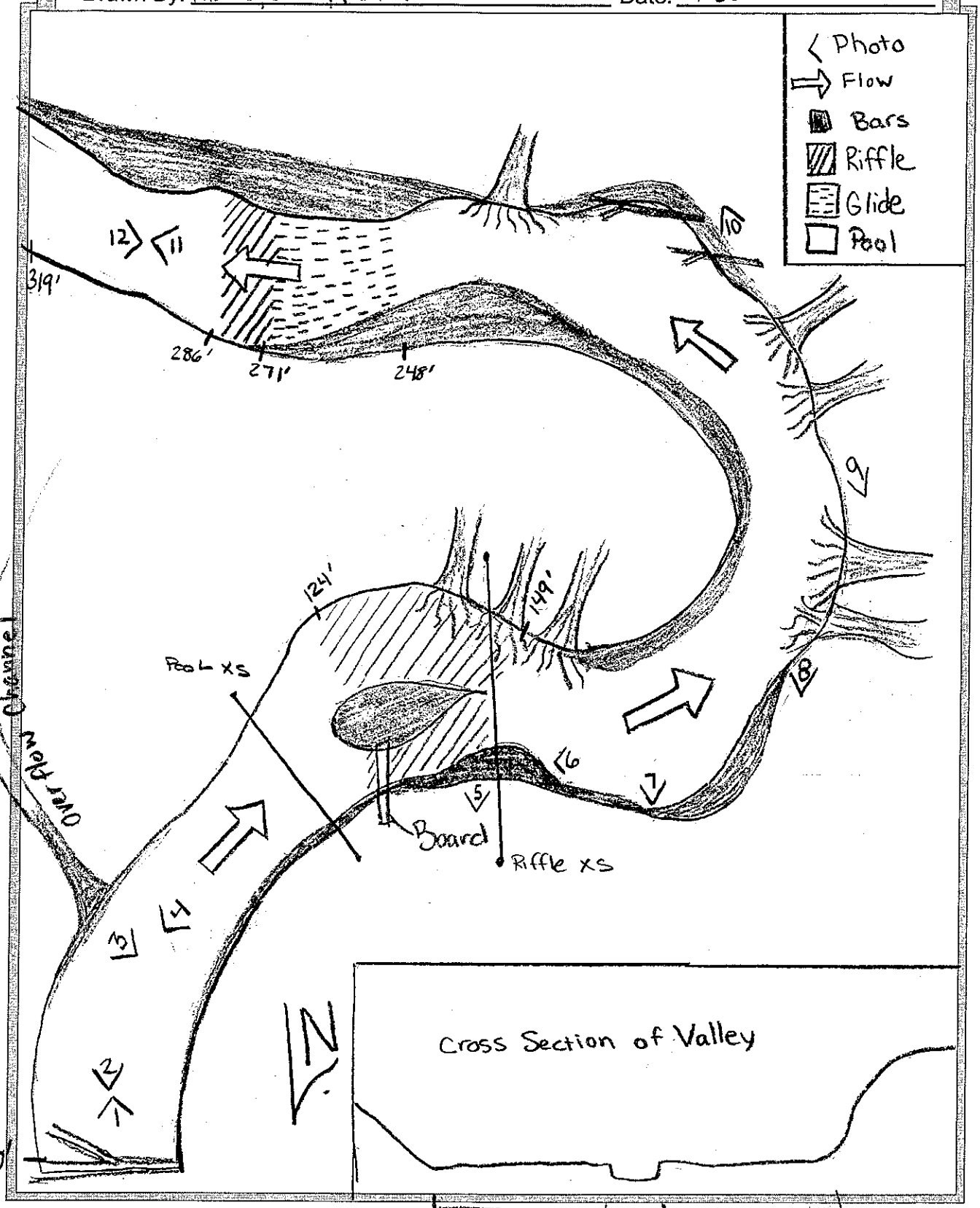
Presentation Order
Applied Fluvial Geomorphology

- Sketch Map
- Cross-Section
- Longitudinal Profile
- Pebble Counts
  - Representative Pebble Count
  - Active Bed Riffle Pebble Count
- Velocity Computations (Worksheet A-2)
- Stream Classification (Worksheet A-1)
- Summary of Morphological Variables (Worksheet A-3)

AREA-SITE LOCATION....REACH MAP

Stream: Israel Cr. Washington Co., MD Reach: Team 2 The Snappers

Drawn By: Marie, Emily, Colin Date: 4-20-10



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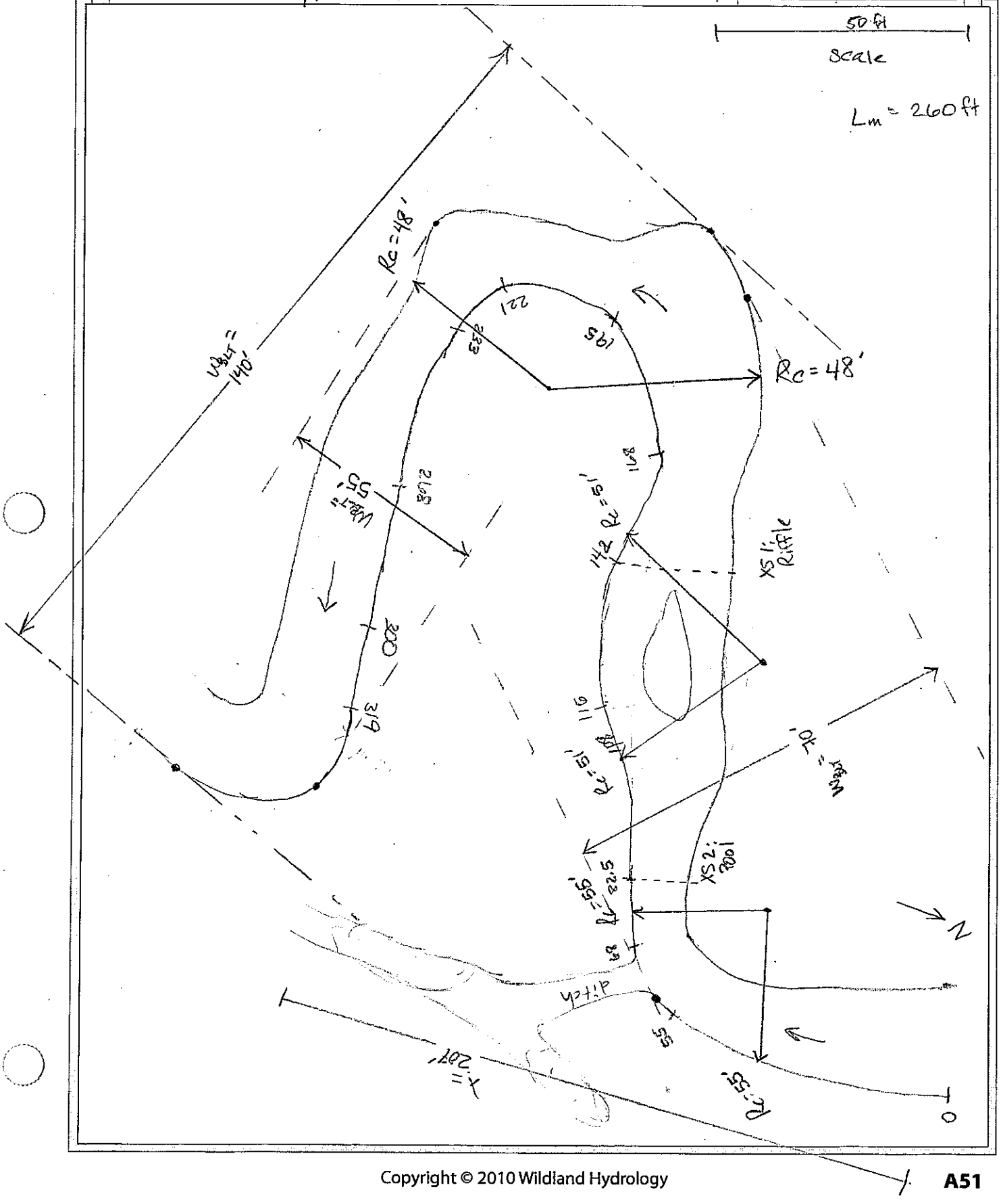
AREA-SITE LOCATION....REACH MAP

Stream: Israel Creek Reach: Team 2: The Snappers

Drawn By: Emily, Mari, Colin Date: April 20, 2010



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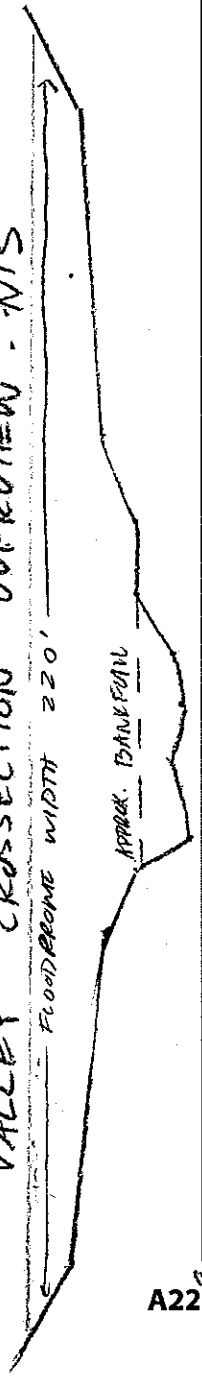
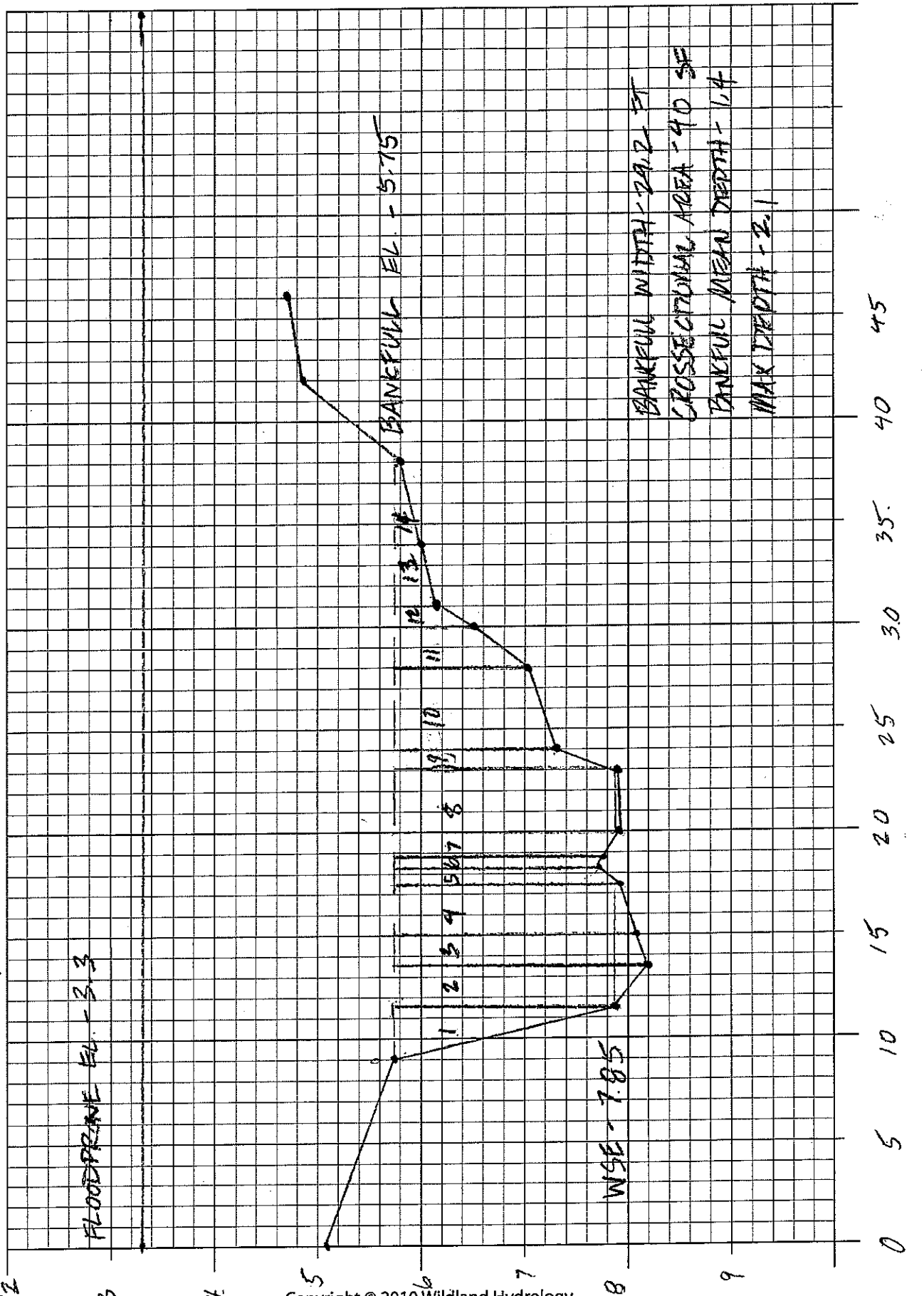
Israel Cr Reach 2

RIFFLE CROSSECTION

VALLEY CROSSECTION OVERVIEW - NTS





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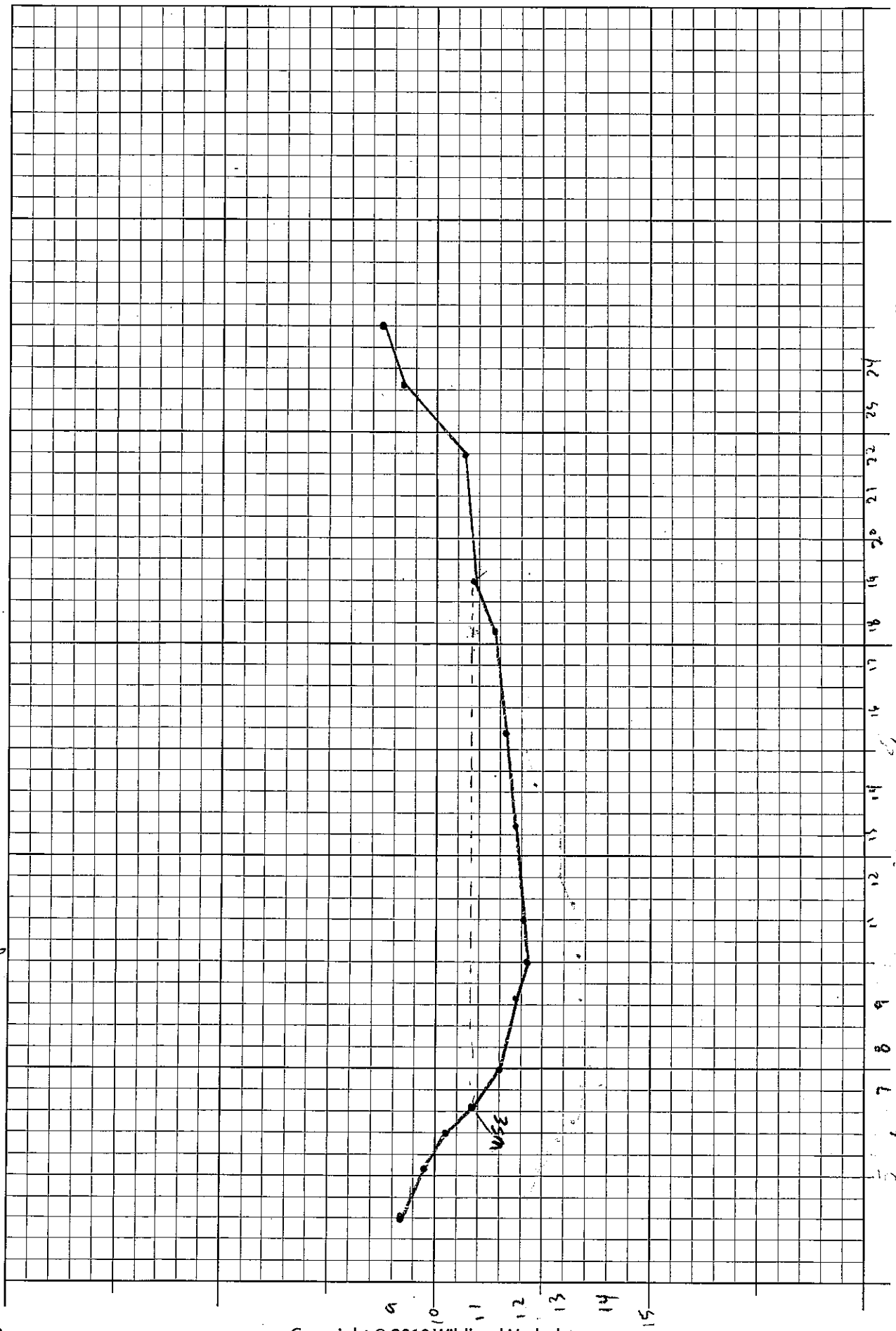

4/20/10 Israel Creek

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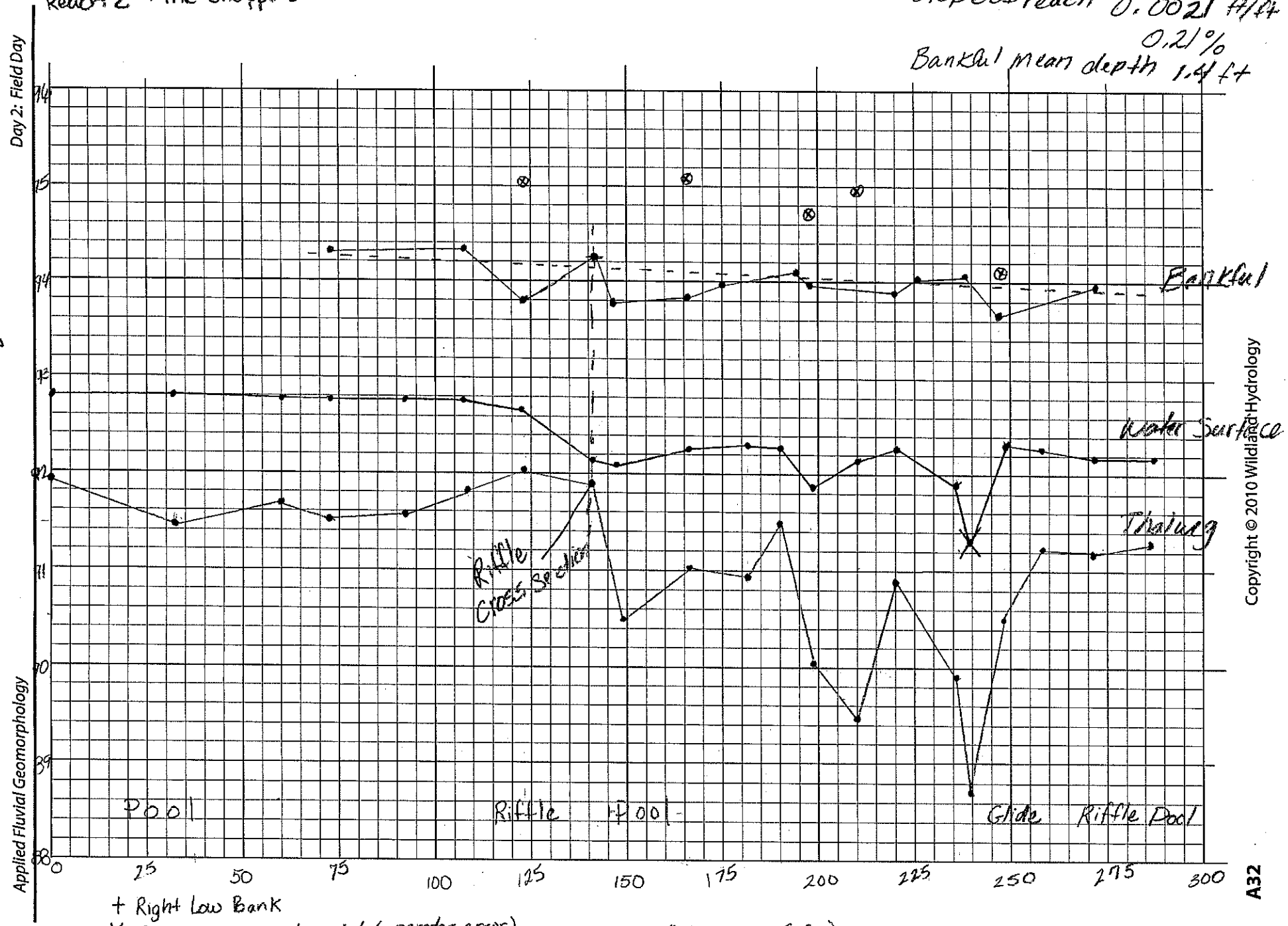
Israel Cr [illegible]
4/20/10
Reach 2 : The Snappers

Slope of reach 0.0021 ft/ft
0.21%
Bankful mean depth 1.4 ft



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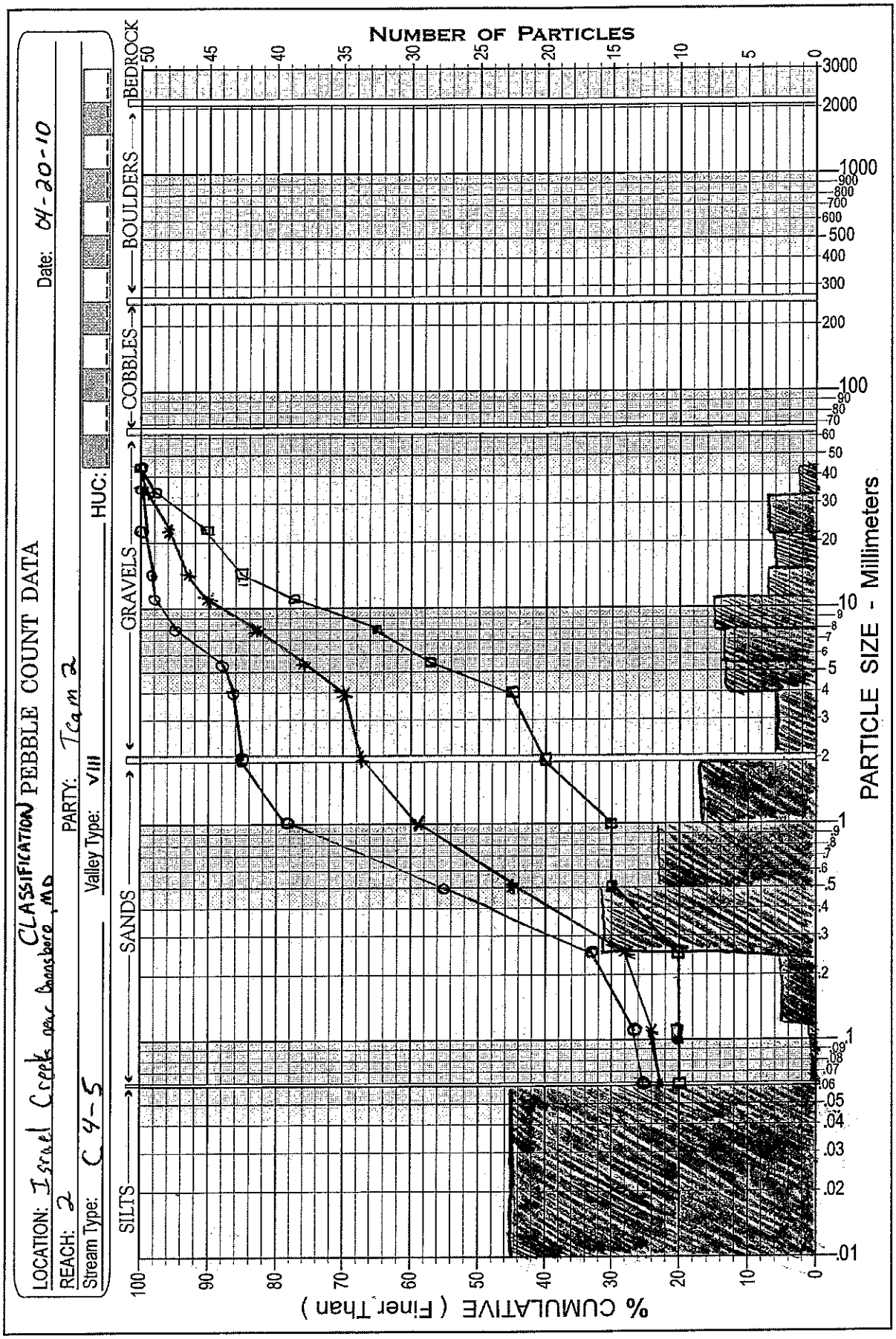

D_{50} = 0.65
D_{84} = 8.5

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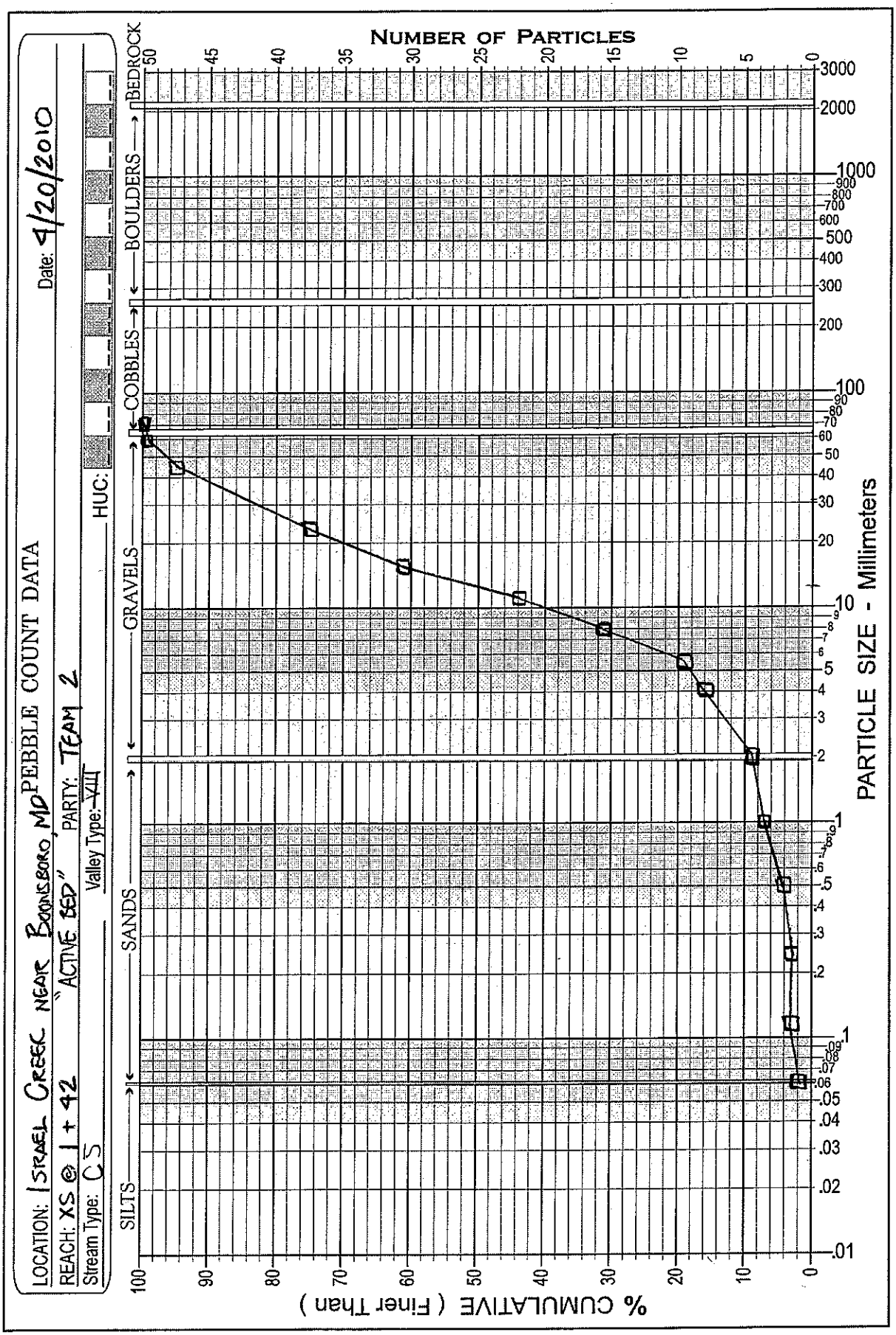

$D_{50} = 12\ mm$

$D_{84} = 32\ mm$

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SURVEY DATA → CROSS-SECTION 1

SITE: Training group 2 Date: 4/20/2010

Location: 141.5' on @ along rio

Party / Notes: 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	0			5.15	100	
2	7			5.5		top of bank
3	9			5.~~85~~		top of bank — B/F
4	10.5			6.64		middle of Slope
5	11.5			7.85		water surface
6	12.2			8.13		~~thalweg~~
7	13.5			8.12		thalweg
8	15.0			8.15		
9	16.0			8.05		
10	17.0			7.96		
11	17.8			7.87		water edge at point Bar
12	18.1			7.76		top of Bar
13	18.7			7.86		water edge —
14	19.8			7.91		thalweg
15	20.0			7.89		
16	20.6			7.83		
17	21.0			7.84		
18	21.5			7.82		top of small deposit
19	22			7.80		
20	22.8			7.75		water's edge LBWE
21	23.4			7.28		
22	24.0			7.15		
23	25.5			7.20		
24	26.5			7.22		
25	28.0			7.07		
26	29.0			6.95		
27	30.0			6.96		
28	31.0			6.19		RBF #1

Profile #5

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SURVEY DATA ⟶ **CROSS - SECTION 2**

SITE: Israel Cr Rch 2 **Date:** 4/20/16

Item	STATION ft	BS ft	HI ft	FS ft	Elevation ft	NOTES COMMENTS REMARKS
29	33.0			6.11		
30	34.0			6.0		[redacted]
31	35.0			6.18		
32	36.2			6.12		
33	37.0			5.90		
34	38.0			5.8		
35	39.0			5.55		
36	40.0			5.32		
37	42.0			4.85		top of Bank
38	46.0			4.71		pin
39	82.0			5.26		
40	116.5			4.19		2x Bankfull
41						
42						
43		Valley width 219				
44						
45	4.0				9.20	TB
46	5.2				9.72	slope
47	6.0				10.31	slope
48	6.6				10.90	W surface (left)
49	7.5				11.50	
50	9.2				11.95	
51	10.0				12.10	
52	11.0				12.00	
53	13.3				11.80	
54	15.4				11.6	
55	17.8				11.44	
56	19.0				10.90	Water surface (right)
57	22.0				10.70	slope
58	23.6				9.65	slope
59	25.0				9.25	Bankfull height

Riffle XS

Pool XS

Pool

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SURVEY DATA → LONGITUDINAL PROFILE 1

SITE: Israel Creek Date: 4/20/10

Location: Washington CO, MD

Party / Notes: Team 2 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 ft	Low Bank HI Fore-Sight FS ft	Low Bank HI Elevation Elev. ft	NOTES e.g. Riffle Run Pool Glide	
1	0			8.06		0.84						POOL	TOP
2	31			8.46		1.26							
3	60			8.35		1.10							
4	73			8.43		1.18		5.81		5.70			
5	93			8.31		1.05						Bottom of POOL Top of Glide	BUP
6	109			8.13		0.87		5.69					
7	124			7.90		0.58		6.25		4.97		Riffle	
8	1415			8.2		7.85	0.35	5.75		5.74 (BUP)		CX Bottom riffle	
9	149			9.5		7.89	1.61	6.26				POOL	TOP
10	166			8.97		1.21		6.23		4.85			
11	181			9.09		1.39							
12	190			8.47		0.75							
13	199			9.97		1.81		6.01		5.35			
14	210			10.55		2.72							
15	220			9.17		1.40		6.18		5.04			
16	230			10.20		2.1							
17	239			11.21		2.51*						POOL	TOP
18	248			9.47		1.79		6.33		5.88		Top of Glide	BUP
19	257			8.77		1.01						Glide	
20	271			8.80		0.99		6.07				RIFFLE	
21	286			8.71		0.90						POOL	TOP
22	~~299~~			~~8.72~~		~~0.91~~							
23	~~319~~			~~8.82~~		~~0.90~~							BUP
24													
25													
26													
27													

* bad data point operator error

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Israel Creek Rch 2
4/20/10 Riffle XS AREA CALC's

		FL	DEPTH	WIDTH	
		5.75			
1	11.5	7.85	2.75	2.5	0+2.75/2 x2.5 = 3.43
2	13.5	8.2	2.45	2	2.75+2.45/2x2 = 5.2
3	15	8.1	2.35	1.5	2.45+2.35/2 x 1.5 = 3.6
4	17.5	7.85	2.1	2.5	2.35+2.1/2 x2.5 = 5.56
5	18.5	7.75	2	.1	2+2.1/2x1 = 2.05
6	19	7.8	2.05	.5	2.05+2/2x.5 = 1.01
7	20	7.85	2.1	1	2.05+2.1/2 x1 = 2.075
8	23	7.75	2	3	2+2.1/2 x 3 = 6.15
9	24	7.25	1.5	1	2+1.5/2 = 1.75
10	28	7.0	1.75	4	1.75+1.5/2 x4 = 6.5
11	30	6.45	.7	2	1.75+.7/2x2 = 2.45
12	31	6.2	.45	1	.7+.45/2 = .575
13	34	6	.25	3	.45+.25/2 x3 = 1.05
14	38	5.75	0	4	.25+0/2 x4 = .5

41.9 SF

Classification Pebble Count Data

Site: ISRAEL CREEK NEAR BOONSBORO, MD Date: 4/20/2010

Location: HUC:

Party: TEAM 2

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				8	20	20	15	25	25	23	23	23
	Very Fine	.062 - .125	SAND				0	0	20	1	1.67	26.67	1	1	24
	Fine	.125 - .25	SAND				0	0	20	4	6.67	33.34	4	4	28
	Medium	.25 - .50	SAND				4	10	30	13	21.67	55	17	17	45
	Coarse	.50 - 1.0	SAND				0	0	30	19	23.33	78.33	14	14	59
.04 - .08	Very Coarse	1.0 - 2	GRAVEL				4	10	40	4	6.67	85	8	8	67
.08 - .16	Very Fine	2 - 4	GRAVEL				2	5	45	1	1.67	86.67	3	3	70
.16 - .22	Fine	4 - 5.7	GRAVEL				5	12.5	57.5	1	1.67	8833	6	6	76
.22 - .31	Fine	5.7 - 8	GRAVEL				3	7.5	65	4	6.67	95	7	7	83
.31 - .44	Medium	8 - 11.3	GRAVEL				5	12.5	77.5	2	3.33	98.33	7	7	90
.44 - .63	Medium	11.3 - 16	GRAVEL				3	7.5	85	0	0	98.33	3	3	93
.63 - .89	Coarse	16 - 22.6	GRAVEL				2	5	90	1	1.67	100	3	3	96
.89 - 1.3	Coarse	22.6 - 32	GRAVEL				3	7.5	97.5	0	0	100	3	3	99
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL				1	2.5	100	0	0	100	1	1	100
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL												
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128	COBBLE												
5.0 - 7.1	Large	128 - 180	COBBLE												
7.1 - 10.1	Large	180 - 256	COBBLE												
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK												
						TOTAL →	40			60			100		

Stream Type: Valley Type:

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Active Bed Pebble Count

Site: ISRAEL CREEK NEAR BOONSBORO, MD Date: 4/20/2010

Location: 1+42 (@ XS) HUC: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Party: TEAM 2

Inches	PARTICLE	Millimeters		Dot Count for RIFFLE 1	POOL 2	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	:			2	2	2						
	Very Fine	.062 - .125	SAND	.			1	1	3						
	Fine	.125 - .25	SAND				0	0	0						
	Medium	.25 - .50	SAND	.			1	1	4						
	Coarse	.50 - 1.0	SAND	:.			3	3	7						
.04 - .08	Very Coarse	1.0 - 2	SAND	:.			2	2	9						
.08 - .16	Very Fine	2 - 4	GRAVEL	::			7	7	16						
.16 - .22	Fine	4 - 5.7	GRAVEL	:			3	3	19						
.22 - .31	Fine	5.7 - 8	GRAVEL	⊠ :			12	12	31						
.31 - .44	Medium	8 - 11.3	GRAVEL	⊠ :			13	13	44						
.44 - .63	Medium	11.3 - 16	GRAVEL	⊠ ::			17	17	61						
.63 - .89	Coarse	16 - 22.6	GRAVEL	⊠ :			14	14	75						
.89 - 1.3	Coarse	22.6 - 32	GRAVEL	⊠ :			14	14	89						
1.3 - 1.8	Very Coarse	32 - 45	GRAVEL	::			6	6	95						
1.8 - 2.5	Very Coarse	45 - 64	GRAVEL	::			4	4	99						
2.5 - 3.5	Small	64 - 90	COBBLE	.			1	1	100						
3.5 - 5.0	Small	90 - 128	COBBLE												
5.0 - 7.1	Large	128 - 180	COBBLE												
7.1 - 10.1	Large	180 - 256	COBBLE												
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512	BOULDER												
20 - 40	Medium	512 - 1024	BOULDER												
40 - 80	Large-Vry Large	1024 - 2048	BOULDER												
	Bedrock		BDRK												
						TOTAL→	100								

Stream Type: **Valley Type:**

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

Bankfull VELOCITY / DISCHARGE Estimates

Site:	ISRAEL CREEK	Location:	Washington Co, MD
Date:	4/20/10	Stream Type:	C4/5
Valley Type:	VIII		
Observers:	TEAM 2 : The Snappers	HUC:	

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Cross-sectional AREA	40	A_{bkf} (ft^2)	Bankfull Mean DEPTH	1.4	d_{bkf} (ft)
Bankfull WIDTH	29.2	W_{bkf} (ft)	Wetted PERIMETER $= 2 * d_{bkf} + W_{bkf}$	30.5	W_p (ft)
D_{84} @ Riffle	28.	Dia. (mm)	D_{84} mm / 304.8 =	0.092	D_{84} (ft)
Bankfull SLOPE	0.0021	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.31	R (ft)
Gravitational Acceleration	32.2	g (ft / sec^2)	Relative Roughness R (ft) / D_{84} (ft)	14.2	
Drainage AREA	5.3	DA (mi^2)	Shear Velocity $u^* = \sqrt{gRS}$	0.3	u^* (ft / sec)

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 \text{ Log } \{ R / D_{84} \}] u^*$	2.81	ft / sec	112.30	cfs
2. Roughness Coefficient: a) Manning's 'n' from friction factor / relative roughness (Figs. A-19, A-20) $u = 1.49 * R^{2/3} * S^{1/2} / n$ n = 0.032	2.55	ft / sec	102.19	cfs
2. Roughness Coefficient: $u = 1.49 * R^{2/3} * S^{1/2} / n$ b) Manning's 'n' from Jarrett (USGS): $n = 0.39 S^{.38} R^{-.16}$ n = 0.036	2.27	ft / sec	90.83	cfs
Note: This equation is for applications involving steep, step-pool, high boundary roughness, cobble- and boulder-dominated stream systems; for stream types A1, A2, A3, B1, B2, B3, C2 and E3.				
2. Roughness Coefficient: $u = 1.49 * R^{2/3} * S^{1/2} / n$ c) Manning's 'n' from Stream Type n = 0.031	2.64	ft / sec	105.44	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) Regional Curves $u = Q / A$ Return Period for Bankfull Discharge Q = ____ Year	4.10	ft / sec	163.99	cfs
4. Continuity Equations: b) USGS Gage Data $u = Q / A$	N/A	ft / sec	N/A	cfs

u/u* = 9.37

Options for Using the D_{84} Term in the Relative Roughness Relation (R/D_{84}) when Using 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 the 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 sufaces above channel bed elevations. 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:	Ismel Creek
Basin:	Drainage Area: 5.3 acres 5.3 mi^2
Location:	Maryland
Twp. & Rge:	Sec. & Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 4-20-10
Observers: Team 2: The Snappers	Valley Type: IIX

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	29.2	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A / W_{bkf}$).	1.4	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	40	ft^2
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	21.3	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.	2.5	ft
WIDTH of Flood-Prone Area (W_{fpa}) Twice maximum DEPTH, or ($2 \times d_{max}$) = the stage/elevation at which flood-prone area WIDTH is determined in a riffle section.	2.20	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	7.5	ft/ft
Channel Materials (Particle Size Index) D_{50} The D_{50} particle size index represents the mean diameter of channel materials, as sampled from the channel surface, between the bankfull stage and Thalweg elevations.	0.64	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.	0.21%	ft/ft 0.0021 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 (VS / S).	1.54	

Stream Type C4/5 **See Classification Key (Figure A-1)**

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Worksheet A-3. Summary of Morphological Variables.

Stream: Israel Creek			Location: Washington County, MD		
Team: Team 2: The Snappers		Date: 4/20/10	Drainage Area: 5.30 mi²		
Riffle Channel Dimensions					
1. Bankfull Riffle Width (W_{bkf}) (ft)	29.2		2. Mean Bankfull Riffle Depth (d_{bkf}) (ft)	1.4	
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	21.3		4. Riffle Cross-Sectional Area (A_{bkf}) (ft^2)	40	
5. Maximum Bankfull Riffle Depth (d_{max}) (ft)	2.5		6. Width of Flood-Prone Area (W_{fpa}) (ft)	220	
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	7.5				
Channel Pattern			***Dimensionless Ratios***		
8. Belt Width (W_{blt}) (ft)	Mean	88.3	9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf})	Mean	3.02
	Min	55		Min	1.88
	Max	140		Max	4.79
10. Stream Meander Length (L_m) (ft)	Mean	260	11. Meander Length Ratio (MLR) (L_m / W_{bkf})	Mean	9.9
	Min	NA		Min	NA
	Max	NA		Max	NA
12. Linear Wavelength (λ) (ft)	Mean	207	13. Linear Wavelength to Bankfull Width (λ / W_{bkf})	Mean	7.09
	Min	NA		Min	NA
	Max	NA		Max	NA
14. Radius of Curvature (R_c) (ft)	Mean	51.3	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf})	Mean	1.76
	Min	44		Min	1.64
	Max	55		Max	1.88
Channel Particles					
Representative Pebble Count					
16. D_{16} (mm)	0.062	17. D_{35} (mm)	0.33	18. D_{50} (mm)	0.64
19. D_{84} (mm)	9.4	20. D_{95} (mm)	20	21. D_{100} (mm)	45
Active Bed Riffle Pebble Count					
22. D_{16} (mm)	4.0	23. D_{35} (mm)	9.8	24. D_{50} (mm)	13
25. D_{84} (mm)	29	26. D_{95} (mm)	45	27. D_{100} (mm)	90
Classification					
28. Sinuosity (k)	1.5		29. Average Water Surface Slope (S)	0.0021	
30. Stream Type	C4/5		31. Valley Type	9	
Velocity & Discharge					
32. Friction Factor (u / u*)	9.37		33. Relative Roughness (R / D_{84})	14.2	
34. Manning's "n" from Friction Factor / Relative Roughness	0.032		35. Manning's "n" from Stream Type	0.031	
36. Estimated Mean Velocity (u_{bkf}) (ft/sec)	2.81		37. Estimated Bankfull Discharge (cfs)	112.30	
38. Estimation Method Selected for Velocity & Discharge	Friction Factor / Relative Roughness				

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