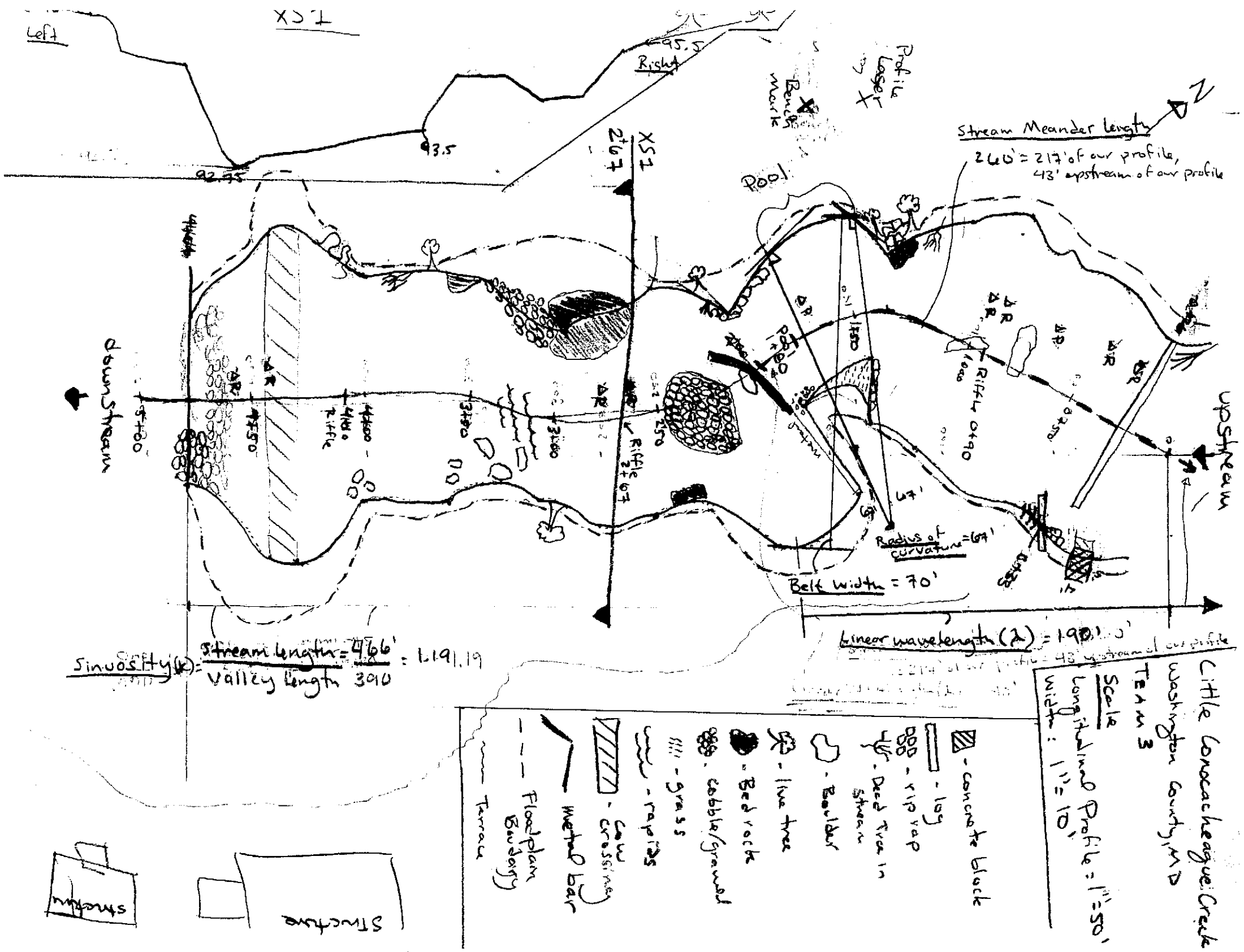


XS 1
Left
Right
95.5
93.5
92.75
Profile Laser
Bench Mark
Pool
Stream Meander length
260' = 217' of our profile, 43' upstream of our profile
N
XS 1 2+67
downstream
upstream
Riffle 2+67
Riffle 0+90
Radius of curvature = 67'
Belt width = 70'
Linear wavelength (λ) = 190'
Sinuosity (k) = Stream length / Valley length = 466' / 390 = 1.191.19
Little Conocacheague Creek
Washington County, MD
Team 3
Scale
Longitudinal Profile = 1" = 50'
Width: 1" = 10'
- concrete block
- log
- rip rap
- Dead Tree in stream
- Boulder
- live tree
- Bed rock
- cobble/gravel
- grass
- rapids
- cow crossing
- metal bar
- Floodplain Boundary
- Terrace
structure
structure

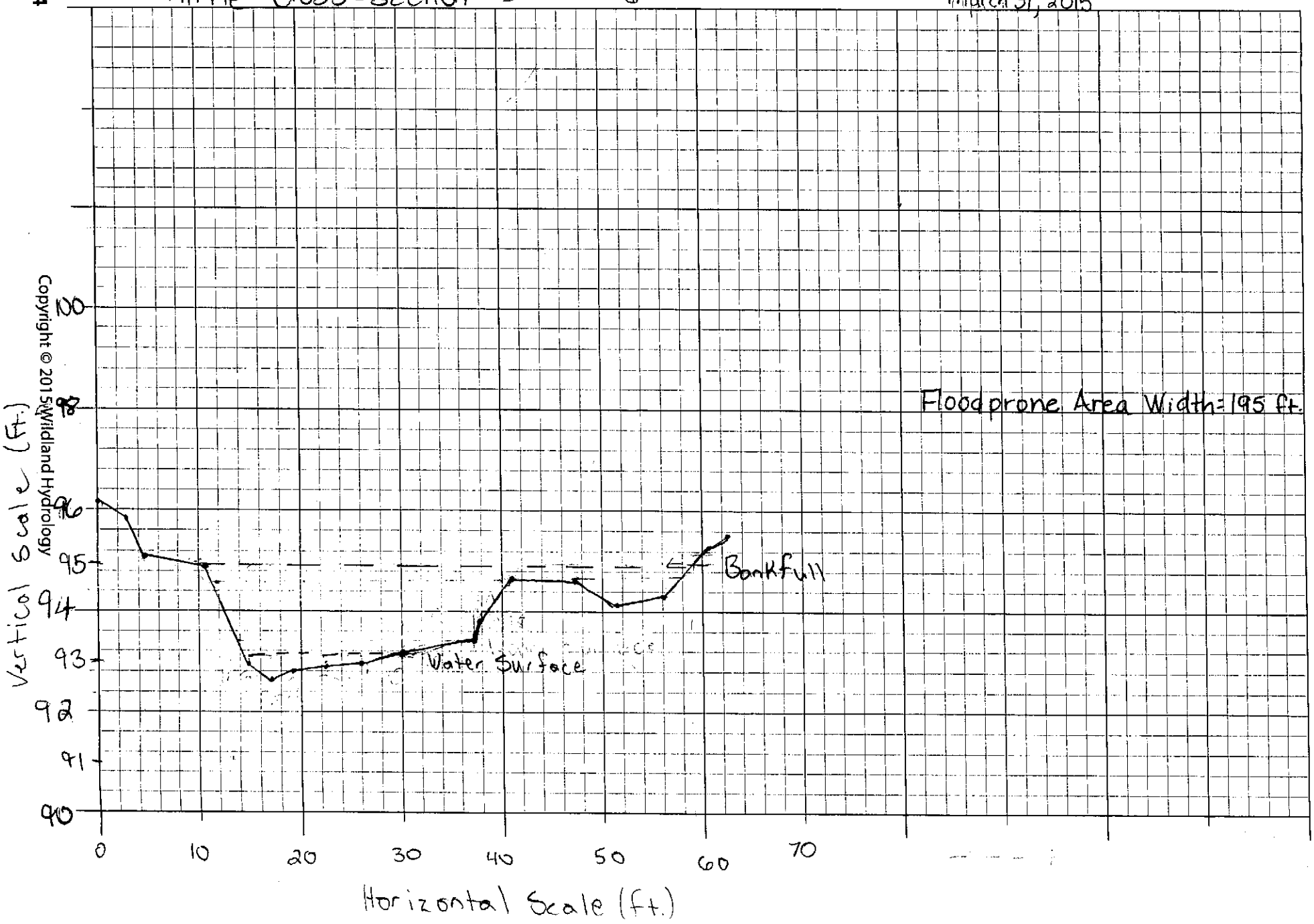
Team 3

Little Conococheague Creek
Washington County, Maryland
March 31, 2015

Riffle Cross-Section

width/depth ratio
30.2/1.5 = 20.13

entrenchment ratio
195/30.2 = 6.46



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SURVEY DATA ⟶ **LONGITUDINAL PROFILE 1**

SITE: Little Conococheague Date: 3/31/2015

Location: Reach 3

Party / Notes: H. Fuller, M. Wolfard, P. Rhodes 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	4.7	104.7		100							
2	0+00			11.50	92.68	9.44	97.74	7.33	99.85			
3	0+20			10.73	96.45	9.48	97.71	7.37	99.81			log instrm
4	0+45			11.21	96.06	9.54	97.64	7.67	99.51			
5	0+64			11.15	96.03	9.63	97.55	7.52	99.66			
6	0+93			10.34	96.84	9.65	97.53	7.47	99.71			
7	1+19			10.73	96.45	9.77	97.41	7.67	99.51			
8	1+41			10.92	96.26	9.86	97.32	7.86	99.32			
9	1+66			12.12	95.06	9.93	97.25	8.05	99.13			
10	1+80.6			12.62	94.56	9.94	97.24	8.29	98.89			
11	1+97			11.75	95.43	9.92	97.26	8.27	98.91			Upstrm of metal wall
12	2+06			11.33	95.85							
13	2+24			11.67	95.51							
14	2+63			10.73	96.26							
15	2+76.4			10.92	96.26	10.29	96.89	8.39	98.79			Cross-Sect
16	3+54			12.64	94.54							
17	4+09			12.44	94.74							
18	Stream Crossing											
19	4+66			12.9	94.28	11.78	95.4	9.88	97.3	End of Reach		
20												
21												
22												
23												
24												
25												
26												
27												

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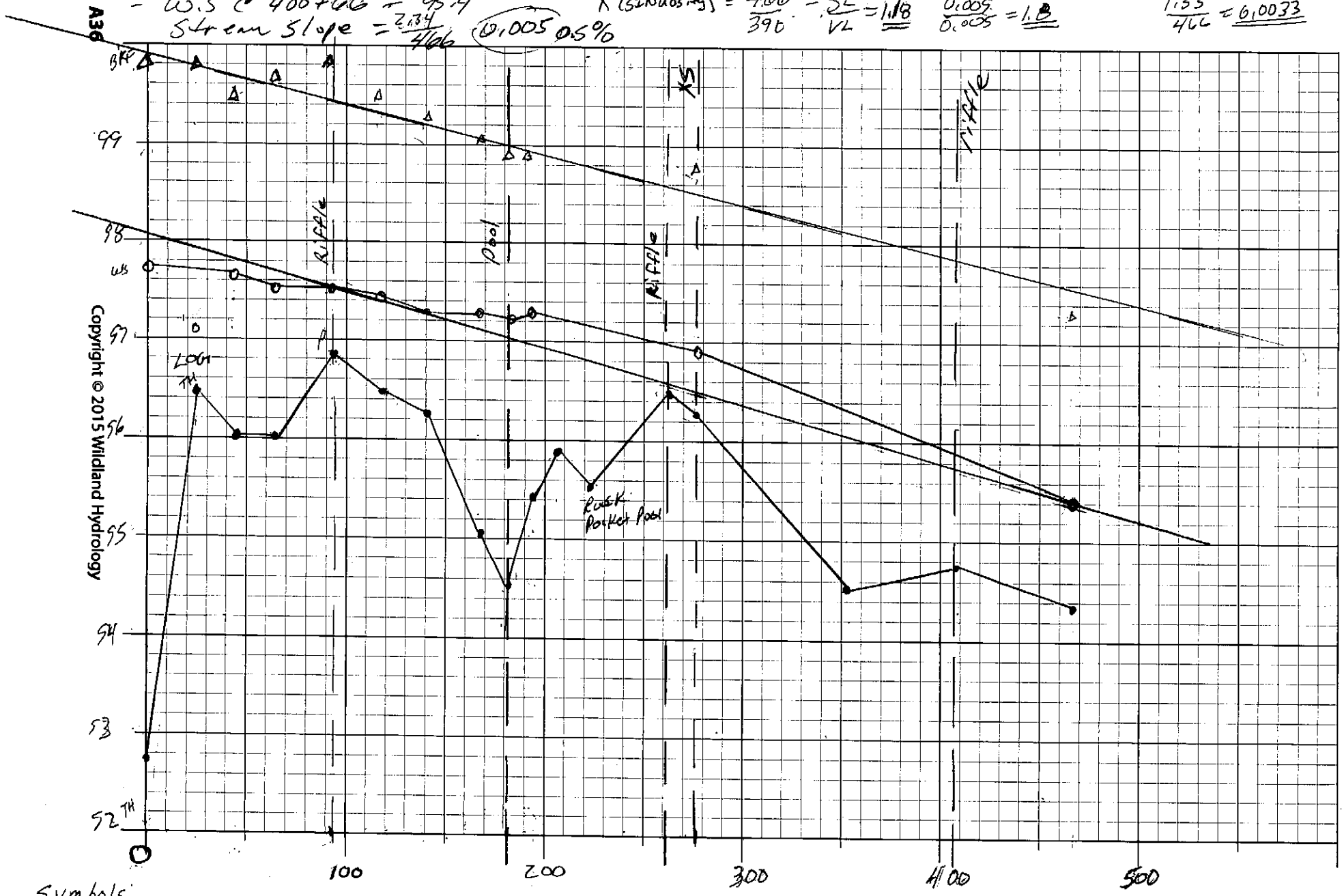
- Total Stream Length – 466'
- Valley Length – 390
- W.S. @ 0+00 = 97.74
- W.S @ 400+66 = 95.4
- Stream Slope = 2.34 / 466 (0.005) 0.5%

Valley Elev @ 0+00 = 101.75
Valley Elev @ 4+66 = 97.92
Valley Slope = VS = 3.83/390 = 0.009
K (sinuosity) = 466/390 = SL/VL = 1.18 0.009/0.005 = 1.8

BKF. Slope
98.85
97.30
1.55
1.55/466 = 0.0033



Symbols
BKF – Δ
WS – O
TH – •

Little Conococheague
Team # 3

Date: 3/31/2015

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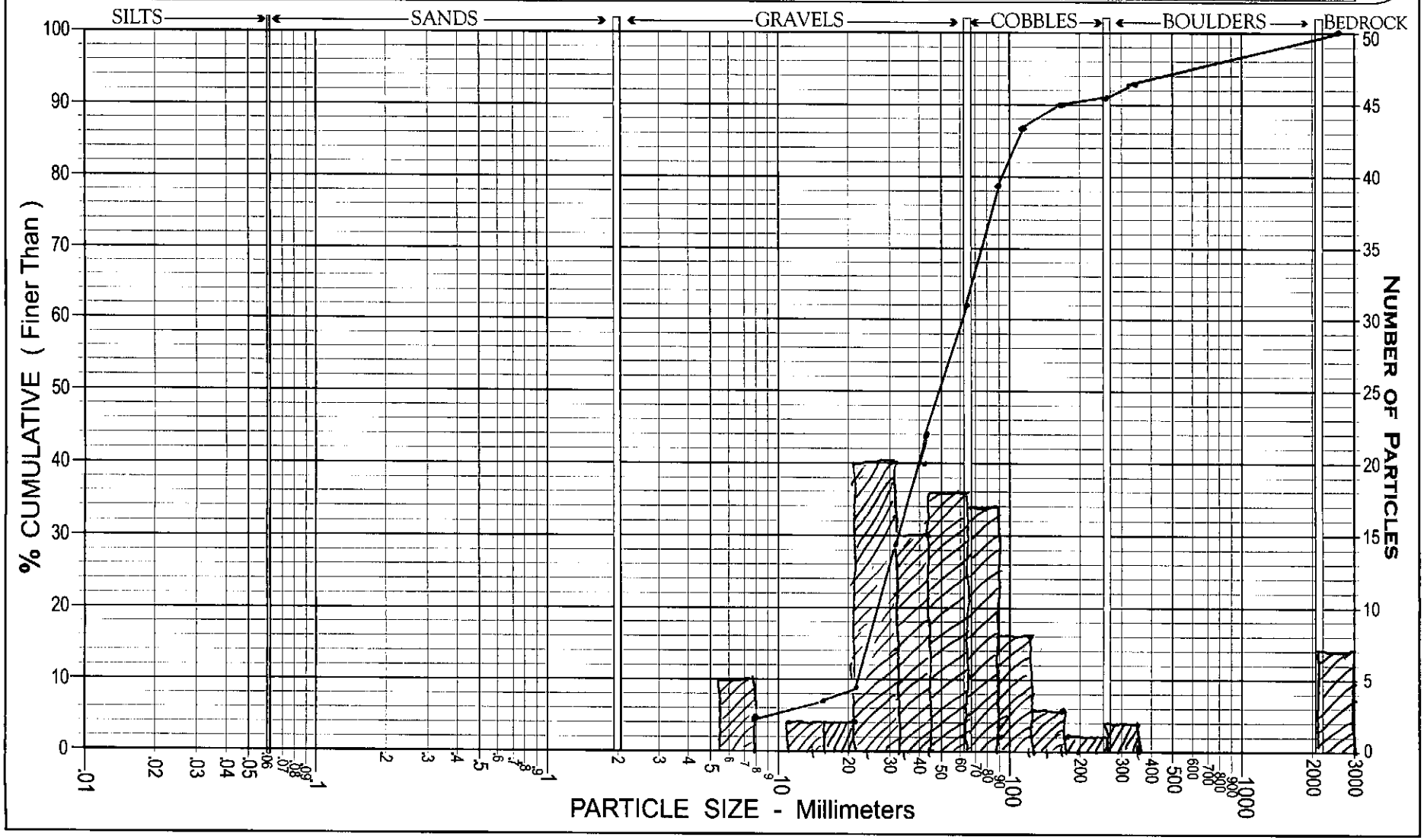
LOCATION: Active Bed Riffle (Little Conococheague Creek) PEBBLE COUNT DATA Date: 3/31/15

REACH: Team 3 PARTY:

Stream Type: C-4 Valley Type: Confined alluvial terrace HUC:



D_{84} = 105 mm

D_{50} = 55 mm

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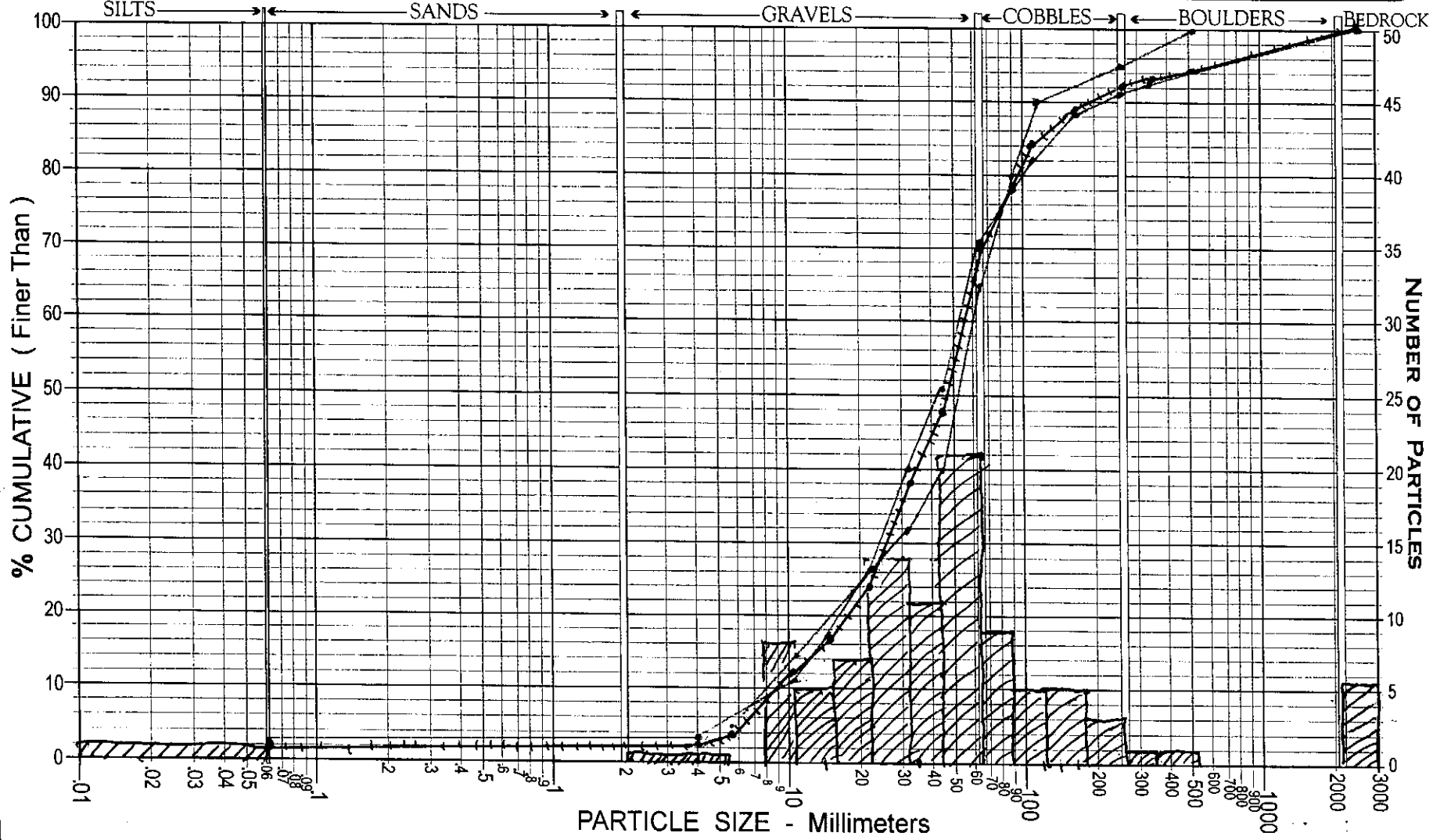
LOCATION: Representative Pebble Count (Little Conococheague Creek) PEBBLE COUNT DATA Date: 3-31-15

REACH: Team 3 PARTY:

Stream Type: C-4 Valley Type: Confined Alluvial Terrace HUC:



RIFFLE

POOL

COMPOSITE

$D_{84} = 110$

$D_{50} = 48$ mm

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Site: Representative pebble count Date:

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	Silt / Clay	< .062	S/C				2	2.5	2.5				2	2	2
	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				1	1.25	3.75				1	1	3
.16 - .22	Fine	4 - 5.7								1	5	5	1	1	4
.22 - .31	Fine	5.7 - 8													
.31 - .44	Medium	8 - 11.3					6	7.5	11.25	2	10	15	8	8	12
.44 - .63	Medium	11.3 - 16					5	6.25	17.5				5	5	17
.63 - .89	Coarse	16 - 22.6					7	8.75	26.25				7	7	24
.89 - 1.3	Coarse	22.6 - 32					11	13.75	40	3	15	30	11	11	38
1.3 - 1.8	Very Coarse	32 - 45					9	11.25	51.25	2	10	40	9	9	49
1.8 - 2.5	Very Coarse	45 - 64					16	20	71.25	5	25	65	21	21	70
2.5 - 3.5	Small	64 - 90	COBBLE				6	7.5	78.75	3	15	80	9	9	79
3.5 - 5.0	Small	90 - 128					3	3.75	82.5	2	10	90	5	5	84
5.0 - 7.1	Large	128 - 180					5	6.25	88.75				5	5	89
7.1 - 10.1	Large	180 - 256					2	2.5	91.25	1	5	95	3	3	92
10.1 - 14.3	Small	256 - 362	BOULDER				1	1.25	92.5				1	1	93
14.3 - 20	Small	362 - 512								1	5	100	1	1	94
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK				6	7.5	100				6	6	100
Stream Type:			Valley Type:			TOTAL →	80	100	100	20	100	100	100		

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Site: Active bed riffle Date:

Location: HUC:

Party:

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	COMP. 3	RIFFLE (1) TOT #	ITEM %	% CUM	POOL (2) TOT #	ITEM %	% CUM	COMPOSITE (3) TOT #	ITEM %	% CUM
							Reach:			Reach:			Reach:		
							Date:			Date:			Date:		
	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					5	5	5						
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16					2	2	7						
.63 - .89	Coarse	16 - 22.6					2	2	9						
.89 - 1.3	Coarse	22.6 - 32					20	20	29						
1.3 - 1.8	Very Coarse	32 - 45					15	15	44						
1.8 - 2.5	Very Coarse	45 - 64					18	18	62						
2.5 - 3.5	Small	64 - 90	COBBLE				17	17	79						
3.5 - 5.0	Small	90 - 128					8	8	87						
5.0 - 7.1	Large	128 - 180					3	3	90						
7.1 - 10.1	Large	180 - 256					1	1	91						
10.1 - 14.3	Small	256 - 362	BOULDER				2	2	93						
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK				7	7	100						
						TOTAL→	100	100	100						

Stream Type: **Valley Type:**

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	Little Conococheague	Location:	Confined Terraced alluvial
Date: 3/31/15	Stream Type: C-4	Valley Type:	
Observers:	Team 3	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	56.17	A_{bkf} (ft^2)	Bankfull Riffle Mean DEPTH	1.8	d_{bkf} (ft)
Bankfull Riffle WIDTH	48.2	W_{bkf} (ft)	Wetted PERIMETER ~ $(2 * d_{bkf}) + W_{bkf}$	51.8	W_p (ft)
D_{84} at Riffle	105	Dia. (mm)	D_{84} (mm) / 304.8	0.34	D_{84} (ft)
Bankfull SLOPE	0.0033	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.8	R (ft)
Gravitational Acceleration	32.2	g (ft / sec²)	Relative Roughness R(ft) / D_{84} (ft)	5.29	R / D_{84}
Drainage Area	12	DA (mi²)	Shear Velocity $u^* = (gRS)^{1/2}$	0.44	u* (ft/sec)

$D_{50} = 55$
$D_{AVG} = 80$

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $\bar{u} = [\,2.83 + 5.66 * Log\{R / D_{84}\}\,]\,u^*$	3.04	ft / sec	170.8	cfs
2. Roughness Coefficient: a) Manning's n from Friction Factor / Relative Roughness (Figs. A-28, A-29) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.037	3.42	ft / sec	192.1	cfs
2. Roughness Coefficient: b) Manning's n from Stream Type (Fig. A-30) $\bar{u} = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ 0.031	4.09	ft / sec	229.7	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 $n =$ .04	3.16	ft / sec	177.5	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 = 220 year	3.91	ft / sec		cfs
4. Continuity Equations: b) Regional Curves $\bar{u} = Q / A$		ft / sec		cfs

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

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

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Worksheet A-1. Field Form for Level II Stream Classification.

Stream: Little Conococheague	
Basin:	Drainage Area: acres 12 mi^2
Location: reach 3	
Twp.&Rge:	Sec.&Qtr.:
Cross-Section Monuments (Lat./Long.):	Date:
Observers: team 3 (carl's team)	Valley Type: confined terraced alluvial

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	48.2	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	1.8	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	86.49	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	26.78	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.	2.46	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.	195	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	4.05	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.	55	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.	0.005	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).	1.19	

Stream Type C4 3 — **See Classification Key (Figure A-2)**

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Worksheet A-3. Summary of Morphological Variables.

Stream: Little Conococheague		Location: reach 3	
Team: 3	Date: 3/31/15	Drainage Area: 12 sq. mi.	

Riffle Channel Dimensions

1. Bankfull Width (W_{bkf}) (ft)	48.2	2. Bankfull Mean Depth (d_{bkf}) (ft)	1.8
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	26.78	4. Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)	86.17
5. Bankfull Maximum Depth (d_{max}) (ft)	2.46	6. Width of Flood-Prone Area (W_{fpa}) (ft)	195
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	4.05 Good		

Channel Pattern / Dimensionless Ratios

8. Belt Width (W_{blt}) (ft)	Mean	70	9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf}) 70 / 48.2 ~~30.2~~	Mean	~~2.3~~ 1.45
	Min			Min	
	Max			Max	
10. Stream Meander Length (L_m) (ft)	Mean	260	11. Meander Length Ratio (MLR) (L_m / W_{bkf}) 260 / 48.2 ~~30.2~~	Mean	~~5.39~~
	Min			Min	
	Max			Max	
12. Linear Wavelength (λ) (ft)	Mean	190	13. Linear Wavelength to Bankfull Width (λ / W_{bkf}) 190 / 48.2 ~~30.2~~	Mean	3.94
	Min			Min	
	Max			Max	
14. Radius of Curvature (R_c) (ft)	Mean	67	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf}) 67 / 48.2 ~~30.2~~	Mean	1.39
	Min			Min	
	Max			Max	

Channel Particles

Representative Pebble Count

16. D_{16} (mm)	15	17. D_{35} (mm)	33	18. D_{50} (mm)	48
19. D_{84} (mm)	110	20. D_{95} (mm)	550	21. D_{100} (mm)	2500

Active Bed Riffle Pebble Count

22. D_{16} (mm)	25	23. D_{35} (mm)	37	24. D_{50} (mm)	55
25. D_{84} (mm)	105	26. D_{95} (mm)	700	27. D_{100} (mm)	2500

Classification

28. Sinuosity (k)	1.19	29. Average Water Surface Slope (S)	0.005
30. Stream Type	C4	31. Valley Type	confined terraced alluvial

Velocity & Discharge

32. Friction Factor ($\bar{u}$ / u^*)	7	33. Relative Roughness (R / D_{84})	4.35
34. Manning's 'n' from Friction Factor / Relative Roughness	0.037	35. Manning's 'n' from Stream Type	0.031
36. Estimated Bankfull Mean Velocity ($\bar{u}_{bkf}$) (ft/sec)	3.42	37. Estimated Bankfull Discharge (cfs)	192.1
38. Estimation Method Selected for Velocity & Discharge	Friction Factor + Roughness Coefficient		

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