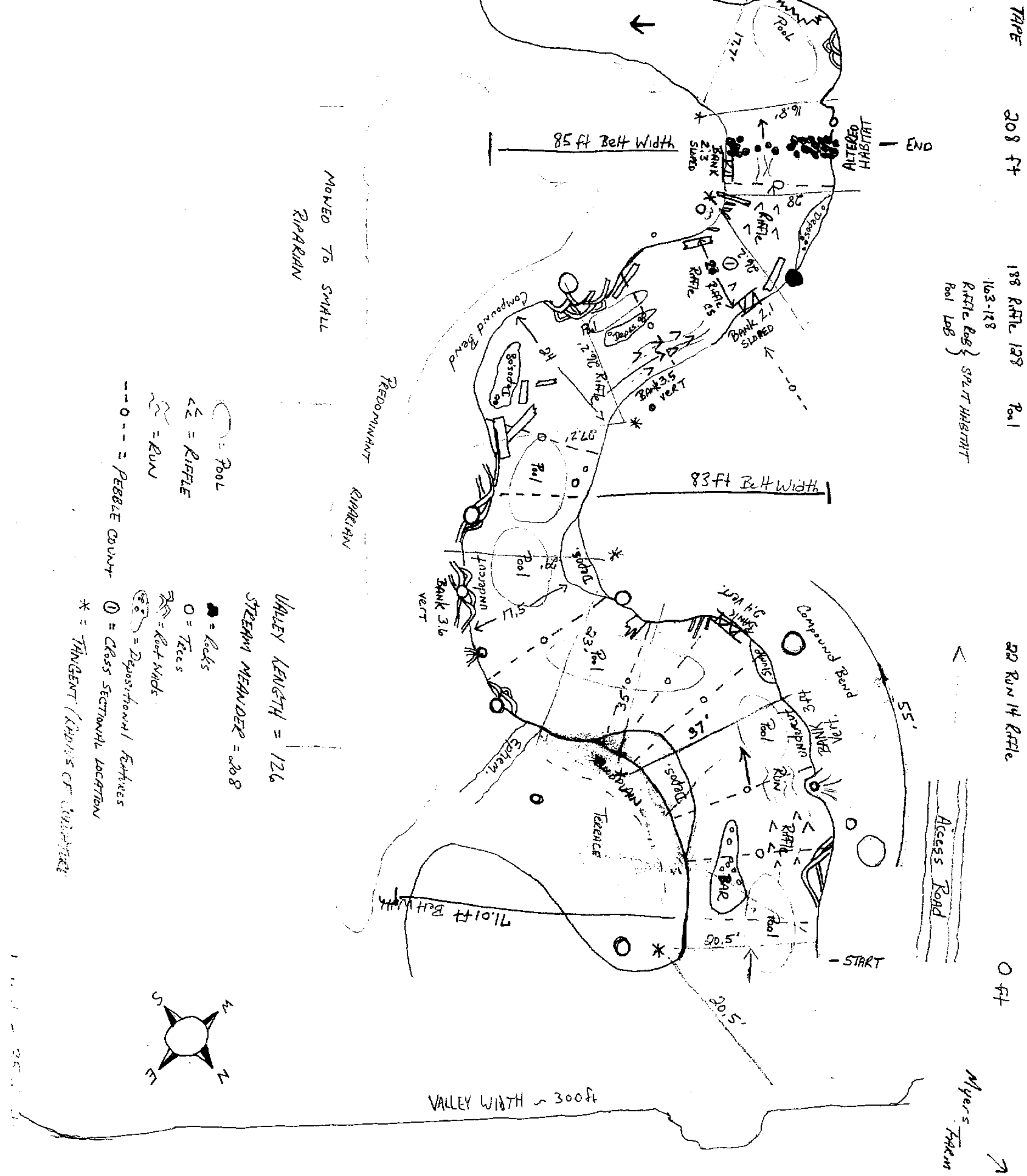
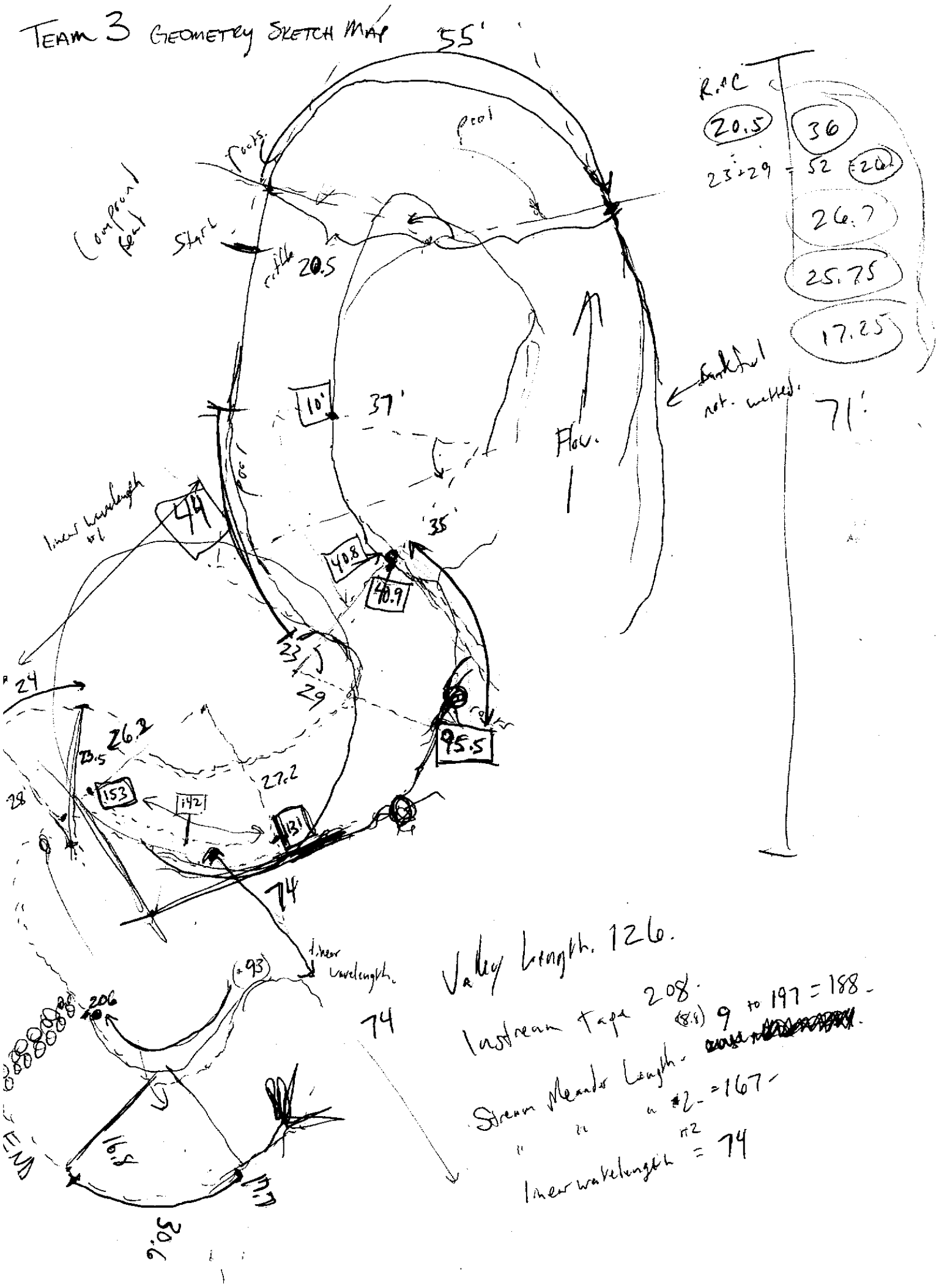
ISREAL CREEK WASH. CTY MD
4/17/12 REACH 3
DRAWN BY GLENN NELSON
TEAM 3



see back

TEAM 3 GEOMETRY SKETCH MAP



ISRAEL CREEK REACH 3 TEAM 3 Elev = 4.44 - reading + 100
POTOMAC RIVER Washington Co, MD PAGE 1 of 2

SURVEY DATA → **CROSS - SECTION 1**

SITE: ISRAEL CREEK, REACH 3 Date: 4-17-12

Location: Riffle

Party / Notes: TEAM 3 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	tripod	104.44			100	
2	-0+01.5			2.49	101.95	TOP 1' pin (3.54 gs)
3	0+00			3.51	100.93	
4	0+02			3.28	101.16	
5	0+06			3.31	101.13	
6	0+08			3.21	101.23	
7	0+10			3.16	101.28	
8	0+12			3.18	101.26	
9	0+14			3.20	101.24	
10	0+16			3.32	101.12	
11	0+17			3.42	101.02	TOB
12	0+18			4.12	100.32	
13	0+19			4.89	99.55	.43
14	0+20			5.46	98.98	1.0
15	0+21			6.67	97.77	2.21
16	0+22			6.86	97.58	LEW 2.4
17	0+23			7.03	97.41	2.57
18	0+23.4			6.93	97.51	left of log 2.47
19	0+23.7			6.52	97.92	top of log
20	0+24			6.94	97.50	right of log 2.48
21	0+27			7.07	97.37	2.61
22	0+27.3			7.18	97.26	TW 2.72
23	0+30			7.13	97.31	2.67
24	0+32			7.00	97.44	2.54
25	0+34			7.10	97.34	2.64
26	0+35.5			6.87	97.57	REW 2.41
27	0+37			5.72	98.72	1.26
28	0+38			4.80	~~100.56~~ 99.64	0.34

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avg dbkfl $\frac{31.09}{15}$

Israel Creek Reach 3 Team 3 PAGE 2 of 2
Potomac River Washington Co, MD

SURVEY DATA ⟶ **CROSS - SECTION** ~~2~~ 1

SITE: ISRAEL CREEK, REACH 3 Date: 4/17/12

Item	STATION ft	B S ft	H I ft	F S ft	Elevation ft	NOTES COMMENTS REMARKS
29	0+38.5			4.46	99.98	BKFl
30	0+40			4.23	100.21	
31	0+42			4.46	99.98	
32	0+46			4.25	100.19	
33	0+52			4.06	100.38	
34	0+56			4.11	100.33	
35	0+59			4.15	100.29	
36	0+61			3.16	101.28	Top right pin
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						

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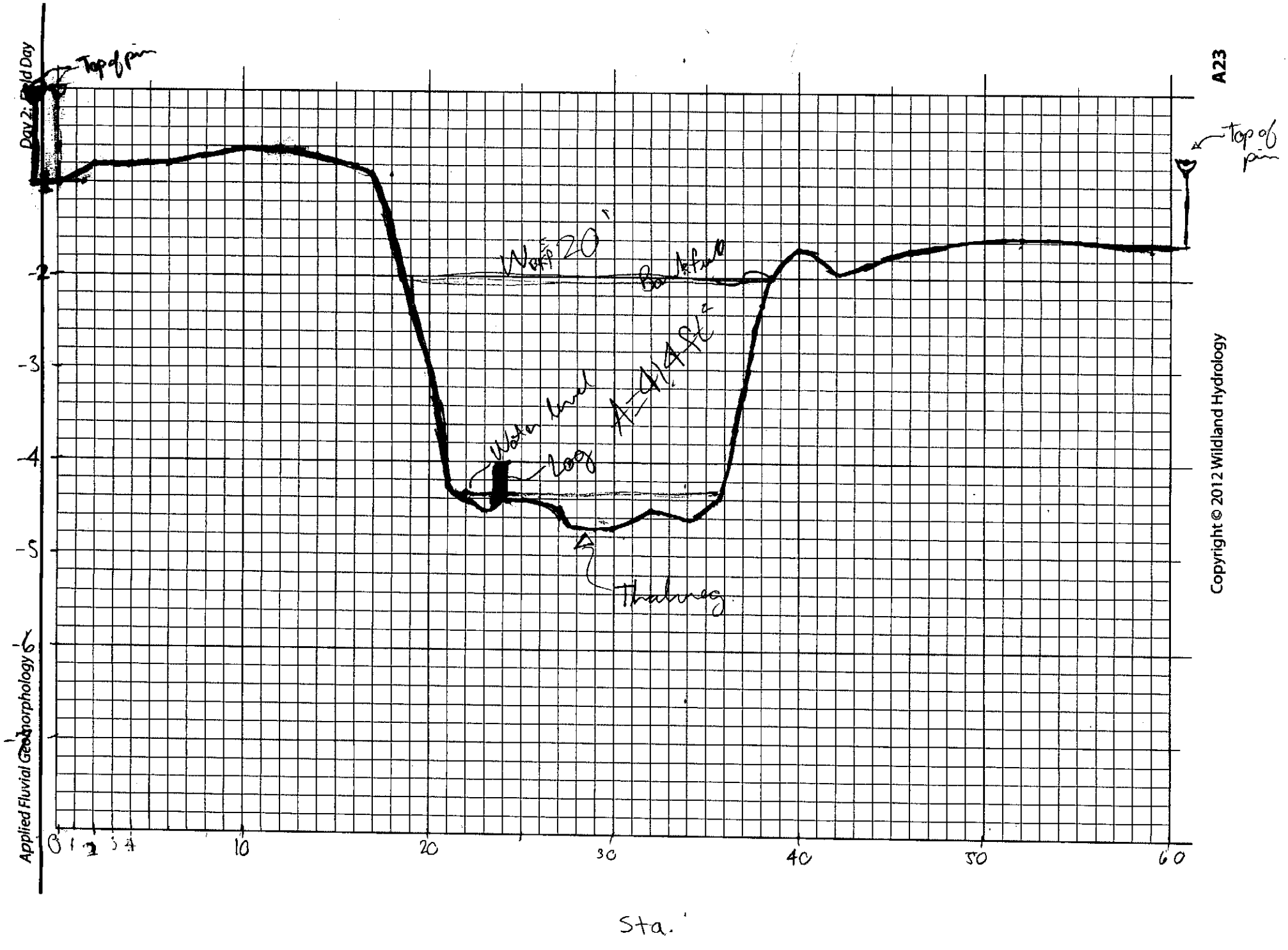
ISRAEL CREEK POTOMAC RIVER REACH 3 WASHINGTON CO. MD TEAM 3 4-17-12

Riffle X-sec



Applied Fluvial Geomorphology

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SURVEY DATA → LONGITUDINAL PROFILE 2

SITE: ISRAEL CREEK - [redacted] Reach 3 Date: 4/17/2012

Location: WASHINGTON COUNTY, MARYLAND

Party / Notes: JB, JM, JB, TK, JM, TF, JH, JV, PE, GN, KB, 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
28	0.0		106.45	8.92	97.53	8.52	97.93					riffle
29	11.8		↓	8.90	97.55	8.70	97.75			5.47	100.98	end riffle top of run
30	19.1			9.78	96.67	8.70	97.75					mid run
31	9.9			8.93	97.52	8.70	97.75*	6.34	100.11	5.43	101.02	↓
32	22.6			10.1	96.35	8.70	97.75					End of run Top of pool
33	31.0			9.47	96.96	8.70	97.75*	6.73	99.72	6.06	100.39	mid pool
34	40.0			9.93	96.52	8.70	97.75					
35	50.0			10.38	96.07	8.70	97.75			6.10	100.35	↓
36	60.0			10.16	96.29	8.70	97.75					
37	70.0			9.61	96.84	8.70	97.75			5.60	100.85	
38	80.0			10.09	96.36	8.70	97.75					
39	90.7			10.06	96.39	8.70	97.75*	6.53	99.92	4.52	101.93	
40	102.5			10.31	96.11	8.70	97.75*	6.60	99.85	5.44	101.01	
41	112.9			9.98	96.47	8.70	97.75					End of pool Top of glide
42	121.1			9.36	97.09	8.70	97.75*	6.69	99.76	6.75	99.7	mid glide
43	126.8			9.23	97.22	8.71	97.74					End of glide Top of riffle
44	140.4			10.12	96.33	8.78	97.67					mid riffle
45	150.0			9.19	97.26	8.83	97.62			5.91	100.54	
46	167.5			10.13	96.32	8.90	97.55			6.44	100.01	↓
47	178.0			9.23	97.22	8.96	97.49*	6.47	99.98	6.39	100.06	
48	188.5			9.76	96.69	9.05	97.4	7.11	99.34	6.72	99.73	End riffle Top of run
49	189.4			10.15	96.3	9.01	97.44			[illegible]		End of run top of pool
50	200.1			9.74	96.71	9.05	97.4	7.00	99.45	5.98	100.47	mid pool
51	206.0			9.55	96.9	9.03	97.42					End pool ROCK CREEK DAM
52												
53												
54												

Reach Length = 206 ft

* = bankfull identified by the entire group

CROSS SECTION → 47

END OF REACH → 51

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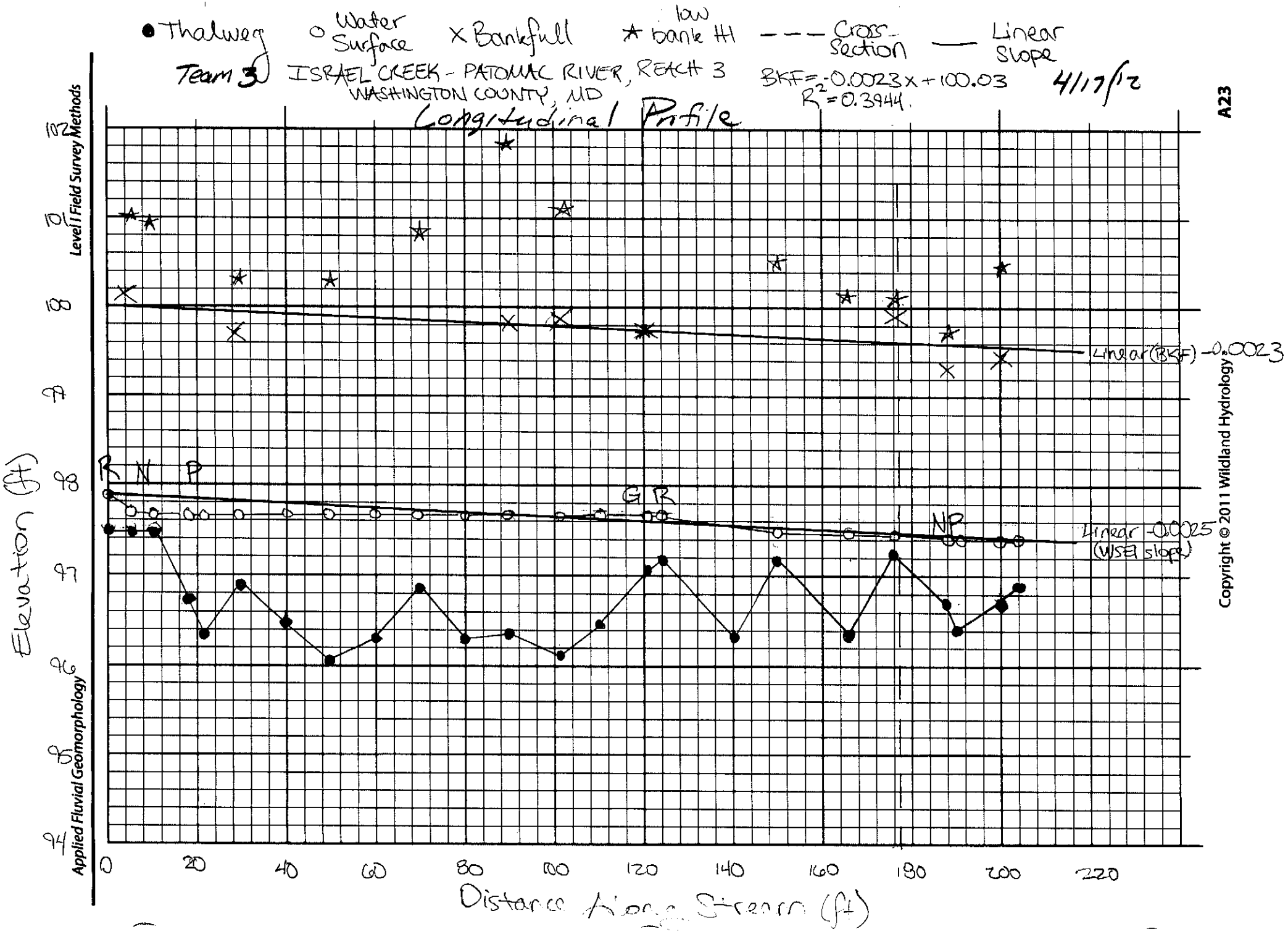
● Thalweg
○ Water Surface
× Bankfull
★ low bank HI
--- Cross Section
— Linear Slope
Team 3
ISRAEL CREEK - PATOMAC RIVER, REACH 3
WASHINGTON COUNTY, MD
BKF = -0.0023x + 100.03
R² = 0.3944
4/17/12
Longitudinal Profile
Level I Field Survey Methods
Applied Fluvial Geomorphology
A23
Elevation (ft)
102
101
100
99
98
97
96
95
94
R N P
G R
NP
Linear (BKF) -0.0023
Linear -0.0025 (WSEL slope)
0
20
40
60
80
100
120
140
160
180
200
220
Distance Along Stream (ft)
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Site: Isreal Creek Date: 4-17-2012

Location: Maryland HUC:

Party: 3

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: 0+00 - 2+02			Reach:			Reach:		
							Date: 4/17/12			Date: 4/17/12			Date: 4/17/12		
	Silt / Clay	< .062	S/C				6	6/30 20%	20	10	10/74 13.5	13.5	16	16/104 15.3	15.3
	Very Fine	.062 - .125	SAND				1	1/30 3.3%	23.3	10	13.5	27.0	11	10.5	25.8
	Fine	.125 - .25					1	3.3	26.6	2	2.7	29.7	3	2.8	28.6
	Medium	.25 - .50					0	0	26.6	9	12.2	41.9	9	8.6	37.2
	Coarse	.50 - 1.0					3	10	36.6	10	13.5	54.6	13	125	49.7
.04 - .08	Very Coarse	1.0 - 2					0	0	36.6	3	4.0	58.6	3	2.8	52.5
.08 - .16	Very Fine	2 - 4	GRAVEL				4	13.3	49.9	5	6.7	65.3	9	8.6	61.1
.16 - .22	Fine	4 - 5.7					3	10	59.9	6	8.1	73.4	9	8.6	69.7
.22 - .31	Fine	5.7 - 8					5	16.7	76.6	9	12.2	85.6	14	13.4	83.1
.31 - .44	Medium	8 - 11.3					5	16.7	93.3	6	8.1	93.7	11	10.5	93.6
.44 - .63	Medium	11.3 - 16					1	3.3	96.6	2	2.7	96.4	3	2.8	96.4
.63 - .89	Coarse	16 - 22.6					1	3.3	100	1	1.3	97.7	2	1.9	98.3
.89 - 1.3	Coarse	22.6 - 32								1	1.3	99	1	0.9	99.2
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type: C4/5			**Valley Type:** VIII e			TOTAL→	30		100	74		99	104		

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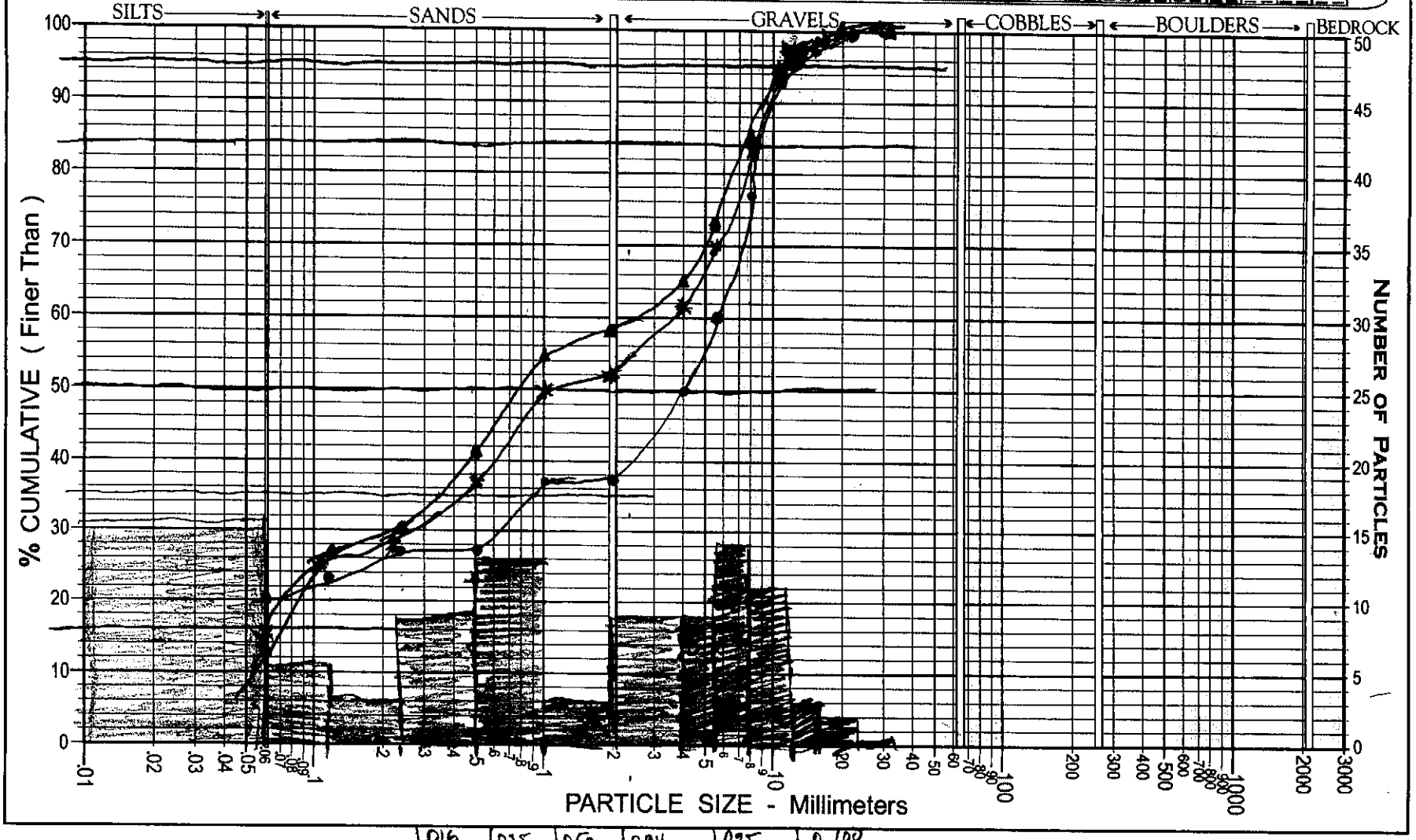
PEBBLE COUNT DATA

LOCATION: Israel Creek Washington Co. MY
REACH: 3
PARTY: Team 3
Date: 4/17/2012
Stream Type: C4
Valley Type: VIII C
HUC:



	D16	D35	D50	D84	D95	D100
● Riffle	[illegible]	.9 Coarse SAND	4.0 Very Fine	8.0 FINE	11.9 Medium	22.0 COARSE
▲ Pool	.07 very fine silt	.35 med silt	8.0 Fine	7.0 Fine	11 Medium	20 COARSE
✳ Composite	.06 very fine silt	.45 med silt	1.0 coarse silt	2.5 medium	13.0 medium	30 COARSE

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Site: 178 FT Cross section ACTIVE Date: 4/17/12

Location: Washington Co MP HUC:

Party: 3

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: 178 (3)			Reach:			Reach:		
							Date: 4/17/12			Date:			Date:		
	Silt / Clay	< .062	S/C				16	15.7	15.7						
	Very Fine	.062 - .125	SAND				2	1.9	17.6						
	Fine	.125 - .25					3	2.9	20.5						
	Medium	.25 - .50					2	1.9	22.4						
	Coarse	.50 - 1.0					6	5.9	28.3						
.04 - .08	Very Coarse	1.0 - 2					3	2.9	31.2						
.08 - .16	Very Fine	2 - 4	GRAVEL				6	5.9	37.1						
.16 - .22	Fine	4 - 5.7					9	8.8	45.9						
.22 - .31	Fine	5.7 - 8					22	21.6	67.5						
.31 - .44	Medium	8 - 11.3					19	18.6	86.1						
.44 - .63	Medium	11.3 - 16					10	9.8	95.9						
.63 - .89	Coarse	16 - 22.6					4	3.9	99.8						
.89 - 1.3	Coarse	22.6 - 32													
1.3 - 1.8	Very Coarse	32 - 45													
1.8 - 2.5	Very Coarse	45 - 64													
2.5 - 3.5	Small	64 - 90	COBBLE												
3.5 - 5.0	Small	90 - 128													
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256													
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BDRK												
Stream Type:			**Valley Type:**			TOTAL→	102								

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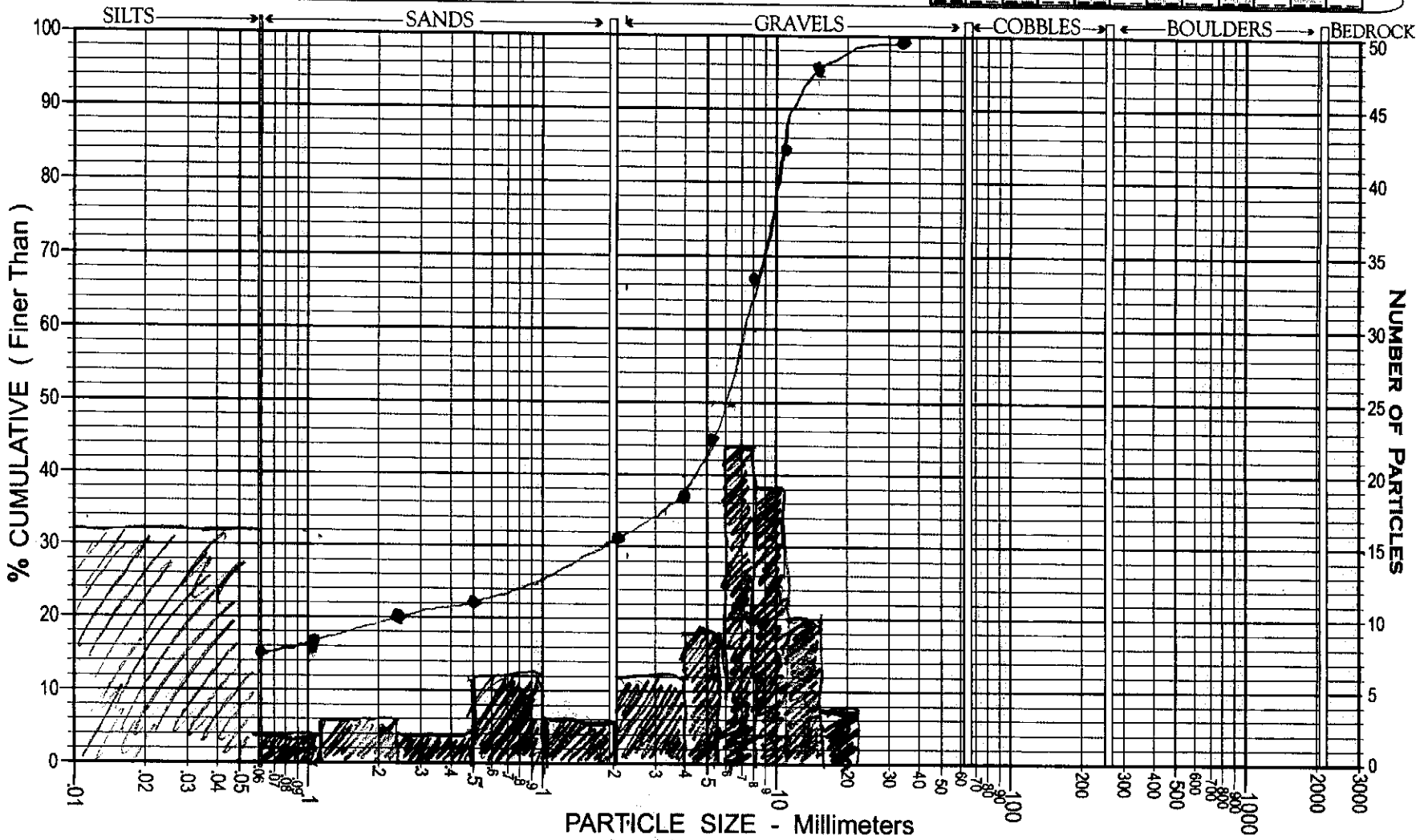
LOCATION: Cross active reference riffles PEBBLE COUNT DATA ISRAEL CREEK Date: 4/17/2012
REACH: 3 PARTY: TEAM 3
Stream Type: C4 Valley Type: 8C HUC:



D-16 / 1.1 course D-84 / 11.0 medium
D-35 / 3.3 very fine D-95 / 17.0 course
D50 / 6.1 fine D-100 / 35.0 very course

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TEAM 3 4-17-12

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

Stream: Israel Creek	
Basin: Potomac River	Drainage Area: 3456 acres 5.40 mi²
Location: Washington Co Maryland	
Twp.&Rge: N/A	Sec.&Qtr.:
Cross-Section Monuments (Lat./Long.):	Date: 4-17-12
Observers: JB, JM, JB, TK, JM, TF, JH, JV, KB, PE, GN - Team 3	Valley Type: 8c

Bankfull WIDTH (W_{bkf}) WIDTH of the stream channel at bankfull stage elevation, in a riffle section.	29	ft
Bankfull DEPTH (d_{bkf}) Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section ($d_{bkf} = A_{bkf} / W_{bkf}$).	2.07	ft
Bankfull X-Section AREA (A_{bkf}) AREA of the stream channel cross-section, at bankfull stage elevation, in a riffle section.	47.84	ft²
Width/Depth Ratio (W_{bkf} / d_{bkf}) Bankfull WIDTH divided by bankfull mean DEPTH, in a riffle section.	9.66	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.	2.7	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.	~300	ft
Entrenchment Ratio (ER) The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH (W_{fpa} / W_{bkf}) (riffle section).	15.0	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.	1	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.	.0025	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).	1.635	

* BIMODE — ADJUSTED DURING PRESENTATION TO REFLECT REACH D_{50}

206/126

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

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

Bankfull VELOCITY & DISCHARGE Estimates

Stream:	ISRAEL CREEK	Location:	WASHINGTON COUNTY, MD reach 3
Date:	4.17.12	Stream Type:	C4
Valley Type:	8c		
Observers:	TEAM 3 - JB, JM, JB, TK, JM, TF, JH, JV, KB	HUC:	-- -- -- -- -- -- -- -- -- -- --

INPUT VARIABLES			OUTPUT VARIABLES		
Bankfull Riffle Cross-Sectional AREA	41.4	A_{bkf} (ft²)	Bankfull Riffle Mean DEPTH	2.07	d_{bkf} (ft)
Bankfull Riffle WIDTH	20	W_{bkf} (ft)	Wetted PERMIMETER ~ (2 * d_{bkf}) + W_{bkf}	24.14	W_p (ft)
D_{84} at Riffle	11	Dia. (mm)	D_{84} (mm) / 304.8	.036	D_{84} (ft)
Bankfull SLOPE	.0023	S_{bkf} (ft / ft)	Hydraulic RADIUS A_{bkf} / W_p	1.73	R (ft)
Gravitational Acceleration	32.2	g (ft / sec²)	Relative Roughness R(ft) / D_{84} (ft)	48.06	R / D_{84}
Drainage Area	5.4	DA (mi²)	Shear Velocity $u^* = (gRS)^{1/2}$	.289	u* (ft/sec)

median gravel

$\frac{V}{U_*} = 12.35$

ESTIMATION METHODS	Bankfull VELOCITY		Bankfull DISCHARGE	
1. Friction Factor / Relative Roughness $u = [2.83 + 5.66 * Log\{R / D_{84}\}] u^*$	4.61	ft / sec	190.9	cfs
2. Roughness Coefficient: a) Manning's *n* from Friction Factor / Relative Roughness (Figs. A-27, A-28) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .024	4.47	ft / sec	185.1	cfs
2. Roughness Coefficient: b) Manning's *n* from Stream Type (Fig. A-29) $u = 1.49*R^{2/3}*S^{1/2}/n$ $n =$ .04	2.68	ft / sec	111.0	cfs
2. Roughness Coefficient: c) Manning's *n* from Jarrett (USGS): $u = 1.49*R^{2/3}*S^{1/2}/n$ $n = 0.39*S^{0.38}*R^{-0.16}$ 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 $n =$		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 u = Q / A Return Period for Bankfull Discharge Q = year		ft / sec		cfs
4. Continuity Equations: b) Regional Curves u = Q / A	4.03	ft / sec	167	cfs

MD AP/VR

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 **"protrustion 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-3. Summary of Morphological Variables.

Stream: ISRAEL CREEK		**Location:** WASHINGTON COUNTY MD - reach 3	
Team: 3	**Date:** 4.17.12	**Drainage Area:** 5.4	

Riffle Channel Dimensions

1. Bankfull Width (W_{bkf}) (ft)	20.0	2. Bankfull Mean Depth (d_{bkf}) (ft)	2.07
3. Width/Depth Ratio (W_{bkf} / d_{bkf})	9.66	4. Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)	41.4
5. Bankfull Maximum Depth (d_{max}) (ft)	2.7	6. Width of Flood-Prone Area (W_{fpa}) (ft)	~300
7. Entrenchment Ratio (ER) (W_{fpa} / W_{bkf})	15.0		

Channel Pattern			***Dimensionless Ratios***		
8. Belt Width (W_{blt}) (ft)	Mean	79.67	9. Meander Width Ratio (MWR) (W_{blt} / W_{bkf})	Mean	3.98
	Min	71		Min	3.55
	Max	85		Max	4.25
10. Stream Meander Length (L_m) (ft)	Mean	177.5	11. Meander Length Ratio (MLR) (L_m / W_{bkf})	Mean	8.88
	Min	167		Min	8.35
	Max	188		Max	9.4
12. Linear Wavelength (λ) (ft)	Mean	141	13. Linear Wavelength to Bankfull Width (λ / W_{bkf})	Mean	7.05
	Min	74		Min	3.7
	Max	208		Max	10.4
14. Radius of Curvature (R_c) (ft)	Mean	25.37	15. Radius of Curvature to Bankfull Width (R_c / W_{bkf})	Mean	1.27
	Min	17.25		Min	0.86
	Max	36		Max	1.8

Channel Particles

Representative Pebble Count

16. D_{16} (mm)	0.06	17. D_{35} (mm)	0.45	18. D_{50} (mm)	1.0
19. D_{84} (mm)	8.5	20. D_{95} (mm)	13.0	21. D_{100} (mm)	30.0

Active Bed Riffle Pebble Count

22. D_{16} (mm)	1.1	23. D_{35} (mm)	3.3	24. D_{50} (mm)	6.1
25. D_{84} (mm)	11.0	26. D_{95} (mm)	17.0	27. D_{100} (mm)	35.0

Classification

28. Sinuosity (k)	1.65	29. Average Water Surface Slope (S)	.0025
30. Stream Type	C4/5	31. Valley Type	8c

Velocity & Discharge

32. Friction Factor (u / u*)	12.35	33. Relative Roughness (R / D_{84})	48.06
34. Manning's "n" from Friction Factor / Relative Roughness	.024	35. Manning's "n" from Stream Type	.04
36. Estimated Mean Velocity (u_{bkf}) (ft/sec)	4.47	37. Estimated Bankfull Discharge (cfs)	185.1
38. Estimation Method Selected for Velocity & Discharge	Roughness Coefficient - A- Manning's n from friction Factor/Relative Roughness		

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