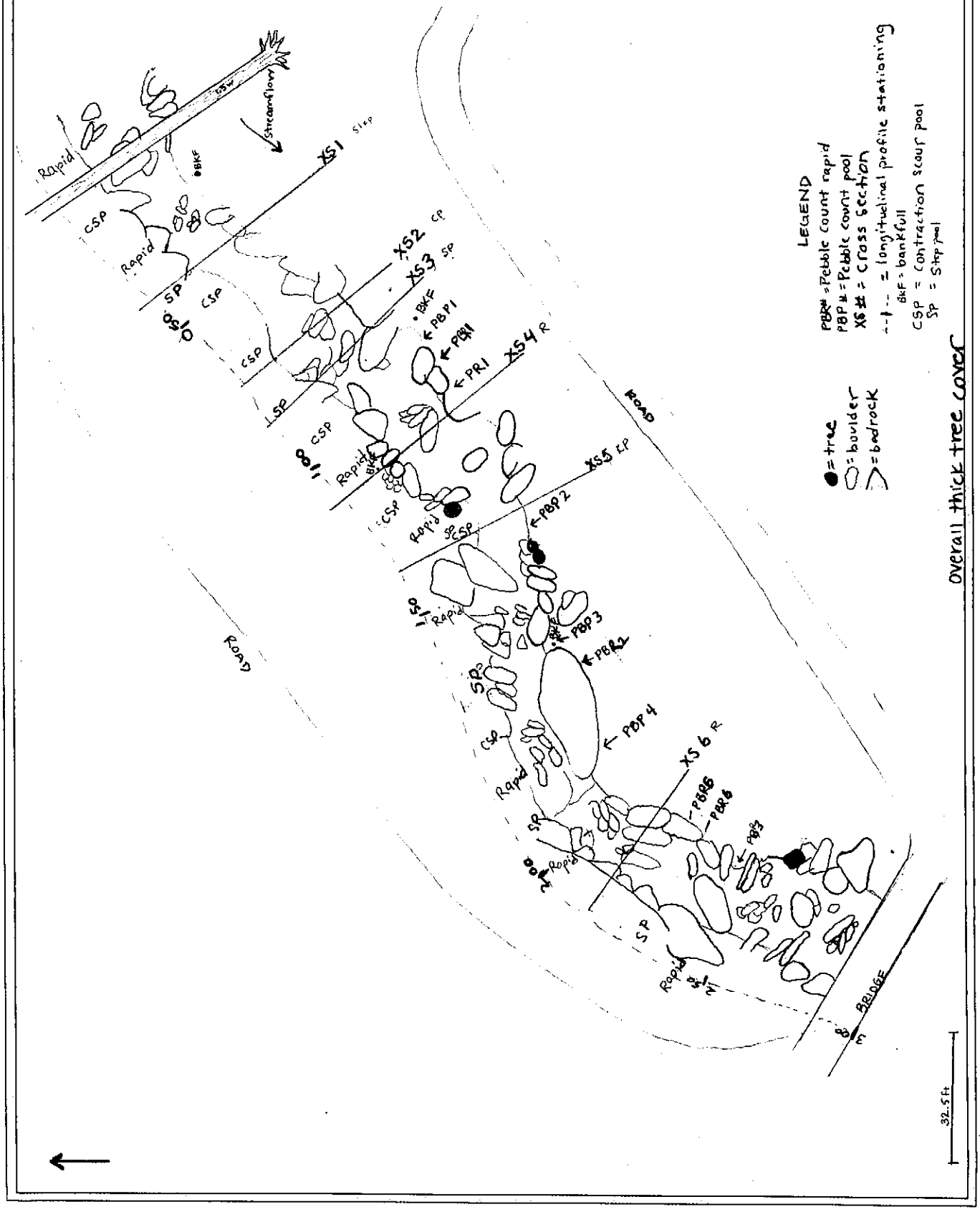
AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Sharman's Branch Washington Co MD Site/Reach: 1

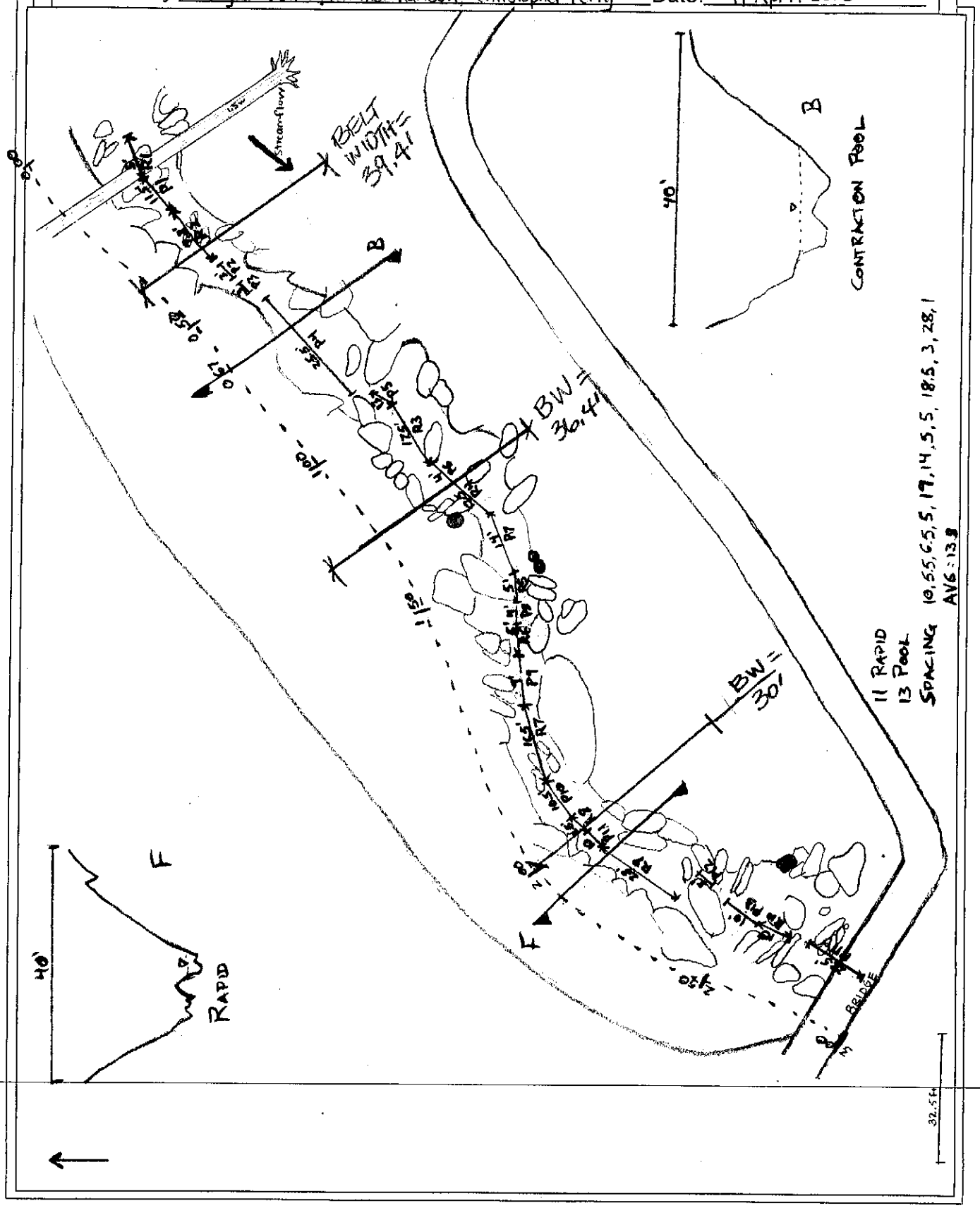
Drawn By: Megan Bean, Heather Hanson, Christopher Perry Date: 19 April 2016



AREA-SITE LOCATION....REACH MAP

Stream/Drainage: Sharman's Branch Washington Co MD Site/Reach: 1

Drawn By: Megan Bean, Heather Hanson, Christopher Perry Date: 19 April 2016



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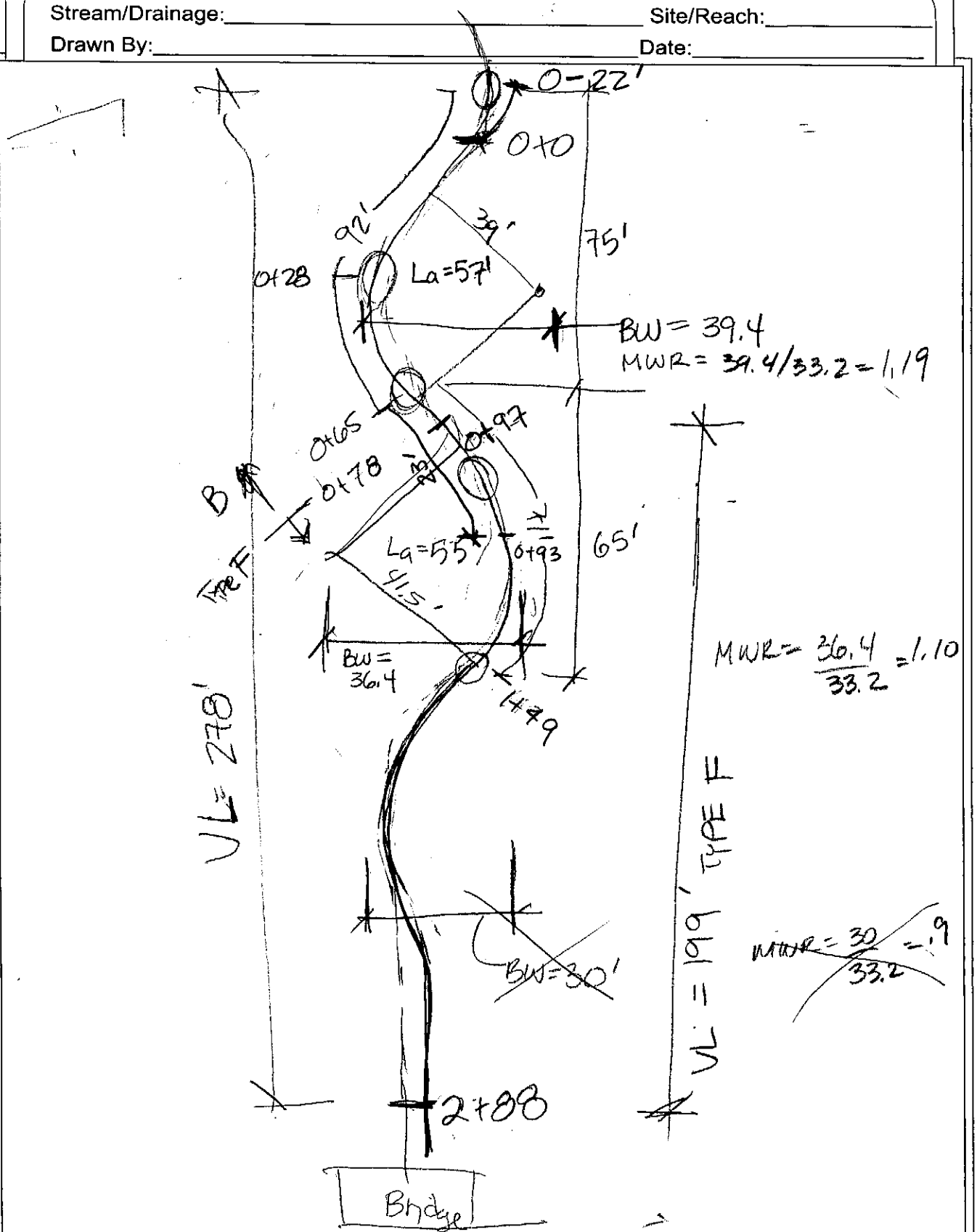
AREA-SITE LOCATION....REACH MAP

Stream/Drainage:_____ Site/Reach:_____

Drawn By:_____ Date:_____



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SURVEY DATA ⟹ **CROSS - SECTION** 5

SITE: SHARMAN CREEK TEAM 1 LP = 40.8 Date: 04/19/2016

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	9.44	109.44			
2	0+0			5.41	104.03	
3	0+5			7.06	102.38	
4	0+20			8.29	101.15	
5	0+25			9.48	99.96	
6	0+28.4			10.26	99.18	
7	0+30.7			10.22	99.22	
8	0+31.3			10.69	98.75	
9	0+31.9			10.99	98.45	Left edge water side channel
10	0+33.3			11.21	98.23	
11	0+34			10.67	98.77	EWater
12	0+34.7			10.14	99.3	~~edge water main channel~~
13	0+35.5			10.63	98.81	
14	0+36.1			10.88	98.56	
15	0+37.2			10.78	98.66	
16	0+39			11.42	98.02	low point
17	0+39.8			10.36	99.08	BFR
18	0+42.2			10.30	99.14	
19	0+42.7			10.75	98.69	
20	0+43			10.96	98.48	~~BFR~~ low point side channel
21	0+43.4			10.72	98.72	edge water
22	0+47.8			9.72	99.72	
23	0+48			8.31	101.13	BFR
24	0+54			5.94	103.5	"
25	0+55.9			5.40	104.04	
26	BM	9.46				
27						
28						
29						
30						
31						

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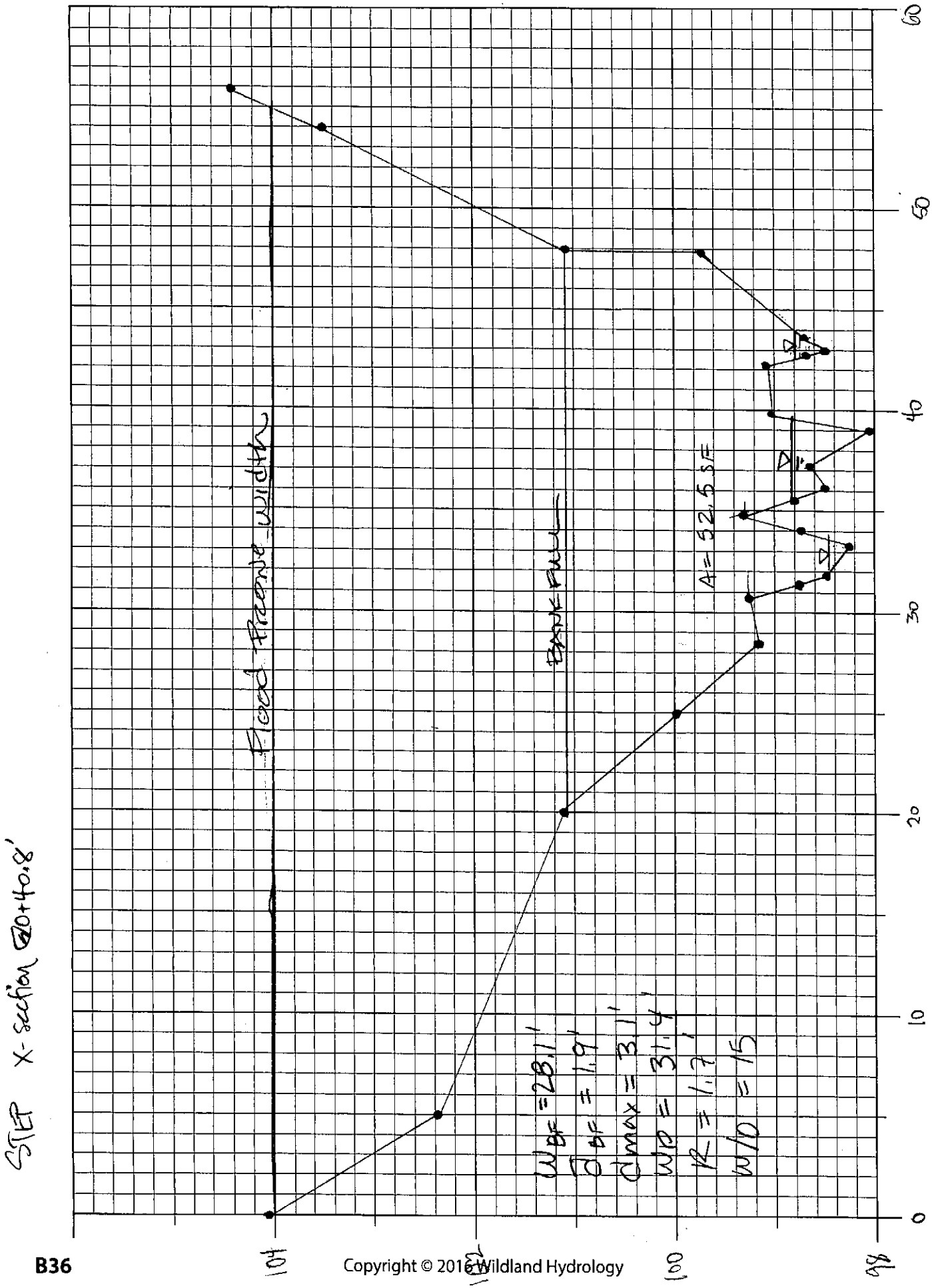

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SURVEY DATA ⟹ **CROSS - SECTION** 3

SITE: Sharman Bk Sta. 67 Contraction Pool 1 **Date:** 4-19-16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	100	5.83	105.83			
2	0.0			4.59	101.24	
3	8.0			6.99	98.84	
4	14.0			8.27	97.56	~~edge of water~~
5	17.6			8.30	97.53	edge of water
6	23.2			9.46	96.37	
7	25.7			10.82	95.01	
8	29.2			9.87	95.96	
9	33.0			10.84	94.99	
10	35.5			8.83	97.0	
11	35.8			8.32	97.51	edge of water
12	39.4			4.92	100.91	
13	44.0			3.20	102.63	
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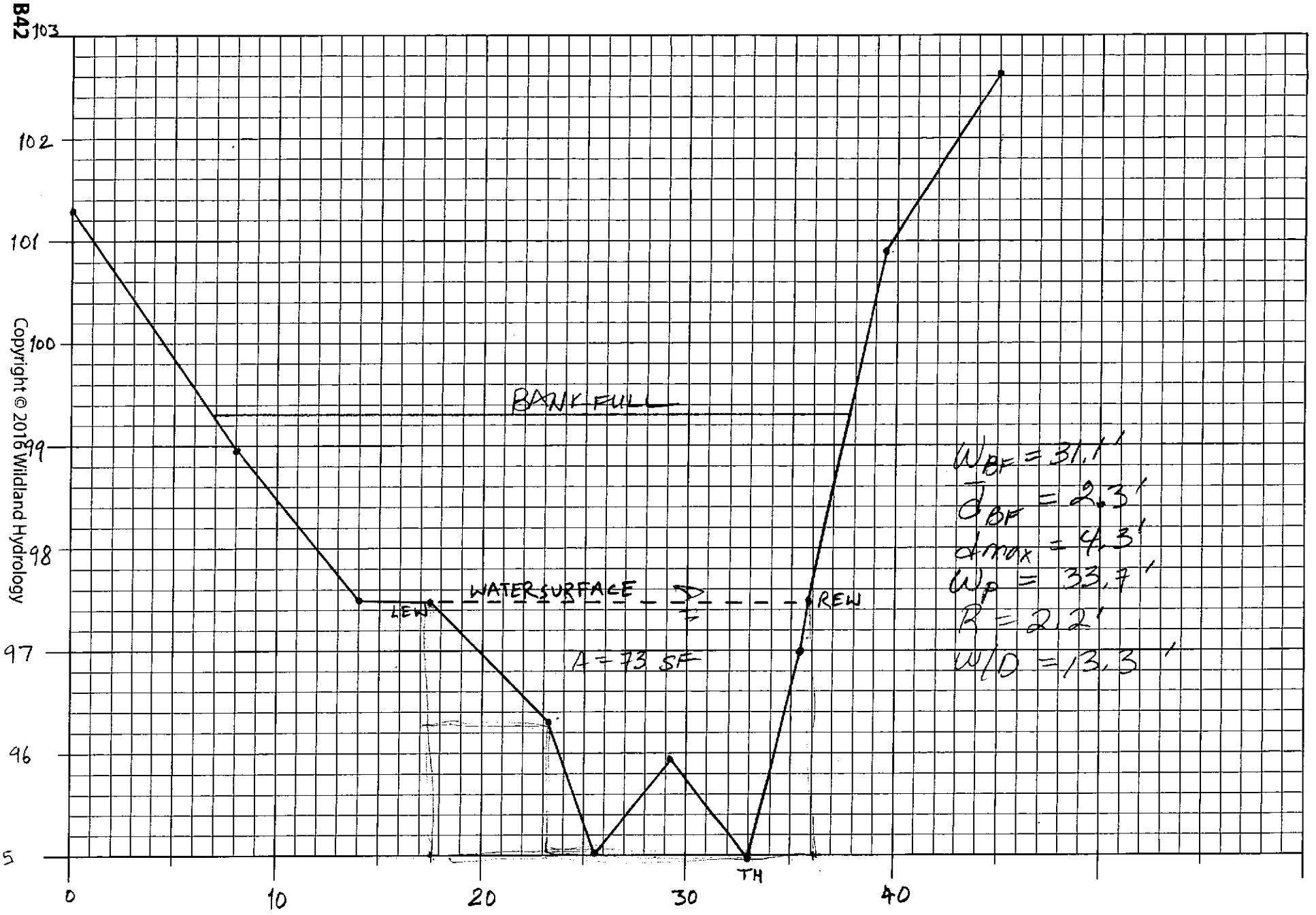
X-section @ Contraction Pool 0+67



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SURVEY DATA ⟹ **CROSS-SECTION 6**

SITE: SHERMAN CREEK TEAM 1 LP STA 0+99 Date: 4/19/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
1	BM	7.63	107.63		100	
2	0+0			4.98	102.65	
3	0+5			6.44	101.19	
4	0+8.4			7.57	100.06	
5	0+10.2			8.74	98.89	
6	0+12.6			10.25	97.38	
7	0+14			10.26	97.37	
8	0+14.5			10.80	96.83	edge water side channel
9	0+15.8			11.04	96.59	
10	0+17.3			11.08	96.55	
11	0+19			10.68	96.95	
12	0+20.7			10.84	96.79	edge water side channel
13	0+21			9.62	98.01	BFR
14	0+24.7			9.70	97.93	
15	0+26.1			9.87	97.76	edge water main channel
16	0+27.4			10.03	97.6	
17	0+27.8			10.28	97.35	~~low~~
18	0+28.1			10.49	97.14	low point main channel
19	0+28.8			10.07	97.56	
20	0+29.5			9.94	97.69	
21	0+29.9			~~9.71~~ 9.71-97.92		right edge water main channel
22	0+30.8			9.62	98.01	
23	0+31.4			9.27	98.36	
24	0+33.4			9.39	98.24	
25	0+34			9.73	97.9	left edge side channel
26	0+34.3			10.51	97.12	
27	0+35.3			10.78	96.85	
28	0+35.5			9.52	98.11	BFR
29	0+37.[illegible]	37.5		8.83	98.8	"
30	0+38.5			9.77	97.86	"
31	0+40.4			10.13	97.5	

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SURVEY DATA ⟹ **CROSS - SECTION** ~~5~~ 6 (cont)

SITE: SHARMAN CR. TEAM 1 LP STATION 0+79 **Date:** 4/19/16

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
1	0+42			9.85	97.78	right edge water
2	0+45.3			8.68	98.95	
3	0+47.2			8.2	99.43	
4	0+47.7			7.97	99.66	Bank Full
5	0+49.2			7.16	100.47	
6	0+50.3			5.70	101.93	
7	BM			7.63	100	
8						
9						
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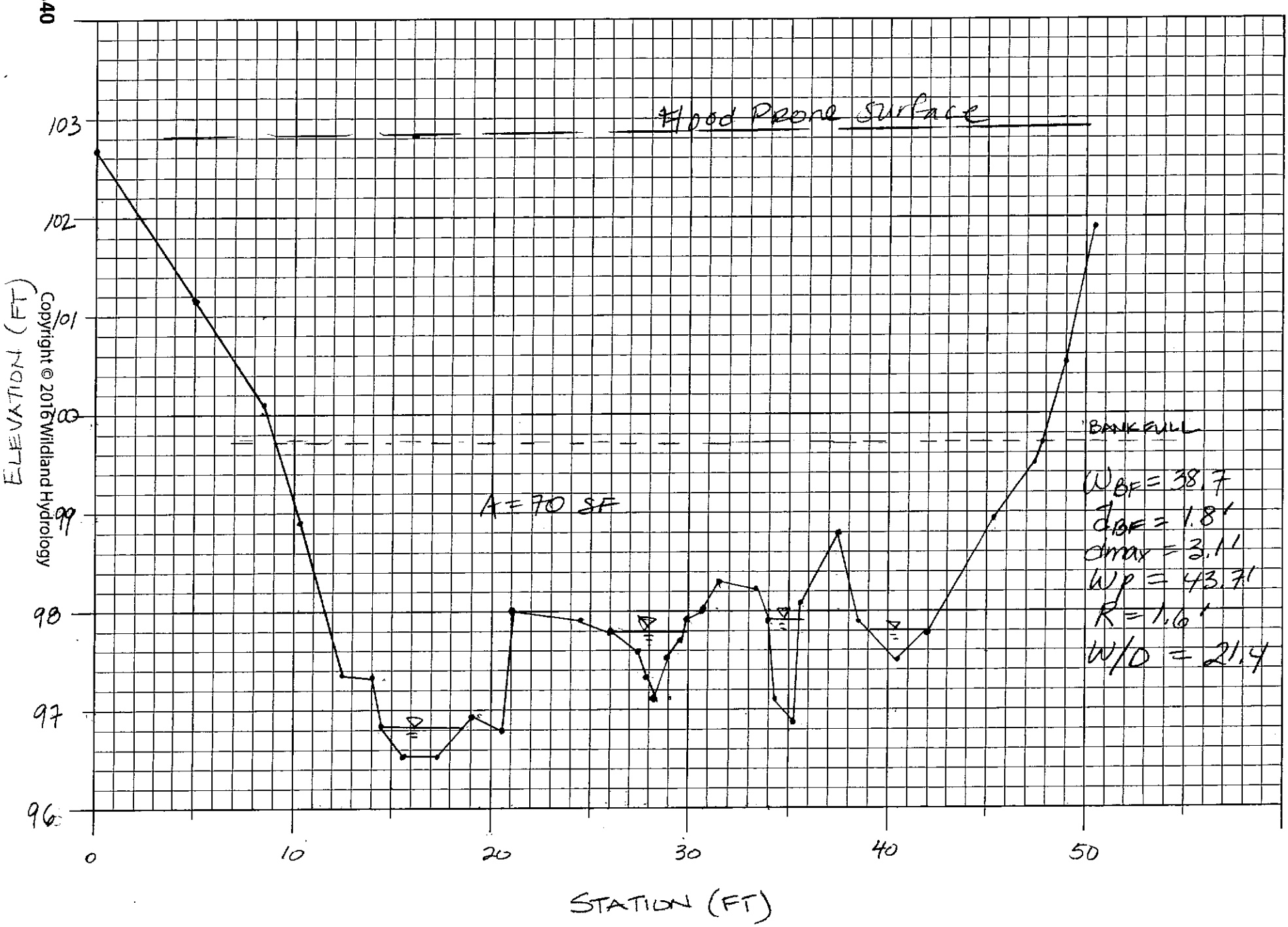
STEP X-SECTION @ 0+79



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Rapid X-section

SURVEY DATA ⟹ **CROSS - SECTION** 1

SITE: SHARMAN CREEK Date: 04/19/2016

Location: TEAM 1 LP=105'

Observers: RAJ, MAT 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	~~7.26~~	~~107.26~~		100	
0	2	~~B~~3.0			4.92	102.34	
3.6	3	0.6			7.42	99.84	
4.1	4	1.1			7.54	99.72	
4.4	5	1.4			8.29	98.97	
5.1	6	2.1			9.03	98.23	
6.4	7	3.4			9.53	97.73	
10	8	7.0			10.23	97.03	
10.7	9	7.7			10.59	96.67	LEW
10.9	10	7.9			11.03	96.23	
11.8	11	8.8			11.20	96.06	
13.4	12	10.4			11.25	96.01	TH
14.7	13	11.7			11.15	96.11	
16.2	14	13.2			10.81	96.45	
17.8	15	14.8			10.63	96.63	
18.9	16	15.9			10.41	96.85	
21	17	18.0			10.67	96.59	
23	18	20.0			10.50	96.76	
25	19	22.0			10.66	96.60	
26.2	20	23.2			10.53	96.73	REW
34.3	21	31.3			9.56	97.7	
36.5	22	33.5			9.30	97.96	
38.1	23	35.1			8.82	98.44	BKF
39.9	24	36.9			8.22	99.04	
40.3	25	37.3			6.75	100.59	
41.2	26	38.2			6.51	100.75	
43	27	40.0			5.86	101.4	
44	28	41			5.48	101.78	

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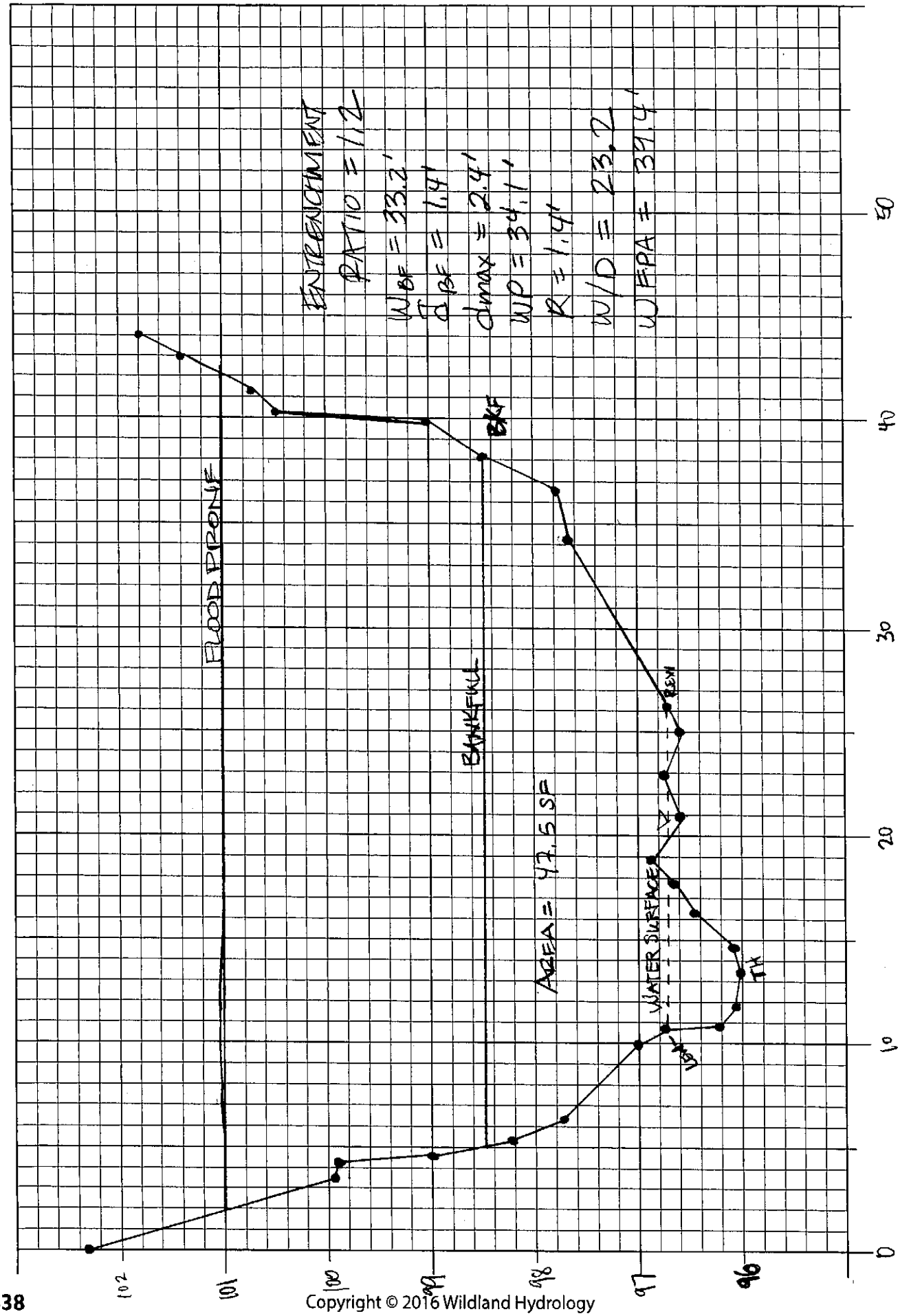

RAPID - X-Section @ 105'

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SURVEY DATA ⟹ **CROSS - SECTION 2**

SITE: SHARMAN CREEK TEAM 1 LP = 137.5 **Date:** 04/19/2016

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	8.3	108.3			
2	0			4.8	103.5	
3	3.0			4.95	103.35	
4	5.0			5.47	102.83	
5	5.5			7.06	101.24	
6	7.6			9.61	98.69	
7	8.7			10.40	97.90	
8	10.5			10.77	97.53	
9	12.0			12.15	96.15	
10	13.3			11.54	96.76	
11	13.9			12.14	96.16	
12	14.4			12.72	95.58	LEW
13	14.6			13.15	95.15	
14	16.9			13.10	95.20	
15	19.6			13.19	95.11	
16	20.5			13.33	94.97	
17	21.0			12.92	95.83	
18	23.5			13.02	95.28	
19	25.5			12.65	95.65	REW
20	26.6			12.48	95.82	
21	27.9			12.40	95.90	
22	28.5			10.88	97.42	
23	29.6			11.65	96.65	
24	31.9			12.14	96.16	
25	34.9			11.76	96.54	
26	38.6			10.75	97.55	BKf
27	45.4			9.94	98.36	
28	49.5			9.00	99.30	
29	52.6			7.93	100.37	
30	55.9			6.18	102.12	
31	58.0			5.13	103.17	

Continue PTO

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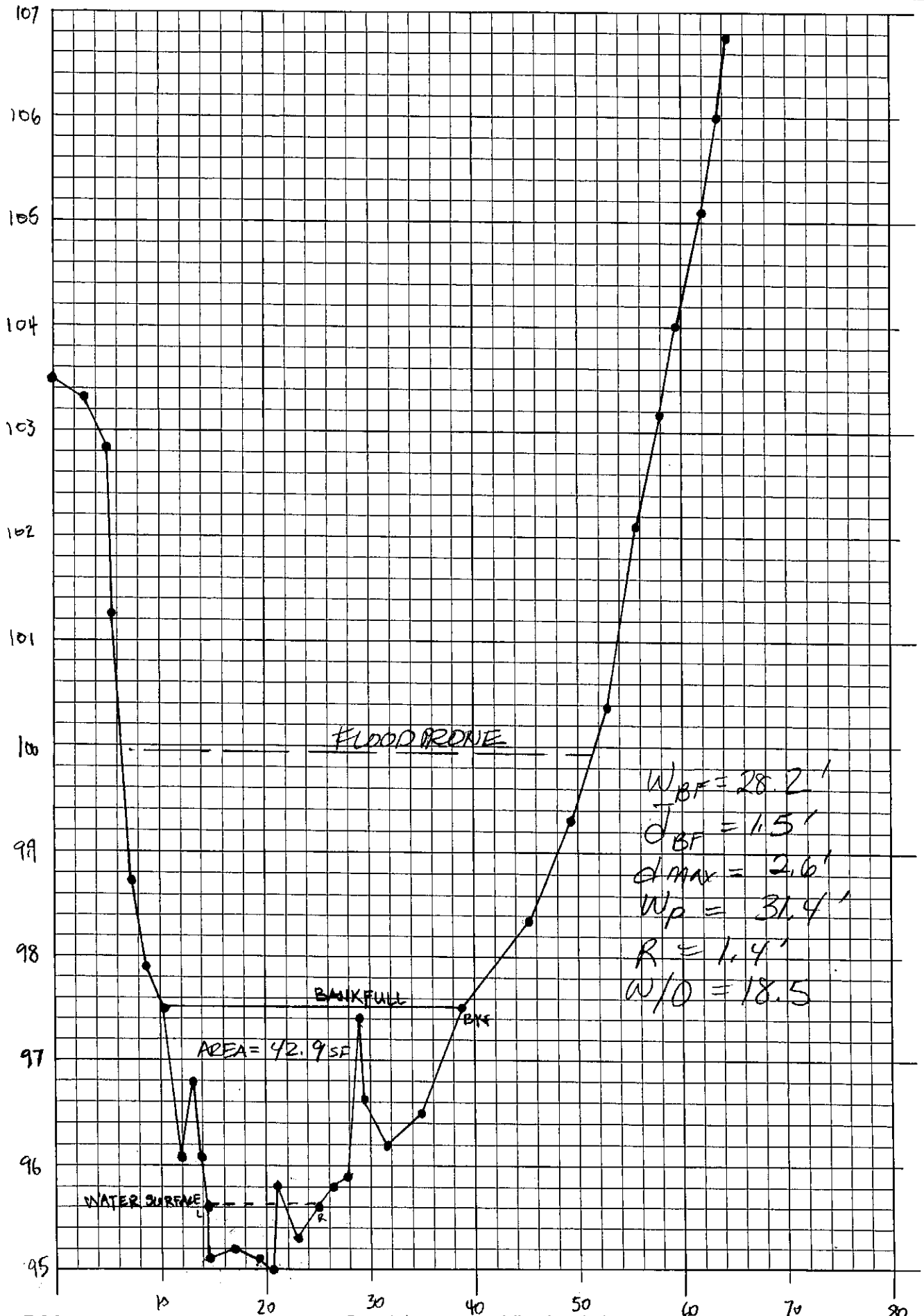
POOL X-SECTION @ 1+37.5



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SURVEY DATA ⟹ **CROSS - SECTION 4**

SITE: SHARMAN CREEK TEAM 1 LP = 212.4 Date: 04/19/2016

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	5.12	105.12			
2	0			3.87	101.25	
3	3.0			4.51	100.61	
4	4.6			5.28	99.84	
5	5.0			6.25	98.87	
6	7.2			7.59	97.53	
7	8.3			8.85	96.27	
8	10.8			10.71	94.41	
9	13.7			11.44	93.68	
10	14.4			12.01	93.11	
11	15.8			11.82	93.3	
12	16.4			12.14	92.98	
13	18.1			12.06	93.06	
14	18.3			11.25	93.87	
15	20.8			11.85	93.27	
16	21.8			12.10	93.02	LEW
17	22.6			12.64	92.48	
18	24.1			12.94	92.18	
19	25.8			12.98	92.14	
20	26.4			12.88	92.24	
21	27.2			12.53	92.59	
22	27.6			13.05	92.07	
23	27.7			12.18	92.94	REW
24	30.1			10.57	94.55	BKF
25	35.1			8.83	96.29	
26	38.0			8.63	96.49	
27	39.5			7.97	97.15	
28	41.0			7.68	97.44	
29	41.2			8.53	96.59	
30	44.6			7.77	97.35	
31	46.5			7.30	97.82	

Turning Point = 2.33

94.6

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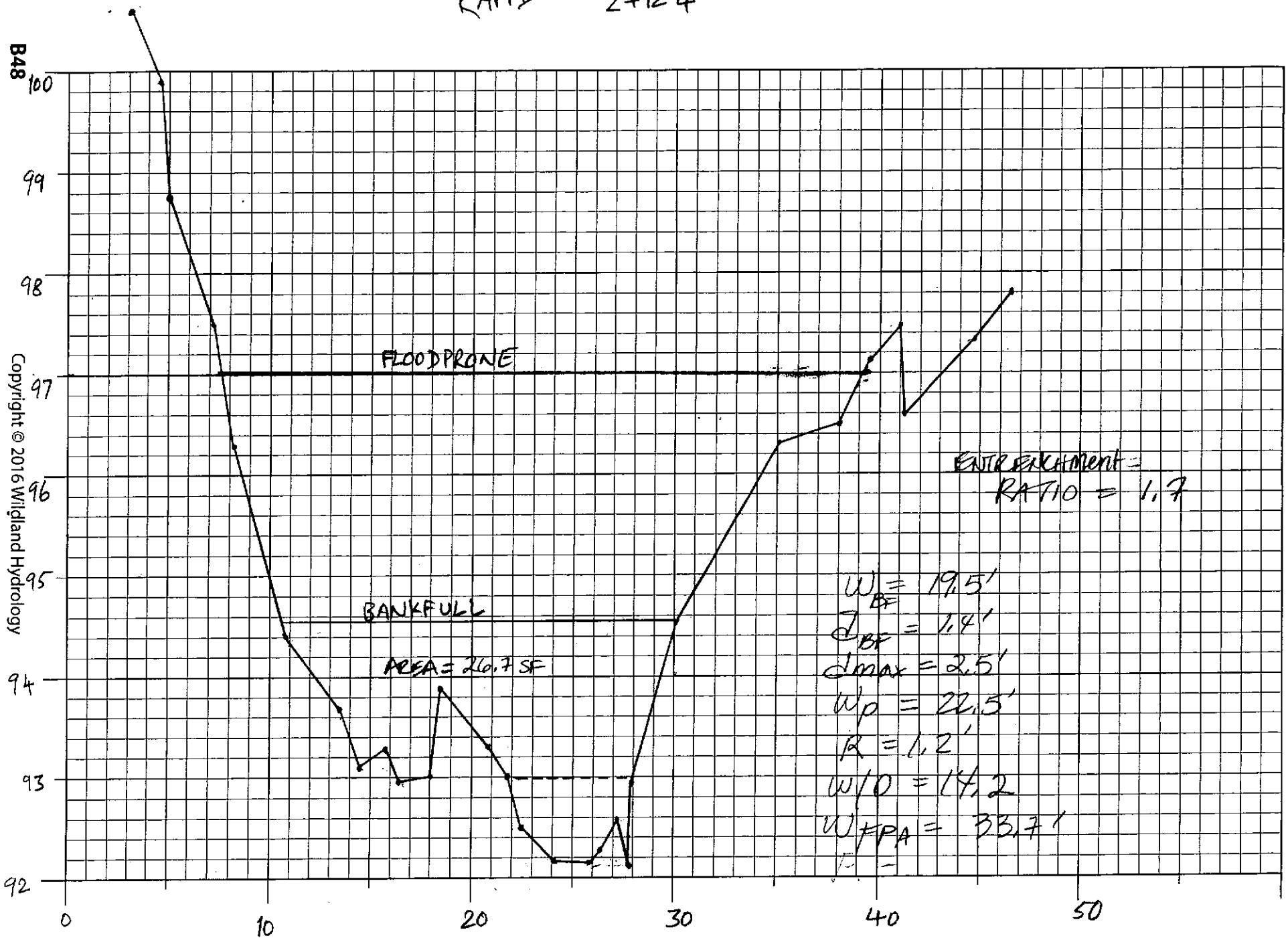
RAPID 2+12.4



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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Sharman's Branch **Date:** 4/19/2016

Location: Team 1 Page 1 of 2

Observers: 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
1	BM	6.92	106.92									BM = 100'
2	0.00			7.94	98.98	7.09	99.83			3.14	103.78	
3	12.00			7.64	99.28	7.11	99.81					top of rapid
4	17.00			7.81	99.11	7.32	99.60					mid rapid
5	22.6			8.91	98.01	7.52	99.40			max	~~depth~~	~~top of~~ Cont. section
6	20.7			8.36	98.56	7.50	99.42			top of		Pool
7	32.2			7.99	98.93	7.62	99.30	5.80	101.12	3.81	103.11	top of rapid
8	42.0			8.30	98.62	8.21	98.71					top of step
9	43.5			9.40	97.52	8.73	98.19					top of pool (step)
10	45.5			9.13	97.79	8.80	98.12					top of step
11	48.0			9.73	97.19	9.12	97.80					top of pool (step)
12	51.0			9.82	97.10	9.13	97.79					mid rapid
13	54.5			10.39	96.53	9.45	97.47					top of pool
14	61.6			12.02	94.90	9.40	97.52					~~max~~ pool (contraction)
15	68.0			12.65	94.27	9.40	97.52					max pool (contraction)
16	80.0			10.23	96.69	9.53	97.39	7.89	99.03			top of step
17	85.0			11.36	95.56	10.18	96.74					top of pool (contract)
18	90.0			11.60	95.32	10.13	96.79					max depth pool (cont)
19	98.5			10.33	96.59	10.22	96.70					top of rapid
20	105.0			10.97	95.95	10.21	96.71	8.50	98.42			mid rapid
21	116.0			11.01	95.91	10.37	96.55					Top of step
22	117.0			11.40	95.52	10.74	96.18					Max Pool (step)
23	120.5			11.18	95.74	10.87	96.05					Top of step
24	121.5			11.54	95.38	11.24	95.68					Bottom Step - Top Rapid
25	134.0			12.17	94.75	11.39	95.53					Mid Rapid/Top Pool
26	138.0			12.65	94.27	11.35	95.57					Max Pool (Contract)
27	148			12.04	94.88	11.43	95.49					Head Rapid

B80 X sharpie X on boulder assume 100' Team 2 ~~BM~~ instrument = 13.2' at Team 1 BM

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SURVEY DATA ⟶ LONGITUDINAL PROFILE 2

SITE: Sharmans Branch **Date:** 4/19/16

Location: Team 1

Observers: **HUC:**

	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instru-ment 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
28	153			13.1	93.82	11.93	94.99					Bottom Riffle/Top Pool
29	158			13.15	93.77	11.91	95.01	10.26	96.66			Mid Pool (contract)
30	162			12.22	94.7	11.93	94.99					Head Rapid
31	170.5			14.36	92.64	13.106	93.86					Bottom Rapid/Head Pool
32	181			14.58	92.34	13.05	93.87					Mid Pool (Contraction)
33	189.0			13.90	93.52	12.95	93.97					Top Riffle/Rapid
34	191.5			14.07	92.85	13.49	93.43					Top Pool (Contract)
35	196.0			14.50	92.42	13.52	93.4					MDP (Contract)
36	202.0			13.94	92.98	13.62	933					Top Rap./Riffle
37	216.0			14.91	92.01	14.02	929					Mid Rapid
38	227.0			14.57	92.35	14.32	92.6					~~Top Pool (Contraction~~
39	230.0			16.17	90.75	14.87	92.05					Bottom Rapid/Top Step
40	234.0			16.32	90.6	14.87	92.05					MDP (Contraction)
41	242.0			15.62	91.30	14.97	91.95					Top Step/end pool
42	245.0			16.45	90.47	15.57	91.35					Bottom Rapid (Top Contract. Pool)
43	252.0			16.58	90.34	15.77	91.15					MDP
44	255.0			16.15	90.77	15.77	91.15	14.67	92.25			Top riffle (rapid)
45	265.0			16.71	90.21	16.19	90.73					mid rapid
46	266.5			17.35	89.57	16.92	90.00					bottom step mid (rapid)
47	289.0			17.62	89.30	17.28	89.64					mid rapid (end site)
48												
49												
50												
51												
52												
53												
54												

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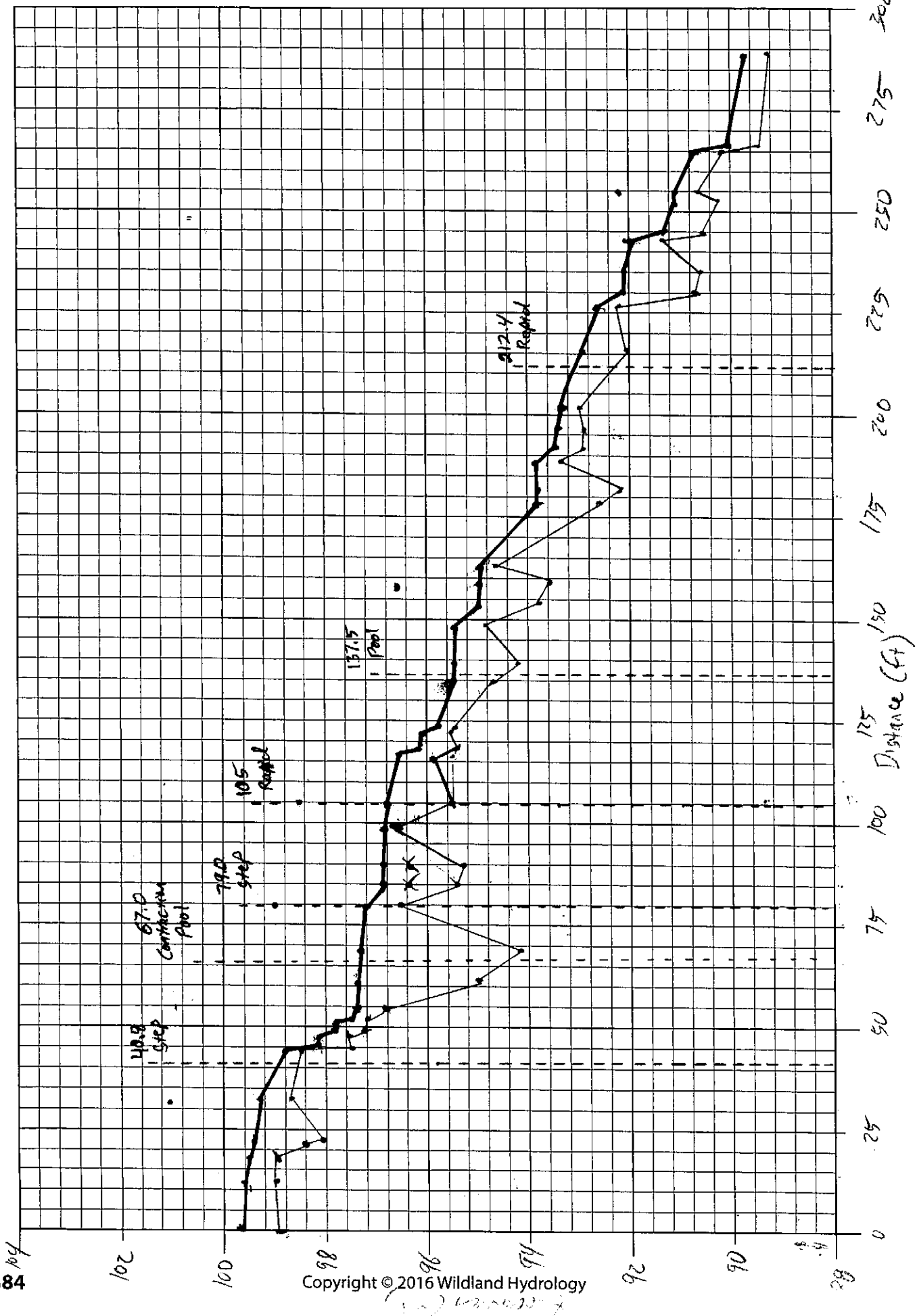

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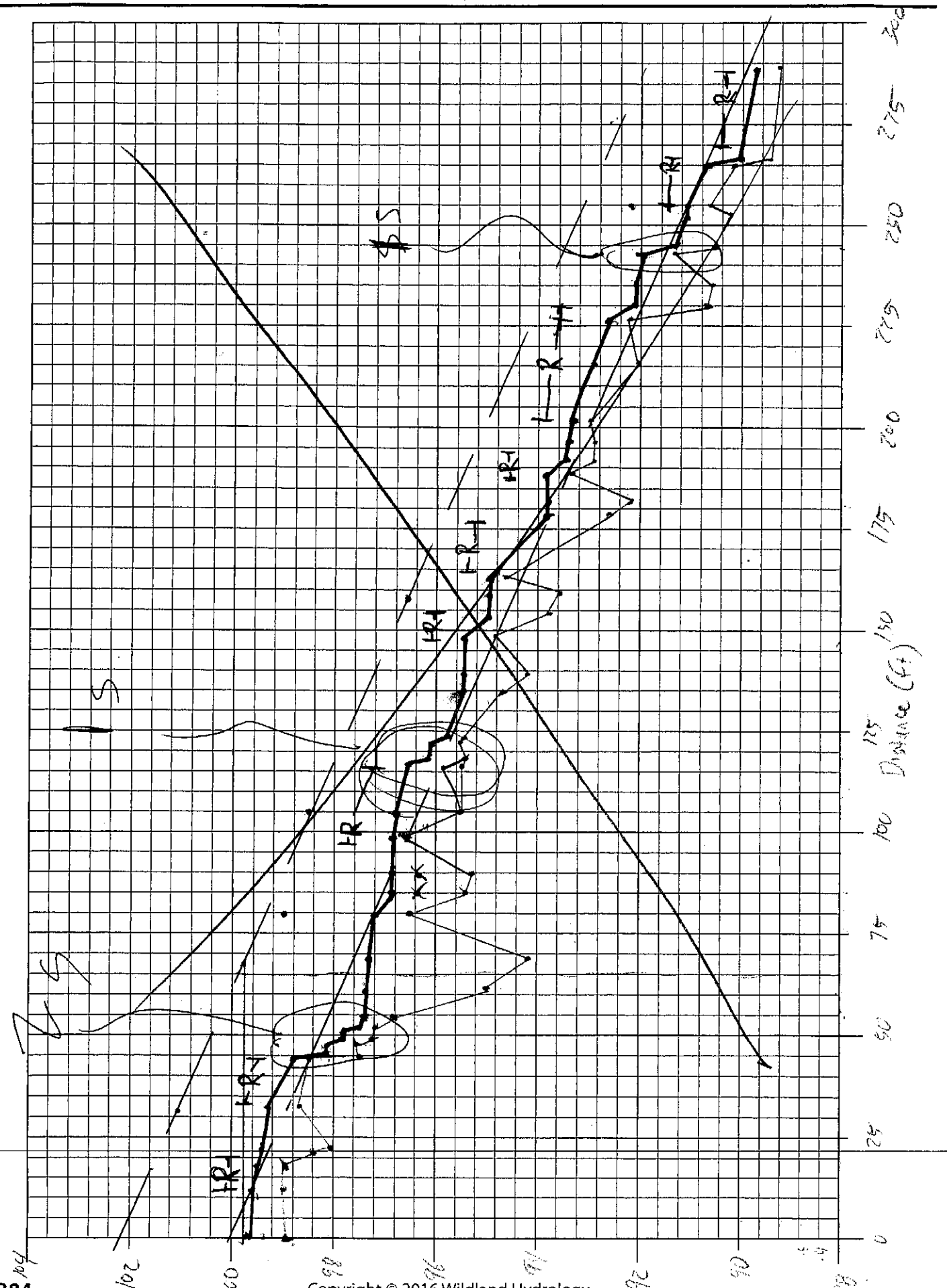

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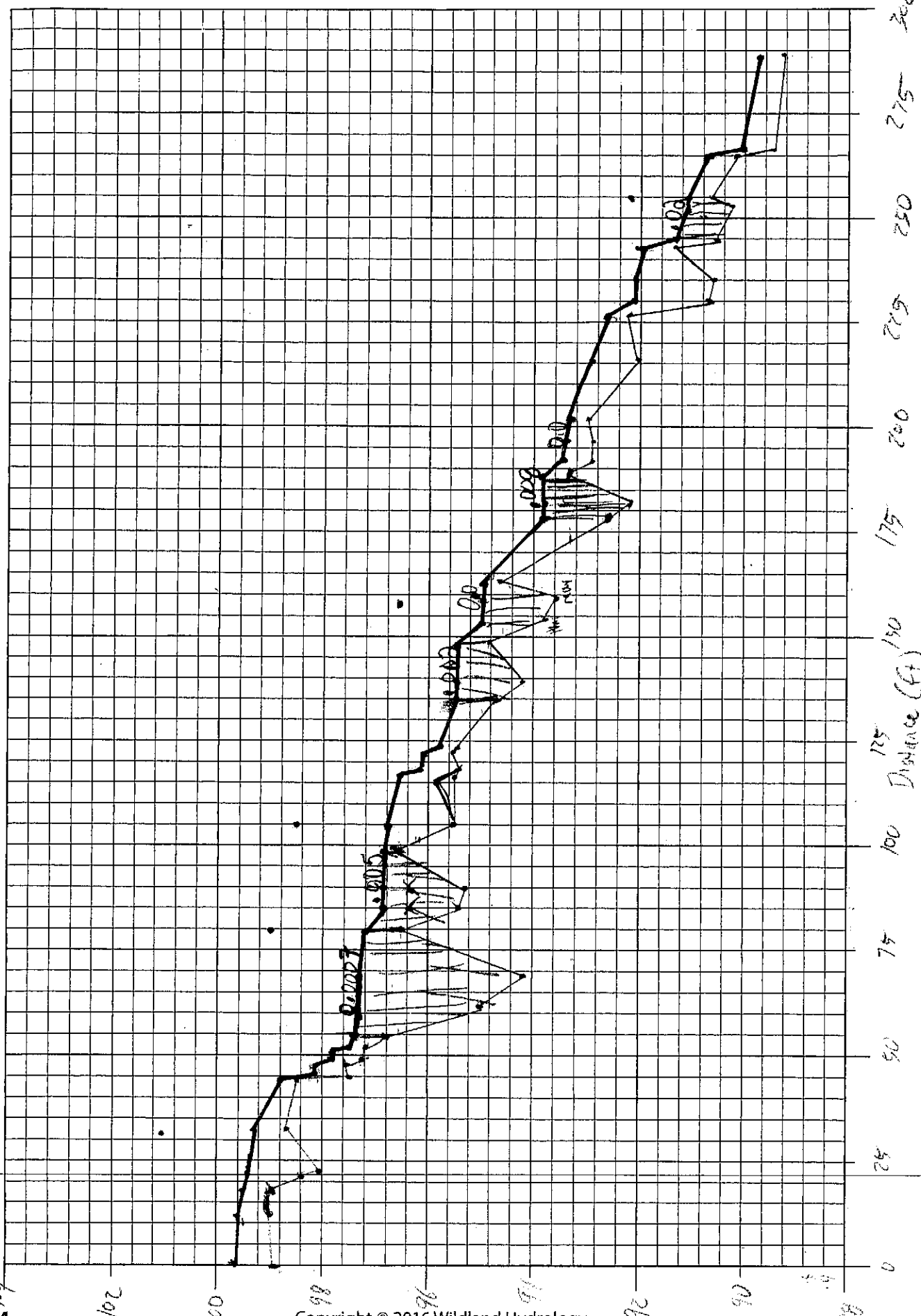

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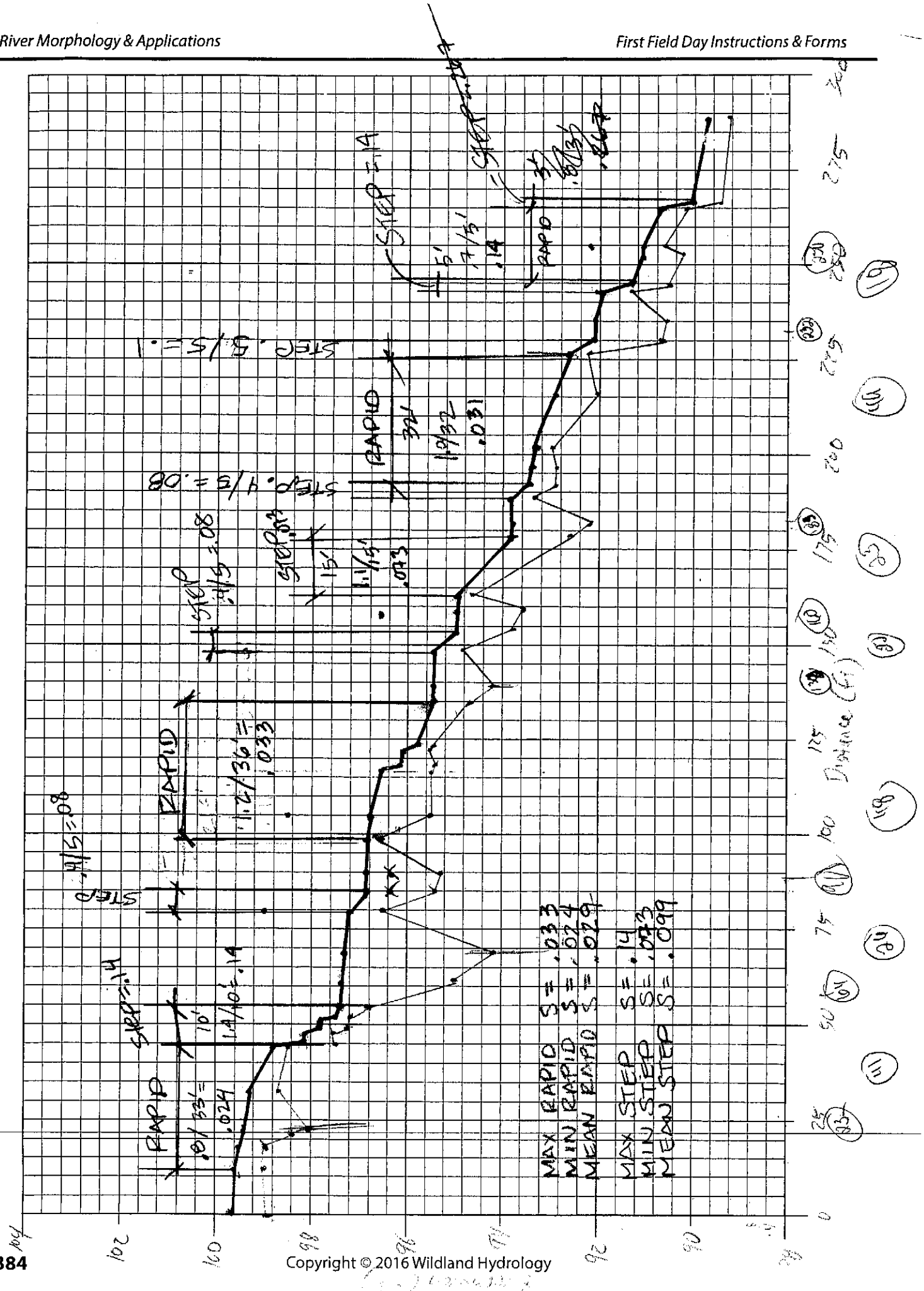

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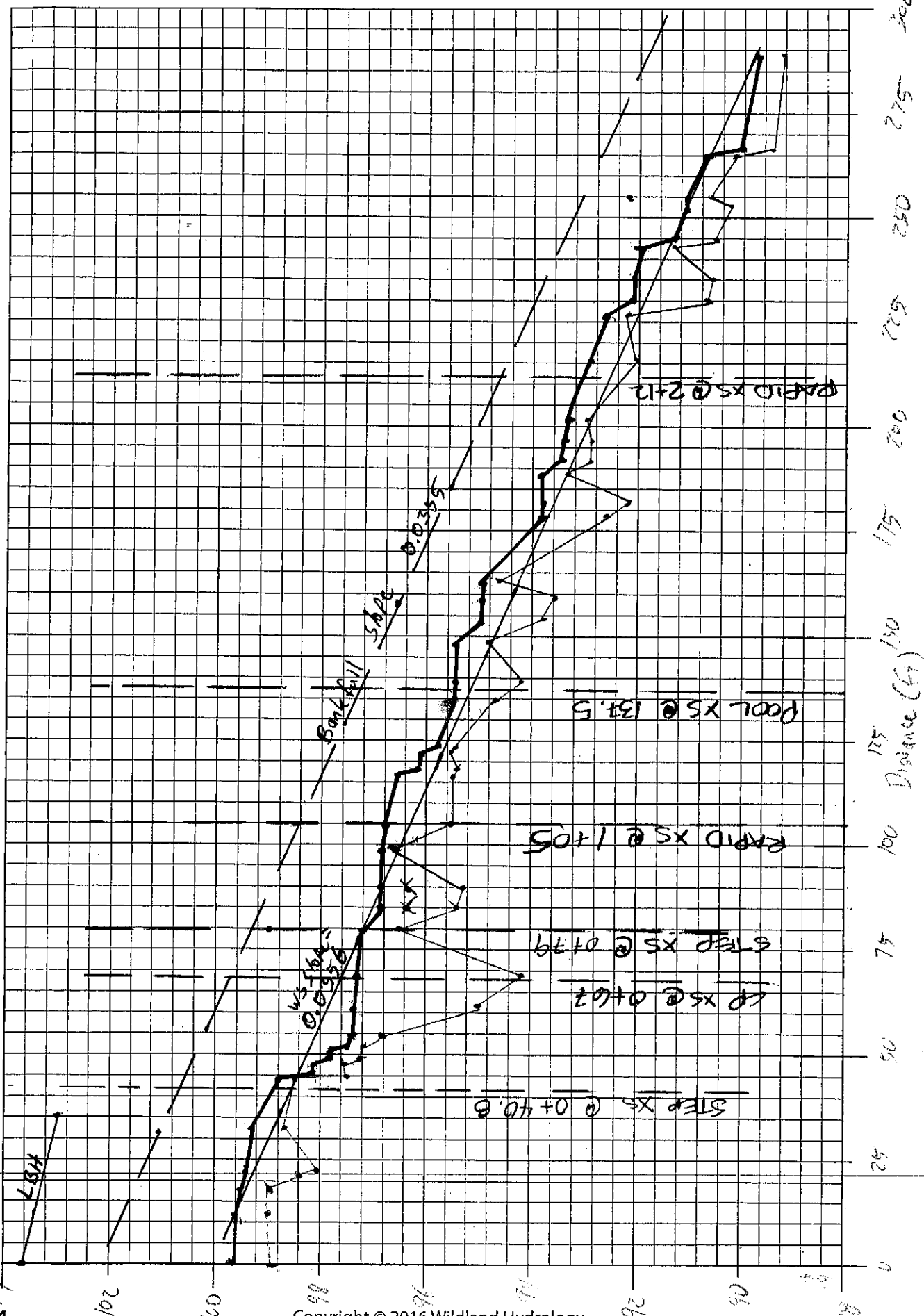

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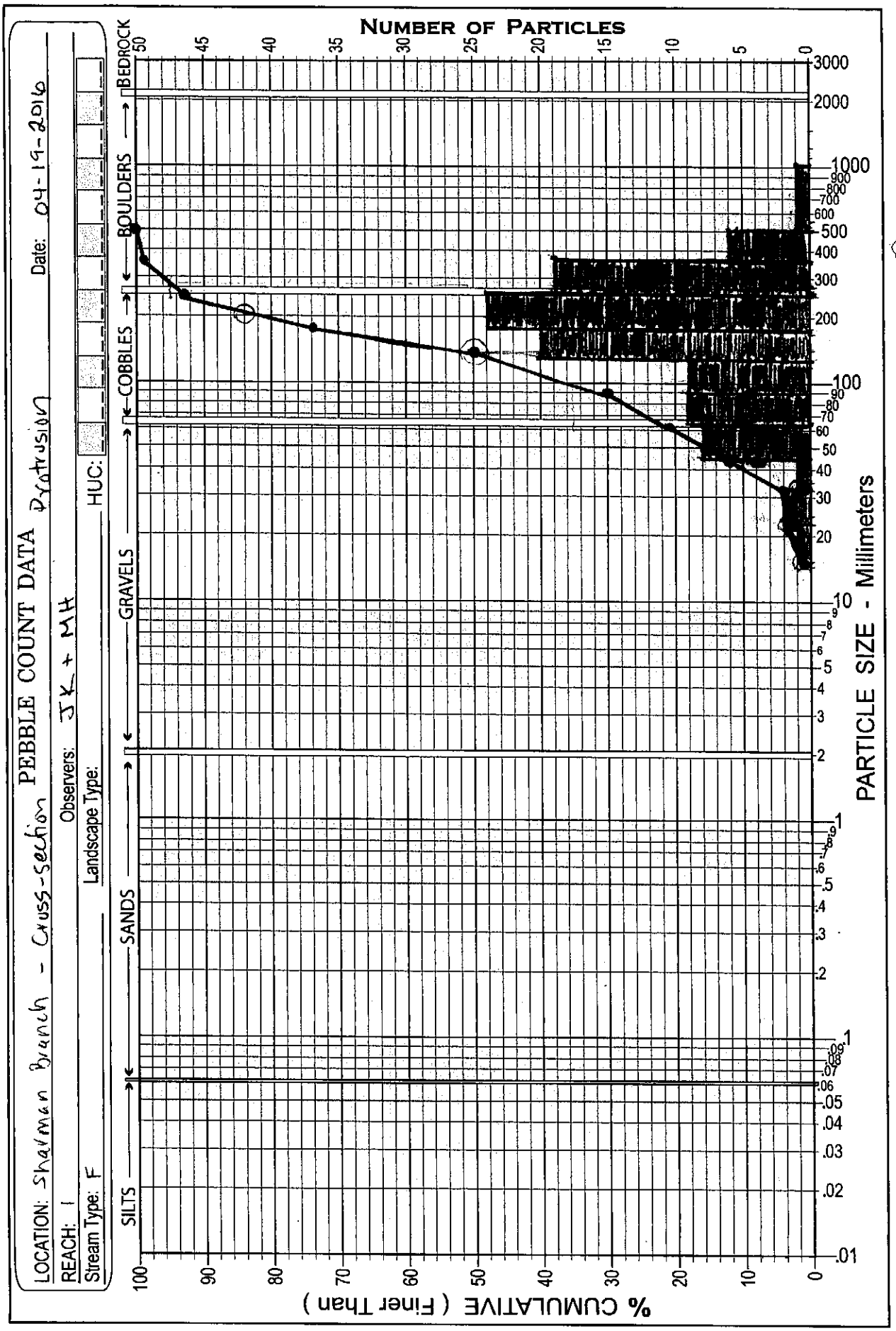

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Site: Sherman's Branch
Location: Team 1 Reach HUC: _____
Observers: JK, MH

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:			Reach:			Reach:		
							Date: 4-19-2016			Date: 4-19-2016			Date: 4-19-2016		
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0		•	•	2	1	3.3	3.3	1	1.4	1.4	2	2	2
.04 - .08	Very Coarse	1.0 - 2			•	1				1	1.4	2.8	1	1	3
.08 - .16	Very Fine	2 - 4	GRAVEL			~~2~~									
.16 - .22	Fine	4 - 5.7			•	1				1	1.4	4.2	1	1	4
.22 - .31	Fine	5.7 - 8		•	••	~~2~~ 3	1	3.3	6.6	2	2.9	7.1	3	3	7
.31 - .44	Medium	8 - 11.3		••	•	~~5~~ 6	4	13.3	19.9	1	1.4	8.5	5	5	12
.44 - .63	Medium	11.3 - 16		•		9	3	10	29.9	6	8.6	17.1	9	9	21
.63 - .89	Coarse	16 - 22.6		•	•	4	1	3.3	33.2	3	4.3	21.4	4	4	25
.89 - 1.3	Coarse	22.6 - 32		•		3	2	6.7	39.9	1	1.4	22.8	3	3	28
1.3 - 1.8	Very Coarse	32 - 45				6				6	8.6	31.4	6	6	34
1.8 - 2.5	Very Coarse	45 - 64		•	•	5	2	6.7	46.6	3	4.3	35.7	5	5	39
2.5 - 3.5	Small	64 - 90	COBBLE	•	•	8	3	10	56.6	5	7.1	42.8	8	8	47
3.5 - 5.0	Small	90 - 128		•	•	~~15~~ 16	6	20	76.6	9	12.9	55.7	15	15	62
5.0 - 7.1	Large	128 - 180		•	•	5				5	7.1	62.8	5	5	67
7.1 - 10.1	Large	180 - 256		•	•	10	2	6.7	63.3	8	11.4	74.2	10	10	77
10.1 - 14.3	Small	256 - 362	BOULDER	•	•	5				5	7.1	81.3	5	5	~~82~~
14.3 - 20	Small	362 - 512		•	•	3				3	4.3	85.6	3	3	85
20 - 40	Medium	512 - 1024		•	•	5	2	6.7	90.0	3	4.3	89.9	5	5	90
40 - 80	Large-Vry Large	1024 - 2048		•	•	9	2	6.7	96.7	7	10.0	99.9	9	9	99
	Bedrock		BDRK	•		1	1	3.3	100.0				1	1	100
Stream Type:			**Landscape Type:**			TOTAL →	30	100		70	99.9	99.9	100	100	100

~~82~~ 70

Riffles: sta 246 (last)
sta 99 (second)
sta 169 (fourth)
N=3

Pools: sta 231
sta 90 (first)
sta 140 (third)

sta 182 (fifth)
sta 237 (sixth)
sta 157 (seventh)
n=7

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90

Protrusion measurements

Site: Sherman Br.
Location: Riffle Sta. 103 ± HUC:
Observers: J.K., M.H.

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
	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					1	1	1						
.89 - 1.3	Coarse	22.6 - 32					2	2	3						
1.3 - 1.8	Very Coarse	32 - 45					1	1	4						
1.8 - 2.5	Very Coarse	45 - 64					8	8	12						
2.5 - 3.5	Small	64 - 90	COBBLE				9	9	21						
3.5 - 5.0	Small	90 - 128					9	9	30						
D50 - 5.0 - 7.1	Large	128 - 180					20	20	50						
D84 - 7.1 - 10.1	Large	180 - 256					24	24	74						
10.1 - 14.3	Small	256 - 362	BOULDER				19	19	93						
14.3 - 20	Small	362 - 512					6	6	99						
20 - 40	Medium	512 - 1024					1	1	100						
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			**Landscape Type:**			TOTAL →	100	100							

R 1.586
S 0.887

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

Stream:	Sharman Branch				
Basin:		Drainage Area:	acres	3.6	mi^2
Location:	Somewhere in Maryland				
Twp.&Rge:		Sec.&Qtr.:			
Cross-Section Monuments (Lat./Long.):			Date:		
Observers:			Landscape Type:	Co. Us	

Bankfull Width (W_{bkf}) The surface width of the stream at bankfull stage elevation, in a riffle section.	33.2	ft
Bankfull Mean Depth (d_{bkf}) Mean depth of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.4	ft
Bankfull Cross-Sectional Area (A_{bkf}) Area of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	47.5	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) *Bankfull Width* divided by *Bankfull Mean Depth*, in a riffle section.	23.7	ft/ft
Bankfull 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.	2.4	ft
Flood-Prone Area Width (W_{fpa}) Width of the channel at an elevation that is twice the *Bankfull Maximum Depth*, measured perpendicular to the fall line of the valley in a riffle section.	39.4	ft
Entrenchment Ratio (ER) The *Flood-Prone Area Width* divided by *Bankfull Width* (W_{fpa} / W_{bkf}), in a riffle section.	1.2	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.	95	mm
Average Water Surface Slope (S) The elevation difference of water surface measurements over the stream length between two similar bed features (e.g., start of riffle to start of last riffle) for several riffle-pool or step-pool sequences, representing channel gradient.	0.036	ft/ft
Channel Sinuosity (k) An index of channel pattern determined from stream length divided by valley length (SL / VL), or from valley slope divided by average water surface slope (S_{val} / S).	1.03	ft/ft

Stream Type F3b/1 **See Classification Key (Figure B-2)**

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Sharman's Branch	Location:	Team 1 Reach
Date:	4/19/16	Stream Type:	F-3b-1-2
Observers:	Team 1	Landscape Type:	C-CO-US
		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional Area	47.5	A_{bkf} (ft^2)	Bankfull Riffle Mean Depth	1.4	d_{bkf} (ft)
Bankfull Riffle Width	33.2	W_{bkf} (ft)	Wetted Perimeter ≈ (2 * d_{bkf}) + W_{bkf}	36	W_p (ft)
D_{84} Particle Size at Riffle	270	~~D_{84}~~ D_{95} (mm)	~~D_{84}~~ D_{95} Particle Size in Feet (mm) / 304.8	0.8858	D_{84} (ft)
Bankfull Slope	0.0356	S_{bkf} (ft / ft)	Hydraulic Radius A_{bkf} / W_p	1.32	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	1.49	R / ~~D_{84}~~ D_{95} (ft / ft)
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{½}$	1.23	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	3.1	ft / sec	147	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor/Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 R^{2/3} S^{1/2} / n$ $n =$ 0.60	5.38	ft / sec	255.5	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $\bar{u} = 1.49 R^{2/3} S^{1/2} / n$ $n =$ 0.054	6.25	ft / sec	296.9	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 $n =$ 0.105	3.2	ft / sec	152	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 Q $Q =$ ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	2.13	ft / sec	101	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.

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

Stream: SHARMAN CREEK Location:

Observers: Date: 04/19/2016 Landscape Type: C-CO-US Stream Type: F3b-1-2

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, ***

Riffle Dimensions*, **, ***	Mean	Min.	Max.		Riffle Dimensions & Dimensionless Ratios*, **, ***	Mean	Min.	Max.
Riffle Width (W_{bkf})	26.35	19.5	33.2	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	37.1	26.7	47.5
Riffle Mean Depth (d_{bkf})	1.4	1.4	1.4	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	18.82	13.93	23.71
Riffle Maximum Depth (d_{max})	2.45	2.4	2.5	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.75	1.7	1.8
Width of Flood-Prone Area (W_{fpa})	36.55	33.7	39.4	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.45	1.2	1.7
Riffle Inner Berm Width (W_{ib})	7.25	6.1	8.4	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	0.28	0.31	0.25
Riffle Inner Berm Depth (d_{ib})	0.81	0.8	0.82	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	0.58	0.57	0.59
Riffle Inner Berm Area (A_{ib})	4.43	3.93	4.92	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	0.125	0.10	0.15
Riffle Inner Berm W/d Ratio (W_{ib} / d_{ib})	8.94	7.63	10.24					

Pool Dimensions*, **, ***

Pool Dimensions*, **, ***	Mean	Min.	Max.		Pool Dimensions & Dimensionless Ratios*, **, ***	Mean	Min.	Max.
Pool Width (W_{bkfp})	29.7	28.2	31.1	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	1.20	0.94	1.45
Pool Mean Depth (d_{bkfp})	1.9	1.5	2.3	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	1.36	1.07	1.64
Pool Cross-Sectional Area (A_{bkfp})	57.95	42.9	73.0	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.58	1.54	1.61
Pool Maximum Depth (d_{maxp})	3.45	2.6	4.3	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.47	1.86	3.07
Pool Inner Berm Width (W_{ibp})	14.75	11.0	18.5	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	0.49	0.39	0.59
Pool Inner Berm Depth (d_{ibp})	1.55	1.6	2.5	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	0.75	0.4	1.09
Pool Inner Berm Area (A_{ibp})	15.75	3.5	28	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	0.23	0.08	0.38
Point Bar Slope (S_{pb})				ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	12.9	7.4	18.3

18.3

Run Dimensions*

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*

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 Dimensions**

Step Dimensions**	Mean	Min.	Max.		Step Dimensionless Ratios**	Mean	Min.	Max.
Step Width (W_{bkfs})	33.4	28.1	38.7	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	1.31	1.17	1.44
Step Mean Depth (d_{bkfs})	1.85	1.8	1.9	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	1.48	1.29	1.36
Step Cross-Sectional Area (A_{bkfs})	61.25	52.5	70.0	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	2.14	1.65	2.62
Step Maximum Depth (d_{maxs})	3.1	3.1	3.1	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	2.21	2.21	2.21
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	18.0	15.6	20.4	ft/ft				

*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.

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

Stream: Sharmans Run Location: Reach 4

Observers: Team 1 Stream Type: F/B3-1-2 Landscape Type: C-CO-US Date: 4/19/16

Pool Type		Dimensional Values: Pool Length (L_p)	Dimensional Values: Pool Max Depth ($d_{max\,p}$)	Dimensional Values: Pool Slope (S_p)	Dimensionless Ratios	Pool Length to Riffle Width (L_p / W_{bkf})	Pool Max Depth to Riffle Mean Depth ($d_{max\,p} / d_{bkf}$)	Pool Slope to Average Slope (S_p / S)
1. Lateral Scour Pool (LSP)	Mean	–			Mean			
	Min.	–			Min.			
	Max.	–			Max.			
2. Contraction Scour Pool (CSP)	Mean	13.6	3.2	.0064	Mean	.410	2.28	.112
	Min.	9.0	2.05	0	Min.	.271	1.46	0
	Max.	25.0	4.69	.012	Max.	.754	3.56	.337
3. Step/Pool (SP)	Mean	4.24	2.62	.0042	Mean	.127	1.67	1.17
	Min.	2.74	2.41	.003	Min.	.082	1.72	.084
	Max.	4.74	2.62	.127	Max.	.142	1.87	3.56
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	8.83	2.33	.0056	Mean	.265	1.66	.157
	Min.	7.63	2.24	.0035	Min.	.229	1.6	.098
	Max.	11.0	2.41	.0076	Max.	.331	1.72	.213
7. Lateral Protrusion Pool (LPP)	Mean	–			Mean			
	Min.	–			Min.			
	Max.	–			Max.			
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.			

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

Stream: Sharman's Branch Location: Team 1 Reach 4
Observers: Team 1 Date: 4/19/16 Landscape Type: C-CO-US Stream Type: F3b-1-2

Hydraulics

River Reach Summary Data.....2

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)	N/A			ft	Linear Wavelength to Riffle Width (λ / W_{bkf})	—		
Stream Meander Length (L_m)	N/A			ft	Stream Meander Length Ratio (L_m / W_{bkf})	—		
Radius of Curvature (R_c)	N/A			ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	—		
Belt Width (W_{blt})	37.9	36.4	39.4	ft	Meander Width Ratio (W_{blt} / W_{bkf})	1.15	1.1	1.19
Arc Length (L_a)				ft	Arc Length to Riffle Width (L_a / W_{bkf})	—		
Riffle Length (L_r)	34	32	36	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	1.02	.97	1.08
Individual Pool Length (L_p)	11.9	8.3	36.8	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	.337	.25	1.09
Pool-to-Pool Spacing (P_s)	32	18	49	ft	Pool-to-Pool Spacing to Riffle Width (P_s / W_{bkf})	.96	.54	1.48

Channel Profile

Valley Slope (S_{val})	.0366 5	ft/ft	Average Water Surface Slope (S)	.0356	ft/ft	Sinuosity (S_{val} / S)		1.03
Stream Length (SL)	288	ft	Valley Length (VL)	278	ft	Sinuosity (SL / VL)		1.039
Low Bank Height (LBH)	start	ft	Bankfull Max Depth (d_{max})	start	ft	Bank-Height Ratio (BHR) (LBH / d_{max})	start	
	end	ft		end	ft		end	

Facet Slopes	Mean	Min.	Max.		Dimensionless Facet Slope Ratios	Mean	Min.	Max.
Riffle Slope (S_{rif})	.029	.024	.033	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	.8	.67	.93
Run Slope (S_{run})				ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)			
Pool Slope (S_p)	.004	0.0	.012	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	.1384	0.0	.33
Glide Slope (S_g)				ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)			
Step Slope (S_s)	.099	.073	.14	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	2.8	2.05	3.93

Max Depths[a]	Mean	Min.	Max.		Dimensionless Depth Ratios	Mean	Min.	Max.
Max Riffle Depth (d_{max})	2.45	1.9	3.04	ft	Max Riffle Depth to Mean RIffle Depth (d_{max} / d_{bkf})	1.75	1.35	2.17
Max Run Depth (d_{maxr})				ft	Max Run Depth to Mean Riffle Depth (d_{maxr} / d_{bkf})			
Max Pool Depth (d_{maxp})	3.2	2.55	4.99	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.2	1.82	3.56
Max Glide Depth (d_{maxg})				ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})			
Max Step Depth (d_{maxs})	2.62	2.41	2.67	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.87	1.72	1.87

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	0	0		D_{16}	10	0		50	mm
% Sand	3	3.3		D_{35}	45	25		100	mm
% Gravel	36	43.3		D_{50}	95	70		128	mm
% Cobble	41	36.7		D_{84}	390	250		200	mm
% Boulder	19	16.7		D_{95}	1600	1600		270	mm
% Bedrock	1	0		D_{100}	3000	2048		512	mm

[a] *Mean*, *Min.*, and *Max.* depths are measured from Thalweg to bankfull at mid-point of feature for riffles, runs, and steps, the deepest part of pools, and 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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Stream: Sharmans Branch Location: Team 1 Reach 4 F3b-1-2

Observers: Team 1 Date: 4/19/16 Valley Type: C-CO-US Stream Type: ~~B~~

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	mi²

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})	37.9	36.4	39.4	ft	Meander Width Ratio (W_{blt} / W_{bkf})	1.15	1.1	1.19
Arc Length (L_a)	—			ft	Arc Length to Riffle Width (L_a / W_{bkf})	—		
Riffle Length (L_r)	129	25	28	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	.39	.075	.84
Individual Pool Length (L_p)	11.2	8.3	36.2	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	.337	.25	1.09
Pool to Pool Spacing (P_s)	32	18	49	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	.96	.54	1.48

Channel Profile

Valley Slope (S_{val})	0.03665	ft/ft	Average Water Surface Slope (S)		0.0356	ft/ft	Sinuosity (S_{val} / S)	1.03
Stream Length (SL)	289	ft	Valley Length (VL)		278	ft	Sinuosity (SL / VL)	1.039
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})	0.0432 ~~0.067~~	0.009	0.176	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.742	0.253	28.088
Run Slope (S_{run})	—	—	—	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	—	—	—
Pool Slope (S_p)	0.004	0.0	0.012	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	0.1364	0.0	0.33
Glide Slope (S_g)	—	—	—	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	—	—	—
Step Slope (S_s)	0.042	0.003	0.127	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	1.180	0.084	3.567

Max Riffle Depth (d_{maxrif})	2.43 ~~2.90~~	1.9	3.04	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	~~0.50~~	1.35	2.17
Max Run Depth (d_{maxrun})	—	—		ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})			
Max Pool Depth (d_{maxp})	3.8	2.05	4.06	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	22	1.82	3.96
Max Glide Depth (d_{maxg})	—	—		ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	—		
Max Step Depth (d_{maxs})	2.62	2.41	2.62	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.61	1.72	1.87

Channel Materials

% Silt/Clay	0	0		D_{16}	10	0		50 mm
% Sand	3	3.3		D_{35}	45	25		100 mm
% Gravel	36	43.3		D_{50}	95	70		128 mm
% Cobble	41	36.7		D_{84}	390	250		200 mm
% Boulder	19	16.7		D_{95}	1600	1600		270 mm
% Bedrock	1	0		D_{100}	3000	2048		512 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-2. Computations of velocity and discharge using various methods (*First Field Day*).

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Sharman's Branch	Location:	Team 1 Reach
Date:	4-19-2016	Stream Type:	F-3b-1-2
Observers:	Team 1	Landscape Type:	C-BR-BC
		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional Area	47.5	A_{bkf} (ft^2)	Bankfull Riffle Mean Depth	1.4	d_{bkf} (ft)
Bankfull Riffle Width	33.2	W_{bkf} (ft)	Wetted Perimeter ≈ (2 * d_{bkf}) + W_{bkf}	36	W_p (ft)
D_{84} Particle Size at Riffle	200	D_{84} (mm)	D_{84} Particle Size in Feet D_{84} (mm) / 304.8	0.656	D_{84} (ft)
Bankfull Slope	0.0356	S_{bkf} (ft / ft)	Hydraulic Radius A_{bkf} / W_p	1.32	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	2.01	R / D_{84} (ft / ft)
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.23	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	5.6	ft / sec	266	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor/Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.063	5.35	ft / sec	254.1	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. B-36) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.054	6.25	ft / sec	296.9	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 $n =$ 0.105	3.2	ft / sec	152	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 Q $Q =$ ____ year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$	2.13	ft / sec	101	cfs

If D_{50} used, Relative Rough $\bar{u} = 6.9$ ft/sec

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.

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