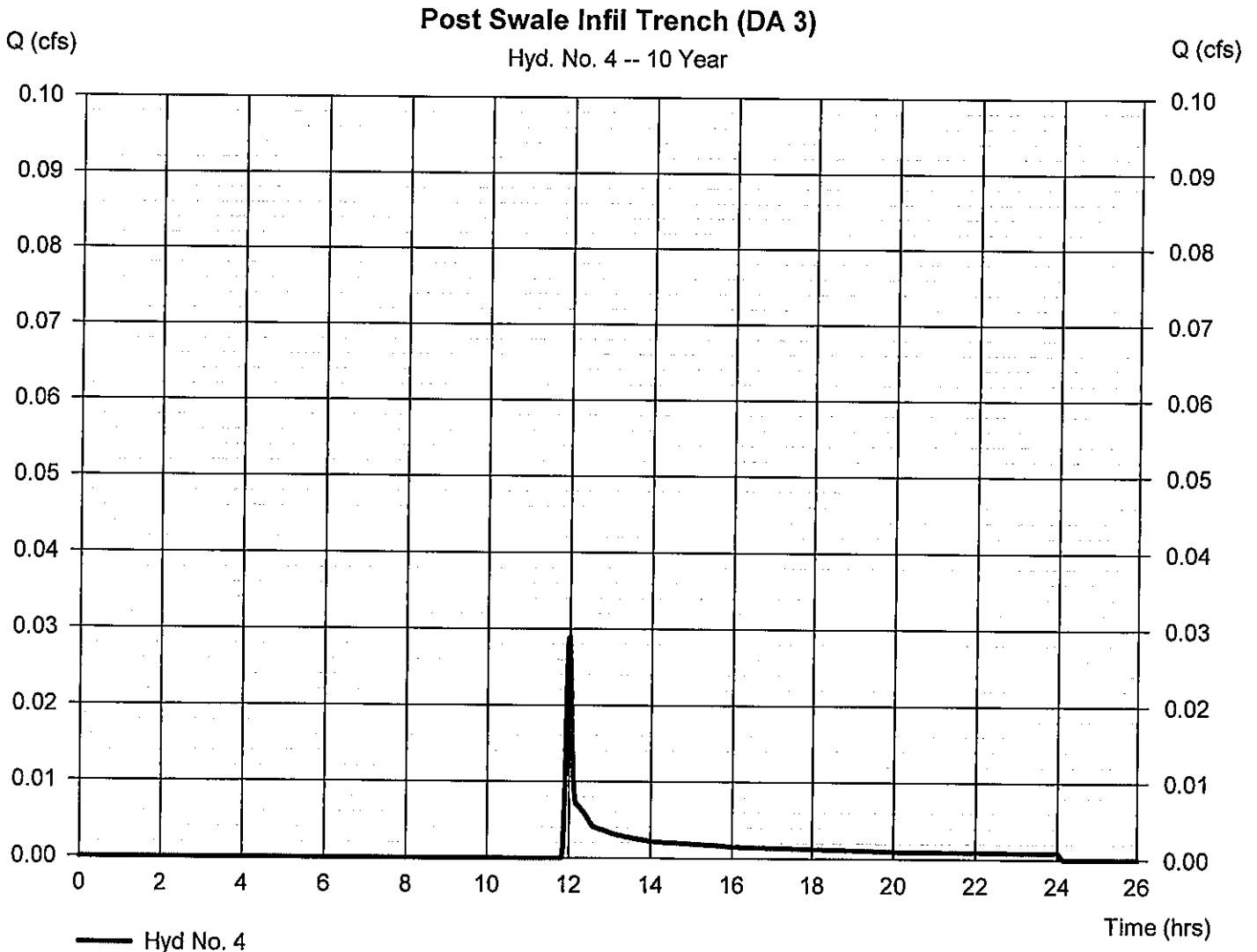
# Hydrograph Report

## Hyd. No. 4

### Post Swale Infil Trench (DA 3)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.029 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 86 cuft
Drainage area	= 0.030 ac	Curve number	= 39*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.160 x 98) + (0.160 x 30)] / 0.030



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

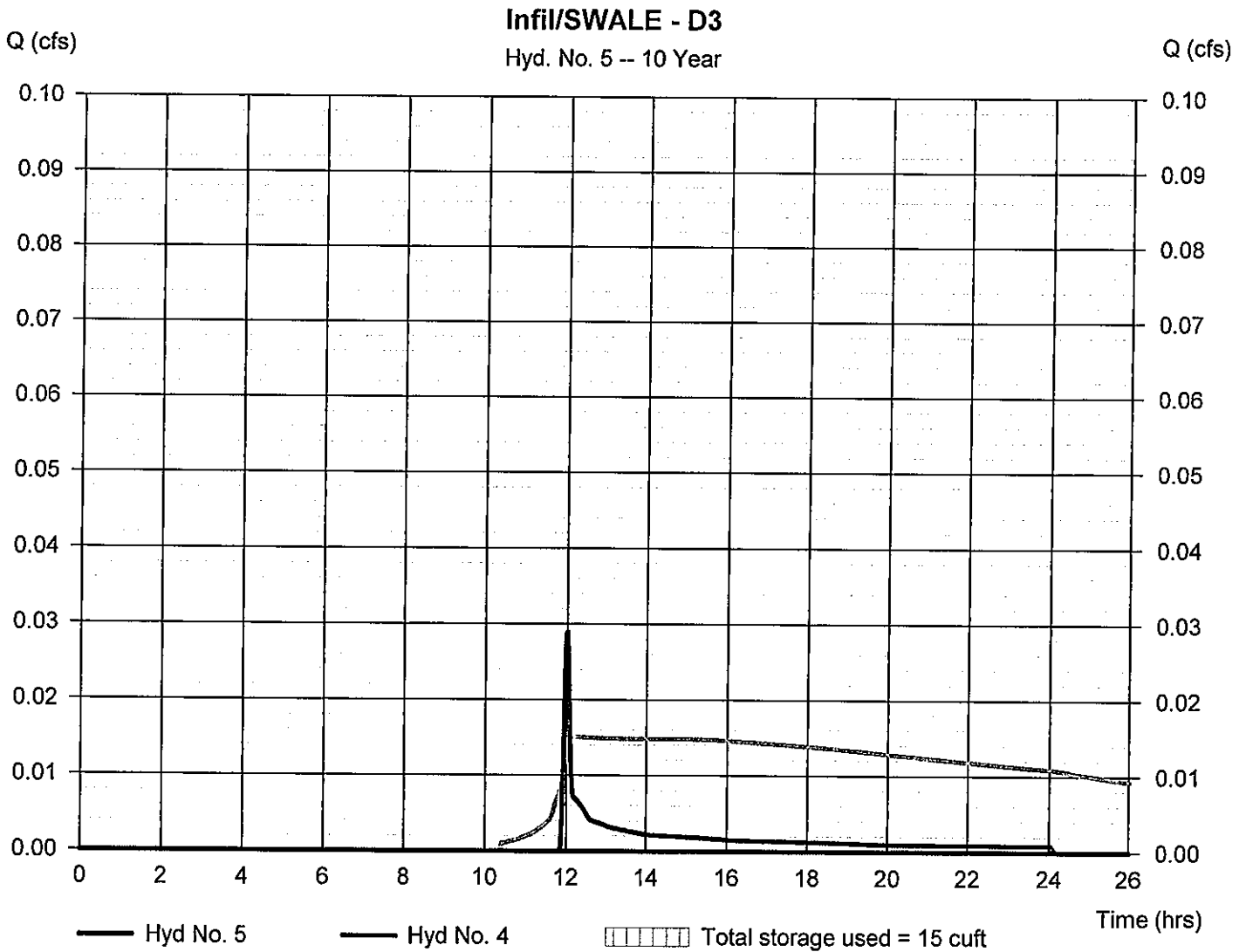
Wednesday, 10 / 26 / 2016

## Hyd. No. 5

Infil/SWALE - D3

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.98 hrs
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Swale Infil Trench (DWS)	Max. Elevation	= 14.63 ft
Reservoir name	= Infil Trench SWALE	Max. Storage	= 15 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Pond Report

## Pond No. 2 - Infil Trench SWALE

### Pond Data

UG Chambers -Invert elev. = 14.75 ft, Rise x Span = 1.00 x 1.00 ft, Barrel Len = 133.00 ft, No. Barrels = 1, Slope = 0.40%, Headers = No  
 Encasement -Invert elev. = 14.25 ft, Width = 2.00 ft, Height = 2.00 ft, Voids = 40.00%

### Stage / Storage Table

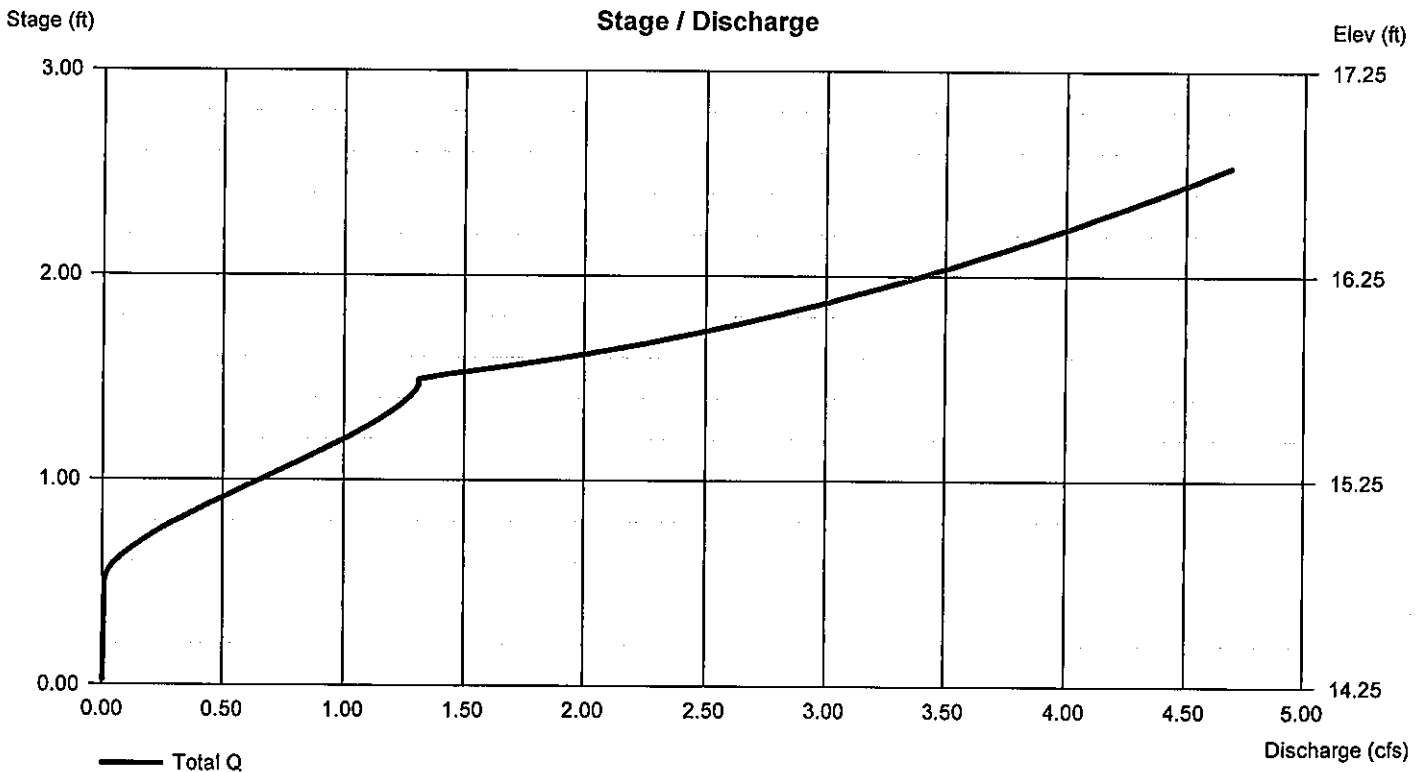
Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	14.25	n/a	0	0
0.25	14.50	n/a	4	4
0.51	14.76	n/a	22	26
0.76	15.01	n/a	29	55
1.01	15.26	n/a	38	93
1.27	15.52	n/a	45	138
1.52	15.77	n/a	45	183
1.77	16.02	n/a	38	221
2.03	16.28	n/a	29	250
2.28	16.53	n/a	27	277
2.53	16.78	n/a	27	304

### Culvert / Orifice Structures

### Weir Structures

	[A]	[B]	[C]	[PrfRsr]		[A]	[B]	[C]	[D]
Rise (in)	= 12.00	0.00	0.00	0.00	Crest Len (ft)	= 0.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00	Crest El. (ft)	= 0.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0	Weir Coeff.	= 3.33	3.33	3.33	3.33
Invert El. (ft)	= 14.75	0.00	0.00	0.00	Weir Type	= ---	---	---	---
Length (ft)	= 17.00	0.00	0.00	0.00	Multi-Stage	= No	No	No	No
Slope (%)	= 0.50	0.00	0.00	n/a					
N-Value	= .013	.013	.013	n/a					
Orifice Coeff.	= 0.60	0.60	0.60	0.60	Exfil.(in/hr)	= 1.200 (by Contour)			
Multi-Stage	= n/a	No	No	No	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).

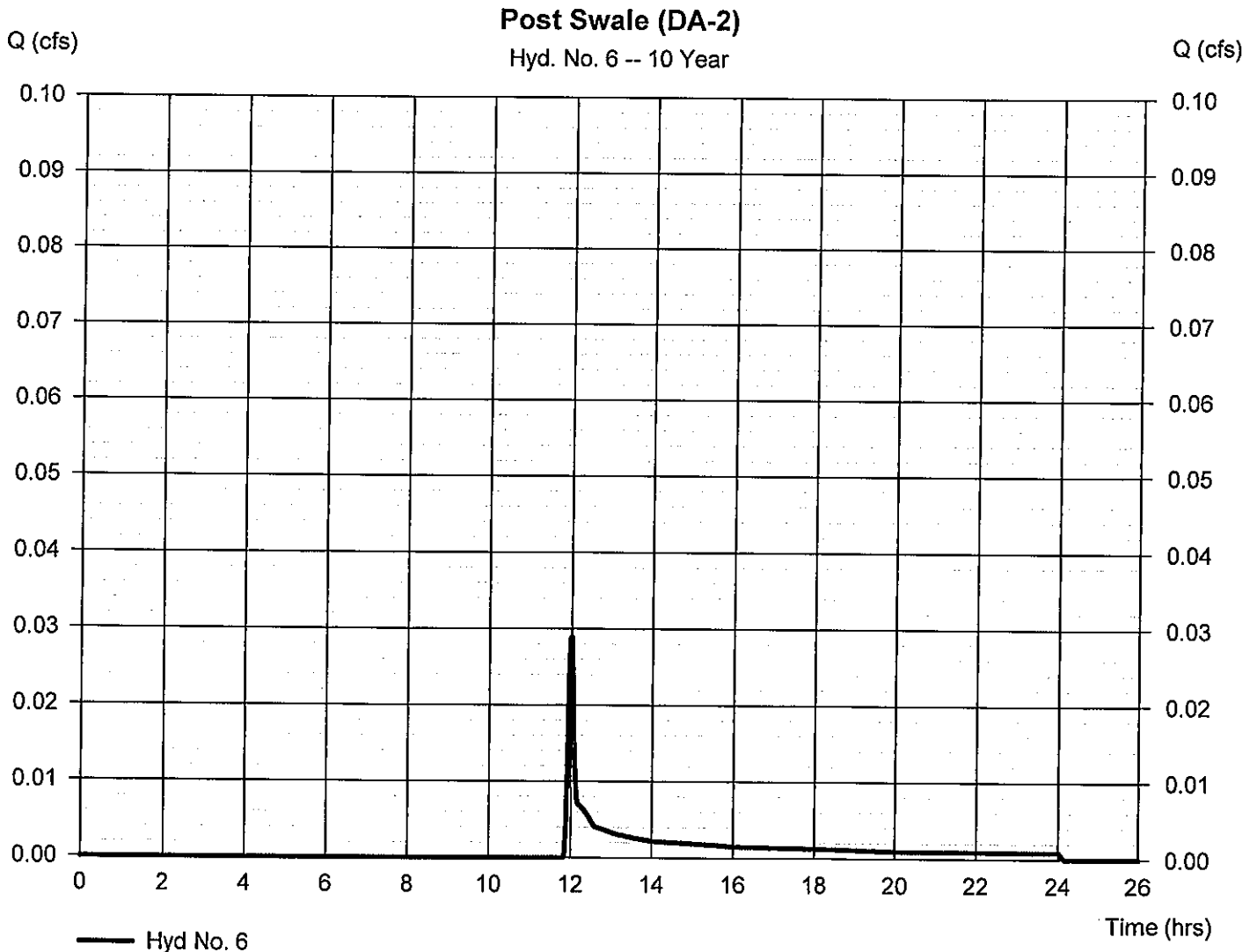


# Hydrograph Report

## Hyd. No. 6

### Post Swale (DA-2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.029 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 86 cuft
Drainage area	= 0.030 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

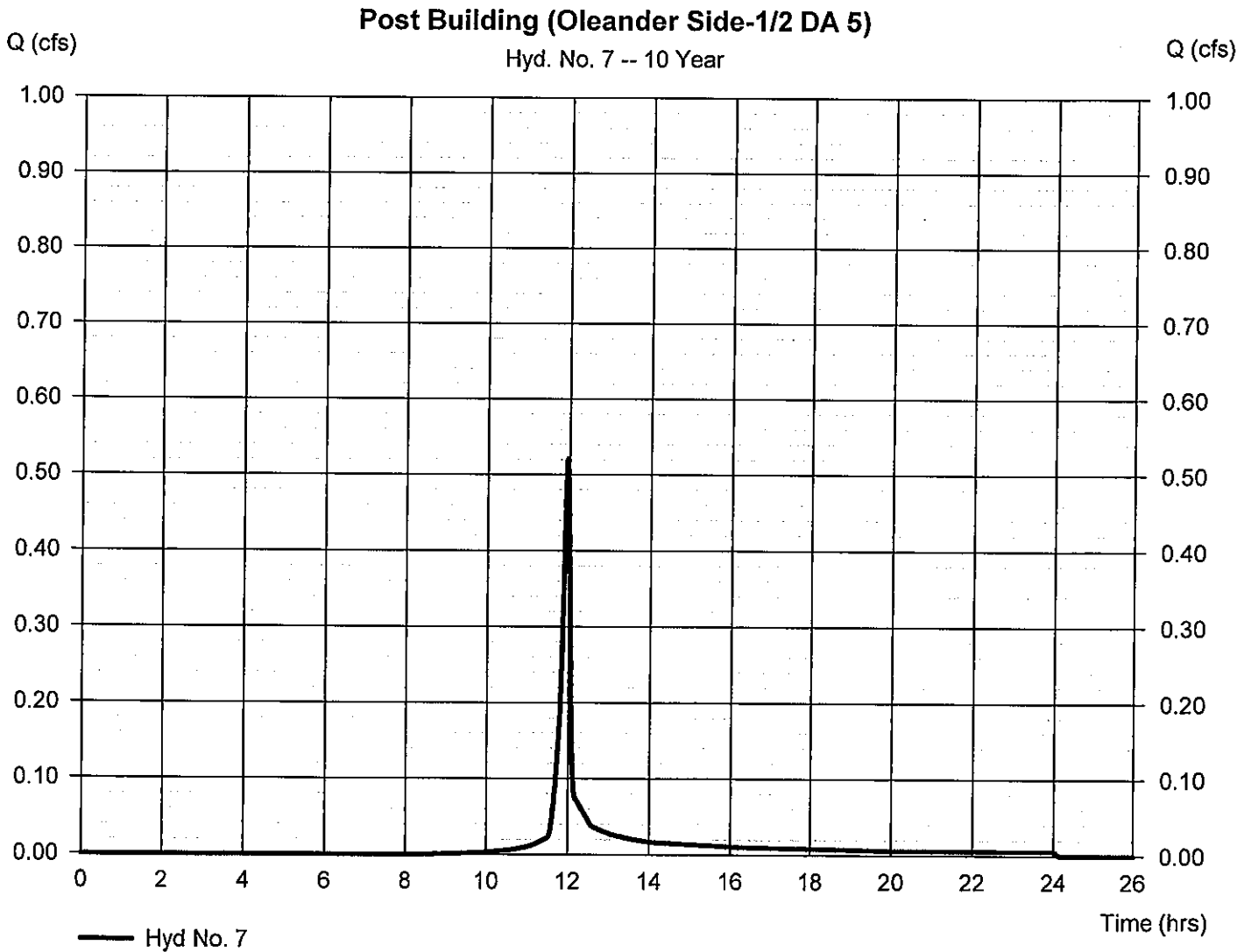
Wednesday, 10 / 26 / 2016

## Hyd. No. 7

Post Building (Oleander Side-1/2 DA 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.521 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 1,052 cuft
Drainage area	= 0.080 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.040 \times 98) + (0.040 \times 39)] / 0.080$





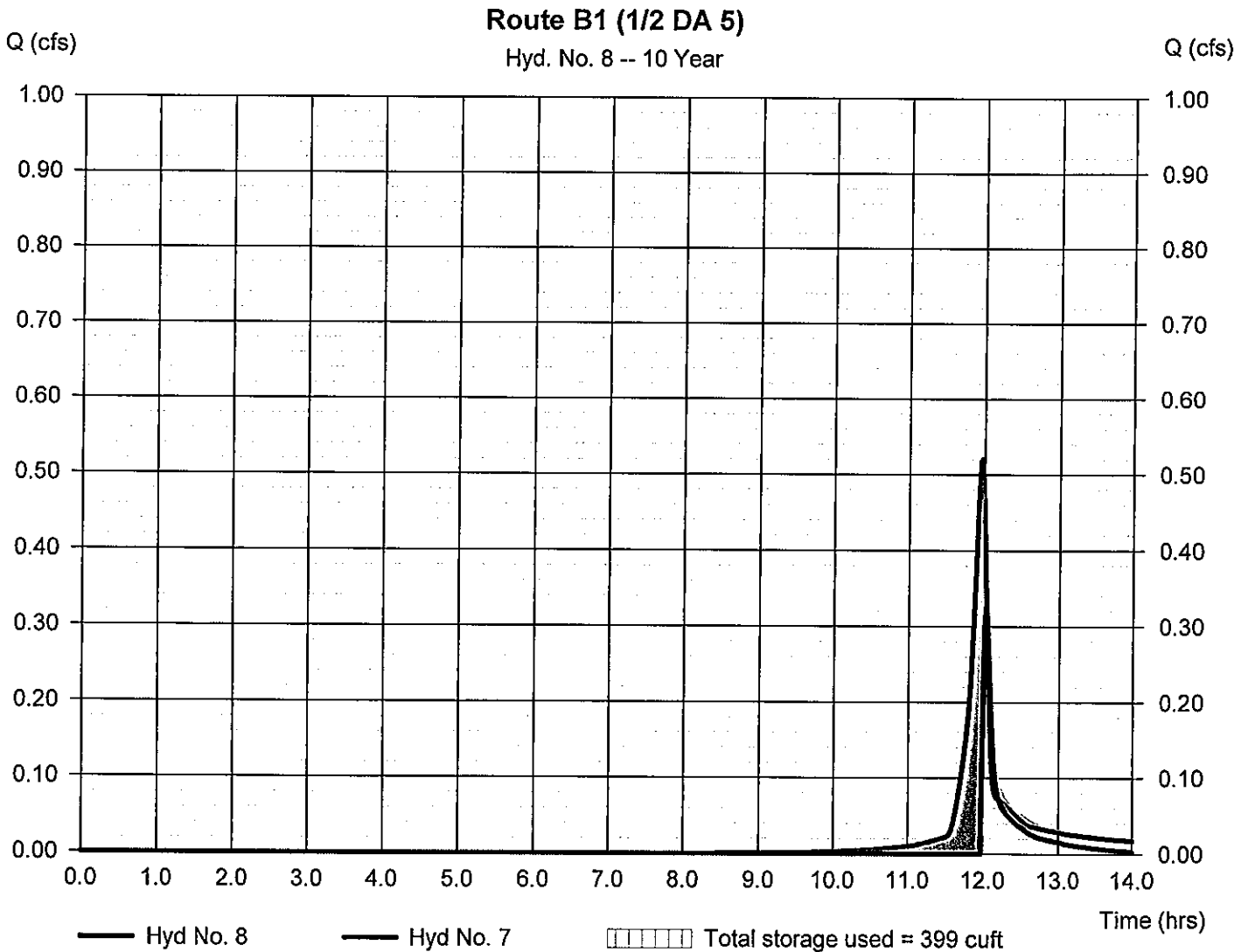
# Hydrograph Report

## Hyd. No. 8

Route B1 (1/2 DA 5)

Hydrograph type	= Reservoir	Peak discharge	= 0.324 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 1 min	Hyd. volume	= 277 cuft
Inflow hyd. No.	= 7 - Post Building (Oleander Max 1/2 DA 5)	Max. Water Depth	= 19.08 ft
Reservoir name	= Infil Basin B1 Bldg Oleander Max. Storage		= 399 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Pond Report

## Pond No. 4 - Infil Basin B1 Bldg Oleander

### Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 18.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	18.00	195	0	0
1.00	19.00	533	350	350
1.20	19.20	645	118	468

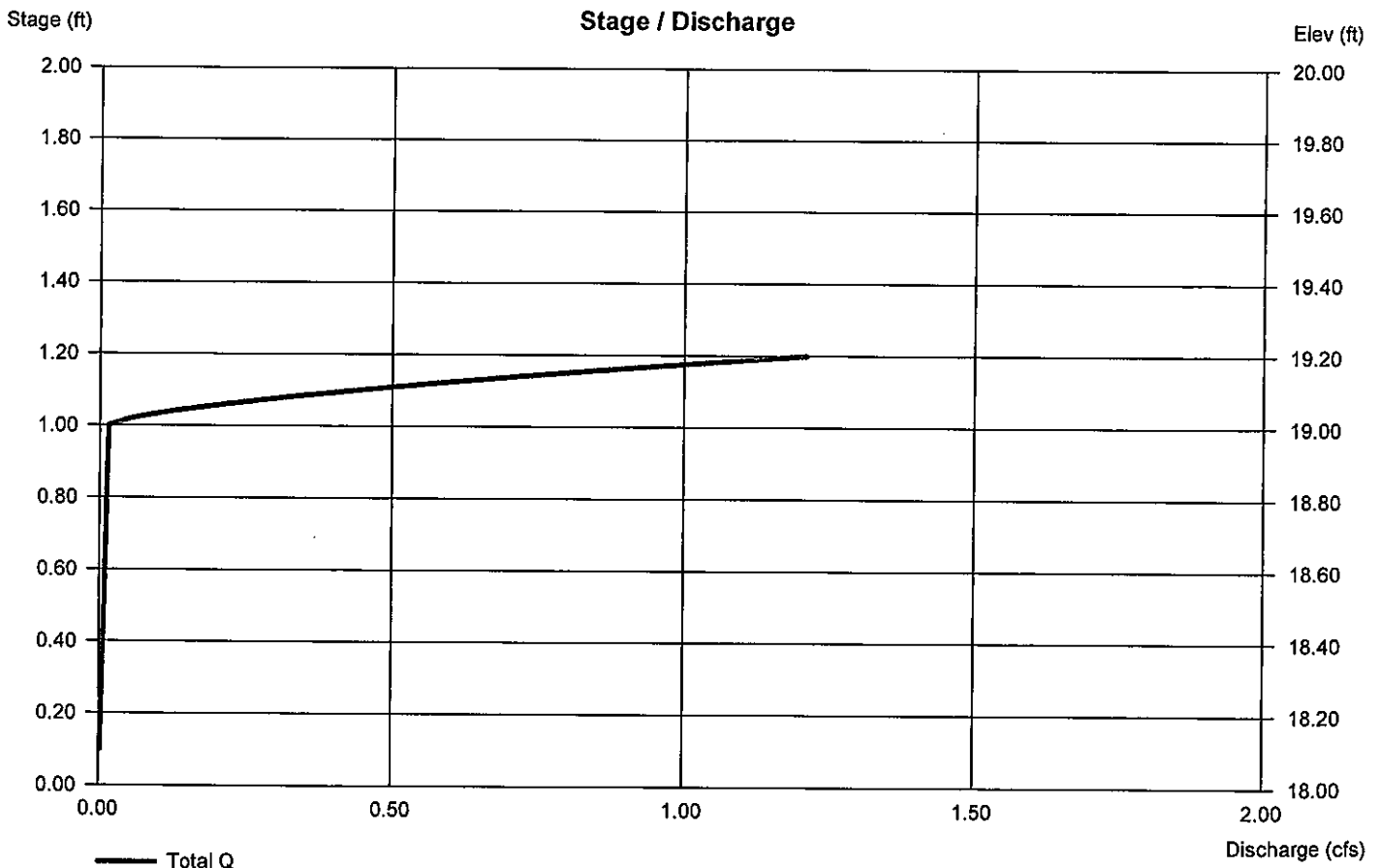
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 16.80	0.00	0.00	0.00
Length (ft)	= 130.00	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 19.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 1.200 (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).



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

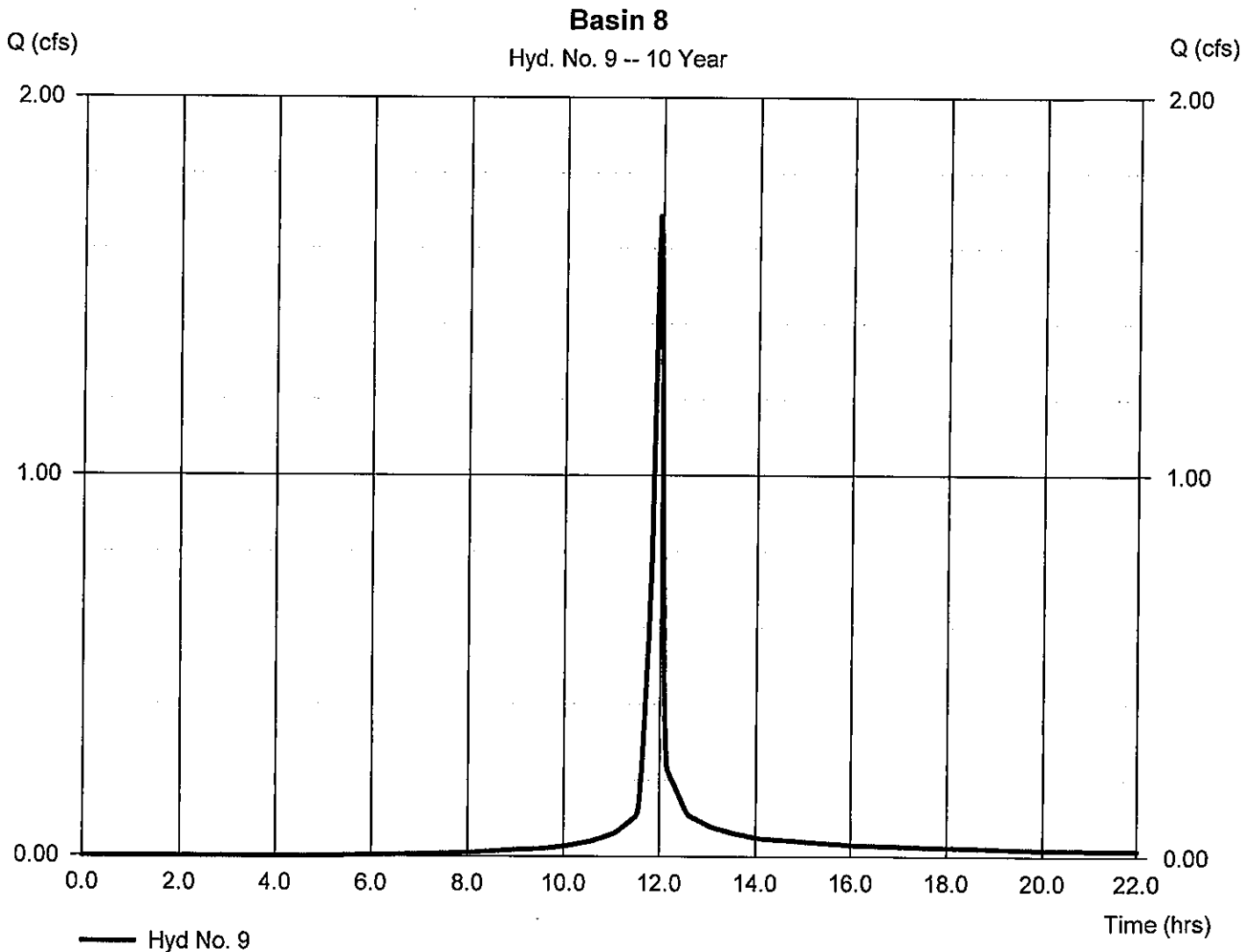
Wednesday, 10 / 26 / 2016

## Hyd. No. 9

### Basin 8

Hydrograph type	= SCS Runoff	Peak discharge	= 1.686 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 3,576 cuft
Drainage area	= 0.190 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.160 \times 98)] / 0.190$



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

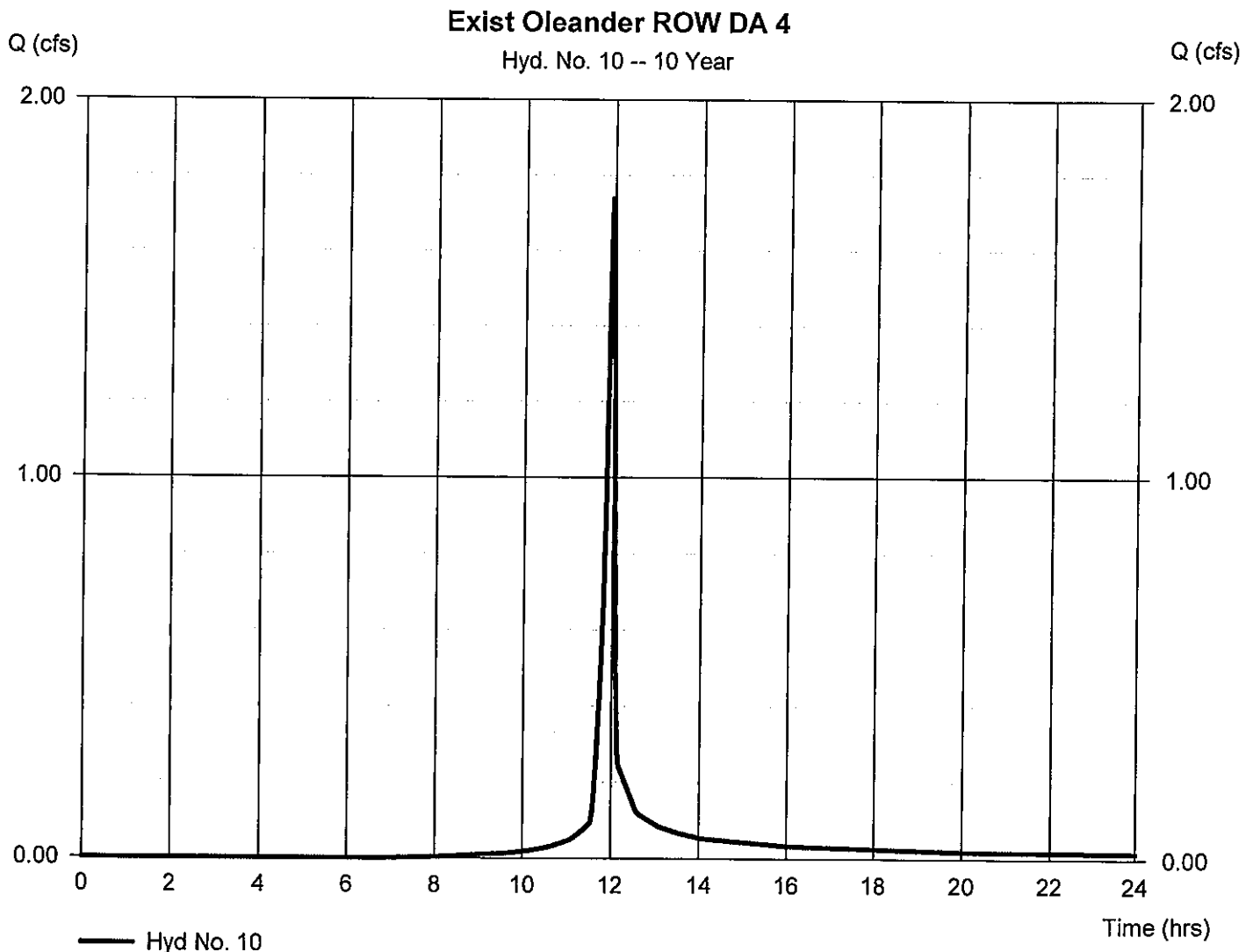
Wednesday, 10 / 26 / 2016

## Hyd. No. 10

Exist Oleander ROW DA 4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.739 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 3,573 cuft
Drainage area	= 0.230 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.140 \times 98) + (0.090 \times 39)] / 0.230$

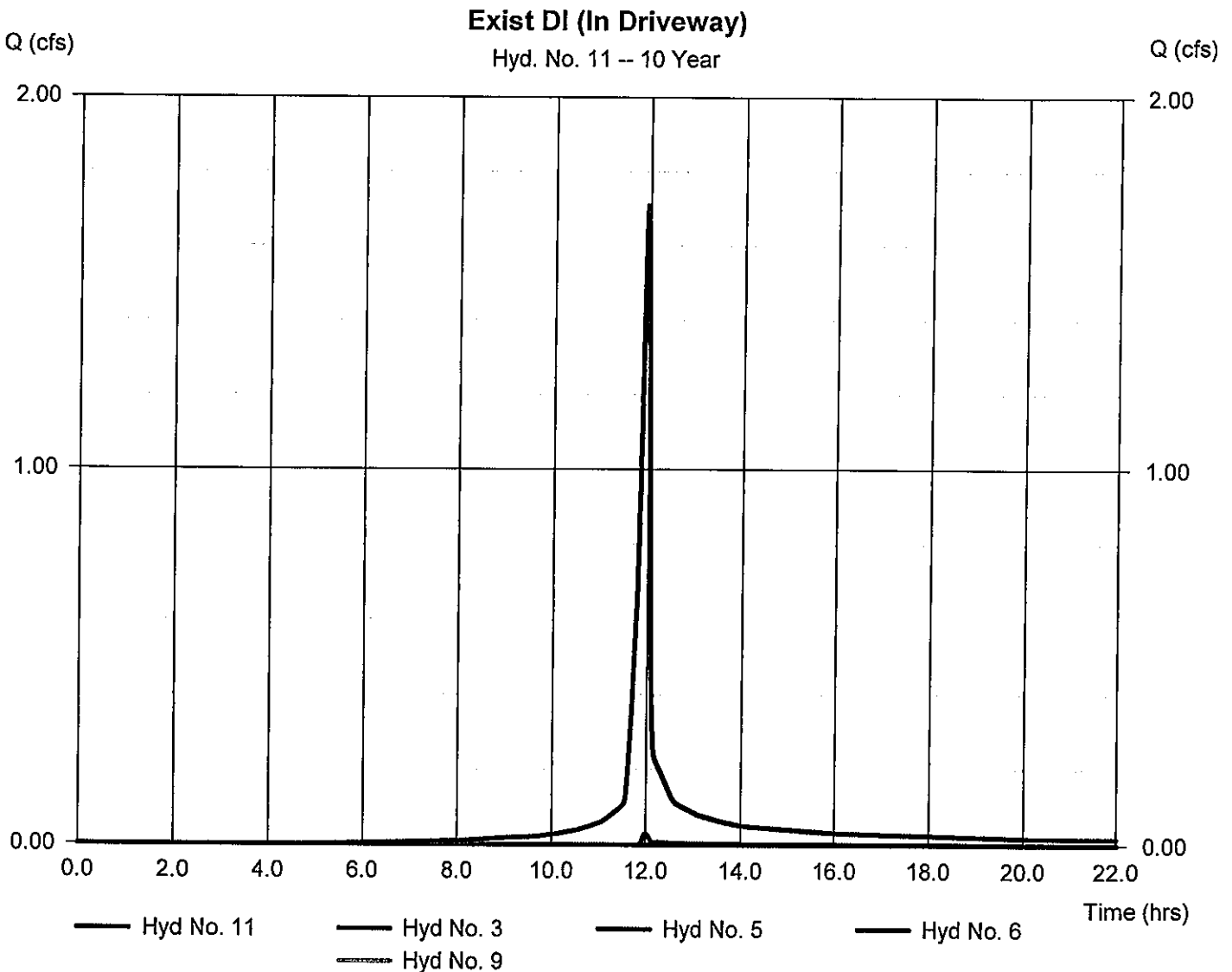


# Hydrograph Report

## Hyd. No. 11

Exist DI (In Driveway)

Hydrograph type	= Combine	Peak discharge	= 1.708 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 3,662 cuft
Inflow hyds.	= 3, 5, 6, 9	Contrib. drain. area	= 0.220 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

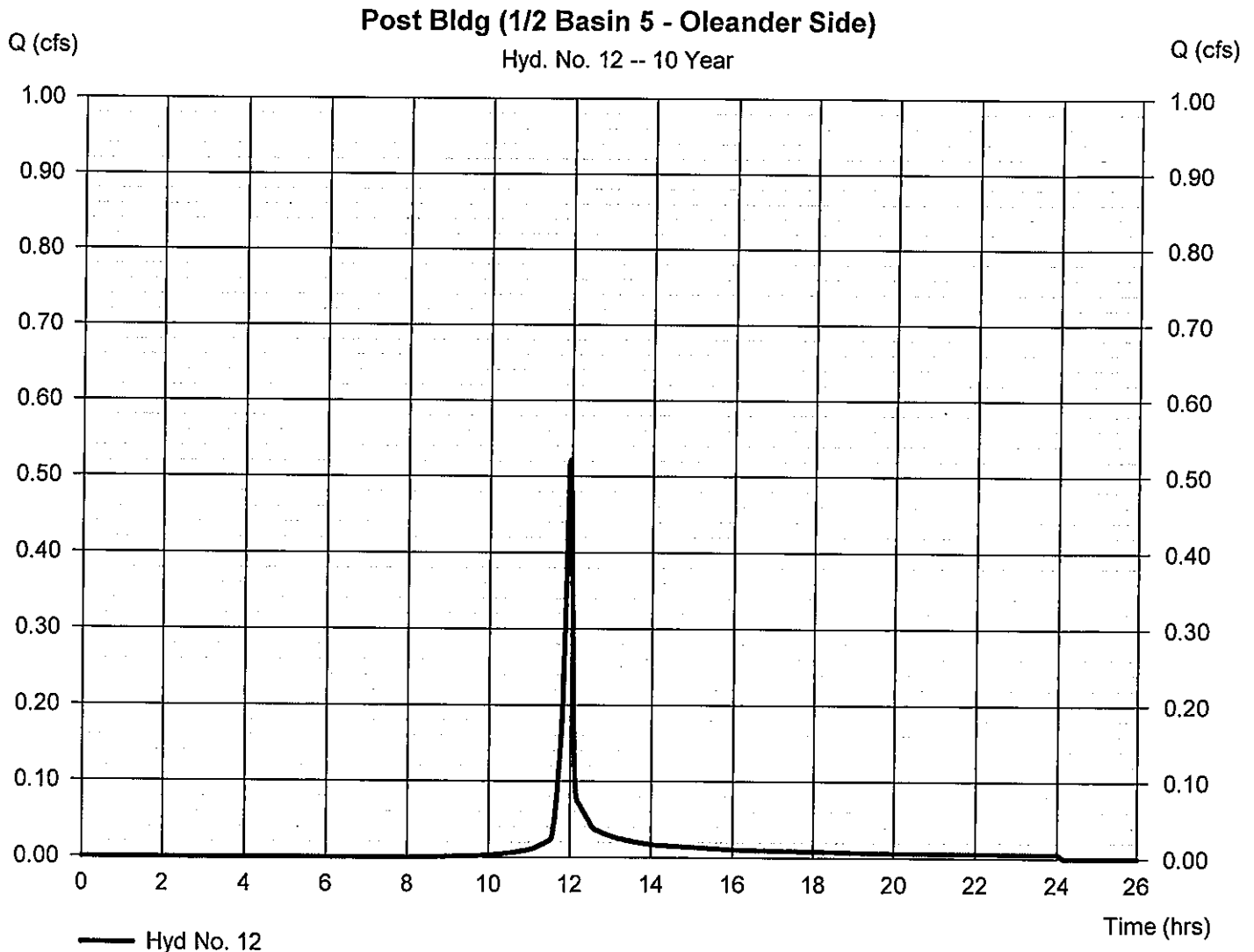
Wednesday, 10 / 26 / 2016

## Hyd. No. 12

Post Bldg (1/2 Basin 5 - Oleander Side)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.521 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	1,052 cuft
Drainage area	=	0.080 ac	Curve number	=	69*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

\* Composite (Area/CN) =  $[(0.040 \times 98) + (0.040 \times 39)] / 0.080$



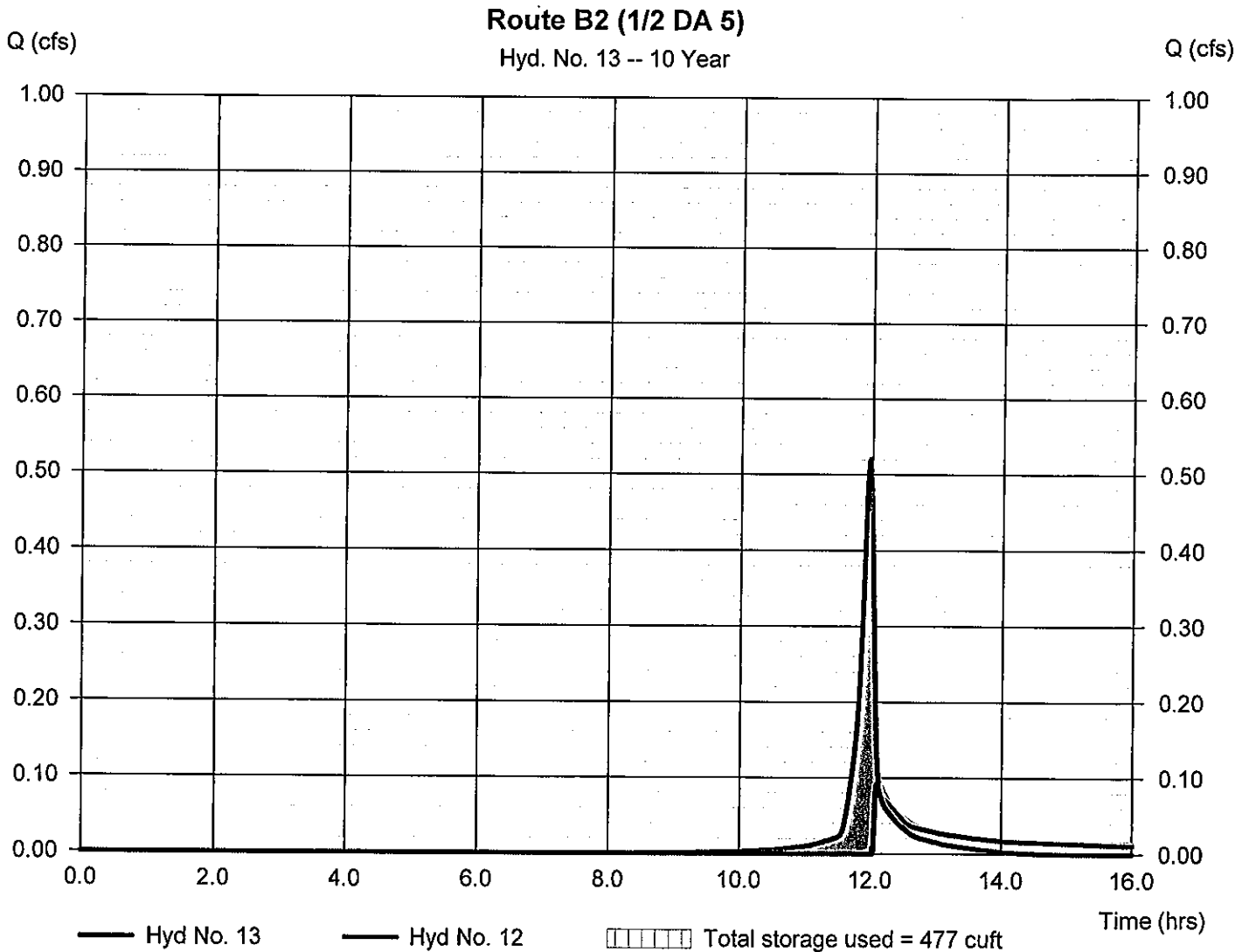
# Hydrograph Report

## Hyd. No. 13

Route B2 (1/2 DA 5)

Hydrograph type	= Reservoir	Peak discharge	= 0.091 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.12 hrs
Time interval	= 1 min	Hyd. volume	= 165 cuft
Inflow hyd. No.	= 12 - Post Bldg (1/2 Basin 5 - <del>Oleander</del> )	Clearance	= 19.04 ft
Reservoir name	= Infil Basin B2 Bldg Oleander	Max. Storage	= 477 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Pond Report

## Pond No. 5 - Infil Basin B2 Bldg Oleander

### Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 17.50 ft

### Stage / Storage Table

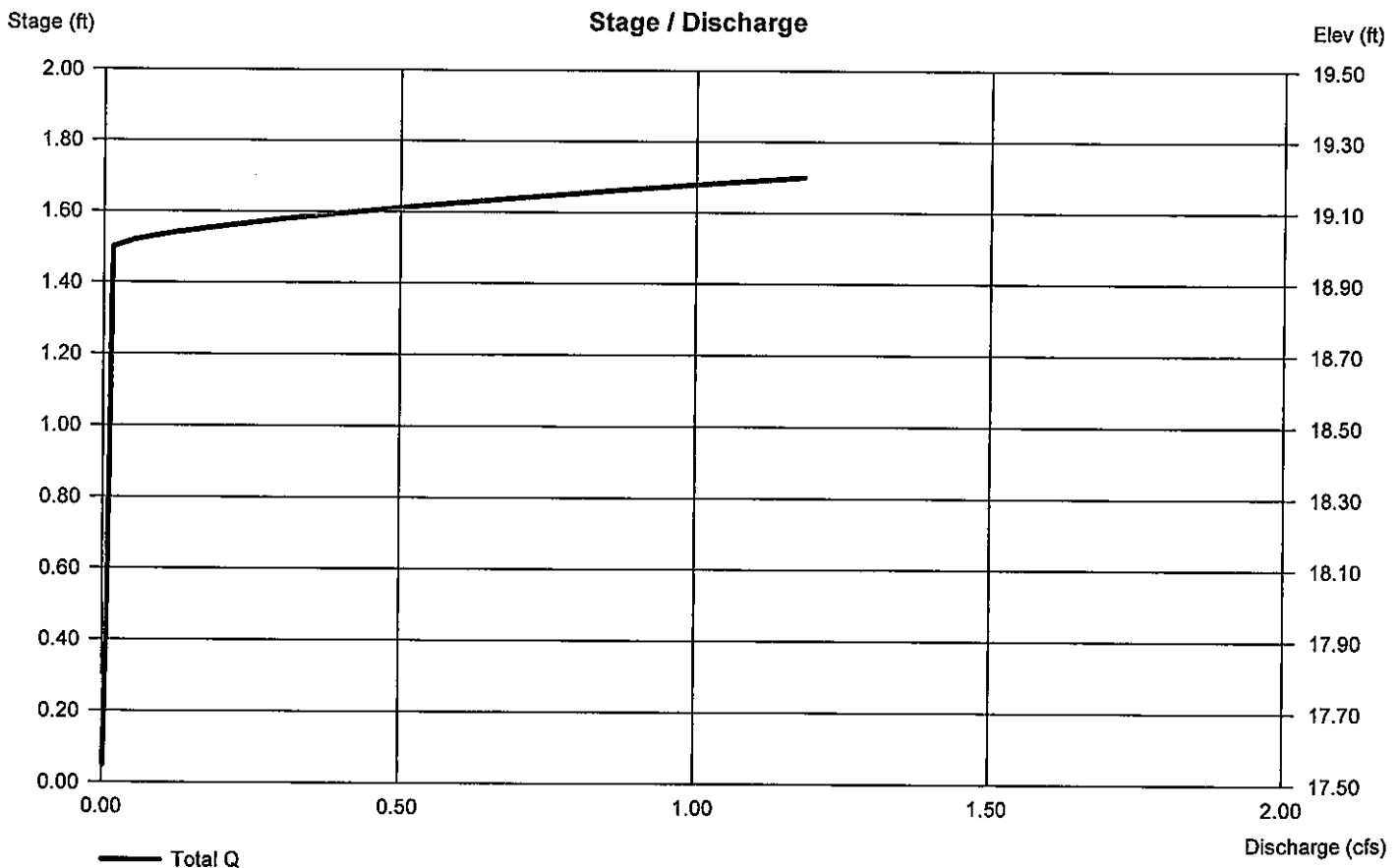
Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	17.50	108	0	0
0.50	18.00	233	83	83
1.50	19.00	534	373	456
1.70	19.20	604	114	570

### Culvert / Orifice Structures

### Weir Structures

	[A]	[B]	[C]	[PrfRsr]		[A]	[B]	[C]	[D]
Rise (in)	= 0.00	0.00	0.00	0.00	Crest Len (ft)	= 5.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00	Crest El. (ft)	= 19.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0	Weir Coeff.	= 2.60	3.33	3.33	3.33
Invert El. (ft)	= 0.00	0.00	0.00	0.00	Weir Type	= Broad	---	---	---
Length (ft)	= 0.00	0.00	0.00	0.00	Multi-Stage	= No	No	No	No
Slope (%)	= 0.00	0.00	0.00	n/a					
N-Value	= .013	.013	.013	n/a					
Orifice Coeff.	= 0.60	0.60	0.60	0.60	Exfil.(in/hr)	= 1.200 (by Contour)			
Multi-Stage	= n/a	No	No	No	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).





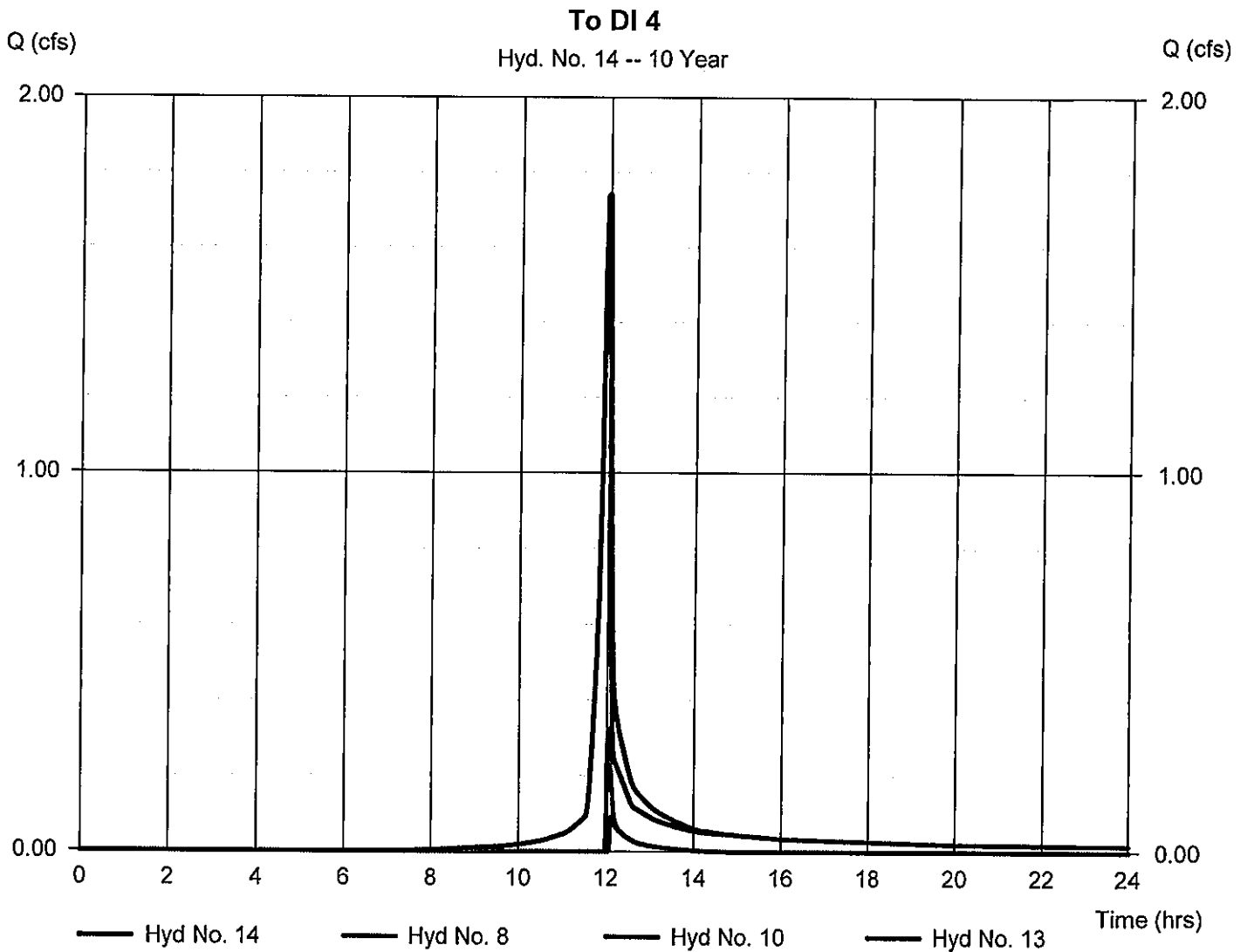
# Hydrograph Report

## Hyd. No. 14

To DI 4

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 8, 10, 13

Peak discharge = 1.742 cfs  
Time to peak = 11.98 hrs  
Hyd. volume = 4,014 cuft  
Contrib. drain. area = 0.230 ac



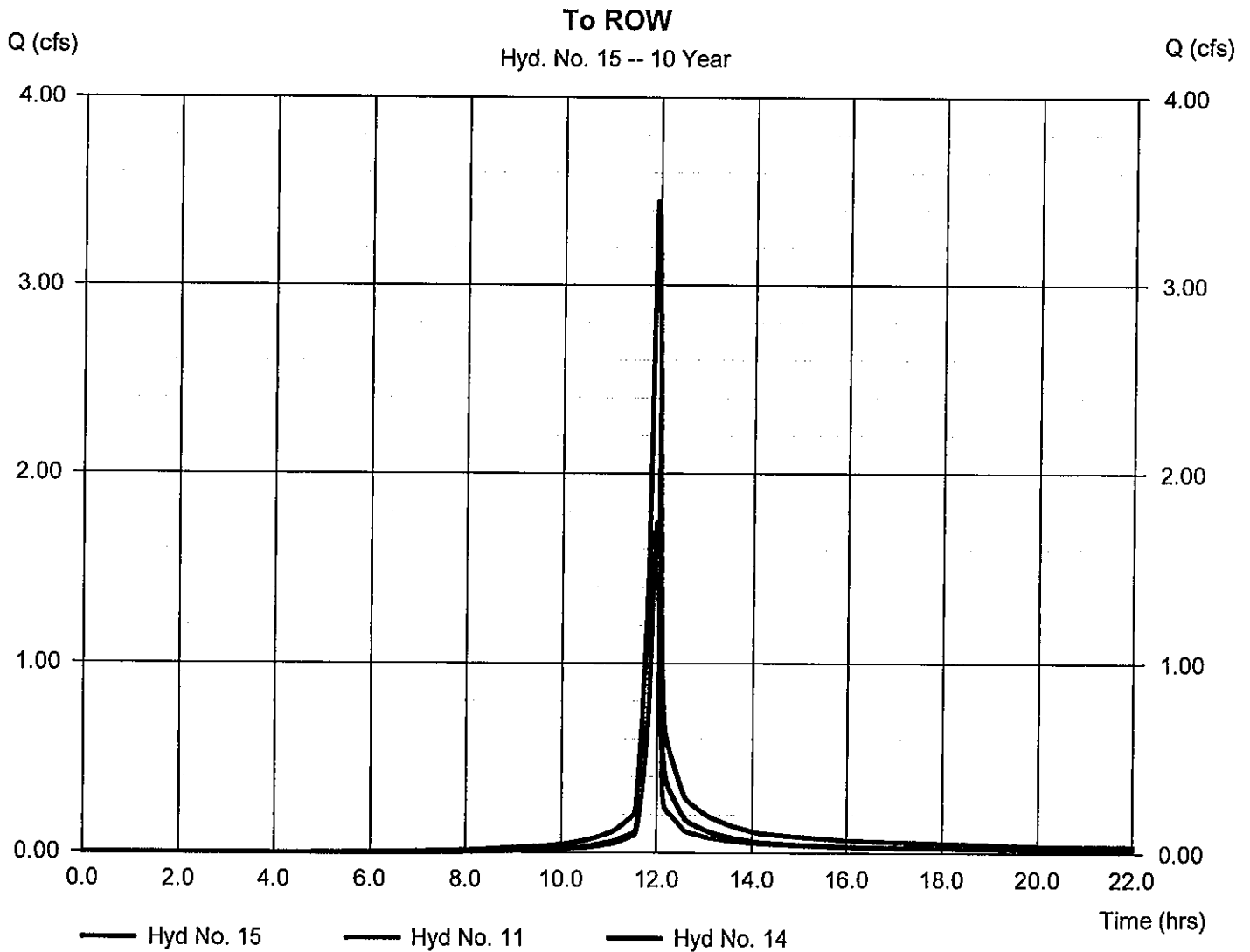
# Hydrograph Report

## Hyd. No. 15

To ROW

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 11, 14

Peak discharge = 3.447 cfs  
Time to peak = 11.95 hrs  
Hyd. volume = 7,676 cuft  
Contrib. drain. area = 0.000 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	4.766	1	717	9,813	----	----	----	Wells Pre
2	SCS Runoff	2.604	1	718	5,284	----	----	----	Wells Post (PC Area - All Parking a
3	Reservoir	0.000	1	714	0	2	18.58	2,348	Route all PC
4	SCS Runoff	0.053	1	719	132	----	----	----	Post Swale Infil Trench (DA 3)
5	Reservoir	0.003	1	735	5	4	14.77	28.0	Infil/SWALE - D3
6	SCS Runoff	0.053	1	719	132	----	----	----	Post Swale (DA-2)
7	SCS Runoff	0.647	1	718	1,315	----	----	----	Post Building (Oleander Side-1/2 D
8	Reservoir	0.555	1	720	483	7	19.12	421	Route B1 (1/2 DA 5)
9	SCS Runoff	1.998	1	717	4,285	----	----	----	Basin 8
10	SCS Runoff	2.115	1	717	4,380	----	----	----	Exist Oleander ROW DA 4
11	Combine	2.046	1	717	4,422	3, 5, 6, 9,	----	----	Exist DI (In Driveway)
12	SCS Runoff	0.647	1	718	1,315	----	----	----	Post Bldg (1/2 Basin 5 - Oleander Si
13	Reservoir	0.406	1	722	368	12	19.10	513	Route B2 (1/2 DA 5)
14	Combine	2.647	1	720	5,230	8, 10, 13	----	----	To DI 4
15	Combine	4.615	1	718	9,653	11, 14	----	----	To ROW
									Total Post
Perv Pavement Routing10-19-16.gpw					Return Period: 25 Year			Wednesday, 10 / 26 / 2016	

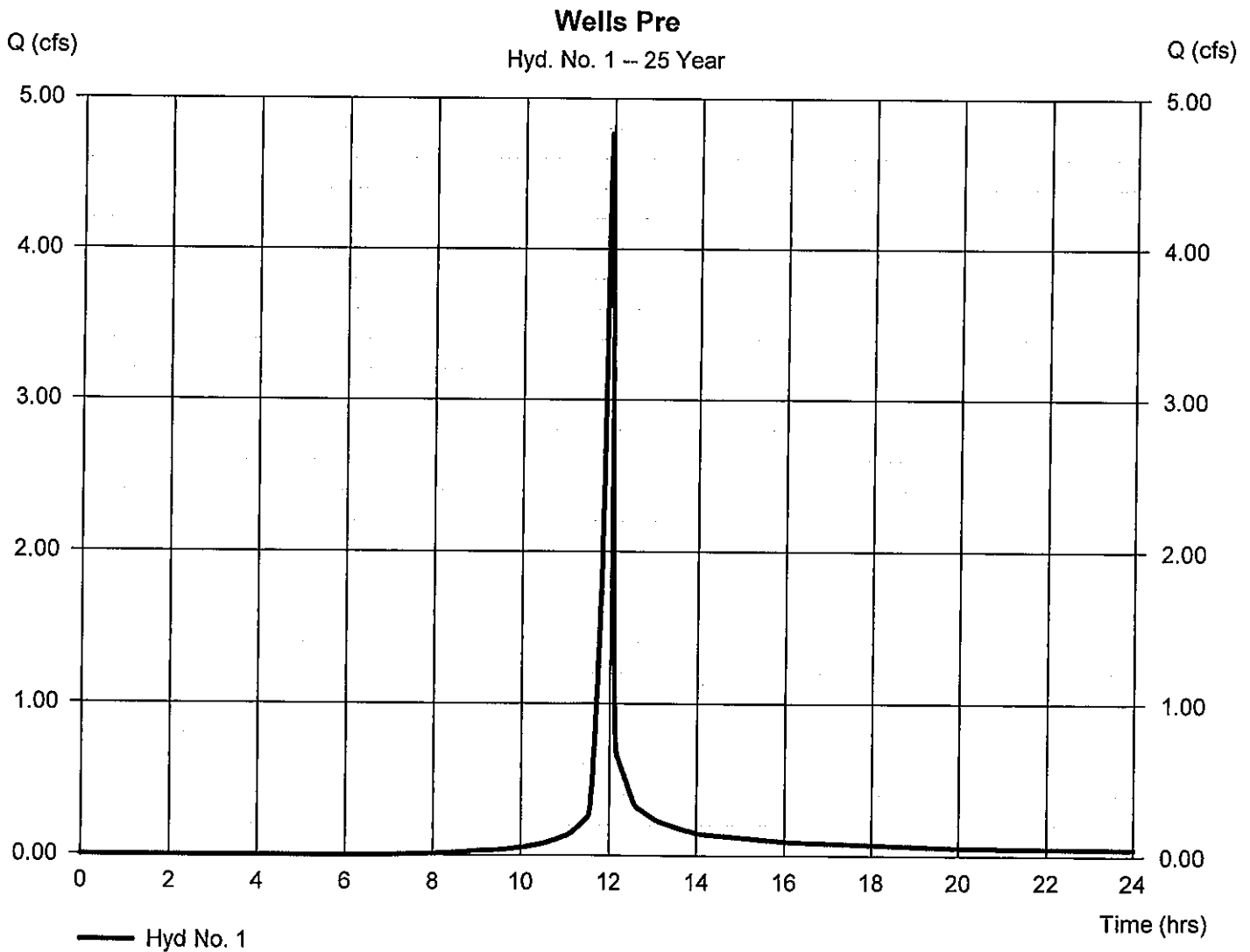
# Hydrograph Report

## Hyd. No. 1

### Wells Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 4.766 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 9,813 cuft
Drainage area	= 0.540 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.230 \times 39) + (0.310 \times 98)] / 0.540$



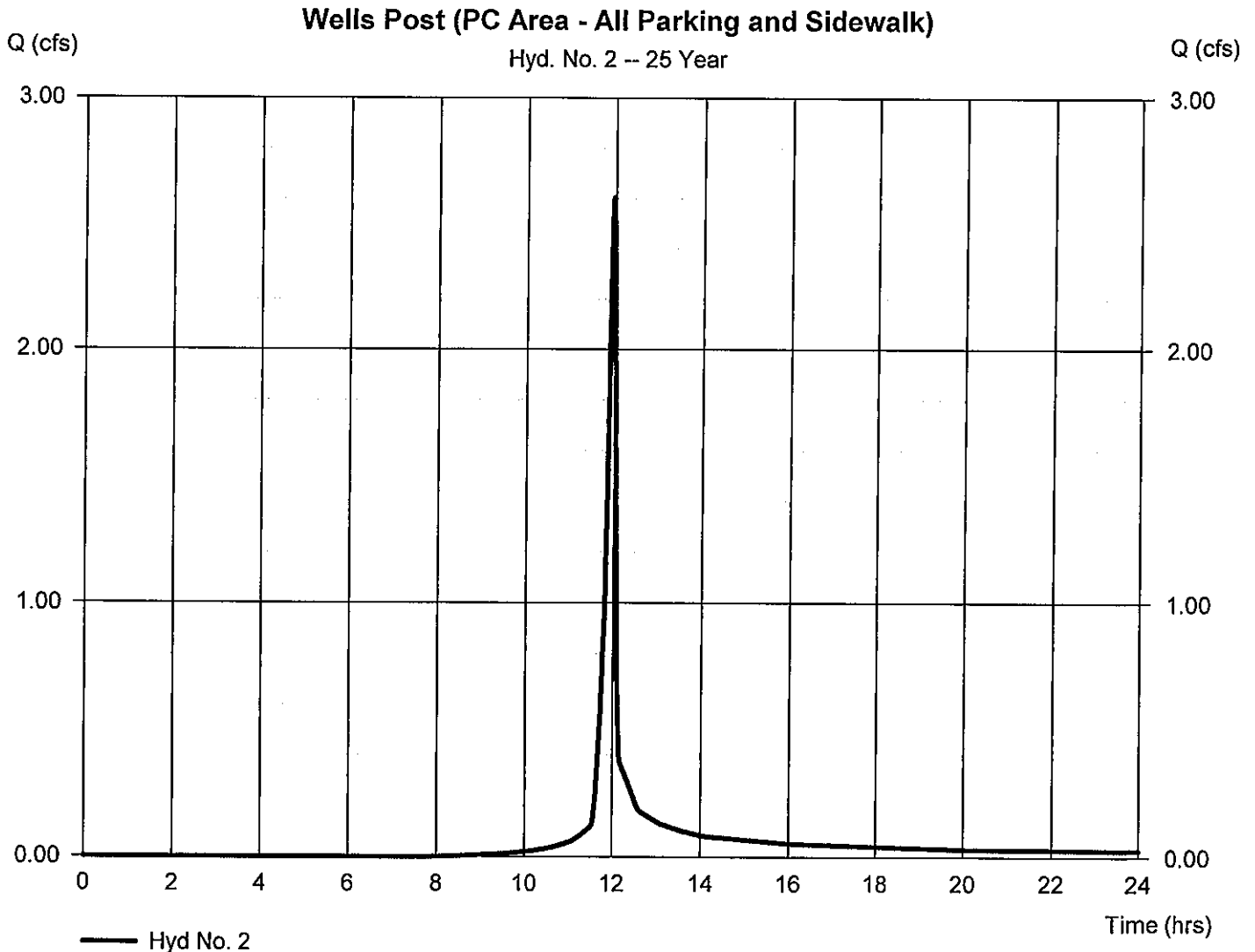
# Hydrograph Report

## Hyd. No. 2

Wells Post (PC Area - All Parking and Sidewalk)

Hydrograph type	= SCS Runoff	Peak discharge	= 2.604 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 5,284 cuft
Drainage area	= 0.330 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.160 \times 98) + (0.170 \times 39)] / 0.330$



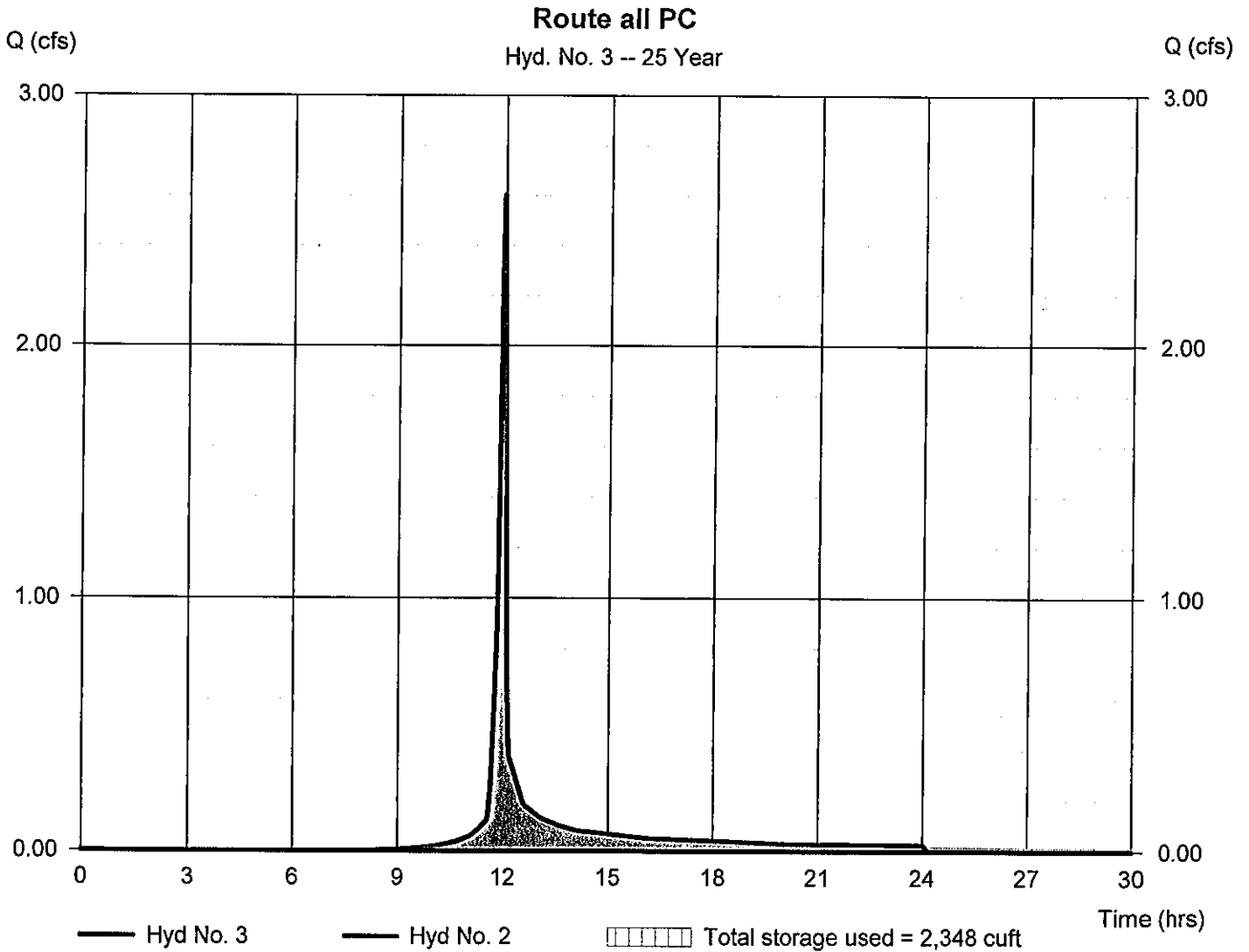
# Hydrograph Report

## Hyd. No. 3

Route all PC

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.90 hrs
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Wells Post (PC Area - All Parking and Sidewalk)	Max. Flood	= 18.58 ft
Reservoir name	= Pervious Concrete	Max. Storage	= 2,348 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



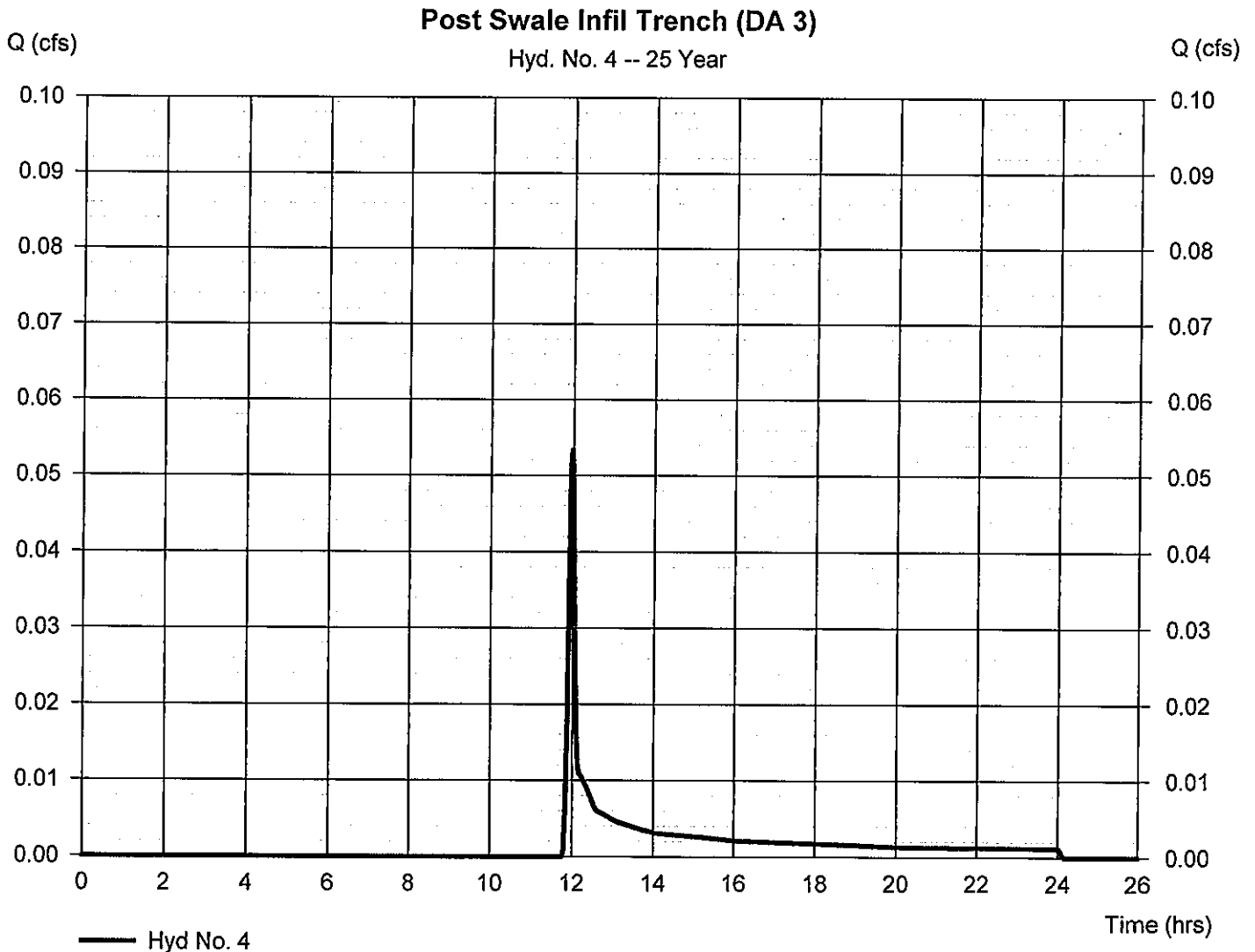
# Hydrograph Report

## Hyd. No. 4

### Post Swale Infil Trench (DA 3)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.053 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.98 hrs
Time interval	= 1 min	Hyd. volume	= 132 cuft
Drainage area	= 0.030 ac	Curve number	= 39*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.160 \times 98) + (0.160 \times 30)] / 0.030$



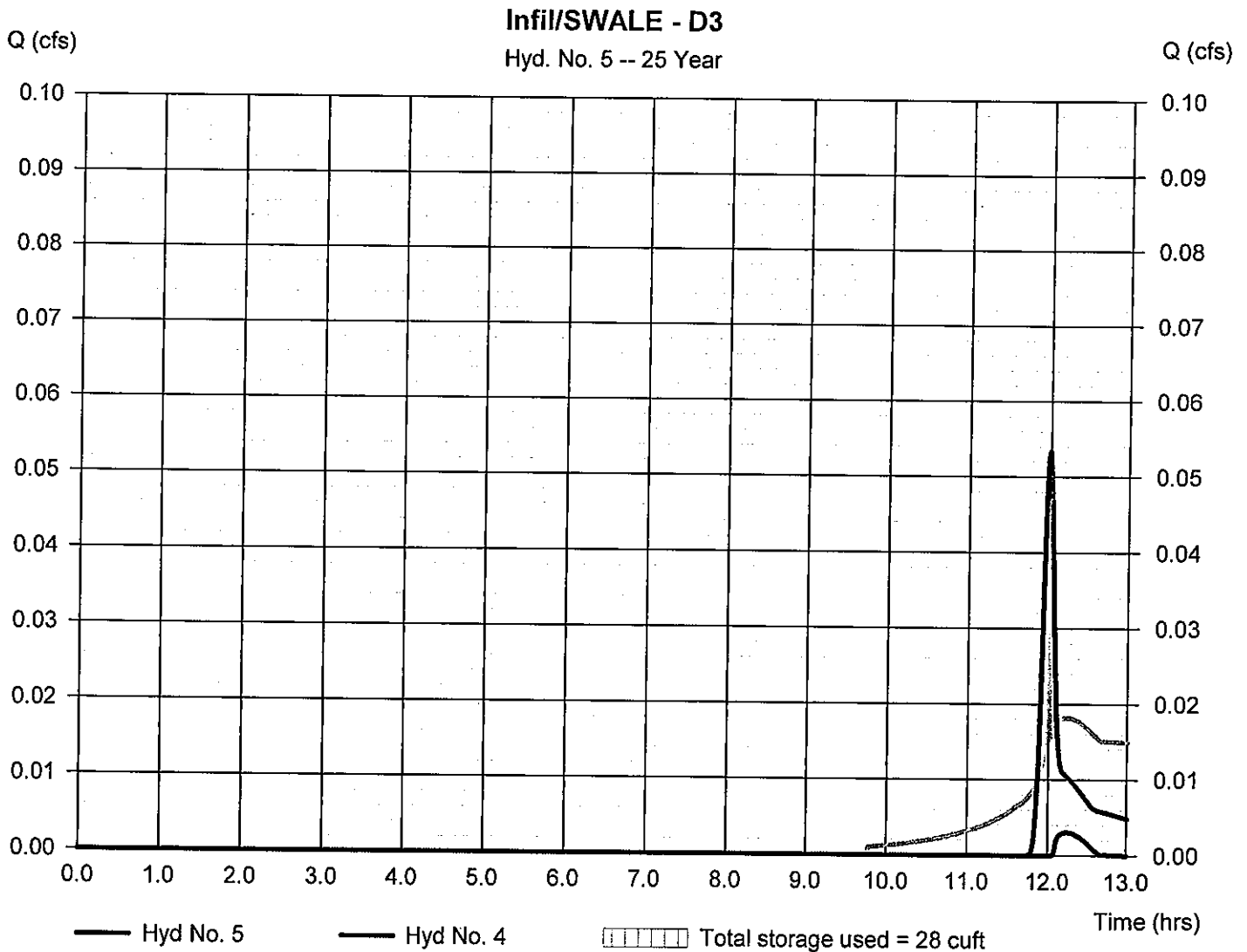
# Hydrograph Report

## Hyd. No. 5

Infil/SWALE - D3

Hydrograph type	= Reservoir	Peak discharge	= 0.003 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.25 hrs
Time interval	= 1 min	Hyd. volume	= 5 cuft
Inflow hyd. No.	= 4 - Post Swale Infil Trench (DWA)	Max. Elevation	= 14.77 ft
Reservoir name	= Infil Trench SWALE	Max. Storage	= 28 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



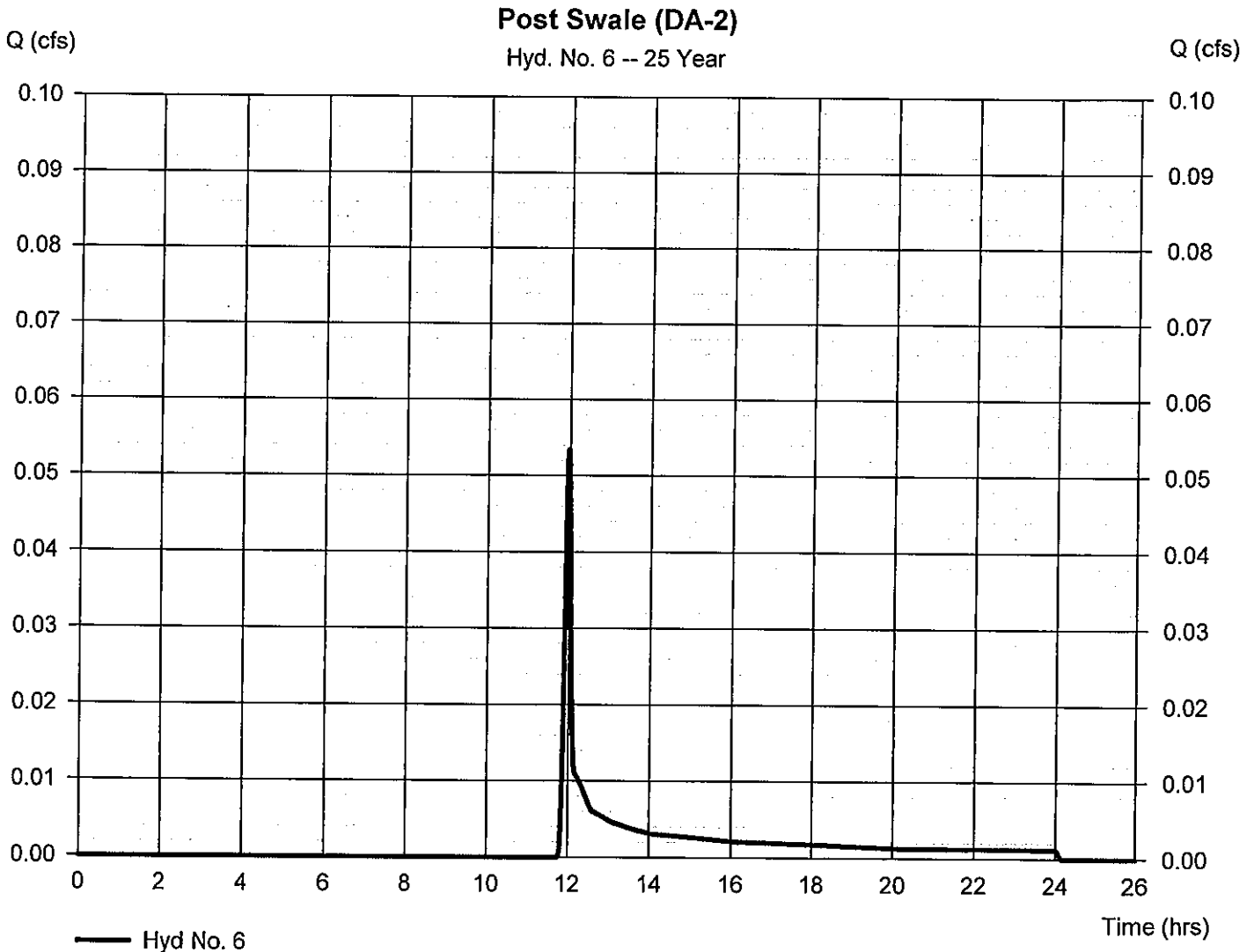


# Hydrograph Report

## Hyd. No. 6

Post Swale (DA-2)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.053 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.98 hrs
Time interval	= 1 min	Hyd. volume	= 132 cuft
Drainage area	= 0.030 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



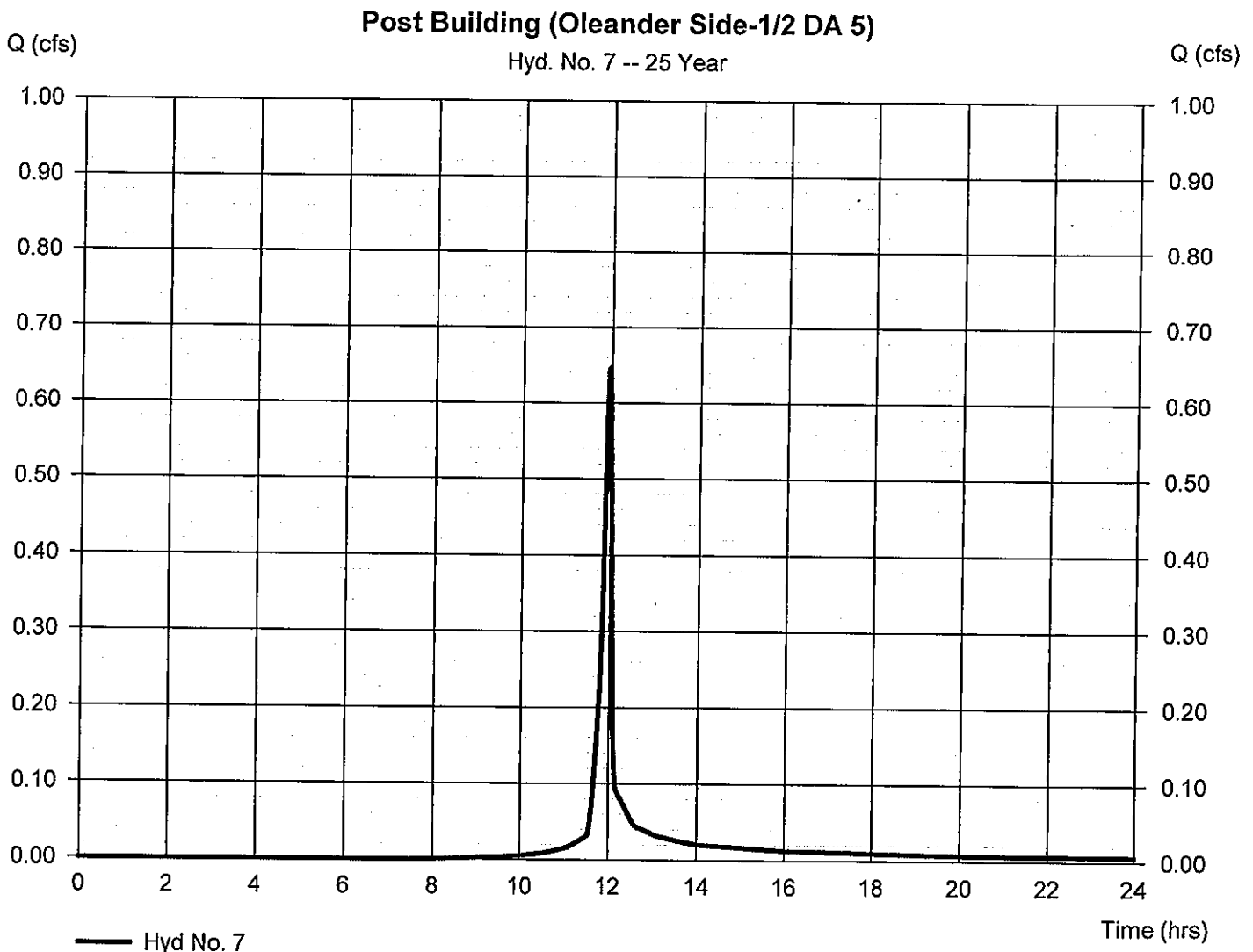
# Hydrograph Report

## Hyd. No. 7

Post Building (Oleander Side-1/2 DA 5)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.647 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 1,315 cuft
Drainage area	= 0.080 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.040 \times 98) + (0.040 \times 39)] / 0.080$



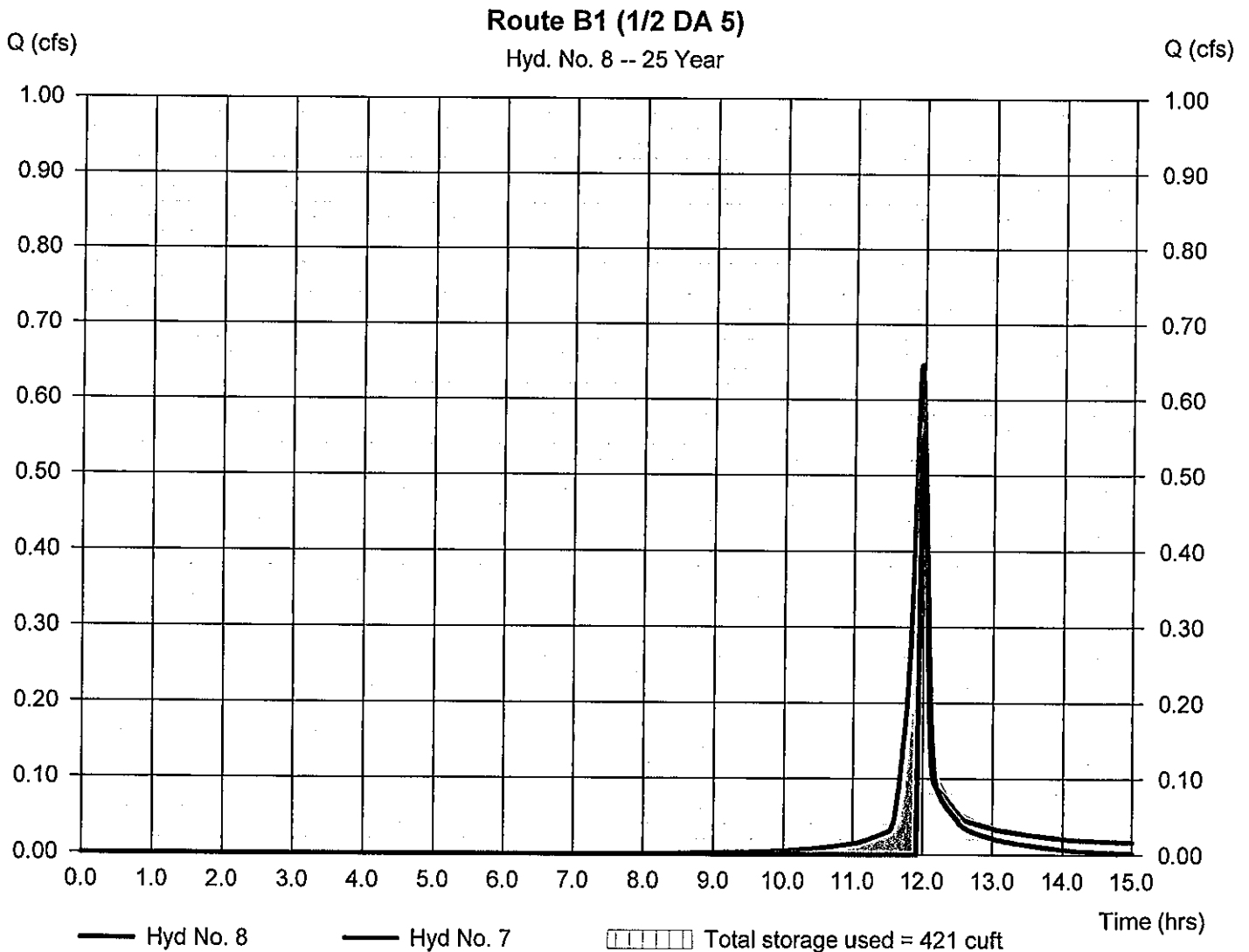
# Hydrograph Report

## Hyd. No. 8

Route B1 (1/2 DA 5)

Hydrograph type	= Reservoir	Peak discharge	= 0.555 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 483 cuft
Inflow hyd. No.	= 7 - Post Building (Oleander Max 1/2 DA 5)	Max. Storage	= 19.12 ft
Reservoir name	= Infil Basin B1 Bldg Oleander	Max. Storage	= 421 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

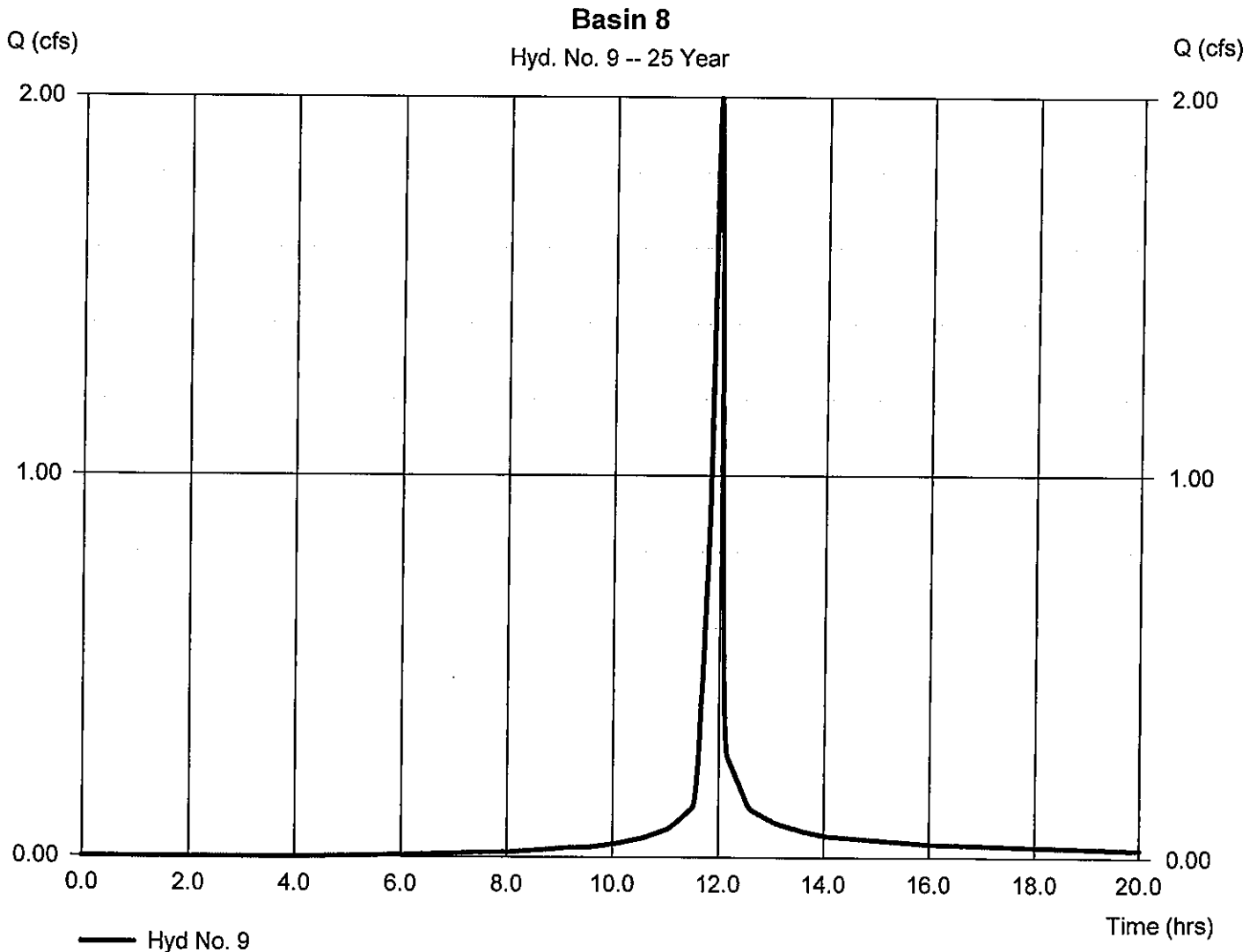
Wednesday, 10 / 26 / 2016

## Hyd. No. 9

### Basin 8

Hydrograph type	= SCS Runoff	Peak discharge	= 1.998 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 4,285 cuft
Drainage area	= 0.190 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.160 x 98)] / 0.190



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

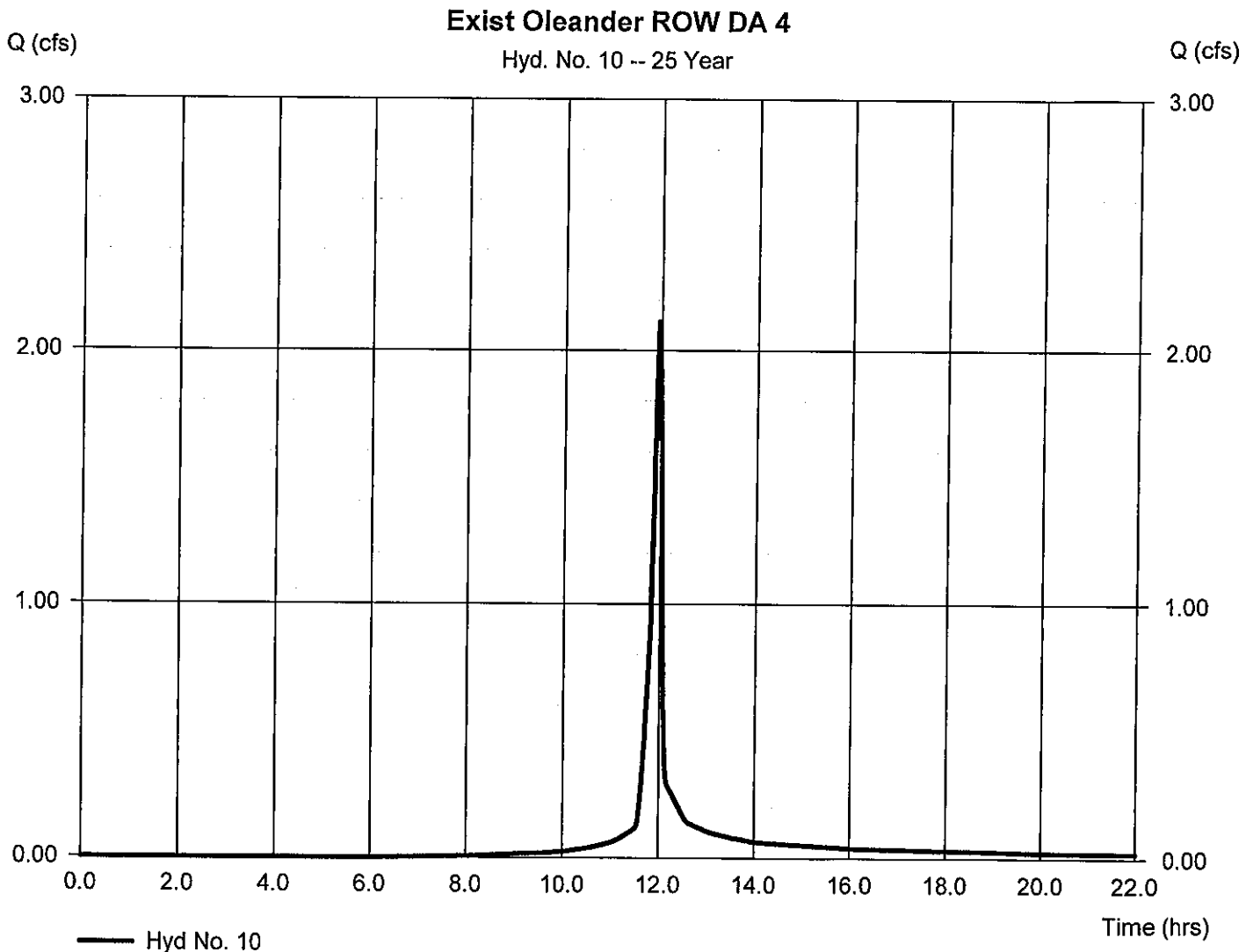
Wednesday, 10 / 26 / 2016

## Hyd. No. 10

Exist Oleander ROW DA 4

Hydrograph type	= SCS Runoff	Peak discharge	= 2.115 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 4,380 cuft
Drainage area	= 0.230 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.140 x 98) + (0.090 x 39)] / 0.230

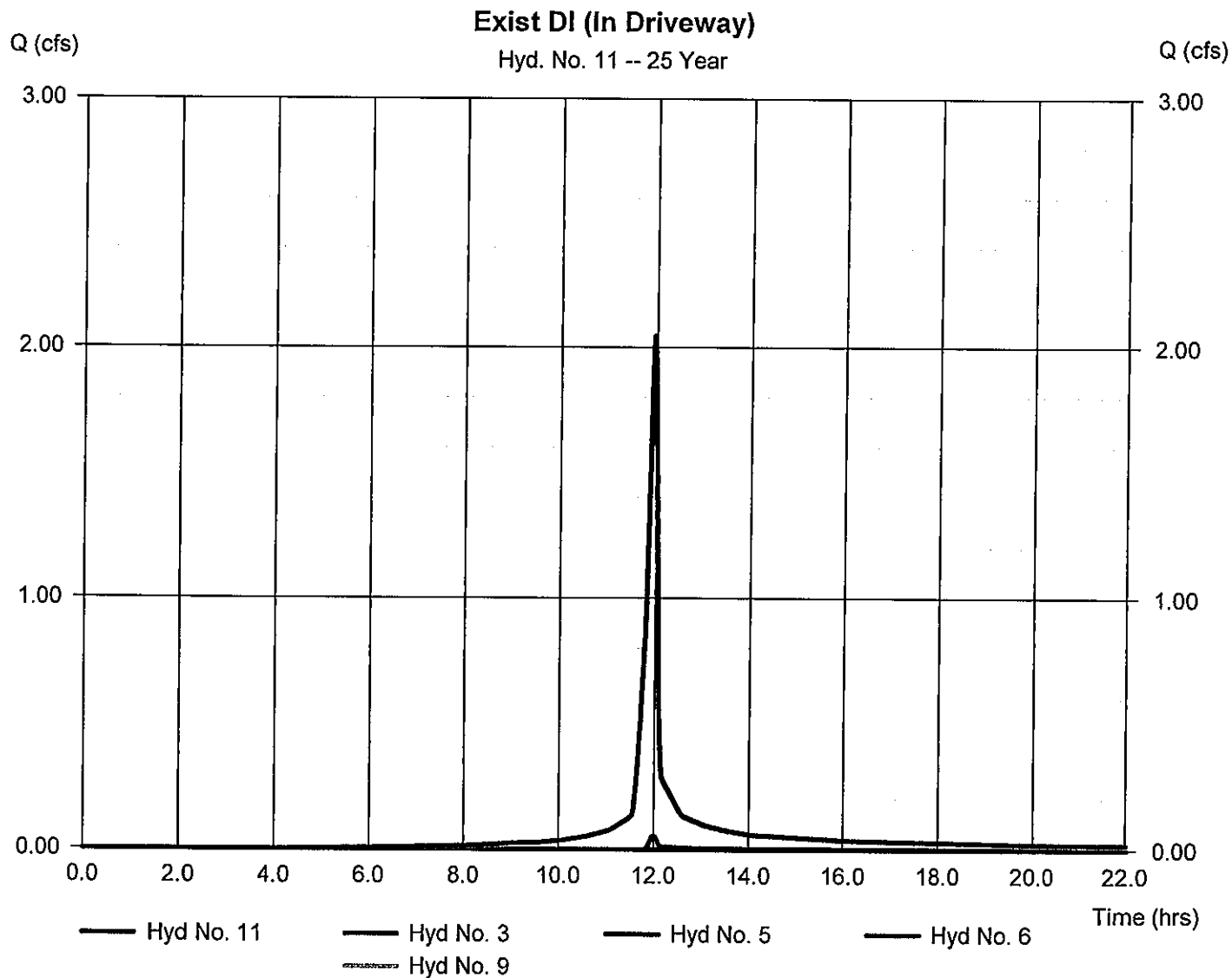


# Hydrograph Report

## Hyd. No. 11

Exist DI (In Driveway)

Hydrograph type	= Combine	Peak discharge	= 2.046 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 4,422 cuft
Inflow hyds.	= 3, 5, 6, 9	Contrib. drain. area	= 0.220 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

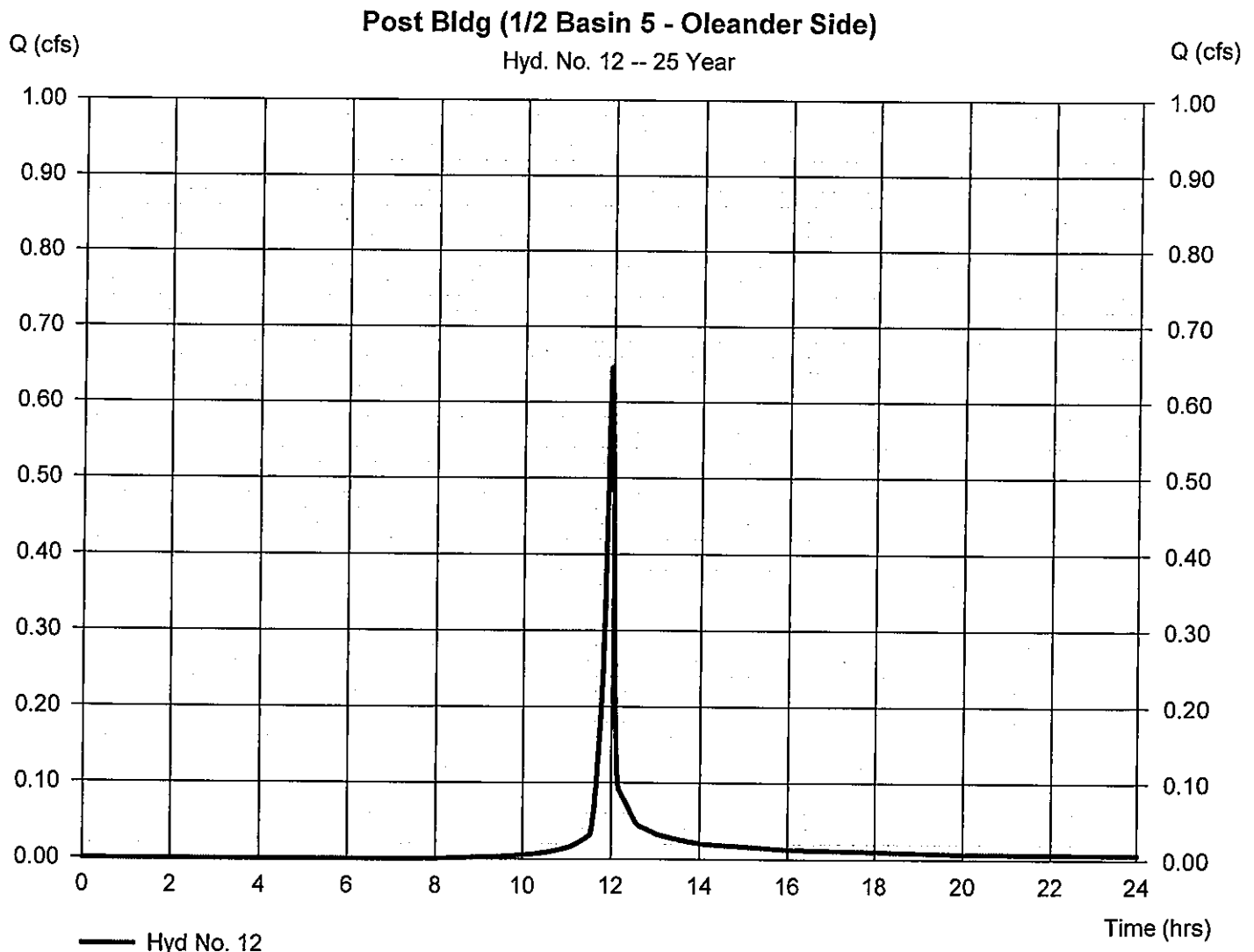
Wednesday, 10 / 26 / 2016

## Hyd. No. 12

Post Bldg (1/2 Basin 5 - Oleander Side)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.647 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 1,315 cuft
Drainage area	= 0.080 ac	Curve number	= 69*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(0.040 \times 98) + (0.040 \times 39)] / 0.080$



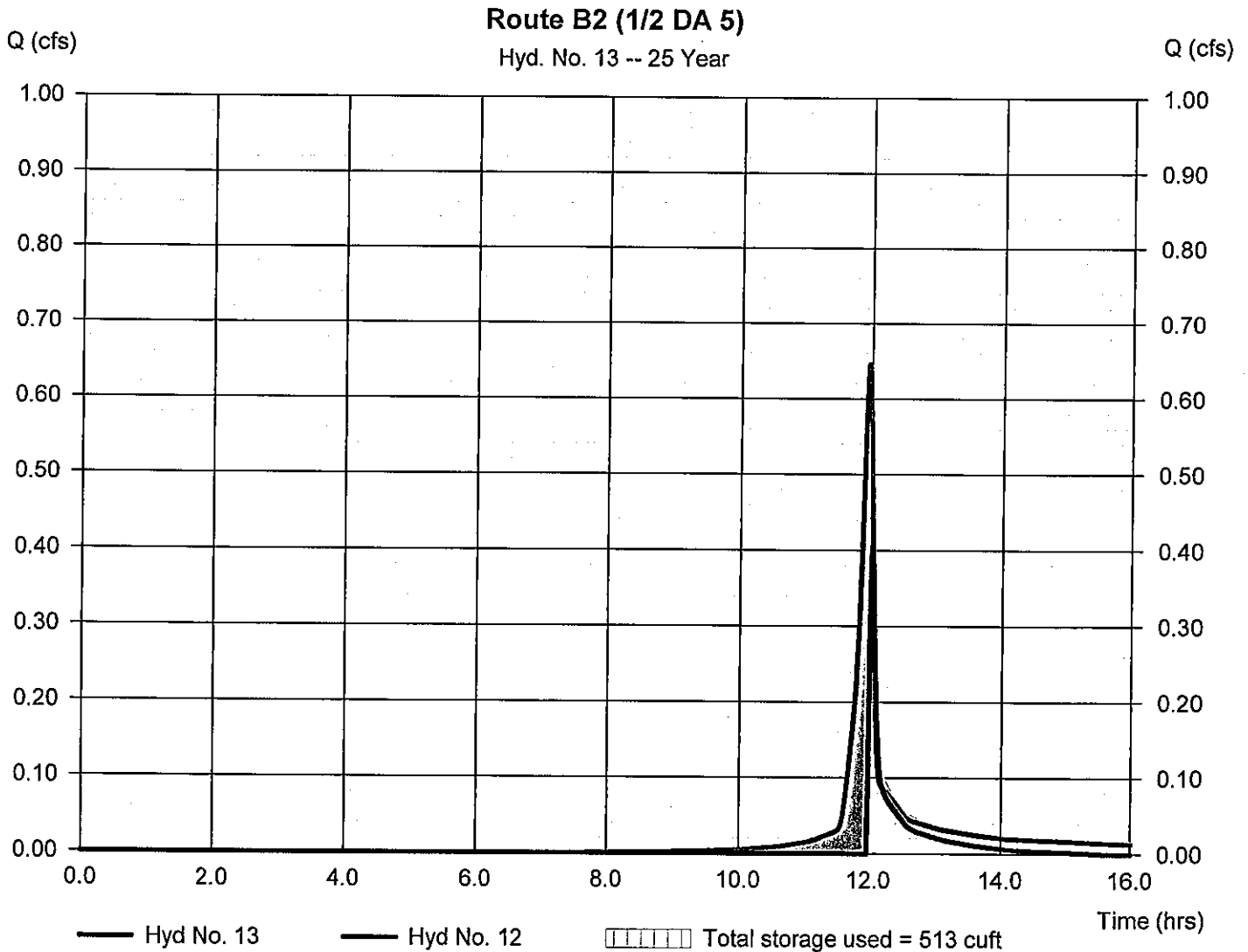
# Hydrograph Report

## Hyd. No. 13

Route B2 (1/2 DA 5)

Hydrograph type	= Reservoir	Peak discharge	= 0.406 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 1 min	Hyd. volume	= 368 cuft
Inflow hyd. No.	= 12 - Post Bldg (1/2 Basin 5 - <del>Oleander Elev Site</del> )	Max. Storage	= 513 cuft
Reservoir name	= Infil Basin B2 Bldg Oleander		

Storage Indication method used. Exfiltration extracted from Outflow.





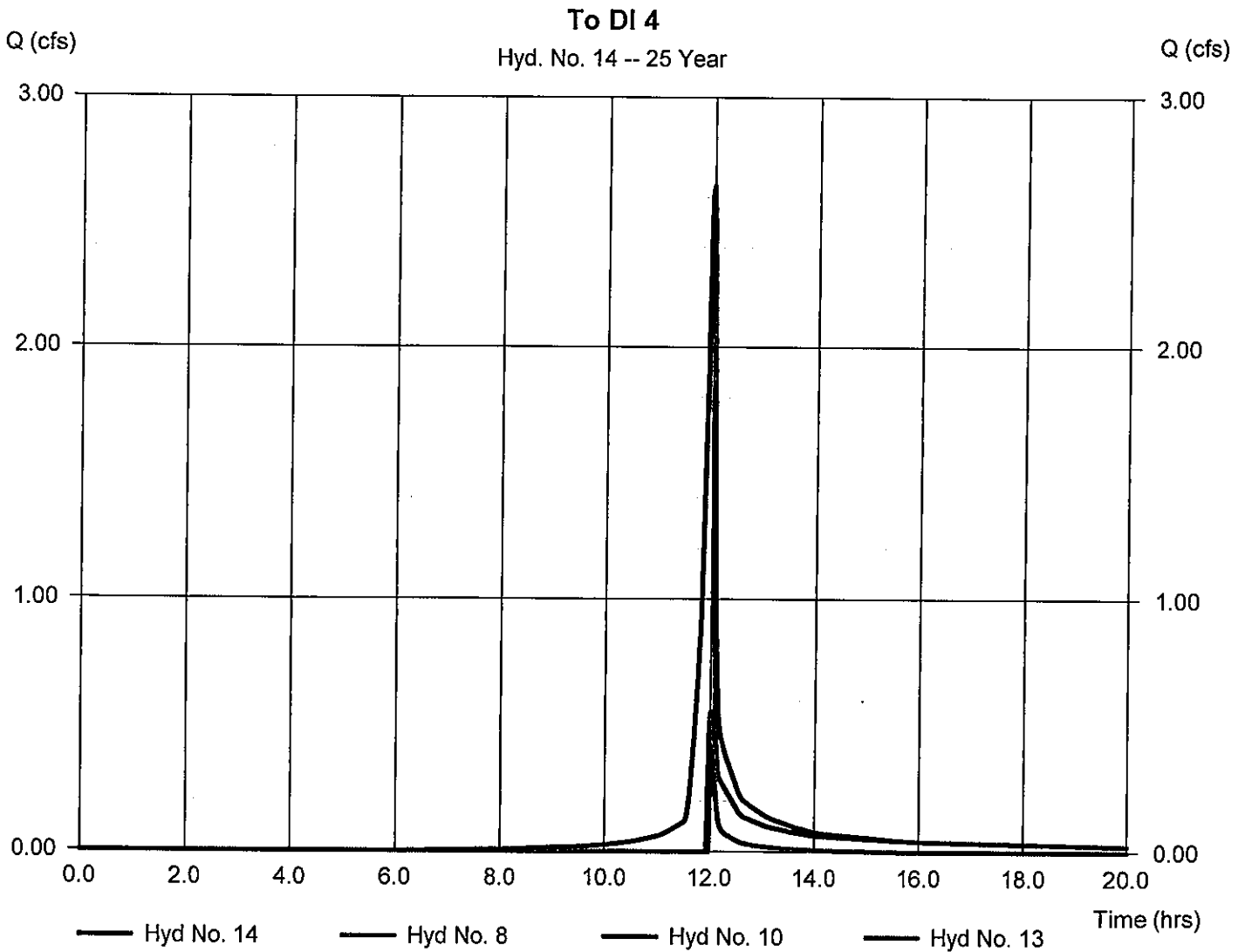
# Hydrograph Report

## Hyd. No. 14

To DI 4

Hydrograph type = Combine  
Storm frequency = 25 yrs  
Time interval = 1 min  
Inflow hyds. = 8, 10, 13

Peak discharge = 2.647 cfs  
Time to peak = 12.00 hrs  
Hyd. volume = 5,230 cuft  
Contrib. drain. area = 0.230 ac



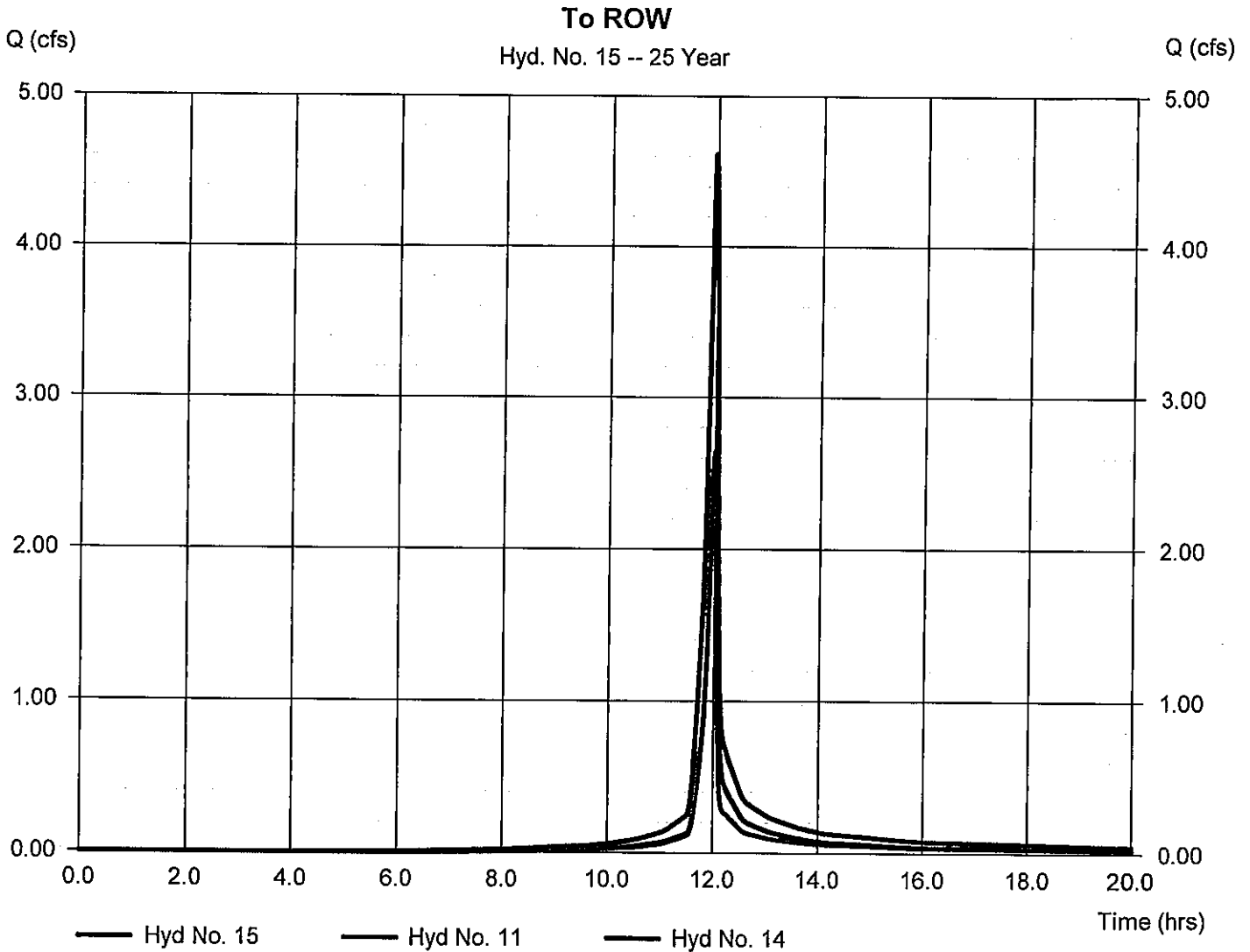
# Hydrograph Report

## Hyd. No. 15

To ROW

Hydrograph type = Combine  
Storm frequency = 25 yrs  
Time interval = 1 min  
Inflow hyds. = 11, 14

Peak discharge = 4.615 cfs  
Time to peak = 11.97 hrs  
Hyd. volume = 9,653 cuft  
Contrib. drain. area = 0.000 ac





**ECS CAROLINAS, LLP**

Geotechnical • Construction Materials • Environmental • Facilities

July 22, 2008

Mr. Harry Stovall  
Stovall-Belmont, LLC  
P.O. Box 4577  
Wilmington, North Carolina 28406

Re: Infiltration Evaluation  
5712 Oleander Drive  
Wilmington, North Carolina

ECS Project No. 22.14269

Dear Mr. Stovall,

ECS Carolinas, LLP (ECS) recently conducted an infiltration evaluation for the proposed infiltration area at the site located at 5712 Oleander Drive in Wilmington, North Carolina. This letter, with attachments, is the report of our evaluation.

**Field Testing**

On July 21, 2008 ECS conducted an exploration of the subsurface soil and ground water conditions at one requested location shown on the attached Site Diagram. The test area was field located by utilizing a site location map provided by Mr. Harry Stovall. The purpose of this exploration was to obtain subsurface information of the in-place soils for the proposed infiltration area. We explored the subsurface soil and ground water conditions by advancing one hand auger boring into the existing ground surface at the requested boring location. We visually classified the subsurface soils and obtained representative samples of each soil type encountered. We also recorded the ground water level observed at the time of the hand auger boring. The attached Infiltration Evaluation Form provides a summary of the subsurface conditions encountered at each hand auger boring location.

The ground water level and the seasonal high ground water level (SHWL) were estimated at the boring location below the existing grade elevation. Below is a summary of each boring location.

Location	Water Level	SHWL
1	48 inches	18 inches

We have conducted an infiltration test utilizing a compact constant head permeameter near the hand auger boring to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWL.

Infiltration Evaluation  
5712 Oleander Drive  
Wilmington, North Carolina  
ECS Project No. 22.14269  
July 21, 2008

<u>Location</u>	<u>Depth</u>	<u>Soil Description</u>
1	0-12"	Grey silty SAND
	12"-16"	Brown silty cemented SAND (hard pan)
	16"-32"	Grey fine SAND w/silt lenses
	32"-60"	Orange/grey CLAY w/sand

Seasonal High Water Table was estimated to be at 18 inches below the existing grade elevation.

Infiltration Rate: 0.02 inches per minute (1.2 inches per hour)

Test was conducted at 10 inches below existing grade elevation

Ground water was encountered at 48 inches below the existing grade elevation.

Infiltration Evaluation  
5712 Oleander Drive  
Wilmington, North Carolina  
ECS Project No. 22.14269

### Field Test Results

Below is a summary of the infiltration test results:

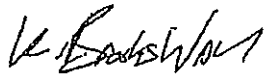
Location	Description	Depth	Inches/hour	Inches/minute
I	Grey silty fine SAND	10 inches	1.2	0.02

Infiltration rates and SHWL may vary within the proposed site due to changes in elevation and subsurface conditions.

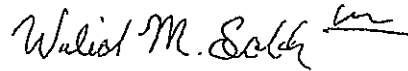
If you have any questions regarding this report, please contact us at (910) 686-9114.

Respectfully,

ECS CAROLINAS, LLP



K. Brooks Wall  
Staff Geologist



Walid M. Sobh, P. E.  
Principal Engineer  
NC License No. 22983

Attachments: Site Diagram  
Infiltration Evaluation