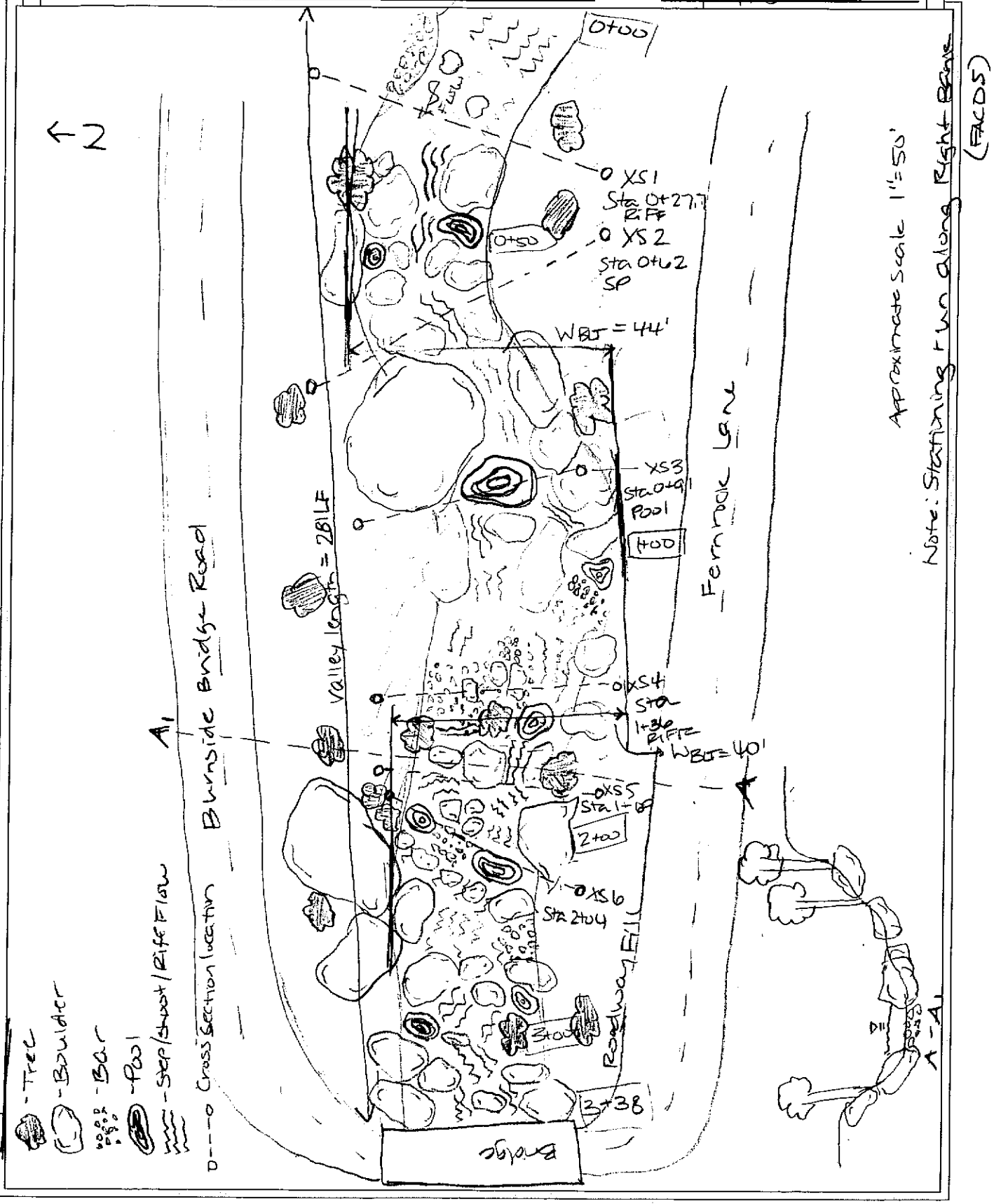
AREA-SITE LOCATION....REACH MAP

Stream: Sharmans Branch Reach: 1

Drawn By: Team 1 Date: 4/16/13



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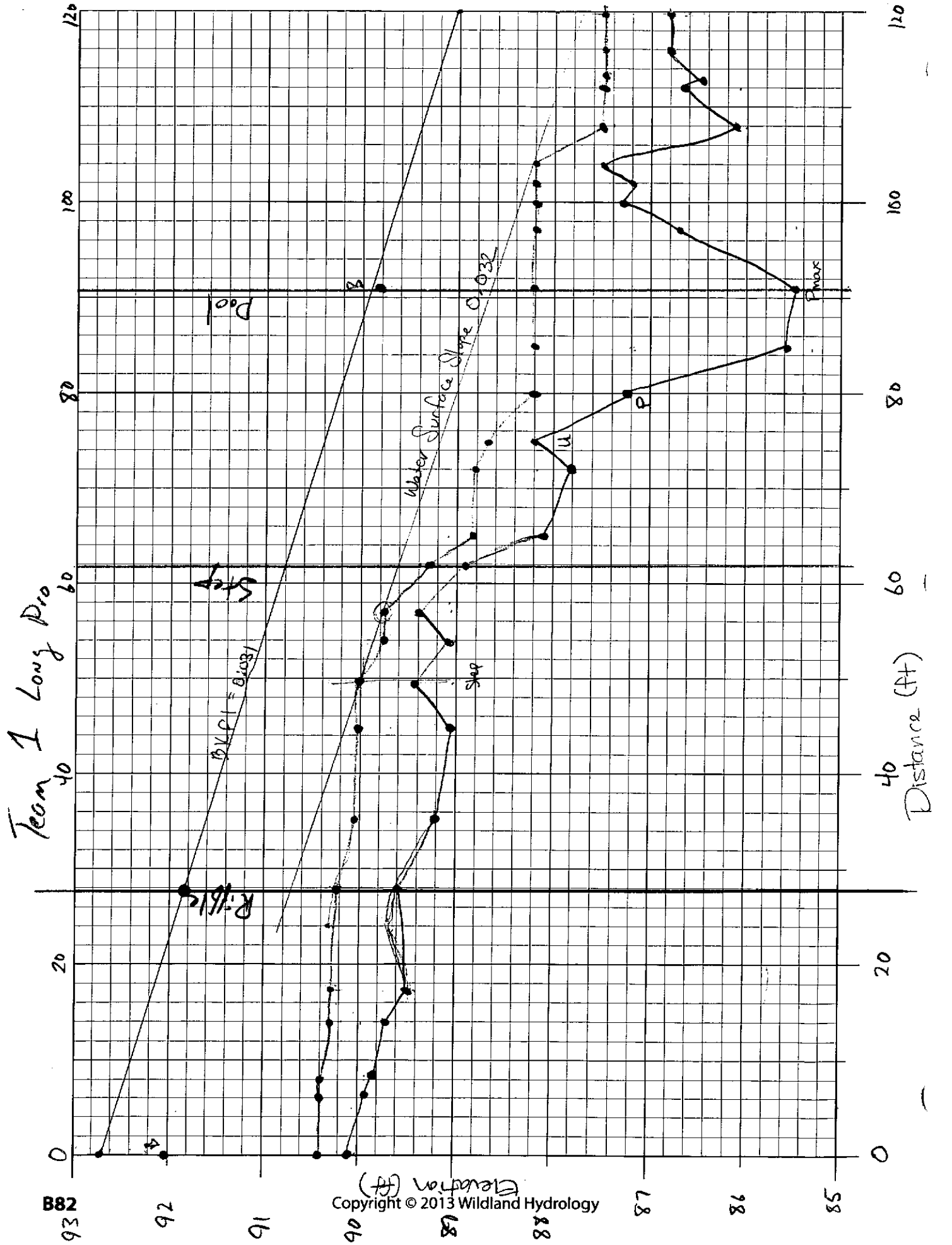

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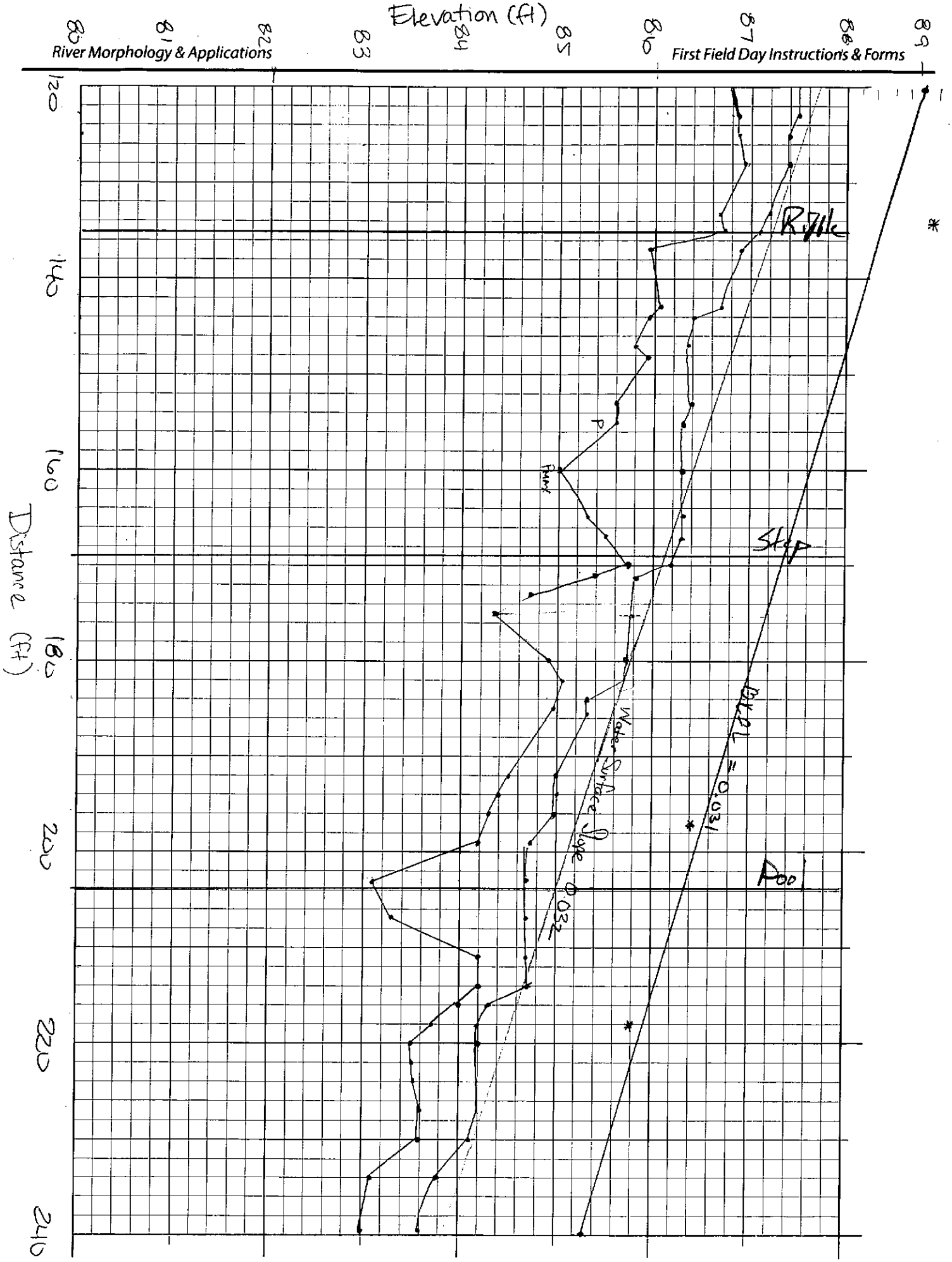

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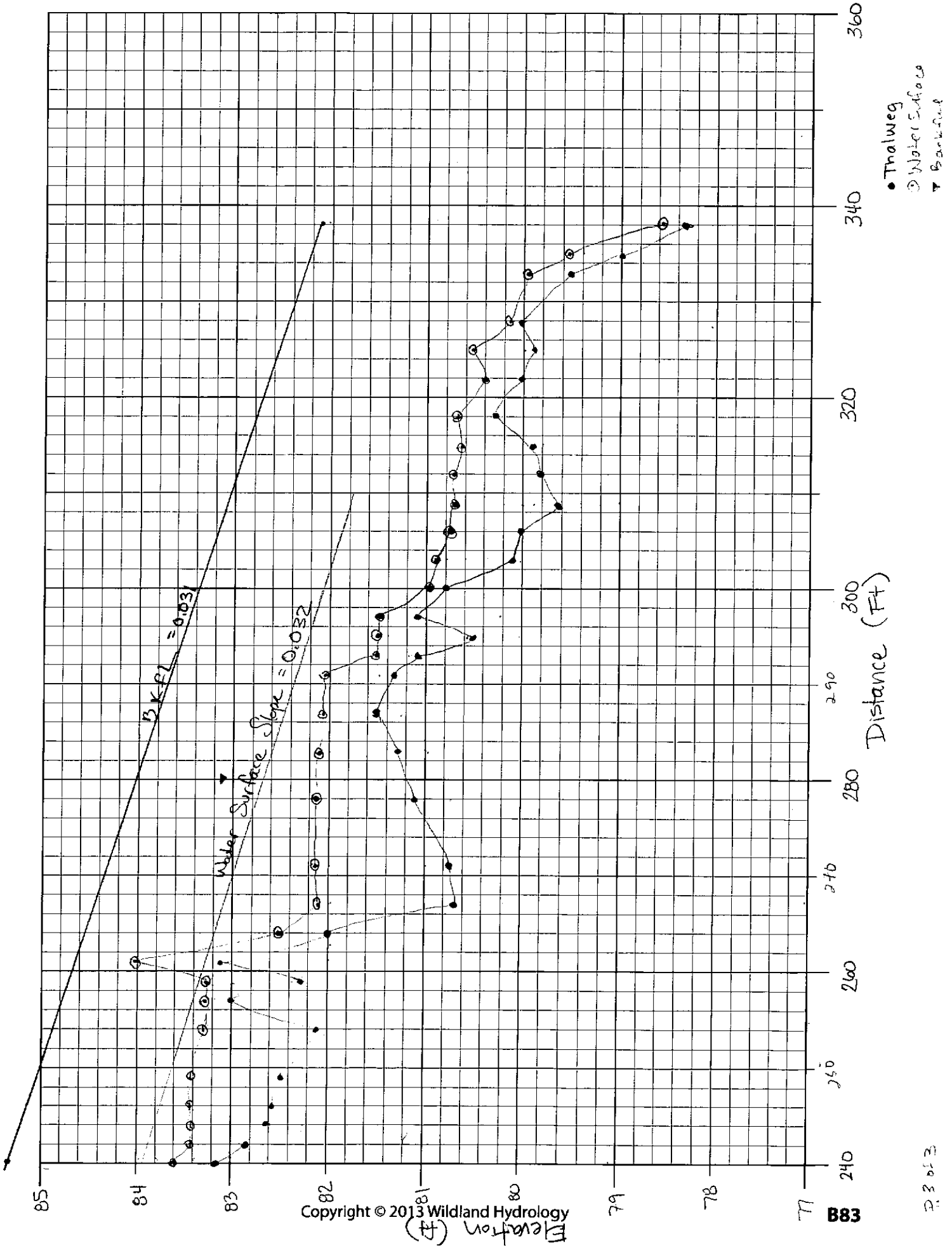

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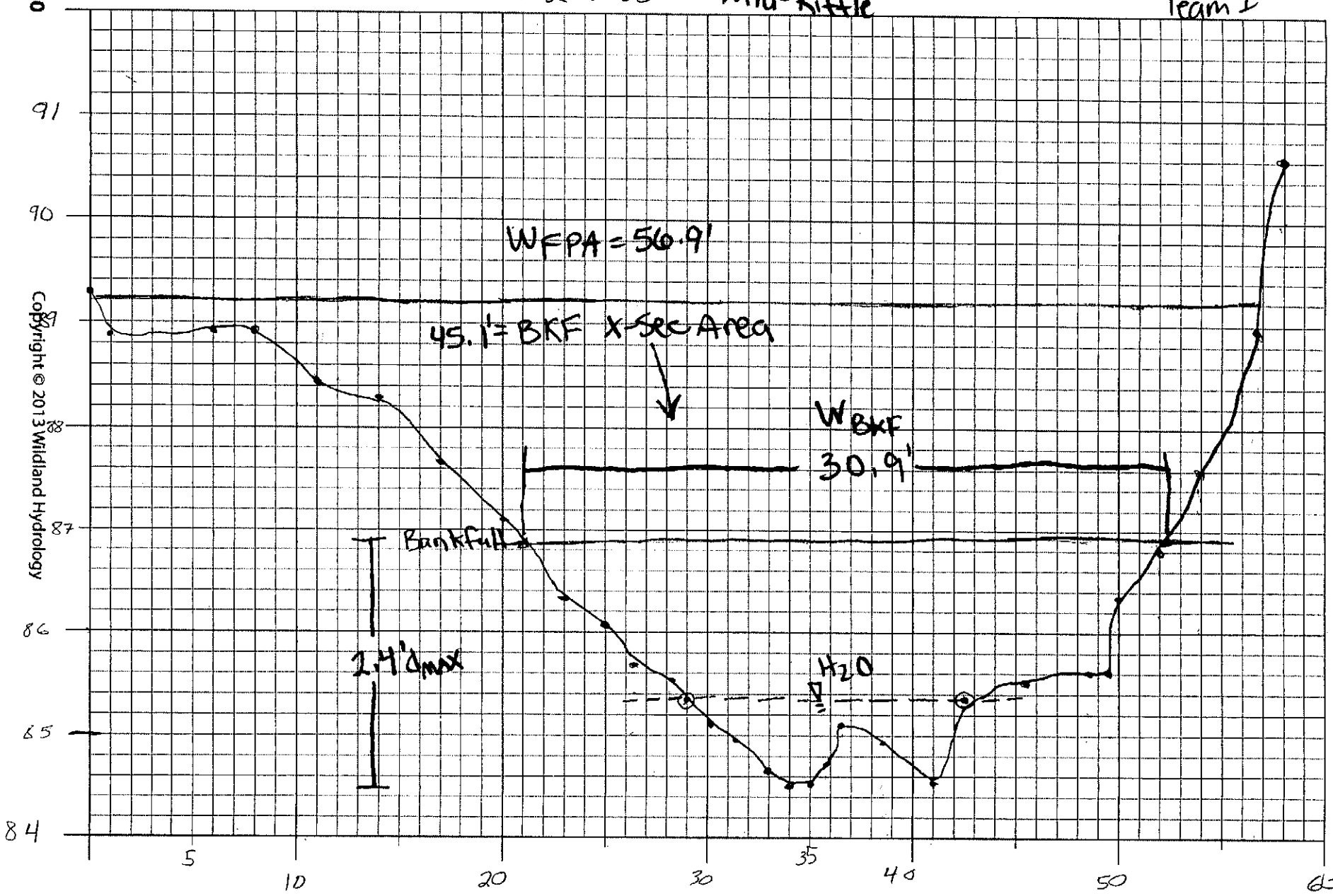
Cross Section 1

Sta 0+28 Mid-Riffle

4/16/13

Team 1



W-D Ration: 21.2

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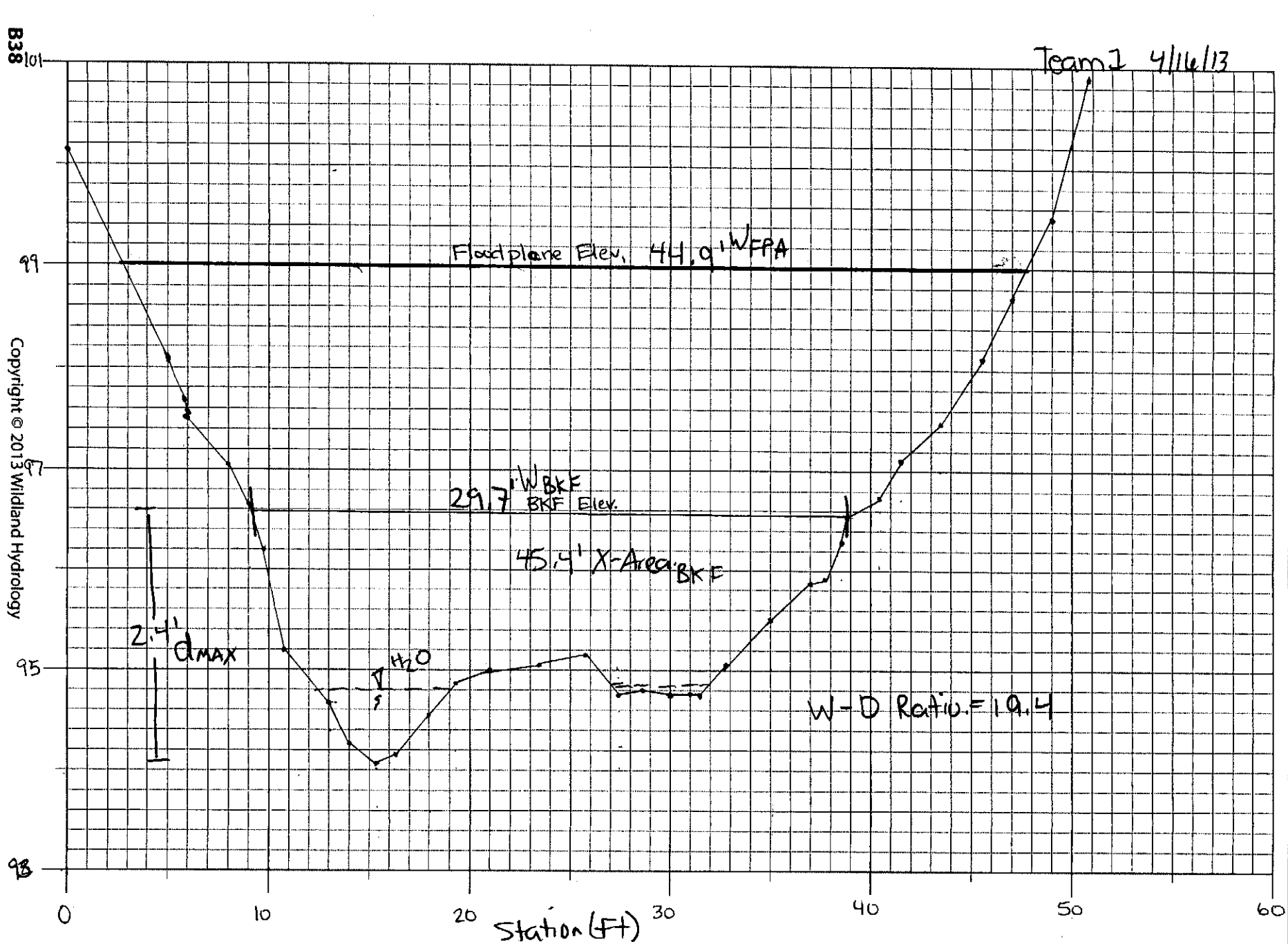
Cross-Section 1+36 RIFFLE



XS 1+36 RIFFLE

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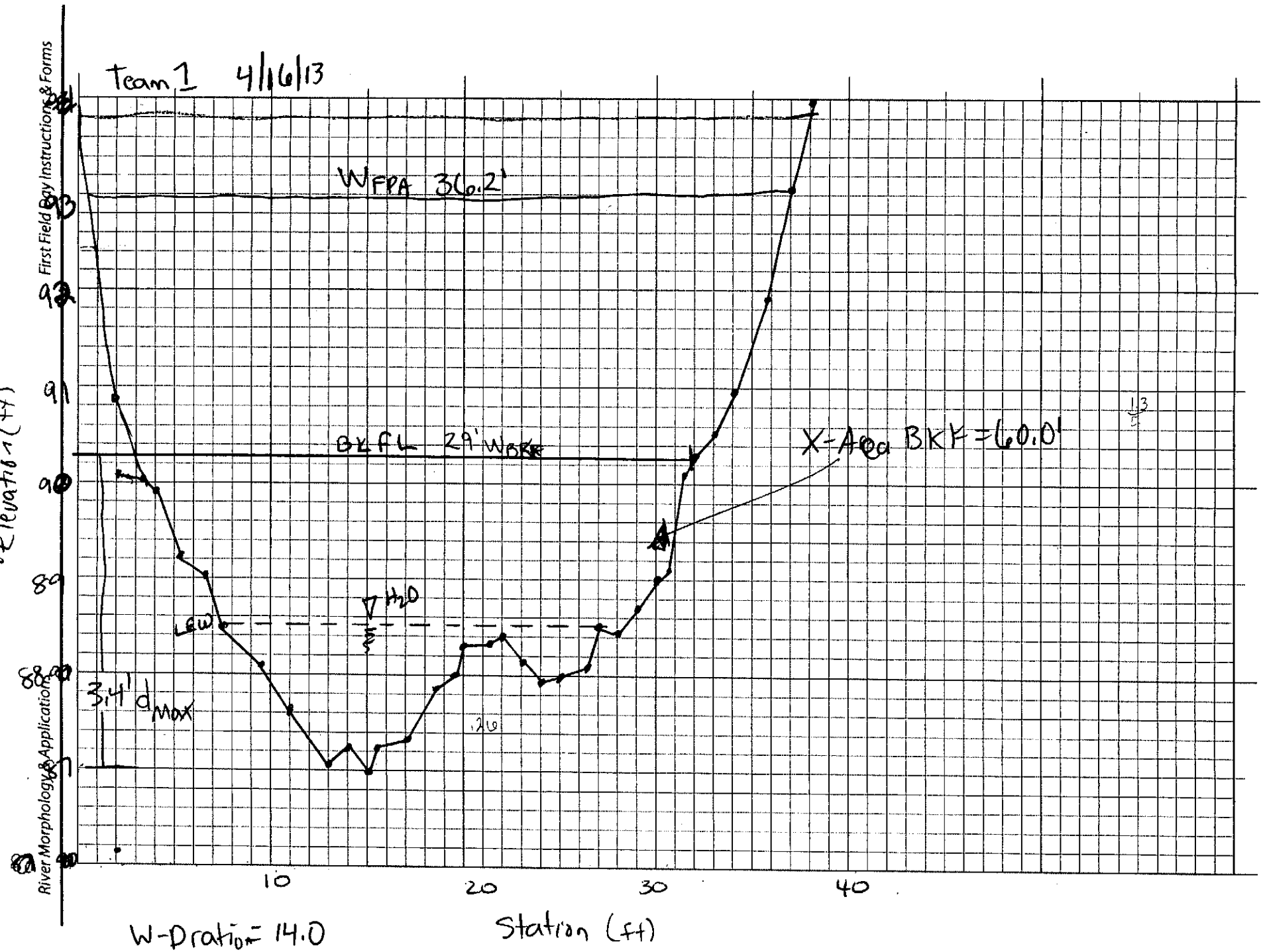
XS 204 Pool



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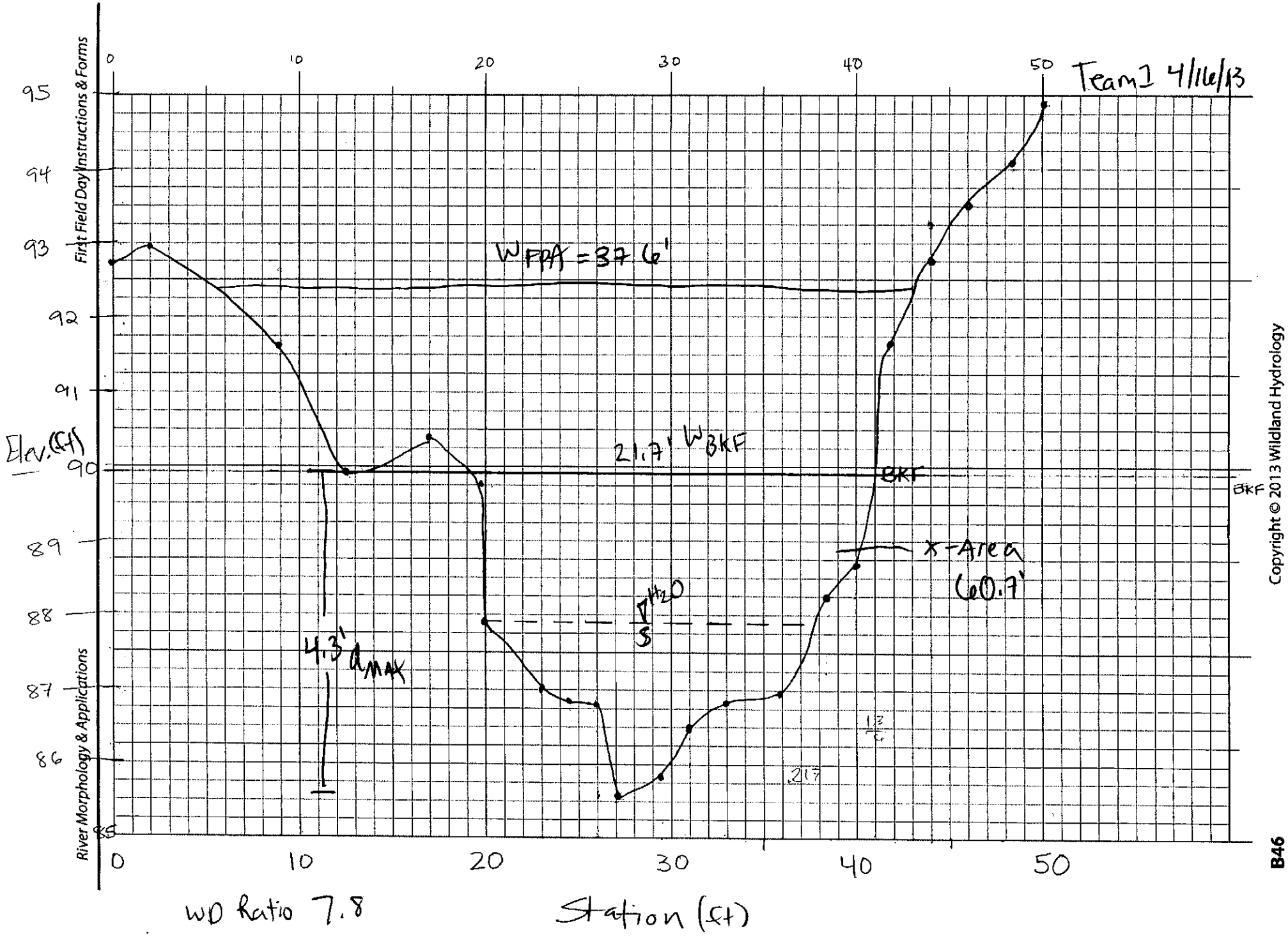
XS91 Pool



WD Ratio 7.8

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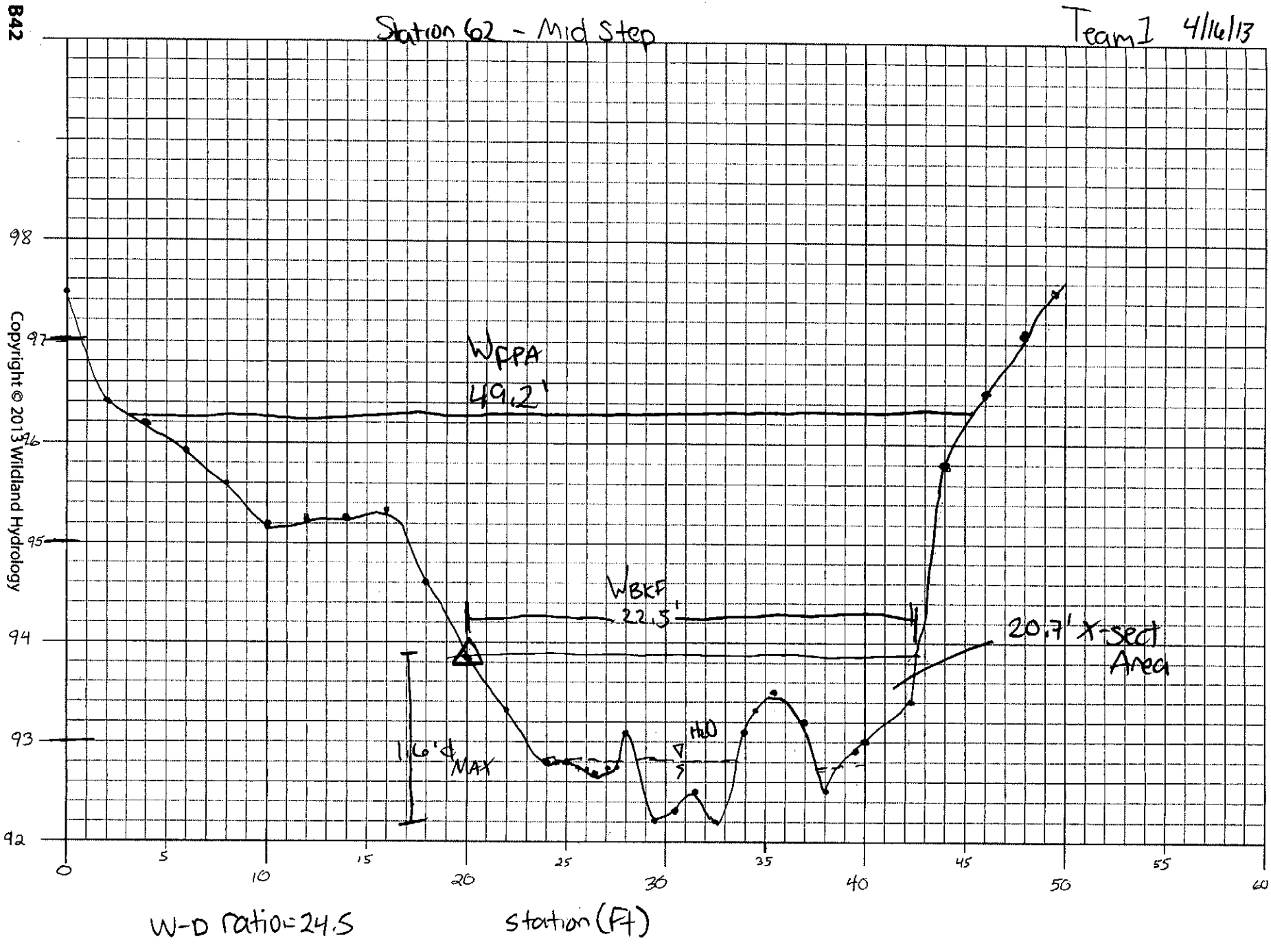
XS91



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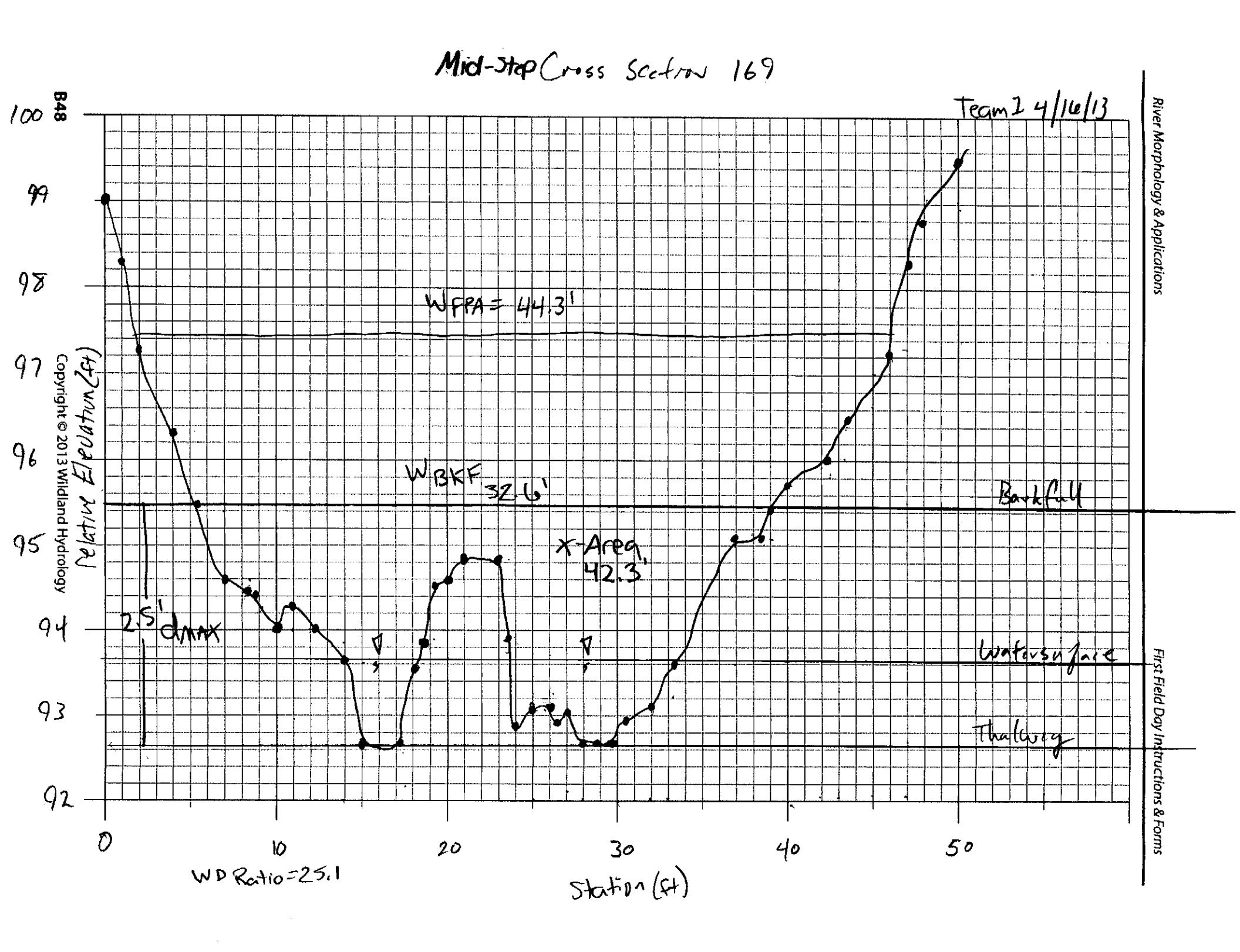
Mid-Step Cross Section 169
B48
Team 1 4/16/13
100
99
98
97
96
95
94
93
92
Elevation (ft)
WFPA = 44.3'
WBKF 32.6'
Bankfull
X-Area 42.3'
2.5' dmax
Watersurface
Thalweg
0
10
20
30
40
50
WD Ratio = 25.1
Station (ft)
River Morphology & Applications
First Field Day Instructions & Forms
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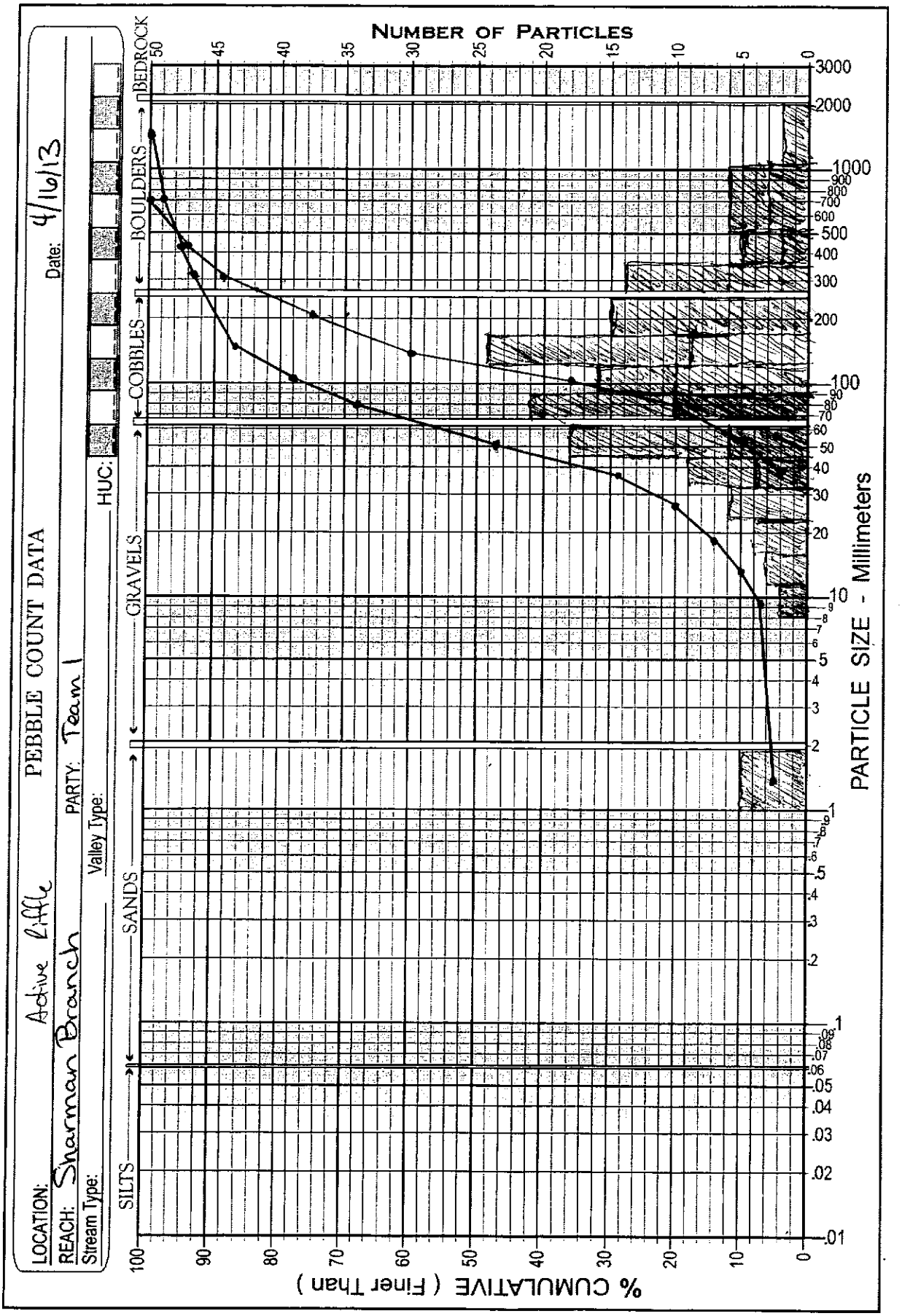

- Protruction $D_{84} = 256$
- Pebble $D_{84} = 150$

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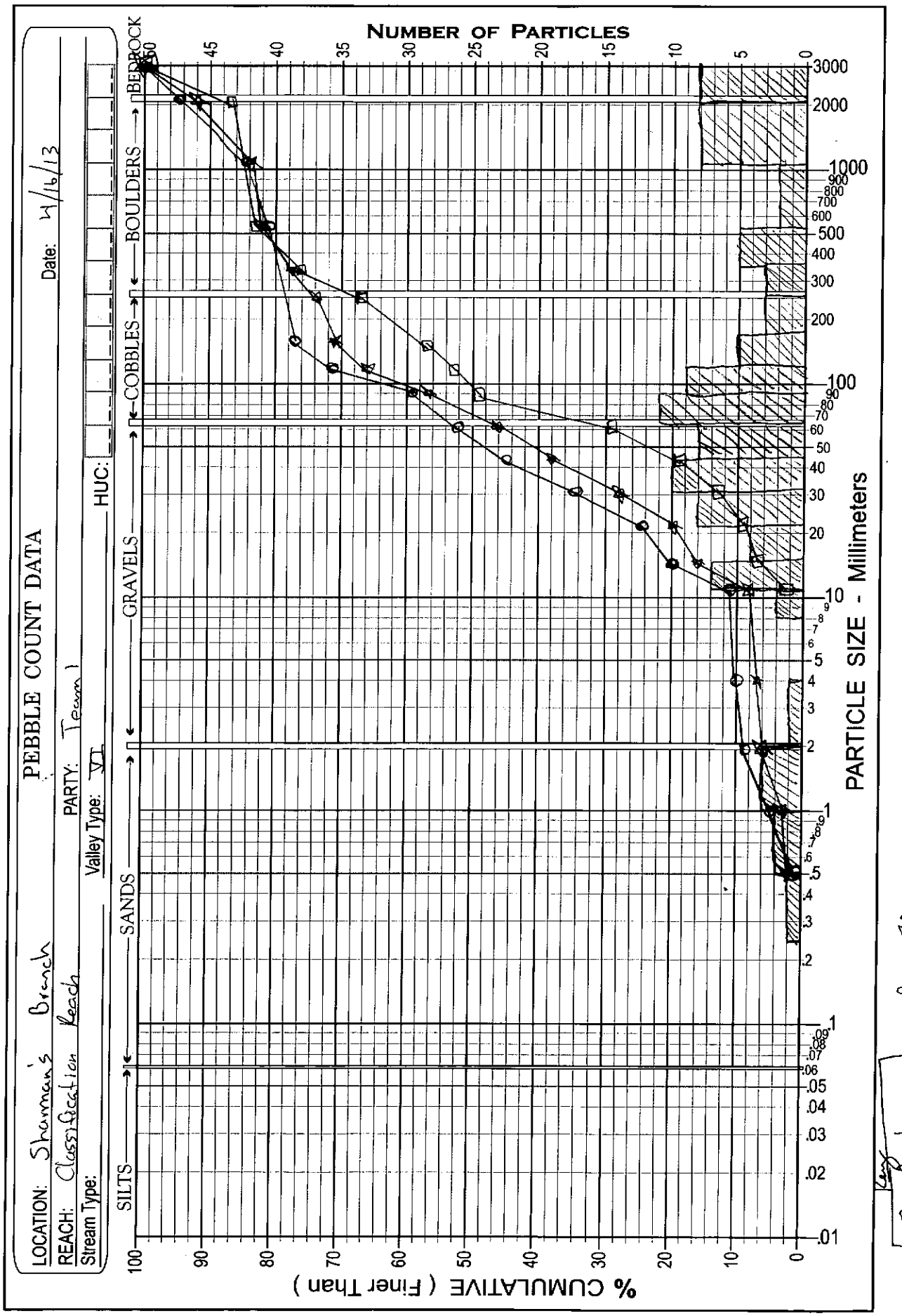

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Wetted Perimeter — Protrution — Pebble

Site: Sharman's Branch — Date: 4/16/13

Location: Active Riffle #1 — HUC:

Party: KU, SL (Team 1)

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE (1) Protrudum	POOL (2) Pebble	COMP. (3)	RIFFLE (1) Reach: / Date: TOT #	ITEM %	% CUM	POOL (2) Reach: / Date: TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: / Date: TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C				0								
	Very Fine	.062 - .125	SAND				0								
	Fine	.125 - .25	SAND				0								
	Medium	.25 - .50	SAND				0								
	Coarse	.50 - 1.0	SAND				0								
.04 - .08	Very Coarse	1.0 - 2	SAND		1 :		0			5	5	5			
.08 - .16	Very Fine	2 - 4	GRAVEL				0			0	·	5			
.16 - .22	Fine	4 - 5.7	GRAVEL				0			0		5			
.22 - .31	Fine	5.7 - 8	GRAVEL				0			0		5			
.31 - .44	Medium	8 - 11.3	GRAVEL		· ·		0			2	2	7			
.44 - .63	Medium	11.3 - 16	GRAVEL		: ·		0			3	3	10			
.63 - .89	Coarse	16 - 22.6	GRAVEL		: ·		0			4	4	14			
.89 - 1.3	Coarse	22.6 - 32	GRAVEL		⌐ ·		0			6	6	20			
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	: ·	□ ·		4	4%	4	9	9	29			
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	⌐ ·	■ □		6	6	10	18	18	47			
2.5 - 3.5	Small	64 - 90	COBBLE	☒	☒ ☒ ·		10	10	20	21	21	68			
3.5 - 5.0	Small	90 - 128	COBBLE	☒ ⌐ ·	☑ ·		16	16	36	10	10	78			
5.0 - 7.1	Large	128 - 180	COBBLE	☒ ☒ : ·	☑		24	24	60	9	9	87			
7.1 - 10.1	Large	180 - 256	COBBLE	☒ : ·			15	15	75	0		87			
10.1 - 14.3	Small	256 - 362	BOULDER	☒ : ·	⌐ ·		15	14	89	6	6	93			
14.3 - 20	Small	362 - 512	BOULDER	: ·	: ·		5	5	94	2	2	95			
20 - 40	Medium	512 - 1024	BOULDER	⌐ ·	: ·		6	6	100	3	3	98			
40 - 80	Large-Vry Large	1024 - 2048	BOULDER		: ·		0	0	100	2	2	100			
	Bedrock		BDRK				0								
Stream Type:				**Valley Type:**		TOTAL →	100			100					

HH HH

HH HH 1

24
18

5 10 15 80
20 25 30 85
35 40 45 90
50 55 60 95
65 70 75 100

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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:	Washington County, MD
Date:	4/16/13	Stream Type:	B3/2
Observers:	Team 1	Valley Type:	VT
		HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	45.1	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.46	d_{bkf} (ft)
Bankfull Riffle WIDTH	30.9	W_{bkf} (ft)	Wetted PERIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	33.8	W_p (ft)
D_{84} at Riffle	pebble = 163.7, protrusion = 324	Dia. (mm)	D_{84} (mm) / 304.8	pebble = 0.53, protrusion = 1.1	D_{84} (ft)
Bankfull SLOPE	0.031	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.33	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R(ft) / D_{84} (ft)	pebble = 2.51, protrusion = 1.21	R / D_{84}
Drainage Area	3.6	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	1.15	u^* (ft/sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [2.83 + 5.66 * Log(R / D_{84})] u^*$	pebble = 5.9, protrusion = 3.9	ft / sec	pebble = 264, protrusion = 176	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. B-34, B-35) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.055, 0.09	pebble 5.8, protrusion 3.5	ft / sec	pebble 260, protrusion 159	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. B-36) $\bar{u} = 1.49 * R^{2/3} * S^{1/2} / n$ $n =$ 0.074	4.3	ft / sec	193	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 $n =$ 0.099	3.2	ft / sec	144	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 $\bar{u} = Q / A$	2.7	ft / sec	120	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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Site: Sharman's Branch Date: 4/16/13
Location: Reach Count HUC:
Party: KV, SL (Team 1)

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) Reach: Date: 4/16/13 TOT #	ITEM %	% CUM	POOL (2) Reach: Date: 4/16/13 TOT #	ITEM %	% CUM	COMPOSITE (3) Reach: Date: 4/16/13 TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C	30	70										
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25	SAND												
	Medium	.25 - .50	SAND							1	1.4	1.4	1	1	1
	Coarse	.50 - 1.0	SAND							2	2.9	4.3	2	2	3
.04 - .08	Very Coarse	1.0 - 2	SAND							3	4.3	8.6	3	3	6
.08 - .16	Very Fine	2 - 4	GRAVEL							1	1.4	10.0	1	1	7
.16 - .22	Fine	4 - 5.7	GRAVEL												
.22 - .31	Fine	5.7 - 8	GRAVEL												
.31 - .44	Medium	8 - 11.3	GRAVEL				1	3.3	3.3	1	1.4	11.4	2	2	9
.44 - .63	Medium	11.3 - 16	GRAVEL				1	3.3	6.6	6	8.6	20	7	7	16
.63 - .89	Coarse	16 - 22.6	GRAVEL				1	3.3	9.9	3	4.3	24.3	4	4	20
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				1	3.3	13.2	7	10	34.3	8	8	28
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				2	6.7	19.9	8	11.4	45.7	10	10	38
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL				3	10	29.9	5	7.1	52.8	8	8	46
2.5 - 3.5	Small	64 - 90	COBBLE				6	20	49.9	5	7.1	59.9	11	11	57
3.5 - 5.0	Small	90 - 128	COBBLE				1	3.3	53.2	8	11.4	71.3	9	9	66
5.0 - 7.1	Large	128 - 180	COBBLE				1	3.3	56.5	4	5.7	77	5	5	71
7.1 - 10.1	Large	180 - 256	COBBLE				3	10	66.5				3	3	74
10.1 - 14.3	Small	256 - 362	BOULDER				3	10	76.5				3	3	77
14.3 - 20	Small	362 - 512	BOULDER				2	6.7	83.2	3	4.3	81.3	5	5	82
20 - 40	Medium	512 - 1024	BOULDER							2	2.9	84.2	2	2	84
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				1	3.3	86.5	7	10	94.2	8	8	92
	Bedrock		BDRK				4	13.3	100	4	5.7	100	8	8	100
Stream Type:			**Valley Type:** VI			TOTAL→	30			70			100		

Station Range	Feature Type
~~245 - 210~~	~~chute~~
248 - 240	pool
*210 - 197	pool
*180 - 173	pool
*168 - 158	pool
*158 - 130	chute (riffle)

station range	feature type
*121 - 110	pool
~~104 - 110~~	~~chute~~
*53 - 82	chute
*43 - 48	pool (pocket)
*40 - 10	chute

139 total
52 pool
87 riffle

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

Stream: Sharmin's Branch | Location: | Observers: Team #2 | Date: 4/16/13 | Valley Type: II / Sub-6 | Stream Type: B3

River Reach Dimension Summary Data.....1

Riffle Dimensions*, **, ***

Riffle Dimensions*, **, ***	Mean	Min	Max		Riffle Dimensions & Dimensionless Ratios***	Mean	Min	Max
Riffle Width (W_{bkf})	30.3	29.7	31.9	ft	Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	45.25	45.1	45.4
Riffle Mean Depth (d_{bkf})	1.5	1.5	1.5	ft	Riffle Width/Depth Ratio (W_{bkf} / d_{bkf})	20.3	19.4	21.2
Riffle Maximum Depth (d_{max})	2.4	2.4	2.4	ft	Riffle Max Depth to Riffle Mean Depth (d_{max} / d_{bkf})	1.60	1.60	1.60
Width of Flood-Prone Area (W_{fpa})	50.9	44.9	56.9	ft	Entrenchment Ratio (W_{fpa} / W_{bkf})	1.65	1.5	1.8
Riffle Inner Berm Width (W_{ib})	6.563	6.5	6.75	ft	Riffle Inner Berm Width to Riffle Width (W_{ib} / W_{bkf})	.2185	.219	.218
Riffle Inner Berm Depth (d_{ib})	.775	.75	.80	ft	Riffle Inner Berm Depth to Mean Depth (d_{ib} / d_{bkf})	.5116	.5	.53
Riffle Inner Berm Area (A_{ib})	5.8	5.4	6.2	ft^2	Riffle Inner Berm Area to Riffle Area (A_{ib} / A_{bkf})	.13	.12	.137
Riffle Inner Berm W/D Ratio (W_{ib} / d_{ib})	8.56	8.67	8.44					

Pool Dimensions*, **, ***

Pool Dimensions*, **, ***	Mean	Min	Max		Pool Dimensions & Dimensionless Ratios***	Mean	Min	Max
Pool Width (W_{bkfp})	25.35	21.7	29	ft	Pool Width to Riffle Width (W_{bkfp} / W_{bkf})	.83	.7	.93
Pool Mean Depth (d_{bkfp})	2.45	2.1	2.8	ft	Pool Mean Depth to Riffle Mean Depth (d_{bkfp} / d_{bkf})	1.63	1.4	1.87
Pool Cross-Sectional Area (A_{bkfp})	60.55	60	60.7	ft	Pool Area to Riffle Area (A_{bkfp} / A_{bkf})	1.33	1.33	1.33
Pool Maximum Depth (d_{maxp})	5.85	3.4	4.3	ft	Pool Max Depth to Riffle Mean Depth (d_{maxp} / d_{bkf})	2.57	2.26	2.86
Pool Inner Berm Width (W_{ibp})	12.25	11.5	13.0	ft	Pool Inner Berm Width to Pool Width (W_{ibp} / W_{bkfp})	.49	.45	.53
Pool Inner Berm Depth (d_{ibp})	1.4	1.3	1.5	ft	Pool Inner Berm Depth to Pool Depth (d_{ibp} / d_{bkfp})	.578	.538	.619
Pool Inner Berm Area (A_{ibp})	8	6.3	9.7	ft^2	Pool Inner Berm Area to Pool Area (A_{ibp} / A_{bkfp})	.133	.105	.16
Point Bar Slope (S_{pb})	.239	.217	.260	ft/ft	Pool Inner Berm Width/Depth Ratio (W_{ibp} / d_{ibp})	~~.17~~	~~.167~~	.197

Mean 8.756 | Min 8.64 | Max 8.84

Run Dimensions*

Run Dimensions*	Mean	Min	Max		Run Dimensions***	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**

Step**	Mean	Min	Max		Step Dimensionless Ratios***	Mean	Min	Max
Step Width (W_{bkfs})	27.5	22.5	32	ft	Step Width to Riffle Width (W_{bkfs} / W_{bkf})	.91	0.75	1.05
Step Mean Depth (d_{bkfs})	1.1	1.3	0.9	ft	Step Mean Depth to Riffle Mean Depth (d_{bkfs} / d_{bkf})	.73	.60	.87
Step Cross-Sectional Area (A_{bkfs})	31.5	20.7	42.3	ft	Step Area to Riffle Area (A_{bkfs} / A_{bkf})	.69	.45	.93
Step Maximum Depth (d_{maxs})	2.05	1.6	2.5	ft	Step Max Depth to Riffle Mean Depth (d_{maxs} / d_{bkf})	.85	.67	1.04
Step Width/Depth Ratio (W_{bkfs} / d_{bkfs})	24.8	24.5	25.1					

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

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

Observers: Team 1 | Date: 4/16/13 | Valley Type: II / Su6 | Stream Type: B3

River Reach Summary Data.....2

Hydraulics

Streamflow: Estimated Mean Velocity at Bankfull Stage ($\bar{u}_{bkf}$)	3.2	ft/sec	Estimation Method	Jarrett	
Streamflow: Estimated Discharge at Bankfull Stage (Q_{bkf})	144	cfs	Drainage Area	3.6	mi^2

Channel Pattern

Geometry	Mean	Min	Max		Dimensionless Geometry Ratios	Mean	Min	Max
Linear Wavelength (λ)	NA	NA	NA	ft	Linear Wavelength to Riffle Width (λ / W_{bkf})	—	—	—
Stream Meander Length (L_m)	NA	NA	NA	ft	Stream Meander Length Ratio (L_m / W_{bkf})	—	—	—
Radius of Curvature (R_c)	NA	NA	NA	ft	Radius of Curvature to Riffle Width (R_c / W_{bkf})	—	—	—
Belt Width (W_{blt})	42	40	44	ft	Meander Width Ratio (W_{blt} / W_{bkf})	1.36	1.29	1.42
Arc Length (L_a)	NA	NA	NA	ft	Arc Length to Riffle Width (L_a / W_{bkf})	—	—	—
Riffle Length (L_r)	21.78	15.34	30.69	ft	Riffle Length to Riffle Width (L_r / W_{bkf})	0.7	0.5	1.0
Individual Pool Length (L_p)	8.15	4.83	12.79	ft	Individual Pool Length to Riffle Width (L_p / W_{bkf})	0.26	0.16	0.41
Pool to Pool Spacing (P_s)	96.6	69.1	116.5	ft	Pool to Pool Spacing to Riffle Width (P_s / W_{bkf})	3.1	2.2	3.8

Channel Profile

Valley Slope (S_{val})	3.1%	ft/ft	Average Water Surface Slope (S)	3.3%	ft/ft	Sinuosity (S_{val} / S)		1.2
Stream Length (SL)	338	ft	Valley Length (VL)	281	ft	Sinuosity (SL / VL)		1.2
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	

Facet Slopes	Mean	Min	Max		Dimensionless Facet Slope Ratios	Mean	Min	Max
Riffle Slope (S_{rif})	.045	.027	.087	ft/ft	Riffle Slope to Average Water Surface Slope (S_{rif} / S)	1.45	0.82	2.8
Run Slope (S_{run})	—	—	—	ft/ft	Run Slope to Average Water Surface Slope (S_{run} / S)	—	—	—
Pool Slope (S_p)	.009	0.0	.024	ft/ft	Pool Slope to Average Water Surface Slope (S_p / S)	.28	0.00	.76
Glide Slope (S_g)	—	—	—	ft/ft	Glide Slope to Average Water Surface Slope (S_g / S)	—	—	—
Step Slope (S_s)	.1	.06	.19	ft/ft	Step Slope to Average Water Surface Slope (S_s / S)	3.32	1.92	6.18

Max Depths[a]	Mean	Min	Max		Dimensionless Depth Ratios	Mean	Min	Max
Max Riffle Depth (d_{maxrif})	2.4	2.37	2.43	ft	Max Riffle Depth to Mean Riffle Depth (d_{maxrif} / d_{bkf})	1.64	1.62	1.66
Max Run Depth (d_{maxrun})	—	—	—	ft	Max Run Depth to Mean Riffle Depth (d_{maxrun} / d_{bkf})	—	—	—
Max Pool Depth (d_{maxp})	3.83	3.4	4.26	ft	Max Pool Depth to Mean Riffle Depth (d_{maxp} / d_{bkf})	2.62	2.33	2.92
Max Glide Depth (d_{maxg})	—	—	—	ft	Max Glide Depth to Mean Riffle Depth (d_{maxg} / d_{bkf})	—	—	—
Max Step Depth (d_{maxs})	2.05	1.62	2.48	ft	Max Step Depth to Mean Riffle Depth (d_{maxs} / d_{bkf})	1.4	1.11	1.7

Channel Materials

	Reach[b]	Riffle[c]	Bar		Reach[b]	Riffle[c]	Bar	Protrusion Height[d]	
% Silt/Clay	—	—	—	D_{16}	16	25.73	—	79.6	mm
% Sand	6	5	—	D_{35}	41.1	51.33	—	125.63	mm
% Gravel	40	42	—	D_{50}	73.45	67.71	—	158.33	mm
% Cobble	28	40	—	D_{84}	1024	162.67	—	324.14	mm
% Boulder	18	13	—	D_{95}	BEDROCK	512	—	597.33	mm
% Bedrock	8	0	—	D_{100}	BEDROCK	2047.95	—	1023.99	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-1. Field Form for Level II Stream Classification (*First Field Day*).

Stream:	Sharman's Branch		
Basin:	Drainage Area:	acres 3.6	mi^2
Location:	Washington Canty, MD		
Twp.&Rge:	Sec.&Qtr.:		
Cross-Section Monuments (Lat./Long.):		Date:	4/16/13
Observers:		Valley Type:	

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	30.9	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.96	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	45.1	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	20.66	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.	2.4	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.	56.9	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	1.84	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.	70	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.	0.031	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).	1.2	

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

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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Shamans Branch Date: 4/16/13

Location: Ref Reach 1

Party / Notes: Team 1 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	
1	0	~~5.29~~ 5.34	~~98.81~~ 98.82	9.9	90.10	[illegible]	90.41	9.99	92.01	7.56	92.44	Riffle
2	0.5			10.16	89.84	0.8	90.64					Bottom of Riffle
3	8.3			10.71	89.29	1.2	90.49					pool
4	14.1			10.25	89.75	.43	90.38					Top Riffle
5	17.5			10.56	89.44	.93	90.37					Pedcal Pool
6	~~25.1~~	28.0		10.70	89.6	.45	90.25	8.17	91.83			
7	35.6			10.91	89.09	.95	90.04					Shute
8	45.8			10.96	89.04	.99	90.03					pocket Pool
9	~~49.1~~			10.55		10.05						~~Shute LEW~~
10	54.0			10.87	89.13	0.62	89.75					
11	49.4			10.55	89.45	9.99	S 90.01					
12	57.3			10.60	89.4	10.22	S 89.78					TOP STEP
13	62.6			11.09	88.91	10.76	S 89.24					XS STEP
14	64.8			11.94	88.06	11.19	S 88.81					
15	71.2			12.07	87.93	.90	D 88.83					Step run
16	75.8			11.81	88.19	11.30	S 88.70					TOP Shute
17	80.8			12.79	87.21	11.82	S 88.18					
18	85.1			14.41	85.59	11.83	S 88.17					TOP POOL
19	91.3			14.47	85.53	11.83	S 88.17 ~~10.59~~					MidP XS Not good BKF feature
20	97.2			13.43	86.57	1.62	D 88.19					P
21	99.7			12.67	87.33	0.82	D 88.15					
22	102.0			12.78	87.22	0.92	D 88.14					
23	104.5			12.53	87.47	0.69	D 88.16					TOP STEP
24	108.6			13.90	86.10	1.48	D 87.58					
25	111.7			13.33	86.67	0.86	D 87.53 09					
26	91.0							10.08	89.91			Moved XS flag
27	112.8			13.55	86.45	1.22	87.67					

Range
93 - 87.56
93 - 88.14
93 - 85

11.83 - 10.09

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P1

SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: Shamans Reach Date: 4/16/13

Location: Ref Reach 1

Party / Notes: Team 1 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	
28	~~115~~			~~13.56~~		0.65	D					run
29	~~119.5~~			~~13.86~~								
30	116			13.19	86.81	0.72	D 87.53					run
31	120			13.20	86.80	0.76	D 87.56					
32	123.2			13.16	86.84	0.72	D 87.56					
33	125.6			13.25	86.75	0.65	D 87.40					flat riffle
34	~~1282~~			13.10	86.90	0.49	D 87.39					
35	133.4			13.35	86.65	0.56	D 87.21					
36	135.3			13.27	86.73	12.96	S 87.04	10.69	89.31			~~Riff~~ XS
37	137			14.02	85.98	13.21	S 86.79					step
38	142.5			13.84	86.16	13.31	S 86.69					
39	144.2			14.09	85.91	0.49	D 86.40					
40	146.5			14.21	85.79	13.64	S 86.36					
41	148.0			14.25	85.75	0.70	d 86.45					
42	153.2			14.38	85.62	0.76	d 86.38					
43	155.4			14.40	85.60	0.69	d 86.29					
44	158.8			14.97	85.03	1.22	d 86.25					pool pocket
45	~~163.2~~ 165			14.73	85.27	1.0	d 86.27					pool
46	167			14.55	85.45	0.83	d 86.28					~~top step~~
47	169.1			14.24	85.76	13.78	S 86.22					top step
48	171			14.64	85.36	14.18	S 85.82					step
49	173.2			15.33	84.67	14.52	S 85.68					chute
50	174.6			15.63	84.37	1.45	d 85.92					
51	178.3			15.20	84.70	1.05	d 85.75					pool pool
52	179.6			15.15	84.85	0.85	d 85.70					
53	182.7			14.95	85.05	0.69	d 85.74					
54	184.3			14.72	85.28	0.42	d 85.70					TOPSTEP

83.15

LEW

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P.2.

SURVEY DATA → LONGITUDINAL PROFILE 3

SITE: Shamans Branch Date: 4/16/13

Location: Reach 1 - Ref Reach length

Party / Notes: Team 1 HUC: _____

Turning Point FS 14.76 BS 7.91 FS2 ~~9.11~~

	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	
55	185.1			15.01	84.99	0.36	d85.35					step/riffle
56	191.9			15.48	84.52	0.52	d85.04					
57	194.4			15.58	84.42	0.62	d85.04					shute
58	195.7			15.69	84.31	0.68	d84.99					
59	199.2			15.81	84.19	1.27	d84.73					
60	202.5			16.90	83.10	1.64	d84.74					top pool
61	197							13.59	86.41			
62	~~TP1~~			~~14.76~~	~~90.28~~							~~TURN~~
63	TP1	4.04		7.91								
64	207			12.87	83.26	1.45	d84.71					pool
65	211			11.97	84.16	.59	d84.75					pool
66	214			11.92	84.21	.46	d84.67					step
67	216.2			12.13	84.00	1.81	s84.32					step
68	217.7			12.40	83.73	.46	d84.19	10.29	85.84			
69	219.7			12.61	83.52	.66	d84.18					
70	222			12.66	83.47	.65	d84.12					
71	224			12.57	83.56	.56	d84.12					
72	226.5			12.50	83.63	12.05	s84.08					
73	230.4			12.50	83.63	.46	d84.09					
74	234			13.06	83.07	.71	d83.78					
75	238.5			13.16	82.97	.65	d83.62					
76	240			12.98	83.15	12.54	s83.59					
77	242			13.28	82.85	.56	d83.41					
78	244			13.50	82.63	.78	d83.41					
79	246			13.55	82.58	.85	d83.43					
80	249			13.63	82.50	.92	d83.42					
81	254			14.02	82.11	1.21	d83.32					

96.13

Turning Pt

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8.3

SURVEY DATA → LONGITUDINAL PROFILE 4

SITE: Shamans Branch Date: 4/16/13

Location: Ref Reach 1

Party / Notes: Team 1 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	257			13.13	83.00	.29	d 83.27					
83	259			13.85	82.28	.97	d 83.25					
84	260.5			13.05	83.08	.1	d 84.05					
85	263.5			13.13 13.63	82.5	.3	d 82.80					
86	267			15.40	80.73	1.31	d 82.04					
87	270.5			15.36	80.77	1.29	d 82.06					
88	278			15.07	81.06	1.0	d 82.06					
89	283			14.78	81.35	.69	d 82.04					
90	287			14.63	81.50	.55	d 82.05					
91	291			14.75	81.38	.56	d 82.94					
92	293			15.0	81.13	14.61	s 81.52					
93	295			15.60	80.53	1.05	d 81.58					
94	296.5			15.01	81.12	14.62	s 81.58					
95	300			15.34	80.79	.16	d 80.95					
96	302			16.02	80.11	.78	d 80.89					Pool
97	306			16.08	80.05	.73	d 80.78					
98	309			16.49	79.64	1.11	d 80.75					
99	312			16.30	79.83	.89	d 80.72					
100	315			15.45 16.2	79.93	15.45	s 80.68					
101	318			15.80	80.33	.41	sd 80.74					
102	322			16.11	80.01	.55	sd 80.42					
103	325			16.23	79.90	.56	sd 80.46					
104	328			16.20	80.01	15.96	s 80.17					
105	333			16.61	79.52	.45	d 79.97					
106	335			17.13	79.00	.54	d 79.54					
107	338			17.80	78.33	1.2	d 79.53					
108	260.3							12.98	83.15			? LEW

16.13

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10.91 85.22

?REW

94

XS 0+28 (Riffle)

Tape	FS	ELEV.	NOTE
0	5.71	102.96	LEP
1	6.11	102.56	
6	6.1	102.57	
8	6.1	102.57	
11	6.54	102.13	
14	6.6	102.07	
17	7.32	101.35	
20	7.82	100.85	
23	8.67	100	
25	8.88	99.79	
26.5	9.31	99.36	
28.3	9.58	99.09	IB
29	9.69	98.98	LEW
30.5	10.07	98.6	
31.4	9.98	98.69	
33	10.34	98.33	
34	10.49	98.18	
35.2	10.41	98.26	
35.9	10.22	98.45	
36.4	9.86	98.81	
38.6	10.08	98.59	
41	10.41	98.26	TW
42.5	9.77	98.9	REW
45.5	9.43	99.24	
48.3	9.56	99.11	
49.5	9.57	99.1	
50	8.6	100.07	
52	8.12	100.55	BKF
54	7.36	101.31	
56.8	5.99	102.68	REP

XS 0+62 (Step)

Tape	FS	ELEV.	NOTE
0	2.52	100	
2	3.58	98.94	
4	3.8	98.72	
6	4.03	98.49	
8	4.38	98.14	
10	4.58	97.94	
12	4.78	97.74	
14	4.78	97.74	
16	4.65	97.87	
18	5.37	97.15	
20	6.16	96.36	BKF
22	6.7	95.82	
24	7.18	95.34	LEW
24.5	7.22	95.3	
25	7.21	95.31	
25.5	7.25	95.27	
26	7.26	95.26	
26.5	7.32	95.2	
27	7.24	95.28	
27.5	7.22	95.3	
28	6.88	95.64	
29.5	7.78	94.74	
30.5	7.69	94.83	
31.5	7.55	94.97	
32.5	7.78	94.74	TW
34	6.91	95.61	
34.5	6.74	95.78	
35.5	6.68	95.84	
37	6.8	95.72	
38	7.48	95.04	
39.5	7.11	95.41	
40	6.98	95.54	REW
42.2	6.6	95.92	
44	4.19	98.33	
46	3.48	99.04	
48	2.9	99.62	
49.2	2.53	99.99	

XS 0+91 (Pool)

Tape	FS	ELEV.	NOTE
0	7.29	100	
2	7.01	100.28	
9	8.32	98.97	
12.5	10.09	97.2	BKF
17	9.54	97.75	
19.7	10.24	97.05	
20	12.14	95.15	LEW
23	12.97	94.32	
24.5	13.13	94.16	
26	13.18	94.11	
27.1	14.35	92.94	TW
29.5	14.19	93.1	
31	13.52	93.77	
33.2	13.2	94.09	
35.9	13.02	94.27	
38.5	11.76	95.53	REW
40.2	11.3	95.99	
41.7	8.53	98.76	
44	7.25	100.04	
46	6.49	100.8	
48.5	5.82	101.47	
50.3	5.09	102.2	

XS 1+36 (Riffle)

Tape	FS	ELEV.	NOTE
0	0.15	100	
4.9	1.88	98.27	
5.9	2.32	97.83	
6	2.42	97.73	
8	2.97	97.18	
9	3.38	96.77	
9.8	3.8	96.35	
10.8	4.8	95.35	
13	5.35	94.8	LEW
14	5.76	94.39	
15.3	5.88	94.27	TW
16.1	5.82	94.33	
18	5.43	94.72	
19.2	5.16	94.99	
21	5	95.15	
23.4	4.94	95.21	
25.9	4.85	95.3	
27.3	5.23	94.92	
28.7	5.2	94.95	
30	5.22	94.93	
31.5	5.23	94.92	REW
32.9	4.96	95.19	
35	4.48	95.67	
37	4.14	96.01	
37.7	4.07	96.08	
38.5	3.73	96.42	
38.8	3.45	96.7	BKF
40.4	3.27	96.88	
41.5	2.88	97.27	
43.3	2.54	97.61	
45.5	1.84	98.31	
47	1.28	98.87	
49	0.52	99.63	
50.9	0	100.15	

XS 1+69 (Step)

Tape	FS	ELEV.	NOTE
-0.4	0.1	100	
0	1	99.1	
1	1.71	98.39	
2	2.74	97.36	
4	3.63	96.47	
5.5	4.54	95.56	
7	5.4	94.7	
8.2	5.44	94.66	
8.6	5.6	94.5	
9	5.72	94.38	
10	5.92	94.18	
11	5.66	94.44	
12.6	5.97	94.13	
14	6.38	93.72	LEW
15.5	7.34	92.76	TW
17.2	7.23	92.87	
18.1	6.36	93.74	
18.7	6.12	93.98	
19.2	5.46	94.64	
20.1	5.41	94.69	
21.2	5.12	94.98	
23	5.12	94.98	
23.7	6.12	93.98	
24.1	7.08	93.02	
25	6.97	93.13	
25.8	6.9	93.2	
26.2	7.06	93.04	
26.8	6.99	93.11	
28	7.25	92.85	
28.8	7.25	92.85	
29.8	7.24	92.86	
30.5	7.04	93.06	
32.3	6.85	93.25	REW
33.2	6.4	93.7	
37	4.86	95.24	BKF
38.4	4.92	95.18	
39.6	4.6	95.5	
40.8	4.22	95.88	
42.7	3.97	96.13	
43.4	3.52	96.58	
45.6	2.73	97.37	
47.4	1.65	98.45	
48	1.21	98.89	
49.2	0.49	99.61	

XS 2+04 (Pool)

Tape	FS	ELEV.	NOTE
-0.5	5.3	100	
1	8.29	97.01	
2	9.1	96.2	
3.2	9.65	95.65	
4	10.15	95.15	
5.1	10.72	94.58	
6.8	10.94	94.36	
7.6	11.46	93.84	LEW
9.3	11.87	93.43	
11	12.38	92.92	
13	12.86	92.44	TW
14	12.77	92.53	
14.9	13	92.3	
15.5	12.76	92.54	
16.9	12.62	92.68	
18.3	12.18	93.12	
19.2	12.03	93.27	
20.1	11.68	93.62	
21.2	11.64	93.66	
22	11.61	93.69	
23.1	11.82	93.48	
24	12.09	93.21	
25	12.04	93.26	
26.4	11.87	93.43	
26.8	11.48	93.82	
28	11.56	93.74	
28.8	11.44	93.86	REW
30.2	10.72	94.58	
30.8	10.3	95	
31.5	9.87	95.43	
31.8	9.63	95.67	BKF
32	9.66	95.64	
33	9.44	95.86	
33.2	9.41	95.89	
34	9.03	96.27	
35.8	8.1	97.2	
37	6.95	98.35	
38	6.06	99.24	