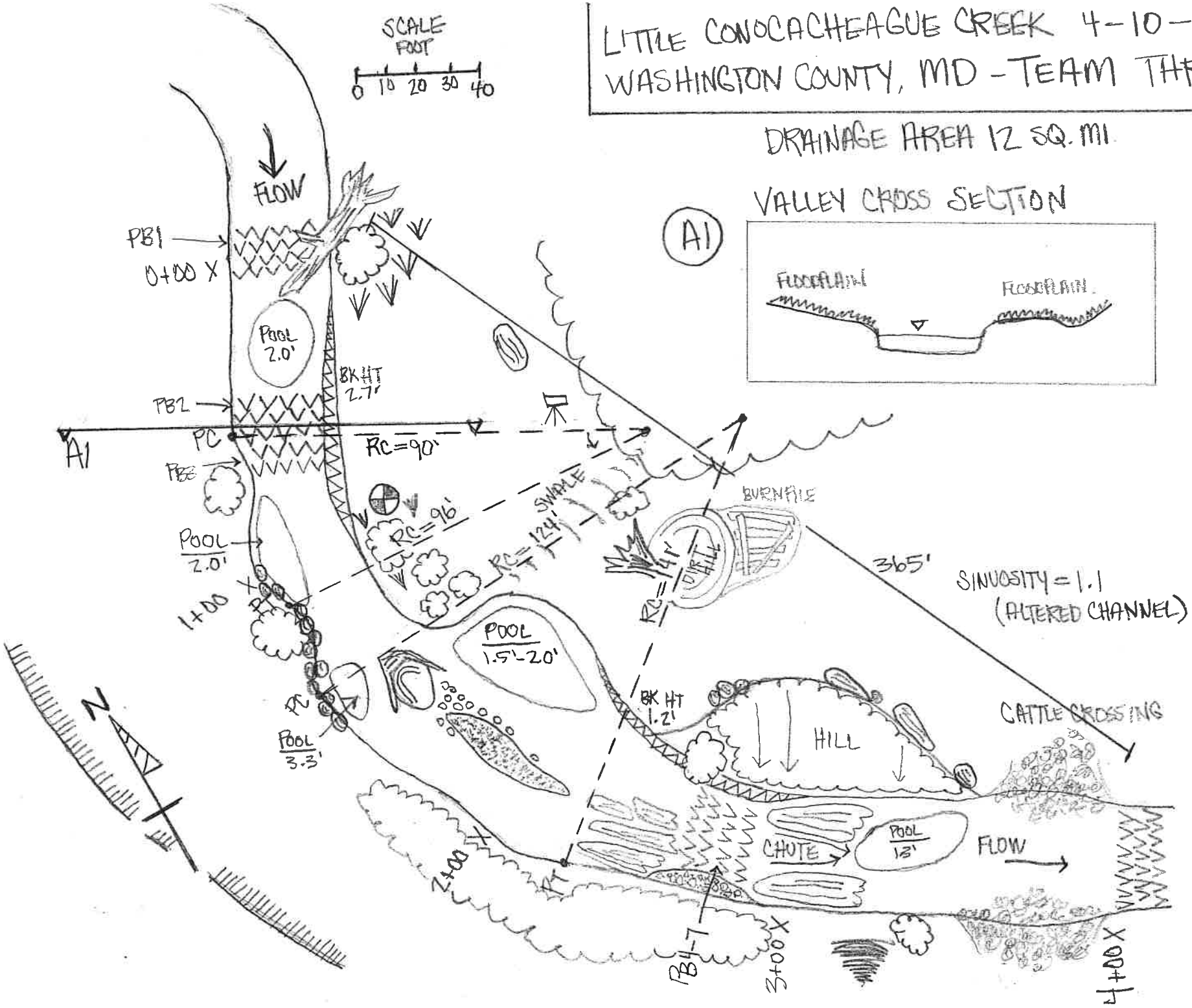
LITTLE CONOCACHEAGUE CREEK 4-10-18
WASHINGTON COUNTY, MD - TEAM THREE

DRAINAGE AREA 12 SQ. MI.



SURVEY DATA ⟶ **CROSS - SECTION 1**

SITE: Little Conococheague Creek Date: 4/10/18

Location: Washington County

Observers: Nick, Marilyn, Lucy HUC:

Item	Distance, Point, or STATION ft	Back-Sight BS ft	Height of Instrument HI ft	Fore-Sight FS ft	Elevation ft	NOTES / COMMENTS / REMARKS
1	BM	6.09	106.09		100	Sta 0+63 pin @ bank
2	0			5.18	100.91	
3	13.3			7.85	98.24	0.62' below bkfl
4	19.8			6.60	99.49	
5	24.8			6.34	99.75	
6	29.8			6.19	99.90	
7	34.8			6.30	99.79	
8	39.8			6.03	100.06	
9	44.8			5.93	100.16	
10	49.8			5.99	100.10	(L) Top of bank
11	53.6			6.06	100.03	(L) Top of bank
12	53.9			7.09	99.0	
13	54.5			7.23 / 7.57	98.86 / 98.52	LBKL 54.1 STA 98.86 ELEV
14	55.0			8.29	97.80	
15	55.5			8.76	97.33	(L) edge of water surface
16	56.7			9.49	96.60	
17	58.0			9.66	96.43	
18	60.4			9.63	96.46	
19	63.0			9.61	96.48	
20	65.5			9.62	96.47	
21	67.3			9.76	96.33	
22	69.5			9.95	96.14	thalweg
23	70.7			9.83	96.26	
24	72.4			9.90	96.19	
25	74.3			9.90	96.19	
26	76.6			9.94	96.15	
27	78.1			9.79	96.30	
28	79.2			9.62	96.47	

0 54.1 →
0.4 0.
0.9
1.4
2.6
3.9
6.3
8.9
11.4
13.2
15.4
16.6
18.3
20.2
22.5
24.0
25.1

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SURVEY DATA → **CROSS - SECTION 2**

SITE: Little Conocacheague Creek Date: 4/10/18

	Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
25.8	29	79.9			9.43	96.66	
26.1	30	80.2			9.32	96.77	
26.1	31	80.2			8.74	97.35	(R) edge of water top
26.5	32	80.6			8.35	97.74	(R) top of bank
27.2	33	81.3			8.04	98.05	
28.3	34	82.4			7.77	98.32	
29.2	35	83.3			7.52	98.57	
31.1	36	85.2			7.23	98.86	(R) BKFl
	37	87.0			7.11	98.98	
	38	88.7			6.74	99.35	
	39	90.0			6.32	99.77	
	40	92.4			5.96	100.13	
	41	95.4			5.71	100.38	
	42	97.4			5.54	100.55	
	43	98.1			5.66	100.43	
	44	99.3			5.32	100.77	
	45	102.8			5.06	101.03	
	46	107.8			4.76	101.33	
	47	112.8			4.50	101.59	(R) Flood Prone Area
	48	117.8			4.27	101.82	
	49	119.8			3.99	102.10	Rock
	50						
	51	-6			4.45	101.64	(L) FPA
2	52	-8			4.26	101.83	
0	53	-10			4.10	101.99	
	54	BM	6.09			100.00	Check
	55						
	56						
	57						
	58						
	59						

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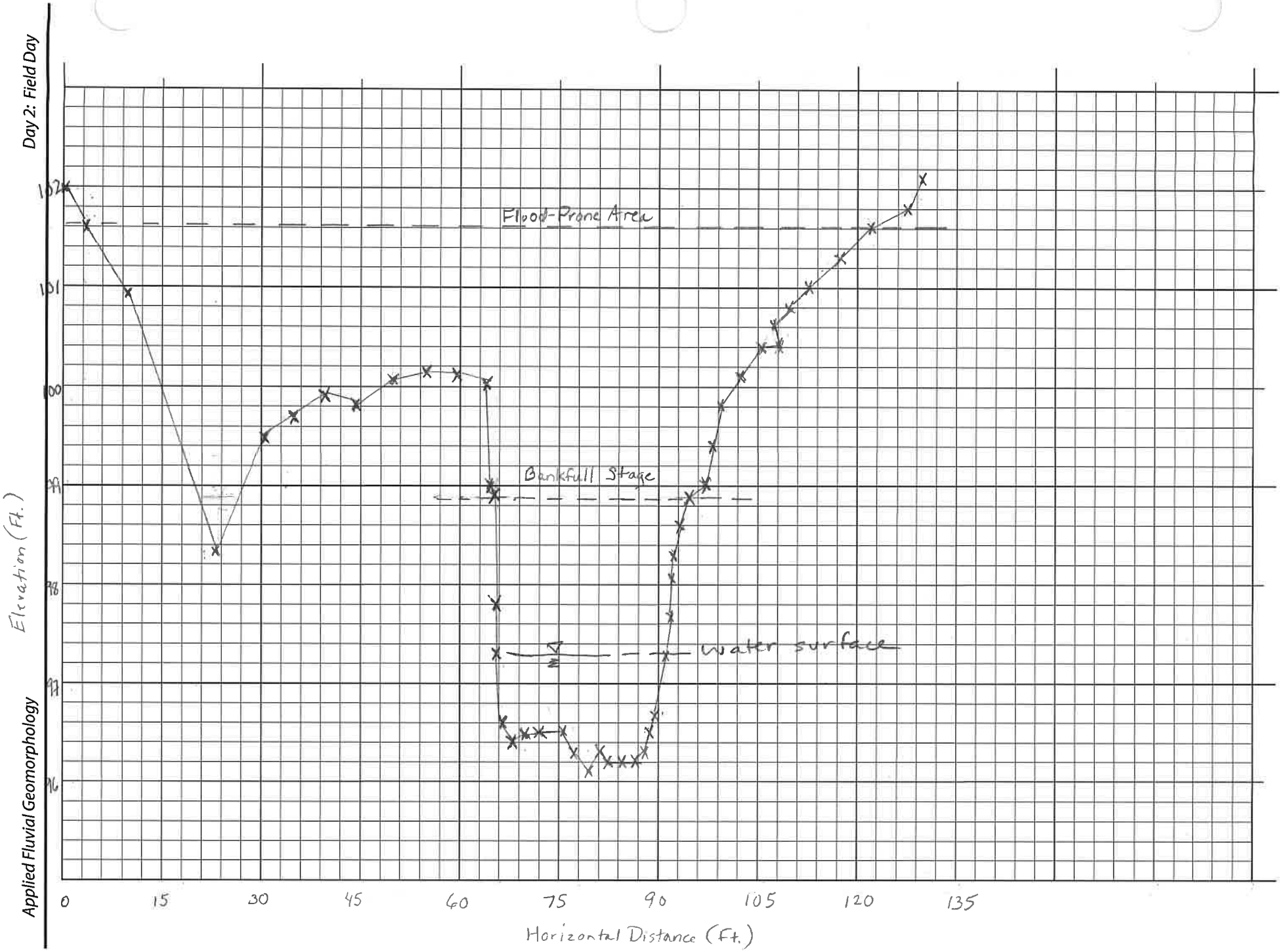
Riffle Cross-Section — Little Conococheague Creek 4/10/18
Team 3



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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 1**

SITE: Little Conococheague Reach 3 Date: 4/10/18

Location: Team 3

Observers: Jon, Tyler Charles HUC:

BM 100.0

	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	0		105.24										
2	0			-8.95	96.29	-7.85	97.39			-5.75	99.49	riffle top	
3	0+17			-9.5	95.74	-7.85	97.39	-6.51	98.73	-6.51	98.73	riffle bottom	1.46
4	0+30			-9.92	95.32	-7.9	97.34			-6.18	99.06	Pool	
5	0+52			-9.5	95.74	-7.93	97.31	-6.53	98.71	-6.53	98.71	riffle top & x-section	1.4
6	0+89			-9.29	95.95	-8.13	97.11			-6.16	99.08	bottom riffle	
7	0+124			-10.41	94.83	-8.4	96.84	-7.2	98.04	-7.2	98.04	Pool	1.2
8	0+136			-11.62	93.62	-8.32	96.92			-7.37	97.87	Pool	
9	0+153			-8.69	96.55	-8.35	96.89			-7.2	98.04	Glide	
10	0+171			-10.03	95.21	-8.45	96.79			-6.45	98.79	Pool	
11	0+221			-9.51	95.73	-8.56	96.68	-7.41	97.83	-7.41	97.83	Top Riffle	1.2
12	0+297			-10.77	94.47	-9.75	95.49			-7.32	97.92	bottom riffle	
13	0+308			-10.93	94.31	-9.67	95.57			-7.25	97.99	pool	
14	0+322			-10.71	94.53	-9.71	95.53			-7.87	97.37	top riffle	
15	0+334			-10.83	94.41	-9.95	95.29			-8.10	97.14	bottom riffle	
16	0+357			-10.98	94.26	-9.79	95.45	-8.87	96.37		96.37	BKFL	.9
17	0+371			-10.85	94.39	-9.74	95.50	-8.67	96.57		96.57	BKFL	1.07
18	0+400			-10.34	94.90	-9.90	95.34		96.41	-8.83	96.41	end of reach / riffle	
19													
20									Stream =			400'	
21									Valley =			359	+ 37
22												730 ÷ 2 = 365'	
23													
24									87 ft			Meander Belt Width	
25													
26									Meander			Length	
27												540 ft	

metal object

4.4
0.90

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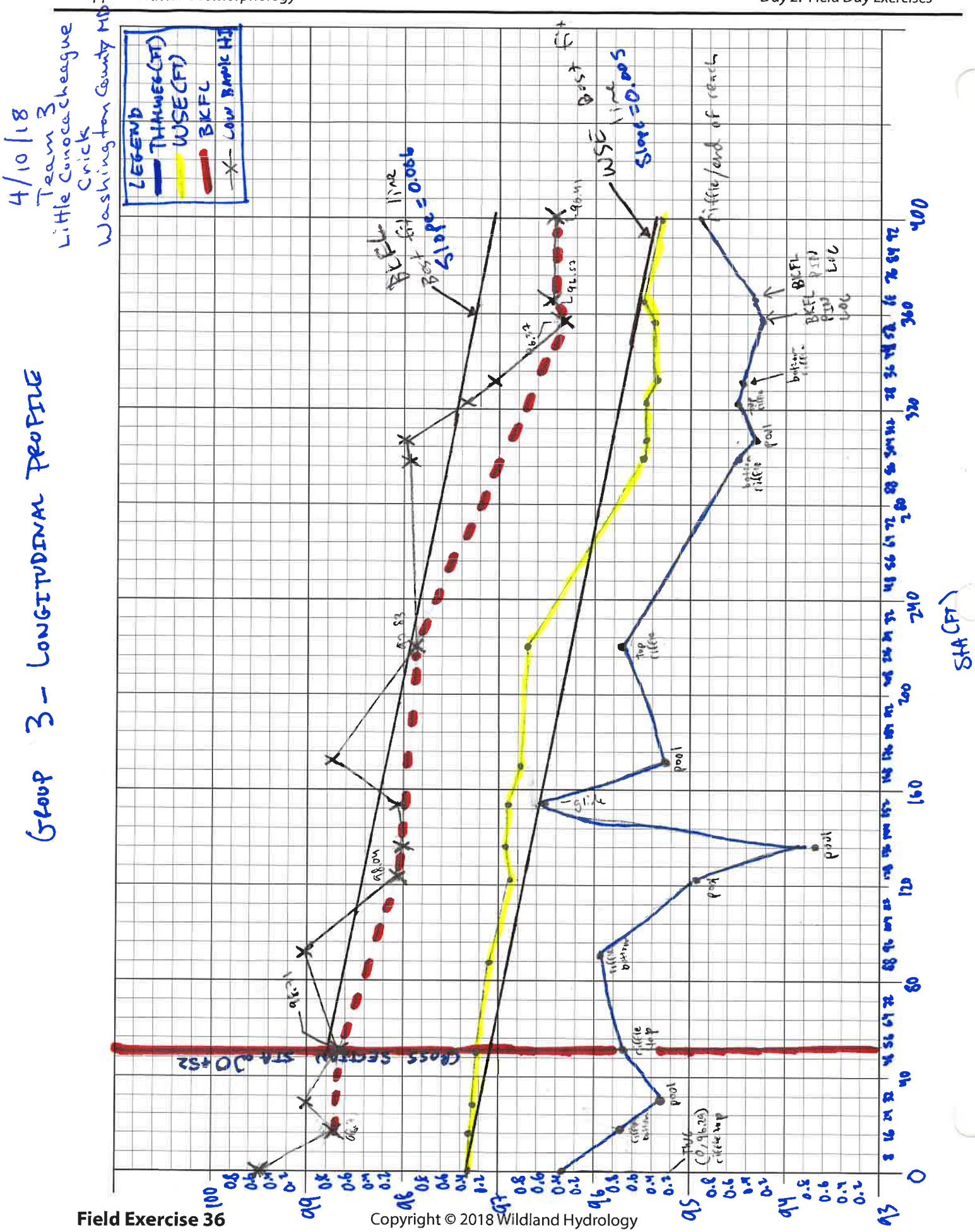

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4/10/2018
Team 3
Little Conococheague

Site: XSec Riffle
Location: HUC:
Observers:

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:			Date:			Date:		
	Silt / Clay	< .062	S/C				19	19	19						
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25					1	1	20						
	Medium	.25 - .50					4	4	24						
	Coarse	.50 - 1.0					4	4	28						
.04 - .08	Very Coarse	1.0 - 2													
.08 - .16	Very Fine	2 - 4	GRAVEL				2	2	30						
.16 - .22	Fine	4 - 5.7					3	3	33						
.22 - .31	Fine	5.7 - 8					2	2	35						
.31 - .44	Medium	8 - 11.3					8	8	43						
.44 - .63	Medium	11.3 - 16					10	10	53						
.63 - .89	Coarse	16 - 22.6					6	6	59						
.89 - 1.3	Coarse	22.6 - 32					3	3	62						
1.3 - 1.8	Very Coarse	32 - 45					3	3	65						
1.8 - 2.5	Very Coarse	45 - 64					8	8	73						
2.5 - 3.5	Small	64 - 90	COBBLE				7	7	80						
3.5 - 5.0	Small	90 - 128					4	4	84						
5.0 - 7.1	Large	128 - 180					8	8	92						
7.1 - 10.1	Large	180 - 256					7	7	99						
10.1 - 14.3	Small	256 - 362	BOULDER				1	1	100						
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
						TOTAL→	100	100							

Stream Type: **Landscape Type:**

D84 = 128 mm

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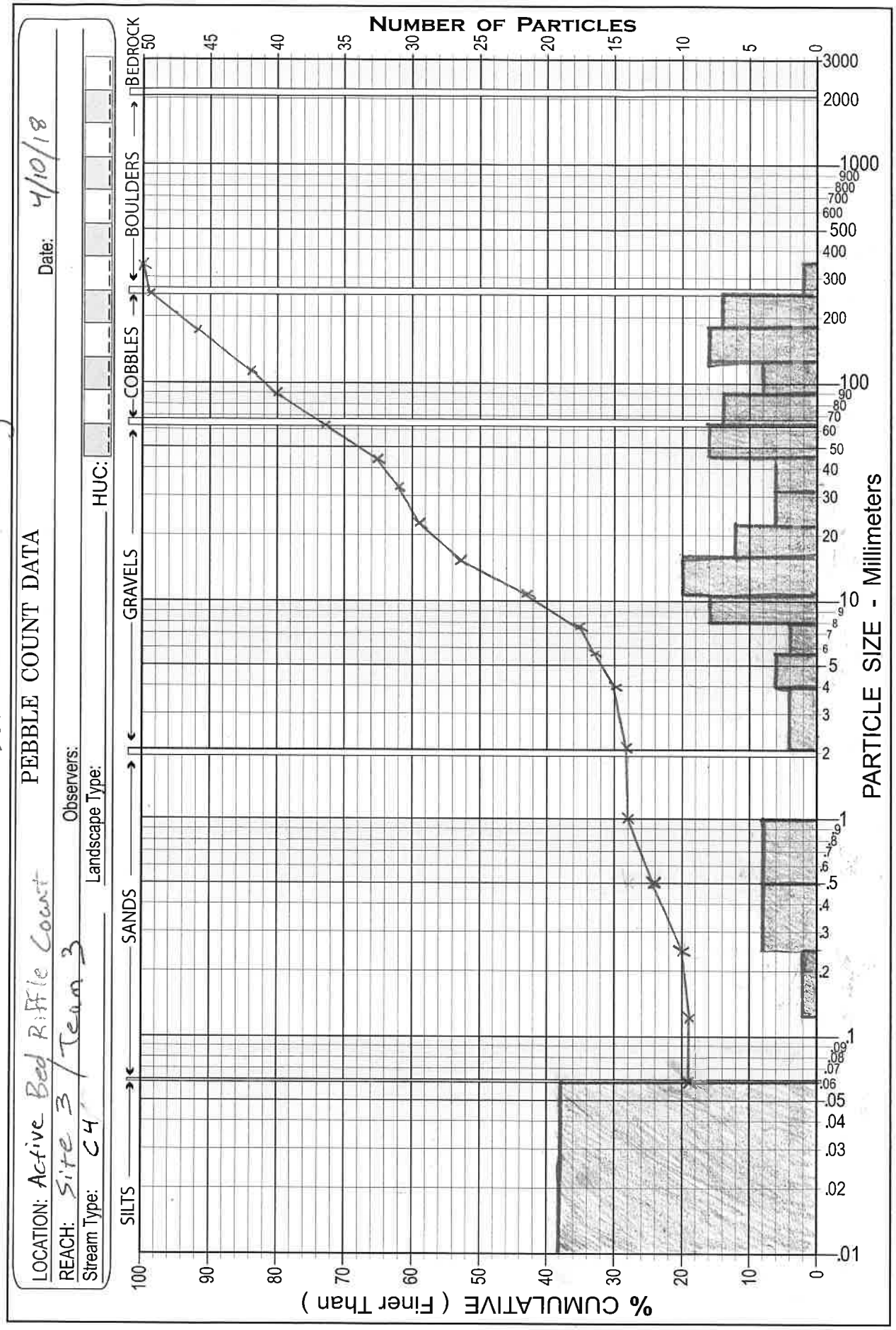

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4/10/2018
Little Conocacheague

2=2.9 = .5
3=4.3
13=18.6

Site: 3 / Team 3
Location: HUC:
Observers:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1 (7)	POOL 2 (3)	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		⊠		2	2.9	2.9	10	33.3	33.3	12	12	12
	Very Fine	.062 - .125	SAND				0	0.0	2.9	0	0.0	33.3	0	0	12
	Fine	.125 - .25	SAND				1	1.4	4.3	0	0.0	33.3	1	1	13
	Medium	.25 - .50	SAND				0	0.0	4.3	1	3.3	36.6	1	1	14
	Coarse	.50 - 1.0	SAND				2	2.9	7.2	0	0.0	36.6	2	2	16
.04 - .08	Very Coarse	1.0 - 2	SAND				0	0.0	7.2	0	0.0	36.6	0	0	16
.08 - .16	Very Fine	2 - 4	GRAVEL				0	0.0	7.2	0	0.0	36.6	0	0	16
.16 - .22	Fine	4 - 5.7	GRAVEL				1	1.4	8.6	2	6.7	43.3	3	3	19
.22 - .31	Fine	5.7 - 8	GRAVEL				1	1.4	10	1	3.3	46.6	2	2	21
.31 - .44	Medium	8 - 11.3	GRAVEL				4	5.7	15.7	2	6.7	53.3	6	6	27
.44 - .63	Medium	11.3 - 16	GRAVEL				5	7.1	22.8	1	3.3	56.6	6	6	33
.63 - .89	Coarse	16 - 22.6	GRAVEL				3	4.9	27.2	0	0.0	56.6	3	3	36
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				5	7.1	34.3	2	6.7	63.3	7	7	43
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				8	11.4	45.7	3	10.0	73.3	11	11	54
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	⊠			10	14.2	59.9	1	3.3	76.6	11	11	65
2.5 - 3.5	Small	64 - 90	COBBLE	⊠			13	18.6	78.5	1	3.3	79.9	14	14	79
3.5 - 5.0	Small	90 - 128	COBBLE				2	2.9	81.4	0	0.0	79.9	2	2	81
5.0 - 7.1	Large	128 - 180	COBBLE				2	2.9	84.3	0	0.0	79.9	2	2	83
7.1 - 10.1	Large	180 - 256	COBBLE				1	1.4	85.7	0	0.0	79.9	1	1	84
10.1 - 14.3	Small	256 - 362	BOULDER				0	0.0	85.7	2	6.7	86.6	2	2	86
14.3 - 20	Small	362 - 512	BOULDER				0	0.0	85.7	0	0.0	86.6	0	0	86
20 - 40	Medium	512 - 1024	BOULDER				2	2.9	88.6	0	0.0	86.6	2	2	88
40 - 80	Large-Vry Large	1024 - 2048	BOULDER				0	0.0	88.6	0	0.0	86.6	0	0	88
	Bedrock		BDRK				8	11.4	100	4	13.3	100	12	12	100
Stream Type:			**Landscape Type:**			TOTAL→	70			30			100		

7 / 3

D50 = 14 mm

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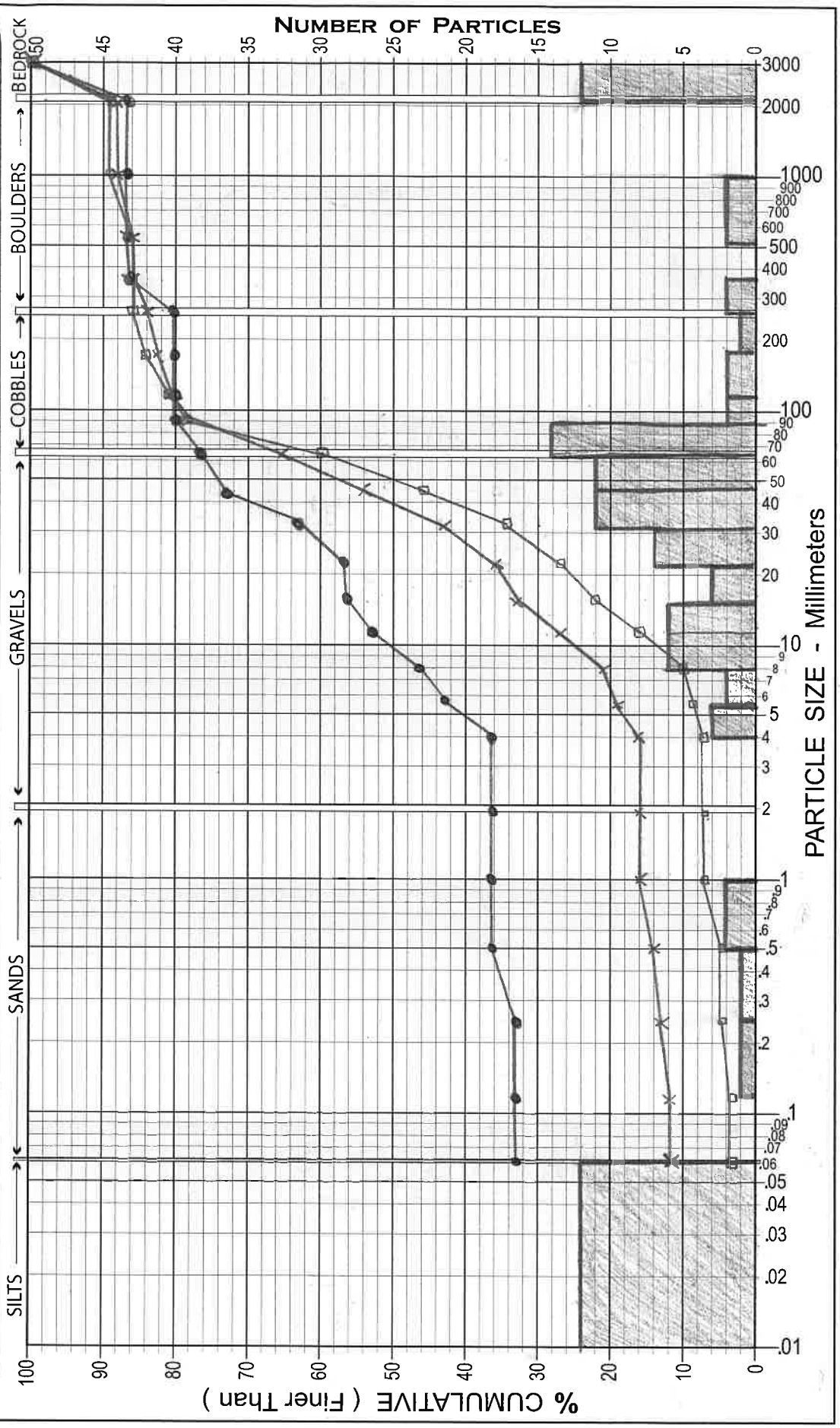
Little Conococheague

LOCATION: Representative Pebble Count PEBBLE COUNT DATA Date: 4/10/18

REACH: Site 3 / Team 3 Observers:

Stream Type: C4 Landscape Type: HUC:



□ riffle
● pool
X total

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Worksheet 2. Computations of velocity and discharge using various methods.

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Little Conococheague Creek	Location:	~~Reach~~ Washington County, MD
Date: 4/10/18	Stream Type: C4/1	Landscape Type:	Confined Alluvial
Observers:	Team 3 Reach 3	HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional Area	66	A_{bkf} (ft^2)	Bankfull Riffle Mean Depth	2.1	d_{bkf} (ft)
Bankfull Riffle Width	31.1	W_{bkf} (ft)	Wetted Perimeter $\approx (2 * d_{bkf}) + W_{bkf}$	35.3	W_p (ft)
D_{84} Particle Size at Riffle	128	D_{84} (mm)	D_{84} Particle Size in Feet D_{84} (mm) / 304.8	.42	D_{84} (ft)
Bankfull Slope	.006	S_{bkf} (ft / ft)	Hydraulic Radius A_{bkf} / W_p	1.87	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	4.5	R / D_{84} (ft / ft)
Drainage Area	12	DA (mi^2)	Shear Velocity $u^* = (gRS)^{1/2}$	.6	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	3.9	ft / sec	258	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor/Relative Roughness (Figures 27–28) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .045	3.9	ft / sec	258	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Figure 29) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .04	4.4	ft / sec	290	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 $n =$		ft / sec		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 $\bar{u} = Q / A$	3.2	ft / sec	210 ~~300~~	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 1. Field Form for Level II Stream Classification.

Stream: Little Conocacheague Creek	
Basin:	Drainage Area: ~~mi~~ acres 12 mi^2
Location:	
Twp.&Rge:	Sec.&Qtr.: Reach 3
Cross-Section Monuments (Lat./Long.):	Date: 4/10/18
Observers: Team 3	Landscape Type:

Bankfull Width (W_{bkf}) The surface width of the stream at bankfull stage elevation, in a riffle section.	31.1	ft
Bankfull Mean Depth (d_{bkf}) Mean depth of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	2.1	ft
Bankfull Cross-Sectional Area (A_{bkf}) Area of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	66	ft^2
Bankfull Width/Depth Ratio (W_{bkf} / d_{bkf}) *Bankfull Width* divided by *Bankfull Mean Depth*, in a riffle section.	14.8	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.	2.72	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.	118.8	ft
Entrenchment Ratio (ER) The *Flood-Prone Area Width* divided by *Bankfull Width* (W_{fpa} / W_{bkf}), in a riffle section.	3.82	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.	40	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.	.005	ft/ft
Channel Sinuosity (k) An index of channel pattern determined from stream length divided by valley length (L_{st} / L_{val}), or from valley slope divided by average water surface slope (S_{val} / S).	1.1	ft/ft

Stream Type C4/1 **See Classification Key (Figure 2)**

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Worksheet 3. Summary of Morphological Variables.

Stream: Little Conococheague Cr.		**Location:** Washington County	
Team: 3 Reach 3	**Date:** 4/10/18	**Drainage Area:** 12 sq. mi	

Riffle Channel Dimensions

1. Bankfull Width (W_{bkf}) (ft)	31.1'	2. Bankfull Mean Depth (d_{bkf}) (ft)	2.1
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	14.8	4. Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)	66
5. Bankfull Maximum Depth (d_{max}) (ft)	2.72'	6. Width of Flood-Prone Area (W_{fpa}) (ft)	118.8'
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	3.8		

Channel Pattern / Pattern Ratios

8. Belt Width (W_{blt}) (ft)	Mean:		9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf})	Mean:	
	Min:	87'		Min:	2.8
	Max:			Max:	
10. Stream Meander Length (L_m) (ft)	Mean:		11. Meander Length Ratio (MLR) (L_m / W_{bkf})	Mean:	
	Min:	64		Min:	2.06
	Max:			Max:	
12. Linear Wavelength (λ) (ft)	Mean:		13. Linear Wavelength to Bankfull Width (λ / W_{bkf})	Mean:	
	Min:	540'		Min:	17.36
	Max:			Max:	
14. Radius of Curvature (R_c) (ft)	Mean:	113	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf})	Mean:	3.63
	Min:	90		Min:	
	Max:	141		Max:	

Channel Particles

Representative Pebble Count

16. D_{16} (mm)	.062	17. D_{35} (mm)	14	18. D_{50} (mm)	40
19. D_{84} (mm)	256	20. D_{95} (mm)	2500	21. D_{100} (mm)	BDRK

Active Bed Riffle Pebble Count

22. D_{16} (mm)	.062	23. D_{35} (mm)	8	24. D_{50} (mm)	14
25. D_{84} (mm)	128	26. D_{95} (mm)	210	27. D_{100} (mm)	362

Classification

28. Sinuosity (k)	1.1	29. Average Water Surface Slope (S)	.005
30. Stream Type	C4	31. Landscape Type	C-AL-AD

Velocity & Discharge

32. Friction Factor ($\bar{u}$ / u^*)	6	33. Relative Roughness (R / D_{84})	.015
34. Manning's 'n' from Friction Factor / Relative Roughness	.045	35. Manning's 'n' from Stream Type	.04
36. Estimated Bankfull Mean Velocity ($\bar{u}_{bkf}$) (ft/sec)	3.9	37. Estimated Bankfull Discharge (cfs)	258
38. Estimation Method Selected for Velocity & Discharge	1. Friction Factor/Relative Roughness		

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