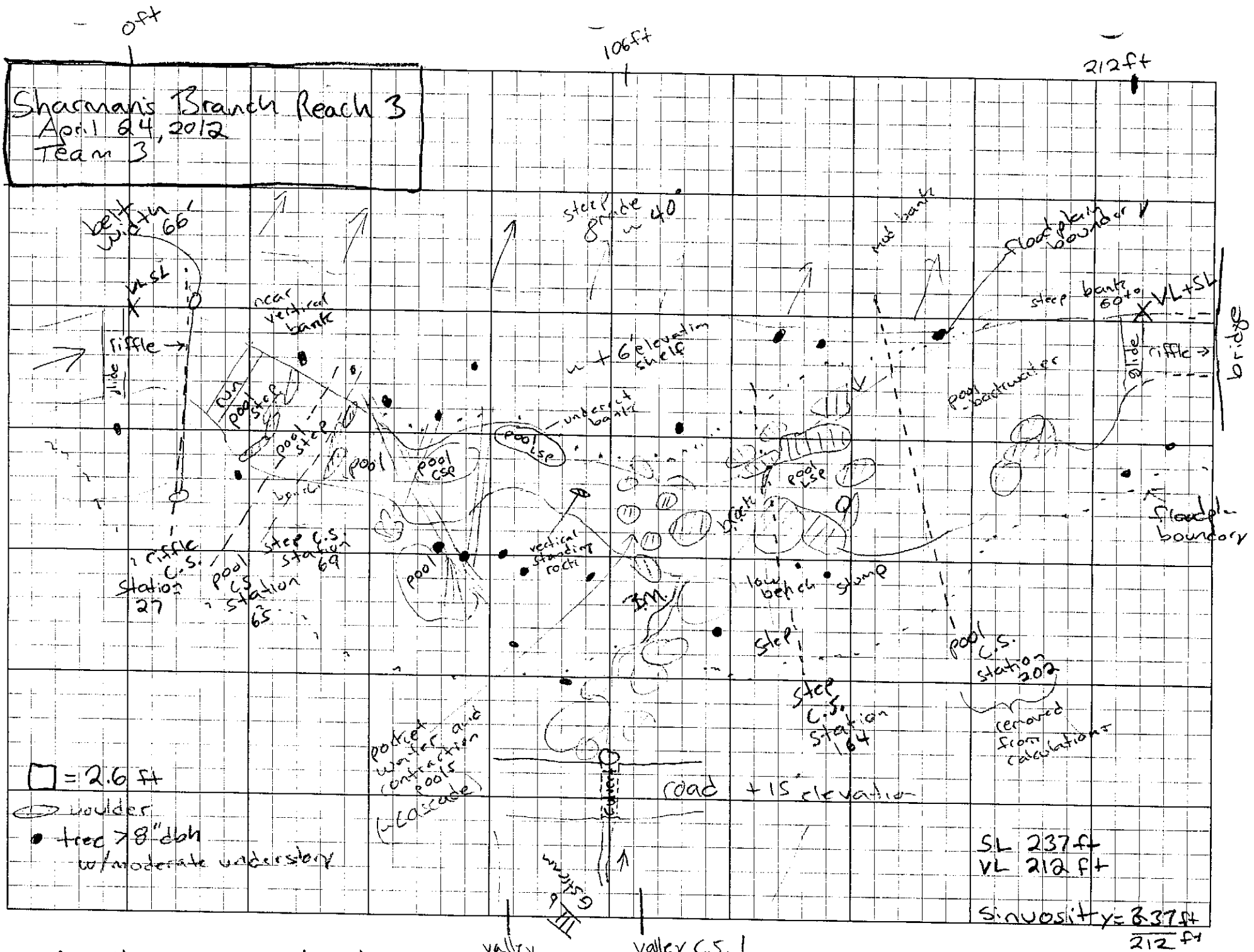
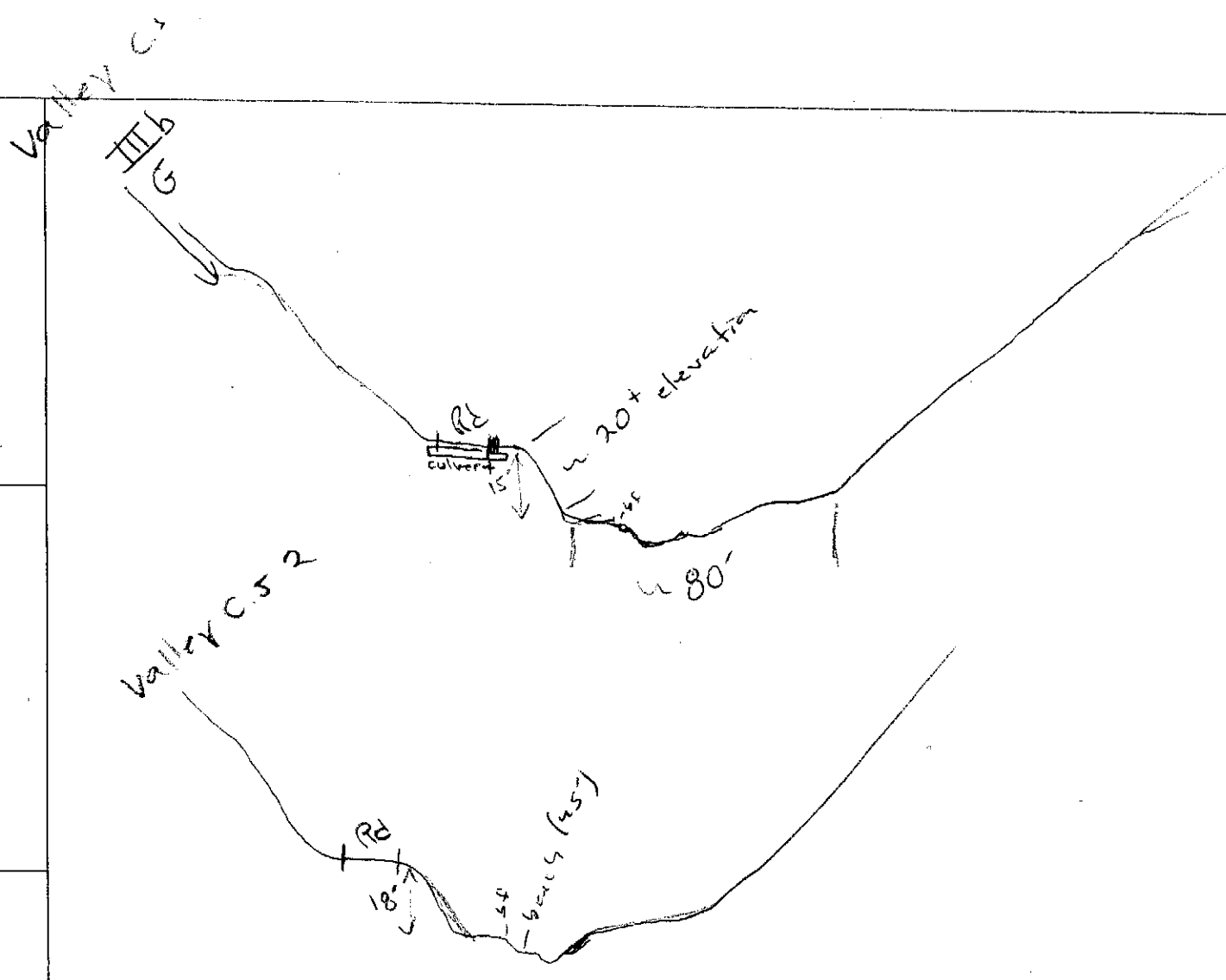


Sharman's Branch Reach 3
April 24, 2012
Team 3
0ft
106ft
212ft
belt width 66'
VL SL
riffle
near vertical bank
run
pool step
pool
pool CSP
pool LSP
underset bank
steep grade ~40°
~+6' elevation shelf
mud bank
floodplain boundary
steep bank 60+
VL+SL
riffle
bridge
glide
pool backwater
floodplain boundary
riffle C.S. station 27
pool CS station 65
step C.S. station 69
vertical standing rock
B.M.
low bench
stump
step
step C.S. station 164
pool C.S. station 202
removed from calculations
pocket water and contraction pools (~cascade)
road +15' elevation
= 2.6 ft
boulder
tree >8" dbh w/moderate understory
SL 237 ft
VL 212 ft
Sinuosity = 237 ft / 212 ft = 1.12
valley CS 2
valley C.S. 1
N
(valley cross-section) on other side

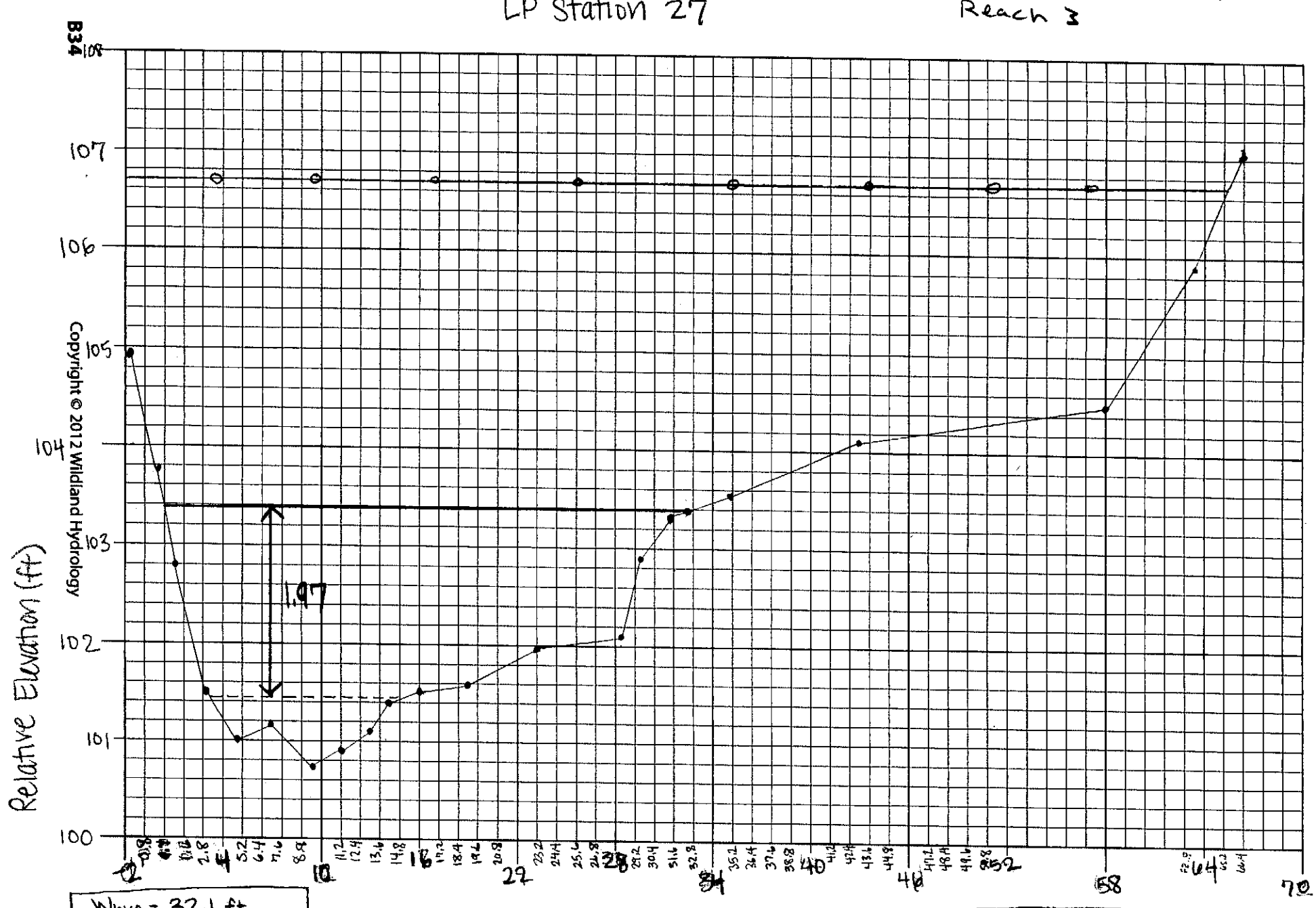


National® Brand
42-381 50 SHEETS EYE-EASE® · 5 SQUARES
42-382 100 SHEETS EYE-EASE® · 5 SQUARES
42-388 200 SHEETS EYE-EASE® · 5 SQUARES

4/24/12

Team 3 Representative Riffle Cross-Section – Sharman's Branch

LP Station 27 Reach 3



W_{bkf} = 32.1 ft
d_{bkf} = 1.68 ft
d_{max} = 2.65 ft
W_{fpa} = 70.5 ft

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SURVEY DATA → CROSS-SECTION 1

SITE: Sharman Branch **Date:** 4/24/12

Location: Team 3 - Riffle at station 27

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	66.4			4.99	107.01	
2	63.4			6.10	105.9	
3	58.0			7.51	104.49	
4	43.0			7.90	104.1	
5	35.0			8.43	103.57	
6	32.5			8.61	103.39	RBKF per DR
7	31.5			8.69	103.31	
8	29.5			9.10	102.90	
9	28.3			9.91	102.09	
10	23.2			10.02	101.98	
11	19.0			10.41	101.59	
12	16.0			10.50	101.50	
13	14.3			10.58	101.42	REW → on ground
14	12.9			10.90	101.10	
15	11.2			11.10	100.90	~~THL~~
16	9.4			11.26	100.74	THL
17	7.1			10.82	101.18	on rock
18	5.0			10.96	101.04	~~on rock~~
19	2.9			10.52	101.48	LEW → holding on H2O
20	1.1			9.22	102.78	
21	0			8.24	103.76	
22	n -1.65			7.14	104.86	At pin → left bank vertical from here
23	BM1	12.0	112		~~102~~	BM1 @ elev = 100ft
24						
25						
26						
27						
28						

Station 27 on long pro

x dmax = 15.3

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4/24/2012
REACH #3
(STATION 202 ft)

SHARMAN'S BRANCH
(POOL CROSS-SECTION)

BANKFULL
WSE

$\bar{d}$ = 3.02'
A = 99 ft²
WID = 11.3

BF-WS = 2.4

2.4

B80

ELEVATION (ft)

100
99
98
97
96
95
94
93
92

0
10
20
30
40
50
60

STATION (ft)

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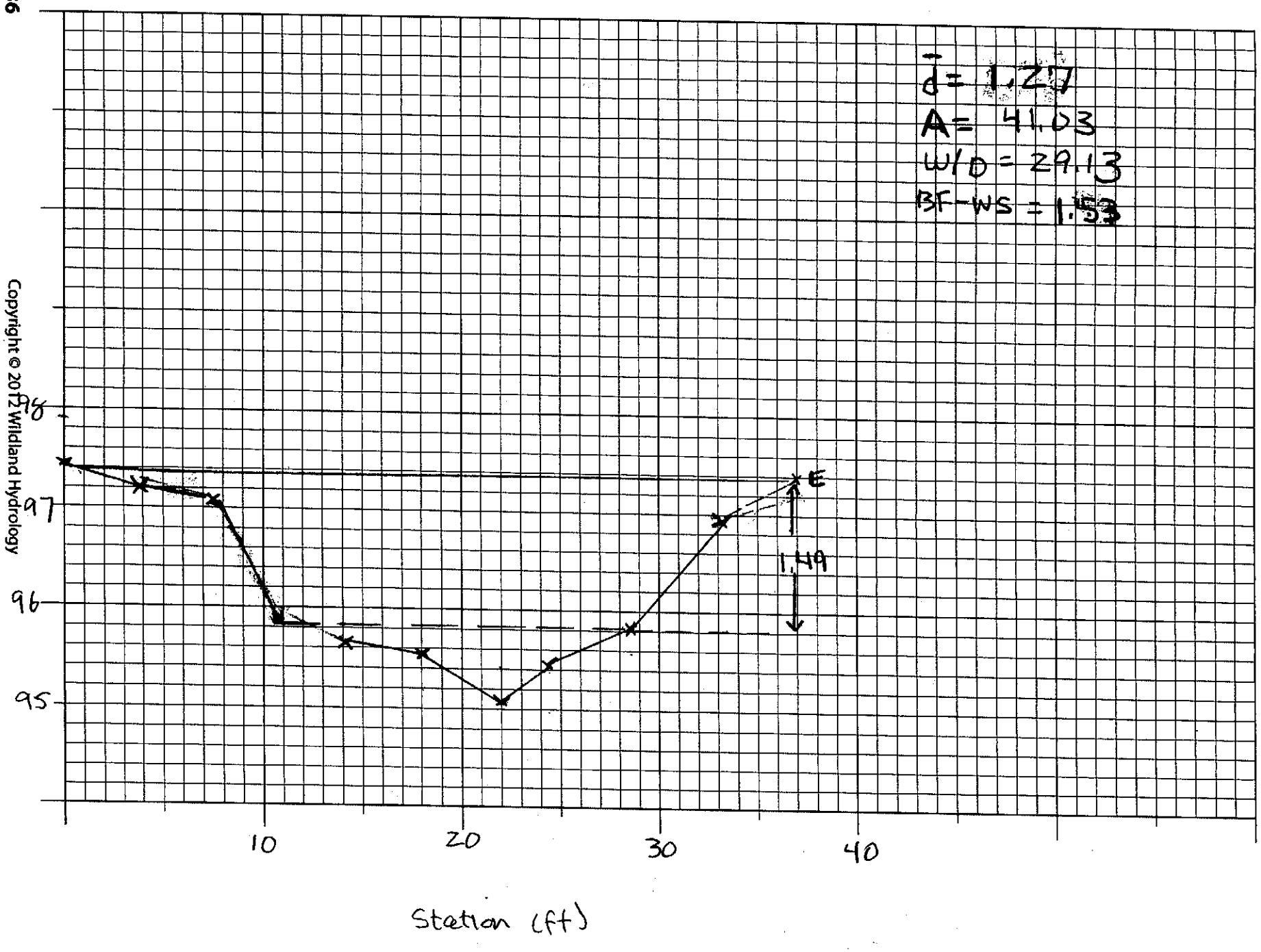
4/24/2012
Reach #3
(Station 164 ft)

Sherman's Branch
(Step Cross-Section)

— — — water surface elevation
——— bankfull

B36



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SURVEY DATA → CROSS-SECTION 2

SITE: Team 3 - Riffle Pool #2 @ Station 202 on LP Date: 4/24/12

used laser level

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS	Depth	Incremental Area
29	0			7.63	98.77		0	
30	3			7.78	98.62		Depth	Cell width
31	8			9.17	97.23	LBKF	1.30	2.42
32	11			10.12	96.28		~~0.95~~	3
33	14.4			10.83	95.57		~~1.66~~	3.4
34	15			11.59	94.81	LEW - just upstream blc rock	~~2.42~~	2.42/.6
35	20.5			13.22	93.18		4.05	5.5
36	24			13.30	93.10		3.13	3.5
37	28			13.45	92.95	THL	3.28	4
38	30			13.33	93.07		4.16	2
39	34			13.2	93.20		4.03	4
40	36.8			13.17	93.23		4	2.8
41	38			11.57	94.83	REW	2.4	1.2
42	39			10.36	96.04	on rock (boulder)	1.19	1
43	42			9.08	97.32	on rock (boulder)	0	3
44	45			7.93	98.47	on rock (boulder)		
45	50			6.56	99.84			
46								
47								
48	Bm1	6.40	106.40		100	from LP own		
49	0			8.95	97.46			
50	4			9.14	97.27			
51	7.4			9.28	97.13			
52	10.9			10.52	95.89	LEW		
53	14			10.78	95.64			
54	18			10.83	95.58	on rock		
55	22			11.30	95.11			
56	24.5			10.86	95.55			
57	28.6			10.56	95.85	REW		
58	33			9.43	96.98			
59	Bm1	6.42	106.42	~~Xs~~	100	from our own rod		

Step #1 at 164ft LP station

106.41

Team 3 Sherman's Branch

99

1,425 4,437 1,224 17.8 14.31 16.82 8.44 16.38 11.24 3.84 1.8 1,785

4.05 4.05 2.42 2.4 4.16 4.03 2.8 1.2 1 3

Bankfull: 97.38 − 95.89 = 1.49

37 E

97.4 E

2.00 water surface - bankfull TWE @ 8:10 pm

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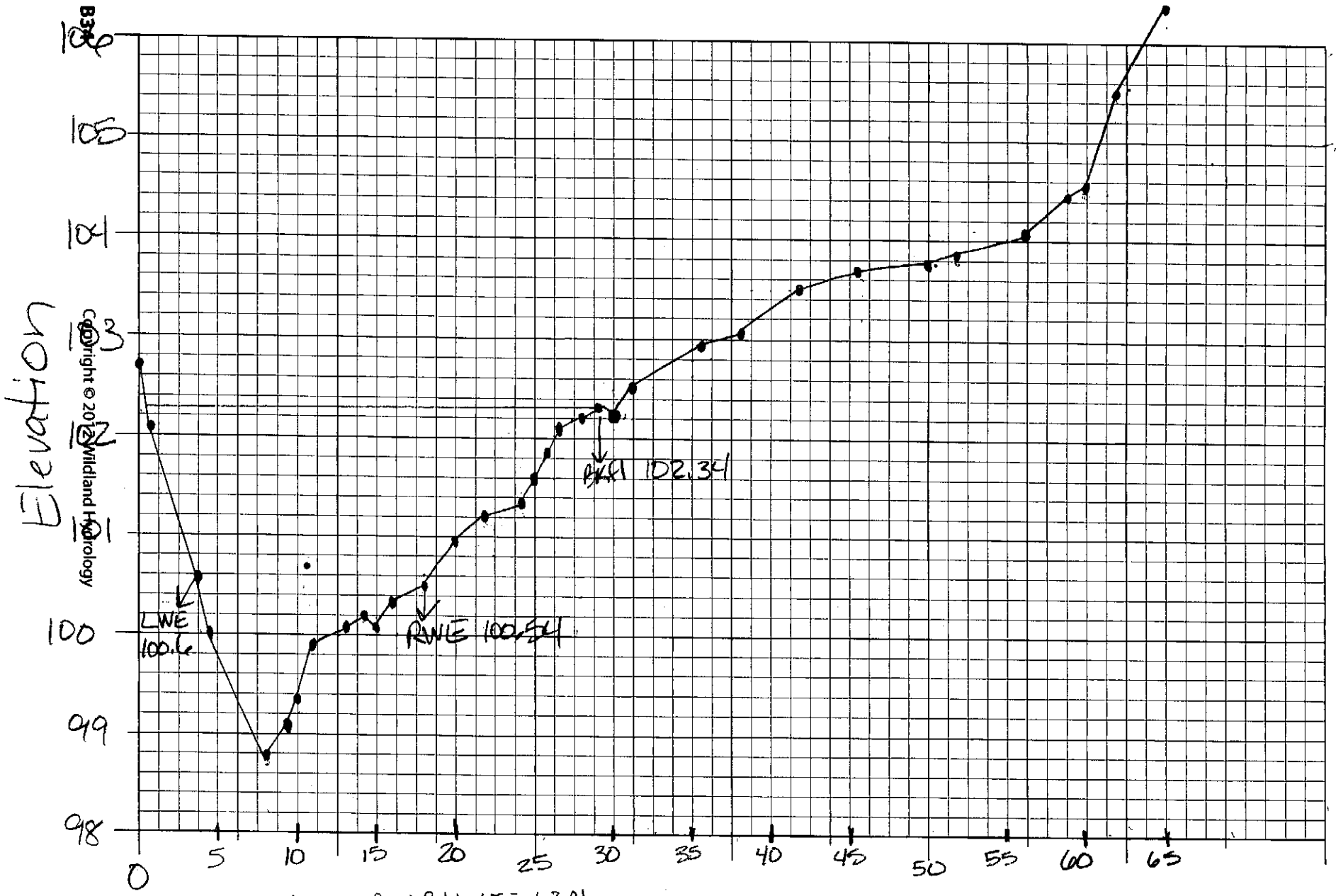
Sherman Branch - Reach 3

Pool X-section - Stn 65

4/24/12



W_{bkfl} = 27.2'

$\bar{d}_{bkfl}$ = 1.85'

A_{bkfs} = 50.23 ft2

W/D = 14.7

Backful to ws = 1.8 ft

d_{max} = 3.56 ft

1.8

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SURVEY DATA Reach 3 → **CROSS - SECTION** 1

SITE: Pool X-section Date: 4/24/12

Location: Stn 65

Party / Notes: used site level 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	BM	12	112.0		100	
2						
3	65			5.59	106.41	
4	62			6.5	105.5	
5	60			7.3	104.7	
6	58			7.52	104.48	
7	56			7.84	104.16	
8	53			8.11	103.89	
9	50			8.25	103.75	
10	46			8.34	103.66	
11	42			8.48	103.52	
12	38			8.91	103.09	
13	36			9.11	102.89	
14	32			9.49	102.51	
15	30			9.78	102.22	
16	29			9.76	102.24	
17	27.7			9.66	102.34	BKfl
18	27			9.8	102.2	
19	26.6			9.89	102.11	
20	26			10.16	101.84	
21	25			10.4	101.6	
22	24			10.68	101.32	
23	22			10.8	101.2	
24	20			11.09	100.91	(inner berm?)
25	18.4			11.46	100.54	rt water
26	16			11.73	100.27	
27	15			11.87	100.13	
28	14			11.79	100.21	on a rock

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SURVEY DATA ⟹ CROSS - SECTION 2

SITE: Date:

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29	13			11.94	100.06	
30	11.6			12.17	99.83	
31	10			12.63	99.37	
32	9			12.89	99.11	
33	8			13.2	98.8	
34	7			13.22	98.78	pool max
35	4.3			12.0	100	
36	3.8			11.4	100.6	1ft water
37	.7			9.9	102.1	
38	0			9.22	102.78	
39						
40						
41						
42						
43	Bkfl width 27.7 - .5 = 27.2'					
44	A = 50.225					+ Table B-5 (pg B30) + B7
45	$\bar{d}$ = 50.225/27.2 = 1.85					
46	w/d = 14.7					
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

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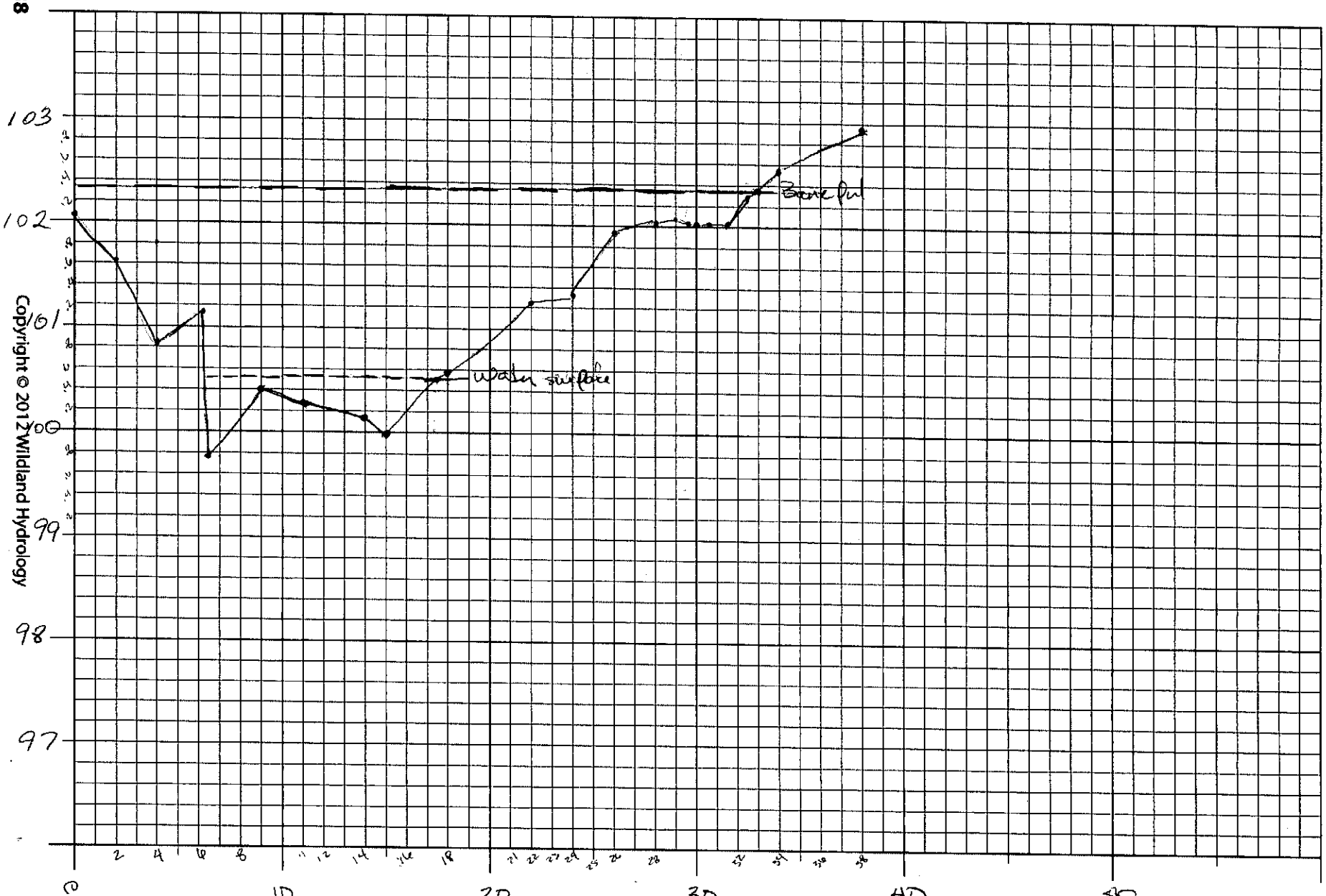
Sherman's Branch - Reach 3
Step Cross-Section
Stn 49

4/24/12



$W_{bkfl} = 33.0 ft$
$d_{bkfl} = 1.27 ft$
$A_{bkfs} = 41.85 ft^2$
$W/D = 26.02$

Bankful to WS = 1.9 ft
$d_{max} = 2.6 ft$

Width @ bkfl = 33*
*full ht on left was not surveyed based on revised bankfull.

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SURVEY DATA → **CROSS-SECTION** 4

SITE: Step Cross-Section Sherman's Branch - Reach 3 Stn 69 Date: 4/24/12

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
29		12	112		100	
30	38			9.03	102.97	
31	34			9.43	102.57	
32	33			9.62	102.38	BkfA
33	32.6			9.74	102.26	
34	31.6			9.99	102.01	
35	30.6			9.99	102.01	
36	30			9.98	102.02	
37	29.6			9.99	102.01	
38	29			9.92	102.08	
39	28			9.92	102.08	
40	26			10.12	101.88	
41	24			10.46	101.54	
42	22			10.74	101.26	
43	18			11.41	100.59	
44	17.3			11.52	100.48	RWE
45	15			12	100.00	
46	14			11.84	100.16	
47	11			11.75	100.25	
48	9			11.6	100.40	
49	6.2			12.22	99.78	beside rock
50	6.1			10.86	101.14	on rock
51	4			11.19	100.81	
52	2			10.39	101.61	
53	0			9.94	102.06	
54						
55	W_{BKFS} = 33.0 ft					
56	d_{BKFS} = 1.87 ft					
57	A_{BKFS} = 41.85 ft^2					
58	d_{max} = 2.68					
59	W/d = 26.02					

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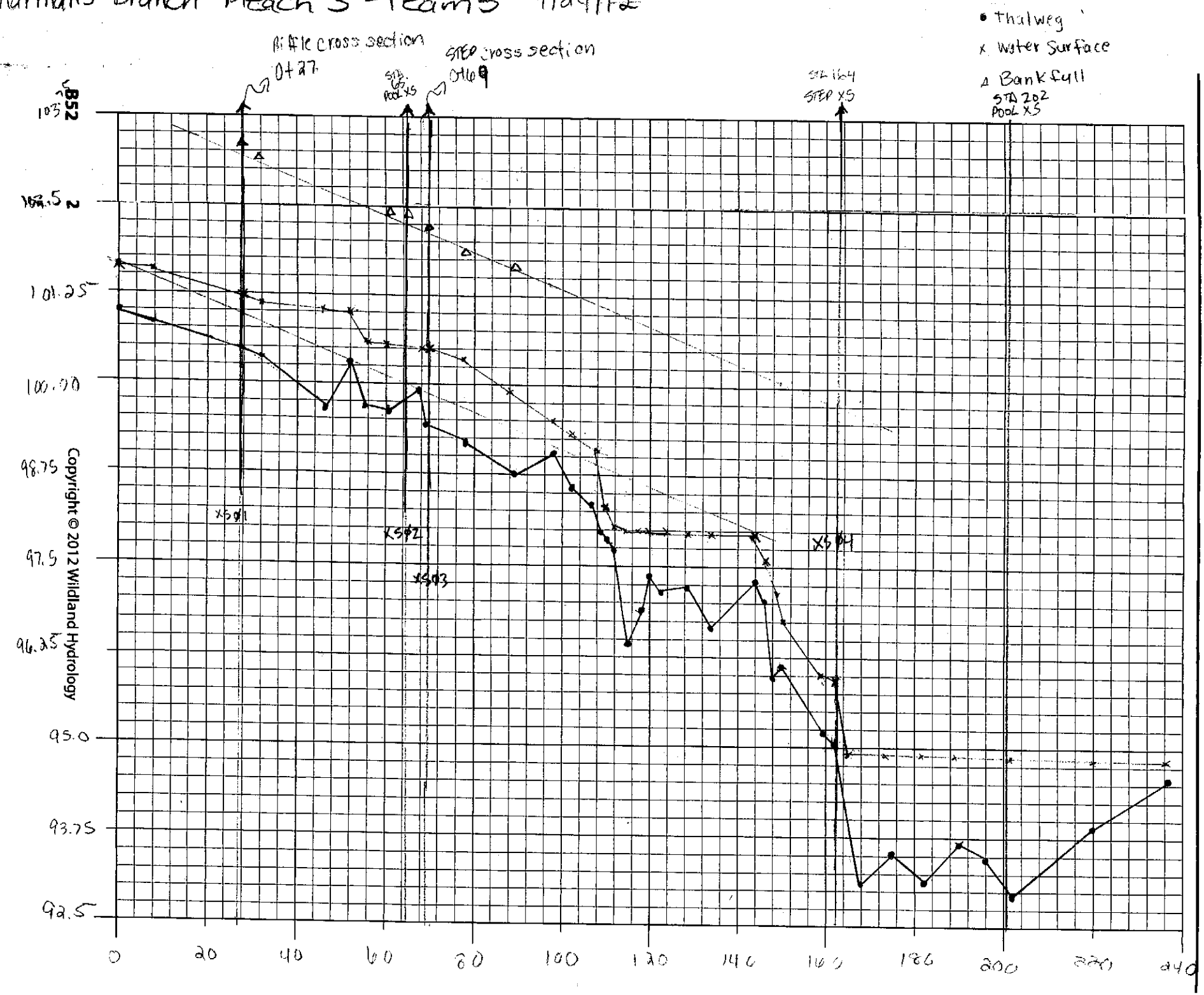
Sharmans Branch - Reach 3 - Team 3 4/24/12



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SURVEY DATA → LONGITUDINAL PROFILE 3

SITE: Sharmans Branch **Date:** 4/24/12

Location: Reach 3

Party / Notes: Team 3 HUC:

	Distance, Point, or	Back-Sight	Height of Instrument	Thalweg		Water Surface		Bankfull		Low Bank HI		NOTES
				Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	e.g. Riffle Run Pool Glide
	STATION	BS	HI	FS	Elev.	FS	Elev.	FS	Elev.	FS	Elev.	
	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
55	0+00		106.41	5.41	101.00	4.72	101.69					
56	0+07			5.61	100.8	4.83	101.58					
57	0+27			5.92	100.49	5.19	101.22	3.03	103.38			Riffle X-sxn (2.16) (2.04)
58	0+33			6.02	100.39	5.28	101.13	3.24	103.17			
59	0+46			6.77	99.64	5.33	101.08					
60	0+52			6.12	100.29	5.33	101.08					
61	0+55			6.71	99.70	5.81	100.6	4.12?	102.29			(1.69)
62	0+61			6.83	99.58	5.84	100.57	4.03	102.38			(1.81)
63	0+65					5.88	100.53	4.03	102.38			pool X-sxn (1.85)
64	0+67			6.52	99.89	5.88	100.53	~~4.03~~				pocket pool ~~X-sxn~~
65	0+69			7.05	99.36	5.99	100.42	4.27	102.14			step X-sxn (1.72)
66	0+77.5			7.22	99.19	6.45	99.96	4.58	101.83			(1.87)
67	0+89			7.66	98.75	6.57	99.84	4.75	101.66			(1.82)
68	0+98			7.35	99.06	6.88	99.53	4.63	101.78			
69	1+02			7.85	98.56	7.12	99.29					
70	1+07			7.84	98.57	7.37	99.04					
71	1+08.5			8.42	97.99	7.87	98.54					
72	1+10			8.59	97.82	8.13	98.28					
73	1+12			8.71	97.70	8.31	98.1					
74	1+15			9.72	96.38	8.31	98.1					
75	1+17.5			9.48	96.93	8.31	98.1					
76	1+20.4			9.08	97.33	8.38	98.03					
77	1+23			9.22	97.19	8.47	97.94					
78	1+29			9.18	97.23	8.47	97.94					
79	1+34			9.72	96.69	8.51	97.9					
80	1+44			9.13	97.28	8.48	97.93					
81	1+46			9.34	97.05	8.83	97.58					

BM 1 + 2 = 6.41'

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SURVEY DATA → LONGITUDINAL PROFILE 4

SITE: Sharmans Branch Date: 4/24/12

Location: Reach 3

Party / Notes: Team 3 HUC:

	Distance, Point, or	Back-Sight	Height of Instru-ment	Thalweg		Water Surface		Bankfull		Low Bank HI		NOTES
				Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	Fore-Sight	Elevation	e.g. Riffle Run Pool Glide
	STATION	BS	HI	FS	Elev.	FS	Elev.	FS	Elev.	FS	Elev.	
	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	
82	1+48			10.43	95.98	9.28	97.13					
83	1+50			10.29	96.12	9.39	97.02					
84	1+59			11.21	95.20	10.54	95.87					pocket pool
85	1+62			11.25	95.06	10.61	95.8					pocket pool
86	1+64			10.43	95.98	10.43	95.98	9.03	97.38			step x-sxn (2.40)
87	1+68			13.29	93.12	11.45	94.96					
88	1+74.6			12.89	93.52	11.45	94.96					
89	1+82			13.24	93.17	11.45	94.96					
90	1+90			12.74	93.67	11.53	94.88					
91	1+96			13.04	93.47	11.60	94.81					
92	2+02			13.52	92.89	11.55	94.86	9.19	97.22			pool x-sxn (2.36 2.51)
93	2+20			12.53	93.88	11.56	94.85					
94	2+37			11.83	94.58	11.56	94.85					
95												
96												
97												
98												
99												
100												
101												
102												
103												
104												
105												
106												
107												
108												

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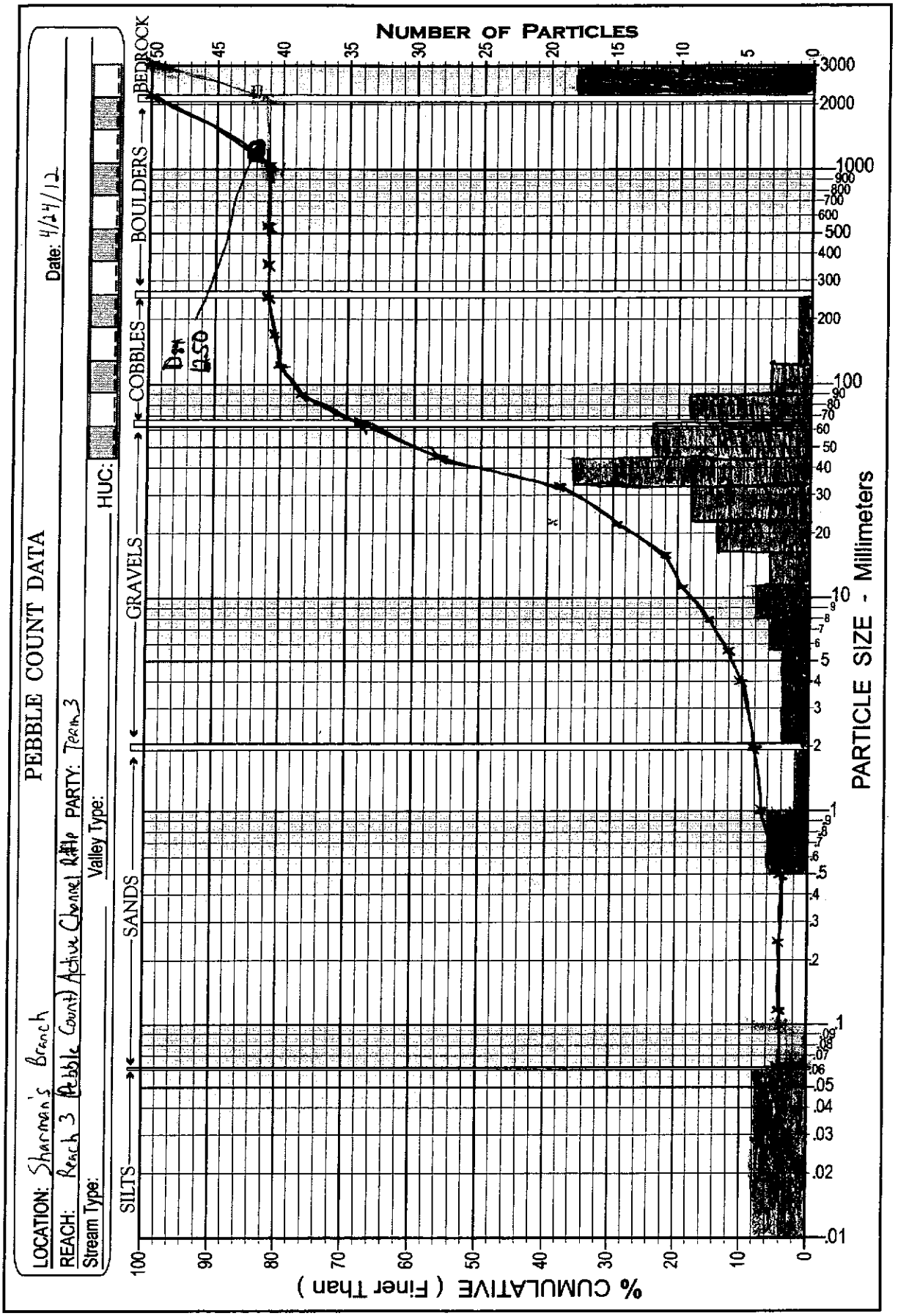
6.84



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Site: Sharman's Branch Date: 4-24-2012

Location: Reach 3 (Pebble Ct.) HUC:

Party: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1 / POOL 2 / COMP. 3	RIFFLE (1) TOT #	RIFFLE (1) ITEM %	RIFFLE (1) % CUM	POOL (2) TOT #	POOL (2) ITEM %	POOL (2) % CUM	COMPOSITE (3) TOT #	COMPOSITE (3) ITEM %	COMPOSITE (3) % CUM
					Reach: 00+00 – 54+00			Reach:			Reach:		
					Date: 4/24/12			Date:			Date:		
	Silt / Clay	< .062	S/C	:	4	4	4						
	Very Fine	.062 - .125	SAND										
	Fine	.125 - .25	SAND										
	Medium	.25 - .50	SAND										
	Coarse	.50 - 1.0	SAND	:	3	3	7						
.04 - .08	Very Coarse	1.0 - 2	SAND	.	1	1	8						
.08 - .16	Very Fine	2 - 4	GRAVEL	.	2	2	10						
.16 - .22	Fine	4 - 5.7	GRAVEL	.	2	2	12						
.22 - .31	Fine	5.7 - 8	GRAVEL	:	3	3	15						
.31 - .44	Medium	8 - 11.3	GRAVEL	:	4	4	19						
.44 - .63	Medium	11.3 - 16	GRAVEL	:	3	3	22						
.63 - .89	Coarse	16 - 22.6	GRAVEL	⌑	7	7	29						
.89 - 1.3	Coarse	22.6 - 32	GRAVEL	⌑	9	9	38						
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	⌑ ⌑	18	18	56						
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	⌑ :	12	12	68						
2.5 - 3.5	Small	64 - 90	COBBLE	⌑	9	9	77						
3.5 - 5.0	Small	90 - 128	COBBLE	:	3	3	80						
5.0 - 7.1	Large	128 - 180	COBBLE	.	1	1	81						
7.1 - 10.1	Large	180 - 256	COBBLE	.	1	1	82						
10.1 - 14.3	Small	256 - 362	BOULDER										
14.3 - 20	Small	362 - 512	BOULDER										
20 - 40	Medium	512 - 1024	BOULDER										
40 - 80	Large-Vry Large	1024 - 2048	BOULDER										
	Bedrock		DRK	⌑ ⌑	18	18	100						
Stream Type:			***Valley Type:***		TOTAL→	100							

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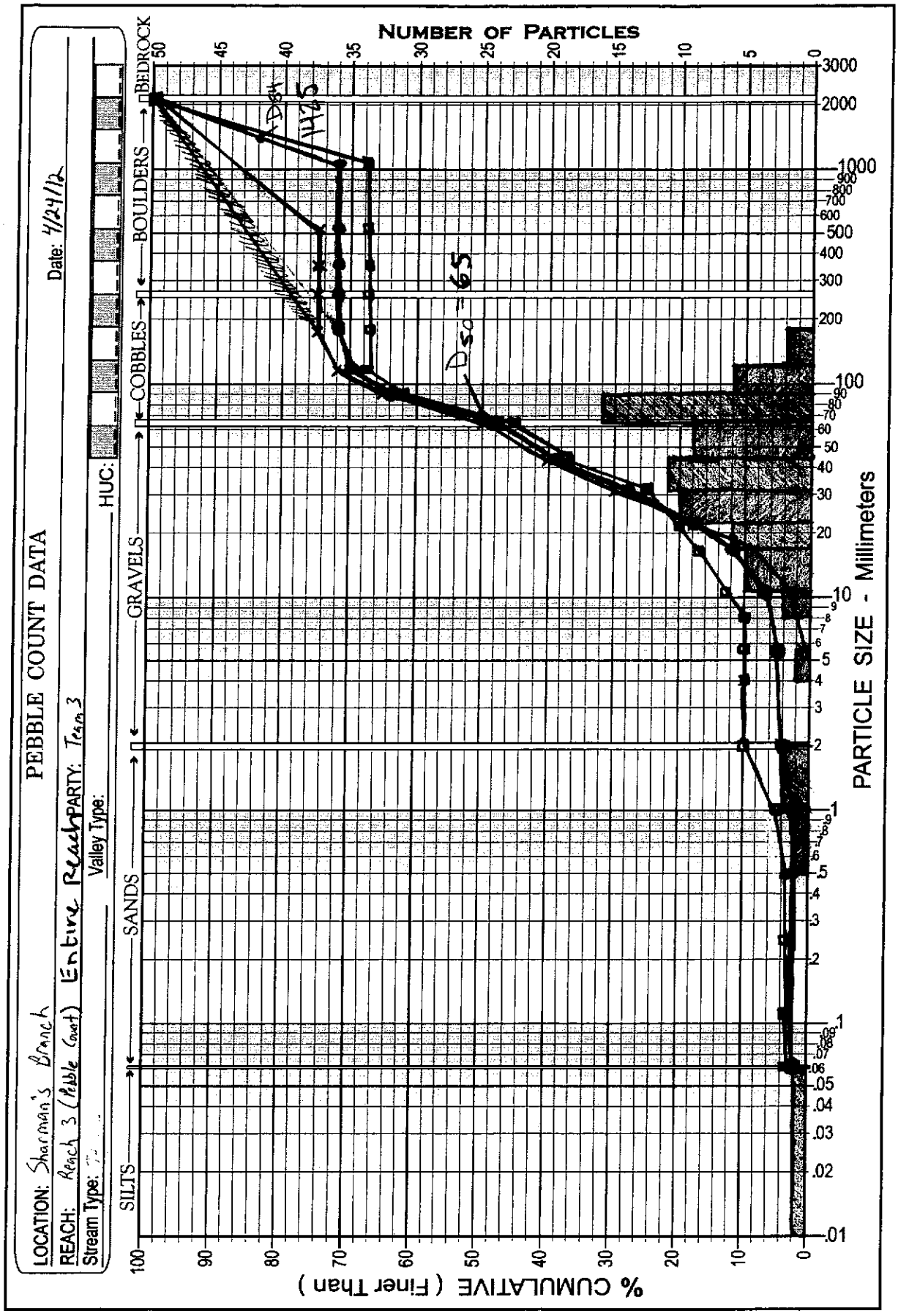

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Site: Sharman's Branch Date: 4-24-2012

Location: Reach 3 HUC:

Party: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	RIFFLE (1) ITEM %	RIFFLE (1) % CUM	POOL (2) TOT #	POOL (2) ITEM %	POOL (2) % CUM	COMPOSITE (3) TOT #	COMPOSITE (3) ITEM %	COMPOSITE (3) % CUM
							Reach: Rep.			Reach: Rep.			Reach: Rep.		
							Date: 4/24/12			Date: 4/24/12			Date: 4/24/12		
	Silt / Clay	< .062	S/C		•	•				1	2.5	2.5	1	1	1
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0			•	•				1	2.5	5	1	1	2
.04 - .08	Very Coarse	1.0 - 2			••	••				2	5	10	2	2	4
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7		•		•	1	1.67	1.67				1	1	5
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3		•	•	••	1	1.67	3.34	1	2.5	12.5	2	2	7
.44 - .63	Medium	11.3 - 16		••	••	•••	3	5	8.34	2	5	17.5	5	5	12
.63 - .89	Coarse	16 - 22.6		•••	••	•••	5	8.33	16.67	1	2.5	20	6	6	18
.89 - 1.3	Coarse	22.6 - 32		▫	••	▪	8	13.33	30.00	2	5	25	10	10	28
1.3 - 1.8	Very Coarse	32 - 45		•••	•••	▪•	6	10	40.00	5	12.5	37.5	11	11	39
1.8 - 2.5	Very Coarse	45 - 64		•••	•••	▪	6	10	50.00	3	7.5	45	9	9	48
2.5 - 3.5	Small	64 - 90	COBBLE	▪	•••	▪••	9	15	65.00	7	17.5	62.5	16	16	64
3.5 - 5.0	Small	90 - 128		•••	••	•••	4	6.67	71.67	2	5	67.5	6	6	70
5.0 - 7.1	Large	128 - 180		••		••	2	3.33	75.00				2	2	72
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK	▪ •••	▪ ••	▪ ▪ ▫	15	25	100	13	32.5	100	28	28	100
Stream Type:			**Valley Type:**			TOTAL→	60			40			100		

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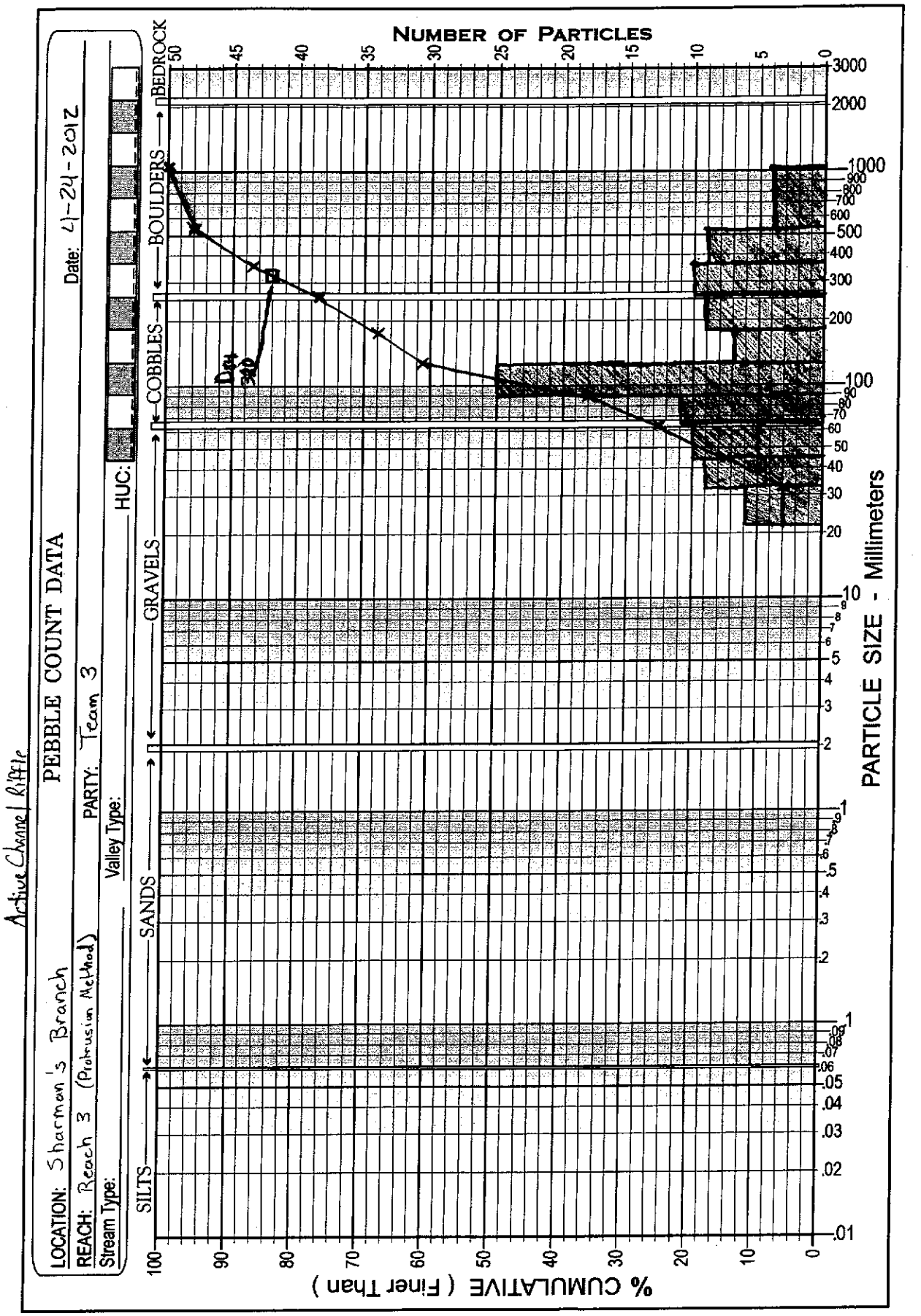

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Site: Sharman's Branch Date: 4-24-2012

Location: Reach 3 (Protrusion) HUC:

Party: Team 3

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: 00+00-54+00 Date: 4/24/12 TOT #	ITEM %	% CUM	POOL (2) Reach: Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL												
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16													
.63 - .89	Coarse	16 - 22.6													
.89 - 1.3	Coarse	22.6 - 32		1			6	6	6						
1.3 - 1.8	Very Coarse	32 - 45		2			9	9	15						
1.8 - 2.5	Very Coarse	45 - 64		2			10	10	25						
2.5 - 3.5	Small	64 - 90	COBBLE	2			11	11	36						
3.5 - 5.0	Small	90 - 128		3			25	25	61						
5.0 - 7.1	Large	128 - 180		1			7	7	68						
7.1 - 10.1	Large	180 - 256		2			9	9	77						
10.1 - 14.3	Small	256 - 362	BOULDER	2			10	10	87						
14.3 - 20	Small	362 - 512		2			9	9	96						
20 - 40	Medium	512 - 1024		3			4	4	100						
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		DR												

Stream Type: **Valley Type:** TOTAL→ 100

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

Stream:	SHARMANS BRANCH		Location:	REACH 3	
Date:	4.24.12	Stream Type: B3/1	Valley Type:	VIII B	
Observers:	TEAM 3		HUC:		

Bankfull Riffle Cross-Sectional AREA	53.15	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.68	d_{bkf} (ft)
Bankfull Riffle WIDTH	32.1	W_{bkf} (ft)	Wetted PERMIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	35.46	W_p (ft)
D_{84} at Riffle	1250pbl / 320 ppr	Dia. (mm)	D_{84} (mm) / 304.8	4.10 / 1.05	D_{84} (ft)
Bankfull SLOPE	.026	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.50	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	.37 / 1.43	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	1.12	u^* (ft/sec)

ESTIMATION METHODS			VELOCITY		DISCHARGE	
1. Friction Factor / Relative Roughness	$u = [2.83 + 5.66 * Log(R / D_{84})] u^*$		0.4 / 4.15	ft / sec	21.26 / 206	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. B-34, B-35)	$u = 1.49 * R^{2/3} * S^{1/2} / n$	$n =$ 0.2 / 0.07	1.57 / 4.5	ft / sec	83.4 / 239	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36)	$u = 1.49 * R^{2/3} * S^{1/2} / n$	$n =$ 0.058	5.43	ft / sec	288.5	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): 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	$u = 1.49 * R^{2/3} * S^{1/2} / n$ $n = 0.39 * S^{0.38} * R^{-0.16}$	$n =$ 0.09	3.5	ft / sec	185.9	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 Return Period for Bankfull Discharge	$u = Q / A$	Q = ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves	$u = Q / A$	$Q = 120$ $DA \geq 3.6$	2.26	ft / sec	120	cfs

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.

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

Stream: SHARMANS BRANCH			
Basin: POTOMAC	Drainage Area:	acres 3.6	mi^2
Location: REACH 3			
Twp.&Rge: SHARPSBURG – WASHINGTON CO,	Sec.&Qtr.:		
Cross-Section Monuments (Lat./Long.):		Date: 4.24.12	
Observers: TEAM 3		Valley Type: VIII B	

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	32.1	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.68	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	53.15	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	19.16	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.	2.65	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.	70.5	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	2.20	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.	65	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.	.026	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).	1.12	

Stream Type [redacted] **See Classification Key (Figure B-2)**

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

Stream: Sharman's Br. Location: Reach 3

Observers: TEAM 3 Date: 4/24/12 Valley Type: VIII b Stream Type: B3/1

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage (u_{bkf})	3.5	ft/sec	Estimation Method	JARRETT	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	185.9	cfs	Drainage Area	3.6	mi^2

Channel Pattern

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})	606	606	606	ft	Meander Width Ratio (W_{blt} / W_{bkf})	2.05		
Arc Length (L_a)				ft	Arc Length to Riffle Width (L_a / W_{bkf})			
Riffle Length (L_r)	23	19	27	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.72	0.59	0.84
Individual Pool Length (L_p)	21	12	32	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.65	0.37	1.00
Pool to Pool Spacing (P_s)	24	3	45	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	0.75	0.09	1.40

Channel Profile

Valley Slope (S_{val})	.029	ft/ft	Average Water Surface Slope (S)	0.026	ft/ft	Sinuosity (S_{val} / S)		1.12
Stream Length (SL)	237	ft	Valley Length (VL)	212	ft	Sinuosity (SL / VL)		1.12
Low Bank Height (LBH)	start	ft	Max Depth (d_{max})	start	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start	
	end	ft		end	ft		end	

Riffle Slope (S_{rif})	0.04	0.07	0.07	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.65	0.65	2.69
~~Run~~ Slope (S_{run}) Cascade	0.14	0.12	0.12	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	4.385	4.385	4.385
Pool Slope (S_p)	0.004	0.003	0.004	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.154	0.115	0.23
Glide Slope (S_g)	3.5	3	4	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)			
Step Slope (S_s)	0.08	0.05	0.50	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	3.346	0.962	1.923

Max Riffle Depth (d_{maxrif})	2.62	2.34	2.90	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.56	1.39	1.73
Max ~~Run~~ Depth (d_{maxrun})	4.165	4.165	4.165	ft	Max ~~Run~~ Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	2.77	2.77	2.77
Max Pool Depth (d_{maxp})	3.01	2.72	3.25	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	1.79	1.62	1.93
Max Glide Depth (d_{maxg})				ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})			
Max Step Depth (d_{maxs})	2.56	1.33	4.00	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.52	0.79	2.38

Cascade

Channel Materials

% Silt/Clay	1	4		D_{16}	21	9	46	mm
% Sand	3	4		D_{35}	38	29	87	mm
% Gravel	44	60		D_{50}	65	40	107	mm
% Cobble	24	14		D_{84}	1450	1250	320	mm
% Boulder	0	0		D_{95}	1900	1900	510	mm
% Bedrock	28	18		D_{100}	2048	2048	1024	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.

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

Stream: Sharman's Branch | Location: Reach 3

Observers: Team 3 | Date: 4/24/12 | Valley Type: VIII B | Stream Type: B 3/1

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, *

Riffle Width (W_{bkf})	32.1	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	53.15
Riffle Mean Depth (d_{bkf})	1.68	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	19.16
Riffle Maximum Depth (d_{max})	2.65	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.58
Width of Flood-Prone Area (W_{fpa})	70.5	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	2.20
Riffle Inner Berm Width (W_{ib})		ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	
Riffle Inner Berm Depth (d_{ib})		ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	
Riffle Inner Berm Area (A_{ib})		ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})				

Pool Dimensions*, **, *

Pool Width (W_{bkfp})	27.2	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	0.85
Pool Mean Depth (d_{bkfp})	1.85	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	1.10
Pool Cross-Sectional Area (A_{bkfp})	50.2	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	0.94
Pool Maximum Depth (d_{maxp})	3.56	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.12
Pool Inner Berm Width (W_{ibp})		ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	
Pool Inner Berm Depth (d_{ibp})		ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	
Pool Inner Berm Area (A_{ibp})		ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	
Point Bar Slope (S_{pb})		ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	

Run Dimensions*

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*

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**

Step Width (W_{bkfs})	36	33	37	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	1.09	1.03	1.15
Step Mean Depth (d_{bkfs})	1.27	1.27	1.27	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	0.76	0.76	0.76
Step Cross-Sectional Area (A_{bkfs})	41.44	41.03	41.85	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	0.78	0.77	0.79
Step Maximum Depth (d_{maxs})	2.44	2.27	2.6	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	1.45	1.35	1.55
Step Width/Depth Ratio (W_{bkfs}/d_{bkfs})	27.58	26.02	29.13					

*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.

Step #1

W_{bkfs} = 33.0

d_{bkfs} = 1.27

A_{bkfs} = 41.85

d_{max} = 2.6

W/D: 26.02

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