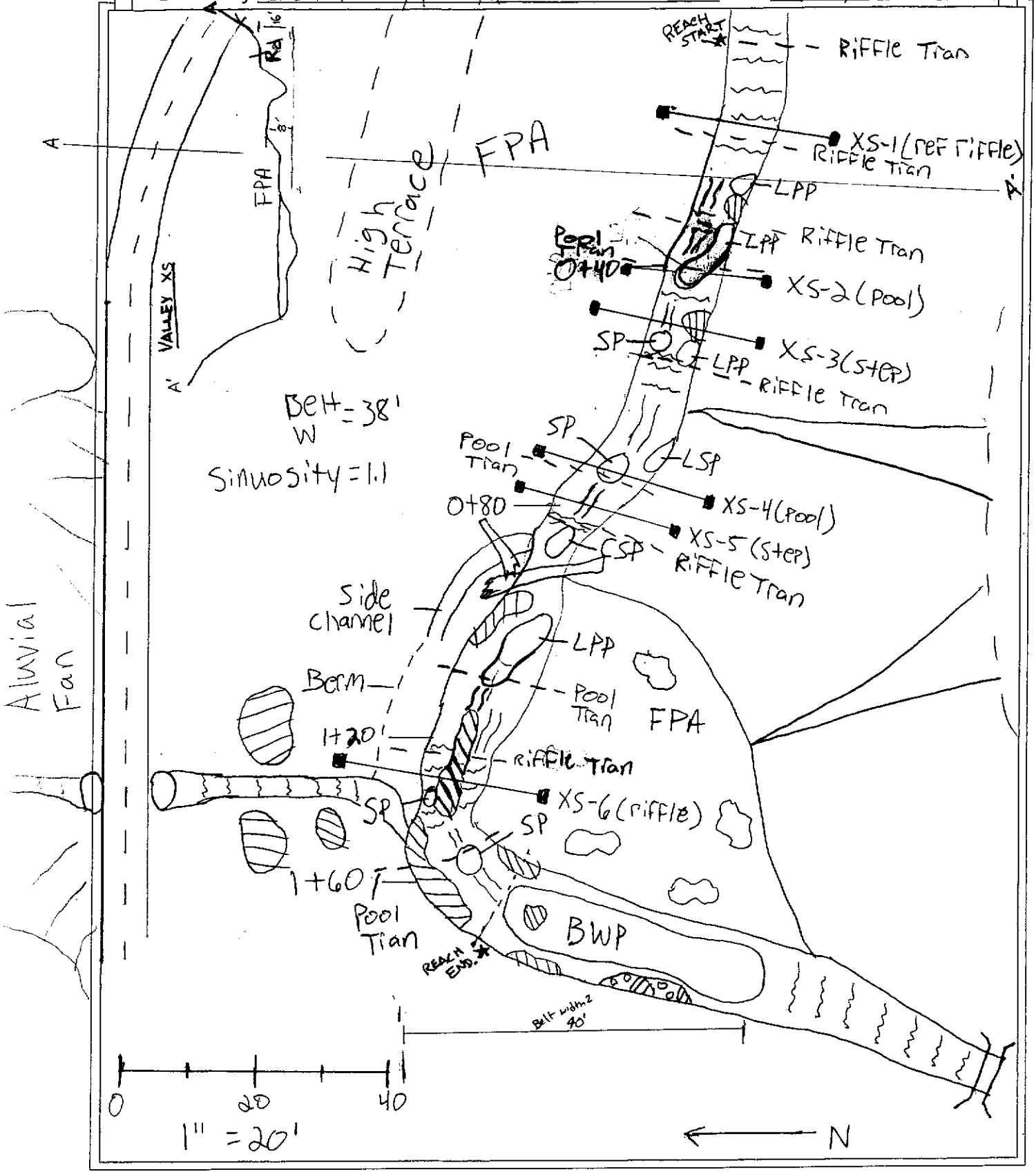
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: _____ Site/Reach: Sherman's Branch

Drawn By: Zach Tate, Franklin Date: 4/14/15 R-3

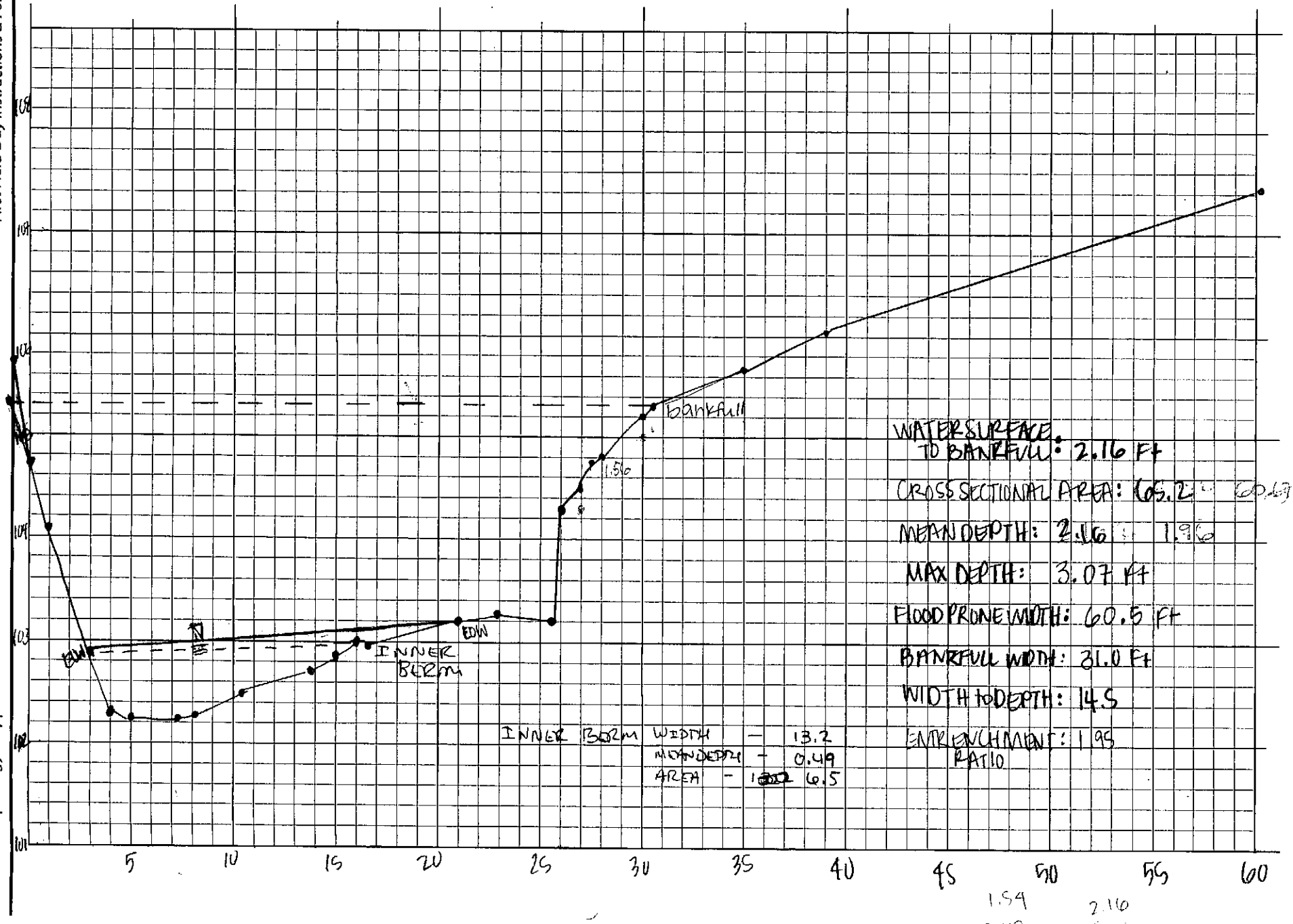


Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

CROSS SECTION 1 - RAPID / TRANSVERSE RIFFLE

STATION 00+16



WATERSURFACE TO BANKFULL: 2.16 Ft

CROSS SECTIONAL AREA: 65.2 60.67

MEAN DEPTH: 2.16 1.96

MAX DEPTH: 3.07 Ft

FLOOD PRONE WIDTH: 60.5 Ft

BANKFULL WIDTH: 31.0 Ft

WIDTH to DEPTH: 14.5

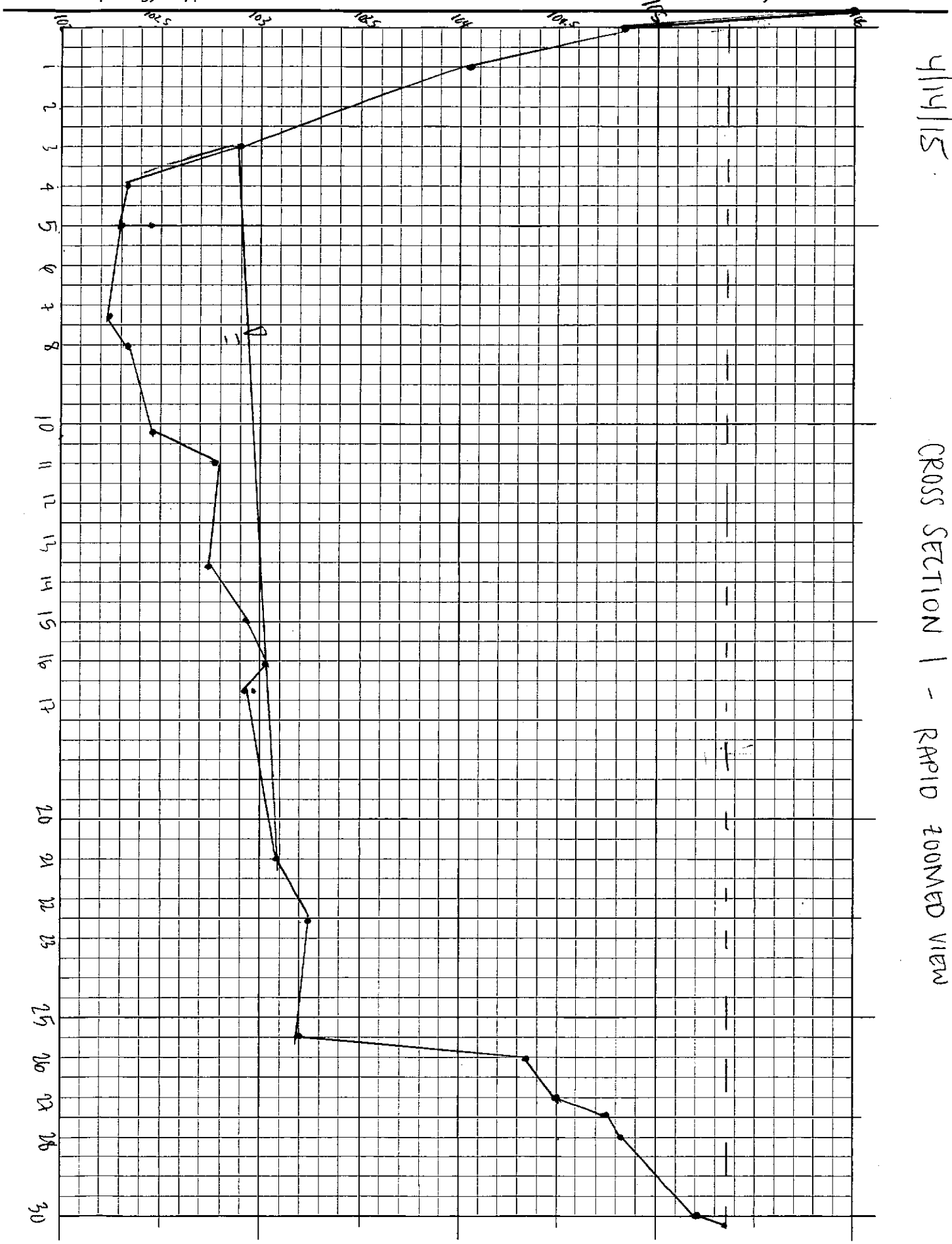
ENTRENCHMENT RATIO: 1.95

INNER BERM WIDTH - 13.2
MEAN DEPTH - 0.49
AREA - 6.5

Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

CROSS SECTION 1 - RAPID ZOOMED VIEW

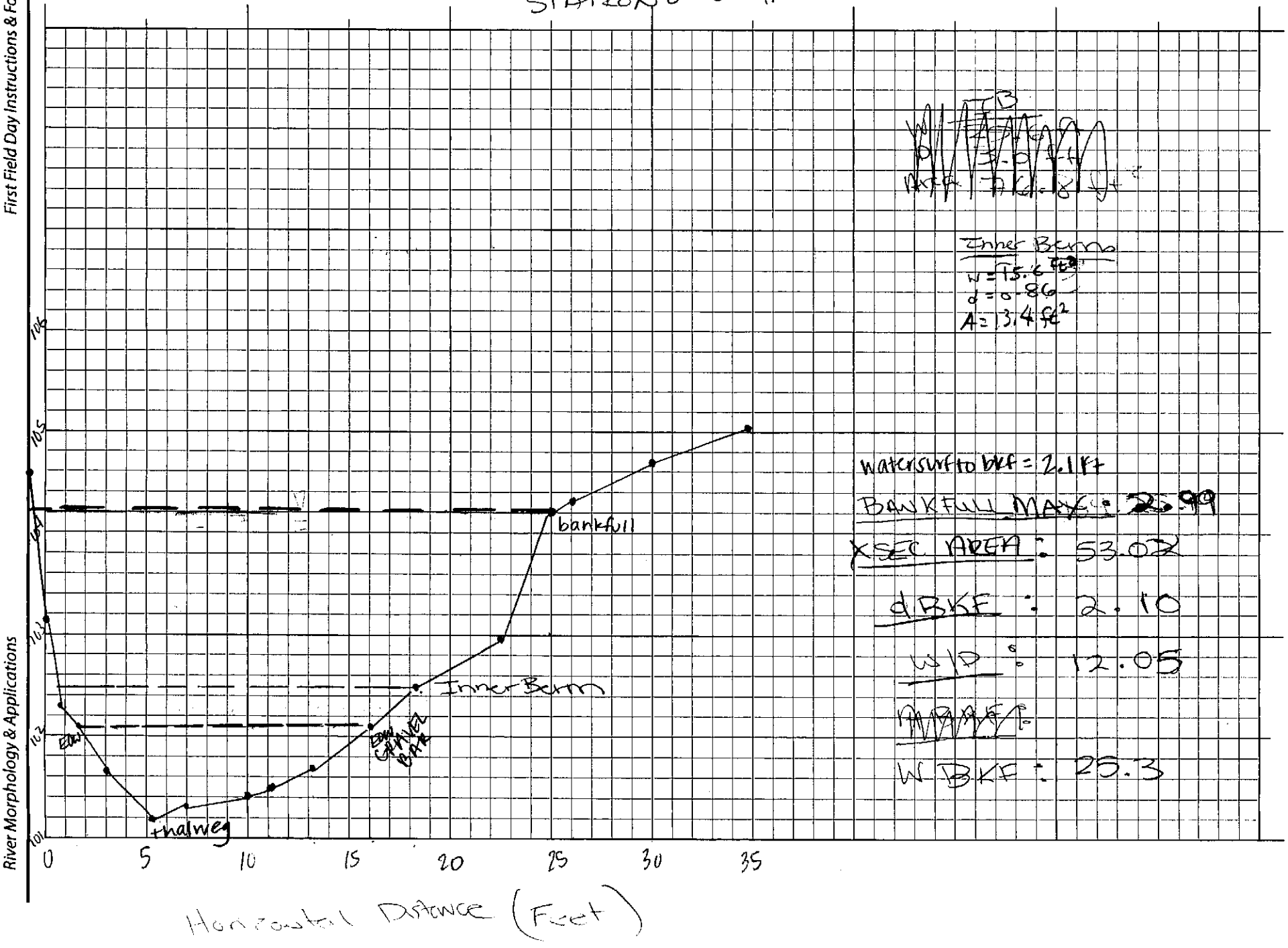


Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

CROSS SECTION 2 - POOL - lateral protrusion pool

STATION @ 00+41

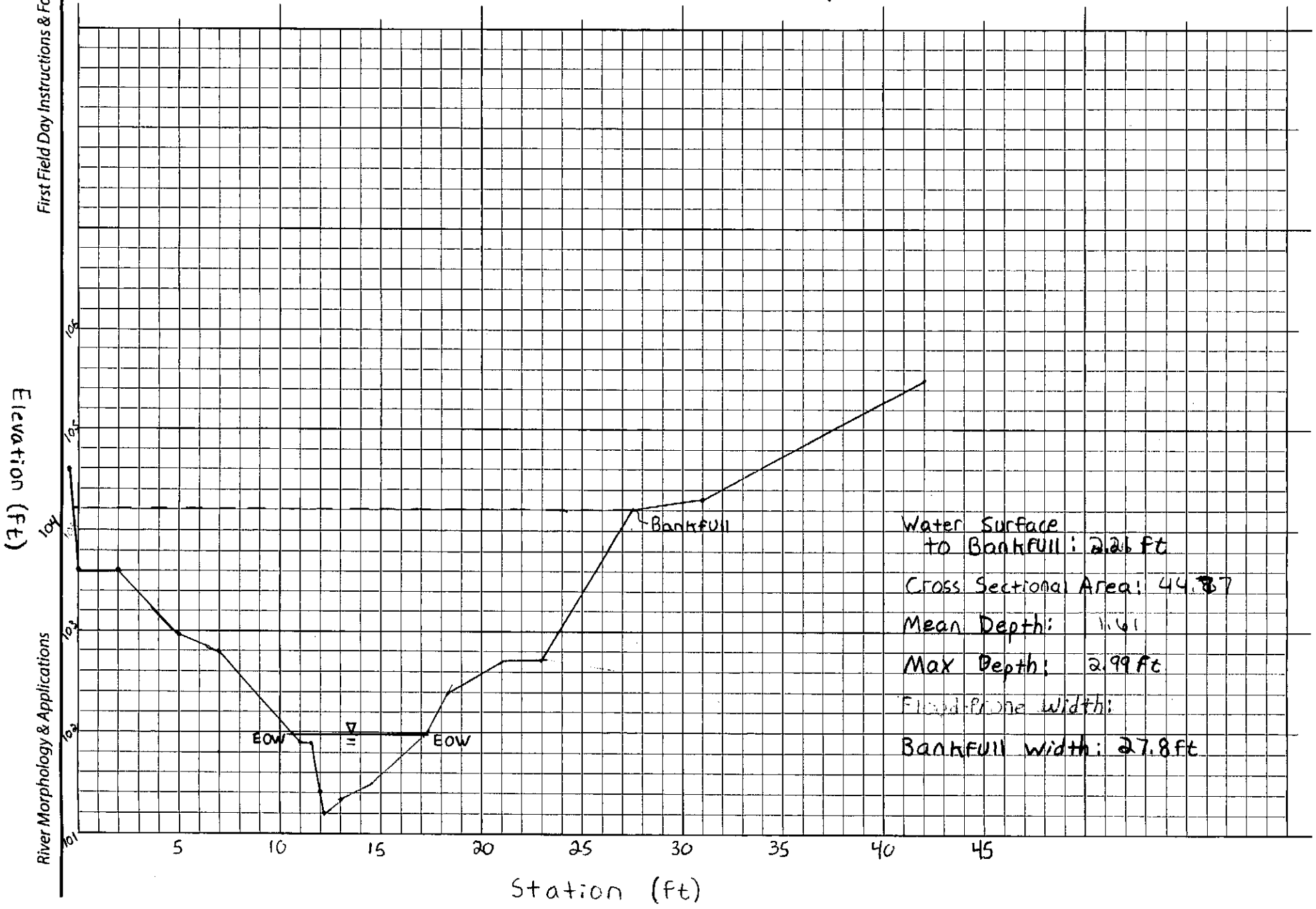


First Field Day Instructions & Forms
River Morphology & Applications
Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

Reach 3

Cross Section 3 - Step



Water Surface to Bankfull: 2.26 ft

Cross Sectional Area: 44.87

Mean Depth: 1.61

Max Depth: 2.99 ft

Flood-Prone Width:

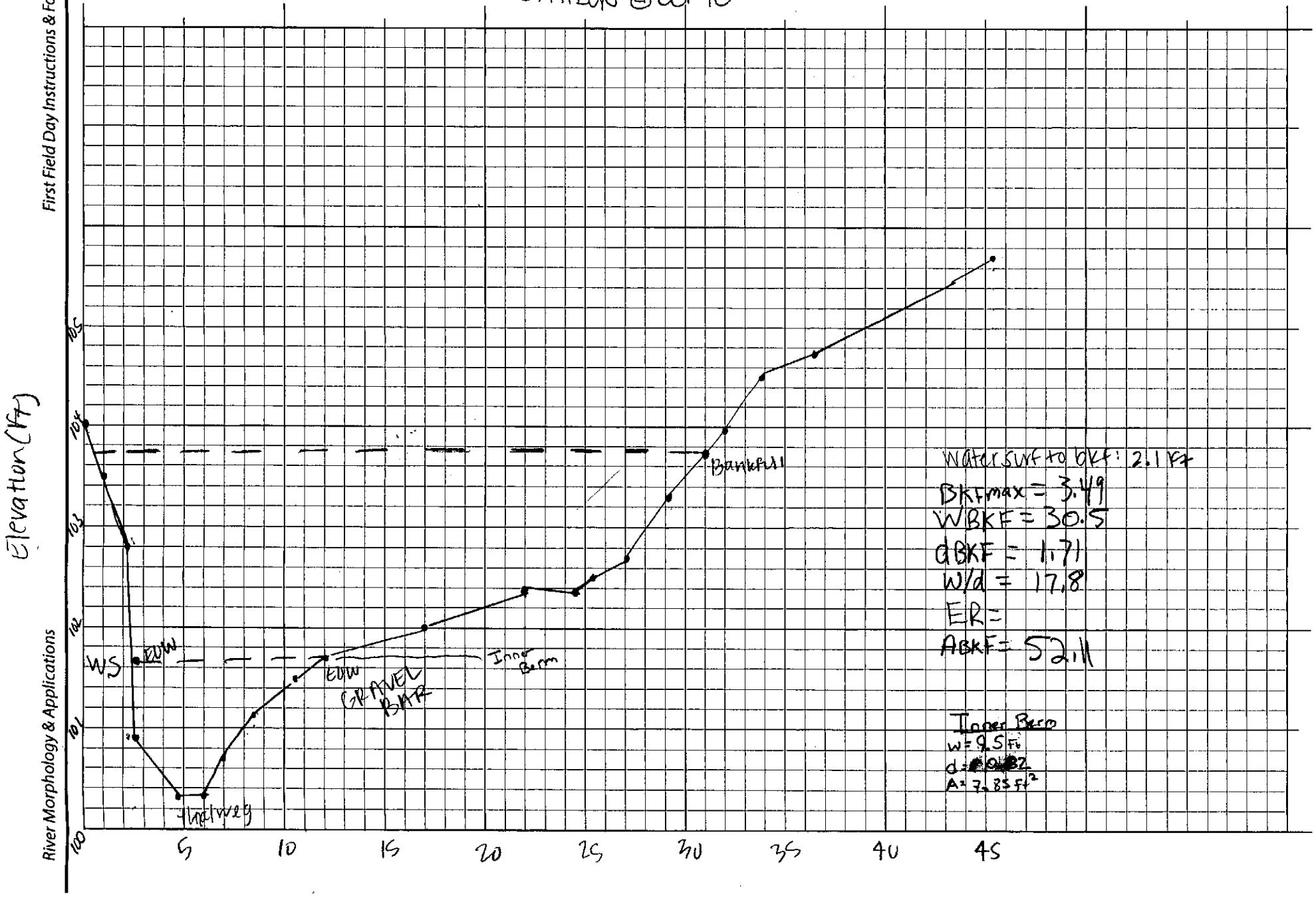
Bankfull width: 27.8 ft

Copyright © 2015 Wildland Hydrology

TEAM #3
4/15/15

CROSS SECTION 4 - POOL - Step pool

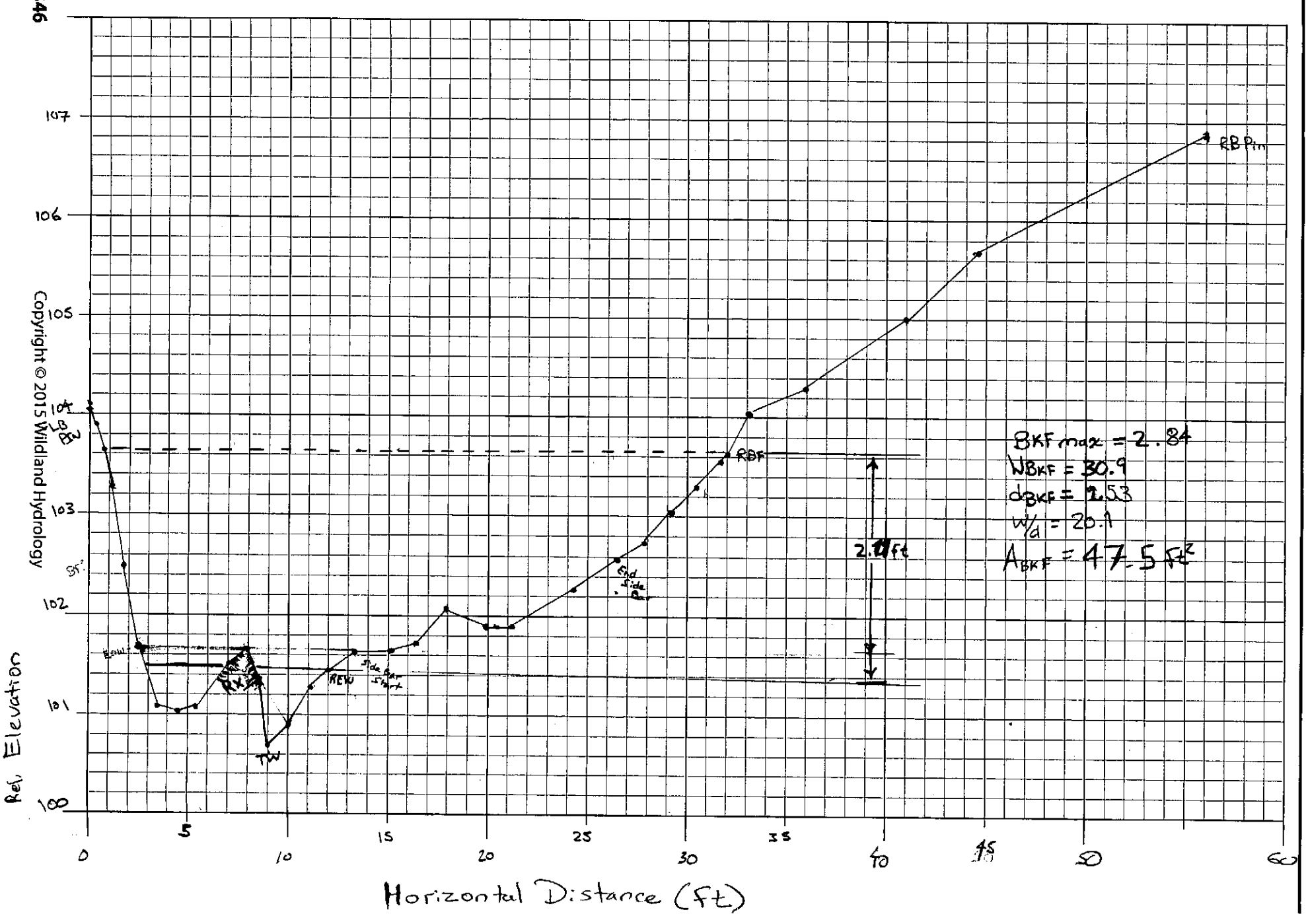
STATION @ 00+70



Copyright © 2015 Wildland Hydrology

STEP - Cross Section #5 (Station - 79 ft)

TEAM 3
SHARMEN BRANCH REACH 3

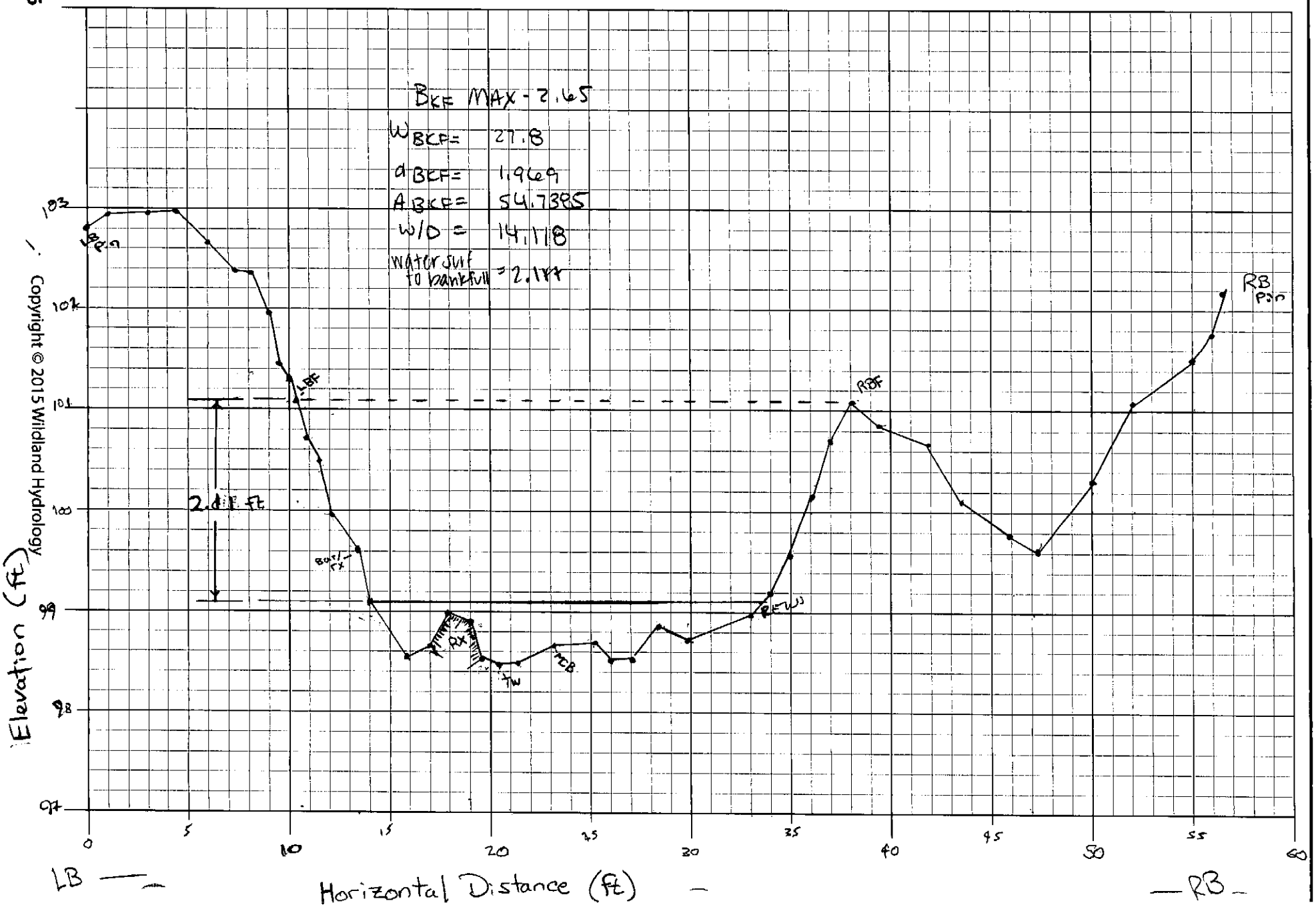


Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

Riffle Cross Section #6 (Station 135ft)

15 1
42 2
99 = 3
70 = 4
99 = 5
135 = 6



Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15 RIFFLE CROSS SECTION #1

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: Sharman's Branch **Date:** 4/14/15

Location: STA 16 Reference Riffle

Party / Notes: **HUC:**

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	REMARKS / COMMENTS / NOTES	
1		11.13	11.13		100		
2	-0.6				105.92		
3	0.0			6.41	104.72	Steep left bank (0.5:1)	
4	1.0			7.07	104.06		
5	3.0			8.24	102.89	Edge of Water (EOW)	2.45
6	4.0			8.80	102.33		
7	5.0			8.83	102.30		
8	7.3			8.86	102.27	Thalweg	
9	8.1			8.80	102.33		
10	10.5			8.68	102.45		
11	12.0			8.35	102.78		
12	13.6			8.38	102.75		
13	15.0			8.20	102.93		
14	16.2			8.08	103.05		
15	16.7			8.20	102.93		
16	21.0			7.95	103.18	EOW	2.16
17	22.6			7.88	103.25		
18	25.5			7.94	103.19	Toe of bank	
19	26.1			6.79	104.34	Top of bank	
20	27.0			6.63	104.50		
21	27.4			6.39	104.74		1.56
22	28.0			6.30	104.83		
23	30.0			5.91	105.22		
24	30.7			5.79	105.34	Bankfull	
25	35.0			5.47	105.66		
26	39.0			5.08	106.05		105.34 - 104.92
27	60.2	2		2.72	108.41		
28							

Copyright © 2015 Wildland Hydrology

Station	elevation	Width	depth	Averagedepth	Area
-0.3	105.34		0		
0	104.72	0.3	0.62	0.31	0.93
1.0	104.06	1.0	1.28	1.9	1.9
3.0	102.89	2.0	2.45	1.865	3.73
4.0	102.33	1.0	3.01	2.73	2.73
5.0	102.30	1.0	3.04	3.025	3.025
7.3	102.27	2.3	3.07	3.055	7.0265
8.1	102.33	0.8	3.01	3.04	2.432
10.5	102.45	2.4	2.89	2.95	7.08
12.0	102.78	1.5	2.56	2.725	4.0875
13.6	102.75	1.6	2.59	2575	4.12
15.0	102.93	1.4	2.41	2.5	3.5
16.2	103.05	1.2	2.29	2.35	2.82
16.7	102.93	0.5	2.41	2.35	1.175
21.0	103.18	4.3	2.16	2.285	9.8255
22.6	103.25	1.6	2.09	2.125	3.4
25.5	103.A	2.9	2.15	2.12	6.148
26.1	104.3A	0.6	1.0	1.575	0.945
27.0	104.50	0.9	0.84	0.92	0.828
27.4	104.74	0.4	0.6	0.72	0.288
28.0	104.83	0.6	0.51	0.555	0.333
30.0	105.22	2.0	0.12	0.315	0.63
30.7	105.34	0.7	0	0.06	0.042

Total = 66.9955 ft^2

~67 ft^2

Mean depth = 2.16 ft

FT	Depth (from bkf)	Width
0.3	0	
0	0.62	0.3 x 0.31
1	1.28	1.0 x 0.95
3	2.45	2.0 x 1.865
4	3.01	1.0 x 0.28
5	3.04	1.0
7.3	3.07	2.3
8.1	3.01	0.8
10.5	2.89	2.4
12.0	2.56	1.5
13.6	2.59	1.6
15.0	2.41	1.4
16.2	2.29	1.2
16.7	2.41	0.5
21.0	2.16	4.3
22.6	2.09	1.6
25.5	2.5	2.9
26.1	1.0	0.6
27.0	0.84	0.9
27.4	0.60	0.4
28.0	0.51	0.6
30.0	0.12	2.0
30.7	0	0.7

TEAM #3 4/14/15 POOL CROSS SECTION #2

SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: Sharman's Branch — STA-41 Date: 4-14-15

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29		11.13	111.13		100	
30	-0.6				104.38	
31	0.0	7.95		7.95	103.18	Steep bank (0.5:1 slope)
32	0.8	8.82		8.82	102.31	
33	1.6	8.98		8.98	102.15	Edge of water
34	3.0			9.50	101.63	
35	5.2			9.91	101.22	Thalweg
36	7.0			9.83	101.30	
37	10.0			9.73	101.40	
38	11.3			9.67	101.46	
39	13.3			9.40	101.73	
40	16.1			9.02	102.11	Edge of water
41	18.4			8.54	102.59	gravel bar
42	22.4			8.15	102.98	Toe of bank
43	25.0			6.92	104.21	Top of bank / bankfull
44	26.7			6.81	104.32	
45	30.0			6.47	104.66	
46	34.5			6.09	105.04	
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

2.1 ft watersurf to bkf.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/15/15 STEP CROSS SECTION #3

SURVEY DATA ⟹ **CROSS - SECTION** #3

SITE: STA - 49 Date: 4-14-15

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29		11.13	111.13		100	
30	-0.5			6.54	104.59	
31	0.0	7.54		7.54	103.59	on bedrock
32	2.0	7.53		7.53	103.60	on bedrock
33	5.0			8.19	102.94	on bedrock
34	7.0			8.34	102.79	on bedrock
35	11.0			9.20	101.93	
36	11.5			9.22	101.91	Edge of Water
37	12.0			9.72	101.41	
38	12.1			9.93	101.20	Thalweg
39	13.0			9.78	101.35	
40	14.4			9.69	101.44	
41	17.2			9.15	101.98	Edge of Water
42	18.3			8.73	102.40	
43	21.0			8.44	102.69	
44	23.0			8.41	102.72	
45	27.5			6.94	104.19	Bank Full
46	31.0			6.88	104.25	
47	42.0			5.61	105.52	
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

2.21 ft watersurf to bkf

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15 POOL CROSS SECTION #4

SURVEY DATA ⟹ **CROSS - SECTION** 84 pg 1/2

SITE: Shaman's Branch STA-70 Date: 4/14/15

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0.0			7.11	104.02	
30	1.0			7.65	103.48	
31	2.2			8.33	102.80	
32	2.7			9.51	101.62	
33	2.7			10.26	100.87	Edge of water (water surface)
34	4.9			10.85	100.28	Bed
35	6.0			10.83	100.30	
36	7.0			10.42	100.71	
37	8.5			9.97	101.16	
38	10.5			9.62	101.51	
39	12.2			9.46	101.67	Edge of water
40	17.0			9.10	102.03	Gravel bar
41	22.0			8.75	102.38	
42	24.8			8.77	102.36	
43	25.1			8.56	102.57	
44	27.3			8.43	102.7	
45	29.1			7.77	103.36	
46	31.0			7.36	103.77	Bank full
47	32.0			7.14	103.99	
48	33.8			6.57	104.56	
49	36.5			6.37	104.76	
50	45.3			5.45	105.68	
51						
52						
53						
54						
55						
56						
57						
58						
59						

2.1 water surf to bankfull

Copyright © 2015 Wildland Hydrology

Team 3
Reach 01

Pool xs
pg 2/2

Sta	Elev	Depth	Cell W.	Avg Cell D	A
0.5	103.7	0			
1	103.48	0.22	0.5	0.11	0.06
2.2	102.8	0.9	1.2	0.56	0.67
2.7	101.62	2.08	0.5	1.49	0.75
4.9	100.87	2.83	0	2.46	0
6	100.28	3.42	2.2	3.13	6.89
7	100.3	3.4	1.1	3.41	3.75
8.5	100.71	2.99	1	3.20	3.2
10.5	101.16	2.54	1.5	2.77	4.16
12.2	101.57	2.19	2	2.37	4.74
14.7	101.67	2.03	1.7	2.11	3.59
22	102.03	1.67	4.8	1.85	8.88
24.8	102.38	1.32	5	1.5	7.5
25.1	102.36	1.34	2.8	1.33	3.72
27.3	102.57	1.13	0.3	1.24	0.37
29.1	102.7	1	2.2	1.07	2.35
31	103.36	0.34	1.8	0.67	1.21
	103.77	-0.07	1.9	0.14	0.27
					52.11

TEAM #3 4/14/15 STEP CROSS SECTION #5

SURVEY DATA ⟹ **CROSS - SECTION 5**

SITE: Sharmans Branch LP-79 (step) Date: 4/14/15

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	0	10.6	110.6	6.48	104.12	L Pin
30	0.4			6.72	103.88	
31	0.8			6.98	103.62	
32	1.1			7.33	103.27	
33	1.8			8.08	102.52	
34	2.5			8.9	101.7	LEW
35	3.5			9.51	101.09	
36	4			9.55	101.05	
37	5.5			9.53	101.07	
38	7			9.07	101.53	Rock
39	8			8.96	101.64	Rock
40	8.6			9.23	101.37	Rock
41	9			9.87	100.73	TW
42	10			9.72	100.88	
43	11.3			9.33	101.27	
44	12			9.14	101.46	REW
45	13.4			8.97	101.63	Side Bar
46	15.1			8.98	101.62	
47	16.4			8.85	101.75	
48	17.9			8.53	102.07	
49	19.8			8.72	101.88	
50	21.3			8.67	101.93	
51	24.3			8.33	102.27	
52	26.6			8.02	102.58	Side Bar
53	27.8			7.85	102.75	
54	29.3			7.5	103.1	
55	30.5			7.28	103.32	
56	31.7			7.03	103.57	RBF
57	32			6.97	103.63	RBF
58	33.2			6.5	104.1	
59	36			6.27	104.33	
	41			5.6	105	

2.11 water surf to bkf

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15 RIFFLE CROSS SECTION #6

SURVEY DATA ⟹ **CROSS - SECTION** 6 pg 1/2

SITE: Sharmans Branch LP-135 (riffle) **Date:** 4/14/15

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0	8.1	108.1	5.3	102.8	L Pin
30	1			5.18	102.92	
31	3			5.15	102.95	
32	4.6			5.24	102.96	
33	6			5.48	102.62	
34	7.4			5.62	102.38	
35	8.1			5.76	102.34	
36	9			6.16	101.94	
37	9.6			6.67	101.43	
38	10			6.81	101.29	
39	10.3			7.02	101.08	LBF
40	10.7			7.33	100.77	
41	11.5			7.58	100.52	
42	12.1			8.16	99.94	
43	13.4			8.44	99.66	Dep. Bar/ rock
44	14			9.02	99.08	LEW
45	15.8			9.56	98.54	
46	16.9			9.47	98.63	rock
47	17.8			9.12	98.98	
48	19			9.11	98.89	
49	19.6			9.59	98.51	rock
50	20.4			9.67	98.43	TW
51	21.3			9.61	98.49	
52	23.1			9.43	98.67	MCB
53	25.2			9.42	98.68	
54	26			9.56	98.54	
55	27.3			9.54	98.56	
56	28.4			9.24	98.86	
57	29.9			9.4	98.7	
58	33			9.14	98.96	REW
59	34			8.91	99.19	

Copyright © 2015 Wildland Hydrology

TEAM #3
4/14/15

RIFFLE CROSS SECTION #6

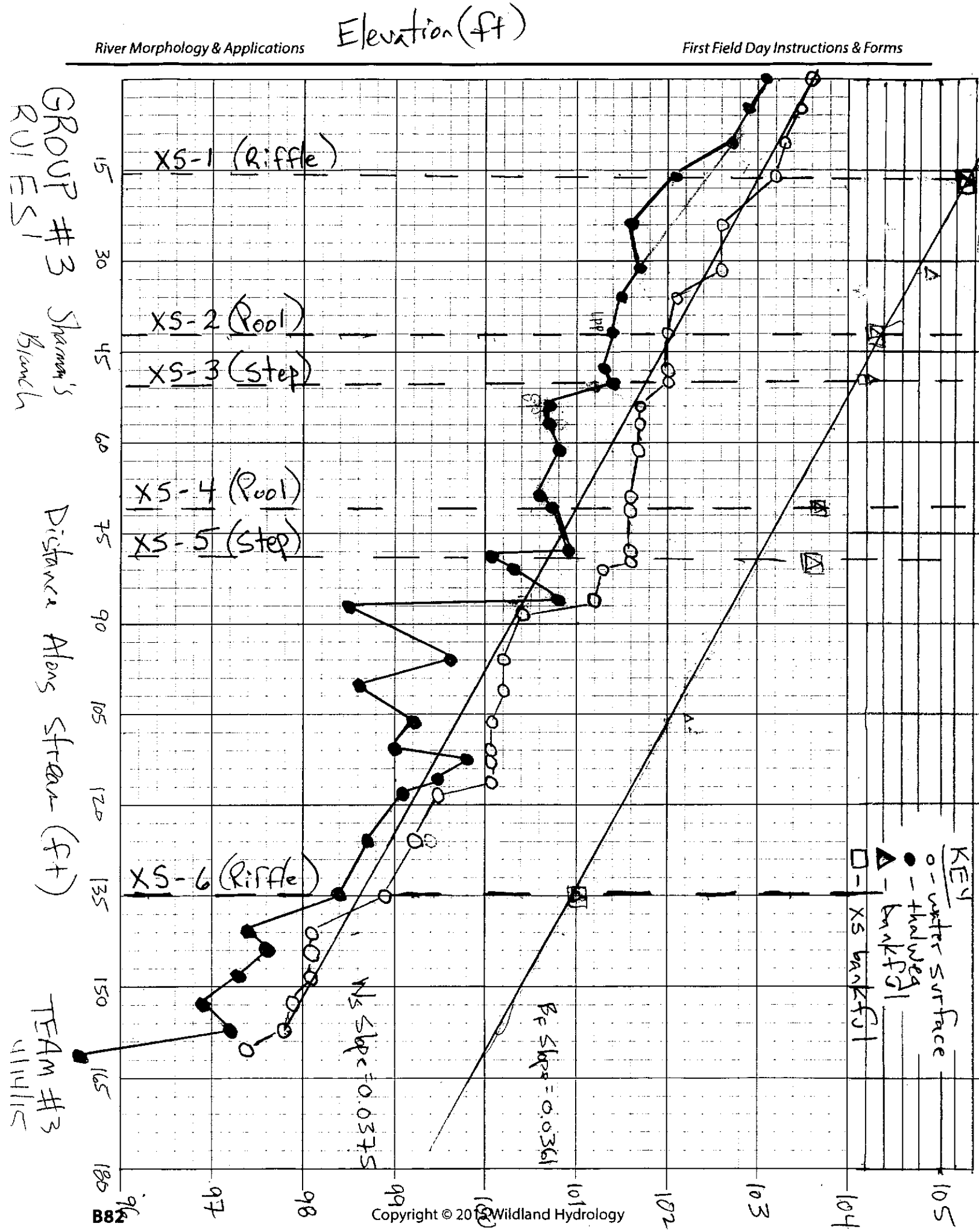
pg 2/2

SURVEY DATA ⟹ **CROSS - SECTION 6**

SITE: Sharmans Branch LP-135 (riffle) **Date:** 4/14/15

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	35	8.11	108.1	8.51	99.59	
30	36.1			7.94	100.16	
31	37			7.38	100.72	
32	38.1			7.03	101.07	RBF
33	39.4			7.25	100.85	
34	41.7			7.46	100.64	
35	43.5			7.99	100.11	
36	45.8			8.31	99.79	
37	47.4			8.5	99.6	
38	50			7.81	100.29	
39	52			7.04	101.06	
40	55			6.56	101.54	
41	56			6.32	101.78	
42	56.5			5.91	102.19	R Pin
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

2.11 water surf to blef



Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

SURVEY DATA ⟶ LONGITUDINAL PROFILE 1

SITE: Sharman's Branch 1 **Date:** 4/14/15

Location: Reach #3, Team #3

Party / Notes: Matthew, **HUC:**

	Distance, Point, or STATION (ft)	Back-Sight BS (ft)	Height of Instrument HI (ft)	Thalweg Fore-Sight FS (ft)	Thalweg Elevation Elev. (ft)	Water Surface Fore-Sight FS (ft)	Water Surface Elevation Elev. (ft)	Bankfull Fore-Sight FS (ft)	Bankfull Elevation Elev. (ft)	Low Bank Hl Fore-Sight FS (ft)	Low Bank Hl Elevation Elev. (ft)	NOTES e.g. Riffle Run Pool Glide	B_F - W_S
1	BM	11.13	111.130										
2	0			8.07	103.06	7.52	103.61					Triffle	No B_F
3	5			8.21 LPP	102.92	7.64	103.49					Mriffle	
4	10			8.41	102.72	7.88	103.25	5.97	105.16			Mriffle	1.91 ?
5	16			9.04	102.09	7.97	103.16	6.2	104.93			Csection	1.77 ✗
6	16							5.82	105.31			Csection	2.15 ✓
7	24			9.52	101.61	8.52	102.61	6.61	104.52			Mriffle	1.91 ?
8	31			9.40	101.73	8.53	102.6	6.25	104.88			Tshoot	2.28 ?
9	36			9.67	101.46	9.00	102.13	6.96	104.17			Tpool	2.04 ✓
10	42			9.77	101.36	9.09	102.04					Mpool	DMAX
11	48			9.81	101.32	9.12	102.01					Tstep	
12	53			9.98	101.15	9.39	101.74					Bstep	- Tpool
13	56			10.41	100.72	9.40	101.73					Mpool	DMAX
14	61			10.31	100.82	9.44	101.69					Break	slope?
15	69			10.5	100.63	9.51	101.62					Mpool	Dmax
16	77			10.25	100.88	9.58	101.55					Tstep	
17	82			10.85	100.28	9.88	101.25					Bstep	
18	86			10.38	100.75	9.92	101.21					Tstep	LOG ✗
19	89			12.66	98.47	10.76	100.37					Bstep	- Tpool
20	95			11.49	99.64	10.89	100.24					Mpool	
21	101			12.54	98.59	10.94	100.19			Dmax		Mpool	Cont. Scour Pool
22	106			11.94	99.19	11.01	100.13					Mpool	
23	111			12.09	99.04	11.0	100.13					Mpool	
24	112			11.32	99.81	11.0	100.13					Tstep	
25	116			11.65	99.48	11.0	100.13						Small Pool
26	118			12.04	99.09	11.6	99.53					Bstep	
27	122			11.42		11.09						Tstep	

ASEP

LPP

1

Mpool

??

LPP = lateral profession pool

Copyright © 2015 Wildland Hydrology

SURVEY DATA ⟶ **LONGITUDINAL PROFILE 2**

SITE: Sharman's Branch Date: 4/14/15

Location: Reach #3 Team #3

Party / Notes: HUC:

	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Thalweg Fore-Sight FS ft	Thalweg Elevation Elev. ft	Water Surface Fore-Sight FS ft	Water Surface Elevation Elev. ft	Bankfull Fore-Sight FS ft	Bankfull Elevation Elev. ft	Low Bank HI Fore-Sight FS ft	Low Bank HI Elevation Elev. ft	NOTES e.g. Riffle Run Pool Glide	BF
28	126			12.41	98.72	11.92	99.21					B-step	
29	135			12.69	98.44	12.28	98.85	10.12	101.01			C section	2.16 ✓
30	106			11.94	99.19	11.0	100.13	8.85	102.28				2.15 ✓
31	140			13.71	97.42	13.02	98.11					Bstep - Tpool	
32	145			13.58	97.55	13.05	98.08					Bpool - Tstep	
33	149			13.83	97.3	13.07	98.06					Bstep - Tpool	
34	152			14.22	96.91	13.28	97.85					Mpool	Dmax.
35	156			13.96	97.17	13.38	97.75					Tstep - Bpool	
36	160			15.72	95.41	13.76	97.37					Bstep - Tpool	
37	49			9.75	101.38	9.17	101.96	6.9	104.23			C-section - Step	
38	70			10.46	100.67	9.45	101.68	7.41	103.72			C-section - Pool	
39	41			9.7	101.43	9.00	102.13	6.91	104.22			C-section - Pool	
40													
41													
42													
43													
44	79			10.2	101.1	9.54	101.59	7.54	103.6			C-section - Step	
45													
46													49 2.27
47													70 2.04
48													41 2.09
49													79 2
50													
51													
52													
53													
54													

Redo (6) out of sequence

Bottom of Reach (3)

(4)

(2)

X-sections

(5)

$$\text{Slope} = \frac{13.38 - 7.52}{156} = 3.75\%$$

-slope calculation-

Copyright © 2015 Wildland Hydrology

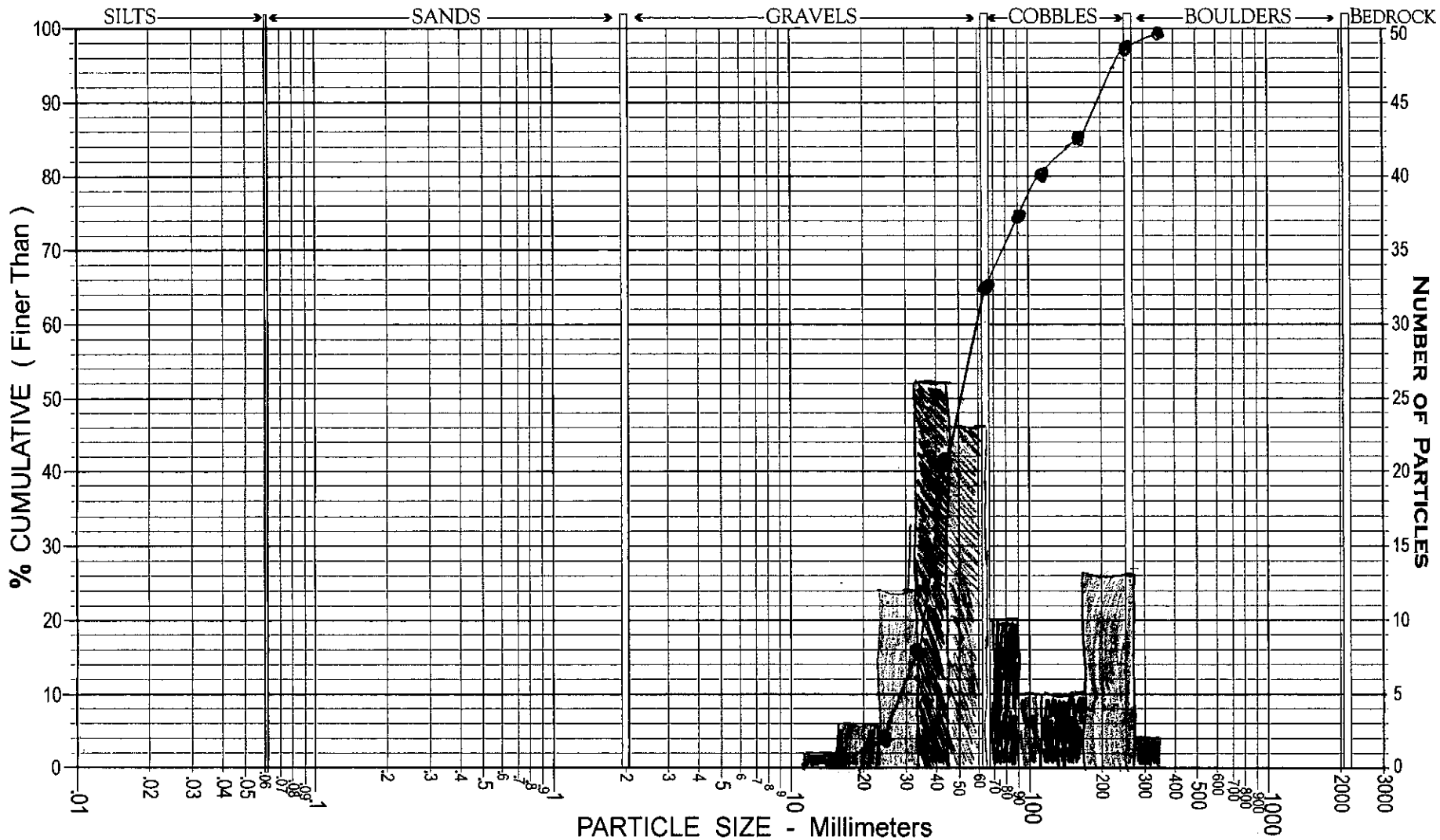
PROTRUSION

PEBBLE COUNT DATA

LOCATION: SHARMIN BRANCH @ 00+16 Date: 4-14-15

REACH: REACH 3 PARTY: TEAM 3

Stream Type: Valley Type: HUC:

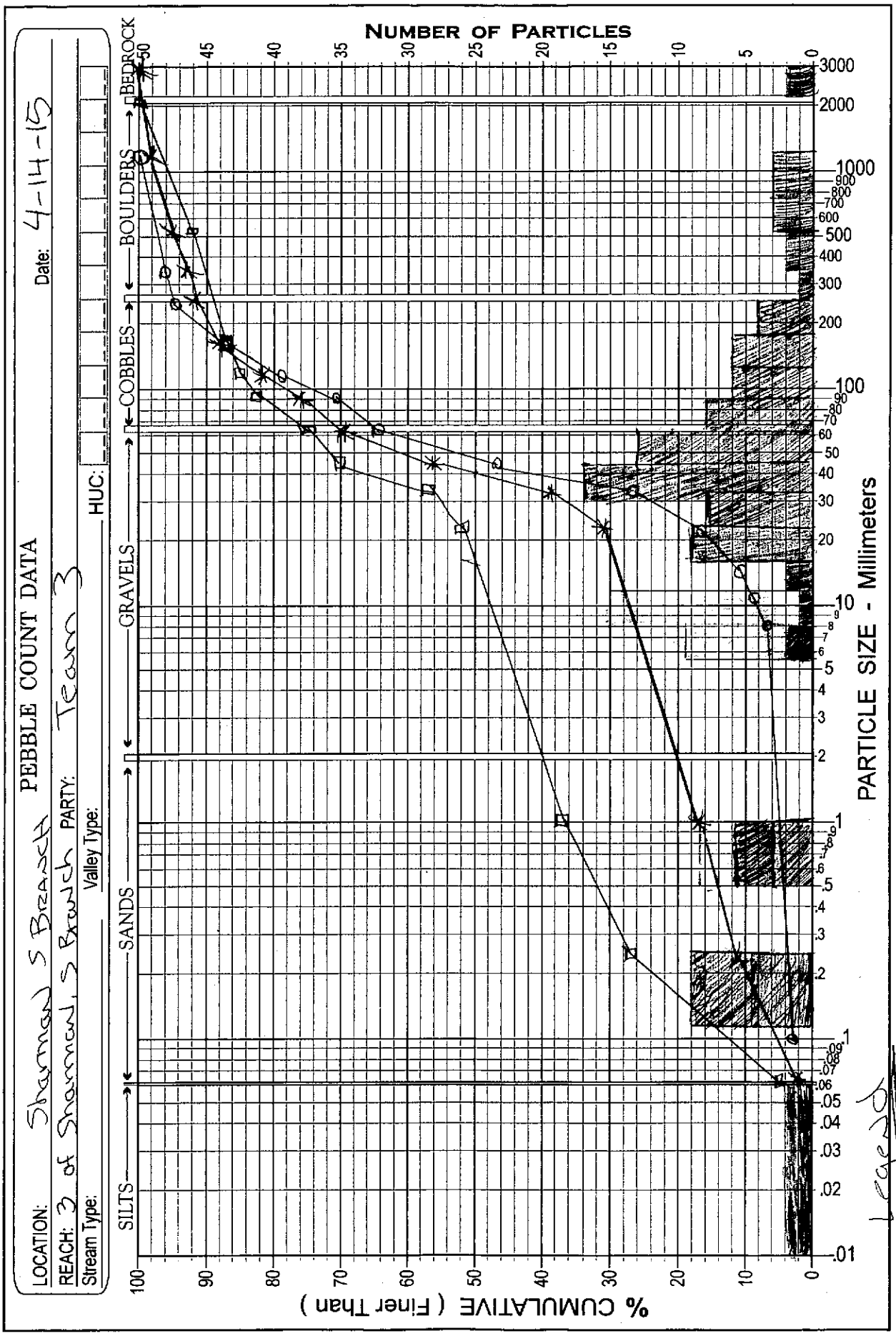


$D_{50} \sim 52$ $D_{95} \sim 220$

$D_{84} \sim 150$

Copyright © 2015 Wildland Hydrology

REPRESENTATIVE REACH PEBBLE COUNT



Copyright © 2015 Wildland Hydrology

PEBBLE COUNT DATA

LOCATION: ~~Representative~~ ACTIVE Pebble Count

Date: 4-14-15

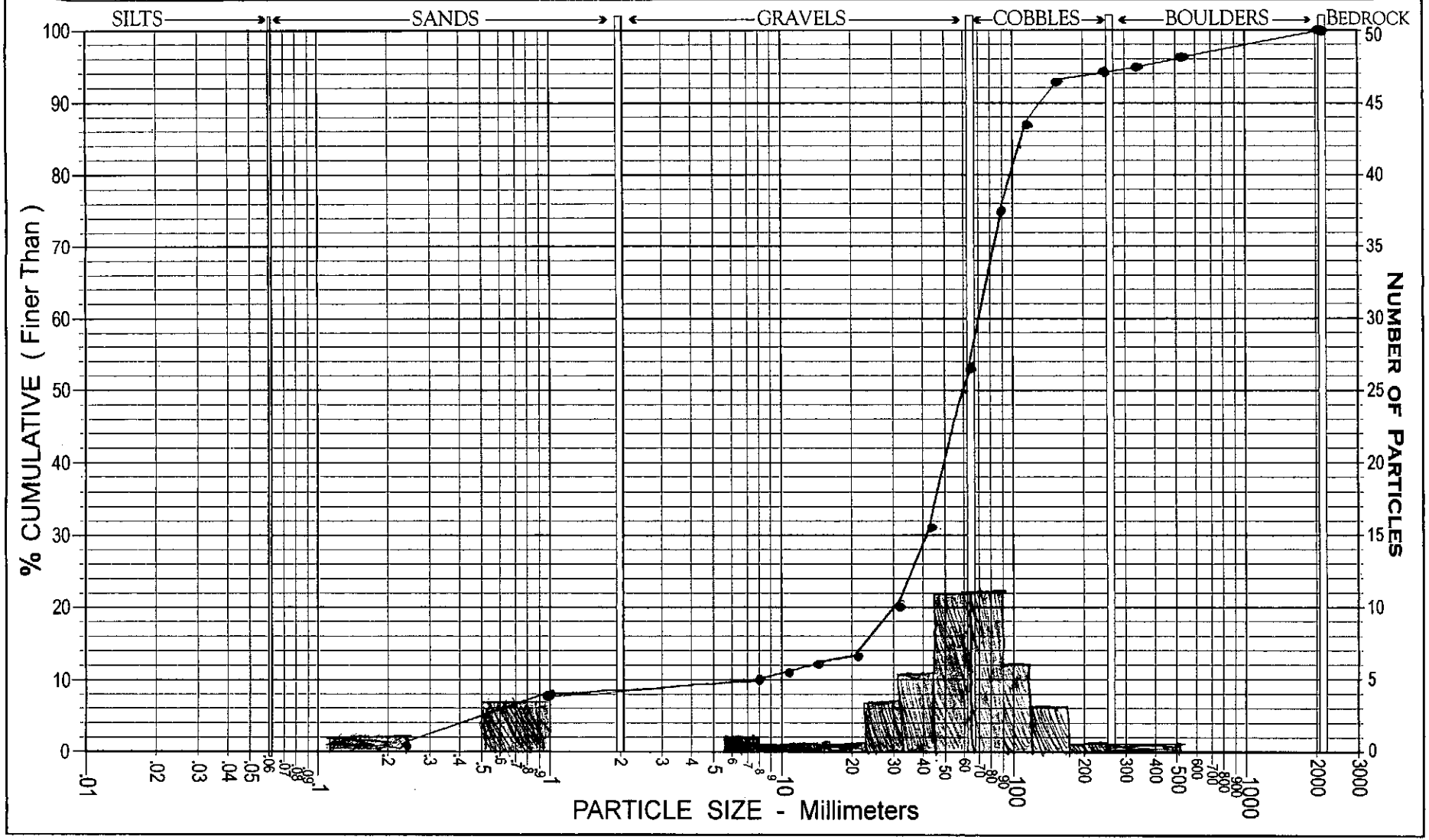
REACH: 3

PARTY: Team 3

Stream Type:

Valley Type:

HUC:



D_{16} - 24

D_{35} - 45

D_{50} ~ 68

D_{84} ~ 115

D_{95} - 350

D_{100} - 1000

Copyright © 2015 Wildland Hydrology

B100

Site: SHARMAN BRANCH @ 00+16 Date: 4-14-15

Location: Reach 3 HUC:

Party:

				Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach: 3			Reach:			Reach:		
							Date: 4-15-15			Date:			Date:		
Inches	PARTICLE	Millimeters													
0	Silt / Clay	< .062	S/C				0	0	0						
	Very Fine	.062 - .125	SAND				0	0	0						
8	Fine	.125 - .25		•			1	1	1						
	Medium	.25 - .50					0	0	1						
	Coarse	.50 - 1.0		⊏			7	7	8						
.04 - .08	Very Coarse	1.0 - 2					0	0	8						
.08 - .16	Very Fine	2 - 4	GRAVEL				0	0	8						
.16 - .22	Fine	4 - 5.7					0	0	8						
.22 - .31	Fine	5.7 - 8		• •			2	2	10						
45 .31 - .44	Medium	8 - 11.3		•			1	1	11						
.44 - .63	Medium	11.3 - 16		•			1	1	12						
.63 - .89	Coarse	16 - 22.6		•			1	1	13						
.89 - 1.3	Coarse	22.6 - 32		⊏			7	7	20						
1.3 - 1.8	Very Coarse	32 - 45		⊠ •			11	11	31						
1.8 - 2.5	Very Coarse	45 - 64		⊠ ⊠ :			22	22	53						
2.5 - 3.5	Small	64 - 90	COBBLE	⊠ ⊠ :			22	22	75						
3.5 - 5.0	Small	90 - 128		⊠ :			12	12	87						
41 5.0 - 7.1	Large	128 - 180		⊏			6	6	93						
7.1 - 10.1	Large	180 - 256		•			1	1	94						
10.1 - 14.3	Small	256 - 362	BOULDER	•			1	1	95						
14.3 - 20	Small	362 - 512		•			1	1	96						
2 20 - 40	Medium	512 - 1024					0	0	96						
40 - 80	Large-Vry Large	1024 - 2048					0	0	96						
4	Bedrock		BDRK	: :			4	4	100						
Stream Type:			**Valley Type:**			TOTAL→	100								

Copyright © 2015 Wildland Hydrology

Site: Reach 3 Date: 4-14-15

Location: Sharman HUC:

Party: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: 3 Date: 4-14-15 TOT #	ITEM %	% CUM	POOL (2) Reach: 3 Date: 4-14-15 TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: 3 Date: 4-14-15 TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C				0	0	0	2	5.0	5.0	2	2.0	2.0
	Very Fine	.062 - .125	SAND				0	0	0	0	0	5.0	0	0	2.0
	Fine	.125 - .25	SAND				0	0	0	9	22.5	27.5	9	9.0	11.0
	Medium	.25 - .50	SAND				0	0	0	0	0	27.5	0	0	11.0
	Coarse	.50 - 1.0	SAND				2	3.3	3.3	4	10.0	37.5	6	6.0	17.0
.04 - .08	Very Coarse	1.0 - 2	SAND				0	0	3.3	0	0	37.5	0	0	17.0
.08 - .16	Very Fine	2 - 4	GRAVEL				0	0	3.3	0	0	37.5	0	0	17.0
.16 - .22	Fine	4 - 5.7	GRAVEL				0	0	3.3	0	0	37.5	0	0	17.0
.22 - .31	Fine	5.7 - 8	GRAVEL				2	3.3	6.6	0	0	37.5	2	2.0	19.0
.31 - .44	Medium	8 - 11.3	GRAVEL				1	1.7	8.3	0	0	37.5	1	1.0	20.0
.44 - .63	Medium	11.3 - 16	GRAVEL				2	3.3	11.6	0	0	37.5	2	2.0	22.0
.63 - .89	Coarse	16 - 22.6	GRAVEL				3	5.0	16.6	6	15.0	52.5	9	9.0	31.0
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				6	10.0	26.6	2	5.0	57.5	8	8.0	39.0
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				12	20.0	46.6	5	12.5	70	17	17.0	56.0
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL				11	18.3	64.3	2	5.0	75	13	13.0	69.0
2.5 - 3.5	Small	64 - 90	COBBLE				4	6.7	71	3	7.5	82.5	7	7.0	76.0
3.5 - 5.0	Small	90 - 128	COBBLE				5	8.3	79.3	1	2.5	85	6	6.0	82.0
5.0 - 7.1	Large	128 - 180	COBBLE				5	8.3	87.6	1	2.5	87.5	6	6.0	88.0
7.1 - 10.1	Large	180 - 256	COBBLE				4	6.7	94.3	0	0	87.5	4	4.0	92.0
10.1 - 14.3	Small	256 - 362	BOULDER				1	1.7	96	0	0	87.5	1	1.0	93.0
14.3 - 20	Small	362 - 512	BOULDER				0	0	96	2	5.0	92.5	2	2.0	95.0
20 - 40	Medium	512 - 1024	BOULDER				2	3.3	99.9	1	2.5	95	3	3.0	98.0
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				0	0	99.3	0	0		0	0	98.0
	Bedrock		BDRK				0	0	99.3	2	5.0	100	2	2.0	100
Stream Type:			**Valley Type:**			TOTAL→	60			40			100		

Copyright © 2015 Wildland Hydrology

PROTRUSION

Site: SHARMAN BRANCH @ 00+16 Date:

Location: REACH 3 HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach: 3			Reach:			Reach:		
							Date: 4-14-15			Date:			Date:		
	Silt / Clay	< .062	S/C				0	0	0						
	Very Fine	.062 - .125	SAND				0	0	0						
	Fine	.125 - .25					0	0	0						
	Medium	.25 - .50					0	0	0						
	Coarse	.50 - 1.0					0	0	0						
.04 - .08	Very Coarse	1.0 - 2					0	0	0						
.08 - .16	Very Fine	2 - 4	GRAVEL				0	0	0						
.16 - .22	Fine	4 - 5.7					0	0	0						
.22 - .31	Fine	5.7 - 8					0	0	0						
.31 - .44	Medium	8 - 11.3					0	0	0						
.44 - .63	Medium	11.3 - 16					1	1	1						
.63 - .89	Coarse	16 - 22.6					3	3	4						
.89 - 1.3	Coarse	22.6 - 32					12	12	16						
1.3 - 1.8	Very Coarse	32 - 45					26	26	42						
1.8 - 2.5	Very Coarse	45 - 64					23	23	65						
2.5 - 3.5	Small	64 - 90	COBBLE				10	10	75						
3.5 - 5.0	Small	90 - 128					5	5	80						
5.0 - 7.1	Large	128 - 180					5	5	85						
7.1 - 10.1	Large	180 - 256					13	13	98						
10.1 - 14.3	Small	256 - 362	BOULDER				2	2	100						
14.3 - 20	Small	362 - 512					0	0	100						
20 - 40	Medium	512 - 1024					0	0	100						
40 - 80	Large-Vry Large	1024 - 2048					0	0	100						
	Bedrock		BDRK				0	0	100						
Stream Type:			**Valley Type:**			TOTAL→	100		100						

Copyright © 2015 Wildland Hydrology

Worksheet B-2. Computations of bankfull mean velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Sharman's Branch	Location:	Wash County MD
Date:	4/14/15 Stream Type: B4/1	Valley Type:	C-CO-U
Observers:	Team #3	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	65.2	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	2.16	d_{bkf} (ft)
Bankfull Riffle WIDTH	31.0	W_{bkf} (ft)	Wetted PERIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	35.32	W_p (ft)
D_{84} at Riffle	150	Dia. (mm)	D_{84} (mm) / 304.8	0.492	D_{84} (ft)
Bankfull SLOPE	0.036	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.84	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	3.739	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	2.132	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\ 2.83 + 5.66 * Log\ \{ R / D_{84} \}\ ]\ u^*$	10.00	ft / sec	652	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .038	11.15	ft / sec	727	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .037	11.46	ft / sec	747	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ Note: This equation is applicable to steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ 0.042	4.245	ft / sec	276.8	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Discharge Q = year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$		ft / sec		cfs

Protrusion Height Options for the D_{84} Term in the Relative Roughness Relation (R/D_{84}) – Estimation Method 1

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrusion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

 CROSS SECTION 6 Velocity Calcs

Worksheet B-2. Computations of bankfull mean velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Sharman's Branch	Location:	Cross Section 6
Date: 4/14/15	Stream Type: B4/N	Valley Type:	C-CO-V
Observers:		HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	54.74	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.969	d_{bkf} (ft)
Bankfull Riffle WIDTH	27.8	W_{bkf} (ft)	Wetted PERIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	31.73	W_p (ft)
D_{84} at Riffle		Dia. (mm)	D_{84} (mm) / 304.8		D_{84} (ft)
Bankfull SLOPE	0.036	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.725	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)		R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.41	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$		ft / sec		cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$		ft / sec		cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ B4 $n =$ 0.056	7.26	ft / sec	397.4	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ Note: This equation is applicable to steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ 0.101	4.03	ft / sec	220.6	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Discharge Q = year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$		ft / sec		cfs

Protrusion Height Options for the D_{84} Term in the Relative Roughness Relation (R/D_{84}) – Estimation Method 1

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrustion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

Worksheet B-2. Computations of velocity and discharge using various methods (*First Field Day*).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Shaman's Branch	Location:	Washington County, MD
Date: 4/14/15	Stream Type: B4/2	Valley Type:	C-CO-4
Observers:	Team 2	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	65.2	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	2.16	d_{bkf} (ft)
Bankfull Riffle WIDTH	31.0	W_{bkf} (ft)	Wetted PERIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	35.32	W_p (ft)
D_{84} at Riffle	115	Dia. (mm)	D_{84} (mm) / 304.8	0.377	D_{84} (ft)
Bankfull SLOPE	0.036	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.84	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	4.88	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	2.46	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	19.82	ft / sec	1640.3	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.06	7.08	ft / sec	461.3	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.058	7.32	ft / sec	477.2	cfs
2. Roughness Coefficient: c) Manning's n from Jarrett (USGS): $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ Note: This equation is applicable to steep, step/pool, high boundary roughness, cobble- and boulder-dominated stream systems; i.e., for Stream Types A1, A2, A3, B1, B2, B3, C2 & E3 $n =$ 0.100	4.25	ft / sec	276.8	cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
3. Other Methods (Hey, Darcy-Weisbach, Chezy C, etc.)		ft / sec		cfs
4. Continuity Equations: a) USGS Gage Data $\bar{u} = Q / A$ Return Period for Bankfull Discharge Q = ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	1.76	ft / sec	115	cfs

Protrusion Height Options for the D_{84} Term in the Relative Roughness Relation (R/D_{84}) – Estimation Method 1

Option 1.	For **sand-bed** channels: Measure 100 **"protrusion heights"** of sand dunes from the downstream side of feature to the top of feature. Substitute the D_{84} sand dune protrusion height in ft for the D_{84} term in method 1.
Option 2.	For **boulder-dominated** channels: Measure 100 **"protrusion heights"** of boulders on the sides from the bed elevation to the top of the rock on that side. Substitute the D_{84} boulder protrusion height in ft for the D_{84} term in method 1.
Option 3.	For **bedrock-dominated** channels: Measure 100 **"protrusion heights"** of rock separations, steps, joints or uplifted surfaces above channel bed elevation. Substitute the D_{84} bedrock protrusion height in ft for the D_{84} term in method 1.
Option 4.	For **log-influenced** channels: Measure **"protrusion heights"** proportionate to channel width of log diameters or the height of the log on upstream side if embedded. Substitute the D_{84} protrusion height in ft for the D_{84} term in method 1.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

Worksheet B-1. Field Form for Level II Stream Classification (*First Field Day*).

Stream: Shaman's Branch			
Basin:	Drainage Area:	acres 3.6	mi²
Location: Section #3			
Twp.&Rge:	Sec.&Qtr.:		
Cross-Section Monuments (Lat./Long.):		Date:	
Observers: Group 3		Valley Type: C-C6	

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	31	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	2.16	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	65.2	ft²
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	14.5	ft/ft
Maximum DEPTH (d_{max}) Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and Thalweg elevations, in a riffle section.	3.07	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or ($2 \times d_{mbkf}$) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	60.5	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	1.95	ft/ft
Channel Materials (Particle Size Index) D_{50} The D_{50} particle size index represents the median or dominant diameter of channel materials, as sampled proportionately from the channel surface, between the bankfull stage and Thalweg elevations.	42	mm
Water Surface SLOPE (S) Channel slope = "rise over run" for a reach approximately 20–30 bankfull channel widths in length, with the "riffle-to-riffle" water surface slope representing the gradient at bankfull stage.	0.0375	ft/ft
Channel SINUOSITY (k) Sinuosity is an index of channel pattern, determined from a ratio of stream length divided by valley length (SL / VL); or estimated from a ratio of valley slope divided by channel slope (S_{val} / S).	1.1	

Stream Type B 4/2 **See Classification Key (Figure B-2)**

Copyright © 2015 Wildland Hydrology

Worksheet B-3a. Morphological relations, including dimensionless ratios (*First Field Day*).

Stream: Sharman's Branch Location: Washington County, MD

Observers: Team 3 Date: 4/14/15 Valley Type: C-CO Stream Type: B4/2

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, ***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios****	Mean	Min	Max
Riffle Width (W_{bkf})	29.4	27.8	31	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	59.97	54.74	65.2
Riffle Mean Depth (d_{bkf})	2.06	1.96	2.16	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	14.31	14.12	14.5
Riffle Maximum Depth (d_{max})	2.86	2.65	3.07	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.38	1.27	1.42
Width of Flood-Prone Area (W_{fpa})	73.75	60.5	87	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	2.54	1.95	3.13
Riffle Inner Berm Width (W_{ib})	13.2	13.2	13.2	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	0.43	0.43	0.43
Riffle Inner Berm Depth (d_{ib}) mean	0.49	0.49	0.49	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	0.23	0.23	0.23
Riffle Inner Berm Area (A_{ib})	6.51	6.51	6.51	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	0.10	0.10	0.10
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	26.8	26.8	26.8					

Pool Dimensions*, **, ***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios****	Mean	Min	Max
Pool Width (W_{bkfp})	27.9	25.3	30.5	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	0.90	0.82	0.98
Pool Mean Depth (d_{bkfp})	1.905	1.71	2.10	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	0.88	0.79	0.97
Pool Cross-Sectional Area (A_{bkfp})	52.57	52.11	53.02	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	0.81	0.80	0.81
Pool Maximum Depth (d_{maxp})	3.24	2.99	3.49	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	1.58	1.38	1.62
Pool Inner Berm Width (W_{ibp})	12.55	9.5	15.6	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	0.40	0.31	0.50
Pool Inner Berm Depth (d_{ibp})	1.68	0.82	0.86	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	0.78	0.38	0.39
Pool Inner Berm Area (A_{ibp})	10.63	7.85	13.4	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	0.16	0.12	0.21
Point Bar Slope (S_{pb})	—	—	—	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	7.47	11.6	18.1

Run Dimensions*	Mean	Min	Max		Run Dimensionless Ratios****	Mean	Min	Max
Run Width (W_{bkfr})				ft	Run Width to Riffle Width (W_{bkfr} / W_{bkf})			
Run Mean Depth (d_{bkfr})				ft	Run Mean Depth to Riffle Mean Depth (d_{bkfr} / d_{bkf})			
Run Cross-Sectional Area (A_{bkfr})				ft	Run Area to Riffle Area (A_{bkfr} / A_{bkf})			
Run Maximum Depth (d_{maxr})				ft	Run Max Depth to Riffle Mean Depth (d_{maxr} / d_{bkf})			
Run Width/Depth Ratio (W_{bkfr} / d_{bkfr})				ft				

Glide Dimensions*	Mean	Min	Max		Glide Dimensions & Dimensionless Ratios****	Mean	Min	Max
Glide Width (W_{bkfg})				ft	Glide Width to Riffle Width (W_{bkfg} / W_{bkf})			
Glide Mean Depth (d_{bkfg})				ft	Glide Mean Depth to Riffle Mean Depth (d_{bkfg} / d_{bkf})			
Glide Cross-Sectional Area (A_{bkfg})				ft	Glide Area to Riffle Area (A_{bkfg} / A_{bkf})			
Glide Maximum Depth (d_{maxg})				ft	Glide Max Depth to Riffle Mean Depth (d_{maxg} / d_{bkf})			
Glide Width/Depth Ratio (W_{bkfg} / d_{bkfg})				ft/ft	Glide Inner Berm Width/Depth Ratio (W_{ibg} / d_{ibg})			
Glide Inner Berm Width (W_{ibg})				ft	Glide Inner Berm Width to Glide Width (W_{ibg}/W_{bkfg})			
Glide Inner Berm Depth (d_{ibg})				ft	Glide Inner Berm Depth to Glide Depth (d_{ibg} / d_{bkfg})			
Glide Inner Berm Area (A_{ibg})				ft^2	Glide Inner Berm Area to Glide Area (A_{ibg} / A_{bkfg})			

Step**	Mean	Min	Max		Step Dimensionless Ratios****	Mean	Min	Max
Step Width (W_{bkfs})	29.38	27.8	30.9	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	0.94	0.89	0.99
Step Mean Depth (d_{bkfs})	1.57	1.53	1.61	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	0.73	0.71	0.75
Step Cross-Sectional Area (A_{bkfs})	45.3	43.1	47.5	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.69	0.66	0.72
Step Maximum Depth (d_{maxs})	2.915	2.84	2.99	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	0.95	0.92	0.97
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	19.06	17.93	20.19					

*Riffle–Pool system (i.e., C, E, F stream types) bed features include riffles, runs, pools and glides.

**Step–Pool system (i.e., A, B, G stream types) bed features include riffles, rapids, chutes, pools and steps (note: include rapids and chutes in riffle category).

***Convergence-Divergence system (i.e., D stream types) bed features include riffles and pools; cross-sections taken at riffles for classification purposes.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

Worksheet B-3b. Morphological relations, including dimensionless ratios (*First Field Day*).

Stream: Sharman's Branch Location: Washington County, MD

Observers: Team 3 Date: 4/14/15 Valley Type: C-CO-U Stream Type: B4/2

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage ($\bar{u}_{bkf}$)		ft/sec	Estimation Method		
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})		cfs	Drainage Area		mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Linear Wavelength (λ)	—	—	—	ft	Linear Wavelength to Riffle Width (λ / W_{bkf})			
Stream Meander Length (L_m)	—	—	—	ft	Stream Meander Length Ratio (L_m / W_{bkf})			
Radius of Curvature (R_c)	—	—	—	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})			
Belt Width (W_{blt})	38	36	40	ft	Meander Width Ratio (W_{blt} / W_{bkf})	1.23	1.16	1.29
Arc Length (L_a)	—	—	—	ft	Arc Length to Riffle Width (L_a / W_{bkf})			
Riffle Length (L_r)	26.5	22	31	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.85	0.71	1
Individual Pool Length (L_p)	12.3	4	23	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.397	0.129	0.742
Pool to Pool Spacing (P_s)	10.6	4	28	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	0.342	0.129	0.903

Channel Profile

Valley Slope (S_{val})	—	ft/ft	Average Water Surface Slope (S)	0.0375	ft/ft	Sinuosity (S_{val} / S)	1.1
Stream Length (SL)	160	ft	Valley Length (VL)	150	ft	Sinuosity (SL / VL)	1.1
Low Bank Height (LBH) start		ft	Max Depth (d_{max}) start		ft	Bank-Height Ratio (BHR) (LBH / d_{max}) start	
Low Bank Height (LBH) end		ft	Max Depth (d_{max}) end		ft	Bank-Height Ratio (BHR) (LBH / d_{max}) end	

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	0.041	0.032	0.065	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.31	0.88	1.73
Run Slope (S_{run})	—	—	—	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	—	—	—
Pool Slope (S_p)	0.009	0.008	0.01	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.25	0.21	0.27
Glide Slope (S_g)	—	—	—	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	—	—	—
Step Slope (S_s)	0.075	0.05	0.1	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	2.08	1.39	2.67

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.65	2.6	2.7	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.26	1.2	1.25
Max Run Depth (d_{maxrun})	—	—	—	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	—	—	—
Max Pool Depth (d_{maxp})	3.4	2.6	4.3	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	1.57	1.2	1.99
Max Glide Depth (d_{maxg})	—	—	—	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	—	—	—
Max Step Depth (d_{maxs})	2.46	1.9	3	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.14	0.88	1.39

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	2	0		D_{16}	1	24		35	mm
% Sand	15	18		D_{35}	30	45		44	mm
% Gravel	52	45		D_{50}	42	58		52	mm
% Cobble	23	41		D_{84}	120	115		150	mm
% Boulder	6	2		D_{95}	400	350		250	mm
% Bedrock	2	4		D_{100}	2700	2000		350	mm

[a] Min, max & mean depths are measured from Thalweg to bankfull at mid-point of feature for riffles, runs & steps, the deepest part of pools, & at the tail-out of glides.

[b] Composite sample of riffles and pools within the designated reach.

[c] Active bed of a riffle.

[d] Height of roughness feature above bed.

Copyright © 2015 Wildland Hydrology

TEAM #3 4/14/15

Worksheet B-4. Dimensionless ratios of the ten pool types (*First Field Day*).

Stream: Sharman's Branch Location: Reach 3

Observers: Team 3 Stream Type: B4/2 Valley Type: C-CO-V Date: 4/14/15

	Pool Type		Dimensional Values: Pool Length (L_p)	Pool Max Depth (d_{maxp})	Pool Slope (S_p)		Dimensionless Ratios: Pool Length to Riffle Width (L_p / W_{bkf})	Pool Max Depth to Riffle Mean Depth (d_{maxp}/d_{bkf})	Pool Slope to Average Slope (S_p / S)
(1)	1. Lateral Scour Pool (LSP)	Mean	20	*	*	Mean	0.645		
		Min.	20			Min.	0.645		
		Max.	20			Max.	0.645		
(1)	2. Contraction Scour Pool (CSP)	Mean	4	2.82	0.01	Mean	0.129	1.31	0.278
		Min.	4	2.82	0.01	Min.	0.129	1.31	0.278
		Max.	4	2.82	0.01	Max.	0.129	1.31	0.278
(4)	3. Step/Pool (SP)	Mean	12	3.15	0.019	Mean	0.39		
		Min.	5	2.77	0.008	Min.	0.16		
		Max.	24	3.39	0.044	Max.	0.77		
	4. Backwater Pool (BWP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			
	5. Plunge Pool (PP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			
	6. Pocket Water Pool (PWP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			
(4)	7. Lateral Protrusion Pool (LPP)	Mean	17.5	3.45	0.009	Mean	0.56	1.597	0.25
		Min.	12	2.67	0.008	Min.	0.387	5.55	0.22
		Max.	23	4.23	0.01	Max.	0.742	10.65	0.28
	8. Straight Dissipator Pool (SDP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			
	9. Converging Confluence Pool (CCP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			
	10. Compound Pool (CP)	Mean				Mean			
		Min.				Min.			
		Max.				Max.			

Copyright © 2015 Wildland Hydrology

Team #3, 4/14/15

Table B-1. List of morphological relations and variables to estimate for the ***First Field Day***.

Estimate the Following Morphological Relations and Variables			
1. Bankfull Riffle Width (W_{bkf}) (ft)	31	2. Bankfull Riffle Mean Depth (d_{bkf})	2.16
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	14.5	4. Bankfull Riffle Cross-Sectional Area (A_{bkf})	65.2
5. Width of Flood-Prone Area (W_{fpa})	60.5	6. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	1.95
7. Sinuosity (k)	1.1	8. Average Water Surface Slope (S)	0.036
9. D_{50} Particle Size for Reach	42	10. Bankfull Discharge (Q_{bkf})	276.8
11. Valley Type	C-CO-U	12. Stream Type	B4/1

Table B-2. List of morphological relations and variables to estimate for the ***Second Field Day***.

Estimate the Following Morphological Relations and Variables			
1. Bankfull Riffle Width (W_{bkf}) (ft)		2. Bankfull Riffle Mean Depth (d_{bkf})	
3. Width/Depth Ratio (W_{bkf} / d_{bkf})		4. Bankfull Riffle Cross-Sectional Area (A_{bkf})	
5. Width of Flood-Prone Area (W_{fpa})		6. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	
7. Sinuosity (k)		8. Average Water Surface Slope (S)	
9. D_{50} Particle Size for Reach		10. Bankfull Discharge (Q_{bkf})	
11. Valley Type		12. Stream Type	

Copyright © 2015 Wildland Hydrology