APPENDIX J-1

REVISED HYDROLOGY STUDY

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Preliminary Hydrology Study
for
Upper Road Land Division
Town of Ross, Marin County

Prepared By:
CSW/Stuber-Stroeh
Engineering Group, Inc
by: Wayne F. Leach
by: Julia A. Harberson

Prepared On:
June 4, 2012
Revised On: November 12, 2012

Project No.: 8.7440.10

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RAINFALL INTENSITY

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CLIENT _____ SUBJECT Rainfall Intensity CHK'D WM DATE 6.5.12

IDF Curve (San Rafael, Marin County)

Zone "B2" Design Rainfall, Map "V"

$P_{60} = 1.2$" Design Rainfall Intensities, Map "I"

$R_{D\,10} = 0.68$ I_{10}/I_{100}, from Chart "K" Zone B

Frequency Distribution, Ratios Chart "R":

$R_{D,2} = 0.42$

$R_{D,10} = 0.68$

$R_{D,25} = 0.79$

$R_{D,100} = 1.0$

$R_{D,T} = I_{D,T}/I_{D,100}$

$I_{D,T} = R_{D,T}\,(I_{D,100})$

Frequency	Duration 5min	10min	15min	30min	1hr
2	1.69	1.23	1.02	0.69	0.50
10	2.76	2.00	1.67	1.12	0.82
25	3.20	2.33	1.93	1.30	0.95
100	4.05	2.95	2.45	1.65	1.20

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RUNOFF COEFFICIENTS

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SHEET NO. 1/2

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Runoff Coefficient CHK'D WLC DATE 6.5.12

Existing Conditions Runoff Coefficient

C = 0.59* ← From HDM Figure 819.2A

* For all existing condition watersheds.

Proposed Conditions Runoff Coefficient

Areas 2, 5, 6, 87: C = 0.59 ← no change from existing condition

Area 3: C = 0.59 ← area regraded, but same as existing condition

Area 1: Buildings = 17,116 sf ± ≈ 0.39 ac ±
Road/Dwy = 13,376 sf ± ≈ 0.31 ac ±
0.70 ac ± Impervious Area (C=0.9)

Graded/Ungraded = 1808880 sf ± ≈ 41.52 ac ± (C=0.59)

$$C_{com} = \frac{(0.9)(0.7ac) + (0.59)(41.52ac)}{(42.22ac)}$$

$C_{com, Area1} = 0.60$

Area 3: Roads = 12,780 sf ± ≈ 0.29 ac ± Impervious Area (C=0.9)

Graded/Ungraded = 24,049 sf ± ≈ 0.55 ac ± (C=0.59)

$$C_{com} = \frac{(0.9)(0.29ac) + (0.59)(0.55ac)}{(0.84\,ac)}$$

$C_{com, Area3} = 0.69$

Runoff Coefficients for Undeveloped Areas

Watershed Types

	Extreme	High	Normal	Low
Relief	.28-.35 Steep, rugged terrain with average slopes above 30%	.20-.28 Hilly, with average slopes of 10 to 30%	.14-.20 Rolling, with average slopes of 5 to 10%	.08-.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	.12-.16 No effective soil cover, either rock or thin soil mantle of negligible Infiltration capacity	.08-.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	.06-.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	.04-.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	.12-.16 No effective plant cover, bare or very sparse cover	.08-.12 Poor to fair; clean cultivation crops, or poor natural cover, less that 20% of drainage area over good cover	.06-.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	.04-.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	.10-.12 Negligible surface depression few and shallow; drainageways steep and small, no marshes	.08-.10 Low; well defined system of small drainageways; no ponds or marshes	.06-.08 Normal; considerable surface depression storage; lakes and pond marshes	.04-.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Given An undeveloped watershed consisting of; 1) rolling terrain with average slopes of 5%, 2) clay type soils, 3) good grassland area, and 4) normal surface depressions.

Find The runoff coefficient, C, for the above watershed.

Solution:

Relief	0.14	0.35
Soil Infiltration	0.08	0.06
Vegetal Cover	0.04	0.06
Surface Storage	0.06	0.12
C =	0.32	

0.59 ✓

Figure 819.2A

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EXISTING HYDROLOGY

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SHEET NO. 1/3

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Existing Conditions CHK'D WR DATE 6.5.12

Area 1

Time of Concentration

$$t_c = \frac{1.8(1.1-C)L^{1/2}}{(S(100))^{1/3}} + 5\,min$$

Where: t_c = time (min) ← overland
C = runoff coefficient
L = length (LF)
S = slope (ft/ft)

P+A → P+ B: (overland flow)

$$S = \frac{1145-1100}{400} = 0.11\ ft/ft$$

T_c 100 ≈ T_c 25 ∴ T_c 100 was calculated & used for Q_{100} & Q_{25}

$$t_c = \frac{1.8(1.1-0.59)(400)^{1/2}}{((0.11)(100))^{1/3}} + 5 = 13.3\,min \quad \therefore i_{100} = 2.65\ in/hr$$

$$Q_{100} = CiA = (0.59)(2.65)(2.02) = 3.16\ cfs$$

P+B → POC #4: (channelized flow)

$$Q/A = (3.16\ cfs)/(2.02\ ac) = 1.56\ cfs/ac$$

$$Q_{est} = (1.56\ cfs/ac)(41.96ac) = 65.46\ cfs$$

$$S = \frac{1100' - 75'}{3561.8'} = 0.28\ ft/ft$$

$$Q_{AVE} = 3.16 + \frac{65.46 - 3.16}{2} = 34.31\ cfs$$

V = 9.68 ft/s ← from Flow Master (Assume natural swale w/ 5:1 side slope n=0.045)

$$T_c = 3561.8\left(\frac{1\,sec}{9.68}\right)\left(\frac{1\,min}{60\,sec}\right) = 6.1\ min$$

Travel Time:

$$T_c = 13.3\ min + 6.1\ min = \underline{\underline{19.4\,min}}$$

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SHEET NO. 2/3

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/14/12

CLIENT _____ SUBJECT Existing Conditions CHK'D WZL DATE 6.5.12

Area 1 con't

$i_{25} = 1.74$ in/hr

$i_{100} = 2.22$ in/hr

$Q_{25,1}$ POC#4 $= (0.59)(1.74)(41.96) =$ 43.08 cfs

$Q_{100,1}$ POC#4 $= (0.59)(2.22)(41.96) =$ 54.96 cfs

Worksheet for EX - AREA 1 - B to POC#4

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.045	
Channel Slope:	0.28000	ft/ft
Left Side Slope:	5.00	ft/ft (H:V)
Right Side Slope:	5.00	ft/ft (H:V)
Discharge:	34.31	ft^3/s
Results		
Normal Depth:	0.84	ft
Flow Area:	3.54	ft^2
Wetted Perimeter:	8.59	ft
Top Width:	8.42	ft
Critical Depth:	1.24	ft
Critical Slope:	0.03552	ft/ft
Velocity:	9.68	ft/s
Velocity Head:	1.46	ft
Specific Energy:	2.30	ft
Froude Number:	2.63	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.84	ft
Critical Depth:	1.24	ft
Channel Slope:	0.28000	ft/ft
Critical Slope:	0.03552	ft/ft

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SHEET NO. 1/2

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Existing Conditions CHK'D WZ DATE 6.5.12

Area 2:

Pt. J → Pt. H:

$T_{c100} \approx T_{c25}$ ∴ T_{c100} was calculated & used for Q_{100} & Q_{25}

Assume Overland flow

$S = \frac{285' - 217'}{254'} = 0.26\ ft/ft$

$t_c = \frac{1.8(1.1-0.59)(254)^{1/2}}{[(0.26)(100)]^{1/3}} + 5\ min = 9.9\ min \quad i_{100} = 2.97\ in/hr$

$Q_{100} = (0.59)(2.97)(0.29) = 0.51\ cfs$

Pt. H → POC #5: (channelized flow)

$Q/A = (0.51\ cfs)(0.29\ ac) = 1.76\ cfs/ac$

$Q_{est} = (1.76\ cfs/ac)(1.0\ ac) = 1.76\ cfs$

$Q_{Ave} = 0.51\ cfs + \frac{1.76\ cfs - 0.51\ cfs}{2} = 1.14\ cfs$

$V = 4.22\ ft/s$ ← From Flow Master (Assume natural swale w/ 3:1 side slope & n=.045)

$t_c = 289\ ft \left(\frac{1\ s}{4.22\ ft}\right)\left(\frac{1\ min}{60\ s}\right) = 1.1\ min$

$T_c = 9.9\ min + 1.1\ min = 11\ min$

$i_{25} = 2.29\ in/hr$

$i_{100} = 2.85\ in/hr$

$Q_{25,\ POC\#5} = (0.59)(2.25)(1.00) = 1.33\ cfs$

$Q_{100,\ POC\#5} = (0.59)(2.85)(1.00) = 1.68\ cfs$

Worksheet for EX - AREA 2 - H to POC#5

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.045	
Channel Slope:	0.22000	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	1.14	ft^3/s
Results		
Normal Depth:	0.30	ft
Flow Area:	0.27	ft^2
Wetted Perimeter:	1.90	ft
Top Width:	1.80	ft
Critical Depth:	0.39	ft
Critical Slope:	0.05460	ft/ft
Velocity:	4.22	ft/s
Velocity Head:	0.28	ft
Specific Energy:	0.58	ft
Froude Number:	1.92	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.30	ft
Critical Depth:	0.39	ft
Channel Slope:	0.22000	ft/ft
Critical Slope:	0.05460	ft/ft

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CLIENT _____ SUBJECT Existing Conditions CHK'D WTC DATE 6.5.12

Area 3

Assume all overland flow

$$S = \frac{225 - 75}{349'} = 0.43 \text{ ft/ft}$$

$$T_c = \frac{1.8(1.1 - 0.59)(349)^{1/2}}{(0.43(100))^{1/3}} + 5 \text{ min} = \underline{9.9 \text{ min}}$$

$\therefore i_{25} = 2.33$ in/hr
$i_{100} = 2.95$ in/hr

$Q_{25, POC\#3} = (0.59)(2.33)(2.63) = \underline{3.62 \text{ cfs}}$

$Q_{100, POC\#3} = (0.59)(2.95)(2.63) = \underline{4.58 \text{ cfs}}$

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CLIENT _____ SUBJECT Existing Conditions CHK'D WZ DATE 6.5.12

Area 4

$T_{c100} \approx T_{c25}$ ∴ T_{c100} was calculated & used for Q_{100} & Q_{25}

Pt C → Pt D: (overland flow)

$$S = \frac{665 - 567}{400} = 0.24 \text{ ft/ft}$$

$$t_c = \frac{1.8(1.1 - 0.59)(400)^{1/2}}{((0.24)(100))^{1/3}} + 5 = 11.4 \text{ min} \therefore i_{100} = 2.85 \text{ in/hr}$$

$$Q_{100} = (0.59)(2.85)(0.6) = 1.01 \text{ cfs}$$

Pt D → POC #2: (channelized flow)

$$Q/A = (1.01 \text{ cfs})/(0.6 \text{ ac}) = 1.68 \text{ cfs/ac}$$

$$Q_{est} = (1.68 \text{ cfs/ac})(13.02 \text{ ac}) = 21.92 \text{ cfs}$$

$$Q_{AVE} = 1.01 \text{ cfs} + \frac{21.92 - 1.01}{2} = 11.47 \text{ cfs}$$

$$S = \frac{567' - 751'}{1470.3'} = 0.33 \text{ ft/ft}$$

$V = 8.75$ ft/s ← from Flow Master (Assume natural swale w/ 3:1 side slope $n = 0.045$)

$$T_c = 1470.3 \left(\frac{1 \text{ sec}}{8.75 \text{ ft}}\right)\left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = 2.8 \text{ min}$$

Travel Time:

$$T_c = 11.4 \text{ min} + 2.8 \text{ min} = \underline{14.2 \text{ min}} \therefore i_{25} = 1.95 \text{ in/hr}, \; i_{100} = 2.53 \text{ in/hr}$$

Flows:

$$Q_{25,\ POC\#2} = (0.59)(1.95)(13.02) = \underline{14.98 \text{ cfs}}$$

$$Q_{100,\ POC\#2} = (0.59)(2.53)(13.02) = \underline{19.43 \text{ cfs}}$$

Worksheet for EX - AREA 4 - D to POC#2

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.045	
Channel Slope:	0.33000	ft/ft
Left Side Slope:	3.00	ft/ft (H:V)
Right Side Slope:	3.00	ft/ft (H:V)
Discharge:	11.47	ft^3/s
Results		
Normal Depth:	0.66	ft
Flow Area:	1.31	ft^2
Wetted Perimeter:	4.18	ft
Top Width:	3.97	ft
Critical Depth:	0.98	ft
Critical Slope:	0.04014	ft/ft
Velocity:	8.75	ft/s
Velocity Head:	1.19	ft
Specific Energy:	1.85	ft
Froude Number:	2.68	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.66	ft
Critical Depth:	0.98	ft
Channel Slope:	0.33000	ft/ft
Critical Slope:	0.04014	ft/ft

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CLIENT _____ SUBJECT Existing Conditions CHK'D WZL DATE 6.5.12

Area 5

Assume all overland flow

$$S = \frac{417 - 75}{705'} = 0.48 \text{ ft/ft}$$

$$T_c = \frac{1.8(1.1 - 0.59)(705)^{1/2}}{(0.48(100))^{1/3}} + 5 \text{ min} = \underline{11.7 \text{ min}}$$

$\therefore i_{25} = 2.19$ in/hr
$i_{100} = 2.78$ in/hr

$Q_{25, POC\#1} = (0.59)(2.19)(6.79) = \underline{8.77 \text{ cfs}}$

$Q_{100, POC\#1} = (0.59)(2.78)(6.79) = \underline{11.14 \text{ cfs}}$

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SHEET NO. 1/3

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CLIENT ____ SUBJECT Existing Conditions CHK'D WZL DATE 6.5.12

Area 6

Pt E → Pt F: (overland flow)

$S = \frac{700' - 525'}{400'} = 0.43$ ft/ft

$t_c = \frac{1.8(1.1-0.59)(400)^{1/2}}{(0.43(100))^{1/3}} + 5\text{ min} = 10.2$ min $\therefore i_{100} = 2.93$ in/hr

$Q_{100,7} = (0.59)(2.93)(0.54) = 0.93$ cfs

Tc100 ≈ Tc25 ∴ Tc100 was calculated & used for Q100 & Q25

Pt F → POC #6 (channelized flow)

$Q/A = (0.93\text{ cfs})/(0.54\text{ ac}) = 1.72$ cfs/ac

$Q_{est} = (1.72\text{ cfs/ac})(7.86\text{ ac}) = 13.52$ cfs

$Q_{AVE} = 0.93\text{cfs} + \frac{13.52\text{ cfs} - 0.93\text{cfs}}{2} = 7.22$ cfs

$S = \frac{525' - 158'}{1052'} = 0.35$ ft/ft

$V = 7.22$ ft/s ← from Hydraflow (Assume natural swale w/ 4:1 side slopes & n = 0.045)

$T_c = 1304\left(\frac{1\text{ sec}}{7.22\text{ ft}}\right)\left(\frac{\text{min}}{60\text{ sec}}\right) = 3.0$ min

Tc @ POC #6 = 10.2 min + 3.0 min = 13.2 min ∴ $i_{25} = 2.07$ in/hr, $i_{100} = 2.63$ in/hr

$Q_{25,\ POC\#6} = (0.59)(2.07)(7.86) = 9.60$ cfs

$Q_{100,\ POC\#6} = (0.59)(2.63)(7.86) = 12.20$ cfs

Channel Report

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Hydraflow Express Extension for AutoCAD® Civil 3D® 2008 by Autodesk, Inc. Thursday, Nov 15 2012

Area 6 - Point F to POC#6

Triangular

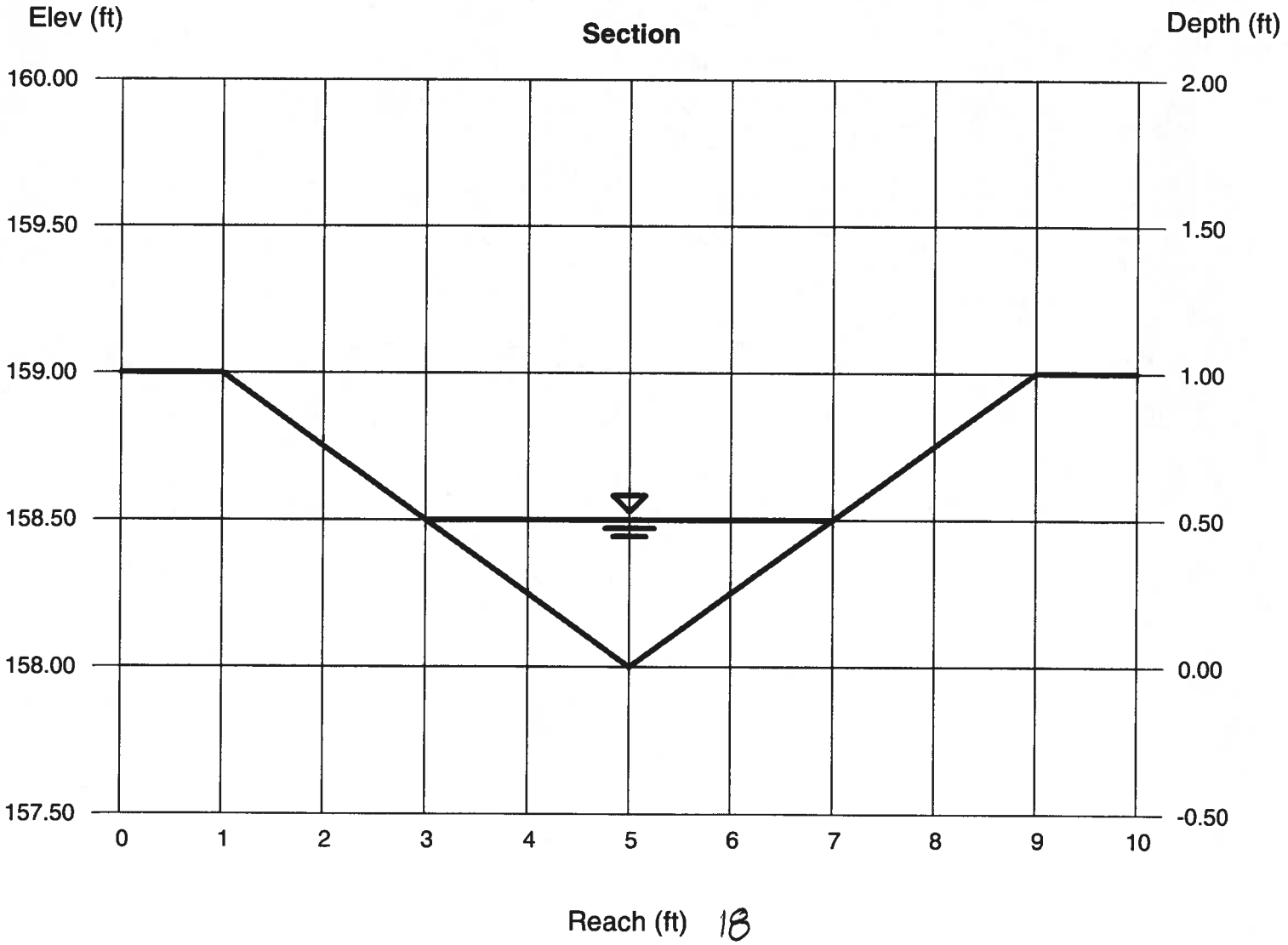
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 158.00
Slope (%)	= 35.00
N-Value	= 0.045

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.22

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 7.220
Area (sqft)	= 1.00
Velocity (ft/s)	= 7.22
Wetted Perim (ft)	= 4.12
Crit Depth, Yc (ft)	= 0.73
Top Width (ft)	= 4.00
EGL (ft)	= 1.31



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SHEET NO. 1/1

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CLIENT _____ SUBJECT Existing Conditions Summary CHK'D WZL DATE 6.5.12

POC	Area #	Area (ac)	Tc (min)	C-factor	Q25 (cfs)	Q100 (cfs)
1	5	6.79	11.7	0.59	8.77	11.14
2	4	13.02	14.2	0.59	14.98	19.43
3	3	2.63	9.9	0.59	3.62	4.58
4	1	41.96	19.4	0.59	43.08	54.96
5	2	1.00	11.0	0.59	1.33	1.68
6	6	7.86	13.2	0.59	9.60	12.20

- See H1 - Existing Conditions Hydrology Map

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SHEET NO. _____

JOB NO. 8744010 JOB Upper Road BY _____ DATE _____

CLIENT _____ SUBJECT _____ CHK'D _____ DATE _____

PROPOSED CONDITIONS

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SHEET NO. 1/2

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12
CLIENT _____ SUBJECT Proposed Conditions CHK'D WZL DATE 6.5.12

- See Hydrology Map H2-Proposed Conditions
- Areas 5, 6, 87 same as Existing Conditions

Area 1

$T_{c100} \approx T_{c25}$ ∴ T_{c100} was calculated & used for Q_{25} & Q_{100}

Impervious Area = 0.82 ac

$$C = \frac{(0.59)(41.23) + (0.9)(0.82)}{(42.22)} = 0.60$$

P+A → P+B:

$$S = \frac{1140' - 1100'}{400'} = 0.11 \text{ ft/ft}$$

$$t_c = \frac{1.8(1.1 - 0.60)(400)^{1/2}}{((0.11)(100))^{1/3}} + 5 \text{ min} = 13.1 \text{ min} \therefore i_{100} = 2.64 \text{ in/hr}$$

$$Q_{100} = (0.60)(2.64)(2.02) = 3.20 \text{ cfs}$$

P+B → POC #4:

$$Q/A = (3.20 \text{cfs})/(2.02 \text{ac}) = 1.58 \text{ cfs/ac}$$

$$Q_{est} = (1.58 \text{ cfs/ac})(42.22 \text{ ac}) = 66.70 \text{ cfs}$$

$$Q_{ave} = 3.20 \text{cfs} + \frac{66.70 \text{ cfs} - 3.20 \text{ fs}}{2} = 34.95 \text{ cfs}$$

$$S = \frac{1100' - 75'}{3561.8'} = 0.28 \text{ ft/ft}$$

V = 9.67 ft/s ← from Flow Master (Assume natural swale 5:1 side slope, n = 0.045)

$$t_c = 3561.8 \text{ft}\left(\frac{1 \text{s}}{9.67 \text{ ft}}\right)\left(\frac{1 \text{min}}{60 \text{s}}\right) = 6.1 \text{ min}$$

$T_c = 13.1 \text{ min} + 6.1 \text{ min} = \underline{19.2 \text{ min}}$ ∴ $i_{25} = 1.75$ in/hr; $i_{100} = 2.22$ in/hr

$$Q_{25_{POC\#4}} = (0.60)(1.75)(42.22) = \underline{44.33 \text{ cfs}}$$

$$Q_{100} = (0.60)(2.22)(42.22) = 56.23 \text{ cfs}$$

Channel Report

2/2

Hydraflow Express Extension for AutoCAD® Civil 3D® 2008 by Autodesk, Inc. Tuesday, Jun 5 2012

Area 1 - Point B to POC#4

Triangular

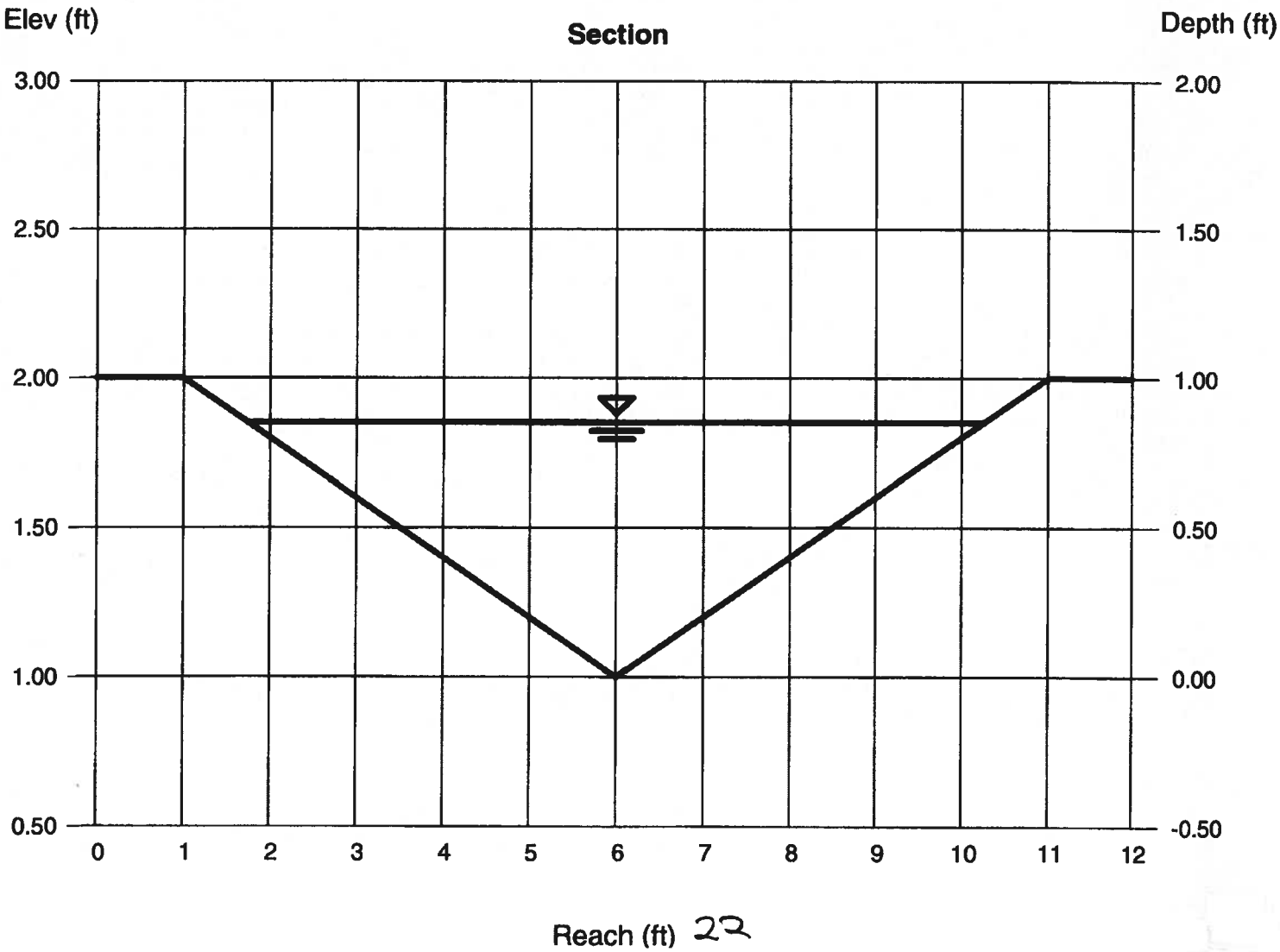
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 28.00
N-Value	= 0.045

Calculations

Compute by:	Known Q
Known Q (cfs)	= 34.95

Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 34.95
Area (sqft)	= 3.61
Velocity (ft/s)	= 9.67
Wetted Perim (ft)	= 8.67
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 8.50
EGL (ft)	= 2.31



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SHEET NO. 1/2

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT ____ SUBJECT Proposed Conditions CHK'D WZL DATE 6-5-12

Area 2

$T_{c100} \approx T_{c25}$ ∴ T_{c100} was used for Q_{100} & Q_{25}

Pt C → Pt D:

$$S = \frac{700' - 525'}{400'} = 0.43 \text{ ft/ft}$$

$$t_c = \frac{1.8(1.1 - 0.59)(400)^{1/2}}{((0.43)(100))^{1/3}} + 5 \text{ min} = 10.2 \text{ min} \quad \therefore i_{100} = 2.93 \text{ in/hr}$$

$$Q_{100} = (0.59)(2.93)(0.54) = 0.93 \text{ cfs}$$

Pt D → POC #6

$$Q/A = (0.93 \text{ cfs})/(0.54 \text{ ac}) = 1.72 \text{ cfs/ac}$$

$$Q_{est} = (1.72 \text{ cfs/ac})(7.18 \text{ ac}) = 12.34 \text{ cfs}$$

$$Q_{ave} = 0.93 \text{ cfs} + \frac{12.34 \text{ cfs} - 0.93 \text{ cfs}}{2} = 6.63 \text{ cfs}$$

$$S = \frac{525' - 158'}{1052'} = 0.34 \text{ ft/ft}$$

V = 7.26 ft/s ← From Flow Master (Assume natural swale w/ 4:1 side slope, n=0.045)

$$t_c = 1304 \text{ ft}\left(\frac{1 \text{ s}}{7.26 \text{ ft}}\right)\left(\frac{1 \text{ min}}{60 \text{ s}}\right) = 3.0 \text{ min}$$

$T_c = 10.2 \text{ min} + 3.0 \text{ min} = 13.2 \text{ min}$ ∴ $i_{25} = 2.06$ in/hr

$i_{100} = 2.61$ in/hr

POC #6 includes Area 2 & Area 4

∴ A = 7.18 ac + 0.56 ac = 7.74 ac

$C_{cum} = 0.59$

$Q_{25, POC\#6} = (0.59)(7.74)(2.06) = 9.41 \text{ cfs}$

$Q_{100, POC\#6} = (0.59)(7.74)(2.61) = 11.92 \text{ cfs}$

Worksheet for ALT - AREA 2 - D to POC#5

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.045	
Channel Slope:	0.34000	ft/ft
Left Side Slope:	4.00	ft/ft (H:V)
Right Side Slope:	4.00	ft/ft (H:V)
Discharge:	6.63	ft^3/s
Results		
Normal Depth:	0.48	ft
Flow Area:	0.91	ft^2
Wetted Perimeter:	3.94	ft
Top Width:	3.82	ft
Critical Depth:	0.70	ft
Critical Slope:	0.04355	ft/ft
Velocity:	7.26	ft/s
Velocity Head:	0.82	ft
Specific Energy:	1.30	ft
Froude Number:	2.62	
Flow Type:	Supercritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.48	ft
Critical Depth:	0.70	ft
Channel Slope:	0.34000	ft/ft
Critical Slope:	0.04355	ft/ft

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SHEET NO. V4

JOB NO. 8744010 JOB Upper Road BY JAH DATE 11/12/12

CLIENT _____ SUBJECT Proposed Conditions CHK'D _____ DATE _____

Area 3

$T_{c100} \approx T_{c25}$ ∴ T_{c100} was calculated & used

Impervious Area = 0.28 ac

$$C = \frac{(0.59)(0.51) + (0.9)(0.28)}{(0.79)} = 0.69$$

Point F → Point G (Drop Inlet)

Assume 300 LF of Overlan Flow & 500 LF Gutter Flow

Overland Flow ⇒ $s = \frac{237 - 205}{300} = 0.11$ ft/ft

$$T_c = \frac{1.8(1.1 - 0.69)(300)^{1/2}}{(0.11 \times 100)^{1/3}} + 5\,min = 10.7\,min \quad \therefore i_{100} = 2.88\ in/hr$$

$Q_{100} = (0.69)(2.88)(0.15) = 0.30$ cfs

Gutter Flow => (UCS Type 'A' Curb & Gutter)

$Q/A = (0.30\,cfs)/(0.15\,ac) = 2.0\,cfs/ac$

$Q_{est} = (2.0\,cfs/ac)(0.28\,ac) = 0.56\,cfs$

$Q_{ave} = 0.15\,cfs + \frac{0.56\,cfs - 0.15\,cfs}{2} = 0.36\,cfs$

$S = \frac{205 - 160}{251} = 0.18$ ft/ft

V = 4.50 ft/s ← From Hydraflow Express

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SHEET NO. 3/4

JOB NO. 8744010 JOB Upper Road BY JAH DATE 11/12/12

CLIENT _____ SUBJECT Proposed Conditions CHK'D _____ DATE _____

Area 3 Continued

$t_c = 251\ LF \left(\frac{1\ sec}{4.50\ ft}\right)\left(\frac{1\ min}{60\ s}\right) = 0.9\ min$

$Tc_{PTG} = 10.7\ min + 0.9\ min = 11.6\ min \therefore C_{100} = 2.79\ in/hr$

$Q_{100,\ P+G} = (0.69)(2.79)(0.28) = 0.53\ cfs$

Point G (New Drop Inlet) → POC#5:

Pipe Flow → No additional area added through pipe

$Q_{100} = 0.53\ cfs$

$s = \frac{160 - 154}{40\ LF} = 0.15\ ft/ft$

$V = 7.84\ ft/s$ ← From Hydraflow Express

$t_{c\ G \to POC\#5} = 40\ LF \left(\frac{1\ sec}{7.84\ ft}\right)\left(\frac{1\ min}{60\ s}\right) = 0.1\ min$

$Tc_{POC\#5} = 11.6\ min + 0.1\ min = \underline{11.7\ min}$ $\therefore C_{25} = 2.19\ in/hr$, $C_{100} = 2.78\ in/hr$

$Q_{25,\ POC\#5} = (0.69)(2.19)(0.86) = \underline{1.30\ cfs}$

$Q_{100,\ POC\#5} = (0.69)(2.78)(0.86) = \underline{1.65\ cfs}$

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2008 by Autodesk, Inc. Monday, Nov 12 2012

Area 3 - Point F to Point G

User-defined

Invert Elev (ft)	= 106.00
Slope (%)	= 18.00
N-Value	= 0.014

Calculations

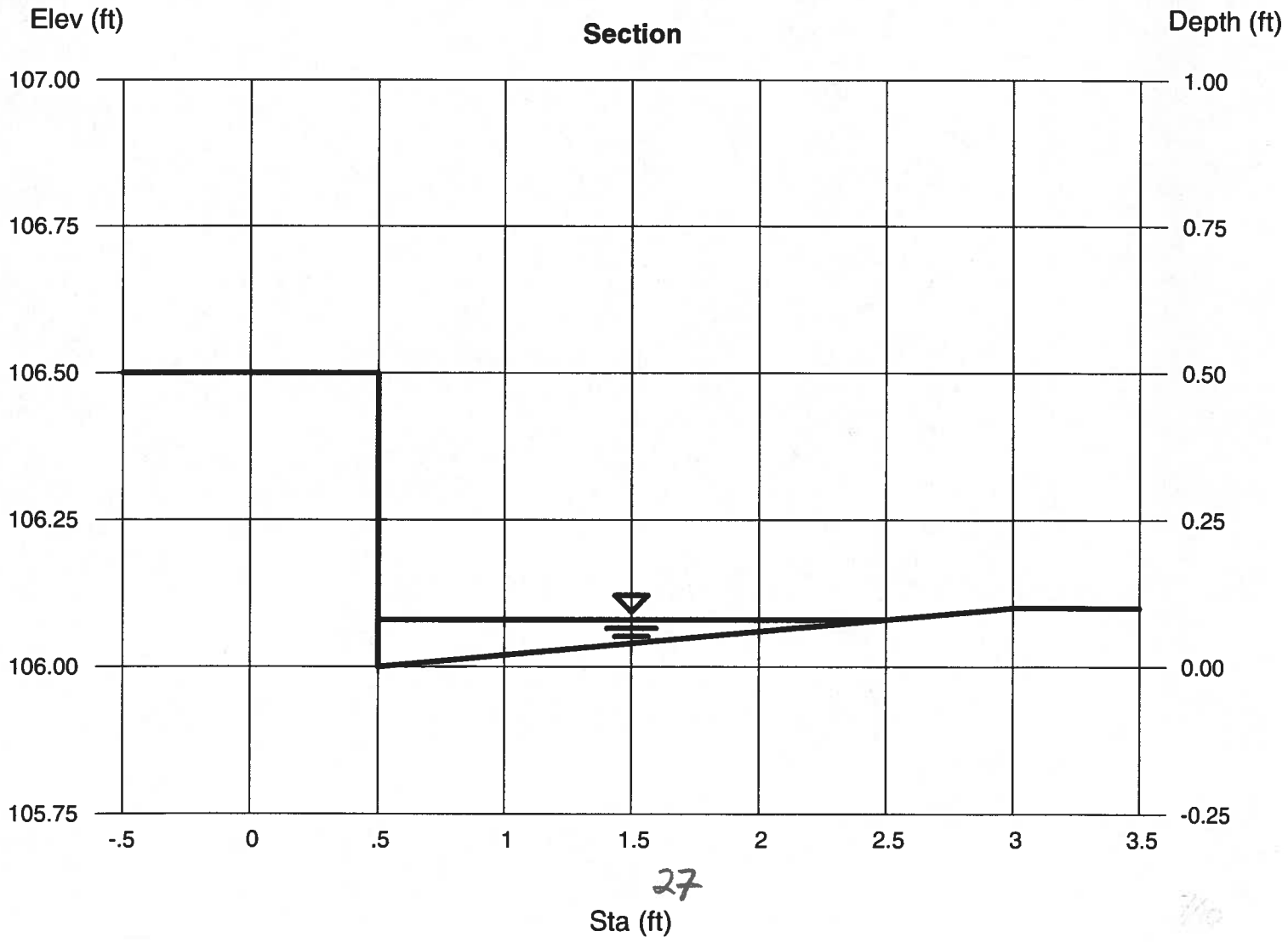
Compute by:	Known Q
Known Q (cfs)	= 0.36

(Sta, El, n)-(Sta, El, n)...

(0.00, 106.50)-(0.50, 106.50, 0.014)-(0.50, 106.00, 0.014)-(3.00, 106.10, 0.014)

Highlighted

Depth (ft)	= 0.08
Q (cfs)	= 0.360
Area (sqft)	= 0.08
Velocity (ft/s)	= 4.50
Wetted Perim (ft)	= 2.08
Crit Depth, Yc (ft)	= 0.14
Top Width (ft)	= 2.00
EGL (ft)	= 0.39



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2008 by Autodesk, Inc. Monday, Nov 12 2012

Area 3 - Point G to POC#5

Circular

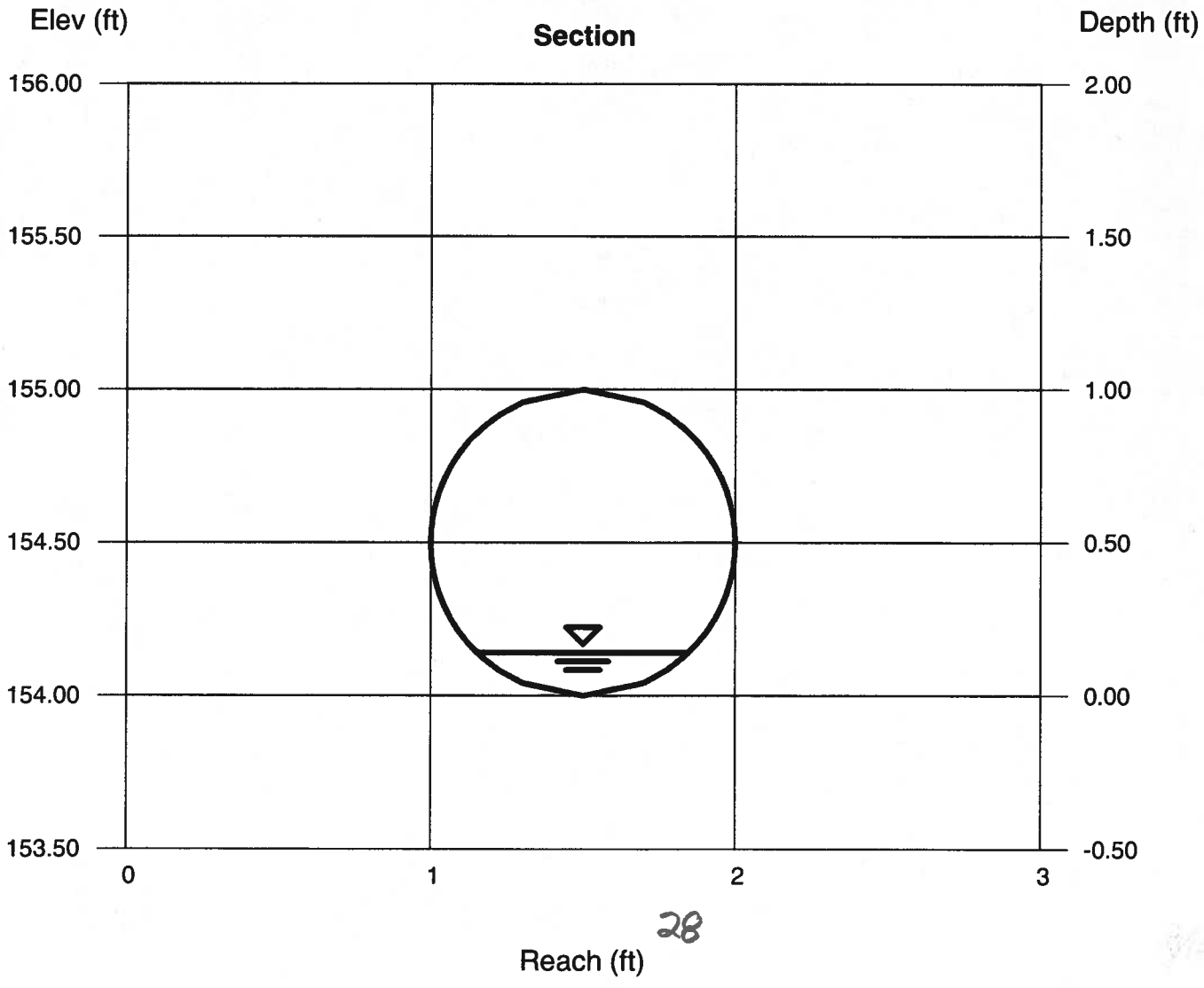
Diameter (ft)	= 1.00
Invert Elev (ft)	= 154.00
Slope (%)	= 15.00
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.53

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 0.530
Area (sqft)	= 0.07
Velocity (ft/s)	= 7.84
Wetted Perim (ft)	= 0.77
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 0.70
EGL (ft)	= 1.10



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SHEET NO. 1/1

JOB NO. 8744010 JOB Upper Road BY JAH DATE 11/9/12

CLIENT _____ SUBJECT Proposed Conditions CHK'D _____ DATE _____

Area 4

Assume all Overland Flow

$$S = \frac{280 - 158}{450 LF} = 0.27 FT/FT$$

$$T_c = \frac{1.8(1.1 - 0.59)(450)^{1/2}}{(0.27 \times 100)^{1/3}} + 5 min = \underline{11.5 min}$$

T_c Area 4 = 11.5 min < T_c Area 2 = 13.2 min

∴ See Area 2 for Further Calculations

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SHEET NO. 1/1

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Pro. & Ex. Conditions Summary CHK'D WZL DATE 6·5·12

POC	Area #	(E) $A_{(ac)}$	$A_{(ac)}$	(E) C	C	(E) $T_{c(min)}$	$T_{c(min)}$	(E) Q_{25}	Q_{25}
1	7	6.79	6.79	0.59	0.59	11.7	11.7	8.77	= 8.77
2	6	13.02	13.02	0.59	0.59	14.2	14.2	14.98	= 14.98
3	5	2.63	2.63	0.59	0.59	9.9	9.9	3.62	= 3.62
4	1	41.96	42.22	0.59	0.60	19.4	19.2	43.08	< 44.33 *
5	3	1.00	0.86	0.59	0.69	11.0	11.7	1.33	> 1.30
6	2/4	7.86	7.74	0.59	0.59	13.2	13.2	9.60	> 9.41

POC	Area #	ΔQ_{25} (cfs)	(E) Q_{100} (cfs)	Q_{100} (cfs)	ΔQ_{100} (cfs)
1	7	0	11.14	11.14	0
2	6	0	19.43	19.43	0
3	5	0	4.58	4.58	0
4	1	1.25 *	54.96	56.23	1.27 *
5	3	-0.03	1.68	1.65	-0.03
6	2/4	-0.19	12.20	11.92	-0.28

* See Detention Calculations for Peak Discharge Rate increase mitigation.

- See H2 - Proposed Conditions Hydrology Map

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SHEET NO. _____

JOB NO. 8744010 JOB Upper Road BY _____ DATE _____

CLIENT _____ SUBJECT _____ CHK'D _____ DATE _____

DETENTION CALCULATIONS

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SHEET NO. 1/2

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Detention Calculations CHK'D [illegible] DATE 6.5.12

Intention

Mitigate the Peak Discharge Rate increase at POC #4 which results from the Upper Road Subdivision. Detention will occur in Swan Swale.

Existing Conditions

Tributary Area = 41.96ac

Tc @ POC#4 = 19.4min

Runoff Coefficient = 0.59

Proposed Conditions

Tributary Area = 42.22ac

Tc @ POC #4 = 19.2min

Runoff Coefficient = 0.60

Ponds

Upper Pond : Base elevation = 275 (Bottom of Pond)

Lower Pond : Base elevation = 190 (Bottom of Pond)

See Detention Outfall for outfall details and calculations

Hydrographs

Hydrographs were created using Hydraflow Hydrographs Extension for Civil 3D 2012.

A 1 to 3 Lead to Lag Leg ratio was used to determine hydrograph geometry

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SHEET NO. 3/3

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT _____ SUBJECT Detention Calculations CHK'D WZL DATE 6.5.12

Results Basin Area 1

(E) Q25 (cfs)	No Detention Q25 (cfs)	w/Detention Q25 (cfs)
43.08	44.33	42.89

(E) Q100 (cfs)	No Detention Q100 (cfs)	w/Detention Q100 (cfs)
54.96	56.23	54.63

See Hydraflow Hydrograph output for pond reports

There is sufficient capacity in the combined Upper Pond and Lower Pond to mitigate the increase in Peak Dischare Rate at POC #4

Hydraflow Table of Contents

Upper Road.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Tuesday, 00 5, 2012

25 - Year

100 - Year

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	44.33	1	19	101,064	—	—	—	Proposed Conditions
2	Reservoir	43.67	1	20	99,025	1	280.82	4,016	Discharge Upper Pond
3	Reservoir	42.89	1	22	93,715	2	195.80	8,478	Discharge Lower Pond

Hydrograph Report

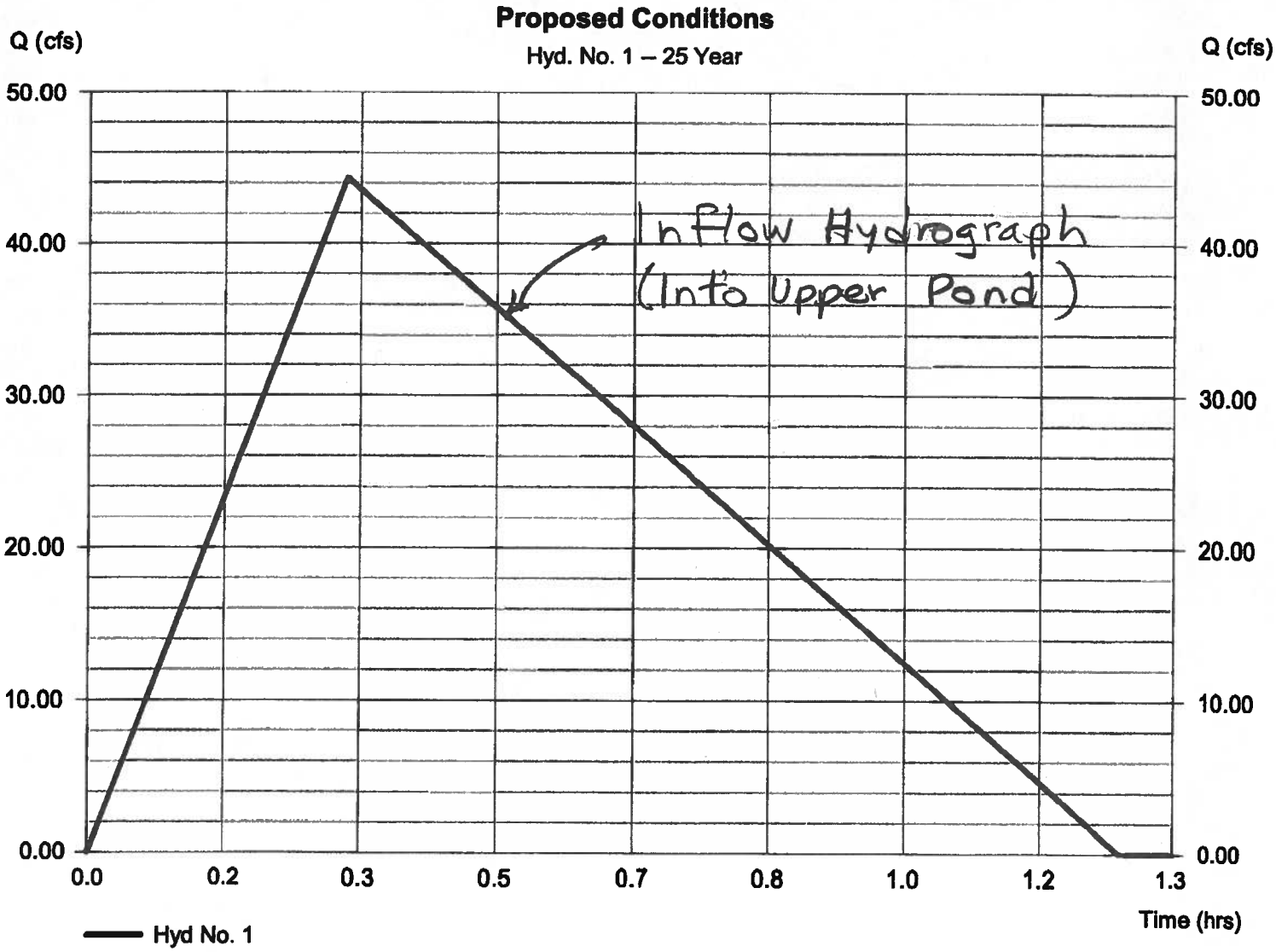
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

Hyd. No. 1 ; Basin Area 1 ←

Proposed Conditions

Hydrograph type	= Rational	Peak discharge	= 44.33 cfs
Storm frequency	= 25 yrs	Time to peak	= 0.32 hrs
Time interval	= 1 min	Hyd. volume	= 101,064 cuft
Drainage area	= 42.220 ac	Runoff coeff.	= 0.6
Intensity	= 1.750 in/hr	Tc by User	= 19.00 min
IDF Curve	= test.IDF	Asc/Rec limb fact	= 1/3

(Hydrograph for Entire Basin)



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

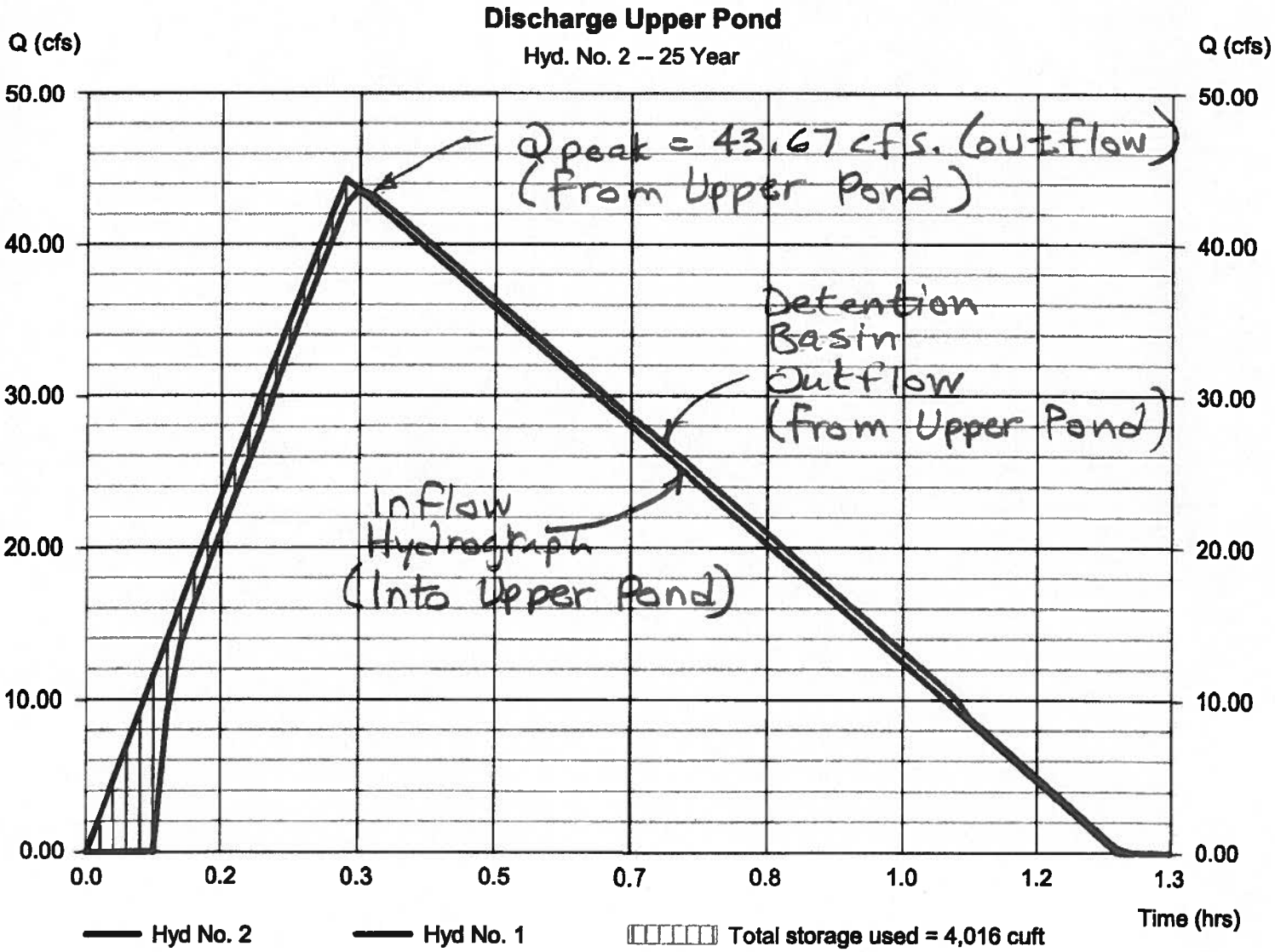
Hyd. No. 2 Basin Area 1 ←

Discharge Upper Pond

Hydrograph type	= Reservoir	Peak discharge	= 43.67 cfs
Storm frequency	= 25 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 99,025 cuft
Inflow hyd. No.	= 1 - Proposed Conditions	Max. Elevation	= 280.82 ft
Reservoir name	= Upper Pond	Max. Storage	= 4,016 cuft

Storage Indication method used.

Hydrograph No. 1 (Proposed Conditions) Routed through Upper Pond



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 Tuesday, 00 5, 2012

Pond No. 1 - Upper Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 275.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	275.00	57	0	0
5.00	280.00	1,058	2,268	2,268
10.00	285.00	3,463	10,725	12,993

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)	= 11.00	10.00	0.00	0.00
Crest El. (ft)	= 279.50	283.00	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	3.33
Weir Type	= Broad	Broad	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	275.00	---	---	---	---	0.00	0.00	---	---	---	---	0.000
5.00	2,268	280.00	---	---	---	---	10.11	0.00	---	---	---	---	10.11
10.00	12,993	285.00	---	---	---	---	368.90	73.54	---	---	---	---	442.44

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

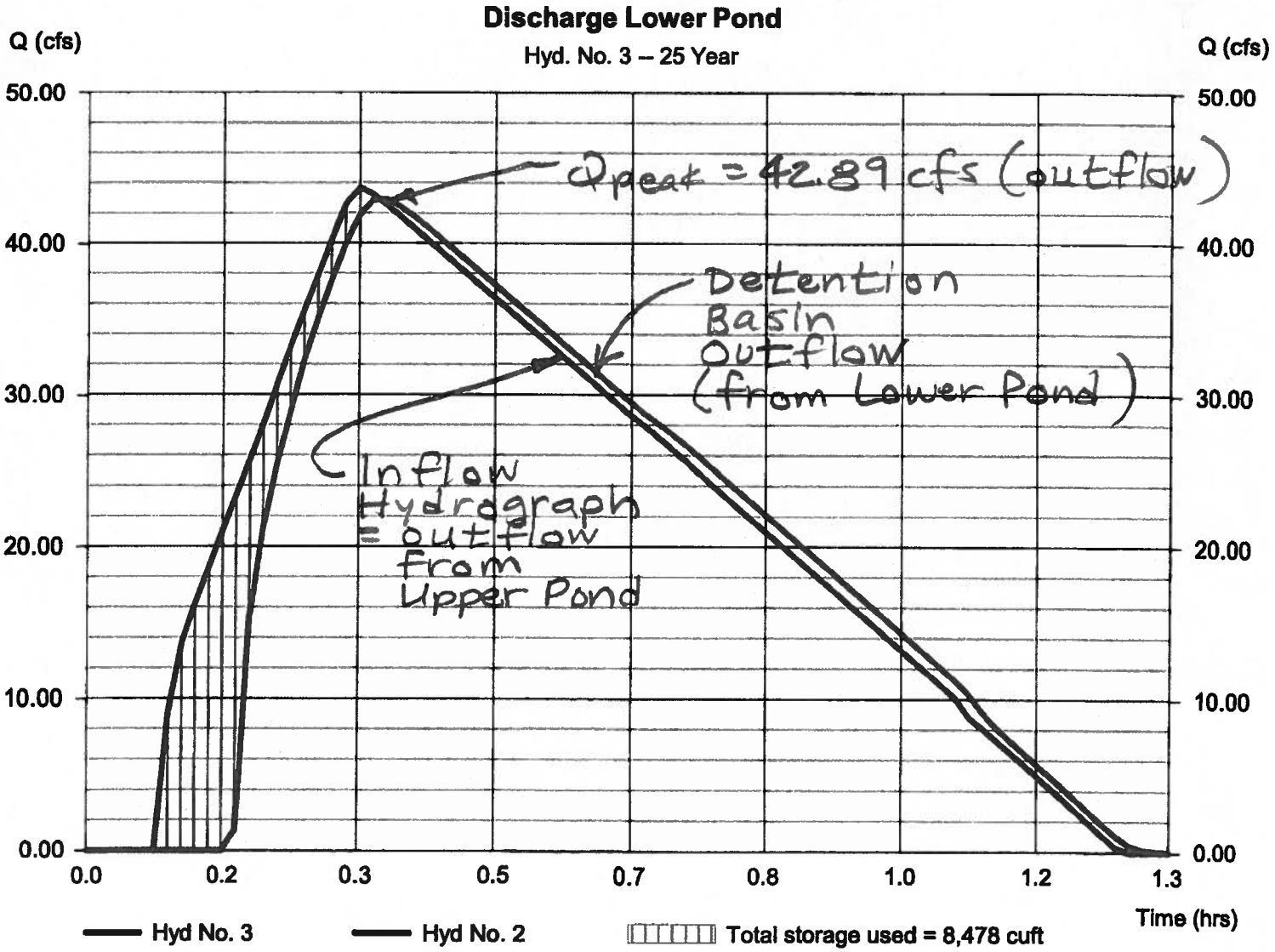
Hyd. No. 3 — Basin Area 1 ←

Discharge Lower Pond

Hydrograph type	= Reservoir	Peak discharge	= 42.89 cfs ←
Storm frequency	= 25 yrs	Time to peak	= 0.37 hrs
Time interval	= 1 min	Hyd. volume	= 93,715 cuft
Inflow hyd. No.	= 2 - Discharge Upper Pond	Max. Elevation	= 195.80 ft ←
Reservoir name	= Lower Pond	Max. Storage	= 8,478 cuft

Storage Indication method used.

Hydrograph No. 2 (Discharge Upper Pond) Routed through Lower Pond



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Tuesday, 00 5, 2012

Pond No. 2 - Lower Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 190.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	190.00	488	0	0
5.00	195.00	2,051	5,899	5,899
10.00	200.00	4,576	16,150	22,049

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)	= 11.00	10.00	0.00	0.00
Crest El. (ft)	= 194.50	197.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	Broad	—	—
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	190.00	—	—	—	—	0.00	0.00	—	—	—	—	0.000
5.00	5,899	195.00	—	—	—	—	10.11	0.00	—	—	—	—	10.11
10.00	22,049	200.00	—	—	—	—	368.90	173.03	—	—	—	—	541.93

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	56.23	1	19	128,208	—	—	—	Proposed Conditions
2	Reservoir	55.56	1	20	126,169	1	281.06	4,528	Discharge Upper Pond
3	Reservoir	54.63	1	21	120,859	2	196.04	9,248	Discharge Lower Pond

Hydrograph Report

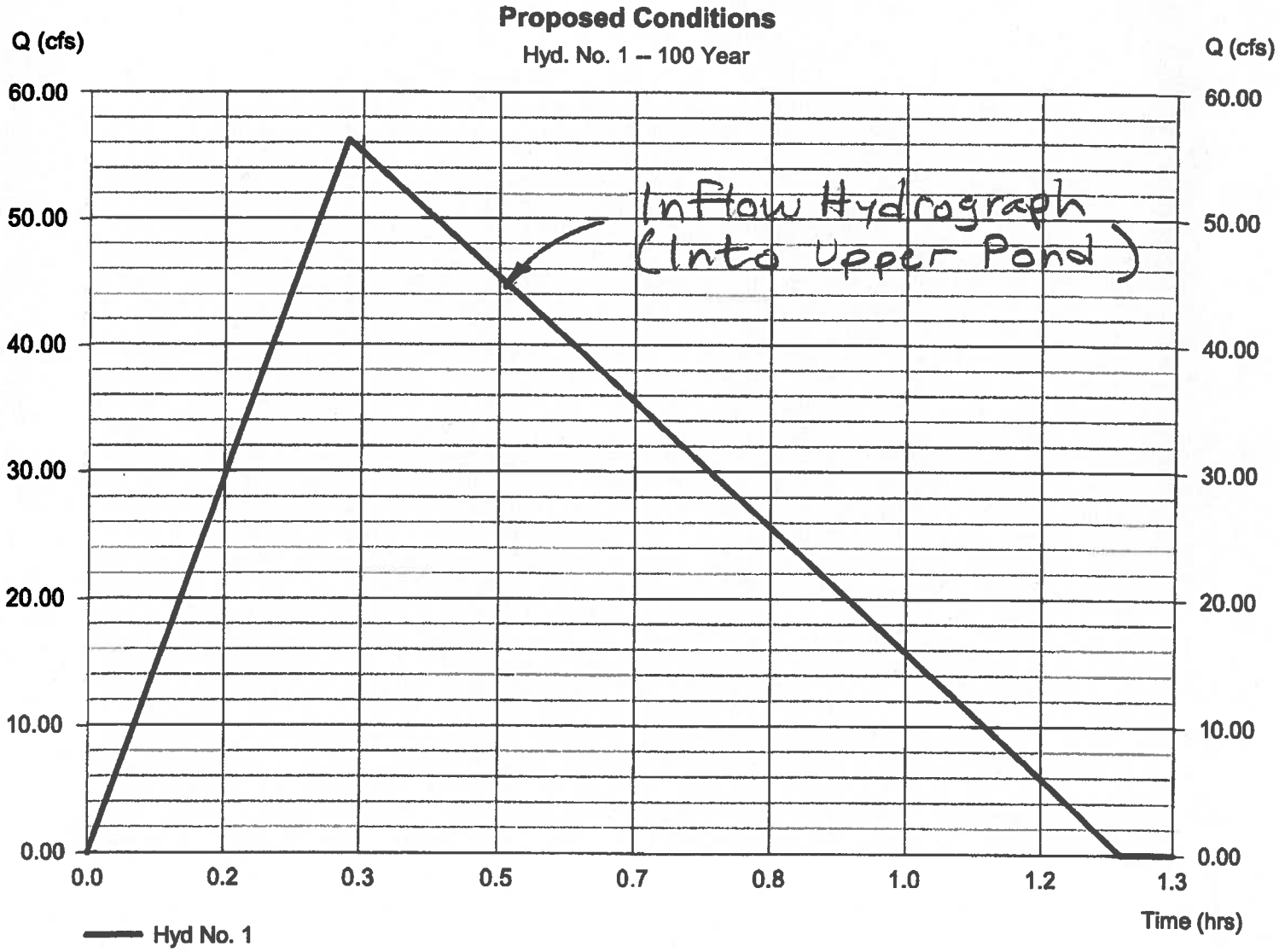
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

Hyd. No. 1

Proposed Conditions — Basin Area 1

Hydrograph type	= Rational	Peak discharge	= 56.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.32 hrs
Time interval	= 1 min	Hyd. volume	= 128,208 cuft
Drainage area	= 42.220 ac	Runoff coeff.	= 0.6
Intensity	= 2.220 in/hr	Tc by User	= 19.00 min
IDF Curve	= test.IDF	Asc/Rec limb fact	= 1/3

(Hydrograph for Entire Basin)



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

Hyd. No. 2 Basin Area 1

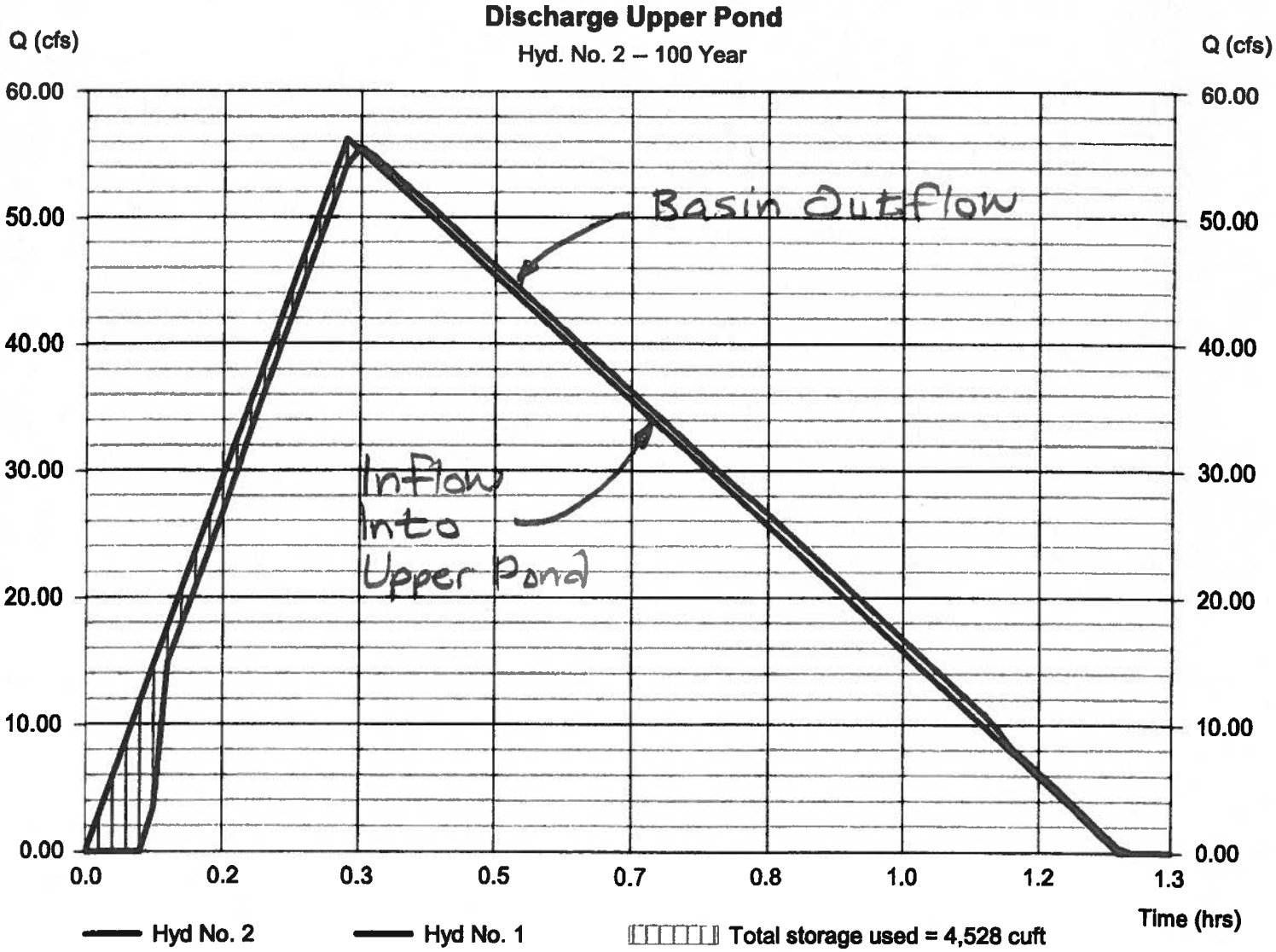
Discharge Upper Pond ←

Hydrograph type	= Reservoir	Peak discharge	= 55.56 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 126,169 cuft
Inflow hyd. No.	= 1 - Proposed Conditions	* Max. Elevation	= 281.06 ft <283'
Reservoir name	= Upper Pond	Max. Storage	= 4,528 cuft

Storage Indication method used.

Hydrograph No. 1 (Proposed Condition) Routed through Upper Pond

Water Surface Contained Within Basin



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 — Tuesday, 00 5, 2012

Hyd. No. 3 Basin Area 1

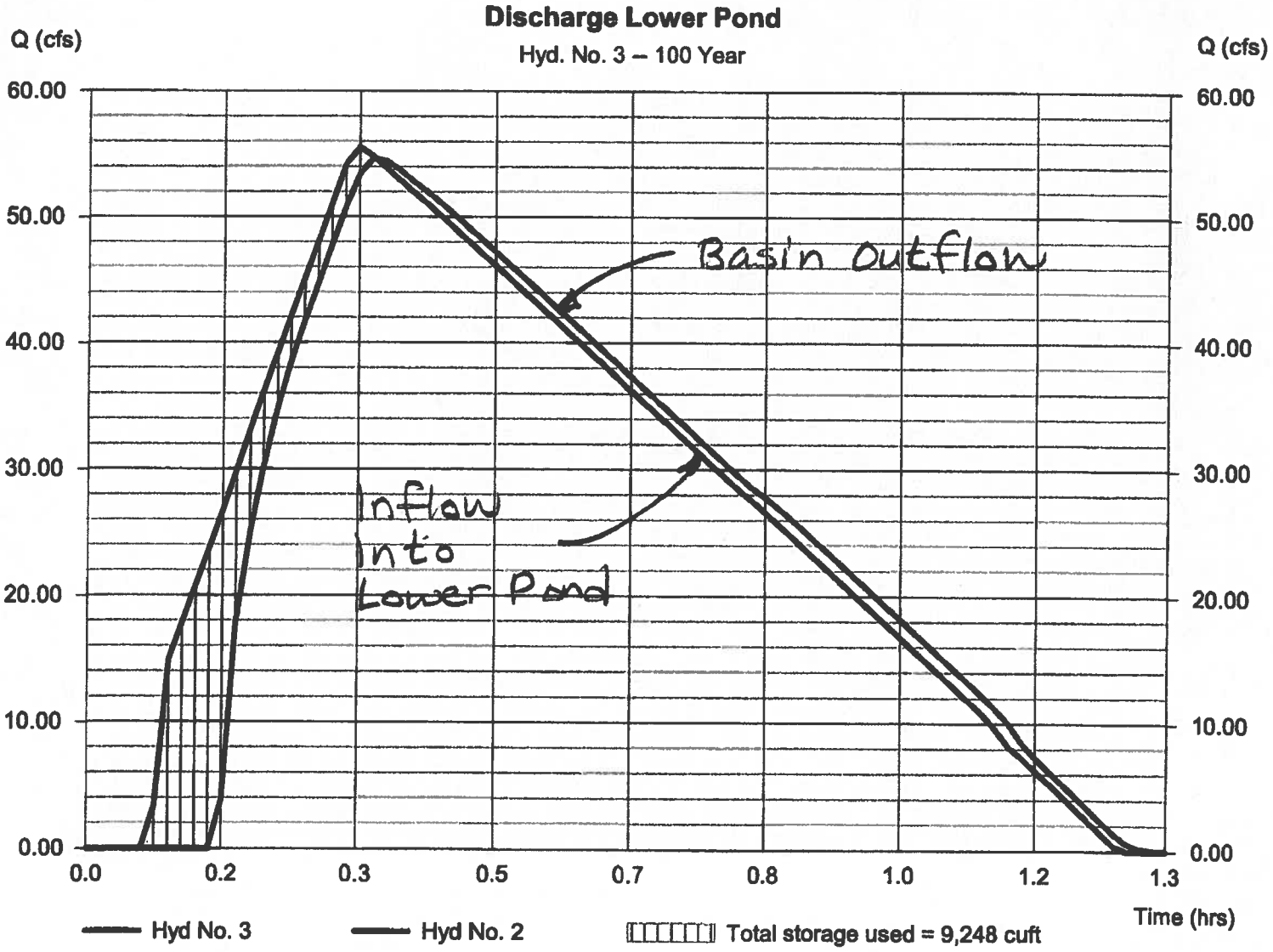
Discharge Lower Pond ←

Hydrograph type	= Reservoir	Peak discharge	= 54.63 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.35 hrs
Time interval	= 1 min	Hyd. volume	= 120,859 cuft
Inflow hyd. No.	= 2 - Discharge Upper Pond	Max. Elevation	= 196.04 ft < 197.0
Reservoir name	= Lower Pond	Max. Storage	= 9,248 cuft

Storage Indication method used.

Hydrograph No. 2 (Discharge Upper Pond) Routed through Lower Pond

Water Surface Contained Within Basin



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1310 Redwood Way, Suite 200, Petaluma, CA 94954 Tel 707.795.4764 Fax 707.795.0516

SHEET NO. 1/3

JOB NO. 8744010 JOB Upper Road BY JAH DATE 6/4/12

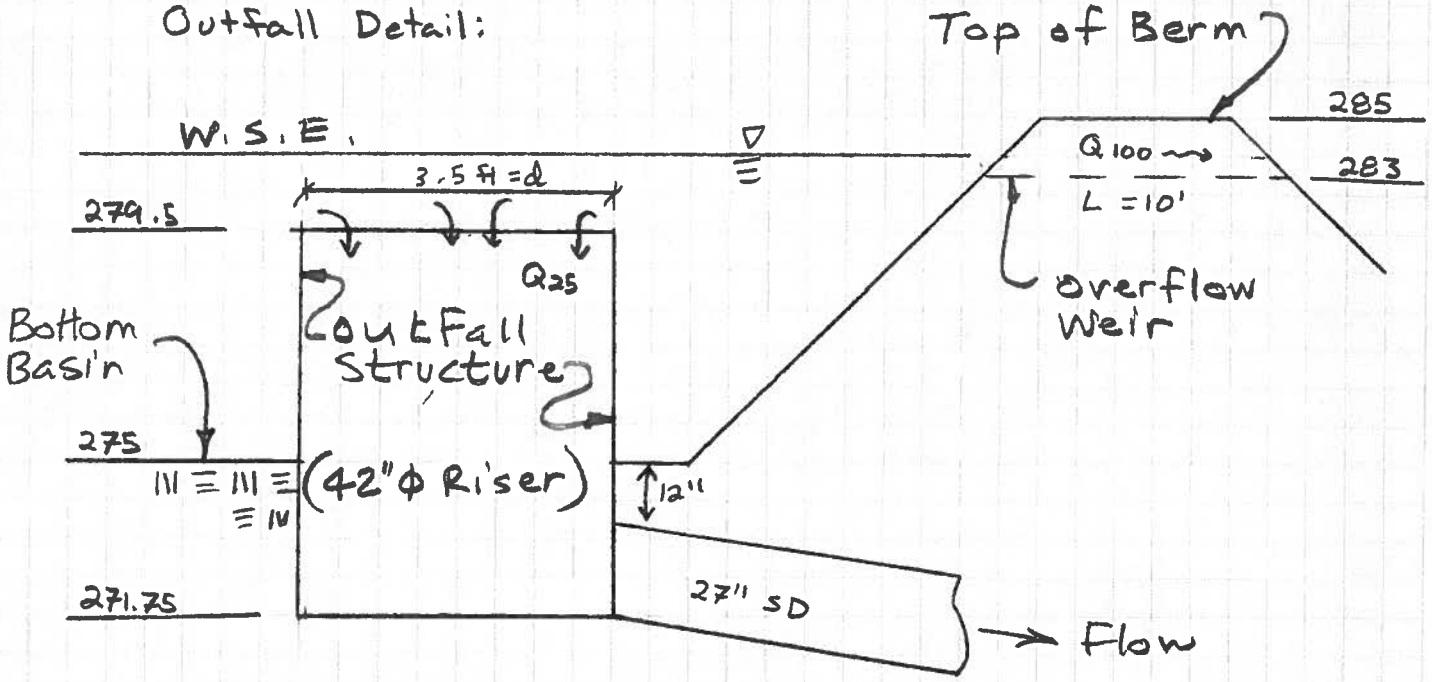
CLIENT _____ SUBJECT Detention Outfall CHK'D WK DATE 6-5-12

Upper Pond

Q_{25} (E) = 43.08 cfs

Q_{25} = 44.33 cfs

Outfall Detail:



Outfall Pipe:

Orifice Eqn → $Q = C_d A \sqrt{2g\Delta h}$

where: Q = Flow (cfs)
C_d = Orifice Coeff. (0.62, square Edge)
A = Pipe Area (ft)
g = gravitational Constant (32.2 ft/s²)
Δh = height (ft)

$Q_{max} = (0.62)(2.25/2)^2 \pi \sqrt{2(32.2)(9\,ft)}$

Q_{max} = 59.34 cfs > Q_{25} ∴ 27" SD sufficient

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SHEET NO. 2/3

JOB NO. B744010 JOB Upper Road BY JAH DATE 6/4/12

CLIENT SUBJECT Detention Outfall CHK'D WZ DATE 6.5.12

Upper Pond Continued

Inlet Size:

$Q = 3 \rho h^{3/2}$ where: Q = flow (cfs)
ρ = perimeter (ft)
h = water elevation above inlet (ft)

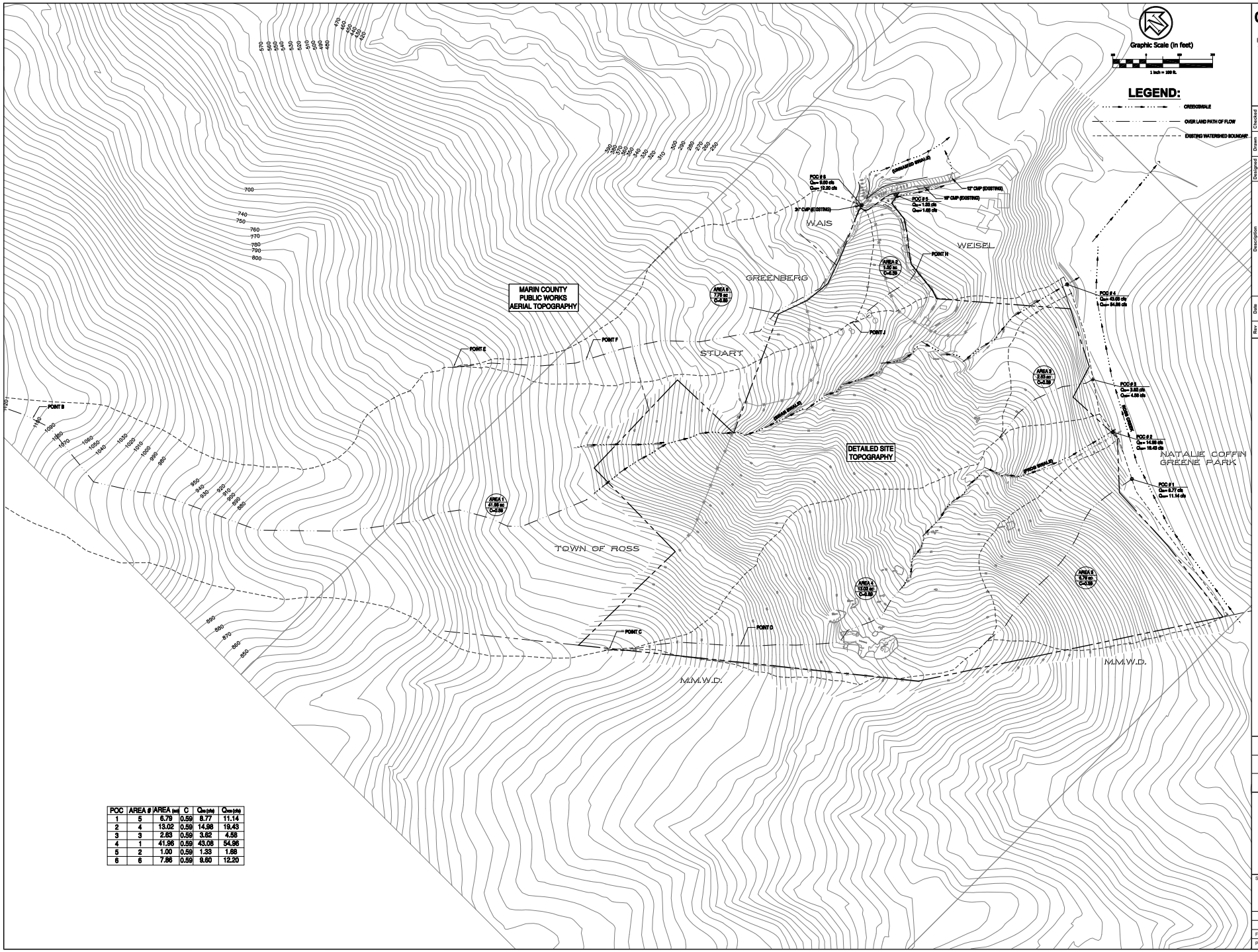
$44.33 cfs = 3 \rho (283 - 279.5)^{3/2}$

$\rho = 4.22$ ft

$\rho = \pi d$ where: ρ = perimeter (ft)
d = diameter (ft)

$4.22 ft = \pi d$

$d = 1.34$ ft ∴ 3.5 ft is sufficient



POC	AREA #	AREA (ac)	C	Q_{100} (cfs)	Q_{500} (cfs)
1	5	6.79	0.59	8.77	11.14
2	4	13.02	0.59	14.96	19.43
3	3	2.63	0.59	3.62	4.58
4	1	41.96	0.59	43.08	54.96
5	2	1.00	0.59	1.33	1.68
6	6	7.86	0.59	9.60	12.20

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UPPER ROAD LAND DIVISION

EXISTING CONDITIONS HYDROLOGY MAP

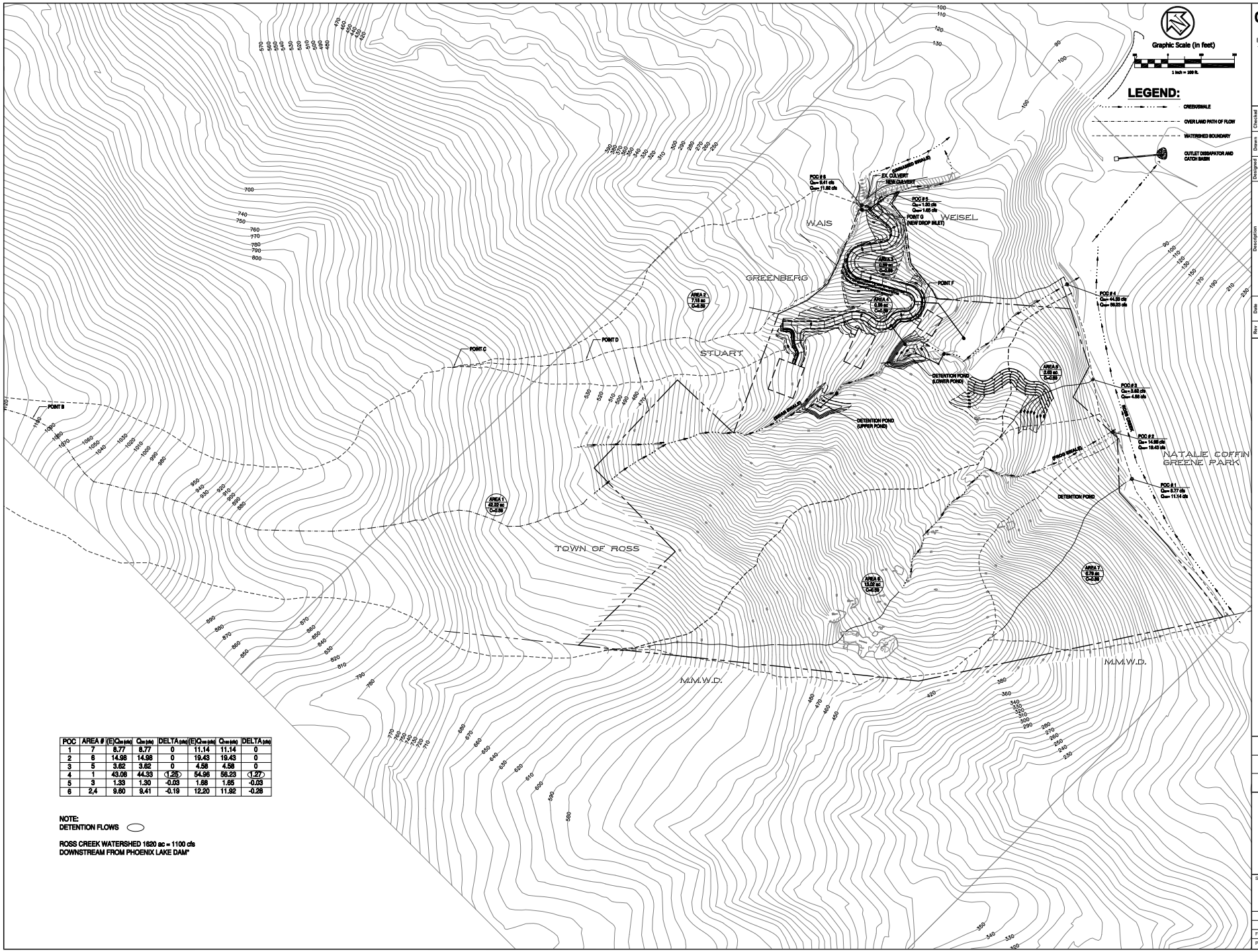
Town Of
Ross
County Of
Marin
State Of
California

Prepared Under the Direction of:

Sheet
H1

Scale: 1" = 100'

File: 8.744.010
Plan File: D-XXXX.XX



POC	AREA #	(E)Q_{10} (cfs)	Q_{10} (cfs)	DELTA (cfs)	(E)Q_{100} (cfs)	Q_{100} (cfs)	DELTA (cfs)
1	7	8.77	8.77	0	11.14	11.14	0
2	6	14.98	14.98	0	19.43	19.43	0
3	5	3.62	3.62	0	4.58	4.58	0
4	1	43.06	44.33	(1.25)	54.96	56.23	(1.27)
5	3	1.33	1.30	-0.03	1.68	1.65	-0.03
6	2,4	9.60	9.41	-0.19	12.20	11.92	-0.28

NOTE:
DETENTION FLOWS ( )

ROSS CREEK WATERSHED 1620 ac = 1100 cfs
DOWNSTREAM FROM PHOENIX LAKE DAM*

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UPPER ROAD LAND DIVISION

PROPOSED CONDITIONS HYDROLOGY MAP

Town Of: Ross
County Of: Marin
State Of: California

Prepared Under the Direction of:

Sheet: H2

Scale: 1" = 100'

File: 8.744.010
Plan File: D-XXXX.XX

POC # 6
Q_{25} = 9.41 cfs
Q_{100}= 11.92 cfs

(UNNAMED SWALE)

EX. CULVERT
NEW CULVERT

POC # 5
Q_{25} = 1.30 cfs
Q_{100}= 1.65 cfs

POINT G
(NEW DROP INLET)

WAIS

WEISEL

AREA 2
7.18 ac
C=0.59

AREA 3
0.86 ac
C=0.69

GREENBERG

POINT F

AREA 4
0.56 ac
C=0.59

TOP OF BANK

CREEK BRIDGE

GRADE BREAK

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Rev	Date	Description	Designed	Drawn	Checked

UPPER ROAD LAND DIVISION

PROPOSED CONDITIONS HYDROLOGY MAP - ENLARGEMENT

Town Of
Ross

County Of
Marin

State Of
California

Prepared Under the Direction of:

Sheet
H3

Scale: 1" = 20'

File: 8.744.010

Plan File: D-XXXXJXX